

## Matching Tracks - Corrected Distributions

### Introduction

A sample of located m CC events is used to determine the SFT to Emulsion coordinate alignment. The 68 events used here have a muon unambiguously reconstructed in the spectrometer with SFT hits, as well as a clear match to emulsion tracks. Further, the alignment procedure from m-file data can be tested for the subset of events which have an m-file at Fermilab, a total of 20 events.

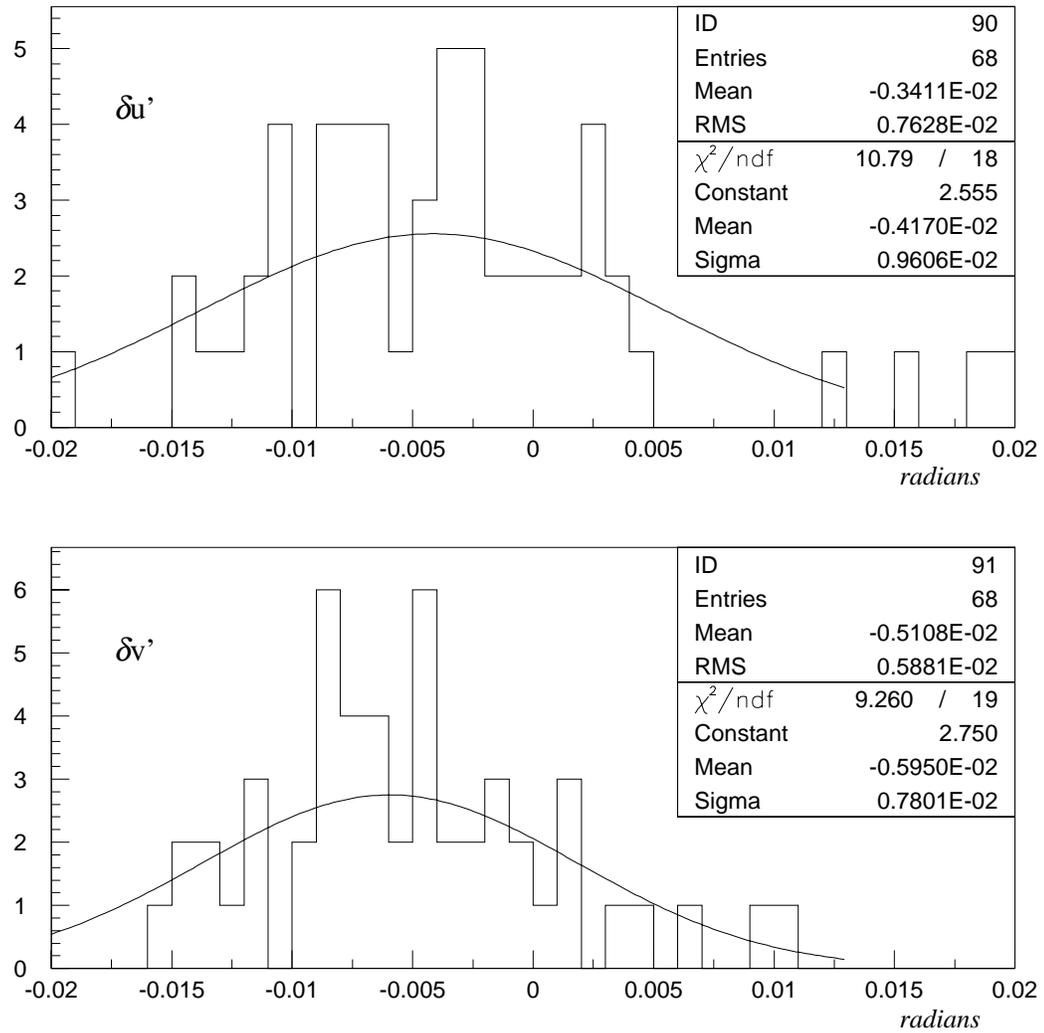
Gina selected this set of events from Period 3 and 4. Although the m-files are available for only 30% of the data it is sufficient to show the results of the method to a resolution of better than 2 milliradians ( $0.005/\sqrt{20}$ ).

### Results

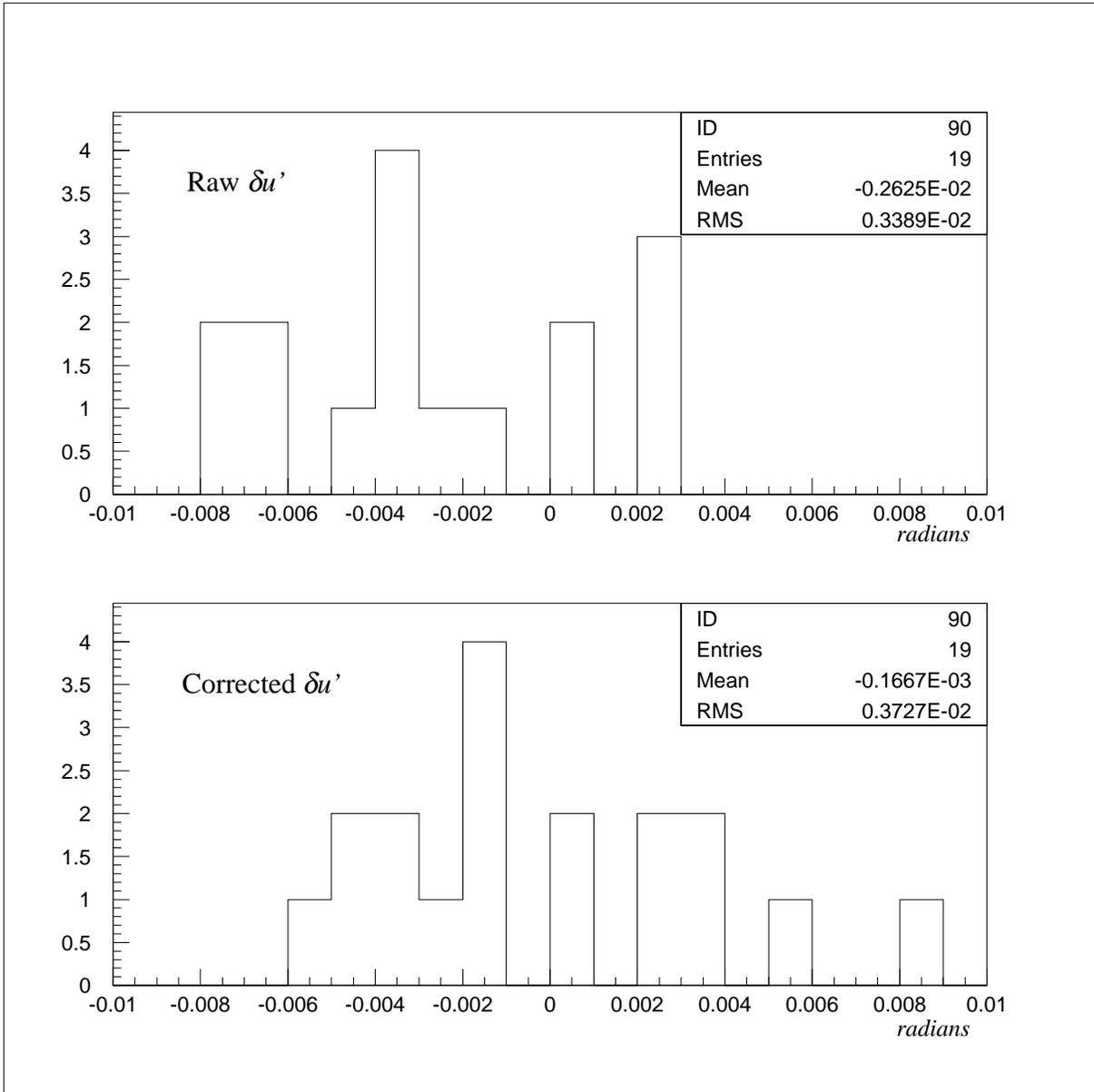
The uncorrected distributions of the difference between the Emulsion and fiber tracks ( $\delta u' \equiv u'_{emul} - u'_{SFT}$ ) for the entire data set (Fig. 1) show an offset of approximately -4 mrad in both  $u'$  and  $v'$ . This indicates that there is a residual rotation of coordinate systems between the emulsion data as found in the "m-files" ( and \*.ecv files ) and the spectrometer system as found in the SFT. This has been noted before when comparing distributions of the straight-thru tracks from m-files and the T1•T3 triggers found in the normally targeted (PW7) data. This is due mainly to a 7 mrad offset in  $y'$ . These offsets actually vary with position in the target, as noted before. Note also, that the uncorrected RMS widths of the histograms is 6 to 7 mrad and the fit  $\sigma$  is 8 to 9 mrad. The expected  $\sigma$  is the combined effects from the resolution of the emulsion track (calibration and scattering) and the resolution of the SFT system :  $\sigma_{tot} = \sigma_{emul} \oplus \sigma_{SFT} \cong 2 \text{ mrad} \oplus 3 \text{ mrad} = 4 \text{ mrad}$ , where scattering is neglected.

The  $d(u', v')$  data can be corrected on an event-by-event basis, using the m-file data, and has been studied earlier (see June - Sep 99 memos). It was found that the corrected  $v'$  distribution was centered but the  $u'$  distribution remained offset by 3 mrad, and was not explained. Figures 2 and 3 show the corrected distributions of the matched muons from a subset of 19 events that had m-files readily available at Fermilab. For the  $u'$  corrected data, an additional 4mrad offset was added to center the distribution. Apparently, the corrections derived from the T1•T3 data do not show this offset seen when comparing emulsion data and SFT data, eventhough the change in the position of the "eyes" in angle-space as function of transverse spatial position is clearly seen and about the magnitude. For now this extra correction is put in *ad-hoc* and applied to the data. Note that the RMS widths in this subset of data, ~4mrad, is smaller than the entire sample. There is no significant improvement seen in the width in the corrected sample. This indicates that for this data set, the same results could be obtained with a simple offset, independent of position, for each view.

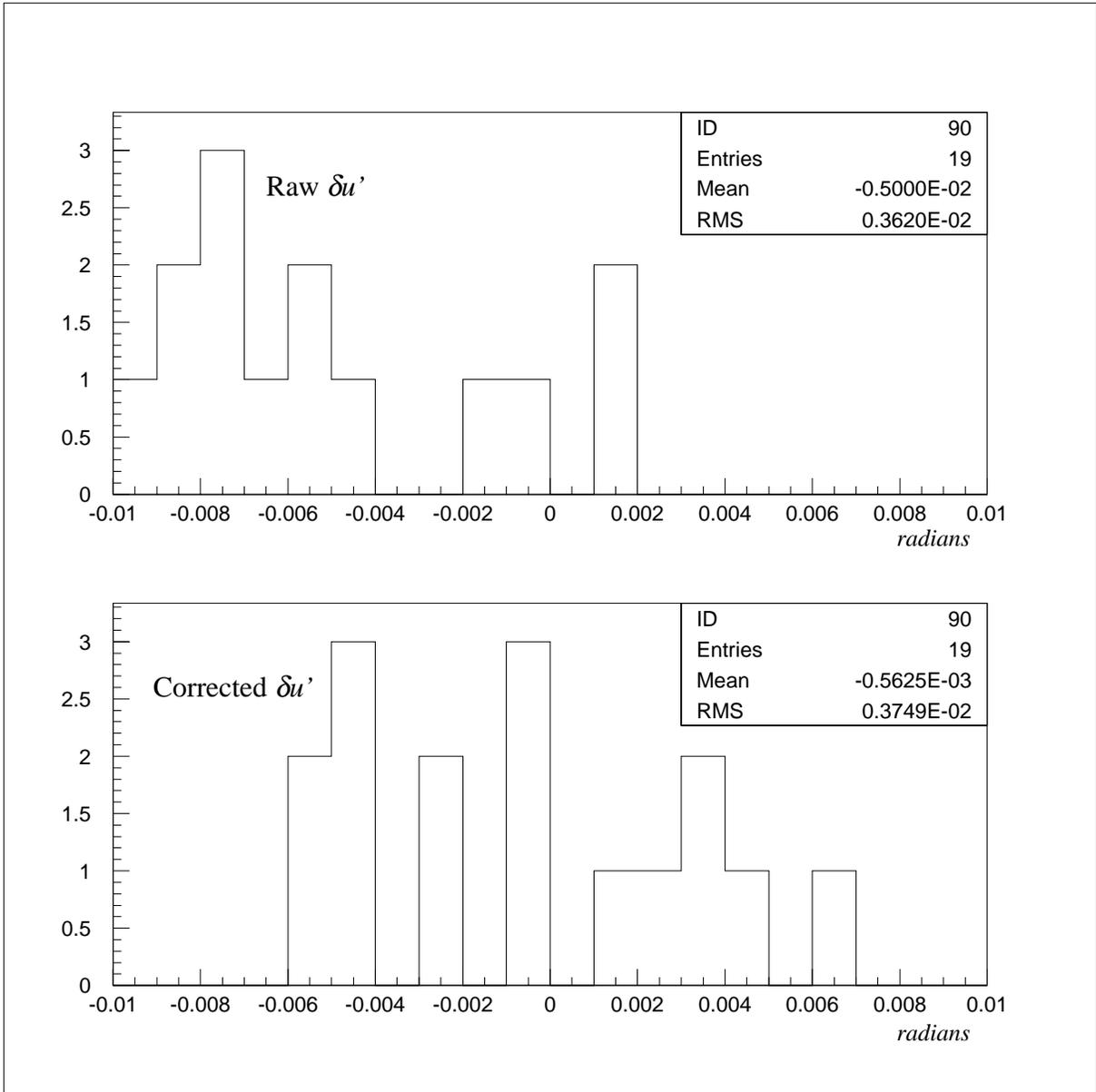
The angular distance between the "eyes" is a measure of the longitudinal ( $z$ -scale) error from a systematic thickness difference in the processed emulsion. The effect of applying this correction is shown in Figure 6. There are small improvements in the RMS width of the distributions.



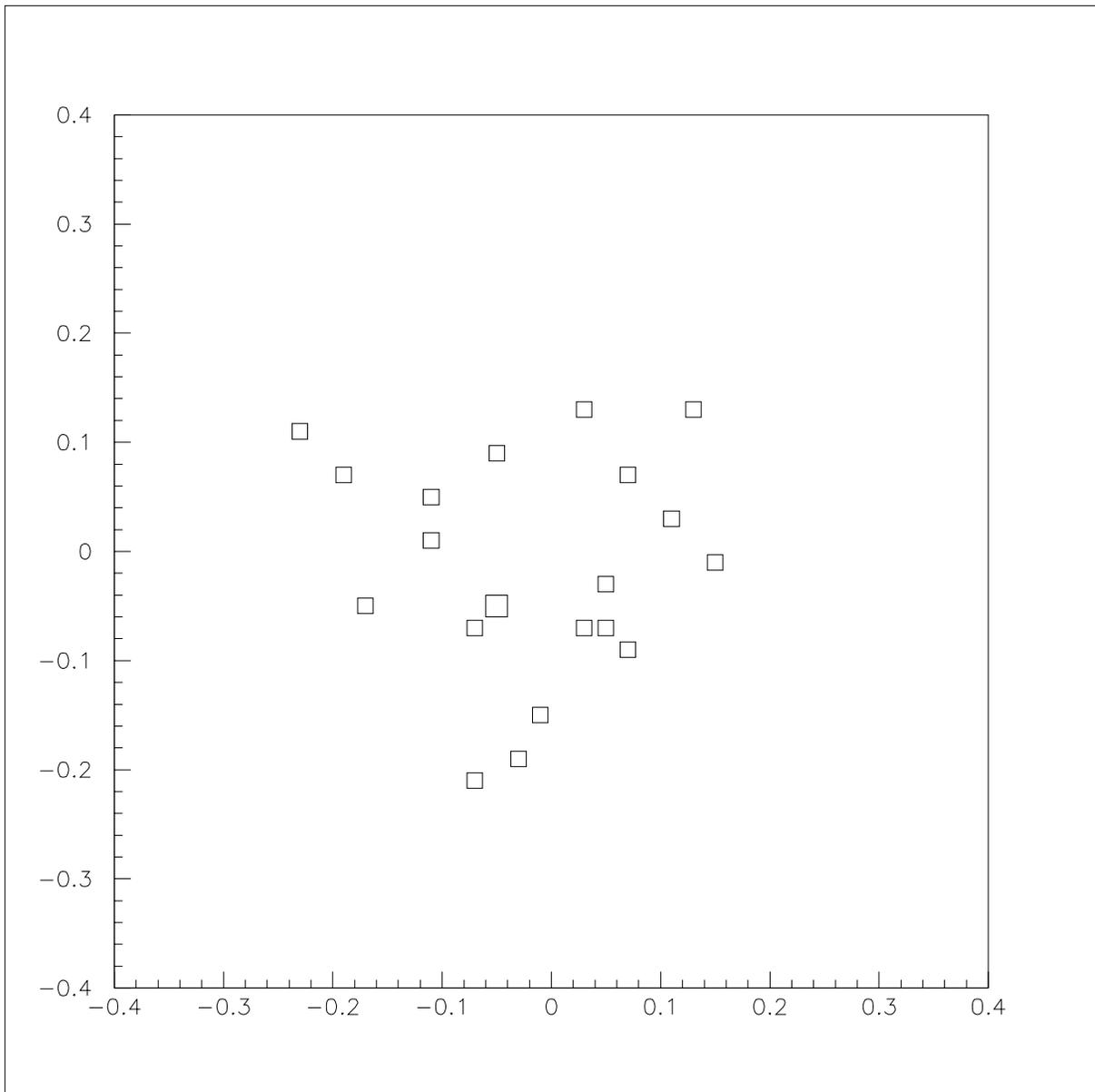
**Figure 1.** The uncorrected distributions of  $u'_{emul} - u'_{SFT}$  (top) and  $v'_{emul} - v'_{SFT}$  (bottom).



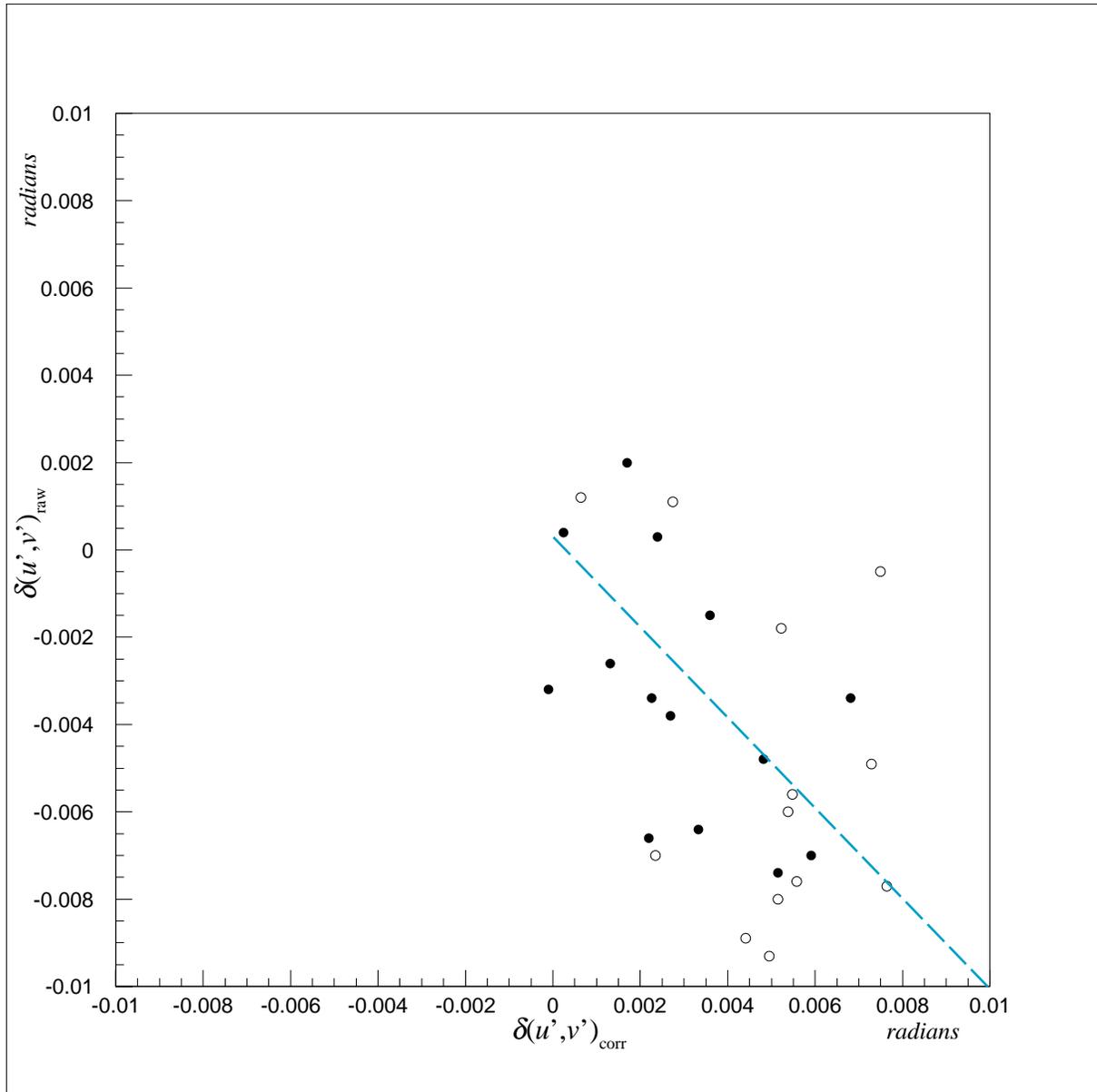
**Figure 2.** The  $\delta u'$  from the data (*top*) and the corrected data distribution (*bottom*).



**Figure 3.** The  $\delta v'$  from the data (*top*) and the corrected data distribution (*bottom*).



**Figure 4.** The transverse distribution of m CC events used for the corrected sample of events.



**Figure 5.** The raw difference in angles  $\delta(u', v')$  plotted vertical versus the corrected difference in the angles. The open circles are  $u'$  data and the filled circles are the  $v'$  data. The points show a degree of correlation consistent with the measurement errors (approx,  $\pm 4$  mrad.)

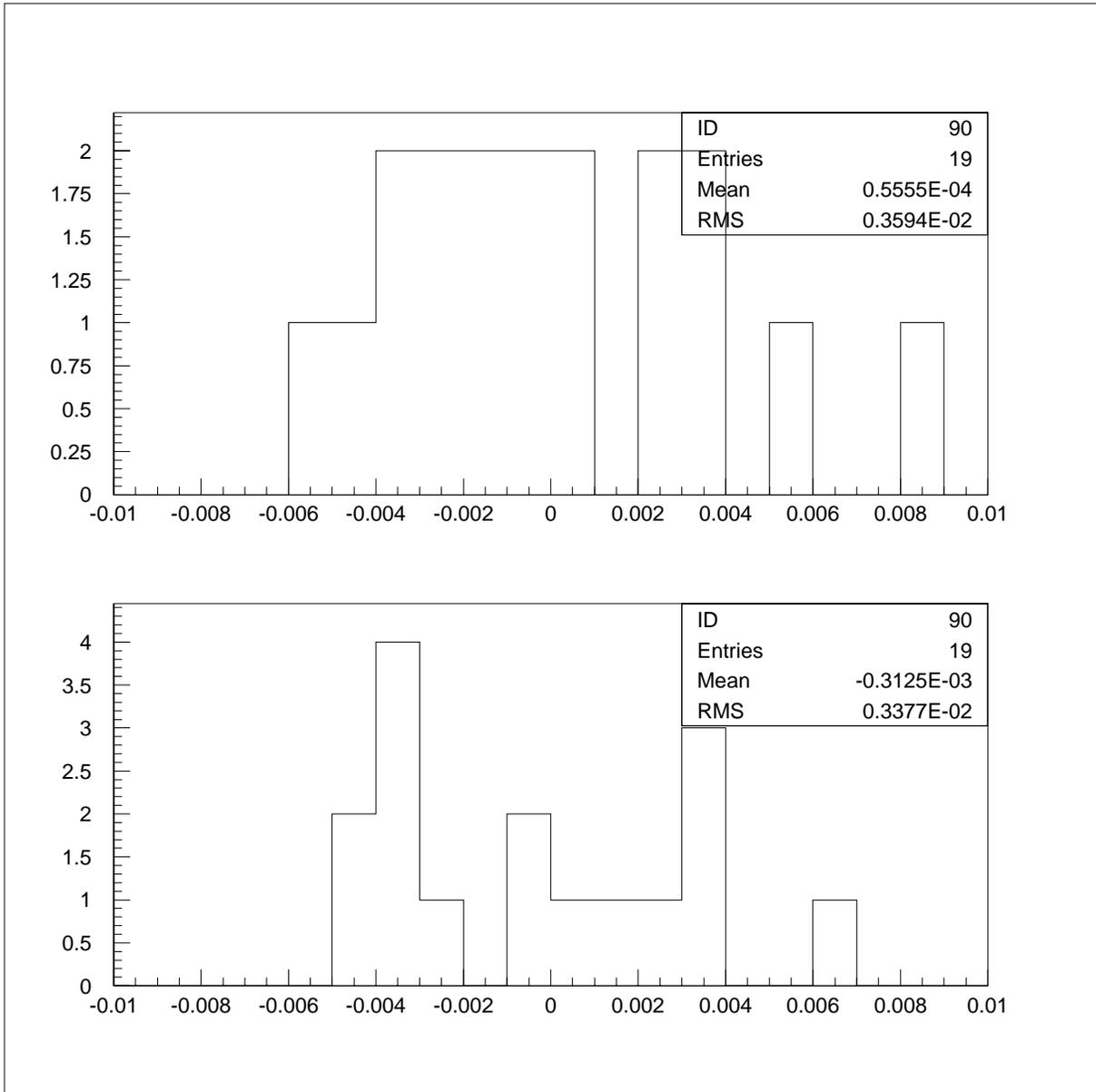


Figure 6. The  $\delta(u', v')$  distributions corrected for both angular offset and  $z$ -scale errors, as derived from the m-file data for each event.