K_L^0 – THIS IS PART 1 OF 4

To reduce the size of this section's PostScript file, we have divided it into four PostScript files. We present the following index:

PART 1

PART 2

PART 3

PART 4

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).

OUR FIT is described in the note on "*CP* Violation in K^0_L Decay" in the K^0_L Particle Listings.

VALUE (10^{10} $\hbar$ s^{-1})	*DOCUMENT ID*		*TECN*	*COMMENT*
0.5304±0.0014 OUR FIT				
0.5310±0.0019 OUR AVERAGE Error includes scale factor of 1.2.				
0.5274±0.0029 ±0.0005	ADLER	95	CPLR	Charge asymmetry in K^0_{e3}
0.5297±0.0030 ±0.0022	[1] SCHWINGEN...	95	E773	20–160 GeV K beams
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 in $K^0_{\ell 3}$
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] Fits Δm and ϕ_{+-} simultaneously.

[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 Δm 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 Error includes scale factor of 1.1.				
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	$3\pi^0$		(21.12 ±0.27) %	S=1.1
Γ_2	$\pi^+\pi^-\pi^0$		(12.56 ±0.20) %	S=1.7
Γ_3	$\pi^\pm\mu^\mp\nu$ Called $K^0_{\mu 3}$.	[a]	(27.17 ±0.25) %	S=1.1
Γ_4	$\pi^-\mu^+\nu_\mu$			
Γ_5	$\pi^+\mu^-\overline{\nu}_\mu$			
Γ_6	$\pi^\pm e^\mp\nu_e$ Called K^0_{e3}.	[a]	(38.78 ±0.27) %	S=1.1
Γ_7	$\pi^- e^+\nu_e$			

Γ_8	$\pi^+ e^- \overline{\nu}_e$				
Γ_9	2γ			$(5.92 \pm 0.15) \times 10^{-4}$	
Γ_{10}	3γ			$< 2.4 \times 10^{-7}$	CL=90%
Γ_{11}	$\pi^0 2\gamma$		[b]	$(1.70 \pm 0.28) \times 10^{-6}$	
Γ_{12}	$\pi^0 \pi^\pm e^\mp \nu$		[a]	$(5.18 \pm 0.29) \times 10^{-5}$	
Γ_{13}	$(\pi \mu \,\text{atom})\nu$			$(1.06 \pm 0.11) \times 10^{-7}$	
Γ_{14}	$\pi^\pm e^\mp \nu_e \gamma$		[a,b,c]	(1.3 ± 0.8) %	
Γ_{15}	$\pi^+ \pi^- \gamma$		[b,c]	$(4.61 \pm 0.14) \times 10^{-5}$	
Γ_{16}	$\pi^0 \pi^0 \gamma$			$< 5.6 \times 10^{-6}$	

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

Γ_{17}	$\pi^+ \pi^-$	*CPV*		$(2.067 \pm 0.035) \times 10^{-3}$	S=1.1
Γ_{18}	$\pi^0 \pi^0$	*CPV*		$(9.36 \pm 0.20) \times 10^{-4}$	
Γ_{19}	$\mu^+ \mu^-$	*S1*		$(7.2 \pm 0.5) \times 10^{-9}$	S=1.4
Γ_{20}	$\mu^+ \mu^- \gamma$	*S1*		$(3.23 \pm 0.30) \times 10^{-7}$	
Γ_{21}	$e^+ e^-$	*S1*		$< 4.1 \times 10^{-11}$	CL=90%
Γ_{22}	$e^+ e^- \gamma$	*S1*		$(9.1 \pm 0.5) \times 10^{-6}$	
Γ_{23}	$e^+ e^- \gamma\gamma$	*S1*	[b]	$(6.5 \pm 1.2) \times 10^{-7}$	
Γ_{24}	$\pi^+ \pi^- e^+ e^-$	*S1*		$< 2.5 \times 10^{-6}$	CL=90%
Γ_{25}	$\mu^+ \mu^- e^+ e^-$	*S1*		$< 4.9 \times 10^{-6}$	CL=90%
Γ_{26}	$e^+ e^- e^+ e^-$	*S1*	[d]	$(4.1 \pm 0.8) \times 10^{-8}$	S=1.2
Γ_{27}	$\pi^0 \mu^+ \mu^-$	*CP,S1*	[e]	$< 5.1 \times 10^{-9}$	CL=90%
Γ_{28}	$\pi^0 e^+ e^-$	*CP,S1*	[e]	$< 4.3 \times 10^{-9}$	CL=90%
Γ_{29}	$\pi^0 \nu \overline{\nu}$	*CP,S1*	[f]	$< 5.8 \times 10^{-5}$	CL=90%
Γ_{30}	$e^\pm \mu^\mp$	*LF*	[a]	$< 3.3 \times 10^{-11}$	CL=90%

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

[b] See the Particle 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 46 measurements and one constraint to determine 8 parameters. The overall fit has a $\chi^2 = 41.2$ for 39 degrees of freedom.

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

	x_1	x_2	x_3	x_6	x_9	x_{17}	x_{18}
x_2	−19						
x_3	−37	−28					
x_6	−49	−28	−36				
x_9	−8	22	−6	−5			
x_{17}	−12	35	−8	−8	64		
x_{18}	−10	27	−7	−6	84	77	
Γ	0	0	0	0	0	0	0

	Mode	Rate (10^8 s^{-1})	Scale factor
Γ_1	$3\pi^0$	0.0408 ± 0.0006	
Γ_2	$\pi^+\pi^-\pi^0$	0.0243 ± 0.0004	1.5
Γ_3	$\pi^\pm \mu^\mp \nu$ Called $K^0_{\mu3}$.	[a] 0.0525 ± 0.0007	1.1
Γ_6	$\pi^\pm e^\mp \nu_e$ Called K^0_{e3}.	[a] 0.0750 ± 0.0008	1.1
Γ_9	2γ	$(1.144 \pm 0.031) \times 10^{-4}$	
Γ_{17}	$\pi^+\pi^-$	$(4.00 \pm 0.07) \times 10^{-4}$	1.1
Γ_{18}	$\pi^0\pi^0$	$(1.81 \pm 0.04) \times 10^{-4}$	

K^0_L DECAY RATES

$\Gamma(3\pi^0)$ Γ_1

VALUE (10^6 s^{-1})	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
4.08±0.06 OUR FIT					
$5.22^{+1.03}_{-0.84}$	54	BEHR	66	HLBC	Assumes *CP*

$\Gamma(\pi^+\pi^-\pi^0)$ Γ_2

VALUE (10^6 s^{-1})	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
2.43±0.04 OUR FIT Error includes scale factor of 1.5.					
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 $\Gamma(\pi^+\pi^-\pi^0)/\left[\Gamma(\pi^+\pi^-\pi^0) + \Gamma(\pi^\pm\mu^\mp\nu) + \Gamma(\pi^\pm e^\mp \nu_e)\right]$. 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	COMMENT
5.25±0.07 OUR FIT Error includes scale factor of 1.1.					
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$4.54^{+1.24}_{-1.08}$	19	LOWYS	67	HLBC	

$\Gamma(\pi^{\pm}e^{\mp}\nu_e)$ — Γ_6

VALUE (10^6 s^{-1})	EVTS	DOCUMENT ID		TECN	COMMENT
7.50±0.08 OUR FIT Error includes scale factor of 1.1.					
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

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

$K^0_L \rightarrow$ charged.

VALUE (10^6 s^{-1})	EVTS	DOCUMENT ID		TECN
15.18±0.14 OUR FIT Error includes scale factor of 1.1.				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
15.1 ±1.9	98	AUERBACH	66B	OSPK

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

VALUE (10^6 s^{-1})	EVTS	DOCUMENT ID		TECN	COMMENT
12.75±0.12 OUR FIT Error includes scale factor of 1.1.					
11.9 ±0.6 OUR AVERAGE Error includes scale factor of 1.2.					
12.4 ±0.7	410	[8] BURGUN	72	HBC	$K^+p \rightarrow K^0p\pi^+$
13.1 ±1.3	252	[8] WEBBER	71	HBC	$K^-p \rightarrow n\overline{K}^0$
11.6 ±0.9	393	[8,9] CHO	70	DBC	$K^+n \rightarrow K^0p$
$9.85^{+1.15}_{-1.05}$	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	$K^-p \rightarrow n\overline{K}^0$
10.3 ±0.8	335	[9] HILL	67	DBC	$K^+n \rightarrow K^0p$

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

K^0_L BRANCHING RATIOS

$\Gamma(3\pi^0)/\Gamma_{total}$ — Γ_1/Γ

VALUE	EVTS	DOCUMENT ID		TECN
0.2112±0.0027 OUR FIT Error includes scale factor of 1.1.				
0.2105±0.0028	38k	[10] KREUTZ	95	NA31

[10] KREUTZ 95 measure $3\pi^0$, $\pi^+\pi^-\pi^0$, and $\pi e \nu_e$ modes. They assume PDG 1992 values for $\pi\mu\nu_\mu$, 2π, and 2γ modes.

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
1.68 ±0.04 OUR FIT Error includes scale factor of 1.3.					
1.63 ±0.05 OUR AVERAGE Error includes scale factor of 1.4.					
1.611±0.014±0.034	38k	[11] KREUTZ	95	NA31	
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

[11] KREUTZ 95 excluded from fit because it is not independent of their $\Gamma(3\pi^0)/\Gamma_{total}$ measurement, which is in the fit.

$\Gamma(3\pi^0)/\Gamma(\pi^{\pm}e^{\mp}\nu_e)$ — Γ_1/Γ_6

VALUE	EVTS	DOCUMENT ID		TECN
0.545±0.009 OUR FIT Error includes scale factor of 1.1.				
0.545±0.004±0.009	38k	[12] KREUTZ	95	NA31

[12] KREUTZ 95 measurement excluded from fit because it is not independent of their $\Gamma(3\pi^0)/\Gamma_{total}$ measurement, which is in the fit.

$\Gamma(3\pi^0)/[\Gamma(\pi^+\pi^-\pi^0)+\Gamma(\pi^\pm\mu^\mp\nu)+\Gamma(\pi^\pm e^\mp\nu_e)]$ $\quad\Gamma_1/(\Gamma_2+\Gamma_3+\Gamma_6)$

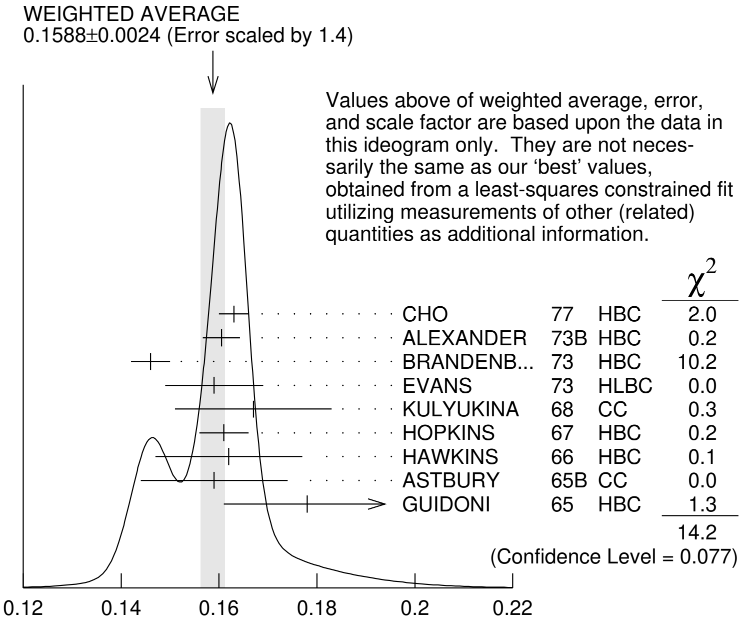
VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.269±0.004 OUR FIT	Error includes scale factor of 1.1.				
0.260±0.011 OUR AVERAGE					
0.251±0.014	549	BUDAGOV	68	HLBC	ORSAY measur.
0.277±0.021	444	BUDAGOV	68	HLBC	Ecole polytec.meas
0.31 $^{+0.07}_{-0.06}$	29	KULYUKINA	68	CC	
0.24 ±0.08	24	ANIKINA	64	CC	

$\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ $\quad\Gamma_2/\Gamma$

VALUE	DOCUMENT ID
0.1256±0.0020 OUR FIT	Error includes scale factor of 1.7.

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.1600±0.0025 OUR FIT	Error includes scale factor of 1.7.				
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	



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

$\Gamma(\pi^+\pi^-\pi^0)/\Gamma(\pi^\pm e^\mp\nu_e)$ $\quad\Gamma_2/\Gamma_6$

VALUE	EVTS	DOCUMENT ID		TECN
0.324±0.006 OUR FIT	Error includes scale factor of 1.6.			
0.336±0.003±0.007	28k	KREUTZ	95	NA31

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.701±0.009 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	[13] BEILLIERE	69	HLBC	
0.648±0.030	1309	EVANS	69	HLBC	Repl. by EVANS 73
0.67 ±0.13		[14] 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	

[13] BEILLIERE 69 is a scanning experiment using same exposure as BUDAGOV 68.
[14] KULYUKINA 68 $\Gamma(\pi^{\pm}\mu^{\mp}\nu)/\Gamma(\pi^{\pm}e^{\mp}\nu_e)$ is not measured independently from $\Gamma(\pi^{+}\pi^{-}\pi^{0})/\left[\Gamma(\pi^{+}\pi^{-}\pi^{0}) + \Gamma(\pi^{\pm}\mu^{\mp}\nu) + \Gamma(\pi^{\pm}e^{\mp}\nu_e)\right]$ and $\Gamma(\pi^{\pm}e^{\mp}\nu_e)/\left[\Gamma(\pi^{+}\pi^{-}\pi^{0}) + \Gamma(\pi^{\pm}\mu^{\mp}\nu) + \Gamma(\pi^{\pm}e^{\mp}\nu_e)\right]$.

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

VALUE	EVTS	DOCUMENT ID		TECN
0.3461±0.0030 OUR FIT Error includes scale factor of 1.1.				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.335 ±0.055	330	[15] KULYUKINA	68	CC
0.39 $^{+0.08}_{-0.10}$	172	[15] ASTBURY	65	CC
0.356 ±0.07	251	[15] LUERS	64	HBC

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

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

VALUE	EVTS	DOCUMENT ID		TECN
0.4939±0.0030 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

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

VALUE	EVTS	DOCUMENT ID		TECN
0.5880±0.0033 OUR FIT				
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.415 ±0.120	320	ASTIER	61	CC

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

VALUE	DOCUMENT ID
0.6596±0.0030 OUR FIT Error includes scale factor of 1.2.	

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

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
5.92±0.15 OUR FIT					
• • • We do not use the following data for averages, fits, limits, etc. • • •					
4.54±0.84		[16] BANNER	72B	OSPK	
4.5 ±1.0	23	ENSTROM	71	OSPK	K^0_L 1.5–9 GeV/c
5.0 ±1.0		[17] REPELLIN	71	OSPK	
5.5 ±1.1	90	KUNZ	68	OSPK	Norm.to 3 π(C+N)
7.4 ±1.6	33	[18] CRONIN	67	OSPK	
6.7 ±2.2	32	TODOROFF	67	OSPK	Repl. CRIEGEE 66
1.3 ±0.6		[19] CRIEGEE	66	OSPK	

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

[17] 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.

[18] CRONIN 67 replaced by KUNZ 68.

[19] 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*
2.80±0.08 OUR FIT	Error includes scale factor of 1.1.				
• • • We do not use the following data for averages, fits, limits, etc. • • •					
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_{18}

VALUE	*EVTS*	*DOCUMENT ID*		*TECN*
0.632±0.009 OUR FIT				
0.632±0.004±0.008	110k	BURKHARDT	87	NA31

$\Gamma(3\gamma)/\Gamma_{total}$ — Γ_{10}/Γ

VALUE	*CL%*	*DOCUMENT ID*		*TECN*
<2.4 x 10^{-7}	90	[20] BARR	95C	NA31

[20] Assumes a phase-space decay distribution.

$\Gamma(\pi^0 2\gamma)/\Gamma_{total}$ — Γ_{11}/Γ

VALUE (units 10^{-6})	*CL%*	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
1.7 ±0.2 ±0.2		63	[21] 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	[22] BARR	90C	NA31	$m_{\gamma\gamma}$ > 280 MeV
< 2.7	90		PAPADIMITR...89		E731	In PAPADI...91
<230	90	0	BANNER	69	OSPK	

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

[22] BARR 90C superseded by BARR 92.

$\Gamma(\pi^0\pi^\pm e^\mp\nu)/\Gamma_{total}$ — Γ_{12}/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		[23] DONALDSON	74	SPEC

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

$\Gamma((\pi\mu\,\text{atom})\nu)/\Gamma(\pi^\pm\mu^\mp\nu)$ — Γ_{13}/Γ_3

VALUE (units 10^{-7})	*EVTS*	*DOCUMENT ID*		*TECN*
3.90±0.39	155	[24] ARONSON	86	SPEC
• • • We do not use the following data for averages, fits, limits, etc. • • •				
seen	18	COOMBES	76	WIRE

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

$\Gamma(\pi^\pm e^\mp \nu_e\gamma)/\Gamma(\pi^\pm e^\mp\nu_e)$ — Γ_{14}/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_{15}/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	[25] RAMBERG	93	E731	E_γ >20 MeV
4.41±0.32	1062	[26] CARROLL	80B	SPEC	E_γ >20 MeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.52±0.16	516	[27] CARROLL	80B	SPEC	E_γ >20 MeV
2.89±0.28	546	[28] CARROLL	80B	SPEC	
6.2 ±2.1	24	[29] DONALDSON	74C	SPEC	

[25] RAMBERG 93 finds that fraction of Direct Emission (DE) decays with E_γ >20 MeV is 0.685 ± 0.041.
[26] Both components. Uses $K_L^0 \to \pi^+\pi^-\pi^0$/(all K_L^0) decays = 0.1239.
[27] Internal Bremsstrahlung component only.
[28] Direct γ emission component only.
[29] Uses $K_L^0 \to \pi^+\pi^-\pi^0$/(all K_L^0) decays = 0.126.

$\Gamma(\pi^0\pi^0\gamma)/\Gamma_{total}$ — Γ_{16}/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_{17}/Γ

Violates *CP* conservation.

VALUE (units 10^{-3})	DOCUMENT ID	
2.067±0.035 OUR FIT Error includes scale factor of 1.1.		
2.107±0.055	[30] ETAFIT	96

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

$\Gamma(\pi^+\pi^-)/\Gamma(\pi^+\pi^-\pi^0)$ — Γ_{17}/Γ_2

Violates *CP* conservation.

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
1.645±0.030 OUR FIT Error includes scale factor of 1.1.					
1.64 ±0.04	4200	MESSNER	73	ASPK	η_{+-} = 2.23

$\Gamma(\pi^+\pi^-)/[\Gamma(\pi^\pm\mu^\mp\nu)+\Gamma(\pi^\pm e^\mp\nu_e)]$ — $\Gamma_{17}/(\Gamma_3+\Gamma_6)$

Violates *CP* conservation.

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
3.13±0.06 OUR FIT Error includes scale factor of 1.1.					
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	[31] DEBOUARD	67	OSPK	η_{+-}=2.00 ± 0.09
2.35±0.19	525	[31] FITCH	67	OSPK	η_{+-}=1.94 ± 0.08

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

$\Gamma(\pi^+\pi^-)/[\Gamma(\pi^+\pi^-\pi^0)+\Gamma(\pi^\pm\mu^\mp\nu)+\Gamma(\pi^\pm e^\mp\nu_e)]$ — $\Gamma_{17}/(\Gamma_2+\Gamma_3+\Gamma_6)$

Violates *CP* conservation.

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
2.63 ±0.04 OUR FIT					
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2.60 ±0.07	4200	[32] MESSNER	73	ASPK	η_{+-} = 2.23 ± 0.05
1.93 ±0.26		[33] BASILE	66	OSPK	η_{+-} = 1.92 ± 0.13
1.993±0.080		[33] BOTT-...	66	OSPK	η_{+-} = 1.95 ± 0.04
2.08 ±0.35	54	[33] GALBRAITH	65	OSPK	η_{+-} = 1.99 ± 0.16
2.0 ±0.4	45	[33] CHRISTENS...	64	OSPK	η_{+-} = 1.95 ± 0.20

[32] From same data as $\Gamma(\pi^+\pi^-)/\Gamma(\pi^+\pi^-\pi^0)$ MESSNER 73, but with different normalization.
[33] Old experiments excluded from fit. See subsection on η_{+-} in section on "PARAMETERS FOR $K_L^0 \to 2\pi$ DECAY" below for average η_{+-}.

$\Gamma(\pi^0\pi^0)/\Gamma_{total}$ — Γ_{18}/Γ

Violates *CP* conservation.

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
0.936±0.020 OUR FIT					
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2.5 ±0.8	189	[34] GAILLARD	69	OSPK	η_{00}=3.6 ± 0.6
1.2 $^{+1.5}_{-1.2}$	7	[35] CRIEGEE	66	OSPK	

[34] Latest result of this experiment given by FAISSNER 70 $\Gamma(\pi^0\pi^0)/\Gamma(3\pi^0)$.
[35] CRIEGEE 66 experiment not designed to measure $2\pi^0$ decay mode.

$\Gamma(\pi^0\pi^0)/\Gamma(3\pi^0)$ — Γ_{18}/Γ_1

Violates *CP* conservation.

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
0.443±0.012 OUR FIT Error includes scale factor of 1.1.					
0.39 ±0.06 OUR AVERAGE					
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
0.46 ±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. • • •					
1.21 ±0.30	150	[36] REY	76	OSPK	η_{00}=3.8 ± 0.5
0.90 ±0.30	172	[37] FAISSNER	70	OSPK	η_{00}=3.2 ± 0.5
1.31 ±0.31	133	[36] CENCE	69	OSPK	η_{00}=3.7 ± 0.5
1.89 ±0.31	109	[38] CRONIN	67	OSPK	η_{00}=4.9 ± 0.5
1.36 ±0.18		[38] CRONIN	67B	OSPK	η_{00}=3.92 ± 0.3

[36] CENCE 69 events are included in REY 76.
[37] FAISSNER 70 contains same $2\pi^0$ events as GAILLARD 69 $\Gamma(\pi^0\pi^0)/\Gamma_{total}$.
[38] CRONIN 67B is further analysis of CRONIN 67, now both withdrawn.

$\Gamma(\pi^0\pi^0)/\Gamma(\pi^+\pi^-)$ — Γ_{18}/Γ_{17}

Violates *CP* conservation.

VALUE	DOCUMENT ID	
0.453 ±0.006 OUR FIT		
0.4535±0.0063	[39] ETAFIT	96

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

$\Gamma(\mu^+\mu^-)/[\Gamma(\pi^+\pi^-\pi^0)+\Gamma(\pi^\pm\mu^\mp\nu)+\Gamma(\pi^\pm e^\mp\nu_e)]$ — $\Gamma_{19}/(\Gamma_2+\Gamma_3+\Gamma_6)$

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_{19}/Γ_{17}

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

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
3.50±0.21 OUR AVERAGE Error includes scale factor of 1.4.						
3.87±0.30		179	[40] AKAGI	95	SPEC	
3.38±0.17		707	HEINSON	95	B791	
• • • We do not use the following data for averages, fits, limits, etc. • • •						
3.9 ±0.3 ±0.1		178	[41] AKAGI	91B	SPEC	In AKAGI 95
3.45±0.18±0.13		368	[42] HEINSON	91	SPEC	In HEINSON 95
4.1 ±0.5		54	INAGAKI	89	SPEC	In AKAGI 91B
2.8 ±0.3 ±0.2		87	MATHIAZHA...	89B	SPEC	In HEINSON 91
4.0 $^{+1.4}_{-0.9}$		15	SHOCHET	79	SPEC	
4.2 $^{+5.1}_{-2.6}$		3	[43] FUKUSHIMA	76	SPEC	
5.8 $^{+2.3}_{-1.5}$		9	[44] CARITHERS	73	SPEC	
< 1.53	90	0	[45] CLARK	71	SPEC	
< 18.	90	0	DARRIULAT	70	SPEC	
<140.	90	0	FOETH	69	SPEC	

[40] AKAGI 95 gives this number multiplied by the PDG 1992 average for $\Gamma(K^0_L \rightarrow \pi^+\pi^-)/\Gamma(\text{total})$.
[41] AKAGI 91B give this number multiplied by the 1990 PDG average for $\Gamma(K^0_L \rightarrow \pi^+\pi^-)/\Gamma(\text{total})$.
[42] 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.
[43] FUKUSHIMA 76 errors are at CL = 90%.
[44] CARITHERS 73 errors are at CL = 68%, W.Carithers, (private communication 79).
[45] 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_{20}/Γ

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

VALUE (units 10^{-6})	*CL%*	*EVTS*	*DOCUMENT ID*		*TECN*
0.323±0.023±0.019		197	SPENCER	95	E799
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.28 ±0.28		1	[46] CARROLL	80D	SPEC
<7.81	90		[47] DONALDSON	74	SPEC

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

$\Gamma(e^+e^-)/\Gamma_{\text{total}}$ — Γ_{21}/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	[48] ARISAKA	93B	B791	
• • • We do not use the following data for averages, fits, limits, etc. • • •						
< 1.6	90	1	AKAGI	95	SPEC	
< 1.6	90	1	AKAGI	91	SPEC	Sup. by AKAGI 95
< 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		[49] CLARK	71	ASPK	
<1500	90	0	FOETH	69	ASPK	

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

$\Gamma(e^+e^-)/\left[\Gamma(\pi^+\pi^-\pi^0)+\Gamma(\pi^\pm\mu^\mp\nu)+\Gamma(\pi^\pm e^\mp\nu_e)\right]$ — $\Gamma_{21}/(\Gamma_2+\Gamma_3+\Gamma_6)$

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_{22}/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	[50] CARROLL	80D	SPEC
<27	90	0	[51] BARMIN	72	HLBC

[50] Uses $K^0_L \rightarrow \pi^+\pi^-\pi^0/(\text{all } K^0_L)$ decays = 0.1239.
[51] Uses $K^0_L \rightarrow 3\pi^0/\text{total} = 0.214$.

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

$\Gamma(\pi^+\pi^- e^+ e^-)/\Gamma_{total}$ Γ_{24}/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		[52] DONALDSON	76	SPEC
<30			ANIKINA	73	STRC

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

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

$\Gamma(e^+ e^- e^+ e^-)/\Gamma_{total}$ Γ_{26}/Γ

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

VALUE (units 10^{-8})	*CL%*	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
4.1 ±0.8 OUR AVERAGE Error includes scale factor of 1.2.						
6 ±2 ±1		18	[53] AKAGI	95	SPEC	m_{ee} >470 MeV
10.4 ±3.7 ±1.1		8	[54] BARR	95	NA31	
3.96±0.78±0.32		27	GU	94	E799	
3.07±1.25±0.26		6	VAGINS	93	B845	
• • • We do not use the following data for averages, fits, limits, etc. • • •						
7 ±3 ±2		6	[53] AKAGI	95	SPEC	m_{ee} >470 MeV
6 ±2 ±1		18	AKAGI	93	CNTR	Sup. by AKAGI 95
4 ±3		2	BARR	91	NA31	Sup. by BARR 95
<260	90		BALATS	83	SPEC	

[53] Values are for the total branching fraction, acceptance-corrected for the m_{ee} cuts shown.

[54] Distribution of angles between two $e^+ e^-$ pair planes favors $CP=-1$ for K^0_L.

$\Gamma(\pi^0\mu^+\mu^-)/\Gamma_{total}$ Γ_{27}/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	[55] CARROLL	80D	SPEC
<56600	90		[56] DONALDSON	74	SPEC

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

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

$\Gamma(\pi^0 e^+ e^-)/\Gamma_{total}$ Γ_{28}/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	[57] CARROLL	80D	SPEC

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

$\Gamma(\pi^0\nu\overline{\nu})/\Gamma_{total}$ Γ_{29}/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		[58] LITTENBERG	89	RVUE

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

$\Gamma(e^{\pm}\mu^{\mp})/\Gamma_{total}$ Γ_{30}/Γ

Test of lepton family number conservation.

VALUE (units 10^{-11})	*CL%*	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
< 3.3	90	0	[59] ARISAKA	93	B791	
• • • We do not use the following data for averages, fits, limits, etc. • • •						
< 9.4	90	0	AKAGI	95	SPEC	
< 3.9	90	0	ARISAKA	93	B791	
< 9.4	90	0	AKAGI	91	SPEC	Sup. by AKAGI 95
< 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		[60] CLARK	71	ASPK	

[59] This is the combined result of ARISAKA 93 and MATHIAZHAGAN 89.

[60] Possible (but unknown) systematic errors. See note on CLARK 71 $\Gamma(\mu^+\mu^-)/\Gamma(\pi^+\pi^-)$ entry.

$\Gamma(e^{\pm}\mu^{\mp})/\left[\Gamma(\pi^+\pi^-\pi^0)+\Gamma(\pi^{\pm}\mu^{\mp}\nu)+\Gamma(\pi^{\pm}e^{\mp}\nu_e)\right]$ $\Gamma_{30}/(\Gamma_2+\Gamma_3+\Gamma_6)$

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