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

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		[89] 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	[90] COUPAL	85	SPEC	$P(K)$=70 GeV/c
2.09 ±0.02		[91] ARONSON	82B	SPEC	E=30–110 GeV

[89] 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."
[90] 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.
[91] ARONSON 82B find that $|\eta_{+-}|$ may depend on the kaon energy.

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

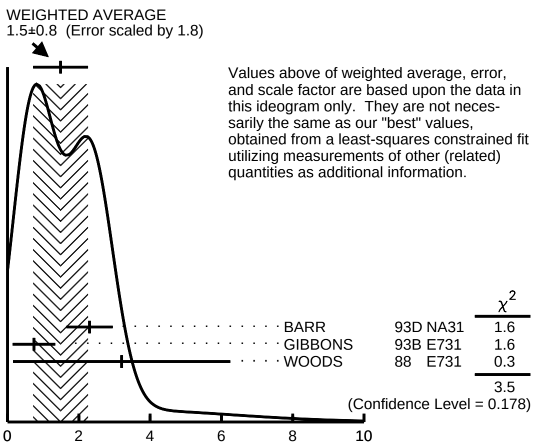
VALUE	EVTS	DOCUMENT ID		TECN
0.9955±0.0023 OUR FIT Error includes scale factor of 1.8.				
0.9930±0.0020 OUR AVERAGE				
0.9931±0.0020		[92,93] BARR	93D	NA31
0.9904±0.0084±0.0036		[94] WOODS	88	E731
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.9939±0.0013±0.0015	1M	[92] BARR	93D	NA31
0.9899±0.0020±0.0025		[92] 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		[95] CHRISTENS...	79	ASPK
1.03 ±0.07	124	BANNER	72	OSPK
1.00 ±0.06	167	HOLDER	72	ASPK

[92] This is the square root of the ratio R given by BURKHARDT 88 and BARR 93D.
[93] This is the combined results from BARR 93D and BURKHARDT 88, taking into account a common systematic uncertainty of 0.0014.
[94] We calculate $|\eta_{00}/\eta_{+-}| = 1-3(\epsilon'/\epsilon)$ from WOODS 88 (ϵ'/ϵ) value.
[95] 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		[96] BARR	93D	NA31	
0.74±0.52±0.29	>5E5	GIBBONS	93B	E731	
3.2 ±2.8 ±1.2		[97] WOODS	88	E731	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2.0 ±0.7	1M	[97] BARR	93D	NA31	
−0.4 ±1.4 ±0.6		PATTERSON	90	E731	in GIBBONS 93B
3.3 ±1.1		[97] BURKHARDT	88	NA31	

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



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

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

[98] GIBBONS 93 measures ϕ_{+-}–ϕ_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 ± 1.4)° for their $\Delta(m)$ and τ_S.
[99] ADLER 92B quote separately two systematic errors: ±0.4 from their experiment and ±1.0 degrees due to the uncertainty in the value of $\Delta(m)$.
[100] CAROSI 90 $\phi_{+-} = 46.9 \pm 1.4 \pm 0.7 + 579\,[\Delta(m) - 0.5351] + 303\,[\tau_S - 0.8922]$°.
[101] CARITHERS 75 $\phi_{+-} = (45.5 \pm 2.8) + 224[\Delta(m) - 0.5348]$°. $\phi_f = -40.9 \pm 2.6$°.
[102] GEWENIGER 74B $\phi_{+-} = (49.4 \pm 1.0) + 565[\Delta(m) - 0.540]$°.
[103] KARLSSON 90 systematic error does not include regeneration phase uncertainty.
[104] ARONSON 82 find that ϕ_{+-} may depend on the kaon energy.
[105] CARNEGIE 72 ϕ_{+-} is insensitive to $\Delta(m)$. $\phi_f = -56.2 \pm 5.2$°.
[106] BALATS 71 $\phi_{+-} = (39.0 \pm 12.0) + 198[\Delta(m) - 0.544]$°. $\phi_f = -43.0 \pm 4.0$°.
[107] JENSEN 70 $\phi_{+-} = (42.4 \pm 4.0) + 576[\Delta(m) - 0.538]$°.
[108] BENNETT 69 uses measurement of $(\phi_{+-})-(\phi_f)$ of ALFF-STEINBERGER 66B. BENNETT 69 $\phi_{+-} = (34.9 \pm 10.0) + 69[\Delta(m) - 0.545]$°. $\phi_f = -49.9 \pm 5.4$°.
[109] BOHM 69B $\phi_{+-} = (41.0 \pm 12.0) + 479(\Delta(m) - 0.526)$°.
[110] FAISSNER 69 error enlarged to include error in regenerator phase. FAISSNER 69 $\phi_{+-} = (49.3 \pm 7.4) + 205[\Delta(m) - 0.555]$°. $\phi_f = -42.7 \pm 5.0$°.
[111] BENNETT 69 is a re-evaluation of BENNETT 68B.
[112] 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		[113] CAROSI	90	NA31	
• • • We do not use the following data for averages, fits, limits, etc. • • •					
47.4± 1.4±0.9		[114] KARLSSON	90	E731	
55.7± 5.8		CHRISTENS...	79	ASPK	
38.0±25.0	56	[115] WOLFF	71	OSPK	Cu reg., 4γ's
51.0±30.0		[116] CHOLLET	70	OSPK	Cu reg., 4γ's
first quadrant preferred		GOBBI	69B	OSPK	

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

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	[117] GIBBONS	93	E731
0.2± 2.6±1.2	[118] 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	[118] CHRISTENS...	79	ASPK
7.6±18.0	[119] BARBIELLINI	73	ASPK

[117] 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 $m_{K^0_L} - m_{K^0_S}$).
[118] Not independent of ϕ_{+-} and ϕ_{00} values. This is taken into account in our fitting procedure.
[119] Independent of regenerator mechanism, $\Delta(m)$, and lifetimes.