$D_s^{\pm}$

$I(J^P) = 0(0^-)$

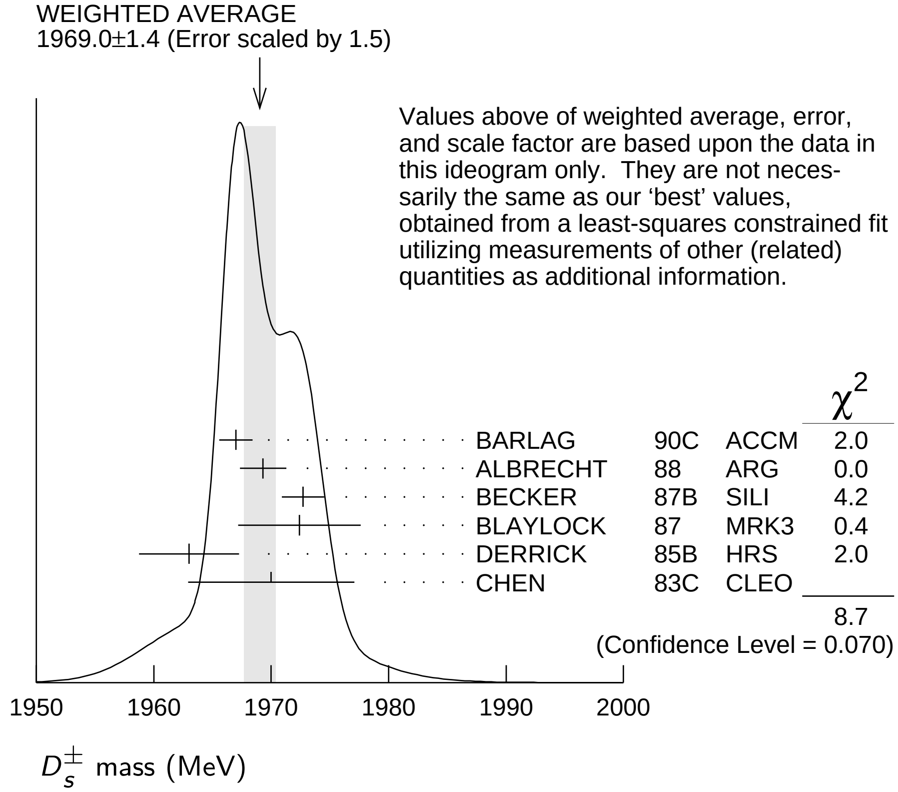
The angular distributions of the decays of the ϕ and $\overline{K}^*(892)^0$ in the $\phi\pi^+$ and $K^+\overline{K}^*(892)^0$ modes strongly indicate that the spin is zero. The parity given is that expected of a $c\overline{s}$ ground state.

$D_s^{\pm}$ MASS

The fit includes $D^{\pm}$, D^0, $D_s^{\pm}$, $D^{*\pm}$, D^{*0}, and $D_s^{*\pm}$ mass and mass difference measurements. Measurements of the $D_s^{\pm}$ mass with an error greater than 10 MeV are omitted from the fit and average. A number of early measurements have been omitted altogether.

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
1968.49± 0.34 OUR FIT Error includes scale factor of 1.3.					
1969.0 ± 1.4 OUR AVERAGE Error includes scale factor of 1.5. See the ideogram below.					
1967.0 ± 1.0 ± 1.0	54	BARLAG	90C	ACCM	π^- Cu 230 GeV
1969.3 ± 1.4 ± 1.4		ALBRECHT	88	ARG	e^+e^- 9.4–10.6 GeV
1972.7 ± 1.5 ± 1.0	21	BECKER	87B	SILI	200 GeV π,K,p
1972.4 ± 3.7 ± 3.7	27	BLAYLOCK	87	MRK3	e^+e^- 4.14 GeV
1963 ± 3 ± 3	30	DERRICK	85B	HRS	e^+e^- 29 GeV
1970 ± 5 ± 5	104	CHEN	83C	CLEO	e^+e^- 10.5 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1968.3 ± 0.7 ± 0.7	290	[1] ANJOS	88	E691	Photoproduction
1980 ±15	6	USHIDA	86	EMUL	ν wideband
1973.6 ± 2.6 ± 3.0	163	ALBRECHT	85D	ARG	e^+e^- 10 GeV
1948 ±28 ±10	65	AIHARA	84D	TPC	e^+e^- 29 GeV
1975 ± 9 ±10	49	ALTHOFF	84	TASS	e^+e^- 14–25 GeV
1975 ± 4	3	BAILEY	84	ACCM	hadron$^+$ Be $\rightarrow$ $\phi\pi^+$X

[1] ANJOS 88 enters the fit via $m_{D_s^{\pm}} - m_{D^{\pm}}$ (see below).



$m_{D_s^\pm} - m_{D^\pm}$

The fit includes $D^\pm$, D^0, $D_s^\pm$, $D^{*\pm}$, D^{*0}, and $D_s^{*\pm}$ mass and mass difference measurements.

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
98.87±0.30 OUR FIT	Error includes scale factor of 1.4.				
98.85±0.25 OUR AVERAGE	Error includes scale factor of 1.1.				
99.41±0.38±0.21		ACOSTA	03D	CDF2	$\overline{p}p$, $\sqrt{s}$= 1.96 TeV
98.4 ±0.1 ±0.3	48k	AUBERT	02G	BABR	$e^+e^- \approx \Upsilon(4S)$
99.5 ±0.6 ±0.3		BROWN	94	CLE2	$e^+e^- \approx \Upsilon(4S)$
98.5 ±1.5	555	CHEN	89	CLEO	e^+e^- 10.5 GeV
99.0 ±0.8	290	ANJOS	88	E691	Photoproduction

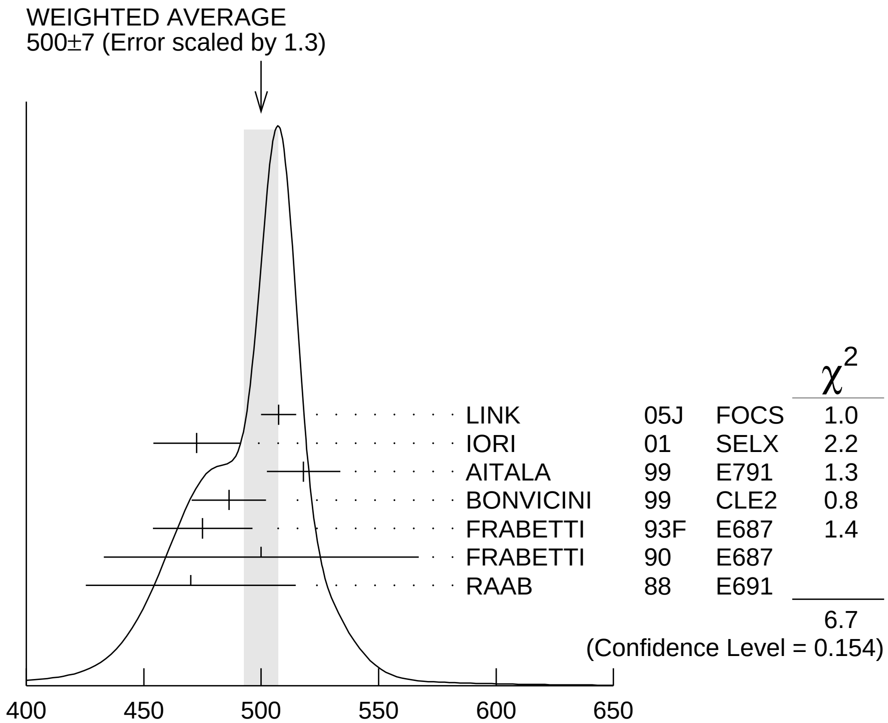
$D_s^\pm$ MEAN LIFE

Measurements with an error greater than 100×10^{-15} s or with fewer than 100 events have been omitted from the Listings.

VALUE (10^{-15} s)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
500 ± 7 OUR AVERAGE	Error includes scale factor of 1.3. See the ideogram below.				
507.4± 5.5± 5.1	13.6k	LINK	05J	FOCS	$\Phi\pi^+$ and $\overline{K}^{*0}K^+$
472.5±17.2± 6.6	760	IORI	01	SELX	600 GeV Σ^-, π^-, p
518 ±14 ± 7	1662	AITALA	99	E791	π^- nucleus, 500 GeV

$486.3 \pm 15.0 {}^{+\ 4.9}_{-\ 5.1}$	2167	[2] BONVICINI	99	CLE2	$e^+ e^- \approx \Upsilon(4S)$
$475 \pm 20 \pm 7$	900	FRABETTI	93F	E687	γ Be, $\phi \pi^+$
$500 \pm 60 \pm 30$	104	FRABETTI	90	E687	γ Be, $\phi \pi^+$
$470 \pm 40 \pm 20$	228	RAAB	88	E691	Photoproduction

[2] BONVICINI 99 obtains 1.19 ± 0.04 for the ratio of D_s^+ to D^0 lifetimes.



$D_s^{\pm}$ mean life (10^{-15} s)

D_s^+ DECAY MODES

Unless otherwise noted, the branching fractions for modes with a resonance in the final state include all the decay modes of the resonance. D_s^- modes are charge conjugates of the modes below.

	Mode	Fraction (Γ_i/Γ)	Confidence level
	Inclusive modes		
Γ_1	K^- anything	$(13\ {}^{+14}_{-12})$ %	
Γ_2	$\overline{K}^0$ anything + K^0 anything	(39 ± 28) %	
Γ_3	K^+ anything	$(20\ {}^{+18}_{-14})$ %	
Γ_4	(non-$K \overline{K}$) anything	(64 ± 17) %	

Γ_5	η anything	[a]	(24 ± 4) %	
Γ_6	η' anything		(8.7 ± 2.1) %	
Γ_7	ϕ anything		(16.1 ± 1.6) %	
Γ_8	e^+ anything		$(8\ {}^{+6}_{-5})$ %	

Leptonic and semileptonic modes

Γ_9	$e^+\nu_e$		$< 1.3 \times 10^{-4}$	90%
Γ_{10}	$\mu^+\nu_\mu$		$(6.3 \pm 0.5) \times 10^{-3}$	
Γ_{11}	$\tau^+\nu_\tau$		(6.6 ± 0.6) %	
Γ_{12}	$K^+K^-e^+\nu_e$			
Γ_{13}	$\phi e^+\nu_e$		(2.61 ± 0.17) %	
Γ_{14}	$\eta\ell^+\nu_\ell + \eta'(958)\ell^+\nu_\ell$	[b]	(4.4 ± 0.7) %	
Γ_{15}	$\eta\ell^+\nu_\ell$	[b]	(3.2 ± 0.5) %	
Γ_{16}	$\eta'(958)\ell^+\nu_\ell$	[b]	(1.12 ± 0.35) %	

Hadronic modes with a $K\overline{K}$ pair

Γ_{17}	$K^+K^0_S$		(1.49 ± 0.09) %	
Γ_{18}	$K^+K^-\pi^+$	[c]	(5.50 ± 0.28) %	
Γ_{19}	$\phi\pi^+$	[d,e]	(4.39 ± 0.34) %	
Γ_{20}	$\phi\pi^+$, $\phi \to K^+K^-$	[d]	(2.18 ± 0.33) %	
Γ_{21}	$K^+\overline{K}^*(892)^0$			
Γ_{22}	$K^+\overline{K}^*(892)^0$, $\overline{K}^{*0} \to K^-\pi^+$		(2.6 ± 0.4) %	
Γ_{23}	$f_0(980)\pi^+$, $f_0 \to K^+K^-$		$(6.0 \pm 2.4) \times 10^{-3}$	
Γ_{24}	$K^+\overline{K}^*_0(1430)^0$, $\overline{K}^*_0 \to K^-\pi^+$		$(5.1 \pm 2.5) \times 10^{-3}$	
Γ_{25}	$f_0(1710)\pi^+$, $f_0 \to K^+K^-$			
Γ_{26}	$K^+K^-\pi^+$ nonresonant			
Γ_{27}	$K^0\overline{K}^0\pi^+$		—	
Γ_{28}	$K^*(892)^+\overline{K}^0$	[e]	(5.3 ± 1.2) %	
Γ_{29}	$K^+K^-\pi^+\pi^0$		(5.6 ± 0.5) %	
Γ_{30}	$\phi\pi^+\pi^0$, $\phi \to K^+K^-$			
Γ_{31}	$\phi\rho^+$, $\phi \to K^+K^-$		$(4.0\ {}^{+1.1}_{-1.2})$ %	
Γ_{32}	$\phi\pi^+\pi^0$ 3-body, $\phi \to K^+K^-$		< 1.5 %	90%
Γ_{33}	$K^+K^-\pi^+\pi^0$ non-ϕ		< 11 %	90%
Γ_{34}	$K^0_SK^-\pi^+\pi^+$		(1.64 ± 0.12) %	
Γ_{35}	$K^*(892)^+\overline{K}^*(892)^0$	[e]	(7.0 ± 2.5) %	
Γ_{36}	$K^0K^-2\pi^+$ (non-$K^{*+}\overline{K}^{*0}$)		< 3.5 %	90%
Γ_{37}	$K^+K^0_S\pi^+\pi^-$		$(9.6 \pm 1.3) \times 10^{-3}$	
Γ_{38}	$K^+K^-\pi^+\pi^+\pi^-$		$(8.8 \pm 1.6) \times 10^{-3}$	
Γ_{39}	$\phi\pi^+\pi^+\pi^-$, $\phi \to K^+K^-$		$(5.9 \pm 1.1) \times 10^{-3}$	
Γ_{40}	$K^+K^-\rho^0\pi^+$ non-ϕ		$< 2.6 \times 10^{-4}$	90%

Γ_{41}	$\phi\rho^0\pi^+$, $\phi\to K^+K^-$		$(6.6\pm1.3)\times10^{-3}$	
Γ_{42}	$\phi a_1(1260)^+$, $\phi\to K^+K^-$, $a_1^+\to\rho^0\pi^+$		$(7.5\pm1.3)\times10^{-3}$	
Γ_{43}	$K^+K^-\pi^+\pi^+\pi^-$ nonresonant		$(9\pm7)\times10^{-4}$	
Γ_{44}	$K_S^0K_S^0\pi^+\pi^+\pi^-$		$(8.4\pm3.5)\times10^{-4}$	
	Hadronic modes without K's			
Γ_{45}	$\pi^+\pi^0$		$<6\times10^{-4}$	90%
Γ_{46}	$\pi^+\pi^+\pi^-$		(1.11 ± 0.08) %	
Γ_{47}	$\rho^0\pi^+$		not seen	
Γ_{48}	$\pi^+(\pi^+\pi^-)_{S-\text{wave}}$	[f]	$(9.7\pm1.1)\times10^{-3}$	
Γ_{49}	$f_0(980)\pi^+$, $f_0\to\pi^+\pi^-$			
Γ_{50}	$f_0(1370)\pi^+$, $f_0\to\pi^+\pi^-$			
Γ_{51}	$f_0(1500)\pi^+$, $f_0\to\pi^+\pi^-$			
Γ_{52}	$f_2(1270)\pi^+$, $f_2\to\pi^+\pi^-$		$(1.1\pm0.6)\times10^{-3}$	
Γ_{53}	$\rho(1450)^0\pi^+$, $\rho^0\to\pi^+\pi^-$		$(7\pm6)\times10^{-4}$	
Γ_{54}	$\pi^+\pi^+\pi^-$ nonresonant			
Γ_{55}	$\pi^+\pi^+\pi^-\pi^0$		<15 %	90%
Γ_{56}	$\eta\pi^+$	[e]	(1.58 ± 0.21) %	
Γ_{57}	$\omega\pi^+$	[e]	$(2.5\pm0.9)\times10^{-3}$	
Γ_{58}	$3\pi^+2\pi^-$		$(8.0\pm0.9)\times10^{-3}$	
Γ_{59}	$\pi^+\pi^+\pi^-\pi^0\pi^0$		—	
Γ_{60}	$\eta\rho^+$	[e]	(13.1 ± 2.2) %	
Γ_{61}	$\eta\pi^+\pi^0$ 3-body	[e]	<5 %	90%
Γ_{62}	$3\pi^+2\pi^-\pi^0$		(4.9 ± 3.2) %	
Γ_{63}	$\eta'(958)\pi^+$	[e]	(3.8 ± 0.4) %	
Γ_{64}	$3\pi^+2\pi^-2\pi^0$		—	
Γ_{65}	$\eta'(958)\rho^+$	[e]	(12.2 ± 2.0) %	
Γ_{66}	$\eta'(958)\pi^+\pi^0$ 3-body	[e]	<1.8 %	90%
	Modes with one or three K's			
Γ_{67}	$K^+\pi^0$		$(8.2\pm2.2)\times10^{-4}$	
Γ_{68}	$K_S^0\pi^+$		$(1.25\pm0.15)\times10^{-3}$	
Γ_{69}	$K^+\eta$		$(1.41\pm0.31)\times10^{-3}$	
Γ_{70}	$K^+\eta'(958)$		$(1.6\pm0.5)\times10^{-3}$	
Γ_{71}	$K^+\pi^+\pi^-$		$(6.9\pm0.5)\times10^{-3}$	
Γ_{72}	$K^+\rho^0$		$(2.7\pm0.5)\times10^{-3}$	
Γ_{73}	$K^+\rho(1450)^0$, $\rho^0\to\pi^+\pi^-$		$(7.4\pm2.6)\times10^{-4}$	
Γ_{74}	$K^*(892)^0\pi^+$, $K^{*0}\to K^+\pi^-$		$(1.50\pm0.26)\times10^{-3}$	
Γ_{75}	$K^*(1410)^0\pi^+$, $K^{*0}\to K^+\pi^-$		$(1.30\pm0.31)\times10^{-3}$	
Γ_{76}	$K^*(1430)^0\pi^+$, $K^{*0}\to K^+\pi^-$		$(5\pm4)\times10^{-4}$	
Γ_{77}	$K^+\pi^+\pi^-$ nonresonant		$(1.1\pm0.4)\times10^{-3}$	

Γ_{78}	$K^0_S \pi^+ \pi^+ \pi^-$			(3.0 ± 1.1)	$\times 10^{-3}$	
Γ_{79}	$K^+ K^+ K^-$			(4.9 ± 1.7)	$\times 10^{-4}$	
Γ_{80}	ϕK^+, $\phi \to K^+ K^-$			< 2.8	$\times 10^{-4}$	90%

Doubly Cabibbo-suppressed modes

Γ_{81}	$K^+ K^+ \pi^-$			(2.9 ± 1.1)	$\times 10^{-4}$	

Baryon-antibaryon mode

Γ_{82}	$p \overline{n}$			(1.3 ± 0.4)	$\times 10^{-3}$	

$\Delta C = 1$ weak neutral current (*C1*) modes,
Lepton family number (*LF*), or
Lepton number (*L*) violating modes

Γ_{83}	$\pi^+ e^+ e^-$		[g]	< 2.7	$\times 10^{-4}$	90%
Γ_{84}	$\pi^+ \mu^+ \mu^-$		[g]	< 2.6	$\times 10^{-5}$	90%
Γ_{85}	$K^+ e^+ e^-$	*C1*		< 1.6	$\times 10^{-3}$	90%
Γ_{86}	$K^+ \mu^+ \mu^-$	*C1*		< 3.6	$\times 10^{-5}$	90%
Γ_{87}	$K^*(892)^+ \mu^+ \mu^-$	*C1*		< 1.4	$\times 10^{-3}$	90%
Γ_{88}	$\pi^+ e^\pm \mu^\mp$	*LF*	[h]	< 6.1	$\times 10^{-4}$	90%
Γ_{89}	$K^+ e^\pm \mu^\mp$	*LF*	[h]	< 6.3	$\times 10^{-4}$	90%
Γ_{90}	$\pi^- e^+ e^+$	*L*		< 6.9	$\times 10^{-4}$	90%
Γ_{91}	$\pi^- \mu^+ \mu^+$	*L*		< 2.9	$\times 10^{-5}$	90%
Γ_{92}	$\pi^- e^+ \mu^+$	*L*		< 7.3	$\times 10^{-4}$	90%
Γ_{93}	$K^- e^+ e^+$	*L*		< 6.3	$\times 10^{-4}$	90%
Γ_{94}	$K^- \mu^+ \mu^+$	*L*		< 1.3	$\times 10^{-5}$	90%
Γ_{95}	$K^- e^+ \mu^+$	*L*		< 6.8	$\times 10^{-4}$	90%
Γ_{96}	$K^*(892)^- \mu^+ \mu^+$	*L*		< 1.4	$\times 10^{-3}$	90%

Γ_{97}	A dummy mode used by the fit.	(73.6 ± 1.3) %

[a] This fraction includes η from η' decays.

[b] For now, we average together measurements of the $X e^+ \nu_e$ and $X \mu^+ \nu_\mu$ branching fractions. This is the *average*, not the *sum*.

[c] The branching fraction for this mode may differ from the sum of the submodes that contribute to it, due to interference effects. See the relevant papers.

[d] We decouple the $D_s^+ \to \phi \pi^+$ branching fraction obtained from mass projections (and used to get some of the other branching fractions) from the $D_s^+ \to \phi \pi^+$, $\phi \to K^+ K^-$ branching fraction obtained from the Dalitz-plot analysis of $D_s^+ \to K^+ K^- \pi^+$. That is, the ratio of these two branching fractions is not exactly the $\phi \to K^+ K^-$ branching fraction 0.491.

[e] This branching fraction includes all the decay modes of the final-state resonance.

[*f*] This comes from a K-matrix parametrization of the $\pi^+\pi^-$ S-wave and is a sum over the $f_0(980)$, $f_0(1300)$, $f_0(1200–1600)$, $f_0(1500)$, and $f_0(1750)$. Not all of these correspond to particles in our Tables.

[*g*] This mode is not a useful test for a ΔC=1 weak neutral current because both quarks must change flavor in this decay.

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

CONSTRAINED FIT INFORMATION

An overall fit to 12 branching ratios uses 16 measurements and one constraint to determine 11 parameters. The overall fit has a $\chi^2 = 2.1$ for 6 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, $x_i \equiv \Gamma_i/\Gamma_{total}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_{17}	0									
x_{18}	0	77								
x_{19}	36	0	0							
x_{29}	0	43	49	0						
x_{34}	0	52	59	0	33					
x_{46}	0	41	46	0	25	31				
x_{56}	0	39	44	0	24	30	23			
x_{63}	0	47	53	0	32	37	28	28		
x_{71}	0	38	45	0	23	29	22	21	26	
x_{97}	−14	−71	−81	−29	−72	−59	−46	−52	−69	−41
	x_{10}	x_{17}	x_{18}	x_{19}	x_{29}	x_{34}	x_{46}	x_{56}	x_{63}	x_{71}

D_s^+ BRANCHING RATIOS

A number of older, now obsolete results have been omitted. They may be found in earlier editions.

——— Inclusive modes ———

$\Gamma(K^-\text{anything})/\Gamma_{total}$ **Γ_1/Γ**

VALUE	DOCUMENT ID		TECN	COMMENT
$0.13^{+0.14}_{-0.12}\pm0.02$	COFFMAN	91	MRK3	e^+e^- 4.14 GeV

$\left[\Gamma(\overline{K}^0\text{anything}) + \Gamma(K^0\text{anything})\right]/\Gamma_{total}$ **Γ_2/Γ**

VALUE	DOCUMENT ID		TECN	COMMENT
$0.39^{+0.28}_{-0.27}\pm0.04$	COFFMAN	91	MRK3	e^+e^- 4.14 GeV

$\Gamma(K^+\text{ anything})/\Gamma_{\text{total}}$ — Γ_3/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
$0.20^{+0.18}_{-0.13}\pm0.04$	COFFMAN	91	MRK3	e^+e^- 4.14 GeV

$\Gamma((\text{non-}K\overline{K})\text{ anything})/\Gamma_{\text{total}}$ — Γ_4/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
0.64±0.17±0.03	[3] COFFMAN	91	MRK3	e^+e^- 4.14 GeV

[3] COFFMAN 91 uses the direct measurements of the kaon content to determine this non-$K\overline{K}$ fraction. This number implies that a large fraction of D_s^+ decays involve η, η', and/or non-spectator decays.

$\Gamma(\eta\text{ anything})/\Gamma_{\text{total}}$ — Γ_5/Γ

This ratio includes η particles from η' decays.

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
23.5±3.1±2.0	674 ± 91	HUANG	06B	CLEO	e^+e^- at 4170 MeV

$\Gamma(\eta'\text{ anything})/\Gamma_{\text{total}}$ — Γ_6/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
8.7±1.9±0.8	68 ± 15	HUANG	06B	CLEO	e^+e^- at 4170 MeV

$\Gamma(\phi\text{ anything})/\Gamma_{\text{total}}$ — Γ_7/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
16.1±1.2±1.1	398 ± 27	HUANG	06B	CLEO	e^+e^- at 4170 MeV

$\Gamma(e^+\text{ anything})/\Gamma_{\text{total}}$ — Γ_8/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
$0.077^{+0.057}_{-0.043}{}^{+0.024}_{-0.021}$	BAI	97	BES	$e^+e^-\to D_s^+D_s^-$

Leptonic and semileptonic modes

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$\Gamma(e^+\nu_e)/\Gamma_{\text{total}}$ — Γ_9/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<1.3\times10^{-4}$	90	PEDLAR	07A	CLEO	$e^+e^-\to D_s^+D_s^{*-}$, 4170 MeV

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

See the note on "Decay Constants of Charged Pseudoscalar Mesons" in the D_s^+ Listings.

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
6.3 ±0.5 OUR FIT					
6.1 ±0.6 OUR AVERAGE					
6.44±0.76±0.57	169 ± 18	[4] WIDHALM	08	BELL	$e^+e^-\approx\Upsilon(4S)$
5.94±0.66±0.31	88	[5] PEDLAR	07A	CLEO	$e^+e^-\to D_s^+D_s^{*-}$, 4.17 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
6.8 ±1.1 ±1.8	553	[6] HEISTER	02I	ALEP	Z decays

[4] WIDHALM 08 gets f_{D_s} = (275 ± 16 ± 12) MeV from the branching fraction.

[5] PEDLAR 07A also fits μ^+ and τ^+ events together and gets an effective $\mu^+\nu_\mu$ branching fraction of (6.38 ± 0.59 ± 0.33) × 10^{-3}

[6] This HEISTER 02I result is not actually an independent measurement of the absolute $\mu^+\nu_\mu$ branching fraction, but is in fact based on our $\phi\pi^+$ branching fraction of 3.6 ± 0.9%, so it cannot be included in our overall fit. HEISTER 02I combines its $D_s^+ \rightarrow \tau^+\nu_\tau$ and $\mu^+\nu_\mu$ branching fractions to get f_{D_s} = (285 ± 19 ± 40) MeV.

$\Gamma(\mu^+\nu_\mu)/\Gamma(\phi\pi^+)$ — Γ_{10}/Γ_{19}

See the note on "Decay Constants of Charged Pseudoscalar Mesons" in the D_s^+ Listings.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.143±0.013 OUR FIT				
0.148±0.017 OUR AVERAGE				
0.143±0.018±0.006	489 ± 55	[7] AUBERT 07V	BABR	$e^+e^- \approx \Upsilon(4S)$
0.173±0.023±0.035	182	[8] CHADHA 98	CLE2	$e^+e^- \approx \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.23 ±0.06 ±0.04	18	[9] ALEXANDROV 00	BEAT	π^- nucleus, 350 GeV
0.245±0.052±0.074	39	[10] ACOSTA 94	CLE2	See CHADHA 98

[7] AUBERT 07V gets $f_{D_s^+}$ = (283 ± 17 ± 16) MeV, using $\Gamma(D_s^+ \rightarrow \phi\pi^+)/\Gamma(\text{total})$ = (4.71 ± 0.46)%.

[8] CHADHA 98 obtains f_{D_s} = (280 ± 19 ± 28 ± 34) MeV from this measurement, using $\Gamma(D_s^+ \rightarrow \phi\pi^+)/\Gamma(\text{total})$ = 0.036 ± 0.009.

[9] ALEXANDROV 00 uses $f_D^2/f_{D_s}^2$ = 0.82 ± 0.09 from a lattice-gauge-theory calculation to get the relative numbers of $D^+ \rightarrow \mu^+\nu_\mu$ and $D_s^+ \rightarrow \mu^+\nu_\mu$ events. The present result leads to f_{D_s} = (323 ± 44 ± 36) MeV.

[10] ACOSTA 94 obtains f_{D_s} = (344 ± 37 ± 52 ± 42) MeV from this measurement, using $\Gamma(D_s^+ \rightarrow \phi\pi^+)/\Gamma(\text{total})$ = 0.037 ± 0.009.

$\Gamma(\tau^+\nu_\tau)/\Gamma_{total}$ — Γ_{11}/Γ

See the note on "Decay Constants of Charged Pseudoscalar Mesons" in the D_s^+ Listings.

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
6.6 ±0.6 OUR AVERAGE				
6.17±0.71±0.34	102	[11] ECKLUND 08	CLEO	$e^+e^- \rightarrow D_s^+ D_s^{*-}$, 4170 MeV
8.0 ±1.3 ±0.4	47	[11] PEDLAR 07A	CLEO	$e^+e^- \rightarrow D_s^+ D_s^{*-}$, 4170 MeV
5.79±0.77±1.84	881	[12] HEISTER 02I	ALEP	Z decays
7.0 ±2.1 ±2.0	22	[13] ABBIENDI 01L	OPAL	$D_s^{*+} \rightarrow \gamma D_s^+$ from Z's
7.4 ±2.8 ±2.4	16	[14] ACCIARRI 97F	L3	$D_s^{*+} \rightarrow \gamma D_s^+$ from Z's

[11] ECKLUND 08 and PEDLAR 07A are independent: ECKLUND 08 uses $\tau^+ \rightarrow e^+ \nu_e \overline{\nu}_\tau$ events, PEDLAR 07A uses $\tau^+ \rightarrow \pi^+ \overline{\nu}_\tau$ events.

[12] HEISTER 02I combines its $D_s^+ \rightarrow \tau^+ \nu_\tau$ and $\mu^+ \nu_\mu$ branching fractions to get $f_{D_s} =$ (285 ± 19 ± 40) MeV.

[13] This ABBIENDI 01L value gives a decay constant f_{D_s} of (286 ± 44 ± 41) MeV.

[14] The second ACCIARRI 97F error here combines in quadrature systematic (0.016) and normalization (0.018) errors. The branching fraction gives f_{D_s} = (309 ± 58 ± 33 ± 38) MeV.

$\Gamma(\tau^+ \nu_\tau)/\Gamma(\mu^+ \nu_\mu)$ — Γ_{11}/Γ_{10}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
11.0±1.4±0.6	102	[15] ECKLUND	08	CLEO	$e^+ e^- \rightarrow D_s^+ D_s^{*-}$, 4170 MeV

[15] This ECKLUND 08 value also uses results from PEDLAR 07A, and it is not independent of other results in these Listings. Combined with earlier CLEO results, the decay constant f_{D_s} is 274 ± 10 ± 5 MeV.

$\Gamma(K^+ K^- e^+ \nu_e)/\Gamma(K^+ K^- \pi^+)$ — Γ_{12}/Γ_{18}

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.558±0.007±0.016	[16] AUBERT	08AN	BABR	$e^+ e^-$ at $\Upsilon(4S)$

[16] This AUBERT 08AN ratio is only for the $K^+ K^-$ mass in the range 1.01–to–1.03 GeV in the numerator and 1.0095–to–1.0295 GeV in the denominator.

$\Gamma(\phi e^+ \nu_e)/\Gamma_{\text{total}}$ — Γ_{13}/Γ

See the end of the D_s^+ Listings for measurements of $D_s^+ \rightarrow \phi e^+ \nu_e$ form factors.

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
2.61±0.03±0.17	(25 ± 0.5)k	AUBERT	08AN	BABR	$e^+ e^-$ at $\Upsilon(4S)$

$\Gamma(\phi e^+ \nu_e)/\Gamma(\phi \pi^+)$ — Γ_{13}/Γ_{19}

As noted in the comment column, most of these measurements use $\phi \mu^+ \nu_\mu$ events in addition to or instead of $\phi e^+ \nu_e$ events.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.540±0.033±0.048	793	LINK	02J	FOCS	Uses $\phi \mu^+ \nu_\mu$
0.54 ±0.05 ±0.04	367	BUTLER	94	CLE2	Uses $\phi e^+ \nu_e$ and $\phi \mu^+ \nu_\mu$
0.58 ±0.17 ±0.07	97	FRABETTI	93G	E687	Uses $\phi \mu^+ \nu_\mu$
0.57 ±0.15 ±0.15	104	ALBRECHT	91	ARG	Uses $\phi e^+ \nu_e$
0.49 ±0.10 $^{+0.10}_{-0.14}$	54	ALEXANDER	90B	CLEO	Uses $\phi e^+ \nu_e$ and $\phi \mu^+ \nu_\mu$

$\Gamma(\eta \ell^+ \nu_\ell)/\Gamma(\phi e^+ \nu_e)$ — Γ_{15}/Γ_{13}

Unseen decay modes of the η and the ϕ are included.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
1.24±0.12±0.15	440	[17] BRANDENB...	95	CLE2	$e^+ e^- \approx \Upsilon(4S)$

[17] BRANDENBURG 95 uses both e^+ and μ^+ events and makes a phase-space adjustment to use the μ^+ events as e^+ events.

$\Gamma(\eta'(958)\ell^+\nu_\ell)/\Gamma(\phi e^+\nu_e)$ — Γ_{16}/Γ_{13}

Unseen decay modes of the resonances are included.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.43±0.11±0.07	29	[18] BRANDENB... 95	CLE2	$e^+e^- \approx \Upsilon(4S)$

[18] BRANDENBURG 95 uses both e^+ and μ^+ events and makes a phase-space adjustment to use the μ^+ events as e^+ events.

$[\Gamma(\eta\ell^+\nu_\ell)+\Gamma(\eta'(958)\ell^+\nu_\ell)]/\Gamma(\phi e^+\nu_e)$ — $\Gamma_{14}/\Gamma_{13} = (\Gamma_{15}+\Gamma_{16})/\Gamma_{13}$

Unseen decay modes of the resonances are included.

VALUE	DOCUMENT ID	TECN	COMMENT
1.67±0.17±0.17	[19] BRANDENB... 95	CLE2	$e^+e^- \approx \Upsilon(4S)$

[19] This BRANDENBURG 95 data is redundant with data in previous blocks.

Hadronic modes with a $K\overline{K}$ pair.

$\Gamma(K^+K^0_S)/\Gamma_{total}$ — Γ_{17}/Γ

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
1.49±0.09 OUR FIT			
1.49±0.07±0.05	[20] ALEXANDER 08	CLEO	e^+e^- at 4.17 GeV

[20] ALEXANDER 08 uses single- and double-tagged events in an overall fit. The correlation matrix for the branching fractions is used in the fit.

$\Gamma(K^+K^0_S)/\Gamma(\phi\pi^+)$ — Γ_{17}/Γ_{19}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.58±0.16±0.10	68	ANJOS 90C	E691	γ Be
0.46±0.16±0.10		ADLER 89B	MRK3	e^+e^- 4.14 GeV
0.50±0.09±0.05		CHEN 89	CLEO	e^+e^- 10 GeV

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

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
5.50±0.28 OUR FIT			
5.50±0.23±0.16	[21] ALEXANDER 08	CLEO	e^+e^- at 4.17 GeV

[21] ALEXANDER 08 uses single- and double-tagged events in an overall fit. The correlation matrix for the branching fractions is used in the fit.

$\Gamma(\phi\pi^+)/\Gamma_{total}$ — Γ_{19}/Γ

The results here are model-independent. For earlier, model-dependent results, see our PDG 06 edition. See also the header note in the next block of data.

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
4.39±0.34 OUR FIT				
4.5 ±0.4 OUR AVERAGE				
4.62±0.36±0.51		[22] AUBERT 06N	BABR	e^+e^- at $\Upsilon(4S)$
4.81±0.52±0.38	212 ± 19	[23] AUBERT 05V	BABR	$e^+e^- \approx \Upsilon(4S)$
3.59±0.77±0.48		[24] ARTUSO 96	CLE2	e^+e^- at $\Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$3.9\ ^{+5.1}_{-1.9}\ ^{+1.8}_{-1.1}$		[25] BAI 95C	BES	e^+e^- 4.03 GeV

[22] This AUBERT 06N measurement uses $\overline{B}^0 \to D_s^{(*)-} D^{(*)+}$ and $B^- \to D_s^{(*)-} D^{(*)0}$ decays, including some from other papers. However, the result is independent of AUBERT 05V.

[23] AUBERT 05V uses the ratio of $B^0 \to D^{*-} D_s^{*+}$ events seen in two different ways, in both of which the $D^{*-} \to \overline{D}^0 \pi^-$ decay is fully reconstructed: (1) The $D_s^{*+} \to D_s^+ \gamma$, $D_s^+ \to \phi \pi^+$ decay is fully reconstructed. (2) The number of events in the D_s^+ peak in the missing mass spectrum against the $D^{*-} \gamma$ is measured.

[24] ARTUSO 96 uses partially reconstructed $\overline{B}^0 \to D^{*+} D_s^{*-}$ decays to get a model-independent value for $\Gamma(D_s^- \to \phi \pi^-)/\Gamma(D^0 \to K^- \pi^+)$ of 0.92 ± 0.20 ± 0.11.

[25] BAI 95C uses $e^+ e^- \to D_s^+ D_s^-$ events in which one or both of the $D_s^\pm$ are observed to obtain the first model-independent measurement of the $D_s^+ \to \phi \pi^+$ branching fraction, without assumptions about $\sigma(D_s^\pm)$. However, with only two "doubly-tagged" events, the statistical error is very large.

$\Gamma(\phi\pi^+, \phi \to K^+ K^-)/\Gamma(K^+ K^- \pi^+)$ — Γ_{20}/Γ_{18}

This is the "fit fraction" from the Dalitz-plot analysis. We decouple the $D_s^+ \to \phi \pi^+$ branching fraction obtained from mass projections (and used to get some of the other branching fractions) from the $D_s^+ \to \phi \pi^+$, $\phi \to K^+ K^-$ branching fraction obtained from the Dalitz-plot analysis of $D_s^+ \to K^+ K^- \pi^+$. That is, the ratio of these two branching fractions is not exactly the $\phi \to K^+ K^-$ branching fraction 0.491.

VALUE	*DOCUMENT ID*		*TECN*	*COMMENT*
0.396±0.033±0.047	FRABETTI	95B	E687	Dalitz fit, 701 evts

$\Gamma(K^+ \overline{K}^*(892)^0, \overline{K}^{*0} \to K^- \pi^+)/\Gamma(K^+ K^- \pi^+)$ — Γ_{22}/Γ_{18}

This is the "fit fraction" from the Dalitz-plot analysis.

VALUE	*DOCUMENT ID*		*TECN*	*COMMENT*
0.478±0.046±0.040	FRABETTI	95B	E687	Dalitz fit, 701 evts

$\Gamma(K^+ \overline{K}^*(892)^0)/\Gamma(\phi\pi^+)$ — Γ_{21}/Γ_{19}

Unseen decay modes of the resonances are included. However, we now get branching fractions for resonant submodes of 3-body decays from Dalitz-plot analyses.

VALUE	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.85±0.34±0.20	9	ALVAREZ	90C	NA14	Photoproduction
0.84±0.30±0.22		ADLER	89B	MRK3	$e^+ e^-$ 4.14 GeV
1.05±0.17±0.12		CHEN	89	CLEO	$e^+ e^-$ 10 GeV
0.87±0.13±0.05	117	ANJOS	88	E691	Photoproduction
1.44±0.37	87	ALBRECHT	87F	ARG	$e^+ e^-$ 10 GeV

$\Gamma(f_0(980)\pi^+, f_0 \to K^+ K^-)/\Gamma(K^+ K^- \pi^+)$ — Γ_{23}/Γ_{18}

This is the "fit fraction" from the Dalitz-plot analysis.

VALUE	*DOCUMENT ID*		*TECN*	*COMMENT*
0.11±0.035±0.026	FRABETTI	95B	E687	Dalitz fit, 701 evts

$\Gamma(f_0(1710)\pi^+, f_0 \to K^+K^-)/\Gamma(K^+K^-\pi^+)$ — Γ_{25}/Γ_{18}

This is the "fit fraction" from the Dalitz-plot analysis.

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.034±0.023±0.035	[26] FRABETTI	95B	E687	Dalitz fit, 701 evts

[26] In other words, FRABETTI 95B doesn't see this resonance.

$\Gamma(K^+\overline{K}{}^*_0(1430)^0, \overline{K}{}^*_0 \to K^-\pi^+)/\Gamma(K^+K^-\pi^+)$ — Γ_{24}/Γ_{18}

This is the "fit fraction" from the Dalitz-plot analysis.

VALUE	DOCUMENT ID		TECN	COMMENT
0.093±0.032±0.032	FRABETTI	95B	E687	Dalitz fit, 701 evts

$\Gamma(K^*(892)^+\overline{K}{}^0)/\Gamma(\phi\pi^+)$ — Γ_{28}/Γ_{19}

Unseen decay modes of the resonances are included.

VALUE	DOCUMENT ID		TECN	COMMENT
1.20±0.21±0.13	CHEN	89	CLEO	e^+e^- 10 GeV

$\Gamma(K^+K^-\pi^+\pi^0)/\Gamma_{\text{total}}$ — Γ_{29}/Γ

VALUE (units 10^{-2})	DOCUMENT ID		TECN	COMMENT
5.6 ±0.5 OUR FIT				
5.65±0.29±0.40	[27] ALEXANDER	08	CLEO	e^+e^- at 4.17 GeV

[27] ALEXANDER 08 uses single- and double-tagged events in an overall fit. The correlation matrix for the branching fractions is used in the fit.

$\Gamma(\phi\rho^+, \phi \to K^+K^-)/\Gamma(\phi\pi^+, \phi \to K^+K^-)$ — Γ_{31}/Γ_{20}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
$1.86\pm0.26^{+0.29}_{-0.40}$	253	AVERY	92	CLE2	$e^+e^- \simeq$ 10.5 GeV

$\Gamma(\phi\pi^+\pi^0\ \text{3-body}, \phi \to K^+K^-)/\Gamma(\phi\pi^+, \phi \to K^+K^-)$ — Γ_{32}/Γ_{20}

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.71	90	DAOUDI	92	CLE2	$e^+e^- \approx$ 10.5 GeV

$\Gamma(K^+K^-\pi^+\pi^0\ \text{non-}\phi)/\Gamma(\phi\pi^+)$ — Γ_{33}/Γ_{19}

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<2.4	90	ANJOS	89E	E691	Photoproduction

$\Gamma(K^0_S K^-\pi^+\pi^+)/\Gamma_{\text{total}}$ — Γ_{34}/Γ

VALUE (units 10^{-2})	DOCUMENT ID		TECN	COMMENT
1.64±0.12 OUR FIT				
1.64±0.10±0.07	[28] ALEXANDER	08	CLEO	e^+e^- at 4.17 GeV

[28] ALEXANDER 08 uses single- and double-tagged events in an overall fit. The correlation matrix for the branching fractions is used in the fit.

$\Gamma(K^*(892)^+\overline{K}{}^*(892)^0)/\Gamma(\phi\pi^+)$ — Γ_{35}/Γ_{19}

Unseen decay modes of the resonances are included.

VALUE	DOCUMENT ID		TECN	COMMENT
1.6±0.4±0.4	ALBRECHT	92B	ARG	$e^+e^- \simeq$ 10.4 GeV

$\Gamma(K^0 K^- 2\pi^+ (\text{non-}K^{*+}\overline{K}^{*0}))/\Gamma(\phi\pi^+)$ — Γ_{36}/Γ_{19}

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.80	90	ALBRECHT	92B	ARG	$e^+e^- \simeq$ 10.4 GeV

$\Gamma(K^+ K^0_S \pi^+\pi^-)/\Gamma(K^0_S K^-\pi^+\pi^+)$ — Γ_{37}/Γ_{34}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.586±0.052±0.043	476	LINK	01C	FOCS	γ nucleus, $\overline{E}_\gamma \approx$ 180 GeV

$\Gamma(K^+K^-\pi^+\pi^+\pi^-)/\Gamma(K^+K^-\pi^+)$ — Γ_{38}/Γ_{18}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.160±0.027 OUR AVERAGE					
0.150±0.019±0.025	240	LINK	03D	FOCS	γ A, $\overline{E}_\gamma \approx$ 180 GeV
0.188±0.036±0.040	75	FRABETTI	97C	E687	γBe, $\overline{E}_\gamma \approx$ 200 GeV

$\Gamma(\phi\pi^+\pi^+\pi^-,\ \phi\to K^+K^-)/\Gamma(\phi\pi^+, \phi\to K^+K^-)$ — Γ_{39}/Γ_{20}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.269±0.027 OUR AVERAGE					
0.249±0.024±0.021	136	LINK	03D	FOCS	γ A, $\overline{E}_\gamma \approx$ 180 GeV
0.28 ±0.06 ±0.01	40	FRABETTI	97C	E687	γBe, $\overline{E}_\gamma \approx$ 200 GeV
0.58 ±0.21 ±0.10	21	FRABETTI	92	E687	γBe
0.42 ±0.13 ±0.07	19	ANJOS	88	E691	Photoproduction
1.11 ±0.37 ±0.28	62	ALBRECHT	85D	ARG	e^+e^- 10 GeV

$\Gamma(\phi\pi^+\pi^+\pi^-,\ \phi\to K^+K^-)/\Gamma(K^+K^-\pi^+\pi^+\pi^-)$ — Γ_{39}/Γ_{38}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.21±0.05±0.06	136	[29] LINK	03D	FOCS	γ A, $\overline{E}_\gamma \approx$ 180 GeV

[29] This LINK 03D result is redundant with its $\Gamma(\phi\pi^+\pi^+\pi^-)/\Gamma(\phi\pi^+)$ result above.

$\Gamma(K^+K^-\rho^0\pi^+\ \text{non-}\phi)/\Gamma(K^+K^-\pi^+\pi^+\pi^-)$ — Γ_{40}/Γ_{38}

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.03	90	LINK	03D	FOCS	γ A, $\overline{E}_\gamma \approx$ 180 GeV

$\Gamma(\phi\rho^0\pi^+,\ \phi\to K^+K^-)/\Gamma(K^+K^-\pi^+\pi^+\pi^-)$ — Γ_{41}/Γ_{38}

VALUE	DOCUMENT ID		TECN	COMMENT
0.75±0.06±0.04	LINK	03D	FOCS	γ A, $\overline{E}_\gamma \approx$ 180 GeV

$\Gamma(\phi a_1(1260)^+,\ \phi\to K^+K^-,\ a_1^+\to\rho^0\pi^+)/\Gamma(K^+K^-\pi^+)$ — Γ_{42}/Γ_{18}

VALUE	DOCUMENT ID		TECN	COMMENT
0.137±0.019±0.011	LINK	03D	FOCS	γ A, $\overline{E}_\gamma \approx$ 180 GeV

$\Gamma(K^+K^-\pi^+\pi^+\pi^-\ \text{nonresonant})/\Gamma(K^+K^-\pi^+\pi^+\pi^-)$ — Γ_{43}/Γ_{38}

VALUE	DOCUMENT ID		TECN	COMMENT
0.10±0.06±0.05	LINK	03D	FOCS	γ A, $\overline{E}_\gamma \approx$ 180 GeV

$\Gamma(K^0_S K^0_S \pi^+\pi^+\pi^-)/\Gamma(K^0_S K^-\pi^+\pi^+)$ — Γ_{44}/Γ_{34}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.051±0.015±0.015	37 ± 10	LINK	04D	FOCS	γ A, $\overline{E}_\gamma \approx$ 180 GeV

Pionic modes

$\Gamma(\pi^+\pi^0)/\Gamma(K^+ K^0_S)$ — Γ_{45}/Γ_{17}

This decay is forbidden by isospin conservation.

VALUE (units 10^{-2})	CL%	DOCUMENT ID		TECN	COMMENT
<4.1	90	ADAMS	07A	CLEO	e^+e^-, E_{cm}=4.17 GeV

$\Gamma(\pi^+\pi^+\pi^-)/\Gamma_{total}$ — Γ_{46}/Γ

VALUE (units 10^{-2})	DOCUMENT ID		TECN	COMMENT
1.11±0.08 OUR FIT				
1.11±0.07±0.04	[30] ALEXANDER	08	CLEO	e^+e^- at 4.17 GeV

[30] ALEXANDER 08 uses single- and double-tagged events in an overall fit. The correlation matrix for the branching fractions is used in the fit.

$\Gamma(\pi^+\pi^+\pi^-)/\Gamma(K^+K^-\pi^+)$ — Γ_{46}/Γ_{18}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.265±0.041±0.031	98	FRABETTI	97D	E687	γ Be ≈ 200 GeV

$\Gamma(\pi^+\pi^+\pi^-)/\Gamma(\phi\pi^+)$ — Γ_{46}/Γ_{19}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$0.245\pm0.028^{+0.019}_{-0.012}$	848	AITALA	01A	E791	π^- nucleus, 500 GeV
0.33 ±0.10 ±0.04	29	ADAMOVICH	93	WA82	π^- 340 GeV
0.44 ±0.10 ±0.04	68	ANJOS	89	E691	Photoproduction

$\Gamma(\rho^0\pi^+)/\Gamma(\pi^+\pi^+\pi^-)$ — Γ_{47}/Γ_{46}

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
not seen		LINK	04	FOCS	Dalitz fit, 1475 ± 50 evts
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.058±0.023±0.037		AITALA	01A	E791	Dalitz fit, 848 evts
<0.073	90	FRABETTI	97D	E687	γ Be ≈ 200 GeV

$\Gamma(\rho^0\pi^+)/\Gamma(\phi\pi^+)$ — Γ_{47}/Γ_{19}

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.08	90	ANJOS	89	E691	Photoproduction
<0.22	90	ALBRECHT	87G	ARG	e^+e^- 10 GeV

$\Gamma(\pi^+(\pi^+\pi^-)_{S-\text{wave}})/\Gamma(\pi^+\pi^+\pi^-)$ — Γ_{48}/Γ_{46}

This is the "fit fraction" from the Dalitz-plot analysis. See also KLEMPT 08, which uses 568 $D_s^+ \to 3\pi$ decays (over 280 background events) from FNAL E791 to study various parametrizations of the decay amplitudes. The emphasis is more on S-wave $\pi\pi$ decay products — 20 different solutions are given — than on D_s^+ fit fractions.

VALUE	DOCUMENT ID		TECN	COMMENT
0.8704±0.0560±0.0438	[31] LINK	04	FOCS	Dalitz fit, 1475 ± 50 evts

[31] LINK 04 borrows a K-matrix parametrization from ANISOVICH 03 of the full π-π S-wave isoscalar scattering amplitude to describe the $\pi^+\pi^-$ S-wave component of the $\pi^+\pi^+\pi^-$ state. The fit fraction given above is a sum over five f_0 mesons, the $f_0(980)$, $f_0(1300)$, $f_0(1200\text{–}1600)$, $f_0(1500)$, and $f_0(1750)$. See LINK 04 for details and discussion.

$\Gamma(f_0(980)\pi^+, f_0 \to \pi^+\pi^-)/\Gamma(\pi^+\pi^+\pi^-)$ — Γ_{49}/Γ_{46}

This is the "fit fraction" from the Dalitz-plot analysis.

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.565±0.043±0.047	AITALA	01A	E791	Dalitz fit, 848 evts
1.074±0.140±0.043	FRABETTI	97D	E687	γ Be ≈ 200 GeV

$\Gamma(f_0(1370)\pi^+, f_0 \to \pi^+\pi^-)/\Gamma(\pi^+\pi^+\pi^-)$ — Γ_{50}/Γ_{46}

This is the "fit fraction" from the Dalitz-plot analysis.

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.324±0.077±0.017	AITALA	01A	E791	Dalitz fit, 848 evts

$\Gamma(f_0(1500)\pi^+, f_0 \to \pi^+\pi^-)/\Gamma(\pi^+\pi^+\pi^-)$ — Γ_{51}/Γ_{46}

This is the "fit fraction" from the Dalitz-plot analysis.

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.274±0.114±0.019	[32] FRABETTI	97D	E687	γ Be ≈ 200 GeV

[32] FRABETTI 97D calls this mode $S(1475)\pi^+$, but finds the mass and width of this $S(1475)$ to be in excellent agreement with those of the $f_0(1500)$.

$\Gamma(f_2(1270)\pi^+, f_2 \to \pi^+\pi^-)/\Gamma(\pi^+\pi^+\pi^-)$ — Γ_{52}/Γ_{46}

This is the "fit fraction" from the Dalitz-plot analysis.

VALUE	DOCUMENT ID		TECN	COMMENT
0.0974±0.0449±0.0294	LINK	04	FOCS	Dalitz fit, 1475 ± 50 evts
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.197 ±0.033 ±0.006	AITALA	01A	E791	Dalitz fit, 848 evts
0.123 ±0.056 ±0.018	FRABETTI	97D	E687	γ Be ≈ 200 GeV

$\Gamma(\rho(1450)^0\pi^+, \rho^0 \to \pi^+\pi^-)/\Gamma(\pi^+\pi^+\pi^-)$ — Γ_{53}/Γ_{46}

This is the "fit fraction" from the Dalitz-plot analysis.

VALUE	DOCUMENT ID		TECN	COMMENT
0.0656±0.0343±0.0440	LINK	04	FOCS	Dalitz fit, 1475 ± 50 evts
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.044 ±0.021 ±0.002	AITALA	01A	E791	Dalitz fit, 848 evts

$\Gamma(\pi^+\pi^+\pi^-$ nonresonant$)/\Gamma(\pi^+\pi^+\pi^-)$ — Γ_{54}/Γ_{46}

This is the "fit fraction" from the Dalitz-plot analysis.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$0.005\pm0.014\pm0.017$		AITALA	01A	E791	π^- nucleus, 500 GeV
<0.269	90	FRABETTI	97D	E687	γ Be $\approx$ 200 GeV

$\Gamma(\pi^+\pi^+\pi^-\pi^0)/\Gamma(\phi\pi^+)$ — Γ_{55}/Γ_{19}

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<3.3	90	ANJOS	89E	E691	Photoproduction

$\Gamma(\eta\pi^+)/\Gamma_{total}$ — Γ_{56}/Γ

Unseen decay modes of the η are included.

VALUE (units 10^{-2})	DOCUMENT ID		TECN	COMMENT
1.58±0.21 OUR FIT				
1.58±0.11±0.18	[33] ALEXANDER	08	CLEO	e^+e^- at 4.17 GeV

[33] ALEXANDER 08 uses single- and double-tagged events in an overall fit. The correlation matrix for the branching fractions is used in the fit.

$\Gamma(\eta\pi^+)/\Gamma(\phi\pi^+)$ — Γ_{56}/Γ_{19}

Unseen decay modes of the resonances are included.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$0.48\pm0.03\pm0.04$	920	JESSOP	98	CLE2	$e^+e^- \approx \Upsilon(4S)$
$0.54\pm0.09\pm0.06$	165	ALEXANDER	92	CLE2	See JESSOP 98

$\Gamma(\omega\pi^+)/\Gamma(\eta\pi^+)$ — Γ_{57}/Γ_{56}

Unseen decay modes of the resonances are included.

VALUE	DOCUMENT ID		TECN	COMMENT
0.16±0.04±0.03	BALEST	97	CLE2	$e^+e^- \approx \Upsilon(4S)$

$\Gamma(3\pi^+2\pi^-)/\Gamma(K^+K^-\pi^+)$ — Γ_{58}/Γ_{18}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.146±0.014 OUR AVERAGE					
$0.145\pm0.011\pm0.010$	671	LINK	03D	FOCS	γ A, $\overline{E}_\gamma \approx$ 180 GeV
$0.158\pm0.042\pm0.031$	37	FRABETTI	97C	E687	γBe, $\overline{E}_\gamma \approx$ 200 GeV

$\Gamma(\eta\rho^+)/\Gamma(\phi\pi^+)$ — Γ_{60}/Γ_{19}

Unseen decay modes of the resonances are included.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
2.98±0.20±0.39	447	JESSOP	98	CLE2	$e^+e^- \approx \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$2.86\pm0.38^{+0.36}_{-0.38}$	217	AVERY	92	CLE2	See JESSOP 98

$\Gamma(\eta\pi^+\pi^0\ \text{3-body})/\Gamma(\phi\pi^+)$ — Γ_{61}/Γ_{19}

Unseen decay modes of the resonances are included.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<1.1	90	JESSOP	98	CLE2	$e^+e^- \approx \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.82	90	[34] DAOUDI	92	CLE2	See JESSOP 98

[34] We use the JESSOP 98 limit, even though the DAOUDI 92 limit, from the same experiment but with a much smaller data sample, is more restrictive.

$\Gamma(3\pi^+2\pi^-\pi^0)/\Gamma_{total}$ — Γ_{62}/Γ

VALUE	DOCUMENT ID		TECN	COMMENT
$\mathbf{0.049^{+0.033}_{-0.030}}$	BARLAG	92C	ACCM	π^- 230 GeV

$\Gamma(\eta'(958)\pi^+)/\Gamma_{total}$ — Γ_{63}/Γ

Unseen decay modes of the $\eta'(958)$ are included.

VALUE (units 10^{-2})	DOCUMENT ID		TECN	COMMENT
3.8 ±0.4 OUR FIT				
3.77±0.25±0.30	[35] ALEXANDER	08	CLEO	e^+e^- at 4.17 GeV

[35] ALEXANDER 08 uses single- and double-tagged events in an overall fit. The correlation matrix for the branching fractions is used in the fit.

$\Gamma(\eta'(958)\pi^+)/\Gamma(\phi\pi^+)$ — Γ_{63}/Γ_{19}

Unseen decay modes of the resonances are included.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.03±0.06±0.07	537	JESSOP	98	CLE2	$e^+e^- \approx \Upsilon(4S)$
1.20±0.15±0.11	281	ALEXANDER	92	CLE2	See JESSOP 98
$2.5 \pm 1.0\ ^{+1.5}_{-0.4}$	22	ALVAREZ	91	NA14	Photoproduction
2.5 ±0.5 ±0.3	215	ALBRECHT	90D	ARG	$e^+e^- \approx 10.4$ GeV

$\Gamma(\eta'(958)\rho^+)/\Gamma(\phi\pi^+)$ — Γ_{65}/Γ_{19}

Unseen decay modes of the resonances are included.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
2.78±0.28±0.30	137	JESSOP	98	CLE2	$e^+e^- \approx \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$3.44 \pm 0.62\ ^{+0.44}_{-0.46}$	68	AVERY	92	CLE2	See JESSOP 98

$\Gamma(\eta'(958)\pi^+\pi^0\ \text{3-body})/\Gamma(\phi\pi^+)$ — Γ_{66}/Γ_{19}

Unseen decay modes of the resonances are included.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.4	90	JESSOP	98	CLE2	$e^+e^- \approx \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.85	90	DAOUDI	92	CLE2	See JESSOP 98

Modes with one or three K's

$\Gamma(K^+\pi^0)/\Gamma(K^+K^0_S)$ — Γ_{67}/Γ_{17}

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
5.5±1.3±0.7	141 ± 34	ADAMS	07A	CLEO	e^+e^-, E_{cm}=4.17 GeV

$\Gamma(K^0_S\pi^+)/\Gamma(K^+K^0_S)$ — Γ_{68}/Γ_{17}

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
8.4±0.9 OUR AVERAGE					
10.4±2.4±1.4	113 ± 26	LINK	08	FOCS	γ A, $\overline{E}_\gamma \approx$ 180 GeV
8.2±0.9±0.2	206 ± 22	ADAMS	07A	CLEO	e^+e^-, E_{cm}=4.17 GeV

$\Gamma(K^+\eta)/\Gamma(\eta\pi^+)$ — Γ_{69}/Γ_{56}

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
8.9±1.5±0.4	113 ± 18	ADAMS	07A	CLEO	e^+e^-, E_{cm}=4.17 GeV

$\Gamma(K^+\eta'(958))/\Gamma(\eta'(958)\pi^+)$ — Γ_{70}/Γ_{63}

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
4.2±1.3±0.3	28 ± 9	ADAMS	07A	CLEO	e^+e^-, E_{cm}=4.17 GeV

$\Gamma(K^+\pi^+\pi^-)/\Gamma_{total}$ — Γ_{71}/Γ

VALUE (units 10^{-2})	DOCUMENT ID		TECN	COMMENT
0.69±0.05 OUR FIT				
0.69±0.05±0.03	[36] ALEXANDER	08	CLEO	e^+e^- at 4.17 GeV

[36] ALEXANDER 08 uses single- and double-tagged events in an overall fit. The correlation matrix for the branching fractions is used in the fit.

$\Gamma(K^+\pi^+\pi^-)/\Gamma(K^+K^-\pi^+)$ — Γ_{71}/Γ_{18}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.126±0.009 OUR FIT					
0.127±0.007±0.014	567 ± 31	LINK	04F	FOCS	γ A, $\overline{E}_\gamma \approx$ 180 GeV

$\Gamma(K^+\pi^+\pi^-)/\Gamma(\phi\pi^+)$ — Γ_{71}/Γ_{19}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.28±0.06±0.05	85	FRABETTI	95E	E687	γBe, $\overline{E}_\gamma$= 220 GeV

$\Gamma(K^+\rho^0)/\Gamma(K^+\pi^+\pi^-)$ — Γ_{72}/Γ_{71}

This is the "fit fraction" from the Dalitz-plot analysis.

VALUE	DOCUMENT ID		TECN	COMMENT
0.3883±0.0531±0.0261	LINK	04F	FOCS	Dalitz fit, 567 evts

$\Gamma(K^+\rho(1450)^0, \rho^0\to\pi^+\pi^-)/\Gamma(K^+\pi^+\pi^-)$ — Γ_{73}/Γ_{71}

This is the "fit fraction" from the Dalitz-plot analysis.

VALUE	DOCUMENT ID		TECN	COMMENT
0.1062±0.0351±0.0104	LINK	04F	FOCS	Dalitz fit, 567 evts

$\Gamma(K^*(892)^0\pi^+, K^{*0}\to K^+\pi^-)/\Gamma(K^+\pi^+\pi^-)$ — Γ_{74}/Γ_{71}

This is the "fit fraction" from the Dalitz-plot analysis.

VALUE	DOCUMENT ID		TECN	COMMENT
0.2164±0.0321±0.0114	LINK	04F	FOCS	Dalitz fit, 567 evts

$\Gamma(K^*(1410)^0\pi^+, K^{*0}\to K^+\pi^-)/\Gamma(K^+\pi^+\pi^-)$ — Γ_{75}/Γ_{71}

This is the "fit fraction" from the Dalitz-plot analysis.

VALUE	DOCUMENT ID		TECN	COMMENT
0.1882±0.0403±0.0122	LINK	04F	FOCS	Dalitz fit, 567 evts

$\Gamma(K^*(1430)^0\pi^+, K^{*0} \to K^+\pi^-)/\Gamma(K^+\pi^+\pi^-)$ — Γ_{76}/Γ_{71}

This is the "fit fraction" from the Dalitz-plot analysis.

VALUE	*DOCUMENT ID*		*TECN*	*COMMENT*
0.0765±0.0500±0.0170	LINK	04F	FOCS	Dalitz fit, 567 evts

$\Gamma(K^+\pi^+\pi^-$ nonresonant$)/\Gamma(K^+\pi^+\pi^-)$ — Γ_{77}/Γ_{71}

This is the "fit fraction" from the Dalitz-plot analysis.

VALUE	*DOCUMENT ID*		*TECN*	*COMMENT*
0.1588±0.0492±0.0153	LINK	04F	FOCS	Dalitz fit, 567 evts

$\Gamma(K^0_S\pi^+\pi^+\pi^-)/\Gamma(K^0_S K^-\pi^+\pi^+)$ — Γ_{78}/Γ_{34}

VALUE	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
0.18±0.04±0.05	179 ± 36	LINK	08	FOCS	γ A, $\overline{E}_\gamma \approx$ 180 GeV

$\Gamma(K^+K^+K^-)/\Gamma(K^+K^-\pi^+)$ — Γ_{79}/Γ_{18}

VALUE (units 10^{-3})	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
$\mathbf{8.95 \pm 2.12^{+2.24}_{-2.31}}$	31	LINK	02I	FOCS	γ nucleus, $\approx$ 180 GeV

$\Gamma(\phi K^+, \phi \to K^+K^-)/\Gamma(\phi\pi^+, \phi \to K^+K^-)$ — Γ_{80}/Γ_{20}

VALUE	*CL%*	*DOCUMENT ID*		*TECN*	*COMMENT*
<0.013	90	FRABETTI	95F	E687	γ Be, $\overline{E}_\gamma \approx$ 220 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.071	90	ANJOS	92D	E691	γ Be, $\overline{E}_\gamma$ = 145 GeV

Doubly Cabibbo-suppressed modes

$\Gamma(K^+K^+\pi^-)/\Gamma(K^+K^-\pi^+)$ — Γ_{81}/Γ_{18}

VALUE	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
0.0052±0.0017±0.0011	27 ± 9	LINK	05K	FOCS	<0.78%, CL = 90%

Baryon-antibaryon mode

$\Gamma(p\overline{n})/\Gamma_{total}$ — Γ_{82}/Γ

This is the only baryonic mode allowed kinematically.

VALUE (units 10^{-3})	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
$\mathbf{1.30 \pm 0.36^{+0.12}_{-0.16}}$	13.0 ± 3.6	ATHAR	08	CLEO	e^+e^-, $E_{cm} \approx$ 4170 MeV

Rare or forbidden modes

$\Gamma(\pi^+e^+e^-)/\Gamma_{total}$ — Γ_{83}/Γ

This mode is not a useful test for a ΔC=1 weak neutral current because both quarks must change flavor in this decay.

VALUE	*CL%*	*DOCUMENT ID*		*TECN*	*COMMENT*
$\mathbf{<2.7 \times 10^{-4}}$	90	AITALA	99G	E791	$\pi^- N$ 500 GeV

$\Gamma(\pi^+ \mu^+ \mu^-)/\Gamma_{total}$ — Γ_{84}/Γ

This mode is not a useful test for a ΔC=1 weak neutral current because both quarks must change flavor in this decay.

VALUE	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
<2.6 × 10^{-5}	90		LINK	03F	FOCS	γ nucleus, $\overline{E}_\gamma \approx$ 180 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •						
$<1.4 \times 10^{-4}$	90		AITALA	99G	E791	$\pi^- N$ 500 GeV
$<4.3 \times 10^{-4}$	90	0	KODAMA	95	E653	π^- emulsion 600 GeV

$\Gamma(K^+ e^+ e^-)/\Gamma_{total}$ — Γ_{85}/Γ

A test for the ΔC=1 weak neutral current. Allowed by higher-order electroweak interactions.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<1.6 × 10^{-3}	90	AITALA	99G	E791	$\pi^- N$ 500 GeV

$\Gamma(K^+ \mu^+ \mu^-)/\Gamma_{total}$ — Γ_{86}/Γ

A test for the ΔC=1 weak neutral current. Allowed by higher-order electroweak interactions.

VALUE	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
<3.6 × 10^{-5}	90		LINK	03F	FOCS	γ nucleus, $\overline{E}_\gamma \approx$ 180 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •						
$<1.4 \times 10^{-4}$	90		AITALA	99G	E791	$\pi^- N$ 500 GeV
$<5.9 \times 10^{-4}$	90	0	KODAMA	95	E653	π^- emulsion 600 GeV

$\Gamma(K^*(892)^+ \mu^+ \mu^-)/\Gamma_{total}$ — Γ_{87}/Γ

A test for the ΔC=1 weak neutral current. Allowed by higher-order electroweak interactions.

VALUE	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
<1.4 × 10^{-3}	90	0	KODAMA	95	E653	π^- emulsion 600 GeV

$\Gamma(\pi^+ e^\pm \mu^\mp)/\Gamma_{total}$ — Γ_{88}/Γ

A test of lepton-family-number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<6.1 × 10^{-4}	90	AITALA	99G	E791	$\pi^- N$ 500 GeV

$\Gamma(K^+ e^\pm \mu^\mp)/\Gamma_{total}$ — Γ_{89}/Γ

A test of lepton-family-number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<6.3 × 10^{-4}	90	AITALA	99G	E791	$\pi^- N$ 500 GeV

$\Gamma(\pi^- e^+ e^+)/\Gamma_{total}$ — Γ_{90}/Γ

A test of lepton-number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<6.9 × 10^{-4}	90	AITALA	99G	E791	$\pi^- N$ 500 GeV

$\Gamma(\pi^- \mu^+ \mu^+)/\Gamma_{total}$ — Γ_{91}/Γ

A test of lepton-number conservation.

VALUE	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
$<2.9 \times 10^{-5}$	90		LINK	03F	FOCS	γ nucleus, $\overline{E}_\gamma \approx$ 180 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •						
$<8.2 \times 10^{-5}$	90		AITALA	99G	E791	$\pi^- N$ 500 GeV
$<4.3 \times 10^{-4}$	90	0	KODAMA	95	E653	π^- emulsion 600 GeV

$\Gamma(\pi^- e^+ \mu^+)/\Gamma_{total}$ — Γ_{92}/Γ

A test of lepton-number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<7.3 \times 10^{-4}$	90	AITALA	99G	E791	$\pi^- N$ 500 GeV

$\Gamma(K^- e^+ e^+)/\Gamma_{total}$ — Γ_{93}/Γ

A test of lepton-number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<6.3 \times 10^{-4}$	90	AITALA	99G	E791	$\pi^- N$ 500 GeV

$\Gamma(K^- \mu^+ \mu^+)/\Gamma_{total}$ — Γ_{94}/Γ

A test of lepton-number conservation.

VALUE	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
$<1.3 \times 10^{-5}$	90		LINK	03F	FOCS	γ nucleus, $\overline{E}_\gamma \approx$ 180 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •						
$<1.8 \times 10^{-4}$	90		AITALA	99G	E791	$\pi^- N$ 500 GeV
$<5.9 \times 10^{-4}$	90	0	KODAMA	95	E653	π^- emulsion 600 GeV

$\Gamma(K^- e^+ \mu^+)/\Gamma_{total}$ — Γ_{95}/Γ

A test of lepton-number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<6.8 \times 10^{-4}$	90	AITALA	99G	E791	$\pi^- N$ 500 GeV

$\Gamma(K^*(892)^- \mu^+ \mu^+)/\Gamma_{total}$ — Γ_{96}/Γ

A test of lepton-number conservation.

VALUE	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
$<1.4 \times 10^{-3}$	90	0	KODAMA	95	E653	π^- emulsion 600 GeV

$D_s^+ - D_s^-$ *CP*-VIOLATING DECAY-RATE ASYMMETRIES

This is the difference of the D_s^+ and D_s^- partial widths divided by the sum of the widths.

$A_{CP}(K^\pm K_S^0)$ in $D_s^\pm \rightarrow K^\pm K_S^0$

VALUE	DOCUMENT ID		TECN	COMMENT
$+0.049 \pm 0.021 \pm 0.009$	ALEXANDER	08	CLEO	$e^+ e^-$ at 4.17 GeV

$A_{CP}(K^+ K^- \pi^\pm)$ in $D_s^\pm \rightarrow K^+ K^- \pi^\pm$

VALUE	DOCUMENT ID		TECN	COMMENT
$+0.003 \pm 0.011 \pm 0.008$	ALEXANDER	08	CLEO	$e^+ e^-$ at 4.17 GeV

$A_{CP}(K^+K^-\pi^\pm\pi^0)$ in $D_s^\pm \to K^+K^-\pi^\pm\pi^0$

VALUE	DOCUMENT ID	TECN	COMMENT
$-0.059\pm0.042\pm0.012$	ALEXANDER 08	CLEO	e^+e^- at 4.17 GeV

$A_{CP}(K_S^0K^\mp 2\pi^\pm)$ in $D_s^+ \to K_S^0K^-2\pi^+$, $D_s^- \to K_S^0K^+2\pi^-$

VALUE	DOCUMENT ID	TECN	COMMENT
$-0.007\pm0.036\pm0.011$	ALEXANDER 08	CLEO	e^+e^- at 4.17 GeV

$A_{CP}(\pi^+\pi^-\pi^\pm)$ in $D_s^\pm \to \pi^+\pi^-\pi^\pm$

VALUE	DOCUMENT ID	TECN	COMMENT
$+0.020\pm0.046\pm0.007$	ALEXANDER 08	CLEO	e^+e^- at 4.17 GeV

$A_{CP}(\pi^\pm\eta)$ in $D_s^\pm \to \pi^\pm\eta$

VALUE	DOCUMENT ID	TECN	COMMENT
$-0.082\pm0.052\pm0.008$	ALEXANDER 08	CLEO	e^+e^- at 4.17 GeV

$A_{CP}(\pi^\pm\eta')$ in $D_s^\pm \to \pi^\pm\eta'$

VALUE	DOCUMENT ID	TECN	COMMENT
$-0.055\pm0.037\pm0.012$	ALEXANDER 08	CLEO	e^+e^- at 4.17 GeV

$A_{CP}(K^\pm\pi^0)$ in $D_s^\pm \to K^\pm\pi^0$

VALUE	DOCUMENT ID	TECN	COMMENT
$+0.02\pm0.29$	ADAMS 07A	CLEO	e^+e^-, $E_{\rm cm}$=4.17 GeV

$A_{CP}(K_S^0\pi^\pm)$ in $D_s^\pm \to K_S^0\pi^\pm$

VALUE	DOCUMENT ID	TECN	COMMENT
$+0.27\pm0.11$	ADAMS 07A	CLEO	e^+e^-, $E_{\rm cm}$=4.17 GeV

$A_{CP}(K^\pm\pi^+\pi^-)$ in $D_s^\pm \to K^\pm\pi^+\pi^-$

VALUE	DOCUMENT ID	TECN	COMMENT
$+0.112\pm0.070\pm0.009$	ALEXANDER 08	CLEO	e^+e^- at 4.17 GeV

$A_{CP}(K^\pm\eta)$ in $D_s^\pm \to K^\pm\eta$

VALUE	DOCUMENT ID	TECN	COMMENT
-0.20 ± 0.18	ADAMS 07A	CLEO	e^+e^-, $E_{\rm cm}$=4.17 GeV

$A_{CP}(K^\pm\eta'(958))$ in $D_s^\pm \to K^\pm\eta'(958)$

VALUE	DOCUMENT ID	TECN	COMMENT
-0.17 ± 0.37	ADAMS 07A	CLEO	e^+e^-, $E_{\rm cm}$=4.17 GeV

$D_s^+ - D_s^-$ T-VIOLATING DECAY-RATE ASYMMETRIES

$A_{Tviol}(K_S^0K^\pm\pi^+\pi^-)$ in $D_s^\pm \to K_S^0K^\pm\pi^+\pi^-$

$C_T \equiv \vec{p}_{K^+}\cdot(\vec{p}_{\pi^+}\times\vec{p}_{\pi^-})$ is a T-odd correlation of the K^+, π^+, and π^- momenta for the D_s^+. $\overline{C}_T \equiv \vec{p}_{K^-}\cdot(\vec{p}_{\pi^-}\times\vec{p}_{\pi^+})$ is the corresponding quantity for the D_s^-. $A_T \equiv [\Gamma(C_T>0)-\Gamma(C_T<0)]\,/\,[\Gamma(C_T>0)+\Gamma(C_T<0)]$ would, in the absence of strong phases, test for T violation in D_s^+ decays (the Γ's are partial widths). With $\overline{A}_T \equiv [\Gamma(-\overline{C}_T > 0) - \Gamma(-\overline{C}_T < 0)] / [\Gamma(-\overline{C}_T > 0) + \Gamma(-\overline{C}_T < 0)]$, the asymmetry $A_{Tviol} \equiv \frac{1}{2}(A_T - \overline{A}_T)$ tests for T violation even with nonzero strong phases.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
−0.036±0.067±0.023	508 ± 34	LINK	05E	FOCS	γ A, $\overline{E}_\gamma \approx$ 180 GeV

$D_s^+ \rightarrow \phi \ell^+ \nu_\ell$ FORM FACTORS

$r_2 \equiv A_2(0)/A_1(0)$ in $D_s^+ \rightarrow \phi \ell^+ \nu_\ell$

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.84 ±0.11 OUR AVERAGE	Error includes scale factor of 2.4.				
0.816±0.036±0.030	25±0.5k	[37] AUBERT	08AN	BABR	$\phi e^+ \nu_e$
0.713±0.202±0.284	793	LINK	04C	FOCS	$\phi \mu^+ \nu_\mu$
1.57 ±0.25 ±0.19	271	AITALA	99D	E791	$\phi e^+ \nu_e$, $\phi \mu^+ \nu_\mu$
1.4 ±0.5 ±0.3	308	AVERY	94B	CLE2	$\phi e^+ \nu_e$
1.1 ±0.8 ±0.1	90	FRABETTI	94F	E687	$\phi \mu^+ \nu_\mu$
2.1 $^{+0.6}_{-0.5}$ ±0.2	19	KODAMA	93	E653	$\phi \mu^+ \nu_\mu$

[37] To compare with previous measurements, this AUBERT 08AN value is from a fit that fixes the pole masses at m_A = 2.5 GeV/c^2 and m_V = 2.1 GeV/c^2. A simultaneous fit to r_2, r_V, r_0 (a significant s-wave contribution) and m_A, gives r_2 = 0.763 ± 0.071 ± 0.065.

$r_v \equiv V(0)/A_1(0)$ in $D_s^+ \rightarrow \phi \ell^+ \nu_\ell$

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
1.80 ±0.08 OUR AVERAGE					
1.807±0.046±0.065	25±0.5k	[38] AUBERT	08AN	BABR	$\phi e^+ \nu_e$
1.549±0.250±0.148	793	LINK	04C	FOCS	$\phi \mu^+ \nu_\mu$
2.27 ±0.35 ±0.22	271	AITALA	99D	E791	$\phi e^+ \nu_e$, $\phi \mu^+ \nu_\mu$
0.9 ±0.6 ±0.3	308	AVERY	94B	CLE2	$\phi e^+ \nu_e$
1.8 ±0.9 ±0.2	90	FRABETTI	94F	E687	$\phi \mu^+ \nu_\mu$
2.3 $^{+1.1}_{-0.9}$ ±0.4	19	KODAMA	93	E653	$\phi \mu^+ \nu_\mu$

[38] To compare with previous measurements, this AUBERT 08AN value is from a fit that fixes the pole masses at m_A = 2.5 GeV/c^2 and m_V = 2.1 GeV/c^2. A simultaneous fit to r_2, r_V, r_0 (a significant s-wave contribution) and m_A, gives r_V = 1.849 ± 0.060 ± 0.095.

Γ_L/Γ_T in $D_s^+ \rightarrow \phi \ell^+ \nu_\ell$

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.72±0.18 OUR AVERAGE					
1.0 ±0.3 ±0.2	308	AVERY	94B	CLE2	$\phi e^+ \nu_e$
1.0 ±0.5 ±0.1	90	[39] FRABETTI	94F	E687	$\phi \mu^+ \nu_\mu$
0.54±0.21±0.10	19	[39] KODAMA	93	E653	$\phi \mu^+ \nu_\mu$

[39] FRABETTI 94F and KODAMA 93 evaluate Γ_L/Γ_T for a lepton mass of zero.

$D_s^{\pm}$ REFERENCES

ALEXANDER	08	PRL 100 161804	J.P. Alexander *et al.*	(CLEO Collab.)
ATHAR	08	PRL 100 181802	S.B. Athar *et al.*	(CLEO Collab.)
AUBERT	08AN	PR D78 051101R	B. Aubert *et al.*	(BABAR Collab.)
ECKLUND	08	PRL 100 161801	K.M. Ecklund *et al.*	(CLEO Collab.)
KLEMPT	08	EPJ C55 39	E. Klempt, M. Matveev, A.V. Sarantsev	(BONN+)
LINK	08	PL B660 147	J.M. Link *et al.*	(FNAL FOCUS Collab.)
WIDHALM	08	PRL 100 241801	L. Widhalm *et al.*	(BELLE Collab.)
ADAMS	07A	PRL 99 191805	G.S. Adams *et al.*	(CLEO Collab.)
AUBERT	07V	PRL 98 141801	B. Aubert *et al.*	(BABAR Collab.)
PEDLAR	07A	PR D76 072002	T.K. Pedlar *et al.*	(CLEO Collab.)
Also		PRL 99 071802	M. Artuso *et al.*	(CLEO Collab.)
AUBERT	06N	PR D74 031103R	B. Aubert *et al.*	(BABAR Collab.)
HUANG	06B	PR D74 112005	G.S. Huang *et al.*	(CLEO Collab.)
PDG	06	JPG 33 1	W.-M. Yao *et al.*	(PDG Collab.)
AUBERT	05V	PR D71 091104R	B. Aubert *et al.*	(BABAR Collab.)
LINK	05E	PL B622 239	J.M. Link *et al.*	(FNAL FOCUS Collab.)
LINK	05J	PRL 95 052003	J.M. Link *et al.*	(FNAL FOCUS Collab.)
LINK	05K	PL B624 166	J.M. Link *et al.*	(FNAL FOCUS Collab.)
LINK	04	PL B585 200	J.M. Link *et al.*	(FNAL FOCUS Collab.)
LINK	04C	PL B586 183	J.M. Link *et al.*	(FNAL FOCUS Collab.)
LINK	04D	PL B586 191	J.M. Link *et al.*	(FNAL FOCUS Collab.)
LINK	04F	PL B601 10	J.M. Link *et al.*	(FNAL FOCUS Collab.)
ACOSTA	03D	PR D68 072004	D. Acosta *et al.*	(FNAL CDF-II Collab.)
ANISOVICH	03	EPJ A16 229	V.V. Anisovich *et al.*	
LINK	03D	PL B561 225	J.M. Link *et al.*	(FNAL FOCUS Collab.)
LINK	03F	PL B572 21	J.M. Link *et al.*	(FNAL FOCUS Collab.)
AUBERT	02G	PR D65 091104R	B. Aubert *et al.*	(BaBar Collab.)
HEISTER	02I	PL B528 1	A. Heister *et al.*	(ALEPH Collab.)
LINK	02I	PL B541 227	J.M. Link *et al.*	(FNAL FOCUS Collab.)
LINK	02J	PL B541 243	J.M. Link *et al.*	(FNAL FOCUS Collab.)
ABBIENDI	01L	PL B516 236	G. Abbiendi *et al.*	(OPAL Collab.)
AITALA	01A	PRL 86 765	E.M. Aitala *et al.*	(FNAL E791 Collab.)
IORI	01	PL B523 22	M. Iori *et al.*	(FNAL SELEX Collab.)
LINK	01C	PRL 87 162001	J.M. Link *et al.*	(FNAL FOCUS Collab.)
ALEXANDROV	00	PL B478 31	Y. Alexandrov *et al.*	(CERN BEATRICE Collab.)
AITALA	99	PL B445 449	E.M. Aitala *et al.*	(FNAL E791 Collab.)
AITALA	99D	PL B450 294	E.M. Aitala *et al.*	(FNAL E791 Collab.)
AITALA	99G	PL B462 401	E.M. Aitala *et al.*	(FNAL E791 Collab.)
BONVICINI	99	PRL 82 4586	G. Bonvicini *et al.*	(CLEO Collab.)
CHADHA	98	PR D58 032002	M. Chada *et al.*	(CLEO Collab.)
JESSOP	98	PR D58 052002	C.P. Jessop *et al.*	(CLEO Collab.)
ACCIARRI	97F	PL B396 327	M. Acciarri *et al.*	(L3 Collab.)
BAI	97	PR D56 3779	J.Z. Bai *et al.*	(BES Collab.)
BALEST	97	PRL 79 1436	R. Balest *et al.*	(CLEO Collab.)
FRABETTI	97C	PL B401 131	P.L. Frabetti *et al.*	(FNAL E687 Collab.)
FRABETTI	97D	PL B407 79	P.L. Frabetti *et al.*	(FNAL E687 Collab.)
ARTUSO	96	PL B378 364	M. Artuso *et al.*	(CLEO Collab.)
BAI	95C	PR D52 3781	J.Z. Bai *et al.*	(BES Collab.)
BRANDENB...	95	PRL 75 3804	G.W. Brandenburg *et al.*	(CLEO Collab.)
FRABETTI	95B	PL B351 591	P.L. Frabetti *et al.*	(FNAL E687 Collab.)
FRABETTI	95E	PL B359 403	P.L. Frabetti *et al.*	(FNAL E687 Collab.)
FRABETTI	95F	PL B363 259	P.L. Frabetti *et al.*	(FNAL E687 Collab.)
KODAMA	95	PL B345 85	K. Kodama *et al.*	(FNAL E653 Collab.)
ACOSTA	94	PR D49 5690	D. Acosta *et al.*	(CLEO Collab.)
AVERY	94B	PL B337 405	P. Avery *et al.*	(CLEO Collab.)
BROWN	94	PR D50 1884	D. Brown *et al.*	(CLEO Collab.)
BUTLER	94	PL B324 255	F. Butler *et al.*	(CLEO Collab.)
FRABETTI	94F	PL B328 187	P.L. Frabetti *et al.*	(FNAL E687 Collab.)
ADAMOVICH	93	PL B305 177	M.I. Adamovich *et al.*	(CERN WA82 Collab.)
FRABETTI	93F	PRL 71 827	P.L. Frabetti *et al.*	(FNAL E687 Collab.)
FRABETTI	93G	PL B313 253	P.L. Frabetti *et al.*	(FNAL E687 Collab.)
KODAMA	93	PL B309 483	K. Kodama *et al.*	(FNAL E653 Collab.)
ALBRECHT	92B	ZPHY C53 361	H. Albrecht *et al.*	(ARGUS Collab.)
ALEXANDER	92	PRL 68 1275	J. Alexander *et al.*	(CLEO Collab.)
ANJOS	92D	PRL 69 2892	J.C. Anjos *et al.*	(FNAL E691 Collab.)
AVERY	92	PRL 68 1279	P. Avery *et al.*	(CLEO Collab.)
BARLAG	92C	ZPHY C55 383	S. Barlag *et al.*	(ACCMOR Collab.)
Also		ZPHY C48 29	S. Barlag *et al.*	(ACCMOR Collab.)

DAOUDI	92	PR D45 3965	M. Daoudi *et al.*	(CLEO Collab.)
FRABETTI	92	PL B281 167	P.L. Frabetti *et al.*	(FNAL E687 Collab.)
ALBRECHT	91	PL B255 634	H. Albrecht *et al.*	(ARGUS Collab.)
ALVAREZ	91	PL B255 639	M.P. Alvarez *et al.*	(CERN NA14/2 Collab.)
COFFMAN	91	PL B263 135	D.M. Coffman *et al.*	(Mark III Collab.)
ALBRECHT	90D	PL B245 315	H. Albrecht *et al.*	(ARGUS Collab.)
ALEXANDER	90B	PRL 65 1531	J. Alexander *et al.*	(CLEO Collab.)
ALVAREZ	90C	PL B246 261	M.P. Alvarez *et al.*	(CERN NA14/2 Collab.)
ANJOS	90C	PR D41 2705	J.C. Anjos *et al.*	(FNAL E691 Collab.)
BARLAG	90C	ZPHY C46 563	S. Barlag *et al.*	(ACCMOR Collab.)
FRABETTI	90	PL B251 639	P.L. Frabetti *et al.*	(FNAL E687 Collab.)
ADLER	89B	PRL 63 1211	J. Adler *et al.*	(Mark III Collab.)
Also		PRL 63 2858 (erratum)	J. Adler *et al.*	(Mark III Collab.)
ANJOS	89	PRL 62 125	J.C. Anjos *et al.*	(FNAL E691 Collab.)
ANJOS	89E	PL B223 267	J.C. Anjos *et al.*	(FNAL E691 Collab.)
CHEN	89	PL B226 192	W.Y. Chen *et al.*	(CLEO Collab.)
ALBRECHT	88	PL B207 349	H. Albrecht *et al.*	(ARGUS Collab.)
ANJOS	88	PRL 60 897	J.C. Anjos *et al.*	(FNAL E691 Collab.)
RAAB	88	PR D37 2391	J.R. Raab *et al.*	(FNAL E691 Collab.)
ALBRECHT	87F	PL B179 398	H. Albrecht *et al.*	(ARGUS Collab.)
ALBRECHT	87G	PL B195 102	H. Albrecht *et al.*	(ARGUS Collab.)
BECKER	87B	PL B184 277	H. Becker *et al.*	(NA11 and NA32 Collab.)
BLAYLOCK	87	PRL 58 2171	G.T. Blaylock *et al.*	(Mark III Collab.)
USHIDA	86	PRL 56 1767	N. Ushida *et al.*	(FNAL E531 Collab.)
ALBRECHT	85D	PL 153B 343	H. Albrecht *et al.*	(ARGUS Collab.)
DERRICK	85B	PRL 54 2568	M. Derrick *et al.*	(HRS Collab.)
AIHARA	84D	PRL 53 2465	H. Aihara *et al.*	(TPC Collab.)
ALTHOFF	84	PL 136B 130	M. Althoff *et al.*	(TASSO Collab.)
BAILEY	84	PL 139B 320	R. Bailey *et al.*	(ACCMOR Collab.)
CHEN	83C	PRL 51 634	A. Chen *et al.*	(CLEO Collab.)

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