



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

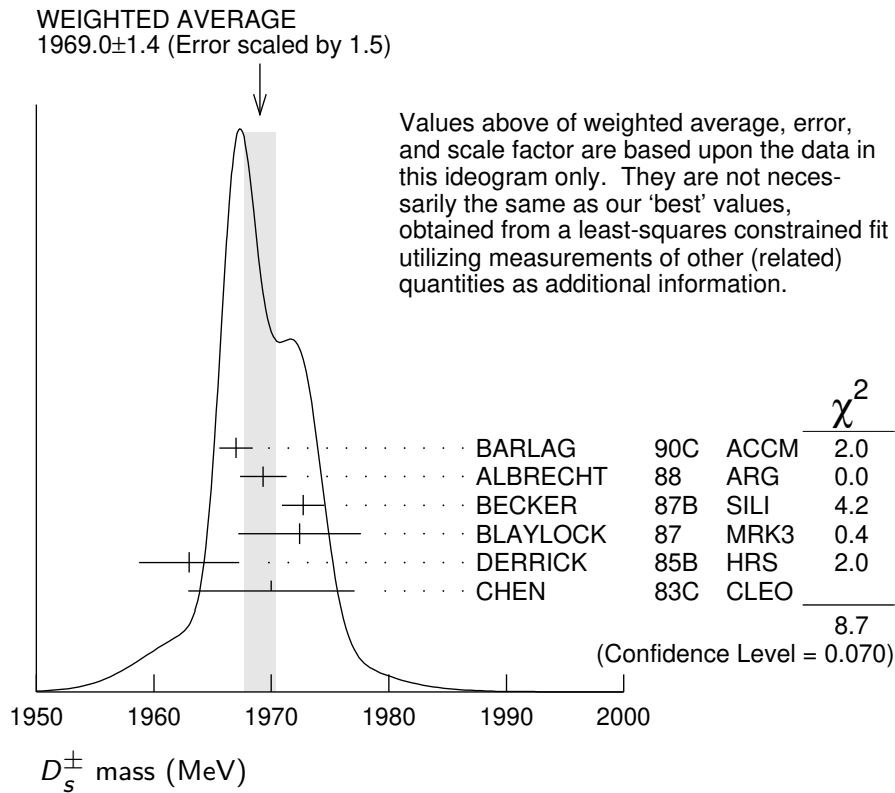
The angular distributions of the decays of the ϕ and $\bar{K}^*(892)^0$ in the $\phi\pi^+$ and $K^+\bar{K}^*(892)^0$ modes strongly indicate that the spin is zero. The parity given is that expected of a $c\bar{s}$ ground state.

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
1968.35 ± 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 → $\phi\pi^+X$

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	$\bar{p}p$, $\sqrt{s}=1.96$ 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 $\bar{K}^{*0} K^+$
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±15.0 ⁺ _{5.1}	2167	² BONVICINI	99	CLE2	$e^+e^- \approx \mathcal{R}(4S)$
475 ±20 ± 7	900	FRABETTI	93F	E687	γ Be, $\phi\pi^+$
500 ±60 ±30	104	FRABETTI	90	E687	γ Be, $\phi\pi^+$
470 ±40 ±20	228	RAAB	88	E691	Photoproduction

¹This 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.

²BONVICINI 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_j/Γ)	Scale factor/ Confidence level
Inclusive modes		
Γ_1 e^+ semileptonic	[a] (6.33 ±0.15) %	
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, $f_0 \rightarrow \pi^+\pi^-$	< 1.3 %	CL=90%
Γ_{12} ϕ anything	(15.7 ±1.0) %	
Γ_{13} K^+K^- anything	(15.8 ±0.7) %	
Γ_{14} $K_S^0K^+$ anything	(5.8 ±0.5) %	
Γ_{15} $K_S^0K^-$ 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} $\mu^+\nu_\mu$	(5.43 ±0.15) $\times 10^{-3}$	
Γ_{21} $\tau^+\nu_\tau$	(5.32 ±0.11) %	
Γ_{22} $\gamma e^+\nu_e$	< 1.3 $\times 10^{-4}$	CL=90%
Γ_{23} $K^+K^-e^+\nu_e$	—	
Γ_{24} $\phi e^+\nu_e$	[d] (2.39 ±0.16) %	S=1.3
Γ_{25} $\phi\mu^+\nu_\mu$	(1.9 ±0.5) %	

Γ_{26}	$\eta e^+ \nu_e + \eta'(958) e^+ \nu_e$	[d]	(3.03 \pm 0.24) %	
Γ_{27}	$\eta e^+ \nu_e$	[d]	(2.32 \pm 0.08) %	
Γ_{28}	$\eta'(958) e^+ \nu_e$	[d]	(8.0 \pm 0.7) $\times 10^{-3}$	
Γ_{29}	$\eta \mu^+ \nu_\mu$		(2.4 \pm 0.5) %	
Γ_{30}	$\eta'(958) \mu^+ \nu_\mu$		(1.1 \pm 0.5) %	
Γ_{31}	$\omega e^+ \nu_e$	[e]	< 2.0 $\times 10^{-3}$	CL=90%
Γ_{32}	$K^0 e^+ \nu_e$		(3.4 \pm 0.4) $\times 10^{-3}$	
Γ_{33}	$K^*(892)^0 e^+ \nu_e$	[d]	(2.15 \pm 0.28) $\times 10^{-3}$	S=1.1
Γ_{34}	$f_0(980) e^+ \nu_e, f_0 \rightarrow \pi^+ \pi^-$			
Γ_{35}	$a_0(980)^0 e^+ \nu_e, a_0(980)^0 \rightarrow \pi^0 \eta$		< 1.2 $\times 10^{-4}$	CL=90%

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

Γ_{36}	$K^+ K_S^0$		(1.453 \pm 0.035) %	
Γ_{37}	$K^+ K_L^0$		(1.49 \pm 0.06) %	
Γ_{38}	$K^+ \bar{K}^0$		(2.95 \pm 0.14) %	
Γ_{39}	$K^+ K^- \pi^+$	[f]	(5.38 \pm 0.10) %	S=1.1
Γ_{40}	$\phi \pi^+$	[d,g]	(4.5 \pm 0.4) %	
Γ_{41}	$\phi \pi^+, \phi \rightarrow K^+ K^-$	[g]	(2.22 \pm 0.06) %	
Γ_{42}	$K^+ \bar{K}^*(892)^0, \bar{K}^{*0} \rightarrow K^- \pi^+$		(2.58 \pm 0.06) %	
Γ_{43}	$f_0(980) \pi^+, f_0 \rightarrow K^+ K^-$		(1.11 \pm 0.19) %	
Γ_{44}	$f_0(1370) \pi^+, f_0 \rightarrow K^+ K^-$		(7.1 \pm 2.9) $\times 10^{-4}$	
Γ_{45}	$f_0(1710) \pi^+, f_0 \rightarrow K^+ K^-$		(6.7 \pm 2.8) $\times 10^{-4}$	
Γ_{46}	$K^+ \bar{K}_0^*(1430)^0, \bar{K}_0^* \rightarrow K^- \pi^+$		(1.76 \pm 0.25) $\times 10^{-3}$	
Γ_{47}	$K^+ K_S^0 \pi^0$		(1.52 \pm 0.22) %	
Γ_{48}	$2K_S^0 \pi^+$		(7.7 \pm 0.6) $\times 10^{-3}$	
Γ_{49}	$K^0 \bar{K}^0 \pi^+$		—	
Γ_{50}	$K^*(892)^+ \bar{K}^0$	[d]	(5.4 \pm 1.2) %	
Γ_{51}	$K^+ K^- \pi^+ \pi^0$		(5.50 \pm 0.24) %	S=1.3
Γ_{52}	$\phi \rho^+$	[d]	(5.59 \pm 0.34) %	
Γ_{53}	$\bar{K}_1(1270)^0 K^+, \bar{K}_1(1270)^0 \rightarrow K^- \rho^+$		(5.7 \pm 0.6) $\times 10^{-3}$	
Γ_{54}	$\bar{K}_1(1270)^0 K^+, \bar{K}_1(1270)^0 \rightarrow K^*(892) \pi$		(1.31 \pm 0.25) %	
Γ_{55}	$\bar{K}_1(1400)^0 K^+, \bar{K}_1(1400)^0 \rightarrow K^*(892) \pi$		(2.0 \pm 0.4) %	
Γ_{56}	$a_0(980)^0 \rho^+, a_0(980)^0 \rightarrow K^+ K^-$		(1.9 \pm 0.4) $\times 10^{-3}$	
Γ_{57}	$f_1(1420)^0 \pi^+, f_1(1420)^0 \rightarrow K^*(892)^{\mp} K^{\pm}$		(3.9 \pm 0.7) $\times 10^{-3}$	
Γ_{58}	$f_1(1420)^0 \pi^+, f_1(1420)^0 \rightarrow a_0(980)^0 \pi^0, a_0(980)^0 \rightarrow K^+ K^-$		(4.0 \pm 1.4) $\times 10^{-4}$	

Γ_{59}	$\eta(1475)\pi^+, \eta(1475) \rightarrow$ $a_0(980)^0\pi^0, a_0(980)^0 \rightarrow$ K^+K^-	(7.0 \pm 2.8) $\times 10^{-4}$	
Γ_{60}	$K_S^0 K^- 2\pi^+$	(1.53 \pm 0.08) %	S=1.5
Γ_{61}	$K^*(892)^+ \bar{K}^*(892)^0$	[d] (5.64 \pm 0.35) %	
Γ_{62}	$\eta(1475)K_S^0, \eta \rightarrow$ $K^*(892)^0\pi^+, K^{*0} \rightarrow$ $K^-\pi^+$	(3.4 \pm 1.0) $\times 10^{-4}$	
Γ_{63}	$\eta(1475)\pi^+, \eta \rightarrow$ $\bar{K}^*(892)^+ K^-, \bar{K}^{*+} \rightarrow$ $K_S^0\pi^+$	(3.4 \pm 1.0) $\times 10^{-4}$	
Γ_{64}	$\eta(1475)\pi^+, \eta \rightarrow$ $a_0(980)^-\pi^+, a_0^- \rightarrow$ $K_S^0 K^-$	(1.7 \pm 0.9) $\times 10^{-3}$	
Γ_{65}	$f_1(1285)\pi^+, f_1 \rightarrow$ $a_0(980)^-\pi^+, a_0^- \rightarrow$ $K_S^0 K^-$	(3.4 \pm 0.8) $\times 10^{-4}$	
Γ_{66}	$K^+ K_S^0\pi^+\pi^-$	(9.5 \pm 0.8) $\times 10^{-3}$	S=1.1
Γ_{67}	$K^+ K^- 2\pi^+\pi^-$	(8.6 \pm 1.5) $\times 10^{-3}$	
Γ_{68}	$\phi 2\pi^+\pi^-$	[d] (1.21 \pm 0.16) %	
Γ_{69}	$\phi\rho^0\pi^+, \phi \rightarrow K^+K^-$	(6.4 \pm 1.3) $\times 10^{-3}$	
Γ_{70}	$\phi a_1(1260)^+, \phi \rightarrow$ $K^+K^-, a_1^+ \rightarrow$ $\rho^0\pi^+$	(7.4 \pm 1.2) $\times 10^{-3}$	
Γ_{71}	$\phi 2\pi^+\pi^- \text{ non-}\rho, \phi \rightarrow$ K^+K^-	(1.8 \pm 0.7) $\times 10^{-3}$	
Γ_{72}	$K^+ K^- \rho^0\pi^+ \text{ non-}\phi$	< 2.6 $\times 10^{-4}$	CL=90%
Γ_{73}	$K^+ K^- 2\pi^+\pi^- \text{ nonresonant}$	(9 \pm 7) $\times 10^{-4}$	
Γ_{74}	$2K_S^0 2\pi^+\pi^-$	(7.8 \pm 3.3) $\times 10^{-4}$	

Hadronic modes without K 's

Γ_{75}	$\pi^+\pi^0$	< 1.2 $\times 10^{-4}$	CL=90%
Γ_{76}	$2\pi^+\pi^-$	(1.08 \pm 0.04) %	
Γ_{77}	$\rho^0\pi^+$	(1.9 \pm 1.2) $\times 10^{-4}$	
Γ_{78}	$\pi^+(\pi^+\pi^-)_{S\text{-wave}}$	[h] (9.0 \pm 0.4) $\times 10^{-3}$	
Γ_{79}	$f_0(980)\pi^+, f_0 \rightarrow \pi^+\pi^-$		
Γ_{80}	$f_0(1370)\pi^+, f_0 \rightarrow \pi^+\pi^-$		
Γ_{81}	$f_0(1500)\pi^+, f_0 \rightarrow \pi^+\pi^-$		
Γ_{82}	$f_2(1270)\pi^+, f_2 \rightarrow \pi^+\pi^-$	(1.09 \pm 0.19) $\times 10^{-3}$	
Γ_{83}	$\rho(1450)^0\pi^+, \rho^0 \rightarrow \pi^+\pi^-$	(2.9 \pm 1.9) $\times 10^{-4}$	
Γ_{84}	$\pi^+ 2\pi^0$	(6.5 \pm 1.3) $\times 10^{-3}$	
Γ_{85}	$2\pi^+\pi^-\pi^0$	—	
Γ_{86}	$\eta\pi^+$	[d] (1.68 \pm 0.09) %	S=1.1
Γ_{87}	$\omega\pi^+$	[d] (1.92 \pm 0.30) $\times 10^{-3}$	

Γ_{88}	$3\pi^+2\pi^-$		$(7.9 \pm 0.8) \times 10^{-3}$	
Γ_{89}	$2\pi^+\pi^-2\pi^0$		—	
Γ_{90}	$\eta\rho^+$	[d]	$(8.9 \pm 0.8) \%$	
Γ_{91}	$\eta\pi^+\pi^0$		$(9.5 \pm 0.5) \%$	
Γ_{92}	$\eta(\pi^+\pi^0) P\text{-wave}$		$(5.1 \pm 3.1) \times 10^{-3}$	
Γ_{93}	$2\pi^+\pi^-\eta$		$(3.12 \pm 0.16) \%$	
Γ_{94}	$a_1(1260)^+\eta, a_1^+ \rightarrow$ $\rho(770)^0\pi^+, \rho^0 \rightarrow \pi^+\pi^-$		$(1.73 \pm 0.16) \%$	
Γ_{95}	$a_1(1260)^+\eta, a_1^+ \rightarrow$ $f_0(500)\pi^+, f_0 \rightarrow \pi^+\pi^-$		$(2.5 \pm 0.9) \times 10^{-3}$	
Γ_{96}	$a_0(980)^{+0}\pi^{0+},$ $a_0(980)^{+0} \rightarrow \eta\pi^{+0}$		$(2.2 \pm 0.4) \%$	
Γ_{97}	$a_0(980)^+\rho(770)^0, a_0^+ \rightarrow$ $\eta\pi^+$		$(2.1 \pm 0.9) \times 10^{-3}$	
Γ_{98}	$\eta(1405)\pi^+, \eta(1405) \rightarrow$ $a_0(980)^-\pi^+, a_0^- \rightarrow \eta\pi^-$		$(2.2 \pm 0.7) \times 10^{-4}$	
Γ_{99}	$\eta(1405)\pi^+, \eta(1405) \rightarrow$ $a_0(980)^+\pi^-, a_0^+ \rightarrow \eta\pi^+$		$(2.2 \pm 0.7) \times 10^{-4}$	
Γ_{100}	$f_1(1420)\pi^+, f_1 \rightarrow$ $a_0(980)^-\pi^+, a_0^- \rightarrow \eta\pi^-$		$(5.9 \pm 1.8) \times 10^{-4}$	
Γ_{101}	$f_1(1420)\pi^+, f_1 \rightarrow$ $a_0(980)^+\pi^-, a_0^+ \rightarrow \eta\pi^+$		$(5.3 \pm 1.8) \times 10^{-4}$	
Γ_{102}	$\omega\pi^+\pi^0$	[d]	$(2.8 \pm 0.7) \%$	
Γ_{103}	$3\pi^+2\pi^-\pi^0$		$(4.9 \pm 3.2) \%$	
Γ_{104}	$\omega 2\pi^+\pi^-$	[d]	$(1.6 \pm 0.5) \%$	
Γ_{105}	$\eta'(958)\pi^+$	[c,d]	$(3.94 \pm 0.25) \%$	
Γ_{106}	$3\pi^+2\pi^-2\pi^0$		—	
Γ_{107}	$\omega\eta\pi^+$	[d]	< 2.13	% CL=90%
Γ_{108}	$\eta'(958)\rho^+$	[c,d]	$(5.8 \pm 1.5) \%$	
Γ_{109}	$\eta'(958)\pi^+\pi^0$		$(5.6 \pm 0.8) \%$	
Γ_{110}	$\eta'(958)\pi^+\pi^0$ nonresonant		< 5.1	% CL=90%

Modes with one or three K's

Γ_{111}	$K^+\pi^0$		$(7.4 \pm 0.5) \times 10^{-4}$	
Γ_{112}	$K_S^0\pi^+$		$(1.10 \pm 0.05) \times 10^{-3}$	
Γ_{113}	$K^+\eta$	[d]	$(1.73 \pm 0.08) \times 10^{-3}$	
Γ_{114}	$K^+\omega$	[d]	$(8.7 \pm 2.5) \times 10^{-4}$	
Γ_{115}	$K^+\eta'(958)$	[d]	$(2.64 \pm 0.24) \times 10^{-3}$	
Γ_{116}	$K^+\pi^+\pi^-$		$(6.5 \pm 0.4) \times 10^{-3}$	
Γ_{117}	$K^+\rho^0$		$(2.5 \pm 0.4) \times 10^{-3}$	
Γ_{118}	$K^+\rho(1450)^0, \rho^0 \rightarrow \pi^+\pi^-$		$(6.9 \pm 2.4) \times 10^{-4}$	
Γ_{119}	$K^*(892)^0\pi^+, K^{*0} \rightarrow K^+\pi^-$		$(1.40 \pm 0.24) \times 10^{-3}$	

Γ_{120}	$K^*(1410)^0 \pi^+, K^{*0} \rightarrow K^+ \pi^-$	$(1.22 \pm 0.28) \times 10^{-3}$	
Γ_{121}	$K^*(1430)^0 \pi^+, K^{*0} \rightarrow K^+ \pi^-$	$(5.0 \pm 3.4) \times 10^{-4}$	
Γ_{122}	$K^+ \pi^+ \pi^-$ nonresonant	$(1.03 \pm 0.34) \times 10^{-3}$	
Γ_{123}	$K^0 \pi^+ \pi^0$	$(1.08 \pm 0.06) \%$	
Γ_{124}	$K_S^0 2\pi^+ \pi^-$	$(2.8 \pm 1.0) \times 10^{-3}$	
Γ_{125}	$K^+ \omega \pi^0$	$[d] < 8.2$	$\times 10^{-3}$ CL=90%
Γ_{126}	$K^+ \omega \pi^+ \pi^-$	$[d] < 5.4$	$\times 10^{-3}$ CL=90%
Γ_{127}	$K^+ \omega \eta$	$[d] < 7.9$	$\times 10^{-3}$ CL=90%
Γ_{128}	$2K^+ K^-$	$(2.15 \pm 0.20) \times 10^{-4}$	
Γ_{129}	$\phi K^+, \phi \rightarrow K^+ K^-$	$(8.8 \pm 2.0) \times 10^{-5}$	

Doubly Cabibbo-suppressed modes

Γ_{130}	$2K^+ \pi^-$	$(1.276 \pm 0.031) \times 10^{-4}$	
Γ_{131}	$K^+ K^*(892)^0, K^{*0} \rightarrow K^+ \pi^-$	$(6.0 \pm 3.4) \times 10^{-5}$	

Baryon-antibaryon mode

Γ_{132}	$p \bar{n}$	$(1.22 \pm 0.11) \times 10^{-3}$	
Γ_{133}	$p \bar{p} e^+ \nu_e$	< 2.0	$\times 10^{-4}$ CL=90%

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

Γ_{134}	$\pi^+ e^+ e^-$	$[i] < 5.5$	$\times 10^{-6}$	CL=90%
Γ_{135}	$\pi^+ \phi, \phi \rightarrow e^+ e^-$	$[j] (6 \begin{smallmatrix} +8 \\ -4 \end{smallmatrix})$	$\times 10^{-6}$	
Γ_{136}	$\pi^+ \mu^+ \mu^-$	$[i] < 1.8$	$\times 10^{-7}$	CL=90%
Γ_{137}	$K^+ e^+ e^-$	C1 < 3.7	$\times 10^{-6}$	CL=90%
Γ_{138}	$K^+ \mu^+ \mu^-$	C1 < 1.4	$\times 10^{-7}$	CL=90%
Γ_{139}	$K^*(892)^+ \mu^+ \mu^-$	C1 < 1.4	$\times 10^{-3}$	CL=90%
Γ_{140}	$\pi^+ e^+ \mu^-$	LF < 1.1	$\times 10^{-6}$	CL=90%
Γ_{141}	$\pi^+ e^- \mu^+$	LF < 9.4	$\times 10^{-7}$	CL=90%
Γ_{142}	$K^+ e^+ \mu^-$	LF < 7.9	$\times 10^{-7}$	CL=90%
Γ_{143}	$K^+ e^- \mu^+$	LF < 5.6	$\times 10^{-7}$	CL=90%
Γ_{144}	$\pi^- 2e^+$	L < 1.4	$\times 10^{-6}$	CL=90%
Γ_{145}	$\pi^- 2\mu^+$	L < 8.6	$\times 10^{-8}$	CL=90%
Γ_{146}	$\pi^- e^+ \mu^+$	L < 6.3	$\times 10^{-7}$	CL=90%
Γ_{147}	$K^- 2e^+$	L < 7.7	$\times 10^{-7}$	CL=90%
Γ_{148}	$K^- 2\mu^+$	L < 2.6	$\times 10^{-8}$	CL=90%
Γ_{149}	$K^- e^+ \mu^+$	L < 2.6	$\times 10^{-7}$	CL=90%
Γ_{150}	$K^*(892)^- 2\mu^+$	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 $u\bar{u}$ or $d\bar{d}$ content in the D_s^+ . Neither Cabibbo-favored nor Cabibbo-suppressed decays can contribute, and ω - ϕ 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 $D_s^+ \rightarrow \phi \pi^+$ 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.
- [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 $\Delta C=1$ weak neutral current because both quarks must change flavor in this decay.
- [j] This is *not* a test for the $\Delta C=1$ weak neutral current, but leads to the $\pi^+ \ell^+ \ell^-$ final state.

CONSTRAINED FIT INFORMATION

An overall fit to 13 branching ratios uses 21 measurements and one constraint to determine 10 parameters. The overall fit has a $\chi^2 = 11.6$ for 12 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta x_i \delta x_j \rangle / (\delta x_i \delta x_j)$, 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 ₃₉	27							
x ₅₁	8	1						
x ₆₀	25	6	15					
x ₆₆	20	4	12	46				
x ₇₆	17	33	2	7	5			
x ₈₆	1	14	-9	-15	-12	6		
x ₈₇	0	1	0	-1	0	0	4	
x ₁₁₆	3	20	-6	-9	-7	7	12	0
	x ₃₆	x ₃₉	x ₅₁	x ₆₀	x ₆₆	x ₇₆	x ₈₆	x ₈₇

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.

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
6.33±0.15 OUR AVERAGE				
6.30±0.13±0.10	17k	^{1,2} ABLIKIM	21AC BES3	e^+e^- at 4.178–4.230 GeV
6.52±0.39±0.15	0.5k	³ ASNER	10 CLEO	e^+e^- at 3774 MeV

¹ ABLIKIM 21AC finds that the ratio of the D_s^+ and D^0 semielectronic widths is $0.790 \pm 0.016 \pm 0.020$.

² ABLIKIM 21AC reports a value of $(6.30 \pm 0.13 \pm 0.09 \pm 0.04) \times 10^{-2}$, where the last uncertainty is an external systematic from $B(D_s^+ \rightarrow \tau\nu)$. We have added the systematic uncertainties in quadrature.

³ Using the D_s^+ and D^0 lifetimes, ASNER 10 finds that the ratio of the D_s^+ and D^0 semileptonic widths is $0.828 \pm 0.051 \pm 0.025$.

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

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

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

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

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

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

 $\Gamma(\phi \text{ anything})/\Gamma_{\text{total}}$ 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
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$\Gamma(K^+ K^- \text{ anything})/\Gamma_{\text{total}}$					Γ_{13}/Γ
VALUE (%)		DOCUMENT ID	TECN	COMMENT	
15.8±0.6±0.3		DOBBS	09	CLEO	$e^+ e^-$ at 4170 MeV
$\Gamma(K_S^0 K^+ \text{ anything})/\Gamma_{\text{total}}$					Γ_{14}/Γ
VALUE (%)		DOCUMENT ID	TECN	COMMENT	
5.8±0.5±0.1		DOBBS	09	CLEO	$e^+ e^-$ at 4170 MeV
$\Gamma(K_S^0 K^- \text{ anything})/\Gamma_{\text{total}}$					Γ_{15}/Γ
VALUE (%)		DOCUMENT ID	TECN	COMMENT	
1.9±0.4±0.1		DOBBS	09	CLEO	$e^+ e^-$ at 4170 MeV
$\Gamma(2K_S^0 \text{ anything})/\Gamma_{\text{total}}$					Γ_{16}/Γ
VALUE (%)		DOCUMENT ID	TECN	COMMENT	
1.7±0.3±0.1		DOBBS	09	CLEO	$e^+ e^-$ at 4170 MeV
$\Gamma(2K^+ \text{ anything})/\Gamma_{\text{total}}$					Γ_{17}/Γ
VALUE (%)	CL%	DOCUMENT ID	TECN	COMMENT	
<0.26	90	DOBBS	09	CLEO	$e^+ e^-$ at 4170 MeV
$\Gamma(2K^- \text{ anything})/\Gamma_{\text{total}}$					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](#)

$\Gamma(e^+ \nu_e)/\Gamma_{\text{total}}$					Γ_{19}/Γ
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<0.83 × 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 × 10 ⁻⁴	90	DEL-AMO-SA..10J	BABR		$e^+ e^-$, 10.58 GeV
<1.2 × 10 ⁻⁴	90	ALEXANDER	09	CLEO	$e^+ e^-$ at 4170 MeV
<1.3 × 10 ⁻⁴	90	PEDLAR	07A	CLEO	See ALEXANDER 09
¹ ZUPANC 13 also gives the limit as < 1.0 × 10 ⁻⁴ at 95% CL.					

$\Gamma(\mu^+ \nu_\mu)/\Gamma_{\text{total}}$					Γ_{20}/Γ
VALUE (units 10 ⁻³)	EVTS	DOCUMENT ID	TECN	COMMENT	
5.43±0.15 OUR AVERAGE					
5.35±0.13±0.16	2.2k	ABLIKIM	21BE	BES3	$e^+ e^-$, 4.178, 4.226 GeV
5.17±0.75±0.21	69	¹ ABLIKIM	16O	BES3	$e^+ e^-$ at 4.009 GeV
5.31±0.28±0.20	492 ± 26	² ZUPANC	13	BELL	$e^+ e^-$ at $\Upsilon(4S), \Upsilon(5S)$
6.02±0.38±0.34	275 ± 17	³ DEL-AMO-SA..10J	BABR		$e^+ e^-$, 10.58 GeV
5.65±0.45±0.17	235 ± 14	ALEXANDER	09	CLEO	$e^+ e^-$ at 4170 MeV

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

5.49±0.16±0.15	1.1k	ABLIKIM	19E	BES3	e ⁺ e ⁻ at 4178 MeV
6.44±0.76±0.57	169 ± 18	⁴ WIDHALM	08	BELL	See ZUPANC 13
5.94±0.66±0.31	88	⁵ PEDLAR	07A	CLEO	See ALEXANDER 09
6.8 ± 1.1 ± 1.8	553	⁶ HEISTER	02I	ALEP	Z decays

¹ ABLIKIM 160 also reports that when constrained by the Standard Model ratio of $\Gamma(D_s^+ \rightarrow \tau^+ \nu_\tau)/\Gamma(D_s^+ \rightarrow \mu^+ \nu_\mu) = 9.76$, the branching fraction is found to be $(0.495 \pm 0.067 \pm 0.026)\%$. 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 $3.6 \pm 0.9\%$, 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 $f_{D_s} = (285 \pm 19 \pm 40)$ MeV.

$\Gamma(\mu^+ \nu_\mu)/\Gamma(\phi\pi^+)$

Γ_{20}/Γ_{40}

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.143±0.018±0.006	489 ± 55	¹ AUBERT	07V	BABR	e ⁺ e ⁻ ≈ $\Upsilon(4S)$
0.23 ± 0.06 ± 0.04	18	² ALEXANDROV	00	BEAT	π^- nucleus, 350 GeV
0.173±0.023±0.035	182	³ CHADHA	98	CLE2	e ⁺ e ⁻ ≈ $\Upsilon(4S)$
0.245±0.052±0.074	39	⁴ ACOSTA	94	CLE2	See CHADHA 98

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

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 $D^+ \rightarrow \mu^+ \nu_\mu$ and $D_s^+ \rightarrow \mu^+ \nu_\mu$ 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 $\Gamma(D_s^+ \rightarrow \phi\pi^+)/\Gamma(\text{total}) = 0.036 \pm 0.009$.

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

$\Gamma(\tau^+ \nu_\tau)/\Gamma_{\text{total}}$

Γ_{21}/Γ

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

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
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5.32±0.11 OUR AVERAGE

5.29±0.25±0.20	1.7k	¹ ABLIKIM	21AF	BES3	e ⁺ e ⁻ at 4.178, 4.226 GeV
5.27±0.10±0.12	4.9k	² ABLIKIM	21AZ	BES3	e ⁺ e ⁻ at 4.178, 4.226 GeV
5.21±0.25±0.17	950	³ ABLIKIM	21BE	BES3	e ⁺ e ⁻ at 4.178, 4.226 GeV

$3.28 \pm 1.83 \pm 0.37$	33	⁴ ABLIKIM	160	BES3	e^+e^- at 4.009 GeV
$5.70 \pm 0.21^{+0.31}_{-0.30}$	2.2k	⁵ ZUPANC	13	BELL	e^+e^- at $\Upsilon(4S), \Upsilon(5S)$
$4.96 \pm 0.37 \pm 0.57$	748	⁶ DEL-AMO-SA..10J	BABR		$e^-\bar{\nu}_e\nu_\tau, \mu^-\bar{\nu}_\mu\nu_\tau$
$6.42 \pm 0.81 \pm 0.18$	126	⁷ ALEXANDER	09	CLEO	$\tau^+ \rightarrow \pi^+\bar{\nu}_\tau$
$5.52 \pm 0.57 \pm 0.21$	155	⁷ NAIK	09A	CLEO	$\tau^+ \rightarrow \rho^+\bar{\nu}_\tau$
$5.30 \pm 0.47 \pm 0.22$	181	⁷ ONYISI	09	CLEO	$\tau^+ \rightarrow e^+\nu_e\bar{\nu}_\tau$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
$6.17 \pm 0.71 \pm 0.34$	102	⁸ ECKLUND	08	CLEO	See ONYISI 09
$8.0 \pm 1.3 \pm 0.4$	47	⁸ PEDLAR	07A	CLEO	See ALEXANDER 09
$5.79 \pm 0.77 \pm 1.84$	881	⁹ HEISTER	02I	ALEP	Z decays
$7.0 \pm 2.1 \pm 2.0$	22	¹⁰ ABBIENDI	01L	OPAL	$D_s^{*+} \rightarrow \gamma D_s^+$ from Z's
$7.4 \pm 2.8 \pm 2.4$	16	¹¹ ACCIARRI	97F	L3	$D_s^{*+} \rightarrow \gamma D_s^+$ from Z's

¹ ABLIKIM 21F uses $\tau^+ \rightarrow \pi^+\pi^0\bar{\nu}$ decays.

² ABLIKIM 21AZ uses $\tau^+ \rightarrow e^+\nu_e\bar{\nu}_\tau$ decays.

³ ABLIKIM 21BE uses $\tau^+ \rightarrow e^+\nu_e\bar{\nu}_\tau$ decays. When constrained by the Standard Model ratio of $\Gamma(D_s^+ \rightarrow \tau^+\nu_\tau)/\Gamma(D_s^+ \rightarrow \mu^+\nu_\mu) = 9.75$, the branching fraction is found to be $(5.22 \pm 0.10 \pm 0.14)\%$.

⁴ ABLIKIM 160 also reports that when constrained by the Standard Model ratio of $\Gamma(D_s^+ \rightarrow \tau^+\nu_\tau)/\Gamma(D_s^+ \rightarrow \mu^+\nu_\mu) = 9.76$; the branching fraction is found to be $(4.83 \pm 0.65 \pm 0.26)\%$.

⁵ ZUPANC 13 uses both $\mu^+\nu$ and $\tau^+\nu$ events to get $f_{D_s} = (255.5 \pm 4.2 \pm 5.1)$ MeV.

⁶ 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.

⁷ 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.

⁸ ECKLUND 08 and PEDLAR 07A are independent: ECKLUND 08 uses $\tau^+ \rightarrow e^+\nu_e\bar{\nu}_\tau$ events, PEDLAR 07A uses $\tau^+ \rightarrow \pi^+\bar{\nu}_\tau$ events.

⁹ HEISTER 02I combines its $D_s^+ \rightarrow \tau^+\nu_\tau$ and $\mu^+\nu_\mu$ branching fractions to get $f_{D_s} = (285 \pm 19 \pm 40)$ MeV.

¹⁰ This ABBIENDI 01L value gives a decay constant f_{D_s} of $(286 \pm 44 \pm 41)$ MeV.

¹¹ The second ACCIARRI 97F error here combines in quadrature systematic (0.016) and normalization (0.018) errors. The branching fraction gives $f_{D_s} = (309 \pm 58 \pm 33 \pm 38)$ MeV.

$\Gamma(\tau^+\nu_\tau)/\Gamma(\mu^+\nu_\mu)$

Γ_{21}/Γ_{20}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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● ● ● 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 $274 \pm 10 \pm 5$ MeV.

$\Gamma(\gamma e^+ \nu_e)/\Gamma_{\text{total}}$

Γ_{22}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.3 \times 10^{-4}$	90	ABLIKIM	19AD BES3	for $E_\gamma > 10$ MeV

$\Gamma(K^+ K^- e^+ \nu_e)/\Gamma(K^+ K^- \pi^+)$

Γ_{23}/Γ_{39}

VALUE	DOCUMENT ID	TECN	COMMENT
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• • • 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 $\Upsilon(4S)$

¹This 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_{24}/Γ

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

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
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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

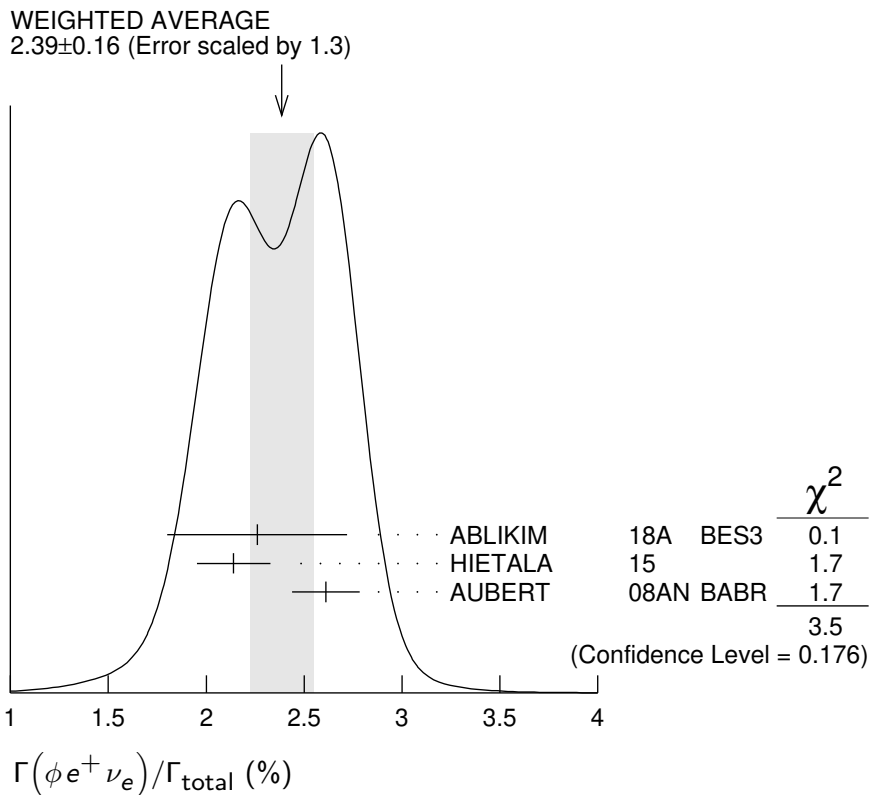
$2.14 \pm 0.17 \pm 0.08$ 207 HIETALA 15 Uses CLEO data

$2.61 \pm 0.03 \pm 0.17$ 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_{24}/Γ_{40}

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.

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
● ● ● 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 $\phi e^+ \nu_e$
$0.49 \pm 0.10 \begin{smallmatrix} +0.10 \\ -0.14 \end{smallmatrix}$	54	ALEXANDER	90B CLEO	Uses $\phi e^+ \nu_e$ and $\phi \mu^+ \nu_\mu$

 $\Gamma(\phi \mu^+ \nu_\mu)/\Gamma_{\text{total}}$ Γ_{25}/Γ

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

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

Unseen decay modes of the η are included.

<u>VALUE (%)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
2.32 ± 0.08 OUR AVERAGE				
$2.323 \pm 0.063 \pm 0.063$	1.8k	ABLIKIM	19S BES3	$e^+ e^-$ at 4178 MeV
$2.30 \pm 0.31 \pm 0.08$	63	ABLIKIM	16T BES3	$e^+ e^-$ at 4.009 GeV
$2.28 \pm 0.14 \pm 0.19$	358	¹ 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

¹ Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration.

 $\Gamma(\eta e^+ \nu_e)/\Gamma(\phi e^+ \nu_e)$ Γ_{27}/Γ_{24}

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

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
● ● ● 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_{28}/Γ

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

<u>VALUE (%)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.80 ± 0.07 OUR AVERAGE				
$0.824 \pm 0.073 \pm 0.027$	261	ABLIKIM	19S BES3	$e^+ e^-$ at 4178 MeV
$0.93 \pm 0.30 \pm 0.05$	14	ABLIKIM	16T BES3	$e^+ e^-$ at 4009 MeV
$0.68 \pm 0.15 \pm 0.06$	20	¹ 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

¹ Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration.

$\Gamma(\eta'(958)e^+\nu_e)/\Gamma(\phi e^+\nu_e)$ Γ_{28}/Γ_{24}

Unseen decay modes of the resonances are included.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.43±0.11±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.

$[\Gamma(\eta e^+\nu_e) + \Gamma(\eta'(958)e^+\nu_e)]/\Gamma(\phi e^+\nu_e)$ $\Gamma_{26}/\Gamma_{24} = (\Gamma_{27}+\Gamma_{28})/\Gamma_{24}$

Unseen decay modes of the resonances are included.

VALUE	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

1.67±0.17±0.17 ¹ BRANDENB... 95 CLE2 See HIETALA 15

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

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

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

$\Gamma(\eta'(958)\mu^+\nu_\mu)/\Gamma_{total}$ Γ_{30}/Γ

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

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

A test for $u\bar{u}$ or $d\bar{d}$ 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
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<0.20 90 MARTIN 11 CLEO e^+e^- at 4170 MeV

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

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
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0.34 ±0.04 OUR AVERAGE

0.325±0.038±0.016 117 ¹ ABLIKIM 19D BES3 e^+e^- at 4178 MeV

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

¹ K^0 reconstructed via $K^0 \rightarrow K_S^0 \rightarrow \pi^+\pi^-$ decays.

$\Gamma(K^*(892)^0 e^+\nu_e)/\Gamma_{total}$ Γ_{33}/Γ

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

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
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0.215±0.028 OUR AVERAGE Error includes scale factor of 1.1.

0.237±0.026±0.020 155 ABLIKIM 19D BES3 e^+e^- at 4178 MeV

0.18 ±0.04 ±0.01 32 ¹ HIETALA 15 e^+e^- at 4.170 GeV

• • • 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

¹ Uses CLEO data, but not authored by the CLEO collaboration

$\Gamma(f_0(980)e^+\nu_e, f_0 \rightarrow \pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{34}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.13 \pm 0.03 \pm 0.01$	42	¹ HIETALA	15	Uses CLEO data
$0.20 \pm 0.03 \pm 0.01$	44	ECKLUND	09	CLEO See HIETALA 15
$0.13 \pm 0.04 \pm 0.01$	13	YELTON	09	CLEO See ECKLUND 09

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

$\Gamma(a_0(980)^0 e^+\nu_e, a_0(980)^0 \rightarrow \pi^0\eta)/\Gamma_{\text{total}}$ Γ_{35}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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$< 1.2 \times 10^{-4}$	90	ABLIKIM	21Y BES3	e^+e^- at 4.178–4.226 GeV
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————— Hadronic modes with a $K\bar{K}$ pair —————

$\Gamma(K^+K_S^0)/\Gamma_{\text{total}}$ Γ_{36}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
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1.453 ± 0.035 OUR FIT

1.46 ± 0.05 OUR AVERAGE Error includes scale factor of 1.2.

$1.425 \pm 0.038 \pm 0.031$	1.8k	ABLIKIM	19AMBES3	e^+e^- at 4178 MeV
$1.52 \pm 0.05 \pm 0.03$		ONYISI	13 CLEO	e^+e^- at 4.17 GeV

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

$1.49 \pm 0.07 \pm 0.05$		¹ ALEXANDER	08 CLEO	See ONYISI 13
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¹ ALEXANDER 08 uses single- and double-tagged events in an overall fit.

$\Gamma(K^+K_S^0)/\Gamma(K^+K^-\pi^+)$ Γ_{36}/Γ_{39}

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
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27.55 ± 0.18 ± 0.50	40k	ABLIKIM	20R BES3	e^+e^- , 4178 ~ 4226 MeV
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$\Gamma(K^+K_L^0)/\Gamma_{\text{total}}$ Γ_{37}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
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1.485 ± 0.039 ± 0.046	2.3k	ABLIKIM	19AMBES3	e^+e^- at 4178 MeV
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$\Gamma(K^+\bar{K}^0)/\Gamma_{\text{total}}$ Γ_{38}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
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2.95 ± 0.11 ± 0.09	2.0k	¹ ZUPANC	13 BELL	e^+e^- at $\Upsilon(4S), \Upsilon(5S)$
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¹ ZUPANC 13 finds the \bar{K}^0 from its missing-mass squared, not from $K_S^0 \rightarrow \pi^+\pi^-$.

The DCS ($D_S^+ \rightarrow K^+K^0$) contribution to this fraction is estimated to be an order of magnitude below the statistical uncertainty.

$\Gamma(K^+K^-\pi^+)/\Gamma_{\text{total}}$ Γ_{39}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
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5.38 ± 0.10 OUR FIT Error includes scale factor of 1.1.

5.45 ± 0.11 OUR AVERAGE Error includes scale factor of 1.1.

$5.47 \pm 0.08 \pm 0.13$	5.1k	ABLIKIM	21AE BES3	e^+e^- at 4.178 GeV
$5.55 \pm 0.14 \pm 0.13$		ONYISI	13 CLEO	e^+e^- at 4.17 GeV
$5.06 \pm 0.15 \pm 0.21$	4.1k	ZUPANC	13 BELL	e^+e^- at $\Upsilon(4S), \Upsilon(5S)$
$5.78 \pm 0.20 \pm 0.30$		DEL-AMO-SA..10J	BABR	e^+e^- , 10.58 GeV

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

5.50±0.23±0.16 ¹ ALEXANDER 08 CLEO See ONYISI 13

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

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

Γ_{40}/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±0.36±0.51		¹ AUBERT	06N BABR	e^+e^- at $\Upsilon(4S)$
4.81±0.52±0.38	212 ± 19	² AUBERT	05V BABR	$e^+e^- \approx \Upsilon(4S)$
3.59±0.77±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 +1.8}/_{-1.9 -1.1} ⁴ BAI 95C BES e^+e^- 4.03 GeV

¹ This AUBERT 06N measurement uses $\bar{B}^0 \rightarrow D_s^{(*)-} D^{(*)+}$ 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 $D^{*-} \rightarrow \bar{D}^0 \pi^-$ decay is fully reconstructed: (1) The $D_s^{*+} \rightarrow D_s^+ \gamma$, $D_s^+ \rightarrow \phi\pi^+$ 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 $\bar{B}^0 \rightarrow D^{*+} D_s^{*-}$ decays to get a model-independent value for $\Gamma(D_s^- \rightarrow \phi\pi^-)/\Gamma(D^0 \rightarrow K^-\pi^+)$ of $0.92 \pm 0.20 \pm 0.11$.

⁴ BAI 95C uses $e^+e^- \rightarrow D_s^+ D_s^-$ events in which one or both of the D_s^\pm are observed to obtain the first model-independent measurement of the $D_s^+ \rightarrow \phi\pi^+$ branching fraction, without assumptions about $\sigma(D_s^\pm)$. However, with only two “doubly-tagged” events, the statistical error is very large.

$\Gamma(\phi\pi^+, \phi \rightarrow K^+K^-)/\Gamma(K^+K^-\pi^+)$

Γ_{41}/Γ_{39}

This is the “fit fraction” from the Dalitz-plot analysis. 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 (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
41.2±0.7 OUR AVERAGE				
40.5±0.7±0.9	18.6k	ABLIKIM	21AE BES3	e^+e^- at 4.178 GeV
41.4±0.8±0.5		DEL-AMO-SA..11G	BABR	Dalitz fit, 96k 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

$\Gamma(K^+ \bar{K}^*(892)^0, \bar{K}^{*0} \rightarrow K^- \pi^+) / \Gamma(K^+ K^- \pi^+)$ $\Gamma_{42} / \Gamma_{39}$

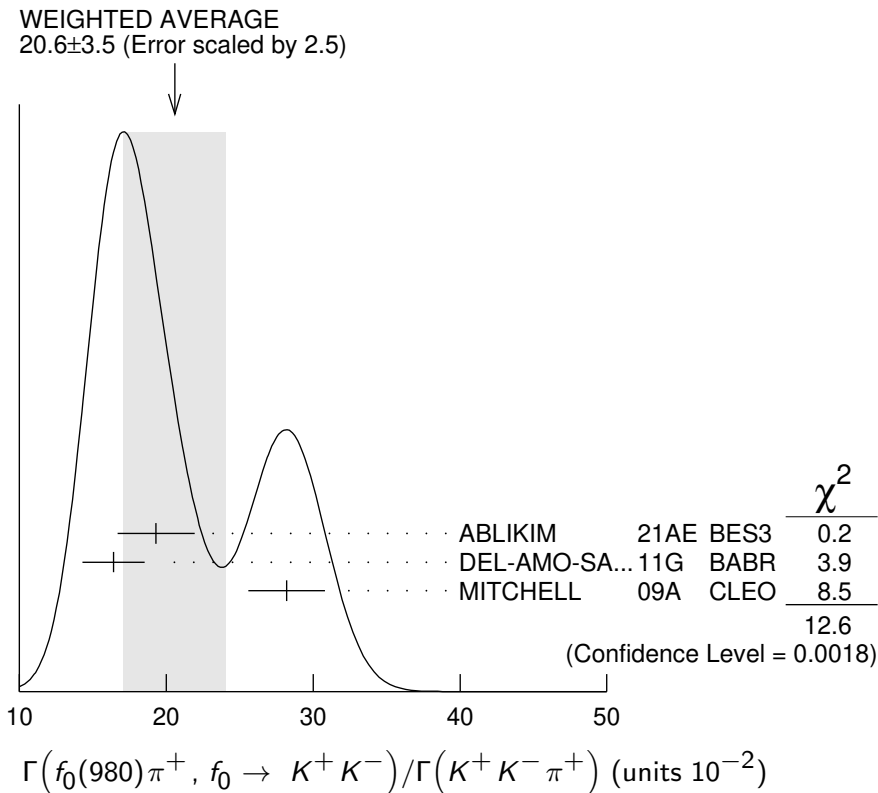
This is the "fit fraction" from the Dalitz-plot analysis.

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
47.9 ± 0.6 OUR AVERAGE				
48.3 ± 0.9 ± 0.6	18.6k	ABLIKIM	21AE BES3	$e^+ e^-$ at 4.178 GeV
47.9 ± 0.5 ± 0.5		DEL-AMO-SA...11G	BABR	Dalitz fit, 96k 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

$\Gamma(f_0(980)\pi^+, f_0 \rightarrow K^+ K^-) / \Gamma(K^+ K^- \pi^+)$ $\Gamma_{43} / \Gamma_{39}$

This is the "fit fraction" from the Dalitz-plot analysis. This is likely a superposition of $D_s^+ \rightarrow f_0(980)\pi$ and $D_s^+ \rightarrow a_0(980)\pi$ which are indistinguishable in such an analysis.

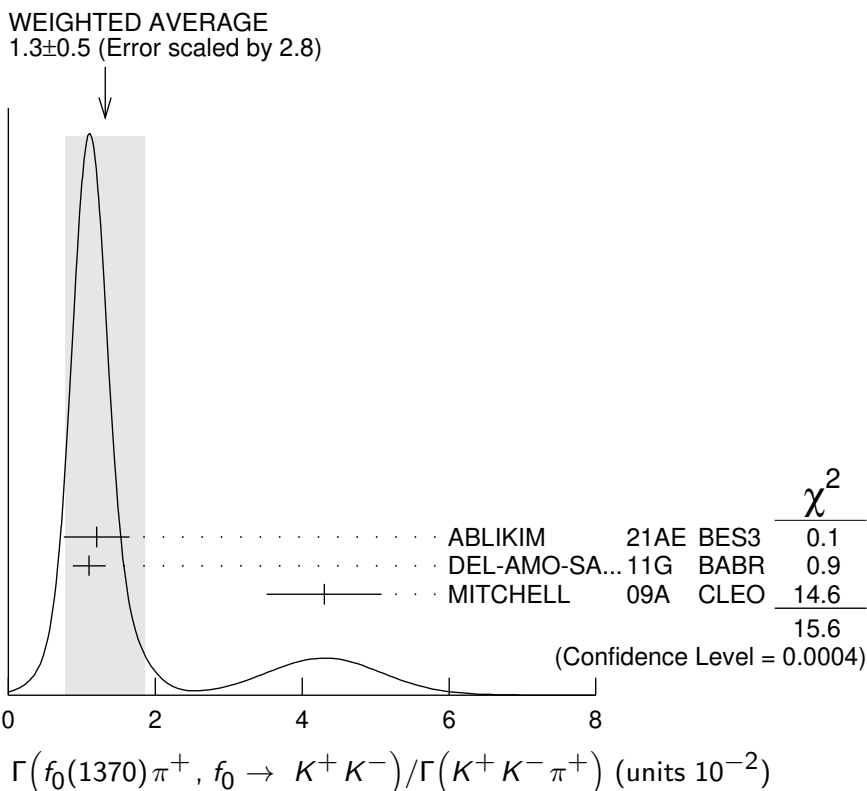
VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
20.6 ± 3.5 OUR AVERAGE Error includes scale factor of 2.5. See the ideogram below.				
19.3 ± 1.7 ± 2.0	18.6k	ABLIKIM	21AE BES3	$e^+ e^-$ at 4.178 GeV
16.4 ± 0.7 ± 2.0		DEL-AMO-SA...11G	BABR	Dalitz fit, 96k evts
28.2 ± 1.9 ± 1.8		MITCHELL	09A CLEO	Dalitz 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



$\Gamma(f_0(1370)\pi^+, f_0 \rightarrow K^+K^-)/\Gamma(K^+K^-\pi^+)$ Γ_{44}/Γ_{39}

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

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
1.3±0.5 OUR AVERAGE				Error includes scale factor of 2.8. See the ideogram below.
1.2±0.4±0.2	18.6k	ABLIKIM	21AE BES3	e^+e^- at 4.178 GeV
1.1±0.1±0.2		DEL-AMO-SA..11G	BABR	Dalitz fit, 96k evts
4.3±0.6±0.5		MITCHELL	09A CLEO	Dalitz fit, 12k evts



$\Gamma(f_0(1710)\pi^+, f_0 \rightarrow K^+K^-)/\Gamma(K^+K^-\pi^+)$ Γ_{45}/Γ_{39}

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

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
1.3±0.5 OUR AVERAGE				Error includes scale factor of 3.8.
1.9±0.4±0.6	18.6k	ABLIKIM	21AE BES3	e^+e^- at 4.178 GeV
1.1±0.1±0.1		DEL-AMO-SA..11G	BABR	Dalitz fit, 96k 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

$\Gamma(K^+\bar{K}_0^*(1430)^0, \bar{K}_0^* \rightarrow K^-\pi^+)/\Gamma(K^+K^-\pi^+)$ Γ_{46}/Γ_{39}

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

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
3.3±0.5 OUR AVERAGE				
3.0±0.6±0.5	18.6k	ABLIKIM	21AE BES3	e^+e^- at 4.178 GeV
2.4±0.3±1.0		DEL-AMO-SA..11G	BABR	Dalitz fit, 96k 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

$\Gamma(K^+ K_S^0 \pi^0)/\Gamma_{\text{total}}$ Γ_{47}/Γ

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

$\Gamma(2K_S^0 \pi^+)/\Gamma_{\text{total}}$ Γ_{48}/Γ

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

$\Gamma(K^*(892)^+ \bar{K}^0)/\Gamma(\phi\pi^+)$ Γ_{50}/Γ_{40}

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_{51}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
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5.50±0.24 OUR FIT Error includes scale factor of 1.3.

5.51±0.28 OUR AVERAGE Error includes scale factor of 1.5.

5.42±0.10±0.17 3k ¹ ABLIKIM 21U BES3 e^+e^- at 4.178–4.226 GeV

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 ² ALEXANDER 08 CLEO See ONYISI 13

¹ ABLIKIM 21U uses an amplitude analysis of $D_s^+ \rightarrow K^+ K^- \pi^+ \pi^0$ with 9 components.

² ALEXANDER 08 uses single- and double-tagged events in an overall fit.

$\Gamma(\phi\rho^+)/\Gamma_{\text{total}}$ Γ_{52}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
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5.59±0.15±0.30 3k ¹ ABLIKIM 21U BES3 e^+e^- at 4.178–4.226 GeV

¹ ABLIKIM 21U uses an amplitude analysis of $D_s^+ \rightarrow K^+ K^- \pi^+ \pi^0$ with 9 components.

$\Gamma(\bar{K}_1(1270)^0 K^+, \bar{K}_1(1270)^0 \rightarrow K^- \rho^+)/\Gamma_{\text{total}}$ Γ_{53}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
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0.57±0.05±0.04 3k ¹ ABLIKIM 21U BES3 e^+e^- at 4.178–4.226 GeV

¹ ABLIKIM 21U uses an amplitude analysis of $D_s^+ \rightarrow K^+ K^- \pi^+ \pi^0$ with 9 components.

$\Gamma(\bar{K}_1(1270)^0 K^+, \bar{K}_1(1270)^0 \rightarrow K^*(892)\pi)/\Gamma_{\text{total}}$ Γ_{54}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
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1.31±0.18±0.18 3k ^{1,2} ABLIKIM 21U BES3 e^+e^- at 4.178–4.226 GeV

¹ ABLIKIM 21U uses an amplitude analysis of $D_s^+ \rightarrow K^+ K^- \pi^+ \pi^0$ with 9 components.

² $\bar{K}_1(1270)^0 \rightarrow K^*(892)\pi$ denotes a sum over $\bar{K}(892)^0 \pi^0$ and $K(892)^- \pi^+$ final states, which are assumed to have relative branching ratio 1/2, as per isospin.

$\Gamma(\bar{K}_1(1400)^0 K^+, \bar{K}_1(1400)^0 \rightarrow K^*(892)\pi)/\Gamma_{\text{total}}$ Γ_{55}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
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1.98±0.27±0.32 3k ¹ ABLIKIM 21U BES3 e^+e^- at 4.178–4.226 GeV

¹ $\bar{K}_1(1400)^0 \rightarrow K^*(892)\pi$ denotes a sum over $\bar{K}(892)^0 \pi^0$ and $K(892)^- \pi^+$ final states, which are assumed to have relative branching ratio 1/2, as per isospin.

$\Gamma(a_0(980)^0 \rho^+, a_0(980)^0 \rightarrow K^+ K^-) / \Gamma_{\text{total}}$ Γ_{56} / Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$0.19 \pm 0.03 \pm 0.03$	3k	¹ ABLIKIM	21U	BES3 $e^+ e^-$ at 4.178–4.226 GeV
¹ ABLIKIM 21U uses an amplitude analysis of $D_s^+ \rightarrow K^+ K^- \pi^+ \pi^0$ with 9 components.				

 $\Gamma(f_1(1420)^0 \pi^+, f_1(1420)^0 \rightarrow K^*(892)^{\mp} K^{\pm}) / \Gamma_{\text{total}}$ Γ_{57} / Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$0.39 \pm 0.06 \pm 0.03$	3k	¹ ABLIKIM	21U	BES3 $e^+ e^-$ at 4.178–4.226 GeV
¹ ABLIKIM 21U uses an amplitude analysis of $D_s^+ \rightarrow K^+ K^- \pi^+ \pi^0$ with 9 components.				

 $\Gamma(f_1(1420)^0 \pi^+, f_1(1420)^0 \rightarrow a_0(980)^0 \pi^0, a_0(980)^0 \rightarrow K^+ K^-) / \Gamma_{\text{total}}$ Γ_{58} / Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$0.04 \pm 0.01 \pm 0.01$	3k	¹ ABLIKIM	21U	BES3 $e^+ e^-$ at 4.178–4.226 GeV
¹ ABLIKIM 21U uses an amplitude analysis of $D_s^+ \rightarrow K^+ K^- \pi^+ \pi^0$ with 9 components.				

 $\Gamma(\eta(1475) \pi^+, \eta(1475) \rightarrow a_0(980)^0 \pi^0, a_0(980)^0 \rightarrow K^+ K^-) / \Gamma_{\text{total}}$ Γ_{59} / Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$0.07 \pm 0.02 \pm 0.02$	3k	¹ ABLIKIM	21U	BES3 $e^+ e^-$ at 4.178–4.226 GeV
¹ ABLIKIM 21U uses an amplitude analysis of $D_s^+ \rightarrow K^+ K^- \pi^+ \pi^0$ with 9 components.				

 $\Gamma(\phi \rho^+) / \Gamma(\phi \pi^+)$ $\Gamma_{52} / \Gamma_{40}$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
$1.86 \pm 0.26^{+0.29}_{-0.40}$	253	AVERY	92	CLE2 $e^+ e^- \simeq 10.5$ GeV

 $\Gamma(K_S^0 K^- 2\pi^+) / \Gamma_{\text{total}}$ Γ_{60} / Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
1.53 ± 0.08 OUR FIT	Error includes scale factor of 1.5.			
1.53 ± 0.11 OUR AVERAGE	Error includes scale factor of 1.8.			
$1.46 \pm 0.05 \pm 0.05$	1.3k	ABLIKIM	21k	BES3 $e^+ e^-$ at 4.178–4.226 GeV
$1.69 \pm 0.07 \pm 0.08$		ONYISI	13	CLEO $e^+ e^-$ at 4.17 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$1.64 \pm 0.10 \pm 0.07$		¹ ALEXANDER 08	08	CLEO See ONYISI 13
¹ ALEXANDER 08 uses single- and double-tagged events in an overall fit.				

 $\Gamma(K^*(892)^+ \bar{K}^*(892)^0) / \Gamma(K_S^0 K^- 2\pi^+)$ $\Gamma_{61} / \Gamma_{60}$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$40.6 \pm 2.9 \pm 4.9$	1.3k	^{1,2} ABLIKIM	21k	BES3 $e^+ e^-$ at 4.178–4.226 GeV
¹ Predominantly S -wave, with a significant D -wave component.				
² $D_s^+ \rightarrow K_S^0 K^- 2\pi^+$ amplitude analysis with 13 components.				

$\Gamma(\eta(1475)\pi^+, \eta \rightarrow a_0(980)^- \pi^+, a_0^- \rightarrow K_S^0 K^-) / \Gamma(K_S^0 K^- 2\pi^+) \quad \Gamma_{64}/\Gamma_{60}$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
10.8±2.6±5.2	1.3k	¹ ABLIKIM	21K	BES3 $e^+ e^-$ at 4.178–4.226 GeV
¹ $D_s^+ \rightarrow K_S^0 K^- 2\pi^+$ amplitude analysis with 13 components.				

$\Gamma(\eta(1475)K_S^0, \eta \rightarrow K^*(892)^0 \pi^+, K^{*0} \rightarrow K^- \pi^+) / \Gamma(K_S^0 K^- 2\pi^+) \quad \Gamma_{62}/\Gamma_{60}$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.2±0.6±0.2	1.3k	¹ ABLIKIM	21K	BES3 $e^+ e^-$ at 4.178–4.226 GeV
¹ $D_s^+ \rightarrow K_S^0 K^- 2\pi^+$ amplitude analysis with 13 components.				

$\Gamma(\eta(1475)\pi^+, \eta \rightarrow \bar{K}^*(892)^+ K^-, \bar{K}^{*+} \rightarrow K_S^0 \pi^+) / \Gamma(K_S^0 K^- 2\pi^+) \quad \Gamma_{63}/\Gamma_{60}$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.2±0.6±0.2	1.3k	¹ ABLIKIM	21K	BES3 $e^+ e^-$ at 4.178–4.226 GeV
¹ $D_s^+ \rightarrow K_S^0 K^- 2\pi^+$ amplitude analysis with 13 components.				

$\Gamma(f_1(1285)\pi^+, f_1 \rightarrow a_0(980)^- \pi^+, a_0^- \rightarrow K_S^0 K^-) / \Gamma(K_S^0 K^- 2\pi^+) \quad \Gamma_{65}/\Gamma_{60}$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
2.2±0.5±0.2	1.3k	¹ ABLIKIM	21K	BES3 $e^+ e^-$ at 4.178–4.226 GeV
¹ $D_s^+ \rightarrow K_S^0 K^- 2\pi^+$ amplitude analysis with 13 components.				

$\Gamma(K^*(892)^+ \bar{K}^*(892)^0) / \Gamma_{\text{total}} \quad \Gamma_{61}/\Gamma$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
5.64±0.23±0.27	3k	¹ ABLIKIM	21U	BES3 $e^+ e^-$ at 4.178–4.226 GeV
¹ ABLIKIM 21U uses an amplitude analysis of $D_s^+ \rightarrow K^+ K^- \pi^+ \pi^0$ with 9 components.				

$\Gamma(K^*(892)^+ \bar{K}^*(892)^0) / \Gamma(\phi \pi^+) \quad \Gamma_{61}/\Gamma_{40}$
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

$\Gamma(K^+ K_S^0 \pi^+ \pi^-) / \Gamma_{\text{total}} \quad \Gamma_{66}/\Gamma$

VALUE (%)	DOCUMENT ID	TECN	COMMENT
0.95±0.08 OUR FIT	Error includes scale factor of 1.1.		
1.03±0.06±0.08	ONYISI	13	CLEO $e^+ e^-$ at 4.17 GeV

$\Gamma(K^+ K_S^0 \pi^+ \pi^-) / \Gamma(K_S^0 K^- 2\pi^+) \quad \Gamma_{66}/\Gamma_{60}$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.62 ±0.05 OUR FIT				
0.586±0.052±0.043	476	LINK	01C	FOCS γ A, $\bar{E}_\gamma \approx 180$ GeV

$\Gamma(K^+ K^- 2\pi^+ \pi^-) / \Gamma(K^+ K^- \pi^+) \quad \Gamma_{67}/\Gamma_{39}$

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

$\Gamma(\phi 2\pi^+ \pi^-)/\Gamma(\phi \pi^+)$ Γ_{68}/Γ_{40}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.269±0.027 OUR AVERAGE				
0.249±0.024±0.021	136	LINK	03D FOCS	γ A, $\bar{E}_\gamma \approx 180$ GeV
0.28 ±0.06 ±0.01	40	FRABETTI	97C E687	γ Be, $\bar{E}_\gamma \approx 200$ GeV
0.58 ±0.21 ±0.10	21	FRABETTI	92 E687	γ Be
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_{72}/Γ_{67}

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

 $\Gamma(\phi \rho^0 \pi^+, \phi \rightarrow K^+ K^-)/\Gamma(K^+ K^- 2\pi^+ \pi^-)$ Γ_{69}/Γ_{67}

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

 $\Gamma(\phi a_1(1260)^+, \phi \rightarrow K^+ K^-, a_1^+ \rightarrow \rho^0 \pi^+)/\Gamma(K^+ K^- \pi^+)$ Γ_{70}/Γ_{39}

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

 $\Gamma(K^+ K^- 2\pi^+ \pi^- \text{nonresonant})/\Gamma(K^+ K^- 2\pi^+ \pi^-)$ Γ_{73}/Γ_{67}

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

 $\Gamma(\phi 2\pi^+ \pi^- \text{non-}\rho, \phi \rightarrow K^+ K^-)/\Gamma(K^+ K^- 2\pi^+ \pi^-)$ Γ_{71}/Γ_{67}

VALUE	DOCUMENT ID	TECN	COMMENT
0.21±0.05±0.06	LINK	03D FOCS	γ A, $\bar{E}_\gamma \approx 180$ GeV

 $\Gamma(2K_S^0 2\pi^+ \pi^-)/\Gamma(K_S^0 K^- 2\pi^+)$ Γ_{74}/Γ_{60}

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

Pionic modes $\Gamma(\pi^+ \pi^0)/\Gamma(K^+ K_S^0)$ Γ_{75}/Γ_{36}

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
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 $\Gamma(\pi^+ \pi^0)/\Gamma_{\text{total}}$ Γ_{75}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<1.2 × 10⁻⁴	90	¹ GUAN	21 BELL	$e^+ e^- \approx \Upsilon(4,5S)$

¹ Uses $B(D_S^+ \rightarrow \pi^+ \phi, \phi \rightarrow K^+ K^-) = (2.24 \pm 0.08)\%$.

$$\Gamma(2\pi^+\pi^-)/\Gamma_{\text{total}} \qquad \Gamma_{76}/\Gamma$$

VALUE (%)	DOCUMENT ID	TECN	COMMENT
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1.08±0.04 OUR FIT**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 ¹ALEXANDER 08 CLEO See ONYISI 13¹ALEXANDER 08 uses single- and double-tagged events in an overall fit.
$$\Gamma(2\pi^+\pi^-)/\Gamma(K^+K^-\pi^+) \qquad \Gamma_{76}/\Gamma_{39}$$

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
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0.200±0.007 OUR FIT**0.199±0.004±0.009** $\approx 10.5k$ AUBERT 090 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
$$\Gamma(\rho^0\pi^+)/\Gamma(2\pi^+\pi^-) \qquad \Gamma_{77}/\Gamma_{76}$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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0.018±0.005±0.010 AUBERT 090 BABR Dalitz fit, $\approx 10.5k$ 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
$$\Gamma(\pi^+(\pi^+\pi^-)_{S\text{-wave}})/\Gamma(2\pi^+\pi^-) \qquad \Gamma_{78}/\Gamma_{76}$$

This is the “fit fraction” from the Dalitz-plot analysis. See also KLEMPT 08, which uses 568 $D_s^+ \rightarrow 3\pi$ 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
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0.833 ±0.020 OUR AVERAGE0.830 ±0.009 ±0.019 ¹AUBERT 090 BABR Dalitz fit, $\approx 10.5k$ evts0.8704±0.0560±0.0438 ²LINK 04 FOCS Dalitz fit, 1475 ± 50 evts¹AUBERT 090 gives the amplitude and phase of the $\pi^+\pi^-$ S -wave in 29 $\pi^+\pi^-$ invariant-mass bins.²LINK 04 borrows a K-matrix parametrization from ANISOVICH 03 of the full $\pi\pi$ 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.
$$\Gamma(f_0(980)\pi^+, f_0 \rightarrow \pi^+\pi^-)/\Gamma(2\pi^+\pi^-) \qquad \Gamma_{79}/\Gamma_{76}$$

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

VALUE	DOCUMENT ID	TECN	COMMENT
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• • • 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

$\Gamma(f_0(1370)\pi^+, f_0 \rightarrow \pi^+\pi^-)/\Gamma(2\pi^+\pi^-)$ Γ_{80}/Γ_{76}

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

VALUE	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.324 \pm 0.077 \pm 0.017$	AITALA	01A	E791	Dalitz fit, 848 evts
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 $\Gamma(f_0(1500)\pi^+, f_0 \rightarrow \pi^+\pi^-)/\Gamma(2\pi^+\pi^-)$ Γ_{81}/Γ_{76}

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

VALUE	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.274 \pm 0.114 \pm 0.019$	¹ FRABETTI	97D	E687	γ Be \approx 200 GeV
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¹FRABETTI 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 $f_0(1500)$.

 $\Gamma(f_2(1270)\pi^+, f_2 \rightarrow \pi^+\pi^-)/\Gamma(2\pi^+\pi^-)$ Γ_{82}/Γ_{76}

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

VALUE	DOCUMENT ID	TECN	COMMENT
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0.101 \pm 0.018 OUR AVERAGE

$0.101 \pm 0.015 \pm 0.011$	AUBERT	09O	BABR	Dalitz fit, \approx 10.5k evts
$0.0974 \pm 0.0449 \pm 0.0294$	LINK	04	FOCS	Dalitz fit, 1475 ± 50 evts

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

$0.197 \pm 0.033 \pm 0.006$	AITALA	01A	E791	Dalitz fit, 848 evts
$0.123 \pm 0.056 \pm 0.018$	FRABETTI	97D	E687	γ Be \approx 200 GeV

 $\Gamma(\rho(1450)^0\pi^+, \rho^0 \rightarrow \pi^+\pi^-)/\Gamma(2\pi^+\pi^-)$ Γ_{83}/Γ_{76}

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

VALUE	DOCUMENT ID	TECN	COMMENT
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0.027 \pm 0.018 OUR AVERAGE

$0.023 \pm 0.008 \pm 0.017$	AUBERT	09O	BABR	Dalitz fit, \approx 10.5k evts
$0.0656 \pm 0.0343 \pm 0.0440$	LINK	04	FOCS	Dalitz fit, 1475 ± 50 evts

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

$0.044 \pm 0.021 \pm 0.002$	AITALA	01A	E791	Dalitz fit, 848 evts
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 $\Gamma(\pi^+2\pi^0)/\Gamma_{\text{total}}$ Γ_{84}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
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0.65 \pm 0.13 \pm 0.03	72 ± 16	NAIK	09A	CLEO e^+e^- at 4170 MeV
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 $\Gamma(2\pi^+\pi^-\pi^0)/\Gamma(\phi\pi^+)$ Γ_{85}/Γ_{40}

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<3.3	90	ANJOS	89E	E691	Photoproduction
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$\Gamma(\eta\pi^+)/\Gamma_{\text{total}}$ Γ_{86}/Γ

Unseen decay modes of the η are included.

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
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1.68±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
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¹ ALEXANDER 08 uses single- and double-tagged events in an overall fit.

$\Gamma(\eta\pi^+)/\Gamma(K^+K_S^0)$ Γ_{86}/Γ_{36}

Unseen decay modes of the η are included.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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1.15 ±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
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$\Gamma(\eta\pi^+)/\Gamma(\phi\pi^+)$ Γ_{86}/Γ_{40}

Unseen decay modes of the resonances are included.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.48±0.03±0.04	920	JESSOP	98	CLE2	$e^+e^- \approx \Upsilon(4S)$
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0.54±0.09±0.06	165	ALEXANDER	92	CLE2	See JESSOP 98
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$\Gamma(\eta\pi^+)/\Gamma(\phi\pi^+, \phi \rightarrow K^+K^-)$ Γ_{86}/Γ_{41}

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
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84.80±0.47±2.64 22k GUAN 21 BELL $e^+e^- \approx \Upsilon(4,5S)$

$\Gamma(\eta\pi^+)/\Gamma(K^+K^-\pi^+)$ Γ_{86}/Γ_{39}

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
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31.94±0.33±0.49 19.5k ABLIKIM 20R BES3 e^+e^- , 4178 ~ 4226 MeV

$\Gamma(2\pi^+\pi^-\eta)/\Gamma_{\text{total}}$ Γ_{93}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
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3.12±0.13±0.09 2.1k ABLIKIM 21AR BES3 e^+e^- at 4.178–4.226 GeV

$\Gamma(a_1(1260)^+\eta, a_1^+ \rightarrow \rho(770)^0\pi^+, \rho^0 \rightarrow \pi^+\pi^-)/\Gamma(2\pi^+\pi^-\eta)$ Γ_{94}/Γ_{93}

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
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55.4±3.9±2.0 ¹ ABLIKIM 21AR BES3 e^+e^- at 4.178–4.226 GeV

¹ $D_S^+ \rightarrow 2\pi^+\pi^-\eta$ amplitude analysis with 11 components.

$\Gamma(a_1(1260)^+\eta, a_1^+ \rightarrow f_0(500)\pi^+, f_0 \rightarrow \pi^+\pi^-)/\Gamma(2\pi^+\pi^-\eta)$ Γ_{95}/Γ_{93}

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
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8.1±1.9±2.1 ¹ ABLIKIM 21AR BES3 e^+e^- at 4.178–4.226 GeV

¹ $D_S^+ \rightarrow 2\pi^+\pi^-\eta$ amplitude analysis with 11 components.

$\Gamma(a_0(980)^+ \rho(770)^0, a_0^+ \rightarrow \eta\pi^+)/\Gamma(2\pi^+\pi^-\eta)$ Γ_{97}/Γ_{93}

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
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$6.7 \pm 2.5 \pm 1.5$	¹ ABLIKIM	21AR BES3	e^+e^- at 4.178–4.226 GeV
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¹ $D_S^+ \rightarrow 2\pi^+\pi^-\eta$ amplitude analysis with 11 components. $\Gamma(\eta(1405)\pi^+, \eta(1405) \rightarrow a_0(980)^-\pi^+, a_0^- \rightarrow \eta\pi^-)/\Gamma(2\pi^+\pi^-\eta)$ Γ_{98}/Γ_{93}

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
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$0.7 \pm 0.2 \pm 0.1$	¹ ABLIKIM	21AR BES3	e^+e^- at 4.178–4.226 GeV
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¹ $D_S^+ \rightarrow 2\pi^+\pi^-\eta$ amplitude analysis with 11 components. $\Gamma(\eta(1405)\pi^+, \eta(1405) \rightarrow a_0(980)^+\pi^-, a_0^+ \rightarrow \eta\pi^+)/\Gamma(2\pi^+\pi^-\eta)$ Γ_{99}/Γ_{93}

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
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$0.7 \pm 0.2 \pm 0.1$	¹ ABLIKIM	21AR BES3	e^+e^- at 4.178–4.226 GeV
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¹ $D_S^+ \rightarrow 2\pi^+\pi^-\eta$ amplitude analysis with 11 components. $\Gamma(f_1(1420)\pi^+, f_1 \rightarrow a_0(980)^-\pi^+, a_0^- \rightarrow \eta\pi^-)/\Gamma(2\pi^+\pi^-\eta)$ Γ_{100}/Γ_{93}

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
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$1.9 \pm 0.5 \pm 0.3$	¹ ABLIKIM	21AR BES3	e^+e^- at 4.178–4.226 GeV
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¹ $D_S^+ \rightarrow 2\pi^+\pi^-\eta$ amplitude analysis with 11 components. $\Gamma(f_1(1420)\pi^+, f_1 \rightarrow a_0(980)^+\pi^-, a_0^+ \rightarrow \eta\pi^+)/\Gamma(2\pi^+\pi^-\eta)$ Γ_{101}/Γ_{93}

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
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$1.7 \pm 0.5 \pm 0.3$	¹ ABLIKIM	21AR BES3	e^+e^- at 4.178–4.226 GeV
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¹ $D_S^+ \rightarrow 2\pi^+\pi^-\eta$ amplitude analysis with 11 components. $\Gamma(\omega\pi^+)/\Gamma_{\text{total}}$ Γ_{87}/Γ Unseen decay modes of the ω are included.

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
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 0.192 ± 0.030 OUR FIT **0.181 ± 0.032 OUR AVERAGE**

$0.177 \pm 0.032 \pm 0.013$	65 ± 12	ABLIKIM	19AH BES3	e^+e^- at 4.178 GeV
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$0.21 \pm 0.09 \pm 0.01$	6 ± 2.4	GE	09A CLEO	e^+e^- at 4170 MeV
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 $\Gamma(\omega\pi^+)/\Gamma(\eta\pi^+)$ Γ_{87}/Γ_{86}

Unseen decay modes of the resonances are included.

VALUE	DOCUMENT ID	TECN	COMMENT
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 0.115 ± 0.018 OUR FIT **$0.16 \pm 0.04 \pm 0.03$**

BALEST	97	CLE2	$e^+e^- \approx \Upsilon(4S)$
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 $\Gamma(3\pi^+2\pi^-)/\Gamma(K^+K^-\pi^+)$ Γ_{88}/Γ_{39}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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 0.146 ± 0.014 OUR AVERAGE

$0.145 \pm 0.011 \pm 0.010$	671	LINK	03D FOCS	$\gamma A, \bar{E}_\gamma \approx 180$ GeV
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$0.158 \pm 0.042 \pm 0.031$	37	FRABETTI	97C E687	$\gamma Be, \bar{E}_\gamma \approx 200$ GeV
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$\Gamma(\eta\rho^+)/\Gamma_{\text{total}}$ Γ_{90}/Γ Unseen decay modes of the η are included.

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

 $\Gamma(\eta\rho^+)/\Gamma(\phi\pi^+)$ Γ_{90}/Γ_{40}

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. • • •				
$2.98 \pm 0.20 \pm 0.39$	447	JESSOP	98 CLE2	$e^+e^- \approx \mathcal{T}(4S)$
$2.86 \pm 0.38^{+0.36}_{-0.38}$	217	AVERY	92 CLE2	See JESSOP 98

 $\Gamma(\eta\rho^+)/\Gamma(\eta\pi^+\pi^0)$ Γ_{90}/Γ_{91}

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$78.3 \pm 5.0 \pm 2.1$	1.2k	ABLIKIM	19BE BES3	$\eta\pi^+\pi^0$ amplitude analysis

 $\Gamma(\eta\pi^+\pi^0)/\Gamma_{\text{total}}$ Γ_{91}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
9.5 ± 0.5 OUR AVERAGE				
$9.50 \pm 0.28 \pm 0.41$	2.6k	ABLIKIM	19BE BES3	e^+e^- at 4.178 GeV
$9.2 \pm 0.4 \pm 1.1$		ONYISI	13 CLEO	e^+e^- at 4.17 GeV

 $\Gamma(\eta(\pi^+\pi^0)_{\rho\text{-wave}})/\Gamma(\eta\pi^+\pi^0)$ Γ_{92}/Γ_{91}

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$5.4 \pm 2.1 \pm 2.5$	1.2k	ABLIKIM	19BE BES3	$\eta\pi^+\pi^0$ amplitude analysis

 $\Gamma(a_0(980)^+\pi^0, a_0(980)^+ \rightarrow \eta\pi^+\pi^0)/\Gamma(\eta\pi^+\pi^0)$ Γ_{96}/Γ_{91}

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$23.2 \pm 2.3 \pm 3.3$	1.2k	¹ ABLIKIM	19BE BES3	$\eta\pi^+\pi^0$ amplitude analysis

¹ Coherent sum of $D_s^+ \rightarrow a_0^+\pi^0 \rightarrow \eta\pi^+\pi^0$ and $D_s^+ \rightarrow a_0^0\pi^+ \rightarrow \eta\pi^+\pi^0$. ABLIKIM 19BE find $a_0(980)^0 - f(980)$ mixing effects negligibly small in this $D_s^+ \rightarrow \eta\pi^+\pi^0$ Dalitz plot analysis.

 $\Gamma(\omega\pi^+\pi^0)/\Gamma_{\text{total}}$ Γ_{102}/Γ Unseen decay modes of the ω are included.

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

 $\Gamma(3\pi^+2\pi^-\pi^0)/\Gamma_{\text{total}}$ Γ_{103}/Γ

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

 $\Gamma(\omega 2\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{104}/Γ Unseen decay modes of the ω are included.

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

$\Gamma(\eta'(958)\pi^+)/\Gamma_{\text{total}}$ Γ_{105}/Γ Unseen decay modes of the $\eta'(958)$ are included.

VALUE (%)	DOCUMENT ID	TECN	COMMENT
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3.94±0.15±0.20	ONYISI	13	CLEO e^+e^- at 4.17 GeV
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• • • We do not use the following data for averages, fits, limits, etc. • • •

3.77±0.25±0.30	¹ ALEXANDER	08	CLEO See ONYISI 13
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¹ALEXANDER 08 uses single- and double-tagged events in an overall fit. $\Gamma(\eta'(958)\pi^+)/\Gamma(K^+K_S^0)$ Γ_{105}/Γ_{36} Unseen decay modes of the $\eta'(958)$ are included.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

2.654±0.088±0.139	1436 ± 47	MENDEZ	10	CLEO See ONYISI 13
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 $\Gamma(\eta'(958)\pi^+)/\Gamma(\phi\pi^+)$ Γ_{105}/Γ_{40}

Unseen decay modes of the resonances are included.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

1.03±0.06±0.07	537	JESSOP	98	CLE2 $e^+e^- \approx \Upsilon(4S)$
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1.20±0.15±0.11	281	ALEXANDER	92	CLE2 See JESSOP 98
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2.5 ± 1.0 $\begin{smallmatrix} +1.5 \\ -0.4 \end{smallmatrix}$	22	ALVAREZ	91	NA14 Photoproduction
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2.5 ± 0.5 ± 0.3	215	ALBRECHT	90D	ARG $e^+e^- \approx 10.4$ GeV
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 $\Gamma(\eta'(958)\pi^+)/\Gamma(K^+K^-\pi^+)$ Γ_{105}/Γ_{39}

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
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69.4±0.8±3.8	9.9k	ABLIKIM	20R	BES3 e^+e^- , 4178 ~ 4226 MeV
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 $\Gamma(\omega\eta\pi^+)/\Gamma_{\text{total}}$ Γ_{107}/Γ Unseen decay modes of the ω and η are included.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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<2.13 × 10⁻²	90	GE	09A	CLEO e^+e^- at 4170 MeV
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 $\Gamma(\eta'(958)\rho^+)/\Gamma_{\text{total}}$ Γ_{108}/Γ

VALUE (%)	DOCUMENT ID	TECN	COMMENT
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5.8±1.4±0.4	ABLIKIM	15Z	BES3 482 pb ⁻¹ , 4009 MeV
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 $\Gamma(\eta'(958)\rho^+)/\Gamma(\phi\pi^+)$ Γ_{108}/Γ_{40}

Unseen decay modes of the resonances are included.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

2.78±0.28±0.30	137	¹ JESSOP	98	CLE2 $e^+e^- \approx \Upsilon(4S)$
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3.44±0.62 $\begin{smallmatrix} +0.44 \\ -0.46 \end{smallmatrix}$	68	AVERY	92	CLE2 See JESSOP 98
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¹This JESSOP 98 fraction, when combined with other η' fractions, greatly overshoots the inclusive η' fraction. See the measurement just above, which fits nicely. $\Gamma(\eta'(958)\pi^+\pi^0)/\Gamma_{\text{total}}$ Γ_{109}/Γ

VALUE (%)	DOCUMENT ID	TECN	COMMENT
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5.6±0.5±0.6	ONYISI	13	CLEO e^+e^- at 4.17 GeV
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$\Gamma(\eta'(958)\pi^+\pi^0\text{nonresonant})/\Gamma_{\text{total}}$ Γ_{110}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<5.1 \times 10^{-2}$	90	ABLIKIM	15Z BES3	482 pb ⁻¹ , 4009 MeV

Modes with one or three K's

 $\Gamma(K^+\pi^0)/\Gamma(K^+K_S^0)$ Γ_{111}/Γ_{36}

VALUE (units 10 ⁻²)	EVTS	DOCUMENT ID	TECN	COMMENT
$4.2 \pm 1.4 \pm 0.2$	202 ± 70	MENDEZ	10 CLEO	e ⁺ e ⁻ at 4170 MeV

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

$5.5 \pm 1.3 \pm 0.7$	141 ± 34	ADAMS	07A CLEO	See MENDEZ 10
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 $\Gamma(K^+\pi^0)/\Gamma(K^+K^-\pi^+)$ Γ_{111}/Γ_{39}

VALUE (units 10 ⁻³)	EVTS	DOCUMENT ID	TECN	COMMENT
$13.73 \pm 0.90 \pm 0.33$	2.3k	ABLIKIM	20R BES3	e ⁺ e ⁻ , 4178 ~ 4226 MeV

 $\Gamma(K^+\pi^0)/\Gamma(\phi\pi^+, \phi \rightarrow K^+K^-)$ Γ_{111}/Γ_{41}

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
$3.28 \pm 0.23 \pm 0.13$	12k	GUAN	21 BELL	e ⁺ e ⁻ ≈ $\Upsilon(4,5S)$

 $\Gamma(K_S^0\pi^+)/\Gamma(K^+K_S^0)$ Γ_{112}/Γ_{36}

VALUE (units 10 ⁻²)	EVTS	DOCUMENT ID	TECN	COMMENT
8.12 ± 0.28 OUR AVERAGE				

8.5 ± 0.7 ± 0.2	393 ± 33	MENDEZ	10 CLEO	e ⁺ e ⁻ at 4170 MeV
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8.03 ± 0.24 ± 0.19	17.6k ± 481	WON	09 BELL	e ⁺ e ⁻ at $\Upsilon(4S)$
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10.4 ± 2.4 ± 1.4	113 ± 26	LINK	08 FOCS	$\gamma A, \bar{E}_\gamma \approx 180 \text{ GeV}$
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• • • 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
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 $\Gamma(K_S^0\pi^+)/\Gamma(K^+K^-\pi^+)$ Γ_{112}/Γ_{39}

VALUE (units 10 ⁻³)	EVTS	DOCUMENT ID	TECN	COMMENT
$20.35 \pm 0.62 \pm 0.42$	2.7k	ABLIKIM	20R BES3	e ⁺ e ⁻ , 4178 ~ 4226 MeV

 $\Gamma(K^+\eta)/\Gamma(K^+K_S^0)$ Γ_{113}/Γ_{36}

Unseen decay modes of the η are included.

VALUE (units 10 ⁻²)	EVTS	DOCUMENT ID	TECN	COMMENT
$11.8 \pm 2.2 \pm 0.6$	222 ± 41	MENDEZ	10 CLEO	e ⁺ e ⁻ at 4170 MeV

 $\Gamma(K^+\eta)/\Gamma(\eta\pi^+)$ Γ_{113}/Γ_{86}

VALUE (units 10 ⁻²)	EVTS	DOCUMENT ID	TECN	COMMENT
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• • • 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
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 $\Gamma(K^+\eta)/\Gamma(K^+K^-\pi^+)$ Γ_{113}/Γ_{39}

VALUE (units 10 ⁻²)	EVTS	DOCUMENT ID	TECN	COMMENT
$2.97 \pm 0.18 \pm 0.06$	1.8k	ABLIKIM	20R BES3	e ⁺ e ⁻ , 4178 ~ 4226 MeV

$\Gamma(K^+\eta)/\Gamma(\phi\pi^+, \phi \rightarrow K^+K^-)$ Γ_{113}/Γ_{41}

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
7.81±0.22±0.24	14k	GUAN	21	BELL $e^+e^- \approx \Upsilon(4,5S)$

 $\Gamma(K^+\omega)/\Gamma_{\text{total}}$ Γ_{114}/Γ Unseen decay modes of the ω are included.

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
8.7±2.4±0.8		29	¹ ABLIKIM	19AH	BES3 e^+e^- at 4.178 GeV

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

<24 90 GE 09A CLEO e^+e^- at 4170 MeV¹Evidence for mode at 4.4σ . $\Gamma(K^+\eta'(958))/\Gamma(K^+K_S^0)$ Γ_{115}/Γ_{36} 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

 $\Gamma(K^+\eta'(958))/\Gamma(\eta'(958)\pi^+)$ $\Gamma_{115}/\Gamma_{105}$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
4.2±1.3±0.3	28 ± 9	ADAMS	07A	CLEO See MENDEZ 10

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

 $\Gamma(K^+\eta'(958))/\Gamma(K^+K^-\pi^+)$ Γ_{115}/Γ_{39}

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
4.91±0.31±0.31	675	ABLIKIM	20R	BES3 e^+e^- , 4178 ~ 4226 MeV

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

VALUE (%)	DOCUMENT ID	TECN	COMMENT
0.65 ±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 ¹ALEXANDER 08 CLEO See ONYISI 13¹ALEXANDER 08 uses single- and double-tagged events in an overall fit. $\Gamma(K^+\pi^+\pi^-)/\Gamma(K^+K^-\pi^+)$ Γ_{116}/Γ_{39}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.120±0.007 OUR FIT				
0.127±0.007±0.014	567 ± 31	LINK	04F	FOCS $\gamma A, \bar{E}_\gamma \approx 180$ GeV

 $\Gamma(K^+\rho^0)/\Gamma(K^+\pi^+\pi^-)$ $\Gamma_{117}/\Gamma_{116}$

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

 $\Gamma(K^+\rho(1450)^0, \rho^0 \rightarrow \pi^+\pi^-)/\Gamma(K^+\pi^+\pi^-)$ $\Gamma_{118}/\Gamma_{116}$

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

$$\Gamma(K^*(892)^0 \pi^+, K^{*0} \rightarrow K^+ \pi^-) / \Gamma(K^+ \pi^+ \pi^-) \quad \Gamma_{119} / \Gamma_{116}$$

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

$$\Gamma(K^*(1410)^0 \pi^+, K^{*0} \rightarrow K^+ \pi^-) / \Gamma(K^+ \pi^+ \pi^-) \quad \Gamma_{120} / \Gamma_{116}$$

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

$$\Gamma(K^*(1430)^0 \pi^+, K^{*0} \rightarrow K^+ \pi^-) / \Gamma(K^+ \pi^+ \pi^-) \quad \Gamma_{121} / \Gamma_{116}$$

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

$$\Gamma(K^+ \pi^+ \pi^- \text{ nonresonant}) / \Gamma(K^+ \pi^+ \pi^-) \quad \Gamma_{122} / \Gamma_{116}$$

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

$$\Gamma(K^0 \pi^+ \pi^0) / \Gamma_{\text{total}} \quad \Gamma_{123} / \Gamma$$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
1.08 ± 0.06 OUR AVERAGE				
1.086 ± 0.060 ± 0.030	666	¹ ABLIKIM	21AB	BES3 e ⁺ e ⁻ at 4.178–4.226 GeV
1.00 ± 0.18 ± 0.04	44	NAIK	09A	CLEO e ⁺ e ⁻ at 4170 MeV

¹ ABLIKIM 21AB uses an amplitude analysis with 5 resonant modes plus one background component, and measures $B(D_s^+ \rightarrow K_S^0 \pi^+ \pi^0) = (5.43 \pm 0.30 \pm 0.15) \times 10^{-3}$.

$$\Gamma(K_S^0 2\pi^+ \pi^-) / \Gamma(K_S^0 K^- 2\pi^+) \quad \Gamma_{124} / \Gamma_{60}$$

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

$$\Gamma(K^+ \omega \pi^0) / \Gamma_{\text{total}} \quad \Gamma_{125} / \Gamma$$

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

$$\Gamma(K^+ \omega \pi^+ \pi^-) / \Gamma_{\text{total}} \quad \Gamma_{126} / \Gamma$$

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

$$\Gamma(K^+ \omega \eta) / \Gamma_{\text{total}} \quad \Gamma_{127} / \Gamma$$

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

$$\Gamma(2K^+ K^-) / \Gamma(K^+ K^- \pi^+) \quad \Gamma_{128} / \Gamma_{39}$$

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 $\gamma(4S)$

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

$8.95 \pm 2.12^{+2.24}_{-2.31}$ 31 LINK 02I FOCS γ A, ≈ 180 GeV

$\Gamma(\phi K^+, \phi \rightarrow K^+ K^-) / \Gamma(2K^+ K^-)$ $\Gamma_{129} / \Gamma_{128}$

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

———— Doubly Cabibbo-suppressed modes ————

$\Gamma(2K^+ \pi^-) / \Gamma(K^+ K^- \pi^+)$ $\Gamma_{130} / \Gamma_{39}$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
2.371 ± 0.034 OUR AVERAGE				
$2.372 \pm 0.024 \pm 0.025$	67k	AAIJ	19G	LHCB pp at 8 TeV
$2.3 \pm 0.3 \pm 0.2$	356 ± 52	DEL-AMO-SA..11G	BABR	$e^+ e^- \approx \Upsilon(4S)$
$2.29 \pm 0.28 \pm 0.12$	281 ± 34	KO	09	BELL $e^+ e^-$ at $\Upsilon(4S)$
$5.2 \pm 1.7 \pm 1.1$	27 ± 9	LINK	05k	FOCS $< 0.78\%$, CL = 90%

$\Gamma(K^+ K^*(892)^0, K^{*0} \rightarrow K^+ \pi^-) / \Gamma(2K^+ \pi^-)$ $\Gamma_{131} / \Gamma_{130}$

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

———— Baryon-antibaryon mode ————

$\Gamma(p\bar{p}) / \Gamma_{\text{total}}$ Γ_{132} / Γ

This is the only baryonic mode allowed kinematically.

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.2 ± 0.11 OUR AVERAGE				
$1.21 \pm 0.10 \pm 0.05$	193 ± 17	ABLIKIM	190	BES3 $e^+ e^-$, $E_{\text{cm}} = 4178$ MeV
$1.30 \pm 0.36^{+0.12}_{-0.16}$	13.0 ± 3.6	ATHAR	08	CLEO $e^+ e^-$, $E_{\text{cm}} \approx 4170$ MeV

$\Gamma(p\bar{p}e^+\nu_e) / \Gamma_{\text{total}}$ Γ_{133} / Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 2.0 \times 10^{-4}$	90	ABLIKIM	19BD	BES3 $e^+ e^-$ at 4178 MeV

———— Rare or forbidden modes ————

$\Gamma(\pi^+ e^+ e^-) / \Gamma_{\text{total}}$ Γ_{134} / Γ

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 5.5 \times 10^{-6}$	90	AAIJ	21T	LHCB $1.6 \text{ fb}^{-1} pp$

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

$< 13 \times 10^{-6}$	90	LEES	11G	BABR $e^+ e^- \approx \Upsilon(4S)$
$< 2.2 \times 10^{-5}$	90	¹ RUBIN	10	CLEO $e^+ e^-$ at 4170 MeV
$< 27 \times 10^{-5}$	90	AITALA	99G	E791 $\pi^- N$ 500 GeV

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

$\Gamma(\pi^+ \phi, \phi \rightarrow e^+ e^-)/\Gamma_{\text{total}}$ Γ_{135}/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
$(6_{-4}^{+8} \pm 1) \times 10^{-6}$	3	RUBIN	10	CLEO $e^+ e^-$ at 4170 MeV

 $\Gamma(\pi^+ \mu^+ \mu^-)/\Gamma_{\text{total}}$ Γ_{136}/Γ

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 1.8 \times 10^{-7}$	90	AAIJ	21T	LHCB $1.6 \text{ fb}^{-1} pp$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$< 4.1 \times 10^{-7}$	90	AAIJ	13AF	LHCB pp at 7 TeV
$< 4.3 \times 10^{-5}$	90	LEES	11G	BABR $e^+ e^- \approx \Upsilon(4S)$
$< 2.6 \times 10^{-5}$	90	LINK	03F	FOCS $\gamma A, \bar{E}_\gamma \approx 180 \text{ GeV}$
$< 1.4 \times 10^{-4}$	90	AITALA	99G	E791 $\pi^- N$ 500 GeV
$< 4.3 \times 10^{-4}$	90	KODAMA	95	E653 π^- emulsion 600 GeV

 $\Gamma(K^+ e^+ e^-)/\Gamma_{\text{total}}$ Γ_{137}/Γ

A test for the $\Delta C=1$ weak neutral current. Allowed by higher-order electroweak interactions.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 3.7 \times 10^{-6}$	90	LEES	11G	BABR $e^+ e^- \approx \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$< 4.9 \times 10^{-6}$	90	AAIJ	21T	LHCB $1.6 \text{ fb}^{-1} pp$
$< 5.2 \times 10^{-5}$	90	RUBIN	10	CLEO $e^+ e^-$ at 4170 MeV
$< 1.6 \times 10^{-3}$	90	AITALA	99G	E791 $\pi^- N$ 500 GeV

 $\Gamma(K^+ \mu^+ \mu^-)/\Gamma_{\text{total}}$ Γ_{138}/Γ

A test for the $\Delta C=1$ weak neutral current. Allowed by higher-order electroweak interactions.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 1.4 \times 10^{-7}$	90	AAIJ	21T	LHCB $1.6 \text{ fb}^{-1} pp$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$< 21 \times 10^{-6}$	90	LEES	11G	BABR $e^+ e^- \approx \Upsilon(4S)$
$< 3.6 \times 10^{-5}$	90	LINK	03F	FOCS $\gamma A, \bar{E}_\gamma \approx 180 \text{ GeV}$
$< 1.4 \times 10^{-4}$	90	AITALA	99G	E791 $\pi^- N$ 500 GeV
$< 5.9 \times 10^{-4}$	90	KODAMA	95	E653 π^- emulsion 600 GeV

 $\Gamma(K^*(892)^+ \mu^+ \mu^-)/\Gamma_{\text{total}}$ Γ_{139}/Γ

A test for the $\Delta C=1$ weak neutral current. Allowed by higher-order electroweak interactions.

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

 $\Gamma(\pi^+ e^+ \mu^-)/\Gamma_{\text{total}}$ Γ_{140}/Γ

A test of lepton-family-number conservation.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 1.1 \times 10^{-6}$	90	AAIJ	21T	LHCB $1.6 \text{ fb}^{-1} pp$

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

$<12 \times 10^{-6}$ 90 LEES 11G BABR $e^+e^- \approx \gamma(4S)$

$\Gamma(\pi^+ e^- \mu^+)/\Gamma_{\text{total}}$ Γ_{141}/Γ

A test of lepton-family-number conservation.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 9.4 \times 10^{-7}$	90	AAIJ	21T LHCB	$1.6 \text{ fb}^{-1} pp$

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

$<20 \times 10^{-6}$ 90 LEES 11G BABR $e^+e^- \approx \gamma(4S)$

$\Gamma(K^+ e^+ \mu^-)/\Gamma_{\text{total}}$ Γ_{142}/Γ

A test of lepton-family-number conservation.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 7.9 \times 10^{-7}$	90	AAIJ	21T LHCB	$1.6 \text{ fb}^{-1} pp$

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

$<14 \times 10^{-6}$ 90 LEES 11G BABR $e^+e^- \approx \gamma(4S)$

$\Gamma(K^+ e^- \mu^+)/\Gamma_{\text{total}}$ Γ_{143}/Γ

A test of lepton-family-number conservation.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<5.6 \times 10^{-7}$	90	AAIJ	21T LHCB	$1.6 \text{ fb}^{-1} pp$

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

$<9.7 \times 10^{-6}$ 90 LEES 11G BABR $e^+e^- \approx \gamma(4S)$

$\Gamma(\pi^- 2e^+)/\Gamma_{\text{total}}$ Γ_{144}/Γ

A test of lepton-number conservation.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 1.4 \times 10^{-6}$	90	AAIJ	21T LHCB	$1.6 \text{ fb}^{-1} pp$

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

$< 4.1 \times 10^{-6}$ 90 LEES 11G BABR $e^+e^- \approx \gamma(4S)$

$< 1.8 \times 10^{-5}$ 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_{145}/Γ

A test of lepton-number conservation.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<8.6 \times 10^{-8}$	90	AAIJ	21T LHCB	$1.6 \text{ fb}^{-1} pp$

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

$<1.2 \times 10^{-7}$ 90 AAIJ 13AF LHCB pp at 7 TeV

$<1.4 \times 10^{-5}$ 90 LEES 11G BABR $e^+e^- \approx \gamma(4S)$

$<2.9 \times 10^{-5}$ 90 LINK 03F FOCS $\gamma A, \bar{E}_\gamma \approx 180 \text{ GeV}$

$<8.2 \times 10^{-5}$ 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_{146}/Γ

A test of lepton-number conservation.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<6.3 \times 10^{-7}$	90	AAIJ	21T LHCB	$1.6 \text{ fb}^{-1} pp$

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

$< 8.4 \times 10^{-6}$	90	LEES	11G	BABR	$e^+e^- \approx \Upsilon(4S)$
$< 7.3 \times 10^{-4}$	90	AITALA	99G	E791	$\pi^- N$ 500 GeV

$\Gamma(K^- 2e^+)/\Gamma_{\text{total}}$ Γ_{147}/Γ

A test of lepton-number conservation.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 7.7 \times 10^{-7}$	90	AAIJ	21T	LHCB 1.6 fb ⁻¹ pp

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

$< 5.2 \times 10^{-6}$	90	LEES	11G	BABR	$e^+e^- \approx \Upsilon(4S)$
$< 1.7 \times 10^{-5}$	90	RUBIN	10	CLEO	e^+e^- at 4170 MeV
$< 63 \times 10^{-5}$	90	AITALA	99G	E791	$\pi^- N$ 500 GeV

$\Gamma(K^- 2\mu^+)/\Gamma_{\text{total}}$ Γ_{148}/Γ

A test of lepton-number conservation.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 2.6 \times 10^{-8}$	90	AAIJ	21T	LHCB 1.6 fb ⁻¹ pp

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

$< 1.3 \times 10^{-5}$	90	LEES	11G	BABR	$e^+e^- \approx \Upsilon(4S)$
$< 1.3 \times 10^{-5}$	90	LINK	03F	FOCS	$\gamma A, \bar{E}_\gamma \approx 180$ GeV
$< 1.8 \times 10^{-4}$	90	AITALA	99G	E791	$\pi^- N$ 500 GeV
$< 5.9 \times 10^{-4}$	90	KODAMA	95	E653	π^- emulsion 600 GeV

$\Gamma(K^- e^+ \mu^+)/\Gamma_{\text{total}}$ Γ_{149}/Γ

A test of lepton-number conservation.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 2.6 \times 10^{-7}$	90	AAIJ	21T	LHCB 1.6 fb ⁻¹ pp

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

$< 6.1 \times 10^{-6}$	90	LEES	11G	BABR	$e^+e^- \approx \Upsilon(4S)$
$< 6.8 \times 10^{-4}$	90	AITALA	99G	E791	$\pi^- N$ 500 GeV

$\Gamma(K^*(892)^- 2\mu^+)/\Gamma_{\text{total}}$ Γ_{150}/Γ

A test of lepton-number conservation.

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

D_s^\pm Amplitude analyses

$D_s^+ \rightarrow K^+ K^- \pi^+$ partial wave analyses

Amplitude analyses of D_s^+ decays to the $K^+ K^- \pi^+$ final state, fitting simultaneously different partial wave components.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	18.6k	¹ ABLIKIM	21AE	BES3 e^+e^- at 4.178 GeV
seen	96k	¹ DEL-AMO-SA..11G	BABR	e^+e^- at $\Upsilon(4S)$
seen	12k	¹ MITCHELL	09A	CLEO e^+e^- at 4.17 GeV
seen	701	² FRABETTI	95B	E687

¹ Amplitude analysis with 6 components.

² Amplitude analysis with 5 components.

$D_s^+ \rightarrow 2\pi^+\pi^-\eta$ partial wave analyses

Amplitude analyses of D_s^+ decays to the $\pi^+\pi^+\pi^-\eta$ final state, fitting simultaneously different partial wave components.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	2.1k	¹ ABLIKIM	21AR BES3	e^+e^- at 4.178–4.226 GeV

¹ Amplitude analysis with 11 components.

 $D_s^+ \rightarrow (KS)^0 K^- 2\pi^+$ partial wave analyses

Amplitude analyses of D_s^+ decays to the $K_S^0 K^- 2\pi^+$ final state, fitting simultaneously different partial wave components.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	1.3k	¹ ABLIKIM	21K BES3	e^+e^- at 4.178–4.226 GeV

¹ Amplitude analysis with 13 components.

 $D_s^+ \rightarrow K^- K^+ \pi^+ \pi^0$ partial wave analyses

Amplitude analyses of D_s^+ decays to the $K^- K^+ \pi^+ \pi^0$ final state, fitting simultaneously different partial wave components.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
seen	3k	¹ ABLIKIM	21U BES3	e^+e^- at 4.178–4.226 GeV

¹ ABLIKIM 21U uses an amplitude analysis with 9 components.

 $D_s^+ - D_s^-$ 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:

$$A_{CP}(f) = [\Gamma(D_s^+ \rightarrow f) - \Gamma(D_s^- \rightarrow \bar{f})] / [\Gamma(D_s^+ \rightarrow f) + \Gamma(D_s^- \rightarrow \bar{f})].$$

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

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
-0.2 ± 2.5 OUR AVERAGE				
$-1.2 \pm 2.5 \pm 1.0$	2.2k	ABLIKIM	21BE BES3	e^+e^- at 4.178, 4.226 GeV
4.8 ± 6.1		ALEXANDER	09 CLEO	e^+e^- at 4170 MeV

 $A_{CP}(\tau^\pm\nu)$ in $D_s^+ \rightarrow \tau^+\nu_\tau$, $D_s^- \rightarrow \tau^-\bar{\nu}_\tau$

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
$2.9 \pm 4.8 \pm 1.0$	950	¹ ABLIKIM	21BE BES3	e^+e^- at 4.178, 4.226 GeV

¹ ABLIKIM 21BE also reports that when constrained by the Standard Model ratio of $\Gamma(D_s^+ \rightarrow \tau^+\nu_\tau)/\Gamma(D_s^+ \rightarrow \mu^+\nu_\mu) = 9.75$, the result is $(-0.1 \pm 1.9 \pm 1.0)\%$.

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

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.09 ± 0.26 OUR AVERAGE				
$0.6 \pm 2.8 \pm 0.6$	1.8k	ABLIKIM	19AMBES3	e^+e^- at 4178 MeV
$-0.05 \pm 0.23 \pm 0.24$	288k	¹ LEES	13E BABR	e^+e^- at $\Upsilon(4S)$
$2.6 \pm 1.5 \pm 0.6$		ONYISI	13 CLEO	e^+e^- at 4.17 GeV
$0.12 \pm 0.36 \pm 0.22$		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 $K^0 - \bar{K}^0$ mixing, the CP asymmetry is $(+0.28 \pm 0.23 \pm 0.24)\%$.

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

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
-1.1 ± 2.6 ± 0.6	2.3k	ABLIKIM	19AMBES3	$e^+ e^-$ at 4178 MeV

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

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 $D_s^\pm \rightarrow \phi \pi^\pm$

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

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

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 $D_s^\pm \rightarrow 2K_S^0 \pi^\pm$

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 $D_s^\pm \rightarrow K^+ K^- \pi^\pm \pi^0$

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 $D_s^\pm \rightarrow K^\pm K_S^0 \pi^+ \pi^-$

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

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

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 $D_s^\pm \rightarrow \pi^+ \pi^- \pi^\pm$

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. • • •

$2.0 \pm 4.6 \pm 0.7$ ALEXANDER 08 CLEO See ONYISI 13

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

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.3 ± 0.4 OUR AVERAGE				

$0.8 \pm 0.7 \pm 0.5$ 38k AAIJ 21U LHCB *pp* at 13 TeV
 $0.2 \pm 0.3 \pm 0.3$ 22k GUAN 21 BELL $e^+ e^- \approx \Upsilon(4, 5S)$

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

$1.1 \pm 3.0 \pm 0.8$ ONYISI 13 CLEO $e^+ e^-$ at 4.17 GeV
 $-4.6 \pm 2.9 \pm 0.3$ 2.5k MENDEZ 10 CLEO See ONYISI 13
 $-8.2 \pm 5.2 \pm 0.8$ ALEXANDER 08 CLEO See MENDEZ 10

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

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
-0.9 ± 0.5 OUR AVERAGE				

$-0.82 \pm 0.36 \pm 0.35$ 152k AAIJ 17AF LHCB *pp* at 7, 8 TeV
 $-2.2 \pm 2.2 \pm 0.6$ ONYISI 13 CLEO $e^+ e^-$ at 4.17 GeV

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

$-6.1 \pm 3.0 \pm 0.3$ 1.4k MENDEZ 10 CLEO See ONYISI 13
 $-5.5 \pm 3.7 \pm 1.2$ 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 ± 3.9 ± 2.0	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 ± 7.4 ± 1.9	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
2 ± 4 OUR AVERAGE Error includes scale factor of 1.2.				

$-0.8 \pm 3.9 \pm 1.2$ 2.8k AAIJ 21U LHCB *pp* at 7, 8, 13 TeV
 $6.4 \pm 4.4 \pm 1.1$ 12k GUAN 21 BELL $e^+ e^- \approx \Upsilon(4, 5S)$

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

$-26.6 \pm 23.8 \pm 0.9$ 202 MENDEZ 10 CLEO $e^+ e^-$ at 4170 MeV
 2 ± 29 ADAMS 07A CLEO See MENDEZ 10

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

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.4 ± 0.5 OUR AVERAGE				

$0.38 \pm 0.46 \pm 0.17$ 121k ¹AAIJ 14BD LHCB *pp* at 7, 8 TeV
 $0.3 \pm 2.0 \pm 0.3$ 14k LEES 13E BABR $e^+ e^-$ at $\Upsilon(4S)$

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

$0.61 \pm 0.83 \pm 0.14$ 26k AAIJ 13W LHCB See AAIJ 14BD

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

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

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.20 ± 0.18 OUR AVERAGE				
0.16 ± 0.17 ± 0.05	721k	AAIJ	19T	LHCB pp at 7, 8, 13 TeV
0.6 ± 2.0 ± 0.3	14k	LEES	13E	BABR e^+e^- at $\Upsilon(4S)$
5.45 ± 2.50 ± 0.33		KO	10	BELL $e^+e^- \approx \Upsilon(4S)$
16.3 ± 7.3 ± 0.3	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

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

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

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

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
2.7 ± 5.5 ± 0.9	666	¹ ABLIKIM	21AB BES3	e^+e^- at 4.178–4.226 GeV
¹ ABLIKIM 21AB uses an amplitude analysis with 5 resonant modes plus one background component.				

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

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
1.8 ± 1.9 OUR AVERAGE				
0.9 ± 3.7 ± 1.1	2.5k	AAIJ	21U	LHCB pp at 13 TeV
2.1 ± 2.1 ± 0.4	14k	GUAN	21	BELL $e^+e^- \approx \Upsilon(4, 5S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
9.3 ± 15.2 ± 0.9	222	MENDEZ	10	CLEO e^+e^- at 4170 MeV
−20 ± 18		ADAMS	07A	CLEO See MENDEZ 10

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

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

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

$C_T \equiv \vec{p}_{K^+} \cdot (\vec{p}_{\pi^+} \times \vec{p}_{\pi^-})$ is a parity-odd correlation of the K^+ , π^+ , and π^- momenta for the D_s^+ . $\bar{C}_T \equiv \vec{p}_{K^-} \cdot (\vec{p}_{\pi^-} \times \vec{p}_{\pi^+})$ is the corresponding quantity for the D_s^- . Then

$$A_T \equiv [\Gamma(C_T > 0) - \Gamma(C_T < 0)] / [\Gamma(C_T > 0) + \Gamma(C_T < 0)], \text{ and}$$

$$\bar{A}_T \equiv [\Gamma(-\bar{C}_T > 0) - \Gamma(-\bar{C}_T < 0)] / [\Gamma(-\bar{C}_T > 0) + \Gamma(-\bar{C}_T < 0)], \text{ and}$$

$A_{Tviol} \equiv \frac{1}{2}(A_T - \bar{A}_T)$. C_T and \bar{C}_T are commonly referred to as T -odd moments, because they are odd under T reversal. However, the T -conjugate process $K_S^0 K^\pm \pi^+ \pi^- \rightarrow D_S^\pm$ is not accessible, while the P -conjugate process is.

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
$-13.6 \pm 7.7 \pm 3.4$	$29.8 \pm 0.3k$	LEES	11E BABR	$e^+ e^- \approx \gamma(4S)$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$-36 \pm 67 \pm 23$	508 ± 34	LINK	05E FOCS	$\gamma A, \bar{E}_\gamma \approx 180 \text{ GeV}$

D_s^+ Semileptonic Form Factors and Decay Constants

$r_2 \equiv A_2(0)/A_1(0)$ 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.			
$0.816 \pm 0.036 \pm 0.030$	$25 \pm 0.5k$	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	$\phi \mu^+ \nu_\mu$
$2.1 \begin{smallmatrix} +0.6 \\ -0.5 \end{smallmatrix} \pm 0.2$	19	KODAMA	93 E653	$\phi \mu^+ \nu_\mu$

¹To compare with previous measurements, this AUBERT 08AN value is from a fit that fixes the pole masses at $m_A = 2.5 \text{ GeV}/c^2$ and $m_V = 2.1 \text{ GeV}/c^2$. 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				
$1.807 \pm 0.046 \pm 0.065$	$25 \pm 0.5k$	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	$\phi \mu^+ \nu_\mu$
$2.3 \begin{smallmatrix} +1.1 \\ -0.9 \end{smallmatrix} \pm 0.4$	19	KODAMA	93 E653	$\phi \mu^+ \nu_\mu$

¹To compare with previous measurements, this AUBERT 08AN value is from a fit that fixes the pole masses at $m_A = 2.5 \text{ GeV}/c^2$ and $m_V = 2.1 \text{ GeV}/c^2$. 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 $D_s^+ \rightarrow \phi \ell^+ \nu_\ell$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.72 ± 0.18 OUR AVERAGE				
$1.0 \pm 0.3 \pm 0.2$	308	AVERY	94B CLE2	$\phi e^+ \nu_e$
$1.0 \pm 0.5 \pm 0.1$	90	¹ FRABETTI	94F E687	$\phi \mu^+ \nu_\mu$
$0.54 \pm 0.21 \pm 0.10$	19	¹ KODAMA	93 E653	$\phi \mu^+ \nu_\mu$

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

$f_+(0) |V_{cs}|$ in $D_s^+ \rightarrow \eta e^+ \nu_e$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.4455±0.0053±0.0044	1.8k	ABLIKIM	19S BES3	$e^+ e^-$ at 4178 MeV

 $f_+(0) |V_{cs}|$ in $D_s^+ \rightarrow \eta' e^+ \nu_e$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.477±0.049±0.011	261	ABLIKIM	19S BES3	$e^+ e^-$ at 4178 MeV

 $f_+(0) |V_{cd}|$ in $D_s^+ \rightarrow K^0 e^+ \nu_e$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.162±0.019±0.003	117	¹ ABLIKIM	19D BES3	$K_S^0 e^+ \nu_e$

¹ Using a two parameter fit in the z expansion.

 $r_V \equiv V(0)/A_1(0)$ in $D_s^+ \rightarrow K^*(892)^0 e^+ \nu_e$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
1.67±0.34±0.16	155	ABLIKIM	19D BES3	$e^+ e^-$ at 4178 MeV

 $r_2 \equiv A_2(0)/A_1(0)$ in $D_s^+ \rightarrow K^*(892)^0 e^+ \nu_e$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.77±0.28±0.07	155	ABLIKIM	19D BES3	$e^+ e^-$ at 4178 MeV

 $f_{D_s^+} |V_{cs}|$ in $D_s^+ \rightarrow \mu^+ \nu_\mu$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
243.1±3.0±3.6±1.0	2.2K	¹ ABLIKIM	21BE BES3	$e^+ e^-$ at 4.178, 4.226 GeV

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

246.2±3.6±3.5	1.1k	ABLIKIM	19E BES3	$e^+ e^-$ at 4178 MeV
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¹ The third uncertainty is dominated by the uncertainty of the D_s^+ lifetime.

 $f_{D_s^+} |V_{cs}|$ in $D_s^+ \rightarrow \tau^+ \nu_\tau$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
245.3±3.0 OUR AVERAGE				
251.6±5.9±4.9	1.7k	¹ ABLIKIM	21AF BES3	$e^+ e^-$ at 4.178, 4.226 GeV
244.4±2.3±2.9	4.9k	² ABLIKIM	21AZ BES3	$e^+ e^-$ at 4.178, 4.226 GeV
243.0±5.8±4.0±1.0	950	^{3,4} ABLIKIM	21BE BES3	$e^+ e^-$ at 4.178, 4.226 GeV

¹ ABLIKIM 21F uses $\tau^+ \rightarrow \pi^+ \pi^0 \bar{\nu}$ decays.

² ABLIKIM 21AZ uses $\tau^+ \rightarrow e^+ \nu_e \bar{\nu}_\tau$ decays.

³ ABLIKIM 21BE uses $\tau^+ \rightarrow e^+ \nu_e \bar{\nu}_\tau$ decays. When constrained by the Standard Model ratio of $\Gamma(D_s^+ \rightarrow \tau^+ \nu_\tau)/\Gamma(D_s^+ \rightarrow \mu^+ \nu_\mu) = 9.75$, the result is $243.2 \pm 2.3 \pm 3.3 \pm 1.0$.

⁴ The third uncertainty is dominated by the uncertainty of the D_s^+ lifetime.

 D_s^\pm REFERENCES

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ABLIKIM	15Z	PL B750 466	M. Ablikim <i>et al.</i>	(BESIII Collab.)
HIETALA	15	PR D92 012009	J. Hietala <i>et al.</i>	(MINN, LUTH, OXF)
LEES	15D	PR D91 019901 (errat.)	J.P. Lees <i>et al.</i>	(BABAR Collab.)
AAIJ	14BD	JHEP 1410 025	R. Aaij <i>et al.</i>	(LHCb Collab.)
ABAZOV	14B	PRL 112 111804	V.M. Abazov <i>et al.</i>	(D0 Collab.)
AAIJ	13AF	PL B724 203	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	13V	JHEP 1306 065	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	13W	JHEP 1306 112	R. Aaij <i>et al.</i>	(LHCb Collab.)
LEES	13E	PR D87 052012	J.P. Lees <i>et al.</i>	(BABAR Collab.)
ONYISI	13	PR D88 032009	P.U.E. Onyisi <i>et al.</i>	(CLEO Collab.)
ZUPANC	13	JHEP 1309 139	A. Zupanc <i>et al.</i>	(BELLE Collab.)
DEL-AMO-SA...	11G	PR D83 052001	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
LEES	11E	PR D84 031103	J.P. Lees <i>et al.</i>	(BABAR Collab.)
LEES	11G	PR D84 072006	J.P. Lees <i>et al.</i>	(BABAR Collab.)
MARTIN	11	PR D84 012005	L. Martin <i>et al.</i>	(CLEO Collab.)
ASNER	10	PR D81 052007	D.M. Asner <i>et al.</i>	(CLEO Collab.)
DEL-AMO-SA...	10J	PR D82 091103	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
Also		PR D91 019901 (errat.)	J.P. Lees <i>et al.</i>	(BABAR Collab.)
KO	10	PRL 104 181602	B.R. Ko <i>et al.</i>	(BELLE Collab.)
MENDEZ	10	PR D81 052013	H. Mendez <i>et al.</i>	(CLEO Collab.)
RUBIN	10	PR D82 092007	P. Rubin <i>et al.</i>	(CLEO Collab.)
ALEXANDER	09	PR D79 052001	J.P. Alexander <i>et al.</i>	(CLEO Collab.)
AUBERT	09O	PR D79 032003	B. Aubert <i>et al.</i>	(BABAR Collab.)
DOBBS	09	PR D79 112008	S. Dobbs <i>et al.</i>	(CLEO Collab.)
ECKLUND	09	PR D80 052009	K.M. Ecklund <i>et al.</i>	(CLEO Collab.)
GE	09A	PR D80 051102	J.Y. Ge <i>et al.</i>	(CLEO Collab.)
KO	09	PRL 102 221802	B.R. Ko <i>et al.</i>	(BELLE Collab.)
MITCHELL	09A	PR D79 072008	R.E. Mitchell <i>et al.</i>	(CLEO Collab.)
NAIK	09A	PR D80 112004	P. Naik <i>et al.</i>	(CLEO Collab.)
ONYISI	09	PR D79 052002	P.U.E. Onyisi <i>et al.</i>	(CLEO Collab.)
WON	09	PR D80 111101	E. Won <i>et al.</i>	(BELLE Collab.)
YELTON	09	PR D80 052007	J. Yelton <i>et al.</i>	(CLEO Collab.)
ALEXANDER	08	PRL 100 161804	J.P. Alexander <i>et al.</i>	(CLEO Collab.)
ATHAR	08	PRL 100 181802	S.B. Athar <i>et al.</i>	(CLEO Collab.)
AUBERT	08AN	PR D78 051101	B. Aubert <i>et al.</i>	(BABAR Collab.)
ECKLUND	08	PRL 100 161801	K.M. Ecklund <i>et al.</i>	(CLEO Collab.)
KLEMPPT	08	EPJ C55 39	E. Klempt, M. Matveev, A.V. Sarantsev	(BONN+)
LINK	08	PL B660 147	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
WIDHALM	08	PRL 100 241801	L. Widhalm <i>et al.</i>	(BELLE Collab.)
ADAMS	07A	PRL 99 191805	G.S. Adams <i>et al.</i>	(CLEO Collab.)
AUBERT	07V	PRL 98 141801	B. Aubert <i>et al.</i>	(BABAR Collab.)
PEDLAR	07A	PR D76 072002	T.K. Pedlar <i>et al.</i>	(CLEO Collab.)
Also		PRL 99 071802	M. Artuso <i>et al.</i>	(CLEO Collab.)
AUBERT	06N	PR D74 031103	B. Aubert <i>et al.</i>	(BABAR Collab.)

HUANG	06B	PR D74 112005	G.S. Huang <i>et al.</i>	(CLEO Collab.)
PDG	06	JP G33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)
AUBERT	05V	PR D71 091104	B. Aubert <i>et al.</i>	(BABAR Collab.)
LINK	05E	PL B622 239	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
LINK	05J	PRL 95 052003	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
LINK	05K	PL B624 166	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
LINK	04	PL B585 200	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
LINK	04C	PL B586 183	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
LINK	04D	PL B586 191	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
LINK	04F	PL B601 10	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
ACOSTA	03D	PR D68 072004	D. Acosta <i>et al.</i>	(FNAL CDF-II Collab.)
ANISOVICH	03	EPJ A16 229	V.V. Anisovich <i>et al.</i>	
LINK	03D	PL B561 225	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
LINK	03F	PL B572 21	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
AUBERT	02G	PR D65 091104	B. Aubert <i>et al.</i>	(BABAR Collab.)
HEISTER	02I	PL B528 1	A. Heister <i>et al.</i>	(ALEPH Collab.)
LINK	02I	PL B541 227	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
LINK	02J	PL B541 243	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
ABBIENDI	01L	PL B516 236	G. Abbiendi <i>et al.</i>	(OPAL Collab.)
AITALA	01A	PRL 86 765	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)
IORI	01	PL B523 22	M. Iori <i>et al.</i>	(FNAL SELEX Collab.)
LINK	01C	PRL 87 162001	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
ALEXANDROV	00	PL B478 31	Y. Alexandrov <i>et al.</i>	(CERN BEATRICE Collab.)
AITALA	99	PL B445 449	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)
AITALA	99D	PL B450 294	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)
AITALA	99G	PL B462 401	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)
BONVICINI	99	PRL 82 4586	G. Bonvicini <i>et al.</i>	(CLEO Collab.)
CHADHA	98	PR D58 032002	M. Chada <i>et al.</i>	(CLEO Collab.)
JESSOP	98	PR D58 052002	C.P. Jessop <i>et al.</i>	(CLEO Collab.)
ACCIARRI	97F	PL B396 327	M. Acciarri <i>et al.</i>	(L3 Collab.)
BALEST	97	PRL 79 1436	R. Balest <i>et al.</i>	(CLEO Collab.)
FRABETTI	97C	PL B401 131	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)
FRABETTI	97D	PL B407 79	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)
ARTUSO	96	PL B378 364	M. Artuso <i>et al.</i>	(CLEO Collab.)
BAI	95C	PR D52 3781	J.Z. Bai <i>et al.</i>	(BES Collab.)
BRANDENB...	95	PRL 75 3804	G.W. Brandenburg <i>et al.</i>	(CLEO Collab.)
FRABETTI	95B	PL B351 591	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)
KODAMA	95	PL B345 85	K. Kodama <i>et al.</i>	(FNAL E653 Collab.)
ACOSTA	94	PR D49 5690	D. Acosta <i>et al.</i>	(CLEO Collab.)
AVERY	94B	PL B337 405	P. Avery <i>et al.</i>	(CLEO Collab.)
BROWN	94	PR D50 1884	D. Brown <i>et al.</i>	(CLEO Collab.)
BUTLER	94	PL B324 255	F. Butler <i>et al.</i>	(CLEO Collab.)
FRABETTI	94F	PL B328 187	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)
FRABETTI	93F	PRL 71 827	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)
FRABETTI	93G	PL B313 253	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)
KODAMA	93	PL B309 483	K. Kodama <i>et al.</i>	(FNAL E653 Collab.)
ALBRECHT	92B	ZPHY C53 361	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
ALEXANDER	92	PRL 68 1275	P. Alexander <i>et al.</i>	(CLEO Collab.)
AVERY	92	PRL 68 1279	P. Avery <i>et al.</i>	(CLEO Collab.)
BARLAG	92C	ZPHY C55 383	S. Barlag <i>et al.</i>	(ACCMOR Collab.)
Also		ZPHY C48 29	S. Barlag <i>et al.</i>	(ACCMOR Collab.)
FRABETTI	92	PL B281 167	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)
ALBRECHT	91	PL B255 634	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
ALVAREZ	91	PL B255 639	M.P. Alvarez <i>et al.</i>	(CERN NA14/2 Collab.)
ALBRECHT	90D	PL B245 315	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
ALEXANDER	90B	PRL 65 1531	J. Alexander <i>et al.</i>	(CLEO Collab.)
BARLAG	90C	ZPHY C46 563	S. Barlag <i>et al.</i>	(ACCMOR Collab.)
FRABETTI	90	PL B251 639	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)
ANJOS	89E	PL B223 267	J.C. Anjos <i>et al.</i>	(FNAL E691 Collab.)
CHEN	89	PL B226 192	W.Y. Chen <i>et al.</i>	(CLEO Collab.)
ALBRECHT	88	PL B207 349	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
ANJOS	88	PRL 60 897	J.C. Anjos <i>et al.</i>	(FNAL E691 Collab.)
RAAB	88	PR D37 2391	J.R. Raab <i>et al.</i>	(FNAL E691 Collab.)
BECKER	87B	PL B184 277	H. Becker <i>et al.</i>	(NA11 and NA32 Collabs.)
BLAYLOCK	87	PRL 58 2171	G.T. Blaylock <i>et al.</i>	(Mark III Collab.)
USHIDA	86	PRL 56 1767	N. Ushida <i>et al.</i>	(FNAL E531 Collab.)
ALBRECHT	85D	PL 153B 343	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
DERRICK	85B	PRL 54 2568	M. Derrick <i>et al.</i>	(HRS Collab.)
AIHARA	84D	PRL 53 2465	H. Aihara <i>et al.</i>	(TPC Collab.)
ALTHOFF	84	PL 136B 130	M. Althoff <i>et al.</i>	(TASSO Collab.)

BAILEY	84	PL 139B 320	R. Bailey <i>et al.</i>	(ACCMOR Collab.)
CHEN	83C	PRL 51 634	A. Chen <i>et al.</i>	(CLEO Collab.)

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