τ – THIS IS PART 1 OF 4

To reduce the size of this section's PostScript file, we have divided it into four PostScript files. We present the following index:

PART 1

PART 2

PART 3

PART 4

τ

$J = \frac{1}{2}$

τ discovery paper was PERL 75. $e^+ e^- \to \tau^+ \tau^-$ cross-section threshold behavior and magnitude are consistent with pointlike spin-1/2 Dirac particle. BRANDELIK 78 ruled out pointlike spin-0 or spin-1 particle. FELDMAN 78 ruled out $J = 3/2$. KIRKBY 79 also ruled out J=integer, $J = 3/2$.

τ MASS

VALUE (MeV)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
$1777.00^{+0.30}_{-0.27}$ OUR AVERAGE					
$1776.96^{+0.18}_{-0.21}{}^{+0.25}_{-0.17}$	65	[1] BAI	96	BES	E^{ee}_{cm}= 3.54–3.57 GeV
1777.8 $\pm$0.7 $\pm$1.7	35k	[2] BALEST	93	CLEO	E^{ee}_{cm}= 10.6 GeV
1776.3 $\pm$2.4 $\pm$1.4	11k	[3] ALBRECHT	92M	ARG	E^{ee}_{cm}= 9.4–10.6 GeV
$1783\ ^{+3}_{-4}$	692	[4] BACINO	78B	DLCO	E^{ee}_{cm}= 3.1–7.4 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$1776.9\ ^{+0.4}_{-0.5}$ $\pm$0.2	14	[5] BAI	92	BES	Repl. by BAI 96

[1] BAI 96 fit $\sigma(e^+ e^- \to \tau^+ \tau^-)$ at different energies near threshold.

[2] BALEST 93 fit spectra of minimum kinematically allowed τ mass in events of the type $e^+ e^- \to \tau^+ \tau^- \to (\pi^+ n\pi^0 \nu_\tau)(\pi^- m\pi^0 \nu_\tau)$ $n \leq 2$, $m \leq 2$, $1 \leq n+m \leq 3$. If $m_{\nu_\tau} \neq 0$, result increases by $(m^2_{\nu_\tau}/1100$ MeV).

[3] ALBRECHT 92M fit τ pseudomass spectrum in $\tau^- \to 2\pi^- \pi^+ \nu_\tau$ decays. Result assumes m_{ν_τ}=0.

[4] BACINO 78B value comes from $e^\pm X^\mp$ threshold. Published mass 1782 MeV increased by 1 MeV using the high precision $\psi(2S)$ mass measurement of ZHOLENTZ 80 to eliminate the absolute SPEAR energy calibration uncertainty.

[5] BAI 92 fit $\sigma(e^+ e^- \to \tau^+ \tau^-)$ near threshold using $e\mu$ events.

τ MEAN LIFE

VALUE (10^{-15} s)	*EVTS*	*DOCUMENT ID*		*TECN*	*COMMENT*
290.7$\pm$ 1.3 OUR AVERAGE					
291.4$\pm$ 3.0		ABREU	96B	DLPH	1991–1993 LEP runs
290.1$\pm$ 4.0	34k	ACCIARRI	96K	L3	1994 LEP run
289.2$\pm$ 1.7$\pm$ 1.2		ALEXANDER	96E	OPAL	1990–1994 LEP runs
289.0$\pm$ 2.8$\pm$ 4.0	57.4k	BALEST	96	CLEO	E^{ee}_{cm}= 10.6 GeV
293.7$\pm$ 2.7$\pm$ 1.6	42k	BUSKULIC	96B	ALEP	1989–1992 LEP runs
297 $\pm$ 9 $\pm$ 5	1671	ABE	95Y	SLD	1992–1993 SLC runs

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

293 $\pm$ 9 $\pm$12	5743	ADRIANI	93M	L3	1991 LEP run
304 $\pm$ 14 $\pm$ 7	4100	BATTLE	92	CLEO	E^{ee}_{cm}= 10.6 GeV
309 $\pm$ 23 $\pm$30	2817	ADEVA	91F	L3	1990 LEP run
301 $\pm$ 29	3780	KLEINWORT	89	JADE	E^{ee}_{cm}= 35–46 GeV
288 $\pm$ 16 $\pm$17	807	AMIDEI	88	MRK2	E^{ee}_{cm}= 29 GeV
306 $\pm$ 20 $\pm$14	695	BRAUNSCH...	88C	TASS	E^{ee}_{cm}= 36 GeV
299 $\pm$ 15 $\pm$10	1311	ABACHI	87C	HRS	E^{ee}_{cm}= 29 GeV
295 $\pm$ 14 $\pm$11	5696	ALBRECHT	87P	ARG	E^{ee}_{cm}= 9.3–10.6 GeV
309 $\pm$ 17 $\pm$ 7	3788	BAND	87B	MAC	E^{ee}_{cm}= 29 GeV
325 $\pm$ 14 $\pm$18	8470	BEBEK	87C	CLEO	E^{ee}_{cm}= 10.5 GeV
460 $\pm$190	102	FELDMAN	82	MRK2	E^{ee}_{cm}= 29 GeV

τ MAGNETIC MOMENT ANOMALY

$\mu_\tau/(e\hbar/2m_\tau)-1 = (g_\tau-2)/2$

For a theoretical calculation [$(g_\tau-2)/2 = 11773(3) \times 10^{-7}$], see SAMUEL 91B.

VALUE	*CL%*	*DOCUMENT ID*		*TECN*	*COMMENT*
<0.01	95	[6] ESCRIBANO	93	RVUE	$Z \to \tau^+\tau^-$ at LEP
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.12	90	GRIFOLS	91	RVUE	$Z \to \tau\tau\gamma$ at LEP
<0.023	95	[7] SILVERMAN	83	RVUE	$e^+e^- \to \tau^+\tau^-$ at PETRA

[6] ESCRIBANO 93 limit derived from $\Gamma(Z \to \tau^+\tau^-)$, and is on the absolute value of the magnetic moment anomaly.

[7] SILVERMAN 83 limit is derived from $e^+e^- \to \tau^+\tau^-$ total cross-section measurements for q^2 up to $(37\text{ GeV})^2$.

τ ELECTRIC DIPOLE MOMENT

A nonzero value is forbidden by both T invariance and P invariance.

VALUE (e cm)	*CL%*	*DOCUMENT ID*		*TECN*	*COMMENT*
$<5 \times 10^{-17}$	95	[8] ESCRIBANO	93	RVUE	$Z \to \tau^+\tau^-$ at LEP
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<7 \times 10^{-16}$	90	GRIFOLS	91	RVUE	$Z \to \tau\tau\gamma$ at LEP
$<1.6 \times 10^{-16}$	90	DELAGUILA	90	RVUE	$e^+e^- \to \tau^+\tau^-$ E^{ee}_{cm}= 35 GeV

[8] ESCRIBANO 93 limit derived from $\Gamma(Z \to \tau^+\tau^-)$, and is on the absolute value of the electric dipole moment.

τ WEAK DIPOLE MOMENT (d^w_τ)

A nonzero value is forbidden by CP invariance.

Re(d^w_τ)

VALUE (e cm)	*CL%*	*DOCUMENT ID*		*TECN*	*COMMENT*
$<0.78 \times 10^{-17}$	95	[9] AKERS	95F	OPAL	1991–1993 LEP runs

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

$<1.5 \times 10^{-17}$	95	[9] BUSKULIC	95C	ALEP	1990–1992 LEP runs
$<7.0 \times 10^{-17}$	95	[9] ACTON	92F	OPAL	$Z \rightarrow \tau^+\tau^-$ at LEP
$<3.7 \times 10^{-17}$	95	[9] BUSKULIC	92J	ALEP	Repl. by BUSKULIC 95C

[9] Limit is on the absolute value of the real part of the weak dipole moment, and applies for $q^2 = m_Z^2$.

$\mathrm{Im}(d_\tau^w)$

VALUE (e cm)	*CL%*	*DOCUMENT ID*		*TECN*	*COMMENT*
$<4.5 \times 10^{-17}$	95	[10] AKERS	95F	OPAL	1991–1993 LEP runs

[10] Limit is on the absolute value of the imaginary part of the weak dipole moment, and applies for $q^2 = m_Z^2$.

τ^- DECAY MODES

τ^+ modes are charge conjugates of the modes below. "$h^\pm$" stands for $\pi^\pm$ or $K^\pm$. "ℓ" stands for e or μ. "Neutral" means neutral hadron whose decay products include γ's and/or π^0's.

	Mode		Fraction (Γ_i/Γ)	Scale factor/ Confidence level
	Modes with one charged particle			
Γ_1	particle$^-$ ≥ 0 neutrals $\geq 0 K_L^0 \nu_\tau$ ("1-prong")		(84.96 ± 0.14) %	S=1.3
Γ_2	particle$^-$ ≥ 0 neutrals $\geq 0 K^0 \nu_\tau$		(85.53 ± 0.14) %	S=1.3
Γ_3	$\mu^- \overline{\nu}_\mu \nu_\tau$	[a]	(17.35 ± 0.10) %	
Γ_4	$\mu^- \overline{\nu}_\mu \nu_\tau \gamma$	[b]	$(3.0 \pm 0.6) \times 10^{-3}$	
Γ_5	$e^- \overline{\nu}_e \nu_\tau$	[a]	(17.83 ± 0.08) %	
Γ_6	$h^- \geq 0$ neutrals $\geq 0 K_L^0\ \nu_\tau$		(49.78 ± 0.17) %	S=1.2
Γ_7	$h^- \geq 0 K_L^0\ \nu_\tau$		(12.51 ± 0.13) %	S=1.1
Γ_8	$h^- \nu_\tau$		(12.03 ± 0.14) %	S=1.1
Γ_9	$\pi^- \nu_\tau$	[a]	(11.31 ± 0.15) %	S=1.1
Γ_{10}	$K^- \nu_\tau$	[a]	$(7.1 \pm 0.5) \times 10^{-3}$	
Γ_{11}	$h^- \geq 1 \pi^0 \nu_\tau$		(36.97 ± 0.18) %	S=1.1
Γ_{12}	$h^- \pi^0 \nu_\tau$		(25.76 ± 0.15) %	S=1.1
Γ_{13}	$\pi^- \pi^0 \nu_\tau$	[a]	(25.24 ± 0.16) %	S=1.1
Γ_{14}	$\pi^- \pi^0$ non-$\rho(770) \nu_\tau$		$(3.0 \pm 3.2) \times 10^{-3}$	
Γ_{15}	$K^- \pi^0 \nu_\tau$	[a]	$(5.2 \pm 0.5) \times 10^{-3}$	
Γ_{16}	$h^- \geq 2\pi^0 \nu_\tau$		(10.95 ± 0.16) %	S=1.1
Γ_{17}	$h^- 2\pi^0 \nu_\tau$		(9.50 ± 0.14) %	S=1.1

Γ_{18}	$h^- 2\pi^0 \nu_\tau$ (ex.K^0)		(9.35± 0.14) %	S=1.1
Γ_{19}	$\pi^- 2\pi^0 \nu_\tau$ (ex.K^0)	[a]	(9.27± 0.14) %	S=1.1
Γ_{20}	$K^- 2\pi^0 \nu_\tau$ (ex.K^0)	[a]	(8.1 ± 2.7) $\times 10^{-4}$	
Γ_{21}	$h^- \geq 3\pi^0 \nu_\tau$		(1.46± 0.11) %	S=1.1
Γ_{22}	$h^- 3\pi^0 \nu_\tau$		(1.28± 0.10) %	
Γ_{23}	$\pi^- 3\pi^0 \nu_\tau$ (ex.K^0)	[a]	(1.14± 0.14) %	
Γ_{24}	$K^- 3\pi^0 \nu_\tau$ (ex.K^0)	[a]	(5.0 $^{+10.0}_{-\ 3.3}$) $\times 10^{-4}$	
Γ_{25}	$h^- 4\pi^0 \nu_\tau$ (ex.K^0)		(1.8 ± 0.6) $\times 10^{-3}$	
Γ_{26}	$h^- 4\pi^0 \nu_\tau$ (ex.K^0,η)	[a]	(1.2 ± 0.6) $\times 10^{-3}$	
Γ_{27}	$K^- \geq 1$ (π^0 or K^0) ν_τ		(9.4 ± 1.0) $\times 10^{-3}$	
	Modes with K^0's			
Γ_{28}	$h^- \overline{K}^0 \geq 0$ neutrals $\geq 0 K^0_L \nu_\tau$		(1.54± 0.10) %	S=1.3
Γ_{29}	$h^- \overline{K}^0 \nu_\tau$		(9.2 ± 0.8) $\times 10^{-3}$	S=1.3
Γ_{30}	$\pi^- \overline{K}^0 \nu_\tau$	[a]	(7.7 ± 0.8) $\times 10^{-3}$	S=1.3
Γ_{31}	$\pi^- \overline{K}^0$ (non-$K^*(892)^-$)ν_τ		< 1.7 $\times 10^{-3}$	CL=95%
Γ_{32}	$K^- K^0 \nu_\tau$	[a]	(1.55± 0.28) $\times 10^{-3}$	
Γ_{33}	$h^- \overline{K}^0 \pi^0 \nu_\tau$		(5.5 ± 0.5) $\times 10^{-3}$	
Γ_{34}	$\pi^- \overline{K}^0 \pi^0 \nu_\tau$	[a]	(4.1 ± 0.6) $\times 10^{-3}$	
Γ_{35}	$K^- K^0 \pi^0 \nu_\tau$	[a]	(1.38± 0.32) $\times 10^{-3}$	
Γ_{36}	$h^- K^0_S K^0_S \nu_\tau$		(2.5 ± 0.6) $\times 10^{-4}$	
Γ_{37}	$\pi^- K^0 \overline{K}^0 \nu_\tau$	[a]	(1.01± 0.23) $\times 10^{-3}$	
Γ_{38}	$K^- K^0 \geq 0$ neutrals ν_τ		(2.9 ± 0.4) $\times 10^{-3}$	
Γ_{39}	$K^- \geq 0\pi^0 \geq 0K^0 \nu_\tau$		(1.65± 0.10) %	
Γ_{40}	K^0(particles)$^- \nu_\tau$		(1.58± 0.10) %	S=1.2
Γ_{41}	$K^0 h^+ h^- h^- \geq 0$ neut. ν_τ		< 1.7 $\times 10^{-3}$	CL=95%
	Modes with three charged particles			
Γ_{42}	$h^- h^- h^+ \geq$ 0neut. ν_τ ("3-prong")		(14.91± 0.14) %	S=1.3
Γ_{43}	$h^- h^- h^+ \geq$ 0 neutrals ν_τ (ex. $K^0_S \rightarrow \pi^+ \pi^-$)		(14.36± 0.14) %	S=1.3
Γ_{44}	$\pi^- \pi^+ \pi^- \geq 0$ neutrals ν_τ		(14.09± 0.31) %	
Γ_{45}	$h^- h^- h^+ \nu_\tau$		(9.80± 0.10) %	S=1.1
Γ_{46}	$h^- h^- h^+ \nu_\tau$ (ex.K^0)		(9.48± 0.10) %	S=1.1
Γ_{47}	$h^- h^- h^+ \nu_\tau$ (ex.K^0,ω)	[a]	(9.44± 0.10) %	S=1.1
Γ_{48}	$h^- h^- h^+ \geq 1$ neutrals ν_τ		(5.08± 0.11) %	S=1.2
Γ_{49}	$h^- h^- h^+ \geq 1$ neutrals ν_τ (ex. $K^0_S \rightarrow \pi^+ \pi^-$)		(4.88± 0.11) %	S=1.2
Γ_{50}	$h^- h^- h^+ \pi^0 \nu_\tau$		(4.44± 0.09) %	S=1.1
Γ_{51}	$h^- h^- h^+ \pi^0 \nu_\tau$ (ex.K^0)		(4.25± 0.09) %	S=1.1
Γ_{52}	$h^- h^- h^+ \pi^0 \nu_\tau$ (ex. K^0, ω)	[a]	(2.55± 0.09) %	
Γ_{53}	$h^- (\rho\pi)^0 \nu_\tau$		(2.84± 0.34) %	

Γ_{54}	$(a_1(1260)h)^- \nu_\tau$		< 2.0 %	CL=95%
Γ_{55}	$h^- \rho \pi^0 \nu_\tau$		(1.33 ± 0.20) %	
Γ_{56}	$h^- \rho^+ h^- \nu_\tau$		$(4.4 \pm 2.2) \times 10^{-3}$	
Γ_{57}	$h^- \rho^- h^+ \nu_\tau$		(1.15 ± 0.23) %	
Γ_{58}	$h^- h^- h^+ 2\pi^0 \nu_\tau$		$(5.2 \pm 0.5) \times 10^{-3}$	
Γ_{59}	$h^- h^- h^+ 2\pi^0 \nu_\tau (\text{ex.}K^0)$		$(5.1 \pm 0.5) \times 10^{-3}$	
Γ_{60}	$h^- h^- h^+ 2\pi^0 \nu_\tau (\text{ex.}K^0,\omega,\eta)$	[a]	$(1.0 \pm 0.4) \times 10^{-3}$	
Γ_{61}	$h^- h^- h^+ \geq 3\pi^0 \nu_\tau$	[a]	$(1.1 \pm 0.6) \times 10^{-3}$	
Γ_{62}	$K^- h^+ h^- \geq 0$ neutrals ν_τ		$< 6 \times 10^{-3}$	CL=90%
Γ_{63}	$K^- \pi^+ \pi^- \geq 0$ neut. ν_τ		$(3.9 {}^{+1.9}_{-1.6}) \times 10^{-3}$	S=1.5
Γ_{64}	$K^- \pi^+ K^- \geq 0$ neut. ν_τ		$< 9 \times 10^{-4}$	CL=95%
Γ_{65}	$K^- K^+ \pi^- \geq 0$ neut. ν_τ		$(1.5 {}^{+0.9}_{-0.8}) \times 10^{-3}$	
Γ_{66}	$K^- K^+ \pi^- \nu_\tau$		$(2.2 {}^{+1.8}_{-1.2}) \times 10^{-3}$	
Γ_{67}	$\phi \pi^- \nu_\tau$		$< 2.0 \times 10^{-4}$	CL=90%
Γ_{68}	$K^- K^+ K^- \geq 0$ neut. ν_τ		$< 2.1 \times 10^{-3}$	CL=95%
Γ_{69}	$\phi K^- \nu_\tau$		$< 6.7 \times 10^{-5}$	CL=90%
Γ_{70}	$\pi^- K^+ \pi^- \geq 0$ neut. ν_τ		$< 2.5 \times 10^{-3}$	CL=95%
Γ_{71}	$e^- e^- e^+ \overline{\nu}_e \nu_\tau$		$(2.8 \pm 1.5) \times 10^{-5}$	
Γ_{72}	$\mu^- e^- e^+ \overline{\nu}_\mu \nu_\tau$		$< 3.6 \times 10^{-5}$	CL=90%
	Modes with five charged particles			
Γ_{73}	$3h^- 2h^+ \geq 0$ neutrals ν_τ (ex. $K^0_S \to \pi^- \pi^+$) ("5-prong")		$(9.7 \pm 0.7) \times 10^{-4}$	
Γ_{74}	$3h^- 2h^+ \nu_\tau (\text{ex.}K^0)$	[a]	$(7.5 \pm 0.7) \times 10^{-4}$	
Γ_{75}	$3h^- 2h^+ \pi^0 \nu_\tau (\text{ex.}K^0)$	[a]	$(2.2 \pm 0.5) \times 10^{-4}$	
Γ_{76}	$3h^- 2h^+ 2\pi^0 \nu_\tau$		$< 1.1 \times 10^{-4}$	CL=90%
	Miscellaneous other allowed modes			
Γ_{77}	$(5\pi)^- \nu_\tau$		$(3.3 \pm 0.7) \times 10^{-3}$	
Γ_{78}	$4h^- 3h^+ \geq 0$ neutrals ν_τ ("7-prong")		$< 1.9 \times 10^{-4}$	CL=90%
Γ_{79}	$K^*(892)^- \geq 0 (h^0 \neq K^0_S) \nu_\tau$		(1.94 ± 0.31) %	
Γ_{80}	$K^*(892)^- \geq 0$ neutrals ν_τ		(1.33 ± 0.13) %	
Γ_{81}	$K^*(892)^- \nu_\tau$		(1.28 ± 0.08) %	
Γ_{82}	$K^*(892)^0 K^- \geq 0$ neutrals ν_τ		$(3.2 \pm 1.4) \times 10^{-3}$	
Γ_{83}	$K^*(892)^0 K^- \nu_\tau$		$(2.0 \pm 0.6) \times 10^{-3}$	
Γ_{84}	$\overline{K}^*(892)^0 \pi^- \geq 0$ neutrals ν_τ		$(3.8 \pm 1.7) \times 10^{-3}$	
Γ_{85}	$\overline{K}^*(892)^0 \pi^- \nu_\tau$		$(2.5 \pm 1.1) \times 10^{-3}$	
Γ_{86}	$K_1(1270)^- \nu_\tau$		$(4 \pm 4) \times 10^{-3}$	
Γ_{87}	$K_1(1400)^- \nu_\tau$		$(8 \pm 4) \times 10^{-3}$	

Γ_{88}	$K_2^*(1430)^- \nu_\tau$		$<$ 3	$\times 10^{-3}$	CL=95%
Γ_{89}	$a_0(980)^- \geq 0$ neutrals ν_τ				
Γ_{90}	$\eta \pi^- \nu_\tau$		$<$ 1.4	$\times 10^{-4}$	CL=95%
Γ_{91}	$\eta \pi^- \pi^0 \nu_\tau$	[a]	(1.71± 0.28)	$\times 10^{-3}$	
Γ_{92}	$\eta \pi^- \pi^0 \pi^0 \nu_\tau$		$<$ 4.3	$\times 10^{-4}$	CL=95%
Γ_{93}	$\eta K^- \nu_\tau$		(2.6 ± 0.7)	$\times 10^{-4}$	
Γ_{94}	$\eta \pi^+ \pi^- \pi^- \geq 0$ neutrals ν_τ		$<$ 3	$\times 10^{-3}$	CL=90%
Γ_{95}	$\eta \eta \pi^- \nu_\tau$		$<$ 1.1	$\times 10^{-4}$	CL=95%
Γ_{96}	$\eta \eta \pi^- \pi^0 \nu_\tau$		$<$ 2.0	$\times 10^{-4}$	CL=95%
Γ_{97}	$h^- \omega \geq 0$ neutrals ν_τ		(2.32± 0.11)	%	
Γ_{98}	$h^- \omega \nu_\tau$	[a]	(1.91± 0.09)	%	
Γ_{99}	$h^- \omega \pi^0 \nu_\tau$	[a]	(4.1 ± 0.6)	$\times 10^{-3}$	

Lepton Family number (*LF*), Lepton number (*L*), or Baryon number (*B*) violating modes (In the modes below, ℓ means a sum over *e* and μ modes)

L means lepton number violation (*e.g.* $\tau^- \rightarrow e^+ \pi^- \pi^-$). Following common usage, *LF* means lepton family violation *and not* lepton number violation (*e.g.* $\tau^- \rightarrow e^- \pi^+ \pi^-$).

Γ_{100}	$e^- \gamma$	*LF*	$<$ 2.7	$\times 10^{-6}$	CL=90%
Γ_{101}	$\mu^- \gamma$	*LF*	$<$ 3.0	$\times 10^{-6}$	CL=90%
Γ_{102}	$e^- \pi^0$	*LF*	$<$ 1.4	$\times 10^{-4}$	CL=90%
Γ_{103}	$\mu^- \pi^0$	*LF*	$<$ 4.4	$\times 10^{-5}$	CL=90%
Γ_{104}	$e^- K^0$	*LF*	$<$ 1.3	$\times 10^{-3}$	CL=90%
Γ_{105}	$\mu^- K^0$	*LF*	$<$ 1.0	$\times 10^{-3}$	CL=90%
Γ_{106}	$e^- \eta$	*LF*	$<$ 6.3	$\times 10^{-5}$	CL=90%
Γ_{107}	$\mu^- \eta$	*LF*	$<$ 7.3	$\times 10^{-5}$	CL=90%
Γ_{108}	$e^- \rho^0$	*LF*	$<$ 4.2	$\times 10^{-6}$	CL=90%
Γ_{109}	$\mu^- \rho^0$	*LF*	$<$ 5.7	$\times 10^{-6}$	CL=90%
Γ_{110}	$e^- K^*(892)^0$	*LF*	$<$ 6.3	$\times 10^{-6}$	CL=90%
Γ_{111}	$\mu^- K^*(892)^0$	*LF*	$<$ 9.4	$\times 10^{-6}$	CL=90%
Γ_{112}	$\pi^- \gamma$	*L*	$<$ 2.8	$\times 10^{-4}$	CL=90%
Γ_{113}	$\pi^- \pi^0$	*L*	$<$ 3.7	$\times 10^{-4}$	CL=90%
Γ_{114}	$e^- e^+ e^-$	*LF*	$<$ 3.3	$\times 10^{-6}$	CL=90%
Γ_{115}	$e^- \mu^+ \mu^-$	*LF*	$<$ 3.6	$\times 10^{-6}$	CL=90%
Γ_{116}	$e^+ \mu^- \mu^-$	*LF*	$<$ 3.5	$\times 10^{-6}$	CL=90%
Γ_{117}	$\mu^- e^+ e^-$	*LF*	$<$ 3.4	$\times 10^{-6}$	CL=90%
Γ_{118}	$\mu^+ e^- e^-$	*L*	$<$ 3.4	$\times 10^{-6}$	CL=90%
Γ_{119}	$\mu^- \mu^+ \mu^-$	*LF*	$<$ 4.3	$\times 10^{-6}$	CL=90%
Γ_{120}	$e^- \pi^+ \pi^-$	*LF*	$<$ 4.4	$\times 10^{-6}$	CL=90%
Γ_{121}	$e^+ \pi^- \pi^-$	*L*	$<$ 4.4	$\times 10^{-6}$	CL=90%

Γ_{122}	$\mu^- \pi^+ \pi^-$	*LF*	$<$	7.4	$\times 10^{-6}$	CL=90%
Γ_{123}	$\mu^+ \pi^- \pi^-$	*L*	$<$	6.9	$\times 10^{-6}$	CL=90%
Γ_{124}	$e^- \pi^+ K^-$	*LF*	$<$	7.7	$\times 10^{-6}$	CL=90%
Γ_{125}	$e^- \pi^- K^+$	*LF*	$<$	4.6	$\times 10^{-6}$	CL=90%
Γ_{126}	$e^+ \pi^- K^-$	*L*	$<$	4.5	$\times 10^{-6}$	CL=90%
Γ_{127}	$\mu^- \pi^+ K^-$	*LF*	$<$	8.7	$\times 10^{-6}$	CL=90%
Γ_{128}	$\mu^- \pi^- K^+$	*LF*	$<$	1.5	$\times 10^{-5}$	CL=90%
Γ_{129}	$\mu^+ \pi^- K^-$	*L*	$<$	2.0	$\times 10^{-5}$	CL=90%
Γ_{130}	$\overline{p}\gamma$	*L*,*B*	$<$	2.9	$\times 10^{-4}$	CL=90%
Γ_{131}	$\overline{p}\pi^0$	*L*,*B*	$<$	6.6	$\times 10^{-4}$	CL=90%
Γ_{132}	$\overline{p}\eta$	*L*,*B*	$<$	1.30	$\times 10^{-3}$	CL=90%
Γ_{133}	$e^- \overline{K}^*(892)^0$	*LF*	$<$	1.1	$\times 10^{-5}$	CL=90%
Γ_{134}	$\mu^- \overline{K}^*(892)^0$	*LF*	$<$	8.7	$\times 10^{-6}$	CL=90%
Γ_{135}	e^- light boson	*LF*	$<$	2.7	$\times 10^{-3}$	CL=95%
Γ_{136}	μ^- light boson	*LF*	$<$	5	$\times 10^{-3}$	CL=95%

[*a*] Basis mode for the τ.

[*b*] See the Particle Listings below for the energy limits used in this measurement.

CONSTRAINED FIT INFORMATION

An overall fit to 57 branching ratios uses 128 measurements and one constraint to determine 25 parameters. The overall fit has a $\chi^2 = 115.2$ for 104 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, $x_i \equiv \Gamma_i/\Gamma_{\mathrm{total}}$. The fit constrains the x_i whose labels appear in this array to sum to one.

x_5	−7									
x_9	−11	−9								
x_{10}	0	0	−31							
x_{13}	−15	−12	−20	2						
x_{15}	0	0	2	−7	−35					
x_{19}	−14	−12	−16	1	−21	1				
x_{20}	0	0	1	−3	1	−4	−19			
x_{23}	−6	−5	−13	13	−14	16	−12	8		
x_{24}	0	0	7	−19	8	−23	2	−11	−71	
x_{26}	−4	−4	−6	0	−8	0	−7	0	−3	0
x_{30}	−1	−1	−27	1	−2	1	−9	0	−2	2
x_{32}	0	0	−5	−3	1	−4	−1	−2	8	−11
x_{34}	−2	−2	−3	1	−4	2	−4	1	−10	4
x_{35}	−1	0	1	−4	1	−4	0	−2	7	−12
x_{37}	−1	−1	−5	0	−2	0	−2	0	−1	0
x_{47}	−8	−7	−6	0	−14	0	−12	0	−6	0
x_{52}	−3	−3	−5	0	−6	0	−6	0	−2	0
x_{60}	−1	−1	−1	0	−2	0	−1	0	−1	0
x_{61}	−4	−3	−5	0	−7	0	−6	0	−3	0
x_{74}	0	0	−1	0	−1	0	−1	0	0	0
x_{75}	0	0	0	0	0	0	0	0	0	0
x_{91}	−1	−1	−1	0	−2	0	−2	0	−1	0
x_{98}	−3	−3	−5	0	−6	0	−6	0	−2	0
x_{99}	−3	−3	−4	0	−5	0	−5	0	−2	0
	x_3	x_5	x_9	x_{10}	x_{13}	x_{15}	x_{19}	x_{20}	x_{23}	x_{24}

	x_{26}	x_{30}	x_{32}	x_{34}	x_{35}	x_{37}	x_{47}	x_{52}	x_{60}	x_{61}
x_{30}	0									
x_{32}	0	−15								
x_{34}	−1	−3	0							
x_{35}	0	0	−2	−35						
x_{37}	−1	−1	0	−1	0					
x_{47}	−4	−17	−4	−2	0	−1				
x_{52}	−2	0	0	−8	−2	−1	−5			
x_{60}	2	0	0	0	0	0	0	0		
x_{61}	−2	0	0	0	0	−1	−6	−8	−1	
x_{74}	0	0	0	0	0	0	0	0	0	0
x_{75}	0	0	0	0	0	0	0	0	0	0
x_{91}	−16	0	0	0	0	0	−1	−1	−16	−1
x_{98}	−2	0	0	−6	−2	−1	−7	−43	−1	−7
x_{99}	−2	0	0	0	0	0	0	−4	−49	−3

	x_{74}	x_{75}	x_{91}	x_{98}
x_{75}	−24			
x_{91}	0	0		
x_{98}	0	0	−1	
x_{99}	0	0	0	−2