K_S^0

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

K_S^0 MEAN LIFE

For earlier measurements, beginning with BOLDT 58B, see our our 1986 edition, Physics Letters **170B** 130 (1986).

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

The FITS given below are from the 2002 edition and do NOT include the new data which are indicated by the change bars at the right.

VALUE (10^{-10} s)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
0.8935 ±0.0008 OUR FIT	Assuming *CPT*				
0.8937 ±0.0012 OUR FIT	Not assuming *CPT*				
0.8965 ±0.0007		[1] ALAVI-HARATI	03	KTEV	Δm free, $\phi_{+-} = \phi_{SW}$
0.8958 ±0.0013		[2] ALAVI-HARATI	03	KTEV	Δm, ϕ_{+-} free
0.89598±0.00048±0.00051	16M	LAI	02C	NA48	
0.8971 ±0.0021		BERTANZA	97	NA31	
0.8941 ±0.0014 ±0.0009		SCHWINGEN...	95	E773	Δm free, $\phi_{+-}=\phi_{SW}$
0.8929 ±0.0016		GIBBONS	93	E731	Δm free, $\phi_{+-}=\phi_{SW}$
0.8920 ±0.0044	214k	GROSSMAN	87	SPEC	
0.8924 ±0.0032 ±0.0002		[3] CARITHERS	75	SPEC	
0.8937 ±0.0048	6M	GEWENIGER	74B	ASPK	
0.8958 ±0.0045	50k	[4] SKJEGGEST...	72	HBC	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.905 ±0.007		[5] ARONSON	82B	SPEC	
0.881 ±0.009	26k	ARONSON	76	SPEC	
0.856 ±0.008	19994	[6] DONALD	68B	HBC	
0.872 ±0.009	20000	[6,7] HILL	68	DBC	

[1] ALAVI-HARATI 03 τ_S is correlated with their $\Delta m = m_{K_L^0} - m_{K_S^0}$ measurement in the K_L^0 listings. The correlation coefficient $\rho(\tau_S,\Delta m) = -0.396$.

[2] ALAVI-HARATI 03 fit Δm, ϕ_{+-}, and τ_{K_S} simultaneously. See ϕ_{+-} in the "K_L *CP* violation" section for correlation information. *CPT* is not assumed.

[3] CARITHERS 75 measures the Δm dependence of the total decay rate (inverse mean life) to be $\Gamma(K_S^0) = [(1.122 \pm 0.004) + 0.16(\Delta m - 0.5348)/\Delta m] 10^{10}$/s, or, in terms of mean life, CARITHERS 75 measures $\tau_S = (0.8913 \pm 0.0032) - 0.238\ [\Delta m - 0.5348]$ (10^{-10} s). We have adjusted the measurement to use our best values of ($\Delta m = 0.5303 \pm 0.0009$) ($10^{10}$ $\hbar$ s^{-1}). Our first error is their experiment's error and our second error is the systematic error from using our best values.

[4] HILL 68 has been changed by the authors from the published value (0.865 ± 0.009) because of a correction in the shift due to η_{+-}. SKJEGGESTAD 72 and HILL 68 give detailed discussions of systematics encountered in this type of experiment.

[5] ARONSON 82 find that K_S^0 mean life may depend on the kaon energy.

[6] Pre-1971 experiments are excluded from the average because of disagreement with later more precise experiments.

[7] HILL 68 has been changed by the authors from the published value (0.865 ± 0.009) because of a correction in the shift due to η_{+-}. SKJEGGESTAD 72 and HILL 68 give detailed discussions of systematics encountered in this type of experiment.

K^0_S DECAY MODES

	Mode		Fraction (Γ_i/Γ)		Scale factor/ Confidence level
	Hadronic modes				
Γ_1	$\pi^0\pi^0$		(31.05 ± 0.14) %		S=1.1
Γ_2	$\pi^+\pi^-$		(68.95 ± 0.14) %		S=1.1
Γ_3	$\pi^+\pi^-\pi^0$		$(3.2\ ^{+1.2}_{-1.0}) \times 10^{-7}$		
	Modes with photons or $\ell\overline{\ell}$ pairs				
Γ_4	$\pi^+\pi^-\gamma$	[a,b]	$(1.79\pm0.05) \times 10^{-3}$		
Γ_5	$\pi^+\pi^-e^+e^-$		$(4.5\ \pm0.8\ ) \times 10^{-5}$		
Γ_6	$\gamma\gamma$		$(2.77\pm0.07) \times 10^{-6}$		
	Semileptonic modes				
Γ_7	$\pi^\pm e^\mp \nu_e$	[c]	$(6.9\ \pm0.4\ ) \times 10^{-4}$		
Γ_8	$\pi^\pm \mu^\mp \nu_\mu$	[c]			
	***CP* violating (*CP*) and $\Delta S = 1$ weak neutral current (*S1*) modes**				
Γ_9	$3\pi^0$	*CP*	< 1.4	$\times 10^{-5}$	CL=90%
Γ_{10}	$\mu^+\mu^-$	*S1*	< 3.2	$\times 10^{-7}$	CL=90%
Γ_{11}	e^+e^-	*S1*	< 1.4	$\times 10^{-7}$	CL=90%
Γ_{12}	$\pi^0 e^+e^-$	*S1*	< 1.4	$\times 10^{-7}$	CL=90%

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

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

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

CONSTRAINED FIT INFORMATION

An overall fit to 3 branching ratios uses 14 measurements and one constraint to determine 2 parameters. The overall fit has a $\chi^2 =$ 18.8 for 13 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\left\langle\delta x_i \delta x_j\right\rangle/(\delta x_i \cdot \delta x_j)$, in percent, from the fit to 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_2	−100
	x_1

K^0_S DECAY RATES

$\Gamma(\pi^\pm e^\mp \nu_e)$ Γ_7

VALUE (10^6 s^{-1})	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
• • • We do not use the following data for averages, fits, limits, etc. • • •					
8.1 ±1.6	75	[8] AKHMETSHIN	99	CMD2	Tagged K^0_S using $\phi \to K^0_L K^0_S$
7.50±0.08		[9] PDG	98		
seen		BURGUN	72	HBC	$K^+ p \to K^0 p \pi^+$
9.3 ±2.5		AUBERT	65	HLBC	ΔS=ΔQ, *CP* cons. not assumed

[8] AKHMETSHIN 99 is from a measured branching ratio B($K^0_S \to \pi e \nu_e$)= $(7.2 \pm 1.4) \times 10^{-4}$ and $\tau_{K^0_S} = (0.8934 \pm 0.0008) \times 10^{-10}$ s. Not independent of measured branching ratio.

[9] PDG 98 from K^0_L measurements, assuming that ΔS=ΔQ in K^0 decay so that $\Gamma(K^0_S \to \pi^\pm e^\mp \nu_e)$= $\Gamma(K^0_L \to \pi^\pm e^\mp \nu_e)$.

$\Gamma(\pi^\pm \mu^\mp \nu_\mu)$ Γ_8

VALUE (10^6 s^{-1})	*DOCUMENT ID*	
• • • We do not use the following data for averages, fits, limits, etc. • • •		
5.25±0.07	[10] PDG	98

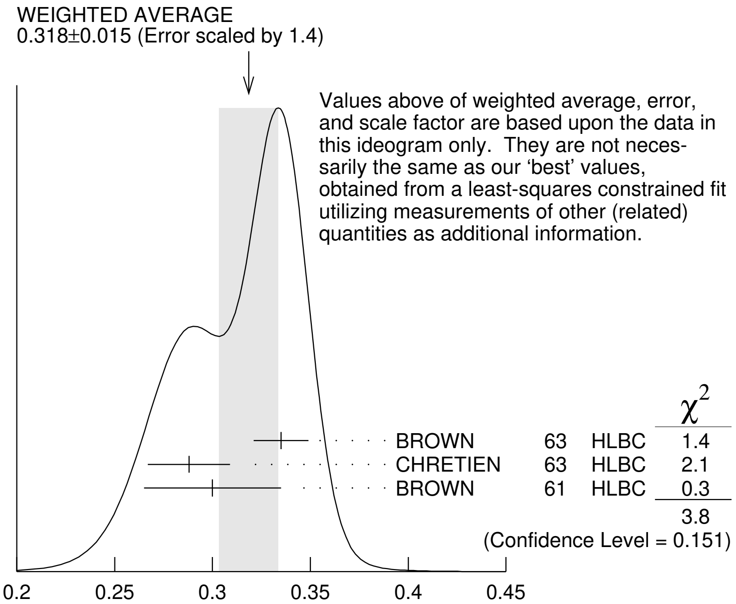
[10] PDG 98 from K^0_L measurements, assuming that ΔS=ΔQ in K^0 decay so that $\Gamma(K^0_S \to \pi^\pm \mu^\mp \nu_\mu)$= $\Gamma(K^0_L \to \pi^\pm \mu^\mp \nu_\mu)$.

K^0_S BRANCHING RATIOS

—— Hadronic modes ——

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

VALUE	*EVTS*	*DOCUMENT ID*		*TECN*
0.3105±0.0014 OUR FIT Error includes scale factor of 1.1.				
0.318 ±0.015 OUR AVERAGE Error includes scale factor of 1.4. See the ideogram below.				
0.335 ±0.014	1066	BROWN	63	HLBC
0.288 ±0.021	198	CHRETIEN	63	HLBC
0.30 ±0.035		BROWN	61	HLBC



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

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

VALUE	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
0.6895±0.0014 OUR FIT Error includes scale factor of 1.1.					
0.670 ±0.010	3447	DOYLE	69	HBC	$\pi^- p \rightarrow \Lambda K^0$

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

VALUE	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
2.221±0.014 OUR FIT Error includes scale factor of 1.1.					
2.225±0.014 OUR AVERAGE Error includes scale factor of 1.1.					
2.236±0.003±0.015	766k	ALOISIO	02B	KLOE	Incl. Rad. Decays ($\pi^+\pi^-\gamma$)
2.11 ±0.09	1315	EVERHART	76	WIRE	$\pi^- p \rightarrow \Lambda K^0$
2.169±0.094	16k	COWELL	74	OSPK	$\pi^- p \rightarrow \Lambda K^0$
2.16 ±0.08	4799	HILL	73	DBC	$K^+ d \rightarrow K^0 p p$

2.22 ±0.10	3068	[11] ALITTI	72	HBC	$K^+ p \to \pi^+ p K^0$
2.22 ±0.08	6380	MORSE	72B	DBC	$K^+ n \to K^0 p$
2.10 ±0.11	701	[12] NAGY	72	HLBC	$K^+ n \to K^0 p$
2.22 ±0.095	6150	[13] BALTAY	71	HBC	$K p \to K^0$ neutrals
2.282±0.043	7944	[14] MOFFETT	70	OSPK	$K^+ n \to K^0 p$
2.10 ±0.06	3700	MORFIN	69	HLBC	$K^+ n \to K^0 p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2.12 ±0.17	267	[12] BOZOKI	69	HLBC	
2.285±0.055	3016	[14] GOBBI	69	OSPK	$K^+ n \to K^0 p$

[11] The directly measured quantity is $K^0_S \to \pi^+\pi^-/\text{all } K^0 = 0.345 \pm 0.005$.

[12] NAGY 72 is a final result which includes BOZOKI 69.

[13] The directly measured quantity is $K^0_S \to \pi^+\pi^-/\text{all } \overline{K}^0 = 0.345 \pm 0.005$.

[14] MOFFETT 70 is a final result which includes GOBBI 69.

$\Gamma(\pi^+\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_3/Γ

VALUE (units 10^{-7})	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
$3.2^{+1.2}_{-1.0}$ OUR AVERAGE					
$2.5^{+1.3}_{-1.0}{}^{+0.5}_{-0.6}$	500k	[15] ADLER	97B	CPLR	
$4.8^{+2.2}_{-1.6}\pm 1.1$		[16] ZOU	96	E621	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$4.1^{+2.5}_{-1.9}{}^{+0.5}_{-0.6}$		[17] ADLER	96E	CPLR	Sup. by ADLER 97B
$3.9^{+5.4}_{-1.8}{}^{+0.9}_{-0.7}$		[18] THOMSON	94	E621	Sup. by ZOU 96

[15] ADLER 97B find the *CP*-conserving parameters $\text{Re}(\lambda) = (28 \pm 7 \pm 3) \times 10^{-3}$, $\text{Im}(\lambda) = (-10 \pm 8 \pm 2) \times 10^{-3}$. They estimate $B(K^0_S \to \pi^+\pi^-\pi^0)$ from $\text{Re}(\lambda)$ and the K^0_L decay parameters. See also ANGELOPOULOS 98C.

[16] ZOU 96 is from the the measured quantities $|\rho_{+-0}| = 0.039^{+0.009}_{-0.006} \pm 0.005$ and $\phi_\rho = (-9 \pm 18)^\circ$.

[17] ADLER 96E is from the measured quantities $\text{Re}(\lambda) = 0.036 \pm 0.010^{+0.002}_{-0.003}$ and $\text{Im}(\lambda)$ consistent with zero. Note that the quantity λ is the same as ρ_{+-0} used in other footnotes.

[18] THOMSON 94 calculates this branching ratio from their measurements $|\rho_{+-0}| = 0.035^{+0.019}_{-0.011} \pm 0.004$ and $\phi_\rho = (-59 \pm 48)^\circ$ where $|\rho_{+-0}| e^{i\phi_\rho} = A(K^0_S \to \pi^+\pi^-\pi^0, I=2)/A(K^0_L \to \pi^+\pi^-\pi^0)$.

—— Modes with photons or $\ell\overline{\ell}$ pairs ——

$\Gamma(\pi^+\pi^-\gamma)/\Gamma(\pi^+\pi^-)$ Γ_4/Γ_2

VALUE (units 10^{-3})	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
2.60±0.08 OUR AVERAGE					
2.56±0.09	1286	RAMBERG	93	E731	p_γ >50 MeV/c
2.68±0.15		[19] TAUREG	76	SPEC	p_γ >50 MeV/c
2.8 ±0.6		[20] BURGUN	73	HBC	p_γ >50 MeV/c
• • • We do not use the following data for averages, fits, limits, etc. • • •					
7.10±0.22	3723	RAMBERG	93	E731	p_γ >20 MeV/c
3.0 ±0.6	29	[21] BOBISUT	74	HLBC	p_γ >40 MeV/c

[19] TAUREG 76 find direct emission contribution <0.06, CL = 90%.
[20] BURGUN 73 estimates that direct emission contribution is 0.3 ± 0.6.
[21] BOBISUT 74 not included in average because p_γ cut differs. Estimates direct emission contribution to be 0.5 or less, CL = 95%.

$\Gamma(\pi^+\pi^- e^+ e^-)/\Gamma_{total}$ — Γ_5/Γ

VALUE (units 10^{-5})	EVTS	DOCUMENT ID		TECN
4.5±0.7±0.4	56	LAI	00B	NA48

$\Gamma(\gamma\gamma)/\Gamma_{total}$ — Γ_6/Γ

VALUE (units 10^{-6})	CL%	EVTS	DOCUMENT ID		TECN
2.77±0.07 OUR AVERAGE					
2.78±0.06±0.04		7.5k	[22] LAI	03	NA48
2.58±0.36±0.22		149	LAI	00	NA48
2.4 ±0.9		35	[23] BARR	95B	NA31
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2.2 ±1.1		16	[24] BARR	95B	NA31
< 13	90		BALATS	89	SPEC
2.4 ±1.2		19	BURKHARDT	87	NA31
<133	90		BARMIN	86B	XEBC

[22] LAI 03 uses PDG 00 value of B($K^0_S \rightarrow \pi^0\pi^0$).
[23] BARR 95B quotes this as the combined BARR 95B + BURKHARDT 87 result after rescaling BURKHARDT 87 to use same branching ratios and lifetimes as BARR 95B.
[24] BARR 95B result is calculated using B($K_L \rightarrow \gamma\gamma$) = $(5.86 \pm 0.17) \times 10^{-4}$.

Semileptonic modes

$\Gamma(\pi^\pm e^\mp \nu_e)/\Gamma_{total}$ — Γ_7/Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID		TECN	COMMENT
6.9 ±0.4 OUR AVERAGE					
6.91±0.34±0.15	624	[25] ALOISIO	02	KLOE	Tagged K^0_S using $\phi \rightarrow K^0_L K^0_S$
7.2 ±1.4	75	AKHMETSHIN	99	CMD2	Tagged K^0_S using $\phi \rightarrow K^0_L K^0_S$

[25] Uses the PDG 00 value for B($K^0_S \rightarrow \pi^+\pi^-$).

CP violating (*CP*) and $\Delta S = 1$ weak neutral current (*S1*) modes

$\Gamma(3\pi^0)/\Gamma_{total}$ — Γ_9/Γ

Violates *CP* conservation.

VALUE (units 10^{-5})	CL%	EVTS	DOCUMENT ID		TECN
<1.4	90	7M	ACHASOV	99D	SND
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<1.9	90	17300	[26] ANGELOPO...	98B	CPLR
<3.7	90		BARMIN	83	HLBC

[26] ANGELOPOULOS 98B is from Im(η_{000}) = −0.05 ± 0.12 ± 0.05, assuming Re(η_{000}) = Re(ϵ) = 1.635×10^{-3} and using the value B($K^0_L \rightarrow \pi^0\pi^0\pi^0$) = 0.2112 ± 0.0027.

$\Gamma(\mu^+\mu^-)/\Gamma_{\text{total}}$ Γ_{10}/Γ

Test for $\Delta S = 1$ weak neutral current. Allowed by first-order weak interaction combined with electromagnetic interaction.

VALUE (units 10^{-5})	*CL%*	*DOCUMENT ID*		*TECN*
<0.032	90	GJESDAL	73	ASPK
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.7	90	HYAMS	69B	OSPK

$\Gamma(e^+e^-)/\Gamma_{\text{total}}$ Γ_{11}/Γ

Test for $\Delta S = 1$ weak neutral current. Allowed by first-order weak interaction combined with electromagnetic interaction.

VALUE (units 10^{-7})	*CL%*	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
< 1.4	90		ANGELOPO...	97	CPLR	
• • • We do not use the following data for averages, fits, limits, etc. • • •						
< 28	90	0	BLICK	94	CNTR	Hyperon facility
<100	90		BARMIN	86	XEBC	

$\Gamma(\pi^0 e^+e^-)/\Gamma_{\text{total}}$ Γ_{12}/Γ

Test for $\Delta S = 1$ weak neutral current. Allowed by first-order weak interaction combined with electromagnetic interaction.

VALUE (units 10^{-6})	*CL%*	*EVTS*	*DOCUMENT ID*		*TECN*
< 0.14	90		LAI	01	NA48
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 1.1	90	0	BARR	93B	NA31
<45	90		GIBBONS	88	E731

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CP-VIOLATION PARAMETERS IN K^0_S DECAY

$\mathrm{Im}(\eta_{+-0})^2 = \Gamma(K^0_S \to \pi^+\pi^-\pi^0$, *CP*-violating$)$ / $\Gamma(K^0_L \to \pi^+\pi^-\pi^0)$

CPT assumed valid (i.e. $\mathrm{Re}(\eta_{+-0}) \simeq 0$).

VALUE	*CL%*	*EVTS*	*DOCUMENT ID*		*TECN*
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.23	90	601	[27] BARMIN	85	HLBC
<0.12	90	384	METCALF	72	ASPK

[27] BARMIN 85 find $\mathrm{Re}(\eta_{+-0}) = (0.05 \pm 0.17)$ and $\mathrm{Im}(\eta_{+-0}) = (0.15 \pm 0.33)$. Includes events of BALDO-CEOLIN 75.

$\mathrm{Im}(\eta_{+-0}) = \mathrm{Im}(\mathrm{A}(K^0_S \to \pi^+\pi^-\pi^0$, *CP*-violating$)$ / $\mathrm{A}(K^0_L \to \pi^+\pi^-\pi^0))$

VALUE	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
$\mathbf{-0.002 \pm 0.009 ^{+0.002}_{-0.001}}$	500k	[28] ADLER	97B	CPLR	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$-0.002 \pm 0.018 \pm 0.003$	137k	[29] ADLER	96D	CPLR	Sup. by ADLER 97B
$-0.015 \pm 0.017 \pm 0.025$	272k	[30] ZOU	94	SPEC	

[28] ADLER 97B also find $\mathrm{Re}(\eta_{+-0}) = -0.002 \pm 0.007^{+0.004}_{-0.001}$. See also ANGELOPOULOS 98C.

[29] The ADLER 96D fit also yields $\mathrm{Re}(\eta_{+-0}) = 0.006 \pm 0.013 \pm 0.001$ with a correlation $+0.66$ between real and imaginary parts. Their results correspond to $|\eta_{+-0}| < 0.037$ with 90% CL.

[30] ZOU 94 use theoretical constraint $\mathrm{Re}(\eta_{+-0}) = \mathrm{Re}(\epsilon) = 0.0016$. Without this constraint they find $\mathrm{Im}(\eta_{+-0}) = 0.019 \pm 0.061$ and $\mathrm{Re}(\eta_{+-0}) = 0.019 \pm 0.027$.

$\mathrm{Im}(\eta_{000})^2 = \Gamma(K^0_S \to 3\pi^0) \,/\, \Gamma(K^0_L \to 3\pi^0)$

CPT assumed valid (i.e. $\mathrm{Re}(\eta_{000}) \simeq 0$). This limit determines branching ratio $\Gamma(3\pi^0)/\Gamma_{\text{total}}$ above.

VALUE	*CL%*	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<0.1	90	632	[31] BARMIN	83	HLBC	
<0.28	90		[32] GJESDAL	74B	SPEC	Indirect meas.

[31] BARMIN 83 find $\mathrm{Re}(\eta_{000}) = (-0.08 \pm 0.18)$ and $\mathrm{Im}(\eta_{000}) = (-0.05 \pm 0.27)$. Assuming *CPT* invariance they obtain the limit quoted above.

[32] GJESDAL 74B uses $K2\pi$, $K_{\mu 3}$, and K_{e3} decay results, unitarity, and *CPT*. Calculates $|(\eta_{000})| = 0.26 \pm 0.20$. We convert to upper limit.

$\mathrm{Im}(\eta_{000}) = \mathrm{Im}(A(K^0_S \to \pi^0\pi^0\pi^0)/A(K^0_L \to \pi^0\pi^0\pi^0))$

$K^0_S \to \pi^0\pi^0\pi^0$ violates *CP* conservation, in contrast to $K^0_S \to \pi^+\pi^-\pi^0$ which has a *CP*-conserving part.

VALUE	*EVTS*	*DOCUMENT ID*		*TECN*
−0.05±0.12±0.05	17300	[33] ANGELOPO...	98B	CPLR

[33] ANGELOPOULOS 98B assumes $\mathrm{Re}(\eta_{000}) = \mathrm{Re}(\epsilon) = 1.635 \times 10^{-3}$. Without assuming *CPT* invariance, they obtain $\mathrm{Re}(\eta_{000}) = 0.18 \pm 0.14 \pm 0.06$ and $\mathrm{Im}(\eta_{000}) = 0.15 \pm 0.20 \pm 0.03$.

K^0_S REFERENCES

ALAVI-HARATI	03	PR D67 012005	A. Alavi-Harati *et al.*	(FNAL KTeV Collab.)
LAI	03	PL B551 7	A. Lai *et al.*	(CERN NA48 Collab.)
ALOISIO	02	PL B535 37	A. Aloisio *et al.*	(KLOE Collab.)
ALOISIO	02B	PL B538 21	A. Aloisio *et al.*	(KLOE Collab.)
LAI	02C	PL B537 28	A. Lai *et al.*	(CERN NA48 Collab.)
LAI	01	PL B514 253	A. Lai *et al.*	(CERN NA48 Collab.)
LAI	00	PL B493 29	A. Lai *et al.*	(CERN NA48 Collab.)
LAI	00B	PL B496 137	A. Lai *et al.*	(CERN NA48 Collab.)
PDG	00	EPJ C15 1	D.E. Groom *et al.*	
ACHASOV	99D	PL B459 674	M.N. Achasov *et al.*	
AKHMETSHIN	99	PL B456 90	R.R. Akhmetshin *et al.*	(Novosibirsk CMD-2 Collab.)
ANGELOPO...	98B	PL B425 391	A. Angelopoulos *et al.*	(CPLEAR Collab.)
ANGELOPO...	98C	EPJ C5 389	A. Angelopoulos *et al.*	(CPLEAR Collab.)
PDG	98	EPJ C3 1	C. Caso *et al.*	
ADLER	97B	PL B407 193	R. Adler *et al.*	(CPLEAR Collab.)
ANGELOPO...	97	PL B413 232	A. Angelopoulos *et al.*	(CPLEAR Collab.)
BERTANZA	97	ZPHY C73 629	L. Bertanza	(PISA, CERN, EDIN, MANZ, ORSAY+)
ADLER	96D	PL B370 167	R. Adler *et al.*	(CPLEAR Collab.)
ADLER	96E	PL B374 313	R. Adler *et al.*	(CPLEAR Collab.)
ZOU	96	PL B369 362	Y. Zou *et al.*	(RUTG, MINN, MICH)
BARR	95B	PL B351 579	G.D. Barr *et al.*	(CERN, EDIN, MANZ, LALO+)
SCHWINGEN...	95	PRL 74 4376	B. Schwingenheuer *et al.*	(EFI, CHIC+)
BLICK	94	PL B334 234	A.M. Blick *et al.*	(SERP, JINR)
THOMSON	94	PL B337 411	G.B. Thomson *et al.*	(RUTG, MINN, MICH)
ZOU	94	PL B329 519	Y. Zou *et al.*	(RUTG, MINN, MICH)
BARR	93B	PL B304 381	G.D. Barr *et al.*	(CERN, EDIN, MANZ, LALO+)

GIBBONS	93	PRL 70 1199	L.K. Gibbons *et al.*	(FNAL E731 Collab.)
Also	97	PR D55 6625	L.K. Gibbons *et al.*	(FNAL E731 Collab.)
RAMBERG	93	PRL 70 2525	E. Ramberg *et al.*	(FNAL E731 Collab.)
BALATS	89	SJNP 49 828 Translated from YAF 49 1332.	M.Y. Balats *et al.*	(ITEP)
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