Noise Validation in ATLAS' Tile Calorimeter

CERN REU, Summer 2009 - Second Presentation

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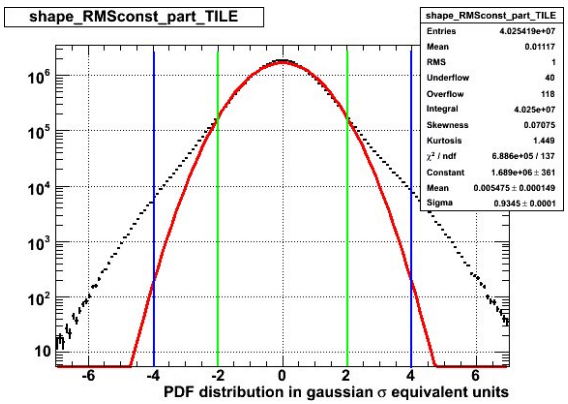
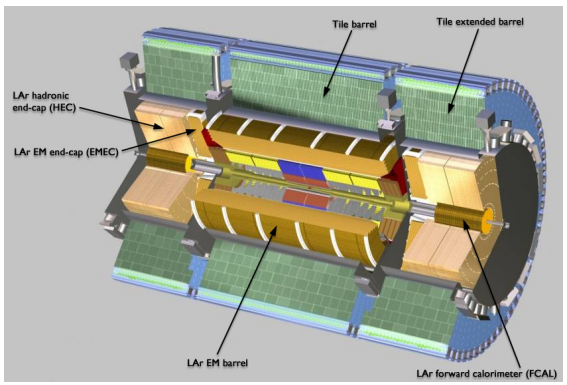
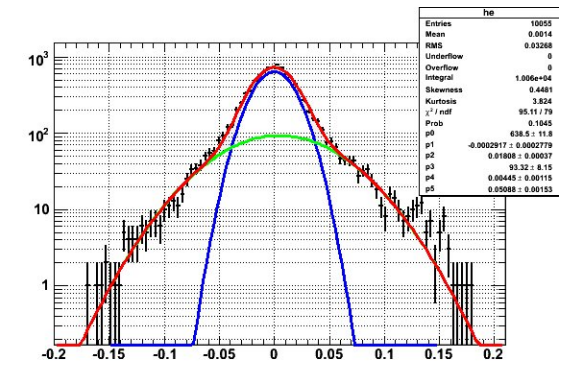
Background

- TileCal is the Hadronic Calorimeter of the ATLAS detector. It is made of plastic scintillator tiles, which are grouped into cells.
- Studies performed in spring 2008 showed that cell noise has non-gaussian tails.
- A new noise description using a double gaussian fit was proposed in December 2008 and initially implemented by A.Artamonov in Spring 2009.



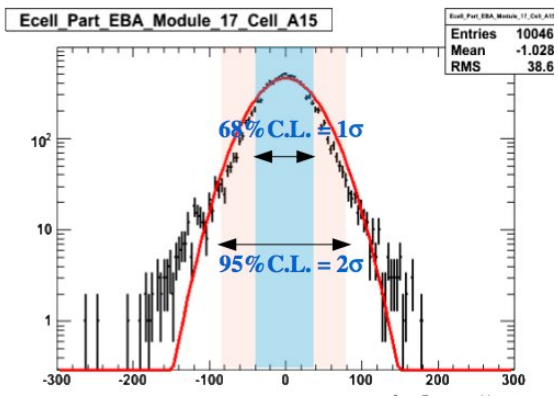


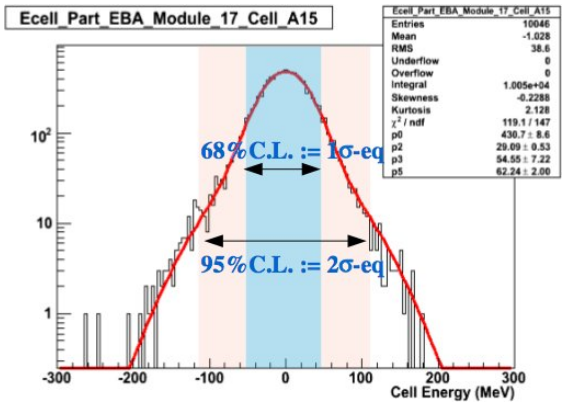


Double gaussian description

- The goal of the double gaussian description is to specify 2σ and 4σ equivalent values to match the significances of a normal distribution.

Level	Normal Distribution
Above 2σ	4.55%
Above 4σ	6.3×10^{-5}



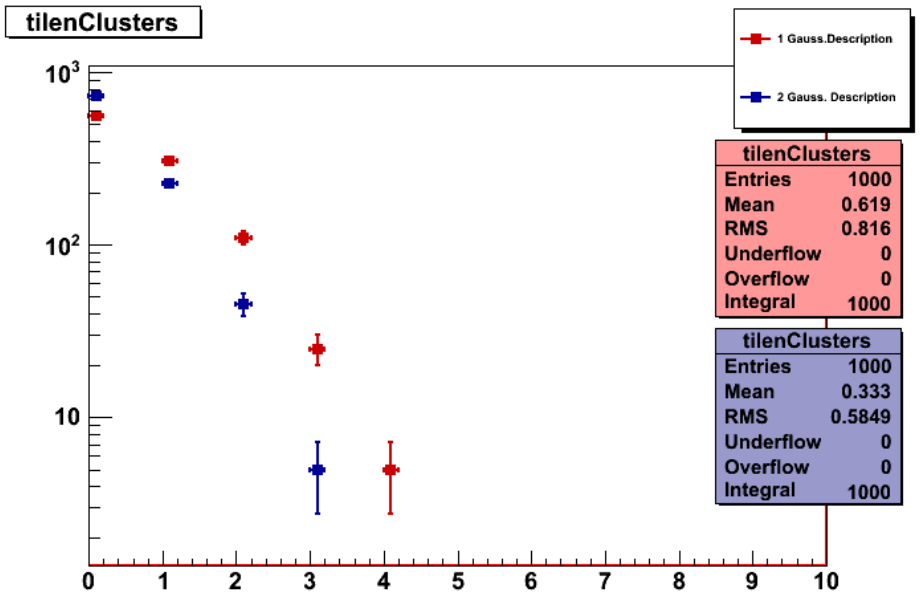


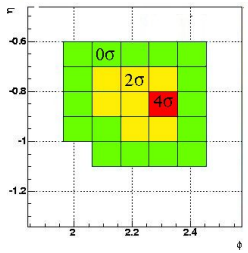
My Project:

Verify that the double gaussian noise description does improve the identification of noise signals.

Step 1: Check cluster formation

- Analyzed 1000 events from a pedastle run using the new double gaussian description and the original single gaussian description.





Description	Cluster Seeds
Single Gaussian	1.08/event
Double Gaussian	0.50/event
Ideal Noise	0.29/event

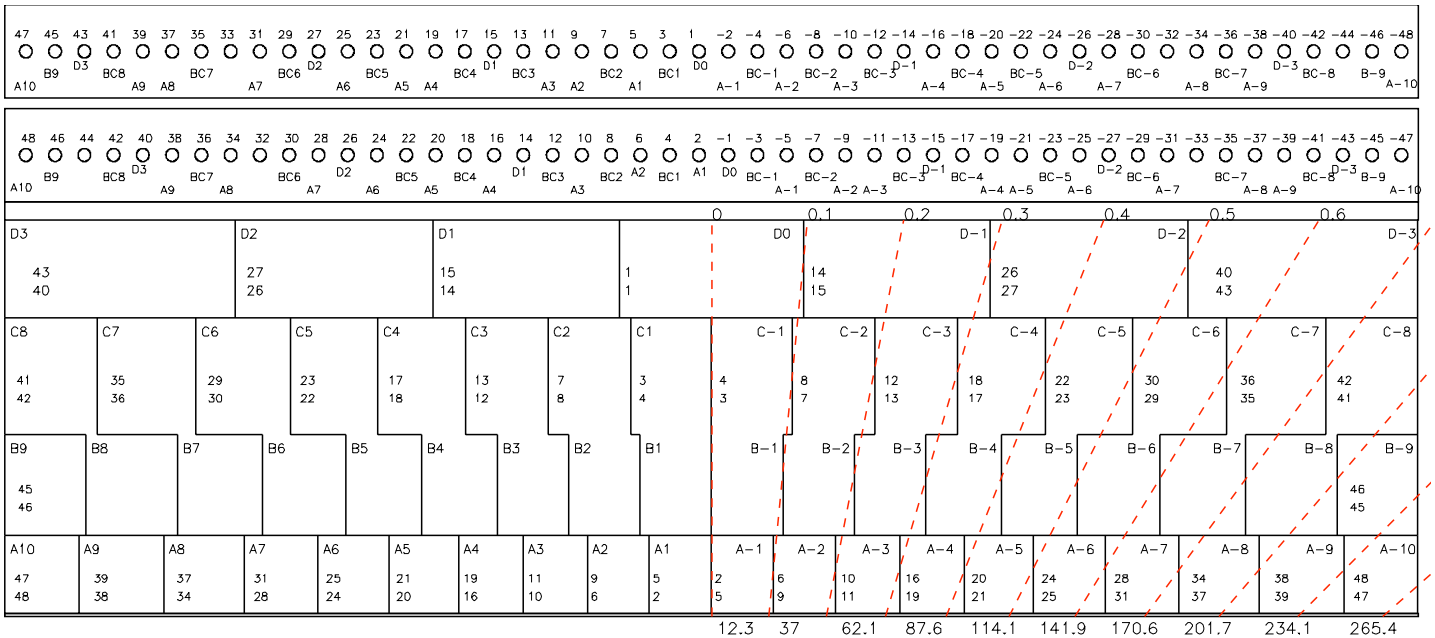
Results

The double gaussian description did reduce the average number of clusters formed in each event, but still resulted in a value greater than would be expected from a normal distribution 4σ limit.

Step 2: Take a closer look at seed cells.

- Looked at the number of times each cell acted as a $> 4\sigma$ seed cell.
  $\rightarrow$ For normal distribution, fraction of events would be 6.3×10^{-5}

- Of cells that were cluster seeds $> 1\%$ of the events, all but one lacked double gaussian noise constants.
- A more complete set of noise constants is being developed and should be finished within a week or so.



The next steps:

- Repeat analysis using new set of noise constants
- Rerun analysis on more events to build statistics.
- Run on data from different time periods to verify stability of description.
- Look at distribution of E/σ_{equiv}

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Any questions?