CB Note 347

JDC geometrical z distortion in April 1996 data and possibly all data after that

Mark Lakata

April 27, 1999

(This note is a summary of a section of CB Note 346).

The z-dimension of the JDC was discovered to be incorrectly calculated in the reconstruction by a significant amount in CB Note 328, using the alignment of the tracks to PEDs. We have discovered the same effect, but using the information from the JDC alone.

We found that the invariant mass of the V1 $\pi^+\pi^-$ pair was dependent on the orientation of the decay. If one takes the normal to the K_S decay plane

$$\hat{n} = \vec{p}_{\pi^+} \times \vec{p}_{\pi^-} \tag{0.1}$$

and then looks at the invariant mass of the pair as a function of

$$\cos\theta = \hat{n}_z/|\hat{n}|, \tag{0.2}$$

one could see a significant drop in mass as $\cos\theta \longrightarrow 1$. This is because for $\cos\theta = 0$, the z dimension has no affect on the opening angle calculation, but as $\cos\theta \longrightarrow 1$ the z dimension becomes important. If the z dimension is compressed, the angle becomes smaller too, and the invariant mass falls. This is shown in figure 0.1.

There are two explanations for this behavior. The first is that the resistive length of the wire in the database is somehow wrong, which is stated in CB Note 328. The alternative is that the charge division algorithm was tainted by a DC offset. The z position is calculated as

$$z = \frac{A_u - A_l}{A_u + A_l} * \frac{L}{2} \tag{0.3}$$

where A_x are the integrated amplitudes on the up and down stream wires and L is the resistive length of the wire. However, if there is a DC offset in A_x of about 3% of the maximum signal, then this will cause a similar behavior to rescaling the resistive wire length – the DC offset is cancelled in the numerator but not in the denominator. We did notice that the dE/dx information did exhibit a DC offset compared to the Monte Carlo, although we have not investigated this behavior any further.

To determine the correct JDC z dimension, the z dimension was scaled by a parameter until the invariant mass was no longer dependent on the polar angle of $\hat{n}$. The scaling factor of

$$s_z = 1.0709 \pm 0.005 \tag{0.4}$$

was determined to satisfy this condition. This is in agreement with the determination of $s_z = 1.06$ in CB Note 328. Figure 0.1 shows that the V1 mass is now constant with respect to decay plane angle.

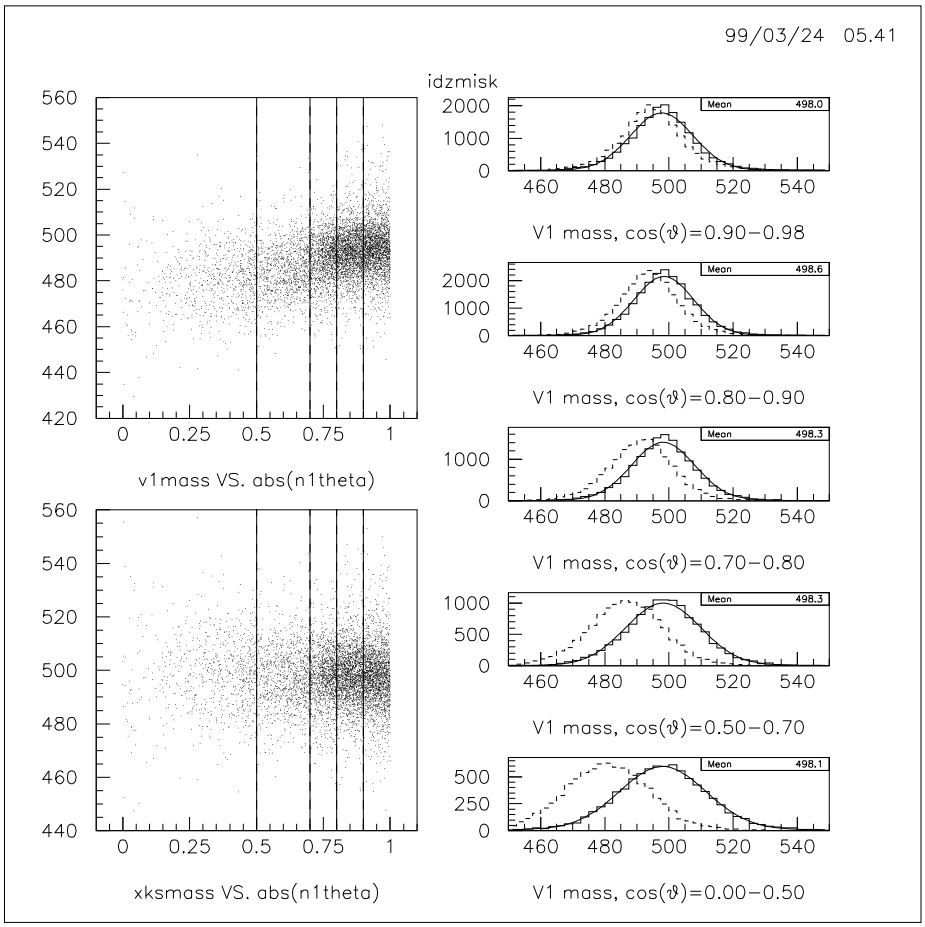

Figure 0.1: V1 invariant mass, before and after z-dimension rescaling. In (a) is shown the invariant mass of V1 versus the decay plane angle (see equation 0.2). In (b) the same is plotted, except after the rescaling of the z dimension. The right column shows the slices of the scatter plots. The solid line is the corrected data, and the dashed line is the uncorrected data.