Preliminary analysis of MIPP thin carbon target data

All analysis performed using run 12421, taken on Feb.17 with 7254 events. Data is compared to Fluka simulation of carbon target using proton, pion, and kaon beams, with roughly 10000 events in each case.

1 Finding Target Position

First, find the location of the target in TPC coordinate system. To do this, I ran the TPC vertex reconstruction software and plotted the Z distribution of reconstructed vertices (see fig.1). As expected there is a peak in the distribution a few centimeters upstream of the TPC window, around -80 cm. I then selected vertices within 5 cm in order to get most of the peak but not too much of the tail, and plotted the X (fig.2) and Y (fig.3) distributions. Gaussian fit results are in table 1.

For this analysis I required vertices within 3 sigma of the mean according to these fits.

2 Data/Fluka Comparison of Multiplicity

There is reasonable agreement between the data and Fluka except at multiplicities below about 7, where we do not see a dip the data as in Fluka. See fig.4.

3 Data/Fluka Comparison of Momentum Distribution

The data and Fluka agree well in the range of 2-5 GeV, after which the data dips below the Fluka results. Low statistics above 25 GeV make it difficult to draw any conclusions beyond this point. See fig.5.

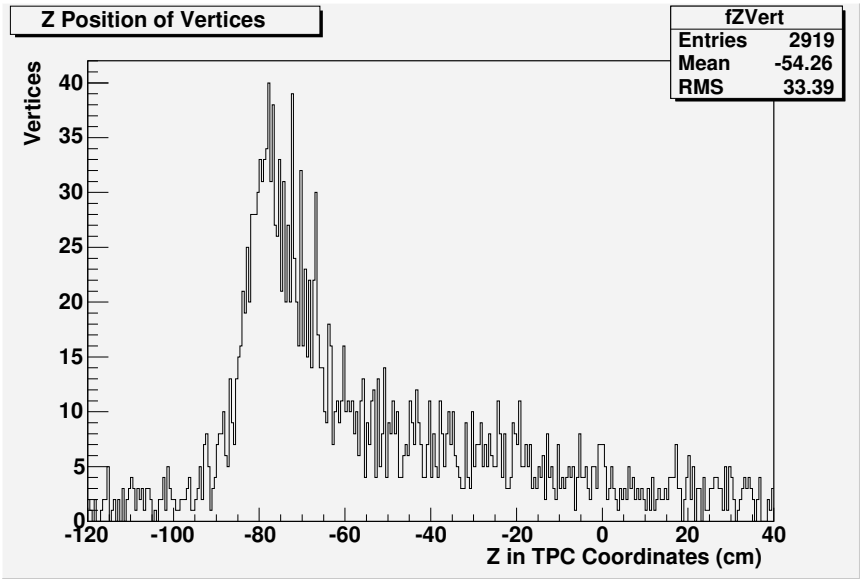


Figure 1: Distribution of vertex z coordinates.

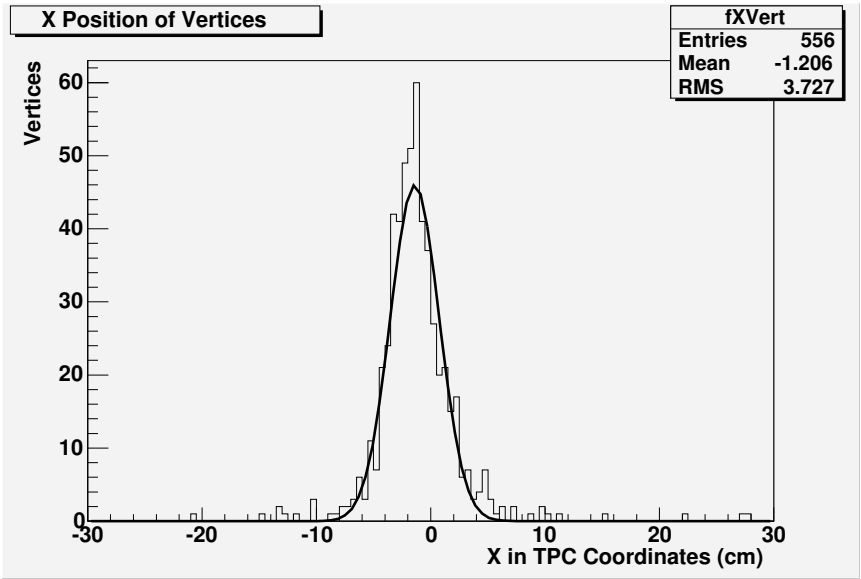


Figure 2: Distribution of vertex x coordinates.

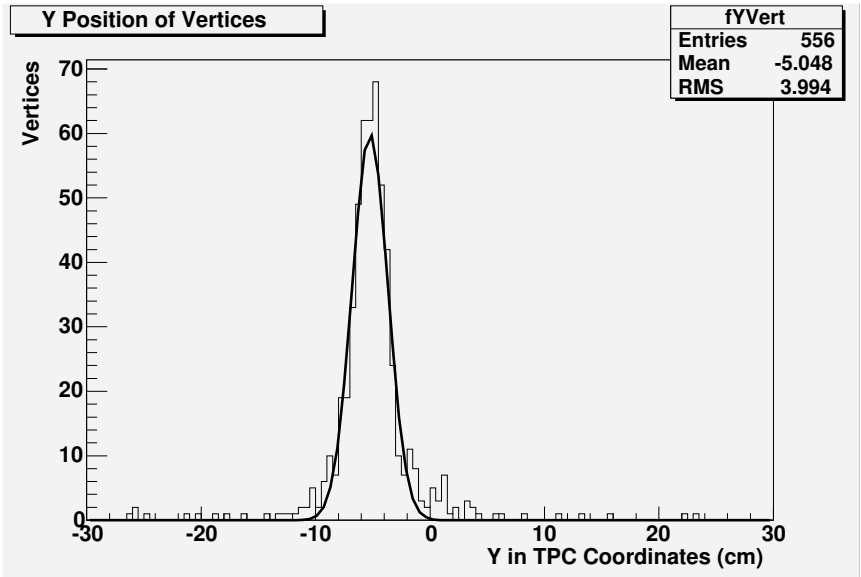
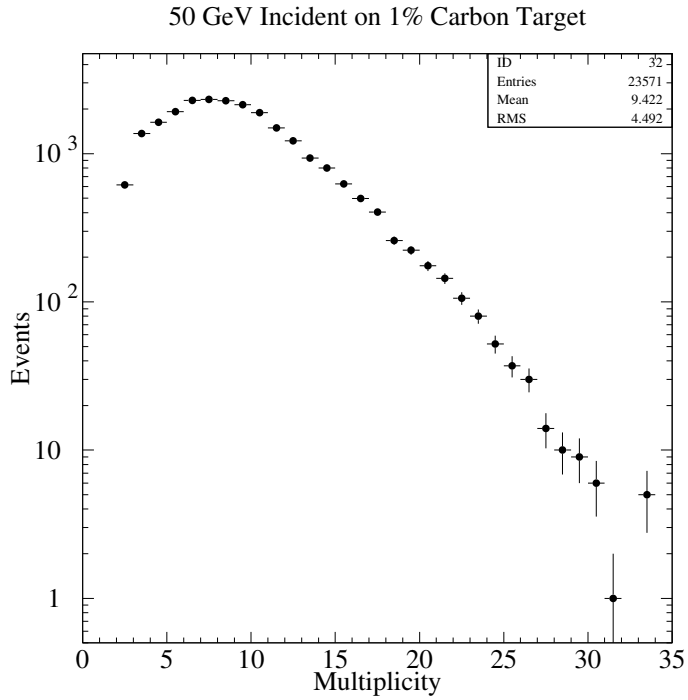


Figure 3: Distribution of vertex y coordinates.

Coordinate	Mean	Sigma
X	-1.14	2.39
Y	-5.31	1.89

Table 1: Summary of Gaussian fit to vertex position distributions.



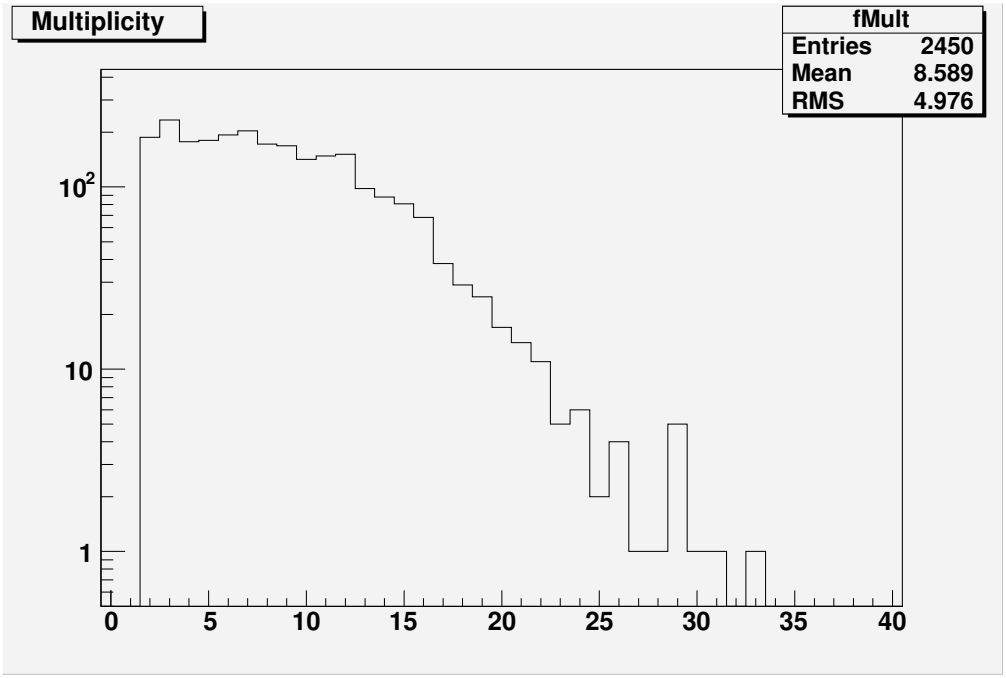


Figure 4: Top: Distribution of multiplicty for Fluka interactions in carbon target. Bottom: Distribution of multiplicity for carbon data interactions.

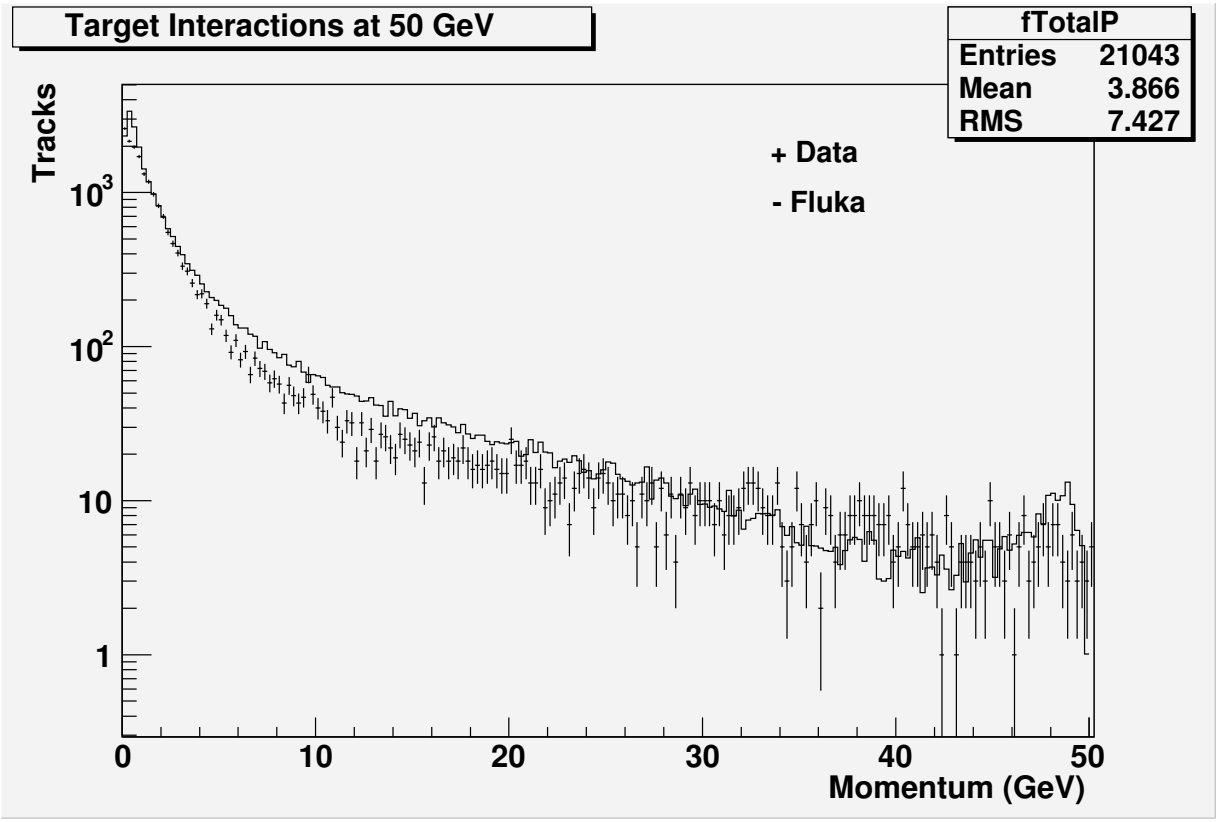


Figure 5: Data/Fluka momentum comparison for carbon target.

4 Data/Fluka Comparison of Transverse Momentum Distribution

Both distributions show a peak around 250-300 GeV. This is expected as it is near the Feynman energy. However, agreement between the two is quite poor. The data suggests an exponential decrease, dissimilar to the Fluka curve. See fig.6.

5 Data/Fluka Comparison of Invariant Mass

Using Fluka, invariant mass was calculated for each pair of oppositely charged pions associated with a given vertex. One would expect to see a narrow peak at the kaon mass (500 MeV), assuming Fluka handles the decay of k-shorts. What is seen is a very narrow (1 bin) peak superimposed on a second wide peak.

Since pid is not yet available for the data, invariant mass was calculated for all oppositely charged pairs assuming pions. The data shows a similar wide peak but within the narrower peak on top of it. See fig.7.

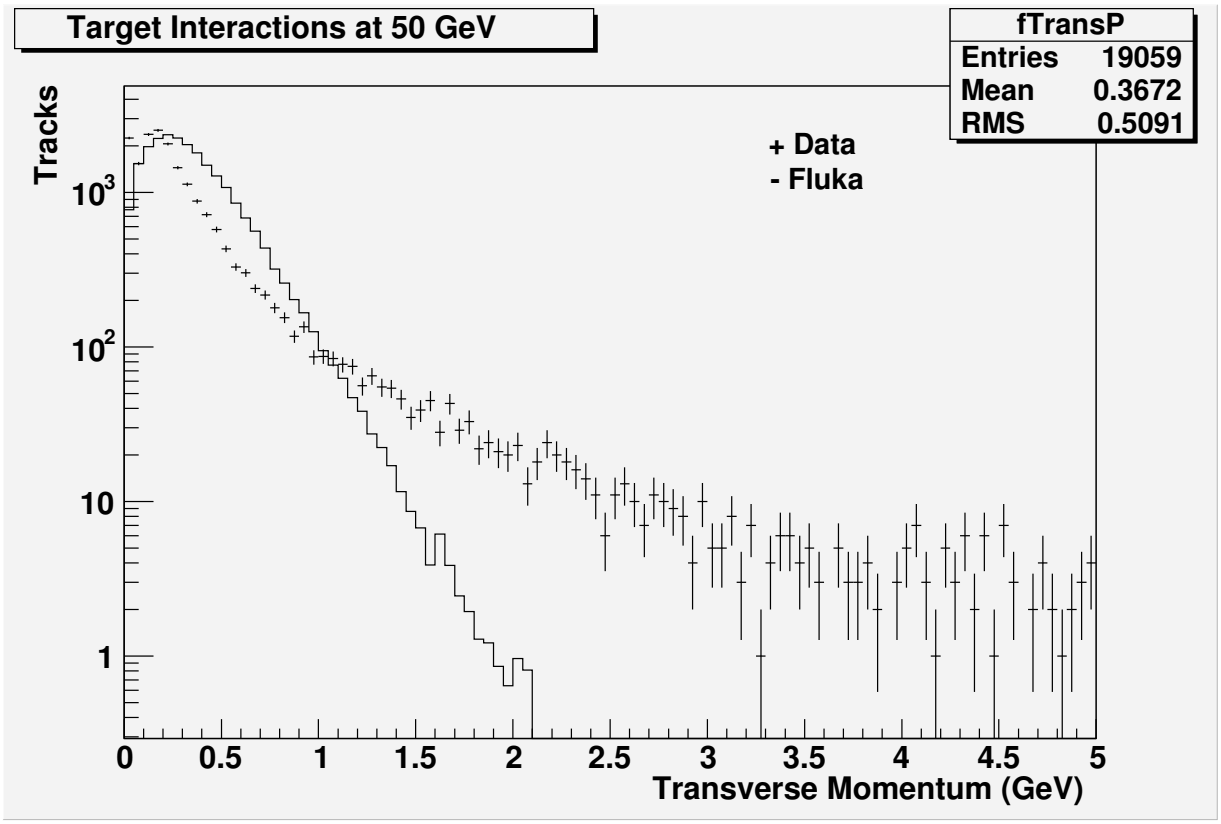


Figure 6: Data/Fluka transverse momentum comparison for carbon target and total momentum of track less than 20 GeV.

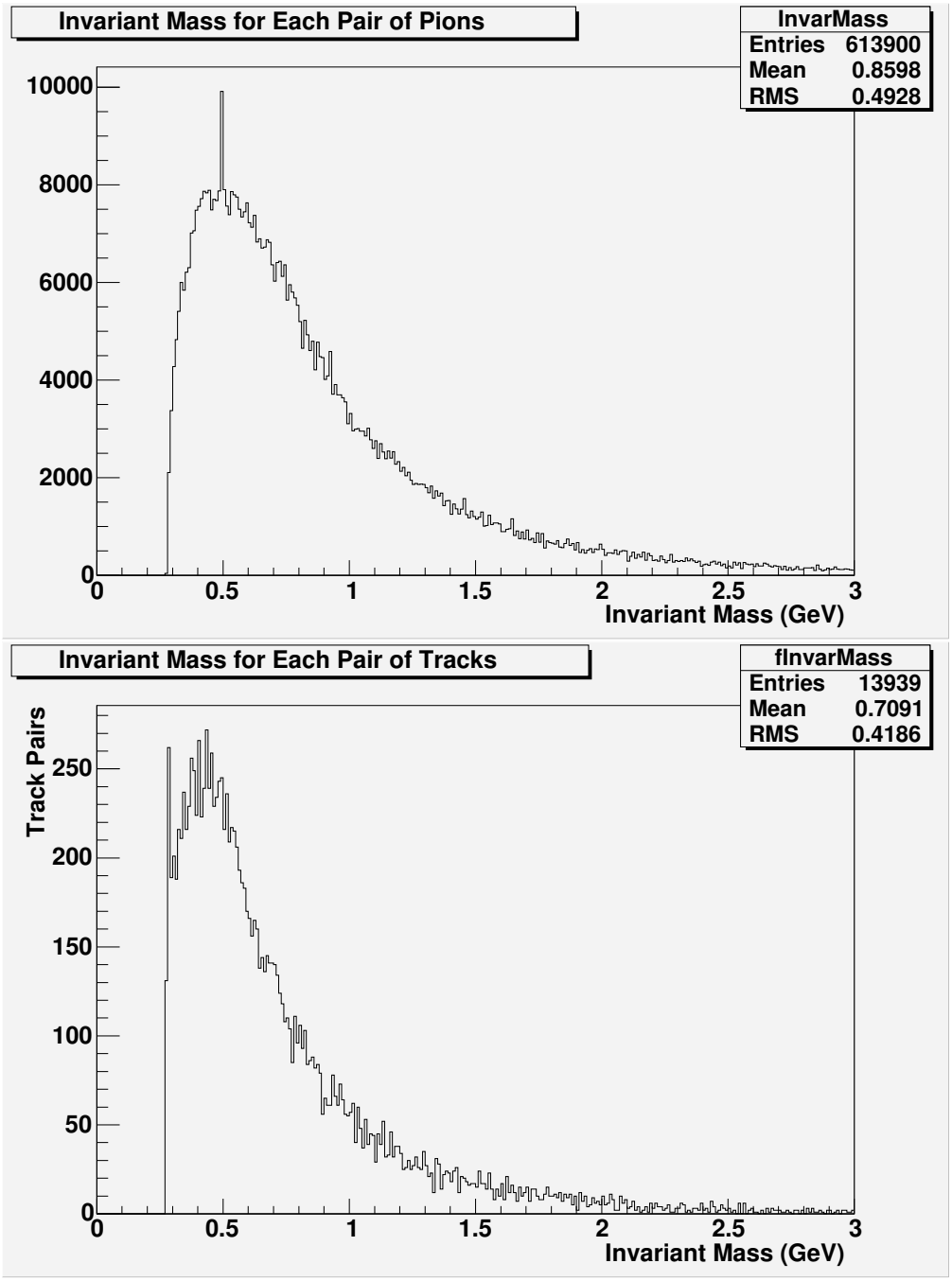


Figure 7: Top: Invariant mass of oppositely charged pions from fluka simulation of carbon target. Bottom: Invariant mass of pion pairs from carbon target data.