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TPC analysis
of
Cosmic Ray data

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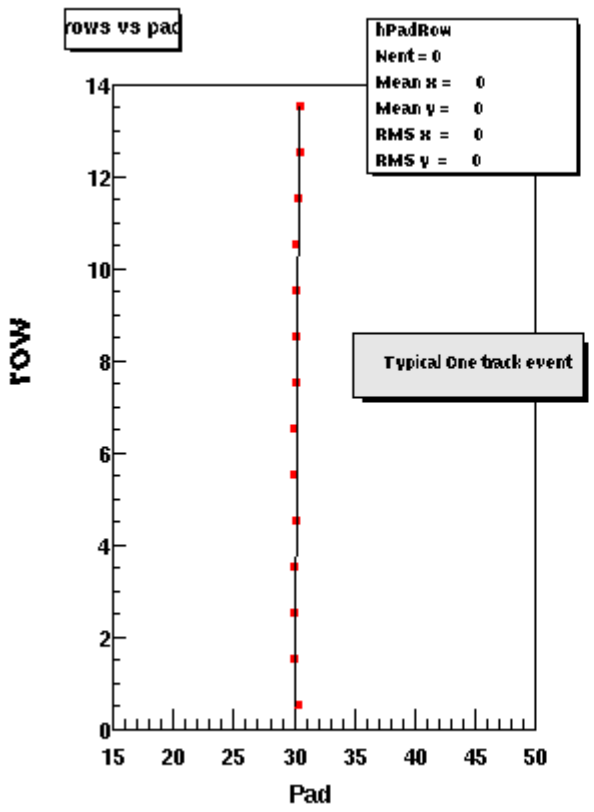
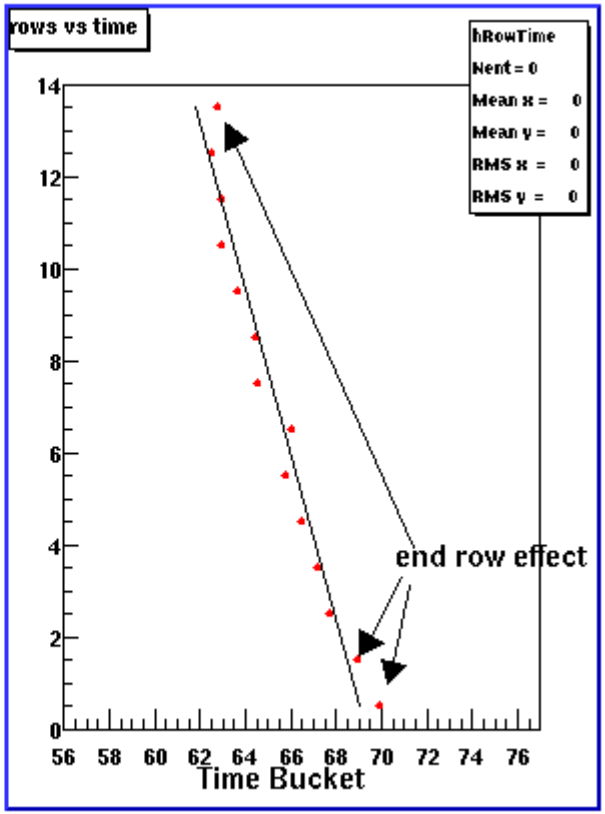
Data taking

- The TPC data that was taken in November-January period with the 'old' T1 top. Several configurations of HV settings for the Anode Field settings were employed.
- The data were (re-)mapped and pedestal subtracted by DAQ or after the fact program (Olchanski)
  - The Brat based routine to read the raw TPC data was added to BrRawInputData
  - The data from the first step was pedestal subtracted but not pedestal suppressed. Thus a method was written to digest the raw data, and create much shorter files that has sequences of 2 or more adc data (in time direction) above a threshold (6 counts). The bin before and after was also kept.
  - The data was then fed into the existing Brat TPC local tracking code to find clusters and tracks in T1 (all row were instrumented though some pad in the first 6(8) row were not.
  - Several modification to the code was necessary, particular to suppress random noise pattern from apparent real clusters.
- The following slides show some selected results.

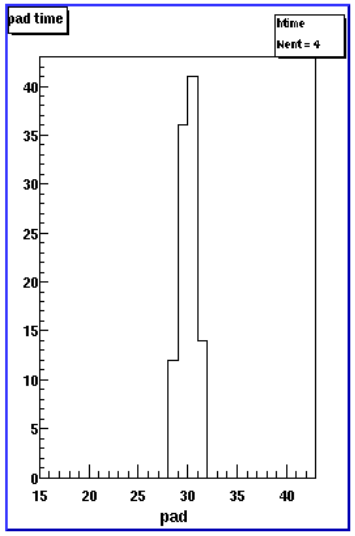
Single Track events

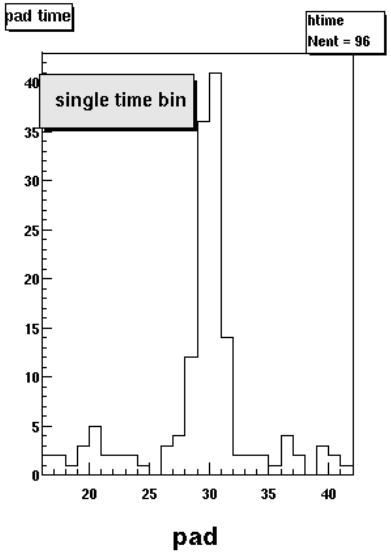
- Color code (on multiple slides)
- o good single cluster
- . Small cluster (noise)
- o De convoluted good cluster
- o intermediate cluster

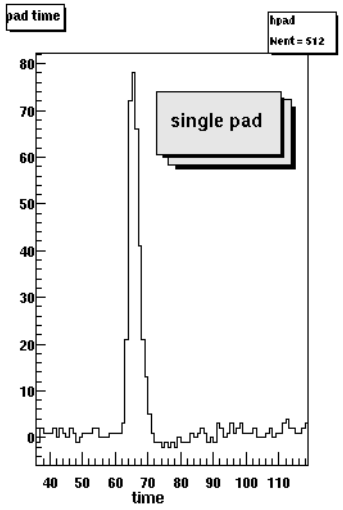


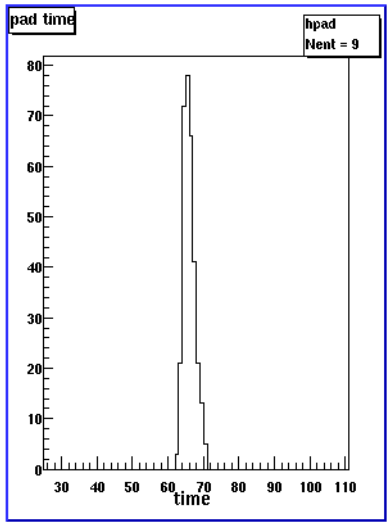


Pad time distributions









A double track event

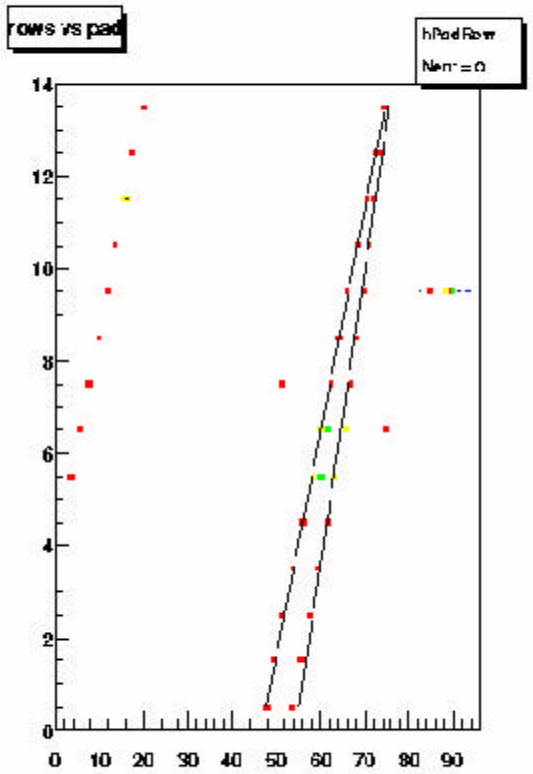
Color code (on multiple slides)

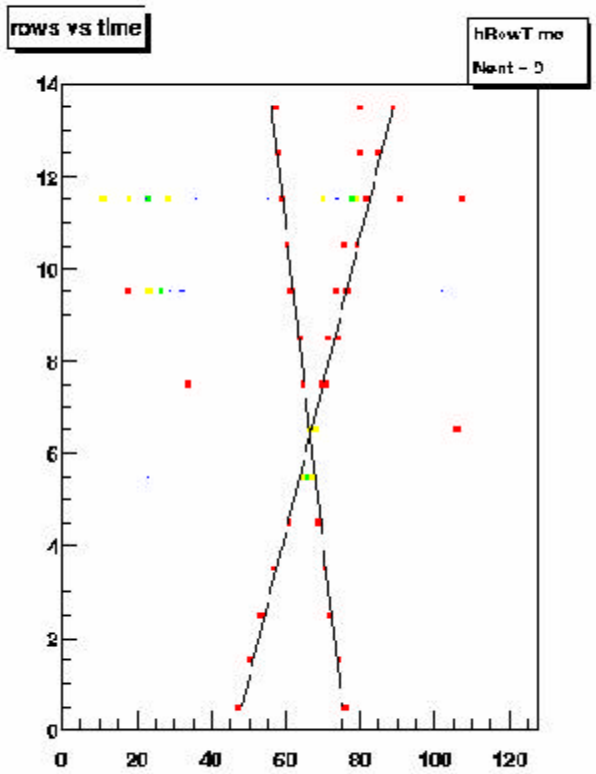
o good single cluster

. Small cluster (noise)

o De convoluted good cluster

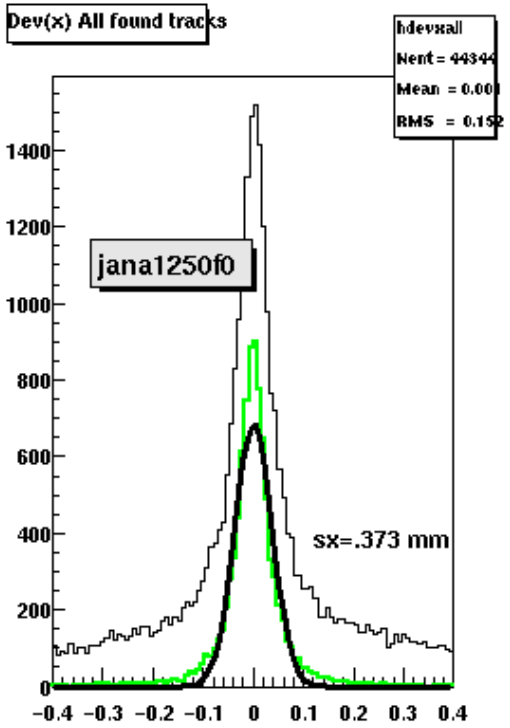
o intermediate cluster

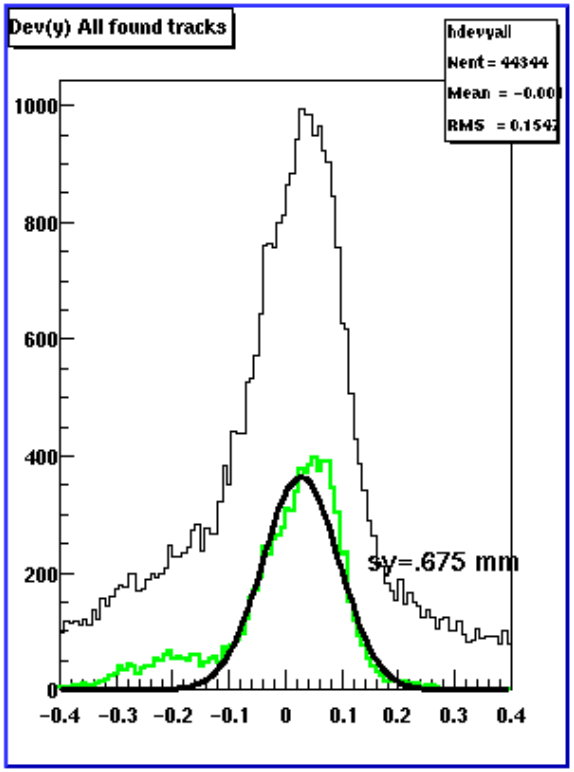




Track Fitting Results

- Method
- The deviations of a cluster position (in x, y) from the calculated/fitted track position (track residuals) was calculated for a) All tracks found (including ghosts) and b) events assigned a single track.
- The most recent data set Jana1250f0 shows the best results s(x) 380 μm and s(y) ~ 500-540 μm .
- The earlier runs and different sets have values somewhat larger.





Analysis Summary

- Cosmic ray data is a poor mans solution to study detector performance. Only about 40-50% of the events can be characterized as clean single track. The remaining ones range from having very short tracks, detector noise pickup, no tracks/clusters at all to a few nice multi track events. A fair number of curved tracks - low energy electrons? are also observed. Due to this it is not obvious what kind of resolution (track residuals) to expect.
- Noise conditions tend to be worse in some of the earlier runs in fact most of the 1250V data from November. The January are good.
- The edge pads (ie #0 and 95) are quite noisy, making this difficult to use.
- The Anode 1250(1253) setting with Field=0 seems quite satisfactory in term s of average pulse height and integrated ADC(dedx) count.
- The setting of 1600V 700V field gives a 40% lower value in de/dx while 1650/700 is slightly above the 1250. It is suspected but have still to proven that the fluctuations in this later case are larger.
- Track residuals so far are in the order of 450-500 micron for single track in pad direction, and worse in drift with clear systematic deviation (visual as well as zero offset deviation) for first and last pad row. The value is about 600-650 micron (assuming 10Mhz clock and 1.8cm/microsec)
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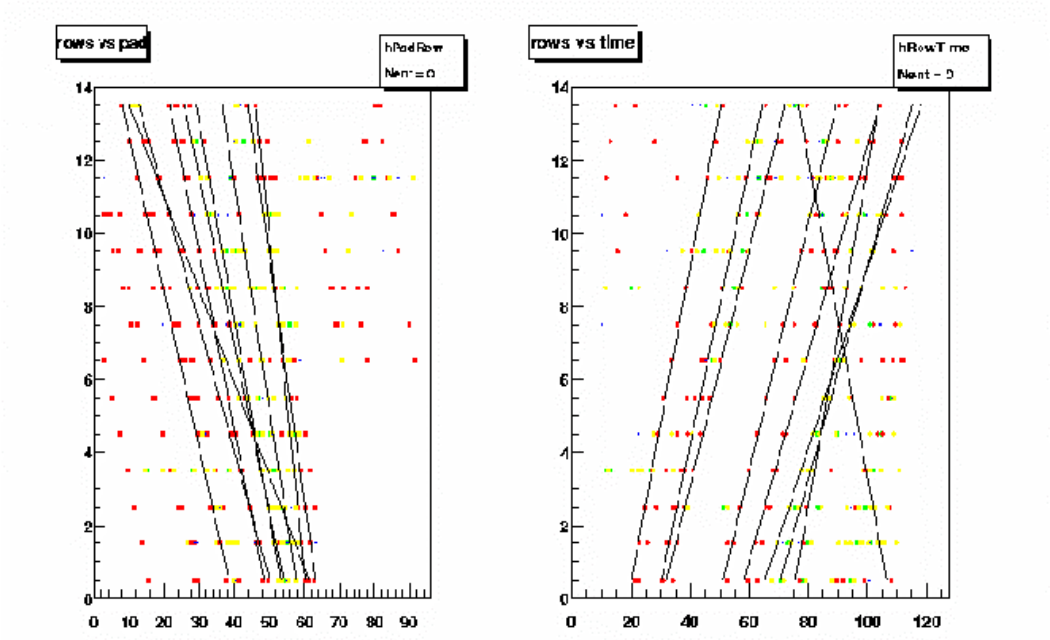
Summary continued

- Despite these short comings the results are actual quite encouraging. Visual inspection of time-pad clusters distribution for multi-track events, as well as performance of reconstruction code shows good promise for handling the high track environment. The real issue here might be the space change effects (track density, gating grid effectiveness, beam DC character) additional background, RF pickup we do not know about yet.
- These impressions from analyzing a subset of the cosmic data, and only looking a selected results (track deviation, de/dx) are quite encouraging.

Multi track event

A sample of events have multiple tracks. The present status and capability of BRAT TPC tracking is illustrated by the following plots.



Row 6.