Measuring $\mathrm{B}(\pi^0 \to e^+e^-\gamma)$ using $K_L \to 3\pi^0$

Erin Abouzaid

University of Chicago

12 March 2005

Outline

- Current PDG Value
- Sample & Statistics
- A Few Plots
- Current Work and Next Steps

PDG Average for π^0 Dalitz Decay

$\frac{\Gamma(\gamma e^+ e^-)}{\Gamma(2\gamma)} = (1.213 \pm .030)\%$

From

$(1.25 \pm .04)\%$ Schardt 1981, $\pi^- p \to n\pi^0$

$(1.166 \pm .047)\%$ Samios 1961, 3071 events, $\pi^- p \to n\pi^0$

$(1.17 \pm .15)\%$ Budagov 1960, 27 events

No measurements of π^0 Dalitz decay BR for $\sim$ 20 years. The 2.5% uncertainty on the current number feeds in to many other measurements. KTeV has plenty of events to reduce the uncertainty, and this will have a broad impact on other measurements.

Sample & Statistics

Idea

- Use $K_L \to 3\pi^0$, where one $\pi^0 \to e^+e^-\gamma$ as signal
- Normalization mode is $K_L \to 3\pi^0$ with $\pi^0 \to \gamma\gamma$
- Ideally use trigger 6 for both, but too restrictive (requires exactly 6 clusters at L3)

Trigger 14 for Dalitz decay events

Trigger 14: combination charged & neutral trigger; similar to trigger 1 (charged mode trigger for ϵ'); requires 7 or more HCC, has HA veto

Event selection:

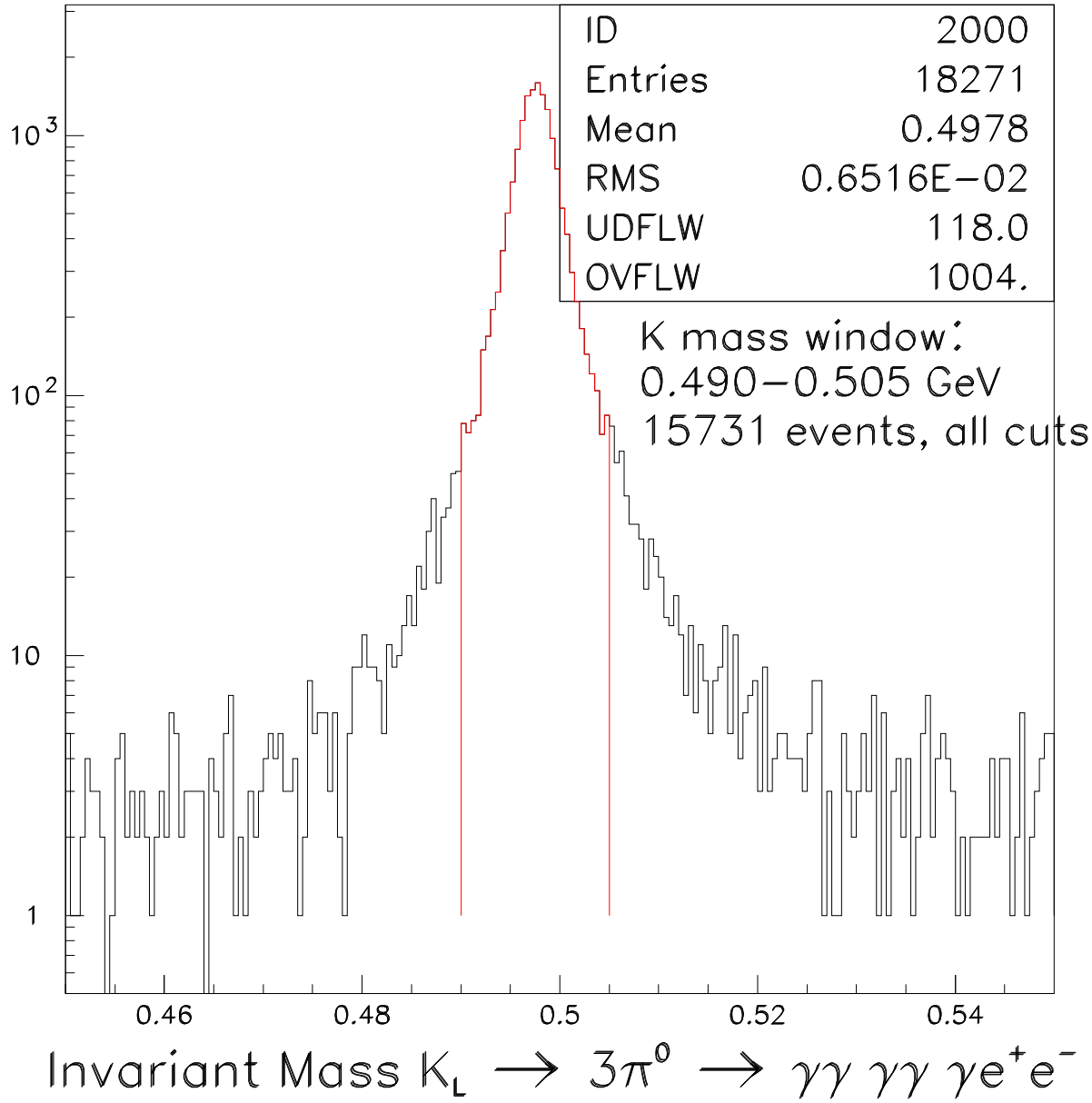
- kaon mass: [0.490, 0.505] GeV/c^2
- kaon z: [123.0, 158.0] m
- kaon energy: [40.0, 160.0] GeV
- min cluster energy: 3.0 GeV

$\to$ end up with $\sim$ 270,000 events

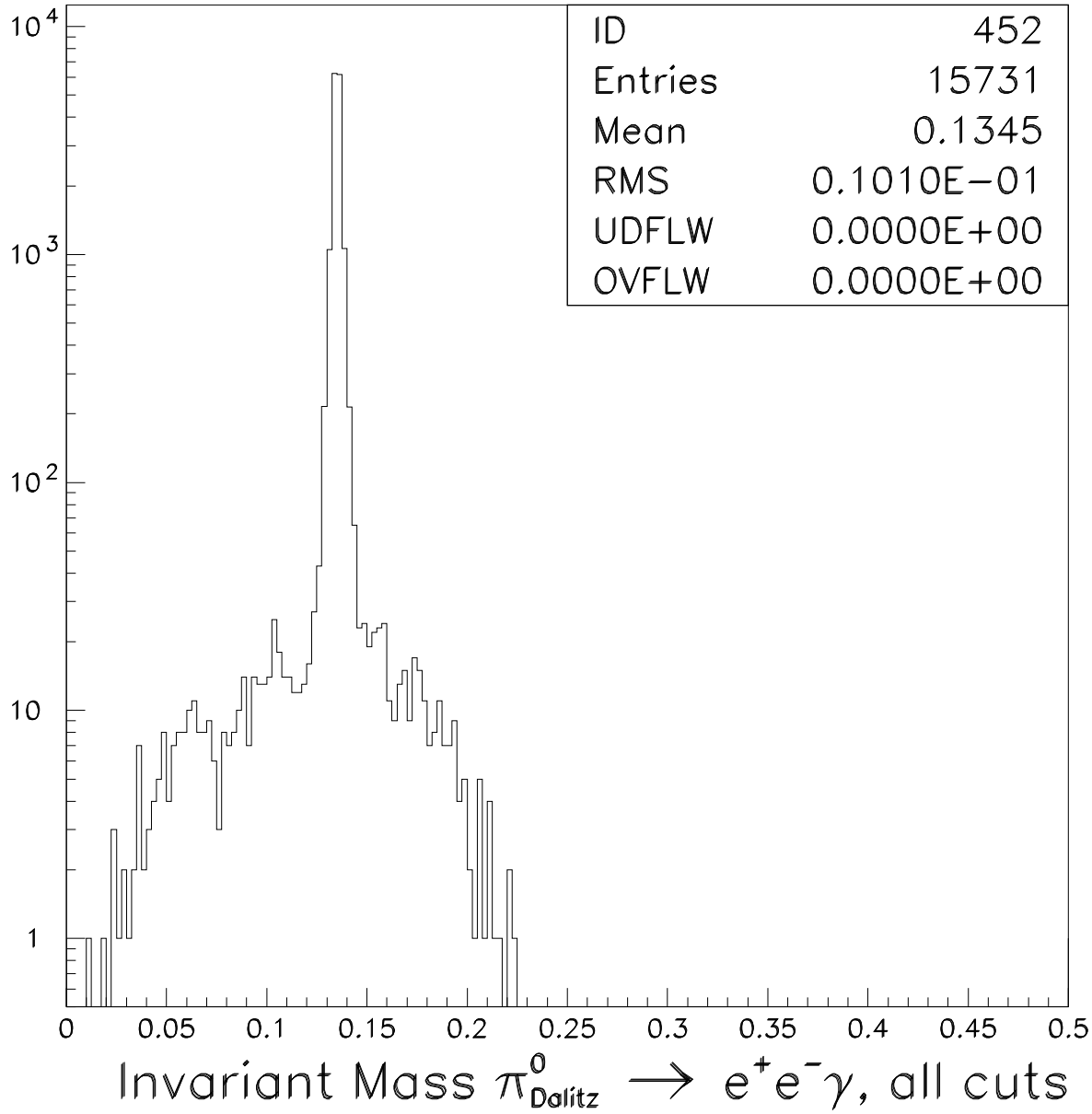
$\to$ statistical uncertainty around 0.19%

Trigger 6 for $K_L \to 3\pi^0$ events, for normalization (prescale by 10)

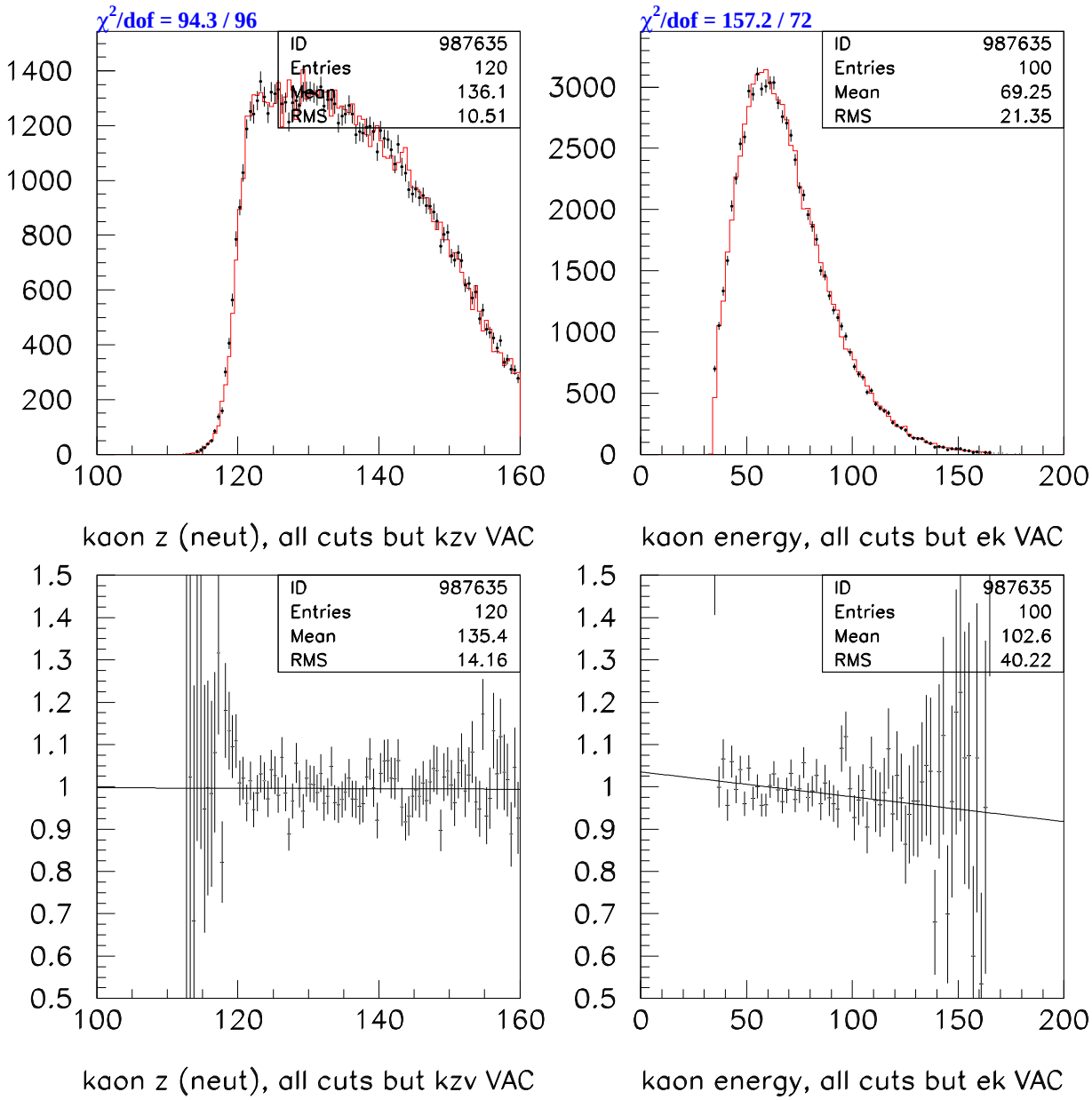
K_L invariant mass for Dalitz events



$e^+e^-\gamma$ invariant mass



$K_L \to 3\pi^0 \to 6\gamma$



Current Work & Next Steps

Studying trigger efficiency: using random accepts from trigger 6

Working on full-sample Data-MC overlays

Beginning to think about dealing with tracking issues, systematics

Very important to make the measurement in an independent sample with different systematics

- $K_L \to \pi^+\pi^-\pi^0$
- $K_L \to 3\pi^0$ without tracking requirement in trigger