Noise file for EMEC-HEC 2002 data

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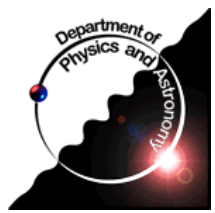
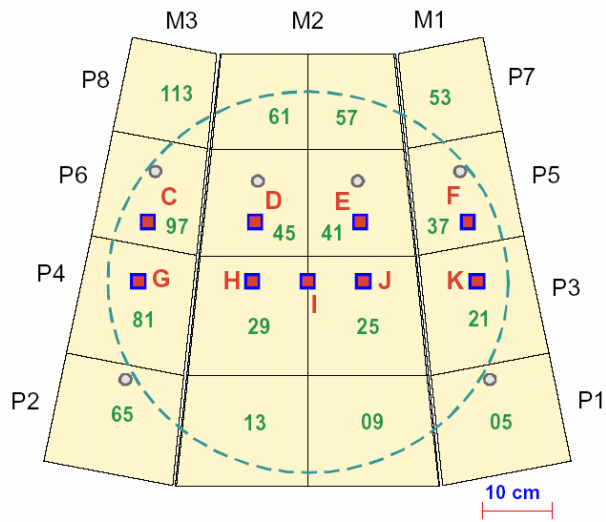


Motivation and Data set

- No random trigger data sets available for EMEC-HEC 2002
- Use normal runs to estimate the cell noise
  - we are interested in the noise present after optimal filtering
  - required for the Athena based analysis of EMEC-HEC 2002 data
  - these noise values should probably eventually be available to Athena through a database
- Data set
  - muon runs 13182, 13184, 13186, 13187, 13188, 13204, 13211, 13212
  - impact point C to K, except E
  - TDC available for these runs



Athena Ntuple production

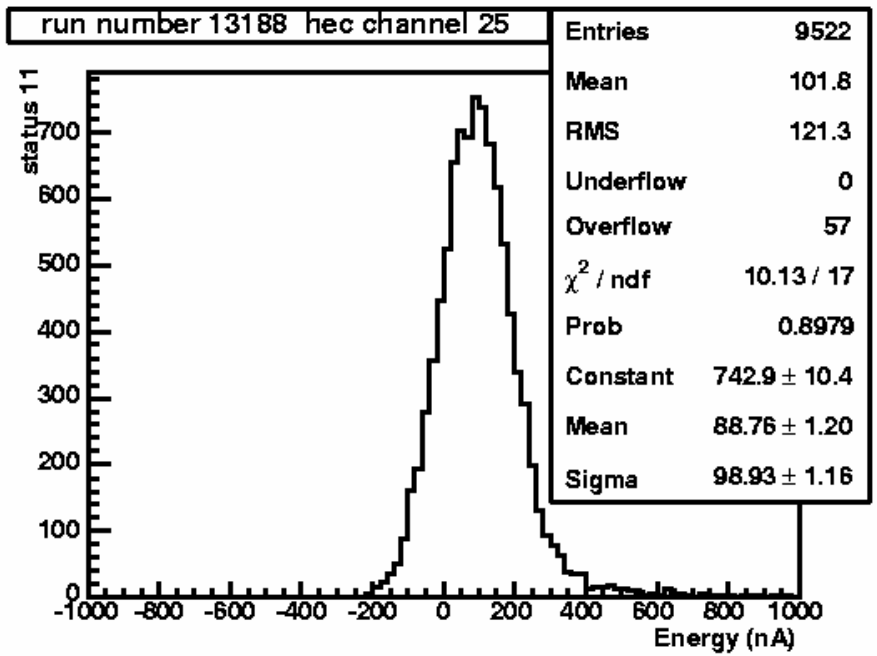
- Use Athena LArHECTBAna to produce combined ntuples
  - Ntuples produced by Naoko did not use the latest calibrations
  - Used Athena 9.0.4 (thanks to Rolf's help)
    - event signal array is now compressed (connected channels only)
    - pedrms arrays contain unconnected channels
  - A bug has been uncovered in LArTBCombinedNtup.cxx
    - pedrms arrays were truncated
  - Use TDC
  - Used the same calibrations as used by Rolf to produce ESD's
    - /afs/cern.ch/user/h/hectbmon/public/tb/aug02/dig/coeff_hec_aug02_030504.dat
    - /afs/cern.ch/user/h/hectbmon/public/tb/aug02/dig/coeff_emec_high_aug02_031203.dat
    - /afs/cern.ch/user/h/hectbmon/public/tb/aug02/dig/weights_hec_amp_aug02_030731.dat
    - /afs/cern.ch/user/h/hectbmon/public/tb/aug02/dig/weights_hec_tim_aug02_030731.dat
    - /afs/cern.ch/user/h/hectbmon/public/tb/aug02/dig/time_offset_hec_aug02_030521.dat
    - /afs/cern.ch/user/h/hectbmon/public/tb/aug02/dig/weights_emec_high_amp_aug02_031206.dat
    - /afs/cern.ch/user/h/hectbmon/public/tb/aug02/dig/weights_emec_high_tim_aug02_031206.dat
    - /afs/cern.ch/user/h/hectbmon/public/tb/aug02/dig/time_offset_emec_aug02_031206.dat
  - Verified (looking at one event!) that Naoko's ntuples can be reproduced with Athena 9.0.4 when using the appropriate calibration and weights files

TBRootAna noise file production

- Method
  - define a criteria that identifies cells that have particle signal in them; these are called contaminated cells
  - for non-contaminated cells, the only signal is electronics noise; accumulate events and fit for the noise
  - compute the average noise/pedrms per pseudorapidity layer using non-contaminated cells noise results
  - for contaminated cells, scale their pedrms by the appropriate average noise/pedrms

Noise file production

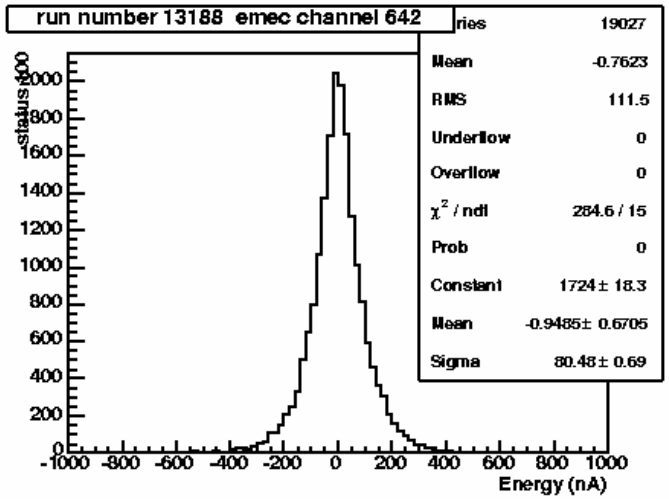
- Cell contamination criteria
  - If too loose, then there ends up too many interpolation, which is not good since there are important variations in the noise/pedrms ratio from cell to cell
  - If too tight, contamination of beam particle signal biases the noise; this is not a serious problem for muon runs
- HistoMean-FitMean > 3*FitMeanError (fit in +/- 2 σ)
- HistoMean > 0.15*HistoRMS

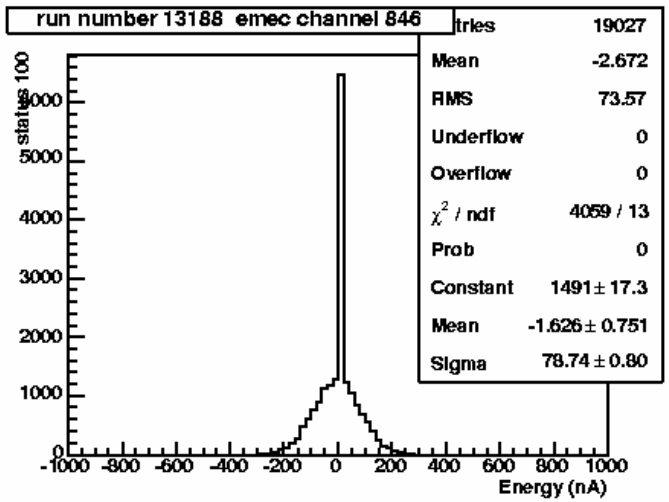


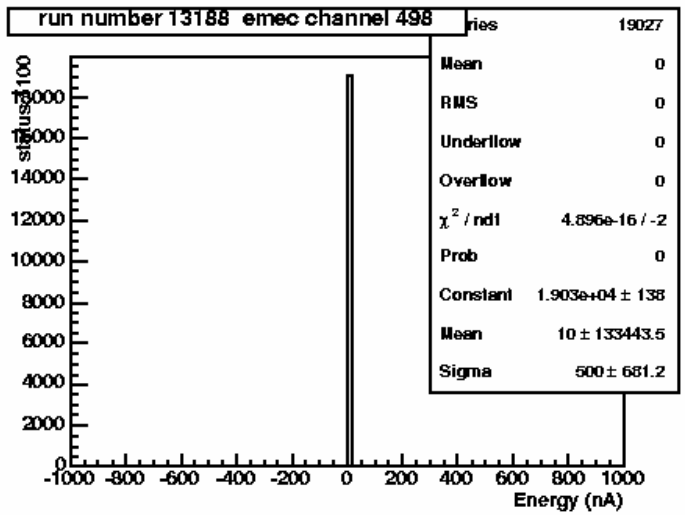
example, run 13188 150 GeV μ^-: this HEC cell qualifies as a contaminated on both counts!

Example noise production: 150 GeV μ^-

- Pathological cells

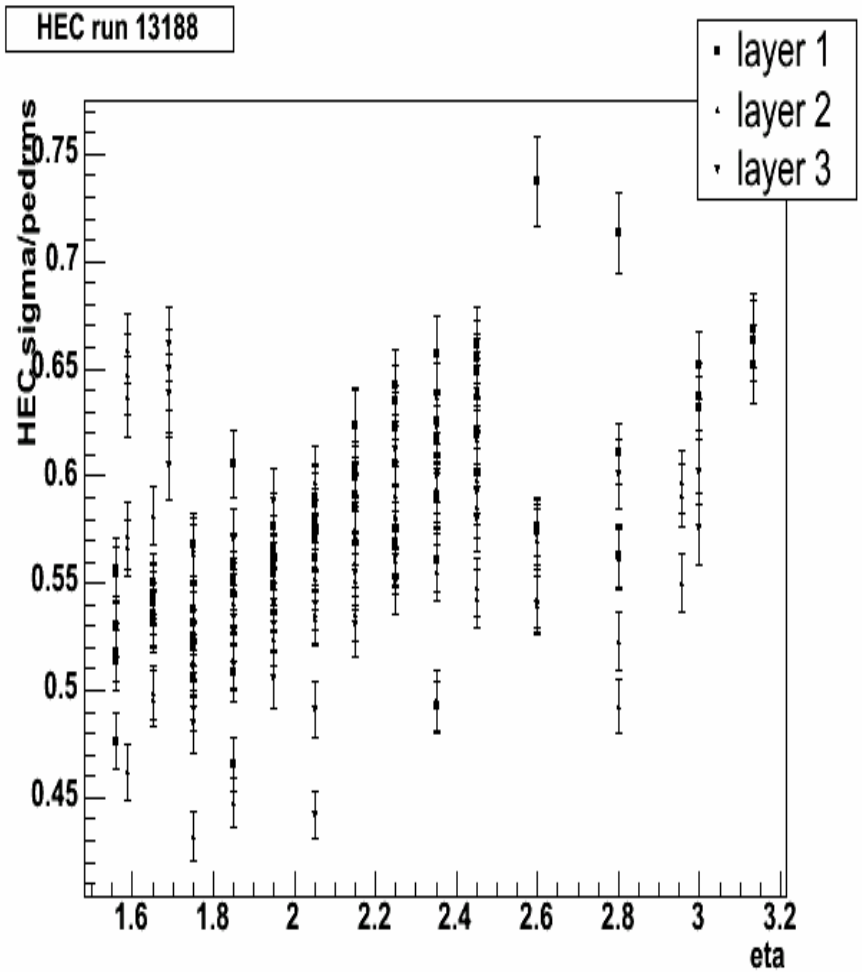


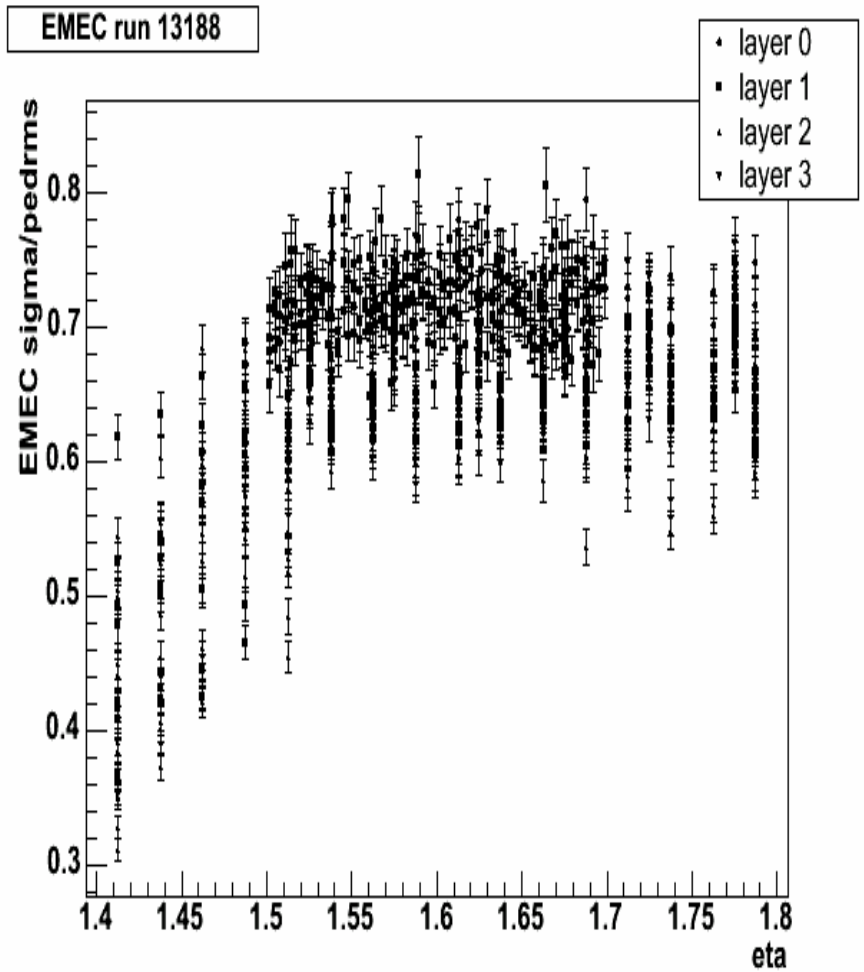




Example: 150 GeV μ^-

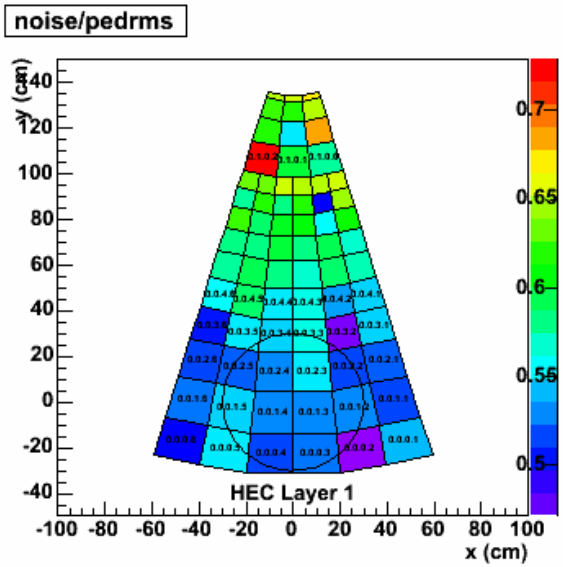
- HEC: 9 cells out of 183 are identified as contaminated
- EMEC: 34 cells out of 976 are identified as contaminated

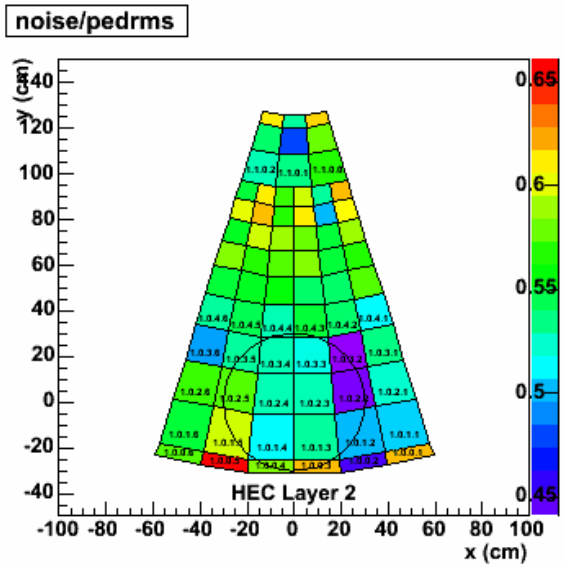


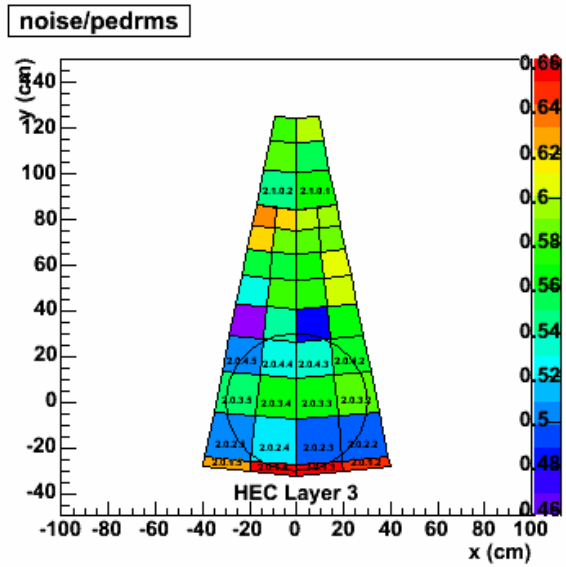


Example: 150 GeV μ^-

- HEC: noise/pedrms run 13188

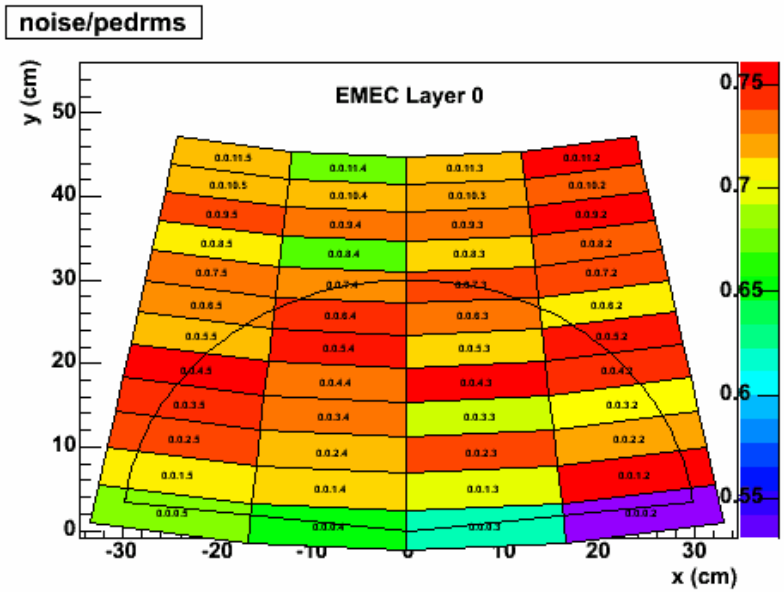


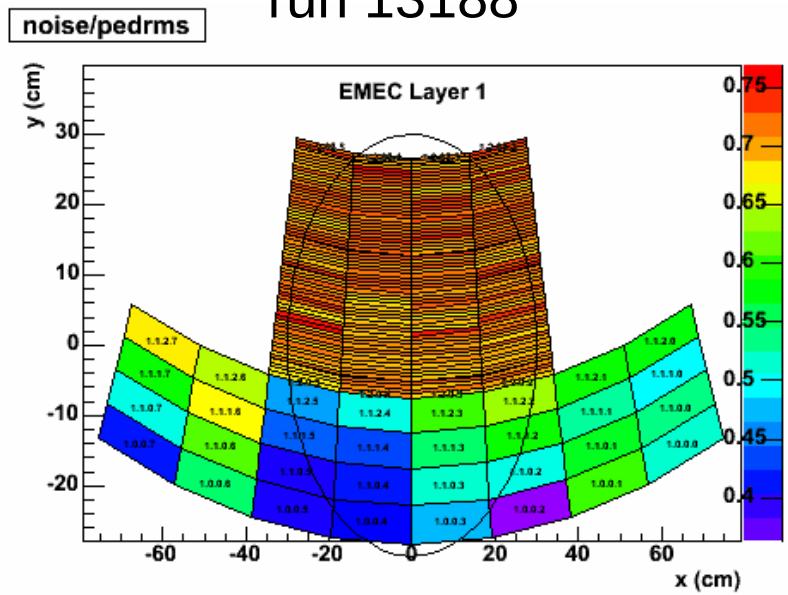


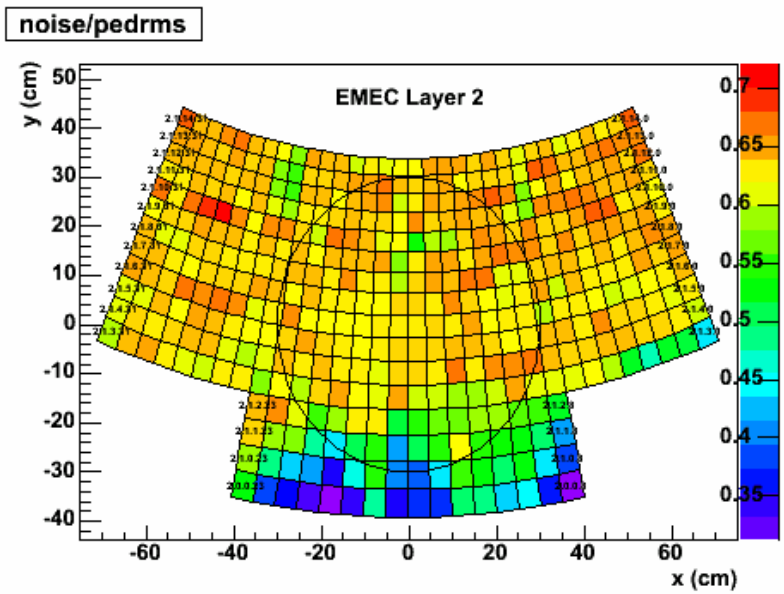


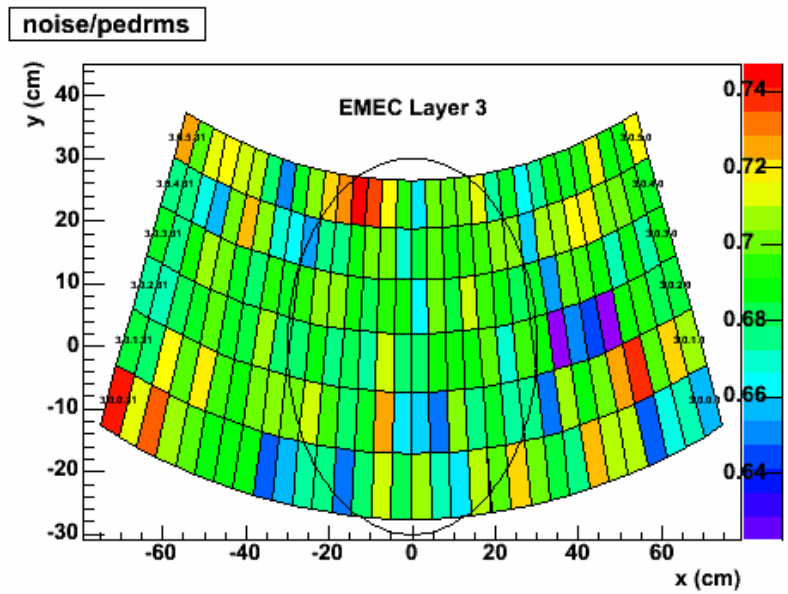
Example: 150 GeV μ^-

- EMEC: noise/pedrms run 13188



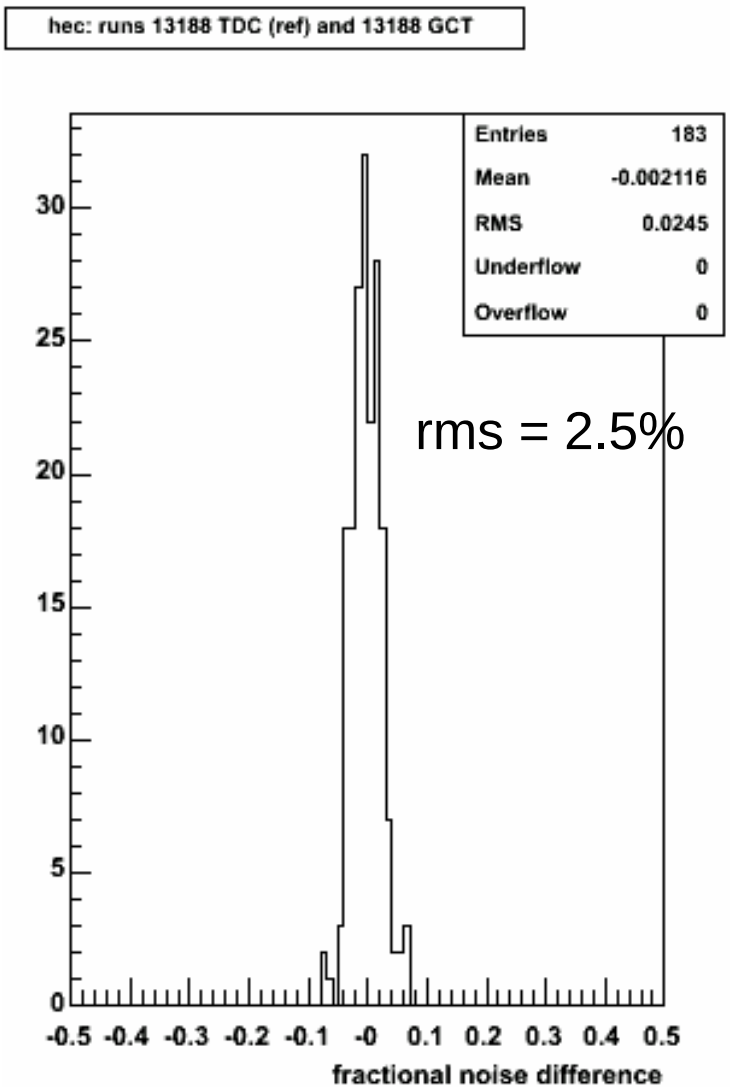


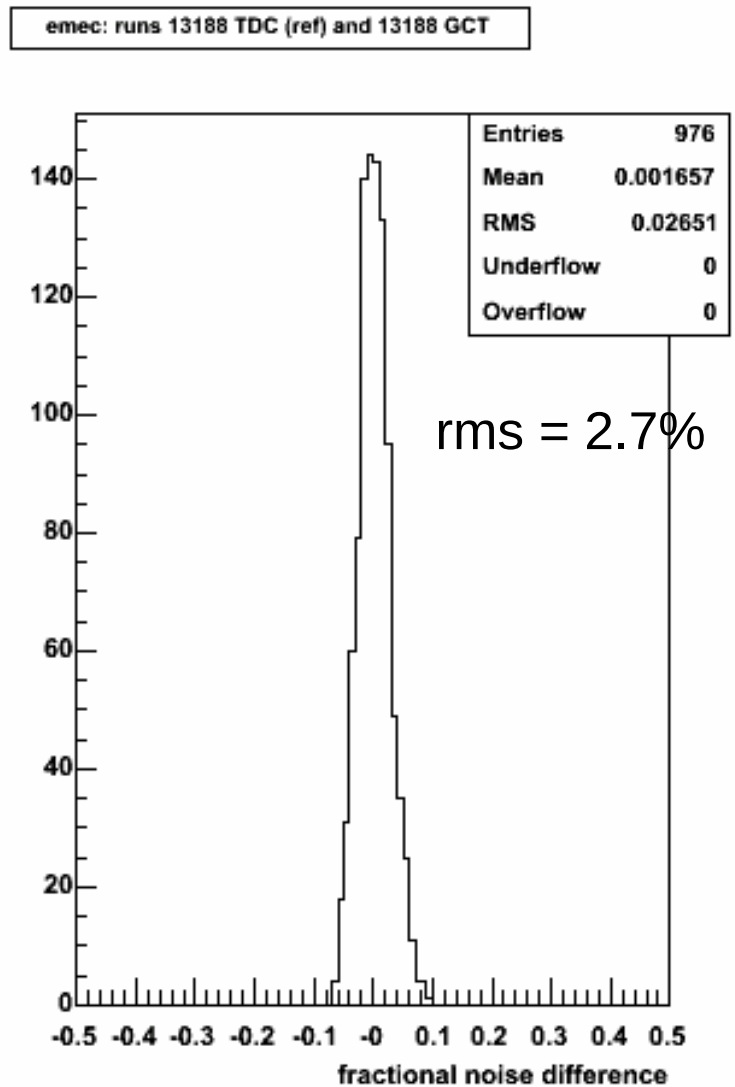




Comparing TDC vs GCT: 150 GeV μ^-

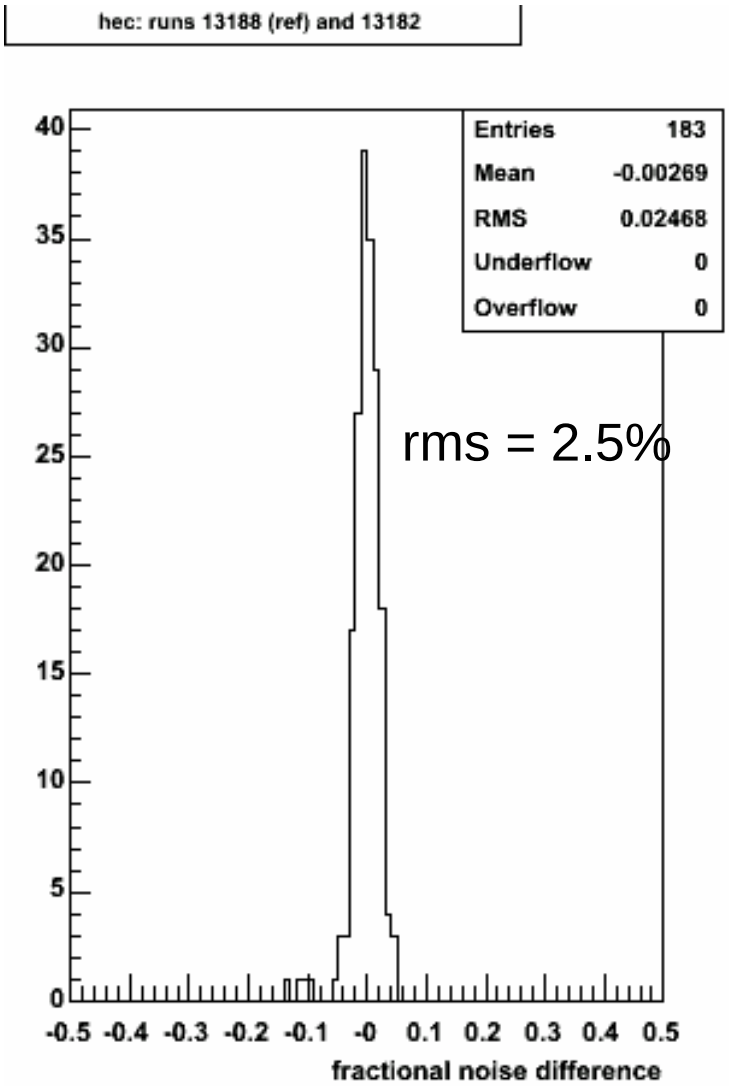
- Fractional noise difference

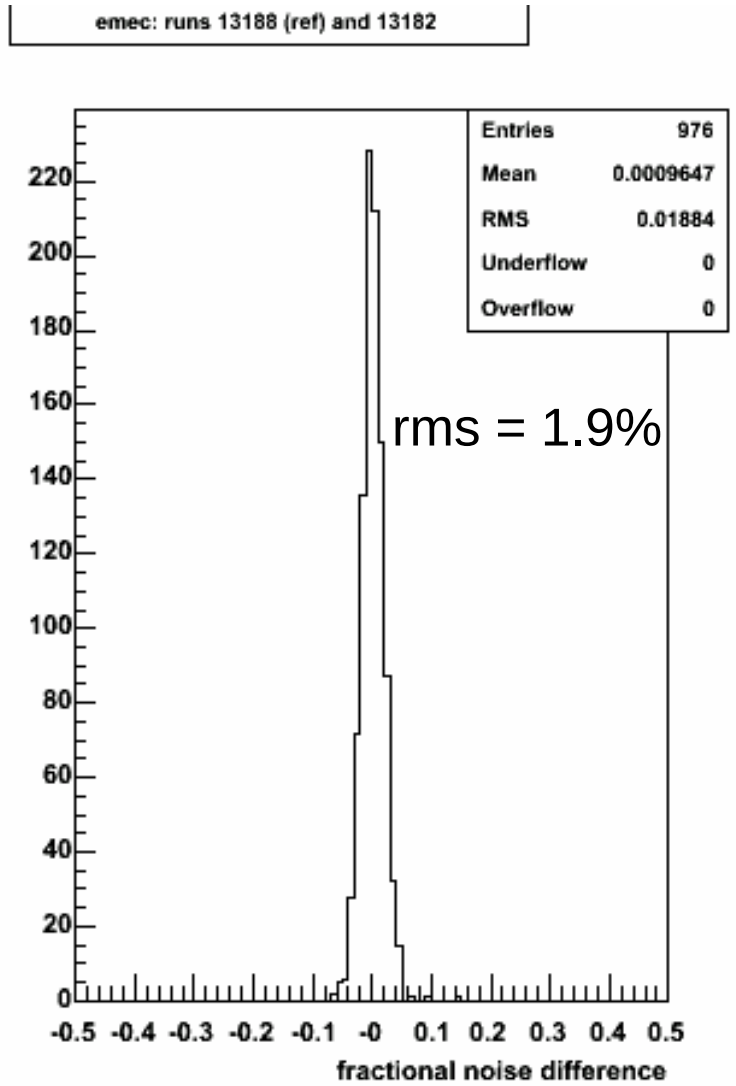




Comparing two runs: 150 GeV μ^-

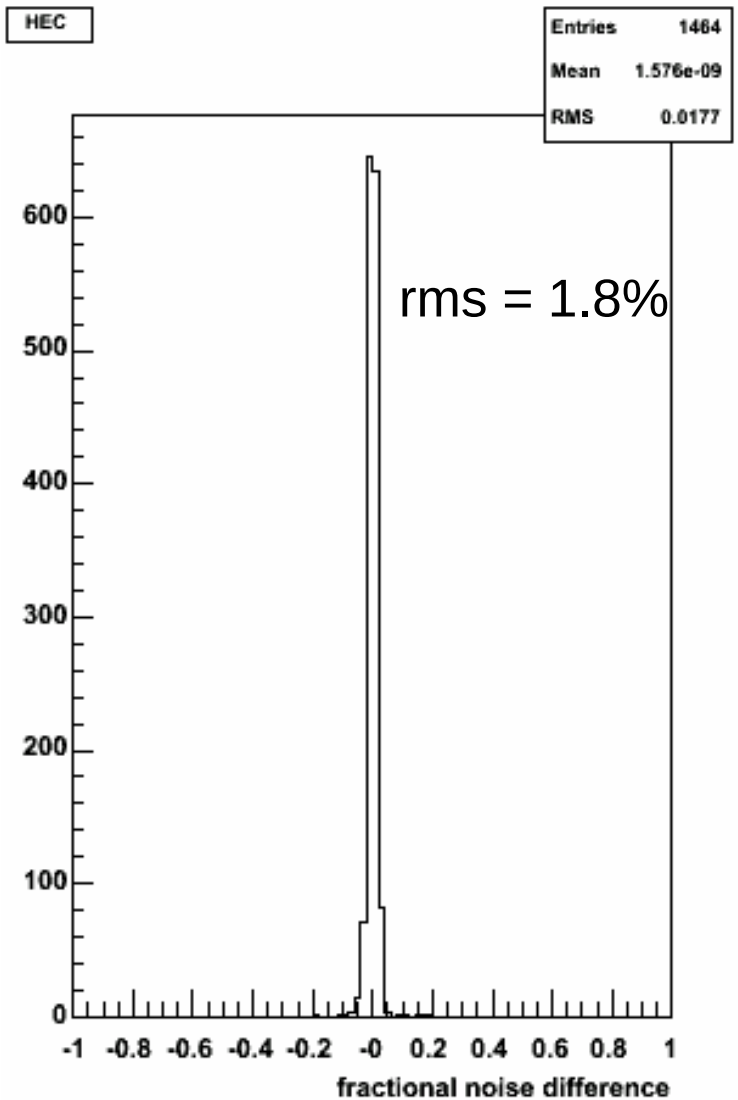
- Fractional noise difference

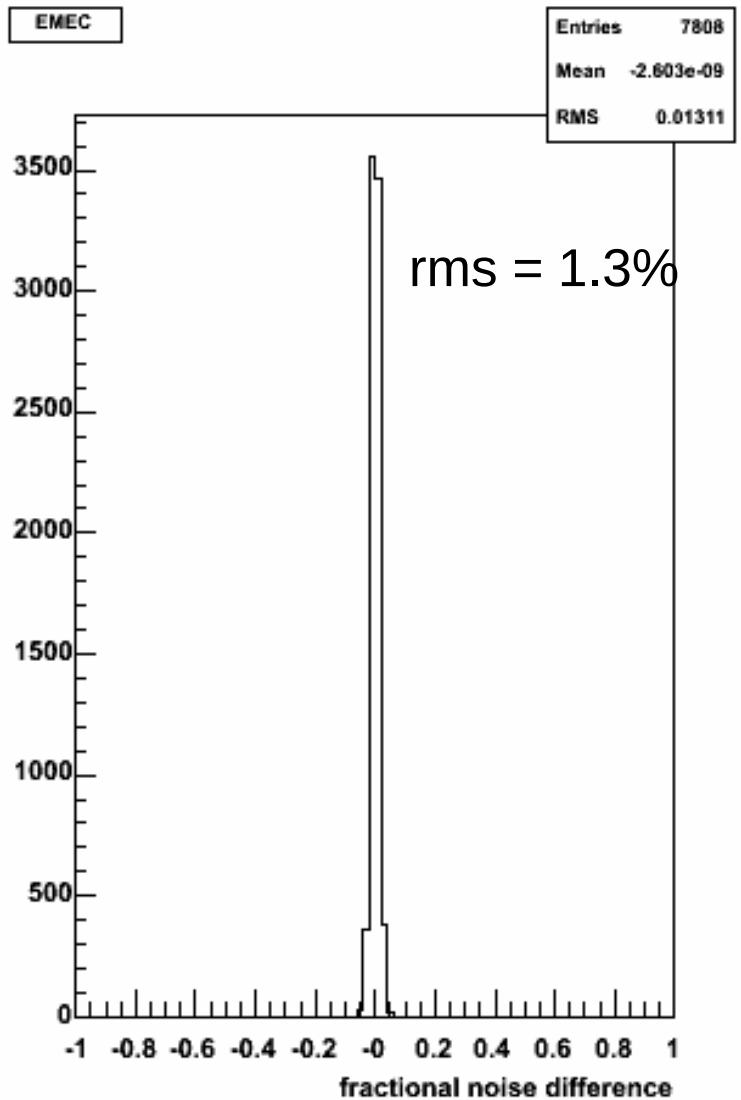




Comparing eight runs: 150 GeV μ^-

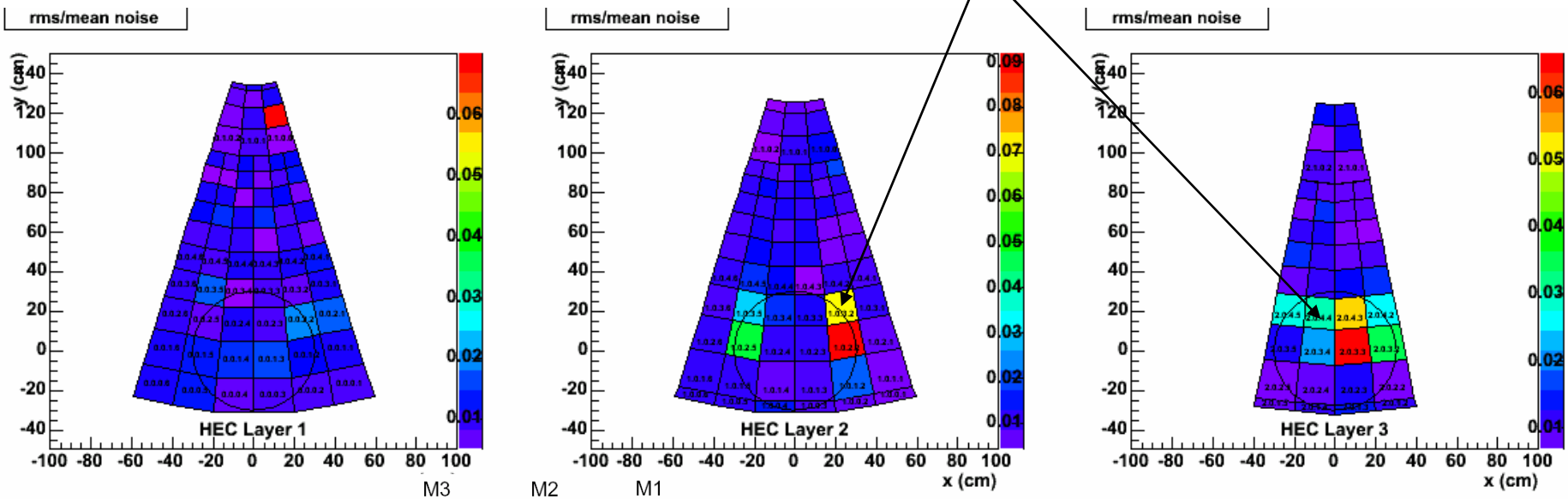
- Fractional noise difference with the mean noise

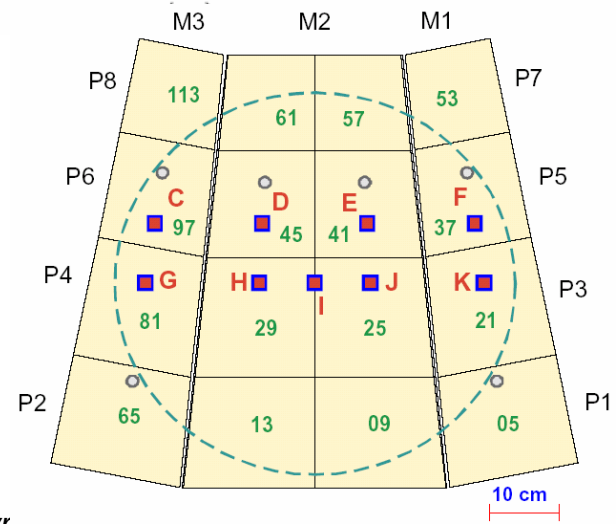




Comparing eight runs: 150 GeV μ^-

- HEC: rms/mean noise
  - evidence of small muon contamination

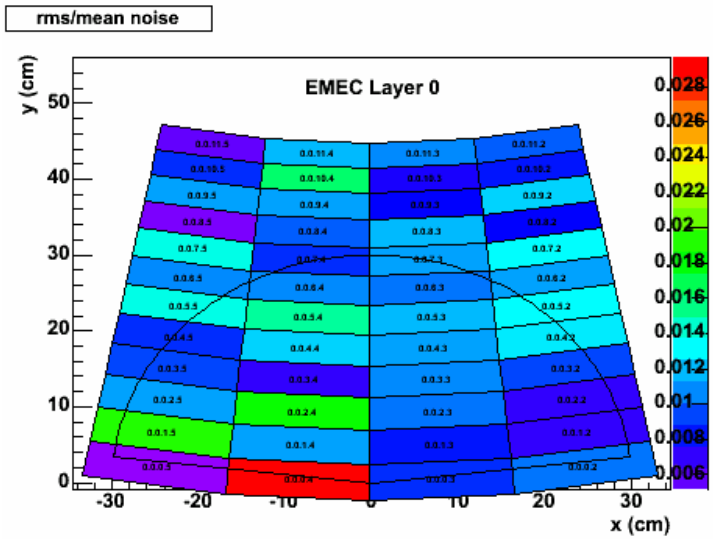


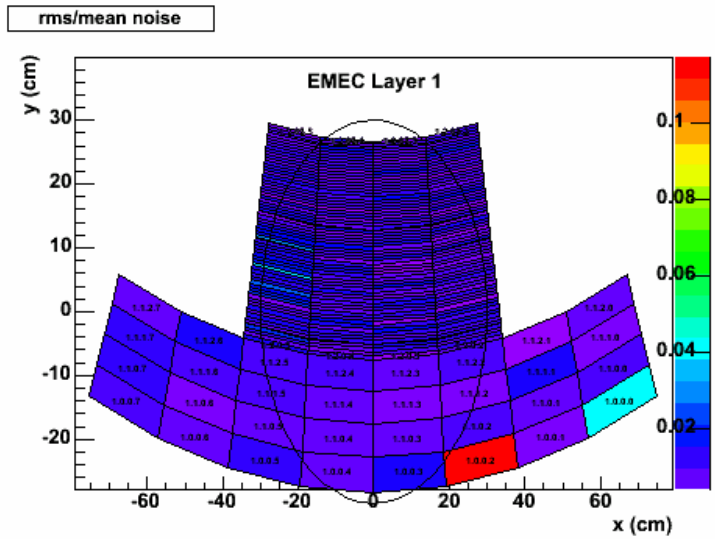


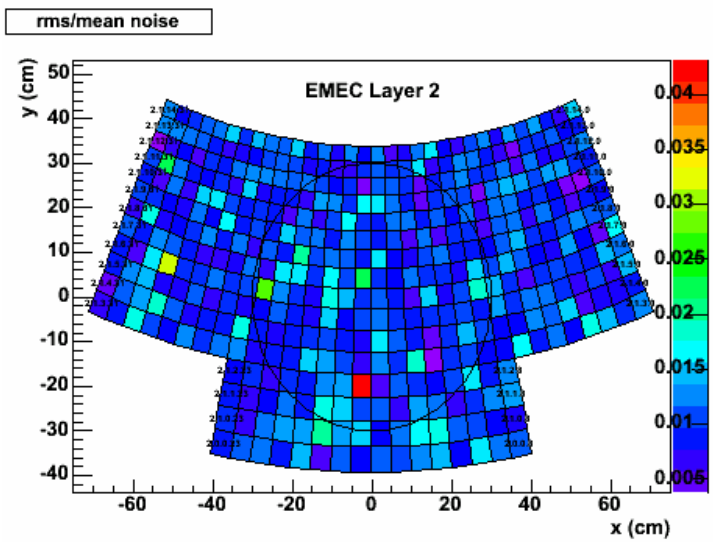
- The eight runs are on impact points C to K, except E

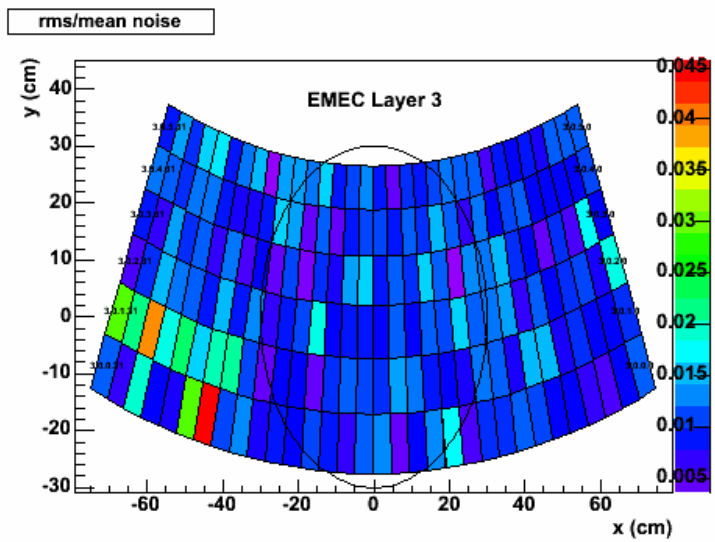
Comparing eight runs: 150 GeV μ^-

- EMEC: rms/mean noise
  - no clear evidence of muon contamination









Noise files for Athena

/afs/cern.ch/user/h/hectbmon/public/tb/aug02/noise/H6_2002Noise13188.dat

/afs/cern.ch/user/h/hectbmon/public/tb/aug02/noise/H6_2002NoiseMuons.dat

```
# H6 2002 EMEC    HEC noise file
# Produced from an average over muon+ 150 GeV runs
# 13182, 13187, 13204, 13184, 13186, 13188, 13211, 13212
# /afs/cern.ch/user/h/hectbmon/public/tb/aug02/tdc/tdc_wac_021212.dat
# /afs/cern.ch/user/h/hectbmon/public/tb/aug02/ped/ped_{runno}_hec.dat
# /afs/cern.ch/user/h/hectbmon/public/tb/aug02/dig/weights_hec_amp_aug02_030731.dat
# /afs/cern.ch/user/h/hectbmon/public/tb/aug02/dig/weights_hec_tim_aug02_030731.dat
# /afs/cern.ch/user/h/hectbmon/public/tb/aug02/dig/time_offset_hec_aug02_030521.dat
# /afs/cern.ch/user/h/hectbmon/public/tb/aug02/dig/coeff_hec_aug02_030504.dat
# /afs/cern.ch/user/h/hectbmon/public/tb/aug02/ped/ped_{runno}_emec_high.dat
# /afs/cern.ch/user/h/hectbmon/public/tb/aug02/dig/weights_emec_high_amp_aug02_031206.dat
# /afs/cern.ch/user/h/hectbmon/public/tb/aug02/dig/weights_emec_high_tim_aug02_031206.dat
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# /afs/cern.ch/user/h/hectbmon/public/tb/aug02/dig/coeff_emec_high_aug02_031203.dat
#
# HEC:  3.27 MeV/nA
# EMEC: 0.43 MeV/nA
#
# HEC noise
#  offlineID   noise(MeV) error(MeV) febno      offlineID
  838864896   236.548     2.25145     1    [4.2.2.0.0.0.1]
  847253504    170.49     1.22538     2    [4.2.2.1.0.0.1]
  838868992   236.898     2.31214     5    [4.2.2.0.0.0.2]
  847257600   174.019     1.55644     6    [4.2.2.1.0.0.2]
  838873088   242.477     2.21541     9    [4.2.2.0.0.0.3]
```
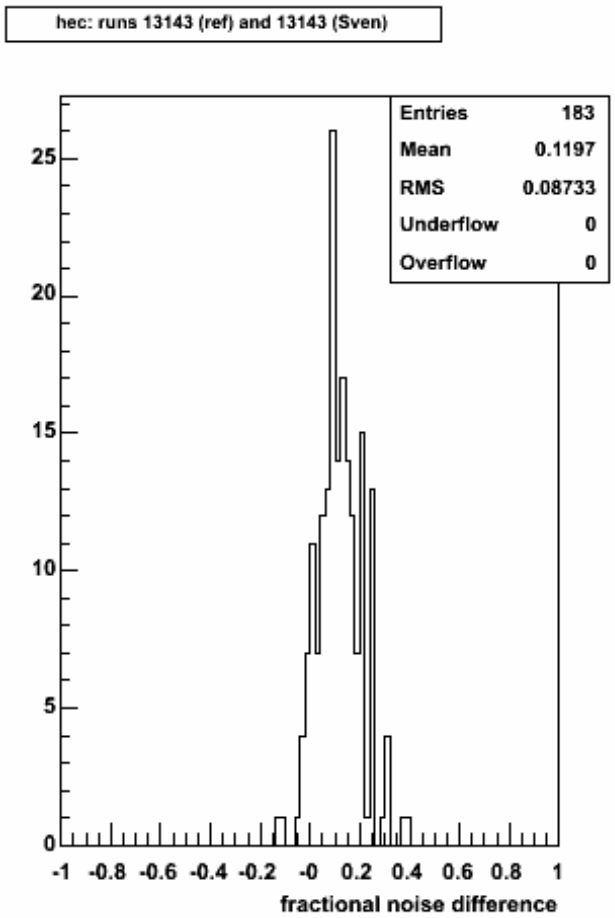
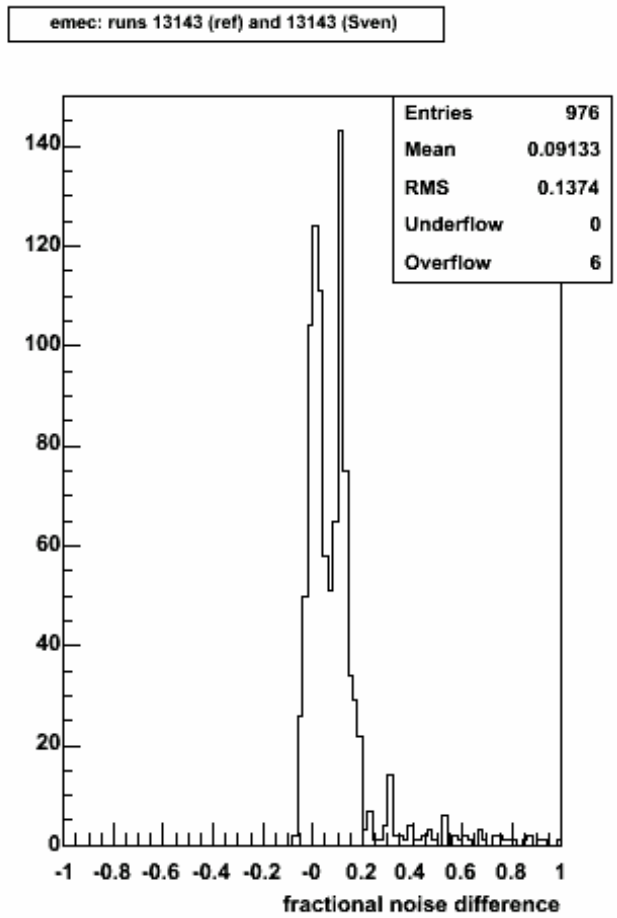

Comparison with Sven's noise file

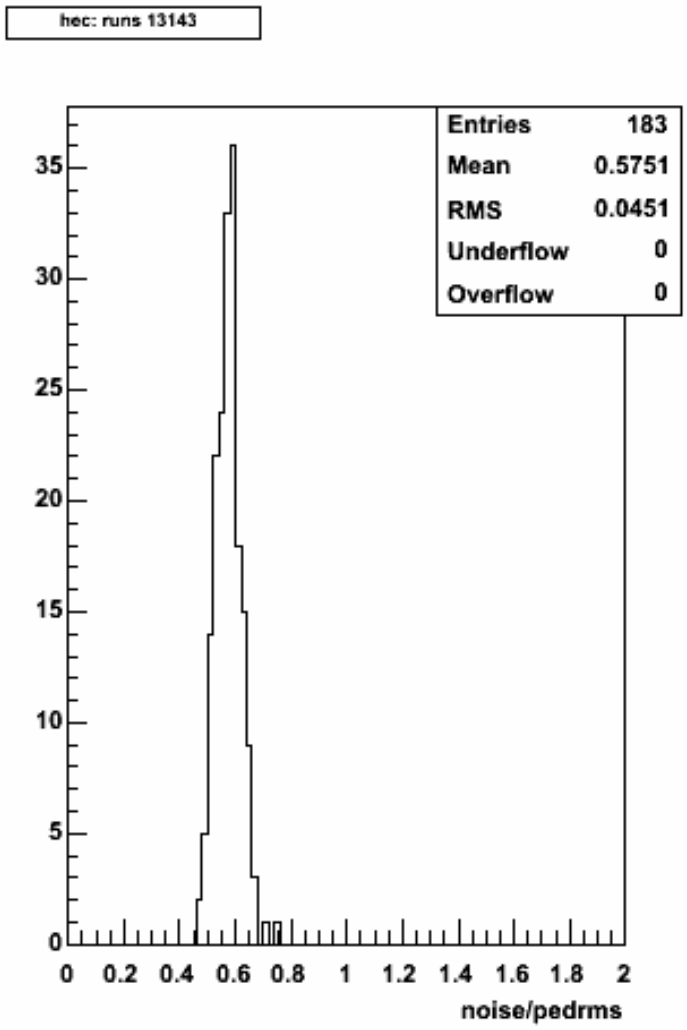
- Differences in production
  - Sven's noise file assumed constant noise/pedrms ratios
  - Sven used different calibration files
    - correct for this before comparing

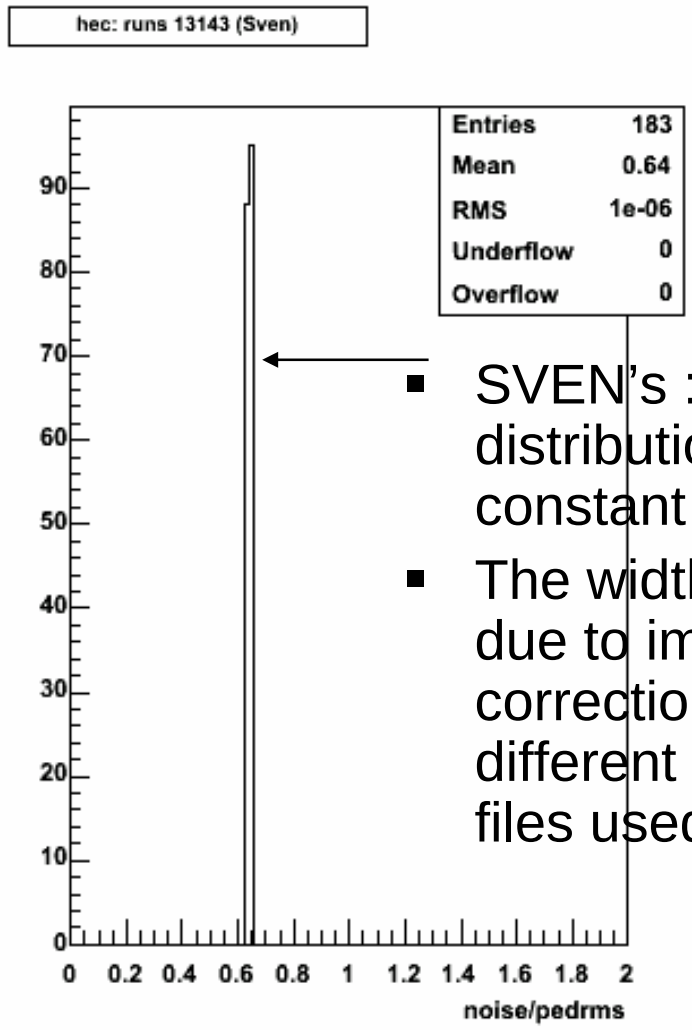




Comparison with Sven's noise file

- HEC: check noise/pedrms

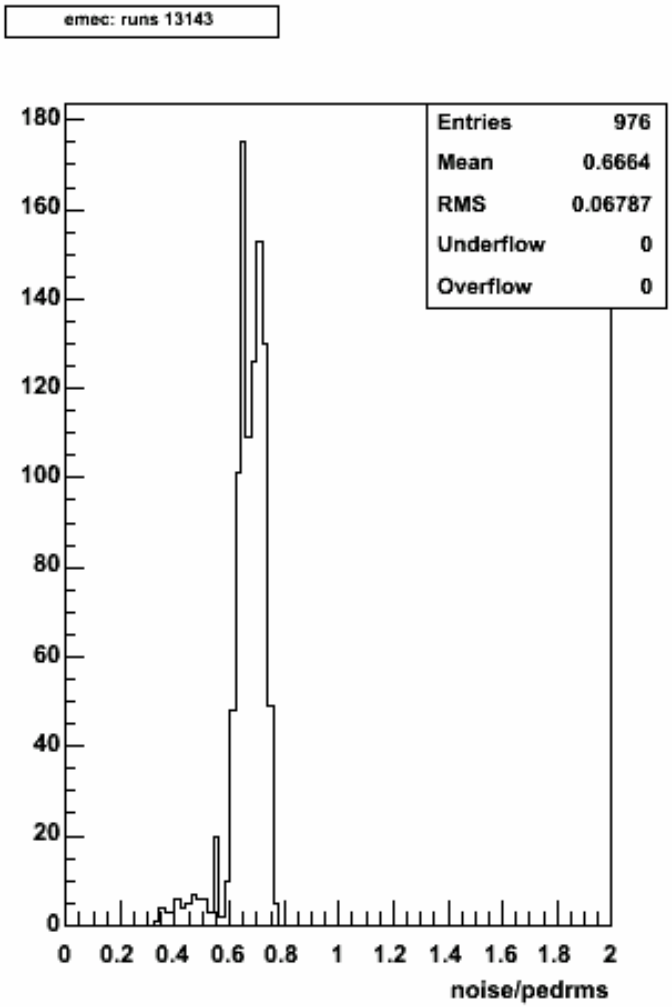


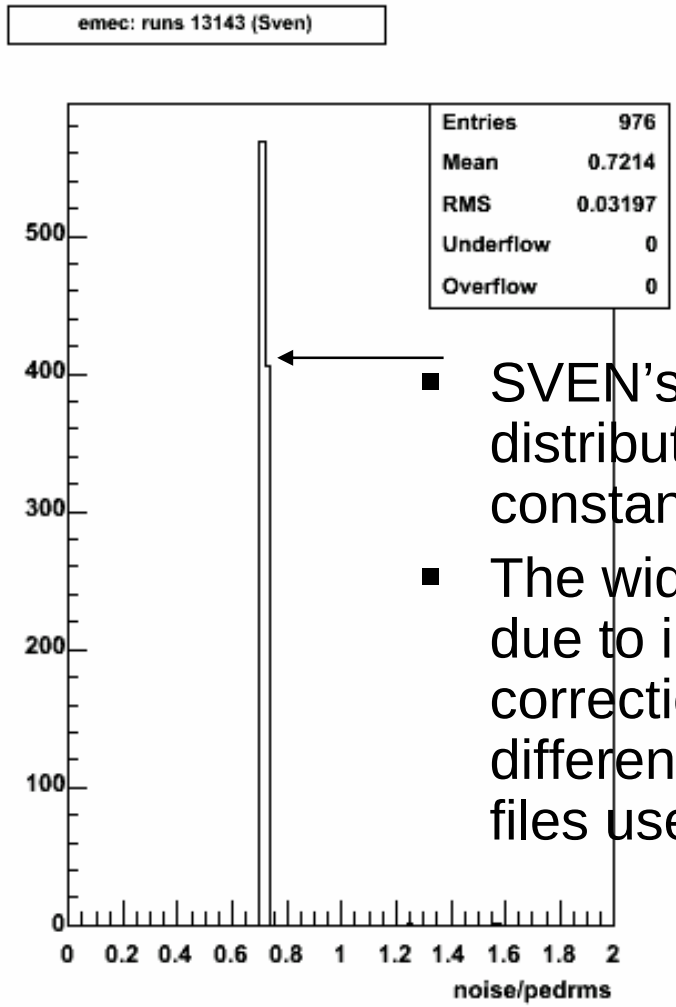


- SVEN's : the ratio distribution is a constant
- The width here is due to imperfect correction for different calibration files used

Comparison with Sven's noise file

- EMEC: check noise/pedrms





- SVEN's : the ratio distribution is a constant
- The width here is due to imperfect correction for different calibration files used

SimpleNoiseToolFromTextFile

- A NoiseTool has been written to input noise from a text file
- It will be committed very soon, along with Rolf's improvements to the NoiseTool interface

Conclusions and outlook

- Noise values have been computed for the EMEC-HEC 2002 TB
  - probably accurate at the 2% level
  - noise/pedrms is not a constant
  - there may still some work required with regards to pathological cells
- Thanks to Rolf:
  - new NoiseTool soon available
  - ESD's for 2002 TB data are being produced and will be made available; with the noise file, the data can then be analysed in Athena