

Review of Particle Properties

Particle Data Group

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This review of the properties of leptons, mesons, and baryons is an updating of Rosenfeld *et al.* [Rev. Mod. Phys. **40**, 77 (1968)]. Data are evaluated, listed, averaged, and summarized in tables and wallet sheets. A data booklet is also available.

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I. INTRODUCTION

This review is an updating through October 1968 of Rosenfeld *et al.* (1968), with minor changes.

We point out in each edition that it is inappropriate to make reference to this compilation instead of to an original work (to which we even provide a handy citation), but some people still just quote us, without warning the reader that ours is a review and not an experiment. To emphasize this point we ask that this

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article be referred to as "Review of Particle Properties" and that the tables with the averaged values be referred to as "Particle Properties Tables." Further, please attribute them to the Particle Data Group rather than to individuals.

To make communication easier we now state who has concentrated on each major table. The list for the last 12 months is:

Stable Particles: N. Barash-Schmidt, A. Barbaro-Galtieri, G. Conforto, L. R. Price, and M. Roos; with help from Hans Bichsel and Peter Schmidt (on hyperon masses), and from George H. Trilling and William J. Willis (on K decays).

Mesons: P. Söding, M. Roos, and A. H. Rosenfeld, with assistance from L. Dubal.

Baryons: A. Barbaro-Galtieri and C. G. Wohl. We thank Claude Bricman, Claiborne Johnson, and Herbert Steiner for their advice on phase-shift analyses, Philip Dauber for advice on Ξ^* 's, and Robert D. Tripp for general helpful discussions.

We enjoy and need your help in the form of suggestions, preprints, the verification forms that you return, and even irritated phone calls. Please keep up the necessary communication.

II. GENERAL REMARKS

Our procedures are as follows. We read journals and preprints and from information so obtained we punch data cards and reference cards for each relevant experiment. These cards are listed following the main text.

Computer programs make weighted averages of these data, and the results are summarized in three tables:

(i) Table S covers all stable particles (leptons, mesons, and baryons), i.e., those states which are immune to decay via the strong interaction.

(ii) Meson Resonances.

(iii) Baryon Resonances.

Each table is of slightly different form; thus, Table S

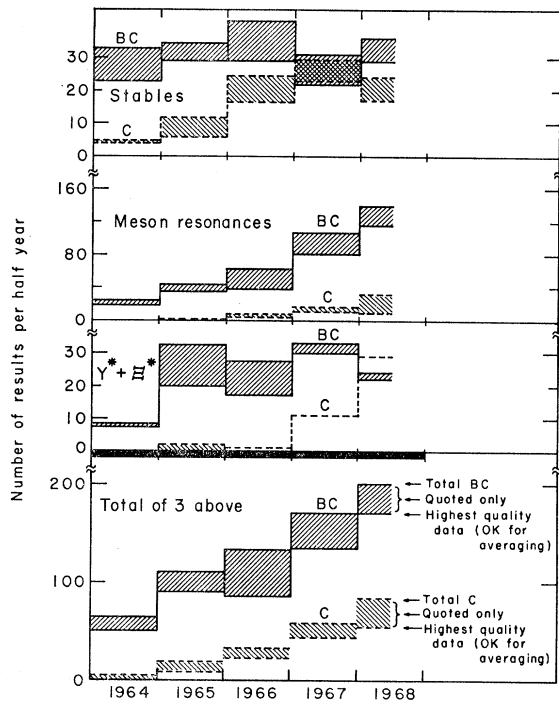


FIG. 1. Statistics on the increasing rate of production of data in particle physics. From the top to the bottom, the number of results per half year are presented for stable particles, meson resonances, $Y^* + Z^*$'s, and the total of three above. The full lines correspond to bubble-chamber techniques (BC) and interrupted lines correspond to counters, spark chambers, and mass spectrometers (C). Within each topic (stables, meson resonances, etc.) and for both techniques (BC and C) the lower lines correspond to highest-quality data (accepted for averaging and fitting) and the upper lines correspond to all the results (including those which we only quote). The dashed areas give the number of nonaveraged results.

includes magnetic moments and weak-decay asymmetry parameters, the meson table has two columns of names, one familiar, another more orderly, and the baryon table includes information on what momentum pion and K -meson beams will form certain resonances.

These three tables, along with other useful information, appear at the end of this article on perforated "wallet sheets." The sheets are thin and durable, and the reader can fold them to carry around.

Of course most of our work involves deciding how to handle data. Often it is best not to average a given result, either because it is already incorporated in a later paper or because we have some reservations about the experiment. When the data for a particle have received special treatment, this is noted in a "mini-review" in the listings.

III. SOME STATISTICS

In this section we present two sets of statistics: *first* on the increasing rate of production of data in particle physics by year and by experimental techniques, *second* on our procedure for critical compilation of data.

A. Growth of Data

On our data cards we punch both "year published" and "technique used," so that it is relatively easy to sort input by topic and technique.

In Fig. 1 we have divided the entries into three topics:

(1) Stable Particles.

(2) Meson Resonances.

(3) Baryon Resonances. For baryons we have excluded N^* 's because so many of our references are to review articles rather than to the many counter experiments, the most important of which involve polarization measurements. We have also excluded Z^* 's, where there are only a handful of experiments, and it is not even clear that there are any Z^* 's.

For all the above we have excluded cards appearing in the listings but applying to resonances that are still so tentative that they are excluded from our tables.

We have sorted data entries according to two major techniques, omitting about 20 emulsion results and 30 results attributed to "reviews." The two major techniques are called BC (for Bubble Chambers of all kinds) and C (for Counters, spark Chambers, and mass spectrometers).

We wondered whether to count only the highest-quality data (those results which are accepted for averaging and fitting) or all data, including those that we list enclosed in parentheses. We have plotted both in Fig. 1, and they seem to tell the same story.

The entries in Fig. 1 and Table I tend to rise from year to year, and a quick glance may suggest that they give cumulative counts. This is not so; we list entries per unit time, and the slope indicates only that our field is still growing. Naturally, the keenest competition between bubble chambers and "counters" is in experiments with stable particles. Bubble chambers provide almost all the information on mesons, but electronic devices and polarized targets have been needed to disentangle most of the N^* 's.

Professor H. D. Taft recently made a similar sorting by technique of the last 450 publications in *Physical Review Letters*. Nearly $\frac{2}{3}$ were theoretical, but (of the remaining 35%) 15% described bubble-chamber experiments, 20% related to other techniques. How can Taft's count show bubble chambers trailing 15 to 20, whereas at the bottom of Fig. 1 we show them far ahead? The explanation is probably that bubble-chamber experiments tend to produce results bearing on several different states, each of which we count as an entry. By contrast, counter and spark-chamber experiments tend to be single-purpose and produce only one result per experiment.

B. Selection of Data

We hear comments from some of our colleagues that we should be more selective in our acceptance criteria

TABLE I. Results accepted per year. The top two rows of this table are plotted at the bottom of Fig. 1. Note that this table gives results per full year, whereas Fig. 1 gives results per half-year.

Technique	Code ^a	Year					Total
		1964	1965	1966	1967	1968 (½ year)	
Bubble chambers	<i>a</i>	33	45	92	73	31	271
	<i>+b</i>	+98	+178	+171	+267	+170	+869
	<i>=c</i>	=131	=223	=263	=340	=201	=1140
Counters + spark chamb. + missing-mass spec- trometers	<i>a</i>	1	19	24	28	30	102
	<i>+b</i>	+8	+19	+43	+87	+55	+212
	<i>=c</i>	=9	+38	=67	=115	=85	=314
Emulsions	<i>a</i>	2	2	0	1	0	5
	<i>+b</i>	+3	+9	+1	+3	+0	+16
	<i>=c</i>	=5	=11	=1	=4	=0	=21
RVUE (review)	<i>a</i>	1	4	2	2	6	15
	<i>+b</i>	+2	+2	+0	+2	+8	+14
	<i>=c</i>	=3	=6	=2	=4	=14	=29

^a Code: *a* = quoted only, *b* = averaged, *c* = total.

for input data, and from some others that we should be less selective (particularly with the phone list at the end of the Data Booklet!). Accordingly, we have decided to give occasional statistics as to how much we “refine” the input.

At the top of each page of the listings there is a note, “Data in parentheses have not been included in our averages.” We now explain when we use this “ignore” feature, although a glance at the listings may be more informative.

After we have read a paper, we keypunch the results, even if we do not want to average them. Of course, if a quantity is presented with no error stated, our averaging programs have to ignore it. In addition, we may want to exclude it for several other reasons:

(i) The result comes from a preprint or conference report, and has not yet been verified by the authors. Our problems with such prepublications are discussed further in Sec. V.B.

(ii) It involves some assumptions that we do not wish to incorporate.

(iii) It is of poor quality, e.g., bad signal-to-noise ratio.

All the above are put in parentheses and ignored in our fitting procedures.

For last summer’s edition we surveyed the *Meson Table*. There were 550 reference cards, which generated 860 data entries. Of these, about 50% were considered useful enough to average, and another 5% were significant upper limits which also influenced the tables in some way.

IV. EXPLAINING PEAKS VS EXPLAINING THEM AWAY

We would like to be able to state here some precise criteria for accepting a bump as a resonance; however,

the eventual formulation of such criteria must await the solution of some of the most fundamental theoretical problems about the strong interaction, and even when they are finally understood there is no reason to assume that there will be a clean line of demarcation between “particles,” background, and other phenomena. For a discussion of resonances, particles, and poles see Chew (1966).

Many physicists feel that even though a bump is experimentally convincing, one should always first try to explain it away in terms of some threshold or *t*-channel effect, and only if this “fails” should one consider it as a possible resonance. Thus, when we tabulate the A1 mesons, we warn “Existence still in doubt” because there are Deck-effect or similar interpretations. But here we want to warn against such warnings and emphasize that there may be no intrinsic contradiction between *s*-channel explanations (resonances) and *t*-channel effects (forces). Thus, for peaks like the A1, we are beginning to realize that we should compile data on the complete uninterpreted peak (without model-dependent background subtractions) and wait for theoretical progress.

There are cases in which we have dismissed an experimentally notable bump, for example, the K^+p bump near $K\Delta$ threshold—called Z_1 in our listings. Enough $K\Delta$ events are now available to permit a partial-wave analysis. It turns out that both the P1 and the P3 wave are large at the bump, and that neither of them looks very resonant. If, later, better partial-wave results (particularly from the elastic channel) should show resonant behavior, we would move Z_1 back into our tables. The point we want to emphasize here is that in judging which bumps to accept we consider that precise data are much more decisive than general criteria, and that we do not try to dismiss a bump just because of a possible nonresonant interpretation.

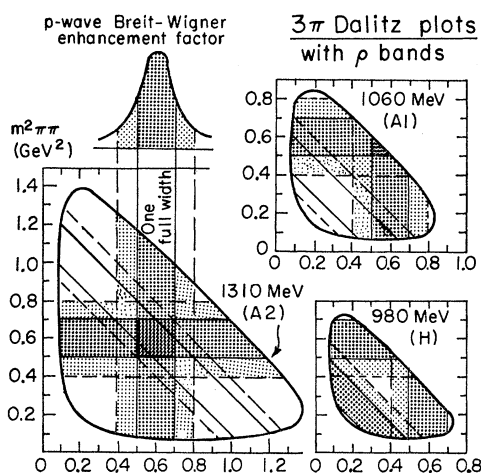


FIG. 2. Dalitz plots for three-pion states of total mass 980, 1060, and 1310 MeV, illustrating the overlap of the ρ bands.

The above should not be taken to mean that we eagerly try to add bumps to the table—we have strict experimental criteria. The data must be statistically sound, and we consider the evidence available from confirmatory or conflicting experiments.

We check also that bumps are not accidentally enhanced by imposing too many selections on the data. For example, see Fig. 2, which we have always carried as a warning about the H meson, a bump said to be mainly in the $\pi^+\pi^-\pi^0$ spectrum near $\rho\pi$ threshold. (We no longer believe in the H, but the discussion still applies in the A1 meson region.) The figure shows that just above $\rho\pi$ threshold the Dalitz plot is almost fully covered by ρ bands; then, as the 3π mass increases, the Dalitz plot grows, so there is a decrease in the fraction covered by ρ bands. Hence, ρ selection causes a relatively smooth 3π spectrum to peak up at $\rho\pi$ threshold. Every experimentalist knows this; nevertheless, one must be on guard that an ordinary 3σ (σ denotes the standard deviation) fluctuation is not accidentally amplified to 4σ or 5σ by this effect and then taken too seriously.

V. NOTES ON THE TABLES

A. General Notes

Quoted errors represent standard deviations. Inequalities are also standard deviations or $1/e$ confidence levels. In $I^G(J^P)C$ we have I =isotopic spin, J =spin, and P =parity. The others— G and C (or C_n)—are discussed in Sec. VII (Mesons). Well-established quantum numbers are underlined (except in Table S, where most of the quantum numbers are established). We have used flimsy evidence to guess many of the remaining ones, and we have indicated with “?” the ones for which there is almost no evidence.

As is customary, we define antiparticles as the result of operating with CPT on particles, so both share the same spins, masses, and mean lives. Whenever there is a

particularly interesting test of CPT invariance we include it on Table S.

For resonances, Γ represents the full width at half-maximum.

For broad resonances there is an inconsistency in the way the central value M_R is usually stated. For a well-studied resonance like $\Delta(1236)$ or $\Lambda(1520)$, it is conventional to call M_R or E_R the energy at which the resonant amplitude would (in the absence of background) become pure imaginary. But this does not mean that the peak in an observed cross section occurs at M_R , because kinematic factors enter into the relation between amplitude and cross section.¹ Thus, the peak in the πp cross section near $\Delta(1236 \text{ MeV})$ actually occurs at 1223 MeV. Nevertheless, some papers still simply report the energy of the peak in the observed cross section. For well-studied resonances, we have protected the averaging programs from masses and widths obtained without the proper kinematical factors or the proper background treatment. For the others, we have used whatever data were available.

B. Fluctuations in Average Values Since the Preceding Edition

Any quantity which has changed by ≥ 1 (old) standard deviation from its tabulated value in January or August of 1968 is italicized. Our motivation is twofold: (1) we are calling attention to poor procedures either on our part or on the part of the experimenters; (2) we suspect that quantities which have fluctuated unexpectedly in the past may continue to do so in the future. (We are not sure that this latter point is correct, but it seems reasonable. In particular we guess that there is a correlation between harder-than-average experiments and large fluctuations in the results.)

The most common reason for this kind of fluctuation is that physicists often *report* a value and error for a parameter in a conference report or preprint, and then *enlarge* the error by the time the experiment is published in a journal. If the preliminary result is included in our average, the central value is shifted sharply towards this new measurement and the error shrinks. Later, when more reasonable errors are published for the experiment in question, the averaged value again returns close to the old number, which is often a shift of more than one shrunken standard deviation. We are attempting to avoid this in the future by not averaging data from conference reports or preprints *unless* the authors specifically write us that the errors they have quoted are not likely to be enlarged before the paper is published in its final form.

VI. NOTES ON TABLE S (STABLE PARTICLES)

Rates. For K decays we tabulate partial decay rates in addition to branching ratios. For comparison of experimental data with theoretical predictions, it is

¹ See, for example, Jackson, 1964.

necessary to know the rates and errors coming from an over-all fit that takes into account the correlations between the various measured quantities. Our programs provide such fitted quantities. A comparison with the $\Delta I = \frac{1}{2}$ rule is reported in Appendix I.

CP violation in K^0 decays. Parameters of current interest are

$$\begin{aligned}\eta_{+-} &= A(K_L \rightarrow \pi^+ \pi^-) / A(K_S \rightarrow \pi^+ \pi^-) \\ &= |\eta_{\pm}| \exp(i\phi_{+-}), \\ \eta_{00} &= A(K_L \rightarrow \pi^0 \pi^0) / A(K_S \rightarrow \pi^0 \pi^0) \\ &= |\eta_{00}| \exp(i\phi_{00}).\end{aligned}$$

The phases ϕ_{+-} and ϕ_{00} have been measured directly, whereas the magnitudes $|\eta_{+-}|$ and $|\eta_{00}|$ are derived parameters. We have used, as far as we could, the directly measured quantities as input, and have calculated $|\eta_{+-}|$ and $|\eta_{00}|$ from the values given by our constrained fits. Therefore, if one looks at the data card listings, most of the $|\eta|$ measurements do not appear as such, but in the form of branching ratios, with appropriate comments.

$\Delta S = \Delta Q$ rule in K^0 decays. The validity of this rule is measured by the parameter x , defined as

$$x = A(\bar{K}^0 \rightarrow \pi^- l^+ \nu) / A(K^0 \rightarrow \pi^- l^+ \nu).$$

We list $\text{Re } x$ and $\text{Im } x$.

Form factors in K_{13} leptonic decays. Assuming that only the vector current contributes to these decays, we write the matrix element as

$$\langle \pi | J_\lambda | K \rangle \propto [f_+(q^2) (P_K + P_\pi)_\lambda + f_-(q^2) (P_K - P_\pi)_\lambda],$$

where P_K and P_π are the four-momenta of K and π mesons; f_+ and f_- are dimensionless form factors which can depend only on $q^2 = (P_K - P_\pi)^2$, the square of the momentum transfer to the leptons. The parameters we list are

λ_+ , the energy dependence of the $f_+(q^2)$ form factor,

$$f_+(q^2) = f_+(0) [1 + \lambda_+ (q/m_\pi)^2];$$

and ξ , the ratio of the two form factors,

$$\xi = f_- / f_+.$$

The quantity ξ can be determined in different ways. See the note in the listing, after K^+ decays, for discussions of methods used to measure ξ and of experimental results.

A/V ratio for baryon leptonic decays. The baryon part of the matrix element for these decays may be written as

$$\langle B_f | \gamma_\lambda (g_V - g_A \gamma_5) | B_i \rangle,$$

where B_i and B_f represent initial and final baryons, and g_A and g_V the axial and vector coupling constants. The Pauli metric is used for the γ matrices and therefore the value of g_A/g_V in neutron beta decay is negative. We

compile the ratio g_A/g_V for those decays for which it has been measured.

Asymmetry parameters in nonleptonic hyperon decays. The transition matrix for the hyperon decay may be written as

$$M = s + p(\mathbf{P}_Y \cdot \mathbf{q}), \quad (1)$$

where s and p are the parity-changing and the parity-conserving amplitudes, respectively, \mathbf{P}_Y is the hyperon polarization, and \mathbf{q} is a unit vector along the direction of the decay baryon in the hyperon rest frame.

The asymmetry parameters are defined by the relations

$$\begin{aligned}\alpha &= 2 \text{Re}(s^* p) / (|s|^2 + |p|^2), \\ \beta &= 2 \text{Im}(s^* p) / (|s|^2 + |p|^2), \\ \gamma &= (|s|^2 - |p|^2) / (|s|^2 + |p|^2).\end{aligned}$$

With the transition matrix (1), the angular distribution of the decay baryon, in the hyperon rest system, is of the form

$$I = 1 + \alpha \mathbf{P}_Y \cdot \mathbf{q}.$$

The polarization \mathbf{P}_B of the decay baryon is²

$$\mathbf{P}_B = \frac{(\alpha + \mathbf{P}_Y \cdot \mathbf{q}) \mathbf{q} + \beta (\mathbf{P}_Y \times \mathbf{q}) + \gamma \mathbf{q} \times (\mathbf{P}_Y \times \mathbf{q})}{1 + \alpha \mathbf{P}_Y \cdot \mathbf{q}},$$

where \mathbf{P}_B is defined in that rest system of the baryon obtained by a Lorentz transformation along \mathbf{q} from the hyperon rest system in which \mathbf{q} and \mathbf{P}_Y are defined. Note that α is the helicity of the decay baryon for unpolarized hyperons.

The three parameters α , β , and γ satisfy the relation

$$\alpha^2 + \beta^2 + \gamma^2 = 1.$$

It is then convenient to describe hyperon nonleptonic decays in terms of the two independent parameters α and the angle ϕ defined by

$$\begin{aligned}\beta &= (1 - \alpha^2)^{1/2} \sin \phi, \\ \gamma &= (1 - \alpha^2)^{1/2} \cos \phi,\end{aligned}$$

which has a more nearly Gaussian distribution than β or γ . Evidently

$$\begin{aligned}-\frac{1}{2}\pi &\leq \phi \leq \frac{1}{2}\pi & \text{for } \gamma > 0, \\ \frac{1}{2}\pi &\leq \phi \leq \frac{3}{2}\pi & \text{for } \gamma < 0.\end{aligned}$$

In discussing time-reversal invariance, the quantity of interest is Δ , defined by

$$\begin{aligned}\alpha &= 2 |s| |p| \cos \Delta / (|s|^2 + |p|^2), \\ \beta &= -2 |s| |p| \sin \Delta / (|s|^2 + |p|^2); \end{aligned}$$

² Lee and Yang (1957.) Note that this paper contains a misprint. The minus sign in the definition of β should be replaced by a 2. In addition our unit vector \mathbf{q} is the direction of the baryon, whereas their unit vector \mathbf{p} is the direction of the pion.

that is, Δ is the phase angle of s relative to p . Evidently

$$\begin{aligned} -\frac{1}{2}\pi \leq \Delta \leq \frac{1}{2}\pi & \quad \text{for } \alpha > 0, \\ +\frac{1}{2}\pi \leq \Delta \leq \frac{3}{2}\pi & \quad \text{for } \alpha < 0. \end{aligned}$$

(Note that this definition of Δ is slightly different from the one of the 1967 edition.) Under the assumption of time-reversal invariance, the angle Δ must satisfy the relation

$$\Delta = \delta_s - \delta_p,$$

modulo π , where δ_s and δ_p are the pion-baryon scattering phase shifts at the appropriate energy and for the appropriate isospin state. For Λ decay, assuming the validity of the $|\Delta I| = \frac{1}{2}$ rule,

$$\Delta = \delta_s - \delta_p = \delta_{1\rightarrow 11} = (6.8 \pm 2.0) \text{ deg.}^3$$

On the data cards, we list α and ϕ for each decay, since they are the most closely related to the experiments and are essentially uncorrelated. Whenever necessary we have changed the signs of the reported values, so as to agree with our conventions. In Table S we give α , ϕ , and Δ with errors; and for convenience we also give the central value of γ , without an error.

VII. NOTES ON THE MESON TABLE

A. The Symbol-Minded Approach

If a meson has a well-accepted colloquial name, we use it. If not, we name it by a single symbol which specifies its atomic mass number A ($=0$ for mesons), its hypercharge Y , its isospin I , and, for a nonstrange meson, its G parity [see Eqs. (2) and (3)]. We choose

$$\begin{aligned} I=0; & \quad \eta \text{ if } G \text{ is even, } \phi \text{ if it is odd} \\ I=1; & \quad \rho \text{ if } G \text{ is even, } \pi \text{ if it is odd} \\ I=\frac{1}{2}; & \quad K \\ I=\frac{3}{2}; & \quad (\text{if ever established}) L. \end{aligned}$$

To crowd even more information onto the symbol, we add a subscript giving J^P . Thus $\eta_{0+}(1070)$. If J^P is not known, but must be normal (0^+ , 1^- , 2^+ , \dots), e.g., because $\pi\pi$ or $\bar{K}K$ decays are seen, we use the subscript N . Thus $K_N(1400)$. If $\pi\pi$ and $\bar{K}K$ modes are *not* seen [and are not otherwise forbidden, e.g., by Eq. (5b) below], we *guess* it is because J is abnormal, and we write, for example, $K_A(1320)$.

When two states have identical quantum numbers, we add a "prime" to the heavier, e.g., η , η' ; f , f' [and for baryons we write N , $N'(1400, \frac{1}{2}^+)$].

B. G Parity and the Shorthand C_n

The charge conjugation operator C turns particle into antiparticle, and has eigenvalues ± 1 only for neutral

³ This value for $\delta_s - \delta_p$ is derived from the phase-shift analyses by L. D. Roper, R. M. Wright, B. T. Feld, Phys. Rev. **138**, B190 (1965). The error is our estimation of the uncertainty.

states; so it is useful to define an extension G which has eigenvalues for charged states too.⁴ It is usually⁴ defined by

$$G = C \exp(i\pi I_y). \quad (2)$$

A neutral nonstrange state is an eigenstate of $\exp(i\pi I_y)$ with eigenvalue $(-1)^I$. Then we can write the eigenvalue equation for the whole multiplet as

$$G = C_n (-1)^I, \quad (3)$$

where C_n (n for neutral) is the eigenvalue C would have if applied to the neutral member of the multiplet. Thus, for a π^0 , C has the eigenvalue $+1$, and since $I=1$, $G=-1$. For the charged pion there are no eigenvalues corresponding to C and to the isospin rotation, but C_n is still $+1$, and Eq. (3) still gives $G=-1$.

C. C , P , G for Meson \leftrightarrow Particle-Antiparticle (e.g., $\pi\pi$, $\bar{K}K$, $\bar{p}p$, or Quark-Antiquark)

The formulas below, starting with Eq. (6), are useful for several reasons.

(i) The presence or absence of $\pi\pi$ or $\bar{K}K$ decay modes (neutral or charged) helps determine G .

(ii) Since $\bar{p}p$ captures at rest are known to be from S states (Day *et al.*, 1961) there are constraints on the $I^G(J^P)$ of the mesons produced.

(iii) The quark model $\bar{q}q$ predicts unitary multiplets of mesons with P , C , and G defined by Eqs. (11) and (12), below.

We now present a summary of the arguments leading to Eqs. (7) through (13), and put details in Appendix II.

For two identical spinless bosons, like $\pi^0\pi^0$, Bose statistics require that the wave function $\psi(\mathbf{r})$ must be symmetric under an exchange operator X .

Bose symmetry can be extended to $\pi^+\pi^-$. The "indistinguishable" pions now have two coordinates, \mathbf{r} and I_z , or (better for this argument) \mathbf{r} and charge Q . Complete exchange, X , can then be written

$$X\psi(\mathbf{r}, I_z) = X_r(\mathbf{r}) X_I(I_z)\psi,$$

or better,

$$X\psi(\mathbf{r}, Q) = X_r(\mathbf{r}) C(Q)\psi.$$

If the state has angular momentum l , so that $\psi \propto Y^m_l(\cos\theta)$, then X_r has eigenvalue $(-1)^l$. [We avoid calling X_r "parity" because when we get to the case of fermion-antifermion X_r will still be $(-1)^l$, but parity will be $-(-1)^l$.]

⁴ Most texts define it as in Eq. (2); see, e.g., Gasiorowicz 1966; however, sometimes the rotation is taken about I_x . The difference between the two conventions is mentioned in a footnote in Källén 1964.

Bose symmetry still requires that

$$X_r C = +1, \quad (4)$$

so $C_n = X_l = (-1)^l, \quad (5a)$

and, by (3), $G = (-1)^{l+l}. \quad (5b)$

We show in Appendix II that Eq. (5b) can be extended to apply to meson-antimeson pairs, both with total charge $Q=0$ (e.g., K^+K^-) and also nonzero (e.g., K^+K^0 or $\pi^+\pi^0$).

We can further allow the meson (and antimeson) to have spin ($\mathbf{S}_1 + \mathbf{S}_2 = \mathbf{S}$). We exchange spins with an operator X_S , which for two particles each with the same integral spin is

$$X_S = (-1)^S. \quad (6)$$

Then $X = X_l C X_S = +1 \quad (7)$

gives $C_n (-1)^{l+S}, \quad (8a)$

and $G = (-1)^{l+S+l}. \quad (8b)$

The spin factor seldom comes up for meson-antimeson pairs, but it allows us to cast the expressions in a form in which they apply identically to fermion-antifermion, as we now show.

For two identical *fermions*, such as $p\bar{p}$, with orbital angular momentum l and spin S , the symmetry requirements of Fermi statistics require $X = -1$. Spatial interchange X_r again introduces $(-1)^l$, and two *spinors* have a spin symmetry

$$X_S = -(-1)^S. \quad (9)$$

Again we extend Fermi statistics to $\bar{N}N$ or $\bar{q}q$ states. Complete interchange can then be written

$$X = X_r C X_S = -1. \quad (10)$$

The minus signs in (9) and (10) cancel, giving

$$C_n = (-1)^{l+S}. \quad (11a)$$

Note that (8a) and (11a) are identical, as we promised.

Finally, from (3), we get the familiar expression for G ,

$$G = (-1)^{l+S+l}. \quad [(11b) = (8b)]$$

Next we give some examples of Eqs. (8).

Examples of meson $\rightarrow \bar{K}K$

As an example of Eqs. (4), (5) or (7), (8) consider the A_2 meson. Its main decay mode is $\pi\rho$, hence $G = -1$. The A_2 may actually be *two* nearly overlapping mesons, but at least one component seems to go into $K^-K_S^0$, so $l=1$ for that component. Then, by (5b), l is even.

Or consider the $I=1$ A_1 meson. Its main decay is again $\pi\rho$, so again $G = -1$. Hence, by (5b) we'll see a $\bar{K}K$ decay mode only if l is even. In fact no $\bar{K}K$ mode is seen.

Example of neutral meson $\rightarrow \bar{K}^0K^0$

Whenever l is even, neutral $\bar{K}K$ must appear as $K_S K_S$, $K_L K_L$, and $K^+ K^-$ in the ratio 1:1:2. If l is odd, we can find only $K_S K_L$ and $K^+ K^-$, in equal numbers (Goldhaber *et al.*, 1958; Inglis, 1961).

Table II and the $\bar{q}q$ model

First we want to note the parity of a $\bar{q}q$ state. Spatial exchange X_l has eigenvalue $(-1)^l$, but an extra minus sign enters into the parity of fermion-antifermion (see Appendix II):

$$P = -(-1)^l. \quad (12)$$

For the $\bar{q}q$ model it is often convenient to multiply (11a) and (12), so that l cancels and we have

$$C_n P = -(-1)^S. \quad (13)$$

Thus for the singlets

$${}^1S_0, {}^1P_1, \dots C_n P = -1. \quad (13a)$$

and for the triplets

$${}^3S_1, {}^3P_{0,1,2}, \dots C_n P = +1. \quad (13b)$$

With Eqs. (12) through (13) we can construct Table II (similar to Table III of Goldhaber, 1968). In an attempt to make the logic easy to follow we have put in much redundancy.

Do not confuse the two different meanings of the word "abnormal" on the table. Its first use is in the connection between J and P . We call "normal" the series $J^P = 0^+, 1^-, 2^-, \dots = N$; and "abnormal" the series $J^P = 0^+, 1^-, 2^+, \dots = A$. Its second use is to describe the relation to the eigenvalue of C (or C_n) and J^P . If the sign of C can be explained in terms of a quark-antiquark model ($\bar{q}q$), as in fact it can for all known mesons, we say that C is "normal"; otherwise we call it "abnormal." At the bottom of the table we list such abnormal states, all waiting to be discovered.

As a final remark on Table II, we point out that (except for one special case) these abnormal C states have normal J^P and $CP = -1$. In order to demonstrate this we made a separate column which displays with a subscript normal and abnormal J^P . It is then easy to see that the $J^P = A$ mesons come from both singlet and triplet $\bar{q}q$ states, each with a different value of CP ; $J^P = N$ cannot come from singlets, and so cannot have $CP = -1$. The reason for the special case of course is that there is no 3S state with the same J^P as 1S_0 .

VIII. NOTES ON BARYON TABLE

Just as we did for mesons, we identify baryon states by a single symbol which specifies atomic number ($A=1$), hypercharge Y , and isospin I , but for baryons no attempt has been made to attach a subscript about

TABLE II. $I^G(J^P)$ of mesons from $\bar{q}q$ model. For the distinction between abnormal J^P and abnormal C, see text. $I=\frac{1}{2}$ states share the same values of J^P as the $I=0$ and 1 states shown, but are not eigenstates of G . The middle column, which gathers together $(J^P)_N$ or ${}_A CP$, is redundant and serves only to clarify the logic.

Parity	$\bar{q}q$ State		Normal or abnormal (J^P) _N CP	$I^G(J^P)C_n$	Examples and comments
	CP	CP			
Parity -	-	+	$(0^-)_{A^-}$	$\begin{cases} 0^+(0^-)+ \\ 1^-(0^-)+ \end{cases}$	η, η' π
			$(1^+)_{N^+}$	$\begin{cases} 0^-(1^-)- \\ 1^+(1^-)- \end{cases}$	ω, ϕ ρ
Parity +			$(1^+)_{A^-}$	$\begin{cases} 0^-(1^+)- \\ 1^+(1^+)- \end{cases}$	A1
			$(0^+)_{N^+}$	$\begin{cases} 0^+(0^+)+ \\ 1^-(0^+)+ \end{cases}$	$\eta_N(1070)$ $\pi_N(1016)$
			$(1^+)_{A^+}$	$\begin{cases} 0^+(1^+)+ \\ 1^-(1^+)+ \end{cases}$	B
			$(2^+)_{N^+}$	$\begin{cases} 0^+(2^+)+ \\ 1^-(2^+)+ \end{cases}$	f, f' A2
Parity -			$(2^-)_{A^-}$	$\begin{cases} 0^-(2^-)+ \\ 1^+(2^-)+ \end{cases}$	Regge recurrence of ${}^1S_0, 0^-$
			$(1^-)_{N^+}$	same as 3S_1	
			$(2^-)_{A^+}$	$\begin{cases} 0^+(2^-)- \\ 0^-(2^-)- \end{cases}$	Regge recurrence of abnormal C, $J^P=0^-$, CP = +1
			$(3^-)_{N^+}$	$\{ J > 2$	
Parity +			$(3^+)_{A^-}$	$\{ J > 2$	
			$(2^+)_{N^+}$	same as 3P_2	
			$(3^+)_{A^+}$	$\{ J > 2$	
			$(4^+)_{N^+}$	etc.	

ABNORMAL C STATES THAT CANNOT COME FROM $\bar{q}q$ MODEL

Abnormal C states Have no $\bar{q}q$ model	$(0^-)_{A^+}$	$\begin{cases} 0^-(0^-)- \\ 1^+(1^-)- \end{cases}$	All except $J^P = 0^-$ are $J^P = \text{normal}$, CP = -1
	$(1^-)_{N^-}$	$\begin{cases} 0^+(1^-)+ \\ 1^-(1^-)+ \end{cases}$	
	$(0^+)_{N^-}$	$\begin{cases} 0^-(0^+)- \\ 1^+(0^+)- \end{cases}$	
	$(2^+)_{N^-}$	$\begin{cases} 0^-(2^+)- \\ 1^+(2^+)- \end{cases}$	
	$(3^-)_{N^-}$	$\begin{cases} 0^+(3^-)+ \\ 1^-(3^-)+ \end{cases}$	

J and P . The symbols are

Z_I for $Y=2$,	$I=0, 1$;
N for $Y=1$,	$I=\frac{1}{2}$;
Δ for $Y=1$,	$I=\frac{1}{2}$;
Λ for $Y=0$,	$I=0$;
Σ for $Y=0$,	$I=1$;
Ξ for $Y=-1$,	$I=\frac{1}{2}$;
Ω for $Y=-2$,	$I=0$.

For the lowest-mass state of each Y and I we use the symbol standing alone; mass is in parentheses [i.e., $N(1688)$, $\Lambda(1405)$, $\Sigma(1770)$, etc.]. The J^P assignment is reported in the table as $\frac{1}{2}^+$, $\frac{3}{2}^-$, $\frac{5}{2}^+$, etc., and also by the symbols P_{11} , D_{13} , F_{15} , which refer to the partial-wave amplitude where the resonant state occurs (the first subscript refers to the isospin state).

Most of the N , Δ , Λ , and Σ with $M < 2000$ MeV have been discovered either in phase-shift analysis or partial-wave analysis. Masses and widths of most of these states are dependent on the data and on the model used by the different groups that performed these analyses; therefore, we do not quote an error, but only the most plausible values of M and Γ .

Resonances with mass $M > 2000$ MeV have been detected primarily in total cross section experiments. Any bump in the total cross section of size σ_{res} at the value of the resonant mass gives information on the elasticity x_e and the J assignment of the resonance through the expression

$$\sigma_{\text{res(tot)}} = 4\pi\lambda^2(J + \frac{1}{2})x_e.$$

If J and x_e are not separately known, the product $(J + \frac{1}{2})x_e$ for the resonance is given in the baryon table.

IX. PROCEDURES FOR TREATING THE DATA

A. General Procedures

Except for trivial cases, all branching ratios and rate measurements are analyzed by computer program AHR. This program makes a simultaneous least-squares fit to all the data, and outputs the partial-decay fractions \bar{P}_i , widths \bar{W}_i , and their error matrix.

The original version of AHR was written by J. Peter Berge. It is documented separately, and we wish here only to give the simplest nontrivial example that permits us to comment on the error matrix and the scale factor.

Assume that a state has only three partial decay fractions, P_1 , P_2 , and P_3 ($\sum P_i = 1$), which have been measured in four different ratios, $R_1 = P_1/P_2$, $R_2 = P_1/P_3$, $R_3 \dots$, $R_4 \dots$. Further assume that *each* ratio has been measured by N experiments (we designate each experiment with a greek subscript, e.g., $R_{1\alpha}$). Then AHR finds

the best values of P_1 , P_2 , and P_3 by minimizing χ^2 , namely

$$\chi^2 = \sum_{r=1}^4 \left\{ \sum_{\alpha=1}^N \left[\frac{R_{r\alpha} - R_r(P_1, P_2, P_3)}{\delta R_{r\alpha}} \right]^2 \right\}. \quad (14)$$

In addition to the fitted values \bar{P}_i , the program calculates an error matrix $\delta\bar{P}_i \delta\bar{P}_j$. We tabulate the diagonal elements $\delta\bar{P}_i = (\delta\bar{P}_i \delta\bar{P}_i)^{1/2}$ (except that some of the errors are "scaled." See the following Section IX.B). But if any of the correlations $c_{ij} = \delta\bar{P}_i \delta\bar{P}_j / (|\delta\bar{P}_i| |\delta\bar{P}_j|)$ is $> \frac{1}{2}$, we insert warnings in the listings, except for the obvious binomial cases like charged vs neutral Λ decay.

Two further comments on the example above:

(1) If partial widths had been reported along with the partial fractions, we would have entered them in our listings as W_i ; AHR would then introduce another parameter, the total rate Γ , with the condition that $\sum \Gamma_i = \Gamma$.

(2) Note that we do *not* allow for correlations between input data. We *do* try to pick those ratios and widths which are as independent and as close to the original data as possible.

When *inequalities* are reported, on the first iteration we ignore them; we then check to see if the weighted average of the other data violates the inequality. If an upper limit is violated, we change the input data: $< x \rightarrow 0 \pm x$. If a lower limit is violated, one cannot always invoke such a simple prescription, and each case must be handled individually.

✱ In *asymmetric* errors, we use a continuous function of $\delta(P)^+$ and $\delta(P)^-$ in the fitting. When no errors are reported, we merely list the data for inspection.

Hyperon decay parameters

The program AHR handles any type of input, α , Φ , Δ , β , or γ , according to the definitions of Sec. VI. If for a particular hyperon decay there are data for more than two of the decay parameters, they are analyzed by using the constraint

$$\alpha^2 + \beta^2 + \gamma^2 = 1.$$

Conversion of mean lives to rates

An experimenter has a choice of reporting a mean life or a rate. Suppose he has an infinitely large bubble chamber; then he can report a mean time

$$\tau = N^{-1} \sum t_i,$$

where N is the total number of decays observed, and t_i is the elapsed proper time for each decay.

Alternatively he can report a rate

$$\Gamma = N / \sum t_i.$$

If his errors are large it is probably because N is small. In that case one can see that the distribution of rate Γ ,

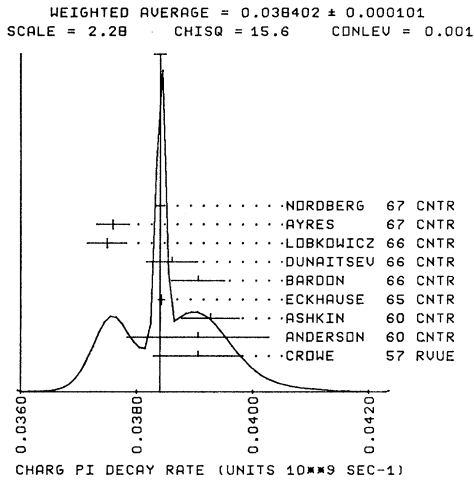


FIG. 3. Typical ideogram: π^\pm decay rates. Results are usually published as mean lives τ , but we average rates, $\Gamma = 1/\tau$, because rates are more normally distributed. The rms average $\bar{\Gamma} = (38.40 \pm 0.10) 10^6 \text{ sec}^{-1}$ is drawn as a vertical line, with an error flag at the top scaled up by a scale factor $S = 2.3$. (It is easily seen that even after scaling, this final result is not a satisfactory statement of the situation.) Only four experiments, indicated by + error flags, were precise enough to satisfy Eq. (15) and be accepted in the calculation of the scale factor. The less precise experiments were included in the calculation of $\bar{\Gamma}$ but not of scale; they have \perp flags.

with N in the numerator, should be fairly Poisson. But the distribution of mean life τ , with N in the denominator, will be badly skewed. Accordingly, we have inverted all mean lives before averaging data or making ideograms.

B. χ^2 Scale Factor

When we calculate the weighted average \bar{x} , we also calculate the χ^2 that all the measurements of x agree. If there are N experiments, each with properly estimated errors normally distributed, the average value of χ^2 should be $N - 1$. If χ^2 is much larger than $N - 1$, we average the data even though this may not be warranted. But we plot an ideogram (see Fig. 3) to help the reader decide which data to reject. He can then make his own selected average. However, if χ^2 is not much greater than $N - 1$, and we cannot select a single bad experiment, we can still be conservative by the following approach: Instead of rejecting one culprit, we can assume that all experimentalists underestimated their errors by the same factor (which is, of course, $[\chi^2 / (N - 1)]^{1/2} \equiv \text{SCALE}$). If this were true, we should enlarge the output error $\delta(\bar{x})$ by SCALE.

In fact, this is exactly what we do. This scaling approach is already common practice in bubble-chamber experiments, where track distortion is not fully understood. For bubble-chamber data it can be justified. For this compilation, it has all the disadvantages of penalizing a whole class of students because of one naughty

child, but (like the schoolmaster) we sometimes know of no other simple solution.

If all the experiments have errors of about the same size, the above (straightforward) procedure for calculating SCALE is carried out. If, however, we are to combine experiments with widely varying errors, we must modify the procedure slightly. This is because it is the more precise experiments that most influence not only the average value \bar{x} , but also the error $\delta(\bar{x})$. Now, on the average, the low-precision experiments each contribute about unity to *both* the numerator and the denominator of SCALE, hence the χ^2 contribution of the sensitive experiments is diluted, i.e., reduced. Therefore, we evaluate SCALE by using *only* experiments for which the errors are not much greater than those of the more precise experiments. Explicitly, to calculate SCALE we use only the most sensitive experiments, i.e., those with errors less than δ_0 , where the ceiling δ_0 is (arbitrarily) chosen to be

$$\delta_0 = 3N^{1/2}\delta(\bar{x}). \quad (15)$$

Here $\delta(\bar{x})$ is the unscaled error of the mean of all the experiments. Note that if each experiment had the same error, δ_i , then $\delta(\bar{x})$ would be $\delta_i/N^{1/2}$, so each individual experiment would be well under the ceiling on SCALE.

This scaling approach has the property that if there are two values with comparable errors separated by much more than their stated errors (with or without a number of other experiments of lower accuracy) the error on the mean value, $\delta(\bar{x})$ is increased so that it is approximately half the interval between the two discrepant values.

We wish to emphasize the fact that our scaling procedures for *errors* in no way affect central values. In addition, if one wishes to recover the unscaled errors, $\delta(\bar{x})$, he need only divide the given errors by the SCALE factor given for that error.

A slightly *different approach* must be taken when a number of different (but related) quantities enter the *constrained* averaging program AHR.

According to our simple example, which led to Eq. (14), the double sum for χ^2 is summed over experiments, leaving a single sum over ratios

$$\chi^2 = \sum_{r=1}^4 \{x_r^2\}. \quad (16)$$

From these x_r^2 's we form SCALE factors (just as before), i.e.,

$$(\text{SCALE})_r^2 = x_r^2 / \langle x_r^2 \rangle,$$

and if any $(\text{SCALE})_r$ is greater than ≈ 1 , all N of the measurements of that particular ratio are equally penalized by having their errors increased by SCALE. Program AHR then recycles on all the data, those with errors unchanged as well as those with errors increased.

We then get new values for $\delta(\bar{P}_i)$, i.e., the *errors* of the partial-decay modes. These errors are then folded with the shifts in the central values, to give the tabulated errors, i.e.,

$$\delta(\bar{P}_i)_{\text{tab}} = [\delta(\bar{P}_i')^2 + (\bar{P}_i - \bar{P}_i')^2]^{1/2},$$

where \bar{P}_i is the fitted value of the i th partial decay mode before scaling, \bar{P}_i' is its value after scaling, and $\delta(\bar{P}_i')$ is the error in \bar{P}_i' . The SCALE factors we finally list in such cases are defined by

$$(\text{SCALE})_i = \delta(\bar{P}_i)_{\text{tab}} / \delta(\bar{P}_i').$$

However, in line with our policy of not letting SCALE affect the central values, we give the values of \bar{P}_i obtained from the original (unscaled) fits. [The differences between the \bar{P}_i 's calculated with either the scaled or the unscaled errors are, of course, always within the tabulated errors, $\delta(\bar{P}_i)_{\text{tab}}$.]

X. NOTES ON THE DATA CARD LISTINGS

For each quantity that has been measured by more than one experiment, we have added a line to the data listings, giving the average value and scaled error for that quantity. In addition, if a constrained fit has been made, we have added a line giving the constrained result.

We illustrate with an example: Assume a particular particle has only three decay modes, P_1 , P_2 , and P_3 ($\sum P_i = 1$). Now suppose that three independent branching ratios $R_1 = P_1/P_2$, $R_2 = P_1/(P_1 + P_2)$, $R_3 = \dots$, have been measured (the problem is then overconstrained). From these data our fitting program, AHR, calculates two types of results:

(1) P_i^{fitted} with errors (which have always appeared on the tables).

(2) R_i^{fitted} with errors (which now appear in the listings, since there is no place for them in the tables).

We also give the straight, unfitted average for each R_i .

On most data cards punched since May 1966, we have indicated the date punched. On cards which have been added since our most recent edition (Rosenfeld, 1968), we have put an asterisk after the date.

For two-body decays our computer program calculates the Q value and the momentum of decay. For three-body decays, it calculates Q , and then calculates the maximum momentum that any of the three particles can have.

If skewed errors are reported, as is often the case for mean-life experiments, both the fields "Error+" and "Error-" are used. If there is no entry in "Error-," then the errors are symmetric.

Some of the data on the mass of the ρ , for example, are followed at the far right by the entries +, -, or 0, with the sign depending on whether the experiment involved ρ^+ , ρ^- , or ρ^0 .

In the spring of 1966 we removed some of the obsolete data and references. They may be found in our earlier editions, e.g., Rosenfeld (1965).

Starting in September 1966, we decided to punch cross-section information on some rare mesons, providing the information is new and easily available in papers we are processing anyway. We do not check or average these cross sections as carefully as our other input. This is an experiment, pursued randomly by some of us; absence of cross-section cards for a given paper does not imply absence of such information in that paper.

XI. HOW TO OBTAIN WALLET SHEETS, DATA BOOKLETS, AND APPOINTMENT BOOKLETS

Extra copies of the tables from this edition are available from CERN or LRL-Berkeley, both in the form of 7×10-in. wallet sheets and 3×5-in. booklets. We can also supply 3×5-in. pocket diaries for physicists, which cover the academic year starting September 1968. We occasionally receive requests for multiple copies for classroom use; we can supply wallet sheet sets for 5¢ each, data booklets for 10¢ each, or the data booklet plus diary in plastic cover for 50¢.

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EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED ON THE DATA CARDS

Measurement Technique (TECH)

- CC Cloud chamber
- CNTR Counters, electronics
- EMUL Emulsions
- HBC Hydrogen bubble chambers
- HEBC Helium bubble chambers
- DBC Deuterium bubble chambers
- PBC Propane bubble chambers
- XBC Heavy liquid bubble chambers
- SPRK Spark chambers
- MMS Missing mass spectrometer
- RVUE Review of previous experimental data

Journals

- ADVP Advances in Physics
- ANP Annals of Physics
- ARNS Annual Reviews of Nuclear Science
- BAPS Bulletin of the American Physical Society
- JETP English Translation of Soviet Physics JETP
- NC Nuovo Cimento
- NP Nuclear Physics
- PL Physics Letters
- PPSL Proceedings of the Physical Society of London
- PR Physical Review
- PRL Physical Review Letters
- PRSL Proceedings of the Royal Society of London
- RMP Reviews of Modern Physics
- ZPHY Zeitschrift für Physik

The following abbreviations refer to proceedings of Conferences.

- AIX International Conference on Elementary Particles, Aix-en-Provence, 1961
- ARGONNE International Conference on Weak Interactions, Argonne National Laboratory, 1965
- ATHENS Athens Topical Conference on Recently Discovered Resonant Particles, Ohio University, 1963
- BALATON Symposium on Weak Interactions, Balatonvilagos, Hungary, 1966
- BERKELEY International Conference on High Energy Physics, 1966
- BNL International Conference on Fundamental Aspects of Weak Interactions, Brookhaven National Laboratory, 1963
- BOULDER Symposium on Strong Interactions 1965
- CERN International Conference on High Energy Physics, 1958 and 1962
- CORAL GABLES Conference on Symmetry Principles at High Energy, 1964 and 1965
- DESY Internation Symposium on Electron and Photon Interactions at High Energies, Hamburg, 1965
- DUBNA International Conference on High Energy Physics, 1964
- KIEV Ninth Annual International Conference on High Energy Physics, 1959
- OXFORD International Conference on Elementary Particles, 1965
- ROCH Fifth (Sixth, Seventh) Annual Rochester Conference on High Energy Nuclear Physics 1955 (1956, 1957). Annual International Conference on High Energy Physics, Rochester, 1960.
- SIENA International Conference on Nucleon Structure, 1963.

Finally,

- BNL Brookhaven National Laboratory
- CU Columbia University, includes Nevis Reports
- NYO New York Operations Office, AEC
- UCRL Lawrence Radiation Laboratory (University of California)
- etc. refer to unpublished reports of the Author's Institution.

Beginning in January 1969, when we must abbreviate an institutional name on the data cards we will use the following (which is the list used by the HERA group at CERN):

- | | | |
|--|---|---|
| <p>AACH AACHEN,GERMANY</p> <p>AERE HARWELL,BERKS,ENGL.</p> <p>AMES AMES, IOWA,USA</p> <p>AM. ARGONNE,ILL,USA</p> <p>ANNA ANN ARBOR,MICH,USA</p> <p>ARIZ TUCSON,ARIZ,USA</p> <p>ATEM ATHENS,GREECE</p> <p>ATHO ATHENS,GREECE,USA</p> <p>BARI BARI, ITALY</p> <p>BELG BRUXELLES,BELGIUM</p> <p>BERG BERGEN,NORWAY</p> <p>BERK BERKELEY,CAL,USA</p> <p>BERL ZEUTHEN,BERLIN,GERM</p> <p>BERN BERN, SWITZERLAND</p> <p>BGNA BOLOGNA,ITALY</p> <p>BIRM BIRMINGHAM,ENGLAND</p> <p>BNL UPTON LI,NY,USA</p> <p>BOHR COPENHAGEN,DENMARK</p> <p>BONN BONN, GERMANY</p> <p>BRAN WALTHAM,MASS,USA</p> <p>BROW PROVIDENCE,RH,USA</p> <p>BRUX BRUXELLES,BELGIUM</p> <p>BUFF BUFFALO,NY,USA</p> <p>CAEN CAEN, FRANCE</p> <p>CALT PASADENA,CAL,USA</p> <p>CARN PITTSBURGH,PA,USA</p> <p>CASE CLEVELAND,OHIO,USA</p> <p>CAVE CAMBRIDGE,ENGLAND</p> <p>CCNY NEW YORK,NY,USA</p> <p>CDEF PARIS,FRANCE</p> <p>CEA CAMBRIDGE,MASS,USA</p> <p>CERN GENEVA,SWITZERLAND</p> <p>CHIC CHICAGO,ILL,USA</p> <p>COLO BOULDER,COL,USA</p> <p>CORN NEW YORK,NY,USA</p> <p>CORN ITHACA,NY,USA</p> <p>DARE DARESBURY,ENGLAND</p> <p>DESY HAMBURG,GERMANY</p> <p>DUKE DURHAM,ENGLAND</p> <p>DURM DURHAM,ENGLAND</p> <p>EFIN CHICAGO,ILL,USA</p> <p>EPOL PARIS,FRANCE</p> <p>ETHZ ZURICH,SWITZERLAND</p> <p>FIRZ FIRENZE,ITALY</p> <p>FLAS TALLAHASSEE,FLA,USA</p> <p>FLOP GAINESVILLE,FLA,USA</p> <p>FRAS FRASER,ITALY</p> <p>GENO GENOVA,ITALY</p> <p>GEVA GENEVA,SWITZERLAND</p> <p>GLAS GLASGOW,SCOTLAND</p> <p>GRAZ GRAZ, AUSTRIA</p> <p>HAMB HAMBURG,GERMANY</p> <p>HARV CAMBRIDGE,MASS,USA</p> <p>HAWA HONOLULU,HAWAII,USA</p> <p>HEID HEIDELBERG,GERMANY</p> <p>HELH HELSINKI,FINLAND</p> <p>URBANA,ILL,USA</p> <p>IND BLOOMINGTON,IND,USA</p> <p>IOWA IOWA CITY,IOWA,USA</p> <p>IPN ORSAY,FRANCE</p> <p>IRAD PARIS,FRANCE</p> <p>IRVN IRVINE,CAL,USA</p> <p>ITEP MOSCOW,USSR</p> <p>JMOP BALTIMORE,MG,USA</p> <p>JINR DUBNA,USSR</p> <p>KARL KARLSRUHE,GERMANY</p> <p>KRAK KRAKOW,POLAND</p> <p>LANC LANCASTER,ENGLAND</p> <p>LEBO MOSCOW,USSR</p> <p>LEID LEIDEN,NETHERLANDS</p> <p>LIVP LIVERPOOL,ENGLAND</p> <p>LOIC LONDON,ENGLAND</p> <p>LOUC LONDON,ENGLAND</p> | <p>TECHNISCHE UNIV. AACHEN</p> <p>ATOMIC ENERGY RESEARCH ESTABLISHMENT</p> <p>ARGONNE NAT. LAB.</p> <p>UNIV. OF MICHIGAN</p> <p>UNIV. OF ARIZONA</p> <p>NUCLEAR RESEARCH CENTRE DEMOKRITOS</p> <p>ATHO UNIV.</p> <p>UNIV. DEGLI STUDI DI BARI</p> <p>INSTITUT INTERUNIVERSITAIRE DES SCIENCES NUCLEAIRES</p> <p>PHYSIK INSTITUTT</p> <p>UNIV. OF CALIFORNIA</p> <p>FORSCHUNGSSTELLE FÜR PHYS. HOHER ENERGIEN DER DAW</p> <p>UNIV. OF BIRMINGHAM</p> <p>UNIV. DI BOLOGNA</p> <p>BIRMINGHAM UNIV. LAB.</p> <p>BROOKHAVEN UNIV.</p> <p>NIELS BOHR INSTITUTE</p> <p>BROWN UNIV.</p> <p>BRANDEIS UNIVERSITY</p> <p>UNIV. LIBRE DE BRUXELLES</p> <p>STATE UNIV. OF NEW YORK AT BUFFALO</p> <p>LAB. OF PHYS. CORPUSCULAIRE</p> <p>CALIFORNIA INST. OF TECHNOLOGY</p> <p>CARNEGIE INST. OF TECHNOLOGY</p> <p>CASE WESTERN RESERVE UNIV.</p> <p>CAVENDISH LAB.,CAMBRIDGE UNIV.</p> <p>CITY COLL. OF THE CITY OF NEW YORK</p> <p>COLLEGE DE FRANCE</p> <p>CAMBRIDGE ELECTRON ACCELERATOR</p> <p>EUROPEAN ORGANISATION FOR NUCL. RESEARCH.</p> <p>UNIV. OF CHICAGO</p> <p>UNIV. OF COLORADO</p> <p>COLUMBIA UNIV.</p> <p>CORNEL UNIV.</p> <p>DARESBURY NUCL. PHYS. LAB.</p> <p>DESY'SCHES ELEKTRONEN-SYNCHROTRON</p> <p>DUKE UNIV.</p> <p>UNIV. OF DURHAM</p> <p>ENRICO FERMI INST. FOR NUCL. STUDIES</p> <p>ECOLE POLYTECHNIQUE</p> <p>EDGENÖSSISCHE TECHNISCHE HOCHSCHULE</p> <p>FLORIDA STATE UNIV.</p> <p>UNIV. OF FLORIDA</p> <p>LABORATORIO NAZIONALE DEL SINCROTRONE</p> <p>UNIV. DI GENOVA</p> <p>UNIV. OF GENEVA</p> <p>UNIV. OF GLASGOW</p> <p>UNIV. OF GRAZ</p> <p>UNIV. OF HAWAII</p> <p>UNIV. HEIDELBERG</p> <p>HELSINKI UNIV. OF TECHNOLOGY</p> <p>UNIV. OF ILLINOIS</p> <p>UNIV. OF INDIANA</p> <p>UNIV. OF IOWA</p> <p>INST. DE PHYS. NUCLEAIRE</p> <p>INSTITUTE DU RADIUM</p> <p>UNIV. OF IRVINE</p> <p>INST. FOR THEOR. AND EXPERIM. PHYS.</p> <p>JOHNS HOPKINS UNIVERSITY</p> <p>JOINT INST. FOR NUCL. RESEARCH</p> <p>TECHNISCHE UNIV. KARLSRUHE</p> <p>JAGELLONIAN UNIV.</p> <p>LANCASTER UNIV.</p> <p>LEBEDEV PHYSICS INSTITUTE</p> <p>INST. LORENTZ</p> <p>LIVERPOOL UNIV.</p> <p>IMPERIAL COLL. OF SCIENCE AND TECHNOLOGY</p> <p>UNIV. COLL.</p> | <p>LOUISIANA STATE UNIV.</p> <p>LAWRENCE RADIATION LAB.,UNIV. OF CALIFORNIA</p> <p>UNIV. I LUND</p> <p>JUNTA DE ENERGIA NUCLEAR</p> <p>MANHATTAN COLL.</p> <p>UNIV. MAINZ</p> <p>UNIV. OF MASSACHUSETTS</p> <p>MC GILL UNIV.</p> <p>UNIV. OF MANCHESTER</p> <p>MICHIGAN STATE UNIV.</p> <p>UNIV. DI MILANO</p> <p>MASSACHUSETTS INST. OF TECHNOLOGY</p> <p>MAX-PLANCK-INST. FÜR PHYSIK UND ASTROPHYSIK</p> <p>NATIONAL ACCELERATOR LAB.</p> <p>UNIV. DI NAPOLI</p> <p>NORTHWESTERN UNIV.</p> <p>NOTRE DAME UNIV.</p> <p>NORTHEASTERN UNIV.</p> <p>NEVIS LABS,NY,USA</p> <p>UNIV. OF NJMAGEN</p> <p>UNIV. OF NJMAGEN</p> <p>UNIV. OF NORTHWESTERN</p> <p>OHIO STATE UNIV.</p> <p>UNIV. OF OREGON</p> <p>OAK RIDGE NAT. LAB.</p> <p>UNIV. DE PARIS, FACULTE DES SCIENCES</p> <p>UNION CARBIDE NUCL. DIVISION</p> <p>OSLO UNIV.</p> <p>NATIONAL RESEARCH COUNCIL</p> <p>UNIV. OF PADOVA</p> <p>UNIV. OF PENNSYLVANIA</p> <p>UNIV. DI PISA</p> <p>UNIV. OF PITTSBURGH</p> <p>PRINCETON UNIV.</p> <p>PRINCETON-PENNSYLVANIA PROTON ACCELERATOR</p> <p>PURDUE UNIV.</p> <p>WEIZMANN INST. OF SCIENCE</p> <p>RUTHERFORD HIGH ENERGY LAB. (ENGLAND)</p> <p>RESEARCH ESTABLISHMENT RISO</p> <p>UNIV. OF CALIFORNIA</p> <p>UNIV. OF ROCHESTER</p> <p>UNIV. DEGLI STUDI DI ROMA</p> <p>UNIV. OF SARUTGERS</p> <p>INSTITUT DES ETUDES NUCLEAIRES SACLAY (FRANCE)</p> <p>UNIV. OF SOUTHAMPTON</p> <p>STANFORD LINEAR ACCELERATOR CENTER</p> <p>STANFORD UNIV.</p> <p>SUSSEX UNIV.</p> <p>WASHINGTON UNIV.</p> <p>STOCKHOLM UNIV.</p> <p>UNIV. OF STONY BROOK (USA)</p> <p>CENTRE DES RECHERCHES NUCLEAIRES</p> <p>SUSSEX UNIV.</p> <p>SYRACUSE UNIV.</p> <p>UNIV. OF TENNESSEE</p> <p>UNIV. OF TORONTO</p> <p>UNIV. DI TORINO</p> <p>UNIV. OF TRIESTE</p> <p>TUFTS UNIV.</p> <p>UNIV. OF CALIFORNIA</p> <p>UNIV. OF CALIFORNIA (USA)</p> <p>UNIV. OF CALIFORNIA</p> <p>UNIV. OF CALIFORNIA,SAN DIEGO</p> <p>UNIV. OF YAMAH</p> <p>UNIV. OF UTAH (USA)</p> <p>VANDERBILT UNIV.</p> <p>UNIV. OF WARSAW</p> <p>UNIV. OF WASHINGTON</p> <p>WIEN UNIV.</p> <p>UNIV. OF WISCONSIN</p> <p>YALE UNIVERSITY</p> |
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Change in Notation. The subscript N stands for "normal spin-parity series" (J^P=0⁺, 1⁻, 2⁺, ...), A for "abnormal" (J^P=0⁻, 1⁺, 2⁻, ...). Quantities in italics have changed by more than one (old) standard deviation since January, 1968.

Main table with columns: Symbol (J^P), I^G(J^P)C_N, Mass M (MeV), Width Γ (MeV), M²(a) ± M (GeV)², Mode, Fraction %, Q, P of P_{max} (b) (MeV/c). Rows include mesons like π, η, ρ, ω, η', φ, η(958), δ, η(1016), φ(1019), η₀, A1, B, f, D, A2, A2', E, f'.

Table with columns: K*(494), K*(498), K*(890), K*(1240), K*(1420), K*(1780), K*(1420), K*(1780), K*(1420), K*(1780). Rows include various meson states and their properties.

The following bumps, excluded above, are listed among the data cards: σ(410); η₀(720); H(990); A1.5(1170); ρ(1410); K₀K₀(1440); π/ρ(1550); φ(1650); R(1750); η or ρ(1830)-4π; φ or ρ(1830)-ωππ; S(1930); T(2200); N₁(2380); U(2380); K(725); K_N(1100-1200); K_A(1=3/2)(1175); K_A(1=3/2)(1265); K_A(1=1/2)(1280); K_N(1=1/2)(1660); K*(2240)→πN. (See note (p).)

* Quoted error includes scale factor S = √(N-1). See footnote to Table S.
† Square brackets indicate a subtraction of the previous (unbracketed) decay mode.
‡ This is only an educated guess; the error given is larger than the error of the average of the published values (see listings for the latter).
(a) ΓM is the half-width of the resonance when plotted against M².
(b) For decay modes into ≥ 3 particles P_{max} is the maximum momentum that any of the particles in the final state can have. The moments have been calculated using the averaged central mass values, without taking into account the widths of the resonances.
(c) The values given for M(ρ) and Γ(ρ) and their errors are not average values from various experiments, but rather are intended to give the range where we believe the actual values are most likely to fall. Contrast the results tabulated in this note:
Energy-independent width is a narrow-resonance approximation which tends to give lower mass and width. Thus an analysis of all e⁺e⁻→π⁺π⁻ data with Omnès' formula and energy-dependent width gives M = 770±6 MeV, Γ = 122±6 MeV (M, Roos, priv. comm.).
(d) The quoted value of the rate ρ⁰→e⁺e⁻ is the average from two e⁺e⁻→π⁺π⁻ experiments (which alone give an average of (0.006±0.0006)%) and one photoproduction experiment of high mass resolution. Interference effects with a decay are hoped to be small.
(e) Warning: The values given in the literature, and in our table, for the rate ρ⁰→μ⁺μ⁻ may be somewhat too high, due to possible interference with ω decay.

(Footnotes continued on page 24)

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Particle or resonance †	$I(J^P)$ — estab.	Beam π, K (BeV) (BeV/c)	Mass (MeV)	Γ (MeV)	$M^2 \pm \Gamma M$ (BeV ²)	Partial decay modes			$4\pi k^2$ (mb)
						Mode	Fraction (%)	p or p_{max}^{\dagger} (MeV/c)	
p	$1/2(1/2^+)$		938.3 939.6		0.880 0.883				
N ⁺ (1470)	$1/2(1/2^+)$ F ₁₁	T=0.52p p=0.64	1460	260	2.13 ± 0.38	N _{rr} [NO] ^a [Δn] ^a	55 45 271 162	412 360 271 162	28.8
N (1518)	$1/2(3/2^-)$ D ₁₃	T=0.60 p=0.73	1515	115	2.30 ± 0.17	N _{rr} [Δ(1236) _{rr}] ^a N _{rr}	50 50 219 137	452 406 219 137	23.9
N (1550)	$1/2(1/2^-)$ S ₁₁	T=0.62 p=0.75	1525	80	2.33 ± 0.12	N _{rr} N _{rr} N _{rr}	35 65 414	450 161 414	23.1
N (1680)	$1/2(5/2^-)$ D ₁₅	T=0.88 p=1.01	1675	145	2.81 ± 0.24	N _{rr} N _{rr} [Δ(1236) _{rr}] ^a ΔK N _{rr}	45 55 361 161 374	564 530 361 209 374	15.4
N (1688)	$1/2(5/2^+)$ F ₁₅	T=0.90 p=1.03	1690	125	2.86 ± 0.21	N _{rr} N _{rr} [Δ(1236) _{rr}] ^a ΔK N _{rr}	60 40 374 234 390	574 540 374 234 390	14.9
N ⁺ (1710)	$1/2(1/2^-)$ S ₁₁	T=0.95 p=1.08	1715	280	2.94 ± 0.48	N _{rr}	65	590	14.0
N ⁺ (1750)	$1/2(1/2^+)$ F ₁₁	T=1.08 p=1.21	1785	405	3.19 ± 0.72	N _{rr} ΔK	34 seen	636	12.1
N (2190)	$1/2(7/2^-)$ C ₁₇	T=1.94 p=2.07	2190	300	4.80 ± 0.66	N _{rr}	35	894	6.21
N (2650)	$1/2(?)$	T=3.12 p=3.26	2650	360	7.02 ± 0.95	N _{rr}	(J+1/2) _{rr} =0.45 ^b	1154	3.67
N (3030)	$1/2(?)$	T=4.26 p=4.40	3030	400	9.48 ± 1.21	N _{rr}	(J+1/2) _{rr} =0.05 ^b	1377	2.62
Δ(1236)	$3/2(3/2^+)$ F ₃₃	T=0.195 p=0.304 m ₀ -m ₊₊ = 0.45±0.85 m ₋ -m ₊₊ = 7.9±6.8	1236.0 ±0.6	120 ±2	1.53 ± 0.15	N _{rr} N _{rr} N _{rr}	100 0 -0.6	231 89 262	91.9
Δ(1640)	$3/2(1/2^-)$ S ₃₁	T=0.80 p=0.93	1630	160	2.69 ± 0.26	N _{rr} N _{rr}	25 75	533	17.2
Δ(1690)	$3/2(3/2^-)$ D ₃₃	T=0.87 p=1.00	1670	225	2.79 ± 0.38	N _{rr}	15	560	15.6
Δ(1910)	$3/2(5/2^-)$ F ₃₅	T=1.27 p=1.40	1880	250	3.53 ± 0.47	N _{rr}	20	697	10.1
Δ(1930)	$3/2(1/2^+)$ F ₃₁	T=1.37 p=1.50	1905	300	3.63 ± 0.57	N _{rr}	25	713	9.62
Δ(1950)	$3/2(7/2^-)$ F ₃₇	T=1.39 p=1.52	1940	210	3.76 ± 0.41	N _{rr} ΣK Σ(1385)K Δ(1236) _{rr} Δ(1236) _p	40 2.4 215 50 seen	735 450 215 564	8.90
Δ(2420)	$3/2(11/2^+)$	T=2.50 p=2.64	2420	310	5.86 ± 0.75	N _{rr} N _{rr}	11 > 20	1024 1007	4.67
Δ(2850)	$3/2(?^+)$	T=3.71 p=3.85	2850	400	8.12 ± 1.14	N _{rr}	(J+1/2) _{rr} =0.25 ^b	1266	3.05
Δ(3230)	$3/2(?)$	T=4.94 p=5.08	3230	440	10.4 ± 1.4	N _{rr}	(J+1/2) _{rr} =0.05 ^b	1475	2.24
Λ	$0(1/2^+)$		1115.6		1.24		See Table S		
Λ(1405)	$0(1/2^-)$ S ₀₁	p < 0 K ⁺ p ±5 ^c	1405 ±5 ^c	40 ±10 ^c	1.97 ± 0.06	Σ _{rr}	100	140	
Λ(1520)	$0(3/2^-)$ D ₀₃	p=0.392	1518.8 ±1.5	16 ±2	2.31 ± 0.02	NK ΣK Δ _{rr} Δ _{rr}	45±4 45±4 10±1 0.9±0.2	235 258 251 350	83.6
Λ ⁺ (1670)	$0(1/2^-)$ S ₀₁	p=0.74	1670	25	2.79 ± 0.04	NK Δ _{rr} Σ _{rr}	14 33 45	410 66 387	28.5
Λ ⁺ (1700)	$0(3/2^-)$ D ₀₃	p=0.78	1690	40	2.86 ± 0.07	NK Σ _{rr} Δ _{rr} Σ _{rr}	25 35 20 20	429 403 419 350	26.1
Λ(1815)	$0(5/2^-)$ F ₀₅	p=1.05	1815 ±5 ^c	75 ±10 ^c	3.30 ± 0.14	NK Σ _{rr} Σ(1385) _{rr} Δ _{rr}	65 11 9 1	538 500 359 346	16.7
Λ(1830)	$0(5/2^-)$ D ₀₅	p=1.08	1830	80	3.35 ± 0.15	NK Σ _{rr}	10 35	550 510	16.0
Λ(2100)	$0(7/2^-)$ C ₀₇	p=1.68	2100	140	4.41 ± 0.29	NK Σ _{rr} Δ _{rr} ΣK Δ _{rr}	30 4 3 -1 -10	748 699 617 483 443	8.68
Λ(2350)	$0(?)$	p=2.29 Seen in total c. s.	2350	210	5.52 ± 0.49	NK	(J+1/2) _{rr} =0.6 ^b	913	5.85
Σ	$1(1/2^+)$				1.44		See Table S		
Σ(1385)	$1(3/2^+)$ F ₁₃	p < 0 K ⁺ p S=4.8 ^d | → (-) 1388±3 S=2.1 ^e | (-) 1388±3	(+1189.4 01492.5 -11497.3)	1.92 ±0.05	1.42 ±0.05	Λ _{rr} Σ _{rr}	90±3 10±3	208 117	
Σ(1610)	$1(?)$	p=0.62	1615	65	2.61 ± 0.10	NK Λ _{rr} Σ(1385) _{rr}	small domin. mode seen	355 406 171	37.9
Σ(1660)	$1(3/2^-)$ D ₁₃	p=0.72	1660	50	2.76 ± 0.08	Λ(1405) _{rr} NK	small small for both	197 400	29.9
Σ(1700)	$1(?)$	p=0.80	1700	110	2.89 ± 0.19	Λ _{rr} Σ _{rr}	large not disentangled	470 411	25.1

(Footnotes are on page 24)

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Footnotes for the MESON Table

- (f) Reported values range between 1% and 10%, and depend on assumptions on ρ - ω interference.
- (g) This $\omega \rightarrow e^+e^-$ value is the average from a $\pi^+p \rightarrow e^+e^-n$ experiment (giving $0.0040 \pm 0.0015\%$ [$\pm 0.0014\%$ from possible $\rho\omega$ interference]) and an $e^+e^- \rightarrow \pi^+\pi^-\pi^0$ experiment (giving $0.0085 \pm 0.0016\%$).
- (h) This 0^- meson was named η' on discovery, when it looked as if it completed the 0^- nonet. With the recent evidence that the $E(1420)$ is probably also 0^- , it is no longer clear whether η' or E or both are mixed in with the π , η , K octet; so the name η' may be misleading.
- (i) Empirical limits on fractions for other decay modes of η' (958): $\pi^+\pi^- < 7\%$, $3\pi < 7\%$, $4\pi < 1\%$, $6\pi < 1\%$, $\pi^+\pi^-e^+e^- < 0.6\%$, $\pi^0e^+e^- < 1.3\%$, $\eta e^+e^- < 1.1\%$, $\pi^0\rho^0 < 4\%$, $\pi^0\omega < 8\%$.
- (j) Empirical limits on fractions for other decay modes of $\phi(1019)$: $\pi^+\pi^- < 20\%$, $\eta\gamma < 8\%$, $\eta + \text{neutrals} < 13\%$, $\pi^+\pi^-\gamma < 4\%$, $\omega\gamma < 5\%$, $\rho\gamma < 2\%$.
- (k) Width of $\eta_{0+}(1070) \rightarrow K_S K_S$: Average value from two bubble chamber experiments is $\Gamma = (72 \pm 13)$ MeV, whereas two spark chamber experiments give $\Gamma > 100$ MeV. The latter also allow a scattering length fit. It is not clear whether the reported narrow ($\Gamma \lesssim 25$ MeV) $\pi^+\pi^-$ enhancements near 1070 MeV have anything to do with the $\eta_{0+}(1070)$.
- (l) $\rho\pi$ fraction of 3π mode difficult to distinguish because ρ bands cover most of the Dalitz plot.
- (m) Empirical limits on fractions for decay modes of $B(1220)$: $\pi\pi < 30\%$, $KK < 2\%$, $4\pi < 50\%$, $\phi\pi < 1.5\%$, $\eta\pi < 25\%$, $(KK)^\pm \pi^0 < 8\%$, $K_S K_S \pi^\pm < 2\%$, $K_S K_L \pi^\pm < 6\%$.
- (n) Although the splitting of the A_2 needs further confirmation, we give the results from the two published experiments that have observed a split A_2 . Since most experiments have only seen one, rather wide, A_2 enhancement, we here list its ("combined") properties: $1G(J^P)C_N = 1^-(2^+)_+$; $M = 1297 \pm 10$ MeV ($S=1.8^*$) (δ), $\Gamma = 91 \pm 10$ MeV ($S=1.1^*$) (δ); partial decay modes: $\rho\pi$ $86 \pm 2\%$, KK $2.4 \pm 0.5\%$, $\eta\pi$ $11 \pm 2\%$, $\eta'\pi$ $0.5 \pm 0.4\%$ ($S=2.1^*$); $\pi^+\pi^-\pi^0$ (excl. $\rho\pi$) $< 17\%$.
- (o) There is only a weak indication for a $K^*K + \bar{K}^*K$ mode of the $f'(1514)$. If this mode does not exist, the $K\bar{K}$ branching fraction will have to be reported as $(80 \pm 13)\%$ (rather than $(72 \pm 12)\%$ as given in the table), and $\eta\pi\pi$ as $(20 \pm 13)\%$.
- (p) See the listings for many statistically weak $Y = 0$ bumps with $M \geq 1700$ MeV, seen in bubble chambers. We tabulate here 9 statistically strong bumps seen with a missing mass spectrometer ($\pi^+p \rightarrow p(MM^-)$) or in HBC or counter experiments on NN elastic scattering or total cross sections.

Name	I	M (MeV)	Γ (MeV)	Decay Modes Observed
R1(1630)	≥ 1	1630 ± 15	≤ 21	$1/3 / > 3$ charg. part. $\approx .37/.59/.04$
R2(1700)	≥ 1	1700 ± 15	≤ 30	$1/3 / > 3$ charg. part. $\approx .43/.56/.01$
R3(1750)	≥ 1	1748 ± 15	< 38	$1/3 / > 3$ charg. part. $> .14 / < .80 / .15$
? $NN(1925)$	0, 1	≈ 1925	≈ 10	structure in pp backw. el. scatt.
S(1930)	≥ 1	1929 ± 14	< 35	$1/3 / > 3$ charg. part. $\approx 0/.92/0$
? $NN(1945)$	0, 1	≈ 1945	≈ 22	structure in pp backw. el. scatt.
? $NN(2190)$	1	2190 ± 10	≈ 85	structure in NN total cross section
T(2200)	≥ 1	2195 ± 15	≤ 13	$(MM)^- \rightarrow 3$ charged part. $\approx 94\%$
? $NN(2345)$	1	2345 ± 10	≈ 140	structure in NN total cross section
U(2380)	≥ 1	2382 ± 24	≤ 30	$(MM)^- \rightarrow 1/3 / > 3$ chrgd part. $\approx 30/45/25$
$NN(2380)$	0	2380 ± 10	≈ 140	structure in NN total cross section

There is no evidence on the G, J, or P quantum numbers of these bumps (apart from the suggestion of $l = \text{odd}$ for $NN(1925)$, $l = \text{even}$ for $NN(1945)$), nor is there satisfactory agreement between them and the other bubble chamber claims. Further, the σ_{tot} (NN) bumps are broader than the $(MM)^-$ bumps, and there is no evidence for or against their interpretation as resonances.

- (q) Taken from compilation by T. Ferbel, Proc. 1968 Philadelphia Conf. See the data listings for averages of the values given in the literature. Also see B. French's review of Mesons (Proc. 14th International Conf. High Energy Physics, Vienna (1968), p. 91) for possible differences between M and Γ of charged and neutral $\rho_N(1650)$.
- (r) See note in listings. Some investigators see a broad enhancement in mass ($K\pi\pi$) from 1200 - 1350 MeV, and others see structure. A further bump at 1280 MeV, $\Gamma = 80$ MeV, has been suggested. In light of this confusion, the masses, widths, quantum numbers, and branching ratios are at best tentative. For the mass region 1200 - 1350 MeV, the decay rate into $K^*(890)\pi$ is large, and a $K\rho$ decay is seen. The $K\eta$, $K\omega$ and $K\pi$ rates are less than a few percent.
- (s) This $\eta' \rightarrow \gamma\gamma$ value is from a constrained fit under the assumption that $\eta\pi\pi$, $\pi^+\pi^-\gamma$ (inclusive $\rho^0\gamma$), and $\gamma\gamma$ are the only existing decay modes. Note that direct measurement of the $\eta' \rightarrow \gamma\gamma$ branching fraction gave the slightly different result of $(5.5^{+3.0}_{-3.0})\%$.

Mixing angles from Quadratic SU(3) Mass Formula: 0^- nonet (π, K, η, η') $\theta = 10.4^\circ \pm 0.2^\circ$; alternative 0^- nonet (π, K, η, E) $\theta = 6.2^\circ \pm 0.1^\circ$; 1^- nonet ($\rho(m=765 \pm 15 \text{ MeV}), K^*, \phi, \omega$) $\theta = 39.9 \pm 1.1^\circ$; 2^+ nonet ($A_2, K_N(1420), f', f$) $\theta = 29.9^\circ \pm 2.2^\circ$.

Footnotes for the BARYON Table

- * Quoted error includes an S(scale) factor. See footnote to Table S.
- † For decay modes into ≥ 3 particles p_{max} is the maximum momentum that any of the particles in the final state can have. The momenta have been calculated using the averaged central mass values, without taking into account the widths of the resonances.
- a. Square brackets indicate a sub-reaction of the previous unbracketed decay mode.
- b. J is not known; x is $\Gamma_{\text{el}}/\Gamma$.
- c. This is only an educated guess; the error given is larger than the error of the average of the published values (see listings for the latter).

- † For the baryon states, the name [such as $N(1470)$] contains the mass, which shifts by 5 or 10 MeV with each new analysis. We can't keep up with changing labels in the card-listing section, so we don't try. The name (col. 1) is the same as can be found in large print in the listings. The best current value of the mass (col. 4) is what we use to determine the beam parameters, $M^2 \pm \Gamma M$, c.m. decay momenta, etc., that are found in other columns.
- An arrow at the left of the Table indicates a candidate that has been omitted because the evidence for the existence of the effect and (or) for its interpretation as a resonance is open to considerable question. See listings for information on the following: $\Delta(1690)P_{33}$, $N(1730)D_{13}$, $N(1860)P_{13}$, $N(1980)D_{13}$, $N(2080)$, $N_9(3245)$, $N(3690)$, $N(3755)$, $Z_0(1865)$, $Z_1(1900)$, $\Lambda(1327)$, $\Lambda(1745)F_{01}$, $\Lambda(1750)S_{01}$, $\Lambda(1860)F_{07}$, $\Sigma(1440)$, $\Sigma(1650)S_{11}$, $\Sigma(1780)$, $\Sigma(1880)$, and $\Xi(1705)$.

DATA CARD LISTINGS

STABLE PARTICLES

I.E. IMMUNE TO STRONG DECAY

Data in parentheses have not been included in our averages.

CODE EVENTS QUANTITY ERROR+ ERROR- REFERENCE YR TECN SIGN COMMENTS DATE
ABOVE PUNCHED
BACKGROUND

γ
0 GAMMA (0,J=1)
0 GAMMA MASS

M * 2.0 (10**21 MEV) OR LESS PATEL 65 6/68*

REFERENCES
0 GAMMA
PATEL 65 PL 14 105 V. L. PATEL (NEW HAMPSHIRE)

ν_e
1 E-NEUTRINO (0,J=1/2)
1 E-NEUTRINO MASS (KEV)

M * LESS THAN 0.25 LANGER 52 CNTR 7/66
M * LESS THAN 0.15 HAMILTON 53 CNTR 7/66
M * LESS THAN 0.55 OR-0.28 FRIEDMAN 58 CNTR

REFERENCES
1 E-NEUTRINO (0,J=1/2)
LANGER 52 PR 88 689 L M LANGER,R J D MOFFAT (INDIANA)
HAMILTON 53 PR 92 1521 D HAMILTON,W P ALFORD,L GROSS (PRINCETON)
FRIEDMAN 58 PR 109 2214 LEWIS FRIEDMAN,LINCOLN G SMITH (BNL)

ν_μ
2 MU-NEUTRINO (0,J=1/2)
2 MU-NEUTRINO MASS (MEV)

M * 3.5 OR LESS BARKAS 56 EMUL 7/66
M * 4.0 OR LESS DUDZIAK 59 CNTR 7/66
M * 3.6 OR LESS FEINBERG 63 RVUE
M * 3.0 OR LESS ALLCOCK 65 RVUE
M * 2.5 OR LESS BARDON 65 SPRK
M * 2.1 OR LESS SHAFER 65 CNTR CONF LEV = 68PCT 7/66
M * 1.6 OR LESS BODTH 67 CNTR 90 PERCNT C.L. 3/68*
M * 2.2 OR LESS,C.L.=0.90 HYMAN 67 HEGC 0. K- HE 11/67
M * (0.46) (0.64) (0.46) FRANK 68 CNTR C.L.=0.67 9/68*

REFERENCES
2 MU-NEUTRINO (0,J=1/2)
BARKAS 56 PR 101 778 W H BARKAS,W BIRNBAUM,F M SMITH (LRL)
DUDZIAK 59 PR 114 336 W F DUDZIAK,R SAGANE,J VEDDER (LRL)
FEINBERG 63 ARNS 13 431 G FEINBERG, L M LEDERMAN (COLUMBIA)
ALLCOCK 65 PPSL 85 875 G R ALLCOCK (LIVERPOOL)
BARDON 65 PRL 14 449 BARDON,NORTON,PEOPLES + (COLUM+STONY BROOK)
SHAFER 65 PRL 14 923 R E SHAFER,GROVE,JENKINS (LRL)
BODTH 67 PL 268 32 BODTH,JOHNSON,WILLIAMS,NORMALD (LIVERPOOL)
HYMAN 67 PL 25 B 376 +LOKEN,PEMITT,MCKENZIE,KEYES+(ARG+CARN+NNU)
FRANK 68 VIENNA ABS. 365 FRANK,GAMET,LAKIN (SHAM+LIV+STAN)

e
3 ELECTRON (0.5,J=1/2)
3 ELECTRON MASS (MEV)

M 0.511006 0.000002 COHEN 65 RVUE

3 ELECTRON LIFETIME (UNITS 10**21 YR)
T * OVER 2.0 MOE 65 CNTR 6/66

3 ELECTRON MAGNETIC MOMENT(E/2ME)
MM * (1.0011609)(0000024) SCHUPP 61 CNTR - 8/66
MM * 1.001159622 +- (27)*10**9 WILKINSON 63 CNTR - 8/66
MM * (1.001168) (000011) RICH 66 CNTR + POSITRON 8/66
MM * 1.001159557 +- (30)*10**9 RICH 68 CNTR - 6/68*
MM R RICH 68 IS REEVALUATION OF WILKINSON 63

REFERENCES
3 ELECTRON (0.5,J=1/2)
SCHUPP 61 PR 121 1 A A SCHUPP,R W PIDD,H R CRANE (MICHIGAN)
WILKINSON 63 PR 130 852 D T WILKINSON,H R CRANE (MICHIGAN)
COHEN 65 RMP 37 537 E R COHEN, J W M DUMOND (NAASC+CALTECH)
MOE 65 PR 140 B 992 M K MOE,F REINES (CASE INST TECHNOLOGY)
RICH 66 PRL 17 271 A RICH, H R CRANE (MICHIGAN)
RICH 68 PRL 20 967 A RICH (MICHIGAN)

μ
4 MUON (106,J=1/2)
4 MUON MASS (MEV)
M 105.659 0.002 FEINBERG 63 RVUE
M FIT 105.659 0.002 VALUE FROM CONSTRAINED FIT 6/68*

4 MUON LIFETIME (UNITS 10**6)
T 2.198 0.001 0.001 FARLEY 62 CNTR
T 2.203 0.004 LUNDY 62 CNTR CONLEV=98 11/67
T 2.202 0.003 0.003 ECKHAUSE 63 CNTR +
T 2.197 0.002 0.002 MEYER 63 CNTR +
T 2.198 0.002 0.002 MEYER 63 CNTR - 7/66
T AVG 2.1983 +.0008 -.0008 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)

4 RATIO OF LIFETIME OF MU+ TO MU-
DT 1.000 0.001 MEYER 63 CNTR LIFETIME MU+/MU- 7/66

4 MUON PARTIAL DECAY MODES
P1 MUON INTO E (E-NEU)'(MU-NEU) .5+ 0+ 0
P2 MUON INTO E 2GAMMA .5+ 0+ 0
P3 MUON INTO 3ELECTRONS .5+ .5+ .5
P4 MUON INTO E GAMMA .5+ 0

4 MUON BRANCHING RATIOS
R1 * MUON INTO E+2GAMMA (IN UNITS OF 10**5) (P2)/(P1)
R1 * LESS THAN 1.6 FRANKEL 1 63 SPRK
R2 * MUON INTO 3E (IN UNITS OF 10**7) (P3)/(P1)
R2 * LESS THAN 5.0 PARKER 1 62 CNTR
R2 * LESS THAN 1.3 ALIKHANOV 62 SPRK
R2 * LESS THAN 1.5 FRANKEL 2 63 CNTR
R2 * LESS THAN 1.45 BABAEV 63 SPRK
R3 * MUON INTO E+GAMMA (IN UNITS OF 10**8) (P4)/(P1)
R3 * LESS THAN 1.2 FRANKEL 1 63 SPRK
R3 * LESS THAN 0.6 PARKER 2 64 SPRK

4 MUON ANOMALOUS MAGN. MOMENT (10**6*E/(2*MUON MASS))
MM 1162.0 5.0 CHARPAK 62 CNTR +
MM P (1165.0) (3.0) FARLEY 66 CNTR - STORAGE RINGS 6/68*
MM P (1166.6) (0.3) BAILEY 67 CNTR - STORAGE RING 6/68*
MM P (1166.45) (0.33) BAILEY 68 CNTR - STORAGE RINGS 11/68*
MM 1166.14 0.31 BAILEY 68 CNTR - STOR. RINGS. 6/68*
MM P BAILEY 68 IS AN UPDATING OF BAILEY 67 AND FARLEY 66 6/68*
MM AVG 1166.1241 +.309 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)

REFERENCES
4 MUON (106,J=1/2)
CHARPAK 61 PRL 6 128 CHARPAK,FARLEY,GARWIN,MULLER,SENS + (CERN)
HUTCHINS 61 PRL 7 129 D P HUTCHINSON,J MENES + (COLUMBIA)
ALIKHANOV 62 CERN CONF 423 A I ALIKHANOV,A BABAEV + (ITEP MOSCOW)
CHARPAK 62 PL 1 16 G CHARPAK,F J M FARLEY,R L GARWIN + (CERN)
FARLEY 62 CERN CONF 415 FARLEY,MASSAN,MULLER,ZICHICH (CERN)
LUNDY 62 PR 125 1686 RICHARD A LUNDY (EFINS)
PARKER 62 NC 23 485 S PARKER,S PENMAN (EFINS)
SHAPIRO 62 PR 125-1022 G SHAPIRO,L M LEDERMAN (COLUMBIA)
BABAEV 63 JETP 16 1397 BABAEV,BALATS,KAFTANOV,LANDSBERG + (ITEP)
ECKHAUSE 63 PR 132 422 M ECKHAUSE,T A FILIPPAS + (CARNEGIE)
FEINBERG 63 ARNS 13 431 GERALD FEINBERG, L M LEDERMAN (COLUMBIA)
FRANKEL 63 NC 27 894 S FRANKEL,W FRATI,J HALPERK + (PENNA)
FRANKEL 63 PR 130 351 S FRANKEL,W FRATI,J HALPERN + (PENNA)
MEYER 63 PR 132 2693 S L MEYER,ANDERSON,BLESER,LEDERMAN+ (COLUM)
PARKER 64 PR 133B 768 S PARKER,H L ANDERSON,C REY (EFINS)
FARLEY 66 NC 45A 281 FARLEY,BAILEY,BROWN,GIESCH + (CERN)
BAILEY 67 SLAC CONF. 48 +BARTL,BROWN,PICASSO,FARLEY + (CERN)
BAILEY 68 WASH NTNG. APS +BARTL,BROWN,PICASSO,FARLEY + (CERN)
BAILEY 68 VIENNA ABS. 405 +BARTL,VON BOCHMANN,BROWN,FARLEY+ (CERN)

OLD REFERENCES NOT REFERRED TO IN DATA CARDS
FISHER 59 PRL 3 349 FISHER,LEONTIC,LUNDBY,MEUNIER,STRODT (CERN)
ASTBURY 60 ROCH CONF 60 542 ASTBURY,HATTERSLEY,HUSSAIN + (LIVERPOOL)
DEVONS 60 PRL 5 330 DEVONS,GIDAL,LEDERMAN,SHAPIRO (COLUMBIA)
LATHROP 60 NC 17 109 J LATHROP,R A LUNDY,V L TELEGTI + (EFINS)
LATHROP 60 NC 17 114 J LATHROP,R A LUNDY,S PENMAN + (EFINS)
REITER 60 PRL 5 22 REITER,ROMANOWSKI,SUTTON + (CARNEGIE)
TELEGTI 60 ROCH CONF 60 713 V L TELEGTI (CERN)

π[±]
8 CHARGED PION (140,JPG=0--)=1
8 CHARGED PI MASS (MEV)
M 139.37 0.20 CROWE 54 CNTR -
M 139.68 0.15 BARKAS 56 EMUL +
M 139.577 0.013 SHAFER 67 CNTR MESONIC ATOMS 6/68*
M AVG 139.5769 -.0129 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)
M FIT 139.578 0.013 VALUE FROM CONSTRAINED FIT 6/68*

STABLE PARTICLES

Data in parentheses have not been included in our averages.

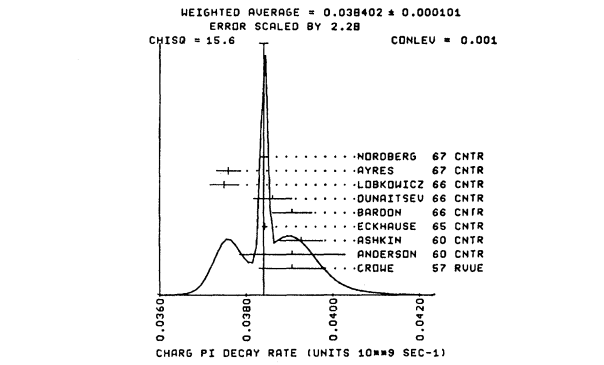
8 PI+ MU+ MASS DIFFERENCE (MEV)

O	34.00	0.076	BARKAS	56 EMUL
D	33.89	0.076	BARKAS	56 EMUL
D	33.9450	0.0550	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)	
D	33.920	0.013	VALUE FROM CONSTRAINED FIT	

8 CHAR.PI LIFETIME (UNITS 10--9)**

T	25.6	0.5	0.5	CROME	57 RVUE
T	25.6	0.8	0.8	ANDERSON	60 CNTR
T	8000	25.46	0.32	ASHKIN	60 CNTR +
T	26.02	0.04		MERRISON	62 RVUE
T	25.6	0.3		ECKHAUSE	65 CNTR +
T	25.9	0.3		BARON	66 CNTR
T	(26.40)	(0.08)		DUNAITSEV	66 CNTR
T	N	SYSTEMATIC ERRORS IN CALIBR. IN THIS EXP. DISCUSSED BY NORDBERG 67		KINSEY	66 CNTR +
T	26.67	0.24		LOBKOWICZ	66 CNTR
T	26.6	0.2		AYRES	67 CNTR
T	26.04	0.05		NORDBERG	67 CNTR +
T	AVG	26.0404	+ .0688 - .0686	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 2.3 (SEE IDEOGRAM BELOW))	

CZIRR	43 PR 130 341	JOHN B CZIRR	(LRL)
DEPOMMIE	63 PL 7 285	P DEPOMMIER, HEINTZE, RUBBIA, SOERDEL	(CERN)
BARTLETT	64 PR 1368 1432	BARTLETT, DEVONS, MEYER, ROSEN	(COLUMBIA)
DI CAPUA	64 PR 1338 1333	DI CAPUA, GARLANC, PONDROM, STRELZOFF	(COLUM)
BACASTOW	65 PR 139 8407	*GHESQUIERE, WIEGAND, LARSEN	(LRL+SLAC)
BERTRAM	65 PR 139 B 617	BERTRAM, MEYER, CARRIGAN*	(MICH+CARNEGIE)
CLINE	65 PL 15 293	A CLINE, W F FRY	(MISCONSIN)
DUNAITSE	65 JETP 20 58	DUNAITSEV, PETRUKHIN, PROKOSHIN +	(DUBNA)
ECKHAUSE	65 PL 19 348	ECKHAUSE, HARRIS, SHULER*	(WILLIAM AND MARY)
BARON	66 PL 16 775	BARON, DORE, DORFAN, KRIEGER +	(COLUMBIA)
DUNAITSE	66 PL 23 283	*KUTVIN, PROKOSHIN, RASUVAEV, SIMONOV	(DUBNA)
KINSEY	66 PR 144 1132	KINSEY, LOBKOWICZ, NORDBERG	(ROCHESTER UNIV)
LOBKOWIC	66 PRL 17 548	LOBKOWICZ, MELISSINOS, NAGASHIMA*	(ROCH+BNL)
AYRES	67 PL 248 483	D S AYRES, CALDWELL, GREENBERG, KURZ*	(LRL)
ALSO	67 PR 157 1288	AYRES, CALDWELL, GREENBERG, KENNEY, KURZ*	(LRL)
NORDBERG	67 PL 248 594	NORDBERG, LOBKOWICZ, BURMAN	(ROCHESTER UNIV)
SHAFFER	67 PR 163 1491	ROBERT E. SHAFFER	(LRL)
SEE ALSO	PRL 14 923	SHAFFER, CROME, JENKINS	(LRL)
AYRES	68 PRL 21 261	AYRES, CORMACK, GREENBERG, KENNEY*	(LRL, UCSB)
DEPOMMIE	68 NUC PHYS 84 189	DEPOMMIER, DUCLOS, HEINTZE, KLEINNECHT*	(CERN)
PETRUKHIN	68 JINR-P1-3862	PETRUKHIN, RYKALIN, KHAZINS, CISEK	(DUBNA)



9 NEUTRAL PION (135, JPC=0--1) I=1

9 PI MASS DIFFERENCE (PI+-)-(PI0)(MEV)

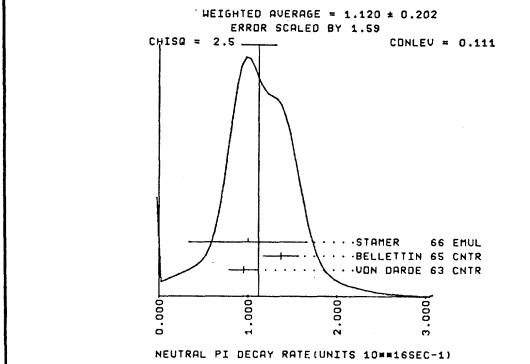
D	(5.37)	(1.0)	PANOFSKY	51 CNTR -
D	4.50	0.31	CHINOWSKY	54 CNTR -
D	4.62	0.05	HADDUCK	59 CNTR -
D	4.60	0.04	HILLMAN	59 CNTR -
D	4.55	0.07	CASSELS	59 CNTR -
D	4.6056	0.0055	CZIRR	63 CNTR -
D	4.59	0.03	PETRUKHIN	63 CNTR -
D	4.6034	0.0052	VASILEVSK	66 CNTR -
D	AVG	4.6041	.0037	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)

9 PION LIFETIME (UNITS 10--16)**

T	N	76	(1.9)	(0.5)	(0.5)	GLASSER	61 EMUL
T	N	45	(2.3)	(1.1)	(1.0)	TIETGE	62 EMUL
T	N	88	(2.8)	(0.9)	(0.9)	KOLLER	63 EMUL
T	N	105	0.18	0.18	0.18	VON DARDE	63 CNTR
T	N	75	(1.7)	(0.5)		SHM	64 EMUL
T	N		0.730	0.105		BELLETTIN	65 CNTR
T	N	67	(1.6)	(0.6)	(0.5)	EVANS	65 EMUL
T	N	OLD EMULSION MEASUREMENTS NOT USED BECAUSE OF POSSIBLE SYSTEMATIC					
T	N	SHIFT TO LARGER LIFETIME VALUES					
T	K	232	1.0	0.5		STAMER	66 EMUL
T	K	INCLUDES EVENTS OF KOLLER 63					
T		(0.6)	(0.2)	(0.08)		BRAUNSCHW	68 CNTR
T							PRIMAKOFF EFF.
T	AVG	.8931	.1815	.1446		AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.6) (SEE IDEOGRAM BELOW)	

8 MEANLIFE DIFFERENCE, (+)-(-)/AVG. (PERCENT)

DT	N	THIS QUANTITY IS A MEASURE OF CPT INVARIANCE IN W.I.				
DT		0.23	0.40	LOBKOWICZ	66 CNTR	SEE NOTE L
DT	L	ABOVE IS THE MOST CONSERVATIVE VALUE QUOTED BY AUTHORS				
DT		0.4	0.7	BARON	66 CNTR	
DT		0.56	0.28	AYRES	67 CNTR	
DT		0.064	0.069	AYRES	68 CNTR	NEW EXPERIMENT
DT		-0.14	0.29	PETRUKHIN	68 CNTR	
DT	AVG	.0871	.0713	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.1)		



8 CHARGED PION PARTIAL DECAY MODES

P1	CHAR. PION INTO MU (MU-NEU)	105+	0	DECAY PASSES
P2	CHAR. PION INTO E (E-NEU)	+5	0	
P3	CHAR. PION INTO MU (MU-NEU) GAMMA	105+	0+ 0	
P4	CHAR. PION INTO PI0 E (E-NEU)	134+	+5+ 0	
P5	CHAR. PION INTO E NEU GAMMA	15+	0+ 0	

9 NEUTRAL PION PARTIAL DECAY MODES

P1	PI0 INTO 2 GAMMA	0+	0	DECAY PASSES
P2	PI0 INTO E+ E- GAMMA	+5+	+5+ 0	
P3	PI0 INTO 4 ELECTRONS	+5+	+5+ +5+	
P4	PI0 INTO 3 GAMMA	0+	0+ 0	

8 CHARGED PION BRANCHING RATIOS

R1	* CHAR. PION INTO MU NEU GAMMA (UNITS 10**--4)	(P3)/(P1)				
R1	26	1.24	0.25	CASTAGNOL	58 EMUL	E(MU).LT.3.38 MV
R2	* CHAR. PION INTO E NEU (UNITS 10**--4)	(P2)/(P1)				
R2	1.21	0.07		ANDERSON	60 CNTR	
R2	1.247	0.028		DI CAPUA	64 CNTR	
R2	AVG	1.2419	.0260	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)		
R3	* CHAR. PION INTO PI0 E NEU (UNITS 10**--8)	(P4)/(P1)				
R3	36	0.97	0.20	BARTLETT	64 SPRK	
R3	38	1.07	0.21	BACASTOW	65 SPRK +	
R3	1.10	0.26		BERTRAM	65 SPRK	
R3	43	1.1	0.2	DUNAITSEV	65 CNTR	
R3	332	1.00	0.08	0.10	DEPOMMIER	68 CNTR
R3	AVG	1.0228	.0689	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)		
R4	* CHAR. PION INTO E NEU GAMMA (UNITS 10**--8)	(P5)/(P1)				
R4	143	3.0	0.5	DEPOMMIER	63 CNTR	GAM KE 50-90 MEV

9 NEUTRAL PION BRANCHING RATIOS

R1	* PI0 INTO (GAMMA E+ E-)/(2 GAMMA) (P2)/(P1)				
R1	0.01196	THEORETICAL CAL. JOSEPH	61	QUANTUM ELECT.	
R1	27	0.0117	0.0015	BUDAGOV	60 HBC
R1	3071	0.01166	0.00047	SAMIOS	61 HBC
R1	S	SAMIOS VALUE USES PANOFSKY RATIO = 1.62			
R1	AVG	.0117	.0004	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)	

REFERENCES

8 CHARGED PION (140, JPC=0--1) I=1

CROME	54 PR 96 470	K M CROME, R H PHILLIPS	(LRL)
BARKAS	56 PR 101 778	W H BARKAS, W BIRNBAUM, F M SMITH	(LRL)
CROME	57 NC 5 541	K M CROME	(STANFORD HEPL)
CASTAGNO	58 PR 112 1779	C CASTAGNOLI, M MUCHNIK	(ROME I F)
ANDERSON	60 PR 119 2050	H L ANDERSON, T FUJII, R H MILLER +	(EFINS)
ASHKIN	60 NC 16 490	ASHKIN, FAZZINI, FIDEGAR, LIPMAN +	(CERN)
MERRISON	62 ADVP 11 1	A W MERRISON	(LIVERPOOL)
SHAPIRO	62 PR 125 1022	G SHAPIRO, L M LEDERMAN	(COLUMBIA)

8 CHARGED PION PARTIAL DECAY MODES

R2	* PI0 INTO (3 GAMMA)/(2 GAMMA) (UNITS 10**--6)	(P4)/(P1)			
R2	0	5.0 OR LESS	DUCLOS	65 CNTR	CL=90 PERCENT
R2	0	5.0 OR LESS	KUTIN	65 CNTR	90 PERCENT C.L.
R3	* PI0 INTO (E+ E- E-)/(2 GAMMA) (UNITS 10**--5)	(P3)/(P1)			
R3		3.47	THEORETICAL CAL. KROLL	55	QUANTUM ELECT.
R3	146	3.18	0.30	SAMIOS	62 HBC
R3	N	ABOVE VALUE USES PANOFSKY RATIO=1.62			

STABLE PARTICLES

Data in parentheses have not been included in our averages.

REFERENCES
9 NEUTRAL PION (135, JPC=0⁻-)1=1

PANOFSKY 51 PR 81 565	M K H PANOFSKY, R L AAMODT, J HADLEY (LRL)
CHINDNSK 54 PR 93 586	M CHINDNSKY, J STEINBERGER (COLUMBIA)
KROLL 55 PR 98 1355	M KROLL, W HADA (COLUMBIA+NRW)
CASSELLS 59 PPS 74 92	CASSELLS, JONES, MURPHY, O. NEILL (LIVERPOOL)
HADDOCK 59 PRL 3 478	HADDOCK, ABASHIAN, CROME, CZIRR (LRL)
HILLMAN 59 NC 14 887	HILLMAN, MIDDELKOOP, YAMAGATA, ZAVATTINI (CERN)
BUDAGOV 40 JETP 11 755	BUDAGOV, VIKTOR, DZHELEPOV, ERPOLOV + (JINR)
JOSEPH 60 NC 16 997	D W JOSEPH (EFI)
GLASSER 61 PR 123 1014	R G GLASSER, N SEEMAN, B STILLER (INRL)
SAMIOS 61 PR 121 275	N P SAMIOS (COLUMBIA+BNL)
SAMIOS 62 PR 126 1844	SAMIOS, PLANO, PRODELL + (COLUMBIA+BNL)
TIETGE 62 PR 127 1324	J TIETGE, W PUESCHEL (MAX PLANCK INST)
CZIRR 63 PR 130 341	JOHN B CZIRR (LRL)
KOLLER 63 NC 27 1405	E L KOLLER, S TAYLOR, T HUETTER (STEVENS)
VOLLER 63 SEE ALSO STAMER 66	
PETRUHKH 63 SIENA CONF 208	V I PETRUHKH, YU D PROKOSHKIN (JINR)
VON DARD 63 PL 4 51	VON DARD, DEKKERS, HERMOLD, VAN PUTTEN + (CERN)
SHWE 64 PR 1368 1839	H SHWE, F M SMITH, M H BARKAS (LRL)
BELLETTI 65 NC 40 A 1139	BELLETTI, BEMPORAD, BRACCINI + (PISA+FIRENZE)
DUCLOS 65 PL 19 253	DUCLOS, FREYTAG, HEINTZE + (CERN+HEIDELBERG)
EVANS 65 PR 139 B 982	D A EVANS (OXFORD)
KUTIN 65 JETP LETT 2 243	KUTIN, PETRUHKHIN, PROKOSHKIN (JINR)
STAMER 66 PR 151 1108	STAMER, TAYLOR, KOLLER, HUETTER + (STEVENS)
VASILEVS 66 PL 23 281	VASILEVSKY, VISHNYAKOV, DUNNITSEV + (DOUBNA)
BRUNSCH 66 VIENNA ABS. 297	BRUNSCHWEIG, HUSMANN, LUBELSMEYER + (BOHN)

K[±]

10 CHARGED K (49% JP=0⁻) I=1/2

10 CHARGED K MASS (MEV)

M	493.9	0.2	COHEN	57 RVUE +	
M	493.7	0.3	BARKAS	63 EMUL -	
M	493.78	0.17	GREINER	65 EMUL +	VIA TAU DECAY
M	493.8099	.1189			AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)
M	493.82	0.11			VALUE FROM CONSTRAINED FIT

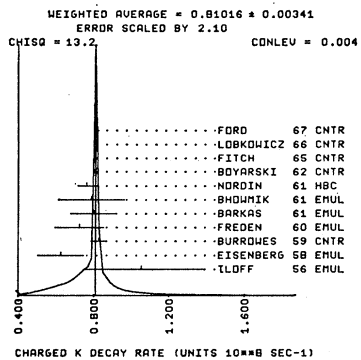
10 CHAR.K LIFETIME (UNITS 10^{**-8})

CHARGED K CONSTRAINED FIT

OVERALL FIT OF LIFETIME, WIDTHS AND BRANCHING RATIOS USES 45 DATA POINTS TO DETERMINE SEVEN QUANTITIES. OVERALL FIT HAS CHISQ=71. MAIN CONTRIBUTION (12.7) COMES FROM R19 OF AACHENZ 68 (WE SEE NO REASON TO REJECT THIS EXPERIMENT AT THIS TIME)

T * CHAR. K LIFETIME

T	0.95	0.36	0.25	ILOFF	56 EMUL
T	1.40	0.3	0.3	EISENBERG	58 EMUL
T	1.21	0.06	0.06	BURROWS	59 CNTR
T	1.38	0.24	0.24	FREDEN	60 EMUL
T	1.25	0.22	0.17	BARKAS	61 EMUL
T	1.27	0.36	0.23	BHOWMIK	61 EMUL
T	293	1.31	0.08	NORDIN	61 HBC -
T	(1.24)	(0.07)		NORDIN	61 RVUE +
T	1.231	0.011	0.011	BOYARSKI	62 CNTR +
T	1.2443	0.0038		FITCH	65 CNTR +
T	1.2265	0.0036		LOBKOWICZ	66 CNTR +
T	1.221	0.011		FORD	67 CNTR +
T	(1.244)	(0.005)		GIACOMELLI	67 CNTR +
T	GIACOMELLI	67	VALUE JUST A CHECK ON APPARATUS		
T	AVG	1.2343	+ .0052		AVERAGE (ERROR INCLUDES SCALE FACTOR OF 2.1)
T	FIT	.810	.003		VALUE FROM CONSTRAINED FIT (SEE IDEOGRAM BELOW)



10 LIFETIME DIFFERENCE, (+)-(-)/AVG. (PERCENT)

DT N THIS QUANTITY IS A MEASURE OF CPT INVARIANCE IN N.1.

DT	0.049	0.097	LOBKOWICZ 66 CNTR	SEE NOTE L	9/66
DT	L	ABOVE IS THE MOST CONSERVATIVE VALUE QUOTED BY AUTHORS	FORD 67 CNTR		9/66
DT	0.47	0.30			8/67
DT	AVG	.0888	.1232	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.3)	

10 DECAY RATES DIFF., (+)-(-)/AV. (PERCENT)

D1	* DIFFERENCE IN K MU2 RATES ((W1+)-(W1-))/W1				
D1		-0.54	0.41	FORD 67 CNTR	8/67
D2	* DIFFERENCE IN TAU RATES ((W2+)-(W2-))/W2				
D2		-0.04	0.21	FORD 67 CNTR	8/67
D2		-0.50	0.90	FLETCHER 67 SPRK	8/67
D2	AVG	-0.639	.2045	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)	

D3 * DIFFERENCE IN TAU PRIME RATES ((W4+)-(W4-))/AVERAGE

D3		-0.0071	(0.016)	HERZD 68	10/68*
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10 CHARGED K PARTIAL DECAY MODES

P1	CHAR. K INTO MU (NEU)	K MU2	105+ 0	DECAY PASSES
P2	CHAR. K INTO PI P10	K P12	139+ 134	
P3	CHAR. K INTO PI P1+ PI-	TAU	139+ 139+ 139	
P4	CHAR. K INTO PI 2P10	TAU PRIME	139+ 134+ 134	
P5	CHAR. K INTO MU P10 NEU	K W3	105+ 134+ 0	
P6	CHAR. K INTO E P10 NEU	K E3	+5+ 134+ 0	
P7	POSIT.K INTO P1+ P1- E+ NEU	K E+ 4	139+ 139+ .5+ 0	
P8	POSIT.K INTO P1+ P1- E- NEU	K E- 4	139+ 139+ .5+ 0	
P9	POSIT.K INTO P1+ P1- MU+ NEU	K+MU+ 4	139+ 139+ 105+ 0	
P10	POSIT.K INTO P1+ P1- MU- NEU	K+MU- 4	139+ 139+ 105+ 0	
P11	CHAR. K INTO E NEU	K E 2	.5+ 0	
P12	CHAR. K INTO MU NEU GAMMA	K MU RAD	105+ 0+ 0	
P13	CHAR. K INTO PI P10 GAMMA	K PI RAD	139+ 134+ 0	
P14	CHAR. K INTO PI P1+ P1- GAMMA	TAU RAD	139+ 139+ 139+ 0	
P15	CHAR. K INTO PI E+ E-	PI E E	139+ .5+ .5	
P16	CHAR. K INTO P1 MU+ MU-	PI MU MU	139+ 105+ 105	
P17	CHAR. K INTO P1 GAMMA GAMMA	PI GAM GAM	139+ 0+ 0	
P18	CHAR. K INTO P1 E+ NEUTRINO GAMMA	PI E NEU GAM	139+ .5+ 0+ 0	
P19	NEG. K INTO P1+ E- E-	PI+ E- E-	139+ .5+ .5	
P20	CHAR. K INTO P1 NEU NEU	PI NEU NEU	139+ 0+ 0	

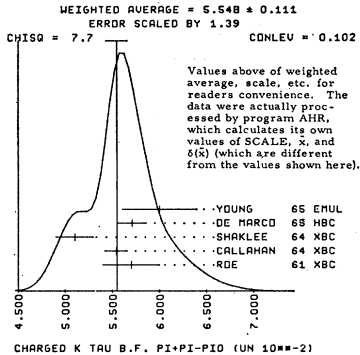
10 CHARGED K DECAY RATES

W1	* CHAR. K INTO MU NEU (K MU)	(UN. 10**6 SEC-1) (P1)	
W1		51.2	0.8
W1		FORD	67 CNTR +-
W1	FIT	51.542	.297
W1			VALUE FROM CONSTRAINED FIT
W2	* CHARG. K INTO PI P1+ PI- (TAU)	(UN. 10**6 SEC-1) (P3)	
W2		4.496	0.030
W2		FORD	67 CNTR +-
W2	FIT	4.515	.028
W2			VALUE FROM CONSTRAINED FIT

10 CHARGED K BRANCHING RATIOS

R 0 OLD DATA EXCLUDED

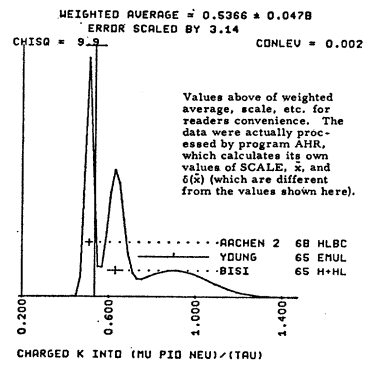
R1	* CHAR. K INTO MU NEU (MU2)	(UNITS 10** ⁻²) (P11)/TOTAL	
R1		(58.5)	(3.0)
R1		(56.9)	(2.6)
R1		ALEXANDER 57 EMUL +	
R1	FIT	63.650	.286
R1			VALUE FROM CONSTRAINED FIT
R2	* CHAR. K INTO PI P10 (P12)	(UNITS 10** ⁻²) (P21)/TOTAL	
R2		(27.7)	(2.7)
R2		(23.2)	(2.2)
R2		(21.0)	(0.6)
R2		(21.6)	(0.6)
R2		TRILLING 65 RVUE	SEE R17
R2	FIT	21.033	.301
R2			VALUE FROM CONSTRAINED FIT
R3	* CHAR. K INTO PI P1+ PI- (TAU)	(UNITS 10** ⁻²) (P31)/TOTAL	
R3		(5.6)	(0.4)
R3		(6.8)	(0.4)
R3		(5.2)	(0.3)
R3		5.7	0.3
R3		5.54	0.12
R3	2332	5.1	0.2
R3	940	5.71	0.15
R3	44	6.0	0.4
R3		YOUNG 65 EMUL +	
R3		DE MARCO 65 HBC	
R3		SHAKLEE 64 XBC +	
R3		CALLAHAN 64 XBC +	
R3		ALEXANDER 57 EMUL +	
R3		TAYLOR 59 EMUL +	
R3		ROE 61 XBC +	9/66
R3		CALLAHAN 64 XBC +	9/66
R3		SHAKLEE 64 XBC +	9/66
R3		DE MARCO 65 HBC	9/66
R3		YOUNG 65 EMUL +	9/66
R3	AVG	5.5477	.112
R3		.039	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.4)
R3	FIT	5.575	.039
R3			VALUE FROM CONSTRAINED FIT (SEE IDEOGRAM BELOW)



STABLE PARTICLES

Data in parentheses have not been included in our averages.

R4 *	CHAR. K INTO PI P10 (TAU PRIME)(UNITS 10 ⁺⁺⁻²) (P4)/TOTAL				
R4 0	(2.1) (0.5)	BIRGE	56 EMUL +		
R4 0	(2.2) (0.4)	ALEXANDER	57 EMUL +		
R4 0	(1.5) (0.2)	TAYLOR	59 EMUL +		
R4	1.7	ROE	61 XBC +	11/67	
R4	1.8	SHAKLEE	64 XBC +	11/67	
R4	1.7500	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)			
R4 FIT	1.703	VALUE FROM CONSTRAINED FIT			
R5 *	CHAR. K INTO MU P10 NEU (MU3) (UNITS 10 ⁺⁺⁻²) (P5)/TOTAL				
R5 0	(2.8) (1.0)	BIRGE	56 EMUL +		
R5 0	(5.9) (1.3)	ALEXANDER	57 EMUL +		
R5 0	(2.8) (0.4)	TAYLOR	59 EMUL +		
R5 FIT	3.182	VALUE FROM CONSTRAINED FIT			
R6 *	CHAR. K INTO E P10 NEU (E3) (UNITS 10 ⁺⁺⁻²) (P6)/TOTAL				
R6 0	(3.2) (1.3)	BIRGE	56 EMUL +		
R6 0	(5.1) (1.3)	ALEXANDER	57 EMUL +		
R6	5.0	ROE	61 XBC +	11/67	
R6	4.7	SHAKLEE	64 XBC +	11/67	
R6 AVG	4.7794	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)			
R6 FIT	4.858	VALUE FROM CONSTRAINED FIT			
R7 *	POSIT.K INTO PI+ PI- E+ NEU (UNITS 10 ⁺⁺⁻⁵) (P7)/TOTAL				
R8 *	POSIT.K INTO PI+ PI- E- NEU (UNITS 10 ⁺⁺⁻⁷) (P8)/TOTAL				
R8 0	20.0	BIRGE	65 FBC + 95 PER CT CONF	8/66	
R8 0	7.0	ELY	68 HLBC CL=95 PC.	11/68*	
R9 *	POSIT.K INTO PI+ PI- MU+ NEU (UNITS 10 ⁺⁺⁻⁵) (P9)/TOTAL				
R9 1	0.77	CLINE	65 FBC +	8/66	
R10 *	POSIT.K INTO PI+ PI+ MU- NEU (UNITS 10 ⁺⁺⁻⁶) (P10)/TOTAL				
R10 0	3.0	BIRGE	65 FBC + 95 PER CT CONF	8/66	
R11 *	CHAR. K INTO E NEU (UNITS 10 ⁺⁺⁻³) (P11)/TOTAL				
R11 0	16.0	BORREANI	64 HBC + CONLEV=0.95	11/67	
R11 4	2.1	BOWEN	67 SPRK +	8/67	
R11 *	BOWEN RESULT SHOULD BE CORRECTED TO 1.9(±1.7, -1.2) BECAUSE OF K+ TO E+ NEU GAMMA DECAYS BEFORE COMPARING WITH BOTTERILL 67 R28				
R12 *	CHAR. K INTO MU NEU GAMMA (UNITS 10 ⁺⁺⁻⁵) (P12)/TOTAL				
R13 *	CHAR. K INTO PI P10 GAMMA (UNITS 10 ⁺⁺⁻⁴) (P13)/TOTAL				
R13 0	18 (2.2) (0.7)	CLINE	64 FBC + PI+ KE 55-80 MEV	8/66	
R14 *	CHAR. K INTO PI PI+ PI- GAMMA(UNITS 10 ⁺⁺⁻⁴) (P14)/TOTAL				
R14 1.0	0.4	STAMER	65 EMUL +	8/66	
R15 *	CHAR. K INTO PI E+ E- (UNITS 10 ⁺⁺⁻⁶) (P15)/TOTAL				
R15 1	1.1	CAMERINI	64 FBC +	8/66	
R15 *	CLINE	67 FBC +		11/67	
R15	4.4	BISI	67 DBC + 90 PER CT CONF	11/67	
R16 *	CHAR. K INTO PI MU+ MU- (UNITS 10 ⁺⁺⁻⁶) (P16)/TOTAL				
R16 3.0	OR LESS	CAMERINI	65 FBC + 90 PER CT CONF	8/66	
R16 2.4	OR LESS	BISI	67 DBC + 90 PER CT CONF	11/67	
R17 *	CHAR. K INTO (PI P10)/TAU (P21)/(P3)				
R17 134	3.24	0.34	YOUNG	65 EMUL +	8/66
R17 1045	3.96	0.15	CALLAHAN	66 FBC +	9/66
R17 AVG	3.8427	0.2659	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.9)		
R17 FIT	3.772	0.062	VALUE FROM CONSTRAINED FIT		
R18 *	CHAR. K INTO (PI' 2P10)/TAU (P4)/(P3)				
R18 2027	0.303	0.009	BISI	65 H+HL	8/66
R18 17	0.393	0.099	YOUNG	65 EMUL +	8/66
R18 AVG	0.3037	0.0092	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)		
R18 FIT	0.305	0.008	VALUE FROM CONSTRAINED FIT		
R19 *	CHAR. K INTO (MU P10 NEU)/TAU (P5)/(P3)				
R19 2175	0.632	0.055	BISI	65 H+HL	8/66
R19 38	0.90	0.16	YOUNG	65 EMUL +	8/66
R19 1905	0.510	0.017	AACHEN 2	68 HLBC +	11/68*
R19 AVG	0.5566	0.0478	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 3.1)		
R19 FIT	0.571	0.025	VALUE FROM CONSTRAINED FIT (SEE IDEOGRAM BELOW)		



R20 *	CHAR. K INTO (E P10 NEU)/TAU (P6)/(P3)				
R20 230	0.90	0.06	BORREANI	64 HBC +	8/66
R20 37	0.90	0.16	YOUNG	65 EMUL +	8/66
R20 854	0.94	0.09	BELLOTTI	67 HLBC	11/67
R20 4385	0.846	0.021	AACHEN 2	68 HLBC +	11/68*
R20 AVG	0.8566	0.0478	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)		
R20 FIT	0.871	0.013	VALUE FROM CONSTRAINED FIT		
R21 *	POSIT.K INTO (PI+ PI- E+ NEU)/TAU(UNITS 10 ⁺⁺⁻⁴)(P7)/(P3)				
R21 69	5.90	0.65	BIRGE	65 FBC +	8/66
R21 269	5.90	0.65	ELY	68 HLBC	11/68*
R21 AVG	6.0265	0.5964	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)		

R22 *	POSIT.K INTO (PI+ PI- MU+ NEU)/TAU(UNITS 10 ⁺⁺⁻⁴)(P9)/(P3)					
R22 1	2.5	APPROX	GREINER	64 EMUL +	8/66	
R22 7	2.57	1.55	BISI	67 DBC +	11/67	
R23 *	CHAR. K INTO (E P10 NEU)/(MU2+PI2)(UNITS 10 ⁺⁺⁻²)(P6)/(P1+P2)					
R23 1679	5.89	0.21	CESTER	66 SPRK +	8/67	
R23 5110	6.16	0.22	ESCHSTRUT	68 SPRK +	3/68*	
R23 AVG	6.0187	0.219	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)			
R23 FIT	5.737	0.089	VALUE FROM CONSTRAINED FIT			
R24 *	CHAR. K INTO (PI P10)/(MU NEU) (P21)/(P1)					
R24 0.3253	0.0065	AUERBACH	67 SPRK +	8/67		
R24 FIT	0.330	0.006	VALUE FROM CONSTRAINED FIT			
R25 *	CHAR. K INTO (E P10 NEU)/(MU NEU) (P6)/(P1)					
R25 472	0.0797	0.0054	AUERBACH	67 SPRK +	8/67	
R25 *	THE VALUE 0.0785 ± 0.0025 GIVEN IN THE ABOVE REF. IS AN AVERAGE OF AUERBACH 67 R25 AND CESTER 66 R23.					
R25 960	0.0775	0.0033	BOTTERILL	68 SPRK +	5/68*	
R25 561	0.069	0.006	GARLAND	68 SPRK +	4/68*	
R25 AVG	0.0765	0.0026	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)			
R25 FIT	0.076	0.001	VALUE FROM CONSTRAINED FIT			
R26 *	CHAR. K INTO (MU P10 NEU)/(MU NEU) (P5)/(P1)					
R26 310	0.0602	0.0046	AUERBACH	67 SPRK +	8/67	
R26 424	0.055	0.004	GARLAND	68 SPRK +	4/68*	
R26 AVG	0.0572	0.0030	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)			
R26 FIT	0.050	0.002	VALUE FROM CONSTRAINED FIT			
R27 *	CHAR. K INTO (MU NEU)/(TAU) (P11)/(P3)					
R27 R	427 (10.38) (0.82)	YOUNG	65 EMUL +	9/66		
R27 *	R DELETED FROM OVERALL FIT BECAUSE YOUNG 65 CONSTRAINS HIS RESULTS TO R TO ADD UP TO 1. ONLY YOUNG MEASURED MU2 DIRECTLY.					
R27 FIT	11.416	1.02	VALUE FROM CONSTRAINED FIT			
R28 *	CHAR. K INTO (E NEU)/(MU NEU) (UNITS 10 ⁺⁺⁻⁵) (P11)/(P1)					
R28 10	1.9	0.7	0.5	BOTTERILL	67 SPRK +	11/67
R29 *	CHAR. K INTO (MU P10 NEU)/(E P10 NEU) (P5)/(P6)					
R29 1509	0.703	0.056	CALLAHAN	66 HLBC	6/68*	
R29 A	8050 (0.604) (0.023)	AACHEN 2	68 HLBC	10/68*		
R29 13371	0.667	0.017	BOTTERILL	68 SPRK +	6/68*	
R29 A	ONLY INDIVIDUAL RATIOS INCLUDED IN FIT--SEE R19 AND R20--					
R29 AVG	0.6700	0.013	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)			
R29 FIT	0.655	0.015	VALUE FROM CONSTRAINED FIT			
R29C	FROM THIS EXPERIMENT WE USE ONLY THE MU3/E3 RATIO AND DO NOT INCLUDE IN THE FIT THE RATIOS MU3/TAU AND E3/TAU, SINCE THEY SHOW LARGE DISAGREEMENTS WITH THE REST OF THE DATA.					
R30 *	CHAR. K INTO PI GAMMA GAMMA/TOTAL(UNITS 10 ⁺⁺⁻⁴)(P17)/TOTAL					
R30 1.1	OR LESS	CHEN	68 SPRK +	5/68*		
R31 *	CHAR. K INTO PI E NEU GAMMA/PI E NEU (P18)/(P6)					
R31 0.012	0.008	BELLOTTI	67 HLBC +	11/67		
R32 *	CHAR. K INTO (PI2 + MU3)/(TOTAL) (P2+P5)/TOTAL					
R32 *	WE COMBINE THESE TWO MODES FOR EXPTS MEASURING THEM IN XENON BC BECAUSE OF DIFFICULTIES OF SEPARATING THEM THERE					
R32 23.4	1.1	ROE	61 XBC +	11/67		
R32 886	25.4	0.9	SHAKLEE	64 XBC +	11/67	
R32 AVG	24.5980	0.902	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.4)			
R32 FIT	24.214	0.274	VALUE FROM CONSTRAINED FIT			
R33 *	K- INTO PI+ E- TOTAL (UNITS 10 ⁺⁺⁻⁵) (P19)/TOTAL					
R33 1.5	OR LESS	CHANG	68 HBC - CL=	3/68*		
R34 *	CHAR. K INTO PI NEU NEU/ TOTAL (UNITS 10 ⁺⁺⁻⁴) (P20)/TOTAL					
R34 1.0	OR LESS	CAMERINI	68	TEST NEUTR.-CURR.	11/68*	

THE FOLLOWING BRANCHING FRACTIONS HAVE CORRELATED ERRORS GREATER THAN .5
P1 P2 - .844

K⁺ Form Factors

The parameter ξ can be determined in three different ways:

- (1) by measuring the K_{μ3}/K_{e3} branching ratio and comparing it with the theoretical ratio as given in terms of ξ:

$$\Gamma(K_{\mu 3})/\Gamma(K_{e 3}) = C_1 + C_2 \operatorname{Re} \xi + C_3 |\xi|^2 + C_4 \lambda_+ + C_5 \lambda_- \operatorname{Re} \xi,$$

- where the C_i are calculable constants;
- (2) by measuring the π or lepton momentum spectra and comparing them with the predicted spectra, which are functions of ξ (see, for example, BRENE 61).

STABLE PARTICLES

Data in parentheses have not been included in our averages.

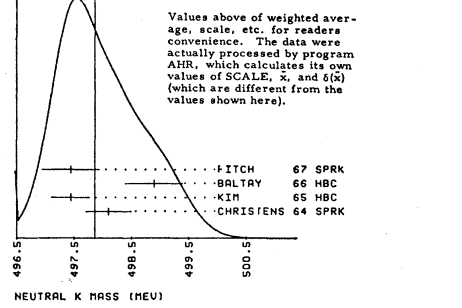
BIRGE 65 PR 139 B 1600	BIRGE, ELY, GIDAL, CAMERINI, CLINE + (LRL+MIS)
BISI 65 NC 35 768	BISI, BORREANI, CESTER, FERRARO + (TURIN)
BISI 65 PR 139 B 1068	BISI, MARZARI-CHIESA, RINAUDO (TURIN; INFN)
BORREANI 65 PR 140 B 1686	BORREANI, GIDAL, RINAUDO, CAFORIO + (BARI; TURIN)
CALLAHAN 65 PRL 15 129	A CALLAHAN, D CLINE (WISCONSIN)
CAMERINI 65 NC 37 1795	CAMERINI, CLINE, GIDAL, KALMUS, KERMAN (WISCONSIN)
CLINE 65 PL 15 293	A CLINE, M F FRY (WISCONSIN)
CUTTS 65 PR 138 B 8969	CUTTS, ELIOPF, STIENING (LRL)
DEBOUARD 65 PL 15 58	DEBOUARD, DEKKERS, JORDAN + (MUNICH; CERN; ORSAY)
DE MARCO 65 PR 140 B 1430	DE MARCO, GROSSO, RINAUDO (TURIN; CERN)
ALSO 68 PR 169 1045	SAYER, BEALL, DEVLIN, SHEPHARD + (MD+PPA+PALMER)
FITCH 65 PR 140 B 1088	FITCH, QUARLES, WILKINS (PRINCETON+MIT HOLYK)
GREINER 65 ARNS 15 67	QUOTED BY BARKAS (LRL)
STAMER 65 PR 138 B 440	STAMER, HUETTER, KOLLER, TAYLOR, GRAUMAN (STEV)
TRILLING 65 UCRL 16473	GEORGE H TRILLING (LRL)
TRILLING 65 IS UPDATED FROM	1965 ARGONNE CONF, PAGE 5 (LRL)
YOUNG 65 UCRL 16362	POH-SHIEN YOUNG (THEISIS, BERKELEY) (LRL)
ALSO 67 PR 156 1464	P-S YOUNG, W.Z. OSBORNE, W.H. BARKAS (LRL)
BELLOTTI 66 PL 20 690	BELLOTTI, FIORINI, PULLIA + (MILAN)
CALLAHAN 66 PR 150 1153	CALLAHAN, CAMERINI (WISCONSIN; LRL; RIVERSIDE; BARI)
CALLAHAN 66 NC 444 90	A C CALLAHAN (WISCONSIN)
CESTER 66 PL 21 343	CESTER, ESCHTRUTH, ONEILL + (PRINCETON-PENN)
CESTER 66 SEE ALSO FOOTNOTE	1 OF AUERBACH 67
LOBKOWICZ 66 PRL 17 548	LOBKOWICZ, MELISSINOS, NAGASHIMA + (ROCH+BNL)
BELLOTTI 67 HEIDELBERG CONF	BELLOTTI, PULLIA (MILAN)
BELLOTTI 67 NC 52A 1287	BELLOTTI, FIORINI, PULLIA (MILAN)
BISI 67 PR 258 572	BISI, CESTER, CHIESA, YIGONE (TORINO)
BOTTERILL 67 PRL 19 982	BOTTERILL, BROWN, CORBETT, CULLIGAN + (OXFORD)
BOTTERILL 67 SEE ALSO BOTTERILL	68
BOWEN 67 PR 154 1314	BOWEN, MANN, MCFARLANE, HUGHES + (PENN-PRINCETO)
CLINE 67 HEIDELBERG CONF	CLINE, HAGGERTY, SINGLETON, FRY + (WISCONSIN)
FLETCHER 67 PRL 19 98	FLETCHER, BEIER, EDWARDS + (ILL INDS)
FORD 67 PRL 18 1214	LEMONICK, HAUGENBERG, PIRQUE (PRINCETON)
GIACOMEL 67 BNL 11056	GIACOMELLI, KYCIA, LI, FEIGER (BNL)
GINSBERG 67 PR 162 1570	EDWARD S GINSBERG (TU, MASS BOSTON)
IMLAY 67 PR 160 1203	IMLAY, ESCHTRUTH, FRANKLIN + (PRINCETON)
KALMUS 67 PR 159 1187	KALMUS, KERMAN (LRL)
WILLIS 67 HEIDELBERG 273	W J WILLIS -RAPORTEUR TALK (VALE)
AACHEN 68 NC 56A 1106	AACHEN-BARI-BERGEN-CERN-EP-NIJMEIEN-ORSAY +
AACHEN 68 PL 278 586	AACHEN-BARI-CERN-EP-ORSAY-PADOVA (VALENCIA)
BOTTERILL 68 PR 171 1402	BOTTERILL, BROWN, CORBETT, CULLIGAN + (OXFORD)
BOTTERILL 68 PR 174 1661	BOTTERILL, BROWN, CLEGG, CORBETT + (OXFORD)
BOTTERILL 68 PRL 21 766	BOTTERILL, BROWN, CLEGG, CORBETT + (OXFORD)
CAMERINI 68 VIENNA ABS. 537	CAMERINI, CHIESA, YOUNG (MIS)
CHANG 68 PRL 20 510	CHANG, YODH, EHRLICH, PLAND + (MARYLAND, RUTGERS)
CHEN 68 PRL 20 73	CHEN, CUTTS, KLEWSKI, STIENING + (LRL; MIT)
CRONIN 68 VIENNA CONF	RAPORTEUR TALK (PRINCETON)
CUTTS 68 PRL 20 955	CUTTS, STIENING, WIEGAND, DEUTSCH (LRL; MIT)
EISLER 68 PR 169 1090	EISLER, FUNG, MARATECK, MEYER, PLAND (RUTGERS)
ELY 68 PR TO BE PUBL	ELY, KALMUS + (LRL+UCLA+WISC)
ESCHTRUTH 68 PR 165 1487	ESCHTRUTH, FRANKLIN, HUGHES + (PRINCETON, PENN)
GARLAND 68 PR 167 1225	+TSIPIS, DEVONS, ROSEN + (COLUMBIA, RUTG, WISC)
HERZD 68 VIENNA ABS. 300	HERZD, BANNEK, BEIER, BERTRAM, EDWARDS + (ILL)

QUANTUM NUMBER DETERMINATIONS NOT REFERRED TO IN THE DATA CARDS
BLOCK 62 CERN CONF 371 BLOCK, LENDINARA, MONARI (NMU+BOLOGNA)

K⁰
11 NEUTRAL K (JP=0-) I=1/2

M	498.1	0.4	CHRISTENS 64 SPRK		
M	2223	497.44	0.33	KIM 65 HBC	KO FROM PBAR P 6/66
M	4500	498.9	0.5	BALTAY 66 HBC	KO FROM PBAR P 6/66
M		497.44	0.50	FITCH 67 SPRK	11/67
M					
M	AVG	497.8653	.3158	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.5)	
M	FIT	497.76	0.16	VALUE FROM CONSTRAINED FIT 6/68*	
				(SEE IDEOGRAM BELOW)	

WEIGHTED AVERAGE = 497.865 ± 0.316
ERROR SCALED BY 1.53
CONLEV = 0.072



11 KO-K CH. MASS DIFFERENCE (MEV)

D	3.9	0.6	ROSENFELD 59 HBC		
D	4.4	1.1	CRAWFORD 59 HBC	+	
D	9	3.90	0.25	BURNSTEIN 65 HBC	-
D	7	3.71	0.35	KIM 65 HBC	- K- P TO KO N 6/68*
D	417	3.95	0.21	HILL 68 DBC	+ K+D TO KOPP 3/68*
D					
D	AVG	3.9163	.1408	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)	
D	FIT	3.94	0.13	VALUE FROM CONSTRAINED FIT 6/68*	

REFERENCES
11 NEUTRAL K (JP=0-) I=1/2
CRAWFORD 59 PRL 2 112 CRAWFORD, CRESTI, GOOD, STEVENSON, TICHO (LRL)
ROSENFELD 59 PRL 2 110 A H ROSENFELD, F SOLMITZ, R D TRIPP (LRL)
CHRISTEN 64 PRL 13 138 CHRISTENSON, CRONIN, FITCH, TURLAY (PRINCETON)

BURNSTEIN 65 PR 138 B 895	R A BURNSTEIN, H A RUBIN (MARYLAND)
KIM 65 PR 140 B 1334	J K KIM, L KIRSCH, D MILLER (COLUMBIA)
BALTAY 66 PR 142 932	BALTAY, SANDWEISS, STONEHILL + (VALE+BNL)
FITCH 67 PR 164 1711	FITCH, ROTH, RUSS, VERNON (PRINCETON)
HILL 68 PR 168 1534	HILL, ROBINSON, SAKITI, CANTER (BNL, CARNEGIE)

K⁰S
12 SHORT-LIVED NEUTRAL K (498, JP=0-) I=1/2

T	0	90	(1.07)	(0.13)	(0.13)	BOLDT 58 CC	
T	0	512	0.94	0.05	0.05	CRAWFORD 59 HBC	
T	0	63	(1.091)	(0.18)	(0.15)	BOWEN 60 CC	
T	0	OLD	EXPTS WITH LOW STATISTICS NOT INCLUDED IN AVERAGE.				
T	0	378	0.94	0.05	0.05	BERTANZA 62 HBC	6/68*
T	0	503	0.87	0.05	0.05	CHRETIEN 63 PBC	
T	0	545	0.86	0.04	0.04	KREISLER 64 SPRK	
T	0	572	0.90	0.06	0.05	AUERBACH 66 SPRK	9/66
T	0	4500	0.92	0.04	0.04	BALTAY 66 HBC	8/67
T	0	B	(0.904)	(0.024)		BOTT-BODE 66 SPRK	9/66
T	0	B	KOS LIFETIME NOT THE PRIMARY QUANTITY MEASURED IN THIS EXPT.				
T	0	5000	0.843	0.013	0.013	KIRSCH 66 HBC	6/66
T	0	19994	0.856	0.008	0.008	DONALD 68 HBC	6/68*
T	0	20000	0.865	0.009	0.009	HILL 68 DBC	6/68*
T	0	H	HILL 68 GIVES A DETAILED DISCUSSION OF SYSTEMATICS ENCOUNTERED IN THIS TYPE OF EXPERIMENT.				
T	0	AVG	.8619	.0062	.0062	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.2)	

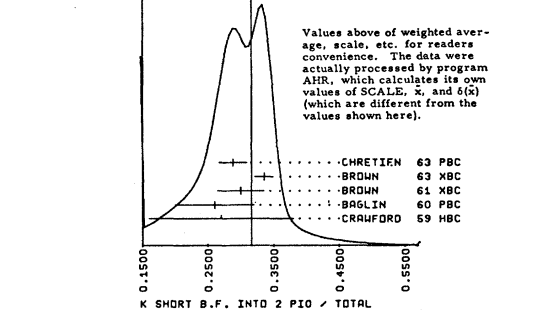
12 KOS PARTIAL DECAY MODES

P1	KOS INTO P1+ P10	139+ 139
P2	KOS INTO P10 P10	134+ 134
P3	KOS INTO MU+ MU-	105+ 105

12 KOS BRANCHING RATIOS

R1	* KOS INTO (P1+ P1-)/TOTAL		(P1)/TOTAL
R1		0.68	0.04
R1		0.70	0.08
R1	U	(0.740)	(0.024)
R1	AVG	.6840	.0398
R1	FIT	.684	.011
R2	* KOS INTO (P10 P10)/TOTAL		(P2)/TOTAL
R2		0.27	0.11
R2		0.26	0.06
R2		0.30	0.035
R2	1066	0.335	0.014
R2	198	0.288	0.021
R2	AVG	.3161	.0135
R2	FIT	.316	.011

WEIGHTED AVERAGE = 0.3161 ± 0.0135
ERROR SCALED BY 1.25
CONLEV = 0.195



R3	* (KOS INTO P1+ P1- P10)/(KOS INTO P1+ P1- P10)		
R3		0.45	OR LESS
R4	* KOS INTO (MU+ MU-)/CHARGED (UNITS 10**5)		(P3)/(P1)
R4		10.0	OR LESS

REFERENCES
12 SHORT-LIVED NEUTRAL K (498, JP=0-) I=1/2

BOLDT 58 PRL 1 150	E BOLDT, D O CALDWELL, Y PAL (MIT)
CRAWFORD 59 PRL 2 266	CRAWFORD, CRESTI, DOUGLASS, GOOD, TICHO + (LRL)
BAGLIN 60 NC 18 1043	BAGLIN, BLOCH, BRILSON, HENNESSY + (PARIS EP)
BIRGE 60 ROCH CONF 601	R W BIRGE, P ELY + (LRL+WISCONSIN)
BOWEN 60 PR 119 2030	BOWEN, HARDY, REYNOLDS, SUN, MOORE + (PRINC+BNL)
COLUMBIA 60 RUCH CONF 727	M SCHWARTZ + (COLUMBIA)
MULLER 60 PRL 4 418	MULLER, BIRGE, FOWLER, GOOD, PICCIONI + (LRL+BNL)
BROWN 61 NC 19 1155	BROWN, BRYANT, BURNSTEIN, GLASER, KADYK + (MICH)
FITCH 61 NC 22 1160	V FITCH, P PIRQUE, R PERKINS (PRINC+LASL)
GOOD 61 PR 124 1223	GOOD, MATS, MULLER, PICCIONI + (LRL)
ANDERSON 62 CERN CONF 836	J A ANDERSON, F S CRAWFORD + (LRL)
BERTANZA 62 PREPRINT D105	BERTANZA, CONNOLLY, CULWICK, EISLER + (BNL)
CRAWFORD 62 CERN CONF 827	(BERTANZA UNPUBLISHED, BUT RECERTIFIED BY AUTHORS, AUGUST 66) F S CRAWFORD
BROWN 63 PR 130 769	BROWN, KADYK, TRILLING, ROE + (LRL+MICHIGAN)
CHRETIEN 63 PR 131 2208	CHRETIEN + (BRANDEIS+BRONNHARVARD+MIT)
KREISLER 64 PR 136 B 1074	M KREISLER, D OVERSETH, J CRONIN (PRINCETON)
AUERBACH 65 PRL 14 192	AUERBACH, LANDE, MANN, SCULLI, UTO + (PENN)
TRILLING 65 UCRL 16473	GEORGE H TRILLING (LRL)
TRILLING 65	IS UPDATED FROM 1965 ARGONNE CONF, PAGE 115

STABLE PARTICLES

Data in parentheses have not been included in our averages.

ALFF-STE 66 PL 21 595	ALFF-STEINBERGER, HEUER, KLEINKNECHT + (CERN)
AUERBACH 66 PK 149 1052	AUERBACH, DOBBS, LANDE, MANN, SCULLI + (PENN)
SEE ALSO AUERBACH 65	
BALTAY 66 PR 142 932	BALTAY, SANDWEISS, STONEHILL + (YALE+BNL)
BEHR 66 PL 22 540	BEHR, BRISSON, PETIAU + (EP, MILAN, PADUA, CRISAY)
BOTT-BOD 66	BOTT-BODENHAUSEN, DE BOUARD + (CERN)
KIRSCH 66 PR 147 939	L KIRSCH, P SCHMIDT (COLUMBIA)
BOTT-BOD 67 PL 248 194	BOTT-BODENHAUSEN, DE BOUARD, CASSEL + (CERN)
DONALD 68 PL 278 58	DONALD, EDWARDS, NISAR + (LIVERPOOL, CERN, PARIS)
HILL 68 PR 141 1418	HILL, ROBINSON, SAMBITT + (BNL, CARNEGIE)

K_L

13 LONG-LIVED NEUTRAL K (498, JP=0-) I=1/2

13 KOL-KOS MASS DIFFERENCE (UNITS ARE INVERSE KOS LIFETIME)

D *	(1.9)	(0.3)	FITCH 61 CNTR		
D	0.84	0.29	0.21 GOOD 61 PBC		
D	0.88	0.20	CAMERINI 62 PBC	SEE NOTE C BELOW 8/67	
D	C VALUE CHANGED FROM 1.5 (SEE TABLE I OF CAMERINI 66)			8/67	
D	0.47	0.21	AUBERT 65 PBC	6/66	
D	0.26	0.36	0.26 BALDO-CEO 65 PRC	ASS. CP CCNS. 8/67	
D	0.55	0.1	CHRISTENS 65 SPRK	6/66	
D *	0.60	DR LESS	FITCH 65 SPRK	CF. MEISNER 66 7/66	
D V 130	(0.82)	(0.14)	WISHNEVSKY 65 SPRK	CU AND AL REGEN 8/67	
D	0.445	0.034	ALFF-STEI 66 SPRK	3/68*	
D	84	0.36	0.21	0.31 BALDO-CEO 66 HLBC	KO+N INTO HYPER. 8/67
D	0.480	0.024	BOTT-BOD 66 SPRK	9/66	
D	77	0.50	0.15	CAMERINI 66 HBC	DBC KO+N INTO HYPER 8/67
D N 72	(+ 0.54)	(0.15)	CANTER 66 DBC	KO SCATTER IN D2 11/66	
D N	ERROR IGNORES UNCERTAINTY OF PHASE SHIFTS				
D	95	0.54	0.09	0.14 CHANG 66 HBC	KO+P INTG HYPER. 8/67
D	0.72	0.15	FUJII 66 SPRK	IRON REGENERATOR 9/66	
D C 89	(0.62)	(0.16)	HILL 66 DBC	KO+D INTG HYPER. 9/66	
D	59	0.65	0.30	MEISNERI 66 HBC	SEE NOTE M 6/66
D M I	+ SIGN FAVORED				
D	(+ 0.44)	(0.06)	MEHLHOP 66 SPRK	SEE NOTE M 9/66	
D C 136	(0.67)	(0.15)	CANTER 67 DBC	KO+D INTG HYPER. 11/67	
D C	CANTER 67 IS A PRELIMINARY RESULT, INCLUDES HILL 66 EVENTS			11/66	
D	0.35	0.15	JOVANOVIC 66 SPRK	C+URANIUM REGEN. 11/66	
D	0.57	0.10	MISCHKE 67 SPRK	11/67	
D	590	0.53	0.12	BALATZ 68 SPRK	AL REGENERATOR 3/68*
D	0.445	0.038	CARNEGIE 68 HBC	CAP METHOD 3/68*	
D	0.42	0.04	MELHOP 68 SPRK	ST. STEEL REGEN 6/88*	
D M	MELHOP 68 IS A FURTHER ANALYSIS OF MELHOP 66			6/88*	
D	AVG	0.4691	0.149	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)	

NEUTRAL K CONSTRAINED FIT
 OVERALL FIT OF LIFETIME WIDTHS AND BRANCHING RATIOS USES 68 DATA POINTS TO DETERMINE FIVE QUANTITIES. OVERALL FIT HAS CHISQ=37. VALUES OF BRANCHING RATIOS CHANGED MAINLY BECAUSE OF NEW MEASUREMENTS OF R1, R10, R18. PARTIAL WIDTHS HAVE LARGE SCALE FACTORS BECAUSE LIFETIME HAS S=1.7

13 KOL LIFETIME (MICROSEC)

T *	ASSUMED DS=DQ AND DELTA I=1/2	CRANFORD 59 HBC			
T	34	0.081	0.032	0.024 BARON 58 CC	
T	15	0.051	0.024	0.013 DARMON 62 FBC	
T	0.053	0.006		FUJII 64 SPRK 8/67	
T	1700	0.061	0.015	0.012 ASTBURY 65 CC	8/67
T	0.0515	0.0014		DEVLIN 67 CNTR 8/67	
T L	(0.050)	(0.005)		LOWYS 67 HLBC	SEE NOTE L BELOW 8/67
T	L SUM OF PARTIAL DECAY RATES				
T	AVG	0.0520	0.0014	0.0013	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)
T	FIT	0.054	0.001		VALUE FROM CONSTRAINED FIT

13 KOL PARTIAL DECAY MODES

P1	KOL INTO 3PI0	DECAY PASSES	134+ 134+ 134
P2	KOL INTO PI+ PI- PI0		139+ 139+ 134
P3	KOL INTO PI MU NEUTRINO		139+ 105+ 0
P4	KOL INTO PI E NEUTRINO		139+ 5+ 0
P5	KOL INTO PI+ PI-		139+ 139
P6	KOL INTO MU+ MU-		105+ 105
P7	KOL INTO E+ E-		5+ 5
P8	KOL INTO E MU		5+ 105
P9	KOL INTO TWO GAMMAS		0+ 0
P10	KOL INTO PI+ PI- GAMMA		139+ 139+ 0
P11	KOL INTO PI0 PI0		134+ 134

13 KOL DECAY RATES

W1 *	KOL INTO PI0 PI0 PI0	(UNITS 10**6 SEC-1) (P1)		
W1	54	5.22	1.03	0.84 BEHR 66 HLBC ASSUMES CP 8/66
W1	FIT	3.998	0.202	VALUE FROM CONSTRAINED FIT
W2 *	KOL INTO PI+ PI- P0	(UNITS 10**6 SEC-1) (P2)		
W2	18	3.26	0.77	ANDERSON 65 HBC 8/66
W2	14	1.4	0.4	FRANZINI 65 HBC 6/66
W2	136	2.62	0.28	0.27 BEHR 66 HLBC ASSUMES CP 8/66
W2	2.54	0.43		HILL 66 DBC 9/66
W2	AVG	2.3573	0.3207	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.7)
W2	FIT	2.358	0.103	VALUE FROM CONSTRAINED FIT (SEE IDEOGRAM BELOW)
W3 *	KOL INTO PI E NEUTRINO	(UNITS 10**6 SEC-1) (P4)		
W3	7.52	0.85	0.72	AUBERT 65 HLBC @ DS=DQ, CP ASSUMED 8/67
W3	FIT	7.011	0.297	VALUE FROM CONSTRAINED FIT
W4 *	KOL INTO CHARGED (3-BODY)	(UNITS 10**6 SEC-1) (P2+P3+P4)		
W4	98	15.1	1.9	AUERBACH 66 SPRK 8/67
W4	FIT	14.593	0.543	VALUE FROM CONSTRAINED FIT

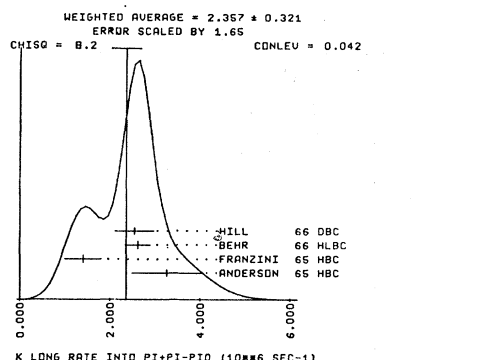
W5 *	KOL INTO LEPTONIC (KMU3+KE3) (UNITS 10**6 SEC-1) (P3+P4)			
W5	109	9.4	1.3	FRANZINI 65 HBC 6/66
W5	54	11.3	1.9	GOLDEN 66 HBC 9/66
W5	335	10.3	0.8	HILL 67 DBC K+N TO KO P 8/67
W5	AVG	10.1949	0.6413	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)
W5	FIT	12.235	0.462	VALUE FROM CONSTRAINED FIT
W6 *	KOL INTO PI MU NEUTRINO (UNITS 10**6 SEC-1) (P3)			
W6	19	4.54	1.24	1.08 LOWYS 67 HLBC 8/67
W6	FIT	5.224	0.211	VALUE FROM CONSTRAINED FIT

13 DECAY RATES DIFF. (+) - (-) / (+) + (-) (PERCENT)

D1 *	KOL INTO (MU+PI-MU)-(MU+PI+MU)/(MU+PI-MU)+(MU+PI+MU)			
D1	10**6	0.4036	0.134	DORFAN 67 SPRK DERIVED FROM R16 11/67
D2 *	KOL INTO (E+PI-MU)-(E+PI+MU)/(E+PI-MU)+(E+PI+MU)			
D2	1**7	0.224	0.036	BENNETT 67 CNTR 11/67

13 KOL BRANCHING RATIOS

R1 *	KOL INTO (PI0 PI0)/CHARGED	(P1)/(P2+P3+P4)		
R1	24	0.24	0.08	ANTIKINA 64 CC 6/66
R1	0.31	0.06		KULYUKINA 66 CC 9/66
R1	549	0.251	0.014	BUDAGOV 68 HLBC 10/68*
R1	444	0.277	0.021	BUDAGOV 68 HLBC 10/68*
R1	AVG	0.2604	0.0113	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)
R1	FIT	0.274	0.011	VALUE FROM CONSTRAINED FIT
R2 *	KOL INTO (PI+ PI- PI0)/CHARGED	(P2)/(P2+P3+P4)		
R2	59	0.185	0.038	ASTIER 61 CC 8/66
R2	79	0.151	0.020	ADAIR 64 HBC 8/66
R2	75	0.4908	0.0353	0.04 LUERS 64 HBC 8/66
R2	66	0.15	0.03	0.04 ASTBURY 65 CC 8/66
R2	326	0.159	0.015	ASTBURY 65 CC 6/66
R2	586	0.178	0.017	GUIDONI 65 HBC 6/66
R2	*4729	(0.144)	(0.004)	HOPKINS 65 HBC 6/66
R2	126	0.162	0.015	HAWKINS 66 HBC 6/66
R2	180	0.17	0.03	KULYUKINA 66 CC 9/66
R2	*	0.161	0.005	HOPKINS 67 HBC 8/67
R2	*	(0.15)	(0.01)	HOPKINS 68 HLBC 10/68*
R2	AVG	0.1618	0.0041	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)
R2	FIT	0.162	0.004	VALUE FROM CONSTRAINED FIT
R3 *	KOL INTO (PI MU NEUTRINO)/CHARGED	(P3)/(P2+P3+P4)		
R3	C 251	(0.356)	(0.07)	LUERS 64 HBC 7/66
R3	C 172	(0.391)	(0.08)	(0.10) ASTBURY 65 CC 8/66
R3	C 330	(0.32)*	(0.07)	KULYUKINA 66 CC 9/66
R3	C	THIS MODE NOT MEASURED INDEPENDENTLY FROM R2 AND R4		
R3	FIT	0.358	0.010	VALUE FROM CONSTRAINED FIT
R4 *	KOL INTO (PI E NEUTRINO)/CHARGED	(P4)/(P2+P3+P4)		
R4	153	0.487	0.05	LUERS 64 HBC 7/66
R4	202	0.46	0.08	0.10 ASTBURY 65 CC 11/67
R4	500	0.51	0.06	KULYUKINA 66 CC 11/67
R4	AVG	0.4908	0.0353	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)
R4	FIT	0.480	0.010	VALUE FROM CONSTRAINED FIT
R5 *	KOL INTO (PI E NEU)/(PI E NEU)+(PI MU NEU)	(P4)/(P3+P4)		
R5	320	0.415	0.120	ASTIER 61 CC 8/66
R5	FIT	0.573	0.012	VALUE FROM CONSTRAINED FIT
R6 *	KOL INTO (PI+ PI- PI0)/TOTAL	(P2)/TOTAL		
R6	FIT	0.127	0.003	VALUE FROM CONSTRAINED FIT
R7 *	KOL INTO (LEPTON PI NEUTRINO)/TOTAL	(P3+P4)/TOTAL		
R7	FIT	0.658	0.007	VALUE FROM CONSTRAINED FIT
R8 *	KOL INTO (2 GAMMA)/TOTAL (UN. 10**4)	(P9)/TOTAL		
R8	C	(1.3)	(0.6)	CRIEGEE 66 SPRK 8/66
R8	32	6.7	2.2	TODDORFF 67 SPRK REPL. CRIEGEE66 11/67
R8	33	7.6	1.6	CRONIN 1 67 SPRK 11/67
R8	C	CRIEGEE 66 REPLACED BY TODDORFF 67		11/68*
R8	AVG	7.1578	1.2940	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)
R9 *	KOL INTO (PI+ PI-)/CHARGED (UNIT 10**3)	(P5)/(P2+P3+P4)		
R9	45	2.0	0.4	CHRISTENS 64 SPRK ETA +- = 1.94
R9	54	2.08	0.35	GALBRAITH 65 SPRK ETA +- = 2.02
R9	1.93	0.26		BASILE 66 SPRK ETA +- = 1.86 9/66
R9	1.993	0.080		BOTT-BODE 66 SPRK ETA +- = 1.935 9/66
R9	AVG	1.9920	0.0734	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)



STABLE PARTICLES

Data in parentheses have not been included in our averages.

R10 *	KOL INTO (PI MU NEU)/(PI E NEU)	(P3)/(P4)	6/66
R10	0.81 0.19	ADAIR 64 HBC	
R10 N	(0.78) (0.15)	DE BOUARD 65 CNTR	SEE NOTE N BELOW
R10	0.82 0.10	DEBOUARD 67 SPRK	SEE NOTE N BELOW
R10 N	0.7 0.2	DEBOUARD 65 REPLACES DEBOUARD 65	11/67
R10 273	0.81 0.08	HOPKINS 67 HBC	8/67
R10	(0.625) (0.04)	HOPKINS 67 HBC	8/67
R10	0.71 0.05	BASILEI 68 SPRK	10/68*
R10 *	(0.65) (0.05)	BUDAGOV 68 HBC	10/68*
R10		HOPKINS 68 HBC	10/68*
R10 AVG	.7511 .0376	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)	
R10 FIT	.745 .035	VALUE FROM CONSTRAINED FIT	
R11 *	KOL INTO (MU+MU-)/CHARGED	(UNITS 10**=-6) (P6)/(P2+P3+P4)	6/66
R11	100.0 OR LESS	ANIKINA 65 CC	6/66
R11	250.0 OR LESS	ABASHIAN 66 SPRK	90 PER CT CONF
R11	250.0 OR LESS	ALFF 66 SPRK	90.90 CONF. LEVEL
R11	2.0 OR LESS	BOTT-BODE 67 SPRK	90 PER CT CONF
R11	35.0 OR LESS	FITCH 67 SPRK	90 PER CT CONF
R12 *	KOL INTO (PI+ PI- GAMMA)/TOTAL	(UNITS 10**=-3) (P10)/TOTAL	6/66
R12	15.0 OR LESS	ANIKINA 65 CC	6/66
R12	0 5.0 OR LESS	BELOTTI 66 HBC	GAM KE 40-130 MV
R12	1 3.0 OR LESS	NEFKENS 66 SPRK	GAM KE 120 MEV
R12	0.4 OR LESS	THATCHER 68 SPRK	90 PER CT CONF
R13 *	KOL INTO (E+ E-)/CHARGED	(UNITS 10**=-6) (P7)/(P2+P3+P4)	6/66
R13	1000.0 OR LESS	ANIKINA 65 CC	6/66
R13	50.0 OR LESS	ABASHIAN 66 SPRK	90 PRCT CONF
R13	200.0 OR LESS	ALFF 66 SPRK	90 PRCT CONF
R13	23.0 OR LESS	BOTT-BODE 67 SPRK	90 PER CT CONF
R14 *	KOL INTO (E MU)/CHARGED	(UNITS 10**=-4) (P8)/(P2+P3+P4)	6/66
R14	10.0 OR LESS	ANIKINA 65 CC	6/66
R14	1.0 OR LESS	CARPENTER 66 SPRK	90 PER CT CONF
R14	0.107 OR LESS	BOTT-BODE 67 SPRK	90 PER CT CONF
R14	0.08 OR LESS	FITCH 67 SPRK	90 PER CT CONF
R15 *	KOL INTO(E+ PI- NEU)/(E- PI+ NEU)	(P11)/(P1)	8/66
R15 O	97 (0.90) (0.18)	NEAGU 61 CC	8/66
R15 O	(1.01) (0.16)	LUERS 64 HBC	9/66
R15 O	894 (0.99) (0.023)	KULYUKINA 66 CC	9/66
R15 O	1539 (1.06) (0.05)	VERHEY 66 SPRK	8/67
R15 O	LOW PRECISION EXPTS NOT AVERAGED. FOR MORE PRECISE VALUE, SEE S1302 (BENNETT 67)		
R16 *	KOL INTO(MU+ PI- NEU)/(MU- PI+ NEU)	(P9)/(P2+P3+P4)	8/66
R16	3200 1.02 0.04	ABASHIAN 66 SPRK	8/66
R16 10**6	1.0081 0.0027	DRIFAN 67 SPRK	11/67
R17 *	KOL INTO (PI0 PI0)/TOTAL	(UNITS 10**=-3) (P11)/TOTAL	7/66
R17 C	(1.2) (1.5) (1.2)	CRIEGEE 66 SPRK	7/66
R17 C	CRIEGEE EXPT NOT DESIGNED TO MEASURE 2 PI0 DECAY MODE		
R17 G	87 (3.3) (1.8) (1.1)	GAILLARD 67 SPRK	KD REGENER. IN CA
R17 G	180 (2.5) (0.8)	GAILLARD 68 SPRK	E00=3.6+-0.6
R17 G	GAILLARD 68 REPLACES GAILLARD 67		11/68*
R18 *	KOL INTO (3PI0)/(PI+PI-PI0)	(P11)/(P2)	9/66
R18	188 2.0 0.6	ALEXSANYA 64 FRC	10/68*
R18	1010 1.80 0.13	BUDAGOV 68 HBC	10/68*
R18 AVG	1.8090 .1271	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)	
R18 FIT	1.696 .074	VALUE FROM CONSTRAINED FIT	
R19 *	KOL INTO (2PI0)/(3PI0)	(UNITS 10**=-2) (P11)/(P1)	8/67
R19 C	109 (1.89) (0.31)	CRONIN 1 67 SPRK	ETA00=4.9+-0.5
R19 C	(1.36) (0.18)	CRONIN 2 67 SPRK	ETA00=3.92+-0.3
R19 C	CRONIN IS FURTHER ANALYSIS OF CRONINI +NDM BOTH WITHDRAWN		11/68*
R19 S	58 (0.46) (0.11)	BANNERZ 68 SPRK	ETA00=2.3+-0.3
R19 S	(1.2) (0.2)	UH-LRL 68 SPRK	ETA00=3.6+-0.4
R19 S	SYSTEMATICS BEING EVALUATED -VALUE ONLY PRELIMINARY		11/68*
R19 S	61 (0.45) (0.18)	BUDAGOV1 68 HBC	ETA00=2.2+-0.4
R19	NO EVENTS SEEN	BARTLETT 68 SPRK	SEE E00 BELOW
R20 *	KOL INTO (PI+ PI-)/(KE3 + KMU3)	(UNITS 10**=-3) (P5)/(P3+P4)	6/68*
R20	309 2.51 0.23	DEBOUARD 67 SPRK	ETA+-=1.91+-0.6
R20	525 2.35 0.19	FITCH 67 SPRK	
R20 AVG	2.4149 .1465	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)	
R21 *	(2 GAMMA)/(13 PI0)	(UNITS 10**=-3) (P9)/(P1)	11/68*
R21	16 2.5 0.7	ARNOLD 68 HBC	VACUUM DECAY
R21	115 2.24 0.28	BANNER1 68 SPRK	SEE NOTE B
R21 B	THIS IS NEW EXPER. -NOT TO BE CONF. WITH K8 OF CRONINI 67-		11/68*
R21			
R21 AVG	2.2759 .2600	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)	

THE FOLLOWING BRANCHING FRACTIONS HAVE CORRELATED ERRORS GREATER THAN .5
P3 P4 -.658

13 K02 FORM FACTORS 8/67

FOR DISCUSSION OF FORM FACTORS SEE NOTE PRECEDING K+ FORM FACTORS

XIA *	XIA = F-/F+ (DETERMINED FROM SPECTRA AND KMU3/KE3)	
XIA	389 +1.1 0.9	1.3 ADAIR 64 HBC KMU3/KE3
XIA	+0.66 0.9	1.3 LUERS 64 HBC KMU3/KE3
XIA *	1371 (+1.2) (0.3)	CARPENTER 66 SPRK MU,PI SPECTRA
XIA *	1371 (-0.82) (0.6)	CARPENTER 66 SPRK MU,PI SPECTRA.C.
XIA C	2ND CARPENTER VALUE ALLOWS ENERGY DEP OF F+/-	
XIA	-0.2 1.0	1.7 KULYUKINA 66 CC MU,PI SPECTRA
XIA *	(-2.9) (0.1)	BASILEI 68 SPRK + DALITZ PLOT
XIA *	(-0.4) (0.3)	BASILEI 68 SPRK + KMU3/KE3
XIA *	770 +0.3 +0.4	BUDAGOV 68 HBC KMU3/KE3
XIA *	(-0.2) (0.4)	HOPKINS 68 HBC + KMU3/KE3
XIA AVG	.3810 .3440	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)

XIB * XIB = F-/F+ (DETERMINED FROM MU POLARIZATION IN KPUS)
XIB * MEAS OF XI USING POLARIZATION IS LESS SENSITIVE TO FORM FACTOR VARIATIONS.

XIB	-1.1 0.5	ABRAMS 66 SPRK POLARIZATION
XIB	2608 -1.2 0.5	AUERBACH 66 SPRK POLARIZATION
XIB	-1.81 0.50	0.26 LONGO 68 CNTR POLARIZATION
XIB AVG	-1.4562 .2588	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)

LM* LAMBDA + (LINEAR ENERGY DEPENDENCE OF F+ IN K0 E3 DECAY) 8/67

LM* FOR RAD. CORR. TO THE DALITZ PLOT OF K+, SEE GINSBERG 67.

LM*	153 (+0.07) (0.06)	LUERS 64 DLTZ PLY,NO RAD CORR
LM*	(+0.15) (0.08)	FISHER 65 SPRKDLTZ PLY,NO RAD CORR
LM*	762 (-0.01) (0.02)	FIRESTONE 67 HBC DLTZ PLY,NO RAD CORR
LM*	531 (+0.01) (0.015)	KADYK 67 HBC E,PI SPEC,NG RAD CCR
LM*	240 (+0.08) (0.10)	1.08 LOWYS 67 FRC PI SPEC,NO RAD CORR
LM*	1000 (+0.020) (0.013)	ARONSON 68 SPRK PI SPEC,NO RAD CORR
LM*	7233 (+0.023) (0.012)	BASILE 68 SPRK DLTZ PLY,NC RAD CCR

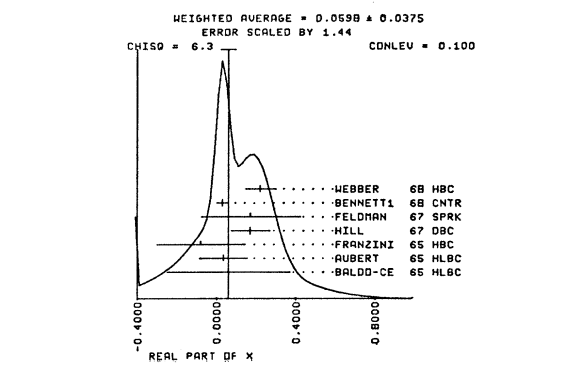
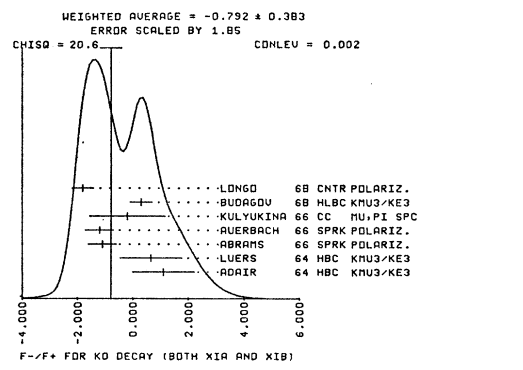
13 X + (DS=-DQ AMPLITUDE /DS+DQ AMPLITUDE)

REX * REAL PART OF X

REX	152 0.06 0.18	0.44 BALDO-CE 65 HBC	K+ CHARGE EXCHNG
REX	196 0.035 0.11	0.13 AUBERT 65 HBC	K+ CHARGE EXCHNG
REX	109 -0.08 0.16	0.28 FRANZINI 65 HBC	PBAR P
REX	FRANZINI 65 GIVES X AND THETA.FOR REX AND IMX SEE SCHMIDT 67		11/67
REX	335 0.17 0.10	HILL 67 DBC	K+D YIELDS KOPP
REX	116 0.17 0.16	0.35 FELDMAN 67 SPRK	PI-P TO K0 LMBDA
REX	0.03 0.03	BENNETT1 68 CNTR	
REX	121 (0.09) (0.13)	(0.11) JAMES 68 HBC	PBAR P
REX	(0.11) (0.18)	(0.14) LITTENBER 68 SPRK	K+ N,K0 P
REX	242 0.22 0.07	0.09 WEBBER 68 HBC	
REX AVG	.0598 .0375	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.4)	

IMX * IMAGINARY PART OF X (ASSUMES M(KL)-M(KS) POSITIVE -- SEE S130)

IMX	152 -0.44 0.32	0.19 BALDO-CE 65 HBC	K+ CHARGE EXCHNG
IMX	BALDO-CE 65 GIVES X AND THETA.CONVERTED BY US TO REX AND IMX		11/67
IMX	196 -0.21 0.11	0.15 AUBERT 65 HBC	K+ CHARGE EXCHNG
IMX	109 +0.24 0.40	0.30 FRANZINI 65 HBC	PBAR P
IMX	FRANZINI 65 GIVES X AND THETA.FOR REX AND IMX SEE SCHMIDT 67		11/67
IMX	116 0.0 0.25	FELDMAN 67 SPRK	PI-P TO K0 LMBDA
IMX	335 -0.20 0.10	HILL 67 DBC	K+D YIELDS KOPP
IMX H	FTNOTE 10 OF HILL 67 SHOULD READ +0.58, NOT -0.58 (PRIV COMM)		11/67
IMX	121 (+0.22) (0.29)	(0.37) JAMES 68 HBC	PBAR P
IMX	(-0.21) (0.08)	LITTENBER 68 SPRK	K+ N,K0 P
IMX	-0.08 0.08	WEBBER 68 HBC	
IMX AVG	-1.1401 .0531	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)	



STABLE PARTICLES

Data in parentheses have not been included in our averages.

13 CP VIOLATION PARAMETERS
ETA+- = A1KL TO P1+P1-/A(KS TO P1+P1-)
ETA00 = A1KL TO P10P10/A(KS TO P10P10)
THE MAGNITUDES OF ETA+- AND OF ETA00 ARE DERIVED FROM BR. RATIOS.
FOR VALUES OF MAGNITUDE(ETA+-) QUOTED BY INDIVIDUAL EXPTS, SEE
LISTINGS OF S13R9 AND S13R20.
E00 * ETA 0 0 = A1KL TO P10 P10/A(KS TO P10 P10) (UNITS 10^-3)
E00 * VALUES NOT AVERAGED BECAUSE OF LARGE DISCREPANCIES
E00 * (2.3) (0.3) BANNER2 68 SPRK 11/68
E00 * LESS THAN 3.0 BARTLETT 68 SPRK (E00)**2--2+-7 11/68
E00 * (12.2) (0.4) BUDAGOV1 68 HBC 11/68
E00 * 180 (13.6) (0.6) GAILLARD 68 SPRK 11/68
E00 S (13.6) (0.4) UM-LRL 68 SPRK ERROR STATIST. 11/68
E00 S SYSTEMATICS BEING EVALUATED -VALUE ONLY PRELIMINARY 11/68
F+- * PHASE OF ETA+- (DEGREES)
F+- 45.0 50.0 FITCH 65 SPRK BE REGEN 11/67
F+- 30.0 45.0 FIRESTONE 66 HBC C REGEN 11/67
F+- 70.0 21.0 BOTT-BODE 67 SPRK C REGEN 11/67
F+- 25.0 35.0 MISCHKE 67 SPRK CU REGEN 7/68
F+- R (84.0) (17.0) RUBBIA 67 SPRK CU REGEN 7/68
F+- R RUBBIA 67 REPLACED BY BENNETT 68
F+- C 51.0 11.0 BENNETT2 68 CNTR CU REG. USES 8/68
F+- C MEASUREMENT OF (F+-)-(PHI) OF ALFF-STEINBERGER 66
F+- 3560 15.0 BOMH 68 SPRK VACUUM REGEN 8/68
F+- B (68.0) (17.5) BISI 68 CNTR USES BENNETT2 68 10/68
F+- B FOR VALUE OF PHIF, REGENER. PHASE IN CU
F+- (59.0) (16.0) CRONIN 68 RVUE INCLUDES BISI68 11/68
F+- AVG 50.2130 7.7413 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)

13 LONG-LIVED NEUTRAL K (498, JP=0-) I=1/2

REFERENCES
BARDON 58 ANP 5 156 M BARDON, K LANDE, L LEDERMAN (COLUMBIA+BNL)
CRAWFORD 59 PRL 2 361 CRAWFORD, CRESTI, DOUGLASS, GOOD + (LRL)
ASTIER 61 AIX CONF 1 227 ASTIER, BLASKOVIC, RIVET, STAUD + (PARIS+EP)
FITCH 61 NC 22 1160 V FITCH, P PIRQUE, R PERKINS (PRINCETON)
GOOD 61 PRL 124 1223 GOOD, MATSEN, MULLER, PICCIONI, POWELL + (LRL)
NEAGU 61 PRL 6 552 NEAGU, OKONOV, PETROV, ROSANOVA, RUSAKOV (JINR)
ALEXANDER 62 PRL 9 69 G ALEXANDER, S ALMEIDA, F CRAWFORD (LRL)
CAMERINI 62 PRL 128 362 CAMERINI, FRY, GAIDOS, BIRGE, ELY + (MISC+LRL)
DARMON 62 PL 2 57 J DARMON, A ROUSSET, J SIA (PARIS+EP)
JOVANOVI 63 BNL CONF 42 JOVANOVIC, FISCHER, BURRIS + (BNL+MARYLAND)
ADAIR 64 PL 12 67 R K ADAIR, L B LEIPMUR (YALE+BNL)
ALEKSANY 64 DUBNA 2 102 ALEKSANYAN, ALTKHANYAN, VARTAZARYAN + (EREVANI)
SEE ALSO JETP 19 1019
ANIKINA 64 JETP 19 42 ANIKINA, ZHURAVLEVA + (GEORG ACAD SCI+ DUBNA)
CHRISTEN 64 PRL 13 138 CHRISTENSON, CRONIN, FITCH, TURLAY (PRINCETON)
FUJII 64 DUBNA 2 1445 FUJII, JOVANOVIC, TURKOT, ZORN (BNL+MARYLAND)
LUERS 64 PRL 133 8 1276 LUERS, MITTRA, WILLIS, YAMAMOTO (BNL)
STERN 64 PRL 12 459 STERN, BINFORD, LIND, ANDERSON + (MISC+LRL)
ANIKINA 65 JINR P 2488 ANIKINA, VARDENGA, ZHURAVLEVA, KOTLYA + (DUBNA)
ANDERSON 65 PRL 14 475 ANDERSON, CRAWFORD, GOLDEN, STERN + (LRL+MISC)
ASTBURY1 65 PL 16 80 ASTBURY, FINOCCHIARO, BEUSCH + (CERN+ZURICH)
ASTBURY2 65 PL 18 175 ASTBURY, MICHELINI, BEUSCH + (CERN+ZURICH)
ASTBURY3 65 PL 18 178 ASTBURY, MICHELINI, BEUSCH + (CERN+ZURICH)
AUBERT 65 PL 17 59 AUBERT, BEHR, CANAVAN, CHOUNET + (PARIS+ORSAY)
AUBERT 65 SEE ALSO LOMYS 67
BALDO-CE 65 NC 38 684 BALDO-CEOLIN, CALIMANI, CIAMPOLILLO + (PADUA)
BEHR 65 ARGONNE CONF 59 BEHR, BRISSON, BELLOTTI + (EP+MILAN+PADUA)
CHRISTEN 65 PR 140 8 CHRISTENSON, CRONIN, FITCH, TURLAY (PRINCETON)
CHRISTENSON 65 HAS BEEN CORRECTED FOR INTERFERENCE BY FITCH(65, FOOTNOTE)
DE BOUARD 65 PL 15 58 DE BOUARD, DEKKERS, SCHARFF + (CERN+ORSAY+MPI)
FISHER 65 ANL 7130 83 FISHER, ABASHIAN, ABRAMS, CARPENTER + (ILLINOIS)
FITCH 65 PRL 15 73 FITCH, ROTH, RUSS, VERNON (PRINCETON)
FRANZINI 65 PR 140 B 127 FRANZINI, KIRSCH, PLAND + (COLUMBIA+RUTGERS)
GALBRAITH 65 PRL 14 383 GALBRAITH, MANNING, JONES + (AERE+BRIST+YALE)
GUIDONI 65 ARGONNE CONF 49 +BARNES, FOELSCH, FERBEL, FIRESTO + (BNL+MHL)
HOPKINS 65 ARGONNE CONF 67 H W K HOPKINS, BACON, EISLER (VAN+RUTGERS)
MESTVIFI 65 UCRL 16473 MESTVIFI, ILAGU, PETROV, RUSAKOV + (LJNR)
TRILLING 65 UCRL 16473 GEORGE H TRILLING
TRILLING 65 IS UPDATED FROM 1965 ARGONNE CONF, PAGE 115
VISHNEVS 65 PL 18 339 VISHNEVSKY, GALANINA, SEMENOV + (MCSOON)
ABASHIAN 66 BERKELEY CONF 28 ABASHIAN, ABRAMS, VERHEY + // URBANA
ABRAMS 66 BERKELEY CONF 28 ABRAMS, ABASHIAN, CARPENTER + (ILLINOIS)
ALFF-STE 66 PL 21 595 ALFF-STEINBERGER, HEUER, RUBBIA + (CERN)
AUERBACH 66 PRL 17 980 AUERBACH, MANN, MCFARLANE, SCIULLI + (PENN)
AUERBACH 66 PR 149 1052 AUERBACH, DOBBS, LANDE, MANN, SCIULLI + (PENN)
AUERBACH 66 SEE ALSO PRL 14 192
BALDO-CE 66 NC 45A 733 BALDO-CEOLIN, CALIMANI, CIAMPOLILLO + (PADUA)
BASILE 66 BALATON CONF BASILE, CRONIN, THEVENET + (SACLAY)
BEHR 66 PL 22 540 BEHR, BRISSON, BALDO-CEOLIN, AUBERT + (PADUA, EP)
BELLOTTI 66 NC 45A 737 BELLOTTI, PULLIA, BALDO-CEOLIN + (MILAN, PADUA)
BOTT-BOD 66 PL 23 277 BOTT-BODENHAUSEN, DE BOUARD, CASSEL + (CERN)
CAMERINI 66 PR 150 1148 CAMERINI, CLINE, ENGLISH, FISCHER, ENGLISH (CNS)
CANTER 66 PL 17 942 CHO, ENGLER, FISK, HILL + (CARNEGIE+BNL)
CARPENTER 66 PR 142 871 CARPENTER, ABASHIAN, ABRAMS, FISHER (ILLINOIS)
CHANG 66 PL 23 702 CHANG, BASSANO, KIKUCHI, DODD + (SYRACUSE+YALE)
CRIGEE 66 PRL 17 150 +FOX, FRAUENFELDER, HANSON, MOSCAT + (ILLINOIS)
FIRESTONE 66 PRL 16 556 FIRESTONE, KIM, LACH, SANDWEISS + (YALE, BNL)
FIRESTONE 66 PRL 17 116 FIRESTONE, KIM, LACH, SANDWEISS + (YALE, BNL)
FUJII 66 PRL 13 253 FUJII, JOVANOVIC, TURKOT, ZORN (BNL+MARYLAND)
FRUJII 66 IS THE CORRECTED VALUE GIVEN BY JOVANOVIC + 66)
GOLDEN 66 BERKELEY CONF R. GOLDEN, F. CRAWFORD, D. STERN (LRL)
HAWKINS 66 PL 21 238 C J B HAWKINS (YALE)
ALSO 67 PR 156 1444 C J B HAWKINS (YALE)
HILL 66 BNL 10608 HILL, ROBINSON, SAKITT, CANTER + (BNL, CARNEGIE)
JOVANOVI 66 PRL 17 1075 JOVANOVIC, FUJII, TURKOT, ZORN + (BNL+M+MIT)
KULYUKIN 66 BERKELEY CONF 28 JOVANOVIC, FUJII, TURKOT, ZORN + (BNL+M+MIT)
MEISNER1 66 PRL 16 278 G W MEISNER, B B CRAWFORD, F CRAWFORD (LRL)
MEISNER2 66 PRL 17 492 G W MEISNER, B CRAWFORD, F CRAWFORD (LRL)
MEHLHOP 66 BERKELEY CONF MEHLHOP, GOOD, PICCIONI + (LA JOLLA)
MEHLHOP 66 SEE ALSO HURTY 67
MISCHKE 66 BERKELEY CONF. + ABASHIAN, ABRAMS, CARPENTER + (ILLINOIS)
NEPKENS 66 PL 19 706 NEPKENS, ABASHIAN, ABRAMS, CARPENTER + (ILL)
VERHEY 66 PRL 17 669 VERHEY, NEPKENS, ABASHIAN+// URBANA
BENNETT 67 PRL 19 993 BENNETT, NYGREN, SAAL, STEINBERGER + (COLUMBIA)
BOTT-BOD 67 PL 248 194 BOTT-BODENHAUSEN, DEBOUARD, CASSEL + (CERN)
BOTT-BOD 67 PL 248 438 BOTT-BODENHAUSEN, DEBOUARD, DEKKERS + (CERN)
ALSO 66 PL 20 212 BOTT-BODENHAUSEN, DEBOUARD, CASSEL + (CERN)
ALSO 66 PL 23 277 BOTT-BODENHAUSEN, DEBOUARD, CASSEL + (CERN)
CANTER 67 HEIDELBERG CONF CANTER, CHO, DRALLE, ENGLER + (CARNEGIE, BNL)

CRONIN 1 67 PRL 18 25 +KUNZ, RISK, WHEELER (PRINCETON)
CRONIN 2 67 PRINC CONF(11/67) +KUNZ, RISK, WHEELER (PRINCETON)
DEBOUARD 67 NC 52A 662 DEBOUARD, DEKKERS, JORDAN, MERMOD + (CERN)
DEVLIN 67 PRL 18 54 DEVLIN, SOLOMON, SHEPARD, BEALL + (PRINC+HARV.)
DORFAN 67 PRL 19 987 DORFAN, ENSTROM, RAYMOND, SCHWARTZ + (SLAC+LRL)
FELDMAN 67 PR 155 1611 FELDMAN, FRANKEL, HIGHLAND, SLOAN (U OF PENN)
FIRESTONE 67 PRL 18 176 FIRESTONE, KIM, LACH, SANDWEISS + (YALE, BNL)
FITCH 67 PR 164 1711 FITCH, ROTH, RUSS, VERNON (PRINCETON)
GAILLARD 67 PRL 18 20 +KRIEEN, GALBRAITH, HUSARI + (CERN+RUTH+AACH)
GINSBERG 67 PR 162 1570 EDWARD S GINSBERG (U. MASS BOSTON)
HAWKINS 67 PR 156 1444 C J B HAWKINS (YALE)
HILL 67 PRL 19 668 HILL, LUERS, ROBINSON, CANTER + (BNL, CARNEGIE)
HOPKINS 67 PRL 19 185 HOPKINS, BACON, EISLER (BNL)
KADYK 67 PRL 19 597 KADYK, CHAN, DRIJARD, OREN, SHELDON (LRL)
LOWYS 67 PL 248 75 LOWYS, AUBERT, CHOUNET, PASCAUD + (EP, ORSAY)
MISCHKE 67 PRL 18 138 MISCHKE, ABASHIAN, ABRAMS + (ILLINOIS)
RUBBIA 67 PL 248 531 C. RUBBIA, J. STEINBERGER (CERN+COL)
ALSO 1 66 PL 20 207 ALFF-STEINBERGER, HEUER, KLEINKNECHT + (CERN)
ALSO 2 66 PL 21 595 ALFF-STEINBERGER, HEUER, KLEINKNECHT + (CERN)
ALSO 3 66 PL 23 167 C. RUBBIA, J. STEINBERGER (CERN+COL)
SCHMIDT 67 NEVIS 1601THESIS) P. SCHMIDT (ILLINOIS)
TODOROFF 67 THESIS JOHN A TODOROFF (ILLINOIS)
ARNOLD 68 PL 288 56 ARNOLD, BUDAGOV, CUNDY, AUBERT + (CERN+ORSAY)
ARONSON 68 PRL 20 287 S. H. ARONSON, K. W. CHEN (PRINCETON)
BALATZ 68 PL 268 320 BALATZ, BEREZIN, VISHNEVSKY, GALANINA + (MCSOON)
BANNER1 68 PRL 21 1103 BANNER, CRONIN, LIV, PILCHER (PRINCETON)
BANNER2 68 PRL 21 1107 BANNER, CRONIN, LIV, PILCHER (PRINCETON)
BARTLETT 68 PRL 21 558 BARTLETT, CARNEGIE, FITCH + (PRINCETON)
BASILE1 68 VIENNA ABS. 175 BASILE, CRONIN, THEVENET, TURLAY + (SACLAY)
BASILE 68 PL 268 542 BASILE, CRONIN, THEVENET, TURLAY + (SACLAY)
BENNETT1 68 PL 278 244 BENNETT, NYGREN, STEINBERGER + (COLUMBIA+CEMN)
BENNETT2 68 PL 278 248 BENNETT, NYGREN, STEINBERGER + (COLUMBIA+CEMN)
BISI 68 VIENNA CONF BISI + ABSTRACT 990 (CERN, AACHEN, TO)
BOMH 68 PL 278 321 BOMH, DARRILLAT, GROSS, KAFTANOV (CERN)
BUDAGOV 68 NC 57A 182 BUDAGOV, BURMEISTER, CUNDY + (CERN, ORSAY, PARIS)
BUDAGOV1 68 PL TO BE PUBLIS. BUDAGOV, CUNDY, AUBERT, REHR + (CERN+ORSAY+EP)
CARNEGIE 68 BAPS 13 16 CARNEGIE, FITCH, KAMAE, ROTH, RUSS + (PRINCETON)
CRONIN 68 VIENNA CONF CRONIN, RAPPOORTEURS TALK (PRINCETON)
GAILLARD 68 PREPRINT RPP/H135 GAILLARD, GALBRAITH + (CERN+RUTH+AACHEN)
HOPKINS 68 VIENNA ABS. 242 HOPKINS, BUDAGOV, HEZRICK + (CERN, EDINBURGH)
JAMES 68 VIENNA ABS. 332 F. JAMES, H. BRIAND (PARIS, CERN)
LITTENBERG 68 VIENNA ABS. 684 LITTENBERG, FIELD, PICCIONI, MELHOP + (UCSD)
LONGO 68 PR TO BE PUBLIS. LONGO, YOUNG, HELLAND (MICHIGAN+UCLA, MICHIGAN)
ALSO 68 PRL 21 257 HELLAND, LONGO, YOUNG
MELHOP 68 PR 172 1613 MELHOP, MURTY, BOWLES, BURNETT + (LA JOLLA)
THATCHER 68 PR 174 1674 THATCHER, ABASHIAN, ABRAMS, CARPENTER + (ILL)
UM-LRL 68 VIENNA CONF CENCE ET AL. ABST +76 (UN. OF HAMAM+LRL)
WEBER 68 PRL 21 498 WEBER, SOLMITZ, CRAWFORD, ALSTONGARNJOST (LRL)

14 ETA (549, JP=0+) I=0
FOR C. BALTAYS REVIEW OF THE ETA MESON, SEE PROG. UNIV. OF PENN. CONF. ON MESON SPECTROSCOPY, N.A. BENJAMIN, TO BE PUBLISHED.

Table with 4 columns: M, ETR MASS (MEV), BASTIEN, HBC. Includes rows for M 53, 39, 91, 148, 325, 548.2, 250, 548.8176 and their corresponding mass values and HBC counts.

WEIGHTED AVERAGE = 548.818 ± 0.557
ERROR SCALED BY 1.44
CHI SQ = 12.4 CDNEU = 0.054

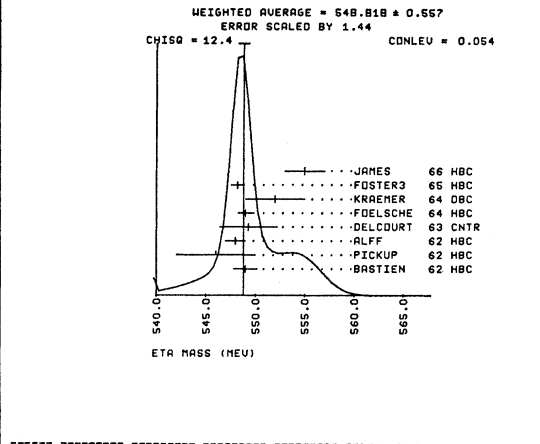


Table with 4 columns: W, 14 ETA WIDTH (MEV), ALFF, HBC. Includes rows for W 91, 148, 31, 4.0, 4.9 and their corresponding width values and HBC counts.

STABLE PARTICLES

Data in parentheses have not been included in our averages.

14 ETA PARTIAL DECAY MODES			
P1	ETA INTO 2GAMMA		DECAY PASSES
P2	ETA INTO 3P10		0+ 0
P3	ETA INTO P1+ P1- P10		134+ 134+ 134
P4	ETA INTO P1+ P1- GAMMA		139+ 139+ 0
P5	ETA INTO E+E-P10	VIOLATES C IN E.M.I.	134+ .5+ .5
P6	ETA INTO E+E-P1+P1-		139+ 139+ .5+ .5
P7	ETA INTO P10 2GAMMA		134+ 0+ 0
P8	ETA INTO E+E-GAMMA		.5+ .5+ 0
P9	ETA INTO 2P10 GAMMA	VIOLATES C	134+ 134+ 0
P10	ETA INTO P1+P1-P10 GAMMA		139+ 139+ 134+ 0
P11	ETA INTO P1+P1- 2GAMMA		139+ 139+ 0+ 0
P12	ETA INTO MU+MU-		105+ 105
P13	ETA INTO MU+MU-GAMMA		105+ 105+ 0
P14	ETA INTO MU+MU-P10		105+ 105+ 134

14 ETA DECAY RATES			
M1	ETA INTO 2GAMMA (UNITS KEV)	(P1)	
M1	(0.93) (0.2)	BEMPORAD 67 CNTR	PRIMAKOFF EFFECT 11/67

The above value for $\Gamma_{\gamma\gamma}$ assumes that $\Gamma_{\gamma\gamma}/\Gamma_{total} = 31.4\%$. However, the results of that experiment may be stated more generally than is given in the paper, as

$$\Gamma_{\gamma\gamma} \times \frac{\Gamma_{\gamma\gamma}}{\Gamma_{total}} = 0.380 \pm 0.083 \text{ keV}$$

(private communication from C. Bemporad). Thus our new value of

$$\Gamma_{\gamma\gamma}/\Gamma_{total} = 38.1 \pm 2.2\%$$

would give

$$\Gamma_{\gamma\gamma} = 1.00 \pm 0.22 \text{ keV}$$

and

$$\Gamma_{total} = 2.63 \pm 0.64 \text{ keV.}$$

ETA DECAY INTO NEUTRALS

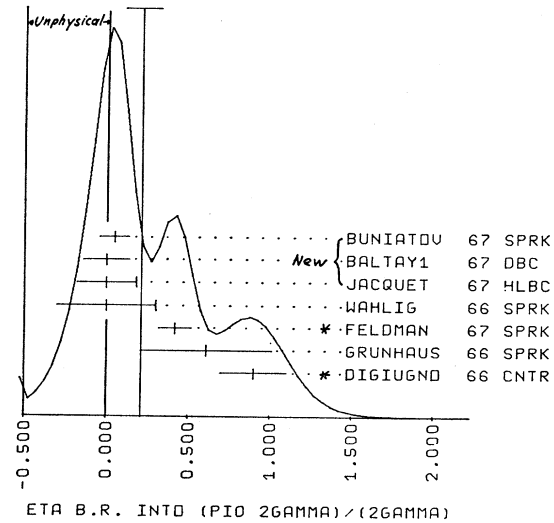
As is well known, there are great inconsistencies among the various experiments which report etas decaying into neutrals. The controversy is over whether the mode $\eta \rightarrow \pi^0 \gamma\gamma$ is ≈ 0 (as the newer experiments indicate) or $\gtrsim 20\%$ (as the older experiments indicated).

The discrepancies are displayed in the ideogram below, in which all seven relevant experiments have been converted to a common ratio, $\pi^0 \gamma\gamma/\gamma\gamma$. Also upper limits, $<x$, have been converted to $0 \pm x$. The confidence level for consistency of all seven is 4×10^{-4} !

At the time of our last edition, the top three experiments (Buniatov, Baltay, and Jacquet) were new and had not borne the tests of time. Hence we were reluctant to discard older experiments, even though the new were inconsistent with the old. We merely warned that the truth must lie somewhere in between.

But by now, and after fruitful discussion with Charles Baltay,* we feel that we should consider all seven experiments on an a priori equal basis, and then follow the prescription

WEIGHTED AVERAGE = 0.214 ± 0.109
SCALE = 2.02 CHISQ = 24.6 CONLEV = 0.000



of deleting large χ^2 experiments until the confidence level rises to some reasonable value. If we remove the Feldman and DiGiugno experiments, χ^2 decreases from 25 (for all seven) to nearly zero (for the remaining five). Accordingly we have removed these experiments and used the remaining five experiments in our overall fit.

14 ETA BRANCHING RATIOS

(P9) IS ASSUMED = 0 IN ALL RATIOS

R1	* ETA INTO NEUTRALS/CHARGED		(P1+P2+P7)/(P3+P4)
R1	N 10 (2.5) (1.0)	PICKUP 62 HBC	
R1	N 53 (3.20) (1.26)	BASTIEN 62 HBC	
R1	N (2.7) (0.8)	SHAHER 62 HBC	
R1	2.6 .9	BUSCHBECK 63 HBC	7/66
R1	N 280 (4.5) (1.0)	JAMES 66 HBC	6/66
R1	N THESE EXPERIMENTS HAVE NOT BEEN USED IN COMPUTING THE AVERAGES		
R1	N AS THEY WERE UNABLE TO CLEARLY SEPARATE PARTIAL MODES (3) AND (4)		
R1	N FROM EACH OTHER. THE REPORTED VALUES THUS PROBABLY CONTAIN		
R1	N SOME (UNKNOWN) FRACTION OF MODE (4).		
R1	2.64 .23	BALTAY2 67 DBC	11/67
R1	AVG	2.6375 .2228	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)
R1	FIT	2.481 .161	VALUE FROM CONSTRAINED FIT
R2	* ETA INTO 2GAMMA/CHARGED		(P1)/(P3+P4)
R2	0.99 0.48	CRAWFORD 63 HBC	
R2	FIT	1.326 .115	VALUE FROM CONSTRAINED FIT
R3	* ETA INTO (P10 2GAMMA)/NEUTRALS		(P7)/(P1+P2+P7)
R3	S (0.375) (0.072)	DIGIUGNO 66 CNTR	ERROR DOUBLED
R3	* THE ERRORS OF DIGIUGNO+ 66 HAVE BEEN INCREASED BY A FACTOR		6/66
R3	* OF TWO, TO TAKE INTO ACCOUNT POSSIBLE SYSTEMATIC ERRORS, AS		
R3	* SUGGESTED BY THE AUTHORS.		
R3	.27 .10	GRUNHAUS 66 SPRK	8/67
R3	S (.244) (.05)	FELDMAN 67 SPRK	8/67
R3	S SEE THE NOTE ON ETA DECAY INTO NEUTRALS ABOVE.		
R3	.028 .044	BUNIATOV 67 SPRK	11/67
R3	AVG	.0673 .0892	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 2.2)
R3	FIT	.035 .044	VALUE FROM CONSTRAINED FIT
R4	* ETA INTO (P1+ P1- GAMMA)/(P1+ P1- P10)		(P4)/(P3)
R4	0.14 0.08	FOELSCHE 64 HBC	
R4	M 24 (0.73) (0.25)	PAULI 64 DBC	
R4	M THIS EXPERIMENT HAS NOT BEEN INCLUDED IN THE AVERAGES SINCE		
R4	M IT IS NOT CLEAR THAT THEIR CLASS B EVENTS ARE ACTUALLY FROM ETAS.		
R4	0.30 0.06	CRAWFORD 66 HBC	6/66
R4	.10 .10	KRAEMER 64 DBC	7/66
R4	.196 .041	FOSTER3 65 HBC	7/66
R4	.25 .035	LITCHFIEL 67 DBC	8/67
R4	0.28 0.04	BALTAY2 67 DBC	11/67
R4	AVG	.2377 .0229	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.2)
R4	FIT	.235 .021	VALUE FROM CONSTRAINED FIT

* See C. Baltay, Proc. of the 1968 Univ. of Penn. Conf. on Meson Spectroscopy (W. A. Benjamin, to be published).

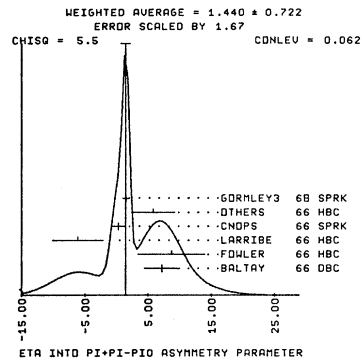
STABLE PARTICLES

Data in parentheses have not been included in our averages.

R5 *	ETA INTO (3P10)+ 2/3(P10 2GAMMA)/ PI+PI-P10	(P2+2/3P7)/P3		
R5	0.83	0.32	CRAWFORD 63 HBC	7/66
R5	2.0	1.0	FOELSCH 64 HBC	7/66
R5	0.90	0.24	FOSTER1 65 HBC	7/66
R5	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)			
R5 AVG	.9148	.1886		
R5 FIT	1.391	.111	VALUE FROM CONSTRAINED FIT	
R6 *	ETA INTO 3P10/2GAMMA	(P2)/(P1)		
R6	.90	OR MORE	CHRETIEN 62 PBC	
R6	0.88	0.16	BALTAY1 67 DBC	11/67
R6	1.1	0.2	CENCE 67 SPRK	1/68*
R6 C	(1.06)	(0.31)	STRUGALSK 68 HLBC	CONFERENCE REPORT 11/68*
R6	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)			
R6 AVG	.9659	.1249		
R6 FIT	.806	.096	VALUE FROM CONSTRAINED FIT	
R7 *	ETA INTO 2GAMMA/(PI+ PI- P0)	(P1)/(P3)		
R7	1.61	0.39	FOSTER1 65 HBC	
R7	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)			
R7 FIT	1.637	.144	VALUE FROM CONSTRAINED FIT	
R8 *	ETA INTO NEUTRAL/(PI+ PI- P10)	(P1+P2+P7)/(P3)		
R8	280	3.6	0.8	KRAEMER 64 DBC
R8		3.8	1.1	PAULI 64 DBC
R8		2.89	0.56	ALFF-STEI 66 HBC
R8	244	3.6	0.6	FLATTEZ 67 HBC
R8	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)			
R8 AVG	3.3488	.3460		
R8 FIT	3.177	.102	VALUE FROM CONSTRAINED FIT	
R9 *	ETA INTO (E+E-PI0)/(PI+PI-P10)	(UNITS 10**--2) (P5)/(P3)		
R9	1.1	OR LESS	PRICE 65 HBC	
R9	0	0.77	OR LESS FOSTER2 65 HBC	
R9	0	.42	OR LESS BAGLINI 67 HLBC	.9 CONF.LEVEL 8/67
R9	0	.16	OR LESS BILLING 67 HLBC	.9 CONF.LEVEL 11/67
R10 *	ETA INTO (E+E-PI+PI-)/TOTAL	(UNITS 10**--2) (P6)/TOTAL		
R10	0.7	OR LESS	RITTENBER 65 HBC	6/66
R11 *	ETA INTO (E+E-PI+PI-)/(PI+PI-GAMMA)	(P6)/(P4)		
R11	1	0.026	0.026	GROSSMAN 66 HBC
R12 *	ETA INTO 2 GAMMA/NEUTRALS	(P1)/(P1+P2+P7)		
R12 S	(0.416)	(0.044)	DIGIUGNO 66 CNTR	ERROR DOUBLED 6/66
R12	.64	.07	GRUNHAUS 66 SPRK	8/67
R12 S	(.579)	(.052)	FELDMAN 67 SPRK	8/67
R12 S	SEE THE NOTE ON ETA DECAY INTO NEUTRALS ABOVE.			
R12 T	(0.39)	(0.06)	JONES 66 CNTR	8/67
R12 T	THIS RESULT FROM COMBINING CROSS-SECTIONS FROM TWO DIFFERENT EXPTS.			
R12	.59	.033	BUNIATOV 67 SPRK	11/67
R12	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.9)			
R12 AVG	.534	.030		
R12 FIT	.534	.030	VALUE FROM CONSTRAINED FIT	
R13 *	ETA INTO 3P10/NEUTRALS	(P2)/(P1+P2+P7)		
R13 S	(0.209)	(0.054)	DIGIUGNO 66 CNTR	ERROR DOUBLED 6/66
R13 R	(.29)	(.10)	GRUNHAUS 66 SPRK	8/67
R13 S	(.177)	(.035)	FELDMAN 67 SPRK	8/67
R13 S	SEE THE NOTE ON ETA DECAY INTO NEUTRALS ABOVE.			
R13 R	(.41)	(.033)	BUNIATOV 67 SPRK	11/67
R13 R	REDUNDANT INFORMATION FROM THIS EXPERIMENT			
R13	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)			
R13 FIT	.431	.040	VALUE FROM CONSTRAINED FIT	
R14 *	ETA INTO P10 (2GAMMA)/2GAMMA	(P7)/(P1)		
R14	.5	OR LESS	WAHLIG 66 SPRK	.9 CONF LEVEL 7/66
R14	0.0	0.14	BALTAY1 67 DBC	11/67
R14 N	(0.05)	(0.04)	BONAMY 67 SPRK	PRELIMINARY RESULT 11/67
R14 C	(0.30)	(0.22)	STRUGALSK 68 HLBC	CONFERENCE REPORT 11/68*
R14	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)			
R14 FIT	.065	.075	VALUE FROM CONSTRAINED FIT	
R15 *	ETA INTO (E+E-PI0)/TOTAL	(UNITS 10**--2) (P5)/TOTAL		
R15	0.7	OR LESS	RITTENBER 65 HBC	6/66
R15	0.084	OR LESS	BAZIN 68 DBC	.9 CONF LEVEL 6/68*
R16 *	ETA INTO 2GAMMA/(3P10 + P10 2GAMMA)	(P1)/(P2+P7)		
R16	0.80	.25	BACCI 63 CNTR	7/66
R16	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)			
R16 FIT	1.081	.122	VALUE FROM CONSTRAINED FIT	
R17 *	ETA INTO (PI+PI-P10 GAMMA)/(PI+PI-P10)	(P10)/(P3)		
R17	.07	OR LESS	FLATTE 67 HBC	8/67
R17	.009	OR LESS	PRICE 67 HBC	8/67
R17	.016	OR LESS	BALTAY2 67 DBC	.95 CONF LEVEL 11/67
R17	.017	OR LESS	ARNOLD 68 HLBC	.9 CONF LEVEL 9/68*
R18 *	ETA INTO (PI+PI- 2GAMMA)/(PI+PI-P10)	(P11)/(P3)		
R18	.009	OR LESS	PRICE 67 HBC	8/67
R18	.016	OR LESS	BALTAY2 67 DBC	.95 CONF LEVEL 11/67
R19 *	ETA INTO 3P10/(PI+ PI- P10)	(P2)/(P3)		
R19	1.3	.4	MICHAEL 67 HLBC	8/67
R19	1.47	0.20	BAGLINZ 67 HLBC	8/67
R19	1.3596	.1506	BULLOCK 68 HLBC	9/68*
R19	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)			
R19 FIT	1.320	.123	VALUE FROM CONSTRAINED FIT	
R20 *	ETA INTO 2GAMMA/(3P10)+2/3(P10 2GAMMA)	(P1)/(P2+2/3P7)		
R20	1.10	0.5	MULLER 63 DBC	7/66
R20	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)			
R20 FIT	1.176	.132	VALUE FROM CONSTRAINED FIT	
R21 *	ETA INTO NEUTRALS/TOTAL	(P1+P2+P7)/TOTAL		
R21	.79	.08	BUNIATOV 67 SPRK	11/67
R21	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)			
R21 FIT	.713	.013	VALUE FROM CONSTRAINED FIT	
R22 *	ETA INTO (PIZRO 2GAMMA)/TOTAL	(P7)/TOTAL		
R22	.12	OR LESS	JACQUET 67 HLBC	.9 CONF LEVEL 11/67
R22	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)			
R22 FIT	.025	.031	VALUE FROM CONSTRAINED FIT	
R23 *	ETA INTO MU+MU-/TOTAL	(UNITS 10**--5) (P12)/TOTAL		
R23	0	2.	OR LESS WEHMANN 68 SPRK	.95 CONF LEVEL 4/68*
R24 *	ETA INTO MU+MU-P10/TOTAL	(UNITS 10**--4) (P14)/TOTAL		
R24	5.	OR LESS	WEHMANN 68 SPRK	4/68*

THE FOLLOWING BRANCHING FRACTIONS HAVE CORRELATED ERRORS GREATER THAN .5
P2 P7 --.665

14 ETA C-NONCONSERVING DECAY PARAMETER			
A	DECAY ASYMMETRY PARAMETER FOR PI+ PI- P10	(UNITS 10**--2)	
A	1351	7.2	2.8
A	355	8.7	5.3
A	705	-6.1	4.0
A	10665	0.3	1.0
A	1300	5.8	3.4
A	36800	1.5	.5
A	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.7)		
A	AVG	1.4398	.7225
		(SEE IDEOGRAM BELOW)	



H. Yuta and S. Okubo (PRL 24, 784) have pointed out that an asymmetry in the decay $\eta \rightarrow \pi^+ \pi^- 0$ of about 2% need not imply a breakdown of C invariance, since an asymmetry of this amount could be caused by an interference between the η and the 3π background.

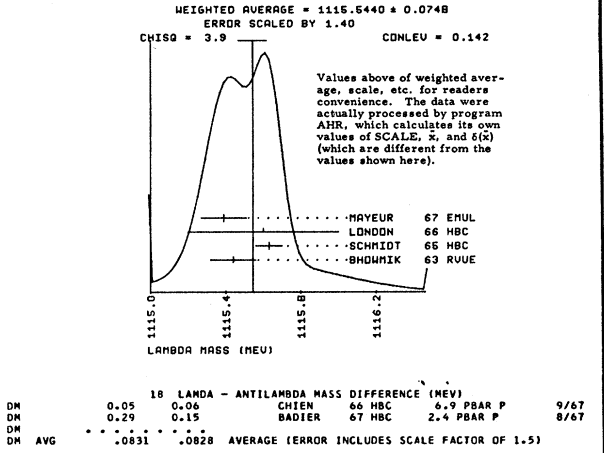
B	DECAY ASYMMETRY PARAMETER FOR PI+ PI- GAMMA	(UNITS 10**--2)	
B	33	-2.	17.
B	1620	1.5	2.5
B	N ABOVE EXPERIMENT IS SENSITIVE ONLY TO UPPER .4 OF GAMMA-RAY SPECTRUM		
B	6710	2.4	1.4
B	6710	2.4	1.4
B	AVG	2.0239	1.2045
		AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)	

Any simple model of C noninvariance in the decay $\eta \rightarrow \pi^+ \pi^- \gamma$ predicts a maximum asymmetry in the lowest part of the γ -ray energy spectrum (i. e., as $E_\gamma \rightarrow 0$). This is easily seen by remembering that (experimentally) the C-conserving part of the decay puts the dipion in a J = 1 state. However, the C-violating part of the interaction must put the dipion in an even J state (and J ≥ 2). One then expects the competition between J = 1 and J = 2 (4, 6, ...) to be the greatest when $m_{\pi\pi}$ is largest, i. e., as $E_\gamma \rightarrow 0$.

However, the lower limits on γ -ray energies detected in the experiments on this asymmetry range from about 50 MeV to about 125 MeV (the maximum energy of the γ in this decay is 204 MeV). Thus no experiment has yet really investigated the potentially most sensitive region.

STABLE PARTICLES

Data in parentheses have not been included in our averages.



18 LAMBDA LIFETIME (UNITS 10**10)

T	188	2.63	0.21	0.21	BOLDT	58 CC	
T	825	2.72	0.16	0.16	CRAWFORD	59 HBC	
T	140	2.72	0.29	0.27	BOMEN	60 CC	
T	186	2.60	0.28	0.20	CHANG	62 HBC	
T	799	2.69	0.11	0.11	HUMPHREY	62 HBC	
T	2239	2.36	0.06	0.06	BLOCK	63 HBC	
T	706	2.76	0.20		CHRETIEN	63 PBC	
T	794	2.59	0.09		HUBBARD	64 HBC	
T	2260	2.31	0.10		KREISLER	64 SPRK	
T	1378	2.59	0.07		SCHWARTZ	64 HBC	
T	635	2.51	0.16		BALTAY	65 HBC	6/66
T	2334	2.6	0.1		HILL	65 SPRK	
T	916	2.35	0.09		BURAN	66 HLBC	6/66
T	S 1147	(2.50)	(0.14)		CHIEN	66 HBC	6.9 PBAR P 9/67
T	S 972	(2.70)	(0.20)		CHIEN	66 HBC	6.9 PBAR P, ANTI 9/67
T	2213	2.452	0.056	0.054	ENGELMANN	66 HBC	9/66
T	585	2.68	0.13	0.11	AUERBACH	67 SPRK	8/67
T		2.44	0.15		BADIER	67 HBC	2.4 PBAR P 6/68*
T		2.55	0.15		BADIER	67 HBC	2.4 PBAR P, ANTI 6/68*
T	G 8342	(2.535)	(0.035)		GRIMM	68 HBC	6/68*
T	2600	2.47	0.08		HEPP	68 HBC	8/68*
T	S	ERROR PURELY STATISTICAL					
T	G	TEMPORARILY NOT AVERAGED SINCE ERRORS ARE ONLY STATISTICAL					11/68*
T	AVG	2.5141	0.0300	0.0294	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.3)		

(SEE IDEOGRAM BELOW)

18 LIFETIME DIFFERENCE, (LAMBDA-ANTILAMBDA)/AVERAGE

DT	0.044	0.085	BADIER	67 HBC	2.4 PBAR P	8/67
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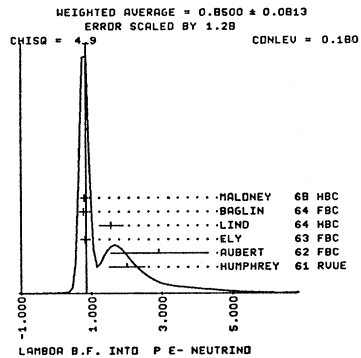
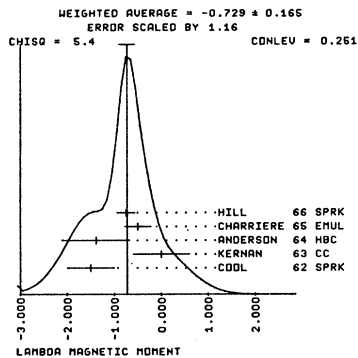
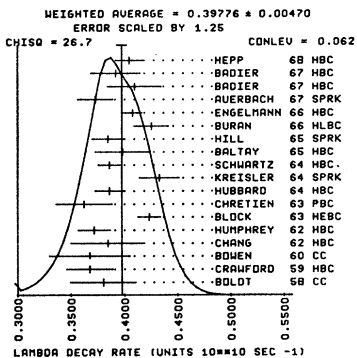
18 LAMBDA MAGNETIC MOMENT (MAGNETONS, 938.26 MEV)

MM	-1.5	0.5	COOL	62 SPRK			
MM	0.0	0.6	KERNAN	63 CC			
MM	8553	-1.39	0.72	ANDERSON	64 HBC		
MM	151	-0.5	0.28	CHARIERE	65 EMUL		
MM	-0.75	0.19	HILL	66 SPRK		9/66	
MM	.....					
MM	AVG	-0.7289	0.1654	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.2)			

(SEE IDEOGRAM BELOW)

18 LAMBDA PARTIAL DECAY MODES

P1	LAMBDA INTO PROTON P1-	DECAY PASSES	938* 139
P2	LAMBDA INTO NEUTRON P10		938* 134
P3	LAMBDA INTO PROTON MU- NEUTRINO		938* 105* 0
P4	LAMBDA INTO PROTON E- NEUTRINO		938* 154* 0



18 LAMBDA BRANCHING RATIOS

R1	* LAMBDA INTO (P P1-)/(P P1-)+(N P10)	(P1)/(P1+P2)					
R1	0.627	0.031	CRAWFORD	59 HBC			
R1	0.65	0.05	COLUMBIA	60 HBC			
R1	U	(0.685)	(0.017)	ANDERSON	62 HBC		
R1	903	0.643	0.016	HUMPHREY	62 HBC		
R1	AVG	.....	.....	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)		
R1	FIT	0.653	0.013	VALUE FROM CONSTRAINED FIT			
R2	* LAMBDA INTO (N P10)/(P P1-)+(N P10)	(P2)/(P1+P2)					
R2	0.23	0.09	EISLER	57 PBC			
R2	0.43	0.14	CRAWFORD	59 HBC			
R2	0.28	0.08	BAGLIN	60 PBC			
R2	0.35	0.05	BROWN	63 HBC			
R2	75	0.291	0.034	CHRETIEN	63 PBC		
R2	AVG	0.3044	0.0250	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)			
R2	FIT	0.347	0.012	VALUE FROM CONSTRAINED FIT			
R3	* LAMBDA INTO (P E- NEU)/TOTAL	(UNITS 10**3)	(P4)/(P1+P2)				
R3	15	2.0	0.5	HUMPHREY	61 RVUE		
R3	8	2.9	1.5	1.2	AUBERT	62 FBC	
R3	150	0.82	0.12	0.13	ELY	63 FBC	
R3	20	1.55	0.34		LIND	64 HBC	
R3	102	0.78	0.12		BAGLIN	64 FBC	
R3	137	0.8	0.1		MALONEY	68 HBC	PRELIMINARY 11/68*
R3	AVG	0.8500	0.0813	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.3)			
R3	FIT	(SEE IDEOGRAM BELOW)			
R4	* LAMBDA INTO (P MU- NEU)/TOTAL	(UNITS 10**4)	(P3)/(P1+P2)				
R4	1	0.2	OR GREATER	GOOD	62 HBC		
R4	1	1.0	OR LESS	ALSTON	63 HBC		
R4	2	1.0	OR LESS	KERNAN	64 FBC		
R4	* BETWEEN 1.3 AND 6.0			LIND	64 HBC		
R4	3	1.3	0.7		LIND	64 RVUE	7/66
R4	2	1.5	1.2		RONNE	64 FBC	
R4	AVG	1.3508	0.6046	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)			

18 LAMBDA DECAY PARAMETERS

A-	* ALPHA LAMBDA- (LAMBDA INTO PI- PROTON)						
A-	1156	0.62	0.07	CROMIN	63 CNTR	LAMBDA FROM PI-P 8/67	
A-	10	(0.663)	(0.022)	BERGE	66 RVUE	INCLUDES ABOVE 9/66	
A-	10130	0.645	0.17	OVERSETH	67 SPRK	LAMBDA FROM PI-P 8/67	
A-	3520	0.67	0.06	DAURER	68 HBC	FROM XI DECAY 6/68*	
A-	M 2529	(0.747)	(0.086)	MERRILL	68 HBC	REPL BY DAURER 68 6/68*	
A-	AVG	0.6455	0.0159	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)			
AO	* ALPHA /ALPHA- FOR LAMBDA (L INTO P10 N/L INTO PI- P)						
AO	1.10	0.27		CORK	60 CNTR		
F-	* PHI ANGLE (SIN(PHI)/COS(PHI)=BETA/GAMMA) (DEGRESS)						
F-	1156	13.0	17.0	CROMIN	63 SPRK	LAMBDA FROM PI-P 11/67	
F-	10130	-8.0	6.0	OVERSETH	67 SPRK	LAMBDA FROM PI-P 11/67	
F-	7377	(-9.2)	(5.2)	CLELAND	67 SPRK	REP BY ANDERSSON 11/68*	
F-	.....	-6.7	4.5	ANDERSSON	68 SPRK	11/68*
F-	AVG	-6.3024	3.5219	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)			
AL	* ASYMMETRY PARAMETER IN ELECTRON - LAMBDA SPIN CORRELATION						
AL	0.06	0.19		BARLOW	65 SPRK	7/66	
AV	* G/A FOR LAMBDA BETA DECAY (SEE TEXT FOR SIGN CONVENTION)						
AV	C 22	(-1.03)		LIND	64 HBC	6/68*	
AV	C 102	ABS VALUE GREATER THAN 0.6		BAGLIN	65 HLBC	6/68*	
AV	C	BETW 0. AND -1.1		BARLOW	65 SPRK	6/68*	
AV	-1.14	0.23	0.33	CONFORTO	65 RVUE	11/67
AV	C 102	ABS VALUE GREATER THAN 0.7		ELY	65 HLBC	95 PCT CCNF LEV 6/68*	
AV	M 137	-0.77	0.17	0.25	MALONEY	68 HBC	PRELIMINARY 11/68*
AV	30	(-0.23)	(0.20)	(0.33)	CHU	68 SPRK	PRELIMINARY 11/68*
AV	A	(0.97)	(0.14)	(0.22)	AVERAGE OBTAINED BY ADDING LCG OF 11/68*		
AV	A	LIKELIHOOD FUNCTIONS OF CONFORTO 65 AND MALONEY 68				11/68*	
AV	M	EXPTS INCLUDED IN CONFORTO 65, RVUE				6/68*	
AV	M	MALONEY 68 MEASURES THE ABSOLUTE VALUE OF A/V					
AV	AVG	-0.9032	0.1776	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.1)			

REFERENCES

18 LAMBDA (1115, JP=1/2+) I=C

EISLER	57 NC	5 1700	EISLER, PLANO, SAMIOS, SCHWARTZ + (COLU+BNL)
BOLDT	58 PRL	1 148	E BOLDT, D O CALDWELL, Y PAL (MIT)
CRAWFORD	59 PRL	2 266	CRAWFORD, CRESTI, DOUGLASS, GOOD + (LRL)
BAGLIN	60 NC	18 1043	BAGLIN, BLOCH, BRISSON, HENNESSY + (PARIS-EP)
BOMEN	60 PR	119 2030	BOMEN, HARDY, REYNOLDS, SUN + (PRINCETON)
CORK	60 PR	120 1000	CORK, KEITH, MENZEL, CROMIN, COOL (LRL+PR+BNL)
COLUMBIA	60 ROCH	CONF 726	M SCHWARTZ + (COLUMBIA)
HUMPHREY	61 PRL	6 478	HUMPHREY, KIRZ, ROSENFELD, RHEE + (LRL+SYRAC)

STABLE PARTICLES

Data in parentheses have not been included in our averages.

Table of references for Sigma- particles, listing authors, institutions, and publication details.

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Table of experimental data for Sigma+ magnetic moment, including values and error bars.

Table of experimental data for Sigma+ partial decay modes, listing various decay channels.

Table of experimental data for Sigma+ branching ratios, including values and error bars.

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Table of experimental data for Sigma+ branching ratios, including values and error bars.

Summation symbol and reference list for Sigma+ mass measurements.

Table of Sigma+ mass measurements, listing values and error bars.

Weighted average calculation for Sigma+ mass, including formula and result.

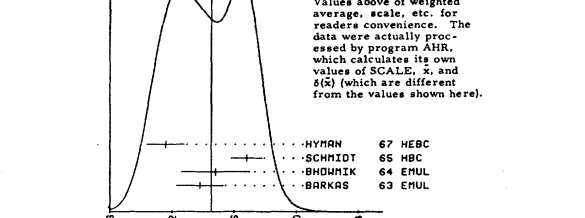


Table of Sigma+ lifetime measurements, listing values and error bars.

Table of Sigma+ lifetime measurements, listing values and error bars.

Table of Sigma+ lifetime measurements, listing values and error bars.

Table of experimental data for Sigma+ branching ratios, including values and error bars.

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Table of experimental data for Sigma+ branching ratios, including values and error bars.

STABLE PARTICLES

Data in parentheses have not been included in our averages.

QUARENI 65 NC 40 A 928 QUARENI,CARTACCI + (BOL+FR+GEN+PARMA) P SCHMIDT (COLUMBIA)
BANGENTE 66 PRL 17 495 BANGENTER,GALTIERI,BERGE,MURRAY+ (LRL)
BERLEY 66 PRL 17 1071 +HERZBACH,KOFLER,YAMAMOTO + (BNL+MASS+YALE)
CHIEN 66 PR 152 1171 +LACH,SANDWEISS,TAFT,YEH,OREN + (YALE+BNL)
COOK 66 PRL 17 223 V COOK,EWART,MASEK,ORR,PLATNER (WASHINGTON)
BARASH 67 PRL 19 181 BARASH,DAY,GLASSER,KEHDE,KNOP + (MARYLAND)
BRISTOL 67 HEIDELBERG CONF BRISTOL-CERN-LAUSANNE-MUNICH-ROME (COLLABOR)
EISELE 67 ZEIT.PHYS.205,409 +ENGELMANN,FILTHUTH,FOLISH,HEPP+ (HEIDELB.)
HYMAN 67 PL 25 B 376 ALOKEN,PEMITI,MCKENZIE,KEYES+(ARG+CARR+NUU)
KOTELCHU 67 PRL 18 1166 KOTELCHUCK,GOZA,SULLIVAN,ROSS (VANDERBILT)
SULLIVAN 67 PRL 18 1163 SULLIVAN,MCINTURFF,KOTELCHUCK (VANDERBILT)
ALSO 64 PRL 13 246 A D MCINTURFF,C E ROOS (VANDERBILT)
ANG 68 VIENNA ABS. 570,2 ANG,EISELE,ENGELMANN,FILTHUTH+(HEIDELBERG)
ALSO 68 PRIVATE COMMUNICATION FROM M. L. STEVENSON (LRL)
BAGGETT 68 VIENNA ABS. 374 BAGGETT,KEHDE (MARYLAND)
ALSO 67 PRL 19 1458 BAGGETT,DAY,GLASSER,KEHDE,KNOP+ (MARYLAND)
ALSO 68 PRIVATE COMMUNICATION FROM N. BAGGETT (MARYLAND)
BALYAY 68 TO BE PUBL. FRANZINI,BALYAY+ VIENNA 263 (COL,STONYBARK)
BANGENTE 68 PR TO BE PUBL. BANGENTER,GARJUST,GALTIERI+ (LRL)
BIERMAN 68 PRL 20 1459 BIEMAN,KOUNOUSI,NAUENBERG + (PRINCETON)
CERN 68 NC 56A 54 CERN-BRISTOL-LAUSANNE-MUNICH-ROME-COLLAB
EISELE 68 VIENNA ABS. 569 EISELE,ENGELMANN,FILTHUTH+(HEIDELBERG)
MAST 68 PRL 20 1312 MAST,GERSHWIN,ALSTON-GARJUST+(LRL)

QUANTUM NUMBER DETERMINATIONS NOT REFERRED TO IN THE DATA CARDS

TRIPP 62 PRL 8 175 R TRIPP,M WATSON,M FERRO-LUZZI (LRL)
ALFF 63 SIENA CONF 1 205 ALFF,NAUENBERG,KIRSCH,BERLEY+(COL+RUT+BNL)
ALSO 65 PR 137 B 1105 ALFF,GELFAND,BRUGGER,BERLEY+(COL+RUT+BNL)
COURANT 63 SIENA CONF 1 73 COURANT,FILTHUTH,BURNSTEIN,DAY+(CERN+MARY)

Table with 2 columns: 20 SIGMA- (1198,JP=1/2+) I=1 and 20 SIGMA- MASS (MEV). Values include 0.11 and 0.11.

M N SEE NOTE PRECEDING LAMBDA MASS LISTINGS
M 3000 1197.47 0.11 SCHMIDT 65 HBC SEE NOTE N 6/68*
M 2279 81.64 0.09 HEPP 68 HBC 6/68*
M FIT 1197.32 0.11 VALUE FROM CONSTRAINED FIT 6/68*

20 SIGMA- MASS DIFFER. (-)(+)(MEV)

Table with columns for D, D AVG, and FIT values, and corresponding HBC or EMUL references.

20 (SIGMA-) - (LAMBDA) MASS DIFFERENCE (MEV)

Table with columns for DL, DL AVG, and FIT values, and corresponding HBC or EMUL references.

20 SIGMA- LIFETIME (UNITS 10**-10)

Table with columns for T, T S, and T AVG values, and corresponding HBC or EMUL references.

WEIGHTED AVERAGE = 0.6103 +/- 0.0202 ERRORD SCALED BY 2.41. CONLEV = 0.003

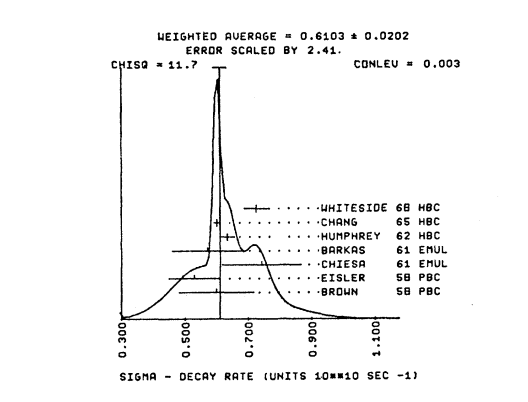


Table with 2 columns: 20 SIGMA- PARTIAL DECAY MODES and DECAY PASSES. Values include 9394 139, 9394 139+, 9394 105+, 9394 .5+, 1115+ .5+.

20 SIGMA- BRANCHING RATIOS

Table with columns for R1, R1 AVG, R2, R2 AVG, R3, R3 AVG, R4, R4 AVG values and corresponding HBC or EMUL references.

20 SIGMA- BRANCHING RATIOS (continued)

Table with columns for R2, R2 AVG, R3, R3 AVG, R4, R4 AVG values and corresponding HBC or EMUL references.

20 SIGMA- BRANCHING RATIOS (continued)

Table with columns for R3, R3 AVG, R4, R4 AVG values and corresponding HBC or EMUL references.

20 SIGMA- BRANCHING RATIOS (continued)

Table with columns for A-, A-, A-, A-, A- AVG values and corresponding HBC or EMUL references.

20 SIGMA- BRANCHING RATIOS (continued)

Table with columns for F-, F-, F-, F-, F- AVG values and corresponding HBC or EMUL references.

20 SIGMA- BRANCHING RATIOS (continued)

Table with columns for AV, AV S, AV C, AV I, AV I AVG, AV I A, AV I A values and corresponding HBC or EMUL references.

20 SIGMA- BRANCHING RATIOS (continued)

Table with columns for AV I AVG, AV I A, AV I A values and corresponding HBC or EMUL references.

20 SIGMA- BRANCHING RATIOS (continued)

Table with columns for BROWN, EISLER, BROWN, BARKAS, CHIESA, HUMPHREY, TRIPP, BARKAS, BURNSTEIN, COURANT, MILLER, MURPHY, NAUENBERG, BAZIN, DOSCH, CHUNG YUN CHANG, SCHMIDT, BANGENTE, CHIEN, BARASH, BERLEY, ANG, BAGGETT, BALYAY, BANGENTE, BIEMAN, COLLERAI, EISELE, GERSHWIN, HEPP, SECHIZOR, WHITESIDE values and corresponding HBC or EMUL references.

20 SIGMA- BRANCHING RATIOS (continued)

Table with columns for BROWN, EISLER, BROWN, BARKAS, CHIESA, HUMPHREY, TRIPP, BARKAS, BURNSTEIN, COURANT, MILLER, MURPHY, NAUENBERG, BAZIN, DOSCH, CHUNG YUN CHANG, SCHMIDT, BANGENTE, CHIEN, BARASH, BERLEY, ANG, BAGGETT, BALYAY, BANGENTE, BIEMAN, COLLERAI, EISELE, GERSHWIN, HEPP, SECHIZOR, WHITESIDE values and corresponding HBC or EMUL references.

STABLE PARTICLES

Data in parentheses have not been included in our averages.

Σ^0

21 SIGMA 0 (1193,JP=1/2+) I=1

D1 N	SEE NOTE PRECEDING LAMBDA MASS LISTINGS.
D1	18 4.75 0.1 BURNSTEIN 64 HBC
D1	37 4.87 0.12 DOSCH 65 HBC
D1	12 4.99 0.13 SCHMIDT 65 HBC SEE NOTE N 6/68*
D1	*****
D1	AVG 4.8486 ± 0.092 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)
D1	FIT 4.86 0.07 VALUE FROM CONSTRAINED FIT 6/68*

21 (SIGMA 0) - (LAMBDA) MASS DIFFERENCE (MEV)

DL N	SEE NOTE PRECEDING LAMBDA MASS LISTINGS.
DL	208 76.63 0.28 SCHMIDT 65 HBC SEE NOTE N 6/68*
DL	*****
DL	FIT 76.86 0.09 VALUE FROM CONSTRAINED FIT 6/68*

21 SIGMA 0 LIFETIME (UNITS 10**14)

T *	1.0 OR LESS DAVIS 62 EMUL 7/66
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21 SIGMA 0 PARTIAL DECAY MODES

P1	SIGMA 0 INTO LAMBDA GAMMA	DECAY PASSES
P2	SIGMA 0 INTO LAMBDA E+ E-	1115+ 0
		1115+ .5+ .5
R1 *	SIGMA 0 INTO LAMBDA E+ E- / TOTAL	(P2)/(P1+P2)
R1 *	0.00545 THEORET. CAL. FEINBERG 58	QUANTUM ELECT. 9/66

REFERENCES

21 SIGMA 0 (1193,JP=1/2+) I=1

FEINBERG 58	PR 109 1019	G. FEINBERG	(BNL)
DAVIS 62	PR 127 605	D. DAVIS, R. SETTI, M. RAYMOND, G. TOMASIN	(CHI)
COURANT 63	PR 10 409	COURANT, FILTHUTH, FRANZINI+ (CERN+UND+USNRL)	
BURNSTEIN 64	PR 13 66	BURNSTEIN, DAY, KEHOE, SECHI ZORN, SNOW (MARY)	
DOSCH 65	PL 14 239	DOSCH, ENGLHANN, FILTHUTH, HEPP, KLUGE+ (HEID)	
SCHMIDT 65	PR 140 8 1328	P. SCHMIDT	(COLUMBIA)

QUANTUM NUMBER DETERMINATIONS NOT REFERRED TO IN THE DATA CARDS

ALFF 65	PR 137 81105	ALFF, GELFAND, NAUENBERG+ (COLUMBIA+RUTG+BNL) P
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Σ^-

22 XI- (1321,JP=1/2) I=1/2

22 XI- MASS (MEV)

M H	11(1317.0)	(2.2)	WANG 61 PBC
M H	10(1317.9)	(1.9)	FOWLER 61 PBC
M H	(OLD DATA AND LOW STATISTICS DROPPED ON SUGGESTION OF J R HUBBARD)		
M *	1(1322.0)	(1.3)	BROWN 62 HBC ANTI-XI-
M *	517(1321.4)	0.4	JAUNEAU 63 FBC
M *	62(1321.1)	0.65	SCHNEIDER 63 HBC
M *	241(1321.1)	0.3	BADIERI 64 HBC
M *	ALL MASSES ABOVE WERE RAISED 0.09 MEV BECAUSE LAMBDA MASS RAISED		
M *	149(1321.3)	0.3	PJERROU 65 HBC
M *	5(1320.69)	0.93	CHIEN 66 HBC + 6.9 PBAR P, ANTI
M *	6(1321.67)	0.52	CHIEN 66 HBC - 6.9 PBAR P
M *	299(1321.4)	1.1	LONDON 66 HBC
M S	12(1321.7)	(0.6)	SHEN 67 HBC ANTI-XI-
M S	THE ERROR IS STATISTICAL ONLY		
M	*****		
M	AVG 1321.2502 ± 0.1777 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)		
M	FIT 1321.25 0.18 VALUE FROM CONSTRAINED FIT 6/68*		

22 MASS DIFFERENCE, (XI-) - (ANTI-XI-) IN MEV

DM	1.0 1.1 CHIEN 66 HBC 6.9 PBAR P 9/67
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22 XI- LIFETIME (UNITS 10**10)

T H	11 (3.5)	(3.4)	(1.23)	WANG 61 PBC
T H	18 (1.28)	(0.41)	(0.25)	FOWLER 61 PBC
T H	(OLD DATA AND LOW STATISTICS DROPPED ON SUGGESTION OF J R HUBBARD)			
T	517	1.86	0.15	0.14 JAUNEAU 63 FBC
T	62	1.55	0.31	0.31 SCHNEIDER 63 HBC
T *	356 (1.77)	(0.12)	0.31	CARMONY 64 HBC REP BY PJERROU 65
T	794	1.69	0.07	HUBBARD 64 HBC
T	246	1.70	0.12	PJERROU 65 HBC
T S	6 (1.37)	(0.51)		CHIEN 66 HBC - 6.9 PBAR P 11/67
T S	5 (1.51)	(0.55)		CHIEN 66 HBC + 6.9 PBAR P, ANTI 9/67
T S	299	1.80	0.16	LONDON 66 HBC 6/66
T S	12 (1.9)	(0.7)	(0.5)	SHEN 67 HBC ANTI-XI- 6/66
T S	2610	1.61	0.04	DAUBER 68 HBC 6/68*
T S	THE ERROR IS STATISTICAL ONLY			
T	*****			
T	AVG 1.6603 ± 0.0366 - 0.0352 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.1)			

22 XI- PARTIAL DECAY MODES

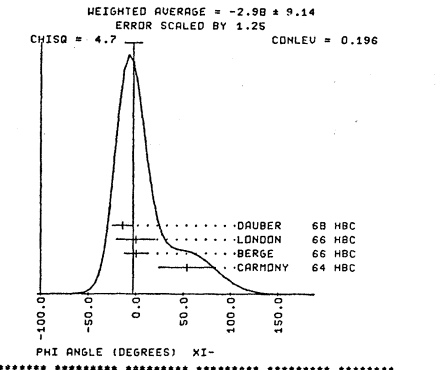
P1	XI- INTO LAMBDA PI-	DECAY PASSES
P2	XI- INTO LAMBDA E- NEUTRINO	1115+ 139
P3	XI- INTO NEUTRON PI-	939+ 139
P4	XI- INTO LAMBDA MU- NEUTRINO	1115+ 105+ 0
P5	XI- INTO SIGMA 0 E- NEUTRINO	1192+ .5+ 0
P6	XI- INTO SIGMA 0 MU- NEUTRINO	1192+ 105+ 0
P7	XI- INTO NEUTRON E- NEUTRINO	939+ .5+ 0

22 XI- BRANCHING RATIOS

R1 *	XI- INTO (LAMBDA E- NEU)/(LAMBDA PI-) (UNITS 10**3) (P2)/(P1)	
R1	1 155 EFFECTIVE DENOM. CARNDY 63 HBC 11/67	
R1	0 260 EFFECTIVE DENOM. JAUNEAU 63 HBC 11/67	
R1	0 220 EFFECTIVE DENOM. BERGE 66 HBC 11/67	
R1	1 155 EFFECTIVE DENOM. LONDON 66 HBC 11/67	
R1	0 717 EFFECTIVE DENOM. TRIPPE 67 HBC 11/67	
R1	2 1976 EFFECTIVE DENOM. HUBBARD 68 HBC 6/68*	
R1	4 0.90 0.71 0.43 HUBBARD 68 RVUE 6/68*	
R1 *	HUBBARD 68 (RVUE) INCLUDES ALL ABOVE EVENTS 6/68*	
R2 *	XI- INTO INEUTRON PI-/(LAMBDA PI-) (UNITS 10**3) (P3)/(P1)	
R2	5.0 OR LESS FERRO-LUZ 63 HBC 6/68*	
R2	1.1 OR LESS DAUBER 68 HBC 6/68*	
R3 *	XI- INTO (LAMBDA MU- NEUTRINO)/TOTAL (UNITS 10**3) (P4)/TOTAL	
R3	12.0 OR LESS BERGE 66 HBC 6/68*	
R3	1.3 OR LESS DAUBER 68 HBC 6/68*	
R4 *	XI- INTO (SIGMA 0 E- NEUTRINO)/TOTAL (UNITS 10**3) (P5)/TOTAL	
R4	3.0 OR LESS BERGE 66 HBC 6/68*	
R4	0.5 OR LESS DAUBER 68 HBC 6/68*	
R5 *	XI- INTO (SIGMA 0 MU- NEUTRINO)/TOTAL (P6)/TOTAL	
R5	0.005 OR LESS BERGE 66 HBC 7/66	
R6 *	XI- INTO (N E- NEUTRINO) / (LAMBDA PI-) (P7)/(P1)	
R6 *	0.01 OR LESS BINGHAM 65 RVUE CONF-LIMIT 0.9 9/66	
R7 *	XI- INTO (SIGMA 0 E NEU + LAMBDA E NEU)/TOTAL (10**3) (P2+P5)/TOTAL	
R7	0 0.62 0.20 0.30 DUCLOS 68 SPRK PREL-SEE NOTE D 10/68*	
R7 D	THIS EXPERIMENT CANNOT DISTINGUISH SIGMA 0 FROM LAMBDA. THE CABIBBO	
R7 D	THEORY EXPECT SIGMA 0 RATE ABOUT A FACTOR 6 SMALLER THAN THE LAMBDA	
R7 D	TO GET A VALUE FOR THE TABLE RT HAS BEEN AVERAGED WITH R1 -	

22 XI- DECAY PARAMETERS

A *	ALPHA XI-	
A C	(-0.44) (0.12) JAUNEAU 63 FBC SEE NOTE D BELOW 6/68*	
A D	(-0.73) (0.23) SCHNEIDER 63 HBC SEE NOTE D BELOW 6/68*	
A	240 -0.5 0.38 BADIERI 64 HBC SEE NOTE D BELOW 6/68*	
A	356 -0.62 0.13 CARMONY 64 HBC SEE NOTE D BELOW 6/68*	
A	1004 -0.365 0.068 BERGE 66 HBC SEE NOTE D BELOW 6/68*	
A	364 -0.47 0.13 LONDON 66 HBC SEE NOTE D BELOW 6/68*	
A L	LONDON 66 USES ALPHA-LAMBDA = 0.62	
A *	(-0.391) (0.032) BERGE 2 66 RVUE INCLUDES ALL ABOVE 9/66	
A	2781 -0.391 0.045 DAUBER 68 HBC SEE NOTE A BELOW	
A	A USED ALPHALAMBDA = 0.647 PLUS OR MINUS 0.020	
A M	2529 (-0.375) (0.051) MERRILL 68 HBC 6/68*	
A M	DATA OF MERRILL 68 INCLUDED IN DAUBER 68.	
A D	OLD DATA NOT INCLUDED IN AVERAGE.	
A D	ERRORS MULTIPLIED BY 1.1 DUE TO APPROXIMATIONS USED FOR XI	
A D	POLARIZATION. (SEE DAUBER 68 FOR DETAILED DISCUSSION)	
A	*****	
A	AVG -0.4070 ± 0.0370 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.1)	
F *	PHI ANGLE (SIN(PHI)/COS(PHI))=BETA/GAMMA (DEGREES)	
F D	(-16.0) (45.0) JAUNEAU 63 FBC SEE NOTE D BELOW 6/68*	
F D	62 (45.0) (36.0) SCHNEIDER 63 HBC SEE NOTE D BELOW 6/68*	
F	356 54.0 30.0 CARMONY 64 HBC SEE NOTE D BELOW 6/68*	
F	1004 0 12.0 BERGE 66 HBC SEE NOTE D BELOW 6/68*	
F	364 0 20.4 LONDON 66 HBC SEE NOTE D BELOW 6/68*	
F L	LONDON 66 USES ALPHA-LAMBDA = 0.62	
F	2781 -14. 11. DAUBER 68 HBC SEE NOTE A BELOW	
F M	A USED ALPHALAMBDA = 0.647 PLUS OR MINUS 0.020	
F M	2529 (9.8) (11.6) MERRILL 68 HBC 6/68*	
F M	DATA OF MERRILL 68 INCLUDED IN DAUBER 68.	
F D	OLD DATA NOT INCLUDED IN AVERAGE.	
F D	ERRORS MULTIPLIED BY 1.2 DUE TO APPROXIMATIONS USED FOR XI	
F D	POLARIZATION. (SEE DAUBER 68 FOR DETAILED DISCUSSION)	
F	*****	
F	AVG -2.9751 ± 0.1417 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.3)	
	(SEE IDEOGRAM BELOW)	



REFERENCES

22 XI- (1321,JP=1/2) I=1/2

FOWLER 61	PR 137 8 134	FOWLER, BIRGE, EBERHARD, ELY, GCOO, POWELL+ (LRL)
WANG 61	JLTP 13 512	K. WANG, F. WANG, VIERYASOV, TING, SOLOVIEV+ (JINR)
BERTANZA 62	PR 9 229	BERTANZA, BRISSON, GOLDBERG, GRAY+ (BNL+SYRAC)
BROWN 62	PL 8 255	BROWN, CULWICK, FOWLER, GAILLUD + (BNL+YALE)
CARMONY 63	PR 10 381	CARMONY, PJERROU (UCLA)
FERRERLUZ 63	PR 130 1568	FERRERLUZ, ALSTON, ROSENFELD, WOJCICKI (LRL)
JAUNEAU 63	SIENA CONF 4	JAUNEAU+ (PARIS+CERN+LOND+RUTH+BERGEN)
JAUNEAU 63	PL 9 261	JAUNEAU, MORELLET+ (EP,CERN,LON,RUTH+BERGEN)
SCHNEIDER 63	PL 4 360	H. SCHNEIDER (CERN)

STABLE PARTICLES

Data in parentheses have not been included in our averages.

CARMONY 64 PRL 12 482	CARMONY,PJERROU,SCHLEIN,SLATER,STORK*(UCLA)
BADIERI 64 DUBNA CONF 1 593	BADIER,DEMOULIN,BARL,DOUARD* (PARIS+SAC+ZEE)
HUBBARD 64 PR 135 B 183	HUBBARD,BERGE,KALBFLEISCH,SHAFER* (LRL)
BINGHAM 65 PRSL 285 202	H H BINGHAM (CERN)
PJERROU 65 PRL 14 275	* SCHLEIN,SLATER,SMITH,STORK,TICHO (UCLA)
PJERROU 65 THESIS	G M PJERROU (UCLA)

BERGE 66 PR 147 945	BERGE,EBERHARD,HUBBARD,MERRILL* (LRL)
BERGE 2 66 BERKELEY CONF 46	BERGE,CARIBBO (RVUE)
LONDON 66 PR 143 1034	LONDON,RAU,GOLDBERG,LICHTMAN*(BNL+SYRACUS)
CHIEN 66 PR 152 1171	*LACH,SANDWEISS,TAFT,YEH,OREN* (YALE+BNL)
SHEN 67 PL 25 B 443	B.C.SHEN,A.FIRESTONE,G.GOLDHABER (UCB+LRL)
TRIPPE 67 PRIV. COMM.	T. TRIPPE (UCLA)
DAUBER 68 UCRL 18388	*BERGE,HUBBARD,MERRILL,MILLER (LRL)
DUCLLOS 68 TO BE PUBL.	DUCLLOS,FREYTAG* VIENNA 253(CERN,HEIDELBERG)
HUBBARD 68 PRL 20 485	HUBBARD,BERGE,DAUBER (LRL)
MERRILL 68 PR 167 1202	MERRILL,SHAFER (LRL)

QUANTUM NUMBER DETERMINATIONS NOT REFERRED TO IN THE DATA CARDS

CARMONY 64 PRL 12 482	CARMONY,PJERROU,SCHLEIN,SLATER,STORK*(UCLA) J
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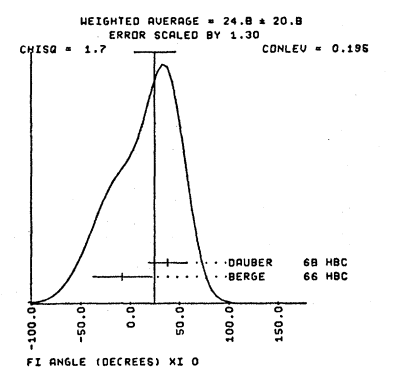
23 XI 0 (1314,JP=1/2) I=1/2	
23 XI 0 MASS (MEV)	
M 1 1313.4 1.8 PALMER 68 HBC 3/68*	
M FIT 1314.69 0.70 VALUE FROM CONSTRAINED FIT 6/68*	
23 XI MASS DIFFERENCE (-)-(0)(MEV)	
D 23 6.8 1.6 JAUNEAU 63 FBC	
D * 45 (6.1) (1.6) CARMONY 64 HBC REP BY PJERROU 65	
D 88 6.1 0.9 PJERROU 65 HBC 11/67	
D 29 6.9 2.2 LONDON 66 HBC 6/66	
D AVG 6.3395 .7389 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)	
D FIT 6.56 0.68 VALUE FROM CONSTRAINED FIT 6/68*	

23 XI 0 LIFETIME (UNITS 10**=-10)	
T 24 3.9 1.4 0.80 JAUNEAU 63 FBC	
T * 45 (3.5) (1.0) (0.8) CARMONY 64 HBC REP BY PJERROU 65	
T 101 2.5 0.4 0.3 HUBBARD 64 HBC 11/97* .5+ 0	
T 80 3.0 0.5 PJERROU 65 HBC 11/67	
T 340 3.07 0.22 0.20 DAUBER 68 HBC 6/68*	
T AVG 3.0327 +.1815 -.1621 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)	

23 XI 0 PARTIAL DECAY MODES	
P1 XI 0 INTO LAMBDA P10	1115+ 134
P2 XI 0 INTO PROTON P1-	938+ 139
P3 XI 0 INTO PROTON E- NEU	938+ .5+ 0
P4 XI 0 INTO SIGMA+ E- NEU	1189+ .5+ 0
P5 XI 0 INTO SIGMA- E+ NEU	1197+ .5+ 0
P6 XI 0 INTO SIGMA+ MU- NEUTRINO	1189+ 105+ 0
P7 XI 0 INTO SIGMA- MU+ NEUTRINO	1197+ 105+ 0
P8 XI 0 INTO PROTON MU- NEUTRINO	938+ 105+ 0

23 XI 0 BRANCHING RATIOS	
R1 * XI0 INTO (PROTON P1-)/(LAMBDA P10) (UNITS 10**=-3) (P2)/(P1)	
R1 27.0 OR LESS TICHO 63 HBC 6/68*	
R1 5.0 OR LESS HUBBARD 66 HBC 6/68*	
R1 1.9 OR LESS DAUBER 68 HBC 6/68*	
R2 * XI0 INTO (PROTON E- NEU)/(LAMBDA P10) (UNITS 10**=-3) (P3)/(P1)	
R2 27.0 OR LESS TICHO 63 HBC 6/68*	
R2 6.0 OR LESS HUBBARD 66 HBC 6/68*	
R2 1.3 OR LESS DAUBER 68 HBC 6/68*	
R3 * XI0 INTO (SIGMA+ E- NEU)/(LAMBDA P10) (UNITS 10**=-3) (P4)/(P1)	
R3 13.0 OR LESS TICHO 63 HBC 6/68*	
R3 7.0 OR LESS HUBBARD 66 HBC 6/68*	
R3 1.5 OR LESS DAUBER 68 HBC 6/68*	
R4 * XI0 INTO (SIGMA- E+ NEU)/(LAMBDA P10) (UNITS 10**=-3) (P5)/(P1)	
R4 6.0 OR LESS HUBBARD 66 HBC 6/68*	
R4 1.5 OR LESS DAUBER 68 HBC 6/68*	
R5 * XI0 INTO (SIGMA+ MU- NEU)/TOTAL (UNITS 10**=-3) (P6)/TOTAL	
R5 7.0 OR LESS HUBBARD 66 HBC 6/68*	
R5 1.5 OR LESS DAUBER 68 HBC 6/68*	
R6 * XI0 INTO (SIGMA- MU+ NEU)/TOTAL (UNITS 10**=-3) (P7)/TOTAL	
R6 6.0 OR LESS HUBBARD 66 HBC 6/68*	
R6 1.5 OR LESS DAUBER 68 HBC 6/68*	
R7 * XI0 INTO (PROTON MU- NEU)/TOTAL (UNITS 10**=-3) (P8)/TOTAL	
R7 6.0 OR LESS HUBBARD 66 HBC 6/68*	
R7 1.3 OR LESS DAUBER 68 HBC 6/68*	

23 XI 0 DECAY PARAMETER	
A * ALPHA XI 0	
A 0.09 0.46 PJERROU 65 HBC SEE NOTE D BELOW 6/68*	
A 146 -0.13 0.17 BERGE 66 HBC SEE NOTE D BELOW 6/68*	
A 46 -0.2 0.4 LONDON 66 HBC SEE NOTE D BELOW 6/68*	
A L LONDON 66 USES ALPHA-LAMBDA = 0.62	
A M 490 (-0.33) (0.11) MERRILL 66 HBC SEE NOTE D BELOW 6/68*	
A M MERRILL 66 REPLACED BY DAUBER 68	
A D ERRORS MULTIPLIED BY 1.1 DUE TO APPROXIMATIONS USED FOR XI	
A D POLARIZATION. (SEE DAUBER 68 FOR DETAILED DISCUSSION)	
A F 739 -0.43 0.09 DAUBER 68 SEE NOTE A BELOW	
A A USED ALPHALAMBDA = 0.647 PLUS OR MINUS 0.020	
A AVG -0.3506 .0769 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)	
F * PHI ANGLE (SIN(PHI)/COS(PHI)-BETA/GAMMA) (DEGREES)	
F 146 .89 30. BERGE 66 HBC SEE NOTE D BELOW 6/68*	
F M 490 (107.0) (146.0) MERRILL 66 HBC SEE NOTE D BELOW 6/68*	
F M MERRILL 66 REPLACED BY DAUBER 68	
F D ERRORS MULTIPLIED BY 1.2 DUE TO APPROXIMATIONS USED FOR XI	
F D POLARIZATION. (SEE DAUBER 68 FOR DETAILED DISCUSSION)	
F F 739 .39 19. DAUBER 68 HBC SEE NOTE A BELOW	
F A USED ALPHALAMBDA = 0.647 PLUS OR MINUS 0.020	
F AVG 24.8311 20.7930 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.3) (SEE IDEOGRAM BELOW)	

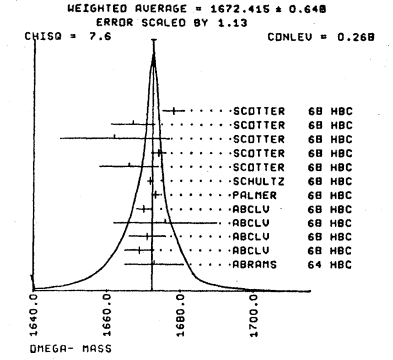


REFERENCES

ALVAREZ 59 PRL 2 215	ALVAREZ,EBERHARD,GOOD,GRAZIANO,TICHO* (LRL)
JAUNEAU 63 STENA CONF 1 1	JAUNEAU* (PARIS+CERN+LOND+RUTH+BERGEN)
TICHO 63 BNL CONF 410	JAUNEAU* (PARIS+CERN+LOND+RUTH+BERGEN)
	HAROLD K TICHO (UCLA)
CARMONY 64 PRL 12 482	CARMONY,PJERROU,SCHLEIN,SLATER,STORK*(UCLA)
HUBBARD 64 PR 135 B 183	HUBBARD,BERGE,KALBFLEISCH,SHAFER* (LRL)
PJERROU 65 PRL 14 275	* SCHLEIN,SLATER,SMITH,STORK,TICHO (UCLA)
PJERROU 65 THESIS	G M PJERROU (UCLA)
BERGE 66 PR 147 945	BERGE,EBERHARD,HUBBARD,MERRILL* (LRL)
HUBBARD 66 UCRL 11510	J RICHARD HUBBARD (THESIS,BERKELEY) (LRL)
LONDON 66 PR 143 1034	LONDON,RAU,GOLDBERG,LICHTMAN*(BNL+SYRACUS)
MERRILL 66 BERKELEY CONF CF.	MERRILL,SHAFER,BERGE (LRL)
	DEANE MERRILL (THESIS, BERKELEY) (LRL)
DAUBER 68 UCRL 18388	*BERGE,HUBBARD,MERRILL,MILLER (LRL)
PALMER 68 PL 26B 323	PALMER,RADJICIC,RAU,RICHARDSON* (BNL,SYR)

Ω^-

24 OMEGA- (1675,JP=3/2+) I=0	
QUANTUM NUMBERS ASSIGNED FROM SU3	
24 OMEGA- MASS (MEV)	
M * 11620.0 (25.0) (10.0) EISENBERG 54 EMUL	
M 1 1673.0 8.0 ABRAMS 64 HBC INTO XI- P10 3/68*	
M 1 1669.0 4.0 ABCLV 68 HBC INTO LAMBDA K- 3/68*	
M 1 1671.0 5.0 ABCLV 68 HBC INTO LAMBDA K- 3/68*	
M 1 1676.0 14.0 ABCLV 68 HBC INTO LAMBDA K- 3/68*	
M 1 1670.0 2.0 ABCLV 68 HBC INTO LAMBDA K- 3/68*	
M P 111675.63 (5.4) PALMER 68 HBC INTO XI0 P1- 3/68*	
M P 111673.6 (11.2) PALMER 68 HBC INTO LAMBDA K- 3/68*	
M P 111672.5 (11.8) PALMER 68 HBC INTO LAMBDA K- 3/68*	
THE 3 ABOVE EVENTS WERE ORIGINALLY PUBLISHED WITH PASSES 10861+-121, 10741+-3 AND 16711+-51 IN BANERJI(64), AND RICHARDSON 65	
ALL ARE INCLUDED IN THE MASS GIVEN ON THE FOLLOWING LINE --	
M 3 1673.3 1.0 PALMER 68 HBC ALL 3 LAMBDA K- 3/68*	
M 3 1671.8 0.9 SCHULTZ 68 HBC INTO XI0 P1- 3/68*	
M 1 1666.0 8.0 SCOTTER 68 HBC INTO XI0 P1- 3/68*	
M 1 1674.0 2.0 SCOTTER 68 HBC INTO LAMBDA K- 3/68*	
C THE ABOVE EVENT WAS ORIGINALLY PUBLISHED AS COLLEY 65	
M 1 1662.0 15.0 SCOTTER 68 HBC INTO XI0 P1- 3/68*	
M 1 1667.0 6.0 SCOTTER 68 HBC INTO XI0 P1- 3/68*	
M 1 1678.0 3.0 SCOTTER 68 HBC INTO LAMBDA K- 3/68*	
M AVG 1672.4148 .4485 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.1) (SEE IDEOGRAM BELOW)	



MESON RESONANCES

Data in parentheses have not been included in our averages.

24 OMEGA- LIFETIME (UNITS 10 ⁻¹⁰ SEC)			
T	A	1	(1.63)
T	A	1	(0.7)
T	A	1	(1.4)
T	A	1	(1.85)
T	A	1	(1.5)
T	A	1	(0.93)
T	A	1	(2.6)
T	A	1	(1.6)
T	A	1	(1.21)
T	A	1	(1.20)
T	A	1	(0.06)
T	A	1	(0.63)
T	A	1	(0.25)
T	A	1	(0.30)
T	A	1	(0.71)
T	A	1	(0.08)
T	A	1	(1.04)
T	A	1	(2.38)
T	A	ALLISON INCLUDES ALL ABOVE + 3 MORE BNL EVENTS, UNPUBLISHED.	
T	A	21	1.31 0.37 0.24 ALLISON 68 RVUE

24 OMEGA- BRANCHING RATIOS			
7/66	ABRAMS	64	HBC
7/66	BARNES 1	64	HBC
7/66	BARNES 2	64	HBC
7/66	COLLEY	65	HBC
7/66	RICHARDSO	65	HBC
11/67	ABCLV COL	68	HBC
11/67	ABCLV COL	68	HBC
11/67	ABCLV COL	68	HBC
11/67	SCHULTZ	68	HBC
11/67	SCHULTZ	68	HBC
11/67	SCHULTZ	68	HBC
6/68*	SCOTTER	68	HBC
6/68*	SCOTTER	68	HBC
6/68*	SCOTTER	68	HBC
6/68*	SCOTTER	68	HBC
6/68*	SCOTTER	68	HBC
6/68*	SCOTTER	68	HBC
6/68*	SCOTTER	68	HBC

P1 OMEGA- INTO LAMBDA K-		DECAY PASSES		
P2 OMEGA- INTO XI 0 P1-		938*	105*	0
P3 OMEGA- INTO XI- P1 0		938*	105*	0

25 EXAMPLES OF OMEGA - PRODUCTION HAVE BEEN REPORTED. 13 HAVE DECAYED INTO LAMBDA K-, 8 INTO XI 0 P1-, 3 INTO XI- P10, AND ONE IS AMBIGUOUS BETWEEN LAMBDA K- AND XI 0 P1-.

REFERENCES
24 OMEGA-(1675,JP=3/2+) I=0

EISENBERG 54 PR 96 541 Y EISENBERG (CORNELL)
ABRAMS 64 PRL 13 670 + BURNSTEIN, GLASSER + (MARYLAND+USNRL)
BARNES 1 64 PRL 12 204 V E BARNES, CONNOLLY, CRENNELL, CULWICK + (BNL)
BARNES 2 64 PL 12 134 V E BARNES, CONNOLLY, CRENNELL, CULWICK + (BNL)
COLLEY 65 PL 19 152 COLLEY, DODD + (BIRMINGHAM+OXF+RHEL)
RICHARDS 65 BAPS 10 115 RICHARDSON, BARNES, CRENNELL + (BNL+SYRACUSE)
SAMIOS 65 ARGONNE CONF 189 N P SAMIOS (RVUE) BNL

ABCLV 68 NUC PHYS 84 326 AACHEN+BERLIN+CERN+LONDON IMP.(OLL.+VIENNA)
ALLISON 68 PRIV. COMM. JOHN ALLISON (LANCASTER)
PALMER 68 PL 268 323 PALMER, RADDJITIC, RAU, RICHARDSON + (BNL, SYR)
SCHULTZ 68 PR 168 1509 SCHULTZ + (ILL, ARGONNE, NORTHWESTERN, WISC)
SCOTTER 68 PL 268 474 SCOTTER + (BIRM, GLASGOW, IC LONDON, MUNICH, OXF)

MESON RESONANCES

CODE EVENTS QUANTITY ERROR+ ERROR- REFERENCE YR TECN SIGN COMMENTS DATE ABOVE BACKGROUND PUNCHED

π P1 MESON (JPG=0-) I=1
SEE LISTINGS OF STABLE PARTICLES

$\sigma(410)$ 7 SIGMA MESON (410, JPG=0++) I=0
NO EVIDENCE FOR RESONANCE OMITTED FROM TABLE.
SEE NOTE ON ETA 0+(720)

REFERENCES ON SIGMA

SAMIOS 62 PRL 9 139	+BACHMAN, LEA+ (BNL+CCNY+COXRY)
BLOKHINTSEVA 63 JETP 17 80	BLOKHINTSEVA, GREIBINNIK, ZHUKOV + (DUBNA)
BOOTH 63 PR 132 2314	+ ABASHIAN (LRL)
KIRZ 63 PR 130 2481	+SCHWARTZ + TRIPP (LRL)
BARISH 64 PR 135 B 416	BARISH, KURZ, PEREZ-MENDEZ, SOLOMON (LRL)
CRANFORD 64 PRL 13 421	+GROSSMAN, LLOYD, PRICE, FOMER (LRL)
DEL FABR 64 PRL 12 674	DEL FABRO, DE PRETIS, JONES+ FRAICATI)
KALMUS 64 PRL 13 99	+KERNAN, PU, POWELL, DODD (LRL+WISCONSIN)
BIRGE 65 PR 139 B 1600	+ELY+GIDAL+KALMUS+CAMERINI+ (LRL+WISC)
BROWN 65 CORAL GABLES 219	BROWN+FAIER (NORTHWESTERN)
WOLF 65 PL 19 328	WOLF (DESY)
JACOBS 66 PRL 16 669	+SELVE (LRL)
KOPPELHAN 66 PL 22 118	+ALLEN, GODDEN, MARSHALL + (COLORADO+IOWA)
LOVELACE 66 PL 22 332	LOVELACE, HEINZ, DONNACHIE (CERN)
ANDERSON 67 PRL 18 89	+FUKUI+KESSLER+ (CHIC+ANL+OTT+MCGILL+QMC)
CORBETT 67 PR 156 1451	+DAMERELL+MIDDLEMIS+NEWTON OXF+RUTHERF)
MALAMUD 67 PRL 19 1096	E. MALAMUD + P.E. SCHLEIN (UCLA)
WALKER 67 PRL 18 630	+CARROLL, GARFINKEL, OH (WISCONSIN)
BANDER 68 PR 168 1679	M. BANDER, G.L. SHAM, J.R. FULCO (UCI+UCSB)
BISWAS 68 PL 27 B 513	+CASON, JOHNSON, KENNEY, POIRIER + (NOTRE DAME)
EISENHAN 68 PRL 20 758	EISENHANLER, MISTRY, HOSTEK + (CORNELL)
FOSTER 68 NP B 6 107	+GAVILLET+LABROSSE+MONTANET+ (CERN+PARIS)
GUTAY 68 CDD-1428-65	+ARMONY, CSOKKA, LOEFFLER, MEIERE (PURDUE)
JONES 68 PR 166 1405	+CALDWELL+ZACHARDY+HARTING+BLEULER+ (CERN)
MARATECK 68 VIENNA ADS. 803	+HAGOPJAN, SELVE (PENN)

η 14 ETA (549, JPG=0-) I=0
SEE LISTINGS OF STABLE PARTICLES

$\eta_{0+}(720)$ 14 ETA 0+(720, JPG=0++) I=0
OMITTED FROM TABLE.

Narrow $J^P = 0^+$ $\pi\pi$ resonances have been claimed around 400 MeV (" σ meson") and 700 MeV (" ϵ "), but the evidence is unconvincing.

It is, however, suggested from several recent attempts at determining the $\pi\pi$ phase shifts (CLEGG 67, MALAMUD 67, GUTAY 68, JONES 68, MARATECK 68) that δ_{00} (the I=0, S-wave $\pi\pi$ phase shift) may have the behavior characteristic of a wide resonance in the region between 650 and 850 MeV. Such a possibility was first advocated by LOVELACE 66, who observed that to interpret πN elastic scattering data in a dispersion theoretic framework one has to assume the exchange of such a $\pi\pi$ resonance in the t channel.

The $\pi\pi$ phase-shift analyses yield two (or three) different possible solutions for δ_{00} , all of which are quite large in the region 600 to 900 MeV; for one (or two) of these solutions, δ_{00} passes through 90 deg somewhere near 700 MeV. From the small rate of rise of $\delta_{00}(m_{\pi\pi})$ one estimates that the width of this possible $J^P = 0^+$ resonance may be 100 to several hundred MeV.

There is even more uncertainty about the behavior of δ_{00} in the lower energy region $m_{\pi\pi} < 600$ MeV. At present, there is no indication for δ_{00} to be as large as 90 deg anywhere here.

MESON RESONANCES

Data in parentheses have not been included in our averages.

Table with columns for meson type (e.g., rho, omega), mass (M), width (Gamma), and various decay channels and references (e.g., EISNER 67 HBC, MALAMUD 67 RVUE).

Notes section containing various remarks and clarifications regarding the data, such as 'FROM CHEW-LOW EXTRAPOLATION' and 'PHOTOPRODUCTION, UNCORRECTED'.

Table titled '9 RHO PARTIAL DECAY MODES' showing decay channels like 'RHO INTO 2PI', 'RHO INTO 4PI', and 'RHO INTO PI+ PI- PI0'.

Table titled '9 RHO BRANCHING RATIOS' providing numerical values for various decay modes of the rho meson.

Table with columns for meson type, mass, width, and references, covering various mesons like omega, eta, and pi.

Notes section for the second table, including 'NOTE P ON LEPTONIC DECAY MODES' and 'WITH LEPTONIC DECAYS OF THE OMEGA HAS TO BE TAKEN INTO ACCOUNT'.

REFERENCES FOR RHO

Large table of references for rho meson decays, listing authors, journals, and years (e.g., ANDERSON 61 PRL 6 365, KENNEY 62 PR 126 736).

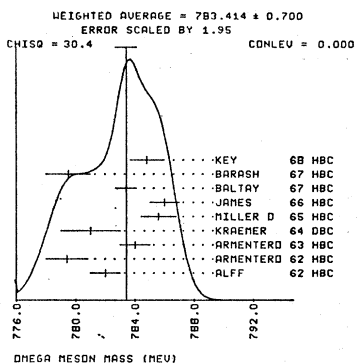
omega (783) 1 OMEGA (783, JPG=1--1) I=0

Table for omega(783) meson, showing mass, width, and various decay channels and references (e.g., M 400 782.0 1.0, ALFF 62 HBC).

Notes for the omega(783) table, including 'AVERAGE (ERROR INCLUDES SCALE FACTOR OF 2.0)'.

MESON RESONANCES

Data in parentheses have not been included in our averages.



1 OMEGA FULL WIDTH (MEV)

W	34	9.0	3.0	ARMENTERO	63 HBC	0.0 PBAR P
W		13.4	2.0	MILLER D	65 HBC	SEEN WITH K+ K-
W	M	(11.6)	(3.0)	MILLER D	65 HBC	SEEN WITH K1 K1
W		666	20.0	DATA INCLUDED IN BARASH	67 BELOW	
W		155	12.3	JAMES	66 HBC	2.1 PI+P
W		14.0	2.4	BARRASH	67 HBC	SEEN WITH K1 K1
W				AUGUSTIN	68 SPRK	E+ E- COLL.BEAMS
W	AVG	12.5593	1.1289	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)		

1 OMEGA PARTIAL DECAY MODES

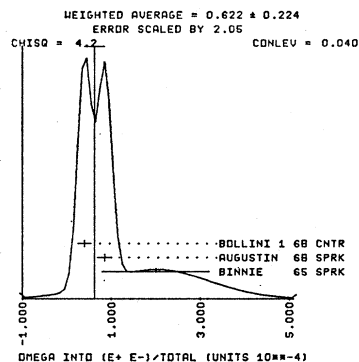
P1	OMEGA INTO PI+ PI- PI0	139+ 139+ 134	DECAY PASSES
P2	OMEGA INTO PI+ PI- (VIOLATES G)	139+ 139	
P3	OMEGA INTO PI+ PI- GAMMA	139+ 139+ 0	
P4	OMEGA INTO P10 GAMMA	134+ 0	
P5	OMEGA INTO 2P10 GAMMA	134+ 134+ 0	
P6	OMEGA INTO MU+ MU-	105+ 105	
P7	OMEGA INTO E+ E-	+5 + 5	
P8	OMEGA INTO ETA GAMMA	548+ 0	
P9	OMEGA INTO ETA P10 (VIOLATES C)	548+ 134	
P10	OMEGA INTO 3 GAMMA	0+ 0+ 0	
P11	OMEGA INTO P10 MU+ MU-	134+ 105+ 105	

1 OMEGA BRANCHING RATIOS

R1	OMEGA INTO NEUTRAL / (PI+ PI- PI0)	0.0 PBAR P
R1	0.17 0.04	ARMENTERO 63 HBC
R1	0.11 0.02	BUSCHBECK 63 HBC
R1	0.08 0.03	KRAEMER 64 HBC
R1	(0.13) (0.035)	MILLER D 65 HBC
R1	0.10 0.04	ALFF-STEI 66 HBC CERN BY SCHULTZ(COL)
R1	0.134 0.026	DI GIUGNO 66 CNTR
R1	0.097 0.016	FLATTE 66 HBC
R1	0.06 0.05	0.02 JAMES 66 HBC
R1	0.10 0.03	BARASH 67 HBC
R1	0.1043 ± 0.0091	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)
R2	OMEGA INTO (PI+ PI-)/(PI+ PI- PI0)	1.6 PBAR P
R2	0.07	ALTTI 63 HBC
R2	0.05 OR LESS	ARMENTERO 63 HBC
R2	0.05 OR GREATER	FICKINGER 63 HBC
R2	0.05 OR LESS	KRAEMER 64 HBC
R2	0.005 OR LESS	LUTJENS 64 RVUE NC INTERFERENCE
R2	0.018 0.012	0.006 WALKER 64 RVUE
R2	0.04 OR GREATER	BATON 65 HBC
R2	0.010 OR LESS	CLARK 65 SPRK
R2	0.035 OR LESS	MILLER D 65 HBC
R2	0.02 OR LESS	ALFF-STEI 66 HBC
R2	(0.023) (0.020)	FLATTE 66 HBC NO INTERFERENCE
R2	0.029 0.011	0.009 FLATTE 66 HBC INTERFERENCE
R2	NOT ESTABLISHED WHETHER ANY PI+PI- SIGNAL HAS I=0, SEE PISUT 68.	
R2	0.0229 ± 0.0067	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)

R3	OMEGA INTO (P10 GAMMA) / (PI+ PI- PI0)	2.8 PI-P
R3	0.125 0.025 OR GRTR.	BARMIN 64 PXBC
R3	(0.15) (0.06)	BAGLIN 66 HBC
R3	BAGLIN 66 SUPERSEDED BY JACQUET 67 BELOW	
R3	0.13 0.04	JACQUET 67 HLRC
R4	OMEGA INTO (PI+ PI- GAMMA)/(PI+ PI- PI0)	1.8 K-P
R4	0.05 OR LESS	FLATTE 66 HBC
R6	OMEGA INTO (MU+ MU-)/(PI+ PI- PI0) (UNITS 10**+3)	2.7 K-P
R6	1.2 OR LESS	GALTIERI 65 HBC
R6	1.7 OR LESS	FLATTE 66 HBC
R7	OMEGA INTO (2P10 GAMMA)/(PI0 GAMMA)	1.3-2.8 PI-P
R7	0.1 OR LESS	BARMIN 64 PXBC
R8	OMEGA INTO (ETA P10 + ETA GAMMA)/(PI+PI-PI0)	1.8 K-P
R8	0.017 OR LESS	FLATTE 66 HBC
R8	0.026 OR LESS	JACQUET 67 HLRC
R9	OMEGA INTO (NEUTRAL) / (CHARGED)	1.2 PI-P
R9	0.124 0.021	FELDMAN 67 SPRK
R10	OMEGA INTO (2P10 GAMMA)/(PI+PI-PI0)	CL=0.90
R10	0.1 OR LESS	JACQUET 67 HLRC
R11	OMEGA INTO (3 GAMMA)/(PI0 GAMMA)	2.34 PI+N
R11	0.35 OR LESS	KANAREK 67 KEBC
R12	OMEGA INTO (P10 MU+ MU-) / TOTAL (UNITS 10**+3)	12 PI- FE
R12	2. OR LESS	WEHMANN 68 SPRK

R13 * OMEGA INTO (E+ E-)/TOTAL (UNITS 10**+4) 6/66
 R13 3 2. 1.2 BINNIE 65 SPRK PI-P NEAR THLD.
 R13 B MASS RESOLUTION OF BINNIE 65 IS ABOUT 15 MEV.
 R13 H (1.0) (1.7) (0.75) HERTZBACH 67 SPRK ASSUME SU(3)+MIXING 0/66
 R13 K 13 (0.48) (0.15) (0.48) KHACHATUR 67 SPRK ASSUME SU(3)+MIXING 5/67
 R13 K SUPERSEDED BY ASTVACATUROV 68 BELOW
 R13 A 33 (0.65) (0.13) ASTVACATUROV 68 SPRK ASSUME SU(3)+MIXING 6/68*
 R13 A NOT RESOLVED FROM RHO DECAY. ERROR STATISTICAL ONLY.
 R13 0.85 0.16 AUGUSTIN 68 SPRK E+ E- COLL.BEAMS 9/68*
 R13 0.40 0.15 BOLLINI 1 68 CNTR 1.7PI-P NOTE Z 9/68*
 R13 Z MASS RESOLUTION OF BOLLINI 1 IS +10 MEV. ABOVE NUMBER IS WITHOUT RHO-OMEGA INTERFERENCE. COMPLETE INTERFERENCE WOULD CHANGE IT BY +35 PER CENT.
 R13 * * * * * .2239 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 2.1)
 R13 AVG * * * * * .6220 (SEE IDEOGRAM BELOW)



R14 * OMEGA INTO NEUTRALS / TOTAL 6/68*
 R14 0.084 0.015 BOLLINI 68 CNTR 2.1 PI-P

REFERENCES FOR OMEGA

MAGLIC 61 PRL 7 178 B MAGLIC, ALVAREZ, ROSENFELD, STEVENSON (LRL)
 PEVSNER 61 PRL 7 421 PEVSNER, KRAEMER, NUSSBAUM, RICHARD+ (JHU+NY)
 XUONG 61 PRL 7 327 NGUYEN HUU XUONG, GERALD R LYNCH (LRL)
 ALFF 62 PRL 9 325 ALFF, BERLEY, COLLEY, GELFAND + (COLU+RUTGERS)
 ARMENTERO 62 CERN CONF 90 R ARMENTEROS, R BUDE+ (CERN+COLL+FRANCE)
 BUTTON 62 PR 126 1858 BUTTON, KALBELEISCH, LYNCH, MAGLIC + (LRL)
 STEVENSON 62 PR 125 687 STEVENSON, ALVAREZ, MADANSKI, RUSSELL (LRL)
 ALITTI 63 NC 29 515 ALITTI, BATON, BERTHELOT+ (LPCHE+PAR+BAR+I+BO)
 ARMENTERO 63 SIENA CONF 1 296 ARMENTEROS, EDWARDS, JACOBSEN+ (CERN+SIENA)
 BARMIN 63 SIENA CONF 1 207 BARMIN, DOLGOLEK, KRESTNIKOV+ (ITEP)
 BERTHELOT 63 SIENA CONF 2 60 A BERTHELOT (CERN-SACLAY)
 BUSCHBECK 63 SIENA CONF 1 166 BUSCHBECK, CZAPP+ (WIENNA+CERN+AMSTERDAM)
 FICKINGER 63 PRL 10 457 FICKINGER, D K ROBINSON, E SALANT (BNL)
 GELFAND 63 PRL 11 436 GELFAND, MILLER, NUSSBAUM, RATAU+ (COLUM+RUTG)
 MURRAY 63 PL 7 358 MURRAY, FERROLUZZI, HUNE, SHAFER, SOLMITZ+ (LRL)
 BARMIN 64 JETP 18 1289 BARMIN, DOLGOLEK, KRESTNIKOV + (ITEP)
 BEZAGUET 64 PL 12 170 BEZAGUET, NGUYEN KHAC, ROUSSET+ (PAR+BERG+LO)
 KRAEMER 64 PR 136 B 496 KRAEMER, MADANSKY, MEER, FIELDS+ (JHU+M+WOOD)
 LUTJENS 64 PRL 12 517 G LUTJENS, J STEINBERGER (COLUMBIA)
 WALKER 64 PL 8 208 WALKER, BOYD, ERWIN, SATTERBLOD + (WISCONSIN)
 BATON 65 NC 35 713 BATON, BERTHELOT, DELER, BENEDETTI+ (SAC+BOLOG)
 BINNIE 65 PL 18 348 BINNIE, DUANE, JANE, W JONES+ (IC-LOND+MANCHE)
 CLARK 65 PR 139 B 1556 CLARK, CHRISTENSON, CIRCINI, TURLEY (PRINCETON)
 GALTIERI 65 PRL 14 279 A BARBARO GALTIERI, R D TRIPP (LRL)
 MILLER D 65 CU-237 (NEVIS 1311) DAVID C MILLER (THEISS) (COLUMBIA)
 MILLER 65 INCLUDES DATA OF GELFAND 63 ABOVE
 ZDANIS 65 PRL 14 721 ZDANIS, MADANSKY, KRAEMER, HERTZBACH+ (JHU+BNL)
 ALFF-STE 66 PR 145 1072 ALFF-STEINBERGER, BERLEY, BRUGGER+ (COL+RUTG)
 BAGLIN 66 PL 23 286 +BEZAGUET, DEGRANGE, HAUTUF+ (EP+BERGEN)
 DI GIUGNO 66 NC 44A 1272 DI GIUGNO, PERUZZI, TROISE+ (NAPL+FRAS+TRST)
 FLATTE 66 PR 145 1050 +HUNE, MURRAY, BUTTON-SHAFER, SOLMITZ+ (LRL)
 JAMES 66 PR 142 896 F E JAMES, KRABILL (YALE+BROOKHAVEN)
 BALTAY 67 PRL 18 93 +FRANZINI, SEVERIENS, YEH, ZANELLO (COLUMBIA)
 BARASH 67 PR 156 1399 BARASH, KIRSCH, MILLER, TAN (COLUMBIA)
 FELDMAN 67 PR 159 1219 +FRATI, GLESON, HALPERN, NUSSBAUM+ (PENNA)
 HERTZBACH 67 PR 155, 1461 HERTZBACH, KRAEMER, MADANSKI, ZDANIS+ (JHU+BNL)
 (SEE ALSO ZDANIS 65)
 JACQUET 67 HEBRO CONF P-364 +NGUYEN-KHAC, BAGLIN, HAUTUF+ (EPP+BERGEN)
 KANAREK 67 YADERN-F12-6 786 +LOSKEVICH, MARTYNOV, NICHIPORUK+ (DUBNA)
 KHACHATUR 67 PL 248 349 KHACHATURYAN+AZIPOV+BALDIN+BELOUSOV+ (DUBNA)
 ASTVACAT 68 PL 27 B 45 ASTVACATUROV, AZIMOV, BALDIN+ (JINR+MOSSCU)
 AUGUSTIN 68 VIENNA CONF. +LEFRANCOIS, LEHMANN, MARIN+ (CERN+SA)
 (SEE S. TING, RAPPORTEURS TALK, DESY F31/4)
 BLUMENFELD 68 VIENNA ABS. 272 BLUMENFELD, BRUYANT, ABRAMOVITCH+ (CERN+SA)
 BOLLINI 68 NC 56 A 531 +BUHLER, DALPIAZ, MASSAM+ (CERN+BGNA+STRB)
 BOLLINI 68 NC 57 A 404 +BUHLER, DALPIAZ, MASSAM+ (CERN+BGNA+STRB)
 DIAZ 68 VIENNA ABS. 676 +GAVILLET, FOSTER, HOLTHUIZEN+ (CERN+COEF)
 DONALD 68 VIENNA ABS. 323 +EDWARDS, BURAN, HETTING+ (LLTP+OSLD+PAD)
 KEY 68 PR 166 1430 +PRENTICE+COOPER+MANNER+WALKER+ (TO+ANL+MS)
 PISUT 68 NP B 6 325 J.PISUT, M.ROOS (CERN)
 WEHMANN 68 PRL 20 748 +ENGLS+ (HARVARD+CASE+SLAC+CORNELL+MGILL)

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Data in parentheses have not been included in our averages.

2 ETA PRIME (958, J^{PC}=0⁻⁺) I=0

KNOWN ALSO AS X0
(JP = 2- NOT YET EXCLUDED,)
(SEE NOTE ON QUANTUM NUMBERS AT END OF LISTING)

η' (958)

2 ETA PRIME MASS (MEV)

M	85	957.0		DAUBER	64	HBC	1.95	K-P		
M		958.0	1.0	KALBFLEIS	64	HBC	2.7	K-P	6/66	
M		957.0	3.0	BADIER	65	HBC	3.0	K-P		
M	8	960.0	2.0	TRILLING	65	HBC	3.05	Pi+ P	9/66	
M	7	955.0	10.0	COHN	66	DBC	3.3	Pi+C	6/66	
M		959.0	3.0	LONDON	66	HBC	2.2	K-P	6/66	
M	*	(960.0)	(5.0)	MOTT	68	HBC	4.1-5.5	K-P	9/68*	
M	AVG	958.3171	.0214	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)						

2 ETA PRIME WIDTH (MEV)

M	85	4.0	OR LESS	DAUBER	64	HBC	1.95	K-P	
M		7.0	OR LESS	KALBFLEIS	64	HBC	2.7	K-P	6/66
M		30.0	OR LESS	BADIER	65	HBC	3.0	K-P	
M		15.0	OR LESS	LONDON	66	HBC	2.2	K-P	6/66

2 ETA PRIME PARTIAL DECAY MODES

P1	ETA PRIME INTO PI+ PI- ETA	DECAY MASSES	
	P1(N) ETAS DECAY INTO ALL NEUTRALS	139+ 139+ 548	
	P1(C) ETAS DECAY CHARGED		
P2	ETA PRIME INTO P10 P10 ETA	134+ 134+ 548	
	P2(N) ETAS DECAY INTO ALL NEUTRALS		
	P2(C) ETAS DECAY CHARGED		
P3	ETA PRIME INTO PI+ PI- GAMMA	139+ 139+ 0	
	(INCLUDING RHOO GAMMA)		
P6	ETA PRIME INTO GAMMA GAMMA	0+ 0	
P6	ETA PRIME INTO RHOO GAMMA	0+ 770	
P10	ETA PRIME INTO PI+ PI- E+ E-	139+ 139+ .5+ .5	
P11	ETA PRIME INTO 2 PI	139+ 139	
P12	ETA PRIME INTO 3 PI	139+ 139+ 134	
P13	ETA PRIME INTO 4 PI	139+ 139+ 139+ 139	
P14	ETA PRIME INTO 6 PI	139+ 139+ 139+ 139	
P15	ETA PRIME INTO P10 GAMMA GAMMA	134+ 0+ 0	
P16	ETA PRIME INTO P10 E+ E- (VIOLATES C IN BORN APPROX.)	134+ .5+ .5	
P17	ETA PRIME INTO ETA E+ E- (VIOLATES C IN BORN APPROX.)	548+ .5+ .5	
P18	ETA PRIME INTO P10 RH0 0 (VIOLATES C)	134+ 770	
P19	ETA PRIME INTO P10 OMEGA (VIOLATES C)	134+ 783	

In our previous calculation of the constrained branching fractions of the η' (958) [RMP 40, 77 (1968), see note on η' , p. 100], we assumed the following decay modes to exist:

- (1) $\eta\pi\pi$ (including $\eta\pi^0\pi^0$, 71% of the η' 's neutral).
- (2) $\pi^+\pi^-\gamma$ (including $\rho^0\gamma$).
- (3) Other neutrals, not yet identified.

Since the $\gamma\gamma$ mode now appears to have been directly observed, we redetermine the branching fractions under the assumption that category (3) above consists entirely of $\gamma\gamma$ decays. Note that the $\gamma\gamma$ value measured by BOLLINI 68 (5.5 + 3.6 / - 3.0 %) is slightly different from the result of the overall fit (6.1 ± 3.1%) because of independent measurements of $\eta' \rightarrow$ all neutrals/ $\eta' \rightarrow$ total. In the fit we do not use the constraint $R = \Gamma(\eta' \rightarrow \eta\pi^+\pi^-) / \Gamma(\eta' \rightarrow \eta\pi^0\pi^0) = 2$ from I-spin conservation. The result of the fit is in reasonable agreement with it, $R = 1.61 \pm 0.32$.

2 ETA PRIME BRANCHING RATIOS

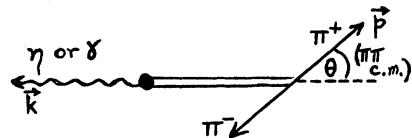
R1 *	ETA PRIME INTO (PI+ PI- ETA (NEUTRAL DEC.))/TOTAL									
R1	68	0.36	0.05	KALBFLEIS	64	HBC	2.7	K-P	0/66	
R1	FIT	.308	.025	VALUE FROM CONSTRAINED FIT						
R2 *	ETA PRIME INTO (PI+ PI- NEUTRALS, EXCLUDING PI+ PI- GAMMA)/TOTAL									
R2	33	0.35	0.06	BADIER	65	HBC	3.0	K-P	0/66	
R2	39	0.4	0.1	LONDON	66	HBC	2.2	K-P	0/66	
R2	AVG	.3632	.0514	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)						
R2	FIT	.389	.020	VALUE FROM CONSTRAINED FIT						
R3 *	ETA PRIME INTO (PI+ PI- ETA (CHRGD. DECAY))/TOTAL									
R3	44	0.12	0.02	KALBFLEIS	64	HBC	2.7	K-P	0/66	
R3	7	0.07	0.04	BADIER	65	HBC	3.0	K-P	0/66	
R3	10	0.1	0.04	LONDON	66	HBC	2.2	K-P	0/66	
R3	AVG	.1083	.0163	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)						
R3	FIT	.125	.010	VALUE FROM CONSTRAINED FIT						
R4 *	ETA PRIME INTO (PI+ PI- NEUTRALS, EXCLUDING PI+ PI- ETA AND PI+ PI- GAMMA)/TOTAL									
R4	10	0.05	0.04	KALBFLEIS	64	HBC	2.7	K-P	0/66	
R4	FIT	.082	.015	VALUE FROM CONSTRAINED FIT						
R5 *	ETA PRIME INTO (NEUTRALS) / TOTAL									
R5	54	0.25	0.05	KALBFLEIS	64	HBC	2.7	K-P	0/66	
R5	16	0.24	0.17	BADIER	65	HBC	3.0	K-P	0/66	
R5	32	0.3	0.1	LONDON	66	HBC	2.2	K-P	0/66	
R5	AVG	.2587	.0432	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)						
R5	FIT	.263	.029	VALUE FROM CONSTRAINED FIT						
R6 *	ETA PRIME INTO (PI+ PI- GAMMA (INCLUDING RHOO GAMMA))/TOTAL									
R6	42	0.22	0.04	KALBFLEIS	64	HBC	2.7	K-P	0/66	
R6	8	(0.34)	(0.09)	BADIER	65	HBC	3.0	K-P	0/66	
R6	B	CONTRIVERSIAL BACKGROUND SUBTRACTION								
R6	20	0.2	0.1	LONDON	66	HBC	2.2	K-P	0/66	
R6	AVG	.2172	.0371	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)						
R6	FIT	.223	.028	VALUE FROM CONSTRAINED FIT						
R7 *	ETA PRIME INTO (PI+ PI- GAMMA (INCLUDING RHOO GAMMA))/(PI PI ETA)									
R7	7	0.25	0.14	DAUBER	64	HBC	1.95	K-P	0/66	
R7	FIT	.312	.051	VALUE FROM CONSTRAINED FIT						
R8 *	ETA PRIME INTO (PI0 E+ E-)/TOTAL									
R8	0	0.013	OR LESS	RITTENBER	65	HBC	2.7	K-P	0/66	
R9 *	ETA PRIME INTO (ETA E+ E-)/TOTAL									
R9	0	0.011	OR LESS	RITTENBER	65	HBC	2.7	K-P	0/66	
R10 *	ETA PRIME INTO (PI0 RHOO)/TOTAL									
R10	0	0.04	OR LESS	RITTENBER	65	HBC	2.7	K-P	0/66	
R11 *	ETA PRIME INTO (PI0 OMEGA) /TOTAL									
R11	0	0.08	OR LESS	RITTENBER	65	HBC	2.7	K-P	0/66	
R12 *	ETA PRIME INTO (PI+ PI- E+ E-)/TOTAL									
R12	0	0.006	OR LESS	RITTENBER	65	HBC	2.7	K-P	0/66	
R13 *	ETA PRIME INTO (2 PI)/TOTAL									
R13	0	0.07	OR LESS	COMP. BY LONDON	66	HBC			0/66	
R14 *	ETA PRIME INTO (3 PI)/TOTAL									
R14	0	0.07	OR LESS	COMP. BY LONDON	66	HBC			0/66	
R15 *	ETA PRIME INTO (4 PI)/TOTAL									
R15	0	0.01	OR LESS	COMP. BY LONDON	66	HBC			0/66	
R16 *	ETA PRIME INTO (6 PI)/TOTAL									
R16	0	0.01	OR LESS	COMP. BY LONDON	66	HBC			0/66	
R17 *	ETA PRIME INTO (PI0 GAMMA GAMMA) / TOTAL									
R17	* 21 (POSSIBLY SEEN (PRELIM.))	STRUGALSK	67	HLBC	2.3	Pi+ N			7/67	
R18 *	ETA PRIME INTO (RHOO GAMMA)/(PI PI ETA)									
R18	0	0.31	0.15	DAVIS	68	HBC	5.5	K-P	9/68*	
R18	FIT	.312	.051	VALUE FROM CONSTRAINED FIT						
R19 *	ETA PRIME INTO (2 GAMMA)/TOTAL									
R19	5	(0.03)	(0.05)	AZIMOV	68	SPR	4.0	Pi- P	9/68*	
R19	0	0.055	0.036	0.030	BOLLINI	68	CNTR	1.9	Pi- P	9/68*
R19	FIT	.062	.031	VALUE FROM CONSTRAINED FIT						

THE FOLLOWING BRANCHING FRACTIONS HAVE CORRELATED ERRORS GREATER THAN .5

P1 P2 - .631
P2 P4 - .652

UNCERTAINTY IN THE J^P ASSIGNMENT η' (958)

The dominant (70%) decay of η' is to $\eta\pi\pi$, but because the Dalitz-plot population is rather flat, exhibiting no significant zeroes, analyses of this mode have not permitted a unique J^P assignment (GOLDBERG 66, DAUBER 64, KALBFLEISCH 64). The flat



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Data in parentheses have not been included in our averages.

Dalitz plot distribution does rule out the $J^P = \text{normal series}$. Thus, using the notation of the sketch, any normal matrix element M needs a factor $\sin \theta$ so as to go to zero at the edge of the Dalitz plot [A. C. Zemach, Phys. Rev. 133, B1204 (1964)].

We must still try to distinguish between $0^-, 1^+, 2^-, \dots$. In the discussion below, the confidence levels are preliminary values from Alan Rittenberg (LRL) based on fits of 314 $\pi^+\pi^-\eta_{\text{neut}}$ decays (see ~ 100 more in the compilation of LONDON 66) and 184 $\pi^+\pi^-\gamma$ decays (including the 40 in the Letter of KALBFLEISCH 64).

- $J = 0^-$: The simplest M is constant. Conf. level = 15%.
- 1^+ $M = k$. This simply does not fit. Of course a strong $\pi\pi$ final-state interaction could help; it seems unlikely but further work is needed.
- 2^- $M = akk + bpp$, where a and b are arbitrary. Here according to London et al., $|M|^2$ gives a good fit to the data with $b \sim 3a$. According to Rittenberg, it gives a poor fit.

Hence, to rule out $J^P = 2^-$, one turns to the 25% mode $\eta' \rightarrow \pi^-\pi^+\gamma$, and the usual $J^P = 0^-$ assignment is based primarily on this Dalitz plot (KALBFLEISCH 64). It shows that the decay is mainly $\rho^0\gamma$, and the θ distribution shows a preference for equatorial decays (again, all the figures quoted are from Alan Rittenberg):

$$\frac{d\sigma}{d(\cos \theta)} = (0.5 \pm 3.0) + \sin^2 \theta.$$

- $J^P = 0^-$ fits well. The only matrix element is magnetic dipole, M_1 . $|M_1|^2$ predicts $d\sigma/d\omega \propto \sin^2 \theta$, and the confidence level is ~80%, BUT
- $J^P = 2^-$ also fits well. Again the simplest transition is M_1 , and this time the predicted distribution is $6 + \sin^2 \theta$, with a confidence level of ~40%!

So all available Dalitz-plot data for both modes seem to permit $J^P = 2^-$! London et al. have a qualitative remark that the 2^- hypothesis is inconsistent with the observed 3:1 ratio of $\pi\pi\eta : \pi\pi\gamma$, but if all the evidence against 2^- is to be based on this consideration, it should be checked carefully.

One can return to the $\pi\pi\gamma$ Dalitz plot and ask if it confirms the "ruling out" of $J^P = 1^+$. Rittenberg assumes an $E1$ matrix element and finds a confidence level of 8%, which on its own would not be enough to rule out 1^+ . Further, we should warn that the $\pi\pi\gamma$ decay has a very high Q value ($0 < k < 460$ MeV) with the average experimental value of k about 250 MeV. Hence we must not be too quick to consider only the smallest powers of k/M in matrix elements. Specifically this warning means the following. KALBFLEISCH 64, and we in this note, have considered only the lowest

possible electric or magnetic multipole transition. Thus the 8% confidence level just mentioned for the 1^+ hypothesis was based on an $E1$ matrix element, which has a leading term $\propto (k/M)$. But of course M_2 is also possible, and has an independent coupling which could be large. It has $M \propto (k/M)^2$, and can interfere with $E1$ to give almost any angular distribution. So the $\pi\pi\gamma$ mode is likely to be unreliable. We want to thank V. I. Ogievetsky and W. Tybor for pointing this out to us. See Zaslavsky, Ogievetsky, and Tybor, JINR Preprint E2-4061, Dubna, 1968.

Since a $J = 1$ particle cannot decay into $\gamma\gamma$, an observation of a $\gamma\gamma$ decay excludes $J^P = 1^+$. BOLLINI 68 observed 5 events of this kind over a background of only about 1 event. The probability that this is due to a statistical fluctuation of the background is less than 1%, hence at the same level of confidence $J^P = 1^+$ can be excluded.

REFERENCES FOR ETA PRIME	
DAUBER 64 PRL 13 449	DAUBER, SLATER, SMITH, STORK, TICHO (UCLA) JP
ALSO 64 DUBNA CONF 1 418	DAUBER, SLATER, L T SMITH, STORK, TICHO (UCLA)
KALBFLEI 64 PRL 13 349	G. R. KALBFLEISCH, O. DAHL, A. RITTENBERG (LRL) JP
BADIER 65 PL 17 337	BADIER, DEMOULIN, BARLOUTAUD + (PAR+SAC+ZEEMA)
KIENZLE 65 PL 19 438	KIENZLE, MAGLIC, LEVRAT, LEFEBVRES + (CERN)
RITTENBE 65 PRL 15 556	RITTENBERG, KALBFLEISCH (LRL+BNL)
TRILLING 65 PL 19 427	*BROWN, GOLDMAN, RADYK, SCANIO (LRL)
COHN 66 PL 21 347	COHN, MCCULLOCH, BUGG, CONDO (CERN+TENN+UNCAR)
LONDON 66 PR 143 1034	LONDON, RAU, SAMIOS, GOLDBERG + (BNL+SYRACUSE) IJP
STRUGALS 67 JINR E1-3100	STRUGALSKI+CHUVILO+IVANOVSKAJA+ (DUBNA)
AZIMOV 68 VIENNA ABS. 772	*HLADKY, KHACHATURYAN, BALDIN+ (JINR+LEBD)
BOLLINI 68 NC 58 A 289	*BUHLER, DALPIAZ, MASSAM+ (CERN+BGNA+STRB)
DAVIS 68 PL 27 B 532	*AMMAR, MOTT, DAGAN, DERRICK, FIELDS (INWES+ANL)
MOTT 68 VIENNA ABS. 351	*AMMAR, DAVIS, KROPAC, SLATE, DAGAN+ (INWES+ANL)
QUANTUM NUMBER DETERMINATIONS NOT REFERRED TO IN THE DATA CARDS	
MARTIN 66 PL 22, 352	MARTIN, CRITTENDEN, SCHROEDER (INDIANA U I)
BARBARO 68 PRL 20 349	BARBARO-GALTIERI, MATTISON, RITTENBERG+ (LRL) I=0
BARLOUTA 68 PL 26 B 674	BARLOUTAUD+ (SACLAY+AMSD+BCLOG+WEIZM+E. P.) I=0

36 DELTA MESON [962, JPG =] I = 1, 2

8 (963) The original $\delta^-(962)$ was seen with the CERN MMS with $\Gamma < 5$ MeV. Several "confirmations" are unconvincing, but as of the 1968 Vienna Conference, three experiments reported peaks in $\pi^- + \text{neutral}$ (probably $\pi^-\eta_{\text{neutral}}$) at 970 to 980 MeV, with larger Γ 's (25 to 80 MeV). They did not agree as to details. (See B. French's Vienna Rapporteur Talk, and SAMIOS 68).

If we accept that $\delta \rightarrow \pi\eta$ by strong decay, then $I^G = 1^-$ and nonobservation of 3π decay can be explained by choosing $J^P = 0^+$, or simply by saying that 3π background is too large to permit detection. These quantum numbers $1^-(0^+)$ are then the same as those

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Data in parentheses have not been included in our averages.

most likely for the $\bar{K}K$ bump called $\pi_N(1016)$, which could then just be the $\bar{K}K$ decay mode of $\delta(962)$. This would require that $\delta(962)$ have a mass ≈ 975 MeV, $\Gamma \approx 50$ MeV (when measured below $\bar{K}K$ threshold), and a strong $\bar{K}K$ coupling, but these possibilities are not ruled out (see DEFOIX 68). Defoix et al. see some evidence for the decay $D^0(1285) \rightarrow \delta^{\pm} \pi^{\mp}$, which also suggests that δ has $I^G = 1^-$.

An unattractive alternative is to believe that δ is really very narrow, and guess that its $\pi\eta$ decay is G-violating electromagnetic. (It is not clear whether there would be competition from $\pi\pi\eta$ decay, which is strong, but has much smaller phase space.) However, in this electromagnetic (em) case, one would also expect slightly faster decay into $\pi\pi$, and we are not sure whether this mode should have been detected. To see why we expect $\pi\pi$ decay, note that these em decays into $\pi^-\pi^0$ or $\pi^-\eta$ involve emission and reabsorption of a photon, with rates proportional to e^4 (also $\pi\pi$ has slightly larger phase space than $\pi\eta$).

Neutral em decays (as in the familiar $\eta^0 \rightarrow 3\pi$) have selection rules either

$$\Delta G = \text{Yes, } \Delta|I| = 1$$

or

$$\Delta G = \text{No, } \Delta|I| = 2,$$

but charged decays ($\delta^- \rightarrow \pi^-\pi^0$ or $\pi^-\eta$) have no such rules (except $\Delta|I| \leq 2$).

36 DELTA (1962) MASS (MEV)

M	262	962.0	5.0	KIENZLE	65 MMS	-	3-5 PI- P	9/66
M	B	NOTE THAT BANNER 1 AT 1.8 PI-P DOES NOT SEE IT.						
M	O	(966.0)	(6.0)	OOSTENS	66 MMS	+	3.8 PP TC D + MM	9/66
M	O	FOR A CONTRADICTIONARY RESULT SEE BANNER2 67						
M	*	(939.)	(15.)	ALLISON	67 HBC	+	6 K-P, (3PI)+...	1/68*
M	*	(913.)	(25.)	ALLISON	67 HBC	+	6 K-P, (3PI)+...	1/68*
M	A	(900.0)		AMMAR	68 HBC	+	5.5 K- P,ETA PI	9/68*
M	A	MASS+WIDTH OF THIS PEAK MAKE IDENTIFICATION WITH DELTA DUBIOUS.						
M	*	(975.0)		BARNES	68 HBC	-	4.6 K- P,PI MM	9/68*
M	*	(970.0)		DEFOIX	68 HBC	+	1.2 PB P,ETA PI	9/68*
M	*							
M	V	NOTE THAT THE PI(1016) AS SEEN BY ASTIER 67, IF INTERPRETED AS A						
M	V	VIRTUAL BOUND STATE RESONANCE, WOULD CORRESPOND TO A NARROW RESO-						
M	V	NANCE OF M = 975 (+15/-10) MEV.						

36 DELTA (1962) WIDTH (MEV)

M	O	262	5.0	OR LESS	KIENZLE	65 MMS	-	3-5 PI- P	9/66
M	O	10.0	OR LESS	OOSTENS	66 MMS	+	SEE NOTE D ABOVE	9/66	
M	W	25.	OR LESS	ALLISON	67 HBC	+	6 K-P, (3PI)+...	1/68*	
M	W	30.	OR LESS	ALLISON	67 HBC	+	6 K-P, (3PI)+...	1/68*	
M	A	(100.0)		AMMAR	68 HBC	+	5.5 K- P,ETA PI	9/68*	
M	*	(25.0)		DEFOIX	68 HBC	+	1.2 PB P,ETA PI	9/68*	

W NOTES, SEE UNDER MASS LISTING

36 DELTA MESON PARTIAL DECAY MODES

P2	DELTA MESON INTO 3 PI	134+ 134+ 134
P3	DELTA MESON INTO 4 PI	134+ 134+ 134+ 134
P5	DELTA MESON INTO ETA PI	548+ 134

36 DELTA MESON BRANCHING RATIOS

R1	CHARGED DELTA INTO (1 CHARGED) / (3 OR MORE CHARGED)		
R1	1.3	0.9	0.7 KIENZLE 65 MMS - 3-5 PI- P 9/66
R2	DELTA MESON INTO (PI ETA) / (PI + MISSING MASS)		
R2	0.30	OR LESS	BARNES 68 HBC - 4.6 K- P 9/68*

36 SIGMA(MICROB.) FOR PI- P -- P X-

CS	*	15	-	5 BRANCH-RATIO ABOVE.	KIENZLE	65 MMS	-	3-5 PI-	7/67
CS	*	KIENZLE	15.	REVISED TO A FEW...	FODACCI	66 MMS	-	3-5 PI-	7/67
CS	*	17	OR LESS (2 PRONGS)	JACOBS	66 HBC	+	3.2 PI-	7/67	
CS	*	3.0	OR LESS (1GEV/C)**2	BANNER 1	67 MMS	-	1.8 PI-P,	P+M	9/67
CS	*	3.3	+	1.7 PI- PI+ PI-	ETA CHUNG	68 HBC	+		5/68*
CS	*	2	OR LESS PI- PI+ PI-	MM CHUNG	68 HBC	+	3.2-4.2 PI-	5/68*	
CS	*	1.50R	LESS PI- PI+ PI-	PIO CHUNG	68 HBC	+	3.2 PI-	5/68*	

REFERENCES FOR DELTA(1962)

TUNKOT	63	SIENNA CONF 1	661	+COLLINS-FUJII,KEMP*	(BNL+PITTSBURGH)
KIENZLE	65	PL 19	438	+ MAGLIC,LEVRAI,LEFEBVRES +	(CERN)
ALLEN D	66	PL 22	543	+GP FISHER,G GODDEN,L MARSHALL,SEARS (COLO)G+	(CERN)
FODACCI	66	PL 17	890	+ KIENZLE,LEVRAI,MAGLIC,MARTIN	(CERN)
OOSTENS	66	PL 22	709	+CHARANON-CROZON,TOCQUEVILLE	(SACLAY,CF11-1)
ALLISON	67	PL 29B	619	+CRUZ+ (OFX+MUN+BRM+RUTH+GLASG+LON)IC11)	
ASTIER	67	PL 25 B	294	+MONTANET,BAUBILLIER,DUBOC+ (CDF+CERN+IDR)	
AMMAR	68	PL TO BE PUB		+DAVIS,KROPAC,HOIT,SLATE,WERNER+ (MMS+ANL)	
BARNES	68	VIENNA ABS.	259	+BORNAN,QUIDON1, SAKIOS,GOLDBERG (BNL+SYR)	
DEFOIX	68	VIENNA ABS.	653	+STAUD,RIVET,SHIVELY,CONFORTO(CDF+IPN+CERN)	
JUHALA	68	PL 27 B	257	+LEACOCK,RHODE,KOPELMAN,LIBBY+ (IOWA+COLO)	

REFERENCES AGAINST 2PI DECAYS OF DELTA(1962)

JACOBS	66	UCRL 16877-THESIS		+D.DAHL, J. KIRZ, D.H.MILLER	(LRL)
WEST	66	PR 149	1089	WEST,BOYD,ERWIN,WALKER	(WISCONSIN)
CLEAR	67	NC 49A	399	+JOHNSTON+PILCHER+COOPER+(ITCRONT+ANL+MIS)C	
ROOS	67	NP B 2	615	M. ROOS	(CERN)
FRENCH	68	VIENNA CONF.	104	RAPPORTEUR	
SAMIOS	68	PROG. 1968 UNIV.OF PENN.CONF.		ON MESON SPECTROSCOPY	

REFERENCES AGAINST DELTA(1962)

BANNER 1	67	PL 25 B	300	+FAYOUX,HAMEL,ZSEMBERY,CHEZE+ (SACLAY+CAEN)
BANNER 2	67	PL 25 B	569	+CHEZE,HAMEL,MAREL,TEIGER,CROZON+(CDF+SACL)
CHUNG S	68	PR 165	1491	+D.DAHL, J. KIRZ, D.H.MILLER
GALIERI	68	PR 20	349	BARBARO-GALTIERI,MATISON,RIITTENBERG+ (LRL)
SABRE CC	68	PL 26B	674	SACL+AMSTAD+ROLDGA+REHOVOT+HEGDE (PIVY.)

H (990) IT IS SHOWN BY BARBARO-GALTIERI 68 THAT THE OBSERVED H ENHANCEMENT IS COMPATIBLE WITH BEING ENTIRELY DUE TO MISIDENTIFIED RHO0-GAMMA DECAYS OF ETA PRIME(958).

35 H MASS (MEV)

M	50	975.0	15.0	BARTSCH	64 HBC	4.0	PI+ P	8/66
M	30	975.0	APPROX	GOLDBABER	65 HBC	3.65	PI+ P	9/66
M	30	998.	10.	BENSON	66 DBC	3.65	PI+ D	9/66
M	*	980.	APPROX.	COHN	67 DBC	3.3	PI+ D	1/67
M	A	990.9231	10.6154	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.3)				

35 H WIDTH (MEV)

M	90	120.0	30.0	BARTSCH	64 HBC	4.0	PI+ P	8/66
M	30	45.0	30.0	BENSON	66 DBC	3.65	PI+ D	9/66
M	W	60.	OR LESS	COHN	67 DBC	3.3	PI+ D	1/67

35 H PARTIAL DECAY MODES

PI	H INTO 3 PI	DECAY PASSES
P2	H INTO RHO PI	139+ 139+ 134
		770+ 139

H MESON CROSS SECTION (MICROBARRNS)

CS	75.0	15.0	BENSON	66 DBC	3.65	PI+ D TC HPP	9/66
CS	50.	OR LESS	COHN	67 DBC	3.3	PI+ D HPP	1/67
CS	100.	OR LESS	KIRZ	67	THRESHOLD TO 2.3 PI		

REFERENCES ON H MESON

BARTSCH	64	PL 11	167	AACHEN-ZEUTHEN-BIRM-BONN-HAMB-MUNCHEN (OLL)
GOLDBABER	65	CURAL GABLES P	76	G. GOLDBABER
BENSON	66	PR 17	1234	+MARQUIT,ROE,SINCLAIR,VANDER VELDE (MICH.)IJP
BENSON	66	ANALYSIS FAVORS JP1*		
GOLDBABER	66	BERKELEY CONF		G. GOLDBABER, SAMIOS, ASTIER, SHEN, LAI. (ESON RE)IEM
COHN	67	NP B1	57	+MC GULLDCH,BUGG,CONDO (CAK R.+UNIV.TENN)
ROSENFEL	67	RMP 39	1,APPENDIX	ROSENFELD, BARBARO-GALTIERI+(LRL+MICH+YALE)
ARMENISE	68	PL 26B	336	+GHOINI,FORDEN* (BARI+BOLOGNA+IRENZ+CRSA)
BARBARO-	68	UCRL-18271		A. BARBARO-GALTIERI, P. SODING (LRL)
AND 68	PROG.1968 UNIV.OF PENN.CONF.			ON MESON SPECTROSCOPY
FUNG	68	PR 21	47	+JACKSON+PU+BROWN+GIDAL (U.C.RIVERS+LRL)

$\pi_N(1016)$ 16 PI(1016, JPC=0+-) I=1 STILL NOT DECIDED WHETHER (K KBAR) RESONANCE, VIRTUAL BOUND STATE OR ANIBOUND STATE. MAY BE RELATED TO ETA PI MINUS PEAK AT 975-980, SEE NOTE UNDER DELTA (1962) ABOVE.

16 PI(1016) MASS (MEV)

M	*	143	1003.3	7.0+SYSTEMATIC	ROSENFELD	65 RVUE	+	8/66
M	*	SCAT	LENGTH 2 TO 6 FERMIS.	RALTAY	66 HBC	3.7	PBAR P	8/66
M	A	100(1016.)	(10.)	ASTIER	67 HBC	+	0 PBAR P	7/67
M	*	SCATT-LENGTH ALSO FITS.	SEE BELOW					
M	*	SCATT-LENGTH +2.5 +-1.	FERMI	ASTIER	67 HBC	+	0-1.2 PBAR P	7/67
M	*	OR CMPLX, RE PART=-2.5 F	*****					7/67
M	*	IM PART=.5F OR LESS	*****					7/67

MESON RESONANCES

Data in parentheses have not been included in our averages.

16 PI(1016) WIDTH (MEV)

W	143	57.0	13.0	SYSTEMATIC APPROX.	ROSENFELD 65 RVUE	493 + 497	8/66
W	A	100	25.		ASTIER 67 HBC	548 + 139	9/67

16 PI(1016) PARTIAL DECAY MODES

P1	PI(1016) INTO K KBAR	493 + 497
P2	PI(1016) INTO ETA PI	548 + 139

16 PI(1016) BRANCHING RATIOS

R1	PI(1016) INTO (ETA PI) / (K KBAR)	5.0	OR LESS	ASTIER 67 HBC	0. PBAR P	9/67
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REFERENCES FOR PI(1016)

ARMENTERO 65 PL 17 344 ARMENTEROS, EDWARDS, JACOBSEN + (CERN+PARIS)
 BARASH 65 PR 139 B 1659 +FRANZINI, KIRSCH, MILLER, STEINBERGER (COLUM)
 ROSENFELD 65 OXFORD CONF 58 A H ROSENFELD (LRL+RVUE)
 GALTAY 66 PR 142 B 932 +LACH, SANDWEISS, TAFT, YEH, STONEHILL + (YALE)
 ASTIER 67 PL 25 B 294 +MONTANET, BAUBILLIER, DUBOC + (CDF+CERN+IDR)
 ASTIER 67 INCLUDES INFORMATION FROM BARLOW 67, CONFORTO 67I, ARMENTEROS 165.
 GAILLON 67 NC 50A 393 +EDWARDS, ANDLUA, ASTIER + (CERN+CDF +IR)
 BARLOW 67 NC 50 A 701 +MONTANET, D-ANDLUA + (CERN+CDF+IDR+LIVERPOOL)
 CONFORTO 67 NP 83 469 CONFORTO, MARECHAL, MONTANET + (CERN+PARIS+LIV)

4 PHI (1019, JPG=1) I=0

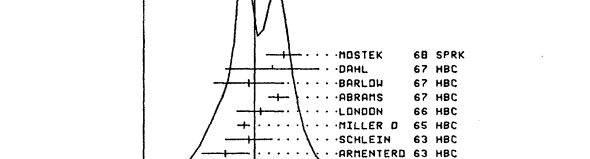
M	1017.0	2.0	ARMENTERO 63 HBC	0.0	PBAR P
M	1019.0	2.0	SCHLEIN 63 HBC	2.0	K-P
M	1018.6	0.5	MILLER D 65 HBC	0.0	PBAR P
M	1020.0	2.0	LONDON 66 HBC	2.2	K-P
M	1021.5	0.8	ABRAMS 67 HBC	4.2	K-P
M	1019.	3.	BARLOW 67 HBC	1.2	PBAR P
M	1021.0	4.0	DAHL 67 HBC	1-4	PI- P
M	(1018.5)	(1.0)	HYAMS 68 SPRK	11-2	PI- P
M	165 1022.	1.5	MOSTEK 68 SPRK	1-8	GAMMA + C
M	(1021.0)	(3.0)	MOTT 68 HBC	4.1-5.5	K-P
M	AVG	1019.5071			

WEIGHTED AVERAGE = 1019.507 ± 0.580
 ERROR SCALED BY 1.53

CHISO = 14.0 CONLEV = 0.030

4 PHI MASS (MEV)

M	1017.0	2.0	ARMENTERO 63 HBC	0.0	PBAR P
M	1019.0	2.0	SCHLEIN 63 HBC	2.0	K-P
M	1018.6	0.5	MILLER D 65 HBC	0.0	PBAR P
M	1020.0	2.0	LONDON 66 HBC	2.2	K-P
M	1021.5	0.8	ABRAMS 67 HBC	4.2	K-P
M	1019.	3.	BARLOW 67 HBC	1.2	PBAR P
M	1021.0	4.0	DAHL 67 HBC	1-4	PI- P
M	(1018.5)	(1.0)	HYAMS 68 SPRK	11-2	PI- P
M	165 1022.	1.5	MOSTEK 68 SPRK	1-8	GAMMA + C
M	(1021.0)	(3.0)	MOTT 68 HBC	4.1-5.5	K-P
M	AVG	1019.5071			



4 PHI WIDTH (MEV)

W	34	3.4	1.7	ARMENTERO 63 HBC	0.0	PBAR P	
W	5	5.0	OR LESS	SCHLEIN 63 HBC	2.0	K-P	
W	3	3.5	1.0	MILLER D 65 HBC	0.0	PBAR P	
W	6	6.0	4.0	LONDON 66 HBC	2.2	K-P	
W	1	1.8	3.0	1.5	ABRAMS 67 HBC	4.2	K-P
W	10.	OR LESS	BARLOW 67 HBC	1.2	PBAR P		
W	165	(4.5)	(3.0)	(2.0)	MOSTEK 68 SPRK	1-8	GAMMA + C
W	4.	2.	0.9	AUGUSTIN 68 SPRK	E+ E- COLL.BEAMS	0/68	
W	AVG	3.7288					

4 PHI PARTIAL DECAY MODES

P1	PHI INTO K+ K-	493 + 497
P2	PHI INTO K0 K0	497 + 497
P3	PHI INTO PI+ PI- (INCLUDING RHO PI)	139 + 139 + 134
P4	PHI INTO PI+ PI- (VIOLATES G)	139 + 139
P5	PHI INTO E+ E-	5 + 5
P6	PHI INTO MU+ MU-	105 + 105
P7	PHI INTO PI0 GAMMA	134 + 0
P8	PHI INTO ETA GAMMA	548 + 0
P9	PHI INTO PI+ PI- GAMMA	139 + 139 + 0
P10	PHI INTO OMEGA GAMMA (VIOLATES C)	783 + 0
P11	PHI INTO ETA PI0 (VIOLATES C)	548 + 134
P12	PHI INTO RHO GAMMA (VIOLATES C)	770 + 0

4 PHI BRANCHING RATIOS

R1	PHI INTO (K+ K-)/TOTAL	0.26	(0.06)	BADIER 65 HBC	(SEE NOTE B BELOW)	0/66
R1	252	0.48	0.04	LINDSEY 66 HBC	2.7 K-P	0/66
R1	0.48	0.04	0.04	AUGUSTIN 68 SPRK	E+ E- COLL.BEAMS	0/68
R1	AVG	0.4800	0.0206			
R1	FIT	0.476	0.018		VALUE FROM CONSTRAINED FIT	

R2 * PHI INTO (K1 K2)/TOTAL

R2	B	25	(0.23)	(0.06)	BADIER 65 HBC	(SEE NOTE B BELOW)	0/66
R2	167	0.40	0.04	LINDSEY 66 HBC	2.7 K-P	0/66	
R2	0.40	0.04	0.04	AUGUSTIN 68 SPRK	E+ E- COLL.BEAMS	0/68	
R2	AVG	0.3241	0.0303		AVERAGE (ERROR INCLUDES SCALE FACTOR OF 2.0)		
R2	FIT	0.328	0.018		VALUE FROM CONSTRAINED FIT		

R3 * PHI INTO (PI+ PI- PI0 (INCL.RHO PI))/TOTAL

R3	B	57	(0.51)	(0.09)	BADIER 65 HBC	3.0 K-P	0/66
R3	B	30	CONTRVERSIAL BACKGROUND SUBTRACTION		LINDSEY 66 HBC	2.7 K-P	0/66
R3	0.208	0.04	0.04	AUGUSTIN 68 SPRK	E+ E- COLL.BEAMS	0/68	
R3	AVG	0.1904	0.0358		AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)		
R3	FIT	0.196	0.023		VALUE FROM CONSTRAINED FIT		

R4 * PHI INTO (PI+ PI- PI0 (INCL.RHO PI))/(K KBAR)

R4	10	0.40	0.15	SCHLEIN 63 HBC	2.0 K-P	0/66
R4	52	0.48	0.07	BADIER 65 HBC	3.0 K-P	11/67
R4	0.44	0.07	0.07	LONDON 66 HBC	2.2 K-P	0/66
R4	AVG	0.408	0.044		AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)	
R4	FIT	0.408	0.018		VALUE FROM CONSTRAINED FIT	

R5 * PHI INTO (PI+ PI- PI0 (INCL.RHO PI))/(K KBAR)

R5	10	0.40	0.15	SCHLEIN 63 HBC	2.0 K-P	0/66
R5	52	0.48	0.07	BADIER 65 HBC	3.0 K-P	11/67
R5	0.44	0.07	0.07	LONDON 66 HBC	2.2 K-P	0/66
R5	AVG	0.408	0.044		AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)	
R5	FIT	0.408	0.018		VALUE FROM CONSTRAINED FIT	

R6 * PHI INTO (PI+ PI- PI0 (INCL.RHO PI))/(K KBAR)

R6	10	0.40	0.15	SCHLEIN 63 HBC	2.0 K-P	0/66
R6	52	0.48	0.07	BADIER 65 HBC	3.0 K-P	11/67
R6	0.44	0.07	0.07	LONDON 66 HBC	2.2 K-P	0/66
R6	AVG	0.408	0.044		AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)	
R6	FIT	0.408	0.018		VALUE FROM CONSTRAINED FIT	

R7 * PHI INTO (PI+ PI- PI0 (INCL.RHO PI))/(K1 K2)

R7	0.3	OR LESS	BERLEY 65 HBC	2.9	PI+ P	0/66
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R8 * PHI INTO (PI+ PI-)/(K KBAR)

R8	0.2	OR LESS	LONDON 66 HBC	2.2	K-P	0/66
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R9 * PHI INTO (E+ E-)/(K+ K-)

R9	40	5.7	1.7	BECKER 68 CNTR	GAMMA C	9/68
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R10 * PHI INTO (MU+ MU-)/TOTAL (UNITS 10**4)

R10	53.	OR LESS	GALTIERI 65 HBC	2.7	K-P	0/66
R10	7.4	OR LESS	CHASE 68 CNTR	PHOTOPROD.	6/68	
R10	3.5	3.5	1.8	WEHMANN 68 SPRK	12 K-C	6/68

R11 * PHI INTO (ETA GAMMA)/TOTAL

R11	0.2	OR LESS	BADIER 65 HBC	3.0	K-P	0/66
R11	0.08	OR LESS	LINDSEY 66 HBC	2.7	K-P	0/66

R12 * PHI INTO (PI+ PI- GAMMA)/(K KBAR)

R12	0.05	OR LESS	LINDSEY 65 HBC	2.7	K-P	0/66
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R13 * PHI INTO (ETA NEUTRALS)/(K KBAR)

R13	0.15	OR LESS	LINDSEY 66 HBC	2.7	K-P	0/66
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R14 * PHI INTO (OMEGA GAMMA) / TOTAL

R14	0.05	OR LESS	LINDSEY 66 HBC	2.7	K-P	0/66
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R15 * PHI INTO (RHO GAMMA) / TOTAL

R15	0.02	OR LESS	LINDSEY 66 HBC	2.7	K-P	0/66
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R16 * PHI INTO (E+ E-)/TOTAL (UNITS 10**4)

R16	A	5	(6.6)	(4.4)	(2.8)	ASTVACATOV 68 SPRK	4	PI- P	6/68
R16	A	ERROR OF ASTVACATOV 68 DOES NOT INCLUDE SIGMA(PHI) UNCERTAINTY.							6/68
R16	9	6.1	2.6	2.6	BOLLINI 68 CNTR	1.9	PI- P	9/68	
R16	3.9	0.62	0.62	AUGUSTIN 68 SPRK	E+ E- COLL.BEAMS	0/68			
R16	AVG	4.0927	0.5960		AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)				

THE FOLLOWING BRANCHING FRACTIONS HAVE CORRELATED ERRORS GREATER THAN .5

P1 P3	-623
P2 P3	-634

REFERENCES FOR PHI

BERTANZA 62 PRL 9 180 BERTANZA, BRISSON, CONNOLLY, HART + (BNL+SYR)
 ARMENTEROS 63 SIENA CONF 2 70 ARMENTEROS, EDWARDS, ASTIER + (CERN+CDF+PARIS)
 GELFAND 63 PRL 11 438 GELFAND, MILLER, NUSSBAUM, KIRSCH + (COLU+RUTG)
 GELFAND 63 DATA INCLUDED IN MILLER 65 BELOW
 SCHLEIN 63 PRL 10 368 SCHLEIN, SLATER, SMITH, STORK, TICHON (UCLA)

BADIER 65 PL 17 337 BADIER, DEMOULIN, BARLOUTAUD + (PAR+LPCH+ZEE)
 BERLEY 65 PR 139 B 1097 D BERLEY, N GELFAND (BNL+COLUMBIA)
 GALTIERI 65 PRL 279 A BARRARD GALTIERI, R D TRIPP (LRL)
 LINDSEY 65 PRL 15 221 JAMES S LINDSEY, GERALD A SMITH (LRL)
 LINDSEY 65 DATA INCLUDED IN LINDSEY 66 BELOW
 MILLER C 65 CU-237(NEVIS 131) DAVID C MILLER (THESIS) (COLUMBIA)

GRAY, L 66 PRL 17 501 +HAGERTY, BIZZARRI, CIAPETTI + (SYR+RDM+JPG)
 LINDSEY 66 PR 147 913 JAMES S LINDSEY, GERALD A SMITH (LRL)
 LINDSEY 66 PL 20 99 J.S.LINDSEY, G.A.SMITH (LRL)
 LINDSEY 66 DATA INCLUDED IN LINDSEY 66 ABOVE
 LONDON 66 PR 143 1034 LONDON, RAU, SAMIOS, GOLDBERG + (BNL+SYNACUSE)

ABRAMS 67 MD TECH REP 720 GERALD ABRAMS + THESIS (MARYLAND)
 BARLOW 67 NC 50A 701 +LILLESTOL, MONTANET + (CERN+CDF+IR+LIVERPOOL)
 CHASE 67 PRL 18 710 R.C.CHASE, P. RUTHWELL, R. WEINSTEIN (CEA+NEAST)
 DAHL 67 PR 163 1377 +HAGERTY, HESS, KIRK + MILLER (LRL)
 HERTZBACH 67 PR 155 1461 HERTZBACH, KRÄEMER, MADANSKI, ZDANIS + (JHU+BNL)
 KHACHATRALI 67 PL 248 349 KHACHATURYAN, AZIMOV, BALDIN + (BELUOSD + (CUBNA)

ASTVACATOV 68 PL 27 B 45 ASTVACATOV, AZIMOV, BALDIN + (JINR+MSSCOV)
 AUGUSTIN 68 VIENNA ABS. +BIZOT, BUONDELICOURT, HAISSINSKI + (CRSAY)
 ALSO 67 PRL 19 869 S.TING, RAPPORTEURS TALK
 BECKER 68 VIENNA CONF. 953 +BERTRAM, BINKLEY, JORDAN, KNASEL + (DESY+MIT)
 ALSO 67 PRL 19 869 ASBURY, BECKER, BERTRAM, TING + (DESY+COLUMBIA)
 BINNIE 68 PL 278 106 +DUANE+ FARUQI+ HCRSEY + (I.C.LON+RUTHERF)
 BOLLINI 68 NC 56 A 1171 +BUHLER, DALPIAZ, MASSA + (CERN+BGNA+STRB)
 68 VIENNA ABS. 765 +KOCHE, PUTTER, LINDNER, LORENZ + (CERN+BNL+PHM)
 MOSTEK 68 PRL 20 1057 +EISENHANDLER, MCCLELLAN, MISTRY + (CORNELL)
 MOTT 68 VIENNA ABS. 351 +AMMAR, DAVIS, KROPAC, SLATE, DAGAN + (INRES+ANL)
 WEHMANN 68 PRL 20 748 +ENGELS + (HARVARD+CASE+SLAC+CORNELL+PGCILL)

eta(1070) 3 ETA (1070, JPG=0+)=I=0

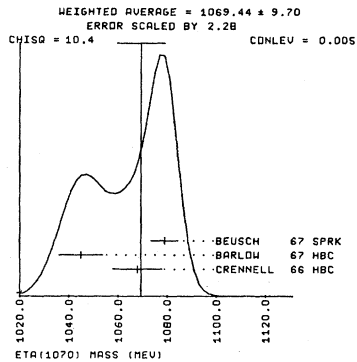
NAMED S* BY CRENNELL 66.
 THE DISAGREEMENT BETWEEN SOME OF THE OBSERVED WIDTHS IS RELATED TO AN AMBIGUITY IN INTERPRETATION OF THESE KS KS PEAK EITHER AS A RESONANCE ABOVE THRESHOLD OR AS A SCATTERING LENGTH EFFECT. HOANG 68 SHOW THAT THE SPRK DATA OF REUSCH 67 AND PHELAN 68 BELOW 1115 MEV CAN BE FITTED WITH A VIRTUAL KKBAR BOUND STATE.

MESON RESONANCES

Data in parentheses have not been included in our averages.

3 ETA (1070) MASS (MEV)

M *	1000.0	APPROX	BINGHAM	62 PRC	6-18 PI-N	
M *	1000.0	APPROX	BIGI	62 HBC	10.0 PI-P	
M *	(1000.0)		ERWIN	62 HBC	2.10 PI-P	0/66
M *	30 1030.0	APPROX.	BALTAY	64 HBC	3.7 PBAR P	
M *	1025.0	APPROX.	BARMIN	64 HLBC	2.8 PI-P	6/66
M *	20 1068.0	10.0	CRENNELL	66 HBC	6.0 PI-P	6/66
M H	120	SCATT. LENGTH FITS BETTER.	HESS	66 HBC	1.6+4.2 PI-P	0/66
M	35 1045.	9.	BARLOW	67 HBC	1.2 PBAR P	11/66
M	730 1079.0	6.0	BEUSCH	67 SPRK	5.7,12 PI-P	9/67
M *	(1030.0)	(7.0)	D. ANDLAU	68 HBC	0.7 PB P+4 BODY	9/68
M P	(1050.0)	(10.0)	MILLER	68 HBC	4.0 PI-P	9/68
M A	(1065.)	(10.)	PHELAN	68 SPRK	4 PI-P - KS KS N	6/68
M A	(1045.)	(10.)	PHELAN	68 SPRK	4 PI-P - KS KS N	6/68
M A	(1035.)	(10.)	PHELAN	68 SPRK	4 PI-P - KS KS N	6/68
M A	ABOVE 3 VALUES ASSUMING NO 2PI DECAY.				2PI/KKBAR +1, 2PI/KKBAR-2	
M A	RESPECTIVELY SCATTERING LENGTH (+-1.1 + 0.2*1) F ALSO FITS.					
M P	70(1085.0)	(10.0)	WHITEHEAD	68 SPRK	3.1-3.6 PI-P	0/67
M P	PI+PI- MODE (NOT CLEAR IF THIS IS THE S+ J=0 IS NOT FAVORED.)					
M *	NOTE THAT IN A COMPILATION OF PI N HBC DATA WITH TWICE THE STATISTICS					
M *	OF WHITEHEADS COMPILATION, NO PI+ PI- PEAK IS SEEN. (P. SCHLEIN 68)					
M	AVG	1069.4383	9.6955	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 2.3)		
				(SEE IDEOGRAM BELOW)		



3 ETA (1070) WIDTH (MEV)

W	20	80.0	15.0	CRENNELL	66 HBC	6.0 PI-P	6/66
W	35	50.	24.	BARLOW	67 HBC	1.2 PBAR P	11/66
W S	(168.0)	(21.0)	(19.0)	BEUSCH	67 SPRK	5.7,12 PI-P	9/67
W	ASSUME NO S WAVE SCATTERING LENGTH WITH S WAVE THE WIDTH IS NARROWER						
W *	(50.0)	(15.0)		D. ANDLAU	68 HBC	0.7 PB P+4 BODY	9/68
W P	40.0	OR LESS		MILLER	68 HBC	4.0 PI-P	9/68
W A	(170.)	(40.)		PHELAN	68 SPRK	4 PI-P - KS KS N	6/68
W A	(140.)	(50.)	(30.)	PHELAN	68 SPRK	4 PI-P - KS KS N	6/68
W A	(140.)	(40.)		PHELAN	68 SPRK	4 PI-P - KS KS N	6/68
W A	SEE NOTE A UNDER MASS ABOVE.						
W P	25.0	OR LESS		WHITEHEAD	68 SPRK	3.1-3.6 PI-P	0/67
W P	PI+PI- MODE (NOT CLEAR IF THIS IS THE S+ J=0 IS NOT FAVORED.)						
W	AVG	71.5730	13.4831	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.1)			

3 ETA (1070) PARTIAL DECAY MODES

P1	ETA (1070) INTO KKBAR	493+ 497
P2	ETA (1070) INTO PIP1	139+ 134

3 ETA (1070) BRANCHING RATIOS

R1 *	ETA (1070) INTO (PI P1)/(K KBAR)				
R1	2.5	OR LESS	CRENNELL 66 HBC	90 PCT CONF LEV	7/66
R1 I	(0.92)	(0.57)	WHITEHEAD 68 RVUE		6/68
R1 I	NOT CLEAR IF THE OBSERVED PI+PI- PEAK IS A MODE OF THE				
R1 I	ETA(1070). NOTE THE SMALL WIDTH AND THE PREFERENCE OF J.G.T.O.				
R1 I	(1.0)	(0.6)	LAI 68 HBC	6 PI-P	11/68

REFERENCES FOR ETA(1070)

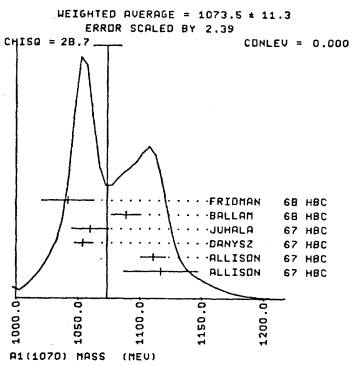
BIGI	62 CERN CONF 247	A BIGI,S BRANDT, R CARRARA + (CERN)
BINGHAM	62 CERN CONF 240	H H BINGHAM,M BLOCH + (PARIS+EC POLY+CERN)
ERWIN	62 PRL 9 34	ERWIN,HOYER,MARCH,WALKER,WANGLER (WIS+BNL)
BALTAY	64 DUBNA CONF 1 409	BALTAY,LACH,CRENNELL,OREN,STUMP +(YALE+BNL)
BARMIN	64 DUBNA CONF 1 433	BARMIN,DOLGOLENGK,YEROFEEV,KRESTINI+ (ITEP)
CRENNELL	66 PRL 16 1025	CRENNELL,KALBFLEISCH,LAI,SCARR,SCHU+ (BNL)
HESS	66 PRL 17 1109	DAHL+HARDY+KIRZ+MILLER (LRL)
HESS REPLACES	PRL 9 460	ALEXANDER,DAHL,JACOBS,KALBFLEISCH + (LRL)
BARLOW	67 NC 50A 701	+LILLESTOL+MONTANET+(CERN+CDF+IR+LIVERPOOL)
BEUSCH	67 PL 25 B 357	+FISCHER,GOBBI,ASTBURY,MICHELINI+IETH+CERN)
DAHL	67 PR 163 1377	+HARDY+HESS+KIRZ+MILLER (LRL)
D. ANDLAU	68 VIENNA ABS. 626	+ASTIER,COHEN,AGUILAR-BENITEZ+ (CDF+CERN)
HOANG	68 PREPRINT	T.F. HOANG (BNL)
LAI	68 PHILADEL. CONF.	KWAN WU LAI (BNL)
MILLER	68 VIENNA ABS. 804	+GUTAY,JOHNSON,KENNEY+ (PURDUE+NDAME+SLAC)
PHELAN	68 THESIS	JAMES J. PHELAN (ANL+ST. LOUIS UNIV)
ALSO 68 PRL 21 316		HOANG,EARLT,Y. PHELAN,ROBERTS+(ANL+CHIC+NDAM)
SCHLEIN	68 PRIV. COMM.	P. SCHLEIN (UCLA)
WHITEHEAD	68 NC 53 A 817	C. WHITEHEAD + (HARNELL+STAMPT+U.C. LON)

10 A1 MESON (1070, JPC=1+-) I=1

A1(1080)

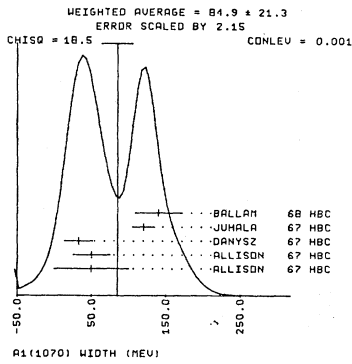
10 A1 MESON MASS (MEV)

M *	MASS AND WIDTH MIGHT HAVE LARGE SYSTEMATIC					
M *	ERRORS DUE TO COMPLICATED BEHAVIOR OF BACKGROUND.					
M	1080.0		ADERHOLZ 64 HBC	4.0 PI+P		
M	1117.	30.	ALLISON 67 HBC	+ 6 K-P,LAM +4 PI	1/68*	
M	1111.	10.	ALLISON 67 HBC	+ 6 K-P,LAM +5 PI	1/68*	
M	1054.	7.	DANYSZ 67 HBC	- 3,3,6 PBAR P	7/67	
M	1060.	15.	JUHALA 67 HBC	0 4,6-5 K-P,5BODY	1/68*	
M *	306(1066.0)	(12.0)	ABBCH COL 68 HBC	- 16.0 PI- P(3 PI)	9/68*	
M *	(1058.0)	(7.0)	ABBCH COL 68 HBC	- 16.0 PI- P(5 PI)	9/68*	
M	1090.		ASCOLI 68 HBC	- 0.5 PI-P	6/68*	
M	1089.0	12.0	BALLAM 68 HBC	- 16.0 PI- P	9/68*	
M	1080.	APPROX.	BOESEBECK 68 HBC	+ 8 PI+ P	6/68*	
M *	(1073.0)	(7.0)	CASON 68 HBC	+ 18.5 PI+P,P+3PI	9/68*	
M	1080.	APPROX.	CASO 68 HBC	- 11 PI- P	6/68*	
M	1090.	APPROX.	CHUNG 68 HBC	- 3,2,+2 PI-P	2/67	
M	1042.	21.	FRIDMAN 68 HBC	- 5.7 PBAR P	6/68*	
M K	(1119.)	(30.)	KEY	68 HBC	- 3 PI-P	9/68*
M K	SHOULDER ON A2 ONLY					
M	AVG	1073.5351	11.2629	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 2.4)		
				(SEE IDEOGRAM BELOW)		



10 A1 MESON WIDTH (MEV)

M *	SEE NOTE UNDER A1 MESON MASS.					
M	80.0		ADERHOLZ 64 HBC	4.0 PI+P		
M	50.	50.	ALLISON 67 HBC	+ 6 K-P,LAM +4 PI	1/68*	
M	50.	25.	ALLISON 67 HBC	+ 6 K-P,LAM +5 PI	1/68*	
M	33.	19.	DANYSZ 67 HBC	- 3,3,6 PBAR P	7/67	
M	120.	15.	JUHALA 67 HBC	0 4,6-5 K-P,5BODY	1/68*	
M *	306 (146.0)	(18.0)	ABBCH COL 68 HBC	- 16.0 PI- P(3 PI)	9/68*	
M *	(140.0)	(31.0)	BALLAM 68 HBC	- 16.0 PI- P	9/68*	
M	100.	APPROX.	BOESEBECK 68 HBC	+ 8 PI+ P	6/68*	
M	100.	APPROX.	CASO 68 HBC	- 11 PI- P	6/68*	
M *	(41.0)	(32.0)	CASON 68 HBC	+ 18.5 PI+P,P+3PI	9/68*	
M	125.	APPROX.	CHUNG 68 HBC	- 3,2,+2 PI-P	2/67	
M	130.	APPROX.	FRIDMAN 68 HBC	- 5.7 PBAR P	6/68*	
M K	(76.)	(46.)	KEY	68 HBC	- 3.0 PI- P	11/67
M K	SHOULDER ON A2 ONLY					
M	AVG	84.8775	21.2552	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 2.2)		
				(SEE IDEOGRAM BELOW)		



10 A1 PARTIAL DECAY MODES

P1	A1 INTO RHO PI	770+ 139
P2	A1 INTO KBAR K	493+ 497
P3	A1 INTO ETA PI	548+ 139
P4	A1 INTO ETA PRIME PI	958+ 139
P5	A1 INTO 3 PI	139+ 139+ 139

MESON RESONANCES

Data in parentheses have not been included in our averages.

10 A1 BRANCHING RATIOS

R1 * A1 INTO (KBAR K1)/(RHO P1)
R1 0.025 OR LESS DAHL 67 HBC - 4.0 PI-P 0/66
R1 * A1 INTO (KBAR K1)/(RHO P1)

REFERENCES FOR A1

ADERHOLZ 64 PL 10 226 AACH+BERL+BRN+BDN+DESY+HAMB+IMP.COL+ MPI
ALLISON 67 PL 25B 619 +CRUZ+ (OXF+MUN+BRN+RUTH+GLASG+LON(IC))
DAHL 67 PR 163 1377 +HARDY+HESS+KIRZ+MILLER (LRL)
DANYSZ 67 NC 51 A 801 DANYSZ+FRENCH+SIMAK (CERN)
JUHALA 67 PRL 19 1355 +LEACOCK+RHODE+KOPPELMAN+ (IDM+COLD)

ABCH CO 68 VIENNA ABS. 466 COLLABORATION AACHEN-BERLIN+BDN+(CERN+HEID)
ASCOLI 68 COD-1195-121 +CRAWLEY,KRUSE,MORTARA,SCHAFFER+ (ILL INDI)
BALLAM 68 PRL 21 934 +BRDDY,CHADWICK,FRIES,GUIRAGOSSIAN+ (SLAC)JP
BOESEBECK 68 NP B 4 501 BOESEBECK,DEUTSCHMANN,+ (AACHEN+BERLIN+CERN)
CASO 68 NC 54 A 983 +CONTE+CORSO+DIAZ+ (GENOVA+HAMB+MIL+SACL)
CASON 68 VIENNA ABS. 24 +HONES,MCGAHAN,BISWAS,JOHNSON,KENNEY+(INDAM)
CHUNG 68 PR 165 1491 S.U.CHUNG,O.DAHL,J.KIRZ,D.H.MILLER (LRL)
CNOPS 68 VIENNA ABS. 210 +HOUGH,COHN,BUGG+ (BNL+ORNL+ORUC+TENN+PENN)
FRIDMAN 68 PR 167 1268 +MAURER,NICHALON,OUDET+(HEIDELB+STRASBOURG)
KEY 68 PR 166 1430 +PRENTICE+COOPER+MANNER+WALKER+(TO+ANL+MIS)

PAPERS NOT REFERRED TO IN DATA CARDS

BELLINI 63 NC 29 896 BELLINI,FIORINI,HERZ,NEGRI,RATTI (MILAN)
GOLDHABER 64 PRL 12 336 GOLDHABER,BROWN,KADYK,SHEN,TRILING(LRL+UC)
LANDER 64 PRL 13 346 A LANDER,ABOLINS,CARMONY,HENDRICKS+ (UCSD) JP
ABOLINS 65 ATHENS(OHIO)CONF. +CARMONY,LANDER,XUONG,YAGER (LA JOLLA) I=1
ALITTI 65 PL 15 69 ALITTI,BATON,DELER,GRUSSARD+ (SAC+BOL)
ALLARD 66 NC 46A 737 +DRIJARD+HENNESSY+ (ORSAY+MILAN+SAC+BERK)
ALLARD 66 GET GOOD FIT TO (MPI RHO) ONLY WHEN (SSUPING ADDITIONAL RESI-
NANCES BETWEEN 940 AND 1315 MEV
HESS 66 UCRL-16832 R I HESS (THEISIS, BERKELEY) (LRL)
SLATTERY 67 NC 50A 377 +KRAYBILL+FORMAN+FERBEL (YALE+ROCH) JP
ARMENSE 68 PL 26 B 336 +FORINO+CARACCI+ (BARI+BOL+FIR+CRSAY)

A_{1,5}(1170)

44 A 1.5 (1170, J_{PC}= -) I=1
BUMP IN 3 PI AND RHO PI MASS SPECTRA BETWEEN A1 AND A2.
EVIDENCE FOR RESONANCE NOT COMPELLING. OMITTED FROM TABLE.

44 MASS (MEV)

M *	(1190.)	(4.)	CASON	67 HBC	- 8 PI-P	6/68*
M *	(1190.0)	(8.0)	ABCH COL	68 HBC	- 16.0 PI- P,5 PI	9/68*
M D	111(1194.0)	(9.0)	ABCH COL	68 HBC	- 16.0 PI- P(3 PI)	9/68*
M D	FROM FIT WHERE THE A2 IS FIXED AT MASS 1305 MEV, WIDTH 90 MEV		ASCOLI	68 HBC	- 5 PI-P	6/68*
M A	(1170.0)	(21.0)	CASON	68 HBC	+ 18.5 PI+P,P+3PI	9/68*
M A	(1231.0)	(11.0)	CASON	68 HBC	+ 18.5 PI+P,P+3PI	9/68*
M *	NO A2 MESON PEAK IS SEEN		VON KROGH	68 HBC	- 6.7 PI-P	9/68*
M *	(1195.0)	(15.0)	VON KROGH	68 HBC	- 6.7 PI-P	9/68*

44 WIDTH (MEV)

W *	(17.)	(12.)	(6.)	CASON	67 HBC	- 8 PI-P	6/68*
W D	111 (52.0)	(20.0)		ABCH COL	68 HBC	- 16.0 PI- P(3 PI)	9/68*
W D	FROM FIT WHERE THE A2 IS FIXED AT MASS 1305 MEV, WIDTH 90 MEV			ASCOLI	68 HBC	- 5 PI-P	6/68*
W *	45.	15.		CASON	68 HBC	+ 18.5 PI+P,P+3PI	9/68*
W A	(132.0)	(60.0)	(36.0)	CASON	68 HBC	+ 18.5 PI+P,P+3PI	9/68*
W A	(63.0)	(12.0)		CASON	68 HBC	+ 18.5 PI+P,P+3PI	9/68*
W A	NO A2 MESON PEAK IS SEEN			VON KROGH	68 HBC	- 6.7 PI-P	9/68*
W *	(20.0)	(10.0)		VON KROGH	68 HBC	- 6.7 PI-P	9/68*

REFERENCES ON A 1.5 (1170)

BUTTERMO 67 HEIDELB.CONF.P.28 REVIEW TALK ON MESONS (AT HEIDELBERG CONF.)
CASON 67 PRL 18 880 +LAWA,BISWAS,DERADO,GROVES,+ (NOTREDAME)
ABCH CO 68 VIENNA ABS. 466 COLLABORATION AACHEN-BERLIN+BDN+(CERN+HEID)
ASCOLI 68 PRL 21 113 +CRAWLEY,KRUSE,MORTARA,SCHAFFER+ (ILL INDI)
CASON 68 VIENNA ABS. 24 +HONES,MCGAHAN,BISWAS,JOHNSON,KENNEY+(INDAM)
DONALD 68 PL 26 B 327 +FROESELE,BETTINI,+ (LIVERPOOL,OSLO,PADUA)
VONKROGH 68 PL 27B 253 +MIYASHITA,KOPPELMAN,MARSHALL LIBBY (COLD)

B(1210)

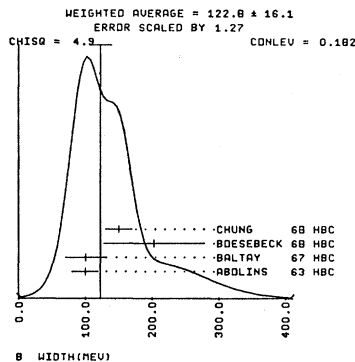
11 B MESON (1220, J_{PC}=1++) I=1
ASCOLI 68 FIND JP EITHER =1+, OR = 2+,3-....
THE SERIES JP=3-,5-,... SEEMS UNLIKELY BECAUSE 2PI AND K KBAR DECAYS ARE NOT OBSERVED.

11 B MESON MASS (MEV)

M	60 1220.0		ABOLINS	63 HBC	+ 3.5 PI+P	
M	1220.0		GOLDHABER	65 HBC	3.7 PI+,PI-P	
M B	(1320.)		BALLAM	67 HBC	- 16 PI-P	11/67
M B	BALLAM 68 IS UPDATING OF BALLAM 67		BALTAY	67 HBC	+- 0.0 PBAR P	2/67
M	376 1200.	20.	BISWAS	67 HBC	- 8.0 PI-P	11/67
M *	(1270.)		LEE	67 HBC	- 3.6 PI-P	1/68*
M *	25 1250.	ESTIMATED	LEE	67 HBC	- 3.6 PI-P	1/68*
M *	(1250.0)	(35.0)	BALLAM	68 HBC	- 16.0 PI-P	9/68*
M	1259.0	27.0	BOESEBECK	68 HBC	+ 8.0 PI+P	0/67
M	1290.	APPROX.	CASO	68 HBC	- 11 PI-P	6/68*
M	1220.	20.	CHUNG	68 HBC	- 3.2,4.2 PI-P	9/67
M *	IN THE 3-4 PI+P DATA, THE B ENHANCEMENT MAY BE DECK EFFECT (CHUNG 68)		CHUNG	68 HBC	- 3.2,4.2 PI-P	9/67
M	150 1230.	APPROX.	GIDAL	68 HBC	+ 3-4 PI+P	6/68*
M	AVG	1220.5490	15.5578	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.2)		

11 B MESON WIDTH (MEV)

W	60 100.0	20.0	ABOLINS	63 HBC	+ 3.5 PI+P	
W	80.0		GOLDHABER	65 HBC	3.7 PI+,PI-P	
W	376 100.	30.	BALTAY	67 HBC	+- 0.0 PBAR P	2/67
W *	(250.)		BISWAS	67 HBC	- 8.0 PI-P	11/67
W *	25 100.	ESTIMATED	LEE	67 HBC	- 3.6 PI-P	1/68*
W *	(200.0)	(50.0)	BALLAM	68 HBC	- 16.0 PI-P	9/68*
W	203.	75.	BOESEBECK	68 HBC	+ 8.0 PI+P	11/67
W	150.	20.	CHUNG	68 HBC	- 3.2,4.2 PI-P	9/67
W	AVG	122.7880	16.0668	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.3)		
				(SEE IDEOGRAM BELOW)		



11 B MESON PARTIAL DECAY MODES

P1	B MESON INTO OMEGA+PI	783+ 139
P2	B MESON INTO 2PI+ 2PI-	139+ 139+ 139+ 139
P3	B MESON INTO K KBAR	493+ 493
P4	B MESON INTO PI PI	139+ 139
P5	B MESON INTO PI PHI	134+1019
P6	B MESON INTO ETA PI (FORBIDDEN BY G)	548+ 139
P7	B MESON INTO K KBAR PI	493+ 493+ 139

11 B MESON BRANCHING RATIOS

R1 *	B INTO 4PI/(OMEGA PI)		ABOLINS	63 HBC	+ 3.5 PI+P	
R1	0.5 OK LESS					
R2 *	B MESON INTO (K KBAR)/(OMEGA PI)		DAHL	67 HBC	- 1.6-4.2 PI-P	0/66
R2	0.02 OR LESS		BALTAY	67 HBC	+- 0.0 PBAR P	2/67
R3 *	B MESON INTO (PI PI)/(PI OMEGA)		ADERHOLZ	64 HBC	4.0 PI+P	7/66
R3	0.3 OR LESS					
R4 *	B MESON INTO (PI PHI) / (PI OMEGA)		DAHL	67 HBC	1.6-4.2 PI-P	0/66
R4	0.015 OR LESS					
R5 *	B MESON INTO (ETA PI) / (PI OMEGA)		BALTAY	67 HBC	+- 0.0 PBAR P	2/67
R5	0.25 OR LESS (CL 90)					
R6 *	B- INTO ((K KBAR)+ (PI)) / (PI OMEGA)		BALTAY	67 HBC	+- 0.0 PBAR P	2/67
R6	0.08 OR LESS (CL 90)					
R6 *	B- INTO (KS KS PI+) / (PI OMEGA)		BALTAY	67 HBC	+- 0.0 PBAR P	2/67
R6	0.02 OR LESS (CL 90)					
R6 *	B- INTO (KS KL PI+) / (PI OMEGA)		BALTAY	67 HBC	+- 0.0 PBAR P	2/67
R6	0.06 OR LESS (CL 90)					

REFERENCES FOR B MESON

ABOLINS 63 PRL 11 381 ABOLINS,LANDER,MEHLHOP,XUCNG,YAGER (UCSD)
ADERHOLZ 64 PL 10 240 AACHEN+BERLIN+BRN+BDN+HAMB+URIC+LOI+(MPI)
GOLDHABER 65 PRL 15 118 G GOLDHABER'S GOLDHABER,KADYK,SHEN (LRL)

BALLAM 67 HEIDBG CONF P.33 +BRDDY,CHADWICK,FRIES,GUIRAGOSSIAN+ (SLAC)
BALTAY 67 PRL 18 93 +SEVERIENS,YEH+ZANELLO (COL+BNL)
BISWAS 67 HEIDBG CONF P.33 +GROVES,CASON,KENNEY,POIRIER+ (NCTRE DAME)
DAHL 67 PR 163 1377 +HARDY+HESS+KIRZ+MILLER (LRL)
FOSTER 67 HEIDELB.CONF.P.33 +GAVILLET,LAROSSE,MONTANE+ (CERN+DC F)
LEE 67 PR 159 1156 +WOBES,ROE+SINCLAIR,VANDERVEIDE (MICHIGAN)

ASCOLI 68 PRL 20 1411 +CRAWLEY,MORTARA,SHAPIRO (URBANA) JP
BOESEBECK 68 NP B 4 501 BOESEBECK,DEUTSCHMANN,+ (AACHEN+BERLIN+CERN)
CASO 68 NC 54 A 983 +CONTE+CORSO+DIAZ+ (GENOVA+HAMB+MIL+SACL)
CHUNG 68 PR 165 1491 S.U.CHUNG,O.DAHL,J.KIRZ,D.H.MILLER (LRL)
GIDAL 68 UCRL-17984 +BROWN,BIRGE,BACASTON,FUNG+(LRL+U.C.RIVERS)

PAPERS NOT REFERRED TO IN DATA CARDS

BONDAR 63 PL 5 209 BONDAR,DODD+ (AACHEN+BRN+HAMB+IC-LOND+MPI)
CARMONY 64 PRL 12 254 CARMONY,LANDER,RINDLEFISCH,XUONG,YAGER (UC) JP
SLATTERY 67 NC 50A 377 +KRAYBILL+FORMAN+FERBEL (YALE+ROCH)
BALLAM 68 VIENNA ABS. 919 +BRDDY,CHADWICK,GUIRAGOSSIAN,LEITH+ (SLAC)

MESON RESONANCES

Data in parentheses have not been included in our averages.

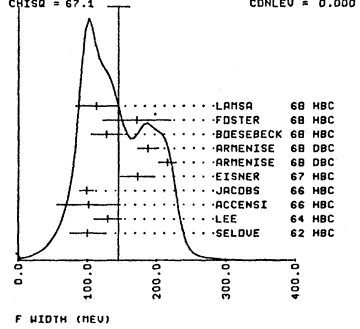
f(1260) 5 F (1260, JPC=2++) I=0

5 F MASS (MEV)			
M	1250.0	25.0	SELDOVE 62 HBC 3.0 P1-P
M	1260.0	35.0	BONDAR 63 HBC 4.0 P1-P
M	1250.0	25.0	VEILLET 63 FBC 6.1 P1-P
M	1270.0	10.0	GUIRAGOSS 63 HBC 3.3 P1-P
M	1240.0	20.0	LEE 64 HBC 3.7 P1-P
M	1267.0	10.0	DERADO 65 HBC 4.0 P1-P 6/66
M	1275.0	25.0	ACCENSI 66 HBC 5.7 PBAR P 6/66
M	(1255.) (13.)		JACOBS 66 HBC 2-3 P1-P, T CUT20 0/67
M	(1271.) (9.)		WAHLIG 66 SPRK 10.0 P1-P 6/66
M	1264. 7.		BARLOW 67 HBC (K01 K01 MODE) 11/66
M	(1262.0) (17.0)		EISNER 67 HBC 4.2 P1-P (ALL T) 9/67
M	(1276.) (11.)		EISNER 67 HBC 4.2 P1-P (T CUT 20) 9/67
M			POIRIER 67 HBC 8.0 P1-P 11/67
M			RABIN 67 HBC 8.5 P1+ P 9/67
M			ARMENISE 68 DBC 5.1 P1+N, P P1+ - 6/68*
M			ARMENISE 68 DBC 5.1 P1+N, P P10 0 6/68*
M			ARMENISE 68 DBC 9.0 P1+ D 9/68*
M			BOESEBECK 68 HBC 8 P1+ P 6/68*
M			FOSTER 68 HBC PBAR P AT REST 6/68*
M			LAMSA 68 HBC 8 P1-P 0/67
M			MASON 68 HBC 2.5 PBAR P 9/68*
M			WHITEHEAD 68 SPRK 3.2 P1-P, P1+P1-N 6/68*
M	AVG	1264.1715 2.4985	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)

5 F WIDTH (MEV)

M	100.0	25.0	SELDOVE 62 HBC 3.0 P1-P
M	85 (140.0)		BONDAR 63 HBC 4.0 P1-P
M	200.0 OR LESS		VEILLET 63 FBC 6.1 P1-P
M	130.0 20.0		LEE 64 HBC 3.7 P1-P
M	150.0 46.0		DERADO 65 HBC 4.0 P1-P 6/66
M	102.0 10.0		ACCENSI 66 HBC 5.7 PBAR P 6/66
M	1416 99.0 10.0		JACOBS 66 HBC 2-3 P1-P, T CUT20 0/67
M	100.		WAHLIG 66 SPRK 10.0 P1-P 11/66
M	(82.) (34.)		BARLOW 67 HBC (K01 K01 MODE) 11/66
M	(219.) (39.)		EISNER 67 HBC 4.2 P1-P (ALL T) 9/67
M	173. 25.		EISNER 67 HBC 4.2 P1-P (T CUT 20) 9/67
M	(163.0) (16.0)		POIRIER 67 HBC 8.0 P1-P 11/67
M	(155.) (17.)		RABIN 67 HBC 8.5 P1+ P 9/67
M			ARMENISE 68 DBC 5.1 P1+N, P P1+ - 6/68*
M	216. 13.		ARMENISE 68 DBC 5.1 P1+N, P P10 0 6/68*
M	188. 15.		ARMENISE 68 DBC 9.0 P1+ D 9/68*
M	(272.0) (20.0)		BOESEBECK 68 HBC 8 P1+ P 6/68*
M	128. 23.		FOSTER 68 HBC PBAR P AT REST 6/68*
M	172. 49.		LAMSA 68 HBC 8 P1-P 0/67
M	115. 30.		MASON 68 HBC 2.5 PBAR P 9/68*
M	(181.0) (40.0)		WHITEHEAD 68 SPRK 3.2 P1-P, P1+P1-N 6/68*
M	(160.0) (20.0)		
M	AVG	145.3259 15.7796	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 2.7) (SEE IDEOGRAM BELOW)

WEIGHTED AVERAGE = 145.3 ± 15.8
ERROR SCALED BY 2.73
CHI SQ = 67.1 CONLEV = 0.000



5 F PARTIAL DECAY MODES

Mode	Decay Masses
P1 F INTO P1+ P1-	139+ 139
P2 F INTO 2P1+ 2P1-	139+ 139+ 139+ 139
P3 F INTO K KBAR	497+ 497

5 F BRANCHING RATIOS

R1	F INTO (2P1+ 2P1-) / TOTAL	
R1	0.08 0.06	BONDAR 63 HBC 4.0 P1-P
R1	0.04 OR LESS	CHUNG 65 HBC 3.2 P1-P
R1	0.01 APPROX.	FERBEL 68 HBC 5 P1-P 6/68*
R2	F INTO (K KBAR) / (P1 P1)	
R2	DETERMINATION DIFFICULT BECAUSE PROXIMITY OF A2 WHICH HAS SAME NEUTRAL (K KBAR) MODES	
R2	0.09 OR LESS	BARMIN 65 HBC 2.8 P1-
R2	0.16 OR LESS	WANGLER 65 HBC 3.0 P1-P
R2	PROBABLY SEEN	BARLOW 67 HBC 1.2 PBAR P - K1K1 11/66
R2	0.047 0.012 + SYST.	BEUSCH 67 SPRK 5.7, 12 P1-P 9/67
R2	PEAK UNRESOLVED FROM A2	
R2	0.025 OR LESS	DAHL 67 HBC 1.6-4.2 P1-P 0/66
R2	(0.055) (0.038)	ABCCW COL 68 HBC 8.0 P1+ P 9/68*
R2	K+K- PEAK IS AT ABOUT 1260 MEV WHILE (KKBAR) PEAKS AT 1320.	

REFERENCES FOR F

SELDOVE 62 PRL 9 272	SELDOVE, HAGOPIAN, BRODY, BAKER, LEBDY (PENNA)
BONDAR 63 PL 5 153	BONDAR+ (AACHEN+BIEM+BOHN+DESY+IC-LOND+MPI)
GUIRAGOS 63 PRL 11 85	Z-G-T. GUIRAGOSSIAN (LRL)
VEILLET 63 PRL 10 29	VEILLET, HENNESSY, BINGHAM, BLOCH+ (PAR+PILAN)
LEE 64 PRL 12 342	LEE, ROE, SINCLAIR, VANDELVELDE (MICHIGAN)
BARMIN 65 SJMP 1 623	+DOLGOLENKO+EROFEEV+KRESTINOV+ (ITEP MOSC)
CHUNG 65 PRL 15 325	CHUNG, DAHL, HARDY, HESS, JACOBS, KIRZ (LRL)
DERADO 65 PRL 14 872	DERADO, KENNEY, POIRIER, SHEPHARD (NOTRE DAME)
GUIRAGOS 65 PRL 11 85	Z G T GUIRAGOSSIAN (LRL)
WANGLER 65 PR 137 B 414	T P WANGLER, A R ERWIN, W WALKER (WISCONSIN)
ACCENSI 66 PL 20 557	ACCENSI, ALLES-BODRELLI, FRENCH, FRISK+ (CERN)
JACOBS 66 UCL-16877	L.D. JACOBS, THESIS (LRL)
WAHLIG 66 PR 147 941	+SHIBATA, GORDON, FRISCH, MANNELLI (MIT+PISA) J
BARLOW 67 NC 50A 701	+LILLETOL+MONTANET+ (CERN+CDF+IR+LIVERPOOL)
BEUSCH 67 PL 25 B 357	+FISCHER, GOBI, ASTOURY, MICHELINI+ (ETH+CERN)
DAHL 67 PR 163 1377	+HARDY+HESS+KIRZ+WILLER (LRL)
EISNER 67 PR 164 1699	+JOHNSON+KLEIN+PETERS+SAHNI+YEN+ (PURDUE)
POIRIER 67 PR 163 1462	+BISWAS, CASON, DERADO, KENNEY+ (INDRAN+PENN)
RABIN 67 THESIS	M. RABIN (TRUTGERS)
ABCCW COL 68 VIENNA ABS. 454	COLLABORATION AACHEN-BERLIN+ (CERN+RAK+WARS)
ARMENISE 68 NC 54 A 999	+FORINO+CARITACCI+ (BARI+BOLOG+FIRENZE+ORSAY)
ARMENISE 68 VIENNA ABS. 412	ARMENISE, FORINO, CARITACCI+ (BARI+BOLOG+FIREZ)
BOESEBECK 68 NP B 4 501	BOESEBECK, DEUTSCHMANN, + (AACHEN+BERLIN+CERN)
FERBEL 68 PREP - PHILA. CONF	T. FERBEL, QUOT. RES. OF PORTARA+ (ILL.) (ROCH)
FOSTER 68 NP B 6 101	+GAVILLI, LABROSSE+MONTANI+ (CERN+PARIS)
LAMSA 68 PR 166 1395	+CASON+BISWAS+DERADO+GROVES+ (NOTREDAME)
MASON 68 VIENNA ABS. 275	+MUIRHEAD, POPPLETON, RIGOPOLUOS+ (LIVP+ATEN)
WHITEHEAD 68 NC 53A 817	+MCENEN, OTT, AITKEN+ (AERE+SHAMPT+UC-LOND)

PAPERS NOT REFERRED TO IN DATA CARDS

HAGOPIAN 63 PRL 10 533	V HAGOPIAN, W SELDOVE (PENNA)
ADERHOLZ 64 PL 10 240	AACHEN+BERLIN+IR+BOHN+HAMBURG+IC-LOND+MPI) J
BRUYANT 64 PL 10 232	BRUYANT, GOLDBERG, HOLDER, FLEURY, HUC (CERN)
SODICKSON 64 PRL 12 485	SODICKSON, WAHLIG, MANNELLI, FRISCH+ (MIT) I
BARMIN 65 SJMP 1 230	+DOLGOLENKO, ELENKY, EROFEEV+ (ITEP MOSCOW) JP
STRUGALS 67 JINR E1-3100	STRUGALSKI+CHUVILO+IVANOVSKAJA+ (DUBNA)

D(1285) 8 D MESON (1285, JPC=+) I=0
(JP=0-, 1+, 2- WITH 1+ FAVORED.)

8 D MESON MASS (MEV)

M	1290. APPROX.	BARLOW 67 HBC 1.2 PBAR P, 4 BODY	5/67
M	1283.0	DAHL 67 HBC 1.6-4.2 P1-P	0/66
M	1290. 7.	D. ANDLAU 68 HBC 1.2 PBAR P, 5-6 BODY	6/68*
M	46(1270.0) (10.0)	D. ANDLAU 68 HBC 0.7 PB P, 5 BODY	9/68*
M	(1300.0)	DEFDIX 68 HBC 1.2 PB P, 7 PI	9/68*
M	AVG	1285.3649 4.0687	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)

8 D MESON WIDTH (MEV)

M	35.0 10.0	DAHL 67 HBC 1.6-4.2 P1-P	0/66
M	30. 5.	D. ANDLAU 68 HBC 1.2 PBAR P, 5-6 PFS	6/68*
M	46 (65.0) (20.0)	D. ANDLAU 68 HBC 0.7 PB P, 5 BODY	9/68*
M	(40.0)	DEFDIX 68 HBC 1.2 PB P, 7 PI	9/68*
M	AVG	31.0000 4.4721	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)

8 D MESON PARTIAL DECAY MODES

Mode	Decay Masses
P1 D MESON INTO K KBAR P1	497+ 497+ 134
P2 D MESON INTO P1 P1 RHO	134+ 134+ 770
P3 D MESON INTO ETA P1 P1	548+ 134+ 134
P4 D MESON INTO DELTA(962) P1	962+ 134

8 D MESON BRANCHING RATIOS

R1	D MESON INTO (P1 P1 RHO) / (K KBAR P1)	
R1	2.0 OR LESS	DAHL 67 HBC CHARGED P1 ONLY 0/66
R1	4.0 OR LESS	DONALD 68 HBC 1.2 PB P, 5 PI 9/68*
R1	THIS IS FOR (RHOO P1+ P1-)/(K KBAR P10)	
R2	D MESON INTO (K KBAR P1)/(ETA P1 P1)	
R2	(0.142) (0.035)	DEFDIX 68 HBC 1.2 PB P, 7 PI 9/68*
R3	D MESON INTO (DELTA P1)/(ETA P1 P1)	
R3	POSSIBLY SEEN	DEFDIX 68 HBC 1.2 PB P, 7 PI 9/68*

REFERENCES FOR D MESON

BARLOW 67 NC 50 A 701	+MONTANET, D-ANDLAU+ (CERN+CDF+IDR+LIVERPOOL)
DAHL 67 PR 163 1377	+HARDY+HESS+KIRZ+WILLER (LRL) I JP
SEE ALSO 65 PRL 4 1074	MILLER, CHUNG, DAHL, HESS, HARDY, KIRZ+ (LRL+UC)
D. ANDLAU 68 NP B 5 693	+ASTIER, BARLOW, MONTANET+ (CDF+CERN+RAD+LIV) JP
D. ANDLAU 68 VIENNA ABS. 626	D. ANDLAU, ASTIER, COHEN+CONFORTO+ (CDF+IPN+CERN)
DEFDIX 68 VIENNA ABS. 653	+STAUD, RIVET, SHIVELY, CONFORTO+ (CDF+IPN+CERN)
DONALD 68 VIENNA ABS. 323	+EDWARDS, BURAN, BETTINI+ (LIVP+OSL+C-PADO)

A2(1300) 12 A2 MESON (1300, JPC=2+) I=1

THE MASS AND WIDTH DATA ARE SEPARATED INTO 4 GROUPS
A2L CONTAINS INFORMATION ON THE LOWER PEAK
A2H CONTAINS INFORMATION ON THE HIGHER PEAK
A2K CONTAINS INFORMATION ON WHETHER UNDECIDED
A2 CONTAINS THE REMAINING INFORMATION (NO SEPARATION)

MESON RESONANCES

Data in parentheses have not been included in our averages.

12 A2L MESON MASS (MEV)

ML	1274.	16.	CHIKOVANI 67 HMS	- 6.7 P1- P	6/68*
ML	1269.0	5.0	CRENNELL 68 HBC	- 6.0 P1-P,X-	6/68*
ML *	(1266.)	(8.)	KIENZLE 68 HMS	- 2.65 P1- P	6/68*
ML AVG	1269.4448	4.7724	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)		

12 A2L MESON WIDTH (MEV)

ML	29.	10.	CHIKOVANI 67 HMS	- 6.7 P1- P	6/68*
ML	24.0	10.0	CRENNELL 68 HBC	- 6.0 P1-P,X-	6/68*
ML *	(28.)	(5.)	KIENZLE 68 HMS	- 2.65 P1- P	6/68*
ML AVG	26.5000	7.0711	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)		

12 A2H MESON MASS (MEV)

MH	1320.	16.	CHIKOVANI 67 HMS	- 6.7 P1- P	6/68*
MH	1315.0	5.0	CRENNELL 68 HBC	- 6.0 P1-P,X-	6/68*
MH *	(1319.)	(8.)	KIENZLE 68 HMS	- 2.65 P1- P	6/68*
MH AVG	1315.4448	4.7724	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)		

12 A2H MESON WIDTH (MEV)

MH	35.	10.	CHIKOVANI 67 HMS	- 6.7 P1- P	6/68*
MH	12.0	10.0	CRENNELL 68 HBC	- 6.0 P1-P,X-	6/68*
MH *	(26.)	(5.)	KIENZLE 68 HMS	- 2.65 P1- P	6/68*
MH AVG	23.5000	11.5000	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.6)		

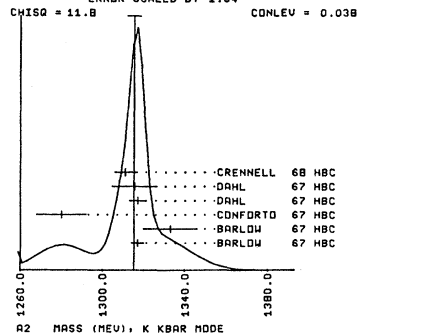
12 A2 MESON MASS (MEV), K KBAR MODE

MK	80	1317.0	3.0	BARLOW 67 HBC	- 1.2 PBAR P, KK	9/67
MK	60	1333.0	13.0	BARLOW 67 HBC	- 1.2 PBAR P, KK	9/67
MK N	(1344.0)	(17.)	(6.)	BEUSCH 67 SPRK	0 5-12 P1- P	7/67
MK N	K01 K01	MODE=	PEAK UNRESOLVED FROM F.			
MK	130	1280.0	12.0	CONFORTO 67 HBC	- 0. PBAR P IN KK	9/67
MK	1317.2	4.0	DAHL 67 HBC	- 2.7-4.5 P1- P	8/67	
MK	1315.7	10.8	DAHL 67 HBC	0 2.7-4.5 P1- P	8/67	
MK	1311.0	5.0	CRENNELL 68 HBC	- 6.0 P1-P,K1K1	6/68*	
MK AVG	1315.2943	3.1680	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.5)			

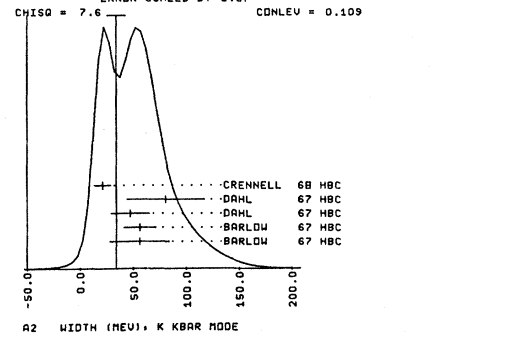
12 A2 MESON WIDTH (MEV), K KBAR MODE

MK	60	56.0	28.0	BARLOW 67 HBC	- 1.2 PBAR P, KK	9/67
MK	80	56.0	15.0	BARLOW 67 HBC	- 1.2 PBAR P, KK	9/67
MK N	(88.)	(23.)	(22.)	BEUSCH 67 SPRK	0 5-12 P1- P	7/67
MK N	K01 K01	MODE=	PEAK UNRESOLVED FROM F.			
MK	130	90.0		CONFORTO 67 HBC	- 0. PBAR P IN KK	9/67
MK	47.	18.		DAHL 67 HBC	- 2.7-4.5 P1- P	8/67
MK	80.5	36.5		DAHL 67 HBC	0 2.7-4.5 P1- P	8/67
MK	21.0	10.0		CRENNELL 68 HBC	- 6.0 P1-P,K1K1	6/68*
MK AVG	33.9103	8.6596	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.4)			

WEIGHTED AVERAGE = 1315.29 ± 3.17
ERRR SCALED BY 1.54



WEIGHTED AVERAGE = 33.91 ± 8.66
ERRR SCALED BY 1.37



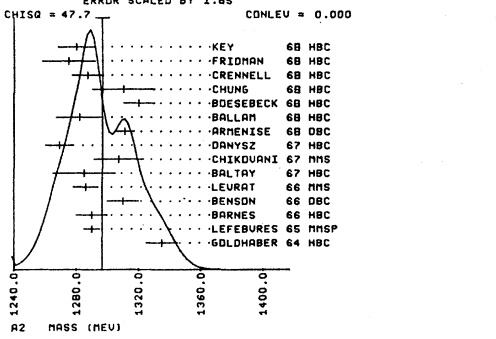
12 A2 MESON MASS (MEV), 3PI MODE, SPLITTING UNRESOLVED

M	1320.0		ADERHOLZ 64 HBC	- 4.0 P1+P		
M	1335.0	10.0	GOLDBER 64 HBC	- 3.7 P1+ P		
M	130	1310.0	FORINO 65 DBC	+ 0 4.5 P1+ D	0/66	
M	1425	1290.0	5.0	LEFEBVRES 65 MMSP	- 5.6,6.0 P1-P	6/66
M	1300.0		SEIDLITZ 65 DBC	- 3.2 P1-D	6/66	
M	1290.0	10.0	BARNES 66 HBC	- 6.0 P1-P	6/66	
M	1310.0	10.0	BENSON 66 DBC	0 3.65 P1+D	6/66	
M *	1800	1310.0	10.0	COMP-BY FERBEL 66 HBC	- 6.7 P1- P	10/66
M	1060	1286.	8.	LEVRAIT 66 HBC	- 6.7 P1- P	2/67
M	137	1285.	20.	BALTAY 67 HBC	0 8.5 P1+ P	7/67
M A	(1288.)	(14.)		CASON 67 HBC	- 8 P1- P	5/67
M A	ANALYSIS	COMPLICATED BY NEARBY PEAK (A1.5) AT 1190 MEV				
M	4000	1307.	16.	CHIKOVANI 67 HMS	- 7 P1- P	8/67
M	1269.	9.	DANYSZ 67 HBC	- 3.3,6 PBAR P	7/67	
M *	(1306.0)	(7.0)	ARBG COL 68 HBC	- 16.0 P1- P,5 P1	9/68*	
M *	1311.0	6.0	ARMENISE 68 DBC	0 5.1 P1+D	9/67	
M *	(1306.0)	(10.0)	ASCOLI 2 68 HBC	- 5.0 P1- P	9/68*	
M *	1282.0	15.0	BALLAM 68 HBC	- 16.0 P1- P	9/68*	
M *	(1315.0)	(15.0)	BLUMENFEL 68 HBC	- 3.9 P1- P	9/68*	
M	1320.	10.	BOESEBECK 68 HBC	0 8 P1+ P	6/68*	
M B	(1280.)	(10.)	BOESEBECK 68 HBC	+ 8 P1+ P	6/68*	
M B	ASSUMING A1 AND A1.5 MESONS OF FIXED MASS AND WIDTH					
M	1300.	APPROX.	CASO 68 HBC	- 11 P1- P	6/68*	
M	1310.	20.	CHUNG 68 HBC	- 2.7-4.5 P1- P	5/68*	
M	1287.0	10.0	CRENNELL 68 HBC	- 6.0 P1-P,X-	6/68*	
M	1275.	17.	FRIDMAN 68 HBC	- 5.7 PBAR P	6/68*	
M	1280.	12.	KEY 68 HBC	- 3 P1- P	11/67	
M *	(1301.0)	(8.0)	VON KROGH 68 HBC	- 6.7 P1- P	9/68*	
M AVG	1296.6581	4.4843	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.8)			

12 A2 MESON WIDTH (MEV)

W	100.0		ADERHOLZ 64 HBC	- 4.0 P1+P		
W	90.0	10.0	GOLDBER 64 HBC	- 3.7 P1+ P		
W	1425	99.0	15.0	LEFEBVRES 65 MMSP	- 6.0 P1- P	6/66
W	140.0		SEIDLITZ 65 DBC	- 3.2 P1-D	6/66	
W	70.0	10.0	BARNES 66 HBC	- 6.0 P1-P	6/66	
W N	(110.0)	(45.0)	BENSON 66 DBC	0 3.65 P1+D	6/66	
W N	SUPERSEDED BY BENSON 1 66					
W	100.	15.	BENSON 1 66 DBC	0 3.65 P1+D	1/67	
W *	1800	80.0	10.0	COMP-BY FERBEL 66 HBC	- 6.7 P1- P	10/66
W	1060	98.	5.	LEVRAIT 66 HBC	- 6.7 P1- P	2/67
W	137	100.	25.	BALTAY 67 HBC	0 8.5 P1+ P	7/67
W A	(84.)	(30.)	(20.)	CASON 67 HBC	- 8 P1- P	5/67
W A	ANALYSIS	COMPLICATED BY NEARBY PEAK (A1.5) AT 1190 MEV				
W	4000	90.	15.	CHIKOVANI 67 HMS	- 7 P1- P	8/67
W	45.	22.	DANYSZ 67 HBC	- 3.3,6 PBAR P	7/67	
W	96.0	16.0	ARMENISE 68 DBC	0 5.1 P1+D	9/67	
W *	(108.0)	(110.0)	ASCOLI 2 68 HBC	- 5.0 P1- P	9/68*	
W *	125.0	40.0	BALLAM 68 HBC	- 16.0 P1- P	9/68*	
W	90.	APPROX.	BOESEBECK 68 HBC	+ 8 P1+ P	6/68*	
W	56.	21.	BOESEBECK 68 HBC	0 8 P1+ P	6/68*	
W	80.	APPROX.	CASO 68 HBC	- 11 P1- P	6/68*	
W	80.	20.	CHUNG 68 HBC	- 2.7-4.5 P1- P	5/68*	
W	94.0	30.0	20.0	CRENNELL 68 HBC	- 6.0 P1-P,X-	6/68*
W	80.	APPROX.	FRIDMAN 68 HBC	- 5.7 PBAR P	6/68*	
W	91.	18.	KEY 68 HBC	- 3 P1- P	11/67	
W *	(40.0)	(25.0)	VON KROGH 68 HBC	- 6.7 P1- P	9/68*	
W AVG	90.8811	3.6713	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.1)			

WEIGHTED AVERAGE = 1296.66 ± 4.48
ERRR SCALED BY 1.85



12 A2 MESON PARTIAL DECAY MODES

P1	A2 MESON INTO RHO P1	770 ± 139
P2	A2 MESON INTO KBAR K	693 ± 697
P3	A2 MESON INTO ETA PI	548 ± 139
P4	A2 MESON INTO ETA PRIME PI	958 ± 139
P5	A2 MESON INTO P1+ P1- P10	139 ± 139 ± 134

12 A2 MESON BRANCHING RATIOS

R1 *	A2 MESON INTO (K KBAR) / (RHO P1)					
R1 *	0.08 OR LESS	LANDER 64 HBC	+ 3.5 P1+ P	0/66		
R1 N	(0.13) (0.03)	BEUSCH 67 SPRK	0 5.7,12 P1+ P	9/67		
R1 N	K01 K01	MODE=	UNRESOLVED FROM F.			
R1 *	(0.15) (0.05)	BOCKMANN 67 HBC	0 5.0 P1+ P	9/67		
R1 *	(0.09) (0.05)	BOCKMANN 67 HBC	+ 5.0 P1+ P	9/67		
R1	11	0.09	0.06	ASCOLI 68 HBC	- 5 P1- P	6/68*
R1	0.022	0.008		BOESEBECK 68 HBC	+ 8 P1+ P	6/68*
R1	0.054	0.022		CHUNG 68 HBC	- 3.2 P1- P	1/67
R1	0.03	0.012		DONALD 68 HBC	- 1.2 PBAR P	6/68*
R1	AVG	.0274	.0063	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)		
R1	FIT	.027	.006	VALUE FROM CONSTRAINED FIT		
R2 *	A2 MESON INTO (ETA P1)/TOTAL					
R2 *	0.084	0.023		BOESEBECK 68 HBC	+ 8 P1+ P	6/68*
R2	FIT	.108	.021	VALUE FROM CONSTRAINED FIT		

MESON RESONANCES

Data in parentheses have not been included in our averages.

Table with columns for resonance name (e.g., A2 MESON INTO), parameters (eta, rho, pi), and experimental references (e.g., ADERHOLZ 64 HBC).

Table with columns for resonance name (A2 MESON INTO), parameters (eta, rho, pi), and experimental references (R3 FIT, R4, R5).

Table with columns for resonance name (A2 MESON INTO), parameters (eta, rho, pi), and experimental references (R5 FIT).

Table with columns for resonance name (A2 MESON INTO), parameters (eta, rho, pi), and experimental references (R6).

THE FOLLOWING BRANCHING FRACTIONS HAVE CORRELATED ERRORS GREATER THAN .5

P1 P3 --.950

***** REFERENCES FOR A2 *****

Table of references for A2 meson, listing authors and publication details.

Table of references for A2 meson, listing authors and publication details.

Table of references for A2 meson, listing authors and publication details.

Table of references for A2 meson, listing authors and publication details.

PAPERS NOT REFERRED TO IN DATA CARDS

Table of papers not referred to in data cards, listing authors and publication details.

Table with columns for resonance name (A2 I=2), parameters (A2, I=2), and experimental references (VANDERHAG).

Table with columns for resonance name (A2 I=2), parameters (A2, I=2), and experimental references (VANDERHAG).

Table with columns for resonance name (A2 I=2), parameters (A2, I=2), and experimental references (VANDERHAG).

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Table with columns for resonance name (A2 I=2), parameters (A2, I=2), and experimental references (VANDERHAG).

Table with columns for resonance name (A2 I=2), parameters (A2, I=2), and experimental references (VANDERHAG).

Table with columns for resonance name (E(1420)), parameters (E, I=0), and experimental references (BAILLON).

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Table with columns for resonance name (E(1420)), parameters (E, I=0), and experimental references (BAILLON).

Table with columns for resonance name (E(1420)), parameters (E, I=0), and experimental references (BAILLON).

MESON RESONANCES

Data in parentheses have not been included in our averages.

13 F PRIME(1515) WIDTH (MEV)

M	B	5	(53.)	(18.)	ABRAMS	67 HBC	4.25 K- P	5/67
W	B	BACKGROUND ESTIMATION DIFFICULT.						5/67
W		35.0	25.0		AMMAR	67 HBC	5.5 K- P	9/67
W		70	87.0	15.0	BARNES	67 HBC	4.6, 5.0 K- P	0/67
W	*	20	(50.0)	(10.0)	D.ANDLAU	68 HBC	0.7 PB P, 3 BODY	9/68*
W	AVG	73.2353		22.9412	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.8)			

13 F PRIME PARTIAL DECAY MODES

P1	F PRIME INTO PI+ PI-	DECAY MASSES
P2	F PRIME INTO K KBAR	139+ 139
P3	F PRIME INTO K K*(890)	497+ 497
P4	F PRIME INTO ETA ETA	493+ 892
P5	F PRIME INTO PI PI ETA	548+ 548
P6	F PRIME INTO PI K KBAR	139+ 139+ 548
		139+ 497+ 497

13 F PRIME BRANCHING RATIOS

R1	* F PRIME INTO (PI+ PI-)/(K KBAR)	67 HBC	5.5 K- P CL- .67	9/67		
R1	0.18 OR LESS	BARNES	67 HBC	4.6, 5.0 K- P	0/67	
R1 N	.03 ESTIMATE FROM SU3 GLASHOW	65 SU3				
R3	* F PRIME INTO (ETA ETA)/(K KBAR)	67 HBC	4.6, 5.0 K- P	0/67		
R3	0.50 OR LESS	BARNES				
R4	* F PRIME INTO (PI PI ETA)/(K KBAR)	67 HBC	CL=0.67	0/67		
R4	0.3 OR LESS	AMMAR				
R4	0.25 0.13	BARNES	67 HBC	4.6, 5.0 K- P	0/67	
R5	* F PRIME INTO (PI K KBAR + K K*(890))/(K KBAR)	67 HBC	CL=0.67	0/67		
R5	0.4 OR LESS	AMMAR				
R5	0.14 OR LESS	BARNES	67 HBC	4.6, 5.0 K- P	0/67	
R5 B	DR AS 0.14	0.14	BARNES	67 HBC	4.6, 5.0 K- P	0/67

REFERENCES FOR F PRIME

CRENNELL 66 PRL 16 1025 + KALBFLEISCH, LAI, SCARR, SCHLMANN + (BNL) I
 ABRAMS 67 PRL 18 620 + KEHOE, GLASSER, SECHI-ZORN, WOLSKY (MARYLAND)
 AMMAR 67 PRL 19 1071 + DAVIS, HANG, DAGAN, DERRICK + (INRU+ANL) JP
 BARNES 67 PRL 19 564 + DORNAN, GILBERG, LEITNER + (BNL+SYRACUSE) IC JP
 D.ANDLAU 68 VIENNA ABS. 626 + STIER, COHEN, AGUILAR-BENITEZ + (CDFE+CCERN)

$\pi/\rho(1550)$
 $\rightarrow K\bar{K}\pi$
 47 PI/RHO (1550, J_{PC}= 1 I=1)
 PRELIMINARY EVIDENCE, OMITTED FROM TABLE

47 PI/RHO (1550) MASS (MEV)

M	*	1550.0	APPROX.	AGUILAR	68 HBC	0.7 PR P	9/68*
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47 PI/RHO (1550) WIDTH (MEV)

M	*	40.0	APPROX.	AGUILAR	68 HBC	0.7 PB P	9/68*
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47 PI/RHO (1550) PARTIAL DECAY MODES

P1	PI/RHO (1550) INTO K KBAR PI	DECAY MASSES
P2	PI/RHO (1550) INTO K*(890) KBAR	134+ 497+ 497
		892+ 497

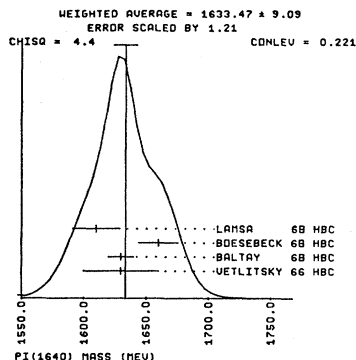
REFERENCES FOR PI/RHO (1550)

AGUILAR 68 VIENNA ABS. 760 + BARLOW, JACOBS, MALECKI, MONTANET + (CCERN+CDFE)

$\pi(1640)$
 34 PI (1640, J_{PC}= -) I=1
 [ALSO CALLED A3.]
 THIS ENTRY CONTAINS G=-1 PEAKS AND THE R1 PEAK

34 PI (1640) MASS (MEV)

M		30	1600.0		FORINO	65 DBC	0.45 PI+ D	0/66
M		20	1630.0	30.0	VELTITSKY	66 HBC	- 4.7 PI- P	6/68*
M	D	(1689.)	(10.)		DANYSZ	67 HBC	0 3, 3.6 PBAR P	6/68*
M	D	OBSERVED IN (OMEGA PI+ PI-)	[AND POSSIBLY (OMEGA RHO(0))] MODE					
M	D	NOTE THAT THE WIDTH OF THIS PEAK IS SMALL						
M	R	(1630.)	(15.)		DUBAL	67 HBC	- 7.11, 5.12 PI- P	7/67
M	R	R1 PEAK FROM CERN HRS EXPT. DECAY MODES AND G PARITY UNKNOWN.						
M	R	NOTE THAT THE R1 HAS SMALLER WIDTH THAN THE OTHER ENTRIES.						
M	*	218(1659.0)	(32.0)		ABRICH COL	68 HBC	- 16.0 PI- PI(3 PI)	9/68*
M	*	1630.	10.		BALTAY	68 HBC	+ 7.8 5 PI+ P	6/68*
M	*	(1708.)	(10.)		BISWAS	68 HBC	0 8 PI- P	6/68*
M	*	1660.	16.		BOESEBECK	68 HBC	+ 8 PI+ P	6/68*
M	*	(1700.0)	(16.0)		BOESEBECK	68 HBC	+ 8.0 PI+ P, PI+ F	0/67
M	*	1660.			CASO 1	68 HBC	- 11 PI- P	6/68*
M	*	(1680.0)			CASO 1	68 HBC	- 11 PI- P, PI- F	6/68*
M	*	(1710.0)	(22.0)		CNDPS	68 DBC	+ 8.0 PI+ P, PI+ F	9/68*
M	*	1650.0			IOFFREDDO	68 HBC	- 13-20 PI- P, PI- F	9/68*
M	*	1610.	19.		LAMSA	68 HBC	- 8.0 PI- P, PI- F	11/67
M	Q	(1670.0)	(18.0)		YOST	68 HRC	0.4 3 K-P, LMBD, 5 PI	9/68*
M	Q	OBSERVED IN (OMEGA PI+ PI-)	BUT NOT IN (OMEGA RHO 0)					
M	AVG	1633.4736			0.0898			AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.2)
								(SEE IDEOGRAM BELOW)



34 PI (1640) WIDTH (MEV)

W	R	21.	OR LESS	LEVRYAT	66 HRS	- 7.12 PI- P	7/67	
W	R	R1 PEAK FROM CERN HRS EXPT. DECAY MODES AND G PARITY UNKNOWN.						
W		20	100.	VELTITSKY	66 HBC	- 4.7 PI- P	6/66	
W	D	(138.)	(18.)	DANYSZ	67 HBC	0 3, 3.6 PBAR P	7/67	
W	D	OBSERVED IN (OMEGA PI+ PI-)	[AND POSSIBLY (OMEGA RHO(0))] MODE					
W	*	218 (278.0)	(70.0)	ABRICH COL	68 HBC	- 16.0 PI- PI(3 PI)	9/68*	
W	*	70.	40.	BALTAY	68 HBC	+ 7.8 5 PI+ P	6/68*	
W	*	(116.)	(30.)	(23.)	BISWAS	68 HBC	0 8 PI- P	6/68*
W	*	115.	45.		BOESEBECK	68 HBC	+ 8 PI+ P	6/68*
W	*	(152.0)	(51.0)		BOESEBECK	68 HBC	+ 8.0 PI+ P, PI+ F	9/68*
W	*	130.			CASO 1	68 HBC	- 11 PI- P	6/68*
W	*	(150.0)			CASO 1	68 HBC	- 11.0 PI- P, PI- F	6/68*
W	*	(170.0)	(50.0)		CNDPS	68 DBC	+ 8.0 PI+ P, 3 PI	9/68*
W	*	100.	50.	30.	LAMSA	68 HBC	- 8.0 PI- P, PI- F	11/67
W	Q	(50.0)	(15.0)		YOST	68 HBC	0.4 3 K-P, LMBD, 5 PI	9/68*
W	Q	OBSERVED IN (OMEGA PI+ PI-)	BUT NOT IN (OMEGA RHO 0)					
W	AVG	93.4956	23.9468	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)				

34 PI (1640) PARTIAL DECAY MODES

P1	PI(1640) INTO 3 PI	DECAY MASSES
P2	PI(1640) INTO RHO PI	134+ 134+ 134
P3	PI(1640) INTO ETA PI	134+ 770
P4	INTO 5 PI	134+ 548
P5	PI(1640) INTO K K*(890)	497+ 892
P6	PI(1640) INTO K KBAR PI	497+ 497+ 134
P7	PI(1640) INTO K KBAR	497+ 497
P8	PI(1640) INTO F PI	126+ 134

34 PI (1640) BRANCHING RATIOS

R1	* PI(1640) INTO (K KBAR) / (ALL 3 PI)			
R2	* PI(1640)++ INTO (PI+- RHO0)/(ALL PI+- PI+ PI-)			
R2	0.2 OR LESS	BALTAY 68 HBC + 7-8.5 PI+ P	5/68*	
R2	BUT COMPILED AS 0.4 OR LESS BY FERBEL 68.			
R2 C	0.35 OR LESS	CASO 1 68 HBC	- 11.0 PI- P	6/68*
R2 C	CASO 2 68 IS UPDATING OF CASO 1 68			
R2 C	(0.03) (0.36) (0.03) CASO 2	68 HBC	- 11.0 PI- P	9/68*
R2 C	CONSISTENT WITH 0.0	IOFFREDDO 68 HBC	- 13-20 PI- P	9/68*
R3	* PI(1640)++ INTO (PI+- F)/(ALL PI+- PI+ PI-)			
R3	(WITH F INTO PI+ PI-)			
R3	INDICATION SEEN	LUBATTI 66 HLCB	+ 7.8 5 PI+ P	11/66
R3	0.35 0.20	BALTAY 68 HBC	+ 7.8 5 PI+ P	5/68*
R3	SEEN	BOESEBECK 68 HBC	+ 8 PI+ P	6/68*
R3 C	CONSISTENT WITH 1.0	CASO 1 68 HBC	- 11 PI- P	6/68*
R3 C	CASO 2 68 IS UPDATING OF CASO 1 68			
R3 C	(0.94) (0.06) (0.29) CASO 2	68 HBC	- 11.0 PI- P	9/68*
R3 C	SEEN	IOFFREDDO 68 HBC	- 13-20 PI- P, PI- F	9/68*
R4	* R1 MESON FRACTION INTO ONE / THREE / FIVE OR MORE CHARGED TRACKS			
R4	0.37 / 0.59 / 0.04	FGACCII 66 HRS	- 3-12 PI- P	0/66
R5	* PI(1640) +- INTO (PI+- ETA)/(ALL PI+- PI+ PI-)			
R5	0.09 OR LESS	BALTAY 68 HBC	+ 7.8 5 PI+ P	5/68*
R6	* PI(1640)++ INTO (PI+- 2PI+ 2PI-)/(ALL PI+- PI+ PI-)			
R6	0.1 OR LESS	BALTAY 68 HBC	+ 7.8 5 PI+ P	6/68*

REFERENCES FOR PI(1640)

FORINO 65 PL 19 68 + GESSAROLI + LENDINARA + (DBL+BAR+FI+OR+S+DAC)
 FERBEL 66 BERG, CONF. P 131 SEE G. GOLDBERGER, REVIEW ON MESONS (LRL)
 FGACCII 66 PRL 17 890 CERN MISSING MASS SPECTROMETER GROUP (CCERN)
 LEVRYAT 66 PL 22 714 CERN MISSING MASS SPECTROMETER GROUP (CCERN)
 LUBATTI 66 THESIS BERKELEY H.J. LUBATTI (LRL) 1-2-
 VELTITSKY 66 PL 21 579 VELTITSKY, GUSZAVIN, KLIGER, ZOLGANOV + (ITEP)

DANYSZ 67 NC 51 A 801 DANYSZ + FRENCH + SIMAK (CCERN)
 DUBAL 67 NP 83 435 CERN MISSING MASS SPECTROMETER GROUP (CCERN)
 L.DUBAL ALSO 68 THESIS 1456 (GENEVE)

ABRICH CO 68 VIENNA ABS. 466 COLLABORATION AACHEN-BERLIN+BOON+CIRM+HEID
 BALTAY 68 PRL 20 887 + KUNG-YEH+FERBEL + (COL+M+RCH+RUTO+VALE) I=1
 BARTSCH 68 CERN 68-10 --NP + KEPPLE, GROTE, BOTTCHER, + (AACH+BERL+CCERN) JP
 BISWAS 68 PREPRINT -ATHENS + CASON, GROVES, KENNEY, POIRIER + (INTRADAME)
 BOESEBECK 68 NP 8 4 501 BOESEBECK, DEUTSCHMANN, + (AACHEN+BERL+CCERN)
 CASO 1 68 NC 54 A 983 + CONTE+CORDS+DIAS + (GENOVA+HAM+MIL+SACL)
 CASO 2 68 VIENNA ABS. 325 + CONTE, CORDS, RATTI + (GENOVA+HAM+MIL+SACL)
 CNDPS 68 VIENNA ABS. 210 + HOUGH, COHN, BUGG + (BNL+ORNL+ORUC+TENN+PENN)
 FERBEL 68 PREP--PHILA, CONF T. FERBEL + (ROCHESTER)
 IOFFREDDO 68 PRL 21 1212 + BRANDENBURG, BRENNER, EISENSTEIN + (HARVARD)
 LAMSA 68 PR 166 1395 + CASON + BISWAS + DERADDO + GROVES + (NOTREDAME)
 YOST 68 VIENNA ABS. 65 + YODH, EINSCHLAG, CAY, GLASSER (MARYLAND)

MESON RESONANCES

Data in parentheses have not been included in our averages.

45 ϕ (1650, JPC = -) I=0
 PRELIMINARY EVIDENCE, OMITTED FROM TABLE
 THIS ENTRY CONTAINS NEUTRAL 3 PI ENHANCEMENTS FOR WHICH
 A (RHO 0 PI 0) DECAY MODE HAS BEEN SUGGESTED. IF TRUE,
 I=0 SO THAT IT CANNOT BE THE RHO(1650). HOWEVER, THE
 EXISTENCE OF THE (RHO 0 PI 0) MODE HAS NOT BEEN PROVEN.

45 ϕ (1650) MASS (MEV)

M	1636.0	20.0	ARMENISE 68 DBC	0 5.1 PI+D	9/68*
M	(1667.0)	(16.0)	CNDPS 68 DBC	0 8.0 PI+D, PI RHO	9/68*

45 ϕ (1650) WIDTH (MEV)

W	112.0	60.0	ARMENISE 68 DBC	0 5.1 PI+D	9/68*
W	(118.0)	(39.0)	CNDPS 68 DBC	0 8.0 PI+D, PI RHO	9/68*

45 ϕ (1650) PARTIAL DECAY MODES

P1	ϕ (1650) INTO RHO PI	DECAY PASSES
P2	ϕ (1650) INTO RHO 0 PI 0	139+ 770

45 ϕ (1650) BRANCHING RATIOS

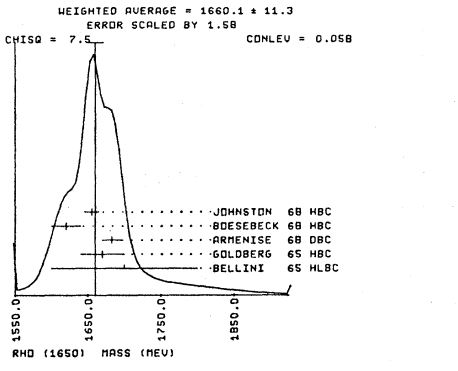
R1	ϕ (1650) INTO (RHO 0 PI 0) / (RHO PI)	DECAY PASSES
R1	(0.35) (0.08)	139+ 770
R1		134+ 770

REFERENCES FOR ϕ (1650)
 ARMENISE 68 PL 268 336 *GHIDINI, FORINO+ (BARI+BOLOGN+FIRENZ+CRSAY)
 CNDPS 68 VIENNA ABS. 210 *HOUGH, COHN, BUGG+ (BNL+ORNL+ORUC+TENN+PENN)

15 RHO (1650, JPC = N+) I=1
 THIS ENTRY CONTAINS THE R1, G(2 PI) AND K KBAR PEAKS.
 FOR POSSIBLE 4 PI MODES SEE RHO(1700)
 CRENNELL 67 SUGGEST JP=3- FROM THE PI PI SCATTERING ANGLE DISTR.

15 RHO (1650) MASS (MEV)

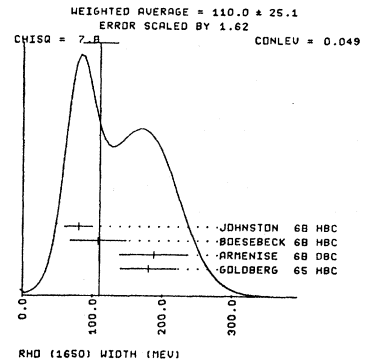
M	1700.0	100.0	BELLINI 65 HLBC	0 6.1 PI-P	6/66
M	1640.0	45 DBC	FORINO 65 DBC	0 4.5 PI+D	6/66
M	1670.0	30.0	GOLDBERG 65 HBC	0 6 PI+D, 8 PI-P	6/68*
M	50(1630.0)		CRENNELL 67 HBC	- 6.0 PI-P	3/67
M	70(1700.0)		CRENNELL 67 HBC	0 6.0 PI-P	3/67
M	CRENNELL 68 IS UPDATING OF CRENNELL 67				
M	(1630.0)	(15.0)	DUBAL 67 MMS	- 7.11.5, 12PI- P	7/67
M	R1 PEAK FROM CERN MMS EXPT. DECAY MODES AND G PARITY UNKNOWN.				
M	R NOTE THAT THE R1 HAS MUCH SMALLER WIDTH THAN THE OTHER ENTRIES.				
M	1683.0	13.0	ARMENISE 68 DBC	0 8.0 PI- P	11/67
M	(1737.0)	(35.0)	ARMENISE2 68 DBC	0 9.0 PI+ D	9/68*
M	1620.0	20.0	BOESEBECK 68 HBC	+ 8 PI+ P	6/68*
M	(1750.0)		CASO 68 HBC	0 11.0 PI-P, 2 PI	9/68*
M	(1707.0)	(16.0)	CNDPS 68 DBC	0 8.0 PI+D, PI+PI-	9/68*
M	(1720.0)	(20.0)	CRENNELL 68 HBC	0 6.0 PI- P	9/68*
M	(1640.0)	(25.0)	CRENNELL 68 HBC	- 6.0 PI- P	9/68*
M	(1640.0)	(20.0)	CRENNELL 68 HBC	+ 6.0 PI-P, KBAR K	9/68*
M	1655.0	10.0	JOHNSTON 68 HBC	0 7.0 PI-P	6/68*
M	AVG	1660.0614	11.2795	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.6)	



15 RHO (1650) WIDTH (MEV)

W	40.0	40.0	FORINO 65 DBC	0 4.5 PI+D	6/66
W	21.0	OR LESS	GOLDBERG 65 HBC	0 6 PI+D, 8 PI-P	6/68*
W	R1 PEAK FROM CERN MMS EXPT. DECAY MODES AND G PARITY UNKNOWN.				
W	21.0	OR LESS	LEVAT 66 MMS	- 7.12 PI- P	7/67
W	70(1700.0)		CRENNELL 67 HBC	0 6.0 PI-P	3/67
W	50(1630.0)		CRENNELL 67 HBC	0 6.0 PI-P	3/67
W	CRENNELL 68 IS UPDATING OF CRENNELL 67				
W	(226.0)	(46.0)	POIRIER 67 HBC	0 8.0 PI- P	11/67
W	188.0	49.0	ARMENISE 68 DBC	0 5.1 PI+ D	6/68*
W	(131.0)	(20.0)	ARMENISE2 68 DBC	0 9.0 PI+ D	9/68*

M	108.0	40.0	BOESEBECK 68 HBC	+ 8 PI+ P	6/68*
M	(1200.0)		CASO 68 HBC	0 11.0 PI-P, 2 PI	9/68*
M	(173.0)	(65.0)	CNDPS 68 DBC	0 8.0 PI+D, PI+PI-	9/68*
M	(200.0)	(100.0)	CRENNELL 68 HBC	- 6.0 PI- P	9/68*
M	(200.0)	(100.0)	CRENNELL 68 HBC	0 6.0 PI- P	9/68*
M	(179.0)	(70.0)	CRENNELL 68 HBC	+ 6.0 PI-P, KBAR K	9/68*
M	80.0	20.0	JOHNSTON 68 HBC	0 7.0 PI- P	6/68*
M	AVG	109.9968	25.0588	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.6)	



15 RHO (1650) PARTIAL DECAY MODES

P1	RHO (1650) INTO PI PI	DECAY PASSES
P2	RHO (1650) INTO 4PI	139+ 139
P2	RHO (1650) INTO K KBAR	497+ 497

15 RHO (1650) BRANCHING RATIOS

R1	R1 MESON FRACTION INTO ONE / THREE / FIVE OR MORE CHARGED TRACKS	
R1	0.37 / 0.59 / 0.04	FOCACCI 66 MMS -
R3	RHO(1650) INTO (K KBAR) / (2 PI)	
R3	INDICATION SEEN	EHRLICH 66 HBC +0 7.9 PI- P
R3	PROBABLY SEEN	ABRAMS 67 HBC 0 4.25 K- P
R3	0.10 OR LESS	CRENNELL 67 HBC 6.0 PI-P
R3	CRENNELL 68 IS UPDATING OF CRENNELL 67	
R3	(0.08) (0.08) (0.03)	CRENNELL 68 HBC 6.0 PI- P

REFERENCES FOR RHO(1650)
 BELLINI, DI CORATO, DUJMINO, FORINO (MILANO)
 FORINO 65 PL 19 65 FORINO, GESSARDI + (BOLOGNA+ORSAY+SACLAY)
 GOLDBERG 65 PL 17 354 GOLDBERG+ (CERN+PARIS+ORSAY+MILANO+CEA-SACL)
 EHRLICH 66 PR 152 1194 R. EHRLICH, M. SELIGER, H. YUTA (PENNSYLVANIA)
 FOCACCI 66 PRL 17 890 CERN MISSING MASS SPECTROMETER GROUP (CERN)
 LEVAT 66 PL 22 714 CERN MISSING MASS SPECTROMETER GROUP (CERN)
 ABRAMS 67 PRL 18 620 *KENOE+GLASSER+SECHI-ZORN+WCLSKY (MARYLAND)
 CRENNELL 67 PRL 18 323 *HOUGH, KALBFLEISCH, LAI, BACHMAN+ (BNL, CCNY, I J)
 DUBAL 67 NP 83 435 CERN MISSING MASS SPECTROMETER GROUP (CERN)
 ALSO 68 THESIS 1456 L. DUBAL (GENEVE)
 POIRIER 67 PR 163 1462 *BISWAS, CASON, DERADO, KENNEY+ (NOTRDAM+PENN)
 ARMENISE 68 NG 54 A 999 *FORINO+CARACCIA+ (BARI+BOLOGN+FIRENZ+CRSAY) I
 ARMENISE2 68 VIENNA ABS. 412 ARMENISE, FORINO, CARACCIA+ (BARI+BOLOGN+FIREZ)
 BOESEBECK 68 NP 8 4 501 BOESEBECK, DEUTSCHMANN, (AACHEN+BERLIN+GENE)
 CASO 68 VIENNA ABS. 907 *CONTE, BENZ, CORDS+ (GENEVA+HAMB+MILA+SACL)
 CNDPS 68 VIENNA ABS. 210 *HOUGH, COHN, BUGG+ (BNL+ORNL+ORUC+TENN+PENN)
 CRENNELL 68 VIENNA ABS. 158 *KARSHON, LAI, SCARR, SKILLICRN (BNL)
 JOHNSTON 68 PRL 20 1414 *PRENTICE, STEENBERG, YOON (TORONTO+MISC)

ρ (1700) 38 RHO(1700, JPC = +) I = 1 OR 2
 THIS ENTRY CONTAINS 4PI, RHO 2PI, 2RHO, OMEGA PI, AND K KBAR
 ENHANCEMENTS, AND THE R2.

38 MASS (MEV)

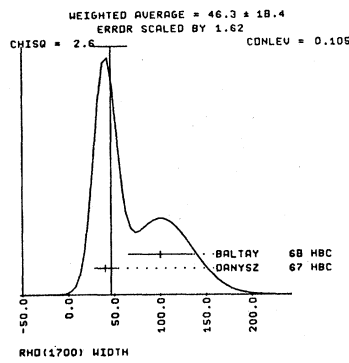
M	80 1717.0	7.0	DANYSZ 67 HBC	OSEE NOTE R BELOW	9/67
M	R SEEN IN 2.5-3 PBAR P. 2PI+2PI-, WITH 0, 1, 2 PI+PI- PAIRS IN RHO BAND				
M	(1700.0)	(15.0)	DUBAL 67 MMS	- 7.11.5, 12PI- P	7/67
M	R2 PEAK FROM CERN MMS EXPT. DECAY MODES AND G PARITY UNKNOWN.				
M	K (1700.0)		FRENCH 67 HBC	0 3, 3, 6 PBAR P	7/67
M	K OBSERVED IN NEUTRAL (K KBAR) MODE (G-PARITY UNKNOWN)				
M	(1700.0)	(35.0)	BALLAM 68 HBC	- 10.0 PI- P	9/68*
M	1720.0	15.0	BALTAY 68 HBC	+ 7. 8.5 PI+ P	6/68*
M	(1710.0)	(23.0)	BISWAS 68 HBC	- 8 PI- P	6/68*
M	(1720.0)		CASO 1 68 HBC	- 11.0 PI-P, RHO 2PI	6/68*
M	C (1670.0)		CASO 1 68 HBC	- 11.0 PI-P, 4PI	9/68*
M	C (1700.0)		CASO 2 68 HBC	- 11.0 PI- P	9/68*
M	C SEEN IN RHO- PI- PI+ AND RHO- RHO (OMEGA ANTISELECTED)				
M	C CASO 2 68 IS UPDATING OF CASO 1 68				
M	O (18(1630.0))		CASO 2 68 HBC	- 11.0 PI- P	9/68*
M	O SEEN IN THE OMEGA PI- SYSTEM				
M	J (1675.0)	(10.0)	JOHNSTON 68 HBC	- 7.0 PI- P	6/68*
M	J NOT SEPARATED FROM 2 PI DECAY				
M	AVG	1717.5365	6.3433	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)	

MESON RESONANCES

Data in parentheses have not been included in our averages.

38 WIDTH (MEV)

M	H	30.	OR LESS	LEVRAT	66 MMS	-	7-12 PI-P	7/67	
M	H	R2 PEAK FROM CERN MMS EXPT.	DECAY MODES AND G PARITY UNKNOWN.						
M	H	80	40.	DANYSZ	67 HBC	OSEE NOTE R BELOW		5/67	
M	R	SEEN IN 2.5-3 PBAR P.	2PI+2PI- WITH 0,1,2 PI+PI- PAIRS IN RHO BAND						
M	*	(110.0)	(50.0)	BALLAM	68 HBC	-	16.0 PI-P	9/68*	
M	*	100.	35.	BALTAY	68 HBC	+	7, 8.5 PI+ P	6/68*	
M	*	(162.)	(58.)	(40.)	BISWAS	68 HBC	-	8 PI-P	6/68*
M	C	(120.0)		CASO 1	68 HBC	-	11.0 PI-P, 4PI	6/68*	
M	C	(100.0)		CASO 1	68 HBC	-	11.0PI-P,RHO 2PI	6/68*	
M	C	(200.0)		CASO 2	68 HBC	-	11.0 PI-P	9/68*	
M	C	SEEN IN RHO- PI- PI+ AND RHO- RHO (OMEGA ANTISELECTED)							
M	C	CASO 2 68 IS UPDATING OF CASO 1 68							
M	D	18	(60.0)	CASO 2	68 HBC	-	11.0 PI-P	9/68*	
M	D	SEEN IN THE OMEGA PI- SYSTEM							
M	J	(90.0)	(20.0)	JOHNSTON	68 HBC	-	7.0 PI-P	6/68*	
M	J	NOT SEPARATED FROM 2 PI DECAY							
M	AVG	46.3112	18.4076	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.6)					
				(SEE 10EDGRAM BELOW)					



38 RHO (1700) PARTIAL DECAY MODES

P1	RHO(1700) INTO 4 PI	DECAY MASSES
P2	RHO(1700) INTO A2 PI	139+ 139+ 139+ 139
P3	RHO(1700) INTO OMEGA PI	139+ 783
P4	RHO(1700) INTO PHI PI	1019+ 139
P5	RHO(1700) INTO 2 RHO	770+ 770

38 RHO(1700) BRANCHING RATIOS

R1	R2 MESON FRACTION INTO ONE / THREE / FIVE OR MORE CHARGED TRACKS	0.42 / 0.56 / 0.01	FOCACCI	66 MMS	-		0/66
R2	RHO(1720)+ INTO (PI+ A20)/(ALL PI+ PI+ PI- PI0)						
R2	(WITH A20 INTO (PI+ PI- PI0))						
R2	NOT SEEN		BALLAM	68 HBC	-	16.0 PI-P	9/68*
R2	0.40	0.20	BALTAY	68 HBC	+	7, 8.5 PI+P	6/68*
R2	NOT SEEN		JOHNSTON	68 HBC	-	7 PI-P	6/68*
R3	RHO(1720)+ INTO (PI OMEGA)/(ALL PI+ PI+ PI- PI0)						
R3	(WITH OMEGA INTO (PI+ PI- PI0))						
R3	(0.17)	(0.30)	BALLAM	68 HBC	-	16.0 PI-P	9/68*
R3	0.25	0.10	BALTAY	68 HBC	+	7-8.5 PI+P	5/68*
R3	.25	0.10	JOHNSTON	68 HBC	-	7.0 PI-P	6/68*
R3	AVG	.2500	.0707	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)			
R4	RHO(1720)+ INTO (PI PHI)/(ALL PI+ PI+ PI- PI0)						
R4	0.11	OR LESS	EHRlich	68 HBC	+	7-8.5 PI+P	6/68*
R5	RHO(1720)+ INTO (RHO 2PI)/(ALL 4PI)						
R5	CONSISTENT WITH 1.		CASO 1	68 HBC	-	11 PI-P	6/68*
R6	RHO(1720)+ INTO (RHO+ RHO0)/(ALL RHO 2PI)						
R6	(0.48)	(0.16)	CASO 1	68 HBC	-	11 PI-P	6/68*
R7	RHO(1720) INTO (2 RHO) / (ALL 4PI)						
R7	33	(0.33)	DANYSZ	67 HBC	0	3-4 PBAR P	5/68*
R7	SEEN		BALLAM	68 HBC	-	16.0 PI-P	9/68*
R7	SEEN		BALTAY	68 HBC	+	7, 8.5 PI+P	6/68*
R7	SEEN		JOHNSTON	68 HBC	-	7 PI-P	6/68*
R8	RHO(1720)+ INTO (PI+ 2PI+ 2PI- PI0)/(ALL PI+ PI+ PI- PI0)						
R8	0.15	OR LESS	BALTAY	68 HBC	+	7, 8.5 PI+ P	6/68*
R9	RHO(1720)+ INTO (PI+ PI0) / (ALL PI+ PI+ PI- PI0)						
R9	0.08	OR LESS	BALTAY	68 HBC	+	7-8.5 PI+ P	6/68*
R9	USING DATA OF DEUTSCHMANN 65 ON PI+P TO PI+ PI0 P						6/68*

REFERENCES FOR RHO(1700)

DEUTSCHMANN	65 PL 18 351	M. DEUTSCHMANN ET AL (AACHEN-BERLIN-CERN)
FOCACCI	66 PRL 17 890	CERN MISSING MASS SPECTROMETER GROUP (CERN)
LEVRAT	66 PL 22 714	CERN MISSING MASS SPECTROMETER GROUP (CERN)
DANYSZ	67 PL 248 309	+FRENCH+KINSON+SIMAK+ (CERN+LIVERPOOL)
DUBAL	67 NP B3 435	+FOCACCI+KIENZLE+LECHANOINE+LEVRAT+ (CERN)
ALSO	68 THESIS 1456	L. DUBAL (GENEVE)
FRENCH	67 NC 524 442	+KINSON+MCDONALD+RIDDIFORD+ (CERN+BIRM)
BALLAM	68 VIENNA ABS. 919	+BRODY+CHADWICK+GUIRAGOSSIAN+LEITH+ (SLAC)
BALTAY	68 PRL 20 887	+KUNG+VENH+FERBEL+ (COLPB+ROCH+RUTG+YALE) I-1
BISWAS	68 PREPRINT	+CASON+GROVES+KENNEY+POIRIER+ (INTRODAME)
CASO 1	68 NC 54 A 983	+CONTE+CORDS+DIAZ+ (GENOVA+HAMB+MIL+SACL)
CASO 2	68 VIENNA ABS. 325	+CONTE+CORDS+RATTI+ (GENOVA+HAMB+MILAN+SACL)
EHRlich	68 OUT-BY BALTAY 68	R. EHRlich (TU GIESSEN)
JOHNSTON	68 PRL 20 1414	+PRENTICE+STEENBERG+YODN (TORONTO+MCSJLIP)

R (1750) 39 R(1750) I=1

THIS ENTRY CONTAINS I=1 PEAKS AND THE R3 PEAK NOT A FIRMLY ESTABLISHED RESONANCE - OMITTED FROM TABLE

M	H	1748.	16.	DUBAL	67 MMS	-	7, 11.5, 12 PI-P	7/67
M	F	(1740.)		FRENCH	67 HBC	(KO K+)	3-4 PBAR P	7/67
M	F	SEE FIG. 9 OF FRENCH 67						

39 R(1750) WIDTH (MEV)

M	H	38.	OR LESS	LEVRAT	66 MMS	-	7, 12 PI-P	7/67
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39 R(1750) BRANCHING RATIOS

R3	R3 MESON FRACTION INTO ONE / THREE / FIVE OR MORE CHARGED TRACKS	0.14 / 0.80 / 0.05	FOCACCI	66 MMS	-		0/66
R3	C FRACTION INTO ONE CHARGED PROB. LARGER THAN GIVEN ABOVE. CF. DUBAL+67						

REFERENCES FOR R (1750)

FOCACCI	66 PRL 17 890	CERN MISSING MASS SPECTROMETER GROUP (CERN)
LEVRAT	66 PL 22 714	CERN MISSING MASS SPECTROMETER GROUP (CERN)
DUBAL	67 NP B3 435	CERN MISSING MASS SPECTROMETER GROUP (CERN)
FRENCH	67 NC 524 442	+KINSON+MCDONALD+RIDDIFORD+ (CERN+BIRM)

$\eta_{A,I=0}(1830)$
 $4\pi, K^*K$

ETA OR RHO (1830) G=+1 (JPG= +) I=0 OR GREATER

THIS ENTRY CONTAINS 4 PI AND K PI KBAR AND THE R4 MMS PEAK. R4 IS ONLY A 3 STANDARD DEVIATIONS EFFECT. OMITTED FROM TABLE.

42 MASS (MEV)

M	H	110	1832.	6.	DANYSZ	67 HBC	OSEE NOTE R BELOW	5/67
M	R	SEEN IN 2.5-3 PBAR P.	2PI+2PI- WITH 0,1,2 PI+PI- PAIRS IN RHO BAND					
M	H	(110.0)	(15.)	DUBAL	67 MMS	-	7, 11.5, 12 PI-P	6/68*
M	H	MISSING MASS R4 PEAK, FINAL STATE UNKNOWN						
M	H	1820.	12.	FRENCH	67 HBC	OSEE NOTE K BELOW		7/67
M	K	SEEN IN 3.-3.6 PBAR P TO (KS KO PI0...)	G PARITY UNKNOWN					
M	AVG	1829.6000	5.3666	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)				

42 WIDTH (MEV)

M	H	110	42.	11.	DANYSZ	67 HBC	OSEE NOTE R BELOW	5/67
M	R	SEEN IN 2.5-3 PBAR P.	2PI+2PI- WITH 0,1,2 PI+PI- PAIRS IN RHO BAND					
M	H	30.0	OR LESS	DUBAL	67 MMS	-	7, 11.5, 12 PI-P	6/68*
M	H	MISSING MASS R4 PEAK, FINAL STATE UNKNOWN						
M	H	50.	23.	FRENCH	67 HBC	OSEE NOTE K BELOW		7/67
M	K	SEEN IN 3.-3.6 PBAR P TO (KS KC PI0...)	G PARITY UNKNOWN					
M	AVG	43.4892	9.9235	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)				

42 PARTIAL DECAY MODES

P1	ETA OR RHO (1830) INTO 4 PI	DECAY MASSES
P2	ETA OR RHO (1830) INTO RHO PI PI	139+ 139+ 139+ 139
P3	ETA OR RHO (1830) INTO RHO RHO	770+ 770
P4	ETA OR RHO (1830) INTO K KBAR PI	134+ 497+ 497

REFERENCES

DANYSZ	67 PL 248 309	+FRENCH+KINSON+SIMAK+ (CERN+LIVERPOOL)
DUBAL	67 NP B3 435	CERN MISSING MASS SPECTROMETER GROUP (CERN)
ALSO	68 THESIS 1456	L. DUBAL (GENEVE)
FRENCH	67 NC 524 442	+KINSON+MCDONALD+RIDDIFORD+ (CERN+BIRM)

$\phi_{A,I=0}(1830)$
 $5\pi, K^*K$

PHI OR PI (1830) G=-1 (JPG= -) I=0 OR GREATER

THIS ENTRY CONTAINS OMEGA PI PI AND K PI KBAR AND THE R4 PEAK. R4 IS ONLY A 3 STANDARD DEVIATIONS EFFECT. I=1 IF (OMEGA RHO) MODE EXISTS. OMITTED FROM TABLE.

43 MASS (MEV)

M	C	(1848.)	(11.)	DANYSZ	67 HBC	0	3, 3.6 PBAR P	7/67
M	O	OBSERVED IN (OMEGA PI+ PI-)	(AND POSSIBLY (OMEGA RHO(0)))	MODE				
M	K	(1820.)	(12.)	FRENCH	67 HBC	0	3, 3.6 PBAR P	7/67
M	K	OBSERVED IN (KS KO PI0...)	MODE (G PARITY UNKNOWN)					
M	H	(1830.)	(15.)	DUBAL	67 MMS	-	7, 11.5, 12 PI-P	6/68*
M	H	MISSING MASS R4 PEAK, FINAL STATE UNKNOWN						

43 WIDTH (MEV)

M	O	(67.)	(27.)	DANYSZ	67 HBC	0	3, 3.6 PBAR P	7/67
M	O	OBSERVED IN (OMEGA PI+ PI-)	(AND POSSIBLY (OMEGA RHO(0)))	MODE				
M	K	(50.)	(20.)	FRENCH	67 HBC	0	3-4 PBAR P	7/67
M	K	OBSERVED IN (KS KO PI0...)	MODE (G PARITY UNKNOWN)					
M	H	30.0	OR LESS	DUBAL	67 MMS	-	7, 11.5, 12 PI-P	6/68*
M	H	MISSING MASS R4 PEAK, FINAL STATE UNKNOWN						

43 PARTIAL DECAY MODES

P1	PHI (1830) INTO 5 PI	DECAY MASSES
P2	PHI (1830) INTO OMEGA PI PI	139+ 139+ 139+ 139
P3	PHI (1830) INTO OMEGA RHO	783+ 770
P4	PHI (1830) INTO K KBAR PI	134+ 497+ 497

MESON RESONANCES

Data in parentheses have not been included in our averages.

REFERENCES
 DANYSZ 67 NC 51A 801 DANYSZ+FRENCH+SIMAK (CERN)
 DUBAL 67 NP B3 435 CERN MISSING MASS SPECTROMETER GROUP (CERN)
 ALSO 68 THESES 1456 L.DUBAL (GENEVE)
 FRENCH 67 NC 52A 442 *KINSON+MCDONALD+RIDDFORD+ (CERN+DIRM)

S(1930) 31 S(1930, JPG=) I=1 OR 2
 THIS ENTRY CONTAINS, BESIDES THE S(1930) SEEN BY CHIKOVANI 66 WITH A MMS, VARIOUS OTHER PEAKS NEARBY.

31 S(1930) MASS (MEV)

M	1929.0	14.0	CHIKOVANI 66 MMS	- 12.0 PI-P	8/66
M	1900.	40.	BOESEBECK 68 HBC	+ 8 PI+ P, PI+ P10	6/68
M	C (1985.0)		CASO 68 HBC	- 11.0 PI- P	9/68
M	C		SEEN IN RHO- PI+ PI- (OMEGA ANTISELECTED)		
M	1945.0		CLINE 68 HBC	+3-7 PB P ELAST	9/68
M	1925.0		CLINE 68 HBC	+3-7 PB P ELAST	9/68
M	AVG	1925.8352 13.2140	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)		

31 S(1930) WIDTH (MEV)

W	35.0	OR LESS	CHIKOVANI 66 MMS	- 12.0 PI-P	8/66
W	216.	105.	BOESEBECK 68 HBC	+ 8 PI+ P, PI+ P10	6/68
W	C (100.0)		CASO 68 HBC	- 11.0 PI- P	9/68
W	C		SEEN IN RHO- PI+ PI- (OMEGA ANTISELECTED)		
W	22.0		CLINE 68 HBC	+3-7 PB P ELAST	9/68
W	10.0		CLINE 68 HBC	+3-7 PB P ELAST	9/68

31 D(SIGMA)/DIT (MICROBARN/(GEV/C)**2)

CS	35.0	12.0	FOCACCI 66 MMS	.22 LTE T LTE .36	9/66
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REFERENCES FOR S(1930)
 CHIKOVAN 66 PL 22 233 CERN MISSING MASS SPECTROMETER GROUP (CERN)
 FOCACCI 66 PRL 17 890 CERN MISSING MASS SPECTROMETER GROUP (CERN)
 BOESEBECK 68 NP B 4 501 BOESEBECK+DEUTSCHMANN+ (AACHEN+BERLIN+CERN)
 CASO 68 VIENNA ABS. 325 +CONTE+CORDS+RATTI+ (GENOA+HAMB+MILAN+SACL)
 CLINE 68 PRL 21 1268 +ENGLISH+REIDER, TERRELL, TWITTY (WISCONSIN)

T(2195) 32 T(2200, JPG=) I=1 OR 2
 THIS ENTRY CONTAINS, BESIDES THE T(2200) SEEN BY CHIKOVANI 66 WITH A MMS, VARIOUS OTHER PEAKS NEARBY.

32 T(2200) MASS (MEV)

M	2195.0	15.0	CHIKOVANI 66 MMS	- 12.0 PI-P	8/66
M	B (2190.)	(5.)	ABRAMS 67 CNTR	S CHANNEL NBAR N	7/67
M	B		SEEN AS BUMP IN I=1 STATE. WIDTH MUCH LARGER THAN IN THE MMS EXPT.		
M	B		SEE ALSO COOPER 68.		
M	2207.	13.	ALLES-BOR 67 HBC	0 5.7 PBAR P	12/66
M	A ALLES-BORELLI 67	SEE NEUTRAL MODE ONLY (PI+PI-PI0)			
M	2190.0	10.0	CLAYTON 67 HBC	+ 2.5PBAR, A2+OMEGA	0/67
M	C (2200.0)		CASO 68 HBC	- 11.0 PI- P	9/68
M	C		SEEN IN RHO- PI+ PI- (OMEGA ANTISELECTED)		
M	AVG	2196.0316 7.0080	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)		

32 T(2200) WIDTH (MEV)

W	13.0	OR LESS	CHIKOVANI 66 MMS	- 12.0 PI-P	8/66
W	B (85.)		ABRAMS 67 CNTR	S CHANNEL NBAR N	7/67
W	B		SEE NOTE B UNDER T(2200) MASS ABOVE.		
W	62.	52.	ALLES-BOR 67 HBC	0 5.7 PBAR P	12/66
W	C (130.0)		CASO 68 HBC	- 11.0 PI- P	9/68
W	C		SEEN IN RHO- PI+ PI- (OMEGA ANTISELECTED)		

32 D(SIGMA)/DIT (MICROBARN/(GEV/C)**2)

CS	29.0	10.0	FOCACCI 66 MMS	.22 LTE T LTE .36	9/66
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32 SIGMA (MB) FOR FORMATION BY NUCLEON ANTINUCLEON

CS	6.		ABRAMS 67 CNTR	S CHANNEL NBAR N	7/67
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REFERENCES FOR T(2200)
 CHIKOVAN 66 PL 22 233 CERN MISSING MASS SPECTROMETER GROUP (CERN)
 FOCACCI 66 PRL 17 890 CERN MISSING MASS SPECTROMETER GROUP (CERN)
 ABRAMS 67 PRL 18 1209 +COOL+GIACOMELLI+KYCIA+LECNIC+LI+ (BNL)
 ALLES-BOR 67 NC 50 A 776 ALLES-BORELLI+FRENCH+FRISK+ (CERN+BOINI)G--
 CASO 68 VIENNA ABS. 325 +CONTE+CORDS+RATTI+ (GENOA+HAMB+MILAN+SACL)
 CLAYTON 67 HEIDBG.CONF.-P.57 +MASON+MUIRHEAD, FILIPPAS+ (LIVPOOL+ATHENS)
 COOPER 68 PRL 20 1059 +HYMAN, MANNER, MUSGRAVE, VOYVODIC (ANL)

N_{I=0}(2380) N NBAR (2380) (I=0)
 EVIDENCE FOR RESONANCE PRELIMINARY, OMITTED FROM TABLE.

41 MASS

M	2380.	10.	ABRAMS 67 CNTR	S CHANNEL NBAR N	7/67
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W 140. 41 WIDTH ABRAMS 67 CNTR S CHANNEL NBAR N 7/67
 41 SIGMA (MB) FOR FORMATION BY NUCLEON ANTINUCLEON
 CS * (2.) ABRAMS 67 CNTR 7/67

REFERENCES FOR N NBAR (2380)
 ABRAMS 67 PRL 18 1209 +COOL+GIACOMELLI+KYCIA+LECNIC+LI+ (BNL)

U(2380) 33 U(2380, JPG=) I=1 OR 2
 THIS ENTRY CONTAINS (A2 OMEGA), N NBAR (I=1), AND THE U (MMS) PEAK.

33 U(2380) MASS (MEV)

M	2382.0	24.0	CHIKOVANI 66 MMS	- 12.0 PI-P	8/66
M	B (2345.)	(10.)	ABRAMS 67 CNTR	S CHANNEL NBAR N	7/67
M	B		SEEN AS BUMP IN I=1 STATE. WIDTH MUCH LARGER THAN IN THE MMS EXPT.		
M	M 2380.0	10.0	CLAYTON 67 HBC	+ 2.5PBAR, A2+OMEGA	0/67
M	AVG	2380.2959 9.2308	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)		

33 U(2380) WIDTH (MEV)

W	30.0	OR LESS	CHIKOVANI 66 MMS	- 12.0 PI-P	8/66
W	B (140.)		ABRAMS 67 CNTR	S CHANNEL NBAR N	7/67
W	B		SEEN AS BUMP IN I=1 STATE. WIDTH MUCH LARGER THAN IN THE MMS EXPT.		

33 D(SIGMA)/DIT (MICROBARN/(GEV/C)**2)

CS	42.0	14.0	FOCACCI 66 MMS	.28 LTE T LTE .36	9/66
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33 SIGMA (MB) FOR FORMATION BY NUCLEON ANTINUCLEON
 CS * (3.) ABRAMS 67 CNTR S CHANNEL NBAR N 7/67

33 U MESON BRANCHING RATIOS
 RI * U- MESON FRACTION INTO ONE / THREE / FIVE OR MORE CHARGED TRACKS
 RI 0.30 / 0.45 / 0.25 FOCACCI 66 MMS - 0/66

REFERENCES FOR U(2380)
 CHIKOVAN 66 PL 22 233 CERN MISSING MASS SPECTROMETER GROUP (CERN)
 FOCACCI 66 PRL 17 890 CERN MISSING MASS SPECTROMETER GROUP (CERN)
 ABRAMS 67 PRL 18 1209 +COOL+GIACOMELLI+KYCIA+LECNIC+LI+ (BNL)
 CLAYTON 67 HEIDBG.CONF.-P.57 +MASON, MUIRHEAD, FILIPPAS+ (LIVPOOL+ATHENS)

K K MESON (JP=0-) I = 1/2
 SEE LISTINGS OF STABLE PARTICLES

K(725) 17 KAPPA (725, JP=) I=1/2
 EVIDENCE NOT COMPELLING. OMITTED FROM TABLE.
 FOR A COMPILATION, SEE APPENDIX A OF JAN 67 EDITION
 TRIP 39, 1) OF THIS DATA SUMMARY.
 SEE ALSO ROSENFELD, PROC. 1968 UNIV. OF PENN. CONF. ON MESON SPECTROSCOPY

K*(892) 18 K* (890, JP=1-) I=1/2

18 K* (890) MASS (MEV)

M	898.0	5.0	CHADWICK 63 HBC	+ 1.5 K+P	
M	891.0	3.0	FERRI-LUZ 65 HBC	+ 3.0 K+P	
M	895.	3.	ROSE 67 HBC	+ 2.3 K+P	7/67
M	891.	2.	DE BAERE 67 HBC	+ 3.5 K+P (KO PI+)	7/67
M	892.5	2.5	DE BAERE 67 HBC	+ 3.5 K+P (K+ PI0)	7/67
M	898.	4.	SALLSTROM 67 HBC	+ 3. K+ P (KO PI+)	7/67
M	883.	5.	SALLSTROM 67 HBC	+ 3. K+ P (K+ PI0)	7/67
M	890.	2.	BARLOW 67 HBC	+ 1.2 PBAR P	11/66
M	889.	3.	BARLOW 67 HBC	+ 1.2 PBAR P	11/66
M	896.0	5.0	CONFORTI 67 HBC	+ 0. PBAR P	9/67
M	891.0	1.0	MUJICIKII 64 HBC	- 1.7 K-P	
M	889.5	2.5	ADELPHAN 65 HBC	- 1.5 K-P	6/66
M	895.0	3.0	GELSEMA 65 HBC	- 1.5 K-P	
M	893.	4.	ADERNHOLZ 68 HBC	- 1.0 K-P	6/68
M	891.	4.	FICENEC 68 HBC	- 1.3 K-P (K-PI0)	9/67
M	887.	3.	FICENEC 68 HBC	- 1.3 K-P (KOPI-)	9/67
M	896.0	4.0	SCHWEINGR 68 HBC	- 4.1 K-P	9/67
M	892.0	2.0	SCHWEINGR 68 HBC	- 5.5 K-P	9/67
M	AVG	891.4197 .5778	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)		
M	200	880.0	ALEXANDER 62 HBC	+ 0 2.2 PI-P	
M	895.0	2.0	FERRI-LUZ 65 HBC	+ 0 3.0 K+P	6/66
M	895.	5.	WANGLER 65 HBC	+ 0 3.0 PI- P	6/66
M	894.	5.	FRENCH 67 HBC	+ 0 3-4 PBAR P	6/67
M	AVG	894.8621 1.8570	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)		

MESON RESONANCES

Data in parentheses have not been included in our averages.

Table listing meson resonance parameters including mass, width, and decay modes. Columns include experimental reference, mass (MeV), width (MeV), and decay channels like K pi pi or K pi eta.

Summary table for K*(890) resonance, showing mass and width from various experiments (D, BARASH, etc.).

Table listing meson resonance parameters for K*(890) width, including sources like CHADWICK, FERRO-LUZ, BOMSE, etc.

Table listing meson resonance parameters for K*(890) partial decay modes, including decay widths for different channels.

Table listing meson resonance parameters for K*(890) branching ratios, showing ratios of decay widths.

Table listing meson resonance parameters for K*(890) partial decay modes, including decay masses.

Table listing meson resonance parameters for K*(890) branching ratios, showing ratios of decay widths.

Table listing meson resonance parameters for K*(890) branching ratios, showing ratios of decay widths.

K_N (1100-1200) section with a diagram of the K pi pi resonance and text describing the resonance properties and experimental data.

REFERENCES

DE BAERE 67 NC 51 A 401 +DEBAISIEUX,GOLDSCHMIDT-CLERM.+ (CERN+BRUX)
TRIPPE 68 UCLA-1024 +CHIEN,MALAMUD,MELLEMA,SCHLEIN,SLATER(UCLA) 0+

K_{3/2} (1175) 24 KA 3/2 (1175,JP=) I = 3/2
EVIDENCE NOT COMPELLING, OMITTED FROM TABLE.
FOR A DISCUSSION SEE ROSENFELD 68

K_{3/2} (1270) 25 KA3/2(1265,JP=) I=3/2
EVIDENCE NOT COMPELLING, OMITTED FROM TABLE.
FOR A DISCUSSION SEE ROSENFELD 68

THERE EXIST MANY PAPERS REPORTING A BROAD I=1/2 (K PI PI) ENHANCEMENT
IN THE MASS REGION 1.23-1.36 GEV. IT IS PROBABLY DUE TO SOME
COMBINATION OF DECK EFFECT AND ONE, TWO, OR THREE REAL RESONANCES.

K_A (1200-1350) KA(1200-1350) I=1/2

28 KA(1200-1350) MASS (MEV)
M 200 1280. 20. BERLINGHI 67 HBC + 12.7 K+ P 7/67

28 KA(1200-1350) WIDTH (PEV)
W 200 130. 15. BERLINGHI 67 HBC + 12.7 K+ P 7/67

28 KA(1200-1350) PARTIAL DECAY MODES
P1 * KA(1200-1350) INTO K*(890) PI 493+ 139+ 139

28 KA(1200-1350) BRANCHING RATIOS
R1 200 KA(1200-1350) INTO K*(890) PI AND K RHO (OVERLAPPING BANDS)

28 KA(1200-1350) BRANCHING RATIOS (continued)
R2 * KA(1200-1350) INTO (K PI) / TOTAL BERLINGHI 67 HBC + 12.7 K+ P 11/67

28 KA(1200-1350) BRANCHING RATIOS (continued)
R7 * KA(1200-1350) INTO (K PI) / TOTAL ABCLV COL 68 HBC - 10.0 K- P 9/68*

REFERENCES FOR KA (1200-1350)
BERLINGHI 67 PRL 18 1087 BERLINGHI+ERBER+FERBEL+FRUMAN+ (ROCHI)JP

MESON RESONANCES

Data in parentheses have not been included in our averages.

$K_A(1230)$

20 $K_A(1230, JP = 1^- 1/2^-)$

FORMERLY CALLED G MESON
(JP = 1^- FAVORED)

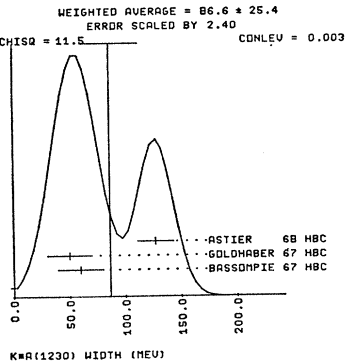
SEE NOTE PRECEDING $K_A(1200-1350)$

20 $K_A(1230)$ MASS (MEV)

M	1230.0	15.0	BASSOMPIE 67 HBC	+ 5. K+ P	11/67
M	1250.0	10.0	GOLDBER 67 HBC	9.0 K+ P	0/67
M	1250	APPROX.	BGO COLL. 68 HBC	+ 10.0 K+ P	9/68*
M	1242.	9.	ASTIER 68 HBC	+0 0 PBAR P	6/68*
M	(1277.)	(9.)	ASTIER 68 HBC	+0 0 PBAR P	6/68*
M			FROM FIT WITH A $K_A(1320)$.		
M	AVG	1243.0447	6.2592	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)	

20 $K_A(1230)$ WIDTH (MEV)

M	60.0	20.0	BASSOMPIE 67 HBC	+ 5. K+ P	11/67
M	50.0	20.0	GOLDBER 67 HBC	9.0 K+ P	0/67
M	127.	7.	ASTIER 68 HBC	+0 0 PBAR P	6/68*
M	(83.)	(20.)	ASTIER 68 HBC	+0 0 PBAR P	6/68*
M			SEE NOTE M UNDER MASS ABOVE.		
M	AVG	86.5789	25.4017	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 2.4)	
				(SEE IDEOGRAM BELOW)	



20 $K_A(1230)$ PARTIAL DECAY MODES

P1	KC INTO K RHO	493+ 770
P2	KC INTO K* PI	892+ 139
P3	KC INTO K PI	497+ 139+ 139

20 $K_A(1230)$ BRANCHING RATIOS

R1	* $K_A(1230)$ INTO (K RHO) / TOTAL	(UNITS OF 10^{**2})	0.0 PBAR P	6/66
R1	75.0	10.0	ARMENTERO 64 HBC	
R2	* $K_A(1230)$ INTO (K* PI) / TOTAL	(UNITS OF 10^{**2})	0.0 PBAR P	6/66
R2	25.0	10.0	ARMENTERO 64 HBC	

REFERENCES FOR $K_A(1230)$

ARMENTERO 64 DUBNA CONF 1 577 ARMENTEROS, EDWARDS, D-ANDLUA + (CERA+CDF)
SEE ALSO PL 9, 207
ALSO DUBNA CONF 1 617 R ARMENTEROS (RAPPORTEUR)
SEE ALSO 66 PR 145-1095 BARASH, KIRSCH, MILLER, TAN (COLUMBIA)
BASSOMPI 67 PL 26B 30 BASSOMPIERRE, GOLDSCHMIDT+ (CERN+BRUX+BIRM) IJP
GOLDBER 67 PRL 19 972 G. GOLDBER, FIRESTONE, SHEN (LRL)
ASTIER 68 VIENNA ABS. 501 + PARECHAL, MONTANET+CODEF+CERN+IPN(P)+IPDOL
BGO COLL 68 VIENNA ABS. 217 // BIRMINGHAM+GLASGOW+OXFORD

$K_A(1280)$

26 $K_A(1280, JP = 1^- 1/2^-)$

SEE NOTE PRECEDING $K_A(1200-1350)$

26 $K_A(1280)$ MASS (MEV)

M	S	(1280.0)	SHEN	66 HBC + 0 4.6 K+P	11/67
M	S	SEEN IN FIVE-BODY FINAL STATE. MAY BE ASSOCIATED WITH $K_A(1320)$.			
M	S	35 1280.0	10.0	BASSOMPIE 67 HBC + 5. K+ P	11/67
M	N	45 (1300.)	10.0	CRENNELL 67 HBC 0 6 PI- P	7/67
M	N	THESE PEAKS MAY BETTER BE ASSOCIATED WITH THE $K_A(1320)$.			
M	G	(1250.0)	(10.0)	GOLDBER 67 HBC 9.0 K+ P	0/67
M	G	(50.0)	(20.0)	GOLDBER 67 HBC 9.0 K+ P	0/67
M	G	THIS PEAK MAY BETTER BE ASSOCIATED WITH THE $K_A(1230)$.			

26 $K_A(1280)$ WIDTH (MEV)

M	S	(100.0)	(20.0)	SHEN	66 HBC + 0 4.6 K+ P	11/67
M	S	SEEN IN FIVE-BODY FINAL STATE. MAY BE ASSOCIATED WITH $K_A(1320)$.				
M	N	35 80.0	20.0	BASSOMPIE 67 HBC + 5. K+ P	11/67	
M	N	45 (60.)	20.0	CRENNELL 67 HBC 0 6 PI- P	7/67	
M	N	THESE PEAKS MAY BETTER BE ASSOCIATED WITH THE $K_A(1320)$.				
M	G	(50.0)	(20.0)	GOLDBER 67 HBC 9.0 K+ P	0/67	
M	G	THIS PEAK MAY BETTER BE ASSOCIATED WITH THE $K_A(1230)$.				

26 $K_A(1280)$ PARTIAL DECAY MODES

P1	KA INTO K*(890) PI	892+ 139
P2	KA INTO K RHO	497+ 770
P3	KA INTO K OMEGA	497+ 783
P4	KA INTO K PI	493+ 139
P5	KA INTO K ETA	493+ 548

26 $K_A(1280)$ BRANCHING RATIOS

R1	* $K_A(1280)$ INTO (K PI) / (K*(890) PI)	SHEN	66 HBC	4.6 K+P	11/67
R1	S	0.8	OR LESS		
R1	S	SEEN IN FIVE-BODY FINAL STATE. MAY BE ASSOCIATED WITH $K_A(1320)$.			

REFERENCES FOR $K_A(1280)$

SHEN 66 PRL 17 726 +BUTTERWORTH, FU, GOLDBERS, TRILLING (LRL)
BASSOMPI 67 PL 26B 30 BASSOMPIERRE, GOLDSCHMIDT+ (CERN+BRUX+BIRM) IJP
CRENNELL 67 PRL 19 44 +KALBFLEISCH, LAI, SCARR, SCHUMANN (BNL) I
GOLDBER 67 PRL 19 972 G. GOLDBER, FIRESTONE, SHEN (LRL)

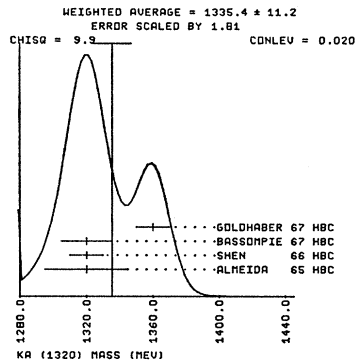
$K_A(1320)$

21 $K_A(1320, JP = 1^- 1/2^-)$

(JP = 1^- FAVORED)
SEE NOTE PRECEDING $K_A(1200-1350)$

21 $K_A(1320)$ MASS (MEV)

M	12	1320.0	25.0	ALMEIDA 65 HBC	+ 3-5 K+ P	8/66
M	70	1320.0	10.0	SHEN 66 HBC	+ 4.6 K+ P	8/66
M	S	(1280.0)		SHEN 66 HBC + 0 4.6 K+P		11/67
M	S	SEEN IN FIVE-BODY FINAL STATE. MAY BE ASSOCIATED WITH $K_A(1280)$.				
M	S	1320.0	15.0	BASSOMPIE 67 HBC + 5. K+ P		11/67
M	N	45 (1300.)		CRENNELL 67 HBC 0 6 PI- P		7/67
M	N	THESE PEAKS MAY POSSIBLY BE ASSOCIATED WITH THE $K_A(1280)$.				
M	N	(1330.)	(12.)	ASTIER 68 HBC	+0 0 PBAR P	0/67
M	N					6/68*
M	AVG	1335.3584	11.2317	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.8)		
				(SEE IDEOGRAM BELOW)		



21 $K_A(1320)$ WIDTH (MEV)

M	12	60.0	20.0	ALMEIDA 65 HBC	+ 3-5 K+P	8/66
M	70	80.0	20.0	SHEN 66 HBC	+ 4.6 K+P	8/66
M	S	(100.0)	(20.0)	SHEN 66 HBC + 0 4.6 K+ P		11/67
M	S	SEEN IN FIVE-BODY FINAL STATE. MAY BE ASSOCIATED WITH $K_A(1280)$.				
M	N	45 (60.)	20.0	BASSOMPIE 67 HBC + 5. K+ P		11/67
M	N	THESE PEAKS MAY POSSIBLY BE ASSOCIATED WITH THE $K_A(1280)$.				
M	N	80.0	20.0	GOLDBER 67 HBC 9.0 K+ P		0/67
M	N	(120.)	(20.)	ASTIER 68 HBC	+0 0 PBAR P	6/68*
M	AVG	70.0000	10.0000	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)		

21 $K_A(1320)$ PARTIAL DECAY MODES

P1	KA INTO K*(890) PI	892+ 139
P2	KA INTO K RHO	497+ 770
P3	KA INTO K OMEGA	497+ 783
P4	KA INTO K PI	493+ 139
P5	KA INTO K ETA	493+ 548

21 $K_A(1320)$ BRANCHING RATIOS

R1	* $K_A(1320)$ INTO (K*(890) PI AND K RHO (OVERLAPPING BANDS))	SHEN	66 HBC + 4.6 K+P	8/66
R1	70	1.0		
R2	* $K_A(1320)$ INTO (K*(890) PI)	SHEN	66 HBC + 4.6 K+P	0/66
R2	0.1	OR LESS		
R8	* $K_A(1320)$ INTO (K PI) / (K*(890) PI)	SHEN	66 HBC + 4.6 K+P	0/66
R8	0.30	OR LESS		
R9	* $K_A(1320)$ INTO (K+ PI-) / (K+0 PI+ PI-)	CRENNELL	67 HBC 0 6.0 PI-P	7/67
R9	0.2	OR LESS (CL=.90)		
R10	* $K_A(1320)$ INTO (K0 PI+ PI- PI0) / (K+0 PI+ PI-)	CRENNELL	67 HBC 0 6.0 PI-P	7/67
R10	0.1	OR LESS (CL=.90)		

MESON RESONANCES

Data in parentheses have not been included in our averages.

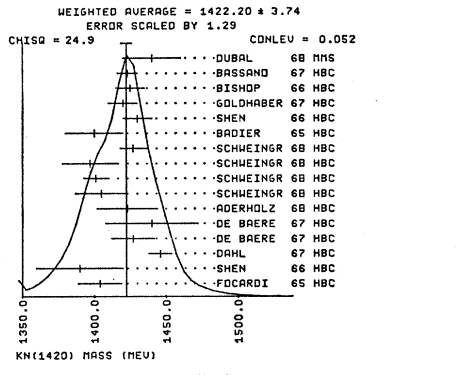
REFERENCES FOR KN(1420)
 ALMEIDA 65 PL 16 184 ALMEIDA,ATHERTON,BYER,DORNAK,FORSON*(CAMBR)
 SHEN 66 PRL 17 726 *RUTTERNORTH,FU,GOLDHABERS,TRILLING (LRL)
 ALSO 66 (PRIVATE COMMUN)GERSON GOLDHABER
 BASSOMPIERRE 67 PRL 268 30 *BASSOMPIERRE,GOLDSCHMIDT*(CERN+BRUX+BIJRM)JP
 CRENNELL 67 PRL 19 44 *KALBFLEISCH,LAI,SCARR,SCHUMANN (BNL)
 GOLDHABER 67 PRL 19 972 G.GOLDHABER,FIRESTONE,SHEN (LRL)
 ASTIER 68 VIENNA ABS. 501 *MARECHAL,MONTANET*(CDEF+CERN+IPN)+POOL

KN(1420) 22 KN (1420,JP=2+) I=1/2
 JP = 3- IS UNLIKELY BUT NOT YET COMPLETELY RULED OUT.

22 KN(1420) MASS (MEV)

M	1404.0	15.0	FOCARDI 65 HBC	-0.3. K-P (K P1)	0/66
M	1390.0	30.0	SHEN 66 HBC	+ 0.4,6 K+P (K P1)	0/66
M	1446.0	7.9	DAHL 67 HBC	0.4,PI- P (K P1)	0/66
M	1427.0	15.0	DE BAERE 67 HBC	+ 3.5 K+P (K P1)	0/66
M	1440.0	24.0	DE BAERE 67 HBC	+ 3.5 K+P (K+ P10)	0/66
M	(1430.0)	(20.0)	GEORGE 67 HBC	0.5. K+P (K P1)	0/66
M	1423.0	21.0	ADERHOLZ 68 HBC	- 10 K-P (K P1)	6/68*
M	(1396.0)	(8.0)	BASSOMPIERRE 68 HBC	+ 5.0 K+P (K P1)	9/68*
M	1405.0	18.0	SCHWEINGR 68 HBC	+ 0.4,1 K-P (K P1)	9/67
M	1401.0	8.0	SCHWEINGR 68 HBC	+ 4.1 K-P (K P1)	9/67
M	1397.0	19.0	SCHWEINGR 68 HBC	+ 0.5,5 K-P (K P1)	9/67
M	1427.0	9.0	SCHWEINGR 68 HBC	- 5.5 K-P (K P1)	9/67
M	1400.0	20.0	BADIER 65 HBC	- 3. K-P (K+P1)	0/66
M	1430.0	10.0	SHEN 66 HBC	+ 0.4,6 K+P (K+P1)	0/66
M	(1420.0)	(10.0)	BASSOMPIERRE 67 HBC	+ 5. K+P (K 2P1)	11/67
M	1440.0		BASSOMPIERRE 68 IS UPDATING OF BASSOMPIERRE 67 AND GEORGE 67		
M	1420.0	10.0	ADERHOLZ 67 HBC	0.6 PI- P (K 2P1)	7/67
M	(1396.0)	(5.0)	GOLDHABER 67 HBC	9.0 K+P (K 2P1)	0/67
M	(1422.0)	(5.0)	BASSOMPIERRE 68 HBC	+ 5.0 K+P (K 2P1)	9/68*
M			BASSOMPIERRE 68 HBC	+ 5.0 K+P (K 2P1)	9/68*
M			THE FOLLOWING VALUES ARE FROM BOTH (K P1) AND (K 2P1) MODES		
M	1425.0	10.0	BISHOP 66 HBC	+ 3.5 K+P	0/66
M	1423.0	7.0	BASSANO 67 HBC	-0.4,6; 5.0 K-P	0/67
M	20 1440.0	20.0	DUBAL 68 HBC	- 11.5 K-P	6/68*
M	AVG	1422.1971	3.7401	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.3)	

(SEE IDEOGRAM BELOW)



22 KN(1420) WIDTH (MEV)

M	92.0	14.0	FOCARDI 65 HBC	-0.3.0 K-P (K P1)	
M	75.0	25.0	SHEN 66 HBC	4.6 K+P	8/66
M	61.0	24.0	DAHL 67 HBC	0.3,0.4,2 PI- P	0/66
M	90.0	28.0	DE BAERE 67 HBC	+ 3.5 K+P	0/66
M	(110.0)	(40.0)	GEORGE 67 HBC	0.5.0 K+P	0/66
M	175.0	57.0	ADERHOLZ 68 HBC	- 10 K-P (K P1)	6/68*
M	(123.0)	(25.0)	BASSOMPIERRE 68 HBC	+ 5.0 K+P (K P1)	9/68*
M	107.0	20.0	SCHWEINGR 68 HBC	-0.4,1,5,5 K-P	9/67
M	105.0	30.0	BADIER 65 HBC	- 3.0 K-P	6/66
M	(80.0)	(20.0)	BASSOMPIERRE 67 HBC	+ 5. K+P (K+ P1)	11/67
M	80.0	20.0	GOLDHABER 67 HBC	9.0 K+P (K 2P1)	0/67
M	(110.0)	(10.0)	BASSOMPIERRE 68 HBC	+ 5.0 K+P (K 2P1)	9/68*
M	(110.0)	(10.0)	BASSOMPIERRE 68 HBC	+ 5.0 K+P (K 2P1)	9/68*
M	96.0	10.0	BISHOP 66 HBC	+ 3.5 K+P	6/66
M	65.0	20.0	BASSANO 67 HBC	-0.4,6; 5.0 K-P	0/67
M	AVG	89.7795	5.9098	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)	

22 KN (1420) PARTIAL DECAY MODES

P1	KN(1420) INTO K PI	493+ 139
P2	KN(1420) INTO K*(890) PI	892+ 139
P3	KN(1420) INTO K RHO	493+ 170
P4	KN(1420) INTO K OMEGA	493+ 783
P5	KN(1420) INTO K ETA	493+ 548

22 KN(1420) BRANCHING RATIOS

R1	* KN(1420) INTO (K P1)/TOTAL		
R1	R	(0.37) (0.19)	BADIER 65 HBC 3.0 K-P 6/66
R1	R	(0.33) (0.07)	BISHOP 66 HBC 3.5 K+P 6/66
R1	R	(0.39) (0.11)	BASSANO 67 HBC - 4.6; 5.0 K-P 0/67
R1	R		THIS BRANCHING RATIO CONTAINS REDUNDANT INFORMATION, SINCE WE
R1	R		CONSTRAIN THE SUM OF ALL BRANCHING RATIOS TO BE 1.0
R1	FIT	.507 .047	VALUE FROM CONSTRAINED FIT

R2	* KN(1420) INTO (K*(890) P1) / TOTAL		
R2	R	.41 0.14	BADIER 65 HBC 3.0 K-P 6/66
R2	R	0.56 0.10	BISHOP 66 HBC 3.5 K+P 6/66
R2	R	0.47 0.10	BASSANO 67 HBC - 4.6; 5.0 K-P 0/67
R2	AVG	.4937 .0631	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)
R2	FIT	.330 .034	VALUE FROM CONSTRAINED FIT
R3	* KN(1420) INTO (K RHO)/TOTAL		
R3	R	0.14 0.05	BADIER 65 HBC 3.0 K-P 6/66
R3	R	0.10 0.05	BISHOP 66 HBC 3.5 K+P 6/66
R3	R	0.14 0.10	BASSANO 67 HBC 0.4,6; 5.0 K-P 0/67
R3	AVG	.1222 .0333	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)
R3	FIT	.109 .031	VALUE FROM CONSTRAINED FIT
R4	* KN(1420) INTO (K OMEGA)/TOTAL		
R4	R	0.07 0.04	BADIER 65 HBC 3.0 K-P 6/66
R4	FIT	.034 .012	VALUE FROM CONSTRAINED FIT
R5	* KN(1420) INTO (K ETA)/TOTAL		
R5	R	0.02 0.02	BADIER 65 HBC 3.0 K-P 6/66
R5	FIT	.020 .016	VALUE FROM CONSTRAINED FIT
R6	* KN(1420) INTO (K*(890) P1) / (K P1)		
R6	R	0.33 0.33	CHUNG 65 HBC + 0.3,9-4.2 PI- P 8/66
R6	R	0.65 0.20	SHEN 66 HBC 0.4,6 K+P 0/66
R6	R	0.63 0.20	SHEN 66 HBC + NO NR PRODUCED 0/66
R6	R	(1.1) (0.3)	BASSOMPIERRE 68 HBC - 5.0 K+P 9/68*
R6	R	(1.5) (0.3)	BASSOMPIERRE 68 HBC 0.5.0 K+P 9/68*
R6	R	0.52 0.12	SCHWEINGR 68 HBC 0.4,1,5,5 K-P 0/67
R6	AVG	.5531 .0882	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)
R6	FIT	.652 .115	VALUE FROM CONSTRAINED FIT
R7	* KN(1420) INTO (K OMEGA) / K PI		
R7	R	0.08 OR LESS	SHEN 66 HBC 4.6 K+P 8/66
R7	R	0.1 OR LESS	BASSOMPIERRE 68 HBC + 5.0 K+P 9/68*
R7	R	0.03 OR LESS	BASSOMPIERRE 68 HBC 0.5.0 K+P 9/68*
R7	FIT	.068 .026	VALUE FROM CONSTRAINED FIT
R8	* KN(1420) INTO (K RHO) / (K P1)		
R8	R	0.09 OR LESS	CHUNG 65 HBC + 0.3,9-4.2 PI- P 8/66
R8	R	0.2 OR LESS	BASSOMPIERRE 68 HBC 0.5.0 K+P 9/68*
R8	R	0.2 OR LESS	BASSOMPIERRE 68 HBC + 5.0 K+P 9/68*
R8	R	0.26 0.16	SCHWEINGR 68 HBC 0.4,1,5,5 K-P 0/67
R8	FIT	.215 .072	VALUE FROM CONSTRAINED FIT
R9	* KN(1420) INTO (K RHO) / (K*(890) P1)		
R9	R	0.39 OR LESS	BASSOMPIERRE 67 HBC + 5. K+P 9/67
R9	R	0.4C OR LESS (CL=.90)	FIELD 67 HBC - 3.8 K-P 6/67
R9	FIT	.325 .112	VALUE FROM CONSTRAINED FIT
R10	* KN(1420) INTO (K OMEGA) / (K*(890) P1)		
R10	R	0.10 0.04	FIELD 67 HBC - 3.8 K-P 6/67
R10	FIT	.104 .036	VALUE FROM CONSTRAINED FIT
R11	* KN(1420) INTO (K ETA) / (K*(890) P1)		
R11	R	0.07 0.04	FIELD 67 HBC - 3.8 K-P 6/67
R11	FIT	.061 .046	VALUE FROM CONSTRAINED FIT
R12	* KN(1420) INTO (K ETA) / (K P1)		
R12	R	0.025 OR LESS	BASSOMPIERRE 68 HBC 5.0 K+P 9/68*
R12	FIT	.040 .033	VALUE FROM CONSTRAINED FIT

THE FOLLOWING BRANCHING FRACTIONS HAVE CORRELATED ERRORS GREATER THAN .5
 P1 P2 -.584

REFERENCES FOR KN(1420)
 BADIER 65 PL 19 612 BADIER,DEMOULIN,GOLDBERG*(EP+SACLAY+ZEEMAN)
 CHUNG 65 PRL 15 325 *DAHL,HARDY,HESS,JACOBS,KIMZ,MILLER (LRL)
 FOCARDI 65 PL 16 351 FOCARDI,MINGUZZI,RANZI,SERRA*(BOLOGNA+CEN)
 BISHOP 66 PRL 16 1069 BISHOP,GOSHAWK,WIN,THOMPSON*(WISCONSIN)
 SHEN 66 PRL 17 726 *RUTTERNORTH,FU,GOLDHABERS,TRILLING (LRL)
 ALSO 66 (PRIVATE COMMUN)GERSON GOLDHABER
 BASSANO 67 PRL 19 968 *GOLDBERG,GOZ,BARNES,LEITNER*(BNL+SYRACUSE)
 BASSOMPIERRE 67 PRL 268 30 *BASSOMPIERRE,GOLDSCHMIDT*(CERN+BRUX+BIJRM)JP
 CRENNELL 67 PRL 19 44 *KALBFLEISCH,LAI,SCARR,SCHUMANN (BNL)
 DAHL 67 PR 163 1377 *HARDY+HESS+KIRZ+MILLER (LRL)
 SEE ALSO 65 PRL 14 401 HARDY,CHUNG,DAHL,HESS,KIRZ,MILLER (LRL)
 DE BAERE 67 NC 51 A 401 *GOLDSCHMIDT+CLERMONT+HENRI*(BRUX+CERN)
 FIELD 67 PL 248 638 *HENDRICKS+PICCIONI+VAGER (LAJOLLA)
 GEORGE 67 NC 49A 9 *GOLDSCHMIDT+CLERMONT+HENRI*(CERN+BRUX)
 GOLDHABER 67 PRL 19 972 G.GOLDHABER,FIRESTONE,SHEN (LRL)
 ADERHOLZ 68 NP 8 5 567 *DEUTSCHMANN*(AACH+BERL+CERN+L.G.+VIENNA)
 BASSOMPIERRE 68 VIENNA ABS. 446 *BASSOMPIERRE,GOLDSCHMIDT+CLERMONT*(CERN+BRUX)
 SEE ALSO 66 PL 22 357 BARTSCH,DEUTSCHMANN,MORRISCH*(AACH+L.G.)
 DUBAL 68 THESIS 1456 L.DUBAL (GENEVE)
 SCHWEINGRUBER 68 PR 166 1317 SCHWEINGRUBER,DERRICK,FIELDS,AMMAR*(ANL+BNL)
 ALSO 67 THESIS F.L.SCHWEINGRUBER (NORTHWESTERN,EVANSTON)

KN(1660) 27 KN (1660,JP=) I = 1/2
 EVIDENCE NOT COMPELLING, OMITTED FROM TABLE

27 KN (1660) MASS (MEV)

M	1660.0	10.0	CARMONY 67 HBC	- 3.8 K-P, OMEGA K	11/67
M	J	CLAIMED BY JOBS IN (K P1), (K*(890) P1), AND (K*(1420) P1) MODES.			11/67
M	J	JOBS 67 SEES THE K PI BUMP MUSTLY IN INTERFERENCE WITH N*(1236).			11/67

27 KN (1660) WIDTH (MEV)

M	60.0	20.0	JOBS 67 HBC	+ 5. K+P	11/67
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BARYON RESONANCES

Data in parentheses have not been included in our averages.

27 KN (1660) PARTIAL DECAY MODES

			DECAY PASSES	
P1	KN*(1660) INTO K PI		493+ 139	
P2	KN*(1660) INTO K PI PI		493+ 139+ 139	
P3	KN*(1660) INTO K*(890) PI		892+ 139	
P4	KN*(1660) INTO KN*(1430) PI		1420+ 139	

REFERENCES FOR KN(1660)

CARMONY 67 PRL 18 615 D.CARMONY,T.HENDRICKS,L.LANDER (LA JOLLA)
 JOBES 67 PL 268 49 +BASSOMPIERRE,DE BAERE + (BIRM+CERN+BRUX)

K_A (1780) 23 KA (1780, JP=) I = 1/2
 (ALSO CALLED L MESON)
 (JP = 1+, 2- SEEM MOST LIKELY)

23 KA (1780) MASS (MEV)

M	V	(1785.0)	(12.0)	ABCLV COL 67 HBC	- 10.0 K- PIK 2PI)	6/68*
M	V	20	178.0	ABCLV COL 68 IS UPDATING OF	BERLINGHI 67 HBC + 12.7 K+P	7/67
M	V	1760.0	15.0	JOBES 67 HBC +	5. K+ P	11/67
M	*	(1789.0)	(8.0)	ABCLV COL 68 HBC	- 10.0 K- PIK NPI)	9/68*

23 KA (1780) WIDTH (MEV)

M	V	(127.0)	(43.0)	ABCLV COL 67 HBC	- 10.0 K- PIK 2PI)	6/68*
M	V	20	80.0	ABCLV COL 68 IS UPDATING OF	BERLINGHI 67 HBC + 12.7 K+P	7/67
M	V	60.0	20.0	JOBES 67 HBC +	5. K+ P	11/67
M	*	(132.0)	(28.0)	ABCLV COL 68 HBC	- 10.0 K- PIK NPI)	9/68*

23 KA (1780) PARTIAL DECAY MODES

			DECAY MASSES
P1	KA INTO K PI		497+ 134
P2	KA INTO K RHO		497+ 770
P3	KA INTO K*(890) PI		134+ 892
P4	KA INTO K DMEGA		497+ 783
P5	KA INTO K PI PI		497+ 134+ 134
P6	KA INTO K*(1420) PI		134+1420
P7	KA INTO K ETA		497+ 546
P8	KA INTO K PHI		497+1019
P9	KA INTO K*(890) ETA		548+ 892

23 KA (1780) BRANCHING RATIOS

R1	*	KA INTO (K PI)/TOTAL	ABCLV COL 67 HBC	- 10.0 K- P	0/67
R1	V	0.023 OR LESS			
R1	V	ABCLV COL 68 IS UPDATING OF ABCLV COL 67			
R1	*	0.06 OR LESS, C.L.=.95	ABCLV COL 68 HBC	- 10.0 K- P	9/68*
R1	*	0.1 OR LESS	ANTICH 68 DBC	- 12.6 K- D	9/68*

R2 * KA INTO (K RHO)/TOTAL (0.059) (0.06) ABCLV COL 67 HBC - 10.0 K- P 0/67

R2 V ABCLV COL 68 IS UPDATING OF ABCLV COL 67 9/68*

R2 * 31 (0.11) (0.09) ABCLV COL 68 HBC - 10.0 K- P 9/68*

R2 * (0.2) (0.15) (0.2) ANTICH 68 DBC - 12.6 K- D 9/68*

R3	*	KA INTO (K*(890) PI)/TOTAL	ABCLV COL 67 HBC	- 10.0 K- P	0/67
R3	V	(0.244) (0.08)			
R3	V	ABCLV COL 68 IS UPDATING OF ABCLV COL 67			
R3	*	92 (0.36) (0.12)	ABCLV COL 68 HBC	- 10.0 K- P	9/68*
R3	*	(0.29) (0.09) (0.14)	ANTICH 68 DBC	- 12.6 K- D	9/68*

R4	*	KA INTO (K OMEGA)/TOTAL	ABCLV COL 67 HBC	- 10.0 K- P	0/67
R4	V	(0.048) (0.02)			
R4	V	ABCLV COL 68 IS UPDATING OF ABCLV COL 67			
R4	*	25 (0.08) (0.05)	ABCLV COL 68 HBC	- 10.0 K- P	9/68*

R5	*	KA INTO (K*(890) ETA)/TOTAL	ABCLV COL 68 HBC	- 10.0 K- P	9/68*
R5	V	0.05 OR LESS, C.L.=.95			

R6	*	KA INTO (K PI PI)/TOTAL	ABCLV COL 67 HBC	- 10.0 K- P	0/67
R6	V	(0.445) (0.15)			
R6	V	ABCLV COL 68 IS UPDATING OF ABCLV COL 67			
R6	R	77 (0.28) (0.13)	ABCLV COL 68 HBC	- 10.0 K- P	9/68*
R6	R	(0.31) (0.30) (0.15)	ANTICH 68 DBC	- 12.6 K- C	9/68*
R6	R	THIS BRANCHING RATIO CONTAINS REDUNDANT INFORMATION, SINCE WE CONstrain THE SUM OF ALL BRANCHING RATIOS TO BE 1.0			

R7	*	KA INTO (K*(1420) PI) / TOTAL	ABCLV COL 67 HBC	- 10.0 K- P	0/67
R7	V	(0.164) (0.08)			
R7	V	ABCLV COL 68 IS UPDATING OF ABCLV COL 67			
R7	*	51 (0.19) (0.05)	ABCLV COL 68 HBC	- 10.0 K- P	9/68*
R7	*	(0.20) (0.09) (0.15)	ANTICH 68 DBC	- 12.6 K- D	9/68*

R8	*	KA INTO (K ETA)/TOTAL	ABCLV COL 67 HBC	- 10.0 K- P	0/67
R8	V	0.01 OR LESS			

R9	*	KA INTO (K PHI)/TOTAL	ABCLV COL 68 HBC	- 10.0 K- P	9/68*
R9	*	0.05 OR LESS, C.L.=.95			

REFERENCES FOR KA(1780)

ABCLV CO 67 HEIDBG CONF P.43 AACHEN+BERLIN+CERN+LONDON (C+VIENNA COLLAB)
 SEE ALSO 66 PL 22 357 BARTSCH,DEUTSCHMANN,MORRISCHN+ (ABCLV COL)
 BERLINGHI 67 PRL 18 1087 BERLINGHI,FERI+BARBER+FEREL+FORMAN+ (ROCH) I
 JOBES 67 PL 268 49 +BASSOMPIERRE,DE BAERE + (BIRM+CERN+BRUX)
 ABCLV CO 68 VIENNA CONF. 466 COLLABORATION AACHEN-BERLIN+(CERN+LOIC+MIEN)
 ANTICH 68 VIENNA CONF. 493 +BOSCO,CALLAHAN,CDX,DENERGI+JOHNS HOPKINS I JP
 BGD COL. 68 VIENNA CONF. 500 COLLABORATION BIRMINGHAM +GL(SGDW + OXFORD)
 DENERGI 68 PRL 20 1194 +CALLAHAN+ETTLINGER+GILLESPIE+ (JOHNHOPK) 2-

K* (2240) 40 K* (2240, JP=) I=1/2
 ENHANCEMENT SEEN IN (ANTIHYPERON+NUCLEON) MASS.
 EVIDENCE NOT COMPELLING, OMITTED FROM TABLE.

40 K* (2240) MASS (MEV)

M	V	15 2240.	20.	ALEXANDER 68 HBC	+ 0 9 K+P,YBAR+N+..	6/68*
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40 K* (2240) WIDTH (MEV)

M	V	15 70.	20.	ALEXANDER 68 HBC	+ 0 9 K+P,YBAR+N+..	6/68*
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REFERENCES FOR K*(2240)

ALEXANDE 68 PRL 20 755 ALEXANDER,FIRESTONE,GOLDBABER,SHEN (LRL)

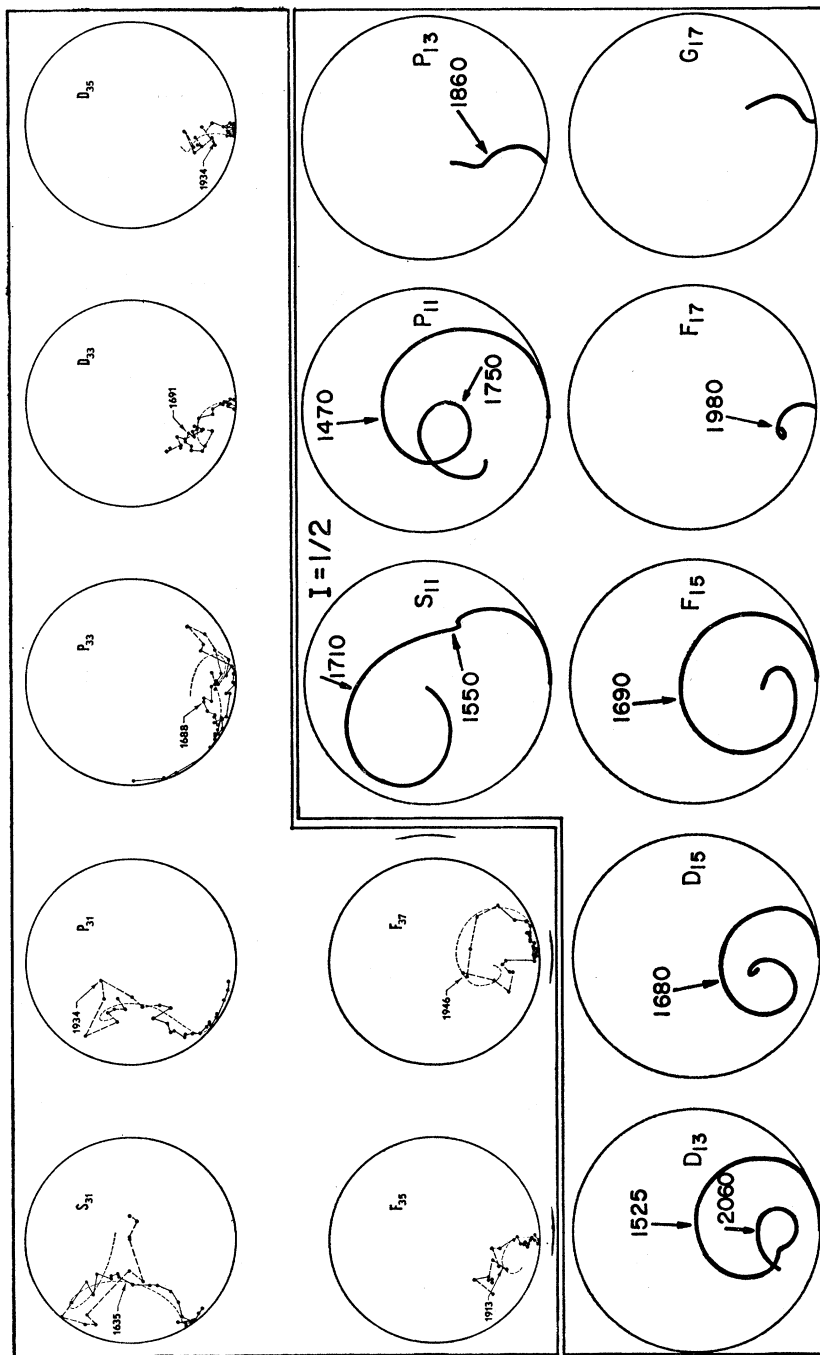
BARYON RESONANCES

Note on Nucleon Resonances

There are five "modern" phase-shift analyses of πN elastic scattering, made by groups at Saclay, ¹ CERN (Paper I), ² Berkeley, ³ Glasgow, ⁴ and CERN (Paper II) ⁵—the last a reanalysis of the isospin-3/2 phase shifts using different methods than CERN (I). Our only source for the Glasgow and CERN (II) results—and for much of the rest of the last year's work on nucleon resonances—is the 1968 Vienna Conference rapporteur talk by Donnachie, ⁶ which, together with a talk by Rushbrooke, ⁷ should be read by anyone inter-

ested in this field. Here we reproduce (slightly modified) some tables from Donnachie, and add the CERN (II) phase-shift solutions to our previous Argand diagrams. We have not seen the Glasgow or recent Berkeley diagrams. We have added a column to the first table giving our evaluation of the status of the resonances. Those listed "good" or "fair" are included in the Baryon Table. Those listed "poor" are not. In two or three cases, our evaluation is based in part on the results of a phase-shift analysis of the reaction $\pi^- p \rightarrow K^0 \Lambda$ made by Lovelace et al. ⁸ Their Argand diagrams may be found in Donnachie. ⁶

PARTIAL WAVE AMPLITUDES OBTAINED FROM THE DISPERSION RELATION RESULTS OF THE CERN GROUP
 (Arrows point to approximate resonance positions.)



Partial-wave amplitudes obtained by the CERN analyses.^{2, 5}

The CERN (I) results are the smooth curves (light lines in the isospin-3/2 diagrams). This analysis used dispersion relations to join and smooth the solutions found at different energies. The isospin-3/2 analysis was redone using a "shortest-path" method, devised by the Berkeley group,³ to join the solutions at different energies (jagged lines). Arrows point to approximate positions of resonances claimed by the CERN group.

BARYON RESONANCES

PARTIAL WAVE AMPLITUDES OBTAINED BY THE SACLAY PHASE SHIFT ANALYSIS (BAREYRE et al)

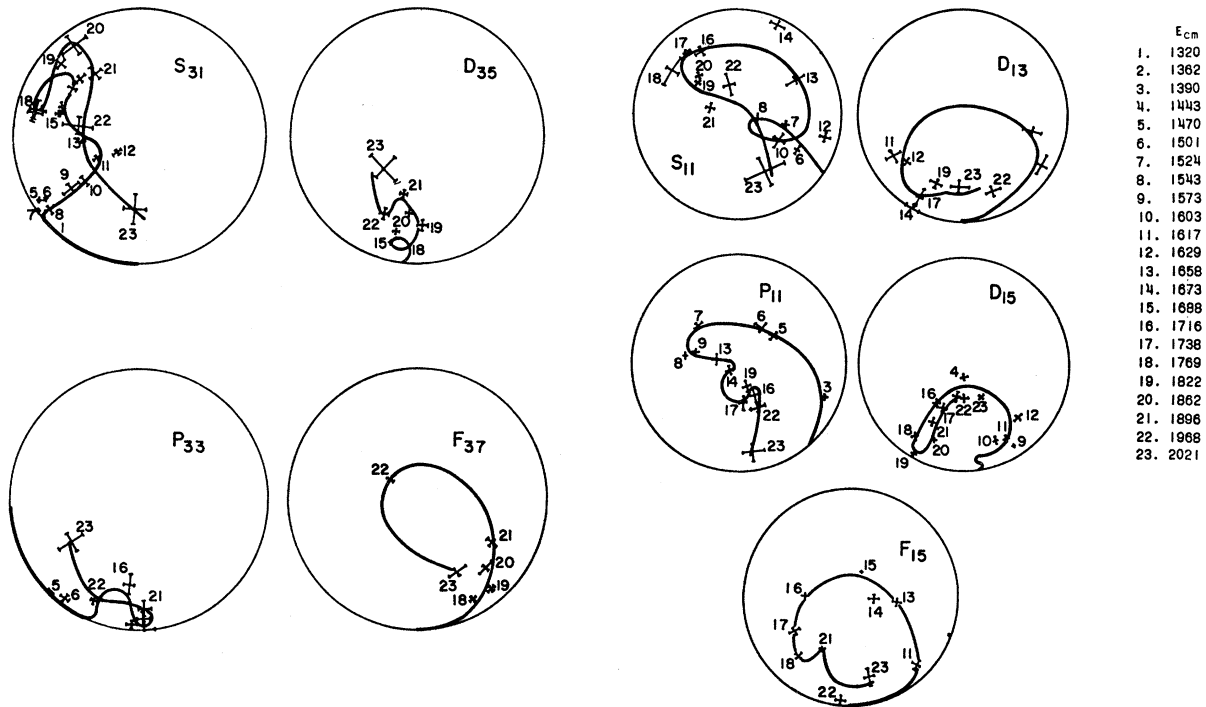


Table I. The status of nucleon resonances as seen in various phase-shift analyses and inelastic channels (there D means definite and P means probable or possible). The CERN I and II and Saclay phase-shift diagrams are shown in accompanying figures. See A. Donnachie, ⁶ from whom this table is adapted, for a discussion. We have added a column giving our evaluation of the status of the resonances.

Possible resonances	Berkeley	CERN I	Saclay	Glasgow	CERN II	Our evaluation	ηN	$K\Lambda$	$K\Sigma$	$\pi\Delta$	ρN	γN
$P_{33}(1236)$		We will not argue about this one					Good					D
$S_{31}(1640)$	Definite	Definite	Definite	Definite	Definite	Good				P		
$D_{33}(1690)$	Possible	Possible	Ambiguous	Definite	Definite	Fair				P		
$P_{33}(1690)$	Probable	Probable	Ambiguous	Possible	Definite	Poor				P		
$F_{35}(1910)$	Probable	Probable	Ambiguous	Definite	Definite	Fair						
$P_{31}(1930)$	Probable	Probable	Ambiguous	Definite	Definite	Good						
$F_{37}(1950)$	Definite	Definite	Definite	Definite	Definite	Good			P	D	D	D
$D_{35}(1950)$	Doubtful	Doubtful	Ambiguous	No	Possible	Poor						
$P_{11}(1470)$	Definite	Definite	Definite	Definite	--	Good				D		P
$D_{13}(1520)$	Definite	Definite	Definite	Definite	--	Good				D		D
$S_{11}(1550)$	Definite	Definite	Definite	Definite	--	Good	D					D
$D_{15}(1680)$	Definite	Definite	Definite	Definite	--	Good				P		
$F_{15}(1690)$	Definite	Definite	Definite	Definite	--	Good				P		D
$S_{11}(1710)$	Definite	Definite	Definite	Definite	--	Good (K Λ)	P	P				
$D_{13}(\sim 1730)$	No	Use imagination	No	No	--	Poor		P				
$P_{11}(1750)$	No	Possible	No	Definite	--	Fair (K Λ)	P	P		P		
$P_{13}(1860)$	No	Possible	No	Definite	--	Poor						
$F_{17}(1980)$	No	Doubtful	No	Transferred to G_{17}	--	Poor						
$D_{13}(\sim 2030)$	No	Probable	No	No	--	Poor						
$G_{17}(2190)$	Ambiguous	Definite	--	--	--	Good						P

BARYON RESONANCES

Table II. Resonances observed in pion-nucleon scattering with a mass of less than 2.2 GeV. The masses, widths, and elasticities conjectured in the CERN I² analysis and the two results of the Glasgow analysis⁴ are shown, together with the "average." In forming this "aver-

age," the two Glasgow results were first combined, and then taken with the CERN I analysis. The differences in the resonance parameters give some guide to the uncertainty in extracting these numbers from Argand diagrams.

Partial wave	CERN I			Glasgow (A)			Glasgow (B)			Composite		
	Mass	Γ_{tot}	$\Gamma_{\text{el}}/\Gamma_{\text{tot}}$	Mass	Γ_{tot}	$\Gamma_{\text{el}}/\Gamma_{\text{tot}}$	Mass	Γ_{tot}	$\Gamma_{\text{el}}/\Gamma_{\text{tot}}$	Mass	Γ_{tot}	$\Gamma_{\text{el}}/\Gamma_{\text{tot}}$
P ₃₃	1236	125	1.00	1238	120	1.00	1238	120	1.00	1237	122.5	1.00
S ₃₁	1640	177	0.28	1617	141	0.28	1623	140	0.25	1630	160	0.27
D ₃₃	1690	269	0.14	1649	188	0.12	1650	174	0.13	1670	225	0.13
P ₃₃	1690	281	0.10	-	-	-	-	-	-	1690	280	0.10
F ₃₅	1910	350	0.16	1841	136	0.20	1852	150	0.19	1880	250	0.18
P ₃₁	1930	339	0.30	1914	290	0.18	1843	231	0.24	1905	300	0.25
F ₃₇	1950	221	0.39	1935	196	0.51	1935	212	0.39	1940	210	0.42
P ₁₁	1470	211	0.66	1462	391	0.49	1436	224	0.46	1460	260	0.57
D ₁₃	1520	114	0.57	1512	106	0.45	1512	125	0.49	1515	115	0.52
S ₁₁	1550	116	0.33	1502	36	0.36	1499	53	0.35	1525	80	0.34
D ₁₅	1680	173	0.39	1669	115	0.50	1667	115	0.43	1675	145	0.43
F ₁₅	1690	132	0.68	1685	104	0.54	1684	123	0.54	1690	125	0.61
S ₁₁	1710	300	0.79	1766	404	0.56	1671	121	0.51	1715	280	0.66
D ₁₃	1730?	?	?	-	-	-	-	-	-	1730?	?	?
P ₁₁	1750	327	0.32	1770	445	0.43	1867	525	0.30	1785	405	0.34
P ₁₃	1860	296	0.21	1844	449	0.40	1854	307	0.26	1855	335	0.27
D ₁₃	2030?	290	0.26	-	-	-	-	-	-	2030?	290?	0.26?
G ₁₇	2190	300	0.35	-	-	-	-	-	-	2190	300	0.35

REFERENCES AND FOOTNOTES

1. P. Bareyre, C. Bricman, and G. Villet, *Phys. Rev.* **165**, 1730 (1968).
2. A. Donnachie, R. G. Kirsopp, and C. Lovelace, *Phys. Letters* **26 B**, 161 (1968).
3. C. H. Johnson, P. D. Grannis, M. J. Hansroul, O. Chamberlain, G. Shapiro, and H. M. Steiner, communication to Intern. Conf. on Elementary Particles, Heidelberg, 1967;
4. A. T. Davies and R. G. Moorhouse, communication to Intern. Conf. on High-Energy Physics, Vienna, 1968.
5. C. Lovelace and F. Wagner, communication to Intern. Conf. on High-Energy Physics, University of California, Irvine, 1967;
6. C. H. Johnson, UCRL-17683, 1967.

BARYON RESONANCES

Data in parentheses have not been included in our averages.

- tion to Intern. Conf. on High-Energy Physics, Vienna, 1968.
6. A. Donnachie, 14th Intern. Conf. on High-Energy Physics, Vienna, 1968 (CERN, Geneva, 1968), p. 139.
 7. J. G. Rushbrooke, 14th Intern. Conf. on High-Energy Physics, Vienna, 1968 (CERN, Geneva, 1968), p. 158.
 8. C. Lovelace, F. Wagner, and J. Iliopoulos, communication to Intern. Conf. on High-Energy Physics, Vienna, 1968.

CODE EVENTS QUANTITY ERROR+ ERROR- REFERENCE YR TECN SIGN COMMENTS DATE ABOVE BACKGROUND PUNCHED

P 16 PROTON (938, J=1/2) I=1/2
SEE LISTINGS OF STABLE PARTICLES

n 17 NEUTRON (939, J=1/2) I=1/2
SEE LISTINGS OF STABLE PARTICLES

Δ(1236) 81 N*3/2(1236, JP=3/2+) I=3/2 P₃₃
THE LATEST RESULTS ON NUCLEON RESONANCES, PRESENTED AT THE 1968 VIENNA CONFERENCE, ARE NOT INCLUDED IN THE CARD LISTINGS, BUT ARE DISCUSSED IN A NOTE PRECEDING THE N*3/2(1236).

M * (1236.0)	ROPER 65 RVUE	O*PHASE-SHIFT ANAL	6/68*
M * (1235.8)	DONNACHIE 68 RVUE	PHASE-SHIFT ANAL	
M++ (1236.0)	0.55	OLSSON 65 RVUE ++ TOTAL-SIGMA DATA	
M++ (1232.0)	(6.0)	FERRO-LUZ 65 HBC ++ K+P TO KO P P1+	
M++ (1233.4)	(4.4)	GIDAL 66 DBC ++ D D TO NN(INN) PI	7/66
M++ (1236.0)		DEANS 66 RVUE ++ P1+P TOTAL	7/66
MO 1236.45	0.65	OLSSON 65 RVUE 0	
M- (1241.3)	(5.1)	GIDAL 66 DBC -	7/66

81 N*(0) - N*(++) MASS DIFFERENCE (MEV) -----
D R (0.45) (0.85) OLSSON 65 RVUE
D R REDUNDANT WITH DATA IN MASS LISTING.

81 N*(-) - N*(++) MASS DIFFERENCE (MEV) -----
D 7.9 6.8 GIDAL 66 DBC

M * (125.1)	DONNACHIE 68 RVUE	6/68*
M++ (120.0)	2.0	OLSSON 65 RVUE ++
M++ (125.0)	(30.0)	FERRO-LUZ 65 HBC ++
M++ (124.0)	(14.0)	GIDAL 66 DBC ++
M++ (121.0)		DEANS 66 RVUE ++
MO 119.6	2.4	OLSSON 65 RVUE 0
M- (149.0)	(18.0)	GIDAL 66 DBC -

81 N*3/2(1236) PARTIAL DECAY MODES -----
P1 N*3/2(1236) INTO PI N DECAY PASSES 139+ 938
P2 N*3/2(1236) INTO N GAMMA 0+ 938

81 N*3/2(1236) BRANCHING RATIOS -----
R1 N*3/2(1236) INTO (N GAMMA)/TOTAL (PERCENT) (P2)/(P1)
R1 0.55 0.02 DALITZ 66 RVUE 7/66*

REFERENCES -- N*3/2(1236)
OLSSON 65 PRL 14 118 M G OLSSON (WISC)
FERRO-LU 65 NC 36 1101 FERRO-LUZZI, GEORGE, + (CERN)
ROPER 65 PR 138 B190 L D ROPE, R M WRIGHT, B T FELD (LRL, MIT) JP
DALITZ 66 PR 146 1180 DALITZ, SUTHERLAND (OXFORD)
DEANS 66 PREPRINT S R DEANS, W G HOLLADAY (VANDERBILT)
GIDAL 66 PR 141 1261 G GIDAL, A KERNAN, S KIM (LRL)
DONNACHIE 68 PL 268 161 A DONNACHIE, R G KIRSOPP, C LOVELACE (CERN) IJP

FOR EXTENSIVE REFERENCES TO DATA AND PHASE-SHIFT ANALYSES TILL 1965, SEE ROPE 65, ESPECIALLY APPENDIX II.

N(1470) 61 N*1/2(1470, JP=1/2+) I=1/2 P₁₁
THE LATEST RESULTS ON NUCLEON RESONANCES, PRESENTED AT THE 1968 VIENNA CONFERENCE, ARE NOT INCLUDED IN THE CARD LISTINGS, BUT ARE DISCUSSED IN A NOTE PRECEDING THE N*3/2(1236).

THE MASS AND WIDTH ARE BEST DETERMINED FROM PHASE-SHIFT ANALYSES. WE NO LONGER LIST THEM AS DETERMINED FROM PRODUCTION EXPERIMENTS. SEE THE PREVIOUS EDITION (RMP 40, 77, 1968) FOR SUCH A LIST.

M * (1380.0)	ROPER 65 RVUE	PHASE-SHIFT ANAL	9/66
M * (1370.0) <td>BRANDSEN 65 RVUE</td> <td>PHASE-SHIFT ANAL</td> <td>9/66</td>	BRANDSEN 65 RVUE	PHASE-SHIFT ANAL	9/66
M 1 (1470.0)	BAREYRE 68 RVUE	PHASE-SHIFT ANAL	11/67
M 1	WHERE THE PARTIAL-WAVE TOTAL CROSS SECTION IS GREATEST.		
M 2 (1505.0)	BAREYRE 68 RVUE	PHASE-SHIFT ANAL	11/67
M 2	WHERE THE VELOCITY OF THE AMPLITUDE ACROSS THE ARGAND DIAGRAM IS GREATEST.		
M 3 (1466.0)	DONNACHIE 68 RVUE	PHASE-SHIFT ANAL	6/68*
M 3	WHERE THE ABSORPTION IS GREATEST.		

W 1 (255.0)	BAREYRE 68 RVUE	11/67
W 2 (205.0) <td>BAREYRE 68 RVUE</td> <td>11/67</td>	BAREYRE 68 RVUE	11/67
W 3 (211.0) <td>DONNACHIE 68 RVUE</td> <td>6/68*</td>	DONNACHIE 68 RVUE	6/68*

SEE THE NOTES ACCOMPANYING THE MASSES QUOTED.

61 N*1/2(1470) PARTIAL DECAY MODES -----
P1 N*1/2(1470) INTO PI N DECAY PASSES 139+ 938
P2 N*1/2(1470) INTO N SIGMA (SIGMA MESON) 938+ 400
P3 N*1/2(1470) INTO N*3/2(1236) PI 1236+ 139
P4 N*1/2(1470) INTO N PI P1 938+ 139+ 139

61 N*1/2(1470) BRANCHING RATIOS -----
R1 N*1/2(1470) INTO (PI N)/TOTAL (P1)/TOTAL 11/67
R1 1 (0.68) BAREYRE 68 RVUE 6/68*
R1 3 (0.658) DONNACHIE 68 RVUE
SEE THE NOTES ACCOMPANYING THE MASSES QUOTED.

R2 N*1/2(1470) INTO (N SIGMA)/TOTAL (P2)/TOTAL 11/67
R2 DOMINANT INELASTIC DECAY THURNAUER 65 RVUE - 11/67
R2 DOMINANT INELASTIC DECAY NARYSLOWS 66 RVUE - 11/67
R2 DOMINANT INELASTIC DECAY ROSENFELD 67 RVUE - 11/67
R2 DOMINANT INELASTIC DECAY MORGAN 68 RVUE ISOBAR MODEL 6/68*

R3 N*1/2(1470) INTO (N*3/2(1236) PI)/TOTAL (P3)/TOTAL 11/68*
R3 PROBABLY SEEN LAMSA 68 HBC PI-P 8 BEV/C 11/68*
R3 PROBABLY SEEN JESPERSEN 68 HBC PP 22 BEV/C 11/68*

REFERENCES -- N*1/2(1470)
ROPER 65 PR 138 B190 LD ROPE, RM WRIGHT, BT FELD (LRL-LVPR, MIT) IJP
BRANDSEN 65 PR 139 B1566 +ODONNELL, MOORHOUSE (DURHAM, RTIFD) IJP
THURNAUER 65 PRL 14 908 P G THURNAUER (ROCH)
NARYSLOW 66 PR 157 1328 NARYSLOWSKI, RAZMI, ROBERTS (STAN, EDINB, IJC)
ROSENFELD 67 IRVINE CONF A H ROSENFELD, P SODING (LRL)
BAREYRE 68 PR 165 1731 P BAREYRE, C BRICMAN, G VILLET (SACLAY) IJP
DONNACHIE 68 PL 268 161 A DONNACHIE, R G KIRSOPP, C LOVELACE (CERN) IJP
LAMSA 68 PR 166 1395 +CASON, BISWAS, DERADDO, GROVES, + (NOTRE DAME)
MORGAN 68 PR 166 1731 D MORGAN (RTIFD)
JESPERSE 68 PRL 21 1368 JESPERSEN, KANG, KERNAN, + (IOWA STATE)

PAPERS NOT REFERRED TO IN DATA CARDS.
BAREYRE 64 PL 8 137 +BRICMAN, VALLADAS, VILLET, + (SACLAY, CERN) IJ
ADELMAA 65 PRL 14 1043 S L ADELMAN (CAMBRIDGE, CERN)
DALITZ 65 PL 14 159 R H DALITZ, R G MOORHOUSE (OXF, RTIFD)
BAREYRE 65 PL 18 342 +BRICMAN, STIRLING, VILLET (SACLAY) IJP
JOHNSON 67 UCRL-17683 THESIS C H JOHNSON (LRL)
THE FOLLOWING ARE THEORETICAL PAPERS CONCERNING THE N*1/2(1470) --
RESNICK 66 PR 150 1292 L RESNICK (NIELS BOHR)
SCHWARZ 66 PR 152 1325 J H SCHWARZ (LRL)
GOLDBERG 67 PR 154 1558 H GOLDBERG (CORNELL)
BALL 67 PR 155 1725 JS RALL, GL SHAN, DY WONG (UCLA, UCI, UCSD)

N(1518) 62 N*1/2(1518, JP=3/2-) I=1/2 D₁₃
THE LATEST RESULTS ON NUCLEON RESONANCES, PRESENTED AT THE 1968 VIENNA CONFERENCE, ARE NOT INCLUDED IN THE CARD LISTINGS, BUT ARE DISCUSSED IN A NOTE PRECEDING THE N*3/2(1236).

M * (1536.0)	ROPER 65 RVUE	PHASE-SHIFT ANAL	9/66
M * (1530.0) <td>BRANDSEN 65 RVUE</td> <td>PHASE-SHIFT ANAL</td> <td>9/66</td>	BRANDSEN 65 RVUE	PHASE-SHIFT ANAL	9/66
M 1 (1510.0) <td>BAREYRE 68 RVUE</td> <td>PHASE-SHIFT ANAL</td> <td>11/67</td>	BAREYRE 68 RVUE	PHASE-SHIFT ANAL	11/67
M 1	WHERE THE PARTIAL-WAVE TOTAL CROSS SECTION IS GREATEST.		
M 2 (1515.0) <td>BAREYRE 68 RVUE</td> <td>PHASE-SHIFT ANAL</td> <td>11/67</td>	BAREYRE 68 RVUE	PHASE-SHIFT ANAL	11/67
M 2	WHERE THE VELOCITY OF THE AMPLITUDE ACROSS THE ARGAND DIAGRAM IS GREATEST.		
M 3 (1541.0) <td>DONNACHIE 68 RVUE</td> <td>PHASE-SHIFT ANAL</td> <td>6/68*</td>	DONNACHIE 68 RVUE	PHASE-SHIFT ANAL	6/68*
M 3	WHERE THE ABSORPTION IS GREATEST.		

W 1 (125.0)	BAREYRE 68 RVUE	11/67
W 2 (110.0) <td>BAREYRE 68 RVUE</td> <td>11/67</td>	BAREYRE 68 RVUE	11/67
W 3 (149.0) <td>DONNACHIE 68 RVUE</td> <td>6/68*</td>	DONNACHIE 68 RVUE	6/68*

SEE THE NOTES ACCOMPANYING THE MASSES QUOTED.

62 N*1/2(1518) PARTIAL DECAY MODES -----
P1 N*1/2(1518) INTO PI N DECAY PASSES 139+ 938
P2 N*1/2(1518) INTO N*3/2(1236) PI 1236+ 139
P3 N*1/2(1518) INTO N PI P1 938+ 139+ 139
P4 N*1/2(1518)+ INTO NEUTRON P1+ 938+ 139
P5 N*1/2(1518)+ INTO PROTON P1+ PI- 938+ 139+ 139
P6 N*1/2(1518) INTO N ETA 938+ 548
P7 N*1/2(1518) INTO N SIGMA (SIGMA MESON) 938+ 400

BARYON RESONANCES

Data in parentheses have not been included in our averages.

62 N ^{1/2} (1518) BRANCHING RATIOS			
R1	N ^{1/2} (1518) INTO (PI N)/TOTAL	(PI1)/TOTAL	
R1 1	(0.54) BAREYRE 68 RVUE		11/67
R1 3	(0.509) DONNACHIE 68 RVUE		6/68*
SEE THE NOTES ACCOMPANYING THE MASSES QUOTED.			
ALMOST THE ENTIRE INELASTICITY IS IN N PI PI (ONLY N ETA COULD COMPETE, AND IT DOESN'T). THE N PI PI SEEMS TO BE MAINLY N ^{3/2} (1236) PI, IN BOTH S AND D WAVES.			
R2	N ^{1/2} (1518) INTO (N ^{3/2} (1236) PI)/TOTAL	(P4)/TOTAL	
R2	DOMINANT INEL DECAY OLSSON 66 RVUE	PI P TO PI PI N	9/66
R2	0.20 0.05 KIRZ 66 HBC 0	ASSUMING R1=0.72	9/66
R3	N ^{1/2} (1518) INTO (N PI)/TOTAL	(PI1)/(PI3)	
R3	1.25 0.44 0.71 A-BORELLI 67 HBC 0	PBAR P 5.7 BEV/C	9/66
R4	N ^{1/2} (1518) INTO (N ^{3/2} (1236) PI)/(N PI PI)	(PI1)/(PI2)	
R4	0.00 0.09 A-BORELLI 67 HBC		9/66
R4	LARGE THURNAUER 65 RVUE		11/67
R4	LARGE NAMYSLAWSKI 66 RVUE		11/67
R4	LARGE ROBERTS 67 RVUE		11/67
R4	LARGE ROSENFELD 67 RVUE		11/67
R4	LARGE MORGAN 68 RVUE	ISOBAR MODEL	6/68*
R5	N ^{1/2} (1518) INTO (NEUTRON PI+)/(PI P1-)	(P41)/(P5)	
R5	0.77 0.45 ALEXANDER 67 HBC	PP 5.5 BEV/C	9/66
R6	N ^{1/2} (1518) INTO (N PI)/(PI N ^{3/2} (1236))	(PI1)/(PI2)	
R6	0.42 OR LESS LEE 67 HBC		11/67
R7	N ^{1/2} (1518) INTO (N ETA)/TOTAL	(P6)/TOTAL	
R7	0.006 APPROX DAVIES 67 RVUE		11/67
DAVIES 67 GIVES SEVERAL VALUES DEPENDING ON INPUT DATA. ALL ARE SMALL			
R8	N ^{1/2} (1518) INTO (N SIGMA)/TOTAL	(P7)/TOTAL	
R8	PROBABLY PRESENT MORGAN 68 RVUE	ISOBAR MODEL	6/68*

REFERENCES -- N ^{1/2} (1518)			
SEE A PREVIOUS EDITION (RMP 37, 633, 1965) FOR EARLIER REFERENCES.			
RUPER	65 PR 138 B190	LD RUPER, RM WRIGHT, BT FELD	(LRL-LVPR, MIT) IJP
BRANDSEN	65 PR 139 B166	+ODONNELL, MOORHOUSE	(DURHAM, RTHFD) IJP
THURNAUER	65 PR 141 985	P G THURNAUER	(ROCH)
NAMYSLAWSKI	66 PR 157 1328	NAMYSLAWSKI, RAZMI, ROBERTS	(STAN, EDIN, IC)
KIRZ	66 PRIVATE COMM	J KIRZ	(LRL)
-- NUMBER EXTRACTED FROM DATA DISCUSSED IN KIRZ 63.			
OLSSON	66 PR 145 1309	M G OLSSON, G B YODH	(WISC, MD)
A-BORRELLI	67 NC 47 232	ALLES-BORRELLI, FRENCH, FRISK, MICHEJDA	(CERN)
ALEXANDER	67 PR 154 1284	ALEXANDER, BERNARD, CAPEK, WEIZMANN	(CERN)
LEE	67 PR 159 1156	+MOEBS, ROE, SINGLAI, VANDER VELDE	(MICH)
ROBERTS	67 PREPRINT	M G ROBERTS	(DURHAM)
ROSENFELD	67 IRVINE CONF	A H ROSENFELD, P SODING	(LRL)
DAVIES	67 NC 52A 1112	A T DAVIES, R G MOORHOUSE	(GLASGOW, RTHFD)
MORGAN	68 PR 166 1731	D MORGAN	(RTHFD)
BAREYRE	68 PR 165 1731	P BAREYRE, C BRICHMAN, G VILLET	(SACLAY) IJP
DONNACHIE	68 PL 268 161	A DONNACHIE, R G KIRSOPP, C LOVELACE	(CERN) IJP
PAPERS NOT REFERRED TO IN DATA CARDS.			
KIRZ	63 PR 130 2401	J KIRZ, J SCHWARTZ, R D TRIPP	(LRL)
CROUCH	65 DESY CONF 11 21	+ (BROWN, CEA, HARVARD, MIT, PADOVA, WEIZMANN)	
DERADD	65 ATHENS CONF 244	+KENNEY, LAMSA, + (NOTRE DAME, KENTUCKY)	
BAREYRE	65 PL 18 342	+ BRICHMAN, STIRLING, VILLET	(SACLAY) IJP
MERLO	66 P ROY SOC 289 489 J P MERLO, G VALLADAS		(SACLAY)
-- THE ABOVE PAPERS DISCUSS INELASTIC CHANNELS NEAR THE RESONANCE.			
JOHNSON	67 UCRL-17683 THESIS	C H JOHNSON	(LRL)

N (1550) 63 N ^{1/2} (1550, JP=1/2-) I=1/2 S ₁₁			
THE LATEST RESULTS ON NUCLEON RESONANCES, PRESENTED AT THE 1968 VIENNA CONFERENCE, ARE NOT INCLUDED IN THE CARD LISTINGS, BUT ARE DISCUSSED IN A NOTE PRECEDING THE N ^{3/2} (1236).			
63 N ^{1/2} (1550) MASS (MEV)			
M *	(1519.0)	HENDRY 65 RVUE	ETA N + S11 PI N 9/66
M	1570.0	MICHAEL 66 RVUE	FITS BAREYRE S11 7/66
M N	1557.0 OR 1565.0	UCHIYAMA 66 RVUE	FITS N ETA DATA 9/66
M N	FITTING GIVES TWO SOLUTIONS. PROBLEMS MATCHING PI P PHASE SHIFT		
M 1	(1535.0)	BAREYRE 68 RVUE	PHASE-SHIFT ANAL 11/67
M 1	WHERE THE PARTIAL-WAVE TOTAL CROSS SECTION IS GREATEST.		
M 2	(1515.0)	BAREYRE 68 RVUE	PHASE-SHIFT ANAL 11/67
M 2	WHERE THE VELOCITY OF THE AMPLITUDE ACROSS THE ARGAND DIAGRAM		
M 2	IS GREATEST.		
M 3	(1591.0)	DONNACHIE 68 RVUE	PHASE-SHIFT ANAL 6/68*
M 3	WHERE THE ABSORPTION IS GREATEST.		
63 N ^{1/2} (1550) WIDTH (MEV)			
M *	(130.0)	HENDRY 65 RVUE	9/66
M	130.0	MICHAEL 66 RVUE	7/66
M N	156.0 OR 144.0	UCHIYAMA 66 RVUE	SEE NOTE ON MASS 9/66
M 1	(155.0)	BAREYRE 68 RVUE	11/67
M 2	(105.0)	BAREYRE 68 RVUE	11/67
M 3	268.0 APPROX	DONNACHIE 68 RVUE	6/68*
SEE THE NOTES ACCOMPANYING THE MASSES QUOTED.			
63 N ^{1/2} (1550) PARTIAL DECAY MODES			
P1	N ^{1/2} (1550) INTO PI N	139+ 938	DECAY PASSES
P2	N ^{1/2} (1550) INTO N ETA	939+ 548	
P3	N ^{1/2} (1550) INTO N PI PI	938+ 139+ 139	
63 N ^{1/2} (1550) BRANCHING RATIOS			
R1	N ^{1/2} (1550) INTO (PI N)/TOTAL	(PI1)/TOTAL	
R1 *	(0.41)	HENDRY 65 RVUE	9/66
R1 *	(0.32)	MICHAEL 66 RVUE	9/66
R1 N	0.71 OR 0.28	UCHIYAMA 66 RVUE	SEE NOTE ON MASS 9/66
R1	0.31 OR 0.43	DAVIES 67 RVUE	SOLUT. B OR C 11/67
R1 3	(0.696)	DONNACHIE 68 RVUE	6/68*
R2	N ^{1/2} (1550) INTO (N ETA)/TOTAL	(P2)/TOTAL	
R2	0.68	HENDRY 65 RVUE	9/66
R2 N	0.71	UCHIYAMA 66 RVUE	SEE NOTE ON MASS 9/66
R2	0.22 OR 0.14	BASSOMPIERE 67 HBC	+ K+P TO K* N* 11/68*
R2	0.69 OR 0.45	DAVIES 67 RVUE	SOLUT. B OR C 11/67
R3	N ^{1/2} (1550) INTO (N PI PI)/TOTAL	(P3)/TOTAL	
R3	0.08 OR LESS	BASSOMPIERE 67 HBC	+ K+P TO K* N* 11/68*

REFERENCES -- N ^{1/2} (1550)			
HENDRY	65 PL 18 171	A W HENDRY, R G MOORHOUSE	(RTHFD)
-- REVIEWS EARLY PHASE-SHIFT ANALYSIS RESULTS AND PI- P TO ETA N EXPERIMENTS. WE TAKE NUMBERS FROM THE SOLUTION USING BRANSEN 65.			
BAREYRE	65 PL 18 342	+ BRICHMAN, STIRLING, VILLET	(SACLAY) IJP
MICHAEL	66 PL 21 93	C MICHAEL	(OXF)
UCHIYAMA	66 PR 149 1220	F UCHIYAMA-CAMPBELL, R K LOGAN	(ILL) IJP
BASSOMPIERE	67 PL 258 440	BASSOMPIERE, +	(CERN, BRUXELLES)
DAVIES	67 NC 52A 1112	A T DAVIES, R G MOORHOUSE	(GLASGOW, RTHFD)
BAREYRE	68 PR 165 1731	P BAREYRE, C BRICHMAN, G VILLET	(SACLAY) IJP
DONNACHIE	68 PL 268 161	A DONNACHIE, R G KIRSOPP, C LOVELACE	(CERN) IJP
PAPERS NOT REFERRED TO IN DATA CARDS.			
BRANSEN	65 PR 139 B1566	+ODONNELL, MOORHOUSE	(DURHAM, RTHFD) IJP
BASIS OF NUMBERS WE QUOTE FROM HENDRY 65.			
LOVELACE	67 HEIDELBERG C. 79	C LOVELACE	(CERN) IJP
JOHNSON	67 UCRL-17683 THESIS	C H JOHNSON	(LRL)
THERE IS GETTING TO BE A WHOLE LITERATURE ON THE REACTIONS PI- P TO ETA N AND GAMMA P TO ETA P NEAR THRESHOLD AND THEIR CONNECTION WITH THE BEHAVIOR OF THE S11 AMPLITUDE AS DETERMINED IN PI P PHASE-SHIFT ANALYSIS. THE READER IS INVITED TO PERUSE THE FOLLOWING RATHER INDIGESTIBLE COLLECTION. FURTHER REFERENCES MAY BE FOUND IN THESE.			
MAINLY EXPERIMENTAL --			
BULOS	64 PRL 13 484	+ (BROWN, BRANDEIS, HARVARD, MIT, PADOVA)	I
RICHARDS	66 PRL 16 1221	+ CHIU, EANDI, HELMHOLTZ, KENNEY, +	(LRL, HAWAII) IJ
JONES	66 PL 23 597	+ BINNIE, DUANE, HCRSEY, PASON, +	(IMPOL, RTHFD)
BACCI	66 NC 45A 983	+ PENSO, SALVINI, MENCUCINI, +	(ROME, FRASCATI) IJP
PREPOST	67 PRL 18 82	R PREPOST, D LUNDQUIST, D QUINN	(STANFORD)
BLOOM	68 PRL 21 1100	+ HEUSCH, PRESCOTT, ROCHESTER	(CALTECH)
-- MAINLY THEORETICAL --			
DOBSON	66 PR 145 1022	P N DOBSON	(HAWAII)
MINAMI	66 PR 147 1123	S MINAMI	(OSAKA)
BALL	66 PR 149 1191	J S BALL	(UCLA)
LOGAN	67 PR 153 1634	R K LOGAN, F UCHIYAMA-CAMPBELL	(ILL)
MENCUCINI	67 NC 48A 579	C MENCUCINI, A REALE	(FRASCATI)
DEANS	67 PR 161 1466	S R DEANS, W G HOLLADAY	(VANDEBILT)
MINAMI	67 PR 162 1619	S MINAMI	(OSAKA)
MOSS	67 PR 163 1705	T A MOSS	(LSU)
DEANS	68 PR 165 1886	S R DEANS, W G HOLLADAY	(VANDERBILT)
PAL	68 PR 167 1350	B K PAL	(NPL NEW DELHI)

Δ(1640) 62 N ^{3/2} (1640, JP=1/2-) I=3/2 S ₃₁			
THE LATEST RESULTS ON NUCLEON RESONANCES, PRESENTED AT THE 1968 VIENNA CONFERENCE, ARE NOT INCLUDED IN THE CARD LISTINGS, BUT ARE DISCUSSED IN A NOTE PRECEDING THE N ^{3/2} (1236).			
62 N ^{3/2} (1640) MASS (MEV)			
M *	(1648.0)	(12.0)	DEVLIN 65 CNTR
M 1	(1695.0)	BAREYRE 68 RVUE	PHASE-SHIFT ANAL 11/67
M 1	WHERE THE PARTIAL-WAVE TOTAL CROSS SECTION IS GREATEST.		
M 2	(1650.0)	BAREYRE 68 RVUE	PHASE-SHIFT ANAL 11/67
M 2	WHERE THE VELOCITY OF THE AMPLITUDE ACROSS THE ARGAND DIAGRAM		
M 2	IS GREATEST.		
M 3	(1635.0)	DONNACHIE 68 RVUE	PHASE-SHIFT ANAL 6/68*
M 3	WHERE THE ABSORPTION IS GREATEST.		
62 N ^{3/2} (1640) WIDTH (MEV)			
M 1	(250.0)	BAREYRE 68 RVUE	11/67
M 2	(130.0)	BAREYRE 68 RVUE	11/67
M 3	(177.0)	DONNACHIE 68 RVUE	6/68*
SEE THE NOTES ACCOMPANYING THE MASSES QUOTED.			
62 N ^{3/2} (1640) PARTIAL DECAY MODES			
PI	N ^{3/2} (1640) INTO PI N	139+ 938	DECAY PASSES
62 N ^{3/2} (1640) BRANCHING RATIOS			
R1	N ^{3/2} (1640) INTO (PI N)/TOTAL	(PI1)/TOTAL	
R1 3	(0.284)	DONNACHIE 68 RVUE	6/68*

REFERENCES -- N ^{3/2} (1640)			
DEVLIN	65 PRL 14 1031	T J DEVLIN, J SOLOMON, G BERTSCH	(PRINCETON) I
BAREYRE	68 PR 165 1731	P BAREYRE, C BRICHMAN, G VILLET	(SACLAY) IJP
DONNACHIE	68 PL 268 161	A DONNACHIE, R G KIRSOPP, C LOVELACE	(CERN) IJP
PAPERS NOT REFERRED TO IN DATA CARDS.			
CARRUTHERS	60 PRL 4 303	P CARRUTHERS	(CORNELL) I
DEVLIN	62 PR 125 690	T J DEVLIN, B J MOYER, V PEREZ-MENDEZ	(LRL) I
HELLAND	64 PR 134 B1062	+DEVLIN, HAGGE, LONGO, MOYER, WOOD	(LRL) I
BAREYRE	65 PL 18 342	+ BRICHMAN, STIRLING, VILLET	(SACLAY) IJP
JOHNSON	67 UCRL-17683 THESIS	C H JOHNSON	(LRL)

N(1680) 64 N ^{1/2} (1680, JP=5/2-) I=1/2 D ₁₅			
THE LATEST RESULTS ON NUCLEON RESONANCES, PRESENTED AT THE 1968 VIENNA CONFERENCE, ARE NOT INCLUDED IN THE CARD LISTINGS, BUT ARE DISCUSSED IN A NOTE PRECEDING THE N ^{3/2} (1236).			
64 N ^{1/2} (1680) MASS (MEV)			
M *	1650.0	APPROX	BRANSEN 65 RVUE
M *	(1674.0)	DUKE 68 CNTR	PI-P EL + POL 7/66
M 1	(1680.0)	BAREYRE 68 RVUE	PHASE-SHIFT ANAL 11/67
M 1	WHERE THE PARTIAL-WAVE TOTAL CROSS SECTION IS GREATEST.		
M 2	(1655.0)	BAREYRE 68 RVUE	PHASE-SHIFT ANAL 11/67
M 2	WHERE THE VELOCITY OF THE AMPLITUDE ACROSS THE ARGAND DIAGRAM		
M 2	IS GREATEST.		
M 3	(1678.0)	DONNACHIE 68 RVUE	PHASE-SHIFT ANAL 6/68*
M 3	WHERE THE ABSORPTION IS GREATEST.		
64 N ^{1/2} (1680) WIDTH (MEV)			
M 1	(135.0)	BAREYRE 68 RVUE	11/67
M 2	(105.0)	BAREYRE 68 RVUE	11/67
M 3	(173.0)	DONNACHIE 68 RVUE	6/68*
SEE THE NOTES ACCOMPANYING THE MASSES QUOTED.			

BARYON RESONANCES

Data in parentheses have not been included in our averages.

64 N*1/2(1680) PARTIAL DECAY MODES

	INTO	PI N	DECAY MASSES
P1	N*1/2(1680)	INTO PI N	139+ 938
P2	N*1/2(1680)	INTO N ETA	939+ 548
P3	N*1/2(1680)	INTO LAMBDA K	1115+ 497
P4	N*1/2(1680)	INTO N*3/2(1236) PI	1236+ 139

64 N*1/2(1680) BRANCHING RATIOS

	INTO (PI N)/TOTAL	(P1)/TOTAL	
R1	N*1/2(1680)	INTO (PI N)/TOTAL	(P1)/TOTAL
R1	1	(0.41)	DUKE 68 CNTR PI-P EL POL 6/68
R1	3	(0.391)	DONNACHIE 68 RVUE 11/67
SEE THE NOTES ACCOMPANYING THE MASSES QUOTED.			
R2	N*1/2(1680)	INTO (ETA)/TOTAL	(P2)/TOTAL
R2	2	(0.025)	OR LESS TRIPP 67 RVUE 8/67
R3	N*1/2(1680)	INTO (LAMBDA K)/TOTAL	(P3)/TOTAL
R3	3	(0.016)	OR LESS TRIPP 67 RVUE 8/67

SEE NOTE PRECEDING THE N*1/2(1680) INELASTIC DECAY MODE MEASUREMENTS.

REFERENCES -- N*1/2(1680)

DUKE	65 PRL 15 468	+ JONES, KEMP, MURPHY, PRENTICE, + (RTHFD, OXF) IJP
BRANDSEN	65 PL 19 420	+ O'DONNELL, MOORHOUSE (DURHAM, RTHFD) IJP
TRIPP	67 NP 83 10	+ LEITH, + (LRL, SLAC, CERN, HEIDEL, SACLAY)
DUKE	68 PR 166 1448	+ JONES, KEMP, MURPHY, THRESHER, + (RTHFD, OXF) IJP
-- INSIGHTFUL QUALITATIVE ARGUMENTS CONCERNING EXISTENCE AND IJP.		
BAREYRE	68 PR 165 1731	P BAREYRE, C BRICMAN, G VILLET (SACLAY) IJP
DONNACHI	68 PL 268 161	A DONNACHIE, R G KIRSOPP, C LOVELACE (CERN) IJP

PAPER NOT REFERRED TO IN DATA CARDS.

BAREYRE	65 PL 18 342	+ BRICMAN, STIRLING, VILLET (SACLAY) IJP
JOHNSON	67 UCRL-17683	THESIS C H JOHNSON (LRL)

N(1688) 65 N*1/2(1688), JP=5/2+ I=1/2 F₁₅

THE LATEST RESULTS ON NUCLEON RESONANCES, PRESENTED AT THE 1968 VIENNA CONFERENCE, ARE NOT INCLUDED IN THE CARD LISTINGS, BUT ARE DISCUSSED IN A NOTE PRECEDING THE N*3/2(1236).

65 N*1/2(1688) MASS (MEV)

M					
M	*	(1680.0)	BRANDSEN	65 RVUE	PHASE-SHIFT ANAL 7/66
M	*	(1682.0)	DUKE	68 CNTR	PI-P EL POL 6/68
M	1	(1690.0)	BAREYRE	68 RVUE	PHASE-SHIFT ANAL 11/67
M	1		WHERE THE PARTIAL-WAVE TOTAL CROSS SECTION IS GREATEST.		
M	2	(1680.0)	BAREYRE	68 RVUE	PHASE-SHIFT ANAL 11/67
M	2		WHERE THE VELOCITY OF THE AMPLITUDE ACROSS THE ARGAND DIAGRAM		
M	2		IS GREATEST.		
M	3	(1687.0)	DONNACHIE	68 RVUE	PHASE-SHIFT ANAL 6/68
M	3		WHERE THE ABSORPTION IS GREATEST.		

65 N*1/2(1688) WIDTH (MEV)

W	1	(110.0)	BAREYRE	68 RVUE	11/67
W	2	(105.0)	BAREYRE	68 RVUE	11/67
W	3	(177.0)	DONNACHIE	68 RVUE	6/68

SEE THE NOTES ACCOMPANYING THE MASSES QUOTED.

65 N*1/2(1688) PARTIAL DECAY MODES

	INTO	PI N	DECAY MASSES
P1	N*1/2(1688)	INTO PI N	139+ 938
P2	N*1/2(1688)	INTO N ETA	939+ 548
P3	N*1/2(1688)	INTO LAMBDA K	1115+ 497
P4	N*1/2(1688)	INTO N*3/2(1236) PI	1236+ 139
P5	N*1/2(1688)	INTO N PI	938+ 139+ 139
P6	N*1/2(1688)+	INTO NEUTRON PI+	939+ 139
P7	N*1/2(1688)+	INTO PROTON PI+	938+ 139+ 139
P8	N*1/2(1688)+	INTO N*3/2(1236)+ PI-	1236+ 139

65 N*1/2(1688) BRANCHING RATIOS

	INTO (PI N)/TOTAL	(P1)/TOTAL	
R1	N*1/2(1688)	INTO (PI N)/TOTAL	(P1)/TOTAL
R1	1	(0.64)	BAREYRE 68 RVUE 11/67
R1	3	(0.560)	DONNACHIE 68 RVUE 6/68

SEE THE NOTES ACCOMPANYING THE MASSES QUOTED.

WE LIST MEASUREMENTS OF THE INELASTIC DECAY MODES OF THE 1688 MEV BUMP. SUCH MEASUREMENTS HAVE NOT UNTANGLED THE D15 AND F15 (AND POSSIBLE S11) COMPONENTS. IT IS CLEAR THAT BOTH D15 AND F15 DECAY ALOT INTO N PI PI. MERLO 66 FINDS SOME N*3/2(1236) PI (SLIGHTLY MORE THAN PHASE SPACE). ROBERTS 67 SUGGESTS THAT THE DOMINANT MODE IS N*1/2(1518).

N*1/2(1688) INTO (ETA)/TOTAL (P2)/TOTAL

R2	N*1/2(1688)	INTO (ETA)/TOTAL	(P2)/TOTAL
R2	2	(0.025)	OR LESS KRAEMER 64 DBC + PI+0 1.23 BEV/C 9/66
R2	2	(0.042)	OR LESS (95PC CL) A-BORELLI 67 HBC + PBAR P 5.7 BEV/C 8/67
R2	2	(0.015)	TRIPP 67 RVUE 8/67

N*1/2(1688) INTO (ETA)/TOTAL (P2)/(P1)

R3	N*1/2(1688)	INTO (ETA)/TOTAL	(P2)/(P1)
R3	3	(0.027)	OR LESS HEUSCH 66 RVUE + PI0, ETA PHOTO 9/66

N*1/2(1688) INTO (LAMBDA K)/TOTAL (P3)/TOTAL

R4	N*1/2(1688)	INTO (LAMBDA K)/TOTAL	(P3)/TOTAL
R4	4	(0.013)	OR LESS (95PC CL) A-BORELLI 67 HBC 8/67
R4	4	(0.0013)	TRIPP 67 RVUE 8/67
R4	4	SEEN	CHINDOSKY 68 HBC PP TO K+ Y N 6/68

N*1/2(1688) INTO (N PI)/TOTAL (P1)/(P5)

R5	N*1/2(1688)	INTO (N PI)/TOTAL	(P1)/(P5)
R5	5	1.26	OR LESS (95PC CL) A-BORELLI 67 HBC + 8/67

N*1/2(1688) INTO (N*3/2(1236) PI)/TOTAL (P4)/(P5)

R6	N*1/2(1688)	INTO (N*3/2(1236) PI)/TOTAL	(P4)/(P5)
R6	6	NO EVIDENCE	A-BORELLI 67 HBC + 8/67
R6	6	SEE MERLO 66	FOR A REVIEW.

N*1/2(1688) INTO (NEUTRON PI+)/(P PI+ PI-)

R7	N*1/2(1688)	INTO (NEUTRON PI+)/(P PI+ PI-)	(P6)/(P7)
R7	7	0.67	0.40 ALEXANDER 67 HBC + PP 5.5 BEV/C 11/67

N*1/2(1688) INTO (N*(1236)+ PI-)/(P PI+ PI-)

R8	N*1/2(1688)	INTO (N*(1236)+ PI-)/(P PI+ PI-)	(P8)/(P7)
R8	8	0.74	0.14 ALEXANDER 67 HBC + PP 5.5 BEV/C 11/67
R8	8	1.0	0.3 ALMEIDA 66 HBC + PP 10 BEV/C 9/66
R8	8	0.83	KAYAS 68 PP 8.1 BEV/C 11/68

N*1/2(1688) INTO (LAMBDA K)/(P PI+ PI-)

R9	N*1/2(1688)	INTO (LAMBDA K)/(P PI+ PI-)	(P3)/(P7)
R9	9	0.034	OR LESS ALEXANDER 67 HBC + PP 5.5 BEV/C 11/67

N*1/2(1688) INTO (PI N)/(PI N*3/2(1236))

R10	N*1/2(1688)	INTO (PI N)/(PI N*3/2(1236))	(P1)/(P4)
R10	10	0.77	OR LESS LEE 67 HBC 11/67

REFERENCES -- N*1/2(1680)

SEE A PREVIOUS EDITION (RMP 37, 633, 1965) FOR EARLIER REFERENCES.

KRAEMER	64 PRL 136 8496	+ MADANSKY, + (J HOPKINS, WESTERN, WOODSTOCK) I
DUKE	65 PRL 15 468	+ JONES, KEMP, MURPHY, PRENTICE, + (RTHFD, OXF) IJP
BRANDSEN	65 PL 19 420	+ O'DONNELL, MOORHOUSE (DURHAM, RTHFD) IJP
HEUSCH	66 PRL 17 1019	C A HEUSCH, C Y PRESCOTT, R F DASHEN (CIT)
ALMEIDA	66 BERKELEY CONF	+ RUSHBROOKE, + (CAVNSH, DESY) (CERN)
MERLO	66 P ROY SOC 289 489	J P MERLO, G VALLADAS (SACLAY)
ALEXANDE	67 PR 154 1284	ALEXANDER, BENARY, CZAPEK, + (WEIZMANN) (CERN)
A-BORELLI	67 NC 47 232	ALLES-BORELLI, FRENCH, FRISK, PICHEIDA (CERN)
LEE	67 PR 159 1156	+ MOBS, ROE, SINCLAIR, VANDER VELDE (MICH)
TRIPP	67 NP 83 10	+ LEITH, + (LRL, SLAC, CERN, HEIDEL, SACLAY)
CHINDOSK	68 PR 165 1466	CHINDOSKY, KINSEY, KLEIN, + (LRL, SLAC)
BAREYRE	68 PR 165 1731	P BAREYRE, C BRICMAN, G VILLET (SACLAY) IJP
DUKE	68 PR 166 1448	+ JONES, KEMP, MURPHY, THRESHER, + (RTHFD, OXF) IJP
DONNACHI	68 PL 268 161	A DONNACHIE, R G KIRSOPP, C LOVELACE (CERN) IJP
KAYAS	68 NP 85 169	+ GUYADER, SENE, YIOU, ALITTI, + (ORSAY, SACLAY)

PAPERS NOT REFERRED TO IN DATA CARDS.

COUCH	65 DESY CONF II 21	+ (BROWN, CEA, HARVARD, MIT, PADOVA, WEIZMANN)
DERADO	65 ATHENS CONF 244	+ KENNEY, LAMSA, + (NOTRE DAME, KENTUCKY)
ROBERTS	67 PREPRINT	R G ROBERTS (DURHAM)
BANNER	68 PR 166 1347	+ DETOUF, FAYOUX, HAMEL, + (SACLAY, CAEN)
-- THE ABOVE PAPERS DISCUSS INELASTIC CHANNELS NEAR THE BUMP.		
BAREYRE	65 PL 18 342	+ BRICMAN, STIRLING, VILLET (SACLAY) IJP
JOHNSON	67 UCRL-17683	THESIS C H JOHNSON (LRL)

Δ(1690)

N*3/2(1690), JP=3/2- I=3/2

D₃₃

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REFERENCES -- N*3/2(1690), JP=3/2- I=3/2

N*3/2(1690), JP=3/2- I=3/2 F₃₃

THE LATEST RESULTS ON NUCLEON RESONANCES, PRESENTED AT THE 1968 VIENNA CONFERENCE, ARE NOT INCLUDED IN THE CARD LISTINGS, BUT ARE DISCUSSED IN A NOTE PRECEDING THE N*3/2(1236).

N(1710)

66 N*1/2(1710), JP=1/2- I=1/2

S₁₁

THE LATEST RESULTS ON NUCLEON RESONANCES, PRESENTED AT THE 1968 VIENNA CONFERENCE, ARE NOT INCLUDED IN THE CARD LISTINGS, BUT ARE DISCUSSED IN A NOTE PRECEDING THE N*3/2(1236).

66 N*1/2(1710) MASS (MEV)

M					
M	*	(1695.0)	BRANDSEN	65 RVUE	PHASE-SHIFT ANAL 9/66
M	*	(1700.0)	MICHAEL	66 RVUE	FITS BAREYRE S11 7/66
M	1	(1710.0)	BAREYRE	68 RVUE	PHASE-SHIFT ANAL 11/67
M	1		WHERE THE PARTIAL-WAVE TOTAL CROSS SECTION IS GREATEST.		
M	2	(1665.0)	BAREYRE	68 RVUE	PHASE-SHIFT ANAL 11/67
M	2		WHERE THE VELOCITY OF THE AMPLITUDE ACROSS THE ARGAND DIAGRAM		
M	2		IS GREATEST.		
M	3	(1709.0)	LOVELACE	67 RVUE	PHASE-SHIFT ANAL 11/67
M	3		WHERE THE ABSORPTION IS GREATEST.		

66 N*1/2(1710) WIDTH (MEV)

W	*	(240.0)	MICHAEL	66 RVUE	7/66
W	1	(260.0)	BAREYRE	68 RVUE	11/67
W	2	(110.0)	BAREYRE	68 RVUE	11/67
W	3	(300.0)	LOVELACE	67 RVUE	PHASE-SHIFT ANAL 11/67

SEE THE NOTES ACCOMPANYING THE MASSES QUOTED.

66 N*1/2(1710) PARTIAL DECAY MODES

	INTO	PI N	DECAY MASSES
P1	N*1/2(1710)	INTO PI N	139+ 938
P2	N*1/2(1710)	INTO N ETA	939+ 548
P3	N*1/2(1710)	INTO LAMBDA K	1115+ 497

66 N*1/2(1710) BRANCHING RATIOS

	INTO (PI N)/TOTAL	(P1)/TOTAL	
R1	N*1/2(1710)	INTO (PI N)/TOTAL	(P1)/TOTAL
R1	1	(1.0)	MICHAEL 66 RVUE 7/66
R1	3	(0.786)	LOVELACE 67 RVUE PHASE-SHIFT ANAL 11/67

REFERENCES -- N*1/2(1710)

BAREYRE	65 PL 18 342	+ BRICMAN, STIRLING, VILLET (SACLAY) IJP
BRANDSEN	65 PL 19 420	+ O'DONNELL, MOORHOUSE (DURHAM, RTHFD) IJP
MICHAEL	66 PL 21 93	C MICHAEL, MOORHOUSE (OXF)
JOHNSON	67 UCRL-17683	THESIS C H JOHNSON (LRL)
BAREYRE	68 PR 165 1731	P BAREYRE, C BRICMAN, G VILLET (SACLAY) IJP

N(1730)

N*1/2(1730), JP=3/2- I=1/2

D₁₃

THE LATEST RESULTS ON NUCLEON RESONANCES, PRESENTED AT THE 1968 VIENNA CONFERENCE, ARE NOT INCLUDED IN THE CARD LISTINGS, BUT ARE DISCUSSED IN A NOTE PRECEDING THE N*3/2(1236).

REFERENCES -- N*1/2(1730), JP=3/2- I=1/2

N*1/2(1750), JP=1/2+ I=1/2 P₁₁

THE LATEST RESULTS ON NUCLEON RESONANCES, PRESENTED AT THE 1968 VIENNA CONFERENCE, ARE NOT INCLUDED IN THE CARD LISTINGS, BUT ARE DISCUSSED IN A NOTE PRECEDING THE N*3/2(1236).

BARYON RESONANCES

Data in parentheses have not been included in our averages.

N(1860) $N^*3/2(1860, JP=3/2^+)$ $I=1/2$ P_{13}
 THE LATEST RESULTS ON NUCLEON RESONANCES, PRESENTED AT THE 1968 VIENNA CONFERENCE, ARE NOT INCLUDED IN THE CARD LISTINGS, BUT ARE DISCUSSED IN A NOTE PRECEDING THE N*3/2(1236).

$\Delta(1910)$ $N^*3/2(1910, JP=5/2^+)$ $I=3/2$ F_{35}
 THE LATEST RESULTS ON NUCLEON RESONANCES, PRESENTED AT THE 1968 VIENNA CONFERENCE, ARE NOT INCLUDED IN THE CARD LISTINGS, BUT ARE DISCUSSED IN A NOTE PRECEDING THE N*3/2(1236).

$\Delta(1930)$ $N^*3/2(1930, JP=1/2^+)$ $I=3/2$ P_{31}
 THE LATEST RESULTS ON NUCLEON RESONANCES, PRESENTED AT THE 1968 VIENNA CONFERENCE, ARE NOT INCLUDED IN THE CARD LISTINGS, BUT ARE DISCUSSED IN A NOTE PRECEDING THE N*3/2(1236).

$\Delta(1950)$ $N^*3/2(1950, JP=7/2^+)$ $I=3/2$
 THE LATEST RESULTS ON NUCLEON RESONANCES, PRESENTED AT THE 1968 VIENNA CONFERENCE, ARE NOT INCLUDED IN THE CARD LISTINGS, BUT ARE DISCUSSED IN A NOTE PRECEDING THE N*3/2(1236).

83 N*3/2(1950) MASS (MEV)

M	1922.0	APPROX	COOL	56 CNTR	PI+ P TOTAL	7/66
M	(1912.0)	(15.0)	BRISSON	61 CNTR	PI+ P TOTAL	7/66
M	(1956.0)		LAYSON	63 RVUE	PI P TOTAL, EL	7/66
M	N	ASSUMES AN N*3/2(1855).				
M	(1920.0)		HOHLER	64 RVUE	DATA + DISP REL	7/66
M	(1900.0)	(9.0)	DEVILIN	65 CNTR	PI+ P TOTAL	7/66
M	1950.0	APPROX	YOKOSAWA	66 CNTR	PI- P DSIG + PDL	7/66
M	(1920.0)		DUKE	68 CNTR	PI-P EL + PDL	6/68
M	1		BARREYRE	68 RVUE	PHASE-SHIFT ANAL	11/67
M	1		WHERE THE PARTIAL-WAVE TOTAL CROSS SECTION IS GREATEST.			
M	2		WHERE THE VELOCITY OF THE AMPLITUDE ACROSS THE ARGAND DIAGRAM IS GREATEST.			
M	3		WHERE THE ABSORPTION IS GREATEST.			

83 N*3/2(1950) WIDTH (MEV)

M	(170.0)		HOHLER	64 RVUE		7/66
M	(256.0)	(139.0)	DEVILIN	65 CNTR		7/66
M	(170.0)		DUKE	65 CNTR		7/66
M	200.0	APPROX	YOKOSAWA	66 CNTR		7/66
M	(180.0)		BARREYRE	68 RVUE		11/67
M	(140.0)		BARREYRE	68 RVUE		11/67
M	(221.0)		DONNACHIE	68 RVUE		6/68

SEE THE NOTES ACCOMPANYING THE MASSES QUOTED.

83 N*3/2(1950) PARTIAL DECAY MODES

P1	N*3/2(1950) INTO PI N	139+ 938	DECAY PASSES
P2	N*3/2(1950) INTO SIGMA K	1189+ 493	
P3	N*3/2(1950) INTO N*3/2(1236) PI	1236+ 139	
P4	N*3/2(1950) INTO N*3/2(1385) K	1385+ 493	
P5	N*3/2(1950) INTO N*3/2(1236) RHO	1236+ 770	
P6	N*3/2(1950) INTO NEUTRON PI+ PI+	939+ 139+ 139	
P7	N*3/2(1950) INTO N*3/2(1236) PI PI (NOT RHO)	1236+ 139+ 139	

83 N*3/2(1950) BRANCHING RATIOS

R1	N*3/2(1950) INTO (PI N)/TOTAL	(P1)/TOTAL	
R1	N	(0.33)	LAYSON 63 RVUE 7/66
R1	N	ASSUMES AN N*3/2(1855).	
R1	*	0.73 OR LESS	HOHLER 63 RVUE DATA + DISP REL 7/66
R1	*	(0.57) (0.12)	DEVILIN 65 CNTR 7/66
R1	*	(0.41)	DUKE 65 CNTR VERY ENERGY DEP 7/66
R1	*	(0.57) APPROX	YOKOSAWA 66 CNTR 11/67
R1	1	(0.57)	BARREYRE 68 RVUE 6/68
R1	3	(0.386)	DONNACHIE 68 RVUE 6/68

SEE THE NOTES ACCOMPANYING THE MASSES QUOTED.

83 N*3/2(1950) INTO (SIGMA K)/(PI N)

R2	N*3/2(1950) INTO (SIGMA K)/(PI N)	(P2)/(P1)	
R2	0.059 0.024	CHINDOSKY 68 HBC ++ PP TO P SIG K	11/68

83 N*3/2(1950) INTO ((PI N)*(N*3/2(1236) PI))/TOTAL

R3	N*3/2(1950) INTO ((PI N)*(N*3/2(1236) PI))/TOTAL	(P1*P3)/TOTAL	
R3	0.23 0.04	FUNG 68 HBC ++ PI+P TO PI+PIO P	11/68

83 N*3/2(1950) INTO (PI N)/(N*3/2(1236) PI)

R4	N*3/2(1950) INTO (PI N)/(N*3/2(1236) PI)	(P1)/(P3)	
R4	LESS THAN 0.55	LEE 67 HBC PI-P 3.63 BEV/C	11/67

83 N*3/2(1950) INTO ((PI N)*(NEUTRON PI+ PI+))/TOTAL

R5	N*3/2(1950) INTO ((PI N)*(NEUTRON PI+ PI+))/TOTAL	(P1*P6)/TOTAL	
R5	0.05 0.013	GALLOWAY 68 RVUE ++ PI+P TO N PI+	6/68

83 N*3/2(1950) INTO (Y*1(1385) K)/(PI N)

R6	N*3/2(1950) INTO (Y*1(1385) K)/(PI N)	(P4)/(P1)	
R6	0.035 0.015	CHINDOSKY 68 HBC ++ PP TO P LAM K PI	11/68

83 N*3/2(1950) INTO (N*3/2(1236) RHO)/(PI N)

R7	N*3/2(1950) INTO (N*3/2(1236) RHO)/(PI N)	(P5)/(P1)	
R7	0.45 APPROX	CHINDOSKY 68 HBC ++ PP TO (P 3P1) N	11/68

THIS INCLUDES CORRECTION FOR UNSEEN DECAY (SPIN FACTOR 5/3).

83 N*3/2(1950) INTO N*3/2(1236) PI PI (NOT RHO)

R8	N*3/2(1950) INTO N*3/2(1236) PI PI (NOT RHO)	(P7)/(P1)	
R8	SEEN	CHINDOSKY 68 HBC ++ PP TO (P 3P1) N	11/68

REFERENCES -- N*3/2(1950)

COOL	56 PR 103 1082	R COOL, O PICCIONI, D CLARK (BNL) I
BRISSON	61 NC 19 210	+DETOUF, FALK-VAIRANT, VAN ROSSUM, + (SACLAY) I
LAYSON	63 NC 27 724	M H LAYSON (CERN) I
HOHLER	63 NP 48 470	G HOHLER, G EBEL (KARLSRUHE) I
HOHLER	64 PL 12 149	G HOHLER, J GIESECKE (KARLSRUHE) I
DEVILIN	65 PRL 14 1031	T J DEVILIN, J SOLOMON, G BERTSCH (PRINCETON) I
DUKE	65 PRL 15 468	+JONES, KEMP, MURPHY, PRENTICE, + (RTHFD, OXF) I, J
HOLLADAY	65 PR 139 1348	M C HOLLADAY (VANDERBILT) I
YOKOSAWA	66 PRL 16 714	+SUNA, HILL, ESTERLING, BOOTH (ARG, CHI) I, J
LEE	67 PR 159 1156	+MOERS, ROE, SINCLAIR, VANDER VELDE (MICH) I
GALLOWAY	68 PL 268 334	K F GALLOWAY (INDIANA) I
BARREYRE	68 PR 165 1731	P BARREYRE, C BRICMAN, G WILLET (SACLAY) I, J
DONNACHIE	68 PL 268 161	A DONNACHIE, R G KIRSOPP, C LOVELACE (CERN) I, J
CHINDOSKY	68 PR 171 1421	CHINDOSKY, CONDON, KINSEY, KLEIN, + (LRL, SLAC) I
FUNG	68 VIENNA CONF.	FUNG, KERNAN, KALMUS, BIRGE (RIVERSIDE, LRL) I

PAPERS NOT REFERRED TO IN DATA CARDS.

HELLAND 64 PR 134 B1062 +DEVILIN, HAGGE, LONGO, MOYER, HOOD (LRL) I, J
 AUVIL 64 NC 33 473 P AUVIL, C LOVELACE (IMPCCOL) I, J
 JOHNSON 67 UCRL-17683 THESIS C H JOHNSON (LRL)

N(1980) $N^*1/2(1980, JP=3/2^-)$ $I=1/2$ D_{13}
 THE LATEST RESULTS ON NUCLEON RESONANCES, PRESENTED AT THE 1968 VIENNA CONFERENCE, ARE NOT INCLUDED IN THE CARD LISTINGS, BUT ARE DISCUSSED IN A NOTE PRECEDING THE N*3/2(1236).

N(2080) $70 N^*(2080, JP=)$ $I=$
 YUON 67 SEE A NARROW BUMP IN THE INVARIANT MASS OF (P PI+ PI- PI0) FROM 3 BEV/C PI- P TO (PI- P PI+ PI- RHO-), AT 3.2 BEV/C, WITH APPROXIMATELY FOUR TIMES THE NUMBER OF EVENTS, THE EFFECT IS NOT SEEN (CHUNG 68) - OMITTED FROM TABLE.

70 N* (2080) MASS (MEV)

M	2080.0	12.0	YUON	67 HBC + 3 BEV/C PI-P	8/67
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70 N* (2080) WIDTH (MEV)

M	40.0	20.0	YUON	67 HBC +	8/67
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70 N* (2080) PARTIAL DECAY MODES

70 N* (2080) INTO PI N

P1	N* (2080) INTO PI N	139+ 938	DECAY PASSES
P2	N* (2080) INTO N*3/2(1236) RHO	1236+ 770	

70 N* (2080) BRANCHING RATIOS

R1	N* (2080) INTO (N*3/2(1236) RHO)/TOTAL	(P2)/TOTAL	
R1	SEEN	YUON 67 HBC +	8/67

REFERENCES -- N* (2080)

YUON 67 PL 248 307 +BERENYI, KEY, PRENTICE, + (TORONTO, WISC) I, J
 CHUNG 68 PR 165 1491 S U CHUNG, DAHL, KIRZ, MILLER (LRL)

N(2190) $N^*1/2(2190, JP=7/2^-)$ $I=1/2$
 THE LATEST RESULTS ON NUCLEON RESONANCES, PRESENTED AT THE 1968 VIENNA CONFERENCE, ARE NOT INCLUDED IN THE CARD LISTINGS, BUT ARE DISCUSSED IN A NOTE PRECEDING THE N*3/2(1236).

71 N*1/2(2190) MASS (MEV)

M	2190.0		DIDDENS	63 CNTR	PI+ P TOTAL	
M	2210.0		HOHLER	64 RVUE	DATA + DISP REL	7/66
M	2190.0	APPROX	YOKOSAWA	66 CNTR	PI- P DSIG + PDL	7/66
M	2265.0		DONNACHIE	68 RVUE	PHASE-SHIFT ANAL	6/68

71 N*1/2(2190) WIDTH (MEV)

M	200.0		DIDDENS	63 CNTR		7/66
M	200.0		HOHLER	64 RVUE		7/66
M	220.0	APPROX	YOKOSAWA	66 CNTR		7/66
M	298.0		DONNACHIE	68 RVUE		6/68

71 N*1/2(2190) PARTIAL DECAY MODES

P1	N*1/2(2190) INTO PI N	139+ 938	DECAY PASSES
P2	N*1/2(2190) INTO LAMBDA K	1115+ 497	

71 N*1/2(2190) BRANCHING RATIOS

R1	N*1/2(2190) INTO (PI N)/TOTAL	(P1)/TOTAL	
R1	0.3	APPROX	DIDDENS 63 CNTR 7/66
R1	0.3	APPROX	YOKOSAWA 66 CNTR 7/66
R1	0.349	APPROX	DONNACHIE 68 RVUE 6/68

REFERENCES -- N*1/2(2190)

DIDDENS 63 PRL 10 262 +JENKINS, KYCIA, RILEY (BNL) I
 HOHLER 64 PL 12 149 G HOHLER, J GIESECKE (KARLSRUHE) I
 YOKOSAWA 66 PRL 16 714 +SUNA, HILL, ESTERLING, BOOTH (ARG, CHI) I, J
 DONNACHIE 68 PL 268 161 A DONNACHIE, R G KIRSOPP, C LOVELACE (CERN) I, J

QUANTUM NUMBER DETERMINATIONS NOT REFERRED TO IN DATA CARDS.

CARROLL 66 PRL 16 288 +CORBETT, DAMERELL, MIDDLEMAS, + (RTHFD, OXF) J-L
 CARROLL 66 PRL 17 1274 +CORBETT, DAMERELL, MIDDLEMAS, + (RTHFD, OXF) J-L
 -- ERRATUM CHANGING THE RATHER WEAK DETERMINATION OF J-L TO 1/2.
 KORNANYO 66 PRL 16 709 KORNANYOS, KRISCH, OFALLON, + (MICH, ARG) P
 BARGER 66 PRL 16 913 V BARGER, D CLINE (MISC) P
 BUSZA 67 NC 52A 331 +DAVIS, DUFF, HEYMANN, + (UNICOL, WESTFIELD) I

$\Delta(2420)$ $84 N^*3/2(2420, JP=1/2^-)$ $I=3/2$
 PARTIAL WAVE ANALYSIS OF BELLAMY 67 SUGGESTS J=1/2

84 N*3/2(2420) MASS (MEV)

M	(2360.0)		DIDDENS	63 CNTR	PI+ P TOTAL	
M	(2320.0)	(40.0)	ALVAREZ	64 CNTR	PI PHOTOPROD	7/66
M	2400.0	APPROX	WAHLIG	64 SPRK 0	PI-P CH EX	
M	(2440.0)		HOHLER	64 RVUE	DATA + DISP REL	7/66
M	2423.0	10.0	CITRON	66 CNTR	PI+ P TOTAL	11/67
M	(2452.0)		BARGER	66 RVUE	TOTAL + CH EX	11/67

84 N*3/2(2420) WIDTH (MEV)

M	(200.0)		DIDDENS	63 CNTR		
M	(245.0)		HOHLER	64 RVUE		7/66
M	310.0	20.0	CITRON	66 CNTR		7/66
M	(275.0)		BARGER	66 RVUE	TOTAL + CH EX	11/67

BARYON RESONANCES

Data in parentheses have not been included in our averages.

84 N³/2(2420) PARTIAL DECAY MODES

	DECAY PASSES	
P1	N ³ /2(2420) INTO PI N	139+ 938
P2	N ³ /2(2420) INTO SIGMA K	1197+ 499
P3	N ³ /2(2420) INTO N ³ /2(1236) PI	1236+ 139
P4	N ³ /2(2420) INTO NEUTRON PI+ PI+	939+ 139+ 139

84 N³/2(2420) BRANCHING RATIOS

	INTO (PI N)/TOTAL	(PI1)/TOTAL
R1	N ³ /2(2420) INTO (PI N)/TOTAL	(PI1)/TOTAL
R1 *	0.067 APPROX	DIDDENS 63 CNTR ASSUMING J=11/2 7/66
R1	0.113 (0.036)	CITRON 66 CNTR ASSUMING J=11/2 7/66
R1 B	(0.12)	BARGER 67 FIT ASSUMING J=11/2 11/67
B	USES REGGE AMP.+RESON. TO CALCULATE DIF. CROSS SECTIONS AT 180 DEGRE	
B	FOR CRITICISM OF THIS METHOD, SEE DOLEN 68.	
R1 D	(0.153)	DIKMEN 67 FIT ASSUMING J=11/2 11/67
D	USES ONLY RESONANCES TO CALCULATE DIF. CROSS SECTIONS AT 180 DEGREES	
R1	0.06	KORMANYOS 67 CNTR ASSUMING J=11/2 11/67

R2 N³/2(2420) INTO (PI N)*(NEUTRON PI+ PI+)/(TOTAL*2) (PI*P4)/TOTAL*2

R2	0.0195 0.0048	GALLOWAY 68 RVUE 6/68*
----	---------------	------------------------

REFERENCES -- N³/2(2420)

DIDDENS 63 PRL 10 262	+JENKINS, KYCIA, RILEY (BNL) I
ALVAREZ 64 PRL 12 710	+BAR-YAM, KERN, LUCKEY, OSBORNE, + (MIT,CEA)
WAHLIG 64 PRL 13 103	+MANNELLI, SODICKSON, FACKLER, HARD, + (MIT)
HOHLER 64 PRL 12 149	G HOHLER, J GIESECKE (KARLSRUHE) I
CITRON 66 PR 144 1101	+GALBRAITH, KYCIA, LEONTIC, PHILLIPS, + (BNL) I
BARGER 66 PR 151 1123	V BARGER, M OLSSON (WISC) P
BARGER 67 PR 155 1792	V BARGER, D CLINE (WISC) P
DIKMEN 67 PRL 18 798	F N DIKMEN (MICH) P
KORMANYO 67 PR 164 1661	KORMANYOS, KRISCH, OFALLON, + (MICH,ARG) P
DOLEN 68 PR 166 1768	R DOLEN, D HORN, C SCHMID (CAL TECH)
GALLOWAY 68 PL 268 334	K F GALLOWAY (INDIANA) I

PAPERS NOT REFERRED TO IN DATA CARDS.

DOBROWOL 67 PL 248 203 DOBROWOLSKI, GUSKOV, LIXHACHEV, + (DUUNA) P

BELLAMY 67 PRL 19 476 +BUCKLEY, DOBINSON, + (WESTFIELD, UNICOL) J-P

BAACKE 67 NC 514 761 J BAACKE, M YVERT (KARLSRUHE, CRSAV) J-L

WAHLIG 68 PR 168 1515 M A WAHLIG, I MANNELLI (MIT, PISA)

--- FINAL VERSION OF DATA USED IN WAHLIG 64. IN CONJUNCTION WITH CITRON 66 TOTAL CROSS SECTIONS, THIS CHARGE EXCHANGE DATA GIVES COMPLEX ELASTIC SCATTERING AMPLITUDE AT 0 DEGREES.

72 N¹/2(2650, JP= -) I=1/2

72 N¹/2(2650) MASS (MEV)

M *	(2700.0)	ALVAREZ 64 CNTR PI PHOTOPROD
M *	2600.0	WAHLIG 64 SPRK 0 PI-P CH EX
M *	(2660.0)	HOHLER 64 RVUE DATA + DISP REL
M *	2649.0	CITRON 66 CNTR PI+ P TOTAL 7/66
M *	(2633.0)	BARGER 66 FIT TOTAL + CH EX 11/67

72 N¹/2(2650) WIDTH (MEV)

W *	(100.0)	ALVAREZ 64 CNTR	7/66
W *	(200.0)	HOHLER 64 RVUE	7/66
W *	360.0	CITRON 66 CNTR	7/66
W *	(425.0)	BARGER 66 FIT	TOTAL + CH EX 11/67

72 N¹/2(2650) PARTIAL DECAY MODES

	INTO PI N	DECAY PASSES
P1	N ¹ /2(2650) INTO PI N	139+ 938
P2	N ¹ /2(2650) INTO LAMBDA K	1115+ 497

72 N¹/2(2650) BRANCHING RATIOS

	INTO (PI N)/TOTAL	(PI1)/TOTAL
R1	N ¹ /2(2650) INTO (PI N)/TOTAL	(PI1)/TOTAL
R1	ONLY (J+1/2)* PI N/TOTAL MEASURED FOR THIS STATE	
R1	0.456 (0.018)	CITRON 66 CNTR TOTAL CRCS-SEC. 11/67
R1 B	(0.30)	BARGER 66 RVUE TOTAL + CH EXC. 11/67
B	USES REGGE AMP.+RESON. TO CALCULATE DIF. CROSS SECTIONS AT 180 DEGRE	
B	FOR CRITICISM OF THIS METHOD, SEE DOLEN 68.	
R1 D	(0.24)	DIKMEN 67 RVUE USES KORMANYOS 66 11/67
D	USES ONLY RESONANCES TO CALCULATE DIF. CROSS SECTIONS AT 180 DEGREES	
R1	0.06	KORMANYOS 67 CNTR PI-P AT 180 DEG. 11/67

REFERENCES -- N¹/2(2650)

ALVAREZ 64 PRL 12 710	+BAR-YAM, KERN, LUCKEY, OSBORNE, + (MIT,CEA)
WAHLIG 64 PRL 13 103	+MANNELLI, SODICKSON, FACKLER, HARD, + (MIT)
HOHLER 64 PRL 12 149	G HOHLER, J GIESECKE (KARLSRUHE) I
CITRON 66 PR 144 1101	+GALBRAITH, KYCIA, LEONTIC, PHILLIPS, + (BNL) I
BARGER 66 PR 151 1123	V BARGER, M OLSSON (WISC) P
BARGER 67 PR 155 1792	V BARGER, D CLINE (WISC) P
DIKMEN 67 PRL 18 798	F N DIKMEN (MICH) P
KORMANYO 67 PR 164 1661	KORMANYOS, KRISCH, OFALLON, + (MICH,ARG) P
DOLEN 68 PR 166 1768	R DOLEN, D HORN, C SCHMID (CAL TECH)

PAPER NOT REFERRED TO IN DATA CARDS.

BAACKE 67 NC 514 761 J BAACKE, M YVERT (KARLSRUHE, CRSAV) J-L

WAHLIG 68 PR 168 1515 M A WAHLIG, I MANNELLI (MIT, PISA)

--- FINAL VERSION OF DATA USED IN WAHLIG 64. IN CONJUNCTION WITH CITRON 66 TOTAL CROSS SECTIONS, THIS CHARGE EXCHANGE DATA GIVES COMPLEX ELASTIC SCATTERING AMPLITUDE AT 0 DEGREES.

85 N³/2(2850, JP= +) I=3/2

85 N³/2(2850) MASS (MEV)

M *	2700.0	WAHLIG 64 SPRK 0 PI-P CH EX
M *	(2870.0)	HOHLER 64 RVUE DATA + DISP REL
M *	2850.0	CITRON 66 CNTR PI+ P TOTAL 7/66
M *	(2850.0)	BARDADIN 66 HBC ++ N* TO P + 3 PIS 7/66

85 N³/2(2850) WIDTH (MEV)

W *	400.0	CITRON 66 CNTR	7/66
W *	(150.0)	BARDADIN 66 HBC ++	7/66

85 N³/2(2850) PARTIAL DECAY MODES

	INTO PI N	DECAY PASSES
P1	N ³ /2(2850) INTO PI N	139+ 938
P2	N ³ /2(2850) INTO P PI PI	938+ 139+ 139+ 139

85 N³/2(2850) BRANCHING RATIOS

	INTO (PI N)/TOTAL	(PI1)/TOTAL
R1	N ³ /2(2850) INTO (PI N)/TOTAL	(PI1)/TOTAL
R1	ONLY (J+1/2)* PI N/TOTAL MEASURED FOR THIS STATE	
R1	0.261 0.048	CITRON 66 CNTR TOTAL CRCS-SEC. 11/67
R1 B	(0.224) (0.016)	BARGER 66 RVUE TOTAL + CH EXC. 11/67
R1 B	(0.40)	BARGER 67 RVUE USES KORMANYOS 66 11/67
B	USES REGGE AMP.+RESON. TO CALCULATE DIF. CROSS SECTIONS AT 180 DEGRE	
B	FOR CRITICISM OF THIS METHOD, SEE DOLEN 68.	
R1 D	(0.48)	DIKMEN 67 RVUE USES KORMANYOS 67 11/67
D	USES ONLY RESONANCES TO CALCULATE DIF. CROSS SECTIONS AT 180 DEGREES	
R1	0.10	KORMANYOS 67 CNTR PI-P AT 180 DEG. 11/67
R1	0.39	DOBROWOLSKI, GUSKOV, LIXHACHEV, + (DUUNA) P

REFERENCES -- N³/2(2850)

WAHLIG 64 PRL 13 103	+MANNELLI, SODICKSON, FACKLER, HARD, + (MIT)
HOHLER 64 PL 12 149	G HOHLER, J GIESECKE (KARLSRUHE) I
CITRON 66 PR 144 1101	+GALBRAITH, KYCIA, LEONTIC, PHILLIPS, + (BNL) I
BARDADIN 66 PL 21 357	BARDADIN-DWINDOWSKA, DANYSE, + (KARSAN)
BARGER 66 PR 151 1123	V BARGER, M OLSSON (WISC) P
BARGER 67 PR 155 1792	V BARGER, D CLINE (WISC) P
DIKMEN 67 PRL 18 798	F N DIKMEN (MICH) P
DOBROWOL 67 PL 248 203	DOBROWOLSKI, GUSKOV, LIXHACHEV, + (DUUNA) P
KORMANYO 67 PR 164 1661	KORMANYOS, KRISCH, OFALLON, + (MICH,ARG) P
DOLEN 68 PR 166 1768	R DOLEN, D HORN, C SCHMID (CAL TECH)

PAPERS NOT REFERRED TO IN DATA CARDS.

BAACKE 67 NC 514 761 J BAACKE, M YVERT (KARLSRUHE, CRSAV) J-L

WAHLIG 68 PR 168 1515 M A WAHLIG, I MANNELLI (MIT, PISA)

--- FINAL VERSION OF DATA USED IN WAHLIG 64. IN CONJUNCTION WITH CITRON 66 TOTAL CROSS SECTIONS, THIS CHARGE EXCHANGE DATA GIVES COMPLEX ELASTIC SCATTERING AMPLITUDE AT 0 DEGREES.

N(3030)

73 N¹/2(3030, JP=) I=1/2

73 N¹/2(3030) MASS (MEV)

M *	(3080.0)	HOHLER 64 RVUE DATA + DISP REL 7/66
M *	3030.0	CITRON 66 CNTR PI+ P TOTAL 7/66

73 N¹/2(3030) WIDTH (MEV)

W *	400.0	CITRON 66 CNTR	7/66
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73 N¹/2(3030) PARTIAL DECAY MODES

	INTO PI N	DECAY PASSES
P1	N ¹ /2(3030) INTO PI N	139+ 938

73 N¹/2(3030) BRANCHING RATIOS

	INTO (PI N)/TOTAL	(PI1)/TOTAL
R1	N ¹ /2(3030) INTO (PI N)/TOTAL	(PI1)/TOTAL
R1	ONLY (J+1/2)* PI N/TOTAL MEASURED FOR THIS STATE	
R1	0.048	CITRON 66 CNTR TOTAL CRCS-SEC. 11/67
R1 B	(0.088) (0.016)	BARGER 66 RVUE TOTAL + CH EXC. 11/67
R1 B	(0.12)	BARGER 67 CNTR USES KORMANYOS 66 11/67
B	USES REGGE AMP.+RESON. TO CALCULATE DIF. CROSS SECTIONS AT 180 DEGRE	
B	FOR CRITICISM OF THIS METHOD, SEE DOLEN 68.	
R1 D	(0.016)	DIKMEN 67 RVUE USES KORMANYOS 67 11/67
D	USES ONLY RESONANCES TO CALCULATE DIF. CROSS SECTIONS AT 180 DEGREES	

REFERENCES -- N¹/2(3030)

HOHLER 64 PL 12 149	G HOHLER, J GIESECKE (KARLSRUHE) I
CITRON 66 PR 144 1101	+GALBRAITH, KYCIA, LEONTIC, PHILLIPS, + (BNL) I
BARGER 66 PR 151 1123	V BARGER, M OLSSON (WISC) P
KORMANYO 67 PR 164 1661	KORMANYOS, KRISCH, OFALLON, + (MICH,ARG) P
BARGER 67 PR 155 1792	V BARGER, D CLINE (WISC) P
DIKMEN 67 PRL 18 798	F N DIKMEN (MICH) P
DOLEN 68 PR 166 1768	R DOLEN, D HORN, C SCHMID (CAL TECH)

86 N³/2(3230, JP=) I=3/2

86 N³/2(3230) MASS (MEV)

M *	3230.0	CITRON 66 CNTR PI+ P TOTAL 7/66
-----	--------	---------------------------------

86 N³/2(3230) WIDTH (MEV)

W *	440.0	CITRON 66 CNTR	7/66
-----	-------	----------------	------

86 N³/2(3230) PARTIAL DECAY MODES

	INTO PI N	DECAY PASSES
P1	N ³ /2(3230) INTO PI N	139+ 938

86 N³/2(3230) BRANCHING RATIOS

	INTO (J+1/2)* PI N/TOTAL	MEASURED FOR THIS STATE
R1	ONLY (J+1/2)* PI N/TOTAL MEASURED FOR THIS STATE	
R1	0.06	CITRON 66 CNTR TOTAL CRCS. SEC. 11/67
R1 B	(0.03) (0.01)	BARGER 66 RVUE TOTAL + CH EXC. 11/67
R1 B	(0.03)	BARGER 67 CNTR USES KORMANYOS 66 11/67
B	USES REGGE AMP.+RESON. TO CALCULATE DIF. CROSS SECTIONS AT 180 DEGRE	
B	FOR CRITICISM OF THIS METHOD, SEE DOLEN 68.	
R1 D	(0.25)	DIKMEN 67 RVUE USES KORMANYOS 67 11/67
D	USES ONLY RESONANCES TO CALCULATE DIF. CROSS SECTIONS AT 180 DEGREES	

REFERENCES -- N³/2(3230)

CITRON 66 PR 144 1101	+GALBRAITH, KYCIA, LEONTIC, PHILLIPS, + (BNL) I
BARGER 66 PR 151 1123	V BARGER, M OLSSON (WISC) P
KORMANYO 67 PR 164 1661	KORMANYOS, KRISCH, OFALLON, + (MICH,ARG) P
BARGER 67 PR 155 1792	V BARGER, D CLINE (WISC) P
DIKMEN 67 PRL 18 798	F N DIKMEN (MICH) P
DOLEN 68 PR 166 1768	R DOLEN, D HORN, C SCHMID (CAL TECH)

BARYON RESONANCES

Data in parentheses have not been included in our averages.

N₇ (3245)
 →
 74 N° /2(3245) MASS (MEV) -----
 M 3245.0 10.0 KORMANYOS 67 CNTR PI-P 180 DEG EL 6/68*

 74 N° /2(3245) WIDTH (MEV) -----
 W 35.0 OR LESS KORMANYOS 67 CNTR 6/68*

 74 N° /2(3245) PARTIAL DECAY MODES -----
 P1 N° /2(3245) INTO PI N DECADES 139+ 938
 R1 J IS NOT KNOWN. FOLLOWING IS IJ+1/2I*(PI N1/TOTAL KORMANYOS 67 CNTR 6/68*
 0.37

 REFERENCES -- N° /2(3245)
 KORMANYO 67 PR 164 1661 KORMANYOS, KRISCH, OFALLON, + (MICH,ARG) P

N (3690)
 →
 75 N°1/2(3690) MASS (MEV) -----
 M 3690.0 10.0 BARTKE 67 HBC + PI+P 8 PRONGS 8/67

 75 N°1/2(3690) WIDTH (MEV) -----
 W 50.0 30.0 BARTKE 67 HBC + 8/67

 75 N°1/2(3690) PARTIAL DECAY MODES -----
 P1 N°1/2(3690) INTO N + 7 PIS DECADES 1420

 REFERENCES -- N°1/2(3690)
 BARTKE 67 PL 24B 118 *CZYZEWSKI,DANYSZ, + (CRACOW,ORSAY(CERN)) I

N₇ (3755)
 →
 76 N° /2(3755) MASS (MEV) -----
 M 3755.0 8.0 EHRLICH 68 HBC + PI+ P P PBAR 6/68*

 76 N° /2(3755) WIDTH (MEV) -----
 W 40.0 20.0 EHRLICH 68 HBC + 6/68*

 76 N° /2(3755) PARTIAL DECAY MODES -----
 P1 N° /2(3755) INTO PI+ P P PBAR DECADES

 REFERENCES -- N° /2(3755)
 EHRLICH 68 PRL 20 686 R EHRLICH,R J PLANO,J B WHITTAKER (RUTGERS)

N_{5/2}* (1560)
 →
 91 N°5/2(1560) MASS (MEV) -----
 M 1560.0 20.0 GOLDHABER 64 HBC +++3.65 BEV/C PI+ P 7/66
 M 1570.0 20.0 ALEXANDER 67 HBC +++PP 4PI 5.5 BEV/C 9/66
 M 1562.0 18.0 CAMBRIDGE 68 HBC +++GAMMA P TO 6 BEV 6/68*
 M AVG 1561.1050 13.3793 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)

 91 N°5/2(1560) WIDTH (MEV) -----
 W 220.0 20.0 GOLDHABER 64 HBC +++ 7/66
 W 140.0 20.0 ALEXANDER 67 HBC +++ 9/66
 W 200.0 54.0 CAMBRIDGE 68 HBC +++GAMMA P TO 6 BEV 6/68*
 W AVG 217.5875 18.7550 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)

 91 N°5/2(1560) PARTIAL DECAY MODES -----
 P1 N°5/2(1560) INTO N PI PI DECADES 938+ 139+ 139
 P2 N°5/2(1560) INTO N°3/2(1236) PI 1236+ 139

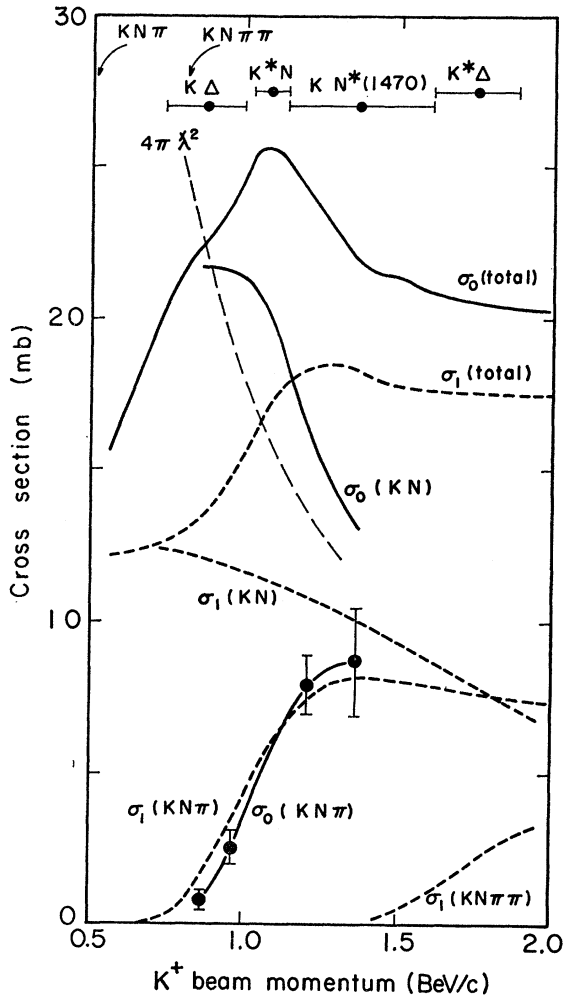
 REFERENCES -- N°5/2(1560)
 GOLDHABE 64 DUBNA CONF I 480 G+S GOLDHABER,OHALLORAN,SHEN (LRL(RNL)) I
 DASH 65 LRL UC10-2752 J DASH, G GOLDHABER, J SHIHART (LRL) I
 CONTE 66 BERKELEY CONF +DAMERI,RATTI,RUSSO, + (GENOVA,MILAN,UXF)
 ALEXANDE 67 PR 154 1284 ALEXANDER,BENARY,CZAPEK,* (WEIZMANN(CERN)) I
 GOLDHABE 67 CORAL GABLES 190 G GOLDHABER (LRL) I
 KRAMER 67 PR 164 1887 I KRAMER (LRL) I
 CAMBRIDG 68 PR 169 1081 BROWN, CEA, HARVARD, MIT, PADOVA, WEIZ(ANN) I

Note on Possible KN Resonances (Z's)

The K⁺p and K⁺d total cross sections have been accurately measured by COOL 66 and BUGG 68. They show similarly shaped asymmetric peaks near 1 BeV/c incident K⁺ momentum. The K⁺p is a direct measurement of the isospin-1 KN cross section. The isospin-0 KN cross section is extracted from the K⁺d cross section. To do this, it is necessary to correct for the shielding and motion of the nucleons within the deuteron, which requires making approximations the validity and effect of which are not fully understood. For a discussion and references, see TRIPP 68. The isospin-0 cross section so deduced has a peak, also near 1 BeV/c, that is higher, narrower, and more symmetric than the isospin-1 peak. This is shown in the accompanying figure. Peaks in πN and KN cross sections are nearly always attributed to resonances. However, the consequences of the existence of KN resonances are severe. In particular, all well-established strongly interacting particles and resonances have quantum numbers that permit their classification as quark-antiquark (for meson) or triple-quark (for baryon) states, and KN resonances will not fit into this scheme. States that will not are called exotic or "far-out." The only s-channel experiment one can arrange for seeking exotic resonances is KN scattering.

CARTER 67 used the total-cross-section data in a dispersion-relation analysis, and found that the Argand diagram for the isospin-0 forward scattering amplitude has the behavior of a resonance-like circle added to a smoothly varying background. This merely reflects the fact that there is a large, narrow peak in the cross section. The crucial question is whether it is a single partial wave or some general coordinated behavior of several of them that is responsible for the rapidly varying part of the full amplitude.

BARYON RESONANCES



KN total and partial cross sections. Subscripts indicate isospin. Total cross sections are from CARTER 68, which uses data from COOL 66 and BUGG 68. Isospin-1 partial cross sections are adapted from a compilation made by BLAND 68. Isospin-0 partial cross sections are from HIRATA 68. Thresholds for various processes are indicated at the top.

Only a few channels are open in KN scattering at low energies. The thresholds and final-state-particle cross sections are shown in the figure. BLAND 67 (for the isospin-1 channel) and HIRATA 68 (for the isospin-0 channel) have shown that the only important inelastic process (up to momenta well above the peaks) is $KN \rightarrow KN\pi$. Even this channel does not become important until the thresholds for the quasi-two-body channels $KN \rightarrow K\Delta$ (forbidden to the isospin-0 channel) and $KN \rightarrow K^*N$ are reached; in the region of the peaks, 70 to 90% of the $KN\pi$ final state is $K\Delta$ or K^*N . It is clear from the figure that the structure in the total cross sections is associated with the rise of the $KN \rightarrow KN\pi$ cross section at the thresholds of the quasi-two-body reactions. Furthermore, the production and decay angular distributions for these reactions are qualitatively consistent with simple t-channel exchange models. Once upon a time, these threshold and t-channel characteristics of the reactions that can be most closely associated with the structure in the total cross sections would probably have been enough to discourage a resonance interpretation. However, since Schmid has shown that a decomposition of t-channel Regge-exchange amplitudes may lead to resonance-like circles in the s-channel partial-wave amplitudes, the question is no longer either-or between s- and t-channel interpretations. See Sec. IV of the introduction to this Review for further brief comments, and HARARI 68 for an extended discussion and references on the twofold interpretation of amplitudes. In summary, the simple characteristics of the reaction channels are not sufficient to answer the question whether KN resonances exist.

No further analysis has yet been performed with the isospin-0 channel, but the much more accessible isospin-1 channel has been studied in greater detail, and no evidence

BARYON RESONANCES

Data in parentheses have not been included in our averages.

has been found for resonant behavior of any partial wave in the region of the peak in the total cross section. BLAND 67 made a partial-wave analysis of the reaction $K^+p \rightarrow K\Delta$ and found no rapid variation of any phase. HITE 67 made a K-matrix analysis of K^+p reactions, which reproduced the main features (though not the details) of the data without invoking a resonance. LEA 68 made a partial-wave analysis of total and elastic-scattering data and found some suggestion that the $P_{1/2}$ wave resonates near 2 BeV (≈ 1.5 BeV/c), rather far above the peak in the total cross section. However, this analysis has severe limitations, forced by lack of polarization data. In particular, the favored solution keeps the $P_{3/2}$ wave completely elastic, whereas BLAND 67 showed this to be the largest of the amplitudes feeding the reaction $K^+p \rightarrow K\Delta$. MARTIN 68 extended the work of LEA 68, and again found that the $P_{1/2}$ wave might be resonating, but the analysis is subject to the same limitations as was that of Lea et al. Phase-shift analyses of the elastic-scattering data can be no more than suggestive until there are accurate polarization data.

In production experiments, there is no solid evidence for KN resonances. BASSOMPIERRE 68 found no structure in mass spectra of systems recoiling against a pion in the reactions $K^+p \rightarrow KN\pi$, $KN\pi\pi$, and $KN\pi\pi\pi$. TYSON 67 and MORI 68 found some structure in mass spectra in the reaction $\gamma p \rightarrow K^-(MM)^+$, but the interpretation of this as due to KN resonances is indirect and, at best, no more than suggestive. BIRNBAUM 67 found some structure in the mass spectra in the reaction $\pi^-p \rightarrow K^-(MM)^+$, but it was later found that the position of the structure varied with incident π^- momentum.

The approximate parameters of the cross-section structure, if interpreted as resonant, are given in the data-card listings. In addition, ABRAMS 67 extended the total-cross-section measurements and found very

small bumps in the isospin-1 channel at 2190 and 2505 MeV, and borderline indications of structure in the isospin-0 channel. We do not include the possible Z's in the BARYON TABLE.

Z ₀ (1865)									
96 Z ⁰ (1865, JP=) I=0									
SEE THE PRECEDING NOTE.									

96 Z ⁰ (1865) MASS (MEV)									
M	1868.0	10.0	KYCIA	67 CNTR	K+P, D TCTAL	8/67			
M	1860.0	15.0	CARTER	67 THEO	DISPERSION REL.	8/67			
M	AVG	1865.5385	8.3205	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)					

96 Z ⁰ (1865) WIDTH (MEV)									
W	160.0	30.0	KYCIA	67 CNTR		8/67			
W	200.0	50.0	CARTER	67 THEO		8/67			
W	AVG	170.5882	25.7248	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)					

96 Z ⁰ (1865) PARTIAL DECAY MODES									
P1	Z ⁰ (1865)	INTO K N			DECAY PASSES				
P2	Z ⁰ (1865)	INTO N K*(890)			493+ 939				
					938+ 892				

96 Z ⁰ (1865) BRANCHING RATIOS									
R1	Z ⁰ (1865)	INTO (K N)/TOTAL			(P1)/TOTAL				
R1	0.40	0.05	KYCIA	67 CNTR	IF J=1/2	8/67			
R1	0.31	0.05	CARTER	67 THEO	IF J=1/2	8/67			
R1	AVG	.3550	.0450	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.31)					
R2	Z ⁰ (1865)	INTO N K*(890)			(P2)				
R2		MAIN INELASTIC DECAY	HIRATA	68 HBC		11/68*			

REFERENCES -- Z ⁰ (1865)									
SEE REFERENCES FOR THE Z ⁰ (1900)									

Z ₁ (1910)									
97 Z ¹ (1900, JP=) I=1									
SEE THE NOTE PRECEDING THE Z ⁰ (1865).									

97 Z ¹ (1900) MASS (MEV)									
M	1900.0	10.0	KYCIA	67 CNTR ++	K+P TOTAL	8/67			

97 Z ¹ (1900) WIDTH (MEV)									
W	260.0	50.0	KYCIA	67 CNTR ++		8/67			

97 Z ¹ (1900) PARTIAL DECAY MODES									
P1	Z ¹ (1900)	INTO K N			DECAY PASSES				
P2	Z ¹ (1900)	INTO N*3/2(1236) K			493+ 938				
					1236+ 493				

97 Z ¹ (1900) BRANCHING RATIOS									
R1	Z ¹ (1900)	INTO (K N)/TOTAL			(P1)/TOTAL				
R1	0.25	0.06	KYCIA	67 CNTR ++	IF J=1/2	8/67			
R1	0.10	OR LESS	CARTER	67 THEO	DISPERSION REL.	8/67			
R2	Z ¹ (1900)	INTO K N*3/2(1236)			(P2)				
R2		MAIN INELASTIC DECAY	BLAND	67 HBC ++		8/67			

REFERENCES -- Z ¹ (1900)									
TOTAL-CROSS-SECTION EXPERIMENTS ---									
COOL	66 PRL 17 102	*GIACOMELLI, KYCIA, LEONTIC, LI, LINDBY, + (BNL) I							
		-- SLIGHTLY REVISED RESULTS FROM KYCIA 67 REPLACE COOL 66 --							
KYCIA	67 PRIVATE COMM.	T F KYCIA (BNL) I							
ABRAMS	67 PRL 19 259	*COOL, GIACOMELLI, KYCIA, LEONTIC, LI, + (BNL) I							
HUGG	68 PK 168 1466	*GILMORE, KNIGHT, + (RTHFD, BRGNH, CVNDISH) I							
DISPERSION-RELATION CALCULATION USING TOTAL-CROSS-SECTION DATA ---									
CARTER	67 PRL 18 801	A A CARTER (CAVENDISH)							
CARTER	68 PKEPRINT	A A CARTER (CAVENDISH)							
PARTIAL-CROSS-SECTION EXPERIMENTS ---									
BLAND	67 PRL 18 1077	*BOHLER, BRUNN, G+S GOLDBER, SEEGER, + (LRL)							
		-- BLAND 68 IS MORE COMPLETE THAN BLAND 67 --							
BLAND	68 UCRL-18131	THESES R W BLAND (LRL)							
HIRATA	68 PRL 21 1485	HIRATA, WOH, GOLDBER, TRILLING (LRL)							
K-MATRIX (HITE 67) AND ELASTIC-SCATTERING PHASE-SHIFT ANALYSES ---									
HITE	67 THESIS	G E HITE (ILLINDIS)							
LEA	68 PR 165 1770	LEA, MARTIN, DADES (RTHFD, BNL, CERN)							
MARTIN	68 PRL 21 1287	D R MARTIN (BNL)							
PRODUCTION EXPERIMENTS ---									
TYSON	67 PRL 19 255	*GREENBERG, HUGHES, LU, MINEHART, MORI, + (YALE)							
MORI	68 PL 288 152	*GREENBERG, HUGHES, LU, ROTHBERG, + (YALE)							
BIRNBAUM	67 HEIDELBERG CONF.	*EDELSTEIN, HEIN, MCMAHON, + (CARNegie, BNL)							
BASSOMPI	68 PL 278 468	BASSOMPIERRE, + (CERN, BRUXELLES)							
LATEST RELEVANT RAPORTEUR TALKS ---									
TRIPP	68 VIENNA CONF 173	R D TRIPP (LRL)							
HARARI	68 VIENNA CONF 195	H HARARI (WEIZMANN, SLAC)							

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Data in parentheses have not been included in our averages.

Λ 18 LAMBDA (1115, JP=1/2+) I=0
 SEE LISTINGS OF STABLE PARTICLES
Λ (1320) 87 Y*0(1327, JP=) I=0
 A PEAK IN THE LAMBDA GAMMA INVARIANT MASS IS BELIEVED TO BE EVIDENCE FOR A NEW RESONANCE— A SIMILAR PEAK WAS PREVIOUSLY INTERPRETED AS A MANIFESTATION OF Y*0(1370)— SEE NOTE IN CM MASS AND WIDTH OF THIS STATE —
 CONTRADICTORY EVIDENCE ON THE RESONANCE INTERPRETATION OF THIS PEAK CAN BE FOUND IN THE DATA OF DAHL 67 — SEE TRIPP 68 FOR A DETAILED DISCUSSION
 87 Y*0(1327) MASS (MEV)
 M 1327 BUGACHEV 68 PBC 0 PI- AT 5.1 GEV/C 12/68*
 W 87 Y*0(1327) WIDTH (MEV)
 M1 25. OR LESS BUGACHEV 68 PBC 0 PI- AT 5.1 GEV/C 12/68*
 W 87 Y*0(1327) PARTIAL DECAYS
 P1 Y*0(1327) INTO LAMBDA GAMMA DECAY PASSES 1115+ 0
 R1 Y*0(1327) INTO (LAMBDA GAMMA)/TOTAL (P1)/TOTAL 36 MAIN DECAY MODE BUGACHEV 68 PBC PI- AT 5.1 GEV/C 12/68*
 REFERENCES — Y*0(1327)
 BUGACHEV 68 VIENNA 895. 87 N P BUGACHEV + (DUBNA)
 DAHL 67 PR 163 1377 DAHL, HARDY, MESS, KIRZ, MILLER (LRL)
 TRIPP 68 VIENNA CONF 173 RAPPOURTEUR 5 TALK (LRL)
Λ (1405) 37 Y*0(1405, JP=1/2-) I=0 S₀₁
 THIS RESONANCE CAN BE IDENTIFIED WITH THE VIRTUAL BOUND STATE IN THE KBAR-N SYSTEM THAT IS DEDUCED FROM THE I=0 SCATTERING LENGTH DETERMINED FROM LOW ENERGY K-P INTERACTIONS. THE DIFFICULTIES IN EXTRAPOLATING FROM THE PHYSICAL REGION TO THE RESONANCE LOCATION ARE DISCUSSED BY DALITZ 67. THE NUMBERS WE USE IN AVERAGING ARE FROM PRODUCTION EXPERIMENTS ONLY.
 37 Y*0(1405) MASS (MEV)
 M 1405.0 ALSTON 61 HBC K-P 1.15 BEV/C
 M 1410.0 ALEXANDER 62 HBC PI-P 2.1 BEV/C
 M 1405.0 ALSTON 62 HBC K-P 1.2-2.5 BEV/C
 M 1400.0 24.0 MUSGRAVE 65 HBC PBAR P 3-4 BEV/C
 M * (1382.0) (8.0) ENGLER 65 HBC PI-P, PI+D 1.68 7/66
 M * (1410.7) (1.0) KIM 65 HBC 0-EFF-RANGE FIT 7/66
 M N (1409.6) (1.7) SAKITT 65 HBC 0-EFF-RANGE FIT 7/66
 M N DATA OF SAKITT ARE USED IN FIT BY KITTEL.
 M * (1407.5) (1.2) KITTEL 66 HBC 0-EFF-RANGE FIT 7/66
 M * 67 1400.0 5.0 BIRMINGHAM 66 HBC 3.5 K- P 8/67
 M * (1403.0) (3.0) KIM 67 HBC K MATRIX FIT(KP) 6/68*
 M 120 1405.0 5.0 GALTIERI 68 DBC K-D 2.1-2.7 BEV/C
 M AVG 1402.4469 3.4978 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)
 37 Y*0(1405) WIDTH (MEV)
 W 20.0 ALSTON 61 HBC 7/66
 W 35.0 5.0 ALEXANDER 62 HBC 7/66
 W 50.0 ALSTON 62 HBC 7/66
 W 60.0 20.0 MUSGRAVE 65 HBC 7/66
 W * (89.0) (20.0) ENGLER 65 HBC 7/66
 W * (37.0) (3.2) KIM 65 HBC 7/66
 W N (128.2) (4.1) SAKITT 65 HBC 7/66
 W N DATA OF SAKITT ARE USED IN FIT BY KITTEL.
 W * (34.1) (4.1) KITTEL 66 HBC 7/66
 W * 67 50.0 10.0 BIRMINGHAM 66 HBC 3.5 K- P 9/67
 W * (150.0) (5.0) KIM 67 HBC K MATRIX FIT(KP) 6/67
 W 120 35.0 8.0 GALTIERI 68 DBC K-D 2.1-2.7 BEV/C 6/68*
 W AVG 38.1193 3.9257 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)
 37 Y*0(1405) PARTIAL DECAY MODES
 P1 Y*0(1405) INTO SIGMA PI DECAY PASSES 1197+ 139
 REFERENCES — Y*0(1405)
 ALSTON 61 PRL 6 698 +ALVAREZ, EBERHARD, GODO, GRAZIANO, + (LRL) I
 ALEXANDE 62 PRL 8 447 ALEXANDER, KALBELEISCH, MILLER, SMITH (LRL) I
 ALSTON 62 CERN CONF 311 +ALVAREZ, FERRO-LUZZI, ROSENFELD, + (LRL) I
 MUSGRAVE 65 NC 35 735 +PETMEZAS, + (BIRMGHM, CERN, EP, IMPCOL, SACLAY)
 ENGLER 65 PRL 15 224 +FISK, KRAEMER, MELTZER, WESTGARD, + (CRNG, RNL) IJ
 KIM 65 PRL 14 29 J K KIM (COLUMBIA) IJP
 SAKITT 65 PR 139 8719 +DAY, GLASSER, SEEMAN, FRIEDMAN, + (MD, LRL) IJP
 KITTEL 66 PL 21 349 W KITTEL, G OTTER, I WACEK (VIENNA) IJP
 BIRMINGHAM 66 PR 152 1148 BIRMINGHAM, GLASGOW, J.C., OXFORD, RUTHERFORD
 DALITZ 67 PR 153 1617 DALITZ, WONG, RAJASEKARAN (OXFORD, BOMBAY)
 KIM 67 PRL 19 1074 J KIM (VALE) JP
 GALTIERI 68 PRL 21 573 BARBARO-GALTIERI, CHADWICK + (LRL, SLAC)
 PAPERS NOT REFERRED TO IN DATA CARDS.
 ABRAMS 65 PR 139 8454 G S ABRAMS, B SECHI-ZORN (MD) IJP
 KADYK 66 PRL 17 599 +OREN, G+S GOLDHABER, TRILLING (MD) IJP
 DONALD 66 PL 22 711 +EDWARDS, LYS, NISAR, MOORE (LIVERPOOL)
 --- ABRAMS 65, KADYK 66, AND DONALD 66 SUPPORT THOSE EFFECTIVE-RANGE-FIT SOLUTIONS GIVING AN I=0 S_{1/2} RESONANCE.
Λ (1520) 38 Y*0(1520, JP=3/2-) I=0 D₀₃
 38 Y*0(1520) MASS (MEV)
 M 1519.4 2.0 WATSON 63 HBC K-P ALL CHANNELS
 M 145 1517.2 3.0 GALTIERI 63 DBC K-D 1.51 BEV/C
 M 29 1520.0 4.0 ALMEIDA 64 HBC K-P 1.45 BEV/C
 M * 1511.0 15.0 MUSGRAVE 65 HBC PBAR P 3-4 BEV/C 7/66
 M * 30(1510.0) (2.0) BIRMINGHAM 66 HBC 3.5 K- P 9/67
 M AVG 1518.8293 1.5284 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)

W 16.4 38 Y*0(1520) WIDTH (MEV)
 W * (19.0) (19.0) WATSON 63 HBC
 W * 30 (50.0) (10.0) MUSGRAVE 65 HBC 7/66
 W 18.0 OR LESS BIRMINGHAM 66 HBC 9/67
 W DAHL 68 HBC 9/66
 W FIT 13.207 2.292 VALUE FROM CONSTRAINED FIT
 38 Y*0(1520) PARTIAL DECAY MODES
 P1 Y*0(1520) INTO KBAR N DECAY PASSES 497+ 939
 P2 Y*0(1520) INTO SIGMA PI 1197+ 139
 P3 Y*0(1520) INTO LAMBDA PI PI 1115+ 139+ 139
 P4 Y*0(1520) INTO LAMBDA GAMMA 1115+ 0
 38 Y*0(1520) PARTIAL WIDTHS (MEV)
 M1 Y*0(1520) INTO KBAR N (P1)
 M1 4.8 WATSON 63 HBC
 M1 FIT 6.002 1.078 VALUE FROM CONSTRAINED FIT
 M2 Y*0(1520) INTO SIGMA PI (P2)
 M2 9.0 WATSON 63 HBC
 M2 FIT 5.890 1.131 VALUE FROM CONSTRAINED FIT
 38 Y*0(1520) BRANCHING RATIOS
 R1 Y*0(1520) INTO (SIGMA PI)/(KBAR N) (P2)/(P1)
 R1 1.72 .78 MUSGRAVE 65 HBC
 R1 0.73 0.11 DAUBER 67 HBC K-P AT 2.0 GEV/C 8/67
 R1 0.96 0.20 DAHL 68 HBC PI-P 1.6-4 GEV/C 9/66
 R1 AVG .7975 .0974 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)
 R1 FIT .981 .210 VALUE FROM CONSTRAINED FIT
 R2 Y*0(1520) INTO (LAMBDA PI PI)/(KBAR N) (P3)/(P1)
 R2 0.21 0.18 DAUBER 67 HBC K-P AT 2.0 GEV/C 8/67
 R2 0.17 0.05 DAHL 68 HBC PI-P 1.6-4 GEV/C 9/66
 R2 AVG .1729 .0482 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)
 R2 FIT .219 .052 VALUE FROM CONSTRAINED FIT
 R3 Y*0(1520) INTO (SIGMA PI)/(LAMBDA PI PI) (P2)/(P3)
 R3 4.5 1.0 ARMENTERO 65 HBC 7/66
 R3 3.3 1.1 BIRMINGHAM 66 HBC 3.5 K- P 9/67
 R3 4.8 1.2 UHLIG 67 HBC K-P .9-1.0 BEV/C 9/66
 R3 AVG 4.1892 .6298 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)
 R3 FIT 4.481 .559 VALUE FROM CONSTRAINED FIT
 R4 Y*0(1520) INTO (LAMBDA GAMMA)/TOTAL (P4)/TOTAL
 R4 238 0.86 0.14 MAST 68 HBC 0 K-P TO LAM. GAMMA 11/68*
 THE FOLLOWING BRANCHING FRACTIONS HAVE CORRELATED ERRORS GREATER THAN .5
 P1 P2 -.951
 REFERENCES — Y*0(1520)
 WATSON 63 PR 131 2248 M B WATSON, M FERRO-LUZZI, R D TRIPP (LRL) IJP
 GALTIERI 63 PL 6 296 A BARBARO-GALTIERI, A HUSSAIN, RO TRIPP (LRL)
 ALMEIDA 64 PL 9 204 S P ALMEIDA, G R LYNCH (CERN)
 MUSGRAVE 65 NC 35 735 +PETMEZAS, + (BIRMGHM, CERN, EP, IMPCOL, SACLAY)
 ARMENTER 65 PL 19 338 ARMENTERUS, F-LUZZI, + (CERN, HEIDEL, SACLAY)
 BIRMINGHAM 66 PR 152 1148 BIRMINGHAM, GLASGOW, J.C., OXFORD, RUTHERFORD
 DAUBER 67 PL 248 925 +PALAMUD, SCHLEIN, SLATER, STCRK (UCLA)
 UHLIG 67 PR 155 1448 +CHARLTON, CONDON, GLASSER, YCDH, + (MD, USNR)
 DAHL 68 PR 163 1377 DAHL, HARDY, MESS, KIRZ, MILLER (LRL)
 MAST 68 PRL TO BE PUBL. MAST, ALSTON, BANGERTER, GALTIERI + (LRL)

*
 Y*⁺s in the region 1600 to 1900 MeV

There is much information from production and formation experiments in this energy region; however, a consistent picture of what is going on in this energy region is not yet possible. The states with J > 3/2 are adequately treated in the listings and the table. The lower J states are badly entangled and require discussion here.

Production experiments show evidence for Σ(1610), Σ(1660), and Σ(1690), but cannot give information on the I = 0 states, since it is very difficult to disentangle the natural production of the I = 1 states. The separation of Σ(1660) and Σ(1690) is not very clear; it is based only on the evidence that in the reaction K⁻p → Y*⁺π⁻ the branching fractions for the decay Y*⁺(≈1660) into Λπ and Σπ

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change with incident K^- momentum. As for $\Sigma(1616)$, it has been detected in only one experiment (CRENNELL 68), and needs further confirmation.

Formation experiments. Partial-wave analyses in almost all channels are now available throughout this energy region. Recent results on the two-body final states

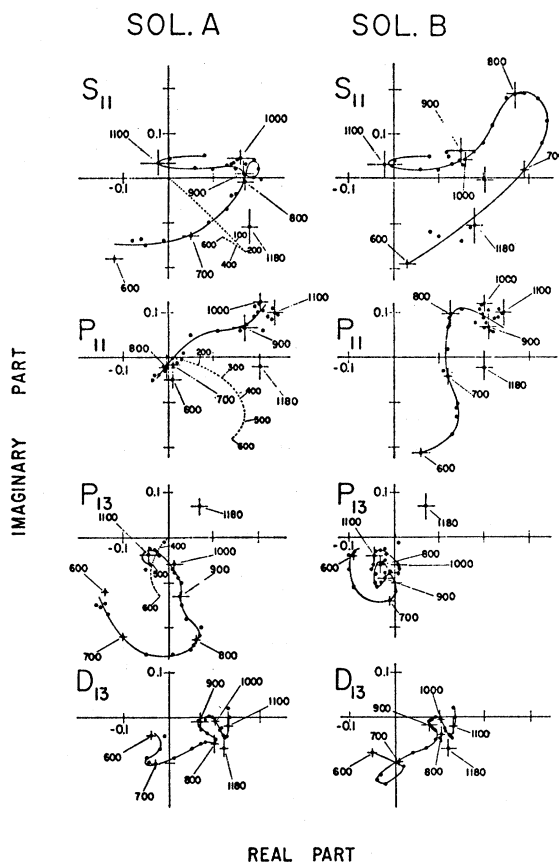
$K^-p \rightarrow \bar{K}N, \Lambda\pi, \Sigma\pi$ have been reported by:

	(ARMENTEROS 68) on $\bar{K}N$ $E_{cm} = 1.61$ to 1.98 GeV
CHS	(ARMENTEROS1 68) on $\Lambda\pi$ $E_{cm} = 1.61$ to 1.98 GeV
	(ARMENTEROS2 68) on $\Sigma\pi$ $E_{cm} = 1.61$ to 1.80 GeV
Chicago-Heid	(CONFORTO 68) and (CONFORTO1 68) on K^-p $E_{cm} = 1.69$ to 1.89 GeV
LRL	(SMART 68) on $\Lambda\pi$ $E_{cm} = 1.6$ to 1.9 GeV
PI-BNL-Yale	(BERTANZA 68) on $\bar{K}N$ $E_{cm} = 1.65$ to 1.71 GeV
BNL	(BERLEY 68) on $\Sigma\pi$ $E_{cm} = 1.61$ to 1.71 GeV

All partial-wave analyses are energy dependent (except CHS's $\Lambda\pi$) and treat each channel independently; hence each channel gives a slightly different mass and width for a given resonance. All parameterize the resonances as Breit-Wigner amplitudes, and use assorted parameterizations for the backgrounds.

The first attempt to perform an energy-independent analysis has been reported by the CHS collaboration in the $\Lambda\pi$ channel, where differential cross sections and polarizations have been measured. As expected, this type of analysis has shown a lot of structure, although better statistics are required to draw final conclusions. Four states with $J < 3/2$ show a resonant behavior between 1610 and 1670 MeV. The $\Sigma(1610)$ seen here could be identified with the one seen in production experiments by Crennell et al. This identification should still be taken with some caution:

1610 MeV is right at the bottom of the CHS mass range, and only one of the two CHS solutions requires a $\Sigma(1610)$ resonance. We reproduce their Argand diagrams, to show the statistical uncertainties present in such experiments.



Amplitudes of the two solutions of the CHS energy independent partial-wave analysis.

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We present here the table of R. D. Tripp in his rapporteur talk at the Vienna Conference, with his evaluation of the significance of the various states. The $\Lambda\pi$ enhancement at 1680 MeV, which we had in our earlier tables as $\Sigma(1690)$, can be either the S_{11} or the P_{13} seen by the CHS collaboration. There is no information from production experiments on this point, so no choice can be made. Of the four new states we list in the Baryon Table

only $\Sigma(1610)$; for the others we wait for confirmation.

In conclusion, in the 1600- to 1700-MeV region with $J \leq 3/2$, there are now established two $I = 0$ states and three $I = 1$ states, with one more awaiting confirmation. In the 1700- to 1800-MeV region there await confirmation one state with $I = 1$ and two $I = 0$ states. Above 1800 MeV there is one tentative state.

Summary of evidence for Y^* 's of $J \leq 3/2$ in the 1600- to 1900-MeV mass region.
(Table from R. D. Tripp, Proceedings of Vienna Conference, 173, 1968.)

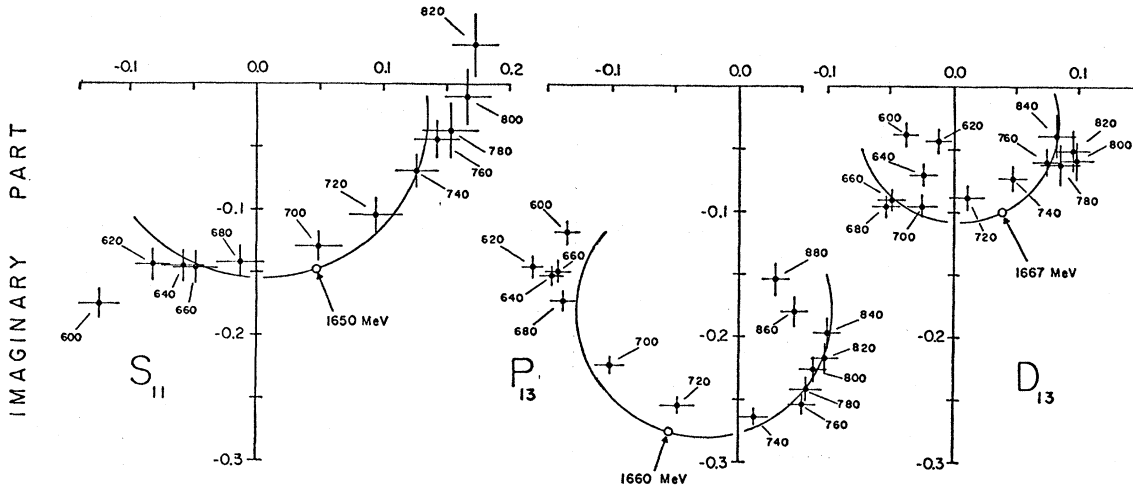
$L_{I, 2J}(J^P)$		New status			Laboratory	Quality ^a	Old states RMP 40, 77 (68)	New states
		Mass (MeV)	Width (MeV)	Br. fract. (%)				
$S_{01}(1/2^-)$	$\Lambda\eta$ resonance at ≈ 1670 MeV	$\bar{K}N$	1663	26	14	} CHS BNL	A	$\Lambda(1670)^c$
		$\Sigma\pi$	1678	26	45			
		$\Delta\eta$	1670	18	28			
--	--	$\bar{K}N$	1750	110	20	Ch+H	C	$\Lambda(1750)$
$S_{11}(1/2^-)$	$\Lambda\pi$ enhance- ment ^b at ≈ 1680 MeV	$\bar{K}N$	--	--	7-10	} CHS	B	$\Sigma(1650)$
		$\Delta\pi$	1650	100	70-100			
		$\Sigma\pi$	--	--	--			
--	$\Sigma\eta$ threshold effect at ≈ 1750 MeV	$\bar{K}N$	1769	123	12	Ch+H	B	$\Sigma(1780)$
$P_{01}(1/2^+)$	--	$\bar{K}N$	1745	147	40	} CHS	C	$\Lambda(1745)$
		$\Sigma\pi$	--	--	--			
$P_{11}(1/2^+)$	--	$\bar{K}N$	--	--	2-10	} CHS BNL (no J^P dat.)	B	$\Sigma(1610)^c$
		$\Delta\pi$	1610	60	20-100			
		$\Sigma\pi$	--	--	--			
		$\Delta\pi$ prod.	1616	60	--			
--	--	$\Delta\pi$	1882	222	--	LRL	C	$\Sigma(1880)$
$P_{03}(3/2^+)$	--	--	--	--	--	--	--	--
$P_{13}(3/2^+)$	See footnote b	$\bar{K}N$	--	--	4-10	} CHS	C	$\Sigma(1690)^c$
		$\Lambda\pi$	1660	80	40-100			
		$\Sigma\pi$	--	--	--			
$D_{03}(3/2^-)$	$\Lambda(1690)$	$\bar{K}N$	1696	35	18	} CHS	A	$\Lambda(1700)^c$
		$\Sigma\pi$	1681	85	60			
		$\Sigma\pi\pi$	--	--	20			
$D_{13}(3/2^-)$	$\Sigma(1660)$	$\bar{K}N$	1668	56	9	CHS	A	$\Sigma(1660)^c$
		$\Delta\pi$	1667	50	29			
		$\Sigma\pi$	1661	44	49			
		$\Lambda(1405)\pi$	--	--	~ 8			
		$\Lambda\pi\pi$	--	--	~ 10			

a. A stands for "well established," B for "good evidence but in need of confirmation," C for "shaky evidence."
 b. It is not clear if $\Sigma(1690)$ seen in production experiments corresponds to the S_{11} or to the P_{13} state detected by the CHS collaboration in their $\Lambda\pi$ energy-independent partial-wave analysis. We temporarily list $\Sigma(1690)$ as the P_{13} state.
 c. This state is included in the Baryon Table.

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Data in parentheses have not been included in our averages.

REAL PART



S_{11} , P_{13} , and D_{13} of solution A in the resonant region. Arrows indicate positions of resonance.

$\Lambda(1670)$ 40 $Y^*(1670, JP=1/2^-) I=0$ S_{01}
 SEE NOTE ABOVE
 SEE ALSO NOTE IN $Y^*(1327)$ LISTINGS
 40 $Y^*(1670)$ MASS (MEV)

M	B	[1680.0]	Y-CHANG 64 PBC	PI-PRP 7-8 BEV/C	7/66
M	N	1670.0	BERLEY 65 HBC	K-P TO LAM ETA	7/66
M	N	50(1645.0)	(6.0) BIRMINGHAM 66 HBC	K-P AT 3.5 GEV/C	11/67
M	B	(1680.1)	BURELEV 67 PBC	PI-PRP AT 4GEV/C	8/67
M	S	1663. 3.	ARMENTERO 68 HBC	O K-P ELAST.+CEXC.	11/68*
M	S	1678. 2.	ARMENTERO 68 HBC	O K-P TO SIGMA PI	11/68*

M N AUTHORS SEE A SIGNAL IN NEUTRAL (Σ IG PI) BUT NOT IN CHARGED. IT IS NOT CLEAR THAT IT CORRESPONDS TO THIS STATE
 M S SYSTEMATIC ERRORS NOT INCLUDED. ONLY INDETERM. IN FIT QUOTED
 M B THESE TWO EXPERIMENTS HAVE DETECTED A PEAK IN THE LAMBDA GAMMA MASS
 M B PLOT. A NEW SIMILAR EXPERIMENT IN A LARGER CHAMBER SUGGESTS THAT
 M B THIS PEAK SHOULD NOT BE ASSIGNED TO $Y^*(1670)$ -SEE NOTE FOR $Y^*(1327)$
 M
 M AVG 1673.3846 6.9231 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 4.2)

40 $Y^*(1670)$ WIDTH (MEV)

W	B	20.0	DR LESS	Y-CHANG 64 PBC	7/66
W	N	18.0	BERLEY 65 HBC	K-P TO LAM ETA	7/66
W	N	50 (40.0)	(10.0) BIRMINGHAM 66 HBC	K-P AT 3.5 GEV/C	11/67
W	B	20. OR LESS	BURELEV 67 PBC	PI-PRP AT 4GEV/C	8/67
W	S	26. 8.	ARMENTERO 68 HBC	O K-P ELAST.+CEXC.	11/68*
W	S	26. 5.	ARMENTERO 68 HBC	O K-P TO SIGMA PI	11/68*

M N AUTHORS SEE A SIGNAL IN NEUTRAL (Σ IG PI) BUT NOT IN CHARGED. IT IS NOT CLEAR THAT IT CORRESPONDS TO THIS STATE
 M S SYSTEMATIC ERRORS NOT INCLUDED. ONLY INDETERM. IN FIT QUOTED
 M B SEE NOTE IN MASS ABOVE
 W AVG 26.0000 4.2400 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)

40 $Y^*(1670)$ PARTIAL DECAY MODES

P1	$Y^*(1670)$ INTO KBAR N	497+ 939
P2	$Y^*(1670)$ INTO LAMBDA ETA	1197+ 139
P3	$Y^*(1670)$ INTO SIGMA PI	1197+ 139+ 139

40 $Y^*(1670)$ BRANCHING RATIOS

R1	$Y^*(1670)$ INTO (KBAR N)/TOTAL	(P1)/TOTAL	O K-P ELAST.+CEXC.	11/68*
R1	0.14	0.04	ARMENTERO 68 HBC	
R2	$Y^*(1670)$ INTO ((SIGMA PI)*(KBAR N))/TOTAL**2	(P3*P1)/TOTAL**2	O K-P TO SIGMA PI	11/68*
R2	0.063	0.03	ARMENTERO 68 HBC	
R3	$Y^*(1670)$ INTO ((KBAR N)(LAM ETA))/TOTAL**2	(P1*P2)/TOTAL**2		7/66
R3	0.046		BERLEY 65 HBC	

REFERENCES -- $Y^*(1670)$

Y-CHANG 64 DUBNA CONF I 615
 BERLEY 65 PRL 15 641
 BIRMINGHAM 66 PR 152 1148
 BURELEV 67 PL 248 246
 ARMENTERO 68 NP TO BE PUBLIS.
 ARMENTERO 68 PREPRINT

YUNG-CHANG, IN, KLDNITSKAYA, + (DUBNA) I
 *CONNOLLY, HART, RAHM, STONEHILL, + (BNL) IJP
 BIRMINGHAM, GLASGOW, I. C., OXFORD, RUTHER (ORD)
 *CHADRONA, CHUVILO, HI IN+ (JINR, BUC, CERN)
 ARMENTEROS, BAILLON + (CERN+HEID+SACLAY) IJP
 ARMENTEROS+BAILLON + (CERN+HEID+SACLAY) IJP

$\Lambda(1700)$ 55 $Y^*(1700, JP=3/2^-) I=0$ D_{03}
 SEE NOTE PRECEDING $Y^*(1670)$ LISTINGS
 55 $Y^*(1700)$ MASS (MEV)

M	*	(1698.0)	DAVIES 67 CNTR	K-P, D TCTAL	11/66	
M	S	1696. 3.	ARMENTERO 68 HBC	O K-P ELAST.+CH. EX	11/68*	
M	S	1681.0	2.0	ARMENTERO 68 HBC	O K-P TO SIGMA PI	11/68*
M	S	1681.0	8.0	BARTLEY 68 DBC	O K-P AND K-D DATA	11/68*
M	S	1701. 2.0	BERTANZA 68 HBC	O KP ELAS.+CH. EX.	11/68*	
M	S	1695.0	4.0	BUGG 68 CNTR	K-P, D TOTAL	7/68*
M	C	(1697.1)	(2.1)	CONFORTO 68 HBC	O K-P ELASTIC	11/68*

M C FIT TO K-P ELAS. DIFFER. CROSS SECTIONS (PART OF DATA INCLUDED IN M C ARMENTEROS 68 WHICH FIT LEGEN. POLYN. COEFFICENTS)
 M S SYSTEMATIC ERRORS NOT INCLUDED. ONLY INDETERM. IN FIT QUOTED 11/67
 M AVG 1691.9421 4.4555 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 3.7)

55 $Y^*(1700)$ WIDTH (MEV)

W	S	35. 7.	ARMENTERO 68 HBC	O K-P ELAST.+CH. EX	11/68*	
W	S	(85.0)	(7.0)	ARMENTERO 68 HBC	O K-P TO SIGMA PI	11/68*
W	S	48.0	15.0	BARTLEY 68 DBC	O K-P AND K-D DATA	11/68*
W	S	24. 3.0	BERTANZA 68 HBC	O KP ELAS.+CH. EX.	11/68*	
W	C	40.0	10.0	BUGG 68 CNTR	TOTAL CROSS SECT	11/66
W	S	(27.1)	(5.1)	CONFORTO 68 HBC	O NOTE C IN MASS	11/68*

M S SYSTEMATIC ERRORS NOT INCLUDED. ONLY INDETERM. IN FIT QUOTED 11/67
 W AVG 27.3649 3.6820 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.4)

55 $Y^*(1700)$ PARTIAL DECAY MODES

P1	$Y^*(1690)$ INTO KBAR N	497+ 939
P2	$Y^*(1690)$ INTO SIGMA PI	1197+ 139
P3	$Y^*(1690)$ INTO SIGMA PI PI	1197+ 139+ 139
P4	$Y^*(1670)$ INTO LAMBDA PI PI	1115+ 139+ 139

55 $Y^*(1700)$ BRANCHING RATIOS

R1	$Y^*(1700)$ INTO (KBAR N)/TOTAL	(P1)/TOTAL	DAVIES 67 CNTR	(P1)/TOTAL	11/66
R1	0.24	0.03	ARMENTERO 68 HBC	ASSURING J=3/2	11/66
R1	0.18	0.03	ARMENTERO 68 HBC	O K-P ELAST.+CH. EX	11/68*
R1	0.28	0.02	BERTANZA 68 HBC	O KP ELAS.+CH. EX.	11/68*
R1 C	(0.22)	(0.03)	CONFORTO 68 HBC	O NOTE C IN MASS	11/68*
R1	0.2492	0.0462			
R1	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 2.8)				
R2	$Y^*(1700)$ INTO ((SIGMA PI)*(KBAR N))/TOTAL**2	(P2*P1)/TOTAL**2			8/67
R2	0.096	0.013	ARMENTERO 68 HBC	O K-P TO SIGMA PI	11/68*
R2	0.073		BERLEY 65 HBC	O K-P +D-82 BEV/C	11/68*
R3	$Y^*(1700)$ INTO ((LAMBDA PI PI)*(KBAR N))/TOTAL**2	(P4*P1)/TOTAL**2			11/68*
R3	0.06	0.01	BARTLEY 68 DBC	O K-P AND K-D DATA	11/68*
R4	$Y^*(1700)$ INTO ((SIGMA PI PI)/TOTAL ABOUT 0.25	(P3)/TOTAL	ARMENTERO 68 HBC	K-P AND K-D	11/68*

REFERENCES -- $Y^*(1690)$

DAVIES 67 PRL 18 62
 ARMENTERO 68 NP TO BE PUBLIS.
 ALSO 67 NP 93 592
 ARMENTERO 68 PREPRINT
 ALSO 67 PL 248 198

*DOWELL, HATTERSLEY, HOMER+ (BIRMI, CAMB, RUTH) I
 ARMENTEROS, BAILLON + (CERN+HEID+SACLAY) IJP
 ARMENTEROS, FERRO-LUZZI+ (CERN+HEID+SACLAY) IJP
 ARMENTEROS+BAILLON + (CERN+HEID+SACLAY) IJP
 ARMENTEROS, FERRO-LUZZI+ (CERN+HEID+SACLAY) IJP

BARYON RESONANCES

Data in parentheses have not been included in our averages.

ARMEN3 68 VIENNA CONF ARMENTEROS, BAILLON + (CERN+HEID+SACLAY) I
 BARTLEY 68 PRL 21 1111 BARTLEY, CHU, DOWD, SIMS, MEER* (TUFTS+PLD+BR) +
 BERLEY 68 VIENNA CONF BERLEY, HART, RAHM, WILLIS, YAMAMOTO (BNL)
 BERTANZA 68 PR TO BE PUBLIS. BERTANZA, BIGI+BERLEY, HART* (PISA+BNL+YALE) JP
 BUGG 68 PR 168 1466 *GILMORE, KNIGHT, DAVIES* (BIRM, CAMB, RUTH) I
 CONFORTO 68 EPI 68-62 NP TBP. B. CONFORTO, HARMSEN+BURKHARDT* (EFINS+HEID)

Δ (1745) 77 Y*(1745, JP=1/2+) I=0 P₀₁
 SEE NOTE PRECEDING Y*(1670) LISTINGS

PARTIAL WAVE ANALYSIS OF CHS COLLABORATION INDICATES PRESENCE OF THIS STATE ONLY IN KBAR N -

77 Y*(1745) MASS (MEV) -----

M 1745. ARMENTER 68 HBC O K-P .6-1.2 GEV/C 11/68*

77 Y*(1745) WIDTH (MEV) -----

W 147. ARMENTER 68 HBC K-P ELAST.+CH. EX 11/68*

77 Y*(1745) PARTIAL DECAY MODES -----

DECAY MASSES
 P1 Y*(1745) INTO KBAR N 497+ 939
 P2 Y*(1745) INTO SIGMA PI 1197+ 139

77 Y*(1745) BRANCHING RATIOS -----

R1 Y*(1745) INTO (KBAR N)/TOTAL (P1)/TOTAL
 R1 0.40 ARMENTER 68 HBC O K-P .6-1.2 GEV/C 11/68*

REFERENCES -- Y*(1745)

ARMEN3 68 NP TO BE PUBLIS. ARMENTEROS, BAILLON + (CERN+HEID+SACLAY) IJP

Δ (1750) 76 Y*(1750, JP=1/2-) I=0 P₀₁
 SEE NOTE PRECEDING Y*(1670) LISTINGS

PARTIAL WAVE ANALYSIS OF K-P DATA (PART OF WHICH ARE INCLUDED IN CHS ANALYSIS) INDICATES THE PRESENCE OF SUCH STATE

76 Y*(1750) MASS (MEV) -----

M 1750. CONFORT1 68 HBC O K-P ELASTIC 11/68*

76 Y*(1750) WIDTH (MEV) -----

W 110. CONFORT1 68 HBC O K-P ELASTIC 11/68*

76 Y*(1750) PARTIAL DECAY MODES -----

DECAY MASSES
 P1 Y*(1750) INTO KBAR N 497+ 939

76 Y*(1750) BRANCHING RATIOS -----

R1 Y*(1750) INTO (KBAR N)/TOTAL (P1)/TOTAL
 R1 0.2 CONFORT1 68 HBC O K-P ELASTIC 11/68*

REFERENCES -- Y*(1750)

CONFORT1 68 VIENNA CONF CONFORTO, LEVI-SETTI, KLUGE* (CHICAGO+HEID)

Δ (1815) 39 Y*(1815, JP=5/2+) I=0 F₀₅
 39 Y*(1815) MASS (MEV) -----

M * (1815.0) GALTIERI 63 K-P RVUE 7/66
 M 1815.0 BIRGE 65 HBC KBAR N, LAM PI PI 7/66
 M 50 1810.0 20.0 BIRMINGHAM 66 HBC 3.5 K-P 9/67
 M N (1811.0) (4.0) GELFAND 66 HBC O K-P ELASTIC 8/67
 M N RES + DIFFRACTIVE BGD FOR K-P EL-- DATA ARE IN ARMENT 68 FITS TO

M S 1813.0 2.0 ARMENTER 67 HBC O K-P TO SIGMA PI 8/67
 M S 1816.0 4.0 BELL 67 HBC OKP, KD TO SIG PI 11/67
 M S 1817. 2. ARMENTER 68 HBC O K-P ELAST.+CH. EX 11/68*

M 1819.0 4.0 BUGG 68 CNTR K-P, D TOTAL 6/68*

M C (1816.) (2.) CONFORTO 68 HBC O K-P ELASTIC 11/68*

M C FIT TO K-P ELAS. DIFFER. CROSS SECTIONS (PART OF DATA INCLUDED IN

M C ARMENTEROS 68 WHICH FIT LEGEN. POLYN. COEFFICIENTS)

M S SYSTEMATIC ERROR NOT INCLUDED . ONLY INDETERM. IN FIT QUOTED 6/68*

M AVG 1815.4781 1.2624 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)

39 Y*(1815) WIDTH (MEV) -----

W * (70.0) GALTIERI 63 K-P RVUE 7/66
 W 60.0 BIRGE 65 HBC 3.5 K-P 9/67
 W 50 110.0 50.0 BIRMINGHAM 66 HBC O K-P ELASTIC 8/67
 W N RES + DIFFRACTIVE BGD FOR K-P EL-- DATA ARE IN ARMENT 68 FITS TO

W N (73.0) (10.0) GELFAND 66 HBC O K-P ELASTIC 8/67
 W N 87.0 15.0 ARMENTER 67 HBC O K-P TO SIGMA PI 8/67
 W 64.0 12.0 BELL 67 HBC OKP, KD TO SIG PI 11/67
 W S 71. 4. ARMENTER 68 HBC O K-P ELAST.+CH. EX 11/68*

W S 75.0 7.0 BUGG 68 CNTR K-P, D TOTAL 6/68*

W C (72.) (7.) CONFORTO 68 HBC O NOTE C IN MASS 11/68*

M S SYSTEMATIC ERROR NOT INCLUDED . ONLY INDETERM. IN FIT QUOTED 6/68*

M AVG 72.2644 3.2496 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)

39 Y*(1815) PARTIAL DECAY MODES -----

DECAY MASSES
 P1 Y*(1815) INTO KBAR N 497+ 939
 P2 Y*(1815) INTO SIGMA PI 1197+ 139
 P3 Y*(1815) INTO Y*(1385) PI 1385+ 139
 P4 Y*(1815) INTO LAMBDA ETA 1115+ 548
 P5 Y*(1815) INTO SIGMA PI PI 1197+ 139+ 139

39 Y*(1815) BRANCHING RATIOS -----

R1 Y*(1815) INTO (KBAR N)/TOTAL (P1)/TOTAL
 R1 0.81 GALTIERI 63 K-P RVUE 7/66
 R1 N (0.67) (0.08) GELFAND 66 HBC O K-P ELASTIC 8/67

R1 0.80 KYCIA 67 CNTR TOTAL CROSS-SEC. 8/67
 R1 0.62 ARMENTER 68 HBC O K-P ELAST.+CH. EX 11/68*
 R1 0.72 BUGG 68 CNTR 6/68*
 R1 C (0.45) (0.01) CONFORTO 68 HBC O NOTE C IN MASS 11/68*
 R1 N RES + DIFFRACTIVE BGD FOR K-P EL-- DATA ARE IN ARMENT 68 FITS TO

R2 Y*(1815) INTO (SIGMA PI)*(KBAR N)/TOTAL**2 (P2*P1)/TOTAL**2
 R2 0.073 0.005 ARMENTER 67 HBC O 8/67
 R2 0.054 0.012 BELL 67 HBC OKP, KD TO SIG PI 11/67

R2 AVG .0702 .0067 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.5)

R3 Y*(1820) INTO (Y*(1385) PI)*(KBAR N)/TOTAL**2 (P3*P1)/TOTAL**2
 R3 0.057 0.013 ARMENTE2 67 HBC O K-P TO LAM.PI PI 8/67

R4 Y*(1815) INTO (Y*(1385) PI)/TOTAL (P3)/TOTAL
 R4 0.20 0.05 BIRGE 65 HBC 7/66

R5 Y*(1815) INTO (SIGMA PI)/TOTAL (P5)/TOTAL
 R5 C ABOUT 0.03 ARMENTE3 68 HBC K-P AND K-D 11/68*
 R5 C CONSISTENT WITH SIG 2PI MODE OF THE Y*(1385)+PI DECAY 11/68*

REFERENCES -- Y*(1815)

GALTIERI 63 PL 6 296 A BARBARO-GALTIERI, A HUSSAIN, RD TRIPP (LRL) IJ
 BIRGE 65 ATHENS CONF 296 +ELY, KALMUS, KERNAN, LOUIE, SAHOURIA, + (LRL) IJP
 BIRMINGHAM 66 PR 152 1148 BIRMINGHAM, GLASGOW, I. C., OXFORD, RUTHER (ORD)
 GELFAND 66 PRL 17 1224 *HARMSEN, LEVI-SETTI, PREDAZZI* (EFINS, ARGON)
 ALSO 68 PR 163 1792 LASINSKI, LEVI-SETTI, PREDAZZI (EFINS) IJP

ARMEN3 67 PL 248 198 ARMENTEROS, FERRO-LUZZI+ (CERN, HEID, SACLAY) IJP
 ARMENTE2 67 ZEIT. PHYS. 202, 486 ARMENTEROS, FERRO-LUZZI+ (CERN, HEID, SACLAY) IJP
 BELL 67 PRL 19 936 R B BELL (L R L)
 KYCIA 67 PRIVATE COMM. T F KYCIA (BNL) I
 ARMENTER 68 NP TO BE PUBLIS. ARMENTEROS, BAILLON + (CERN+HEID+SACLAY) IJP
 M ALSO 67 NP 83 592 ARMENTEROS, FERRO-LUZZI+ (CERN, HEID, SACLAY) IJP
 ARMENTE3 68 VIENNA CONF ARMENTEROS, BAILLON + (CERN+HEID+SACLAY) IJP
 BUGG 68 PR 168 1466 *GILMORE, KNIGHT, DAVIES* (BIRM, CAMB, RUTH) I
 CONFORTO 68 EPI 68-62 NP TBP. B. CONFORTO, HARMSEN+BURKHARDT* (EFINS+HEID)

PAPERS NOT REFERRED TO IN DATA CARDS.

CHAMBERL 62 PR 125 1696 CHAMBERLAIN, CRONE, KEEFE, WERTH, + (LRL) I
 -- FIRST SEEN IN CHAMBERLAIN 62 TOTAL CROSS SECTION MEASUREMENTS.
 SODICKSON 64 PK 133 B757 SODICKSON, MANNELLI, FRISCH, WAHLIG (MIT) (BNL) J
 HOLLEY 65 UCRL-16274 THESIS W R HOLLEY (LRL) J
 -- SODICKSON 64 AND HOLLEY 65 ELASTIC SCATTERING WORK INDICATED J=5/2.

Δ (1830) 56 Y*(1830, JP=5/2-) I=0 D₀₅
 56 Y*(1830) MASS (MEV) -----

M S 1827.0 3.0 ARMENTER 67 HBC O K-P TO SIGMA PI 8/67
 M S 1837. 11. BELL 67 HBC OKP, KD TO SIG PI 11/67
 M S 1807. 10. ARMENTER 68 HBC O K-P ELAST.+CH. EX 11/68*
 M C (1840.) (5.) CONFORTO 68 HBC O K-P ELASTIC 11/68*

M C FIT TO K-P ELAS. DIFFER. CROSS SECTIONS (PART OF DATA INCLUDED IN

M C ARMENTEROS 68 WHICH FIT LEGEN. POLYN. COEFFICIENTS)

M S SYSTEMATIC ERROR NOT INCLUDED . ONLY INDETERM. IN FIT QUOTED 6/68*

M AVG 1826.0929 4.2710 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.5)

56 Y*(1830) WIDTH (MEV) -----

M S (75.0) (9.0) ARMENTER 67 HBC O K-P TO SIGMA PI 8/67
 M S (74.0) (18.0) BELL 67 HBC OKP, KD TO SIG PI 11/67
 M S (123.) (32.) ARMENTER 68 HBC O K-P ELAST.+CH. EX 11/68*
 W C (66.) (25.) CONFORTO 68 HBC O NOTE C IN MASS 11/68*
 M S SYSTEMATIC ERROR NOT INCLUDED . ONLY INDETERM. IN FIT QUOTED 6/68*

56 Y*(1830) PARTIAL DECAY MODES -----

DECAY MASSES
 P1 Y*(1830) INTO KBAR N 497+ 939
 P2 Y*(1830) INTO SIGMA PI 1197+ 139

56 Y*(1830) BRANCHING RATIOS -----

R1 Y*(1830) INTO (KBAR N)/TOTAL (P1)/TOTAL
 R1 0.09 0.01 ARMENTER 68 HBC O K-P ELAST.+CH. EX 11/68*
 R1 C (0.10) (0.01) CONFORTO 68 HBC O NOTE C IN MASS 11/68*

R2 Y*(1830) INTO (SIGMA PI)*(KBAR N)/TOTAL**2 (P2*P1)/TOTAL**2
 R2 0.0225 0.006 ARMENTER 67 HBC O K-P TO SIG PI 8/67
 R2 0.037 0.003 BELL 67 HBC OKP, KD TO SIG PI 11/67

R2 AVG .0341 .0058 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 2.2)

REFERENCES -- Y*(1830)

ARMEN3 67 PL 248 198 ARMENTEROS, FERRO-LUZZI+ (CERN, HEID, SACLAY) IJP
 BELL 67 PRL 19 936 R B BELL (L R L)
 ARMENTER 68 NP TO BE PUBLIS. ARMENTEROS, BAILLON + (CERN+HEID+SACLAY) IJP
 M ALSO 67 NP 83 592 ARMENTEROS, FERRO-LUZZI+ (CERN, HEID, SACLAY) IJP
 CONFORTO 68 EPI 68-62 NP TBP. B. CONFORTO, HARMSEN+BURKHARDT* (EFINS+HEID)

Δ (1860) 60 Y*(1860, JP=7/2+) I=0 F₀₇
 PARTIAL WAVE ANALYSIS OF ELASTIC AND CHARGE EXCHANGE DATA REQUIRE A RESONANT F07 AMPLITUDE. EXISTENCE NOT CONCLUSIVELY ESTABLISHED. SEEN ALSO IN FORMATION EXPERIMENT. FIT TO TOTAL CROSS SECTION DATA IMPROVES IF THIS STATE IS ACCEPTED.

60 Y*(1860) MASS (MEV) -----

M S 1864. 2. ARMENTER 68 HBC O K-P ELAST.+CH. EX 11/68*
 M 1870.0 5.0 BUGG 68 CNTR K-P, D TOTAL 7/68*
 M C (1865.) (2.) CONFORTO 68 HBC O K-P ELASTIC 11/68*
 M N (1860.0) (10.0) GALTIERI 68 HBC K-D 2.1-2.7BEV/C 6/68*
 M S SYSTEMATIC ERROR NOT INCLUDED . ONLY INDETERM. IN FIT QUOTED 6/68*

M N SIGNAL SEEN ONLY IN NEUTRAL STATE--NARROW WIDTH SUGGESTS THIS ASSIG.

M C FIT TO K-P ELAS. DIFFER. CROSS SECTIONS (PART OF DATA INCLUDED IN

M C ARMENTEROS 68 WHICH FIT LEGEN. POLYN. COEFFICIENTS)

M AVG 1864.8276 2.0690 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.1)

BARYON RESONANCES

Data in parentheses have not been included in our averages.

----- Y*0(1860) WIDTH (MEV) -----
M S 39. 7. ARMENTERGO 68 HBC 0 K-P ELAST.+CH. EX 11/68*
M 40. 10. BUGG 68 CNTR K-P, D TOTAL 7/68*
M C (49.) (9.) CONFORTO 68 HBC 0 NOTE C IN MASS 11/68*
M 35.01 (10.01) GALTIERI 68 DBC K-D 2.1-2.7BEV/C 6/68*
M S SYSTEMATIC ERROR NOT INCLUDED - ONLY INDETERM. IN FIT QUOTED 6/68*
M * * * * *
M AVG 39.3289 5.7346 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)
M SIGNAL SEEN ONLY IN NEUTRAL STATE - NARRC WIDTH SUGGESTS THIS ASSIG.

----- Y*0(1860) PARTIAL DECAY MODES -----
P1 Y*0(1860) INTO KBAR N DECAY MASSES 497+ 939
P2 Y*0(1860) INTO SIGMA PI 1197+ 139

----- Y*0(1860) BRANCHING RATIOS -----
R1 Y*0(1860) INTO (KBAR N)/TOTAL (P1)/TOTAL
R1 0.12 0.02 ARMENTERGO 68 HBC 0 K-P ELAST.+CH. EX 11/68*
R1 0.10 0.02 BUGG 68 CNTR K-P, D TOTAL 7/68*
R1 C (0.10) (0.04) CONFORTO 68 HBC 0 NOTE C IN MASS 11/68*
R2 Y*0(1860) INTO SIGMA PI / TOTAL (P2)/TOTAL
R2 * SEEN - NO RATIO GIVEN GALTIERI 68 DBC 6/68*

***** REFERENCES -- Y*0(1860) *****
ARMENTERGO 68 NP TO BE PUBLIS. ARMENTERGO, BAILLON + (CERN+HEID+SACLAY) JP
ALSO 67 NP 83 392 ARMENTERGO, FERRO-LUZZI + (CERN+HEID+SACLAY) JP
BUGG 68 PR 168 1466 + GILMORE, KNIGHT, DAVIES + (BIRM., CMB, CVNDSH) I
CONFORTO 68 EF 68-62 NP TDP. B. CONFORTO, HARMSEN+BURKHARDT + (EFINS+HEID)
GALTIERI 68 PRL 21 573 BARBARO-GALTIERI, CHADNICK + (LRL, SLAC)

----- $\Lambda(2100)$ 41 Y*0(2100, JP=7/2-) I=0 -----
WOHL 66 AND DAUM 68 FMD JP=7/2-
----- 41 Y*0(2100) MASS (MEV) -----
M * (2097.0) (6.0) BOCK 65 HBC PBAR P 5.7 BEV/C 7/66
M * (2120.0) WOHL 66 HBC K-P CH ER 7/66
M 2103.0 10.0 KYCIA 67 CNTR K-P, D TOTAL 8/67
M 2100.0 7.0 BUGG 68 CNTR K-P, D TOTAL 6/68*
M AVG 2100.9866 5.7346 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)

----- 41 Y*0(2100) WIDTH (MEV) -----
M * (24.0) (14.0) (24.0) BOCK 65 HBC INTO KBAR N (P1) 7/66
M * (145.0) WOHL 66 HBC 7/66
M 143.0 10.0 KYCIA 67 CNTR 8/67
M 140.0 15.0 BUGG 68 CNTR 6/68*
M AVG 142.0769 8.3205 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)

----- 41 Y*0(2100) PARTIAL DECAY MODES -----
P1 Y*0(2100) INTO KBAR N DECAY MASSES 497+ 939
P2 Y*0(2100) INTO SIGMA PI 1197+ 139
P3 Y*0(2100) INTO LAMBDA ETA 1115+ 548
P4 Y*0(2100) INTO XI K 1321+ 497
P5 Y*0(2100) INTO LAMBDA OMEGA 1115+ 783
P6 Y*0(2100) INTO KBAR N PI 497+ 939+ 139

----- 41 Y*0(2100) BRANCHING RATIOS -----
R1 Y*0(2100) INTO (KBAR N)/TOTAL (P1)/TOTAL
R1 0 (0.25) WOHL 66 HBC 7/66
R1 0.323 0.013 KYCIA 67 CNTR 8/67
R1 0.305 BUGG 68 CNTR 6/68*
R2 Y*0(2100) INTO SIGMA PI (P2)
R2 SEEN GALTIERI 68 HBC K-P TO SIGMA PI 11/68*
R3 Y*0(2100) INTO (LAMBDA ETA)+(KBAR N)/TOTAL**2 (P3)/(P1)/TOTAL**2
R3 0.0087 OR LESS FLATTE 2 67 HBC K-P TO LAM ETA 6/68*
R4 Y*0(2100) INTO (XI K)+(KBAR N)/TOTAL**2 (P4)/(P1)/TOTAL**2
R4 0.0029 TRIPP 67 RVUE 8/67
R4 MAYBE SEEN BURGUN 68 HBC K-P TO XI K 11/68*

----- 41 Y*0(2100) BRANCHING RATIOS -----
R5 Y*0(2100) INTO (LAMBDA OMEGA)/TOTAL (P5)/TOTAL
R5 0.1 OR LESS FLATTE 1 67 HBC 8/67
R6 Y*0(2100) INTO (KBAR N PI)/TOTAL (P6)/TOTAL
R6 SEEN BOCK 65 HBC

***** REFERENCES -- Y*0(2100) *****
BOCK 65 PL 17 166 +COOPER, FRENCH, KINSON, + (CERN+SACLAY)
CDOL 66 PRL 16 1228 +GIACOMELLI, KYCIA, LEDNTIC, LI, LUNDROY, + (BNL) I
CDOL --- SLIGHTLY REVISED RESULTS FROM KYCIA 67 REPLACE CDOL 66 --- (BNL) I
KYCIA 67 PRIVATE COMM. T F KYCIA
WOHL 66 PRL 17 107 C G WOHL, F T SOLMITZ, M L STEVENSON (LRL) JP
FLATTE 1 67 PR 155 1517 S M FLATTE (LRL)
TRIPP 67 NP 83 10 + LEITH, + (LRL, SLAC, CERN, HEIDEL, SACLAY)
FLATTE 2 67 PR 163 1441 S M FLATTE, C G WOHL (LRL)
BUGG 68 PR 168 1466 +GILMORE, KNIGHT, + (RTHFD, BRMGHM, CVNDSH) I
DAUM 68 NP 87 19 +ERNE, LAGNAUX, SENS, STEUER, UDD (CERN) JP
GALTIERI 68 PRIVATE COMM. L BARBARO-GALTIERI (LRL)
BURGUN 68 PREPRINT +MEYER, PAULI, + (SACLAY, COLFRANCE, RTHFD)
--- A RESONANCE-LIKE EFFECT IS SEEN IN THIS REGION IN THE REACTION
K-P TO XI K, BUT A PERHAPS MORE LIKELY EXPLANATION OF THE DATA IS
IN TERMS OF A δ SO FAR OTHERWISE UNOBSERVED RESONANCE HAVING SPIN
LESS THAN 7/2. THE SITUATION REMAINS TO BE CLARIFIED.

----- $\Lambda(2350)$ 42 Y*0(2350, JP=) I=0 -----
DAUM 68 FAVORS JP=7/2- OR 9/2+.

----- 42 Y*0(2350) MASS (MEV) -----
M 2352.0 11.0 KYCIA 67 CNTR K-P, D TCTAL 8/67
M 2340.0 7.0 BUGG 68 CNTR K-P, D TOTAL 6/68*
M * * * * *
M AVG 2343.4588 5.9056 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)

----- 42 Y*0(2350) WIDTH (MEV) -----
M 210.0 50.0 KYCIA 67 CNTR 8/67
M 140.0 20.0 BUGG 68 CNTR 6/68*
M * * * * *
M AVG 149.6552 24.1379 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.3)

----- 42 Y*0(2350) PARTIAL DECAY MODES -----
P1 Y*0(2350) INTO KBAR N DECAY MASSES 497+ 939

----- 42 Y*0(2350) BRANCHING RATIOS -----
R1 Y*0(2350) INTO (KBAR N)/TOTAL (P1)/TOTAL
R1 J IS NOT KNOWN. FOLLOWING IS (J+1/2)*(KBAR N)/TOTAL
R1 0.68 0.10 KYCIA 67 CNTR 8/67
R1 0.57 BUGG 68 CNTR 6/68*

***** REFERENCES -- Y*0(2350) *****
COOL --- 66 PRL 16 1228 +GIACOMELLI, KYCIA, LEDNTIC, LI, LUNDROY, + (BNL) I
--- SLIGHTLY REVISED RESULTS FROM KYCIA 67 REPLACE COOL 66 --- (BNL) I
KYCIA 67 PRIVATE COMM. T F KYCIA
BUGG 68 PR 168 1466 +GILMORE, KNIGHT, + (RTHFD, BRMGHM, CVNDSH) I
DAUM 68 NP 87 19 +ERNE, LAGNAUX, SENS, STEUER, UDD (CERN) JP

----- Σ^+ 19 SIGMA + (1189, JP=1/2+) I=1 -----
SEE LISTINGS OF STABLE PARTICLES

----- Σ^- 20 SIGMA - (1198, JP=1/2+) I=1 -----
SEE LISTINGS OF STABLE PARTICLES

----- Σ^0 21 SIGMA 0 (1193, JP=1/2+) I=1 -----
SEE LISTINGS OF STABLE PARTICLES

----- $\Sigma(1385)$ 43 Y*1(1385, JP=3/2+) I=1 -----
FOR THE TABLES WE USE ONLY THE UNSTARRED DATA, WHICH ATTEMPTS TO OBTAIN THE SEPARATE CHARGE-STATE MASSES AND WIDTHS. SEE HOWEVER THE IDEOGRAMS INSERTED IN LISTING THESE INDICATE SERIOUS SYSTEMATICS, PERHAPS ARISING FROM INTERFERENCE EFFECTS THAT CHANGE WITH PRODUCTION MECHANISM AND BEAM MOMENTUM.

----- 43 Y*1(1385) MASS (MEV) -----
M * 141(1384.0) ALSTON 60 HBC +- K-P 1.15 BEV/C
M * 38(1384.0) MARTIN 61 HBC 0+ K20 P .58 BEV/C
M * (1385.0) BERGE 61 HBC +- K-P .4-.85 BEV/C
M * (1392.0) (7.0) COLLEY 62 PBC 0- P1- PRP 2. BEV/C
M * 106(1381.0) (4.8) CURTIS 63 SPK 0 P1-P 1.5 BEV/C
M * (1392.0) (10.0) MUSGRAVE 65 HBC +-OPBAR P 3-4 BEV/C 7/66
M * (1389.0) (3.0) BALTAY 65 HBC +- PBAR P 3.7 BEV/C 7/66

----- 43 Y*1(1385) MASS (MEV) -----
M * 154 1376.0 3.0 ELY 61 PBC +- K-P 1.11 BEV/C
M * 170 1375.0 3.9 COOPER 64 HBC +- K-P 1.45 BEV/C
M * 859 1381.0 1.6 HUME 64 HBC +- K-P 1.22 BEV/C
M * 1382.0 1.0 ARMENTERGO 65 HBC +- K-P 9-1.2 BEV/C
M * 1382.6 1.4 SMITH 65 HBC +- K-P 1.95 BEV/C 9/66
M * 1384.3 1.1 SMITH 65 HBC +- K-P 1.8 BEV/C 9/66
M * 40 1385.0 2.0 BIRMINGHA 66 HBC +- 3.5 K- P 9/67
M * 1378.0 5.0 LONDON 66 HBC +- K-P 2.24 BEV/C 7/66
M * * * * *
M AVG 1382.2440 .7961 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.4)
(SEE IDEOGRAM BELOW)

----- 43 Y*1(1385) MASS (MEV) -----
M - 93 1382.0 3.0 DAHL 61 DBC +- K-D 0.45 BEV/C
M - 224 1376.0 3.0 ELY 61 PBC -
M - 200 1392.0 6.2 COOPER 64 HBC -
M - 1086 1385.3 1.5 HUME 64 HBC -
M - 1384.0 1.0 ARMENTERGO 65 HBC -
M - 1391.5 1.8 SMITH 65 HBC - K-P 1.8 BEV/C 9/66
M - 1395.8 1.4 SMITH 65 HBC - K-P 1.95 BEV/C 9/66
M - 1389.0 9.0 LONDON 66 HBC -
M - * * * * *
M AVG 1388.0068 3.0064 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 4.8)
(SEE IDEOGRAM BELOW)

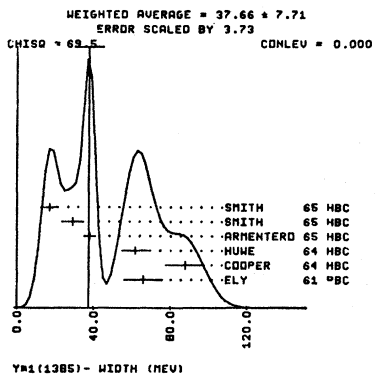
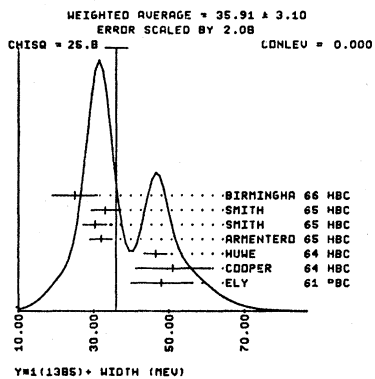
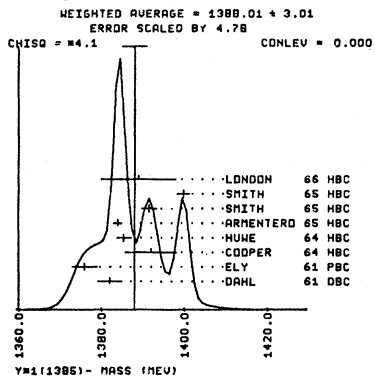
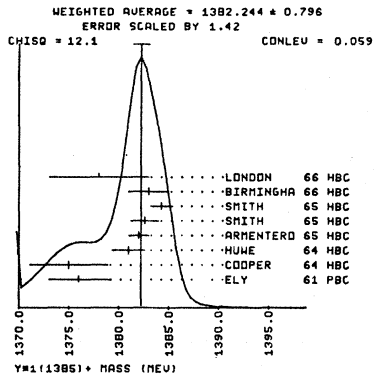
----- 43 Y*(-) - Y*(+) MASS DIFFERENCE (MEV) -----
D R (0.0) (4.2) ELY 61 PBC +- K-P 1.11 BEV/C 8/66
D R (4.3) (2.2) HUME 64 HBC +- K-P 1.22 BEV/C 8/66
D R (2.0) (1.5) ARMENTERGO 65 HBC +- K-P 9-1.2 BEV/C 8/66
D R (17.2) (2.1) SMITH 65 HBC +- K-P 1.0 BEV/C 9/66
D R (17.2) (2.0) SMITH 65 HBC +- K-P 1.95 BEV/C 9/66
D R REDUNDANT WITH DATA IN MASS LISTING.
D R (11.0) (9.0) LONDON 66 HBC +- K-P 2.24 BEV/C 8/66
D R 9.0 6.0 LONDON 66 HBC +- LAMBDA 3 PI EVTS 7/66

----- 43 Y*1(1385) WIDTH (MEV) -----
M * (64.0) ALSTON 60 HBC +-
M * 20.0 OR LESS MARTIN 61 HBC 0+
M * (40.0) BERGE 61 HBC +-
M * (80.0) (10.0) COLLEY 62 PBC 0-
M * (30.0) (9.0) CURTIS 63 SPK C
M * (38.0) (9.0) MUSGRAVE 65 HBC +-0 7/66
M * (26.0) (5.0) BALTAY 65 HBC +- 7/66
M * * * * *
M * 48.0 8.0 ELY 61 PBC +
M * 51.0 10.0 COOPER 64 HBC +
M * 46.5 3.0 HUME 64 HBC +-
M * 32.0 3.0 ARMENTERGO 65 HBC +
M * 30.3 3.1 SMITH 65 HBC +- K-P 1.8 BEV/C 9/66
M * 33.1 3.8 SMITH 65 HBC +- K-P 1.95 BEV/C 9/66
M * 40 25.0 6.0 BIRMINGHA 66 HBC +- 3.5 K- P 9/67
M * * * * *
M AVG 35.9114 3.0970 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 2.1)
(SEE IDEOGRAM BELOW)

----- 43 Y*(-) - Y*(+) MASS DIFFERENCE (MEV) -----
M - 40.0 DAHL 61 DBC -
M - 66.0 10.0 ELY 61 PBC -
M - 88.0 10.0 COOPER 64 HBC -
M - 62.0 7.0 HUME 64 HBC -
M - 38.0 3.0 ARMENTERGO 65 HBC -
M - 29.2 5.7 SMITH 65 HBC - K-P 1.80 BEV/C 9/66
M - 17.1 4.4 SMITH 65 HBC - K-P 1.95 BEV/C 9/66
M - * * * * *
M AVG 37.6555 7.7088 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 3.7)
(SEE IDEOGRAM BELOW)

BARYON RESONANCES

Data in parentheses have not been included in our averages.



43 Y*(1385) PARTIAL DECAY MODES

P1	Y*(1385) INTO	DECAY PASSES
P2	INTO LAMBDA PI	1115 ± 139
	INTO SIGMA PI	1197 ± 139

43 Y*(1385) BRANCHING RATIOS

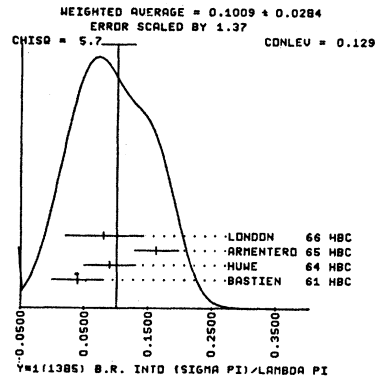
R1	Y*(1385) INTO (SIGMA PI)/(LAMBDA PI)	(P2)/(P1)
R1	0.04	0.04 BASTIEN 61 HBC +-0
R1	0.04	OR LESS ALSTON 62 HBC +-0
R1	0.09	0.04 HUME 64 HBC +-0
R1	0.163	0.035 ARMENTERO 65 HBC +-0
R1	0.08	0.06 LONDON 66 HBC +-0
R1	AVG	0.1009 ± 0.0284 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.4) (SEE IDEOGRAM BELOW)

REFERENCES -- Y*(1385)

ALSTON 60 PRL 5 520	+ALVAREZ, EBERHARD, GODO, GRAZIANO, + (LRL) I
DAHL 61 PRL 6 142	+HORNITZ, MILLER, MURRAY, WHITE (LRL)
MARTIN 61 PRL 6 283	+LEIPUNER, CHINOWSKY, SHIVELY, + (BNL, YALE)
BERGE 61 PRL 6 557	+BASTIEN, DAHL, FERRO-LUZZI, KRIZ, + (LRL)
BASTIEN 61 PRL 6 702	+BASTIEN, FERRO-LUZZI, A. N. ROSENFELD (LRL)
ELY 61 PRL 7 461	+FUNG, GIDAL, PAN, POWELL, WHITE (LRL) J
ALSTON 62 CERN CONF 311	+ALVAREZ, FERRO-LUZZI, ROSENFELD, + (LRL)
COLLEY 62 PR 128 1930	+GELFAND, HAUENBERG, + (COLUMBIA, HUTGERS) JP
CURTIS 63 PR 132 1771	+COFFIN, MEYER, TERMILLIGER (MICH) J
COOPER 64 PL 8 365	+FILTHUTH, FRIDMAN, MALAMUD, + (CERN, AMSTR) J
HUME 64 UCLR-11291 THESIS D O HUME	(LRL) JP
MUSGRAVE 65 NC 35 735	+PETMEZAS, + (BIRMGHM, CERN, EP, IMPCOL, SACLAY)
ARMENTERO 65 PL 19 75	ARMENTEROS, + (CERN, HEIDEL, SACLAY)
BALTAY 65 PR 140 B1027	+SANDWEISS, TAFT, CULWICK, KOPP, + (YALE, BNL)
SMITH 65 THESIS (UCLA)	L T SMITH (UCLA)
BIRMINGHAM 66 PR 152 1148	BIRMINGHAM, GLASGOW, I.C., O(FORDYRUTHERFORD)
LONDON 66 PR 143 1034	+RAU, SAMIOS, YAMAMOTO, GOLOBERG, + (BNL, SYCR) J

QUANTUM NUMBER DETERMINATIONS NOT REFERRED TO IN DATA CARDS.

SHAFER 64 PR 134 B1372	J B SHAFER, D O HUME (LRL) JP
MALAMUD 64 PL 10 145	E MALAMUD, P E SCHLEIN (CERN, UCLA) JP



Λπ Enhancement at 1440 MeV

The most plausible explanation of this enhancement is a kinematical effect. A Monte Carlo calculation of a double reaction process involving both nucleons of the deuteron generates a peak in the Λπ mass plot at this value without invoking a Λπ resonant state (ALEXANDER 68). The possibility of the kinematical origin of this peak was also pointed out by CLINE 68.

We omit this enhancement from the table until it is detected in an experiment other than K⁻d.

BARYON RESONANCES

Data in parentheses have not been included in our averages.

$\Sigma(1440)$ 80 $\gamma(1440, JP=)$ I=1
 EFFECT BEING A RESONANCE VERY MUCH IN DOUBT- SEE PRECEDING NOTE 11/68*
 80 $\gamma(1440)$ MASS (MEV)
 M 1440. CLINE 68 DBC K-D TO Λ N, P I 11/68*
 W 80 $\gamma(1440)$ WIDTH (MEV)
 M 30. CLINE 68 DBC K-D TO Λ N, P I 11/68*

REFERENCES -- $\gamma(1440)$
 ALEXANDE 68 TO BE PUBLIS. ALEXANDER, HALL, JEN, KALMUS, KERMAN (LRL+UCR)
 CLINE 68 PRL 21 1372 CLINE, LAUMANN, HAPP (MISCONSIN)

$\Sigma(1610)$ 78 $\gamma(1610, JP=)$ I=1 P_{11}
 SEE NOTE PRECEDING $\gamma(1670)$ LISTINGS
 78 $\gamma(1610)$ MASS (MEV)
 M 66 1610. 8. CRENNELL 68 HBC OKP TO Λ MBDA PI 11/68*
 M 8 1610. ARMENTERI 68 HBC OKP TO Λ MBDA PI 11/68*
 M 8 SOLUTION B OF THE ENERGY INDEPND. ANALYSIS INCLUDES THIS STATE
 $\gamma(1610)$ WIDTH (MEV)
 M 8 160. ARMENTERI 68 HBC OK-P TO Λ MBDA PI 11/68*
 W 8 66. 16. CRENNELL 68 HBC OKP TO Λ MBDA PI 11/68*
 M 8 SOLUTION B OF THE ENERGY INDEPND. ANALYSIS INCLUDES THIS STATE

$\gamma(1610)$ PARTIAL DECAY MODES
 P1 $\gamma(1610)$ INTO KBAR N 497+ 939
 P2 $\gamma(1610)$ INTO Λ MBDA PI 115+ 139
 P3 $\gamma(1610)$ INTO $\gamma(1385)$ PI 1385+ 139
 $\gamma(1610)$ BRANCHING RATIOS
 R1 $\gamma(1610)$ INTO (Λ MBDA PI)/TOTAL (P1)/TOTAL 11/68*
 R1 66 DOMINANT MODE CRENNELL 68 HBC 0
 R2 $\gamma(1610)$ INTO (KOBAR-P)/(Λ MBDA PI) (P1)/(P2) 11/68*
 R2 0.0 0.1 CRENNELL 68 HBC 0
 R3 $\gamma(1610)$ INTO ($\gamma(1385)$ PI)/(Λ MBDA PI) (P3)/(P2) 11/68*
 R3 0.2 0.1 CRENNELL 68 HBC 0
 R4 $\gamma(1610)$ INTO (Λ MBDA PI)*(KBAR N)/TOTAL*2 (P2*P1)/TOTAL*2 11/68*
 R4 0.025 ARMENTERI 68 HBC OSOLUTION B

REFERENCES -- $\gamma(1610)$
 ARMENTE1 68 NP TOBE PUBLIS. ARMENTEROS, BAILLON + (CERN+HEID+SACLAY) IJP
 CRENNELL 68 PRL 21 648 CRENNELL, DELANEY, FLAMINIO + (BNL+CCNY)

$\Sigma(1650)$ 79 $\gamma(1650, JP=1/2-)$ I=1 S_{11}
 SEE NOTE PRECEDING $\gamma(1670)$ LISTINGS
 ENERGY INDEPENDENT ANALYSIS OF Λ MBDA PI CHANNEL BY
 CMS COLLABORATION INDICATES THE PRESENCE OF THIS
 POSSIBLE STATE.
 79 $\gamma(1650)$ MASS (MEV)
 M 1650. ARMENTE1 68 HBC 0 11/68*
 79 $\gamma(1650)$ WIDTH (MEV)
 M 100. ARMENTE1 68 HBC 0 K-P TO Λ MBDA PI 11/68*

$\gamma(1650)$ PARTIAL DECAY MODES
 P1 $\gamma(1650)$ INTO KBAR N 497+ 939
 P2 $\gamma(1650)$ INTO Λ MBDA PI 115+ 139
 $\gamma(1650)$ BRANCHING RATIOS
 R1 $\gamma(1650)$ INTO (Λ MBDA PI)*(KBAR N)/TOTAL*2 (P2*P1)/TOTAL*2 11/68*
 R1 0.0676 ARMENTE1 68 HBC 0 K-P TO Λ MBDA PI

REFERENCES -- $\gamma(1650)$
 ARMENTE1 68 NP TOBE PUBLIS. ARMENTEROS, BAILLON + (CERN+HEID+SACLAY) IJP

$\Sigma(1660)$ 44 $\gamma(1660, JP=3/2-)$ I=1 D_{13}
 SEE NOTE PRECEDING $\gamma(1670)$ LISTINGS
 THE $\gamma(1660)$ HAS APPEARED IN BOTH FORMATION AND PRO-
 DUCATION EXPERIMENTS. THE PRESENT DATA ON FORMATION EX-
 PERIMENTS IS NOT SUFFICIENT TO CLARIFY THE SITUATION OF
 THE I=1 STATE. PRODUCTION EXPERIMENTS HAVE SHOWN LARGE INCONSISTENCIES
 IN THE BRANCHING RATIOS (CHANGING WITH INCIDENT ENERGY). THE $\gamma(1690)$
 MIGHT BE A SECOND I=1 STATE IN THIS ENERGY REGION. BRANCHING RATIOS
 HOWEVER ARE NOT YET DISENTANGLED.
 AS FOR THE QUANTUM NUMBERS, THE ANALYSES OF Λ MBDA PI CHANNEL (IN
 FORMATION EXP.) AND $\gamma(1405)+\pi$ CHANNEL (IN PROD. EXP.) ARE CONSISTENT
 WITH $JP=3/2-, JP$ OF $\gamma(1690)$ NOT YET KNOWN.

$\gamma(1660)$ MASS (MEV)
 M 1685.0 ALEXANDER 62 HBC 0 π -P 2-2-2 BEV/C
 M 1660.0 10.0 ALVAREZ 63 HBC + K-P 1.51 BEV/C
 M 1660.0 BERLEY 64 HBC 0 K-P TO Λ N P I 7/66
 M 1645.0 7.0 LEVEQUE 65 HBC + K-P TO $\gamma(1660)$ PI 7/66
 M S (1668.1) (5.1) ARMENTER 68 HBC 0 K-P ELAS.+CH. EX 11/68*
 M 1667. ARMENTE1 68 HBC 0 K-P TO Λ MBDA PI 11/68*
 M S (1661.0) (2.0) ARMENTE2 68 HBC 0 K-P TO Λ MBDA PI 11/68*
 M 1680. 10.0 ARMENTE4 68 DBC K-N TO SIG- P I 12/68*
 M 1665.0 5.0 BUGG 68 CNTR K-P, D TCTAL C.S.
 M 70 1661. 9. PRIMER 68 HBC + K-P 4.6-5. GEV/C 7/68*
 M S SYSTEMATIC ERROR NOT INCLUDED. ONLY INDETERM. IN FIT QUOTED 6/68*
 M AVG 1661.1452 5.0555 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.5)

44 $\gamma(1660)$ WIDTH (MEV)
 W 45.0 ALEXANDER 62 HBC 0-
 W 40.0 10.0 ALVAREZ 63 HBC +
 W 60.0 BERLEY 64 HBC 0 7/66
 W 55.0 10.0 LEVEQUE 65 HBC + 7/66
 W 50. 18. ARMENTER 68 HBC 0 K-P ELAS.+CH. EX 11/68*
 W 50. ARMENTE1 68 HBC 0 K-P TO Λ MBDA PI 11/68*
 W S (44.0) (4.0) ARMENTE2 68 HBC 0 K-P TO Λ MBDA PI 11/68*
 W 65. 20.0 ARMENTE4 68 DBC K-N TO SIG- P I 12/68*
 W 30.0 15.0 BUGG 68 CNTR 11/66
 W 70 60. 20. PRIMER 68 HBC + K-P 4.6-5. GEV/C 7/68*
 W S SYSTEMATIC ERROR NOT INCLUDED. ONLY INDETERM. IN FIT QUOTED 6/68*
 W AVG 48.2211 5.5444 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)

44 $\gamma(1660)$ PARTIAL DECAY MODES
 P1 $\gamma(1660)$ INTO KBAR N 497+ 939
 P2 $\gamma(1660)$ INTO Λ MBDA PI 115+ 139
 P3 $\gamma(1660)$ INTO Λ MBDA PI 1197+ 139
 P4 $\gamma(1660)$ INTO Λ MBDA PI PI 1115+ 139+ 139
 P5 $\gamma(1660)$ INTO Λ MBDA PI PI 1197+ 139+ 139
 P6 $\gamma(1660)$ INTO $\gamma(1385)$ PI 1385+ 139
 P7 $\gamma(1660)$ INTO $\gamma(1405)$ PI 1405+ 139

44 $\gamma(1660)$ BRANCHING RATIOS
 R1 $\gamma(1660)$ INTO (KBAR N)/TOTAL (P1)/TOTAL
 R1 0.05 OR LESS ALVAREZ 63 HBC + K-P AT 1.15 BEV/C
 R1 B 0.16 OR MORE BASTIEN 2 63 HBC 0 K-P TO Λ N, P I 7/66
 R1 B ANALYSIS DID NOT INCLUDE I=0 RESONANT STATE $\gamma(1690)$ 11/67
 R1 0.2 OR LESS LONDON 66 HBC + K-P AT 2.25 BEV/C 7/66
 R1 0.025 OR LESS BUGG 68 CNTR 0 ASSUMING $J=3/2$ 11/66
 R1 0.15 OR LESS PRIMER 68 HBC + K-P 4.6-5. GEV/C 7/68*

$\gamma(1660)$ INTO (Λ MBDA PI)/TOTAL (P2)/TOTAL
 R2 0.32 ALVAREZ 63 HBC + K-P AT 1.15 BEV/C
 R2 B 0.09 OR LESS BASTIEN 2 63 HBC 0 K-P TO Λ N, P I 7/66
 R2 B ANALYSIS DID NOT INCLUDE I=0 RESONANT STATE $\gamma(1690)$ 11/67
 R2 0.2 OR LESS LONDON 66 HBC + K-P AT 2.25 BEV/C 7/66
 R2 0.06 OR LESS SMART 66 DBC - ASSUMING $R_1=0.15$ 7/66
 $\gamma(1660)$ INTO (Λ MBDA PI)/(SIGMA PI)/TOTAL (P3)/TOTAL
 R3 0.27 ALVAREZ 63 HBC + K-P AT 1.15 BEV/C
 R3 B (0.23) (0.06) BASTIEN 2 63 HBC 0 K-P TO Λ N, P I 7/66
 R3 B ANALYSIS DID NOT INCLUDE I=0 RESONANT STATE $\gamma(1690)$ 11/67
 R3 0.25 0.15 LONDON 66 HBC + K-P AT 2.25 BEV/C 7/66
 R3 A 53 (0.63) (0.20) PRIMER 68 HBC + K-P 4.6-5. GEV/C 7/68*
 R3 A ASSUMING THAT P3 AND P7 ARE THE ONLY DECAY MODES OF $\gamma(1660)$ 7/68*

$\gamma(1660)$ INTO (Λ MBDA PI) PI/(SIGMA PI) TOTAL (P4)/TOTAL
 R4 0.18 ALVAREZ 63 HBC + K-P AT 1.15 BEV/C
 R4 B (0.16) (0.05) BASTIEN 2 63 HBC 0 K-P TO Λ N, P I 7/66
 R4 B ANALYSIS DID NOT INCLUDE I=0 RESONANT STATE $\gamma(1690)$ 11/67
 R4 0.2 OR LESS LONDON 66 HBC + K-P AT 2.25 BEV/C 7/66
 $\gamma(1660)$ INTO (Λ MBDA PI) PI/(SIGMA PI) TOTAL (P5)/TOTAL
 R5 0.18 ALVAREZ 63 HBC + K-P AT 1.15 BEV/C
 R5 B (0.25) (0.06) BASTIEN 2 63 HBC 0 K-P TO SIG PI PI 7/66
 R5 A 0.14 OR LESS ARMENTE3 68 HBC + K-P AND D-P I=0 11/68*
 R5 A RATIO ONLY FOR (SIG PI) SYSTEM IN I=1, WHICH CANNOT BE $\gamma(1385)$ 11/68*
 R5 B ANALYSIS DID NOT INCLUDE I=0 RESONANT STATE $\gamma(1690)$ 11/67

$\gamma(1660)$ INTO ($\gamma(1405)$ PI)/TOTAL (P7)/TOTAL
 R6 0.75 0.25 LONDON 66 HBC + K-P AT 2.25 BEV/C 7/66
 R6 0.06 OR LESS ARMENTE3 68 HBC K-P AND D-P I=0 11/68*
 R6 A 17 (0.37) (0.15) PRIMER 68 HBC + K-P 4.6-5. GEV/C 7/68*
 R6 A ASSUMING THAT P3 AND P7 ARE THE ONLY DECAY MODES OF $\gamma(1660)$ 7/68*

$\gamma(1660)$ INTO (KBAR N)/(Λ MBDA PI) (P1)/(P2)
 R7 0.43 OR MORE SMITH 63 HBC 0-
 $\gamma(1660)$ INTO (SIGMA PI)/(Λ MBDA PI) (P3)/(P2)
 R8 0.86 SMITH 63 HBC 0-
 R8 6.8 3.0 HUME 64 HBC +
 $\gamma(1660)$ INTO (Λ MBDA PI) PI/(Λ MBDA PI) (P4)/(P2)
 R9 0.14 SMITH 63 HBC 0-
 $\gamma(1660)$ INTO ($\gamma(1405)$ PI)/(SIGMA PI) PI) (P7)/(P5)
 R10 0.90 0.10 0.16 EBERHARD 65 + K-P AT 2.45 BEV/C 7/66
 $\gamma(1660)$ INTO ($\gamma(1405)$ PI)/($\gamma(1385)$ PI) (P7)/(P6)
 R11 0.8 OR MORE EBERHARD 65 + K-P AT 2.45 BEV/C 7/66
 $\gamma(1660)$ IN (Λ MBDA PI) PI/(SIGMA PI) PI) (P4)/(P5)
 R12 0.35 0.2 BIRMINGHAM 66 HBC + K-P AT 3.5 GEV/C 11/67
 $\gamma(1660)$ INTO (Λ MBDA PI)/(SIGMA PI) PI) (P2)/(P5)
 R13 .2 OR LESS BIRMINGHAM 66 HBC + K-P AT 3.5 GEV/C 11/67
 $\gamma(1660)$ INTO (SIGMA PI)/(SIGMA PI) PI) (P3)/(P5)
 R14 .4 OR LESS BIRMINGHAM 66 HBC + K-P AT 3.5 GEV/C 11/67
 $\gamma(1660)$ INTO (Λ MBDA PI)*(KBAR N)/TOTAL*2 (P2*P1)/TOTAL*2
 R15 0.0256 ARMENTE1 68 HBC 0 K-P TO Λ MBDA PI 11/68*
 $\gamma(1660)$ INTO (SIGMA PI)*(KBAR N)/TOTAL*2 (P3*P1)/TOTAL*2
 R16 0.044 .004 ARMENTE2 68 HBC 0 K-P TO SIGMA PI 11/68*
 R16 0.029 BERLEY 68 HBC 0 K-P .6-.82 BEV/C 11/68*

$\gamma(1660)$ INTO $\gamma(1385)$ *(KBAR N)/TOTAL*2 (P6*P1)/TOTAL*2
 R17 0.031 0.006 SIMS 68 DBC - 11/68*
 $\gamma(1660)$ INTO ($\gamma(1405)$ PI)/(SIG PI) (P7)/(P3)
 R18 0.5 OR LESS BERLEY 68 HBC 0 K-P .6-.82 BEV/C 11/68*

44 QUANTUM NUMBERS DETERMINATION

Q1 * $JP=3/2+$ LEVEQUE 65 HBC INTO $\gamma(1405)+\pi$ 11/68*
 Q1 * $JP=3/2-$ SCHLEIN 66 DBC 0 INTO Λ MBDA π 11/68*
 Q1 * $JP=3/2-$ EBERHARD 67 HBC + INTO $\gamma(1405)+\pi$ 11/68*
 Q1 * 400 $JP=3/2-$ BUTION-SH 68 HBC + INTO SIGZKO π 11/68*
 REFERENCES -- $\gamma(1660)$
 ALEXANDE 62 CERN CONF 320 ALEXANDER, JACOBS, KALBFLEISCH, MILLER, + (LRL) I
 ALVAREZ 63 PRL 10 184 *ALSTON FERRO-LUZZI, HUME, + (LRL) I
 BASTIEN 2 63 UCRL-10779 THESIS P L BASTIEN (LRL) I
 SMITH 63 ATHENS CONF 67 G A SMITH (LRL)
 HUME 64 UCRL-11291 THESIS D D HUME (LRL)
 BERLEY 64 DUBNA CONF 1 565 *CONNOLLY, HART, RAHN, STONHILL, + (BNL) IJP
 EBERHARD 65 PRL 14 466 *SHIVELY, ROSS, SIEGAL, FICENEC, + (LRL, ILL) I
 LEVEQUE 65 PRL 10 69 *SACLAY, EP, GLASGOW, IMPCOL, JOE, RITFDI, JP
 BIRMINGHAM 66 PR 152 1148 BIRMINGHAM, GLASGOW, I.C.V. OXFORD/RUOHERFORD
 LONDON 66 PR 143 1034 *RAU, SAMIOS, YAMAMOTO, GOLDBERG, + (BNL, SYCR) I
 SPART 66 PRL 17 556 *W SMART, A. KERMAN, G. KALMUS, R. ELY (LRL) IJP
 EBERHARD 67 PR 163 3446 *PRIPSTEIN, SHIVELY, KRUSE, SHANSON (LRL, ILL) IJP

BARYON RESONANCES

Data in parentheses have not been included in our averages.

ARMENTER 68 NP TO BE PUBLIS. ARMENTEROS,BAILLON + (CERN+HEID+SACLAY)JJP
 ARMENTE1 68 NP TOBE PUBLIS. ARMENTEROS,BAILLON + (CERN+HEID+SACLAY)JJP
 ALSO 67 NP 33 592 ARMENTEROS,FERRO-LUZZI+ (CERN,HEID,SACLAY)
 ARMENTE2 68 PREPRINT ARMENTEROS,BAILLON + (CERN+HEID+SACLAY)JJP
 ALSO 2 67 PL 248 198 ARMENTEROS,FERRO-LUZZI+ (CERN,HEID,SACLAY)JJP
 ARMENTE3 68 VIENNA CONF ARMENTEROS,BAILLON + (CERN+HEID+SACLAY)JJP
 ARMENTE4 68 VIENNA ABST 523 ARMENTEROS,BAILLON,MINTEN + (CERN+SACLAY) J

BERLEY 68 VIENNA CONF BERLEY,HART,RAHM,WILLIS,YAPAPOTO (BNL)
 BUGG 68 PR 168 1466 +GILMORE,KWIGHT,DAVIES+ (BIRMI,CAMB,RUTH)I
 BUTTON-5 68 PRL 21 1123 J BUTTON SHAFER (UNIV.MAS+LRL) JP
 PRIMER 68 PRL 20 610 +GOLDBERG,JAEGER,BARNES,DORNAN + (SYR,BNL)
 SIMS 68 PRL 21 1413 SIMS,ALBRIGHT,BARTLEY,MEER+ (FLD+TAFTS+OR)

PAPERS NOT REFERRED TO IN DATA CARDS.

BASTIEN 63 PRL 10 188 P L BASTIEN, J P BERGE (LRL) IJ
 -- REPLACED BY BASTIEN 2, BUT SIMILAR AND MORE READILY AVAILABLE.
 T-ZADEH 63 PRL 11 470 TAHER-ZADEH,PROMSE,SCHLEIN,SLATER,+ (UCLA) JP
 -- SEE NOTE FOLLOWING SCHLEIN 66.
 LEE 66 PRL 17 45 Y Y LEE, D D REEDER, R M HARTUNG (MISC) JP
 SCHLEIN 66 UCLA-1016 P E SCHLEIN, T G TRIPPE (UCLA) JP
 -- REANALYZES DATA OF TAHER-ZADEH 63 AND BASTIEN 63 AND ALL PUBLISHED
 LAMBDA PI CROSS SECTION DATA IN THE LIGHT OF THE NOW KNOWN
 Y*(11765) AND REVERSES THE MODEL-DEPENDENT CONCLUSION OF TAHER-
 ZADEH ON THE PREFERRED JP ASSIGNMENT (FROM 3/2+ TO 3/2-).

Σ (1690) US8 Y*(11690, JP=) I=1
 SEE NOTE PRECEDING Y*(11660) LISTINGS

ENERGY INDEPENDENT PARTIAL WAVE ANALYSIS BY GHS COL
 LABORTION INDICATES THE PRESENCE OF A P13 STATE AT
 THIS ENERGY -WHETHER OR NOT IT HAS TO BE IDENTI-
 FIED WITH THE Y*(11690) SEEN IN PRODUCTION EXPERI-
 MENTS IS NOT CLEAR YET.

58 Y*(11690) MASS (MEV)

M	30	1715.0	12.0	COLLEY	67 HBC	+ K-P AT 6.0 GEV/C	8/67
M	53	1683.0	15.0	DERRICK	67 HBC	+ K-P AT 5.5 GEV/C	8/67
M	164	1640.		ARMENTE1	68 HBC	OK-P TO LAMBDA PI	11/68*
M	60	1694.	24.	PRIMER	68 HBC	+ K-P 4.6-5. GEV/C	7/68*
M	S	(1700.)	1.	SIMS	68 DBC	- INTO Y*(11385)PI	11/68*
M	S	SIMS	68 SUGGEST JP=5/2+ FOR THIS STATE -NEEDS CONFIRMATION-				11/68*
M	AVG	1701.3862	10.4821	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.2)			

58 Y*(11690) WIDTH (MEV)

M	30	100.0	35.0	COLLEY	67 HBC	+ K-P AT 6.0 GEV/C	8/67
M	53	120.	30.	DERRICK	67 HBC	+ K-P AT 5.5 GEV/C	8/67
M	164	160.		ARMENTE1	68 HBC	OK-P TO LAMBDA PI	11/68*
M	60	105.	35.	PRIMER	68 HBC	+ K-P 4.6-5. GEV/C	7/68*
M	S	(62.)	11.	SIMS	68 DBC	- INTO Y*(11385)PI	11/68*
M	S	SIMS	68 SUGGEST JP=5/2+ FOR THIS STATE -NEEDS CONFIRMATION-				11/68*
M	AVG	109.5868	19.0909	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)			

58 Y*(11690) PARTIAL DECAY MODES

P1	Y*(11690)	INTO KBAR N	497+ 939	DECAY MASSES
P2	Y*(11690)	INTO LAMBDA PI	1115+ 134	
P3	Y*(11690)	INTO SIGMA PI	1197+ 139	
P4	Y*(11690)	INTO Y*(11385) PI	1385+ 139	

58 Y*(11690) BRANCHING RATIOS

R1	Y*(11690)	INTO (LAMBDA PI)/(KBAR N)	(P2)/(P1)				
R1	18	0.80	0.50	COLLEY	67 HBC	+ KO BAR FIN.STATE	8/67
R1	15	0.6	0.40	DERRICK	67 HBC	+ KO BAR FIN.STATE	8/67
R1	*	MAIN DECAY MODE	PRIMER	68 HBC	+ K-P 4.6-5. GEV/C	7/68*	
R1	AVG	.6780	.3123	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)			
R2	Y*(11690)	INTO (SIGMA PI)/(LAMBDA PI)	(P3)/(P2)				
R2	0.3	0.3	COLLEY	67 HBC	+ CHARG.SIGMA F.5.	8/67	
R2	0.25	OR LESS	DERRICK	67 HBC	+ NEUTR. SIGMA F.5	8/67	
R3	Y*(11690)	INTO (Y*(11385) PI)/(LAMBDA PI)	(P4)/(P2)				
R3	14	1.0	0.3	DERRICK	67 HBC	+ LAMBDA 2PI F.5.	8/67
R3	0.49	0.29	COLLEY	67 HBC	+ LAMBDA 2PI F.5.	8/67	
R3	AVG	.7364	.2549	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.2)			
R4	Y*(11690)	INTO (LAMBDA PI)*(KBAR N)/TOTAL**2	(P2*P1)/TOTAL**2				
R4	0.04		ARMENTE1	68 HBC	OK-P TO LAMBDA PI	11/68*	

REFERENCES -- Y*(11690)
 COLLEY 67 PL 248 489 +MACDONALD,MUSGRAVE+(DI,UG,IC,MP,OXF,RUTH)
 DERRICK 67 PRL 18 266 +FIELDS,LOKEN,AMMAR,DAVIS (ARGONNE,NORTH)
 ARMENTE1 68 NP TOBE PUBLIS. ARMENTEROS,BAILLON + (CERN+HEID+SACLAY)JJP
 PRIMER 68 PRL 20 610 +GOLDBERG,JAEGER,BARNES,DORNAN + (SYR,BNL)
 SIMS 68 PRL 21 1413 SIMS,ALBRIGHT,BARTLEY,MEER+ (FLD+TAFTS+OR)

PAPERS NOT REFERRED TO IN DATA CARDS

MEYER 67 HEIDELBERG CONF. J MEYER - RAPORTEUR ON BARYON RES.(SACLAY)

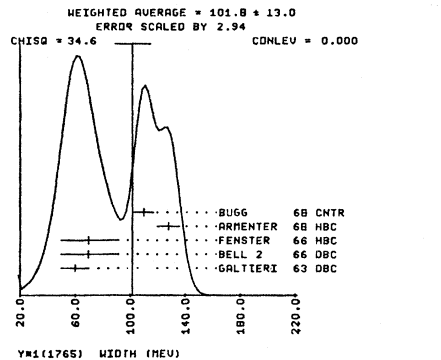
Σ (1765) 45 Y*(1765, JP=5/2-) I=1 D₁₅

45 Y*(1765) MASS (MEV)

M	1765.0	10.0	GALTIERI	63 DBC	0 K-D 1.51 BEV/C	7/66	
M	1755.0	10.0	ARMENTER	65 HBC	0 K-P TO Y*(1520) PI	7/66	
M	1760.0	10.0	BELL 1	65 DBC	- K-N TO Y*(1520) PI	7/66	
M	1746.0	8.0	FENSTER	66 HBC	0 K-P TO Y*(1520) PI	9/66	
M	N	(1758.0)	(11.0)	GELFAND	66 HBC	0 K-P ELASTIC	8/67
M	S	1768.		ARMENTER	68 HBC	0 K-P ELAS.+CH.EX	11/68*
M	1768.0	4.0	BUGG	68 CNTR	K-P, D TOTAL	11/66	
M	C	(1765.)	(3.)	CONFORTO	68 HBC	0 K-P ELASTIC	11/68*
M	S	(1775.0)	(7.0)	SMART	68 DBC	- K-N TO LAM.PI-	7/68*
M	C	FIT TO K-P ELAS. DIFFER. CROSS SECTIONS (PART OF DATA INCLUDED IN					
M	C	ARMENTEROS 68 WHICH FIT LEGEN. POLYN. COEFFICIENTS)					
M	N	RES + DIFFRACTIVE BGD FOR K-P EL-- DATA ARE IN ARMENT 67 FITS TO					7/68*
M	S	SYSTEMATIC ERROR NOT INCLUDED -ONLY INDETERMINATION OF FIT INCLUDED					
M	AVG	1766.3700	2.2458	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.3)			

45 Y*(1765) WIDTH (MEV)

M	60.0	10.0	GALTIERI	63 DBC	0		
M	70.0	20.0	BELL 2	66 DBC	-		7/66
M	70.0	20.0	FENSTER	66 HBC	0		9/66
M	N	(113.0)	(25.0)	GELFAND	66 HBC	0 K-P ELASTIC	8/67
M	128.	8.	ARMENTER	68 HBC	0 K-P ELAS.+CH.EX		11/68*
M	110.0	7.0	BUGG	68 CNTR	K-P, D TOTAL		7/68*
M	C	(112.)	(5.)	CONFORTO	68 HBC	0 NOTE C IN MASS	11/68*
M	S	(146.0)	(9.0)	SMART	68 DBC	- K-N TO LAM.PI-	7/68*
M	S	SYSTEMATIC ERROR NOT INCLUDED - ONLY INDETERM. IN FIT QUOTED					6/68*
M	N	RES + DIFFRACTIVE BGD FOR K-P EL-- DATA ARE IN ARMENT 67 FITS TO					
M	AVG	101.7946	13.0241	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 2.9) (SEE IDEOGRAM BELOW)			



45 Y*(1765) PARTIAL DECAY MODES

P1	Y*(1765)	INTO KBAR N	497+ 939	DECAY MASSES
P2	Y*(1765)	INTO LAMBDA PI	1115+ 134	
P3	Y*(1765)	INTO SIGMA PI	1197+ 139	
P4	Y*(1765)	INTO SIGMA ETA	1192+ 568	
P5	Y*(1765)	INTO Y*(11385) PI	1385+ 139	
P6	Y*(1765)	INTO Y*(1520) PI	1518+ 139	
P7	Y*(1765)	INTO SIGMA PI PI	1197+ 139+ 139	

45 Y*(1765) BRANCHING RATIOS

R1	Y*(1765)	INTO (KBAR N)/TOTAL	(P1)/TOTAL				
R1	*	(0.46)	GALTIERI	63 HBC	0 K-P RVUE		
R1	N	(0.46)	(0.05)	GELFAND	66 HBC	0 K-P ELASTIC	8/67
R1	0.34		KYCIA	67 CNTR	TOTAL CROSS-SEC.		8/67
R1	0.53	0.09	UHLIG	67 HBC	0		9/66
R1	0.45	0.01	ARMENTER	68 HBC	0 K-P ELAS.+CH.EX		11/68*
R1	0.37		BUGG	68 CNTR			11/66
R1	C	(0.44)	(0.03)	CONFORTO	68 HBC	0 NOTE C IN MASS	11/68*
R1	N	RES + DIFFRACTIVE BGD FOR K-P EL-- DATA ARE IN ARMENT 67 FITS TO					
R1	AVG	.4510	.0099	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)			
R1	FIT	.455	.010	VALUE FROM CONSTRAINED FIT			
R2	Y*(1765)	INTO (LAMBDA PI)*(KBAR N)/TOTAL**2	(P2*P1)/TOTAL**2				
R2	0.07		SMART	68 DBC			7/68*
R2	FIT	.069	.007	VALUE FROM CONSTRAINED FIT			
R3	Y*(1765)	INTO (Y*(1520) PI)*(KBAR N)/TOTAL**2	(P3*P1)/TOTAL**2				
R3	0.075	0.015	ARMENTERC	65 HBC	OHYPERONS FIN.ST.		9/66
R3	0.12	0.03	FENSTER	66 HBC	OKBAR N FIN. ST.		9/66
R3	AVG	.0840	.0180	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.3)			
R3	FIT	.068	.010	VALUE FROM CONSTRAINED FIT			
R4	Y*(1765)	INTO (Y*(11385) PI)*(KBAR N)/TOTAL**2	(P4*P1)/TOTAL**2				
R4	0.09	0.03	ARMENTE2	67 HBC	0 K-P TO LAM.PI PI		8/67
R4	0.105	0.040	SIMS	68 DBC	- K-N TO LAM.PI PI		11/68*
R4	AVG	.0954	.0240	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)			
R4	FIT	.068	.015	VALUE FROM CONSTRAINED FIT			
R5	Y*(1765)	INTO (SIGMA PI)*(KBAR N)/TOTAL**2	(P5*P1)/TOTAL**2				
R5	0.005	0.003	ARMENTERO	67 HBC	0 K-P TO SIGMA PI		8/67
R5	FIT	.005	.003	VALUE FROM CONSTRAINED FIT			
R6	Y*(1765)	INTO (LAMBDA PI)/(KBAR N)	(P2)/(P1)				
R6	0.33	0.05	UHLIG	67 HBC	0 K-P, 9 GEV/C		9/66
R6	FIT	.334	.035	VALUE FROM CONSTRAINED FIT			
R7	Y*(1765)	INTO (Y*(1520) PI)/(KBAR N)	(P3)/(P1)				
R7	0.28	0.05	UHLIG	67 HBC	0 K-P, 9 GEV/C		9/66
R7	FIT	.327	.047	VALUE FROM CONSTRAINED FIT			
R8	Y*(1765)	INTO (Y*(11385) PI)/(KBAR N)	(P4)/(P1)				
R8	0.25	0.09	UHLIG	67 HBC	0 K-P, 9 GEV/C		9/66*
R8	FIT	.329	.071	VALUE FROM CONSTRAINED FIT			
R9	Y*(1765)	INTO (SIGMA PI PI)/TOTAL	(P7)/TOTAL				
R9	C	ABOUT 0.12	ARMENTE3	68 HBC	K-P AND K-D		11/68*
R9	C	CONSISTENT WITH (SIG 2PI) MODE OF Y*(11385)PI AND Y*(1520)PI					
R9	Y*(1765)	INTO (SIGMA ETA)/TOTAL	(P6)/TOTAL				
R9	FIT	.083	.044	VALUE FROM CONSTRAINED FIT			
R9	FIT	.083	.044	VALUE FROM CONSTRAINED FIT			

THE FOLLOWING BRANCHING FRACTIONS HAVE CORRELATED ERRORS GREATER THAN .5
 P4 P6 - .756

BARYON RESONANCES

Data in parentheses have not been included in our averages.

REFERENCES -- Y*(11765)

GALTIERI 63 PL 6 296. A BARBARO-GALTIERI, A HUSSAIN, RD TRIPP (LRL) IJ
 ARMENTER 65 PL 19 338. ARMENTEROS, + (CERN, HEIDELBERG, SACLAY) IJP
 BELL 1 66 PRL 16 203. R B BELL, R W BIRGE, Y-L PAN, R T PU (LRL) IJP
 BELL 2 66 UCLR-10936 THESIS R B BELL (LRL) IJP
 FENSTER 66 PRL 17 841. +GELFAND, HARMSEN, L-SETTI, + (CHI, ARG, CERN) IJP
 GELFAND 66 PRL 17 1224. +HARMSEN, LEVI-SETTI, PREDAZZI, + (EFINS, ARGON)
 ALSO 68 PR 163 1792. LASINSKI, LEVI-SETTI, PREDAZZI (EFINS) IJP

ARMENTER 67 PL 248 198. ARMENTEROS, FERRO-LUZZI + (CERN, HEID, SACLAY) IJP
 ARMENTER 67 ZEIT, PHYS. 202, 486. ARMENTEROS, FERRO-LUZZI + (CERN, HEID, SACLAY)
 KYCIA 67 PRIVATE COMM. T F KYCIA (BNL) I
 UHLIG 67 PR 155 1448. +CHARLTON, CONDON, GLASSER, YCDH, + (MD, USNRL)
 ARMENTER 68 NP TO BE PUBLIS. ARMENTEROS, BAILLON + (CERN, HEID, SACLAY) IJP
 ALSO 67 NP 83 592. ARMENTEROS, FERRO-LUZZI + (CERN, HEID, SACLAY) IJP
 ARMENTER 68 VIENNA CONF. ARMENTEROS, BAILLON + (CERN, HEID, SACLAY) I
 BUGG 68 PR 168 1466. +GILMORE, KNIGHT, DAVIES + (BIRNI, CAMB, RUTH) I
 CONFORTO 68 EFI 68-62 NP TBP. B. CONFORTO, HARMSEN + BURKHARDT + (EFINS + HEID)
 SIMS 68 PRL 21 1413. SIMS, ALBRIGHT, BARTLEY, MEER + (FLD, TAFTS + ORA)
 SMART 68 PR 169 1330. W M SMART (LRL) IJP
 ALSO 66 PRL 17 556. W M SMART, A KERNAN, G E KALMUS, R P ELY (LRL) IJP

PAPERS NOT REFERRED TO IN DATA CARDS.

YODH 65 ATHENS CONF 269 G B YODH (MARYLAND) IJ
 BIRGE 65 ATHENS CONF 296 +ELY, KALMUS, KERNAN, LOUIE, SAHOURIA, + (LRL) IJP
 -- YODH 65 AND BIRGE 65 ARE PRECURSORS OF UHLIG 66 AND BELL 66.

 Σ (1780) 57 Y*(1780, JP= 1) I=1
 SEE NOTE PRECEDING Y*(1670) LISTINGS
 A SIGMA ETA THRESHOLD EFFECT. INTERPRETATION AS A
 RESONANCE IS NOT CONCLUSIVE. OMITTED FROM TABLE.
 SEE FERRO-LUZZI 66.

----- 57 Y*(1780) MASS (MEV) -----
 M 1780.0 CLINE 67 DBC - K-N TO SIG- ETA 9/66
 M 1769. CONFORTI 68 HBC 0 K-P ELASTIC 11/68*

----- 57 Y*(1780) WIDTH (MEV) -----
 W 100.0 CLINE 67 DBC - 9/66
 W 123. CONFORTI 68 HBC 0 K-P ELASTIC 11/68*

----- 57 Y*(1780) PARTIAL DECAY MODES -----
 P1 Y*(1780) INTO KBAR N 497+ 939
 P2 Y*(1780) INTO SIGMA ETA 1197+ 548

----- 57 Y*(1780) BRANCHING RATIOS -----
 R1 Y*(1780) INTO (KBAR N)/TOTAL (P1)/TOTAL
 R1 0.12 CONFORTI 68 HBC 0 K-P ELASTIC 11/68*

REFERENCES -- Y*(1780)

CLINE 67 PL 258 41. CLINE, OLSSON (MISCONSIN)
 CONFORTI 68 VIENNA CONF. CONFORTO, LEVI-SETTI, KLUGE* (CHICAGO/HEID)

PAPERS NOT REFERRED TO IN DATA CARDS

FERRO-LU 66 BERKELEY 183. ARMENTEROS, FERRO-LUZZI + (CERN, HEID, SACLAY)
 MEYER 67 HEIDELBERG C. 117 J MEYER - RAPPORTEUR ON BARYON RES. (SACLAY)

 Σ (1880) 67 Y*(1880, JP=1/2+) I=1 P II
 SEE NOTE PRECEDING Y*(1670) LISTINGS
 PARTIAL WAVE ANALYSIS OF K-P TO LAMBDA PI DATA
 REQUIRE A P11 AMPLITUDE AT THIS MASS. EXISTENCE
 NOT CONCLUSIVELY ESTABLISHED.

----- Y*(1880) MASS (MEV) -----
 M 1882. 40. SMART 68 RVUE -0 K-N TO LAM. PI 7/68*

----- Y*(1880) WIDTH (MEV) -----
 W 222. 150. SMART 68 RVUE -0 K-N TO LAM. PI 7/68*

----- Y*(1880) PARTIAL DECAY MODES -----
 P1 Y*(1880) INTO KBAR N 497+ 939
 P2 Y*(1880) INTO LAMBDA PI 1197+ 139

----- Y*(1880) BRANCHING RATIOS -----
 R1 Y*(1880) INTO (LAMBDA PI)*(KBAR N)/TOTAL**2 (P2)*(P1)/TOTAL**2
 R1 0.012 0.007 SMART 68 RVUE -0 K-N TO LAM. PI 7/68*

REFERENCES -- Y*(1880)

SMART 68 PR 169 1330. W M SMART (LRL) IJP

 Σ (1915) 46 Y*(1915, JP=5/2+) I=1 F 15
 SOME RESERVATION SHOULD BE HELD AGAINST COMPLETE
 ACCEPTANCE OF THE INTERPRETATION OF THIS EFFECT

----- 46 Y*(1915) MASS (MEV) -----
 M * (1942.0) (9.0) BOCK 65 HBC PBAR P 5.7 BEV/C 7/66
 M 1915.0 20.0 COOL 66 CNTR 0 - K-P, D TOTAL 11/66
 M 1905.0 9.0 BUGG 68 CNTR K-P, D TOTAL 7/68*
 M 1902.0 11.0 SMART 68 RVUE -0 K-N TO LAM. PI 7/68*
 M AVG 1905.0041 4.4383 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)

----- 46 Y*(1915) WIDTH (MEV) -----
 W * (36.0) (20.0) (36.0) BOCK 65 HBC 7/66
 W 65.0 COOL 66 CNTR 0- 11/66
 W 60.0 10.0 BUGG 68 CNTR 11/67
 W C (50.0) (20.0) ARMENTER 67 HBC OK-P EL. +CH. EXC. 11/67
 W C LACK OF DATA PREVENTS AUTHORS FROM DETERMINING UNAMBIG THIS AMPLITU. 11/67
 W 52.0 25.0 SMART 68 RVUE -0 K-N TO LAM. PI 7/68*
 W * * * * *
 W AVG 58.8966 9.2848 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)

----- 46 Y*(1915) PARTIAL DECAY MODES -----
 P1 Y*(1915) INTO KBAR N 497+ 939
 P2 Y*(1915) INTO LAMBDA PI 1115+ 139
 P3 Y*(1915) INTO SIGMA PI 1197+ 139

----- 46 Y*(1915) BRANCHING RATIOS -----
 R1 Y*(1915) INTO (KBAR N)/TOTAL (P1)/TOTAL
 R1 * (0.103) COOL 66 CNTR ASSUMING J=5/2 7/66
 R1 0.09 KYCIA 67 CNTR TOTAL CROSS-SEC. 8/67
 R1 A (0.12) (.01) ARMENTER 67 HBC 0 K-P EL. +CH. EXC. 11/67
 R1 A LACK OF DATA PREVENTS AUTHORS FROM DETERMINING UNAMBIG THIS AMPLITU. 11/67
 R1 C 0.06 BUGG 68 CNTR ASSUMING J=5/2 6/68*
 R1 C (0.10) (0.01) CONFORTO 68 HBC 0 K-P ELASTIC 11/68*
 R1 C FIT TO K-P ELAS. DIFFER. CROSS SECTIONS (PART OF DATA INCLUDED IN 11/68*
 R1 C ARMENTEROS 68 WHICH FIT LEGEN. POLYN. COEFFICIENTS)

R2 Y*(1915) INTO (LAMBDA PI)*(KBAR N)/TOTAL**2 (P1*P2)/TOTAL**2
 R2 A (0.006) ARMENTER 67 HBC OK-P TO LAM. PI 11/67
 R2 A LACK OF DATA PREVENTS AUTHORS FROM DETERMINING UNAMBIG THIS AMPLITU. 11/67
 R2 C 0.006 0.003 SMART 68 RVUE -0 K-N TO LAM. PI 7/68*

R3 Y*(1915) INTO (SIGMA PI)*(KBAR N)/TOTAL**2 (P1*P3)/TOTAL**2
 R3 C (0.01) (0.01) K-P TO SIG-PI + 11/67
 R3 C LACK OF DATA PREVENTS AUTHORS FROM DETERMINING UNAMBIG THIS AMPLITU. 11/67

R4 Y*(1915) INTO (LAMBDA PI)/TOTAL (P2)/TOTAL
 R4 * 50 SEEN PRIMER 68 HBC + K-P 4.6-5. GEV/C 7/68*

REFERENCES -- Y*(1915)

BOCK 65 PL 17 166. +COOPER, FRENCH, KINSON, + (CERN, SACLAY) I
 COOL 66 PRL 16 1228. +GIACOMELLI, KYCIA, LEONTIC, LI, LUNDY + (BNL) I
 SMART 66 PRL 17 556. W M SMART, A KERNAN, G E KALMUS, R P ELY (LRL) IJP
 ARMENTER 67 PL 248 198. ARMENTEROS, FERRO-LUZZI + (CERN, HEID, SACLAY)
 ARMENTER 67 NP 83 592. ARMENTEROS, FERRO-LUZZI + (CERN, HEID, SACLAY)
 KYCIA 67 PRIVATE COMM. T F KYCIA (BNL) I

BUGG 68 PR 168 1466. +GILMORE, KNIGHT, DAVIES + (BIRNI, CAMB, RUTH) I
 CONFORTO 68 EFI 68-62 NP TBP. B. CONFORTO, HARMSEN + BURKHARDT + (EFINS + HEID)
 PRIMER 68 PRL 20 610. +GOLDBERG, JAEGER, BARNES, DORNAN + (SYR, BNL)
 SMART 68 PR 169 1330. W M SMART (LRL)

 Σ (2030) 47 Y*(2030, JP=7/2+) I=1
 WOHL 66, SMART 68, AND DAUM 68 FIND JP=7/2+.

----- 47 Y*(2030) MASS (MEV) -----
 M * (2022.0) (20.0) BLANPIED 65 CNTR 0 GAMMA P TO K+ Y* 7/66
 M * (2030.0) (20.0) WOHL 66 HBC 0 K-P TO LAM PID 8/67
 M 2026.0 19.0 KYCIA 67 CNTR K-P, D TOTAL 6/68*
 M 2020.0 7.0 BUGG 68 CNTR K-P, D TOTAL 6/68*
 M 2032.0 6.0 SMART 68 RVUE K-N TO LAM PI 6/68*
 M * * * * *
 M AVG 2026.8678 4.4300 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)

----- 47 Y*(2030) WIDTH (MEV) -----
 W * (120.0) (20.0) BLANPIED 65 CNTR 0 7/66
 W * (170.0) (20.0) WOHL 66 HBC 0 8/67
 W 120.0 10.0 KYCIA 67 CNTR- 6/68*
 W 130.0 10.0 BUGG 68 CNTR 6/68*
 W 160.0 16.0 SMART 68 RVUE INCLUDES WOHL 66 6/68*
 W * * * * *
 W AVG 130.7190 9.7049 AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.5)

----- 47 Y*(2030) PARTIAL DECAY MODES -----
 P1 Y*(2030) INTO KBAR N 497+ 939
 P2 Y*(2030) INTO LAMBDA PI 1115+ 134
 P3 Y*(2030) INTO SIGMA PI 1197+ 139
 P4 Y*(2030) INTO XI K 1321+ 497

----- 47 Y*(2030) BRANCHING RATIOS -----
 R1 Y*(2030) INTO (KBAR N)/TOTAL (P1)/TOTAL
 R1 * (0.25) WOHL 66 HBC 0 K-P CH EX 7/66
 R1 0.105 0.005 KYCIA 67 CNTR 8/67
 R1 0.131 BUGG 68 CNTR 6/68*
 R2 Y*(2030) INTO (LAMBDA PI)*(KBAR N)/TOTAL**2 (P2)*(P1)/TOTAL**2
 R2 * (0.040) WOHL 66 HBC K-P TO LAM P10 7/66
 R2 0.045 0.004 SMART 68 RVUE INCLUDES WOHL 66 6/68*
 R3 Y*(2030) INTO SIGMA PI (P3)
 R3 SEEN GALTIERI 68 HBC K-P TO SIGMA PI 11/68*
 R4 Y*(2030) INTO (XI K)*(KBAR N)/TOTAL**2 (P4)*(P1)/TOTAL**2
 R4 0.00256 OR LESS TRIPP 67 RVUE 8/67

REFERENCES -- Y*(2030)

BLANPIED 65 PRL 14 741. +GREENBERG, HUGHES, KITCHING, LU, + (YALE/CEA)
 COOL 66 PRL 16 1228. +GIACOMELLI, KYCIA, LEONTIC, LI, LUNDY + (BNL) I
 -- SLIGHTLY REVISED RESULTS FROM KYCIA 67 REPLACE COOL 66 --
 KYCIA 67 PRIVATE COMM. T F KYCIA (BNL) I
 WOHL 66 PRL 17 107. C G WOHL, F T SOLMITZ, M L STEVENSON (LRL) IJP
 TRIPP 67 NP 83 10. + LEITH, + (LRL, SLAC, CERN, HEIDEL, SACLAY)
 BUGG 68 PR 168 1466. +GILMORE, KNIGHT, + (RTHFD, BRGMH, CVNOSH) I
 SMART 68 PR 169 1336. W M SMART (LRL) IJP
 DAUM 68 NP 87 19. +ERNE, LAGNAUX, SENS, STEUER, UDO (CERN) IJP
 GALTIERI 68 PRIVATE COMM. L BARBARO-GALTIERI (LRL)

BARYON RESONANCES

Data in parentheses have not been included in our averages.

Σ (2250) 48 Y*1(2250, JP=) I=1

M	2245.0	10.0	BLANPIED	65 CNTR	GAMMA P TO K+ Y*	
M	(2299.0)	(6.0)	BOCK	65 HBC	PBAR P 5.7 BEV/C	
M	2252.0	10.0	KYCIA	67 CNTR	K-P, D TOTAL	8/67
M	2250.0	7.0	BUGG	68 CNTR	K-P, D TOTAL	6/68*
M	AVG	2250.6577	5.7346	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)		

48 Y*1(2250) WIDTH (MEV)

M	(150.0)		BLANPIED	65 CNTR	
M	(21.0)	(17.0)	BOCK	65 HBC	
M	200.0	20.0	KYCIA	67 CNTR	
M	230.0	20.0	BUGG	68 CNTR	
M	AVG	215.0000	15.0000	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.1)	

48 Y*1(2250) PARTIAL DECAY MODES

P1	Y*1(2250)	INTO KBAR N	497*	DECAY MASSES
P2	Y*1(2250)	INTO KBAR N PI	497* 939*	139

48 Y*1(2250) BRANCHING RATIOS

R1	Y*1(2250)	INTO (KBAR N)/TOTAL	(P1)/TOTAL
R1	J IS NOT KNOWN.	FOLLOWING IS (J+1/2)*(KBAR N)/TOTAL	
R1	0.31	0.02	KYCIA 67 CNTR
R1	0.47		BUGG 68 CNTR

REFERENCES -- Y*1(2250)

BLANPIED 65 PRL 14 741 +GREENBERG, HUGHES, KITCHING, + (YALE(CEA))
 BOCK 65 PL 17 166 +COOPER, FRENCH, KINGSON, + (CERN, SAUCLAY)
 COOL 66 PRL 16 1228 +GIACOMELLI, KYCIA, LEONTIC, LI, LUNDBY, + (BNL) I
 KYCIA 67 PRIVATE COMM. T F KYCIA
 BUGG 68 PR 168 1466 +GILMORE, KNIGHT, + (RTHFD, BRMGHM, CVNDOSH) I

PAPER NOT REFERRED TO IN DATA CARDS.

DAUBER 66 PL 23 154 +SCHLEIN, SLATER, STORK, TICHU (UCLA(LRL)) J
 -- SUGGESTS J=9/2 RESONANT BEHAVIOR IN SIGMA- PI+, BUT APPEARS INCONSISTENT WITH PARAMETERS OF COOL 66.

Σ (2455) 53 Y*1(2455, JP=) I=1

ONE OF TWO NEW SMALL BUMPS IN THE I=1 TOTAL CROSS SECTION (SEE THE Y*1(2595)). IT IS REASONABLE TO INTERPRET THEM AS RESONANCES, THOUGH THAT IS NOT CERTAIN. THERE IS ALSO LESSER EVIDENCE FOR NEW STRUCTURE IN THE I=0 CROSS SECTION -- SEE ABRAMS 67.
 THERE IS ALSO SOME SLIGHT EVIDENCE FOR Y* STATES IN THIS MASS REGION FROM THE REACTION GAMMA + P TO K+ + MISSING MASS -- SEE GREENBERG 68.

M	2455.0	10.0	ABRAMS	67 CNTR	K-P, D TOTAL	11/67
M	2455.0	7.0	BUGG	68 CNTR	K-P, D TOTAL	6/68*
M	AVG	2455.0000	5.7346	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)		

53 Y*1(2455) WIDTH (MEV)

M	140.0		ABRAMS	67 CNTR	
M	100.0	20.0	BUGG	68 CNTR	

53 Y*1(2455) PARTIAL DECAY MODES

P1	Y*1(2455)	INTO KBAR N	497*	DECAY MASSES
			939*	

53 Y*1(2455) BRANCHING RATIOS

R1	Y*1(2455)	INTO (KBAR N)/TOTAL	(P1)/TOTAL
R1	J IS NOT KNOWN.	FOLLOWING IS (J+1/2)*(KBAR N)/TOTAL	
R1	0.26		ABRAMS 67 CNTR
R1	0.3		BUGG 68 CNTR

REFERENCES -- Y*1(2455)

ABRAMS 67 PRL 19 678 +COOL, GIACOMELLI, KYCIA, LEONTIC, LI, + (BNL)
 BUGG 68 PR 168 1466 +GILMORE, KNIGHT, + (RTHFD, BRMGHM, CVNDOSH) I
 GREENBERG 68 PRL 20 221 GREENBERG, HUGHES, LU, MINEHART, + (YALE)

Σ (2595) 54 Y*1(2595, JP=) I=1

SEE NOTE UNDER THE Y*1(2455).

M	2595.0	10.0	ABRAMS	67 CNTR	K-P, D TOTAL	11/67
---	--------	------	--------	---------	--------------	-------

54 Y*1(2595) WIDTH (MEV)

M	140.0		ABRAMS	67 CNTR	
---	-------	--	--------	---------	--

54 Y*1(2595) PARTIAL DECAY MODES

P1	Y*1(2595)	INTO KBAR N	497*	DECAY MASSES
			939*	

54 Y*1(2595) BRANCHING RATIOS

R1	Y*1(2595)	INTO (KBAR N)/TOTAL	(P1)/TOTAL
R1	J IS NOT KNOWN.	FOLLOWING IS (J+1/2)*(KBAR N)/TOTAL	
R1	0.26		ABRAMS 67 CNTR

REFERENCES -- Y*1(2595)

ABRAMS 67 PRL 19 678 +COOL, GIACOMELLI, KYCIA, LEONTIC, LI, + (BNL)

Σ (3000) 59 Y*1(3000, JP=) I=1

ENHANCEMENT IN LAMBDA PI AND KBAR N INVARIANT MASS SPECTRA AND IN MISSING MASS OF NEUTRALS RECOILING AGAINST KO. EVIDENCE NOT CONCLUSIVE. OMITTED FROM TABLE.

M	3000.0		EHRlich	66 HBC	0 PI-P 7.91 BEV/C	9/66
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59 Y*1(3000) PARTIAL DECAY MODES

P1	Y*1(3000)	INTO KBAR N	497*	DECAY MASSES
P2	Y*1(3000)	INTO LAMBDA PI	939*	1115*
			139	

REFERENCES -- Y*1(3000)

EHRlich 66 PR 152 1194 R EHRlich, M SELGVE, H YUTA (PENNLBNL) I

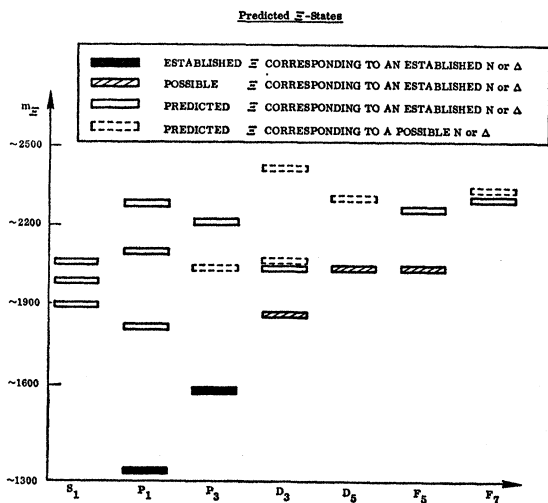
Note on Ξ's

This year, for the first time since 1966, there is significant new information on Ξ's. ALITTI 68 have given new information on the Ξ(1820), have confirmed the Ξ(1930), and have discovered a Ξ(2030). New information on the Ξ(1930) also has come from DAUBER 68. However, for none of these resonances is the spin-parity known, nor is there more than semiquantitative information on branching ratios. Only the other (and lowest-mass) Ξ resonance, the Ξ(1530), can be said to be well understood. The reason for this scarcity of information is of course that Ξ's cannot be produced in attainable s-channel formation experiments, and their production cross sections are very small.

SU(3) symmetry predicts that for each N and Δ there is a Ξ. We here reproduce a figure given by H. Harari, which shows the approximate spectrum to be expected from the known or suspected N and Δ states. The retarded state of information on Ξ's is evident; moreover Ξ's are so inaccessible that no rapid improvement is foreseen. Furthermore, when apparent discrepancies among experiments occur [for example, see the Ξ(1820) → ΣK̄ decay branching ratio], it may mean only that the different experiments are seeing different Ξ's (or different mixtures of them) having about the same mass, and not that one or another of the experiments is wrong.

BARYON RESONANCES

Data in parentheses have not been included in our averages.



The predicted Ξ spectrum. The approximate mass scale is based on adding 300 to 350 MeV to the mass of the corresponding N or Δ state. This figure is taken from H. Harari (rapporteur talk, 1968 Vienna Conference, p. 195).

Ξ^- 22 Ξ^- (1321, JP=1/2) I=1/2
SEE LISTINGS OF STABLE PARTICLES

Ξ^0 23 Ξ^0 (1314, JP=1/2) I=1/2
SEE LISTINGS OF STABLE PARTICLES

$\Xi(1530)$ 49 $\Xi(1530)$ (1530, JP=3/2) I=1/2
49 $\Xi(1530)$ MASS (MEV)

M	1529.0	15.0	PJERROU	62 HBC	0- K-P 1.8 BEV/C	
M	1532.0	12.0	BADIER	64 HBC	0- K-P 3 BEV/C	7/66
M	1535.7	3.2	LONDON	66 HBC	- K-P 2.24 BEV/C	7/66
M	1528.7	1.1	LONDON	66 HBC	0	7/66

49 $\Xi(1530)$ MASS DIFFERENCE (MEV)

D	5.7	3.0	PJERROU	65 HBC	0- K-P 1.8-1.95 B/C	7/66
D	7.0	4.0	LONDON	66 HBC	0-	7/66
D	2.0	3.2	MERRILL	66 HBC	0- K-P 1.7-2.7 BEV/C	7/66
D	3.9692	2.1886	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)			

49 $\Xi(1530)$ WIDTH (MEV)

M	7.0	2.0	SCHLEIN	63 HBC	0 K-P 1.8-1.95 B/C	7/66
M	8.5	3.5	LONDON	66 HBC	0	7/66
M	7.0	7.0	BERGE	66 HBC	0 K-P 1.5-1.7 BEV/C	7/66
M	7.3478	1.6854	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)			

49 $\Xi(1530)$ PARTIAL DECAY MODES

P1	$\Xi(1530)$ INTO Ξ P1	DECAY PHASES	1321+ 139
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REFERENCES -- $\Xi(1530)$

PJERROU 62 PRL 9 114 +PROHSE,SCHLEIN,SLATER,STORK,TICHO (UCLA) I
 SCHLEIN 63 PRL 11 167 +CARMONY,PJERROU,SLATER,STORK,TICHO (UCLA) IJP
 BADIER 64 DUBNA I 593 +DEMOLIN,GOLDBERG,+ (EP,SACLAY,AMSTR) I
 PJERROU 65 PRL 14 275 +SCHLEIN,SLATER,SMITH,STORK,TICHO (UCLA)
 LONDON 66 PR 143 1034 +RAU,SARIDIS,YAHAMOTO,GOLDBERG,+ (BNL,SYR) IJ
 BERGE 66 PR 147 945 +EBERHARD,HUBBARD,MERRILL,B-SHAFFER,+ (LRL) I
 MERRILL 66 UCRL-16455 THESIS D W MERRILL (LRL) JP
 SHAFER 66 PR 142 883 BUTTON-SHAFFER,LINDSEY,MURRAY,SMITH (LRL) JP
 -- A SPIN-PARITY DETERMINATION.

$\Xi(1700)$ 51 $\Xi(1700)$ (1700, JP=) I=1/2
EVIDENCE NOT COMPELLING. OMITTED FROM TABLE.

51 $\Xi(1700)$ MASS (MEV)

M	1705.0	APPROX	SMITH	65 HBC	0- K-P 2.1-2.7 BEV/C
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51 $\Xi(1700)$ WIDTH (MEV)

M	20.0	APPROX	SMITH	65 HBC	0-
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51 $\Xi(1700)$ PARTIAL DECAY MODES

P1	$\Xi(1700)$ INTO Ξ P1	DECAY PHASES	1321+ 139
P2	$\Xi(1700)$ INTO Λ B-KAR	DECAY PHASES	1115+ 497

REFERENCES -- $\Xi(1700)$

SMITH 65 ATHENS CONF 251 G A SMITH, J S LINDSEY (LRL) I

$\Xi(1820)$ 50 $\Xi(1820)$ (1820, JP=) I=1/2
50 $\Xi(1820)$ MASS (MEV)

M	1770.0	7.0	HALSTEINS	63 HBC	0- K-P 3.5 BEV/C	
M	1814.0	4.0	SMITH	65 HBC	0- K-P 2.4-2.7 BEV/C	
M	1830.0	10.0	BADIER	65 HBC	0 K-P 3 BEV/C	11/68*
M	1830.0	10.0	ALITTI	68 HBC	- K-P 3.9-5 BEV/C	11/68*
M	1816.3811	3.4541	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.1)			

50 $\Xi(1820)$ WIDTH (MEV)

M	80.0	OR LESS	HALSTEINS	63 HBC	0-	
M	12.0	4.0	BADIER	65 HBC	0	
M	30.0	7.0	SMITH	65 HBC	0-	
M	60.0	35.0	20.0	ALITTI	68 HBC	-
M	17.1148	7.7226	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 2.2)			

50 $\Xi(1820)$ PARTIAL DECAY MODES

P1	$\Xi(1820)$ INTO Λ B-KAR	DECAY PHASES	1115+ 497
P2	$\Xi(1820)$ INTO Ξ P1	DECAY PHASES	1321+ 139
P3	$\Xi(1820)$ INTO Σ B-KAR	DECAY PHASES	1197+ 497
P4	$\Xi(1820)$ INTO $\Xi(1530)$ P1	DECAY PHASES	1530+ 139
P5	$\Xi(1820)$ INTO Ξ P1 P1 (Ξ P1 NOT $\Xi(1530)$)	DECAY PHASES	1321+ 139+ 139

50 $\Xi(1820)$ BRANCHING RATIOS

R1	$\Xi(1820)$ INTO (Λ B-KAR)/TOTAL	(P1)/TOTAL		
R1	LARGE	BADIER	65 HBC	
R1	LARGE	SMITH	2 65 HBC	
R1	0.6	ALITTI	68 HBC	
R1			7/66	
R2	$\Xi(1820)$ INTO (Ξ P1)/TOTAL	(P2)/(P1)		
R2	0.20	0.20	BADIER	65 HBC
R2	SMALL	SMITH	2 65 HBC	
R2	SMALL	ALITTI	68 HBC	
R2			7/66	
R2			IF $\Xi(1933)$ EXIST	
R2			7/66	
R3	$\Xi(1820)$ INTO (Σ B-KAR)/TOTAL	(P3)/TOTAL		
R3	0.02	OR LESS	TRIPP	67 RVUE
R3	0.3		ALITTI	68 HBC
R3				8/67
R3				11/68*
R4	$\Xi(1820)$ INTO ($\Xi(1530)$ P1)/TOTAL	(P4)/(P1)		
R4	0.26	0.13	SMITH	1 65 HBC
R4	SMALL	BADIER	65 HBC	
R4				7/66
R5	$\Xi(1820)$ INTO (Ξ P1 P1)/TOTAL	(P5)/(P1)		
R5	0.1	OR MORE	SMITH	1 65 HBC
R5	SMALL	BADIER	65 HBC	
R5				7/66
R6	$\Xi(1820)$ INTO ($\Xi(1530)$ P1)/TOTAL	(P4)/TOTAL		
R6	0.1		ALITTI	68 HBC
R6				11/68*

REFERENCES -- $\Xi(1820)$

HALSTEIN 63 SIENA CONF 173 HALSTEINSLID,+ (BERGEN,CERN,EP,RTHF,UNICOL) I
 SMITH 1 65 PRL 14 25 +LINDSEY,BUTTON-SHAFFER,MURRAY (LRL) IJP
 BADIER 65 PL 16 171 +DEMOLIN,GOLDBERG,+ (EP,SACLAY,AMSTR) I
 SMITH 2 65 ATHENS CONF 251 G A SMITH, J S LINDSEY (LRL)
 TRIPP 67 NP B3 10 + LEITH,+ (LRL,SLAC,CERN,HEIDEL,SACLAY)
 MERRILL 68 PR 167 1202 D W MERRILL, J BUTTON-SHAFFER (LRL)
 -- WEAK EVIDENCE CONCERNING JP.
 ALITTI 68 VIENNA CONFERENCE +FLAMINIO,METZGER,RADDJICIC,+ (BNL,SYRACUSE) I

$\Xi(1930)$ 52 $\Xi(1930)$ (1930, JP=) I=1/2
52 $\Xi(1930)$ MASS (MEV)

M	35 1933.0	16.0	BADIER	65 HBC	0 K-P 3 BEV/C	
M	19 1930.0	20.0	ALITTI	68 HBC	0 K-P 4.6-5 BEV/C	11/68*
M	66(1894.0)	(18.0)	DAUBER	68 HBC	- K-P 2.7 BEV/C	11/68*
M	1931.8293	12.4939	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.0)			

52 $\Xi(1930)$ WIDTH (MEV)

M	35 140.0	35.0	BADIER	65 HBC	0	
M	19 80.0	40.0	ALITTI	68 HBC	0	11/68*
M	66 (98.0)	(23.0)	DAUBER	68 HBC	-	11/68*
M	113.9823	29.7345	AVERAGE (ERROR INCLUDES SCALE FACTOR OF 1.1)			

52 $\Xi(1930)$ PARTIAL DECAY MODES

P1	$\Xi(1930)$ INTO Ξ P1	DECAY PHASES	1321+ 139
P2	$\Xi(1930)$ INTO Λ B-KAR	DECAY PHASES	1115+ 497

52 $\Xi(1930)$ BRANCHING RATIOS

R1	$\Xi(1930)$ INTO Ξ P1	(P1)	
R1	SEEN	BADIER	65 HBC
R1	SEEN	ALITTI	68 HBC
R1	SEEN	DAUBER	68 HBC
R1			11/68*
R1			11/68*

LOOKED FOR BUT NOT SEEN IN OTHER CHANNELS. SEE ALITTI 68.

BARYON RESONANCES

Data in parentheses have not been included in our averages.

REFERENCES -- XI*1/2(1930)

BADIER 65 PL 16 171 +DEMOULIN, GOLDBERG, + (EP, SACLAY, AMST) I
 ALITTI 68 PNL 21 1119 +FLAMINIO, METZGER, RADOJICIC, + (BNL, SYRACUSE) I
 DAUBER 68 PR (SUBMITTED) +BERGE, HUBBARD, MERRILL, MULLER (LRL) I

 Ξ (2030) 68 XI*1/2(2030, JP= 1 1=1/2
 68 XI*1/2(2030) MASS (MEV) -----
 M 2030.0 10.0 ALITTI 68 HBC - K-P 3.9-5 BEV/C 11/68*
 ----- 68 XI*1/2(2030) WIDTH (MEV) -----
 W 50.0 25.0 20.0 ALITTI 68 HBC - 11/68*
 ----- 68 XI*1/2(2030) PARTIAL DECAY MODES -----
 DECAY MASSES
 P1 XI*1/2(2030) INTO XI P1 1321+ 139
 P2 XI*1/2(2030) INTO LAMBDA KBAR 1115+ 497
 P3 XI*1/2(2030) INTO SIGMA KBAR 1197+ 497
 P4 XI*1/2(2030) INTO XI*1/2(1530) P1 1530+ 139
 ----- 68 XI*1/2(2030) BRANCHING RATIOS -----
 R1 XI*1/2(2030) INTO (XI P1)/TOTAL (P1)/TOTAL
 R1 SMALL ALITTI 68 HBC - 11/68*
 R2 XI*1/2(2030) INTO (LAMBDA KBAR)/TOTAL (P2)/TOTAL
 R2 0.5 ALITTI 68 HBC - 11/68*
 R3 XI*1/2(2030) INTO (SIGMA KBAR)/TOTAL (P3)/TOTAL
 R3 0.5 ALITTI 68 HBC - 11/68*
 R4 XI*1/2(2030) INTO (XI*1/2(1530) P1)/TOTAL (P4)/TOTAL
 R4 SMALL ALITTI 68 HBC - 11/68*

REFERENCES -- XI*1/2(2030)

ALITTI 68 VIENNA CONFERENCE +FLAMINIO, METZGER, RADOJICIC, + (BNL, SYRACUSE) I

Ω^- 24 OMEGA - (1675, JP=3/2+) I=0
 SEE LISTINGS OF STABLE PARTICLES

APPENDIX I. Test of $\Delta I = 1/2$ Rule
for K Decays

The quantities of interest for making tests of theoretical predictions regarding K decay are usually partial decay rates for single channels or special sums of channels. It is not possible to compute the errors on sums, difference, and ratios of partial decay rates from the information given in Table S because of the presence of off-diagonal terms in the error matrix. For this reason we give some of these quantities below.

Table I.

$\Gamma_{K_{l3}^+} = \Gamma_{K_{e3}^+} + \Gamma_{K_{\mu 3}^+} = (6.51 \pm .15) \times 10^6 \text{ sec}^{-1}$
$\Gamma_{K_{\tau}^+} - \Gamma_{K_{\tau'}^+} = (3.14 \pm .05) \times 10^6 \text{ sec}^{-1}$
$\Gamma_{K_{\mu 3}^+} / \Gamma_{K_{e3}^+} = 0.66 \pm .02$
$\Gamma_{K_{\tau}^+} / \Gamma_{K_{\tau'}^+} = 3.28 \pm .09$
$\Gamma_{K_{l3}^0} = \Gamma_{K_{e3}^0} + \Gamma_{K_{\mu 3}^0} = (12.24 \pm 0.46) \times 10^6 \text{ sec}^{-1}$
$\Gamma_{K_{\mu 3}^0} / \Gamma_{K_{e3}^0} = 0.75 \pm 0.04$
$\Gamma_{K_{\pi^0 \pi^0 \pi^0}^0} / \Gamma_{K_{\pi^+ \pi^- \pi^0}^0} = 1.70 \pm 0.07$

The $\Gamma_{K_{l3}}$ rates are useful in testing the leptonic $\Delta I = 1/2$ rule in the way suggested by Trilling.¹ The predictions are

$$\Gamma_{K_{l3}^0} / 2\Gamma_{K_{l3}^+} = 1.01, \text{ a phase-space factor,}^2$$

and $\Gamma_{K_{\mu 3}^0} / \Gamma_{K_{e3}^0} = \Gamma_{K_{\mu 3}^+} / \Gamma_{K_{e3}^+}$.

From Table I,

$$\Gamma_{K_{l3}^0} / 2\Gamma_{K_{l3}^+} = 0.94 \pm 0.04$$

$$\text{and } \frac{\Gamma_{K_{\mu 3}^0}}{\Gamma_{K_{e3}^0}} \left[\frac{\Gamma_{K_{\mu 3}^+}}{\Gamma_{K_{e3}^+}} \right]^{-1} = 1.14 \pm 0.07.$$

These results seem to show a less than 2σ disagreement with the predictions, but the errors should be regarded with caution in view of the internal disagreements in the data. (Note the ideograms in the data listing for the charged K meson.)

The three pion ratios may be used in the following tests of the $\Delta I = 1/2$ rule:

$$R_1 = \frac{2}{3} \frac{\Gamma_{K^0 \pi^0 \pi^0 \pi^0}}{\phi_1} \left[\frac{\Gamma_{K^+ \pi^+ \pi^- \pi^0}}{\phi_2} \right]^{-1} = 1,$$

$$R_2 = \frac{1}{4} \frac{\Gamma_{K_{\tau}^+}}{\phi_3} \left[\frac{\Gamma_{K_{\tau'}^+}}{\phi_4} \right]^{-1} = 1,$$

$$R_3 = \frac{1}{2} \frac{\Gamma_{K^0 \pi^+ \pi^- \pi^0}}{\phi_2} \left[\frac{\Gamma_{K_{\tau'}^+}}{\phi_4} \right]^{-1} = 1,$$

$$R_4 = \frac{\Gamma_{K_{\pi^0 \pi^0 \pi^0}^0}}{\phi_1} \left[\frac{\Gamma_{K_{\tau}^+}}{\phi_3} - \frac{\Gamma_{K_{\tau'}^+}}{\phi_4} \right]^{-1} = 1,$$

where the ϕ_i are phase-space factors. They have been calculated by Trilling (UDP),¹ assuming uniform Dalitz plot distributions for the three pions, and by Devlin and Barshay (NUDP),³ including the mass differences between the pions and the observed slopes for the Dalitz plot distributions. These values are

	Method	
	UDP	NUDP
ϕ_1	1.495	1.480
ϕ_2	1.225	1.310
ϕ_3	1.000	1.000
ϕ_4	1.248	1.210

The corresponding values of the ratios are

	Method	
	UDP	NUDP
R ₁	0.93 ± 0.04	1.00 ± 0.04
R ₂	1.02 ± 0.03	0.99 ± 0.03
R ₃	0.87 ± 0.04	0.79 ± 0.04
R ₄	0.79 ± 0.04	0.80 ± 0.04

For the first two ratios there seems to be good agreement with the predictions of the $\Delta I = 1/2$ rule. For R₃ and R₄ the disagreement seems to be significant. This would indicate that a $\Delta I = 3/2$ transition is present in $K \rightarrow 3\pi$ decay.

FOOTNOTES

1. G. Trilling, K-Meson Decays, UCRL-16473 (updated from Argonne Conference Proceedings, 1965, p. 115).
2. N. Brene (CERN), private communication. In our Jan. 1968 edition we had erroneously used 1.04.
3. T. Devlin and S. Barshay, Phys. Rev. Letters 19, 881 (1967).

APPENDIX II. (C. Zemach)

Selection Rules for Meson Decays

Some considerations related to quantum number assignments are sketched here with emphasis on points that sometimes cause uncertainty.

A1. C, P, and G for Decays into Particle-Antiparticle

The reasoning behind Eqs. (8) through (12) of the text is presented here in more detail.

First consider boson-antiboson ($\bar{b}b$) and fermion-antifermion ($\bar{f}f$) states, where \bar{b} and \bar{f} are the antiparticles of the b and f respectively. Later, as in Section A4, we suppose that b, f are members of isotopic multiplets,

and that \bar{b}, \bar{f} are any members of the antiparticle multiplets.

The properties C and P for particle-antiparticle states are determined by the relation of states to the field operators that create the particles out of the vacuum, and to their commutation properties.

Any state may be represented as a superposition of free particle states. Let $\psi_\alpha^N(\underline{x})$ be the field operator which, acting upon the vacuum state Ψ_{vac} , creates a free particle at position \underline{x} with spin component α and particle number N (where $N = +1$ for particle, $N = -1$ for antiparticle). The state Ψ containing, among other things, two particles of this field is given by

$$\Psi = \left[\sum_{\alpha, \beta} \int d\underline{x} d\underline{y} \int f_{\alpha, \beta}^{N, M}(\underline{x}, \underline{y}, \dots) \times \psi_\alpha^N(\underline{x}) \psi_\beta^M(\underline{y}) \dots \right] \Psi_{\text{vac}} + \dots \quad (\text{A1})$$

(The dots inside the bracket refer to other particles and the dots outside the brackets refer to possible admixture of states with other numbers of particles of the ψ field. For simplicity, ignore these notational complications.) The wave function f , by its dependence on $\underline{x}, \underline{y}$ and $\underline{g}, \underline{\beta}$ may specify a definite orbital angular momentum ℓ , with orbital parity $(-1)^\ell$, and total spin S . The behavior of Ψ under particle exchange X, parity P, and charge conjugation C is determined by the behavior of the field operators.

For spin zero,

- (a) $\psi^{-1}(\underline{x}) = (\psi^{+1}(\underline{x}))^\dagger$ (\dagger = adjoint),
- (b) $\psi^N(\underline{x})$ and $\psi^M(\underline{y})$ commute*,
- (c) $P \psi^N(\underline{x}) = \eta_P \psi^N(-\underline{x})$ ($\eta_P = \pm 1$ = intrinsic parity),
- (d) $C \psi^N(\underline{x}) = \eta_C \psi^{-N}(\underline{x})$ ($\eta_C = \pm 1$ = intrinsic charge-conjugation number)

* In the commutation or anticommutation of ψ^{+1} and ψ^{-1} , a δ function of $\underline{x}-\underline{y}$ also enters, but this will not affect the explicitly written parts of Eq. (A1), and we ignore it.

For spin 1/2, we use the following representation of the Dirac γ matrices

$$\gamma_0 = \begin{vmatrix} 1 & 0 \\ 0 & -1 \end{vmatrix}, \quad \gamma_k = \begin{vmatrix} 0 & \sigma_k \\ -\sigma_k & 0 \end{vmatrix}, \quad (\text{A2})$$

and, also

$$\bar{\psi} = \psi^\dagger \gamma_0 = \gamma_0 \psi^\dagger. \quad (\text{A3})$$

If ψ^{+1} is the field operator for a particle, and ψ^{-1} is the field operator for its antiparticle, then ψ^{-1} is charge conjugation upon ψ^{+1} and with representation (A2),

$$(a') \quad \psi^{-1} = i\gamma_0 \gamma_2 \psi^{+1},$$

which, by (A3), is equivalent to

$$(a'') \quad \psi^{-1} = -i\gamma_2 (\psi^{+1})^\dagger.$$

$$(b') \quad \psi^N(\underline{x}) \text{ and } \psi^M(\underline{y}) \text{ anticommute.}^*$$

Under parity, $\psi(\underline{x})$ transforms into $\gamma_0 \psi(-\underline{x})$,
 $\bar{\psi}(\underline{x})$ transforms into $\gamma_0 \bar{\psi}(-\underline{x})$.

Introducing an intrinsic parity $\eta_P = \pm 1$ for particles, we write

$$(c') \quad P\psi^{+1}(\underline{x}) = \eta_P \gamma_0 \psi^{+1}(-\underline{x}),$$

but the equivalent expression (c'') for antiparticles has a factor of -1. [§] In fact, operating with P on (a'), and using (c'), then (A3), then $\gamma_0^2 = 1$, then (a''), we have

$$(c'') \quad P\psi^{-1}(\underline{x}) = -\eta_P \gamma_0 \psi^{-1}(-\underline{x}).$$

Next consider charge conjugation. Again there is an intrinsic charge conjugation number $\eta_C = \pm 1$, so we write

$$(d') \quad C\psi^{+1}(\underline{x}) = \eta_C \psi^{-1}(\underline{x}).$$

Unlike the parity case there is no factor of -1 in Eq. (d'') for antiparticles, but simply

$$(d'') \quad C\psi^{-1}(\underline{x}) = \eta_C \psi^{+1}(\underline{x}).$$

(To get d'' from d' use $\gamma_2^2 = -1$, $\gamma_2^\dagger = -\gamma_2$,
 $\gamma_2^{\text{transpose}} = +\gamma_2$.)

For spin $> 1/2$, we assert that the conclusions below for spin 0 are valid for bosons in general, and the conclusions for spin 1/2 are valid for fermions.

With Eqs. (a) through (d), or their primed equivalents, the effects of P and C operations

[§]This point has been verified experimentally in the $\gamma\gamma$ decay of 1S_0 positronium; see C. S. Wu and I. Shaknow, Phys. Rev. 77, 136 (1950).

on a particle-antiparticle state in Eq. (A1) are easily computed when the state carries definite ℓ and S. Interchanging space coordinates in the center of mass yields

$$f(\underline{y}, \underline{x}) = f(-\underline{x}, -\underline{y}) = (-1)^\ell f(\underline{x}, \underline{y}).$$

Exchanging spins introduces a sign X_S ,

$$f_{\alpha\beta} = X_S f_{\beta\alpha},$$

with $X_S = (-1)^S$ for integral spins. (A4)

and $X_S = (-1)^{S+1/2}$ for half-integral spins. (A5)

Operating with C, we get

$$\begin{aligned} C\Psi_{\bar{f}\bar{f}} &= \int d\underline{x}d\underline{y} f_{\alpha\beta}^{+1,-1}(\underline{x}, \underline{y}) C\psi_\alpha^{+1}(\underline{x}) C\psi_\beta^{-1}(\underline{y}) \Psi_{\text{vac}} \\ &= \int d\underline{x}d\underline{y} f_{\alpha\beta}^{+1,-1}(\underline{x}, \underline{y}) \psi_\alpha^{-1}(\underline{x}) \psi_\beta^{+1}(\underline{y}) \Psi_{\text{vac}}. \end{aligned}$$

Commuting the ψ 's for fermions yields the crucial factor of -1, i. e.

$$= - \int d\underline{x}d\underline{y} f_{\alpha\beta}^{+1,-1}(\underline{x}, \underline{y}) \psi_\beta^{+1}(\underline{y}) \psi_\alpha^{-1}(\underline{x}) \Psi_{\text{vac}}.$$

We can then interchange the variables $\underline{x}, \underline{y}$ and α, β to relabel the ψ 's as in (A1),

$$= - \int d\underline{y}d\underline{x} f_{\beta\alpha}^{+1,-1}(\underline{y}, \underline{x}) \psi_\alpha^{+1}(\underline{x}) \psi_\beta^{-1}(\underline{y}) \Psi_{\text{vac}}.$$

Thus the net effect of C on $f_{\alpha\beta}(\underline{x}, \underline{y})$ is equivalent to space and spin exchange times minus one. Using (A4) and (A5) we get text Eq. (11a),

$$C(\bar{f}\bar{f}) = (-1)^{\ell+S} (\bar{f}\bar{f}). \quad (\text{A6})$$

Similarly we can get Eq. (12),

$$P(\bar{f}\bar{f}) = -(-1)^\ell (\bar{f}\bar{f}). \quad (\text{A7})$$

Once we have worked through the above for $\bar{f}\bar{f}$, we can even more easily see that for $b\bar{b}$ we get the same equation, numbered (8a) in the text,

$$C(b\bar{b}) = (-1)^{\ell+S} (b\bar{b}), \quad (\text{A8})$$

and for parity,

$$P(b\bar{b}) = (-1)^\ell (b\bar{b}). \quad (\text{A9})$$

In summary we can restate the words above (A6) as follows. By using commutation for bosons (or anticommutation for fermions) we have generalized to particle-antiparticle pairs the familiar rules for the exchange of bosons,

$$X = X_P CX_S = +1, \quad (7)$$

and fermions,

$$X = X_P CX_S = -1. \quad (10)$$

A2. Extended Statistics

A state of N different particles can be described by a wave function $\phi(x_1, x_2, x_3, \dots)$ supplemented by an ordering convention that the first coordinate stands for particle 1, the second for particle 2, etc. Alternatively, we may introduce a type variable t , which takes on discrete values labeling the different particles, and consider functions $\phi(x_1, t_1; x_2, t_2; \dots)$ in the enlarged set of variables. Then there is no need for an ordering convention. Each physical state is described by $N!$ different functions, obtained by the $N!$ permutations of the arguments (x_i, t_i) , $i = 1, 2, \dots, N$. To remove the ambiguity, we may require that only the function completely symmetric (or anti-symmetric) under interchange of x and t be used to represent a state. If the particles are all bosons (fermions) and the restriction that the particles are all different is dropped, then clearly the choice of symmetry (antisymmetry) is appropriate, as the requirement of ordinary Bose (Fermi) statistics is imposed when, and only when, it is applicable.

So far, this procedure is purely formal. It becomes useful if the interaction among the particles is symmetric. Then an initially symmetric or antisymmetric state remains so automatically, even if the dynamics transforms one type of particle into another. Thus, e. g., the combined implications of statistics and isospin invariance for a multipion state can be most efficiently realized when the state is regarded as completely symmetric

under simultaneous interchange of space and isospin coordinates.

A3. On Isotopic Spin

The incorporation of sets of elementary particles into isotopic multiplets with definite phase relationships follows from, by now, standard expressions for the interactions, e. g., $\bar{N}\gamma_5\tau N \cdot \pi$, $\bar{N}_\alpha\gamma_5\Lambda K_\alpha$, etc. Let the proton and neutron operators transform under C like $C p = i\gamma_0\gamma_2\bar{p}$ and $C n = i\gamma_0\gamma_2\bar{n}$, i. e., same intrinsic C for p and n assumed. Then, under C , $\bar{N}\tau_1 N$ transforms into itself for $i = 1, 3$ and into its own negative for $i = 2$. Thus (π_1, π_2, π_3) is an isovector in (Cartesian) three-space and for C invariance of the interaction, must have the C properties

$$C(\pi_1) = +\pi_1, \quad C(\pi_2) = -\pi_2, \quad C(\pi_3) = +\pi_3.$$

In terms of the convention for charged pions,

$$\pi^+ = (\pi_1 + i\pi_2)/\sqrt{2}, \quad \pi^0 = \pi_3, \quad \pi^- = (\pi_1 - i\pi_2)/\sqrt{2},$$

we have

$$C(\pi^+) = +\pi^-, \quad C(\pi^0) = +\pi^0, \quad C(\pi^-) = +\pi^+,$$

and the triplet $(-\pi^+, \pi^0, \pi^-)$ transforms like an $I = 1$ multiplet with $I_z = +1, 0, -1$, respectively according to the usual (Condon-Shortly) conventions. (Note the minus sign in front of π^+ .)

Let $\{a_m\}$ be an isotopic multiplet of particles of isotopic spin I , where $m = I, I-1, \dots, -I$ labels the z component of isospin. Then for any isospin rotation, there exists a matrix D_{mn} and a transformation law

$$a'_m = \sum_n D_{mn} a_n. \quad (A10)$$

Now let \bar{a}_m be a member of the antiparticle multiplet, again with m labeling the z component of isospin. Then \bar{a}_m is the charge conjugate of a_{-m} . That is, $\bar{a}_m = \overline{(a_{-m})}$. Under a rotation, the \bar{a}_m do not follow the same transformation law (A10) as the a_m . But the

correct law for transformation of the \bar{a}_m is inferred from the requirement that $\sum_m \bar{a}_m a_m$ be invariant. In fact (see, e.g., A. R. Edmonds, Angular Momentum) the quantity $(-1)^{I+m} \bar{a}_m$ does follow the same law as a_m . Thus, if (K^+, K^0) and (p, n) are K meson and nucleon doublets transforming, respectively, like the $I_z = +1/2$ and the $I_z = -1/2$ members of an isospinor, then $(-K^0, K^-)$ and (\bar{n}, \bar{p}) transform likewise. It is instructive to compare the isoscalar and isovector states formed (a) from a KK state and (b) from a $K\bar{K}$ state:

	KK	$K\bar{K}$
I = 0:	$(K^+K^0 - K^0K^+)/\sqrt{2}$	$(K^+K^- + K^0\bar{K}^0)/\sqrt{2}$
	K^+K^+	$-K^+\bar{K}^0$
I = 1:	$(K^+K^0 + K^0K^+)/\sqrt{2}$	$(K^+K^- - K^0\bar{K}^0)/\sqrt{2}$
	K^0K^0	K^0K^-

A4. G Parity

The G-conjugation operator is defined by

$$G = C e^{i\pi I_y} \quad (\text{A11})$$

and is conserved in strong interactions. The factor $e^{i\pi I_y}$ represents rotation by π around the y axis of isospin space. A useful fact about this rotation is

$$e^{i\pi I_y} |I, I_z\rangle = (-1)^{I-I_z} |I, -I_z\rangle. \quad (\text{A12})$$

Let $\{a_m\}$ be an isotopic multiplet of definite I, with $m \equiv I_z$, which is closed to C, that is, the charge conjugate (= antiparticle) of each member of the multiplet is also a member of the multiplet. Since C reverses I_z , charge, baryon number, hypercharge, etc., such a multiplet has baryon number zero, hypercharge zero, and the neutral member has $I_z = 0$. The pion triplet and any multiplet of particle-antiparticle pairs are examples.

We now show that all members of such a multiplet are eigenstates of G with the same

eigenvalue. This eigenvalue is called the G parity of the multiplet and is either +1 or -1. The previous section told us that the quantities

$$(-1)^{I+m} \overline{a_{-m}}, \quad m = I, I-1, \dots, -I$$

transform under isospin rotations just like the quantities a_m . Then, for this multiplet closed to C,

$$\begin{aligned} (-1)^{I+m} C(a_{-m}) &\equiv (-1)^{I+m} \overline{a_{-m}} \\ &= a_m \times \text{coefficient independent of } m. \end{aligned}$$

Therefore, by Eqs. (A11) and (A12),

$$\begin{aligned} G(a_m) &= (-1)^{I+m} C(a_{-m}) \\ &= a_m \times \text{coefficient independent of } m, \end{aligned}$$

as asserted.

The unknown coefficient is determined by comparison with the $m = 0$ (neutral) case. Let $Ca_0 = C_n a_0$ where the constant C_n is the C parity of the neutral member. Then

$$G(a_0) = C_n e^{i\pi I_y} a_0 = C_n (-1)^I a_0;$$

that is,

$$G \text{ parity} = C_n (-1)^I.$$

The G parity of a particle-antiparticle ($p\bar{p}$) multiplet is then derived from the C properties of the neutral member, as given in Eqs. (A6) and (A8),

$$G(p\bar{p}) = (-1)^{I+S+I} (p\bar{p}),$$

giving both text equations (8b) for $b\bar{b}$ and (11b) for $f\bar{f}$.

Finally, we note the action of G on some familiar particles. For isospinors,

$$e^{i\pi I_y} = e^{i(\pi/2)\sigma_2} = i\sigma_2 = \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix},$$

so that

$$G \begin{pmatrix} K^+ \\ K^0 \end{pmatrix} = \begin{pmatrix} \bar{K}^0 \\ -K^- \end{pmatrix}, \quad G \begin{pmatrix} \bar{K}^0 \\ -K^- \end{pmatrix} = \begin{pmatrix} -K^+ \\ \bar{K}^0 \end{pmatrix}$$

and

$$G \begin{pmatrix} p \\ n \end{pmatrix} = \begin{pmatrix} \bar{n} \\ -\bar{p} \end{pmatrix}, \quad G \begin{pmatrix} \bar{n} \\ -\bar{p} \end{pmatrix} = \begin{pmatrix} -p \\ n \end{pmatrix}.$$

For a single pion, the rotation $e^{i\pi I_y}$ changes the sign of π_1 and π_3 , and C changes the sign of π_2 . Hence

$$G(\pi_i) = (-1)\pi_i \text{ for } i = 1, 2, 3.$$

Thus for an n-pion state, regardless of the charges, $G = (-1)^n$.