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DATA ON ELEMENTARY PARTICLES AND RESONANT STATES

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This data survey represents a merging of two periodic compilations of data--UCRL-8030, by Barkas and Rosenfeld, which has been issued several times since 1957, with accompanying wallet cards, and the tables of Matts Roos.[1] The wallet cards contain considerably more information than is summarized here; accordingly, they and the complete UCRL-8030 Rev. will continue to be available from the Lawrence Radiation Laboratory, University of California, Berkeley. (The wallet cards can be requested in two sizes: 2.5×3.5 in., to fit American wallets, and 7×10 cm, to fit European wallets.) We hope that readers will inform us of mistakes and omissions in our data.

As the available particle-spectroscopic data have grown, so has the job of compiling them, and we have finally automated the process. Accordingly, all data and references have been punched on cards. Cards are listed on pages 21-31. The data-averaging has in most cases been done by a computer program. Further, our program plots ideograms of the input data, so that we can display clearly the cases with inconsistencies which make that averaging fraught with danger. Wherever it is possible, we have calculated a χ^2 for the sample, and if χ^2 is larger than its expectation value, we have written in the tables, after each error, "× Scale," where

TABLES FROM UCRL-8030(rev.) June 1964

Table S - Stable particles

		$I(J^{PG})CA$	Mass (MeV)	Mass diff. (MeV)	Mean life (sec)	$Mass^2$ $(BeV)^2$	Important decays: Partial mode	Fraction	Q (MeV)	p or p_{max} (MeV/c)
	γ	$J^P=1^- C^- A^+$?	0		stable	0	stable			
LEPTONS	ν_e	J=1/2	0(<0.2 keV)		stable	0	stable			
	ν_μ		0(<4 MeV)			0				
	$e^\mp$	J=1/2	0.511006 ±0.000002		stable	0.000	stable			
	$\mu^\mp$	J=1/2	105.659 ±0.002	-33.95 ±0.05 (μ–$\pi^\pm$)	2.2001×10^{-6} ±.0008 ×scale=2.5	0.011	$e\nu\nu$	100%	105.15	52.8
MESONS	$\pi^\pm$	$1(0^{--})C_n^+A^-$?	139.60 ±0.05		2.551×10^{-8} ±.026	0.019	$\mu\nu$	100%	33.95	29.80
							$e\nu$	$(1.24\pm.05)10^{-4}$	139.10	69.80
							$\mu\nu\gamma$	$(1.24\pm.25)10^{-4}$	33.94	29.81
							$\pi^0 e\nu$	$(1.5\ \pm.3)10^{-8}$	4.08	4.49
	π^0		135.01 ±0.05	4.590 ±.004 ×scale=2.4 ($\pi^\pm$–π^0)	1.80×10^{-16} ±.29 ×scale=1.3	0.018	$\gamma\gamma$	98.8	135.01	67.51
							γe^+e^-	$(1.19\pm.05)\%$	133.99	67.50
	$K^\pm$	$1/2(0^-)A^-$?	493.8 ±0.2		1.229×10^{-8} ±.008	0.244	$\mu\nu$	$(63.1\pm.4)\%$	388.1	235.6
							$\pi^\pm\pi^0$	$(21.5\pm.4)\%$	219.2	205.2
							$\pi^\pm\pi^-\pi^+$	$(\ 5.5\pm.1)\%$	75.0	125.5
							For other decays see Table S Decays			
	K^0		498.0 ±0.5	-4.2 ±0.5 ×scale=1.2 ($K^\pm$–K^0)	50% K1, 50%K2					
	K_1				0.92×10^{-10} ±.02	0.248	$\pi^+\pi^-$	$(69.4\pm5.1)\%$	218.8	206.2
							$\pi^0\pi^0$	$(30.6\pm1.1)\%$	228.0	209.2
	K_2			$-0.91\times1/\tau_1$ ±0.07 ×scale=2.3 (K_1–K_2)	5.62×10^{-8} ±.68	0.248	$\pi^0\pi^0\pi^0$	$(27.1\pm3.6)\%$	93.0	139.5
							$\pi^+\pi^-\pi^0$	$(12.7\pm1.7)\%$	83.8	133.1
							$\pi\mu\nu$	$(26.6\pm3.2)\%$	252.7	216.2
							$\pi e\nu$	$(33.6\pm3.3)\%$	357.9	229.4
	η	$0(0^{-+})C^+A^-$?	548.7 ±0.5		Γ <10 MeV	0.301	$\gamma\gamma$	$(35.3\pm3.0)\%$ ×scale=1.1	548.7	274.4
							$3\pi^0$ or $\pi^0 2\gamma$	$(31.8\pm2.3)\%$	143.7	179.4
							$\pi^+\pi^-\pi^0$	$(27.4\pm2.5)\%$	134.5	174.4
							$\pi^+\pi^-\gamma$	$(\ 5.5\pm1.3)\%$	269.5	236.2
BARYONS	p	$1/2(1/2^+)$	938.256 ±0.005	-1.2933 ±.0001 (p–n)	stable	0.880				
	n		939.550 ±0.005		1.01×10^3 ±.03	0.883	$pe^-\nu$	100%	0.78	1.19
	Λ	$1/2(1/2^+)$	1115.40 ±0.11		2.62×10^{-10} ±.02 ×scale=1.5	1.244	$p\pi^-$	$(67.7\pm1.0)\%$ ×scale=1.2	37.5	100.2
							$n\pi^0$	$(31.6\pm2.6)\%$	40.9	103.6
							$p\mu\nu$	$<1\times10^{-4}$	71.5	130.7
							$pe\nu$	$(.88\pm.08)10^{-3}$ ×scale=1.7	176.6	163.1
	Σ^+	$1/2(1/2^+)$	1189.41 ±0.14	2.9 (Σ^+–Σ^0)	0.788×10^{-10} ±.027	1.415	$p\pi^0$	51.0±2.4%	116.13	189.03
							$n\pi^+$	49.0±2.4%	110.26	185.06
							For other decays see Table S Decays			
	Σ^0		1192.3 ±0.3		$<1.0\times10^{-14}$	1.422	$\Lambda\gamma$	100%	77.0	74.5
	Σ^-		1197.08 ±0.19 ×scale=1.4	4.75 ±.10 (Σ^0–Σ^-)	1.58×10^{-10} ±.05	1.433	$n\pi^-$	100%	116.94	191.73
							For other decays see Table S Decay			
	Ξ^0	$1/2(1/2^+)$?	1314.3 ±1.0	6.5 ±1.0 (Ξ^0–Ξ^-)	3.06×10^{-10} ±.40	1.727	$\Lambda\pi^0$	100%	76.9	150.1
							For other decays see Table S Decay			
	Ξ^-		1320.8 ±0.2 ×scale=1.3		1.74×10^{-10} ±.05	1.745	$\Lambda\pi^-$	100%	65.8	138.7
							$\Lambda e^-\nu$	$(3.0\pm1.7)10^{-3}$	204.9	189.4
							$n\pi^-$	$<5\times10^{-3}$	214.7	303.0
	Ω^-	$0(3/2^+)$? ?	1675 ±3		$\sim0.7\times10^{-10}$		$\Xi\pi$	?	221	296
							ΛK	?	66	216

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Table S Decay

An Appendix to Table S for particles with many decay modes

	Partial mode	Rate	Q (MeV)	p or p_{max} (MeV/c)
$K^{\pm}$	$\mu^{\pm}\nu$	63.1±.5% (×scale=1.6)	388.1	235.6
	$\pi^{\pm}\pi^{0}$	21.5±.4% (×scale=1.6)	219.2	205.2
	$\pi^{\pm}\pi^{+}\pi^{-}$	5.5±.1% (×scale=1.6)	75.0	125.5
	$\pi^{\pm}\pi^{0}\pi^{0}$	1.7±.1% (×scale=1.6)	84.2	133.0
	$\pi^{0}\mu^{\pm}\nu$	3.4±.2% (×scale=1.6)	253.1	215.2
	$\pi^{0}e^{\pm}\nu$	4.8±.2% (×scale=1.6)	358.3	228.4
	$\pi^{\pm}\pi^{\mp}e^{\pm}\nu$	$(4.3\pm.9)10^{-5}$	214.1	203.5
	$\pi^{\pm}\pi^{\pm}e^{\mp}\nu$	$<0.1\times10^{-5}$	214.1	203.5
Σ^{+}	$p\pi^{0}$	(51.0±2.4)%	116.1	189.0
	$n\pi^{+}$	(49.0±2.4)%	110.3	185.1
	$n\pi^{+}\gamma$	$\sim0.4\times10^{-4}$	110.3	185.1
	$\Lambda e^{+}\nu$	$\sim0.2\times10^{-4}$	73.5	71.7
	$p\gamma$	$\sim3\times10^{-3}$	251.1	224.6
	$n\mu^{+}\nu$	$<2.3\times10^{-4}$	144.2	202.4
	$ne^{+}\nu$	$<1.0\times10^{-4}$	249.3	223.6
Σ^{-}	$n\pi^{-}$	100%	117.9	192.7
	$n\pi^{-}\gamma$	$\sim0.1\times10^{-4}$	117.9	192.7
	$n\mu^{-}\nu$	$(0.66\pm0.14)10^{-3}$	151.9	209.3
	$ne^{-}\nu$	$(1.4\pm0.3)10^{-3}$	257.0	229.8
	$\Lambda e^{-}\nu$	$(0.75\pm0.28)10^{-4}$	81.2	78.9
Ξ^{0}	$\Lambda\pi^{0}$	~ 100%	76.9	150.1
	$p\pi^{-}$	<0.4%	249.4	309.3
	$pe^{-}\nu$	<0.4%	388.5	332.0
	$\Sigma^{+}e^{-}\nu$	<0.3%	137.4	130.7
	$\Sigma^{-}e^{+}\nu$	<0.25%	129.7	123.8

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Mesons

		Mass (MeV)	I(J^{PG})CA — = estab.	Symb.	Γ (MeV)	M^2 (BeV^2)	Important decays: Partial modes	Fraction %	Q (MeV)	p or p_{max} (MeV/c)
η	η	548.7	$0(0^{-+})C^+A^-$	η_β	<10	0.301	See table S			
		±0.5	|——|							
	ω	782.8	$0(1^{--})C^-A^-$	η_γ	9.4	0.613	$\pi^+\pi^-\pi^0$	86	369	327
		±0.5	|——|		±1.7		$\pi^+\pi^-$	<1	504	366
		Xscale = 1.8					neutral($\pi^0\gamma$)	11±1	648	380
							$\pi^+\pi^-\gamma$	3.2±1	504	366
							e^+e^-	<0.3	782	391
							$\mu^+\mu^-$	<0.5	572	377
	η2π	959	$0(0^{-+},1^{++},\ldots)C^+A^-$	η	<12	0.920	η2π	large	131	232
		±2					2π	<20	680	459
			Conceivably strongly decaying				3π	<30	540	427
			$1(J^{P+})C^-$ or electromagnetic				4π	< 3	400	372
			decay of G = -1 meson				6π	< 3	121	189
							ππγ	?	680	459
	K_1K_1	~1000	May be just large $\bar{K}K$ scattering length, see listings of data cards.							
	φ	1019.5	$0(1^{--})C^-A^+$	η_γ	3.1	1.040	K_1K_2	41±6	23	109
		±0.3	|——|		±0.6		K^+K^-	59±6	32	126
		Xscale = 1.7					ππ	<8	740	490
			Suppressed by A=+1 approximation				{ πρ+3π	<10	117	188
							{ $\pi^0\gamma$		885	501
	f	1253	$0(2^{++})C^+A^+$	η_α^{II}	100	1.571	ππ	large	974	611
		±20	|——|		±25		4π	8±6	695	547
							$\bar{K}K$	?	265	386
	$\bar{K}K\pi$	1410	$\leq 1(0^{-+}1^{++},\ldots)C^+A^-$	η	60		$K^*\bar{K}$	large	25	126
			—				$K\bar{K}\pi$	small	283	421
			If we guess I=0, then G=+1				2π	?	1131	691
							$\bar{K}K$	?	422	503
							3π	?	991	670
π	$\pi^\pm$	139.6	$1(0^{--})C_n^+A^-$	π_β			See table S			
	π^0	135.0	|——|							
	ρ	763	$1(1^{-+})C_n^-A^+$	π_γ	106	0.582	2π	100	483	355
		±4	|——|		±5		4π	small	204	241
					Xscale=1.5					
	A1	1090	$\geq 1(0^{--})C_nA^-$	π	125		ρπ	~100	188	251
		±?	|—| |-| ?		±25		$\bar{K}K$	<5	G-forbidden for odd ℓ if I=1	
		May be just large ρπ scattering length								
		Only recently separated from A2								
	B	1215	$1(1^{++},2^-)C_n^-A^+$	π_δ	122	1.476	ωπ	~100	293	335
		±18	|-| |-| |—|		±17		ππ	<30	I forbidden for even ℓ	
					Xscale = 1.9		$\bar{K}K$	<10	G forbidden for even ℓ	
							4π	<50	657	525
	A2	1310	$1(2^{+-})C_n^+A$?	π_α^{II}	80		ρπ	~70	408	418
			|——|				$\bar{K}K$	~30±7	816	562
		Only recently separated from A1(1090)					ηπ	seen	622	529
K	$K^\pm$	493.8	$1/2(0^-)A^-$	K_β		0.244	See table S			
	K^0	498.0	|——|							
	κ	725	Existence not yet definitely established							
	K^*	891	$1/2(1^-)A^+$	K_γ	50	0.794	Kπ	~100	258	288
		±1	|——|		±2		Kππ	<0.2	118	215
					Xscale=1.3		κπ	<0.2	27	82
	K_C	1215	$\leq 3/2(1^+)A^-$	K	60	1.476	Kρ	strong	-30	<0
		±15	|——| ? ?		±10		$K^*\pi$	?	184	253

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Baryons

		Beam πp(MeV) or Kp(MeV/c)	I(J^P) ⊢⊣=estab.	Sym-bol	Mass (MeV)	Γ (MeV)	Mass^2 (BeV)^2	Important Decays: Partial mode	Frac-tion (%)	Q (MeV)	p or p_{max} (MeV/c)
N	p n		1/2($1/2^+$) ⊢——⊣	N_α	938.2 939.6		0.88 0.88	See table S			
N	$N^*_{1/2}(1480)$	550 πp (MeV)	1/2($1/2^+$) ⊢——⊣	N_α	~1480	~240	2.19	πN	~50	402	426
N	$N^*_{1/2}(1512)$	600 πp	1/2($3/2^-$) ⊢——⊣	N_γ	1518 ± 10	125 ±12	2.30	πN Nππ	~80	440 301	454 408
N	$N^*_{1/2}(1688)$	900 πp	1/2($5/2^+$) ⊢——⊣	N^{II}_α	1688	100	2.85	πN N ππ	~80	610 471	572 538
N	$N^*_{1/2}(2190)$	1935 πp	1/2($9/2^+$) ⊢—⊣ ??	N^{III}_α(?)	2190	~200	4.80	πN Λk	~30	1112 577	888 710
N	$N^*_{1/2}(2700)$	3265 πp	1/2 ⊢⊣	N	2700	~100	7.29	ηN πN	large ~6	1213 1622	1115 1182
Δ	$N^*_{3/2}(1238)$	198 πp	3/2($3/2^+$) ⊢——⊣	Δ_δ	1236 ± 2	125	1.53	πN	100	160	233
Δ	$N^*_{3/2}(1920)$	1347 πp	3/2($7/2^+$) ⊢——⊣	Δ^{II}_δ	1924	170	3.70	πN ΣK	34	842 237	722 430
Δ	$N^*_{3/2}(2360)$	2350 πp	3/2($11/2^+$) ⊢—⊣ ? ?	Δ^{III}_δ(?)	2360	~200	5.57	πN	~10	1282	988
Λ	Λ		0($1/2^+$) ⊢——⊣	Λ_α	1115.4		1.24	See table S			
Λ	$Y^*_0(1405)$	<0 Kp	0($1/2^-$) ⊢⊣	Λ_β	1405	50	1.97	Σπ Λππ	100 < 1	76 10	151 69
Λ	$Y^*_0(1520)$	Kp 395 (MeV/c)	0($3/2^-$) ⊢——⊣	Λ_γ	1518.9 ±1.5	16 ±2	2.31	Σπ K̄N Λππ	55±7 29±4 16±2	190 87 124	266 243 251
Λ	$Y^*_0(1815)$	1040 Kp	0($5/2^+$) ⊢——⊣	Λ^{II}_α	1815	70	3.29	K̄N Σπ Λππ Λη	80 <10 <15 ?	383 486 420 151	541 504 515 344
Σ	Σ	<0 Kp	1($1/2^+$) ⊢——⊣	Σ_α	+1189.4 -1197.1 1192.4		1.41 1.43 1.42	See table S			
Σ	$Y^*_1(1385)$	<0 Kp	1 ($3/2^+$) ⊢——⊣	Σ_δ	1382.1 ±.9 ×scale=1.5	53 ±2 ×scale=2.4	1.91	Λπ Σπ	96±4 9±4	127 55	205 124
Σ	$Y^*_1(1660)$	715 Kp	1 ( ) ⊢⊣	Σ	1660 ±10	44 ±5	2.76	K̄N Σπ Λπ Σππ Λππ	~16 ~32 ~ 6 ~33 ~23	225 328 405 188 265	406 383 439 321 389
Σ	$Y^*_1(1765)$	940 Kp	1($5/2^-$) ⊢——⊣	Σ	1765 ±10	60 ±10	3.12	K̄N Λπ Σπ Λππ	60 Not yet resolved from $Y^*_0(1815)$	343 510	508 517
	Only recently resolved from $Y^*_0(1815)$										
Ξ	Ξ		1/2($1/2^+$) ⊢——⊣	Ξ_α	-1321 1314		1.75 1.73	See table S			
Ξ	$\Xi^*(1530)$		1/2($3/2^+$) ⊢——⊣ p wave	Ξ_δ	1529.1 ±1.0	7.5 ±1.7	2.34	Ξπ	~100	73	148
Ξ	$\Xi^*(1810)$		1/2( ) ⊢—⊣	Ξ	1810 ±20	~70	3.27	$\Xi^*\pi$ ΛK̄ Ξπ ΣK̄	~45 ~45 <10 <10	141 197 354 127	225 386 406 307
Ω	$\Omega^-(1675)$		0($3/2^+$) ⊢⊣	Ω_δ	1675 ±3		2.81	See table S			

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"Scale" = $\sqrt{\chi^2/(N-1)}$, N being the number of experiments used in the calculation. Whenever this warning is included, we suggest that the reader look at the appropriate ideogram (pages 32-35) and make his own estimates of the experimental situation. "Scale" is discussed further under "Procedures for Treating the Data."

The data are summarized in three tables. Table S covers all the stable particles: leptons, mesons, and baryons--i.e., those states which are immune to decay via the strong interaction.

There are two tables of data on the unstable particles, one on meson resonances and one on baryon resonances. For the reader's convenience, these tables include basic information on stable mesons and baryons.

Each table is of slightly different form; thus Table S includes mass differences, and will eventually include magnetic moments, whereas the baryon table includes information on what pion and K-meson beams will form certain resonaces.

NOTES ON THE TABLES

Quoted errors represent standard deviations.

The quantum number C stands for the eigenvalue of the charge-conjugation operator applied to a neutral meson. The notation C_n (n for neutral) means the eigenvalue of C applied to the neutral member of a nonstrange triplet, like the pion.

The approximate quantum number A has been suggested for mesons and the photon by Bronzan and Low.[2] It is far from established as a good approximation even for low-mass mesons, but we list it because at present it is a handy mnemonic.

Well established quantum numbers are underlined (except for 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.

We assume that particles and antiparticles share the same spins, masses, and mean lives.[3-5]

For particles whose quantum numbers are well established we list only those decays which do not violate strong selection rules.

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 $N^*_{3/2}(1238)$ or $Y^*_0(1520)$ it is conventional to call M_R or E_R the energy at which the resonant amplitude becomes pure imaginary. [For $N^*_{3/2}(1238)$ this corresponds to 1238 MeV.] 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. This is discussed in Appendix I to the original UCRL-8030. Thus the peak in the πp cross section near 1238 MeV actually occurs at 1225 MeV. Nevertheless, for all resonances except $Y^*_0(1520)$ and $N^*_{3/2}(1238)$, it is conventional simply to report the energy of the peak in the observed cross section. We follow this inconsistent convention. Perhaps our next edition will include a small correction table.

Notes on Table S

The quantum numbers of all the stable particles seem well established, with the exception of the parity of Ξ. Of course, if we accept SU_3, then Ξ becomes $1/2^+$, and Ω^- must be $3/2^+$.

Note that, since the preceding compilation, the proton mass has risen by 43 keV, and the Λ mass by 40 keV (see notes on these individual entries).

Notes on the Meson Table

Quantum Numbers and the Symbol C_n

For nonstrange mesons we list the eigenvalue of the G parity operator[6, 7]

$$G = Ce^{2\pi i I_y} . \quad (1)$$

For neutral mesons, C has the eigenvalue ±1, and it turns out that we can write[8]

$$G = C(-1)^I. \quad (2)$$

Now G and I have eigenvalues, of course, for all members of a charge multiplet, while C only for the neutral member. So to generalize Eq. (2) we define C_n as the eigenvalue of C for the neutral member of the multiplet, and then write for any member of the multiplet

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

The Symbol-Minded Approach

In addition to their colloquial names, we have used the names suggested by Chew, Gell-Mann, and Rosenfeld:[9, 10] atomic mass number A, hypercharge Y, and isospin I have been grouped into a single symbol. For mesons (A = 0), we use η for (Y=I=0), π for (Y=0, I=1), and K for (Y=1, I=1/2). A, Y, I are easily determined, so all mesons can be given a symbol independent of ideas about Regge trajectories or SU_3. In addition we introduce some subscripts to condense data on J and P:

α for 0^+, α^{II} for its Regge recurrence 2^+, γ for 1^- (like the γ ray),

β for 0^-, β^{II} for its Regge recurrence 2^-, δ for 1^+.

Meson Decays into 2π or $\bar{K}K$

In this discussion we use $\bar{K}K$ as an example. If the $\bar{K}K$ system is in a state with orbital angular momentum ℓ, Bose statistics require[9] that for a neutral pair

$$C = (-1)^{\ell}; \tag{4}$$

for a charged pair, C has no eigenvalue, but G does,[9] namely,

$$G = (-1)^{\ell + I}. \tag{5}$$

Thus consider the A2 meson $\pi(1310)$. Its main decay mode is $\pi\rho$, hence G = -1. It is also seen to go to K^-K_1, so I=1. Then, by (5), observation of this mode establishes that ℓ is even.

Next consider the A1 meson $\pi(1090)$. Its main decay is again $\pi\rho$, so again G = -1, then again $\ell(\bar{K}K)$ must be even. Of course, if we have guessed correctly that A1 has $J^P = 0^-$, we never expect to see $\bar{K}K$.

Finally consider the B meson $\pi(1220)$. Its main decay mode is $\pi\omega$, so G = +1, I = 1. This time (5) forces $\ell(\bar{K}K)$ to be odd. Hence non-observation of $\bar{K}K$ is evidence against a 1^- interpretation of B.

Whenever ℓ is even, neutral $\bar{K}K$ must appear as K_1K_1, K_2K_2, and K^+K^- in the ratio 1:1:2. If ℓ is odd, we can find only K_1K_2 and K^+K^-, in equal numbers.[11]

Notes on the Baryon Table

Here we have included one extra column to describe the beam with which these resonances can be formed. In the case of "πp" resonances, where we are accustomed to talking of the "600 MeV" and "900 MeV" resonances, we have listed the beam energy in MeV. But beams nowadays are usually referred to by momentum, so for the more recently discovered "Kp" resonances, we list the K beam in MeV/c. One can convert back and forth with the help of Fig. 2 on wallet card 2.

Symbol-Minded Approach for Baryons

Again we use familiar symbols to denote A = 1, and various values of strangeness and isospin: namely N, Λ (for Y_0^*), Σ (for Y_1^*), Ξ, and Ω^-. Since there is no current symbol for $N_{3/2}^*$, we invent Δ.

To get subscripts we add 1/2 unit of J to the list of subscripts for mesons, i.e.,

α for $1/2^+$, α^{II} for $5/2^+$, like the Regge series N(938), N(1688), ⋯,

β for $1/2^-$,

γ for $3/2^-$,

δ for $3/2^+$, like the series Δ(1238), Δ(1920), ⋯ .

PROCEDURES FOR TREATING THE DATA

Except for mean lives, we have averaged the input data weighted according to inverse-square error, i.e., according to the prescription of least squares. We have belatedly realized that it would have been just as easy to weight them according to the prescription of maximum likelihood, and we may do this in the next edition.

When no errors are reported, we merely list the data for inspection.

When inequalities are reported, we have on the first iteration ignored that experiment; then checked to see if the weighted average violates the inequality. If so we changed the input data from $<x$ to $x \pm x$, or from $>x$ also to $x \pm x$.

χ^2 Scale Factor

When we calculate the weighted average $\langle x \rangle$, we also calculate χ^2. 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 should probably not average the data. So we plot an ideogram to help the reader decide which data to reject. He can then make his own selected average. However, if χ^2 is not too 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 $\sqrt{\chi^2/N-1} \equiv$ "Scale"). If this were true, then we could correct the calculated error of the mean $\delta \langle x \rangle$ simply by multiplying it by "Scale." The reader may wish to do this. This scaling approach is already common practice in bubble chamber experiments, where track distortion are 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.

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

$$\tau = \Sigma t_i / N,$$

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

Or alternatively he can report a rate

$$\Gamma = N/\Sigma t_i \quad .$$

If his errors are large it is probably because N is small. In that case one can see that the distribution of rate Γ, with N in the numerator, should be fairly Poisson. But the distribution on mean life τ, with N in the denominator, will be badly skewed. Accordingly we have inverted all mean lives before averaging or making ideograms.

Branching Ratios

We take the η as an example. We can think of only four decay modes (partial widths) which should add up to 100%, i. e. P1($\eta \to \gamma\gamma$), P2($\to 3\pi^0 + \pi^0\gamma\gamma$), P3($\to \pi^+\pi^-\pi^0$), and P4($\to \pi^+\pi^-\gamma$).

Six different sorts of branching ratios have already been reported, each involving different combinations of P1 $\cdots$ P4, i. e., (see page 19)

$$R1 = \frac{\text{Neutral}}{\text{Charged}} = \frac{P1 + P2}{P3 + P4},$$

$$R2 = \frac{2\gamma}{\text{Charged}} = \frac{P1}{P3 + P4} ,$$

$$R4 = \frac{\pi^+\pi^-\gamma}{\pi^+\pi^-\pi^0} = \frac{P4}{P3} , \text{ etc.}$$

J. Peter Berge has kindly provided us with a program which makes a simultaneous best χ^2 fit of all Pi (where i = 1, 2, 3, $\cdots$) to the input ratios, and then calculates an error matrix. We list the $\langle Pi \rangle$ and $\delta \langle Pi \rangle$ from this program, where $\delta \langle Pi \rangle$ are the diagonal elements of the error matrix.

NOTES ON THE DATA CARDS

Most of the entries are self-explanatory. In the case of bubble chamber experiments on resonances, we thought it useful to fill in the actual number of events seen in the resonance peak -- hence the second field entitled "Events in Peak."

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

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 were symmetric.

Partial Decay Modes: 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. The numbers S-- or U-- in the far right-hand fields are simply the mass codes of the decay products for this program.

COMMENTS ON THE INDIVIDUAL PARTICLES

Stable Particles

Mass of the Electron

This is taken from Cohen and DuMond (COHEN 63). Note that the electron mass estimate has increased by about one part in 10^4.

Mass of the Charged Pion

A series of experiments by Barkas et al. (BARKAS 56) yielded

$$m_\pi/m_p = 0.148876 \pm 0.00016.$$

(The error here is a standard deviation; originally a probable error was quoted.)

Using the current proton mass value, we then have

$$m_\pi = 139.68 \pm 0.15 \text{ MeV}.$$

These experiments also report a mass for the negative pion, but in view of the present evidence that the stopping power of matter is not the same for negative particles as for positive, the result for negative pions is now rejected. A good measurement has, however, been made by Crowe and Phillips (CROWE 54) by observing photons from π^- capture in hydrogen:

$$m_\pi = 139.37 \pm 0.14 \text{ MeV}.$$

These constitute the reliable direct measurements of the charged pion masses. By assuming that the neutral particle emitted in π^+ decay is massless, however, and by measuring the momentum of the muon emitted in pion decay, Barkas, Birnbaum, and Smith were able to make another estimate of the pion-muon mass difference which apparently is more accurate. The measurements obtained in two experiments are

$$m_\pi - m_\mu = 34.00 \pm 0.076 \text{ MeV},$$

and

$$m_\pi - m_\mu = 33.89 \pm 0.076 \text{ MeV};$$

$$\text{average} = 33.94 \pm 0.05 \text{ MeV}.$$

With this mass difference, and the muon mass quoted above, one obtains the value listed in Table S:

$$m_\pi = 139.60 \pm 0.05 \text{ MeV}.$$

Because the masses of all the heavier mesons, of the unstable baryons, and of the strongly decaying states all depend on the pion mass, the present situation in which everything depends on a single ten-year-old experiment is unsatisfactory, especially because the current mass value is nearly two standard deviations larger than the excellent measurement by Crowe and Phillips.

The pion-to-proton mass ratio was carefully measured and is believed to be reliable to the accuracy quoted for it. The muon decay momentum, from which the π-μ mass difference is obtained, on the other hand, was something of a by-product of the main experiment. Consequently it was not measured many times and with a variety of experimental arrangements, as it should have been had it then been considered of prime importance. The two determinations from which the present value are derived in fact differ by 0.11 MeV. It is clear that a new, precise determination of the pion mass is overdue.

Mass of the Neutral Pion

The $\pi^- - \pi^0$ mass difference has been measured with a very good accuracy and the quoted error is too small to affect the π^0 mass uncertainty, which is therefore the same as that for the charged pion.

Mass of Charged K Mesons

Because the three-pion decay mode has a low Q value, the K^+ mass is best obtained from the measured ranges of the pion decay products. The Q value adopted by Cohen, Crowe, and DuMond (COHEN 57) need not be changed because there has been no better new data: it is $Q = 75.11 \pm 0.14$ MeV. This, with the mass of three pions, gives $M_{K^+} = 493.9 \pm 0.2$ MeV. A measurement of the K^- mass has been made with comparable accuracy by Barkas, Dyer, and Heckman. They give

$$M_{K^-} = 493.7 \pm 0.3 \text{ MeV.}$$

We take for the mass of the charged K meson 493.8 ± 0.2 MeV.

Sign of the K_1-K_2 Mass Difference

According to the experiment performed by Meisner et al. (MEISNER 63), K_2 is heavier than K_1.

Mass of the Proton

This report does not undertake any new re-evaluation of the fundamental physical constants. We quote the National Research Council Committee on Fundamental Constants (COHEN 63) for the proton mass and other equally basic data. Even such well-known quantities are, however, still in a state of flux. When the current values are compared with those in the book of Cohen, Crowe, and DuMond (COHEN 57), for example, the electron charge is found now to be larger by one part in 40 000 and the electron mass is larger by 9 parts in 10^5. Although none of the changes is serious for most work in high-energy physics, the proton mass has been readjusted upwards by 0.043 MeV to a point where it affects the Λ mass.

Mass of the Neutron

Here we use the neutron-proton mass difference, the error in which is too small to affect the neutron mass. Taken together with the new proton mass, this number gives the quoted neutron mass.

Mass of the Λ Hyperon

The Λ mass from emulsion measurements has been recently reviewed (BHOWMIK 63). This is combined with hydrogen bubble chamber measurements (BALTAY 62) (ARMENTEROS 62). The weighted average obtained was

$$M_{\Lambda} = 1115.35 \pm 0.11 \text{ MeV}.$$

In view of the readjusted proton mass, we quote it as

$$M_{\Lambda} = 1115.40 \pm 0.11 \text{ MeV},$$

which is about 0.04 MeV higher than one value of 1115.36 quoted in the preceding edition of UCRL-8030.

Masses of the Charged Σ Hyperons

These come from Barkas, Dyer, and Heckman (BARKAS 63) and from Burnstein et al. (BURNSTEIN 64).

The errors are largely systematic and reflect the uncertainty in the π and K masses as well as in the hydrogen and emulsion range-energy relations. The raising of proton and pion masses has a slight effect on the Σ masses.

Masses of Cascade Hyperons

These are affected to the extent of 0.04 MeV by the revised mass of the Λ.

Branching Ratios of the η Mesons

The neutral decay modes of the η have so far been resolved experimentally only into "2γ" and "non-2γ". For the latter, the most likely candidates are $3\pi^0$ and $\pi^0\gamma\gamma$, both of which are electromagnetic decays of amplitude e^2 with comparable phase space. However, we have the theoretical prejudice that $3\pi^0$ should be rather close to $(3/2)\ \pi^+\pi^-\pi^0$. Accordingly all experimentalists have assumed that the "non 2γ" decays represented six photons coming from the decay of $3\pi^0$, and calculated their detection efficiency on this reasonable hypothesis.

UNSTABLE MESONS

Difficulties with Assignment of the Approximate Quantum Number to the A2 Meson

The two dominant decay modes of A2 seem to be $\rho\pi$ and $\bar{K}K$, roughly in the ratio of 7/3. But $\rho\pi$ has A = -1, $\bar{K}K$ must of course have A = +1. This seems to be the only meson for which the A approximation fails almost completely. Even if the approximation turns out to be good for low mass, it apparently becomes poor for these heavier mesons.

2π Decay Mode of the K_1K_1 Enhancement

The K_1K_1 enhancement (be it an actual resonance or a large s-wave scattering) probably has a two-pion mode, but even if the $\pi\pi/\bar{K}K$ branching ratio were as large as 3 to 5 the two-pion mode would not yet have been detected. The explanation is that the production of K_1K_1 is very small compared with the production of pion pairs. Thus Alexander et al. (ALEXANDER 62) reported a K_1K_1 peak containing about 30 visible events. For their path length of 10 events/μb, if we assume that there exists a 0^{++} state X^0 that decays into K_1K_1, K_2K_2, and $K^{\pm}K^{\mp}$ in the ratio of 1:1:2, and that K_1K_1 pairs are seen only 4/9 of the time, this still corresponds to X^0 production of only $\approx$ 30 μb.

Now the cross section for the reaction $\pi^- p \Rightarrow n\pi^+\pi^-$ induced by pions of the same momentum (about 2 BeV/c) is 5 mb, and 1/10 of these pion pairs have an invariant mass in the X^0 region (1000 ± 50) MeV. For the purpose of this discussion this means that the two-pion background in the K region is 500 μb, or 15-fold larger than the signal, and explains why interesting upper limits in the $\pi\pi/\bar{K}K$ ratio are experimentally inaccessible.

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DATA FOR TABLE S (REFERENCES AT LOWER RIGHT)

(GALTIERI,ROSENFELD JUNE/64)

DATA FOR TABLE S ON STABLE PARTICLES
STABLE MEANING IMMUNE TO STRONG DECAY

CODE	EVENT IN PEAK	QUANTITY	ERROR+	ERROR-	REFERENCE	YR	TECHNIQUE.

* INDICATES DATA IGNORED BY PROGRAMS

ν

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

1 E-NEUTRINO MASS (KEV)

S 1M *		LESS THAN		0.25	LANGER	52	CNTR
S 1M *		LESS THAN		0.15	HAMILTON	53	CNTR
S 1M *		LESS THAN	0.55 +OR-	0.28	FRIEDMAN	58	CNTR

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

2 MU-NEUTRINO MASS (MEV)

S 2M *		LESS THAN		3.5	BARKAS	56	EMUL
S 2M *		LESS THAN		4.0	DUDZIAK	59	CNTR

e

3 ELECTRON (0.5,J=1/2)

3 ELECTRON MASS (MEV)

S 3M		0.511006	0.000002		COHEN	63	RVUE

μ

4 MUON (106,J=1/2)

4 MUON MASS (MEV)

S 4M		105.659	0.002		FEINBERG	63	RVUE

4 MUON LIFETIME (UNITS 10**-6)

S 4T		2.200	0.015	0.015	FISHER	59	CNTR
S 4T		2.211	0.003	0.003	REITER	60	CNTR
S 4T		2.225	0.006	0.006	ASTBURY	60	CNTR
S 4T		2.208	0.004	0.004	TELEGDI	60	CNTR
S 4T		2.203	0.004	0.004	LUNDY	62	CNTR
S 4T		2.198	0.001	0.001	FARLEY	62	CNTR
S 4T		2.202	0.003	0.003	ECKHAUSE	62	CNTR
S 4T		2.197	0.002	0.002	MEYER	63	CNTR

4 MUON PARTIAL DECAY MODES

S 4P1	MUON INTO E (E-NEU) (MU-NEU)	S 3S 1S 2
S 4P2	MUON INTO E 2GAMMA	S 3S 0S 0
S 4P3	MUON INTO 3ELECTRONS	S 3S 3S 3
S 4P4	MUON INTO E GAMMA	S 3S 0

4 MUON BRANCHING RATIOS

S 4R1* MUON INTO E+2GAMMA (IN UNITS OF 10**-5) (P2)/(P1)

S 4R1*	LESS THAN	1.6	FRANKEL 1	63 SPRK

S 4R2* MUON INTO 3E (IN UNITS OF 10**-7) (P3)/(P1)

S 4R2*	LESS THAN	5.0	PARKER 1	62 CNTR
S 4R2*	LESS THAN	1.3	ALIKHANOV	62 SPRK
S 4R2*	LESS THAN	1.5	FRANKEL 2	63 CNTR
S 4R2*	LESS THAN	1.45	BABAEV	63 SPRK

S 4R3* MUON INTO E+GAMMA (IN UNITS OF 10**-8) (P4)/(P1)

S 4R3*	LESS THAN	1.2	FRANKEL 1	63 SPRK
S 4R3*	LESS THAN	0.6	PARKER 2	64 SPRK

π±

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

8 CHARGED PI MASS (MEV)

S 8M *		139.37	0.14		CROWE	54	CNTR -
S 8M *		139.68	0.15		BARKAS	56	EMUL +

8 PI+ MU+ MASS DIFFERENCE (MEV)

S 8D		34.00	0.076		BARKAS	56	EMUL
S 8D		33.89	0.076		BARKAS	56	EMUL

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

S 8T		25.6	0.5	0.5	CROWE	57	RVUE
S 8T	8000	25.46	0.32	0.32	ASHKIN	60	CNTR
S 8T		25.6	0.8	0.8	ANDERSON	60	CNTR
S 8T *					MERRISON	62	RVUE

8 CHARGED PION PARTIAL DECAY MODES

S 8P1	CHAR.PION INTO MU (MU-NEU)	S 4S 2
S 8P2	CHAR.PION INTO E (E-NEU)	S 3S 1
S 8P3	CHAR.PION INTO MU (MU-NEU) GAMMA	S 4S 2S 0
S 8P4	CHAR.PION INTO PIO E (E-NEU)	S 9S 3S 1

8 CHARGED PION BRANCHING RATIOS

S 8R1* CHAR.PION INTO MU NEU GAMMA (UNITS 10**-4) (P3)/(P1)

S 8R1	26	1.24	0.25		CASTAGNOLI	58	EMUL

S 8R2* CHAR.PION INTO E NEU (UNITS 10**-4) (P2)/(P1)

S 8R2		1.21	0.07		ANDERSON	60	CNTR
S 8R2		1.247	0.028		DI CAPUA	64	CNTR

S 8R3* CHAR.PION INTO PIO E NEU (UNITS 10**-8) (P4)/(P1)

S 8R3	10	2.0	0.6		BACASTOW	62	CNTR
S 8R3	52	1.15	0.22		DEPOMMIER	63	CNTR
S 8R3	40	1.30	0.35		DUNAITSEV	63	CNTR
S 8R3		0.96	0.23		BARTLETT	64	SPRK

π0

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

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

S 9D		4.59	0.01		PANOFSKY	51	CNTR +
S 9D		4.59	0.01		CHINOWSKY	54	CNTR -
S 9D		4.54	0.01		HADDOCK	59	CNTR -
S 9D		4.60	0.04		HILLMAN	59	CNTR
S 9D		4.55	0.07		CASSELS	59	CNTR
S 9D		4.6056	0.0055		CZIRR	63	CNTR
S 9D		4.59	0.03		PETRUKHIN	63	CNTR -

CODE	EVENT IN PEAK	QUANTITY	ERROR+	ERROR-	REFERENCE	YR	TECHNIQUE.

* INDICATES DATA IGNORED BY PROGRAMS

9 PIO LIFETIME (UNITS 10**-16)

S 9T	76	1.9	0.5	0.5	GLASSER	61	EMUL
S 9T	44	1.9	1.3	0.8	SHWE	62	EMUL
S 9T	45	2.3	1.1	1.0	TIETGE	62	EMUL
S 9T	88	2.8	0.9	0.9	KOLLER	63	EMUL
S 9T		1.05	0.18	0.18	VON DARDEL	63	CNTR
S 9T	47	1.25	0.57	0.45	EVANS	63	EMUL

9 NEUTRAL PION PARTIAL DECAY MODES

S 9P1	PIO INTO 2GAMMA	S 0S 0
S 9P2	PIO INTO E+ E- GAMMA	S 3S 3S 0
S 9P3	PIO INTO 4ELECTRONS	S 3S 3S 3S 3

9 NEUTRAL PION BRANCHING RATIOS

S 9R1* PIO INTO (GAMMA E+ E-)/(2GAMMA) (P2)/(P1)

S 9R1		0.01187	0.00048		SAMIOS	61	HBC

S 9R1* USING PANOFSKY RATIO = 1.54

S 9R1	27	0.0117	0.0015		BUDAGOV	60	HBC

REFERENCES FOR TABLE S ON STABLE PARTICLES

IDENTIFIC.	YR		AUTHORS	JOUR.	VOL	PAGE	YR	INSTITUTION	COD
ν			1 E-NEUTRINO (0,J=1/2)						
LANGER	52	CNTR	L M LANGER , RJD MOFFAT	PR	88	689	52	INDIANA	S 1
HAMILTON	53	CNTR	D R HAMILTON +	PR	92	1521	53	PRINCETON	S 1
FRIEDMAN	58	CNTR	L FRIEDMAN , L G SMITH	PR	109	2214	58	B N L	S 1
			2 MU-NEUTRINO (0,J=1/2)						
BARKAS	56	EMUL	W H BARKAS +	PR	101	778	56	L R L	S 2
DUDZIAK	59	CNTR	W DUDZIAK +	PR	114	336	59	L R L	S 2
e			3 ELECTRON (0.5,J=1/2)						
COHEN	63	RVUE	E R COHEN ,JWM DUMOND	REPORT	IUPAP		63	RVUE	S 3
μ			4 MUON (106,J=1/2)						
FISHER	59	CNTR	J FISHER +	PRL	3	349	59	CERN	S 4
ASTBURY	60	CNTR	A ASTBURY +	ROCH	60	542	60	LIVERPOOL	S 4
DEVONS	60	XRAY	S DEVONS +	PRL	5	330	60	COLUMBIA	S 4
LATHROP	60	XRAY	J LATHROP +	NC	17	109	60	CHICAGO	S 4
LATHROP	60	XRAY	J LATHROP +	NC	17	114	60	CHICAGO	S 4
REITER	60	CNTR	R A REITER +	PRL	5	22	60	CARNEGIE	S 4
TELEGDI	60	CNTR	V L TELEGDI	ROCH	60	713	60	CHICAGO	S 4
CHARPAK	61	CNTR	G CHARPAK +	PRL	6	128	61	CERN	S 4
HUTCHINSON	61	CNTR	D P HUTCHINSON +	PRL	7	129	61	COLUMBIA	S 4
ALIKHANOV	62	SPRK	A I ALIKHANOV +	CERN		423	62	ITEP	S 4
CHARPAK	62	CNTR	G CHARPAK +	PL	1	16	62	CERN	S 4
FARLEY	62	CNTR	F J M FARLEY +	CERN	62	415	62	CERN	S 4
LUNDY	62	CNTR	R A LUNDY	PR	125	1686	62	CHICAGO	S 4
PARKER 1	62	CNTR	S PARKER, S PENMAN	NC	23	485	62	EFINS	S 4
SHAPIRO	62	RVUE	G SHAPIRO +	PR	125	1022	62	COLUMBIA	S 4
BABAEV	63	SPKK	A I BABAEV +	JETP	16	1397	63	ITEP	S 4
ECKHAUSE	63	CNTR	M ECKHAUSE	PR	132	422	63	CARNEGIE	S 4
FEINBERG	63	RVUE	G FEINBERG, LM LEDERMAN	ARNS	13	431	63	RVUE	S 4
FRANKEL 1	63	SPRK	S FRANKEL +	NC	27	894	63	PEN + LRL	S 4
FRANKEL 2	63	CNTR	S FRANKEL +	PR	130	351	63	PEN + LRL	S 4
MEYER	63	CNTR	S L MEYER +	PR	132	2693	63	COLUMBIA	S 4
PARKER 2	64	SPRK	PARKER,ANDERSON,RAY	PR	133	B768	64	EFINS	S 4
π±			8 CHARGED PION (140,JPG=0--) I=1						
CROWE	54	CNTR	K M CROWE,RH PHILLIPS	PR	96	470	54	L R L	S 8
BARKAS	56	EMUL	BARKAS,BIRNBAUM,SMITH	PR	101	778	56	L R L	S 8
CROWE	57	RVUE	K M CROWE	NC	5	541	57	STANFORD	S 8
CASTAGNOLI	58	EMUL	C CASTAGNOLI,M MUCHNICH	PR	112	1779	58	ROME	S 8
ANDERSON	60	CNTR	H L ANDERSON +	PR	119	2050	60	EFINS	S 8
ASHKIN	60	CNTR	J ASHKIN +	NC	16	490	60	CERN	S 8
BACASTOW	62	CNTR	R BACASTOW +	PRL	9	400	62	L R L	S 8
MERRISON	62	RVUE	A W MERRISON	ADVP	11	1	62	LIVERPOOL	S 8
SHAPIRO	62	RVUE	G SHAPIRO +	PR	125	1022	62	COLUMBIA	S 8
CZIRR	63	CNTR	J B CZIRR	PR	130	341	63	L R L	S 8
DEPOMMIER	63	CNTR	P DEPOMMIER +	PL	5	61	63	CERN	S 8
DUNAITSEV	63	CNTR	A F DUNAITSEV +	BNL		344	63	JINR	S 8
BARTLETT	64	SPRK	D BARTLETT +	BAPS	9	71	64	COLUMBIA	S 8
DI CAPUA	64	CNTR	E DI CAPUA +	PR	133	B1333	64	COLUMBIA	S 8
π0			9 NEUTRAL PION (135,JPG=0--) I=1						
PANOFSKY	51	CNTR	PANOFSKY,AAMODT,HADLEY	PR	81	565	51	L R L	S 9
CASSELS	59	CNTR	J M CASSELS +	PPS	74	92	59		S 9
CHINOWSKY	54	CNTR	W CHINOWSKY,STEINBERGER	PR	93	586	54	COLUMBIA	S 9
HADDOCK	59	CNTR	R P HADDOCK	PRL	3	478	59	L R L	S 9
HILLMANN	59	CNTR	P HILLMAN +	NC	14	887	59		S 9
BUDAGOV	60	HBC	YU BUGADOV, WIKTOR	JETP	11	755	60	JINR	S 9
SAMIOS	61	HBC	N P SAMIOS	PR	121	275	61	COLUMBIA+BNL	S 9
GLASSER	61	EMUL	R G GLASSER +	PR	123	1014	61	NAVAL RES	S 9
SHWE	62	EMUL	H SHWE +	PR	125	1024	62	L R L	S 9
TIETGE	62	EMUL	J TIETGE +	PR	127	1324	62	M PLANCK	S 9
CZIRR	63	CNTR	J B CZIRR	PR	130	341	63	L R L	S 9
EVANS	63	EMUL	D EVANS, J MULVEY	SIENA		477	63	OXFORD	S 9
KOLLER	63	EMUL	E L KOLLER +	NC	27	1405	63	STEVENS	S 9
PETRUKHIN	63	CNTR	VI PETRUKHIN,PROKOSHKIN	SIENA		208	63	DUBNA	S 9
VON DARDEL	63	CNTR	G VON DARDEL +	PL	4	51	63	CERN	S 9

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                    (GALTIERI,ROSENFELD JUNE/64)

          DATA FOR TABLE S ON STABLE PARTICLES
              STABLE MEANING IMMUNE TO STRONG DECAY

CODE EVENT QUANTITY  ERROR+    ERROR-     REFERENCE  YR TECH SIGN
   IN PEAK

  * INDICATES DATA IGNORED BY PROGRAMS
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$K^{\pm}$

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                    10  CHARGED K  (494,JP=0-)  I=1/2

                    10  CHARGED K  MASS (MEV)

S10M       493.9    0.2                 COHEN       57 RVUE +
S10M       493.7    0.3                 BARKAS      63 EMUL  -

                    10  CHAR.K  LIFETIME (UNITS 10**-8)

S10T         0.95   0.36     0.25       ILOFF       56 EMUL
S10T         1.211  0.026    0.026      FITCH       57 CNTR
S10T         1.227  0.015    0.015      ALVAREZ     57 CNTR
S10T    52   1.60   0.3      0.3        EISENBERG   58 EMUL
S10T         1.21   0.06     0.06       BURROWES    59 CNTR

S10T    33   1.38   0.24     0.24       FREDEN      60 EMUL
S10T    51   1.27   0.36     0.23       BHOWMIK     61 EMUL
S10T   293   1.31   0.08     0.08       NORDIN      61 H BC
S10T         1.25   0.22     0.17       BARKAS      61 EMUL
S10T         1.231  0.011    0.011      BOYARSKY    62 CNTR

                    10  CHARGED K PARTIAL DECAY MODES

S10P1      CHAR. K INTO MU (NEU)               K MU 2        S 4S 2

S10P2      CHAR. K INTO PI PIO                 K PI 2        S 8S 9
S10P3      CHAR. K INTO PI PI+ PI-             TAU           S 8S 8S 8
S10P4      CHAR. K INTO PI 2PIO                TAU PRIME     S 8S 9S 9
S10P5      CHAR. K INTO MU PIO NEU             K MU 3        S 4S 9S 2
S10P6      CHAR. K INTO E PIO NEU              K E  3        S 3S 9S 1
S10P7      POSIT.K INTO PI+ PI- E+NEU          K E+ 4        S 8S 8S 3S 1
S10P8      POSIT.K INTO PI+ PI+ E-NEU          K E- 4        S 8S 8S 3S 1

                    10  CHARGED K BRANCHING RATIOS

S10R1*     CHAR. K INTO MU NEU (MU2)      (UNITS 10**-2)      (P1)/TOTAL
S10R1        58.5         3.0              BIRGE       56 EMUL +
S10R1        56.9         2.6              ALEXANDER   57 EMUL +
S10R1        64.2         1.3              ROE         61 XBC  +
S10R1        63.0         0.8              SHAKLEE     64 XBC  +

S10R2*     CHAR. K INTO PI PIO (PI2)      (UNITS 10**-2)      (P2)/TOTAL
S10R2        27.7         2.7              BIRGE       56 EMUL +
S10R2        23.2         2.2              ALEXANDER   57 EMUL +
S10R2        18.6         0.9              ROE         61 XBC  +
S10R2        22.4         0.8              SHAKLEE     64 XBC  +

S10R3*     CHAR. K INTO PI PI+ PI-(TAU)   (UNITS 10**-2)      (P3)/TOTAL
S10R3         5.6         0.4              BIRGE       56 EMUL +
S10R3         6.8         0.4              ALEXANDER   57 EMUL +
S10R3         5.2         0.3              TAYLOR      59 EMUL +
S10R3         5.7         0.3              ROE         61 XBC  +
S10R3         5.1         0.2              SHAKLEE     64 XBC  +
S10R3 2332    5.52        0.13             CALLAHAN    64 XBC  +

S10R4*     CHAR. K INTO PI 2PIO (TAU PRIME)(UNITS 10**-2)     (P4)/TOTAL
S10R4         2.1         0.5              BIRGE       56 EMUL +
S10R4         2.2         0.4              ALEXANDER   57 EMUL +
S10R4         1.5         0.2              TAYLOR      59 EMUL +
S10R4         1.7         0.2              ROE         61 XBC  +
S10R4         1.8         0.2              SHAKLEE     64 XBC  +

S10R5*     CHAR. K INTO MU PIO NEU (MU3)  (UNITS 10**-2)      (P5)/TOTAL
S10R5         2.8         1.0              BIRGE       56 EMUL +
S10R5         5.9         1.3              ALEXANDER   57 EMUL +
S10R5         2.8         0.4              TAYLOR      59 EMUL +
S10R5         4.8         0.6              ROE         61 XBC  +
S10R5         3.0         0.5              SHAKLEE     64 XBC  +

S10R6*     CHAR. K INTO E PIO NEU (E3)    (UNITS 10**-2)      (P6)/TOTAL
S10R6         5.1         1.3              ALEXANDER   57 EMUL +
S10R6         3.2         1.3              BIRGE       56 EMUL +
S10R6         5.0         0.5              ROE         61 XBC  +
S10R6         4.7         0.3              SHAKLEE     64 XBC  +

S10R7*     POSIT.K INTO PI+ PI- E+ NEU    (UNITS 10**-5)      (P7)/TOTAL
S10R7  11     2.3         0.7              BIRGE       63 FBC  +
S10R7  75     4.3         0.9              BIRGE       64 FBC  +

S10R8*     POSIT.K INTO PI+ PI+ E- NEU    (UNITS 10**-5)      (P8)/TOTAL
S10R8*  0       0.1 OR LESS                BIRGE       64 FBC  +

S10R9*     CHAR. K INTO (MU PIO NEU)/(PI PI+ PI-)             (P5)/(P3)
S10R9 1220    0.61        0.05             BISI        64 PBC
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K^0

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                    11  NEUTRAL K  (JP=0-)  I=1/2

                    11  KO-K CH. MASS DIFFERENCE (MEV)

S11D         3.9    0.6                 ROSENFELD   59 HBC  -
S11D         5.4    1.1                 CRAWFORD    59 HBC  +
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K_1^0

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                    12  KO1 LIFETIME (UNITS 10**-10)

S12T    90   1.07   0.13     0.13       BOLDT       58 CC
S12T    62   0.81   0.23     0.15       BROWN       58 PBC
S12T    29   0.84   0.35     0.19       COOPER      58 CC
S12T    39   1.15   0.40     0.25       BLUMENFELD  58 CC
S12T   259   1.06   0.08     0.06       EISLER      58 PBC

S12T   512   0.94   0.05     0.05       CRAWFORD    59 HBC
S12T    63   1.09   0.18     0.15       BOWEN       60 CC
S12T   500   0.90   0.05     0.05       GARFINKEL   62 HBC
S12T   378   0.94   0.05     0.05       BERTANZA    62 HBC
S12T  2500   0.885  0.025    0.025      GOLDEN      62 HBC

S12T   600   0.85   0.04     0.04       WOJCICKI    63 HBC
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CODE EVENT QUANTITY  ERROR+    ERROR-     REFERENCE  YR TECH SIGN
   IN PEAK

  * INDICATES DATA IGNORED BY PROGRAMS

                    12 .KO1 PARTIAL DECAY MODES

S12P1        KO1 INTO PI+ PI-                                 S 8S 8
S12P2        KO1 INTO PIO PIO                                 S 9S 9

                    12  KO1  BRANCHING RATIOS

S12R1*       KO1 INTO (PI+ PI-)/TOTAL                         (P1)/TOTAL
S12R1           0.68       0.09                CRAWFORD    59 HBC
S12R1           0.70       0.18                COLUMBIA    60 HBC
S12R1           0.74       0.07                ANDERSON    62 HBC

S12R2*       KO1 INTO (PIO PIO)/TOTAL                         (P2)/TOTAL
S12R2           0.27       0.11                CRAWFORD    59 HBC
S12R2           0.26       0.06                BAGLIN      60 PBC
S12R2           0.30       0.035               BROWN       61 XBC
S12R2 1066      0.335      0.014               BROWN       63 XBC
S12R2  198      0.288      0.021               CHRETIEN    63 PBC
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                 REFERENCES FOR TABLE S ON STABLE PARTICLES

IDENTIFIC.  YR AUTHORS                        JOUR.VOL PAGE YR INSTITUTION      COD
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$K^{\pm}$

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                         10 CHARGED K  (494,JP=0-)  I=1/2

BIRGE        56 EMUL R W BIRGE +              NC      4  834 56 L R L             S10
ILOFF        56 EMUL E L ILOFF +              PR    102  927 56 L R L             S10
ALEXANDER    57 EMUL G ALEXANDER +            NC      6  478 57 DUBLIN            S10
ALVAREZ      57 CNTR L W ALVAREZ +            UCRL8030       57 L R L             S10
COHEN        57 RVUE E R COHEN,CROWE,DUMOND   FUND.CONS.PHYS57 RVUE              S10
FITCH        57 CNTR V FITCH +                UCRL8030       57 PRINCETON         S10

EISENBERG    58 EMUL Y EISENBERG +            NC      8  663 58 BERN              S10
BURROWES     59 CNTR H C BURROWES +           PRL     2  117 59 M I T             S10
TAYLOR       59 EMUL S TAYLOR +               PR    114  359 59 COLUMBIA          S10
FREDEN       60 EMUL S C FREDEN +             PR    118  564 60 L R L LIV         S10

BARKAS       61 EMUL W H BARKAS +             PR    124 1209 61 L R L             S10
BHOWMIK      61 EMUL B BHOWMIK +              NC     20  857 61 DELHI             S10
NORDIN       61 HBC  P NORDIN JR              PR    123 2168 61 L R L             S10

ROE          61 XBC  B P ROE +                PRL     9  346 61 MICHIGAN+LRL      S10
BOYARSKY     62 CNTR A M BOYARSKY +           PR    128 2398 62 M I T             S10

BARKAS       63 EMUL BARKAS,DYER,HECKMAN      PRL    11   26 63 L R L             S10
BIRGE        63 FBC  R W BIRGE +              PRL    11   35 63 LRL+WISCON+BARI   S10
BIRGE        64 FBC  R W BIRGE +              DUBNA          64 LRL+WISCON+BARI   S10
BISI         64 PBC  BISI,BORREANI,CESTER +   PRL    12  490 64 TORINO            S10
CALLAHAN     64 XBC  CALLAHAN,MARCH,STARK     SUBM. PR JUNE 64 WISCONSIN         S10
SHAKLEE      64 XBC  F S SHAKLEE +            BAPS    9   34 64 MICHIGAN          S10

          QUANTUM NUMBERS DETERMINATIONS NOT REFERRED TO IN DATA CARDS

BLOCK        62 HEBC BLOCK,LENDINARA,MONARI   CERN       371 62 NWEST+BOLOGNA     S10
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K^0

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                         11  NEUTRAL K  (JP=0-)  I=1/2

CRAWFORD     59 HBC  F S CRAWFORD +           PRL     2  112 59 L R L             S11
ROSENFELD    59 HBC  ROSENFELD,SOLMITZ,TRIPP  PRL     2  110 59 L R L             S11
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K_1^0

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                         12  KO1  (JP=0-)  I=1/2

BLUMENFELD   58 CC   H BLUMENFELD +           CERN       272 58 COLUMBIA          S12
BOLDT        58 CC   E BOLDT +                PRL     1  150 58 M I T             S12
BROWN        58 PBC  J BROWN +                CERN       272 58 MICHIGAN          S12
COOPER       58 CC   A COOPER +               CERN       272 58 JUNGFRAU          S12
EISLER       58 PBC  F EISLER +               CERN       272 58 COLUMBIA          S12

CRAWFORD     59 HBC  F S CRAWFORD +           PRL     2  266 59 L R L             S12
BAGLIN       60 PBC  C BAGLIN +               NC     18 1043 60 ECOL.POLYT.       S12
BIRGE        60 PBC  R W BIRGE +              ROCH   60  601 60 L R L             S12
BOWEN        60 CC   T BOWEN +                PR    119 2030 60 PRINCETON         S12
COLUMBIA     60 HBC  REPORTED VIA M SCHWARZ   ROCH       727 60 COLUMBIA          S12
MULLER       60 PBC  F MULLER +               PRL     4  418 60 L R L             S12

BROWN        61 XBC  J L BROWN +              NC     19 1155 61 LRL+MICHIGAN      S12
FITCH        61 CNTR V L FITCH +              NC     22 1160 61 PRINCETON         S12
GOOD         61 PBC  R H GOOD +               PR    124 1223 61 L R L             S12

ANDERSON     62 HBC  J A ANDERSON +           CERN       836 62 L R L             S12
BERTANZA     62 HBC  L BERTANZA +             PREPRINT       62 BROOKHAV.         S12
CRAWFORD     62 RVUE F S CRAWFORD             CERN       827 62 RVUE              S12
GARFINKEL    62 HBC  A F GARFINKEL            NEVIS104       62 COLUMBIA          S12
GOLDEN       62 HBC  R L GOLDEN               CERN       839 62 L R L             S12

BROWN        63 XBC  J L BROWN +              PR    130  769 63 LRL+MICHIG        S12
CHRETIEN     63 PBC  M CHRETIEN +             PR    131 2208 63 BRA+BRO+HAR+MIT   S12
WOJCICKI     63 HBC  S G WOJCICKI             PRIV COMM      63 L R L             S12
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                              (GALTIERI,ROSENFELD JUNE/64)

               DATA FOR TABLE S ON STABLE PARTICLES
                    STABLE MEANING IMMUNE TO STRONG DECAY

   CODE EVENT QUANTITY  ERROR+    ERROR-    REFERENCE  YR TECH SIGN
        IN PEAK

K2 0  * INDICATES DATA IGNORED BY PROGRAMS

                     13  K02-K01  MASS DIF.(UNITS OF 1/TAU1)

S13D *      FOR SIGN OF MASS DIFF.,SEE MEISNER 63
S13D          1.9        0.3                 FITCH        61 CNTR
S13D          0.84       0.29      0.21      GOOD         61 PBC
S13D          1.5        0.2                 CAMERINI     62 PBC
S13D * 48     0.6        0.6                 CRAWFORD     64 HBC
S13D          0.47       0.15      0.20      CHRISTENSON63 SPRK
S13D          0.78       0.20                AUBERT       64 PBC
S13D          0.82       0.12                FUJII        64 SPRK

                     13  K02 LIFETIME (NANOSEC)

S13T *      ASSUMED DS=DQ AND DELTA I=1/2 CRAWFORD     59 HBC
S13T   34    81.0       32.0      24.0       BARDON       58 CC
S13T   15    51.0       24.0       13.0      DARMON       62 FBC
S13T         54.0        6.0                 FUJII        64 SPRK

                     13  K02 PARTIAL DECAY MODES

S13P1       K02 INTO 3PIO                                           S 9S 9S 9
S13P2       K02 INTO PI+ PI- PIO                                    S 8S 8S 9
S13P3       K02 INTO PI MU NEUTRINO                                 S 8S 4S 2
S13P4       K02 INTO PI E NEUTRINO                                  S 8S 3S 1
S13P5       K02 INTO PI+ PI-                                        S 8S 8

                     13  K02 BRANCHING RATIOS

S13R1*      K02 INTO (PIO PIO PIO)/CHARGED                          (P1)/(P2+P3+P4)
S13R1          0.38       0.07               ANIKINA      62 CC

S13R2*      K02 INTO (PI+ PI- PIO)/CHARGED                          (P2)/(P2+P3+P4)
S13R2 320     0.185      0.038     0.034     ASTIER       61 CC
S13R2  304    0.13       0.02                CERN+ETH     63 CC
S13R2 479     0.157      0.03                LUERS        64 HBC

S13R3*      K02 INTO (PI MU NEUTRINO)/CHARGED                       (P3)/(P2+P3+P4)
S13R3* 304    0.18       0.03                CERN+ETH     63 CC
S13R3 479     0.356      0.07                LUERS        64 HBC

S13R4*      K02 INTO (PI E NEUTRINO)/CHARGED                        (P4)/(P2+P3+P4)
S13R4* 304    0.69       0.03                CERN+ETH     63 CC
S13R4 479     0.487      0.05                LUERS        64 HBC

S13R5*      K02 INTO (PI E NEU)/((PI E NEU)+(PI MU NEU))            (P4)/(P3+P4)
S13R5  320    0.415      0.120               ASTIER       61 CC

S13R6*      K02 INTO(PI+ PI- PIO)/TOTAL                             (P2)/TOTAL
S13R6  16     0.18       0.05                STERN        64 HBC

S13R7*      K02 INTO(LEPTON PI NEUTRINO)/TOTAL                      (P3+P4)/TOTAL
S13R7  14     0.58       0.17                ALEXANDER    62 HBC


S13R9*      K02 INTO (PI+ PI-)/CHARGED                              (P5)/(P2+P3+P4)
S13R9*  0     0.01 OR LESS                   NEAGU        61 CC
S13R9*  0     0.015 OR LESS                  LUERS        64 HBC

η                    14  ETA (549,JPG=0-+)  I=0

                     14  ETA  MASS (MEV)

S14M   53  549.0       1.2                   BASTIEN      62 HBC
S14M   35  546.0       4.0                   PICKUP       62 HBC
S14M   91  548.0       1.0                   ALFF         62 HBC
S14M   50  546.0                             TOOHIG       62 HBC
S14M       549.3       2.9                   DELCOURT     63 CNTR
S14M  148  549.0       0.7                   FOELSCHE     64 HBC

                     14  ETA  WIDTH (MEV)

S14W * 53     12 OR LESS                     BASTIEN      62 HBC
S14W * 91     10 OR LESS                     ALFF         62 HBC
S14W * 50     14.0 OR LESS                   TOOHIG       62 HBC
S14W *148     10 OR LESS                     FOELSCHE     64 HBC

                     14  ETA PARTIAL DECAY MODES

S14P1       ETA INTO 2GAMMA                                         S 0S 0
S14P2       ETA INTO 3PIO AND PIO 2 GAMMA, CALLED 3PIO              S 9S 9S 9
S14P3       ETA INTO PI+ PI- PIO                                    S 8S 8S 9
S14P4       ETA INTO PI+ PI- GAMMA                                  S 8S 8S 0

                     14 ETA   BRANCHING RATIOS

S14R1*      ETA INTO NEUTRAL/CHARGED                                (P1+P2)/(P3+P4)
S14R1  10     2.5        1.0                 PICKUP       62 HBC
S14R1  53     3.20       1.26                BASTIEN      62 HBC
S14R1  91     2.5        0.5                 ALFF         62 HBC
S14R1         2.7        0.8                 SHAFER       62 HBC
S14R1         3.1        0.7                 FIELDS       63 HBC

S14R2*      ETA INTO 2GAMMA/CHARGED                                 (P1)/(P3+P4)
S14R2         0.99       0.48                CRAWFORD     63 HBC
S14R2         1.05       0.45                PETERS       64 HBC

S14R3*      ETA INTO 3PIO/CHARGED                                   (P2)/(P3+P4)
S14R3         0.66       0.25                CRAWFORD     63 HBC
S14R3         0.55       0.23                PETERS       64 HBC

S14R4*      ETA INTO (PI+ PI- GAMMA)/(PI+ PI- PIO)                  (P4)/(P3)
S14R4         0.26       0.08                FOWLER       63 HBC
S14R4         0.14       0.08                FOELSCHE     64 HBC

S14R5*      ETA INTO 3PIO/(PI+ PI- PIO)                             (P2)/(P3)
S14R5         2.0        1.0                 FOELSCHE     64 HBC

S14R6*      ETA INTO 2GAMMA/3PIO                                    (P1)/(P2)
S14R6*        1.1        0.3 OR LESS         CHRETIEN     62 PBC
S14R6         0.80       0.25                BACCI        63 CNTR
S14R6         1.10       0.5                 MULLER       63 DBC
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CODE EVENT QUANTITY  ERROR+    ERROR-    REFERENCE  YR TECH SIGN
     IN PEAK

      * INDICATES DATA IGNORED BY PROGRAMS

p                    16  PROTON  (938,J=1/2)  I=1/2

                     16  PROTON  MASS (MEV)

S16M        938.256      0.005               COHEN        63 RVUE

                     16  PROTON LIFETIME  (UNITS 10**26 YR)

S16T *     OVER                    1.5       BACKENSTOSS60 CNTR
S16T *     OVER                    1.0       GIAMATI      62 CNTR

n                    17  NEUTRON (939,J=1/2)  I=1/2

                     17  NEUTRON-PROTON MASS DIF.(MEV)

S17D         1.2939      0.0004              BONDELID     60 CNTR
S17D         1.2933      0.0001              SALGO        64

                     17  NEUTRON LIFETIME (UNITS 10**3)

S17T         1.01        0.03      0.03      SOSNOVSKIJ 59 PILE
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                   REFERENCES FOR TABLE S ON STABLE PARTICLES

IDENTIFIC.  YR AUTHORS                     JOUR.VOL PAGE YR INSTITUTION      COD

K2 0                     13  K02  (JP=0-)  I=1/2

BARDON      58 CC   M BARDON ET AL         ANP     5  156 58 COLUMBIA         S13
CRAWFORD    59 HBC  F S CRAWFORD +         PRL     2  361 59 L R L            S13
ASTIER      61 CC   A ASTIER +             AIX     1  227 61 ECOLE POLYT.     S13
FITCH       61 CNTR V L FITCH,PIROUE,PERKINSNC    22 1160 61 PRINC+LOSALA.    S13
GOOD        61 PBC  R H GOOD +             PR    124 1223 61 L R L            S13
NEAGU       61 CC   D NEAGU +              PRL     6  552 61 JINR (MOSCOW)    S13

ALEXANDER   62 HBC  G ALEXANDER +          PRL     9   69 62 L R L            S13
ANIKINA     62 CC   M H ANIKINA +          CERN       452 62 DUBNA            S13
CAMERINI    62 PBC  U CAMERINI +           PR    128  362 62 WISCONSIN+LRL    S13
DARMON      62 FBC  J DARMON,ROUSSET,SIX   PL      3   57 62 EP               S13

CERN+ETH    63 HBC  CERN+ETH               SIENA       25 63 CERN+ETH         S13
   DATA NOT USED, TOTAL LEPTONIC RATES NORMAL, BUT MU3/E3 SURPRISINGLY SMALL
CHRISTENSON 63 SPRK J H CHRISTENSON +      BNL         74 63 PRINCETON        S13
JOVANOVICH  63 SPRK J V JOVANOVICH +       BNL         42 63 BNL/MD           S13
MEISNER     63 HBC  G W MEISNER,CRAWFORD+  BNL         67 63 L R L            S13

AUBERT      64 PBC  B AUBERT +             PREPRINT       64 ECOLE POLIT.     S13
CRAWFORD    64 HBC  CRAWFORDS,GULDEN,MEISNERBAPS   9  443 64 L R L            S13
FUJII       64 SPRK T FUJII +              BAPS    9  442 64 BNL + MARYLAND   S13
LUERS       64 HBC  D LUERS +              PR   133B1277 64 B N L             S13
STERN       64 HBC  D STERN +              PRL    12  459 64 WISCONSIN+LRL    S13

η                        14  ETA (549,JPG=0-+)  I=0

PEVSNER     61 HBC  A PEVSNER +            PRL     7  421 61 HOPKINS/N-WSTRN S14
ALFF        62 HBC  C ALFF +               PRL     9  322 62 COLUMBIA+RUTU    S14
BASTIEN     62 HBC  PL BASTIEN +           PRL     8  114 62 L R L            S14
CHRETIEN    62 PBC  M CHRETIEN  +          PRL     9  127 62 BRA+BRO+HA+MIT+PS14
FOELSCHE    62 HBC  HW FOELSCHE,+          PRL     9  223 62 YALE             S14
PICKUP      62 HBC  E PICKUP +             PRL     8  329 62 MRC OTTAWA+ BNL  S14
SHAFER      62 HBC  J BUTTON-SHAFER +      CERN       309 62 L R L            S14
TOOHIG      62 HBC  T TOOHIG +             CERN        99 62 JOHNS-HOPK+NWS   S14

BACCI       63 CNTR C BACCI +              PRL    11   37 63 FRASCATI         S14
BERTHELOT   63 RVUE A BERTHELOT            SIENA   2   64 63 RVUE             S14
BUSCHBECK-CZ63 HBC  B BUSCHBECK-CZAPP +    SIENA   1  166 63 VIENNA-CERN-AR   S14
CRAWFORD    63 HBC  F S CRAWFORD +         PRL    10  546 63 L R L +DUKE      S14
DELCOURT    63 CNTR B DELCOURT +           PL      7  215 63 ENS-ORSAY        S14

FIELDS      63 HBC  T FIELDS +             ATHENS     185 63 N-WES,JHOPK,WOC  S14
FOWLER      63 HBC  E C FOWLER +           PRL    10  110 63 DUKE+LRL         S14
MULLER      63 DBC  A MULLER +             SIENA       99 63 SACLAY+ROME      S14
FOELSCHE    64 HBC  HW FOELSCHE,H KRAYBILL PR TO BE PUBL 64 YALE              S14
PETERS      64 HBC  M W PETERS             THESIS         64 WISCONSIN        S14

         QUANTUM NUMBER DETERMINATIONS NOT REFERRED TO IN DATA CARDS

BASTIEN     62 HBC  PL BASTIEN +           PRL     8  114 62 I,J,P,G,C        S14
CARMONY     62 HBC  D D CARMONY +          PRL     8  117 62 I,J              S14
ROSENFELD   62 HBC  A H ROSENFELD +        PRL     8  293 62 G                S14

p                        16  PROTON  (938,J=1/2)  I=1/2

BACKENSTOSS 60 CNTR G K BACKENSTOSS +      NC     16  749 60 CERN             S16
GIAMATI     62 CNTR C C GIAMATI + F REINES PR    126 2178 62 CASE IT          S16
COHEN       63 RVUE E R COHEN,JWM DUMOND   REPORT IUPAP  63 RVUE             S16

n                        17  NEUTRON (939,J=1/2)  I=1/2

SOSNOVSKIJ  59 PILE SOSNOVSKIJ +           JETP    9  717 59 RUSSIA           S17
BONDELID    60 CNTR R O BONDELID +         PR    120  887 60 USNR+CATOUNI.    S17
SALGO       64          SALGO +            NP     53  457 64                  S17
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(GALTIERI,ROSENFELD JUNE/64)

DATA FOR TABLE S ON STABLE PARTICLES
STABLE MEANING IMMUNE TO STRONG DECAY

CODE EVENT QUANTITY ERROR+ ERROR- REFERENCE YR TECH SIGN
IN PEAK

* INDICATES DATA IGNORED BY PROGRAMS

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18 LAMBDA (1115,JP=1/2+) I=0

18 LAMBDA MASS (MEV)

CODE	EVENT IN PEAK	QUANTITY	ERROR+	ERROR-	REFERENCE	YR	TECH	SIGN
S18M		1115.25	0.36		BALTAY	62	HBC	
S18M	25	1115.04	0.41		ARMENTEROS	62	HBC	
S18M	317	1115.40	0.13		BHOWMIK	63	RVUE	
S18M *	LAMBDA MASS TO BE RAISED OF 0.043 BECAUSE PROTON MASS RAISED							

18 LAMBDA LIFETIME (UNITS 10**-10)

CODE	EVENT IN PEAK	QUANTITY	ERROR+	ERROR-	REFERENCE	YR	TECH	SIGN
S18T	188	2.63	0.21	0.21	BOLDT	58	CC	
S18T	74	2.75	0.45	0.38	BLUMENFELD	58	CC	
S18T	61	2.08	0.46	0.31	BROWN	58	PBC	
S18T	40	3.04	0.78	0.51	COOPER	58	CC	
S18T	454	2.29	0.15	0.13	EISLER	58	HBC	
S18T	825	2.72	0.16	0.16	CRAWFORD	59	HBC	
S18T	140	2.72	0.29	0.27	BOWEN	60	CC	
S18T	600	2.69	0.14	0.12	FUNG	62	PBC	
S18T	799	2.69	0.11	0.11	HUMPHREY	62	HBC	
S18T	748	2.58	0.11	0.11	BERTANZA	62	HBC	
S18T	900	2.44	0.11	0.11	GARFINKEL	62	HBC	
S18T	2250	2.31	0.09	0.09	CRONIN	62	SPRK	
S18T	5000	2.68	0.03	0.03	GOLDEN	62	HBC	
S18T		2.60	0.28	0.20	C-C CHANG	62	HBC	
S18T	2500	2.70	0.07	0.07	MURRAY	62	HBC	
S18T	2239	2.36	0.06	0.06	BLOCK	63	HEBC	
S18T	820	2.75	0.12	0.12	BERGE	63	HBC	
S18T	794	2.59	0.09		HUBBARD	64	HBC	
S18T	1378	2.59	0.07		SCHWARTZ	64	HBC	

18 LAMBDA PARTIAL DECAY MODES

S18P1	LAMBDA INTO PROTON PI-	S16S 8
S18P2	LAMBDA INTO NEUTRON PIO	S17S 9
S18P3	LAMBDA INTO PROTON MU- NEUTRINO	S16S 4S 2
S18P4	LAMBDA INTO PROTON E- NEUTRINO	S16S 3S 1

18 LAMBDA BRANCHING RATIOS

CODE	EVENT IN PEAK	QUANTITY	ERROR+	ERROR-	REFERENCE	YR	TECH	SIGN
S18R1*	LAMBDA INTO (P PI-)/((P PI-)+(N PIO))							(P1)/(P1+P2)
S18R1		0.627	0.031		CRAWFORD	59	HBC	
S18R1		0.65	0.05		COLUMBIA	60	HBC	
S18R1	903	0.643	0.016		HUMPHREY	62	HBC	
S18R1		0.685	0.017		ANDERSON	62	HBC	
S18R2*	LAMBDA INTO (N PIO)/((P PI-)+(N PIO))							(P2)/(P1+P2)
S18R2		0.23	0.09		EISLER	57	PBC	
S18R2		0.43	0.14		CRAWFORD	59	HBC	
S18R2		0.28	0.08		BAGLIN	60	PBC	
S18R2		0.35	0.05		BROWN	63	XBC	
S18R2	75	0.291	0.034		CHRETIEN	63	PBC	
S18R3*	LAMBDA INTO (P E- NEU)/TOTAL				(UNITS 10**-3)			(P4)/(P1+P2)
S18R3	15	2.0	0.5		HUMPHREY	61	RVUE	
S18R3	8	3.0	1.5	1.2	AUBERT	61	FBC	
S18R3	150	0.82	0.12	0.13	ELY	63	FBC	
S18R3	95	0.78	0.12		BAGLIN	63	FBC	
S18R3	20	1.55	0.34		LIND	64	HBC	
S18R4*	LAMBDA INTO (P MU- NEU)/TOTAL				(UNITS 10**-4)			(P3)/(P1+P2)
S18R4*	1	0.2 OR GREATER			GOOD	62	HBC	
S18R4*	1	1.0 OR LESS			ALSTON	63	HBC	
S18R4*	2	1.0 OR LESS			KERNAN	64	FBC	

18 LAMBDA MAGNETIC MOMENT (MAGNETONS,938.26 MEV)

CODE	EVENT IN PEAK	QUANTITY	ERROR+	ERROR-	REFERENCE	YR	TECH	SIGN
S18MM*		-1.5	0.5		COOL	62	SPRK	
S18MM*		0.0	0.6		KERNAN	63	CC	
S18MM*	8500	-1.4	0.7		ANDERSON	64	HBC	

Σ+

19 SIGMA+ (1189,JP=1/2+) I=1

CODE	EVENT IN PEAK	QUANTITY	ERROR+	ERROR-	REFERENCE	YR	TECH	SIGN
S19M		1189.40	0.15		BARKAS	63	EMUL	
S19M		1189.5	0.5		BURNSTEIN	64	HBC	

19 SIGMA+ LIFETIME (UNITS 10**-10)

CODE	EVENT IN PEAK	QUANTITY	ERROR+	ERROR-	REFERENCE	YR	TECH	SIGN
S19T *					GLASER	58	RVUE	
S19T	127	0.98	0.16	0.12	PUSCHEL	60	EMUL	
S19T	41	0.82	0.34	0.20	EVANS	60	EMUL	
S19T	117	0.85	0.14	0.11	FREDEN	60	EMUL	
S19T	54	0.80	0.10	0.067	KAPLON	60	EMUL	
S19T	23	0.76	0.22	0.14	CHIESA	61	EMUL	
S19T	49	0.75	0.13	0.09	BERTHELOT	61	PBC	
S19T	140	0.82	0.10	0.08	BARKAS	61	EMUL	
S19T	192	0.749	0.056	0.052	GRARD	62	HBC	
S19T	456	0.765	0.04	0.04	HUMPHREY	62	HBC	

19 SIGMA+ PARTIAL DECAY MODES

S19P1	SIGMA + INTO PROTON PIO	S16S 9
S19P2	SIGMA + INTO NEUTRON PI+	S17S 8
S19P3	SIGMA + INTO NEUTRON PI+ GAMMA	S17S 8S 0
S19P4	SIGMA + INTO LAMBDA E+ NEU	S18S 3S 0
S19P5	SIGMA + INTO PROTON GAMMA	S16S 0
S19P6	SIGMA + INTO NEUTRON MU+ NEUTRINO	S17S 4S 2
S19P7	SIGMA + INTO NEUTRON E+ NEUTRINO	S17S 3S 1

CODE EVENT QUANTITY ERROR+ ERROR- REFERENCE YR TECH SIGN
IN PEAK

* INDICATES DATA IGNORED BY PROGRAMS

19 SIGMA+ BRANCHING RATIOS

CODE	EVENT IN PEAK	QUANTITY	ERROR+	ERROR-	REFERENCE	YR	TECH	SIGN
S19R1*	SIGMA+ INTO (NEUTRON PI+)(NUCLEON PI)							(P2)/(P1+P2)
S19R1	308	0.490	0.024		HUMPHREY	62	HBC	
S19R2*	SIGMA+ INTO (NEUTRON PI+ GAM)/(PI+ N)				(10**-4)			(P3)/(P2)
S19R2*		ABOUT		0.4	COURANT	63	HBC	
S19R3*	SIGMA+ INTO (LAMBDA E+ NEU)/(PI+ N)				(10**-4)			(P4)/(P2)
S19R3*	1	0.25 APPROX			BURNSTEIN	63	HBC	
S19R4*	SIGMA+ INTO (N MU+/NEU)/(PI+N)				(10**-4)			(P6)/(P2)
S19R4*	0	LESS THAN		2.3	BURNSTEIN	63	HBC	
S19R5*	SIGMA+ INTO (N E+ NEU)/(N PI+)				(UNITS 10**-4)			(P7)/(P2)
S19R5*	0	LESS THAN		2.6	BURNSTEIN	63	HBC	
S19R5*		LESS THAN		4.0	MURPHY	64	PBC	
S19R5*	1	LESS THAN		1.03	NAUENBERG	64	HBC	
S19R6*	SIGMA+ INTO (P GAMMA)/(P PIO)				(10**-3)			(P5)/(P1)
S19R6*	8	ABOUT		3.0	NAUENBERG	64	HBC	

19 SIGMA+ MAGNETIC MOMENT (MAGNETONS,938.26 MEV)

CODE	EVENT IN PEAK	QUANTITY	ERROR+	ERROR-	REFERENCE	YR	TECH	SIGN
S19MM*		3.8	1.3		MCINTURF	64	EMUL	

REFERENCES FOR TABLE S ON STABLE PARTICLES

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18 LAMBDA (1115,JP=1/2+) I=0

IDENTIFIC.	YR		AUTHORS	JOUR.	VOL	PAGE	YR	INSTITUTION	COD
EISLER	57	PBC	F EISLER +	NC	5	1700	57	COLUMBIA+BNL	S18
BLUMENFELD	58	CC	H BLUMENFELD +	CERN		270	58	COLUMBIA	S18
BOLDT	58	CC	E BOLDT +	PRL	1	148	58	M I T	S18
BROWN	58	PBC	J BROWN +	CERN		270	58	MICHIGAN	S18
COOPER	58	CC	A COOPER +	CERN		270	58	JUNGFRAU	S18
EISLER	58	HBC	F EISLER +	CERN		270	58	COLUMBIA+PI+BO	S18
CRAWFORD	59	HBC	F S CRAWFORD +	PRL	2	266	59	L R L	S18
BAGLIN	60	PBC	C BAGLIN +	NC	18	1043	60	ECOLE POLYT	S18
BOWEN	60	CC	T BOWEN +	PR	119	2030	60	PRINCETON	S18
COLUMBIA	60	HBC	REPORTED BY M SCHWARTZ	ROCH		726	60	COLUMBIA	S18
AUBERT	61	FBC	B AUBERT +	AIX	1	197	61	ECOLE POLIT.	S18
HUMPHREY	61	RVUE	W E HUMPHREY +	PRL	6	478	61	L R L	S18
ANDERSON	62	HBC	J A ANDERSON +	CERN		832	62	L R L	S18
ARMENTEROS	62	HBC	R ARMENTEROS +	CERN		236	62	CERN ETC	S18
BALTAY	62	HBC	C BALTAY +	CERN		233	62	YALE,BRKH	S18
BERTANZA	62	HBC	L BERTANZA +	PREPRINT			62	B N L	S18
CHANG	62	HBC	C-C CHANG	NSA	16	29676	62	DUKE	S18
COOL	62	SPRK	COOL,JENKINS,KYCIA,HILL+	PR	127	2223	62	B N L	S18
CRONIN	62	SPRK	J CRONIN +	CERN		459	62	PRINCETON	S18
FUNG	62	PBC	S YIU FUNG	BAPS	7	619	62	L R L	S18
GARFINKEL	62	HBC	A F GARFINKEL	NEVIS104			62	COLUMBIA	S18
			AND	PRIV COMM			63	COLUMBIA	S18
GOLDEN	62	HBC	R L GOLDEN +	CERN		839	62	L R L	S18
GOOD	62	HBC	M L GOOD,V G LIND	PRL	9	518	62	WISCONSIN	S18
HUMPREY	62	HBC	W HUMPREY,R RUSS	PR	127	1305	62	L R L	S18
MURRAY	62	HBC	MURRAY +	CERN		839	62	L R L	S18
ALSTON	63	HBC	M H ALSTON +	UCRL		10926	63	L R L	S18
BAGLIN	63	FBC	C BAGLIN +	SIENA		8	63	EP+CERN+UC+RU+BE	S18
BERGE	63	HBC	J P BERGE	THESIS			63	L R L	S18
BHOWMIK	63	RVUE	B BHOWMIK,DP GOYAL	NC	28	1494	63	RVUE	S18
BLOCK	63	HEBC	M M BLOCK +	PR	130	766	63	N WESTERN	S18
BROWN	63	XBC	J L BROWN +	PR	130	769	63	LRL+MICHIG	S18
CHRETIEN	63	PBC	H R CHRETIEN +	PR	131	2208	63	BRA+BRO+HAR+MIT	S18
ELY	63	FBC	R P ELY +	PR	131	868	63	LRL+UNIV.COL.	S18
KERNAN	63	CC	KERNAN,NOVEY,WARSHAW +	PR	129	870	63	ARGONNE	S18
ANDERSON	64	HBC	J ANDERSON,CRAWFORD	BAPS	9	459	64	L R L	S18
HUBBARD	64	HBC	J R HUBBARD +	PR		JUNE	64	L R L	S18
KERNAN	64	FBC	A KERNAN +	PR	133	B1271	64	LRL+UNIV.COL.	S18
LIND	64	HBC	LIND,BINFORD,GOOD,STERN	PREPRINT			64	WISCONSIN	S18
SCHWARTZ	64	HBC	J SCHWARTZ	UCRL		11360	64	L R L	S18

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19 SIGMA + (1189,JP=1/2+) I=1

IDENTIFIC.	YR		AUTHORS	JOUR.	VOL	PAGE	YR	INSTITUTION	COD
GLASER	58	RVUE	D A GLASER +	CERN		270	58	RVUE	S19
EVANS	60	EMUL	D EVANS +	NC	15	873	60	BRISTOL	S19
FREDEN	60	EMUL	S C FREDEN +	NC	16	611	60	L R L LIV	S19
KAPLON	60	EMUL	M F KAPLON +	ANP	9	139	60	ROCHESTER	S19
PUSCHEL	60	EMUL	W PUSCHEL	NP	20	254	60	M PLANCK	S19
BARKAS	61	EMUL	W H BARKAS +	PR	124	1209	61	L R L	S19
BERTHELOT	61	PBC	A BERTHELOT +	NC	21	693	61	SACLAY	S19
CHIESA	61	EMUL	A M CHIESA +	NC	19	1171	61	TORINO	S19
GRARD	62	HBC	F GRARD + G A SMITH	PR	127	607	62	L R L	S19
HUMPHREY	62	HBC	W E HUMPHREY + R R RUSS	PR	127	1305	62	L R L	S19
BARKAS	63	EMUL	BARKAS,DYER,HECKMAN	PRL	11	26	63	L R L	S19
ALSO	61	EMUL	J DYER	UCRL		9450	61	L R L	S19
BURNSTEIN	63	HBC	R A BURNSTEIN +	BNL		427	63	MARYL+CERN+BNL	S19
COURANT	63	HBC	H COURANT +	SIENA		15	63	CERN+MARYLAND	S19
BURNSTEIN	64	HBC	BURNSTEIN,DAY,KEHOE +	PREPRINT			64	MARYL	S19
MCINTURF	64	EMUL	A D MUCFNTURF,ROOS	BAPS	9	459	64	VANDERBILT	S19
MURPHY	64	PBC	C T MURPHY	PR	134	8188	64	WISCONSIN	S19
NAUENBERG	64	HBC	U NAUENBERG +	PRL	12	679	64	COL+RUTG+PRIN	S19
			AND	PRIV COMM		MAY	64	COL+RUTG+PRINC	S19

QUANTUM NUMBER DETERMINATIONS NOT REFERRED TO IN DATA CARDS

IDENTIFIC.	YR		AUTHORS	JOUR.	VOL	PAGE	YR	INSTITUTION	COD
TRIPP	62	HBC	TRIPP,WATSON,FERROLUZZI	PRL	8	175	62	P	S19
ALFF	63	HBC	C ALFF +	SIENA	1	205	63	COLUM+RUTG+BNL	S19
COURANT	63	HBC	H COURANT +	SIENA	1	73	63	MARYL+CERN+NRL	S19

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                         (GALTIERI,ROSENFELD JUNE/64)

            DATA FOR TABLE S ON STABLE PARTICLES
               STABLE MEANING IMMUNE TO STRONG DECAY

CODE EVENT QUANTITY  ERROR+    ERROR-     REFERENCE  YR TECH SIGN
    IN PEAK

  * INDICATES DATA IGNORED BY PROGRAMS
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                    20  SIGMA-  (1198,JP=1/2+)  I=1

                    20  SIGMA-    MASS (MEV)

S20M      1197.6    0.5                  BARKAS     63 EMUL
S20M  588 1197.0    0.2                  BURNSTEIN  64 HBC

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

S20T        1.67    0.40     0.28        BROWN      58 PBC
S20T        1.89    0.33     0.25        EISLER     58 PBC
S20T        1.45    0.12     0.12        CRAWFORD   59 HBC
S20T   45   1.35    0.32     0.17        CHIESA     61 EMUL
S20T   41   1.75    0.39     0.30        BARKAS     61 EMUL

S20T 1208   1.58    0.06     0.06        HUMPHREY   62 HBC

                    20  SIGMA- PARTIAL DECAY MODES

S20P1     SIGMA - INTO  NEUTRON PI-                          S17S 8
S20P2     SIGMA - INTO  NEUTRON PI- GAMMA                    S17S 8S 0
S20P3     SIGMA - INTO  NEUTRON MU- NEUTRINO                 S17S 4S 2
S20P4     SIGMA - INTO  NEUTRON E- NEUTRINO                  S17S 3S 1
S20P5     SIGMA - INTO  LAMBDA E- NEUTRINO                   S18S 3S 1

                    20  SIGMA-  BRANCHING RATIOS

S20R1*    SIGMA - INTO (N MU- NEU)/(N PI-) (UNITS 10**-3)  (P3)/(P1)
S20R1       0.66    0.14                 BURNSTEIN  63 HBC

S20R2*    SIGMA - INTO (N E- NEU)/(N PI-)  (UNITS 10**-3)  (P4)/(P1)
S20R2       1.4     0.3                  BURNSTEIN  63 HBC
S20R2   9   1.0     0.4      0.3         MURPHY     64 PBC
S20R2  16   1.37    0.34                 NAUENBERG  64 HBC

S20R3*    SIGMA - INTO (LAMBDA E- NEU)/(N PI-) (UN. 10**-4)(P5)/(P1)
S20R3       0.75    0.28                 BURNSTEIN  63 HBC

S20R4*    SIGMA - INTO (N PI- GAMMA)/(N PI-) (UN. 10**-4)  (P2)/(P1)
S20R4*    ABOUT                  0.1     COURANT    63 HBC
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                    21  SIGMA 0  (1193,JP=1/2+)  I=1

                    21  SIGMA- MASS DIFFER.(-)-(0)(MEV)

S21D   18    4.75   0.1                  BURNSTEIN  64 HBC

                    21  SIGMA0 LIFETIME (UNITS 10**-14)

S21T *      1.0 OR LESS                  DAVIS      62 EMUL
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                    22  XI-  (1321,JP=1/2 ) I=1/2

                    22  XI-   MASS (MEV)

S22M   12 1320.4    2.2                  UCRL 8030  58 RVUE
S22M   11 1317.0    2.2                  KANG-CHANG 61 PBC
S22M   18 1317.9    1.9                  FOWLER     61 PBC
S22M    1 1322.0    1.3                  BROWN      62 HBC
S22M      1321.0    0.5                  BERTANZA   62 HBC

S22M   62 1321.1    0.65                 SCHNEIDER  63 HBC
S22M  517 1321.4    0.4                  JANEAU     63 FBC
S22M  505 1320.4    0.3                  LONDON     64 HBC
S22M *    ALL THE XI- MASSES TO BE RAISED 0.09 MEV BECAUSE LAMBDA RAISED

                    22  XI-  LIFETIME (UNITS 10**-10)

S22T   11   3.5     3.4      1.23        KANG-CHANG 61 PBC
S22T   18   1.28    0.41     0.25        FOWLER     61 PBC
S22T   62   1.55    0.31     0.31        SCHNEIDER  63 HBC
S22T  332   1.80    0.16     0.15        CONNOLLY   63 HBC
S22T  517   1.86    0.15     0.14        JAUNEAU    63 FBC
S22T  356   1.77    0.12                 CARMONY    64 HBC
S22T  794   1.69    0.07                 HUBBARD    64 HBC

                    22  XI- PARTIAL DECAY MODES

S22P1     XI- INTO LAMBDA PI-                                S18S 8
S22P2     XI- INTO LAMBDA E- NEUTRINO                        S18S 3S 1
S22P3     XI- INTO NEUTRON PI-                               S17S 8

                    22  XI-  BRANCHING RATIOS

S22R1*    XI- INTO (LAMBDA E- NEU)/(LAMBDA PI-)  (10**-3)  (P2)/(P1)
S22R1*  1   1.7     OR LESS              CARMONY + 63 HBC QUOTED BY TICHO

S22R2*    XI- INTO (NEUTRON PI-)/(LAMBDA PI-)    (10**-3)  (P3)/(P1)
S22R2*  0 LESS THAN            5.0       FERRO-LUZZI63 HBC
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                    23  XI 0  (1314,JP=1/2 ) I=1/2

                    23  XI          MASS DIFFERENCE (-)-(0)(MEV)

S23D   23    6.8    1.6                  JAUNEAU    63 FBC
S23D   34    6.9    2.2                  LONDON     64 HBC
S23D   45    6.1    1.6                  CARMONY    64 HBC

                    23  XI 0 LIFETIME (UNITS 10**-10)

S23T    1    1.5                         ALVAREZ    59 HBC
S23T   24    3.8    1.0      0.65        JAUNEAU    63 FBC
S23T   45    3.5    1.0      0.8         CARMONY    63 HBC
S23T  101    2.5    0.4      0.3         HUBBARD    63 HBC
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CODE EVENT QUANTITY  ERROR+    ERROR-     REFERENCE  YR TECH SIGN
   IN PEAK

  * INDICATES DATA IGNORED BY PROGRAMS

                  23  XI 0   PARTIAL DECAY MODES
S23P1     XI 0 INTO LAMBDA PIO                               S18S 9
S23P2     XI 0 INTO PROTON PI-                               S16S 8
S23P3     XI 0 INTO PROTON E- NEU                            S16S 3S 1
S23P4     XI 0 INTO SIGMA+ E- NEU                            S19S 3S 1
S23P5     XI 0 INTO SIGMA- E+ NEU                            S20S 3S 1

                  23  XI 0  BRANCHING RATIOS

S23R1*    XI 0 INTO(PROTON PI-)/(LAMBDA PIO)               (P2)/(P1)
SR3R1*  0 0.027      OR LESS              TICHO      63 HBC

S23R2*    XI 0 INTO(PROTON E- NEU)/(LAMBDA PIO)            (P3)/(P1)
S23R2*  0 0.027      OR LESS              TICHO      63 HBC

S23R3*    XI 0 INTO(SIGMA+ E- NEU)/(LAMBDA PIO)            (P4)/(P1)
S23R3*  0 0.013      OR LESS              TICHO      63 HBC
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                  24  OMEGA-  (1675,JP=3/2+)   I=0

                  24  OMEGA-  MASS (MEV)
S24  *            QUANTUM NUMBERS ASSIGNED FROM SU3
S24M    1 1620.0    25.0     10.0        EISENBERG  54 EMUL
S24M    2 1675.0     3.0                 BARNES     64 HBC

                  24  OMEGA - LIFETIME (UNITS 10**-10)

S24T    1   0.7                          BARNES     64 HBC

0         1         2         3         4         5         6         7         8
12345*78901234567890123456789012345678901234567890123456789012345678901234567890
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REFERENCES FOR TABLE S ON STABLE PARTICLES

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IDENTIFIC.  YR AUTHORS                     JOUR.VOL PAGE YR INSTITUTION     COD
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                   20  SIGMA - (1198,JP=1/2+)  I=1

BROWN        58 PBC  J BROWN +               CERN      270 58 MICHIGAN        S20
EISLER       58 PBC  F EISLER +              CERN      270 58 COLUMBIA        S20
CRAWFORD     59 HBC  F S CRAWFORD +          PRIV COMM      59 L R L          S20
BARKAS       61 EMUL W H BARKAS +            PR    124 1209 61 L R L          S20
CHIESA       61 EMUL A M CHIESA +            NC     19 1171 61 TORINO         S20

HUMPHREY     62 HBC  W E HUMPHREY + R R ROSS PR    127 1305 62 L R L          S20
BARKAS       63 EMUL W H BARKAS,DYER,HECKMAN PRL    11   26 63 L R L          S20
BURNSTEIN    63 HBC  R A BURNSTEIN +         BNL       427 63 MARYL+CERN+BNL  S20
                            AND PRIV COMM                  64 MARYL+CERN+BNL  S20
COURANT      63 HBC  H COURANT +             SIENA      15 63 CERN+MARYLAND   S20

BURNSTEIN    64 HBC  BURNSTEIN, DAY, KEHOE + PREPRINT JUNE 64 MARYL           S20
MURPHY       64 PBC  C T MURPHY              PR             64 WISCONSIN      S20
NAUENBERG    64 HBC  U NAUENBERG +           PRL    12  679 64 COL+RUTG+PRIN  S20
                                    AND PRIV COMM MAY      64 COL+RUTG+PRINC  S20
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Σ^0

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

DAVIS        62      D H DAVIS +             PR    127  605 62 EFINS          S21
BURNSTEIN    64 HBC  BURNSTEIN,DAY,KEHOE +   PREPRINT       64 MARYL          S21
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                   22  XI -  (1321,JP=1/2)  I=1/2

UCRL8030     58 RVUE W H BARKAS A H ROSENFELDUCRL8030       58 RVUE           S22
FOWLER       61 PBC  W B FOWLER +            PRL     6  134 61 L R L          S22
KANG-CHANG   61 PBC  W KANG-CHANG +          JETP   13  512 61 JINR RUSS      S22

BERTANZA     62 HBC  L BERTANZA +            PRL     9  229 62 BROOKHAV.      S22
BROWN        62 HBC  H N BROWN +             PRL     8  255 62 BROOKHAV       S22
CONNOLLY     63 HBC  P L CONNOLLY +          SIENA      34 63 B N L          S22
                        AND PRIV COMM BY G LONDON APRIL    64 B N L          S22
FERRO-LUZZI  63 HBC  M FERRO-LUZZI +         PR    130 1568 63 L R L          S22

JAUNEAU      63 FBC  L JAUNEAU +             SIENA       4 63 EP+CERN+UC+RU+BES22
       ALSO  63 FBC  L JAUNEAU +             PL      4   49 63 EP+            S22
SCHNEIDER    63 HBC  H SCHNEIDER             PL      4  360 63 CERN           S22
TICHO        63 RVUE H K TICHO               BNL       410 63 RVUE           S22

CARMONY      64 HBC  D D CARMONY +           PRL    12  482 64 UCLA           S22
HUBBARD      64 HBC  J R HUBBARD +           PR        JUNE 64 L R L          S22
LONDON       64 HBC  G W LONDON +            BAPS    9   22 64 BNL+SYR        S22
          QUANTUM NUMBER DETERMINATIONS NOT REFERRED TO IN DATA CARDS

CARMONY      64 HBC  D D CARMONY +           PRL    12  482 64 UCLA,  J       S22
SHAFER       64 HBC  J B SHAFER,     ALVAREZ MEMO 508  MAY 64 L R L, J        S22
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                   23  XI 0  (1314,JP=1/2)  I=1/2

ALVAREZ      59 HBC  L W ALVAREZ +           PRL     2  215 59 L R L          S23
JAUNEAU      63 FBC  L JAUNEAU +             SIENA   1    1 63 EP+CERN+UC+RU+BES23
       ALSO  63 FBC  L JAUNEAU +             PL      4   49 63 EP+            S23
TICHO        63 RVUE HUBBARD +,CARMONY +     BNL       410 63 LRL+UCLA       S23

CARMONY      64 HBC  D D CARMONY +           PRL    12  482 64 UCLA           S23
HUBBARD      63 HBC  J R HUBBARD +           PR        JUNE 64 L R L          S23
LONDON       64 HBC  G W LONDON +            BAPS    9   22 64 BNL+SYR        S23
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                   24  OMEGA - (1675,JP=3/2+)   I=0

EISENBERG    54 EMUL Y EISENBERG             PR     96  541 54 CORNEL         S24
BARNES       64 HBC  V E BARNES +            PRL    12  204 64 B N L          S24
                                    AND PRIV COMM MAY      64 B N L          S24

0         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789
```

DATA ON MESON RESONANCES (REFERENCES AT LOWER RIGHT)

(GALTIERI,ROSENFELD JUNE/6/64)

DATA ON MESON RESONANCES

* INDICATES DATA IGNORED BY PROGRAMS

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1 OMEGA (780,JPG=1--) I=0

1 OMEGA MASS (MEV)

CODE	EVENT	QUANTITY IN PEAK	ERROR+	ERROR-	REFERENCE	YR	TECHNIQUE	
U 1M	400	782.0	1.0		ALFF	62	HBC	
U 1M	64	779.4	1.4		ARMENTEROS	62	HBC	
U 1M	90	784.0	0.9		GELFAND	63	HBC	
U 1M	650	782.0			MURRAY	63	HBC	
U 1M	34	784.0	1.0		ARMENTEROS	63	HBC	

1 OMEGA FULL WIDTH (MEV)

CODE	EVENT	QUANTITY IN PEAK	ERROR+	ERROR-	REFERENCE	YR	TECHNIQUE	
U 1W	90	9.5	2.1		GELFAND	63	HBC	
U 1W	34	9.0	3.0		ARMENTEROS	63	HBC	

1 OMEGA PARTIAL DECAY MODES

U 1P1	OMEGA INTO PI+ PI- PIO	S 8S 8S 9
U 1P2	OMEGA INTO PI+ PI-	S 8S 8
U 1P3	OMEGA INTO PI+ PI- GAMMA	S 8S 8S 0
U 1P4	OMEGA INTO PIO GAMMA	S 9S 0
U 1P5	OMEGA INTO 2PIO GAMMA	S 9S 9S 0
U 1P6	OMEGA INTO MU+ MU-	S 4S 4
U 1P7	OMEGA INTO E+ E-	S 3S 3

1 OMEGA BRANCHING RATIOS

CODE	EVENT	QUANTITY IN PEAK	ERROR+	ERROR-	REFERENCE	YR	TECHNIQUE	
U 1R1*		OMEGA INTO NEUTRAL/(PI+ PI- PIO) I.E.						(P4+P5)/(P1)
U 1R1		0.10	0.04		ALFF	62	HBC	
U 1R1	40	0.10	0.03		MURRAY	63	HBC	
U 1R1		0.17	0.04		ARMENTEROS	63	HBC	
U 1R1	20	0.11	0.02		BUSCHBECK-C	63	HBC	
U 1R1		0.09	0.04		FIELDS	63	HBC	
U 1R2*		OMEGA INTO (PI+ PI-)/(PI+ PI- PIO)						(P2)/(P1)
U 1R2*		0.010 OR LESS			BUTTON	61	HBC	
U 1R2*		0.02 OR LESS			ALFF	62	HBC	
U 1R2*	100	0.005 OR GREATER			FICKINGER	63	HBC	
U 1R2*		0.07			ALITTI	63	HBC	
U 1R2*	32	0.045	0.016	0.01	MURRAY	63	HBC	NO INTERFERE
U 1R2*		0.005 OR LESS			ARMENTEROS	63	HBC	
U 1R2*		0.02			JAMES	63	HBC	
U 1R2*		0.018	0.012	0.006	WALKER	64	RVUE	
U 1R2*		0.005 OR LESS			LUTJENS	64	RVUE	NO INTERFERE
U 1R2*	42	0.006 - 0.002 OR GREATER			HUWE	64	HBC	- INTEFERE
U 1R2*	42	0.11 + 0.01 OR LESS			HUWE	64	HBC	+ INTERFERE
U 1R3*		OMEGA INTO (PIO+GAMMA)/(NEUTRAL)						(P4)/(P1)
U 1R3*		DOMINANT			BARMIN 1	63	XBC	
U 1R4*		OMEGA INTO (PI+ PI- GAMMA)/(PI+ PI- PIO)						(P3)/(P1)
U 1R4		0.032	0.013		SHAFER	63	HBC	
U 1R5*		OMEGA INTO (E+ E-)/(PI+ PI- PIO)						(P7)/(P1)
U 1R5		0.005	0.003		SHAFER	63	HBC	
U 1R5*		0.0039 + 0.0015 OR LESS			BARMIN 2	63	PBC	
U 1R5*		0.003 OR LESS			GALTIERI	64	HBC	
U 1R6*		OMEGA INTO (MU+ MU-)/(PI+ PI- PIO)						(P6)/(P1)
U 1R6*		0.007 OR LESS			GALTIERI	64	HBC	

η2π

2 ETA,2PI (960,JPG= +) I=0,1
PROBABLY STRONG DECAY OF 0(0-+ OR 1++) C = +1

2 ETA,2PI MASS (MEV)

CODE	EVENT	QUANTITY IN PEAK	ERROR+	ERROR-	REFERENCE	YR	TECHNIQUE
U 2M		950.0			GOLDBERG 1	64	HBC
U 2M	81	959.0	2.0		KALBFLEISCH	64	HBC
U 2M	89	960.0	5.0		GOLDBERG 2	64	HBC

2 ETA,2PI WIDTH (MEV)

CODE	EVENT	QUANTITY IN PEAK	ERROR+	ERROR-	REFERENCE	YR	TECHNIQUE
U 2W *	81	12.0 OR LESS			KALBFLEISCH	64	HBC
U 2W *	89	20.0 OR LESS			GOLDBERG 2	64	HBC

2 ETA,2PI PARTIAL DECAY MODES

U 2P1	ETA,2PI INTO ETA 2PI	S14S 8S 8
U 2P2	ETA,2PI INTO 2PI	S 8S 8
U 2P3	ETA,2PI INTO 3PI	S 8S 8S 8
U 2P4	ETA,2PI INTO OTHER	

2 ETA,2PI BRANCHING RATIOS

CODE	EVENT	QUANTITY IN PEAK	ERROR+	ERROR-	REFERENCE	YR	TECHNIQUE
U 2R1*		ETA,2PI INTO PI+ PI-+(NEUTRAL + CHARGED ETA)					
U 2R1*	33	33/70	0.1		KALBFLEISCH	64	HBC
U 2R2*		ETA,2PI INTO ALL NEUTRALS (PROB. 2PIO (NEUTRAL ETA))					
U 2R2*	27	27/70	0.1		KALBFLEISCH	64	HBC
U 2R3*		ETA,2PI INTO PI+ PI-+(NEUTRAL HEAVIER THAN 2PIO BUT NOT ETA)					
U 2R3*	10	10 OR LESS/70			KALBFLEISCH	64	HBC
U 2R4*		ETA,2PI INTO PI+ PI-+(NEUTRAL LIGHTER THAN 2PIO)					
U 2R4*		NOT YET STUDIED			KALBFLEISCH	64	HBC

K_1K_1

3 K1 K1 (1020,JPG=EVEN++) I=0
K1 K1 MAYBE JUST LARGE KK SCATTERING LENGTH, OMITTED FROM TABLE

3 K1 K1 MASS (MEV)

CODE	EVENT	QUANTITY IN PEAK	ERROR+	ERROR-	REFERENCE	YR	TECHNIQUE
U 3M *	16	1020.0			ALEXANDER	62	HBC
U 3M *		1000.0	APPROX		BINGHAM	62	PBC
U 3M *		1000.0	APPROX		BIGI	62	HBC

3 K1K1 DECAY MODES AND BRANC. RATIOS SEE TEXT

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4 PHI (1020,JPG=1.-) I=0

4 PHI MASS (MEV)

CODE	EVENT	QUANTITY IN PEAK	ERROR+	ERROR-	REFERENCE	YR	TECHNIQUE
U 4M	34	1019.0	2.0		SCHLEIN	63	HBC
U 4M	19	1018.6	0.5		GELFAND	63	HBC
U 4M		1017.0	2.0		ARMENTEROS	63	HBC
U 4M	85	1020.5	0.5		CONNOLLY 2	63	HBC

* INDICATES DATA IGNORED BY PROGRAMS

4 PHI WIDTH (MEV)

CODE	EVENT	QUANTITY IN PEAK	ERROR+	ERROR-	REFERENCE	YR	TECH	SIGN
U 4W *	34	5.0 OR LESS			SCHLEIN	63	HBC	
U 4W	19	3.1	1.0		GELFAND	63	HBC	
U 4W	85	3.1	0.8		CONNOLLY 2	63	HBC	
U 4W		3.4	1.7		ARMENTEROS	63	HBC	

4 PHI PARTIAL DECAY MODES

CODE	MODE	SIGN
U 4P1	PHI INTO K+ K-	S10S10
U 4P2	PHI INTO K01 K02	S11S11
U 4P3	PHI INTO RHO PI	U 9S 8
U 4P4	PHI INTO PI+ PI-	S 8S 8
U 4P5	PHI INTO E+ E-	S 3S 3
U 4P6	PHI INTO MU+ MU-	S 4S 4
U 4P7	PHI INTO PIO GAMMA	S 9S 0

4 PHI BRANCHING RATIOS

CODE	EVENT	QUANTITY IN PEAK	ERROR+	ERROR-	REFERENCE	YR	TECH	SIGN
U 4R1*		PHI INTO (K1 K2)/(K1 K2 AND K+ K-)						(P2)/(P1+P2)
U 4R1	10	0.40	0.10		SCHLEIN	63	HBC	
U 4R1	26	0.41	0.07		LAI	64	HBC	
U 4R2*		PHI INTO (RHO PI)/(K KBAR)						(P3)/(P1+P2)
U 4R2		0.1	0.1		LAI	64	HBC	
U 4R3*		PHI INTO (PI+ PI-)/(K KBAR)						(P4)/(P1+P2)
U 4R3*		0.08 OR LESS			CONNOLLY 2	63	HBC	
U 4R4*		PHI INTO (E+ E-)/(K KBAR)						(P5)/(P1+P2)
U 4R4*		0.01 OR LESS			GALTIERI	64	HBC	
U 4R5*		PHI INTO (MU+ MU-)/(K KBAR)						(P6)/(P1+P2)
U 4R5*		0.01 OR LESS			GALTIERI	64	HBC	

REFERENCES ON MESON RESONANCES

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1 OMEGA (780,JPG=1--) I=0

IDENTIFIC.	YR		AUTHORS	JOUR.	VOL	PAGE	YR	INSTITUTION	COD
BUTTON	61	HBC	J BUTTON +	UCRL		9814	61	L R L	U 1
MAGLIC	61	HBC	B C MAGLIC +	PRL	7	178	61	L R L	U 1
PEVSNER	61	HBC	A PEVSNER +	PRL	7	421	61	HOPKINS+N-WST	U 1
ALFF	62	HBC	C ALFF +	PRL	9	322	62	COLUMBIA+RUTG	U 1
ALFF	62	HBC	C ALFF +	PRL	9	325	62	COLUMBIA+RUTG	U 1
ARMENTEROS	62	HBC	R ARMENTEROS +	CERN		90	62	CERN+CF+EP	U 1
ALITTI	63	HBC	J ALITTI +	NC	29	515	63	SAC+ORS+BA+BO	U 1
ARMENTEROS	63	HBC	R ARMENTEROS +	SIENA	1	296	63	CERN+CF	U 1
BARMIN 1	63	XBC	V V BARMIN +	PL	6	279	63	ITEP-MUSCOW	U 1
BARMIN 2	63	PBC	V V BARMIN +	SIENA	1	207	63	ITEP	U 1
BERTHELOT	63	RVUE	A BERTHELOT	SIENA	2	60	63	RVUE	U 1
BUSCHBECK-CZ	63	HBC	B BUSCHBECK-CZAPP +	SIENA	1	166	63	VIENNA+CERN+AMS	U 1
FICKINGER	63	HBC	FICKINGER,ROBINSON,SALAN	PRL	10	457	63	B N L	U 1
FIELDS	63	HBC	T FIELDS +	ATHENS		185	63	N-WES,JHOPK,WOC	U 1
GELFAND	63	HBC	N GELFAND +	PRL	11	436	63	COLUMBIA+RUTG	U 1
JAMES	63	HBC	JAMES,H L KRAYBILL	PREPRINT			63	YALE	U 1
MURRAY	63	HBC	J J MURRAY +	PL	7	358	63	L R L	U 1
SHAFER	63	HBC	J BUTTON-SHAFER +	STANFORD			63	L R L	U 1
GALTIERI	64	HBC	BARBARO-GALTIERI,TRIPP	DUBNA			64	L R L	U 1
HUWE	64	HBC	D O HUWE	THESIS			64	L R L	U 1
LUTJENS	64	RVUE	G LUTJENS,STEINBERGER	PRL	12	517	64	COLUMBIA	U 1
WALKER	64	HBC	W D WALKER +	PL	8	208	64	WISCONSIN	U 1

QUANTUM NUMBER DETERMINATIONS NOT REFERRED TO IN DATA CARDS

IDENTIFIC.	YR		AUTHORS	JOUR.	VOL	PAGE	YR	INSTITUTION	COD
XUONG	61	HBC	N H XUONG +	PRL	7	327	61	I,J,P	U 1
STEVENSON	62	HBC	M L STEVENSON	PR	125	687	62	I,J,P	U 1

η2π

2 ETA,2PI (960,JPG= +) I=0,1

IDENTIFIC.	YR		AUTHORS	JOUR.	VOL	PAGE	YR	INSTITUTION	COD
GOLDBERG 1	64	HBC	M GOLDBERG +	BAPS	9	23	64	BNL+SYR	U 2
KALBFLEISCH	64	HBC	G R KALBFLEISCH +	PRL	12	527	64	L R L	U 2
GOLDBERG 2	64	HBC	M GOLDBERG +	PRL	12	546	64	BNL+SYR	U 2
KALBFLEISCH	64	HBC	G R KALBFLEISCH +	DUBNA			64	L R L	U 2

K_1K_1

3 K1,K1 (1020,EVEN++) I=0

IDENTIFIC.	YR		AUTHORS	JOUR.	VOL	PAGE	YR	INSTITUTION	COD
ALEXANDER	62	HBC	G ALEXANDER +	PRL	9	460	62	L R L	U 3
BIGI	62	HBC	A BIGI +	CERN		247	62	CERN	U 3
BINGHAM	62	PBC	H H BINGHAM +	CERN		240	62	EP+CERN	U 3
ERWIN	62	HBC	A R ERWIN +	PRL	9	34	62	WISCONSIN	U 3

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4 PHI (1020,JPG=1--) I=0

IDENTIFIC.	YR		AUTHORS	JOUR.	VOL	PAGE	YR	INSTITUTION	COD
BERTANZA	62	HBC	L BERTANZA +	PRL	9	180	62	B N L	U 4
ARMENTEROS	63	HBC	QUOTED BY BERTHELOT	SIENA	2	70	63	CERN+CDF	U 4
CONNOLLY 1	63	HBC	P L CONNOLLY +	PRL	10	371	63	B N L	U 4
CONNOLLY 2	63	HBC	P L CONNOLLY +	SIENA	1	130	63	BNL+SYR	U 4
GELFAND	63	HBC	N GELFAND +	PRL	11	438	63	COLUMBIA+RUTG	U 4
SCHLEIN	63	HBC	P SCHLEIN +	PRL	10	368	63	UCLA	U 4
GALTIERI	64	HBC	BARBARO-GALTIERI,TRIPP	DUBNA			64	L R L	U 4
LAI	64	HBC	K W LAI +	BAPS	9	22	64	BNL+SYR	U 4

QUANTUM NUMBERS DETERMINATIONS NOT REFERRED TO IN DATA CARDS

IDENTIFIC.	YR		AUTHORS	JOUR.	VOL	PAGE	YR	INSTITUTION	COD
CONNOLLY	63	HBC	P L CONNOLLY +	SIENA		130	63	BNL+SYR	U 4

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                              (GALTIERI,ROSENFELD JUNE/64)

                    DATA ON MESON RESONANCES

CODE EVENT QUANTITY  ERROR+    ERROR-    REFERENCE  YR TECH SIGN
     IN PEAK

     * INDICATES DATA IGNORED BY PROGRAMS
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                    5  F  (1250,JPG= ++)  I=0

                    5  F   MASS (MEV)

U 5M       1250.0      25.0                SELOVE      62 HBC
U 5M       1260.0      35.0                VEILLET     63 FBC
U 5M    65 1250.0                          GUIRAGOSSIA63 HBC
U 5M    85 1260.0                          BONDAR      63 HBC
U 5M   100 1250.0                          LEE         64 HBC

                    5  F   WIDTH (MEV)

U 5W        100.0      25.0                SELOVE      62 HBC
U 5W *      200. OR LESS                   VEILLET     63 FBC
U 5W    85  160.0                          BONDAR      63 HBC
U 5W        140.0                          LEE         64 HBC

                    5  F  PARTIAL DECAY MODES

U 5P1      F  INTO PI+ PI-                                      S 8S 8
U 5P2      F  INTO 2PI+ 2PI-                                    S 8S 8S 8S 8

                    5  F   BRANCHING RATIOS

U 5R1*     F  INTO (4PI)/(2PI)                                (P2)/(P1)
U 5R1          0.08       0.06             BONDAR      63 HBC
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KKπ

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                    6  KKPI     (1410,JPG=  )  I=0,1

                    6  KKPI  MASS (MEV)

U 6M       1410.0                          ARMENTEROS 63 HBC    0

                    6  KKPI  WIDTH (MEV)

U 6W         60.0                          ARMENTEROS 63 HBC    0
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                    7  SIGMA MESON (390,JPG=    )  I=0
          EVIDENCE NOT YET COMPELLING,OMITTED FROM TABLE
                         PROBABLY 0(0++)

                    7  SIGMA MESON  MASS (MEV)

U 7M  173  395.0      10.0                SAMIOS      62 HBC
U 7M       390.0                          KIRZ        63 HBC
U 7M       379.0       4.0                DEL FABBRO  64 SPRK
S 7M *     394.0             VIA ETA      CRAWFORD    63 HBC BROWN-SINGER MODEL
S 7M *1800 337.0       4.0   VIA TAU PRIME KALMUS     64 PBC BROWN-SINGER MODEL

                    7  SIGMA MESON  WIDTH (MEV)

U 7W  173   50.0      20.0                SAMIOS      62 HBC
U 7W        80.0                          KIRZ        63 HBC
U 7W       139.0      13.0                DEL FABBRO  64 SPRK
S 7W *     104.0             VIA ETA      CRAWFORD    63 HBC BROWN-SINGER MODEL
S 7W *1800  87.0       9.0   VIA TAU PRIME KALMUS     64 PBC BROWN-SINGER MODEL
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                    9 RHO (750,JPG=1-+)  I=1

                    9 RHO  MASS (MEV)

U 9M  610  770.0      10.0                 ALFF        62 HBC  +
U 9M       748.0                           KENNEY      62 HBC  -
U 9M  130  775.0                           GUIRAGOSSIA63 HBC   -
U 9M       765.0      10.0                 ERWIN       63 HBC  -
U 9M       765.0      30.0                 LEE         64 HBC  -

U 9M  290  755.0                           CHADWICK    63 HBC  +-0
U 9M       740.0                           WALKER      62 HBC   -0
U 9M  240  752.0                           ALITTI      63 HBC   -0

U 9M  190  750.0      20.0                 SAMIOS      62 HBC    0
U 9M  300  750.0      10.0                 ALFF        62 HBC    0
U 9M  160  775.0                           GUIRAGOSSIA63 HBC     0
U 9M  300  760.0      10.0                 ABOLINS     63 HBC    0
U 9M       763.0      10.0                 ERWIN       63 HBC    0
U 9M  500  770.0      10.0                 GOLDHABER   64 HBC    0
U 9M       765.0      15.0                 LEE         64 HBC    0

                    9  RHO  WIDTH (MEV)

U 9W  610  130.0      10.0                 ALFF        62 HBC  +
U 9W        90.0      10.0                 SACLAY      63 HBC  +
U 9W  290  110.0                           CHADWICK    63 HBC  +-0

U 9W  130  125.0                           GUIRAGOSSIA63 HBC   -
U 9W        65.0      20.0                 ERWIN       63 HBC  -
U 9W   98  180.0                           BONDAR      64 HBC  -
U 9W       120.0                           WALKER      62 HBC   -0

U 9W  190  150.0      20.0                 SAMIOS      62 HBC    0
U 9W  300  100.0      10.0                 ALFF        62 HBC    0
U 9W  160  175.0                           GUIRAGOSSIA63 HBC     0
U 9W  300   90.0      10.0                 ABOLINS     63 HBC    0
U 9W  500  130.0                           GOLDHABER   64 HBC    0
U 9W       165.0      20.0                 ERWIN       63 HBC    0
U 9W   96  210.0                           BONDAR      64 HBC    0

                    9  RHO PARTIAL DECAY MODES

U 9P1      RHO INTO 2PI                                        S 8S 8
U 9P2      RHO INTO 4PI                                        S 8S 8S 8S 8

                    9  RHO BRANCHING RATIOS

U 9R1*     RHO INTO 4PI/2PI                                   (P2)/(P1)
U 9R1*         0.05 OR LESS                XUONG       62 HBC
```

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CODE EVENT QUANTITY  ERROR+    ERROR-    REFERENCE  YR TECH SIGN
     IN PEAK

     * INDICATES DATA IGNORED BY PROGRAMS
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A1

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                    10  A1 MESON (1200,JPG=  -) I=1

                    10  A1 MESON  MASS (MEV)

U10M *     1200.0    APPROX                BELLINI     63 PBC   -
U10M *170  1200.0    APPROX                GOLDHABER   64 HBC  +
U10M   70  1090.0                          CHUNG       64 HBC   -
U10M       1080.0                          ADERHOLZ    64 HBC

                    10  A1 MESON  WIDTH (MEV)

U10W *170   350.0    APPROX                GOLDHABER   64 HBC  +
U10W        150.0                          CHUNG       64 HBC   -
U10W   70   125.0       25.0               CHUNG,HESS  64 HBC   -
U10W         80.0                          ADERHOLZ    64 HBC

                    10  A1 PARTIAL DECAY MODES

U10P1      A1 INTO RHO PI                                       U 9S 8
U10P2      A1 INTO PI PI                                        S 8S 8
U10P3      A1 INTO KBAR K                                       S10S11

                    10  A1 BRANCHING RATIOS

U10R1*     A1 INTO (PI PI)/(RHO PI)                           (P2)/(P1)

U10R2*     A1 INTO (KBAR K)/(RHO PI)                          (P3)/(P1)
U10R2*        0.05   OR LESS               CHUNG       64 HBC
```


```
                    REFERENCES ON MESON RESONANCES

IDENTIFIC.   YR AUTHORS                    JOUR.VOL PAGE YR INSTITUTION      COD
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f

```
                    5  F  (1250,JPG= ++)  I=0

SELOVE       62 HBC  W SELOVE +             PRL    9  272 62 PEN+BNL         U 5
BONDAR       63 HBC  L BONDAR +             PL     5  153 63 AACHEN+         U 5
GUIRAGOSSIAN63 HBC  Z G T GUIRAGOSSIAN     PRL   11   85 63 L R L           U 5
VEILLET      63 FBC  J J VEILLET +          PRL   10   29 63 EP+MILAN        U 5
LEE          64 HBC  Y Y LEE +              PRL   12  342 64 MICHIGAN        U 5

       QUANTUM NUMBER DETERMINATIONS NOT REFERRED TO IN DATA CARDS

HAGOPIAN     63 HBC  V HAGOPIAN,W SELOVE    PRL   10  533 63 I,J             U 5
ADERHOLZ     64 HBC  M ADERHOLZ +(AACHEN+)  PL    10  240    I               U 5
SODICKSON    64 SPCH L SODICKSON +          PRL   12  485 64 I               U 5
```

KKπ

```
                    6  KKPI     (1410,JPG=  ) I=0,1

ARMENTEROS   63 HBC  R ARMENTEROS +         SIENA     287 63 CERN+CDF        U 6
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σ

```
                    7  SIGMA MESON (390,JPG=    )  I=0

SAMIOS       62 HBC  N P SAMIOS +           PRL    9  139 62 BNL+CCNY+CO+KY  U 7
CRAWFORD     62 HBC  F S CRAWFORD +         PRL   11  564 63 L R L           U 7
DEL FABBRO   64 SPRK R DEL FABBRO +         PRL   12  674 64 FRASCATI        U 7
KIRZ         63 HBC  KIRZ,SCHWARTZ,TRIPP    PR   130 2481 63 L R L           U 7
KALMUS       64 PBC  G E KALMUS +           SUBM. PR JUNE 64 WISCONSIN+LRL   U 7
```

ρ

```
                    9 RHO (750,JPG=1-+)  I=1

ANDERSON     61 HBC  J A ANDERSON +         PRL    6  365 61 L R L           U 9
ALFF         62 HBC  C ALFF +               PRL    9  322 62 COL.+RUTG       U 9
KENNEY       62 HBC  V P KENNEY +           PR   126  736 62 KENTUCKY UN.    U 9
SAMIOS       62 HBC  N P SAMIOS +           PRL    9  139 62 BNL+CCNY+CO+KY  U 9
WALKER       62 HBC  W D WALKER +           CERN       42 62 WISCONSIN       U 9
XUONG        62 HBC  N XUONG,G R LYNCH      PR   128 1849 62 L R L           U 9

ABOLINS      63 HBC  M ABOLINS +            PRL   11  381 63 UCSD            U 9
ALITTI       63 HBC  J ALITTI +             NC    29  515 63 SAC+ORS+BA+BO   U 9
CHADWICK     63 HBC  G B CHADWICK +         PRL   10   62 63 OXFORD + PADOVA U 9
GUIRAGOSSIAN63 HBC  ZGT GUIRAGOSSIAN       PRL   11   85 63 L R L           U 9
ERWIN        63 HBC  ERWIN,SATTERBLOM,WALKER+SIENA    112 63 WISCONSIN       U 9
SACLAY       63 HBC  SACLAY,ORSAY,BARI,BOLOG SIENA    239 63 SAC,ORS,BA,BO   U 9

BONDAR       64 HBC  L BONDAR +             NC    31  729 64 AAC,BI,BO,HA,IC+U 9
GOLDHABER    64 HBC  G GOLDHABER +          PRL   12  336 64 L R L           U 9
LEE          64 HBC  LEE,ROE,SINCLAIR +     PRL   12  342 64 MICHIGAN        U 9

       QUANTUM NUMBER DETERMINATIONS NOT REFERRED TO IN DATA CARDS

ERWIN        61 HBC  A R ERWIN +            PRL    6  628 61  I,J            U 9
PICKUP       61 HBC  E PICKUP +             PRL    7  192 61  J              U 9
STONEHILL    61 HBC  D L STONEHILL +        PRL    6  624 61  I,J            U 9
```

A1

```
                    10  A1 MESON (1200,JPG=  -) I=1

BELLINI      63 PBC  G BELLINI +            NC    29  896 63 MILAN           U10
HUSON        63 PBC  F R HUSON,W B FRETTER  BAPS   8  325 63 UC BERKELEY     U10

ADERHOLZ     64 HBC  M ADERHOLZ +           PL    10  226 64 AACHEN+         U10
CHUNG        64 HBC  S U CHUNG +            PRL   12  621 64 L R L           U10
GOLDHABER    64 HBC  G GOLDHABER +          PRL   12  336 64 L R L           U10
HESS         64 HBC  HESS,CHUNG,DAHL,MILLER+ DUBNA 64      64 L R L           U10
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                                   (GALTIERI,ROSENFELD JUNE/64)
                        DATA ON MESON RESONANCES

CODE EVENT QUANTITY  ERROR+    ERROR-    REFERENCE  YR TECH SIGN
     IN PEAK

     * INDICATES DATA IGNORED BY PROGRAMS
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B

```
                        11  B MESON (1220,JPG=  +) I=1

                        11  B MESON  MASS (MEV)

U11M   60 1220.0                         ABOLINS    63 HBC  +
U11M   95 1215.0      85.0               CHUNG      64 HBC   -

                        11  B MESON  WIDTH (MEV)

U11W   60  100.0      20.0               ABOLINS    63 HBC  +
U11W   95  170.0      30.0               CHUNG,HESS 64 HBC   -

                        11  B MESON PARTIAL DECAY MODES

U11P1     B MESON INTO OMEGA+PI                             U 1S 8
U11P2     B MESON INTO 2PI+ 2PI-                            S 8S 8S 8S 8
U11P3     B MESON INTO K KBAR                               S10S10
U11P4     B MESON INTO PI PI                                S 8S 8

                        11  B MESON  BRANCHING RATIOS

U11R1*    B INTO  4PI/(OMEGA PI)                          (P2)/(P1)
U11R1*       0.5 OR LESS                 ABOLINS    63 HBC  +

U11R2*    B MESON INTO (K KBAR)/(OMEGA PI)                (P3)/(P1)
U11R2*       0.10   OR LESS              HESS       64 HBC

U11R2*    B MESON INTO(PI PI)/(PI OMEGA)                  (P4)/(P1)
U11R2*       0.3    OR LESS              ADERHOLZ   64 HBC
```

A2

```
                        12  A2 MESON (1310,JPG=2+-)  I=1

                        12  A2 MESON  MASS (MEV)

U12M   70 1310.0                         CHUNG      64 HBC   -
U12M      1320.0                         ADERHOLZ   64 HBC

                        12  A2 MESON  WIDTH (MEV)

U12W   70   80.0                         CHUNG      64 HBC   -
U12W       100.0                         ADERHOLZ   64 HBC

                        12  A2 MESON PARTIAL DECAY MODES

U12P1     A2 MESON INTO RHO PI                              U 9S 8
U12P2     A2 MESON INTO KBAR K                              S10S12
U12P3     A2 MESON INTO ETA PI                              S14S 8

                        12  A2 MESON  BRANCHING RATIOS

U  R1*    A2 MESON  INTO (K K)/(RHO PI)                   (P2)/(P1)
U12R1        0.30      0.07              CHUNG,HESS 64 HBC   -
```

κ

```
                        17  KAPPA  (725,JP =  )  I=1/2

          KAPPA,SEEN WEAKLY AND IN OCCASIONAL EXPERIMENTS

                        17  KAPPA  MASS (MEV)

U17M       730.0                         ALEXANDER  62 HBC  + 0
U17M   92  726.0       3.0               MILLER     63 HBC  + 0
U17M   33  723.0       3.0               WOJCICKI   63 HBC   -
U17M       725.0                         CONNOLLY   63 HBC

                        17  KAPPA  WIDTH (MEV)

U17W * 92   20.0 OR LESS                 MILLER     63 HBC  + 0
U17W * 33   12.0 OR LESS                 WOJCICKI   63 HBC   -
```

K*

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

                        18  K*  MASS (MEV)

U18M       898.0       5.0               CHADWICK   63 HBC  +
U18M   200 880.0                         ALEXANDER  62 HBC  + 0
U18M       885.0                         ARMENTEROS 62 HBC  +-0
U18M  3870 891.0       1.0               WOJCICKI   63 HBC   -

U18M   70  897.0      10.0               COLLEY     62 HBC    0
U18M   150 885.0                         SMITH      63 HBC    0
U18M   200 892.0       2.0               KRAEMER    63 HBC    0

                        18  K*  WIDTH (MEV)

U18W        46.0       8.0               CHADWICK   63 HBC  +
U18W   200  60.0       5.0               ALEXANDER  62 HBC  + 0
U18W        55.0                         ARMENTEROS 62 HBC  +-0
U18W  3870  46.0       3.0               WOJCICKI   63 HBC   -

U18W   70   60.0      10.0               COLLEY     62 HBC    0
U18W   150  50.0                         SMITH      63 HBC    0
U18W   200  50.0       5.0               KRAEMER    63 HBC    0

                        18  K* PARTIAL DECAY MODES

U18P1     K* INTO K PI                                      S10S 8
U18P2     K* INTO K2PI                                      S10S 8S 8
U18P3     K* INTO KAPPA PI                                  U17S 8

                        18  K*  BRANCHING RATIOS

U18R1*    K* INTO  (KAPPA PI)/(K PI)                      (P3)/(P1)
U18R1*  3    0.005 OR LESS               GOLDHABER  63 HBC   -
U18R1*  0    0.002 OR LESS               WOJCICKI+  63 HBC   -

U18R2*    K* INTO  (K 2PI)/(K PI)                         (P2)/(P1)
U18R2*  0    0.002 OR LESS               WOJCICKI+  63 HBC   -
```

$K\pi\pi$

```
                        19  K,RHO (1200,JP =   )  I=1/2

                        19  K,RHO  MASS (MEV)

U19M   23 1175.0                         WANGLER    64 HBC
U19M      1215.0      15.0               ARMENTEROS 64 HBC

                        19  K,RHO  WIDTH (MEV)

U19W * 23   25.0 OR LESS                 WANGLER    64 HBC
U19W        60.0      10.0               ARMENTEROS 64 HBC

0        1         2         3         4         5         6         7         8
12345*78901234567890123456789012345678901234567890123456789012345678901234567890
```

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                 REFERENCES ON MESON RESONANCES

IDENTIFIC.  YR AUTHORS                     JOUR.VOL PAGE YR INSTITUTION      COD
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B

```
                         11  B MESON (1220,JPG=  +) I=1

ABOLINS     63 HBC  M ABOLINS +             PRL   11  381 63 UCSD              U11
BONDAR      63 HBC  L BONDAR +              PL     5  209 63 AACHEN +          U11
CHUNG       63 HBC  SU CHUNG +              SIENA     201 63 L R L             U11

ADERHOLZ    64 HBC  ADERHOLZ +              PL    10  240 64 AA+BI,BO,HA,IC+ U11
HESS        64 HBC  HESS,CHUNG,DAHL,MILLER+ DUBNA 64      64 L R L             U11

        QUANTUM NUMBERS DETERMINATIONS NOT REFERRED TO IN DATA CARDS

CARMONY     64 HBC  D D CARMONY +           PRL   12  254 64 UCSD J,P          U11
```

A2

```
                         12  A2 MESON (1310,JPG=2+-)  I=1

ADERHOLZ    64 HBC  M ADERHOLZ +            PL    10  236 64 AACHEN+           U12
CHUNG       64 HBC  S U CHUNG +             PRL   12  621 64 L R L             U12
HESS        64 HBC  HESS,CHUNG,DAHL,MILLER+ DUBNA 64      64 L R L             U12
```

κ

```
                         17  KAPPA  (725,JP =   )  I=1/2

ALEXANDER   62 HBC  G ALEXANDER +           PRL    8  447 62 L R L             U17
CONNOLLY    63 HBC  P L CONNOLLY +          SIENA     125 63 BNL+SYR           U17
MILLER      63 HBC  D H MILLER +            PL     5  279 63 L R L             U17
WOJCICKI    63 HBC  S G WOJCICKI +          PL     5  283 63 L R L             U17
```

K*

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

ALSTON      61 HBC  M H ALSTON +            PRL    6  300 61 L R L             U18
ALEXANDER   62 HBC  G ALEXANDER +           PRL    8  447 62 L R L.            U18
ARMENTEROS  62 HBC  R ARMENTEROS +          CERN      229 62 CERN+CDF+EP       U18
COLLEY      62 HBC  D COLLEY +              CERN      315 62 COLUMBIA+RUTG     U18

CHADWICK    63 HBC  G B CHADWICK +          PL     6  309 63 OXFORD+PADUVA     U18
GOLDHABER   63 HBC  S GOLDHABER             ATHENS     92 63 L R L             U18
KRAEMER     63 HBC  R KRAEMER +             ATHENS    130 63 JOHNS HOPK.       U18
SMITH       63 HBC  G A SMITH +             PRL   10  138 63 L R L             U18
WOJCICKI    63 HBC  S G WOJCICKI            UCRL    11138 63 L R L             U18
WOJCICKI+   63 HBC  S J WOJCICKI +          UCRL    11139 63 L R L             U18

        QUANTUM NUMBER DETERMINATIONS NOT REFERRED TO IN DATA CARDS

CHINOWSKY   62 HBC  W CHINOWSKY +           PRL    9  330 62 J                 U18
```

$K\pi\pi$

```
                         19  K,RHO(1200,JP=   )  I=1/2

ARMENTEROS  64 HBC  R ARMENTEROS +          PL     9  207 64 CERN+CDF          U19
                          AND PRIVATE COMUNICATION  MAY 64 CERN+CDF          U19
WANGLER     64 HBC  TP WANGLER,WALKER,ERWIN PL     9   71 64 WISCONSIN         U19

0        1         2         3         4         5         6         7         8
12345*78901234567890123456789012345678901234567890123456789012345678901234567890
```

DATA ON BARYON RESONANCES (REFERENCES AT LOWER RIGHT)

(GALTIERI,ROSENFELD JUNE/64)

DATA ON BARYON RESONANCES

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CODE EVENT QUANTITY  ERROR+    ERROR-     REFERENCE  YR TECH SIGN
     IN PEAK

      * INDICATES DATA IGNORED BY PROGRAMS
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$N^*_{1/2}$(1480)

```
                           24  N*1/2 (1480,JP=1/2+)  I=1/2
U24  *          EXISTENCE AND JP ASSIGNMENTS SLIGHTLY DUBIOUS
                           24  N*1/2(1480) MASS (MEV)

U24M *    1400.0   APPROX                   COCCONI    64 CNTR
U24M *    1415.0   APPROX                   BAREYRE    64 RVUE
U24M *    1485.0   APPROX                   ROPER      64 RVUE

                           24  N*1/2(1480) WIDTH (MEV)

U24W       240.0                            BAREYRE    64 RVUE
U24W       238.0                            ROPER      64 RVUE
```

N*(1512)

```
                           25  N*1/2 (1512,JP=3/2-)  I=1/2
                            PARITY ASSIGNMENT STILL NOT FINAL
                           25  N*1/2(1512)  MASS (MEV)

S25M      1512.0                            PEIERLS    60 RVUE
U25M      1512.0                            FALK-VARIAN61 RVUE
U25M      1512.0                            MOYER      61 RVUE
U25M      1515.0                            DETOEUF    61 RVUE
U25M      1518.0       10.0                 BELLETTINI 63 CNTR

U25M      1518.0                            AUVIL      64 RVUE

                           25  N*1/2(1512)  WIDTH (MEV)

U25W       140.0                            FALK-VARIAN61 RVUE
U25W       125.0       12.5                 DETOEUF    61 RVUE
U25W *      80.0    APPROX                  BELLETTINI 63 CNTR
U25W *      46.0    LOWER HALF WIDTH        AUVIL      64 RVUE

                           25  N*1/2(1512) PARTIAL DECAY MODES
U25P1     N*1/2(1512) INTO N PI                                  S16S 8
U25P2     N*1/2(1512) INTO N PI PI                               S16S 8S 8

                           25  N*1/2(1512) BRANCHING RATIOS

U25R1*    N*1/2(1512) INTO (N PI)/TOTAL                         (PI)/TOTAL
U25R1        0.79                           OMNES      61 RVUE
U25R1        0.62                           DEVLIN     62 CNTR
U25R1        0.67                           LAYSON     63 RVUE
U25R1        0.71      0.08                 DETOEUF    64 CNRT
U25R1        0.54      0.03                 AUVIL      64 RVUE
```

N*(1688)

```
                           26  N*1/2  (1688,JP=5/2+) I=1/2
                  ITY ASSIGNMENT STILL NOT FINAL
                           26  N*1/2(1688)  MASS (MEV)

S26M      1715.0                            PEIERLS    60 RVUE
U26M      1683.0                            FALK-VAIRAN61 RVUE
U26M      1688.0                            MOYER      61 RVUE
U26M      1699.4                            AUVIL      64 RVUE

                           26  N*1/2(1688)  WIDTH (MEV)

U26W       120.0                            FALK-VAIRAN61 RVUE
U26W       170.0      20.0       10.0       OMNES      61 RVUE
U26W *      49.0   LOWER  HALF WIDTH        AUVIL      64 RVUE
U26W *      48.0   HIGHER HALF WIDTH        AUVIL      64 RVUE

                           26  N*1/2(1688) DECAY MODES
U26P1     N*1/2(1688) INTO N PI                                  S16S 8
U26P2     N*1/2(1688) INTO N PI PI                               S16S 8S 8
U26P3     N*1/2(1688) INTO LAMBDA K                              S18S11
U26P4     N*1/2(1688) INTO ETA PROTON                            S14S16

                           26  N*1/2(1688) BRANCHING RATIOS

U26R1*    N*1/2(1688) INTO (N PI)/TOTAL                         (PI)/TOTAL
U26R1        0.91     0.10       0.13       OMNES      61 RVUE
U26R1        0.88                           LAYSON     63 RVUE
U26R1        0.64                           AUVIL      64 RVUE
```

N*(2190)

```
                           27  N*1/2  (2190,JP=    )  I=1/2
                           27  N*1/2(2190)  MASS (MEV)

U27M      2190.0                            DIDDENS    63 CNTR

                           27  N*1/2(2190)  WIDTH (MEV)

U27W       200.0                            DIDDENS    63 CNTR

                           27  N*1/2(2190) PARTIAL DECAY MODES
U27P1     N*1/2(2190) INTO N PI                                  S16S 8
U27P2     N*1/2(2190) INTO LAMBDA K                              S18S11

U27P1*    PI P FRACTION BASED ON GUESS THAT J=9/2
U27P2*    SOME LAMBDA K MODE REPORTED BY  SCHWARTZ 64
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CODE EVENT QUANTITY  ERROR+    ERROR-     REFERENCE  YR TECH SIGN
     IN PEAK

      * INDICATES DATA IGNORED BY PROGRAMS
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N*(2700)

```
                           28  N*1/2 (2700,JP=    )  I=1/2
                         EVIDENCE NOT YET COMPELLING
                           28  N*1/2(2700) MASS (MEV)

U28M      2700.0                            R ALVAREZ  64 CNTR

                           28  N*1/2(2700) WIDTH (MEV)

U28W       100.0                            R ALVAREZ  64 CNTR

                           28  N*1/2(2700) PARTIAL DECAY MODES

U28P1     N*1/2(2700) INTO N ETA                                 S16S14
U28P2     N*1/2(2700) INTO N PI                                  S16S 8

                           28  N*1/2(2700) BRANCHING RATIOS

U28R1*    N*1/2(2700) INTO (N PI)/TOTAL                         (P2)/TOTAL
U28R1*       0.06   OR LESS                 R ALVAREZ  64 CNTR
```

REFERENCES ON BARYON RESONANCES

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IDENTIFIC.  YR AUTHORS                        JOUR.VOL PAGE YR INSTITUTION     COD
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N(1480)

```
                           24  N*1/2 (1480,JP=1/2+)  I=1/2

BAREYRE      64 RVUE P BAREYRE +              PL      8  137 64 SACLAY+CAEN     U24
COCCONI      64 CNTR G COCCONI +              PL      8  134 64 CERN            U24
ROPER        64 RVUE L D ROPER                PRL    12  340 64 LRL-LIVERMORE   U24
ROPER        64 RVUE L D ROPER                PRIV.COM  MAY 64 LRL-LIVERMORE   U24
                           25  N*1/2 (1512,JP=3/2-)  I=1/2

PEIERLS      60 RVUE R F PEIERLS              PR    118  325 60 RVUE            U25
DETOEUF      61 RVUE J F DETOEUF              AIX     2   57 61 RVUE            U25
FALK-VARIANT61 RVUE FALK-VARIANT,VALLADAS     RMP    33  362 61 RVUE            U25
MOYER        61 RVUE B J MOYER                RMP    33  367 61                 U25
OMNES        61 RVUE R OMNES,G VALLADAS       AIX     1  467 61 RVUE            U25

DEVLIN       62 CNTR DEVLIN,MOYER,PEREZMENDEZPR 125  690 62 CNTR            U25
BELLETTINI   63 CNTR G BELLETTINI +           NC     29 1195 63 PISA+FIR+WCL    U25
LAYSON       63 RVUE W M LAYSON               NC     27  724 63 RVUE            U25

AUVIL        64 RVUE P AUVIL,C LOVELACE       PREP. ICTP 37 64 IMPER.COLLEGE    U25
DETOEUF      64 CNTR J F DETOEUF +            PL      8   74 64 SACLAY          U25

         QUANTUM NUMBER DETERMINATIONS NOT REFERRED TO IN DATA CARDS

CENCE        63 CNTR R CENCE,MOYER +          STANFORD      63 J P              U25
AUVIL        64 RVUE P AUVIL,C LOVELACE       PREP ICTP/37  64 J P              U25
ROPER        64 RVUE L D ROPER                PRL    12  340 64 J P             U25
ROPER        64 RVUE L D ROPER                PRL    12  340 64 LRL-LIVERMORE   U25
```

N(1688)

```
                           26  N*1/2  (1688,JP=5/2+)  I=1/2

PEIERLS      60 RVUE R F PEIERLS              PR    118  325 60 RVUE            U26
FALK-VARIANT61 RVUE FALK-VARIANT,VALLADAS     RMP    33  362 61 RVUE            U26
MOYER        61 RVUE B J MOYER                RMP    33  367 61 RVUE            U26
OMNES        61 RVUE R OMNES,G VALLADAS       AIX     1  467 61 RVUE            U26

LAYSON       63 RVUE W M LAYSON               NC     27  724 63 RVUE            U26
AUVIL        64 RVUE P AUVIL,C LOVELACE       PREP. ICTP 37 64 IMPER.COLLEGE    U26

         QUANTUM NUMBER DETERMINATIONS NOT REFERRED TO IN DATA CARDS       U26

DETOEUF      61 RVUE J F DETOEUF              AIX     2   57 61 J               U26
CENCE        63 CNTR R CENCE,MOYER +          STANFORD      63 J P              U26
HELLAND      63 SPRK J A HELLAND +            PRL    10   27 63 J               U26
AUVIL        64 RVUE P AUVIL,C LOVELACE       PREP ICTP/37  64 J P              U26
```

N(2190)

```
                           27  N*1/2  (2190,JP=    )  I=1/2

DIDDENS      63 CNTR A N DIDDENS +            PRL    10  262 63 B N L           U27
SCHWARTZ     64 HBC  J SCHWARTZ +             BAPS    9  420 64 L R L           U27
```

N(2700)

```
                      28  N*1/2(2700,JP=    ) I=1/2

R ALVAREZ    64 CNTR R ALVAREZ +              PREPRINT  MAY 64 MIT+CAMBRIDGE    U28
```

```
                                    (GALTIERI,ROSENFELD JUNE/64)

                        DATA UN BARYON RESUNANCES

CODE EVENT QUANTITY  ERROR+    ERROR-    REFERENCE  YR TECH SIGN
    IN PEAK

     * INDICATES DATA IGNORED BY PROGRAMS
```

$\Delta(1238)$

```
                        31  N*3/2  (1238 JP=3/2+)  I=3/2

                        31  N*3/2(1238)  MASS (MEV)

U31M      1238.0                       DE HOFFMANN54 RVUE
U31M      1236.1      0.3              KLEPIKOV   60 RVUE
U31M      1234.0                       ROPER      64 RVUE

                        31  N*3/2(1238)  WIDTH (MEV)

U31W *      42.8   LOWER HALF WIDTH    DE HOFFMANN54 RVUE
U31W       118.9      5.9              KLEPIKOV   60 RVUE
U31W *      82.0   UPPER  HALF WIDTH   VIK        63 CNTR
U31W *      48.2   LOWER HALF WIDTH    ROPER      64 RVUE
U31W *      82.6   UPPER HALF WIDTH    ROPER      64 RVUE

                        31  N*3/2(1238)  PARTIAL DECAY MODES

U31P1*   N*312(1238) INTO N PI                             S16S 8
```

$\Delta(1640)$

```
                        32  N*3/2  (1640,JP=    )  I=3/2
              EVIDENCE NOT YET COMPELLING,OMITTED FROM TABLE

U32M *    1680.0   APPROX                CARRUTHERS 60 RVUE
U32M *    1632.0   APPROX                DEVLIN     62 CNTR
```

$\Delta(1920)$

```
                        33  N*3/2  (1920,JP=7/2+)  I=3/2

                        33  N*3/2(1920)  MASS (MEV)

U33M      1922.0                         DEVLIN     62 CNTR
U33M      1926.0                         AUVIL      64 RVUE

                        33  N*3/2(1920)  WIDTH (MEV)

U33W *    109.0    LOWER HALF WIDTH      AUVIL      64 RVUE
U33W *     58.6    HIGHER HALF WIDTH     AUVIL      64 RVUE

                        33  N*3/2(1920) PARTIAL DECAY MODES
U33P1     N*1/2(1920) INTO N PI                              S16S 8
U33P2     N*1/2(1920) INTO SIGMA K                           S19S10


                        33  N*3/2(1920) BRANCHING RATIOS

U33R1*    N*3/2(1920) INTO (N PI)/TOTAL                   (P1)/TOTAL
U33R1        0.34                       AUVIL      64 RVUE
```

$\Delta(2360)$

```
                        34  N*3/2  (2360,JP=    )  I=3/2

                        34  N*3/2(2360)  MASS (MEV)

U34M      2360.0                        DIDDENS    63 CNTR

                        34  N*3/2(2360)  WIDTH (MEV)

U34W       200.0                        DIDDENS    63 CNTR
                        34  N*3/2(2360) PARTIAL DECAY MODES

U34P1*    PI P FRACTION BASED ON GUESS THAT J=11/2
```

$\Delta(2520)$

```
                        35  N*3/2 (2520,JP=    )  I=3/2
                      EVIDENCE NOT YET COMPELLING, OMITTED FROM TABLE

                        35  N*3/2(2520)  MASS (MEV)

U35M *    2520.0    APPROX.              R ALVAREZ  64 CNTR
```

$Y_0^*(1405)$

```
                        37  Y*0 (1405,JP=    )  I=0

                        37  Y*0(1405)  MASS (MEV)

U37M      1405.0                         ALSTON     62 HBC
U37M      1405.0                         ALEXANDER  62 HBC

                        37  Y*0(1405)  WIDTH (MEV)

U37W        50.0                         ALSTON     62 HBC
U37W        35.0      5.0                ALEXANDER  62 HBC
```

$Y_0^*(1520)$

```
                        38  Y*0 (1520,JP=3/2-)  I=0

                        38  Y*0(1520)  MASS (MEV)

U38M      1519.4      2.0                FERRO-LUZZI62 HBC
U38M  145 1517.0      3.0                GALTIERI   63 DBC
U38M      1520.0      4.0                ALMEIDA    64 HBC

                        38  Y*0(1520)  WIDTH (MEV)

U38W        16.0      2.0                FERRO-LUZZI62 HBC

                        38  Y*0(1520) PARTIAL DECAY MODES
U38P1     Y*(1520) INTO SIGMA PI                            S19S 8
U38P2     Y*(1520) INTO KBAR N                              S12S17
U38P3     Y*(1520) INTO LAMBDA PI+ PI-                      S18S 8S 8

                        38  Y*0(1520)  BRANCHING RATIOS

U38R1*    Y*0(1520) INTO SIG  PI                          (P1)/TOTAL
U38R1        0.546      0.067            WATSON     63 HBC

U38R2*    Y*0(1520) INTO K    N                           (P2)/TOTAL
U38R2        0.293      0.035            WATSON     63 HBC

U38R3*    Y*0(1520) INTO LAMBDA PI PI                     (P3)/TOTAL
U38R3        0.16       0.02             WATSON     63 HBC
```

```
CODE EVENT QUANTITY  ERROR+    ERROR-    REFERENCE  YR TECH SIGN
    IN PEAK

     * INDICATES DATA IGNORED BY PROGRAMS
```

$Y_0^*(1815)$

```
                        39  Y*0 (1815,JP=5/2 )  I=0

                        39  Y*0(1815)  MASS (MEV)

U39M      1815.0                         CHAMBERLAIN62 CNTR

                        39  Y*0(1815)  WIDTH (MEV)

U39W       120.0                         CHAMBERLAIN62 CNTR
U39W        70.0                         GALTIERI   63 HBC

                        39  Y*0(1815) PARTIAL DECAY MODES

U39P1     Y*0(1815) INTO KBAR N                             S12S17
U39P2     Y*0(1815) INTO SIGMA PI                           S19S 8
U39P3     Y*0(1815) INTO LAMBDA PI+ PI-                     S18S 8S 8
U39P4     Y*0(1815) INTO LAMBDA ETA                         S18S14

                        39  Y*0 (1815) BRANCHING RATIOS

U39R1*    Y*0(1815) INOO KBAR N                           (P1)/TOTAL
U39R1        0.8                       WOHL       64 HBC

U39R2*    Y*0(1815) INTO(SIGMA PI)/TOTAL                  (P2)/TOTAL
U39R2*       0.15   OR LESS            WOHL       64 HBC

U39R3*    Y*0(1815) INTO(LAMBDA 2PI)/TOTAL                (P3)/TOTAL
U39R3*       0.10   OR LESS            WOHL       64 HBC
```

REFERENCES ON BARYON RESONANCES

```
IDENTIFIC.  YR AUTHORS                       JOUR.VOL PAGE YR INSTITUTION     COD
```

$\Delta(1238)$

```
                        31  N*3/2  (1238,JP=3/2+)  I=3/2
DE HOFFMANN 54 RVUE F DE HOFFMANN +          PR     95 1587 54 RVUE           U31
KLEPIKOV    60 RVUE N P KLEPIKOV +           REPORT   D584 60 DUBNA           U31
VIK         63 CNTR O T VIK,H R RUGGE        PR    129 2311 63 L R L          U31
ROPER       64 RVUE L D ROPER                PRIV.COMU MAY 64 LRL-LIVERMORE   U31
```

$\Delta(1640)$

```
                        32  N*3/2  (1640,JP=    )  I=3/2
CARRUTHERS  60 RVUE P CARRUTHERS             PRL     4  303 60 RVUE           U32
DEVLIN      62 CNTR DEVLIN,MOYER,PEREZMENDEZPR  125  690 62 L R L             U32
```

$\Delta(1920)$

```
                        33  N*3/2  (1920,JP=7/2+)  I=3/2
DEVLIN      62 CNTR DEVLIN,MOYER,PEREZMENDEZPR  125  690 62 L R L             U33
AUVIL       64 RVUE P AUVIL,C LOVELACE       PREP. ICTP 37 64 IMPER.COLLEGE   U33
```

$\Delta(2360)$

```
                        34  N*3/2  (2360,JP=    )  I=3/2
DIDDENS     63 CNTR A N DIDDENS +            PRL    10  262 63 B N L          U34
```

$\Delta(2520)$

```
                  35  N*3/2(2520,JP=    ) I=3/2
R ALVAREZ   64 CNTR R ALVAREZ +              PREPRINT       64 MIT+CAMBRIDGE  U35
```

$Y_0^*(1405)$

```
                        37  Y*0 (1405,JP=    )  I=0
ALSTON      61 HBC  M H ALSTON +             PRL     6   698 62 L R L         U37
ALEXANDER   62 HBC  G ALEXANDER +            PRL     8   460 62 L R L         U37
ALSTON      62 HBC  M H ALSTON +             CERN        311 62 L R L         U37
```

$Y_0^*(1520)$

```
                        38  Y*0 (1520,JP=3/2-)  I=0
FERRO-LUZZI 62 HBC  M FERRO-LUZZI +          PRL     8    28 62 L R L         U38
GALTIERI    63 DBC  A BARBARO GALTIERI +     PL      6   296 63 L R L         U38

WATSON      63 HBC  WATSON,FERROLUZZI,TRIPP  PR    131 2248 63 L R L          U38
ALMEIDA     64 HBC  S ALMEIDA,LYNCH          PL      9   204 64 CERN          U38
```

$Y_0^*(1815)$

```
                        39  Y*0 (1815,JP=512 )  I=0
CHAMBERLAIN 62 CNTR O CHAMBERLAIN +          PR    125 1696 62 L R L          U39
GALTIERI    63 HBC  A BARBARO GALTIERI +     PL      6  296 63 L R L          U39
WOHL        64 HBC  C WOHL,S WOJCICKI +      UCRL     11340 64 L R L          U39
          QUANTUM NUMBER DETERMINATIONS NOT REFERRED TO IN DATA CARDS
BEALL       62 SPRK E F BEALL +              CERN        368 62 L R L         U39
                                        ALSO SIENA       123 63 L R L         U39
SODICKSON   64 SPRK L SODICKSON +            PR    133 B757 64 M I T          U39
```

(GALTIERI,ROSENFELD JUNE/64)

DATA ON BARYON RESONANCES

```
CODE EVENT QUANTITY  ERROR+    ERROR-    REFERENCE  YR TECH SIGN
    IN PEAK

   * INDICATES DATA IGNORED BY PROGRAMS
```

$Y_1^*(1385)$

```
                      43  Y*1 (1385,JP=3/2+)  I=1

                      43  Y*1(1385)  MASS (MEV)

U43M  170 1375.0      3.9                  COOPER     64 HBC  +
U43M  681 1381.0      1.6                  HUWE       64 HBC  +

U43M      1385.0                           ALSTON     60 HBC  +-
U43M  378 1376.0      3.0                  ELY        61 PBC  +-
U43M   51 1388.0                           COOPER     62 HBC  +-
U43M   76 1380.0      3.0                  BERTANZA   63 HBC  +-
U43M      1384.0                           MARTIN     61 HBC  +0
U43M      1382.0      3.0                  DAHL       61 HBC  -
U43M  200 1392.0      6.2                  COOPER     64 HBC  -

U43M  803 1385.3      1.5                  HUWE       64 HBC  -
U43M   85 1392.0      7.0                  COLLEY     62 PBC  -0

U43M  106 1381.0      4.0                  CURTIS     63 SPRK  0

                      43  Y*1(1385) MASS DIFF. (-) - (+)

U43D 1500    4.3      2.2                  HUWE       64 HBC
U43D  370   17.0      7.0                  COOPER     64 HBC

                      43  Y*1(1385)  WIDTH (MEV)

U43W  154   48.0      8.0                  ELY        61 PBC  +
U43W  239   51.0      6.5                  COOPER     64 HBC  +
U43W  681   46.5      3.0                  HUWE       64 HBC  +
U43W   51   40.0                           COOPER     62 HBC  +-
U43W   76   50.0     10.0                  BERTANZA   63 HBC  +-

U43W  224   66.0     10.0                  ELY        61 PBC  -
U43W  269   88.0      6.5                  COOPER     64 HBC  -
U43W  803   62.0      7.0                  HUWE       64 HBC  -
U43W   85   80.0     20.0                  COLLEY     62 PBC  -0
U43W  106   30.0      9.0                  CURTIS     63 SPRK  0

                      43  Y*1(1385) PARTIAL DECAY MODES

U43P1     Y*1(1385) INTO LAMBDA PI                              S18S 8
U43P2     Y*1(1385) INTO SIGMA PI                               S21S 9

                      43  Y*1(1385)  BRANCHING RATIOS

U43R1*  Y*1(1385) INTO (SIGMA+PI)/(LAMBDA+PI)                 (P2)/(P1)
U43R1         0.02     0.02                BASTIEN    61 HBC  +-0
U43R1*        0.04     0.04   OR LESS      ALSTON     62 HBC
U43R1 1C0     0.09     0.04                HUWE       64 HBC
```

$Y_1^*(1660)$

```
                      44  Y*1 (1660,JP=    )  I=1

                      44  Y*1(1660)  MASS (MEV)

U44M       1685.0                          ALEXANDER  62 HBC  -0
U44M       1660.0    10.0                  ALVAREZ    63 HBC  +

                      44  Y*1(1660)  WIDTH (MEV)

U44W         45.0     5.0                  ALEXANDER  62 HBC  -0
U44W         40.0    10.0                  ALVAREZ    63 HBC  +

                      44  Y*1(1660) PARTIAL DECAY MODES

U44P1     Y*1(1660) INTO LAMBDA PI                              S18S 8
U44P2     Y*1(1660) INTO SIG PI                                 S21S 8
U44P3     Y*1(1660) INTO LAMBDA 2PI                             S18S 8S 8
U44P4     Y*1(1660) INTO SIGMA 2PI                              S21S 8S 8
U44P5     Y*1(1660) INTO KBAR N                                 S12S17

                      44  Y*1(1660)  BRANCHING RATIOS

U44R1*  Y*1(1660)  INTO LAMBDA+PI                             (P1)/TOTAL
U44R1 130     0.32                         ALVAREZ    63 HBC  +
U44R1*        0.07    OR LESS              BASTIEN    63 HBC

U44R2*  Y*1(1660) INTO SIGMA +PI                              (P2)/TOTAL
U44R2 130     0.27                         ALVAREZ    63 HBC  +
U44R2         0.26        0.05             BASTIEN    63 HBC

U44R3*  Y*1(1660) INTO LAMBDA+2PI                             (P3)/TOTAL
U44R3  90     0.18                         ALVAREZ    63 HBC  +
U44R3         0.19        0.06             BASTIEN    63 HBC

U44R4*  Y*1(1660) INTO SIGMA +2PI                             (P4)/TOTAL
U44R4 180     0.18                         ALVAREZ    63 HBC  +
U44R4         0.28        0.07             BASTIEN    63 HBC

U44R5*  Y*1(1660) INTO K-N                                    (P5)/TOTAL
U44R5*         0.05 OR LESS                ALVAREZ    63 HBC  +
U44R5*         0.18       0.06   OR MORE   BASTIEN    63 HBC

U44R6*    Y*1(1660) INTO (SIGMA PI)/(LAMBDA PI)               (P2)/(P1)
U44R6         0.86                         SMITH      63 HBC
U44R6         6.5         1.5              HUWE       64 HBC

U44R7*    Y*1(1660) INTO (LAMBDA 2PI)/(LAMBDA PI)             (P3)/(P1)
U44R7         0.142                        SMITH      63 HBC

U44R8*    Y*1(1660) INTO (KBAR N)/(LAMBDA PI)                 (P5)/(P1)
U44R8         0.43        0.21             SMITH      63 HBC
```

$Y_1^*(1775)$

```
                      45  Y*1(1765,JP=5/2 )  I=1

                      45  Y*1(1765)  MASS (MEV)
U45M       1765.0     10.0                 GALTIERI   63 HBC

                      45  Y*1(1765)  WIDTH (MEV)

U45W         60.0     10.0                 GALTIERI   63 HBC

                      45  Y*1(1765) PARTIAL DECAY MODES

U45P1     Y*1(1765) INTO KBAR-N                                 S12S17
U45P2     Y*1(1765) INTO SIGMA PI                               S19S 8
U45P3     Y*1(1765) INTO LAMBDA PI                              S18S 8

                      45  Y*1(1765) BRANCHING RATIOS

U45R1*    Y*1(1765) INTO KBAR-N                               (P1)/TOTAL
U45R1         0.6                          GALTIERI   63 DBC

U45R *    OTHER MODES NOT YET SEPARETED FROM Y*0(1815),SEE ABOVE
```

```
CODE EVENT QUANTITY  ERROR+    ERROR-    REFERENCE  YR TECH SIGN
    IN PEAK

   * INDICATES DATA IGNORED BY PROGRAMS
```

$\Xi^*(1530)$

```
                      49  XI* (1530,JP=3/2+)  I=1/2

                      49  XI*(1530)  MASS (MEV)

U49M   57 1529.0      5.0                  PJERROU    62 HBC  -0
U49M   20 1535.0                           BERTANZA   62 HBC  -0
U49M      1535.7      4.7                  LONDON     64 HBC  -
U49M      1528.7      1.1                  LONDON     64 HBC   0

                      49  XI*(1530)  WIDTH (MEV)

U49W * 57     7.0 OR LESS                  PJERROU    62 HBC  -0
U49W * 20    35.0 OR LESS                  BERTANZA   62 HBC  -0
U49W  100     7.0     2.0                  SCHLEIN    63 HBC   0
U49W          8.5     3.0                  LONDON     64 HBC  -0
```

$\Xi^*(1810)$

```
                      50  XI*(1810,JP=    )  I=1/2

                      50  XI*(1810)  MASS (MEV)

U50M   20 1770.0                           HALSTEINSLI63 FBC  -0
U50M   56 1810.0        20.0               SMITH      64 HBC  -0

                      50  XI*(1810)  WIDTH (MEV)

U50W * 20    80.0 OR LESS                  HALSTEINSLI63 FBC  -0
U50W * 56    70.0 APPROX                   SMITH      64 HBC  -0

                      50  XI*(1810) PARTIAL DECAY MODES

U50P1     XI*(1810) INTO XI*(1530) PI                           U49S 8
U50P2     XI*(1810) INTO LAMBDA KOBAR                           S18S11
U50P3     XI*(1810) INTO XI PI                                  S22S 9
U50P4     XI*(1810) INTO SIGMA KBAR                             S19S10

                      50  XI*(1810) BRANCHING RATIOS
U50R1*    XI*(1810) INTO (LAMB.KOBAR)/(XI*(1530) PI)          (P2)/(P1)
U50R1*        0.9 APPROX                   SMITH      64 HBC

U50R2*    XI*(1810) INTO (XI PI)/TOTAL                        (P3)/TOTAL
U50R2*      0.10    OR LESS                SMITH      64 HBC

U50R3*    XI*(1810) INTO (SIGMA KBAR)/TOTAL                   (P4)/TOTAL
U50R3*      0.10    OR LESS                SMITH      64 HBC

0        1         2         3         4         5         6         7         8
12345*78901234567890123456789012345678901234567890123456789012345678901234567890
```

REFERENCES ON BARYON RESONANCES

```
IDENTIFIC.  YR AUTHORS                      JOUR.VOL PAGE YR INSTITUTION      COD
```

$Y_1^*(1385)$

```
                          43  Y*1 (1385,JP=3/2+)  I=1

ALSTON     60 HBC  M H ALSTON +             PRL    5  520 60 L R L            U43
DAHL       61 HBC  O DAHL +                 PRL    6  142 61 L R L            U43
ELY        61 PBC  R P ELY +                PRL    7  461 61 L R L            U43
MARTIN     61 HBC  M J MARTIN,LEIPUNER +    PRL    6  283 61 YALE,BNL         U43
ALSTON     62 HBC  M ALSTON,ALVAREZ +       CERN      311 62 L R L            U43
COLLEY     62 PBC  D COLLEY +               PR   128 1930 62 COL+RUTU         U43
COOPER     62 HBC  W A COOPER +             CERN      298 62 CERN+ZEEM+GLA    U43

BERTANZA   63 HBC  L BERTANZA +             PRL   10  176 63 BNL+SYR          U43
CURTIS     63 SPRK L J CURTIS +             PR   132 1771 63 MICHIGAN         U43
COOPER     64 HBC  WA COOPER +              PL     8  365 64 CERN+ZEEMAN      U43
HUWE       64 HBC  D O HUWE                 UCRL    11291 64 L R L            U43

       QUANTUM NUMBER DETERMINATIONS NOT REFERRED TO IN DATA CARDS

SHAFER     63 HBC  J B SHAFER +             PRL   10  179 63 J P              U43
SHAFER     64 HBC  J B SHAFER +             PR            64 J P              U43
```

$Y_1^*(1660)$

```
                          44  Y*1 (1660,JP=    )  I=1

ALEXANDER  62 HBC  G ALEXANDER +            CERN      320 62 L R L            U44
ALVAREZ    63 HBC  L W ALVAREZ +            PRL   10  184 63 L R L            U44
SMITH      63 RVUE G A SMITH                ATHENS     67 63 L R L            U44
HUWE       64 HBC  D H HUWE                 THESIS        64 LRL              U44

       QUANTUM NUMBER DETERMINATIONS NOT REFERRED TO IN DATA CARDS

BASTIEN    63 HBC  P L BASTIEN,J P BERGE    PRL   10  188 63 I J              U44
BASTIEN    63 HBC  P L BASTIEN              UCRL    10779 63 I J              U44
TAHER      63 HBC  M TAHER-ZADEH +          PRL   11  470 63 J P              U44
```

$Y_1^*(1765)$

```
                          45  Y*1 (1765,JP=5/2 )  I=1

GALTIERI   63 DBC  A BARBARO-GALTIERI +     PL     6  296 63 L R L            U45
```

$\Xi^*(1530)$

```
                          49  XI* (1530,JP=3/2+)  I=1/2

BERTANZA   62 HBC  L BERTANZA +             PRL    9  180 62 BNL+SYR          U49
PJERROU    62 HBC  G M PJERROU +            PRL    9  114 62 UCLA             U49
CONNOLLY   63 HBC  P L CONNOLLY +           SIENA     125 63 BNL+SYR          U49
SCHLEIN    63 HBC  P E SCHLEIN +            PRL   11  167 63 UCLA             U49

LONDON     64 HBC  G W LONDON +             BAPS   9   22 64 BNL+SYR          U49
```

$\Xi^*(1810)$

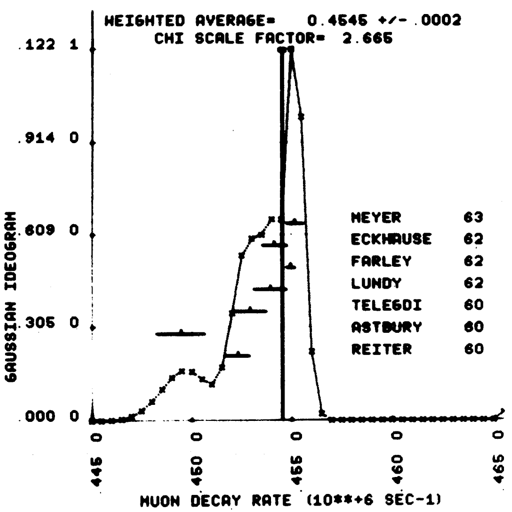
```
                          50  XI*(1810,JP=    )  I=1/2

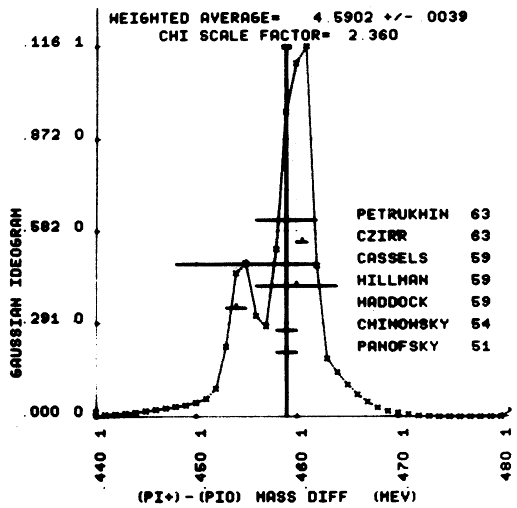
HALSTEINSLID63 FBC A HALSTEINSLID +         SIENA     173 63 BE+CE+EP+R+UC    U50
SMITH      64 HBC  G A SMITH +              PRL           64 L R L            U50

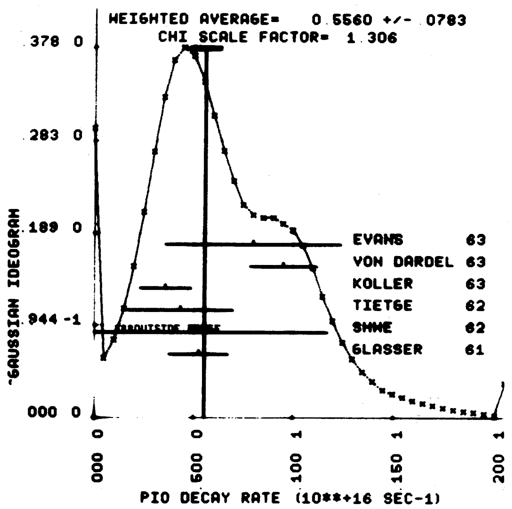
0        1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890
```

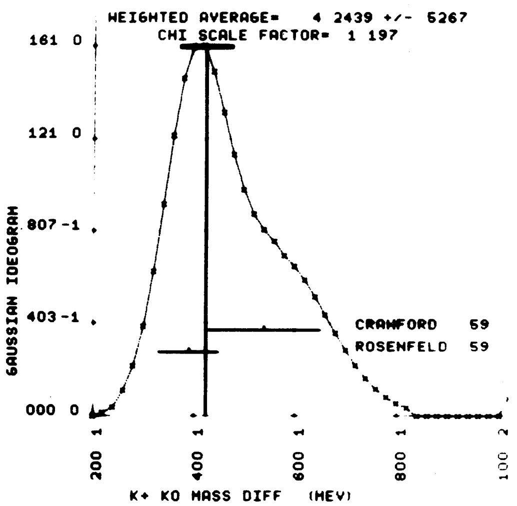
IDEOGRAMS WHICH HAD $\chi^2 > N - 1$

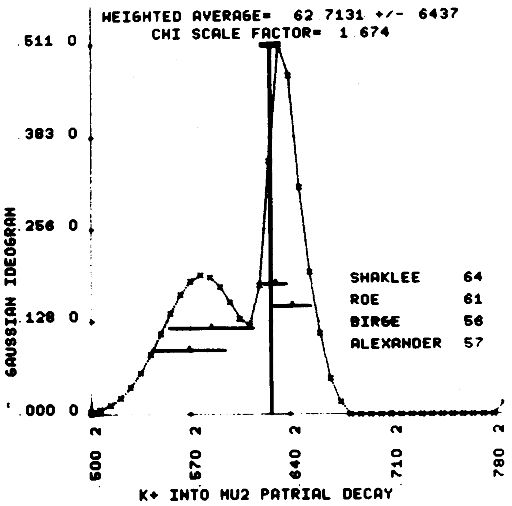
Vertical line and error flag above it show weighted mean and its statistical error

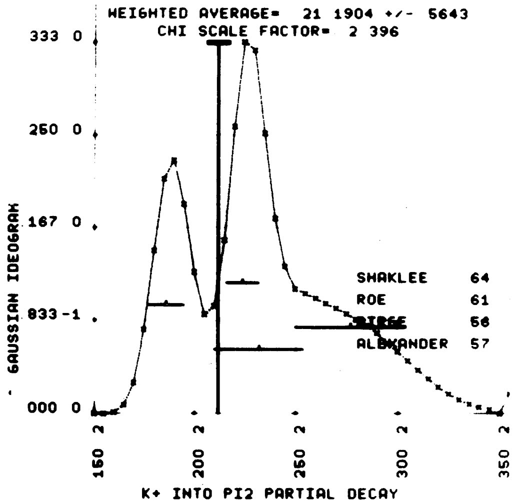


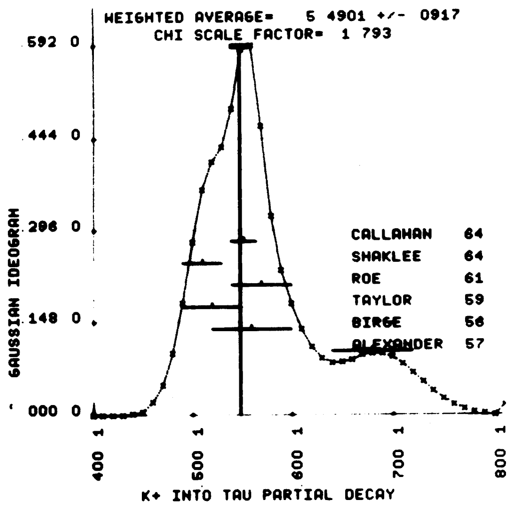


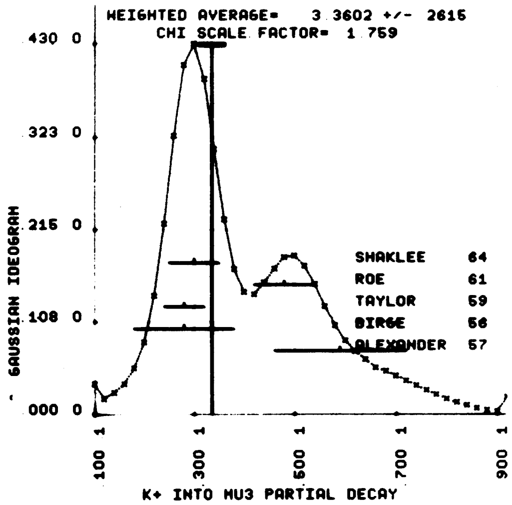


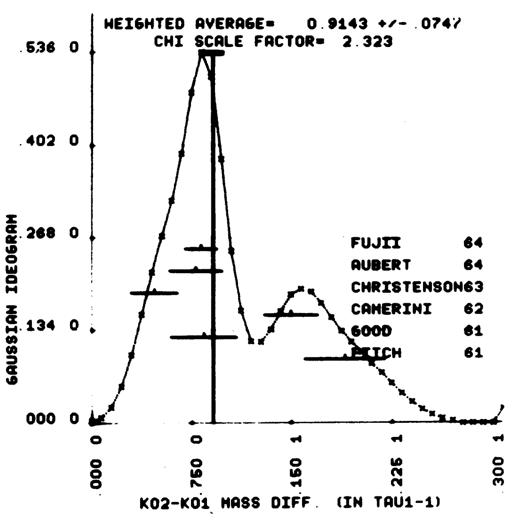


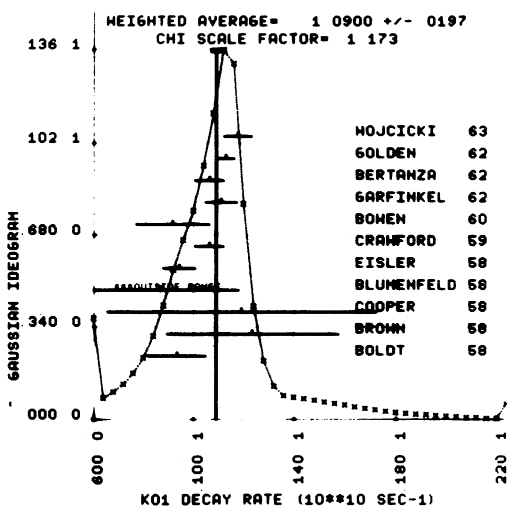

WEIGHTED AVERAGE= 62 7131 +/- 6437
CHI SCALE FACTOR= 1 674
511 0
383 0
256 0
128 0
000 0
GAUSSIAN IDEOGRAM
SHAKLEE 64
ROE 61
BIRGE 56
ALEXANDER 57
600 2
570 2
640 2
710 2
780 2
K+ INTO MU2 PATRIAL DECAY

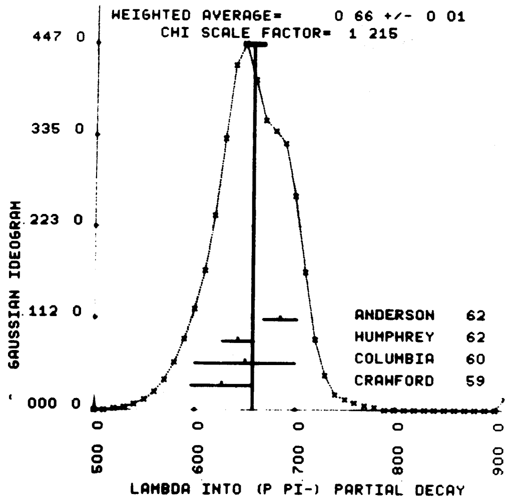

WEIGHTED AVERAGE= 21 1904 +/- 5643
CHI SCALE FACTOR= 2 396
333 0
250 0
167 0
833-1
000 0
GAUSSIAN IDEOGRAM
SHAKLEE 64
ROE 61
BIRGE 56
ALEXANDER 57
150 2
200 2
250 2
300 2
350 2
K+ INTO PI2 PARTIAL DECAY

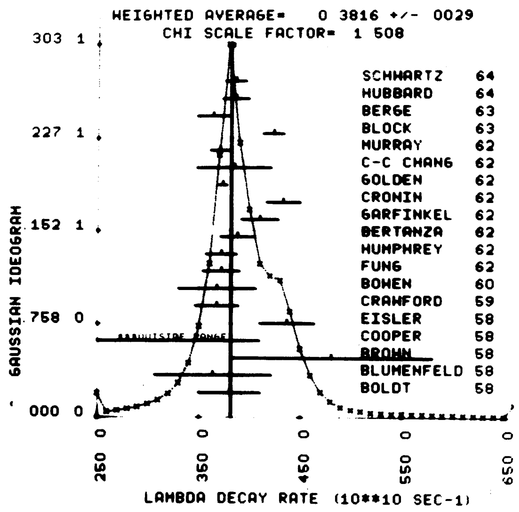

WEIGHTED AVERAGE= 5 4901 +/- 0917
CHI SCALE FACTOR= 1 793
592 0
444 0
296 0
148 0
000 0
GAUSSIAN IDEOGRAM
CALLAHAN 64
SHAKLEE 64
ROE 61
TAYLOR 59
BIRGE 56
ALEXANDER 57
400 1
500 1
600 1
700 1
800 1
K+ INTO TAU PARTIAL DECAY

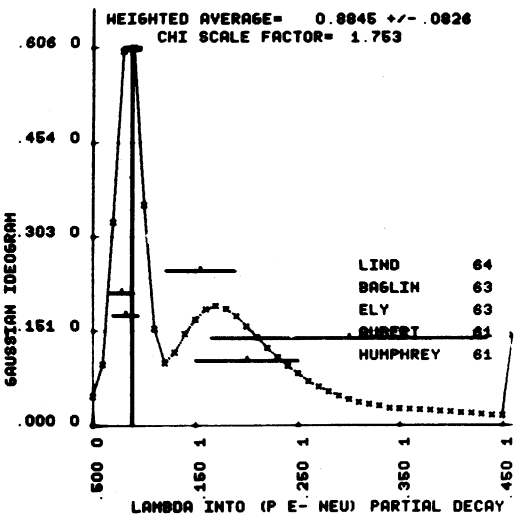

WEIGHTED AVERAGE= 3 3602 +/- 2615
CHI SCALE FACTOR= 1 759
430 0
323 0
215 0
108 0
000 0
GAUSSIAN IDEOGRAM
SHAKLEE 64
ROE 61
TAYLOR 59
BIRGE 56
ALEXANDER 57
100 1
300 1
500 1
700 1
900 1
K+ INTO MU3 PARTIAL DECAY

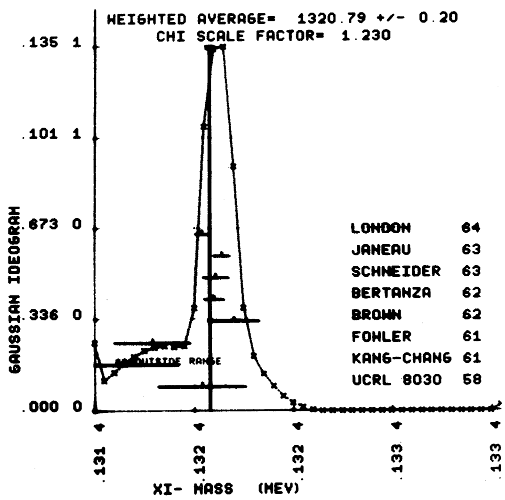

WEIGHTED AVERAGE= 0.9143 +/- .0747
CHI SCALE FACTOR= 2.323
536 0
402 0
268 0
134 0
000 0
GAUSSIAN IDEOGRAM
FUJII 64
AUBERT 64
CHRISTENSON63
CAMERINI 62
GOOD 61
FITCH 61
000 0
750 0
150 1
225 1
300 1
K02-K01 MASS DIFF (IN TAU1-1)

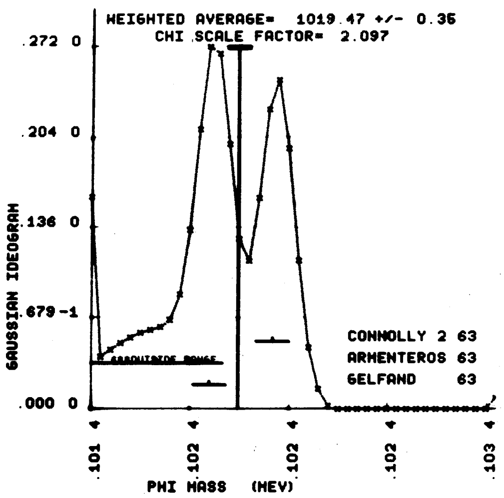

WEIGHTED AVERAGE= 1 0900 +/- 0197
CHI SCALE FACTOR= 1 173
136 1
102 1
680 0
340 0
000 0
GAUSSIAN IDEOGRAM
WOJCICKI 63
GOLDEN 62
BERTANZA 62
GARFINKEL 62
BOWEN 60
CRAWFORD 59
EISLER 58
BLUMENFELD 58
COOPER 58
BROWN 58
BOLDT 58
600 0
100 1
140 1
180 1
220 1
K01 DECAY RATE (10**10 SEC-1)

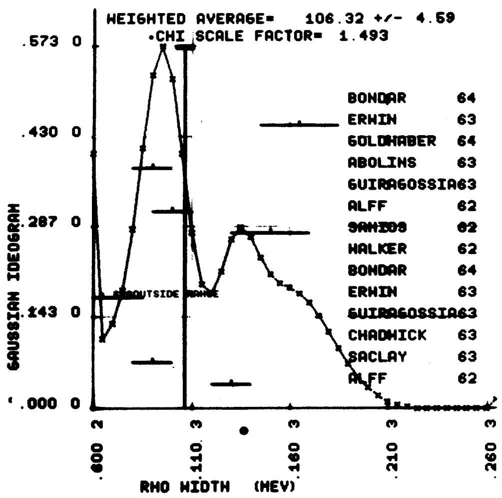

WEIGHTED AVERAGE= 0 66 +/- 0 01
CHI SCALE FACTOR= 1 215
447 0
335 0
223 0
112 0
000 0
GAUSSIAN IDEOGRAM
ANDERSON 62
HUMPHREY 62
COLUMBIA 60
CRAWFORD 59
500 0
600 0
700 0
800 0
900 0
LAMBDA INTO (P PI-) PARTIAL DECAY

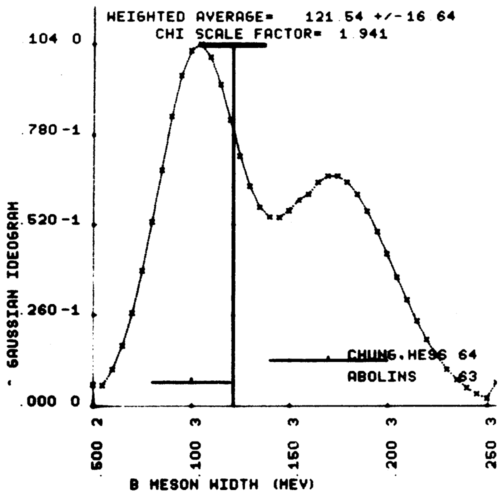

WEIGHTED AVERAGE= 0 3816 +/- 0029
CHI SCALE FACTOR= 1 508
303 1
227 1
152 1
758 0
000 0
GAUSSIAN IDEOGRAM
SCHWARTZ 64
HUBBARD 64
BERGE 63
BLOCK 63
MURRAY 62
C-C CHANG 62
GOLDEN 62
CRONIN 62
GARFINKEL 62
BERTANZA 62
HUMPHREY 62
FUNG 62
BOWEN 60
CRAWFORD 59
EISLER 58
COOPER 58
BROWN 58
BLUMENFELD 58
BOLDT 58
250 0
350 0
450 0
550 0
650 0
LAMBDA DECAY RATE (10**10 SEC-1)

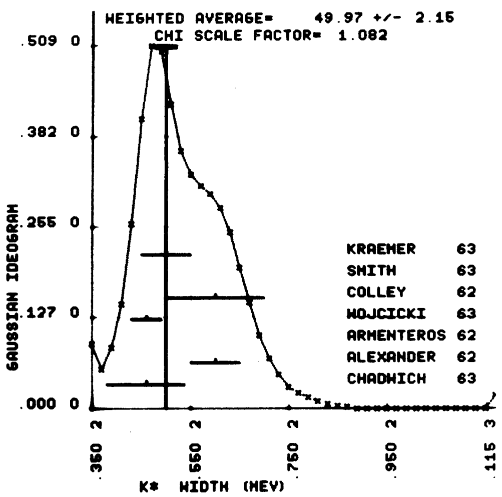

WEIGHTED AVERAGE= 0.8845 +/- .0826
CHI SCALE FACTOR= 1.753
.606 0
.454 0
.303 0
.151 0
.000 0
GAUSSIAN IDEOGRAM
LIND 64
BAGLIN 63
ELY 63
AUBERT 61
HUMPHREY 61
500 0
150 1
250 1
350 1
450 1
LAMBDA INTO (P E- NEU) PARTIAL DECAY

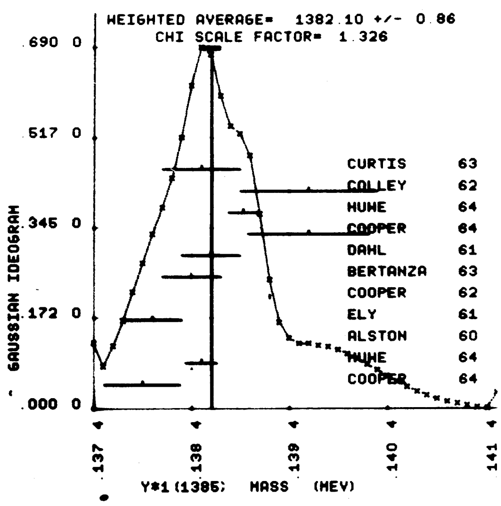

WEIGHTED AVERAGE= 1320.79 +/- 0.20
CHI SCALE FACTOR= 1.230
.135 1
.101 1
.673 0
.336 0
.000 0
GAUSSIAN IDEOGRAM
LONDON 64
JANEAU 63
SCHNEIDER 63
BERTANZA 62
BROWN 62
FOWLER 61
KANG-CHANG 61
UCRL 8030 58
.131 4
.132 4
.132 4
.133 4
.133 4
XI- MASS (MEV)

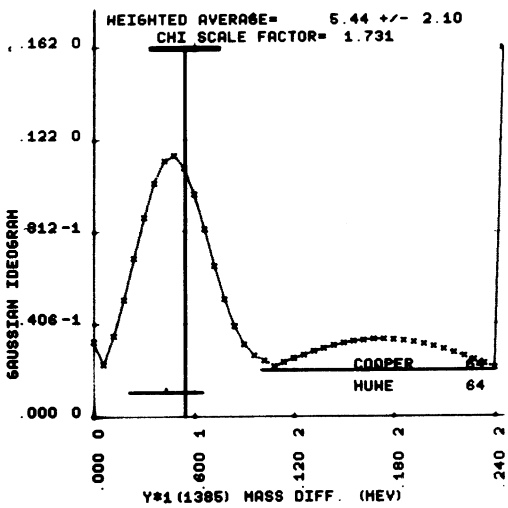

WEIGHTED AVERAGE= 1019.47 +/- 0.35
CHI SCALE FACTOR= 2.097
.272 0
.204 0
.136 0
.679 -1
.000 0
GAUSSIAN IDEOGRAM
CONNOLLY 2 63
ARMENTEROS 63
GELFAND 63
.101 4
.102 4
.102 4
.102 4
.103 4
PHI MASS (MEV)

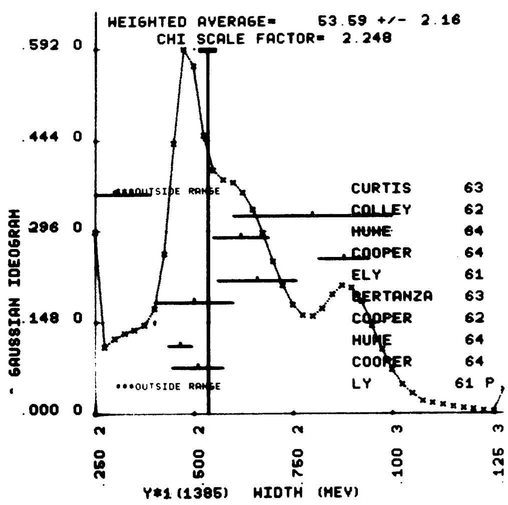

WEIGHTED AVERAGE= 106.32 +/- 4.59
CHI SCALE FACTOR= 1.493
BONDAR 64
ERWIN 63
GOLDHABER 64
ABOLINS 63
GUIRAGOSSIAN63
ALFF 62
WALKER 62
BONDAR 64
ERWIN 63
GUIRAGOSSIAN63
CHADWICK 63
SACLAY 63
ALFF 62
OUTSIDE RANGE
GAUSSIAN IDEOGRAM
RHO WIDTH (MEV)


WEIGHTED AVERAGE= 121.54 +/-16.64
CHI SCALE FACTOR= 1.941
CHUNG,HESS 64
ABOLINS 63
GAUSSIAN IDEOGRAM
B MESON WIDTH (MEV)


WEIGHTED AVERAGE= 49.97 +/- 2.15
CHI SCALE FACTOR= 1.082
KRAEMER 63
SMITH 63
COLLEY 62
WOJCICKI 63
ARMENTEROS 62
ALEXANDER 62
CHADWICH 63
GAUSSIAN IDEOGRAM
K* WIDTH (MEV)


WEIGHTED AVERAGE= 1382.10 +/- 0.86
CHI SCALE FACTOR= 1.326
CURTIS 63
COLLEY 62
HUWE 64
COOPER 64
DAHL 61
BERTANZA 63
COOPER 62
ELY 61
ALSTON 60
HUWE 64
COOPER 64
GAUSSIAN IDEOGRAM
Y*1(1385) MASS (MEV)


WEIGHTED AVERAGE= 5.44 +/- 2.10
CHI SCALE FACTOR= 1.731
COOPER 64
HUWE 64
GAUSSIAN IDEOGRAM
Y*1(1385) MASS DIFF. (MEV)


WEIGHTED AVERAGE= 53.59 +/- 2.16
CHI SCALE FACTOR= 2.248
CURTIS 63
COLLEY 62
HUWE 64
COOPER 64
ELY 61
BERTANZA 63
COOPER 62
HUWE 64
COOPER 64
LY 61 P
OUTSIDE RANGE
GAUSSIAN IDEOGRAM
Y*1(1385) WIDTH (MEV)

TABLES FROM UCRL-8030(rev.) June 1964

Table S - Stable particles

	Particle	$I(J^{PG})CA$	Mass (MeV)	Mass diff. (MeV)	Mean life (sec)	$Mass^2$ $(BeV)^2$	Important decays: Partial mode	Fraction	Q (MeV)	p or p_{max} (MeV/c)
	γ	$J^P=1^-C^-A^+$?	0		stable	0	stable			
LEPTONS	ν_e	J=1/2	0(<0.2 keV)		stable	0	stable			
LEPTONS	ν_μ		0(<4 MeV)			0				
LEPTONS	$e^\mp$	J=1/2	0.511006 ±0.000002		stable	0.000	stable			
LEPTONS	$\mu^\mp$	J=1/2	105.659 ±0.002	-33.95 ±0.05 (μ–$\pi^\pm$)	2.2001×10^{-6} ±.0008 ×scale=2.5	0.011	$e\nu\nu$	100%	105.15	52.8
MESONS	$\pi^\pm$	$1(0^{--})C_n^+A^-$?	139.60 ±0.05		2.551×10^{-8} ±.026	0.019	$\mu\nu$	100%	33.95	29.80
							$e\nu$	$(1.24\pm.05)10^{-4}$	139.10	69.80
							$\mu\nu\gamma$	$(1.24\pm.25)10^{-4}$	33.94	29.81
				4.590 ±.004 ×scale=2.4 ($\pi^\pm$–π^0)			$\pi^0 e\nu$	$(1.5\pm.3)10^{-8}$	4.08	4.49
MESONS	π^0		135.01 ±0.05		1.80×10^{-16} ±.29 ×scale=1.3	0.018	$\gamma\gamma$	98.8	135.01	67.51
							γe^+e^-	$(1.19\pm.05)$%	133.99	67.50
MESONS	$K^\pm$	$1/2(0^-)A^-$?	493.8 ±0.2		1.229×10^{-8} ±.008	0.244	$\mu\nu$	$(63.1\pm.4)$%	388.1	235.6
							$\pi^\pm\pi^0$	$(21.5\pm.4)$%	219.2	205.2
							$\pi^\pm\pi^-\pi^+$	$(5.5\pm.1)$%	75.0	125.5
				-4.2 ±0.5 ×scale=1.2 ($K^\pm$–K^0)			For other decays see Table S Decays			
MESONS	K^0		498.0 ±0.5		50% K1, 50%K2					
MESONS	K_1			-0.91×$1/\tau_1$ ±0.07 ×scale=2.3 (K_1–K_2)	0.92×10^{-10} ±.02	0.248	$\pi^+\pi^-$	(69.4 ± 5.1)%	218.8	206.2
							$\pi^0\pi^0$	(30.6 ± 1.1)%	228.0	209.2
MESONS	K_2				5.62×10^{-8} ±.68	0.248	$\pi^0\pi^0\pi^0$	(27.1 ± 3.6)%	93.0	139.5
							$\pi^+\pi^-\pi^0$	(12.7 ± 1.7)%	83.8	133.1
							$\pi\mu\nu$	(26.6 ± 3.2)%	252.7	216.2
							$\pi e\nu$	(33.6 ± 3.3)%	357.9	229.4
MESONS	η	$0(0^{-+})C^+A^-$?	548.7 ±0.5		Γ <10 MeV	0.301	$\gamma\gamma$	(35.3 ± 3.0)% ×scale=1.1	548.7	274.4
							$3\pi^0$ or $\pi^0 2\gamma$	(31.8 ± 2.3)%	143.7	179.4
							$\pi^+\pi^-\pi^0$	(27.4 ± 2.5)%	134.5	174.4
							$\pi^+\pi^-\gamma$	(5.5 ± 1.3)%	269.5	236.2
BARYONS	p	$1/2(1/2^+)$	938.256 ±0.005	-1.2933 ±.0001 (p–n)	stable	0.880				
BARYONS	n		939.550 ±0.005		1.01×10^{3} ±.03	0.883	$pe^-\nu$	100%	0.78	1.19
BARYONS	Λ	$1/2(1/2^+)$	1115.40 ±0.11		2.62×10^{-10} ±.02 ×scale=1.5	1.244	$p\pi^-$	(67.7 ± 1.0)% ×scale=1.2	37.5	100.2
							$n\pi^0$	(31.6 ± 2.6)%	40.9	103.6
							$p\mu\nu$	$<1\times10^{-4}$	71.5	130.7
							$pe\nu$	$(.88\pm.08)10^{-3}$ ×scale=1.7	176.6	163.1
BARYONS	Σ^+	$1/2(1/2^+)$	1189.41 ±0.14	2.9 (Σ^+–Σ^0)	0.788×10^{-10} ±.027	1.415	$p\pi^0$	51.0±2.4%	116.13	189.03
							$n\pi^+$	49.0±2.4%	110.26	185.06
							For other decays see Table S Decays			
BARYONS	Σ^0		1192.3 ±0.3	4.75 ±.10 (Σ^0–Σ^-)	$<1.0\times10^{-14}$	1.422	$\Lambda\gamma$	100%	77.0	74.5
BARYONS	Σ^-		1197.08 ±0.19 ×scale=1.4		1.58×10^{-10} ±.05	1.433	$n\pi^-$	100%	116.94	191.73
							For other decays see Table S Decay			
BARYONS	Ξ^0	$1/2(1/2^+)$?	1314.3 ±1.0	6.5 ±1.0 (Ξ^0–Ξ^-)	3.06×10^{-10} ±.40	1.727	$\Lambda\pi^0$	100%	76.9	150.1
							For other decays see Table S Decay			
BARYONS	Ξ^-		1320.8 ±0.2 ×scale=1.3		1.74×10^{-10} ±.05	1.745	$\Lambda\pi^-$	100%	65.8	138.7
							$\Lambda e^-\nu$	$(3.0\pm1.7)10^{-3}$	204.9	189.4
							$n\pi^-$	$<5\times10^{-3}$	214.7	303.0
BARYONS	Ω^-	$0(3/2^+)$? ?	1675 ±3		$\sim0.7\times10^{-10}$		$\Xi\pi$	?	221	296
							ΛK	?	66	216

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Table S Decay

An Appendix to Table S for particles with many decay modes

	Partial mode	Rate		Q (MeV)	p or p_{max} (MeV/c)
$K^{\pm}$	$\mu^{\pm}\nu$	63.1±.5%	×scale=1.6	388.1	235.6
	$\pi^{\pm}\pi^{0}$	21.5±.4%	×scale=1.6	219.2	205.2
	$\pi^{\pm}\pi^{+}\pi^{-}$	5.5±.1%	×scale=1.6	75.0	125.5
	$\pi^{\pm}\pi^{0}\pi^{0}$	1.7±.1%	×scale=1.6	84.2	133.0
	$\pi^{0}\mu^{\pm}\nu$	3.4±.2%	×scale=1.6	253.1	215.2
	$\pi^{0}e^{\pm}\nu$	4.8±.2%	×scale=1.6	358.3	228.4
	$\pi^{\pm}\pi^{\mp}e^{\pm}\nu$	$(4.3\pm.9)10^{-5}$		214.1	203.5
	$\pi^{\pm}\pi^{\pm}e^{\mp}\nu$	$<0.1\times10^{-5}$		214.1	203.5
Σ^{+}	$p\pi^{0}$	(51.0±2.4)%		116.1	189.0
	$n\pi^{+}$	(49.0±2.4)%		110.3	185.1
	$n\pi^{+}\gamma$	$\sim0.4\times10^{-4}$		110.3	185.1
	$\Lambda e^{+}\nu$	$\sim0.2\times10^{-4}$		73.5	71.7
	$p\gamma$	$\sim3\times10^{-3}$		251.1	224.6
	$n\mu^{+}\nu$	$<2.3\times10^{-4}$		144.2	202.4
	$ne^{+}\nu$	$<1.0\times10^{-4}$		249.3	223.6
Σ^{-}	$n\pi^{-}$	100%		117.9	192.7
	$n\pi^{-}\gamma$	$\sim0.1\times10^{-4}$		117.9	192.7
	$n\mu^{-}\nu$	$(0.66\pm0.14)10^{-3}$		151.9	209.3
	$ne^{-}\nu$	$(1.4\pm0.3)10^{-3}$		257.0	229.8
	$\Lambda e^{-}\nu$	$(0.75\pm0.28)10^{-4}$		81.2	78.9
Ξ^{0}	$\Lambda\pi^{0}$	~ 100%		76.9	150.1
	$p\pi^{-}$	<0.4%		249.4	309.3
	$pe^{-}\nu$	<0.4%		388.5	332.0
	$\Sigma^{+}e^{-}\nu$	<0.3%		137.4	130.7
	$\Sigma^{-}e^{+}\nu$	<0.25%		129.7	123.8

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Mesons

		Mass (MeV)	$I(J^{PG})CA$ ├─┤ = estab.	Symb.	Γ (MeV)	M^2 (BeV^2)	Important decays: Partial modes	Fraction %	Q (MeV)	p or Pmax (MeV/c)
η	η	548.7	$0(0^{-+})C^+A^-$	η_β	<10	0.301	See table S			
		±0.5	├──────┤							
	ω	782.8	$0(1^{--})C^-A^-$	η_γ	9.4	0.613	$\pi^+\pi^-\pi^0$	86	369	327
		±0.5	├──────┤		±1.7		$\pi^+\pi^-$	<1	504	366
		Xscale = 1.8					neutral($\pi^0\gamma$)	11±1	648	380
							$\pi^+\pi^-\gamma$	3.2±1	504	366
							e^+e^-	<0.3	782	391
							$\mu^+\mu^-$	<0.5	572	377
	η2π	959	$0(0^{-+}, 1^{++}, ...)C^+A^-$	η	<12	0.920	η2π	large	131	232
		±2					2π	<20	680	459
			Conceivably strongly decaying				3π	<30	540	427
			$1(J^{P+})C^-$ or electromagnetic				4π	< 3	400	372
			decay of G = -1 meson				6π	< 3	121	189
							ππγ	?	680	459
	K_1K_1	~1000	May be just large $\bar{K}K$ scattering length, see listings of data cards.							
	φ	1019.5	$0(1^{--})C^-A^+$	η_γ	3.1	1.040	K_1K_2	41±6	23	109
		±0.3	├──────┤		±0.6		K^+K^-	59±6	32	126
		Xscale = 1.7					ππ	<8	740	490
			Suppressed by A=+1 approximation				{ πρ+3π	<10	117	188
							{ $\pi^0\gamma$		885	501
	f	1253	$0(2^{++})C^+A^+$	η_α^{II}	100	1.571	ππ	large	974	611
		±20	├──────┤		±25		4π	8±6	695	547
							$\bar{K}K$	?	265	386
	$\bar{K}K\pi$	1410	$\leq 1(0^{-+}, 1^{++}, ...)C^+A^-$	η	60		$K^*\bar{K}$	large	25	126
			—				$K\bar{K}\pi$	small	283	421
			If we guess I=0, then G=+1				2π	?	1131	691
							$\bar{K}K$	?	422	503
							3π	?	991	670
π	$\pi^\pm$	139.6	$1(0^{--})C_n^+A^-$	π_β			See table S			
	π^0	135.0	├──────┤							
	ρ	763	$1(1^{-+})C_n^-A^+$	π_γ	106	0.582	2π	100	483	355
		±4	├──────┤		±5		4π	small	204	241
					Xscale=1.5					
	A1	1090	$\geq 1(0^{--})C_nA^-$	π	125		ρπ	~100	188	251
		±?	├─┤ ├┤ ?		±25		$\bar{K}K$	<5	G-forbidden for	
		May be just large ρπ scattering length							odd ℓ if I=1	
		Only recently separated from A2								
	B	1215	$1(1^{++}, 2^-)C_n^-A^+$	π_δ	122	1.476	ωπ	~100	293	335
		±18	├┤ ├┤ ├─┤		±17		ππ	<30	I forbidden for even ℓ	
					Xscale = 1.9		$\bar{K}K$	<10	G forbidden for even ℓ	
							4π	<50	657	525
	A2	1310	$1(2^{+-})C_n^+A$?	π_α^{II}	80		ρπ	~70	408	418
			├──────┤				$\bar{K}K$	~30±7	816	562
		Only recently separated from A1(1090)					ηπ	seen	622	529
K	$K^\pm$	493.8	$1/2(0^-)A^-$	K_β		0.244	See table S			
	K^0	498.0	├────┤							
	κ	725	Existence not yet definitely established							
	K^*	891	$1/2(1^-)A^+$	K_γ	50	0.794	Kπ	~100	258	288
		±1	├────┤		±2		Kππ	<0.2	118	215
					Xscale=1.3		κπ	<0.2	27	82
	K_C	1215	$\leq 3/2(1^+)A^-$	K	60	1.476	Kρ	strong	-30	<0
		±15	├───┤ ? ?		±10		$K^*\pi$	?	184	253

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Baryons

		Beam πp(MeV) or Kp(MeV/c)	I(J^P) ⊢⊣=estab.	Symbol	Mass (MeV)	Γ (MeV)	$Mass^2$ $(BeV)^2$	Important Decays: Partial mode	Fraction (%)	Q (MeV)	p or Pmax (MeV/c)
N	p		$1/2(1/2^+)$ ⊢⊣	N_α	938.2		0.88	See table S			
	n				939.6		0.88				
	$N^*_{1/2}(1480)$	550 πp (MeV)	$1/2(1/2^+)$ ⊢⊣	N_α	~1480	~240	2.19	πN	~50	402	426
	$N^*_{1/2}(1512)$	600 πp	$1/2(3/2^-)$ ⊢⊣	N_γ	1518 ± 10	125 ±12	2.30	πN	~80	440	454
								Nππ		301	408
	$N^*_{1/2}(1688)$	900 πp	$1/2(5/2^+)$ ⊢⊣	N^{II}_α	1688	100	2.85	πN	~80	610	572
								Nππ		471	538
	$N^*_{1/2}(2190)$	1935 πp	$1/2(9/2^+)$ ⊢⊣ ??	N^{III}_α(?)	2190	~200	4.80	πN	~30	1112	888
								Λk		577	710
	$N^*_{1/2}(2700)$	3265 πp	1/2 ⊢⊣	N	2700	~100	7.29	ηN	large	1213	1115
								πN	~6	1622	1182
Δ	$N^*_{3/2}(1238)$	198 πp	$3/2(3/2^+)$ ⊢⊣	Δ_δ	1236 ± 2	125	1.53	πN	100	160	233
	$N^*_{3/2}(1920)$	1347 πp	$3/2(7/2^+)$ ⊢⊣	Δ^{II}_δ	1924	170	3.70	πN	34	842	722
								ΣK		237	430
	$N^*_{3/2}(2360)$	2350 πp	$3/2(11/2^+)$ ⊢⊣ ? ?	Δ^{III}_δ(?)	2360	~200	5.57	πN	~10	1282	988
Λ	Λ		$0(1/2^+)$ ⊢⊣	Λ_α	1115.4		1.24	See table S			
	$Y^*_0(1405)$	<0 Kp	$0(1/2^-)$ ⊢⊣	Λ_β	1405	50	1.97	Σπ	100	76	151
								Λππ	< 1	10	69
	$Y^*_0(1520)$	Kp 395 (MeV/c)	$0(3/2^-)$ ⊢⊣	Λ_γ	1518.9 ±1.5	16 ±2	2.31	Σπ	55±7	190	266
								$\bar{K}$N	29±4	87	243
								Λππ	16±2	124	251
	$Y^*_0(1815)$	1040 Kp	$0(5/2^+)$ ⊢⊣	Λ^{II}_α	1815	70	3.29	$\bar{K}$N	80	383	541
								Σπ	<10	486	504
								Λππ	<15	420	515
								Λη	?	151	344
Σ	Σ	<0 Kp	$1(1/2^+)$ ⊢⊣	Σ_α	+1189.4		1.41	See table S			
					-1197.1		1.43				
					1192.4		1.42				
	$Y^*_1(1385)$	<0 Kp	$1(3/2^+)$ ⊢⊣	Σ_δ	1382.1 ±.9 ×scale=1.5	53 ±2 ×scale=2.4	1.91	Λπ	96±4	127	205
								Σπ	9±4	55	124
	$Y^*_1(1660)$	715 Kp	1 ( ) ⊢⊣	Σ	1660 ±10	44 ±5	2.76	$\bar{K}$N	~16	225	406
								Σπ	~32	328	383
								Λπ	~ 6	405	439
								Σππ	~33	188	321
								Λππ	~23	265	389
	$Y^*_1(1765)$	940 Kp	$1(5/2^-)$ ⊢⊣	Σ	1765 ±10	60 ±10	3.12	$\bar{K}$N	60	343	508
								Λπ		510	517
		Only recently resolved from $Y^*_0(1815)$						Σπ, Λππ	Not yet resolved from $Y^*_0(1815)$		
Ξ	Ξ		$1/2(1/2^+)$ ⊢⊣	Ξ_α	-1321		1.75	See table S			
					1314		1.73				
	$\Xi^*(1530)$		$1/2(3/2^+)$ ⊢⊣ p wave	Ξ_δ	1529.1 ±1.0	7.5 ±1.7	2.34	Ξπ	~100	73	148
	$\Xi^*(1810)$		1/2( ) ⊢⊣	Ξ	1810 ±20	~70	3.27	$\Xi^*\pi$	~45	141	225
								Λ$\bar{K}$	~45	197	386
								Ξπ	<10	354	406
								Σ$\bar{K}$	<10	127	307
Ω	$\Omega^-(1675)$		$0(3/2^+)$ ⊢⊣	Ω_δ	1675 ±3		2.81	See table S			

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Table S - Stable particles

		$I(J^{PG})CA$	Mass (MeV)	Mass diff. (MeV)	Mean life (sec)	$Mass^2$ $(BeV)^2$	Important decays: Partial mode	Fraction	Q (MeV)	p or p_{max} (MeV/c)
	γ	$J^P=1^- C^- A^+$?	0		stable	0	stable			
LEPTONS	ν_e ν_μ	J=1/2	0(<0.2 keV) 0(<4 MeV)		stable	0 0	stable			
LEPTONS	$e^\mp$	J=1/2	0.511006 ±0.000002		stable	0.000	stable			
LEPTONS	$\mu^\mp$	J=1/2	105.659 ±0.002	-33.95 ±0.05 (μ–$\pi^\pm$)	2.2001×10^{-6} ±.0008 ×scale=2.5	0.011	$e\nu\nu$	100%	105.15	52.8
MESONS	$\pi^\pm$	$1(0^{--})C_n^+A^-$?	139.60 ±0.05	4.590 ±.004 ×scale=2.4 ($\pi^\pm$–π^0)	2.55×10^{-8} ±.26	0.019	$\mu\nu$ $e\nu$ $\mu\nu\gamma$ $\pi^0 e\nu$	100% $(1.24\pm.05)10^{-4}$ $(1.24\pm.25)10^{-4}$ $(1.5\ \pm.3)10^{-8}$	33.95 139.10 33.94 4.08	29.80 69.80 29.81 4.49
MESONS	π^0		135.01 ±0.05		1.80×10^{-16} ±.29 ×scale=1.3	0.018	$\gamma\gamma$ γe^+e^-	98.8 (1.19±.05)%	135.01 133.99	67.51 67.50
MESONS	$K^\pm$	$1/2(0^-)A^-$?	493.8 ±0.2	-4.2 ±0.5 ×scale=1.2 ($K^\pm$–K^0)	1.229×10^{-8} ±.008	0.244	$\mu\nu$ $\pi^\pm\pi^0$ $\pi^\pm\pi^-\pi^+$ For other decays see Table S Decays	(63.1±.4)% (21.5±.4)% (5.5±.1)%	388.1 219.2 75.0	235.6 205.2 125.5
MESONS	K^0		498.0 ±0.5		50% K1, 50%K2					
MESONS	K_1			$-0.91\times1/\tau_1$ ±0.07 ×scale=2.3 (K_1–K_2)	0.92×10^{-10} ±.02	0.248	$\pi^+\pi^-$ $\pi^0\pi^0$	(69.4±5.1)% (30.6±1.1)%	218.8 228.0	206.2 209.2
MESONS	K_2				5.62×10^{-8} ±.68	0.248	$\pi^0\pi^0\pi^0$ $\pi^+\pi^-\pi^0$ $\pi\mu\nu$ $\pi e\nu$	(27.1±3.6)% (12.7±1.7)% (26.6±3.2)% (33.6±3.3)%	93.0 83.8 252.7 357.9	139.5 133.1 216.2 229.4
	η	$0(0^{-+})C^+A^-$?	548.7 ±0.5		$\Gamma < 10$ MeV	0.301	$\gamma\gamma$ $3\pi^0$ or $\pi^0 2\gamma$ $\pi^+\pi^-\pi^0$ $\pi^+\pi^-\gamma$	(35.3±3.0)% (31.8±2.3)% (27.4±2.5)% (5.5±1.3)% ×scale=1.1	548.7 143.7 134.5 269.5	274.4 179.4 174.4 236.2
BARYONS	p	$1/2(1/2^+)$	938.256 ±0.005	-1.2933 ±.0001 (p–n)	stable	0.880				
BARYONS	n		939.550 ±0.005		1.01×10^3 ±.03	0.883	$pe^-\nu$	100%	0.78	1.19
BARYONS	Λ	$1/2(1/2^+)$	1115.40 ±0.11		2.62×10^{-10} ±.02 ×scale=1.5	1.244	$p\pi^-$ $n\pi^0$ $p\mu\nu$ $pe\nu$	(67.7±1.0)% ×scale=1.2 (31.6±2.6)% $<1\times10^{-4}$ $(.88\pm.08)10^{-3}$ ×scale=1.7	37.5 40.9 71.5 176.6	100.2 103.6 130.7 163.1
BARYONS	Σ^+	$1/2(1/2^+)$	1189.41 ±0.14	2.9 (Σ^+–Σ^0)	0.788×10^{-10} ±.027	1.415	$p\pi^0$ $n\pi^+$ For other decays see Table S Decays	51.0±2.4% 49.0±2.4%	116.13 110.26	189.03 185.06
BARYONS	Σ^0		1192.3 ±0.3	4.75 ±.10 (Σ^0–Σ^-)	$<1.0\times10^{-14}$	1.422	$\Lambda\gamma$	100%	77.0	74.5
BARYONS	Σ^-		1197.08 ±0.19 ×scale=1.4		1.58×10^{-10} ±.05	1.433	$n\pi^-$ For other decays see Table S Decay	100%	116.94	191.73
BARYONS	Ξ^0	$1/2(1/2^+)$?	1314.3 ±1.0	6.5 ±1.0 (Ξ^0–Ξ^-)	3.06×10^{-10} ±.40	1.727	$\Lambda\pi^0$ For other decays see Table S Decay	100%	76.9	150.1
BARYONS	Ξ^-		1320.8 ±0.2 ×scale=1.3		1.74×10^{-10} ±.05	1.745	$\Lambda\pi^-$ $\Lambda e^-\nu$ $n\pi^-$	100% $(3.0\pm1.7)10^{-3}$ $<5\times10^{-3}$	65.8 204.9 214.7	138.7 189.4 303.0
BARYONS	Ω^-	$0(3/2^+)$? ?	1675 ±3		$\sim0.7\times10^{-10}$		$\Xi\pi$ ΛK	? ?	221 66	296 216

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Table S Decay

An Appendix to Table S for particles with many decay modes

	Partial mode	Rate	Q (MeV)	p or p_{max} (MeV/c)
$K^\pm$	$\mu^\pm\nu$	63.1±.5% (×scale=1.6)	388.1	235.6
	$\pi^\pm\pi^0$	21.5±.4% (×scale=1.6)	219.2	205.2
	$\pi^\pm\pi^+\pi^-$	5.5±.1% (×scale=1.6)	75.0	125.5
	$\pi^\pm\pi^0\pi^0$	1.7±.1% (×scale=1.6)	84.2	133.0
	$\pi^0\mu^\pm\nu$	3.4±.2% (×scale=1.6)	253.1	215.2
	$\pi^0 e^\pm\nu$	4.8±.2% (×scale=1.6)	358.3	228.4
	$\pi^\pm\pi^\mp e^\pm\nu$	$(4.3\pm.9)10^{-5}$	214.1	203.5
	$\pi^\pm\pi^\pm e^\mp\nu$	$<0.1\times10^{-5}$	214.1	203.5
Σ^+	$p\pi^0$	(51.0±2.4)%	116.1	189.0
	$n\pi^+$	(49.0±2.4)%	110.3	185.1
	$n\pi^+\gamma$	$\sim0.4\times10^{-4}$	110.3	185.1
	$\Lambda e^+\nu$	$\sim0.2\times10^{-4}$	73.5	71.7
	$p\gamma$	$\sim3\times10^{-3}$	251.1	224.6
	$n\mu^+\nu$	$<2.3\times10^{-4}$	144.2	202.4
	$ne^+\nu$	$<1.0\times10^{-4}$	249.3	223.6
Σ^-	$n\pi^-$	100%	117.9	192.7
	$n\pi^-\gamma$	$\sim0.1\times10^{-4}$	117.9	192.7
	$n\mu^-\nu$	$(0.66\pm0.14)10^{-3}$	151.9	209.3
	$ne^-\nu$	$(1.4\pm0.3)10^{-3}$	257.0	229.8
	$\Lambda e^-\nu$	$(0.75\pm0.28)10^{-4}$	81.2	78.9
Ξ^0	$\Lambda\pi^0$	~ 100%	76.9	150.1
	$p\pi^-$	<0.4%	249.4	309.3
	$pe^-\nu$	<0.4%	388.5	332.0
	$\Sigma^+e^-\nu$	<0.3%	137.4	130.7
	$\Sigma^-e^+\nu$	<0.25%	129.7	123.8

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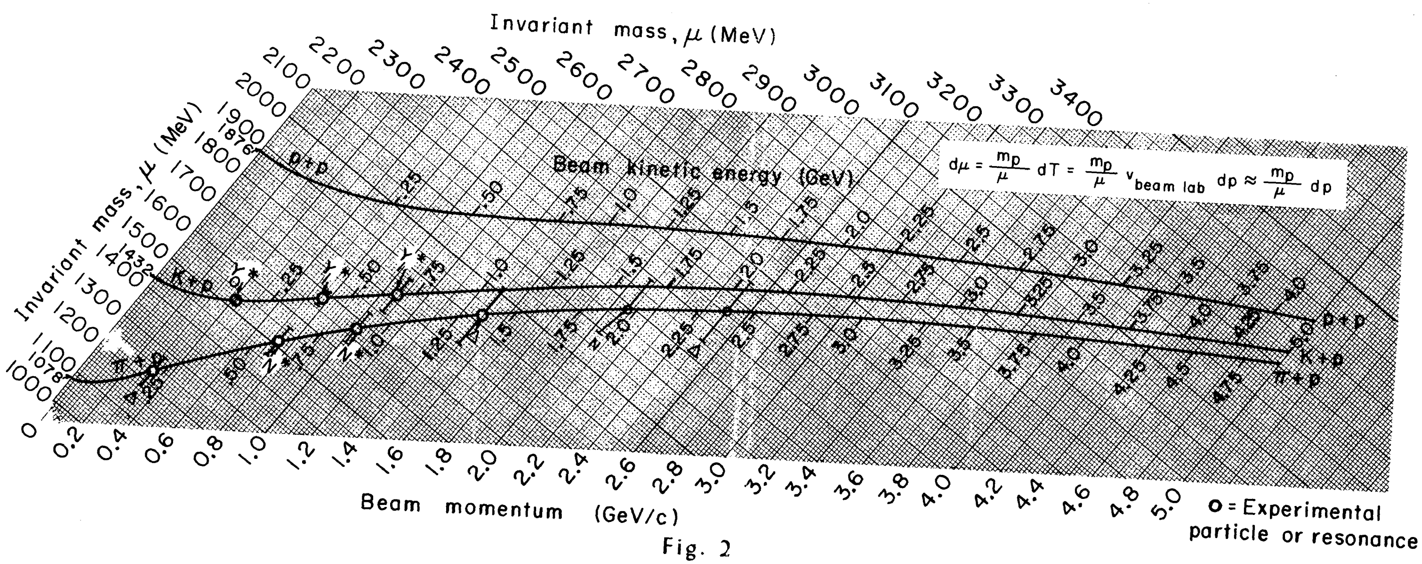

Fig. 2

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Mesons

		Mass (MeV)	$I(J^{PG})CA$ (⊢⊣ = estab.)	Symb.	Γ (MeV)	M^2 (BeV^2)	Important decays: Partial modes	Fraction %	Q (MeV)	p or p_{max} (MeV/c)
η	η	548.7 ±0.5	$0(0^{-+})C^+A^-$	η_β	<10	0.301	See table S			
	ω	782.8 ±0.5	$0(1^{--})C^-A^-$	η_γ	9.4 ±1.7	0.613	$\pi^+\pi^-\pi^0$	86	369	327
	×scale = 1.8						$\pi^+\pi^-$	<1	504	366
							neutral($\pi^0\gamma$)	11±1	648	380
							$\pi^+\pi^-\gamma$	3.2±1	504	366
							e^+e^-	<0.3	782	391
							$\mu^+\mu^-$	<0.5	572	377
	η2π	959 ±2	$0(0^{-+},1^{++},\ldots)C^+A^-$	η	<12	0.920	η2π	large	131	232
			Conceivably strongly decaying $1(J^{P+})C^-$ or electromagnetic decay of G=-1 meson				2π	<20	680	459
							3π	<30	540	427
							4π	< 3	400	372
							6π	< 3	121	189
							ππγ	?	680	459
	K_1K_1	~1000	May be just large $\bar{K}K$ scattering length, see listings of data cards.							
	φ	1019.5 ±0.3	$0(1^{--})C^-A^+$	η_γ	3.1 ±0.6	1.040	K_1K_2	41±6	23	109
	×scale = 1.7						K^+K^-	59±6	32	126
			Suppressed by A=+1 approximation				ππ	<8	740	490
							{πρ+3π	<10	117	188
							{$\pi^0\gamma$		885	501
	f	1253 ±20	$0(2^{++})C^+A^+$	η_a^{II}	100 ±25	1.571	ππ	large	974	611
							4π	8±6	695	547
							$\bar{K}K$	?	265	386
	$\bar{K}K\pi$	1410	$\leqslant 1(0^{-+},1^{++},\ldots)C^+A^-$	η	60		$K^*\bar{K}$	large	25	126
			If we guess I=0, then G=+1				$K\bar{K}\pi$	small	283	421
							2π	?	1131	691
							$\bar{K}K$	?	422	503
							3π	?	991	670
π	$\pi^\pm$ / π^0	139.6 / 135.0	$1(0^{--})C_n^+A^-$	π_β			See table S			
	ρ	763 ±4	$1(1^{-+})C_n^-A^+$	π_γ	106 ±5 ×scale=1.5	0.582	2π	100	483	355
							4π	small	204	241
	A1	1090 ±?	$\geqslant 1(0^{--})C_nA^-$?	π	125 ±25		ρπ	~100	188	251
			May be just large ρπ scattering length. Only recently separated from A2				$\bar{K}K$	<5	G- forbidden for odd ℓ if I=1	
	B	1215 ±18	$1(1^{++},2^-)C_n^-A^+$	π_δ	122 ±17 ×scale = 1.9	1.476	ωπ	~100	293	335
							ππ	<30	I forbidden for even ℓ	
							$\bar{K}K$	<10	G forbidden for even ℓ	
							4π	<50	657	525
	A2	1310	$1(2^{+-})C_n^+A$?	π_a^{II}	80		ρπ	~70	408	418
							$\bar{K}K$	~30±7	816	562
			Only recently separated from A1(1090)				ηπ	seen	622	529
K	$K^\pm$ / K^0	493.8 / 498.0	$1/2(0^-)A^-$	K_β		0.244	See table S			
	κ	725	Existence not yet definitely established							
	K^*	891 ±1	$1/2(1^-)A^+$	K_γ	50 ±2 ×scale=1.3	0.794	Kπ	~100	258	288
							Kππ	<0.2	118	215
							κπ	<0.2	27	82
	K_C	1215 ±15	$\leqslant 3/2(1^+)A^-$??	K	60 ±10	1.476	Kρ	strong	-30	<0
							$K^*\pi$	?	184	253

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Table IIIa. Multiple Coulomb scattering and Lorentz transformation

The rms projected angle θ due to multiple Coulomb scattering (only) of a particle of charge z, momentum P, velocity V is

$$\theta_{proj} = z\,\frac{15(\mathrm{MeV})}{PV(\mathrm{MeV})}\sqrt{\frac{L}{L_{(rad)}}}\,(1+\epsilon)\ \text{radians};$$

L = Length in scatterer; L(radiation) from Table II. For $L \geqslant 1/10\, L(rad)$ ϵ is generally < 1/10. The distribution of θ is not truly Gaussian. The rms projected displacement y on traversing an absorber of thickness L is

$$y_{rms} = L\theta_{proj}/\sqrt{3}$$

Lorentz transformations. Notation: Lower-case type for c.m. 4-momentum $(\vec{p}, w)$ and capitals for lab $(\vec{P}, W)$. ($c \equiv 1$.) To transform from c.m. to lab write

$$\begin{pmatrix} \gamma & 0 & 0 & \eta \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ \eta & 0 & 0 & \gamma \end{pmatrix}\begin{pmatrix} p\cos\theta \\ p\sin\theta \\ 0 \\ w \end{pmatrix} = \begin{pmatrix} \gamma p\cos\theta + \eta w \\ p\sin\theta \\ 0 \\ \eta p\cos\theta + \gamma w \end{pmatrix} = \begin{pmatrix} P\cos\Theta \\ P\sin\Theta \\ 0 \\ W \end{pmatrix}$$

If two particles (1 and 2) collide, the invariant "mass" μ of the system is given by

$$\mu^2 = (W_1 + W_2)^2 - (\vec{P}_1 + \vec{P}_2)^2, \qquad (1)$$

$$\gamma = \frac{W_1 + W_2}{\mu}; \quad \eta = \left|\frac{\vec{P}_1 + \vec{P}_2}{\mu}\right| = \gamma\beta. \qquad (2)$$

Write T for lab kinetic energy, t for c.m.; thus $\mu = m_1 + m_2 + t_1 + t_2 = m_1 + m_2 + Q$. If the target is at rest $(0, m_2)$ μ simplifies:

$$\mu^2 = (m_1 + m_2)^2 + 2T_1m_2. \qquad (3)$$

To get a threshold T_1, set μ = sum of masses of reaction products, then

$$[\Sigma m(\text{products})]^2 = (m_1 + m_2)^2 + 2T_1m_2. \qquad (4)$$

Other invariants are: $w_1w_2 - p_1p_2\cos\theta_{12}$ (5)

and

$$\frac{1}{p}\,\frac{d^2\sigma}{d\omega\,dw}. \qquad (6)$$

The max. lab angle that a particle of c.m. momentum p_i can have is given by

$$\sin\Theta_i = \frac{\eta_i}{\eta}\ \left(\eta_i = \frac{p_i}{m_i}\ \text{must be} < \eta\right); \qquad (7)$$

If $\eta_i > \eta$, then of course Θ_i can be π.

Crawford's mnemonic for extending nonrelativistic formulas to relativistic case: "To the rest energy of each moving particle add Q/2" where Q = the total kinetic energy (c.m.) = $\mu - \Sigma m_i$. Thus in the rest frame of a two-body decay the kinetic energy Q is shared between the two particles according to

$$t_1 = Q\,\frac{m_2 + Q/2}{\mu}, \quad t_2 = Q\,\frac{m_1 + Q/2}{\mu}. \qquad (8)$$

The above of course applies in the c.m. for the production of a two-body final state. To express t in terms of p, apply the mnemonic to a single particle (then Q = t). The non-rel. relation $p^2 = 2tm$ becomes

$$p^2 = 2t(m + t/2) = 2tm + t^2. \qquad (9)$$

Energy Transfer for elastic collisions of beam (P_1, W_1) with resting target $(0, m_2)$, is

$$T_2 = 2m_2\,\frac{P_1^2}{\mu^2}\,\sin^2(\theta_{c.m.}/2). \qquad (10)$$

Note that for max T_2, $\theta_{c.m.} = \pi$, so

$$T_{2max.} = 2m_2\,P_1^2/\mu^2 \approx 2\,m_2\eta^2. \qquad (11)$$

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Baryons

		Beam πp(MeV) or Kp(MeV/c)	$I(J^P)$ ⊢⊣=estab.	Symbol	Mass (MeV)	Γ (MeV)	$Mass^2$ $(BeV)^2$	Important Decays: Partial mode	Fraction (%)	Q (MeV)	p or p_{max} (MeV/c)
N	p		1/2(1/2⁺) ⊢⊣	N_α	938.2		0.88	See table S			
	n				939.6		0.88				
	$N^*_{1/2}(1480)$	550 πp (MeV)	1/2(1/2⁺) ⊢⊣	N_α	~1480	~240	2.19	πN	~50	402	426
	$N^*_{1/2}(1512)$	600 πp	1/2(3/2⁻) ⊢⊣	N_γ	1518 ± 10	125 ±12	2.30	πN	~80	440	454
								Nππ		301	408
	$N^*_{1/2}(1688)$	900 πp	1/2(5/2⁺) ⊢⊣	N^{II}_α	1688	100	2.85	πN	~80	610	572
								Nππ		471	538
	$N^*_{1/2}(2190)$	1935 πp	1/2(9/2⁺) ⊢⊣ ? ?	N^{III}_α(?)	2190	~200	4.80	πN	~30	1112	888
								Λk		577	710
	$N^*_{1/2}(2700)$	3265 πp	1/2 ⊢⊣	N	2700	~100	7.29	ηN	large	1213	1115
								πN	~6	1622	1182
Δ	$N^*_{3/2}(1238)$	198 πp	3/2(3/2⁺) ⊢⊣	Δ_δ	1236 ± 2	125	1.53	πN	100	160	233
	$N^*_{3/2}(1920)$	1347 πp	3/2(7/2⁺) ⊢⊣	Δ^{II}_δ	1924	170	3.70	πN	34	842	722
								ΣK		237	430
	$N^*_{3/2}(2360)$	2350 πp	3/2(11/2⁺) ⊢⊣ ? ?	Δ^{III}_δ(?)	2360	~200	5.57	πN	~10	1282	988
Λ	Λ		0(1/2⁺) ⊢⊣	Λ_α	1115.4		1.24	See table S			
	$Y^*_0(1405)$	<0 Kp	0(1/2⁻) ⊢⊣	Λ_β	1405	50	1.97	Σπ	100	76	151
								Λππ	< 1	10	69
	$Y^*_0(1520)$	Kp 395 (MeV/c)	0(3/2⁻) ⊢⊣	Λ_γ	1518.9 ±1.5	16 ±2	2.31	Σπ	55±7	190	266
								$\bar{K}N$	29±4	87	243
								Λππ	16±2	124	251
	$Y^*_0(1815)$	1040 Kp	0(5/2⁺) ⊢⊣	Λ^{II}_α	1815	70	3.29	$\bar{K}N$	80	.383	541
								Σπ	<10	486	504
								Λππ	<15	420	515
								Λη	?	151	344
Σ	Σ	<0 Kp	1(1/2⁺) ⊢⊣	Σ_α	+1189.4		1.41	See table S			
					-1197.1		1.43				
					1192.4		1.42				
	$Y^*_1(1385)$	<0 Kp	1(3/2⁺) ⊢⊣	Σ_δ	1382.1 ±.9 ×scale=1.5	53 ±2 ×scale=2.4	1.91	Λπ	96±4	127	205
								Σπ	9±4	55	124
	$Y^*_1(1660)$	715 Kp	1( ) ⊢⊣	Σ	1660 ±10	44 ±5	2.76	$\bar{K}N$	~16	225	406
								Σπ	~32	328	383
								Λπ	~ 6	405	439
								Σππ	~33	188	321
								Λππ	~23	265	389
	$Y^*_1(1765)$	940 Kp	1(5/2⁻) ⊢⊣	Σ	1765 ±10	60 ±10	3.12	$\bar{K}N$	60	343	508
								Λπ		510	517
								Σπ, Λππ	Not yet resolved from $Y^*_0(1815)$		
	Only recently resolved from $Y^*_0(1815)$										
Ξ	Ξ		1/2(1/2⁺) ⊢⊣	Ξ_α	-1321		1.75	See table S			
					1314		1.73				
	$\Xi^*(1530)$		1/2(3/2⁺) ⊢⊣ p wave	Ξ_δ	1529.1 ±1.0	7.5 ±1.7	2.34	Ξπ	~100	73	148
	$\Xi^*(1810)$		1/2( ) ⊢⊣	Ξ	1810 ±20	~70	3.27	$\Xi^*\pi$	~45	141	225
								$\Lambda\bar{K}$	~45	197	386
								Ξπ	<10	354	406
								$\Sigma\bar{K}$	<10	127	307
Ω	$\Omega^-(1675)$		0(3/2⁺) ⊢⊣	Ω_δ	1675 ±3		2.81	See table S			

A. H. Rosenfeld, A. Barbaro-Galtieri, W. H. Barkas, P. L. Bastien, J. Kirz, M. Roos UCRL-8030 - Part I. June 1964.

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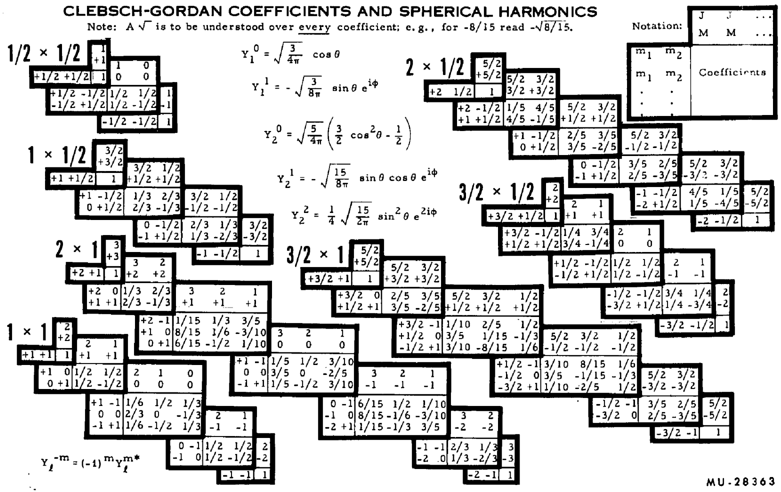
TABLE VII

CLEBSCH-GORDAN COEFFICIENTS AND SPHERICAL HARMONICS

Note: A √ is to be understood over every coefficient; e.g., for -8/15 read $-\sqrt{8/15}$.



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TABLES FROM UCRL-8030(rev.) June 1964

Table IV. Atomic and nuclear constants in units of MeV, cm, and sec[a]

GENERAL ATOMIC CONSTANTS

$N = 6.02252 \times 10^{23}$ molecules/mole[b]

$c = 2.997925 \times 10^{10}$ cm/sec

$e = 4.80298 \times 10^{-10}$ esu $= 1.6021 \times 10^{-19}$ coulomb.

$1\ \text{MeV} = 1.6021 \times 10^{-6}$ erg [$1\ \text{ev} = e(10^8/c)$]

$\hbar = 6.5820 \times 10^{-22}$ MeV sec $= 1.05450 \times 10^{-27}$ erg sec.

$\hbar c = 1.9732 \times 10^{-11}$ MeV cm [$= \lambda\!\!\!^{-}$ for p = 1 MeV/c]

$k = 8.6171 \times 10^{-11}$ MeV/°C [Boltzmann constant]

$\alpha = \frac{e^2}{\hbar c} = 1/137.0388$; $e^2 = 1.4399 \times 10^{-13}$ MeV cm

Cross Section

$\sigma_{\text{Thompson}} = \frac{8}{3} \pi r_e^2 = 0.66516 \times 10^{-24}\ \text{cm}^2 = 0.66516$ barn

Magnetic Moment and Cyclotron Angular Frequency

$\mu_{\text{Bohr}} = \frac{e\hbar}{2mc} = 0.578815 \times 10^{-14}$ MeV/gauss

$\frac{1}{2}\omega_{\text{cyclotron}} = \frac{e}{2mc} = 8.79398 \times 10^{6}$ rad sec^{-1}/gauss

$g_{\text{electron}} = 2[1 + \frac{\alpha}{2\pi} - 0.328 (\frac{\alpha}{\pi})^2] = 2[1.001159615]$[c]

$g_{\text{muon}} = 2[1 + \frac{\alpha}{2\pi} + 0.75 (\frac{\alpha}{\pi})^2] = 2[1.001165010]$[c]

QUANTITIES DERIVED FROM THE ELECTRON MASS, m

Mass and Energy

$m = 0.511006$ MeV $= 1/1836.10\ m_p = 1/273.19\ m_\pi$

Rydberg, $R_\infty = \frac{me^4}{2\hbar^2} = mc^2 \times \frac{\alpha^2}{2} = 13.605$ eV

Length (1 fermi = 10^{-13} cm; 1 A = 10^{-8} cm)

$r_e = e^2/mc^2 = 2.81777$ fermi

$\lambda\!\!\!^{-}_{\text{Compton}} = \frac{\hbar}{mc} = r_e \alpha^{-1} = 3.86144 \times 10^{-11}$ cm

$a_{\infty\ \text{Bohr}} = \frac{\hbar^2}{me^2} = r_e \alpha^{-2} = 0.52967$ A

Hydrogen-like atom (Non. Rel.; $\mu \equiv$ reduced mass).

$E_n = \frac{1}{2} \frac{\mu z^2 e^4}{(n\hbar)^2}$; $a_{n=1} = \frac{\hbar^2}{\mu z e^2}$; $\left.\frac{v}{c}\right)_{\text{rms}} = \frac{ze^2}{n\hbar c}$

QUANTITIES DERIVED FROM THE PROTON MASS, m_p

Rest mass $= 938.256\ \text{MeV}/c^2 = 1836.10\ m_e = 6.721\ m_\pi$

$= 1.0782522\ m_1$

where $m_1 = 1\ \text{amu} = \frac{1}{12}\ C^{12} = 931.478$ MeV

Magnetic Moment and Cyclotron Angular Frequency

$\mu_p = \frac{e\hbar}{2m_p c} = 3.1524 \times 10^{-18}$ MeV/gauss

$\frac{1}{2}\omega_{\text{cyclotron}} = \frac{e}{2m_p c} = 4.7894 \times 10^{3}$ rad sec^{-1}/gauss

$\left.\frac{\mu}{\mu_p}\right)_{\text{proton}} = 2.79276$; $\left.\frac{\mu}{\mu_p}\right)_{\text{neutron}} = -1.9128$

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Table IV (continued)

QUANTITIES DERIVED FROM THE MASS OF THE CHARGED PION, m_π

Rest mass $= 139.60\ \text{MeV}/c^2 = 273.19\ m_e = 0.14878\ m_p$

Length

$\frac{\hbar}{m_\pi c} = 1.4135$ fermi ($\sim \sqrt{2}$ fermi)

Natural (≈ "geometrical") Nucleon Cross Section

$\pi \left(\frac{\hbar}{m_\pi c}\right)^2 = 62.7655$ mb (1 mb = 10^{-27} cm^2)

(3/2, 3/2)πp Resonance of mass 1237 MeV (Q = 159 MeV).

Center-of-mass momentum: $p_\pi = 230$ MeV/c

Lab-system momentum: $P_\pi = 303$ MeV/c ($T_\pi = 195$ MeV)

RADIOACTIVITY

1 curie $= 3.7 \times 10^{10}$ disintegrations/sec

1 R $= 87.8$ ergs/g air $= 5.49 \times 10^{7}$ MeV/g air

Fluxes (per cm^2) to liberate 1 R in carbon:

3×10^7 minimum ionizing singly charged particles
0.9×10^9 photons of 1 MeV energy.

(These fluxes are actually correct to within a factor of two for all materials.)

Natural background: 100 mR/year

"Tolerance" 100 millirem/week [Note, 1 R may produce up to 10 "Rem" (R equivalent for man), depending on type of radiation.]

MISCELLANEOUS

Physical Constants

1 year $= 3.1536 \times 10^7$ sec ($\approx \pi \times 10^7$ sec)

Density of air = 1.205 mg/cm^3 at 20°C

Acceleration by gravity = 980.67 cm/sec^2

1 calorie = 4.184 joules

1 atmosphere = 1033.2 g/cm^2

Numerical Constants

1 radian = 57.29578 deg; e = 2.71828
ln 2 = 0.69315; $\log_{10} e = 0.43429$;
ln 10 = 2.30259; $\log_{10} 2 = 0.30103$.

Stirling's approximation

$\sqrt{2\pi n}\,(\frac{n}{e})^n < n! < \sqrt{2\pi n}\,(\frac{n}{e})^n (1 + \frac{1}{12n-1})$

Gaussianlike Distributions

For n > -1 but not necessarily integral:

$$\int_0^\infty x^{2n+1} \exp\left[-\frac{x^2}{2\sigma^2}\right] dx = 2^n\, n!\, \sigma^{2n+2};\ (\tfrac{1}{2})! = \sqrt{\pi/2}$$

Relation between standard deviation σ and mean deviation α:

$2\sigma^2 = \pi\alpha^2$; $\sigma = 1.4826$ probable error.

Odds against exceeding one standard deviation = 2.15:1; two, 21:1; three, 370:1; four, 16,000:1; five, 1,700,000:1

[a] Based mainly on E. Richard Cohen and J. W. M. DuMond, "Present Status of our Knowledge of the Numerical Values of the Fundamental Physical Constants," Second International Conference on Nuclidic Masses, Vienna, Austria, July 15-19, 1963.

[b] Based on atomic weight of C^{12} being exactly 12.

[c] C. Sommerfield, Phys. Rev. 107, 328 (1957) and A. Petermans, Helv. Phys. Acta. 30, 407 (1957).

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Table II. Atomic and nuclear properties (dE/dx, collision mean free path, radiation length, etc.) of materials used as absorbers and detectors

Material	Z	A	Cross section σ [a] (barns)	$-\frac{dE}{dx}$ min [b] Mev g/cm²	Collision[a] length g/cm²	L_{coll} cm	Radiation[c] length g/cm²	L_{rad} cm	Density ρ (g/cm³)
H_2	1	1.01	0.063	4.14	26.5	374	58	819.0	0.0708 (boiling at 1 atmos)
Li	3	6.94	0.23	1.72	50.4	94.3	77.5	145	0.534 (boiling at 1 atmos)
Be	4	9.01	0.28	1.71	55.0	29.9	62.2	33.8	1.84
C	6	12.00	0.33	1.86	60.4	39.0	42.5	27.4	1.55 (variable)
Al	13	26.97	0.57	1.66	79.2	29.3	23.9	8.86	2.70
Cu	29	63.57	1.00	1.45	105.4	11.8	12.8	1.44	8.9
Sn	50	118.70	1.55	1.27	129.7	17.8	8.54	1.17	7.30
Pb	82	207.21	2.20	1.12	156.2	13.8	5.8	0.51	11.34
U	92	238.07	2.42	1.095	163.6	8.75	5.5	0.29	18.7
Hydrogen (bubble chamber, -27.6°K)				0.243 Mev/cm	26.5	452	58	990	0.0586
Propane (C_3H_8, bubble chamber)				0.935 Mev/cm	48.9	119.3	44.7	109.0	0.41
Freon CF_3Br				2.3	87.1	58.0	17.25	11.5	1.5
Polystyrene (CH scintillator)				2.14 Mev/cm	54.9	52.3	43.4	41.3	~ 1.05
Ilford emulsion				5.49 Mev/cm	103	27.0	11.2	2.91	3.815

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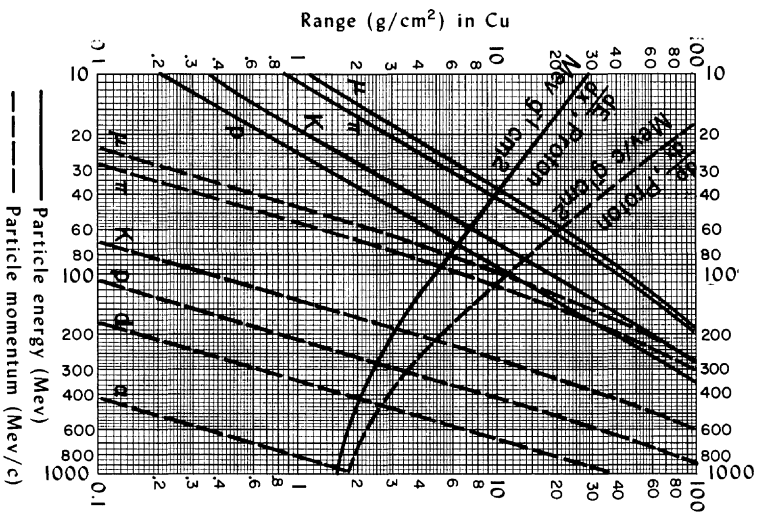

Fig. 1

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