Run 5 p+p single muons: high p_T backgrounds

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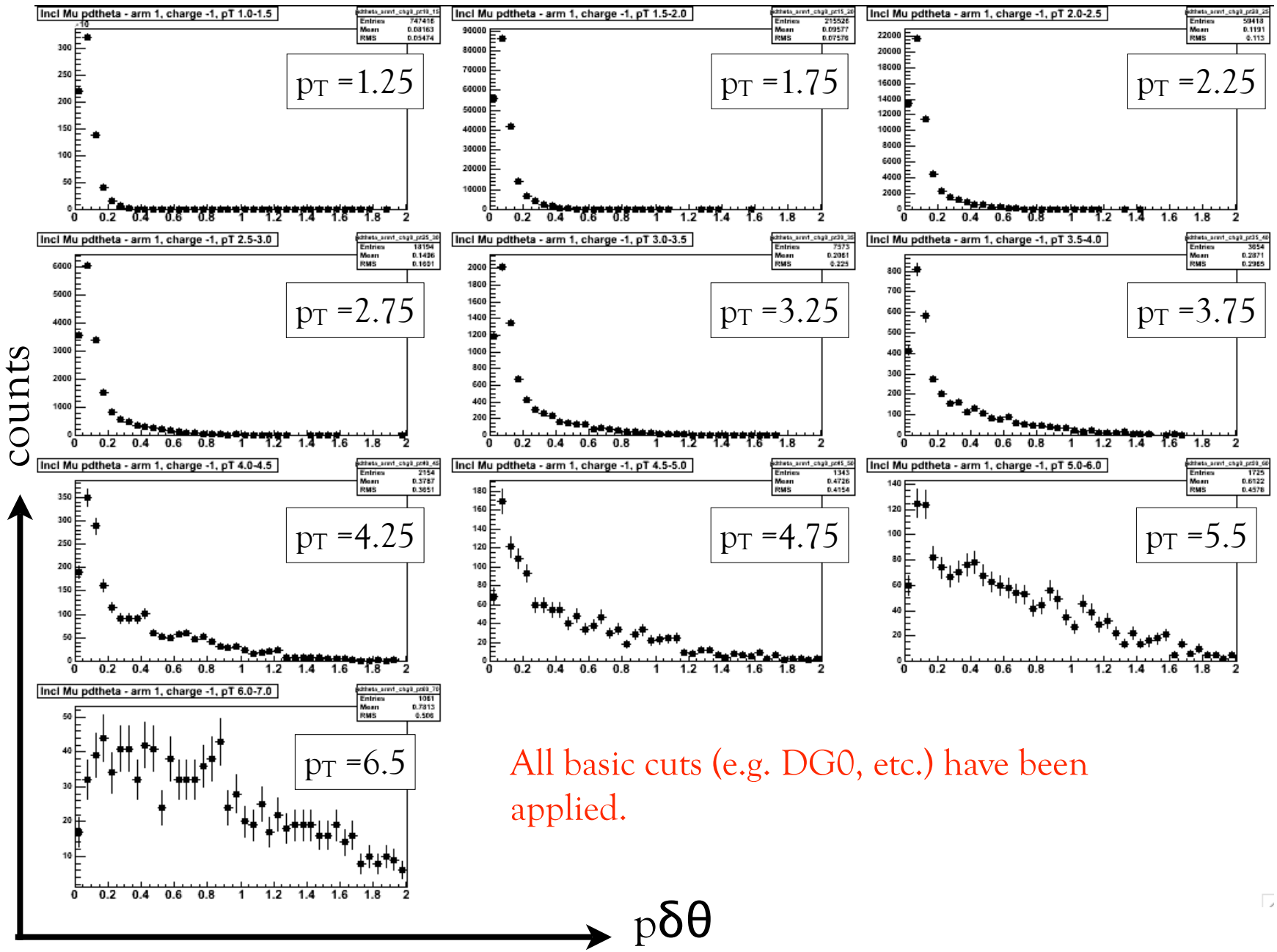
Analysis Webpage:
https://www.phenix.bnl.gov/phenix/WWW/p/draft/claudius/run5pp/single_mu/

pδθ as an indicator of track purity

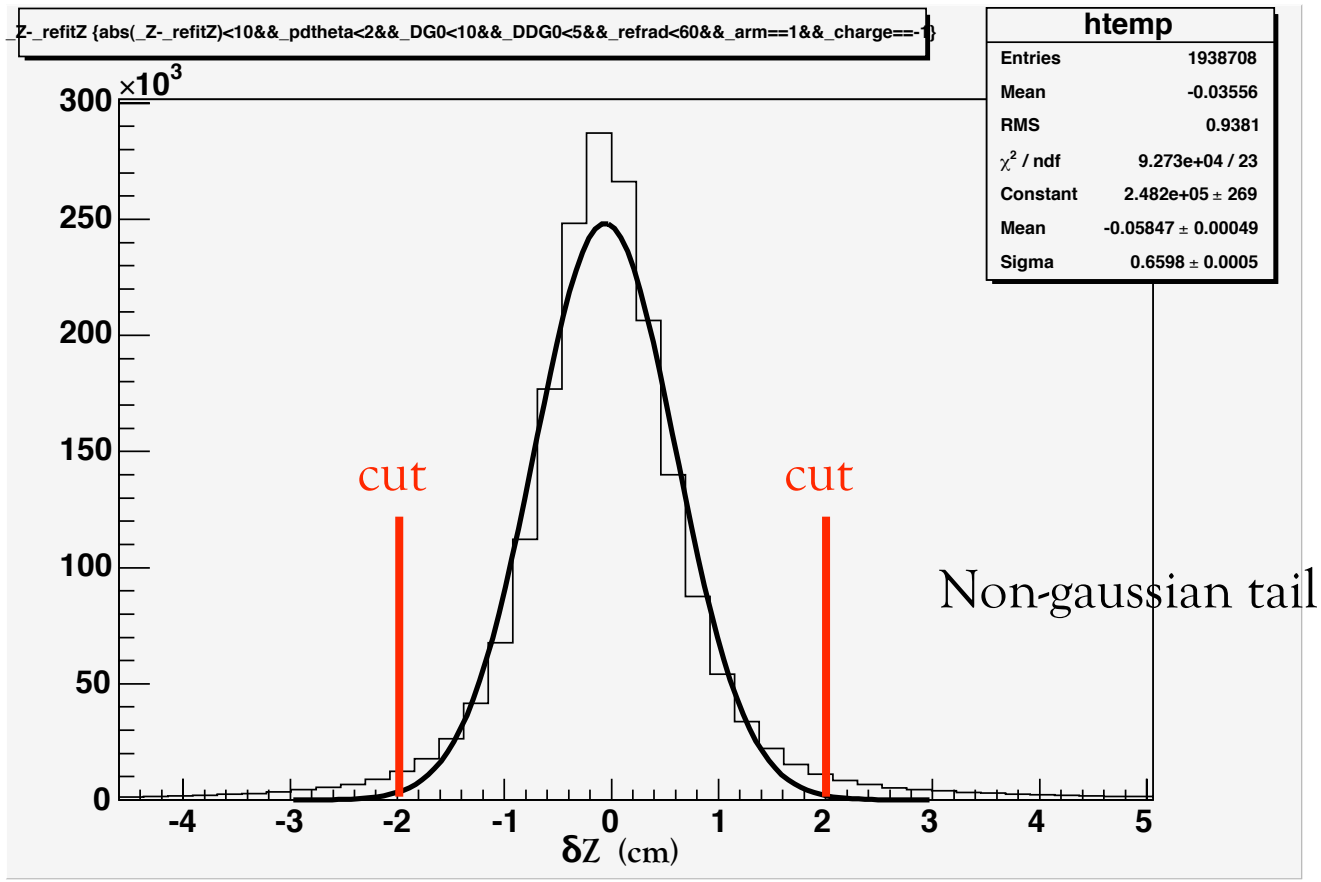


All basic cuts (e.g. DG0, etc.) have been applied.

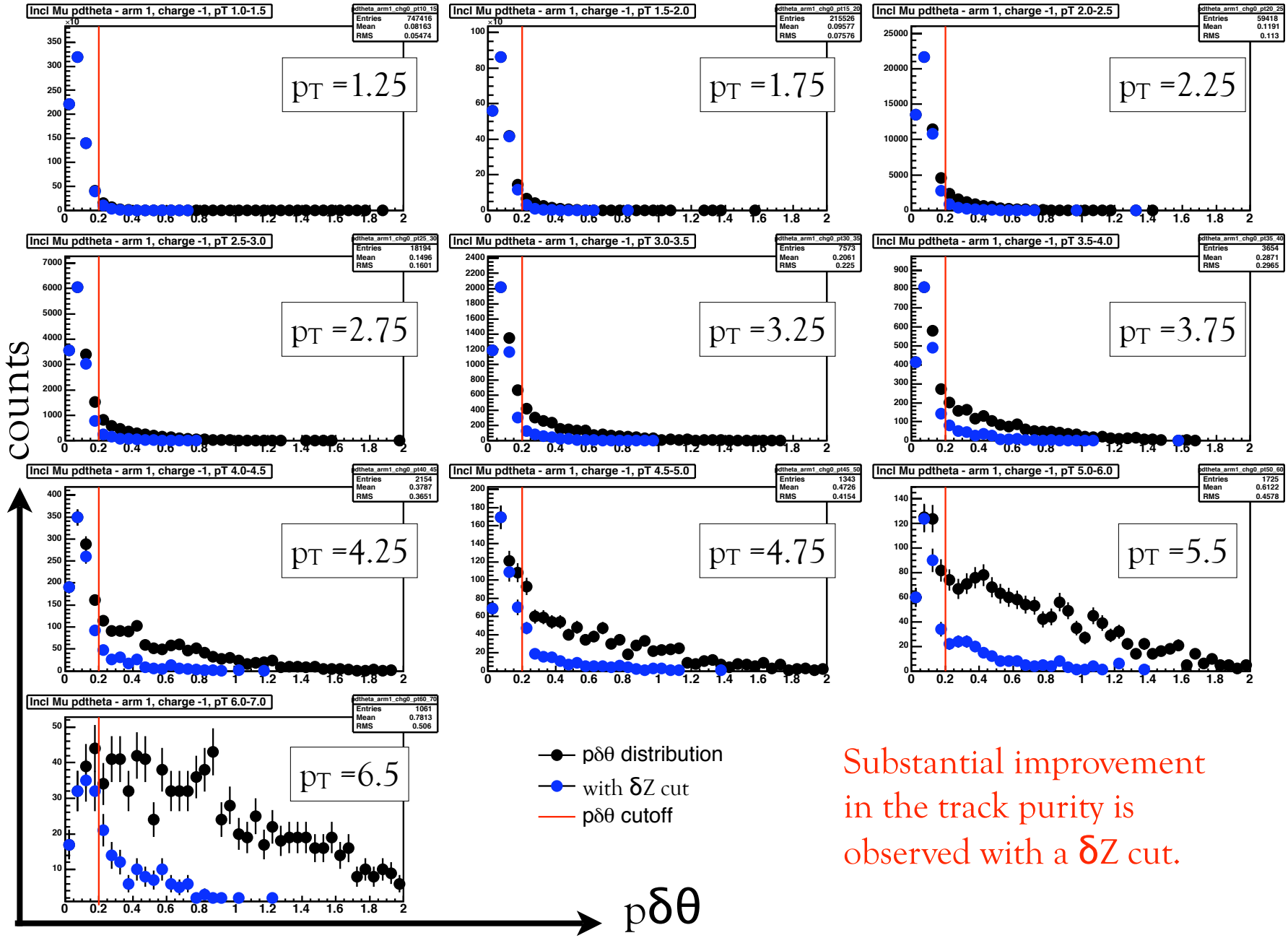
A "δZ" cut

The projected vertex of a reconstructed track differs **rarely** from the BBC *z*-vertex. The distribution appears to be gaussian with non-gaussian tails. A cut of 2 cm was employed (~3σ of fit).

$$\delta Z = (\text{ BBC Z } - \text{ muon track vertex fit })$$

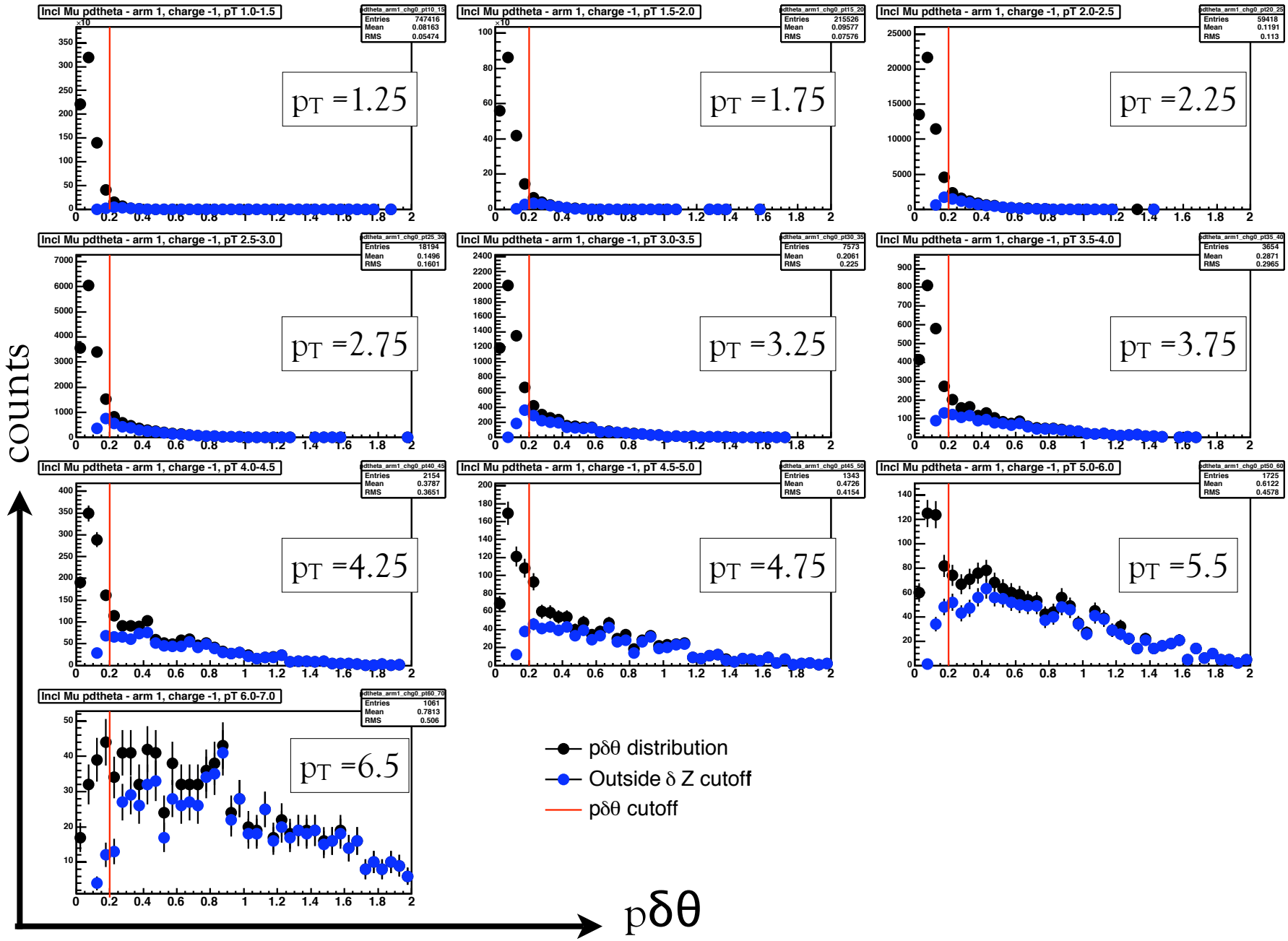


Data pδθ - before and after the δZ cut



Substantial improvement in the track purity is observed with a δZ cut.

pδθ distribution outside of the δZ cut



What tracks/events does the δZ cut identify ?

1. $p\delta\theta$ distributions serve as an indicator of the relative purity of the sample of tracks, since single muons possess a $p\delta\theta < 0.2$.

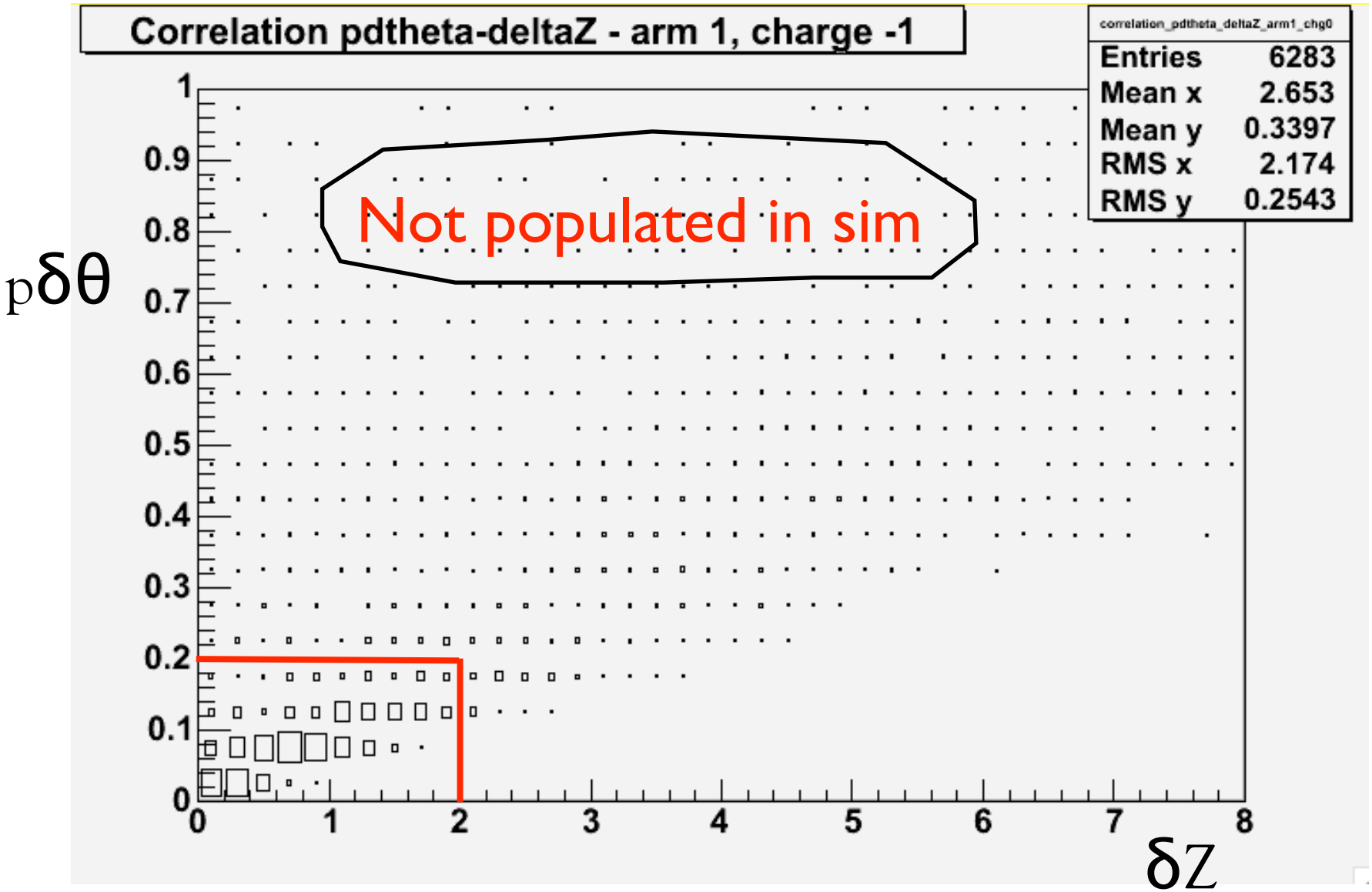
2. Tracks with a large δZ (above 2 cm) correspond to those tracks with large $p\delta\theta$.

3. The disagreement in the $p\delta\theta$ distributions between the hadron cocktail and the data indicates that there is a class of events in the data that the single particle hadron cocktail simulations do not reproduce.

4. Tracks with large δZ's appear to identify this class of events that reside in data but not in the hadron cocktail.

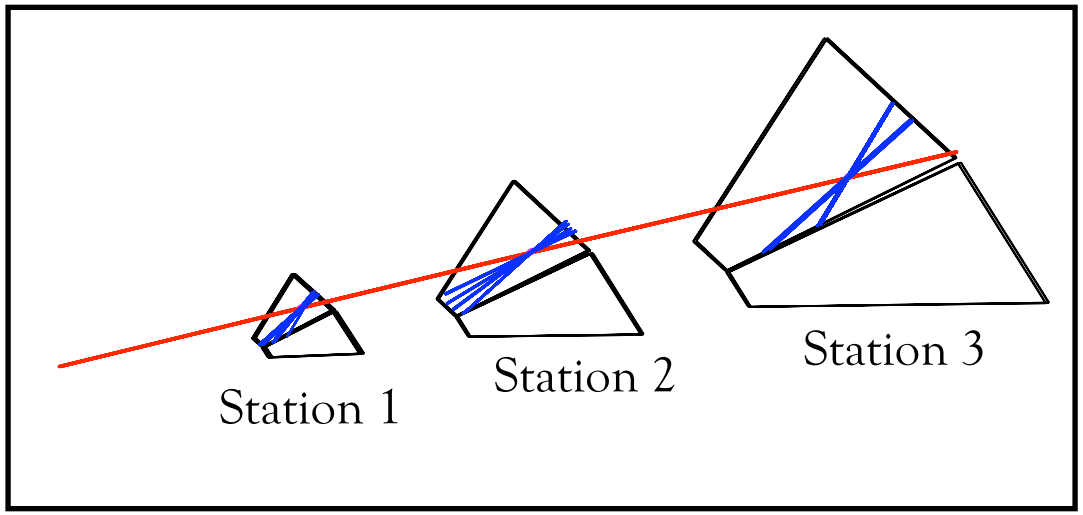
5. This class of events appears to be related to increased local occupancy in the MuTr octants, specifically and especially station 1. Studies are underway to further explore the δZ cut, the correspondance between δZ and $p\delta\theta$, and the exact relationship between MuTr local octant occupancy and δZ and $p\delta\theta$.

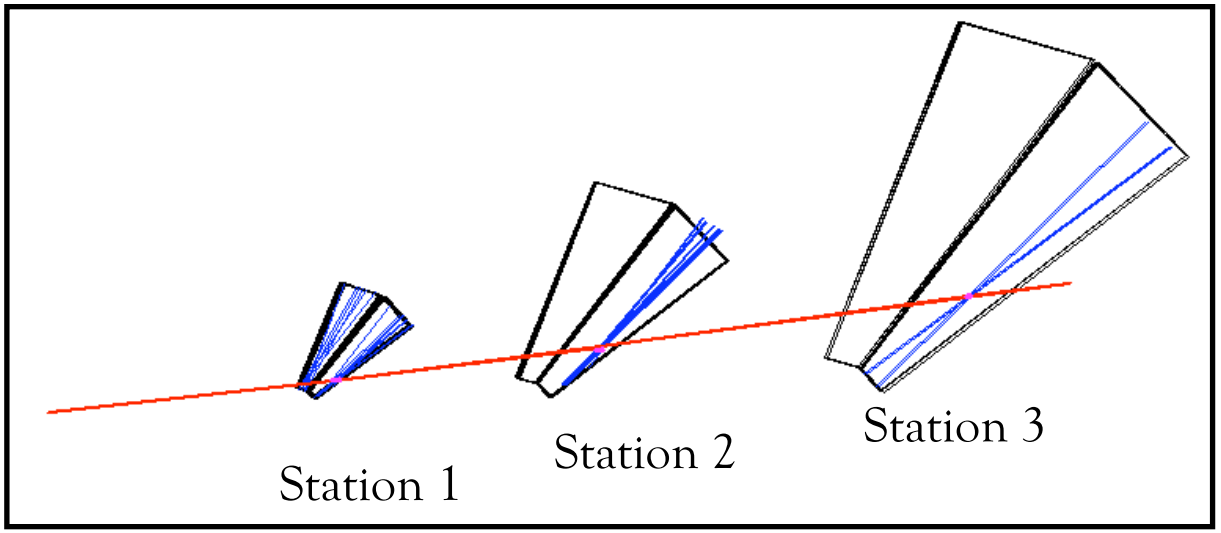
pδθ vs. δZ cut


Correlation pdtheta-deltaZ - arm 1, charge -1
correlation_pdtheta_deltaZ_arm1_chg0
Entries 6283
Mean x 2.653
Mean y 0.3397
RMS x 2.174
RMS y 0.2543
Not populated in sim
pδθ
δZ
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
1
2
3
4
5
6
7
8

Two "more normal" pδθ p+p events - data

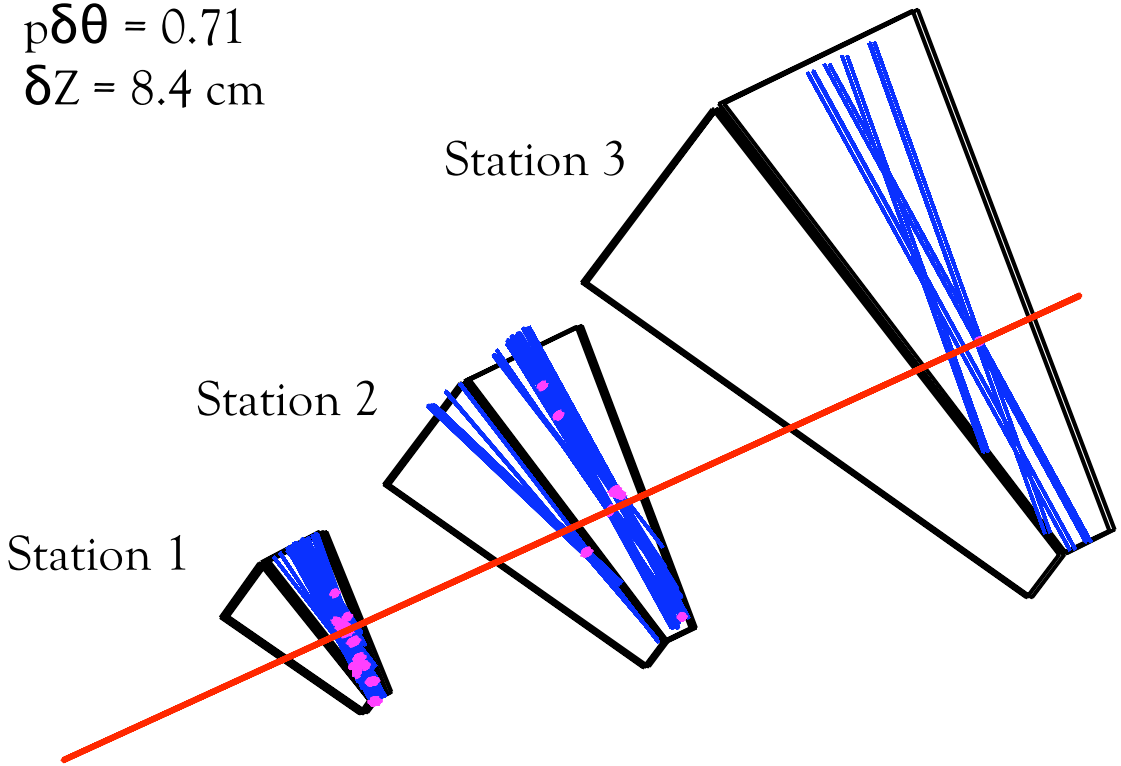
These events can be largely characterized by a single stub per octant

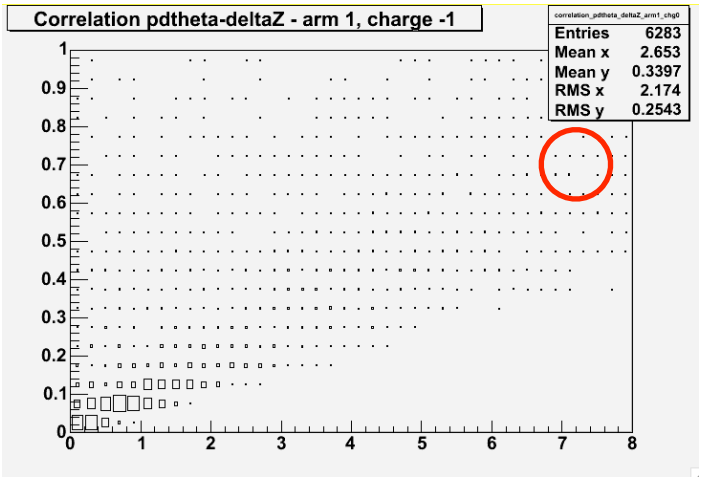




High p_T and $p\delta\theta$ p+p event - data

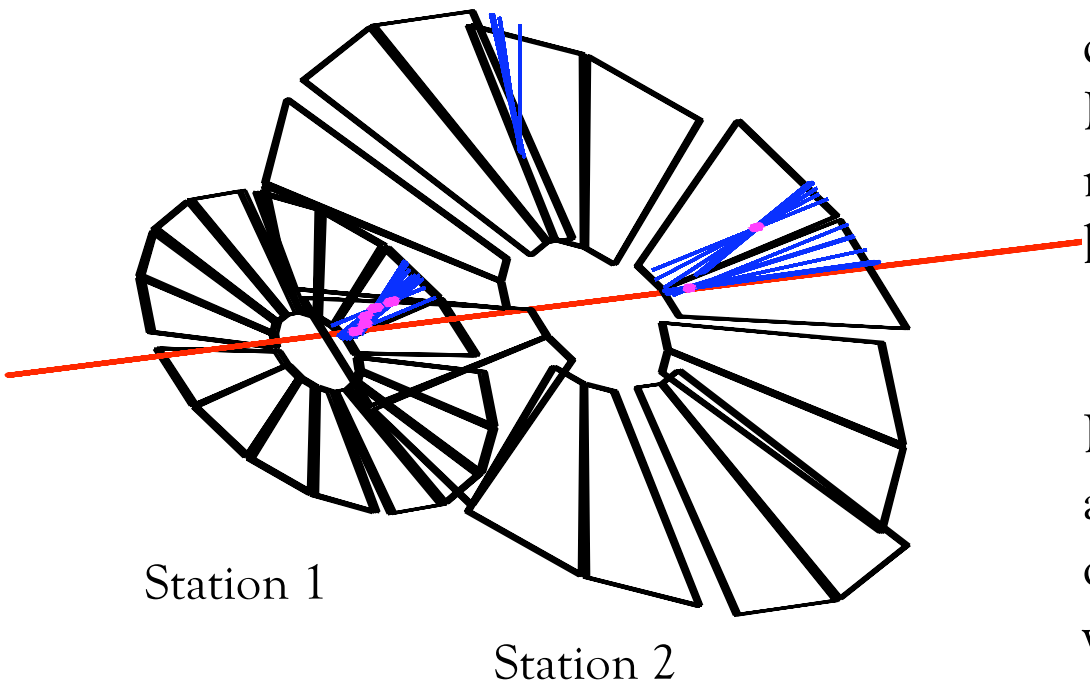
But this can also happen...
p_T = 5.77 GeV/c
$p\delta\theta$ = 0.71
δZ = 8.4 cm





Notice the multiple (13) stubs in Sta 1.

Similar behavior is observed in PYTHIA events



This suggests that there is a class of events in data/ PYTHIA that are not reproduced in single particle hadron simulations

Based on limited scanning, and the observed local occupancy in these events, as well as the strong effect on the p$\delta\theta$ distributions, it is thought is that δZ is correlated with local occupancy.

A question and request

We want to be able to quantify the degree to which δZ is correlated with local occupancy. To do that, we need access to physics quantities (p_T, $p\delta\theta$... MWGPico, MWGVertex, etc.) as well as some sort of local occupancy information, strips? stubs?

We do know how to reprocess a PRDF, placing only selected events into a DST. But from there, we want to make a plot of $p\delta\theta$ vs. "some kind of" local occupancy (yet to be determined).

What (and how) is the best approach to combine this information? If a desirable local occupancy variable (single or set) can be identified which can account for this effect, can this be propagated to a "pDST"?

If these events are due in part to jet fragments or some other kind of "multi-particle" effect that increases with increasing p_T, this is an affect that should be understood for future data sets and analyses.

The End