K^0_L

$I(J^P) = \frac{1}{2}(0^-)$

$m_{K^0_L} - m_{K^0_S}$

For earlier measurements, beginning with GOOD 61 and FITCH 61, see our our 1986 edition, Physics Letters **170B** 132 (1986).

VALUE (10^{10} $\hbar$ s^{-1})	*DOCUMENT ID*		*TECN*	*COMMENT*
0.5333±0.0027 OUR AVERAGE	Error includes scale factor of 1.2.			
0.5257±0.0049	[1] GIBBONS	93C	E731	20–160 GeV *K* beams
0.5340±0.00255±0.0015	[2] GEWENIGER	74C	SPEC	Gap method
0.5334±0.0040 ±0.0015	[2] GJESDAL	74	SPEC	Charge asymmetry
0.542 ±0.006	CULLEN	70	CNTR	
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.5286±0.0028	[3] GIBBONS	93	E731	20–160 GeV *K* beams
0.482 ±0.014	[4] ARONSON	82B	SPEC	*E*=30–110 GeV
0.534 ±0.007	[5] CARNEGIE	71	ASPK	Gap method
0.542 ±0.006	[5] ARONSON	70	ASPK	Gap method

[1] GIBBONS 93C fits $\Delta(m)$ and ϕ_{+-}. Finds above $\Delta(m)$ and $\phi_{+-} = (42.2 \pm 1.4)^\circ$.

[2] These two experiments have a common systematic error due to the uncertainty in the momentum scale, as pointed out in WAHL 89.

[3] GIBBONS 93 value assume $\phi_{+-} = \phi_{00} = \phi_{SW} = (43.7 \pm 0.2)^\circ$.

[4] ARONSON 82 find that $\Delta(m)$ may depend on the kaon energy.

[5] ARONSON 70 and CARNEGIE 71 use K^0_S mean life $= (0.862 \pm 0.006) \times 10^{-10}$ s. We have not attempted to adjust these values for the subsequent change in the K^0_S mean life or in η_{+-}.

K^0_L MEAN LIFE

VALUE (10^{-8} s)	*EVTS*	*DOCUMENT ID*		*TECN*
5.17 ±0.04 OUR FIT				
5.15 ±0.04 OUR AVERAGE				
5.154±0.044	0.4M	VOSBURGH	72	CNTR
5.15 ±0.14		DEVLIN	67	CNTR
• • • We do not use the following data for averages, fits, limits, etc. • • •				
5.0 ±0.5		[6] LOWYS	67	HLBC
$6.1\ ^{+1.5}_{-1.2}$	1700	ASTBURY	65C	CNTR
5.3 ±0.6		FUJII	64	OSPK
$5.1\ ^{+2.4}_{-1.3}$	15	DARMON	62	FBC
$8.1\ ^{+3.2}_{-2.4}$	34	BARDON	58	CNTR

[6] Sum of partial decay rates.

K^0_L DECAY MODES

	Mode		Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Γ_1	$3\pi^0$		(21.6 ±0.8) %	S=1.5
Γ_2	$\pi^+\pi^-\pi^0$		(12.38±0.21) %	S=1.5
Γ_3	$\pi^\pm\mu^\mp\nu$ Called $K^0_{\mu 3}$.	[a]	(27.0 ±0.4) %	S=1.3
Γ_4	$\pi^-\mu^+\nu_\mu$			
Γ_5	$\pi^+\mu^-\overline{\nu}_\mu$			
Γ_6	$\pi^\pm e^\mp\nu$ Called K^0_{e3}.	[a]	(38.7 ±0.5) %	S=1.4
Γ_7	$\pi^- e^+\nu_e$			

*CITATION: L. Montanet et al., Physical Review D50, 1173 (1994) and 1995 off-year partial update for the 1996 edition (URL: http://pdg.lbl.gov/)

Γ_8	$\pi^+ e^- \overline{\nu}_e$			
Γ_9	2γ		$(5.73\pm0.27)\times10^{-4}$	S=2.0
Γ_{10}	$\pi^0 2\gamma$	[b]	$(1.70\pm0.28)\times10^{-6}$	
Γ_{11}	$\pi^0 \pi^\pm e^\mp \nu$	[a]	$(5.18\pm0.29)\times10^{-5}$	
Γ_{12}	$(\pi\mu\,\mathrm{atom})\nu$		$(1.05\pm0.11)\times10^{-7}$	
Γ_{13}	$\pi^\pm e^\mp \nu_e \gamma$	[a,b,c]	$(1.3\ \pm0.8)\ \%$	
Γ_{14}	$\pi^+\pi^-\gamma$	[b,c]	$(4.61\pm0.14)\times10^{-5}$	
Γ_{15}	$\pi^0\pi^0\gamma$		$<5.6\times10^{-6}$	

Charge conjugation × Parity (CP, CPV) or Lepton Family number (LF) violating modes, or $\Delta S = 1$ weak neutral current ($S1$) modes

Γ_{16}	$\pi^+\pi^-$	CPV		$(2.03\pm0.04)\times10^{-3}$	S=1.2
Γ_{17}	$\pi^0\pi^0$	CPV		$(9.14\pm0.34)\times10^{-4}$	S=1.8
Γ_{18}	$\mu^+\mu^-$	$S1$		$(7.4\ \pm0.4)\times10^{-9}$	
Γ_{19}	$\mu^+\mu^-\gamma$	$S1$		$(2.8\ \pm2.8)\times10^{-7}$	
Γ_{20}	e^+e^-	$S1$		$<4.1\times10^{-11}$	CL=90%
Γ_{21}	$e^+e^-\gamma$	$S1$		$(9.1\ \pm0.5)\times10^{-6}$	
Γ_{22}	$e^+e^-\gamma\gamma$	$S1$	[b]	$(6.5\ \pm1.2)\times10^{-7}$	
Γ_{23}	$\pi^+\pi^-e^+e^-$	$S1$		$<2.5\times10^{-6}$	CL=90%
Γ_{24}	$\mu^+\mu^-e^+e^-$	$S1$		$<4.9\times10^{-6}$	CL=90%
Γ_{25}	$e^+e^-e^+e^-$	$S1$	[d]	$(3.9\ \pm0.7)\times10^{-8}$	
Γ_{26}	$\pi^0\mu^+\mu^-$	$CP,S1$	[e]	$<5.1\times10^{-9}$	CL=90%
Γ_{27}	$\pi^0 e^+e^-$	$CP,S1$	[e]	$<4.3\times10^{-9}$	CL=90%
Γ_{28}	$\pi^0\nu\overline{\nu}$	$CP,S1$	[f]	$<5.8\times10^{-5}$	CL=90%
Γ_{29}	$e^\pm\mu^\mp$	LF	[a]	$<3.3\times10^{-11}$	CL=90%

[a] The value is for the sum of the charge states indicated.

[b] See the Full Listings below for the energy limits used in this measurement.

[c] Most of this radiative mode, the low-momentum γ part, is also included in the parent mode listed without γ's.

[d] $m_{e^+e^-} > 470$ MeV.

[e] Allowed by higher-order electroweak interactions.

[f] Violates CP in leading order. Test of direct CP violation since the indirect CP-violating and CP-conserving contributions are expected to be suppressed.

CONSTRAINED FIT INFORMATION

An overall fit to the mean life, 4 decay rate, and 12 branching ratios uses 53 measurements and one constraint to determine 8 parameters. The overall fit has a $\chi^2 = 55.3$ for 46 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\left\langle\delta p_i \delta p_j\right\rangle/(\delta p_i{\cdot}\delta p_j)$, in percent, from the fit to parameters p_i, including the branching fractions, $x_i \equiv \Gamma_i/\Gamma_{\mathrm{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_2	−35						
x_3	−78	6					
x_6	−86	7	46				
x_9	−2	13	−2	−3			
x_{16}	−29	45	14	15	34		
x_{17}	−9	20	2	2	74	48	
Γ	2	−4	0	0	−1	−2	−1
	x_1	x_2	x_3	x_6	x_9	x_{16}	x_{17}

	Mode	Rate (10^8 s^{-1})	Scale factor
Γ_1	$3\pi^0$	0.0419 ± 0.0016	1.4
Γ_2	$\pi^+\pi^-\pi^0$	0.0239 ± 0.0004	1.4

Γ_3	$\pi^{\pm}\mu^{\mp}\nu$ Called $K^0_{\mu 3}$.	[a]	0.0522 ± 0.0008	1.2
Γ_6	$\pi^{\pm}e^{\mp}\nu$ Called K^0_{e3}.	[a]	0.0748 ± 0.0011	1.3
Γ_9	2γ		$(1.11\ \pm0.05\ )\times10^{-4}$	1.9
Γ_{16}	$\pi^+\pi^-$		$(3.93\ \pm0.08\ )\times10^{-4}$	1.2
Γ_{17}	$\pi^0\pi^0$		$(1.77\ \pm0.07\ )\times10^{-4}$	1.7

K^0_L DECAY RATES

$\Gamma(3\pi^0)$ — Γ_1

VALUE (10^6 s^{-1})	EVTS	DOCUMENT ID		TECN	COMMENT
4.19±0.16 OUR FIT Error includes scale factor of 1.4.					
$5.22^{+1.03}_{-0.84}$	54	BEHR	66	HLBC	Assumes *CP*

$\Gamma(\pi^+\pi^-\pi^0)$ — Γ_2

VALUE (10^6 s^{-1})	EVTS	DOCUMENT ID		TECN	COMMENT
2.39±0.04 OUR FIT Error includes scale factor of 1.4.					
2.38±0.09 OUR AVERAGE					
$2.32^{+0.13}_{-0.15}$	192	BALDO-...	75	HLBC	Assumes *CP*
2.35±0.20	180	[7] JAMES	72	HBC	Assumes *CP*
2.71±0.28	99	CHO	71	DBC	Assumes *CP*
2.12±0.33	50	MEISNER	71	HBC	Assumes *CP*
2.20±0.35	53	WEBBER	70	HBC	Assumes *CP*
$2.62^{+0.28}_{-0.27}$	136	BEHR	66	HLBC	Assumes *CP*
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2.5 ±0.3	98	[7] JAMES	71	HBC	Assumes *CP*
3.26±0.77	18	ANDERSON	65	HBC	
1.4 ±0.4	14	FRANZINI	65	HBC	

In the fit this rate is well determined by the mean life and the branching ratio $\Gamma(\pi^+\pi^-\pi^0)/\left[\Gamma(\pi^+\pi^-\pi^0)+\Gamma(\pi^{\pm}\mu^{\mp}\nu)+\Gamma(\pi^{\pm}e^{\mp}\nu)\right]$. For this reason the discrepancy between the $\Gamma(\pi^+\pi^-\pi^0)$ measurements does not affect the scale factor of the overall fit.

[7] JAMES 72 is a final measurement and includes JAMES 71.

$\Gamma(\pi^{\pm}\mu^{\mp}\nu)$ — Γ_3

VALUE (10^6 s^{-1})	EVTS	DOCUMENT ID		TECN
5.22±0.08 OUR FIT Error includes scale factor of 1.2.				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$4.54^{+1.24}_{-1.08}$	19	LOWYS	67	HLBC

$\Gamma(\pi^{\pm}e^{\mp}\nu)$ — Γ_6

VALUE (10^6 s^{-1})	EVTS	DOCUMENT ID		TECN	COMMENT
7.48±0.11 OUR FIT Error includes scale factor of 1.3.					
7.7 ±0.5 OUR AVERAGE					
7.81±0.56	620	CHAN	71	HBC	
$7.52^{+0.85}_{-0.72}$		AUBERT	65	HLBC	$\Delta S=\Delta Q$, *CP* assumed

$\Gamma(\pi^+\pi^-\pi^0)+\Gamma(\pi^{\pm}\mu^{\mp}\nu)+\Gamma(\pi^{\pm}e^{\mp}\nu)$ — $(\Gamma_2+\Gamma_3+\Gamma_6)$

$K^0_L\rightarrow$ charged.

VALUE (10^6 s^{-1})	EVTS	DOCUMENT ID		TECN
15.10±0.19 OUR FIT Error includes scale factor of 1.3.				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
15.1 ±1.9	98	AUERBACH	66B	OSPK

$\Gamma(\pi^{\pm}\mu^{\mp}\nu)+\Gamma(\pi^{\pm}e^{\mp}\nu)$ — $(\Gamma_3+\Gamma_6)$

VALUE (10^6 s^{-1})	EVTS	DOCUMENT ID		TECN	COMMENT
12.70±0.18 OUR FIT Error includes scale factor of 1.3.					
11.9 ±0.6 OUR AVERAGE Error includes scale factor of 1.2.					
12.4 ±0.7	410	[8] BURGUN	72	HBC	$K^+p\to K^0p\pi^+$
13.1 ±1.3	252	[8] WEBBER	71	HBC	$K^-p\to n\overline{K}^0$
11.6 ±0.9	393	[8,9] CHO	70	DBC	$K^+n\to K^0p$
$9.85^{+1.15}_{-1.05}$	109	[8] FRANZINI	65	HBC	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
8.47±1.69	126	[8] MANN	72	HBC	$K^-p\to n\overline{K}^0$
10.3 ±0.8	335	[9] HILL	67	DBC	$K^+n\to K^0p$

[8] Assumes $\Delta S=\Delta Q$ rule.
[9] CHO 70 includes events of HILL 67.

K^0_L BRANCHING RATIOS

$\Gamma(3\pi^0)/\Gamma(\pi^+\pi^-\pi^0)$ — Γ_1/Γ_2

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
1.75±0.08 OUR FIT Error includes scale factor of 1.4.					
1.81±0.13 OUR AVERAGE					
1.80±0.13	1010	BUDAGOV	68	HLBC	
2.0 ±0.6	188	ALEKSANYAN	64B	FBC	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.65±0.07	883	BARMIN	72B	HLBC	Error statistical only

$\Gamma(3\pi^0)/\left[\Gamma(\pi^+\pi^-\pi^0)+\Gamma(\pi^{\pm}\mu^{\mp}\nu)+\Gamma(\pi^{\pm}e^{\mp}\nu)\right]$ — $\Gamma_1/(\Gamma_2+\Gamma_3+\Gamma_6)$

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.277±0.013 OUR FIT Error includes scale factor of 1.5.					
0.260±0.011 OUR AVERAGE					
0.251±0.014	549	BUDAGOV	68	HLBC	ORSAY measur.
0.277±0.021	444	BUDAGOV	68	HLBC	Ecole polytec.meas
$0.31^{+0.07}_{-0.06}$	29	KULYUKINA	68	CC	
0.24 ±0.08	24	ANIKINA	64	CC	

$\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\rm total}$ — Γ_2/Γ

VALUE	DOCUMENT ID
0.1238±0.0021 OUR FIT Error includes scale factor of 1.5.	

$\Gamma(\pi^+\pi^-\pi^0)/\left[\Gamma(\pi^+\pi^-\pi^0)+\Gamma(\pi^{\pm}\mu^{\mp}\nu)+\Gamma(\pi^{\pm}e^{\mp}\nu)\right]$ — $\Gamma_2/(\Gamma_2+\Gamma_3+\Gamma_6)$

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.1586±0.0026 OUR FIT Error includes scale factor of 1.6.					
0.1588±0.0024 OUR AVERAGE Error includes scale factor of 1.4. See the ideogram below.					
0.163 ±0.003	6499	CHO	77	HBC	
0.1605±0.0038	1590	ALEXANDER	73B	HBC	
0.146 ±0.004	3200	BRANDENB...	73	HBC	
0.159 ±0.010	558	EVANS	73	HLBC	
0.167 ±0.016	1402	KULYUKINA	68	CC	
0.161 ±0.005		HOPKINS	67	HBC	
0.162 ±0.015	126	HAWKINS	66	HBC	
0.159 ±0.015	326	ASTBURY	65B	CC	
0.178 ±0.017	566	GUIDONI	65	HBC	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$0.15^{+0.03}_{-0.04}$	66	ASTBURY	65	CC	
0.144 ±0.004	1729	HOPKINS	65	HBC	See HOPKINS 67
0.151 ±0.020	79	ADAIR	64	HBC	
$0.157^{+0.03}_{-0.04}$	75	LUERS	64	HBC	
0.185 ±0.038	59	ASTIER	61	CC	

$$\Gamma\left(\pi^+\pi^-\pi^0\right)/\left[\Gamma\left(\pi^+\pi^-\pi^0\right)+\Gamma\left(\pi^\pm\mu^\mp\nu\right)+\Gamma\left(\pi^\pm e^\mp\nu\right)\right]$$

$\Gamma(\pi^\pm\mu^\mp\nu)/\Gamma(\pi^\pm e^\mp\nu)$ — Γ_3/Γ_6

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.697±0.010 OUR FIT					
0.697±0.010 OUR AVERAGE					
0.702±0.011	33k	CHO	80	HBC	
0.662±0.037	10k	WILLIAMS	74	ASPK	
0.741±0.044	6700	BRANDENB...	73	HBC	
0.662±0.030	1309	EVANS	73	HLBC	
0.71 ±0.05	770	BUDAGOV	68	HLBC	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.68 ±0.08	3548	BASILE	70	OSPK	
0.71 ±0.04	569	[10] BEILLIERE	69	HLBC	
0.648±0.030	1309	EVANS	69	HLBC	Repl. by EVANS 73
0.67 ±0.13		[11] KULYUKINA	68	CC	
0.82 ±0.10		DEBOUARD	67	OSPK	
0.7 ±0.2	273	HAWKINS	67	HBC	
0.81 ±0.08		HOPKINS	67	HBC	
0.81 ±0.19		ADAIR	64	HBC	

[10] BEILLIERE 69 is a scanning experiment using same exposure as BUDAGOV 68.

[11] KULYUKINA 68 $\Gamma(\pi^\pm\mu^\mp\nu)/\Gamma(\pi^\pm e^\mp\nu)$ is not measured independently from $\Gamma(\pi^+\pi^-\pi^0)/\left[\Gamma(\pi^+\pi^-\pi^0)+\Gamma(\pi^\pm\mu^\mp\nu)+\Gamma(\pi^\pm e^\mp\nu)\right]$ and $\Gamma(\pi^\pm e^\mp\nu)/\left[\Gamma(\pi^+\pi^-\pi^0)+\Gamma(\pi^\pm\mu^\mp\nu)+\Gamma(\pi^\pm e^\mp\nu)\right]$.

$\Gamma(\pi^\pm\mu^\mp\nu)/\left[\Gamma(\pi^+\pi^-\pi^0)+\Gamma(\pi^\pm\mu^\mp\nu)+\Gamma(\pi^\pm e^\mp\nu)\right]$ — $\Gamma_3/(\Gamma_2+\Gamma_3+\Gamma_6)$

VALUE	EVTS	DOCUMENT ID		TECN
0.3456±0.0030 OUR FIT				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.335 ±0.055	330	[12] KULYUKINA	68	CC
0.39 $^{+0.08}_{-0.10}$	172	[12] ASTBURY	65	CC
0.356 ±0.07	251	[12] LUERS	64	HBC

[12] This mode not measured independently from $\Gamma(\pi^+\pi^-\pi^0)/\left[\Gamma(\pi^+\pi^-\pi^0)+\Gamma(\pi^\pm\mu^\mp\nu)+\Gamma(\pi^\pm e^\mp\nu)\right]$ and $\Gamma(\pi^\pm e^\mp\nu)/\left[\Gamma(\pi^+\pi^-\pi^0)+\Gamma(\pi^\pm\mu^\mp\nu)+\Gamma(\pi^\pm e^\mp\nu)\right]$.

$\Gamma(\pi^{\pm} e^{\mp} \nu)/[\Gamma(\pi^+ \pi^- \pi^0) + \Gamma(\pi^{\pm} \mu^{\mp} \nu) + \Gamma(\pi^{\pm} e^{\mp} \nu)]$ — $\Gamma_6/(\Gamma_2+\Gamma_3+\Gamma_6)$

VALUE	EVTS	DOCUMENT ID		TECN
0.4958±0.0032 OUR FIT Error includes scale factor of 1.1.				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.498 ±0.052	500	KULYUKINA	68	CC
0.46 $^{+0.08}_{-0.10}$	202	ASTBURY	65	CC
0.487 ±0.05	153	LUERS	64	HBC
0.46 ±0.11	24	NYAGU	61	CC

$\Gamma(\pi^{\pm} e^{\mp} \nu)/[\Gamma(\pi^{\pm} \mu^{\mp} \nu) + \Gamma(\pi^{\pm} e^{\mp} \nu)]$ — $\Gamma_6/(\Gamma_3+\Gamma_6)$

VALUE	EVTS	DOCUMENT ID		TECN
0.5893±0.0033 OUR FIT				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.415 ±0.120	320	ASTIER	61	CC

$[\Gamma(\pi^{\pm} \mu^{\mp} \nu) + \Gamma(\pi^{\pm} e^{\mp} \nu)]/\Gamma_{\text{total}}$ — $(\Gamma_3+\Gamma_6)/\Gamma$

VALUE	DOCUMENT ID
0.656±0.007 OUR FIT Error includes scale factor of 1.5.	

$\Gamma(2\gamma)/\Gamma_{\text{total}}$ — Γ_9/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
5.73±0.27 OUR FIT Error includes scale factor of 2.0.					
4.9 ±0.5 OUR AVERAGE					
4.54±0.84		[13] BANNER	72B	OSPK	
4.5 ±1.0	23	ENSTROM	71	OSPK	K^0_L 1.5–9 GeV/c
5.5 ±1.1	90	KUNZ	68	OSPK	Norm.to 3 π(C+N)
6.7 ±2.2	32	TODOROFF	67	OSPK	Repl. CRIEGEE 66
• • • We do not use the following data for averages, fits, limits, etc. • • •					
5.0 ±1.0		[14] REPELLIN	71	OSPK	
7.4 ±1.6	33	[15] CRONIN	67	OSPK	
1.3 ±0.6		[16] CRIEGEE	66	OSPK	

[13] This value uses $(\eta_{00}/\eta_{+-})^2 = 1.05 \pm 0.14$. In general, $\Gamma(2\gamma)/\Gamma_{\text{total}} = [(4.32 \pm 0.55) \times 10^{-4}]\,[(\eta_{00}/\eta_{+-})^2]$.

[14] Assumes regeneration amplitude in copper at 2 GeV is 22 mb. To evaluate for a given regeneration amplitude and error, multiply by (regeneration amplitude/22mb)^2.

[15] CRONIN 67 replaced by KUNZ 68.

[16] CRIEGEE 66 replaced by TODOROFF 67.

$\Gamma(2\gamma)/\Gamma(3\pi^0)$ — Γ_9/Γ_1

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
2.65±0.16 OUR FIT Error includes scale factor of 1.7.					
2.24±0.22 OUR AVERAGE					
2.13±0.43	28	BARMIN	71	HLBC	
2.24±0.28	115	BANNER	69	OSPK	
2.5 ±0.7	16	ARNOLD	68B	HLBC	Vacuum decay

$\Gamma(2\gamma)/\Gamma(\pi^0 \pi^0)$ — Γ_9/Γ_{17}

VALUE	EVTS	DOCUMENT ID		TECN
0.627±0.020 OUR FIT Error includes scale factor of 2.3.				
0.632±0.004±0.008	110k	BURKHARDT	87	NA31

$\Gamma(\pi^0 2\gamma)/\Gamma_{\text{total}}$ — Γ_{10}/Γ

	VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
	1.7 ±0.2 ±0.2		63	[17] BARR	92	SPEC	
• • • We do not use the following data for averages, fits, limits, etc. • • •							
	1.86±0.60±0.60		60	PAPADIMITR...91		E731	$m_{\gamma\gamma} > 280$ MeV
<	5.1	90		PAPADIMITR...91		E731	$m_{\gamma\gamma} < 264$ MeV
	2.1 ±0.6		14	[18] BARR	90C	NA31	$m_{\gamma\gamma} > 280$ MeV
<	2.7	90		PAPADIMITR...89		E731	In PAPADI...91
<	230	90	0	BANNER	69	OSPK	

[17] BARR 92 find that $\Gamma(\pi^0 2\gamma,\ m_{\gamma\gamma} < 240\ \text{MeV})/\Gamma(\pi^0 2\gamma) < 0.09$ (90% CL).

[18] BARR 90C superseded by BARR 92.

$\Gamma(\pi^0 \pi^\pm e^\mp \nu)/\Gamma_{total}$ — Γ_{11}/Γ

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID		TECN
5.18±0.29 OUR AVERAGE					
5.16±0.20±0.22		729	MAKOFF	93	E731
6.2 ±2.0		16	CARROLL	80C	SPEC
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<220	90		[19] DONALDSON	74	SPEC

[19] DONALDSON 74 uses $K^0_L \to \pi^+ \pi^- \pi^0/(\text{all } K^0_L)$ decays = 0.126.

$\Gamma((\pi\mu\,\text{atom})\nu)/\Gamma(\pi^\pm \mu^\mp \nu)$ — Γ_{12}/Γ_3

VALUE (units 10^{-7})	EVTS	DOCUMENT ID		TECN
3.90±0.39	155	[20] ARONSON	86	SPEC
• • • We do not use the following data for averages, fits, limits, etc. • • •				
seen	18	COOMBES	76	WIRE

[20] ARONSON 86 quote theoretical value of $(4.31 \pm 0.08) \times 10^{-7}$.

$\Gamma(\pi^\pm e^\mp \nu_e \gamma)/\Gamma(\pi^\pm e^\mp \nu)$ — Γ_{13}/Γ_6

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
3.3±2.0	10	PEACH	71	HLBC	γ KE >15 MeV

$\Gamma(\pi^+ \pi^- \gamma)/\Gamma_{total}$ — Γ_{14}/Γ

For earlier limits see our 1992 edition Physical Review **D45,** 1 June, Part II (1992).

VALUE (units 10^{-5})	EVTS	DOCUMENT ID		TECN	COMMENT
4.61±0.14 OUR AVERAGE					
4.66±0.15	3136	[21] RAMBERG	93	E731	E_γ >20 MeV
4.41±0.32	1062	[22] CARROLL	80B	SPEC	E_γ >20 MeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.52±0.16	516	[23] CARROLL	80B	SPEC	E_γ >20 MeV
2.89±0.28	546	[24] CARROLL	80B	SPEC	
6.2 ±2.1	24	[25] DONALDSON	74C	SPEC	

[21] RAMBERG 93 finds that fraction of Direct Emission (DE) decays with E_γ >20 MeV is 0.685 ± 0.041.
[22] Both components. Uses $K^0_L \to \pi^+ \pi^- \pi^0/(\text{all } K^0_L)$ decays = 0.1239.
[23] Internal Bremsstrahlung component only.
[24] Direct γ emission component only.
[25] Uses $K^0_L \to \pi^+ \pi^- \pi^0/(\text{all } K^0_L)$ decays = 0.126.

$\Gamma(\pi^0 \pi^0 \gamma)/\Gamma_{total}$ — Γ_{15}/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID		TECN
< 5.6			BARR	94	NA31
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<230	90	0	ROBERTS	94	E799

$\Gamma(\pi^+ \pi^-)/\Gamma_{total}$ — Γ_{16}/Γ

Violates *CP* conservation.

VALUE (units 10^{-3})	DOCUMENT ID	
2.03 ±0.04 OUR FIT Error includes scale factor of 1.2.		
2.102±0.063	[26] ETAFIT	94

[26] This ETAFIT value is computed from fitted values of $|\eta_{+-}|$, the K^0_L and K^0_S lifetimes, and the $K^0_S \to \pi^+ \pi^-$ branching fraction. See the discussion in the "Note on *CP* violation in K^0_L decay."

$\Gamma(\pi^+ \pi^-)/\Gamma(\pi^+ \pi^- \pi^0)$ — Γ_{16}/Γ_2

Violates *CP* conservation.

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
1.639±0.032 OUR FIT Error includes scale factor of 1.1.					
1.64 ±0.04	4200	MESSNER	73	ASPK	η_{+-} = 2.23

$\Gamma(\pi^+\pi^-)/[\Gamma(\pi^\pm\mu^\mp\nu)+\Gamma(\pi^\pm e^\mp\nu)]$ — $\Gamma_{16}/(\Gamma_3+\Gamma_6)$

Violates *CP* conservation.

VALUE (units 10^{-3})	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
3.09±0.06 OUR FIT	Error includes scale factor of 1.2.				
3.08±0.10 OUR AVERAGE					
3.13±0.14	1687	COUPAL	85	SPEC	η_{+-}=2.28 ± 0.06
3.04±0.14	2703	DEVOE	77	SPEC	η_{+-}=2.25 ± 0.05
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2.51±0.23	309	[27] DEBOUARD	67	OSPK	η_{+-}=2.00 ± 0.09
2.35±0.19	525	[27] FITCH	67	OSPK	η_{+-}=1.94 ± 0.08

[27] Old experiments excluded from fit. See subsection on η_{+-} in section on "PARAMETERS FOR $K^0_L \rightarrow 2\pi$ DECAY" below for average η_{+-} of these experiments and for note on discrepancy.

$\Gamma(\pi^+\pi^-)/[\Gamma(\pi^+\pi^-\pi^0)+\Gamma(\pi^\pm\mu^\mp\nu)+\Gamma(\pi^\pm e^\mp\nu)]$ — $\Gamma_{16}/(\Gamma_2+\Gamma_3+\Gamma_6)$

Violates *CP* conservation.

VALUE (units 10^{-3})	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
2.60 ±0.05 OUR FIT	Error includes scale factor of 1.1.				
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2.60 ±0.07	4200	[28] MESSNER	73	ASPK	η_{+-} = 2.23 ± 0.05
1.93 ±0.26		[29] BASILE	66	OSPK	η_{+-} = 1.92 ± 0.13
1.993±0.080		[29] BOTT-...	66	OSPK	η_{+-} = 1.95 ± 0.04
2.08 ±0.35	54	[29] GALBRAITH	65	OSPK	η_{+-} = 1.99 ± 0.16
2.0 ±0.4	45	[29] CHRISTENS...	64	OSPK	η_{+-} = 1.95 ± 0.20

[28] From same data as $\Gamma(\pi^+\pi^-)/\Gamma(\pi^+\pi^-\pi^0)$ MESSNER 73, but with different normalization.

[29] Old experiments excluded from fit. See subsection on η_{+-} in section on "PARAMETERS FOR $K^0_L \rightarrow 2\pi$ DECAY" below for average η_{+-} of these experiments and for note on discrepancy.

$\Gamma(\pi^0\pi^0)/\Gamma_{total}$ — Γ_{17}/Γ

Violates *CP* conservation.

VALUE (units 10^{-3})	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
0.914±0.034 OUR FIT	Error includes scale factor of 1.8.				
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2.5 ±0.8	189	[30] GAILLARD	69	OSPK	η_{00}=3.6 ± 0.6
$1.2\ ^{+1.5}_{-1.2}$	7	[31] CRIEGEE	66	OSPK	

[30] Latest result of this experiment given by FAISSNER 70 $\Gamma(\pi^0\pi^0)/\Gamma(3\pi^0)$.

[31] CRIEGEE 66 experiment not designed to measure $2\pi^0$ decay mode.

$\Gamma(\pi^0\pi^0)/\Gamma(3\pi^0)$ — Γ_{17}/Γ_1

Violates *CP* conservation.

VALUE (units 10^{-2})	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
0.422±0.023 OUR FIT	Error includes scale factor of 1.6.				
0.44 ±0.09 OUR AVERAGE	Error includes scale factor of 1.6. See the ideogram below.				
1.21 ±0.30	150	[32] REY	76	OSPK	η_{00}=3.8 ± 0.5
0.37 ±0.08	29	BARMIN	70	HLBC	η_{00}=2.02 ± 0.23
0.32 ±0.15	30	BUDAGOV	70	HLBC	η_{00}=1.9 ± 0.5
0.90 ±0.30	172	[33] FAISSNER	70	OSPK	η_{00}=3.2 ± 0.5
0.46 ±0.11	57	BANNER	69	OSPK	η_{00}=2.2 ± 0.3
not seen		BARTLETT	68	OSPK	See η_{00} below
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.31 ±0.31	133	[32] CENCE	69	OSPK	η_{00}=3.7 ± 0.5
1.89 ±0.31	109	[34] CRONIN	67	OSPK	η_{00}=4.9 ± 0.5
1.36 ±0.18		[34] CRONIN	67B	OSPK	η_{00}=3.92 ± 0.3

[32] CENCE 69 events are included in REY 76.

[33] FAISSNER 70 contains same $2\pi^0$ events as GAILLARD 69 $\Gamma(\pi^0\pi^0)/\Gamma_{total}$.

[34] CRONIN 67B is further analysis of CRONIN 67, now both withdrawn.

$\Gamma\left(\pi^0\pi^0\right)/\Gamma\left(3\pi^0\right)$ (units 10^{-2})

$\Gamma(\pi^0\pi^0)/\Gamma(\pi^+\pi^-)$ — Γ_{17}/Γ_{16}

Violates *CP* conservation.

VALUE	*DOCUMENT ID*	
0.451 ±0.015 OUR FIT Error includes scale factor of 2.4.		
0.4539±0.0061	[35] ETAFIT	94

[35] This ETAFIT value is computed from fitted values of $|\eta_{00}\ /\ \eta_{+-}|$ and the $\Gamma(K^0_S \rightarrow \pi^+\pi^-)\ /\ \Gamma(K^0_S \rightarrow \pi^0\pi^0)$ branching fraction. See the discussion in the "Note on *CP* violation in K^0_L decay."

$\Gamma(\mu^+\mu^-)/\left[\Gamma(\pi^+\pi^-\pi^0)+\Gamma(\pi^\pm\mu^\mp\nu)+\Gamma(\pi^\pm e^\mp\nu)\right]$ — $\Gamma_{18}/(\Gamma_2+\Gamma_3+\Gamma_6)$

Test for $\Delta S = 1$ weak neutral current. Allowed by higher-order electroweak interaction.

VALUE (units 10^{-6})	*CL%*	*DOCUMENT ID*		*TECN*
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$<$ 2.0	90	BOTT-...	67	OSPK
$<$ 35.0	90	FITCH	67	OSPK
$<$250.0	90	ALFF-...	66B	OSPK
$<$100.0		ANIKINA	65	CC

$\Gamma(\mu^+\mu^-)/\Gamma(\pi^+\pi^-)$ — Γ_{18}/Γ_{16}

Test for $\Delta S = 1$ weak neutral current. Allowed by higher-order electroweak interaction.

VALUE (units 10^{-6})	*CL%*	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
3.64±0.18 OUR AVERAGE						
3.9 ±0.3 ±0.1		178	[36] AKAGI	91B	SPEC	
3.45±0.18±0.13		368	[37] HEINSON	91	SPEC	
$4.0\ ^{+1.4}_{-0.9}$		15	SHOCHET	79	SPEC	
$4.2\ ^{+5.1}_{-2.6}$		3	[38] FUKUSHIMA	76	SPEC	
$5.8\ ^{+2.3}_{-1.5}$		9	[39] CARITHERS	73	SPEC	
• • • We do not use the following data for averages, fits, limits, etc. • • •						
4.1 ±0.5		54	INAGAKI	89	SPEC	In AKAGI 91B
2.8 ±0.3 ±0.2		87	MATHIAZHA...	89B	SPEC	In HEINSON 91
$<$ 1.53	90	0	[40] CLARK	71	SPEC	
$<$ 18.	90	0	DARRIULAT	70	SPEC	
$<$140.	90	0	FOETH	69	SPEC	

[36] AKAGI 91B give this number multiplied by the 1990 PDG average for $\Gamma(K^0_L \rightarrow \pi^+\pi^-)/\Gamma(\text{total})$.

[37] HEINSON 91 give $\Gamma(K^0_L \rightarrow \mu\mu)/\Gamma_{\text{total}}$. We divide out the $\Gamma(K^0_L \rightarrow \pi^+\pi^-)/\Gamma_{\text{total}}$ PDG average which they used.

[38] FUKUSHIMA 76 errors are at CL = 90%.
[39] CARITHERS 73 errors are at CL = 68%, W.Carithers, (private communication 79).
[40] CLARK 71 limit raised from 1.2×10^{-6} by FIELD 74 reanalysis. Not in agreement with subsequent experiments. So not averaged.

$\Gamma(\mu^+\mu^-\gamma)/\Gamma_{\text{total}}$ Γ_{19}/Γ

Test for $\Delta S = 1$ weak neutral current. Allowed by higher-order electroweak interaction.

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID		TECN
0.28±0.28		1	[41] CARROLL	80D	SPEC
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<7.81	90		[42] DONALDSON	74	SPEC

[41] Uses $K^0_L \rightarrow \pi^+\pi^-\pi^0$/(all K^0_L) decays = 0.1239.
[42] Uses $K^0_L \rightarrow \pi^+\pi^-\pi^0$/(all K^0_L) decays = 0.126.

$\Gamma(e^+e^-)/\Gamma_{\text{total}}$ Γ_{20}/Γ

Test for $\Delta S = 1$ weak neutral current. Allowed by higher-order electroweak interaction.

VALUE (units 10^{-10})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
< 0.41	90	0	[43] ARISAKA	93B	SPEC	
• • • We do not use the following data for averages, fits, limits, etc. • • •						
< 1.6	90	1	AKAGI	91	SPEC	
< 5.6	90		INAGAKI	89	SPEC	In AKAGI 91
< 3.2	90		MATHIAZHA...	89	SPEC	In ARISAKA 93B
< 110	90		COUSINS	88	SPEC	
< 45	90		GREENLEE	88	SPEC	Repl. by JASTRZEMBSKI 88
< 12	90		JASTRZEM...	88	SPEC	
< 15.7	90		[44] CLARK	71	ASPK	
<1500	90	0	FOETH	69	ASPK	

[43] ARISAKA 93B includes all events with <6 MeV radiated energy.
[44] Possible (but unknown) systematic errors. See note on CLARK 71 $\Gamma(\mu^+\mu^-)/\Gamma(\pi^+\pi^-)$ entry.

$\Gamma(e^+e^-)/[\Gamma(\pi^+\pi^-\pi^0)+\Gamma(\pi^\pm\mu^\mp\nu)+\Gamma(\pi^\pm e^\mp\nu)]$ $\Gamma_{20}/(\Gamma_2+\Gamma_3+\Gamma_6)$

Test for $\Delta S = 1$ weak neutral current. Allowed by higher-order electroweak interaction.

VALUE (units 10^{-6})	CL%	DOCUMENT ID		TECN
• • • We do not use the following data for averages, fits, limits, etc. • • •				
< 23.0	90	BOTT-...	67	OSPK
< 200.0	90	ALFF-...	66B	OSPK
<1000.0		ANIKINA	65	CC

$\Gamma(e^+e^-\gamma)/\Gamma_{\text{total}}$ Γ_{21}/Γ

Test for $\Delta S = 1$ weak neutral current. Allowed by higher-order electroweak interaction.

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID		TECN
9.1±0.5 OUR AVERAGE					
9.2±0.5±0.5		1053	BARR	90B	NA31
$9.1\pm0.4^{+0.6}_{-0.5}$		919	OHL	90B	B845
• • • We do not use the following data for averages, fits, limits, etc. • • •					
17.4±8.7		4	[45] CARROLL	80D	SPEC
<27	90	0	[46] BARMIN	72	HLBC

[45] Uses $K^0_L \rightarrow \pi^+\pi^-\pi^0$/(all K^0_L) decays = 0.1239.
[46] Uses $K^0_L \rightarrow 3\pi^0$/total = 0.214.

$\Gamma(e^+e^-\gamma\gamma)/\Gamma_{\text{total}}$ Γ_{22}/Γ

Test for $\Delta S = 1$ weak neutral current. Allowed by higher-order electroweak interaction.

VALUE (units 10^{-7})	EVTS	DOCUMENT ID		TECN	COMMENT
6.5±1.2 OUR AVERAGE					
6.5±1.2±0.6	58	NAKAYA	94	E799	$E_\gamma > 5$ MeV
6.6±3.2		MORSE	92	B845	$E_\gamma > 5$ MeV

$\Gamma(\pi^+\pi^-e^+e^-)/\Gamma_{\text{total}}$ Γ_{23}/Γ

Test for $\Delta S = 1$ weak neutral current. Allowed by higher-order electroweak interaction.

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID		TECN
< 2.5	90	0	BALATS	83	SPEC
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 8.81	90		[47] DONALDSON	76	SPEC
<30			ANIKINA	73	STRC

[47] Uses $K^0_L \rightarrow \pi^+\pi^-\pi^0$/(all K^0_L) decays = 0.126.

$\Gamma(\mu^+\mu^- e^+ e^-)/\Gamma_{\text{total}}$ — Γ_{24}/Γ

Test for $\Delta S = 1$ weak neutral current. Allowed by higher-order electroweak interaction.

VALUE (units 10^{-6})	CL%	DOCUMENT ID		TECN
<4.9	90	BALATS	83	SPEC

$\Gamma(e^+ e^- e^+ e^-)/\Gamma_{\text{total}}$ — Γ_{25}/Γ

Test for $\Delta S = 1$ weak neutral current. Allowed by higher-order electroweak interaction.

VALUE (units 10^{-8})	CL%	EVTS	DOCUMENT ID		TECN
3.9 ±0.7 OUR AVERAGE					
3.96±0.78±0.32		27	GU	94	E799
6 ±2 ±1		18	AKAGI	93	CNTR
3.07±1.25±0.26		6	VAGINS	93	B845
4 ±3		2	BARR	91	NA31
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<260	90		BALATS	83	SPEC

$\Gamma(\pi^0\mu^+\mu^-)/\Gamma_{\text{total}}$ — Γ_{26}/Γ

Violates *CP* in leading order. Test for $\Delta S = 1$ weak neutral current. Allowed by higher-order electroweak interaction.

VALUE (units 10^{-9})	CL%	EVTS	DOCUMENT ID		TECN
< 5.1	90	0	HARRIS	93	E799
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 1200	90	0	[48] CARROLL	80D	SPEC
<56600	90		[49] DONALDSON	74	SPEC

[48] Uses $K^0_L \rightarrow \pi^+\pi^-\pi^0/(\text{all } K^0_L)$ decays = 0.1239.
[49] Uses $K^0_L \rightarrow \pi^+\pi^-\pi^0/(\text{all } K^0_L)$ decays = 0.126.

$\Gamma(\pi^0 e^+ e^-)/\Gamma_{\text{total}}$ — Γ_{27}/Γ

Violates *CP* in leading order. Direct and indirect *CP*-violating contributions are expected to be comparable and to dominate the *CP*-conserving part. Test for $\Delta S = 1$ weak neutral current. Allowed by higher-order electroweak interaction.

VALUE (units 10^{-9})	CL%	EVTS	DOCUMENT ID		TECN
< 4.3	90	0	HARRIS	93B	E799
< 7.5	90	0	BARKER	90	E731
< 5.5	90	0	OHL	90	B845
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 40	90		BARR	88	NA31
< 320	90		JASTRZEM...	88	SPEC
<2300	90	0	[50] CARROLL	80D	SPEC

[50] Uses $K^0_L \rightarrow \pi^+\pi^-\pi^0/(\text{all } K^0_L)$ decays = 0.1239.

$\Gamma(\pi^0\nu\overline{\nu})/\Gamma_{\text{total}}$ — Γ_{28}/Γ

Violates *CP* in leading order. Test of direct *CP* violation since the indirect *CP*-violating and *CP*-conserving contributions are expected to be suppressed. Test of $\Delta S = 1$ weak neutral current.

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID		TECN
< 5.8	90	0	WEAVER	94	E799
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 22	90	0	GRAHAM	92	CNTR
<760	90		[51] LITTENBERG	89	RVUE

[51] LITTENBERG 89 is from retroactive data analysis of CRONIN 67.

$\Gamma(e^\pm\mu^\mp)/\Gamma_{\text{total}}$ — Γ_{29}/Γ

Test of lepton family number conservation.

VALUE (units 10^{-11})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
< 3.3	90	0	[52] ARISAKA	93	SPEC	
• • • We do not use the following data for averages, fits, limits, etc. • • •						
< 3.9	90	0	ARISAKA	93	SPEC	
< 9.4	90	0	AKAGI	91	SPEC	
< 43	90		INAGAKI	89	SPEC	In AKAGI 91
< 22	90		MATHIAZHA...	89	SPEC	
< 190	90		SCHAFFNER	89	SPEC	
<1100	90		COUSINS	88	SPEC	
< 670	90		GREENLEE	88	SPEC	Repl. by SCHAFFNER 89
< 157	90		[53] CLARK	71	ASPK	

[52] This is the combined result of ARISAKA 93 and MATHIAZHAGAN 89.
[53] Possible (but unknown) systematic errors. See note on CLARK 71 $\Gamma(\mu^+\mu^-)/\Gamma(\pi^+\pi^-)$ entry.

$\Gamma(e^\pm\mu^\mp)/\left[\Gamma(\pi^+\pi^-\pi^0)+\Gamma(\pi^\pm\mu^\mp\nu)+\Gamma(\pi^\pm e^\mp\nu)\right]$ $\Gamma_{29}/(\Gamma_2+\Gamma_3+\Gamma_6)$

Test of lepton family number conservation.

VALUE (units 10^{-4})	CL%	DOCUMENT ID		TECN
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$<$ 0.1	90	BOTT-...	67	OSPK
$<$ 0.08	90	FITCH	67	OSPK
$<$ 1.0	90	CARPENTER	66	OSPK
$<$10.0		ANIKINA	65	CC

ENERGY DEPENDENCE OF K^0_L DALITZ PLOT

For discussion, see note on Dalitz plot parameters in the $K^\pm$ section of the Full Listings above. For definitions of a_v, a_t, a_u, and a_y, see the earlier version of the same note in the 1982 edition of this *Review* published in Physics Letters **111B** 70 (1982).

$|\text{matrix element}|^2 = 1 + gu + hu^2 + jv + kv^2$
where $u = (s_3 - s_0)\ /\ m^2_\pi$ and $v = (s_1 - s_2)\ /\ m^2_\pi$

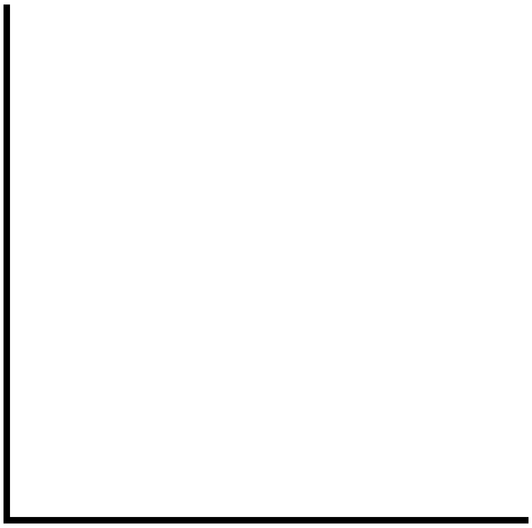
LINEAR COEFFICIENT g FOR $K^0_L \to \pi^+\pi^-\pi^0$

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.670±0.014 OUR AVERAGE	Error includes scale factor of 1.6. See the ideogram below.				
0.681±0.024	6499	CHO	77	HBC	
0.620±0.023	4709	PEACH	77	HBC	
0.677±0.010	509k	MESSNER	74	ASPK	$a_y = -0.917 \pm 0.013$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.69 ±0.07	192	[54] BALDO-...	75	HLBC	
0.590±0.022	56k	[54] BUCHANAN	75	SPEC	$a_u = -0.277 \pm 0.010$
0.619±0.027	20k	[54,55] BISI	74	ASPK	$a_t = -0.282 \pm 0.011$
0.612±0.032		[54] ALEXANDER	73B	HBC	
0.73 ±0.04	3200	[54] BRANDENB...	73	HBC	
0.50 ±0.11	180	[54] JAMES	72	HBC	
0.608±0.043	1486	[54] KRENZ	72	HLBC	$a_t = -0.277 \pm 0.018$
0.688±0.074	384	[54] METCALF	72	ASPK	$a_t = -0.31 \pm 0.03$
0.650±0.012	29k	[54] ALBROW	70	ASPK	$a_y = -0.858 \pm 0.015$
0.593±0.022	36k	[54,56] BUCHANAN	70	SPEC	$a_u = -0.278 \pm 0.010$
0.664±0.056	4400	[54] SMITH	70	OSPK	$a_t = -0.306 \pm 0.024$
0.400±0.045	2446	[54] BASILE	68B	OSPK	$a_t = -0.188 \pm 0.020$
0.649±0.044	1350	[54] HOPKINS	67	HBC	$a_t = -0.294 \pm 0.018$
0.428±0.055	1198	[54] NEFKENS	67	OSPK	$a_u = -0.204 \pm 0.025$
0.64 ±0.17	280	[54] ANIKINA	66	CC	$a_v = -8.2^{+0.9}_{-1.3}$
0.70 ±0.12	126	[54] HAWKINS	66	HBC	$a_v = -8.6 \pm 0.7$
0.32 ±0.13	66	[54] ASTBURY	65	CC	$a_v = -5.5 \pm 1.5$
0.51 ±0.09	310	[54] ASTBURY	65B	CC	$a_v = -7.3^{+0.6}_{-0.8}$
0.55 ±0.23	79	[54] ADAIR	64	HBC	$a_v = -7.6 \pm 1.7$
0.51 ±0.20	77	[54] LUERS	64	HBC	$a_v = -7.3 \pm 1.6$

[54] Quadratic dependence required by some experiments. (See sections on "QUADRATIC COEFFICIENT h" and "QUADRATIC COEFFICIENT k" below.) Correlations prevent us from averaging results of fits not including g, h, and k terms.

[55] BISI 74 value comes from quadratic fit with quad. term consistent with zero. g error is thus larger than if linear fit were used.

[56] BUCHANAN 70 result revised by BUCHANAN 75 to include radiative correlations and to use more reliable K^0_L momentum spectrum of second experiment (had same beam).



Linear coeff. g for $K^0_L \rightarrow \pi^+ \pi^- \pi^0$ matrix element squared

QUADRATIC COEFFICIENT h FOR $K^0_L \rightarrow \pi^+ \pi^- \pi^0$

VALUE	EVTS	DOCUMENT ID		TECN
0.079±0.007 OUR AVERAGE				
0.095±0.032	6499	CHO	77	HBC
0.048±0.036	4709	PEACH	77	HBC
0.079±0.007	509k	MESSNER	74	ASPK
• • • We do not use the following data for averages, fits, limits, etc. • • •				
−0.011±0.018	29k	[57] ALBROW	70	ASPK
0.043±0.052	4400	[57] SMITH	70	OSPK

See notes in section "LINEAR COEFFICIENT g FOR $K^0_L \rightarrow \pi^+ \pi^- \pi^0$ |MATRIX ELEMENT|^2" above.

[57] Quadratic coefficients h and k required by some experiments. (See section on "QUADRATIC COEFFICIENT k" below.) Correlations prevent us from averaging results of fits not including g, h, and k terms.

QUADRATIC COEFFICIENT k FOR $K^0_L \rightarrow \pi^+ \pi^- \pi^0$

VALUE	EVTS	DOCUMENT ID		TECN
0.0098±0.0018 OUR AVERAGE				
0.024 ±0.010	6499	CHO	77	HBC
−0.008 ±0.012	4709	PEACH	77	HBC
0.0097±0.0018	509k	MESSNER	74	ASPK

LINEAR COEFFICIENT j FOR $K^0_L \rightarrow \pi^+ \pi^- \pi^0$ (*CP*-VIOLATING TERM)

Listed in *CP*-violation section below.

QUADRATIC COEFFICIENT h FOR $K^0_L \rightarrow \pi^0 \pi^0 \pi^0$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN
−3.3±1.1±0.7	5M	[58] SOMALWAR	92	E731

[58] SOMALWAR 92 chose m_{π^+} as normalization to make it compatible with the Particle Data Group $K^0_L \rightarrow \pi^+ \pi^- \pi^0$ definitions.

K^0_L FORM FACTORS

For discussion, see note on form factors in the $K^\pm$ section of the Full Listings above.

In the form factor comments, the following symbols are used.

f_+ and f_- are form factors for the vector matrix element.

f_S and f_T refer to the scalar and tensor term.

$f_0 = f_+ + f_- t/(m_K^2 - m_\pi^2)$.

λ_+, λ_-, and λ_0 are the linear expansion coefficients of f_+, f_-, and f_0.

λ_+ refers to the $K^0_{\mu 3}$ value except in the K^0_{e3} sections.

$d\xi(0)/d\lambda_+$ is the correlation between $\xi(0)$ and λ_+ in $K^0_{\mu 3}$.

$d\lambda_0/d\lambda_+$ is the correlation between λ_0 and λ_+ in $K^0_{\mu 3}$.

t = momentum transfer to the π in units of m_π^2.

DP = Dalitz plot analysis.

PI = π spectrum analysis.

MU = μ spectrum analysis.

POL= μ polarization analysis.

BR = $K^0_{\mu 3}/K^0_{e3}$ branching ratio analysis.

E = positron or electron spectrum analysis.

RC = radiative corrections.

λ_+ (LINEAR ENERGY DEPENDENCE OF f_+ IN K^0_{e3} DECAY)

For radiative correction of K^0_{e3} DP, see GINSBERG 67 and BECHERRAWY 70.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.0300±0.0016 OUR AVERAGE		Error includes scale factor of 1.2.			
0.0306±0.0034	74k	BIRULEV	81	SPEC	DP
0.025 ±0.005	12k	[59] ENGLER	78B	HBC	DP
0.0348±0.0044	18k	HILL	78	STRC	DP
0.0312±0.0025	500k	GJESDAL	76	SPEC	DP
0.0270±0.0028	25k	BLUMENTHAL	75	SPEC	DP
0.044 ±0.006	24k	BUCHANAN	75	SPEC	DP
0.040 ±0.012	2171	WANG	74	OSPK	DP
0.045 ±0.014	5600	ALBROW	73	ASPK	DP
0.019 ±0.013	1871	BRANDENB...	73	HBC	PI transv.
0.022 ±0.014	1910	NEUHOFER	72	ASPK	PI
0.023 ±0.005	42k	BISI	71	ASPK	DP
0.05 ±0.01	16k	CHIEN	71	ASPK	DP, no RC
0.02 ±0.013	1000	ARONSON	68	OSPK	PI
+0.023 ±0.012	4800	BASILE	68	OSPK	DP, no RC
−0.01 ±0.02	762	FIRESTONE	67	HBC	DP, no RC
+0.01 ±0.015	531	KADYK	67	HBC	e,PI, no RC
$+0.08\ ^{+0.10}_{-0.08}$	240	LOWYS	67	FBC	PI
+0.15 ±0.08	577	FISHER	65	OSPK	DP, no RC
+0.07 ±0.06	153	LUERS	64	HBC	DP, no RC
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.029 ±0.005	19k	[59] CHO	80	HBC	DP
0.0286±0.0049	26k	BIRULEV	79	SPEC	Repl. by BIRULEV 81
0.032 ±0.0042	48k	BIRULEV	76	SPEC	Repl. by BIRULEV 81

[59] ENGLER 78B uses an unique K_{e3} subset of CHO 80 events and is less subject to systematic effects.

$\xi_a = f_-/f_+$ (determined from $K^0_{\mu 3}$ spectra)

The parameter ξ is redundant with λ_0 below and is not put into the Meson Summary Table.

VALUE	$d\xi(0)/d\lambda_+$	EVTS	DOCUMENT ID		TECN	COMMENT
−0.11±0.09 OUR EVALUATION			From a fit discussed in note on $K_{\ell 3}$ form factors in 1982 edition, PL **111B** (April 1982).			
−0.10±0.09	−12	150k	[60] BIRULEV	81	SPEC	DP
+0.26±0.16	−13	14k	[61] CHO	80	HBC	DP
+0.13±0.23	−20	16k	[61] HILL	79	STRC	DP
−0.25±0.22	−5.9	32k	[62] BUCHANAN	75	SPEC	DP
−0.11±0.07	−17	1.6M	[63] DONALDSON	74B	SPEC	DP
−1.00±0.45	−20	1385	[64] PEACH	73	HLBC	DP
−1.5 ±0.7	−28	9086	[65] ALBROW	72	ASPK	DP
+1.2 ±0.8	−18	1341	[66] CARPENTER	66	OSPK	DP
• • • We do not use the following data for averages, fits, limits, etc. • • •						
+0.50±0.61	unknown	16k	[67] DALLY	72	ASPK	DP
−3.9 ±0.4		3140	[68] BASILE	70	OSPK	DP, indep of λ_+
$-0.68^{+0.12}_{-0.20}$	−26	16k	[67] CHIEN	70	ASPK	DP

[60] BIRULEV 81 error, $d\xi(0)/d\lambda_+$ calculated by us from λ_0, λ_+. $d\lambda_0/d\lambda_+ = 0$ used.

[61] HILL 79 and CHO 80 calculated by us from λ_0, λ_+, and $d\lambda_0/d\lambda_+$.

[62] BUCHANAN 75 is calculated by us from λ_0, λ_+ and $d\lambda_0/d\lambda_+$ because their appendix A value -0.20 ± 22 assumes $\xi(t)$ constant, i.e. $\lambda_- = \lambda_+$.

[63] DONALDSON 74B gives $\xi = -0.11 \pm 0.02$ not including systematics. Above error and $d\xi(0)/d\lambda_+$ were calculated by us from λ_0 and λ_+ errors (which include systematics) and $d\lambda_0/d\lambda_+$.

[64] PEACH 73 gives $\xi(0) = -0.95 \pm 0.45$ for $\lambda_+ = \lambda_- = 0.025$. The above value is for $\lambda_- = 0$. K.Peach, private communication (1974).

[65] ALBROW 72 fit has λ_- free, gets $\lambda_- = -0.030 \pm 0.060$ or $\Lambda = +0.15^{+0.17}_{-0.11}$.

[66] CARPENTER 66 $\xi(0)$ is for $\lambda_+ = 0$. $d\xi(0)/d\lambda_+$ is from figure 9.

[67] CHIEN 70 errors are statistical only. $d\xi(0)/d\lambda_+$ from figure 4. DALLY 72 is a reanalysis of CHIEN 70. The DALLY 72 result is not compatible with assumption $\lambda_- = 0$ so not included in our fit. The nonzero λ_- value and the relatively large λ_+ value found by DALLY 72 come mainly from a single low t bin (figures 1,2). The (f_+,ξ) correlation was ignored. We estimate from figure 2 that fixing $\lambda_- = 0$ would give $\xi(0) = -1.4 \pm 0.3$ and would add 10 to χ^2. $d\xi(0)/d\lambda_+$ is not given.

[68] BASILE 70 is incompatible with all other results. Authors suggest that efficiency estimates might be responsible.

$\xi_b = f_-/f_+$ (determined from $K^0_{\mu 3}/K^0_{e3}$)

The $K^0_{\mu 3}/K^0_{e3}$ branching ratio fixes a relationship between $\xi(0)$ and λ_+. We quote the author's $\xi(0)$ and associated λ_+ but do not average because the λ_+ values differ. The fit result and scale factor given below are not obtained from these ξ_b values. Instead they are obtained directly from the authors $K^0_{\mu 3}/K^0_{e3}$ branching ratio via the fitted $K^0_{\mu 3}/K^0_{e3}$ ratio $(\Gamma(\pi^\pm \mu^\mp \nu)/\Gamma(\pi^\pm e^\mp \nu))$. The parameter ξ is redundant with λ_0 below and is not put into the Meson Summary Table.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
−0.11±0.09 OUR EVALUATION		From a fit discussed in note on $K_{\ell 3}$ form factors in 1982 edition, PL **111B** (April 1982).			
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.5 ±0.4	6700	BRANDENB...	73	HBC	BR, λ_+=0.019 ± 0.013
−0.08±0.25	1309	[69] EVANS	73	HLBC	BR, λ_+=0.02
−0.5 ±0.5	3548	BASILE	70	OSPK	BR, λ_+=0.02
+0.45±0.28	569	BEILLIERE	69	HLBC	BR, λ_+=0
−0.22±0.30	1309	[69] EVANS	69	HLBC	
$+0.2\ ^{+0.8}_{-1.2}$		KULYUKINA	68	CC	BR, λ_+=0
+1.1 ±1.1	389	ADAIR	64	HBC	BR, λ_+=0
$+0.66^{+0.9}_{-1.3}$		LUERS	64	HBC	BR, λ_+=0

[69] EVANS 73 replaces EVANS 69.

$\xi_c = f_-/f_+$ (determined from μ polarization in $K^0_{\mu 3}$)

The μ polarization is a measure of $\xi(t)$. No assumptions on λ_{+-} necessary, t (weighted by sensitivity to $\xi(t)$) should be specified. In λ_+, $\xi(0)$ parametrization this is $\xi(0)$ for $\lambda_+ = 0$. $d\xi/d\lambda = \xi t$. For radiative correction to μ polarization in $K^0_{\mu 3}$, see GINSBERG 73. The parameter ξ is redundant with λ_0 below and is not put into the Meson Summary Table.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
−0.11 ±0.09 OUR EVALUATION		From a fit discussed in note on $K_{\ell 3}$ form factors in 1982 edition, PL **111B** (April 1982).			
+0.178±0.105	207k	[70] CLARK	77	SPEC	POL, $d\xi(0)/d\lambda_+$=+0.68
−0.385±0.105	2.2M	[71] SANDWEISS	73	CNTR	POL, $d\xi(0)/d\lambda_+$=−6
$-1.81\ ^{+0.50}_{-0.26}$		[72] LONGO	69	CNTR	POL, t=3.3
• • • We do not use the following data for averages, fits, limits, etc. • • •					
−1.6 ±0.5	638	[73] ABRAMS	68B	OSPK	Polarization
−1.2 ±0.5	2608	[73] AUERBACH	66B	OSPK	Polarization

[70] CLARK 77 $t = +3.80$, $d\xi(0)/d\lambda_+ = \xi(t)t = 0.178\times3.80 = +0.68$.

[71] SANDWEISS 73 is for $\lambda_+ = 0$ and $t = 0$.

[72] LONGO 69 $t = 3.3$ calculated from $d\xi(0)/d\lambda_+ = -6.0$ (table 1) divided by $\xi = -1.81$.

[73] t value not given.

Im(ξ) in $K^0_{\mu 3}$ DECAY (from transverse μ pol.)

Test of T reversal invariance.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
−0.007±0.026 OUR AVERAGE					
0.009±0.030	12M	MORSE	80	CNTR	Polarization
0.35 ±0.30	207k	[74] CLARK	77	SPEC	POL, t=0
−0.085±0.064	2.2M	[75] SANDWEISS	73	CNTR	POL, t=0
−0.02 ±0.08		LONGO	69	CNTR	POL, t=3.3
−0.2 ±0.6		ABRAMS	68B	OSPK	Polarization
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.012±0.026		SCHMIDT	79	CNTR	Repl. by MORSE 80

[74] CLARK 77 value has additional $\xi(0)$ dependence $+0.21\mathrm{Re}\big[\xi(0)\big]$.

[75] SANDWEISS 73 value corrected from value quoted in their paper due to new value of Re(ξ). See footnote 4 of SCHMIDT 79.

λ_+ (LINEAR ENERGY DEPENDENCE OF f_+ IN $K^0_{\mu 3}$ DECAY)

See also the corresponding entries and notes in section "$\xi_A = f_-/f_+$" above and section "λ_0 (LINEAR ENERGY DEPENDENCE OF f_0 IN $K^0_{\mu 3}$ DECAY)" below. For radiative correction of $K^0_{\mu 3}$ Dalitz plot see GINSBERG 70 and BECHERRAWY 70.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.034 ±0.005 OUR EVALUATION		From a fit discussed in note on $K_{\ell 3}$ form factors in 1982 edition, PL **111B** (April 1982).			
0.0427±0.0044	150k	BIRULEV	81	SPEC	DP
0.028 ±0.010	14k	CHO	80	HBC	DP
0.028 ±0.011	16k	HILL	79	STRC	DP
0.046 ±0.030	32k	BUCHANAN	75	SPEC	DP
0.030 ±0.003	1.6M	DONALDSON	74B	SPEC	DP
0.085 ±0.015	9086	ALBROW	72	ASPK	DP
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.0337±0.0033	129k	DZHORD...	77	SPEC	Repl. by BIRULEV 81
0.046 ±0.008	82k	ALBRECHT	74	WIRE	Repl. by BIRULEV 81
0.11 ±0.04	16k	DALLY	72	ASPK	DP
0.07 ±0.02	16k	CHIEN	70	ASPK	Repl. by DALLY 72

λ_0 (LINEAR ENERGY DEPENDENCE OF f_0 IN $K^0_{\mu 3}$ DECAY)

Wherever possible, we have converted the above values of $\xi(0)$ into values of λ_0 using the associated λ_+^{μ} and $d\xi(0)/d\lambda_+$.

VALUE	$d\lambda_0/d\lambda_+$	EVTS	DOCUMENT ID		TECN	COMMENT
0.025 ±0.006 OUR EVALUATION			From a fit discussed in note on $K_{\ell 3}$ form factors in 1982 edition, PL **111B** (April 1982).			
0.0341±0.0067	unknown	150k	[76] BIRULEV	81	SPEC	DP
+0.050 ±0.008	−0.11	14k	CHO	80	HBC	DP
+0.039 ±0.010	−0.67	16k	HILL	79	STRC	DP
+0.047 ±0.009	1.06	207k	[77] CLARK	77	SPEC	POL
+0.025 ±0.019	+0.5	32k	[78] BUCHANAN	75	SPEC	DP
+0.019 ±0.004	−0.47	1.6M	[79] DONALDSON	74B	SPEC	DP
−0.060 ±0.038	−0.71	1385	[80] PEACH	73	HLBC	DP
−0.018 ±0.009	+0.49	2.2M	[77] SANDWEISS	73	CNTR	POL
−0.043 ±0.052	−1.39	9086	[81] ALBROW	72	ASPK	DP
−0.140 $^{+0.043}_{-0.022}$	+0.49		[77] LONGO	69	CNTR	POL
+0.08 ±0.07	−0.54	1371	[77] CARPENTER	66	OSPK	DP
• • • We do not use the following data for averages, fits, limits, etc. • • •						
0.041 ±0.008		14k	[82] CHO	80	HBC	BR, λ_+=0.028
+0.0485±0.0076		47k	DZHORD...	77	SPEC	In BIRULEV 81
+0.024 ±0.011		82k	ALBRECHT	74	WIRE	In BIRULEV 81
+0.06 ±0.03		6700	[83] BRANDENB...	73	HBC	BR, λ_+=0.019 ± 0.013
−0.067 ±0.227	unknown	16k	[84] DALLY	72	ASPK	DP
−0.333 ±0.034	+1.	3140	[85] BASILE	70	OSPK	DP

[76] BIRULEV 81 gives $d\lambda_0/d\lambda_+ = -1.5$, giving an unreasonably narrow error ellipse which dominates all other results. We use $d\lambda_0/d\lambda_+ = 0$.

[77] λ_0 value is for $\lambda_+ = 0.03$ calculated by us from $\xi(0)$ and $d\xi(0)/d\lambda_+$.

[78] BUCHANAN 75 value is from their appendix A and uses only $K_{\mu 3}$ data. $d\lambda_0/d\lambda_+$ was obtained by private communication, C.Buchanan, 1976.

[79] DONALDSON 74B $d\lambda_0/d\lambda_+$ obtained from figure 18.

[80] PEACH 73 assumes $\lambda_+ = 0.025$. Calculated by us from $\xi(0)$ and $d\xi(0)/d\lambda_+$.

[81] ALBROW 72 λ_0 is calculated by us from ξ_A, λ_+ and $d\xi(0)/d\lambda_+$. They give $\lambda_0 = -0.043 \pm 0.039$ for $\lambda_- = 0$. We use our larger calculated error.

[82] CHO 80 BR result not independent of their Dalitz plot result.

[83] Fit for λ_0 does not include this value but instead includes the $K_{\mu3}/K_{e3}$ result from this experiment.

[84] DALLY 72 gives $f_0 = 1.20 \pm 0.35$, $\lambda_0 = -0.080 \pm 0.272$, $\lambda_0{}' = -0.006 \pm 0.045$, but with a different definition of λ_0. Our quoted λ_0 is his λ_0/f_0. We cannot calculate true λ_0 error without his (λ_0,f_0) correlations. See also note on DALLY 72 in section ξ_A.

[85] BASILE 70 λ_0 is for $\lambda_+ = 0$. Calculated by us from ξ_A with $d\xi(0)/d\lambda_+ = 0$. BASILE 70 is incompatible with all other results. Authors suggest that efficiency estimates might be responsible.

$|f_S/f_+|$ FOR K^0_{e3} DECAY

Ratio of scalar to f_+ couplings.

VALUE	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
<0.04	68	25k	BLUMENTHAL	75	SPEC	
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<0.095	95	18k	HILL	78	STRC	
<0.07	68	48k	BIRULEV	76	SPEC	See also BIRULEV 81
<0.19	95	5600	ALBROW	73	ASPK	
<0.15	68		KULYUKINA	67	CC	

$|f_T/f_+|$ FOR K^0_{e3} DECAY

Ratio of tensor to f_+ couplings.

VALUE	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
<0.23	68	25k	BLUMENTHAL	75	SPEC	
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<0.40	95	18k	HILL	78	STRC	
<0.34	68	48k	BIRULEV	76	SPEC	See also BIRULEV 81
<1.0	95	5600	ALBROW	73	ASPK	
<1.0	68		KULYUKINA	67	CC	

$|f_T/f_+|$ FOR $K^0_{\mu3}$ DECAY

Ratio of tensor to f_+ couplings.

VALUE	DOCUMENT ID		TECN
0.12±0.12	BIRULEV	81	SPEC

α_{K^*} DECAY FORM FACTOR FOR $K_L \to e^+ e^- \gamma$

α_{K^*} is the constant in the model of BERGSTROM 83 which measures the relative strength of the vector-vector transition $K_L \to K^*\gamma$ with $K^* \to \rho, \omega, \phi \to \gamma^*$ and the pseudoscalar-pseudoscalar transition $K_L \to \pi, \eta, \eta' \to \gamma\gamma^*$.

VALUE	DOCUMENT ID		TECN
−0.28 ±0.08 OUR AVERAGE			
−0.28 ±0.13	BARR	90B	NA31
$-0.280^{+0.099}_{-0.090}$	OHL	90B	B845

DECAY FORM FACTORS FOR $K^0_L \to \pi^\pm \pi^0 e^\mp \nu_e$

Given in MAKOFF 93.

MINIREVIEW GOES HERE

CP-VIOLATION PARAMETERS IN K^0_L DECAYS

——— CHARGE ASYMMETRY IN $K^0_{\ell3}$ DECAYS ———

Such asymmetry violates CP. It is related to Re(ϵ).

δ = weighted average of $\delta(\mu)$ and $\delta(e)$

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
0.327±0.012 OUR AVERAGE	Includes data from the 2 datablocks that follow this one.				
0.333±0.050	33M	WILLIAMS	73	ASPK	$K_{\mu3} + K_{e3}$

$\delta(\mu) = [\Gamma(\pi^- \mu^+ \nu_\mu) - \Gamma(\pi^+ \mu^- \overline{\nu}_\mu)]$/SUM

Only the combined value below is put into the Meson Summary Table.

VALUE (%)	EVTS	DOCUMENT ID		TECN
The data in this block is included in the average printed for a previous datablock.				
0.304±0.025 OUR AVERAGE				
0.313±0.029	15M	GEWENIGER	74	ASPK
0.278±0.051	7.7M	PICCIONI	72	ASPK
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.60 ±0.14	4.1M	MCCARTHY	73	CNTR
0.57 ±0.17	1M	[86] PACIOTTI	69	OSPK
0.403±0.134	1M	[86] DORFAN	67	OSPK

[86] PACIOTTI 69 is a reanalysis of DORFAN 67 and is corrected for $\mu^+ \mu^-$ range difference in MCCARTHY 72.

$\delta(e) = [\Gamma(\pi^- e^+ \nu_e) - \Gamma(\pi^+ e^- \overline{\nu}_e)]$/SUM

Only the combined value below is put into the Meson Summary Table.

VALUE (%)	EVTS	DOCUMENT ID		TECN
The data in this block is included in the average printed for a previous datablock.				
0.333±0.014 OUR AVERAGE				
0.341±0.018	34M	GEWENIGER	74	ASPK
0.318±0.038	40M	FITCH	73	ASPK
0.346±0.033	10M	MARX	70	CNTR
0.246±0.059	10M	[87] SAAL	69	CNTR
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.36 ±0.18	600k	ASHFORD	72	ASPK
0.224±0.036	10M	[87] BENNETT	67	CNTR

[87] SAAL 69 is a reanalysis of BENNETT 67.

PARAMETERS FOR $K^0_L \rightarrow 2\pi$ DECAY

η_{+-} = A($K^0_L \rightarrow \pi^+\pi^-$) / A($K^0_S \rightarrow \pi^+\pi^-$)
η_{00} = A($K^0_L \rightarrow \pi^0\pi^0$) / A($K^0_S \rightarrow \pi^0\pi^0$)

The fitted values of $|\eta_{+-}|$ and $|\eta_{00}|$ given below are the results of a fit to $|\eta_{+-}|$, $|\eta_{00}|$, $|\eta_{00}/\eta_{+-}|$, and Re(ϵ'/ϵ). Independent information on $|\eta_{+-}|$ and $|\eta_{00}|$ can be obtained from the fitted values of the $K^0_L \rightarrow \pi\pi$ and $K^0_S \rightarrow \pi\pi$ branching ratios and the K^0_L and K^0_S lifetimes. This information is included as data in the $|\eta_{+-}|$ and $|\eta_{00}|$ sections with a Document ID "BRFIT." See the "Note on CP Violation in K^0_L Decay" above for details.

$|\eta_{00}| = |A(K^0_L \rightarrow 2\pi^0)$ / $A(K^0_S \rightarrow 2\pi^0)|$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
2.259±0.023 OUR FIT Error includes scale factor of 1.1.					
2.12 ±0.09 OUR AVERAGE Error includes scale factor of 1.2.					
2.084±0.080		[88] BRFIT	94		
2.33 ±0.18		CHRISTENS...	79	ASPK	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2.71 ±0.37	56	[89] WOLFF	71	OSPK	Cu reg., 4γ's
2.95 ±0.63		[89] CHOLLET	70	OSPK	Cu reg., 4γ's

[88] This BRFIT value is computed from fitted values of the K^0_L and K^0_S lifetimes and branching fractions to $\pi\pi$. See the discussion in the "Note on CP violation in K^0_L decay."

[89] CHOLLET 70 gives $|\eta_{00}|$ = (1.23 ± 0.24)×(regeneration amplitude, 2 GeV/c Cu)/10000mb. WOLFF 71 gives $|\eta_{00}|$ = (1.13 ± 0.12)×(regeneration amplitude, 2 GeV/c Cu)/10000mb. We compute both $|\eta_{00}|$ values for (regeneration amplitude, 2 GeV/c Cu) = 24 ± 2mb. This regeneration amplitude results from averaging over FAISSNER 69, extrapolated using optical-model calculations of Bohm et al., Physics Letters **27B** 594 (1968) and the data of BALATS 71. (From H. Faissner, private communication).

$|\eta_{+-}| = |A(K^0_L \rightarrow \pi^+\pi^-) / A(K^0_S \rightarrow \pi^+\pi^-)|$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
2.269±0.023 OUR FIT Error includes scale factor of 1.1.					
2.281±0.022 OUR AVERAGE					
2.266±0.030		[90] BRFIT	94		
2.32 ±0.14 ±0.03	10^5	ADLER	92B	SPEC	K^0-$\overline{K}^0$ asymm.
2.27 ±0.12		CHRISTENS...	79B	ASPK	
2.30 ±0.035		GEWENIGER	74B	ASPK	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2.28 ±0.06	1687	[91] COUPAL	85	SPEC	P(K)=70 GeV/c
2.09 ±0.02		[92] ARONSON	82B	SPEC	E=30–110 GeV

[90] This BRFIT value is computed from fitted values of the K^0_L and K^0_S lifetimes and branching fractions to $\pi\pi$. See the discussion in the "Note on CP violation in K^0_L decay."

[91] COUPAL 85 concludes: no energy dependence of $|\eta_{+-}|$, because their value is consistent with above values which occur at lower energies. Not independent of COUPAL 85 $\Gamma(\pi^+\pi^-)/\Gamma(\pi\ell\nu)$ measurement. Enters $|\eta_{+-}|$ via BRFIT value. In editions prior to 1990, this measurement was erroneously also included in our $|\eta_{+-}|$ average and fit. We thank H. Wahl (WAHL 89) for informing us.

[92] ARONSON 82B find that $|\eta_{+-}|$ may depend on the kaon energy.

$|\eta_{00}/\eta_{+-}|$

VALUE	EVTS	DOCUMENT ID		TECN
0.9955±0.0023 OUR FIT Error includes scale factor of 1.8.				
0.9930±0.0020 OUR AVERAGE				
0.9931±0.0020		[93,94] BARR	93D	NA31
0.9904±0.0084±0.0036		[95] WOODS	88	E731
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.9939±0.0013±0.0015	1M	[93] BARR	93D	NA31
0.9899±0.0020±0.0025		[93] BURKHARDT	88	NA31
1.014 ±0.016 ±0.007	3152	BERNSTEIN	85B	SPEC
0.995 ±0.025	1122	BLACK	85	SPEC
1.00 ±0.09		[96] CHRISTENS...	79	ASPK
1.03 ±0.07	124	BANNER	72	OSPK
1.00 ±0.06	167	HOLDER	72	ASPK

[93] This is the square root of the ratio R given by BURKHARDT 88 and BARR 93D.

[94] This is the combined results from BARR 93D and BURKHARDT 88, taking into account a common systematic uncertainty of 0.0014.

[95] We calculate $|\eta_{00}/\eta_{+-}| = 1-3(\epsilon'/\epsilon)$ from WOODS 88 (ϵ'/ϵ) value.

[96] Not independent of $|\eta_{+-}|$ and $|\eta_{00}|$ values which are included in fit.

$\epsilon'/\epsilon \approx \mathrm{Re}(\epsilon'/\epsilon) = (1-|\eta_{00}/\eta_{+-}|)/3$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
1.5 ±0.8 OUR FIT Error includes scale factor of 1.8.					
1.5 ±0.8 OUR AVERAGE Error includes scale factor of 1.8. See the ideogram below.					
2.3 ±0.65		[97] BARR	93D	NA31	
0.74±0.52±0.29	>5E5	GIBBONS	93B	E731	
3.2 ±2.8 ±1.2		[98] WOODS	88	E731	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2.0 ±0.7	1M	[98] BARR	93D	NA31	
−0.4 ±1.4 ±0.6		PATTERSON	90	E731	in GIBBONS 93B
3.3 ±1.1		[98] BURKHARDT	88	NA31	

[97] This is the combined results from BARR 93D and BURKHARDT 88, taking into account their common systematic uncertainty.

[98] These values are derived from $|\eta_{00}/\eta_{+-}|$ measurements. They enter the average in this section but enter the fit via the $|\eta_{00}/\eta_{+-}|$ section only.

$$\epsilon'/\epsilon \;\approx\; \mathrm{Re}(\epsilon'/\epsilon) = (1-\left|\eta_{00}/\eta_{+-}\right|)/3$$

ϕ_{+-}, PHASE of η_{+-}

The dependence of the phase on the $m_{K^0_L} - m_{K^0_S}$ is given for each experiment in the comments below, where $\Delta(m)$ is (mass difference/$\hbar$) in units 10^{10} s^{-1} and τ_s is the K_S mean life in units 10^{-10} s. We have evaluated these mass dependences using our 1994 values, $\Delta(m) = 0.5333 \pm 0.0027$, $\tau_s = 0.8926 \pm 0.0012$ to obtain the values and average quoted below. We also give the regeneration phase ϕ_f in the comments below.

VALUE (°)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
44.3± 0.8 OUR FIT					
44.1± 0.9 OUR AVERAGE					
42.9± 1.2		[99] GIBBONS	93	E731	
42.3± 4.4±1.4	10^5	[100] ADLER	92B	SPEC	K^0-$\overline{K}^0$ asymm.
46.0± 2.2		[101] CAROSI	90	NA31	
45.2± 2.9		[102] CARITHERS	75	SPEC	C regenerator
45.6± 1.8		[103] GEWENIGER	74B	ASPK	Vacuum regen.
• • • We do not use the following data for averages, fits, limits, etc. • • •					
47.7± 2.0±0.9		[104] KARLSSON	90	E731	
35.3± 3.9		[105] ARONSON	82B	SPEC	
41.7± 3.5		CHRISTENS...	79B	ASPK	
36.2± 6.1		[106] CARNEGIE	72	ASPK	Cu regenerator
37 ±12		[107] BALATS	71	OSPK	Cu regenerator
40 ± 4		[108] JENSEN	70	ASPK	Vacuum regen.
34 ±10		[109] BENNETT	69	CNTR	Cu regenerator
44 ±12		[110] BOHM	69B	OSPK	Vacuum regen.
45 ± 7		[111] FAISSNER	69	ASPK	Cu regenerator
51 ±11		[112] BENNETT	68B	CNTR	Cu reg. uses
70 ±21		[113] BOTT-...	67B	OSPK	C regenerator
25 ±35		[113] MISCHKE	67	OSPK	Cu regenerator
30 ±45		[113] FIRESTONE	66	HBC	
45 ±50		[113] FITCH	65	OSPK	Be regenerator

[99] GIBBONS 93 measures $\phi_{+}-\phi_f$ and calculates the regeneration phase ϕ_f from the power law momentum dependence of the regeneration amplitude using analyticity. An error of 0.6° is included for possible uncertainties in the regeneration phase. They find $\phi_{+-} = 42.21 \pm 0.9 + 189\ [\Delta(m) - 0.5286] - 460\ [\tau_s - 0.8922]°$. B. Winstein, private communication, reported in NAKADA 93. GIBBONS 93 reports ϕ_{+-} $(42.2 \pm 1.4)°$ for their $\Delta(m)$ and τ_s. KLEINKNECHT 94 questions the size of the regeneration phase error.

[100] ADLER 92B quote separately two systematic errors: ±0.4 from their experiment and ±1.0 degrees due to the uncertainty in the value of $\Delta(m)$.

[101] CAROSI 90 $\phi_{+-} = 46.9 \pm 1.4 \pm 0.7 + 579\ [\Delta(m) - 0.5351] + 303\ [\tau_s - 0.8922]°$.

[102] CARITHERS 75 $\phi_{+-} = (45.5 \pm 2.8) + 224[\Delta(m) - 0.5348]°$. $\phi_f = -40.9 \pm 2.6°$.

[103] GEWENIGER 74B $\phi_{+-} = (49.4 \pm 1.0)+565[\Delta(m)-0.540]^\circ$.
[104] KARLSSON 90 systematic error does not include regeneration phase uncertainty.
[105] ARONSON 82 find that ϕ_{+-} may depend on the kaon energy.
[106] CARNEGIE 72 ϕ_{+-} is insensitive to $\Delta(m)$. $\phi_f = -56.2 \pm 5.2^\circ$.
[107] BALATS 71 $\phi_{+-} = (39.0 \pm 12.0)+198[\Delta(m)-0.544]^\circ$. $\phi_f = -43.0 \pm 4.0^\circ$.
[108] JENSEN 70 $\phi_{+-} = (42.4 \pm 4.0)+576[\Delta(m)-0.538]^\circ$.
[109] BENNETT 69 uses measurement of $(\phi_{+-})-(\phi_f)$ of ALFF-STEINBERGER 66B. BENNETT 69 $\phi_{+-} = (34.9 \pm 10.0)+69[\Delta(m)-0.545]^\circ$. $\phi_f = -49.9 \pm 5.4^\circ$.
[110] BOHM 69B $\phi_{+-} = (41.0 \pm 12.0)+479(\Delta(m)-0.526)^\circ$.
[111] FAISSNER 69 error enlarged to include error in regenerator phase. FAISSNER 69 $\phi_{+-} = (49.3 \pm 7.4)+205[\Delta(m)-0.555]^\circ$. $\phi_f = -42.7 \pm 5.0^\circ$.
[112] BENNETT 69 is a re-evaluation of BENNETT 68B.
[113] Old experiments with large errors not included in average.

ϕ_{00}, PHASE OF η_{00}

See comment in ϕ_{+-} header above for treatment of $\Delta(m)$ and τ_s dependence.

VALUE (°)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
43.3± 1.3 OUR FIT					
46.2± 2.8		[114] CAROSI	90	NA31	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
47.4± 1.4±0.9		[115] KARLSSON	90	E731	
55.7± 5.8		CHRISTENS...	79	ASPK	
38.0±25.0	56	[116] WOLFF	71	OSPK	Cu reg., 4γ's
51.0±30.0		[117] CHOLLET	70	OSPK	Cu reg., 4γ's
first quadrant preferred		GOBBI	69B	OSPK	

[114] CAROSI 90 $\phi_{00} = 47.1 \pm 2.1 \pm 1.0 + 579\ [\Delta(m) - 0.5351] + 252\ [\tau_s - 0.8922]^\circ$.
[115] KARLSSON 90 systematic error does not include regeneration phase uncertainty.
[116] WOLFF 71 uses regenerator phase $\phi_f = -48.2 \pm 3.5^\circ$.
[117] CHOLLET 70 uses regenerator phase $\phi_f = -46.5 \pm 4.4^\circ$.

PHASE DIFFERENCE $\phi_{00} - \phi_{+-}$

Test of *CPT*.

VALUE (°)	*DOCUMENT ID*		*TECN*
− 1.0± 1.0 OUR FIT			
− 1.2± 1.0 OUR AVERAGE			
− 1.6± 1.2	[118] GIBBONS	93	E731
0.2± 2.6±1.2	[119] CAROSI	90	NA31
− 0.3± 2.4±1.2	KARLSSON	90	E731
• • • We do not use the following data for averages, fits, limits, etc. • • •			
12.6± 6.2	[119] CHRISTENS...	79	ASPK
7.6±18.0	[120] BARBIELLINI	73	ASPK

[118] GIBBONS 93 give detailed dependence of systematic error on lifetime (see the section on the K^0_S mean life) and mass difference (see the section on $m_{K^0_L} - m_{K^0_S}$).
[119] Not independent of ϕ_{+-} and ϕ_{00} values. This is taken into account in our fitting procedure.
[120] Independent of regenerator mechanism, $\Delta(m)$, and lifetimes.

CHARGE ASYMMETRY IN $\pi^+\pi^-\pi^0$ DECAYS

CHARGE ASYMMETRY j FOR $K^0_L \to \pi^+\pi^-\pi^0$

Defined at beginning of section "LINEAR COEFFICIENT g FOR $K^0_L \to \pi^+\pi^-\pi^0$ above. Such asymmetry violates *CP*. See also note on Daltitz plot parameters in $K^\pm$ section and note on *CP* violation in K^0_L decay above.

VALUE	*EVTS*	*DOCUMENT ID*		*TECN*
0.0011±0.0008 OUR AVERAGE				
0.001 ±0.011	6499	CHO	77	
−0.001 ±0.003	4709	PEACH	77	
0.0013±0.0009	3M	SCRIBANO	70	
0.0 ±0.017	4400	SMITH	70	OSPK
0.001 ±0.004	238k	BLANPIED	68	

PARAMETERS for $K^0_L \to \pi^+\pi^-\gamma$ DECAY

$|\eta_{+-\gamma}| = |A(K^0_L \to \pi^+\pi^-\gamma)/A(K^0_S \to \pi^+\pi^-\gamma)|$

VALUE (units 10^{-3})	*EVTS*	*DOCUMENT ID*		*TECN*
2.15±0.26±0.20	3671	RAMBERG	93B	E731

$\phi_{+-\gamma}$ = phase of $\eta_{+-\gamma}$

VALUE (°)	EVTS	DOCUMENT ID		TECN
72±23±17	3671	RAMBERG	93B	E731

$\lvert\epsilon'_{+-\gamma}\rvert/\epsilon$

VALUE	CL%	EVTS	DOCUMENT ID		TECN
<0.3	90	3671	[121] RAMBERG	93B	E731

[121] RAMBERG 93B limit on $\lvert\epsilon'_{+-\gamma}\rvert/\epsilon$ assumes than any difference between η_{+-} and $\eta_{+-\gamma}$ is due to direct CP violation.

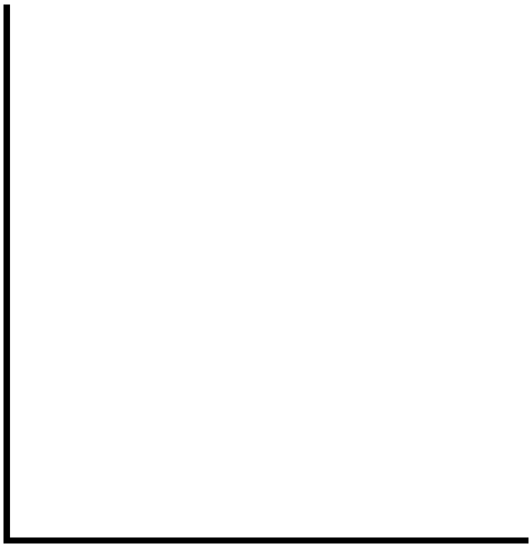
MINIREVIEW GOES HERE

x = A($\overline{K}^0 \to \pi^- \ell^+ \nu$)/A($K^0 \to \pi^- \ell^+ \nu$) = A($\Delta S$=$-\Delta Q$)/A($\Delta S$=$\Delta Q$)

REAL PART OF x

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.006±0.018 OUR AVERAGE		Error includes scale factor of 1.3. See the ideogram below.			
$0.10\ ^{+0.18}_{-0.19}$	79	SMITH	75B	WIRE	$\pi^- p \to K^0 \Lambda$
$0.04\ \pm0.03$	4724	NIEBERGALL	74	ASPK	$K^+ p \to K^0 p \pi^+$
-0.008 ± 0.044	1757	FACKLER	73	OSPK	K_{e3} from K^0
$-0.03\ \pm0.07$	1367	HART	73	OSPK	K_{e3} from $K^0 \Lambda$
-0.070 ± 0.036	1079	MALLARY	73	OSPK	K_{e3} from $K^0 \Lambda X$
$0.03\ \pm0.06$	410	[122] BURGUN	72	HBC	$K^+ p \to K^0 p \pi^+$
$-0.05\ \pm0.09$	442	[123] GRAHAM	72	OSPK	$\pi^- p \to K^0 \Lambda$
$0.26\ ^{+0.10}_{-0.14}$	126	MANN	72	HBC	$K^- p \to n \overline{K}^0$
$0.25\ ^{+0.07}_{-0.09}$	252	WEBBER	71	HBC	$K^- p \to n \overline{K}^0$
$0.12\ \pm0.09$	215	[124] CHO	70	DBC	$K^+ d \to K^0 p p$
-0.020 ± 0.025		[125] BENNETT	69	CNTR	Charge asym+ Cu regen.
$0.09\ ^{+0.14}_{-0.16}$	686	LITTENBERG	69	OSPK	$K^+ n \to K^0 p$
$0.09\ ^{+0.07}_{-0.09}$	121	JAMES	68	HBC	$\overline{p} p$
$0.17\ ^{+0.16}_{-0.35}$	116	FELDMAN	67B	OSPK	$\pi^- p \to K^0 \Lambda$
$0.035\ ^{+0.11}_{-0.13}$	196	AUBERT	65	HLBC	K^+ charge exchange
$0.06\ ^{+0.18}_{-0.44}$	152	[126] BALDO-...	65	HLBC	K^+ charge exchange
$-0.08\ ^{+0.16}_{-0.28}$	109	[127] FRANZINI	65	HBC	$\overline{p} p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$0.04\ ^{+0.10}_{-0.13}$	100	[123] GRAHAM	72	OSPK	$K_{\mu 3}$ from $K^0 \Lambda$
$-0.13\ \pm0.11$	342	[123] MANTSCH	72	OSPK	K_{e3} from $K^0 \Lambda$
$0.04\ ^{+0.07}_{-0.08}$	222	[122] BURGUN	71	HBC	$K^+ p \to K^0 p \pi^+$
$0.03\ \pm0.03$		[125] BENNETT	68	CNTR	
$0.17\ \pm0.10$	335	[124] HILL	67	DBC	$K^+ d \to K^0 p p$

[122] BURGUN 72 is a final result which includes BURGUN 71.
[123] First GRAHAM 72 value is second GRAHAM 72 value combined with MANTSCH 72.
[124] CHO 70 is analysis of unambiguous events in new data and HILL 67.
[125] BENNETT 69 is a reanalysis of BENNETT 68.
[126] BALDO-CEOLIN 65 gives x and θ converted by us to Re(x) and Im(x).
[127] FRANZINI 65 gives x and θ for Re(x) and Im(x). See SCHMIDT 67.



Re(x) ($\Delta S = -\Delta Q$ amplitude)

IMAGINARY PART OF x

Assumes $m_{K^0_L} - m_{K^0_S}$ positive. See Listings above.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
-0.003 ± 0.026 OUR AVERAGE	Error includes scale factor of 1.2.				
$-0.10\ ^{+0.16}_{-0.19}$	79	SMITH	75B	WIRE	$\pi^- p \to K^0 \Lambda$
-0.06 ± 0.05	4724	NIEBERGALL	74	ASPK	$K^+ p \to K^0 p \pi^+$
-0.017 ± 0.060	1757	FACKLER	73	OSPK	K_{e3} from K^0
0.09 ± 0.07	1367	HART	73	OSPK	K_{e3} from $K^0 \Lambda$
$0.107\ ^{+0.092}_{-0.074}$	1079	MALLARY	73	OSPK	K_{e3} from $K^0 \Lambda X$
$0.07\ ^{+0.06}_{-0.07}$	410	[128] BURGUN	72	HBC	$K^+ p \to K^0 p \pi^+$
0.05 ± 0.13	442	[129] GRAHAM	72	OSPK	$\pi^- p \to K^0 \Lambda$
$0.21\ ^{+0.15}_{-0.12}$	126	MANN	72	HBC	$K^- p \to n \overline{K}^0$
0.0 ± 0.08	252	WEBBER	71	HBC	$K^- p \to n \overline{K}^0$
-0.08 ± 0.07	215	[130] CHO	70	DBC	$K^+ d \to K^0 p p$
$-0.11\ ^{+0.10}_{-0.11}$	686	LITTENBERG	69	OSPK	$K^+ n \to K^0 p$
$+0.22\ ^{+0.37}_{-0.29}$	121	JAMES	68	HBC	$\overline{p} p$
0.0 ± 0.25	116	FELDMAN	67B	OSPK	$\pi^- p \to K^0 \Lambda$
$-0.21\ ^{+0.11}_{-0.15}$	196	AUBERT	65	HLBC	K^+ charge exchange
$-0.44\ ^{+0.32}_{-0.19}$	152	[131] BALDO-...	65	HLBC	K^+ charge exchange
$+0.24\ ^{+0.40}_{-0.30}$	109	[132] FRANZINI	65	HBC	$\overline{p} p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$0.12\ ^{+0.17}_{-0.16}$	100	[129] GRAHAM	72	OSPK	$K_{\mu 3}$ from $K^0 \Lambda$
-0.04 ± 0.16	342	[129] MANTSCH	72	OSPK	K_{e3} from $K^0 \Lambda$
$0.12\ ^{+0.08}_{-0.09}$	222	[128] BURGUN	71	HBC	$K^+ p \to K^0 p \pi^+$
-0.20 ± 0.10	335	[130] HILL	67	DBC	$K^+ d \to K^0 p p$

[128] BURGUN 72 is a final result which includes BURGUN 71.
[129] First GRAHAM 72 value is second GRAHAM 72 value combined with MANTSCH 72.
[130] Footnote 10 of HILL 67 should read $+0.58$, not -0.58 (private communication) CHO 70 is analysis of unambiguous events in new data and HILL 67.
[131] BALDO-CEOLIN 65 gives x and θ converted by us to Re(x) and Im(x).
[132] FRANZINI 65 gives x and θ for Re(x) and Im(x). See SCHMIDT 67.

K^0_L REFERENCES

BARR 94 PL B328 528 +Buchholz+ (CERN, EDIN, MANZ, LALO, PISA, SIEG)
BRFIT 94 RPP
ETAFIT 94 RPP
GU 94 PRL 72 3000 + (RUTG, UCLA, EFI, COLO, ELMT, FNAL, ILL, OSAK)
KLEINKNECHT 94 PL B336 581 +Luitz (MANZ, MPIM)
NAKAYA 94 PRL 73 2169 + (OSAK, UCLA, EFI, COLU, ELMT, FNAL, ILL, RUTG)
ROBERTS 94 PR D50 1874 + (UCLA, EFI, COLU, ELMT, FNAL, ILL, OSAK, RUTG)
WEAVER 94 PRL 72 3758 + (UCLA, EFI, COLU, ELMT, FNAL, ILL, OSAK, RUTG)
AKAGI 93 PR D47 R2644 +Fukuhisa, Hemmi+ (TOHOK, TOKY, KYOT, KEK)
ARISAKA 93 PRL 70 1049 +Auerbach, Axelrod, Belz, Biery+ (BNL E791 Collab.)
ARISAKA 93B PRL 71 3910 +Auerbach, Axelrod, Belz, Biery+ (BNL E791 Collab.)
BARR 93D PL B317 233 +Buchholz+ (CERN, EDIN, MANZ, LALO, PISA, SIEG)
GIBBONS 93 PRL 70 1199 +Barker, Briere, Makoff+ (FNAL E731 Collab.)
GIBBONS 93B PRL 70 1203 +Barker, Briere, Makoff+ (FNAL E731 Collab.)
GIBBONS 93C Thesis RX-1487 (CHIC)
HARRIS 93 PRL 71 3914 +Briere, Cheu, Makoff, McFarland+ (FNAL E799 Collab.)
HARRIS 93B PRL 71 3918 +Briere, Cheu, Makoff, McFarlane+ (FNAL E799 Collab.)
MAKOFF 93 PRL 70 1591 +Barker, Briere, Gibbons+ (FNAL E731 Collab.)
NAKADA 93 Lepton Photon Conf. (PSI)
AIP Conf. Proc. 302, p. 425
RAMBERG 93 PRL 70 2525 +Bock, Coleman, Enagonio, Hsiung+ (FNAL E731 Collab.)
RAMBERG 93B PRL 70 2529 +Bock, Coleman, Enagonio, Hsiung+ (FNAL E731 Collab.)
VAGINS 93 PRL 71 35 +Adair, Greenlee, Kasha, Mannelli+ (BNL E845 Collab.)
ADLER 92B PL B286 180 +Alhalel, Angelopoulos, Apostolakis+ (CPLEAR Collab.)
Also 92 SJNP 55 840 Adler, Alhalel, Angelopoulos+ (CPLEAR Collab.)
BARR 92 PL B284 440 +Buchholz+ (CERN, EDIN, MANZ, LALO, PISA, SIEG)
GRAHAM 92 PL B295 169 +Barker, Briere, Gibbons, Makoff+ (FNAL E731 Collab.)
MORSE 92 PR D45 36 +Leipuner, Larsen, Jastrzembski+ (BNL, YALE, VASS)
PDG 92 PR D45, 1 June, Part II Hikasa, Barnett, Stone+ (KEK, LBL, BOST+)
SOMALWAR 92 PRL 68 2580 +Barker, Briere, Gibbons+ (FNAL E731 Collab.)
AKAGI 91 PRL 67 2614 +Fukuhisa, Hemmi+ (TOHOK, TOKY, KYOT, KEK)
AKAGI 91B PRL 67 2618 +Fukuhisa, Hemmi+ (TOHOK, TOKY, KYOT, KEK)
BARR 91 PL B259 389 +Carosi+ (CERN, EDIN, MANZ, LALO, PISA, SIEG)
HEINSON 91 PR D44 R1 + (UCI, UCLA, LANL, PENN, STAN, TEMP, TEXA+)
PAPADIMITR... 91 PR D44 R573 Papadimitriou, Barker, Briere+ (FNAL E731 Collab.)
BARKER 90 PR D41 3546 +Briere, Gibbons, Makoff+ (FNAL E731 Collab.)
Also 88 PRL 61 2661 Gibbons, Papadimitriou+ (FNAL E731 Collab.)
BARR 90B PL B240 283 +Carosi+ (CERN, EDIN, MANZ, LALO, PISA, SIEG)
BARR 90C PL B242 523 +Carosi+ (CERN, EDIN, MANZ, LALO, PISA, SIEG)
CAROSI 90 PL B237 303 +Clarke+ (CERN, EDIN, MANZ, LALO, PISA, SIEG)
KARLSSON 90 PRL 64 2976 +Gollin, Okamitsu, Tschirhart, Barker+(FNAL E731 Collab.)
OHL 90 PRL 64 2755 +Adair, Greenlee, Kasha, Mannelli+ (BNL E845 Collab.)
OHL 90B PRL 65 1407 +Adair, Greenlee, Kasha, Mannelli+ (BNL E845 Collab.)
PATTERSON 90 PRL 64 1491 +Barker+ (FNAL E731 Collab.)
INAGAKI 89 PR D40 1712 +Kobayashi, Sato, Shinkawa+ (KEK, TOKY, KYOT)
LITTENBERG 89 PR D39 3322 (BNL)
MATHIAZHA... 89 PRL 63 2181 Mathiazhagan+ (UCI, UCLA, LANL, PENN, STAN+)
MATHIAZHA... 89B PRL 63 2185 Mathiazhagan+ (UCI, UCLA, LANL, PENN, STAN+)
PAPADIMITR... 89 PRL 63 28 Papadimitriou, Gibbons, Patterson+ (FNAL E731 Collab.)
SCHAFFNER 89 PR D39 990 +Greenlee, Kasha, Mannelli, Ohl+ (YALE, BNL)
WAHL 89 CERN-EP/89-86, H. Wahl — Rare Decay Symposium, Vancouver (CERN)
BARR 88 PL B214 303 +Clarke+ (CERN, EDIN, MANZ, LALO, PISA, SIEG)
BURKHARDT 88 PL B206 169 +Clarke+ (CERN, EDIN, MANZ, LALO, PISA, SIEG)
COUSINS 88 PR D38 2914 +Konigsberg+ (UCLA, LASL, PENN, STAN, TEMP, WILL)
GREENLEE 88 PRL 60 893 +Kasha, Mannelli, Mannelli+ (YALE, BNL)
JASTRZEM... 88 PRL 61 2300 Jastrzembski, Larsen, Leipuner, Morse+ (BNL, YALE)
WOODS 88 PRL 60 1695 +Nishikawa, Patterson, Wah, Winstein+(FNAL E731 Collab.)
BURKHARDT 87 PL B199 139 + (CERN, EDIN, MANZ, LALO, PISA, SIEG)
ARONSON 86 PR D33 3180 +Bernstein, Bock+ (BNL, CHIC, STAN, WISC)
Also 82 PRL 48 1078 Aronson, Bernstein+ (BNL, CHIC, STAN, WISC)
PDG 86C PL 170B 132 Aguilar-Benitez, Porter+ (CERN, CIT+)
BERNSTEIN 85B PRL 54 1631 +Bock, Carlsmith, Coupal+ (CHIC, SACL)
BLACK 85 PRL 54 1628 +Blatt, Campbell, Kasha, Mannelli+ (BNL, YALE)
COUPAL 85 PRL 55 566 +Bernstein, Bock, Carlsmith+ (CHIC, SACL)
BALATS 83 SJNP 38 556 +Berezin, Bogdanov, Vishnevsky+ (ITEP)
Translated from YAF 38 927.
BERGSTROM 83 PL 131B 229 +Masso, Singer (CERN)
ARONSON 82 PRL 48 1078 +Bernstein+ (BNL, CHIC, STAN, WISC)
ARONSON 82B PRL 48 1306 +Bock, Cheng, Fischbach (BNL, CHIC, PURD)
Also 82B PL 116B 73 Fischbach, Cheng+ (PURD, BNL, CHIC)
Also 83 PR D28 476 Aronson, Bock, Cheng+ (BNL, CHIC, PURD)
Also 83B PR D28 495 Aronson, Bock, Cheng+ (BNL, CHIC, PURD)
PDG 82B PL 111B 70 Roos, Porter, Aguilar-Benitez+ (HELS, CIT, CERN)
BIRULEV 81 NP B182 1 +Dzhordzhadze, Genchev, Grigalashvili+ (JINR)
Also 80 SJNP 31 622 Birulev, Vestergombi, Genchev+ (JINR)
Translated from YAF 31 1204.
CARROLL 80B PRL 44 529 +Chiang, Kycia, Li, Littenberg, Marx+ (BNL, ROCH)
CARROLL 80C PL 96B 407 +Chiang, Kycia, Li, Littenberg, Marx+ (BNL, ROCH)
CARROLL 80D PRL 44 525 +Chiang, Kycia, Li, Littenberg, Marx+ (BNL, ROCH)
CHO 80 PR D22 2688 +Derrick, Miller, Schlereth, Engler+ (ANL, CMU)
MORSE 80 PR D21 1750 +Leipuner, Larsen, Schmidt, Blatt+ (BNL, YALE)
BIRULEV 79 SJNP 29 778 +Vestergombi, Gvakhariya, Genchev+ (JINR)
Translated from YAF 29 1516.

CHRISTENS...	79	PRL 43 1209	Christenson, Goldman, Hummel, Roth+	(NYU)
CHRISTENS...	79B	PRL 43 1212	Christenson, Goldman, Hummel, Roth+	(NYU)
HILL	79	NP B153 39	+Sakitt, Snape, Stevens+	(BNL, SLAC, SBER)
SCHMIDT	79	PRL 43 556	+Blatt, Campbell, Grannan+	(YALE, BNL)
SHOCHET	79	PR D19 1965	+Linsay, Grosso-Pilcher, Frisch+	(EFI, ANL)
Also	77	PRL 39 59	Shochet, Linsay, Grosso-Pilcher+	(EFI, ANL)
ENGLER	78B	PR D18 623	+Keyes, Kraemer, Tanaka, Cho+	(CMU, ANL)
HILL	78	PL 73B 483	+Sakitt, Snape, Stevens+	(BNL, SLAC, SBER)
CHO	77	PR D15 587	+Derrick, Lissauer, Miller, Engler+	(ANL, CMU)
CLARK	77	PR D15 553	+Field, Holley, Johnson, Kerth, Sah, Shen	(LBL)
Also	75	Thesis LBL-4275	Shen	(LBL)
DEVOE	77	PR D16 565	+Cronin, Frisch, Grosso-Pilcher+	(EFI, ANL)
DZHORD...	77	SJNP 26 478	Dzhordzhadze, Kekelidze, Krivokhizhin+	(JINR)
		Translated from YAF 26 910.		
PEACH	77	NP B127 399	+Cameron+	(BGNA, EDIN, GLAS, PISA, RHEL)
BIRULEV	76	SJNP 24 178	+Vestergombi, Vovenko, Votruba+	(JINR)
		Translated from YAF 24 340.		
COOMBES	76	PRL 37 249	+Flexer, Hall, Kennelly, Kirkby+	(STAN, NYU)
DONALDSON	76	PR D14 2839	+Hitlin, Kennelly, Kirkby, Liu+	(SLAC)
Also	74	Thesis SLAC-0184	Donaldson	(SLAC)
FUKUSHIMA	76	PRL 36 348	+Jensen, Surko, Thaler+	(PRIN, MASA)
GJESDAL	76	NP B109 118	+Kamae, Presser, Steffen+	(CERN, HEIDH)
REY	76	PR D13 1161	+Cence, Jones, Parker+	(NDAM, HAWA, LBL)
Also	69	PRL 22 1210	Cence, Jones, Peterson, Stenger+	(HAWA, LRL)
BALDO-...	75	NC 25A 688	Baldo-Ceolin, Bobisut, Calimani+	(PADO, WISC)
BLUMENTHAL	75	PRL 34 164	+Frankel, Nagy+	(PENN, CHIC, TEMP)
BUCHANAN	75	PR D11 457	+Drickey, Pepper, Rudnick+	(UCLA, SLAC, JHU)
CARITHERS	75	PRL 34 1244	+Modis, Nygren, Pun+	(COLU, NYU)
SMITH	75B	Thesis UCSD unpub.		(UCSD)
ALBRECHT	74	PL 48B 393		(JINR, BERL, BUDA, PRAG, SERP, SOFI)
BISI	74	PL 50B 504	+Ferrero	(TORI)
DONALDSON	74	Thesis SLAC-0184		(SLAC)
Also	76	PR D14 2839	Donaldson, Hitlin, Kennelly, Kirkby, Liu+	(SLAC)
DONALDSON	74B	PR D9 2960	+Fryberger, Hitlin, Liu+	(SLAC, UCSC)
Also	73B	PRL 31 337	Donaldson, Fryberger, Hitlin, Liu+	(SLAC, UCSC)
DONALDSON	74C	PRL 33 554	+Hitlin, Kennelly, Kirkby+	(SLAC)
Also	74	Thesis SLAC-0184	Donaldson	(SLAC)
Also	76	PR D14 2839	Donaldson, Hitlin, Kennelly, Kirkby, Liu+	(SLAC)
FIELD	74	SLAC-PUB-1498 unpub.		(SLAC)
GEWENIGER	74	PL 48B 483	+Gjesdal, Kamae, Presser+	(CERN, HEIDH)
Also	74	Thesis CERN Int. 74-4	Luth	(CERN)
GEWENIGER	74B	PL 48B 487	+Gjesdal, Presser+	(CERN, HEIDH)
Also	74B	PL 52B 119	Gjesdal, Presser, Steffen+	(CERN, HEIDH)
GEWENIGER	74C	PL 52B 108	+Gjesdal, Presser+	(CERN, HEIDH)
GJESDAL	74	PL 52B 113	+Presser, Kamae, Steffen+	(CERN, HEIDH)
MESSNER	74	PRL 33 1458	+Franklin, Morse+	(COLO, SLAC, UCSC)
NIEBERGALL	74	PL 49B 103	+Regler, Stier+	(CERN, ORSAY, VIEN)
WANG	74	PR D9 540	+Smith, Whatley, Zorn, Hornbostel	(UMD, BNL)
WILLIAMS	74	PRL 33 240	+Larsen, Leipuner, Sapp, Sessoms+	(BNL, YALE)
ALBROW	73	NP B58 22	+Aston, Barber, Bird, Ellison+	(MCHS, DARE)
ALEXANDER	73B	NP B65 301	+Benary, Borowitz, Lande+	(TELA, HEID)
ANIKINA	73	JINR P1 7539	+Balashov, Bannik+	(JINR)
BARBIELLINI	73	PL 43B 529	+Darriulat, Fainberg+	(CERN)
BRANDENB...	73	PR D8 1978	Brandenburg, Johnson, Leith, Loos+	(SLAC)
CARITHERS	73	PRL 31 1025	+Nygren, Gordon+	(COLU, BNL, CERN)
Also	73B	PRL 30 1336	Carithers, Modis, Nygren+	(COLU, CERN, NYU)
EVANS	73	PR D7 36	+Muir, Peach, Budagov+	(EDIN, CERN)
Also	69	PRL 23 427	Evans, Golden, Muir, Peach+	(EDIN, CERN)
FACKLER	73	PRL 31 847	+Frisch, Martin, Smoot, Sompayrac	(MIT)
FITCH	73	PRL 31 1524	+Hepp, Jensen, Strovink, Webb	(PRIN)
Also	72	Thesis COO-3072-13	Webb	(PRIN)
GINSBERG	73	PR D8 3887	+Smith	(MIT, STON)
HART	73	NP B66 317	+Hutton, Field, Sharp, Blackmore+	(CAVE, RHEL)
MALLARY	73	PR D7 1953	+Binnie, Gallivan, Gomez, Peck, Sciulli+	(CIT)
Also	70	PRL 25 1214	Sciulli, Gallivan, Binnie, Gomez+	(CIT)
MCCARTHY	73	PR D7 687	+Brewer, Budnitz, Entis, Graven, Miller+	(LBL)
Also	72	PL 42B 291	McCarthy, Brewer, Budnitz, Entis, Graven+	(LBL)
Also	71	Thesis LBL-550	McCarthy	(LBL)
MESSNER	73	PRL 30 876	+Morse, Nauenberg, Hitlin+	(COLO, SLAC, UCSC)
PEACH	73	PL 43B 441	+Evans, Muir, Hopkins, Krenz	(EDIN, CERN, AACH)
SANDWEISS	73	PRL 30 1002	+Sunderland, Turner, Willis, Keller	(YALE, ANL)
WILLIAMS	73	PRL 31 1521	+Larsen, Leipuner, Sapp, Sessoms+	(BNL, YALE)
ALBROW	72	NP B44 1	+Aston, Barber, Bird, Ellison+	(MCHS, DARE)
ASHFORD	72	PL 38B 47	+Brown, Masek, Maung, Miller, Ruderman+	(UCSD)
BANNER	72	PRL 28 1597	+Cronin, Hoffman, Knapp, Shochet	(PRIN)
BANNER	72B	PRL 29 237	+Cronin, Hoffman, Knapp, Shochet	(PRIN)
BARMIN	72	SJNP 15 636	+Davidenko, Demidov, Dolgolenko+	(ITEP)
		Translated from YAF 15 1149.		
BARMIN	72B	SJNP 15 638	+Barylov, Davidenko, Demidov+	(ITEP)
		Translated from YAF 15 1152.		
BURGUN	72	NP B50 194	+Lesquoy, Muller, Pauli+	(SACL, CERN, OSLO)
CARNEGIE	72	PR D6 2335	+Cester, Fitch, Strovink, Sulak	(PRIN)
DALLY	72	PL 41B 647	+Innocenti, Seppi+	(SLAC, JHU, UCLA)
Also	70	PL 33B 627	Chien, Cox, Ettlinger+	(JHU, SLAC, UCLA)
Also	71	PL 35B 261	Chien, Cox, Ettlinger+	(JHU, SLAC, UCLA)
GRAHAM	72	NC 9A 166	+Abashian, Jones, Mantsch, Orr+	(ILL, NEAS)
HOLDER	72	PL 40B 141	+Radermacher, Staude+	(AACH, CERN, TORI)
JAMES	72	NP B49 1	+Montanet, Paul, Saetre+	(CERN, SACL, OSLO)
KRENZ	72	LNC 4 213	+Hopkins, Evans, Muir, Peach	(AACH, CERN, EDIN)
MANN	72	PR D6 137	+Kofler, Meisner, Hertzbach+	(MASA, BNL, YALE)
MANTSCH	72	NC 9A 160	+Abashian, Graham, Jones, Orr+	(ILL, NEAS)
MCCARTHY	72	PL 42B 291	+Brewer, Budnitz, Entis, Graven+	(LBL)
METCALF	72	PL 40B 703	+Neuhofer, Niebergall+	(CERN, IPN, WIEN)
NEUHOFER	72	PL 41B 642	+Niebergall, Regler, Stier+	(CERN, ORSAY, VIEN)
PICCIONI	72	PRL 29 1412	+Coombes, Donaldson, Dorfan, Fryberger+	(SLAC)
Also	74	PR D9 2939	Piccioni, Donaldson+	(SLAC, UCSC, COLO)

VOSBURGH	72	PR D6 1834	+Devlin, Esterling, Goz, Bryman+	(RUTG, MASA)
Also	71	PRL 26 866	Vosburgh, Devlin, Esterling, Goz+	(RUTG, MASA)
BALATS	71	SJNP 13 53	+Berezin, Vishnevsky, Galanina+	(ITEP)
		Translated from YAF 13 93.		
BARMIN	71	PL 35B 604	+Barylov, Veselovsky, Davidenko+	(ITEP)
BISI	71	PL 36B 533	+Darriulat, Ferrero, Rubbia+	(AACH, CERN, TORI)
BURGUN	71	LNC 2 1169	+Lesquoy, Muller, Pauli+	(SACL, CERN, OSLO)
CARNEGIE	71	PR D4 1	+Cester, Fitch, Strovink, Sulak	(PRIN)
CHAN	71	Thesis LBL-350		(LBL)
CHIEN	71	PL 35B 261	+Cox, Ettlinger+	(JHU, SLAC, UCLA)
Also	72	PL 41B 647	Dally, Innocenti, Seppi+	(SLAC, JHU, UCLA)
CHO	71	PR D3 1557	+Dralle, Canter, Engler, Fisk+	(CMU, BNL, CASE)
CLARK	71	PRL 26 1667	+Elioff, Field, Frisch, Johnson, Kerth+	(LRL)
Also	70	Thesis UCRL 19709	Johnson	(LRL)
Also	71	Thesis UCRL 20264	Frisch	(LRL)
Also	74	SLAC-PUB-1498 unpub.	Field	(SLAC)
ENSTROM	71	PR D4 2629	+Akavia, Coombes, Dorfan+	(SLAC, STAN)
Also	70	Thesis SLAC-0125	Enstrom	(STAN)
JAMES	71	PL 35B 265	+Montanet, Paul, Pauli+	(CERN, SACL, OSLO)
MEISNER	71	PR D3 59	+Mann, Hertzbach, Kofler+	(MASA, BNL, YALE)
PEACH	71	PL 35B 351	+Evans, Muir, Budagov, Hopkins+	(EDIN, CERN)
REPELLIN	71	PL 36B 603	+Wolff, Chollet, Gaillard, Jane+	(ORSAY, CERN)
WEBBER	71	PR D3 64	+Solmitz, Crawford, Alston-Garnjost	(LRL)
Also	68	PRL 21 498	Webber, Solmitz, Crawford, Alston-Garnjost	(LRL)
Also	69	Thesis UCRL 19226	Webber	(LRL)
WOLFF	71	PL 36B 517	+Chollet, Repellin, Gaillard+	(ORSAY, CERN)
ALBROW	70	PL 33B 516	+Aston, Barber, Bird, Ellison+	(MCHS, DARE)
ARONSON	70	PRL 25 1057	+Ehrlich, Hofer, Jensen+	(EFI, ILLC, SLAC)
BARMIN	70	PL 33B 377	+Barylov, Borisov, Bysheva+	(ITEP, JINR)
BASILE	70	PR D2 78	+Cronin, Thevent, Turlay, Zylberajch+	(SACL)
BECHERRAWY	70	PR D1 1452		(ROCH)
BUCHANAN	70	PL 33B 623	+Drickey, Rudnick, Shepard+	(SLAC, JHU, UCLA)
Also	71	Private Comm.	Cox	
BUDAGOV	70	PR D2 815	+Cundy, Myatt, Nezrick+	(CERN, ORSAY, EPOL)
Also	68B	PL 28B 215	Budagov, Cundy, Myatt+	(CERN, ORSAY, EPOL)
CHIEN	70	PL 33B 627	+Cox, Ettlinger+	(JHU, SLAC, UCLA)
Also	71	Private Comm.	Cox	
CHO	70	PR D1 3031	+Dralle, Canter, Engler, Fisk+	(CMU, BNL, CASE)
Also	67	PRL 19 668	Hill, Luers, Robinson, Sakitt+	(BNL, CMU)
CHOLLET	70	PL 31B 658	+Gaillard, Jane, Ratcliffe, Repellin+	(CERN)
CULLEN	70	PL 32B 523	+Darriulat, Deutsch, Foeth+	(AACH, CERN, TORI)
DARRIULAT	70	PL 33B 249	+Ferrero, Grosso, Holder+	(AACH, CERN, TORI)
FAISSNER	70	NC 70A 57	+Reithler, Thome, Gaillard+	(AACH3, CERN, RHEL)
GINSBERG	70	PR D1 229		(HAIF)
JENSEN	70	Thesis		(EFI)
Also	69	PRL 23 615	Jensen, Aronson, Ehrlich, Fryberger+	(EFI, ILL)
MARX	70	PL 32B 219	+Nygren, Peoples+	(COLU, HARV, CERN)
Also	70B	Thesis Nevis 179	Marx	(COLU)
SCRIBANO	70	PL 32B 224	+Mannelli, Pierazzini, Marx+	(PISA, COLU, HARV)
SMITH	70	PL 32B 133	+Wang, Whatley, Zorn, Hornbostel	(UMD, BNL)
WEBBER	70	PR D1 1967	+Solmitz, Crawford, Alston-Garnjost	(LRL)
Also	69	Thesis UCRL 19226	Webber	(LRL)
BANNER	69	PR 188 2033	+Cronin, Liu, Pilcher	(PRIN)
Also	68	PRL 21 1103	Banner, Cronin, Liu, Pilcher	(PRIN)
Also	68	PRL 21 1107	Cronin, Liu, Pilcher	(PRIN)
BEILLIERE	69	PL 30B 202	+Boutang, Limon	(EPOL)
BENNETT	69	PL 29B 317	+Nygren, Saal, Steinberger+	(COLU, BNL)
BOHM	69B	NP B9 605	+Darriulat, Grosso, Kaftanov+	(CERN)
Also	68	PL 27B 321	Bohm, Darriulat, Grosso, Kaftanov	(CERN)
CENCE	69	PRL 22 1210	+Jones, Peterson, Stenger+	(HAWA, LRL)
EVANS	69	PRL 23 427	+Golden, Muir, Peach+	(EDIN, CERN)
FAISSNER	69	PL 30B 204	+Foeth, Staude, Tittel+	(AACH3, CERN, TORI)
FOETH	69	PL 30B 282	+Holder, Radermacher+	(AACH, CERN, TORI)
GAILLARD	69	NC 59A 453	+Galbraith, Hussri, Jane+	(CERN, RHEL, AACH)
Also	67	PRL 18 20	Gaillard, Krienen, Galbraith+	(CERN, RHEL, AACH)
GOBBI	69B	PRL 22 685	+Green, Hakel, Moffett, Rosen, Goz+	(ROCH, RUTG)
LITTENBERG	69	PRL 22 654	+Field, Piccioni, Mehlhop+	(UCSD)
LONGO	69	PR 181 1808	+Young, Helland	(MICH, UCLA)
PACIOTTI	69	Thesis UCRL 19446		(LRL)
SAAL	69	Thesis		(COLU)
ABRAMS	68B	PR 176 1603	+Abashian, Mischke, Nefkens, Smith+	(ILL)
ARNOLD	68B	PL 28B 56	+Budagov, Cundy, Aubert+	(CERN, ORSAY)
ARONSON	68	PRL 20 287	+Chen	(PRIN)
Also	69	PR 175 1708	Aronson, Chen	(PRIN)
BARTLETT	68	PRL 21 558	+Carnegie, Fitch+	(PRIN)
BASILE	68	PL 26B 542	+Cronin, Thevenet, Turlay+	(SACL)
BASILE	68B	PL 28B 58	+Cronin, Thevenet, Turlay, Zylberajch+	(SACL)
BENNETT	68	PL 27B 244	+Nygren, Steinberger+	(COLU, CERN)
BENNETT	68B	PL 27B 248	+Nygren, Steinberger+	(COLU, CERN)
BLANPIED	68	PRL 21 1650	+Levit, Engels+	(CASE, HARV, MCGI)
BOHM	68B	PL 27B 594	+	
BUDAGOV	68	NC 57A 182	+Burmeister, Cundy+	(CERN, ORSAY, IPNP)
Also	68B	PL 28B 215	Budagov, Cundy, Myatt+	(CERN, ORSAY, EPOL)
JAMES	68	NP B8 365	+Briand	(IPNP, CERN)
Also	68	PRL 21 257	Helland, Longo, Young	(UCLA, MICH)
KULYUKINA	68	JETP 26 20	+Mestvirishvili, Nyagu+	(JINR)
		Translated from ZETF 53 29.		

KUNZ 68 Thesis PU-68-46 (PRIN)
BENNETT 67 PRL 19 993 +Nygren, Saal, Steinberger+ (COLU)
BOTT-... 67 PL 24B 194 Bott-Bodenhausen, DeBouard, Cassel+ (CERN)
BOTT-... 67B PL 24B 438 Bott-Bodenhausen, Debouard, Dekkers+ (CERN)
Also 66B PL 20 212 Bott-Bodenhausen, Debouard, Cassel+ (CERN)
Also 66 PL 23 277 Bott-Bodenhausen, DeBouard, Cassel+ (CERN)
CRONIN 67 PRL 18 25 +Kunz, Risk, Wheeler (PRIN)
Also 68 Thesis unpub. Wheeler (PRIN)
CRONIN 67B Princeton 11/67 +Kunz, Risk, Wheeler (PRIN)
DEBOUARD 67 NC 52A 662 +Dekkers, Jordan, Mermod+ (CERN)
Also 65 PL 15 58 DeBouard, Dekkers, Scharff+ (CERN, ORSAY, MPIM)
DEVLIN 67 PRL 18 54 +Solomon, Shepard, Beall+ (PRIN, UMD)
Also 68 PR 169 1045 Sayer, Beall, Devlin, Shephard+ (UMD, PPA, PRIN)
DORFAN 67 PRL 19 987 +Enstrom, Raymond, Schwartz+ (SLAC, LRL)
FELDMAN 67B PR 155 1611 +Frankel, Highland, Sloan (PENN)
FIRESTONE 67 PRL 18 176 +Kim, Lach, Sandweiss+ (YALE, BNL)
FITCH 67 PR 164 1711 +Roth, Russ, Vernon (PRIN)
GINSBERG 67 PR 162 1570 (MASB)
HAWKINS 67 PR 156 1444 (YALE)
HILL 67 PRL 19 668 +Luers, Robinson, Sakitt+ (BNL, CMU)
HOPKINS 67 PRL 19 185 +Bacon, Eisler (BNL)
KADYK 67 PRL 19 597 +Chan, Drijard, Oren, Sheldon (LRL)
KULYUKINA 67 Preprint +Mestvirishvili, Nyagu+ (JINR)
LOWYS 67 PL 24B 75 +Aubert, Chounet, Pascaud+ (EPOL, ORSAY)
MISCHKE 67 PRL 18 138 +Abashian, Abrams+ (ILL)
NEFKENS 67 PR 157 1233 +Abashian, Abrams, Carpenter, Fisher+ (ILL)
SCHMIDT 67 Thesis Nevis 160 (COLU)
TODOROFF 67 Thesis (ILL)
ALFF-... 66B PL 21 595 Alff-Steinberger, Heuer, Kleinknecht+ (CERN)
ANIKINA 66 SJNP 2 339 +Vardenga, Zhuravleva+ (JINR)
Translated from YAF 2 471.
AUERBACH 66B PRL 17 980 +Mann, McFarlane, Sciulli (PENN)
BASILE 66 Balaton Conf. +Cronin, Thevenet+ (SACL)
BEHR 66 PL 22 540 +Brisson, Petiau+ (EPOL, MILA, PADO, ORSAY)
BOTT-... 66 PL 23 277 Bott-Bodenhausen, DeBouard, Cassel+ (CERN)
CARPENTER 66 PR 142 871 +Abashian, Abrams, Fisher (ILL)
CRIEGEE 66 PRL 17 150 +Fox, Frauenfelder, Hanson, Moscat+ (ILL)
FIRESTONE 66 PRL 16 556 +Kim, Lach, Sandweiss+ (YALE, BNL)
HAWKINS 66 PL 21 238 (YALE)
Also 67 PR 156 1444 Hawkins (YALE)
ANDERSON 65 PRL 14 475 +Crawford, Golden, Stern, Binford+ (LRL, WISC)
ANIKINA 65 JINR P 2488 +Vardenga, Zhuravleva, Kotlya+ (JINR)
ASTBURY 65 PL 16 80 +Finocchiaro, Beusch+ (CERN, ZURI)
Also 65 HPA 39 523 Pepin
ASTBURY 65B PL 18 175 +Michelini, Beusch+ (CERN, ZURI)
ASTBURY 65C PL 18 178 +Michelini, Beusch+ (CERN, ZURI)
AUBERT 65 PL 17 59 +Behr, Canavan, Chounet+ (EPOL, ORSAY)
Also 67 PL 24B 75 Lowys, Aubert, Chounet, Pascaud+ (EPOL, ORSAY)
BALDO-... 65 NC 38 684 Baldo-Ceolin, Calimani, Ciampolillo+ (PADO)
FISHER 65 ANL 7130 83 +Abashian, Abrams, Carpenter+ (ILL)
FITCH 65 PRL 15 73 +Roth, Russ, Vernon (PRIN)
FRANZINI 65 PR 140B 127 +Kirsch, Plano+ (COLU, RUTG)
GALBRAITH 65 PRL 14 383 +Manning, Jones+ (AERE, BRIS, RHEL)
GUIDONI 65 Argonne Conf. 49 +Barnes, Foelsche, Ferbel, Firestone+ (BNL, YALE)
HOPKINS 65 Argonne Conf. 67 +Bacon, Eisler (VAND, RUTG)
ADAIR 64 PL 12 67 +Leipuner (YALE, BNL)
ALEKSANYAN 64B Dubna Conf. 2 102 +Alikhanyan, Vartazaryan+ (YERE)
Also 64 JETP 19 1019 Aleksanyan+ (LEBD, MPEI, YERE)
Translated from ZETF 46 1504.
ANIKINA 64 JETP 19 42 +Zhuravleva+ (GEOR, JINR)
Translated from ZETF 46 59.
CHRISTENS... 64 PRL 13 138 Christenson, Cronin, Fitch, Turlay (PRIN)
FUJII 64 Dubna Conf. 2 146 +Jovanovich, Turkot+ (BNL, UMD, MIT)
LUERS 64 PR 133B 1276 +Mittra, Willis, Yamamoto (BNL)
DARMON 62 PL 3 57 +Rousset, Six (EPOL)
ASTIER 61 Aix Conf. 1 227 +Blaskovic, Rivet, Siaud+ (EPOL)
FITCH 61 NC 22 1160 +Piroue, Perkins (PRIN, LASL)
GOOD 61 PR 124 1223 +Matsen, Muller, Piccioni+ (LRL)
NYAGU 61 PRL 6 552 +Okonov, Petrov, Rosanova, Rusakov (JINR)
Also 61B JETP 13 1138 Nyagu, Okonov, Petrov, Rozanova+ (JINR)
Translated from ZETF 40 1618.
BARDON 58 ANP 5 156 +Lande, Lederman (COLU, BNL)

OTHER RELATED PAPERS

HAYAKAWA 93 PR D48 1150 +Sanda (NAGO)
"Searching for T, CP, CPT, $\Delta S = \Delta Q$ Rule Violations in the Neutral K Meson System: A Guide"
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"The Search for Direct CP Violation"
BATTISTON 92 PRPL 214 293 +Cocolicchio, Fogli, Paver (PGIA, CERN, TRSTT)
Status and Perspectives of K Decay Physics
DIB 92 PR D46 2265 +Peccei (UCLA)
Tests of CPT conservation in the neutral kaon system.
KLEINKNECHT 92 CNPP 20 281 (MANZ)
New Results on CP Violation in Decays of Neutral K Mesons.
KLEINKNECHT 90 ZPHY C46 S57 (MANZ)
PEACH 90 JPG 16 131 (EDIN)
BRYMAN 89 IJMP A4 79 (TRIU)
"Rare Kaon Decays"
KLEINKNECHT 76 ARNS 26 1 (DORT)

GINSBERG	73	PR D8 3887	+Smith	(MIT, STON)
GINSBERG	70	PR D1 229		(HAIF)
HEUSSE	70	LNC 3 449	+Aubert, Pascaud, Vialle	(ORSAY)
CRONIN	68C	Vienna Conf. 281		(PRIN)
RUBBIA	67	PL 24B 531	+Steinberger	(CERN, COLU)
Also	66C	PL 23 167	Rubbia, Steinberger	(CERN, COLU)
Also	66C	PL 20 207	Alff-Steinberger, Heuer, Kleinknecht+	(CERN)
Also	66B	PL 21 595	Alff-Steinberger, Heuer, Kleinknecht+	(CERN)
AUERBACH	66	PR 149 1052	+Dobbs, Lande, Mann, Sciulli+	(PENN)
Also	65	PRL 14 192	Auerbach, Lande, Mann, Sciulli, Uto+	(PENN)
FIRESTONE	66B	PRL 17 116	+Kim, Lach, Sandweiss+	(YALE, BNL)
BEHR	65	Argonne Conf. 59	+Brisson, Bellotti+	(EPOL, MILA, PADO)
MESTVIRISH...	65	JINR P 2449	Mestvirishvili, Nyagu, Petrov, Rusakov+	(JINR)
TRILLING	65B	UCRL 16473		(LRL)
Updated from 1965 Argonne Conference, page 115.				
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