$D_s^{\pm}$ was $F^{\pm}$

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

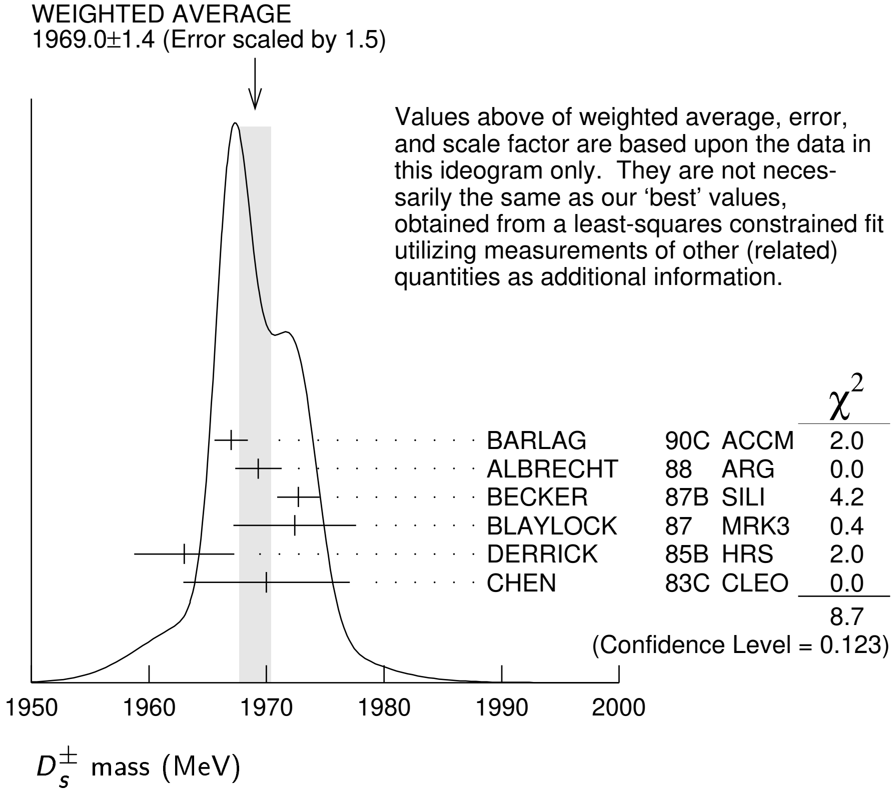
The angular distributions of the decays of the ϕ and $\overline{K}^*(892)^0$ in the $\phi\pi^+$ and $K^+\overline{K}^*(892)^0$ modes strongly indicate that the spin is zero. The parity given is that expected of a $c\overline{s}$ ground state.

$D_s^{\pm}$ MASS

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

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
1968.2± 0.5 OUR FIT	Error includes scale factor of 1.1.				
1969.0± 1.4 OUR AVERAGE	Error includes scale factor of 1.5. See the ideogram below.				
1967.0± 1.0± 1.0	54	BARLAG	90C	ACCM	π^- Cu 230 GeV
1969.3± 1.4± 1.4		ALBRECHT	88	ARG	e^+e^- 9.4–10.6 GeV
1972.7± 1.5± 1.0	21	BECKER	87B	SILI	200 GeV π,K,p
1972.4± 3.7± 3.7	27	BLAYLOCK	87	MRK3	e^+e^- 4.14 GeV
1963 ± 3 ± 3	30	DERRICK	85B	HRS	e^+e^- 29 GeV
1970 ± 5 ± 5	104	CHEN	83C	CLEO	e^+e^- 10.5 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1968.3± 0.7± 0.7	290	[1] ANJOS	88	E691	Photoproduction
1980 ±15	6	USHIDA	86	EMUL	ν wideband
1973.6± 2.6± 3.0	163	ALBRECHT	85D	ARG	e^+e^- 10 GeV
1948 ±28 ±10	65	AIHARA	84D	TPC	e^+e^- 29 GeV
1975 ± 9 ±10	49	ALTHOFF	84	TASS	e^+e^- 14–25 GeV
1975 ± 4	3	BAILEY	84	ACCM	hadron$^+$ Be $\rightarrow \phi\pi^+$X

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



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

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

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

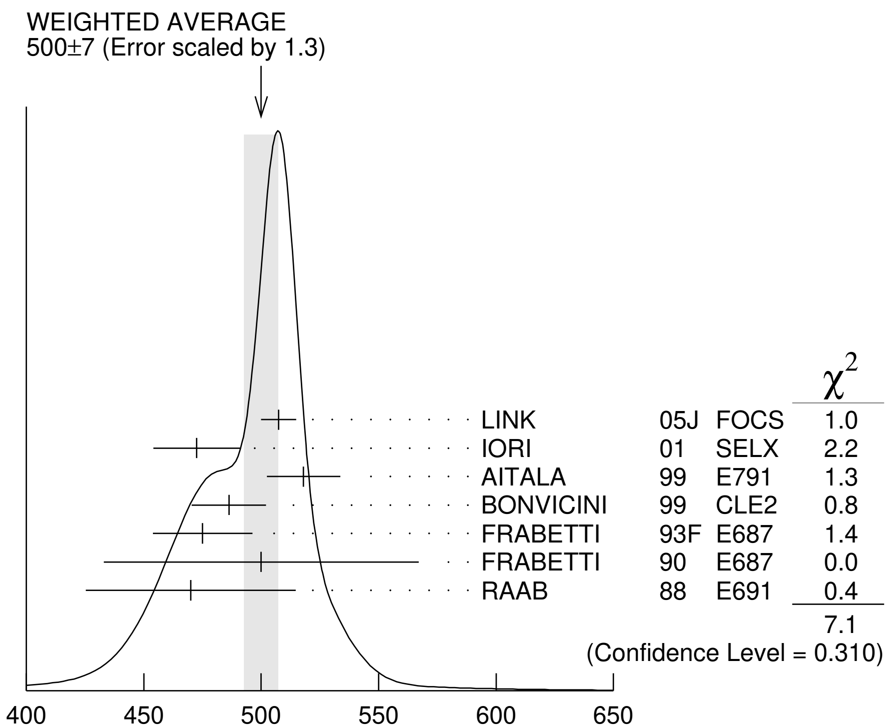
$D_s^\pm$ MEAN LIFE

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

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

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

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



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

D_s^+ DECAY MODES

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

	Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
	Inclusive modes		
Γ_1	K^- anything	$(13\ ^{+14}_{-12})$ %	
Γ_2	$\overline{K}^0$ anything + K^0 anything	(39 ± 28) %	
Γ_3	K^+ anything	$(20\ ^{+18}_{-14})$ %	
Γ_4	(non-$K\overline{K}$) anything	(64 ± 17) %	
Γ_5	e^+ anything	$(8\ ^{+\ 6}_{-\ 5})$ %	
Γ_6	ϕ anything	$(18\ ^{+15}_{-10})$ %	

Leptonic and semileptonic modes

Γ_{7}	$\mu^+ \nu_\mu$		$(6.1 \pm 1.9) \times 10^{-3}$	S=1.4
Γ_{8}	$\tau^+ \nu_\tau$		(6.4 ± 1.5) %	
Γ_{9}	$\phi \ell^+ \nu_\ell$	[a]	(2.4 ± 0.4) %	S=1.1
Γ_{10}	$\eta \ell^+ \nu_\ell + \eta'(958) \ell^+ \nu_\ell$	[a]	(4.2 ± 0.8) %	
Γ_{11}	$\eta \ell^+ \nu_\ell$	[a]	(3.1 ± 0.6) %	
Γ_{12}	$\eta'(958) \ell^+ \nu_\ell$	[a]	(1.08 ± 0.35) %	

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

Γ_{13}	$K^+ \overline{K}^0$		(4.4 ± 0.9) %	
Γ_{14}	$K^+ K^- \pi^+$	[b]	(5.2 ± 0.9) %	S=1.1
Γ_{15}	$\phi \pi^+$	[c]	(4.4 ± 0.6) %	S=1.1
Γ_{16}	$\phi \pi^+, \phi \to K^+ K^-$		(2.16 ± 0.28) %	S=1.1
Γ_{17}	$K^+ \overline{K}^*(892)^0$			
Γ_{18}	$K^+ \overline{K}^*(892)^0, \overline{K}^{*0} \to K^- \pi^+$		(2.5 ± 0.5) %	
Γ_{19}	$f_0(980) \pi^+, f_0 \to K^+ K^-$		$(5.7 \pm 2.5) \times 10^{-3}$	
Γ_{20}	$K^+ \overline{K}_0^*(1430)^0, \overline{K}_0^* \to K^- \pi^+$		$(4.8 \pm 2.5) \times 10^{-3}$	
Γ_{21}	$f_0(1710) \pi^+, f_0 \to K^+ K^-$			
Γ_{22}	$K^+ K^- \pi^+$ nonresonant			
Γ_{23}	$K^0 \overline{K}^0 \pi^+$		—	
Γ_{24}	$K^*(892)^+ \overline{K}^0$	[c]	(5.3 ± 1.3) %	
Γ_{25}	$K^+ K^- \pi^+ \pi^0$		—	
Γ_{26}	$\phi \pi^+ \pi^0$	[c]	(11 ± 5) %	
Γ_{27}	$\phi \rho^+$	[c]	$(8.2 {}^{+2.0}_{-2.4})$ %	
Γ_{28}	$\phi \pi^+ \pi^0$ 3-body	[c]	< 3.1 %	CL=90%
Γ_{29}	$K^+ K^- \pi^+ \pi^0$ non-ϕ		< 11 %	CL=90%
Γ_{30}	$K^+ \overline{K}^0 \pi^+ \pi^-$		(3.1 ± 0.9) %	
Γ_{31}	$K^0 K^- \pi^+ \pi^+$		(5.3 ± 1.4) %	
Γ_{32}	$K^*(892)^+ \overline{K}^*(892)^0$	[c]	(7.0 ± 2.7) %	
Γ_{33}	$K^0 K^- \pi^+ \pi^+$ (non-$K^{*+} \overline{K}^{*0}$)		< 3.5 %	CL=90%
Γ_{34}	$K^+ K^- \pi^+ \pi^+ \pi^-$		$(8.3 \pm 2.0) \times 10^{-3}$	
Γ_{35}	$\phi \pi^+ \pi^+ \pi^-$	[c]	(1.18 ± 0.20) %	
Γ_{36}	$K^+ K^- \rho^0 \pi^+$ non-ϕ		$< 2.5 \times 10^{-4}$	CL=90%
Γ_{37}	$\phi \rho^0 \pi^+$	[c]	(1.24 ± 0.33) %	
Γ_{38}	$\phi a_1(1260)^+$	[c]	(2.9 ± 0.7) %	
Γ_{39}	$K^+ K^- \pi^+ \pi^+ \pi^-$ nonresonant		$(8 \pm 7) \times 10^{-4}$	
Γ_{40}	$K_S^0 K_S^0 \pi^+ \pi^+ \pi^-$		$(2.7 \pm 1.3) \times 10^{-3}$	

	Hadronic modes without K's				
Γ_{41}	$\pi^+\pi^+\pi^-$			(1.22 ± 0.23) %	S=1.2
Γ_{42}	$\rho^0\pi^+$				
Γ_{43}	$\pi^+(\pi^+\pi^-)_{S-\text{wave}}$		[d]	(1.06 ± 0.22) %	
Γ_{44}	$f_0(980)\pi^+$, $f_0\to\pi^+\pi^-$				
Γ_{45}	$f_0(1370)\pi^+$, $f_0\to\pi^+\pi^-$				
Γ_{46}	$f_0(1500)\pi^+$, $f_0\to\pi^+\pi^-$				
Γ_{47}	$f_2(1270)\pi^+$, $f_2\to\pi^+\pi^-$			$(1.2\pm 0.7)\times 10^{-3}$	
Γ_{48}	$\rho(1450)^0\pi^+$, $\rho^0\to\pi^+\pi^-$			$(8\pm 7)\times 10^{-4}$	
Γ_{49}	$\pi^+\pi^+\pi^-$ nonresonant				
Γ_{50}	$\pi^+\pi^+\pi^-\pi^0$			<15 %	CL=90%
Γ_{51}	$\eta\pi^+$		[c]	(2.11 ± 0.35) %	
Γ_{52}	$\omega\pi^+$		[c]	$(3.4\pm 1.2)\times 10^{-3}$	
Γ_{53}	$3\pi^+2\pi^-$			$(7.6\pm 1.6)\times 10^{-3}$	
Γ_{54}	$\pi^+\pi^+\pi^-\pi^0\pi^0$			—	
Γ_{55}	$\eta\rho^+$		[c]	(13.1 ± 2.6) %	
Γ_{56}	$\eta\pi^+\pi^0$ 3-body		[c]	<5 %	CL=90%
Γ_{57}	$3\pi^+2\pi^-\pi^0$			(4.9 ± 3.2) %	
Γ_{58}	$\eta'(958)\pi^+$		[c]	(4.7 ± 0.7) %	
Γ_{59}	$3\pi^+2\pi^-2\pi^0$			—	
Γ_{60}	$\eta'(958)\rho^+$		[c]	(12.2 ± 2.4) %	
Γ_{61}	$\eta'(958)\pi^+\pi^0$ 3-body		[c]	<1.8 %	CL=90%
	Modes with one or three K's				
Γ_{62}	$K^0\pi^+$			$<9\times 10^{-3}$	CL=90%
Γ_{63}	$K^+\pi^+\pi^-$			$(6.6\pm 1.4)\times 10^{-3}$	
Γ_{64}	$K^+\rho^0$			$(2.6\pm 0.7)\times 10^{-3}$	
Γ_{65}	$K^+\rho(1450)^0$, $\rho^0\to\pi^+\pi^-$			$(7.0\pm 2.9)\times 10^{-4}$	
Γ_{66}	$K^*(892)^0\pi^+$, $K^{*0}\to K^+\pi^-$			$(1.4\pm 0.4)\times 10^{-3}$	
Γ_{67}	$K^*(1410)^0\pi^+$, $K^{*0}\to K^+\pi^-$			$(1.2\pm 0.4)\times 10^{-3}$	
Γ_{68}	$K^*(1430)^0\pi^+$, $K^{*0}\to K^+\pi^-$			$(5\pm 4)\times 10^{-4}$	
Γ_{69}	$K^+\pi^+\pi^-$ nonresonant			$(1.0\pm 0.4)\times 10^{-3}$	
Γ_{70}	$K^+K^+K^-$			$(4.6\pm 1.8)\times 10^{-4}$	
Γ_{71}	ϕK^+		[c]	$<6\times 10^{-4}$	CL=90%
	Doubly Cabibbo-suppressed modes				
Γ_{72}	$K^+K^+\pi^-$			$(2.7\pm 1.2)\times 10^{-4}$	
	$\Delta C=1$ weak neutral current (*C1*) modes, Lepton family number (*LF*), or Lepton number (*L*) violating modes				
Γ_{73}	$\pi^+e^+e^-$		[e]	$<2.7\times 10^{-4}$	CL=90%
Γ_{74}	$\pi^+\mu^+\mu^-$		[e]	$<2.6\times 10^{-5}$	CL=90%
Γ_{75}	$K^+e^+e^-$	*C1*		$<1.6\times 10^{-3}$	CL=90%

Γ_{76}	$K^+ \mu^+ \mu^-$	*C1*		$<$ 3.6	$\times 10^{-5}$	CL=90%
Γ_{77}	$K^*(892)^+ \mu^+ \mu^-$	*C1*		$<$ 1.4	$\times 10^{-3}$	CL=90%
Γ_{78}	$\pi^+ e^\pm \mu^\mp$	*LF*	[*f*]	$<$ 6.1	$\times 10^{-4}$	CL=90%
Γ_{79}	$K^+ e^\pm \mu^\mp$	*LF*	[*f*]	$<$ 6.3	$\times 10^{-4}$	CL=90%
Γ_{80}	$\pi^- e^+ e^+$	*L*		$<$ 6.9	$\times 10^{-4}$	CL=90%
Γ_{81}	$\pi^- \mu^+ \mu^+$	*L*		$<$ 2.9	$\times 10^{-5}$	CL=90%
Γ_{82}	$\pi^- e^+ \mu^+$	*L*		$<$ 7.3	$\times 10^{-4}$	CL=90%
Γ_{83}	$K^- e^+ e^+$	*L*		$<$ 6.3	$\times 10^{-4}$	CL=90%
Γ_{84}	$K^- \mu^+ \mu^+$	*L*		$<$ 1.3	$\times 10^{-5}$	CL=90%
Γ_{85}	$K^- e^+ \mu^+$	*L*		$<$ 6.8	$\times 10^{-4}$	CL=90%
Γ_{86}	$K^*(892)^- \mu^+ \mu^+$	*L*		$<$ 1.4	$\times 10^{-3}$	CL=90%

Γ_{87}	A dummy mode used by the fit.	(79.8 ± 2.8) %	S=1.1

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

[*b*] 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.

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

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

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

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

CONSTRAINED FIT INFORMATION

An overall fit to 11 branching ratios uses 19 measurements and one constraint to determine 9 parameters. The overall fit has a $\chi^2 = 11.4$ for 11 degrees of freedom.

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

x_9	46							
x_{11}	32	69						
x_{12}	21	44	31					
x_{14}	36	64	44	28				
x_{15}	49	88	61	39	73			
x_{16}	49	87	61	39	73	100		
x_{41}	35	62	43	27	67	71	71	
x_{87}	−52	−90	−74	−50	−85	−93	−93	−75
	x_7	x_9	x_{11}	x_{12}	x_{14}	x_{15}	x_{16}	x_{41}

D_s^+ BRANCHING RATIOS

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

Inclusive modes

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

VALUE	*DOCUMENT ID*		*TECN*	*COMMENT*
$\mathbf{0.13^{+0.14}_{-0.12} \pm 0.02}$	COFFMAN	91	MRK3	$e^+ e^-$ 4.14 GeV

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

VALUE	*DOCUMENT ID*		*TECN*	*COMMENT*
$\mathbf{0.39^{+0.28}_{-0.27} \pm 0.04}$	COFFMAN	91	MRK3	$e^+ e^-$ 4.14 GeV

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

VALUE	*DOCUMENT ID*		*TECN*	*COMMENT*
$\mathbf{0.20^{+0.18}_{-0.13} \pm 0.04}$	COFFMAN	91	MRK3	$e^+ e^-$ 4.14 GeV

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

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

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

$\Gamma(e^+ \text{anything})/\Gamma_{\text{total}}$ Γ_5/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$\mathbf{0.077^{+0.057}_{-0.043}{}^{+0.024}_{-0.021}}$		BAI 97	BES	$e^+e^- \to D_s^+ D_s^-$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.20	90	[4] BAI 90	MRK3	e^+e^- 4.14 GeV

[4] Expressed as a value, the BAI 90 result is $\Gamma(e^+ \text{anything})/\Gamma_{\text{total}} = 0.05 \pm 0.05 \pm 0.02$.

$\Gamma(\phi \text{ anything})/\Gamma_{\text{total}}$ Γ_6/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
$\mathbf{0.178^{+0.151}_{-0.072}{}^{+0.006}_{-0.063}}$	3	BAI 98	BES	$e^+e^- \to D_s^+ D_s^-$

——— Leptonic and semileptonic modes ———

D_s^+ DECAY CONSTANT

Revised March 2006 by A. Edwards and P. Burchat (Stanford University)

In the Standard Model, the D_s^+ leptonic branching fractions are related to the D_s^+ decay constant f_{D_s} by the equation [1]

$$\mathrm{B}(D_s^+ \to \ell^+\nu_\ell) = \frac{G_F^2}{8\pi}|V_{cs}|^2 f_{D_s}^2 \frac{\tau_{D_s}}{\hbar} m_{D_s} m_\ell^2 \left(1 - \frac{m_\ell^2}{m_{D_s}^2}\right)^2 \ . \quad (1)$$

Hence, measurements of $\mathrm{B}(D_s^+ \to \ell^+\nu_\ell)$ can be used to extract f_{D_s}. The most precise measurements of $D_s^+ \to \ell^+\nu_\ell$ branching fractions come from L3 (ACCIARRI 97F), CLEO (CHADHA 98), BEATRICE (ALEXANDROV 00), OPAL (ABBIENDI 01L), and ALEPH (HEISTER 02I); see the end of the D_s^+ Data Listings for the references. All of these measurements either explicitly or implicitly measure the leptonic branching fraction relative to the branching fraction for $D_s^+ \to \phi\pi^+$. This fraction has, since our 2004 edition, changed from $3.6 \pm 0.9\%$ to $4.4 \pm 0.6\%$. The $D_s^+ \to \ell^+\nu_\ell$ measurements of CLEO and BEATRICE are explicitly normalized to $D_s^+ \to \phi\pi^+$, and so can be easily updated. The LEP experiments (L3, OPAL, ALEPH) share a 23% correlated uncertainty in the normalization of the leptonic branching fraction. They use the partial decay rate for $Z \to c\overline{c}$ and the D_s^+ production rate in $Z \to c\overline{c}$ events, which in turn depends on the assumed value of $\mathrm{B}(D_s^+ \to \phi\pi^+)$.

We determine an average value of f_{D_s} from the above-mentioned five most precise measurements of the $D_s^+ \to \ell^+\nu_\ell$ branching fractions, assuming lepton universality, taking into account correlated uncertainties, and using a consistent and up-to-date set of input parameters [2] for the μ, τ, and D_s^+ masses, the D_s^+ lifetime, V_{cs}, $\mathrm{B}(D_s^+ \to \phi\pi^+)$, and other relevant branching fractions. Although the uncertainty on $\mathrm{B}(D_s^+ \to \phi\pi^+)$ is by far the largest uncertainty, we also take into account correlated uncertainties in other input parameters. Using both $D_s^+ \to \mu^+\nu_\mu$ and $D_s^+ \to \tau^+\nu_\tau$ branching fractions, and assuming lepton universality, we obtain

$$\mathrm{B}(D_s^+ \to \mu^+\nu_\mu) = 0.0074 \pm 0.0013 \; . \qquad (2)$$

Using this value (which is not the same as the $D_s^+ \to \mu^+\nu_\mu$ branching fraction in our Summary Tables, because we do not there use lepton universality), and including the relatively minor uncertainties on the other parameters in Eq. (1), we extract the world average D_s^+ decay constant:

$$f_{D_s} = (294 \pm 27) \;\; \mathrm{MeV} \; . \qquad (3)$$

References

1. See the note on "Pseudoscalar-Meson Decay Constants" at the beginning of the Meson Particle Listings.
2. This *Review*.

$\Gamma(\mu^+\nu_\mu)/\Gamma_{\text{total}}$ **Γ_7/Γ**

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT

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

$0.0068 \pm 0.0011 \pm 0.0018$	553	[5] HEISTER	02I	ALEP	Z decays
$0.015\ {}^{+0.013}_{-0.006}\ {}^{+0.003}_{-0.002}$	3	[6] BAI	95	BES	$e^+e^- \rightarrow D_s^+ D_s^-$
$0.004\ {}^{+0.0018}_{-0.0014}\ {}^{+0.0020}_{-0.0019}$	8	[7] AOKI	93	WA75	π^- emulsion 350 GeV
<0.03	0	[8] AUBERT	83	SPEC	μ^+ Fe, 250 GeV

[5] 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.

[6] BAI 95 uses one actual $D_s^+ \rightarrow \mu^+\nu_\mu$ event together with two $D_s^+ \rightarrow \tau^+\nu_\tau$ events and assumes μ-τ universality. This value of $\Gamma(\mu^+\nu_\mu)/\Gamma_{\text{total}}$ gives a pseudoscalar decay constant of $(430^{+150}_{-130} \pm 40)$ MeV.

[7] AOKI 93 assumes the ratio of production cross sections of the D_s^+ and D^0 is 0.27. The value of $\Gamma(\mu^+\nu_\mu)/\Gamma_{\text{total}}$ gives a pseudoscalar decay constant $f_{D_s} = (232 \pm 45 \pm 52)$ MeV.

[8] AUBERT 83 assume that the $D_s^\pm$ production rate is 20% of total charm production rate.

$\Gamma(\mu^+\nu_\mu)/\Gamma(\phi\pi^+)$ Γ_7/Γ_{15}

VALUE	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
0.14 ±0.04 OUR FIT	Error includes scale factor of 1.4.				
0.19 ±0.04 OUR AVERAGE					
$0.23 \pm 0.06 \pm 0.04$	18	[9] ALEXANDROV	00	BEAT	π^- nucleus, 350 GeV
$0.173 \pm 0.023 \pm 0.035$	182	[10] CHADHA	98	CLE2	$e^+e^- \approx \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$0.245 \pm 0.052 \pm 0.074$	39	[11] ACOSTA	94	CLE2	See CHADHA 98

[9] 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.

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

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

$\Gamma(\mu^+\nu_\mu)/\Gamma(\phi\ell^+\nu_\ell)$ Γ_7/Γ_9

$\Gamma(\phi\ell^+\nu_\ell)$ is an average of $\Gamma(\phi e^+\nu_e)$ and $\Gamma(\phi\mu^+\nu_\mu)$

VALUE	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
0.25±0.07 OUR FIT	Error includes scale factor of 1.5.				
0.16±0.06±0.03	23	[12] KODAMA	96	E653	π^- emulsion, 600 GeV

[12] KODAMA 96 obtains $f_{D_s} = (194 \pm 35 \pm 20 \pm 14)$ MeV from this measurement, using $\Gamma(D_s^+ \rightarrow \phi\ell^+\nu)/\Gamma_{\text{total}} = 0.0188 \pm 0.0029$. The third error is from the uncertainty on $\phi\ell^+\nu_\ell$ branching fraction.

$\Gamma(\tau^+\nu_\tau)/\Gamma_{total}$ Γ_8/Γ

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.064 ±0.015 OUR AVERAGE					
0.0579±0.0077±0.0184	881	[13] HEISTER	02I	ALEP	Z decays
0.070 ±0.021 ±0.020	22	[14] ABBIENDI	01L	OPAL	$D_s^{*+} \to \gamma D_s^+$ from Z's
0.074 ±0.028 ±0.024	16	[15] ACCIARRI	97F	L3	$D_s^{*+} \to \gamma D_s^+$ from Z's

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

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

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

$\Gamma(\phi\ell^+\nu_\ell)/\Gamma(\phi\pi^+)$ Γ_9/Γ_{15}

For now, we average together measurements of the $\Gamma(\phi e^+\nu_e)/\Gamma(\phi\pi^+)$ and $\Gamma(\phi\mu^+\nu_\mu)/\Gamma(\phi\pi^+)$ ratios. See the end of the D_s^+ Listings for measurements of $D_s^+ \to \phi\ell^+\nu_\ell$ form-factor ratios.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.55 ±0.04 OUR FIT					
0.54 ±0.04 OUR AVERAGE					
0.540±0.033±0.048	793	LINK	02J	FOCS	Uses $\phi\mu^+\nu_\mu$
0.54 ±0.05 ±0.04	367	BUTLER	94	CLE2	Uses $\phi e^+\nu_e$ and $\phi\mu^+\nu_\mu$
0.58 ±0.17 ±0.07	97	FRABETTI	93G	E687	Uses $\phi\mu^+\nu_\mu$
0.57 ±0.15 ±0.15	104	ALBRECHT	91	ARG	Uses $\phi e^+\nu_e$
0.49 ±0.10 $^{+0.10}_{-0.14}$	54	ALEXANDER	90B	CLEO	Uses $\phi e^+\nu_e$ and $\phi\mu^+\nu_\mu$

$\Gamma(\eta\ell^+\nu_\ell)/\Gamma(\phi\ell^+\nu_\ell)$ Γ_{11}/Γ_9

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
1.27±0.19 OUR FIT					
1.24±0.12±0.15	440	[16] BRANDENB...	95	CLE2	$e^+e^- \approx \Upsilon(4S)$

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

$\Gamma(\eta'(958)\ell^+\nu_\ell)/\Gamma(\phi\ell^+\nu_\ell)$ Γ_{12}/Γ_9

Unseen decay modes of the resonances are included.

VALUE	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
0.44±0.13 OUR FIT						
0.43±0.11±0.07		29	[17] BRANDENB...	95	CLE2	$e^+e^- \approx \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<1.6	90		[18] KODAMA	93B	E653	π^- emulsion 600 GeV

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

[18] KODAMA 93B uses μ^+ events.

$[\Gamma(\eta \ell^+ \nu_\ell) + \Gamma(\eta'(958) \ell^+ \nu_\ell)]/\Gamma(\phi \ell^+ \nu_\ell)$ $\Gamma_{10}/\Gamma_9 = (\Gamma_{11}+\Gamma_{12})/\Gamma_9$

Unseen decay modes of the resonances are included.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
1.72±0.23 OUR FIT					
3.9 ±1.6	13	[19] KODAMA	93	E653	π^- emulsion 600 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
1.67±0.17±0.17		[20] BRANDENB...	95	CLE2	$e^+e^- \approx \Upsilon(4S)$

[19] KODAMA 93 uses μ^+ events.
[20] This BRANDENBURG 95 data is redundant with data in previous blocks.

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

$\Gamma(K^+\overline{K}^0)/\Gamma(\phi\pi^+)$ Γ_{13}/Γ_{15}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
1.01±0.16 OUR AVERAGE					
1.15±0.31±0.19	68	ANJOS	90C	E691	γ Be
0.92±0.32±0.20		ADLER	89B	MRK3	e^+e^- 4.14 GeV
0.99±0.17±0.10		CHEN	89	CLEO	e^+e^- 10 GeV

$\Gamma(\phi\pi^+)/\Gamma_{total}$ Γ_{15}/Γ

We now have model-independent measurements of this branching fraction, and so we no longer use the earlier, model-dependent results.

VALUE (units 10^{-2})	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
4.4 ±0.6 OUR FIT Error includes scale factor of 1.1.						
4.4 ±0.6 OUR AVERAGE Error includes scale factor of 1.1.						
4.81±0.52±0.38		212 ± 19	[21] AUBERT	05V	BABR	$e^+e^- \approx \Upsilon(4S)$
3.59±0.77±0.48			[22] ARTUSO	96	CLE2	e^+e^- at $\Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •						
$3.9\ ^{+5.1}_{-1.9}\ ^{+1.8}_{-1.1}$			[23] BAI	95C	BES	e^+e^- 4.03 GeV
5.1 ±0.4 ±0.8			[24] BUTLER	94	CLE2	$e^+e^- \approx \Upsilon(4S)$
<4.8	90		MUHEIM	94		
4.6 ±1.5			[25] MUHEIM	94		
3.1 ±0.9			[25] MUHEIM	94		
3.1 ±0.9 ±0.6			[24] FRABETTI	93G	E687	γBe $\overline{E}_\gamma$= 220 GeV
2.4 ±1.0			[24] ALBRECHT	91	ARG	$e^+e^- \approx$ 10.4 GeV
<4.1	90	0	[23] ADLER	90B	MRK3	e^+e^- 4.14 GeV
$3.1\ \pm0.6\ ^{+1.1}_{-0.9}$			[24] ALEXANDER	90B	CLEO	e^+e^- 10.5–11 GeV
4.8 ±1.7 ±1.9			[26] ALVAREZ	90C	NA14	Photoproduction
>3.4	90		[24] ANJOS	90B	E691	γBe, $\overline{E}_\gamma \approx$ 145 GeV
2 ±1		405	[27] CHEN	89	CLEO	e^+e^- 10 GeV
3.3 ±1.6 ±1.0		9	[27] BRAUNSCH...	87	TASS	e^+e^- 35–44 GeV
3.3 ±0.1		30	[27] DERRICK	85B	HRS	e^+e^- 29 GeV

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

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

[23] BAI 95C uses $e^+e^- \to D_s^+ D_s^-$ events in which one or both of the $D_s^\pm$ are observed to obtain the first model-independent measurement of the $D_s^+ \to \phi\pi^+$ branching fraction, without assumptions about $\sigma(D_s^\pm)$. However, with only two "doubly-tagged" events, the statistical error is very large. ADLER 90B used the same method to set a limit.

[24] BUTLER 94, FRABETTI 93G, ALBRECHT 91, ALEXANDER 90B, and ANJOS 90B measure the ratio $\Gamma(D_s^+ \to \phi\ell^+\nu_\ell)/\Gamma(D_s^+ \to \phi\pi^+)$, where $\ell = e$ and/or μ, and then use a theoretical calculation of the ratio of widths $\Gamma(D_s^+ \to \phi\ell^+\nu_\ell)/\Gamma(D^+ \to \overline{K}^{*0}\ell^+\nu)$. Not everyone uses the same value for this ratio.

[25] The two MUHEIM 94 values here are model-dependent calculations based on distinct data sets. The first uses measurements of the $D_2^*(2460)^0$ and $D_{s1}(2536)^+$, the second uses B-decay factorization and $\Gamma(D_s^+ \to \mu^+\nu_\mu)/\Gamma(D_s^+ \to \phi\ell^+\nu_\ell)$. A third calculation using the semileptonic width of $D_s^+ \to \phi\ell^+\nu_\ell$ is not independent of other results listed here. Note also the upper limit, based on the sum of established D_s^+ branching ratios.

[26] ALVAREZ 90C relies on the Lund model to estimate the ratio of D_s^+ to D^+ cross sections.

[27] Values based on crude estimates of the $D_s^\pm$ production level. DERRICK 85B errors are statistical only.

$\Gamma(\phi\pi^+, \phi \to K^+K^-)/\Gamma(\phi\pi^+)$ $\qquad \Gamma_{16}/\Gamma_{15}$

VALUE	DOCUMENT ID	
0.491±0.006 OUR FIT		
0.491±0.006	[28] PDG	06

[28] This is, of course, just the $\phi \to K^+K^-$ branching fraction, but we need it to connect other modes in the fit.

$\Gamma(\phi\pi^+, \phi \to K^+K^-)/\Gamma(K^+K^-\pi^+)$ $\qquad \Gamma_{16}/\Gamma_{14}$

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

VALUE	DOCUMENT ID		TECN	COMMENT
0.42 ±0.05 OUR FIT				
0.396±0.033±0.047	FRABETTI	95B	E687	Dalitz fit, 701 evts

$\Gamma(K^+\overline{K}^*(892)^0, \overline{K}^{*0} \to K^-\pi^+)/\Gamma(K^+K^-\pi^+)$ $\qquad \Gamma_{18}/\Gamma_{14}$

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

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

$\Gamma\big(K^+\overline{K}^*(892)^0\big)/\Gamma\big(\phi\pi^+\big)$ — Γ_{17}/Γ_{15}

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$0.85\pm0.34\pm0.20$	9	ALVAREZ	90C	NA14	Photoproduction
$0.84\pm0.30\pm0.22$		ADLER	89B	MRK3	e^+e^- 4.14 GeV
$1.05\pm0.17\pm0.12$		CHEN	89	CLEO	e^+e^- 10 GeV
$0.87\pm0.13\pm0.05$	117	ANJOS	88	E691	Photoproduction
1.44 ± 0.37	87	ALBRECHT	87F	ARG	e^+e^- 10 GeV

$\Gamma\big(f_0(980)\pi^+,\ f_0\to K^+K^-\big)/\Gamma\big(K^+K^-\pi^+\big)$ — Γ_{19}/Γ_{14}

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

VALUE	DOCUMENT ID		TECN	COMMENT
$0.11\pm0.035\pm0.026$	FRABETTI	95B	E687	Dalitz fit, 701 evts

$\Gamma\big(f_0(1710)\pi^+,\ f_0\to K^+K^-\big)/\Gamma\big(K^+K^-\pi^+\big)$ — Γ_{21}/Γ_{14}

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

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
$0.034\pm0.023\pm0.035$	[29] FRABETTI	95B	E687	Dalitz fit, 701 evts

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

$\Gamma\big(K^+\overline{K}^*_0(1430)^0,\ \overline{K}^*_0\to K^-\pi^+\big)/\Gamma\big(K^+K^-\pi^+\big)$ — Γ_{20}/Γ_{14}

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

VALUE	DOCUMENT ID		TECN	COMMENT
$0.093\pm0.032\pm0.032$	FRABETTI	95B	E687	Dalitz fit, 701 evts

$\Gamma\big(K^+K^-\pi^+\,\text{nonresonant}\big)/\Gamma\big(\phi\pi^+\big)$ — Γ_{22}/Γ_{15}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$0.25\pm0.07\pm0.05$	48	ANJOS	88	E691	Photoproduction

$\Gamma\big(K^*(892)^+\overline{K}^0\big)/\Gamma\big(\phi\pi^+\big)$ — Γ_{24}/Γ_{15}

Unseen decay modes of the resonances are included.

VALUE	DOCUMENT ID		TECN	COMMENT
$1.20\pm0.21\pm0.13$	CHEN	89	CLEO	e^+e^- 10 GeV

$\Gamma\big(K^*(892)^+\overline{K}^0\big)/\Gamma\big(K^+\overline{K}^0\big)$ — Γ_{24}/Γ_{13}

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

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.9	90	FRABETTI	95	E687	γ Be $\overline{E}_\gamma \approx$ 200 GeV

$\Gamma\big(\phi\pi^+\pi^0\big)/\Gamma\big(\phi\pi^+\big)$ — Γ_{26}/Γ_{15}

VALUE	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
$2.4\pm1.0\pm0.5$		11	ANJOS	89E	E691	Photoproduction
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<2.6	90		ALVAREZ	90C	NA14	Photoproduction

$\Gamma(\phi\rho^+)/\Gamma(\phi\pi^+)$ — Γ_{27}/Γ_{15}

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

$\Gamma(\phi\pi^+\pi^0\ \text{3-body})/\Gamma(\phi\pi^+)$ — Γ_{28}/Γ_{15}

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

$\Gamma(K^+K^-\pi^+\pi^0\ \text{non-}\phi)/\Gamma(\phi\pi^+)$ — Γ_{29}/Γ_{15}

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

$\Gamma(K^+\overline{K}^0\pi^+\pi^-)/\Gamma(K^0K^-\pi^+\pi^+)$ — Γ_{30}/Γ_{31}

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

$\Gamma(K^0K^-\pi^+\pi^+)/\Gamma(\phi\pi^+)$ — Γ_{31}/Γ_{15}

VALUE	DOCUMENT ID		TECN	COMMENT
1.2±0.2 ±0.2	ALBRECHT	92B	ARG	$e^+e^- \simeq$ 10.4 GeV

$\Gamma(K^*(892)^+\overline{K}^*(892)^0)/\Gamma(\phi\pi^+)$ — Γ_{32}/Γ_{15}

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

$\Gamma(K^0K^-\pi^+\pi^+(\text{non-}K^{*+}\overline{K}^{*0}))/\Gamma(\phi\pi^+)$ — Γ_{33}/Γ_{15}

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

$\Gamma(K^+K^-\pi^+\pi^+\pi^-)/\Gamma(K^+K^-\pi^+)$ — Γ_{34}/Γ_{14}

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

$\Gamma(\phi\pi^+\pi^+\pi^-)/\Gamma(\phi\pi^+)$ — Γ_{35}/Γ_{15}

VALUE	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
0.269±0.027 OUR AVERAGE						
0.249±0.024±0.021		136	LINK	03D	FOCS	γ A, $\overline{E}_\gamma \approx$ 180 GeV
0.28 ±0.06 ±0.01		40	FRABETTI	97C	E687	γBe, $\overline{E}_\gamma \approx$ 200 GeV
0.58 ±0.21 ±0.10		21	FRABETTI	92	E687	γBe
0.42 ±0.13 ±0.07		19	ANJOS	88	E691	Photoproduction
1.11 ±0.37 ±0.28		62	ALBRECHT	85D	ARG	e^+e^- 10 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •						
<0.24	90		ALVAREZ	90C	NA14	Photoproduction

$\Gamma(\phi\pi^+\pi^+\pi^-)/\Gamma(K^+K^-\pi^+\pi^+\pi^-)$ — Γ_{35}/Γ_{34}

Unseen decay modes of the ϕ are included.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.42±0.10±0.12	136	[30] LINK	03D	FOCS	γ A, $\overline{E}_\gamma \approx$ 180 GeV

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

$\Gamma(K^+K^-\rho^0\pi^+\text{ non-}\phi)/\Gamma(K^+K^-\pi^+\pi^+\pi^-)$ — Γ_{36}/Γ_{34}

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

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

Unseen decay modes of the ϕ are included.

VALUE	DOCUMENT ID		TECN	COMMENT
1.50±0.12±0.08	LINK	03D	FOCS	γ A, $\overline{E}_\gamma \approx$ 180 GeV

$\Gamma(\phi a_1(1260)^+)/\Gamma(K^+K^-\pi^+)$ — Γ_{38}/Γ_{14}

Unseen decay modes of the ϕ and $a_1(1260)^+$ are included.

VALUE	DOCUMENT ID		TECN	COMMENT
0.559±0.078±0.044	LINK	03D	FOCS	γ A, $\overline{E}_\gamma \approx$ 180 GeV

$\Gamma(K^+K^-\pi^+\pi^+\pi^-\text{ nonresonant})/\Gamma(K^+K^-\pi^+\pi^+\pi^-)$ — Γ_{39}/Γ_{34}

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

$\Gamma(K^0_S K^0_S\pi^+\pi^+\pi^-)/\Gamma(K^0K^-\pi^+\pi^+)$ — Γ_{40}/Γ_{31}

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

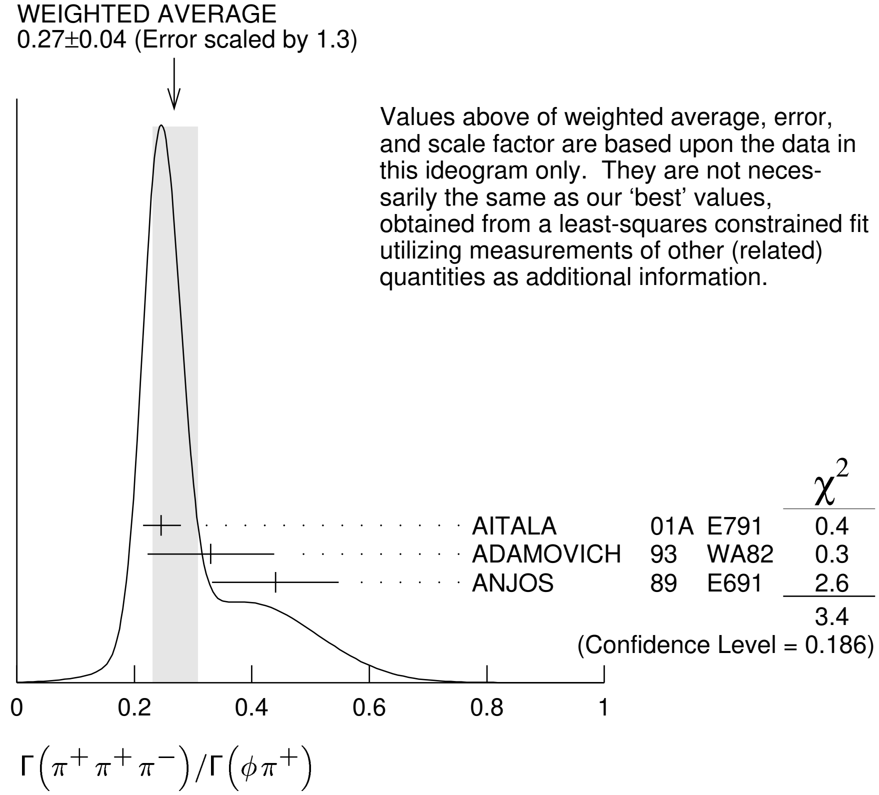
Pionic modes

$\Gamma(\pi^+\pi^+\pi^-)/\Gamma(K^+K^-\pi^+)$ — Γ_{41}/Γ_{14}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.235±0.035 OUR FIT Error includes scale factor of 1.1.					
0.265±0.041±0.031	98	FRABETTI	97D	E687	γ Be $\approx$ 200 GeV

$\Gamma(\pi^+\pi^+\pi^-)/\Gamma(\phi\pi^+)$ — Γ_{41}/Γ_{15}

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.277±0.035 OUR FIT Error includes scale factor of 1.3.					
0.27 ±0.04 OUR AVERAGE Error includes scale factor of 1.3. See the ideogram below.					
$0.245\pm0.028^{+0.019}_{-0.012}$	848	AITALA	01A	E791	π^- nucleus, 500 GeV
0.33 ±0.10 ±0.04	29	ADAMOVICH	93	WA82	π^- 340 GeV
0.44 ±0.10 ±0.04	68	ANJOS	89	E691	Photoproduction



$\Gamma(\rho^0\pi^+)/\Gamma(\pi^+\pi^+\pi^-)$ Γ_{42}/Γ_{41}

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$0.058 \pm 0.023 \pm 0.037$		AITALA	01A	E791	Dalitz fit, 848 evts
<0.073	90	FRABETTI	97D	E687	γ Be $\approx$ 200 GeV

$\Gamma(\rho^0\pi^+)/\Gamma(\phi\pi^+)$ Γ_{42}/Γ_{15}

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

$\Gamma(\pi^+(\pi^+\pi^-)_{S-\text{wave}})/\Gamma(\pi^+\pi^+\pi^-)$ Γ_{43}/Γ_{41}

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

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

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

$\Gamma(f_0(980)\pi^+ , f_0 \to \pi^+\pi^-)/\Gamma(\pi^+\pi^+\pi^-)$ — Γ_{44}/Γ_{41}

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

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

$\Gamma(f_2(1270)\pi^+ , f_2 \to \pi^+\pi^-)/\Gamma(\pi^+\pi^+\pi^-)$ — Γ_{47}/Γ_{41}

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

VALUE	DOCUMENT ID		TECN	COMMENT
$0.0974 \pm 0.0449 \pm 0.0294$	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

$\Gamma(f_0(1370)\pi^+ , f_0 \to \pi^+\pi^-)/\Gamma(\pi^+\pi^+\pi^-)$ — Γ_{45}/Γ_{41}

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

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

$\Gamma(\rho(1450)^0\pi^+ , \rho^0 \to \pi^+\pi^-)/\Gamma(\pi^+\pi^+\pi^-)$ — Γ_{48}/Γ_{41}

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

VALUE	DOCUMENT ID		TECN	COMMENT
$0.0656 \pm 0.0343 \pm 0.0440$	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

$\Gamma(f_0(1500)\pi^+ , f_0 \to \pi^+\pi^-)/\Gamma(\pi^+\pi^+\pi^-)$ — Γ_{46}/Γ_{41}

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

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

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

$\Gamma(\pi^+\pi^+\pi^- \text{ nonresonant})/\Gamma(\pi^+\pi^+\pi^-)$ — Γ_{49}/Γ_{41}

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

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$0.005 \pm 0.014 \pm 0.017$		AITALA	01A	E791	π^- nucleus, 500 GeV
<0.269	90	FRABETTI	97D	E687	γ Be $\approx$ 200 GeV

$\Gamma(\pi^+\pi^+\pi^-\pi^0)/\Gamma(\phi\pi^+)$ — Γ_{50}/Γ_{15}

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

$\Gamma(\eta\pi^+)/\Gamma(\phi\pi^+)$ — Γ_{51}/Γ_{15}

Unseen decay modes of the resonances are included.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.48±0.03±0.04	920	JESSOP	98	CLE2	$e^+e^- \approx \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
0.54±0.09±0.06	165	ALEXANDER	92	CLE2	See JESSOP 98

$\Gamma(\omega\pi^+)/\Gamma(\eta\pi^+)$ — Γ_{52}/Γ_{51}

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

$\Gamma(3\pi^+2\pi^-)/\Gamma(K^+K^-\pi^+)$ — Γ_{53}/Γ_{14}

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

$\Gamma(\eta\rho^+)/\Gamma(\phi\pi^+)$ — Γ_{55}/Γ_{15}

Unseen decay modes of the resonances are included.

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

$\Gamma(\eta\pi^+\pi^0\ \text{3-body})/\Gamma(\phi\pi^+)$ — Γ_{56}/Γ_{15}

Unseen decay modes of the resonances are included.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<1.1	90	JESSOP	98	CLE2	$e^+e^- \approx \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.82	90	[33] DAOUDI	92	CLE2	See JESSOP 98

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

$\Gamma(3\pi^+2\pi^-\pi^0)/\Gamma_{\text{total}}$ — Γ_{57}/Γ

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

$\Gamma(\eta'(958)\pi^+)/\Gamma(\phi\pi^+)$ — Γ_{58}/Γ_{15}

Unseen decay modes of the resonances are included.

VALUE	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
1.08±0.09 OUR AVERAGE						
1.03±0.06±0.07		537	JESSOP	98	CLE2	$e^+e^- \approx \Upsilon(4S)$
$2.5\pm1.0^{+1.5}_{-0.4}$		22	ALVAREZ	91	NA14	Photoproduction
2.5 ±0.5 ±0.3		215	ALBRECHT	90D	ARG	$e^+e^- \approx$ 10.4 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •						
1.20±0.15±0.11		281	ALEXANDER	92	CLE2	See JESSOP 98
<1.3	90		ANJOS	91B	E691	γBe, $\overline{E}_\gamma \approx$ 145 GeV

$\Gamma(\eta'(958)\rho^+)/\Gamma(\phi\pi^+)$ — Γ_{60}/Γ_{15}

Unseen decay modes of the resonances are included.

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

$\Gamma(\eta'(958)\pi^+\pi^0 \text{ 3-body})/\Gamma(\phi\pi^+)$ — Γ_{61}/Γ_{15}

Unseen decay modes of the resonances are included.

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

Modes with one or three K's

$\Gamma(K^0\pi^+)/\Gamma(\phi\pi^+)$ — Γ_{62}/Γ_{15}

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.21	90	ADLER	89B	MRK3	e^+e^- 4.14 GeV

$\Gamma(K^0\pi^+)/\Gamma(K^+\overline{K}^0)$ — Γ_{62}/Γ_{13}

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.53	90	FRABETTI	95	E687	γ Be, $\overline{E}_\gamma \approx 200$ GeV

$\Gamma(K^+\pi^+\pi^-)/\Gamma(K^+K^-\pi^+)$ — Γ_{63}/Γ_{14}

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

$\Gamma(K^+\pi^+\pi^-)/\Gamma(\phi\pi^+)$ — Γ_{63}/Γ_{15}

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

$\Gamma(K^+\rho^0)/\Gamma(K^+\pi^+\pi^-)$ — Γ_{64}/Γ_{63}

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

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

$\Gamma(K^+\rho(1450)^0, \rho^0 \to \pi^+\pi^-)/\Gamma(K^+\pi^+\pi^-)$ — Γ_{65}/Γ_{63}

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

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

$\Gamma(K^*(892)^0\pi^+, K^{*0} \to K^+\pi^-)/\Gamma(K^+\pi^+\pi^-)$ — Γ_{66}/Γ_{63}

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

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

$\Gamma(K^*(1410)^0\pi^+, K^{*0} \to K^+\pi^-)/\Gamma(K^+\pi^+\pi^-)$ — Γ_{67}/Γ_{63}

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

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

$\Gamma(K^*(1430)^0\pi^+, K^{*0} \to K^+\pi^-)/\Gamma(K^+\pi^+\pi^-)$ — Γ_{68}/Γ_{63}

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

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

$\Gamma(K^+\pi^+\pi^-$ nonresonant$)/\Gamma(K^+\pi^+\pi^-)$ — Γ_{69}/Γ_{63}

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

$\Gamma(K^+K^+K^-)/\Gamma(K^+K^-\pi^+)$ — Γ_{70}/Γ_{14}

VALUE (units 10^{-3})	EVTS	DOCUMENT ID		TECN	COMMENT
$\mathbf{8.95\pm2.12^{+2.24}_{-2.31}}$	31	LINK	02I	FOCS	γ nucleus, $\approx$ 180 GeV

$\Gamma(\phi K^+)/\Gamma(\phi\pi^+)$ — Γ_{71}/Γ_{15}

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

Doubly-Cabibbo-suppressed modes

$\Gamma(K^+K^+\pi^-)/\Gamma(K^+K^-\pi^+)$ — Γ_{72}/Γ_{14}

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

Rare or forbidden modes

$\Gamma(\pi^+e^+e^-)/\Gamma_{total}$ — Γ_{73}/Γ

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

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$\mathbf{<2.7\times10^{-4}}$	90	AITALA	99G	E791	π^-N 500 GeV

$\Gamma(\pi^+\mu^+\mu^-)/\Gamma_{total}$ — Γ_{74}/Γ

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

VALUE	CL%	EVTS	DOCUMENT ID		TECN	COMMENT
$\mathbf{<2.6\times10^{-5}}$	90		LINK	03F	FOCS	γ nucleus, $\overline{E}_\gamma \approx$ 180 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •						
$<1.4\times10^{-4}$	90		AITALA	99G	E791	π^-N 500 GeV
$<4.3\times10^{-4}$	90	0	KODAMA	95	E653	π^- emulsion 600 GeV

$\Gamma(K^+ e^+ e^-)/\Gamma_{total}$ Γ_{75}/Γ

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

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<1.6 × 10⁻³	90	AITALA	99G	E791	π^- N 500 GeV

$\Gamma(K^+ \mu^+ \mu^-)/\Gamma_{total}$ Γ_{76}/Γ

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

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

$\Gamma(K^*(892)^+ \mu^+ \mu^-)/\Gamma_{total}$ Γ_{77}/Γ

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

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

$\Gamma(\pi^+ e^\pm \mu^\mp)/\Gamma_{total}$ Γ_{78}/Γ

A test of lepton-family-number conservation.

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

$\Gamma(K^+ e^\pm \mu^\mp)/\Gamma_{total}$ Γ_{79}/Γ

A test of lepton-family-number conservation.

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

$\Gamma(\pi^- e^+ e^+)/\Gamma_{total}$ Γ_{80}/Γ

A test of lepton-number conservation.

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

$\Gamma(\pi^- \mu^+ \mu^+)/\Gamma_{total}$ Γ_{81}/Γ

A test of lepton-number conservation.

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

$\Gamma(\pi^- e^+ \mu^+)/\Gamma_{total}$ Γ_{82}/Γ

A test of lepton-number conservation.

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

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

A test of lepton-number conservation.

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

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

A test of lepton-number conservation.

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

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

A test of lepton-number conservation.

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

$\Gamma(K^*(892)^- \mu^+ \mu^+)/\Gamma_{total}$ Γ_{86}/Γ

A test of lepton-number conservation.

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

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

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

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

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

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

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
1.32 ±0.24 OUR AVERAGE	Error includes scale factor of 1.2.				
$0.713 \pm 0.202 \pm 0.284$	793	LINK	04C	FOCS	$\phi \mu^+ \nu_\mu$
$1.57 \pm 0.25 \pm 0.19$	271	AITALA	99D	E791	$\phi e^+ \nu_e$, $\phi \mu^+ \nu_\mu$
$1.4 \pm 0.5 \pm 0.3$	308	AVERY	94B	CLE2	$\phi e^+ \nu_e$
$1.1 \pm 0.8 \pm 0.1$	90	FRABETTI	94F	E687	$\phi \mu^+ \nu_\mu$
$2.1 {}^{+0.6}_{-0.5} \pm 0.2$	19	KODAMA	93	E653	$\phi \mu^+ \nu_\mu$

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
1.72 ±0.21 OUR AVERAGE					
1.549±0.250±0.148	793	LINK	04C	FOCS	$\phi\mu^+\nu_\mu$
2.27 ±0.35 ±0.22	271	AITALA	99D	E791	$\phi e^+\nu_e$, $\phi\mu^+\nu_\mu$
0.9 ±0.6 ±0.3	308	AVERY	94B	CLE2	$\phi e^+\nu_e$
1.8 ±0.9 ±0.2	90	FRABETTI	94F	E687	$\phi\mu^+\nu_\mu$
2.3 $^{+1.1}_{-0.9}$ ±0.4	19	KODAMA	93	E653	$\phi\mu^+\nu_\mu$

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

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.72±0.18 OUR AVERAGE					
1.0 ±0.3 ±0.2	308	AVERY	94B	CLE2	$\phi e^+\nu_e$
1.0 ±0.5 ±0.1	90	[34] FRABETTI	94F	E687	$\phi\mu^+\nu_\mu$
0.54±0.21±0.10	19	[34] KODAMA	93	E653	$\phi\mu^+\nu_\mu$

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

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ANJOS	91B	PR D43 R2063	J.C. Anjos *et al.*	(FNAL E691 Collab.)
COFFMAN	91	PL B263 135	D.M. Coffman *et al.*	(Mark III Collab.)
ADLER	90B	PRL 64 169	J.C. Adler *et al.*	(Mark III Collab.)
ALBRECHT	90D	PL B245 315	H. Albrecht *et al.*	(ARGUS Collab.)
ALEXANDER	90B	PRL 65 1531	J. Alexander *et al.*	(CLEO Collab.)
ALVAREZ	90C	PL B246 261	M.P. Alvarez *et al.*	(CERN NA14/2 Collab.)
ANJOS	90B	PRL 64 2885	J.C. Anjos *et al.*	(FNAL E691 Collab.)
ANJOS	90C	PR D41 2705	J.C. Anjos *et al.*	(FNAL E691 Collab.)
BAI	90	PRL 65 686	Z. Bai *et al.*	(Mark III Collab.)
BARLAG	90C	ZPHY C46 563	S. Barlag *et al.*	(ACCMOR Collab.)
FRABETTI	90	PL B251 639	P.L. Frabetti *et al.*	(FNAL E687 Collab.)
ADLER	89B	PRL 63 1211	J. Adler *et al.*	(Mark III Collab.)
Also		PRL 63 2858 (erratum)	J. Adler *et al.*	(Mark III Collab.)
ANJOS	89	PRL 62 125	J.C. Anjos *et al.*	(FNAL E691 Collab.)
ANJOS	89E	PL B223 267	J.C. Anjos *et al.*	(FNAL E691 Collab.)
CHEN	89	PL B226 192	W.Y. Chen *et al.*	(CLEO Collab.)
ALBRECHT	88	PL B207 349	H. Albrecht *et al.*	(ARGUS Collab.)
ANJOS	88	PRL 60 897	J.C. Anjos *et al.*	(FNAL E691 Collab.)
RAAB	88	PR D37 2391	J.R. Raab *et al.*	(FNAL E691 Collab.)
ALBRECHT	87F	PL B179 398	H. Albrecht *et al.*	(ARGUS Collab.)
ALBRECHT	87G	PL B195 102	H. Albrecht *et al.*	(ARGUS Collab.)
BECKER	87B	PL B184 277	H. Becker *et al.*	(NA11 and NA32 Collab.)
BLAYLOCK	87	PRL 58 2171	G.T. Blaylock *et al.*	(Mark III Collab.)
BRAUNSCH...	87	ZPHY C35 317	W. Braunschweig *et al.*	(TASSO Collab.)
USHIDA	86	PRL 56 1767	N. Ushida *et al.*	(FNAL E531 Collab.)
ALBRECHT	85D	PL 153B 343	H. Albrecht *et al.*	(ARGUS Collab.)
DERRICK	85B	PRL 54 2568	M. Derrick *et al.*	(HRS Collab.)
AIHARA	84D	PRL 53 2465	H. Aihara *et al.*	(TPC Collab.)
ALTHOFF	84	PL 136B 130	M. Althoff *et al.*	(TASSO Collab.)
BAILEY	84	PL 139B 320	R. Bailey *et al.*	(ACCMOR Collab.)
AUBERT	83	NP B213 31	J.J. Aubert *et al.*	(EMC Collab.)
CHEN	83C	PRL 51 634	A. Chen *et al.*	(CLEO Collab.)

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