K^0_L – 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 1986 edition, Physics Letters **170B** 132 (1986).

OUR FIT is described in the note on "Fits for K^0_L *CP*-Violation Parameters" in the K^0_L Particle Listings.

VALUE (10^{10} $\hbar$ s^{-1})	*DOCUMENT ID*		*TECN*	*COMMENT*
0.5301±0.0014 OUR FIT				
0.5311±0.0019 OUR AVERAGE Error includes scale factor of 1.2.				
0.5274±0.0029 ±0.0005	[1] ADLER	95	CPLR	
0.5297±0.0030 ±0.0022	[2] SCHWINGEN...	95	E773	20–160 GeV *K* beams
0.5257±0.0049 ±0.0021	[2] GIBBONS	93C	E731	20–160 GeV *K* beams
0.5340±0.00255±0.0015	[3] GEWENIGER	74C	SPEC	Gap method
0.5334±0.0040 ±0.0015	[3] 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. • • •				
0.5307±0.0013	[4] ADLER	96C	RVUE	
0.5286±0.0028	[5] GIBBONS	93	E731	20–160 GeV *K* beams
0.482 ±0.014	[6] ARONSON	82B	SPEC	*E*=30–110 GeV
0.534 ±0.007	[7] CARNEGIE	71	ASPK	Gap method
0.542 ±0.006	[7] ARONSON	70	ASPK	Gap method

[1] ADLER 95 uses $\overline{K}^0_{e3}$ and K^0_{e3} strangeness tagging at production and decay.

[2] Fits Δm and ϕ_{+-} simultaneously. GIBBONS 93C systematic error is from B. Winstein via private communtication.

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

[4] ADLER 96C is the result of a fit which includes nearly the same data as entered into the "OUR FIT" value above.

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

[6] ARONSON 82 find that Δm may depend on the kaon energy.

[7] 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		[8] 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

[8] 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 $K^0_{\mu3}$.		[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]	$(3.62 ^{+0.26}_{-0.21}) \times 10^{-3}$	
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*		$(3.25 \pm 0.28) \times 10^{-7}$	
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*	[b] <	4.6		$\times 10^{-7}$	CL=90%
Γ_{25}	$\mu^+\mu^- e^+ e^-$	*S1*		(2.9	$^{+6.7}_{-2.4}$	) $\times 10^{-9}$	
Γ_{26}	$e^+ e^- e^+ e^-$	*S1*		(4.1	± 0.8	) $\times 10^{-8}$	S=1.2
Γ_{27}	$\pi^0 \mu^+ \mu^-$	*CP,S1*	[d] <	5.1		$\times 10^{-9}$	CL=90%
Γ_{28}	$\pi^0 e^+ e^-$	*CP,S1*	[d] <	4.3		$\times 10^{-9}$	CL=90%
Γ_{29}	$\pi^0 \nu \overline{\nu}$	*CP,S1*	[e] <	5.8		$\times 10^{-5}$	CL=90%
Γ_{30}	$e^\pm \mu^\mp$	*LF*	[a] <	3.3		$\times 10^{-11}$	CL=90%
Γ_{31}	$e^\pm e^\pm \mu^\mp \mu^\mp$	*LF*	[a] <	6.1		$\times 10^{-9}$	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] Allowed by higher-order electroweak interactions.

[e] 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 $\left\langle\delta p_i \delta p_j\right\rangle/(\delta p_i \cdot \delta p_j)$, in percent, from the fit to parameters p_i, including the branching fractions, $x_i \equiv \Gamma_i/\Gamma_{total}$. 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 $K^0_{\mu 3}$.	[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	[9] 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	[9] 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.

[9] 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*
5.25±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	[10] BURGUN	72	HBC	$K^+ p \to K^0 p \pi^+$
13.1 ±1.3	252	[10] WEBBER	71	HBC	$K^- p \to n \overline{K}^0$
11.6 ±0.9	393	[10,11] CHO	70	DBC	$K^+ n \to K^0 p$
$9.85^{+1.15}_{-1.05}$	109	[10] FRANZINI	65	HBC	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
8.47±1.69	126	[10] MANN	72	HBC	$K^- p \to n \overline{K}^0$
10.3 ±0.8	335	[11] HILL	67	DBC	$K^+ n \to K^0 p$

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

K^0_L BRANCHING RATIOS

$\Gamma(3\pi^0)/\Gamma_{\text{total}}$ — 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	[12] KREUTZ	95	NA31

[12] 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	[13] 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

[13] KREUTZ 95 excluded from fit because it is not independent of their $\Gamma(3\pi^0)/\Gamma_{\text{total}}$ 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	[14] KREUTZ	95	NA31

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

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

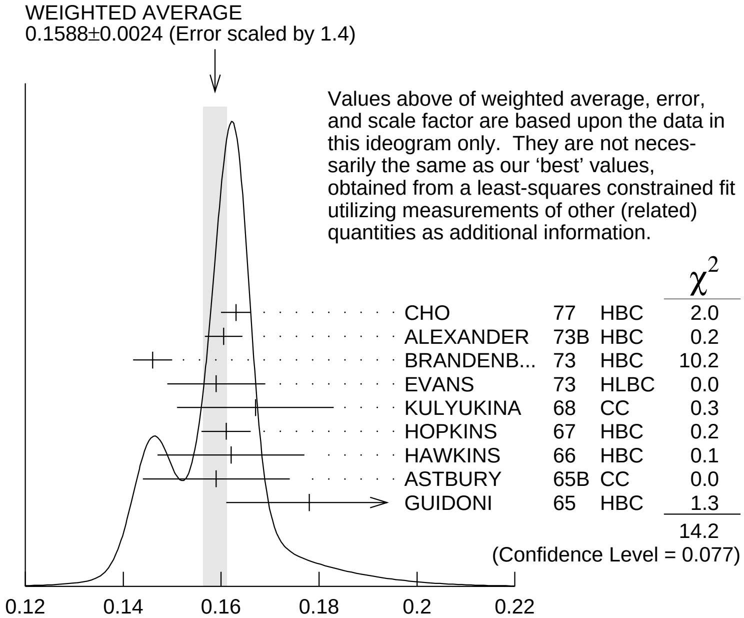
VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.269±0.004 OUR FIT Error includes scale factor of 1.1.					
0.260±0.011 OUR AVERAGE					
0.251±0.014	549	BUDAGOV	68	HLBC	ORSAY measur.
0.277±0.021	444	BUDAGOV	68	HLBC	Ecole polytec.meas
$0.31\ ^{+0.07}_{-0.06}$	29	KULYUKINA	68	CC	
0.24 ±0.08	24	ANIKINA	64	CC	

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

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

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

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	



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

$\Gamma(\pi^+\pi^-\pi^0)/\Gamma(\pi^\pm e^\mp\nu_e)$ — Γ_2/Γ_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	[15] BEILLIERE	69	HLBC	
0.648±0.030	1309	EVANS	69	HLBC	Repl. by EVANS 73
0.67 ±0.13		[16] 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	

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

[16] 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	[17] KULYUKINA	68	CC
0.39 $^{+0.08}_{-0.10}$	172	[17] ASTBURY	65	CC
0.356 ±0.07	251	[17] LUERS	64	HBC

[17] 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

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

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

$\Gamma(2\gamma)/\Gamma_{total}$ — 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		[18] BANNER	72B	OSPK	
4.5 ±1.0	23	ENSTROM	71	OSPK	K^0_L 1.5–9 GeV/c
5.0 ±1.0		[19] REPELLIN	71	OSPK	
5.5 ±1.1	90	KUNZ	68	OSPK	Norm.to 3 π(C+N)
7.4 ±1.6	33	[20] CRONIN	67	OSPK	
6.7 ±2.2	32	TODOROFF	67	OSPK	Repl. CRIEGEE 66
1.3 ±0.6		[21] CRIEGEE	66	OSPK	

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

[19] 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.

[20] CRONIN 67 replaced by KUNZ 68.

[21] 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

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

VALUE	*CL%*	*DOCUMENT ID*		*TECN*
$<2.4 \times 10^{-7}$	90	[22] BARR	95C	NA31

[22] Assumes a phase-space decay distribution.

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

VALUE (units 10^{-6})	*CL%*	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
1.7 ±0.2 ±0.2		63	[23] 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	[24] BARR	90C	NA31	$m_{\gamma\gamma} > 280$ MeV
< 2.7	90		PAPADIMITR...	89	E731	In PAPADI...91
<230	90	0	BANNER	69	OSPK	

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

[24] BARR 90C superseded by BARR 92.

$\Gamma(\pi^0\pi^\pm e^\mp\nu)/\Gamma_{\text{total}}$ — 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		[25] DONALDSON	74	SPEC

[25] DONALDSON 74 uses $K_L^0 \to \pi^+\pi^-\pi^0/(\text{all } K_L^0)$ 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	[26] ARONSON	86	SPEC
• • • We do not use the following data for averages, fits, limits, etc. • • •				
seen	18	COOMBES	76	WIRE

[26] 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
$0.934 \pm 0.036^{+0.055}_{-0.039}$	1384	LEBER	96	NA31	$E^*_{\gamma} \geq$ 30 MeV, $\theta^*_{e\gamma} \geq 20^{\circ}$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
3.3 ±2.0	10	PEACH	71	HLBC	γ KE >15 MeV

$\Gamma(\pi^+\pi^-\gamma)/\Gamma_{\text{total}}$ — 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	[27] RAMBERG	93	E731	E_{γ} >20 MeV
4.41±0.32	1062	[28] CARROLL	80B	SPEC	E_{γ} >20 MeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.52±0.16	516	[29] CARROLL	80B	SPEC	E_{γ} >20 MeV
2.89±0.28	546	[30] CARROLL	80B	SPEC	
6.2 ±2.1	24	[31] DONALDSON	74C	SPEC	

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

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

$\Gamma(\pi^+\pi^-)/\Gamma_{\text{total}}$ — 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	[32] ETAFIT	98

[32] 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 "Fits for K^0_L *CP*-Violation Parameters."

$\Gamma(\pi^+\pi^-)/\Gamma(\pi^+\pi^-\pi^0)$ — 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	[33] DEBOUARD	67	OSPK	η_{+-}=2.00 ± 0.09
2.35±0.19	525	[33] FITCH	67	OSPK	η_{+-}=1.94 ± 0.08

[33] Old experiments excluded from fit. See subsection on η_{+-} in section on "PARAMETERS FOR $K^0_L \to 2\pi$ 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	[34] MESSNER	73	ASPK	η_{+-} = 2.23 ± 0.05
1.93 ±0.26		[35] BASILE	66	OSPK	η_{+-} = 1.92 ± 0.13
1.993±0.080		[35] BOTT-...	66	OSPK	η_{+-} = 1.95 ± 0.04
2.08 ±0.35	54	[35] GALBRAITH	65	OSPK	η_{+-} = 1.99 ± 0.16
2.0 ±0.4	45	[35] CHRISTENS...	64	OSPK	η_{+-} = 1.95 ± 0.20

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

[35] Old experiments excluded from fit. See subsection on η_{+-} in section on "PARAMETERS FOR $K^0_L \to 2\pi$ DECAY" below for average η_{+-}.

$\Gamma(\pi^0\pi^0)/\Gamma_{\text{total}}$ — 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	[36] GAILLARD	69	OSPK	η_{00}=3.6 ± 0.6
1.2 $^{+1.5}_{-1.2}$	7	[37] CRIEGEE	66	OSPK	

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

[37] 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	[38] REY	76	OSPK	η_{00}=3.8 ± 0.5
0.90 ±0.30	172	[39] FAISSNER	70	OSPK	η_{00}=3.2 ± 0.5
1.31 ±0.31	133	[38] CENCE	69	OSPK	η_{00}=3.7 ± 0.5
1.89 ±0.31	109	[40] CRONIN	67	OSPK	η_{00}=4.9 ± 0.5
1.36 ±0.18		[40] CRONIN	67B	OSPK	η_{00}=3.92 ± 0.3

[38] CENCE 69 events are included in REY 76.
[39] FAISSNER 70 contains same $2\pi^0$ events as GAILLARD 69 $\Gamma(\pi^0\pi^0)/\Gamma_{\text{total}}$.
[40] 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	[41] ETAFIT	98

[41] 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 "Fits for K^0_L CP-Violation Parameters."

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

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	[42] AKAGI	95	SPEC	
3.38±0.17		707	HEINSON	95	B791	

• • • We do not use the following data for averages, fits, limits, etc. • • •

$3.9 \pm 0.3 \pm 0.1$		178	[43] AKAGI	91B	SPEC	In AKAGI 95
$3.45 \pm 0.18 \pm 0.13$		368	[44] HEINSON	91	SPEC	In HEINSON 95
4.1 ± 0.5		54	INAGAKI	89	SPEC	In AKAGI 91B
$2.8 \pm 0.3 \pm 0.2$		87	MATHIAZHA...	89B	SPEC	In HEINSON 91
$4.0\ ^{+1.4}_{-0.9}$		15	SHOCHET	79	SPEC	
$4.2\ ^{+5.1}_{-2.6}$		3	[45] FUKUSHIMA	76	SPEC	
$5.8\ ^{+2.3}_{-1.5}$		9	[46] CARITHERS	73	SPEC	
<1.53	90	0	[47] CLARK	71	SPEC	
$<18.$	90	0	DARRIULAT	70	SPEC	
$<140.$	90	0	FOETH	69	SPEC	

[42] AKAGI 95 gives this number multiplied by the PDG 1992 average for $\Gamma(K^0_L \to \pi^+\pi^-)/\Gamma(\text{total})$.

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

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

[45] FUKUSHIMA 76 errors are at CL = 90%.

[46] CARITHERS 73 errors are at CL = 68%, W.Carithers, (private communication 79).

[47] 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^{-7})	CL%	EVTS	DOCUMENT ID		TECN
3.25±0.28 OUR AVERAGE					
$3.4 \pm 0.6 \pm 0.4$		45	FANTI	97	NA48
$3.23 \pm 0.23 \pm 0.19$		197	SPENCER	95	E799
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2.8 ± 2.8		1	[48] CARROLL	80D	SPEC
<78.1	90		[49] DONALDSON	74	SPEC

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

[49] Uses $K^0_L \to \pi^+\pi^-\pi^0/(\text{all } K^0_L)$ 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	[50] 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		[51] CLARK	71	ASPK	
<1500	90	0	FOETH	69	ASPK	

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

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

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

$\Gamma(e^+e^-\gamma)/\Gamma_{total}$ 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	[52] CARROLL	80D	SPEC
<27	90	0	[53] BARMIN	72	HLBC

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

$\Gamma(e^+e^-\gamma\gamma)/\Gamma_{total}$ 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^{-7})	*CL%*	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
< 4.6	90		NOMURA	97	SPEC	$m_{ee} > 4$ MeV
• • • We do not use the following data for averages, fits, limits, etc. • • •						
< 25	90	0	BALATS	83	SPEC	
< 88.1	90		[54] DONALDSON	76	SPEC	
<300			ANIKINA	73	STRC	

[54] 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^{-9})	*CL%*	*EVTS*	*DOCUMENT ID*		*TECN*
$\mathbf{2.9^{+6.7}_{-2.4}}$		1	GU	96	E799
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<4900	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	[55] AKAGI	95	SPEC	m_{ee} >470 MeV
10.4 ±3.7 ±1.1		8	[56] 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	[55] 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	

[55] Values are for the total branching fraction, acceptance-corrected for the m_{ee} cuts shown.
[56] 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	[57] CARROLL	80D	SPEC
<56600	90		[58] DONALDSON	74	SPEC

[57] Uses $K^0_L \rightarrow \pi^+ \pi^- \pi^0/(\text{all } K^0_L)$ decays = 0.1239.
[58] Uses $K^0_L \rightarrow \pi^+ \pi^- \pi^0/(\text{all } K^0_L)$ 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	[59] CARROLL	80D	SPEC

[59] Uses $K^0_L \rightarrow \pi^+ \pi^- \pi^0/(\text{all } K^0_L)$ 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		[60] LITTENBERG	89	RVUE

[60] 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	[61] 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		[62] CLARK	71	ASPK	

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

$\Gamma(e^{\pm}e^{\pm}\mu^{\mp}\mu^{\mp})/\Gamma_{total}$ Γ_{31}/Γ

Test of lepton family number conservation.

VALUE (units 10^{-9})	*CL%*	*EVTS*	*DOCUMENT ID*		*TECN*
<6.1	90	0	[63] GU	96	E799

[63] Assuming uniform phase space distribution.

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

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