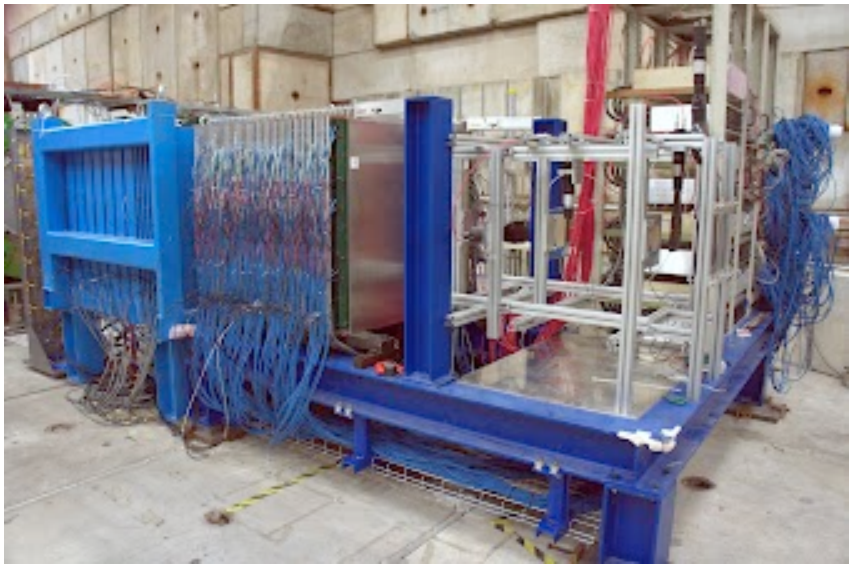
Data Quality in the W-DHCAL test beam data

Helga Holmestad

September 10^{th} 2013,
CALICE Collaboration Meeting,
Annecy

W-DHCAL test beam data

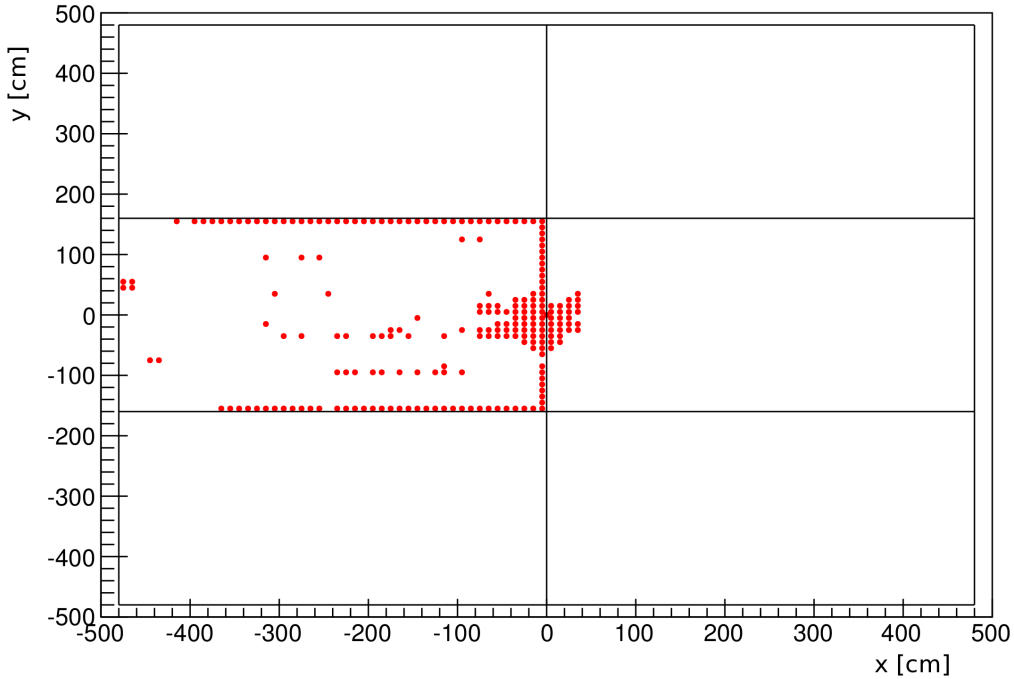
- 54 RPC layers
- Tungsten absorber in main stack
- Steel absorber in tail catcher
- 96 $\times$ 96 cells in each detector layer
- Beam momentum in the range 1-300 GeV
- Used pion runs
- Data taken in 2012 at CERN



Data Quality

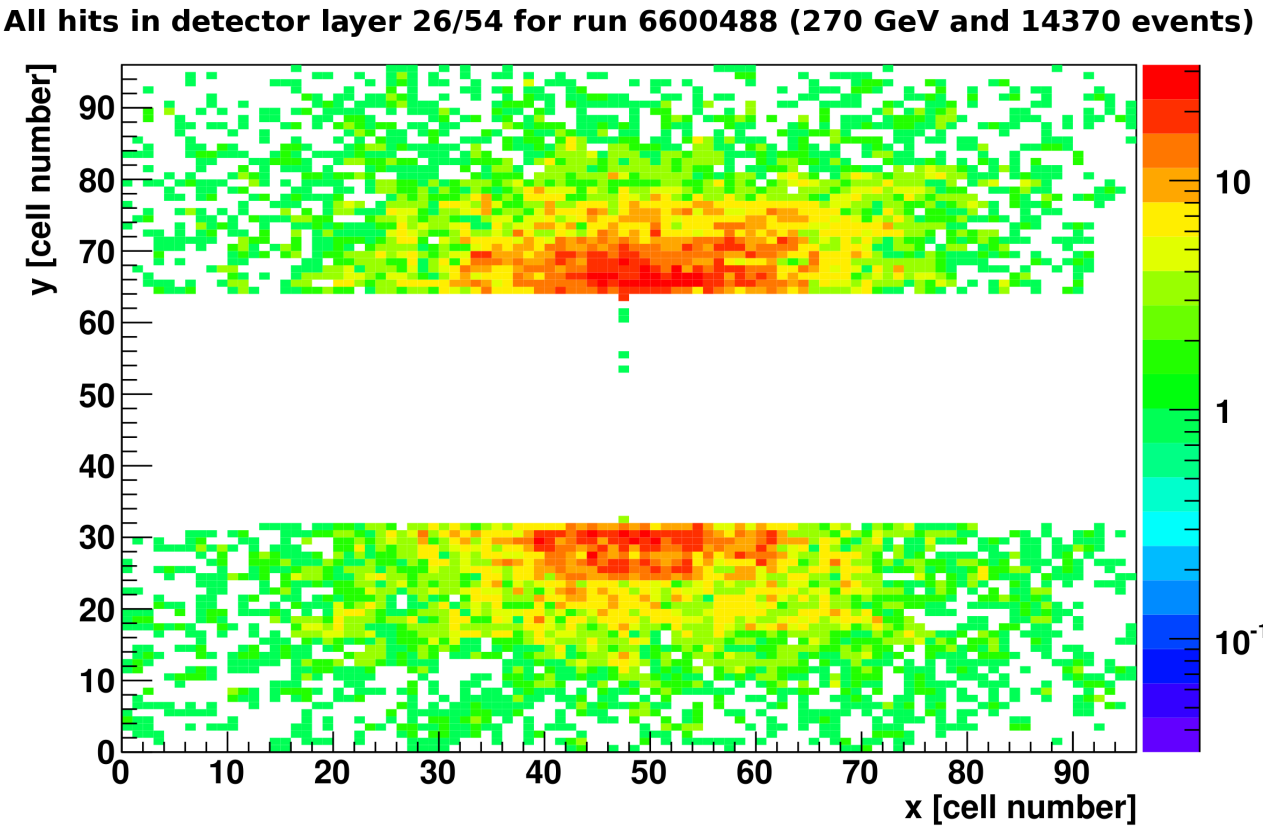
- Data quality issues in the test-beam data
  - Box Events
  - Dead cells
  - Oversensitive cells
- What to do:
  - Box Event $\longrightarrow$ Throw away the event
  - Oversensitive and dead cells $\longrightarrow$ Remove the cells both in data and MC

Box Event



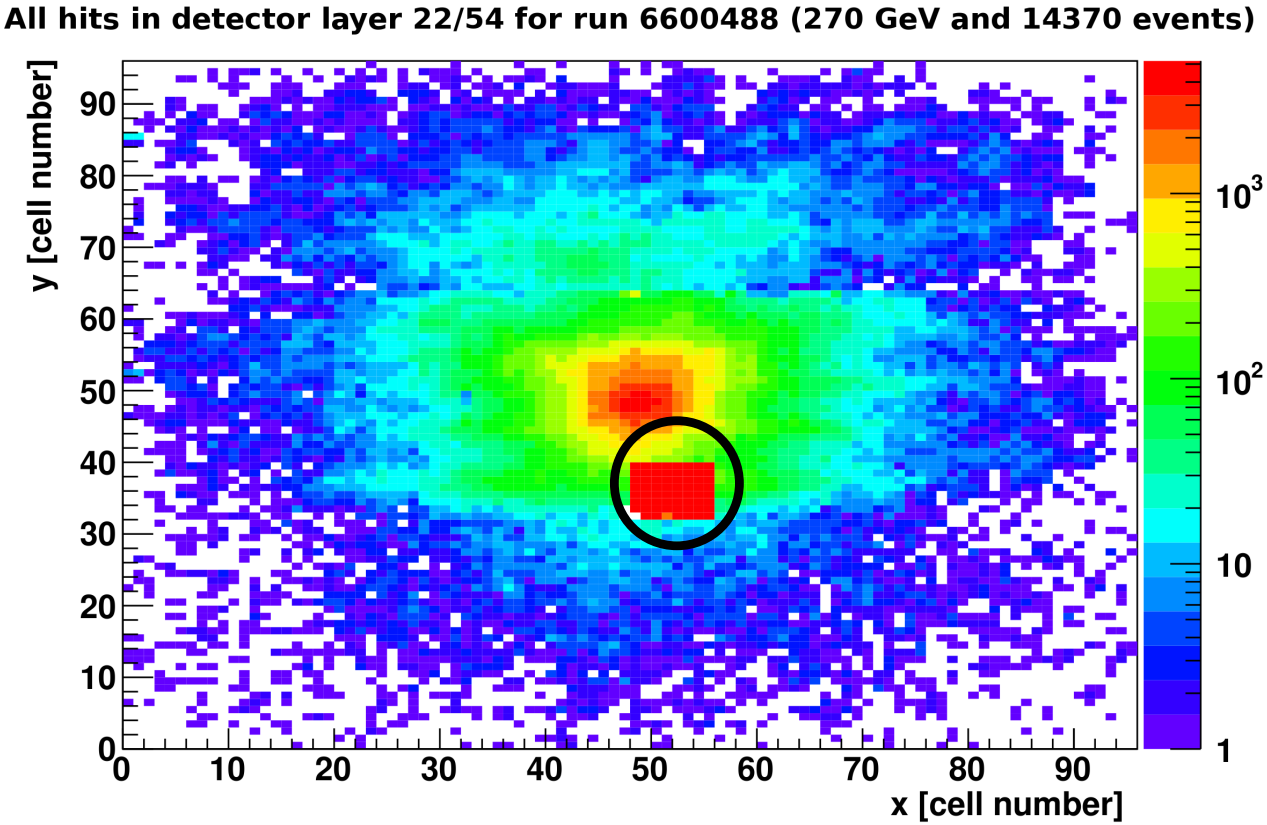
- Seen in some events in individual layers
- Unexpectedly many hits along the border of a Front end Board (FeB)
- The whole FeB might also be filled
- Compare number of hits on border with number inside/outside border

Dead and oversensitive cells



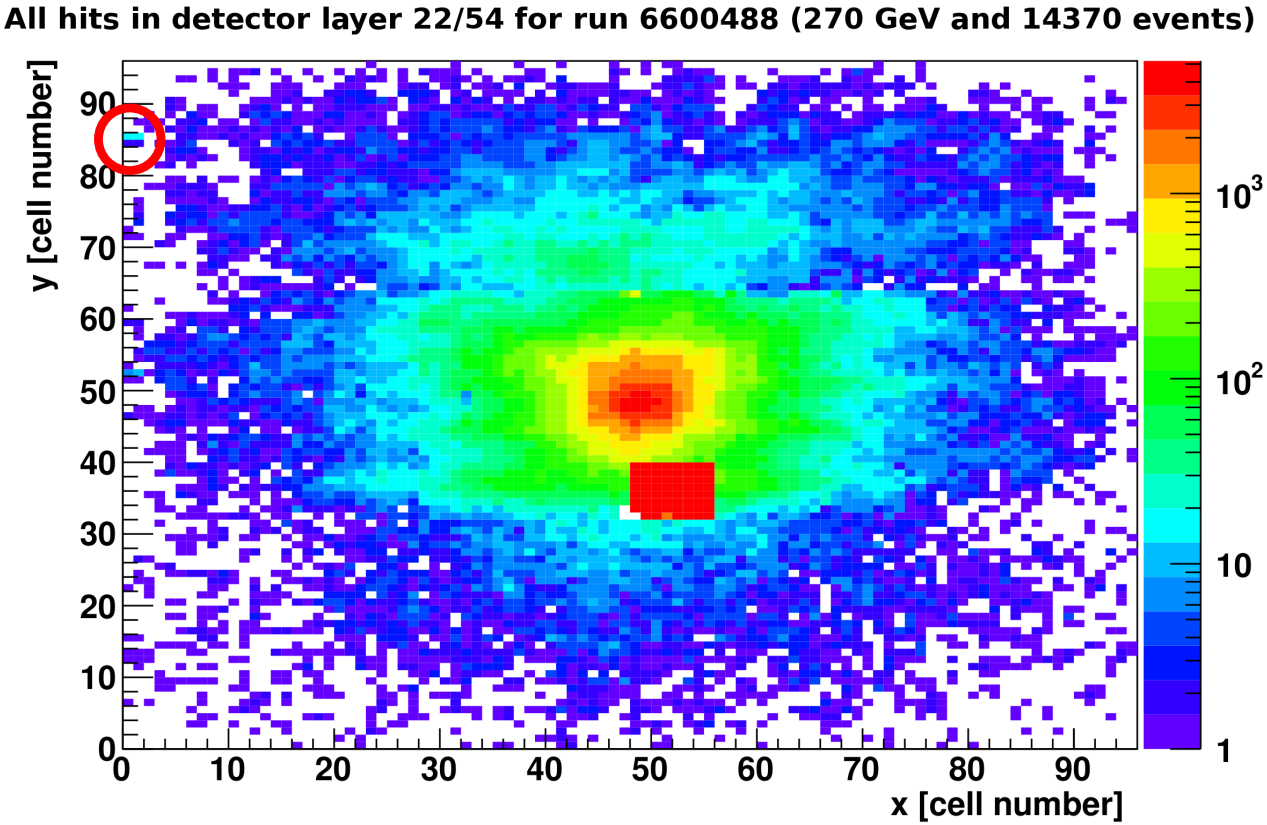
- Project all hits in a run into into one histogram per layer
  - Dead/Ineffective RPC
  - Oversenstive chips
  - Dead Chips
  - Oversensitive cells
  - Dead cells
- Algorithm to analyze these histograms

Dead and oversensitive cells



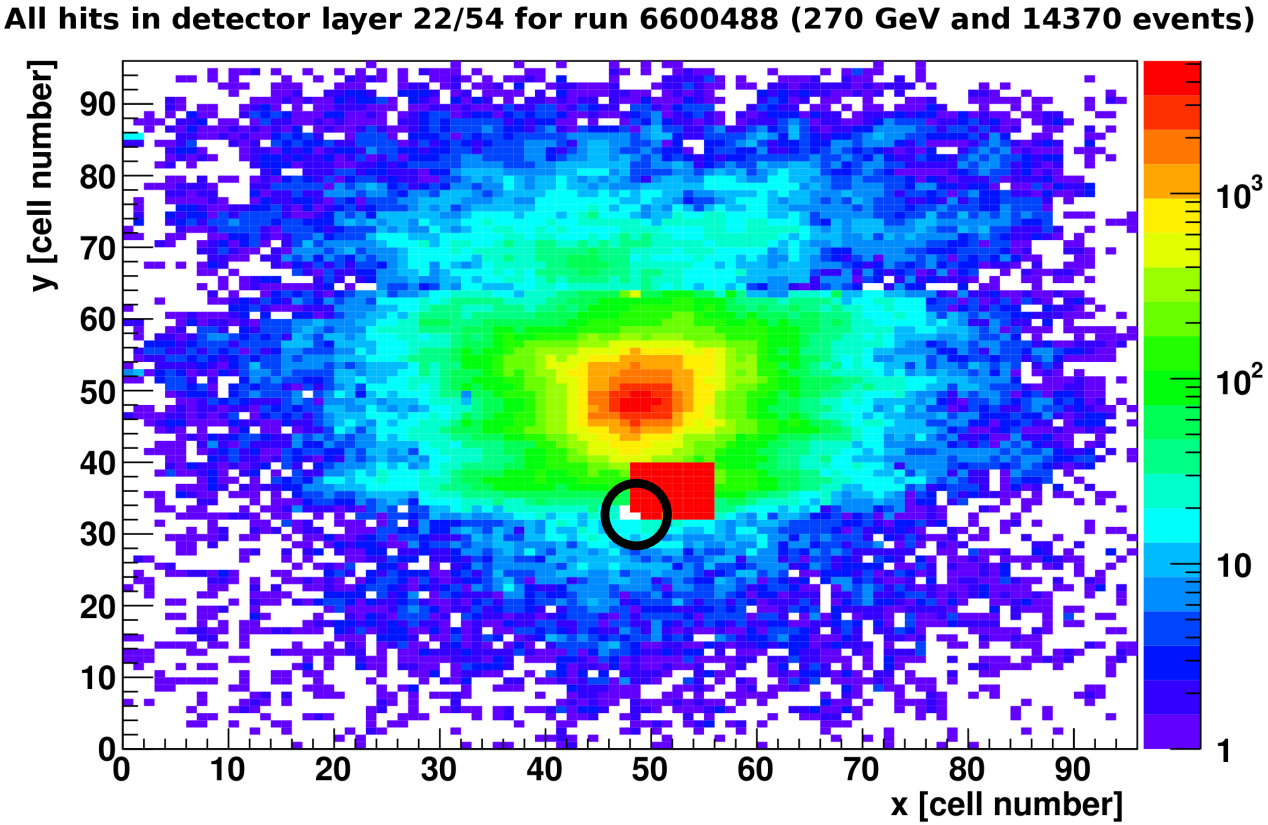
- Project all hits in a run into into one histogram per layer
  - Dead/Ineffective RPC
  - Oversenstive chips
  - Dead Chips
  - Oversensitive cells
  - Dead cells
- Algorithm to analyze these histograms

Dead and oversensitive cells



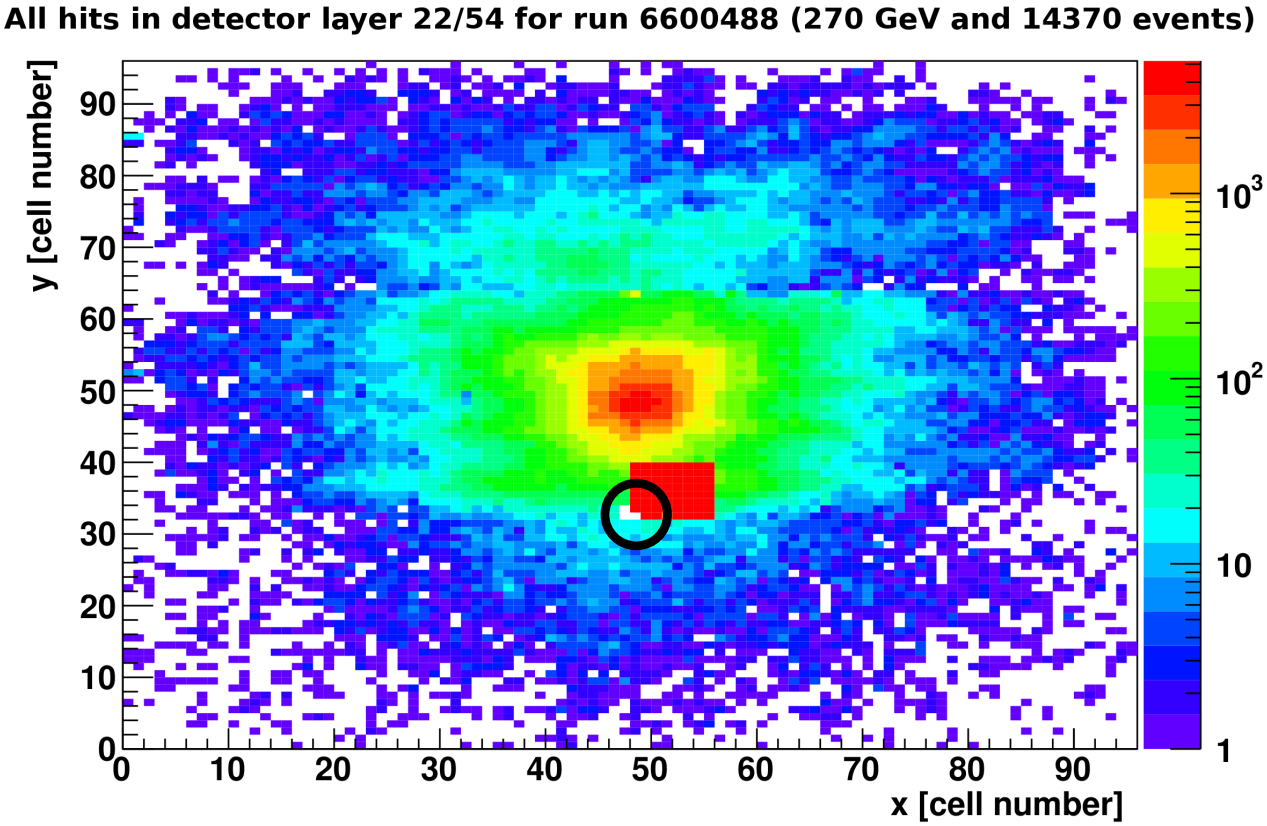
- Project all hits in a run into into one histogram per layer
  - Dead/Ineffective RPC
  - Oversenstive chips
  - Dead Chips
  - Oversensitive cells
  - Dead cells
- Algorithm to analyze these histograms

Dead and oversensitive cells



- Project all hits in a run into into one histogram per layer
  - Dead/Ineffective RPC
  - Oversenstive chips
  - Dead Chips
  - Oversensitive cells
  - Dead cells
- Algorithm to analyze these histograms

Dead and oversensitive cells

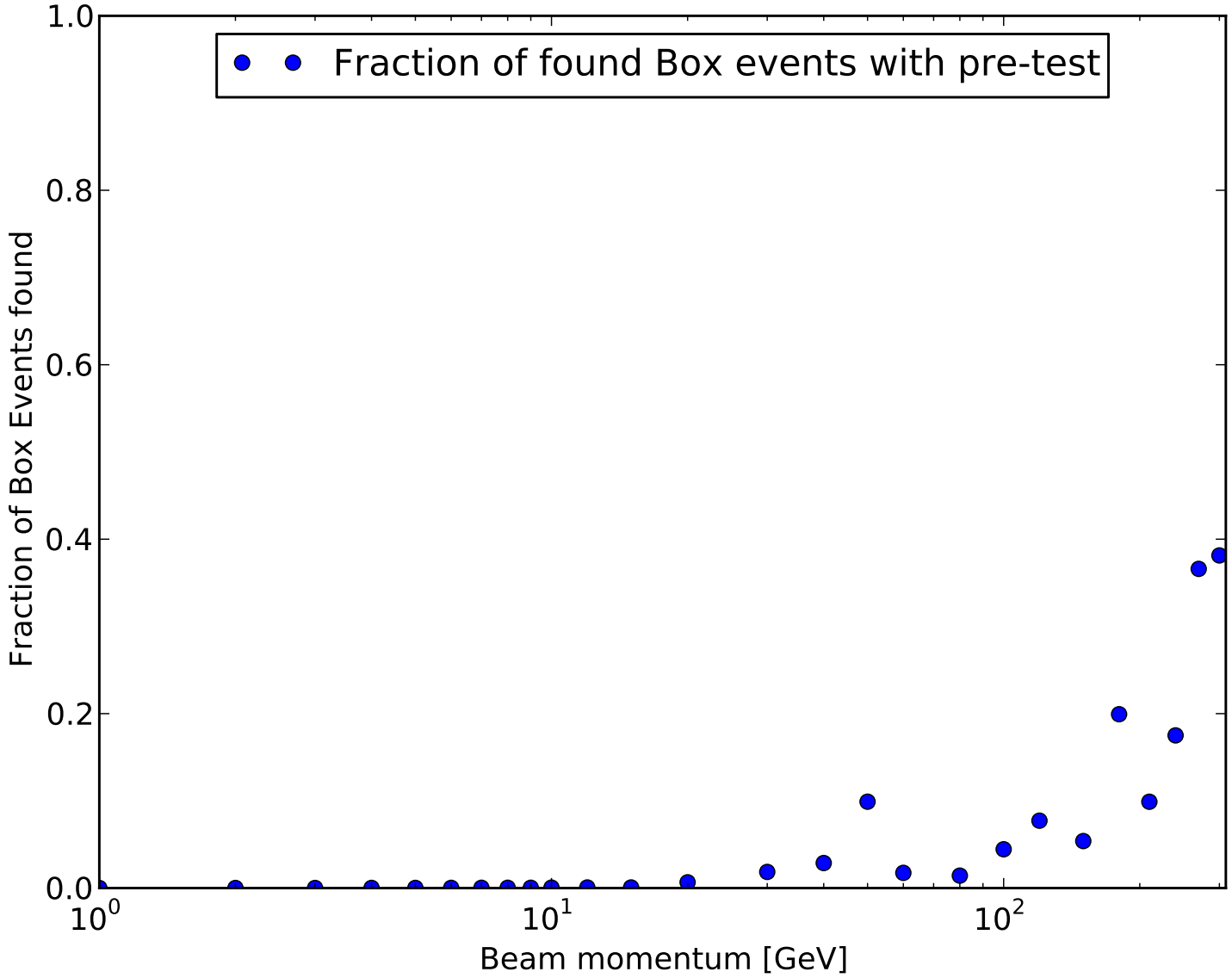


- Project all hits in a run into into one histogram per layer
  - Dead/Ineffective RPC
  - Oversenstive chips
  - Dead Chips
  - Oversensitive cells
  - Dead cells
- Algorithm to analyze these histograms

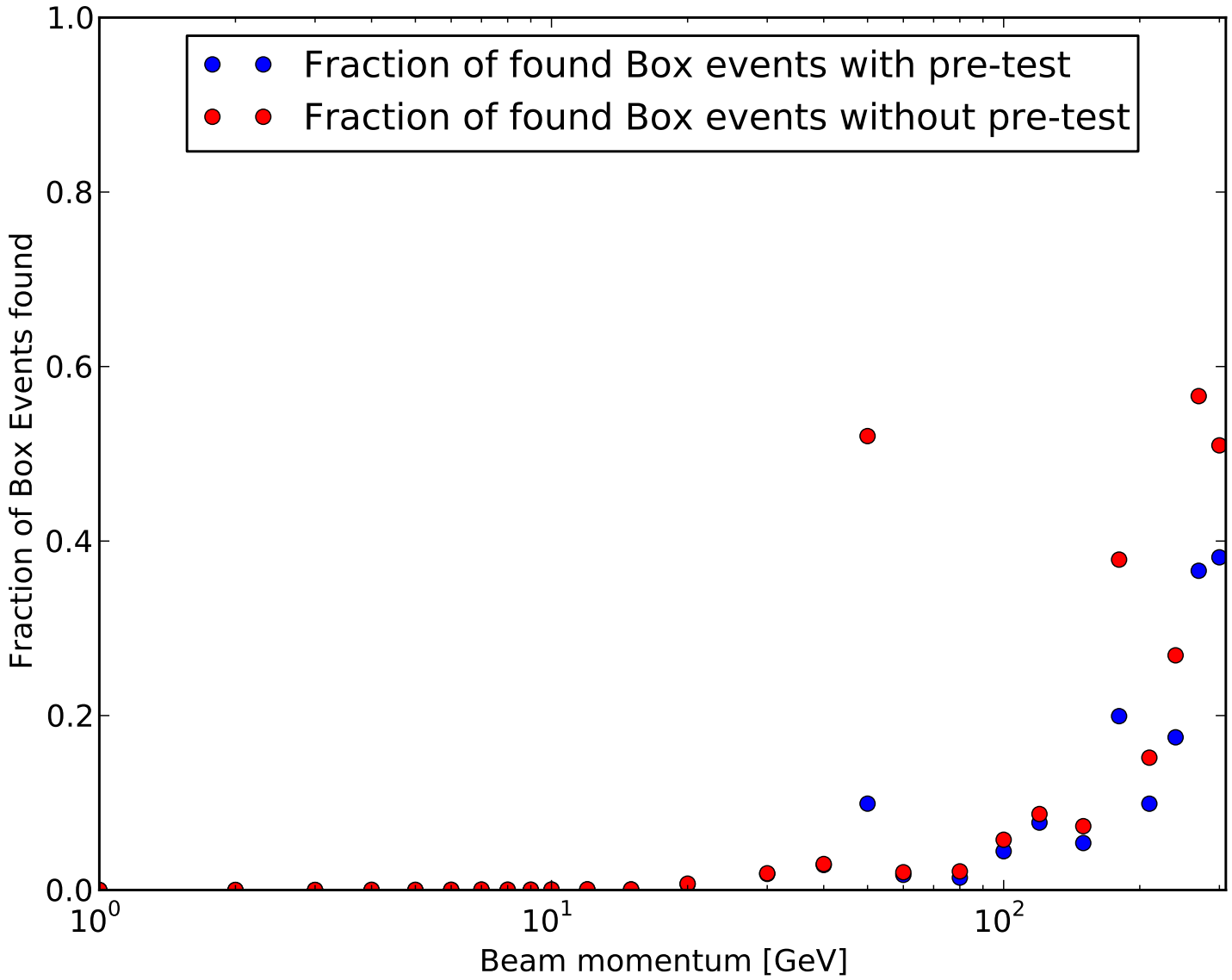
Interference between box events and oversensitive cells

- Oversensitive cells makes fake box events
- Difficult to find dead and oversensitive cells with the box events in the data
- Solution:
  - Pre-test to remove oversensitive chips and ground connector cells
  - Remove box events
  - Full pattern finder to make a list of cell IDs for the bad cells in the run
- Pattern finder algorithm:
  - Use the histograms with the projected hits, one histogram per detector layer
  - Looks for edges (sudden increase/deacrease in the histogram)

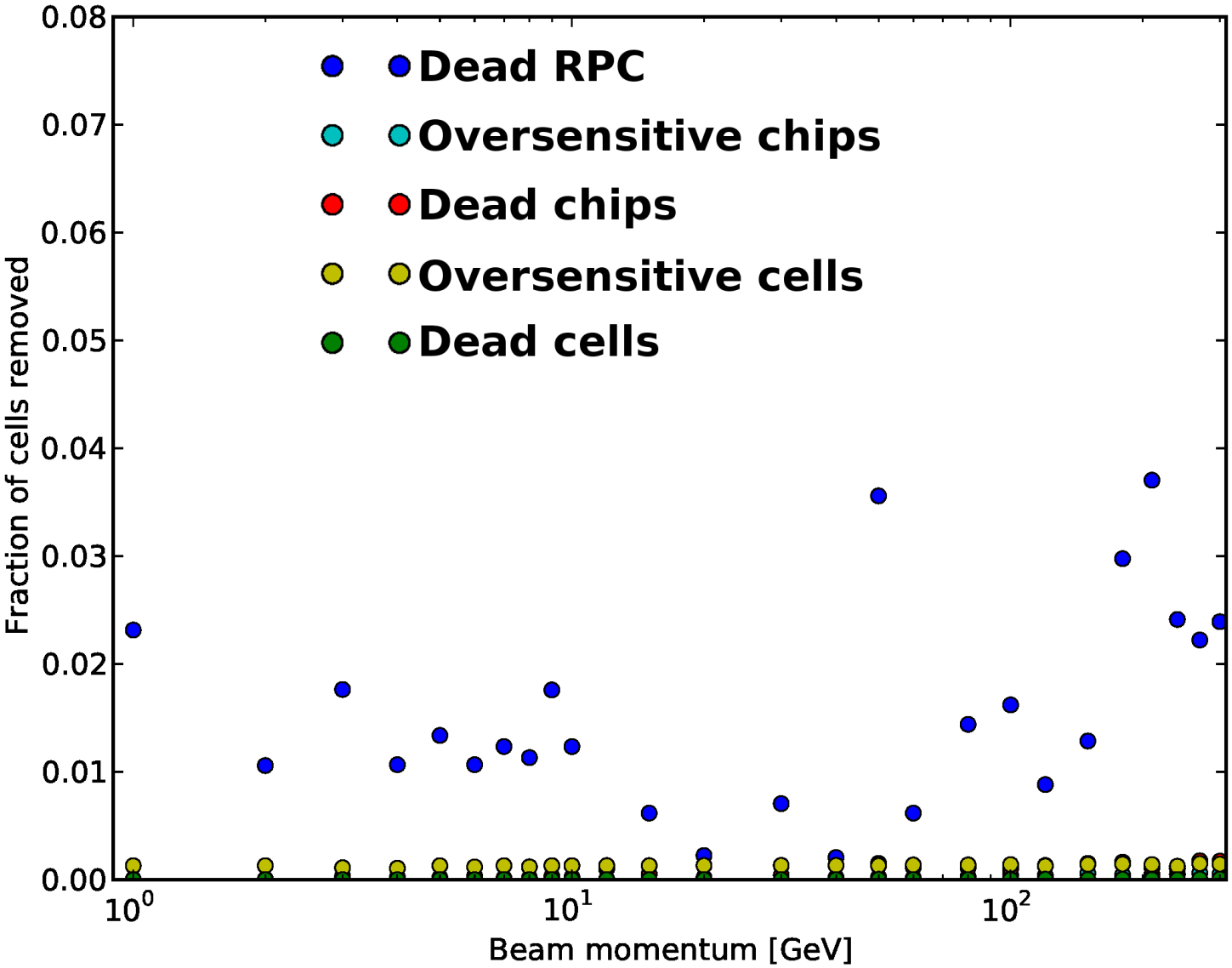
Box event fraction – energy dependence



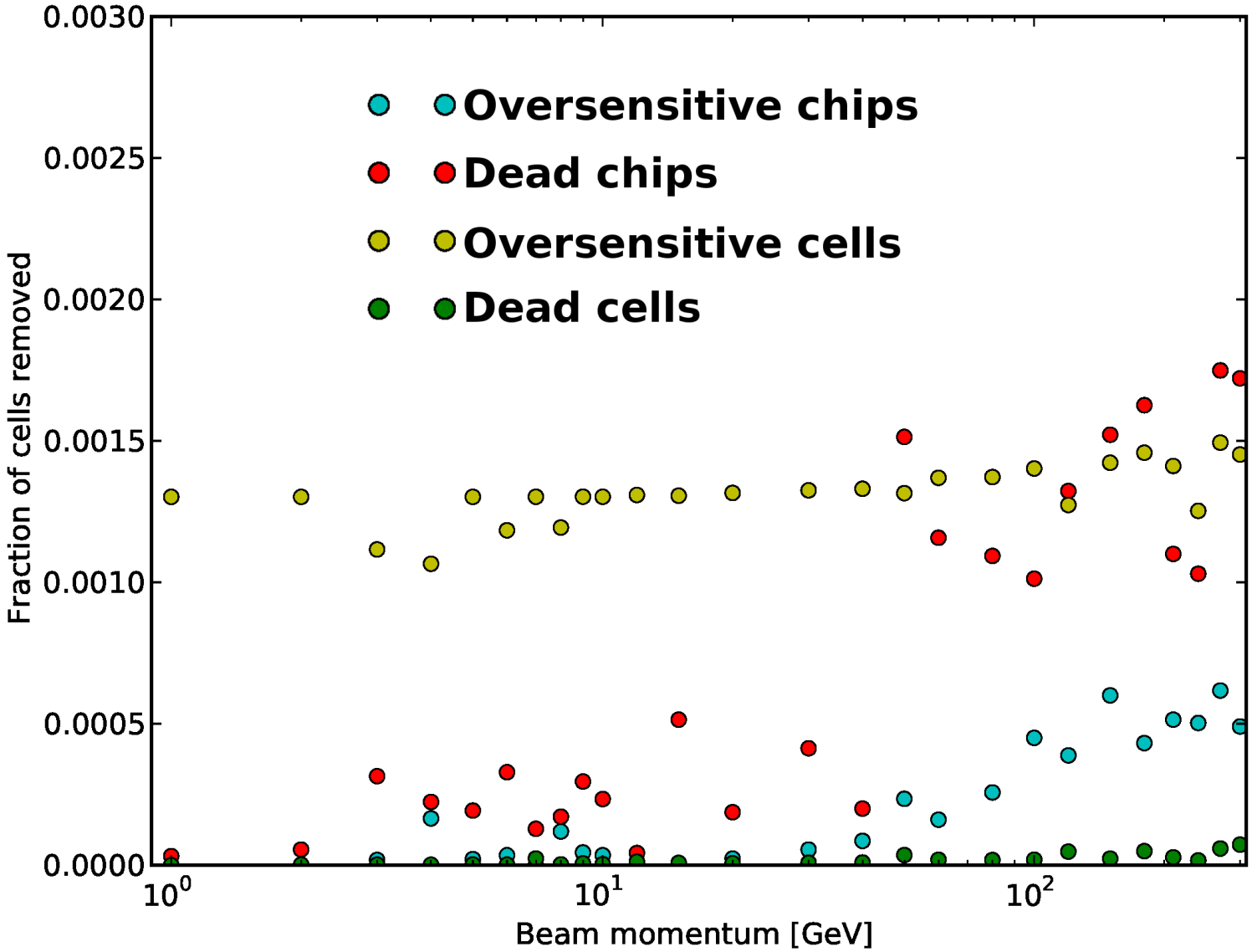
Box event fraction – preclean



Fraction of cells removed



Fraction of cells removed

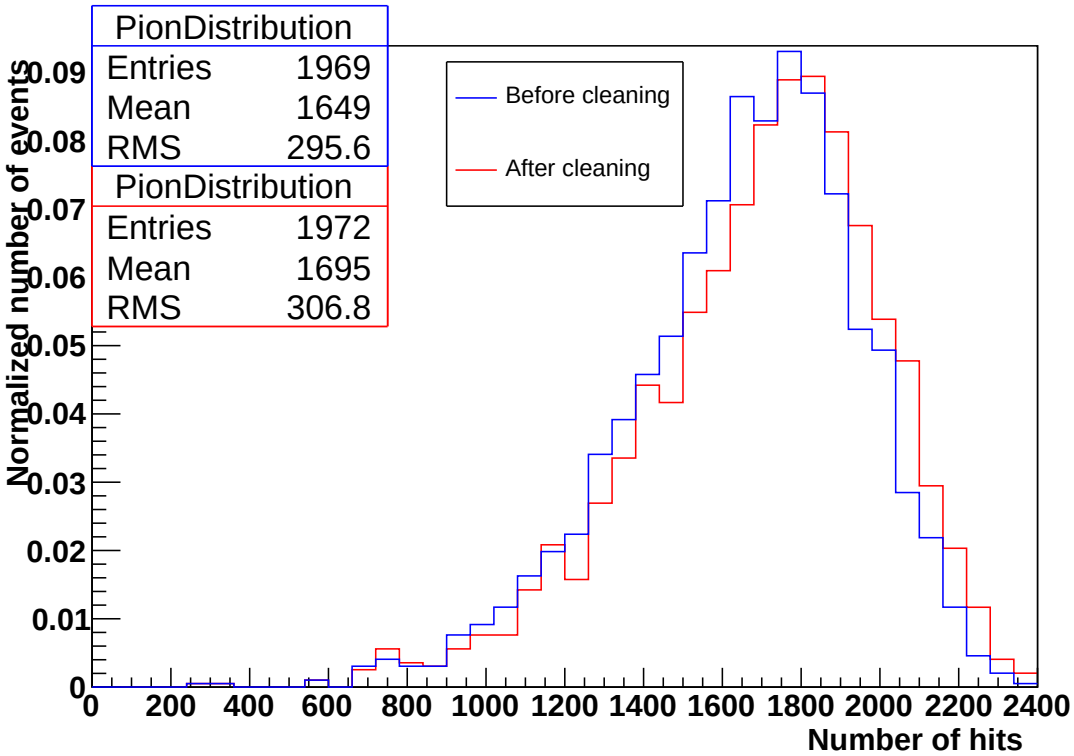


Summary

- Data quality issues
- Box events
  - Remove the event
  - Large fraction of box events at high energies
- Dead and oversensitive cells
  - Remove the problemetic cells
  - Less than 5% of the cells removed

BACKUP SLIDES

Effect on hit distribution



- Did simple particle selection to find pions
- It does not have large effect on the distribution