Calibration with hadronic showers

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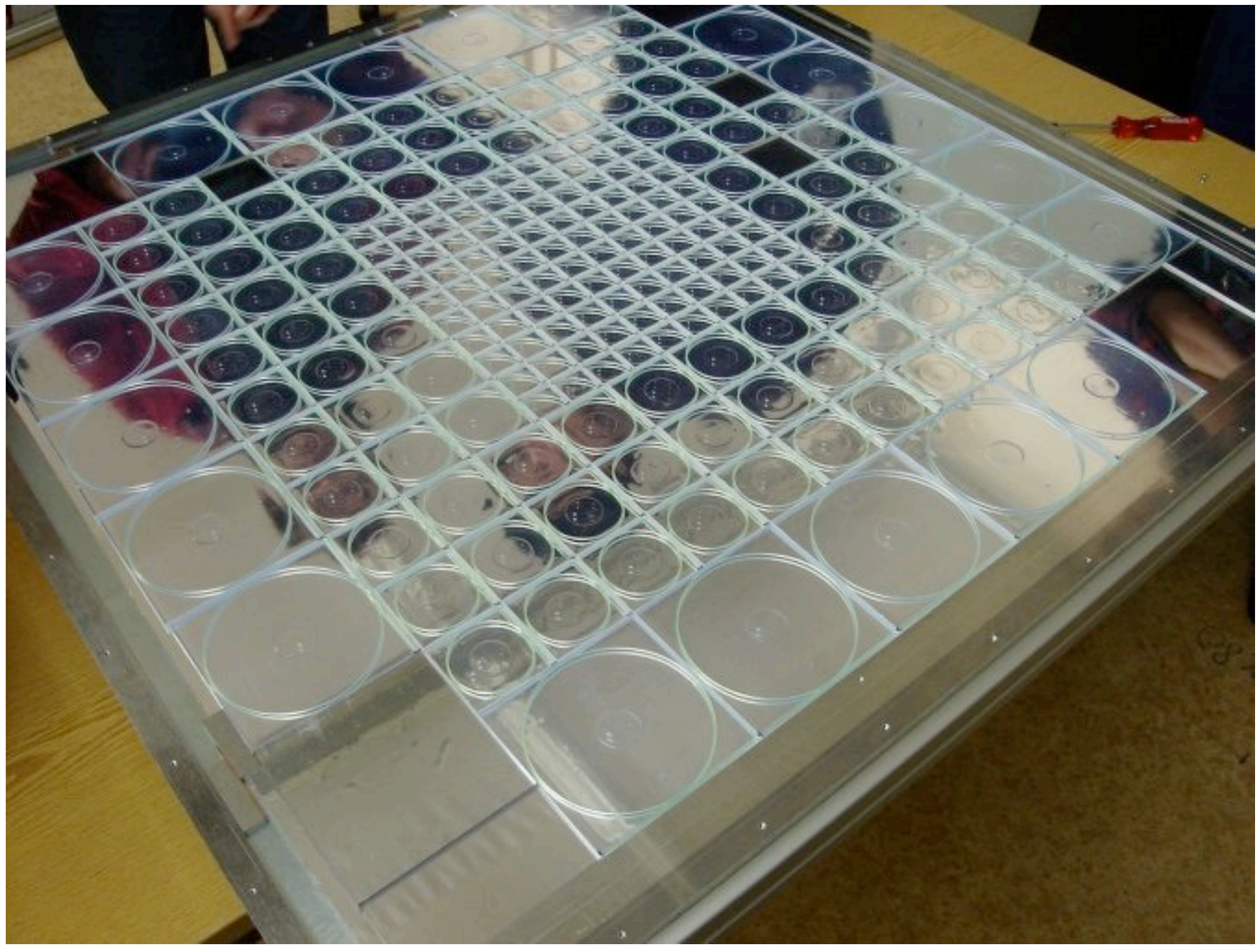
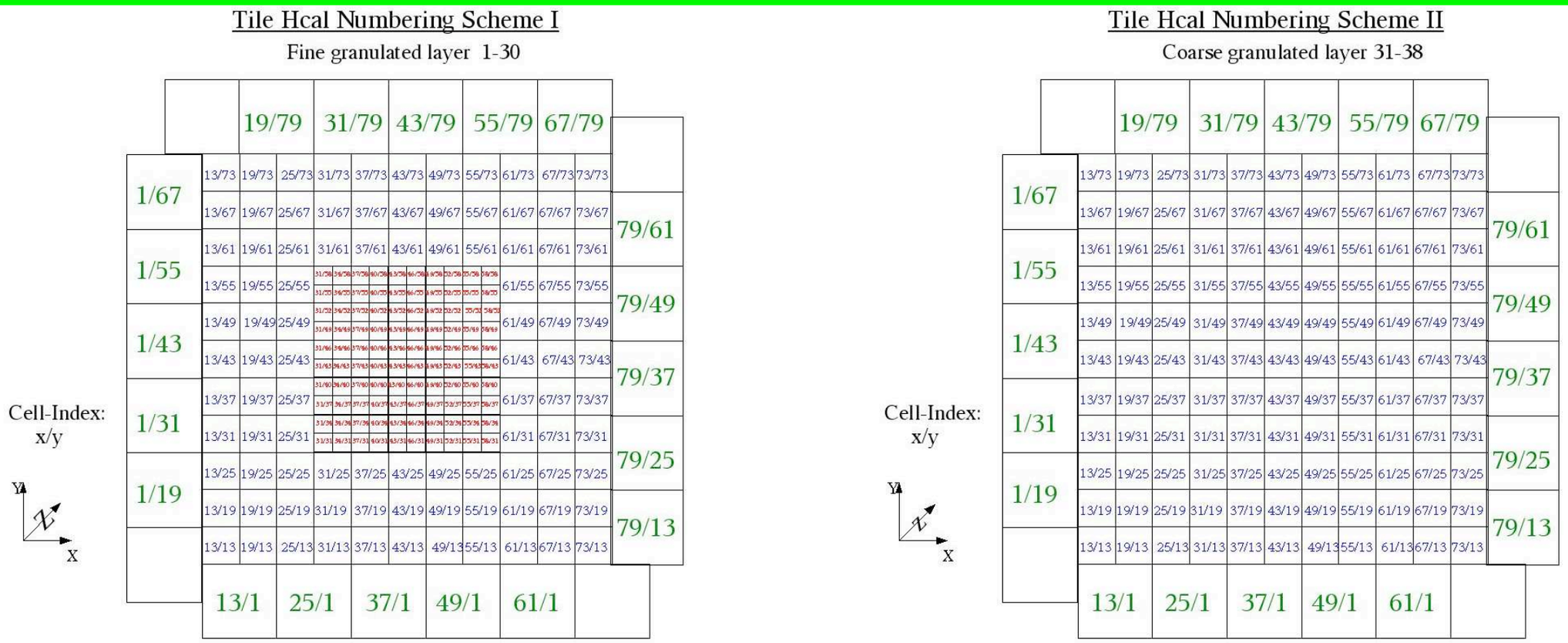
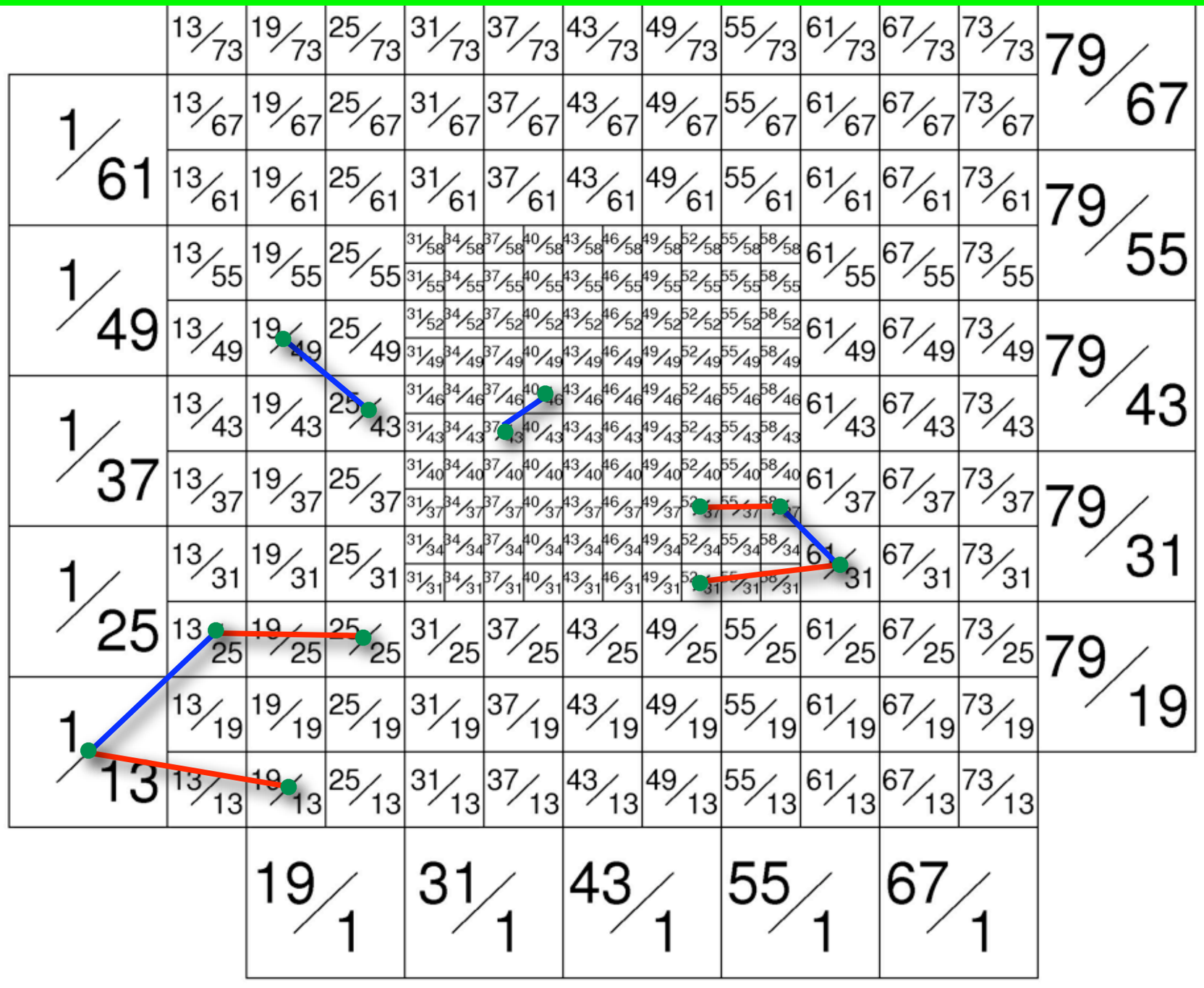


The definition of isolation tiles and track like cluster



- Isolated tile: if it has no ‘neighbor’.
- Track like cluster:
  - consists of isolated hits;
  - The hits need to be in consecutive layers
  - The two hits in consecutive layers need to be in tiles with the same I and J coordinates or the neighboring these.
  - Allow that a layer inside a track may be ‘blank’.

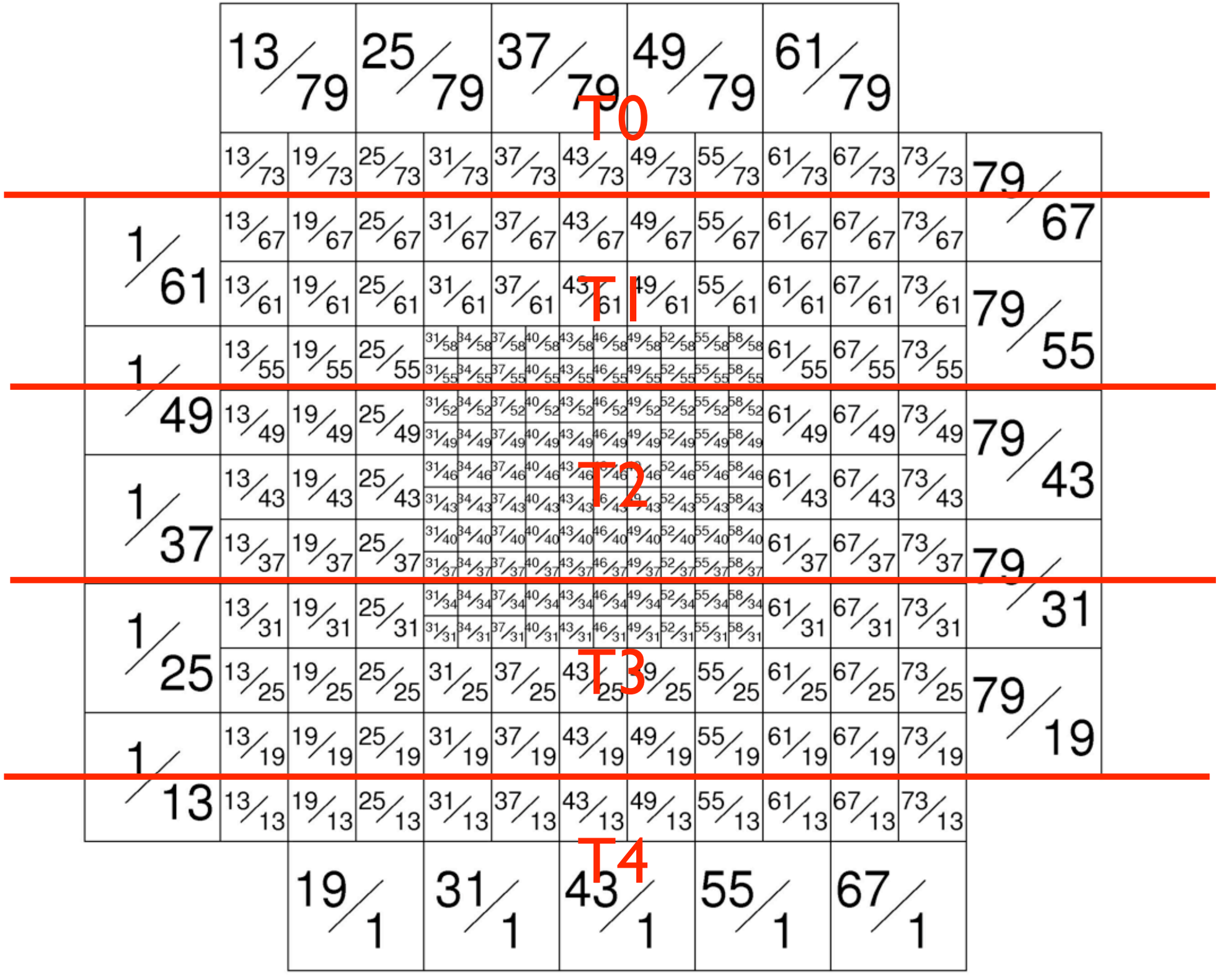
The definition of isolation tiles and track like cluster



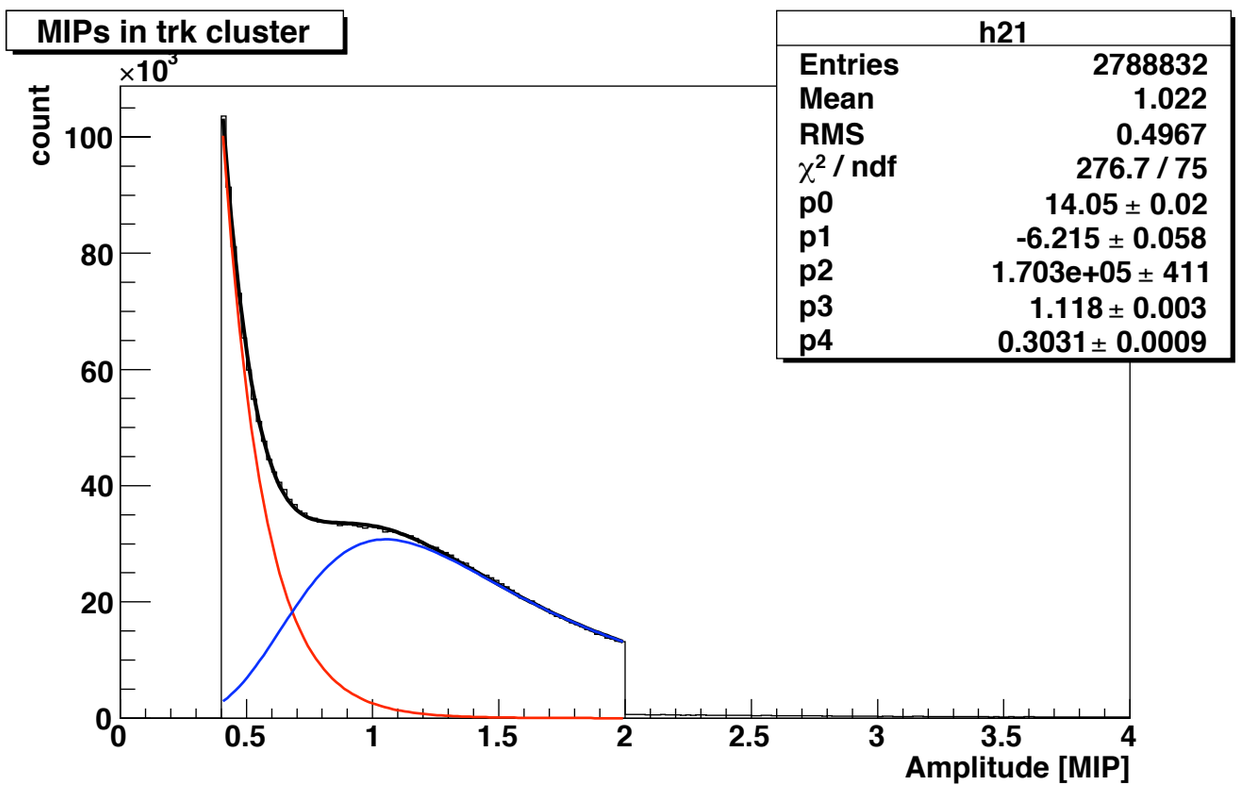
The red lines show the relevant distances used to determine the isolation criteria for different tiles are marked.

The blue lines show the neighboring tiles are marked

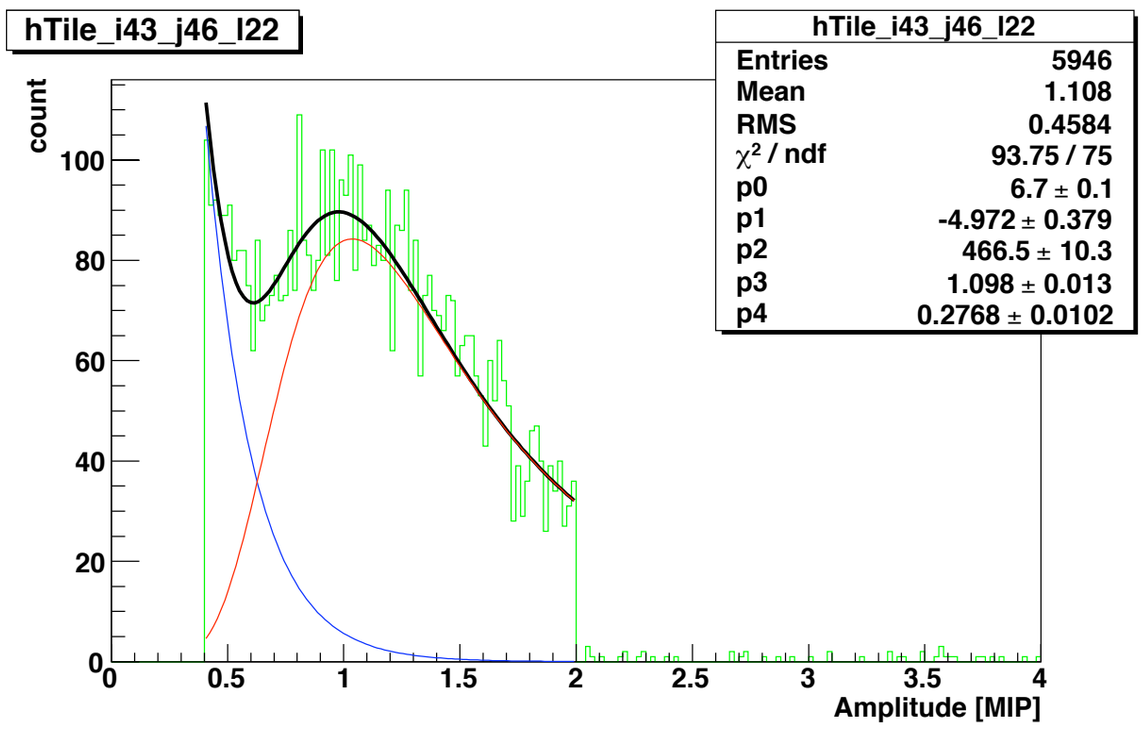
The definition of temperature for isolated tiles

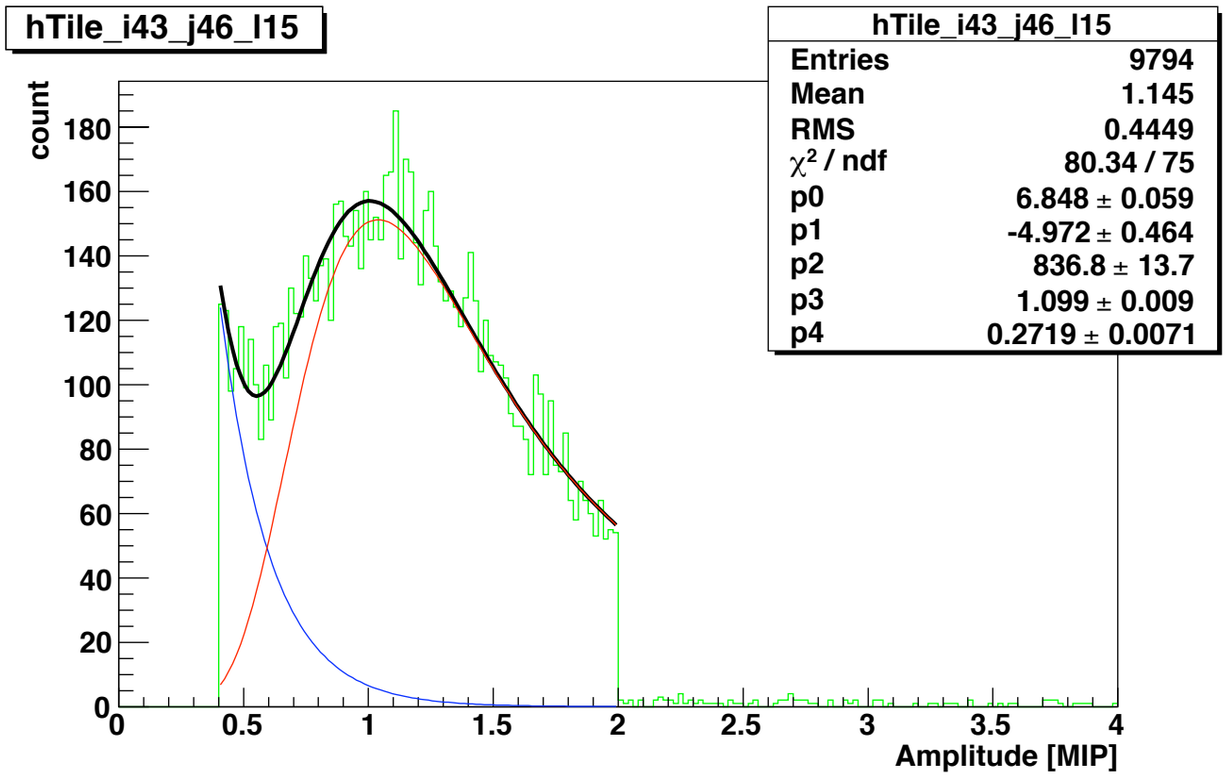


Short review (1)

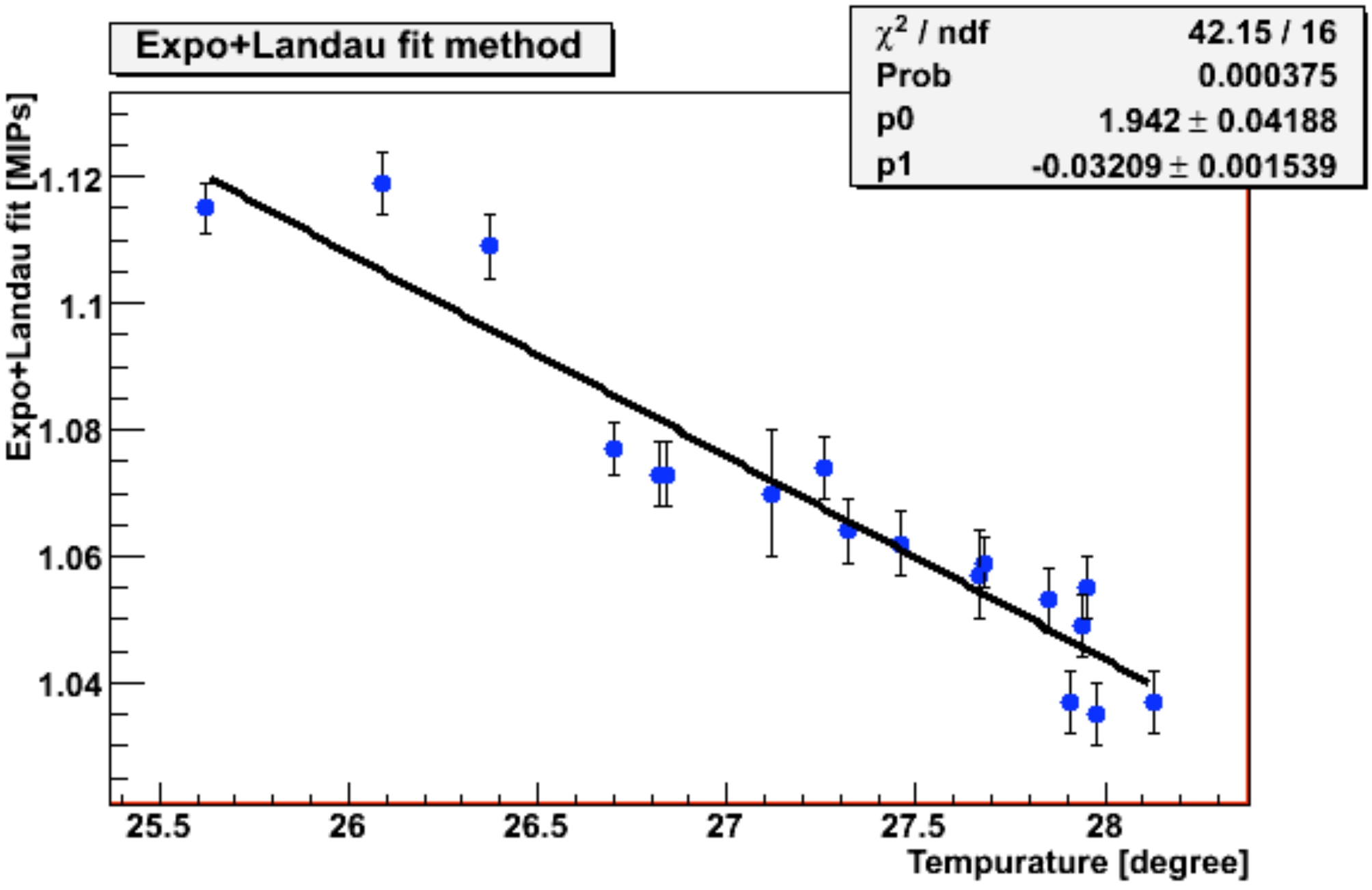


- Track like cluster from deep analysis code.
- Expornatial + Landau fit for the MIPs.



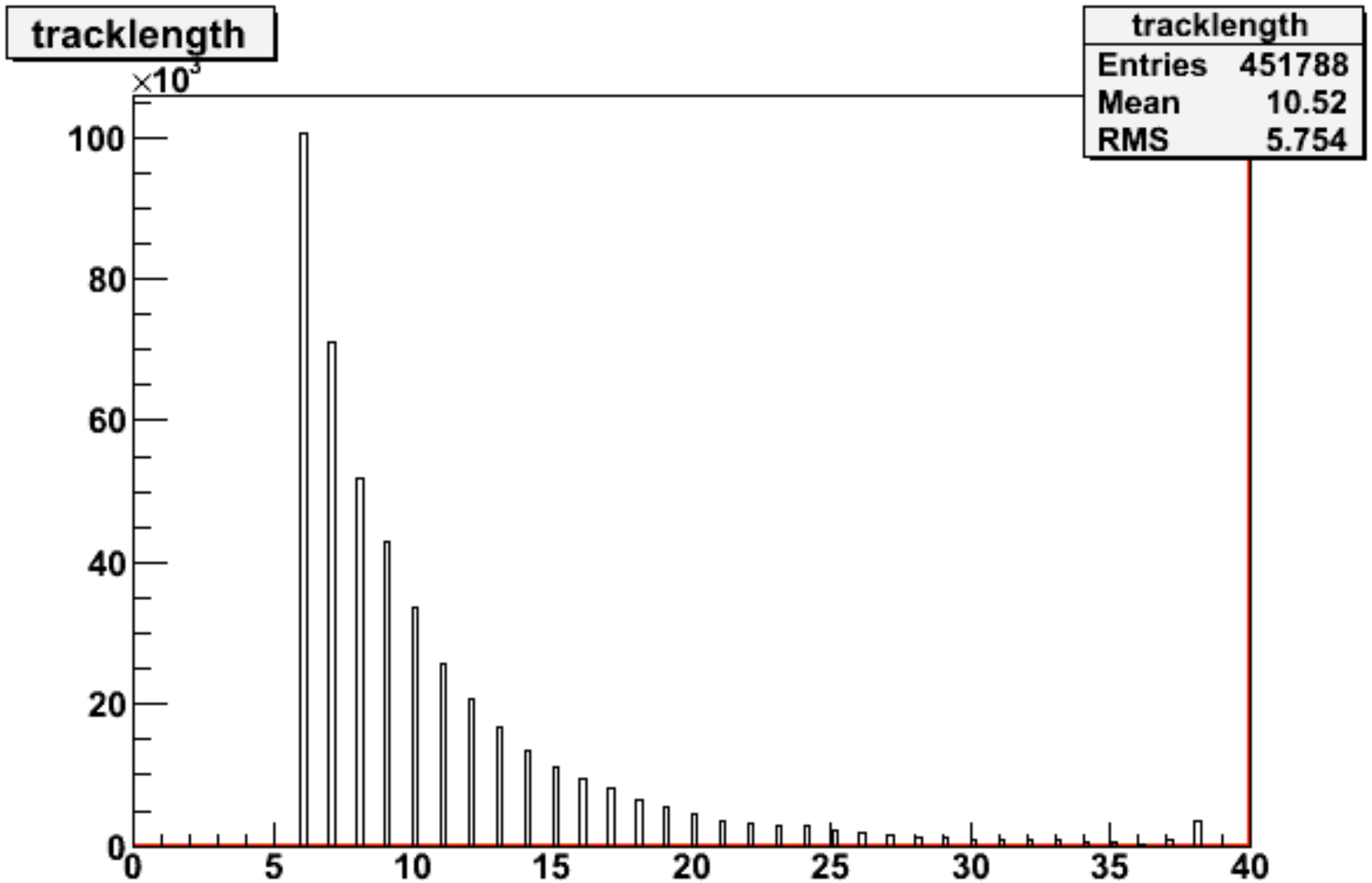


Short review (2)



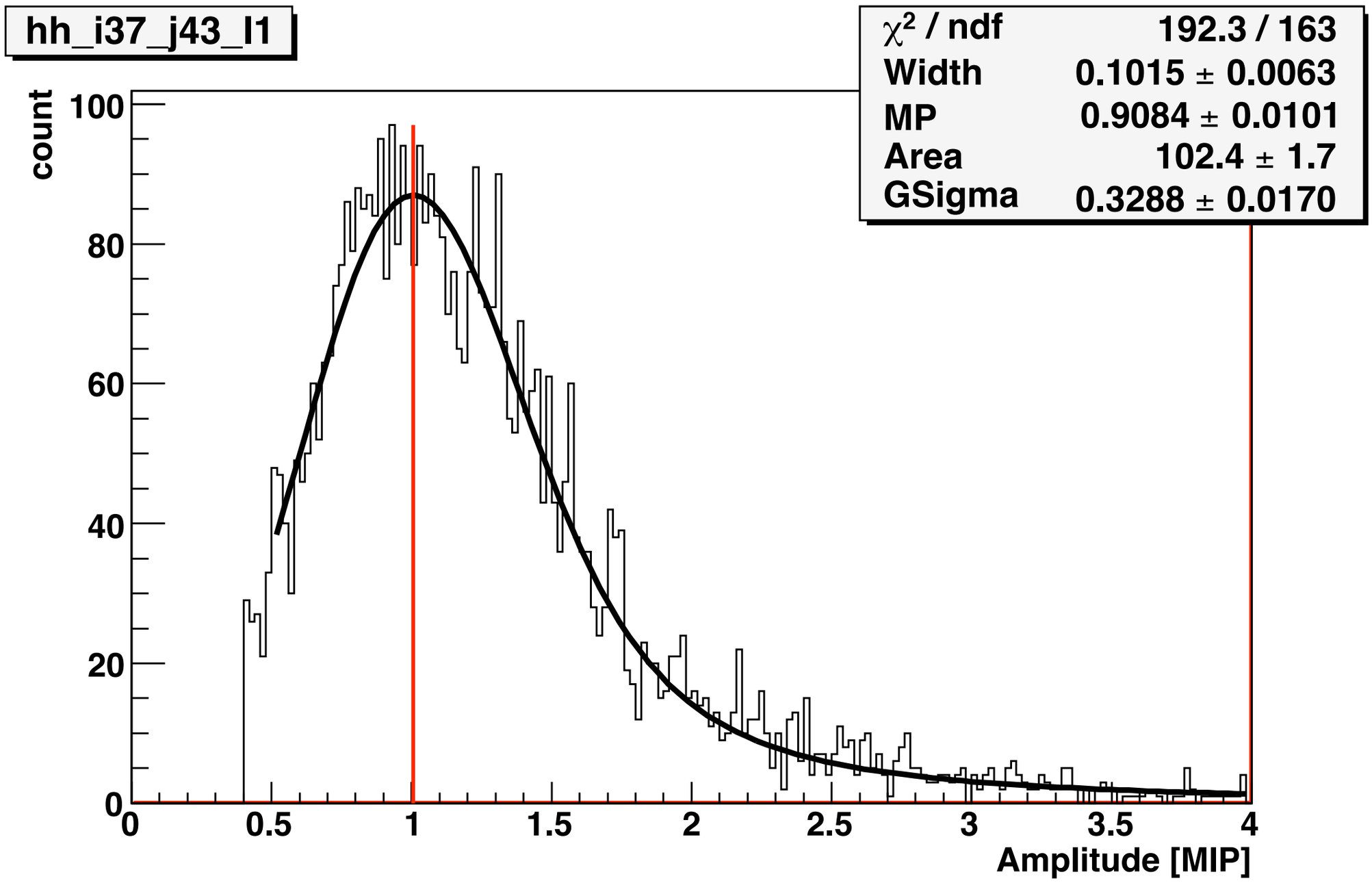
- Mean temperature from all temperature sensors.

The length of track like cluster



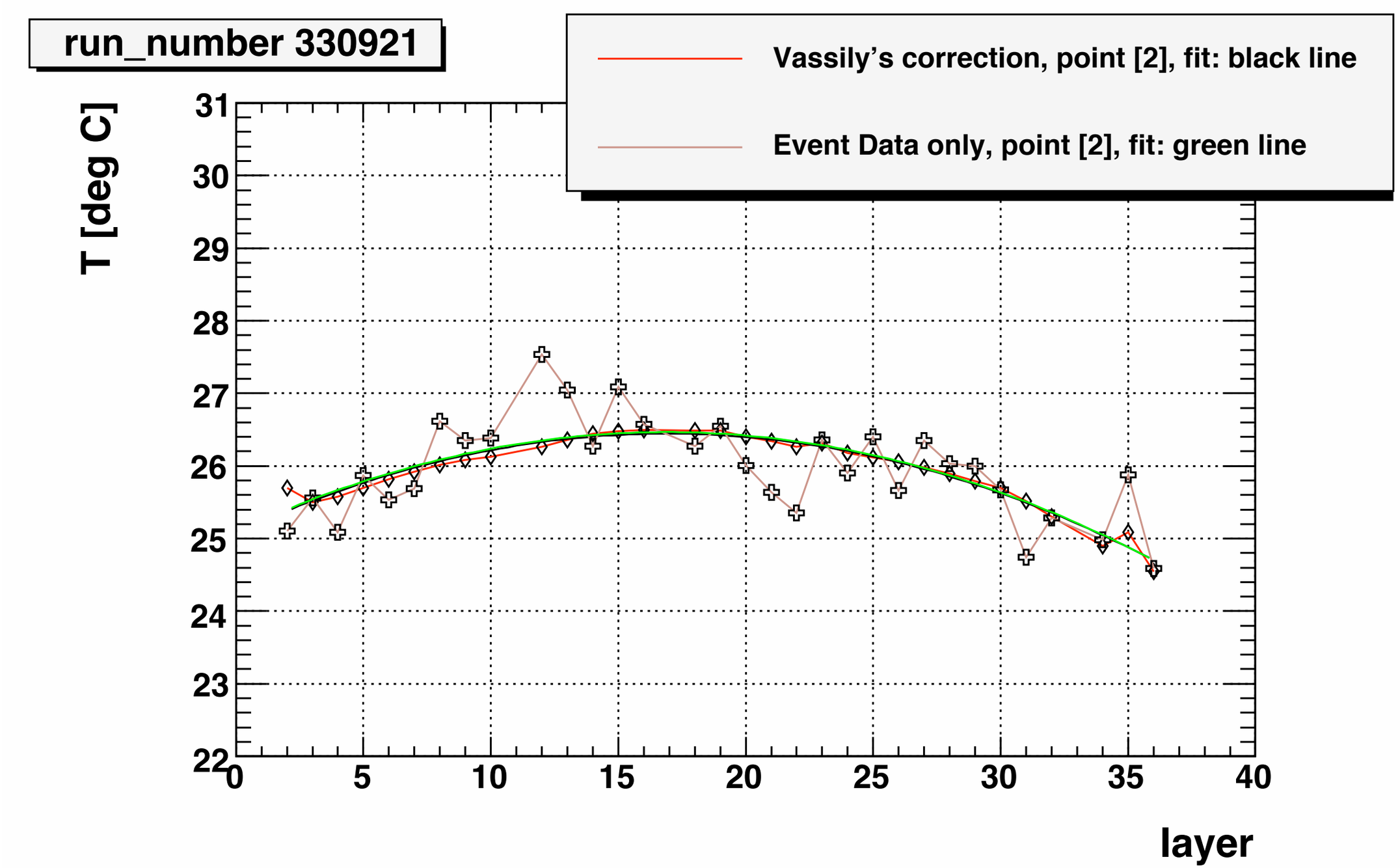
- The cut on track length is six tiles.

The MIPs of the single isolated tile



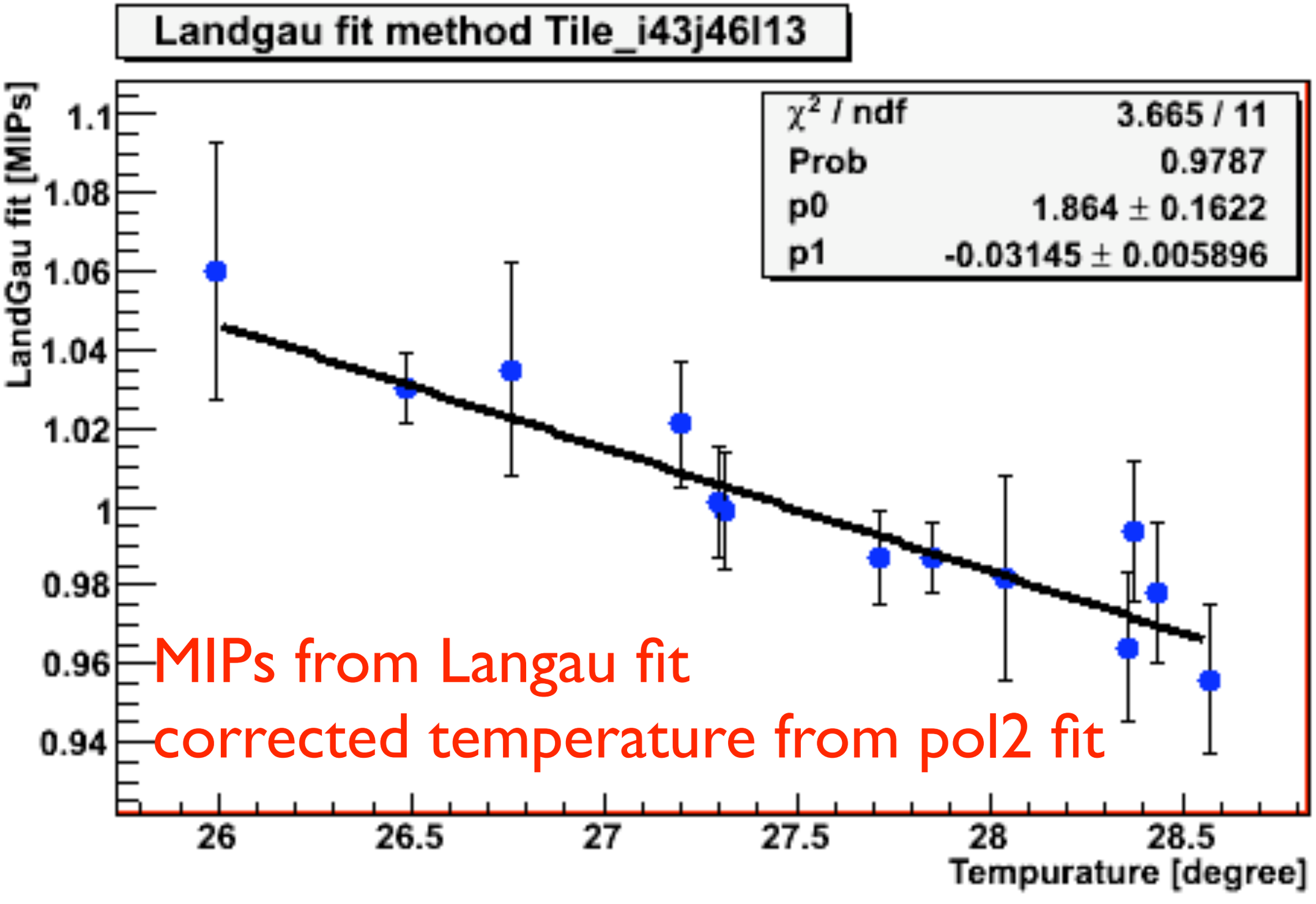
- hits in single tile inside the track like cluster from isolation tiles
- fitted with convoluted Landau and Gaussian Fitting Function

Temperature VS layer



Temperature correction from pol2 fit is used in this analysis

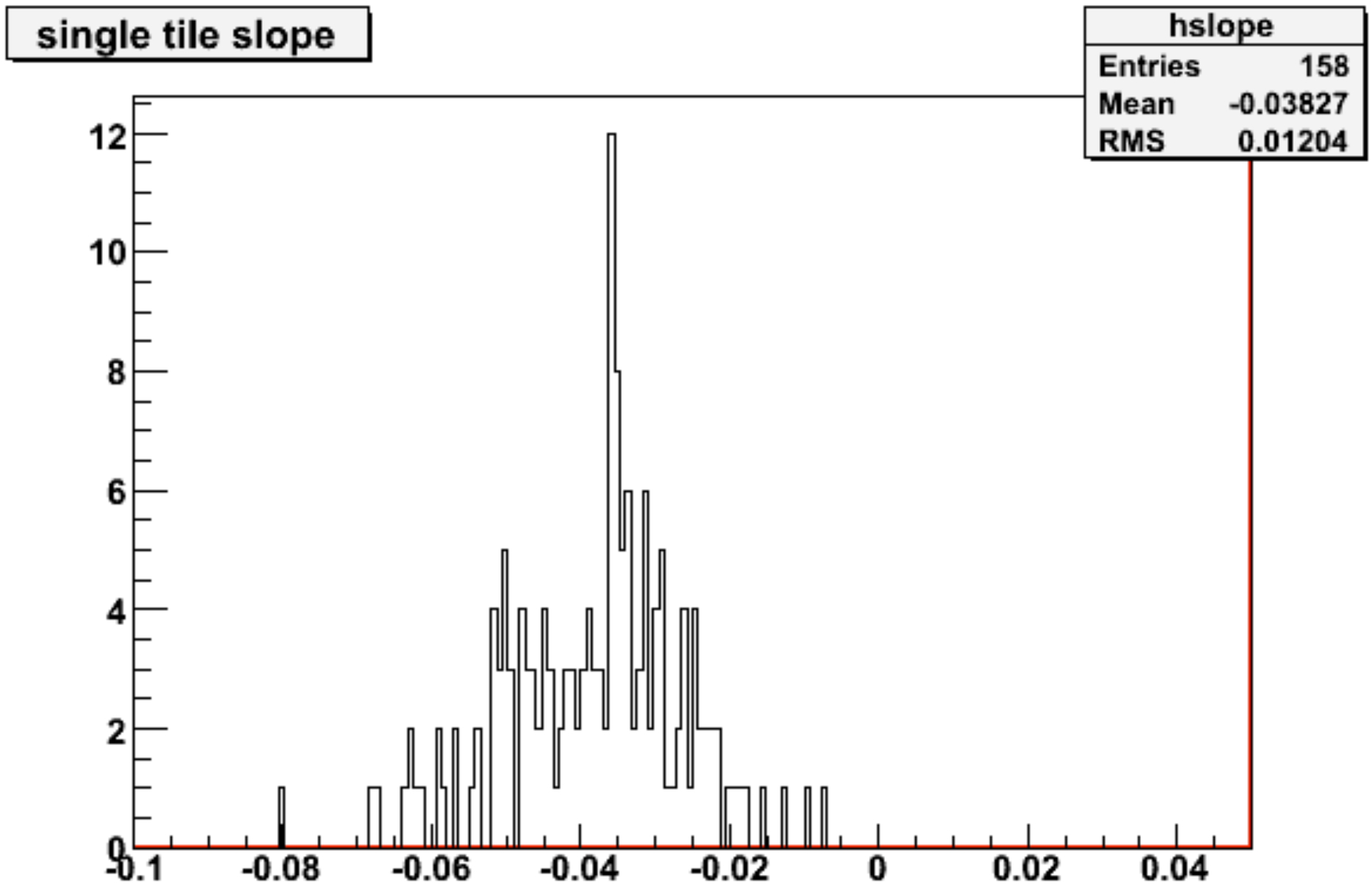
Amplitude VS Temperature



The study in this talk based on

- Amplitude: From single tile
- Track like cluster: From Isolation tile method
- MIPs peak: From convoluted Landau and Gaussian Fitting Function (Langau)
- Temperature: corrected from pol2 fit
- ~7600 Tiles of HCAL in 19 runs have been studied using this method.

The slope distribution

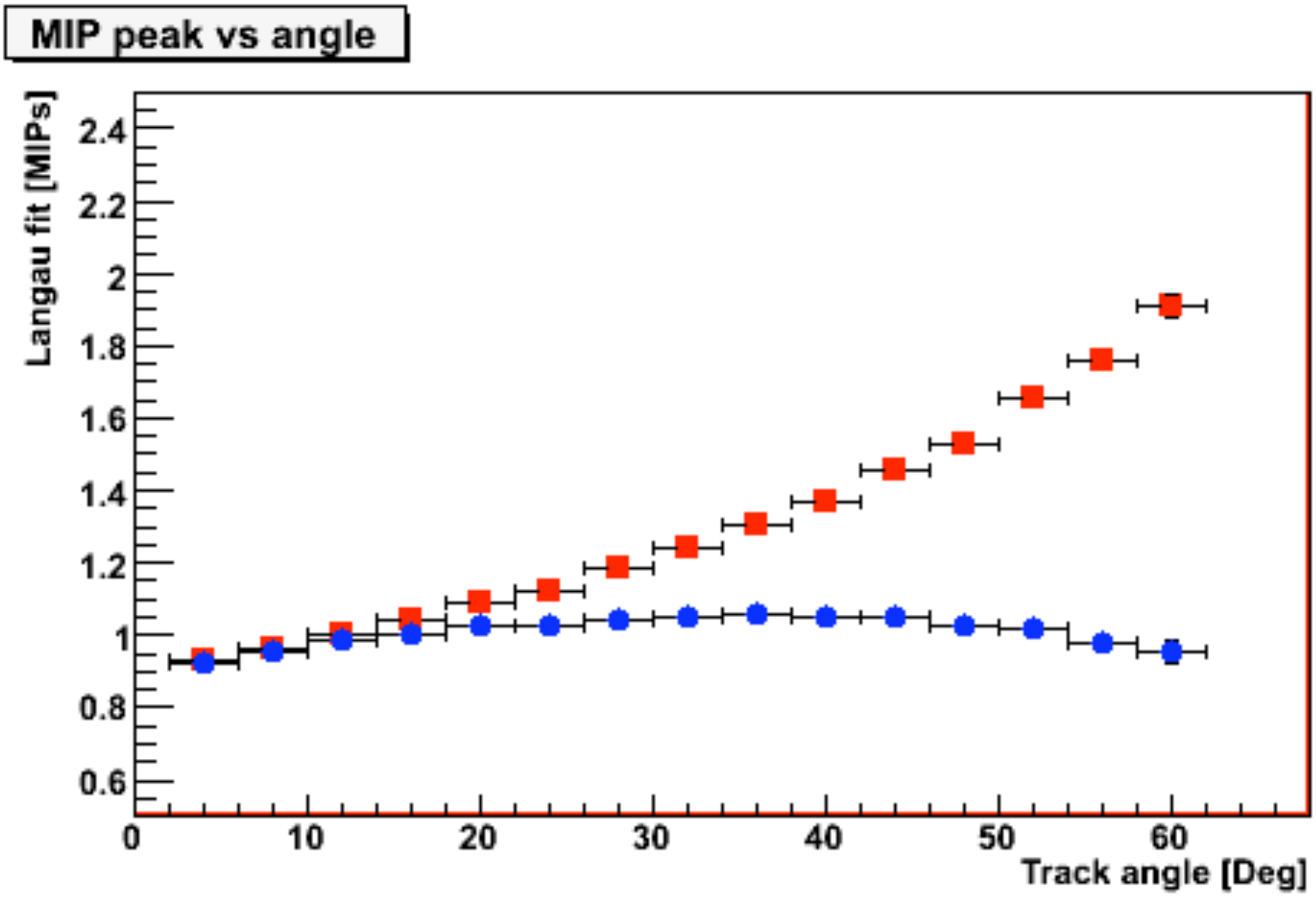


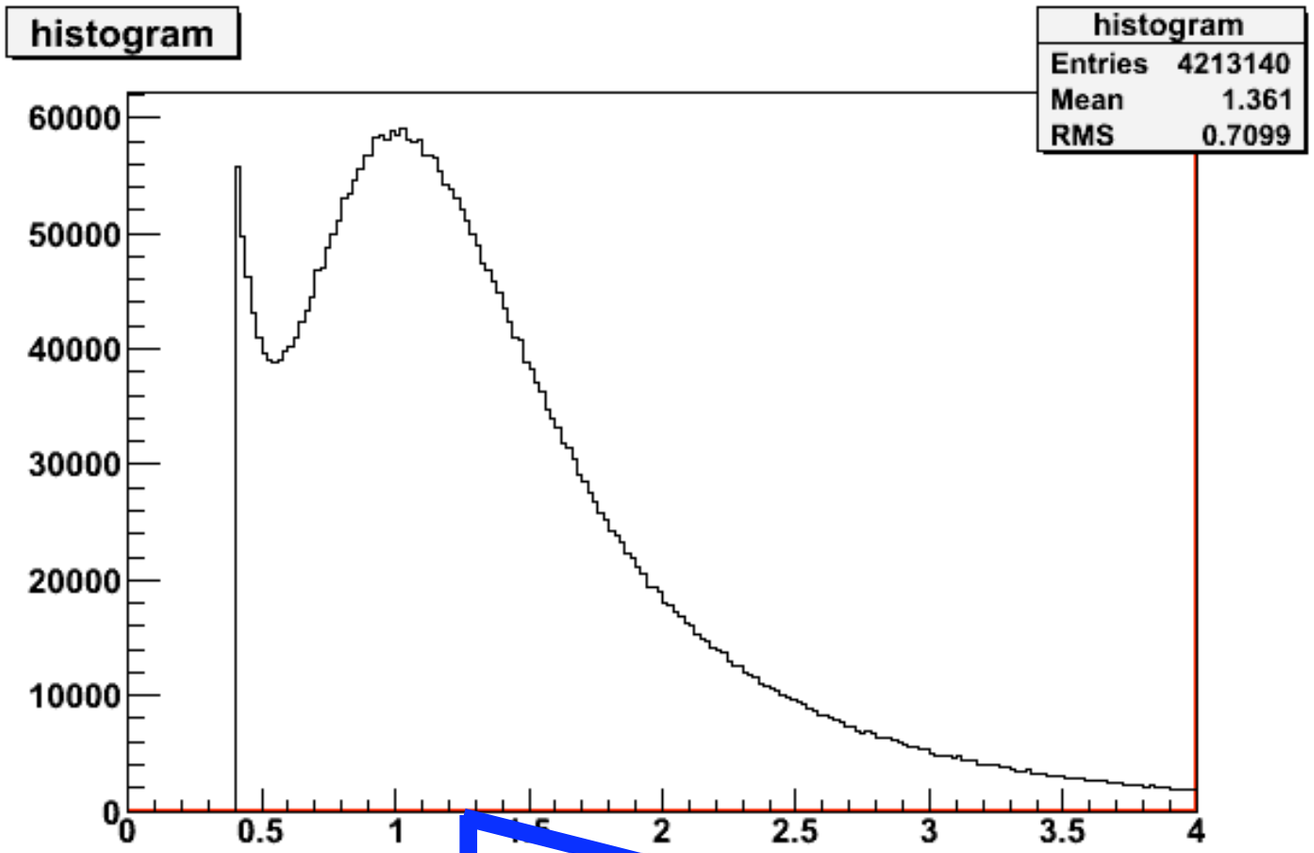
- At least 3000 hits at each temperature point for one tile
- At least six different temperature points are available

More study on this isolation track method

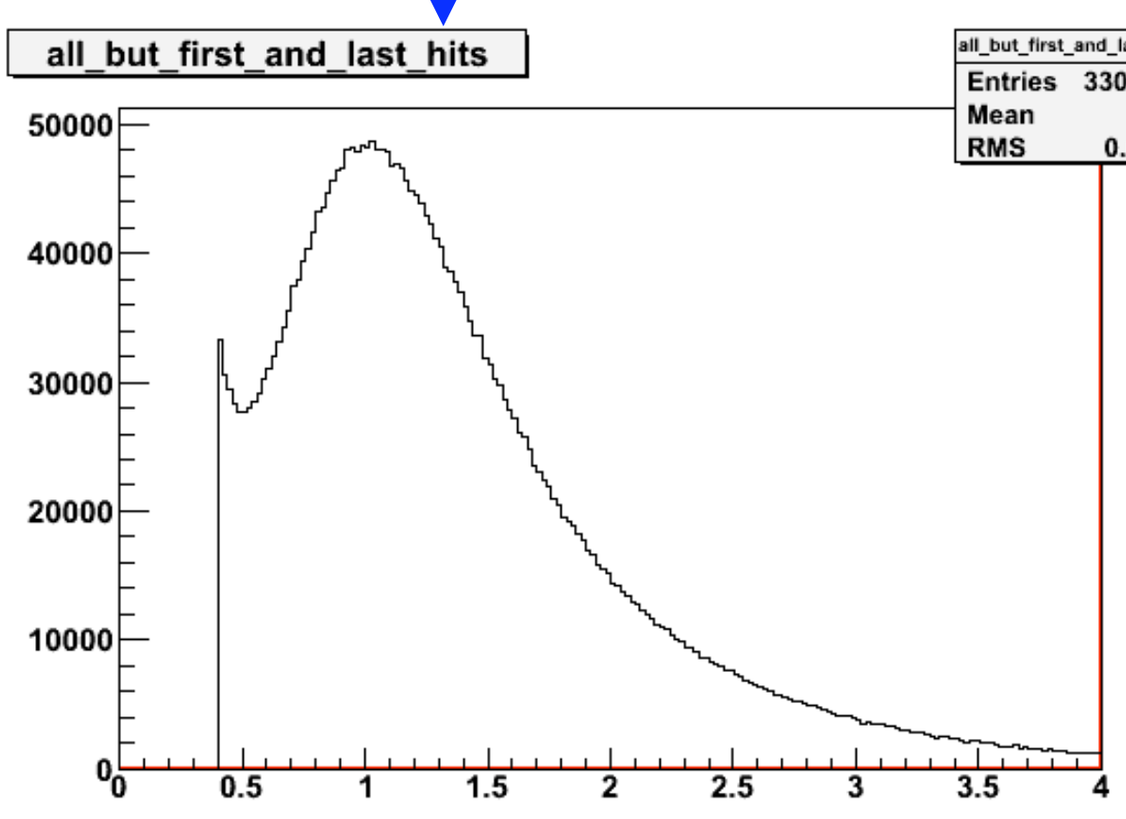
- Amplitudes difference from the angle of the tracks.
- Amplitudes of all tiles but first and last in a track.
- Amplitudes of the first and the last tile in a track.
- weakened isolation criteria

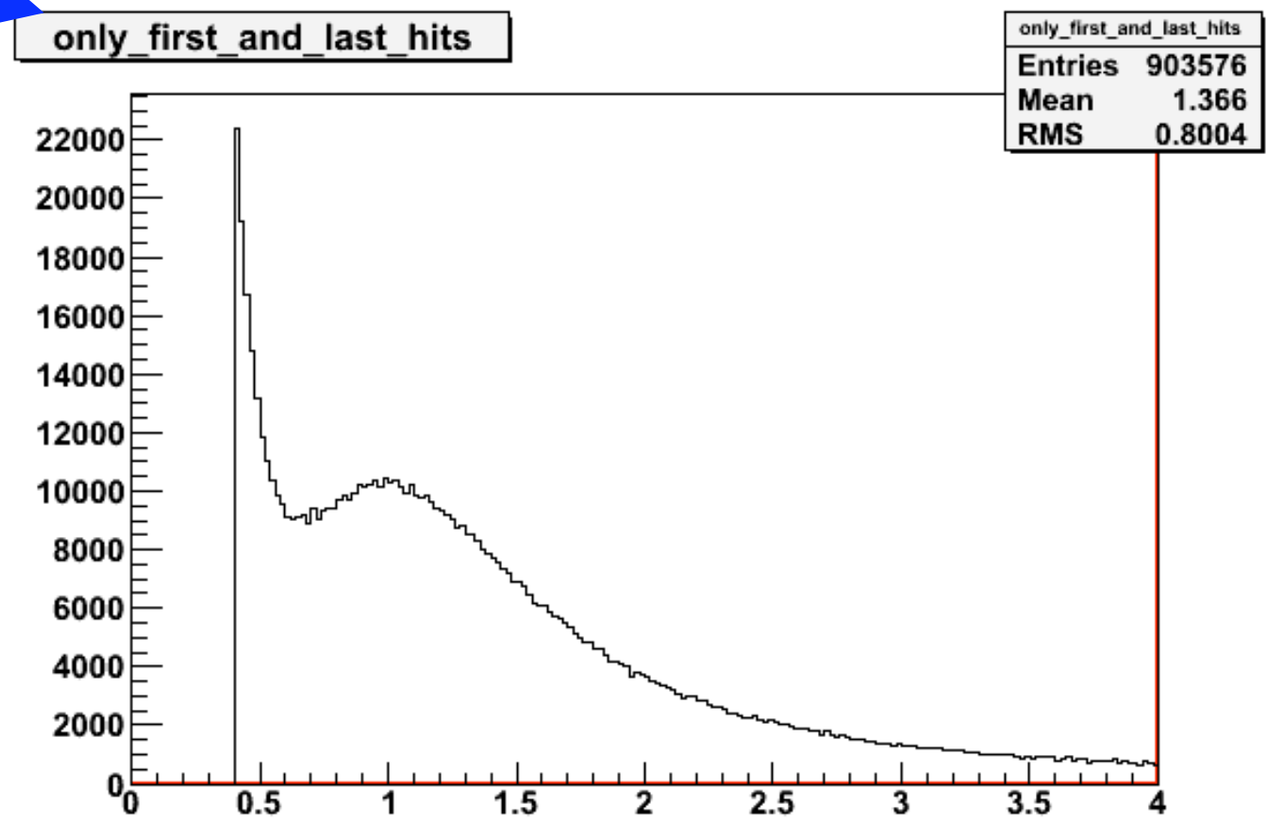
Amplitude VS the angle in the angle track like cluster and correction

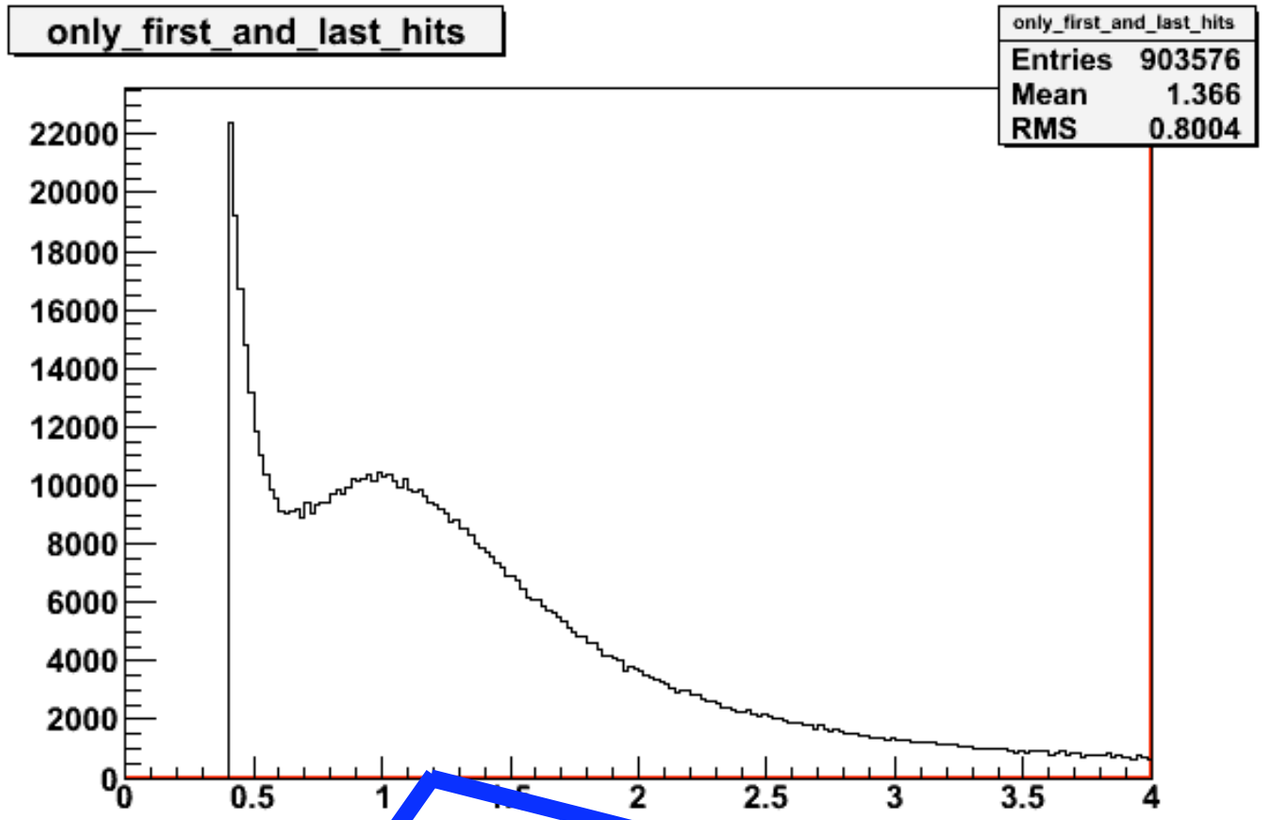




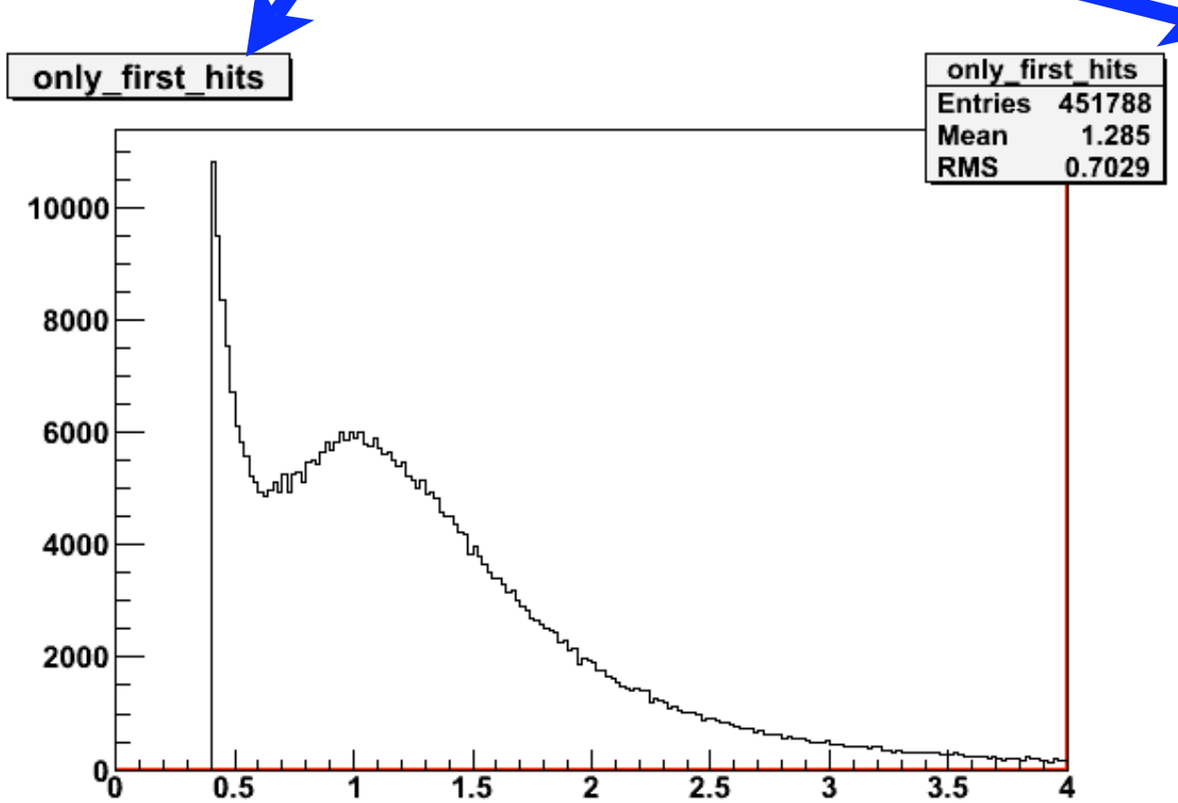
- Inside a track, the first and last tiles have more low energy hits

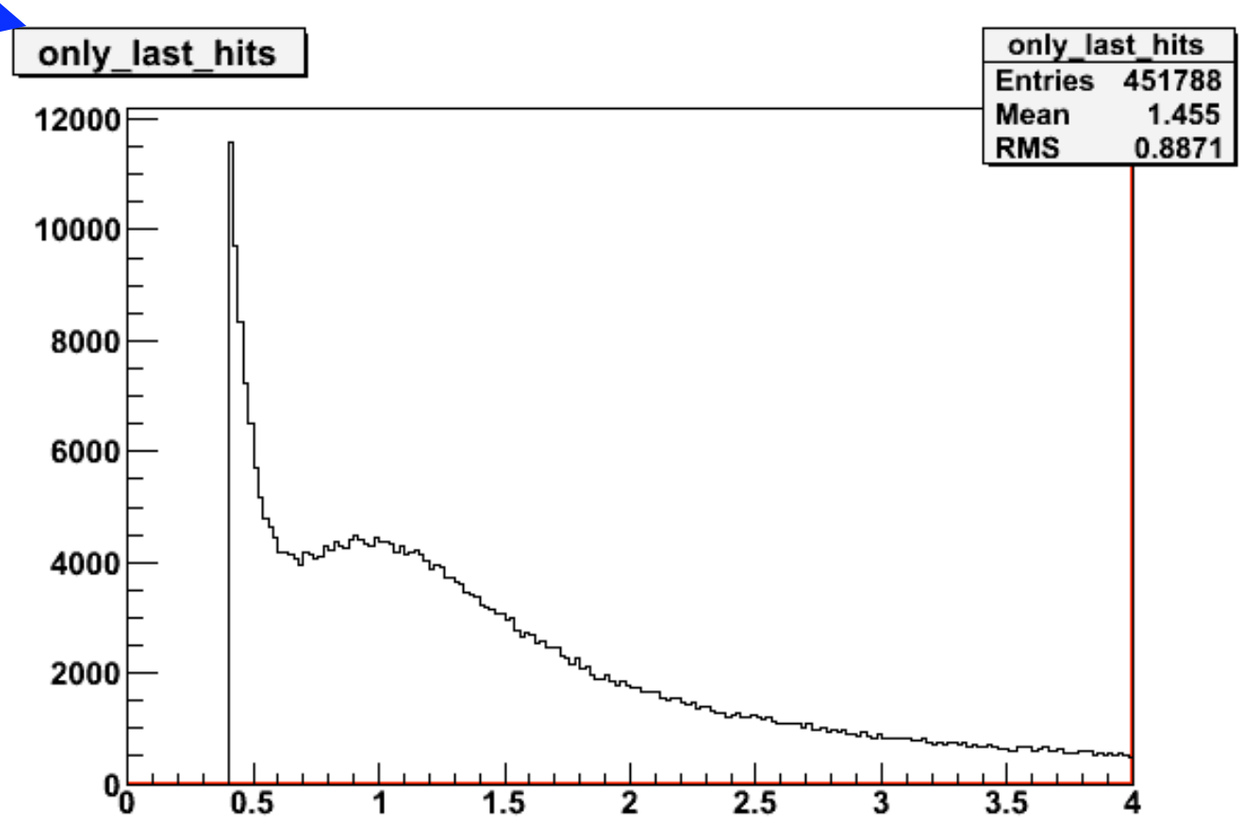






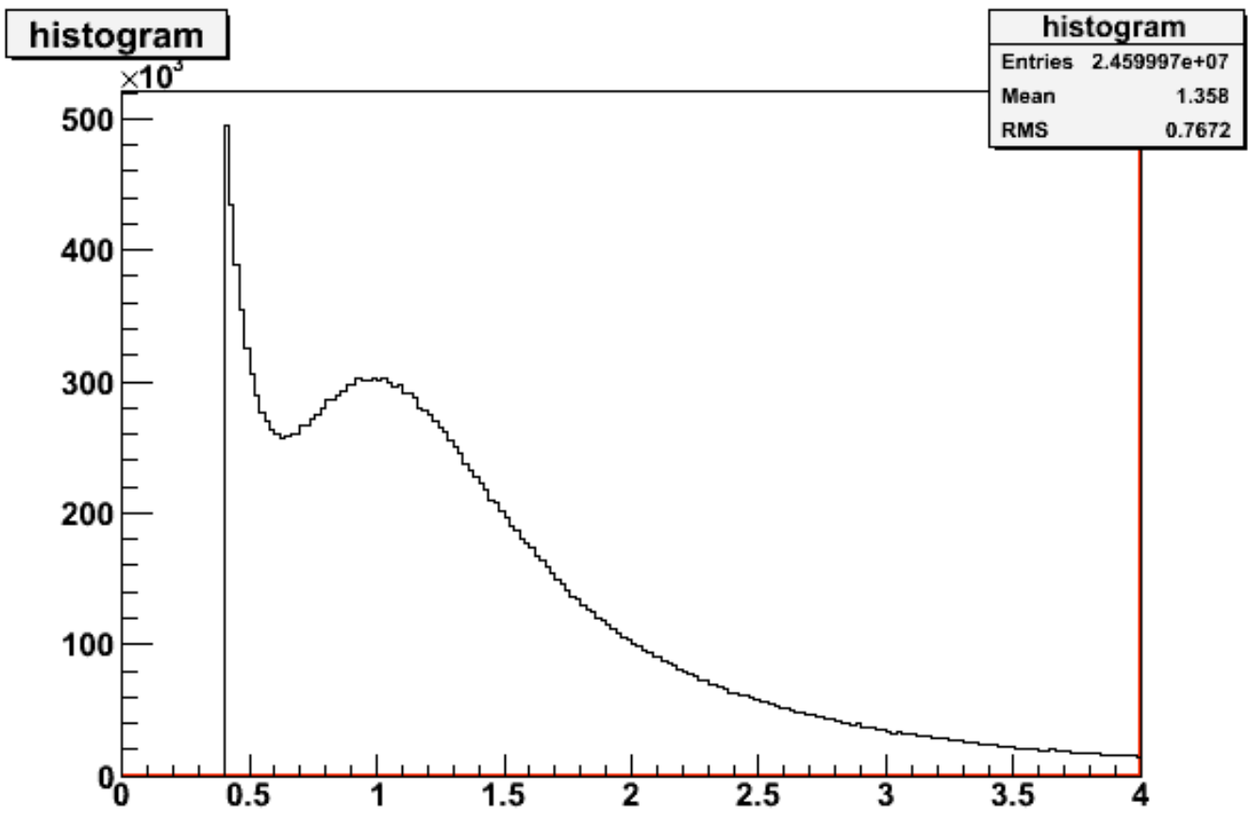
- the last tile has more low energy hit than the first one.

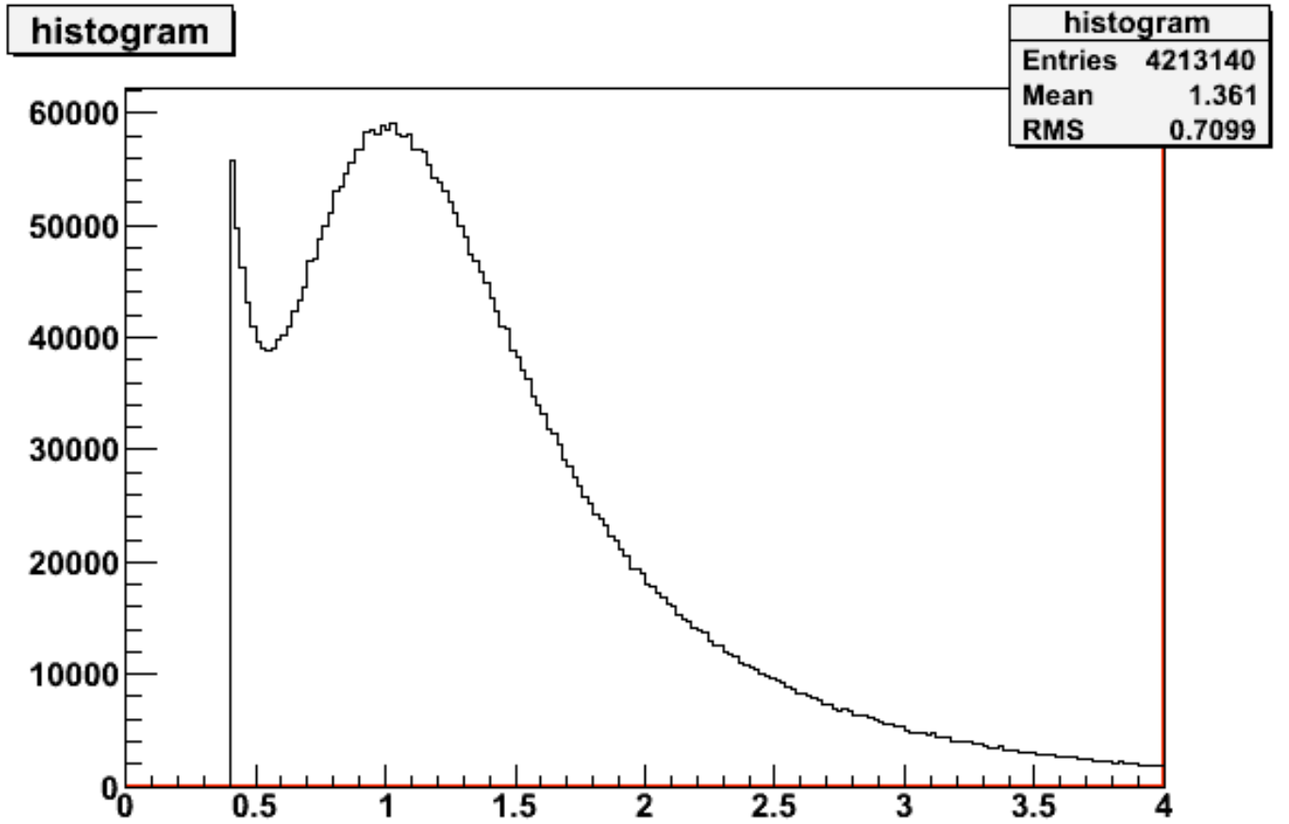




weakened isolation criteria

- If a hit had only one neighbor, it was still considered isolated. (weakened isolation criteria)
- The number of entries in the histograms were expected to increase significantly.
- For the calibration, the larger the amount of data available the better.



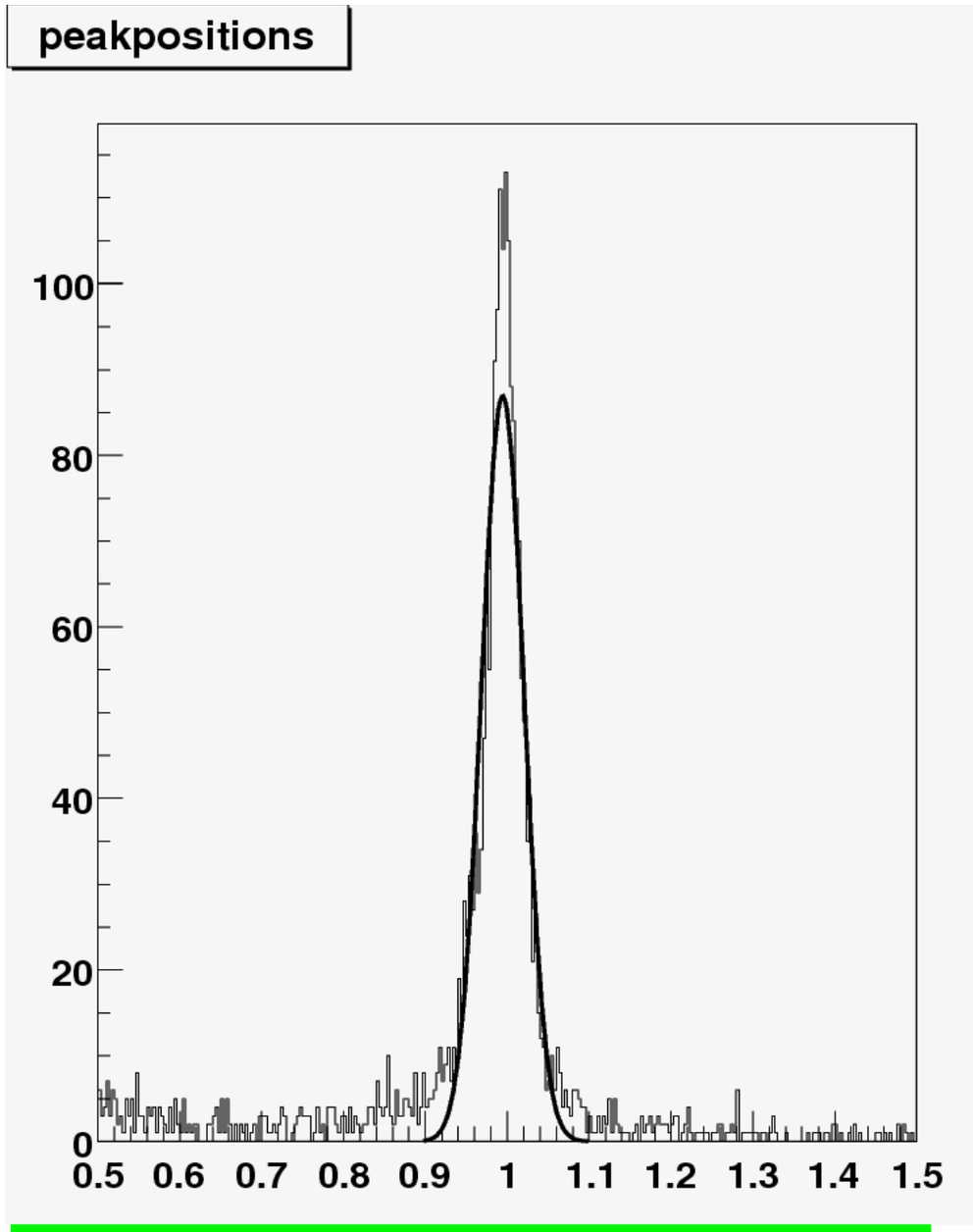


weakened isolation criteria

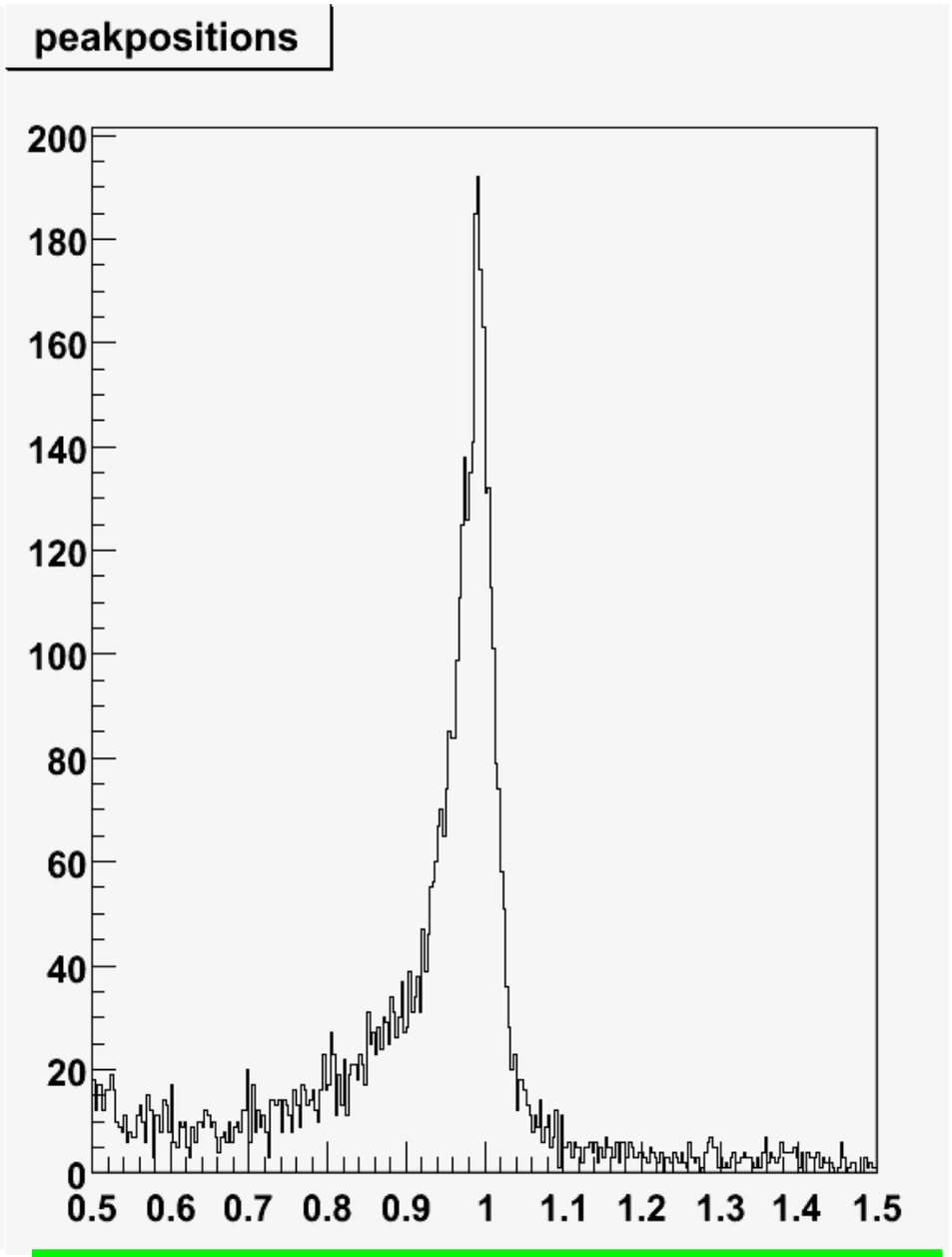
strong isolation criteria

- The number of entries in the histograms were increased significantly with weakened isolation criteria.
- However, the number of low-energy hits showed also a big increase.

MIPs peak position for single tile from two isolation criteria



strong isolation



weakened isolation

Summary

- The temperature and amplitude have been studied with track like cluster from test beam data.
  - Method 1: tiles inside track like cluster from deep analysis and MIPs peak from exponential + Landau fitting.
  - Method 2: tiles inside track like cluster from isolated tiles and MIPs peak from convoluted Landau and Gaussian fitting Function.
- The constant result has been got from different methods.