III KLOE Workshop

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OUTLINE

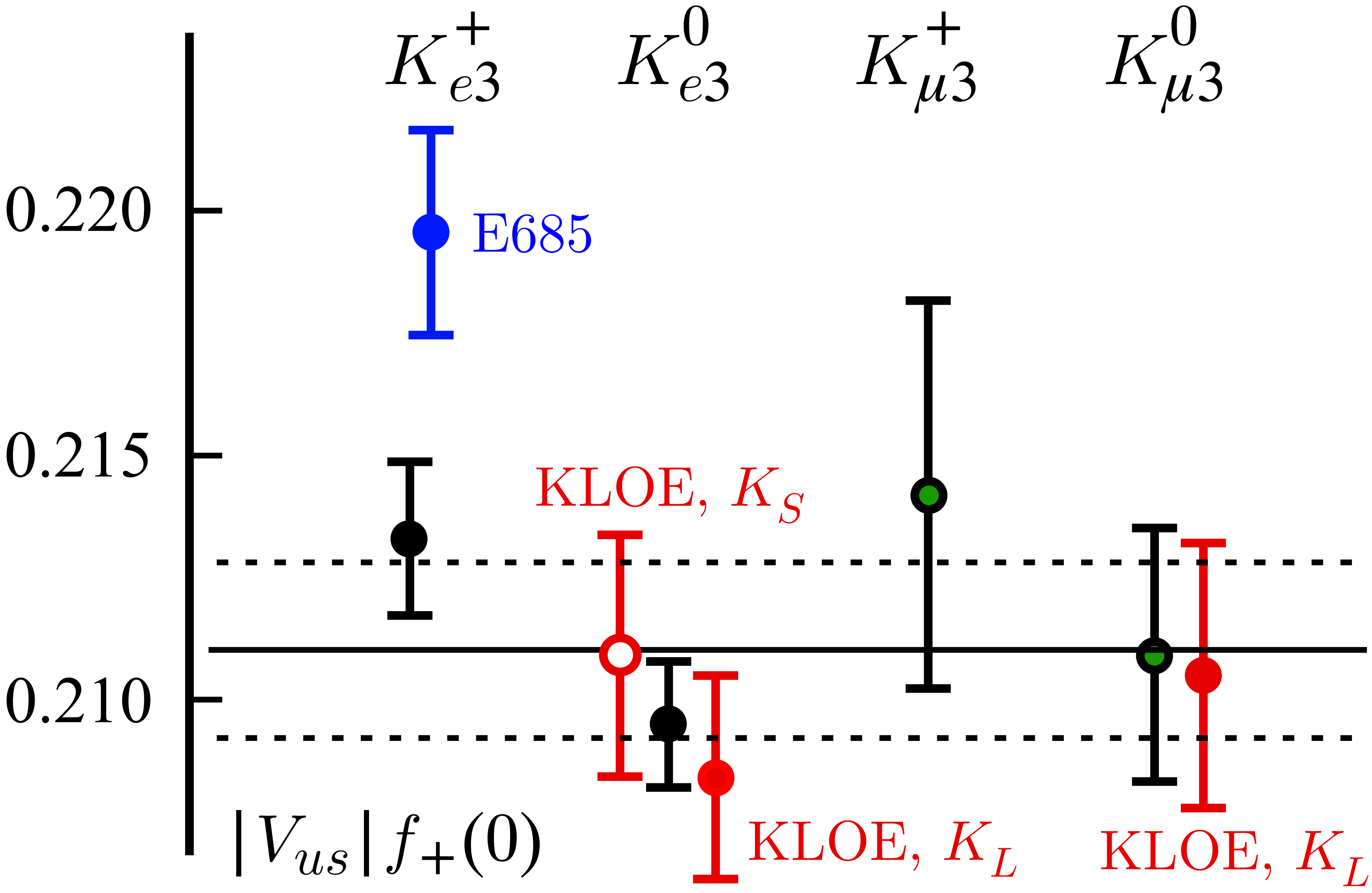
A few thoughts about KLOE since the I (ELBA) and II (OTRANTO) Workshops. Biased maybe by my prejudices

The list of things on their way to results and publications is constantly increasing. And new ideas pop-up all the time.
Significant is the first round on σ(hadr) which comes at a propitious time.

What I like best however are coherent attacks on well defined topics of broad interest. At the moment we have two and they are continuously making progress: kaons and resonances.

Since I am more attached to kaons and $sin\theta_C$, I will make a few remarks on kaons.

Semileptonic Decays



I spoke about this in ELBA. Most entries in the figure are real old. But recently new ones have appeared. E685, about which is hard to get information, has just posted the result in the figure. http://arXif.org/pdf/hep-ex/0305042 Fri, May 16.

The rest is from KLOE. The K_S result in particular is a real achievement and demonstrates the potential of KLOE.

Of course the accuracy must be improved and the charge kaons added in. It will all come, soon, I'm sure.

I want now to make some remarks on technical aspects about those measurements.

Sometimes a width is measured from BR and lifetime.

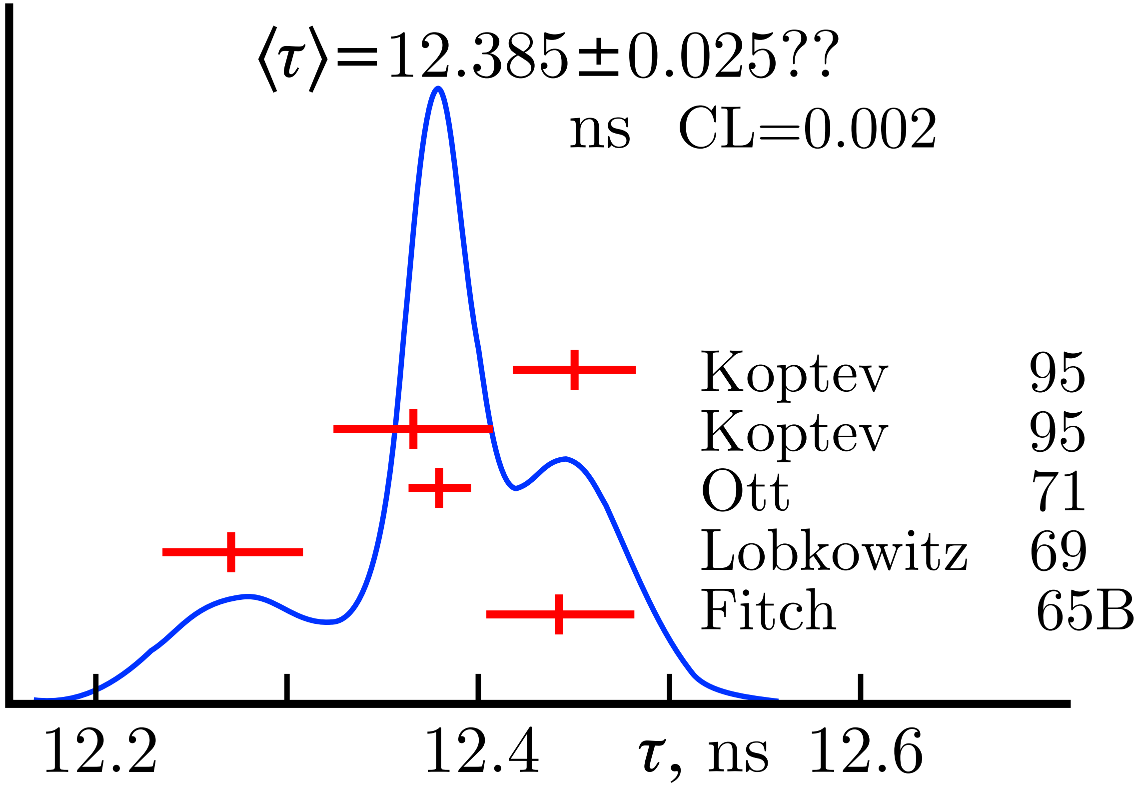
I showed in ELBA how KLOE, because we have a tag, can reduce the error due to the K_L lifetime by a factor of $\sim$5.

I have also said in December that the charged kaon lifetime is not perhaps so well known as the PDG groups quotes.

In http://pdg.lbl.gov/2002/mxxx.pdf
one finds $\tau(K^{\pm})$=12384±24 (fit) or 12385±25 (av.) ps, corresponding to a fractional accuracy of about 0.2%.

However in http://pdg.lbl.gov/2002/s010.pdf,

they give the ideogram on the right



The question is then, can we do something about lifetimes? The answer is very likely yes!!!

The study of $K_L \to \gamma\gamma$ has proved that we can. A first look at charge kaons is not outrageously off.

The fact is that KLOE has the best possibility for K_L and two ways for K^+.

The accuracy with which τ is measured with a sample of N decays, up to $t = \infty$, is given by:

$$\delta\tau = \frac{\tau}{\sqrt{N}}.$$

That is: $\delta\tau/\tau$=0.1% for N=10^6. yeah, stat only

If decays are observed for too short a time accuracy is lost. However after 2-3 lifetimes, the surviving particles are so few that the result is almost correct.

If decays are observed for $\bar{t} < t < \bar{t} + T$, the error on τ is given by

$$\delta\tau = \frac{\tau}{\sqrt{N}} \left(2ab - a^2b^2 - aT^2e^{-T}\right)^{-1/2}$$

where T is the measurement interval in units of the lifetime τ and

$$a = \frac{1}{1 - e^{-T}}$$
$$b = 1 - e^{-T} - Te^{-T}.$$

Values for K_L and 1,000,000 events are below. N_{tot} is the number needed to get an accuracy of 0.1%.

NA48
KTeV

KLOE

T/τ	$\delta\tau/\tau$ (%)	N_{equiv} (10^6)
0.013	3.46	71,007
0.45	0.77	60
0.50	0.70	49
1.00	0.36	13

KLOE is $\sim$1000$\times$better than NA48-KTeV

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is
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Charged Kaons by timing

Use $K^- \to \pi^-\pi^0$ for tag and correct crossing.
Use $K^+ \to \pi^+\pi^0$ for measuring the decay time.

Two corrections are necessary.

1. The decay time requires knowledge of the decay vertex in space.
2. Evaluation of the proper time requires the Lorentz factor γ which is bounded by $1 < \gamma < 1.04$.

The time resolution of KLOE, ∼300 ps is OK to get $\tau(K^+)$=12.384 ns to an accuracy of 24 ps, 0.2%

LET'S HAVE FUN