Update on the $\Xi^0 \to \Sigma^+ \mu^- \bar{\nu}_\mu$ Analysis

E799 - 99 Data

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Last KTeV Meeting

Two Independent Analysis - (*Different Normalization Modes*)

$BR_{\Xi^0 \to \Sigma^+ \mu^- \bar{\nu}_\mu} = (4.3 \pm 1.4) \times 10^{-6}$, using $\Xi^0 \to \Lambda \pi^0$

$BR_{\Xi^0 \to \Sigma^+ \mu^- \bar{\nu}_\mu} = (4.2 \pm 1.4) \times 10^{-6}$, using $\Xi^0 \to \Sigma^+ e^- \bar{\nu}_e$

Consistent Analysis

One more Double Check

$BR_{\Xi^0 \to \Sigma^+ e^- \bar{\nu}_e} = 2.78 \times 10^{-4}$, using $\Xi^0 \to \Lambda \pi^0$

Consistent with Previous Measurement

The Plan

Since $\Xi^0 \to \Sigma^+ e^- \bar{\nu}_e$ is topologicaly identical to $\Xi^0 \to \Sigma^+ \mu^- \bar{\nu}_\mu$ decay;
and since we plan to combine 99 and 97 Data into the Analysis,
but 97 analysis used $\Xi^0 \to \Sigma^+ e^- \bar{\nu}_e$ as norm. mode,

then... we decided to use $\Xi^0 \to \Sigma^+ e^- \bar{\nu}_e$ as norm. mode

However

We need to improve $\Xi^0 \to \Sigma^+ e^- \bar{\nu}_e$ events, eliminating backgrounds.
I'm going to show this improvement at this brief presentation.

Meanwhile, at BEACH Conference (July 2004)...

We presented our preliminary results; and
confirmed NA48 work on both Cascade Beta and Muon Decays

Selection Criteria used to clean $\Xi^0 \to \Sigma^+ e^- \bar{\nu}_e$ Decays

Special Variable: *vtxpt2v*

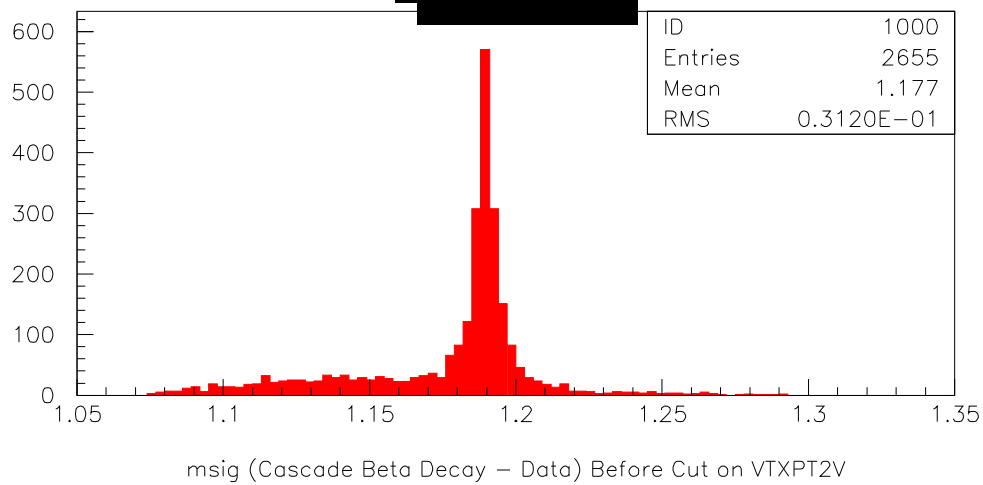
the square of the transverse momentum considering a line connecting the target to the charged vertex

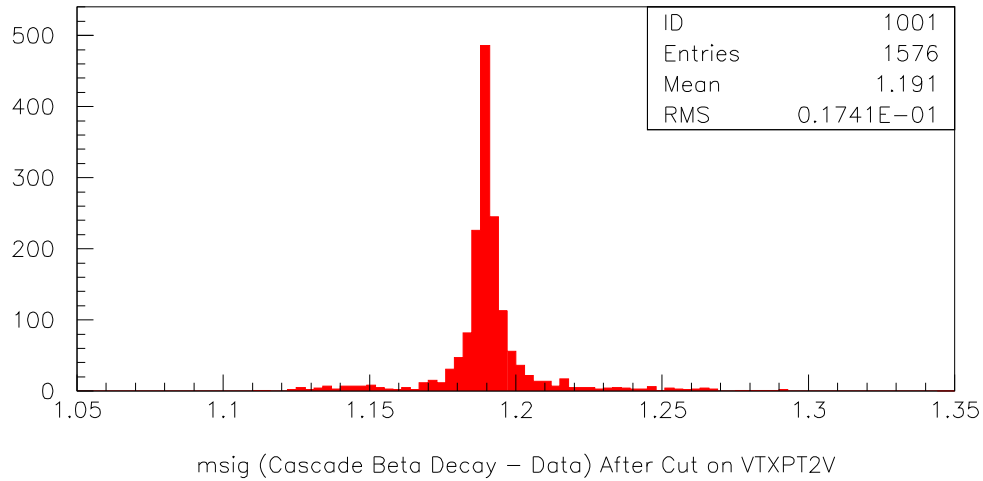
The variable vtxpt2v is related to the quality of the charged vertex. Since $\Xi^0 \to \Sigma^+ e^- \bar{\nu}_e$ (and $\Xi^0 \to \Sigma^+ \mu^- \bar{\nu}_\mu$) has not a charged vertex, we can distinguish it from all possible backgrounds, in particular $\Xi^0 \to \Lambda \pi^0 (\Lambda \to p e \bar{\nu}_e)$

Result: Very Efficient to eliminate our backgrounds

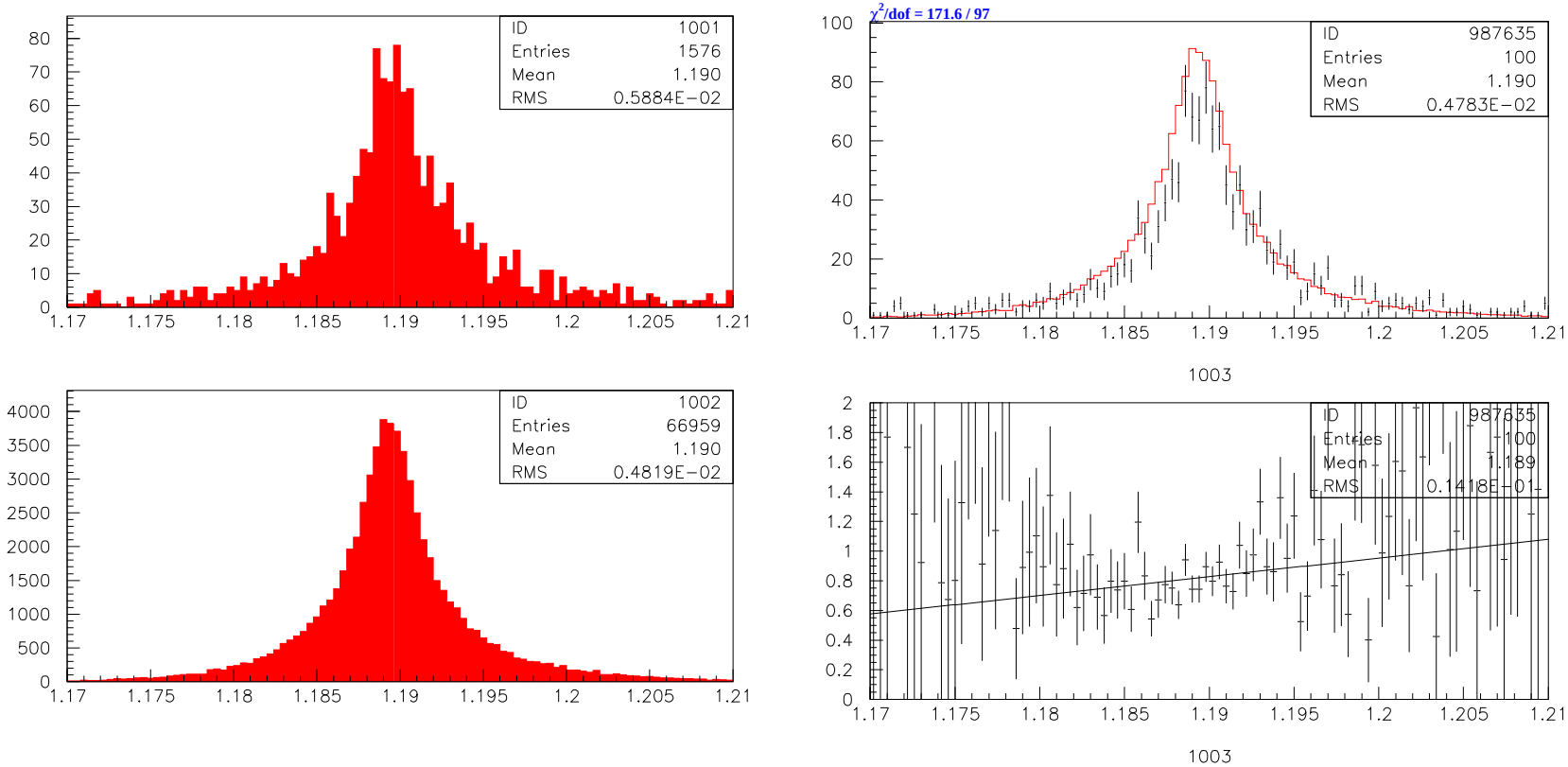
$\Xi^0 \to \Sigma^+ e^- \bar{\nu}_e$ Events
Before and After the cut in vtxpt2v

DATA

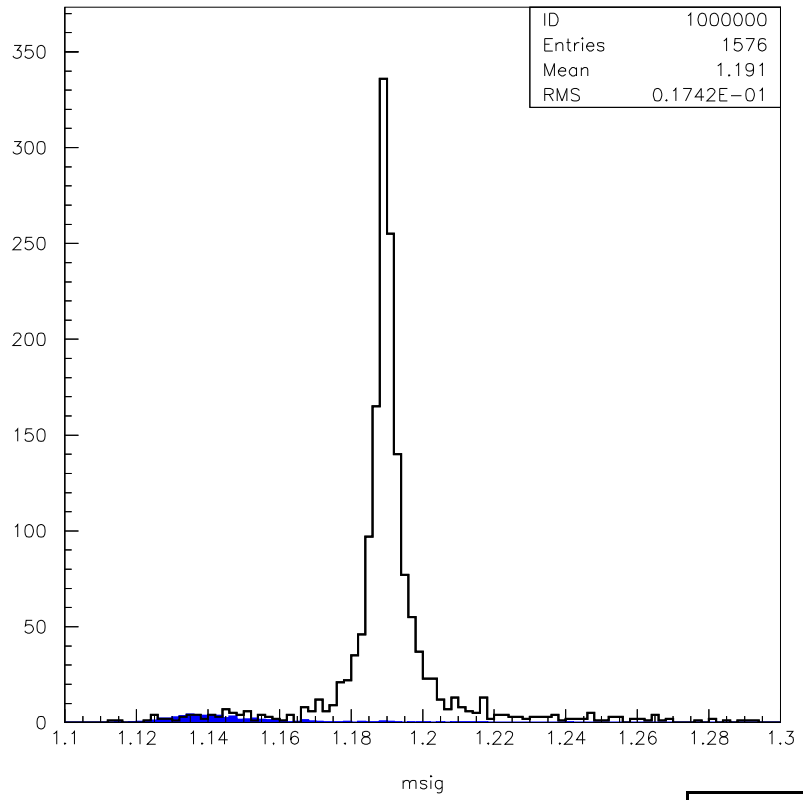


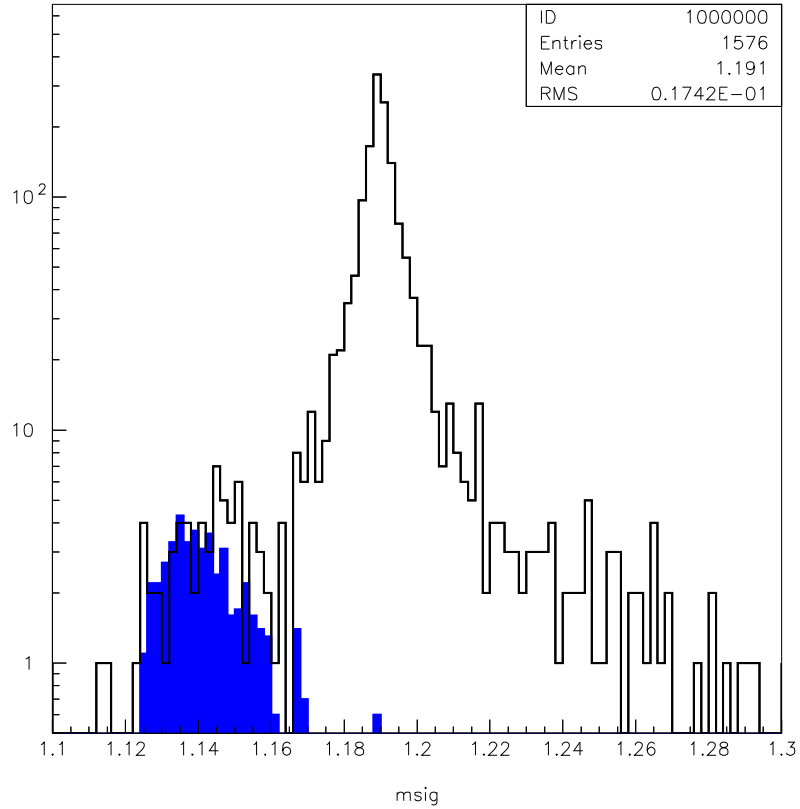


Sigma Mass in $\Xi^0 \to \Sigma^+ e^- \bar{\nu}_e$ Events in DATA and Monte Carlo



Sigma Mass of $\Xi^0 \to \Sigma^+ e^- \bar{\nu}_e$ Events (DATA) and $\Xi^0 \to \Lambda\pi^0(\Lambda \to pe\bar{\nu}_e)$ Background in BLUE (MC)





Normalized

Conclusions (concerning the Norm. Mode)

1. $\Xi^0 \to \Sigma^+ e^- \bar{\nu}_e$ **events are very clean - (less than 1% error)**

2. We understand the background evts - $(\Xi^0 \to \Lambda\pi^0(\Lambda \to pe\bar{\nu}_e))$

Conclusions (concerning the BR Calculation)

99 Analysis: $BR_{\Xi^0 \to \Sigma^+ \mu^- \bar{\nu}_\mu} = (4.5 \pm 1.5) \times 10^{-6}$**, using** $\Xi^0 \to \Sigma^+ e^- \bar{\nu}_e$

Theoretical Prediction: 2.3×10^{-6} **(priv. comm.)**

97 Analysis: $BR_{\Xi^0 \to \Sigma^+ \mu^- \bar{\nu}_\mu} = (3.5^{+2.0}_{-1.6}(stat.)^{+0.5}_{-1.0}(sys.)) \times 10^{-4}$ **(by Nick)**

Present Status

I'm working on systematical and statistical (asymmetrical) error for $\Xi^0 \to \Sigma^+ \mu^- \bar{\nu}_\mu$ Decay; and

I'm writing the paper about the "Observation of the $\Xi^0 \to \Sigma^+ \mu^- \bar{\nu}_\mu$ Decay"

Discussion with the Collaboration

The plan is combine 99 and 97 DATA, and we need to consider the competition.

Let's use the "old" 97 Analysis and conclude the paper soon?

Is there a need for a "new" 97 Analysis? If so, there will necessarily be a delay of the paper.

Future Step

Our sample of $\Xi^0 \to \Sigma^+ e^- \bar{\nu}_e$ events is so clean, that we could publish the 99 Analysis of this decay also!

Cheers!