



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

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.

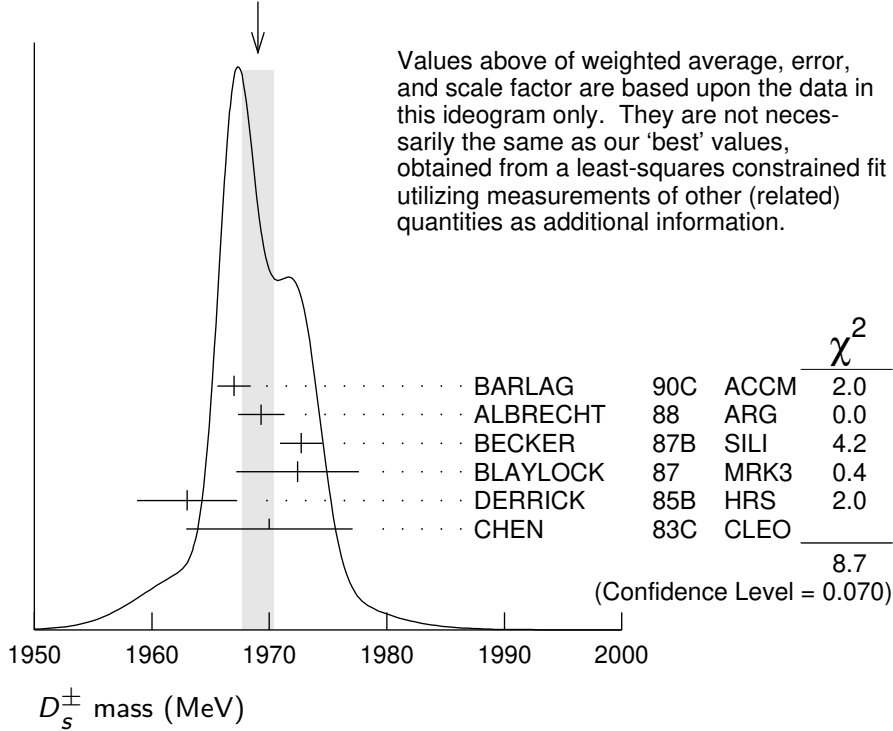
D_s^\pm MASS

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).

WEIGHTED AVERAGE
 1969.0 ± 1.4 (Error scaled by 1.5)



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

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				
$98.68 \pm 0.03 \pm 0.04$		AAIJ	13V LHCb	$D_s^+ \rightarrow K^+ K^- \pi^+$
$99.41 \pm 0.38 \pm 0.21$		ACOSTA	03D CDF2	$\bar{p}p$, $\sqrt{s} = 1.96$ TeV
$98.4 \pm 0.1 \pm 0.3$	48k	AUBERT	02G BABR	$e^+e^- \approx \Upsilon(4S)$
$99.5 \pm 0.6 \pm 0.3$		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
501.2 ± 2.2 OUR AVERAGE				Error includes scale factor of 1.3. See the ideogram below.
$499.5 \pm 1.7 \pm 0.9$	116k	ADACHI	23G BEL2	$D_s^+ \rightarrow \phi \pi^+$
$506.4 \pm 3.0 \pm 1.7 \pm 1.7$		¹ AAIJ	17AN LHCb	pp at 7, 8 TeV
$507.4 \pm 5.5 \pm 5.1$	13.6k	LINK	05J FOCS	$\phi \pi^+$ and $\bar{K}^{*0} K^+$

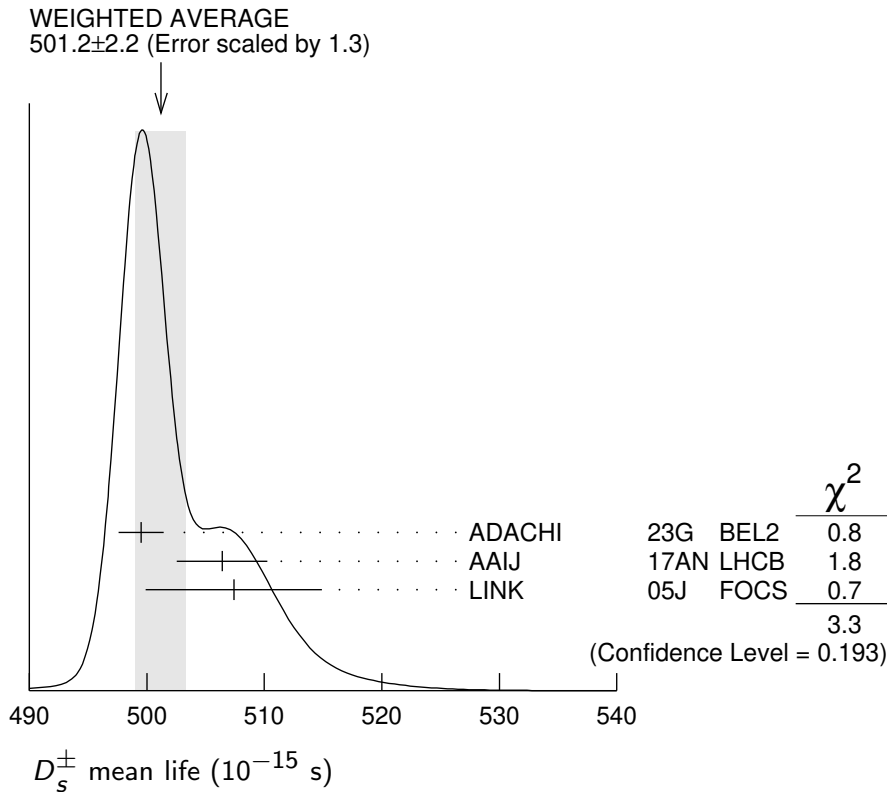
• • • We do not use the following data for averages, fits, limits, etc. • • •

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	$e^+e^- \approx \Upsilon(4S)$
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

¹ This AAIJ 17AN value is derived from the difference between the D_s^- and D^- widths.

The 3rd uncertainty, $\pm 1.7 \times 10^{-15}$ s, arises from the uncertainty of the D^- width.

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



D_s^+ DECAY MODES

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

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Inclusive modes		
Γ_1 e^+ semileptonic	[a] (6.33 ± 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 × 10 ⁻³	CL=90%
Γ_{18}	$2K^-$ anything	< 6 × 10 ⁻⁴	CL=90%
Γ_{19}	$2\pi^+\pi^- +$ anything	(32.8 ±0.7)%	

Leptonic and semileptonic modes

Γ_{20}	$e^+\nu_e$	< 8.3 × 10 ⁻⁵	CL=90%
Γ_{21}	$\mu^+\nu_\mu$	(5.35 ±0.12) × 10 ⁻³	
Γ_{22}	$\tau^+\nu_\tau$	(5.36 ±0.10)%	
Γ_{23}	$\gamma e^+\nu_e$	< 1.3 × 10 ⁻⁴	CL=90%
Γ_{24}	$K^+K^- e^+\nu_e$	—	
Γ_{25}	$K_S^0K_S^0 e^+\nu_e$	< 3.8 × 10 ⁻⁴	CL=90%
Γ_{26}	$\phi e^+\nu_e$	[d] (2.39 ±0.16)%	S=1.3
Γ_{27}	$K_1(1270)^0 e^+\nu_e$	< 4.1 × 10 ⁻⁴	CL=90%
Γ_{28}	$b_1(1235)^0 e^+\nu_e$, $b_1^0 \rightarrow \omega\pi^0$	< 6.4 × 10 ⁻⁴	CL=90%
Γ_{29}	$\phi\mu^+\nu_\mu$	(2.24 ±0.11)%	
Γ_{30}	$\eta e^+\nu_e + \eta'(958) e^+\nu_e$	[d] (3.03 ±0.24)%	
Γ_{31}	$\eta e^+\nu_e$	[d] (2.26 ±0.06)%	
Γ_{32}	$\eta'(958) e^+\nu_e$	[d] (8.0 ±0.4) × 10 ⁻³	
Γ_{33}	$\eta\mu^+\nu_\mu$	(2.4 ±0.5)%	
Γ_{34}	$\eta'(958)\mu^+\nu_\mu$	(1.1 ±0.5)%	
Γ_{35}	$\omega e^+\nu_e$	[e] < 2.0 × 10 ⁻³	CL=90%
Γ_{36}	$K^0 e^+\nu_e$	(3.4 ±0.4) × 10 ⁻³	
Γ_{37}	$K^*(892)^0 e^+\nu_e$	[d] (2.15 ±0.28) × 10 ⁻³	S=1.1
Γ_{38}	$f_0(500) e^+\nu_e$, $f_0 \rightarrow \pi^0\pi^0$	< 7.3 × 10 ⁻⁴	CL=90%
Γ_{39}	$f_0(980) e^+\nu_e$, $f_0 \rightarrow \pi^0\pi^0$	(7.9 ±1.5) × 10 ⁻⁴	
Γ_{40}	$f_0(980) e^+\nu_e$, $f_0 \rightarrow \pi^+\pi^-$		
Γ_{41}	$f_0(980)\mu^+\nu_\mu$, $f_0 \rightarrow K^+K^-$	< 5.45 × 10 ⁻⁴	CL=90%
Γ_{42}	$a_0(980)^0 e^+\nu_e$, $a_0^0 \rightarrow \pi^0\eta$	< 1.2 × 10 ⁻⁴	CL=90%
Γ_{43}	$\pi^0 e^+\nu_e$	< 6.4 × 10 ⁻⁵	CL=90%

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

Γ_{44}	$K^+ K_S^0$	(1.450 ± 0.035) %	
Γ_{45}	$K^+ K_L^0$	(1.49 ± 0.06) %	
Γ_{46}	$K^+ \bar{K}^0$	(2.95 ± 0.14) %	
Γ_{47}	$K^+ K^- \pi^+$	[f] (5.37 ± 0.10) %	S=1.1
Γ_{48}	$\phi \pi^+$	[d,g] (4.5 ± 0.4) %	
Γ_{49}	$\phi \pi^+, \phi \rightarrow K^+ K^-$	[g] (2.21 ± 0.06) %	
Γ_{50}	$K^+ \bar{K}^*(892)^0$	(12.7 $\begin{smallmatrix} +4.0 \\ -3.1 \end{smallmatrix}$) %	
Γ_{51}	$K^+ \bar{K}^*(892)^0, \bar{K}^{*0} \rightarrow$ $K^- \pi^+$	(2.58 ± 0.06) %	
Γ_{52}	$K^+ \bar{K}^*(892)^0, \bar{K}^{*0} \rightarrow K_S^0 \pi^0$	(4.8 ± 0.5) × 10 ⁻³	
Γ_{53}	$f_0(980) \pi^+, f_0 \rightarrow K^+ K^-$	(1.11 ± 0.19) %	
Γ_{54}	$f_0(1370) \pi^+, f_0 \rightarrow K^+ K^-$	(7.1 ± 2.9) × 10 ⁻⁴	
Γ_{55}	$f_0(1710) \pi^+, f_0 \rightarrow K^+ K^-$	(6.7 ± 2.8) × 10 ⁻⁴	
Γ_{56}	$a_0(980)^+ \pi^0, a_0^+ \rightarrow K^+ K_S^0$	(1.1 ± 0.4) × 10 ⁻³	
Γ_{57}	$a_0(1710)^+ \pi^0, a_0^+ \rightarrow K^+ K_S^0$	(3.5 ± 0.6) × 10 ⁻³	
Γ_{58}	$K^+ \bar{K}_0^*(1430)^0, \bar{K}_0^* \rightarrow$ $K^- \pi^+$	(1.76 ± 0.25) × 10 ⁻³	
Γ_{59}	$K^+ \bar{K}_0^*(1410)^0, \bar{K}_0^* \rightarrow$ $K_S^0 \pi^0$	(8.8 ± 2.8) × 10 ⁻⁴	
Γ_{60}	$K^+ K_S^0 \pi^0$	(1.47 ± 0.07) %	
Γ_{61}	$K^*(892)^+ K_S^0, K^{*+} \rightarrow$ $K^+ \pi^0$	(2.04 ± 0.33) × 10 ⁻³	
Γ_{62}	$2K_S^0 \pi^+$	(7.1 ± 0.4) × 10 ⁻³	S=1.3
Γ_{63}	$f_0(980) \pi^+, f_0 \rightarrow K_S^0 K_S^0$	< 1.8 × 10 ⁻⁴	CL=90%
Γ_{64}	$f_0(1710) \pi^+, f_0 \rightarrow K_S^0 K_S^0$	(3.3 ± 0.4) × 10 ⁻³	
Γ_{65}	$K^*(892)^+ K_S^0, K^{*+} \rightarrow$ $K_S^0 \pi^+$	(3.09 ± 0.33) × 10 ⁻³	
Γ_{66}	$K^0 \bar{K}^0 \pi^+$	—	
Γ_{67}	$K^*(892)^+ \bar{K}^0$	[d] (5.4 ± 1.2) %	
Γ_{68}	$K^+ K^- \pi^+ \pi^0$	(5.50 ± 0.24) %	S=1.3
Γ_{69}	$\phi \rho^+$	[d] (5.59 ± 0.34) %	
Γ_{70}	$\bar{K}_1(1270)^0 K^+,$ $\bar{K}_1(1270)^0 \rightarrow K^- \rho^+$	(5.7 ± 0.6) × 10 ⁻³	
Γ_{71}	$\bar{K}_1(1270)^0 K^+,$ $\bar{K}_1(1270)^0 \rightarrow K^*(892) \pi$	(1.31 ± 0.25) %	
Γ_{72}	$\bar{K}_1(1400)^0 K^+,$ $\bar{K}_1(1400)^0 \rightarrow K^*(892) \pi$	(2.0 ± 0.4) %	
Γ_{73}	$a_0(980)^0 \rho^+, a_0^0 \rightarrow K^+ K^-$	(1.9 ± 0.4) × 10 ⁻³	
Γ_{74}	$f_1(1420)^0 \pi^+, f_1(1420)^0 \rightarrow$ $K^*(892)^\mp K^\pm$	(3.9 ± 0.7) × 10 ⁻³	

Γ_{75}	$f_1(1420)^0 \pi^+, f_1(1420)^0 \rightarrow$ $a_0(980)^0 \pi^0, a_0(980)^0 \rightarrow$ $K^+ K^-$	(4.0 \pm 1.4) $\times 10^{-4}$	
Γ_{76}	$\eta(1475) \pi^+, \eta(1475) \rightarrow$ $a_0(980)^0 \pi^0, a_0(980)^0 \rightarrow$ $K^+ K^-$	(7.0 \pm 2.8) $\times 10^{-4}$	
Γ_{77}	$K_S^0 K^- 2\pi^+$	(1.53 \pm 0.08) %	S=1.5
Γ_{78}	$K^+ K^- K_S^0 \pi^+$	(1.29 \pm 0.18) $\times 10^{-4}$	
Γ_{79}	$K^*(892)^+ \bar{K}^*(892)^0$	[d] (5.64 \pm 0.35) %	
Γ_{80}	$\eta(1475) K_S^0, \eta \rightarrow$ $K^*(892)^0 \pi^+, K^{*0} \rightarrow$ $K^- \pi^+$	(3.4 \pm 1.0) $\times 10^{-4}$	
Γ_{81}	$\eta(1475) \pi^+, \eta \rightarrow$ $\bar{K}^*(892)^+ K^-, \bar{K}^{*+} \rightarrow$ $K_S^0 \pi^+$	(3.4 \pm 1.0) $\times 10^{-4}$	
Γ_{82}	$\eta(1475) \pi^+, \eta \rightarrow$ $a_0(980)^- \pi^+, a_0^- \rightarrow$ $K_S^0 K^-$	(1.7 \pm 0.9) $\times 10^{-3}$	
Γ_{83}	$f_1(1285) \pi^+, f_1 \rightarrow$ $a_0(980)^- \pi^+, a_0^- \rightarrow$ $K_S^0 K^-$	(3.4 \pm 0.8) $\times 10^{-4}$	
Γ_{84}	$K^+ K_S^0 \pi^+ \pi^-$	(9.5 \pm 0.8) $\times 10^{-3}$	S=1.1
Γ_{85}	$K^+ K^- 2\pi^+ \pi^-$	(6.6 \pm 0.6) $\times 10^{-3}$	
Γ_{86}	$\phi 2\pi^+ \pi^-$	[d] (1.21 \pm 0.16) %	
Γ_{87}	$\phi \rho^0 \pi^+, \phi \rightarrow K^+ K^-$	(4.9 \pm 0.7) $\times 10^{-3}$	
Γ_{88}	$\phi a_1(1260)^+, \phi \rightarrow$ $K^+ K^-, a_1^+ \rightarrow$ $\rho^0 \pi^+$	(7.4 \pm 1.2) $\times 10^{-3}$	
Γ_{89}	$\phi 2\pi^+ \pi^- \text{ non-}\rho, \phi \rightarrow$ $K^+ K^-$	(1.4 \pm 0.5) $\times 10^{-3}$	
Γ_{90}	$K^+ K^- \rho^0 \pi^+ \text{ non-}\phi$	< 2.0 $\times 10^{-4}$	CL=90%
Γ_{91}	$K^+ K^- 2\pi^+ \pi^- \text{ nonresonant}$	(1.0 \pm 0.4) $\times 10^{-3}$	
Γ_{92}	$2K_S^0 2\pi^+ \pi^-$	(7.8 \pm 3.3) $\times 10^{-4}$	

Hadronic modes without K's

Γ_{93}	$\pi^+ \pi^0$	< 1.2 $\times 10^{-4}$	CL=90%
Γ_{94}	$2\pi^+ \pi^-$	(1.08 \pm 0.04) %	
Γ_{95}	$\rho^0 \pi^+$	(1.12 \pm 0.17) $\times 10^{-4}$	
Γ_{96}	$\pi^+ (\pi^+ \pi^-)_{S\text{-wave}}$	[h] (9.12 \pm 0.35) $\times 10^{-3}$	
Γ_{97}	$f_0(980) \pi^+, f_0 \rightarrow \pi^+ \pi^-$		
Γ_{98}	$f_0(1370) \pi^+, f_0 \rightarrow \pi^+ \pi^-$		
Γ_{99}	$f_0(1500) \pi^+, f_0 \rightarrow \pi^+ \pi^-$		
Γ_{100}	$f_2(1270) \pi^+, f_2 \rightarrow \pi^+ \pi^-$	(1.40 \pm 0.11) $\times 10^{-3}$	
Γ_{101}	$f_2'(1525)^0 \pi^+, f_2' \rightarrow \pi^+ \pi^-$	(5.7 \pm 2.0) $\times 10^{-6}$	

Γ_{102}	$\rho(1450)^0 \pi^+, \rho^0 \rightarrow \pi^+ \pi^-$	(1.8 \pm 0.6) $\times 10^{-4}$	
Γ_{103}	$\rho(1700)^0 \pi^+, \rho^0 \rightarrow \pi^+ \pi^-$	(4 \pm 4) $\times 10^{-5}$	
Γ_{104}	$\pi^+ 2\pi^0$	(5.2 \pm 0.5) $\times 10^{-3}$	S=1.1
Γ_{105}	$f_0(980) \pi^+, f_0 \rightarrow \pi^0 \pi^0$	(2.9 \pm 0.6) $\times 10^{-3}$	
Γ_{106}	$f_0(1370) \pi^+, f_0 \rightarrow \pi^0 \pi^0$	(1.3 \pm 0.6) $\times 10^{-3}$	
Γ_{107}	$f_2(1270) \pi^+, f_2 \rightarrow \pi^0 \pi^0$	(5.0 \pm 3.5) $\times 10^{-4}$	
Γ_{108}	$2\pi^+ \pi^- \pi^0$	—	
Γ_{109}	$\eta \pi^+$	[d] (1.67 \pm 0.09) %	S=1.1
Γ_{110}	$\omega \pi^+$	[d] (1.92 \pm 0.30) $\times 10^{-3}$	
Γ_{111}	$\omega \pi^+, \omega \rightarrow \pi^+ \pi^-$	(3.9 \pm 0.5) $\times 10^{-5}$	
Γ_{112}	$3\pi^+ 2\pi^-$	(7.8 \pm 0.8) $\times 10^{-3}$	
Γ_{113}	$2\pi^+ \pi^- 2\pi^0$	—	
Γ_{114}	$\eta \rho^+$	[d] (8.9 \pm 0.8) %	
Γ_{115}	$\eta \pi^+ \pi^0$	(9.5 \pm 0.5) %	
Γ_{116}	$\eta(\pi^+ \pi^0)_{P\text{-wave}}$	(5.1 \pm 3.1) $\times 10^{-3}$	
Γ_{117}	$a_0(980)^{+0} \pi^{0+},$ $a_0(980)^{+0} \rightarrow \eta \pi^{+0}$	(2.2 \pm 0.4) %	
Γ_{118}	$\omega \pi^+ \pi^0$	[d] (2.8 \pm 0.7) %	
Γ_{119}	$2\pi^+ \pi^- \eta$	(3.12 \pm 0.16) %	
Γ_{120}	$a_1(1260)^+ \eta, a_1^+ \rightarrow$ $\rho(770)^0 \pi^+, \rho^0 \rightarrow \pi^+ \pi^-$	(1.73 \pm 0.16) %	
Γ_{121}	$a_1(1260)^+ \eta, a_1^+ \rightarrow$ $f_0(500) \pi^+, f_0 \rightarrow \pi^+ \pi^-$	(2.5 \pm 0.9) $\times 10^{-3}$	
Γ_{122}	$a_0(980)^+ \rho(770)^0, a_0^+ \rightarrow$ $\eta \pi^+$	(2.1 \pm 0.9) $\times 10^{-3}$	
Γ_{123}	$\eta(1405) \pi^+, \eta(1405) \rightarrow$ $a_0(980)^- \pi^+, a_0^- \rightarrow \eta \pi^-$	(2.2 \pm 0.7) $\times 10^{-4}$	
Γ_{124}	$\eta(1405) \pi^+, \eta(1405) \rightarrow$ $a_0(980)^+ \pi^-, a_0^+ \rightarrow \eta \pi^+$	(2.2 \pm 0.7) $\times 10^{-4}$	
Γ_{125}	$f_1(1420) \pi^+, f_1 \rightarrow$ $a_0(980)^- \pi^+, a_0^- \rightarrow \eta \pi^-$	(5.9 \pm 1.8) $\times 10^{-4}$	
Γ_{126}	$f_1(1420) \pi^+, f_1 \rightarrow$ $a_0(980)^+ \pi^-, a_0^+ \rightarrow \eta \pi^+$	(5.3 \pm 1.8) $\times 10^{-4}$	
Γ_{127}	$3\pi^+ 2\pi^- \pi^0$	(4.9 \pm 3.2) %	
Γ_{128}	$\omega 2\pi^+ \pi^-$	[d] (1.6 \pm 0.5) %	
Γ_{129}	$\eta'(958) \pi^+$	[c,d] (3.94 \pm 0.25) %	
Γ_{130}	$3\pi^+ 2\pi^- 2\pi^0$	—	
Γ_{131}	$\omega \eta \pi^+$	[d] (5.4 \pm 1.3) $\times 10^{-3}$	
Γ_{132}	$\eta'(958) \rho^+$	[c,d] (5.8 \pm 1.5) %	
Γ_{133}	$\eta'(958) \pi^+ \pi^0$	(6.08 \pm 0.29) %	
Γ_{134}	$\eta'(958) \pi^+ \pi^0$ nonresonant	< 5.1 %	CL=90%

Modes with one or three K's

Γ_{135}	$K^+ \pi^0$	(7.4 \pm 0.5) $\times 10^{-4}$
Γ_{136}	$K_S^0 \pi^+$	(1.09 \pm 0.05) $\times 10^{-3}$
Γ_{137}	$K^+ \eta$	[d] (1.73 \pm 0.08) $\times 10^{-3}$
Γ_{138}	$K^+ \omega$	[d] (9.9 \pm 1.5) $\times 10^{-4}$
Γ_{139}	$K^+ \eta'(958)$	[d] (2.64 \pm 0.24) $\times 10^{-3}$
Γ_{140}	$K^+ \pi^+ \pi^-$	(6.20 \pm 0.19) $\times 10^{-3}$
Γ_{141}	$K^+ \rho^0$	(2.17 \pm 0.25) $\times 10^{-3}$
Γ_{142}	$K^+ \rho(1450)^0, \rho^0 \rightarrow \pi^+ \pi^-$	(7.2 \pm 1.7) $\times 10^{-4}$
Γ_{143}	$K^+ f_0(500), f_0 \rightarrow \pi^+ \pi^-$	(4.5 \pm 3.0) $\times 10^{-4}$
Γ_{144}	$K^+ f_0(980), f_0 \rightarrow \pi^+ \pi^-$	(2.8 \pm 1.1) $\times 10^{-4}$
Γ_{145}	$K^+ f_0(1370), f_0 \rightarrow \pi^+ \pi^-$	(1.2 \pm 0.6) $\times 10^{-3}$
Γ_{146}	$K^*(892)^0 \pi^+, K^{*0} \rightarrow$ $K^+ \pi^-$	(1.67 \pm 0.26) $\times 10^{-3}$
Γ_{147}	$K^*(1410)^0 \pi^+, K^{*0} \rightarrow$ $K^+ \pi^-$	(6 \pm 4) $\times 10^{-4}$
Γ_{148}	$K^*(1430)^0 \pi^+, K^{*0} \rightarrow$ $K^+ \pi^-$	(9.3 \pm 3.1) $\times 10^{-4}$
Γ_{149}	$K^+ \pi^+ \pi^-$ nonresonant	(9.9 \pm 3.2) $\times 10^{-4}$
Γ_{150}	$K^0 \pi^+ \pi^0$	
Γ_{151}	$K_S^0 \pi^+ \pi^0$	(5.38 \pm 0.32) $\times 10^{-3}$
Γ_{152}	$K_S^0 \rho(770)^+, \rho^+ \rightarrow \pi^+ \pi^0$	(2.7 \pm 0.5) $\times 10^{-3}$
Γ_{153}	$K_S^0 \rho(1450)^+, \rho^+ \rightarrow \pi^+ \pi^0$	(1.10 \pm 0.34) $\times 10^{-3}$
Γ_{154}	$K^*(892)^0 \pi^+, K^{*0} \rightarrow K_S^0 \pi^0$	(4.5 \pm 1.3) $\times 10^{-4}$
Γ_{155}	$K^*(892)^+ \pi^0, K^{*+} \rightarrow$ $K_S^0 \pi^+$	(2.5 \pm 0.8) $\times 10^{-4}$
Γ_{156}	$K^*(1410)^0 \pi^+, K^{*0} \rightarrow$ $K_S^0 \pi^0$	(1.8 \pm 0.9) $\times 10^{-4}$
Γ_{157}	$K_S^0 2\pi^+ \pi^-$	(2.8 \pm 1.0) $\times 10^{-3}$
Γ_{158}	$K^+ \pi^+ \pi^- \pi^0$	(9.7 \pm 0.6) $\times 10^{-3}$
Γ_{159}	$K^*(892)^0 \rho^+, K^{*0} \rightarrow K^+ \pi^-$	(3.9 \pm 0.4) $\times 10^{-3}$
Γ_{160}	$K^*(892)^+ \rho^0, K^{*+} \rightarrow K^+ \pi^0$	(4.2 \pm 1.2) $\times 10^{-4}$
Γ_{161}	$K_1(1270)^0 \pi^+, K_1^0 \rightarrow K^+ \rho^-$	(3.9 \pm 1.3) $\times 10^{-4}$
Γ_{162}	$K_1(1400)^0 \pi^+, K_1^0 \rightarrow$ $K^*(890)^+ \pi^-, K^{*+} \rightarrow$ $K^+ \pi^0$	(5.4 \pm 0.9) $\times 10^{-4}$
Γ_{163}	$K_1(1400)^0 \pi^+, K_1^0 \rightarrow$ $K^*(890)^0 \pi^0, K^{*0} \rightarrow$ $K^+ \pi^-$	(5.9 \pm 1.0) $\times 10^{-4}$
Γ_{164}	$K^+ a_1(1260)^0, a_1 \rightarrow \rho^+ \pi^-$	(1.8 \pm 1.1) $\times 10^{-4}$
Γ_{165}	$K^+ a_1(1260)^0, a_1 \rightarrow \rho^- \pi^+$	(1.8 \pm 1.1) $\times 10^{-4}$
Γ_{166}	$K^+ \pi^+ \pi^- \pi^0$ nonresonant	(9.2 \pm 2.4) $\times 10^{-4}$
Γ_{167}	$(K^+ \pi^0) P\text{-wave } \rho^0$	(1.01 \pm 0.21) $\times 10^{-3}$
Γ_{168}	$K^+ \omega \pi^0$	[d] < 8.2 $\times 10^{-3}$ CL=90%

Γ_{169}	$K^+ \omega \pi^+ \pi^-$	[d] <	5.4	$\times 10^{-3}$	CL=90%
Γ_{170}	$K^+ \omega \eta$	[d] <	7.9	$\times 10^{-3}$	CL=90%
Γ_{171}	$2K^+ K^-$		(2.15 \pm 0.20)	$\times 10^{-4}$	
Γ_{172}	$\phi K^+, \phi \rightarrow K^+ K^-$		(8.8 \pm 2.0)	$\times 10^{-5}$	

Doubly Cabibbo-suppressed modes

Γ_{173}	$2K^+ \pi^-$		(1.274 \pm 0.031)	$\times 10^{-4}$	
Γ_{174}	$K^+ K^*(892)^0, K^{*0} \rightarrow K^+ \pi^-$		(6.0 \pm 3.4)	$\times 10^{-5}$	

Baryon-antibaryon mode

Γ_{175}	$p \bar{n}$		(1.22 \pm 0.11)	$\times 10^{-3}$	
Γ_{176}	$p \bar{p} e^+ \nu_e$	<	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_{177}	$\pi^+ e^+ e^-$	[i] <	5.5	$\times 10^{-6}$	CL=90%
Γ_{178}	$\pi^+ \phi, \phi \rightarrow e^+ e^-$	[j] (6 $\begin{smallmatrix} +8 \\ -4 \end{smallmatrix}$) $\times 10^{-6}$	
Γ_{179}	$\pi^+ \mu^+ \mu^-$	[i] <	1.8	$\times 10^{-7}$	CL=90%
Γ_{180}	$K^+ e^+ e^-$	C1 <	3.7	$\times 10^{-6}$	CL=90%
Γ_{181}	$K^+ \mu^+ \mu^-$	C1 <	1.4	$\times 10^{-7}$	CL=90%
Γ_{182}	$K^*(892)^+ \mu^+ \mu^-$	C1 <	1.4	$\times 10^{-3}$	CL=90%
Γ_{183}	$\pi^+ e^+ \mu^-$	LF <	1.1	$\times 10^{-6}$	CL=90%
Γ_{184}	$\pi^+ e^- \mu^+$	LF <	9.4	$\times 10^{-7}$	CL=90%
Γ_{185}	$K^+ e^+ \mu^-$	LF <	7.9	$\times 10^{-7}$	CL=90%
Γ_{186}	$K^+ e^- \mu^+$	LF <	5.6	$\times 10^{-7}$	CL=90%
Γ_{187}	$\pi^- 2e^+$	L <	1.4	$\times 10^{-6}$	CL=90%
Γ_{188}	$\pi^- 2\mu^+$	L <	8.6	$\times 10^{-8}$	CL=90%
Γ_{189}	$\pi^- e^+ \mu^+$	L <	6.3	$\times 10^{-7}$	CL=90%
Γ_{190}	$K^- 2e^+$	L <	7.7	$\times 10^{-7}$	CL=90%
Γ_{191}	$K^- 2\mu^+$	L <	2.6	$\times 10^{-8}$	CL=90%
Γ_{192}	$K^- e^+ \mu^+$	L <	2.6	$\times 10^{-7}$	CL=90%
Γ_{193}	$K^*(892)^- 2\mu^+$	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 $\omega-\phi$ mixing is an unlikely explanation for any fraction above about 2×10^{-4} .
- [f] The branching fraction for this mode may differ from the sum of the submodes that contribute to it, due to interference effects. See the relevant papers.
- [g] We decouple the $D_s^+ \rightarrow \phi\pi^+$ 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.

FIT INFORMATION

An overall fit to 16 branching ratios uses 25 measurements to determine 11 parameters. The overall fit has a $\chi^2 = 12.7$ for 14 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, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$.

x_{47}	27									
x_{68}	8	0								
x_{77}	24	4	14							
x_{84}	18	3	12	45						
x_{94}	17	33	1	6	4					
x_{109}	1	15	-8	-15	-12	6				
x_{110}	0	1	0	-1	0	0	4			
x_{138}	0	0	0	0	0	0	0	0		
x_{140}	7	3	4	8	6	2	-4	0	0	
x_{158}	0	0	0	0	0	0	0	0	26	0
	x_{44}	x_{47}	x_{68}	x_{77}	x_{84}	x_{94}	x_{109}	x_{110}	x_{138}	x_{140}

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 **$\Gamma(e^+ \text{ semileptonic})/\Gamma_{\text{total}}$** **$\Gamma_1/\Gamma$**

This is the purely e^+ semileptonic branching fraction: the e^+ fraction from τ^+ decays has been subtracted off.

<u>VALUE (%)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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.

<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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.

<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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.

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

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

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

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

<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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

<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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.

<u>VALUE (%)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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

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

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

<u>VALUE (%)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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
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11.7±1.7±0.7		DOBBS	09	CLEO e^+e^- at 4170 MeV
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• • • 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

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

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

<u>VALUE (%)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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

<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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

<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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

<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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

<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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

$\Gamma(2\pi^+\pi^- + \text{ anything})/\Gamma_{\text{total}}$					Γ_{19}/Γ
VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT	
$32.81 \pm 0.35 \pm 0.63$	25k	¹ ABLIKIM	23AV	BES3	e^+e^- at 4.178 GeV

¹ Charged pions from K_S^0 meson decays are excluded from this measurement

Leptonic and semileptonic modes

See the related review(s):

Leptonic Decays of Charged Pseudoscalar Mesons

$\Gamma(e^+\nu_e)/\Gamma_{\text{total}}$					Γ_{20}/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 $< 1.0 \times 10^{-4}$ at 95% CL.

$\Gamma(\mu^+\nu_\mu)/\Gamma_{\text{total}}$					Γ_{21}/Γ
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See the note on "Decay Constants of Charged Pseudoscalar Mesons."

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
5.35 ± 0.12	OUR AVERAGE			
$5.294 \pm 0.108 \pm 0.085$	2.5k	ABLIKIM	23BR	BES3 e^+e^- at 4.128–4.226 GeV
$5.17 \pm 0.75 \pm 0.21$	69	¹ ABLIKIM	160	BES3 e^+e^- at 4.009 GeV
$5.31 \pm 0.28 \pm 0.20$	490	² ZUPANC	13	BELL e^+e^- at $\Upsilon(4S), \Upsilon(5S)$
$6.02 \pm 0.38 \pm 0.34$	270	³ DEL-AMO-SA..10J	BABR	e^+e^- , 10.58 GeV
$5.65 \pm 0.45 \pm 0.17$	230	ALEXANDER	09	CLEO e^+e^- at 4170 MeV

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

$5.35 \pm 0.13 \pm 0.16$	2.2k	⁴ ABLIKIM	21BE	BES3 e^+e^- , 4.178, 4.226 GeV
$5.49 \pm 0.16 \pm 0.15$	1.1k	⁴ ABLIKIM	19E	BES3 e^+e^- at 4178 MeV
$6.44 \pm 0.76 \pm 0.57$	170	⁵ WIDHALM	08	BELL See ZUPANC 13
$5.94 \pm 0.66 \pm 0.31$	88	⁶ PEDLAR	07A	CLEO See ALEXANDER 09
$6.8 \pm 1.1 \pm 1.8$	553	⁷ 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 Superseded by ABLIKIM 23BR.

⁵ WIDHALM 08 gets $f_{D_s} = (275 \pm 16 \pm 12)$ MeV from the branching fraction.

⁶ PEDLAR 07A also fits μ^+ and τ^+ events together and gets an effective $\mu^+ \nu_\mu$ branching fraction of $(6.38 \pm 0.59 \pm 0.33) \times 10^{-3}$

⁷ 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_{21}/Γ_{48}

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. • • •

$0.143 \pm 0.018 \pm 0.006$	489 ± 55	¹ AUBERT	07V BABR	$e^+ e^- \approx \Upsilon(4S)$
$0.23 \pm 0.06 \pm 0.04$	18	² ALEXANDROV	00 BEAT	π^- nucleus, 350 GeV
$0.173 \pm 0.023 \pm 0.035$	182	³ CHADHA	98 CLE2	$e^+ e^- \approx \Upsilon(4S)$
$0.245 \pm 0.052 \pm 0.074$	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_{22}/Γ

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

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
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5.36 ± 0.10 OUR AVERAGE

$5.44 \pm 0.17 \pm 0.13$	2.4k	¹ ABLIKIM	23BP BES3	$e^+ e^-$ at 4.128–4.226 GeV
$5.37 \pm 0.17 \pm 0.15$	2.3k	² ABLIKIM	23BX BES3	$e^+ e^-$ at 4.128–4.226 GeV
$5.29 \pm 0.25 \pm 0.20$	1.7k	³ ABLIKIM	21AF BES3	$e^+ e^-$ at 4.178, 4.226 GeV
$5.27 \pm 0.10 \pm 0.12$	4.9k	⁴ ABLIKIM	21AZ BES3	$e^+ e^-$ at 4.178, 4.226 GeV
$3.28 \pm 1.83 \pm 0.37$	33	⁵ ABLIKIM	16O BES3	$e^+ e^-$ at 4.009 GeV
$5.70 \pm 0.21^{+0.31}_{-0.30}$	2.2k	⁶ ZUPANC	13 BELL	$e^+ e^-$ at $\Upsilon(4S)$, $\Upsilon(5S)$
$4.96 \pm 0.37 \pm 0.57$	748	⁷ 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	⁸ ALEXANDER	09 CLEO	$\tau^+ \rightarrow \pi^+ \bar{\nu}_\tau$
$5.52 \pm 0.57 \pm 0.21$	155	⁸ NAIK	09A CLEO	$\tau^+ \rightarrow \rho^+ \bar{\nu}_\tau$
$5.30 \pm 0.47 \pm 0.22$	181	⁸ ONYISI	09 CLEO	$\tau^+ \rightarrow e^+ \nu_e \bar{\nu}_\tau$

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

$5.21 \pm 0.25 \pm 0.17$	950	⁹ ABLIKIM	21BE BES3	$e^+ e^-$ at 4.178, 4.226 GeV
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6.17±0.71±0.34	102	¹⁰ ECKLUND	08	CLEO	See ONYISI 09
8.0 ±1.3 ±0.4	47	¹⁰ PEDLAR	07A	CLEO	See ALEXANDER 09
5.79±0.77±1.84	881	¹¹ HEISTER	02I	ALEP	Z decays
7.0 ±2.1 ±2.0	22	¹² ABBIENDI	01L	OPAL	$D_s^{*+} \rightarrow \gamma D_s^+$ from Z's
7.4 ±2.8 ±2.4	16	¹³ ACCIARRI	97F L3		$D_s^{*+} \rightarrow \gamma D_s^+$ from Z's

¹ ABLIKIM 23BP uses $\tau^+ \rightarrow \pi^+ \bar{\nu}_\tau$ decays.

² ABLIKIM 23BX uses $\tau^+ \rightarrow \mu^+ \nu_\mu \bar{\nu}_\tau$ decays.

³ ABLIKIM 21AF uses $\tau^+ \rightarrow \pi^+ \pi^0 \bar{\nu}_\tau$ decays.

⁴ ABLIKIM 21AZ uses $\tau^+ \rightarrow e^+ \nu_e \bar{\nu}_\tau$ decays.

⁵ 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 $(4.83 \pm 0.65 \pm 0.26)\%$.

⁶ ZUPANC 13 uses both $\mu^+ \nu$ and $\tau^+ \nu$ events to get $f_{D_s} = (255.5 \pm 4.2 \pm 5.1)$ MeV.

⁷ 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.

⁸ 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.

⁹ ABLIKIM 21BE uses $\tau^+ \rightarrow \pi^+ \bar{\nu}_\tau$ 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 $(5.22 \pm 0.10 \pm 0.14)\%$. Superseded by ABLIKIM 23BP.

¹⁰ 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.

¹¹ 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.

¹² This ABBIENDI 01L value gives a decay constant f_{D_s} of $(286 \pm 44 \pm 41)$ MeV.

¹³ 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_{22}/Γ_{21}

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

10.73±0.69^{+0.56}_{-0.53} 2.2k/492 ¹ ZUPANC 13 BELL $e^+ e^-$ at $\Upsilon(4S), \Upsilon(5S)$

11.0 ±1.4 ±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_{23}/Γ

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

$\Gamma(K^+K^-e^+\nu_e)/\Gamma(K^+K^-\pi^+)$ Γ_{24}/Γ_{47}

VALUE DOCUMENT ID TECN COMMENT

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

$0.558 \pm 0.007 \pm 0.016$ ¹ AUBERT 08AN BABR e^+e^- at $\Upsilon(4S)$

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.

$\Gamma(K_S^0K_S^0e^+\nu_e)/\Gamma_{total}$ Γ_{25}/Γ

VALUE CL% DOCUMENT ID TECN COMMENT

$<3.8 \times 10^{-4}$ 90 ABLIKIM 22J BES3 e^+e^- at 4.178-4.226 GeV

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

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

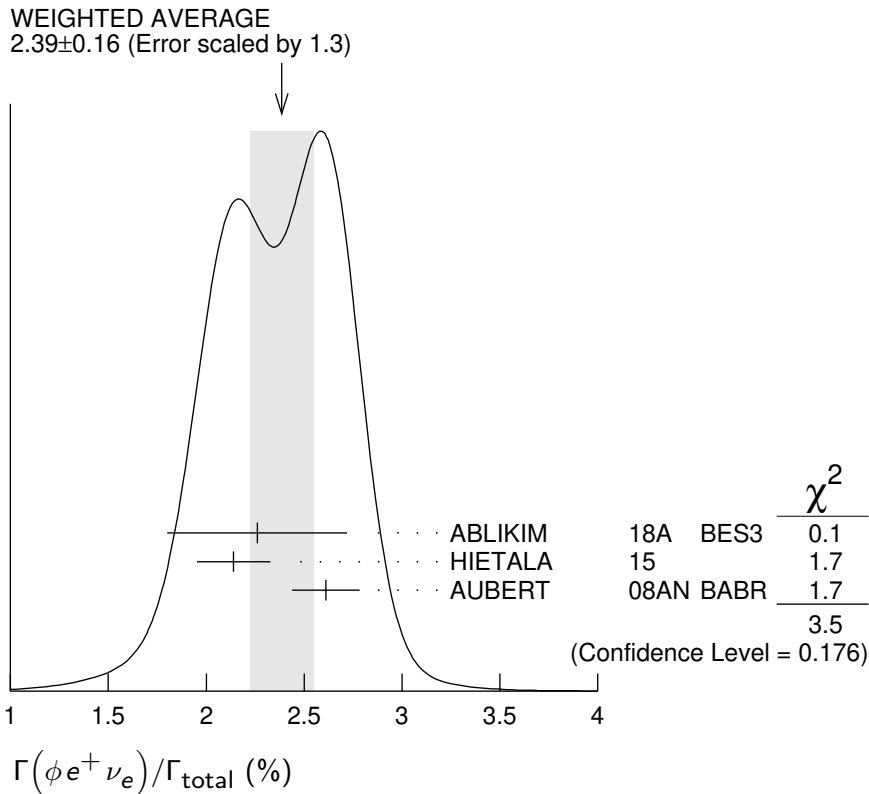
$2.14 \pm 0.17 \pm 0.08$ 207 HIETALA 15 Uses CLEO data

$2.61 \pm 0.03 \pm 0.17$ 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_{26}/Γ_{48}

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

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

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

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
2.24 ± 0.11 OUR AVERAGE				
$2.25 \pm 0.09 \pm 0.07$	1.7k	ABLIKIM	23BZ BES3	$e^+ e^-$ at 4.128–4.226 GeV
$1.94 \pm 0.53 \pm 0.09$	22	ABLIKIM	18A BES3	$e^+ e^-$ at 4.009 GeV

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

Unseen decay modes of the η are included.

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
2.26 ± 0.06 OUR AVERAGE				
$2.255 \pm 0.039 \pm 0.051$	4k	ABLIKIM	23BO BES3	$e^+ e^-$ at 4128–4226 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. ● ● ●				
$2.323 \pm 0.063 \pm 0.063$	1.8k	² ABLIKIM	19S BES3	$e^+ e^-$ at 4178 MeV
$2.48 \pm 0.29 \pm 0.13$	82	YELTON	09 CLEO	See HIETALA 15

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

² Superseded by ABLIKIM 23BO

 $\Gamma(\eta e^+ \nu_e)/\Gamma(\phi e^+ \nu_e)$ Γ_{31}/Γ_{26}

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

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

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

 $\Gamma(\eta'(958) e^+ \nu_e)/\Gamma_{\text{total}}$ Γ_{32}/Γ

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

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.80 ± 0.04 OUR AVERAGE				
$0.810 \pm 0.038 \pm 0.024$	675	ABLIKIM	23BO BES3	$e^+ e^-$ at 4128–4226 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. ● ● ●				
$0.824 \pm 0.073 \pm 0.027$	261	² ABLIKIM	19S BES3	$e^+ e^-$ at 4178 MeV
$0.91 \pm 0.33 \pm 0.05$	7.5	YELTON	09 CLEO	See HIETALA 15

¹ Obtained by analyzing CLEO-c data but not authored by the CLEO Collaboration.² Superseded by ABLIKIM 23B0 $\Gamma(\eta'(958)e^+\nu_e)/\Gamma(\phi e^+\nu_e)$ Γ_{32}/Γ_{26}

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 15¹ BRANDENBURG 95 uses both e^+ and μ^+ events and makes a phase-space adjustment to use the μ^+ events as e^+ events. $[\Gamma(\eta e^+\nu_e) + \Gamma(\eta'(958)e^+\nu_e)]/\Gamma(\phi e^+\nu_e)$ $\Gamma_{30}/\Gamma_{26} = (\Gamma_{31} + \Gamma_{32})/\Gamma_{26}$

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 15¹ This BRANDENBURG 95 data is redundant with data in previous blocks. $\Gamma(\eta\mu^+\nu_\mu)/\Gamma_{\text{total}}$ Γ_{33}/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 $\Gamma(\eta'(958)\mu^+\nu_\mu)/\Gamma_{\text{total}}$ Γ_{34}/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 $\Gamma(\omega e^+\nu_e)/\Gamma_{\text{total}}$ Γ_{35}/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 $\Gamma(K^0 e^+\nu_e)/\Gamma_{\text{total}}$ Γ_{36}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
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0.34 ±0.04 OUR AVERAGE0.325±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. $\Gamma(K_1(1270)^0 e^+\nu_e)/\Gamma_{\text{total}}$ Γ_{27}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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<4.1 × 10⁻⁴ 90 ¹ ABLIKIM 23BS BES3 e^+e^- at 4.128–4.226 GeV¹ ABLIKIM 23BS uses $K_1(1270)^0 \rightarrow K^-\pi^+\pi^0$ decays.

$\Gamma(K^*(892)^0 e^+ \nu_e) / \Gamma_{\text{total}}$ Γ_{37} / Γ Unseen decay modes of the $K^*(892)^0$ are included.

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.215 ± 0.028	OUR AVERAGE	Error includes scale factor of 1.1.		
$0.237 \pm 0.026 \pm 0.020$	155	ABLIKIM	19D BES3	$e^+ e^-$ at 4178 MeV
$0.18 \pm 0.04 \pm 0.01$	32	¹ HIETALA	15	$e^+ e^-$ at 4.170 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$0.18 \pm 0.07 \pm 0.01$	7.5	YELTON	09 CLEO	See HIETALA 15

¹ Uses CLEO data, but not authored by the CLEO collaboration $\Gamma(f_0(500) e^+ \nu_e, f_0 \rightarrow \pi^0 \pi^0) / \Gamma_{\text{total}}$ Γ_{38} / Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 7.3 \times 10^{-4}$	90	ABLIKIM	22J BES3	$e^+ e^-$ at 4.178-4.226 GeV

 $\Gamma(f_0(980) e^+ \nu_e, f_0 \rightarrow \pi^0 \pi^0) / \Gamma_{\text{total}}$ Γ_{39} / Γ

VALUE (units 10^{-4})	EVTS	DOCUMENT ID	TECN	COMMENT
$7.9 \pm 1.4 \pm 0.4$	55	¹ ABLIKIM	22J BES3	$e^+ e^-$ at 4.178-4.226 GeV

¹ Assuming $B(f_0 \rightarrow \pi^0 \pi^0) = 1/3$ via the isospin limit, this result implies $B(D_s^+ \rightarrow f_0(980) e^+ \nu_e) = (2.4 \pm 0.4) \times 10^{-3}$. $\Gamma(f_0(980) e^+ \nu_e, f_0 \rightarrow \pi^+ \pi^-) / \Gamma_{\text{total}}$ Γ_{40} / Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
• • • 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. $\Gamma(f_0(980) \mu^+ \nu_\mu, f_0 \rightarrow K^+ K^-) / \Gamma_{\text{total}}$ Γ_{41} / Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 5.45 \times 10^{-4}$	90	¹ ABLIKIM	23BZ BES3	$e^+ e^-$ at 4.128-4.226 GeV

¹ Partial wave analysis of 939 $D_s^+ \rightarrow K^+ K^- \mu^+ \nu_\mu$ events, assuming $K^+ K^-$ S-wave is 100% $f_0(980)$. $\Gamma(a_0(980)^0 e^+ \nu_e, a_0^0 \rightarrow \pi^0 \eta) / \Gamma_{\text{total}}$ Γ_{42} / Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 1.2 \times 10^{-4}$	90	ABLIKIM	21Y BES3	$e^+ e^-$ at 4.178-4.226 GeV

 $\Gamma(\pi^0 e^+ \nu_e) / \Gamma_{\text{total}}$ Γ_{43} / Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 6.4 \times 10^{-5}$	90	ABLIKIM	22BH BES3	6.32 fb^{-1} of $e^+ e^-$ at 4.178-4.226 GeV

$\Gamma(b_1(1235)^0 e^+ \nu_e, b_1^0 \rightarrow \omega \pi^0) / \Gamma_{\text{total}}$ Γ_{28} / Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<6.4 \times 10^{-4}$	90	ABLIKIM	23BS BES3	$e^+ e^-$ at 4.128–4.226 GeV

———— Hadronic modes with a $K\bar{K}$ pair ———— $\Gamma(K^+ K_S^0) / \Gamma_{\text{total}}$ Γ_{44} / Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
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1.450 ± 0.035 OUR FIT**1.46 ± 0.05 OUR AVERAGE** Error includes scale factor of 1.2.1.425 ± 0.038 ± 0.031 1.8k ABLIKIM 19AMBES3 $e^+ e^-$ at 4178 MeV1.52 ± 0.05 ± 0.03 ONYISI 13 CLEO $e^+ e^-$ at 4.17 GeV

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

1.49 ± 0.07 ± 0.05 ¹ ALEXANDER 08 CLEO See ONYISI 13¹ ALEXANDER 08 uses single- and double-tagged events in an overall fit. $\Gamma(K^+ K_S^0) / \Gamma(K^+ K^- \pi^+)$ $\Gamma_{44} / \Gamma_{47}$

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 $\Gamma(K^+ K_L^0) / \Gamma_{\text{total}}$ Γ_{45} / 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 $\Gamma(K^+ \bar{K}^0) / \Gamma_{\text{total}}$ Γ_{46} / 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 $\Upsilon(4S), \Upsilon(5S)$ 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_{47} / Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
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5.37 ± 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 ± 0.08 ± 0.13 5.1k ABLIKIM 21AE BES3 $e^+ e^-$ at 4.178 GeV5.55 ± 0.14 ± 0.13 ONYISI 13 CLEO $e^+ e^-$ at 4.17 GeV5.06 ± 0.15 ± 0.21 4.1k ZUPANC 13 BELL $e^+ e^-$ at $\Upsilon(4S), \Upsilon(5S)$ 5.78 ± 0.20 ± 0.30 DEL-AMO-SA..10J BABR $e^+ e^-$, 10.58 GeV

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

5.50 ± 0.23 ± 0.16 ¹ ALEXANDER 08 CLEO See ONYISI 13¹ ALEXANDER 08 uses single- and double-tagged events in an overall fit.

$\Gamma(\phi\pi^+)/\Gamma_{\text{total}}$ Γ_{48}/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_{49}/Γ_{47}

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

 $\Gamma(K^+ \bar{K}^*(892)^0)/\Gamma(K^*(892)^+ \bar{K}^0)$ Γ_{50}/Γ_{67}

VALUE	DOCUMENT ID	TECN	COMMENT
2.35^{+0.42}_{-0.23} ± 0.10	ABLIKIM	22AH BES3	Dalitz plot fit to 990 $D_s^\pm \rightarrow K^\pm K_S \pi^0$ evts

$\Gamma(K^+\bar{K}^*(892)^0, \bar{K}^{*0} \rightarrow K^-\pi^+)/\Gamma(K^+K^-\pi^+)$ Γ_{51}/Γ_{47}

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

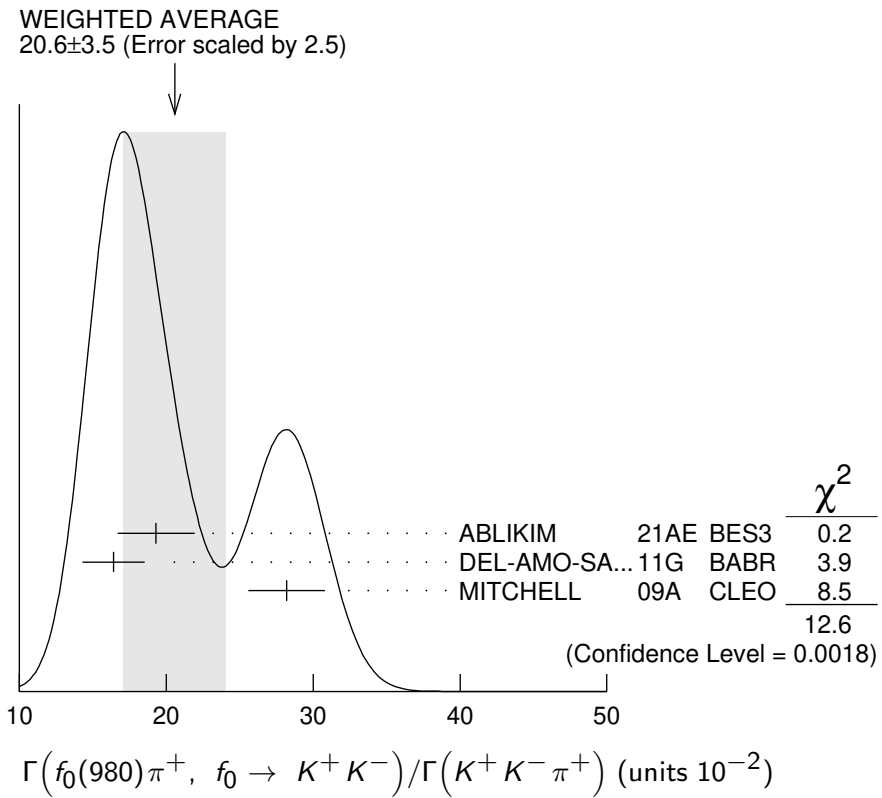
$\Gamma(K^+\bar{K}^*(892)^0, \bar{K}^{*0} \rightarrow K_S^0\pi^0)/\Gamma(K^+K_S^0\pi^0)$ Γ_{52}/Γ_{60}

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
32.7±2.2±1.9			
	ABLIKIM	22AH BES3	Dalitz plot fit, 990 evts

$\Gamma(f_0(980)\pi^+, f_0 \rightarrow K^+K^-)/\Gamma(K^+K^-\pi^+)$ Γ_{53}/Γ_{47}

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.

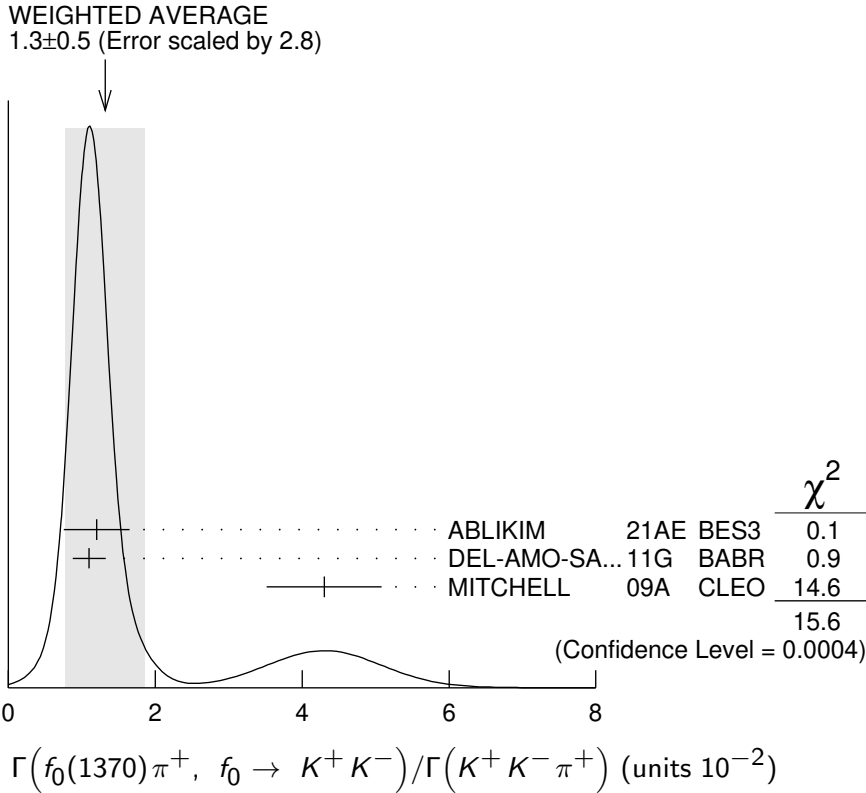
VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
20.6±3.5 OUR AVERAGE Error includes scale factor of 2.5. See the ideogram below.				
19.3±1.7±2.0	18.6k	ABLIKIM	21AE BES3	e^+e^- at 4.178 GeV
16.4±0.7±2.0		DEL-AMO-SA..11G	BABR	Dalitz fit, 96k evts
28.2±1.9±1.8		MITCHELL	09A CLEO	Dalitz fit, 12k evts
• • • 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_{54}/Γ_{47}

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_{55}/Γ_{47}

This is the "fit fraction" from the Dalitz-plot analysis. This is likely a superposition of $D_s^+ \rightarrow f_0(1710)\pi$ and $D_s^+ \rightarrow a_0(1710)\pi$ which are indistinguishable in such an 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

$\Gamma(a_0(980)^+\pi^0, a_0^+ \rightarrow K^+K_S^0)/\Gamma(K^+K_S^0\pi^0)$ Γ_{56}/Γ_{60}

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
7.7±1.7±1.8	ABLIKIM	22AH BES3	Dalitz plot fit, 990 evts

$\Gamma(a_0(1710)^+\pi^0, a_0^+ \rightarrow K^+ K_S^0)/\Gamma(K^+ K_S^0 \pi^0)$ Γ_{57}/Γ_{60}

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
23.6±3.4±2.0	¹ ABLIKIM	22AH BES3	Dalitz plot fit, 990 evts

¹ ABLIKIM 22AH observe an a_0 -like state with mass $m_{a_0} = 1.817 \pm 0.008 \pm 0.020$ GeV, and name the intermediate resonance $a_0(1817)$. We interpret this as the $a_0(1710)$ observed by LEES 21A.

 $\Gamma(K^+ \bar{K}_0^*(1430)^0, \bar{K}_0^* \rightarrow K^- \pi^+)/\Gamma(K^+ K^- \pi^+)$ Γ_{58}/Γ_{47}

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
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 $\Gamma(K^+ \bar{K}^*(1410)^0, \bar{K}_0^* \rightarrow K_S^0 \pi^0)/\Gamma(K^+ K_S^0 \pi^0)$ Γ_{59}/Γ_{60}

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
6.0±1.4±1.3	ABLIKIM	22AH BES3	Dalitz plot fit, 990 evts

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

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
1.47±0.07 OUR AVERAGE				

1.46±0.06±0.05	990	ABLIKIM	22AH BES3	e^+e^- at 4.178–4.226 GeV
1.52±0.09±0.20		ONYISI	13 CLEO	e^+e^- at 4.17 GeV

 $\Gamma(K^*(892)^+ K_S^0, K^{*+} \rightarrow K^+ \pi^0)/\Gamma(K^+ K_S^0 \pi^0)$ Γ_{61}/Γ_{60}

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
13.9±1.7±1.3	ABLIKIM	22AH BES3	Dalitz plot fit, 990 evts

 $\Gamma(2K_S^0 \pi^+)/\Gamma_{\text{total}}$ Γ_{62}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.71±0.04 OUR AVERAGE				Error includes scale factor of 1.3.

0.68±0.04±0.01	370	ABLIKIM	22F BES3	e^+e^- at 4.178–4.226 GeV
0.77±0.05±0.03		ONYISI	13 CLEO	e^+e^- at 4.17 GeV

 $\Gamma(f_0(980)\pi^+, f_0 \rightarrow K_S^0 K_S^0)/\Gamma_{\text{total}}$ Γ_{63}/Γ

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	CL%	DOCUMENT ID	TECN	COMMENT
<1.8 × 10⁻⁴	90	¹ ABLIKIM	22F BES3	Dalitz plot fit

¹ Based on isospin considerations, the authors interpret the suppression in the observed rate of this mode compared to $D_s^+ \rightarrow f_0(980)\pi^+$, $f_0 \rightarrow K^+ K^-$ as likely due to the destructive interference between $a_0(980)$ and $f_0(980)$ in decays to $K_S^0 K_S^0$.

$\Gamma(f_0(1710)\pi^+, f_0 \rightarrow K_S^0 K_S^0)/\Gamma(2K_S^0\pi^+)$ Γ_{64}/Γ_{62}

This is the “fit fraction” from the Dalitz-plot analysis. This is likely a superposition of $D_S^+ \rightarrow f_0(1710)\pi$ and $D_S^+ \rightarrow a_0(1700)\pi$ which are indistinguishable in such an analysis.

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
46.3±4.0±1.2	ABLIKIM	22F	BES3 Dalitz plot fit, 400 evts

 $\Gamma(K^*(892)^+ K_S^0, K^{*+} \rightarrow K_S^0\pi^+)/\Gamma(2K_S^0\pi^+)$ Γ_{65}/Γ_{62}

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
43.5±3.9±0.5	ABLIKIM	22F	BES3 Dalitz plot fit, 400 evts

 $\Gamma(K^*(892)^+\bar{K}^0)/\Gamma(\phi\pi^+)$ Γ_{67}/Γ_{48}

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_{68}/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_{69}/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.

 $\Gamma(\phi\rho^+)/\Gamma(\phi\pi^+)$ Γ_{69}/Γ_{48}

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

 $\Gamma(\bar{K}_1(1270)^0 K^+, \bar{K}_1(1270)^0 \rightarrow K^-\rho^+)/\Gamma_{\text{total}}$ Γ_{70}/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_{71}/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_{72}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
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.

 $\Gamma(a_0(980)^0 \rho^+, a_0^0 \rightarrow K^+ K^-)/\Gamma_{\text{total}}$ Γ_{73}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
0.19±0.03±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_{74}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
0.39±0.06±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_{75}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
0.04±0.01±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_{76}/Γ

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
0.07±0.02±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.

 $\Gamma(K_S^0 K^- 2\pi^+)/\Gamma_{\text{total}}$ Γ_{77}/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±0.05±0.05	1.3k	ABLIKIM	21K BES3	e^+e^- at 4.178–4.226 GeV
1.69±0.07±0.08		ONYISI	13 CLEO	e^+e^- at 4.17 GeV

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

1.64±0.10±0.07		¹ ALEXANDER 08	CLEO	See ONYISI 13
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¹ ALEXANDER 08 uses single- and double-tagged events in an overall fit.

 $\Gamma(K^+ K^- K_S^0 \pi^+)/\Gamma(K^+ K_S^0 \pi^+ \pi^-)$ Γ_{78}/Γ_{84}

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
1.36±0.15±0.04	645	MOON	23 BELL	980 fb^{-1} at $\sim \gamma(4S)$

 $\Gamma(K^*(892)^+ \bar{K}^*(892)^0)/\Gamma_{\text{total}}$ Γ_{79}/Γ

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.

$\Gamma(K^*(892)^+\bar{K}^*(892)^0)/\Gamma(\phi\pi^+)$ Γ_{79}/Γ_{48}

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

 $\Gamma(K^*(892)^+\bar{K}^*(892)^0)/\Gamma(K_S^0 K^- 2\pi^+)$ Γ_{79}/Γ_{77}

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
40.6±2.9±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. $\Gamma(\eta(1475)K_S^0, \eta \rightarrow K^*(892)^0\pi^+, K^{*0} \rightarrow K^- \pi^+)/\Gamma(K_S^0 K^- 2\pi^+)$ Γ_{80}/Γ_{77}

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. $\Gamma(\eta(1475)\pi^+, \eta \rightarrow \bar{K}^*(892)^+ K^-, \bar{K}^{*+} \rightarrow K_S^0 \pi^+)/\Gamma(K_S^0 K^- 2\pi^+)$ Γ_{81}/Γ_{77}

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. $\Gamma(\eta(1475)\pi^+, \eta \rightarrow a_0(980)^- \pi^+, a_0^- \rightarrow K_S^0 K^-)/\Gamma(K_S^0 K^- 2\pi^+)$ Γ_{82}/Γ_{77}

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. $\Gamma(f_1(1285)\pi^+, f_1 \rightarrow a_0(980)^- \pi^+, a_0^- \rightarrow K_S^0 K^-)/\Gamma(K_S^0 K^- 2\pi^+)$ Γ_{83}/Γ_{77}

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. $\Gamma(K^+ K_S^0 \pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{84}/Γ

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

 $\Gamma(K^+ K_S^0 \pi^+ \pi^-)/\Gamma(K_S^0 K^- 2\pi^+)$ Γ_{84}/Γ_{77}

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

 $\Gamma(K^+ K^- 2\pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{85}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
6.60±0.47±0.38	309	ABLIKIM	22AB BES3	e^+e^- at 4.178–4.226 GeV

$\Gamma(K^+ K^- 2\pi^+ \pi^-)/\Gamma(K^+ K^- \pi^+)$ Γ_{85}/Γ_{47}

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_{86}/Γ_{48}

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

 $\Gamma(\phi \rho^0 \pi^+, \phi \rightarrow K^+ K^-)/\Gamma(K^+ K^- 2\pi^+ \pi^-)$ Γ_{87}/Γ_{85}

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_{88}/Γ_{47}

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

 $\Gamma(\phi a_1(1260)^+, \phi \rightarrow K^+ K^-, a_1^+ \rightarrow \rho^0 \pi^+)/\Gamma(K^+ K^- 2\pi^+ \pi^-)$ Γ_{88}/Γ_{85}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.781±0.029±0.016	235	ABLIKIM	22AB BES3	$e^+ e^-$ at 4.178–4.226 GeV

 $\Gamma(\phi 2\pi^+ \pi^- \text{ non-}\rho, \phi \rightarrow K^+ K^-)/\Gamma(K^+ K^- 2\pi^+ \pi^-)$ Γ_{89}/Γ_{85}

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

 $\Gamma(K^+ K^- \rho^0 \pi^+ \text{ non-}\phi)/\Gamma(K^+ K^- 2\pi^+ \pi^-)$ Γ_{90}/Γ_{85}

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.03	90	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_{91}/Γ_{85}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.15 ±0.06 OUR AVERAGE				
0.218±0.029±0.08	235	ABLIKIM	22AB BES3	$e^+ e^-$ at 4.178–4.226 GeV
0.10 ±0.06 ±0.05		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_{92}/Γ_{77}

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

 $\Gamma(\pi^+ \pi^0)/\Gamma_{\text{total}}$ Γ_{93}/Γ

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

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

$\Gamma(\pi^+ \pi^0)/\Gamma(K^+ K_S^0)$ Γ_{93}/Γ_{44}

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

$\Gamma(2\pi^+ \pi^-)/\Gamma_{\text{total}}$ Γ_{94}/Γ

VALUE (%)	DOCUMENT ID	TECN	COMMENT
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	¹ ALEXANDER	08	CLEO See ONYISI 13

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

$\Gamma(2\pi^+ \pi^-)/\Gamma(K^+ K^- \pi^+)$ Γ_{94}/Γ_{47}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.201±0.007 OUR FIT				
0.199±0.004±0.009	≈ 10.5k	AUBERT	09O	BABR $e^+ e^- \approx 10.6$ GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.265±0.041±0.031	98	FRABETTI	97D	E687 γ Be ≈ 200 GeV

$\Gamma(\rho^0 \pi^+)/\Gamma(2\pi^+ \pi^-)$ Γ_{95}/Γ_{94}

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
1.04 ±0.15 OUR AVERAGE			
1.038±0.054±0.097±0.11	¹ AAIJ	23AN	LHCB Dalitz fit, 0.7M events
0.9 ±0.4 ±0.5	ABLIKIM	22BI	BES3 Dalitz fit, 11.1k events
1.8 ±0.5 ±1.0	AUBERT	09O	BABR Dalitz fit, ≈ 10.5k evts
• • • We do not use the following data for averages, fits, limits, etc. • • •			
not seen	LINK	04	FOCS Dalitz fit, 1475 ± 50 evts
5.8 ±2.3 ±3.7	AITALA	01A	E791 Dalitz fit, 848 evts

¹The last error reflects the uncertainty on the amplitude model.

$\Gamma(\omega \pi^+, \omega \rightarrow \pi^+ \pi^-)/\Gamma(2\pi^+ \pi^-)$ Γ_{111}/Γ_{94}

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
3.60±0.16±0.34±0.16	¹ AAIJ	23AN	LHCB Dalitz fit, 0.7M events

¹The last error reflects the uncertainty on the amplitude model.

$\Gamma(\pi^+(\pi^+ \pi^-)_{S\text{-wave}})/\Gamma(2\pi^+ \pi^-)$ Γ_{96}/Γ_{94}

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 (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
84.7 ±0.6 OUR AVERAGE			
84.97±0.14±0.30±0.63	^{1,2} AAIJ	23AN	LHCB Dalitz fit, 0.7M events

$84.2 \pm 0.8 \pm 1.2$	² ABLIKIM	22BI BES3	Dalitz fit, 11.1k events
$83.0 \pm 0.9 \pm 1.9$	² AUBERT	090 BABR	Dalitz fit, ≈ 10.5 k evts
$87.04 \pm 5.60 \pm 4.38$	³ LINK	04 FOCS	Dalitz fit, 1475 ± 50 evts

¹ The last error reflects the uncertainty due to the amplitude model.

² AAIJ 23AN, ABLIKIM 22BI, and AUBERT 090 give the amplitude and phase of the $\pi^+\pi^-$ S -wave in bins of $\pi^+\pi^-$ invariant-mass. (50 bins for AAIJ 23AN, 29 for ABLIKIM 22BI and AUBERT 090.)

³ LINK 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.

$\Gamma(f_0(980)\pi^+, f_0 \rightarrow \pi^+\pi^-)/\Gamma(2\pi^+\pi^-)$ Γ_{97}/Γ_{94}
 This is the “fit fraction” from the Dalitz-plot analysis. See above for the full $\pi^+(\pi^+\pi^-)_{S\text{-wave}}$ fit fraction.

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

$0.565 \pm 0.043 \pm 0.047$	AITALA	01A E791	Dalitz fit, 848 evts
$1.074 \pm 0.140 \pm 0.043$	FRABETTI	97D E687	γ Be ≈ 200 GeV

$\Gamma(f_0(1370)\pi^+, f_0 \rightarrow \pi^+\pi^-)/\Gamma(2\pi^+\pi^-)$ Γ_{98}/Γ_{94}
 This is the “fit fraction” from the Dalitz-plot analysis. See above for the full $\pi^+(\pi^+\pi^-)_{S\text{-wave}}$ fit fraction.

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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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_{99}/Γ_{94}
 This is the “fit fraction” from the Dalitz-plot analysis. See above for the full $\pi^+(\pi^+\pi^-)_{S\text{-wave}}$ fit fraction.

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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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 ≈ 200 GeV
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¹ FRABETTI 97D calls this mode $S(1475)\pi^+$, but finds the mass and width of this $S(1475)$ to be in excellent agreement with those of the $f_0(1500)$.

$\Gamma(f_2(1270)\pi^+, f_2 \rightarrow \pi^+\pi^-)/\Gamma(2\pi^+\pi^-)$ Γ_{100}/Γ_{94}
 This is the “fit fraction” from the Dalitz-plot analysis.

<u>VALUE (units 10^{-2})</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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13.0 \pm 0.9 OUR AVERAGE Error includes scale factor of 1.9. See the ideogram below.

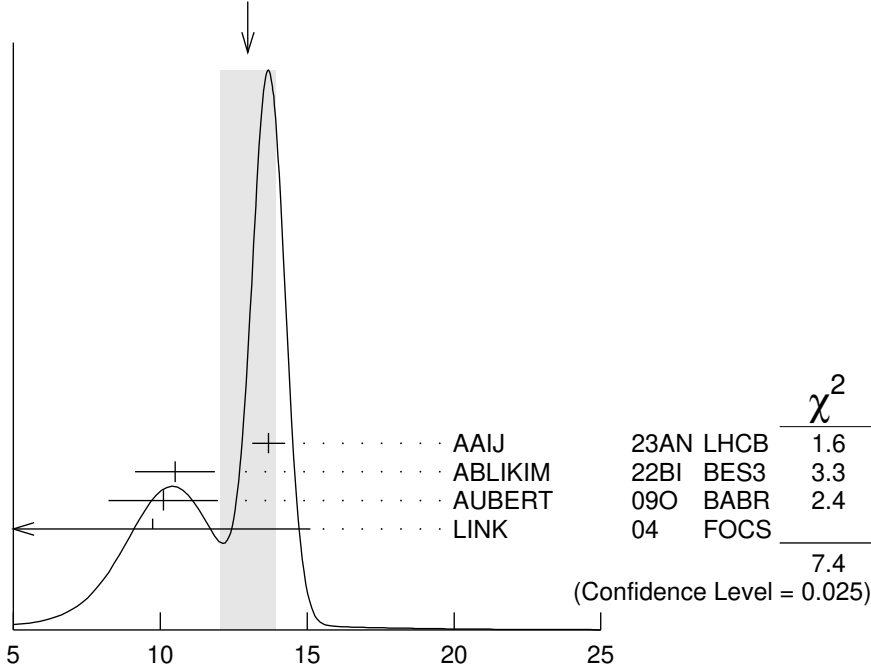
$13.69 \pm 0.14 \pm 0.22 \pm 0.49$	¹ AAIJ	23AN LHCb	Dalitz fit, 0.7M events
$10.5 \pm 0.8 \pm 1.1$	ABLIKIM	22BI BES3	Dalitz fit, 11.1k events
$10.1 \pm 1.5 \pm 1.1$	AUBERT	090 BABR	Dalitz fit, ≈ 10.5 k evts
$9.74 \pm 4.49 \pm 2.94$	LINK	04 FOCS	Dalitz fit, 1475 ± 50 evts

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

$19.7 \pm 3.3 \pm 0.6$	AITALA	01A E791	Dalitz fit, 848 evts
$12.3 \pm 5.6 \pm 1.8$	FRABETTI	97D E687	γ Be ≈ 200 GeV

¹ The last error reflects the uncertainty on the amplitude model.

WEIGHTED AVERAGE
 13.0 ± 0.9 (Error scaled by 1.9)



$$\Gamma(f_2(1270)\pi^+, f_2 \rightarrow \pi^+\pi^-) / \Gamma(2\pi^+\pi^-) \text{ (units } 10^{-2}\text{)}$$

$\Gamma(f_2'(1525)^0\pi^+, f_2' \rightarrow \pi^+\pi^-) / \Gamma(2\pi^+\pi^-)$ Γ_{101}/Γ_{94}

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
$5.28 \pm 0.70 \pm 1.50 \pm 0.87$	¹ AAIJ	23AN LHCB	Dalitz fit, 0.7M events

¹ The last error reflects the uncertainty on the amplitude model.

$\Gamma(\rho(1450)^0\pi^+, \rho^0 \rightarrow \pi^+\pi^-) / \Gamma(2\pi^+\pi^-)$ Γ_{102}/Γ_{94}

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

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
1.7 ± 0.6 OUR AVERAGE			
$3.86 \pm 0.15 \pm 0.14 \pm 2.0$	¹ AAIJ	23AN LHCB	Dalitz fit, 0.7M events
$1.3 \pm 0.4 \pm 0.5$	ABLIKIM	22BI BES3	Dalitz fit, 11.1k events
$2.3 \pm 0.8 \pm 1.7$	AUBERT	09O BABR	Dalitz fit, ≈ 10.5 k evts
$6.56 \pm 3.43 \pm 4.40$	LINK	04 FOCS	Dalitz fit, 1475 ± 50 evts

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

$4.4 \pm 2.1 \pm 0.2$	AITALA	01A E791	Dalitz fit, 848 evts
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¹ The last error reflects the uncertainty on the amplitude model.

$\Gamma(\rho(1700)^0\pi^+, \rho^0 \rightarrow \pi^+\pi^-) / \Gamma(2\pi^+\pi^-)$ Γ_{103}/Γ_{94}

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
$3.65 \pm 0.50 \pm 0.45 \pm 3.40$	¹ AAIJ	23AN LHCB	Dalitz fit, 0.7M events

¹ The last error reflects the uncertainty on the amplitude model.

$\Gamma(\pi^+ 2\pi^0)/\Gamma_{\text{total}}$ Γ_{104}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.52±0.05 OUR AVERAGE				Error includes scale factor of 1.1.
0.50±0.04±0.02	590	ABLIKIM	22Z BES3	e^+e^- at 4.178–4.226 GeV
0.65±0.13±0.03	72 ± 16	NAIK	09A CLEO	e^+e^- at 4170 MeV

 $\Gamma(f_0(980)\pi^+, f_0 \rightarrow \pi^0\pi^0)/\Gamma(\pi^+ 2\pi^0)$ $\Gamma_{105}/\Gamma_{104}$

This is a "fit fraction" from an amplitude analysis.

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
55.4±6.8±7.3	ABLIKIM	22Z BES3	Dalitz plot fit, 440 evts

 $\Gamma(f_0(1370)\pi^+, f_0 \rightarrow \pi^0\pi^0)/\Gamma(\pi^+ 2\pi^0)$ $\Gamma_{106}/\Gamma_{104}$

This is a "fit fraction" from an amplitude analysis.

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
25.5±5.1±9.3	ABLIKIM	22Z BES3	Dalitz plot fit, 440 evts

 $\Gamma(f_2(1270)\pi^+, f_2 \rightarrow \pi^0\pi^0)/\Gamma(\pi^+ 2\pi^0)$ $\Gamma_{107}/\Gamma_{104}$

This is a "fit fraction" from an amplitude analysis.

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
9.7±2.9±6.0	ABLIKIM	22Z BES3	Dalitz plot fit, 440 evts

 $\Gamma(2\pi^+\pi^-\pi^0)/\Gamma(\phi\pi^+)$ Γ_{108}/Γ_{48}

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

 $\Gamma(\eta\pi^+)/\Gamma_{\text{total}}$ Γ_{109}/Γ Unseen decay modes of the η are included.

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
1.67±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

¹ALEXANDER 08 uses single- and double-tagged events in an overall fit. $\Gamma(\eta\pi^+)/\Gamma(K^+K_S^0)$ Γ_{109}/Γ_{44} Unseen decay modes of the η are included.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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

 $\Gamma(\eta\pi^+)/\Gamma(K^+K^-\pi^+)$ Γ_{109}/Γ_{47}

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

$\Gamma(\eta\pi^+)/\Gamma(\phi\pi^+)$ Γ_{109}/Γ_{48}

Unseen decay modes of the resonances 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. • • •				
$0.48 \pm 0.03 \pm 0.04$	920	JESSOP	98 CLE2	$e^+e^- \approx \Upsilon(4S)$
$0.54 \pm 0.09 \pm 0.06$	165	ALEXANDER	92 CLE2	See JESSOP 98

 $\Gamma(\eta\pi^+)/\Gamma(\phi\pi^+, \phi \rightarrow K^+K^-)$ Γ_{109}/Γ_{49}

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

 $\Gamma(\omega\pi^+)/\Gamma_{\text{total}}$ Γ_{110}/Γ Unseen decay modes of the ω are included.

<u>VALUE (%)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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
$0.21 \pm 0.09 \pm 0.01$	6 ± 2.4	GE	09A CLEO	e^+e^- at 4170 MeV

 $\Gamma(\omega\pi^+)/\Gamma(\eta\pi^+)$ $\Gamma_{110}/\Gamma_{109}$

Unseen decay modes of the resonances are included.

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.115 ± 0.018 OUR FIT			
$0.16 \pm 0.04 \pm 0.03$	BALEST	97 CLE2	$e^+e^- \approx \Upsilon(4S)$

 $\Gamma(3\pi^+2\pi^-)/\Gamma(K^+K^-\pi^+)$ Γ_{112}/Γ_{47}

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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
$0.158 \pm 0.042 \pm 0.031$	37	FRABETTI	97C E687	$\gamma Be, \bar{E}_\gamma \approx 200$ GeV

 $\Gamma(\eta\rho^+)/\Gamma_{\text{total}}$ Γ_{114}/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>
$8.9 \pm 0.6 \pm 0.5$	328 ± 22	NAIK	09A CLEO	$\eta \rightarrow 2\gamma$

 $\Gamma(\eta\rho^+)/\Gamma(\phi\pi^+)$ Γ_{114}/Γ_{48}

Unseen decay modes of the resonances 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. • • •				
$2.98 \pm 0.20 \pm 0.39$	447	JESSOP	98 CLE2	$e^+e^- \approx \Upsilon(4S)$
$2.86 \pm 0.38^{+0.36}_{-0.38}$	217	AVERY	92 CLE2	See JESSOP 98

 $\Gamma(\eta\rho^+)/\Gamma(\eta\pi^+\pi^0)$ $\Gamma_{114}/\Gamma_{115}$

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

$\Gamma(\eta\pi^+\pi^0)/\Gamma_{\text{total}}$ Γ_{115}/Γ

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

 $\Gamma(\eta(\pi^+\pi^0)_{P\text{-wave}})/\Gamma(\eta\pi^+\pi^0)$ $\Gamma_{116}/\Gamma_{115}$

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

 $\Gamma(a_0(980)^+\pi^0\pi^+, a_0(980)^+ \rightarrow \eta\pi^+\pi^0)/\Gamma(\eta\pi^+\pi^0)$ $\Gamma_{117}/\Gamma_{115}$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
23.2 ± 2.3 ± 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_{118}/Γ

Unseen decay modes of the ω are included.

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

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

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

 $\Gamma(a_1(1260)^+\eta, a_1^+ \rightarrow \rho(770)^0\pi^+, \rho^0 \rightarrow \pi^+\pi^-)/\Gamma(2\pi^+\pi^-\eta)$ $\Gamma_{120}/\Gamma_{119}$

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
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.

 $\Gamma(a_1(1260)^+\eta, a_1^+ \rightarrow f_0(500)\pi^+, f_0 \rightarrow \pi^+\pi^-)/\Gamma(2\pi^+\pi^-\eta)$ $\Gamma_{121}/\Gamma_{119}$

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
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.

 $\Gamma(a_0(980)^+\rho(770)^0, a_0^+ \rightarrow \eta\pi^+)/\Gamma(2\pi^+\pi^-\eta)$ $\Gamma_{122}/\Gamma_{119}$

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
6.7 ± 2.5 ± 1.5	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.

 $\Gamma(\eta(1405)\pi^+, \eta(1405) \rightarrow a_0(980)^-\pi^+, a_0^- \rightarrow \eta\pi^-)/\Gamma(2\pi^+\pi^-\eta)$ $\Gamma_{123}/\Gamma_{119}$

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
0.7 ± 0.2 ± 0.1	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.

$$\Gamma(\eta(1405)\pi^+, \eta(1405) \rightarrow a_0(980)^+\pi^-, a_0^+ \rightarrow \eta\pi^+)/\Gamma(2\pi^+\pi^-\eta) \quad \Gamma_{124}/\Gamma_{119}$$

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
$0.7 \pm 0.2 \pm 0.1$	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.			

$$\Gamma(f_1(1420)\pi^+, f_1 \rightarrow a_0(980)^-\pi^+, a_0^- \rightarrow \eta\pi^-)/\Gamma(2\pi^+\pi^-\eta) \quad \Gamma_{125}/\Gamma_{119}$$

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
$1.9 \pm 0.5 \pm 0.3$	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.			

$$\Gamma(f_1(1420)\pi^+, f_1 \rightarrow a_0(980)^+\pi^-, a_0^+ \rightarrow \eta\pi^+)/\Gamma(2\pi^+\pi^-\eta) \quad \Gamma_{126}/\Gamma_{119}$$

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
$1.7 \pm 0.5 \pm 0.3$	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.			

$$\Gamma(3\pi^+2\pi^-\pi^0)/\Gamma_{\text{total}} \quad \Gamma_{127}/\Gamma$$

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

$$\Gamma(\omega 2\pi^+\pi^-)/\Gamma_{\text{total}} \quad \Gamma_{128}/\Gamma$$

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

$$\Gamma(\eta'(958)\pi^+)/\Gamma_{\text{total}} \quad \Gamma_{129}/\Gamma$$

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

VALUE (%)	DOCUMENT ID	TECN	COMMENT
$3.94 \pm 0.15 \pm 0.20$	ONYISI	13 CLEO	e^+e^- at 4.17 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •			
$3.77 \pm 0.25 \pm 0.30$	¹ ALEXANDER	08 CLEO	See ONYISI 13
¹ ALEXANDER 08 uses single- and double-tagged events in an overall fit.			

$$\Gamma(\eta'(958)\pi^+)/\Gamma(K^+K_S^0) \quad \Gamma_{129}/\Gamma_{44}$$

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$2.654 \pm 0.088 \pm 0.139$	1436 ± 47	MENDEZ	10 CLEO	See ONYISI 13

$$\Gamma(\eta'(958)\pi^+)/\Gamma(K^+K^-\pi^+) \quad \Gamma_{129}/\Gamma_{47}$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$69.4 \pm 0.8 \pm 3.8$	9.9k	ABLIKIM	20R BES3	e^+e^- , 4178 ~ 4226 MeV

$\Gamma(\eta'(958)\pi^+)/\Gamma(\phi\pi^+)$ Γ_{129}/Γ_{48}

Unseen decay modes of the resonances 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. ● ● ●				
1.03±0.06±0.07	537	JESSOP	98	CLE2 $e^+e^- \approx \gamma(4S)$
1.20±0.15±0.11	281	ALEXANDER	92	CLE2 See JESSOP 98
2.5 ±1.0 $\begin{smallmatrix} +1.5 \\ -0.4 \end{smallmatrix}$	22	ALVAREZ	91	NA14 Photoproduction
2.5 ±0.5 ±0.3	215	ALBRECHT	90D	ARG $e^+e^- \approx 10.4$ GeV

 $\Gamma(\omega\eta\pi^+)/\Gamma_{\text{total}}$ Γ_{131}/Γ Unseen decay modes of the ω and η are included.

<u>VALUE (units 10⁻³)</u>	<u>CL%</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
5.4±1.2±0.4		78	ABLIKIM	23AL	BES3 e^+e^- at 4.128–4.226 GeV
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
<21.3		90	GE	09A	CLEO e^+e^- at 4170 MeV

 $\Gamma(\eta'(958)\rho^+)/\Gamma_{\text{total}}$ Γ_{132}/Γ

<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
5.8±1.4±0.4	ABLIKIM	15Z	BES3 482 pb ⁻¹ , 4009 MeV

 $\Gamma(\eta'(958)\rho^+)/\Gamma(\phi\pi^+)$ Γ_{132}/Γ_{48}

Unseen decay modes of the resonances 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. ● ● ●				
2.78±0.28±0.30	137	¹ JESSOP	98	CLE2 $e^+e^- \approx \gamma(4S)$
3.44±0.62 $\begin{smallmatrix} +0.44 \\ -0.46 \end{smallmatrix}$	68	AVERY	92	CLE2 See JESSOP 98

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

 $\Gamma(\eta'(958)\rho^+)/\Gamma(\eta'(958)\pi^+\pi^0)$ $\Gamma_{132}/\Gamma_{133}$

<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	395	¹ ABLIKIM	22AA	BES3 e^+e^- at 4.178–4.226 GeV

¹Result of an amplitude analysis of $D_s^+ \rightarrow \pi^+\pi^0\eta'$ which found that $D_s^+ \rightarrow \rho^+\eta'$ is the dominant decay mode, with other contributions negligible. No uncertainty is assigned to this 100% fit fraction; however, the fit fractions of non-resonant contributions are shown to be below 1%.

 $\Gamma(\eta'(958)\pi^+\pi^0)/\Gamma_{\text{total}}$ Γ_{133}/Γ

<u>VALUE (%)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
6.08±0.29 OUR AVERAGE				
6.15±0.25±0.18	837	¹ ABLIKIM	22AA	BES3 e^+e^- at 4.178–4.226 GeV
5.6 ±0.5 ±0.6		ONYISI	13	CLEO e^+e^- at 4.17 GeV

¹An amplitude analysis in the same publication finds that $D_s^+ \rightarrow \rho^+\eta'$ is the only statistically significant contribution to this decay.

$\Gamma(\eta'(958)\pi^+\pi^0\text{nonresonant})/\Gamma_{\text{total}}$ Γ_{134}/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_{135}/Γ_{44}

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 ± 1.3 ± 0.7	141 ± 34	ADAMS	07A CLEO	See MENDEZ 10
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 $\Gamma(K^+\pi^0)/\Gamma(K^+K^-\pi^+)$ Γ_{135}/Γ_{47}

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_{135}/Γ_{49}

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_{136}/Γ_{44}

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_{136}/Γ_{47}

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_{137}/Γ_{44}

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

 $\Gamma(K^+\eta)/\Gamma(K^+K^-\pi^+)$ Γ_{137}/Γ_{47}

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_{137}/Γ_{49}

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
$7.81 \pm 0.22 \pm 0.24$	14k	GUAN	21 BELL	e ⁺ e ⁻ ≈ $\Upsilon(4,5S)$

$\Gamma(K^+\eta)/\Gamma(\eta\pi^+)$ $\Gamma_{137}/\Gamma_{109}$

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. • • •

$8.9 \pm 1.5 \pm 0.4$	113 ± 18	ADAMS	07A CLEO	See MENDEZ 10
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 $\Gamma(K^+\omega)/\Gamma_{\text{total}}$ Γ_{138}/Γ Unseen decay modes of the ω are included.

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
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9.9 ± 1.5 OUR FIT**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 MeV¹ Evidence for mode at 4.4σ . $\Gamma(K^+\omega)/\Gamma(K^+\pi^+\pi^-\pi^0)$ $\Gamma_{138}/\Gamma_{158}$

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
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10.3 ± 1.5 OUR FIT**10.9 ± 1.8 ± 0.1** ¹ ABLIKIM 22BL BES3 PWA, 550 $D_s^\pm \rightarrow K^\pm \pi^\pm \pi^\mp \pi^0$ ¹ ABLIKIM 22BL reports $[\Gamma(D_s^+ \rightarrow K^+\omega)/\Gamma(D_s^+ \rightarrow K^+\pi^+\pi^-\pi^0)] \times [B(\omega(782) \rightarrow \pi^+\pi^-\pi^0)] = (9.7 \pm 1.5 \pm 0.6) \times 10^{-2}$ which we divide by our best value $B(\omega(782) \rightarrow \pi^+\pi^-\pi^0) = (89.2 \pm 0.7) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. $\Gamma(K^+\eta'(958))/\Gamma(K^+K_S^0)$ Γ_{139}/Γ_{44} Unseen decay modes of the $\eta'(958)$ are included.

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
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11.8 ± 3.6 ± 0.7 56 ± 17 MENDEZ 10 CLEO e^+e^- at 4170 MeV $\Gamma(K^+\eta'(958))/\Gamma(K^+K^-\pi^+)$ Γ_{139}/Γ_{47}

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
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4.91 ± 0.31 ± 0.31 675 ABLIKIM 20R BES3 e^+e^- , 4178 ~ 4226 MeV $\Gamma(K^+\eta'(958))/\Gamma(\eta'(958)\pi^+)$ $\Gamma_{139}/\Gamma_{129}$

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. • • •

$4.2 \pm 1.3 \pm 0.3$	28 ± 9	ADAMS	07A CLEO	See MENDEZ 10
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 $\Gamma(K^+\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{140}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
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6.20 ± 0.19 OUR FIT**6.20 ± 0.19 OUR AVERAGE**6.11 ± 0.18 ± 0.11 1.3k ABLIKIM 22AC BES3 e^+e^- at 4.178–4.226 GeV6.54 ± 0.33 ± 0.25 ONYISI 13 CLEO e^+e^- at 4.17 GeV

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

6.9 ± 0.5 ± 0.3 ¹ ALEXANDER 08 CLEO See ONYISI 13¹ ALEXANDER 08 uses single- and double-tagged events in an overall fit.

$$\Gamma(K^+\pi^+\pi^-)/\Gamma(K^+K^-\pi^+) \quad \Gamma_{140}/\Gamma_{47}$$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.115±0.004 OUR FIT				Error includes scale factor of 1.1.
0.127±0.007±0.014	567 ± 31	LINK	04F FOCS	γ A, $\bar{E}_\gamma \approx 180$ GeV

$$\Gamma(K^+\rho^0)/\Gamma(K^+\pi^+\pi^-) \quad \Gamma_{141}/\Gamma_{140}$$

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

VALUE	DOCUMENT ID	TECN	COMMENT
0.35 ±0.04 OUR AVERAGE			
0.321±0.037±0.037	ABLIKIM	22AC BES3	Dalitz plot fit, 1.3k evts
0.388±0.053±0.026	LINK	04F FOCS	Dalitz plot fit, 567 evts

$$\Gamma(K^+\rho(1450)^0, \rho^0 \rightarrow \pi^+\pi^-)/\Gamma(K^+\pi^+\pi^-) \quad \Gamma_{142}/\Gamma_{140}$$

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

VALUE	DOCUMENT ID	TECN	COMMENT
0.117±0.028 OUR AVERAGE			
0.131±0.031±0.029	ABLIKIM	22AC BES3	Dalitz plot fit, 1.3k evts
0.106±0.035±0.010	LINK	04F FOCS	Dalitz plot fit, 567 evts

$$\Gamma(K^+f_0(500), f_0 \rightarrow \pi^+\pi^-)/\Gamma(K^+\pi^+\pi^-) \quad \Gamma_{143}/\Gamma_{140}$$

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
7.2±2.1±4.4	ABLIKIM	22AC BES3	Dalitz plot fit, 1.3k evts

$$\Gamma(K^+f_0(980), f_0 \rightarrow \pi^+\pi^-)/\Gamma(K^+\pi^+\pi^-) \quad \Gamma_{144}/\Gamma_{140}$$

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
4.5±1.3±1.2	ABLIKIM	22AC BES3	Dalitz plot fit, 1.3k evts

$$\Gamma(K^+f_0(1370), f_0 \rightarrow \pi^+\pi^-)/\Gamma(K^+\pi^+\pi^-) \quad \Gamma_{145}/\Gamma_{140}$$

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
19.9±2.9±9.3	ABLIKIM	22AC BES3	Dalitz plot fit, 1.3k evts

$$\Gamma(K^*(892)^0\pi^+, K^{*0} \rightarrow K^+\pi^-)/\Gamma(K^+\pi^+\pi^-) \quad \Gamma_{146}/\Gamma_{140}$$

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

VALUE	DOCUMENT ID	TECN	COMMENT
0.27 ±0.04 OUR AVERAGE			Error includes scale factor of 2.0.
0.302 ±0.018 ±0.020	ABLIKIM	22AC BES3	Dalitz plot fit, 1.3k evts
0.2164±0.0321±0.0114	LINK	04F FOCS	Dalitz plot fit, 567 evts

$$\Gamma(K^*(1410)^0\pi^+, K^{*0} \rightarrow K^+\pi^-)/\Gamma(K^+\pi^+\pi^-) \quad \Gamma_{147}/\Gamma_{140}$$

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

VALUE	DOCUMENT ID	TECN	COMMENT
0.10 ±0.07 OUR AVERAGE			Error includes scale factor of 2.7.
0.045 ±0.021 ±0.025	ABLIKIM	22AC BES3	Dalitz plot fit, 1.3k evts
0.1882±0.0403±0.0122	LINK	04F FOCS	Dalitz plot fit, 567 evts

$$\Gamma(K^*(1430)^0\pi^+, K^{*0} \rightarrow K^+\pi^-)/\Gamma(K^+\pi^+\pi^-) \quad \Gamma_{148}/\Gamma_{140}$$

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

VALUE	DOCUMENT ID	TECN	COMMENT
0.15 ±0.05 OUR AVERAGE			Error includes scale factor of 1.7.
0.185 ±0.025 ±0.026	ABLIKIM	22AC BES3	Dalitz plot fit, 1.3k evts
0.0765±0.0500±0.0170	LINK	04F FOCS	Dalitz plot fit, 567 evts

$\Gamma(K^+\pi^+\pi^-\text{ nonresonant})/\Gamma(K^+\pi^+\pi^-)$ $\Gamma_{149}/\Gamma_{140}$

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

 $\Gamma(K_S^0\pi^+\pi^0)/\Gamma_{\text{total}}$ Γ_{151}/Γ

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
5.38±0.32 OUR AVERAGE				
5.43±0.30±0.15	666	¹ ABLIKIM	21AB BES3	e^+e^- at 4.178–4.226 GeV
5.0 ±0.9 ±0.2	44	² NAIK	09A CLEO	e^+e^- at 4170 MeV

¹ ABLIKIM 21AB uses an amplitude analysis with 5 resonant modes plus one background component.² NAIK 09A reports $B(D_S^+ \rightarrow K_S^0\pi^+\pi^-) = (1.00 \pm 0.18 \pm 0.04) \times 10^{-2}$ which we have divided by 2. $\Gamma(K_S^0\rho(770)^+, \rho^+ \rightarrow \pi^+\pi^0)/\Gamma(K_S^0\pi^+\pi^0)$ $\Gamma_{152}/\Gamma_{151}$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
50.2±7.2±3.9	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. $\Gamma(K_S^0\rho(1450)^+, \rho^+ \rightarrow \pi^+\pi^0)/\Gamma(K_S^0\pi^+\pi^0)$ $\Gamma_{153}/\Gamma_{151}$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
20.4±4.3±4.4	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. $\Gamma(K^*(892)^0\pi^+, K^{*0} \rightarrow K_S^0\pi^0)/\Gamma(K_S^0\pi^+\pi^0)$ $\Gamma_{154}/\Gamma_{151}$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
8.4±2.2±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. $\Gamma(K^*(892)^+\pi^0, K^{*+} \rightarrow K_S^0\pi^+)/\Gamma(K_S^0\pi^+\pi^0)$ $\Gamma_{155}/\Gamma_{151}$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
4.6±1.4±0.4	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. $\Gamma(K^*(1410)^0\pi^+, K^{*0} \rightarrow K_S^0\pi^0)/\Gamma(K_S^0\pi^+\pi^0)$ $\Gamma_{156}/\Gamma_{151}$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
3.3±1.6±0.5	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. $\Gamma(K_S^0 2\pi^+\pi^-)/\Gamma(K_S^0 K^- 2\pi^+)$ Γ_{157}/Γ_{77}

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

$$\Gamma(K^+ \pi^+ \pi^- \pi^0) / \Gamma(K^+ K^- \pi^+ \pi^0) \quad \Gamma_{158} / \Gamma_{68}$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
17.13 ± 0.62 ± 0.51	26k	LI	23G BELL	$e^+ e^-$ at/near $\Upsilon(nS)$, $n=1, \dots, 5$

$$\Gamma(K^+ \pi^+ \pi^- \pi^0) / \Gamma_{\text{total}} \quad \Gamma_{158} / \Gamma$$

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
9.7 ± 0.6 OUR FIT				
9.75 ± 0.54 ± 0.17	776	ABLIKIM	22BL BES3	$e^+ e^-$ at 4.178–4.226 GeV

$$\Gamma(K^*(892)^0 \rho^+, K^{*0} \rightarrow K^+ \pi^-) / \Gamma(K^+ \pi^+ \pi^- \pi^0) \quad \Gamma_{159} / \Gamma_{158}$$

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
40.5 ± 2.8 ± 1.5	ABLIKIM	22BL BES3	PWA, 550 $D_s^\pm \rightarrow K^\pm \pi^\pm \pi^\mp \pi^0$

$$\Gamma(K^*(892)^+ \rho^0, K^{*+} \rightarrow K^+ \pi^0) / \Gamma(K^+ \pi^+ \pi^- \pi^0) \quad \Gamma_{160} / \Gamma_{158}$$

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
4.3 ± 1.1 ± 0.6	ABLIKIM	22BL BES3	PWA, 550 $D_s^\pm \rightarrow K^\pm \pi^\pm \pi^\mp \pi^0$

$$\Gamma(K_1(1270)^0 \pi^+, K_1^0 \rightarrow K^+ \rho^-) / \Gamma(K^+ \pi^+ \pi^- \pi^0) \quad \Gamma_{161} / \Gamma_{158}$$

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
4.0 ± 1.2 ± 0.6	ABLIKIM	22BL BES3	PWA, 550 $D_s^\pm \rightarrow K^\pm \pi^\pm \pi^\mp \pi^0$

$$\Gamma(K_1(1400)^0 \pi^+, K_1^0 \rightarrow K^*(890)^+ \pi^-, K^{*+} \rightarrow K^+ \pi^0) / \Gamma(K^+ \pi^+ \pi^- \pi^0) \quad \Gamma_{162} / \Gamma_{158}$$

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
5.6 ± 0.9 ± 0.2	ABLIKIM	22BL BES3	PWA, 550 $D_s^\pm \rightarrow K^\pm \pi^\pm \pi^\mp \pi^0$

$$\Gamma(K_1(1400)^0 \pi^+, K_1^0 \rightarrow K^*(890)^0 \pi^0, K^{*0} \rightarrow K^+ \pi^-) / \Gamma(K^+ \pi^+ \pi^- \pi^0) \quad \Gamma_{163} / \Gamma_{158}$$

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
6.1 ± 0.9 ± 0.2	ABLIKIM	22BL BES3	PWA, 550 $D_s^\pm \rightarrow K^\pm \pi^\pm \pi^\mp \pi^0$

$$\Gamma(K^+ a_1(1260)^0, a_1 \rightarrow \rho^+ \pi^-) / \Gamma(K^+ \pi^+ \pi^- \pi^0) \quad \Gamma_{164} / \Gamma_{158}$$

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
1.9 ± 0.7 ± 0.9	ABLIKIM	22BL BES3	PWA, 550 $D_s^\pm \rightarrow K^\pm \pi^\pm \pi^\mp \pi^0$

$$\Gamma(K^+ a_1(1260)^0, a_1 \rightarrow \rho^- \pi^+) / \Gamma(K^+ \pi^+ \pi^- \pi^0) \quad \Gamma_{165} / \Gamma_{158}$$

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
1.9 ± 0.7 ± 0.9	ABLIKIM	22BL BES3	PWA, 550 $D_s^\pm \rightarrow K^\pm \pi^\pm \pi^\mp \pi^0$

$$\Gamma(K^+ \pi^+ \pi^- \pi^0 \text{ nonresonant}) / \Gamma(K^+ \pi^+ \pi^- \pi^0) \quad \Gamma_{166} / \Gamma_{158}$$

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
9.5 ± 2.2 ± 0.9	ABLIKIM	22BL BES3	PWA, 550 $D_s^\pm \rightarrow K^\pm \pi^\pm \pi^\mp \pi^0$

$\Gamma((K^+\pi^0)_{P\text{-wave}}\rho^0)/\Gamma(K^+\pi^+\pi^-\pi^0)$ $\Gamma_{167}/\Gamma_{158}$

VALUE (units 10^{-2})	CL%	DOCUMENT ID	TECN	COMMENT
10.4 ± 2.0 ± 0.6		ABLIKIM	22BL BES3	PWA, 550 $D_5^\pm \rightarrow K^\pm \pi^\pm \pi^\mp \pi^0$

 $\Gamma(K^+\omega\pi^0)/\Gamma_{\text{total}}$ Γ_{168}/Γ Unseen decay modes of the ω are included.

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

 $\Gamma(K^+\omega\pi^+\pi^-)/\Gamma_{\text{total}}$ Γ_{169}/Γ Unseen decay modes of the ω are included.

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

 $\Gamma(K^+\omega\eta)/\Gamma_{\text{total}}$ Γ_{170}/Γ Unseen decay modes of the ω and η are included.

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

 $\Gamma(2K^+K^-)/\Gamma(K^+K^-\pi^+)$ Γ_{171}/Γ_{47}

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
4.0 ± 0.3 ± 0.2	748 ± 60	DEL-AMO-SA..11G	BABR	$e^+e^- \approx \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
8.95 ± 2.12 ^{+2.24} _{-2.31}	31	LINK	02I	FOCS $\gamma A, \approx 180$ GeV

 $\Gamma(\phi K^+, \phi \rightarrow K^+K^-)/\Gamma(2K^+K^-)$ $\Gamma_{172}/\Gamma_{171}$

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

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

 $\Gamma(2K^+\pi^-)/\Gamma(K^+K^-\pi^+)$ Γ_{173}/Γ_{47}

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

 $\Gamma(K^+K^*(892)^0, K^{*0} \rightarrow K^+\pi^-)/\Gamma(2K^+\pi^-)$ $\Gamma_{174}/\Gamma_{173}$

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

———— Baryon-antibaryon mode ————

 $\Gamma(p\bar{n})/\Gamma_{\text{total}}$ Γ_{175}/Γ

This is the only baryonic mode allowed kinematically.

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
1.22 ± 0.11 OUR AVERAGE				
1.21 ± 0.10 ± 0.05	193 ± 17	ABLIKIM	190BES3	e^+e^- , $E_{\text{cm}} = 4178$ MeV
1.30 ± 0.36 ^{+0.12} _{-0.16}	13.0 ± 3.6	ATHAR	08	CLEO e^+e^- , $E_{\text{cm}} \approx 4170$ MeV

$\Gamma(\rho\bar{\rho}e^+\nu_e)/\Gamma_{\text{total}}$ Γ_{176}/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_{177}/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_{178}/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_{179}/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_{180}/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_{181}/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	$\pi^- N 500 \text{ GeV}$
$< 5.9 \times 10^{-4}$	90	KODAMA	95	E653	$\pi^- \text{ emulsion } 600 \text{ GeV}$

$\Gamma(K^*(892)^+ \mu^+ \mu^-) / \Gamma_{\text{total}}$ Γ_{182} / Γ

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

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

$\Gamma(\pi^+ e^+ \mu^-) / \Gamma_{\text{total}}$ Γ_{183} / Γ

A test of lepton-family-number conservation.

<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$< 1.1 \times 10^{-6}$	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	$e^+e^- \approx \Upsilon(4S)$
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$\Gamma(\pi^+ e^- \mu^+) / \Gamma_{\text{total}}$ Γ_{184} / Γ

A test of lepton-family-number conservation.

<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$< 9.4 \times 10^{-7}$	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	$e^+e^- \approx \Upsilon(4S)$
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$\Gamma(K^+ e^+ \mu^-) / \Gamma_{\text{total}}$ Γ_{185} / Γ

A test of lepton-family-number conservation.

<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$< 7.9 \times 10^{-7}$	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	$e^+e^- \approx \Upsilon(4S)$
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$\Gamma(K^+ e^- \mu^+) / \Gamma_{\text{total}}$ Γ_{186} / Γ

A test of lepton-family-number conservation.

<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$< 5.6 \times 10^{-7}$	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	$e^+e^- \approx \Upsilon(4S)$
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$\Gamma(\pi^- 2e^+) / \Gamma_{\text{total}}$ Γ_{187} / Γ

A test of lepton-number conservation.

<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$< 1.4 \times 10^{-6}$	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	$e^+e^- \approx \Upsilon(4S)$
$< 1.8 \times 10^{-5}$	90	RUBIN	10	CLEO	$e^+e^- \text{ at } 4170 \text{ MeV}$
$< 69 \times 10^{-5}$	90	AITALA	99G	E791	$\pi^- N 500 \text{ GeV}$

$\Gamma(\pi^- 2\mu^+)/\Gamma_{\text{total}}$ Γ_{188}/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	$e^+e^- \approx \Upsilon(4S)$
$<2.9 \times 10^{-5}$	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_{189}/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_{190}/Γ

A test of lepton-number conservation.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<7.7 \times 10^{-7}$	90	AAIJ	21T LHCB	$1.6 \text{ fb}^{-1} pp$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$<5.2 \times 10^{-6}$	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_{191}/Γ

A test of lepton-number conservation.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.6 \times 10^{-8}$	90	AAIJ	21T LHCB	$1.6 \text{ fb}^{-1} pp$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$<1.3 \times 10^{-5}$	90	LEES	11G BABR	$e^+e^- \approx \Upsilon(4S)$
$<1.3 \times 10^{-5}$	90	LINK	03F FOCS	$\gamma A, \bar{E}_\gamma \approx 180 \text{ GeV}$
$<1.8 \times 10^{-4}$	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_{192}/Γ

A test of lepton-number conservation.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<2.6 \times 10^{-7}$	90	AAIJ	21T LHCB	$1.6 \text{ fb}^{-1} pp$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$<6.1 \times 10^{-6}$	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_{193}/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.

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
	990	¹ ABLIKIM	22AH BES3	$e^+ e^-$ at 4.178-4.226 GeV

¹ Amplitude analysis with 5 components.

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
	0.7M	¹ AAIJ	23AN LHCb	Dalitz fit, 0.7M events
	11.1k	² ABLIKIM	22BI BES3	Dalitz fit
	10.5k	² AUBERT	09O BABR	Dalitz fit
	1.5k	³ LINK	04 FOCS	Dalitz fit
	848	⁴ AITALA	01A E791	Dalitz fit

¹ Amplitude analysis with 7 components, one of which is a model-independent $\pi^+ \pi^-$ S-wave parametrisation as complex numbers in 50 $\pi^+ \pi^-$ mass bins.

² Amplitude analysis with 4 components, one of which is a model-independent $\pi^+ \pi^-$ S-wave parametrisation as complex numbers in 29 $\pi^+ \pi^-$ mass bins.

³ Amplitude analysis with 5 components.

⁴ Amplitude analysis with 6 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.

$D_s^+ \rightarrow \pi^+ \pi^0 \eta'$ partial wave analyses.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
	395	¹ ABLIKIM	22AA BES3	$e^+ e^-$ at 4.178-4.226 GeV

¹ The only significant contribution found in this analysis is $D_s^+ \rightarrow \rho^+ \eta'$.

$D_s^+ \rightarrow \pi^+ 2\pi^0$ partial wave analyses.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
	440	ABLIKIM	22Z BES3	$e^+ e^-$ at 4.178-4.226 GeV

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

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
	1.3k	¹ ABLIKIM	22AC BES3	$e^+ e^-$ at 4.178–4.226 GeV

¹ ABLIKIM 22AC uses an amplitude analysis with 8 components .

$D_s^+ \rightarrow K_S^0 \pi^+ \pi^0$ partial wave analyses

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
	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.

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

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
seen	550	¹ ABLIKIM	22BL BES3	$e^+ e^-$ at 4.178–4.226 GeV

¹ Amplitude analysis with 11 components.

$D_s^+ \rightarrow 2K_S^0 \pi^+$ partial wave analyses

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
	400	¹ ABLIKIM	22F BES3	$e^+ e^-$ at 4.178–4.226 GeV

¹ Amplitude analysis with 2 components.

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

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

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
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.

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

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

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

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
	309	ABLIKIM	22AB BES3	$e^+ e^-$ at 4.178–4.226 GeV

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

This is the difference between D_s^+ and D_s^- partial widths for the decay to state f , divided by the sum of the widths:

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

 $A_{CP}(\mu^\pm \nu)$ 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. • • •

$4.7 \pm 1.8 \pm 0.9$	4.0k	MENDEZ	10 CLEO	See ONYISI 13
$4.9 \pm 2.1 \pm 0.9$		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
$-1.1 \pm 2.6 \pm 0.6$	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
$-0.5 \pm 0.8 \pm 0.4$	ONYISI	13 CLEO	$e^+ e^-$ at 4.17 GeV

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

$0.3 \pm 1.1 \pm 0.8$	ALEXANDER	08 CLEO	See ONYISI 13
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 $A_{CP}(\phi \pi^\pm)$ in $D_s^\pm \rightarrow \phi \pi^\pm$

VALUE (%)	DOCUMENT ID	TECN	COMMENT
$-0.38 \pm 0.26 \pm 0.08$	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
$-1.6 \pm 6.0 \pm 1.1$	ONYISI	13 CLEO	$e^+ e^-$ at 4.17 GeV

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

<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$3.1 \pm 5.2 \pm 0.6$	ONYISI 13	CLEO	e^+e^- at 4.17 GeV

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

<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$0.0 \pm 2.7 \pm 1.2$	ONYISI 13	CLEO	e^+e^- at 4.17 GeV

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

$-5.9 \pm 4.2 \pm 1.2$	ALEXANDER 08	CLEO	See ONYISI 13
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 $A_{CP}(K^\pm K_S^0\pi^+\pi^-)$ in $D_s^\pm \rightarrow K^\pm K_S^0\pi^+\pi^-$

<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$-5.7 \pm 5.3 \pm 0.9$	ONYISI 13	CLEO	e^+e^- at 4.17 GeV

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

<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$4.1 \pm 2.7 \pm 0.9$	ONYISI 13	CLEO	e^+e^- at 4.17 GeV

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

$-0.7 \pm 3.6 \pm 1.1$	ALEXANDER 08	CLEO	See ONYISI 13
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 $A_{CP}(\pi^+\pi^-\pi^\pm)$ in $D_s^\pm \rightarrow \pi^+\pi^-\pi^\pm$

<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$-0.7 \pm 3.0 \pm 0.6$	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
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 $A_{CP}(\pi^\pm\eta)$ in $D_s^\pm \rightarrow \pi^\pm\eta$

<u>VALUE (%)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.32 ± 0.31 OUR AVERAGE				
$0.32 \pm 0.51 \pm 0.12$	136k	AAIJ 23E	LHCB	6 fb^{-1} , pp at 13 TeV, $\eta \rightarrow \gamma\pi\pi$
$0.8 \pm 0.7 \pm 0.5$	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 $D_s^\pm \rightarrow \pi^\pm\eta'$

<u>VALUE (%)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
-0.06 ± 0.22 OUR AVERAGE				Error includes scale factor of 1.6.
$0.01 \pm 0.12 \pm 0.08$	1M	AAIJ 23E	LHCB	6 fb^{-1} , pp at 13 TeV, $\eta \rightarrow \gamma\pi\pi$
$-0.82 \pm 0.36 \pm 0.35$	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
$-0.5 \pm 3.9 \pm 2.0$	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
$-0.4 \pm 7.4 \pm 1.9$	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	¹ AAIJ	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				
$0.16 \pm 0.17 \pm 0.05$	721k	AAIJ	19T	LHCB pp at 7, 8, 13 TeV
$0.6 \pm 2.0 \pm 0.3$	14k	LEES	13E	BABR e^+e^- at $\Upsilon(4S)$
$5.45 \pm 2.50 \pm 0.33$		KO	10	BELL $e^+e^- \approx \Upsilon(4S)$
$16.3 \pm 7.3 \pm 0.3$	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 (%)	EVTS	DOCUMENT ID	TECN	COMMENT
3.7 ± 2.7 OUR AVERAGE				
$3.3 \pm 3.0 \pm 1.3$	1.3k	ABLIKIM	22AC	BES3 e^+e^- at 4.178–4.226 GeV
$4.5 \pm 4.8 \pm 0.6$		ONYISI	13	CLEO e^+e^- at 4.17 GeV
••• We do not use the following data for averages, fits, limits, etc. •••				
$11.2 \pm 7.0 \pm 0.9$		ALEXANDER	08	CLEO See ONYISI 13

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

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
$2.7 \pm 5.5 \pm 0.9$	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.

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

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$6.6 \pm 5.4 \pm 0.7$	776	ABLIKIM	22BL BES3	$e^+ e^-$ at 4.178–4.226 GeV

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

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
1.8 ± 1.9 OUR AVERAGE				
$0.9 \pm 3.7 \pm 1.1$	2.5k	AAIJ	21U LHCb	pp at 13 TeV
$2.1 \pm 2.1 \pm 0.4$	14k	GUAN	21 BELL	$e^+ e^- \approx \mathcal{T}(4, 5S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$9.3 \pm 15.2 \pm 0.9$	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
$6.0 \pm 18.9 \pm 0.9$	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

 $D_S^\pm \chi^2$ TESTS OF CP-VIOLATION (CPV)

We list model-independent searches for local CP violation in phase-space distributions of multi-body decays.

Most of these searches divide phase space (Dalitz plot for 3-body decays, five-dimensional equivalent for 4-body decays) into bins, and perform a χ^2 test comparing normalised yields N_i, \bar{N}_i in CP -conjugate bin pairs i : $\chi^2 = \sum_i (N_i - \alpha \bar{N}_i) / \sigma(N_i - \alpha \bar{N}_i)$. The factor $\alpha = (\sum_i N_i) / (\sum_i \bar{N}_i)$ removes the dependence on phase-space-integrated rate asymmetries. The result is used to obtain the probability (p-value) to obtain the measured χ^2 or larger under the assumption of CP conservation [AUBERT 08AO, BEDIAGA 09]. Alternative methods obtain p-values from other test variables based on unbinned analyses [WILLIAMS 11, AAIJ 14C]. Results can be combined using Fisher's method [MOSTELLER 48].

Local CPV in $D_S^\pm \rightarrow K^+ K^- K^\pm$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.133	970k	AAIJ	23L LHCb	χ^2

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

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

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

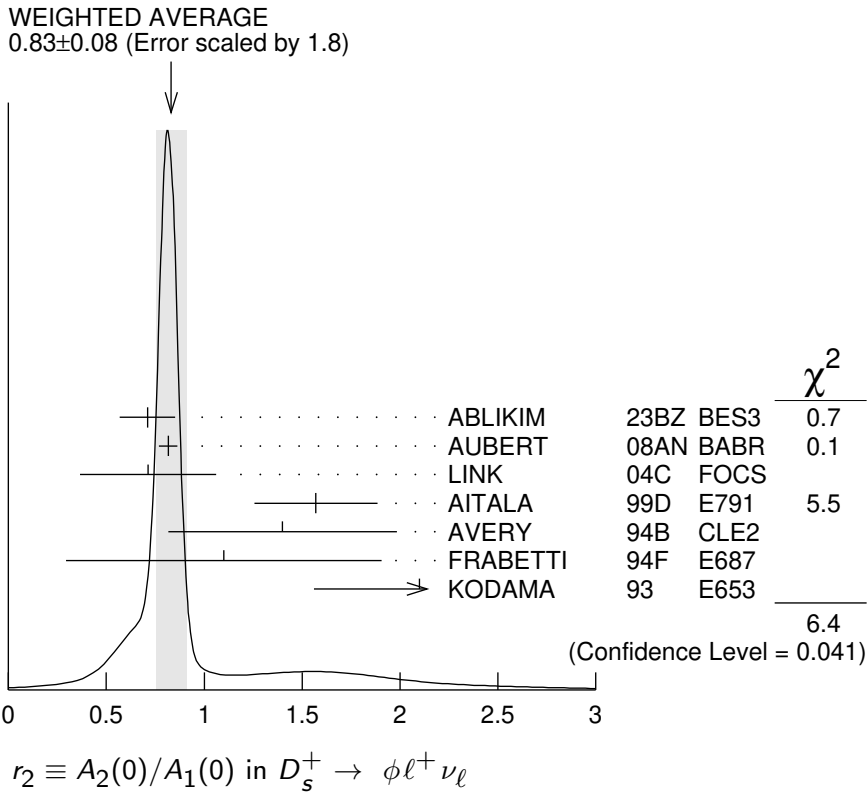
VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
– 8 ± 6 OUR AVERAGE				
– 4.6 ± 6.3 ± 3.8	70k	MOON	23 BELL	980 fb ⁻¹ at $\sim \Upsilon(4S)$
– 13.6 ± 7.7 ± 3.4	29.8k	LEES	11E BABR	$e^+e^- \approx \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
– 36 ± 67 ± 23	508	LINK	05E FOCS	γA , $\bar{E}_\gamma \approx 180$ 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
0.83 ± 0.08 OUR AVERAGE Error includes scale factor of 1.8. See the ideogram below.				
0.71 ± 0.14 ± 0.02		¹ ABLIKIM	23BZ BES3	$D_s^+ \rightarrow K^+ K^- \mu^+ \nu_\mu$
0.816 ± 0.036 ± 0.030	25k	² AUBERT	08AN BABR	$\phi e^+ \nu_e$
0.713 ± 0.202 ± 0.284	793	LINK	04C FOCS	$\phi \mu^+ \nu_\mu$
1.57 ± 0.25 ± 0.19	271	AITALA	99D E791	$\phi e^+ \nu_e, \phi \mu^+ \nu_\mu$
1.4 ± 0.5 ± 0.3	308	AVERY	94B CLE2	$\phi e^+ \nu_e$
1.1 ± 0.8 ± 0.1	90	FRABETTI	94F E687	$\phi \mu^+ \nu_\mu$
2.1 ^{+0.6} _{–0.5} ± 0.2	19	KODAMA	93 E653	$\phi \mu^+ \nu_\mu$

¹ Partial wave analysis of 939 $D_s^+ \rightarrow K^+ K^- \mu^+ \nu_\mu$ events.

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



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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
1.76 ± 0.07	OUR AVERAGE	Error includes scale factor of 1.1.		
$1.58 \pm 0.17 \pm 0.02$		¹ ABLIKIM	23BZ BES3	$D_s^+ \rightarrow K^+ K^- \mu^+ \nu_\mu$
$1.807 \pm 0.046 \pm 0.065$	25k	² 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	$\phi \mu^+ \nu_\mu$

¹ Partial wave analysis of 939 $D_s^+ \rightarrow K^+ K^- \mu^+ \nu_\mu$ events .

² To 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	$\phi \mu^+ \nu_\mu$

¹ FRABETTI 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
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0.4519±0.0071±0.0065	4k	ABLIKIM	23BO BES3	$e^+ e^-$ at 4128–4226 MeV
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.4455±0.0053±0.0044	1.8k	¹ ABLIKIM	19S BES3	$e^+ e^-$ at 4178 MeV
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¹ Superseded by ABLIKIM 23BO

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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0.525±0.024±0.009	675	ABLIKIM	23BO BES3	$e^+ e^-$ at 4128–4226 MeV
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.477±0.049±0.011	261	¹ ABLIKIM	19S BES3	$e^+ e^-$ at 4178 MeV
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¹ Superseded by ABLIKIM 23BO

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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0.162±0.019±0.003	117	¹ ABLIKIM	19D BES3	$K_S^0 e^+ \nu_e$
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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
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1.67±0.34±0.16	155	ABLIKIM	19D BES3	$e^+ e^-$ at 4178 MeV
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 $r_2 \equiv A_2(0)/A_1(0)$ in $D_s^+ \rightarrow K^*(892)^0 e^+ \nu_e$

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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0.77±0.28±0.07	155	ABLIKIM	19D BES3	$e^+ e^-$ at 4178 MeV
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 $f_{D_s^+} |V_{cs}|$ in $D_s^+ \rightarrow \mu^+ \nu_\mu$

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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241.8±2.5±2.2	2.5k	ABLIKIM	23BR BES3	$e^+ e^-$ at 4.128–4.226 GeV
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• • • We do not use the following data for averages, fits, limits, etc. • • •

243.1±3.0±3.6±1.0	2.2K	^{1,2} ABLIKIM	21BE BES3	$e^+ e^-$ at 4.178, 4.226 GeV
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246.2±3.6±3.5	1.1k	² 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.

² Superseded by ABLIKIM 23BR.

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

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
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246.6±2.5 OUR AVERAGE				
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248.3±3.9±3.1±1.0	2.4k	¹ ABLIKIM	23BP BES3	$e^+ e^-$ at 4.128–4.226 GeV
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246.7±3.9±3.6	2.3k	² ABLIKIM	23BX BES3	$e^+ e^-$ at 4.128–4.226 GeV
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251.6±5.9±4.9	1.7k	³ ABLIKIM	21AF BES3	$e^+ e^-$ at 4.178, 4.226 GeV
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244.4±2.3±2.9	4.9k	⁴ ABLIKIM	21AZ BES3	$e^+ e^-$ at 4.178, 4.226 GeV
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• • • We do not use the following data for averages, fits, limits, etc. • • •

243.0±5.8±4.0±1.0	950	^{5,6} ABLIKIM	21BE BES3	$e^+ e^-$ at 4.178, 4.226 GeV
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- ¹ ABLIKIM 23BP uses $\tau^+ \rightarrow \pi^+ \bar{\nu}_\tau$ decays. The third uncertainty is due to the input parameters, mainly the D_s^+ lifetime.
- ² ABLIKIM 23BX uses $\tau^+ \rightarrow \mu^+ \nu_\mu \bar{\nu}_\tau$ decays.
- ³ ABLIKIM 21AF uses $\tau^+ \rightarrow \pi^+ \pi^0 \bar{\nu}_\tau$ decays.
- ⁴ ABLIKIM 21AZ uses $\tau^+ \rightarrow e^+ \nu_e \bar{\nu}_\tau$ decays.
- ⁵ ABLIKIM 21BE uses $\tau^+ \rightarrow \pi^+ \bar{\nu}_\tau$ 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 $243.2 \pm 2.3 \pm 3.3 \pm 1.0$.
- ⁶ The third uncertainty is dominated by the uncertainty of the D_s^+ lifetime. Superseded by ABLIKIM 23BP.

D_s^\pm REFERENCES

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AAIJ	23E	JHEP 2304 081	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	23L	JHEP 2307 067	R. Aaij <i>et al.</i>	(LHCb Collab.)
ABLIKIM	23AL	PR D107 052010	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	23AV	PR D108 032001	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	23BO	PR D108 092003	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	23BP	PR D108 092014	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	23BR	PR D108 112001	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	23BS	PR D108 112002	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	23BX	JHEP 2309 124	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	23BZ	JHEP 2312 072	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ADACHI	23G	PRL 131 171803	I. Adachi <i>et al.</i>	(BELLE II Collab.)
LI	23G	PR D107 033003	L.K. Li <i>et al.</i>	(BELLE Collab.)
MOON	23	PR D108 L111102	H.K. Moon <i>et al.</i>	(BELLE Collab.)
ABLIKIM	22AA	JHEP 2204 058	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	22AB	JHEP 2207 051	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	22AC	JHEP 2208 196	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	22AH	PRL 129 182001	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	22BH	PR D106 112004	M. Ablikim <i>et al.</i>	(BESIII Collab.)
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ABLIKIM	22BL	JHEP 2209 242	M. Ablikim <i>et al.</i>	(BESIII Collab.)
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AAIJ	21T	JHEP 2106 044	R. Aaij <i>et al.</i>	(LHCb Collab.)
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ABLIKIM	21AB	JHEP 2106 181	M. Ablikim <i>et al.</i>	(BESIII Collab.)
ABLIKIM	21AC	PR D104 012003	M. Ablikim <i>et al.</i>	(BESIII Collab.)
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ABLIKIM	21K	PR D103 092006	M. Ablikim <i>et al.</i>	(BESIII Collab.)
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LEES	15D	PR D91 019901 (errata.)	J.P. Lees <i>et al.</i>	(BABAR Collab.)
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ALEXANDER	09	PR D79 052001	J.P. Alexander <i>et al.</i>	(CLEO Collab.)
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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	J. 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.)
MOSTELLER	48	Am.Stat. 3 No.5 30	R.A. Fisher, F. Mosteller	

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