News from the τ-lepton

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Branching ratio review Ken Hayes

Decay parameters review Achim Stahl

τ-Mass

- Best result is still threshold scan from BES (1996)
- Competitive result from KEDR (Novosibirsk, 2007)
- Competitive result also from BELLE with reconstruction method (2007)
- All results are consistent

τ-Lifetime

- Significant results from LEP (+CLEO)
- Last publication 2004
- All results consistent

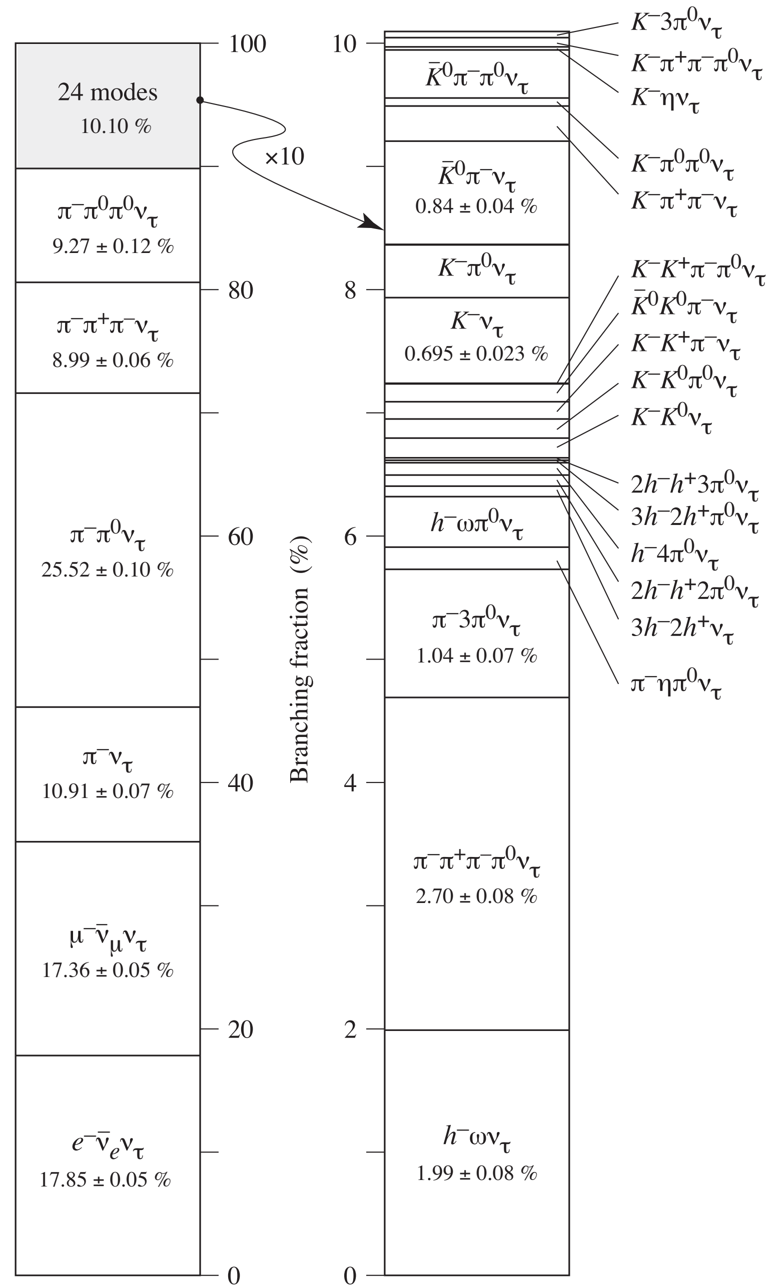
Decay (Michel) parameters

- Main input still LEP (+CLEO, ARGUS)
- Last publication 2001
- Expert average (Achim Stahl) including all correlations

τ-Branching Ratios

Measurements:

- Measurements of branching ratios are still dominated by LEP
- 1st very precise results with identified $\pi^{\pm}$ and $K^{\pm}$ from Barbar and Belle
- Branching ratios are determined with a constraint fit with 31 basis modes
  Philosophy: all decays into particles which themselves decay largely electroweak (incl. η, ω)
- Fit quality good ($\chi^2/\mathrm{ndf} = 95.7/100$) although many modes with error scaling
- Currently miss modes with $\Sigma BR = (0.08 \pm 0.01)\%$, 0.055% of this would be relatively easy to include



Basis modes in fit

$e^-\overline{\nu}_e\nu_\tau$

$\mu^-\overline{\nu}_\mu\nu_\tau$

$\pi^-\nu_\tau$

$\pi^-\pi^0\nu_\tau$

$\pi^-2\pi^0\nu_\tau$ (ex. K^0)

$\pi^-3\pi^0\nu_\tau$ (ex. K^0)

$h^-4\pi^0\nu_\tau$ (ex. K^0, η)

$K^-\nu_\tau$

$K^-\pi^0\nu_\tau$

$K^-2\pi^0\nu_\tau$ (ex. K^0)

$K^-3\pi^0\nu_\tau$ (ex. K^0, η)

$\pi^-\overline{K}^0\nu_\tau$

$\pi^-\overline{K}^0\pi^0\nu_\tau$

$\pi^-K^0_S K^0_S\nu_\tau$

$\pi^-K^0_S K^0_L\nu_\tau$

$K^-K^0\nu_\tau$

$K^-K^0\pi^0\nu_\tau$

$\pi^-\pi^+\pi^-\nu_\tau$ (ex. K^0, ω)

$\pi^-\pi^+\pi^-\pi^0\nu_\tau$ (ex. K^0, ω)

$K^-\pi^+\pi^-\nu_\tau$ (ex. K^0)

$K^-\pi^+\pi^-\pi^0\nu_\tau$ (ex. K^0, η)

$K^-K^+\pi^-\nu_\tau$

$K^-K^+\pi^-\pi^0\nu_\tau$

$h^-h^-h^+2\pi^0\nu_\tau$ (ex. K^0, ω, η)

$h^-h^-h^+3\pi^0\nu_\tau$

$3h^-2h^+\nu_\tau$ (ex. K^0)

$3h^-2h^+\pi^0\nu_\tau$ (ex. K^0)

$h^-\omega\nu_\tau$

$h^-\omega\pi^0\nu_\tau$

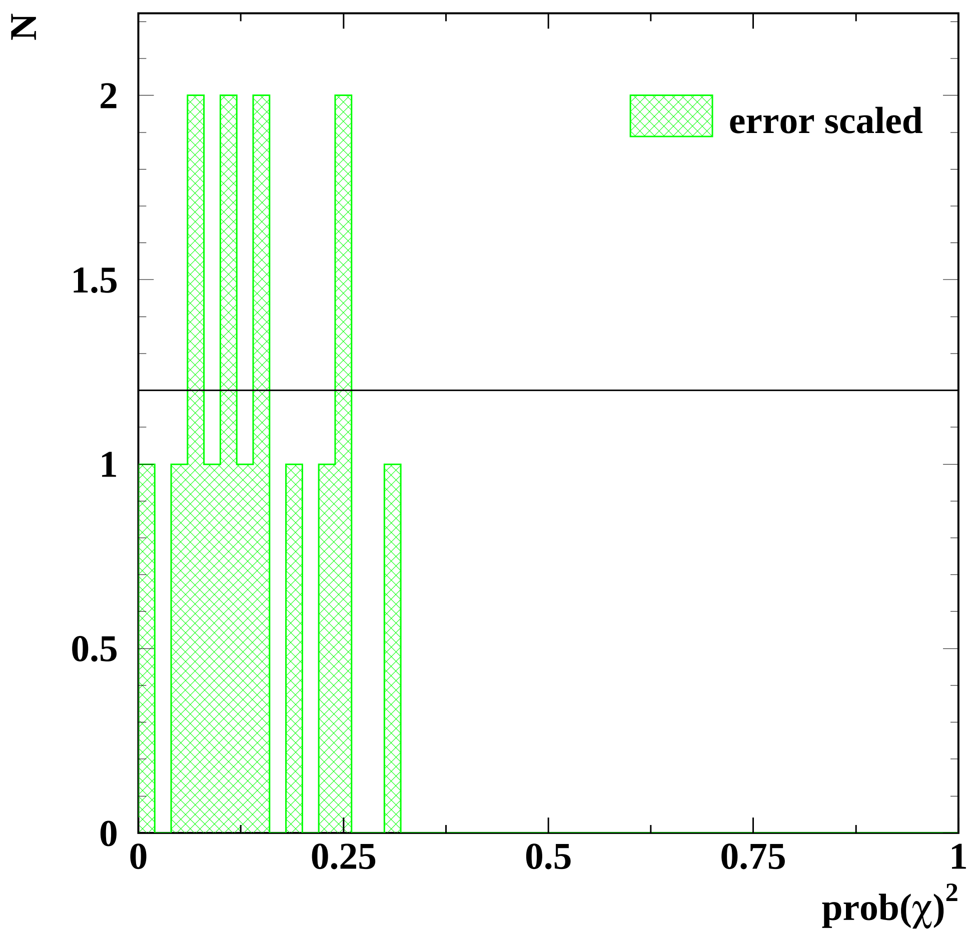
$\eta\pi^-\pi^0\nu_\tau$

$\eta K^-\nu_\tau$

A word on error scaling

- Many modes have few (two or three) measurements
- In this case the χ^2/ndf can go significantly above 1 with a large probability

- Some mode with a probability of 30% get rescaled
- In total 15 out of 60 modes get rescaled
- The probability distribution for these modes looks ok
- The lowest probability is 1%
- Maybe we should base the scaling decision on probability and not on χ^2/ndf



Limits:

- Limits exist for most forbidden modes
- The interesting ones have been remeasured by Barbar and Belle
- Typical limits now are 10^{-8} to 10^{-7}
  (this is typically an improvement by more than a factor 10!)

Conclusions

- The τ is still an active field
- The b-factories have the statistics for large improvements if they find the manpower and get the systematics under control
- We have to adapt our procedures accordingly