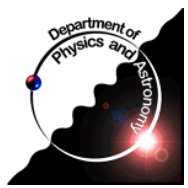
On Noise Characterization

14 August 2003

- Local HEC coordinate system
- Readout families
- Readout channels
- Volume and geometrical center
- Neighbors



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Noise Characterization

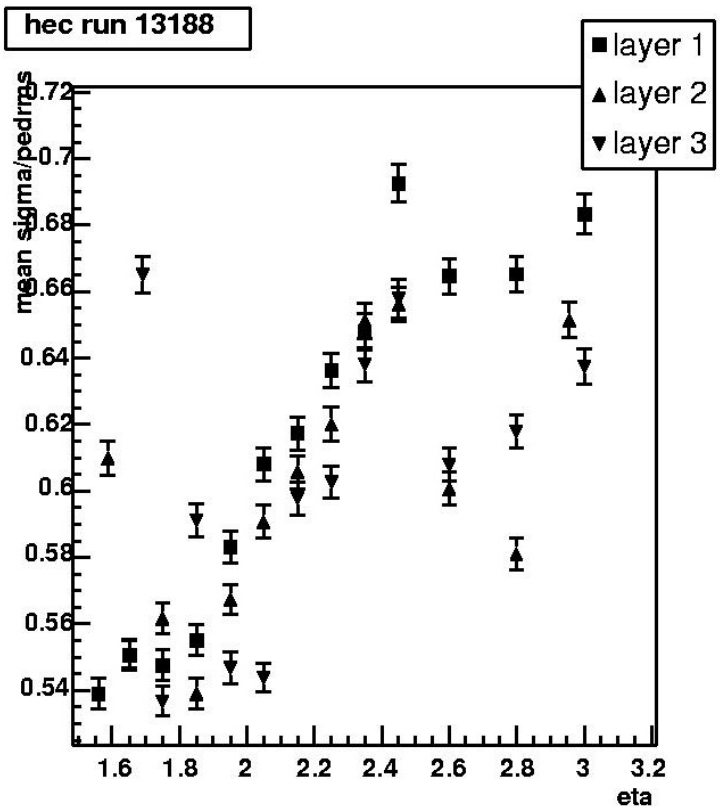
- A good characterization of the digital filtering noise is crucial to most analysis
- The digital filtering noise reduction factor depends on the layer and on η
- Strategy to estimate the digital filtering noise for each channel using only a given data run:
  - The pedrms are obtained from the first time sample the usual way;
  - For the channels with no signal in them (following some criteria), compute the noise/pedrms, where the noise is the result of a gaussian fit;
  - Obtain the average noise/pedrms ratio for a given layer and η;
  - Interpolate to other channels (those considered to have signal in them) using the corresponding average noise/pedrms ratio;
  - This is implemented in TBRootAna as NoiseAlg.

Noise Characterization: HEC

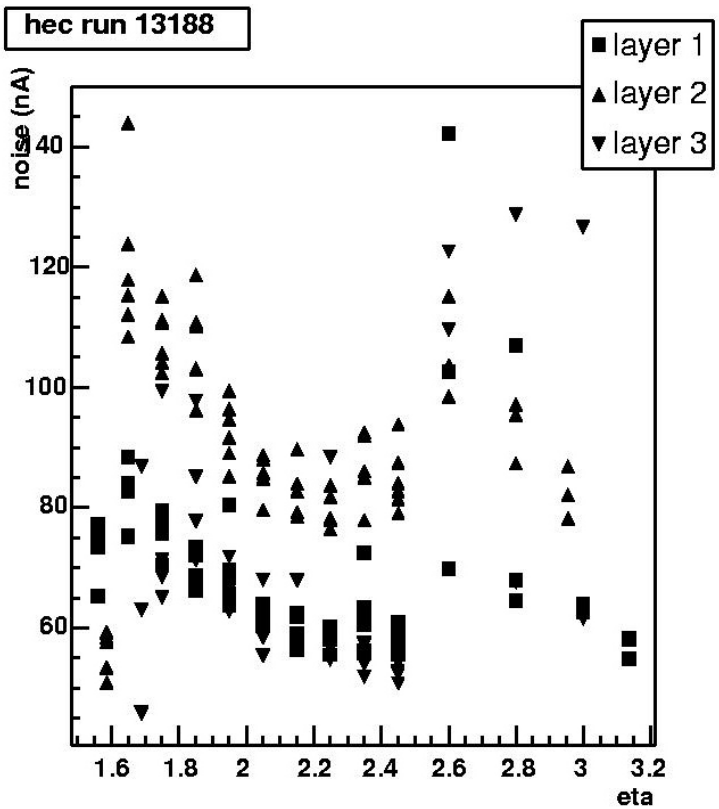
- The digital filtering noise reduction factor depends on the layer and on η and ranges from 0.54 to 0.70

13188 is a muon run

$\langle$noise/pedrms$\rangle$ vs η



noise vs η

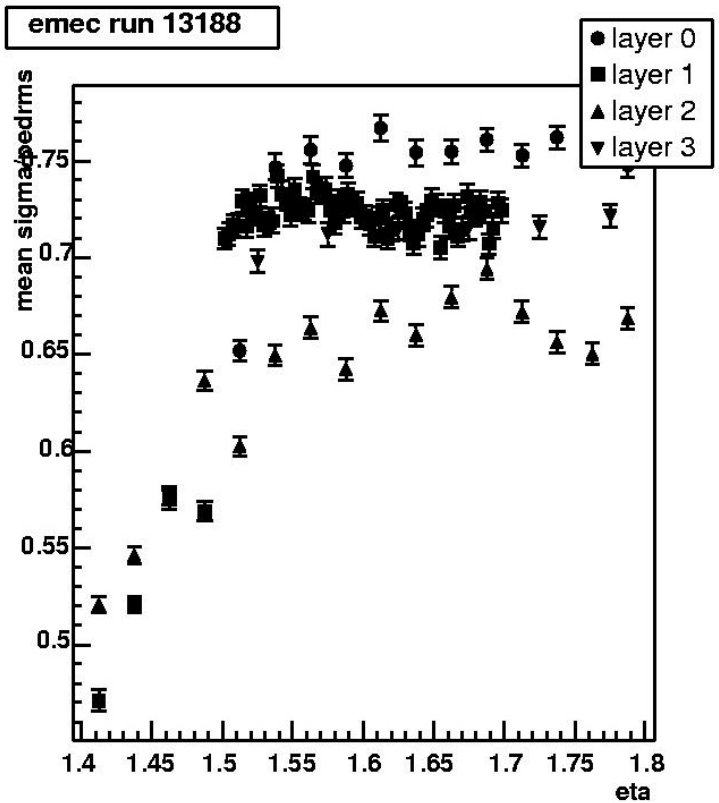


Noise Characterization: EMEC

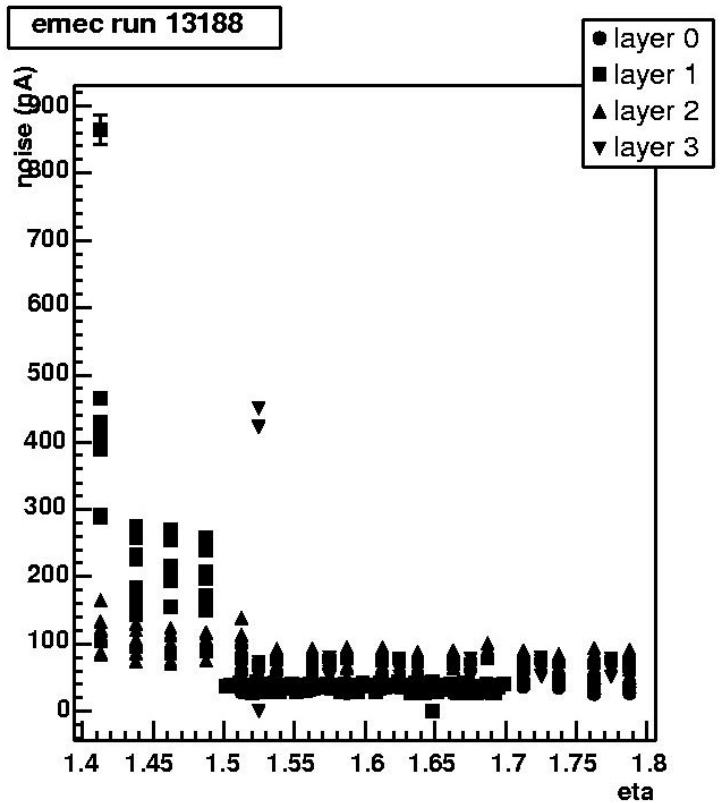
- The digital filtering noise reduction factor depends on the layer and on η and ranges from 0.46 to 0.77

13188 is a muon run

$\langle$noise/pedrms$\rangle$ vs η

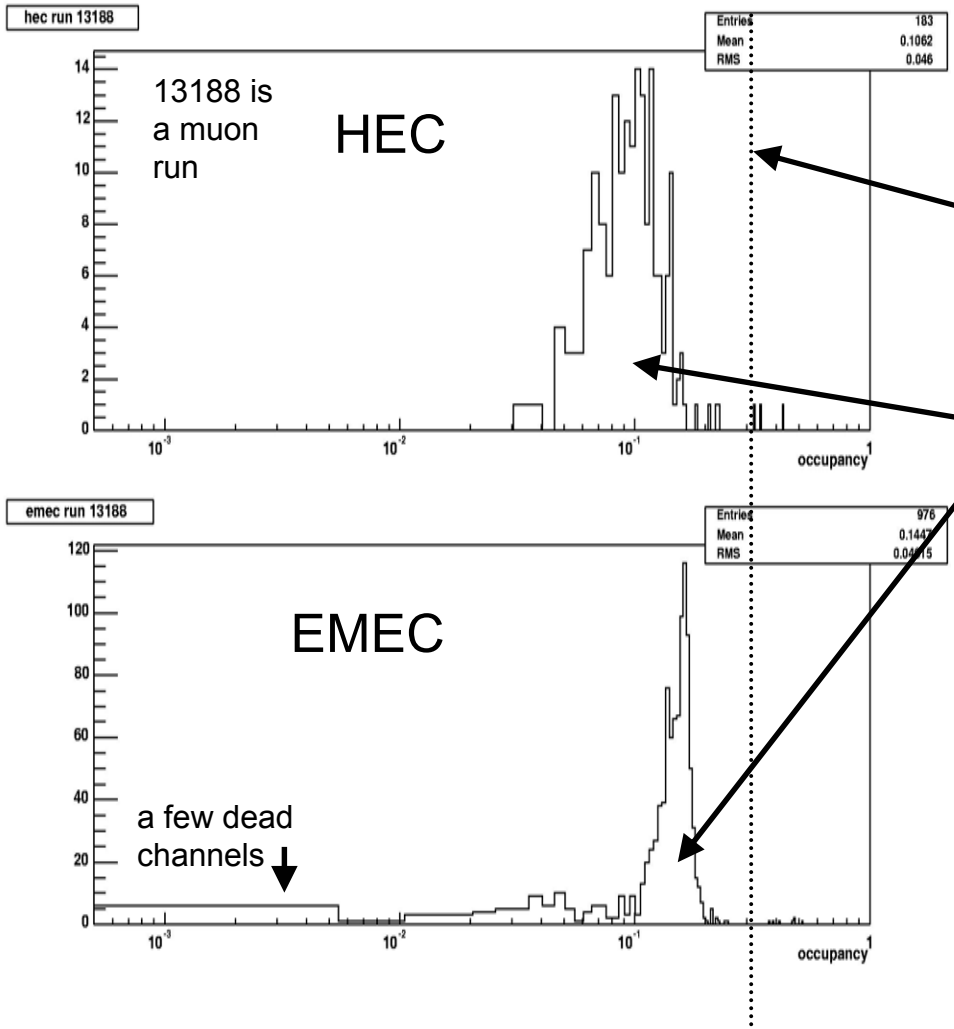


noise vs η



Occupancy

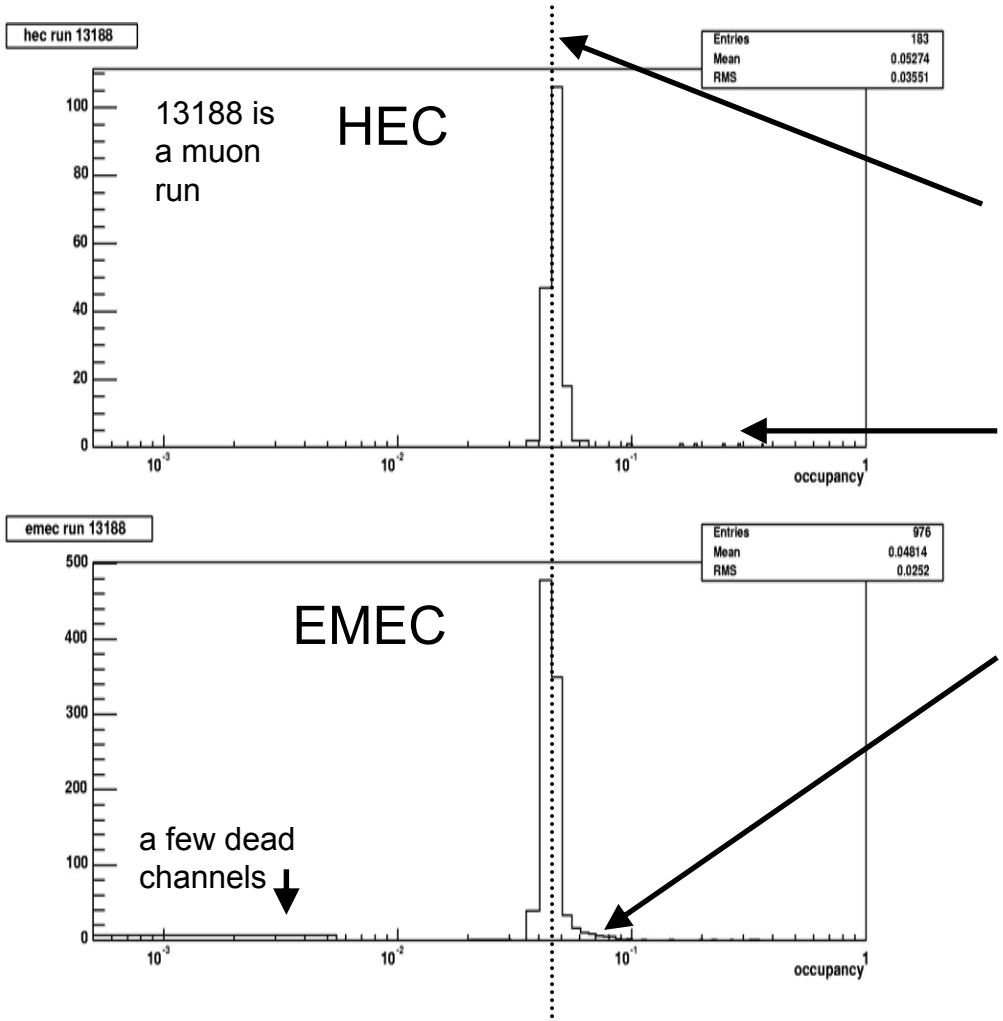
- Consider the occupancy of all cells for a given run, obtained using pedrms as a noise characterization



- occupancy computed using |signal| > 1pedrms
- expect channels with no signal to be at 31.7%. They are not!
- the occupancy distribution is broad because the noise/pedrms ratio varies over the calorimeters
- the number of entries in each plot is the number of connected readout channels for each detector

Noise Quality

- The quality of the digital filtering noise can be assessed by studying the occupancy of all cells for a given run



- occupancy computed using |signal| > 2σ
- expect channels with no signal to be at 4.55%. They are! Their distribution is narrow
- channels with signal in them clearly have large occupancy (here only a few since this is a muon run)
- There are a few very noisy channels with non-gaussian noise (next slide)
- the number of entries in each plot is the number of connected readout channels for each detector

Pathological Channels

- Some very noisy channels have non-gaussian digital filtering noise distribution
  - Their pedestal distribution is gaussian;
  - The non-gaussian nature of the noise distribution seems to be generated by the digital filtering reconstruction
  - A limited range gaussian fit underestimates the noise, and hence overestimates the occupancy
  - They obviously need special treatment...
  - Seems to be limited to some EMEC channels in layers 1 and 2