



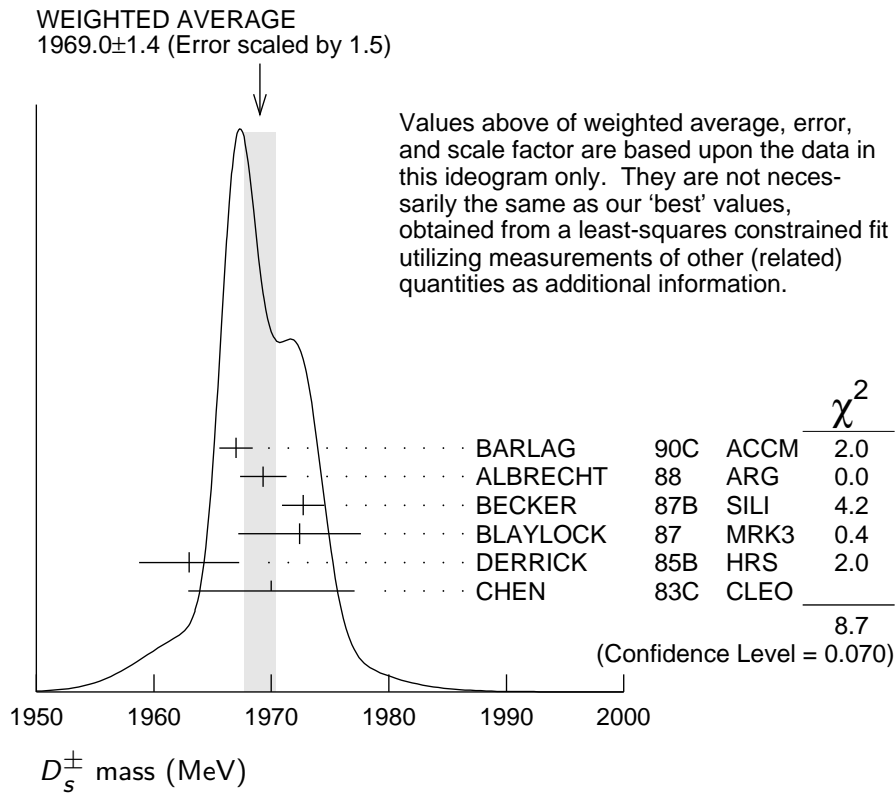
$$I(J^P) = 0(0^-)$$

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.

<u>VALUE (MeV)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
1968.34 ± 0.07 OUR FIT				
1969.0 ± 1.4 OUR AVERAGE		Error includes scale factor of 1.5. See the ideogram below.		
1967.0 ± 1.0 ± 1.0	54	BARLAG	90C ACCM	π^- Cu 230 GeV
1969.3 ± 1.4 ± 1.4		ALBRECHT	88 ARG	e^+e^- 9.4–10.6 GeV
1972.7 ± 1.5 ± 1.0	21	BECKER	87B SILI	200 GeV π, K, p
1972.4 ± 3.7 ± 3.7	27	BLAYLOCK	87 MRK3	e^+e^- 4.14 GeV
1963 ± 3 ± 3	30	DERRICK	85B HRS	e^+e^- 29 GeV
1970 ± 5 ± 5	104	CHEN	83C CLEO	e^+e^- 10.5 GeV
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1968.3 ± 0.7 ± 0.7	290	¹ ANJOS	88 E691	Photoproduction
1980 ± 15	6	USHIDA	86 EMUL	ν wideband
1973.6 ± 2.6 ± 3.0	163	ALBRECHT	85D ARG	e^+e^- 10 GeV
1948 ± 28 ± 10	65	AIHARA	84D TPC	e^+e^- 29 GeV
1975 ± 9 ± 10	49	ALTHOFF	84 TASS	e^+e^- 14–25 GeV
1975 ± 4	3	BAILEY	84 ACCM	hadron ⁺ Be → $\phi\pi^+X$
¹ ANJOS 88 enters the fit via $m_{D_s^\pm} - m_{D^\pm}$ (see below).				



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

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

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
98.69±0.05 OUR FIT				
98.69±0.05 OUR AVERAGE				
98.68±0.03±0.04		AAIJ	13V	LHCB $D_s^+ \rightarrow K^+ K^- \pi^+$
99.41±0.38±0.21		ACOSTA	03D	CDF2 $\bar{p}p$, $\sqrt{s}=1.96$ TeV
98.4 ±0.1 ±0.3	48k	AUBERT	02G	BABR $e^+e^- \approx \Upsilon(4S)$
99.5 ±0.6 ±0.3		BROWN	94	CLE2 $e^+e^- \approx \Upsilon(4S)$
98.5 ±1.5	555	CHEN	89	CLEO e^+e^- 10.5 GeV
99.0 ±0.8	290	ANJOS	88	E691 Photoproduction

D_s^\pm MEAN LIFE

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

VALUE (10^{-15} s)	EVTS	DOCUMENT ID	TECN	COMMENT
504 ± 4 OUR AVERAGE				Error includes scale factor of 1.2.
506.4± 3.0± 1.7±1.7		¹ AAIJ	17AN	LHCB pp at 7, 8 TeV
507.4± 5.5± 5.1	13.6k	LINK	05J	FOCS $\phi \pi^+$ and $\bar{K}^{*0} K^+$
472.5±17.2± 6.6	760	IORI	01	SELX 600 GeV Σ^-, π^-, p

518 ±14 ± 7	1662	AITALA	99	E791	π^- nucleus, 500 GeV
486.3±15.0 ⁺ _{5.1}	2167	² BONVICINI	99	CLE2	$e^+e^- \approx \mathcal{R}(4S)$
475 ±20 ± 7	900	FRABETTI	93F	E687	γ Be, $\phi\pi^+$
500 ±60 ±30	104	FRABETTI	90	E687	γ Be, $\phi\pi^+$
470 ±40 ±20	228	RAAB	88	E691	Photoproduction

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

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

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

D_S^+ DECAY MODES

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

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Inclusive modes		
Γ_1 e^+ semileptonic	[a] (6.5 ±0.4) %	
Γ_2 π^+ anything	(119.3 ±1.4) %	
Γ_3 π^- anything	(43.2 ±0.9) %	
Γ_4 π^0 anything	(123 ±7) %	
Γ_5 K^- anything	(18.7 ±0.5) %	
Γ_6 K^+ anything	(28.9 ±0.7) %	
Γ_7 K_S^0 anything	(19.0 ±1.1) %	
Γ_8 η anything	[b] (29.9 ±2.8) %	
Γ_9 ω anything	(6.1 ±1.4) %	
Γ_{10} η' anything	[c] (10.3 ±1.4) %	S=1.1
Γ_{11} $f_0(980)$ anything, $f_0 \rightarrow \pi^+\pi^-$	< 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%
Leptonic and semileptonic modes		
Γ_{19} $e^+\nu_e$	< 8.3 × 10 ⁻⁵	CL=90%
Γ_{20} $\mu^+\nu_\mu$	(5.50±0.23) × 10 ⁻³	
Γ_{21} $\tau^+\nu_\tau$	(5.48±0.23) %	
Γ_{22} $K^+K^-e^+\nu_e$	—	
Γ_{23} $\phi e^+\nu_e$	[d] (2.39±0.16) %	S=1.3
Γ_{24} $\phi\mu^+\nu_\mu$	(1.9 ±0.5) %	
Γ_{25} $\eta e^+\nu_e + \eta'(958)e^+\nu_e$	[d] (3.03±0.24) %	

Γ_{26}	$\eta e^+ \nu_e$	[d]	(2.29 ± 0.19) %	
Γ_{27}	$\eta'(958) e^+ \nu_e$	[d]	(7.4 ± 1.4) × 10 ⁻³	
Γ_{28}	$\eta \mu^+ \nu_\mu$		(2.4 ± 0.5) %	
Γ_{29}	$\eta'(958) \mu^+ \nu_\mu$		(1.1 ± 0.5) %	
Γ_{30}	$\omega e^+ \nu_e$	[e]	< 2.0 × 10 ⁻³	CL=90%
Γ_{31}	$K^0 e^+ \nu_e$		(3.9 ± 0.9) × 10 ⁻³	
Γ_{32}	$K^*(892)^0 e^+ \nu_e$	[d]	(1.8 ± 0.4) × 10 ⁻³	
Γ_{33}	$f_0(980) e^+ \nu_e, f_0 \rightarrow \pi^+ \pi^-$			

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

Γ_{34}	$K^+ K_S^0$		(1.50 ± 0.05) %	
Γ_{35}	$K^+ \bar{K}^0$		(2.95 ± 0.14) %	
Γ_{36}	$K^+ K^- \pi^+$	[f]	(5.45 ± 0.17) %	S=1.2
Γ_{37}	$\phi \pi^+$	[d,g]	(4.5 ± 0.4) %	
Γ_{38}	$\phi \pi^+, \phi \rightarrow K^+ K^-$	[g]	(2.27 ± 0.08) %	
Γ_{39}	$K^+ \bar{K}^*(892)^0, \bar{K}^{*0} \rightarrow K^- \pi^+$		(2.61 ± 0.09) %	
Γ_{40}	$f_0(980) \pi^+, f_0 \rightarrow K^+ K^-$		(1.15 ± 0.32) %	
Γ_{41}	$f_0(1370) \pi^+, f_0 \rightarrow K^+ K^-$		(7 ± 5) × 10 ⁻⁴	
Γ_{42}	$f_0(1710) \pi^+, f_0 \rightarrow K^+ K^-$		(6.7 ± 2.9) × 10 ⁻⁴	
Γ_{43}	$K^+ \bar{K}_0^*(1430)^0, \bar{K}_0^{*0} \rightarrow K^- \pi^+$		(1.9 ± 0.4) × 10 ⁻³	
Γ_{44}	$K^+ K_S^0 \pi^0$		(1.52 ± 0.22) %	
Γ_{45}	$2K_S^0 \pi^+$		(7.7 ± 0.6) × 10 ⁻³	
Γ_{46}	$K^0 \bar{K}^0 \pi^+$		—	
Γ_{47}	$K^*(892)^+ \bar{K}^0$	[d]	(5.4 ± 1.2) %	
Γ_{48}	$K^+ K^- \pi^+ \pi^0$		(6.3 ± 0.6) %	
Γ_{49}	$\phi \rho^+$	[d]	(8.4 ^{+1.9} _{-2.3}) %	
Γ_{50}	$K_S^0 K^- 2\pi^+$		(1.68 ± 0.10) %	
Γ_{51}	$K^*(892)^+ \bar{K}^*(892)^0$	[d]	(7.2 ± 2.6) %	
Γ_{52}	$K^+ K_S^0 \pi^+ \pi^-$		(1.00 ± 0.08) %	
Γ_{53}	$K^+ K^- 2\pi^+ \pi^-$		(8.7 ± 1.5) × 10 ⁻³	
Γ_{54}	$\phi 2\pi^+ \pi^-$	[d]	(1.21 ± 0.16) %	
Γ_{55}	$K^+ K^- \rho^0 \pi^+ \text{non-}\phi$	<	2.6 × 10 ⁻⁴	CL=90%
Γ_{56}	$\phi \rho^0 \pi^+, \phi \rightarrow K^+ K^-$		(6.5 ± 1.3) × 10 ⁻³	
Γ_{57}	$\phi a_1(1260)^+, \phi \rightarrow K^+ K^-, a_1^+ \rightarrow \rho^0 \pi^+$		(7.5 ± 1.2) × 10 ⁻³	
Γ_{58}	$K^+ K^- 2\pi^+ \pi^- \text{nonresonant}$		(9 ± 7) × 10 ⁻⁴	
Γ_{59}	$2K_S^0 2\pi^+ \pi^-$		(9 ± 4) × 10 ⁻⁴	

Hadronic modes without K 's

Γ ₆₀	$\pi^+\pi^0$	< 3.5	$\times 10^{-4}$	CL=90%
Γ ₆₁	$2\pi^+\pi^-$	(1.09±0.05) %		S=1.1
Γ ₆₂	$\rho^0\pi^+$	(2.0 ±1.2)	$\times 10^{-4}$	
Γ ₆₃	$\pi^+(\pi^+\pi^-)_{S\text{-wave}}$	[h] (9.1 ±0.4)	$\times 10^{-3}$	
Γ ₆₄	$f_0(980)\pi^+, f_0 \rightarrow \pi^+\pi^-$			
Γ ₆₅	$f_0(1370)\pi^+, f_0 \rightarrow \pi^+\pi^-$			
Γ ₆₆	$f_0(1500)\pi^+, f_0 \rightarrow \pi^+\pi^-$			
Γ ₆₇	$f_2(1270)\pi^+, f_2 \rightarrow \pi^+\pi^-$	(1.10±0.20)	$\times 10^{-3}$	
Γ ₆₈	$\rho(1450)^0\pi^+, \rho^0 \rightarrow \pi^+\pi^-$	(3.0 ±2.0)	$\times 10^{-4}$	
Γ ₆₉	$\pi^+2\pi^0$	(6.5 ±1.3)	$\times 10^{-3}$	
Γ ₇₀	$2\pi^+\pi^-\pi^0$	—		
Γ ₇₁	$\eta\pi^+$	[d] (1.70±0.09) %		S=1.1
Γ ₇₂	$\omega\pi^+$	[d] (2.4 ±0.6)	$\times 10^{-3}$	
Γ ₇₃	$3\pi^+2\pi^-$	(8.0 ±0.8)	$\times 10^{-3}$	
Γ ₇₄	$2\pi^+\pi^-2\pi^0$	—		
Γ ₇₅	$\eta\rho^+$	[d] (8.9 ±0.8) %		
Γ ₇₆	$\eta\pi^+\pi^0$	(9.2 ±1.2) %		
Γ ₇₇	$\omega\pi^+\pi^0$	[d] (2.8 ±0.7) %		
Γ ₇₈	$3\pi^+2\pi^-\pi^0$	(4.9 ±3.2) %		
Γ ₇₉	$\omega2\pi^+\pi^-$	[d] (1.6 ±0.5) %		
Γ ₈₀	$\eta'(958)\pi^+$	[c,d] (3.94±0.25) %		
Γ ₈₁	$3\pi^+2\pi^-2\pi^0$	—		
Γ ₈₂	$\omega\eta\pi^+$	[d] < 2.13 %		CL=90%
Γ ₈₃	$\eta'(958)\rho^+$	[c,d] (5.8 ±1.5) %		
Γ ₈₄	$\eta'(958)\pi^+\pi^0$	(5.6 ±0.8) %		
Γ ₈₅	$\eta'(958)\pi^+\pi^0$ nonresonant	< 5.1 %		CL=90%

Modes with one or three K 's

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

Γ_{99}	$K_S^0 2\pi^+\pi^-$		$(3.0 \pm 1.1) \times 10^{-3}$	
Γ_{100}	$K^+\omega\pi^0$	$[d] <$	8.2×10^{-3}	CL=90%
Γ_{101}	$K^+\omega\pi^+\pi^-$	$[d] <$	5.4×10^{-3}	CL=90%
Γ_{102}	$K^+\omega\eta$	$[d] <$	7.9×10^{-3}	CL=90%
Γ_{103}	$2K^+K^-$		$(2.18 \pm 0.21) \times 10^{-4}$	
Γ_{104}	$\phi K^+, \phi \rightarrow K^+K^-$		$(8.9 \pm 2.0) \times 10^{-5}$	

Doubly Cabibbo-suppressed modes

Γ_{105}	$2K^+\pi^-$		$(1.27 \pm 0.13) \times 10^{-4}$	
Γ_{106}	$K^+K^*(892)^0, K^{*0} \rightarrow K^+\pi^-$		$(6.0 \pm 3.4) \times 10^{-5}$	

Baryon-antibaryon mode

Γ_{107}	$p\bar{n}$		$(1.22 \pm 0.11) \times 10^{-3}$	
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$\Delta C = 1$ weak neutral current (C1) modes, Lepton family number (LF), or Lepton number (L) violating modes

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

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

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

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

- [d] This branching fraction includes all the decay modes of the final-state resonance.
- [e] A test for $u\bar{u}$ or $d\bar{d}$ content in the D_s^+ . Neither Cabibbo-favored nor Cabibbo-suppressed decays can contribute, and ω - ϕ mixing is an unlikely explanation for any fraction above about 2×10^{-4} .
- [f] The branching fraction for this mode may differ from the sum of the submodes that contribute to it, due to interference effects. See the relevant papers.
- [g] We decouple the $D_s^+ \rightarrow \phi\pi^+$ branching fraction obtained from mass projections (and used to get some of the other branching fractions) from the $D_s^+ \rightarrow \phi\pi^+$, $\phi \rightarrow K^+K^-$ branching fraction obtained from the Dalitz-plot analysis of $D_s^+ \rightarrow K^+K^-\pi^+$. That is, the ratio of these two branching fractions is not exactly the $\phi \rightarrow K^+K^-$ branching fraction 0.491.
- [h] This is the average of a model-independent and a K -matrix parametrization of the $\pi^+\pi^-$ S -wave and is a sum over several f_0 mesons.
- [i] This mode is not a useful test for a $\Delta C=1$ weak neutral current because both quarks must change flavor in this decay.
- [j] This is *not* a test for the $\Delta C=1$ weak neutral current, but leads to the $\pi^+\ell^+\ell^-$ final state.

CONSTRAINED FIT INFORMATION

An overall fit to 13 branching ratios uses 16 measurements and one constraint to determine 10 parameters. The overall fit has a $\chi^2 = 4.8$ for 7 degrees of freedom.

The following *off-diagonal* array elements are the correlation coefficients $\langle \delta x_i \delta x_j \rangle / (\delta x_i \delta x_j)$, in percent, from the fit to the branching fractions, $x_i \equiv \Gamma_i / \Gamma_{\text{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_{36}	55							
x_{48}	15	27						
x_{50}	36	33	10					
x_{52}	24	26	9	38				
x_{61}	36	55	16	21	18			
x_{71}	16	0	-3	10	2	-1		
x_{72}	2	0	0	1	0	0	11	
x_{91}	21	19	3	13	7	10	12	1
	x_{34}	x_{36}	x_{48}	x_{50}	x_{52}	x_{61}	x_{71}	x_{72}

See the related review(s):

[D_s⁺ Branching Fractions](#)**D_s⁺ BRANCHING RATIOS**

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$\Gamma(\eta \text{ anything})/\Gamma_{\text{total}}$ Γ_8/Γ This ratio includes η particles from η' decays.

<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

 $\Gamma(\omega \text{ anything})/\Gamma_{\text{total}}$ 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
11.7±1.7±0.7		DOBBS	09 CLEO	e^+e^- at 4170 MeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
8.7±1.9±0.8	68	HUANG	06B CLEO	See DOBBS 09

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

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

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

$\Gamma(2K^- \text{ anything})/\Gamma_{\text{total}}$					Γ_{18}/Γ
VALUE (%)	CL%	DOCUMENT ID	TECN	COMMENT	
<0.06	90	DOBBS	09	CLEO	e^+e^- at 4170 MeV

———— Leptonic and semileptonic modes ————

See the related review(s):
[Leptonic Decays of Charged Pseudoscalar Mesons](#)

$\Gamma(e^+ \nu_e)/\Gamma_{\text{total}}$					Γ_{19}/Γ
VALUE	CL%	DOCUMENT ID	TECN	COMMENT	
<0.83 $\times 10^{-4}$	90	¹ ZUPANC	13	BELL	e^+e^- at $\Upsilon(4S), \Upsilon(5S)$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
<2.3 $\times 10^{-4}$	90	DEL-AMO-SA..10J	BABR	e^+e^- , 10.58 GeV	
<1.2 $\times 10^{-4}$	90	ALEXANDER	09	CLEO	e^+e^- at 4170 MeV
<1.3 $\times 10^{-4}$	90	PEDLAR	07A	CLEO	See ALEXANDER 09

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

$\Gamma(\mu^+ \nu_\mu)/\Gamma_{\text{total}}$					Γ_{20}/Γ
VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT	
5.50 ± 0.23 OUR AVERAGE					
4.95 ± 0.67 ± 0.26	69	¹ ABLIKIM	160	BES3	e^+e^- at 4.009 GeV
5.31 ± 0.28 ± 0.20	492 ± 26	² ZUPANC	13	BELL	e^+e^- at $\Upsilon(4S), \Upsilon(5S)$
6.02 ± 0.38 ± 0.34	275 ± 17	³ DEL-AMO-SA..10J	BABR	e^+e^- , 10.58 GeV	
5.65 ± 0.45 ± 0.17	235 ± 14	ALEXANDER	09	CLEO	e^+e^- at 4170 MeV
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
6.44 ± 0.76 ± 0.57	169 ± 18	⁴ WIDHALM	08	BELL	See ZUPANC 13
5.94 ± 0.66 ± 0.31	88	⁵ PEDLAR	07A	CLEO	See ALEXANDER 09
6.8 ± 1.1 ± 1.8	553	⁶ HEISTER	02I	ALEP	Z decays

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

¹ABLIKIM 160 value is constrained by the Standard Model ratio of $\Gamma(D_s^+ \rightarrow \tau^+ \nu_\tau)/\Gamma(D_s^+ \rightarrow \mu^+ \nu_\mu) = 9.76$; the unconstrained value is $(0.517 \pm 0.075 \pm 0.021)\%$. The constrained value is used to obtain the decay constant, $f_{D_s^+} = (241.0 \pm 16.3 \pm 6.6)$ MeV.

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

³DEL-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.

⁴WIDHALM 08 gets $f_{D_s} = (275 \pm 16 \pm 12)$ MeV from the branching fraction.

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

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

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

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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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	$e^+ e^- \approx \gamma(4S)$
$0.23 \pm 0.06 \pm 0.04$	18	² ALEXANDROV	00 BEAT	π^- nucleus, 350 GeV
$0.173 \pm 0.023 \pm 0.035$	182	³ CHADHA	98 CLE2	$e^+ e^- \approx \gamma(4S)$
$0.245 \pm 0.052 \pm 0.074$	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_{21}/Γ

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

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
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5.48 ± 0.23 OUR AVERAGE

$4.83 \pm 0.65 \pm 0.26$	33	¹ ABLIKIM	160 BES3	$e^+ e^-$ at 4.009 GeV
$5.70 \pm 0.21^{+0.31}_{-0.30}$	2.2k	² ZUPANC	13 BELL	$e^+ e^-$ at $\gamma(4S)$, $\gamma(5S)$
$4.96 \pm 0.37 \pm 0.57$	748 ± 53	³ 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 ± 16	⁴ ALEXANDER	09 CLEO	$\tau^+ \rightarrow \pi^+ \bar{\nu}_\tau$
$5.52 \pm 0.57 \pm 0.21$	155 ± 17	⁴ NAIK	09A CLEO	$\tau^+ \rightarrow \rho^+ \bar{\nu}_\tau$
$5.30 \pm 0.47 \pm 0.22$	181 ± 16	⁴ ONYISI	09 CLEO	$\tau^+ \rightarrow e^+ \nu_e \bar{\nu}_\tau$

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

$6.17 \pm 0.71 \pm 0.34$	102	⁵ ECKLUND	08 CLEO	See ONYISI 09
$8.0 \pm 1.3 \pm 0.4$	47	⁵ PEDLAR	07A CLEO	See ALEXANDER 09
$5.79 \pm 0.77 \pm 1.84$	881	⁶ HEISTER	02I ALEP	Z decays
$7.0 \pm 2.1 \pm 2.0$	22	⁷ ABBIENDI	01L OPAL	$D_s^{*+} \rightarrow \gamma D_s^+$ from Z's
$7.4 \pm 2.8 \pm 2.4$	16	⁸ ACCIARRI	97F L3	$D_s^{*+} \rightarrow \gamma D_s^+$ from Z's

¹ ABLIKIM 160 value is constrained by the Standard Model ratio of $\Gamma(D_s^+ \rightarrow \tau^+ \nu_\tau)/\Gamma(D_s^+ \rightarrow \mu^+ \nu_\mu) = 9.76$; the unconstrained value is $(3.28 \pm 1.83 \pm 0.37)\%$.

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

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

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

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

⁶ 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.

⁷ This ABBIENDI 01L value gives a decay constant f_{D_s} of $(286 \pm 44 \pm 41)$ MeV.

⁸ The second ACCIARRI 97F error here combines in quadrature systematic (0.016) and normalization (0.018) errors. The branching fraction gives $f_{D_s} = (309 \pm 58 \pm 33 \pm 38)$ MeV.

$\Gamma(\tau^+ \nu_\tau)/\Gamma(\mu^+ \nu_\mu)$ Γ_{21}/Γ_{20}

VALUE EVTS DOCUMENT ID TECN COMMENT

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

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

$11.0 \pm 1.4 \pm 0.6$ 102 ² ECKLUND 08 CLEO See ONYISI 09

¹ This ZUPANC 13 ratio is not independent of the separate $\tau\nu$ and $\mu\nu$ fractions listed above.

² This ECKLUND 08 value also uses results from PEDLAR 07A, and it is not independent of other results in these Listings. Combined with earlier CLEO results, the decay constant f_{D_s} is $274 \pm 10 \pm 5$ MeV.

$\Gamma(K^+ K^- e^+ \nu_e)/\Gamma(K^+ K^- \pi^+)$ Γ_{22}/Γ_{36}

VALUE DOCUMENT ID TECN COMMENT

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

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

¹ This AUBERT 08AN ratio is only for the $K^+ K^-$ mass in the range 1.01–to–1.03 GeV in the numerator and 1.0095–to–1.0295 GeV in the denominator.

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

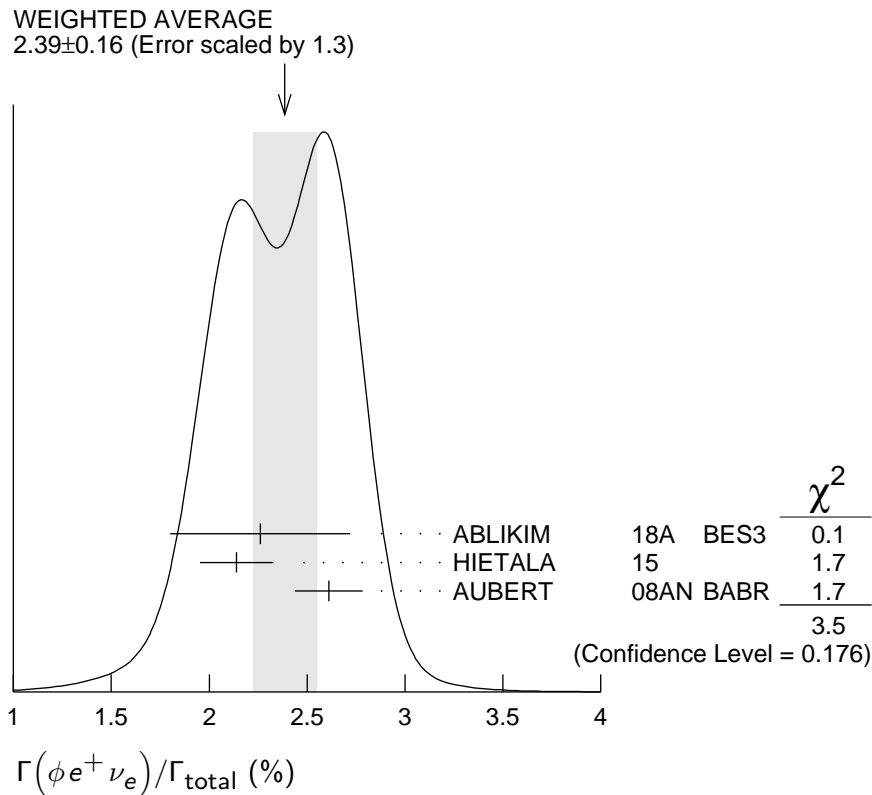
$2.14 \pm 0.17 \pm 0.08$ 207 HIETALA 15 Uses CLEO data

$2.61 \pm 0.03 \pm 0.17$ 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



$\Gamma(\phi e^+ \nu_e) / \Gamma(\phi \pi^+)$

$\Gamma_{23} / \Gamma_{37}$

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

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

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

Γ_{24} / Γ

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

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

Γ_{26} / Γ

Unseen decay modes of the η are included.

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

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

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

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

1.24±0.12±0.15 440 ¹ BRANDENB... 95 CLE2 See HIETALA 15

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

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

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

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
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0.74±0.14 OUR AVERAGE

0.93±0.30±0.05 14 ABLIKIM 16T BES3 $e^+ e^-$ at 4170 MeV

0.68±0.15±0.06 20 HIETALA 15 Uses CLEO data

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

0.91±0.33±0.05 7.5 YELTON 09 CLEO See HIETALA 15

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

Unseen decay modes of the resonances are included.

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

0.43±0.11±0.07 29 ¹ BRANDENB... 95 CLE2 See HIETALA 15

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

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

Unseen decay modes of the resonances are included.

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

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

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

$\Gamma(\eta \mu^+ \nu_\mu)/\Gamma_{\text{total}}$ Γ_{28}/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_{29}/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_{30}/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_{31}/Γ

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

 $\Gamma(K^*(892)^0 e^+ \nu_e)/\Gamma_{\text{total}}$ Γ_{32}/Γ Unseen decay modes of the $K^*(892)^0$ are included.

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

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

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

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

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

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

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

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

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

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

¹ ZUPANC 13 finds the \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.

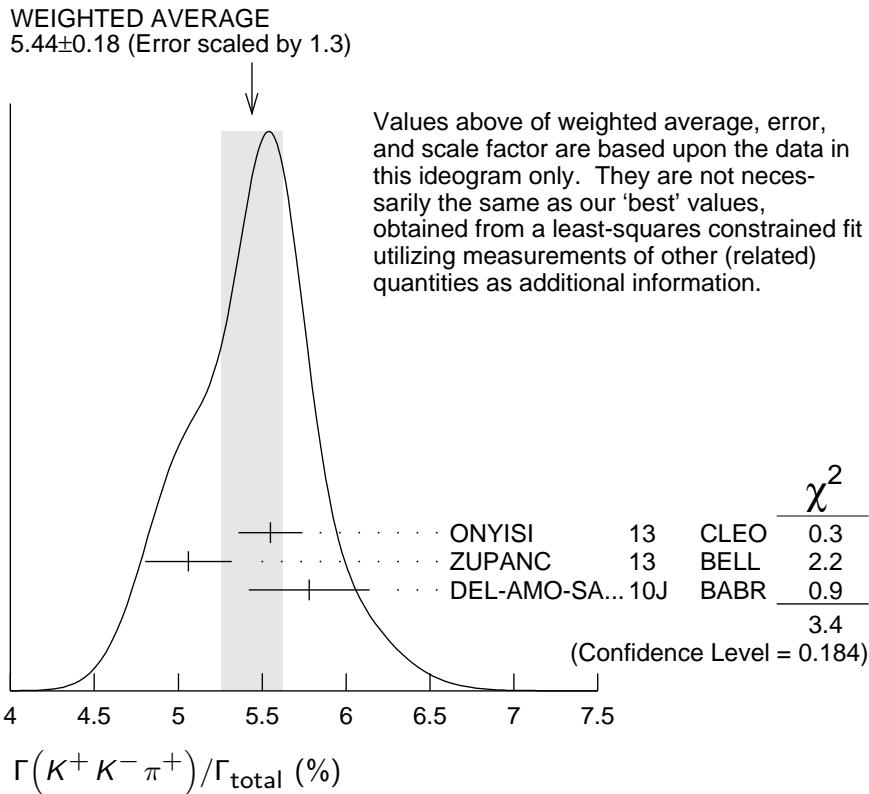
 $\Gamma(K^+ K^- \pi^+)/\Gamma_{\text{total}}$ Γ_{36}/Γ

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

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

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

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



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

Γ_{37} / Γ

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

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

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

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

¹ This AUBERT 06N measurement uses $\bar{B}^0 \rightarrow D_s^{(*)-} D^{(*)+}$ 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_{38}/Γ_{36}

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.

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

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

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>
47.8±0.6 OUR AVERAGE			
47.9±0.5±0.5	DEL-AMO-SA..11G	BABR	Dalitz fit, 96k±369 evts
47.4±1.5±0.4	MITCHELL 09A	CLEO	Dalitz fit, 12k evts
• • • We do not use the following data for averages, fits, limits, etc. • • •			
47.8±4.6±4.0	FRABETTI 95B	E687	Dalitz fit, 701 evts

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

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>
21 ±6 OUR AVERAGE	Error includes scale factor of 3.5.		
16.4±0.7±2.0	DEL-AMO-SA..11G	BABR	Dalitz fit, 96k±369 evts
28.2±1.9±1.8	MITCHELL 09A	CLEO	Dalitz fit, 12k evts
• • • We do not use the following data for averages, fits, limits, etc. • • •			
11.0±3.5±2.6	FRABETTI 95B	E687	Dalitz fit, 701 evts

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

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>
1.3±0.8 OUR AVERAGE	Error includes scale factor of 3.9.		
1.1±0.1±0.2	DEL-AMO-SA..11G	BABR	Dalitz fit, 96k±369 evts
4.3±0.6±0.5	MITCHELL 09A	CLEO	Dalitz fit, 12k evts

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

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

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

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

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

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

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

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

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

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

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

Unseen decay modes of the resonances are included.

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

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

VALUE (%)	DOCUMENT ID	TECN	COMMENT
6.3 ±0.6 OUR FIT			
6.37±0.21±0.56	ONYISI 13	CLEO	e^+e^- at 4.17 GeV
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
5.65±0.29±0.40	¹ ALEXANDER 08	CLEO	See ONYISI 13
¹ ALEXANDER 08 uses single- and double-tagged events in an overall fit.			

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

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

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

VALUE (%)	DOCUMENT ID	TECN	COMMENT
1.68±0.10 OUR FIT			
1.69±0.07±0.08	ONYISI 13	CLEO	e^+e^- at 4.17 GeV
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
1.64±0.10±0.07	¹ ALEXANDER 08	CLEO	See ONYISI 13
¹ ALEXANDER 08 uses single- and double-tagged events in an overall fit.			

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

Unseen decay modes of the resonances are included.

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

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

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

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

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

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.160±0.027 OUR AVERAGE				
0.150±0.019±0.025	240	LINK	03D	FOCS γ A, $\bar{E}_\gamma \approx 180$ 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_{54}/Γ_{37}

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

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

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

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

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_{57}/Γ_{36}

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

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

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

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

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

————— Pionic modes —————

$$\Gamma(\pi^+\pi^0)/\Gamma(K^+K_S^0) \qquad \Gamma_{60}/\Gamma_{34}$$

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

$$\Gamma(2\pi^+\pi^-)/\Gamma_{\text{total}} \qquad \Gamma_{61}/\Gamma$$

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

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

VALUE	EVTs	DOCUMENT ID	TECN	COMMENT
0.201±0.007 OUR FIT				
0.199±0.004±0.009	≈ 10.5k	AUBERT	090	BABR e^+e^- ≈ 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.265±0.041±0.031	98	FRABETTI	97D	E687 γ Be ≈ 200 GeV

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
0.018±0.005±0.010		AUBERT	090	BABR Dalitz fit, ≈ 10.5k evts
• • • We do not use the following data for averages, fits, limits, etc. • • •				
not seen		LINK	04	FOCS Dalitz fit, 1475 ± 50 evts
0.058±0.023±0.037		AITALA	01A	E791 Dalitz fit, 848 evts
<0.073	90	FRABETTI	97D	E687 γ Be ≈ 200 GeV

$$\Gamma(\pi^+(\pi^+\pi^-)_{S\text{-wave}})/\Gamma(2\pi^+\pi^-) \qquad \Gamma_{63}/\Gamma_{61}$$

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

VALUE	DOCUMENT ID	TECN	COMMENT
0.833 ±0.020 OUR AVERAGE			
0.830 ±0.009 ±0.019	¹ AUBERT	090	BABR Dalitz fit, ≈ 10.5k evts
0.8704±0.0560±0.0438	² LINK	04	FOCS Dalitz fit, 1475 ± 50 evts

¹AUBERT 090 gives the amplitude and phase of the $\pi^+\pi^-$ S -wave in 29 $\pi^+\pi^-$ invariant-mass bins.

²LINK 04 borrows a K-matrix parametrization from ANISOVICH 03 of the full $\pi\text{-}\pi$ 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 $f_0(980)$, $f_0(1300)$, $f_0(1200\text{--}1600)$, $f_0(1500)$, 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_{64}/Γ_{61}

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

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

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

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

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

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

$0.324 \pm 0.077 \pm 0.017$	AITALA	01A	E791	Dalitz fit, 848 evts
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$\Gamma(f_0(1500)\pi^+, f_0 \rightarrow \pi^+\pi^-)/\Gamma(2\pi^+\pi^-)$ Γ_{66}/Γ_{61}

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

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

$0.274 \pm 0.114 \pm 0.019$	¹ FRABETTI	97D	E687	γ Be \approx 200 GeV
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¹FRABETTI 97D calls this mode $S(1475)\pi^+$, but finds the mass and width of this $S(1475)$ to be in excellent agreement with those of the $f_0(1500)$.

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

This is the “fit fraction” from the Dalitz-plot analysis.

VALUE	DOCUMENT ID	TECN	COMMENT
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0.101 ± 0.018 OUR AVERAGE

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

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

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

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

This is the “fit fraction” from the Dalitz-plot analysis.

VALUE	DOCUMENT ID	TECN	COMMENT
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0.027 ± 0.018 OUR AVERAGE

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

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

$0.044 \pm 0.021 \pm 0.002$	AITALA	01A	E791	Dalitz fit, 848 evts
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$\Gamma(\pi^+2\pi^0)/\Gamma_{\text{total}}$ Γ_{69}/Γ

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
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0.65 ± 0.13 ± 0.03	72 ± 16	NAIK	09A	CLEO e^+e^- at 4170 MeV
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$\Gamma(2\pi^+\pi^-\pi^0)/\Gamma(\phi\pi^+)$ Γ_{70}/Γ_{37}

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

<3.3	90	ANJOS	89E	E691	Photoproduction
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$\Gamma(\eta\pi^+)/\Gamma_{\text{total}}$ Γ_{71}/Γ

Unseen decay modes of the η are included.

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
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1.70±0.09 OUR FIT Error includes scale factor of 1.1.

1.71±0.08 OUR AVERAGE

1.67±0.08±0.06		ONYISI	13	CLEO	e^+e^- at 4.17 GeV
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1.82±0.14±0.07	0.8k	ZUPANC	13	BELL	e^+e^- at $\Upsilon(4S), \Upsilon(5S)$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

1.58±0.11±0.18		¹ ALEXANDER	08	CLEO	See ONYISI 13
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¹ALEXANDER 08 uses single- and double-tagged events in an overall fit.

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

Unseen decay modes of the η are included.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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1.13 ±0.07 OUR FIT Error includes scale factor of 1.1.

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

1.236±0.043±0.063	2587 ± 89	MENDEZ	10	CLEO	See ONYISI 13
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$\Gamma(\eta\pi^+)/\Gamma(\phi\pi^+)$ Γ_{71}/Γ_{37}

Unseen decay modes of the resonances are included.

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

0.48±0.03±0.04	920	JESSOP	98	CLE2	$e^+e^- \approx \Upsilon(4S)$
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0.54±0.09±0.06	165	ALEXANDER	92	CLE2	See JESSOP 98
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$\Gamma(\omega\pi^+)/\Gamma_{\text{total}}$ Γ_{72}/Γ

Unseen decay modes of the ω are included.

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
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0.24±0.06 OUR FIT

0.21±0.09±0.01	6 ± 2.4	GE	09A	CLEO	e^+e^- at 4170 MeV
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$\Gamma(\omega\pi^+)/\Gamma(\eta\pi^+)$ Γ_{72}/Γ_{71}

Unseen decay modes of the resonances are included.

VALUE	DOCUMENT ID	TECN	COMMENT
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0.14±0.04 OUR FIT

0.16±0.04±0.03	BALEST	97	CLE2	$e^+e^- \approx \Upsilon(4S)$
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$\Gamma(3\pi^+2\pi^-)/\Gamma(K^+K^-\pi^+)$ Γ_{73}/Γ_{36}

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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0.146±0.014 OUR AVERAGE

0.145±0.011±0.010	671	LINK	03D	FOCS	$\gamma A, \bar{E}_\gamma \approx 180$ GeV
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0.158±0.042±0.031	37	FRABETTI	97C	E687	$\gamma Be, \bar{E}_\gamma \approx 200$ GeV
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$\Gamma(\eta\rho^+)/\Gamma_{\text{total}}$ Γ_{75}/Γ

Unseen decay modes of the η are included.

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

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

Unseen decay modes of the resonances are included.

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

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

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

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

Unseen decay modes of the ω are included.

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

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

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

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

Unseen decay modes of the ω are included.

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

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

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

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

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

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

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

Unseen decay modes of the resonances are included.

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

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

Unseen decay modes of the ω and η are included.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 2.13 \times 10^{-2}$	90	GE	09A	CLEO e^+e^- at 4170 MeV

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

VALUE (%)	DOCUMENT ID	TECN	COMMENT
$5.8 \pm 1.4 \pm 0.4$	ABLIKIM	15Z	BES3 482 pb^{-1} , 4009 MeV

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

Unseen decay modes of the resonances are included.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$2.78 \pm 0.28 \pm 0.30$	137	¹ JESSOP	98	CLE2 $e^+e^- \approx \Upsilon(4S)$
$3.44 \pm 0.62 \begin{smallmatrix} +0.44 \\ -0.46 \end{smallmatrix}$	68	AVERY	92	CLE2 See JESSOP 98

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

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

VALUE (%)	DOCUMENT ID	TECN	COMMENT
$5.6 \pm 0.5 \pm 0.6$	ONYISI	13	CLEO e^+e^- at 4.17 GeV

$\Gamma(\eta'(958)\pi^+\pi^0 \text{ nonresonant})/\Gamma_{\text{total}}$ Γ_{85}/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_{86}/Γ_{34}

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
$4.2 \pm 1.4 \pm 0.2$	202 ± 70	MENDEZ	10	CLEO e^+e^- at 4170 MeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$5.5 \pm 1.3 \pm 0.7$	141 ± 34	ADAMS	07A	CLEO See MENDEZ 10

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

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
8.12 ± 0.28 OUR AVERAGE				
$8.5 \pm 0.7 \pm 0.2$	393 ± 33	MENDEZ	10	CLEO e^+e^- at 4170 MeV
$8.03 \pm 0.24 \pm 0.19$	$17.6k \pm 481$	WON	09	BELL e^+e^- at $\Upsilon(4S)$
$10.4 \pm 2.4 \pm 1.4$	113 ± 26	LINK	08	FOCS $\gamma A, \bar{E}_\gamma \approx 180$ GeV

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

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

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

Unseen decay modes of the η are included.

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

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

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

8.9 ± 1.5 ± 0.4 113 ± 18 ADAMS 07A CLEO See MENDEZ 10

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

Unseen decay modes of the ω are included.

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

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

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

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

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

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

4.2 ± 1.3 ± 0.3 28 ± 9 ADAMS 07A CLEO See MENDEZ 10

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

VALUE (%)	DOCUMENT ID	TECN	COMMENT
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0.66 ± 0.04 OUR FIT

0.654 ± 0.033 ± 0.025 ONYISI 13 CLEO e^+e^- at 4.17 GeV

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

0.69 ± 0.05 ± 0.03 ¹ALEXANDER 08 CLEO See ONYISI 13

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

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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0.120 ± 0.007 OUR FIT Error includes scale factor of 1.1.

0.127 ± 0.007 ± 0.014 567 ± 31 LINK 04F FOCS $\gamma A, \bar{E}_\gamma \approx 180$ GeV

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

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

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

$\Gamma(K^+ \rho(1450)^0, \rho^0 \rightarrow \pi^+ \pi^-) / \Gamma(K^+ \pi^+ \pi^-)$ $\Gamma_{93} / \Gamma_{91}$

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

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

$\Gamma(K^*(892)^0 \pi^+, K^{*0} \rightarrow K^+ \pi^-) / \Gamma(K^+ \pi^+ \pi^-)$ $\Gamma_{94} / \Gamma_{91}$

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

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

$\Gamma(K^*(1410)^0 \pi^+, K^{*0} \rightarrow K^+ \pi^-) / \Gamma(K^+ \pi^+ \pi^-)$ $\Gamma_{95} / \Gamma_{91}$

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

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

$\Gamma(K^*(1430)^0 \pi^+, K^{*0} \rightarrow K^+ \pi^-) / \Gamma(K^+ \pi^+ \pi^-)$ $\Gamma_{96} / \Gamma_{91}$

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

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

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

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

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

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

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

$\Gamma(K_S^0 2\pi^+ \pi^-) / \Gamma(K_S^0 K^- 2\pi^+)$ $\Gamma_{99} / \Gamma_{50}$

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

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

Unseen decay modes of the ω are included.

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

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

Unseen decay modes of the ω are included.

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

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

Unseen decay modes of the ω and η are included.

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

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

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
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4.0 ± 0.3 ± 0.2	748 ± 60	DEL-AMO-SA..11G	BABR	$e^+e^- \approx \Upsilon(4S)$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$8.95 \pm 2.12^{+2.24}_{-2.31}$	31	LINK	02I	FOCS γ A, ≈ 180 GeV
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$\Gamma(\phi K^+, \phi \rightarrow K^+K^-)/\Gamma(2K^+K^-)$ $\Gamma_{104}/\Gamma_{103}$

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

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

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
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2.33 ± 0.23 OUR AVERAGE

2.3 ± 0.3 ± 0.2	356 ± 52	DEL-AMO-SA..11G	BABR	$e^+e^- \approx \Upsilon(4S)$
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2.29 ± 0.28 ± 0.12	281 ± 34	KO	09 BELL	e^+e^- at $\Upsilon(4S)$
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5.2 ± 1.7 ± 1.1	27 ± 9	LINK	05K FOCS	<0.78%, CL = 90%
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$\Gamma(K^+K^*(892)^0, K^{*0} \rightarrow K^+\pi^-)/\Gamma(2K^+\pi^-)$ $\Gamma_{106}/\Gamma_{105}$

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

$\Gamma(p\bar{n})/\Gamma_{\text{total}}$ Γ_{107}/Γ

This is the only baryonic mode allowed kinematically.

VALUE (units 10^{-3})	EVTS	DOCUMENT ID	TECN	COMMENT
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1.22 ± 0.11 OUR AVERAGE

1.21 ± 0.10 ± 0.05	193 ± 17	ABLIKIM	190BES3	e^+e^- , $E_{\text{cm}} = 4178$ MeV
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1.30 ± 0.36 ^{+0.12} _{-0.16}	13.0 ± 3.6	ATHAR	08 CLEO	e^+e^- , $E_{\text{cm}} \approx 4170$ MeV
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————— Rare or forbidden modes —————

$\Gamma(\pi^+e^+e^-)/\Gamma_{\text{total}}$ Γ_{108}/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
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<13 × 10⁻⁶	90	LEES	11G	BABR $e^+e^- \approx \Upsilon(4S)$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

< 2.2 × 10 ⁻⁵	90	¹ RUBIN	10	CLEO e^+e^- at 4170 MeV
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<27 × 10 ⁻⁵	90	AITALA	99G	E791 $\pi^- N$ 500 GeV
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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_{109}/Γ

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
$(6_{-4}^{+8} \pm 1) \times 10^{-6}$	3	RUBIN	10	CLEO $e^+ e^-$ at 4170 MeV

 $\Gamma(\pi^+ \mu^+ \mu^-)/\Gamma_{\text{total}}$ Γ_{110}/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
$< 4.1 \times 10^{-7}$	90	AAIJ	13AF	LHCB pp at 7 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$< 4.3 \times 10^{-5}$	90	LEES	11G	BABR $e^+ e^- \approx \Upsilon(4S)$
$< 2.6 \times 10^{-5}$	90	LINK	03F	FOCS $\gamma A, \bar{E}_\gamma \approx 180$ 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_{111}/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. • • •				
$< 5.2 \times 10^{-5}$	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_{112}/Γ

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

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

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

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

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

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

A test of lepton-family-number conservation.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 12 \times 10^{-6}$	90	LEES	11G	BABR $e^+ e^- \approx \Upsilon(4S)$

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

A test of lepton-family-number conservation.

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

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

A test of lepton-family-number conservation.

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

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

A test of lepton-family-number conservation.

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

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

A test of lepton-number conservation.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 4.1 \times 10^{-6}$	90	LEES	11G BABR	$e^+ e^- \approx \Upsilon(4S)$

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

$< 1.8 \times 10^{-5}$	90	RUBIN	10 CLEO	$e^+ e^-$ at 4170 MeV
$<69 \times 10^{-5}$	90	AITALA	99G E791	$\pi^- N$ 500 GeV

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

A test of lepton-number conservation.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.2 \times 10^{-7}$	90	AAIJ	13AF LHCB	pp at 7 TeV

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

$<1.4 \times 10^{-5}$	90	LEES	11G BABR	$e^+ e^- \approx \Upsilon(4S)$
$<2.9 \times 10^{-5}$	90	LINK	03F FOCS	$\gamma A, \bar{E}_\gamma \approx 180$ GeV
$<8.2 \times 10^{-5}$	90	AITALA	99G E791	$\pi^- N$ 500 GeV
$<4.3 \times 10^{-4}$	90	KODAMA	95 E653	π^- emulsion 600 GeV

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

A test of lepton-number conservation.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<8.4 \times 10^{-6}$	90	LEES	11G BABR	$e^+ e^- \approx \Upsilon(4S)$

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

$<7.3 \times 10^{-4}$	90	AITALA	99G E791	$\pi^- N$ 500 GeV
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$\Gamma(K^- 2e^+)/\Gamma_{\text{total}}$ Γ_{121}/Γ

A test of lepton-number conservation.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 5.2 \times 10^{-6}$	90	LEES	11G BABR	$e^+ e^- \approx \Upsilon(4S)$

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

$< 1.7 \times 10^{-5}$	90	RUBIN	10 CLEO	$e^+ e^-$ at 4170 MeV
$<63 \times 10^{-5}$	90	AITALA	99G E791	$\pi^- N$ 500 GeV

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

A test of lepton-number conservation.

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

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

A test of lepton-number conservation.

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

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

A test of lepton-number conservation.

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

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

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

VALUE (%)	EVTS	DOCUMENT ID	TECN	COMMENT
0.08 ± 0.26 OUR AVERAGE				
$-0.05 \pm 0.23 \pm 0.24$	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 $(+0.28 \pm 0.23 \pm 0.24)\%$.

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

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

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

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

VALUE (%)	DOCUMENT ID	TECN	COMMENT
$0.0 \pm 2.7 \pm 1.2$	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

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

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

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

VALUE (%)	DOCUMENT ID	TECN	COMMENT
$4.1 \pm 2.7 \pm 0.9$	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

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

VALUE (%)	DOCUMENT ID	TECN	COMMENT
$-0.7 \pm 3.0 \pm 0.6$	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

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

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

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

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

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

VALUE (%)	DOCUMENT ID	TECN	COMMENT
$-0.5 \pm 3.9 \pm 2.0$	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
$-26.6 \pm 23.8 \pm 0.9$	202 ± 70	MENDEZ	10	CLEO e^+e^- at 4170 MeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
2 ± 29		ADAMS	07A	CLEO See MENDEZ 10

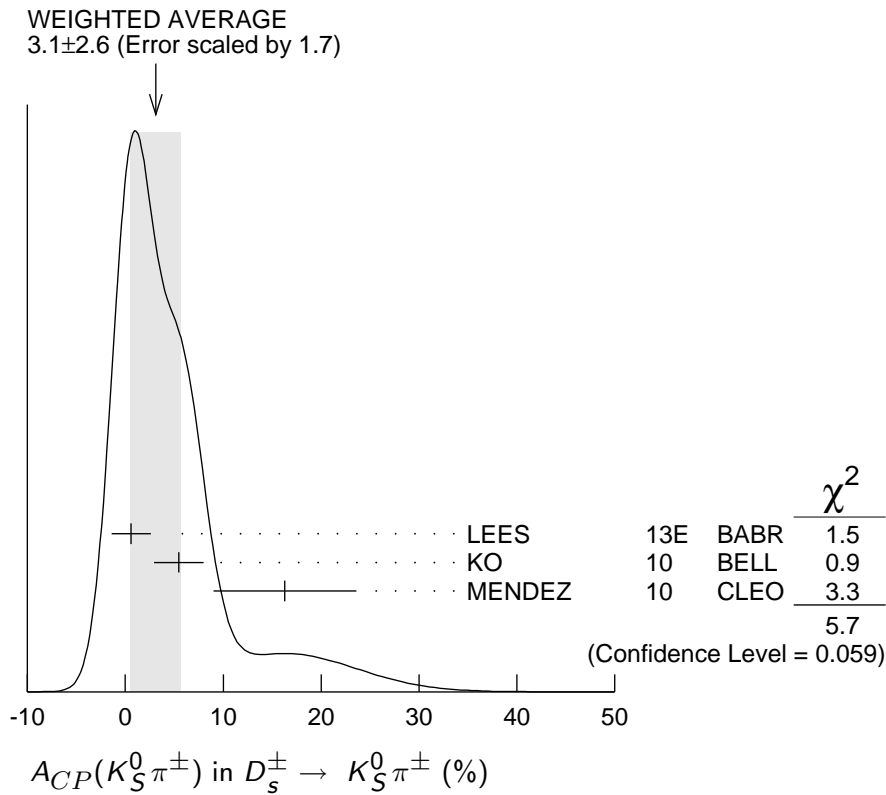
$A_{CP}(\bar{K}^0/K^0\pi^\pm)$ in $D_s^+ \rightarrow \bar{K}^0\pi^+$, $D_s^- \rightarrow K^0\pi^-$

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
3.1 ± 2.6 OUR AVERAGE		Error includes scale factor of 1.7. See the ideogram below.		
$0.6 \pm 2.0 \pm 0.3$	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 $D_s^\pm \rightarrow K^\pm \pi^+ \pi^-$

<u>VALUE (%)</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$4.5 \pm 4.8 \pm 0.6$	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

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

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

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

<u>VALUE (%)</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$6.0 \pm 18.9 \pm 0.9$	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

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

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

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

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.84 ± 0.11 OUR AVERAGE				Error includes scale factor of 2.4.
$0.816 \pm 0.036 \pm 0.030$	$25 \pm 0.5k$	¹ AUBERT	08AN BABR	$\phi e^+ \nu_e$
$0.713 \pm 0.202 \pm 0.284$	793	LINK	04C FOCS	$\phi \mu^+ \nu_\mu$
$1.57 \pm 0.25 \pm 0.19$	271	AITALA	99D E791	$\phi e^+ \nu_e, \phi \mu^+ \nu_\mu$
$1.4 \pm 0.5 \pm 0.3$	308	AVERY	94B CLE2	$\phi e^+ \nu_e$
$1.1 \pm 0.8 \pm 0.1$	90	FRABETTI	94F E687	$\phi \mu^+ \nu_\mu$
$2.1 \begin{smallmatrix} +0.6 \\ -0.5 \end{smallmatrix} \pm 0.2$	19	KODAMA	93 E653	$\phi \mu^+ \nu_\mu$

¹To compare with previous measurements, this AUBERT 08AN value is from a fit that fixes the pole masses at $m_A = 2.5 \text{ GeV}/c^2$ and $m_V = 2.1 \text{ GeV}/c^2$. A simultaneous fit to r_2 , r_V , r_0 (a significant s -wave contribution) and m_A , gives $r_2 = 0.763 \pm 0.071 \pm 0.065$.

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

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

¹To compare with previous measurements, this AUBERT 08AN value is from a fit that fixes the pole masses at $m_A = 2.5 \text{ GeV}/c^2$ and $m_V = 2.1 \text{ GeV}/c^2$. A simultaneous fit to r_2 , r_V , r_0 (a significant s -wave contribution) and m_A , gives $r_V = 1.849 \pm 0.060 \pm 0.095$.

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

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

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

 D_s^\pm REFERENCES

ABLIKIM	19O	PR D99 031101	M. Ablikim <i>et al.</i>	(BES III Collab.)
ABLIKIM	18A	PR D97 012006	M. Ablikim <i>et al.</i>	(BES III Collab.)
AAIJ	17AF	PL B771 21	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	17AN	PRL 119 101801	R. Aaij <i>et al.</i>	(LHCb Collab.)
ABLIKIM	16O	PR D94 072004	M. Ablikim <i>et al.</i>	(BES III Collab.)
ABLIKIM	16T	PR D94 112003	M. Ablikim <i>et al.</i>	(BES III Collab.)
ABLIKIM	15Z	PL B750 466	M. Ablikim <i>et al.</i>	(BES III Collab.)
HIETALA	15	PR D92 012009	J. Hietala <i>et al.</i>	(MINN, LUTH, OXF)
LEES	15D	PR D91 019901 (errata.)	J.P. Lees <i>et al.</i>	(BABAR Collab.)
AAIJ	14BD	JHEP 1410 025	R. Aaij <i>et al.</i>	(LHCb Collab.)
ABAZOV	14B	PRL 112 111804	V.M. Abazov <i>et al.</i>	(D0 Collab.)
AAIJ	13AF	PL B724 203	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	13V	JHEP 1306 065	R. Aaij <i>et al.</i>	(LHCb Collab.)
AAIJ	13W	JHEP 1306 112	R. Aaij <i>et al.</i>	(LHCb Collab.)
LEES	13E	PR D87 052012	J.P. Lees <i>et al.</i>	(BABAR Collab.)
ONYISI	13	PR D88 032009	P.U.E. Onyisi <i>et al.</i>	(CLEO Collab.)
ZUPANC	13	JHEP 1309 139	A. Zupanc <i>et al.</i>	(BELLE Collab.)
DEL-AMO-SA...	11G	PR D83 052001	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
LEES	11E	PR D84 031103	J.P. Lees <i>et al.</i>	(BABAR Collab.)
LEES	11G	PR D84 072006	J.P. Lees <i>et al.</i>	(BABAR Collab.)
MARTIN	11	PR D84 012005	L. Martin <i>et al.</i>	(CLEO Collab.)
ASNER	10	PR D81 052007	D.M. Asner <i>et al.</i>	(CLEO Collab.)
DEL-AMO-SA...	10J	PR D82 091103	P. del Amo Sanchez <i>et al.</i>	(BABAR Collab.)
Also		PR D91 019901 (errata.)	J.P. Lees <i>et al.</i>	(BABAR Collab.)
KO	10	PRL 104 181602	B.R. Ko <i>et al.</i>	(BELLE Collab.)
MENDEZ	10	PR D81 052013	H. Mendez <i>et al.</i>	(CLEO Collab.)
RUBIN	10	PR D82 092007	P. Rubin <i>et al.</i>	(CLEO Collab.)
ALEXANDER	09	PR D79 052001	J.P. Alexander <i>et al.</i>	(CLEO Collab.)
AUBERT	09O	PR D79 032003	B. Aubert <i>et al.</i>	(BABAR Collab.)
DOBBS	09	PR D79 112008	S. Dobbs <i>et al.</i>	(CLEO Collab.)
ECKLUND	09	PR D80 052009	K.M. Ecklund <i>et al.</i>	(CLEO Collab.)
GE	09A	PR D80 051102	J.Y. Ge <i>et al.</i>	(CLEO Collab.)
KO	09	PRL 102 221802	B.R. Ko <i>et al.</i>	(BELLE Collab.)
MITCHELL	09A	PR D79 072008	R.E. Mitchell <i>et al.</i>	(CLEO Collab.)
NAIK	09A	PR D80 112004	P. Naik <i>et al.</i>	(CLEO Collab.)
ONYISI	09	PR D79 052002	P.U.E. Onyisi <i>et al.</i>	(CLEO Collab.)
WON	09	PR D80 111101	E. Won <i>et al.</i>	(BELLE Collab.)
YELTON	09	PR D80 052007	J. Yelton <i>et al.</i>	(CLEO Collab.)
ALEXANDER	08	PRL 100 161804	J.P. Alexander <i>et al.</i>	(CLEO Collab.)
ATHAR	08	PRL 100 181802	S.B. Athar <i>et al.</i>	(CLEO Collab.)
AUBERT	08AN	PR D78 051101	B. Aubert <i>et al.</i>	(BABAR Collab.)
ECKLUND	08	PRL 100 161801	K.M. Ecklund <i>et al.</i>	(CLEO Collab.)
KLEMP	08	EPJ C55 39	E. Klempt, M. Matveev, A.V. Sarantsev	(BONN+)
LINK	08	PL B660 147	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
WIDHALM	08	PRL 100 241801	L. Widhalm <i>et al.</i>	(BELLE Collab.)
ADAMS	07A	PRL 99 191805	G.S. Adams <i>et al.</i>	(CLEO Collab.)
AUBERT	07V	PRL 98 141801	B. Aubert <i>et al.</i>	(BABAR Collab.)
PEDLAR	07A	PR D76 072002	T.K. Pedlar <i>et al.</i>	(CLEO Collab.)
Also		PRL 99 071802	M. Artuso <i>et al.</i>	(CLEO Collab.)
AUBERT	06N	PR D74 031103	B. Aubert <i>et al.</i>	(BABAR Collab.)
HUANG	06B	PR D74 112005	G.S. Huang <i>et al.</i>	(CLEO Collab.)
PDG	06	JP G33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)
AUBERT	05V	PR D71 091104	B. Aubert <i>et al.</i>	(BABAR Collab.)
LINK	05E	PL B622 239	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
LINK	05J	PRL 95 052003	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)

LINK	05K	PL B624 166	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
LINK	04	PL B585 200	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
LINK	04C	PL B586 183	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
LINK	04D	PL B586 191	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
LINK	04F	PL B601 10	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
ACOSTA	03D	PR D68 072004	D. Acosta <i>et al.</i>	(FNAL CDF-II Collab.)
ANISOVICH	03	EPJ A16 229	V.V. Anisovich <i>et al.</i>	
LINK	03D	PL B561 225	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
LINK	03F	PL B572 21	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
AUBERT	02G	PR D65 091104	B. Aubert <i>et al.</i>	(BABAR Collab.)
HEISTER	02I	PL B528 1	A. Heister <i>et al.</i>	(ALEPH Collab.)
LINK	02I	PL B541 227	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
LINK	02J	PL B541 243	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
ABBIENDI	01L	PL B516 236	G. Abbiendi <i>et al.</i>	(OPAL Collab.)
AITALA	01A	PRL 86 765	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)
IORI	01	PL B523 22	M. Iori <i>et al.</i>	(FNAL SELEX Collab.)
LINK	01C	PRL 87 162001	J.M. Link <i>et al.</i>	(FNAL FOCUS Collab.)
ALEXANDROV	00	PL B478 31	Y. Alexandrov <i>et al.</i>	(CERN BEATRICE Collab.)
AITALA	99	PL B445 449	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)
AITALA	99D	PL B450 294	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)
AITALA	99G	PL B462 401	E.M. Aitala <i>et al.</i>	(FNAL E791 Collab.)
BONVICINI	99	PRL 82 4586	G. Bonvicini <i>et al.</i>	(CLEO Collab.)
CHADHA	98	PR D58 032002	M. Chada <i>et al.</i>	(CLEO Collab.)
JESSOP	98	PR D58 052002	C.P. Jessop <i>et al.</i>	(CLEO Collab.)
ACCIARRI	97F	PL B396 327	M. Acciarri <i>et al.</i>	(L3 Collab.)
BALEST	97	PRL 79 1436	R. Balest <i>et al.</i>	(CLEO Collab.)
FRABETTI	97C	PL B401 131	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)
FRABETTI	97D	PL B407 79	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)
ARTUSO	96	PL B378 364	M. Artuso <i>et al.</i>	(CLEO Collab.)
BAI	95C	PR D52 3781	J.Z. Bai <i>et al.</i>	(BES Collab.)
BRANDENB...	95	PRL 75 3804	G.W. Brandenburg <i>et al.</i>	(CLEO Collab.)
FRABETTI	95B	PL B351 591	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)
KODAMA	95	PL B345 85	K. Kodama <i>et al.</i>	(FNAL E653 Collab.)
ACOSTA	94	PR D49 5690	D. Acosta <i>et al.</i>	(CLEO Collab.)
AVERY	94B	PL B337 405	P. Avery <i>et al.</i>	(CLEO Collab.)
BROWN	94	PR D50 1884	D. Brown <i>et al.</i>	(CLEO Collab.)
BUTLER	94	PL B324 255	F. Butler <i>et al.</i>	(CLEO Collab.)
FRABETTI	94F	PL B328 187	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)
FRABETTI	93F	PRL 71 827	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)
FRABETTI	93G	PL B313 253	P.L. Frabetti <i>et al.</i>	(FNAL E687 Collab.)
KODAMA	93	PL B309 483	K. Kodama <i>et al.</i>	(FNAL E653 Collab.)
ALBRECHT	92B	ZPHY C53 361	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
ALEXANDER	92	PRL 68 1275	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.)

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