$\Gamma(e^+\pi^-\pi^-)/\Gamma_{total}$ Γ_{86}/Γ

Test of lepton number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<1.7\times10^{-5}$	90	BOWCOCK	90	CLEO	E^{ee}_{cm} = 10.4–10.9
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<1.8\times10^{-5}$	90	ALBRECHT	92K	ARG	E^{ee}_{cm} = 10 GeV
$<6.3\times10^{-5}$	90	ALBRECHT	87M	ARG	Repl. by ALBRECHT 92K

$\Gamma(\mu^\mp\pi^\pm\pi^-)/\Gamma_{total}$ $\Gamma_{87}/\Gamma=(\Gamma_{88}+\Gamma_{89})/\Gamma$

Test of lepton number or lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<3.9\times10^{-5}$	90	BOWCOCK	90	CLEO	E^{ee}_{cm} = 10.4–10.9

$\Gamma(\mu^-\pi^+\pi^-)/\Gamma_{total}$ Γ_{88}/Γ

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<3.6\times10^{-5}$	90	ALBRECHT	92K	ARG	E^{ee}_{cm} = 10 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<3.9\times10^{-5}$	90	BOWCOCK	90	CLEO	E^{ee}_{cm} = 10.4–10.9
$<4.0\times10^{-5}$	90	ALBRECHT	87M	ARG	Repl. by ALBRECHT 92K

$\Gamma(\mu^+\pi^-\pi^-)/\Gamma_{total}$ Γ_{89}/Γ

Test of lepton number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<3.9\times10^{-5}$	90	BOWCOCK	90	CLEO	E^{ee}_{cm} = 10.4–10.9
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<6.3\times10^{-5}$	90	ALBRECHT	92K	ARG	E^{ee}_{cm} = 10 GeV
$<6.3\times10^{-5}$	90	ALBRECHT	87M	ARG	Repl. by ALBRECHT 92K

$\Gamma(\ell^\pm\pi^\mp K^-)/\Gamma_{total}$ $\Gamma_{90}/\Gamma=(\Gamma_{93}+\Gamma_{94}+\Gamma_{98}+\Gamma_{99})/\Gamma$

Test of lepton number or lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<1.2\times10^{-4}$	90	ALBRECHT	87M	ARG	E^{ee}_{cm} = 10 GeV

$\Gamma((e\pi K)^-,\text{all charged})/\Gamma_{total}$ $\Gamma_{91}/\Gamma=(\Gamma_{93}+\Gamma_{94}+\Gamma_{95})/\Gamma$

Test of lepton number or lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<7.7\times10^{-5}$	90	BOWCOCK	90	CLEO	E^{ee}_{cm} = 10.4–10.9

$\Gamma(e^-\pi^\pm K^\mp)/\Gamma_{total}$ $\Gamma_{92}/\Gamma=(\Gamma_{93}+\Gamma_{94})/\Gamma$

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<5.8\times10^{-5}$	90	BOWCOCK	90	CLEO	E^{ee}_{cm} = 10.4–10.9

$\Gamma(e^-\pi^+K^-)/\Gamma_{total}$ Γ_{93}/Γ

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<2.9\times10^{-5}$	90	ALBRECHT	92K	ARG	E^{ee}_{cm} = 10 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<5.8\times10^{-5}$	90	BOWCOCK	90	CLEO	E^{ee}_{cm} = 10.4–10.9
$<4.2\times10^{-5}$	90	ALBRECHT	87M	ARG	Repl. by ALBRECHT 92K

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

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<5.8\times10^{-5}$	90	BOWCOCK	90	CLEO	E^{ee}_{cm} = 10.4–10.9

$\Gamma(e^+\pi^-K^-)/\Gamma_{total}$ Γ_{95}/Γ

Test of lepton number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<2.0\times10^{-5}$	90	ALBRECHT	92K	ARG	E^{ee}_{cm} = 10 GeV
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<4.9\times10^{-5}$	90	BOWCOCK	90	CLEO	E^{ee}_{cm} = 10.4–10.9
$<12\times10^{-5}$	90	ALBRECHT	87M	ARG	Repl. by ALBRECHT 92K

$\Gamma((\mu\pi K)^-,\text{all charged})/\Gamma_{total}$ $\Gamma_{96}/\Gamma=(\Gamma_{98}+\Gamma_{99}+\Gamma_{100})/\Gamma$

Test of lepton number or lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<7.7\times10^{-5}$	90	BOWCOCK	90	CLEO	E^{ee}_{cm} = 10.4–10.9

$\Gamma(\mu^-\pi^\pm K^\mp)/\Gamma_{total}$ $\Gamma_{97}/\Gamma=(\Gamma_{98}+\Gamma_{99})/\Gamma$

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<7.7\times10^{-5}$	90	BOWCOCK	90	CLEO	E^{ee}_{cm} = 10.4–10.9

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

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<7.7\times10^{-5}$	90	BOWCOCK	90	CLEO	E^{ee}_{cm} = 10.4–10.9
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<11\times10^{-5}$	90	ALBRECHT	92K	ARG	E^{ee}_{cm} = 10 GeV
$<12\times10^{-5}$	90	ALBRECHT	87M	ARG	Repl. by ALBRECHT 92K

$\Gamma(\mu^-\pi^-K^+)/\Gamma_{total}$ Γ_{99}/Γ

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<7.7\times10^{-5}$	90	BOWCOCK	90	CLEO	E^{ee}_{cm} = 10.4–10.9

$\Gamma(\mu^+\pi^-K^-)/\Gamma_{total}$ Γ_{100}/Γ

Test of lepton number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<4.0\times10^{-5}$	90	BOWCOCK	90	CLEO	E^{ee}_{cm} = 10.4–10.9
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<5.8\times10^{-5}$	90	ALBRECHT	92K	ARG	E^{ee}_{cm} = 10 GeV
$<12\times10^{-5}$	90	ALBRECHT	87M	ARG	Repl. by ALBRECHT 92K

$\Gamma(\bar{p}\gamma)/\Gamma_{total}$ Γ_{101}/Γ

Test of lepton number and baryon number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<29\times10^{-5}$	90	ALBRECHT	92K	ARG	E^{ee}_{cm} = 10 GeV

$\Gamma(\bar{p}\pi^0)/\Gamma_{total}$ Γ_{102}/Γ

Test of lepton number and baryon number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<66\times10^{-5}$	90	ALBRECHT	92K	ARG	E^{ee}_{cm} = 10 GeV

$\Gamma(\bar{p}\eta)/\Gamma_{total}$ Γ_{103}/Γ

Test of lepton number and baryon number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
$<130\times10^{-5}$	90	ALBRECHT	92K	ARG	E^{ee}_{cm} = 10 GeV

$\Gamma(e^-\text{light spinless boson})/\Gamma(e^-\overline{\nu}_e\nu_\tau)$ Γ_{104}/Γ_4

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.018	95	[88] ALBRECHT	90E	ARG	E^{ee}_{cm} = 9.4–10.6 GeV
<0.040	95	[89] BALTRUSAIT...85		MRK3	E^{ee}_{cm} = 3.77 GeV

[88] ALBRECHT 90E limit holds for mass $<$ 100 MeV, and rises to 0.050 for mass = 500 MeV.
[89] BALTRUSAITIS 85 limit holds for mass $<$ 100 MeV.

$\Gamma(\mu^-\text{light spinless boson})/\Gamma(e^-\overline{\nu}_e\nu_\tau)$ Γ_{105}/Γ_4

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
<0.033	95	[90] ALBRECHT	90E	ARG	E^{ee}_{cm} = 9.4–10.6 GeV
<0.125	95	[91] BALTRUSAIT...85		MRK3	E^{ee}_{cm} = 3.77 GeV

[90] ALBRECHT 90E limit holds for mass $<$ 100 MeV, and rises to 0.071 for mass = 500 MeV.
[91] BALTRUSAITIS 85 limit holds for mass $<$ 100 MeV.

τ DECAY PARAMETERS

NOTE ON τ-DECAY PARAMETERS

Neglecting radiative corrections and terms proportional to m_ℓ^2/m_τ^2, the energy spectrum of the charged decay lepton ℓ in the τ rest frame is given by

$$\frac{d^2\Gamma_{\tau\to\ell\nu\overline{\nu}}}{d\Omega\,dx}\propto x^2$$
$$\times\left\{12(1-x)+\rho_\tau\left(\frac{32}{3}x-8\right)+24\eta_\tau\,\frac{m_\ell}{m_\tau}\,\frac{(1-x)}{x}\right.$$
$$\left.-P_\tau\,\xi_\tau\cos\theta\,\left[4(1-x)+\delta_\tau\left(\frac{32}{3}x-8\right)\right]\right\}. \qquad (1)$$

Here $x=2E_\ell/m_\tau$ is the scaled lepton energy, P_τ is the τ polarization, and θ is the angle between the τ spin and the lepton momentum. With unpolarized τ's or integrating over the full θ range, the spectrum depends only on ρ_τ and η_τ. Measurements of the other two Michel parameters, ξ_τ and δ_τ, require polarized τ's. Where possible, we give separately the parameters for $\tau^-\to e^-\nu_\tau\overline{\nu}_e$ and $\tau^-\to\mu^-\nu_\tau\overline{\nu}_\mu$, to avoid assumptions about universality.

ρ^τ (e or μ) PARAMETER

($V-A$) theory predicts $\rho=0.75$.

VALUE	EVTS	DOCUMENT ID		TECN	COMMENT
0.74 ±0.04 OUR AVERAGE					
0.742±0.035±0.020	8000	ALBRECHT	90E	ARG	E^{ee}_{cm} = 9.4–10.6 GeV
0.79 ±0.10 ±0.10	3732	FORD	87B	MAC	E^{ee}_{cm} = 29 GeV
0.71 ±0.09 ±0.03	1426	BEHRENDS	85	CLEO	e^+e^- near $\Upsilon(4S)$