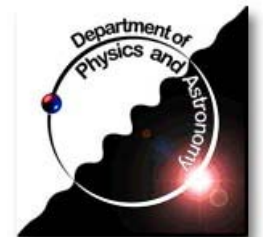
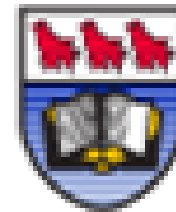


Noise and correlation monitoring using LArNoiseMonToolBase

Endcap expert week
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tools and default jobOptions

- Two concrete implementations of LArNoiseMonToolBase
 - LArDigitNoiseMonTool
 - LArRawChannelNoiseMonTool
 - channels which do not have a valid offlineID are not monitored
- LArDigitNoiseMonTool_jobOptions.py
 - monitor the adc value of time sample 0 of LArDigits
- LArRawChannelNoiseMonTool
 - monitor the energy value of LArRawChannels
- Default jobOptions allows the following monitoring:
 - Summary histo: cryostatEnd context FEB
 - status of noise performance, one entry per FEB
 - FEB context channel mean (pedestal) for all febs, all gains
 - FEB context channel rms (noise) for all febs, all gains
 - cryostatEnd context total/incoherent noise ratio (per FEB)
 - over all channels for each FEB

summary histo

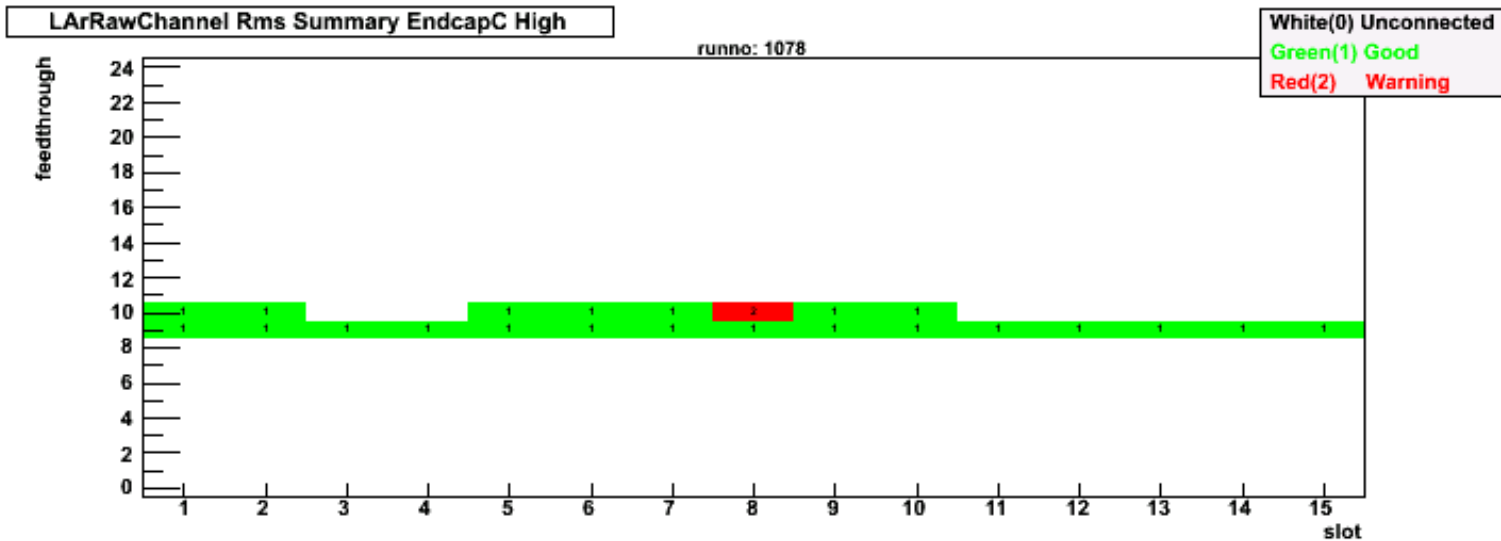
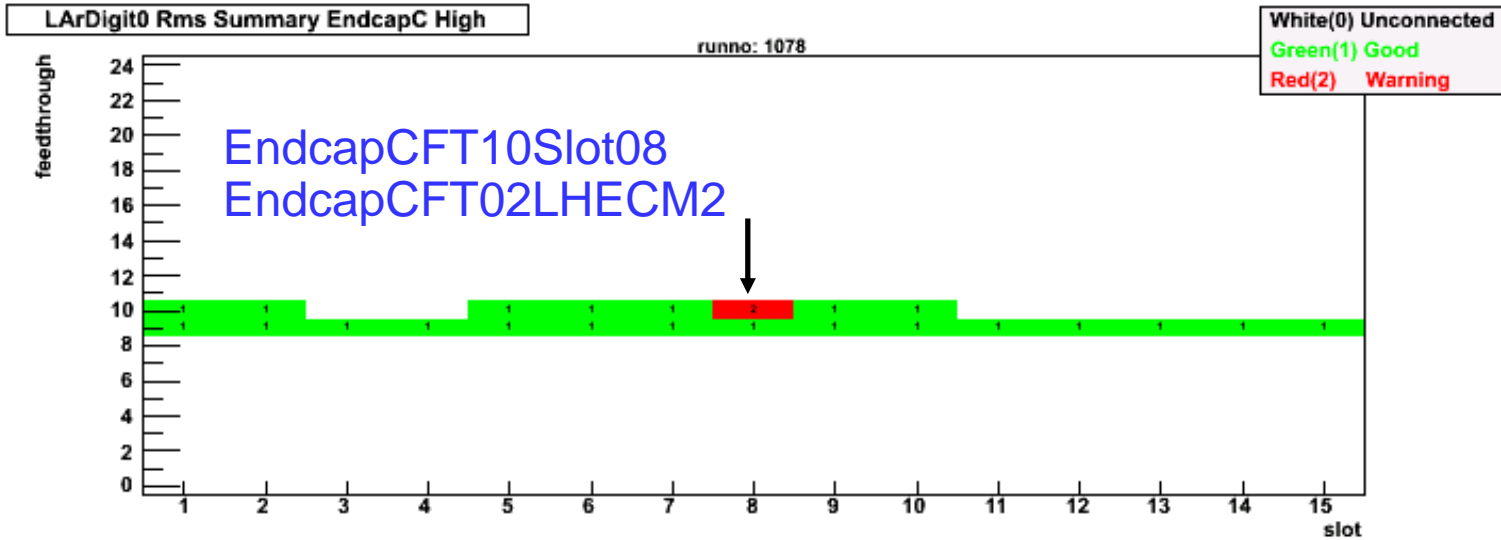
- summarizes noise performance, one entry per FEB
- for tags including LArMonTools-00-01-78
 - for each FEB, the average noise A is computed
 - if at least one channel has noise N such that $|1 - N/A| > D$ then this FEB is flagged as NOT ok.
 - by default, $D = 1$.
 - this criterion works well for the EM (barrel and endcap), where the noise is rather uniform per FEB by design
 - this criterion is not adequate for the HEC, where the noise varies a lot in one FEB, again by design.

summary histo (continued)

- for tags above and including LArMonTools-00-01-79
 - the same criterion is applied for the EM and FCal
 - for the HEC, the same criterion is applied **but per region per ieta within a FEB**
 - this is well adapted to the HEC
 - the noise varies a lot per FEB and per region
 - at least 4 channels for a given (region, ieta) in each HEC FEB, corresponding to different iphi values
 - this is NOT well adapted to the EM
 - often only 2 channels for a given (region, ieta) in a FEB
 - by default, $D = 0.5$
 - better than 1., as it allows to flag very low noise channels

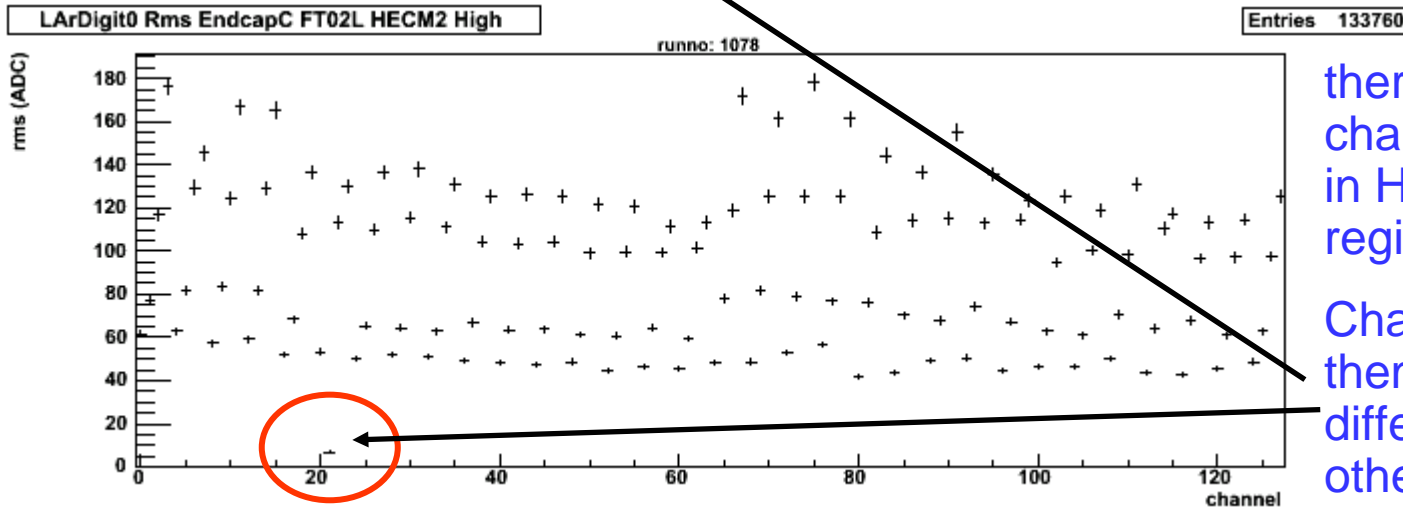
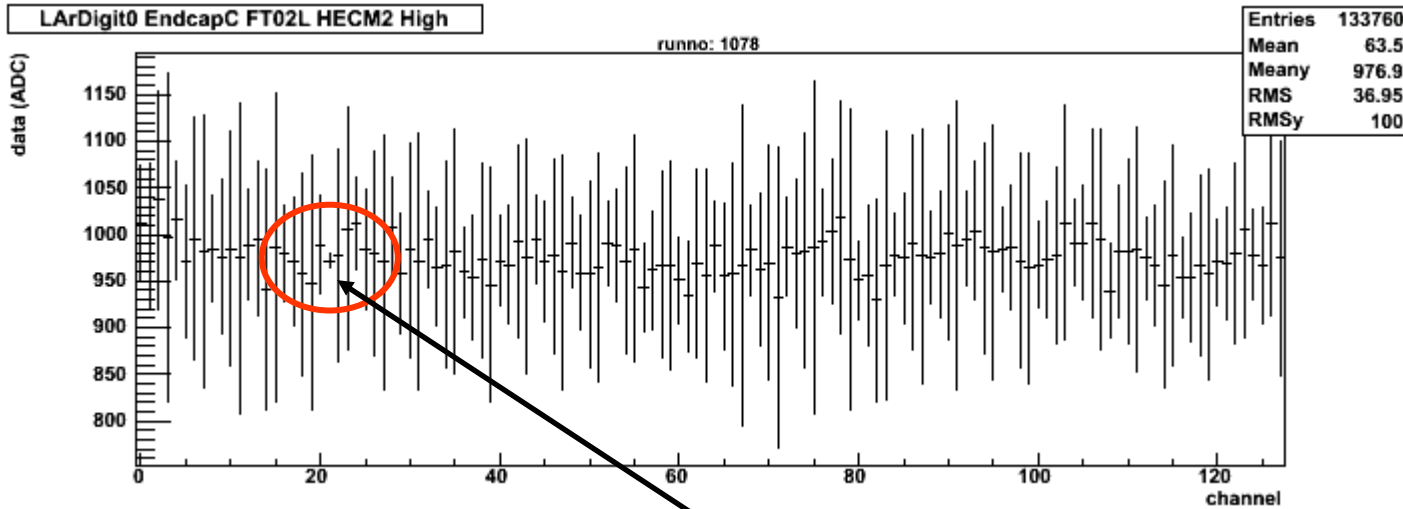
summary histo (continued)

■ example run 1078 (pedestal high gain, 1000 events)



pedestal and noise

■ A closer look at the pedestal noise of the flagged FEB

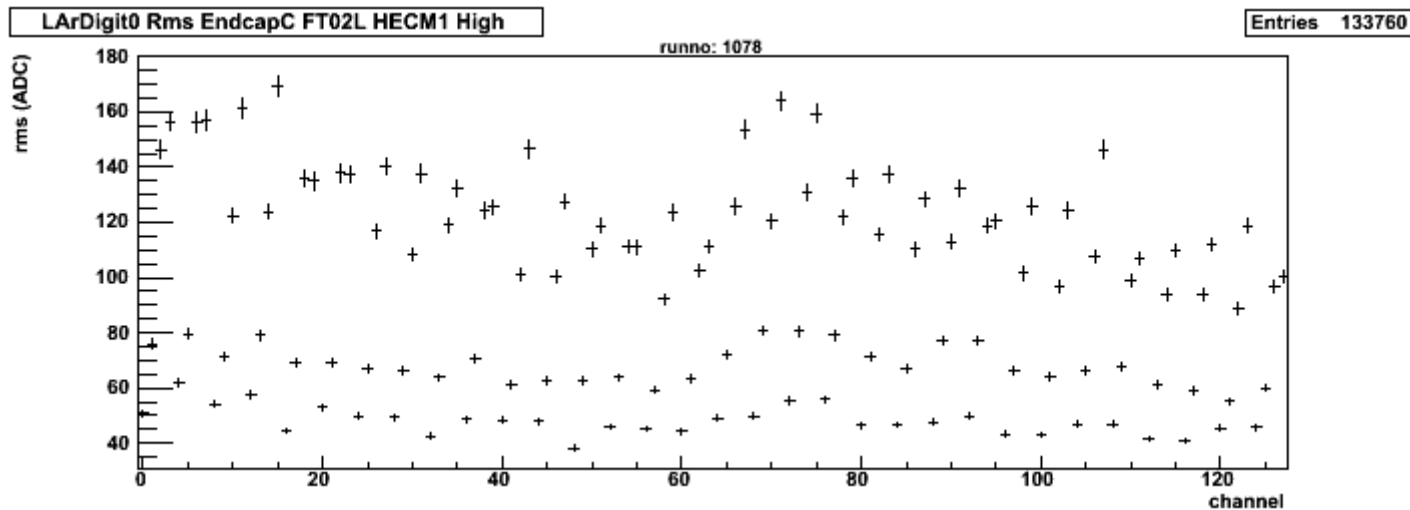
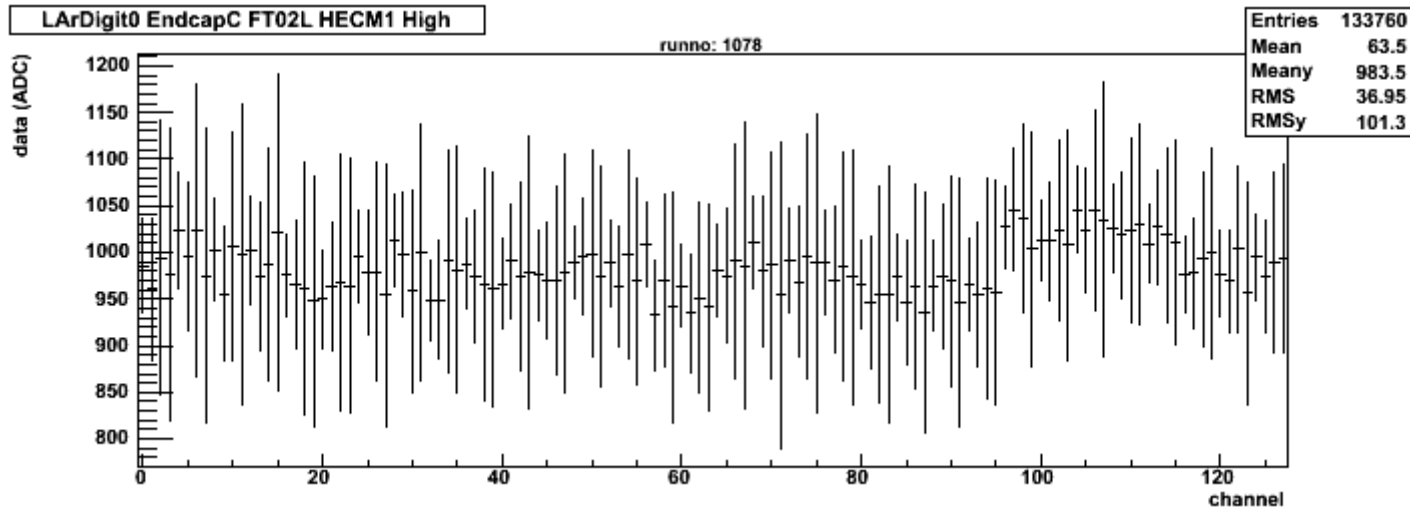


there are in fact 8 channels in this FEB in HEC sampling 1 region 0 and ieta = 5

Channel 21 is one of them, and it is different from the others...

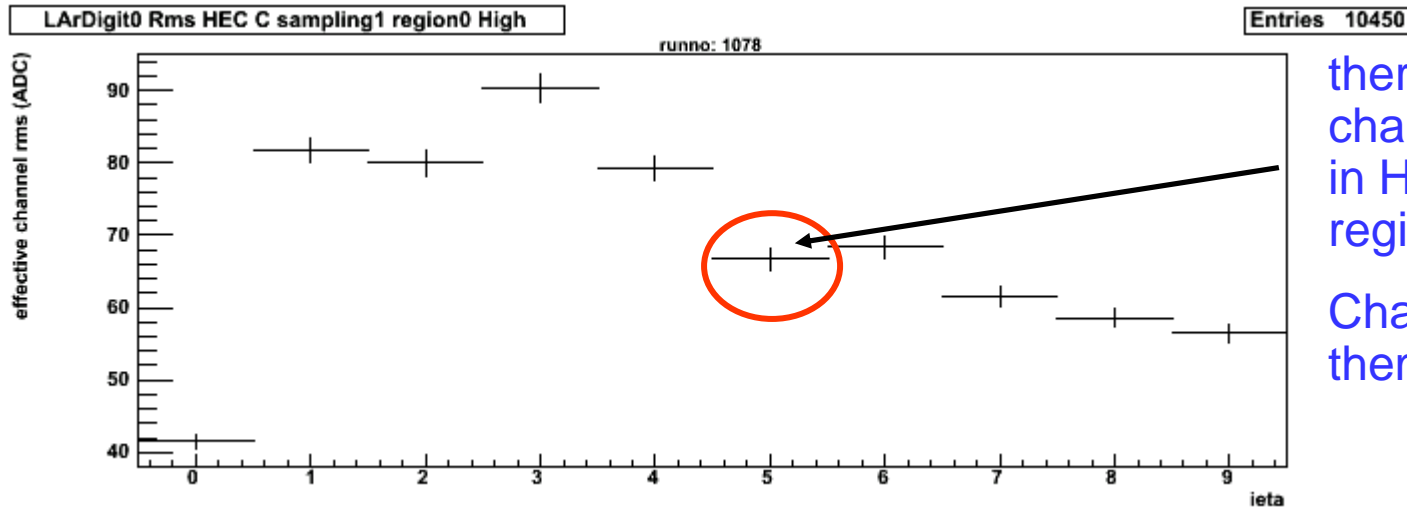
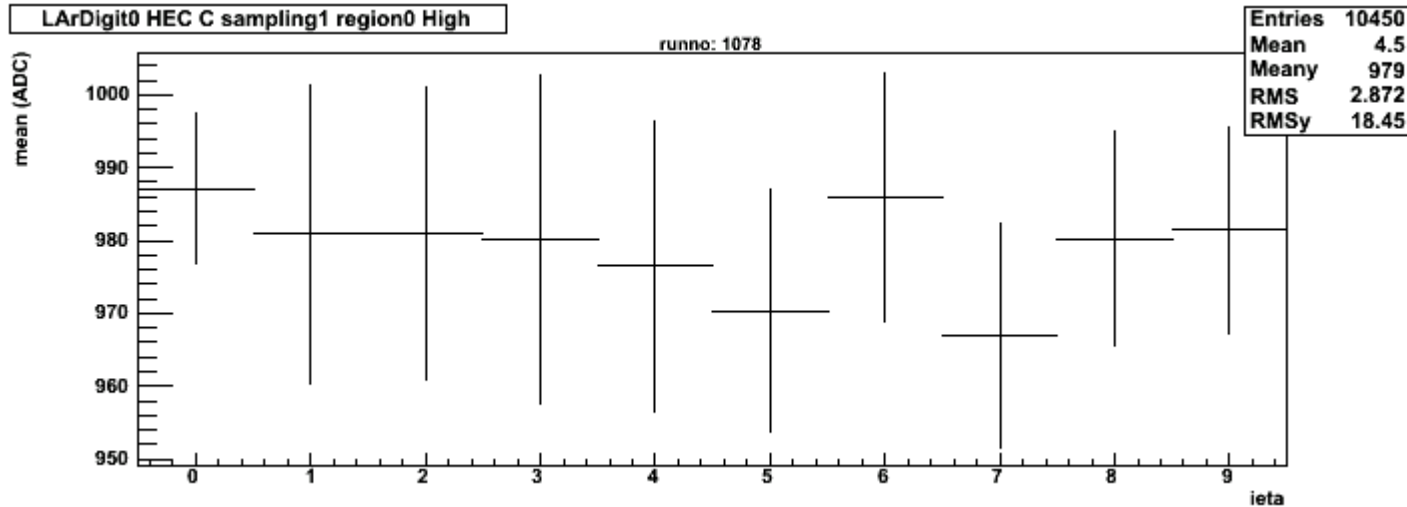
pedestal and noise

pedestal and noise of a “good” FEB



region context histograms

- pedestal and noise can also be monitored in region context



there are in fact 8 channels in this FEB in HEC sampling 1 region 0 and ieta = 5
Channel 21 is one of them.

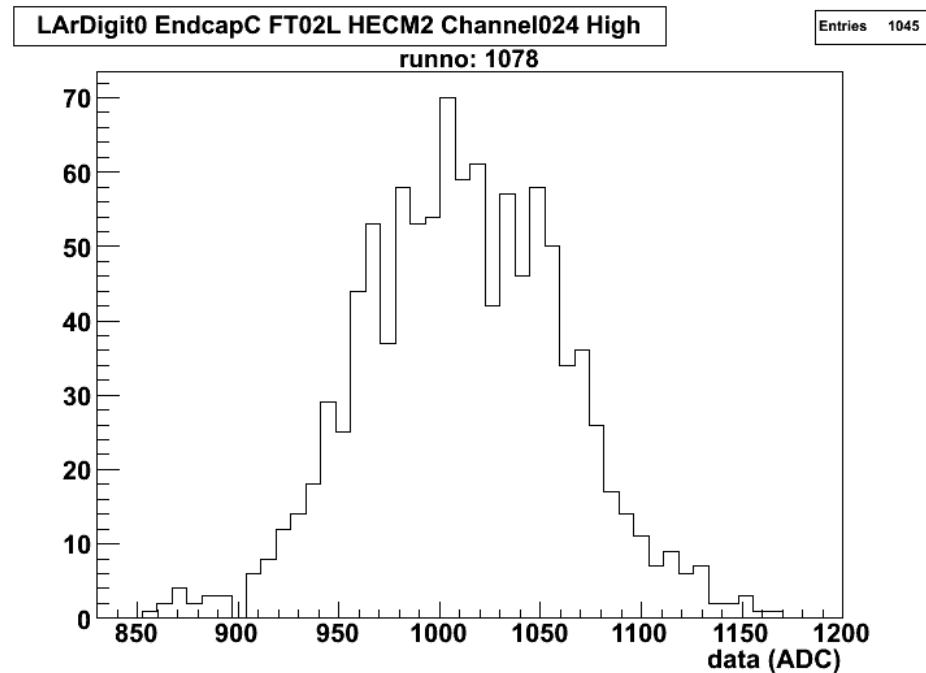
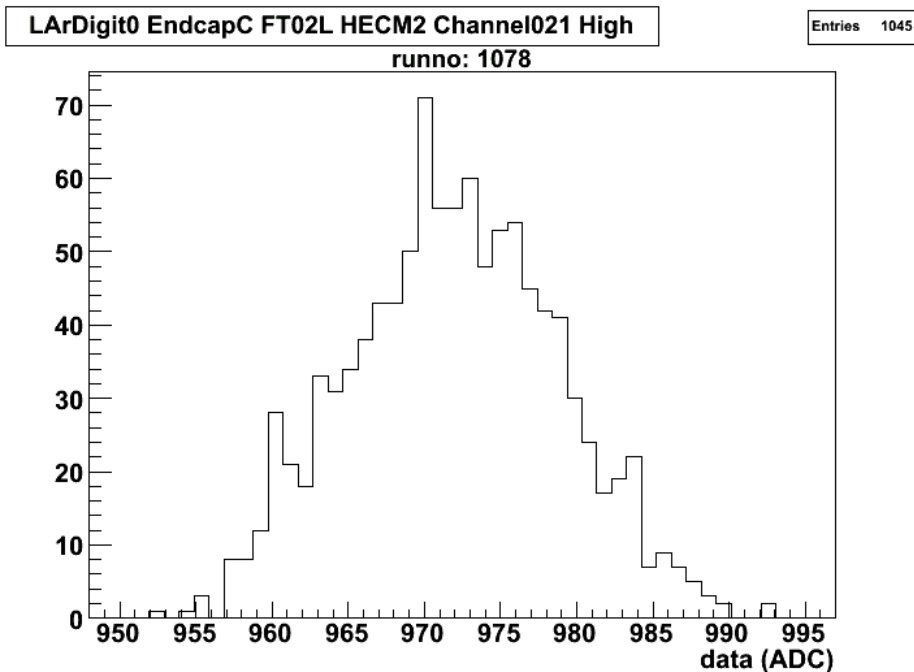
channel data profile

■ use the jobOption

- febNamesForChannelHistos = ["EndcapCFT02LHECM2"]
- and generate signal distribution for all channel is this feb
- default is [] (no FEB enabled)

channel 21
rms = 6.69 ADC

channel 24
rms ~ 50 ADC



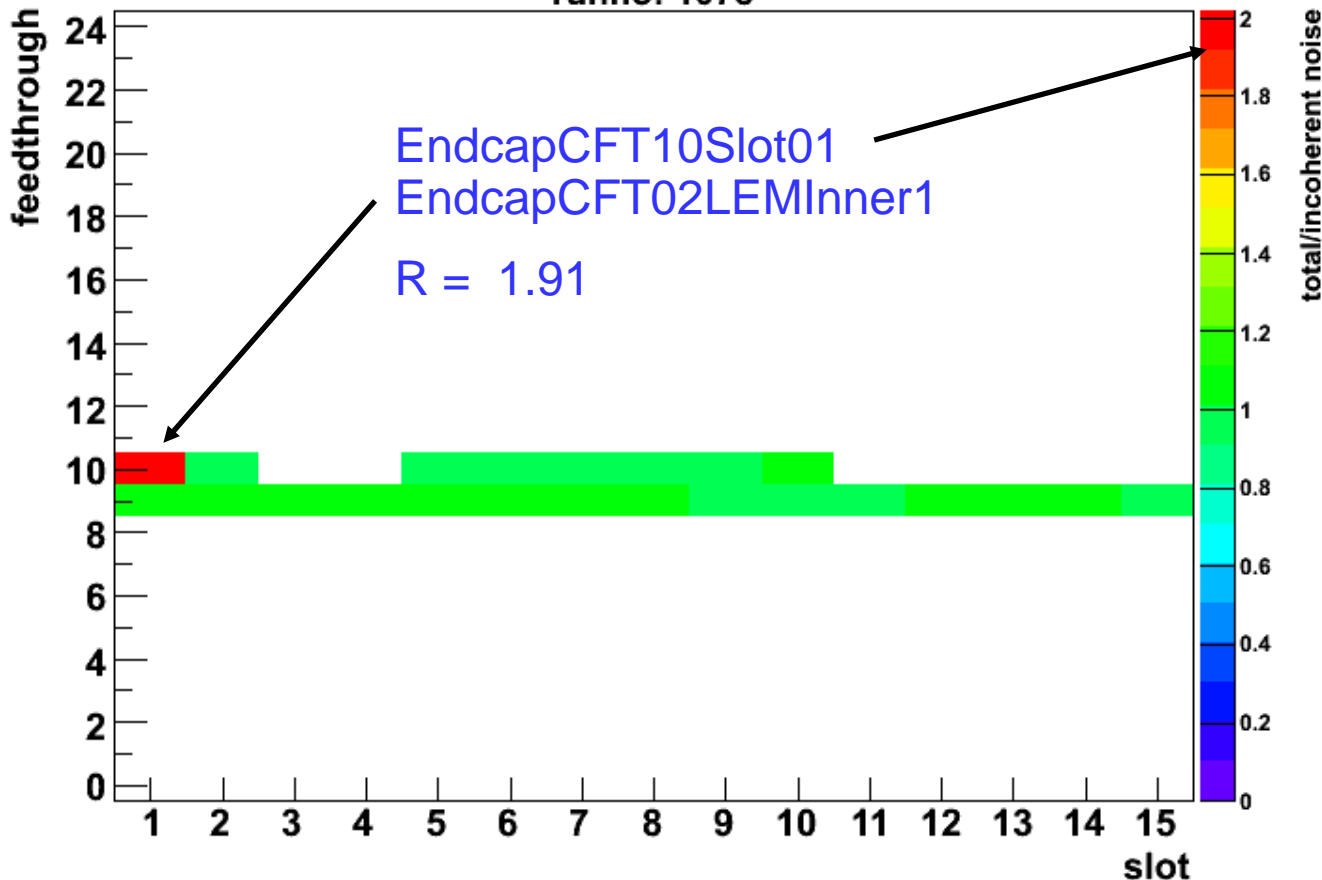
coherent noise summary

■ produced by default jobOptions

- R = total/incoherent noise ratio computed over all channels in a FEB

LArDigit0 Total/Incoherent Noise EndcapC High

runno: 1078



values of R for each FEB are printed as INFO

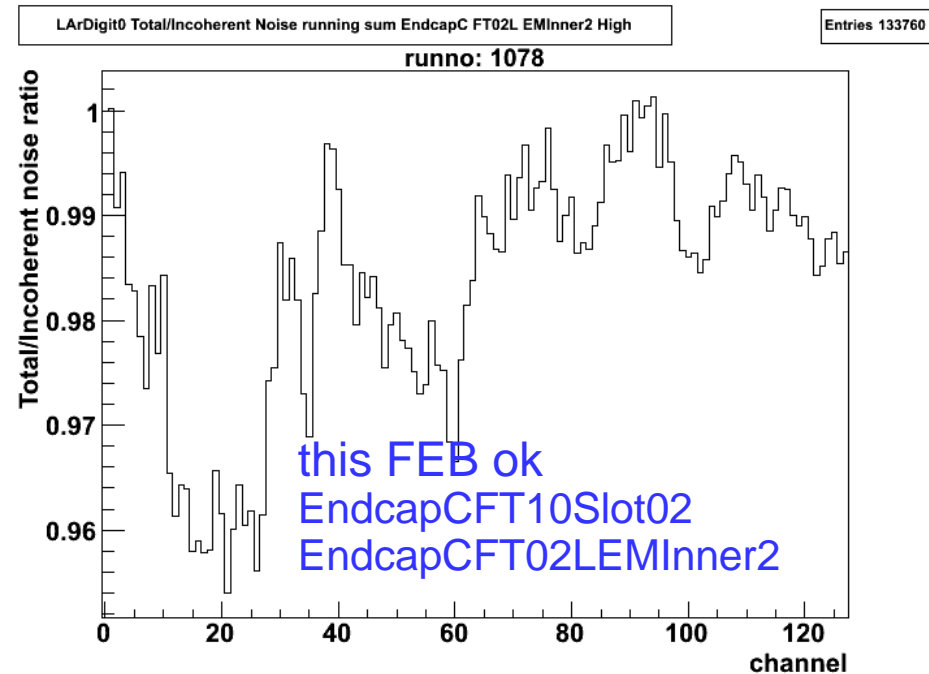
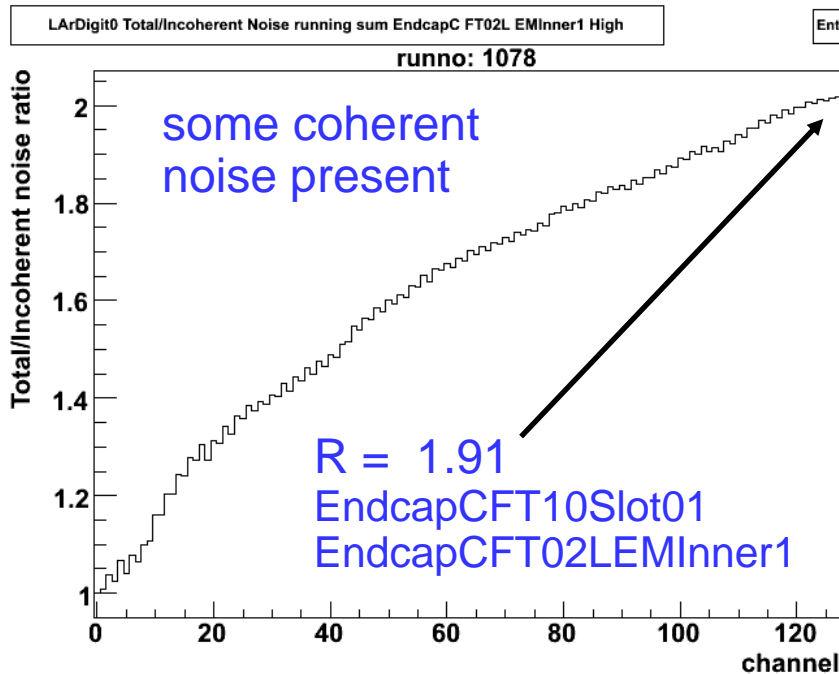
coherent noise investigations: 1d histos

■ use the jobOption

- binWindowSizeForSums = [0,4,8]
- monitorTotalNoise

■ obtain useful histograms sensitive to coherent noise

- 0 means running sums from channel 0 to n
- 4 means sums in sliding window from channel n-3 to n



coherent noise investigations: 2d histos

■ use the jobOption

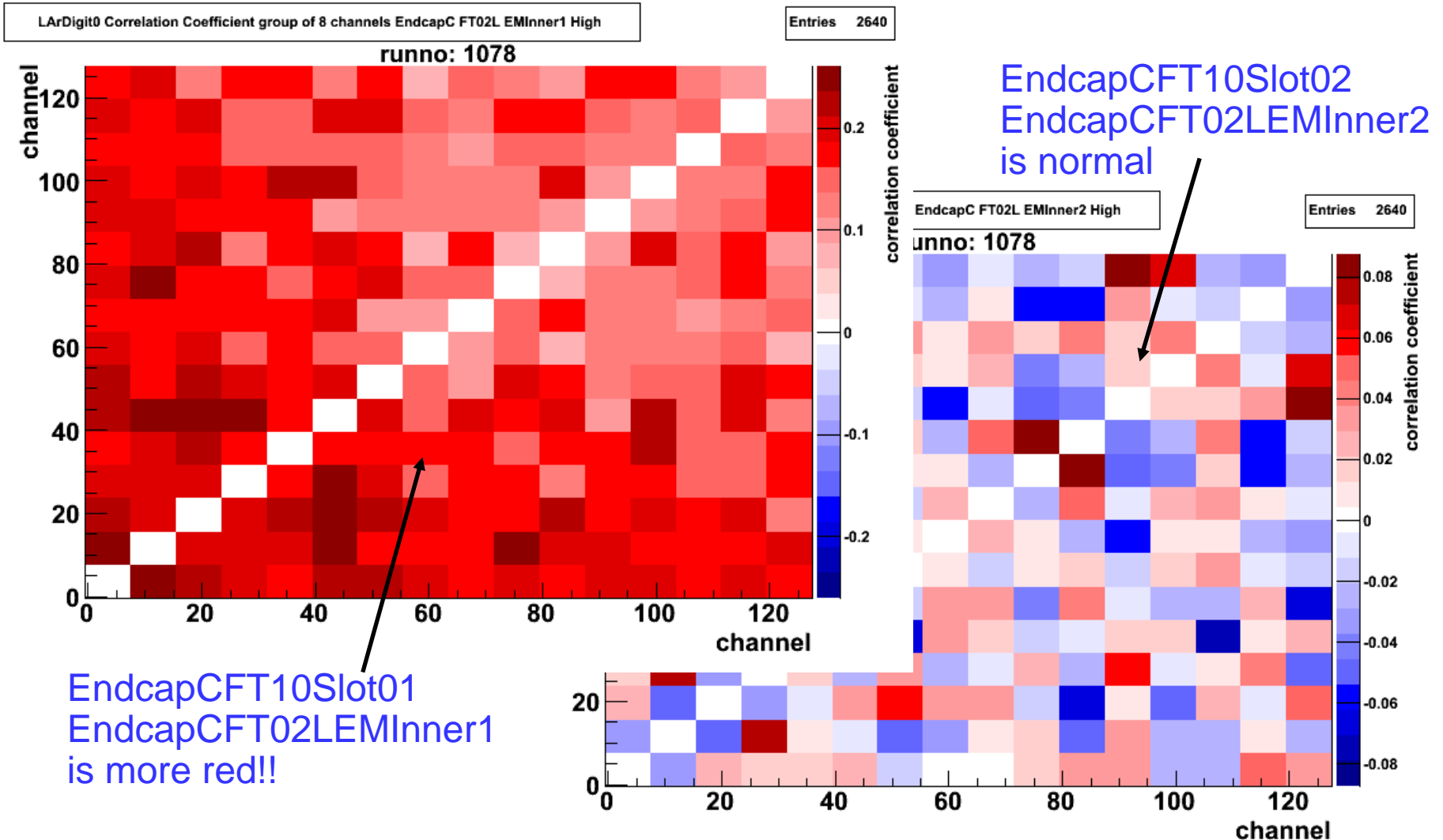
- febNamesFor2dCorrCoef = ["EndcapCFT10Slot01", "EndcapCFT10Slot02"]
- groupSizesFor2dCorrCoef = [1,4,8,16]

■ obtain 2d correlation coefficient matrices

- 1 means 128 x 128 (for a FEB with 128 channels monitored)
- 4 means 32 x 32 (for a FEB with 128 channels monitored)
- nice symmetric colour palette, thanks to Tayfun

correlation coefficient matrices

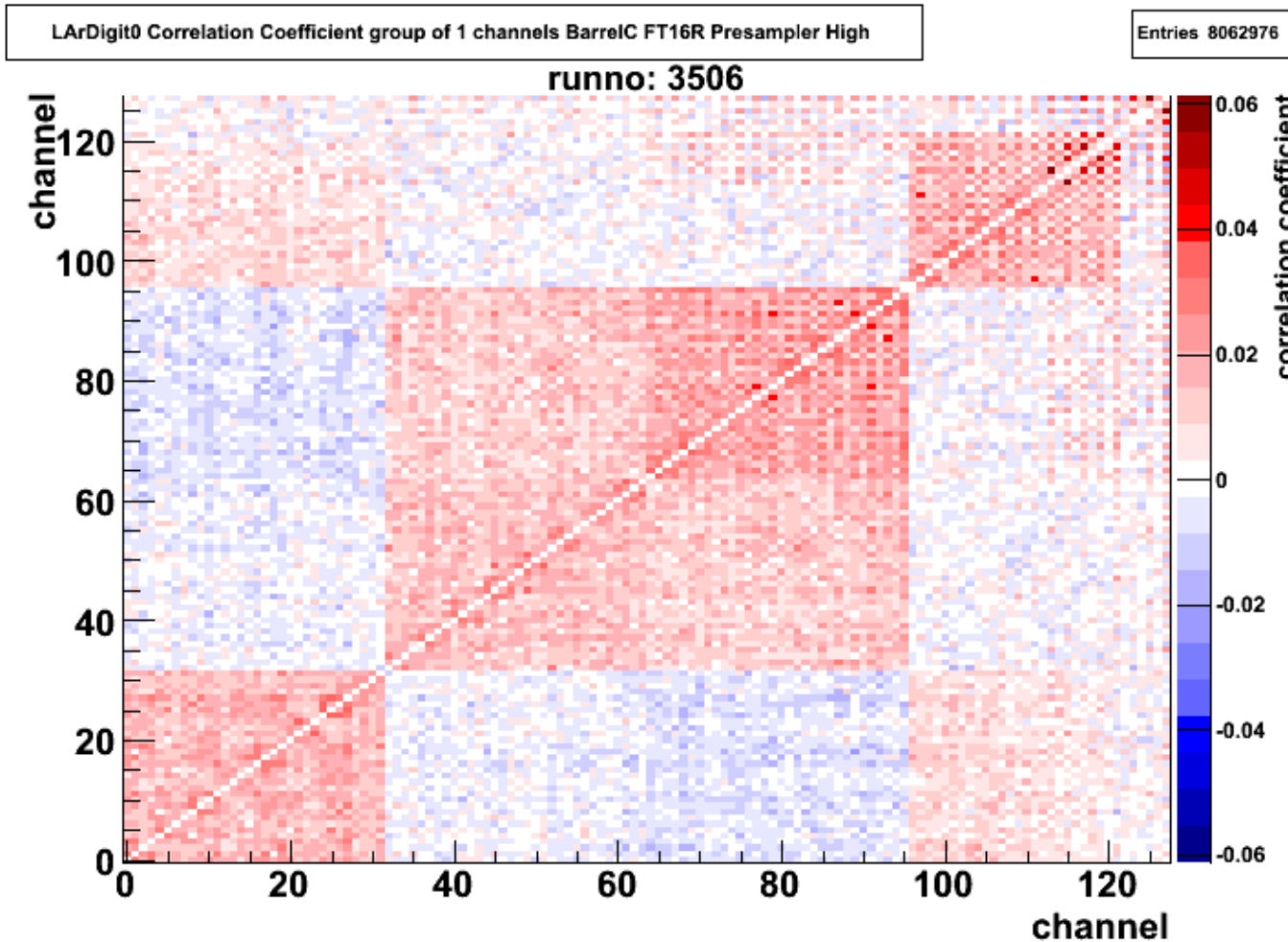
■ 32 x 32 matrices (groups of 4 channels)



barrel commissioning examples

- Interesting features have been observed on barrel commissioning data

run 3506 (2006/05/11)

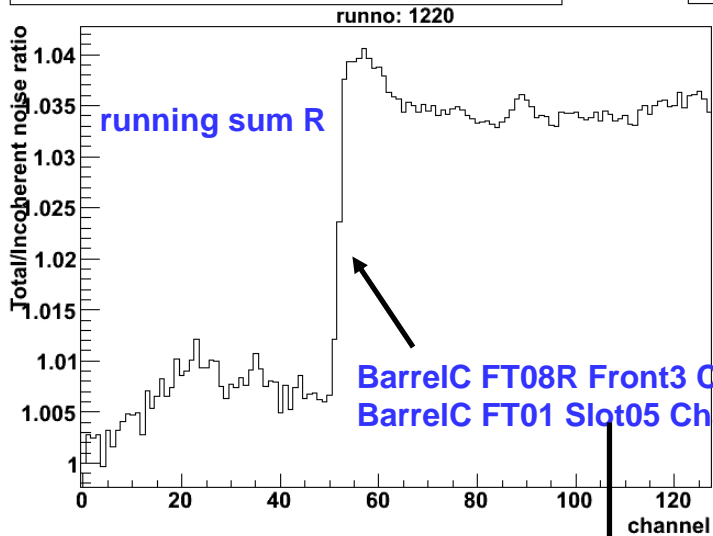


small correlations
with distinctive
pattern

run 1220 (2006/02/02)

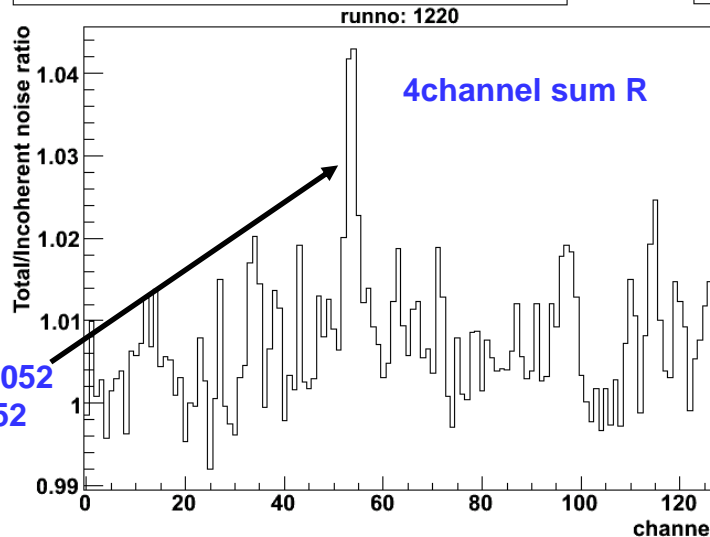
LArDigit0 Total/Incoherent Noise running sum BarrelC FT08R Front3 High

Entries 1287168



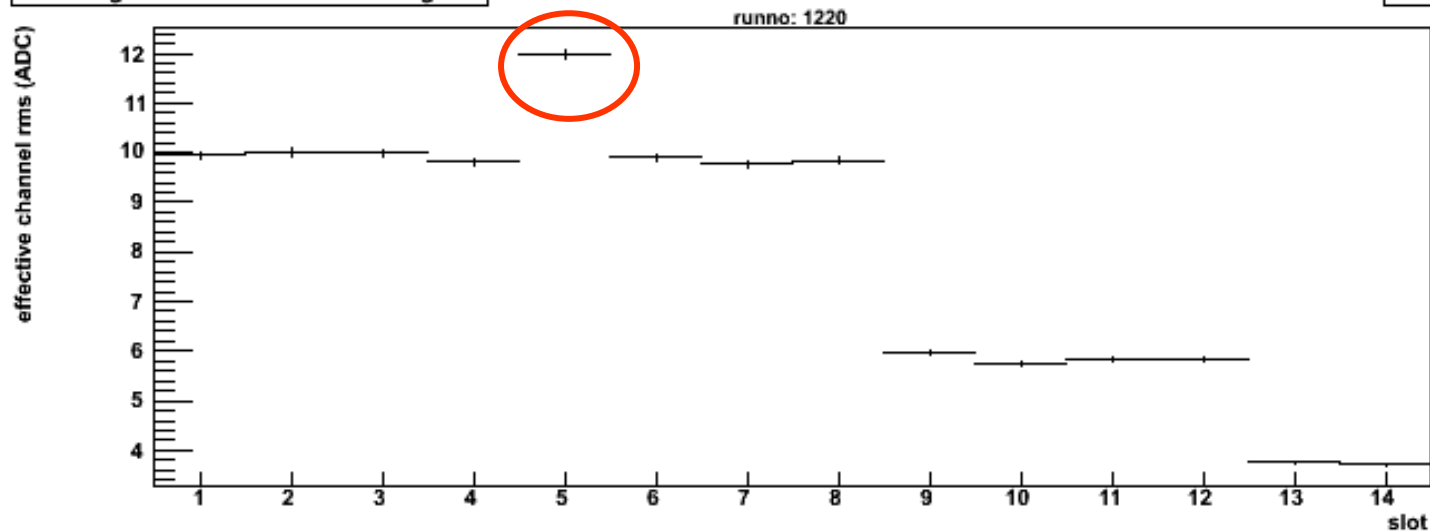
LArDigit0 Total/Incoherent Noise window of 4 bins BarrelC FT08R Front3 High

Entries 1287168

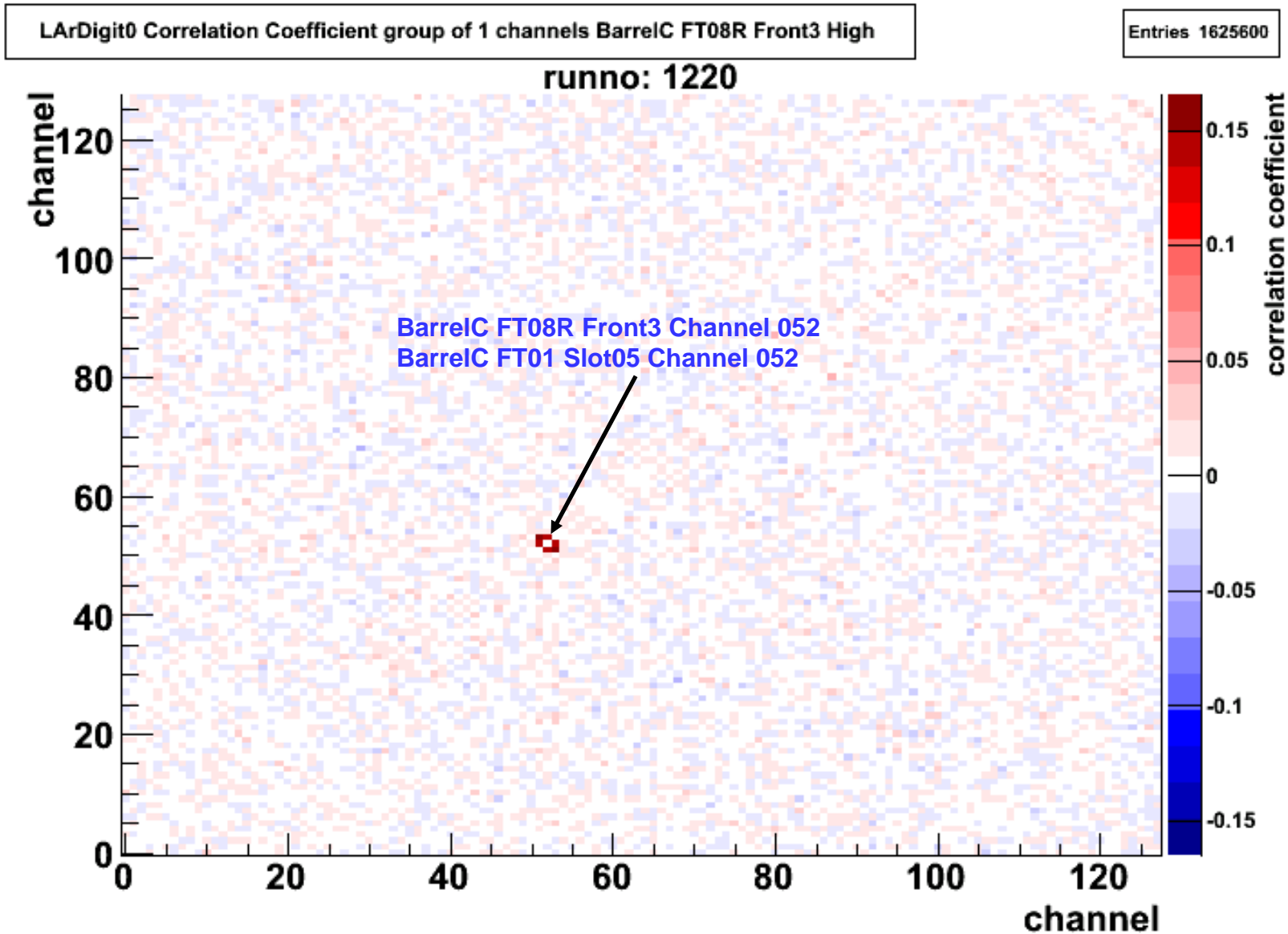


LArDigit0 Rms BarrelC FT08R High

Entries 140784



run 1220 (2006/02/02)

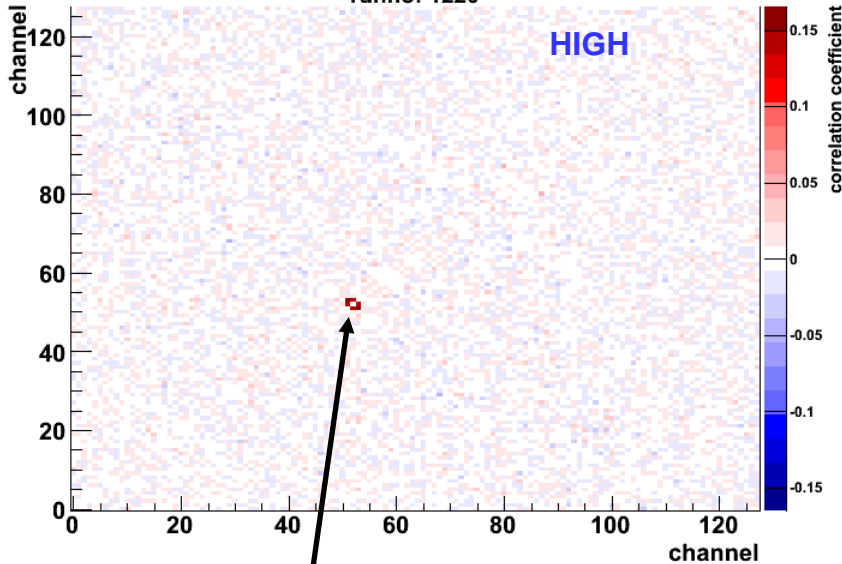


runs 1220, 1221, 1222 (2006/02/02)

LArDigit0 Correlation Coefficient group of 1 channels BarrelC FT08R Front3 High

Entries 1625600

runno: 1220



BarrelC FT08R Front3
BarrelC FT01 Slot05

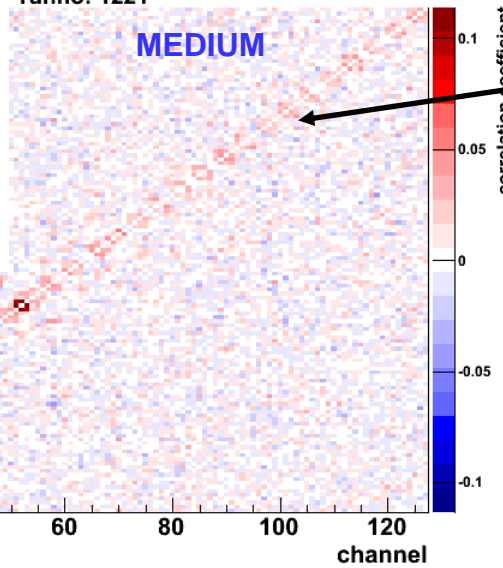
slow growth of
running sum R
caused by near
neighbour
correlations

Channels BarrelC FT08R Front3 Medium

Entries 1625600

runno: 1221

MEDIUM



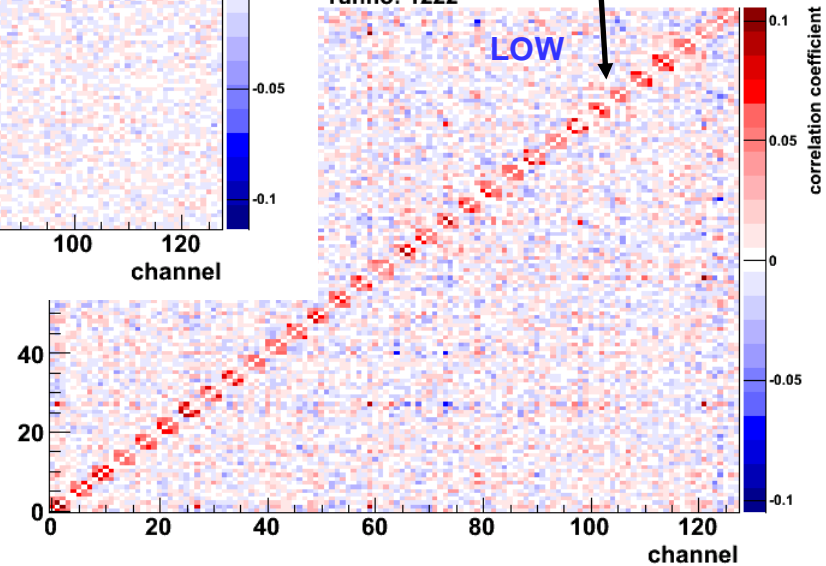
channel 52
region

Channels BarrelC FT08R Front3 Low

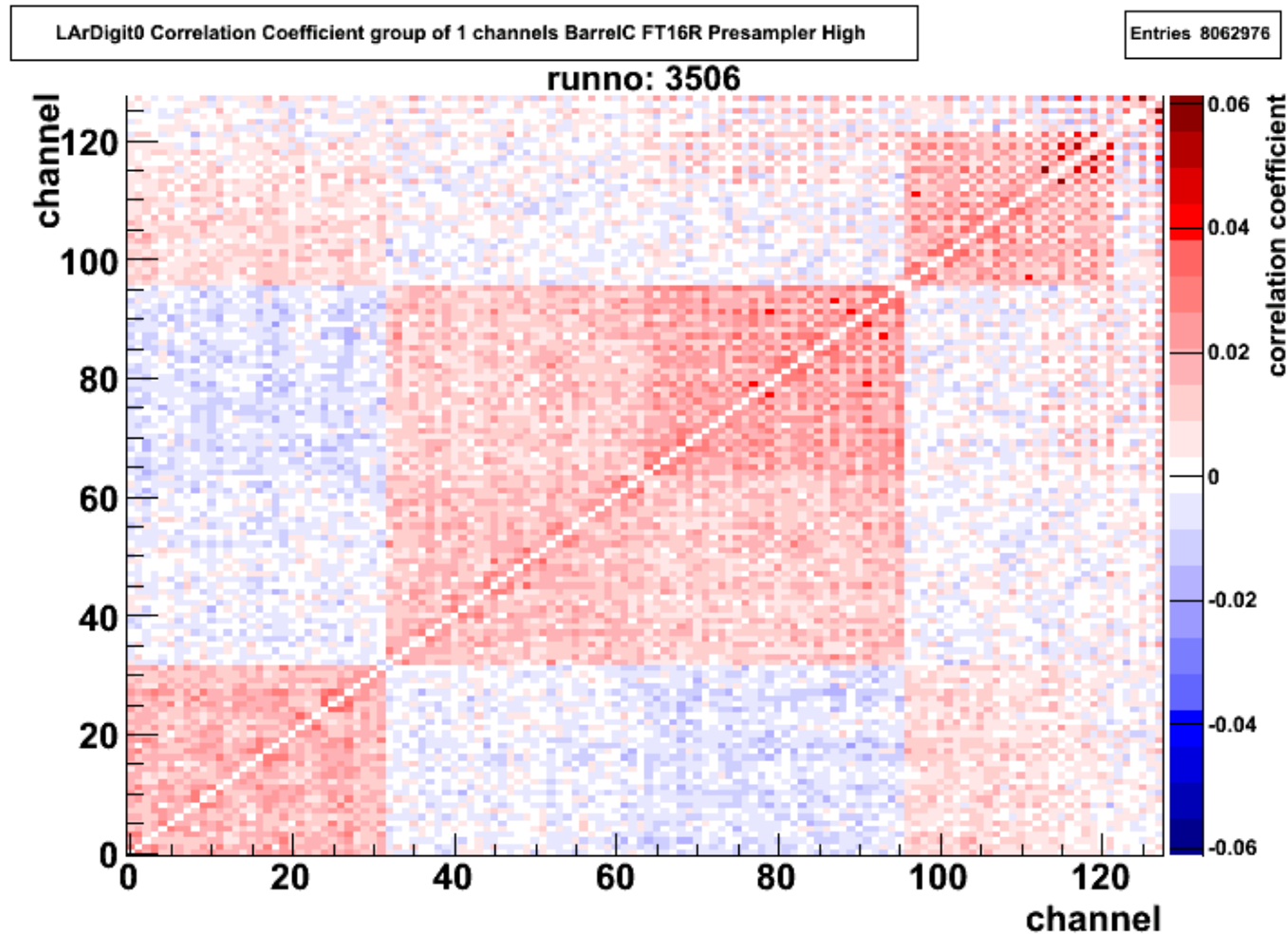
Entries 1625600

runno: 1222

LOW



run 3506 (2006/05/11)



configurable tools

- Have a look at the jobOption files for more options
- Uses the latest LArOnlineIDStrHelper
 - from HWIdentifier to std::string
 - for histo names, histo titles, printouts
 - from std::string to HWIdentifier
 - for jobOptions
 - establishes a standard
 - works with the debugged FCal channel mapping