$D_s^{\pm}$

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

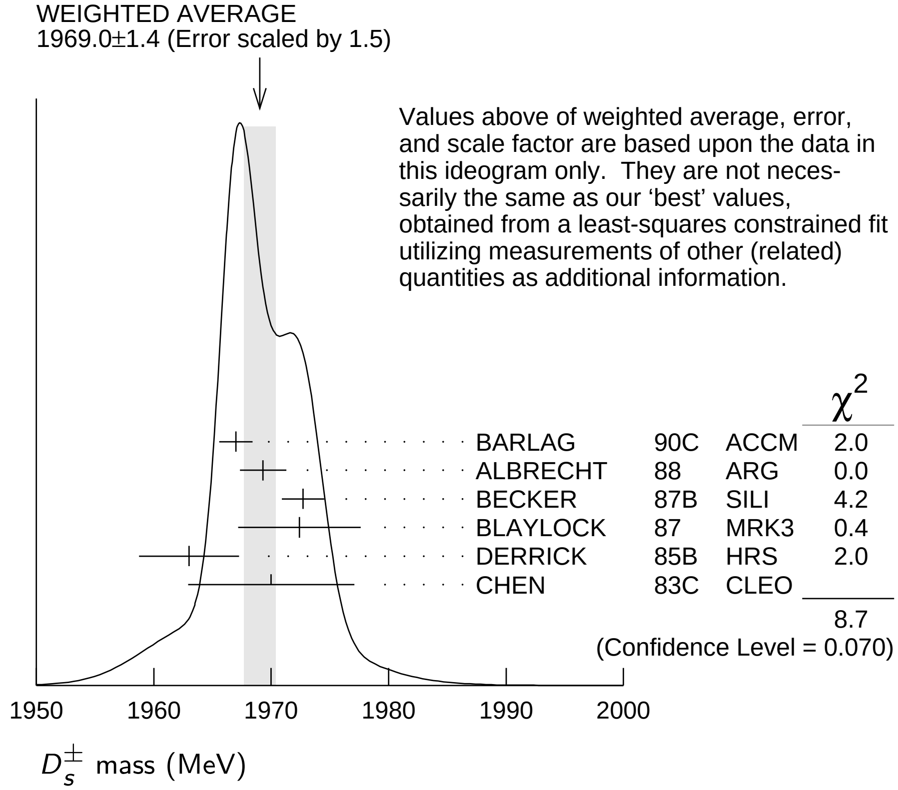
The angular distributions of the decays of the ϕ and $\overline{K}^*(892)^0$ in the $\phi\pi^+$ and $K^+\overline{K}^*(892)^0$ modes strongly indicate that the spin is zero. The parity given is that expected of a $c\overline{s}$ ground state.

$D_s^{\pm}$ MASS

The fit includes $D^{\pm}$, D^0, $D_s^{\pm}$, $D^{*\pm}$, D^{*0}, $D_s^{*\pm}$, $D_1(2420)^0$, $D_2^*(2460)^0$, and $D_{s1}(2536)^{\pm}$ 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*
1968.34± 0.07 OUR FIT					
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}, $D_s^{*\pm}$, $D_1(2420)^0$, $D_2^*(2460)^0$, and $D_{s1}(2536)^\pm$ mass and mass difference measurements.

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
98.69±0.05 OUR FIT					
98.69±0.05 OUR AVERAGE					
98.68±0.03±0.04		AAIJ	13V	LHCB	$D_s^+ \rightarrow K^+ K^- \pi^+$
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*
504 ± 4 OUR AVERAGE	Error includes scale factor of 1.2.				
506.4± 3.0± 1.7±1.7		[1] AAIJ	17AN	LHCB	pp at 7, 8 TeV
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

$518 \pm 14 \pm 7$	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	γBe, $\phi\pi^+$
$500 \pm 60 \pm 30$	104	FRABETTI	90	E687	γBe, $\phi\pi^+$
$470 \pm 40 \pm 20$	228	RAAB	88	E691	Photoproduction

[1] This AAIJ 17AN value is derived from the difference between the D_s^- and D^- widths. The 3rd uncertainty, $\pm 1.7 \times 10^{-15}$ s, arises from the uncertainty of the D^- width.

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

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)	Scale factor/ Confidence level
	Inclusive modes			
Γ_1	e^+ semileptonic	[a]	(6.5 ± 0.4) %	
Γ_2	π^+ anything		(119.3 ± 1.4) %	
Γ_3	π^- anything		(43.2 ± 0.9) %	
Γ_4	π^0 anything		(123 ± 7) %	
Γ_5	K^- anything		(18.7 ± 0.5) %	
Γ_6	K^+ anything		(28.9 ± 0.7) %	
Γ_7	K_S^0 anything		(19.0 ± 1.1) %	
Γ_8	η anything	[b]	(29.9 ± 2.8) %	
Γ_9	ω anything		(6.1 ± 1.4) %	
Γ_{10}	η' anything	[c]	(10.3 ± 1.4) %	S=1.1
Γ_{11}	$f_0(980)$ anything, $f_0 \to \pi^+\pi^-$		< 1.3 %	CL=90%
Γ_{12}	ϕ anything		(15.7 ± 1.0) %	
Γ_{13}	$K^+ K^-$ anything		(15.8 ± 0.7) %	
Γ_{14}	$K_S^0 K^+$ anything		(5.8 ± 0.5) %	
Γ_{15}	$K_S^0 K^-$ anything		(1.9 ± 0.4) %	
Γ_{16}	$2K_S^0$ anything		(1.70 ± 0.32) %	
Γ_{17}	$2K^+$ anything		$< 2.6 \times 10^{-3}$	CL=90%
Γ_{18}	$2K^-$ anything		$< 6 \times 10^{-4}$	CL=90%
	Leptonic and semileptonic modes			
Γ_{19}	$e^+ \nu_e$		$< 8.3 \times 10^{-5}$	CL=90%
Γ_{20}	$\mu^+ \nu_\mu$		$(5.50 \pm 0.23) \times 10^{-3}$	
Γ_{21}	$\tau^+ \nu_\tau$		(5.48 ± 0.23) %	
Γ_{22}	$K^+ K^- e^+ \nu_e$		—	
Γ_{23}	$\phi e^+ \nu_e$	[d]	(2.39 ± 0.16) %	S=1.3
Γ_{24}	$\phi \mu^+ \nu_\mu$		(1.9 ± 0.5) %	
Γ_{25}	$\eta e^+ \nu_e + \eta'(958) e^+ \nu_e$	[d]	(3.03 ± 0.24) %	

Γ_{26}	$\eta e^+ \nu_e$	[d]	(2.29 ± 0.19) %	
Γ_{27}	$\eta'(958) e^+ \nu_e$	[d]	$(7.4\ \pm1.4\ ) \times 10^{-3}$	
Γ_{28}	$\eta \mu^+ \nu_\mu$		$(2.4\ \pm0.5\ )$ %	
Γ_{29}	$\eta'(958) \mu^+ \nu_\mu$		$(1.1\ \pm0.5\ )$ %	
Γ_{30}	$\omega e^+ \nu_e$	[e]	$< 2.0 \times 10^{-3}$	CL=90%
Γ_{31}	$K^0 e^+ \nu_e$		$(3.9\ \pm0.9\ ) \times 10^{-3}$	
Γ_{32}	$K^*(892)^0 e^+ \nu_e$	[d]	$(1.8\ \pm0.4\ ) \times 10^{-3}$	
Γ_{33}	$f_0(980) e^+ \nu_e,\ f_0 \to \pi^+\pi^-$			

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

Γ_{34}	$K^+ K^0_S$		(1.50 ± 0.05) %	
Γ_{35}	$K^+ \overline{K}^0$		(2.95 ± 0.14) %	
Γ_{36}	$K^+ K^- \pi^+$	[f]	(5.45 ± 0.17) %	S=1.2
Γ_{37}	$\phi\pi^+$	[d,g]	$(4.5\ \pm0.4\ )$ %	
Γ_{38}	$\phi\pi^+,\ \phi \to K^+K^-$	[g]	(2.27 ± 0.08) %	
Γ_{39}	$K^+ \overline{K}^*(892)^0,\ \overline{K}^{*0} \to K^-\pi^+$		(2.61 ± 0.09) %	
Γ_{40}	$f_0(980)\pi^+,\ f_0 \to K^+K^-$		(1.15 ± 0.32) %	
Γ_{41}	$f_0(1370)\pi^+,\ f_0 \to K^+K^-$		$(7\ \ \pm5\ \ ) \times 10^{-4}$	
Γ_{42}	$f_0(1710)\pi^+,\ f_0 \to K^+K^-$		$(6.7\ \pm2.9\ ) \times 10^{-4}$	
Γ_{43}	$K^+ \overline{K}^*_0(1430)^0,\ \overline{K}^*_0 \to K^-\pi^+$		$(1.9\ \pm0.4\ ) \times 10^{-3}$	
Γ_{44}	$K^+ K^0_S \pi^0$		(1.52 ± 0.22) %	
Γ_{45}	$2K^0_S \pi^+$		$(7.7\ \pm0.6\ ) \times 10^{-3}$	
Γ_{46}	$K^0 \overline{K}^0 \pi^+$		—	
Γ_{47}	$K^*(892)^+ \overline{K}^0$	[d]	$(5.4\ \pm1.2\ )$ %	
Γ_{48}	$K^+ K^- \pi^+ \pi^0$		$(6.3\ \pm0.6\ )$ %	
Γ_{49}	$\phi\rho^+$	[d]	$(8.4\ ^{+1.9}_{-2.3})$ %	
Γ_{50}	$K^0_S K^- 2\pi^+$		(1.68 ± 0.10) %	
Γ_{51}	$K^*(892)^+ \overline{K}^*(892)^0$	[d]	$(7.2\ \pm2.6\ )$ %	
Γ_{52}	$K^+ K^0_S \pi^+\pi^-$		(1.00 ± 0.08) %	
Γ_{53}	$K^+ K^- 2\pi^+\pi^-$		$(8.7\ \pm1.5\ ) \times 10^{-3}$	
Γ_{54}	$\phi 2\pi^+\pi^-$	[d]	(1.21 ± 0.16) %	
Γ_{55}	$K^+ K^- \rho^0 \pi^+$ non-ϕ		$< 2.6 \times 10^{-4}$	CL=90%
Γ_{56}	$\phi\rho^0\pi^+,\ \phi \to K^+K^-$		$(6.5\ \pm1.3\ ) \times 10^{-3}$	
Γ_{57}	$\phi a_1(1260)^+,\ \phi \to K^+K^-,\ a_1^+ \to \rho^0\pi^+$		$(7.5\ \pm1.2\ ) \times 10^{-3}$	
Γ_{58}	$K^+ K^- 2\pi^+\pi^-$ nonresonant		$(9\ \ \pm7\ \ ) \times 10^{-4}$	
Γ_{59}	$2K^0_S 2\pi^+\pi^-$		$(9\ \ \pm4\ \ ) \times 10^{-4}$	

Hadronic modes without K's

Γ_{60}	$\pi^+\pi^0$		$<$	3.5	$\times 10^{-4}$	CL=90%
Γ_{61}	$2\pi^+\pi^-$			(1.09±0.05)	%	S=1.1
Γ_{62}	$\rho^0\pi^+$			(2.0 ±1.2)	$\times 10^{-4}$	
Γ_{63}	$\pi^+(\pi^+\pi^-)_{S-\text{wave}}$	[h]		(9.1 ±0.4)	$\times 10^{-3}$	
Γ_{64}	$f_0(980)\pi^+$, $f_0 \to \pi^+\pi^-$					
Γ_{65}	$f_0(1370)\pi^+$, $f_0 \to \pi^+\pi^-$					
Γ_{66}	$f_0(1500)\pi^+$, $f_0 \to \pi^+\pi^-$					
Γ_{67}	$f_2(1270)\pi^+$, $f_2 \to \pi^+\pi^-$			(1.10±0.20)	$\times 10^{-3}$	
Γ_{68}	$\rho(1450)^0\pi^+$, $\rho^0 \to \pi^+\pi^-$			(3.0 ±2.0)	$\times 10^{-4}$	
Γ_{69}	$\pi^+2\pi^0$			(6.5 ±1.3)	$\times 10^{-3}$	
Γ_{70}	$2\pi^+\pi^-\pi^0$			—		
Γ_{71}	$\eta\pi^+$	[d]		(1.70±0.09)	%	S=1.1
Γ_{72}	$\omega\pi^+$	[d]		(2.4 ±0.6)	$\times 10^{-3}$	
Γ_{73}	$3\pi^+2\pi^-$			(8.0 ±0.8)	$\times 10^{-3}$	
Γ_{74}	$2\pi^+\pi^-2\pi^0$			—		
Γ_{75}	$\eta\rho^+$	[d]		(8.9 ±0.8)	%	
Γ_{76}	$\eta\pi^+\pi^0$			(9.2 ±1.2)	%	
Γ_{77}	$\omega\pi^+\pi^0$	[d]		(2.8 ±0.7)	%	
Γ_{78}	$3\pi^+2\pi^-\pi^0$			(4.9 ±3.2)	%	
Γ_{79}	$\omega 2\pi^+\pi^-$	[d]		(1.6 ±0.5)	%	
Γ_{80}	$\eta'(958)\pi^+$	[c,d]		(3.94±0.25)	%	
Γ_{81}	$3\pi^+2\pi^-2\pi^0$			—		
Γ_{82}	$\omega\eta\pi^+$	[d]	$<$	2.13	%	CL=90%
Γ_{83}	$\eta'(958)\rho^+$	[c,d]		(5.8 ±1.5)	%	
Γ_{84}	$\eta'(958)\pi^+\pi^0$			(5.6 ±0.8)	%	
Γ_{85}	$\eta'(958)\pi^+\pi^0$ nonresonant		$<$	5.1	%	CL=90%

Modes with one or three K's

Γ_{86}	$K^+\pi^0$			(6.3 ±2.1)	$\times 10^{-4}$	
Γ_{87}	$K^0_S\pi^+$			(1.22±0.06)	$\times 10^{-3}$	
Γ_{88}	$K^+\eta$	[d]		(1.77±0.35)	$\times 10^{-3}$	
Γ_{89}	$K^+\omega$	[d]	$<$	2.4	$\times 10^{-3}$	CL=90%
Γ_{90}	$K^+\eta'(958)$	[d]		(1.8 ±0.6)	$\times 10^{-3}$	
Γ_{91}	$K^+\pi^+\pi^-$			(6.6 ±0.4)	$\times 10^{-3}$	
Γ_{92}	$K^+\rho^0$			(2.5 ±0.4)	$\times 10^{-3}$	
Γ_{93}	$K^+\rho(1450)^0$, $\rho^0 \to \pi^+\pi^-$			(7.0 ±2.4)	$\times 10^{-4}$	
Γ_{94}	$K^*(892)^0\pi^+$, $K^{*0} \to K^+\pi^-$			(1.42±0.24)	$\times 10^{-3}$	
Γ_{95}	$K^*(1410)^0\pi^+$, $K^{*0} \to K^+\pi^-$			(1.24±0.29)	$\times 10^{-3}$	
Γ_{96}	$K^*(1430)^0\pi^+$, $K^{*0} \to K^+\pi^-$			(5.0 ±3.5)	$\times 10^{-4}$	
Γ_{97}	$K^+\pi^+\pi^-$ nonresonant			(1.04±0.34)	$\times 10^{-3}$	
Γ_{98}	$K^0\pi^+\pi^0$			(1.00±0.18)	%	

Γ_{99}	$K^0_S 2\pi^+\pi^-$			$(3.0 \pm 1.1) \times 10^{-3}$	
Γ_{100}	$K^+\omega\pi^0$		[d]	$< 8.2 \times 10^{-3}$	CL=90%
Γ_{101}	$K^+\omega\pi^+\pi^-$		[d]	$< 5.4 \times 10^{-3}$	CL=90%
Γ_{102}	$K^+\omega\eta$		[d]	$< 7.9 \times 10^{-3}$	CL=90%
Γ_{103}	$2K^+K^-$			$(2.18\pm0.21) \times 10^{-4}$	
Γ_{104}	$\phi K^+,\ \phi \to K^+K^-$			$(8.9 \pm 2.0) \times 10^{-5}$	

Doubly Cabibbo-suppressed modes

Γ_{105}	$2K^+\pi^-$			$(1.27\pm0.13) \times 10^{-4}$	
Γ_{106}	$K^+K^*(892)^0,\ K^{*0} \to K^+\pi^-$			$(6.0 \pm 3.4) \times 10^{-5}$	

Baryon-antibaryon mode

Γ_{107}	$p\overline{n}$			$(1.22\pm0.11) \times 10^{-3}$	

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

Γ_{108}	$\pi^+e^+e^-$		[i]	$< 1.3 \times 10^{-5}$	CL=90%
Γ_{109}	$\pi^+\phi,\ \phi \to e^+e^-$		[j]	$(6\ ^{+8}_{-4}) \times 10^{-6}$	
Γ_{110}	$\pi^+\mu^+\mu^-$		[i]	$< 4.1 \times 10^{-7}$	CL=90%
Γ_{111}	$K^+e^+e^-$	*C1*		$< 3.7 \times 10^{-6}$	CL=90%
Γ_{112}	$K^+\mu^+\mu^-$	*C1*		$< 2.1 \times 10^{-5}$	CL=90%
Γ_{113}	$K^*(892)^+\mu^+\mu^-$	*C1*		$< 1.4 \times 10^{-3}$	CL=90%
Γ_{114}	$\pi^+e^+\mu^-$	*LF*		$< 1.2 \times 10^{-5}$	CL=90%
Γ_{115}	$\pi^+e^-\mu^+$	*LF*		$< 2.0 \times 10^{-5}$	CL=90%
Γ_{116}	$K^+e^+\mu^-$	*LF*		$< 1.4 \times 10^{-5}$	CL=90%
Γ_{117}	$K^+e^-\mu^+$	*LF*		$< 9.7 \times 10^{-6}$	CL=90%
Γ_{118}	π^-2e^+	*L*		$< 4.1 \times 10^{-6}$	CL=90%
Γ_{119}	$\pi^-2\mu^+$	*L*		$< 1.2 \times 10^{-7}$	CL=90%
Γ_{120}	$\pi^-e^+\mu^+$	*L*		$< 8.4 \times 10^{-6}$	CL=90%
Γ_{121}	K^-2e^+	*L*		$< 5.2 \times 10^{-6}$	CL=90%
Γ_{122}	$K^-2\mu^+$	*L*		$< 1.3 \times 10^{-5}$	CL=90%
Γ_{123}	$K^-e^+\mu^+$	*L*		$< 6.1 \times 10^{-6}$	CL=90%
Γ_{124}	$K^*(892)^-2\mu^+$	*L*		$< 1.4 \times 10^{-3}$	CL=90%

[a] This is the purely e^+ semileptonic branching fraction: the e^+ fraction from τ^+ decays has been subtracted off. The sum of our (non-τ) e^+ exclusive fractions — an $e^+\nu_e$ with an η, η', ϕ, K^0, or K^{*0} — is 5.99 ± 0.31 %.

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

[c] The sum of our exclusive η' fractions — $\eta' e^+\nu_e$, $\eta'\mu^+\nu_\mu$, $\eta'\pi^+$, $\eta'\rho^+$, and $\eta' K^+$ — is 11.8 ± 1.6%.

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

[*e*] A test for $u\overline{u}$ or $d\overline{d}$ content in the D_s^+. Neither Cabibbo-favored nor Cabibbo-suppressed decays can contribute, and $\omega-\phi$ mixing is an unlikely explanation for any fraction above about 2×10^{-4}.

[*f*] 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.

[*g*] 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.

[*h*] This is the average of a model-independent and a K-matrix parametrization of the $\pi^+\pi^-$ S-wave and is a sum over several f_0 mesons.

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

[*j*] This is *not* a test for the ΔC=1 weak neutral current, but leads to the $\pi^+\ell^+\ell^-$ final state.

CONSTRAINED FIT INFORMATION

An overall fit to 13 branching ratios uses 16 measurements and one constraint to determine 10 parameters. The overall fit has a $\chi^2 = 4.8$ for 7 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_{36}	55							
x_{48}	15	27						
x_{50}	36	33	10					
x_{52}	24	26	9	38				
x_{61}	36	55	16	21	18			
x_{71}	16	0	−3	10	2	−1		
x_{72}	2	0	0	1	0	0	11	
x_{91}	21	19	3	13	7	10	12	1
	x_{34}	x_{36}	x_{48}	x_{50}	x_{52}	x_{61}	x_{71}	x_{72}

See the related review(s):

D_s^+ Branching Fractions

D_s^+ BRANCHING RATIOS

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

Inclusive modes

$\Gamma(e^+ \text{semileptonic})/\Gamma_{\text{total}}$ — Γ_1/Γ

This is the purely e^+ semileptonic branching fraction: the e^+ fraction from τ^+ decays has been subtracted off. The sum of our (non-τ) e^+ exclusive fractions — an $e^+\nu_e$ with an η, η', ϕ, K^0, or K^{*0} — is 5.99 ± 0.31 %.

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
6.52±0.39±0.15	536 ± 29	[1] ASNER	10	CLEO	e^+e^- at 3774 MeV

[1] Using the D_s^+ and D^0 lifetimes, ASNER 10 finds that the ratio of the D_s^+ and D^0 semileptonic widths is 0.828 ± 0.051 ± 0.025.

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

Events with two π^+'s count twice, etc. But π^+'s from $K_S^0 \rightarrow \pi^+\pi^-$ are not included.

VALUE (%)	DOCUMENT ID		TECN	COMMENT
119.3±1.2±0.7	DOBBS	09	CLEO	e^+e^- at 4170 MeV

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

Events with two π^-'s count twice, etc. But π^-'s from $K_S^0 \rightarrow \pi^+\pi^-$ are not included.

VALUE (%)	DOCUMENT ID		TECN	COMMENT
43.2±0.9±0.3	DOBBS	09	CLEO	e^+e^- at 4170 MeV

$\Gamma(\pi^0 \text{ anything})/\Gamma_{\text{total}}$ — Γ_4/Γ

Events with two π^0's count twice, etc. But π^0's from $K_S^0 \rightarrow 2\pi^0$ are not included.

VALUE (%)	DOCUMENT ID		TECN	COMMENT
123.4±3.8±5.3	DOBBS	09	CLEO	e^+e^- at 4170 MeV

$\Gamma(K^- \text{anything})/\Gamma_{\text{total}}$ — Γ_5/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
18.7±0.5±0.2	DOBBS	09	CLEO	e^+e^- at 4170 MeV

$\Gamma(K^+ \text{anything})/\Gamma_{\text{total}}$ — Γ_6/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
28.9±0.6±0.3	DOBBS	09	CLEO	e^+e^- at 4170 MeV

$\Gamma(K_S^0 \text{ anything})/\Gamma_{\text{total}}$ — Γ_7/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
19.0±1.0±0.4	DOBBS	09	CLEO	e^+e^- at 4170 MeV

$\Gamma(\eta\text{ anything})/\Gamma_{total}$ — Γ_8/Γ

This ratio includes η particles from η' decays.

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
29.9±2.2±1.7		DOBBS	09	CLEO	e^+e^- at 4170 MeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
23.5±3.1±2.0	674 ± 91	HUANG	06B	CLEO	See DOBBS 09

$\Gamma(\omega\text{ anything})/\Gamma_{total}$ — Γ_9/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
6.1±1.4±0.3	DOBBS	09	CLEO	e^+e^- at 4170 MeV

$\Gamma(\eta'\text{ anything})/\Gamma_{total}$ — Γ_{10}/Γ

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
10.3±1.4 OUR AVERAGE Error includes scale factor of 1.1.					
8.8±1.8±0.5	68	ABLIKIM	15Z	BES3	482 pb^{-1}, 4009 MeV
11.7±1.7±0.7		DOBBS	09	CLEO	e^+e^- at 4170 MeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
8.7±1.9±0.8	68	HUANG	06B	CLEO	See DOBBS 09

$\Gamma(f_0(980)\text{ anything}, f_0 \to \pi^+\pi^-)/\Gamma_{total}$ — Γ_{11}/Γ

VALUE (%)	CL%	DOCUMENT ID		TECN	COMMENT
<1.3	90	DOBBS	09	CLEO	e^+e^- at 4170 MeV

$\Gamma(\phi\text{ anything})/\Gamma_{total}$ — Γ_{12}/Γ

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
15.7±0.8±0.6		DOBBS	09	CLEO	e^+e^- at 4170 MeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
16.1±1.2±1.1	398 ± 27	HUANG	06B	CLEO	See DOBBS 09

$\Gamma(K^+K^-\text{ anything})/\Gamma_{total}$ — Γ_{13}/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
15.8±0.6±0.3	DOBBS	09	CLEO	e^+e^- at 4170 MeV

$\Gamma(K^0_S K^+\text{ anything})/\Gamma_{total}$ — Γ_{14}/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
5.8±0.5±0.1	DOBBS	09	CLEO	e^+e^- at 4170 MeV

$\Gamma(K^0_S K^-\text{ anything})/\Gamma_{total}$ — Γ_{15}/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
1.9±0.4±0.1	DOBBS	09	CLEO	e^+e^- at 4170 MeV

$\Gamma(2K^0_S\text{ anything})/\Gamma_{total}$ — Γ_{16}/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
1.7±0.3±0.1	DOBBS	09	CLEO	e^+e^- at 4170 MeV

$\Gamma(2K^+\text{ anything})/\Gamma_{total}$ — Γ_{17}/Γ

VALUE (%)	CL%	DOCUMENT ID		TECN	COMMENT
<0.26	90	DOBBS	09	CLEO	e^+e^- at 4170 MeV

$\Gamma(2K^- \text{anything})/\Gamma_{total}$ Γ_{18}/Γ

VALUE (%)	CL%	DOCUMENT ID		TECN	COMMENT
<0.06	90	DOBBS	09	CLEO	e^+e^- at 4170 MeV

Leptonic and semileptonic modes

See the related review(s):

Leptonic Decays of Charged Pseudoscalar Mesons

$\Gamma(e^+\nu_e)/\Gamma_{total}$ Γ_{19}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<0.83 \times 10^{-4}$	90	[1] ZUPANC	13	BELL	e^+e^- at $\Upsilon(4S), \Upsilon(5S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<2.3 \times 10^{-4}$	90	DEL-AMO-SA...	10J	BABR	e^+e^-, 10.58 GeV
$<1.2 \times 10^{-4}$	90	ALEXANDER	09	CLEO	e^+e^- at 4170 MeV
$<1.3 \times 10^{-4}$	90	PEDLAR	07A	CLEO	See ALEXANDER 09

[1] ZUPANC 13 also gives the limit as $< 1.0 \times 10^{-4}$ at 95% CL.

$\Gamma(\mu^+\nu_\mu)/\Gamma_{total}$ Γ_{20}/Γ

See the note on "Decay Constants of Charged Pseudoscalar Mesons" above.

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
5.50±0.23 OUR AVERAGE					
$4.95\pm0.67\pm0.26$	69	[1] ABLIKIM	16O	BES3	e^+e^- at 4.009 GeV
$5.31\pm0.28\pm0.20$	492 ± 26	[2] ZUPANC	13	BELL	e^+e^- at $\Upsilon(4S), \Upsilon(5S)$
$6.02\pm0.38\pm0.34$	275 ± 17	[3] DEL-AMO-SA...	10J	BABR	e^+e^-, 10.58 GeV
$5.65\pm0.45\pm0.17$	235 ± 14	ALEXANDER	09	CLEO	e^+e^- at 4170 MeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$6.44\pm0.76\pm0.57$	169 ± 18	[4] WIDHALM	08	BELL	See ZUPANC 13
$5.94\pm0.66\pm0.31$	88	[5] PEDLAR	07A	CLEO	See ALEXANDER 09
$6.8 \pm1.1 \pm1.8$	553	[6] HEISTER	02I	ALEP	Z decays

[1] ABLIKIM 16O value is constrained by the Standard Model ratio of $\Gamma(D_s^+ \to \tau^+\nu_\tau)/\Gamma(D_s^+ \to \mu^+\nu_\mu) = 9.76$; the unconstrained value is $(0.517 \pm 0.075 \pm 0.021)$%. The constrained value is used to obtain the decay constant, $f_{D_s^+} = (241.0 \pm 16.3 \pm 6.6)$ MeV.

[2] ZUPANC 13 uses both $\mu^+\nu$ and $\tau^+\nu$ events to get $f_{D_s} = (255.5 \pm 4.2 \pm 5.1)$ MeV.

[3] DEL-AMO-SANCHEZ 10J uses $\mu^+\nu_\mu$ and $\tau^+\nu_\tau$ events together to get $f_{D_s} = (258.6 \pm 6.4 \pm 7.5)$ MeV.

[4] WIDHALM 08 gets $f_{D_s} = (275 \pm 16 \pm 12)$ 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 $(6.38 \pm 0.59 \pm 0.33) \times 10^{-3}$

[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 $D_s^+ \to \tau^+\nu_\tau$ and $\mu^+\nu_\mu$ branching fractions to get $f_{D_s} = (285 \pm 19 \pm 40)$ MeV.

$\Gamma(\mu^+\nu_\mu)/\Gamma(\phi\pi^+)$ — Γ_{20}/Γ_{37}

See the note on "Decay Constants of Charged Pseudoscalar Mesons" above.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$0.143\pm0.018\pm0.006$	489 ± 55	[1] AUBERT	07V	BABR	$e^+e^- \approx \Upsilon(4S)$
$0.23\ \pm0.06\ \pm0.04$	18	[2] ALEXANDROV	00	BEAT	π^- nucleus, 350 GeV
$0.173\pm0.023\pm0.035$	182	[3] CHADHA	98	CLE2	$e^+e^- \approx \Upsilon(4S)$
$0.245\pm0.052\pm0.074$	39	[4] ACOSTA	94	CLE2	See CHADHA 98

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

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

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

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

$\Gamma(\tau^+\nu_\tau)/\Gamma_{\text{total}}$ — Γ_{21}/Γ

See the note on "Decay Constants of Charged Pseudoscalar Mesons" above.

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
5.48±0.23 OUR AVERAGE					
$4.83\pm0.65\pm0.26$	33	[1] ABLIKIM	16O	BES3	e^+e^- at 4.009 GeV
$5.70\pm0.21{}^{+0.31}_{-0.30}$	2.2k	[2] ZUPANC	13	BELL	e^+e^- at $\Upsilon(4S)$, $\Upsilon(5S)$
$4.96\pm0.37\pm0.57$	748 ± 53	[3] DEL-AMO-SA..	10J	BABR	$e^-\overline{\nu}_e\nu_\tau$, $\mu^-\overline{\nu}_\mu\nu_\tau$
$6.42\pm0.81\pm0.18$	126 ± 16	[4] ALEXANDER	09	CLEO	$\tau^+ \to \pi^+\overline{\nu}_\tau$
$5.52\pm0.57\pm0.21$	155 ± 17	[4] NAIK	09A	CLEO	$\tau^+ \to \rho^+\overline{\nu}_\tau$
$5.30\pm0.47\pm0.22$	181 ± 16	[4] ONYISI	09	CLEO	$\tau^+ \to e^+\nu_e\overline{\nu}_\tau$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$6.17\pm0.71\pm0.34$	102	[5] ECKLUND	08	CLEO	See ONYISI 09
$8.0\ \pm1.3\ \pm0.4$	47	[5] PEDLAR	07A	CLEO	See ALEXANDER 09
$5.79\pm0.77\pm1.84$	881	[6] HEISTER	02I	ALEP	Z decays
$7.0\ \pm2.1\ \pm2.0$	22	[7] ABBIENDI	01L	OPAL	$D_s^{*+} \to \gamma D_s^+$ from Z's
$7.4\ \pm2.8\ \pm2.4$	16	[8] ACCIARRI	97F	L3	$D_s^{*+} \to \gamma D_s^+$ from Z's

[1] ABLIKIM 16O value is constrained by the Standard Model ratio of $\Gamma(D_s^+ \to \tau^+\nu_\tau)/\Gamma(D_s^+ \to \mu^+\nu_\mu) = 9.76$; the unconstrained value is $(3.28 \pm 1.83 \pm 0.37)\%$.

[2] ZUPANC 13 uses both $\mu^+\nu$ and $\tau^+\nu$ events to get $f_{D_s} = (255.5 \pm 4.2 \pm 5.1)$ MeV.

[3] DEL-AMO-SANCHEZ 10J (with a small correction; see LEES 15D) uses $\mu^+\nu_\mu$ and $\tau^+\nu_\tau$ events together to get $f_{D_s} = (259.9 \pm 6.6 \pm 7.6)$ MeV.

[4] ALEXANDER 09, NAIK 09A, and ONYISI 09 use different τ decay modes and are independent. The three papers combined give $f_{D_s} = (259.7 \pm 7.8 \pm 3.4)$ MeV.

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

[6] HEISTER 02I combines its $D_s^+ \to \tau^+ \nu_\tau$ and $\mu^+ \nu_\mu$ branching fractions to get f_{D_s}= (285 ± 19 ± 40) MeV.
[7] This ABBIENDI 01L value gives a decay constant f_{D_s} of (286 ± 44 ± 41) MeV.
[8] 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_{21}/Γ_{20}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$10.73 \pm 0.69 ^{+0.56}_{-0.53}$	2.2k/492	[1] ZUPANC	13	BELL	e^+e^- at $\Upsilon(4S), \Upsilon(5S)$
$11.0 \pm 1.4 \pm 0.6$	102	[2] ECKLUND	08	CLEO	See ONYISI 09

[1] This ZUPANC 13 ratio is not independent of the separate $\tau\nu$ and $\mu\nu$ fractions listed above.
[2] 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_{22}/Γ_{36}

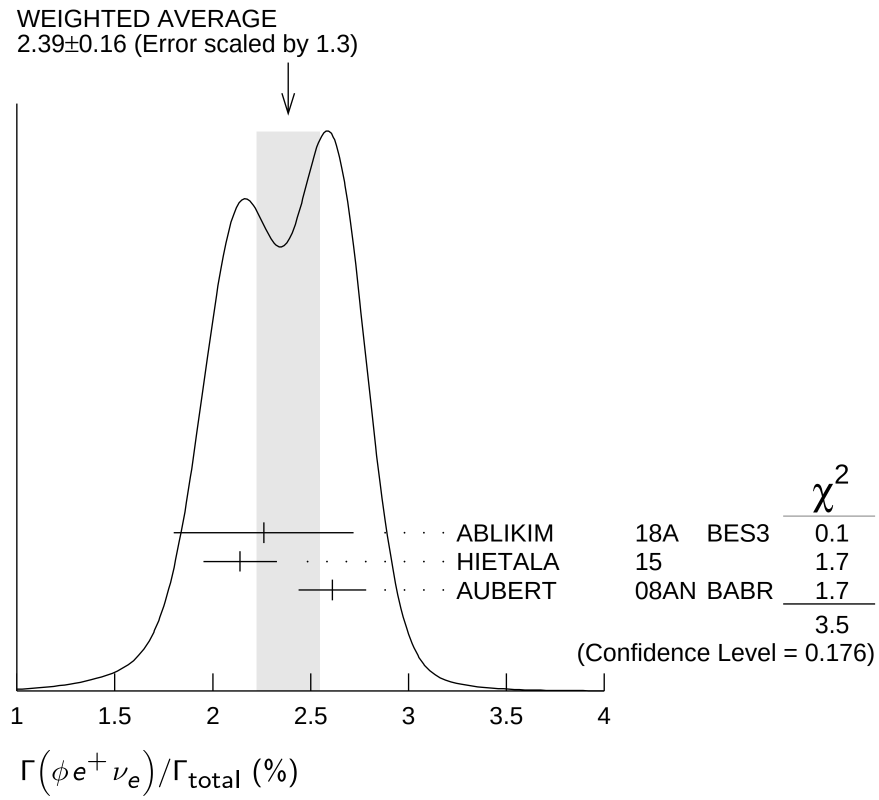
VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$0.558 \pm 0.007 \pm 0.016$	[1] AUBERT	08AN	BABR	e^+e^- at $\Upsilon(4S)$

[1] 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.

$\Gamma(\phi e^+\nu_e)/\Gamma_{total}$ — Γ_{23}/Γ

See the end of the D_s^+ Listings for measurements of $D_s^+ \to \phi e^+ \nu_e$ form factors. Unseen decay modes of the ϕ are included.

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
2.39±0.16 OUR AVERAGE	Error includes scale factor of 1.3. See the ideogram below.				
$2.26 \pm 0.45 \pm 0.09$	26	ABLIKIM	18A	BES3	e^+e^- at 4.009 GeV
$2.14 \pm 0.17 \pm 0.08$	207	HIETALA	15		Uses CLEO data
$2.61 \pm 0.03 \pm 0.17$	25k	AUBERT	08AN	BABR	e^+e^- at $\Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$2.36 \pm 0.23 \pm 0.13$	106	ECKLUND	09	CLEO	See HIETALA 15
$2.29 \pm 0.37 \pm 0.11$	45	YELTON	09	CLEO	See ECKLUND 09



$\Gamma(\phi e^+ \nu_e)/\Gamma(\phi \pi^+)$ Γ_{23}/Γ_{37}

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. • • •					
$0.540 \pm 0.033 \pm 0.048$	793	LINK	02J	FOCS	Uses $\phi \mu^+ \nu_\mu$
$0.54 \pm 0.05 \pm 0.04$	367	BUTLER	94	CLE2	Uses $\phi e^+ \nu_e$ and $\phi \mu^+ \nu_\mu$
$0.58 \pm 0.17 \pm 0.07$	97	FRABETTI	93G	E687	Uses $\phi \mu^+ \nu_\mu$
$0.57 \pm 0.15 \pm 0.15$	104	ALBRECHT	91	ARG	Uses $\phi e^+ \nu_e$
$0.49 \pm 0.10 {}^{+0.10}_{-0.14}$	54	ALEXANDER	90B	CLEO	Uses $\phi e^+ \nu_e$ and $\phi \mu^+ \nu_\mu$

$\Gamma(\phi \mu^+ \nu_\mu)/\Gamma_{total}$ Γ_{24}/Γ

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
$1.94 \pm 0.53 \pm 0.09$	22	ABLIKIM	18A	BES3	$e^+ e^-$ at 4.009 GeV

$\Gamma(\eta e^+ \nu_e)/\Gamma_{total}$ Γ_{26}/Γ

Unseen decay modes of the η are included.

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
2.29 ± 0.19 OUR AVERAGE					
$2.30 \pm 0.31 \pm 0.08$	63	ABLIKIM	16T	BES3	$e^+ e^-$ at 4.009 GeV
$2.28 \pm 0.14 \pm 0.19$	358	HIETALA	15		Uses CLEO data
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$2.48 \pm 0.29 \pm 0.13$	82	YELTON	09	CLEO	See HIETALA 15

$\Gamma(\eta e^+ \nu_e)/\Gamma(\phi e^+ \nu_e)$ — Γ_{26}/Γ_{23}

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$1.24 \pm 0.12 \pm 0.15$	440	[1] BRANDENB... 95	CLE2	See HIETALA 15

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

$\Gamma(\eta'(958) e^+ \nu_e)/\Gamma_{\text{total}}$ — Γ_{27}/Γ

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

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.74±0.14 OUR AVERAGE				
$0.93 \pm 0.30 \pm 0.05$	14	ABLIKIM 16T	BES3	$e^+ e^-$ at 4009 MeV
$0.68 \pm 0.15 \pm 0.06$	20	HIETALA 15		Uses CLEO data
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$0.91 \pm 0.33 \pm 0.05$	7.5	YELTON 09	CLEO	See HIETALA 15

$\Gamma(\eta'(958) e^+ \nu_e)/\Gamma(\phi e^+ \nu_e)$ — Γ_{27}/Γ_{23}

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. • • •				
$0.43 \pm 0.11 \pm 0.07$	29	[1] BRANDENB... 95	CLE2	See HIETALA 15

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

$\left[\Gamma(\eta e^+ \nu_e) + \Gamma(\eta'(958) e^+ \nu_e)\right]/\Gamma(\phi e^+ \nu_e)$ — $\Gamma_{25}/\Gamma_{23} = (\Gamma_{26}+\Gamma_{27})/\Gamma_{23}$

Unseen decay modes of the resonances are included.

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$1.67 \pm 0.17 \pm 0.17$	[1] BRANDENB... 95	CLE2	See HIETALA 15

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

$\Gamma(\eta \mu^+ \nu_\mu)/\Gamma_{\text{total}}$ — Γ_{28}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
$2.42 \pm 0.46 \pm 0.11$	44	ABLIKIM 18A	BES3	$e^+ e^-$ at 4.009 GeV

$\Gamma(\eta'(958) \mu^+ \nu_\mu)/\Gamma_{\text{total}}$ — Γ_{29}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
$1.06 \pm 0.54 \pm 0.07$	10	ABLIKIM 18A	BES3	$e^+ e^-$ at 4.009 GeV

$\Gamma(\omega e^+ \nu_e)/\Gamma_{\text{total}}$ — Γ_{30}/Γ

A test for $u\overline{u}$ or $d\overline{d}$ content in the D_s^+. Neither Cabibbo-favored nor Cabibbo-suppressed decays can contribute, and $\omega - \phi$ mixing is an unlikely explanation for any fraction above about 2×10^{-4}.

VALUE (%)	CL%	DOCUMENT ID	TECN	COMMENT
<0.20	90	MARTIN 11	CLEO	$e^+ e^-$ at 4170 MeV

$\Gamma(K^0 e^+ \nu_e)/\Gamma_{total}$ — Γ_{31}/Γ

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
0.39±0.08±0.03	42	HIETALA	15		Uses CLEO data
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.37±0.10±0.02	14	YELTON	09	CLEO	See HIETALA 15

$\Gamma(K^*(892)^0 e^+ \nu_e)/\Gamma_{total}$ — Γ_{32}/Γ

Unseen decay modes of the $K^*(892)^0$ are included.

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
0.18±0.04±0.01	32	HIETALA	15		Uses CLEO data
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.18±0.07±0.01	7.5	YELTON	09	CLEO	See HIETALA 15

$\Gamma(f_0(980) e^+ \nu_e, f_0 \to \pi^+ \pi^-)/\Gamma_{total}$ — Γ_{33}/Γ

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.13±0.03±0.01	42	[1] HIETALA	15		Uses CLEO data
0.20±0.03±0.01	44	ECKLUND	09	CLEO	See HIETALA 15
0.13±0.04±0.01	13	YELTON	09	CLEO	See ECKLUND 09

[1] HIETALA 15 uses a tighter cut on the reconstructed $\pi^+\pi^-$ mass ($\pm$60 MeV around the f^0) than ECKLUND 09. It finds that applying the same tight cut to both analyses gives consistent results.

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

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

VALUE (%)	DOCUMENT ID		TECN	COMMENT
1.50±0.05 OUR FIT				
1.52±0.05±0.03	ONYISI	13	CLEO	e^+e^- at 4.17 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.49±0.07±0.05	[1] ALEXANDER	08	CLEO	See ONYISI 13

[1] ALEXANDER 08 uses single- and double-tagged events in an overall fit.

$\Gamma(K^+ \overline{K}^0)/\Gamma_{total}$ — Γ_{35}/Γ

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
2.95±0.11±0.09	2.0k	[1] ZUPANC	13	BELL	e^+e^- at $\Upsilon(4S), \Upsilon(5S)$

[1] ZUPANC 13 finds the $\overline{K}^0$ from its missing-mass squared, not from $K^0_S \to \pi^+\pi^-$. The DCS ($D^+_s \to K^+ K^0$) contribution to this fraction is estimated to be an order of magnitude below the statistical uncertainty.

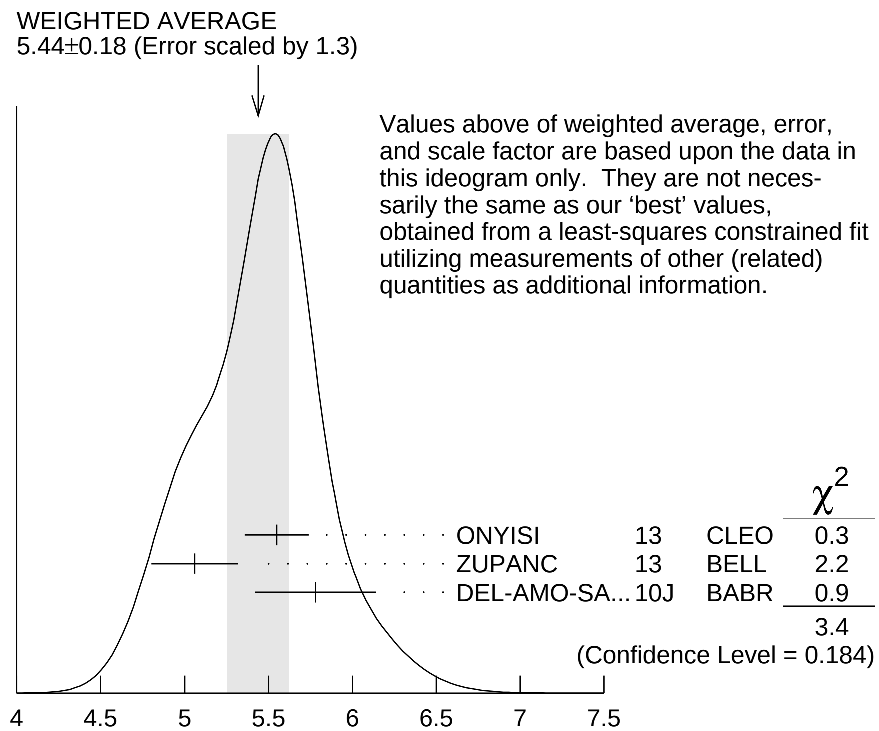
$\Gamma(K^+ K^- \pi^+)/\Gamma_{total}$ — Γ_{36}/Γ

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
5.45±0.17 OUR FIT Error includes scale factor of 1.2.					
5.44±0.18 OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below.					
5.55±0.14±0.13		ONYISI	13	CLEO	e^+e^- at 4.17 GeV
5.06±0.15±0.21	4.1k	ZUPANC	13	BELL	e^+e^- at $\Upsilon(4S), \Upsilon(5S)$
5.78±0.20±0.30		DEL-AMO-SA...	10J	BABR	e^+e^-, 10.58 GeV

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

$5.50 \pm 0.23 \pm 0.16$	[1] ALEXANDER	08	CLEO	See ONYISI 13

[1] ALEXANDER 08 uses single- and double-tagged events in an overall fit.



$\Gamma\left(K^+ K^- \pi^+\right)/\Gamma_{\text{total}}$ (%)

$\Gamma(\phi\pi^+)/\Gamma_{\text{total}}$ Γ_{37}/Γ

The results here are model-independent. For earlier, model-dependent results, see our PDG 06 edition. We decouple the $D_s^+ \rightarrow \phi\pi^+$ branching fraction obtained from mass projections (and used to get some of the other branching fractions) from the $D_s^+ \rightarrow \phi\pi^+$, $\phi \rightarrow K^+ K^-$ branching fraction obtained from the Dalitz-plot analysis of $D_s^+ \rightarrow K^+ K^- \pi^+$. That is, the ratio of these two branching fractions is not exactly the $\phi \rightarrow K^+ K^-$ branching fraction 0.491.

VALUE (%)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
4.5 ±0.4 OUR AVERAGE					
$4.62 \pm 0.36 \pm 0.51$		[1] AUBERT	06N	BABR	$e^+ e^-$ at $\Upsilon(4S)$
$4.81 \pm 0.52 \pm 0.38$	212 ± 19	[2] AUBERT	05V	BABR	$e^+ e^- \approx \Upsilon(4S)$
$3.59 \pm 0.77 \pm 0.48$		[3] ARTUSO	96	CLE2	$e^+ e^-$ at $\Upsilon(4S)$

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

$3.9\ ^{+5.1}_{-1.9}\ ^{+1.8}_{-1.1}$		[4] BAI	95C	BES	$e^+ e^-$ 4.03 GeV

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

[2] AUBERT 05V uses the ratio of $B^0 \rightarrow D^{*-} D_s^{*+}$ events seen in two different ways, in both of which the $D^{*-} \rightarrow \overline{D}^0 \pi^-$ decay is fully reconstructed: (1) The $D_s^{*+} \rightarrow D_s^+ \gamma$,

$D_s^+ \to \phi\pi^+$ 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.

[3] 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.

[4] 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_{38}/Γ_{36}

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 (units 10^{-2})	*DOCUMENT ID*		*TECN*	*COMMENT*
41.6±0.8 OUR AVERAGE				
41.4±0.8±0.5	DEL-AMO-SA...	11G	BABR	Dalitz fit, 96k±369 evts
42.2±1.6±0.3	MITCHELL	09A	CLEO	Dalitz fit, 12k evts
• • • We do not use the following data for averages, fits, limits, etc. • • •				
39.6±3.3±4.7	FRABETTI	95B	E687	Dalitz fit, 701 evts

$\Gamma(K^+\overline{K}^*(892)^0,\ \overline{K}^{*0}\to K^-\pi^+)/\Gamma(K^+K^-\pi^+)$ — Γ_{39}/Γ_{36}

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

VALUE (units 10^{-2})	*DOCUMENT ID*		*TECN*	*COMMENT*
47.8±0.6 OUR AVERAGE				
47.9±0.5±0.5	DEL-AMO-SA...	11G	BABR	Dalitz fit, 96k±369 evts
47.4±1.5±0.4	MITCHELL	09A	CLEO	Dalitz fit, 12k evts
• • • We do not use the following data for averages, fits, limits, etc. • • •				
47.8±4.6±4.0	FRABETTI	95B	E687	Dalitz fit, 701 evts

$\Gamma(f_0(980)\pi^+,\ f_0\to K^+K^-)/\Gamma(K^+K^-\pi^+)$ — Γ_{40}/Γ_{36}

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

VALUE (units 10^{-2})	*DOCUMENT ID*		*TECN*	*COMMENT*
21 ±6 OUR AVERAGE Error includes scale factor of 3.5.				
16.4±0.7±2.0	DEL-AMO-SA...	11G	BABR	Dalitz fit, 96k±369 evts
28.2±1.9±1.8	MITCHELL	09A	CLEO	Dalitz fit, 12k evts
• • • We do not use the following data for averages, fits, limits, etc. • • •				
11.0±3.5±2.6	FRABETTI	95B	E687	Dalitz fit, 701 evts

$\Gamma(f_0(1370)\pi^+,\ f_0\to K^+K^-)/\Gamma(K^+K^-\pi^+)$ — Γ_{41}/Γ_{36}

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

VALUE (units 10^{-2})	*DOCUMENT ID*		*TECN*	*COMMENT*
1.3±0.8 OUR AVERAGE Error includes scale factor of 3.9.				
1.1±0.1±0.2	DEL-AMO-SA...	11G	BABR	Dalitz fit, 96k±369 evts
4.3±0.6±0.5	MITCHELL	09A	CLEO	Dalitz fit, 12k evts

$\Gamma\big(f_0(1710)\pi^+,\, f_0 \to K^+K^-\big)/\Gamma\big(K^+K^-\pi^+\big)$ Γ_{42}/Γ_{36}

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

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
1.2±0.5 OUR AVERAGE	Error includes scale factor of 3.8.		
1.1±0.1±0.1	DEL-AMO-SA..11G	BABR	Dalitz fit, 96k±369 evts
3.4±0.5±0.3	MITCHELL 09A	CLEO	Dalitz fit, 12k evts
• • • We do not use the following data for averages, fits, limits, etc. • • •			
3.4±2.3±3.5	FRABETTI 95B	E687	Dalitz fit, 701 evts

$\Gamma\big(K^+\overline{K}{}^*_0(1430)^0,\, \overline{K}{}^*_0 \to K^-\pi^+\big)/\Gamma\big(K^+K^-\pi^+\big)$ Γ_{43}/Γ_{36}

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

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
3.4±0.7 OUR AVERAGE	Error includes scale factor of 1.2.		
2.4±0.3±1.0	DEL-AMO-SA..11G	BABR	Dalitz fit, 96k±369 evts
3.9±0.5±0.5	MITCHELL 09A	CLEO	Dalitz fit, 12k evts
• • • We do not use the following data for averages, fits, limits, etc. • • •			
9.3±3.2±3.2	FRABETTI 95B	E687	Dalitz fit, 701 evts

$\Gamma\big(K^+K^0_S\pi^0\big)/\Gamma_{\text{total}}$ Γ_{44}/Γ

VALUE (%)	DOCUMENT ID	TECN	COMMENT
1.52±0.09±0.20	ONYISI 13	CLEO	e^+e^- at 4.17 GeV

$\Gamma\big(2K^0_S\pi^+\big)/\Gamma_{\text{total}}$ Γ_{45}/Γ

VALUE (%)	DOCUMENT ID	TECN	COMMENT
0.77±0.05±0.03	ONYISI 13	CLEO	e^+e^- at 4.17 GeV

$\Gamma\big(K^*(892)^+\overline{K}{}^0\big)/\Gamma\big(\phi\pi^+\big)$ Γ_{47}/Γ_{37}

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

$\Gamma\big(K^+K^-\pi^+\pi^0\big)/\Gamma_{\text{total}}$ Γ_{48}/Γ

VALUE (%)	DOCUMENT ID	TECN	COMMENT
6.3 ±0.6 OUR FIT			
6.37±0.21±0.56	ONYISI 13	CLEO	e^+e^- at 4.17 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •			
5.65±0.29±0.40	[1] ALEXANDER 08	CLEO	See ONYISI 13

[1] ALEXANDER 08 uses single- and double-tagged events in an overall fit.

$\Gamma\big(\phi\rho^+\big)/\Gamma\big(\phi\pi^+\big)$ Γ_{49}/Γ_{37}

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

$\Gamma\big(K^0_S K^- 2\pi^+\big)/\Gamma_{\text{total}}$ Γ_{50}/Γ

VALUE (%)	DOCUMENT ID	TECN	COMMENT
1.68±0.10 OUR FIT			
1.69±0.07±0.08	ONYISI 13	CLEO	e^+e^- at 4.17 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1.64±0.10±0.07	[1] ALEXANDER 08	CLEO	See ONYISI 13

[1] ALEXANDER 08 uses single- and double-tagged events in an overall fit.

$\Gamma(K^*(892)^+ \overline{K}^*(892)^0)/\Gamma(\phi\pi^+)$ — Γ_{51}/Γ_{37}

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

$\Gamma(K^+ K^0_S \pi^+\pi^-)/\Gamma_{total}$ — Γ_{52}/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
1.00±0.08 OUR FIT				
1.03±0.06±0.08	ONYISI	13	CLEO	e^+e^- at 4.17 GeV

$\Gamma(K^+ K^0_S \pi^+\pi^-)/\Gamma(K^0_S K^- 2\pi^+)$ — Γ_{52}/Γ_{50}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.60 ±0.05 OUR FIT					
0.586±0.052±0.043	476	LINK	01C	FOCS	γ A, $\overline{E}_\gamma \approx$ 180 GeV

$\Gamma(K^+ K^- 2\pi^+\pi^-)/\Gamma(K^+ K^-\pi^+)$ — Γ_{53}/Γ_{36}

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

$\Gamma(\phi 2\pi^+\pi^-)/\Gamma(\phi\pi^+)$ — Γ_{54}/Γ_{37}

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

$\Gamma(K^+ K^- \rho^0 \pi^+ \text{non-}\phi)/\Gamma(K^+ K^- 2\pi^+\pi^-)$ — Γ_{55}/Γ_{53}

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

$\Gamma(\phi\rho^0\pi^+, \phi \to K^+K^-)/\Gamma(K^+ K^- 2\pi^+\pi^-)$ — Γ_{56}/Γ_{53}

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_{57}/Γ_{36}

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

$\Gamma(K^+ K^- 2\pi^+\pi^- \text{nonresonant})/\Gamma(K^+ K^- 2\pi^+\pi^-)$ — Γ_{58}/Γ_{53}

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

$\Gamma(2K^0_S 2\pi^+\pi^-)/\Gamma(K^0_S K^- 2\pi^+)$ — Γ_{59}/Γ_{50}

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_{60}/Γ_{34}

VALUE (units 10^{-2})	CL%	DOCUMENT ID		TECN	COMMENT
<2.3	90	MENDEZ	10	CLEO	e^+e^- at 4170 MeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<4.1	90	ADAMS	07A	CLEO	See MENDEZ 10

$\Gamma(2\pi^+\pi^-)/\Gamma_{total}$ — Γ_{61}/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
1.09±0.05 OUR FIT Error includes scale factor of 1.1.				
1.11±0.04±0.04	ONYISI	13	CLEO	e^+e^- at 4.17 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
1.11±0.07±0.04	[1] ALEXANDER	08	CLEO	See ONYISI 13

[1] ALEXANDER 08 uses single- and double-tagged events in an overall fit.

$\Gamma(2\pi^+\pi^-)/\Gamma(K^+K^-\pi^+)$ — Γ_{61}/Γ_{36}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.201±0.007 OUR FIT					
0.199±0.004±0.009	≈ 10.5k	AUBERT	09O	BABR	$e^+e^-\approx$ 10.6 GeV
• • • 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

$\Gamma(\rho^0\pi^+)/\Gamma(2\pi^+\pi^-)$ — Γ_{62}/Γ_{61}

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
0.018±0.005±0.010		AUBERT	09O	BABR	Dalitz fit, ≈ 10.5k evts
• • • We do not use the following data for averages, fits, limits, etc. • • •					
not seen		LINK	04	FOCS	Dalitz fit, 1475 ± 50 evts
0.058±0.023±0.037		AITALA	01A	E791	Dalitz fit, 848 evts
<0.073	90	FRABETTI	97D	E687	γ Be ≈ 200 GeV

$\Gamma(\pi^+(\pi^+\pi^-)_{S-\mathrm{wave}})/\Gamma(2\pi^+\pi^-)$ — Γ_{63}/Γ_{61}

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 there 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
0.833 ±0.020 OUR AVERAGE				
0.830 ±0.009 ±0.019	[1] AUBERT	09O	BABR	Dalitz fit, ≈ 10.5k evts
0.8704±0.0560±0.0438	[2] LINK	04	FOCS	Dalitz fit, 1475 ± 50 evts

[1] AUBERT 09O gives the amplitude and phase of the $\pi^+\pi^-$ S-wave in 29 $\pi^+\pi^-$ invariant-mass bins.

[2] 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 $f_0(980)$, $f_0(1300)$, $f_0(1200$–$1600)$, $f_0(1500)$, and $f_0(1750)$. See LINK 04 for details and discussion.

$\Gamma\big(f_0(980)\pi^+ , f_0 \to \pi^+\pi^-\big)/\Gamma\big(2\pi^+\pi^-\big)$ Γ_{64}/Γ_{61}

This is the "fit fraction" from the Dalitz-plot analysis. See above for the full $\pi^+(\pi^+\pi^-)_{S-wave}$ fit fraction.

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

$\Gamma\big(f_0(1370)\pi^+ , f_0 \to \pi^+\pi^-\big)/\Gamma\big(2\pi^+\pi^-\big)$ Γ_{65}/Γ_{61}

This is the "fit fraction" from the Dalitz-plot analysis. See above for the full $\pi^+(\pi^+\pi^-)_{S-wave}$ fit fraction.

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

$\Gamma\big(f_0(1500)\pi^+ , f_0 \to \pi^+\pi^-\big)/\Gamma\big(2\pi^+\pi^-\big)$ Γ_{66}/Γ_{61}

This is the "fit fraction" from the Dalitz-plot analysis. See above for the full $\pi^+(\pi^+\pi^-)_{S-wave}$ fit fraction.

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.274±0.114±0.019	[1] FRABETTI	97D	E687	γ Be ≈ 200 GeV

[1] 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 $f_0(1500)$.

$\Gamma\big(f_2(1270)\pi^+ , f_2 \to \pi^+\pi^-\big)/\Gamma\big(2\pi^+\pi^-\big)$ Γ_{67}/Γ_{61}

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

VALUE	DOCUMENT ID		TECN	COMMENT
0.101 ±0.018 OUR AVERAGE				
0.101 ±0.015 ±0.011	AUBERT	09O	BABR	Dalitz fit, ≈ 10.5k evts
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

$\Gamma\big(\rho(1450)^0\pi^+ , \rho^0 \to \pi^+\pi^-\big)/\Gamma\big(2\pi^+\pi^-\big)$ Γ_{68}/Γ_{61}

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

VALUE	DOCUMENT ID		TECN	COMMENT
0.027 ±0.018 OUR AVERAGE				
0.023 ±0.008 ±0.017	AUBERT	09O	BABR	Dalitz fit, ≈ 10.5k evts
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

$\Gamma\big(\pi^+ 2\pi^0\big)/\Gamma_{total}$ Γ_{69}/Γ

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
0.65±0.13±0.03	72 ± 16	NAIK	09A	CLEO	e^+e^- at 4170 MeV

$\Gamma(2\pi^+\pi^-\pi^0)/\Gamma(\phi\pi^+)$ — Γ_{70}/Γ_{37}

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<3.3	90	ANJOS	89E	E691	Photoproduction

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

Unseen decay modes of the η are included.

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
1.70±0.09 OUR FIT	Error includes scale factor of 1.1.				
1.71±0.08 OUR AVERAGE					
1.67±0.08±0.06		ONYISI	13	CLEO	e^+e^- at 4.17 GeV
1.82±0.14±0.07	0.8k	ZUPANC	13	BELL	e^+e^- at $\Upsilon(4S)$, $\Upsilon(5S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.58±0.11±0.18		[1] ALEXANDER	08	CLEO	See ONYISI 13

[1] ALEXANDER 08 uses single- and double-tagged events in an overall fit.

$\Gamma(\eta\pi^+)/\Gamma(K^+K^0_S)$ — Γ_{71}/Γ_{34}

Unseen decay modes of the η are included.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
1.13 ±0.07 OUR FIT	Error includes scale factor of 1.1.				
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.236±0.043±0.063	2587 ± 89	MENDEZ	10	CLEO	See ONYISI 13

$\Gamma(\eta\pi^+)/\Gamma(\phi\pi^+)$ — Γ_{71}/Γ_{37}

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±0.03±0.04	920	JESSOP	98	CLE2	$e^+e^- \approx \Upsilon(4S)$
0.54±0.09±0.06	165	ALEXANDER	92	CLE2	See JESSOP 98

$\Gamma(\omega\pi^+)/\Gamma_{total}$ — Γ_{72}/Γ

Unseen decay modes of the ω are included.

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
0.24±0.06 OUR FIT					
0.21±0.09±0.01	6 ± 2.4	GE	09A	CLEO	e^+e^- at 4170 MeV

$\Gamma(\omega\pi^+)/\Gamma(\eta\pi^+)$ — Γ_{72}/Γ_{71}

Unseen decay modes of the resonances are included.

VALUE	DOCUMENT ID		TECN	COMMENT
0.14±0.04 OUR FIT				
0.16±0.04±0.03	BALEST	97	CLE2	$e^+e^- \approx \Upsilon(4S)$

$\Gamma(3\pi^+2\pi^-)/\Gamma(K^+K^-\pi^+)$ — Γ_{73}/Γ_{36}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.146±0.014 OUR AVERAGE					
0.145±0.011±0.010	671	LINK	03D	FOCS	γ A, $\overline{E}_\gamma \approx$ 180 GeV
0.158±0.042±0.031	37	FRABETTI	97C	E687	γBe, $\overline{E}_\gamma \approx$ 200 GeV

$\Gamma(\eta\rho^+)/\Gamma_{total}$ — Γ_{75}/Γ

Unseen decay modes of the η are included.

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
8.9±0.6±0.5	328 ± 22	NAIK	09A	CLEO	$\eta \to 2\gamma$

$\Gamma(\eta\rho^+)/\Gamma(\phi\pi^+)$ — Γ_{75}/Γ_{37}

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. • • •					
$2.98\pm0.20\pm0.39$	447	JESSOP	98	CLE2	$e^+e^- \approx \Upsilon(4S)$
$2.86\pm0.38^{+0.36}_{-0.38}$	217	AVERY	92	CLE2	See JESSOP 98

$\Gamma(\eta\pi^+\pi^0)/\Gamma_{total}$ — Γ_{76}/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
9.2±0.4±1.1	ONYISI	13	CLEO	e^+e^- at 4.17 GeV

$\Gamma(\omega\pi^+\pi^0)/\Gamma_{total}$ — Γ_{77}/Γ

Unseen decay modes of the ω are included.

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
2.78±0.65±0.25	34 ± 7.9	GE	09A	CLEO	e^+e^- at 4170 MeV

$\Gamma(3\pi^+2\pi^-\pi^0)/\Gamma_{total}$ — Γ_{78}/Γ

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

$\Gamma(\omega 2\pi^+\pi^-)/\Gamma_{total}$ — Γ_{79}/Γ

Unseen decay modes of the ω are included.

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
1.58±0.45±0.09	29 ± 8.2	GE	09A	CLEO	e^+e^- at 4170 MeV

$\Gamma(\eta'(958)\pi^+)/\Gamma_{total}$ — Γ_{80}/Γ

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

VALUE (%)	DOCUMENT ID		TECN	COMMENT
3.94±0.15±0.20	ONYISI	13	CLEO	e^+e^- at 4.17 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$3.77\pm0.25\pm0.30$	[1] ALEXANDER	08	CLEO	See ONYISI 13

[1] ALEXANDER 08 uses single- and double-tagged events in an overall fit.

$\Gamma(\eta'(958)\pi^+)/\Gamma(K^+K^0_S)$ — Γ_{80}/Γ_{34}

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$2.654\pm0.088\pm0.139$	1436 ± 47	MENDEZ	10	CLEO	See ONYISI 13

$\Gamma(\eta'(958)\pi^+)/\Gamma(\phi\pi^+)$ Γ_{80}/Γ_{37}

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. • • •					
$1.03\pm0.06\pm0.07$	537	JESSOP	98	CLE2	$e^+e^- \approx \Upsilon(4S)$
$1.20\pm0.15\pm0.11$	281	ALEXANDER	92	CLE2	See JESSOP 98
$2.5\ \pm1.0\ {}^{+1.5}_{-0.4}$	22	ALVAREZ	91	NA14	Photoproduction
$2.5\ \pm0.5\ \pm0.3$	215	ALBRECHT	90D	ARG	$e^+e^- \approx 10.4$ GeV

$\Gamma(\omega\eta\pi^+)/\Gamma_{total}$ Γ_{82}/Γ

Unseen decay modes of the ω and η are included.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<2.13\times10^{-2}$	90	GE	09A	CLEO	e^+e^- at 4170 MeV

$\Gamma(\eta'(958)\rho^+)/\Gamma_{total}$ Γ_{83}/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
$5.8\pm1.4\pm0.4$	ABLIKIM	15Z	BES3	482 pb^{-1}, 4009 MeV

$\Gamma(\eta'(958)\rho^+)/\Gamma(\phi\pi^+)$ Γ_{83}/Γ_{37}

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. • • •					
$2.78\pm0.28\pm0.30$	137	[1] JESSOP	98	CLE2	$e^+e^- \approx \Upsilon(4S)$
$3.44\pm0.62{}^{+0.44}_{-0.46}$	68	AVERY	92	CLE2	See JESSOP 98

[1] This JESSOP 98 fraction, when combined with other η' fractions, greatly overshoots the inclusive η' fraction. See the measurement just above, which fits nicely.

$\Gamma(\eta'(958)\pi^+\pi^0)/\Gamma_{total}$ Γ_{84}/Γ

VALUE (%)	DOCUMENT ID		TECN	COMMENT
$5.6\pm0.5\pm0.6$	ONYISI	13	CLEO	e^+e^- at 4.17 GeV

$\Gamma(\eta'(958)\pi^+\pi^0\,\text{nonresonant})/\Gamma_{total}$ Γ_{85}/Γ

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<5.1\times10^{-2}$	90	ABLIKIM	15Z	BES3	482 pb^{-1}, 4009 MeV

Modes with one or three K's

$\Gamma(K^+\pi^0)/\Gamma(K^+K^0_S)$ Γ_{86}/Γ_{34}

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
$4.2\pm1.4\pm0.2$	202 ± 70	MENDEZ	10	CLEO	e^+e^- at 4170 MeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$5.5\pm1.3\pm0.7$	141 ± 34	ADAMS	07A	CLEO	See MENDEZ 10

$\Gamma(K^0_S\pi^+)/\Gamma(K^+K^0_S)$ Γ_{87}/Γ_{34}

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
8.12 ± 0.28 OUR AVERAGE					
$8.5\ \pm0.7\ \pm0.2$	393 ± 33	MENDEZ	10	CLEO	e^+e^- at 4170 MeV
$8.03\pm0.24\pm0.19$	$17.6\text{k}\pm481$	WON	09	BELL	e^+e^- at $\Upsilon(4S)$
$10.4\ \pm2.4\ \pm1.4$	113 ± 26	LINK	08	FOCS	γ A, $\overline{E}_\gamma \approx 180$ GeV

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

8.2 ±0.9 ±0.2	206 ± 22	ADAMS	07A	CLEO	See MENDEZ 10

$\Gamma(K^+\eta)/\Gamma(K^+K^0_S)$ — Γ_{88}/Γ_{34}

Unseen decay modes of the η are included.

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
11.8±2.2±0.6	222 ± 41	MENDEZ	10	CLEO	e^+e^- at 4170 MeV

$\Gamma(K^+\eta)/\Gamma(\eta\pi^+)$ — Γ_{88}/Γ_{71}

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
8.9±1.5±0.4	113 ± 18	ADAMS	07A	CLEO	See MENDEZ 10

$\Gamma(K^+\omega)/\Gamma_{total}$ — Γ_{89}/Γ

Unseen decay modes of the ω are included.

VALUE (%)	CL%	DOCUMENT ID		TECN	COMMENT
<0.24	90	GE	09A	CLEO	e^+e^- at 4170 MeV

$\Gamma(K^+\eta'(958))/\Gamma(K^+K^0_S)$ — Γ_{90}/Γ_{34}

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

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
11.8±3.6±0.7	56 ± 17	MENDEZ	10	CLEO	e^+e^- at 4170 MeV

$\Gamma(K^+\eta'(958))/\Gamma(\eta'(958)\pi^+)$ — Γ_{90}/Γ_{80}

VALUE (units 10^{-2})	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
4.2±1.3±0.3	28 ± 9	ADAMS	07A	CLEO	See MENDEZ 10

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

VALUE (%)	DOCUMENT ID		TECN	COMMENT
0.66 ±0.04 OUR FIT				
0.654±0.033±0.025	ONYISI	13	CLEO	e^+e^- at 4.17 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.69 ±0.05 ±0.03	[1] ALEXANDER	08	CLEO	See ONYISI 13

[1] ALEXANDER 08 uses single- and double-tagged events in an overall fit.

$\Gamma(K^+\pi^+\pi^-)/\Gamma(K^+K^-\pi^+)$ — Γ_{91}/Γ_{36}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.120±0.007 OUR FIT Error includes scale factor of 1.1.					
0.127±0.007±0.014	567 ± 31	LINK	04F	FOCS	γ A, $\overline{E}_\gamma \approx$ 180 GeV

$\Gamma(K^+\rho^0)/\Gamma(K^+\pi^+\pi^-)$ — Γ_{92}/Γ_{91}

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_{93}/Γ_{91}

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_{94}/Γ_{91}

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_{95}/Γ_{91}

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_{96}/Γ_{91}

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

$\Gamma(K^+\pi^+\pi^-\text{ nonresonant})/\Gamma(K^+\pi^+\pi^-)$ — Γ_{97}/Γ_{91}

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

$\Gamma(K^0\pi^+\pi^0)/\Gamma_{total}$ — Γ_{98}/Γ

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
1.00±0.18±0.04	44 ± 8	NAIK	09A	CLEO	e^+e^- at 4170 MeV

$\Gamma(K^0_S 2\pi^+\pi^-)/\Gamma(K^0_S K^- 2\pi^+)$ — Γ_{99}/Γ_{50}

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

$\Gamma(K^+\omega\pi^0)/\Gamma_{total}$ — Γ_{100}/Γ

Unseen decay modes of the ω are included.

VALUE (%)	CL%	DOCUMENT ID		TECN	COMMENT
<0.82	90	GE	09A	CLEO	e^+e^- at 4170 MeV

$\Gamma(K^+\omega\pi^+\pi^-)/\Gamma_{total}$ — Γ_{101}/Γ

Unseen decay modes of the ω are included.

VALUE (%)	CL%	DOCUMENT ID		TECN	COMMENT
<0.54	90	GE	09A	CLEO	e^+e^- at 4170 MeV

$\Gamma(K^+\omega\eta)/\Gamma_{total}$ — Γ_{102}/Γ

Unseen decay modes of the ω and η are included.

VALUE (%)	CL%	DOCUMENT ID		TECN	COMMENT
<0.79	90	GE	09A	CLEO	e^+e^- at 4170 MeV

$\Gamma(2K^+K^-)/\Gamma(K^+K^-\pi^+)$ — Γ_{103}/Γ_{36}

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
4.0 ±0.3 ±0.2	748 ± 60	DEL-AMO-SA...	11G	BABR	$e^+e^- \approx \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$8.95\pm2.12^{+2.24}_{-2.31}$	31	LINK	02I	FOCS	γ A, ≈ 180 GeV

$\Gamma(\phi K^+, \phi\to K^+K^-)/\Gamma(2K^+K^-)$ — $\Gamma_{104}/\Gamma_{103}$

VALUE	DOCUMENT ID		TECN	COMMENT
0.41±0.08±0.03	DEL-AMO-SA...	11G	BABR	$e^+e^- \approx \Upsilon(4S)$

Doubly Cabibbo-suppressed modes

$\Gamma(2K^+\pi^-)/\Gamma(K^+K^-\pi^+)$ — Γ_{105}/Γ_{36}

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
2.33±0.23 OUR AVERAGE					
2.3 ±0.3 ±0.2	356 ± 52	DEL-AMO-SA...	11G	BABR	$e^+e^- \approx \Upsilon(4S)$
2.29±0.28±0.12	281 ± 34	KO	09	BELL	e^+e^- at $\Upsilon(4S)$
5.2 ±1.7 ±1.1	27 ± 9	LINK	05K	FOCS	<0.78%, CL = 90%

$\Gamma(K^+K^*(892)^0, K^{*0}\to K^+\pi^-)/\Gamma(2K^+\pi^-)$ — $\Gamma_{106}/\Gamma_{105}$

VALUE	DOCUMENT ID		TECN	COMMENT
0.47±0.22±0.15	DEL-AMO-SA...	11G	BABR	$e^+e^- \approx \Upsilon(4S)$

Baryon-antibaryon mode

$\Gamma(p\overline{n})/\Gamma_{total}$ — Γ_{107}/Γ

This is the only baryonic mode allowed kinematically.

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
1.22±0.11 OUR AVERAGE					
1.21±0.10±0.05	193 ± 17	ABLIKIM	19O	BES3	e^+e^-, E_{cm}= 4178 MeV
$1.30\pm0.36^{+0.12}_{-0.16}$	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_{108}/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
$<13 \times 10^{-6}$	90	LEES	11G	BABR	$e^+e^- \approx \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$< 2.2\times10^{-5}$	90	[1] RUBIN	10	CLEO	e^+e^- at 4170 MeV
$<27 \times10^{-5}$	90	AITALA	99G	E791	$\pi^- N$ 500 GeV

[1] This RUBIN 10 limit is for the e^+e^- mass in the continuum away from the $\phi(1020)$. See the next data block.

$\Gamma(\pi^+\phi,\ \phi\to e^+e^-)/\Gamma_{total}$ Γ_{109}/Γ

This is *not* a test for the $\Delta C = 1$ weak neutral current, but leads to the $\pi^+e^+e^-$ final state.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
$\mathbf{(6^{+8}_{-4}\pm1)\times10^{-6}}$	3	RUBIN	10	CLEO	e^+e^- at 4170 MeV

$\Gamma(\pi^+\mu^+\mu^-)/\Gamma_{total}$ Γ_{110}/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
$\mathbf{<4.1\times10^{-7}}$	90	AAIJ	13AF	LHCB	pp at 7 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<4.3\times10^{-5}$	90	LEES	11G	BABR	$e^+e^-\approx\ \Upsilon(4S)$
$<2.6\times10^{-5}$	90	LINK	03F	FOCS	γ A, $\overline{E}_\gamma\approx$ 180 GeV
$<1.4\times10^{-4}$	90	AITALA	99G	E791	π^-N 500 GeV
$<4.3\times10^{-4}$	90	KODAMA	95	E653	π^- emulsion 600 GeV

$\Gamma(K^+e^+e^-)/\Gamma_{total}$ Γ_{111}/Γ

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

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$\mathbf{<3.7\times10^{-6}}$	90	LEES	11G	BABR	$e^+e^-\approx\ \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<5.2\times10^{-5}$	90	RUBIN	10	CLEO	e^+e^- at 4170 MeV
$<1.6\times10^{-3}$	90	AITALA	99G	E791	π^-N 500 GeV

$\Gamma(K^+\mu^+\mu^-)/\Gamma_{total}$ Γ_{112}/Γ

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

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$\mathbf{<21\ \times10^{-6}}$	90	LEES	11G	BABR	$e^+e^-\approx\ \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<\ 3.6\times10^{-5}$	90	LINK	03F	FOCS	γ A, $\overline{E}_\gamma\approx$ 180 GeV
$<\ 1.4\times10^{-4}$	90	AITALA	99G	E791	π^-N 500 GeV
$<\ 5.9\times10^{-4}$	90	KODAMA	95	E653	π^- emulsion 600 GeV

$\Gamma(K^*(892)^+\mu^+\mu^-)/\Gamma_{total}$ Γ_{113}/Γ

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

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$\mathbf{<1.4\times10^{-3}}$	90	KODAMA	95	E653	π^- emulsion 600 GeV

$\Gamma(\pi^+e^+\mu^-)/\Gamma_{total}$ Γ_{114}/Γ

A test of lepton-family-number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$\mathbf{<12\times10^{-6}}$	90	LEES	11G	BABR	$e^+e^-\approx\ \Upsilon(4S)$

$\Gamma(\pi^+ e^- \mu^+)/\Gamma_{\text{total}}$ Γ_{115}/Γ

A test of lepton-family-number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<20 \times 10^{-6}$	90	LEES	11G	BABR	$e^+ e^- \approx \Upsilon(4S)$

$\Gamma(K^+ e^+ \mu^-)/\Gamma_{\text{total}}$ Γ_{116}/Γ

A test of lepton-family-number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<14 \times 10^{-6}$	90	LEES	11G	BABR	$e^+ e^- \approx \Upsilon(4S)$

$\Gamma(K^+ e^- \mu^+)/\Gamma_{\text{total}}$ Γ_{117}/Γ

A test of lepton-family-number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<9.7 \times 10^{-6}$	90	LEES	11G	BABR	$e^+ e^- \approx \Upsilon(4S)$

$\Gamma(\pi^- 2e^+)/\Gamma_{\text{total}}$ Γ_{118}/Γ

A test of lepton-number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$< 4.1 \times 10^{-6}$	90	LEES	11G	BABR	$e^+ e^- \approx \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$< 1.8 \times 10^{-5}$	90	RUBIN	10	CLEO	$e^+ e^-$ at 4170 MeV
$<69 \times 10^{-5}$	90	AITALA	99G	E791	$\pi^- N$ 500 GeV

$\Gamma(\pi^- 2\mu^+)/\Gamma_{\text{total}}$ Γ_{119}/Γ

A test of lepton-number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<1.2 \times 10^{-7}$	90	AAIJ	13AF	LHCB	pp at 7 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<1.4 \times 10^{-5}$	90	LEES	11G	BABR	$e^+ e^- \approx \Upsilon(4S)$
$<2.9 \times 10^{-5}$	90	LINK	03F	FOCS	γ A, $\overline{E}_{\gamma} \approx$ 180 GeV
$<8.2 \times 10^{-5}$	90	AITALA	99G	E791	$\pi^- N$ 500 GeV
$<4.3 \times 10^{-4}$	90	KODAMA	95	E653	π^- emulsion 600 GeV

$\Gamma(\pi^- e^+ \mu^+)/\Gamma_{\text{total}}$ Γ_{120}/Γ

A test of lepton-number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<8.4 \times 10^{-6}$	90	LEES	11G	BABR	$e^+ e^- \approx \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<7.3 \times 10^{-4}$	90	AITALA	99G	E791	$\pi^- N$ 500 GeV

$\Gamma(K^- 2e^+)/\Gamma_{\text{total}}$ Γ_{121}/Γ

A test of lepton-number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$< 5.2 \times 10^{-6}$	90	LEES	11G	BABR	$e^+ e^- \approx \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$< 1.7 \times 10^{-5}$	90	RUBIN	10	CLEO	$e^+ e^-$ at 4170 MeV
$<63 \times 10^{-5}$	90	AITALA	99G	E791	$\pi^- N$ 500 GeV

$\Gamma(K^- 2\mu^+)/\Gamma_{total}$ — Γ_{122}/Γ

A test of lepton-number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<1.3 × 10^{-5}	90	LEES	11G	BABR	$e^+e^- \approx \Upsilon(4S)$
<1.3 × 10^{-5}	90	LINK	03F	FOCS	γ A, $\overline{E}_\gamma \approx$ 180 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<1.8 \times 10^{-4}$	90	AITALA	99G	E791	π^- N 500 GeV
$<5.9 \times 10^{-4}$	90	KODAMA	95	E653	π^- emulsion 600 GeV

$\Gamma(K^- e^+ \mu^+)/\Gamma_{total}$ — Γ_{123}/Γ

A test of lepton-number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<6.1 × 10^{-6}	90	LEES	11G	BABR	$e^+e^- \approx \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<6.8 \times 10^{-4}$	90	AITALA	99G	E791	π^- N 500 GeV

$\Gamma(K^*(892)^- 2\mu^+)/\Gamma_{total}$ — Γ_{124}/Γ

A test of lepton-number conservation.

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

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

This is the difference between D_s^+ and D_s^- partial widths for the decay to state f, divided by the sum of the widths:
$A_{CP}(f)= [\Gamma(D_s^+ \to f) - \Gamma(D_s^- \to \overline{f})] / [\Gamma(D_s^+ \to f)+\Gamma(D_s^- \to \overline{f})]$.

$A_{CP}(\mu^\pm \nu)$ in $D_s^+ \to \mu^+ \nu$, $D_s^- \to \mu^- \overline{\nu}_\mu$

VALUE (%)	DOCUMENT ID		TECN	COMMENT
4.8±6.1	ALEXANDER	09	CLEO	e^+e^- at 4170 MeV

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

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
0.08±0.26 OUR AVERAGE					
−0.05±0.23±0.24	288k	[1] LEES	13E	BABR	e^+e^- at $\Upsilon(4S)$
2.6 ±1.5 ±0.6		ONYISI	13	CLEO	e^+e^- at 4.17 GeV
0.12±0.36±0.22		KO	10	BELL	$e^+e^- \approx \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
4.7 ±1.8 ±0.9	4.0k	MENDEZ	10	CLEO	See ONYISI 13
4.9 ±2.1 ±0.9		ALEXANDER	08	CLEO	See MENDEZ 10

[1] LEES 13E finds that after subtracting the contribution due to $K^0 - \overline{K}^0$ mixing, the *CP* asymmetry is (+0.28 ± 0.23 ± 0.24)%.

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

VALUE (%)	DOCUMENT ID		TECN	COMMENT
−0.5±0.8±0.4	ONYISI	13	CLEO	e^+e^- at 4.17 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.3±1.1±0.8	ALEXANDER	08	CLEO	See ONYISI 13

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

VALUE (%)	DOCUMENT ID		TECN	COMMENT
−0.38±0.26±0.08	ABAZOV	14B	D0	$p\overline{p}$ at 1.96 TeV

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

VALUE (%)	DOCUMENT ID		TECN	COMMENT
−1.6±6.0±1.1	ONYISI	13	CLEO	e^+e^- at 4.17 GeV

$A_{CP}(2K_S^0\pi^{\pm})$ in $D_s^{\pm} \to 2K_S^0\pi^{\pm}$

VALUE (%)	DOCUMENT ID		TECN	COMMENT
3.1±5.2±0.6	ONYISI	13	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
0.0±2.7±1.2	ONYISI	13	CLEO	e^+e^- at 4.17 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
−5.9±4.2±1.2	ALEXANDER	08	CLEO	See ONYISI 13

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

VALUE (%)	DOCUMENT ID		TECN	COMMENT
−5.7±5.3±0.9	ONYISI	13	CLEO	e^+e^- at 4.17 GeV

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

VALUE (%)	DOCUMENT ID		TECN	COMMENT
4.1±2.7±0.9	ONYISI	13	CLEO	e^+e^- at 4.17 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
−0.7±3.6±1.1	ALEXANDER	08	CLEO	See ONYISI 13

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

VALUE (%)	DOCUMENT ID		TECN	COMMENT
−0.7±3.0±0.6	ONYISI	13	CLEO	e^+e^- at 4.17 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2.0±4.6±0.7	ALEXANDER	08	CLEO	See ONYISI 13

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

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
1.1±3.0±0.8		ONYISI	13	CLEO	e^+e^- at 4.17 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
−4.6±2.9±0.3	2.5k	MENDEZ	10	CLEO	See ONYISI 13
−8.2±5.2±0.8		ALEXANDER	08	CLEO	See MENDEZ 10

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

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
−0.9 ±0.5 OUR AVERAGE					
−0.82±0.36±0.35	152k	AAIJ	17AF	LHCB	pp at 7, 8 TeV
−2.2 ±2.2 ±0.6		ONYISI	13	CLEO	e^+e^- at 4.17 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
−6.1 ±3.0 ±0.3	1.4k	MENDEZ	10	CLEO	See ONYISI 13
−5.5 ±3.7 ±1.2		ALEXANDER	08	CLEO	See MENDEZ 10

$A_{CP}(\eta\pi^{\pm}\pi^0)$ in $D_s^{\pm} \rightarrow \eta\pi^{\pm}\pi^0$

VALUE (%)	DOCUMENT ID		TECN	COMMENT
$-0.5\pm3.9\pm2.0$	ONYISI	13	CLEO	e^+e^- at 4.17 GeV

$A_{CP}(\eta'\pi^{\pm}\pi^0)$ in $D_s^{\pm} \rightarrow \eta'\pi^{\pm}\pi^0$

VALUE (%)	DOCUMENT ID		TECN	COMMENT
$-0.4\pm7.4\pm1.9$	ONYISI	13	CLEO	e^+e^- at 4.17 GeV

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

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
$-26.6\pm23.8\pm0.9$	202 ± 70	MENDEZ	10	CLEO	e^+e^- at 4170 MeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
2 ± 29		ADAMS	07A	CLEO	See MENDEZ 10

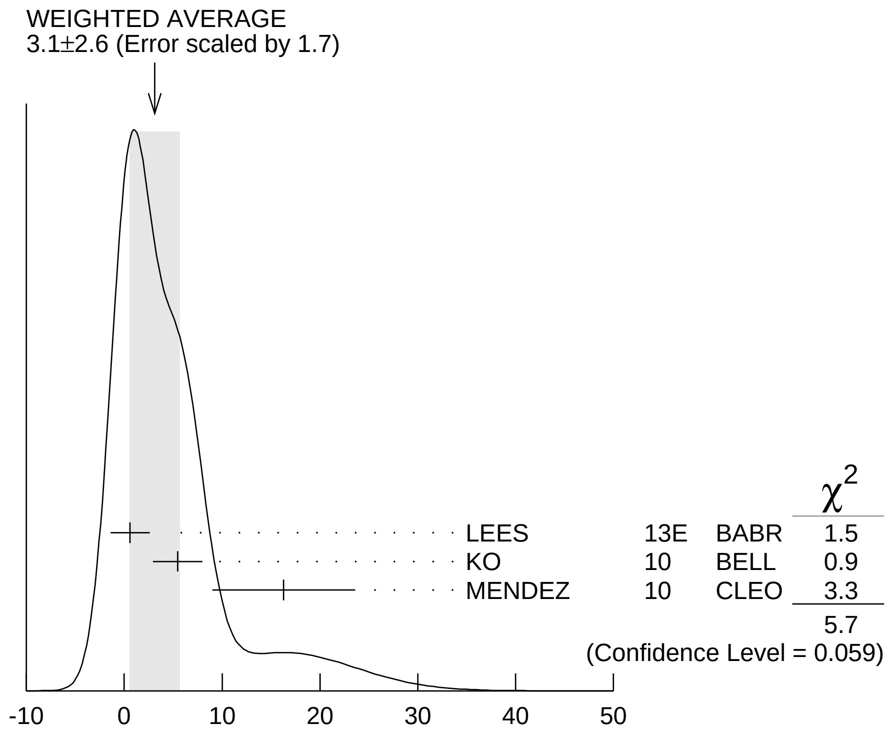
$A_{CP}(\overline{K}^0/K^0\pi^{\pm})$ in $D_s^+ \rightarrow \overline{K}^0\pi^+$, $D_s^- \rightarrow K^0\pi^-$

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
0.4 ± 0.5 OUR AVERAGE					
$0.38\pm0.46\pm0.17$	121k	[1] AAIJ	14BD	LHCB	pp at 7, 8 TeV
$0.3 \pm2.0 \pm0.3$	14k	LEES	13E	BABR	e^+e^- at $\Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$0.61\pm0.83\pm0.14$	26k	AAIJ	13W	LHCB	See AAIJ 14BD

[1] AAIJ 14BD reports its result as $A_{CP}(D_s^{\pm} \rightarrow K_S^0 K^{\pm})$ with CP-violation effects in the $K^0 - \overline{K}^0$ system subtracted. It also measures $A_{CP}(D^{\pm} \rightarrow \overline{K}^0/K^0 K^{\pm}) + A_{CP}(D_s^{\pm} \rightarrow \overline{K}^0/K^0\pi^{\pm}) = (0.41 \pm 0.49 \pm 0.26)\%$.

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

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
3.1 ± 2.6 OUR AVERAGE	Error includes scale factor of 1.7. See the ideogram below.				
$0.6 \pm 2.0 \pm0.3$	14k	LEES	13E	BABR	e^+e^- at $\Upsilon(4S)$
$5.45\pm 2.50\pm0.33$		KO	10	BELL	$e^+e^- \approx \Upsilon(4S)$
$16.3 \pm 7.3 \pm0.3$	0.4k	MENDEZ	10	CLEO	e^+e^- at 4170 MeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
27 ± 11		ADAMS	07A	CLEO	See MENDEZ 10



$A_{CP}(K^0_S\pi^\pm)$ in $D^\pm_s \rightarrow K^0_S\pi^\pm$ (%)

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

VALUE (%)	DOCUMENT ID		TECN	COMMENT
4.5±4.8±0.6	ONYISI	13	CLEO	e^+e^- at 4.17 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
11.2±7.0±0.9	ALEXANDER	08	CLEO	See ONYISI 13

$A_{CP}(K^\pm\eta)$ in $D^\pm_s \rightarrow K^\pm\eta$

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
9.3±15.2±0.9	222 ± 41	MENDEZ	10	CLEO	e^+e^- at 4170 MeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
−20 ±18		ADAMS	07A	CLEO	See MENDEZ 10

$A_{CP}(K^\pm\eta'(958))$ in $D^\pm_s \rightarrow K^\pm\eta'(958)$

VALUE (%)	EVTS	DOCUMENT ID		TECN	COMMENT
6.0±18.9±0.9	56 ± 17	MENDEZ	10	CLEO	e^+e^- at 4170 MeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
−17 ±37		ADAMS	07A	CLEO	See MENDEZ 10

CP VIOLATING ASYMMETRIES OF *P*-ODD (*T*-ODD) MOMENTS

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

$C_T \equiv \vec{p}_{K^+} \cdot (\vec{p}_{\pi^+} \times \vec{p}_{\pi^-})$ is a parity-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^-. Then
$A_T \equiv [\Gamma(C_T > 0) - \Gamma(C_T < 0)] \, / \, [\Gamma(C_T > 0) + \Gamma(C_T < 0)]$, and
$\overline{A}_T \equiv [\Gamma(-\overline{C}_T > 0) - \Gamma(-\overline{C}_T < 0)] \, / \, [\Gamma(-\overline{C}_T > 0) + \Gamma(-\overline{C}_T < 0)]$, and
$A_{Tviol} \equiv \frac{1}{2}(A_T - \overline{A}_T)$. C_T and $\overline{C}_T$ are commonly referred to as *T*-odd moments, because they are odd under *T* reversal. However, the *T*-conjugate process $K^0_S K^\pm \pi^+ \pi^- \rightarrow D_s^\pm$ is not accessible, while the *P*-conjugate process is.

VALUE (units 10^{-3})	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
$-13.6 \pm 7.7 \pm 3.4$	29.8 ± 0.3k	LEES	11E	BABR	$e^+ e^- \approx \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$-36 \pm 67 \pm 23$	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.					
$0.816 \pm 0.036 \pm 0.030$	25 ± 0.5k	[1] AUBERT	08AN	BABR	$\phi e^+ \nu_e$
$0.713 \pm 0.202 \pm 0.284$	793	LINK	04C	FOCS	$\phi \mu^+ \nu_\mu$
$1.57 \pm 0.25 \pm 0.19$	271	AITALA	99D	E791	$\phi e^+ \nu_e$, $\phi \mu^+ \nu_\mu$
$1.4 \pm 0.5 \pm 0.3$	308	AVERY	94B	CLE2	$\phi e^+ \nu_e$
$1.1 \pm 0.8 \pm 0.1$	90	FRABETTI	94F	E687	$\phi \mu^+ \nu_\mu$
$2.1\ ^{+0.6}_{-0.5} \pm 0.2$	19	KODAMA	93	E653	$\phi \mu^+ \nu_\mu$

[1] 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 $r_2 = 0.763 \pm 0.071 \pm 0.065$.

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

VALUE	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
1.80 ± 0.08 OUR AVERAGE					
$1.807 \pm 0.046 \pm 0.065$	25 ± 0.5k	[1] AUBERT	08AN	BABR	$\phi e^+ \nu_e$
$1.549 \pm 0.250 \pm 0.148$	793	LINK	04C	FOCS	$\phi \mu^+ \nu_\mu$
$2.27 \pm 0.35 \pm 0.22$	271	AITALA	99D	E791	$\phi e^+ \nu_e$, $\phi \mu^+ \nu_\mu$
$0.9 \pm 0.6 \pm 0.3$	308	AVERY	94B	CLE2	$\phi e^+ \nu_e$
$1.8 \pm 0.9 \pm 0.2$	90	FRABETTI	94F	E687	$\phi \mu^+ \nu_\mu$
$2.3\ ^{+1.1}_{-0.9} \pm 0.4$	19	KODAMA	93	E653	$\phi \mu^+ \nu_\mu$

[1] 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 $r_V = 1.849 \pm 0.060 \pm 0.095$.

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

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	[1] FRABETTI	94F	E687	$\phi \mu^+ \nu_\mu$
0.54±0.21±0.10	19	[1] KODAMA	93	E653	$\phi \mu^+ \nu_\mu$

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

$D_s^\pm$ REFERENCES

ABLIKIM	19O	PR D99 031101	M. Ablikim et al.	(BES III Collab.)
ABLIKIM	18A	PR D97 012006	M. Ablikim et al.	(BES III Collab.)
AAIJ	17AF	PL B771 21	R. Aaij et al.	(LHCb Collab.)
AAIJ	17AN	PRL 119 101801	R. Aaij et al.	(LHCb Collab.)
ABLIKIM	16O	PR D94 072004	M. Ablikim et al.	(BES III Collab.)
ABLIKIM	16T	PR D94 112003	M. Ablikim et al.	(BES III Collab.)
ABLIKIM	15Z	PL B750 466	M. Ablikim et al.	(BES III Collab.)
HIETALA	15	PR D92 012009	J. Hietala et al.	(MINN, LUTH, OXF)
LEES	15D	PR D91 019901 (errat.)	J.P. Lees et al.	(BABAR Collab.)
AAIJ	14BD	JHEP 1410 025	R. Aaij et al.	(LHCb Collab.)
ABAZOV	14B	PRL 112 111804	V.M. Abazov et al.	(D0 Collab.)
AAIJ	13AF	PL B724 203	R. Aaij et al.	(LHCb Collab.)
AAIJ	13V	JHEP 1306 065	R. Aaij et al.	(LHCb Collab.)
AAIJ	13W	JHEP 1306 112	R. Aaij et al.	(LHCb Collab.)
LEES	13E	PR D87 052012	J.P. Lees et al.	(BABAR Collab.)
ONYISI	13	PR D88 032009	P.U.E. Onyisi et al.	(CLEO Collab.)
ZUPANC	13	JHEP 1309 139	A. Zupanc et al.	(BELLE Collab.)
DEL-AMO-SA...	11G	PR D83 052001	P. del Amo Sanchez et al.	(BABAR Collab.)
LEES	11E	PR D84 031103	J.P. Lees et al.	(BABAR Collab.)
LEES	11G	PR D84 072006	J.P. Lees et al.	(BABAR Collab.)
MARTIN	11	PR D84 012005	L. Martin et al.	(CLEO Collab.)
ASNER	10	PR D81 052007	D.M. Asner et al.	(CLEO Collab.)
DEL-AMO-SA...	10J	PR D82 091103	P. del Amo Sanchez et al.	(BABAR Collab.)
Also		PR D91 019901 (errat.)	J.P. Lees et al.	(BABAR Collab.)
KO	10	PRL 104 181602	B.R. Ko et al.	(BELLE Collab.)
MENDEZ	10	PR D81 052013	H. Mendez et al.	(CLEO Collab.)
RUBIN	10	PR D82 092007	P. Rubin et al.	(CLEO Collab.)
ALEXANDER	09	PR D79 052001	J.P. Alexander et al.	(CLEO Collab.)
AUBERT	09O	PR D79 032003	B. Aubert et al.	(BABAR Collab.)
DOBBS	09	PR D79 112008	S. Dobbs et al.	(CLEO Collab.)
ECKLUND	09	PR D80 052009	K.M. Ecklund et al.	(CLEO Collab.)
GE	09A	PR D80 051102	J.Y. Ge et al.	(CLEO Collab.)
KO	09	PRL 102 221802	B.R. Ko et al.	(BELLE Collab.)
MITCHELL	09A	PR D79 072008	R.E. Mitchell et al.	(CLEO Collab.)
NAIK	09A	PR D80 112004	P. Naik et al.	(CLEO Collab.)
ONYISI	09	PR D79 052002	P.U.E. Onyisi et al.	(CLEO Collab.)
WON	09	PR D80 111101	E. Won et al.	(BELLE Collab.)
YELTON	09	PR D80 052007	J. Yelton et al.	(CLEO Collab.)
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 051101	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 031103	B. Aubert et al.	(BABAR Collab.)
HUANG	06B	PR D74 112005	G.S. Huang et al.	(CLEO Collab.)
PDG	06	JP G33 1	W.-M. Yao et al.	(PDG Collab.)
AUBERT	05V	PR D71 091104	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 091104	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.)
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.)
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.)
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.)
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.)
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.)
ALBRECHT	90D	PL B245 315	H. Albrecht *et al.*	(ARGUS Collab.)
ALEXANDER	90B	PRL 65 1531	J. Alexander *et al.*	(CLEO 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.)
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.)
BECKER	87B	PL B184 277	H. Becker *et al.*	(NA11 and NA32 Collabs.)
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.)

OTHER RELATED PAPERS

RICHMAN 95 RMP 67 893 J.D. Richman, P.R. Burchat (UCSB, STAN)