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

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

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

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

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

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

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

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

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

$|\epsilon'_{+-\gamma}|/\epsilon$

VALUE	CL%	EVTS	DOCUMENT ID		TECN
<0.3	90	3671	[120] RAMBERG	93B	E731

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

NOTE ON $\Delta S = \Delta Q$ IN K^0 DECAYS

The relative amount of $\Delta S \neq \Delta Q$ component present is measured by the parameter x, defined as

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

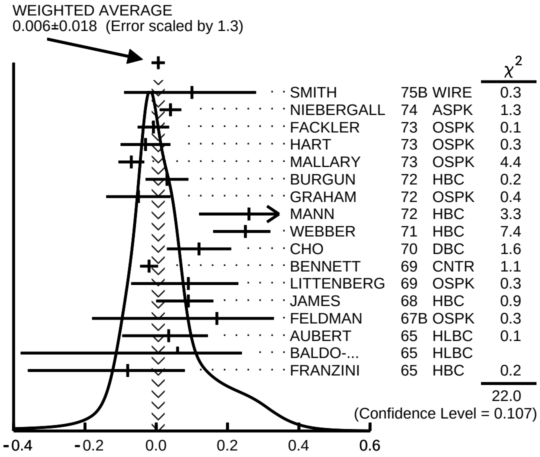
We list Re$\{x\}$ and Im$\{x\}$ for K_{e3} and $K_{\mu3}$ combined.

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

REAL PART OF x

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.006±0.018 OUR AVERAGE		Error includes scale factor of 1.3. See the ideogram below.			
$0.10\ ^{+0.18}_{-0.19}$	79	SMITH	75B	WIRE	$\pi^- p \to K^0\Lambda$
0.04 ±0.03	4724	NIEBERGALL	74	ASPK	$K^+ p \to K^0 p \pi^+$
−0.008±0.044	1757	FACKLER	73	OSPK	K_{e3} from K^0
−0.03 ±0.07	1367	HART	73	OSPK	K_{e3} from $K^0\Lambda$
−0.070±0.036	1079	MALLARY	73	OSPK	K_{e3} from $K^0\Lambda X$
0.03 ±0.06	410	[121] BURGUN	72	HBC	$K^+ p \to K^0 p \pi^+$
−0.05 ±0.09	442	[122] GRAHAM	72	OSPK	$\pi^- p \to K^0\Lambda$
$0.26\ ^{+0.10}_{-0.14}$	126	MANN	72	HBC	$K^- p \to n\overline{K}^0$
$0.25\ ^{+0.07}_{-0.09}$	252	WEBBER	71	HBC	$K^- p \to n\overline{K}^0$
0.12 ±0.09	215	[123] CHO	70	DBC	$K^+ d \to K^0 p p$
−0.020±0.025		[124] BENNETT	69	CNTR	Charge asym+ Cu regen.
$0.09\ ^{+0.14}_{-0.16}$	686	LITTENBERG	69	OSPK	$K^+ n \to K^0 p$
$0.09\ ^{+0.07}_{-0.09}$	121	JAMES	68	HBC	$\overline{p}p$
$0.17\ ^{+0.16}_{-0.35}$	116	FELDMAN	67B	OSPK	$\pi^- p \to K^0\Lambda$
$0.035\ ^{+0.11}_{-0.13}$	196	AUBERT	65	HLBC	K^+ charge exchange
$0.06\ ^{+0.18}_{-0.44}$	152	[125] BALDO-...	65	HLBC	K^+ charge exchange
$-0.08\ ^{+0.16}_{-0.28}$	109	[126] FRANZINI	65	HBC	$\overline{p}p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$0.04\ ^{+0.10}_{-0.13}$	100	[122] GRAHAM	72	OSPK	$K_{\mu3}$ from $K^0\Lambda$
−0.13 ±0.11	342	[122] MANTSCH	72	OSPK	K_{e3} from $K^0\Lambda$
$0.04\ ^{+0.07}_{-0.08}$	222	[121] BURGUN	71	HBC	$K^+ p \to K^0 p \pi^+$
0.03 ±0.03		[124] BENNETT	68	CNTR	
0.17 ±0.10	335	[123] HILL	67	DBC	$K^+ d \to K^0 p p$

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



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

IMAGINARY PART OF x

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
−0.003±0.026 OUR AVERAGE	Error includes scale factor of 1.2.				
$-0.10\ ^{+0.16}_{-0.19}$	79	SMITH	75B	WIRE	$\pi^- p \to K^0\Lambda$
−0.06 ±0.05	4724	NIEBERGALL	74	ASPK	$K^+ p \to K^0 p \pi^+$
−0.017±0.060	1757	FACKLER	73	OSPK	K_{e3} from K^0
0.09 ±0.07	1367	HART	73	OSPK	K_{e3} from $K^0\Lambda$
$0.107\ ^{+0.092}_{-0.074}$	1079	MALLARY	73	OSPK	K_{e3} from $K^0\Lambda X$
$0.07\ ^{+0.06}_{-0.07}$	410	[127] BURGUN	72	HBC	$K^+ p \to K^0 p \pi^+$
0.05 ±0.13	442	[128] GRAHAM	72	OSPK	$\pi^- p \to K^0\Lambda$
$0.21\ ^{+0.15}_{-0.12}$	126	MANN	72	HBC	$K^- p \to n\overline{K}^0$
0.0 ±0.08	252	WEBBER	71	HBC	$K^- p \to n\overline{K}^0$
−0.08 ±0.07	215	[129] CHO	70	DBC	$K^+ d \to K^0 p p$
$-0.11\ ^{+0.10}_{-0.11}$	686	LITTENBERG	69	OSPK	$K^+ n \to K^0 p$
$+0.22\ ^{+0.37}_{-0.29}$	121	JAMES	68	HBC	$\overline{p}p$
0.0 ±0.25	116	FELDMAN	67B	OSPK	$\pi^- p \to K^0\Lambda$
$-0.21\ ^{+0.11}_{-0.15}$	196	AUBERT	65	HLBC	K^+ charge exchange
$-0.44\ ^{+0.32}_{-0.19}$	152	[130] BALDO-...	65	HLBC	K^+ charge exchange
$+0.24\ ^{+0.40}_{-0.30}$	109	[131] FRANZINI	65	HBC	$\overline{p}p$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$0.12\ ^{+0.17}_{-0.16}$	100	[128] GRAHAM	72	OSPK	$K_{\mu3}$ from $K^0\Lambda$
−0.04 ±0.16	342	[128] MANTSCH	72	OSPK	K_{e3} from $K^0\Lambda$
$0.12\ ^{+0.08}_{-0.09}$	222	[127] BURGUN	71	HBC	$K^+ p \to K^0 p \pi^+$
−0.20 ±0.10	335	[129] HILL	67	DBC	$K^+ d \to K^0 p p$

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

K^0_L REFERENCES

BARR 94 PL B (to be pub.) +Buchholz+ (CERN, EDIN, MANZ, LALO, PISA, SIEG)
Search for the decay $K_L \to \pi^0\pi^0\gamma$
BRFIT 94 RPP
ETAFIT 94 RPP
GU 94 PRL 72 3000 + (RUTG, UCLA, EFI, COLO, ELMT, FNAL, ILL, OSAK)
AKAGI 93 PR D47 R2644 +Fukuhisa, Hemmi+ (TOHOK, TOKY, KYOT, KEK)
ARISAKA 93 PRL 70 1049 +Auerbach, Axelrod, Belz, Biery+ (BNL E791 Collab.)
ARISAKA 93B PRL 71 3910 +Auerbach, Axelrod, Belz, Biery+ (BNL E791 Collab.)
BARR 93D PL B317 233 +Buchholz+ (CERN, EDIN, MANZ, LALO, PISA, SIEG)
GIBBONS 93 PRL 70 1199 +Barker, Briere, Makoff+ (FNAL E731 Collab.)
GIBBONS 93B PRL 70 1203 +Barker, Briere, Makoff+ (FNAL E731 Collab.)
GIBBONS 93C Thesis (CHIC)
HARRIS 93 PRL 71 3914 +Briere, Cheu, Makoff, McFarland+ (FNAL E799 Collab.)
HARRIS 93B PRL 71 3918 +Briere, Cheu, Makoff, McFarlane+ (FNAL E799 Collab.)
MAKOFF 93 PRL 70 1591 +Barker, Briere, Gibbons+ (FNAL E731 Collab.)
NAKADA 93 Lepton Photon Conf. (PSI)
AIP Conf. Proc. 302, p. 425
RAMBERG 93 PRL 70 2525 +Bock, Coleman, Enagonio, Hsiung+ (FNAL E731 Collab.)
RAMBERG 93B PRL 70 2529 +Bock, Coleman, Enagonio, Hsiung+ (FNAL E731 Collab.)
VAGINS 93 PRL 71 35 +Adair, Greenlee, Kasha, Mannelli+ (BNL E845 Collab.)
ADLER 92B PL B286 180 +Alhalel, Angelopoulos, Apostolakis+ (CPLEAR Collab.)
Also 92 SJNP 55 840 Adler, Alhalel, Angelopoulos+ (CPLEAR Collab.)
BARR 92 PL B284 440 +Buchholz+ (CERN, EDIN, MANZ, LALO, PISA, SIEG)
GRAHAM 92 PL B295 169 +Barker, Briere, Gibbons, Makoff+ (FNAL E731 Collab.)
MORSE 92 PR D45 36 +Leipuner, Larsen, Jastrzembski+ (BNL, YALE, VASS)
PDG 92 PR D45, 1 June, Part II Hikasa, Barnett, Stone+ (KEK, LBL, BOST+)
SOMALWAR 92 PRL 68 2580 +Barker, Briere, Gibbons+ (FNAL E731 Collab.)