τ –THIS IS PART 1 OF 5

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

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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					
$1776.96^{+0.18+0.25}_{-0.21-0.17}$	65	[1] BAI	96	BES	E^{ee}_{cm}= 3.54–3.57 GeV
1777.8 ±0.7 ±1.7	35k	[2] BALEST	93	CLEO	E^{ee}_{cm}= 10.6 GeV
1776.3 ±2.4 ±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. • • •					
$1776.9\ ^{+0.4}_{-0.5}$ ±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

A consistent treatment of systematic biases (see WASSERBAECH 93) yields a correction of -0.03 fs on the average. In addition, BATTLE 92 assumes an obsolete value of the τ mass; the correction to be applied to the average is -0.01 fs. These corrections do not change the result within rounding errors, so that OUR EVALUATION is equal to OUR AVERAGE.

VALUE (10^{-15} s)	EVTS	DOCUMENT ID		TECN	COMMENT
291.0± 1.5 OUR EVALUATION					
291.0± 1.5 OUR AVERAGE					
291.4± 3.0		ABREU	96B	DLPH	1991–1993 LEP runs
289.2± 1.7± 1.2		ALEXANDER	96E	OPAL	1990–1994 LEP runs
293.7± 2.7± 1.6	42k	BUSKULIC	96B	ALEP	1989–1992 LEP runs
297 ± 9 ± 5	1671	ABE	95Y	SLD	1992–1993 SLC runs
293 ± 9 ±12	5743	ADRIANI	93M	L3	1991 LEP run
304 ± 14 ± 7	4100	BATTLE	92	CLEO	E^{ee}_{cm}= 10.6 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
309 ± 23 ±30	2817	ADEVA	91F	L3	1990 LEP run
301 ± 29	3780	KLEINWORT	89	JADE	E^{ee}_{cm}= 35–46 GeV
288 ± 16 ±17	807	AMIDEI	88	MRK2	E^{ee}_{cm}= 29 GeV
306 ± 20 ±14	695	BRAUNSCH...	88C	TASS	E^{ee}_{cm}= 36 GeV
299 ± 15 ±10	1311	ABACHI	87C	HRS	E^{ee}_{cm}= 29 GeV
295 ± 14 ±11	5696	ALBRECHT	87P	ARG	E^{ee}_{cm}= 9.3–10.6 GeV
309 ± 17 ± 7	3788	BAND	87B	MAC	E^{ee}_{cm}= 29 GeV
325 ± 14 ±18	8470	BEBEK	87C	CLEO	E^{ee}_{cm}= 10.5 GeV
490 ±200	121	FORD	82	MAC	E^{ee}_{cm}= 29 GeV

τ MAGNETIC MOMENT ANOMALY

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

For a theoretical calculation [$(g_\tau-2)/2 = 11773(3)\times10^{-7}$], 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
$<5\ \times10^{-17}$	95	[8] ESCRIBANO	93	RVUE	$Z \to \tau^+\tau^-$ at LEP
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<7\ \times10^{-16}$	90	GRIFOLS	91	RVUE	$Z \to \tau\tau\gamma$ at LEP
$<1.6\times10^{-16}$	90	DELAGUILA	90	RVUE	$e^+e^- \to \tau^+\tau^-$ E_{cm}^{ee}= 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_τ^W)

A nonzero value is forbidden by CP invariance.

Re(d_τ^W)

VALUE (e cm)	CL%	DOCUMENT ID		TECN	COMMENT
$<0.78\times10^{-17}$	95	[9] AKERS	95F	OPAL	1991–1993 LEP runs
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<1.5\ \times10^{-17}$	95	[9] BUSKULIC	95C	ALEP	1990–1992 LEP runs
$<7.0\ \times10^{-17}$	95	[9] ACTON	92F	OPAL	$Z \to \tau^+\tau^-$ at LEP
$<3.7\ \times10^{-17}$	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 $q^2 = m_Z^2$.

Im(d_τ^W)

VALUE (e cm)	CL%	DOCUMENT ID		TECN	COMMENT
$<4.5\times10^{-17}$	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 $\geq 0 K^0_L \nu_\tau$ ("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	$\mu^- \overline{\nu}_\mu \nu_\tau \gamma$ ($E_\gamma > 37$ MeV)		(2.3 ± 1.0) × 10^{-3}	
Γ_5	$e^- \overline{\nu}_e \nu_\tau$	[a]	(17.83 ± 0.08) %	
Γ_6	$h^- \geq 0$ neutrals $\geq 0 K^0_L$ ν_τ		(49.78 ± 0.17) %	S=1.2
Γ_7	$h^- \geq 0 K^0_L$ ν_τ		(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 ± 0.5) × 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 ± 3.2) × 10^{-3}	
Γ_{15}	$K^- \pi^0 \nu_\tau$	[a]	(5.2 ± 0.5) × 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) × 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 $^{+10.0}_{-3.3}$) × 10^{-4}	
Γ_{25}	$h^- 4\pi^0 \nu_\tau$(ex.K^0)		(1.8 ± 0.6) × 10^{-3}	
Γ_{26}	$h^- 4\pi^0 \nu_\tau$(ex.K^0, η)	[a]	(1.2 ± 0.6) × 10^{-3}	
Γ_{27}	$K^- \geq 1$ (π^0 or K^0) ν_τ		(9.4 ± 1.0) × 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) × 10^{-3}	S=1.3
Γ_{30}	$\pi^- \overline{K}^0 \nu_\tau$	[a]	(7.7 ± 0.8) × 10^{-3}	S=1.3
Γ_{31}	$\pi^- \overline{K}^0$ (non-$K^*(892)^-$) ν_τ		< 1.7 × 10^{-3}	CL=95%
Γ_{32}	$K^- K^0 \nu_\tau$	[a]	(1.55 ± 0.28) × 10^{-3}	
Γ_{33}	$h^- \overline{K}^0 \pi^0 \nu_\tau$		(5.5 ± 0.5) × 10^{-3}	
Γ_{34}	$\pi^- \overline{K}^0 \pi^0 \nu_\tau$	[a]	(4.1 ± 0.6) × 10^{-3}	
Γ_{35}	$K^- K^0 \pi^0 \nu_\tau$	[a]	(1.38 ± 0.32) × 10^{-3}	
Γ_{36}	$h^- K^0_S K^0_S \nu_\tau$		(2.5 ± 0.6) × 10^{-4}	
Γ_{37}	$\pi^- K^0 \overline{K}^0 \nu_\tau$	[a]	(1.01 ± 0.23) × 10^{-3}	
Γ_{38}	$K^- K^0 \geq 0$ neutrals ν_τ		(2.9 ± 0.4) × 10^{-3}	
Γ_{39}	$K^- \geq 0 \pi^0 \geq 0 K^0$ ν_τ		(1.65 ± 0.10) %	
Γ_{40}	K^0(particles)$^-$ ν_τ		(1.58 ± 0.10) %	S=1.2
Γ_{41}	$K^0 h^+ h^- h^- \geq 0$ neut. ν_τ		< 1.7 × 10^{-3}	CL=95%
	Modes with three charged particles			
Γ_{42}	$h^- h^- h^+ \geq 0$neut. ν_τ ("3-prong")		(14.91 ± 0.14) %	S=1.3
Γ_{43}	$h^- h^- h^+ \geq 0$ neutrals ν_τ (ex. $K^0_S \to \pi^+ \pi^-$)		(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. $K^0_S \to \pi^+ \pi^-$)		(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 ± 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 ± 0.5)	$\times 10^{-3}$		
Γ_{59}	$h^-\,h^-\,h^+\,2\pi^0\,\nu_\tau$(ex.$K^0$)		(5.1 ± 0.5)	$\times 10^{-3}$		
Γ_{60}	$h^-\,h^-\,h^+\,2\pi^0\,\nu_\tau$(ex.$K^0$,$\omega$,$\eta$)	[a]	(1.0 ± 0.4)	$\times 10^{-3}$		
Γ_{61}	$h^-\,h^-\,h^+ \geq 3\pi^0\,\nu_\tau$	[a]	(1.1 ± 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}	$\phi\,\pi^-\,\nu_\tau$		< 3.5	$\times 10^{-4}$		CL=90%
Γ_{68}	$K^-\,K^+\,K^- \geq 0$ neut. ν_τ		< 2.1	$\times 10^{-3}$		CL=95%
Γ_{69}	$\pi^-\,K^+\,\pi^- \geq 0$ neut. ν_τ		< 2.5	$\times 10^{-3}$		CL=95%
Γ_{70}	$e^-\,e^-\,e^+\,\overline{\nu}_e\,\nu_\tau$		(2.8 ± 1.5)	$\times 10^{-5}$		
Γ_{71}	$\mu^-\,e^-\,e^+\,\overline{\nu}_\mu\,\nu_\tau$		< 3.6	$\times 10^{-5}$		CL=90%

Modes with five charged particles

Γ_{72}	$3h^-\,2h^+ \geq 0$ neutrals ν_τ (ex. $K^0_S \to \pi^-\,\pi^+$) ("5-prong")		(9.7 ± 0.7)	$\times 10^{-4}$		
Γ_{73}	$3h^-\,2h^+\,\nu_\tau$(ex.K^0)	[a]	(7.5 ± 0.7)	$\times 10^{-4}$		
Γ_{74}	$3h^-\,2h^+\,\pi^0\,\nu_\tau$(ex.$K^0$)	[a]	(2.2 ± 0.5)	$\times 10^{-4}$		
Γ_{75}	$3h^-\,2h^+\,2\pi^0\,\nu_\tau$		< 1.1	$\times 10^{-4}$		CL=90%

Miscellaneous other allowed modes

Γ_{76}	$(5\pi)^-\,\nu_\tau$		(3.3 ± 0.7)	$\times 10^{-3}$		
Γ_{77}	$4h^-\,3h^+ \geq 0$ neutrals ν_τ ("7-prong")		< 1.9	$\times 10^{-4}$		CL=90%
Γ_{78}	$K^*(892)^- \geq 0 (h^0 \neq K^0_S)\,\nu_\tau$		(1.94 ± 0.31)	%		
Γ_{79}	$K^*(892)^- \geq 0$ neutrals ν_τ		(1.33 ± 0.13)	%		
Γ_{80}	$K^*(892)^-\,\nu_\tau$		(1.28 ± 0.08)	%		
Γ_{81}	$K^*(892)^0\,K^- \geq 0$ neutrals ν_τ		(3.2 ± 1.4)	$\times 10^{-3}$		
Γ_{82}	$K^*(892)^0\,K^-\,\nu_\tau$		(2.0 ± 0.6)	$\times 10^{-3}$		
Γ_{83}	$\overline{K}^*(892)^0\,\pi^- \geq 0$ neutrals ν_τ		(3.8 ± 1.7)	$\times 10^{-3}$		
Γ_{84}	$\overline{K}^*(892)^0\,\pi^-\,\nu_\tau$		(2.5 ± 1.1)	$\times 10^{-3}$		
Γ_{85}	$K_1(1270)^-\,\nu_\tau$		(4 ± 4)	$\times 10^{-3}$		
Γ_{86}	$K_1(1400)^-\,\nu_\tau$		(8 ± 4)	$\times 10^{-3}$		
Γ_{87}	$K^*_2(1430)^-\,\nu_\tau$		< 3	$\times 10^{-3}$		CL=95%
Γ_{88}	$a_0(980)^- \geq 0$ neutrals ν_τ					
Γ_{89}	$\eta\,\pi^-\,\nu_\tau$		< 1.4	$\times 10^{-4}$		CL=95%
Γ_{90}	$\eta\,\pi^-\,\pi^0\,\nu_\tau$	[a]	(1.71 ± 0.28)	$\times 10^{-3}$		
Γ_{91}	$\eta\,\pi^-\,\pi^0\,\pi^0\,\nu_\tau$		< 4.3	$\times 10^{-4}$		CL=95%
Γ_{92}	$\eta\,K^-\,\nu_\tau$		(2.6 ± 0.7)	$\times 10^{-4}$		
Γ_{93}	$\eta\,\pi^+\,\pi^-\,\pi^- \geq 0$ neutrals ν_τ		< 3	$\times 10^{-3}$		CL=90%
Γ_{94}	$\eta\,\eta\,\pi^-\,\nu_\tau$		< 1.1	$\times 10^{-4}$		CL=95%
Γ_{95}	$\eta\,\eta\,\pi^-\,\pi^0\,\nu_\tau$		< 2.0	$\times 10^{-4}$		CL=95%
Γ_{96}	$h^-\,\omega \geq 0$ neutrals ν_τ		(2.32 ± 0.11)	%		
Γ_{97}	$h^-\,\omega\,\nu_\tau$	[a]	(1.91 ± 0.09)	%		
Γ_{98}	$h^-\,\omega\,\pi^0\,\nu_\tau$	[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.* $\tau^- \to e^+\pi^-\pi^-$). Following common usage, *LF* means lepton family violation *and not* lepton number violation (*e.g.* $\tau^- \to e^-\pi^+\pi^-$).

Γ_{99}	$e^-\gamma$	*LF*	$<$	1.1	$\times 10^{-4}$	CL=90%
Γ_{100}	$\mu^-\gamma$	*LF*	$<$	4.2	$\times 10^{-6}$	CL=90%
Γ_{101}	$e^-\pi^0$	*LF*	$<$	1.4	$\times 10^{-4}$	CL=90%
Γ_{102}	$\mu^-\pi^0$	*LF*	$<$	4.4	$\times 10^{-5}$	CL=90%
Γ_{103}	$e^- K^0$	*LF*	$<$	1.3	$\times 10^{-3}$	CL=90%
Γ_{104}	$\mu^- K^0$	*LF*	$<$	1.0	$\times 10^{-3}$	CL=90%
Γ_{105}	$e^-\eta$	*LF*	$<$	6.3	$\times 10^{-5}$	CL=90%
Γ_{106}	$\mu^-\eta$	*LF*	$<$	7.3	$\times 10^{-5}$	CL=90%
Γ_{107}	$e^-\rho^0$	*LF*	$<$	4.2	$\times 10^{-6}$	CL=90%
Γ_{108}	$\mu^-\rho^0$	*LF*	$<$	5.7	$\times 10^{-6}$	CL=90%
Γ_{109}	$e^- K^*(892)^0$	*LF*	$<$	6.3	$\times 10^{-6}$	CL=90%
Γ_{110}	$\mu^- K^*(892)^0$	*LF*	$<$	9.4	$\times 10^{-6}$	CL=90%
Γ_{111}	$\pi^-\gamma$	*L*	$<$	2.8	$\times 10^{-4}$	CL=90%
Γ_{112}	$\pi^-\pi^0$	*L*	$<$	3.7	$\times 10^{-4}$	CL=90%
Γ_{113}	$e^- e^+ e^-$	*LF*	$<$	3.3	$\times 10^{-6}$	CL=90%
Γ_{114}	$e^-\mu^+\mu^-$	*LF*	$<$	3.6	$\times 10^{-6}$	CL=90%
Γ_{115}	$e^+\mu^-\mu^-$	*LF*	$<$	3.5	$\times 10^{-6}$	CL=90%
Γ_{116}	$\mu^- e^+ e^-$	*LF*	$<$	3.4	$\times 10^{-6}$	CL=90%
Γ_{117}	$\mu^+ e^- e^-$	*L*	$<$	3.4	$\times 10^{-6}$	CL=90%
Γ_{118}	$\mu^-\mu^+\mu^-$	*LF*	$<$	1.9	$\times 10^{-6}$	CL=90%
Γ_{119}	$e^-\pi^+\pi^-$	*LF*	$<$	4.4	$\times 10^{-6}$	CL=90%
Γ_{120}	$e^+\pi^-\pi^-$	*L*	$<$	4.4	$\times 10^{-6}$	CL=90%
Γ_{121}	$\mu^-\pi^+\pi^-$	*LF*	$<$	7.4	$\times 10^{-6}$	CL=90%
Γ_{122}	$\mu^+\pi^-\pi^-$	*L*	$<$	6.9	$\times 10^{-6}$	CL=90%
Γ_{123}	$e^-\pi^+ K^-$	*LF*	$<$	7.7	$\times 10^{-6}$	CL=90%
Γ_{124}	$e^-\pi^- K^+$	*LF*	$<$	4.6	$\times 10^{-6}$	CL=90%
Γ_{125}	$e^+\pi^- K^-$	*L*	$<$	4.5	$\times 10^{-6}$	CL=90%
Γ_{126}	$\mu^-\pi^+ K^-$	*LF*	$<$	8.7	$\times 10^{-6}$	CL=90%
Γ_{127}	$\mu^-\pi^- K^+$	*LF*	$<$	1.5	$\times 10^{-5}$	CL=90%
Γ_{128}	$\mu^+\pi^- K^-$	*L*	$<$	2.0	$\times 10^{-5}$	CL=90%
Γ_{129}	$\overline{p}\gamma$	*L,B*	$<$	2.9	$\times 10^{-4}$	CL=90%
Γ_{130}	$\overline{p}\pi^0$	*L,B*	$<$	6.6	$\times 10^{-4}$	CL=90%
Γ_{131}	$\overline{p}\eta$	*L,B*	$<$	1.30	$\times 10^{-3}$	CL=90%
Γ_{132}	$e^-\overline{K}^*(892)^0$	*LF*	$<$	1.1	$\times 10^{-5}$	CL=90%
Γ_{133}	$\mu^-\overline{K}^*(892)^0$	*LF*	$<$	8.7	$\times 10^{-6}$	CL=90%
Γ_{134}	e^- light boson	*LF*	$<$	2.7	$\times 10^{-3}$	CL=95%
Γ_{135}	μ^- light boson	*LF*	$<$	5	$\times 10^{-3}$	CL=95%

[*a*] Basis mode for the τ.

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, $x_i \equiv \Gamma_i/\Gamma_{\rm total}$. The fit constrains the x_i whose labels appear in this array to sum to one.

	x_3	x_5	x_9	x_{10}	x_{13}	x_{15}	x_{19}	x_{20}	x_{23}	x_{24}
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_{73}	0	0	−1	0	−1	0	−1	0	0	0
x_{74}	0	0	0	0	0	0	0	0	0	0
x_{90}	−1	−1	−1	0	−2	0	−2	0	−1	0
x_{97}	−3	−3	−5	0	−6	0	−6	0	−2	0
x_{98}	−3	−3	−4	0	−5	0	−5	0	−2	0

	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_{73}	0	0	0	0	0	0	0	0	0	0
x_{74}	0	0	0	0	0	0	0	0	0	0
x_{90}	−16	0	0	0	0	0	−1	−1	−16	−1
x_{97}	−2	0	0	−6	−2	−1	−7	−43	−1	−7
x_{98}	−2	0	0	0	0	0	0	−4	−49	−3

	x_{73}	x_{74}	x_{90}	x_{97}
x_{74}	−24			
x_{90}	0	0		
x_{97}	0	0	−1	
x_{98}	0	0	0	−2