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DATA ON PARTICLES AND RESONANT STATES

compiled by

Arthur H. ROSENFELD, Naomi BARASH-SCHMIDT, Angela BARBARO-GALTIERI,
William J. PODOLSKY, LeRoy R. PRICE, Paul SÖDING, Charles G. WOHL

Lawrence Radiation Laboratory, University of California, Berkeley, California

Matts ROOS

CERN, Geneva, Switzerland

William J. WILLIS

Dept. of Physics, Yale University, New Haven, Connecticut

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Table S: STABLE PARTICLES. Sept. 1967 (Next ed. Jan. 1968).

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A. H. Rosenfeld, N. Barash-Schmidt, A. Barbaro-Galtieri, W. J. Podolsky, L. R. Price, Matts Roos, Paul Soding, W. J. Willis, C. G. Wohl

Particle	$I^G(J^P)C_n$	Mass (MeV)	Mass difference (MeV)	Mean life (sec) cτ (cm)	Mass^2 $(\text{GeV})^2$	Decays: Partial mode	Decays: Fraction	Q (MeV) ‡	p or p_{max} (MeV/c)	Magnetic moment ($e\hbar/2m_pc$)	Decay Parameters† Measured: α	Measured: Φ(degree)	Derived: γ	Derived: Δ(degree)
γ	$0, 1(1^-)^-$	0		stable	0	stable								
ν_e	$J = \frac{1}{2}$	0(<0.2 keV)		stable	0	stable								
ν_μ		0(<2.1 MeV)												
$e^\mp$	$J = \frac{1}{2}$	0.511006 ±.000002		stable ($> 2\times10^{21}$ y)	0.000	stable	$\mu_e = \frac{1.001159622}{\pm.000000027} \frac{e\hbar}{2m_ec}$							
$\mu^\mp$	$J = \frac{1}{2}$	105.659 ±.002		2.199×10^{-6} ±.001, S=1.3*	0.011	$e\nu\bar\nu$	100 %	105	53					
				$c\tau = 6.592\times10^4$		$e\gamma\gamma$	$(< 1.6)10^{-5}$	105	53					
	$\mu_\mu = \frac{1.001164}{\pm.000003} \frac{e\hbar}{2m_\mu c}$					3e	$(< 1.3)10^{-7}$	104	53					
			-33.920 ±.014			$e\gamma$	$(< 6)10^{-9}$	105	53					
$\pi^\pm$	$1^-(0^-)^+$	139.579 ±.014		2.604×10^{-8} ±.007, S=2.3*	0.019	$\mu\nu$	100 %	34	30					
				$c\tau = 781$		$e\nu$	$(1.24\pm0.03)10^{-4}$	139	70					
				$(\tau^+ - \tau^-)/\bar\tau = (.4\pm.2)\%$ (test of CPT)		$\mu\nu\gamma$	$(1.24\pm0.25)10^{-4}$	34	30					
			4.6041 ±.0037			$\pi^0 e\nu$	$(1.03\pm0.07)10^{-8}$	4	5					
						$e\nu\gamma$	$(3.0\pm0.5)10^{-8}$	139	70					
π^0	$1^-(0^-)^+$	134.975 ±.014		[b] 0.89×10^{-16} ±.18, S=1.6*	0.018	$\gamma\gamma$	[c] (98.8)%	135	67					
				$c\tau = 2.67\times10^{-6}$		γe^+e^-	(1.169)%	134	67					
						$\gamma\gamma\gamma$	[c] $(< 5)10^{-6}$	135	67					
						$e^+e^-e^+e^-$	$(3.47)10^{-5}$	133	67					
$K^\pm$	$\frac{1}{2}(0^-)$	493.82 ±.11		1.236×10^{-8} ±.003, S=1.4*	0.244	$\mu\nu$	[b] $(63.42\pm0.38)\%$ } S=1.4*	388	236					
				$c\tau = 3\ 70$		$\pi\pi^0$	$(21.11\pm0.35)\%$ }	219	205					
				$(\tau^+ - \tau^-)/\bar\tau = (.09\pm.12)\%$ (test of CPT) S=1.3*		$\pi\pi^-\pi^+$	$(5.57\pm0.03)\%$	75	126					
						$\pi\pi^0\pi^0$	$(1.71\pm0.07)\%$, S=1.4*	84	133					
						$\mu\pi^0\nu$	$(3.40\pm0.22)\%$, S=2.1*	253	215					
						$e\pi^0\nu$	$(4.80\pm0.16)\%$, S=1.8*	358	229					
						$\pi\pi^\mp e^\pm\nu$	$(3.8\pm0.8)10^{-5}$	214	204					
			-4.05 ±.12			$\pi\pi^\pm e^\mp\nu$	$(< 2)10^{-6}$	214	204					
						$\pi\pi^\mp\mu^\pm\nu$	$(\leq 1.4)10^{-5}$	109	151					
						$\pi\pi^\pm\mu^\mp\nu$	$(< 3)10^{-6}$	109	151					
						$e\nu$	$(2.1\pm1.7)10^{-5}$	493	247					
						$\pi\pi^0\gamma$	$(2.2\pm0.7)10^{-4}$	219	205					
						$\pi\pi^+\pi^-\gamma$	$(10\pm4)10^{-5}$	75	126					
						πe^+e^-	$(< 1.1)10^{-6}$	353	227					
						$\pi\mu^+\mu^-$	$(< 3)10^{-6}$	143	172					
K^0	$\frac{1}{2}(0^-)$	497.87 ±0.16		50% K_{Short}, 50% K_{Long}										
K_{Short}	$\frac{1}{2}(0^-)$			0.87×10^{-10} ±.009, S=1.3*	0.248	$\pi^+\pi^-$	$(69.3 \pm1.2)\%$ S=1.25*	219	206					
			$-0.48\times\frac{1}{\tau_S}$ ±.02	$c\tau = 2.61$		$\pi^0\pi^0$	$(30.7)\%$	228	209					
K_{Long}	$\frac{1}{2}(0^-)$			5.73×10^{-8} ±.25	0.248	$\pi^0\pi^0\pi^0$	$(22.6\pm2.1)\%$	93	139					
				$c\tau = 1720$		$\pi^+\pi^-\pi^0$	$(12.6\pm.5)\%$	84	133					
						$\pi\mu\nu$	$(27.8\pm1.3)\%$	253	216					
						$\pi e\nu$	$(36.6\pm1.5)\%$	358	229					
						$\pi^+\pi^-$	$(.153\pm.007)\%$	219	206					
						$\pi^0\pi^0$	$(.36\pm.09)\%$ S=1.5*	228	209					
						$\pi^+\pi^-\gamma$	$(< 0.3)\%$	219	206					
						$e\mu$	$(< 1.4)10^{-5}$	392	238					
						$\gamma\gamma$	$(1.3\pm0.6)10^{-4}$	498	249					
						$\mu^+\mu^-$	$(< 2.5)10^{-6}$	287	225					
						e^+e^-	$(< 3)10^{-5}$	497	249					
η	$0^+(0^-)^+$	548.6 ±0.6		Γ<10 MeV Theoretically~100 eV		Neutral decays 73.3%: $\gamma\gamma$	$(33.5\pm2.7)\%$ S=1.35*	549	274					
						$\pi^0\gamma\gamma$	$(19.6\pm2.6)\%$	414	258					
						$3\pi^0$	$(20.2\pm3.1)\%$ S=1.15*	144	179					
						Charged decays 26.7%: $\pi^+\pi^-\pi^0$	$(21.7\pm1.5)\%$	135	174					
						$\pi^+\pi^-\gamma$	$(4.9\pm0.6)\%$	269	236					
						$\pi^0e^+e^-$	$(< 0.1)\%$	413	258					
						$\pi^+\pi^-e^+e^-$	$(0.1\pm0.1)\%$	268	236					
p	$\frac{1}{2}(\frac{1}{2}^+)$	938.256 ±0.005	-1.2933 ±.0001	stable ($>6\times10^{27}$ y)	0.880					2.792763 ±.000030				
n	$\frac{1}{2}(\frac{1}{2}^+)$	939.550 ±0.005		$(1.01\pm.03)10^3$ $c\tau = 3.03\times10^{13}$	0.882	$pe^-\nu$	100 %	1	1	-1.913148 ±.000066				
Λ	$0(\frac{1}{2}^+)$	1115.58 ±0.10		2.54×10^{-10} ±.03, S=1.4*	1.245	$p\pi^-$	$(66.4 \pm1.1)\%$ S=1.1*	38	100	-0.73 ±.16	.64[illegible]±.016	(-6±5)°	.75	(7±6)°
				$c\tau = 7.61$		$n\pi^0$	$(33.6)\%$	41	104		.73 ±.18			
						$pe\nu$	$(0.88\pm0.15)10^{-3}$	177	163		.06 ±.19			
						$p\mu\nu$	$(1.35\pm0.60)10^{-4}$	72	131					
Σ^+	$1(\frac{1}{2}^+)$	1189.47 ±0.08		0.810×10^{-10} ±.013	1.412	$p\pi^0$	$(52.8 \pm1.5)\%$	116	189	2.4 ±.6	-.960±.067			
				$c\tau = 2.43$		$n\pi^+$	$(47.2)\%$	110	185		+.008±.037	(180±30)°	-1.0	(0±85)°
						$p\gamma$	$(1.9\pm0.4)10^{-3}$	251	225					
						$n\pi^+\gamma$	$(\approx 1.)10^{-3}$	110	185					
						$\Lambda e^+\nu$	$(2.2\pm0.7)10^{-5}$	73	72					
						$n\mu^+\nu$	$(< 1.1)10^{-4}$	144	202					
			-7.97 ±.11			$ne^+\nu$	$(< 5)10^{-5}$	249	224					
Σ^0	$1(\frac{1}{2}^+)$	1192.56 ±0.11		$<1.0\times10^{-14}$ $c\tau<3\times10^{-4}$	1.422	$\Lambda\gamma$	100 %	77	75					
			-4.88 ±.06			Λe^+e^-	[c] $(5.45)10^{-3}$							
Σ^-	$1(\frac{1}{2}^+)$	1197.44 ±0.09		1.65×10^{-10} ±.03, S=1.4*	1.434	$n\pi^-$	100 %	118	193		-.010±.043			
				$c\tau = 4.95$		$ne^-\nu$	$(1.25\pm0.17)10^{-3}$	257	230					
						$n\mu^-\nu$	$(0.62\pm0.12)10^{-3}$	152	210					
						$\Lambda e^-\nu$	$(0.66\pm0.11)10^{-4}$	81	79					
						$n\pi^-\gamma$	$(\approx 1)10^{-3}$	118	193					
Ξ^0	$\frac{1}{2}(\frac{1}{2}^+)$?	1314.7 ±1.0		3.0×10^{-10} ±.5, S=1.3*	1.728	$\Lambda\pi^0$	100 %	64	135		-.33 ±.10			
				$c\tau = 8.99$		$p\pi^-$	$(< .5)\%$	237	299					
						$pe^-\nu$	$(< .6)\%$	376	323					
						$\Sigma^+e^-\nu$	$(< .7)\%$	125	119					
						$\Sigma^-e^+\nu$	$(< .6)\%$	117	112					
			-6.5 ±1.0			$\Sigma^+\mu^-\nu$	$(< .7)\%$	20	64					
						$\Sigma^-\mu^+\nu$	$(< .6)\%$	12	49					
						$p\mu^-\nu$	$(< .6)\%$	271	309					
Ξ^-	$\frac{1}{2}(\frac{1}{2}^+)$?	1321.2 ±0.2		1.74×10^{-10} ±.05	1.746	$\Lambda\pi^-$	100 %	66	139		-.391±.032	(6±8)°	.92	(14±15)°
				$c\tau = 5.22$		$\Lambda e^-\nu$	$(2.5\pm1.8)10^{-3}$	205	190					
						$n\pi^-$	$(< 5)10^{-3}$	242	303					
						$\Lambda\mu^-\nu$	$(< 1.2)\%$	100	163					
						$\Sigma^0e^-\nu$	$(< 0.3)\%$	128	122					
						$\Sigma^0\mu^-\nu$	$(< 0.5)\%$	23	70					
						$ne^-\nu$	$(< 1)\%$	381	327					
Ω^-	$0(3/2^+)$? ?	1674 ±3		$1.0\text{-}2.0\times10^{-10}$ $c\tau \approx 4.5$	2.802	$\Xi\pi$	(~50)%	221	296					
						$\Lambda\bar K$	(~50)%	66	216					

† The definition of these quantities is as follows

$$\alpha = \frac{2\,\mathrm{Re}(S^*P)}{|S|^2+|P|^2}\ ;\quad \beta = \frac{2\,\mathrm{Im}(S^*P)}{|S|^2+|P|^2}\ ;\quad \gamma = \frac{|S|^2-|P|^2}{|S|^2+|P|^2}$$

$$\tan\Phi = \frac{\beta}{\gamma}\ ,\quad \tan\Delta = \frac{-\beta}{\alpha}\ .$$

General Atomic and Nuclear Constants[a]

N	$= 6.02252 \times 10^{23}$	mole^{-1} (based on $A_{C12} = 12$)
c	$= 2.997925 \times 10^{10}$	cm sec^{-1}
e	$= 4.80298 \times 10^{-10}$	esu $= 1.60210\times10^{-19}$ coulomb
1 MeV	$= 1.60210 \times 10^{-6}$	erg
ħ	$= 6.5819 \times 10^{-22}$	MeV sec
	$= 1.05449 \times 10^{-27}$	erg sec
ħc	$= 1.9732 \times 10^{-11}$	MeV cm = 197.32 MeV fermi
k	$= 8.6171 \times 10^{-11}$	MeV deg^{-1} (Boltzmann const.)
α	$= e^2/\hbar c$	$= 1/137.0388$
m_e	$= 0.511006\ \text{MeV}/c^2$	$= 1/1836.10\ m_p$
m_p	$= 938.256\ \text{MeV}/c^2$	$= 1836.10\ m_e = 6.721\ m_{\pi\pm}$
	$= 1.00727663\ m_1$	(where $m_1 = 1$ amu $= \frac{1}{12} m_{C12} = 931.478\ \text{MeV}/c^2$)
r_e	$= e^2/m_ec^2$	$= 2.81777$ fermi (1 fermi $= 10^{-13}$ cm)
$ƛ_e$	$= \hbar/m_ec$	$= r_e\alpha^{-1} = 3.86144\times10^{-11}$ cm
a_∞ Bohr	$= \hbar^2/m_ee^2$	$= r_e\alpha^{-2} = 0.529167$ A (1 A $= 10^{-8}$ cm)
$\sigma_{Thompson}$	$= \frac{8}{3}\pi r_e^2$	$= 0.66516\times10^{-24}\ \text{cm}^2 = 0.66516$ barn
R_∞	$= m_ee^4/2\hbar^2 = m_ec^2\alpha^2/2$	$= 13.60535$ eV (Rydberg)

Hydrogen-like atom (non-rel., μ = reduced mass)

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

μ_{Bohr}	$= e\hbar/2m_ec$	$= 0.578817\times10^{-14}\ \text{MeV gauss}^{-1}$
μ_{nucl}	$= e\hbar/2m_pc$	$= 3.1524\times10^{-18}\ \text{MeV gauss}^{-1}$
$\frac{1}{2}\omega_{cyclotron}$	$= e/2m_ec$	$= 8.79404\times10^6\ \text{rad sec}^{-1}\ \text{gauss}^{-1}$
	$= e/2m_pc$	$= 4.7895\times10^3\ \text{rad sec}^{-1}\ \text{gauss}^{-1}$
$\sigma_{natural}$	$= \pi(\hbar/m_{\pi\pm}c)^2$	$= 62.768$ mb

Other Physical Constants

1 year	$= 3.1536\times10^7$ sec ($\approx \pi\times10^7$ sec)
density of air	$= 1.205\ \text{mg cm}^{-3}$ (at 20°C)
acceleration by gravity	$= 980.67\ \text{cm sec}^{-2}$
gravitational constant	$= 6.670\times10^{-8}\ \text{cm}^3\text{g}^{-1}\ \text{sec}^{-2}$
1 calorie	= 4.184 joules
1 atmosphere	$= 1033.2\ \text{g cm}^{-2}$
1 eV per particle	= 11604.9°K (from E = kT)

Numerical Constants

1 rad	= 57.29578 deg	e	= 2.71828
C	= 0.577216	1/e	= 0.367879
ln 2	= 0.69315	$\log_{10}e$	= 0.43429
ln 10	= 2.30259	$\log_{10}2$	= 0.30103

[a] Based mainly on E. R. Cohen and J. W. M. DuMond, Rev. Mod. Phys. 37, 537 (1965).

* S = Scale factor = $\sqrt{\chi^2/(N-1)}$ where N ≈ number of experiments. S should be ≈ 1. If S > 1, we have enlarged the error of the mean, δx, i.e., δx → S δx. This new convention, is still inadequate, since if S > 1, the real uncertainty is probably even greater than Sδx. See text.

a. See notes on Stable Particles in text. b. See notes in data card listings. c. Theoretical value. See also data card listings.

‡ In decays with more than two bodies, $\bar p_{max}$ is the maximum momentum that any particle can have.

MUB-13977

Symbol(J^P)	$I^G(J^P)C_n$ ├─┤= estab.	Mass M (MeV)	Width Γ (MeV)	M^2 ± ΓM[(a)] $(GeV)^2$	Partial Decay Modes: Mode	Fraction (%)	Q (MeV)	p or p_{max}[(b)] (MeV/c)
η(549)	η(0⁻)	$0^+(0^-)+$	548.6 ±0.6	< 10	0.301	all neutral; $\pi^+\pi^-\pi^0+\pi^+\pi^-\gamma$	73; 27	} See Table S	
ω(783)	φ'(1⁻)	$0^-(1^-)-$	783.3 ±0.7* S=1.9*	12.2 ±1.3	0.614 ±.009	$\pi^+\pi^-\pi^0$	≈ 90	369	328
						$\pi^+\pi^-$	seen (c)	504	366
						$\pi^0\gamma$	9.7±0.8	648	380
						η+ neutral	< 1.5	234	199
						$\pi^+\pi^-\gamma$	< 5	504	366
						$\pi^0\pi^0\gamma$	< 1	513	368
						e^+e^-	0.005±.003 (j)	782	392
						$\mu^+\mu^-$	< 0.10	572	377
η'(958) or X⁰	η'(0⁻)	$0^+(0^-)+$	958.3 ±0.8	<4	0.918 <.004	ηππ	67 ± 7	131	232
						$\pi^+\pi^-\gamma$(incl. $\rho^0\gamma$)	22 ± 4	679	458
						neutrals (excl. ηππ)	11 ± 8		
						for upper limits see footnote (f)			
H(990)	φ(A) ?	$0^-(1^+)-$ ├┤??	990 see note (i)	~80	0.98 ±.08	3π	only mode seen (see note (n))	80	150
φ(1019)	φ(1⁻)	$0^-(1^-)-$	1018.6 ±0.5	3.6 ±0.8	1.039 ±.004	K^+K^-	48 ± 3	31	125
						K_LK_S	40 ± 3	23	107
						$\pi^+\pi^-\pi^0$ (incl. ρπ)	12 ± 4	604	461
						e^+e^- indic. seen,	< 0.2	1018	509
						$\mu^+\mu^-$ seen	< 0.5	807	498
						for upper limits see footnote (g)			
η_V(1050) → K_SK_S	η(0⁺)	$0^+(0^+)+$	1050	50	1.10 ±.05	ππ	< 70	780	507
Some data still favor large scattering length						KK̄	> 30	54	167
f(1250)	η'(2⁺)	$0^+(2^+)+$	1254 ±12	117 ±15	1.57 ±.15	ππ	large	975	611
						$2\pi^+2\pi^-$	< 4	696	547
						KK̄	2.3±0.6	258	381
D(1285)	η'(A)	$0^+(1^+)+$	1285 ±4	32 ±8	1.65 ±.04	KK̄π (mainly π_V(1003)π) only mode seen		154	304
						$K^*\bar{K}+\bar{K}^*K$		-100	
						ππρ	not seen	256	356
E(1420)	η(A)	$0^+(0^-)+$	1415 ±6	74 ±15 S = 1.4*	2.00 ±.11	$K^*\bar{K}+\bar{K}^*K$	53 ±10	38	157
						π_V(1003)π	47 ±10	284	338
						ππρ	not seen	395	462
f'(1500)	η(2⁺)	$0^+(2^+)+$	1514 ±16	86 ±23	2.29 ±.13	ππ	< 14	1235	744
						KK̄	> 60	518	570
						$K^*\bar{K}+\bar{K}^*K$	< 40	128	294
						ηη	not seen	417	522
For information on possible states with mass > 1600 MeV, see the sketch at right.									
$\pi^\pm$(140) π^0(135)	π(0⁻)	$1^-(0^-)+$	139.58 134.98		0.019 0.018	See Table S			
$\rho^\pm$(760)	ρ(1⁻)	$1^+(1^-)-$	774 (h)	128 (h)	0.599 ±.099	ππ	≈100	480	353
						$\pi^\pm\pi^+\pi^-\pi^0$	< 0.2	206	243
						$\pi^\pm\pi^-\pi^+\pi^-$	< 0.2	199	238
						$\pi^0\gamma$	< 0.4	619	367
ρ^0(760)			780 (h)	128 (h)	0.607 ±.100	$\eta\pi^\pm$	< 0.8	71	135
						e^+e^-	.0041±.0024 (k)	759	380
						$\mu^+\mu^-$	.0057±.0020 (l)	549	365
δ(965) confirmation lacking	?( )	1( )	963.1 ±4.2	<5	0.927 <.005	$\delta^\pm$ → 1 charged+neutral(s) ≈ 60			
						$\delta^\pm$ → ≥3 charged+neutral(s) ≈ 40			
π_V(1003) → KK̄	π(0⁺)	$1^-(0^+)+$	1008	70 ±15	1.016 ±.057	$K^\pm K^0$	large	11	75
may also be interpreted as due to large scattering length						ηπ	see note in data listings	315	333
A1(1080)	π(1⁺)	$1^-(1^+)+$ S = 1.4*	1058 ±12	30-130	1.12	3π (see note (n))	≈100	181	245
m and Γ might have large systematic errors due to complicated behaviour of background						KK̄	< 0.25, $G=(-1)^{\ell+I}$ forbids this (Eq. 5		
						ηπ	< 1.5	391	385
						η'π	< 1.5	-19	
B(1210)	ρ(A) ?	$1^+(1^+)-$??	1208 ±12	119 ±24 S=1.6*	1.46 ±.14	ωπ	≈100	297	339
						for upper limits see footnote (m)			
A2(1300)	π(2⁺)	$1^-(2^+)+$ (d)	1311 ±11 S=2.5*	88 ±5 S=1.3*	1.72 .12	ρπ (see note (n))	90 ±3 } S=1.7*	408	417
Some evidence for > 1 meson.						KK̄	3.7±1.3	314	425
						ηπ	6.3±2.9	618	527
						η'π	< 1.5	208	276
						$\pi^+\pi^-\pi^0$(excl. ρπ)	< 17	892	616
π(1640) → 3π	π(A) ?	≥1^-(A)+ ?	1640 ±20	100 ±20	2.69 ±.16	3π	appears dominant	1235	792
						[ρπ	< 40]	746	636
						[fπ	?]	251	319
						KK̄	< 40	644	652
ρ(1650) g→2π	ρ(V)	$1^+(3^-)-$ S=1.4* →	1637 ±23	150 ±50	2.68 ±.24	2π	observed	1358	807
						4π	probably observed	1079	758
						ρππ	probably observed	599	605
						KK̄ indication seen,	< 10	641	650
						ωπ indication seen		714	620
The remaining data in this mass region are too confused to tabulate. See sketch at upper right.									
K^+(494) K^0(498)	K(0⁻)	$1/2(0^-)$	493.78 497.7		0.244 0.248	See Table S			
K^*(890)	K(1⁻)	$1/2(1^-)$	892.4 ±0.6* S=1.1*	49.6 ±1.4* S=1.1*	0.796 ±.044 (S=2.5*)	Kπ	≈100	259	288
$m_0 - m_\pm$ = 6.3±4.1						Kππ	< 0.2	119	216
K_A(1320)	K(A) ?	$1/2(1^+)$??	1309 ±6	70 ±45	1.713 ±.092	$K^*\pi$	dominant } overlap	288	338
There are indications of more structure in this region. Goldhaber + find 2 peaks, one at m=1250 MeV, Γ=50 MeV, the other at m=1360 MeV, Γ=80 MeV.						Kρ	} overlap	63	198
						Kω	< 3	39	155
						Kπ	< 2	687	558
						Kη	< 2	278	405
K_V(1420)	K(2⁺)	$1/2(2^+)$	1417 ±8 S=1.7*	87 ±8 S=1.3*	2.008 ±.123	Kπ	52 ±3	778	610
						$K^*\pi$	35 ±3	379	407
						Kρ	9 ±3 } S=2.81	158	319
						Kω	1.5±0.7	134	293
						Kη	2.3±0.9	368	475
K_A(1800)	K(A)	1/2(A)	1787 ±10	80 ±20	3.20 ±.14	Kπ	< 10	1156	819
						$K^*\pi$	35 ±12	762	664
						K_V(1420)π	8 ± 5	243	315
						Kρ	7 ± 5	532	630
						Remaining Kππ	40 ±15	1021	801
						Kω	10 ± 3	508	616

→ The following bumps, excluded above, are listed among the data cards: σ (410), ϵ (700), K_sK_s (1440) and ρρ (1410), $A2_{I=2}$(1320), κ (725), K_V(1080), K_c(1215), $K^*_{3/2}$(1175), $K^*_?$ (1270).

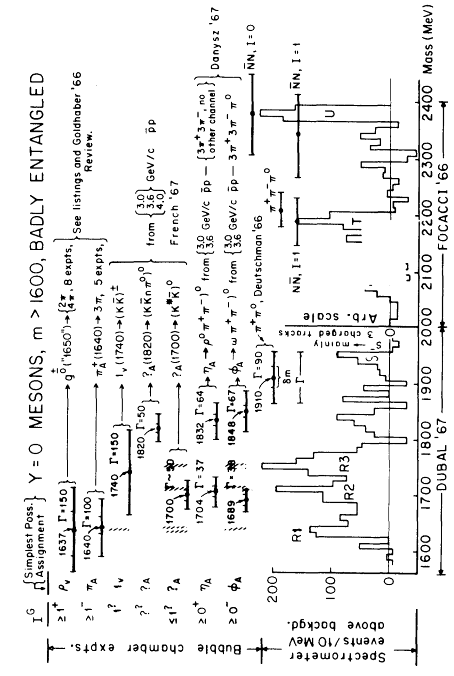
* Quoted error includes scale factor $S = \sqrt{\chi^2/(N-1)}$. See footnote to Table S.

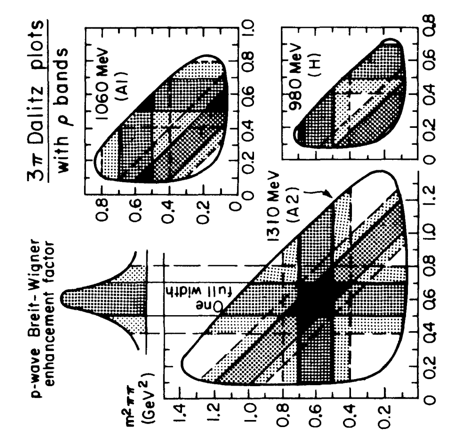
(a) ΓM is the half-width of the resonance when plotted against M^2.

(b) For decay modes into ≥ 3 particles p_{max} is the maximum momentum that any of the particles in the final state can have. The momenta have been calculated using the averaged central mass values, without taking into account the widths of the resonances.

MUB-13978

Footnotes continued at right.





(c) Reported values range between 1% and 15%, and depend on assumptions on ρ-ω interference.

(d) If A2 → both ρπ and KK̄, then $J^P = 2^+$.

(e) S is ρ(V) if identified with $\pi^+\pi^-$ bump at 1910 MeV. See note on mesons.

(f) Empirical limits on fractions for other decay modes of η' (958): $\pi^+\pi^-$ < 7%, 3π < 7%, 4π < 1%, 6π < 1%, $\pi^+\pi^-e^+e^-$ < 0.6%, $\pi^0e^+e^-$ < 1.3%, ηe^+e^- < 1.1%, $\pi^0\rho^0$ < 4%, $\pi^0\omega$ < 8%.

(g) Empirical limits on fractions for other decay modes of φ(1019): $\pi^+\pi^-$ < 20%, ηγ < 8%, η + neutrals < 13%, $\pi^+\pi^-\gamma$ < 4%, e^+e^- < 0.2%, $\mu^+\mu^-$ < 0.5%, ωγ < 5%, ργ < 2%.

(h) m_ρ, Γ_ρ from p-wave fits to compiled spectra of 1.6-5 GeV/c $\pi^\pm p$ into ρN and ρΔ final states. Results depend on momentum transfer and type of reaction, hence real errors unknown, but much larger than statistical errors ~ 2-5 MeV (see M. Roos, to be published).

(i) It seems established that there is a bump in the $(3\pi)^0$ mass spectrum around 1000 MeV although in πN collisions it is seen only between 3 and 4 GeV/c. Recent evidence by Chadwick et al. (LRL/SLAC) for I = 0 suggests that it is indeed different from the $A1^0$ so we list it tentatively as a new resonant state.

(j) SU(3) and ωφ mixing hypothesis used in the analysis of part of the ω data. Without these, the rate $\omega \to e^+e^-$ is (0.02±0.012)%.

(k) SU(3) and ωφ mixing hypothesis used in the analysis of the ρ data.

(l) SU(3) has been used in the analysis of part of the data. Without SU(3), the rate $\rho \to \mu^+\mu^-$ is $(0.0097^{+0.0031}_{-0.0033})$%.

(m) Empirical limits on fractions for other decay modes of B(1210): ππ < 30%, KK̄ < 2%, 4π < 50%, φπ < 1.5%, ηπ < 25%, $(K\bar{K})^\pm\pi^0$ < 8%, $K_SK_S\pi^\pm$ < 2%, $K_SK_L\pi^\pm$ < 6%.

(n) ρπ fraction of 3π mode difficult to distinguish because ρ bands cover most of the Dalitz plots (sketched at right).

Mixing angles from quadratic SU(3) Mass Formula: 0^- nonet (π, K, η, η') θ = 10.4°±0.1°; 1^- nonet (ρ(m = 775±10 MeV), K^*, φ, ω) θ = 40.1°±0.7°; 1^+ nonet (A1, K_A(1320) (?), E(?), D(?)) θ = $30.6°^{+4.6°}_{-5.2°}$ (tentative); 2^+ nonet (A2, K_V(1420), f', f) θ = $30.7°^{+4.2°}_{-4.6°}$.

	Particle or resonance	I(J^P) ⊢⊣ = estab.	Beam π, K (BeV) (BeV/c)	Mass (MeV)	Γ (MeV)	$M^2 \pm \Gamma M$ (BeV^2)	Partial decay modes: Mode	Fraction (%)	Q (MeV)	p or p_{max} ‡ (MeV/c)	$4\pi\lambda^2$ (mb)
$N^*_{1/2}$	p n	1/2(1/2⁺) ⊢⊣		938.3 939.6		0.880 0.883	See Table S				
	N′(1400)	1/2(1/2⁺) P_{11} ⊢⊣	T=0.43πp p=0.55	~1400[a]	~200	1.96 ±0.28	Nπ	70	322	367	36.3
	N(1525)	1/2(3/2⁻) D_{13} ⊢⊣	T=0.62 p=0.75	1525[a]	105	2.33 ±0.16	Nπ Nππ [Δ(1236)π][e]	65 35 [~ 20]	447 308 149	460 414 229	23.2
	N(1570)	1/2(1/2⁻) S_{11} ⊢⊣	T=0.69 p=0.82	1570[a]	130	2.46 ±0.20	Nπ Nη	~ 30 ~ 70	492 82	491 242	20.3
	N(1670)	1/2(5/2⁻) D_{15} ⊢⊣	T=0.87 p=1.00	1670[a]	140	2.79 ±0.23	Nπ Nππ [Δ(1236)π][e] ΛK Nη	40 dom. inel.[a] [?] <1.6 <2.5	592 453 294 57 182	560 526 357 200 368	15.6
	N(1688)	1/2(5/2⁺) F_{15} ⊢⊣	T=0.90 p=1.03	1688[a]	110	2.85 ±0.19	Nπ Nππ [Δ(1236)π][e] ΛK Nη	65 dom. inel.[a] [?] < .13 <1.5	610 471 312 75 200	572 538 372 231 388	14.9
	N′(1700)[c]	1/2(1/2⁻) S_{11} ⊢⊣	T=0.92 p=1.05	1700[a]	240	2.89 ±0.41	Nπ	100	622	580	14.5
	→ N(2190)	1/2(7/2⁻) ⊢⊣	T=1.94 p=2.07	2190	200	4.80 ±0.44	Nπ ΛK	30 ?	1112 577	888 710	6.21
	N(2650)	1/2(11/2⁻)[b] ⊢⊣ ⊢⊣	T=3.12 p=3.26	2650 ± 10	~300	7.02 ±0.80	Nπ ΛK	7 ?	1572 1037	1154 1022	3.67
	N(3030)[c] ⇉	1/2(15/2⁻)[b] ⊢⊣	T=4.26 p=4.40	3030	400	9.18 ±1.21	Nπ	0.7	1972	1377	2.62
$N^*_{3/2}$	Δ(1236)	3/2(3/2⁺) P_{33} ⊢⊣ $m_0 - m_{++} = 0.45 \pm 0.85$	T=0.195 p=0.304 $m_- - m_{++} = 7.9 \pm 6.8$	(++) 1236.0 ±0.6	120 ±2	1.53 ±0.15	Nπ $N\pi^+\pi^-$	100 0	158 18	231 89	91.9
	Δ(1670)	3/2(1/2⁻) S_{31} ⊢⊣	T=0.87 p=1.00	1670[a]	~180	2.79 ±0.30	Nπ Nππ	40 ?	592 453	560 526	15.6
	Δ(1920)	3/2(7/2⁺) ⊢⊣	T=1.35 p=1.48	1920	200	3.69 ±0.38	Nπ ΣK	50 seen	842 229	722 423	9.37
	Δ(2420)	3/2(11/2⁺)[b] ⊢⊣ ⊢⊣	T=2.51 p=2.65	2423 ±10	~275	5.87 ±0.67	Nπ ΣK	10 ?	1345 732	1024 830	4.66
	Δ(2850)	3/2(15/2⁺)[b] ⊢⊣	T=3.71 p=3.85	2850 ±12	~300	8.12 ±0.86	Nπ	3	1772	1266	3.05
	Δ(3230)[c] →	3/2(19/2⁺)[b] ⊢⊣	T=4.94 p=5.08	3230	440	10.4 ±1.4	Nπ	0.6	2152	1475	2.24
Z^*_0	→ Z_0(1865)[c]	0(?) ⊢⊣	p=1.15 K⁺p	1864	180	3.47 ±0.34	NK	35 (if J = 1/2)	432	579	14.6
Y^*_0	Λ	0(1/2⁺) ⊢⊣		1115.6		1.24	See Table S				
	Λ(1405)[d]	0(1/2⁻) ⊢⊣	p<0 K⁻p	1403±3	50±5	1.97 ±0.07	Σπ	100	66	140	
	Λ(1520)	0(3/2⁻) ⊢⊣	p=0.392	1518.8 ±1.5	16 ±2	2.31 ±0.02	NK̄ Σπ Λππ	S=1.7* → {44±4 S=2.3* 46±4 10±1	81 182 124	235 258 251	83.6
	Λ′(1670)[a]	0(1/2⁻) ⊢⊣	p=0.74	1670	18	2.79 ±0.03	Λη NK̄	K⁻p→Λη seen	6 233	66 410	 28.5
	Λ′(1690)	0(3/2⁻) ⊢⊣	p=0.78	1690 ±6 S=4.4*!	52 S=1.3* ±5	2.86 ±0.09	NK̄ Σπ	25 46	253 353	429 403	26.1
	Λ(1815)	0(5/2⁺) ⊢⊣	p=1.05	1816.2 ±2.1 S=1.6*	75.6 ± 6.0	3.30 ±0.14	NK̄ Σπ Σ(1385)π Λη	70 11 10 ~ 1	379 479 292 152	538 500 359 346	16.7
	Λ(1830)	0(5/2⁻) ⊢⊣	p= 1.08	1827	77	3.34 ±0.14	NK̄ Σπ	8 24	390 490	552 508	16.0
	Λ(2100)	0(7/2⁻) ⊢⊣	p=1.68	2103 ±10	143 ±10	4.42 ±0.30	NK̄ Σπ Λη ΞK Λω	33 4 < 3 1 <10	663 763 436 281 201	748 699 617 483 443	8.68
	Λ(2350)	0(?) ⊢⊣	p=2.29	2352 ±11	210 ±50	5.53 ±0.49	NK̄ seen in σ(total)	14 ↳ if J= 9/2	913	913	5.84
Y^*_1	Σ	1(1/2⁺) ⊢⊣		(+)1189.5 (0)1192.6 (-)1197.4		1.41 1.42 1.43	See Table S				
	Σ(1385)	1(3/2⁺) ⊢⊣	p<0 K⁻p S=4.8*! ↔	(+)1382.2±0.9 S=1.6* (-)1388.0±3.0	(+)37±3 S=2.1* (-)38±8, S=3.7*!	1.92 ±0.05	Λπ Σπ	91±3 9±3 S=1.4*	130 48	208 117	
	Σ(1660)[a]	1(3/2⁻) ⊢⊣ Large contradictions among measured branching ratios; there is evidence for two different states at similar mass	p=0.72	1660	50	2.76 ±0.08	Λ(1405)π Σπ Λπ NK̄	large ? ? small	115 323 405 223	197 379 439 400	 29.9
	Σ(1770)	1(5/2⁻) ⊢⊣	p=0.95	1766.8 ±3.6 S=1.5*	95 ±12 S=2.3*	3.13 ±0.16	NK̄ Λπ Λ(1520)π Σ(1385)π Ση Σπ	45 15 17 15 0.5 ~ 1	329 516 108 242 26 430	497 519 190 317 140 463	19.4
	Σ(1910)[c]	1(5/2⁺) ⊢⊣	p=1.25	1910 ±10	60	3.65 ±0.11	NK̄ Λπ Σπ	8 10 3	473 655 573	612 619 568	12.9
	Σ(2030)	1(7/2⁺) ⊢⊣	p=1.52	2028 ±14	120 ±10	4.12 ±0.24	NK̄ Λπ Σπ ΞK	11 36 9 < 2	593 779 693 211	700 700 652 412	9.92
	Σ(2250)[c]	1(?) ⊢⊣	p=2.04	2252 ±10	200 ±20	5.06 ±0.45	NK̄ seen in σ(total)	6.2 ↳ if J = 9/2	813	849	6.76
$\Xi^*_{1/2}$	Ξ	1/2(1/2⁺) ⊢⊣		(0)1314.7 (-)1321.2		1.73 1.75	See Table S				
	Ξ(1530)	1/2(3/2⁺) ⊢⊣ p-wave		(0)1528.9±1.1 (-)1533.8±1.9	7.3 ±1.7	2.34 ±0.01	Ξπ	100	69	145	
	Ξ(1815)	1/2(?) ⊢⊣ Branching ratios poorly known		1815 ±3	16 ±8 S=2.2*	3.29 ±0.03	ΛK̄ Ξπ Ξππ [Ξ(1530)π][e] ΣK̄	~ 65 ~ 10 ~ 25 [~ 20] < 2	202 354 215 145 120	391 409 351 229 299	
	Ξ(1930)[c]	1/2(?) ⊢⊣		1933 ±16	140 ±35	3.74 ±0.27	Ξπ ΛK̄	seen	472 320	501 504	
Ω^-	Ω^-	0(3/2⁺)		1674		2.80	See Table S				

a. See note in data listings.
b. J^P assignment based on straight-line Regge-trajectory-recurrence hypothesis and supported by fits to πp elastic scattering at 180°. See note following data listings.
c. Evidence for the existence of the effect and/or for its interpretation as a resonance is open to some question.
d. A virtual bound state of the K̄N system with negative scattering length [$a_0 = (-1.6 + 0.6i)F$]; i.e., a pole in the S matrix below the elastic threshold. See notes in main text and data listings.
e. Square brackets indicate a sub-reaction of the previous unbracketed decay mode.

→ at left of Table indicates a candidate that has been omitted because the evidence for the existence of the effect and/or for its interpretation as a resonance is open to considerable question. See listings for information on the following: $N_?(2080)$, $N_?(3245)$, N(3690), $N^*_{5/2}(1560)$, $Z^*_1(1900)$, Σ(1780), Σ(1690), Σ(3000), and Ξ(1705).

* Quoted error includes an S(scale) factor. See footnote to Table S.

‡ For decay modes into ≥3 particles, p_{max} is the maximum momentum that any of the particles in the final state can have. The momenta have been calculated using the averaged central mass values, without taking into account the widths of the resonances.

MUB-13979

DATA ON PARTICLES AND RESONANT STATES*

This is an updating, to Aug. 1967, of our January compilation [Rev. Mod. Phys. 39, 1 (1967)]. Apart from one addition to the listings, mentioned below as Note A, the procedures are unchanged, so we do not reproduce the text.

This edition will not be published; it, and separate wallet sheets, will be distributed at the Heidelberg Conference. Both the compilation and the wallet sheets may be requested by mail from Berkeley or CERN.

As always we request comments from readers who notice omissions, incorrect handling of data, or mistakes; and we solicit preprints calling our attention to new data.

NOTE A. Some Averaged Ratios and Fitted Ratios are now included in the data listings.

Until this edition the output of our constrained fits has appeared only in the tables. This time, however, we have punched additional results and put them in the data-card listings.

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

1. P_i^{fitted} with errors (which have always appeared on the tables)
2. R_i^{fitted} with errors (which will now appear in the listings, since there is no place for them in the tables).

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

*This work was done partly under the auspices of the U. S. Atomic Energy Commission.

DATA FOR TABLES ON STABLE PARTICLES

STABLE MEANING IMMUNE TO STRONG DECAY

```
CODE EVENTS QUANTITY  ERROR+  ERROR-  REFERENCE YR TECN SIGN COMMENTS        CATE
       ABOVE                                                              PUNCHED
     BACKGROUNC

     N  ANY SYMBOL IN COLUMN 8 INDICATES DATA IGNORED BY AVERAGING PROGRAMS

      1         2         3         4         5         6         7         8
4567890123456789012345678901234567890123456789012345678901234567890123456789012345678
```

γ

```
                C GAMMA (0,J=1)

****** ********* ********* ********* ********* ********* ********* *********
****** ********* ********* ********* ********* ********* ********* *********
```

ν_e

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

                1  E-NEUTRINO  MASS (KEV)

M    *  LESS THAN              0.25    LANGER     52 CNTR
M    *  LESS THAN              0.15    HAMILTON   53 CNTR
M    *  LESS THAN    C.55 +OR- 0.28    FRIECMAN   58 CNTR

****** ********* ********* ********* ********* ********* ********* *********

                         REFERENCES

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

LANGER   52 PR  88  689      L M LANGER,R J C MOFFAT  ////////  INCIANA
HAMILTON 53 PR  92  1521     D HAMILTON,W P ALFORC,L GRCSS // PRINCETON
FRIECMAN 58 PR 109  2214     LEWIS FRIEDMAN,LINCOLN G SMITH  /////  BNL

****** ********* ********* ********* ********* ********* ********* *********
****** ********* ********* ********* ********* ********* ********* *********
```

ν_μ

```
                2  MU-NEUTRINC  (C,J=1/2)

                2  MU-NEUTRINO  MASS (MEV)

M    *         3.5  CR LESS           BARKAS    56 EMUL
M    *         4.0  OR LESS           DUDZIAK   59 CNTR
M    *         3.6  CR LESS           FEINBERG  63 RVUE                      7/66
M    *         3.0  OR LESS           ALLCOCK   65 RVUE                      7/66
M    *         2.5  OR LESS           BARDON    65 SPRK
M    *         2.1  OR LESS           SHAFER    65 CNTR  CONF LEV = 68PCT    7/66

****** ********* ********* ********* ********* ********* ********* *********

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

BARKAS   56 PR 101  778      W H BARKAS,W BIRNBAUM,F M SMITH  ////  LRL
DUDZIAK  59 PR 114  336      W F DUDZIAK,R SAGANE,J VEDCER  //////  LRL
FEINBERG 63 ARNS 13 431      G FEINBERG, L M LEDERMAN //////// COLUMBIA
ALLCCCK  65 PPSL  65  875    G R ALLCOCK //////////////////// LIVERPOOL
BARDON   65 PRL  14 449      BARDON,NORTON,PEOPLES +//COLUM+STONY BROOK
SHAFER   65 PRL  14 923      R E SHAFER,CROWE,JENKINS  ///////////  LRL

****** ********* ********* ********* ********* ********* ********* *********
****** ********* ********* ********* ********* ********* ********* *********
```

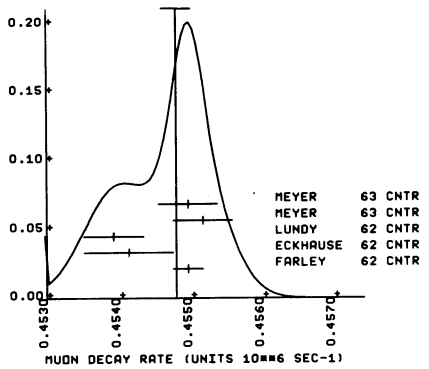
e

```
                3  ELECTRON  (0.5,J=1/2)

                3  ELECTRON  MASS (MEV)

M          0.511006 C.000002          CCHEN     65 RVUE

------ --------- --------- --------- --------- --------- --------- ---------

           3  ELECTRCN LIFETIME (UNITS 10**21 YR)

T    *     CVER                  2.0  MCE       65 CNTR                      6/66

------ --------- --------- --------- --------- --------- --------- ---------

                3  ELECTRON MAGNETIC MCMENT(E/2ME)

MM   *     1.0011609 .0000024         SCHUPP    61 CNTR  -
MM         1.001159622  +-(27)*10**-9 WILKINSON 63 CNTR -                    8/66
MM   *     1.001168 0.000011          RICH      66 CNTR +  POSITRON          8/66

****** ********* ********* ********* ********* ********* ********* *********

                         REFERENCES
                         3  ELECTRON  (0.5,J=1/2)

SCHUPP   61 PR  121   1      A A SCHUPP,R W PIDD,H R CRANE //  MICHIGAN
WILKINSO 63 PR 130 852       D T WILKINSON,H R CRANE ///////// MICHIGAN
COHEN    65 RMP 37 537       E R CCHEN, J W M DUMOND //// NAASC+CALTECH
MOE      65 PR 140 B 592     M K MCE,F REINES //// CASE INST TECHNOLOGY
RICH     66 PRL  17  271     A RICH, H R CRANE                // MICHIGAN

****** ********* ********* ********* ********* ********* ********* *********
****** ********* ********* ********* ********* ********* ********* *********
```

μ

```
                 4  MUON  (1C6,J=1/2)
                 4  MUON  MASS (MEV)
M          1C5.659    0.002            FEINBERG  63 RVUE
------ --------- --------- --------- --------- --------- --------- ---------
                 4  MUON LIFETIME (UNITS 10**-6)
T   N       2.2C0    0.C15     0.C15 FISHER    59 CNTR
T   N       2.225    0.006     0.006 ASTBURY   60 CNTR
T   N       2.211    0.003     0.003 REITER    60 CNTR
T   N       2.2C8    0.004     0.0C4 TELEGCI   60 CNTR
T   N  OLD DATA NEGLECTED FOLLOWING SUGGESTION OF V.TELEGCI
T           2.198    0.001     0.001 FARLEY    62 CNTR
T           2.203    C.002           LUNDY     62 CNTR CONV. FROM CL=.98    9/66
T           2.2C2    0.003     0.003 ECKHAUSE  63 CNTR
T           2.197    0.C02     0.0C2 MEYER     63 CNTR +
T           2.198    0.002     0.002 MEYER     63 CNTR -                    7/66
                          (Ideogram below)
------ --------- --------- --------- --------- --------- --------- ---------
```

WEIGHTED AVERAGE =0.454797 +/- 0.000203
SCALE = 1.34   CHISQ = 7.2   CONLEV = 0.127




```
                 4  RATIO OF LIFETIME OF MU+ TO MU-
LR            1.0CC    0.001            MEYER     63 CNTR  LIFETIME MU+/MU-    7/66
------ --------- --------- --------- --------- --------- --------- ---------
                 4  MUCN PARTIAL DECAY MODES
P1     MUON INTO E (E-NEU) (MU-NEU)                      S 3S 1S 2
P2     MUON INTO E 2GAMMA                                S 3S 0S 0
P3     MUON INTO 3ELECTRONS                              S 3S 3S 3
P4     MUON INTO E GAMMA                                 S 3S 0
------ --------- --------- --------- --------- --------- --------- ---------
                 4  MUON  BRANCHING RATIOS
R1   *  MUON INTO  E+2GAMMA  (IN UNITS OF 10**-5)        (P2)/(P1)
R1   *  LESS THAN                 1.6     FRANKEL 1 63 SPRK

R2   *  MUON INTO 3E (IN UNITS OF 10**-7)                (P3)/(P1)
R2   *  LESS THAN                 5.0     PARKER 1  62 CNTR
R2   *  LESS THAN                 1.3     ALIKHANOV 62 SPRK
R2   *  LESS THAN                 1.5     FRANKEL 2 63 CNTR
R2   *  LESS THAN                 1.45    BABAEV    63 SPRK

R3   *  MUON INTO  E+GAMMA  (IN UNITS OF 10**-8)         (P4)/(P1)
R3   *  LESS THAN                 1.2     FRANKEL 1 63 SPRK
R3   *  LESS THAN                 0.6     PARKER 2  64 SPRK
------ --------- --------- --------- --------- --------- --------- ---------
                 4  MUON  MAGNETIC MOMENT (IN E/(2*MUCN MASS)
MM          1.001162 0.000005          CHARPAK   62 CNTR +
MM          1.001165 C.000003          FARLEY    66 CNTR  - STORAGE RINGS    11/66
****** ********* ********* ********* ********* ********* ********* *********
```


```
                                    REFERENCES
                                    4  MUCN  (106,J=1/2)
FISHER   59 PRL  3  349          FISHER,LEONTIC,LUNDBY,MELNIER,STROOT//CERN
ASTBURY  60 ROCH CONF 60 542     ASTBURY,HATTERSLEY,HUSSAIN + //  LIVERPOOL
DEVCNS   60 PRL  5  330          DEVONS,GIDAL,LECERMAN,SHAPIRO  // COLUMBIA
LATHROP  60 NC     17 109        J LATHROP,R A LUNDY,V L TELEGDI + // EFINS
LATHROP  60 NC     17 114        J LATHROP,R A LUNDY,S PENMAN + ////  EFINS
REITER   60 PRL    5  22         REITER,ROMANOWSKI,SUTTON +  ///// CARNEGIE
TELEGDI  60 ROCH CONF 60 713     V L TELEGCI /////////////////////////  CERN

CHARPAK  61 PRL    6 128         CHARPAK,FARLEY,GARWIN,MULLER,SENS + //CERN
HUTCHINS 61 PRL    7 129         D P HUTCHINSON,J MENES +  //////  COLUMBIA
ALIKHANO 62 CERN CONF 423        A I ALIKHANOV,A BABAEV +  ///  ITEP MOSCOW
CHARPAK  62 PL     1  16         G CHARPAK,F J M FARLEY,R L GARWIN + //CERN
FARLEY   62 CERN CONF 415        FARLEY,MASSAM,MULLER,ZICHICHI  /////  CERN
LUNCY    62 PR 125 1686          RICHARD A LUNDY //////////////////// EFINS
PARKER   62 NC   23  485         S PARKER,S PENMAN ////////////////// EFINS
SHAPIRO  62 PR 125 1C22          G SHAPIRO,L M LECERMAN ////////// COLUMBIA

BABAEV   63 JETP 16 1397         BABAEV,BALATS,KAFTANCV,LANCSBERG + // ITEP
ECKHAUSE 63 PR 132  422          M ECKHAUSE,T A FILIPPAS + /////// CARNEGIE
FEINBERG 63 ARNS 13 431          GERALC FEINBERG, L M LEDERMAN /// COLUMBIA
FRANKEL  63 NC  27   894         S FRANKEL,W FRATI,J HALPERN + ////// PENNA
FRANKEL  63 PR 13C   351         S FRANKEL,W FRATI,J HALPERN + ////// PENNA
MEYER    63 PR   132  2693       S L MEYER,ANDERSCN,BLESER,LEDERMAN+//COLUM
PARKER   64 PR 133B 766          S PARKER,H L ANDERSON,C REY //////// EFINS
FARLEY   66  NC   45A  281       FARLEY,BAILEY,BRCWN,GIESCH +       // CERN
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$\pi^{\pm}$

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                 8  CHARGED PION  (140,JPG=0--)  I=1
                 8  CHARGED PI  MASS (MEV)
M          139.37     0.20             CROWE     54 CNTR  -
M          139.68     C.15             BARKAS    56 EMUL +
M          139.577    C.014            SHAFER    65 CNTR                   6/66
------ --------- --------- --------- --------- --------- --------- ---------
                 8  PI+ MU+ MASS DIFFERENCE (MEV)
D           34.0C     0.076            BARKAS    56 EMUL
D           33.89     C.076            BARKAS    56 EMUL
------ --------- --------- --------- --------- --------- --------- ---------
                 8  CHAR.PI LIFETIME (UNITS 10**-9)
T           25.6      0.5       0.5   CROWE     57 RVUE
T           25.6      0.8       0.6   ANDERSON  60 CNTR
T     8C00  25.46     C.32      0.32  ASHKIN    60 CNTR +
T                                     MERRISON  62 RVUE

T           26.02     0.04            ECKHAUSE  65 CNTR +              9/  6/66
T           25.6      0.3             BARDCN    66 CNTR                    6/66
T           25.9      C.4             DUNAITSEV 66 CNTR                   *4/66
T   N       26.40     0.08            KINSEY    66 CNTR +                  6/66
T   N  SYSTEMATIC ERRORS IN CALIBR.IN THIS EXP. DISCUSSED BY NORDBERG 67   8/67
T           26.67     C.24            LOBKOWICZ 66 CNTR                    9/66

T           26.6      0.2             AYRES     67 CNTR                   10/66
T           26.04     0.05            NORDBERG  67 CNTR +                  8/67
                          (Ideogram below)
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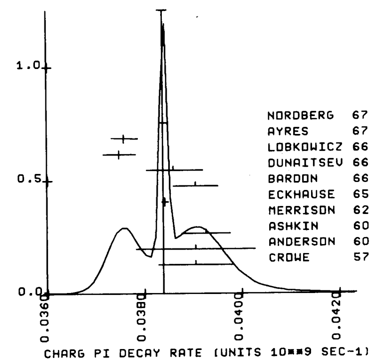
WEIGHTED AVERAGE =0.038401 +/- 0.000101
SCALE = 2.28   CHISQ = 15.6   CONLEV = 0.001

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                 8 MEANLIFE CIFFERENCE,(+)-(-)/AVGE. (PERCENT)
LR  N    THIS QUANTITY IS A MEASURE OF CPT INVARIANCE IN W.I.

LR          0.23      0.40            LCBKOWICZ 66 CNTR    SEE NOTE L    9/66
LR  L    ABOVE IS THE MOST CONSERVATIVE VALUE QUOTED BY AUTHORS          9/66
LR          0.4       0.7             BARDCN    66 CNTR                  7/66
LR          0.56      C.28            AYRES     67 CNTR                 10/66
------ --------- --------- --------- --------- --------- --------- ---------
                 8  CHARGED PION PARTIAL DECAY MODES
P1     CHAR.PION INTC MU (MU-NEU)                        S 4S 2
P2     CHAR.PION INTO E (E-NEU)                          S 3S 1
P3     CHAR.PION INTC MU (MU-NEU) GAMMA                  S 4S 2S C
P4     CHAR.PION INTO PIO E (E-NEU)                      S 9S 3S 1
P5       CHAR.PION INTU E NEU GAMMA                      S 3S 1S C
------ --------- --------- --------- --------- --------- --------- ---------
                 8  CHARGED PION BRANCHING RATIOS
R1   *  CHAR.PION INTC MU NEU GAMMA  (UNITS 10**-4)      (P3)/(P1)
R1      26    1.24      0.25          CASTAGNOL 58 EMUL

R2   *  CHAR.PION INTC E NEU         (UNITS 10**-4)      (P2)/(P1)
R2            1.21      0.07          ANDERSON  60 CNTR
R2            1.247     C.C28         DI CAPUA  64 CNTR
R2   A        1.242      .026     AVERAGE OF ABCVF DATA -- SEE NOTE A IN TEXT  8/67

R3   *  CHAR.PION INTC PIO E NEU     (UNITS 10**-8)      (P4)/(P1)
R3      36    0.97      0.20          BARTLETT  64 SPRK
R3      38    1.07      0.21          BACASTOW  65 SPRK +
R3            1.1C      0.26          BERTRAM   65 SPRK                    6/66
R3      43    1.1       0.2           DUNAITSEV 65 CNTR                    7/66
R3            1.01      0.08     0.10 DEPCMMIER 66 CNTR                    6/66
R3   A        1.029      .069     AVERAGE OF ABOVE DATA -- SEE NOTE A IN TEXT  8/67

R4   *    CHAR.PION INTO E NEU GAMMA (UNITS 10**-8)      (P5)/(P1)
R4     143    3.0       0.5           DEPOMMIER 63 CNTR                    6/66
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                                    REFERENCES
                                    8 CHARGED PION (140,JPG=C--)I=1
CROWE    54 PR   96  470         K M CROWE,R H PHILLIPS /////////////// LRL
BARKAS   56 PR 101   778         W H BARKAS,W BIRNBAUM,F M SMITH ////// LRL
CROWE    57 NC    5  541         K M CROWE ///////////////// STANFORD HEPL
CASTAGNC 58 PR 112 1779          C CASTAGNOLI,M MUCHNIK ////////// ROME I F

ANDERSON 60 PR 119 2050          H L ANDERSON,T FUJII,R H MILLER + // EFINS
ASHKIN   60 NC   16  490         ASHKIN,FAZZINI,FIDECARO,LIPMAN + //// CERN
MERRISON 62 ADVP 11 1            A W MERRISON ///////////////////// LIVERPCOL
SHAPIRC  62 PR 125 1C22          G SHAPIRO,L M LECERMAN ////////// COLUMBIA
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CZIRR     63 PR 130  341          JOHN B CZIRR ////////////////////////// LRL
DEPOMMIE 63 PL 7 285              P DEPOMMIER,HEINTZE,RUBBIA,SOERGEL // CERN
BARTLETT 64 PR 136B 1432          BARTLETT,DEVONS,MEYER,ROSEN ///// COLUMBIA
DI CAPUA 64 PR 133B 1333          DI CAPUA,GARLAND,PONCROM,STRELZOFF //COLUM

BACASTOW 65 PR 139 B407           +GHESQUIERE,WIEGAND,LARSEN        //LRL+SLAC
BERTRAM  65 PR 139 B 617          BERTRAM,MEYER,CARRIGAN+ //// MICH+CARNEGIE
CLINE    65 PL   15  293          A CLINE,W F FRY //////////////// WISCONSIN
DUNAITSE 65 JETP 20 58            DUNAITSEV,PETRUKHIN,PROKOSHKIN + /// CUBNA
ECKHAUSE 65 PL 19 348             ECKHAUSE,HARRIS,SHULER+// WILLIAM AND MARY
SHAFER   65 UCRL 16365 THESIS RCBERT E SHAFER ///////////////////// LRL
REPLACES 65 PRL 14 923            R E SHAFER,K M CROWE,D A JENKINS ///// LRL

BARDON   66 PRL 16 775            BARDON,DORE,DORFAN,KRIEGER + //// COLUMBIA
DEPOMMIE 66    PRIV COMM          DEPOMMIER,SOERGEL /////////////////// CERN
DUNAITSE 66 PL 23 283             +KUTYIN,PROKOSHKIN,RASUVAEV,SIMONOV//CUBNA
KINSEY   66 PR 144   1132         KINSEY,LOBKOWICZ,NORCBERG //ROCHESTER UNIV
LOBKOWIC 66 PRL  17  548          LCBKOWICZ,MELISSINOS,NAGASHIMA+ //ROCH+BNL

AYRES    67 PL 24B  483           D S AYRES,CALDWELL,GREENBERG,KURZ+ /// LRL
 ALSO    67 PR  157  1288         AYRES,CALDWELL,GREENBERG,KENNEY,KURZ+//LRL
NORDBERG 67 PL 24B  594           NORDBERG,LOBKOWICZ,BURMAN //ROCHESTER UNIV
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              9  NEUTRAL PION  (135,JPG=0--)  I=1

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

D    *      5.37       1.0            PANOFSKY  51 CNTR  -
D           4.50       0.31           CHINOWSKY 54 CNTR  -
D           4.62       0.05           HADDOCK   59 CNTR  -
D           4.60       0.04           HILLMAN   59 CNTR
D           4.55       0.07           CASSELS   59 CNTR

D           4.6056     0.0055         CZIRR     63 CNTR
D           4.59       0.03           PETRUKHIN 63 CNTR  -
D           4.6034     0.0052         VASILEVSK 66 CNTR  -                  9/66
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              9  PIO  LIFETIME (UNITS 10**-16)

T    N   76   1.9      0.5      0.5   GLASSER   61 EMUL
T    N   45   2.3      1.1      1.0   TIETGE    62 EMUL
T    N   88   2.8      0.9      0.9   KOLLER    63 EMUL     SEE STAMER 66
T             1.05     0.18     0.18  VON DARDE 63 CNTR

T    N   75   1.7      0.5            SHWE      64 EMUL
T             0.730    0.105          BELLETTIN 65 CNTR                     6/66
T    N   67   1.6      0.6      0.5   EVANS     65 EMUL                     6/66
T    N   OLD EMULSION MEASUREMENTS NOT USED BECAUSE OF PCSSIBLE SYSTEMATIC
T    N      SHIFT TO LARGER LIFETIME VALUES

T       232   1.0      0.5            STAMER    66 EMUL    SEE NOTE K BELCW 8/67
T    K   INCLUDES EVENTS OF KOLLER 63                                       8/67
                        (Ideogram below)
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              9  NEUTRAL PION PARTIAL DECAY MODES

P1        PIO INTO 2GAMMA                                S 0S 0
P2        PIO INTO E+ E- GAMMA                           S 3S 3S 0
P3        PIO INTO 4ELECTRONS                            S 3S 3S 3S 3
P4          PIO INTO 3 GAMMA                             S 0S 0S 0
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              9  NEUTRAL PION BRANCHING RATIOS

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

R1   *       0.01196 THEORETICAL CALC.JOSEPH      61        QUANTUM ELECT.  9/66

R1       27   0.0117   0.0015         BUDAGOV   60 HBC
R1     3071   0.01166  0.00047        SAMIOS    61 HBC      PI-P TO PIO N
R1   S   SAMIOS VALUE USES PANOFSKY RATIO = 1.62
R1   A        0.01166  .00045   AVERAGE OF ABOVE DATA -- SEE NOTE A IN TEXT 8/67

R2   *    PIO INTO (3 GAMMA)/(2 GAMMA) (UNITS 10**-6)     (P4)/(P1)
R2   *    0   5.0 OR LESS                DUCLOS    65 CNTR  CL=90 PERCENT   6/66

R3   *    PIC INTO (E+E+E-E-)/(2 GAMMA) (UNITS 10**-5)   (P3)/(P1)

R3   *        3.47   THEORETICAL CAL. KROLL       55         QUANTUM ELECT.  9/66

R3      146   3.18     0.30           SAMIOS    62 HBC                      6/66
R3   N     ABOVE VALUE USES PANOFSKY RATIO=1.62
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REFERENCES
9 NEUTRAL PION (135,JPG=C--)I=1


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PANOFSKY 51 PR    81  565         W K H PANOFSKY,R L AAMODT,J HADLEY /// LRL
CHINOWSK 54 PR    93  586         W CHINOWSKY,J STEINBERGER /////// COLUMBIA
KROLL    55 PR 98 1355            N KROLL ,W WADA              // COLUMBIA+NRLW
CASSELS  59 PPS  74    92         CASSELS,JONES,MURPHY,O NEILL /// LIVERPOOL
HADDOCK  59 PRL    3  478         HADDOCK,ABASHIAN,CROWE,CZIRR ///////// LRL
HILLMAN  59 NC    14  887         HILLMAN,MIDCELKOOP,YAMAGATA,ZAVATTINI/CERN

BUDAGOV  60 JETP 11   755         BUDAGOV,VIKTOR,DZHELEPOV,ERMOLOV +  //JINR
JOSEPH   60 NC 16 997             D W JOSEPH                          // EFI
GLASSER  61 PR   123 1014         R G GLASSER,N SEEMAN,B STILLER /////// NRL
SAMIOS   61 PR   121  275         N P SAMIOS ////////////////// COLUMBIA+BNL
SAMIOS   62 PR 126 1844           SAMIOS,PLANO,PROCELL + ////// COLUMBIA+BNL
TIETGE   62 PR   127 1324         J TIETGE,W PUESCHEL ////// MAX PLANCK INST

CZIRR    63 PR   130  341         JCHN B CZIRR ///////////////////////// LRL
KOLLER   63 NC    27 1405         E L KOLLER,S TAYLOR,T HUETTER //// STEVENS
KOLLER   63    SEE ALSO STAMER 66
PETRUKHI 63 SIENA CONF 208        V I PETRUKHIN,YU D PROKOSHKIN /////// JINR
VONDARCE 63 PL     4   51         VCN DARDEL,DEKKERS,MERMOD,VAN PUTTEN+/CERN

SHWE     64 PR   136B 1839        H SHWE,F M SMITH,W H BARKAS ////////// LRL
BELLETTI 65 NC 40 A 1139          BELLETTINI,BEMPORAD,BRACCINI+/PISA+FIRENZE
DUCLOS   65 PL 19 253             DUCLOS,FREYTAG,HEINTZE + //CERN+HEIDELBERG
EVANS    65 PR 139 B 982          D A EVANS ////////////////////////// OXFORD

STAMER   66 PR 151  1108          STAMER,TAYLOR,KOLLER,HUETTER+ //// STEVENS
VASILEVS 66 PL   23  281          VASILEVSKY,VISHNYAKOV,DUNAITSEV + // CUBNA
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$K^{\pm}$

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

              10  CHARGED K  MASS (MEV)

M           493.9      0.2            COHEN     57 RVUE +
M           493.7      0.3            BARKAS    63 EMUL  -
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M           493.78     0.17           GREINER   65 EMUL +    VIA TAU DECAY  7/66
------ --------- --------- --------- --------- --------- --------- ---------

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

T             0.95     0.36     0.25  ILOFF     56 EMUL
T        52   1.60     0.3      0.3   EISENBERG 58 EMUL
T             1.21     0.06     0.06  BURROWES  59 CNTR
T        33   1.38     0.24     0.24  FREDEN    60 EMUL

T             1.25     0.22     0.17  BARKAS    61 EMUL
T        51   1.27     0.36     0.23  BHOWMIK   61 EMUL
T       293   1.31     0.08     0.08  NORDIN    61 HBC   -
T    *        1.24     0.07           NORDIN    61 RVUE  -
T             1.231    0.011    0.011 BOYARSKI  62 CNTR +
T             1.2443   0.0038         FITCH     65 CNTR +                   6/66
T             1.2265   0.0036         LOBKOWICZ 66 CNTR +                   9/66
T             1.221    0.011          FORD      67 CNTR +-                  8/67
T             1.244    0.005          GIACOMELL 67 CNTR +                   8/67
                       (Ideograms below)
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              10 LIFETIME DIFFERENCE,(+)-(-)/AVGE. (PERCENT)

LR   N    THIS QUANTITY IS A MEASURE OF CPT INVARIANCE IN W.I.

LR            0.049    0.097          LOBKOWICZ 66 CNTR     SEE NOTE L      9/66
LR   L    ABOVE IS THE MOST CONSERVATIVE VALUE QUOTED BY AUTHORS            9/66
LR            0.47     0.30           FORD      67 CNTR                     8/67
------ --------- --------- --------- --------- --------- --------- ---------

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

L1   *  DIFFERENCE IN K MU2 RATES ((W1+)-(W1-))/W1
L1           -0.54     0.41           FORD      67 CNTR                     8/67

L2   *  DIFFERENCE IN TAU RATES    ((W2+)-(W2-))/W2
L2           -0.04     0.21           FORD      67 CNTR                     8/67
L2           -0.50     0.90           FLETCHER  67 SPRK                     8/67
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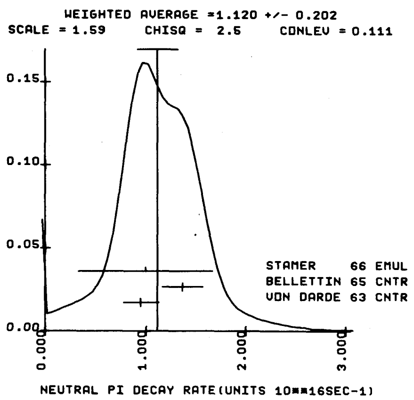

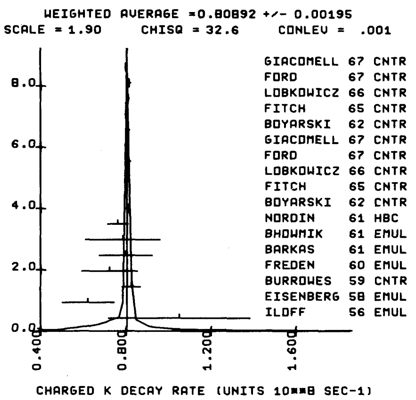

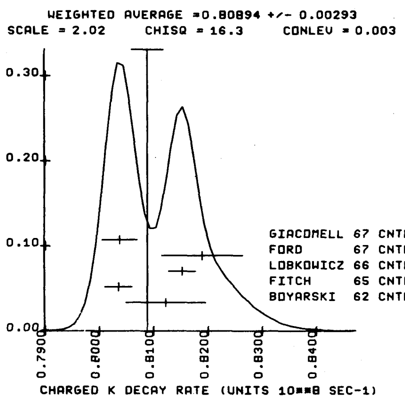

NOTE: Left ideogram contains all the data. Right ideogram contains only those in the central peak.

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                   10  CHARGED K DECAY RATES

W1   *  CHAR. K INTO MU NEU (K MU)      (UN. 10**6 SEC-1) (P1)
W1          51.2       0.8              FORD        67 CNTR +-            8/67

W2   *  CHARG. K INTO PI PI+ PI- (TAU) (UN. 10**6 SEC-1) (P3)
W2           4.496     0.030            FORD        67 CNTR +-            8/67

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                   10  CHARGED K PARTIAL DECAY MODES

P1      CHAR. K INTO MU (NEU)                K MU          S 4S 2
P2      CHAR. K INTO PI PIO                  K PI          S 8S 9
P3      CHAR. K INTO PI PI+ PI-              TAU           S 8S 8S 8
P4      CHAR. K INTO PI 2PIO                 TAU PRIME     S 8S 9S 9
P5      CHAR. K INTO MU PIO NEU              K MU          S 4S 9S 2
P6      CHAR. K INTO E PIO NEU               K E           S 3S 9S 1
P7      POSIT.K INTO PI+ PI- E+NEU           K E+          S 8S 8S 3S 1
P8      POSIT.K INTO PI+ PI+ E-NEU           K E-          S 8S 8S 3S 1
P9       POSIT.K INTO PI+ PI- MU+ NEU        K+MU+ 4       S 8S 8S 4S 2
P10      POSIT.K INTO PI+ PI+ MU- NEU        K+MU- 4       S 8S 8S 4S 2
P11      CHAR. K INTO E NEU                  K E 2         S 3S 1
P12      CHAR. K INTO MU NEU GAMMA           K MU RAD      S 4S 2S 0
P13      CHAR. K INTO PI PIO GAMMA           K PI RAD      S 8S 9S 0
P14      CHAR. K INTO PI PI+ PI- GAMMA       TAU RAD       S 8S 8S 8S 0
P15      CHAR. K INTO PI E+ E-               PI E E        S 8S 3S 3
P16      CHAR. K INTO PI MU+ MU-             PI MU MU      S 8S 4S 4

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                   10  CHARGED K BRANCHING RATIOS

R   C      CLD DATA EXCLUDED

R1   *  CHAR. K INTO MU NEU (MU2)      (UNITS 10**-2)      (P1)/TOTAL
R1   0        58.5      3.0            BIRGE       56 EMUL +
R1   0        56.9      2.6            ALEXANDER 57 EMUL +
R1   FIT      63.42     0.38      OVERALL FITTED RATIO     SEE NOTE A IN TEXT  8/67

R2   *  CHAR. K INTO PI PIO (PI2)      (UNITS 10**-2)      (P2)/TOTAL
R2   C        27.7      2.7            BIRGE       56 EMUL +
R2   0        23.2      2.2            ALEXANDER 57 EMUL +
R2            21.0      0.6            CALLAHAN   65 PBC
R2   *        21.6      0.6            TRILLING   65 RVUE                      6/66
R2   FIT      21.11     0.35      OVERALL FITTED RATIO     SEE NOTE A IN TEXT  8/67

R3   *  CHAR. K INTO PI PI+ PI-(TAU)  (UNITS 10**-2)      (P3)/TOTAL
R3   0         5.6      0.4            BIRGE       56 EMUL +
R3   0         6.8      0.4            ALEXANDER 57 EMUL +
R3   0         5.2      0.3            TAYLOR      59 EMUL +
R3             5.7      0.3            ROE         61 XBC  +                   9/66
R3     2332    5.54     0.12           CALLAHAN   64 XBC  +
R3             5.1      0.2            SHAKLEE    64 XBC  +                   9/66
R3             5.71     0.15           DE MARCO   65 HBC                       6/66
R3             6.0      0.4            YOUNG       65 EMUL +                   6/66
R3   A         5.548     .111     AVERAGE OF ABOVE DATA -- SEE NOTE A IN TEXT  8/67
R3   FIT       5.57     0.03      OVERALL FITTED RATIO     SEE NOTE A IN TEXT  8/67
                        (Ideogram on next page)
R4   *  CHAR. K INTO PI 2PIO (TAU PRIME)(UNITS 10**-2)    (P4)/TOTAL
R4   0         2.1      0.5            BIRGE       56 EMUL +
R4   C         2.2      0.4            ALEXANDER 57 EMUL +
R4   0         1.5      0.2            TAYLOR      59 EMUL +
R4   FIT       1.71     0.07      OVERALL FITTED RATIO     SEE NOTE A IN TEXT  8/67

R5   *  CHAR. K INTO MU PIO NEU (MU3) (UNITS 10**-2)      (P5)/TOTAL
R5   0         2.8      1.0            BIRGE       56 EMUL +
R5   0         5.9      1.3            ALEXANDER 57 EMUL +
R5   0         2.8      0.4            TAYLOR      59 EMUL +
R5   FIT       3.40     0.22      OVERALL FITTED RATIO     SEE NOTE A IN TEXT  8/67

R6   *  CHAR. K INTO E PIO NEU (E3)    (UNITS 10**-2)      (P6)/TOTAL
R6   0         3.2      1.3            BIRGE       56 EMUL +
R6   C         5.1      1.3            ALEXANDER 57 EMUL +
R6   FIT       4.80     0.16      OVERALL FITTED RATIO     SEE NOTE A IN TEXT  8/67

R7   *  POSIT.K INTO PI+ PI- E+ NEU    (UNITS 10**-5)      (P7)/TOTAL

R8   *  POSIT.K INTO PI+ PI+ E- NEU    (UNITS 10**-5)      (P8)/TOTAL
R8             0.2    OR LESS          BIRGE       65 FBC  +  95 PER CT CONF   8/66

R9   *   POSIT.K INTO PI+ PI- MU+ NEU (UNITS 10**-5)      (P9)/TOTAL
R9       1     0.77     0.54      0.50 CLINE       65 FBC  +                   6/66

R10  *   POSIT.K INTO PI+ PI+ MU- NEU (UNITS 10**-6)      (P10)/TOTAL
R10      0     3.0 OR LESS             BIRGE       65 FBC  +  95 PER CT CONF   8/66

R11  *   CHAR. K INTO E NEU            (UNITS 10**-5)      (P11)/TOTAL
R11  *        16.0    OR LESS          BORREANI   64 HBC  +                   8/66
R11      4     2.1      1.8       1.3  BOWEN       67 SPRK +                   8/67

R12  *   CHAR. K INTO MU NEU GAMMA     (UNITS 10**-5)      (P12)/TOTAL

R13  *   CHAR. K INTO PI PIO GAMMA     (UNITS 10**-4)      (P13)/TOTAL
R13  *   18    2.2      0.7            CLINE       64 FBC  +  PI+ KE 55-90 MEV  8/66

R14  *   CHAR. K INTO PI PI+ PI- GAMMA(UNITS 10**-4)      (P14)/TOTAL
R14            1.0      0.4            STAMER      65 EMUL +                   8/66

R15  *   CHAR. K INTO PI E+ E-         (UNITS 10**-6)      (P15)/TOTAL
R15      1     1.1    OR LESS          CAMERINI   64 FBC  +                   8/66

R16  *   CHAR. K INTO PI MU+ MU-       (UNITS 10**-6)      (P16)/TOTAL
R16            3.0    OR LESS          CAMERINI   65 FBC  +  90 PER CT CONF   6/66

R17  *   CHAR. K INTO (PI PIO)/TAU                        (P2)/(P3)
R17 N          3.26     0.23           ROE         61 XBC  +                   8/66
R17 N    KMU RAD VS KMU3 SORTING DIFFICULTIES SUSPECTED BY AUTHORS             9/66
R17            4.40     0.23           SHAKLEE    64 XBC  +                   8/66
R17      134   3.24     0.34           YOUNG       65 EMUL +                   8/66
R17     1045   3.96     0.15           CALLAHAN   66 FBC                       9/66
R17 A          3.989     .237     AVERAGE OF ABOVE DATA -- SEE NOTE A IN TEXT  8/67
R17 FIT        3.789    0.050     OVERALL FITTED RATIO     SEE NOTE A IN TEXT  8/67
                        (Ideogram on next page)
R18  *   CHAR. K INTO (PI 2PIO)/TAU                       (P4)/(P3)
R18            0.30     0.04           ROE         61 XBC  +                   8/66
R18            0.35     0.04           SHAKLEE    64 XBC  +
R18     2027   0.303    0.009          BISI        65 H+HL +                   6/66
R18       17   0.393    0.099          YOUNG       65 EMUL +                   8/66
R18 A          0.306     .009     AVERAGE OF ABOVE DATA -- SEE NOTE A IN TEXT  8/67
R18 FIT        0.306    0.009     OVERALL FITTED RATIO     SEE NOTE A IN TEXT  8/67

R19  *   CHAR. K INTO (MU PIO NEU)/TAU                    (P5)/(P3)
R19 N          0.84     0.14           ROE         61 XBC  +                   8/66
R19 N    KMU RAD VS KMU3 SORTING DIFFICULTIES SUSPECTED BY AUTHORS             9/66
R19            0.59     0.10           SHAKLEE    64 XBC  +                   8/66
R19     2175   0.632    0.035          BISI        65 H+HL +                   8/66
R19       38   0.90     0.16           YOUNG       65 EMUL +                   8/66
R19      636   0.507    0.035          CALLAHAN   66 HLBC +                   8/67
R19 A          0.578     .043     AVERAGE OF ABOVE DATA -- SEE NOTE A IN TEXT  8/67
R19 FIT        0.610    0.019     OVERALL FITTED RATIO     SEE NOTE A IN TEXT  8/67
                        (Ideogram on next page)

R20  *   CHAR. K INTO (E PIO NEU)/TAU                     (P6)/(P3)
R20            0.88     0.11           ROE         61 XBC  +                   8/66
R20      230   0.90     0.06           BORREANI   64 HBC  +                   8/66
R20            0.92     0.08           SHAKLEE    64 XBC  +
R20       37   0.90     0.16           YOUNG       65 EMUL +                   8/66
R20      873   0.722    0.038          CALLAHAN   66 HLBC +                   8/67
R20 A          0.802     .045     AVERAGE OF ABOVE DATA -- SEE NOTE A IN TEXT  8/67
R20 FIT        0.860    0.017     OVERALL FITTED RATIO     SEE NOTE A IN TEXT  8/67
                        (Ideogram on next page)

R21  *   POSIT.K INTO (PI+ PI- E+ NEU)/TAU(UNITS 10**-4)(P7)/(P3)
R21      69    6.7      1.5            BIRGE       65 FBC  +                   8/66

R22  *   POSIT.K INTO (PI+ PI- MU+ NEU)/TAU(UNITS 10**-4)(P9)/(P3)
R22       1    2.5   APPROX            GREINER    64 EMUL +                   8/66

R23  *   CHAR. K INTO (E PIO NEU)/(M2 + P2)(UNITS 10**-2)(P6)/(P1+P2)
R23    1679    5.89     0.21           CESTER     66 SPRK +                   8/67
R23 FIT        5.67     0.11      OVERALL FITTED RATIO     SEE NOTE A IN TEXT  8/67

R24  *   CHAR. K INTO (PI PIO)/(MU NEU)                   (P2)/(P1)
R24            0.3253   0.0065         AUERBACH   67 SPRK +                   8/67
R24 FIT        0.3329   0.0051    OVERALL FITTED RATIO     SEE NOTE A IN TEXT  8/67

R25  *   CHAR. K INTO (E PIO NEU)/(MU NEU)                (P6)/(P1)
R25            0.0785   0.0025         AUERBACH   67 SPRK +                   8/67
R25 FIT        0.0756   0.0015    OVERALL FITTED RATIO     SEE NOTE A IN TEXT  8/67

R26  *   CHAR. K INTO (MU PIO NEU)/(MU NEU)               (P5)/(P1)
R26            0.0602   0.0046         AUERBACH   67 SPRK +                   8/67
R26            0.059    0.004          TSIPIS     66 SPRK +                   9/66
R26 A          0.060     .003     AVERAGE OF ABOVE DATA -- SEE NOTE A IN TEXT  8/67
R26 FIT        0.0536   0.0018    OVERALL FITTED RATIO     SEE NOTE A IN TEXT  8/67

R27  *   CHAR. K INTO (MU NEU)/(TAU)                      (P1)/(P3)
R27 R  427    10.38     0.82           YOUNG       65 EMUL +                   9/66
R27 FIT       11.38     0.09      OVERALL FITTED RATIO     SEE NOTE A IN TEXT  8/67
R27 R ONLY YOUNG MEASURED MU2 DIRECTLY. SEE NOTE FOLLOWING THE K+ BRANCHING
        RATIOS LISTINGS
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1. In a number of experiments, the $K\mu 2$ branching ratio is not determined from kinematically identified events, but essentially by subtracting the sum of other branching ratios from one. Since our averaging program applies this constraint, we omit those unmeasured branching ratios from the input.

2. The tau branching ratios are not all in agreement within the stated errors. Since one would expect the number of taus to be reliably determined in each case, we take this to indicate a systematic error in the total number of K-decays, which would be reflected in errors in the other branching ratios.

Since there are some recent and precise measurements of the tau branching ratio, the following method has been devised. The ratio of the other modes to the number of taus is taken whenever appropriate (of course, in a number of experiments this is the quantity actually measured, with some value of the tau branching ratio being used to convert this measurement to an absolute branching ratio). All the recent measurements of the tau branching ratio are used, and together with the ratios of other modes to taus, are entered in the averaging program.

If there is, as suspected, a large correlation between the tau branching ratio and the other branching ratios, in the presence of certain kinds of systematic errors, this method takes advantage of it, with an unimportant increase in the quoted errors.

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                   10  CHARGED K FORM FACTORS                              8/67

LM   *   LAMBDA +  (LINEAR ENERGY DEPENDENCE OF F+ IN KE3 DECAY)           8/67

LM      217   +0.038     .045            BROWN      62 XEBC +              8/67
LM      230   -0.04      .05             BORREANI   64 HBC  +              8/67
LM      407   -0.010     .029            JENSEN     64 XEBC +              8/67
LM      457   +0.025     .018            BELLOTTI   66 FBC  +              8/67
LM            +0.016     .016            IMLAY      67 SPRK +              8/67
LM      515   +0.026     .013      .014  KALMUS     67 FBC  +              8/67
LM        A   +0.020     .008             AVERAGE OF ABOVE DATA

XIA  *   XIA = F-/F+ (DETERMINED FROM SPECTRA AND KMU3/KE3)

XIA      76   +1.8      1.6              BROWN      62 XEBC +  MU+,PIO SPECTRA   8/67
XIA      87   +0.7      0.5              GIACOMELL 64 EMUL +  MU+ SPECTRUM      8/67
XIA           -0.1      0.7              JENSEN     64 XEBC +  MU+,PIO SPECTRN   8/67
XIA           -0.17     0.75      0.99   SHAKLEE    64 XEBC +  KMU3/KE3          8/67
XIA           +0.6      0.5              BISI       65 HBC  +  KMU3/KE3,MU SPEC  8/67
XIA  *      BTWN +0.2 AND +1.4           CUTTS      65 SPRK +  MU+ SPECTRUM      8/67
XIA    1509   +0.4      0.4       0.22   CALLAHAN   66 FRBC +  KMU3/KE3          8/67
XIA    2648    0.0      1.1       0.9    CALLAHAN   66 FRBC +  MU+ SPECTRUM      8/67
XIA     444   +0.72     0.37             CALLAHAN   66 FRBC +  PIO SPECTRUM      8/67
XIA           +0.75     0.50             AUERBACH   67 SPRK +  KMU3/KE3          8/67
XIA     552   +1.3      0.5              GARLAND    67 SPRK +  KMU3/KE3          8/67
XIA       A   +0.60      .16              AVERAGE OF ABOVE DATA

XIB  *   XIB = F-/F+ (DETERMINED FROM MU POLARIZATION IN KMU3)

XIB    2100   +1.2      2.4       1.8    BORREANI   65 PBC  +  POLARIZATION      8/67
XIB  *      BTWN -4.0 AND +1.7           CUTTS      65 SPRK +  POLARIZATION      8/67
XIB           -1.32     0.33             AACHEN     66 FRBC +  POLARIZATION      8/67
XIB     397   -1.4      1.8              CALLAHAN   66 FRBC +  TOTAL POLAR.      8/67
XIB    2950   -0.7      0.9       3.3    CALLAHAN   66 FRBC +  LONG. POLAR.      8/67
XIB       A   -1.25      .32              AVERAGE OF ABOVE DATA
XIB  *   MEAS OF XI USING POLARIZATION IS LESS SENSITIVE TO FORM FACTOR
XIB  *   VARIATIONS AND PROBABLY GIVES A BETTER EXPERIMENTAL VALUE

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

BIRGE	56 NC 4 634	BIRGE,PERKINS,PETERSCN,STCRK,WHITEHEA//LRL
ILOFF	56 PR 102 927	ILOFF,GOLDHABER,LANNUTTI,GILBERT + /// LRL
ALEXANDE	57 NC 6 478	ALEXANDER,JOHNSTCN,OCEALLAIGH//DUBLIN INST
COHEN	57 FUND.CONS.PHYS.	E R COHEN,K M CROWE,J DUMCNC // AI+LRL+CIT
EISENBER	58 NC 8 663	EISENBERG,KOCH,LOHRMANN,NIKOLIC + /// BERN
BURROWES	59 PRL 2 117	BURROWES,CALDWELL,FRISCH,HILL + ////// MIT
TAYLOR	59 PR 114 359	S TAYLOR,HARRIS,CREAR,LEE,BAUMEL//COLUMBIA
FREDEN	60 PR 118 564	S C FREDEN,F C GILBERT,R S WHITE ///// LRL
BARKAS	61 PR 124 1209	BARKAS,DYER,MASON,NORRIS,NICKOLS,SMIT//LRL
BHOWMIK	61 NC 20 857	B BHOWMIK,P C JAIN,P C MATHUR //DELHI UNIV
NORDIN	61 PR 123 2166	PAUL NORDIN JR /////////////////////// LRL
ROE	61 PRL 7 346	ROE,SINCLAIR,BROWN,GLASER + ///// MICH+LRL
BOYARSKI	62 PR 128 2398	BOYARSKI,LOH,NIEMELA,RITSON ////////// MIT
BROWN	62 PRL 8 450	BROWN,KADYK,TRILLING,ROE+/////////LRL,MICH
BARKAS	63 PRL 11 26	W H BARKAS,J N DYER,H H HECKMAN ////// LRL
BIRGE	63 PRL 11 35	BIRGE,ELY,GIDAL,CAMERINI + // LRL+WIS+BARI
ADAIR	64 PL 12 67	ADAIR,LEIPUNER // YALE,BNL
BORREANI	64 PL 12 123	G BORREANI,G RINAUDO,A WERBROUCK /// TURIN
CALLAHAN	64 PR 136 B 1463	A CALLAHAN,R MARCH,R STARK ///// WISCONSIN
CAMERINI	64 PRL 13 318	CAMERINI,CLINE,FRY,POWELL // WISCONSIN+LRL
CLINE	64 PRL 13 101	D CLINE, W F FRY /////////////// WISCONSIN
GIACOMEL	64 NC 34 1134	GIACOMELLI,MONTI,QUARENI+// BOLOGNA,MUNICH
GREINER	64 PRL 13 284	D GREINER, W OSBORNE, W BARKAS /////// LRL
JENSEN	64 PR 136 B1431	JENSEN,SHAKLEE,ROE,SINCLAIR ///// MICHIGAN
SHAKLEE	64 PR 136 B 1423	SHAKLEE,JENSEN,ROE,SINCLAIR ///// MICHIGAN
BIRGE	65 PR 139 B 1600	BIRGE,ELY,GIDAL,CAMERINI,CLINE + //LRL+WIS
BISI	65 NC 35 768	BISI,BORREANI,CESTER,FERRARO + ///// TURIN
BISI	65 PR 139 B 1068	BISI,MARZARI-CHIESA,RINAUDO // TURINO,INFN
BORREANI	65 PR 140 1686	BORREANI,GIDAL,RINAUDO,CAFORIO+/BARI,TURIN
CALLAHAN	65 PRL 15 129	A CALLAHAN,D CLINE ///////////// WISCONSIN
CAMERINI	65 NC 37 1795	CAMERINI,CLINE,GIDAL,KALMUS,KERNAN/WIS+LRL
CLINE	65 PL 15 293	A CLINE,W F FRY //////////////// WISCONSIN
CUTTS	65 PR 138 B969	CUTTS,ELIOFF,STIENING // // LRL
DEBOUARD	65 PL 15 58	DEBOUARD,DEKKERS,JORDAN+/MUNICH,CERN,ORSAY
DE MARCO	65 PR 140 B 1430	DE MARCO,GROSSO,RINAUDO ////// TURINO+CERN
FITCH	65 PR 140 B 1088	FITCH,QUARLES,WILKINS //PRINCETON+MT HOLYK
GREINER	65 ARNS 15 67	QUOTED BY BARKAS // LRL
STAMER	65 PR 138 B 440	STAMER,HUETTER,KOLLER,TAYLOR,GRAUMAN//STEV
TRILLING	65 UCRL 16473	GEORGE H TRILLING //////////////////// LRL
TRILLING	65 IS UPDATED FROM	1965 ARGONNE CONF, PAGE 5
YOUNG	65 UCRL 16362	PCH-SHIEN YOUNG (THESIS,BERKELEY) //// LRL
SEE ALSO	PR 156 1464	P-S YOUNG,W.Z.OSBORNE,W.H.BARKAS ///// LRL
AACHEN	66 BERKELEY CONF 2B	AACHEN-BARI-BERGEN-CERN-EP-NIJ-ORSAY-PADUA
BELLOTTI	66 PL 20 690	BELLOTTI,FIORINI,PULLIA+ /////////// MILAN
CALLAHAN	66 PR 150 1153	CALLAHAN,CAMERINI+/WISC,LRL,RIVERSIDE,BARI
ALSO	66 NC 44A 90	A C CALLAHAN /////////////////////WISCONSIN
CESTER	66 PL 21 343	CESTER,ESCHSTRUTH,ONEILL+ //PRINCETON-PENN
CESTER	66 SEE ALSO FOOTNOTE 1 OF AUERBACH 67	
LOBKOWIC	66 PRL 17 548	LOBKOWICZ,MELISSINOS,NAGASHIMA+ //ROCH+BNL
TSIPIS	66 BERKELEY CONF	+MEYER,ROSEN+ //COLUMBIA+RUTGERS+ROCH+WISC
AUERBACH	67 PR 155 1505	AUERBACH,DOBBS,MANN+ ////// PRINCETON-PENN
BOWEN	67 PR 154 1314	BOWEN,MANN,MCFARLANE,HUGHES+/PENN-PRINCETO
FLETCHER	67 PRL 19 98	FLETCHER,BEIER,EDWARDS,+//////////ILLINOIS
FORD	67 PRL 18 1214	+LEMONICK,NAUENBERG,PIROUE //PRINCETON
GARLAND	67 THESIS--NEVIS 161	ROBERT W GARLAND /////////////// COLUMBIA
IMLAY	67 PREPRINT	IMLAY,ESCHSTRUTH,FRANKLIN+///////PRINCETON
KALMUS	67 UCRL 17351	KALMUS,KERNAN ///////////////////////// LRL
GIACOMEL	67 BNL 11056	GIACOMELLI,KYCIA,LI,TEIGER /////////// BNL

QUANTUM NUMBER DETERMINATIONS NOT REFERRED TO IN THE DATA CARDS

BLOCK 62 CERN CONF 371 BLOCK,LENDINARA,MONARI /////// NWU+BOLOGNA

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K^0

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

11 KO MASS (MEV)

M		496.1	0.4	CHRISTENS	64 SPRK		
M	2223	497.44	0.33	KIM	65 HBC	KO FROM PBAR P	6/66
M	4500	496.9	0.5	BALTAY	66 HBC	KO FROM PBAR P	6/66

(Ideogram below)

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11 KO-K CH. MASS DIFFERENCE (MEV)

D		3.9	0.6	ROSENFELD	59 HBC	-		
D		5.4	1.1	CRAWFORD	59 HBC	+		
D	9	3.90	0.25	BURNSTEIN	65 HBC	-		
D	17	4.18	0.18	ENGELMANN	65 HBC			6/66
D	25	3.71	0.35	KIM	65 HBC	-	K- P TO KO N	6/66

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

CRAWFORD	59 PRL 2 112	CRAWFORD,CRESTI,GOOD,STEVENSON,TICHO //LRL
ROSENFEL	59 PRL 2 110	A H ROSENFELD,F SOLMITZ,R D TRIPP //// LRL
CHRISTEN	64 PRL 13 138	CHRISTENSON,CRONIN,FITCH,TURLAY//PRINCETON
BURNSTEI	65 PR 138 B 895	R A BURNSTEIN,H A RUBIN ///////// MARYLAND
ENGELMAN	65 PRI COMM	ENGLEMAN,FILTHUTH ////////////// HEIDELBERG
KIM	65 PR 140 B 1334	J K KIM,L KIRSCH,D MILLER /////// COLUMBIA
BALTAY	66 PR 142 932	BALTAY,SANDWEISS,STONEHILL + //YALE+BNL

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K_1^0

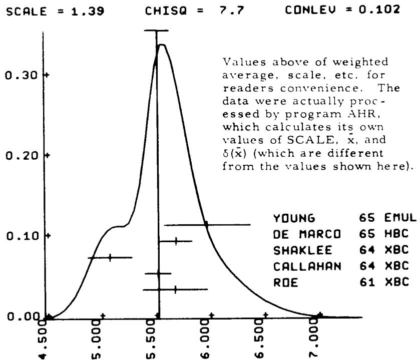
12 SHORT-LIVED NEUTRAL K (498, JP=0-) I=1/2

12 KO1 LIFETIME (UNITS 10**-10)

T		90	1.07	0.13	0.13	BOLDT	58 CC		
T	U	62	0.81	0.23	0.15	BROWN	58 PBC		
T	U	29	0.84	0.35	0.19	COOPER	58 CC		
T	U	39	1.15	0.40	0.25	BLUMENFEL	58 CC		
T	U	259	1.06	0.08	0.06	EISLER	58 PBC		
T	U	UNPUBLISHED DATA EXCLUDED							
T		512	0.94	0.05	0.05	CRAWFORD	59 HBC		
T		63	1.09	0.18	0.15	BOWEN	60 CC		
T		378	0.94	0.05	0.05	BERTANZA	62 HBC		
T		503	0.87	0.05		CHRETIEN	63 PBC		
T		545	0.86	0.04		KREISLER	64 SPRK		
T			0.866	0.016		ALFF-STEI	66 SPRK		9/66
T		572	0.90	0.06	0.05	AUERBACH	66 SPRK		8/67
T		4500	0.92	0.04		BALTAY	66 HBC		6/66
T			0.904	0.024		BOTT-BODE	66 SPRK		9/66
T			0.858	0.014		HILL	66 DBC		9/66
T		5000	0.843	0.013		KIRSCH	66 HBC		6/66

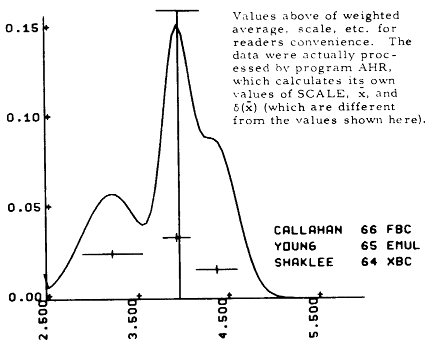
(Ideogram below)

WEIGHTED AVERAGE =5.548 +/- 0.111
SCALE = 1.39 CHISQ = 7.7 CONLEV = 0.102



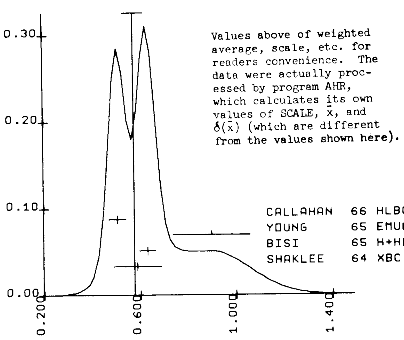
CHARGED K TAU B.F. PI+PI-PIO (UN 10**-2)

WEIGHTED AVERAGE =3.989 +/- 0.237
SCALE = 2.01 CHISQ = 8.1 CONLEV = 0.018



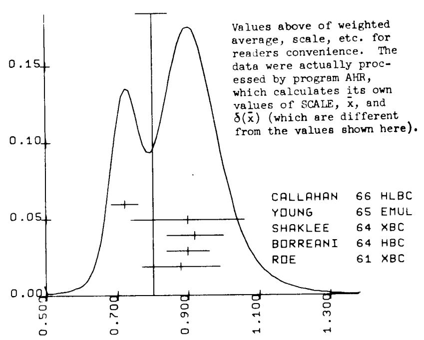
CHARGED K B.R. (2PI)/(TAU)

WEIGHTED AVERAGE =0.5779 +/- 0.0429
SCALE = 1.80 CHISQ = 6.5 CONLEV = 0.039



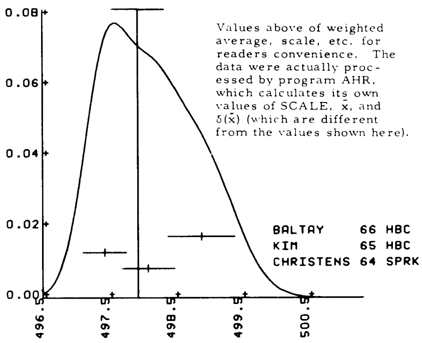
CHARGED K B.R. (MU 3)/(TAU)

WEIGHTED AVERAGE =0.8024 +/- 0.0451
SCALE = 1.59 CHISQ = 10.2 CONLEV = 0.038



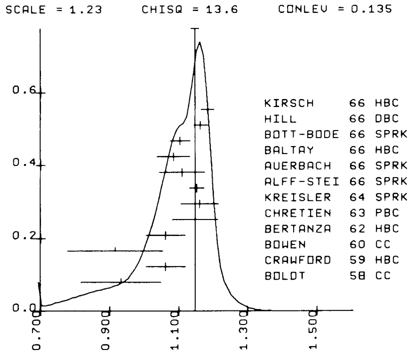
CHARGED K B.R. (E 3)/(TAU)

WEIGHTED AVERAGE =497.953 +/- 0.397
SCALE = 1.75 CHISQ = 6.1 CONLEV = 0.046



NEUTRAL K MASS (MEV)

WEIGHTED AVERAGE =1.1497 +/- 0.0117
SCALE = 1.23 CHISQ = 13.6 CONLEV = 0.135



K SHORT DECAY RATE (UNITS 10**10 SEC-1)

12 K01 PARTIAL DECAY MODES

P1	K01 INTO PI+ PI-	S 8S 8
P2	K01 INTO PI0 PI0	S 9S 9
P3	KCS INTO MU+ MU-	S 4S 4

12 K01 BRANCHING RATIOS

R1	*	K01 INTO (PI+ PI-)/TOTAL						(P1)/TOTAL	
R1			0.68	0.04	CRAWFORD	59	HBC		
R1			0.70	0.08	COLUMBIA	60	HBC		
R1			0.740	0.024	ANDERSON	62	HBC		
R1	A		0.723	.020	AVERAGE OF ABOVE DATA --			SEE NOTE A IN TEXT	8/67
R1	FIT		0.693	0.012	OVERALL FITTED RATIO			SEE NOTE A IN TEXT	8/67
R2	*	K01 INTO (PI0 PI0)/TOTAL						(P2)/TOTAL	
R2			0.27	0.11	CRAWFORD	59	HBC		
R2			0.26	0.06	BAGLIN	60	PBC		
R2			0.30	0.035	BROWN	61	XBC		
R2		1066	0.335	0.014	BROWN	63	XBC		
R2		198	0.288	0.021	CHRETIEN	63	PBC		
R2	A		0.316	.014	AVERAGE OF ABOVE DATA --			SEE NOTE A IN TEXT	8/67
R2	FIT		0.307	0.012	OVERALL FITTED RATIO			SFE NOTE A IN TEXT	8/67

(Ideogram below)

R3	*	(K01 INTO PI+ PI- PI0)/(K02 INTO PI+ PI- PI0)							
R3			0.45	OR LESS	BEHR	66	HLBC	90 PER CT CONF	8/66
R4	*	KCS INTO (MU+ MU-)/CHARGED (UNITS 10**-5)						(P3)/(P1)	
R4			10.0	OR LESS	BOTT-BODE	67	SPRK	90 PER CT CONF	8/67

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

BLUMENFE 58 CERN CONF 272 H BLUMENFELD,W CHINONSKY,L LEDERMAN//COLUM
BOLDT 58 PRL 1 150 E BOLDT,D O CALDWELL,Y PAL /////////// MIT
BROWN 58 CERN CONF 272 J BROWN,D GLASER + ////////////// MICHIGAN
COOPER 58 CERN CONF 272 W A COOPER,H FILTHUTH + ///// JUNGFRAUJUCH
EISLER 58 CERN CONF 272 F EISLER,R PLANO + // BNL+CCL+BOLOGNA+PISA
CRAWFORD 59 PRL 2 266 CRAWFORD,CRESTI,DOUGLASS,GOOD,TICHO +//LRL

BAGLIN 60 NC 18 1043 BAGLIN,BLOCH,BRISSON,HENNESSY + //PARIS EP
BIRGE 60 ROCH CONF 601 R W BIRGE,P P ELY + //////// LRL+WISCCNSIN
BOWEN 60 PR 119 2030 BOWEN,HARDY,REYNOLDS,SUN,MCCRE+/PRINCE+BNL
COLUMBIA 60 ROCH CONF 727 M SCHWARTZ + //////////////////// COLUMBIA
MULLER 60 PRL 4 418 MULLER,BIRGE,FOWLER,GOOD,PICCIOMI+/LRL+BNL

BROWN 61 NC 19 1155 BROWN,BRYANT,BURNSTEIN,GLASER,KADYK+//MICH
FITCH 61 NC 22 1160 V FITCH,P PIROUE,R PERKINS /// PRINCE+LASL
GOOD 61 PR 124 1223 GOOD,MATSEN,MULLER,PICCICNI + //////// LRL
ANDERSON 62 CERN CONF 836 J A ANDERSON,F S CRAWFORD + ////////// LRL
BERTANZA 62 PREPRINT 0105 BERTANZA,CONNOLLY,CULWICK,EISLER + /// BNL
(BERTANZA UNPUBLISHED,BUT RECERTIFIED BY AUTHORS,AUGUST 66)
CRAWFORD 62 CERN CONF 827 F S CRAWFORD ///////////////////////// LRL

BROWN 63 PR 130 769 BROWN,KADYK,TRILLING,ROE + ///LRL+MICHIGAN
CHRETIEN 63 PR 131 2208 CHRETIEN+ //// BRANDEIS+BROWN+HARVARD+ MIT
KREISLER 64 PR 136 B 1074 M KREISLER,O OVERSETH,J CRONIN / PRINCETON
AUERBACH 65 PRL 14 192 AUERBACH,LANDE,MANN,SCIULLI,UTO + /// PENN
TRILLING 65 UCRL 16473 GEORGE H TRILLING ////////////////////// LRL
TRILLING 65 IS UPDATED FROM 1965 ARGONNE CONF , PAGE 115

ALFF-STE 66 PL 21 595 ALFF-STEINBERGER,HEUER,KLEINKNECHT +//CERN
AUERBACH 66 PR 149 1052 AUERBACH,DOBBS,LANDE,MANN,SCIULLI+/// PENN
SEE ALSO AUERBACH 65
BALTAY 66 PR 142 932 BALTAY,SANDWEISS,STONEHILL + /// YALE+BNL
BEHR 66 PL 22 540 BEHR,BRISSON,PETIAU+//EP,MILAN,PADUA,ORSAY
BOTT-BOD 66 BERKELEY CONF. BOTT-BODENHAUSEN,DE BOUARD + // CERN
HILL 66 BERKELEY CONF. HILL,ROBINSON,SAKITT + // BNL+CARNEGIE
KIRSCH 66 PR 147 939 L KIRSCH,P SCHMIDT ////////////// COLUMBIA

BOTT-BOD 67 PL 248 194 BOTT-BODENHAUSEN,DE BOUARD,CASSEL+ ///CERN

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K^0_2

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

13 K02-K01 MASS DIFFERENCE (UNITS OF INVERSE K01 LIFE)

D	*		1.9	0.3		FITCH	61	CNTR		
D			0.84	0.29	0.21	GOOD	61	PBC		
D			0.88	0.20		CAMERINI	62	PBC	SEE NOTE C BELOW	8/67
D	C	VALUE CHANGED FROM 1.5 (SEE TABLE 1 OF CAMERINI 66)								8/67
D			0.47	0.21		AUBERT	65	PBC		6/66
D			0.26	0.36	0.26	BALDO-CEO	65	PBC	ASS.CP CONS.	
D			0.55	0.1		CHRISTENS	65	SPRK		6/66
D	*		0.60	OR LESS		FITCH	65	SPRK	CF. MEISNER 66	7/66
D	V	130	0.82	0.14		VISHNEVSK	65	SPRK	CU AND AL REGEN	8/67
D			0.445	0.034		ALFF-STEI	66	SPRK		6/66
D			0.52	0.15	0.16	BALATZ	66	SPRK	SEE NOTE V	9/66
D	V	BALATZ 66 IS A REANALYSIS OF VISHEVSKY 65								8/67
D		84	0.36	0.21	0.31	BALDO-CEC	66	HLBC	K0+N INTO HYPER.	8/67
D			0.480	0.024		BOTT-BODE	66	SPRK		9/66
D		77	0.50	0.15		CAMERINI	66	HBC, DEC	K0+N INTO HYPER	8/67
D		72	+ 0.54	0.15		CANTER	66	DBC	K0 SCATTER IN D2	11/66
D		95	0.54	0.09	0.14	CHANG	66	HBC	K0+P INTO HYPER.	8/67
D			0.72	0.15		FUJII	66	SPRK	IRON REGENERATOR	9/66
D		89	0.62	0.16		HILL	66	DBC	K0+D INTO HYPER.	9/66
D			+0.35	0.15		JOVANOVIC	66	SPRK	C+URANIUM REGEN.	11/66
D			+ 0.44	0.06		MEHLHOP	66	SPRK		9/66
D		59	0.65	0.30		MEISNER 1	66	HBC	SEE NOTE M	6/66
D	M	+ SIGN FAVORED				MEISNER 2	66	HBC		9/66
D			0.59	0.07		MISCHKE	66	SPRK		9/66

(Ideogram below)

13 K02 LIFETIME (MICROSEC)

T	*	ASSUMED DS=DQ AND DELTA I=1/2				CRAWFORD	59	HBC		
T		34	0.081	0.032	0.024	BARDON	58	CC		
T		15	0.051	0.024	0.013	DARMON	62	FBC		
T			0.053	0.006		FUJII	64	SPRK		8/67
T		1700	0.061	0.015	0.012	ASTBURY3	65	CC		8/67
T			0.0515	0.0014		DEVLIN	67	CNTR		8/67
T	L		0.050	0.005		LOWYS	67	HLBC	SEE NOTE L BELOW	8/67
T	L	SUM OF PARTIAL DECAY RATES								

13 K02 PARTIAL DECAY MODES

P1	K02 INTO 3PI0	S 9S 9S 9
P2	K02 INTO PI+ PI- PI0	S 8S 8S 9
P3	K02 INTO PI MU NEUTRINO	S 8S 4S 2
P4	K02 INTO PI E NEUTRINO	S 8S 3S 1
P5	K02 INTO PI+ PI-	S 8S 8
P6	K02 INTO MU+ MU-	S 4S 4
P7	K02 INTO E+ E-	S 3S 3
P8	K02 INTO E MU	S 3S 4
P9	K02 INTO TWO GAMMAS	S 0S 0
P10	K02 INTO PI+ PI- GAMMA	S 8S 8S 0
P11	K02 INTO PI0 PI0	S 9S 9

13 K02 DECAY RATES

W1	*	K02 INTO PI0 PI0 PI0 (UNITS 10**6 SEC-1) (P1)								
W1		54	5.22	1.03	0.84	BEHR	66	HLBC	ASSUMES CP	8/66
W2	*	K02 INTO PI+ PI- P0 (UNITS 10**6 SEC-1) (P2)								
W2		18	3.26	0.77		ANDERSON	65	HBC		8/66
W2		14	1.4	0.4		FRANZINI	65	HBC		6/66
W2		136	2.62	0.28	0.27	BEHR	66	HLBC	ASSUMES CP	8/66
W2			2.54	0.43		HILL	66	DBC		9/66
W2	A		2.357	.321	AVERAGE OF ABOVE DATA --				SEE NOTE A IN TEXT	8/67

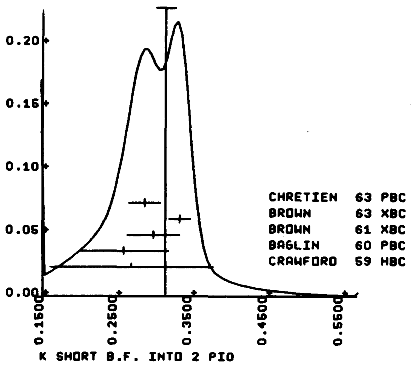
(Ideogram below)

W3	*	K02 INTO PI E NEUTRINO (UNITS 10**6 SEC-1) (P4)								
W3			7.52	0.85	0.72	AUBERT	65	HLBC	DS=DQ,CP ASSUMED	8/67
W4	*	K02 INTO CHARGED (3-BODY) (UNITS 10**6 SEC-1) (P2+P3+P4)								
W4		98	15.1	1.9		AUERBACH	66	SPRK		8/67
W5	*	K02 INTO LEPTONIC (KMU3+KE3) (UNITS 10**6 SEC-1) (P3+P4)								
W5		109	9.4	1.3		FRANZINI	65	HBC		6/66
W5		54	11.3	1.9		GOLDEN	66	HBC		9/66
W5		335	10.3	0.8		HILL	67	DBC	K+N TO K0 P	8/67
W5	A		10.19	.64	AVERAGE OF ABOVE DATA --				SEE NOTE A IN TEXT	8/67
W6	*	K02 INTO PI MU NEUTRINO UNITS 10**6 SEC-1) (P3)								
W6		19	4.54	1.24	1.08	LOWYS	67	HLBC		8/67

13 K02 BRANCHING RATIOS

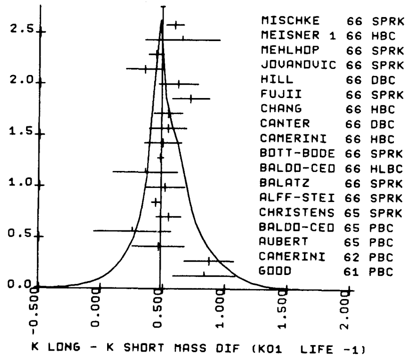
R1	*	K02 INTO (PI0 PI0 PI0)/CHARGED							(P1)/(P2+P3+P4)	
R1		24	0.24	0.08		ANIKINA	64	CC		6/66
R1			0.31	0.06		KULYUKINA	66	CC		9/66
R1	A		0.285	.046	AVERAGE OF ABOVE DATA --				SEE NOTE A IN TEXT	8/67
R1	FIT		0.293	0.036	OVERALL FITTED RATIO				SEE NOTE A IN TEXT	8/67
R2	*	K02 INTO (PI+ PI- PI0)/CHARGED							(P2)/(P2+P3+P4)	
R2		59	0.185	0.038		ASTIER	61	CC		8/66
R2		79	0.151	0.020		ADAIR	64	HBC		8/66
R2		75	0.157	0.03	0.04	LUERS	64	HBC		8/66
R2		66	0.15	0.03	0.04	ASTBURY 1	65	CC		8/66
R2		326	0.159	0.015		ASTBURY 2	65	CC		6/66
R2		566	0.178	0.017		GUIDONI	65	HBC		6/66
R2		* 1729	0.144	0.004		HOPKINS	65	HBC	SEE HOPKINS 67	6/66
R2		126	0.162	0.015		HAWKINS	66	HBC		6/66
R2		180	0.17	0.03		KULYUKINA	66	CC		9/66
R2			0.161	0.005		HOPKINS	67	HBC		8/67
R2	A		0.162	.004	AVERAGE OF ABOVE DATA --				SEE NOTE A IN TEXT	8/67
R2	FIT		0.163	0.004	OVERALL FITTED RATIO				SEE NOTE A IN TEXT	8/67

WEIGHTED AVERAGE =0.3161 +/- 0.0136
SCALE = 1.25 CHISQ = 4.7 CONLEV = 0.196



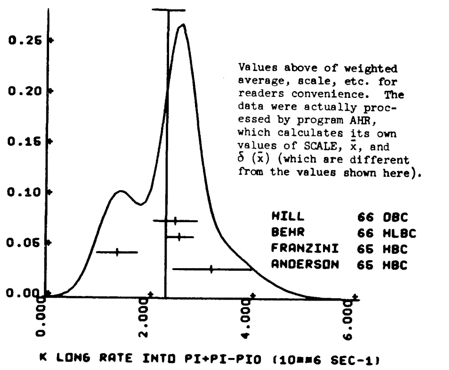
K SHORT B.F. INTO 2 PIO

WEIGHTED AVERAGE =0.4860 +/- 0.0166
SCALE = 1.00 CHISQ = 13.0 CONLEV = 0.450



K LONG - K SHORT MASS DIF (K01 LIFE -1)

WEIGHTED AVERAGE =2.357 +/- 0.321
SCALE = 1.66 CHISQ = 8.2 CONLEV = 0.042



Values above of weighted average, scale, etc. for readers convenience. The data were actually processed by program AHR, which calculates its own values of SCALE, $\bar{x}$, and $\delta(\bar{x})$ (which are different from the values shown here).

K LONG RATE INTO PI+PI-PIO (10**6 SEC-1)

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R3   *  K02 INTO (PI MU NEUTRINO)/CHARGED                      (P3)/(P2+P3+P4)
R3     479     0.356     0.07             LUERS      64 HBC
R3             0.39      0.08      0.10  ASTBURY 1 65 CC                          7/66
R3     330     0.32      0.07             KULYUKINA 66 CC                         9/66
R3   A         0.350      .043     AVERAGE OF ABOVE DATA -- SEE NOTE A IN TEXT  8/67
R3   FIT       0.361     0.014     OVERALL FITTED RATIO     SEE NOTE A IN TEXT  8/67

R4   *  K02 INTO (PI E NEUTRINO)/CHARGED                       (P4)/(P2+P3+P4)
R4     479     0.487     0.05             LUERS      64 HBC
R4             0.46      0.08      0.10  ASTBURY 1 65 CC                          7/66
R4     500     0.51      0.06             KULYUKINA 66 CC                         9/66
R4   A         0.491      .035     AVERAGE OF ABOVE DATA -- SEE NOTE A IN TEXT  8/67
R4   FIT       0.476     0.014     OVERALL FITTED RATIO     SEE NOTE A IN TEXT  8/67

R5   *  K02 INTO (PI E NEU)/((PI E NEU)+(PI MU NEU))         (P4)/(P3+P4)
R5     320     0.415     0.120            ASTIER     61 CC
R5   FIT       0.569     0.017     OVERALL FITTED RATIO     SEE NOTE A IN TEXT  8/67

R6   *  K02 INTO(PI+ PI- PI0)/TOTAL                            (P2)/TOTAL
R6      16     0.18      0.05             STERN      64 HBC
R6   FIT       0.126     0.005     OVERALL FITTED RATIO     SEE NOTE A IN TEXT  8/67

R7   *  K02 INTO(LEPTON PI NEUTRINO)/TOTAL                     (P3+P4)/TOTAL
R7      14     0.58      0.17             ALEXANDER 62 HBC
R7   FIT       0.644     0.018     OVERALL FITTED RATIO     SEE NOTE A IN TEXT  8/67

R8   *    K02 INTO (2 GAMMA)/TOTAL      (UN. 10**-4)           (P9)/TOTAL
R8             1.3       0.6              CRIEGEE    66 SPRK                      8/66
R8      33     7.4       1.6              CRONIN     67 SPRK                      8/67
R8   A         2.052     2.005     AVERAGE OF ABOVE DATA -- SEE NOTE A IN TEXT  8/67

R9   *  K02 INTO (PI+ PI-)/CHARGED      (UNIT 10**-3)          (P5)/(P2+P3+P4)
R9      45     2.0       0.4              CHRISTENS 64 SPRK
R9      54     2.06      0.35             GALBRAITH 65 SPRK
R9             1.97      0.18             CRONIN     65 SPRK                      6/66
R9             1.93      0.26             BASILE     66 SPRK                      9/66
R9             1.993     0.080            BOTT-BODE 66 SPRK                       9/66
R9             2.22      0.27             DEKKERS    66 CNTR                      6/66
R9   A         2.003      .066     AVERAGE OF ABOVE DATA -- SEE NOTE A IN TEXT  8/67

R10 *  K02 INTO (PI MU NEU)/(PI E NEU)                         (P3)/(P4)
R10            0.81      0.19             ADAIR      64 HBC                       6/66
R10            0.78      0.15             DE BOUARD 65 CNTR
R10    273     0.7       0.2              HAWKINS    67 HBC                       8/67
R10            0.81      0.08             HOPKINS    67 HBC                       8/67
R10 A          0.794      .063     AVERAGE OF ABOVE DATA -- SEE NOTE A IN TEXT  8/67
R10 FIT        0.758     0.517     OVERALL FITTED RATIO     SEE NOTE A IN TEXT  8/67

R11 *  K02 INTO (MU+MU-)/CHARGED    (UNITS 10**-6)           (P6)/(P2+P3+P4)
R11          100.0 OR LESS                ANIKINA    65 CC                        6/66
R11           50.0    OR LESS             ABASHIAN  66 SPRK    90 PER CT CONF     8/66
R11          250.0    OR LESS             ALFF       66 SPRK   0.90 CONF. LEVEL   9/66
R11            2.0    OR LESS             BOTT-BODE 67 SPRK     90 PER CT CONF    8/67

R12 *    K02 INTO (PI+ PI- GAMMA)/TOTAL (UNITS 10**-3)  (P10)/TOTAL
R12           15.0 OR LESS                ANIKINA    65 CC                        6/66
R12            5.0  OR LESS               BELLOTTI  66 HLBC                       8/67
R12            3.0 OR LESS                NEFKENS    66 SPRK                      6/66

R13 *    K02 INTO (E+ E-)/CHARGED     (UNITS 10**-6)       (P7)/(P2+P3+P4)
R13         1000.0 OR LESS                ANIKINA    65 CC                        6/66
R13           50.0  OR LESS               ABASHIAN  66 SPRK    90 PRCT CONF       6/66
R13          200.0  OR LESS               ALFF       66 SPRK   90 PRCT CONF       6/66
R13           23.0   OR LESS              BOTT-BODE 67 SPRK     90 PER CT CONF    8/67

R14 *    K02 INTO (E MU)/CHARGED      (UNITS 10**-4)       (P8)/(P2+P3+P4)
R14           10.0   OR LESS              ANIKINA    65 CC                        6/66
R14            1.0    OR LESS             CARPENTER 66 SPRK    90 PER CT CONF     8/66
R14            0.107 OR LESS              BOTT-BODE 67 SPRK     90 PER CT CONF    8/67

R15 *   K02 INTO(E+ PI- NEU)/(E- PI+ NEU)
R15     97     0.90      0.18             NEAGU      61 CC
R15            1.01      0.16             LUERS      64 HBC                       8/66
R15    894     0.99      0.023            KULYUKINA 66 CC                         9/66
R15   1539     1.06      0.05             VERHEY     66 SPRK                      8/67
R15 A          1.001      .026     AVERAGE OF ABOVE DATA -- SEE NOTE A IN TEXT  8/67

R16 *   K02 INTO(MU+ PI- NEU)/(MU- PI+ NEU)
R16   3200     1.02    0.04               ABASHIAN  66 SPRK                       8/66

R17 *       K02 INTO (PI0 PI0)/TOTAL  (UNITS 10**-3)       (P11)/TOTAL
R17      7     1.2       1.5       1.2   CRIEGEE    66 SPRK                      7/66
R17     87     3.3       1.8       1.1   GAILLARD  67 SPRK    KS REGENER.IN CA   8/67
R17 A          2.175     1.045     AVERAGE OF ABOVE DATA -- SEE NOTE A IN TEXT  8/67
R17 FIT        3.55      0.61      OVERALL FITTED RATIO     SEE NOTE A IN TEXT  8/67

R18 *    K02 INTO (3PI0)/(PI+PI-PI0)                         (P1)/(P2)
R18    188     2.0       0.6               ALEKSANYA 64 FBC                       9/66
R18 FIT        1.80      0.22      OVERALL FITTED RATIO     SEE NOTE A IN TEXT  8/67

R19 *  K0L INTO (2PI0)/(3PI0)             (UNITS 10**-2)     (P11)/(P1)
R19    109     1.89      0.31             CRONIN     67 SPRK                      8/67
R19 FIT        1.57      0.27      OVERALL FITTED RATIO     SEE NOTE A IN TEXT  8/67

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                      13  K02  FORM FACTORS                                     8/67

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

LM     153   +0.07       .06              LUERS      64 HBC                      8/67
LM           +0.15       .08              FISHER     65 SPRK                     8/67
LM     762   -0.01       .02              FIRESTONE 67 HBC                       8/67
LM     240   +0.08       .10       .08   LOWYS      67 FBC                      8/67
LM     531   +0.01       .015             KADYK      67 HBC                      8/67
LM       A   +0.01       .01               AVERAGE OF ABOVE DATA

XIA *  XIA = F-/F+ (DETERMINED FROM SPECTRA AND KMU3/KE3)

XIA    389   +1.1        0.9       1.3   ADAIR      64 HBC     KMU3/KE3         8/67
XIA          +0.66       0.9       1.3   LUERS      64 HBC     KMU3/KE3         8/67
XIA          +0.9        0.9       1.1   DE BOUARD 65 SPRK     KMU3/KE3         8/67
XIA   1371   +1.2        0.8              CARPENTER 66 SPRK     MU,PI SPECTRA    8/67
XIA C 1371   -0.82       0.6              CARPENTER 66 SPRK     MU,PI SPECTRA    8/67
XIA C      2ND CARPENTER VALUE ALLOWS ENERGY DEP OF F+,F-
XIA          -0.2        1.0       1.7   KULYUKINA 66 CC        MU,PI SPECTRA    8/67
XIA      A   +0.86       .46               AVERAGE OF ABOVE DATA

XIB *  XIB = F-/F+ (DETERMINED FROM MU POLARIZATION IN KMU3)

XIB          -1.1        0.5              ABRAMS     66 SPRK    POLARIZATION     8/67
XIB   2608   -1.2        0.5              AUERBACH  66 SPRK    POLARIZATION     8/67
XIB      A   -1.15       .35               AVERAGE OF ABOVE DATA
XIB *  MEAS OF XI USING POLARIZATION IS LESS SENSITIVE TO FORM FACTOR
XIB *  VARIATIONS AND PROBABLY GIVES A BETTER EXPERIMENTAL VALUE

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REFERENCES

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


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BARCON    58 ANP 5 156            M BARCON,K LANDE,L LEDERMAN //COLUMBIA+BNL
CRAWFORD  59 PRL 2 361            CRAWFORD,CRESTI,DOUGLASS,GOOD + ////// LRL
ASTIER    61 AIX CONF 1 227       ASTIER,BLASKOVIC,RIVET,SIAUD +/// PARIS+EP
FITCH     61 NC  22 1160          V FITCH,P PIROUE,R PERKINS ///// PRINCETON
GOOD      61 PR 124 1223          GOOD,MATSEN,MULLER,PICCIONI,POWELL +// LRL
NEAGU     61 PRL  6  552          NEAGU,OKONOV,PETROV,ROSANOVA,RUSAKOV//JINR

ALEXANDE  62 PRL 9 69             G ALEXANDER,S ALMEIDA,F CRAWFORD ///// LRL
CAMERINI  62 PR 128 362           CAMERINI,FRY,GAIDOS,BIRGE,ELY +///WISC+LRL
DARMON    62 PL 3 57              J DARMON,A ROUSSET,J SIX /////////PARIS+EP
JOVANOVI  63 BNL CONF 42          JOVANOVIC,FISCHER,BURRIS + // BNL+MARYLAND

ADAIR     64 PL 12 67             R K ADAIR,L B LEIPUNER ////////// YALE+BNL
ALEKSANY  64 DUBNA 2 102          ALEKSANYAN,ALIKHANYAN,VARTAZARYAN+//EREVAN
  SEE ALSO  JETP 19 1019          ALEKSANYAN+/// LEBEDEV+MOS ENG PHYS+EREVAN
ANIKINA   64 JETP 19 42           ANIKINA,ZHURAVLEVA+//GEORG ACAD SCI+ DUBNA
CHRISTEN  64 PRL 13 138           CHRISTENSON,CRONIN,FITCH,TURLAY //PRINCETN
FUJII     64 DUBNA 2 146          FUJII,JOVANOVICH,TURKOT+//BNL,MARYLAND,MIT
LUERS     64 PR 133 B 1276        LUERS,MITTRA,WILLIS,YAMAMOTO ///////// BNL
STERN     64 PRL 12 459           STERN,BINFORD,LIND,ANDERSON + /// WISC+LRL

ANIKINA   65 JINR P 2488          ANIKINA,VARDENGA,ZHURAVLEVA,KOTLYA+//DUBNA
ANDERSON  65 PRL 14 475           ANDERSON,CRAWFORD,GOLDEN,STERN +//LRL+WISC
ASTBURY1  65 PL 16 80             ASTBURY,FINOCCHIARO,BEUSCH + / CERN+ZURICH
ASTBURY1  65  SEE ALSO M PEPIN  HELV.PHYS. ACTA 39 523
ASTBURY2  65 PL 18 175            ASTBURY,MICHELINI,BEUSCH + /// CERN+ZURICH
ASTBURY3  65 PL 18 178            ASTBURY,MICHELINI,BEUSCH + /// CERN+ZURICH

AUBERT    65 PL 17 59             AUBERT,BEHR,CANAVAN,CHOUNET+///PARIS+ORSAY
AUBERT    65  SEE ALSO LOWYS 67
BALDO-CE  65 NC 38 684            BALDO-CEOLIN,CALIMANI,CIAMPOLILLO + /PADVA
BEHR      65 ARGONNE CONF 59      BEHR,BRISSON,BELLOTTI+ // EP+MILANO+PADOVA
CHRISTEN  65 PR 140 B 74          CHRISTENSON,CRONIN,FITCH,TURLAY//PRINCETON
  (CHRISTENSON 65 HAS BEEN CORRECTED FOR INTERFERENCE BY FITCH 65, FOOTNOTE)

CRONIN    65   ARGONNE CONF 17 FITCH,ROTH,RUSS,VERNON-TO BE PUB/PRINCETON
DE BOUAR  65 PL  15  58           DE BOUARD,DEKKERS,SCHARFF+//CERN+ORSAY+MPI
FISHER    65 ANL 7130 63         FISHER,ABASHIAN,ABRAMS,CARPENTER+/ILLINOIS
FITCH     65 PRL 15 73            FITCH,ROTH,RUSS,VERNON ///////// PRINCETON
FRANZINI  65 PR 140 B 127         FRANZINI,KIRSCH,PLANO + / COLUMBIA+RUTGERS
GALBRAIT  65 PRL 14 383           GALBRAITH,MANNING,JONES +//AERE+BRIST+RHEL

GUIDONI   65 ARGONNE CONF 49      +BARNES,FOELSCHE,FERBEL,FIRESTO+//BNL+YALE
HOPKINS   65 ARGONNE CONF 67      H W K HOPKINS,BACON,EISLER // VAND+RUTGERS
MESTVIRI  65 JINR P 2449          MESTVIRISHVILI,NYAGU,PETROV,RUSAKOV+//JINR
TRILLING  65 UCRL 16473           GEORGE H TRILLING //////////////////// LRL
TRILLING  65   IS UPDATED FROM 1965 ARGONNE CONF, PAGE 115
VISHNEVS  65 PL  18   339         VISHNEVSKY,GALANINA,SEMENOV + ///// MOSCOW

ABASHIAN  66 BERKELEY 2B          ABASHIAN,ABRAMS,VERHEY+ // URBANA
ABRAMS    66 BERKELEY CONF 2B     ABRAMS ABASHIAN,CARPENTER+ ////// ILLINOIS
ALFF-STE  66 PL 21 595            ALFF-STEINBERGER,HEUER,RUBBIA +     // CERN
AUERBACH  66 PL 17  980           AUERBACH,MANN,MCFARLANE,SCIULLI ///// PENN
AUERBACH  66 PR  149 1052         AUERBACH,DOBBS,LANDE,MANN,SCIULLI+/// PENN
AUERBACH  66   SEE ALSO PRL 14 192
BALATZ    66 BERKELEY 2B          BALATZ,BEREZIN,VISNEVSKY,GALANINA+//MOSCOW
BALDO-CE  66 NC  45A  733         BALDO-CEOLIN,CALIMANI,CIAMPOLILLO+///PADUA
BASILE    66  BALATON CONF        BASILE,CRONIN,THEVENET +           // SACLAY

BEHR      66 PL  22  540          BEHR,BRISSON,BALDO-CEOLIN,AUBERT+/PADUA,EP
BELLOTTI  66 NC  45A  737         BELLOTTI,PULLIA,BALDO-CEOLIN+ /MILAN,PADUA
BOTT-BOD  66 PL  23  277          BOTT-BODENHAUSEN,DE BOUARD,CASSEL+ // CERN
CAMERINI  66 PR  150 1148         CAMERINI,CLINE,ENGLISH,FISCHBEIN+WISCONSIN
CANTER    66 PRL 17 942           +CHO,ENGLER,FISK,HILL +    // CARNEGIE+BNL
CARPENTE  66 PR  142  871         CARPENTER,ABASHAN,ABRAMS,FISHER///ILLINOIS
CHANG     66 PL  23  702          CHANG,BASSANO,KIKUCHI,DODD+// SYRACUSE,BNL

CRIEGEE   66 PRL 17 150           +FOX,FRAUENFELDER,HANSON,MOSCAT+//ILLINOIS
DEKKERS   66 THESIS BRUSSELS      D DEKKERS + ////////////////////////// CERN
FUJII     66 PRL 13 253           FUJII,JOVANOVICH,TURKOT,ZORN//BNL+MARYLAND
  (FUJII 66 IS THE CORRECTED VALUE GIVEN BY JOVANOVICH+ 66)
GOLDEN    66  BERKELEY 2B         R.GOLDEN,F.CRAWFORD,C.STERN           // LRL
HAWKINS   66 PL 21 238            C J B HAWKINS /////////////////////// YALE
 ALSO     67 PR  156  1444        C J B HAWKINS /////////////////////// YALE

HILL      66 BNL 10608            HILL,ROBINSON,SAKITT,CANTER+//BNL,CARNEGIE
JOVANOVI  66 PRL 17 1075          JOVANOVICH,FUJII,TURKOT,ZORN +//BNL+MD+MIT
KULYUKIN  66  BERKELEY 2B         KULYUKINA,MESTVIRISHVILI,NEAGU,PETR+//JINR
MEISNER1  66 PRL 16 278           G W MEISNER,B B CRAWFORD,F CRAWFORD // LRL
MEISNER2  66 PRL  17  492         G MEISNER,B CRAWFORD,F CRAWFORD ////// LRL
MEHLHOP   66     BERKELEY CONF. MEHLHOP,GOOD,PICCIONI +          // LA JOLLA
MISCHKE   66     BERKELEY CONF. + ABASHIAN,ABRAMS,CARPENTER +  // ILLINOIS
NEFKENS   66 PL 19 706            NEFKENS,ABASHIAN,ABRAMS,CARPENTER+ /// ILL
VERHEY    66 PRL 17 669           VERHEY,NEFKENS,ABASHIAN+// URBANA

BOTT-BOD  67 PL  24B  194         BOTT-BODENHAUSEN,DEBOUARD,CASSEL + ///CERN
CRONIN    67 PRL 18 25            +KUNZ,RISK,WHEELER//////////PRINCETON
DEVLIN    67 PRL 18 54            DEVLIN,SOLOMON,SHEPARD,BEALL+//PRINC+MARY.
FIRESTON  67 PRL 18  176          FIRESTONE,KIM,LACH,SANDWEISS,+////YALE,BNL
GAILLARD  67 PRL 18 20            +KRIENEN,GALBRAITH,HUSSRI+//CERN+RUTH+AACH
HAWKINS   67 PR  156  1444        C J B HAWKINS /////////////////////// YALE
HILL      67 PREPRINT             HILL,LUERS,ROBINSON,CANTER+ //BNL+CARNEGIE
HOPKINS   67 PRL 19  185          HOPKINS,BACON,EISLER //////////////// BNL
KADYK     67 UCRL  17677          KADYK,CHAN,DRIJARD,OREN,SHELDON ///////LRL
LOWYS     67 PL  24B  75          LOWYS,AUBERT,CHOUNET,PASCAUD+/////EP,ORSAY
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14 ETA (549,JPG=0-+) I=0

14 ETA MASS (MEV)

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M        53   549.0      1.2              BASTIEN    62 HBC
M        35   546.0      4.0              PICKUP     62 HBC
M        91   548.0      1.0              ALFF       62 HBC
M             549.3      2.9              DELCOURT   63 CNTR
M       148   549.0      0.7              FOELSCHE   64 HBC
M       325   552.0      3.0              KRAEMER    64 DBC
M             548.2      0.65             FOSTER3    65 HBC                     7/66
M       250   555.0      2.0              JAMES      66 HBC                     6/66

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14 ETA WIDTH (MEV)

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W    *   91   10.0    OR LESS             ALFF       62 HBC
W    *  148   10.0    OR LESS             FOELSCHE   64 HBC
W    *   31   12.0    OR LESS             JAMES      66 HBC                     6/66
W    *         4.0    OR LESS             BALTAY     66 DBC                     7/66
W    *          .9    OR LESS             JONES      66 CNTR    .95 CONF.LEVEL  8/67

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                   14  ETA PARTIAL DECAY MODES

P1      ETA INTO 2GAMMA                                    S 0S 0
P2      ETA INTO 3PIO                                      S 9S 9S 9
P3      ETA INTO PI+ PI- PIO                               S 8S 8S 9
P4      ETA INTO PI+ PI- GAMMA                             S 8S 6S 0
P5      ETA INTO   E+E-PIO          VIOLATES C IN E.M.I.   S 9S 3S 3
P6      ETA INTO E+E-PI+PI-                                S 8S 8S 3S 3
P7      ETA INTO PIO 2GAMMA                                S 9S 0S 0
P8      ETA INTO E+E-GAMMA                                 S 3S 3S 0
P9      ETA INTO 2PIC GAMMA         VIOLATES C             S 9S 9S 0
P10     ETA INTO PI+PI-PIO GAMMA                           S 8S 8S 9S 0
P11     ETA INTO PI+PI- 2GAMMA                             S 8S 8S 0S 0

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                   14 ETA   BRANCHING RATIOS

             (P9) IS ASSUMED = 0 IN ALL RATIOS

R1   *    ETA INTO NEUTRALS/CHARGED                       (P1+P2+P7)/(P3+P4)
R1   N   10    2.5      1.0             PICKUP   62 HBC
R1   N   53    3.20     1.26            BASTIEN  62 HBC
R1   N         2.7      0.8             SHAFER   62 HBC
R1             2.6       .9             BUSCHBECK 63 HBC                    7/66
R1   N  280    4.5      1.0             JAMES    66 HBC                     6/66
     N    THIS EXPERIMENT HAS NOT BEEN USED IN COMPUTING THE AVERAGES
     N  AS IT WAS UNABLE TO CLEARLY SEPARATE PARTIAL MODES (3) AND (4)
     N  FROM EACH OTHER.  THE REPORTED VALUE THUS PROBABLY CONTAINS
     N  SOME (UNKNOWN) FRACTION OF MODE (4), AS POINTED OUT BY E.C. FOWLER
R1   A         2.60      .90     AVERAGE OF ABOVE DATA -- SEE NOTE A IN TEXT  8/67
R1   FIT       2.75     0.26     OVERALL FITTED RATIO     SEE NOTE A IN TEXT  8/67

R2   *  ETA INTO 2GAMMA/CHARGED                           (P1)/(P3+P4)
R2             0.99     0.48            CRAWFORD  63 HBC
R2   FIT       1.26      .15     OVERALL FITTED RATIO     SEE NOTE A IN TEXT  8/67

R3   *    ETA INTO PIO 2GAMMA/NEUTRALS                    (P7)/(P1+P2+P7)
R3             0.375    0.072           DI GIUGNO 66 CNTR   ERROR DOUBLED    6/66
     *    THE ERRORS OF DIGIUGNO+ 66 HAVE BEEN INCREASED BY A FACTOR
     *  OF TWO, TO TAKE INTO ACCOUNT POSSIBLE SYSTEMATIC ERRORS, AS
     *  SUGGESTED BY THE AUTHORS.
R3              .27      .10            GRUNHAUS  66 SPRK                   8/67
R3              .244     .05            FELDMAN   67 SPRK                   8/67
R3   A          .284     .040    AVERAGE OF ABOVE DATA -- SEE NOTE A IN TEXT  8/67
R3   FIT        .267     .034    OVERALL FITTED RATIO     SEE NOTE A IN TEXT  8/67

R4   *  ETA INTO (PI+ PI- GAMMA)/(PI+ PI- PIO)            (P4)/(P3)
R4             0.14     0.08            FOELSCHE  64 HBC
R4   M   24    0.73     0.25            PAULI     64 DBC
     M    THIS EXPERIMENT HAS NOT BEEN INCLUDED IN THE AVERAGES SINCE
     M  IT IS NOT CLEAR THAT THEIR CLASS B EVENTS ARE ACTUALLY FROM ETAS.
R4       33    0.30     0.06            CRAWFORD1 66 HBC                    6/66
R4   N    9    0.27     0.10            PAULI     64 DBC                    6/66
R4   N THE PAULI VALUE BASED ON ONLY 9 EVENTS IS DUE TO CRAWFORD1 66
R4              .10      .10            KRAEMER   64 DBC                    7/66
R4              .196     .041           FOSTER3   65 HBC                    7/66
R4              .25      .035           LITCHFIEL 67 DBC                    8/67
R4   A          .224     .026    AVERAGE OF ABOVE DATA -- SEE NOTE A IN TEXT  8/67
R4   FIT        .225     .023    OVERALL FITTED RATIO     SEE NOTE A IN TEXT  8/67

R5   *  ETA INTO 3PIO/(PI+ PI- PIO)                       (P2)/(P3)
     S  FOR THIS RATIO, SEE NOTES ON TABLE S FOLLOWING THIS LISTING
R5   S         0.83     0.32            CRAWFORD  63 HBC   ASSUM.P7/P2 = C   7/66
R5   S         2.0      1.0             FOELSCHE  64 HBC   ASSUM.P7/P2 = C   7/66
R5   S         0.90     0.24            FOSTER1   65 HBC   ASSUM.P7/P2 = C   7/66
R5   N         0.38     0.15            CRAWFORD2 66 HBC ASSUM.(P7)/(P2)=1.8 6/66
R5   N         0.41     0.11            FOSTER1   65 HBC ASSUM.(P7)/(P2)=1.8 6/66
     N      GIVEN BY CRAWFORD2 66
R5             1.3       .4             BAGLIN2   67 HLBC                   8/67
R5             1.05      .25            MICHAEL   67 HLBC                   8/67
R5   A         1.12      .21     AVERAGE OF ABOVE DATA -- SEE NOTE A IN TEXT  8/67
R5   FIT        .927     .158    OVERALL FITTED RATIO     SEE NOTE A IN TEXT  8/67

R6   *  ETA INTO 2GAMMA/3PIO                              (P1)/(P2)
R6   *         1.1      0.3 OR LESS     CHRETIEN  62 PBC
R6   S         1.10     0.5             MULLER    63 DBC   ASSUM.P7/P2 = C   7/66
     S      FOR PRECEDING CARD, SEE NOTES ON TABEL S FOLLOWING THIS LISTING.
R6   *         2.38 OR MORE            STRUGALSKI 66 HLBC                   9/66

R7   *  ETA INTO 2GAMMA/(PI+ PI- PO)                      (P1)/(P3)
R7             1.61     0.39            FOSTER1   65 HBC
R7   FIT       1.54      .18     OVERALL FITTED RATIO     SEE NOTE A IN TEXT  6/67

R8   *    ETA INTO NEUTRAL/(PI+ PI- PIO)                  (P1+P2+P7)/(P3)
R8      280    3.6      0.6             KRAEMER   64 DBC
R8             3.8      1.1             PAULI     64 DBC                    7/66
R8             2.89     0.56            ALFF-STEI 66 HBC                    9/66
R8   A         3.22      .42     AVERAGE OF ABOVE DATA -- SEE NOTE A IN TEXT  8/67
R8   FIT       3.37      .32     OVERALL FITTED RATIO     SEE NOTE A IN TEXT  8/67

R9   *  ETA INTO  (E+E-PIO)/(PI+PI-PIO)  (UNITS 10**-2) (P5)/(P3)
R9   *  LESS THAN   1.1        1.1      PRICE     65 HBC
R9   *    0    0.77  OR LESS            FOSTER2   65 HBC
R9   *          .42  OR LESS            BAGLIN1   67 HLBC   .9 CONF.LEVEL   8/67

R10  *    ETA INTO (E+E-PI+PI-)/TOTAL  (UNITS 10**-2)     (P6)/TOTAL
R10  *         0.7 OR LESS              RITTENBER 65 HBC                    6/66

R11  *    ETA INTO (E+E-PI+PI-)/(PI+PI-GAMMA)             (P6)/(P4)
R11        1   0.026    0.026           GROSSMAN  66 HBC                    6/66

R12  *    ETA INTO 2 GAMMA/NEUTRALS                       (P1)/(P1+P2+P7)
R12            0.416    0.044           DI GIUGNO 66 CNTR   ERROR DOUBLED    6/66
R12             .44      .07            GRUNHAUS  66 SPRK                   8/67
R12             .579     .052           FELDMAN   67 SPRK                   8/67
R12  T         0.39     0.06            JONES     66 CNTR                   8/67
     T  THIS RESULT FROM COMBINING CROSS-SECTIONS FROM TWO DIFFERENT EXPTS.
R12  A          .476     .053    AVERAGE OF ABOVE DATA -- SEE NOTE A IN TEXT  8/67
R12  FIT        .457     .035    OVERALL FITTED RATIO     SEE NOTE A IN TEXT  8/67
                       (Ideogram below)
R13  *    ETA INTO 3PIO/NEUTRALS                          (P2)/(P1+P2+P7)
R13  R         0.209    0.054           DI GIUGNO 66 CNTR   ERROR DOUBLED    6/66
R13  R          .29      .10            GRUNHAUS  66 SPRK                   8/67
R13  R          .177     .035           FELDMAN   67 SPRK                   8/67
     R REDUNDANT INFORMATION FROM THIS EXPERIMENT

R14  *      ETA INTO PIO 2GAMMA/2GAMMA                    (P7)/(P1)         7/66
R14  *          .5   OR LESS            WAHLIG    66 SPRK   .9 CONF LEVL    7/66
R14            0.86     0.47            STRUGALSK 66 HLBC                   9/66
R14  FIT        .58      .10     OVERALL FITTED RATIO     SEE NOTE A IN TEXT  8/67

R15  *      ETA INTO (E+E-PIO)/TOTAL                      (P5)/TOTAL        7/66
R15  *         0.7 OR LESS              RITTENBER 65 HBC                    6/66

R16  *    ETA INTO 2GAMMA/(3PIO + PIO 2GAMMA)             (P1)/(P2+P7)
R16            0.80      .25            BACCI     63 CNTR                   7/66
R16  FIT        .84      .11     OVERALL FITTED RATIO     SEE NOTE A IN TEXT  8/67

R17  *    ETA INTO (PI+PI-PIO GAMMA)/(PI+PI-PIO)          (P10)/(P3)
R17  *          .07  OR LESS            FLATTE    67 HBC                    8/67
R17  *          .009 OR LESS            PRICE     67 HBC                    8/67

R18  *    ETA INTO (PI+PI- 2GAMMA)/(PI+PI-PIO)            (P11)/(P3)
R18  *          .009 OR LESS            PRICE     67 HBC                    8/67

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                   14  ETA C-NONCONSERVING DECAY PARAMETER

A    DECAY ASYMMETRY PARAMETER FOR PI+ PI- PIO    (UNITS 10**-2)
A      1351     7.2       2.8                BALTAY    66 DBC            6/66
A       355     8.7       5.3                FOWLER    66 HBC            6/66
A       705    -6.1       4.0                LARRIBE   66 HBC            8/67
A     10665     0.3       1.0                CNOPES    66 SPRK           6/67
A      1300     5.8       3.4                OTHERS    66 HBC            6/66
                       (Ideogram below)
B    DECAY ASYMMETRY PARAMETER FOR PI+ PI- GAMMA
B        33    -0.02      0.17               CRAWFORD1 66 HBC           11/66
B      1620     .015      .025               BOWEN     67 SPRK           8/67
     N ABOVE EXPERIMENT IS SENSITIVE ONLY TO UPPER .4 OF GAMMA-RAY SPECTRUM
B               -.04      .08                LITCHFIEL 67 DBC            8/67

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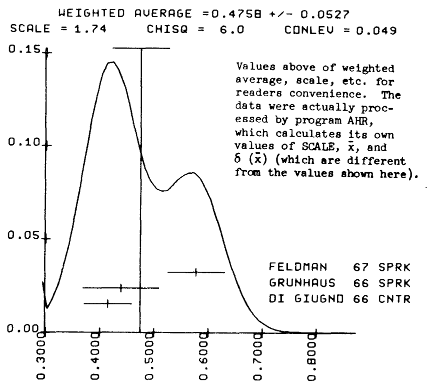
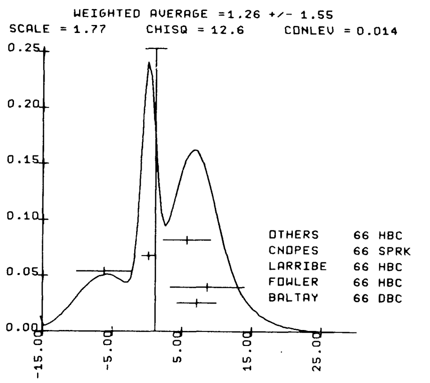


ETA B.R. INTO (GAMMA GAMMA)/(NEUTRALS)



ETA C-NONCONSERVING DECAY PARAM. PERCENT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                                 REFERENCES
                                 14 ETA(549,JPG=0-+)I=0

PEVSNER  61 PRL 7 421            PEVSNER,KRAEMER,NUSSBAUM,RICHARDSON +//JHU

ALFF     62 PRL 9 322            ALFF,BERLEY,COLLEY,BRUGGER +///COL+RUTGERS
BASTIEN  62 PRL 8 114            BASTIEN,BERGE,DAHL,FERRO-LUZZI + ///// LRL
CHRETIEN 62 PRL 9 127            CHRETIEN+ //BRANC+BROWN+HARVARD+MIT+PADOVA
PICKUP   62 PRL 8 329            E PICKUP,ROBINSON,SALANT ///// NRC+CAN+BNL
SHAFER   62 CERN CONF 307        J SHAFER,FERRO-LUZZI,MURRAY + ///// UC+LRL

BACCI    63 PRL 11 37            BACCI,PENSO,SALVINI + //ROME U+CNEN FRASCA
BUSCHBEC 63 SIENA CONF 1 166     BUSCHBECK-CZAPP,COOPER + //VIENNA+CERN+AMS
CRAWFORD 63 PRL 10 546           F S CRAWFORD,LLOYD,FOWLER /////// LRL+DUKE
DELCOUR1 63 PL 7 215             DELCOURT,LEFRANCOIS,PEREZ Y JORBA+// ORSAY
MULLER   63 SIENA CONF 99        MULLER,PAULI + //LPCHE+SACLAY IF+ROME+INFN

FOELSCHE 64 PR 134 B 1138        H W FOELSCHE,H L KRAYBILL /////////// YALE
KRAEMER  64 PR 136 B 496         KRAEMER,MADANSKY,FIELDS + // JHU+NW U+WOOD
PAULI    64 PL 13 351            E PAULI,A MULLER //////////// LPCHE+SACLAY

FOSTER1  65 PR 138 B 652         FOSTER,PETERS,MEER,LOEFFLER +//WISC+PURDUE
FOSTER2  65 ATHENS               FOSTER,GOOD,MEER                //WISCONSIN
FOSTER3  65 THESIS               M.C.FOSTER                      //WISCONSIN
PRICE    65 PRL  15  123         L.R.PRICE,F.S.CRAWFORD                //LRL
RITTENBE 65 PRL 15 556           RITTENBERG,KALBFLEISCH /////////// LRL+BNL

ALFF-STE 66 PR 145 1072          ALFF-STEINBERGER,BERLEY+//COLUMBIA+RUTGERS
BALTAY   66 PRL 16 1224          +FRANZINI,KIM,KIRSCH+/COLUMBIA+STONY BROOK
CRAWFRD1 66 PRL  16  333         F.S.CRAWFORD,L.R.PRICE                //LRL
CRAWFRD2 66 PRL 16 907           F S CRAWFORD,L LLOYD,E FOWLER   //LRL+DUKE
DIGIUGNO 66 PRL 16 767           DIGIUGNO,GIORGI,SILVESTRI+//NAP+TRST+FRASC
GROSSMAN 66 PR 146  993          R GROSSMAN,L PRICE,F CRAWFORD //////// LRL
GRUNHAUS 66 THESIS               J.GRUNHAUS                       //COLUMBIA
JAMES    66 PR 142   896         F E JAMES,H L KRAYBILL ////////// YALE+BNL
JONES    66 PL 23  597           JONES,BINNIE,DUANE,HORSEY,MASON,+/ICL+RUTH
WAHLIG   66 PRL  17  221         WAHLIG,SHIBATA,MANNELLI           //MIT+PISA

BAGLIN1  67 PL 248 637           BAGLIN,BEZAGUET,DEGRANGE,+     //E.POLY+UC
BAGLIN2  67 BAPS 12 567          BAGLIN,BEZAGUET,DEGRANGE,+     //E.POLY+UC
FELDMAN  67 PRL 18 866           FELDMAN,FRATI,GLEESON,HALPERN,+      /PENN
FLATTE   67 PRL 18 976           S.M.FLATTE                            /LRL
MICHAEL  67 THESIS               W.B.MICHAEL                           //UC
PRICE    67 PRL 18 1207          L.R.PRICE,F.S.CRAWFORD                /LRL
STRUGALS 67 JINR-E1-3100         STRUGALSKI,CHUVILE,IVANOVSKAJA,+   //DUBNA
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         QUANTUM NUMBER DETERMINATIONS NOT REFERRED TO IN THE DATA CARDS

BASTIEN   62 PRL 8 114          BASTIEN,BERGE,DAHL,FERRO-LUZZI,MILLER+/LRL
CARMONY   62 PRL 8 117          D CARMONY,A ROSENFELD,VAN DE WALLE /// LRL
ROSENFEL  62 PRL 8 293          A ROSENFELD,D CARMONY,VAN DE WALLE /// LRL

               REFERENCES ON ETA ASYMMETRY PARAMETERS

BALTAY    66 PRL  16  1224      BALTAY,FRANZINI,KIM,KIRSCH+/COLUM+STONY BK
CNOPES    66 PL 22 546          CNOPS,FINOCCHIARS,LASSALLE,+/CERN+ZUR+SACL
CRAWFRD1  66 PRL  16  333       F.S.CRAWFORD,L.R.PRICE                //LRL
FOWLER    66 BAPS 11  380       E.C.FOWLER                           //DUKE
LARRIBE   66 PL 23 600          LARRIBE,LEVEQUE,MULLER,PAULI,+  /SACL+RUTH
OTHERS    66 PR 149  1044       COLUMBIA,LRL,PURDUE,WISCONSIN,YALE

BOWEN     67 PL 24B 206         BOWEN,CNOPES,FINOCCHIARO,+ //CERN+ZUR+SACL
LITCHFIE  67 PL 24B 486         LITCHFIELD,RANGAN,SEGAR,SMITH+/RUTH+SACLAY

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

                   16  PROTON  MASS (MEV)

M            938.256    0.005            COHEN      65 RVUE                  7/66
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                   16  PROTON LIFETIME  (UNITS 10**26 YR)

T  *  OVER                     1.5       BACKENSTC 60 CNTR
T  *  OVER                    60.0       KROPP     65 CNTR                   6/66
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                   16 PROTON MAGNET. MOMENT(E/2MP)

MM           2.792763 0.000030           COHEN      65 RVUE                  7/66
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                         REFERENCES
                         16 PROTON (938,J=1/2) I=1/2

BACKENST 60 NC  16  749        BACKENSTOSS,FRAUENFELDER,HYAMS + //// CERN
COHEN    65 RMP 37 537         E R COHEN, J W M DUMOND //// NAASC+CALTECH
KROPP    65 PR 137 B 740       W R KROPP,F REINES ///CASE INST TECHNOLOGY

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

                   17  NEUTRON-PROTON MASS DIF.(MEV)

D            1.2939   0.0004           BONDELIC   60 CNTR
D            1.2933   0.0001           SALGO      64 CNTR
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                   17  NEUTRON LIFETIME (UNITS 10**3 SEC)

T            1.01      0.03     0.03  SOSNOVSKI 59 PILE
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                   17  NEUTRON MAGNETIC MOMENT (MAGNETONS,938.2 MEV)

MM          -1.913148 0.000066          COHEN      56 SPECIAL               7/66
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                         REFERENCES
                         17 NEUTRON (939,J=1/2) I=1/2

COHEN     56 PR 104 283        V W COHEN, CORNGOLD, RAMSEY // BNL+HARVARD
SOSNOVSK  59 JETP  9  717      SOSNOVSKII,SPIVAK,PROKOFEV + // IAE MOSCOW
BONDELIC  60 PR  120  667      BONDELIC,BUTLER,KENNEDY +//LSNRL+CATH UNIV
SALGO     64 NP   53  457      R SALGO, STAUB, WINKLER, ZAMBONI // ZURICH
COHEN     65 RMP 37 537        E R COHEN,DUMOND ///// NAASC+CAL INST TECH

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Λ

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

For the Λ mass, there is a large discrepancy between the measurement of SCHMIDT 65 and the emulsion measurements reviewed by BHOWMIK 63. The former determination used range measurements in a hydrogen bubble chamber.

The Σ^- mass of SCHMIDT 65 (1196.53 ± 0.24 MeV) also obtained using HBC range measurements, is also in disagreement with previous emulsion determinations and with the one, by the same author, which does not use range measurements. Therefore, as a temporary procedure, we do not include any determinations of absolute masses which use range measurements in HBC. BURNSTEIN 64 has two sorts of measurements: absolute masses which again depend on HBC ranges, and mass differences; we have used only the latter. Both authors, P. Schmidt and G. Snow (representing Burnstein et al.) agree with this procedure.

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                   18  LAMBDA  MASS (MEV)

M   *   25 1115.06      0.41              ARMENTERO 62 HBC      ERROR IS STATIS.
M   *      1115.27      0.36              BALTAY    62 HBC      ERROR IS STATIS.
M          1115.44      0.12              BHOWMIK   63 RVUE +  SEE NOTE L BELOW
M   L  ABOVE LAMBDA MASS HAS BEEN RAISED 35 KEV TO ACCOUNT FOR 46 KEV
    L  INCREASE IN PROTON MASS AND 11 KEV DECREASE IN CHARGED PION MASS.
M   *      1115.4       0.2               BADIER    64 HBC     ERROR IS STATIS.    6/66
M   *  635 1115.86      0.09              BALTAY    65 HBC     ERROR IS STATIS.    6/66
M   N      1115.61      0.07              SCHMIDT   65 HBC                         9/66
M   N SEE NOTE PRECEDING LAMBDA MASS LISTINGS
M          1115.6       0.4               LONDON    66 HBC                         6/66

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                   18  LAMBDA LIFETIME (UNITS 10**-10)


T   U    74     2.75      0.45      0.36  BLUMENFEL 58 CC
T       188     2.63      0.21      0.21  BOLDT     58 CC
T   U    61     2.08      0.46      0.31  BROWN     58 PBC
T   U    40     3.04      0.78      0.51  COOPER    58 CC
T   U   454     2.29      0.15      0.13  EISLER    58 HBC
T       825     2.72      0.16      0.16  CRAWFORD  59 HBC
T       140     2.72      0.29      0.27  BOWEN     60 CC

T   U   748     2.58      0.11      0.11  BERTANZA  62 HBC
T       186     2.60      0.28      0.20  C-C CHANG 62 HBC
T   U 3447      2.52      0.08            FUNG      62 PBC                         6/66
T       799     2.69      0.11      0.11  HUMPHREY  62 HBC

T      2239     2.36      0.06      0.06  BLOCK     63 HEBC
T       706     2.76      0.20            CHRETIEN  63 PBC
T       794     2.59      0.09            HUBBARD   64 HBC
T      2260     2.31      0.10            KREISLER  64 SPRK
T      1378     2.59      0.07            SCHWARTZ  64 HBC

T       635     2.51      0.16            BALTAY    65 HBC                         6/66
T      2534     2.6       0.1             HILL      65 SPRK
T      6473     2.62      0.05            ARMENTERO 66 HBC                         8/67
T       916     2.35      0.09            BURAN     66 HLBC                        6/66
T      2213     2.452     0.056     0.054 ENGELMANN 66 HBC                         9/66
T       585     2.68      0.13      0.11  AUERBACH  67 SPRK                        8/67
                          (Ideogram below)
T   U  UNPUBLISHED MEASUREMENTS (EXCEPT THESES) NOT INCLUDED IN AVERAGE            7/66
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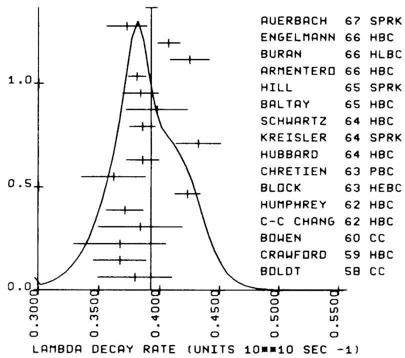
WEIGHTED AVERAGE =0.39341 +/- 0.00493
SCALE = 1.40   CHISQ = 29.5   CONLEV = 0.014

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                   18  LAMBDA MAGNETIC MOMENT (MAGNETONS,938.26 MEV)

MM            -1.5       0.5              COOL       62 SPRK
MM             0.0       0.6              KERNAN     63 CC
MM     8553   -1.39      0.72             ANDERSON   64 HBC
MM      151   -0.5       0.28             CHARRIERE  65 EMUL
MM            -0.75      0.19             HILL       66 SPRK                     9/66
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                   18  LAMBDA PARTIAL DECAY MODES

P1      LAMBDA INTO PROTON PI-                               S16S 8
P2      LAMBDA INTO NEUTRON PI0                              S17S 9
P3      LAMBDA INTO PROTON MU- NEUTRINO                      S16S 4S 2
P4      LAMBDA INTO PROTON E- NEUTRINO                       S16S 3S 1
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                   18  LAMBDA BRANCHING RATIOS

R1   *  LAMBDA INTO (P PI-)/((P PI-)+(N PI0))                (P1)/(P1+P2)
R1              0.627     0.031             CRAWFORD  59 HBC
R1              0.65      0.05              COLUMBIA  60 HBC
R1       903    0.643     0.016             HUMPHREY  62 HBC
R1              0.685     0.017             ANDERSON  62 HBC
R1   A          0.658     0.013      AVERAGE OF ABOVE DATA -- SEE NOTE A IN TEXT  8/67
R1   FIT        0.664     0.011      OVERALL FITTED RATIO     SEE NOTE A IN TEXT  8/67

R2   *  LAMBDA INTO (N PI0)/((P PI-)+(N PI0))                (P2)/(P1+P2)
R2              0.23      0.09              EISLER    57 PBC
R2              0.43      0.14              CRAWFORD  59 HBC
R2              0.28      0.08              BAGLIN    60 PBC
R2              0.35      0.05              BROWN     63 XBC
R2        75    0.291     0.034             CHRETIEN  63 PBC
R2   A          0.304     0.250      AVERAGE OF ABOVE DATA -- SEE NOTE A IN TEXT  8/67
R2   FIT        0.336     0.011      OVERALL FITTED RATIO     SEE NOTE A IN TEXT  8/67

R3   *  LAMBDA INTO (P E- NEU)/TOTAL    (UNITS  10**-3)    (P4)/(P1+P2)
R3       15     2.0       0.5               HUMPHREY  61 RVUE
R3        8     2.9       1.5         1.2   AUBERT    62 FBC
R3      150     0.82      0.12        0.13  ELY       63 FBC
R3       20     1.55      0.34              LIND      64 HBC
R3      102     0.78      0.12              BAGLIN    64 FBC
R3   A          0.884     0.150      AVERAGE OF ABOVE DATA -- SEE NOTE A IN TEXT  8/67
                     (Ideogram on next page)

R4   *  LAMBDA INTO (P MU- NEU)/TOTAL   (UNITS  10**-4)    (P3)/(P1+P2)
R4   *    1     0.2     OR GREATER              GOOD      62 HBC
R4   *    1     1.0     OR LESS                 ALSTON    63 HBC
R4   *    2     1.0     OR LESS                 KERNAN    64 FBC
R4   *   BETWEEN 1.3 AND 6.0                    LIND      64 HBC
R4        3     1.3       0.7                   LIND      64 RVUE                 7/66
R4        2     1.5       1.2                   RONNE     64 FBC
R4   A          1.351     0.605      AVERAGE OF ABOVE DATA -- SEE NOTE A IN TEXT  8/67
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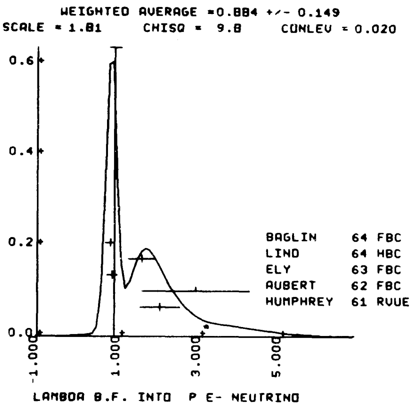


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                  18  LAMBDA DECAY PARAMETERS

A-   *  ALPHA LAMBDA- (LAMBDA INTO PI- PROTON)
A-     1156    0.62      0.07            CRONIN     63 CNTR   LAMBDA FROM PI-P  8/67
A-     2529    0.747     0.086           MERRILL    66 HBC    FROM XI- DECAY    6/69
A-   0 4660    0.655     0.025           OVERSETH   66 SPRK   LAMBDA FROM PI-P  9/66
A-   *         0.663     0.022           BERGE      66 RVUE  INCLUDES ALL ABOVE 9/66
A-    10130    0.645     0.017           OVERSETH   67 SPRK   LAMBDA FROM PI-P  8/67
A-   0  CVERSETH 67 INCLUDES EVENTS CF OVERSETH 66

AO   *  ALPHAO /ALPHA- FOR LAMBDA (L INTO PIO N/L INTO PI- P)
AO             1.10      0.27            CORK       60 CNTR

AE   *      ALPHA LAMBDA E- (LAMBDA INTO PROTON E- NEUTRINC)
AE             0.06      0.19            BARLOW     65 SPRK                     7/66

DT   *  DELTA ANGLE (TAN(DELTA)=BETA/ALPHA)    (CEGREE)
DT     1156  -15.0      20.0             CRONIN     63 SPRK   LAMBDA FROM PI-P  8/67
DT    10130    9.0       5.5             OVERSETH   67 SPRK   LAMBDA FROM PI-P  8/67

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

EISLER    57 NC      5 1700       EISLER,PLANO,SAMIOS,SCHWARTZ + //CULUM+BNL
BLUMENFE  58 CERN CONF 270        H BLUMENFELD,W CHINOWSKY,L LEDERMAN//COLUM
BOLDT     58 PRL     1  148       E BOLCT,D O CALCWELL,Y PAL /////////// MIT
BROWN     58 CERN CONF 270        BROWN,GLASER,GRAVES,PERL,CRCNIN + //  MICH
COOPER    58 CERN CONF 270        W A CCOPER,H FILTHUTH + ///// JUNGFRAUJOCH
EISLER    58 CERN CONF 270        F EISLER,PLANO,BASSI + // BNL+COLUM+BCL+PI
CRAWFORD  59 PRL     2  266       CRAWFCRC,CRESTI,COUGLASS,GCCC + /////  LRL

BAGLIN    60 NC     18 1043       BAGLIN,BLOCH,BRISSON,HENNESSY + //PARIS-EP
BOWEN     60 PR    119 2030       BCWEN,HARDY,REYNCLDS,SUN + ///// PRINCETON
CORK      60 PR    120 1000       CCRK,KERTH,WENZEL,CRCNIN,CCCL //LRL+PR+BNL
COLUMBIA  60 ROCH CONF 726        M SCHWARTZ + ///////////////////// COLUMBIA
HUMPHREY  61 PRL     6  478       HUMPHREY,KIRZ,ROSENFELD,RHEE + //LRL+SYRAC

ANDERSCN  62 CERN CONF 832        ANDERSON,CRAWFORC,GOLDEN,LLCYD + ///// LRL
ARMENTER  62 CERN CONF 236        ARMENTEROS+/CERN+EP+LONDCN+BIRM+CEN-SACLAY
AUBERT    62 NC     25  479       AUBERT,BRISSON,HENNESSY,SIX + /// PARIS-EP
BALTAY    62 CERN CONF 233        BALTAY,FOWLER,SANDWEISS,CULWICK+//YALE+BNL
BERTANZA  62 PREPRINT 0105        BERTANZA,CONNOLLY,CULWICK,EISLER + /// BNL
CHANG     62 THESIS DUKE          CHUEN CHUEN CHANG ///////////////////// DUKE
COOL      62 PR    127 2223       CCOL,HILL,MARSHALL + ///// BNL+MIT+NYU+ANL
FUNG      62 BAPS    7  619       SUN YIU FUNG ////////////////////////// LRL
GOOD      62 PRL     9  518       M L GOOD,V G LINC /////////////// WISCONSIN
HUMPHREY  62 PR    127 1305       W E HUMPHREY,R R ROSS ///////////////// LRL

ALSTCN    63 UCRL 10926           ALSTON,KIRZ,NEUFELD,SOLMITZ,WOHLMUT // LRL
BERGE     63 THESIS (BERKELEY)    J PETER BERGE ///////////////////////// LRL
BHOWMIK   63 NC     28 1494       B BHOWMIK,D P GOYAL ////////////////// CELHI
BLOCK     63 PR    130  766       BLOCK,GESSAROLI,RATTI,KIKUCHI + //NW+BLGNA
BROWN     63 PR    130  769       BROWN,KADYK,TRILLING,ROE + ///LRL+MICHIGAN
CHRETIEN  63 PR    131  2208      CHRETIEN,CROUCH+///BRANC+BRCWN+HARVARC+MIT
CRONIN    63 PR    129 1795       J W CRONIN,O E OVERSETH //////// PRINCETON
ELY       63 PR    131  668       ELY,GIDAL,KALMUS,OSWALD,PCWELL + ///// LRL
KERNAN    63 PR    129  670       KERNAN,NOVEY,WARSHAW,WATTENBERG // ANL+ILL

ANDERSON  64 PRL    13  167       J A ANDERSON,F S CRAWFORC //////////// LRL
BADIER    64 DUBNA CONF 1 593     BADIER,BARLOUTAUC + //////EP+SACLAY+AMSTOM
BAGLIN    64 NC     35  977       BAGLIN,BINGHAM+//EP+CERN+UC LONC+RHEL+BERG
HUBBARD   64 PR    135 B 183      HUBBARD,BERGE,KALBFLEISCH,SHAFER + /// LRL
KERNAN    64 PR    133 B 1271     KERNAN,POWELL,SANDLER + //LRL+UN-COLL-LOND
KREISLER  64 PR 136 B 1074        M N KREISLER,O OVERSETH,J CRONIN ///PRINCE
LIND      64 PR    135 B 1483     LIND,BINFORD,GOOC,STERN //////// WISCONSIN
RONNE     64 PL     11   357      RONNE+ /// CERN+EP+UCOL-LONDON+UNIV.BERGEN
SCHWARTZ  64 UCRL 11360 THESIS    JOSEPH ADAM SCHWARTZ ////////////////// LRL

BALTAY    65 PR 140 B 1027        BALTAY,SANDWEISS,CULWICK,KOPP + //YALE+BNL
BARLOW    65 PL    18   64        J BARLOW,BLAIR,DUKE,MANN+//CERN+RUTH+PENNA
CHARRIER  65 PL    15     66      CHARRIERE,GIBSON+ //// EPUL+BRIST+CERN+MPI
   ALSO      NC    46A  205       CHARRIERE,GIBSON +////EPUL,BRIST,CERN, MPI
HILL      65 PRL   15     85      D A HILL,K K LI /////////////////////// MIT
SCHMIDT   65 PR 140 B 1328        P SCHMIDT ///////////////////////// COLUMBIA

ARMENTER  66 PREPRINT             ARMENTEROS + ////// CERN,HEIDELBERG,SACLAY
BERGE     66    BERKELEY CONF.    BERGE,CABIBBO                      // RVUE
BURAN     66 PL 20 318            BURAN,EIVINDSON,SKJEGGESTAD,TOFTE + //OSLO
ENGELMAN  66 NC 45A  1038         ENGELMANN,FILTHUTH,ALEXANDER+/HEIDBG+WEIZM
HILL      66  BERKELEY CONF       HILL,LI,JENKINS,KYCIA,RUDERMAN      // BNL
LONDON    66 PR 143 1034          LONDON,RAU,GOLDBERG,LICHTMAN+//BNL+SYRACUS
MERRILL   66  BERKELEY CONF       MERRILL,SHAFER,BERGE                // LRL
     CF.  66 UCRL 16455           DEANE MERRILL (THESIS, BERKELEY) ///// LRL
OVERSETH  66  BERKELEY CONF       O.E OVERSETH, R F ROTH//MICHIGAN+PRINCETON

AUERBACH  67 NC    47A  19        AUERBACH,BOWEN,DOBBS,LANDE,MANN+ //U OF PA
OVERSETH  67 PRL   19  391        O E OVERSETH, R F RUTH//MICHIGAN+PRINCETON

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Σ+

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

                  19  SIGMA+ MASS (MEV)

M    N SEE NCTE PRECEDING LAMBDA MASS LISTINGS

M       144 1189.38      0.15             BARKAS     63 EMUL +  SEE NCTE S BELOW
M        58 1189.48      0.22             BHOWMIK    64 EMUL +  SEE NOTE S BELOW
M     S  ABOVE SIGMA+ MASSES HAVE BEEN RAISED 30  KEV TO ACCOUNT FOR 46 KEV
      S  INCREASE IN PROTON MASS AND 21 KEV DECREASE IN PION MASS
M            1189.59     0.11             SCHMIDT    65 HBC                        9/66

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

T    *                                    GLASER      58 RVUE
T       127    0.98      0.16      0.12   PUSCHEL    60 EMUL
T        41    0.82      0.34      0.20   EVANS      60 EMUL
T       117    0.85      0.14      0.11   FREDEN     60 EMUL
T        54    0.60      0.10      0.067  KAPLON     60 EMUL

T        23    0.76      0.22      0.14   CHIESA     61 EMUL
T        49    0.75      0.13      0.09   BERTHELOT  61 PBC
T       140    0.82      0.10      0.08   BARKAS     61 EMUL
T       192    0.749     0.056     0.052  GRARD      62 HBC
T       456    0.765     0.04      0.04   HUMPHREY   62 HBC

T       203    0.84      0.12      0.08   BHOWMIK    64 EMUL
T       181    0.84      0.09             BALTAY     65 HBC                        6/66
T       900    0.76      0.03             CARAYANNC  65 HBC                        6/66
T              0.83      0.018            CHANG      65 HBC                        6/66
T       381    0.60      0.07             COOK       66 SPRK                       7/66

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                  19  SIGMA+ MAGNETIC MOMENT (MAGNETONS,938.26 MEV)

MM   *   43    1.2       1.5              BRISTOL    66 EMUL    PRELIMINARY RES.   8/67
MM      381    1.5       1.1              COOK       66 SPRK                       7/66
MM       52    3.5       1.5              KOTELCHUC  67 EMUL    K-P AT 1.15BEV/C   8/67
MM       51    3.0       1.2              SULLIVAN   67 EMUL    PHOTOPRODUCTION    8/67
MM    13500    2.20      1.0              MAST       67 HBC                        8/67

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                  19  SIGMA+ PARTIAL DECAY MODES

P1       SIGMA + INTO PROTON PIO                              S16S 9
P2       SIGMA + INTO NEUTRON PI+                             S17S 8
P3       SIGMA + INTO NEUTRON PI+ GAMMA                       S17S 8S 0
P4       SIGMA + INTO LAMBDA E+ NEU                           S16S 3S 0
P5       SIGMA + INTO PROTON GAMMA                            S16S 0
P6       SIGMA + INTO NEUTRON MU+ NEUTRINO                    S17S 4S 2
P7       SIGMA + INTO NEUTRON E+ NEUTRINO                     S17S 3S 1

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                  19  SIGMA+  BRANCHING RATIOS

R1   *   SIGMA+  INTO (NEUTRON PI+)/(NUCLEON PI)              (P2)/(P1+P2)
R1       308    0.490     0.024           HUMPHREY  62 HBC
R1              0.46      0.02            CHANG     65 HBC                         6/66
R1   A          0.472     0.015     AVERAGE OF ABOVE DATA -- SEE NOTE A IN TEXT    8/67

R2   *   SIGMA+ INTO (NEUT PI+ GAM)/(PI+N)  (UNITS 10**-3) (P3)/(P2)
R2   *   ABOUT  1.8                       BAZIN2    65 HBC                         8/67
R2   *   FOR PI+ MOM LESS THAN 166 MEV/C

R3   *     SIGMA+ INTO (LAMBDA E+ NEU)/TOTAL (UNIT 10**-5) (P4)/TOTAL
R3         4    3.3       1.7             WILLIS    64 HBC     STOP. K-            9/66
R3         6    2.0       0.8             BARASH    67 HBC     STOP K-             8/67
R3   A          2.2       0.7       AVERAGE OF ABOVE DATA -- SEE NOTE A IN TEXT    8/67

R4   *   SIGMA+  INTO (N MU+ NEU)/(PI+N)    (UNITS 10**-4) (P6)/(P2)
R4   *     1 EVENT SEEN,NO RATIO GIVEN. GALTIERI 62 EMUL
R4   *     0  LESS THAN               2.3  BURNSTEIN 63 HBC

R5   *   SIGMA+  INTO (N E+ NEU)/(N PI+)  (UNITS 10**-4)  (P7)/(P2)
R5   *     0  LESS THAN               2.6  BURNSTEIN 63 HBC
R5   *     0  LESS THAN          4.0       MURPHY    64 PBC
R5   *     1  LESS THAN               1.03 NAUENBERG 64 HBC

R6   *   SIGMA+  INTO (P GAMMA)/(P PIO)  (UNITS 10**-2)   (P5)/(P1)
R6   *     1    0.68  OR LESS             CARRARA   64 HBC
R6        24    0.37      0.08            BAZIN     65 HBC
R6         4    0.17                      QUARENI   65 EMUL                        6/66

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                  19 SIGMA+ DECAY PARAMETERS

A+   *   ALPHA+/ALPHAO FOR SIGMA+ (SIG+ TO PI+ N)/(SIG+ TO PIO P)
A+             +0.04      0.11            CORK      60 CNTR    SIG+ FROM PI+P
A+   *         +0.20      0.24            TRIPP     62 HBC  +  REPLAC.BY BANGER
A+     3500    -.014      0.052           BANGERTER 66 HBC  +  SIG+ FROM K-P       9/66
A+     2600    -.047       .07            BERLEY    66 HBC  +  SIG+ FROM K-P       9/66

AO   *   ALPHA SIGMAO (SIG+ INTO PIO PROTON)
AO             -0.80      0.16            BEALL     62 CNTR
AO   *         -0.90      0.25            TRIPP     62 HBC     REPLAC. BY BANGER
AO     5200    -0.986     0.072           BANGERTER 66 HBC     K-P TO SIG+ PI-     7/66

F    *       PHI ANGLE (TAN(PHI)=BETA/GAMMA)  (CEGREE)
F       370  180.       30.               BERLEY    66 HBC  +  NEUTRON RESCATT.    9/66

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

GLASER    58 CERN CONF 270      GLASER,GOOD,MORRISON //////////// MICH+LRL
EVANS     60 NC 15 873          BRIST+BRUSS+IAS-U.COL-DUBLIN+LON+MILAN+PAD
FREDEN    60 NC 16 611          S FREDEN,H KORNBLUM,R WHITE ////////// LRL
KAPLON    60 ANP 9 139          M KAPLON,A MELISSINOS,YAMANOUCHI // ROCHES
CORK      60 PR 120 1000        CORK,KERTH,WENZEL,CRONIN,CCCL /LRL+PRI+BNL
PUSCHELL  60 NP 20 254          W PUSCHEL ///////////////// MAX PLANCK INST

BARKAS    61 PR 124 1209        BARKAS DYER,MASON,NICHOLS,SMITH ////// LRL
BERTHELO  61 NC 21 693          BERTHELOT,DAUDIN,GOUSSU + /// SACLAY+ORSAY
CHIESA    61 NC 19 1171         CHIESA,QUASSIATI,RINAUDO ////// INFN-TURIN

BEALL     62 PRL 8 75           BEALL,CORK,KEEFE,MURPHY,WENZEL /////// LRL
GRARD     62 PR 127 607         F GRARD,G A SMITH ///////////////////// LRL
GALTIERI  62 PRL 9 26           GALTIERI,BARKAS,HECKMAN,PATRICK,SMITH//LRL
HUMPHREY  62 PR 127 1305        W E HUMPHREY,R R ROSS ///////////////// LRL
TRIPP     62 PRL 9 66           R D TRIPP,M B WATSON,M FERRO-LUZZI /// LRL
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BARKAS    63 PRL 11 26           W H BARKAS,J N DYER,H H HECKMANN ///// LRL
    ALSO 61 UCRL 9450           JOHN DYER (THESIS, BERKELEY)  ///////  LRL
COURANT   63 SIENA CONF  1 15   COURANT,FILTHUTH,BURNSTEIN+ // CERN+MD+NRL

BHOWMIK   64 NP 53 22           B BHOWMIK,P JAIN,P MATHUR,LAKSHMI // DELHI
BURNSTEI 64 PRL 13 66           BURNSTEIN,DAY,KEHOE,SECHI ZORN,SNOW /MARYL
CARRARA   64 PL 12 72           CARRARA,CRESTI,GRIGOLETTO,PERUZZO+//PADOVA
COURANT   64 PR 136 B 1791      COURANT,FILTHUTH+//CERN+HEIDLB+MD+NRL +BNL
MURPHY    64 PR 134 B 188       C THORNTON MURPHY /////////////// WISCONSIN
NAUENBER 64 PRL 12 679          NAUENBERG,MARATECK,BLUMENFELD+ /COL+RUT+PR
WILLIS    64 PRL 13 291         WILLIS,COURANT,ENGELMAN+//BNL+CERN+HEID+MD

BALTAY    65 PR 140 B 1027      BALTAY,SANDWEISS,CULWICK,KOPP + //YALE+BNL
BAZIN     65 PRL 14 154         BAZIN,BLUMENFELD,NAUENBERG +//PRINCE+COLUM
BAZIN2    65 PR 140  B1358        BAZIN,PLANO,SCHMIDT+//PRINCE,RUTG,COLUM
CARAYAN   65 PR 138 B 433       CARAYANNOPOULOS,TAUTFEST,WILLMANN// PURDUE
CHANG     65 NEVIS 145  THESIS CHUNG YUN CHANG ///////////////// COLUMBIA
   ALSO   66 PR  151  1081      CHUNG YUN CHANG ///////////////// COLUMBIA
QUARENI   65 NC 40 A 928        QUARENI,CARTACCI + //////BOL+FIR+GEN+PARMA
SCHMIDT   65 PR 140 B 1328      P SCHMIDT ///////////////////////// COLUMBIA

BANGERTE 66 PRL  17  495        BANGERTER,GALTIERI,BERGE,MURRAY+   // LRL
BERLEY    66 PRL 17 1071        +HERZBACH,KOFLER,YAMAMOTO +//BNL+MASS+YALE
BRISTOL   66  BERKELEY CONF     BRISTOL-CERN-LAUSANNE-MUNICH-ROME COLLABOR
COOK      66 PRL  17  223       V COOK,EWART,MASEK,ORR,PLATNER//WASHINGTON

BARASH    67 PRL 19  181        BARASH,DAY,GLASSER,KEHOE,KNOP +///MARYLAND
KOTELCHU 67 PRL 18 1166         KOTELCHUCK,GOZA,SULLIVAN,ROSS//VANDERBILT
MAST      67 HEIDELBERG CONF    MAST,ALSTON-GARNJOST,BANGERTER+////////LRL
SULLIVAN 67 PRL 18 1163         SULLIVAN,MCINTURFF,KOTELCHUCH//VANDERBILT
    ALSO 64 PRL 13 246          A D MCINTURFF,C E ROOS        // VANDERBILT

       QUANTUM NUMBER DETERMINATIONS NOT REFERRED TO IN THE DATA CARDS

TRIPP     62 PRL 8 175          R TRIPP,M WATSON,M FERRO-LUZZI /////// LRL
ALFF      63 SIENA CONF 1 205   ALFF,NAUENBERG,KIRSCH,BERLEY+/COLU+RUT+BNL
    ALSO 65 PR 137 B 1105       ALFF,GELFAND,BRUGGER,BERLEY+/COLUM+RUT+BNL
COURANT   63 SIENA CONF 1 73    COURANT,FILTHUTH,BURNSTEIN,DAY+//CERN+MARY
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                     20  SIGMA-  (1198,JP=1/2+)  I=1

                     20  SIGMA-   MASS (MEV)

M    N SEE NOTE PRECEDING LAMBDA MASS LISTINGS

M          1197.47     0.11           SCHMIDT   65 HBC                     9/66

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

D      87    8.25      0.40           BARKAS    63 EMUL  -
D    2500    8.25      0.25           DOSCH     65 HBC

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

M    N SEE NOTE PRECEDING LAMBDA MASS LISTINGS

DL          81.70      0.19           BURNSTEIN 64 HBC                     9/66

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

T            1.67      0.40      0.28 BROWN     58 PBC
T            1.89      0.33      0.25 EISLER    58 PBC
T      45    1.35      0.32      0.17 CHIESA    61 EMUL
T      41    1.75      0.39      0.30 BARKAS    61 EMUL

T    1208    1.58      0.06      0.06 HUMPHREY  62 HBC
T            1.666     0.026          CHANG     65 HBC                     6/66

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                     20  SIGMA- PARTIAL DECAY MODES

P1      SIGMA - INTO  NEUTRON PI-                           S17S 8
P2      SIGMA - INTO  NEUTRON PI- GAMMA                     S17S 8S 0
P3      SIGMA - INTO  NEUTRON MU- NEUTRINO                  S17S 4S 2
P4      SIGMA - INTO  NEUTRON E- NEUTRINO                   S17S 3S 1
P5      SIGMA - INTO  LAMBDA E- NEUTRINO                    S18S 3S 1

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                     20  SIGMA-  BRANCHING RATIOS

R1   *  SIGMA - INTO (N MU- NEU)/(N PI-) (UNITS 10**-3)  (P3)/(P1)
R1       22    0.66      0.15           COURANT   64 HBC
R1       11    0.56      0.20           BAZIN     65 HBC      FROM STOP. K-   6/66
R1   A         0.624     0.120    AVERAGE OF ABOVE DATA -- SEE NOTE A IN TEXT 8/67

R2   *  SIGMA - INTO (N E- NEU)/(N PI-)  (UNITS 10**-3)  (P4)/(P1)
R2        9    1.0       0.4       0.3  MURPHY    64 PBC
R2       16    1.37      0.34           NAUENBERG 64 HBC
R2       16    1.15      0.4            MILLER    64 FBC
R2       31    1.4       0.3            COURANT   64 HBC
R2   A         1.251     0.171    AVERAGE OF ABOVE DATA -- SEE NOTE A IN TEXT 8/67

R3   *  SIGMA - INTO (LAMBDA E- NEU)/(N PI-) (UNITS 10**-4)(P5)/(P1)
R3       11    0.75      0.28           COURANT   64 HBC      STOP. K-
R3       35    0.64      0.12           BARASH    67 HBC      STOP K-         8/67
R3   A         0.657     0.110    AVERAGE OF ABOVE DATA -- SEE NOTE A IN TEXT 8/67

R4   *  SIGMA - INTO (N PI- GAMMA)/(NPI-) (UNITS 10**-3)(P2)/(P1)
R4   *  ABOUT  1.1                      BAZIN     65 HBC                      8/67
R4   *  FOR PI- MOM LESS THAN 166 MEV/C

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                     20 SIGMA- DECAY PARAMETERS

A-   *  ALPHA SIGMA-
A-   *          -0.16     0.21           TRIPP     62 HBC      REPL.BY BANGERTER
A-     6500   -0.010     0.043          BANGERTER 66 HBC      K-P TO SIG- PI+  7/66

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                              REFERENCES

                              20 SIGMA-(1198,JP=1/2+)I=1
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BROWN     58 CERN CONF 270      BROWN,GLASER,GRAVES,PERL,CRONIN + /// MICH
EISLER    58 NC SER10 10 150    EISLER,BASSI,CONVERSI + / COL+BNL+BOL+PISA
BROWN     57 PR 108 1036        J BROWN, D GLASER, M PERL / MICHIGAN + BNL

BARKAS    61 PR 124 1209        BARKAS,DYER,MASON,NICKOLS,SMITH ////// LRL
CHIESA    61 NC 19 1171         A M CHIESA,B QUASSIATI,G RINAUDO /// TURIN
HUMPHREY 62 PR 127 1305         W E HUMPHREY,R R ROSS ////////////////  LRL
TRIPP     62 PRL 9 66           R D TRIPP,M WATSON,M FERRO-LUZZI ///// LRL

BARKAS    63 PRL 11 26          W H BARKAS,J N DYER,H H HECKMAN ////// LRL
COURANT   63 SIENA 1 15         COURANT,FILTHUTH,BURNSTEIN+/// CERN+MD+NRL
BURNSTEI 64 PRL 13 66           BURNSTEIN,DAY,KEHOE,SECHI ZORN,SNOW// MARY
COURANT   64 PR 136 B 1791      COURANT,FILTHUTH+///CERN+HEIDLB+MD+NRL+BNL
MILLER    64 PL 11 262          MILLER,STANNARD,BEZAGUET+ /LOND+PARIS+BERG
MURPHY    64 PR 134 B 188       C THORNTON MURPHY /////////////// WISCONSIN
NAUENBER 64 PRL 12 679          NAUENBERG,SCHMIDT,MARATECK+ /COL+RUT+PRINC

BAZIN     65 PR 140 B 1358      BAZIN,PLANO,SCHMIDT +    //PRINC+RUTG+COLUM
CHANG     65 NEVIS 145  THESIS CHUNG YUN CHANG ////////////////  COLUMBIA
  ALSO    66 PR  151  1081      CHUNG YUN CHANG ///////////////// COLUMBIA
DOSCH     65 PL 14 239          DOSCH,ENGELMANN,FILTHUTH,HEPP,KLUGE+ /HEID
SCHMIDT   65 PR 140 B 1328      P SCHMIDT ///////////////////////// COLUMBIA
BANGERTE 66 PRL  17  495        BANGERTER,GALTIERI,BERGE,MURRAY+   // LRL

BARASH    67 PRL 19  181        BARASH,DAY,GLASSER,KEHOE,KNOP +///MARYLAND
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                     21  SIGMA 0  (1193,JP=1/2+)  I=1

                     21  (SIGMA-) - (SIGMA0) MASS DIFFERENCE (MEV)

D1       18    4.75      0.1            BURNSTEIN 64 HBC      SEE NOTE IN TEXT
D1       37    4.87      0.12           DOSCH     65 HBC
D1             4.95      0.12           SCHMIDT   65 HBC      SEE NOTE IN TEXT  6/66

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

M    N SEE NOTE PRECEDING LAMBDA MASS LISTINGS

DL          76.61      0.28           SCHMIDT   65            SEE NOTE IN TEXT  9/66

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                     21  SIGMA0 LIFETIME (UNITS 10**-14)

T    *     1.0 OR LESS                DAVIS     62 EMUL

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              21  SIGMA 0 PARTIAL DECAY MODES

P1        SIGMA 0 INTO LAMBDA GAMMA                        S18S 0
P2        SIGMA 0 INTO LAMBDA E+ E-                        S18S 3S 3

R1   *   SIGMA 0 INTO(LAMBDA E+ E-)/TOTAL                (P2)/(P1+P2)

R1   *         0.00545   THEORET. CAL. FEINBERG  58       QUANTUM ELECT.    9/66

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                              REFERENCES

                              21 SIGMA 0(1193,JP=1/2+)I=1
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FEINBERG 58 PR 109 1019         G.FEINBERG                          // BNL
DAVIS     62 PR 127 605         D DAVIS,R SETTI,M RAYMOND,G TOMASIN ///CHI
COURANT   63 PRL 10 409         COURANT,FILTHUTH,FRANZINI+//CERN+UMD+USNRL
BURNSTEI 64 PRL 13 66           BURNSTEIN,DAY,KEHOE,SECHI ZORN,SNOW //MARY
DOSCH     65 PL 14 239          DOSCH,ENGELMANN,FILTHUTH,HEPP,KLUGE+ /HEID
SCHMIDT   65 PR 140 B 1328      P SCHMIDT ///////////////////////// COLUMBIA

        QUANTUM NUMBER DETERMINATIONS NOT REFERRED TO IN THE DATA CARDS

ALFF      65 PR 137 B1105       ALFF,GELFAND,NAUENBERG+//COLUMBIA+RUTG+BNL P
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                     22  XI-  (1321,JP=1/2 ) I=1/2

                     22  XI-  MASS (MEV)

M    H   11 1317.0       2.2            WANG      61 PBC
M    H   18 1317.9       1.9            FOWLER    61 PBC
M    H (OLD DATA AND LOW STATISTICS DROPPED ON SUGGESTION OF J R HUBBARD)
M    *    1 1322.0       1.3            BROWN     62 HBC     ANTI-XI-         7/66

M       517 1321.4       0.4            JAUNEAU   63 FBC
M        62 1321.1       0.65           SCHNEIDER 63 HBC
M       241 1321.1       0.3            BADIER    64 HBC
M    *  ALL MASSES ABOVE MUST BE RAISED 0.09 MEV BECAUSE LAMBDA MASS RAISED
M       299 1321.4       1.1            LONDON    66 HBC                      6/66

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

T    H   11     3.5      3.4       1.23 WANG      61 PBC
T    H   18     1.26     0.41      0.25 FOWLER    61 PBC
T    H (OLD DATA AND LOW STATISTICS DROPPED ON SUGGESTION OF J R HUBBARD)
T       517     1.86     0.15      0.14 JAUNEAU   63 FBC
T        62     1.55     0.31      0.31 SCHNEIDER 63 HBC
T       356     1.77     0.12           CARMONY   64 HBC
T       794     1.69     0.07           HUBBARD   64 HBC
T       299     1.80     0.16           LONDON    66 HBC                      6/66

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                     22  XI- PARTIAL DECAY MODES

P1       XI- INTO LAMBDA PI-                                S18S 6
P2       XI- INTO LAMBDA E- NEUTRINO                        S18S 3S 1
P3       XI- INTO NEUTRON PI-                               S17S 8
P4           XI- INTO LAMBDA MU- NEUTRINO                   S18S 4S 2
P5           XI- INTO SIGMA0 E- NEUTRINO                    S21S 3S 1
P6           XI- INTO SIGMA0 MU- NEUTRINO                   S21S 4S 2
P7           XI- INTO NEUTRON E- NEUTRINO                   S17S 3S 1

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                    22  XI- BRANCHING RATIOS

R1   *  XI- INTO (LAMBCA E- NEU)/(LAMBCA PI-)              (P2)/(P1)
R1   *    1     0.0017   OR LESS          CARMONY + 63 HBC
R1   *    0      .0C4  OR LESS            JAUNEAU1  63 FBC    -                8/67
R1   *          0.005   OP LESS           BERGE     66 HBC                     7/66
R1   *    1     0.0C6    0.006            LONDON    66 HBC                     6/66
R1              0.0025   0.0018           ROOS      66 RVUE INCLUCES ALL AEOVE 9/66
R1        2    0.0017   0.0012            BERGE     67 HBC                     8/67

R2   *  XI- INTO (NEUTRON PI-)/(LAMBCA PI-)                (P3)/(P1)
R2   *          0.005   OR LESS           FERRO-LUZ 63 HBC

R3   *      X1- INTO (LAMBCA MU- NEUTRINO)/TOTAL              (P4)/TOTAL
R3   *          0.012   OR LESS           BERGE     66 HBC                     7/66

R4   *      X1- INTO (SIGMA0 E- NEUTRINO)/TOTAL               (P5)/TOTAL
R4   *          0.003   OR LESS           BERGE     66 HBC                     7/66

R5   *      X1- INTO (SIGMA0 MU- NEUTRINO)/TOTAL              (P6)/TOTAL
R5   *          0.0C5   OR LESS           BERGE     66 HBC                     7/66

R6   *      XI- INTO (N E- NEUTRINO) / (LAMBDA PI-)           (P7)/(P1)
R6   *          0.01  CR LESS             BINGHAM   65 RVUE    CONF.LIMIT 0.9  9/66

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                    22  XI- DECAY PARAMETERS

A    *  ALPHA XI-
A              -0.44       0.11            JAUNEAU   63 FBC
A        62    -0.73       0.21            SCHNEIDER 63 HBC
A       240    -0.5        0.35            BADIER    64 HBC                     7/66
A       356    -0.62       0.12            CARMONY   64 HBC
A    * 1004    -0.368      0.C57           BERGE     66 HBC   - REPL. BY MERRILL  7/66
A      2529    -0.342      0.044           MERRILL   66 HBC     USED ALPHAL=.747  9/66
A       364    -0.47       0.12            LONDON    66 HBC  USING A-LAME =0.62   6/66
A    *         -0.391      0.032           BERGE 2   66 RVUE  INCLUDES ALL ABOVE  9/66

F    *  PHI ANGLE (TAN(PHI)=BETA/GAMMA)  (DEGREE)
F            -16.        37.               JAUNEAU   63 FBC
F        62   45.0       30.0              SCHNEIDER 63 HBC
F       356   54.0       25.0              CARMONY   64 HBC
F    * 1CC4    0.45      10.7              BERGE     66 HBC   - REPL. BY MERRILL  7/66
F       364    0.0       17.0              LONDON    66 HBC     USED ALPHAL=.62   9/66
F      2529    1.2        7.5              MERRILL   66 HBC     USED ALPHAL=.747  9/66

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REFERENCES

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


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FOWLER   61 PRL 6 134          FCWLER,BIRGE,EBERHARC,ELY,GCCD,PCWELL+/LRL
WANG     61 JETP 13 512        K WANG,T WANG,VIRYASOV,TING,SOLOVEV+//JINR
BERTANZA 62 PRL 9 229          BERTANZA,BRISSON,GOLCBERG,GRAY+/BNL+SYRACU
BROWN    62 PRL 8 255          BROWN,CULWICK,FOWLER,GAILLCUD +///BNL+YALE

CARMONY  63 PRL  10  381       CARMONY,PJERROU                     // UCLA
FERROLUZ 63 PR 13C 1568        FERRO-LUZZI,ALSTCN,RCSENFELC,WOJCICKI//LRL
JAUNEAU  63 SIENA CONF 4       JAUNEAU+ ///// PARIS+CERN+LCND+RUTH+BERGEN
JAUNEAU1 63 PL  5  261         JAUNEAU,MORELLET+//EP,CERN,LCN,RUTH,BERGEN
SCHNEIDE 63 PL 4 360           H SCHNEIDER ////////////////////////// CERN

CARMONY  64 PRL 12 482         CARMONY,PJERROU,SCHLEIN,SLATER,STORK+/UCLA
BADIER   64 DUBNA CONF         BADIER,DEMOULIN,BARLOUTALC+ /PARIS+SAC+ZEE
HUBBARD  64 PR 135 B 183       HUBBARD,BERGE,KALBFLEISCH,SHAFER +/////LRL
BINGHAM  65 PRSL  265  202     H H BINGHAM                         // CERN
PJERROU  65 PRL 14 275         + SCHLEIN,SLATER,SMITH,STCRK,TICHO // UCLA

BERGE    66 PR  147  945       BERGE,EBERHARD,HUBBARD,MERRILL + ///// LRL
BERGE 2  66    BERKELEY CONF.  BERGE,CABIBBO                       // RVUE
LONCON   66 PR 143 1C34        LCNDON,RAU,GOLDBERG,LICHTMAN+//BNL+SYRACUS
MERRILL  66  BERKELEY CONF     MERRILL,SHAFER,BERGE                 // LRL
     CF. 66 UCRL 16455         DEANE MERRILL (THESIS, BERKELEY) ///// LRL

    QUANTUM NUMBER DETERMINATICNS NOT REFERREC TC IN THE DATA CARDS

CARMONY  64 PRL 12 482         CARMONY,PJERROU,SCHLEIN,SLATER,STORK+/UCLA  J
SHAFER   65 UCRL 11884         J BUTTON SHAFER, DEANE MERRILL /////  LRL  J
MERRILL  66 UCRL 16455         DEANE MERRILL (THESIS, BERKELEY)  ///  LRL  J
BERGE    67 PRIV COMM          BERGE,DAUBER,HUBBARC ///////////////// LRL
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                 23  XI 0  (1314,JP=1/2 ) I=1/2

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

D       23    6.8       1.6            JAUNEAU    63 FBC
D       45    6.1       1.6            CARMONY    64 HBC
D       29    6.9       2.2            LONDON     66 HBC                        6/66

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                  23  XI 0 LIFETIME (UNITS 1C**-10)

T       24    3.9       1.4       0.80  JAUNEAU    63 FBC
T       45    3.5       1.0        0.8  CARMONY    64 HBC
T      101    2.5       0.4        0.3  HUBBARD    64 HBC

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                  23  XI 0  PARTIAL DECAY MCDES

P1      XI 0 INTO LAMBDA PI0                               S18S 9
P2      XI 0 INTO PROTON PI-                               S16S 8
P3      XI 0 INTO PROTON E- NEU                            S16S 3S 1
P4      XI 0 INTO SIGMA+ E- NEU                            S19S 3S 1
P5      XI 0 INTO SIGMA- E+ NEU                            S20S 3S 1
P6            X1 0 INTO SIGMA+ MU- NEUTRINO                S19S 4S 2
P7            X1 0 INTO SIGMA- MU+ NEUTRINO                S20S 4S 2
P8            X1 0 INTO PROTON MU- NEUTRINO                S16S 4S 2

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                    23  XI 0  BRANCHING RATIOS

R1   *  XI 0 INTO(PROTON PI-)/(LAMBDA PI0)                     (P2)/(P1)
R1   *    0     0.027  OR LESS          TICHO      63 HBC
R1   *    0     0.005  OR LESS          HUBBARD    66 HBC                      7/66

R2   *  XI 0 INTO(PROTON E- NEU)/(LAMBCA PI0)                  (P3)/(P1)
R2   *    0     0.027  OR LESS          TICHO      63 HBC
R2        0     0.006 OR LESS           HUBBARD    66 HBC                      7/66

R3   *  XI 0 INTO(SIGMA+ E- NEU)/(LAMBCA PI0)                  (P4)/(P1)
R3   *    0     0.013  OR LESS          TICHO      63 HBC
R3        0     0.007 OR LESS           HUBBARD    66 HBC                      7/66

R4   *      X1 0 INTO (SIGMA- E+ NEUTRINO)/TOTAL              (P5)/TOTAL
R4   *    0     0.006  OR LESS          HUBBARD    66 HBC                      7/66

R5   *      X1 0 INTO (SIGMA+ MU- NEUTRINO)/TOTAL             (P6)/TOTAL
R5   *    0     0.007  OR LESS          HUBBARD    66 HBC                      7/66

R6   *      X1 0 INTO (SIGMA- MU+ NEUTRINO)/TOTAL             (P7)/TOTAL
R6   *    0     0.006  OR LESS          HUBBARD    66 HBC                      7/66

R7   *      X1 0 INTO (PROTON MU- NEUTRINO)/TOTAL             (P8)/TOTAL
R7   *    0     0.006  OR LESS          HUBBARD    66 HBC                      7/66

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                    23  XI 0 DECAY PARAMETER

A    *  ALPHA XI 0
A              -0.09       0.42           PJERROU    65 HBC
A    *         -0.149      0.154          BERGE      66 HBC                        7/66
A        46    -0.2        0.4            LONDON     66 HBC  USING A-LAME=0.62     6/66
A       490    -0.33       0.10           MERRILL    66 HBC  A-LAM=0.690+-.048     8/66

F    *  PHI ANGLE XI0  (TAN(PHI)=BETA/GAMMA)  (DEGREE)
F    N  146   -2.9     23.5               BERGE      66 HBC                        7/66
F    N  490  107.0     38.0               MERRILL    66 HBC  USING A-LAME=0.642    8/66
F    N  THE LIKELIHOOD FUNCTION FOR COMBINED DATA IS VERY NON-GAUSSIAN. THE        7/66
F    N    DATA ARE CONSISTENT (2.2 S.D.) WITH PHI BETWEEN -25 AND +225 DEG.        7/66

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REFERENCES

23 XI 0(1314,JP=1/2)I=1/2


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ALVAREZ  59 PRL 2 215          ALVAREZ,EBERHARC,GOOC,GRAZIANO,TICHO+//LRL
JAUNEAU  63 SIENA CONF 1 1     JAUNEAU+ ///// PARIS+CERN+LCND+RUTH+BERGEN
    ALSO 63 PL 4 49            JAUNEAU+ ///// PARIS+CERN+LCND+RUTH+BERGEN
TICHO    63 BNL CONF 410       HAROLD K TICHO ////////////////////////UCLA

CARMONY  64 PRL 12 482         CARMONY,PJERROU,SCHLEIN,SLATER,STORK+/UCLA
HUBBARD  64 PR 135 B 183       HUBBARD,BERGE,KALBFLEISCH,SHAFER +/////LRL
PJERROU  65 PRL 14 275         + SCHLEIN,SLATER,SMITH,STCRK,TICHO // UCLA

BERGE    66 PR  147  945       BERGE,EBERHARD,HUBBARC,MERRILL + ///// LRL
HUBBARD  66 UCRL 11510         J RICHARD HUBBARC (THESIS,BERKELEY) // LRL
LONDCN   66 PR 143 1C34        LCNDON,RAU,GOLDBERG,LICHTMAN+//BNL+SYRACUS
MERRILL  66  BERKELEY CONF     MERRILL,SHAFER,BERGE                 // LRL
     CF. 66 UCRL 16455         DEANE MERRILL (THESIS, BERKELEY) ///// LRL
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                 24  OMEGA- (1675,JP=3/2+)   I=C

    *               QUANTUM NUMBERS ASSIGNED FROM SU3

                 24  OMEGA-   MASS (MEV)

M    *    1 1620.0     25.0      1C.C  EISENBERG 54 EMUL
M    S    1 1673.0      8.0            ABRAMS    64 HBC     INTO XI- PI0      7/66
M    S    1 1686.0     12.0            BARNES 1  64 HBC     INTO XIC PI-      7/66
M    S    1 1674.0      3.0            BARNES 2  64 HBC     INTO LAMBDA K-    7/66
M    S    1 1666.0      8.0            COLLEY    65 HBC     INTO XIC PI-      6/66
M    S    1 1671.0      5.0            RICHARDSO 65 HBC     INTO LAMBDA K-    7/66
M    S      ABOVE EVENTS INCLUDEC IN SAMIOS RVUE                              7/66
M         6 1674.0      3.0            SAMIOS    65 RVUE                      6/66

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                 24  OMEGA- LIFETIME  (UNITS 10**-1C SEC)

T         1    1.63                    ABRAMS    64 HBC                       7/66
T         1    0.7                     BARNES 1  64 HBC                       7/66
T         1    1.4                     BARNES 2  64 HBC                       7/66
T         1    1.85                    COLLEY    65 HBC                       7/66
T         1    1.5                     RICHARDSO 65 HBC                       7/66

                 24 OMEGA- PARTIAL DECAY MODES

P1  OMEGA- INTO LAMBDA K-                                S18S10
P2  OMEGA- INTO XI 0 PI-                                 S23S 8

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


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EISENBER 54 PR 96 541          Y EISENBERG ////////////////////////CORNELL
ABRAMS   64 PRL 13 670         + BURNSTEIN,GLASSER + ///// MARYLAND+LSNRL
BARNES 1 64 PRL  12  204       V E BARNES,CONNOLLY,CRENNELL,CULWICK+//BNL
BARNES 2 64 PL 12 134          V E BARNES,CONNOLLY,CRENNELL,CULWICK+//BNL
COLLEY   65 PL 19 152          COLLEY,DOOD +  //  BIR+GLA+IC+MUN+OXF+RHEL
RICHARDS 65 BAPS 10 115        RICHARDSON,BARNES,CRENNEL+ // BNL+SYRACUSE
SAMIOS   65 ARGONNE CONF 189   N P SAMIOS /////////////////// (RVUE) BNL
```

DATA ON MESON RESONANCES

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

N ANY SYMBCL IN CCLUMN 6 INCICATES DATA IGNOREC BY AVERAGING PROGRAMS

σ (410)

7 SIGMA MESON (410, JPG=C++) I = C

* NO COMPELLING EVIDENCE FOR NARROW RESCNANCE.
* OMITTED FROM TABLE.

σ(410) and ϵ(700)

Narrow $J^P = 0^+$ pion pion resonances have been claimed at each of these energies, but the evidence is poor (see the note at this place in our Jan. 1967 edition).

There is, however, evidence from several studies of

$$\pi^- p \to n\pi^+\pi^-,\ n\pi^0\pi^0$$
$$\pi^+ p \to \Delta^{++}\pi^+\pi^-$$

that δ_{00} (the I=0, s-wave, ππ phase shift) is large and slowly varying between 400 and 600 MeV, and that it is large around 700 MeV.

The most complete and recent study is MALAMUD 67. Malamud and Schlein find three solutions for δ_{00}, two of which suggest a broad resonance at 730 MeV. The slightly preferred solution also hints at a lower resonance, e. g. the σ(400).

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REFERENCES FOR SIGMA

SAMICS 62 PRL 9 139 +BACHMAN,LEA+ ///////////// BNL+CCNY+CO+KY
BLOKHINT 63 JETP 17 8C BLOKHINTSEVA,GREIBINNIK,ZHUKCV + // DUBNA
BOOTH 63 PR 132 2314 + ADASHIAN //////////////////////////// LRL
KIRZ 63 PR 13C 2461 +SCHWARTZ + TRIPP /////////////////// LRL
BARISH 64 PR 135 B 416 BARISH,KURZ,PEREZ-MENDEZ,SCLCMON // LRL
CRAWFORD 64 PRL 13 421 +GROSSMAN,LLOYD,PRICE,FOWLER ///////// LRL
DEL FABR 64 PRL 12 674 DEL FABRO,DE PRETIS,JONES+ FRASCATI
KALMUS 64 PRL 13 99 +KERNAN,PU,POWELL,DOWD ///// LRL+WISCONSIN
BROWN 65 CORAL GABLES 219 BROWN+FAIER ///////////////// NORTHWESTERN
KOPELMAN 66 PL 22 118 +ALLEN,GOODEN,MARSHALL + // COLORADO+IOWA
LOVELACE 66 PL 22 332 LCVELACE,HEINZ,DONNACHIE // CERN
ANDERSON 67 PRL 18 89 +FUKUI+KESSLER+ // CHIC+ANL+OTT+MCGILL+UMC

FOR NEGATIVE EVIDENCE FROM PI PI PHASE SHIFT DETERMINATIONS, SEE

BIRGE 65 PR 139 B 1600 +ELY+GIDAL+KALMUS+CAMERINI+ ///// LRL+WISC
WOLF 65 PL 19 328 WCLF ///////////////////////////////// DESY
BIRGE 66 BERKELEY CONF +ELY+GIDAL+HAGOPIAN+ / LRL+LONDON(UC)+WISC
JACOBS 66 PRL 16 669 +SELOVE ///////////////////////////////// LRL
JONES 66 PL 21 59C +CALDWELL+ZACHAROV+HARTING+BLEULER+ / CERN
CORBETT 67 PR 156 1451 +CAMERELL+MIDDLEMAS+NEWTCN OXF+RUTHERF
WALKER 67 PRL 18 63C +CARRCLL,GARFINKEL,OH ////////// WISCONSIN
MALAMUD 67 PRL TO BE PUBLISHED E.MALAMUD,P.E.SCHLEIN/ / / / / / / UCLA
SEE ALSC DISCUSSION BY G. GOLDHABER, BERKELEY CONF. 1966, MESON REVIEW

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ϵ (700)

14 EPSILON (70C,JPG=0++) I=0

* SEE NOTE ON SIGMA(410) AND EPSILON(7C0) ABOVE.

14 EPSILON (7C0) MASS (MEV)

CODE		EVENTS	QUANTITY	ERROR+	ERROR-	REFERENCE	YR	TECN	COMMENTS	DATE PUNCHED
M			700.0			FELCMAN	65	SPRK		
M		20	710.			FORINO	65	DBC	4.5 PI+ D	10/66
M			720.0			HAGOPIAN	65	HBC		
M	*		740.0			WCLF	65	RVUE		6/66
M	*		600.	APPROX.		CORBETT	67	SPRK	1.7-2.5 PI-P	7/67
M	P	20	709.	18.		STRUGALSK	67	HLBC	2.3 PI+ N	7/67
M	P	PRELIMINARY RESULT								

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14 EPSILON (700) WIDTH (MEV)

CODE		EVENTS	QUANTITY	ERROR+	ERROR-	REFERENCE	YR	TECN	COMMENTS	DATE PUNCHED
W			50.0			FELCMAN	65	SPRK		
W			50.0			HAGOPIAN	65	HBC		
W	*		90.0			WOLF	65	RVUE		6/66
W	*		400.	APPROX.		CORBETT	67	SPRK	1.7-2.5 PI- P	7/67

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REFERENCES FOR EPSILON

COHN 65 PRL 15 906 H O CCHN,BUGG+//ORNL+TENN+UNCAR+COLU+EFINS
DURAND 65 PRL 14 329 L. DURAND AND Y.T. CHIU ///////////// YALE
FELCMAN 65 PRL 14 869 FELDMAN,FRATI,HALPERN,CHOUDRY+/PENNA+COLUM
SEE HOWEVER BUHLER-BROGLIN+ BELOW FOR NEGATIVE EVIDENCE
FORINO 65 PL 19 65 +GESSAROLI,LENDINARA+ /// BOL+ORSAY+SACLAY
HAGOPIAN 65 PRL 14 1077 HAGOPIAN,SELOVE,ALIT+/PENNA+SACLAY+BOLOGNA
SEE HOWEVER ALSO CLARK+65 PR 139 B1556, AND JABIOL+66 PRL 17 1065.
WOLF 65 PL 19 328 G WOLF ////////////////////////////////// DESY
GOLDHABE 66 BERKELEY CONF G.GOLDHABER,SAMIOS,ASTIER,SHEN,LAI.MESON REVIEW
JONES 66 PL 21 590 +CALDWELL+ZACHAROV+HARTING+BLEULER+ / CERN
OLSSON 66 PREPRINT MARTIN G. OLSSON //////////////// WISCONSIN

BANCER 67 PR 155 1675 M.BANCER + G.L.SHAW ////////////////// UCI
BUHLER-B 67 NC 49A 183 BUHLER-BROGLIN+DALPIAZ+ZICHICHI+ //// CERN
CORBETT 67 PR 156 1451 +CAMERELL+MIDDLEMAS+NEWTCN OXF+RUTHERF
GUTAY 67 PRL 18 142 +JOHNSON+LOEFFLER+MCILWAIN+ // PURDUE+UCRL
JOHNSON 67 PREPRINT +EISNER+GUTAY+KLEIN+PETERS+SAHNI+ / PURDUE
STRUGALS 67 JINR E1-3100 STRUGALSKI+CHUVILO+IVANOVSKAJA+ //// DUBNA
SEE ALSO G. GOLDHABER, MESON REVIEW, PROC. 1966 BERKELEY CONF.
WALKER 67 PRL 18 630 +CARROLL,GARFINKEL,OH ////////// WISCONSIN
MALAMUD 67 PRL TO BE PUBLISHED E.MALAMUD,P.E.SCHLEIN/ / / / / // /UCLA

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ω (780)

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

1 OMEGA MASS (MEV)

CODE		EVENTS	QUANTITY	ERROR+	ERROR-	REFERENCE	YR	TECN	COMMENTS	DATE PUNCHED
M		400	782.0	1.0		ALFF	62	HBC		
M		64	779.4	1.4		ARMENTERC	62	HBC		
M		650	782.0			MURRAY	63	HBC		
M		34	784.0	1.0		ARMENTERC	63	HBC		
M		220	781.0	2.0		KRAEMER	64	DBC		
M			785.6	1.2		MILLER D	65	HBC	SEEN WITH K+K-	
M	*		780.8	2.0		MILLER D	65	HBC	SEEN WITH K1 K1	8/66
M		333	786.0	1.0		JAMES	66	HBC		6/66
M		2198	783.4	0.7		BALTAY	67	HBC	0.0 PBAR P	9/66
M		155	779.5	1.5		BARASH	67	HBC	0 PBAR TC K1K1CM	11/66
M	*	BARASH 67 INCLUDES DATA OF MILLER 65								
M			785.5	2.2		GOSHAW	67	HBC	3.5 K+ P	7/67

(Ideogram below)

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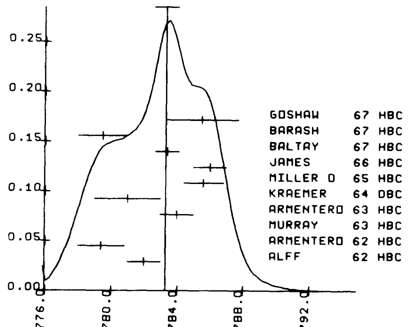
WEIGHTED AVERAGE =783.314 +/- 0.720
SCALE = 1.93 CHISQ = 29.7 CONLEV = .001



OMEGA MESON MASS (MEV)

1 OMEGA FULL WIDTH (MEV)

CODE		EVENTS	QUANTITY	ERROR+	ERROR-	REFERENCE	YR	TECN	COMMENTS	DATE PUNCHED
W		34	9.0	3.0		ARMENTERO	63	HBC		
W			13.4	2.0		MILLER C	65	HBC	SEEN WITH K+ K-	
W	*		11.6	3.0		MILLER D	65	HBC	SEEN WITH K1 K1	6/66
W	*	333	20.0	OR LESS		JAMES	66	HBC		6/66
W		155	12.3	2.0		BARASH	67	HBC	SEEN WITH K1 K1	6/66
W	*	BARASH 67 INCLUDES DATA OF MILLER 65								
W			12.8	7.5		GOSHAW	67	HBC	3.5 K+ P	7/67

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1 OMEGA PARTIAL DECAY MODES

P1	OMEGA INTO PI+ PI- PI0	S 8S 8S 9
P2	CMEGA INTO PI+ PI- (VIOLATES G)	
P3	CMEGA INTO PI+ PI- GAMMA	S 8S 8S 0
P4	CMEGA INTO PI0 GAMMA	S 9S 0
P5	CMEGA INTO 2PI0 GAMMA	S 9S 9S 0
P6	CMEGA INTO MU+ MU-	S 4S 4
P7	CMEGA INTO E+ E-	S 3S 3
P8	CMEGA INTO ETA GAMMA	S14S 0
P9	CMEGA INTO ETA PI0 (VIOLATES C)	

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1 OMEGA BRANCHING RATIOS

CODE		EVENTS	QUANTITY	ERROR+	ERROR-	REFERENCE	YR	TECN	COMMENTS	DATE PUNCHED
R1	*	CMEGA INTO NEUTRAL/(PI+ PI- PI0)							(P4+P5)/(P1)	
R1			0.17	0.04		ARMENTERO	63	HBC		
R1		20	0.11	0.02		BUSCHBECK	63	HBC		
R1		35	0.08	0.03		KRAEMER	64	DBC		
R1	*		0.13	0.035		MILLER D	65	HBC		
R1		65	0.10	0.04		ALFF-STEI	66	HBC	CORR.BY SCHULTZ(COL)	9/66
R1		850	0.134	0.026		DI GIUGNO	66	CNTR		9/66
R1		348	0.097	0.016		FLATTE	66	HBC		9/66
R1			0.06	0.05	0.02	JAMES	66	HBC		6/66
R1		19	0.10	0.03		BARASH	67	HBC		7/67
R2	*	OMEGA INTO (PI+ PI-)/(PI+ PI- PI0)							(P2)/(P1)	
R2	*		0.010 OR LESS			BUTTON	62	HBC		
R2	*		0.07			ALITTI	63	HBC		
R2	*		0.05 OR LESS			ARMENTERO	63	HBC		
R2	*	100	0.05 OR GREATER			FICKINGER	63	HBC		
R2	*		0.02			JAMES	63	HBC		
R2	*		0.05 OR LESS			KRAEMER	64	DBC		
R2	*		0.005 OR LESS			LUTJENS	64	RVUE	NO INTERFERENCE	
R2	*		0.018	0.012	0.006	WALKER	64	RVUE		
R2	*		0.04 OR GREATER			BATON	65	HBC		
R2	*		0.010 OR LESS			CLARK	65	SPRK		6/66
R2	*		0.035 OR LESS			MILLER D	65	HBC		
R2	*		0.02 OR LESS			ALFF-STEI	66	HBC		11/66
R2	*		0.029	0.011	0.009	FLATTE	66	HBC	INTERFERENCE	9/66
R2	*		0.082	0.020		FLATTE	66	HBC	NO INTERFERENCE	9/66
R2	*		0.07	0.06	0.11	ROOS	67	RVUE	NO INTERF. T.LT.10	7/67
R2	*		0.017	0.035	0.026	ROOS	67	RVUE	INTERF. T.LT.10	7/67
R2	*		0.00	0.01		ROOS	67	RVUE	NO INTERF. T=10-30	7/67
R2	*		0.12	0.04	0.2[illegible]	ROOS	67	RVUE	INTERF. T=10-30	7/67
R3	*	CMEGA INTO (PI0 GAMMA) / (PI+ PI- PI0)							(P4)/(P1)	
R3	*		0.125	0.025		BARMIN	64	PXBC		
R3			0.10	0.03		BELYAKOV	64	PXBC		
R3		13	0.15	0.06		BAGLIN	66	HLBC		9/66
R4	*	OMEGA INTO (PI+ PI- GAMMA)/(PI+ PI- PI0)							(P3)/(P1)	
R4	*		0.05	OR LESS		FLATTE	66	HBC		9/66

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R5   *  CMEGA INTO(E+ E-)/(PI+ PI- PIO)  (UNITS 10**-3)  (P7)/(P1)
R5   *          3.9       1.5     CR LESS BARMIN     63 PBC
R5   *    1     2.8    OR LESS            BEZAGUET   64 FBC
R5        3     0.20      0.12            BINNIE     65 SPRK                       6/66
R5   *          1.4    CR LESS            GALTIERI   65 HBC
R5   *          0.3 UR LESS               FLATTE     66 HBC                        9/66
R5              0.10      0.17     0.075 HERTZBACH 67 SPRK ASSUME SU(3)+MIXING 10/66
R5       13     0.048     0.015    0.048 KHACHATUR 67 SPRK ASSUME SU(3)+MIXING  5/67

R6   *  OMEGA INTO (MU+ MU-)/(PI+ PI- PIO)(UNITS 10**-3) (P6)/(P1)
R6   *          1.2    OR LESS            GALTIERI   65 HBC
R6   *          1.7 OR LESS               FLATTE     66 HBC                        9/66

R7   *  CMEGA INTO (2PIO GAMM)/(PIO GAMMA)                  (P5)/(P4)
R7   *          0.1    OR LESS            BARMIN     64 PXBC

R8   *  OMEGA INTO(ETA PIO +ETA GAM)/(PI+PI-PIO)             (P8+P9)/(P1)
R8   *          0.017  UR LESS            FLATTE     66 HBC                        9/66

R9   *  OMEGA INTO (NEUTRALS) / (CHARGED)
R9              0.124     0.021           FELDMAN    67 SPRK     1.2 PI- P          3/67

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REFERENCES FOR OMEGA


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MAGLIC   61 PRL 7 178             B MAGLIC,ALVAREZ,ROSENFELC,STEVENSON //LRL
PEVSNER  61 PRL 7 421             PEVSNER,KRAEMER,NUSSBAUM,RICHARC+///JHU+NW
XUONG    61 PRL 7 327             NGUYEN HUU XUONG,GERALD R LYNCH /////  LRL
ALFF     62 PRL 9 325             ALFF,BERLEY,COLLEY,GELFANC +//COLU+RUTGERS
ARMENTER 62 CERN CONF 90          R ARMENTEROS,R BUDDE + // CERN+COLL+FRANCE
BUTTON   62 PR 126 1858           BUTTON,KALBFLEISCH,LYNCH,MAGLIC + ///  LRL
STEVENSO 62 PR 125 687            STEVENSCN,ALVAREZ,MAGLIC,ROSENFELD /// LRL

ALITTI   63 NC 29 515             ALITTI,BATON,BERTHELOT+//LPCHE+PAR+BARI+BO
ARMENTER 63 SIENA CONF 1 296      ARMENTEROS,EDWARDS,JACOBSEN+ // CERN+PARIS
BARMIN   63 SIENA CONF 1 207      BARMIN,DOLGOLENKC,KRESTNIKCV+ //////  ITEP
BERTHELO 63 SIENA CONF 2 60       A BERTHELOT ////////////////////// CEN-SACLAY
BUSCHBEC 63 SIENA CONF 1 166      BUSCHBECK,CZAPP+ /// VIENNA+CERN+AMSTERDAM
FICKINGE 63 PRL 10 457            W J FICKINGER,D K ROBINSCN,F SALANT // BNL
GELFAND  63 PRL 11 436            GELFAND,MILLER,NUSSBAUM,RATAU+ /COLUM+RUTG
JAMES    63 PREPR. TID-19082      F E JAMES, H L KRAYBILL ///////////// YALE
MURRAY   63 PL 7 358              MURRAY,FERROLUZZI,HUWE,SHAFER,SOLMITZ+/LRL

BARMIN   64 JETP 18 1289          BARMIN,DOLGOLENKO,KRESTNIKCV + /////  ITEP
BELYAKOV 64 DUBNA CONF            BELYAKOV + /////////////// DUBNA+BUCHAREST
BEZAGUET 64 PL 12 70              BEZAGUET,NGUYEN KHAC,ROUSSET+//PAR+BERG+LO
KRAEMER  64 PR 136 B 496          KRAEMER,MADANSKY,MEER,FIELDS+//JHU+NW+WOOD
LUTJENS  64 PRL 12 517            G LUTJENS,J STEINBERGER ///////  COLUMBIA
WALKER   64 PL 8 208              WALKER,BOYD,ERWIN,SATTERBLOM +// WISCONSIN

BATON    65 NC 35 713             BATON,BERTHELOT,DELER,BENEDETTI+/SAC+BOLOG
BINNIE   65 PL 18 348             BINNIE,DUANE,JANE,W JONES+//IC-LOND+MANCHS
CLARK    65 PR 139 B 1556         CLARK,CHRISTENSON,CRONIN,TURLAY//PRINCETON
GALTIERI 65 PRL 14 279            A BARBARO GALTIERI,R D TRIPP ///////// LRL
MILLER   65 CU-237 (NEVIS 131)DAVID C MILLER  (THESIS) //////// COLUMBIA
   MILLER 65 INCLUDES DATA OF GELFAND 63 ABOVE
ZDANIS   65 PRL 14 721            ZDANIS,MADANSKY,KRAEMER,HERTZBACH+/JHU+BNL

ALFF-STE 66 PR 145 1072           ALFF-STEINBERGER,BERLEY,BRUGGER+//COL+RUTG
BAGLIN   66 PL  23  286           +BEZAGUET,DEGRANGE,HAATUFT +  // EP+BERGEN
DIGIUGNO 66 NC 44A 1272           DI GIUGNO,PERUZZI,TROISE+ //NAPL+FRAS+TRST
FLATTE   66 PR  145  1050         +HUWE,MURRAY,BUTTON-SHAFER,SOLMITZ+ // LRL
JAMES    66 PR 142 896            F E JAMES,KRAYBILL //////  YALE+BROOKHAVEN

BALTAY   67 PRL  18  93           +FRANZINI,SEVERIENS,YEH,ZANELLO //COLUMBIA
BARASH   67 PR  156  1399         BARASH,KIRSCH,MILLER,TAN /////////COLUMBIA
FELDMAN  67 PRL TO BE PUBL.       +FRATI,GLEESON,HALPERN,NUSSBAUM+ /// PENNA
GOSHAW   67  PREPRINT             +ERWIN+WALKER+WEINBERG ////////////// WISC
HERTZBAC 67 PR 155, 1461          HERTZBACH,KRAEMER,MADANSKI,ZDANIS+/JHU+BNL
   (SEE ALSO ZDANIS 65)
KHACHATU 67 PL 24B 349            KHACHATURYAN+AZIMOV+BALDIN+BELOUSOV+/DUBNA
ROOS     67  PREPRINT             M. ROOS ////////////////////////////// CERN
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η'(960)

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2   ETA PRIME (958,JPG=0-+)  I=0
    KNOWN EARLIER AS XO OR ETA*

              2   ETA PRIME MASS (MEV)

M        85  957.0                        DAUBER     64 HBC
M            958.0      1.0               KALBFLEIS  64 HBC                        6/66
M            957.0      3.0               BADIER     65 HBC
M         8  960.0      2.0               TRILLING   65 HBC      3.65 PI+ P        9/66
M         7  955.0     10.0               COHN       66 DBC                        6/66
M            959.0      3.0               LONDON     66 HBC                        6/66

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              2   ETA PRIME WIDTH (MEV)

W    *   85    4.0 OR LESS                DAUBER     64 HBC
W    *         7.0 OR LESS                KALBFLEIS  64 HBC                        6/66
W    *        30.0 OR LESS                BADIER     65 HBC
W    *        15.0 OR LESS                LONDON     66 HBC                        6/66

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              2   ETA PRIME PARTIAL DECAY MODES

P1          ETA PRIME INTO  PI+ PI- ETA(NEUTRAL DECAY)     S 8S 8S14
P2          ETA PRIME INTO  PI+ PI- ETA(CHARGED DECAY)     S 8S 8S14
P3          ETA PRIME INTO  PI+ PI- NEUTRALS
                            (EXCLUDING  PI+ PI- ETA(NEUTRAL DECAY))
P4          ETA PRIME INTO  NEUTRALS
P5          ETA PRIME INTO  PI+ PI- GAMMA (INCL. RHO GAM) S 8S 8S 0
P6          ETA PRIME INTO  PIO E+ E- (VIOLATES C IN       S 9S 3S 3
                                      BORN APPROX.)
P7          ETA PRIME INTO  ETA E+ E- (VIOLATES C IN       S14S 3S 3
                                      BORN APPROX.)
P8          ETA PRIME INTO  PIO RHO C (VIOLATES C)         S 9U 9
P9          ETA PRIME INTO  PIO OMEGA (VIOLATES C)         S 9U 1
P10         ETA PRIME INTO  PI+ PI- E+ E-                  S 8S 8S 3S 3
P11         ETA PRIME INTO  2 PI                           S 8S 8
P12         ETA PRIME INTO  3 PI                           S 8S 8S 9
P13         ETA PRIME INTO  4 PI                           S 8S 8S 8S 8
P14         ETA PRIME INTO  6 PI                           S 8S 8S 8S 8S 8S 8
P15         ETA PRIME INTO PIO GAMMA GAMMA                 S 9S 0S 0

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              2   ETA PRIME BRANCHING RATIOS

              PARTIAL MODES  ADJUSTED BY PROGRAM  AHR=12345

R1   *      ETA PRIME INTO (PI+ PI- ETA (NEUTRAL DEC.))  NUM 1
R1   *                      / TOTAL                       DEN 12345
R1      68    0.36     0.05            KALBFLEIS 64 HBC                         10/66

R2   *      ETA PRIME INTO (PI+ PI- NEUTRALS) / TOTAL      NUM 1 3
R2   *                                                     DEN 12345
R2      33    0.35     0.06            BADIER     65 HBC                        10/66
R2      39    0.4      0.1             LONDON     66 HBC                        10/66

R3   *      ETA PRIME INTO (PI+ PI- ETA (CHRGD.DECAY))     NUM  2
R3   *                      / TOTAL                        DEN 12345
R3      44    0.12     0.02            KALBFLEIS 64 HBC                         10/66
R3       7    0.07     0.04            BADIER     65 HBC                        10/66
R3      10    0.1      0.04            LONDON     66 HBC                        10/66

R4   *      ETA PRIME INTO (PI+ PI- NEUTRALS (EXCLUDING   NUM    3
R4   *      PI+ PI- ETA (NEUTR.DEC.))) / TOTAL             DEN 12345
R4      10    0.05     0.04            KALBFLEIS 64 HBC                         10/66

R5   *      ETA PRIME INTO (NEUTRALS) / TOTAL              NUM     4
R5   *                                                     DEN 12345
R5      54    0.25     0.05            KALBFLEIS 64 HBC                         10/66
R5      16    0.24     0.17            BADIER     65 HBC                        10/66
R5      32    0.3      0.1             LONDON     66 HBC                        10/66

R6   *      ETA PRIME INTO (PI+ PI- GAMMA (INCLUDING      NUM      5
R6   *                      RHO GAMMA)) / TOTAL            DEN 12345
R6   *      THIS MODE SEEMS TO BE CONSISTENT WITH BEING ENTIRELY RHO GAMMA
R6      42    0.22     0.04            KALBFLEIS 64 HBC                         10/66
R6   B  35    0.34     0.09            BADIER     65 HBC                        10/66
R6   B      CONTROVERSIAL BACKGROUND SUBTRACTION
R6      20    0.2      0.1             LONDON     66 HBC                        10/66

R7   *      ETA PRIME INTO (PI+ PI- GAMMA (INCLUDING      NUM      5
R7   *                      RHO GAMMA)) /(PI PI ETA)       DEN 1234
R7            0.25     0.14            DAUBER     64 HBC                        10/66

R8   *      ETA PRIME INTO (PIO E+ E-)/TOTAL               NUM       6
R8   *        0.013  OR LESS           RITTENBER 65 HBC   DEN 12345             10/66

R9   *      ETA PRIME INTO (ETA E+ E-)/TOTAL               NUM        7
R9   *        0.011  OR LESS           RITTENBER 65 HBC   DEN 12345             10/66

R10  *      ETA PRIME INTO (PIO RHOO)/TOTAL                NUM         8
R10  *        0.04   OR LESS           RITTENBER 65 HBC   DEN 12345             10/66

R11  *      ETA PRIME INTO (PIO OMEGA) /TOTAL              NUM          9
R11  *        0.08   OR LESS           RITTENBER 65 HBC   DEN 12345             10/66

R12  *      ETA PRIME INTO (PI+ PI- E+ E-)/TOTAL           NUM           0
R12  *        0.006  OR LESS           RITTENBER 65 HBC   DEN 12345             10/66

R13  *      ETA PRIME INTO (2 PI)/TOTAL                    NUM            1
R13  *        0.07   OR LESS  COMP.BY LONDON   66 HBC   DEN 12345             10/66

R14  *      ETA PRIME INTO (3 PI)/TOTAL                    NUM             2
R14  *        0.07   OR LESS  COMP.BY LONDON   66 HBC   DEN 12345             10/66

R15  *      ETA PRIME INTO (4 PI)/TOTAL                    NUM              3
R15  *        0.01   OR LESS  COMP.BY LONDON   66 HBC   DEN 12345             10/66

R16  *      ETA PRIME INTO (6 PI)/TOTAL                    NUM               4
R16  *        0.01   OR LESS  COMP.BY LONDON   66 HBC   DEN 12345             10/66

R17  *      ETA PRIME INTO (PIO GAMMA GAMMA) / TOTAL       NUM                5
R17  *                                                     DEN 12345
R17  *   21 (POSSIBLY SEEN (PRELIM.))  STRUGALSK 67 HLBC    2.3 PI+ N          7/67

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η' branching ratios

Only two partial decay modes of the η' have been established, namely, $\eta' \to \eta\ \pi\pi$ and $\eta' \to \pi^+\pi^-\gamma$. (This electromagnetic mode may be mainly $\rho^0\gamma$.) In addition a recent experiment indicates a possible $\eta' \to \pi^0\gamma\gamma$ decay. In calculating the constrained branching fractions, in a previous edition of this data summary (RMP 39, 1(1967); see note on η' branching ratios on p. 23) we assumed that only the $\eta\ \pi\pi$ and $\pi^+\pi^-\gamma$ decay modes are present, and therefore that $\eta' \to$ (all neutrals) is entirely due to $\eta' \to \pi^0\pi^0\eta$, with $\eta \to$ (neutrals). We now feel, however, compelled to determine the branching fractions without this assumption. This results in the values given in the Meson Table. I-spin conservation is still assumed for the $\eta' \to \eta\ \pi\pi$ mode. This is in accord with all the experimental data on η' decay.

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REFERENCES FOR ETA PRIME


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DAUBER   64 DUBNA CONF 1 418      DAUBER,SLATER,L T SMITH,STORK,TICHO //UCLA
DAUBER 2 64 PRL 13 449            DAUBER,SLATER,SMITH,STORK,TICHO ///// UCLA
KALBFLEI 64 PRL 13 349            G.R.KALBFLEISCH,O.DAHL,A.RITTENBERG // LRL

BADIER   65 PL 17 337             BADIER,DEMOULIN,BARLOUTAUD +/PAR+SAC+ZEEMA
KIENZLE  65 PL 19 438             KIENZLE,MAGLIC,LEVRAT,LEFEBVRES + /// CERN
RITTENBE 65 PRL 15 556            RITTENBERG,KALBFLEISCH //////////  LRL+BNL
TRILLING 65 PL 19 427             +BROWN,GOLDHABERS,KALYK,SCANIO       // LRL

COHN     66 PL 21 347             COHN,MCCULLOCH,BUGG,CONDO//ORNL+TENN+UNCAR
LONDON   66 PR 143 1034           LONDON,RAU,SAMIOS,GOLDBERG +//BNL+SYRACUSE

STRUGALS 67  JINR E1-3100         STRUGALSKI+CHUVILO+IVANOVSKAJA+ //// DUBNA

       QUANTUM NUMBER DETERMINATIONS NOT REFERRED TO IN THE DATA CARDS

GALTIERI 65 OXF.VOL.2,P.10        + RITTENBERG,IN ROSENFELD MESON REVIEW/LRL I=0
GALTIERI 66  BERKELEY CONF        +RITTENBERG, IN GOLDHABER MESON REVIEW/LRL I=0
MARTIN   66 PL 22,352             MARTIN,CRITTENDEN,SCHROEDER   // INDIANA U I
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H (975)

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                   35  H (975, JPG=  -)  I=0

                   FOR COMPILATION SEE APPENDIX A OF JANUARY 1967 EDITION
                   (RMP 39, 1) OF THIS DATA SUMMARY.

                   35  H (975)  MASS  (MEV)

M    C   50  975.0     15.0            BARTSCH    64 HBC      4.0 PI+ P        8/66
M    C   30  975.0   APPROX            GOLDHABER 65 HBC      3.65 PI+P        9/66
M    C   30  998.      10.             BENSON     66 DBC      3.65 PI+D        9/66
M    C   EXPERIMENTS ABOVE COMPILED IN JAN 67 EDITION (RMP 39,1)
M    *       960.    APPROX.           COHN       67 DBC      3.3 PI+ D        1/67
M    *       996.    APPROX.           GALTIERI   67 DBC                       7/67

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                   35  H (975) WIDTH  (MEV)

W    C   90  120.0                     BARTSCH    64 HBC      4.0 PI+ P        8/66
W    C   30   45.0       30.0          BENSON     66 DBC      3.65 PI+ D      10/66
W    C   EXPERIMENTS ABOVE COMPILED IN JAN 67 EDITION (RMP 39,1)
W    *        60.    OR LESS           COHN       67 DBC      3.3 PI+ D        1/67
W    *        80.    APPROX.           GALTIERI   67 DBC                       7/67

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                   H MESON CROSS SECTION (MICROBARNS)

CS   *        75.0     15.0            BENSON     66 DBC  3.65 PI+D TO HPP     9/66
CS   *        50.                      COHN       67 DBC     3.3 PI+D TO HPP   1/67

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                          REFERENCES FOR H MESON

BARTSCH  64 PL  11  167       AACHEN-ZEUTHEN-BIRM-BONN-HAMB-MUNCHEN COLL
GOLDHABE 65 CORAL GABLES P 76 G. GOLDHABER                          // LRL
BENSON   66 PRL 17 1234       +MARQUIT,ROE,SINCLAIR,VANDER VELDE / MICH. IJP
   BENSON 66 ANALYSIS FAVORS  JP=1+
GOLDHABE 66  BERKELEY CONF    G.GOLDHABER,SAMIOS,ASTIER,SHEN,LAI.MESON REVIEW
COHN      67 NP B1 57         +MC CULLOCH,BUGG,CONDO // OAK R.+UNIV.TENN
GALTIERI 67  PRIV. COMM.       +MATTISON+RITTENBERG+CHADWICK+ / LRL+SLAC I
ROSENFEL 67 RMP 39 1           ROSENFELD,BARBARO-GALTIERI+/LRL+CERN+YALE

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φ (1020)

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

                   4  PHI  MASS (MEV)

M          1017.0      2.0             ARMENTERO 63 HBC
M          1019.0      2.0             SCHLEIN    63 HBC    2.0 K- P
M          1018.6      0.5             MILLER     65 HBC                       8/66
M          1019.       3.              BARLOW     66 HBC      1.2 PBAR P      11/66
M          1020.0      2.0             LONDON     66 HBC                       6/66
M          1021.0      4.0             DAHL       67 HBC      1-4 PI- P        9/66

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                   4  PHI  WIDTH (MEV)

W              3.4     1.7             ARMENTERO 63 HBC
W    *   34    5.0  OR LESS            SCHLEIN    63 HBC
W              3.5     1.0             MILLER D   65 HBC                       8/66
W    R        10.      3.              BARLOW     66 HBC      1.2 PBAR P      11/66
W              6.0     4.0             LONDON     66 HBC                       6/66
W    R        10.0     3.0             DAHL       67 HBC      1-4 PI- P        9/66
W    R   MASS RESOLUTION NOT UNFOLDED

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                   4  PHI PARTIAL DECAY MODES

P1       PHI INTO K+ K-                                       S10S10
P2       PHI INTO K01 K02                                     S11S11
P3       PHI INTO PI+ PI- PI0 (INCLUDING RHO PI)              S 8S 8S 9
P4       PHI INTO PI+ PI- (VIOLATES G)                        S 8S 8
P5       PHI INTO E+  E-                                      S 3S 3
P6       PHI INTO MU+ MU-                                     S 4S 4
P7       PHI INTO PI0 GAMMA                                   S 9S 0
P8       PHI INTO ETA GAMMA                                   S14S 0
P9       PHI INTO PI+PI-GAMMA                                 S 8S 8S 0
P10      PHI INTO OMEGA GAMMA (VIOLATES C)                    U 1S 0
P11      PHI INTO ETA PI0 (VIOLATES C)                        S14S 9
P12      PHI INTO RHO GAMMA (VIOLATES C)                      U 9S 0

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                   4  PHI  BRANCHING RATIOS

                   PARTIAL MODES ADJUSTED BY PROGRAM   APR=123

R1   *       PHI INTO (K+ K-)/TOTAL                           NUM 1
R1   *                                                        CEN 123
R1   B    27    0.26       0.06           BADIER     65 HBC                   10/66
R1   B       CONTROVERSIAL BACKGROUND SUBTRACTION
R1       252    0.48       0.04           LINDSEY    66 HBC                   10/66

R2   *       PHI INTO (K1 K2)/TOTAL                           NUM  2
R2   *                                                        CEN 123
R2   B    25    0.23       0.06           BADIER     65 HBC                   10/66
R2   B       CONTROVERSIAL BACKGROUND SUBTRACTION
R2       167    0.40       0.04           LINDSEY    66 HBC                   10/66

R3   *       PHI INTO (PI+ PI- PI0 (INCL.RHO PI))/TOTAL       NUM   3
R3   *                                                        CEN 123
R3   B    57    0.51       0.09           BADIER     65 HBC                   10/66
R3   B       CONTROVERSIAL BACKGROUND SUBTRACTION
R3        30    0.12       0.08           LINDSEY    66 HBC                   10/66

R5   *       PHI INTO (K1 K2)/(K KBAR)                        NUM  2
R5   *                                                        CEN 12
R5              0.44       0.07           LONDON     66 HBC                   10/66
R5        10    0.40       0.10           SCHLEIN    63 HBC                   10/66

R6   *       PHI INTO (PI+ PI- PI0 (INCL.RHO PI))/(K KBAR)NUM   3
R6   *                                                        CEN 12
R6              0.30       0.15           LONDON     66 HBC                   10/66

R7   *       PHI INTO (PI+ PI- PI0 (INCL.RHO PI))/(K1 K2) NUM   3
R7   *                                                        CEN  2
R7              0.3     OR LESS           BERLEY     65 HBC                   10/66

R8   *       PHI INTO (PI+ PI-)/(K KBAR)                      NUM     4
R8   *                                                        CEN 12
R8   *          0.2     OR LESS           LONDON     66 HBC                   10/66

R9   *       PHI INTO (E+ E-)/(K KBAR)                        NUM     5
R9   *                                                        CEN 12
R9   *          0.0036 OR LESS            GALTIERI   65 HBC                   10/66
R9   *          INDICATION SEEN           HERTZBACH 67 SPRK                    7/67
R9   *          0.002  OR LESS            KHACHATUR 67 SPRK                   10/66

R10  *       PHI INTO (MU+ MU-)/(K KBAR)                      NUM      6
R10  *                                                        CEN 12
R10  *          0.0053 OR LESS            GALTIERI   65 HBC                   10/66
R10  *          SEEN                      WEHMANN    67 SPRK    12 K- ON C,FE  6/67

R11  *       PHI INTO (ETA GAMMA)/TOTAL                       NUM        8
R11  *                                                        CEN 123
R11  *          0.2     OR LESS           BADIER     65 HBC                   10/66
R11  *          0.08    OR LESS           LINDSEY    66 HBC                   10/66

R12  *       PHI INTO (PI+ PI- GAMMA)/(K KBAR)                NUM          9
R12  *                                                        CEN 12
R12  *          0.05    OR LESS           LINDSEY    65 HBC                   10/66

R13  *       PHI INTO (ETA NEUTRALS)/(K KBAR)                 NUM        8  1
R13  *                                                        CEN 12
R13  *          0.15    OR LESS           LINDSEY    66 HBC                   10/66

R14  *       PHI INTO (OMEGA GAMMA) / TOTAL                   NUM          0
R14  *                                                        CEN 123
R14  *          0.05    OR LESS           LINDSEY    66 HBC                   10/66

R15  *       PHI INTO (RHO GAMMA) / TOTAL                     NUM          2
R15  *                                                        CEN 123
R15  *          0.02    OR LESS           LINDSEY    66 HBC                   10/66

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                          REFERENCES FOR PHI

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

BADIER   65 PL 17 337         BADIER,DEMOULIN,BARLOUTAUD+//PAR+LPCHE+ZEE
BERLEY   65 PR 139 B 1097     D BERLEY,N GELFAND ////////// BNL+COLUMBIA
GALTIERI 65 PRL 14 279        A BARBARO GALTIERI,R D TRIPP ///////// LRL
LINDSEY  65 PRL 15 221        JAMES S LINDSEY,GERALD A SMITH /////// LRL
   LINDSEY 65 DATA INCLUDED IN LINDSEY 66 BELOW
MILLER   65 CU-237 (NEVIS 131)DAVID C MILLER  (THESIS) //////// COLUMBIA

BARLOW   66  CERN-TC66-22 -NC BARLOW,D.ANDLAU+ //// CERN+PARIS+LIVERPOOL
LINDSEY  66 PR  147  913      JAMES S LINDSEY, GERALD A SMITH  ////  LRL
LINDSEY1 66 PL 20 93          J.S.LINDSEY, G.A.SMITH /////////////// LRL
   LINDSEY 1 66 DATA INCLUDED  IN LINDSEY 66 ABOVE
LONDON   66 PR 143 1034       LONDON,RAU,SAMIOS,GOLDBERG +//BNL+SYRACUSE

DAHL     67  UCRL-16978       +HARDY+HESS+KIRZ+MILLER ////////////// LRL
HERTZBAC 67 PR 155  1461      HERTZBACH,KRAEMER,MACANSKI,ZDANIS+/JHU+BNL
KHACHATU 67 PL 24B 349        KHACHATURYAN+AZIMOV+BALDIN+BELOUSOV+/DUBNA
WEHMANN  67 PRL 18 929        +ENGELS+ /// HARVARD+CWRU+SLAC+CORN+MCGILL

      QUANTUM NUMBER DETERMINATIONS NOT REFERRED TO IN THE DATA CARDS

GRAY, L  66 PRL  17  501      +HAGERTY,BIZZARRI,CIAPETTI +   // SYR+ROME JPG

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η_v (1050)

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                   3 ETA (1050,JPG=0++)I=0

                   NAMED S* BY CRENNELL ET AL.
                   SOME DATA STILL FAVOR LARGE S-WAVE K KBAR SCATTERING
                   LENGTH.

                   3 ETA (1050) MASS (MEV)

M    *       1000.0    APPROX             BINGHAM    62 PBC
M    *       1000.0    APPROX             BIGI       62 HBC
M    *       1000.0                       ERWIN      62 HBC                   10/66
M    *   30  1030.0    APPROX.            BALTAY     64 HBC
M    *       1025.0    APPROX.            BARMIN     64 HLBC                   6/66
M        35  1045.       9.               BARLOW     66 HBC      1.2 PBAR P   11/66
M       135  1056.0                       BEUSCH     66 SPRK                   9/66
M        20  1068.0     10.0              CRENNELL   66 HBC        6.0 PI- P   6/66
M    H  120  SCATT.LENGTH FITS BETTER. HESS          66 HBC      1.6-4.2 PI- P 10/66

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                   3 ETA (1050) WIDTH (MEV)

W        35    50.      24.               BARLOW     66 HBC      1.2 PBAR P   11/66
W              50.0                       BEUSCH     66 SPRK                   9/66
W        20    80.0     15.0              CRENNELL   66 HBC                    6/66

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                   3 ETA (1050) PARTIAL DECAY MODES

P1       ETA (1050) INTO KKBAR
P2       ETA (1050) INTO PIPI

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                   3 ETA (1050) BRANCHING RATIOS

R1   *       ETA (1050) INTO (PI PI)/(K KBAR)                 (P1)/(P2)
R1   *          2.5    OR LESS            CRENNELL   66 HBC      90 PCT CONF LEV   7/66

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                          REFERENCES FOR ETA(1050)

BIGI      62 CERN CONF 247    A BIGI,S BRANDT, R CARRARA + ///////  CERN
BINGHAM   62 CERN CONF 240    H H BINGHAM,M BLOCH + //PARIS+EC POLY+CERN
ERWIN     62 PRL 9 34         ERWIN,HOYER,MARCH,WALKER,WANGLER //WIS+BNL

BALTAY    64 DUBNA CONF 1 409 BALTAY,LACH,CRENNELL,OREN,STUMP +/YALE+BNL
BARMIN    64 DUBNA CONF 1 433 BARMIN,DOLGOLENKO,YEROFEEV,KRESTNI+// ITEP
BARLOW    66  CERN-TC66-22 -NC BARLOW,D.ANDLAU+ //// CERN+PARIS+LIVERPOOL
BEUSCH    66  BERKELEY CONF   BEUSCH,FISCHER,ASTBURY,MICHELINI+/ETH+CERN
CRENNELL 66 PRL 16 1025       CRENNELL,KALBFLEISCH,LAI,SCARR,SCHU+ //BNL
CRENNEL2 66  BERKELEY CONF    +KALBFLEISCH,LAI,SCARR,SCHUMANN+////// BNL I,JP
   CRENNELL 2 HAS MORE DATA THAN CRENNELL  BUT SAME CONCLUSIONS
HESS      66 PRL 17 1109      +DAHL+HARDY+KIRZ+MILLER ////////////// LRL
  HESS REPLACES  PRL 9 460    ALEXANDER,DAHL,JACOBS,KALBFLEISCH + // LRL

DAHL      67  UCRL-16978      +HARDY+HESS+KIRZ+MILLER ////////////// LRL

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f (1250)

5 F (1250,JPG=2++) I=0

5 F MASS (MEV)

M		1250.0	25.0	SELOVE	62	HBC		
M		1260.0	35.0	VEILLET	63	FBC		
M		5 1250.0		GUIRAGUSS	63	HBC		
M		5 1260.0		BONDAR	63	HBC		
M		1250.0		LEE	64	HBC		
M		1240.0	20.0	ACCENSI	66	HBC		6/66
M	*	1255.	13.	BARLOW	66	HBC	(K01 K01 MODE)	11/66
M		1275.0	25.0	WAHLIG	66	SPRK		6/66

5 F WIDTH (MEV)

W		100.0	25.0	SELOVE	62	HBC		
W	*	200.0	OR LESS	VEILLET	63	FBC		
W		85 160.0		BONDAR	63	HBC		
W		130.0	20.0	LEE	64	HBC		
W		102.0	46.0	ACCENSI	66	HBC		6/66
W	*	82.	34.	BARLOW	66	HBC	(K01 K01 MODE)	11/66
W		100.		WAHLIG	66	SPRK		11/66

5 F PARTIAL DECAY MODES

P1	F INTO PI+ PI-	S 8S 8
P2	F INTO 2PI+ 2PI-	S 8S 8S 8S 8
P3	F INTO K KBAR	S12S12

5 F BRANCHING RATIOS

R1	*	F INTO (4PI)/(2PI)					(P2)/(P1)	
R1		0.08	0.06	BONDAR	63	HBC		
R1	*	0.04	OR LESS	CHUNG	65	HBC		
R2	*	F INTO (K KBAR)/(PI PI)					(P3)/(P1)	
R2		0.05	OR LESS	BARMIN	65			10/66
R2	*	0.16	OR LESS	WANGLER	65	HBC		
R2	*	0.06	OR LESS	BRANDT	66	HBC	CONF.LIMIT 0.95	9/66
R2	*	0.05	OR LESS	DEUTSCHMA	66	HBC		6/66
R2		0.023	0.006	FISCHER	66	SPRK		9/66
R2	*	0.025	OR LESS	DAHL	67	HBC	- 1.6-4.2 PI- P	10/66

R *FOR 2+ NONET SU3 RATES SEE E.G. GLASHOW,SCCOLCW, PRL 15,329(65)

REFERENCES FOR F

SELOVE 62 PRL 9 272 — SELOVE,HAGOPIAN,BRODY,BAKER,LEBOY // PENNA
BONDAR 63 PL 5 153 — BONDAR+//AACHEN+BIRM+BONN+DESY+IC-LOND+MPI
VEILLET 63 PRL 10 29 — VEILLET,HENNESSY,BINGHAM,BLOCH+//PAR+MILAN
LEE 64 PRL 12 342 — LEE,ROE,SINCLAIR,VANDERVELDE //// MICHIGAN

BARMIN 65 SJNP 1 870 — +DOLGOLENKO+EROFEEV+KRESTNIKOV+/ ITEP MOSC
CHUNG 65 PRL 15 325 — CHUNG,DAHL,HARDY,HESS,JACOBS,KIRZ //// LRL
GUIRAGOS 65 PRL 11 85 — Z G T GUIRAGOSSIAN ////////////////// LRL
WANGLER 65 PR 137 B 414 — T P WANGLER,A R ERWIN,W WALKER //WISCONSIN

ACCENSI 66 PL 20 557 — ACCENSI,ALLES-BORELLI,FRENCH,FRISK+ //CERN
BARLOW 66 CERN-TC66-22 -NC BARLOW,D.ANDLAU+ //// CERN+PARIS+LIVERPOOL
BEUSCH 66 (PREPRINT) — BEUSCH,FISCHER,ASTBURY,MICHELINI+/ETH+CERN
BRANDT 66 BERKELEY CONF. — BRANDT,COCCONI,CZYZEWSKI+ //CERN+CRAC+WARS
DEUTSCHM 66 PL 20 82 — DEUTSCHMANN,STEINBERG + //AACH+BERLIN+CERN
FISCHER 66 PRIVATE COMMUN. — W E FISCHER (BASED ON BEUSCH 66)//ETH+CERN
WAHLIG 66 PR 147 941 — +SHIBATA,GORDON,FRISCH,MANNELLI //MIT+PISA J

DAHL 67 UCRL-16978 — +HARDY+HESS+KIRZ+MILLER ////////////// LRL
STRUGALS 67 JINR E1-3100 — STRUGALSKI+CHUVILO+IVANOVSKAJA+ //// DUBNA

QUANTUM NUMBER DETERMINATIONS NOT REFERRED TO IN DATA CARDS

HAGOPIAN 63 PRL 10 533 — V HAGOPIAN,W SELOVE //////////////// PENNA
ADERHOLZ 64 PL 10 240 — AACHEN+BERLIN+BIRM+BONN+HAMBUR+IC-LOND+MPI IJ
BRUYANT 64 PL 10 232 — BRUYANT,GOLDBERG,HOLDER,FLEURY,HUC/CERN+PA I
SODICKSO 64 PRL 12 485 — SODICKSON,WAHLIG,MANNELLI,FRISCH+ //// MIT I
BARMIN 65 SJNP 1 230 — +DOLGOLENKO,ELENSKY,EROFEEV+ / ITEP MOSCOW JP

D(1285)

6 D MESON (1285,JPG= +) I=0

JPG DISCUSSED AT OXFORD, SEE ROSENFELD 65
DAHL 67 FAVOR JP=1+, BUT DO NOT EXCLUDE 2-,0-.

8 D MESON MASS (MEV)

M		1290.0	6.0	D.ANDLAU	65	HBC	1.2 PBAR P, 5-6 PFS	
M	*	1290.	APPROX.	BARLOW	67	HBC	1.2 PBAR P, 4PFS	5/67
M		1283.0	5.0	DAHL	67	HBC	1.6-4.2 PI- P	10/66

8 D MESON WIDTH (MEV)

W	25.0	15.0	D.ANDLAU	65	HBC	1.2 PBAR P	9/66
W	35.0	10.0	DAHL	67	HBC	1.6-4.2 PI- P	10/66

8 D MESON PARTIAL DECAY MODES

P1	D MESON INTO K KBAR PI	S11S11S 9
P2	D MESON INTO PI PI RHO	S 9S 9U 9

8 D MESON BRANCHING RATIOS

R1	*	D MESON INTO (PI PI RHO) / (K KBAR PI)					NUM 2	
R1	*						DEN 1	
R1	*	2.0	OR LESS	DAHL	67	HBC	0 CHARGED PI ONLY	10/66

R *FOR 1+ NONET SU3 RATES SEE E.G. GOLDHABER, REVIEW BERKELEY CONF.1966

REFERENCES FOR D MESON

D.ANDLAU 65 PL 17 347 — D.ANDLAU,ASTIER,BARLOW +//CDF+CERN+RAD+LIV
BARLOW 67 NC TO BE PUBL. — +D.ANDLAU+ADAMSON+ ///// CERN+PARIS+LIVERP
DAHL 67 UCRL-16978 — +HARDY+HESS+KIRZ+MILLER ////////////// LRL I JP
SEE ALSO 65 PRL 14 1074 — MILLER,CHUNG,DAHL,HESS,HARDY,KIRZ+//LRL+UC

E(1420)

6 E MESON (1420,JPG= +) I=0

BAILLON 67 FAVOR JP=0-, DAHL 67 FAVOR 1+ BUT DO NOT EXCLUDE 2-, 0-.

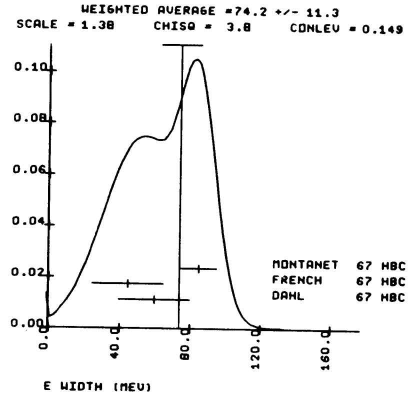
6 E MESON MASS (MEV)

M	M	1425.	7.	BAILLON	67	HBC	0. PBAR P	11/66
M	M	SUPERSEDED BY MONTANET 67 BELOW						
M		1420.0	20.0	DAHL	67	HBC	1.6-4.2 PI- P	10/66
M		1423.	10.	FRENCH	67	HBC	3-4 PBAR P	6/67
M		1410.	7.	MONTANET	67	HBC	0.PBAR P	7/67

6 E MESON WIDTH (MEV)

W	M	80.	10.	BAILLON	67	HBC	0. PBAR P	11/66
W	M	SUPERSEDED BY MONTANET 67 BELOW						
W		60.0	20.0	DAHL	67	HBC	1.6-4.2 PI- P	10/66
W		45.	20.	FRENCH	67	HBC	3-4 PBAR P	6/67
W		85.	10.	MONTANET	67	HBC	0.PBAR P	7/67

(Ideogram below)



6 E MESON PARTIAL DECAY MODES

P1	E INTO K K*(890)	S10U18
P2	E INTO K KBAR PI	S12S12S 8
P3	E MESON INTO PI PI RHO	S 9S 9U 9
P4	E INTO PI(1003) PI	L16S 8

6 E MESON BRANCHING RATIOS

R1	*	E INTO K K*(890)/((K K*)+(PI(1003) PI))					NUM 1	
R1	*						DEN 1 4	
R1	M	.50	.10	BAILLON	67	HBC		11/66
R1	M	SUPERSEDED BY MONTANET 67 BELOW						
R1		0.53	0.10	MONTANET	67	HBC	0.PBAR P	7/67
R2	*	E MESON INTO (PI PI RHO) / (K KBAR PI)					NUM 3	
R2	*						DEN 2	
R2	*	2.0	OR LESS	DAHL	67	HBC	0 CHARGED PI ONLY	10/66

R *FOR 1+ NONET SU3 RATES SEE E.G. GOLDHABER, REVIEW BERKELEY CONF.1966

REFERENCES FOR E MESON

ARMENTER 64 DUBNA CONF 1 467 — ARMENTEROS,EDWARDS,JACOBSEN,ASTIER+ //CERN
ROSENFEL 65 OXFORD CONF 58 — A H ROSENFELD ////////////////// LRL--RVUE
BAILLON 67 NC 50A 393 — +EDWARDS+D.ANDLAU+ASTIER+ //// CERN+CDF+IR
BARASH 67 PR 156 1399 — BARASH,KIRSCH,MILLER,TAN /////////COLUMBIA
DAHL 67 UCRL-16978 — +HARDY+HESS+KIRZ+MILLER ////////////// LRL I JP
SEE ALSO 65 PRL 14 1074 — MILLER,CHUNG,DAHL,HESS,HARDY,KIRZ+ /LRL+UC
FRENCH 67 CERN/TC/PH.66-31 +KINSON+MCDONALD+RIDDIFORD+ //// CERN+BIRM
MONTANET 67 PRIV. COMM. — L. MONTANET ////////////////////////// CERN IJP

$K_S K_S$ (1440) $\rho\rho$(1410)

29 KSKS(1440) AND RHORHO(1410) (JPG=V +) I GTE 0

EVIDENCE NOT YET COMPELLING, OMITTED FROM TABLE
IF RHOO RHOO AND KS KS ARE MODES OF THE SAME RESONANCE THEN I=0.

29 KSKS AND RHORHO MASS (MEV)

M		1410.0		BETTINI	66	DBC	C 0. PBARP TO 5PR	9/66
M		1439.0	SHOULDER ON A2	BEUSCH	66	SPRK	5-12 PI- P	9/66
M	B	POSSIBLY SEEN		ABRAMS	67	HBC	4.25 K- P	5/67
M	B	THE AUTHORS ASSOCIATE THE PEAK WITH THE F PRIME, BUT BACKGROUND						
M	B	ESTIMATION IS DIFFICULT						
M		1412.	23.	BARLOW	67	HBC	1.2 PBAR P	5/67

29 KSKS AND RHORHO WIDTH (MEV)

W	90.0		BETTINI	66	DBC	C 0. PBAR P TO 5PR	9/66
W	43.0	40.0	BEUSCH	66	SPRK	5-12 PI- P	9/66
W	100.	70.	BARLOW	67	HBC	1.2 PBAR P	5/67

REFERENCES FOR KSKS(1440) AND RHO RHO(1410)

BETTINI 66 NC 42A 695 — +CRESTI,LIMENTANI,LORIA,PERUZZO+//PAD+PISA
BEUSCH W 66 BERKELEY CONF — +ASTBURY,FINOCCHIARO,MICHELIN /CERN,ZURICH
ABRAMS 67 PRL 18 620 — +KEHOE,GLASSER,SECHI-ZORN,WOLSKY /MARYLAND
BARLOW 67 NC TO BE PUBL. — +D.ANDLAU+ADAMSON+ ///// CERN+PARIS+LIVERP

f′(1500) 13 F PRIME (1500,JPG=2++) I=0

13 F PRIME(1500) MASS (MEV)

M * 14 1480.0 CRENNELL 66 HBC 6.0 PI- P 8/66
M 35 1514.0 16.0 BARNES 66 HBC K1 K1 ONLY 5.0 K-P 9/66
M B 5 1460. 10. ABRAMS 67 HBC 4.25 K- P 5/67
M B BACKGROUND ESTIMATION DIFFICULT. 5/67

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13 F PRIME(1500) WIDTH (MEV)

W 35 86. 23. BARNES 66 HBC K1 K1 ONLY 5.0 K-P 10/66
W B 5 53. 18. ABRAMS 67 HBC 4.25 K- P 5/67
W B BACKGROUND ESTIMATION DIFFICULT. 5/67

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13 F PRIME PARTIAL DECAY MODES

P1 F PRIME INTO PI+ PI- S0850B
P2 F PRIME INTO K KBAR S12S12
P3 F PRIME INTO K K*(89C) S10016
P4 F PRIME INTO ETA ETA S14S14

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13 F PRIME BRANCHING RATIOS

R1 * F PRIME INTO (PI+ PI-)/(K KBAR) (P1)/(P2)
R1 * 0.14 OR LESS BARNES 66 HBC CONF.LIMIT 0.95 10/66
R1 N SU3 .03 ESTIMATE FROM SU3 GLASHOW 65 SU3

R2 * F PRIME INTO (K KBAR) / TOTAL (P2)/TOTAL
R2 X 0.64 0.31 GOLDBERG 66, WITHDRAWN 8/66
R2 X BARNES 66 POINT OUT THAT F PRIME UNRESOLVABLE FROM F MESON

R3 * F PRIME INTO (ETA ETA)/(K KBAR) (P4)/(P2)
R3 * 1.0 OR LESS BARNES 66 HBC CONF.LIMIT 0.95 10/66

R *FOR 2+ NONET SU3 RATES SEE E.G. GLASHOW,SOCOLOW, PRL 15,329(65)

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REFERENCES FOR F PRIME

GLASHOW 65 PRL 15 329 S L GLASHOW, R H SOCOLOW //SU3 BERKELEY
BARNES 65 PRL 15 322 REPLACED BY REFERENCE BELOW
BARNES 66 BERKELEY CONF. +CORNAN,GUIDONI,KALBFLEISCH,LONDON/BNL,SYR I=0
CRENNELL 66 PRL 16 1025 + KALBFLEISCH,LAI,SCARR,SCHUMANN + // BNL I
GOLDBERG 66 SUBMITTED TO NC + LEITNER,MUSTO,O RAIFEARTAIGH //SYRACUSE
ALSO 66 BERKELEY CONF +KALBFLEISCH,LAI,SCARR,SCHUMANN+////// BNL I=0
ABRAMS 67 PRL 18 620 +KEHOE,GLASSER,SECHI-ZORN,WOLSKY /MARYLAND

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$\phi_{A, I \geq 0}$(1690) 41 PHI(1690) G=-1 (JPG=A -) I = 0 OR GREATER

* MAY BE IDENTICAL WITH NEUTRAL MEMBER OF PI(1640) AND/OR OF R2(1700) (I=1 OR 2) I=1 IF (OMEGA RHO) MODE EXISTS.
* SEE SKETCH ON MESON TABLE
* BUMPS AT ABOUT 1700 MEV ARE OBSERVED IN SEVERAL DIFFERENT MASS DISTRIBUTIONS, WITH BOTH G=+1 AND G=-1 AND ALSO IN STATES WITH UNKNOWN G. HERE WE LIST THE ONES WHICH HAVE (OR MAY HAVE) G=-1. IT IS NOT KNOWN YET WHETHER THEY INDICATE DIFFERENT DECAY MODES OF A SINGLE RESONANT STATE. THE POSSIBILITY ALSO EXISTS THAT SOME OF THE OBSERVATIONS ARE DUE TO STATISTICAL FLUCTUATIONS. FOR THE G=+1 BUMPS, LOOK UNDER ETA(1700) BELOW.

41 MASS (MEV)

M O 1689. 10. DANYSZ 67 HBC 0 3,3.6 PBAR P 7/67
M O OBSERVED IN (OMEGA PI+ PI-) (AND POSSIBLY (OMEGA RHO(0))) MODE
M K 1700. FRENCH 67 HBC 0 3,3.6 PBAR P 7/67
M K OBSERVED IN NEUTRAL(K* KBAR) MODE (G-PARITY UNKNOWN)

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41 WIDTH (MEV)

W O 38. 18. DANYSZ 67 HBC 0 3,3.6 PBAR P 7/67
W O OBSERVED IN (OMEGA PI+ PI-) (AND POSSIBLY (OMEGA RHO(0))) MODE

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REFERENCES FOR PHI(1690)

DANYSZ 67 NC TO BE PUBL. DANYSZ+FRENCH+SIMAK //////////////// CERN
FRENCH 67 CERN/TC/PH.66-31 +KINSON+MCDONALD+RIDDIFORD+ //// CERN+BIRM

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$\eta_{A, I \geq 0}$(1700) 42 ETA(1700) G=+1 (JPG=A +) I = 0 OR GREATER

* MAY BE IDENTICAL WITH NEUTRAL MEMBER OF R2(1700) AND/OR OF R3(1750) (I=1 OR 2)
* SEE SKETCH ON MESON TABLE
* SEE THE NOTE ON PHI(1690) G=-1 ABOVE. HERE WE LIST THE BUMPS WHICH (MAY) HAVE G=+1.

42 MASS (MEV)

M R 80 1717. 7. DANYSZ 67 HBC 0 2.5,3 PBAR P 5/67
M R OBSERVED IN (2PI+ 2PI-) (AND POSSIBLY (RHO(0) PI+ PI-)) MODE
M K 1700. FRENCH 67 HBC 0 3,3.6 PBAR P 7/67
M K OBSERVED IN NEUTRAL(K* KBAR) MODE (G-PARITY UNKNOWN)

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42 WIDTH (MEV)

W R 80 40. 12. DANYSZ 67 HBC 0 2.5,3 PBAR P 5/67
W R OBSERVED IN (2PI+ 2PI-) (AND POSSIBLY (RHO(0) PI+ PI-)) MODE

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REFERENCES FOR ETA(1700)

DANYSZ 67 PL 24B 309 +FRENCH+KINSON+SIMAK+ ///// CERN+LIVERPOOL
FRENCH 67 CERN/TC/PH.66-31 +KINSON+MCDONALD+RIDDIFORD+ //// CERN+BIRM

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$\eta_{A, I \geq 0}$(1830) 38 ETA(1830) G=+1 (JPG=A +) I = 0 OR GREATER

* MAY BE NEUTRAL COMPONENT OF R4(1830) (I=1 OR 2)
* SEE SKETCH ON MESON TABLE
* BUMPS AT ABOUT 1830 MEV ARE OBSERVED IN SEVERAL DIFFERENT MASS DISTRIBUTIONS, WITH BOTH G=+1 AND G=-1 AND ALSO IN STATES WITH UNKNOWN G. HERE WE LIST THE ONES WHICH HAVE (OR MAY HAVE) G=+1. IT IS NOT KNOWN YET WHETHER THEY INDICATE DIFFERENT DECAY MODES OF A SINGLE RESONANT STATE. THE POSSIBILITY ALSO EXISTS THAT SOME OF THE OBSERVATIONS ARE DUE TO STATISTICAL FLUCTUATIONS. FOR THE G=-1 BUMPS, LOOK UNDER PHI(1830) BELOW.

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38 MASS (MEV)

M R 110 1832. 6. DANYSZ 67 HBC 0 2.5,3 PBAR P 5/67
M R OBSERVED IN (2PI+ 2PI-) (AND POSSIBLY (RHO(0) PI+ PI-)) MODE
M K 1820. 12. FRENCH 67 HBC 0 3,3.6 PBAR P 7/67
M K OBSERVED IN (KS K0 PI0...) MODE (G-PARITY UNKNOWN)

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38 WIDTH (MEV)

W R 110 42. 11. DANYSZ 67 HBC 0 2.5,3 PBAR P 5/67
W R OBSERVED IN (2PI+ 2PI-) (AND POSSIBLY (RHO(0) PI+ PI-)) MODE
W K 50. 20. FRENCH 67 HBC 0 3-4 PBAR P 7/67
W K OBSERVED IN (KS K0 PI0...) MODE (G PARITY UNKNOWN)

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REFERENCES FOR ETA(1830)

DANYSZ 67 PL 24B 309 +FRENCH+KINSON+SIMAK+ ///// CERN+LIVERPOOL
FRENCH 67 CERN/TC/PH.66-31 +KINSON+MCDONALD+RIDDIFORD+ //// CERN+BIRM

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$\phi_{A, I \geq 0}$(1830) 40 PHI(1830) G=-1 (JPG=A -) I = 0 OR GREATER

* MAY BE NEUTRAL COMPONENT OF R4(1830) (I=1 OR 2) I=1 IF (OMEGA RHO) MODE EXISTS
* SEE SKETCH ON MESON TABLE
* SEE THE NOTE ON ETA(1830) G=+1 ABOVE. HERE WE LIST THE BUMPS WHICH (MAY) HAVE G=-1.

40 MASS (MEV)

M O 1848. 11. DANYSZ 67 HBC 0 3,3.6 PBAR P 7/67
M O OBSERVED IN (OMEGA PI+ PI-) (AND POSSIBLY (OMEGA RHO(0))) MODE
M K 1820. 12. FRENCH 67 HBC 0 3,3.6 PBAR P 7/67
M K OBSERVED IN (KS K0 PI0...) MODE (G-PARITY UNKNOWN)

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40 WIDTH (MEV)

W O 67. 27. DANYSZ 67 HBC 0 3,3.6 PBAR P 7/67
W O OBSERVED IN (OMEGA PI+ PI-) (AND POSSIBLY (OMEGA RHO(0))) MODE
W K 50. 20. FRENCH 67 HBC 0 3-4 PBAR P 7/67
W K OBSERVED IN (KS K0 PI0...) MODE (G PARITY UNKNOWN)

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REFERENCES FOR PHI(1830)

DANYSZ 67 NC DANYSZ+FRENCH+SIMAK //////////////// CERN
FRENCH 67 CERN/TC/PH.66-31 +KINSON+MCDONALD+RIDDIFORD+ //// CERN+BIRM

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$N\bar{N}_{I=0}$(2380) 37 N NBAR (2380) (I=0)

EVIDENCE FOR RESONANT STATE NOT YET COMPELLING. OMITTED FROM TABLE.

37 MASS

M 2380. 10. ABRAMS 67 CNTR S CHANNEL NBAR N 7/67

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37 WIDTH

W 140. ABRAMS 67 CNTR S CHANNEL NBAR N 7/67

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37 SIGMA (MB) FOR FORMATION BY NUCLEON ANTINUCLEON

CS * 2. ABRAMS 67 CNTR 7/67

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REFERENCES FOR N NBAR (2380)

ABRAMS 67 PRL 18 1209 +COOL+GIACOMELLI+KYCIA+LEONTIC+LI+ /// BNL

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ρ(760) 9 RHO (760,JPG=1-+) I=1

* FOR A RECENT COMPILATION AND DISCUSSION OF MASS AND WIDTH OF THE RHO MESON, AS PRODUCED IN PION NUCLEON COLLISIONS, SEE ROOS 67.

9 RHO MASS (MEV)

THERE ARE WIDE FLUCTUATIONS IN THE MEASURED MASS VALUES OF THE RHO. THEY ARE IN MANY CASES OUTSIDE THE EXPERIMENTAL UNCERTAINTIES, AND PERSIST WHEN ONE TAKES INTO CONSIDERATION ONLY THOSE DATA WHERE A P-WAVE BREIT-WIGNER AMPLITUDE WAS USED TO FIT THE RHO PEAK. FOR THE CHARGED RHO, THE MASS VALUES RANGE FROM 750 MEV TO 777 MEV, DEPENDING ON THE TYPE OF REACTION AND ON THE KINEMATICS (FOR EXAMPLE ON MOMENTUM TRANSFER IN QUASI-TWO-BODY REACTIONS). AN EVEN LARGER VARIATION IS APPARENT FOR THE NEUTRAL RHO. HERE, MASS VALUES AS LOW AS 730 MEV ARE FOUND IN PHOTOPRODUCTION EXPERIMENTS, WHEREAS IN QUASI-TWO-BODY PRODUCTION IN PION NUCLEON COLLISIONS VALUES UP TO 780 MEV ARE MEASURED. IT THEREFORE APPEARS THAT WITHOUT A BETTER UNDERSTANDING OF PRODUCTION DYNAMICS, BACKGROUND INTERFERENCE AND FINAL STATE INTERACTIONS, THE DETERMINATION OF THE RHO MASS WILL SUFFER FROM SYSTEMATIC UNCERTAINTIES WHICH MIGHT WELL BE OF THE ORDER OF 10 MEV OR LARGER.

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M+  R       760.0     9.0        CARMONY   64 HBC  +          TCUT 4
M+          760.     10.         ARMENISE  65 HBC  +
M+  R       765.0     5.0        ALFF-STEI 66 HBC  +   2-3 PI+ P        6/66
M+  *       783.0     6.0        JAMES     66 HBC    + 2.1 PI+ P        6/66
M+          756.0    10.0        JAMES     66 HBC             TCUT 2.5  8/66

M+  S       750.0     3.0        BALTAY    66 HBC  +-  0.0 PBARP        6/66
M+          730.     11.         BARLOW    66 HBC  +- 1.2 PBAR P       11/66
M+          755.     10.         ALLES-BOR 67 HBC  +-  5.7 PBAR P      12/66
M+  C       774.      2.         ROOS      67 RVUE +-  PI N QU-2-BODY   7/67
M+  C  SEE ROOS 67 RVUE FOR DEPENDENCE ON MOM.TRANSFER AND TYPE OF REACTION  7/67
                            (Ideogram below)
M-  *       746.0                KENNEY    62 HBC  -
M-          765.0    10.0        ERWIN     63 HBC  -
M-  *  130  775.0                GUIRAGOSS 63 HBC  -
M-  R       768.0     5.0        BLIEDEN   65 MMSP -  3-5 PI- P         6/66
M-          772.0    19.0        FIDECARO  66 SPRK -  2.5 PI-,T CUT18  11/66
M-  R       770.      5.         HAGOPIAN  66 HBC  - 2.1 PI-P           2/67
M-  R       765.      5.         HAGOPIAN  66 HBC  - 2.1 PI-P,TCUT 12   2/67
M-  R       760.0     5.0        HAGOPIAN  66 HBC  -  3.0 PI- P         6/66
M-  R 1054  754.      5.         JACOBS    66 HBC  -  2-3 PI-,T CUT 6   1/67
M-  R       749.0     3.0        WEST      66 HBC  -  2.1 PI- P        10/66
M-          751.      5.         CLEAR     67 HBC  -  3 PI- P           7/67
M-  R       777.0     6.0        MILLER    67 HBC  -  2.7 PI-,T CUT 5   9/66
M-  R       775.0     5.0        MILLER    67 HBC  -  2.7 PI-,T CUT10   9/66
M-  R       768.0     5.0        MILLER    67 HBC  -  2.7 PI-,T CUT20   9/66
                            (Ideogram below).
MO  *  190  750.0    20.0        SAMIOS    62 HBC   0
MO  R  300  760.0    10.0        ABOLINS   63 HBC   0
MO          763.0    10.0        ERWIN     63 HBC   0
MO  *  160  775.0                GUIRAGOSS 63 HBC   0
MO  R  500  770.0    10.0        GOLDHABER 64 HBC   0
MO  *       735.0    10.0        ALYEA     65 DBC   0 2.2 K- P          6/66
MO          750.0                CLARK     65 SPRK  0
MO  N       736.0                CLARK     65 SPRK  0 1.5 PI- P        10/66
MO  N  AT PI PI SCATT.ANGLE OF 90 DEG.WITHOUT INTERFERENCE WITH NONRES.BACKGD
MO  M       753.0                CLARK     65 SPRK  0 1.5 PI- P        10/66
MO  M  AT PI PI SCATT.ANGLE OF 90 DEG. ALLOWING FOR INTERF.WITH NONRES.BACKGD
MO          763.0                DERADO    65 DBC   0 4.0 PI- P         6/66
MO  S       750.0    15.0        GUTAY     65 HBC   0 2.0 PI- P         6/66
MO          768.0    14.0        ACCENSI   66 HBC   0 5.7 PBARP         6/66
MO  R       750.0     5.0        ALFF-STEI 66 HBC   0 2-3 PI+ P         6/66
MO  S       751.      6.         BALTAY    66 HBC   0 0.0 PBARP         6/66
MO          745.      9.         BARLOW    66 HBC   0 1.2 PBAR P       11/66
MO  S       773.0    12.0        CASON     66 HBC   0 7.0 PI- P         9/66
MO  R       770.      5.         HAGOPIAN  66 HBC   0 2.1 PI-P          2/67
MO  R       770.      5.         HAGOPIAN  66 HBC   0 2.1 PI-,TCUT 12   2/67
MO  R       775.0     5.0        HAGOPIAN  66 HBC   0 3.0 PI- P         6/66
MO  R 1500  758.      5.         JACOBS    66 HBC   0 2-3 PI-,T CUT 4   1/67
MO  R       765.0     8.0        JAMES     66 HBC   0 2.1 PI+ P         6/66
MO  R       760.0     3.0        WEST      66 HBC   0 2.1 PI- P        10/66
MO          766.      3.         CLEAR     67 HBC   0 3 PI- P           7/67
MO     327  750.     10.         DANYSZ    67 HBC   0 3,3.6 PBAR P      7/67
MO  W  184  755.      5.         DANYSZ    67 HBC   0 3,3.6 PBAR P      7/67
MO  W    WIDTH UNUSUALLY SMALL
MO  R       761.      3.         HUWE      67 HBC   0 2.4 PI- P         7/67
MO  R       770.0     4.0        MILLER    67 HBC   0 2.7 PI-,T CUT20   9/66
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MO  C       780.      2.         ROOS      67 RVUE  0 PI N QU-2-BODY    7/67
MO  C  SEE ROOS 67 RVUE FOR DEPENDENCE ON MOM.TRANSFER AND TYPE OF REACTION  7/67

MO  P       740.0    10.0        LANZEROTT 65 CNTR  0 GAMMA P          10/66
MO  P       728.0     8.0        CAMBRIDGE 66 HBC   0 1.0-6.0 GAMMA P  10/66
MO  P       726.0     6.0        ERBE      67 HBC   0 3.5-5.8 GAMMA P  10/66
MO  P  IN GAMMA P TO RHO 0 P, THE RHO MASS APPEARS SHIFTED.
MO  P  FOR CORRECTED VALUE SEE BELOW.
MO  P 1500  774.      3.         ERBE      67 HBC   0 1.4-5.8 GAMMA P   7/67
MO  P       ERBE 67 TAKE INTERFERING BACKGROUND INTO ACCOUNT.
                            (Ideogram below)
M      290  755.0                CHADWICK  63 HBC  +-0
M           744.      9.         FRENCH    67 HBC  +-0 3-4 PBAR P       6/67

M           740.0                WALKER    62 HBC   -0
M      240  752.0                ALITTI    63 HBC   -0
M           765.0                LEE       65 HBC   -0

M   R       INCLUDED IN ROOS 67 RVUE
M   S       S-WAVE BREIT-WIGNER FIT, CANNOT BE COMBINED WITH OTHER VALUES  11/66

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                   9  RHO(0) - RHO(+-) MASS DIFFERENCE (MEV)

D   C         5.7     2.2        ROOS      67 RVUE    PI N QUASI-2-BDY  7/67
D   C   ERROR STATISTICAL ONLY. SEE COMMENT ON RHO MASS ABOVE.

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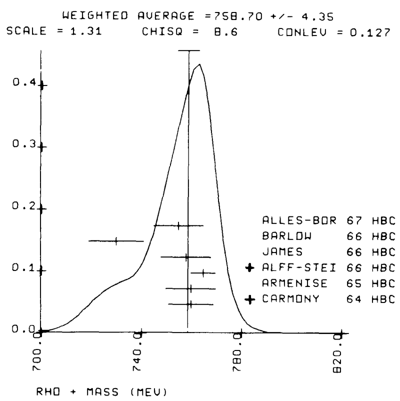
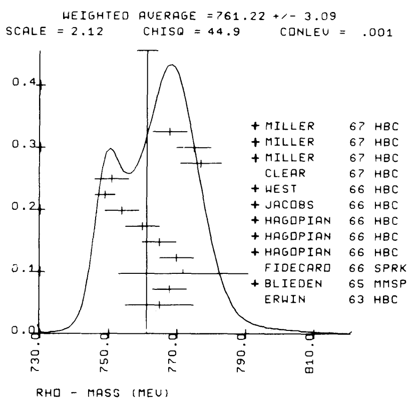
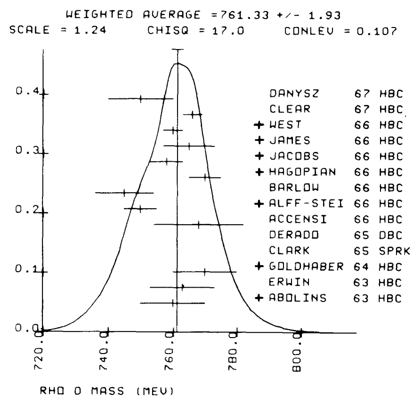
                   9  RHO  WIDTH (MEV)

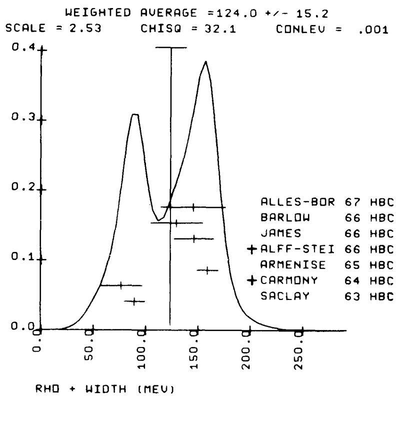
W+           90.0    10.0        SACLAY    63 HBC  +
W+  R        77.0    20.0        CARMONY   64 HBC  +          TCUT 4
W+          160.     10.         ARMENISE  65 HBC  +
W+  R       100.0                ALFF-STEI 66 HBC  +   2-3 PI+ P        6/66
W+  *       177.0    15.0        JAMES     66 HBC    + 2.1 PI+ P        7/66
W+          147.0    19.0        JAMES     66 HBC             TCUT 2.5  8/66

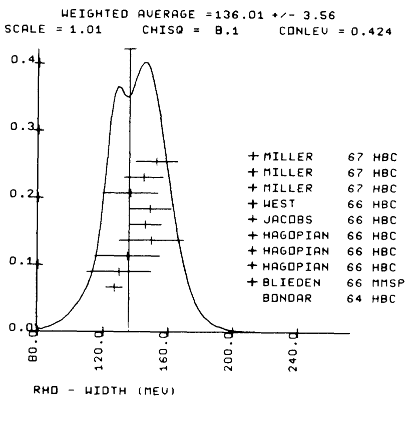
W+  S       150.0    30.0        BALTAY    66 HBC  +-  0.0 PBARP        6/66
W+          130.     25.         BARLOW    66 HBC  +- 1.2 PBAR P       11/66
W+          146.     31.         ALLES-BOR 67 HBC  +-  5.7 PBAR P      12/66
                            (Ideogram below)
W-  *        65.0    20.0        ERWIN     63 HBC  -
W-  *  130  125.0                GUIRAGOSS 63 HBC  -
W-      98  180.0                BONDAR    64 HBC  -
W-  R       127.0     5.0        BLIEDEN   66 MMSP -  3-5 PI- P         6/66
W-  R       130.     20.         HAGOPIAN  66 HBC  - 2.1 PI-P           2/67
W-  R       135.     20.         HAGOPIAN  66 HBC  - 2.1 PI-P,TCUT 12   2/67
W-  R       150.0    20.0        HAGOPIAN  66 HBC  -  3.0 PI- P         6/66
W-  R 1054  146.     10.         JACOBS    66 HBC  -  2-3 PI-,T CUT 6   1/67
W-  R       149.0    13.0        WEST      66 HBC  -  2.1 PI- P        10/66
W-  R       137.0    17.0        MILLER    67 HBC  -  2.7 PI-,T CUT 5   9/66
W-  R       145.0    12.0        MILLER    67 HBC  -  2.7 PI-,T CUT10   9/66
W-  R       153.0    13.0        MILLER    67 HBC  -  2.7 PI-,T CUT20   9/66
                            (Ideogram below)
```

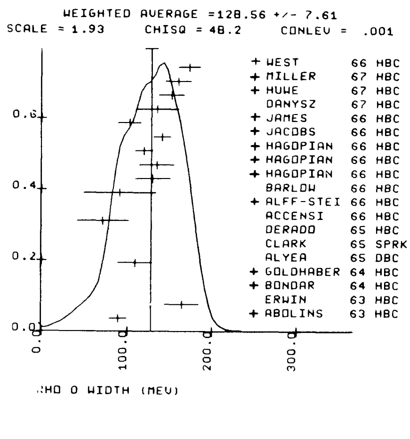












Ideograms above include data from all experiments fitted to p-wave Breit-Wigner. Averages above differ from tabulated values which come from ROOS 67 direct compilation of $\pi\pi$ mass spectra from $\pi N \rightarrow \Delta\rho$ and $N\rho$. Experiments above marked + were included by Roos.

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WO  *  190  150.0      20.0                SAMIOS    62 HBC   0
WO  *  160  175.0                          GUIRAGOSS 63 HBC   0
WO  R  300   90.0      10.0                ABOLINS   63 HBC   0
WO          165.0      20.0                ERWIN     63 HBC   0
WO  R   96  210.0                          BONDAR    64 HBC   0
WO  R  500  130.0                          GOLDHABER 64 HBC   0
WO          110.0      20.0                ALYEA     65 DBC   0 2.2 K- P          6/66
WO          130.0                          CLARK     65 SPRK  0
WO          150.0                          DERADO    65 HBC   0 4.0 PI- P         6/66
WO  S        60.0      15.0                GUTAY     65 HBC   0 2.0 PI- P         6/66
WO  *       150.0      10.0                LANZEROTT 65 CNTR  0
WO           72.0      30.0                ACCENSI   66 HBC   0 5.7 PBARP         6/66
WO  R       100.0                          ALFF-STEI 66 HBC   0 2-3 PI+ P         6/66
WO  S       174.       31.                 BALTAY    66 HBC   0 0.0 PBARP         6/66
WO           92.       42.                 BARLOW    66 HBC   0 1.2 PBAR P       11/66
WO  *       175.0                          CAMBRIDGE 66 HBC   0 5-6 GAM P         9/66
WO  S        57.0      25.0      15.0      CASON     66 HBC   0 7.0 PI- P         9/66
WO  R       130.       20.                 HAGOPIAN  66 HBC   0 2.1 PI-P          2/67
WO  R       135.       20.                 HAGOPIAN  66 HBC   0 2.1 PI-,TCUT 12   2/67
WO  R       120.0      10.0                HAGOPIAN  66 HBC   0 3.0 PI- P         6/66
WO  R 1500  141.       10.                 JACOBS    66 HBC   0 2-3 PI-,T CUT 4   1/67
WO  R       103.0      13.0                JAMES     66 HBC   0 2.1 PI+ P         6/66
WO     327  135.       25.                 DANYSZ    67 HBC   0 3,3.6 PBAR P      7/67
WO  W  184   28.       15.                 DANYSZ    67 HBC   0 3,3.6 PBAR P      7/67
WO  W   WIDTH UNUSUALLY SMALL
WO  R       152.       15.                 HUWE      67 HBC   0 2.4 PI- P         7/67
WO  R       160.0      15.0                MILLER    67 HBC   0 2.7 PI-,T CUT20   9/66
WO  R       173.0      13.0                WEST      66 HBC   0 2.1 PI- P        10/66
                  (Ideogram on previous page)
W      290  110.0                          CHADWICK  63 HBC  +-0
W            98.       30.                 FRENCH    67 HBC  +-0 3-4 PBAR P       6/67

W           120.0                          WALKER    62 HBC   -0
W           125.0      15.                 LEE       65 HBC   -0

W   *       170.0                          WOLF      65 RVUE                      6/66
W   C       128.       5.                  ROOS      67 RVUE +-0 PI N 0U-2-BODY   7/67
W   C  THIS VALUE IS FROM COMBINED DATA ON NEUTRAL AND CHARGED RHOS. NO DE-      7/67
W   C  PENDENCE OF THE RHO WIDTH ON ITS CHARGE HAS BEEN DETECTED WITHIN THE      7/67
W   C  EXPERIMENTAL ACCURACIES OF ABOUT 10 MEV. SEE ROOS 67 RVUE.                 7/67

W   R       INCLUDED IN ROOS 67 RVUE
W   S       S-WAVE BREIT-WIGNER FIT, CANNOT BE COMBINED WITH OTHER VALUES        11/66

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                 9  RHO PARTIAL DECAY MODES

P1     RHO INTO 2PI                                      S 8S 8
P2     RHO INTO 4PI                                      S 8S 8S 8S 8
P3     RHO INTO PI GAMMA                                 S 8S 0
P4     RHO INTO E+ E-                                    S 3S 3
P5     RHO INTO PI ETA (VIOLATES G)                      S 8S14
P6     RHO INTO MU+ MU-                                  S 4S 4

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                 9  RHO BRANCHING RATIOS

R1  *  RHO INTO 4PI/2PI                                (P2)/(P1)

R1  *  RHO+- INTO (PI+- PI+ PI- PI0) / (PI+- PI0)
R1  *        0.026 OR LESS           BLIEDEN    66 MMSP  -  3-5 PI- P          6/66
R1  *        0.01 OR LESS            DEUTSCHMA  66 HBC   +  8.0 PI+ P          6/66
R1  *        0.002 OR LESS           FERBEL     66 HBC   +- PI+- P ABOVE 2.5  10/66
R1  *        0.0035   0.004          JAMES      66 HBC   +                    11/66

R1  *  RHO 0 INTO  (PI+ PI- PI+ PI-) / (PI+ PI-)
R1  *        0.008 OR LESS           JAMES      66 HBC   0                     6/66
R1  *    8   0.006 OR LESS           ERBE       67 HBC   0 3.5-5C5 GAMMA-7

R2  *  RHO INTO PI GAMMA/2PI                            (P3/P1)
R2  *        0.02  OR LESS           DAUDIN     64 HBC   +
R2  N        0.02 OR LESS            LANZEROTT  65 CNTR                       11/66
R2  N     ONE PION EXCHANGE MODEL USED IN THIS ESTIMATION
R2  *        0.005 OR LESS           FIDECARO   66 SPRK  - 0.97 CONF LEV      10/66
R2  *        0.007 OR LESS           HUSON      66 HLBC  -                     6/66
R2  M        0.004 OR LESS           ERBE       67 HBC   0 3.5-5.5 GAMMA P 10/66
R2  M     ONE PION EXCHANGE MODEL USED IN THIS ESTIMATION

R3  *  RHO INTO(E+ E-)/(PI+PI-)     (UNITS 10**-4)      (P4)/(P1)
R3           0.65      1.1       0.5   HERTZBACH 67 SPRK ASSUME SU(3)+MIXING 10/66
R3       13  0.39      0.12      0.39  KHACHATUR 67 SPRK ASSUME SU(3)+MIXING  5/67

R4  *   RHO INTO (PI ETA)/(2PI)                         (P5)/(P1)
R4  *        0.03 OR LESS            DEUTSCHMA  66 HBC   +   8.0 PI+ P         6/66
R4  *        0.008  OR LESS          FERBEL     66 HBC   +- PI+- P ABOVE 2.5 11/66

R5  *   RHO INTO (MU+ MU-)/(PI+ PI-) (UN 10**-4)        (P6)/(P1)
R5  D        0.33      0.16      0.07  DE PAGTER 66 CNTR   0 5.2 GAM P         6/66
R5  D   DE PAGTER 66 ASSUME (OMEGA INTO MU+ MU-)/(RHO INTO MU+ MU-) LESS
R5  D   THAN 5, OTHERWISE THEIR BRANCHING RATIO HAS TO BE CORRECTED.
R5  *        14.0 OR LESS            HERTZBACH 67 SPRK                        10/66
R5           0.97      0.31      0.33  HYAMS     67 SPRK    11 PI- LI H        6/67
R5           0.51      0.12            WEHMANN   67 SPRK   0 12 PI- ON C,FE    6/67
R5  W   A CORRECTION OF 11 PER CENT FOR OMEGA CONTAMINATION IN THE DATA
R5  W   OF WEHMANN 67 IS BASED ON SU(3)

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REFERENCES FOR RHO


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ANDERSON 61 PRL 6 365          ANDERSON,BANG,BURKE,CARMONY,SCHMITZ // LRL
KENNEY   62 PR 126 736         V P KENNEY,W D SHEPHARD,C C GALL /KENTUCKY
SAMIOS   62 PRL 9 139          SAMIOS,BACHMAN,LEA+ // BNL+CCNY+COLUM+KENT
WALKER   62 CERN CONF 42       W D WALKER,E WEST A R ERWIN + // WISCONSIN
XUONG    62 PR 128 1849        NGUYEN HUU XUONG,GERALD R LYNCH ////// LRL

ABOLINS  63 PRL 11 381         ABOLINS,LANDER,MEHLHOP,NGUYEN,YAGER / UCSD
ALITTI   63 NC 29 515          ALITTI,BATON,ARMENISE+/SAC+ORSAY+BARI+BOLO
CHADWICK 63 PRL 10 62          CHADWICK,DAVIES,DERRICK,CRESTI + / OXF+PAD
GUIRAGOS 63 PRL 11 85          ZAVEN GUIRAGOSSIAN ////////////////// LRL
ERWIN    63 SIENA CONF 1 112   ERWIN,SATTERBLOM,WALKER,WEST /// WISCONSIN
SACLAY   63 SIENA CONF 1 239   SACLAY+ORSAY+BARI + BOLOGNA(COLLABORATION)

BATON    64 NC 35 713          BATON,BERTHELOT,ALLES,BORELLI + /CEN+BOLOG
BONDAR   64 NC 31 729          BONDAR+//AACHEN+BIRM+BONN+DESY+IMP-COL+MPI
CARMONY  64 DUBNA CONF 1 486   CARMONY,HOA,LANDER,NG H XUONG,YAGER //UCSD
DAUDIN   64 REPORT CEA-R-2525  DAUDIN,JABIOL,MONGELLI + ///// SACLAY+BARI
GOLDHABE 64 PRL 12 336         GOLDHABER,BROWN,KADYK,SHEN,TRILLING/LRL+UC

ALYEA    65 PL 15 62           ALYEA,CRITTENDEN,MARTIN,RHODE + // INDIANA
ARMENISE 65 NC 37 361          SACLAY+ORSAY+BARI+BOLOGNA (COLLABORATION )
BLIEDEN  65 PL 19 444          BLIEDEN,FREYTAG,GEIBEL,HASSAN + ///// CERN
CLARK    65 PR 139 B 1556      A CLARK,CHRISTENSON,CRONIN,TURLAY/PRINCETO
DERADO   65 PRL 14 872         DERADO,KENNEY,POIRIER,SHEPHARD//NOTRE DAME
GUTAY    65 NC 39 381          GUTAY,LANNUTTI,TULI ////////////// FLORIDA
LANZEROT 65 PRL 15 210         LANZEROTTI,BLUMENTHAL,EHN,FAISSLER +/HARVD
LEE      65 MICH 04938         YONG-YUNG LEE ////////////////// MICHIGAN
WOLF     65 PL 19 328          G WOLF //////////////////////////// DESY
ZDANIS   65 PRL 14 721         ZDANIS,MADANSKY,KRAEMER + //////// JHU+BNL

ACCENSI  66 PL 20 557          ACCENSI,ALLES-BORELLI,FRENCH,FRISK+// CERN
ALFF-STE 66 PR 145 1072        ALFF-STEINBERGER,BERLEY,BRUGGER+//COL+RUTG
BALTAY   66 PR 145 1103        +FRANZINI,LUTJENS,SEVERINS,TYCKO+/COLUMBIA
BARLOW   66  CERN-TC66-22 -NC  BARLOW,D.ANDLAU+ //// CERN+PARIS+LIVERPOOL
BLIEDEN  66 NC 43 71           +FREYTAG,GEIBEL,HASSAN,KIENZLE+ ///// CERN
CAMBRIDG 66 PR  146  994       CAMBRIDGE BUBBLE CHAMBER GROUP //MIT+HARV+
CASON    66 PR  148  1282      N M CASON                     // WISCONSIN
DE PAGTE 66 PRL 16 35          DE PAGTER+//CAM EL ACC+MIT+NORTHEAST+ SLAC
DEUTSCHM 66 PL 20 82           DEUTSCHMANN,STEINBERG +//AACH+BERLIN+ CERN
FERBEL   66 PL 21 111          FERBEL ////////////////////////// ROCHESTER
FIDECARO 66 PL  23  163        G+M FIDECARO,J POIRIER,P SCHIAVON  // CERN
HAGOPIAN 66 PR 145 1126        HAGOPIAN,SELOVE,ALITTI,BATON+//PENN+SACLAY
HUSON    66 PL 20 91           HUSON,ALLARD,DRIJARD,HENNESSY + //ORSAY+EP
JACOBS   66  UCRL-16877        L.D.JACOBS ///////////////////////////// LRL
JAMES    66 PR 142 896         F E JAMES,KRAYBILL /////// YALE+BROOKHAVEN
WEST     66 PR 149 1089        WEST,BOYD,ERWIN,WALKER ////////// WISCONSIN

ALLES-BC 67 NC TO BE PUBL.     ALLES-BORELLI,FRENCH,FRISK,+ /// CERN+BONN
CLEAR    67 NC 49A 399         +JOHNSTON+COOPER+MANNER+WALKER+/TO+ANL+WIS
DANYSZ   67 NC TO BE PUBL.     DANYSZ+FRENCH+SIMAK ///////////////// CERN
ERBE     67 NC 48A 262         +BOTTCHER+MOEBES+HARIGEL+LUKE+ /// ABBDHHM
FRENCH   67  CERN/TC/PH.66-31  +KINSON+MCDONALD+RIDDIFORD+ //// CERN+BIRM
HERTZBAC 67 PR 155  1461       HERTZBACH,KRAEMER,MADANSKI,ZDANIS+/JHU+BNL
    (SEE ALSO ZDANIS 65)
HUWE     67 PL 24B 252         +MARGUIT+OPPENHEIMER+SCHULTZ+WILSON // COL
HYAMS    67 PL 24B 634         +KOCH+PELLETT+POTTER+VONLINDERN+ /CERN+MUN
KHACHATU 67 PL 24B 349         KHACHATURYAN+AZIMOV+BALDIN+BELOUSOV+/DUBNA
MILLER   67  PR 153 1423       MILLER,GUTAY,JOHNSON,LOEFFLER +  // PURDUE
ROOS     67  PREPRINT TH.798   M. ROOS ///////////////////////////// CERN
WEHMANN  67 PRL 18 929         +ENGELS+ /// HARVARD+CWRU+SLAC+CORN+MCGILL
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δ(965)

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          36  DELTA MESON (963,JPG=    )  I = 1

          CONFIRMATION STILL LACKING.

          36  DELTA (963) MASS (MEV)

M           910.                          TURKOT    63 MMS  + 3.3 PP TC D + MM 10/66
M      262  962.0      5.0                KIENZLE   65 MMS  -  3-5 PI- P        9/66
M   *   36  965.0                         ALLEN     66 HBC  -  1.7 PI- P        9/66
M   *  106  965.0   COMPILATION BY        ALLEN     66 HBC +-0 1-8 PI P         9/66
M           966.0      8.0                OOSTENS   66 MMS  + 3. P P TC D + MM  9/66
       FOR RESULTS WHICH DO NOT SUPPORT ALLEN 66,
       SEE JACOBS 66, WEST 66, CLEAR 67, AND ROOS 67

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          36  DELTA (963) WIDTH (MEV)

W            50.                          TURKOT    63 MMS  + 3.3 PP TC D + MM 10/66
W   *  262    5.0   OR LESS               KIENZLE   65 MMS  -  3-5 PI- P        9/66
W   *   36   25.    OR LESS               ALLEN     66 HBC  -  1.7 PI- P        9/66
W   *        10.0   OR LESS               OOSTENS   66 MMS  + 3. P P TC D + MM  9/66

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          36  DELTA MESON PARTIAL DECAY MODES

P1         DELTA MESON INTO 2 PI                          S 8S 8
P2         DELTA MESON INTO 3 PI                          S 9S 9S 9
P3         DELTA MESON INTO 4 PI                          S 9S 9S 9S 9
P4   *     DELTA MESON INTO 5 PI
P5         DELTA MESON INTO ETA PI                        S14S 9
P6         DELTA MESON INTO RHO PI                        L 9S 9

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          36  DELTA MESON BRANCHING RATIOS

R1         CHARGED DELTA INTO (1 CHARGED) / (3 OR MORE CHARGED)
R1            1.3        0.9        0.7   KIENZLE   66 MMS  -  3-5 PI- P        9/66

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

CS   *     15 +- 5 BRANCH.RATIO ABOVE.KIENZLE   65  MMS  -    3-5 PI-          7/67
CS   * KIENZLE 15. REVISED  TO A FEW...FOCACCI   66  MMS  -    3-5 PI-          7/67
CS   *     17 OR LESS (2 PRONGS)      JACOBS    66  HBC     3.2  PI-           7/67
CS   *     3.3 +- 1.7 PI- PI+ PI- ETA CHUNG     67  HBC                        7/67
CS   *     .2 OR LESS PI- PI+ PI- MM  CHUNG     67  HBC     3.2-4.2 PI-        7/67
CS   *     1.5OR LESS PI- PI+ PI- PI0 CHUNG     67  HBC       3.2 PI-          7/67

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REFERENCES FOR DELTA(963)


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TURKOT   63 SIENNA CONF 1 661 +COLLINS,FUJII,KEMP+ ////// BNL+PITTSBURGH
KIENZLE  65 PL  19  436       + MAGLIC,LEVRAT,LEFEBVRES +          // CERN
ALLEN D  66 PL 22  543        +GP FISHER,G GODDEN,L MARSHALL,SEARS//COLO G=+
FOCACCI  66 PL    17  890     + KIENZLE,LEVRAT,MAGLIC,MARTIN       // CERN
JACOBS   66 UCRL 16877-THESIS  +O.DAHL, J. KIRZ, D.H.MILLER //////// LRL
OOSTENS  66 PL  22  708       +CHAVANON,CROZON,TOCQUEVILLE  // SACLAY,CF I=1
WEST     66 PR 149 1089       WEST,BOYD,ERWIN,WALKER ////////// WISCONSIN
CHUNG S  67 UCRL 16881         +O.DAHL, J. KIRZ, D.H.MILLER //////// LRL
CLEAR    67 NC 49A 399        +JOHNSTON+PILCHER+COOPER+/TORONTO+ANL+WISC
ROOS     67  PREPRINT         M. ROOS ////////////////////////////// CERN
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$\pi_V(1003)$

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          16 PI(1003,JPG=0+-) I=1

          STILL NOT DECIDED WETHER (K KBAR) RESONANCE, VIRTUAL
          BOUND STATE OR ANTIBOUND STATE.

          16 PI(1003) MASS  (MEV)

M    *       1060.0                        BELYAKOV  64 PBC       7.5 PI- P       6/66
M    *    50 1025.0   APPROX.              ARMENTERO 65 HBC  +-  0.0 PBAR P
M    *   143 1003.3        7.0+SYSTEMATIC ROSENFELD 65 RVUE +-                   8/66
M    *       SCAT. LENGTH 2 TO 6 FERMIS.BALTAY      66 HBC       3.7 PBAR P      8/66
M    *       SCAT. LENGTH 2.4+-.5 FERMI BARLOW      66 HBC  +-  1.2 PBAR P     11/66
M    A   100 1016.       10.               ASTIER    67 HBC  +-   0 PBAR P       7/67
M    A     SCATT.LENGTH ALSO FITS, SEE BELOW
M    *     SCATT.LENGTH +2.5 +-1. FERMI  ASTIER    67 HBC  +-  0-1.2 PBAR P     7/67
M    *     OR CMPLX, RE PART=-2.3 F      ......    .. ...  ..  ..... ..... .    7/67
M    *               IM PART=.5F OR LESS ......    .. ...  ..  ..... ..... .    7/67

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          16 PI(1003) WIDTH (MEV)

W    *         60.0                        BELYAKOV  64 PBC                       6/66
W    *    50   40.0   APPROX.              ARMENTERO 65 HBC  +-
W    *   143   57.0      13.0+SYSTEMATIC ROSENFELD 65 RVUE +-                    8/66
W              70.       20.               MONTANET  67 HBC                       7/67

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                16 PI(1003) PARTIAL DECAY MODES

P1        PI(1003) INTO K KBAR                              S10S11
P2        PI(1003) INTO ETA PI                              S14S 8

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                16 PI(1003) BRANCHING RATIOS

R1  *     PI(1003) INTO (ETA PI) / (K KBAR)              NUM  2
R1  *                                                    DEN  1
R1  *         5.    OR LESS (TENTAT.) ASTIER     67 HBC                7/67
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The $\pi_V(1003) \rightarrow \bar{K}K$ has been seen clearly only in $\bar{p}p$ annihilations, where no $\eta\pi$ mass spectra are known to us. There are $\eta\pi$ spectra in $\pi^{\pm}p$ interactions [see Alitti et al., Phys. Letters 15, 69 (1965)], but there the total production of $\pi_V(1003)$ is $\lesssim 3\ \mu b$ at 3.2 GeV/c [see Richard I. Hess et al., Phys. Rev. Letters 17, 1109 (1966)]. The preliminary results of the analysis of the annihilation $\bar{p}p \rightarrow \eta\pi^+\pi^-$ seem to exclude a branching ratio $\eta\pi/\bar{K}K$ larger than 5 (see Astier et al., Phys. Letters to be published).

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REFERENCES FOR PI(1003)

BELYAKOV 64 JINR P-1586 BELYAKOV,VIRYASOV,KLADNITSKAYA + /// DUBNA
ARMENTER 65 PL 17 344 ARMENTEROS,EDWARDS,JACOBSEN +///CERN+PARIS
ASTIER 65 OXFORD ABSTRACT 143 AND SUPPLEMENT P 13 // CERN+COLL DE FR.
BARASH 65 PR 139 B 1659 +FRANZINI,KIRSCH,MILLER,STEINBERGER+/COLUM
ROSENFEL 65 OXFORD CONF 58 A H ROSENFELD ////////////////// LRL--RVUE
BALTAY 66 PR 142 B 932 +LACH,SANDWEISS,TAFT,YEH,STONEHILL+ //YALE
BARLOW 66 CERN-TC66-22 -NC BARLOW,D.ANDLAU+ //// CERN+PARIS+LIVERPOOL
ASTIER 67 PL TO BE PUBL. +MONTANET+BAUBILLIER+ /////// CDF+CERN+IDR
MONTANET 67 PRIVATE COMM. L.MONTANET /////////////////////////// CERN

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A1(1080)

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10  A1 MESON (1079, JPG=1+-)  I=1

            SEE COMPILATION AND DISCUSSION IN G.GOLDHABERS REVIEW,
    *       PROC. 1966 BERKELEY CONFERENCE

                10  A1 MESON  MASS (MEV)

M   *  THE DETERMINATION OF THE MASS AND WIDTH OF THE A1 MIGHT SUFFER FROM
M   *  LARGE  SYSTEMATIC  ERRORS SINCE THE BEHAVIOR  OF THE BACKGROUND IN
M   *  THAT REGION IS COMPLICATED AND NOT WELL UNDERSTOOD.

M          1060.0                        ADERHOLZ  64 HBC
M   *      1090.    APPROX.              CHUNG     66 HBC  -  3.2,4.2 PI-P    2/67
M          1076.0    14.0                DEUTSCH 2 66 HBC  +                  9/66
M   U      1126.    APPROX.              CONTE     67 HBC  - 11 PI- P         8/67
M   U  ESTIMATE UNCERTAIN BECAUSE ADDITIONAL PEAKING AT 1200 MEV              8/67
M          1054.      7.                 DANYSZ    67 HBC +-  3,3.6 PBAR P    7/67
M   *      1020.    PRELIM.              FRIDMAN   67 HBC +- 5.7 PBAR P       7/67
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                10  A1 MESON  WIDTH (MEV)

W   *  SEE NOTE UNDER A1 MESON MASS.

W           80.0                         ADERHOLZ  64 HBC
W   *      125.     APPROX.              CHUNG     66 HBC  -  3.2,4.2 PI-P    2/67
W          130.0     50.0      40.0      DEUTSCH 2 66 HBC  +                  9/66
W   *      130.     APPROX.              CONTE     67 HBC  - 11 PI- P         8/67
W           33.      19.                 DANYSZ    67 HBC +-  3,3.6 PBAR P    7/67

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                10  A1 PARTIAL DECAY MODES

P1      A1 INTO RHO PI                                   U 9S 8
P2      A1 INTO KBAR K                                   S10S11
P3      A1 INTO ETA PI                                   S14S 8
P4      A1 INTO ETA PRIME PI                             U 2S 8
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                10  A1 BRANCHING RATIOS

R1  *   A1 INTO (KBAR K)/(RHO PI)                      (P2)/(P1)
R1  *         0.01 OR LESS         DEUTSCH 1 66 HBC  +                       6/66
R1  *         0.0025 OR LESS       DAHL      67 HBC  -   4.0 PI- P          10/66

R2  *    A1 INTO (ETA PI)/(RHO PI)                     (P3)/(P1)
R2  *         0.015 OR LESS        DEUTSCH 1 66 HBC  +                       6/66

R3  *    A1 INTO (ETA PRIME PI)/(RHO PI)               (P4)/(P1)
R3  *         0.015 OR LESS        DEUTSCH 1 66 HBC  +                       6/66

R   *FOR 1+ NONET SU3 RATES SEE E.G. GOLDHABER, REVIEW BERKELEY CONF.1966
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REFERENCES FOR A1

BELLINI 63 NC 29 896 BELLINI,FIORINI,HERZ,NEGRI,RATTI /// MILAN
ADERHOLZ 64 PL 10 226 AACH+BERL+BIRM+BONN+DESY+HAMB+IMP.COL+ MPI
ALLARD 64 PL 12 143 ALLARD+ // PARIS+CERN+MILAN+CEA-SAC+UC-BKY
ALLARD 64 DATA SUPERSEDED BY ALLARD 66
GOLDHABE 64 PRL 12 336 GOLDHABER,BROWN,KADYK,SHEN,TRILLING/LRL+UC
HESS 64 DUBNA CONF 1 422 HESS,CHUNG,DAHL,HARDY,KIRZ,MILLER //// LRL
HESS 64 DATA SUPERSEDED BY CHUNG 66
LANDER 64 PRL 13 346 A LANDER,ABOLINS,CARMONY,HENDRICKS +/// UCSD JP

ABOLINS 65 ATHENS(OHIO)CONF +CARMONY,LANDER,XUONG,YAGER ///// LA JOLLA I=1
ALITTI 65 PL 15 69 ALITTI,BATON,DELER,CRUSSARD+ ///// SAC+BOL

CHUNG 66 UCRL-16981 S. U. CHUNG //////////////////////////// LRL
DEUTSCH1 66 PL 20 82 DEUTSCHMANN,STEINBERG + //AACH+BERLIN+CERN
DEUTSCH2 66 PL 22 112 DEUTSCHMANN,STEINBERG + //AACH+BERLIN+CERN
GOLDHABE 66 BERKELEY CONF G.GOLDHABER,SAMIOS,ASTIER,SHEN,LAI.MESON REVIEW
HESS 66 UCRL-16832 R I HESS (THESIS, BERKELEY) // LRL

CONTE 67 PREPRINT +TOMASINI+CORDS+ //// GENOVA+HAMB+MIL+SACL
DAHL 67 UCRL-16978 +HARDY+HESS+KIRZ+MILLER ////////////// LRL
DANYSZ 67 NC TO BE PUBL. DANYSZ+FRENCH+SIMAK ///////////////// CERN
FRIDMAN 67 PREPRINT +MAURER+MICHALON+OUDET+SCHIBY+/HEID+STRASB

QUANTUM NUMBER DETERMINATIONS NOT REFERRED TO IN THE DATA CARDS

ALLARD 66 NC 46A 737 +DRIJARD+HENNESSY+ // ORSAY+MILAN+SAC+BERK
ALLARD+ 66 GET GOOD FIT TO M(PI RHO) ONLY WHEN ASSUMING ADDITIONAL RESO-
NANCES BETWEEN 940 AND 1315 MEV
SLATTERY 67 NC 50A 377 +KRAYBILL+FORMAN+FERBEL //////// YALE+ROCH JP

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B(1210)

11 B MESON (1210,JPG= +) I=1

The B meson was first seen in πp collisions, where its analysis was complicated by Deck Effect (see CHUNG + 64). However, in 1966 Baltay et al. reported a significant B peak in $\bar{p}p$ annihilations. This seems to confirm the existence of the B.

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                11  B MESON  MASS (MEV)

M        60 1220.0                       ABOLINS   63 HBC  +
M           1220.0                       HESS      64 HBC  -
M           1220.0                       GOLDHABER 65 HBC
M       376 1200.         20.            BALTAY    67 HBC +- 0.0 PBAR P        2/67
M   *       FOR EVIDENCE THAT THE B IS JUST DECK EFFECT, SEE CHUNG 66
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                11  B MESON  WIDTH (MEV)

W        60  100.0    20.0               ABOLINS   63 HBC  +
W            180.0    30.0               HESS      64 HBC  -
W             80.0                       GOLDHABER 65 HBC
W       376  100.     30.                BALTAY    67 HBC +- 0.0 PBAR P        2/67
                 (Ideogram below)
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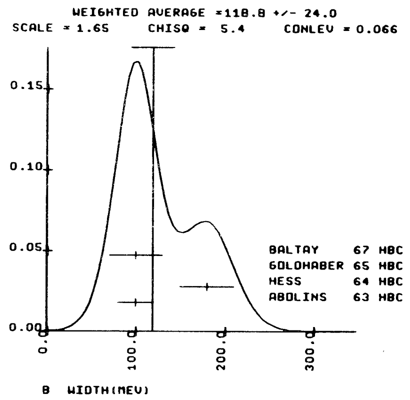


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                11  B MESON PARTIAL DECAY MODES

P1      B MESON INTO OMEGA+PI                            U 1S 8
P2      B MESON INTO 2PI+ 2PI-                           S 8S 8S 8S 8
P3      B MESON INTO K KBAR                              S10S10
P4      B MESON INTO PI PI                               S 8S 8
P5      B MESON INTO PI PHI                              S 9U 4
P6      B MESON INTO ETA PI (FORBIDDEN BY G)             S14S 8
P7      B MESON INTO K KBAR PI                           S10S10S 8

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                11  B MESON  BRANCHING RATIOS

R1  *  B INTO  4PI/(OMEGA PI)                            (P2)/(P1)
R1  *          0.5   OR LESS              ABOLINS   63 HBC  +

R2  *  B MESON INTO (K KBAR)/(OMEGA PI)                  (P3)/(P1)
R2  *          0.02  OR LESS              DAHL      67 HBC  -  1.6-4.2 PI- P   10/66
R2  *          0.10  OR LESS (CL 90)      BALTAY    67 HBC +-                   2/67

R3  *  B MESON INTO (PI PI)/(PI OMEGA)                    (P4)/(P1)
R3  *          0.3   OR LESS              ADERHOLZ  64 HBC                      7/66

R4  *  B MESON INTO (PI PHI) / (PI OMEGA)                 (P5)/(P1)
R4  *          0.015 OR LESS              DAHL      67 HBC     1.6-4.2 PI- P   10/66

R5  *  B MESON INTO (ETA PI) / (PI OMEGA)                 (P6)/(P1)
R5  *          0.25  OR LESS (CL 90)      BALTAY    67 HBC +-                   2/67

R6  *  B MESON INTO (K KBAR PI) / (PI OMEGA)              (P7)/(P1)

R6  *  B+- INTO ((K KBAR)+- PI0) / (PI OMEGA)
R6  *          0.08  OR LESS (CL 90)      BALTAY    67 HBC +-                   2/67

R6  *  B+- INTO (KS KS PI+-) / (PI OMEGA)
R6  *          0.02  OR LESS (CL 90)      BALTAY    67 HBC +-                   2/67

R6  *  B+- INTO (KS KL PI+-) / (PI OMEGA)
R6  *          0.06  OR LESS (CL 90)      BALTAY    67 HBC +-                   2/67
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REFERENCES FOR B MESON

ABOLINS 63 PRL 11 381 ABOLINS,LANDER,MEHLHOP,XUONG,YAGER // UCSD
BONDAR 63 PL 5 209 BONDAR,DODD+//AACHEN+BIRM+HAMB+IC-LOND+MPI
ADERHOLZ 64 PL 10 240 AACHEN+BERLIN+BIRM+BONN+HAMBUR+IC-LOND+MPI
HESS 64 DUBNA CONF 1 422 HESS,CHUNG,DAHL,HARDY,KIRZ,MILLER //// LRL
SEE ALSO CHUNG 66
GOLDHABE 65 PRL 15 118 G GOLDHABER,S GOLDHABER,KADYK,SHEN /// LRL
CHUNG S 66 PRL 16 481 +NEVEL,DAHL,KIRZ,MILLER,GUIRAGOSIAN // LRL

BALTAY 67 PRL 18 93 +SEVERIENS+YEH+ZANELLO /////////// COL+BNL
DAHL 67 UCRL-16978 +HARDY+HESS+KIRZ+MILLER ////////////// LRL
MONTANET 67 PRIV. COMM. L. MONTANET /////////////////////////// CERN
SLATTERY 67 NC 50A 377 +KRAYBILL+FORMAN+FERBEL //////// YALE+ROCH

QUANTUM NUMBER DETERMINATIONS NOT REFERRED TO IN THE DATA CARDS

CARMONY 64 PRL 12 254 CARMONY,LANDER,RINDFLEISCH,XUONG,YAGER//UC JP

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A2(1300)

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12  A2 MESON (130C,JPG=2+-)  I=1

     *             SEE COMPIL. AND DISC. IN G.GOLCHABERS REVIEW,
     *             PROC. 1966 BERKELEY CONFERENCE

     *             LEVRAT 66, CHIKCVANI 67 ANC MORRISCN 67  SUGGEST TWO
     *             CIFFERENT MESONS NEAR 130C MEV.

                   12  A2 MESON  MASS (MEV)

M          1320.0                     ADERHOLZ  64 HBC
M          1335.0    1C.0             GCLCHABER 64 HBC  +-  3.7 PI+- P
M          1285.0                     ARMENTERC 65 HBC     K1K1 DECAY        6/66
M          1270.0                     CERADO    65 HBC                       6/66
M      130 1310.0                     FORINO    65 DBC  + 0 4.5 PI+ D       10/66
M     1425 1290.0     5.0             LEFEBVRES 65 MMSP  -                   6/66
M          1300.0                     SEICLITZ  65 DBC  -                    6/66

M          1317.     3.               BARLOW    66 HBC  +- (K KBAR MODE)    11/66
M          1333.    13.               BARLOW    66 HBC  +- (K KBAR MODE)    11/66
M          1290.0   10.0              BARNES    66 HBC  -                    6/66
M          1310.0   1C.0              BENSON    66 DBC                       6/66
M          1310.    20.               CHUNG     66 HBC  -  2.7-4.5 PI- P     8/67
M          1280.0                     DEUTSCHMA 66 HBC  +  8.0 PI+ P         6/66
M   * 1800 1310.0   1C.0    CCMP.BY   FERBEL    66      +-  PI+- P          10/66
M     1060 1286.     8.               LEVRAT    66 MMS  -  6-7 PI- P         2/67

M          1320.    1C.               ARMENISE  67 DBC   C 5.1 PI+ D         8/67
M      137 1285.    20.               BALTAY    67 HBC   C 8.5 PI+ P         7/67
M          1312.    10.               BARTSCH   67 HBC   0 8 PI+ P           8/67
M          1344.0    7.       6.      BEUSCH    67 SPRK  0 5-12 PI- P        7/67
M   A      1288.    14.               CASON     67 HBC  -  8 PI- P           5/67
M   A  ANALYSIS COMPLICATED BY NEARBY PEAK (A1.5) AT 119C MEV                5/67
M     4000 1307.    16.               CHIKOVANI 67 MMS  -  7 PI- P           8/67
M   *      1300.   APPROX.            CONTE     67 HBC  - 11 PI- P           8/67
M          1317.2    4.C              DAHL      67 HBC  -  2.7-4.5 PI- P     8/67
M          1315.7   10.8              DAHL      67 HBC   C 2.7-4.5 PI- P     8/67
M   K  VALUES OF DAHL 67 ABOVE ARE FROM K KBAR MOLE ONLY.                    8/67
M          1269.     9.               DANYSZ    67 HBC  +-  3,3.6 PBAR P     7/67
M   *      1300.   PRELIM.            FRIDMAN   67 HBC  +- 5.7 PBAR P        7/67
M          1280.    12.               MONTANET  67 HBC  +- 0.PBAR P (KOK+-)  7/67
                  (Ideogram below)
M   *              EVIDENCE FOR TWC-PEAK STRUCTURE

M   *              LEVRAT+ 66 HAVE SLIGHT EVICENCE FOR TWO-PEAK STRUCTURE.
M   *              WITH BASICALLY THE SAME SET-UP, CHIKCVANI+ 67 CCNFIRM
M   *              THIS. COMBINING THEIR DATA WITH THE CLC DATA OF LEVRAT+
M   *              66, CHIKOVANI + 67 GET THE FOLLOWING RESULTS.

M   *      1274.    16.     FCR FIRST  PEAK   (TWO INCEP. PEAKS ASSUMED)   8/67
M   *      1320.    16.     FCR SECCND PEAK   (TWO INCEP. PEAKS ASSUMED)   8/67

M   *      1296.    16.     FOR FIT TC DIPOLE                              8/67

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                   12  A2 MESON  WIDTH (MEV)

W           100.0                     ADERHOLZ  64 HBC
W            90.0   10.0              GCLCHABER 64 HBC  +-  3.7 PI+- P
W           150.0                     DERADO    65 HBC                       6/66
W     1425   99.0   15.0              LEFEBVRES 65 MMSP  -                   6/66
W           140.0                     SEICLITZ  65 DBC  -                    6/66

W            70.0   10.0              BARNES    66 HBC  -                    6/66
W            56.    28.               BARLOW    66 HBC  +- (K KBAR MODE)    11/66
W            56.    15.               BARLOW    66 HBC  +- (K KBAR MODE)    11/66
W   N       110.0   45.C              BENSON    66 DBC                       6/66
W   N  SUPERSEDED BY BENSON 1 66                                             2/67
W           100.    15.               BENSCN 1  66 DBC   0 3.65 PI+D         1/67
W            80.    20.               CHUNG     66 HBC  -  2.7-4.5 PI- P     8/67
W   * 1800   80.0   1C.0    CCMP.BY   FERBEL    66      +-  PI+- P          10/66
W     1060   98.     5.               LEVRAT    66 MMS  - 6,7 PI- P          2/67

W           120.    20.               ARMENISE  67 DBC   0 5.1 PI+ D         8/67
W      137  100.    25.               BALTAY    67 HBC   C 8.5 PI+ P         7/67
W            61.    25.               BARTSCH   67 HBC   0 8 PI+ P           8/67
W            88.    23.       22.     BEUSCH    67 SPRK  0 5-12 PI- P        7/67
W   A        84.    30.       20.     CASON     67 HBC  -  8 PI- P           5/67
W   A  ANALYSIS COMPLICATEC BY NEARBY PEAK (A1.5) AT 119C MEV                5/67
W     4000   90.    15.               CHIKOVANI 67 MMS  -  7 PI- P           8/67
W   *        80.   APPROX.            CONTE     67 HBC  - 11 PI- P           8/67
W            47.    18.               DAHL      67 HBC  -  2.7-4.5 PI- P     8/67
W            80.5   36.5              DAHL      67 HBC   0 2.7-4.5 PI- P     8/67
W   K  VALUES OF DAHL 67 ABOVE ARE FROM K KBAR MODE ONLY.
W            45.    22.               DANYSZ    67 HBC  +-  3,3.6 PBAR P     7/67
W            90.    15.               MONTANET  67 HBC  +- 0.PBAR P (KOK+-)  7/67
                  (Ideogram below)
W   *              RESULTS FOR TWO-PEAK STRUCTURE BY CHICOVANI+ 67
W   *                  (CF. NOTE UNDER MASS LISTINGS ABCVE)

W   *        29.    10.     FOR FIRST  PEAK   (TWO INCEP. PEAKS ASSUMED)   8/67
W   *        35.    10.     FOR SECOND PEAK   (TWO INCEP. PEAKS ASSUMED)   8/67

W   *        30.     3.     FOR FIT TO DIPOLE                              8/67

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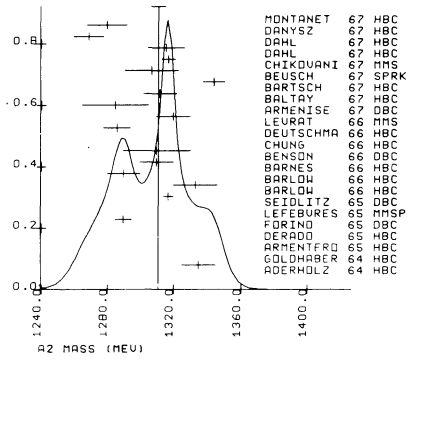
WEIGHTED AVERAGE =1311.23 +/- 4.33
SCALE = 2.55   CHISQ =103.8   CONLEV = .001

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                 12  A2 MESON PARTIAL DECAY MODES

P1       A2 MESON INTO RHO PI                               U 9S 8
P2       A2 MESON INTC KBAR K                               S10S12
P3       A2 MESON INTC ETA PI                               S14S 8
P4       A2 MESON INTC ETA PRIME PI                         U 2S 8
P5       A2 MESON INTO PI+ PI- PIO                          S 8S 8S 9

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                 12  A2 MESON  BRANCHING RATIOS

R1   *   A2 MESON  INTC (K KBAR) / (RHC PI)                 (P2)/(P1)
R1   *        0.08  CR LESS           LANCER    64 HBC  +                   10/66
R1   A        0.02  OR LESS           ARMENTERC 65 HBC  -
R1   A     THE PEAK IN MASS(K KBAR) IS AT 1250 MEV, WICTH 50 MEV, IN THIS
R1   A     EXPERIMENT. THE BRANCHING FRACTION HAS BEEN CCRRECTED BY A FACTOR
R1   A     C.5 FOR UNOBSERVED (RHO+- PIO) CECAYS. THE VALUE IS NOT USED IN
R1   A     AVERAGING BECAUSE THE ERROR IS NOT CLEAR.
R1            0.03      C.02          DEUTSCHMA 66 HBC  +                    6/66
R1            0.05      0.02          CHUNG     67 HBC  -                    1/67

R2   *   A2 MESON INTC (ETA PI)/TOTAL                       (P3)/TOTAL
R2   *        0.03 CR LESS            DEUTSCHMA 66 HBC  +                    6/66

R3   *   A2 MESON INTC (ETA PI) / (RHO PI)                  (P3)/(P1)
R3            0.3       0.2           ADERHOLZ  65 HBC
R3            0.24      C.08          DUBCVIKCV 66 HBC  -                   11/66
R3            0.12      0.08          CHUNG     67 HBC  -                   12/66
R3            0.22      0.09          CONTE     67 HBC  -                    8/67

R4   *   A2 MESON INTC (ETA PRIME PI) / TOTAL               (P4)/TOTAL
R4   *        0.1   CR LESS           CHUNG     65 HBC  -
R4   *        0.015 CR LESS           DEUTSCHMA 66 HBC  +                    6/66

R6   *   A2 MESON INTC (PI+ PI- PIO) / (RHO PI)             (P5)/(P1)
R6   *        0.17  CR LESS           BENSON    66 DBC   0

R    *FOR 2+ NONET SU3 RATES SEE E.G. GLASHOW,SOCOLOW, PRL 15,329(65)

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                 12 QUANTUM NUMBER DETERMINATIONS

Q1   *      IJP FOR NEUTRAL A2
Q1   *      I = 1                     ABOLINS   65
Q1   *      I = 1    JP = 2+          BALTAY    67
Q1   *      I = 1    JP = 2+          BARTSCH   67

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REFERENCES FOR A2


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ADERHOLZ 64 PL 10 248          AACHEN+BERLIN+BIRM+BONN+HAMB+IC-LONDON+MPI
GOLCHABE 64 DUBNA CONF  1 480 G GOLCHABER,S GOLCHABER,CHALLORAN,SHEN/LRL
LANCER   64 PRL 13 346         +ABOLINS,CARMONY,HENCRIKS,XUONG+/ LA JOLLA

ABOLINS  65  ATHENS(CHIO)CONF +CARMONY,LANDER,XUONG,YAGER ///// LA JOLLA I=1
ARMENTER 65 PL 17 344          ARMENTEROS,EDWARCS,JACOBSEN +  //CERN+CDEF
CHUNG    65 PRL  15  325       +CAHL,HARDY,HESS,JACCBS,KIRZ,MILLER // LRL
DERADO   65 PRL 14 872         DERADC,KENNEY,PCIRIER,SHEPHARD//NOTRE DAME
FORINO   65 PL 19 68           +GESSAROLI+LENDINARA+/BOL+BARI+FIR+ORS+SAC
LEFEBVRE 65 PL 19 434          LEFEBVRES,LEVRAT,BLIEDEN,CUBAL +    //CERN
SEIDLITZ 65 PRL 15 217         L SEICLITZ,C I CAHL,C H MILLER /////// LRL

BARLOW   66  CERN-TC66-22 -NC BARLOW,D.ANDLAU+ //// CERN+PARIS+LIVERPOOL
BARNES   66 PRL 16 41          BARNES,FOWLER,LAI,ORENSTEIN + /// BNL+CCNY
BENSON   66 PRL 16 1177        G BENSON,LOVELL,MARQUIT,RCES + // MICHIGAN
BENSCN 1 66  MICH COC-1112-4   G.C.BENSON ////////////////////// MICHIGAN
CHUNG    66  UCRL-16881 REV    S.U.CHUNG ////////////////////////////// LRL
DEUTSCHM 66 PL 20 82           DEUTSCHMANN,STEINBERG + //AACH+BERLIN+CERN
DUBOVIKO 66 PL 23 716+PRIV.C.  DUBOVIKCV,GRIGORIEV,VLACIMIRSKY +  // ITEP
EHRLICH  66 PR 152 1194        R. EHRLICH,W.SELCVE,H.YUTA // PENNSYLVANIA
FERBEL   66 PL 21 111          FERBEL                        // ROCHESTER
GOLCHABE 66  BERKELEY CONF     G.GOLCHABER,SAMIOS,ASTIER,SHEN,LAI.MESON REVIEW
LEVRAT   66 PL  22  714        +TOLSTRUP,SCHUBELEIN,NEF,MAGLIC  + // CERN

ARMENISE 67 PL 25B 53          +FORINO+CARTACCI+ ///// BARI+BOL+FIR+CRSAY
BALTAY   67 PL 25B 160         +KIRSCH+KUNG+YEH+RABIN / COLUM+BNL+RUTGERS
BARTSCH  67 PL 25B 48          +CEUTSCHMANN+GROTE+COCCONI+/AACH+BERL+CERN
BEUSCH   67 PL TO BE PUBL.     +FISCHER,GOBBI,PEPIN,ASTBURY + // ETH+CERN
CASON    67 PRL 18 88C         +LAMSA,BISWAS,DERADO,GROVES,+ // NOTRECAME
CHIKOVAN 67 PL 25B 44          CHIKOVANI+FOCACCI+KIENZLE+MAGLIC+ /// CERN
CHUNG    67 PRL 18 100         +CAHL,HARDY,HESS,KIRZ,MILLER ///////// LRL
    ALSC 66 UCRL-16832         RICHARD I HESS--THESIS,BERKELEY     // LRL
COHN     67 NP B1 57           +MCCULLOCH+BUGG+CONDO //// CRNL+UNIV.TENN.
CONTE    67  PREPRINT          +TOMASINI+CORDS+ //// GENCVA+HAMB+MIL+SACL
DAHL     67  UCRL-16978        +HARDY+HESS+KIRZ+MILLER ////////////// LRL
DANYSZ   67 NC TO BE PUBL.     DANYSZ+FRENCH+SIMAK ///////////////// CERN
FRICMAN  67  PREPRINT          +MAURER+MICHALON+OUDET+SCHIBY+/HEID+STRASB

        QUANTUM NUMEER DETERMINATICNS NOT REFERRED TC IN THE DATA CARDS

LANDER   64 PRL 13 346 A       LANDER,ABOLINS,CARMONY,HENCRICKS +/// UCSD  JP
ADERHOLZ 65 PR 138 B 897       AACHEN+BERLIN+BIRM+BONN+HAMB+LOND+MUENCHEN
ALITTI   65 PL 15 69           ALITTI,BATON,DELER,CRUSSARC+/ SACLAY+BOLOG  JP
MONTANET 67  PRIV. COMM.       L. MONTANET /////////////////////////// CERN  JP
MORRISON 67 PL TO BE PUBL.     D.R.O.MORRISON ///////////////////////////CERN
SLATTERY 67 NC 50A 377         +KRAYBILL+FORMAN+FERBEL //////// YALE+RCCH  JP

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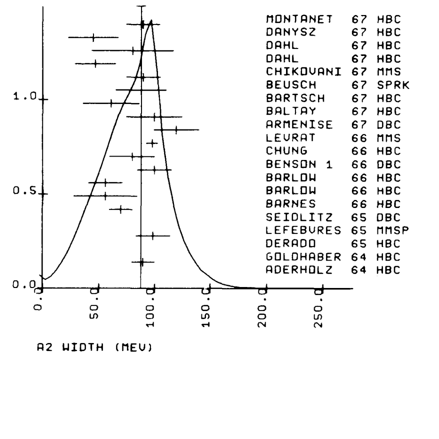
WEIGHTED AVERAGE =87.92 +/- 4.16
SCALE = 1.31   CHISQ = 27.5   CONLEV = 0.036



R1(1630)

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                 43  R1(1630) I=1,2

   *   MAY BE RELATED TO RHO(1650) AND/OR PI(1640), AND/OR TO PEAK AT
   *   1675 MEV (WICTH 150 MEV) SEEN BY CRENNELL 66 IN (PI- PLUS MISSING)
   *   SPECTRUM.

   *               SEE SKETCH CN MESON TABLE

                   43  R1(1630) MASS(MEV)

M         1630.     15.            DUBAL      67 MMS   -  7-12 PI- P        7/67

                   43  R1(1630) WIDTH (MEV)

W    *     21.    OR LESS          LEVRAT     66 MMS   -  7-12 PI- P        7/67

                   43  R1 BRANCHING RATIOS

R1   *     R1 MESON FRACTION INTO ONE / THREE / FIVE OR MORE CHARGEC TRACKS
R1   *        0.37 /   0.59 /   0.04  FOCACCI   66 MMS   -                10/66

****** ********* ********* ********* ********* ********* ********* *********
                          REFERENCES FOR R1(1630)

CRENNEL   66  BERKELEY CONF     +HOUGH,KALBFLEISCH,LAI,BACHMAN+// BNL,CCNY
FOCACCI   66 PL   17  690       + KIENZLE,LEVRAT,MAGLIC,MARTIN      // CERN
LEVRAT    66 PL   22  714       + TOLSTRUP,MAGLIC,FOCACCI,DUBAL +  // CERN
   ALSO SEGUINOT+ 66,  PL 19 712
DUBAL     67 PL TO BE PUBL.     +FOCACCI+KIENZLE+LECHANCINE+LEVRAT+ / CERN

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π_A(1640) $\longrightarrow 3\pi$

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                 34  PI (1640, JPG=  -)  I GTE 1

                 MAY BE IDENTICAL WITH (PART OF) R1(1630)
   *             AND/OR R2(1700).

   *             FOR COMPILATION BY T. FERBEL, SEE REVIEW ON MESCNS,
   *             PROC. 1966 BERKELEY CONFERENCE, P. 132

                 34  PI (1640) MASS  (MEV)

M   C   30 1600.0                    FORINO    65 DBC  C  4.5 PI+ D      10/66
M   C 1700 EVENTS,COMPILED BY FERBEL. ABC COLL. 66  HBC +   8.0 PI+ P    10/66
M   C 4000 EVENTS,COMPILED BY FERBEL. BALTAY    66  HBC +   8.4 PI+ P    10/66
M   C 2000 EVENTS,COMPILED BY FERBEL. SLATTERY  67  HBC +   7.0 PI+ P    10/66
M   C THESE ARE MOST OF THE AVAILABLE DATA ABOVE 6 GEV/C PI+ P           10/66
M      110 1640.      20.            FERBEL    66 RVUE +   7-8 PI P      11/66
M   *   20 1630.0     30.0           VETLITSKY 66 HBC  -   4.7 PI- P

------ --------- --------- --------- --------- --------- --------- ---------

                 34  PI (1640) WIDTH  (MEV)

W      110  100.      20.            FERBEL    66 RVUE +   7-8 PI P      11/66
W   *   20  100.                     VETLITSKY 66 HBC  -                  6/66

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                 34  PI (1640) PARTIAL DECAY MODES

P1          PI(1640) INTO 3 PI                          S 9S 9S 9
P2          PI(1640) INTO RHO PI                        S 9U 9
P3          PI(1640) INTO ETA PI                        S 9S14
P4   *      PI(1640) INTO 5 PI
P5          PI(1640) INTO K K*(890)                     S11U18
P6          PI(1640) INTO K KBAR PI                     S11S11S 9
P7          PI(1640) INTO K KBAR                        S11S11
P8          PI(1640) INTO F PI                          U 5S 9

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                 34  PI (1640)  BRANCHING RATIOS

R1   *      PI(1640) INTO (K KBAR) / (3 PI)             NUM        7
R1   *                                                  CEN 1
R1   *        .40  OR LESS (ESTIMATED FROM DATA OF DEUTSCHMANN 66)       11/66

R2   *      PI(1640) INTO (RHO PI) / (3 PI)             NUM  2
R2   *                                                  CEN 1
R2   *       0.40  OR LESS              FERBEL     66 HBC                11/66

R3   *      PI(1640) INTO (F PI) / (3 PI)               NUM        8
R3   *                                                  CEN 1
R3   *         INDICATION SEEN          LUBATTI    66 HLBC               11/66

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                          REFERENCES FOR PI(1640)

FORINO   65 PL 19 68          +GESSAROLI+LENDINARA+/BOL+BARI+FIR+ORS+SAC
ABC COLL 66 COMP.TO T. FERBEL FOR AUTHORS SEE PL 19 608(65)AACHEN,BERLIN,CERN
BALTAY C 66 COMM.TO T. FERBEL +YEH,FRANZINI,KUNG,PLANO,RAVIN//COL.RUTGER
DEUTSCHM 66 PL 20 82          DEUTSCHMANN,STEINBERG + / AACH+BERLIN+CERN
   ALSO CERN/PH.67-4          D.R.O.MORRISON ///////////////////// CERN
FERBEL   66  BERKELEY CONF.   SEE G. GOLDHABER, REVIEW ON MESONS /// LRL
   ALSO PRIVATE COMM. FROM T. FERBEL
LUBATTI  66  THESIS BERKELEY  H.J.LUBATTI ///////////////////////// LRL 1-2-
VETLITSK 66 PL  21  579       VETLITSKY,GUSZAVIN,KLIGER,ZOLGANOV+ //ITEP
SLATTERY 67 NC 50A 377        +H.KRAYBILL, B.FORMAN, T.FERBEL//ROCH.YALE

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ρ_V(1650) "g" $\longrightarrow 2\pi$

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                 15  RHO (1650, JPG=  +) I=1

                 ALSO KNOWN AS G MESON. MAY BE IDENTICAL WITH (PART OF)
                 R1(1630) AND/OR R2(1700).

   *             FOR COMPILATION,SEE GOLDHABER,MESON REVIEW,
   *             PROC. 1966 BERKELEY CONFERENCE

                 15  RHO (1650)  MASS (MEV)

M          1700.0    100.0            BELLINI   65 HLBC  0                6/66
M          1620.0     20.0            DEUTSCHMA 65 HBC  +                 6/66
M          1640.0                     FORINO    65 DBC   C                6/66
M          1670.0     30.0            GOLDBERG  65 HBC   C
M        70 1700.                     CRENNELL  67 HBC   0 6.0 PI-P       3/67
M        50 1630.                     CRENNELL  67 HBC   -  6.0 PI-P      3/67
M   C      MOST OF DATA ABOVE COMPILED BY GOLDHABER                       9/66
M   C   300 1650.0            COMP. BY GOLDHABER 66 RVUE  0 5-8 PI P, PI D  9/66
M   C    50 1650.0            COMP. BY GOLDHABER 66 RVUE +-  5-8 PI P, PI C  9/66
                 (Ideogram below)
            ------ DECAY INTO FOUR PIONS ------
M   M    23 1610.0    40.             KERNAN    65 HBC    0 2.7 PBAR P    10/66
M   M      1680.0   APPROX.           CONTE     66 HBC   -  11 PI- P      10/66
M   M      (POSSIBLY NOT THE SAME AS THE 2 PION RESONANCE)

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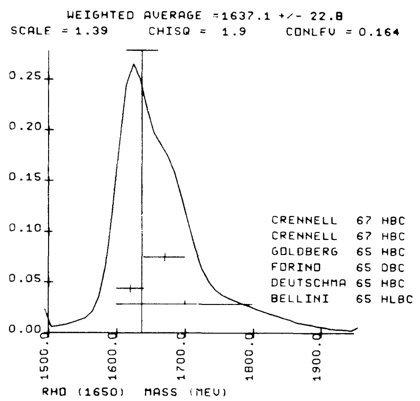


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                 15  RHO (1650)  WIDTH (MEV)

W        13   80.0     40.0             DEUTSCHMA 65 HBC  +                    6/66
W             40.0                      FORINO    65 DBC    C                  6/66
W            180.0     40.0             GOLDBERG  65 HBC    C
W        70  200.                       CRENNELL  67 HBC    0 6.0 PI-P         3/67
W        50  100.                       CRENNELL  67 HBC   -  6.0 PI-P         3/67
W    C  350  150.0     50.0  COMP. BY GOLDHABER 66 RVUE +-0 5-8 PI P, PI C     9/66

            ------ DECAY INTO FOUR PIONS ------
W    W       155.      65.              KERNAN    65 HBC    0 2.7 PBAR P      10/66
W    W       160.0   APPROX.            CONTE     66 HBC   -  11 PI- P        10/66
W    W     (POSSIBLY NOT THE SAME AS THE 2 PION RESONANCE)

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                 15  RHO (1650)     PARTIAL DECAY MODES
P1          RHO (1650) INTO PI PI                       S 8S 8
P2          RHO (1650) INTO PI PI PI PI                 S 8S 8S 8S 8
P3          RHO (1650) INTO PI PI RHO                   S 6S 8U 9
P4          RHO (1650) INTO RHO RHO                     U 9U 9
P5          RHO (1650) INTO K KBAR                      S11S11
P6          RHO (1650) INTO OMEGA PI

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                 15  RHO (1650)  BRANCHING RATIOS

R1   *      RHO(1650) INTO  (4 PI) / TOTAL              NUM  2
R1   *                                                  CEN 1234
R1   *      KERNAN+ PROBABLY SEE THIS MODE                               10/66
R1   *      CONTE+  PROBABLY SEE THIS MODE                               10/66

R1   *      RHO(1650) INTO (PI- PI- PI+ PI0) / (PI- PI0)
R1   *         1.5   OR LESS            CRENNEL   67 HBC                  4/67

R2   *      RHO(1650) INTO  (PI PI RHO) / (4 PI)        NUM   3
R2   *                                                  CEN  2
R2   *         0.25  OR LESS            KERNAN    65 HBC                 10/66
R2   *      SEEN PROBABLY               CONTE     66 HBC                 10/66

R3   *      RHO(1650) INTO (K KBAR) / (2 PI)            NUM      5
R3   *                                                  CEN 1
R3   *         INDICATION SEEN          EHRLICH   66 HBC  +-0 7.9 PI- P   3/67
R3   *         PROBABLY SEEN            ABRAMS    67 HBC    0 4.25 K- P   6/67
R3   *         0.10  OR LESS            CRENNEL   67 HBC                  4/67

R4   *      RHO(1650) INTO (OMEGA PI) / TOTAL           NUM      6
R4   *                                                  CEN 1234
R4   *      INDICATION SEEN             GOLCHABER 65 RVUE +-  3-4 PI+- P  7/67

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                          REFFRENCES FOR RHO(1650)

BELLINI  65 NC 40 A 948       BELLINI,DI CORATO,DUIMINC,FIORINI //MILANO
DEUTSCHM 65 PL 18 351         DEUTSCHMANN,SCHULTE + //// AACH+ZEUTH+CERN
FORINO   65 PL 19 65          FORINO,GESSAROLI +  //BOLOGNA+ORSAY+SACLAY
GOLDBERG 65 PL 17 354         GOLDBERG+/CERN+PARIS+ORSAY+MILANO+CEA-SACL
GOLDHABE 65 UCRL-16295        S. GOLDHABER ///////////////////////// LRL
    (SEE ALSO G.GOLDHABER, MESON REVIEW, PROC.1966 BERKELEY CONF.,P 131)
KERNAN   65 PRL 15 803        +LYON+CRAWLEY //////////////////////// IOWA
    KERNAN+  SEE DECAY ONLY INTO NEUTRAL 4 PION STATE
CONTE    66 PL 22 702         +TOMASINI+DITTMANN+/GENOVA+HAMB+MIL+SACLAY
EHRLICH  66 PR 152 1194       R. EHRLICH,W.SELOVE,H.YUTA // PENNSYLVANIA
GOLCHABE 66  BERKELEY CONF    G.GOLCHABER,SAMIOS,ASTIER,SHEN,LAI.MESON REVIEW
ABRAMS   67 PRL 18 620        +KEHOE+GLASSER+SECHI-ZORN+WOLSKY/ MARYLAND
CRENNEL  67 PRL 18 323        +HOUGH,KALBFLEISCH,LAI,BACHMAN+// BNL,CCNY I  P
    CRENNEL+ SUGGEST JP=3- FROM THE PI PI SCATTERING ANGLE DISTRIBUTION

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R2(1700)

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                 44  R2(1700) I=1,2

   *   MAY BE CHARGED COUNTERPART OF PHI(1690) AND/OR ETA(1700),
   *   AND/OR RELATED TO RHO(1650) AND/OR PI(1640) AND/OR TO PEAK AT 1675
   *   MEV (WIDTH 150 MEV) SEEN BY CRENNELL 66 IN (PI- PLUS MISSING)
   *   SPECTRUM.

   *               SEE SKETCH CN MESON TABLE

                   44  R2(1700) MASS(MEV)

M         1700.     15.            DUBAL      67 MMS   -  7-12 PI- P        7/67

                   44  R2(1700) WICTH (MEV)

W    *     30.    OR LESS          LEVRAT     66 MMS   -  7-12 PI- P        7/67

                   44  R2 BRANCHING RATIOS

R2   *     R2 MESON FRACTION INTO ONE / THREE / FIVE OR MORE CHARGEC TRACKS
R2   *        0.42 /   0.56 /   0.01  FOCACCI   66 MMS   -                10/66

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                         REFERENCES FOR R2(1700)

CRENNEL  66  BERKELEY CONF    +HOUGH,KALBFLEISCH,LAI,BACHMAN+// BNL,CCNY
FOCACCI  66 PL    17  890     + KIENZLE,LEVRAT,MAGLIC,MARTIN      // CERN
LEVRAT   66 PL   22  714      + TOLSTRUP,MAGLIC,FOCACCI,DUBAL +  // CERN
   ALSO SEGLINOT+ 66,  PL 19 712
DUBAL    67 PL TO BE PUBL.    +FOCACCI+KIENZLE+LECHANOINE+LEVRAT+ / CERN

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R3(1750)

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45  R3(1750) I=1,2

    *   MAY BE CHARGED COUNTERPART OF ETA(1700),
    *   AND/OR RELATED TO PEAK AT 1675 MEV (WIDTH 150 MEV) SEEN BY
    *   CRENNELL 66 IN (PI- PLUS MISSING) SPECTRUM.

    *               SEE SKETCH ON MESON TABLE

                    45  R3(1750) MASS(MEV)

M          1748.     16.           DUBAL     67 MMS   -  7-12 PI- P        7/67
M    F     1740.                   FRENCH    67 HBC  (K0 K+-) 3-4 PBAR P   7/67
M    F     SEE FIG. 9

                    45  R3(1750) WIDTH (MEV)

W    *       38.    OR LESS        LEVRAT    66 MMS   -  7-12 PI- P        7/67

                    45  R3 BRANCHING RATIOS

R3   *     R3 MESON FRACTION INTO ONE / THREE / FIVE OR MORE CHARGED TRACKS
R3   C        0.14 /   0.80 /   0.05  FOCACCI   66 MMS   -                10/66
R3   C   FRACTION INTO ONE CHARGED PROB.LARGER THAN GIVEN ABOVE. CF.DUBAL+67

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                         REFERENCES FOR R3(1750)

CRENNEL  66  BERKELEY CONF    +HOUGH,KALBFLEISCH,LAI,BACHMAN+// BNL,CCNY
FOCACCI  66 PL    17  890     + KIENZLE,LEVRAT,MAGLIC,MARTIN      // CERN
LEVRAT   66 PL   22  714      + TOLSTRUP,MAGLIC,FOCACCI,DUBAL +  // CERN
   ALSO SEGLINOT+ 66,  PL 19 712
DUBAL    67 PL TO BE PUBL.    +FOCACCI+KIENZLE+LECHANOINE+LEVRAT+ / CERN
FRENCH   67  CERN/TC/PH.66-31 +KINSON+MCDONALD+RIDDIFORD+ //// CERN+BIRM

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R4(1830)

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46  R4(1830) I=1,2

    *   NOT YET A FIRMLY ESTABLISHED RESONANCE.
    *   MAY BE CHARGED COUNTERPART OF ETA(1830) AND/OR PHI(1830).

    *               SEE SKETCH ON MESON TABLE

                    46  R4(1830) MASS(MEV)

M          1830.     15.           DUBAL     67 MMS   -  7-12 PI- P        7/67

                    46  R4(1830) WIDTH (MEV)

W    *     OBSERVED WIDTH SIMILAR TO EXPERIMENTAL RESOLUTION (30 MEV).

****** ********* ********* ********* ********* ********* ********* *********
                         REFERENCES FOR R4(1830)

DUBAL    67 PL TO BE PUBL.    +FOCACCI+KIENZLE+LECHANOINE+LEVRAT+ / CERN

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S(1930)

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31 S(1930, JP=  , I GTE 1) 3 CHARGED DECAY TRACKS

                    31  S (1930)  MASS (MEV)

M           1929.0     14.0          CHIKOVANI 66 MMSP  -                  8/66
M        15 1910.0     20.0          DEUTSCHMA 66 HBC  +                   6/66

 POSSIBLE CONTRADICTION SINCE MMS  HAS LESS THAN 20 PERCENT OF DECAYS
 WITH 1 CHARGED TRACK, WHEREAS HBC SEES DECAY INTO PI+ PI0.

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                    31  S (1930) WIDTH (MEV)

W    *       35.0   OR LESS          CHIKOVANI 66 MMSP  -                  8/66
W        15  90.0    40.0            DEUTSCHMA 66 HBC  +                   6/66

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                    31 D(SIGMA)/D(T) ( MICROBARNS/(GEV/C)**2 )
CS   *       35.0    12.0            FOCACCI   66 MMS  .22 LTE T LTE .36   9/66

****** ********* ********* ********* ********* ********* ********* *********

                         REFERENCES FOR S(1930)

CHIKOVAN 66 PL  22  233       +DUBAL,FOCACCI,KIENZLE,LEVRAT,MAGLI+/CERN+
FOCACCI  66 PRL  17  890      + KIENZLE,LEVRAT,MAGLIC,MARTIN      // CERN
DEUTSCHM 66  BERK.CONF.--PL   +SCHULTE+STEINBERG+ ///// AACH+BERLIN+CERN G=+
MORRISON 67  CERN/PH.67-4     D.R.O.MORRISON /////////////////////////CERN G=+

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T(2195)

```
32 T(2200, JP=  , I GTE 1) 3 CHARGED DECAY TRACKS

                    32 T(2200)  MASS (MEV)

M           2195.0     15.0          CHIKOVANI 66 MMSP  -                  8/66
M    B      2190.       5.           ABRAMS    67 CNTR    S CHANNEL NBAR N 7/67
M    B   SEEN AS BUMP IN I=1 STATE. WIDTH MUCH LARGER THAN IN THE MMSP EXPT.
M           2207.      13.           ALLES-BOR 67 HBC    0 5.7 PBAR P     12/66
M    A ALLES-BORELLI 67 SEE NEUTRAL MODE ONLY (PI+PI-PI0)

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                    32 T(2200) WIDTH (MEV)

W    *       13.0   OR LESS          CHIKOVANI 66 MMSP  -                  8/66
W    B       85.                     ABRAMS    67 CNTR    S CHANNEL NBAR N 7/67
W    B   SEEN AS BUMP IN I=1 STATE. WIDTH MUCH LARGER THAN IN THE MMSP EXPT.
W            62.      52.            ALLES-BOR 67 HBC    0 5.7 PBAR P     12/66

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                    32 D(SIGMA)/D(T) ( MICROBARNS/(GEV/C)**2 )

CS   *       29.0     10.0           FOCACCI   66 MMS  .22 LTE T LTE .36   9/66

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                    32 SIGMA (MB) FOR FORMATION BY NUCLEON ANTINUCLEON

CS   *        6.                     ABRAMS    67 CNTR                     7/67

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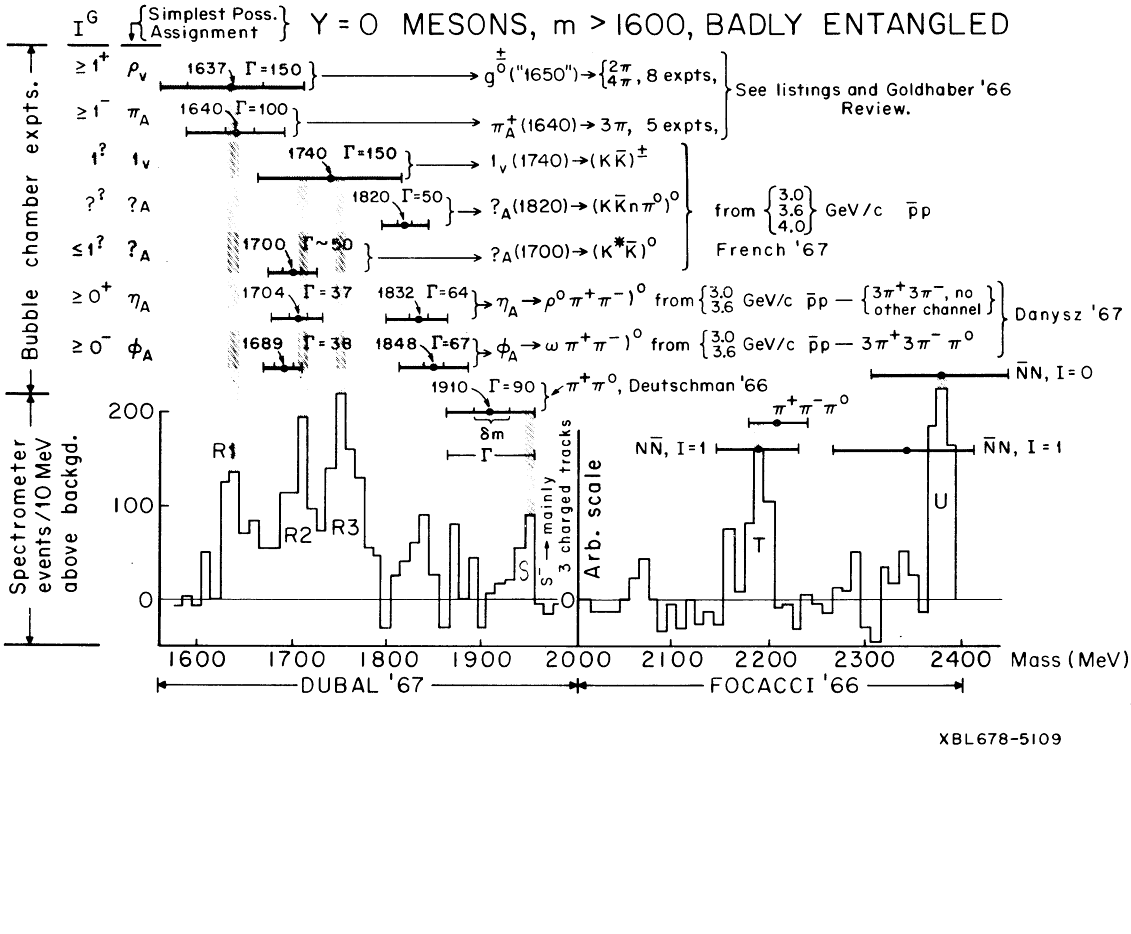

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REFFRENCES FOR T(2200)

CHIKCVAN 66 PL 22 233 +CUBAL,FOCACCI,KIFNZLF,LEVRAT,MAGLI+/CERN+
FOCACCI 66 PRL 17 890 + KIENZLE,LEVRAT,MAGLIC,MARTIN // CERN
ABRAMS 67 PRL 18 1209 +COOL+GIACOMELLI+KYCIA+LEONTIC+LI+ /// BNL
ALLES-BO 67 NC TO BE PUBL. ALLES-BORELLI,FRENCH,FRISK,+ /// CERN+BONN G=-
MORRISCN 67 CERN/PH.67-4 D.R.O.MORRISON ///////////////////////CERN G=+

****** ********* ********* ********* ********* ********* ********* *********
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U(2380)

33 U(2380, JP= , I GTE 1) 1,3,5 CHARGED TRACKS

33 U(2380) MASS (MEV)

M		2382.0	24.0	CHIKOVANI	66	MMSP	-		8/66
M	B	2345.	10.	ABRAMS	67	CNTR	S CHANNEL NBAR N		7/67
M	B	SEEN AS BUMP IN I=1 STATE. WIDTH MUCH LARGER THAN IN THE MMSP EXPT.							

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33 U(2380) WIDTH (MEV)

W	*	30.0	OR LESS	CHIKOVANI	66	MMSP	-	8/66
W	B	140.		ABRAMS	67	CNTR	S CHANNEL PBAR N	7/67
W	B	SEEN AS BUMP IN I=1 STATE. WIDTH MUCH LARGER THAN IN THE MMSP EXPT.						

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33 D(SIGMA)/D(T) (MICROBARNS/(GEV/C)**2)

CS	*	42.0	14.0	FOCACCI	66	MMS	.28 LTE T LTE .36	9/66

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33 SIGMA (MB) FOR FORMATION BY NUCLEON ANTINUCLEON

CS	*	3.	ABRAMS	67	CNTR	7/67

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33 U MESON BRANCHING RATIOS

R1 * U- MESON FRACTION INTO ONE / THREE / FIVE OR MORE CHARGED TRACKS
R1 * 0.30 / 0.45 / 0.25 FOCACCI 66 MMS - 10/66

****** ********* ********* ********* ********* ********* ********* *********

REFERENCES FOR U(2380)

CHIKCVAN 66 PL 22 233 +CUBAL,FOCACCI,KIENZLF,LEVRAT,MAGLI+/CERN+
FOCACCI 66 PRL 17 890 + KIENZLE,LEVRAT,MAGLIC,MARTIN // CERN
ABRAMS 67 PRL 18 1209 +COOL+GIACOMELLI+KYCIA+LEONTIC+LI+ /// BNL
MORRISCN 67 CERN/PH.67-4 D.R.O.MORRISON ///////////////////////CERN G=+

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$A2_{I=2}$(1320)

A2,2 (1320) I=2 OR GREATER

SEEN AS A BUMP IN RHO- PI- MASS SPECTRUM.
EVIDENCE NOT COMPELLING. OMITTED FROM TABLE.

39 MASS (MEV)

M	34	1320.	25.	VANDERHAG	67 DBC	-- 5 PI-D	5/67

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39 WIDTH (MEV)

W	34	150.	APPROX.	VANDERHAG	67 DBC	-- 5 PI-D	5/67

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39 CROSS SECTION (MICROBARNS)

CS	34	15.	5.	VANDERHAG	67 DBC	-- 5 PI-D	5/67

****** ********* ********* ********* ********* ********* ********* *********

REFERENCES FOR A2,2

VANDERHA 67 PL 24B 493 VANDERHAGEN+HUC+FLEURY+ /EP+IPN+BARI+BOLOG

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****** ********* ********* ********* ********* ********* ********* *********

K (725)

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

EVIDENCE NOT COMPELLING. OMITTED FROM TABLE.
FOR A COMPILATION, SEE APPENDIX A OF JAN 67 EDITION
(RMP 39, 1) OF THIS DATA SUMMARY.

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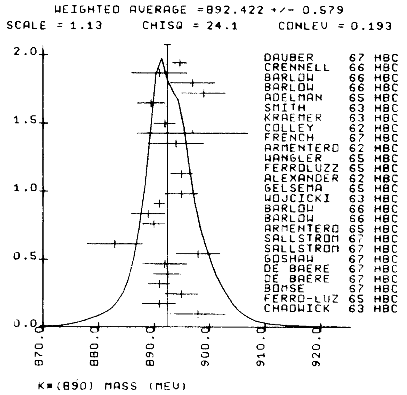
K*(892)

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

18 K* (890) MASS (MEV)

M		898.0	5.0	CHADWICK	63 HBC	+		
M		891.0	3.0	FERRO-LUZ	65 HBC	+		
M		895.	3.	BOMSE	67 HBC	+	2.3 K+P	7/67
M		891.	2.	DE BAERE	67 HBC	+	3.5 K+P (K0 PI+)	7/67
M		892.5	2.5	DE BAERE	67 HBC	+	3.5 K+P (K+ PI0)	7/67
M		892.	4.	GOSHAW	67 HBC	+	3.5 K+ P	7/67
M		898.	4.	SALLSTROM	67 HBC	+	3. K+ P (K0 PI+)	7/67
M		883.	5.	SALLSTROM	67 HBC	+	3. K+ P (K+ PI0)	7/67
M		890.5		ARMENTERO	65 HBC	+-		
M		890.	2.	BARLOW	66 HBC	+-	1.2 PBAR P	11/66
M		889.	3.	BARLOW	66 HBC	+-	1.2 PBAR P	11/66
M	3870	891.0	1.0	WOJCICKI	63 HBC	-		
M		895.0	3.0	GELSEMA	65 HBC	-		
M	200	880.0		ALEXANDER	62 HBC	+ 0		
M		895.0	2.0	FERROLUZZ	65 HBC	+ 0		6/66
M		895.0		WANGLER	65 HBC	+ 0		6/66
M		885.0		ARMENTERO	62 HBC	+-0		
M		894.	5.	FRENCH	67 HBC	+-0	3-4 PBAR P	6/67
M	70	897.0	10.0	COLLEY	62 HBC	0		
M	200	892.0	2.0	KRAEMER	63 HBC	0		
M	150	885.0		SMITH	63 HBC	0		
M		889.5	2.5	ADELMAN	65 HBC			6/66
M		899.	4.	BARLOW	66 HBC	0	1.2 PBAR P	11/66
M		897.	4.	BARLOW	66 HBC	0	1.2 PBAR P	11/66
M	160	891.	5.	CRENNELL	66 HBC	0	6.0 PI-P	10/66
M		894.7	1.3	DAUBER	67 HBC	0	2.0 K- P	12/66

(Ideogram below)



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18 K*(0) - K*(+) MASS DIFF. (MEV)

D	6.3	4.1	BARASH	67 HBC	0 PBAR P	8/67

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18 K* (890) WIDTH (MEV)

W		46.0	8.0		CHADWICK	63 HBC	+		
W		47.0	4.0		FERRO-LUZ	65 HBC	+		
W		50.	5.		BOMSE	67 HBC	+	2.3 K+P	7/67
W		56.	4.5		DE BAERE	67 HBC	+	3.5 K+P (K0 PI+)	7/67
W		53.	8.		DE BAERE	67 HBC	+	3.5 K+P (K+ PI0)	7/67
W		27.	12.	9.	GOSHAW	67 HBC	+	3.5 K+ P	7/67
W		68.	10.		SALLSTROM	67 HBC	+	3. K+ P (K0 PI+)	7/67
W		47.	10.		SALLSTROM	67 HBC	+	3. K+ P (K+ PI0)	7/67
W	3870	46.0	3.0		WOJCICKI	63 HBC	-		
W		50.0	15.0		GELSEMA	65 HBC	-		
W		31.0			ARMENTERO	65 HBC	+-		
W		44.	7.		BARLOW	66 HBC	+-	1.2 PBAR P	11/66
W		43.	9.		BARLOW	66 HBC	+-	1.2 PBAR P	11/66
W		53.	7.		BARLOW	66 HBC	+-	1.2 PBAR P	11/66
W	200	60.0	5.0		ALEXANDER	62 HBC	+ 0		
W		51.8	3.5		FERROLUZZ	65 HBC	+ 0		6/66
W		40.0			WANGLER	65 HBC	+ 0		6/66
W		55.0			ARMENTERO	62 HBC	+-0		
W		60.	10.		FRENCH	67 HBC	+-0	3-4 PBAR P	6/67
W	70	60.0	10.0		COLLEY	62 HBC	0		
W	200	50.0	5.0		KRAEMER	63 HBC	0		
W	150	50.0			SMITH	63 HBC	0		
W		51.0	3.0		ADELMAN	65 HBC			6/66
W		53.	13.		BARLOW	66 HBC	0	1.2 PBAR P	11/66
W		34.	8.		BARLOW	66 HBC	0	1.2 PBAR P	11/66
W	160	49.	6.		CRENNELL	66 HBC	0	6.0 PI-P	10/66
W		44.	4.		DAUBER	67 HBC	0	2.0 K- P	12/66

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18 K* (890) PARTIAL DECAY MODES

P1 K* INTO K PI S105 6
P2 K*(890) INTO (K PI PI) S105 85 8

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18 K* (890) BRANCHING RATIOS

R1 * K*(890) INTO (K PI PI)/(K PI) (P2)/(P1)
R1 * 0 0.002 OR LESS WOJCICKI+ 63 HBC -

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REFERENCES FOR K*

ALSTON 61 PRL 6 300 ALSTON,ALVAREZ,EBERHARD,GOOD,GRAZIANO+/LRL
ALEXANDE 62 PRL 8 447 ALEXANDER,KALBFLEISCH,MILLER,G SMITH //LRL
ARMENTER 62 CERN CONF 295 ARMENTEROS,MONTANET,L ANDLAU + ///CERN+CDF
COLLEY 62 CERN CONF 315 D COLLEY,N GELFAND + //// COLUMBIA+RUTGERS

CHADWICK 63 PL 6 309 CHADWICK,CRENNELL,DAVIES,BETTINI+/OXF+PADU
GOLDHABE 63 ATHENS CONF 92 SULAMITH GOLDHABER /////////////////// LRL
KRAEMER 63 ATHENS CONF 130 R KRAEMER L MADANSKY + //// JOHNS HOPKINS
SMITH 63 PRL 10 138 SMITH,SCHWARTZ,MILLER,KALBFLEISCH,HUF+/LRL

FERROLUZ 64 PL 12 255 FERRO-LUZZI,GEORGE,HENRI,JONGEJANS+ //CERN
WOJCICKI 64 PR 135 B 495 S WOJCICKI,M ALSTON,G KALBFLEISCH //// LRL
WOJCICKI 64 PR 135 B 484 STANLEY G WOJCICKI /////////////////// LRL

ADELMAN 65 ATHENS 527 STUART LEE ADELMAN // CAVENDISH
ARMENTER 65 PL 17 170 ARMENTEROS,EDWARDS,JACOBSEN + //CERN+PARIS
FERROLUZ 65 NC 36 1101 FERRO-LUZZI,GEORGE,HENRI,JONGEJANS // CERN
FERROLUZ 65 NC 39 417 FERRO-LUZZI,GEORGE,GOLDSCHMIDT-CLER+//CERN
GELSEMA 65 THESIS E.S.GELSEMA (SEE ALSO PL 10 341) / AMSTERD
WANGLER 65 PR 137 B 414 WANGLER,ERWIN,WALKER /////////// WISCONSIN

BARLOW 66 CERN-TC66-22 -NC BARLOW,L.ANDLAU+ //// CERN+PARIS+LIVERPOOL
CRENNEL 66 BERKELEY CONF +KALBFLEISCH,LAI,SCARR,SCHUMANN+////// BNL

DAUBER 67 PR 153 1403 +SCHLEIN,SLATER,TICHO /////////////// UCLA
BARASH 67 PR 156 1399 BARASH,KIRSCH,MILLER,TAN /////////COLUMBIA
BOMSE 67 PR 158 1298 +BORENSTEIN+COLE+GILLESPIE+ / JOHN HOPKINS
DE BAERE 67 NC TO BE PUBL. +GOLDSCHMIDT-CLERMONT+ ///////// BRUX+CERN
FRENCH 67 CERN/TC/PH.66-31 +KINSON+MCDONALD+RIDDIFORD+ //// CERN+BIRM
GOSHAW 67 PREPRINT +ERWIN+WALKER+WEINBERG ////////////// WISC
SALLSTRO 67 NC 49A 348 SALLSTROM+OTTER+EKSPONG //////// STOCKHOLM

QUANTUM NUMBER DETERMINATIONS NOT REFERRED TO IN THE DATA CARDS

CHINOWSK 62 PRL 9 330 CHINOWSKY,GOLDHABER,LEE,OHALLORAN //// LRL J

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$K_V(1080)$

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19  KV (108C)

VERY TENTATIVE EVIDENCE HAS BEEN FCUNC BY
CE BAERE+ (BRUXELLES+CERN), NC TO BE PUBL. (PREPRINT
CERN/D.PH.II/PH.67-5).
OMITTED FROM TABLE.

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$K_C(1215)$

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20 KC MESON (1215,JP=  ) I=1/2

  *            SEEN CNLY IN ANNIHILATIONS AT REST ANC IN NEUTRAL MODE.
  *            NC COMPELLING EVIDENCE FOR RESCNANCE
               PCSSIBLY RELATEC TO KA(132C).
  *            CMITTED FROM TABLE.

               2C  KC MASS  (MEV)

M          1215.0     15.C          ARMENTERC 64 HEC

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               2C  KC WIDTH (MEV)

W            60.0     15.C          ARMENTERC 64 HBC

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               2C  KC PARTIAL DECAY MODES

P1     KC INTO K RHC                                        S1OU 9
P2     KC INTO K* PI                                        L16S 8
P3     KC INTO K PI PI                                      S11S 8S 8

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               2C  KC BRANCHING RATICS

R1   *  KC INTO (K RHO)/TOTAL        (UNITS OF 10**-2)  (P1)/TOTAL
R1          75.0      10.0           ARMENTERC 64 HBC                     6/66

R2   *  KC INTO (K* PI)/TOTAL        (UNITS OF 10**-2)  (P2)/TOTAL
R2          25.0      10.0           ARMENTERC 64 HBC                     6/66

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                    REFERENCES FOR KC(1215)

ARMENTER 64 DUBNA CONF 1 577  ARMENTEROS,EDWARCS,C ANCLAC +//// CERN+CDF
                       SEE ALSO PL 9, 207
   ALSO     DUBNA CONF 1 617  R ARMENTEROS (RAPPORTEUR)
SEE ALSO 66 PR  145  1095     BARASH,KIRSCH,MILLER,TAN       // COLUMBIA
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$K_A(1300)$

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21  KA (130C,JP= ) I=1/2

IN MOST OF THE EXPERIMENTS, THIS BUMP IS  SUPERIMPOSEC
ON A DECK TYPE BACKGROUND.  IT IS HOWEVER ALSO
OBSERVED IN THE REACTION PI-P GOES TC KA(1320) LAMBDA,
WHERE THE USUAL DECK EFFECT DOES NCT CONTRIBUTE.
THERE ARE INDICATIONS THAT THE EFFECT MIGHT BE CUE TO
MORE THAN 1 RESCNANCE, ANC PERHAPS RELATED TO KC(1215)
(G.GOLDHABER, PRIV. COMM.)

               21  KA (130C) MASS (MEV)

M       12 1320.0     25.0          ALMEIDA   65  HBC  +  3-5 K+  P          8/66
M   B      1310.0   SEE NOTE BELOW  BRITISH   65 HBC   -  6. K-P TO K 2PI  10/66
M   B      WIDTH ABOUT 300 MEV, MIXED REAL + DECK + TRIANGLE SINGULARITY   10/66
M   *      1330.    APPROX.         BARTSCH   66 HBC   - 10.0 K- P         11/66
M       20 1305.0     10.0          BISHOP    66 HBC   + C 2.6 K+ P         8/66
M       70 1320.0     10.0          SHEN      66  HEC  +  4.6 K+  P         8/66

M   N  200 1280.      20.           BERLINGHI 67 HBC   +   12.7 K+ P        7/67
M   N    SEE NOTE BELOW
M       45 1300.                    CRENNELL  67 HBC    C 6 PI- P           7/67
M   *      1270.    APPROX.         DE BAERE  67 HBC   +  3.5 K+ P          7/67
M          1300.      1C.           GCSHAW    67 HBC    C 3.5 K+ P          7/67
 BERLINGHIERI 67 GET MASS VALUE OF (128C +- 2C) MEV FRCM THE (K*PI) MODE
 ONLY, WHILE THE (RHO K) MASS PEAKS AT 1320 MEV. THEY EXPLAIN THIS AS A
 KINEMATICAL EFFECT SINCE THE (RHO K) THRESHOLC IS AT 126C MEV.

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               21  KA (130C) WIDTH (MEV)

W       12   60.0     20.C          ALMEIDA   65  HBC  +                    8/66
W   *       250.    APPROX.         BARTSCH   66 HBC   -                   11/66
W       60   40.0     15.0          BISHOP    66  HBC  +                    8/66
W       70   80.0     20.0          SHEN      66  HBC  +                    8/66

W      200  130.      15.           BERLINGHI 67 HBC   +   12.7 K+ P        7/67
W       45   60.                    CRENNELL  67 HBC    0 6 PI- P           7/67
W   *       200.    APPROX.         DE BAERE  67 HBC   +  3.5 K+ P          7/67
W            40.      15.           GOSHAW    67 HBC    C 3.5 K+ P          7/67
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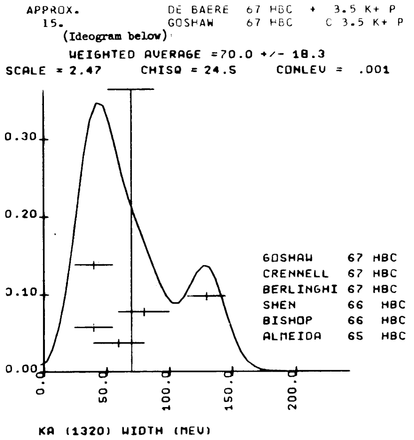
(Ideogram below)

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               21  KA (130C) PARTIAL DECAY MODES

P1        KA INTC K*(890) PI                               L18S08
P2        KA INTC K RHO                                    S11U09
P3        KA INTO K CMEGA                                  S11UC1
P4        KA INTC K PI                                     S10S 8
P5        KA INTC K ETA                                    S10S14

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               21  KA (130C) BRANCHING RATIOS

R1   *     KA INTC K*(890) PI AND K RHO (CVERLAPPING EANCS)
R1       70     1.0                SHEN      66  HBC  +                    8/66
R1      200     1.0                BERLINGHI 67 HBC   +                    7/67

R2   *     KA INTO(K OMEGA)/(K*(890) PI)                  (P3)/(P1)
R2   *        0.1   CR LESS        SHEN      66 HEC   +                   10/66

R3   *     KA (1300) INTU (K*(890) PI)/ TCTAL             (P1)/TOTAL
R3            0.92     0.02     0.20  GOSHAW   67 HBC  (ASS. NO K PI MCDE)  7/67
R3   C        0.46     0.11           GCSHAW   67 HEC  (IF K PI MOLE EX.)   7/67

R4   *     KA(1300) INTO (K PI) / TCTAL                   (P4)/TOTAl
R4   *        0.02  CR LESS        BERLINGHI 67 HBC   +                    7/67
R4   C        0.51     0.11        GCSHAW    67 HBC   +                    7/67

R5   *     KA (1300) INTU (K RHC) / TCTAL                 (P2)/TOTAL
R5   G        0.06     0.06        BISHOP    66 HBC                        6/66
R5   G   LATER PAPER BY GOSHAW+67 DOES NCT OBSERVE K RHC MCDE BUT DOES NOT  7/67
R5   G   GIVE A LIMITING VALUE ON THE BRANCHING RATIO.                     7/67

R6   *     KA (1300) INTO (K ETA) / TCTAL                 (P5)/TOTAL
R6   *        0.02  OR LESS        BERLINGHI 67 HBC   +                    7/67
R6            0.0C     0.12        GOSHAW    67 HBC   +                    7/67

R7   *     KA (1300) INTO ( K OMEGA ) / TOTAL             (P3)/TOTAL
R7   *        0.02  CR LESS        BERLINGHI 67 HBC   +                    7/67
R7            0.06     0.06        GOSHAW    67 HBC   +                    7/67

R8   *     KA (1300) INTO (K PI) / (K*(890) PI)           (P4)/(P1)
R8   *        0.30  CR LESS        SHEN      66 HBC   +                   10/66
R8   *        0.21   OR LESS       DE BAERE  66 HBC                       11/66

R9   *     KA (1300) INTO (K+ PI-) / (K+0 PIO+ PI-)
R9   *        0.2   OR LESS (CL=.90)  CRENNELL  67 HBC    C               7/67

R10  *     KA (1300) INTO (KO PI+ PI- PIO) / (K+0 PIO+ PI-)
R10  *        0.1   OR LESS (CL=.90)  CRENNELL  67 HBC    C               7/67

R11  *     KA(130C) INTO (K*(89C) PI) / (K RHC)           (P1)/(P2)
R11           5.8      4.2      2.1   CHIEN     67 HBC  +  7.3 K+ P        7/67
R11  I   INTERFERING BANDS TAKEN INTO ACCOUNT. NOT CORR. FOR PHASE SP. RATIO.  7/67

R    C   EXISTENCE OF K PI MODE IS CCNTRCVERSIAL. SEE GCSHAW+67.           7/67
R    *FCR 1+ NONET SU3 RATES SEE E.G. GOLDHABER, REVIEW BERKELEY CONF.1966

                    NOTE ON K CMEGA MCDE

BESIDES A WIDE PEAK IN THE (K* PI) MASS DISTRIBUTION, BARTSCH+ SEE A SIMI-
LAR PEAK IN THE (K CMEGA) MASS. SINCE THE (K CMEGA) DECAY OF THE
KV(142C) APPEARS TO BE VERY WEAK, IT APPEARS REASCNABLE TO ASSOCIATE AT
LEAST PART OF THE (K OMEGA) PEAK OBSERVED BY BARTSH+ WITH A (K OMEGA) MODE
OF THE KA(1300). HOWEVER, BERLINGHIERI+ CO NOT OBSERVE THIS MODE.

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                    REFERENCES FOR KA(13C0)

ALMEIDA  65 PL 16 184           ALMEIDA,ATHERTON,BYER,DORNAN,FORSON+/CAMBR
BRITISH  65  OXFORD CCNF        BIRM,GLASGOW,IC--LONDON,MUNICH,OXFORD,RUTH
BARTSCH  66 PL 22 357           +DEUTSCHMANN,GROTE,MORRISCN,+ // ABCL(IC)V
BISHOP   66 PRL 16 1069         +GOSHAW,ERWIN,THOMPSON,WALKER,WEINBE//WISC
SHEN     66 PRL  17  726        +BUTTERWORTH,FU,GOLDHABERS,TRILLING // LRL
  ALSO SHEN  BERKELEY CONF      +BUTTERWORTH,FU,GOLDHABERS,TRILLING // LRL

BERLINGH 67 PRL 18 1087         BERLINGHIERI+FARBER+FERBEL+FORMAN+ // ROCH I JP
CHIEN    67 PRL TO BE PUBL.     +CAUBER+MALAMUD+MELLEMA+SCHLEIN+ //// UCLA   JP
CRENNELL 67 PRL 19  44          +KALBFLEISCH,LAI,SCARR,SCHLMANN ////// BNL I
DE BAERE 67 NC 49A 374          +DEBAISIEUX+FAST+FILIPPAS+ ///// CERN+BRUX
   AND PRIVATE COMMUNICATION BY B. JONGEJANS
GOSHAW   67  PREPRINT           +ERWIN+WALKER+WEINBERG ////////////// WISC
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$K_V(1420)$

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22  KV (142C,JP=2+) I=1/2

JP = 3- IS NOT RULED OUT YET.

22  KV(1420) MASS (MEV)

M   *      1480.0     20.0             BRITISH   65 HBC  -  6. K-P   (K PI) 10/66
M          1402.0      8.0             BRITISH   65 HBC  -0 3.5 K- P (K PI) 10/66
M          1404.0     15.0             FOCARDI   65 HBC  -0 3.  K- P (K PI) 10/66
M       21 1400.0     10.0             HAQUE     65 HBC  -  3.5 K- P (K PI) 10/66
M       40 1440.0                      BARTSCH   66 HBC  - 10.  K- P (K PI)
M       35 1407.0     10.0             CRENNELL  66 HBC   0 6. PI- P (K PI) 10/66
M          1427.      15.0             DE BAERE  67 HBC  +  3.5 K+P (KO PI+) 10/66
M          1440.      24.0      40.    DE BAERE  67 HBC  +  3.5 K+P (K+ PIC) 10/66
M          1446.0      7.9             DAHL      67 HBC   C 4.PI- P (KPI)    10/66
M          1430.0     20.0             GEORGE    67 HBC   0 5.  K+ P (K PI) 10/66
M          1392.0     10.0             SCHWEINGR 66 HBC   0 4.1+5.5 K- P     10/66
                                                                     (K PI)
M          1390.0     30.0             SHEN      66 HBC  + 0 4.6 K+ P (K PI) 10/66

M          1400.0     20.0             BADIER    65 HBC  -  3.  K- P (K*PI) 10/66
M   *      1450.0     20.0             BRITISH   65 HBC  -  6. K-P   (K*PI) 10/66
M          1430.0                      BRITISH   66 HBC   0 6.  K- P (K*PI) 10/66
M   *      1450.0   APPROX.            SCHWEINGR 66 HBC   C 4.1+5.5 K- P     10/66
                                                                     (K*PI)
M          1430.0     10.0             SHEN      66 HBC  + C 4.6 K+ P (K*PI) 10/66
M          1440.                       CRENNELL  67 HBC   C 6 PI- P (K 2PI)   7/67

M   *    THE FOLLOWING VALUES ARE FROM BOTH (K PI) ANC (K 2PI) MOCES

M          1425.0     10.0             BISHOP    66 HBC  +  3.5 K+ P         10/66
M          1400.0     10.0             DUBAL     66 MMS  -  7-12 K- P        10/66
M      140 1425.       5.              GOLDBERG  67 HBC  -0 4.6-5.0 K- P      5/67
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(Ideogram on next page)

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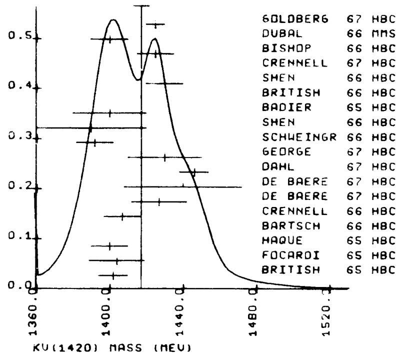
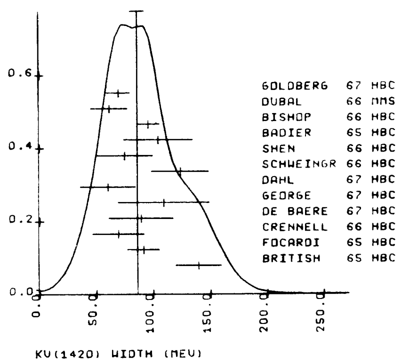
WEIGHTED AVERAGE =1417.27 +/- 4.45
SCALE = 1.71 CHISQ = 38.1 CONLEV = .001



WEIGHTED AVERAGE =86.51 +/- 6.31
SCALE = 1.28 CHISQ = 18.1 CONLEV = 0.078



22 KV(1420) WIDTH (MEV)

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W          140.0    20.0              BRITISH    65 HBC   -C 3.5 K-P   (K PI) 10/66
W   *      150.0    50.C              BRITISH    65 HBC   -  6. K-P    (K PI) 10/66
W           92.0    14.0              FOCARDI    65 HBC
W   *   21 160.0                      HAQUE      65 HBC
W       35  70.     30.       15.     CRENNELL   66 HBC    0 6.0 PI-P         10/66
W           90.0    28.0              DE BAERE   67 HBC   +   3.5 K+ P        10/66
W          110.0    40.0              GEORGE     67 HBC    C 5.0 K+ P         10/66
W           61.0    24.0              DAHL       67 HBC    C 3.8-4.2 PI- P     9/66
W          124.0    25.0              SCHWEINGR  66 HBC    0 4.1+5.5 K- P      9/66
W           75.0    25.0              SHEN       66 HBC     4.6 K+ P           8/66
W          105.0    30.0              BADIER     65 HBC                        6/66
W   *      160.0    50.0              BRITISH    65 HBC   -  6. K-P TO K* PI  10/66
W           96.0    10.0              BISHOP     66 HBC                        6/66
W           62.0    16.0              DUBAL      66 MMS   -  7-12 K- P         9/66
W      140  70.     10.               GOLDBERG   67 HBC   -0 4.6-5.0 K- P      5/67
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(Ideogram above)

22 KV (1420) PARTIAL DECAY MODES

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P1        KV(1420) INTO K PI                          S10S 8
P2        KV(1420) INTO K*(890) PI                    U18S 6
P3        KV(1420) INTO K RHO                         S10U 9
P4        KV(1420) INTO K OMEGA                       S10U 1
P5        KV(1420) INTO K ETA                         S10S14
```

U22 KV(1420) BRANCHING RATIOS

```
R1  *   KV(1420) INTO (K PI)/TOTAL                    (P1)/TOTAL
R1           0.37     0.19       BADIER     65 HBC                         6/66
R1           0.33     0.07       BISHOP     66 HBC                         6/66

R2  *   KV(1420) INTO (K*(890) PI) / TOTAL            (P2)/TOTAL
R2           0.41     0.14       BADIER     65 HBC                         6/66
R2           0.56     0.10       BISHOP     66 HBC                         6/66

R3  *   KV(1420) INTO (K RHO)/TOTAL                   (P3)/TOTAL
R3           0.14     0.05       BADIER     65 HBC                         6/66
R3           0.10     0.05       BISHOP     66 HBC                         6/66

R4  *   KV(1420) INTO (K OMEGA)/TOTAL                 (P4)/TOTAL
R4           0.07     0.04       BADIER     65 HBC                         6/66
R4           0.007    0.008      BISHOP     66 HBC                         6/66

R5  *   KV(1420) INTO (K ETA)/TOTAL                   (P5)/TOTAL
R5           0.02     0.02       BADIER     65 HBC                         6/66
R5           0.017    0.020      BISHOP     66 HBC                         6/66

R6  *   KV(1420) INTO (K*(890) PI) / (K PI)           (P2)/(P1)
R6      6    0.33     0.33       CHUNG      65 HBC  + 0  3.9-4.2 PI- P     8/66
R6           0.56     0.11       SCHWEINGR  66 HBC    0 4.1+5.5 K- P       9/66
R6           0.65     0.20       SHEN       66 HBC    0  N* PRODUCED      10/66
R6           0.63     0.20       SHEN       66 HBC  +    NO N* PRODUCED   10/66

R7  *   KV(1420) INTO (K OMEGA) / K PI                (P4)/(P1)
R7  *        0.08  OR LESS       SHEN       66 HBC                         8/66
R7      4    0.02     0.024      GOSHAW     67 HBC     3.5 K+ P            7/67
```

```
R8  *   KV(1420) INTO (K RHO) / (K PI)                      (P3)/(P1)
R8  *        0.09  OR LESS              CHUNG      65 HBC  + 0  3.9-4.2 PI- P   8/66
R8           0.35     0.20              SCHWEINGR  66 HBC    C 4.1+5.5 K- P     9/66

R9  *   KV(1420) INTO (K RHO) / (K*(890) PI)                (P3)/(P2)
R9  *        0.40  OR LESS  (CL=.90)    FIELD      67 HBC  - 3.8 K- P           6/67
R9  *        1.25  OR LESS              GOLDBERG   67 HBC     4.6-5.0 K- P      5/67

R10 *   KV(1420) INTO (K OMEGA) / (K*(890) PI)              (P4)/(P2)
R10          0.10     0.04              FIELD      67 HBC  - 3.8 K- P           6/67

R11 *   KV(1420) INTO (K ETA) / (K*(890) PI)                (P5)/(P2)
R11          0.07     0.04              FIELD      67 HBC  - 3.8 K- P           6/67

R12 *   KV(1420) INTO (K ETA) / (K PI)                      (P5)/(P1)
R12     2    0.05     0.06              GOSHAW     67 HBC     3.5 K+ P          7/67

R    *FOR 2+ NONET SU3 RATES SEE E.G. GLASHOW,SOCOLOW, PRL 15,329(65)
```

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REFERENCES FOR KV(1420)


```
BADIER    65 PL 19 612          BADIER,DEMOULIN,GOLDBERG+//EP+SACLY+ZEEMAN
BRITISH   65  OXFORD CONF       BIRM,GLASGOW,IC--LONDON,MUNICH,OXFORD,RUTH
CHUNG     65 PRL  15  325       +DAHL,HARDY,HESS,JACOBS,KIRZ,MILLER // LRL
FOCARDI   65 PL 16 351          FOCARDI,MINGUZZI RANZI,SERRA+ /BOLOGNA+CEN
HAQUE     65 PL 14 338          HAQUE,SCOTTER + /////BIRM,IMP COL+OXF+RUTH

BARTSCH   66 PL 22 357          +DEUTSCHMANN+GROTE+MORRISON+ /// ABCL(IC)V
BISHOP    66 PRL 16 1069        BISHOP,GOSHAW,ERWIN,THOMPSON+ // WISCONSIN
BRITISH   66  BERKELEY CONF.    BIRM+GLASGOW+LONDON(IC)+MUNICH+OXFORD+RUTH
CRENNEL   66  BERKELEY CONF     +KALBFLEISCH,LAI,SCARR,SCHUMANN+////// BNL  I,JP
DUBAL     66  BERKELEY CONF     +BAREYRE,BRIDMAN,CHIKOVANI,MAGLIC+ // CERN
SCHWEING  66   (PREPRINT)       SCHWEINGRUBER,SIMPSON,AMMAR+ // ARGONNE+NW
SHEN      66  BERKELEY CONF     +BUTTERWORTH,FU,GOLDHABERS,TRILLING // LRL
ALSO SHEN66 PRL  17  726        +BUTTERWORTH,FU,GOLDHABERS,TRILLING // LRL
    ALSO 66  (PRIVATE COMMUN)GERSON GOLDHABER                        /// LRL

CRENNELL  67 PRL 19  44         +KALBFLEISCH,LAI,SCARR,SCHUMANN ////// BNL
DAHL      67  UCRL-16978        +HARDY+HESS+KIRZ+MILLER ////////////// LRL
SEE ALSO  65 PRL 14 401         HARDY,CHUNG,DAHL,HESS,KIRZ,MILLER //// LRL
DE BAERE  67 NC TO BE PUBL.     +GOLDSCHMIDT-CLERMONT+ ///////// BRUX+CERN
FIELD     67 PL 24B 638         +HENDRICKS+PICCIONI+YAGER //////// LAJOLLA
GEORGE    67 NC 49A 9           +GOLDSCHMIDT-CLERMONT+HENRI+ /// CERN+BRUX
GOLDBERG  67 PRL 18 680         +GOZ,LEITNER,BARNES,DORNAN,+/ SYRACUSE+BNL   JP
GOSHAW    67  PREPRINT          +ERWIN+WALKER+WEINBERG ////////////// WISC
```


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K_A(1800)

```
U23    KA (1800, JP=   )  I = 1/2
       NAMED L BY BARTSCH+
```

U23 KA (1800) MASS (MEV)

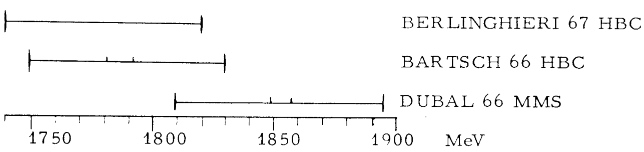
```
M        80 1789.0     10.0            BARTSCH    66 HBC   - 10.0 K-  P     8/66
M    *   35 1852.0      8.0            DUBAL      66 MMS   - 12.0 K-  P     8/66
M        20 1780.                      BERLINGHI  67 HBC   +                7/67
```

U23 KA (1800) WIDTH (MEV)

```
W           60.0       20.0     40.0   BARTSCH    66 HBC                    8/66
W    *      84.0       14.0            DUBAL      66 MMS                    8/66
W        20 80.                        BERLINGHI  67 HBC   +                7/67
```

Mass and Width of K_A(1800)

The results of the three experiments can be sketched as follows:



The total length of the bars is Γ; the smaller hatch marks show the uncertainty in mass reported by the groups. It can be seen that the central values, with the errors reported, are inconsistent ($\chi^2 = 4.9^2$), and accordingly the result of Dubal et al. has been suppressed with an * until more data are obtained, at the suggestion of Bogdan Maglic. However the sketch shows that the results are not really as inconsistent as suggested by the large value of χ^2.

U23 KA (1800) PARTIAL DECAY MODES

```
P1      KA    INTO K PI                                   S11S 9
P2      KA    INTO K RHO                                  S11U 9
P3      KA    INTO K*(890) PI                             S 9U18
P4      KA    INTO K OMEGA                                S11U 1
P5      KA    INTO K PI PI                                S11S 9S 9
P6      KA    INTO K*(1420) PI                            S 9U22
```

U23 KA (1800) BRANCHING RATIOS

```
R1   *  KA    INTO (K PI)/TOTAL               BARTSCH+ SEE NONE(LESS THAN .05).  8/66

R2   *  KA    INTO (K RHO)/TOTAL
R2              0.075     0.05         BARTSCH 2 66 HBC   -                     10/66

R3   *  KA    INTO (K*(890) PI)/TOTAL
R3              0.35      0.12         BARTSCH 2 66 HBC   -                     10/66

R4   *  KA    INTO (K OMEGA)/TOTAL
R4              0.10      0.03         BARTSCH 2 66 HBC   -                     10/66

R5   *  KA    INTO 1 CHARGED/(3 CH.+ 5 CH.) DUBAL 66 GIVE ABOUT 0.4.             8/66

R6   *  KA    INTO (K PI PI)/(TOTAL)                      (P5)/TOTAL
R6              0.40      0.15         BARTSCH 2 66 HBC   -                     10/66

R7   *  KA    INTO (K*(1420) PI) / TOTAL                  (P6)/TOTAL
R7              0.085     0.05         BARTSCH 2 66 HBC                         10/66
```

```
NOTE ON KA [illegible] + NEGATIVE EVIDENCE

        NUMBER OF ACCEPTED KC EVENTS / NUMBER OF KC [illegible]
REACTION   [illegible]   [illegible]   [illegible]   [illegible]

BARTSCH 66  [illegible]   339 / 35    [illegible] / 35    -    [illegible] / 10
GOLMOR  66  [illegible]     -         1150 / [illegible]    740 / [illegible]    -

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                    REFERENCES FOR KA[illegible]

BARTSCH   66 PL 22 357         [illegible],+   //AACHEN[illegible]
BARTSCH2  66 BERKELEY CONF     [illegible] BY GOLDHABER,MESON REVIEW
GOLMOR    66 BERKELEY CONF     [illegible]+MUNICH+OXFORD+RUTH
DUHAL     66 BERKELEY CONF     +BAREYRE,BRIGMAN,CHIKOVANI,MAGLIC+ // CERN
BERLINGH  67 PRL 18 1067       BERLINGHIERI+FARBER+FERBEL+FORMAN+ // ROCH I

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$K^*_{3/2}$(1175)

```
24 KA 3/2 (1175,JP=  ) I = 3/2

      EVIDENCE NOT YET COMPELLING, OMITTED FROM TABLE.
  *   FOR COMPILATIONS + NEG. EVIDENCE, SEE ROSENFELD, OXFORD
  *   1965 SUPPL., P 17.
  *   GOSHAW 67 SEE DOUBLY CHARGED (K*+ PI+) MODE.

      24 K* 3/2 (1175) MASS (MEV)

M  *  23 1175.0              WANGLER   64 HBC
M  *  15 1160.0     10.0     MILLER    65 HBC
M  *     1180.0              GOSHAW    67 [illegible]   I=3/2        7/67

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      [illegible] KA 3/2 (1175) WIDTH (MEV)

W  *  [illegible] [illegible].0  OR LESS     WANGLER   64 HBC
W  *  15   35.0     10.0        MILLER    65 HBC
W  *       [illegible]0.0  APPROX.   [illegible]                         6/66

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      REFERENCES FOR KA3/2(1175)

WANGLER   64 PL 9 71          T P WANGLER,A R ERWIN,W D WALKER //WISCONS
MILLER    65 PL 15 74         [illegible]
ROSENFEL  65 OXFORD CONF 58   A H ROSENFELD /////////// LRL--RVUE
GOSHAW    67 PREPRINT         +ERWIN+[illegible] ////////////// WISC

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$K^*_?$ (1270)

```
25  K* ?/2(1270,JP=    )  I=

                 EVIDENCE NOT YET COMPELLING, OMITTEC FROM TABLE
  *              FOR COMPILATIONS + NEG. EVIDENCE, SEE ROSENFELD, OXFORD
  *              1965 SUPPL., AND G. GOLDHABER, BERKELEY CONF. 1966.

                 25  K*(1270) MASS (MEV)

M   F       1270.0     20.0   I=3/2    BOCK       64 HBC
M   F    BOCK 64 SUPERSEDED BY FRENCH 67
M   *       1270.0   I = 1/2           DE BAERE   66 HBC       3.5-5 K+ P      10/66
M   *       1280.0   I = 1/2           SHEN       66 HBC    +0 4.6 K+P TO  3PI 10/66
M           1265.      10.             FRENCH     67 HBC   I=3/2  3-4 PBAR P    6/67

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                 25  K*(1270) WIDTH (MEV)

W   F         60.0     30.0   I=3/2    BOCK       64 HBC
W   F    BOCK 64 SUPERSEDED BY FRENCH 67
W   *        200.0   I = 1/2           DE BAERE   66 HBC       3.5-5 K+ P      10/66
W   *        100.0     20.0   I = 1/2  SHEN       66 HBC    +C 4.6 K+P TO  3PI 10/66
W             50.      20.             FRENCH     67 HBC   I=3/2  3-4 PBAR P    6/67

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                 25  K*(1270) PARTIAL DECAY MODES

P1          K*(1270) INTO K PI                              S11S 9
P2          K*(1270) INTO K*(890) PI                        U18S 9
P3          K*(1270) INTO K RHO                             S11U 9

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                 25  K*(1270) BRANCHING RATIOS

R1  *       K*(1270) INTO (K PI) / (K*(890) PI)             (P1)/(P2)
R1  *          0.8   OR LESS          SHEN       66 HBC                        10/66

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                          REFERENCES FOR K*(1270)

BOCK      64 PL 12 65           BOCK,FRENCH,KINSON,BADIER+//CERN+PAR+ LOND
ROSENFEL  65 OXFORD CONF 58     A H ROSENFELD ////////////////// LRL--RVUE
DE BAERE  66  BERKELEY CONF     DE BAERE,DEBAISIEUX,DUFOUR+/BRUXELLES+CERN
GOLDHABE  66  BERKELEY CONF     G.GOLDHABER,SAMIOS,ASTIER,SHEN,LAI.MESON REVIEW
SHEN      66  BERKELEY CONF     +BUTTERWORTH,FU,GOLDHABERS,TRILLING // LRL
FRENCH    67  CERN/TC/PH.66-31  +KINSON+MCDONALD+RIDDIFORD+ //// CERN+BIRM

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DATA ON BARYON RESONANCES

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

  N  ANY SYMBOL IN COLUMN 8 INDICATES DATA IGNORED BY AVERAGING PROGRAMS
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N(1400)

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61  N*1/2(1400, JP=1/2+) I=1/2          P11

      WHETHER THE BUMP NEAR 1400 MEV SEEN IN INELASTIC PP
      SCATTERING IS A RESONANCE OR A KINEMATIC EFFECT IS A
      SUBJECT OF DEBATE.  SEE GELLERT 66 FOR THE VIEW THAT
IT IS A KINEMATIC EFFECT -- SEE ALMEIDA 66 FOR THE OPPOSITE VIEW.  WE
LIST BUT STAR RESULTS OF PP SCATTERING EXPERIMENTS.  PHASE-SHIFT ANAL-
YSES APPEAR TO GIVE BETTER EVIDENCE FOR A RESONANCE IN THIS REGION.
HOWEVER THAT DOESNT END THE PROBLEM.  THE RESONANT ENERGY IS PROBABLY
NOT WHERE THE P11 AMPLITUDE BECOMES [illegible] IMAGINARY BUT RATHER SOMEWHAT
LOWER WHERE THE AMPLITUDE VARIES MOST RAPIDLY.  SEE THE NOTE ON THE
N*1/2(1400) FOLLOWING THE LISTINGS.  [illegible] AUTHORS OF THE PHASE-SHIFT
ANALYSES ARE NOT RESPONSIBLE [illegible] THE NUMBERS [illegible] FROM THEIR WORK.)

-- ------------ --    61  N*1/2(1400) MASS (MEV)   -----------------------

M   *      1400.0          APPROX     COCCONI    64 CNTR +  PP 3.6-12 BEV/C
M   *      [illegible]     APPROX     ADELMAN    64 HBC  +  K-P 1.45 BEV/C    7/66
M   *      [illegible]     APPROX     ANKENBRA   65 CNTR +  PP 7.1 BEV/C      7/66
M   *      [illegible]     APPROX     BELLETTI   65 CNTR +  PP 10 16-26 BEV/C  7/66
M   *      [illegible]     35.0       ANDERSON   66 CNTR +  PP 6-30 BEV/C     7/66
M   *      [illegible]     [illegible] [illegible] 66 CNTR + PP 2.7-7.5 BEV/C  9/66
M   *      1450.0          [illegible] [illegible] 66 HBC + [illegible] 1C BEV/C 7/66
M   *      1360.0          ROPER      65 RVUE    PHASE-SHIFT ANAL    9/66
M          [illegible]     BAREYRE    65 RVUE    PHASE-SHIFT ANAL    9/66
M   *      [illegible]     BRANDSEN   65 RVUE    PHASE-SHIFT ANAL    9/66
M   N      1471.0          LOVELACE   66 RVUE    PHASE-SHIFT ANAL    9/66
    N      WHERE THE AMPLITUDE IS PURE IMAGINARY. [illegible] ARGAND DIAGRAM
           [illegible] POINT OF FASTEST VARIATION.

-- ------------ --    61  N*1/2(1400) WIDTH (MEV)   -----------------------

W   *      200.0           APPROX     BELLETTI   65 SPRK +                    7/66
W   *      [illegible]                ANDERSON   66 CNTR +                    7/66
W   *      [illegible]                [illegible]     CNTR +                  7/66
W   *      [illegible]                [illegible]                             7/66
W   N      264.0           LOVELACE   66 RVUE    SEE NOTE ON MASS             9/66

--------------- --    61  N*1/2(1400) PARTIAL DECAY MODES   -------------------

P1         N*1/2(1400) INTO PI N                          S 8S16
P2         N*1/2(1400) INTO [illegible] SIGMA (SIGMA MESON)  S16U 7
P3         N*1/2(1400) INTO N*3/2(1236) PI                U81S 8

--------------- --    61  N*1/2(1400) BRANCHING RATIOS   -----------------------

R1         N*1/2(1400) INTO (PI N)/TOTAL                  (P1)/TOTAL
R1            0.7                  BAREYRE    65 RVUE    -                    7/66
R1  N         0.60                 LOVELACE   66 RVUE    SEE NOTE ON MASS     9/66

R2         N*1/2(1400) INTO (N SIGMA)/TOTAL               (P2)/TOTAL
R2            DOMINANT INEL DECAY  LOVELACE   66 RVUE                         9/66

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                 REFERENCES -- N*1/2(1400)

COCCONI   64 PL 8 134          +LILLETHUN,SCANLON,STAHLBRANDT, +   //CERN
ADELMAN   64 PRL 13 555        S L ADELMAN               //CAMBRIDGE(CERN)
ANKENBRA  65 NC 35 1052        ANKENBRANDT,CLYDE,CORK,KEEFE,KERTH,+ //LRL
BELLETTI  65 PL 18 167         BELLETTINI,COCCONI,DIDDENS, +        //CERN
ANDERSON  66 PRL 16 855        +BLESER,COLLINS,FUJII, +     //BNL,CARNEGIE
BLAIR     66 PRL 17 789        +TAYLOR,CHAPMAN,+//HARWELL,QUEENMARY,RTHFD
GELLERT   66 PRL 17 884        +SMITH,WOJCICKI,COLTON,SCHLEIN,+//LRL,UCLA
ALMEIDA   66 BERKELEY CONF     +RUSHBROOKE, +            //CAVNDSH,HAMBURG
ROPER     65 PR 138 B190       LD ROPER,RM WRIGHT,BT FELD  //LRL-LVMR,MIT IJP
BAREYRE   65 PL 18 342         +BRIGMAN, STIRLING, VILLET         //SACLAY IJP
BRANDSEN  65 PR 139 B1566      +DONNELL, MOORHOUSE         //DURHAM,RTHFD IJP
LOVELACE  66 BERKELEY CONF     C LOVELACE                          //CERN IJP

              PAPERS NOT REFERRED TO IN DATA CARDS.

BAREYRE   64 PL 8 137          +BRIGMAN,VALLADAS,VILLET, +  //SACLAY,CAEN  IJ
ADELMAN   65 PRL 14 1043       S L ADELMAN               //CAMBRIDGE(CERN)
DALITZ    65 PL 14 159         R H DALITZ, R G MOORHOUSE       //OXF,RTHFD
     --  DALITZ 65 REVIEWS EARLY PHASE-SHIFT-ANALYSIS RESULTS (AND DISCUSSES
         WHETHER THEY IN FACT REQUIRE THE EXISTENCE OF A RESONANCE).
FRIDMAN   66 PL 23 386         +MAURER,MICHALON, +     //STRASBOURG,HEIDEL
DONNACHI  66 BERKELEY CONF     DONNACHIE, KIRSOPP, LEA, LOVELACE   //CERN IJP
     --  NUMBERS OF LOVELACE 66 ARE BASED ON THIS PHASE-SHIFT ANALYSIS.
     THE FOLLOWING ARE THEORETICAL PAPERS CONCERNING THE N*1/2(1400) --
RESNICK   66 PR 150 1292       L RESNICK                      //NIELS BOHR
SCHWARZ   66 PR 152 1325       J H SCHWARZ                           //LRL
GOLDBERG  67 PR 154 1556       H GOLDBERG                        //CORNELL
BALL      67 PR 155 1725       JS BALL, GL SHAW, DY WONG  //UCLA,UCI,UCSD

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N(1520)

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62  N*1/2(1518, JP=3/2-) I=1/2      D13

      WE LIST MASS, WIDTH, AND ELASTICITY FROM PHASE-SHIFT
      ANALYSES ALONE.  THE PROXIMITY OF THE P11 AND S11 STATES
      MAKES THE DETERMINATION OF THE D13 PARAMETERS FROM LESS
  SOPHISTICATED METHODS (SUCH AS BUMPS IN TOTAL CROSS SECTIONS OR INVARIANT
  MASSES) SUBJECT TO ERROR.  FOR REFERENCE TO SUCH EARLIER DETERMINATIONS,
  SEE THE LAST EDITION (RMP 37, 633, 1965).

------------ -----   62  N*1/2(1518) MASS (MEV)   --------------------------

M   *     1536.0                     ROPER     65 RVUE    PHASE-SHIFT ANAL  9/66
M         1535.0                     BAREYRE   65 RVUE    PHASE-SHIFT ANAL  9/66
M   *     1530.                      BRANDSEN  65 RVUE    PHASE-SHIFT ANAL  9/66
M         1519.0                     LOVELACE  66 RVUE    PHASE-SHIFT ANAL  9/66

----------------   62  N*1/2(1518) WIDTH (MEV)   --------------------------

W          110.0                     BAREYRE   65 RVUE                      9/66
W   *      111.0                     BRANDSEN  65 RVUE                      9/66
W          102.0                     LOVELACE  66 RVUE                      9/66

----------------   62  N*1/2(1518) PARTIAL DECAY MODES   ------------------

P1        N*1/2(1518) INTO PI N                          S 8S16
P2        N*1/2(1518) INTO N*3/2(1236) PI                U81S 8
P3        N*1/2(1518) INTO N PI PI                       S16S 8S 8
P4        N*1/2(1518)+ INTO NEUTRON PI+                  S17S 8
P5        N*1/2(1518)+ INTO PROTON PI+ PI-               S16S 8S 8
```

---------------- 62 N*1/2(1518) BRANCHING RATIOS --------------------

R1 N*1/2(1518) INTO (PI N)/TOTAL (P1)/TOTAL
R1 0.60 BAREYRE 65 RVUE 9/66
R1 * 0.6 BRANDSEN 65 RVUE 9/66
R1 0.72 LOVELACE 66 RVUE 9/66

EXPERIMENTS DISAGREE ABOUT WHETHER THE N PI PI MODE IS MAINLY N*3/2(123 *8/66
PI. IN ANY CASE THE MEASUREMENTS OF THE INELASTIC BRANCHING RATIOS ARE
MODEL DEPENDENT AND OUGHT NOT BE TAKEN AS MORE THAN QUALITATIVE INDICA-
TIONS OF TRUTH. ONLY OLSSON 66 AND KIRZ 66 DEFINITELY ASSOCIATED THE
OBSERVED EFFECT WITH THE D13 WAVE.

R2 N*1/2(1518) INTO (N*3/2(1236) PI)/TOTAL (P4)/TOTAL
R2 DOMINANT INEL DECAY OLSSON 66 RVUE PI P TO PI PI N 9/66
R2 0.20 0.05 KIRZ 66 HBC 0 ASSUMING R1=0.72 9/66

R3 N*1/2(1518) INTO (N PI)/(N PI PI) (P1)/(P3)
R3 1.25 0.44 0.71 A-BORELLI 66 HBC 0 PBAR P 5.7 BEV/C 9/66

R4 N*1/2(1518) INTO (N*3/2(1236) PI)/(N PI PI) (P2)/(P3)
R4 0.00 0.09 A-BORELLI 66 HBC 9/66

R5 N*1/2(1518) INTO (NEUTRON PI+)/(P PI+ PI-) (P4)/(P5)
R5 0.77 0.45 ALEXANDER 66 HBC + PP 5.5 BEV/C 9/66

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REFERENCES -- N*1/2(1518)

ROPER 65 PR 138 B190 LD ROPER,RM WRIGHT,BT FELD //LRL-LVMR,MIT IJP
BAREYRE 65 PL 18 342 + BRICMAN, STIRLING, VILLET //SACLAY IJP
BRANDSEN 65 PR 139 B1566 +COONNELL, MOORHOUSE //DURHAM,RTHFD IJP
OLSSON 66 PR 145 1309 M G OLSSON, G B YODH //WISC,MD
BORRELLI 67 NC 47 232 ALLES-BORELLI,FRENCH,FRISK,MICHEJDA //CERN
LOVELACE 66 BERKELEY CONF C LOVELACE //CERN IJP
ALEXANDE 66 BERKELEY CONF ALEXANDER,BENARY,CZAPEK,+ //WEIZMANN(CERN)
KIRZ 66 PRIVATE COMM J KIRZ //LRL
-- NUMBER EXTRACTED FROM DATA DISCUSSED IN KIRZ 63.

PAPERS NOT REFERRED TO IN DATA CARDS.
SEE LAST EDITION (RMP 37, 633, 1965) FOR EARLY REFERENCES.

KIRZ 63 PR 130 2481 J KIRZ, J SCHWARTZ, R D TRIPP //LRL
CROUCH 65 DESY CONF II 21 + //BROWN,CEA,HARVARD,MIT,PADOVA,WEIZMANN
DERADO 65 ATHENS CONF 244 +KENNEY,LAMSA, + //NOTRE DAME,KENTUCKY
MERLO 66 P ROY SOC 289 469 J P MERLO, G VALLADAS //SACLAY
-- THE ABOVE PAPERS DISCUSS INELASTIC CHANNELS NEAR THE RESONANCE.
DONNACHI 66 BERKELEY CONF DONNACHIE, KIRSOPP, LEA, LOVELACE //CERN IJP
-- NUMBERS OF LOVELACE 66 ARE BASED ON THIS PHASE-SHIFT ANALYSIS.

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N(1570)

63 N*1/2(1570, JP=1/2-) I=1/2 S11

SEE NOTE IN MAIN TEXT ON S-WAVE BUMPS NEAR THRESHOLD.

63 N*1/2(1570) MASS (MEV) ----------------------------

M * 1519.0 HENDRY 65 RVUE ETA N + S11 PI N 9/66
M 1570.0 MICHAEL 66 RVUE FITS BAREYRE S11 7/66
M N 1557.0 OR 1565.0 UCHIYAMA- 66 RVUE FITS N ETA DATA 9/66
N FITTING GIVES TWO SOLUTIONS. PROBLEMS MATCHING PI P PHASE SHIFTS.
M K 1561.0 LOVELACE 66 RVUE PHASE-SHIFT ANAL 9/66
K AS GIVEN. WITHOUT ARGAND DIAGRAM WE DONT KNOW HOW DETERMINED.

---------------- 63 N*1/2(1570) WIDTH (MEV) -------------------------

W * 130.0 HENDRY 65 RVUE 9/66
W 130.0 MICHAEL 66 RVUE 7/66
W N 156.0 OR 144.0 UCHIYAMA- 66 RVUE SEE NOTE ON MASS 9/66
W K 180.0 LOVELACE 66 RVUE SEE NOTE ON MASS 9/66

---------------- 63 N*1/2(1570) PARTIAL DECAY MODES -----------------

P1 N*1/2(1570) INTO PI N S 8S16
P2 N*1/2(1570) INTO N ETA S17S14
P3 N*1/2(1570) INTO N PI PI S16S 8S 8

---------------- 63 N*1/2(1570) BRANCHING RATIOS --------------------

R1 N*1/2(1570) INTO (PI N)/TOTAL (P1)/TOTAL
R1 * 0.69 HENDRY 65 RVUE 9/66
R1 0.32 MICHAEL 66 RVUE 9/66
R1 N 0.71 OR 0.28 UCHIYAMA- 66 RVUE SEE NOTE ON MASS 9/66
R1 K 0.40 LOVELACE 66 RVUE SEE NOTE ON MASS 9/66

R2 N*1/2(1570) INTO (N ETA)/TOTAL (P2)/TOTAL
R2 DOMINANT INEL DECAY HENDRY 65 RVUE 9/66
R2 0.68 MICHAEL 66 RVUE 9/66
R2 N 0.29 OR 0.71 UCHIYAMA- 66 RVUE SEE NOTE ON MASS 9/66

R3 N*1/2(1570) INTO (N PI PI)/TOTAL (P3)/TOTAL
R3 SMALL TRACE LOVELACE 66 RVUE 9/66

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REFERENCES -- N*1/2(1570)

HENDRY 65 PL 18 171 A W HENDRY, R G MOORHOUSE //RTHFD
-- REVIEWS EARLY PHASE-SHIFT-ANALYSIS RESULTS AND PI- P TO ETA N
EXPERIMENTS. WE TAKE NUMBERS FROM THE SOLUTION USING BRANDSEN 65.
BAREYRE 65 PL 18 342 + BRICMAN, STIRLING, VILLET //SACLAY IJP
MICHAEL 66 PL 21 93 C MICHAEL //OXF
UCHIYAMA 66 PR 149 1220 F UCHIYAMA-CAMPBELL, R K LOGAN //ILL IJP
LOVELACE 66 BERKELEY CONF C LOVELACE //CERN IJP

PAPERS NOT REFERRED TO IN DATA CARDS.

BULOS 64 PRL 13 486 + //BROWN,BRANDEIS,HARVARD,MIT,PADOVA I
RICHARDS 66 PRL 16 1221 +CHIU,EANDI,HELMHOLZ,KENNEY,+ //LRL,HAWAII IJ
-- BULOS 64 AND RICHARDS 66 ARE EXPERIMENTS ON PI- P TO ETA N NEAR
THRESHOLD. THEY ARE IN SOME DISAGREEMENT.
JONES 66 PL 23 597 +BINNIE,DUANE,HORSEY,MASON,+//IMPCOL,RTHFD
-- ANOTHER PAPER ON THE REACTION PI- P TO ETA N NEAR THRESHOLD.
BRANDSEN 65 PR 139 B1566 +COONNELL, MOORHOUSE //DURHAM,RTHFD IJP
-- BASIS OF NUMBERS WE QUOTE FROM HENDRY 65.
BACCI 66 NC 45A 983 +PENSO,SALVINI,MENCUCCINI,+//ROME,FRASCATI IJP
PREPOST 67 PRL 18 82 R PREPOST, D LUNDQUIST, D QUINN //STANFORD
-- BACCI 65 AND PREPOST 67 ARE EXPERIMENTS ON ETA PHOTOPRODUCTION NEAR
THRESHOLD.
THE FOLLOWING THREE ARE ANALYSES OF ETA PRODUCTION NEAR THRESHOLD --
DOBSON 66 PR 146 1022 P N DOBSON //HAWAII
MINAMI 66 PR 147 1123 S MINAMI //OSAKA
BALL 66 PR 149 1191 J S BALL //UCLA
DONNACHI 66 BERKELEY CONF DONNACHIE, KIRSOPP, LEA, LOVELACE //CERN IJP
-- NUMBERS OF LOVELACE 66 ARE BASED ON THIS PHASE-SHIFT ANALYSIS.
LOGAN 67 PR 153 1634 R K LOGAN, F UCHIYAMA-CAMPBELL //ILL
-- APPLIES RESULTS OF SAME AUTHORS (UCHIYAMA-CAMPBELL 66) ON PI- P TO
ETA N TO GAMMA P TO ETA N.

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N(1670)

64 N*1/2(1670, JP=5/2-) I=1/2 D15

UNTANGLED FROM THE 1688 MEV BUMP BY DUKE 65 AND PHASE-
SHIFT ANALYSES. SEE THE NOTE ON THE N*1/2(1688).

---------------- 64 N*1/2(1670) MASS (MEV) --------------------------

M * 1674.0 DUKE 65 CNTR PI+- P EL DSIG,P 7/66
M 1690.0 BAREYRE 65 RVUE PHASE-SHIFT ANAL 7/66
M * 1650.0 APPROX BRANDSEN 65 RVUE PHASE-SHIFT ANAL 7/66
M 1652.0 LOVELACE 66 RVUE PHASE-SHIFT ANAL 9/66

---------------- 64 N*1/2(1670) WIDTH (MEV) -------------------------

W * 100.0 DUKE 65 CNTR 7/66
W 150.0 BAREYRE 65 RVUE 9/66
W 134.0 LOVELACE 66 RVUE 9/66

---------------- 64 N*1/2(1670) PARTIAL DECAY MODES -----------------

P1 N*1/2(1670) INTO PI N S 8S16
P2 N*1/2(1670) INTO N ETA S17S14
P3 N*1/2(1670) INTO LAMBDA K S18S11
P4 N*1/2(1670) INTO N*3/2(1236) PI U81S 8

---------------- 64 N*1/2(1670) BRANCHING RATIOS --------------------

R1 N*1/2(1670) INTO (PI N)/TOTAL (P1)/TOTAL
R1 * 0.42 DUKE 65 CNTR 7/66
R1 0.41 BAREYRE 65 RVUE 9/66
R1 * 0.52 BRANDSEN 65 RVUE 9/66
R1 0.40 LOVELACE 66 RVUE 9/66

R2 N*1/2(1670) INTO (N ETA)/TOTAL (P2)/TOTAL
R2 0.025 OR LESS TRIPP 67 RVUE 8/67

R3 N*1/2(1670) INTO (LAMBDA K)/TOTAL (P3)/TOTAL
R3 0.016 OR LESS TRIPP 67 RVUE 8/67

SEE NOTE PRECEDING THE N*1/2(1688) INELASTIC DECAY MODE MEASUREMENTS.

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REFERENCES -- N*1/2(1670)

DUKE 65 PRL 15 466 +JONES,KEMP,MURPHY,PRENTICE, + //RTHFD,OXF IJP
BAREYRE 65 PL 18 342 + BRICMAN, STIRLING, VILLET //SACLAY IJP
BRANDSEN 65 PL 19 420 +COONNELL, MOORHOUSE //DURHAM,RTHFD IJP
LOVELACE 66 BERKELEY CONF C LOVELACE //CERN IJP
TRIPP 67 NP (ACCEPTED) + LEITH, + //LRL,SLAC,CERN,HEIDEL,SACLAY

PAPER NOT REFERRED TO IN DATA CARDS.

DONNACHI 66 BERKELEY CONF DONNACHIE, KIRSOPP, LEA, LOVELACE //CERN IJP
-- NUMBERS OF LOVELACE 66 ARE BASED ON THIS PHASE-SHIFT ANALYSIS.

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N(1688)

65 N*1/2(1688, JP=5/2+) I=1/2 F15

WE LIST MASS, WIDTH, AND ELASTICITY FROM PHASE-SHIFT
ANALYSES ALONE. THE PROXIMITY OF THE D15 AND S11 STATES
MAKES THE DETERMINATION OF THE F15 PARAMETERS FROM LESS
SOPHISTICATED METHODS (SUCH AS BUMPS IN TOTAL CROSS SECTIONS) SUBJECT TO
SERIOUS ERROR. FOR REFERENCE TO SUCH EARLY DETERMINATIONS, SEE THE LAST
EDITION (RMP 37, 633, 1965).

---------------- 65 N*1/2(1688) MASS (MEV) --------------------------

M * 1688.0 APPROX DUKE 65 CNTR PI+- P EL DSIG,P 7/66
M 1695.0 BAREYRE 65 RVUE PHASE-SHIFT ANAL 7/66
M * 1680.0 BRANDSEN 65 RVUE PHASE SHIFT ANAL 7/66
M 1672.0 LOVELACE 66 RVUE PHASE-SHIFT ANAL 9/66

---------------- 65 N*1/2(1688) WIDTH (MEV) -------------------------

W * 100.0 DUKE 65 CNTR VERY ENERGY DEP 7/66
W 120.0 BAREYRE 65 RVUE 9/66
W 104.0 LOVELACE 66 RVUE 9/66

---------------- 65 N*1/2(1688) PARTIAL DECAY MODES -----------------

P1 N*1/2(1688) INTO PI N S 8S16
P2 N*1/2(1688) INTO N ETA S17S14
P3 N*1/2(1688) INTO LAMBDA K S18S11
P4 N*1/2(1688) INTO N*3/2(1236) PI U81S 8
P5 N*1/2(1688) INTO N PI S16S 8S 8
P6 N*1/2(1688)+ INTO NEUTRON PI+ S17S 8
P7 N*1/2(1688)+ INTO PROTON PI+ PI- S16S 8S 8
P8 N*1/2(1688)+ INTO N*3/2(1236)++ PI- U81S 8

---------------- 65 N*1/2(1688) BRANCHING RATIOS --------------------

R1 N*1/2(1688) INTO (PI N)/TOTAL (P1)/TOTAL
R1 * 0.80 DUKE 65 CNTR 7/66
R1 0.62 BAREYRE 65 RVUE 9/66
R1 * 0.61 BRANDSEN 65 RVUE 9/66
R1 0.66 LOVELACE 66 RVUE 9/66

WE LIST MEASUREMENTS OF THE INELASTIC DECAY MODES OF THE 1688 MEV BUMP.
SUCH MEASUREMENTS HAVE NOT UNTANGLED THE D15 AND F15 (AND POSSIBLE S11)
COMPONENTS. IT IS CLEAR THAT BOTH D15 AND F15 DECAY ALOT INTO N PI PI.
THERE IS SOME DISAGREEMENT ABOUT WHETHER THIS IS DOMINATED BY N*3/2(123 *8/66
PI. IN ANY CASE THE MEASUREMENTS OF THE BRANCHING RATIO TO THIS FINAL
STATE ARE MODEL DEPENDENT AND OUGHT NOT BE TAKEN AS MORE THAN QUALITATIVE
INDICATIONS OF TRUTH.

R2 N*1/2(1688) INTO (N ETA)/TOTAL (P2)/TOTAL
R2 0.025 OR LESS KRAEMER 64 DBC + PI+D 1.23 BEV/C 9/66
R2 0.042 OR LESS (95PC CL) A-BORELLI 67 HBC + PBAR P 5.7 BEV/C 8/67
R2 0.015 TRIPP 67 RVUE 8/67

R3 N*1/2(1688) INTO (N ETA)/(PI N) (P2)/(P1)
R3 0.027 OR LESS HEUSCH 66 RVUE + PI0, ETA PHOTO 9/66

R4 N*1/2(1688) INTO (LAMBDA K)/TOTAL (P3)/TOTAL
R4 0.013 OR LESS (95PC CL) A-BORELLI 67 HBC + 8/67
R4 0.0013 TRIPP 67 RVUE 8/67

R5 N*1/2(1688) INTO (N PI)/(N PI PI) (P1)/(P5)
R5 1.25 OR LESS (95PC CL) A-BORELLI 67 HBC + 8/67

R6 N*1/2(1688) INTO (N*3/2(1236) PI)/(N PI PI) (P4)/(P5)
R6 NO EVIDENCE A-BORELLI 67 HBC + 8/67

R7 N*1/2(1688) INTO (NEUTRON PI+)/(P PI+ PI-) (P6)/(P7)
R7 0.67 0.04 ALEXANDER 66 HBC + PP 5.5 BEV/C 9/66

R8 N*1/2(1688) INTO (N*(1236)++ PI-)/(P PI+ PI-) (P8)/(P7)
R8 0.7 0.3 ALEXANDER 66 HBC + 9/66
R8 1.0 0.3 ALMEIDA 66 HBC + PP 10 BEV/C 9/66

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REFERENCES -- N*1/2(1688)

KRAEMER 64 PR 136 B496 +MADANSKY,+ //J HOPKINS,NWESTERN,WOODSTOCK I
DUKE 65 PRL 15 466 +JONES,KEMP,MURPHY,PRENTICE, + //RTHFC,OXF IJP
BAREYRE 65 PL 18 342 + BRICMAN, STIRLING, VILLET //SACLAY IJP
BRANDSEN 65 PL 19 420 +CDCNNELL, MOORHOUSE //DURHAM,RTHFD IJP
LOVELACE 66 BERKELEY CONF C LOVELACE //CERN IJP
HEUSCH 66 PRL 17 1019 C A HEUSCH, C Y PRESCOTT, R F DASHEN //CIT
ALMEIDA 66 BERKELEY CONF +RUSHBROOKE, + //CAVNDSH,DESY(CERN)
ALEXANDE 66 BERKELEY CONF ALEXANDER,BENARY,CZAPEK,+ //WEIZMANN(CERN)
BORRELLI 67 NC 47 232 ALLES-BORELLI,FRENCH,FRISK,MICHEJDA //CERN
TRIPP 67 NP (ACCEPTED) + LEITH, + //LRL,SLAC,CERN,HEIDEL,SACLAY

PAPERS NOT REFERRED TO IN DATA CARDS.
SEE LAST EDITION (RMP 37, 633, 1965) FOR EARLY REFERENCES.

CROUCH 65 DESY CONF II 21 + //BROWN,CEA,HARVARD,MIT,PADOVA,WEIZMANN
DERADO 65 ATHENS CONF 244 +KENNEY,LAMSA, + //NOTRE DAME,KENTUCKY
MERLO 66 P ROY SOC 289 489 J P MERLO, G VALLALAS //SACLAY
-- THE ABOVE PAPERS DISCUSS INELASTIC CHANNELS NEAR THE BUMP.
DONNACHI 66 BERKELEY CONF DONNACHIE, KIRSOPP, LEA, LOVELACE //CERN IJP
-- NUMBERS OF LOVELACE 66 ARE BASED ON THIS PHASE-SHIFT ANALYSIS.

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N(1700)

66 N*1/2(1700, JP=1/2-) I=1/2 S11

EXISTENCE NOT CONCLUSIVE. SEE LOVELACE 66.

66 N*1/2(1700) MASS (MEV) ----------------------------

M	*	1695.0	BRANDSEN	65 RVUE	PHASE-SHIFT ANAL	9/66
M		1700.0	MICHAEL	66 RVUE	FITS BAREYRE S11	7/66

----------------- 66 N*1/2(1700) WIDTH (MEV) ----------------------------

W	240.0	MICHAEL	66 RVUE	7/66

----------------- 66 N*1/2(1700) PARTIAL DECAY MODES ---------------------

P1	N*1/2(1700) INTO PI N	S 8S16
P2	N*1/2(1700) INTO N ETA	S17S14
P3	N*1/2(1700) INTO LAMBDA K	S18S11

----------------- 66 N*1/2(1700) BRANCHING RATIOS ----------------------

R1	N*1/2(1700) INTO (PI N)/TOTAL				(P1)/TOTAL	
R1	1.0	APPROX	MICHAEL	66 RVUE		7/66

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REFERENCES -- N*1/2(1700)

BAREYRE 65 PL 18 342 + BRICMAN, STIRLING, VILLET //SACLAY IJP
BRANDSEN 65 PL 19 420 +ODONNELL, MOORHOUSE //DURHAM,RTHFD IJP
MICHAEL 66 PL 21 93 C MICHAEL //OXF
LOVELACE 66 BERKELEY CONF C LOVELACE //CERN
-- LOVELACE 66 QUESTIONS THE EXISTENCE OF THIS SECOND S11 RESONANCE.

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N (2080)

70 N* (2080, JP=) I=

YOON 67 SEE A NARROW BUMP IN THE INVARIANT MASS OF (P PI+ PI- PI0) FROM 3 BEV/C PI- P TO (PI- P PI+ PI- RHO-. AT 3.2 BEV/C, WITH APPROXIMATELY THREE TIMES THE NUMBER OF EVENTS, THE EFFECT IS NOT SEEN (CHUNG 66 AND KIRZ 67). OMITTED FROM TABLE.

----------------- 70 N* (2080) MASS (MEV) ----------------------------

M	2080.0	12.0	YOON	67 HBC	+ 3 BEV/C PI-P	8/67

----------------- 70 N* (2080) WIDTH (MEV) ----------------------------

W	40.0	20.0	YOON	67 HBC	+	8/67

----------------- 70 N* (2080) PARTIAL DECAY MODES -------------------

P1	N* (2080) INTO PI N
P2	N* (2080) INTO N*3/2(1236) RHO

----------------- 70 N* (2080) BRANCHING RATIOS --------------------

R1	N* (2080) INTO (N*3/2(1236) RHO)/TOTAL		(P2)/TOTAL		
R1	SEEN	YOON	67 HBC	+	8/67

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REFERENCES -- N* (2080)

YOON 67 PL 24B 307 +BERENYI,KEY,PRENTICE, + //TORONTO,WISC
CHUNG 66 UCRL-16881 THESIS S U CHUNG //LRL
KIRZ 67 PRIVATE COMM. J KIRZ //LRL

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N(2190)

71 N*1/2(2190, JP=7/2-) I=1/2

71 N*1/2(2190) MASS (MEV) ----------------------------

M	2190.0		DIDDENS	63 CNTR	PI+- P TOTAL	
M	2210.0		HOHLER	64 RVUE	DATA + DISP REL	
M	2190.0	APPROX	YOKOSAWA	66 CNTR	PI- P DSIG + POL	7/66

----------------- 71 N*1/2(2190) WIDTH (MEV) ----------------------------

W	200.0		DIDDENS	63 CNTR	
W	200.0		HOHLER	64 RVUE	7/66
W	220.0	APPROX	YOKOSAWA	66 CNTR	7/66

----------------- 71 N*1/2(2190) PARTIAL DECAY MODES -------------------

P1	N*1/2(2190) INTO PI N	S 8S16
P2	N*1/2(2190) INTO LAMBDA K	S18S11

----------------- 71 N*1/2(2190) BRANCHING RATIOS --------------------

R1	N*1/2(2190) INTO (PI N)/TOTAL				(P1)/TOTAL	
R1	0.3	APPROX	DIDDENS	63 CNTR		7/66
R1	0.3	APPROX	YOKOSAWA	66 CNTR		7/66

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REFERENCES -- N*1/2(2190)

DIDDENS 63 PRL 10 262 +JENKINS, KYCIA, RILEY //BNL I
HOHLER 64 PL 12 149 G HOHLER, J GIESECKE //KARLSRUHE I
YOKOSAWA 66 PRL 16 714 +SUWA,HILL,ESTERLING,BOOTH //ARG,CHI JP

QUANTUM NUMBER DETERMINATIONS NOT REFERRED TO IN DATA CARDS.

CARROLL 66 PRL 16 288 +CORBETT,DAMERELL,MIDDLEMAS, + //RTHFC,OXF J-L
CARROLL 66 PRL 17 1274 +CORBETT,DAMERELL,MIDDLEMAS, + //RTHFC,OXF J-L
-- ERRATUM CHANGING THE RATHER WEAK DETERMINATION OF J-L TO +1/2.
KORMANYO 66 PRL 16 709 KORMANYOS,KRISCH,OFALLON, + //MICH,ARG P
BARGER 66 PRL 16 913 V BARGER, D CLINE //WISC P

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N(2650)

72 N*1/2(2650, JP=11/2-) I=1/2

FOR JP ASSIGNMENT SEE BARGER 66 AND NOTE AFTER LISTINGS.

72 N*1/2(2650) MASS (MEV) ----------------------------

M	*	2700.0		ALVAREZ	64 CNTR	PI PHOTOPROD	
M	*	2600.0	APPROX	WAHLIG	64 SPRK C	PI-P CH EX	
M		2660.0		HOHLER	64 RVUE	DATA + DISP REL	
M		2649.0	10.0	CITRON	66 CNTR	PI+- P TOTAL	7/66

----------------- 72 N*1/2(2650) WIDTH (MEV) ----------------------------

W	*	100.0		ALVAREZ	64 CNTR	
W		200.0		HOHLER	64 RVUE	7/66
W		360.0	20.0	CITRON	66 CNTR	7/66

----------------- 72 N*1/2(2650) PARTIAL DECAY MODES -------------------

P1	N*1/2(2650) INTO PI N	S 8S16
P2	N*1/2(2650) INTO LAMBDA K	S18S11

----------------- 72 N*1/2(2650) BRANCHING RATIOS --------------------

R1	N*1/2(2650) INTO (PI N)/TOTAL				(P1)/TOTAL	
R1	0.0703	0.0045	CITRON	66 CNTR	ASSUMING J=11/2	7/66

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REFERENCES -- N*1/2(2650)

ALVAREZ 64 PRL 12 710 +BAR-YAM,KERN,LUCKEY,OSBORNE, + //MIT,CEA
WAHLIG 64 PRL 13 103 +MANNELLI,SODICKSON,FACKLER,WARD, + //MIT
HOHLER 64 PL 12 149 G HOHLER, J GIESECKE //KARLSRUHE I
CITRON 66 PR 144 1101 +GALBRAITH,KYCIA,LEONTIC,PHILLIPS, + //BNL I
BARGER 66 PRL 16 913 V BARGER, D CLINE //WISC P

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N(3030)

73 N*1/2(3030, JP=15/2-) I=1/2

EVIDENCE FOR EXISTENCE NOT COMPLETELY CONCLUSIVE. FOR JP ASSIGNMENT SEE BARGER 66 AND NOTE FOLLOWING LISTINGS.

----------------- 73 N*1/2(3030) MASS (MEV) ----------------------------

M	3080.0	HOHLER	64 RVUE	DATA + DISP REL	7/66
M	3030.0	CITRON	66 CNTR	PI+- P TOTAL	7/66

----------------- 73 N*1/2(3030) WIDTH (MEV) ----------------------------

W	400.0	CITRON	66 CNTR	7/66

----------------- 73 N*1/2(3030) PARTIAL DECAY MODES -------------------

P1	N*1/2(3030) INTO PI N	S 8S16

----------------- 73 N*1/2(3030) BRANCHING RATIOS --------------------

R1	N*1/2(3030) INTO (PI N)/TOTAL			(P1)/TOTAL	
R1	0.0070	CITRON	66 CNTR	ASSUMING J=15/2	7/66

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REFERENCES -- N*1/2(3030)

HOHLER 64 PL 12 149 G HOHLER, J GIESECKE //KARLSRUHE I
CITRON 66 PR 144 1101 +GALBRAITH,KYCIA,LEONTIC,PHILLIPS, + //BNL I
BARGER 66 PRL 16 913 V BARGER, D CLINE //WISC P

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N? (3245)

74 N*?/2(3245, JP=)

EXISTENCE ONLY TENTATIVE. I-SPIN NOT DETERMINED BUT NARROW WIDTH PRECLUDES IDENTIFICATION WITH N*3/2(3230). OMITTED FROM TABLE.

----------------- 74 N* /2(3245) MASS (MEV) ----------------------------

M	3245.0	10.0	KORMANYOS	66 CNTR	PI-P EL AT 180 C	7/66

----------------- 74 N* /2(3245) WIDTH (MEV) ----------------------------

W	35.0	OR LESS	KORMANYOS	66 CNTR	7/66

----------------- 74 N* /2(3245) PARTIAL DECAY MODES -------------------

P1	N* /2(3245) INTO PI N	S 8S16

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REFERENCES -- N* /2(3245)

KORMANYO 66 PRL 16 709 KORMANYOS,KRISCH,OFALLON, + //MICH,ARG

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N (3690)

75 N*1/2(3690, JP=) I=1/2

EVIDENCE PRELIMINARY AND NOT COMPELLING. OMITTED FROM TABLE.

----------------- 75 N*1/2(3690) MASS (MEV) ----------------------------

M	3690.0	10.0	BARTKE	67 HBC	+ PI+P 8 PRONGS	8/67

----------------- 75 N*1/2(3690) WIDTH (MEV) ----------------------------

W	50.0	30.0	BARTKE	67 HBC	+	8/67

----------------- 75 N*1/2(3690) PARTIAL DECAY MODES -------------------

P1	N*1/2(3690) INTO N + 7 PIS	+

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                    REFERENCES -- N*1/2(3690)

BARTKE   67 PL 24B 116          +CZYZEWSKI,DANYSZ, +  //CRACOW,ORSAY(CERN)  I

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Δ(1236)

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81  N*3/2(1236, JP=3/2+) I=3/2      P33

                81  N*3/2(1236) MASS (MEV)      ---------------------------

M    *      1234.0                  ROPER     65 RVUE 0++PHASE-SHIFT ANAL
M++         1236.0       0.55       OLSSON    65 RVUE ++ TOTAL-SIGMA DATA
M++  *      1232.0       6.0        FERRO-LUZ 65 HBC  ++ K+P TO KC P PI+
M++  *      1233.4       4.4        GIDAL     66 DBC  ++ D D TO NN(NN) PI   7/66
M++         1236.0                  DEANS     66 RVUE ++ PI+P TOTAL         7/66
M0          1236.45      0.65       OLSSON    65 RVUE 0
M-   *      1241.3       5.1        GIDAL     66 DBC  -                     7/66

----------------  81  N*(0) - N*(++) MASS DIFFERENCE (MEV)     ------------

D    R        0.45       0.85       OLSSON    65 RVUE
     R      REDUNDANT WITH DATA IN MASS LISTING.

----------------  81  N*(-) - N*(++) MASS DIFFERENCE (MEV)     ------------

D             7.9        6.8        GIDAL     66 DBC

----------------  81  N*3/2(1236) WIDTH (MEV)     --------------------------

W++          120.0       2.0        OLSSON    65 RVUE ++
W++  *       125.0      30.0        FERRO-LUZ 65 HBC  ++
W++  *       124.0      14.0        GIDAL     66 DBC  ++                    7/66
W++          121.0                  DEANS     66 RVUE ++                    7/66
W0           119.6       2.4        OLSSON    65 RVUE 0
W-   *       149.0      18.0        GIDAL     66 DBC  -                     7/66

----------------  81  N*3/2(1236) PARTIAL DECAY MODES     -----------------

P1          N*3/2(1236) INTO PI N                       S 8S16

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                    REFERENCES -- N*3/2(1236)

OLSSON   65 PRL 14 118          M G OLSSON                          //WISC
FERRO-LU 65 NC 36 1101          FERRO-LUZZI,GEORGE, +               //CERN
ROPER    65 PR 138 B190         L D ROPER, R M WRIGHT, B T FELD  //LRL,MIT  JP
GIDAL    66 PR 141 1261         G GIDAL, A KERNAN, S KIM             //LRL
DEANS    66 PREPRINT            S R DEANS, W G HOLLADAY       //VANDERBILT

      FOR EXTENSIVE REFERENCES TO DATA AND PHASE-SHIFT ANALYSES TILL 1965,
      SEE ROPER 65, ESPECIALLY APPENDIX II.

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Δ(1670)

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82  N*3/2(1670, JP=1/2-) I=3/2      S31

                82  N*3/2(1670) MASS (MEV)      ---------------------------

M    *      1648.0      12.0        DEVLIN    65 CNTR   PI+- P TOTAL
M           1665.0                  BAREYRE   65 RVUE   PHASE SHIFT ANAL   7/66
M           1692.0                  LOVELACE  66 RVUE   PHASE-SHIFT ANAL   9/66

----------------  82  N*3/2(1670) WIDTH (MEV)     --------------------------

W    *       201.0      74.0        DEVLIN    65 CNTR   VERY ASYMMETRIC
W            130.0                  BAREYRE   65 RVUE                      7/66
W            230.0                  LOVELACE  66 RVUE                      9/66

----------------  82  N*3/2(1670) PARTIAL DECAY MODES     -----------------

P1          N*3/2(1670) INTO PI N                       S 8S16

----------------  82  N*3/2(1670) BRANCHING RATIOS     --------------------

R1          N*3/2(1670) INTO (PI N)/TOTAL               (P1)/TOTAL
R1   *        0.56                  DEVLIN    65 CNTR
R1            0.33                  BAREYRE   65 RVUE                      7/66
R1            0.44                  LOVELACE  66 RVUE                      9/66

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                    REFERENCES -- N*3/2(1670)

DEVLIN   65 PRL 14 1031         T J DEVLIN,J SOLOMON,G BERTSCH //PRINCETON  I
BAREYRE  65 PL 18 342           + BRICMAN, STIRLING, VILLET       //SACLAY IJP
LOVELACE 66 BERKELEY CONF       C LOVELACE                          //CERN IJP

                PAPERS NOT REFERRED TO IN DATA CARDS.

CARRUTHE 60 PRL 4 303           P CARRUTHERS                     //CORNELL  I
DEVLIN   62 PR 125 690          T J DEVLIN, B J MOYER, V PEREZ-MENDEZ//LRL  I
HELLAND  64 PR 134 B1062        +DEVLIN,HAGGE,LONGO,MOYER,WOOD      //LRL  I
DONNACHI 66 BERKELEY CONF       DONNACHIE, KIRSOPP, LEA, LOVELACE   //CERN IJP
   --  NUMBERS OF LOVELACE 66 ARE BASED ON THIS PHASE-SHIFT ANALYSIS.

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Δ(1920)

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

                83  N*3/2(1920) MASS (MEV)      ---------------------------

M           1922.0        APPROX     COOL      56 CNTR   PI+ P TOTAL        7/66
M           1912.0      15.0         BRISSON   61 CNTR   PI+ P TOTAL        7/66
M    N      1956.0                   LAYSON    63 RVUE   PI P TOTAL, EL     7/66
     N      ASSUMES AN N*3/2(1855).
M           1920.0                   HOHLER    64 RVUE   DATA + DISP REL    7/66
M           1900.0       9.0         DEVLIN    65 CNTR   PI+ P TOTAL
M           1920.0        APPROX     DUKE      65 CNTR   PI+- P EL, POLAR   7/66
M           1950.0        APPROX     YOKOSAWA  66 CNTR   PI- P DSIG + POL   7/66
M           1950.0                   LOVELACE  66 RVUE   PHASE-SHIFT ANAL   9/66

----------------  83  N*3/2(1920) WIDTH (MEV)     --------------------------

W            170.0                   HOHLER    64 RVUE                      7/66
W            256.0      39.0         DEVLIN    65 CNTR
W            170.0                   DUKE      65 CNTR                      7/66
W            200.0        APPROX     YOKOSAWA  66 CNTR                      7/66
W            250.0                   LOVELACE  66 RVUE                      9/66

----------------  83  N*3/2(1920) PARTIAL DECAY MODES     -----------------

P1          N*3/2(1920) INTO PI N                       S 8S16
P2          N*3/2(1920) INTO SIGMA K                    S20S10
P3          N*3/2(1920) INTO N*3/2(1236) PI             U81S 8

----------------  83  N*3/2(1920) BRANCHING RATIOS     --------------------

R1          N*3/2(1920) INTO (PI N)/TOTAL               (P1)/TOTAL
R1   N        0.33                   LAYSON    63 RVUE                      7/66
     N      ASSUMES AN N*3/2(1855).
R1            0.73        OR LESS    HOHLER    63 RVUE   DATA + DISP REL    7/66
R1            0.57      0.12         DEVLIN    65 CNTR
R1            0.41                   DUKE      65 CNTR   VERY ENERGY DEP    7/66
R1            0.4         APPROX     YOKOSAWA  66 CNTR                      7/66
R1            0.50                   LOVELACE  66 RVUE                      9/66

R2          N*3/2(1920) INTO (SIGMA K)/TOTAL            (P2)/TOTAL
R2            SEEN                   HOLLADAY  65 RVUE    PI+P DATA        11/66

R3          N*3/2(1920) INTO (N*3/2(1236) PI)/TOTAL     (P3)/TOTAL
R3          DOMINANT INEL DECAY      LOVELACE  66 RVUE                      9/66

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                    REFERENCES -- N*3/2(1920)

COOL     56 PR 103 1082         R COOL, O PICCIONI, D CLARK          //BNL  I
BRISSON  61 NC 19 210           +DETOEUF,FALK-VAIRANT,VAN ROSSUM,+//SACLAY  I
LAYSON   63 NC 27 724           W M LAYSON                          //CERN  IJ
HOHLER   63 NP 48 470           G HOHLER, G EBEL                //KARLSRUHE  I
HOHLER   64 PL 12 149           G HOHLER, J GIESECKE            //KARLSRUHE  I
DEVLIN   65 PRL 14 1031         T J DEVLIN,J SOLOMON,G BERTSCH //PRINCETON  I
DUKE     65 PRL 15 468          +JONES,KEMP,MURPHY,PRENTICE, + //RTHFD,OXF IJP
HOLLADAY 65 PR 139 B1348        W G HOLLADAY                     //VANDERBILT
YOKOSAWA 66 PRL 16 714          +SUWA, HILL, ESTERLING, BOOTH    //ARG,CHI IJP
LOVELACE 66 BERKELEY CONF       C LOVELACE                          //CERN IJP

                PAPERS NOT REFERRED TO IN DATA CARDS.

HELLAND  64 PR 134 B1062        +DEVLIN,HAGGE,LONGO,MOYER,WOOD      //LRL  IJ
AUVIL    64 NC 33 473           P AUVIL, C LOVELACE             //IMPCOL IJP
DONNACHI 66 BERKELEY CONF       DONNACHIE, KIRSOPP, LEA, LOVELACE   //CERN IJP
   --  NUMBERS OF LOVELACE 66 ARE BASED ON THIS PHASE-SHIFT ANALYSIS.

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Δ(2420)

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84  N*3/2(2420, JP=11/2+) I=3/2

        FOR JP ASSIGNMENT SEE BARGER 66 AND NOTE AFTER LISTINGS.

                84  N*3/2(2420) MASS (MEV)      ---------------------------

M           2360.0                   DIDDENS   63 CNTR   PI+ P TOTAL
M    *      2520.0      40.0         ALVAREZ   64 CNTR   PI PHOTOPROD       7/66
M    *      2400.0        APPROX     WAHLIG    64 SPRK 0 PI-P CH EX
M           2440.0                   HOHLER    64 RVUE   DATA + DISP REL
M           2423.0      10.0         CITRON    66 CNTR   PI+ P TOTAL        7/66

----------------  84  N*3/2(2420) WIDTH (MEV)     --------------------------

W            200.0                   DIDDENS   63 CNTR
W            245.0                   HOHLER    64 RVUE                      7/66
W            310.0      20.0         CITRON    66 CNTR                      7/66

----------------  84  N*3/2(2420) PARTIAL DECAY MODES     -----------------

P1          N*3/2(2420) INTO PI N                       S 8S16
P2          N*3/2(2420) INTO SIGMA K                    S20S10

----------------  84  N*3/2(2420) BRANCHING RATIOS     --------------------

R1          N*3/2(2420) INTO (PI N)/TOTAL               (P1)/TOTAL
R1            0.067       APPROX     DIDDENS   63 CNTR   ASSUMING J=11/2    7/66
R1            0.113     0.0036       CITRON    66 CNTR   ASSUMING J=11/2    7/66

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                    REFERENCES -- N*3/2(2420)

DIDDENS  63 PRL 10 262          +JENKINS, KYCIA, RILEY               //BNL  I
ALVAREZ  64 PRL 12 710          +BAR-YAM,KERN,LUCKEY,OSBORNE, + //MIT,CEA
WAHLIG   64 PRL 13 103          +MANNELLI,SODICKSON,FACKLER,WARD, +  //MIT
HOHLER   64 PL 12 149           G HOHLER, J GIESECKE            //KARLSRUHE  I
CITRON   66 PR 144 1101         +GALBRAITH,KYCIA,LEONTIC,PHILLIPS, + //BNL  I
BARGER   66 PRL 16 913          V BARGER, D CLINE                    //WISC  P

                PAPER NOT REFERRED TO IN DATA CARDS.

DOBROWOL 67 PL 24B 203          DOBROWOLSKI,GUSKOV,LIKHACHEV, +     //DUBNA  P
   --  BACKWARD SCATTERING DATA INDICATING PARITY IS +.

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Δ(2850)

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85  N*3/2(2850, JP=15/2+) I=3/2

        FOR JP ASSIGNMENT SEE BARGER 66 AND NOTE AFTER LISTINGS.

                85  N*3/2(2850) MASS (MEV)      ---------------------------

M    *      2700.0        APPROX     WAHLIG    64 SPRK 0 PI-P CH EX
M           2870.0                   HOHLER    64 RVUE   DATA + DISP REL
M           2850.0      12.0         CITRON    66 CNTR   PI+ P TOTAL        7/66
M           2850.0                   BARDADIN  66 HBC ++ N* TO P + 3 PIS    7/66

----------------  85  N*3/2(2850) WIDTH (MEV)     --------------------------

W            400.0      40.0         CITRON    66 CNTR                      7/66
W            150.0                   BARDADIN  66 HBC  ++                   7/66

----------------  85  N*3/2(2850) PARTIAL DECAY MODES     -----------------

P1          N*3/2(2850) INTO PI N                       S 8S16
P2          N*3/2(2850) INTO P PI PI PI                 S16S 6S 6S 8

----------------  85  N*3/2(2850) BRANCHING RATIOS     --------------------

R1          N*3/2(2850) INTO (PI N)/TOTAL               (P1)/TOTAL
R1            0.0314    0.0025       CITRON    66 CNTR   ASSUMING J=15/2    7/66

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                    REFERENCES -- N*3/2(2850)

WAHLIG   64 PRL 13 103          +MANNELLI,SODICKSON,FACKLER,WARD, +  //MIT
HOHLER   64 PL 12 149           G HOHLER, J GIESECKE            //KARLSRUHE  I
CITRON   66 PR 144 1101         +GALBRAITH,KYCIA,LEONTIC,PHILLIPS, + //BNL  I
BARDADIN 66 PL 21 357           BARDADIN-OTWINOWSKA,DANYSZ, +      //WARSAW
BARGER   66 PRL 16 913          V BARGER, D CLINE                    //WISC  P

                PAPER NOT REFERRED TO IN DATA CARDS.

DOBROWOL 67 PL 24B 203          DOBROWOLSKI,GUSKOV,LIKHACHEV, +     //DUBNA  P
   --  BACKWARD SCATTERING DATA INDICATING PARITY IS +.

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Δ(3230)

86 N*3/2(3230, JP=19/2+) I=3/2

EVIDENCE FOR EXISTENCE NOT COMPLETELY CONCLUSIVE. FOR JP ASSIGNMENT SEE BARGER 66 AND NOTE FOLLOWING LISTINGS.

---------------- 86 N*3/2(3230) MASS (MEV) ----------------

M	3230.0		CITRON	66 CNTR	PI+ P TOTAL	7/66

---------------- 86 N*3/2(3230) WIDTH (MEV) ----------------

W	440.0		CITRON	66 CNTR		7/66

---------------- 86 N*3/2(3230) PARTIAL DECAY MODES ----------------

P1	N*3/2(3230) INTO PI N	S 8S16

---------------- 86 N*3/2(3230) BRANCHING RATIOS ----------------

R1	N*3/2(3230) INTO (PI N)/TOTAL				(P1)/TOTAL	
R1	0.0063		CITRON	66 CNTR	ASSUMING J=19/2	7/66

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REFERENCES -- N*3/2(3230)

CITRON 66 PR 144 1101 +GALBRAITH,KYCIA,LEONTIC,PHILLIPS, + //BNL I

BARGER 66 PRL 16 913 V BARGER, D CLINE //WISC P

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$N^*_{5/2}$ (1560)

91 N*5/2(1560, JP=) I=5/2

IT HAS BEEN SUSPECTED ALMOST FROM THE BEGINNING THAT THIS IS A KINEMATIC EFFECT AND NOT A RESONANCE. RECENT EVIDENCE STRONGLY SUPPORTING THIS INTERPRETATION IS GIVEN IN GOLDHABER 67. OMITTED FROM TABLE.

---------------- 91 N*5/2(1560) MASS (MEV) ----------------

M	1560.0	20.0	GOLDHABER	64 HBC	+++3.65 BEV/C PI+ P	7/66
M	1570.0		ALEXANDER	66 HBC	+++PP 4PI 5.5 BEV/C	9/66

---------------- 91 N*5/2(1560) WIDTH (MEV) ----------------

W	220.0	20.0	GOLDHABER	64 HBC	+++	7/66
W	140.0		ALEXANDER	66 HBC	+++	9/66

---------------- 91 N*5/2(1560) PARTIAL DECAY MODES ----------------

P1	N*5/2(1560) INTO N PI PI	S16S 8S 8
P2	N*5/2(1560) INTO N*3/2(1236) PI	L81S 8

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REFERENCES -- N*5/2(1560)

GOLDHABE 64 DUBNA CONF I 480 G+S GOLDHABER,OHALLORAN,SHEN //LRL(BNL) I

DASH 65 LRL UCID-2752 J DASH, G GOLDHABER, J SWIHART //LRL

CONTE 66 BERKELEY CONF +CAMERI,RATTI,RUSSO, + //GENOVA,MILANO,OXF

ALEXANDE 66 BERKELEY CONF ALEXANDER,BENARY,CZAPEK,+ //WEIZMANN(CERN)

GOLDHABF 67 CORAL GABLES 190 G GOLDHABER //LRL

PAPER NOT REFERRED TO IN DATA CARDS.

ALEXANDE 65 PRL 15 207 ALEXANDER,BENARY,REUTER,+ //WEIZMANN(CERN) I
-- REPLACED BY ALEXANDER 66.

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Z_0 (1865)

96 Z*0(1865, JP=) I=0

THE SIZE AND NARROWNESS OF THE I=0 PEAK MAKE IT DIFFICULT TO INTERPRET IT AS OTHER THAN RESONANT. THE DISPERSION-RELATION ANALYSIS BY CARTER 67 STRONGLY SUPPORTS A RESONANT INTERPRETATION.

---------------- 96 Z*0(1865) MASS (MEV) ----------------

M	1866.0	10.0	ABRAMS	67 CNTR	K+P, D TOTAL	8/67
M	1860.0	15.0	CARTER	67 THEO	DISPERSION REL.	8/67

---------------- 96 Z*0(1865) WIDTH (MEV) ----------------

W	160.0	30.0	ABRAMS	67 CNTR		8/67
W	200.0	50.0	CARTER	67 THEO		8/67

---------------- 96 Z*0(1865) PARTIAL DECAY MODES ----------------

P1	Z*0(1865) INTO K N	S10S17
P2	Z*0(1865) INTO K*(892) N	U18S16

---------------- 96 Z*0(1865) BRANCHING RATIOS ----------------

R1	Z*0(1865) INTO (K N)/TOTAL				(P1)/TOTAL	
R1	0.40	0.05	ABRAMS	67 CNTR	IF J=1/2	8/67
R1	0.31	0.05	CARTER	67 THEO	IF J=1/2	8/67

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REFERENCES -- Z*0(1865)

ABRAMS 67 PRIVATE COMM. +COOL,GIACOMELLI,KYCIA,LEONTIC,LI, + //BNL

CARTER 67 PRL 18 801 A A CARTER //CAVENDISH

PAPER NOT REFERRED TO IN DATA CARDS.

COOL 66 PRL 17 102 +GIACOMELLI,KYCIA,LEONTIC,LI,LUNDBY,+//BNL I
-- REPLACED BY ABRAMS 67.

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Z_1 (1900)

97 Z*1(1900, JP=) I=1

MOST OF THE BUMP IN THE CROSS SECTION IS DUE TO A BUMP IN THE KN* CHANNEL NEAR ITS THRESHOLD. ANALYSIS OF THIS CHANNEL (BLAND 67) NEITHER REQUIRES NOR SUGGESTS THAT ANY OF THE MAIN AMPLITUDES PRESENT BE RESONATING. NEITHER DOES A DISPERSION RELATION ANALYSIS OF THE TOTAL CROSS-SECTION DATA (CARTER 67) REQUIRE EXISTENCE OF A RESONANCE. OMITTED FROM TABLE.

---------------- 97 Z*1(1900) MASS (MEV) ----------------

M	1900.0	10.0	ABRAMS 1	67 CNTR	++ K+P TOTAL	8/67

---------------- 97 Z*1(1900) WIDTH (MEV) ----------------

W	260.0	50.0	ABRAMS 1	67 CNTR	++	8/67

---------------- 97 Z*1(1900) PARTIAL DECAY MODES ----------------

P1	Z*1(1900) INTO K N	S10S16
P2	Z*1(1900) INTO N*3/2(1236) K	U81S10

---------------- 97 Z*1(1900) BRANCHING RATIOS ----------------

R1	Z*1(1900) INTO (K N)/TOTAL				(P1)/TOTAL	
R1	0.25	0.06	ABRAMS 1	67 CNTR	++ IF J=1/2	8/67
R1	0.10	OR LESS	CARTER	67 THEO	DISPERSION REL.	8/67
R2	Z*1(1900) INTO (N*3/2(1236) K)/TOTAL				(P2)/TOTAL	
R2	DOMINANT CONTR TO PEAK		BLAND	67 HBC	++	8/67

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REFERENCES -- Z*1(1900)

ABRAMS 1 67 PRIVATE COMM. +COOL,GIACOMELLI,KYCIA,LEONTIC,LI, + //BNL

CARTER 67 PRL 18 801 A A CARTER //CAVENDISH

BLAND 67 PRL 18 1077 +BOWLER,BROWN,G+S GOLDHABER,SEEGER,+ //LRL

PAPERS NOT REFERRED TO IN DATA CARDS.

COOL 66 PRL 17 102 +GIACOMELLI,KYCIA,LEONTIC,LI,LUNDBY,+//BNL I
-- REPLACED BY ABRAMS 1+2 67.

LEA 66 PL 23 380 LEA, MARTIN, OADES //COPENHAGEN,NORDITA
-- PRELIMINARY PHASE-SHIFT ANALYSIS. THE ONLY WAVE WITH POSITIVE AND INCREASING PHASE IS THE P1/2.

TYSON 67 PRL 19 255 +GREENBERG,HUGHES,LU,MINEHART,MORI, //YALE
-- PHOTOPRODUCTION EVIDENCE FOR S=+1 BARYONS.

ABRAMS 2 67 PRL 19 259 +COOL,GIACOMELLI,KYCIA,LEONTIC,LI, + //BNL
-- LATEST TOTAL CROSS-SECTION DATA, SHOWING SMALL BUMPS AT 2190 AND 2505 MEV AS WELL AS THE LARGE 1900 MEV BUMP.

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Λ(1405)

37 Y*0(1405, JP=1/2-) I=0

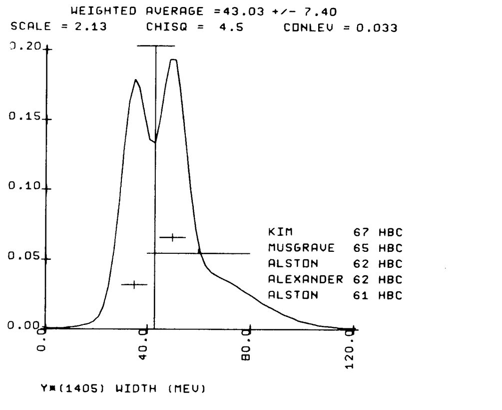
THIS RESONANCE CAN BE IDENTIFIED WITH THE VIRTUAL BOUND STATE IN THE KBAR-N SYSTEM DEDUCED FROM THE I=0 SCATTERING LENGTH DETERMINED FROM LOW ENERGY K-P INTERACTIONS. THE DIFFICULTIES IN EXTRAPOLATING FROM THE PHYSICAL REGION TO THE RESONANCE LOCATION ARE DISCUSSED BY DALITZ 66. THE PARAMETERS ARISING FROM ZERO-EFFECTIVE-RANGE FITS ARE MODEL DEPENDENT AND SHOULD NOT BE TAKEN AS SERIOUSLY AS THE SMALL QUOTED ERRORS SUGGEST. SEE THE NOTE IN THE MAIN TEXT ON S-WAVE BUMPS NEAR THRESHOLD.

---------------- 37 Y*0(1405) MASS (MEV) ----------------

M		1405.0		ALSTON	61 HBC	K-P 1.15 BEV/C	
M		1410.0		ALEXANDER	62 HBC	PI-P 2.1 BEV/C	
M		1405.0		ALSTON	62 HBC	K-P 1.2-.5 BEV/C	
M		1400.0	24.0	MUSGRAVE	65 HBC	PBAR P 3-4 BEV/C	7/66
M	*	1382.0	8.0	ENGLER	65 HDBC	PI-P, PI+D 1.68	7/66
M	*	1410.7	1.0	KIM	65 HBC	0-EFF-RANGE FIT	7/66
M	N	1409.6	1.7	SAKITT	65 HBC	0-EFF-RANGE FIT	7/66
	N	DATA OF SAKITT ARE USED IN FIT BY KITTEL.					
M	*	1407.5	1.2	KITTEL	66 HBC	0-EFF-RANGE FIT	7/66
M		1403.0	3.0	KIM	67 HBC	K MATRIX FIT(KP)	8/67

---------------- 37 Y*0(1405) WIDTH (MEV) ----------------

W		20.0		ALSTON	61 HBC		7/66
W		35.0	5.0	ALEXANDER	62 HBC		
W		50.0		ALSTON	62 HBC		
W		60.0	20.0	MUSGRAVE	65 HBC		7/66
W	*	89.0	20.0	ENGLER	65 HDBC		7/66
W	*	37.0	3.2	KIM	65 HBC		7/66
W	N	28.2	4.1	SAKITT	65 HBC		7/66
	N	DATA OF SAKITT ARE USED IN FIT BY KITTEL.					
W	*	34.1	4.1	KITTEL	66 HBC		7/66
W		50.0	5.0	KIM	67 HBC	K MATRIX FIT(KP)	8/67



---------------- 37 Y*0(1405) PARTIAL DECAY MODES ----------------

P1	Y*0(1405) INTO SIGMA PI	S20S 8

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REFERENCES -- Y*0(1405)

ALSTON 61 PRL 6 698 +ALVAREZ,EBERHARD,GOOD,GRAZIANO, + //LRL I

ALEXANDE 62 PRL 8 447 ALEXANDER,KALBFLEISCH,MILLER,SMITH //LRL I

ALSTON 62 CERN CONF 311 +ALVAREZ,FERRO-LUZZI,ROSENFELD, + //LRL I

MUSGRAVE 65 NC 35 735 +PETMEZAS,+//BIRMGHM,CERN,EP,IMPCOL,SACLAY

ENGLER 65 PRL 15 224 +FISK,KRAEMER,MELTZER,WESTGARD,+//CRNG,BNL IJ

KIM 65 PRL 14 29 J K KIM //COLUMBIA IJP

SAKITT 65 PR 139 B719 +DAY,GLASSER,SEEMAN,FRIEDMAN, + //MD,LRL IJP

KITTEL 66 PL 21 349 W KITTEL, G OTTER, I WACEK //VIENNA IJP

DALITZ 66 PREPRINT DALITZ, WONG, RAJASEKARAN //OXFORD,BOMBAY

KIM 67 PREPRINT J KIM /////////////////////////////////YALE JP

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                    PAPERS NOT REFERRED TC IN CATA CARCS.

ABRAMS   65 PR 139 B454       G S ABRAMS, B SECHI-ZORN               //MD IJP
KADYK    66 PRL 17 599        +OREN, G+S GOLDHABER, TRILLING        //LRL IJP
DONALD   66 PL 22 711         + EDWARDS, LYS, NISAR, MCORF   //LIVERPOOL
     --  ABRAMS 65, KADYK 66, AND CONALD 66 SUPPORT THESE EFFECTIVE-RANGE-
         FIT SOLUTICNS GIVING AN I=0 S1/2 RESCNANCE.

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Λ(1520)

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                  38  Y*0(152C, JP=3/2-) I=C

                  36  Y*0(1520) MASS (MEV)    -----------------------------

M          1519.4     2.0          WATSON    63 HBC    K-P ALL CHANNELS
M      145 1517.2     3.0          GALTIERI  63 CBC    K-C 1.51 BEV/C
M       29 1520.0     4.0          ALMEIDA   64 HBC    K-P 1.45 BEV/C
M          1511.0    15.0          MUSGRAVE  65 HBC    PBAR P 3-4 BEV/C  7/66

----------------  38  Y*0(152C) WIDTH (MEV)   -----------------------------

W            16.4     2.C          WATSON    63 HBC
W            19.0    19.0          MUSGRAVE  65 HBC                      7/66
W            18.0      OR LESS     HARDY     66 HBC                      9/66

----------------  36  Y*0(152C) PARTIAL DECAY MODES  --------------------

P1        Y*C(1520) INTO KBAR N                        S11S17
P2        Y*0(1520) INTO SIGMA PI                      S20S 8
P3        Y*0(1520) INTO LAMBDA PI PI                  S18S 8S 8

----------------  36  Y*0(152C) PARTIAL WIDTHS (MEV)   ------------------

W1        Y*0(1520) INTO KBAR N                        (P1)
W1           4.8      0.5          WATSON    63 HBC

W2        Y*0(1520) INTO SIGMA PI                      (P2)
W2           9.0      1.C          WATSON    63 HBC

----------------  38  Y*0(152C) BRANCHING RATIOS    ----------------------

R1     Y*0(1520) INTC (SIGMA PI)/(KBAR N)              (P2)/(P1)
R1           0.96     0.20         HARDY     66 HBC     PI-P 1.6-4 GEV/C  9/66
R1           0.73     0.11         DAUBER    67 HBC     K-P AT 2.GEV/C    8/67
R1           1.72      .78         MUSGRAVE  67 HBC                       8/67

R2     Y*0(1520) INTO (LAMBCA PI PI)/(KBAR N)          (P3)/(P1)
R2           0.21     0.18         DAUBER    67 HBC     K-P AT 2.GEV/C    8/67
R2           0.17     0.05         HESS      66 HBC     PI-P 1.6-4 GEV/C  9/66

R3    Y*C(1520) INTO (SIGMA PI)/(LAMBCA PI PI)         (P2)/(P3)
R3           4.5      1.0          ARMENTERC 65 HBC                       7/66
R3           4.8      1.2          UHLIG     66 HBC     K-P .9-1.C BEV/C  9/66

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                         REFERENCES -- Y*0(1520)

WATSON    63 PR 131 2248        M B WATSON, M FERRO-LUZZI, R D TRIPP //LRL IJP
GALTIERI  63 PL 6 296           A BARBARO-GALTIERI,A HUSSAIN,RD TRIPP//LRL
ALMEIDA   64 PL 9 204           S P ALMEIDA, G R LYNCH              //CERN
MUSGRAVE  65 NC 35 735          +PETMEZAS,+//BIRMGHM,CERN,EP,IMPCOL,SACLAY
ARMENTER  65 PL 19 338          ARMENTEROS,F-LUZZI, + //CERN,HEIDEL,SACLAY
HARDY     66 UCRL-16786 THESIS L M HARDY                           //LRL
HESS      66 UCRL-16832 THESIS R I HESS                            //LRL
DAUBER    67 PL 248 525         +MALAMUC,SCHLEIN,SLATER,STORK////////UCLA
UHLIG     67 PR 155 1448        +CHARLTON,CONDON,GLASSER,YCDH,+///MD,USNRL

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Λ(1670)

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                  40  Y*0(167C, JP=1/2-) I=0

                  SEE NOTE IN MAIN TEXT ON S-WAVE BUMPS NEAR THRESHOLC.

                  40  Y*0(1670) MASS (MEV)    -----------------------------

M            1680.0                Y-CHANG   64 PBC    PI-PRP 7-8 BEV/C  7/66
M            1670.0                BERLEY    65 HBC    K-P TO LAM ETA    7/66
M            1680.                 BUBELEV   67 PBC    PI-PRP AT 4GEV/C  8/67

----------------  40  Y*0(167C) WIDTH (MEV)   -----------------------------

W              20.0     OR LESS    Y-CHANG   64 PBC                      7/66
W              18.0                BERLEY    65 HBC                      7/66
W              20.   OR LESS       BUBELEV   67 PBC    PI-PRP AT 4GEV/C  8/67

----------------  40  Y*0(1670) PARTIAL DECAY MODES  --------------------

P1        Y*0(1670) INTO KBAR N                        S11S17
P2        Y*0(167C) INTO LAMBDA ETA                    S18S14
P3        Y*0(1670) INTO SIGMA PI                      S20S 8

----------------  40  Y*0(1670) BRANCHING RATIOS    ----------------------

R1  *     Y*0(1670) INTO ((KBAR N)(LAM ETA))/TOTAL**2   (P1*P2)/TOTAL**2
R1  *        0.046                 BERLEY    65 HBC                      7/66

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                         REFERENCES -- Y*C(1670)

Y-CHANG   64 DUBNA CONF I 615  YUNG-CHANG, IN, KLADNITSKAYA, +     //DUBNA  I
BERLEY    65 PRL 15 641        +CONNOLLY,HART,RAHM,STONEHILL, +    //BNL IJP
BUBELEV   67 PL 248 246        +CHADRAA,CHUVILO,HI IN+//////JINR,BUC,CERN

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Λ(1700)

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                  55  Y*0(169C, JP=3/2-) I=C

                  SPIN-PARITY DETERMINATION TENTATIVE.

                  55  Y*0(169C) MASS (MEV)    -----------------------------

M           1682.0    2.0          ARMENTERC 67 HBC    C KP TO SIGMA PI   8/67
M           1699.0    2.0          ARMENTER1 67 HBC    C K-P ELAST+CH.EX  8/67
M           1698.0    5.0          DAVIES    67 CNTR     K-P, D TOTAL    11/66

----------------  55  Y*0(1690) WIDTH (MEV)   -----------------------------

W             55.0    4.0          ARMENTERO 67 HBC    O KP TO SIGMA PI   8/67
W             33.0   15.0          ARMENTER1 67 HBC    C K-P ELAST+CH.EX  8/67
W             40.0   10.0          DAVIES    67 CNTR                     11/66

----------------  55  Y*0(169C) PARTIAL DECAY MODES  --------------------

P1        Y*0(1690) INTO KBAR N                        S11S17
P2        Y*0(1650) INTO SIGMA PI                      S20S 8

----------------  55  Y*0(169C) BRANCHING RATIOS    ----------------------

R1        Y*0(1650) INTO (KBAR N)/TOTAL                   (P1)/TOTAL
R1           0.19     0.07         ARMENTER1 67 HBC   C K-P ELAST+CH.EX   8/67
R1           0.24                  DAVIES    67 CNTR    ASSUMING J=3/2   11/66

R2     Y*0(1690) INTO (SIGMA PI)*(KBAR N)/TOTAL**2    (P2*P1)/TCTAL**2    8/67
R2           0.116    0.014        ARMENTERO 67 HBC   C                   8/67

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                         REFERENCES -- Y*C(1690)

ARMENTER  66 BERKELEY CUNF     ARMENTEROS,F-LUZZI, + //CERN,HEIDEL,SACLAY IJP
ARMENTER  67 PL 248 198        ARMENTEROS,FERRO-LUZZI+///CERN,HEID,SACLAYIJP
ARMENTE1  67  CERN 67-17 TBP   ARMENTEROS,FERRC-LUZZI+///CERN,HEID,SACLAYIJP
DAVIES    67 PRL 18 62         +COWELL,HATTERSLEY,HOMER+//BIRMI,CAMB,RUTH I

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Λ(1815)

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

                  39  Y*0(1815) MASS (MEV)    -----------------------------

M   *     1815.0                   GALTIERI  63           K-P RVUE          7/66
M         1815.0                   BIRGE     65 HBC       KBAR N,LAM PI PI  7/66
M   N     1811.0      4.0          GELFAND   66 HBC     0 BGD PURE IMAG     8/67
M   N     1811.0      4.0          LEVI SETT 66 RVUE      SOME REAL BGD     9/66
    N     RES + CIFFRACTIVE BGC FOR K-P EL.  CATA ARE IN ARMENT 66 FITS TOO.
M         1819.0      2.0          ARMENTER1 67 HBC     C K-P ELAST+CH.EX   8/67
M         1813.0      2.0          ARMENTERC 67 HBC     C K-P TO SIGMA PI   8/67
M         1819.0      5.0          DAVIES    67 CNTR      K-P, D TCTAL     11/66

----------------  39  Y*0(1815) WIDTH (MEV)   -----------------------------

W   *       70.0                   GALTIERI  63
W           60.0                   BIRGE     65 HBC                         7/66
W   N       73.0     10.0          LEVI SETT 66 RVUE      SOME REAL BGD     9/66
W   N       73.0     10.0          GELFAND   66 HBC     C BGD PURE IMAG     8/67
    N     RES + DIFFRACTIVE BGD FOR K-P EL.  DATA ARE IN ARMENT 66 FITS TOO.
W           87.0     15.0          ARMENTERC 67 HBC     C K-P TO SIGMA PI   8/67
W           70.0      7.0          ARMENTER1 67 HBC     C K-P ELAST+CH.EX   8/67
W           90.0     15.0          DAVIES    67 CNTR                       11/66

----------------  39  Y*0(1815) PARTIAL DECAY MODES  --------------------

P1        Y*0(1815) INTO KBAR N                        S11S17
P2        Y*0(1815) INTO SIGMA PI                      S20S 8
P3        Y*C(1815) INTO Y*1(1385) PI                  U43S 8
P4        Y*0(1815) INTO LAMBCA ETA                    S18S14

----------------  39  Y*0(1815) BRANCHING RATIOS    ----------------------

R1        Y*0(1815) INTO (KBAR N)/TOTAL                   (P1)/TOTAL
R1  *        0.8                   GALTIERI  63           K-P RVUE
R1  N        0.67     0.08         LEVI SETT 66 RVUE      SOME REAL BGD     9/66
R1  N        0.67     0.08         GELFAND   66 HBC     C BGD PURE IMAG     8/67
    N     RES + CIFFRACTIVE BGC FOR K-P EL.  CATA ARE IN ARMENT 66 FITS TCC.
R1           0.8C                  ABRAMS    67 CNTR      TOTAL CRCSS-SEC.  8/67
R1           0.63     C.01         ARMENTER1 67 HBC     C K-P ELAST+CH.EX   8/67
R1           0.74                  CAVIES    67 CNTR                       11/66

R2     Y*0(1815) INTO (SIGMA PI)*(KBAR N)/TOTAL**2    (P2*P1)/TOTAL**2
R2           0.073    0.005        ARMENTERC 67 HBC     0                   8/67

R3    Y*0(1820) INTO (Y*1(1385) PI)*(KBAR N)/TCTAL**2  (P3*P1)/TOTAL**2
R3           0.057    0.013        ARMENTER2 67 HBC     C K-P TO LAM.PI PI  8/67

R4        Y*0(1815) INTO (Y*1(1385) PI)/TOTAL             (P3)/TOTAL
R4           0.20     0.05         BIRGE     65 HBC                         7/66

R5        Y*C(1815) INTO (LAMBCA ETA)/TOTAL               (P4)/TOTAL
R5           0.01                  ARMENTERO 66 HBC                         9/66

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                         REFFRENCES -- Y*0(1815)

GALTIERI  63 PL 6 296          A BARBARO-GALTIERI,A HUSSAIN,RD TRIPP//LRL IJ
BIRGE     65 ATHENS CONF 296   +ELY,KALMUS,KERNAN,LOUIE,SAHOURIA, + //LRL IJP
GELFAND   66 PRL 17 1224       +HARMSEN,LEVI-SETTI,PRECAZZI+//EFINS,ARGCN
LEVI SET  66 BERKELEY CONF     R LEVI SETTI, E PREDAZZI              //CHI
ABRAMS    67 PRIVATE CCMM.     +COOL,GIACOMELLI,KYCIA,LECNTIC,LI, + //BNL  I
ARMENTER  67 PL 248 198        ARMENTEROS,FERRO-LUZZI+///CERN,HEID,SACLAY JP
ARMENTE1  67  CERN 67-17 TBP   ARMENTERCS,FERRO-LUZZI+///CERN,HEID,SACLAYIJP
ARMENTE2  67 ZEIT.PHYS.202,486 ARMENTEROS,FERRO-LUZZI+///CERN,HEID,SACLAY
DAVIES    67 PRL 18 62         +COWELL,HATTERSLEY,HOMER+//BIRMI,CAMB,RUTH

                    PAPERS NOT REFERRED TO IN CATA CARCS.

CHAMBERL  62 PR 125 1696       CHAMBERLAIN,CROWE,KEEFE,KERTH, +     //LRL  I
     --  FIRST SEEN IN CHAMBERLAIN 62 TOTAL CROSS SECTION MEASUREMENTS.
SODICKSO  64 PR 133 B757       SODICKSON,MANNELLI,FRISCH,WAHLIG//MIT(BNL)  J
HOLLEY    65 UCRL-16274 THESIS W R HOLLEY                          //LRL  J
     --  SODICKSON 64 AND HOLLEY 65 ELASTIC SCATTERING WORK INDICATED J=5/2.

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Λ(1830)

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                  56  Y*0(1830, JP=5/2-)  I=0    D05

                  56  Y*0(183C) MASS (MEV)

M         1827.0      3.0          ARMENTERO 67 HBC    O K-P TO SIGMA PI   8/67
M         1817.0     20.           ARMENTER1 67 HBC    O K-P ELAST+CH.EX   8/67

                  56  Y*0(1830) WIDTH (MEV)

W           75.0      9.0          ARMENTERC 67 HBC    C K-P TO SIGMA PI   8/67
W           97.0     30.           ARMENTER1 67 HBC    C K-P ELAST+CH.EX   8/67

                  56  Y*0(183C) PARTIAL DECAY MODES

P1     Y*0(183C) INTO KBAR N                           S11S17
P2     Y*0(1830) INTO SIGMA PI                         S20S 8

                  56  Y*0(1830) BRANCHING RATIOS

R1     Y*0(1830) INTC (KBAR N)/TOTAL                      (P1)/TOTAL
R1           0.08     0.01         ARMENTER1 67 HBC    O K-P ELAST+CH.EX   8/67

R2     Y*0(1830) INTC (SIGMA PI)*(KBAR N)/TOTAL**2     (P2*P1)/TOTAL**2
R2           0.0225   0.006        ARMENTERO 67 HBC    O                   8/67

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                         REFERENCES -- Y*0(1830)

ARMENTER  67 PL 248 198        ARMENTEROS,FERRO-LUZZI+///CERN,HEID,SACLAYIJP
ARMENTE1  67  CERN 67-17 TBP   ARMENTEROS,FERRO-LUZZI+///CERN,HEID,SACLAYIJP

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Λ(2100)

41 Y*0(210C, JP=7/2-) I=C

41 Y*0(210C) MASS (MEV) ------------------------------

M	*	2097.0	6.0	BCCK	65 HBC	PBAR P 5.7 BEV/C	7/66
M	*	2120.0		WOHL	66 HBC	K-P CH EX	7/66
M		2103.0	10.0	ABRAMS	67 CNTR	K-P, D TCTAL	8/67

----------------- 41 Y*0(210C) WIDTH (MEV) ------------------------------

W	*	24.0	14.0	24.0	BCCK	65 HBC	INTO KBAR N (PI)	7/66
W		145.0			WOHL	66 HBC		7/66
W		143.0	10.0		ABRAMS	67 CNTR		8/67

----------------- 41 Y*0(210C) PARTIAL DECAY MOLES ---------------------

P1	Y*0(2100) INTO KBAR N	S11S17
P2	Y*0(2100) INTO SIGMA PI	S20S 8
P3	Y*0(2100) INTO LAMBDA ETA	S18S14
P4	Y*0(2100) INTO XI K	S22S11
P5	Y*0(2100) INTO LAMBDA UMEGA	S180 1
P6	Y*0(2100) INTO KBAR N PI	S11S17S 8

----------------- 41 Y*0(210C) BRANCHING RATIOS ---------------------

R1	Y*0(2100) INTO (KBAR N)/TOTAL				(P1)/TOTAL	
R1	0.25		WCHL	66 HBC		7/66
R1	0.333	0.013	ABRAMS	67 CNTR		8/67
R2	Y*0(2100) INTO (SIGMA PI)/TOTAL				(P2)/TOTAL	
R2	0.05		GALTIERI	67 HBC	ASSUMING R1=0.29	8/67
R3	Y*0(2100) INTO (LAMBDA ETA)/TOTAL				(P3)/TOTAL	
R3	0.03	OR LESS	FLATTE	67 HBC	ASSUMING R1=0.29	8/67
R4	Y*0(2100) INTO (XI U)/TOTAL				(P4)/TOTAL	
R4	0.01		TRIPP	67 RVUE	ASSUMING R1=0.29	8/67
R5	0.1	OR LESS	FLATTE	67 HBC		8/67
R5	Y*0(2100) INTO (LAMBDA OMEGA)/TOTAL				(P5)/TOTAL	
R6	Y*0(2100) INTO (KBAR N PI)/TOTAL				(P6)/TOTAL	
R6	SEEN		BCCK	65 HBC		

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REFERENCES -- Y*0(2100)

BOCK 65 PL 17 166 +COOPER,FRENCH,KINSON, + //CERN,SACLAY

WOHL 66 PRL 17 107 C G WOHL, F T SOLMITZ, M L STEVENSON //LRL IJP

FLATTE 67 PR 155 1517 S M FLATTE //LRL

TRIPP 67 NP (ACCEPTED) + LEITH, + //LRL,SLAC,CERN,HEIDEL,SACLAY

FLATTE 67 PR (SUBMITTED) S M FLATTE, C G WOHL //LRL

ABRAMS 67 PRIVATE COMM. +COOL,GIACOMELLI,KYCIA,LEONTIC,LI, + //BNL I

GALTIERI 67 PRIVATE COMM L BARBARO-GALTIERI //LRL

PAPER NOT REFERRED TO IN DATA CARDS.

COOL 66 PRL 16 1228 +GIACOMELLI,KYCIA,LEONTIC,LI,LUNDBY,+//BNL I
-- REPLACED BY ABRAMS 67.

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Λ(2350)

42 Y*0(235C, JP=) I=0

42 Y*0(235C) MASS (MEV) ------------------------------

M	2352.0	11.0	ABRAMS	67 CNTR	K+P, D TCTAL	8/67

----------------- 42 Y*0(235C) WIDTH (MEV) ------------------------------

W	210.0	50.0	ABRAMS	67 CNTR	8/67

----------------- 42 Y*0(235C) PARTIAL DECAY MODES ---------------------

P1	Y*0(2350) INTO KBAR N	S11S17

----------------- 42 Y*0(235C) BRANCHING RATIOS ---------------------

R1	Y*0(2350) INTO (KBAR N)/TOTAL				(P1)/TOTAL	
R1	0.136	0.02	ABRAMS	67 CNTR		8/67

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REFERENCES -- Y*C(2350)

ABRAMS 67 PRIVATE COMM. +COOL,GIACOMELLI,KYCIA,LEONTIC,LI, + //BNL I

PAPER NOT REFERRED TO IN DATA CARDS.

COOL 66 PRL 16 1228 +GIACOMELLI,KYCIA,LEONTIC,LI,LUNDBY,+//BNL I
-- REPLACED BY ABRAMS 67.

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Σ(1385)

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

FOR THE TABLES WE USE ONLY THE UNSTARRED DATA, WHICH ARE ATTEMPTS TO OBTAIN THE SEPARATE CHARGE-STATE MASSES AND WIDTHS. SEE HOWEVER THE IDEOGRAMS INSERTED IN LISTINGS. THESE INDICATE SERIOUS SYSTEMATICS, PERHAPS ARISING FROM INTERFERENCE EFFECTS THAT CHANGE WITH PRODUCTION MECHANISM AND BEAM MOMENTUM.

----------------- 43 Y*1(1385) MASS (MEV) ------------------------------

M	*	141	1384.0		ALSTON	60 HBC	+-	K-P 1.15 BEV/C	
M	*	38	1384.0		MARTIN	61 HBC	C+	K20 P .98 BEV/C	
M	*		1385.0		BERGE	61 HBC	+-	K-P .4-.85 BEV/C	
M	*		1392.0	7.0	COLLEY	62 PBC	C-	PI- PRP 2. BEV/C	
MO	*	106	1381.0	4.0	CURTIS	63 SPRK	C	PI-P 1.5 BEV/C	
M	*		1392.0	10.0	MUSGRAVE	65 HBC	+-C	PBAR P 3-4 BEV/C	7/66
M	*		1389.0	3.0	BALTAY	65 HBC	+-	PBAR P 3.7 BEV/C	7/66
M+		154	1376.0	3.0	ELY	61 PBC	+	K-P 1.11 BEV/C	
M+		170	1375.0	3.9	COOPER	64 HBC	+	K-P 1.45 BEV/C	
M+		859	1381.0	1.6	HUWE	66 HBC	+	K-P 1.22 BEV/C	
M+			1382.0	1.0	ARMENTERC	65 HBC	+	K-P .9-1.2 BEV/C	
M+			1378.0	5.0	LONDON	66 HBC	+	K-P 2.24 BEV/C	7/66
M+			1384.3	1.1	COLTON	66 HBC	+	K-P 1.8 BEV/C	9/66
M+			1382.6	1.4	COLTON	66 HBC	+	K-P 1.95 BEV/C	9/66
M-		93	1382.0	3.0	DAHL	61 DBC	-	K-D 0.45 BEV/C	
M-		224	1376.0	3.0	ELY	61 PBC	-		
M-		200	1392.0	6.2	COOPER	64 HBC	-		
M-		1086	1385.3	1.5	HUWE	64 HBC	-		
M-			1384.0	1.0	ARMENTERC	65 HBC	-		
M-			1389.0	9.0	LONDON	66 HBC	-		7/66
M-			1391.5	1.8	COLTON	66 HBC	-	K-P 1.8 BEV/C	9/66
M-			1399.8	1.4	COLTON	66 HBC	-	K-P 1.95 BEV/C	9/66

----------------- 43 Y*(-) - Y*(+) MASS DIFFERENCE (MEV) ---------------

D	R	0.0	4.2	ELY	61 PBC	+-	K-P 1.11 BEV/C	8/66
D	R	4.3	2.2	HUWE	64 HBC	+-	K-P 1.22 BEV/C	8/66
D	R	2.0	1.5	ARMENTERC	65 HBC	+-	K-P .9-1.2 BEV/C	8/66
D	R	11.0	9.0	LONDON	66 HBC	+-	K-P 2.24 BEV/C	8/66
D	R	7.2	2.1	COLTON	66 HBC	+-	K-P 1.8 BEV/C	9/66
D	R	17.2	2.0	COLTON	66 HBC	+-	K-P 1.95 BEV/C	9/66
	R	REDUNDANT WITH DATA IN MASS LISTING.						
D		9.0	6.0	LONDON	66 HBC	+-	LAMBDA 3 PI EVTS	7/66

----------------- 43 Y*1(1385) WIDTH (MEV) ------------------------------

W	*	64.0		ALSTON	60 HBC	+-		
W	*	20.0	OR LESS	MARTIN	61 HBC	C+		
W	*	40.0		BERGE	61 HBC	+-		
W	*	80.0	10.0	COLLEY	62 PBC	C-		
W	*	30.0	9.0	CURTIS	63 SPRK	0		
W	*	38.0	9.0	MUSGRAVE	65 HBC	+-0		7/66
W	*	26.0	5.0	BALTAY	65 HBC	+-		7/66
W+		46.0	8.0	ELY	61 PBC	+		
W+		51.0	10.0	COOPER	64 HBC	+		
W+		46.5	3.0	HUWE	64 HBC	+		
W+		32.0	3.0	ARMENTERC	65 HBC	+		
W+		30.3	3.1	COLTON	66 HBC	+	K-P 1.8 BEV/C	9/66
W+		33.1	3.6	COLTON	66 HBC	+	K-P 1.95 BEV/C	9/66
W		40.0		DAHL	61 DBC	-		
W-		66.0	10.0	ELY	61 PBC	-		
W-		88.0	10.0	COOPER	64 HBC	-		
W-		62.0	7.0	HUWE	64 HBC	-		
W-		38.0	3.0	ARMENTERO	65 HBC	-		
W-		29.2	5.7	COLTON	66 HBC	-	K-P 1.80 BEV/C	9/66
W-		17.1	4.4	COLTON	66 HBC	-	K-P 1.95 BEV/C	9/66

----------------- 43 Y*1(1385) PARTIAL DECAY MODES ---------------------

P1	Y*1(1385) INTO LAMBDA PI	S18S 8
P2	Y*1(1385) INTO SIGMA PI	S20S 8

----------------- 43 Y*1(1385) BRANCHING RATIOS ---------------------

R1		Y*1(1385) INTO (SIGMA PI)/(LAMBDA PI)					(P2)/(P1)	
R1		0.04	0.04	BASTIEN	61 HBC	+-		
R1	*	0.04	OR LESS	ALSTON	62 HBC	+-0		
R1		0.09	0.04	HUWE	64 HBC	+-		
R1		0.163	0.035	ARMENTERC	65 HBC	+-		7/66
R1		0.08	0.06	LONDON	66 HBC	+		7/66

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REFERENCES -- Y*1(1385)

ALSTON 60 PRL 5 520 +ALVAREZ,EBERHARD,GOOD,GRAZIANO, + //LRL I

DAHL 61 PRL 6 142 +HORWITZ,MILLER,MURRAY,WHITE //LRL

MARTIN 61 PRL 6 283 +LEIPUNER,CHINOWSKY,SHIVELY, + //BNL,YALE

BERGE 61 PRL 6 557 +BASTIEN,DAHL,FERRO-LUZZI,KIRZ, + //LRL

BASTIEN 61 PRL 6 702 P BASTIEN,M FERRO-LUZZI,A H ROSENFELD//LRL

ELY 61 PRL 7 461 +FUNG,GIDAL,PAN,POWELL,WHITE //LRL J

ALSTON 62 CERN CONF 311 +ALVAREZ,FERRO-LUZZI,ROSENFELD, + //LRL

COLLEY 62 PR 128 1930 +GELFAND,NAUENBERG, + //COLUMBIA,RUTGERS JP

CURTIS 63 PR 132 1771 +CUFFIN,MEYER,TERWILLIGER //MICH J

COOPER 64 PL 8 365 +FILTHUTH,FRIDMAN,MALAMUD, + //CERN,AMSTR

HUWE 64 UCRL-11291 THESIS D O HUWE //LRL JP

MUSGRAVE 65 NC 35 735 +PETMEZAS,+//BIRMGHM,CERN,EP,IMPCOL,SACLAY

ARMENTER 65 PL 19 75 ARMENTEROS, + //CERN,HEIDEL,SACLAY

BALTAY 65 PR 140 B1027 +SANDWEISS,TAFT,CULWICK,KOPP, + //YALE,BNL

LONDON 66 PR 143 1034 +RAU,SAMIOS,YAMAMOTO,GOLDBERG,+ //BNL,SYCR J

COLTON 66 H E P MEMO 27 +TICHO,DAUBER,SCHLEIN,SLATER,SMITH,+//UCLA

QUANTUM NUMBER DETERMINATIONS NOT REFERRED TO IN DATA CARDS.

SHAFER 64 PR 134 B1372 J B SHAFER, D O HUWE //LRL JP

MALAMUD 64 PL 10 145 E MALAMUD, P E SCHLEIN //CERN,UCLA JP

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Σ(1660)

44 Y*1(1660, JP=3/2-) I=1

THE Y*1(1660) IS DIFFICULT TO STUDY IN FORMATION EXPERIMENTS BECAUSE (1) IT COUPLES ONLY SLIGHTLY TO THE KBAR N CHANNEL, AND (2) THERE ARE NEIGHBORING RESONANCES, THE Y*0(1670) AND Y*0(1700) AND PERHAPS OTHERS YET UNDETECTED, TO COMPLICATE THE ANALYSIS. THE LAMBDA PI CHANNEL HAS INDICATED THE PROBABLE JP=3/2- ASSIGNMENT. THERE IS NOT MUCH AGREEMENT BETWEEN FORMATION AND PRODUCTION EXPERIMENTS ON BRANCHING RATIOS.

THERE IS ALSO DISAGREEMENT AMONG EXPERIMENTS PRODUCING CHARGED Y*1(1660) AT DIFFERENT ENERGIES. THUS EVEN WHEN THE I=1 STATE IS LOOKED AT ALONE THERE ARE PROBLEMS. HOWEVER, EXCEPT FOR LEVEQUE 65 THE EXPERIMENTS DO AGREE THAT THE MOST PROBABLE JP ASSIGNMENT IS 3/2-.

----------------- 44 Y*1(1660) MASS (MEV) ------------------------------

M	1685.0		ALEXANDER	62 HBC	C-	PI-P 2-2.2 BEV/C	
M	1660.0	10.0	ALVAREZ	63 HBC	+	K-P 1.51 BEV/C	
M	1660.0		BERLEY	64 HBC	C	K-P TO LAM PIO	7/66
M	1645.0	7.0	LEVEQUE	65 HBC	+	K-P TO Y*1660 PI	7/66
M	1662.0	5.0 Y	DAVIES	67 CNTR		K-P, D TCTAL	11/66
M	1665.0	3.0	ARMENTERC	67 HBC	C	K-P TO SIGMA PI	8/67

(Ideogram on next page)

----------------- 44 Y*1(1660) WIDTH (MEV) ------------------------------

W	45.0		ALEXANDER	62 HBC	C-		
W	40.0	10.0	ALVAREZ	63 HBC	+		
W	60.0		BERLEY	64 HBC	C		7/66
W	55.0	10.0	LEVEQUE	65 HBC	+		7/66
W	45.0	15.0	DAVIES	67 CNTR			11/66
W	32.0	4.0	ARMENTERO	67 HBC	0	K-P TO SIGMA PI	8/67

(Ideogram on next page)

----------------- 44 Y*1(1660) PARTIAL DECAY MODES ---------------------

P1	Y*1(1660) INTO KBAR N	S11S17
P2	Y*1(1660) INTO LAMBDA PI	S18S 8
P3	Y*1(1660) INTO SIGMA PI	S20S 8
P4	Y*1(1660) INTO LAMBDA PI PI	S18S 8S 8
P5	Y*1(1660) INTO SIGMA PI PI	S20S 8S 8
P6	Y*1(1660) INTO Y*1(1385) PI	U43S 8
P7	Y*1(1660) INTO Y*0(1405) PI	U37S 8

----------------- 44 Y*1(1660) BRANCHING RATIOS ---------------------

R1		Y*1(1660) INTO (KBAR N)/TOTAL					(P1)/TOTAL	
R1		0.05	OR LESS	ALVAREZ	63 HBC	+		
R1	*	0.16	OR MORE	BASTIEN 2	63 HBC	C		
R1		0.2	OR LESS	LONDON	66 HBC	+		7/66
R1		0.065		DAVIES	66 CNTR		ASSUMING J=3/2	11/66
R2		Y*1(1660) INTO (LAMBDA PI)/TOTAL					(P2)/TOTAL	
R2		0.32		ALVAREZ	63 HBC	+		
R2		0.09	OR LESS	BASTIEN 2	63 HBC	0		
R2		0.2	OR LESS	LONDON	66 HBC	+		7/66
R2		0.06	0.06	SMART	65 DBC	-	ASSUMING R1=0.15	7/66
R2		0.45		ARMENTERC	66 HBC	0	ASSUMING R1=0.15	9/66

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R3          Y*1(1660) INTO (SIGMA PI)/TOTAL                        (P3)/TOTAL
R3               0.27                      ALVAREZ    63 HBC  +
R3   *           0.22       0.06           BASTIEN 2 63 HBC   C
R3               0.25       0.15           LONDON     66 HBC  +                     7/66
R3               0.67       0.10           ARMENTERC 67 HBC    C ASSUMING R1=0.10   8/67
                        (Ideogram below)
R4          Y*1(1660) INTO (LAMBCA PI PI)/TOTAL                    (P4)/TOTAL
R4               0.18                      ALVAREZ    63 HBC  +
R4   *           0.16       0.05           BASTIEN 2 63 HBC   0
R4               0.2          OR LESS      LONDON     66 HBC  +                     7/66

R5          Y*1(1660) INTO (SIGMA PI PI)/TOTAL                     (P5)/TOTAL
R5               0.18                      ALVAREZ    63 HBC  +
R5   *           0.25       0.06           BASTIEN 2 63 HBC   C

R6          Y*1(1660) INTO (Y*0(1405) PI)/TOTAL                    (P7)/TOTAL
R6               0.75       0.25           LONCON     66 HBC  +                     7/66

R7          Y*1(1660) INTO (KBAR N)/(LAMBDA PI)                    (P1)/(P2)
R7               0.43         OR MORE      SMITH      63 HBC  C-

R8          Y*1(1660) INTO (SIGMA PI)/(LAMBDA PI)                  (P3)/(P2)
R8               0.86                      SMITH      63 HBC  C-
R8               6.8        3.0            HUWE       64 HBC  +

R9          Y*1(1660) INTO (LAMBCA PI PI)/(LAMBCA PI)              (P4)/(P2)
R9               0.14                      SMITH      63 HBC  C-

R10         Y*1(1660) INTO (Y*0(1405) PI)/(SIGMA PI PI)            (P7)/(P5)
R10              0.90       0.10      0.16 EBERHARC   65          +                 7/66

R11         Y*1(1660) INTO (Y*0(1405) PI)/(Y*1(1385) PI)           (P7)/(P6)
R11              0.8          OR MORE      EBERHARC   65          +                 7/66

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REFERENCES -- Y*1(1660)


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ALEXANDE 62 CERN CONF 320      ALEXANDER,JACOBS,KALBFLEISCH,MILLER,+//LRL   I
ALVAREZ  63 PRL 10 184         +ALSTCN,FERRO-LUZZI,HUWE, +           //LRL  I
BASTIEN2 63 UCRL-10779 THESIS  P L BASTIEN                           //LRL  IJ
SMITH    63 ATHENS CONF 67     G A SMITH                             //LRL
HUWE     64 UCRL-11291 THESIS  D O HUWE                              //LRL
BERLEY   64 DUBNA CONF I 565   +CONNCLLY,HART,RAHM,STONEHILL, +      //BNL  IJP
EBERHARC 65 PRL 14 466         +SHIVELY,ROSS,SIEGAL,FICENEC, +  //LRL,ILL   I
LEVEQUE  65 PL 18 69            +     //SACLAY,EP,GLASGOW,IMPCOL,OXF,RTHFD  JP
LONDON   66 PR 143 1034        +RAU,SAMIOS,YAMAMOTO,GOLCBERG,+ //BNL,SYCR   IJ
SMART    66 PRL 17 556         W M SMART,A KERNAN,G E KALMUS,R P ELY//LRL IJP
ARMENTER 66 BERKELEY CONF      ARMENTEROS,F-LUZZI, + //CERN,HEIDEL,SACLAY IJP
ARMENTER 67 PL 24B 193         ARMENTEROS,FERRO-LUZZI+///CERN,HEID,SACLAY JP
DAVIES   67 PRL 18 62          +COWELL,HATTERSLEY,HCMER+//BIRMI,CAMB,RUTH
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PAPERS NOT REFERRED TO IN DATA CARCS.


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BASTIEN1 63 PRL 10 188         P L BASTIEN, J P BERGE                //LRL  IJ
     --  REPLACED BY BASTIEN 2, BUT SIMILAR AND MORE READILY AVAILABLE.
T-ZACEH  63 PRL 11 470         TAHER-ZADEH,PROWSE,SCHLEIN,SLATER,+ //UCLA   JP
     --  SEE NOTE FOLLOWING SCHLEIN 66.
SLATER   65 BAPS 10 1196       +CAUBER, SCHLEIN, STORK, TICHO       //UCLA  JP
LEE      66 PRL 17 45          Y Y LEE, D D REEDER, R W HARTUNG     //WISC  JP
SCHLEIN  66 UCLA-1016          P E SCHLEIN, T G TRIPPE              //UCLA  JP
     --  REANALYZES DATA OF TAHER-ZADEH 63 AND BASTIEN 63 AND ALL PUBLISHED
         LAMBDA PI CROSS SECTION DATA IN THE LIGHT OF THE NOW KNOWN
         Y*1(1765) AND REVERSES THE MODEL-DEPENDENT CONCLUSION OF TAHER-
         ZADEH ON THE PREFERRED JP ASSIGNMENT (FROM 3/2+ TO 3/2-).
EBERHARC 67 PREPRINT           +PRIPSTEIN,SHIVELY,KRUSE,SWANSON //LRL,ILL IJP
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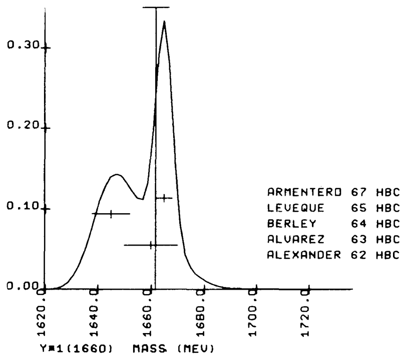
WEIGHTED AVERAGE =1661.76 +/- 4.95
SCALE = 1.86   CHISQ = 6.9   CONLEV = 0.031



Σ (1680)

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           L58  Y*1(1690, JP=    ) I=1

           L58  Y*1(1690) MASS (MEV)

M        30 1715.0      12.0              COLLEY     67 HBC  +  K-P AT 6.0 GEV/C   8/67
M        53 1683.0      15.0              DERRICK    67 HBC  +  K-P AT 5.5 GEV/C   8/67

           L58  Y*1(1690) WIDTH (MEV)

W        30  100.0      35.0              COLLEY     67 HBC  +  K-P AT 6.0 GEV/C   8/67
W        53  120.       30.               DERRICK    67 HBC  +  K-P AT 5.5 GEV/C   8/67

           L58  Y*1(1690) PARTIAL DECAY MODES

P1    Y*1(1690) INTO KBAR N                                   S11S17
P2    Y*1(1690) INTO LAMBDA PI                                S18S 9
P3    Y*1(1690) INTO SIGMA  PI                                S20S 8
P4    Y*1(1690) INTO Y*1(1385) PI                             U43S 8

           L58  Y*1(1690) BRANCHING RATIOS

R1    Y*1(1690) INTO (LAMBDA PI)/(KBAR N)                    (P2)/(P1)
R1       18     0.80       0.50           COLLEY     67 HBC  +  K0 BAR FIN.STATE   8/67
R1       15     0.6        0.40           DERRICK    67 HBC  +  K0 BAR FIN.STATE   8/67

R2    Y*1(1690) INTO (SIGMA PI)/(LAMBCA PI)                  (P3)/(P2)
R2              0.3        0.3            COLLEY     67 HBC  +  CHARG.SIGMA F.S.   8/67
R2              0.25    OR  LESS          DERRICK    67 HBC  +  NEUTR. SIGMA F.S   8/67

R3    Y*1(1690) INTO (Y*1(1385) PI)/(LAMBDA PI)              (P4)/(P2)
R3       14     1.0        0.3            DERRICK    67 HBC  +  LAMBDA 2PI F.S.    8/67
R3              0.49       0.29           COLLEY     67 HBC  +  LAMBDA 2PI F.S.    8/67

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REFERENCES -- Y*1(1690)


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COLLEY   67 PL 24B 489         +MACDCNALD,MUSGRAVE+/BI,LG,IC MPI,OXF,RUTH
DERRICK  67 PRL 18 266         +FIELCS,LOKEN,AMMAR,CAVIS//ARGONNE,NORTHWE
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Σ(1765)

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

             45  Y*1(1765) MASS (MEV)      ----------------------------

M           1765.0      10.0           GALTIERI  63 DBC  C  K-D 1.51 BEV/C
M           1755.0      10.0           ARMENTERC 65 HBC  0  K-P TO Y*1520 PI   7/66
M           1760.0      10.0           BELL 1,2  66 DBC  -  K-N TO Y*1520 PI   7/66
M           1746.0       8.0           FENSTER   66 HBC  0  K-P TO Y*1520 PI   9/66
M    N      1758.0      11.0           GELFAND   66 HBC   0 BGD PURE IMAG      8/67
M    N      1758.0      11.0           LEVI SETT 66 RVUE    SOME REAL BGD      9/66
     N    RES + DIFFRACTIVE BGD FOR K-P EL.  DATA ARE IN ARMENT 66 FITS TOO.
M           1776.0       6.0           SMART     66 DBC  -  K-N TO LAM PI-     7/66
M           1766.0       4.0           ARMENTER1 67 HBC   C K-P ELAST+CH.EX    8/67
M           1775.0       5.0           DAVIES    67 CNTR    K-P, D TOTAL      11/66

----------------  45  Y*1(1765) WIDTH (MEV)  ----------------------------

W             60.0      10.0           GALTIERI  63 DBC  0
W             70.0      20.0           BELL 2    66 DBC  -                     7/66
W            129.0      16.0           SMART     66 DBC  -                     7/66
W             70.0      20.0           FENSTER   66 HBC  C                     9/66
W    N       113.0      25.0           LEVI SETT 66 RVUE    SOME REAL BGD      9/66
W    N       113.0      25.0           GELFAND   66 HBC   0 BGD PURE IMAG      8/67
     N    RES + DIFFRACTIVE BGD FOR K-P EL.  DATA ARE IN ARMENT 66 FITS TOO.
W            114.0       8.0           ARMENTER1 67 HBC   C K-P ELAST+CH.EX    8/67
5W           120.0      20.0           DAVIES    67 CNTR                       6
                              (Ideogram below)
----------------  45  Y*1(1765) PARTIAL DECAY MODES  --------------------

P1          Y*1(1765) INTO KBAR N                           S11S17
P2          Y*1(1765) INTO LAMBDA PI                        S18S 9
P3          Y*1(1765) INTO SIGMA PI                         S20S 8
P4          Y*1(1765) INTO SIGMA ETA                        S21S14
P5          Y*1(1765) INTO Y*1(1385) PI                     U43S 8
P6          Y*1(1765) INTO Y*0(1520) PI                     U38S 8

----------------  45  Y*1(1765) BRANCHING RATIOS  ----------------------

R1     Y*1(1765) INTO (KBAR N)/TOTAL                        (P1)/TOTAL
R1   *         0.6                       GALTIERI  63 HBC  0  K-P RVUE
R1             0.53      0.09            UHLIG     66 HBC  C                      9/66
R1   N         0.46      0.05            GELFAND   66 HBC   0 BGD PURE IMAG       8/67
R1   N         0.46      0.05            LEVI SETT 66 RVUE    SOME REAL BGD       9/66
     N    RES + DIFFRACTIVE BGD FOR K-P EL.  DATA ARE IN ARMENT 66 FITS TOO.
R1             0.34                      ABRAMS    67 CNTR    TOTAL CROSS-SEC.    8/67
R1             0.45      0.02            ARMENTER1 67 HBC   C K-P ELAST+CH.EX     8/67
R1             0.43                      DAVIES    67 CNTR                       11/66

R2     Y*1(1765) INTO (LAMBDA PI)*(KBAR N)/TOTAL**2         (P2*P1)/TOTAL**2
R2             0.090     0.025           ARMENTERO 66 HBC    0
R2             0.07      0.01            SMART     66 DBC   -                     9/66

R3     Y*1(1765) INTO (Y*0(1520) PI)*(KBAR N)/TOTAL**2      (P3*P1)/TOTAL**2
R3             0.075     0.015           ARMENTERO 66 HBC    0HYPERONS FIN.ST.    9/66
R3             0.12      0.03            FENSTER   66 HBC    0KBAR N  FIN. ST.    9/66
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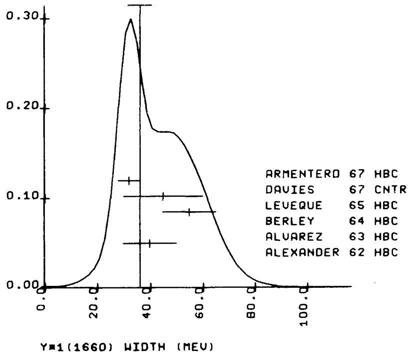
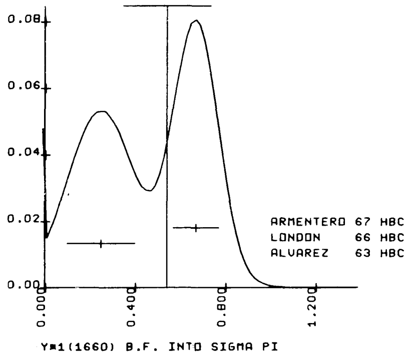
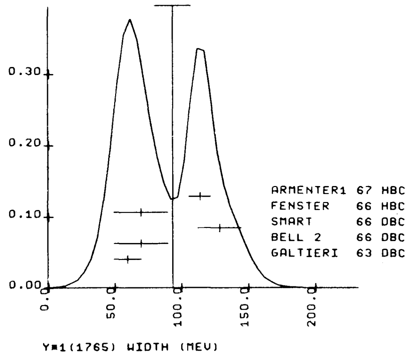
WEIGHTED AVERAGE =36.23 +/- 4.43
SCALE = 1.31   CHISQ = 5.1   CONLEV = 0.163



WEIGHTED AVERAGE =0.541 +/- 0.194
SCALE = 2.33   CHISQ = 5.4   CONLEV = 0.020



WEIGHTED AVERAGE =93.7 +/- 13.6
SCALE = 2.52   CHISQ = 25.5   CONLEV = .001



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R4     Y*1(1765) INTC (Y*1(1385) PI)*(KBAR N)/TCTAL**2    (P4*P1)/TOTAL**2
R4             0.09     0.03           ARMENTER2 67 HBC   C K-P TO LAM.PI PI   8/67

R5     Y*1(1765) INTO (SIGMA PI)*(KBAR N)/TOTAL **2       (P5*P1)/TCTAL**2
R5             0.005    0.003          ARMENTERC 67 HBC   C K-P TO SIGMA PI    8/67

R6     Y*1(1765) INTO (LAMBDA PI)/(KBAR N)                (P2)/(P1)
R6             0.33     0.05           UHLIG     67 HBC   0 K-P,.9 GEV/C       9/66

R7     Y*1(1765) INTO (Y*0(1520)/(KBAR N)                 (P3)/(P1)
R7             0.28     0.05           UHLIG     67 HBC   C K-P,.9 GEV/C       9/66

R8     Y*1(1765) INTO (Y*1(1385)/(KBAR N)                 (P4)/(P1)
R8             0.25     0.09           UHLIG     67 HBC   C K-P,.9 GEV/C       9/66

R9     Y*1(1765) INTO(SIGMA ETA)/TOTAL                    (P5)/TOTAL
R4             0.02        APPROX      ARMENTERC 66 HDBC C-                    9/66

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REFERENCES -- Y*1(1765)


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GALTIERI 63 PL 6 296          A BARBARO-GALTIERI,A HUSSAIN,RD TRIPP//LRL IJ
ARMENTER 65 PL 19 338         ARMENTEROS, +      //CERN,HEIDELBERG,SACLAY IJP
BELL 1   66 PRL 16 203        R B BELL, R W BIRGE, Y-L PAN, R T PU //LRL IJP
BELL 2   66 UCRL-16936 THESIS R B BELL                            //LRL IJP
FENSTER  66 PRL 17 641        +GELFAND,HARMSEN,L-SETTI,+ //CHI,ARG(CERN) IJP
GELFAND  66 PRL 17 1224       +HARMSEN,LEVI-SETTI,PREDAZZI+//EFINS,ARGON
LEVI SET 66 BERKELEY CONF     R LEVI SETTI, E PREDAZZI               //CHI
SMART    66 PRL 17 556        W M SMART,A KERNAN,G F KALMUS,R P ELY//LRL IJP

ABRAMS   67 PRIVATE COMM.     +COOL,GIACOMELLI,KYCIA,LEONTIC,LI, + //BNL  I
ARMENTER 67 PL 24B 198        ARMENTEROS,FERRO-LUZZI+///CERN,HEID,SACLAYIJP
ARMENTE1 67  CERN 67-17 TBP   ARMENTEROS,FERRO-LUZZI+///CERN,HEID,SACLAYIJP
ARMENTE2 67 ZEIT.PHYS.202,486 ARMENTEROS,FERRO-LUZZI+///CERN,HEID,SACLAY
DAVIES   67 PRL 18 62         +COWELL,HATTERSLEY,HOMER+//BIRMI,CAMB,RUTH
UHLIG    67 PR 155 1446       +CHARLTON,CONDON,GLASSER,YODH,+///MD,USNRL
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PAPERS NOT REFERRED TO IN DATA CARDS.

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YODH     65 ATHENS CONF 269   G B YODH                        //MARYLAND IJ
BIRGE    65 ATHENS CONF 296   +ELY,KALMUS,KERNAN,LOUIE,SAHOURIA, + //LRL IJP
     -- YODH 65 AND BIRGE 65 ARE PRECURSORS OF UHLIG 66 AND BELL 66.
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Σ(1780)

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                 57  Y*1(1780, JP=     ) I=1

                 SIGMA ETA THRESHOLD EFFECT.  INTERPRETATION AS RESONANCE
                 NOT CONCLUSIVE.  SEE FERRO-LUZZI 66.  OMITTED FROM TABLE

-----------------  57  Y*1(1780) MASS (MEV)    ------------------------------

M          1780.0                  CLINE     66 DBC  -  K-N TO SIG- ETA   9/66

-----------------  57  Y*1(1780) WIDTH (MEV)   ------------------------------

W           100.0                  CLINE     66 DBC  -                    9/66

-----------------  57  Y*1(1780) PARTIAL DECAY MODES    --------------------

P1         Y*1(1780) INTO KBAR N                          S11S17
P2         Y*1(1780) INTO SIGMA ETA                       S20S14

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REFERENCES -- Y*1(1780)


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FERRO-LU 66 BERKELEY 183      ARMENTEROS+FERRO-LUZZI+//CERN,HEIDE,SACLAY
CLINE    67 PL 25B 41         CLINE,OLSSON/////////////////////WISCONSIN
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Σ(1915)

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                 46  Y*1(1915, JP=5/2+) I=1

                 PERHAPS SOME SLIGHT RESERVATION SHOULD BE HELD AGAINST
                 COMPLETE ACCEPTANCE OF THE INTERPRETATION OF THIS EFFECT
                 AS (1) BEING A RESONANCE (2) HAVING JP = 5/2+.

-----------------  46  Y*1(1915) MASS (MEV)    ------------------------------

M    *    1942.0     9.0           BOCK      65 HBC     PBAR P 5.7 BEV/C
M         1915.0    20.0           COOL      66 CNTR C- K-P, D TOTAL      7/66
M         1905.0     5.0           DAVIES    66 CNTR    K-P, D TOTAL     11/66

-----------------  46  Y*1(1915) WIDTH (MEV)   ------------------------------

W    *      36.0    20.0    36.0   BOCK      65 HBC
W           65.0                   COOL      66 CNTR C-                   7/66
W           60.0    20.0           DAVIES    66 CNTR                     11/66

-----------------  46  Y*1(1915) PARTIAL DECAY MODES    --------------------

P1         Y*1(1915) INTO KBAR N                          S11S17
P2         Y*1(1915) INTO LAMBDA PI                       S18S 8
P3         Y*1(1915) INTO SIGMA PI                        S20S 8

-----------------  46  Y*1(1915) BRANCHING RATIOS   ------------------------

R1         Y*1(1915) INTO (KBAR N)/TOTAL               (P1)/TOTAL
R1             0.103               COOL      66 CNTR    ASSUMING J=5/2    7/66
R1             0.09                ABRAMS    67 CNTR    TOTAL CROSS-SEC.  8/67
R1   *         0.1                 DAVIES    66 CNTR    ASSUMING J=5/2   11/66

R2         Y*1(1915) INTO (LAMBDA PI)/TOTAL            (P2)/TOTAL
R2             0.12     0.08       SMART     66 DBC  -  ASSUMING R1=0.10  7/66
R2   *         0.10                ARMENTERO 66 HBC  C  ASSUMING R1=0.06  9/66

R3         Y*1(1915) INTO (SIGMA PI)/TOTAL             (P3)/TOTAL
R3   *         0.03     0.02       ARMENTERO 66 HBC  0  ASSUMING R1=0.06  9/66
R3   *         0.00     0.01       ARMENTERO 67 HBC  C ASSUMING R1=.06    8/67

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REFERENCES -- Y*1(1915)


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BOCK     65 PL 17 166         +COOPER,FRENCH,KINSON, +      //CERN,SACLAY  I
COOL     66 PRL 16 1228       +GIACOMELLI,KYCIA,LEONTIC,LI,LUNDBY,+//BNL  I
SMART    66 PRL 17 556        W M SMART,A KERNAN,G F KALMUS,R P ELY//LRL IJP
ABRAMS   67 PRIVATE COMM.     +COOL,GIACOMELLI,KYCIA,LEONTIC,LI, + //BNL  I
ARMENTER 67 PL 24B 198        ARMENTEROS,FERRO-LUZZI+///CERN,HEID,SACLAY
DAVIES   67 PRL 18 62         +COWELL,HATTERSLEY,HOMER+//BIRMI,CAMB,RUTH I
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Σ(2030)

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                 47  Y*1(2030, JP=7/2+) I=1
                 47  Y*1(2030) MASS (MEV)    --------------------------

U47M    *     2022.0     20.0           BLANPIED  65 CNTR 0  GAMMA P TO K+ Y
U47M          2030.0     20.0           WOHL      66 HBC  0  K-P TO LAM PIC
U47M          2026.0     19.0           ABRAMS    67 CNTR    K-P, D TOTAL

-------------------  47  Y*1(2030) WIDTH (MEV)   ------------------------

U47W    *      120.0     20.0           BLANPIED  65 CNTR 0
U47W           170.0                    WOHL      66 HBC  0
U47W           120.0     10.0           ABRAMS    67 CNTR

-------------------  47  Y*1(2030) PARTIAL DECAY MODES   ----------------

U47P1         Y*1(2030) INTO KBAR N                        S11S17
U47P2         Y*1(2030) INTO LAMBDA PI                     S18S 9
U47P3         Y*1(2030) INTO SIGMA PI                      S20S 6
U47P4         Y*1(2030) INTO XI K                          S22S11

-------------------  47  Y*1(2030) BRANCHING RATIOS   -------------------

U47R1         Y*1(2030) INTO (KBAR N)/TCTAL                (P1)/TOTAL
U47R1             0.25                  WOHL      66 HBC  0  K-P CH EX
U47R1             0.105     0.005       ABRAMS    67 CNTR

U47R2         Y*1(2030) INTO (LAMBDA PI)/TOTAL             (P2)/TOTAL
U47R2             0.16                  WOHL      66 HEC  0  ASSUMING R1=0.2

U47R3         Y*1(2030) INTO (SIGMA PI)/TOTAL              (P3)/TOTAL
U47R3             0.06                  GALTIERI  67 HBC  0 ASSUMING R1=0.1

U47R4         Y*1(2030) INTO (XI K)/TOTAL                  (P4)/TOTAL
U47R4             0.016      OR LESS    TRIPP     67 RVUE    ASSUMING R1=0.1

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REFERENCES -- Y*1(2030)


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BLANPIED 65 PRL 14 741        +GREENBERG,HUGHES,KITCHING,LU,+//YALE(CEA)
WOHL     66 PRL 17 107        C G WOHL, F T SOLMITZ, M L STEVENSON //LRL IJP
TRIPP    67 NP (ACCEPTED)     + LEITH, +   //LRL,SLAC,CERN,HEIDEL,SACLAY
ABRAMS   67 PRIVATE COMM.     +COOL,GIACOMELLI,KYCIA,LEONTIC,LI, + //BNL  I
GALTIERI 67 PRIVATE COMM      L BARBARO-GALTIERI                     //LRL
```

PAPERS NOT REFERRED TO IN DATA CARDS.

```
SMART    66 PRL 17 556        W M SMART,A KERNAN,G F KALMUS,R P ELY//LRL IJP
ARMENTER 66 BERKELEY CONF     ARMENTEROS,F-LUZZI, + //CERN,HEIDEL,SACLAY IJP
     -- SMART 66 AND ARMENTEROS 66 TEND TO CONFIRM THE JP ASSIGNMENT.
COOL     66 PRL 16 1228       +GIACOMELLI,KYCIA,LEONTIC,LI,LUNDBY,+//BNL  I
     -- REPLACED BY ABRAMS 67.
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Σ(2250)

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                 48  Y*1(2250, JP=     ) I=1
---              48  Y*1(2250) MASS (MEV)    ----------------------------

M    *    2245.0                   BLANPIED  65 CNTR    GAMMA P TO K+ Y*
M    *    2299.0     6.0           BOCK      65 HBC     PBAR P 5.7 BEV/C
M         2252.0    10.0           ABRAMS    67 CNTR    K-P, D TOTAL      8/67

-----------------  48  Y*1(2250) WIDTH (MEV)   ----------------------------

W    *     150.0                   BLANPIED  65 CNTR
W    *      21.0    17.0    21.0   BOCK      65 HBC
W          200.0    20.0           ABRAMS    67 CNTR                      8/67

-----------------  48  Y*1(2250) PARTIAL DECAY MODES    ------------------

P1         Y*1(2250) INTO KBAR N                          S11S17
P2         Y*1(2250) INTO KBAR N PI                       S11S17S 8

-----------------  48  Y*1(2250) BRANCHING RATIOS   ----------------------

R1         Y*1(2250) INTO (KBAR N)/TOTAL               (P1)/TOTAL
R1             0.062    0.004      ABRAMS    67 CNTR    ASSUMING J=9/2    8/67

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REFERENCES -- Y*1(2250)


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BLANPIED 65 PRL 14 741        +GREENBERG,HUGHES,KITCHING, +  //YALE(CEA)
BOCK     65 PL 17 166         +COOPER,FRENCH,KINSON, +      //CERN,SACLAY
ABRAMS   67 PRIVATE COMM.     +COOL,GIACOMELLI,KYCIA,LEONTIC,LI, + //BNL  I
```

PAPERS NOT REFERRED TO IN DATA CARDS.

```
DAUBER   66 PL 23 154         +SCHLEIN, SLATER, STORK, TICHO //UCLA(LRL)  J
     -- SUGGESTS J=9/2 RESONANT BEHAVIOR IN SIGMA- PI+, BUT APPEARS
        INCONSISTENT WITH PARAMETERS OF ABRAMS 67.
COOL     66 PRL 16 1228       +GIACOMELLI,KYCIA,LEONTIC,LI,LUNDBY,+//BNL  I
     -- REPLACED BY ABRAMS 67.
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Σ(3000)

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                 59  Y*1(3000, JP=     ) I=1

                 ENHANCEMENT IN LAMBDA PI AND KBAR N INVARIANT MASS
                 SPECTRA AND IN MISSING MASS OF NEUTRALS RECOILING
                 AGAINST KO.  EVIDENCE NOT CONCLUSIVE.  OMITTED FROM
                 TABLE.

-----------------  59  Y*1(3000) MASS (MEV)    ----------------------------

M          3000.0                  EHRLICH   66 HBC  C  PI-P 7.91 BEV/C   9/66

-----------------  59  Y*1(3000) PARTIAL DECAY MODES    ------------------

P1         Y*1(3000) INTO KBAR N                          S11S17
P2         Y*1(3000) INTO LAMBDA PI                       S18S 8

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REFERENCES -- Y*1(3000)


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EHRLICH  66 PR 152 1194       R EHRLICH, W SELOVE, H YUTA    //PENN(BNL)  I
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Ξ(1530)

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                 49  XI*1/2(1530, JP=3/2+) I=1/2
                 49  XI*1/2(1530) MASS (MEV)    ------------------------

M    *    1529.0     5.0           PJERROU   62 HBC  C- K-P 1.8 BEV/C
M    *    1532.0     2.0           BADIER    64 HBC  C- K-P 3 BEV/C
M-        1535.7     3.2           LONDON    66 HBC  -  K-P 2.24 BEV/C    7/66
MO        1528.7     1.1           LONDON    66 HBC  0                    7/66
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```
-----------------   49  XI*(-)-XI*(0) MASS DIFFERENCE (MEV)   ---------------

D            5.7       3.0            PJERROU   65 HBC  0- K-P 1.8-1.95 B/C  7/66
D   R        7.0       4.0            LONDON    66 HBC  C                    7/66
    R     REDUNDANT WITH DATA IN MASS LISTING.
D            2.0       3.2            MERRILL   66 HBC  C- K-P 1.7-2.7 BE/C  7/66

-----------------   49  XI*1/2(1530) WIDTH (MEV)   --------------------------

W            7.0       2.0            SCHLEIN   63 HBC  C  K-P 1.8-1.95 B/C
W            8.5       3.5            LONDON    66 HBC  C                    7/66
W            7.0       7.0            BERGE     66 HBC  C  K-P 1.5-1.7 BE/C  7/66

-----------------   49  XI*1/2(1530) PARTIAL DECAY MODES   -----------------

P1        XI*1/2(1530) INTO XI PI                        S22S 8

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                      REFERENCES -- XI*1/2(1530)

PJERROU  62 PRL 9 114          +PROWSE,SCHLEIN,SLATER,STORK,TICHO  //UCLA  I
SCHLEIN  63 PRL 11 167         +CARMONY,PJERROU,SLATER,STORK,TICHO //UCLA IJP
BADIER   64 DUBNA I 593        +DEMOULIN,GOLDBERG, +    //EP,SACLAY,AMSTR  I
PJERROU  65 PRL 14 275         +SCHLEIN,SLATER,SMITH,STORK,TICHO   //UCLA
LONDON   66 PR 143 1034        +RAU,SAMIOS,YAMAMOTO,GOLDBERG,+ //BNL,SYCR  IJ
BERGE    66 PR 147 945         +EBERHARD,HUBBARD,MERRILL,B-SHAFER,+ //LRL  I
MERRILL  66 UCRL-16455 THESIS D W MERRILL                          //LRL  JP

          QUANTUM NUMBER DETERMINATION NOT REFERRED TO IN DATA CARDS.

SHAFER   66 PR 142 883         BUTTON-SHAFER,LINDSEY,MURRAY,SMITH   //LRL  JP

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Ξ(1705)

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51  XI*1/2(1705, JP=     ) I=1/2

EVIDENCE NOT COMPELLING.  OMITTED FROM TABLE.

                    51  XI*1/2(1705) MASS (MEV)   --------------------------

M          1705.0        APPROX      SMITH     65 HBC  0- K-P 2.1-.7 BEV/C

-----------------   51  XI*1/2(1705) WIDTH (MEV)   --------------------------

W            20.0        APPROX      SMITH     65 HBC  0-

-----------------   51  XI*1/2(1705) PARTIAL DECAY MODES   -----------------

P1        XI*1/2(1705) INTO XI PI                        S22S 8
P2        XI*1/2(1705) INTO LAMBDA KBAR                  S18S11

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                      REFERENCES -- XI*1/2(1705)

SMITH    65 ATHENS CONF 251   G A SMITH, J S LINDSEY                //LRL  I

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Ξ(1815)

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50  XI*1/2(1815, JP=     ) I=1/2

                    50  XI*1/2(1815) MASS (MEV)   --------------------------

M   *      1770.0                     HALSTEINS 63 FBC  C- K-FR 3.5 BEV/C
M          1817.0      7.0            SMITH 1   65 HBC  C- K-P 2.4-.7 BEV/C
M          1814.0      4.0            BADIER    65 HBC  C  K-P 3 BEV/C

-----------------   50  XI*1/2(1815) WIDTH (MEV)   --------------------------

W   *        80.0         OR LESS     HALSTEINS 63 FBC  C-
W            12.0      4.0            BADIER    65 HBC  C
W            30.0      7.0            SMITH 2   65 HBC  C-

-----------------   50  XI*1/2(1815) PARTIAL DECAY MODES   -----------------

P1        XI*1/2(1815) INTO LAMBDA KBAR                  S18S11
P2        XI*1/2(1815) INTO XI PI                        S22S 8
P3        XI*1/2(1815) INTO SIGMA KBAR                   S20S11
P4        XI*1/2(1815) INTO XI*1/2(1530) PI              L49S 8
P5        XI*(1815) INTO XI PI PI (XI PI NOT XI*(1530)) S22S 8S 8

-----------------   50  XI*1/2(1815) BRANCHING RATIOS   --------------------

R1        XI*1/2(1815) INTO (LAMBDA KBAR)/TOTAL          (P1)/TOTAL
R1  *       LARGE                     BADIER    65 HBC                       7/66
R1  *       LARGE                     SMITH 2   65 HBC                       7/66

R2        XI*1/2(1815) INTO (XI PI)/(LAMBDA KBAR)        (P2)/(P1)
R2           0.20      0.20           BADIER    65 HBC                       7/66
R2  *       SMALL                     SMITH 2   65 HBC    IF XI*1933 EXIST   7/66

R3        XI*1/2(1815) INTO (SIGMA KBAR)/TOTAL           (P3)/TOTAL
R3           0.02       OR LESS       TRIPP     67 RVUE                      8/67

R4        XI*1/2(1815) INTO (XI*(1530) PI)/(LAM KBAR)    (P4)/(P1)
R4           0.26      0.13           SMITH 1   65 HBC
R4  *       SMALL                     BADIER    65 HBC                       7/66

R5        XI*1/2(1815) INTO (XI PI PI)/(LAMBDA KBAR)     (P5)/(P1)
R5           0.1        OR MORE       SMITH 1   65 HBC
R5  *       SMALL                     BADIER    65 HBC                       7/66

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                      REFERENCES -- XI*1/2(1815)

HALSTEIN 63 SIENA CONF 173    HALSTEINSLID,+//BERGEN,CERN,EP,RTHF,UNICOL  I
SMITH 1  65 PRL 14 25         +LINDSEY,BUTTON-SHAFER,MURRAY         //LRL IJP
BADIER   65 PL 16 171         +DEMOULIN,GOLDBERG, +    //EP,SACLAY,AMSTR  I
SMITH 2  65 ATHENS CONF 251   G A SMITH, J S LINDSEY                //LRL
TRIPP    67 NP (ACCEPTED)      + LEITH, +  //LRL,SLAC,CERN,HEIDEL,SACLAY
     --  USES DATA OF SMITH 1.

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Ξ(1935)

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52  XI*1/2(1935, JP=     ) I=1/2

SEEN AS AN ENHANCEMENT IN THE XI PI INVARIANT MASS
SPECTRUM.  LITTLE IS KNOWN ABOUT IT, AND EVEN ITS
EXISTENCE IS NOT CERTAIN.

                    52  XI*1/2(1935) MASS (MEV)   --------------------------

M          1933.0     16.0            BADIER    65 HBC  C  K-P 3 BEV/C

-----------------   52  XI*1/2(1935) WIDTH (MEV)   --------------------------

W           140.0     35.0            BADIER    65 HBC  C

-----------------   52  XI*1/2(1935) PARTIAL DECAY MODES   -----------------

P1        XI*1/2(1935) INTO XI PI                        S22S 8

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                      REFERENCES -- XI*1/2(1935)

BADIER   65 PL 16 171         +DEMOULIN,GOLDBERG, +     //EP,SACLAY,AMST  I

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Eta Decay Into Neutrals (Price, Aug. '67)

Certain HBC and DBC experiments report the mode "$\eta \to 3\pi^0$", but actually they detect both $\eta \to 3\pi^0$ plus $\eta \to \pi^0 2\gamma$, and they cannot distinguish them. Since the detection efficiencies are different for the various modes, one may not merely substitute the combined rate ($3\pi^0 + \pi^0 2\gamma$) for the reported $3\pi^0$ rate in these experiments. MULLER+ 63 (DBC) state that their detection efficiency per γ ray is about the same regardless of the mode of decay ($3\pi^0$ or $\pi^0 2\gamma$). CRAWFORD2 66 (HBC) has shown that the same is true for the HBC experiments listed. Thus for all these experiments (assuming all other neutral modes to be equal to zero)

$$3\pi^0_{\text{true}} = 3\pi^0_{\text{reported}} \times \frac{1}{1+\frac{4}{6}r} \qquad (1)$$

and

$$\pi^0 2\gamma_{\text{true}} = 3\pi^0_{\text{reported}} \times \frac{r}{1+\frac{4}{6}r}, \qquad (2)$$

where

$$r \equiv \frac{\pi^0 2\gamma}{3\pi^0}. \qquad (3)$$

CRAWFORD2 gives values for $3\pi^0/\pi^+\pi^-\pi^0$, using (1) and assuming $r = 1.79 \pm 0.58$, from DIGIUGNO+ 66 (CNTR).

Now in principle it would be possible for us to include "r" in our least-squares fitting, recalculating it at every step. In reality, however, this would require a major programming change in program AHR. Thus we have not included these particular HBC and DBC experiments in our present constrained fitting. For the purposes of comparison, we note that our over-all best fits to all data (excluding the particular HBC and DBC experiments) gives

$$R \equiv \frac{3\pi^0}{\pi^+\pi^-\pi^0} = 0.93 \pm 0.14.$$

If we now use the experimental results from the BC experiments along with our best-fit values for the partial modes $\pi^0 2\gamma$ and $3\pi^0$, we have [Eqs. (1) and (3)]:

$$R = 0.53 \pm 0.10.$$

The agreement is not good (it is about 2 standard deviations). If such a discrepancy persists, we will recode program AHR to accept all of the data.

Notes on Baryon Resonances

Parameters of the lower N^*'s (Rosenfeld, Wohl)

We take masses, widths, and elasticities of the lower N^*'s [except for the $\Delta(1236)$] from phase-shift analyses of BAREYRE 65 and LOVELACE 66. These are the latest of a number of such analyses and appear to be the most complete and comprehensive. However it should be kept in mind that even these are only in qualitative agreement with one another.

The Argand diagrams of BAREYRE 65 are shown in Fig. 1. Those of Donnachie et al. have not yet appeared; their best estimates of resonance parameters are given by LOVELACE 66. We would be happy to include their diagrams (as well as anyone else's) in future editions. Argand diagrams are clearly the most succinct form for presenting and comparing results of phase-shift analyses.

A resonating partial-wave elastic-scattering amplitude with no background has the simple Breit-Wigner form

$$T(E) = x/(\epsilon - i), \qquad (1)$$

where x is elasticity and ϵ is $(M-E)/(\Gamma/2)$. This amplitude traces a circle of diameter x and becomes entirely imaginary at E = M. The amplitude also has greatest velocity $|dT/dE|$ at E = M, for it is easy to show that

$$\left|\frac{dT}{dE}\right| = \frac{x}{\epsilon^2+1} = \text{Im } T, \qquad (2)$$

which is a maximum at E = M. The $P_{33}\,\Delta(1236)$ is a good example of a resonant partial wave with no background until E is well above M.

If the resonance is superimposed on a varying background, the resonant circle may be translated, rotated, and distorted. The S_{31} amplitude shows these effects well. Since this amplitude never becomes entirely imaginary, we must choose another criterion for the resonant energy. If the background varies only slowly, it is reasonable to choose the point at which the velocity of the amplitude is greatest.

The S_{11} amplitude is obviously quite complex. MICHAEL 66 has visually fitted the solution of BAREYRE 65 to two resonant circles plus no background. We use his results.

The influence of background on the P_{11} amplitude is less apparent. The clue is that the amplitude varies most rapidly somewhat below the energy at which it becomes entirely imaginary. This behavior suggests that the resonant circle is rotated, an interpretation supported by the fact that the phase shift starts off negative before commencing its counterclockwise rotation and recrossing the origin at 1175 MeV. Maximum velocity is reached at about 1400 MeV or slightly lower.

Let us consider the P_{11} amplitude to be the result of two opposite forces, a repulsive force responsible for a negative scattering length A, and an attractive resonant interaction. The scattering length will produce a phase shift $2i\delta'$ and a contribution to the T matrix

$$T' = \frac{e^{2i\delta'}-1}{2i}. \qquad (3)$$

The resonant term T will be given by (1). The total amplitude, obtained by multiplying the S-matrix elements[1] (S is related to T by S = 2iT + 1), will now start out negative, and then superimposed on its clockwise motion will be the counterclockwise circular resonant behavior.

How far around this resonant circle is 1400 MeV? To solve this simple problem, assume that the repulsive phase shift $2\delta'$ is related to a scattering length by

$$k^3 \cot\delta' = 1/A,$$

or more precisely, using McKinley's phase shifts,[2]

$$(k/m_\pi)^3 \cot\delta' = -(.015)^{-1}.$$

Then, at 1400 MeV, δ' has reached -15 deg. We have plotted the corresponding point on Fig. 4. It is encouraging that this point lies almost diametrically across the resonant circle from 1400 MeV.

The other resonating amplitudes, the D_{13}, the D_{15}, and the F_{15}, appear to have little background; the variation is most rapid approximately where the amplitude becomes imaginary. Therefore the resonant parameters may be chosen as follows: M is where T(E) is entirely imaginary; x is the length of T at this point; and $\Gamma/2$ is (M - E'), where E' is the energy at which Im T is x/2.

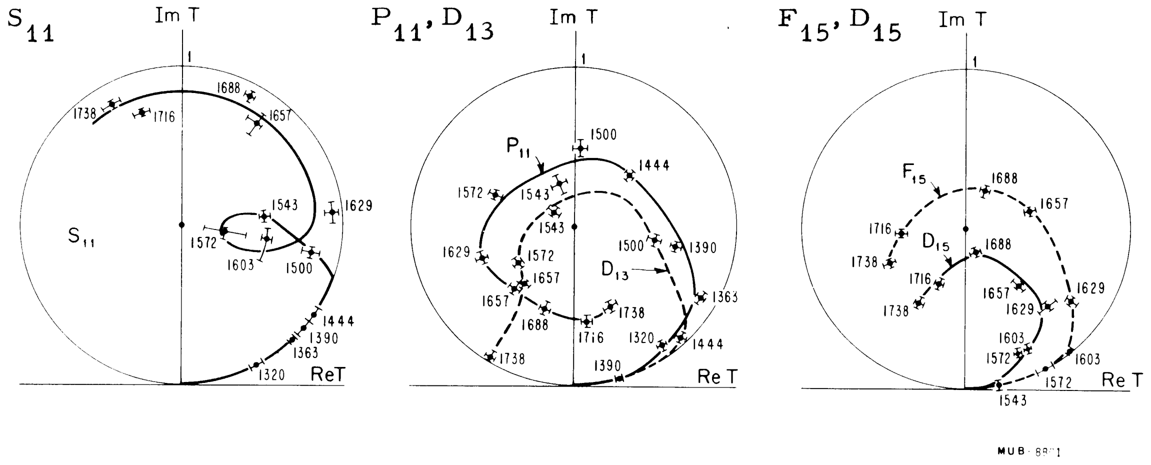
---

1. By multiplying S matrices we get

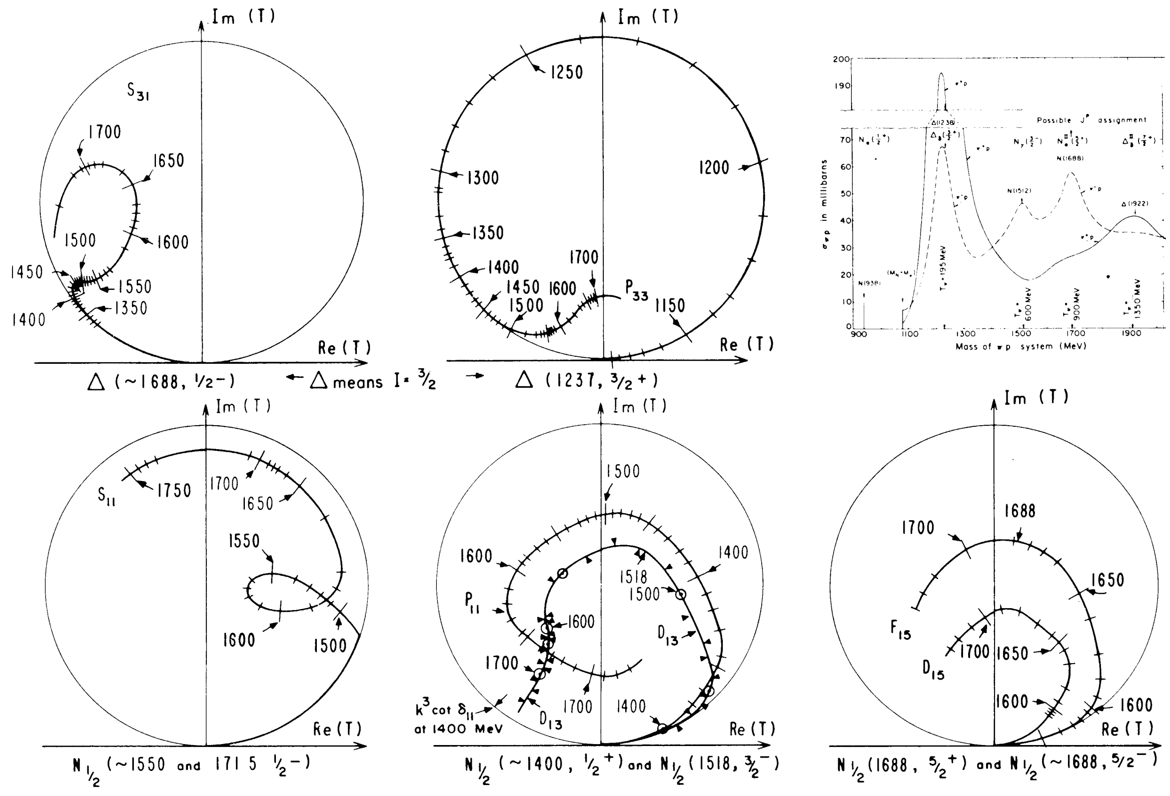
$$S'' = S'\,S = \eta' e^{2i\delta'}\,\eta e^{2i\delta} = 2iT''+1.$$

Hence $T'' = \dfrac{\eta'\eta\, e^{2i(\delta'+\delta)}-1}{2i}$ which rotates the clockwise resonant circle by $2i\delta'$, keeping it tangent to the unit circle.

2. J. M. McKinley, Rev. Mod. Phys. 35, 788 (1963).



Solutions of Bareyre et al. to I-spin 1/2 resonant partial waves. The crosses show the amplitudes and errors computed from the data at various energies. The smooth connecting lines are guesses.



The smooth guessed curves above are replotted with the actual calculated amplitudes replaced by hatch marks interpolated every 10 MeV. For a resonance they should be spaced proportionally to $\mathrm{Im}(T) = (1+\epsilon^2)^{-1}$. The I-spin 3/2 resonant partial waves have been added at the top, along with a summary of the total cross section for π^+p and π^-p.

Fig. 1

MUB-14051

Spin-parity assignments of the higher mass N^*'s

Spins and parities of the higher mass N^*'s are taken from Barger and Cline.[1] They classify most of the N^*'s as Regge recurrences on three straight-line trajectories [namely, recurrences of N(938), N(1525), and Δ(1236)] in a Chew-Frautchi plot. In addition they construct a model for $\pi^- p$ elastic scattering, near and at 180°, based on interference of the resonance amplitude with an amplitude due to Regge exchange of Δ(1236) in the crossed channel. The predictions compare well with the existing experimental data on the energy dependence of the $\pi^- p$ differential cross section at 180° and the general shape of the $\pi^- p$ angular distribution near 180°. This result confirms the consistency of the Regge recurrence parity assignments with the scattering data. In addition to the N^*'s reported in the Table on Baryons, they predict two more states: one at ≈2200 MeV(J^P = 9/2+) and another one at ≈2630 MeV(J^P = 13/2+) which they can accomodate in the prediction of the backward πp scattering by changing the elasticities of the neighboring resonances. We do not list these two resonances since they have not yet been experimentally observed.

Recently Dikmen[2] has shown that the 180° $\pi^- p$ elastic scattering data can be fit with the direct (s) channel resonant amplitudes alone (rather than mixing s- and u-channel amplitudes), using the same spin-parity assignments suggested by Barger and Cline. The success (at least in this area) of Dikmen's model casts some doubt on the interference model of Barger and Cline, but does not affect their more basic assumption of taking spin-parity assignments from extrapolation of Regge trajectories.

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1. V. Barger and D. Cline, Phys. Rev. Letters 16, 913 (1966); V. Barger and D. Cline, Phys. Rev. 155, 1792 (1967). See also V. Barger and M. Olsson, Phys. Rev. 151, 1123 (1966).
2. F. N. Dikmen, Phys. Rev. Letters 18, 798 (1967).

Special Relativity

Notation. 4-vector in c.m. $p = (w, \vec{p})$; in lab $P = (W, \vec{P})$, $T = W - m$.
Solid-angle element $d\omega = 2\pi d\cos\theta$; $d\Omega = 2\pi d\cos\Theta$.
$p^2 = w^2 - \vec{p}^2 = m^2$ is an invariant. Cross section σ is invariant.

Lorentz Transformation

$$\begin{pmatrix} w \\ p_x \\ p_y \\ p_z \end{pmatrix} = \begin{pmatrix} \bar{\gamma} & -\bar{\eta} & 0 & 0 \\ -\bar{\eta} & \bar{\gamma} & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} W \\ P_x \\ P_y \\ P_z \end{pmatrix}$$

If θ and Θ are measured with respect to the transformation axis x,

$$\frac{p_\perp}{p_x} = \tan\theta = \frac{P\sin\Theta}{-\bar{\eta}W + \bar{\gamma}P\cos\Theta} . \qquad (1)$$

If particle 1 is beam, 2 is target, $(W_2, \vec{P}_2) = (m_2, \vec{0})$ and

$$\bar{\gamma} = (W_1 + m_2)/\sqrt{s}, \quad \bar{\eta} = \bar{\gamma}\bar{\beta} = |\vec{P}_1|/\sqrt{s}, \quad |\vec{p}_1| = |\vec{p}_2| = \bar{\eta}m_2 = |\vec{P}_1|m_2/\sqrt{s}. \qquad (2)$$

For $m_1 = m_2$, $\bar{\gamma}^2 = 1 + T_1/2m_1$.

Invariants. Notation: $1 + 2 \rightarrow 1' + 2'$.

$$s = (p_1 + p_2)^2 = m_1^2 + m_2^2 + 2(w_1w_2 - \vec{p}_1 \cdot \vec{p}_2) \qquad (3)$$

$$t = (p'_i - p_i)^2 = m_i^2 + m'^2_i - 2(w_iw'_i - \vec{p}_i \cdot \vec{p}'_i) \quad (i = 1, 2) \qquad (4)$$

$$u = (p'_1 - p_2)^2 = (p'_2 - p_1)^2 \qquad (5)$$

General relation: $s + t + u = m_1^2 + m'^2_1 + m_2^2 + m'^2_2$. (6)

In lab system $P_2 = (m_2, \vec{0})$, and writing $W = m + T$

$$s = m_1^2 + m_2^2 + 2W_1m_2 = (m_1 + m_2)^2 + 2T_1m_2 \qquad (3, \text{lab})$$

$$t = m_2^2 + m'^2_2 - 2W'_2m_2 = (m_2 - m'_2)^2 - 2T'_2m_2 \qquad (4, \text{lab})$$

In c.m. system $dt = +2|\vec{p}_i||\vec{p}'_i|\, d\cos\theta$ (4, cm)

For elastic scattering ($m_1 = m'_1$, $m_2 = m'_2$), (4) in c.m. simplifies to

$$\left.\begin{matrix} t \\ u \end{matrix}\right\} = -2\vec{p}^2(1 \mp \cos\theta) = -4\vec{p}^2 \begin{cases} \sin^2\theta/2 \\ \cos^2\theta/2 \end{cases} \qquad (4, \text{el})$$

For elastic scattering, using (4, lab), (4, el), and (2),

$$T'_2 = \frac{2\vec{P}_1^2 m_2}{s}\sin^2\left(\frac{\theta}{2}\right) \quad \text{(useful for calculating } \delta\text{-ray energies).} \qquad (7)$$

Two-Body States. Energies and momenta in c.m.

$$w_1 = \frac{s + m_1^2 - m_2^2}{2\sqrt{s}}, \quad \vec{p}_1^2 = \vec{p}_2^2 = \frac{1}{4s}[s - (m_1 + m_2)^2][s - (m_1 - m_2)^2]. \qquad (8)$$

3- and 4-Body States. Let $m_{ij}^2 = (p_i + p_j)^2$, etc., then

$$\sum_{i<j} m_{ij}^2 = \sum m_i^2 + m_{123}^2 = \text{const.} \quad (i, j = 1, 2, 3) \text{ (follows from (6)).} \qquad (9)$$

$$\left.\begin{aligned} \sum_{i<j} m_{ij}^2 &= 2\sum m_i^2 + m_{1234}^2 = \text{const.} \\ \sum_{i<j<k} m_{ijk}^2 &= \sum m_i^2 + 2m_{1234}^2 = \text{const.} \end{aligned}\right\} (i, j, k = 1, 2, 3, 4.) \qquad (10)$$

R_n, Invariant Volume in n-Body Momentum Space

A useful invariant is $d^4p\,\delta(p^2 - m^2) = \frac{d^3\vec{p}}{2w} = \frac{\vec{p}^2 d|\vec{p}|d\omega}{2w} = \frac{1}{2}|\vec{p}|dw\,d\omega$.

$R_2 = \pi|\vec{p}_1|/\sqrt{s}$, $R_3 = \pi^2\int dw_1dw_2 = (\pi^2/4s)\int dm_{12}^2\,dm_{23}^2$ (using c.m. quantities)

Recurrence Relation for Factoring R_n (see e.g., Hagedorn, p. 93[a])

Write $N \rightarrow 1, 2, \cdots k, k+1, \cdots n$ (R_n) then
as $N \rightarrow K, k+1, \cdots n$ (R_{n-k+1}), $\hookrightarrow 1, 2, \cdots k$ (R_k) ; $R_n = \int dM_K^2 R_k R_{n-k+1}$

Cross Section (or Decay Rate)

For $1 + 2 \rightarrow n$ particles (or $1 \rightarrow n$ particles)

$\sigma F = |M|^2 R_n$ (or $\Gamma w_1 = |M|^2 R_n$)

where M is an invariant matrix element.

F is (Møller's) invariant flux factor, $F^2 = (p_1p_2)^2 - m_1^2m_2^2$.

In every system where $\vec{p}_1$ and $\vec{p}_2$ are collinear, $F = w_1w_2|\vec{v}_1 - \vec{v}_2|$ $(\vec{v} = \vec{p}/w)$.

If particle 1 is beam, 2 is target ($\vec{P}_2 = 0$), $F = |\vec{P}_1|m_2 = |\vec{p}_1|\sqrt{s}$ [cf. (2)].

The rate (= number per unit 4-dimensional volume $d^4r = dt\,d^3\vec{r}$) is

$d^4N/d^4r = \sigma\,\rho_1\rho_2|\vec{v}_1 - \vec{v}_2|$, ρ_i = volume density of particles (i = 1, 2).

a. R. Hagedorn, Relativistic Kinematics, (W. A. Benjamin, New York, 1964).

C. M. Energy and Momentum vs Beam Momentum of e, π, K, or p on p

$p\,dp = m_p dE = m_p v_{beam,lab}\,dp \approx m_p dp$

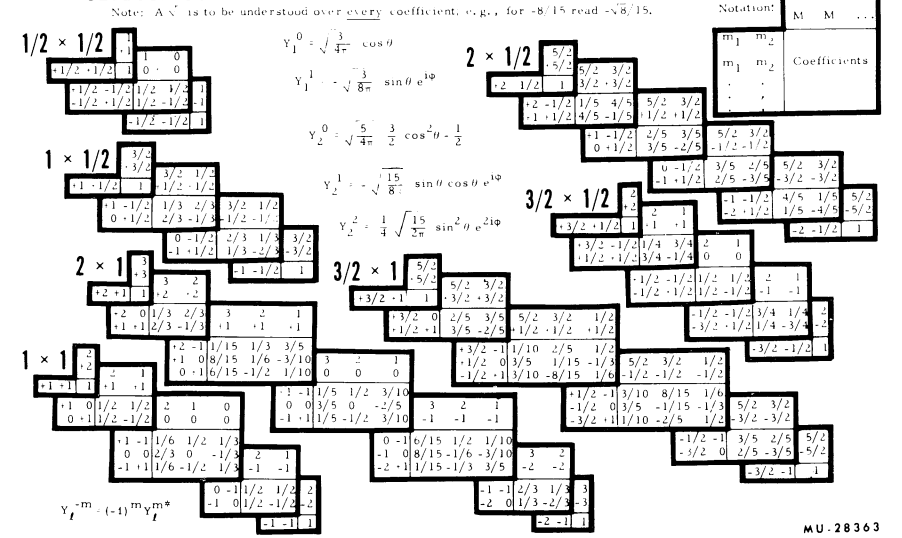
P(LAB) (MEV/C)	INVARIANT MASS (MEV) ep	πp	Kp	pp	P(CMS) (MEV/C) ep	πp	Kp	pp
0	939	1078	1432	1877	0	0	0	0
20	958	1079	1432	1877	20	17	13	10
40	977	1083	1433	1877	38	35	26	20
60	996	1089	1434	1877	56	52	39	30
80	1015	1096	1436	1878	74	68	52	40
T(PI) = PLAB - 59 MEV								
100	1033	1105	1439	1879	91	85	65	50
120	1051	1116	1441	1880	107	101	78	60
140	1069	1127	1445	1882	123	117	91	70
160	1087	1139	1449	1883	138	132	104	80
180	1104	1152	1453	1885	153	147	116	90
T(PI) = PLAB - 92 MEV								
200	1121	1165	1457	1887	167	161	129	99
220	1137	1178	1462	1889	182	175	141	109
240	1154	1192	1468	1892	195	189	153	119
260	1170	1206	1474	1894	209	202	166	129
280	1186	1219	1480	1897	222	215	178	138
T(PI) = PLAB - 107 MEV								
300	1201	1233	1486	1900	234	228	189	148
320	1217	1247	1493	1903	247	241	201	158
340	1232	1261	1500	1906	259	253	213	167
360	1247	1274	1507	1910	271	265	224	177
380	1262	1288	1514	1913	282	277	235	186
T(PI) = PLAB - 115 MEV								
400	1277	1302	1522	1917	294	288	247	196
420	1292	1315	1530	1921	305	300	258	205
440	1306	1329	1538	1925	316	311	268	214
460	1320	1342	1546	1929	327	322	279	224
480	1335	1356	1554	1933	337	332	290	233
T(PI) = PLAB - 120 MEV								
500	1349	1369	1563	1938	348	343	300	242
520	1362	1382	1572	1943	358	353	310	251
540	1376	1395	1580	1947	368	363	321	260
560	1390	1408	1589	1952	378	373	331	269
580	1403	1421	1598	1957	388	383	341	278
T(PI) = PLAB - 123 MEV								
600	1416	1434	1607	1962	397	393	350	287
620	1430	1446	1616	1967	407	402	360	296
640	1443	1459	1625	1973	416	412	370	304
660	1456	1472	1634	1978	425	421	379	313
680	1468	1484	1644	1984	434	430	388	322
T(PI) = PLAB - 125 MEV								
700	1481	1496	1653	1989	443	439	397	330
720	1494	1509	1662	1995	452	448	406	339
740	1506	1521	1671	2001	461	457	415	347
760	1519	1533	1681	2007	470	465	424	355
780	1531	1545	1690	2013	478	474	433	364
T(PI) = PLAB - 127 MEV								
800	1543	1557	1699	2019	486	482	442	372
820	1555	1569	1709	2025	495	490	450	380
840	1567	1580	1718	2031	503	499	459	388
860	1579	1592	1728	2037	511	507	467	396
880	1591	1604	1737	2043	519	515	475	404
T(PI) = PLAB - 129 MEV								
900	1603	1615	1747	2049	527	523	483	412
920	1615	1627	1756	2056	535	531	492	420
940	1626	1638	1765	2062	542	538	500	428
960	1638	1649	1775	2069	550	546	508	435
980	1649	1661	1784	2075	558	554	515	443
T(PI) = PLAB - 130 MEV								
1000	1660	1672	1794	2082	565	561	523	451
1020	1672	1683	1803	2088	573	569	531	458
1040	1683	1694	1812	2095	580	576	538	466
1060	1694	1705	1822	2102	587	583	546	473
1080	1705	1716	1831	2108	594	591	553	481
T(PI) = PLAB - 131 MEV								
1100	1716	1726	1840	2115	601	598	561	488
1120	1727	1737	1850	2122	609	605	568	495
1140	1738	1748	1859	2129	616	612	575	502
1160	1748	1758	1868	2135	622	619	583	510
1180	1759	1769	1877	2142	629	626	590	517
T(PI) = PLAB - 131 MEV								
1200	1770	1780	1887	2149	636	633	597	524
1220	1780	1790	1896	2156	643	639	604	531
1240	1791	1800	1905	2163	650	646	611	538
1260	1801	1811	1914	2170	656	653	618	545
1280	1812	1821	1923	2177	663	660	624	552
T(PI) = PLAB - 132 MEV								
1300	1822	1831	1932	2184	669	666	631	559
1320	1832	1841	1941	2191	676	673	638	565
1340	1843	1851	1950	2198	682	679	645	572
1360	1853	1862	1959	2205	689	685	651	579
1380	1863	1872	1968	2212	695	692	658	585
T(PI) = PLAB - 133 MEV								

P(LAB) (MEV/C)	INVARIANT MASS (MEV) ep	πp	Kp	pp	P(CMS) (MEV/C) ep	πp	Kp	pp
1400	1873	1881	1977	2219	701	698	664	592
1420	1883	1891	1986	2226	708	704	671	599
1440	1893	1901	1995	2233	714	711	677	605
1460	1903	1911	2004	2240	720	717	684	612
1480	1912	1921	2013	2247	726	723	690	618
T(PI) = PLAB - 133 MEV								
1500	1922	1930	2022	2254	732	729	696	624
1520	1932	1940	2031	2261	738	735	702	631
1540	1942	1950	2039	2268	744	741	709	637
1560	1951	1959	2048	2275	750	747	715	643
1580	1961	1969	2057	2282	756	753	721	650
T(PI) = PLAB - 133 MEV								
1600	1970	1978	2065	2289	762	759	727	656
1620	1980	1988	2074	2296	768	765	733	662
1640	1989	1997	2083	2304	773	770	739	668
1660	1999	2006	2091	2311	779	776	745	674
1680	2008	2016	2100	2318	785	782	751	680
T(PI) = PLAB - 134 MEV								
1700	2018	2025	2109	2325	791	788	756	686
1720	2027	2034	2117	2332	796	793	762	692
1740	2036	2043	2126	2339	802	799	768	698
1760	2045	2053	2134	2346	807	805	774	704
1780	2054	2062	2143	2353	813	810	779	710
T(PI) = PLAB - 134 MEV								
1800	2064	2071	2151	2360	818	816	785	716
1820	2073	2080	2159	2367	824	821	791	721
1840	2082	2089	2168	2374	829	827	796	727
1860	2091	2098	2176	2381	835	832	802	733
1880	2100	2107	2184	2388	840	837	808	739
T(PI) = PLAB - 134 MEV								
1900	2108	2115	2193	2395	845	843	813	744
1920	2117	2124	2201	2402	851	848	818	750
1940	2126	2133	2209	2409	856	853	824	756
1960	2135	2142	2217	2416	861	859	829	761
1980	2144	2150	2226	2423	867	864	835	767
T(PI) = PLAB - 135 MEV								
2000	2153	2159	2234	2430	872	869	840	772
2020	2161	2168	2242	2437	877	874	845	778
2040	2170	2176	2250	2444	882	879	851	783
2060	2179	2185	2258	2451	887	885	856	789
2080	2187	2194	2266	2458	892	890	861	794
T(PI) = PLAB - 135 MEV								
2100	2196	2202	2274	2465	897	895	866	799
2120	2204	2211	2282	2472	902	900	872	805
2140	2213	2219	2290	2479	907	905	877	810
2160	2221	2227	2298	2486	912	910	882	815
2180	2230	2236	2306	2493	917	915	887	821
T(PI) = PLAB - 135 MEV								
2200	2238	2244	2314	2500	922	920	892	826
2220	2246	2253	2322	2507	927	925	897	831
2240	2255	2261	2330	2514	932	930	902	836
2260	2263	2269	2338	2520	937	934	907	841
2280	2271	2277	2346	2527	942	939	912	846
T(PI) = PLAB - 135 MEV								
2300	2280	2286	2353	2534	947	944	917	852
2320	2288	2294	2361	2541	951	949	922	857
2340	2296	2302	2369	2548	956	954	927	862
2360	2304	2310	2377	2555	961	959	932	867
2380	2312	2318	2384	2561	966	963	937	872
T(PI) = PLAB - 135 MEV								
2400	2320	2326	2392	2568	970	968	941	877
2420	2328	2334	2400	2575	975	973	946	882
2440	2336	2342	2407	2582	980	977	951	887
2460	2344	2350	2415	2589	984	982	956	892
2480	2352	2358	2423	2595	989	987	960	897
T(PI) = PLAB - 136 MEV								
2500	2360	2366	2430	2602	994	991	965	901
2520	2368	2374	2438	2609	998	996	970	906
2540	2376	2382	2445	2616	1003	1001	975	911
2560	2384	2390	2453	2622	1007	1005	979	916
2580	2392	2398	2460	2629	1012	1010	984	921
T(PI) = PLAB - 136 MEV								
2600	2400	2405	2468	2636	1017	1014	988	926
2620	2408	2413	2475	2643	1021	1019	993	930
2640	2415	2421	2483	2649	1025	1023	998	935
2660	2423	2429	2490	2656	1030	1028	1002	940
2680	2431	2436	2498	2663	1034	1032	1007	944
T(PI) = PLAB - 136 MEV								
2700	2439	2444	2505	2669	1039	1037	1011	949
2720	2446	2452	2512	2676	1043	1041	1016	954
2740	2454	2459	2520	2682	1048	1045	1020	958
2760	2462	2467	2527	2689	1052	1050	1025	963
2780	2469	2474	2534	2696	1056	1054	1029	968
T(PI) = PLAB - 136 MEV								

P(LAB) (GEV/C)	INVARIANT MASS (GEV) πp, ep	Kp	pp	P(CMS) (GEV/C) πp, ep	Kp	pp
3.0	2.56	2.61	2.77	1.10	1.08	1.02
3.2	2.63	2.68	2.83	1.14	1.12	1.06
3.4	2.70	2.75	2.89	1.18	1.16	1.10
3.6	2.77	2.82	2.96	1.22	1.20	1.14
3.8	2.83	2.88	3.02	1.26	1.24	1.18
T(PI) = PLAB - .137 GEV						
4.0	2.90	2.95	3.08	1.29	1.27	1.22
4.2	2.96	3.01	3.14	1.33	1.31	1.26
4.4	3.03	3.07	3.19	1.36	1.34	1.29
4.6	3.09	3.13	3.25	1.40	1.38	1.33
4.8	3.15	3.19	3.31	1.43	1.41	1.36
T(PI) = PLAB - .138 GEV						
5.0	3.21	3.25	3.36	1.46	1.44	1.40
5.2	3.27	3.31	3.42	1.49	1.48	1.43
5.4	3.32	3.36	3.47	1.53	1.51	1.46
5.6	3.38	3.42	3.52	1.56	1.54	1.49
5.8	3.43	3.47	3.58	1.59	1.57	1.52
T(PI) = PLAB - .138 GEV						
6.0	3.49	3.52	3.63	1.61	1.60	1.55
6.2	3.54	3.58	3.68	1.64	1.63	1.58
6.4	3.59	3.63	3.73	1.67	1.65	1.61
6.6	3.65	3.68	3.78	1.70	1.68	1.64
6.8	3.70	3.73	3.83	1.73	1.71	1.67
T(PI) = PLAB - .138 GEV						
7.0	3.75	3.78	3.87	1.75	1.74	1.70
7.2	3.80	3.83	3.92	1.78	1.76	1.72
7.4	3.85	3.88	3.97	1.81	1.79	1.75
7.6	3.89	3.93	4.02	1.83	1.82	1.78
7.8	3.94	3.97	4.06	1.86	1.84	1.80
T(PI) = PLAB - .138 GEV						
8.0	3.99	4.02	4.11	1.88	1.87	1.83
8.2	4.04	4.07	4.15	1.91	1.89	1.85
8.4	4.08	4.11	4.20	1.93	1.92	1.88
8.6	4.13	4.16	4.24	1.95	1.94	1.90
8.8	4.17	4.20	4.29	1.98	1.96	1.93
T(PI) = PLAB - .138 GEV						
9.0	4.22	4.25	4.33	2.00	1.99	1.95
9.2	4.26	4.29	4.37	2.03	2.01	1.97
9.4	4.31	4.33	4.41	2.05	2.03	2.00
9.6	4.35	4.38	4.46	2.07	2.06	2.02
9.8	4.39	4.42	4.50	2.09	2.08	2.04
T(PI) = PLAB - .139 GEV						
10.0	4.43	4.46	4.54	2.12	2.10	2.07
10.5	4.54	4.57	4.64	2.17	2.16	2.12
11.0	4.64	4.67	4.74	2.22	2.21	2.18
11.5	4.74	4.77	4.84	2.28	2.26	2.23
12.0	4.84	4.86	4.93	2.33	2.31	2.28
T(PI) = PLAB - .139 GEV						
12.5	4.94	4.96	5.03	2.38	2.36	2.33
13.0	5.03	5.05	5.12	2.43	2.41	2.38
13.5	5.12	5.15	5.21	2.47	2.46	2.43
14.0	5.21	5.24	5.30	2.52	2.51	2.48
14.5	5.30	5.32	5.39	2.57	2.56	2.53
T(PI) = PLAB - .139 GEV						
15.0	5.39	5.41	5.47	2.61	2.60	2.57
15.5	5.48	5.50	5.56	2.66	2.65	2.62
16.0	5.56	5.58	5.64	2.70	2.69	2.66
16.5	5.64	5.67	5.72	2.74	2.73	2.70
17.0	5.73	5.75	5.81	2.78	2.77	2.75
T(PI) = PLAB - .139 GEV						
17.5	5.81	5.83	5.89	2.83	2.82	2.79
18.0	5.89	5.91	5.97	2.87	2.86	2.83
18.5	5.97	5.99	6.04	2.91	2.90	2.87
19.0	6.05	6.07	6.12	2.95	2.94	2.91
19.5	6.12	6.14	6.20	2.99	2.98	2.95
T(PI) = PLAB - .139 GEV						
20.0	6.20	6.22	6.27	3.03	3.02	2.99
21.0	6.35	6.37	6.42	3.10	3.09	3.07
22.0	6.49	6.51	6.56	3.18	3.17	3.14
23.0	6.64	6.66	6.70	3.25	3.24	3.22
24.0	6.78	6.79	6.84	3.32	3.31	3.29
T(PI) = PLAB - .139 GEV						
25.0	6.91	6.93	6.98	3.39	3.38	3.36
26.0	7.05	7.07	7.11	3.46	3.45	3.43
27.0	7.18	7.20	7.24	3.53	3.52	3.50
28.0	7.31	7.33	7.37	3.59	3.59	3.56
29.0	7.44	7.45	7.50	3.66	3.65	3.63
T(PI) = PLAB - .139 GEV						
30.0	7.56	7.58	7.62	3.72	3.71	3.69
35.0	8.16	8.17	8.21	4.02	4.02	4.00
40.0	8.72	8.73	8.77	4.31	4.30	4.28
45.0	9.24	9.25	9.29	4.57	4.56	4.55
50.0	9.73	9.74	9.78	4.82	4.81	4.80
T(PI) = PLAB - .139 GEV						

CLEBSCH-GORDAN COEFFICIENTS AND SPHERICAL HARMONICS

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



MU-28363

Atomic and Nuclear Properties of Materials

Material	Z	A	Cross Section σ^a barns	Collision Length L_{coll} [b] $g\ cm^{-2}$	Collision Length cm	Minimum $-dE/dx$ [c] $MeV\ g^{-1}\ cm^2$	Minimum $-dE/dx$ $MeV\ cm^{-1}$	Radiation Length L_{rad} [d] $g\ cm^{-2}$	Radiation Length cm	Density ρ $g\ cm^{-3}$
H_2	1	1.01	0.063	26.5	374	4.13	0.292	58.0	819	0.0708[e]
D_2	1	2.01	0.100	33.4	202	2.07	0.342	116	703	0.165[e]
He	2	4.00	0.16	42.0	336	1.94	0.242	85.4	683	0.125[e]
Li	3	6.94	0.23	50.4	94.3	1.69	0.903	78.7	148	0.534
Be	4	9.01	0.28	55.0	29.9	1.60	2.96	63.7	34.7	1.848
C	6	12.01	0.33	60.4	f	1.78	f	42.4	f	≈1.55[f]
N_2	7	14.01	0.36	63.6	78.9	1.81	1.46	37.8	46.7	0.808[e]
Al	13	26.98	0.57	79.2	29.3	1.62	4.37	24.0	8.9	2.70
Fe	26	55.85	0.92	101.2	12.8	1.48	11.6	13.9	1.8	7.87
Cu	29	63.54	1.00	105.4	11.8	1.44	12.9	12.0	1.34	8.96
Sn	50	118.69	1.55	129.7	17.8	1.28	9.4	8.89	1.22	7.31
W	74	183.85	2.02	150.8	7.80	1.17	22.6	6.89	0.36	19.3
Pb	82	207.19	2.20	156.2	13.8	1.13	12.8	6.52	0.58	11.35
U	92	238.03	2.42	163.6	≈8.63	1.09	≈20.6	6.13	≈0.32	≈18.95
Air				64.6	53620	1.81	0.0022	36.5	30290	0.001205[g]
Freon (CF_3Br)				87.1	≈58.0	1.52	≈2.3	16.6	≈11	≈1.5
H_2 (bubble chamber, 27°K)				26.5	442	4.13	0.248	58.0	970	≈0.060[h]
H_2O				57.2	57.2	2.03	2.03	35.7	35.7	1.00
Ilford Emulsion				103.0	27.0		5.49	11.2	2.91	3.815
LiF				63.8	24.2	1.69	4.46	39.0	14.8	2.64
Mylar ($C_5H_4O_2$)				59.1	42.8	1.91	2.64	39.6	28.7	1.38
NaI				119.0	32.4	1.32	4.84	9.58	2.61	3.67
Polyethylene (CH_2)				51.0	≈55.5	2.09	≈1.92	44.1	≈48	≈0.92
Polystyrene (CH)				54.9	≈52.3	2.03	≈2.14	43.4	≈41.3	≈1.05
Propane (C_3H_8, bubble chamber)				48.9	119.3	2.28	0.935	44.6	109	0.41

a. $\sigma = \sigma_{natural} = \pi(\hbar/m_\pi c)^2 \times A^{2/3} = 62.8\ mb \times A^{2/3}$

b. $L_{coll} = A/(N\sigma_{natural}) = 26.5\ g\ cm^{-2} \times A^{1/3}$

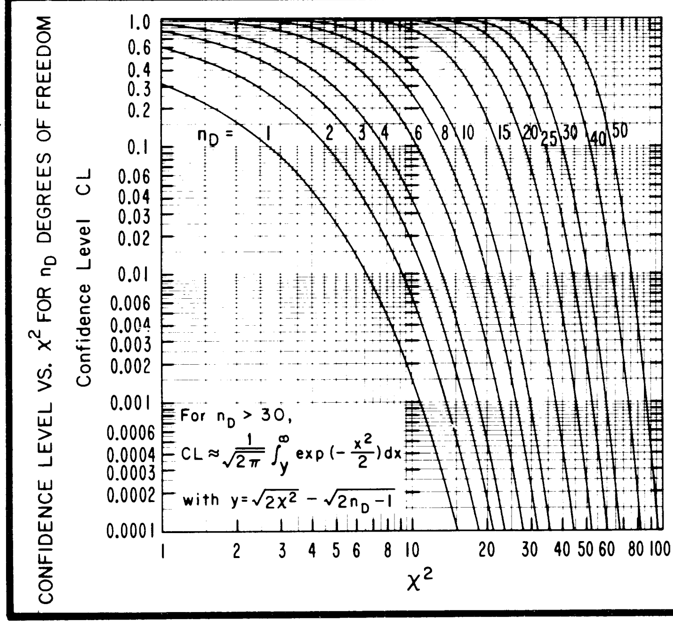
c. From W. H. Barkas and M. J. Berger, Tables of Energy Losses and Ranges of Heavy Charged Particles. NASA SP-3013 (1964)

d. Mainly from High Energy and Nuclear Physics Data Handbook, W. Galbraith and W. S. C. Williams, Ed. (N.I.R.N.S., Rutherford Lab., Chilton, Didcot, Berks.) 1964

e. boiling at 1 atmosphere f. density variable g. at 20°C

h. May vary by about ± 3%, depending on operation conditions

CONFIDENCE LEVEL VS. χ^2 FOR n_D DEGREES OF FREEDOM



STIRLING'S APPROXIMATION

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

Gaussianlike Distributions

For $n > -1$ but not necessarily integral:

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

Relation between standard deviation σ and mean deviation α:

$2\sigma^2 = \pi\alpha^2$; σ = 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

MULTIPLE COULOMB SCATTERING

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

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

L = Length in scatterer

For $L \geq 1/10\ L(rad)$ 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

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

RADIOACTIVITY

1 curie = 3.7×10^{10} disintegrations/sec

1 R = 87.8 ergs/g air = 5.49×10^7 MeV/g air

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

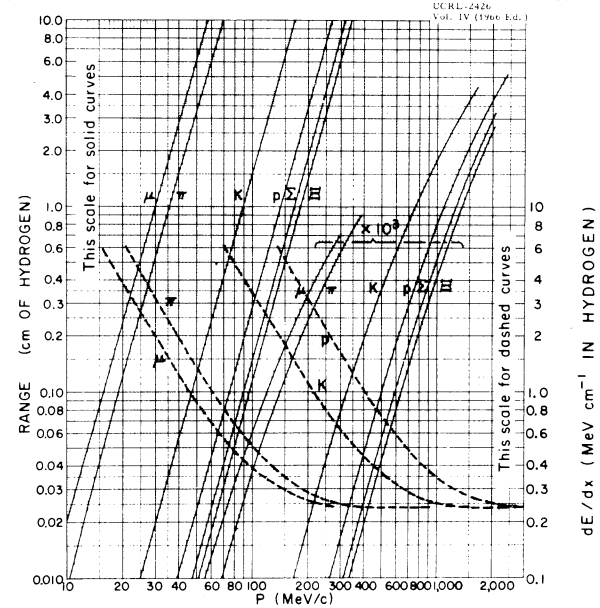
3×10^7 minimum ionizing singly charged particles
0.9×10^9 photons of 1 MeV energy.

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

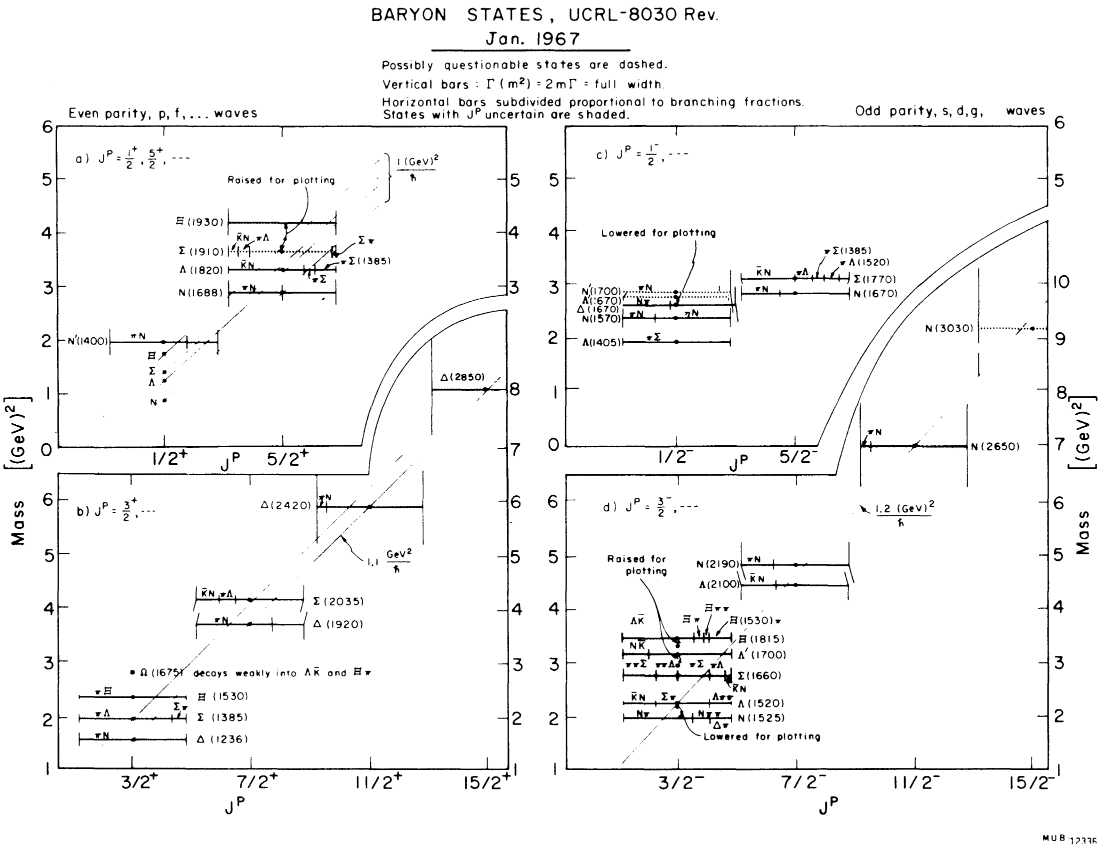
Natural background: 100 mR/year

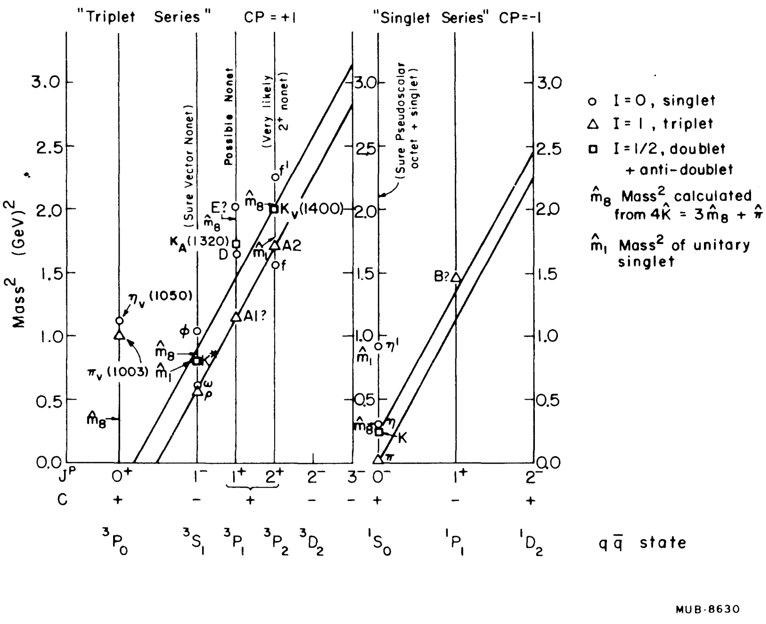
"Tolerance" 100 millirem/week [Note, 1 R may produce up to 10 "Rem" (R equivalent for man), depending on type of radiation.]

UCRL-2426
Vol. IV (1966 Ed.)



Ranges in liquid hydrogen bubble chamber, determined by a μ^+ range of 1.103 ± .003 cm from the $\pi^+ \to \mu^+\nu$ decay. Liquid hydrogen conditions: T = 27.6 ± .1°K; P = 48 ± 5 psia; ρ = (5.86 ± .06)10^{-2} g/cm^3. (Data by Clark and Diehl.)


BARYON STATES, UCRL-8030 Rev.
Jan. 1967
Possibly questionable states are dashed.
Vertical bars : Γ (m²) = 2mΓ = full width.
Horizontal bars subdivided proportional to branching fractions.
States with J^P uncertain are shaded.
Even parity, p, f, ... waves
Odd parity, s, d, g, waves
Raised for plotting
Lowered for plotting
Ω (1675) decays weakly into ΛK̄ and Ξπ
Mass [(GeV)²]
J^P
MUB-12336


"Triplet Series" CP = +1
"Singlet Series" CP = -1
(Sure Vector Nonet)
Possible Nonet
(Very likely 2+ nonet)
(Sure Pseudoscalar octet + singlet)
Mass² (GeV)²
o I = 0, singlet
Δ I = 1, triplet
□ I = 1/2, doublet + anti-doublet
m̂₈ Mass² calculated from 4K̂ = 3m̂₈ + π̂
m̂₁ Mass² of unitary singlet
qq̄ state
MUB-8630