Trending CAL performance and mapping crystals

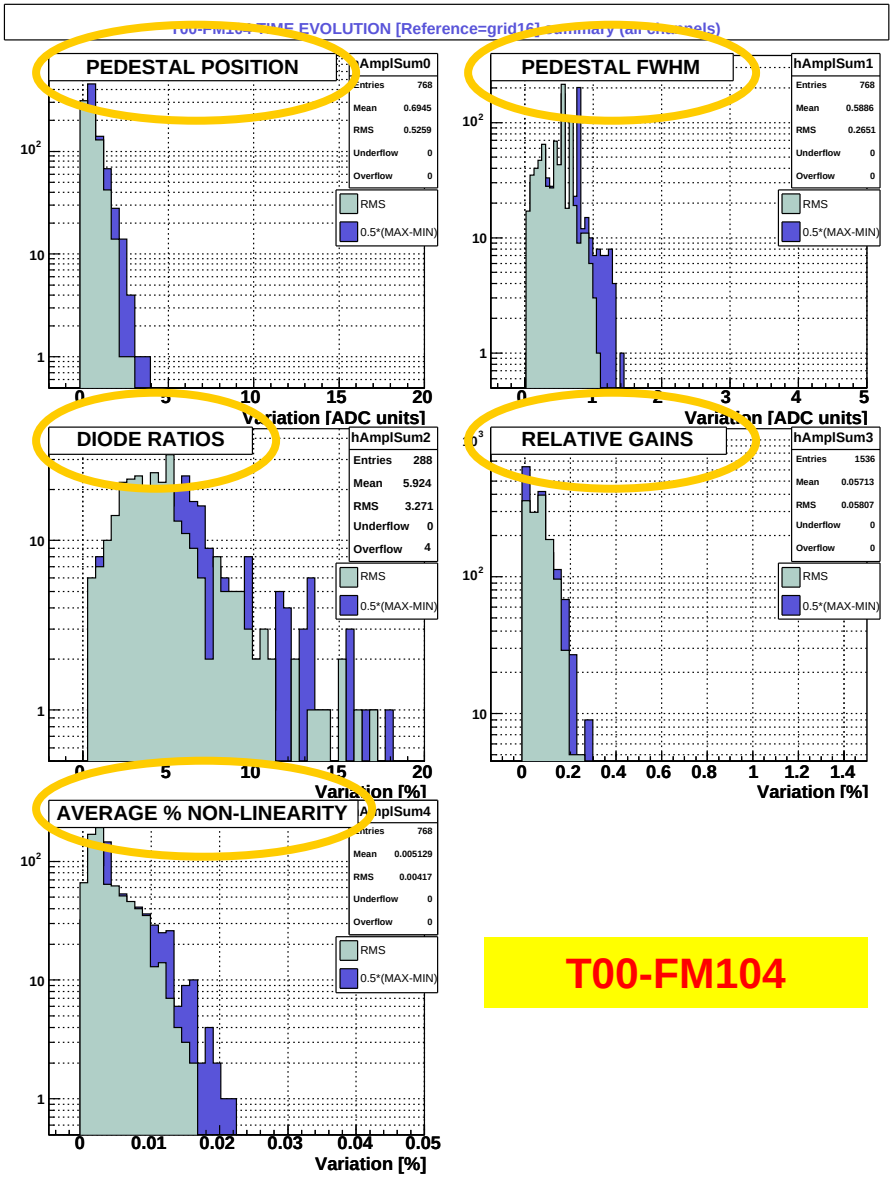
- **Trending CAL performance parameters as a function of LAT assembly phase:**
  - **from Comprehensive Performance Tests**
  - **from calibration files (calibGenCal)**
- **Mapping CAL crystals and energy response**
- **Conclusions**

Trending CAL performance parameters from CPT's 1/10

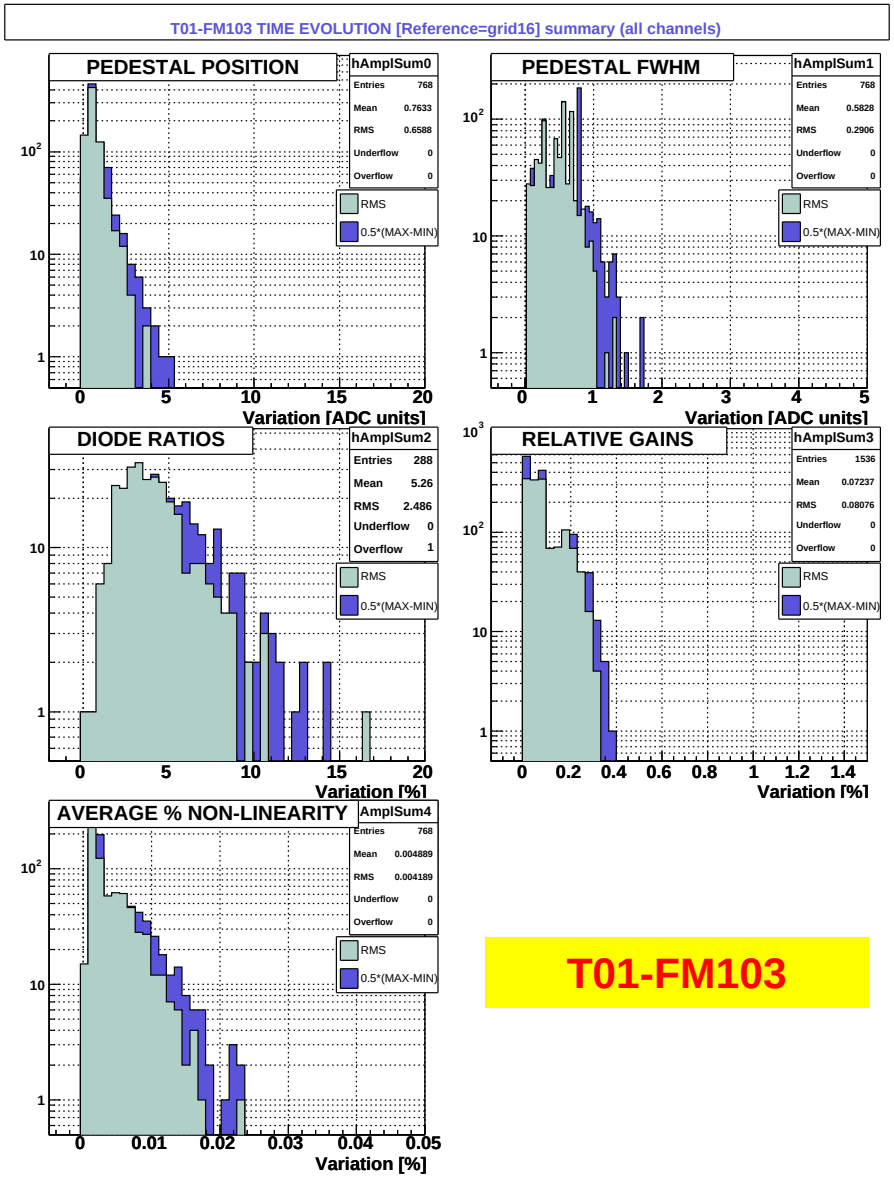
- **What do we trend ?**
  - **Compute pedestals: we trend position and width**
  - **Check optical response (with muons):**
    - **a test for changes in the PDA (photo-diode assembly) optical bond quality is made from the ratio of LE or HE diode signals**
    - **we trend LE+/LE-, LE+/HE+ and LE-/HE-**
  - **Calibrate electronic gains (with CI):**
    - **we trend the lowest and highest relative gains (w.r.t. nominal gains)**
    - **these gains are chosen because any drift from the nominal value would be most greatly amplified**
  - **Determine front-end integral non-linearity and noise (with CI): we trend non-linearity (RMS deviation from linear fit in %)**

- **Which phases ?**
  - **8 first modules: 8T, 16T, 16T_fGASU, 16T_7Feb06**
  - **8 last modules: 16T, 16T_fGASU, 16T_7Feb06**
    - **Except FM117 (data removed by FM116 data…)**

Trending CAL performance parameters from CPT's 2/10



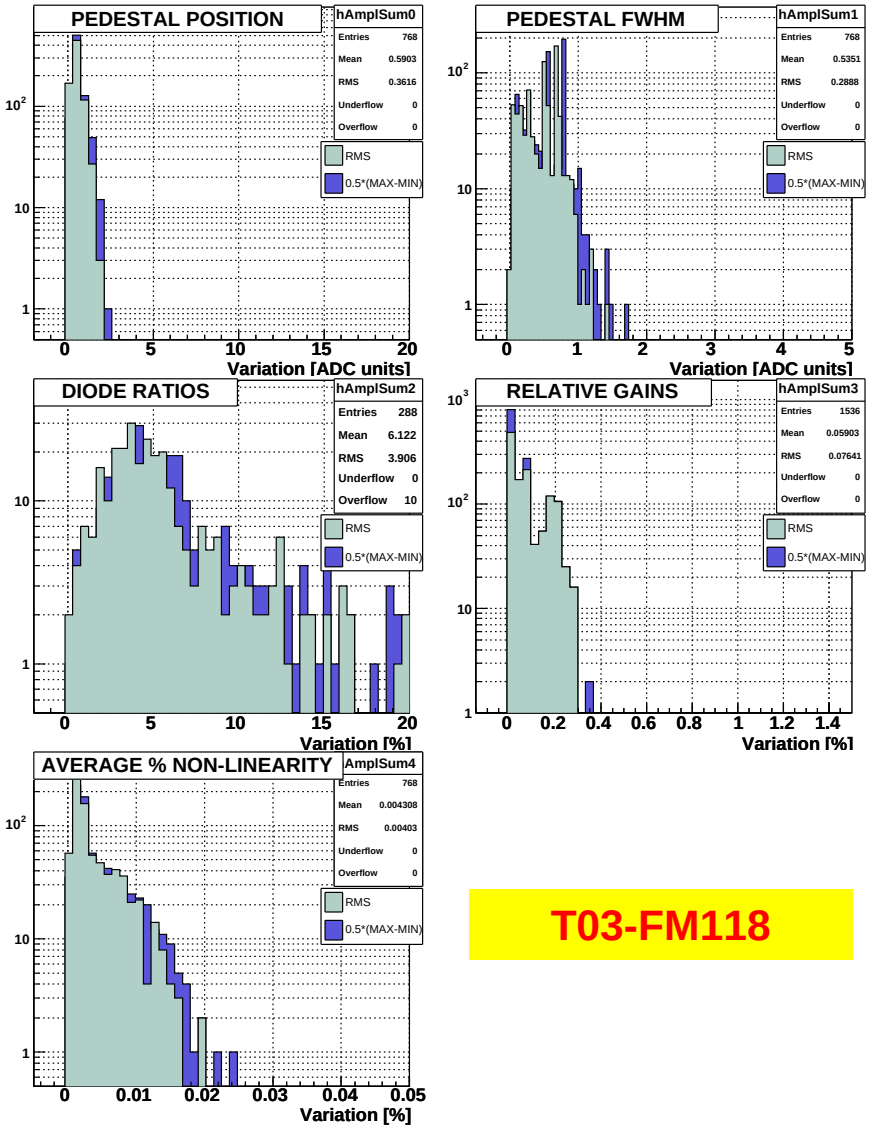
T00-FM104



T01-FM103

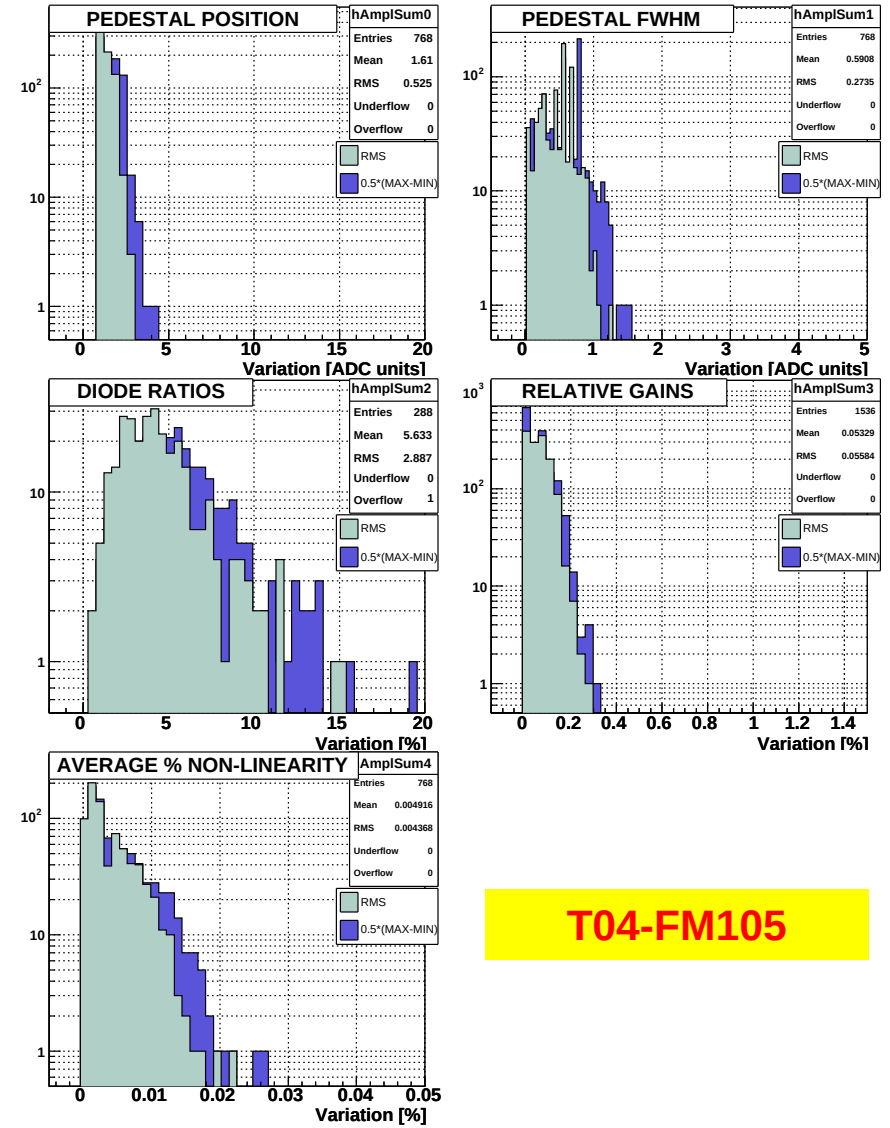
Trending CAL performance parameters from CPT's 3/10

T03-FM118 TIME EVOLUTION [Reference=grid16] summary (all channels)



T03-FM118

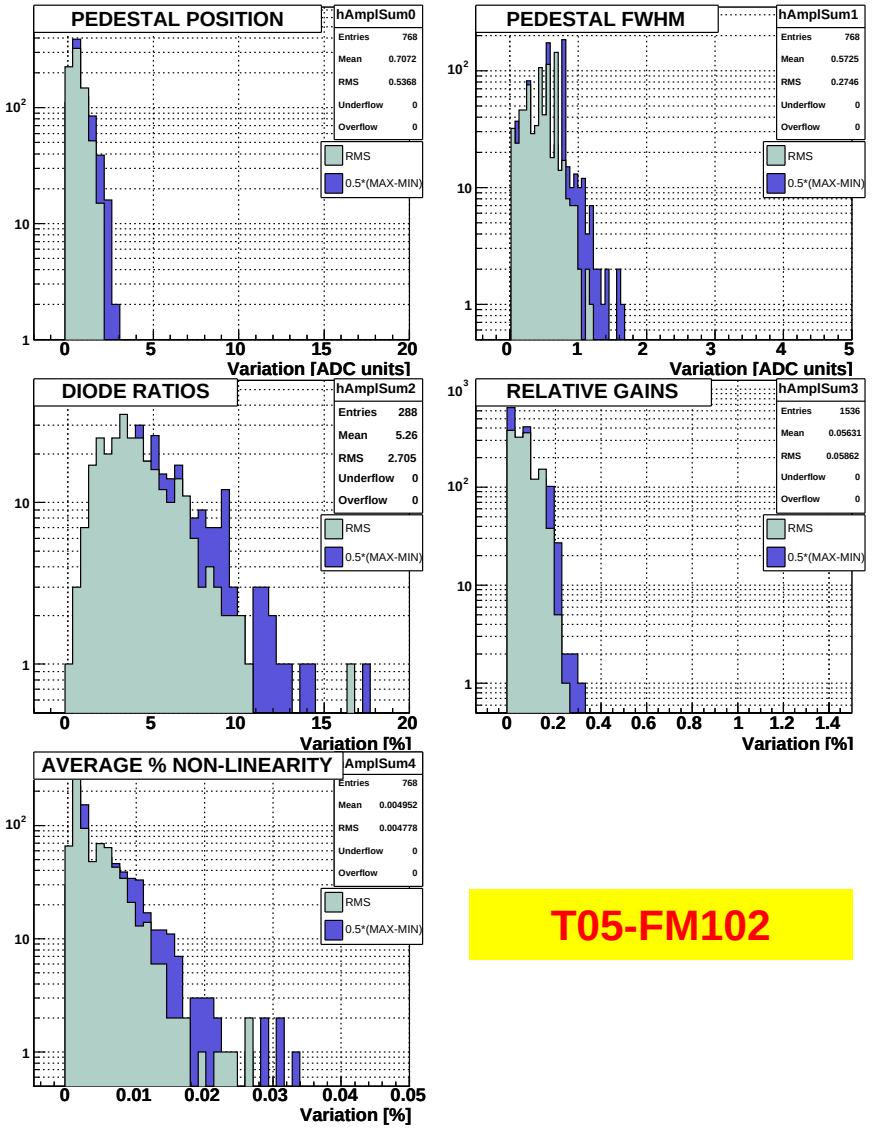
T04-FM105 TIME EVOLUTION [Reference=grid16] summary (all channels)



T04-FM105

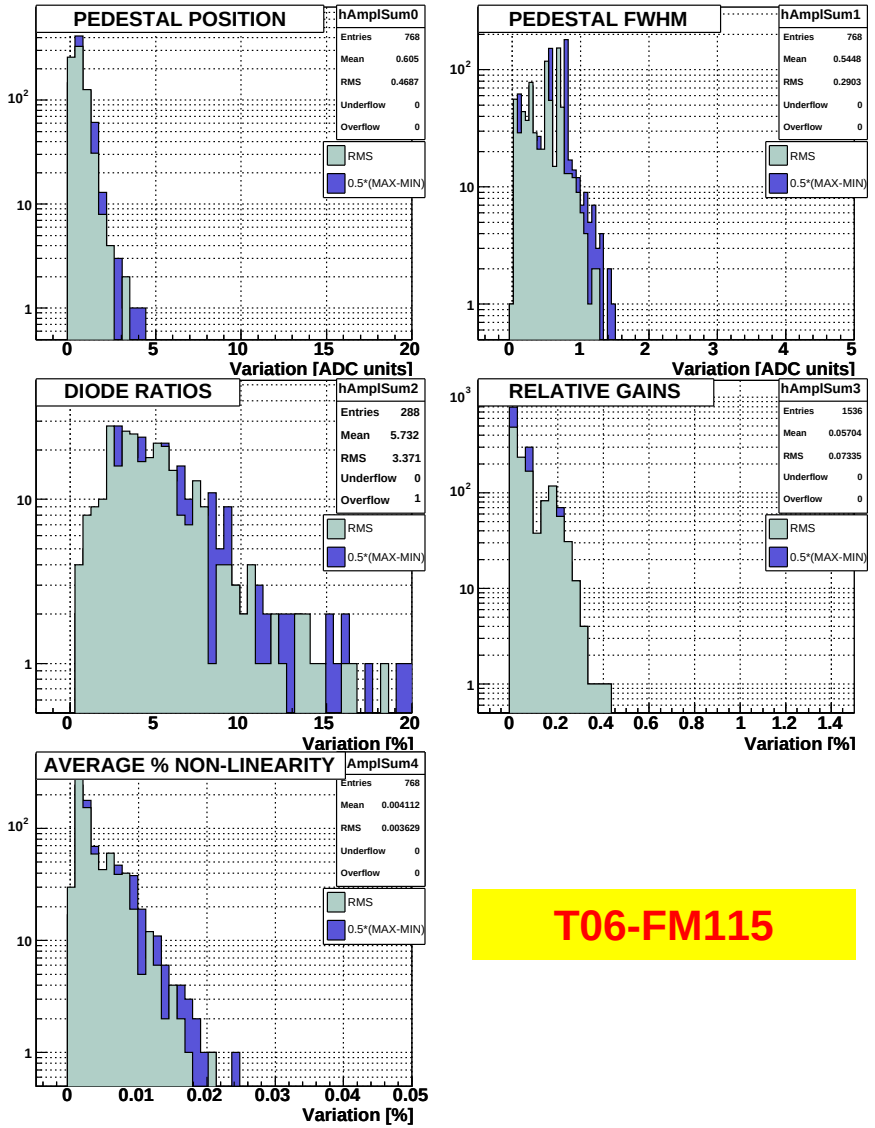
Trending CAL performance parameters from CPT's 4/10

T05-FM102 TIME EVOLUTION [Reference=grid16] summary (all channels)



T05-FM102

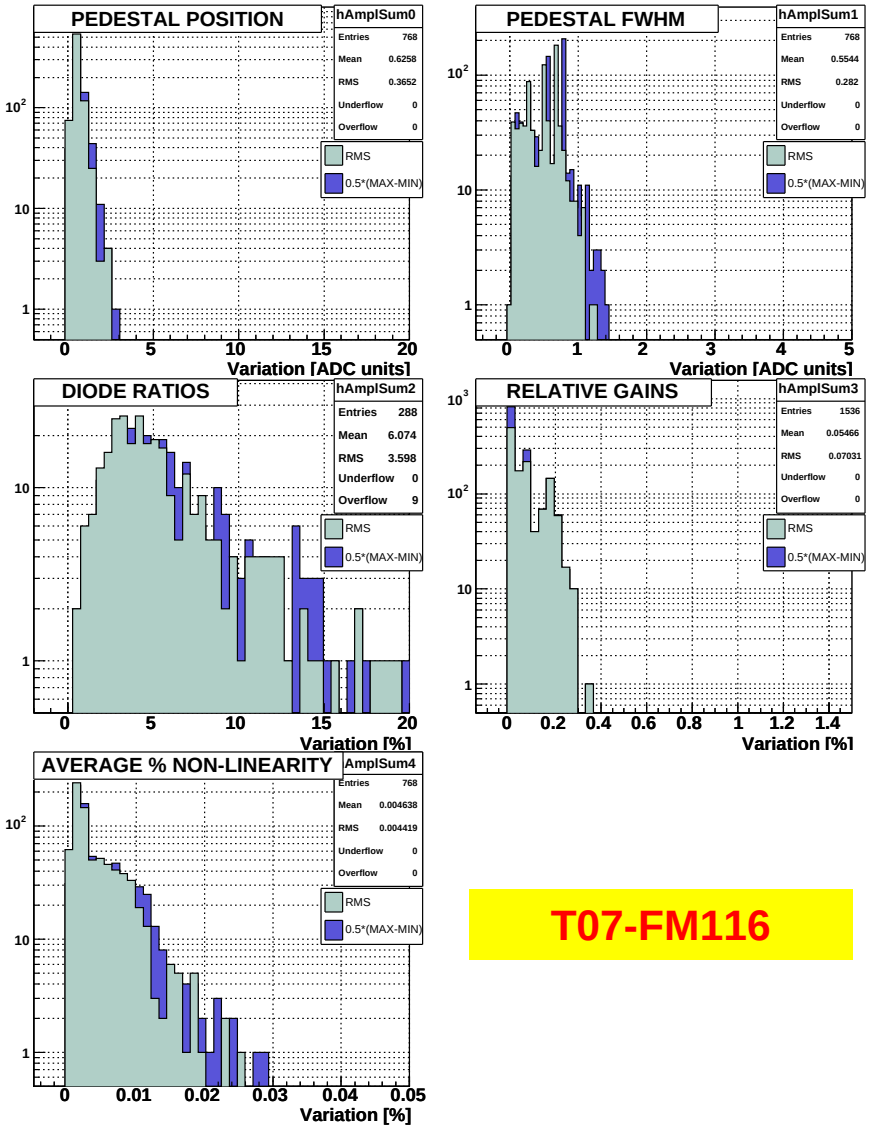
T06-FM115 TIME EVOLUTION [Reference=grid16] summary (all channels)



T06-FM115

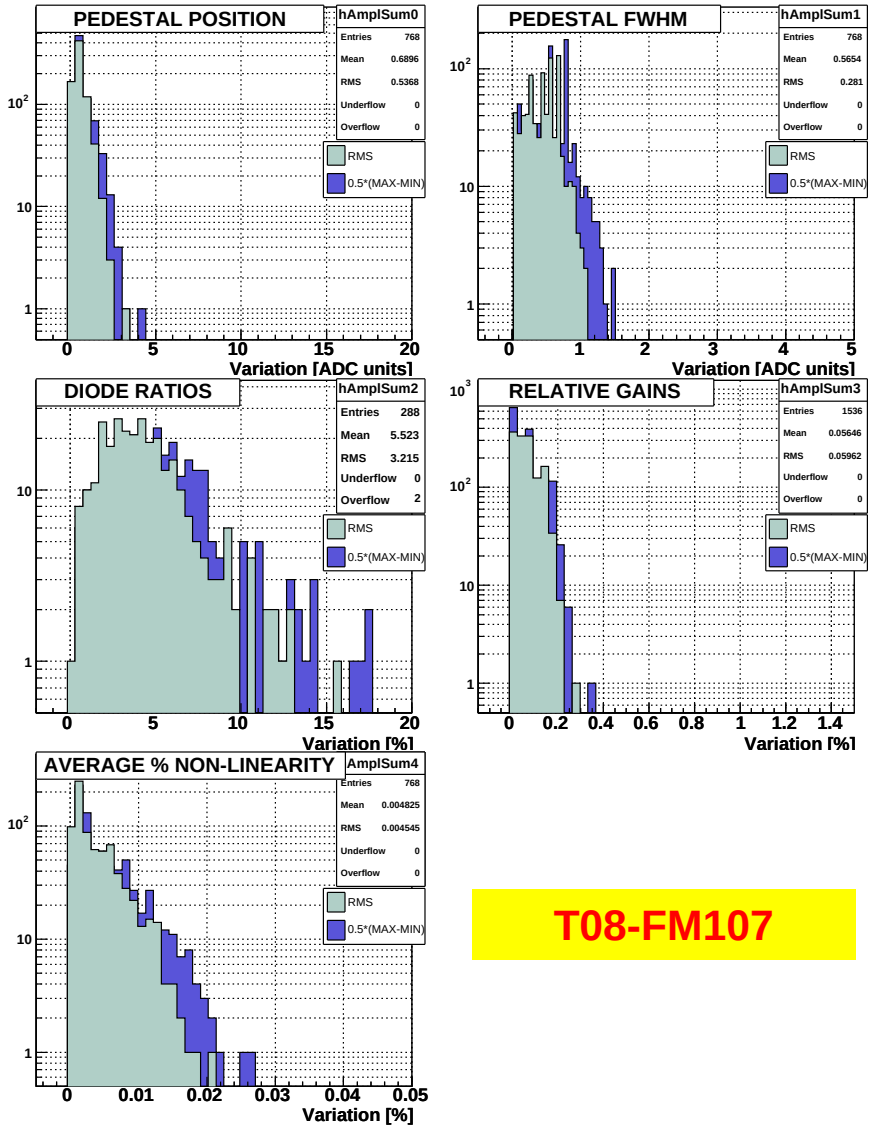
Trending CAL performance parameters from CPT's 5/10

T07-FM116 TIME EVOLUTION [Reference=grid16] summary (all channels)



T07-FM116

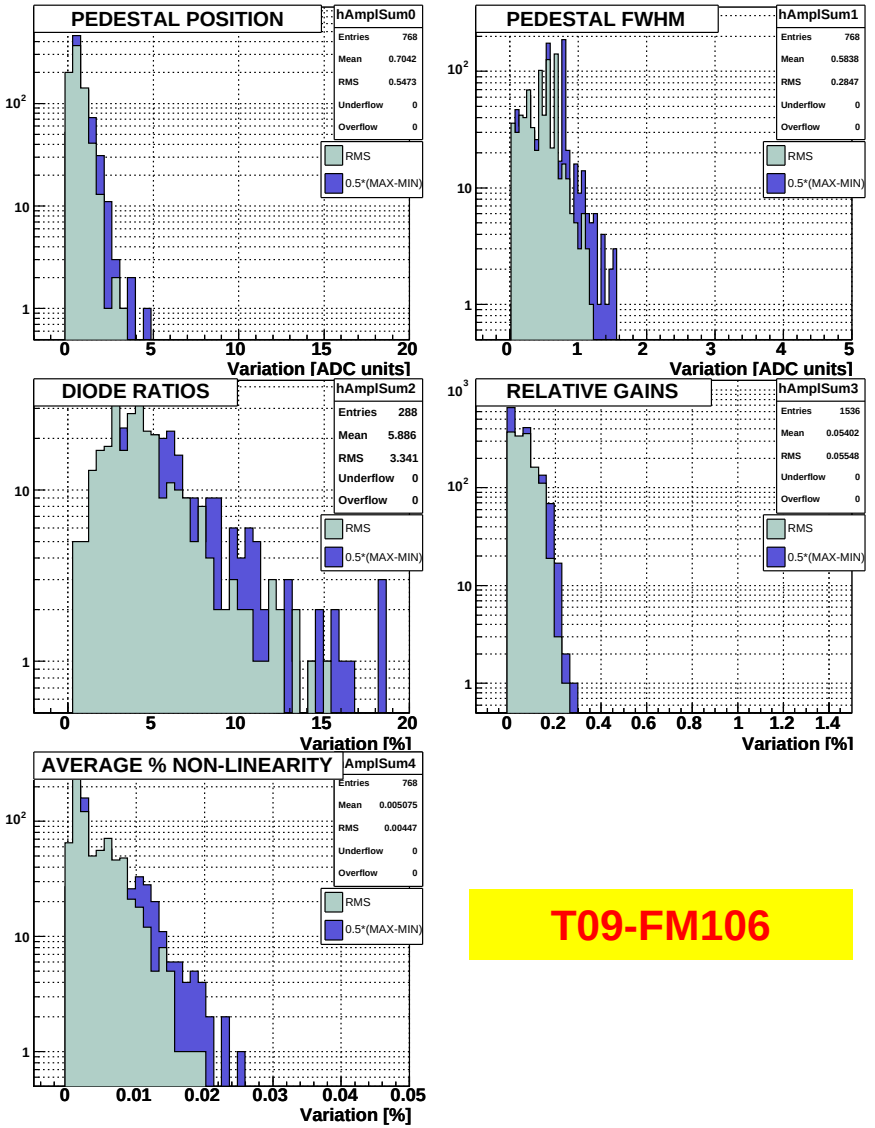
T08-FM107 TIME EVOLUTION [Reference=grid16] summary (all channels)



T08-FM107

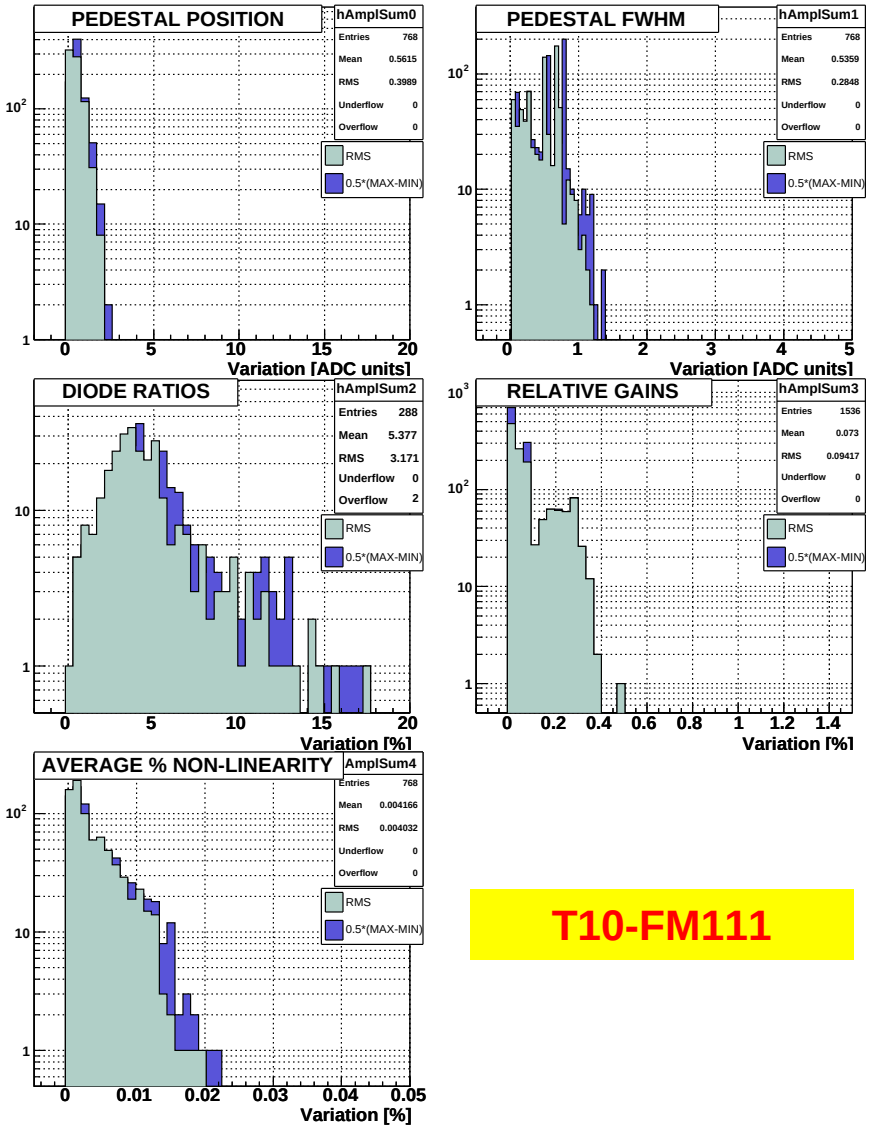
Trending CAL performance parameters from CPT's 6/10

T09-FM106 TIME EVOLUTION [Reference=grid16] summary (all channels)



T09-FM106

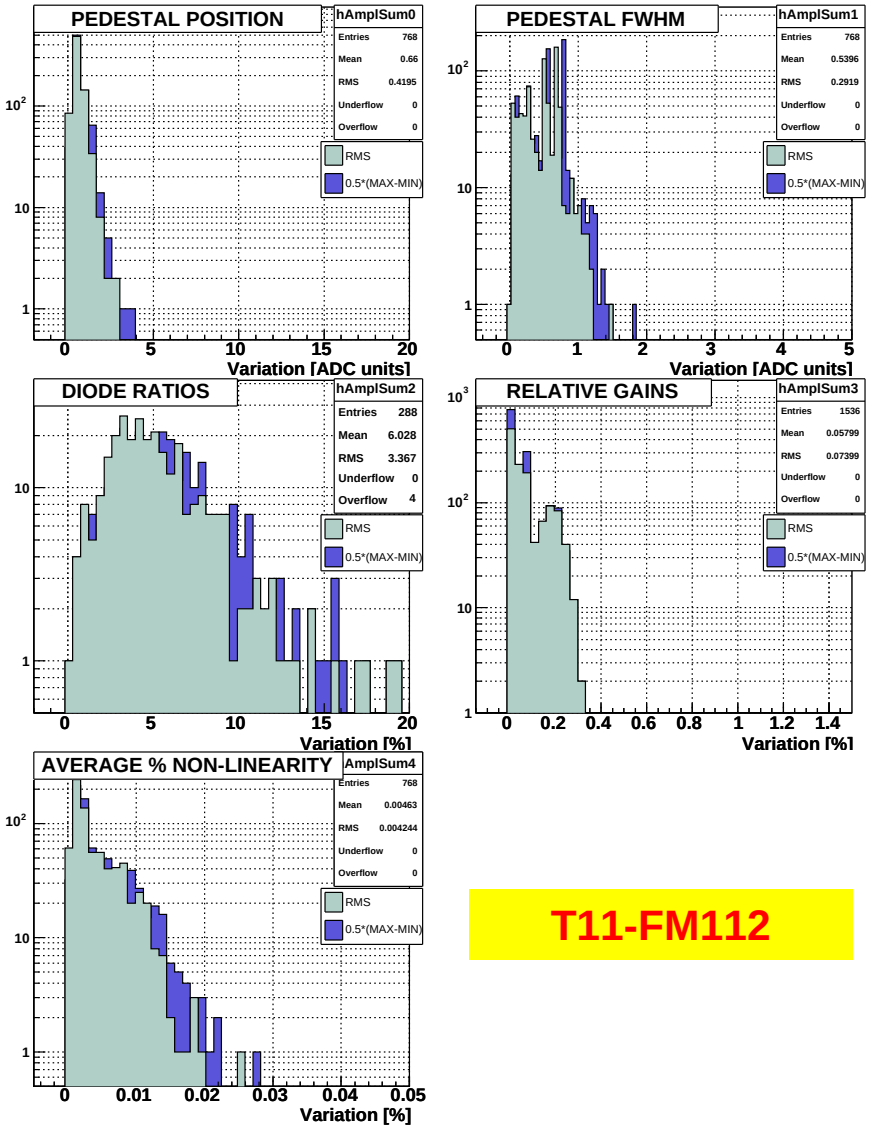
T10-FM111 TIME EVOLUTION [Reference=test1] summary (all channels)



T10-FM111

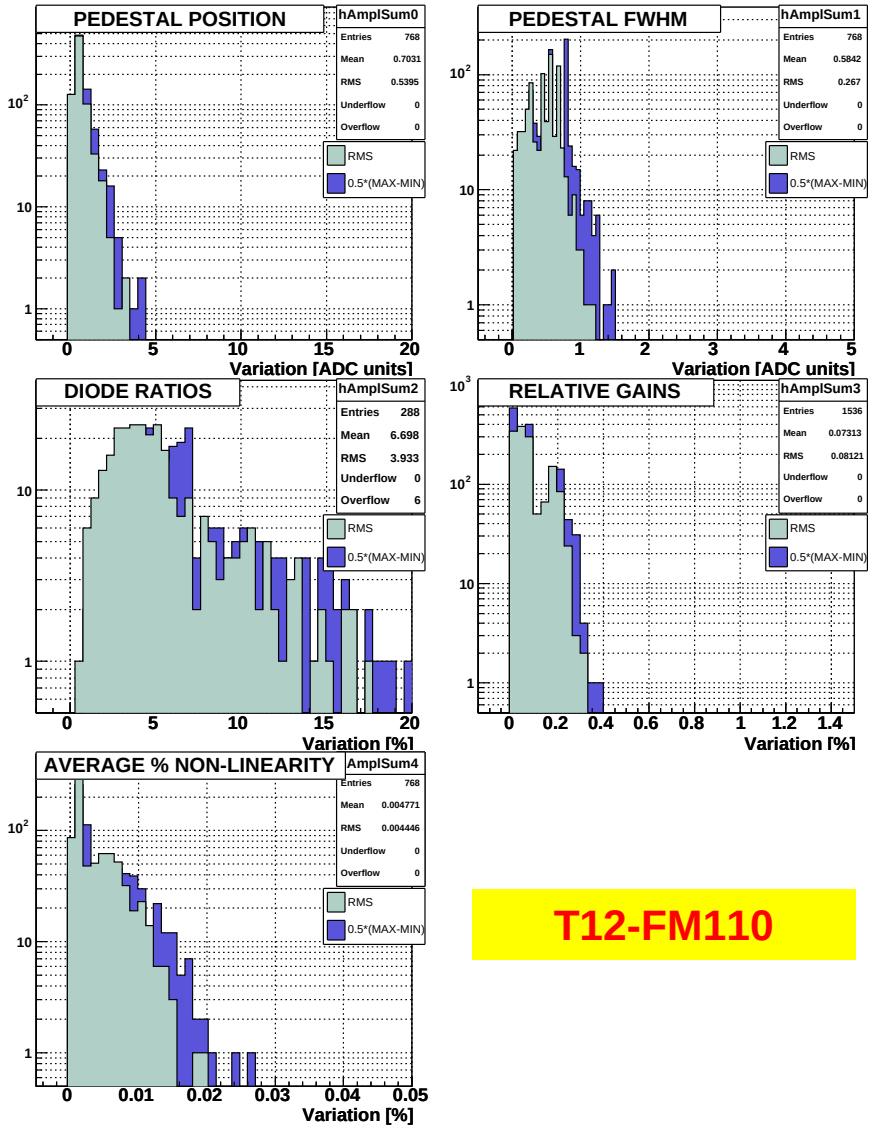
Trending CAL performance parameters from CPT's 7/10

T11-FM112 TIME EVOLUTION [Reference=grid16] summary (all channels)



T11-FM112

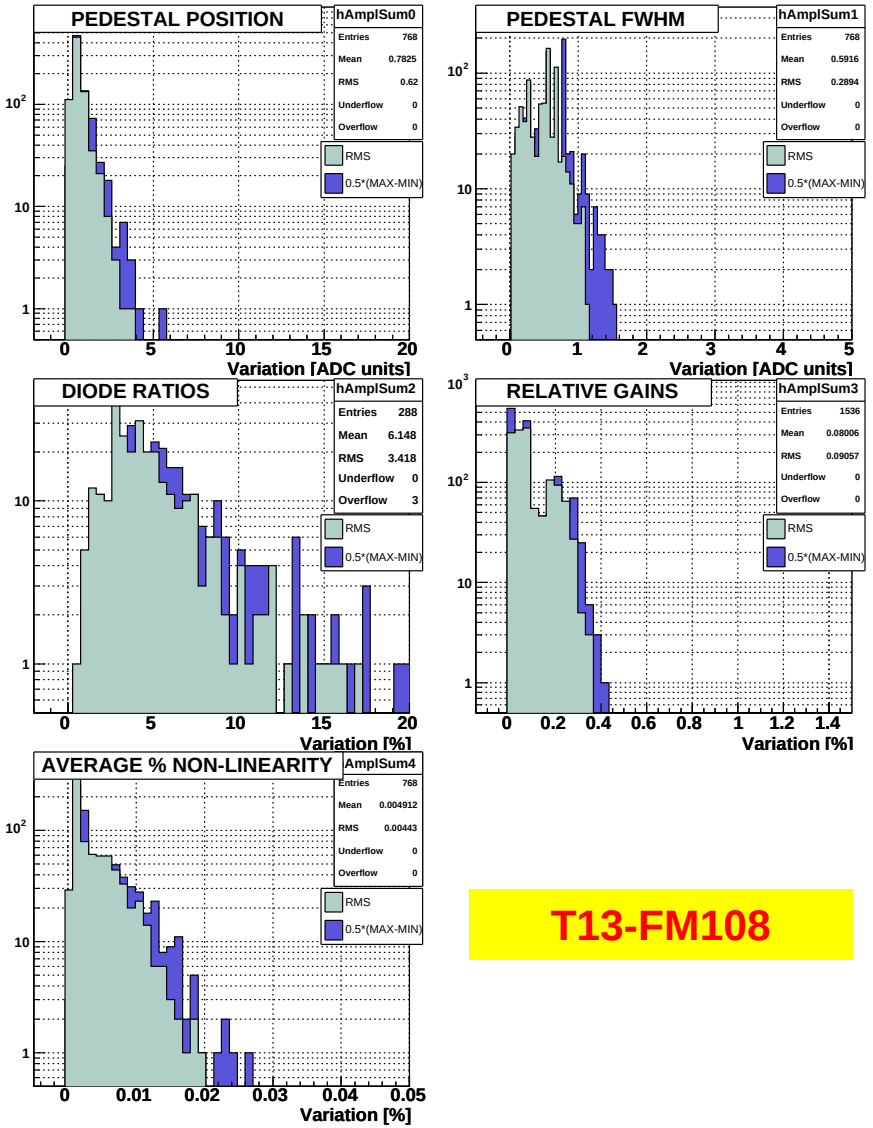
T12-FM110 TIME EVOLUTION [Reference=grid16] summary (all channels)



T12-FM110

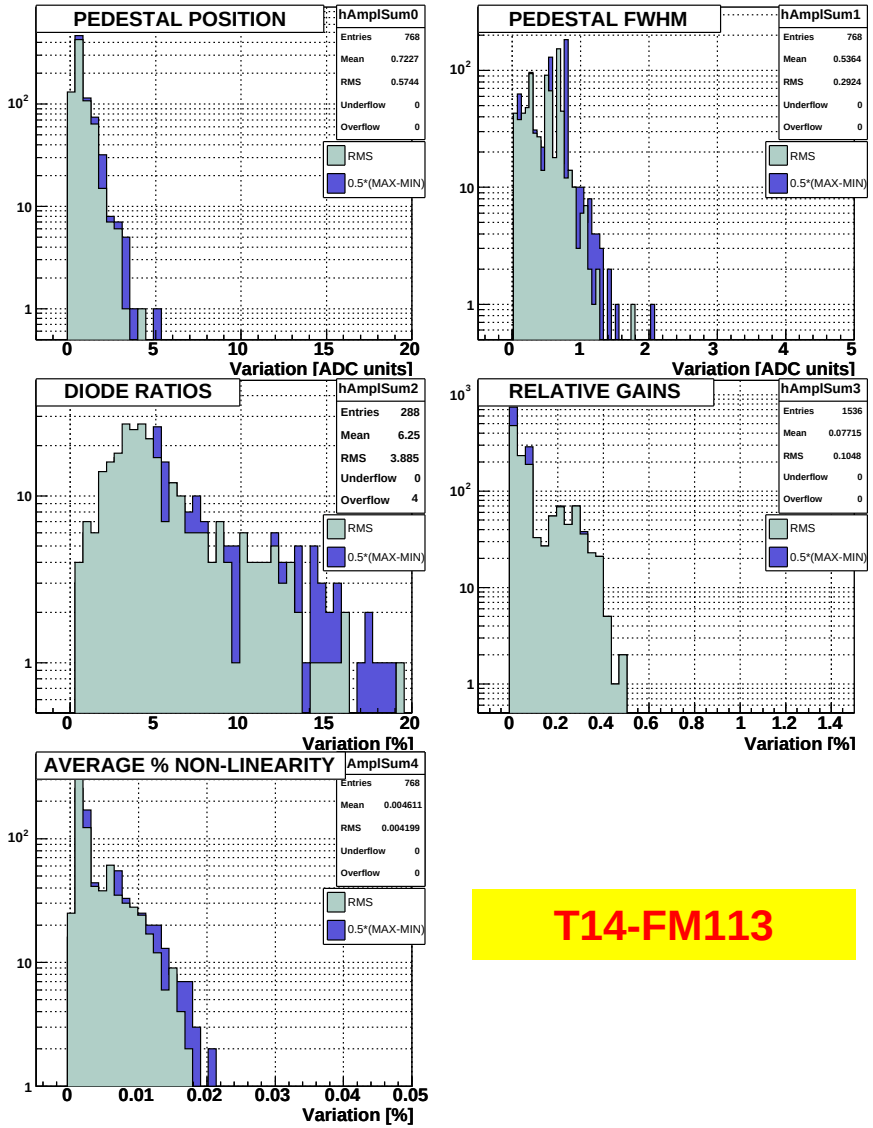
Trending CAL performance parameters from CPT's 8/10

T13-FM108 TIME EVOLUTION [Reference=grid16] summary (all channels)



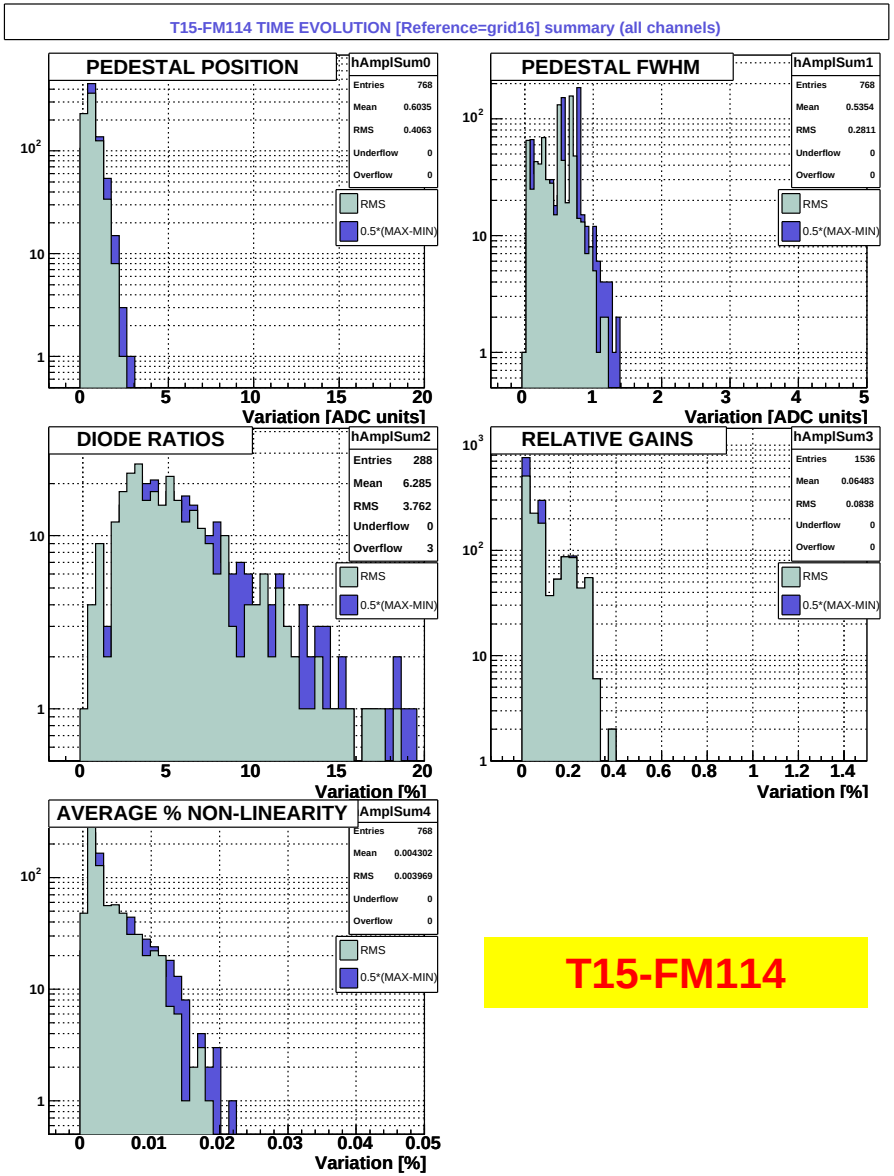
T13-FM108

T14-FM113 TIME EVOLUTION [Reference=grid16] summary (all channels)



T14-FM113

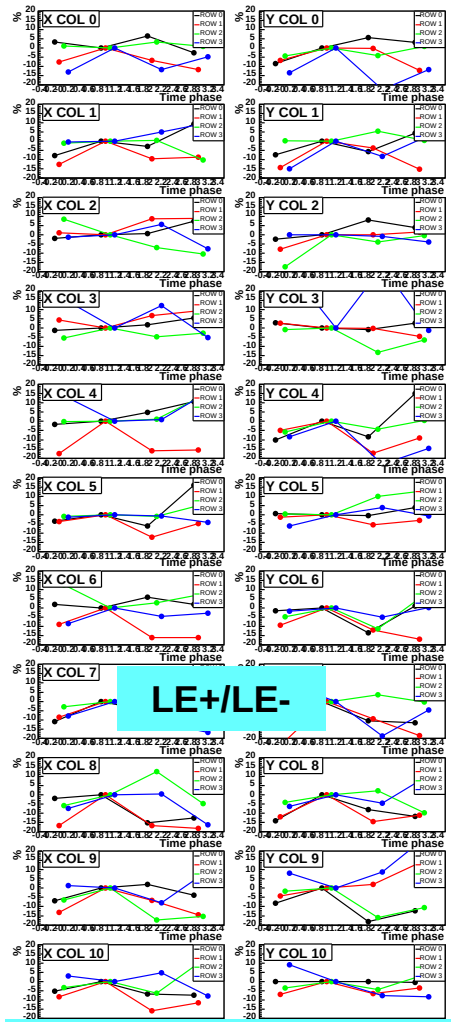
Trending CAL performance parameters from CPT's 9/10



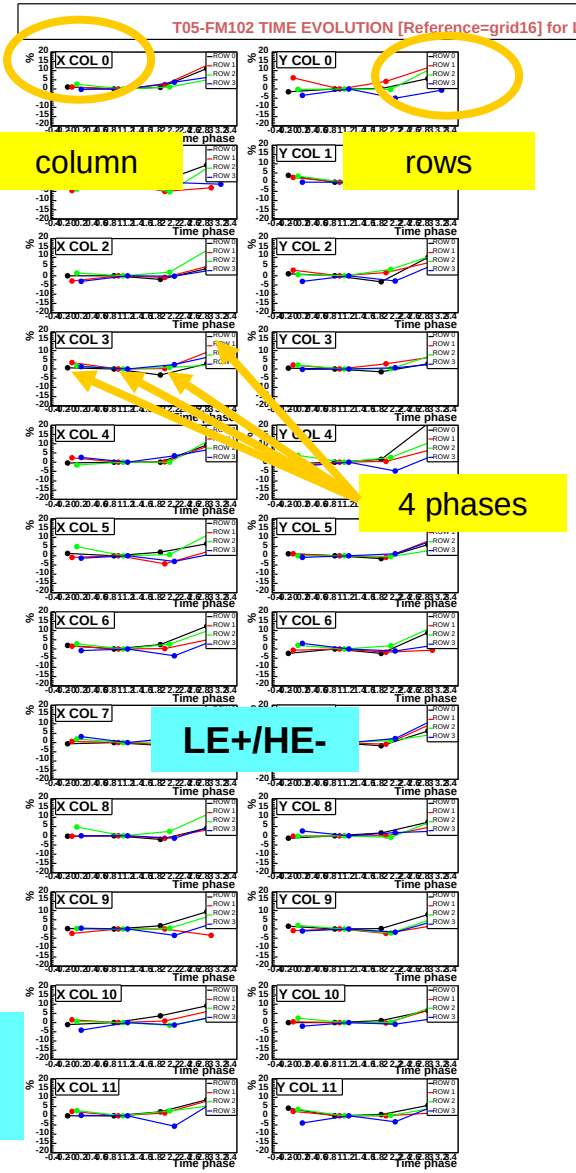
T15-FM114

Trending CAL performance parameters from CPT's 10/10

T05-FM102



LE+/LE-

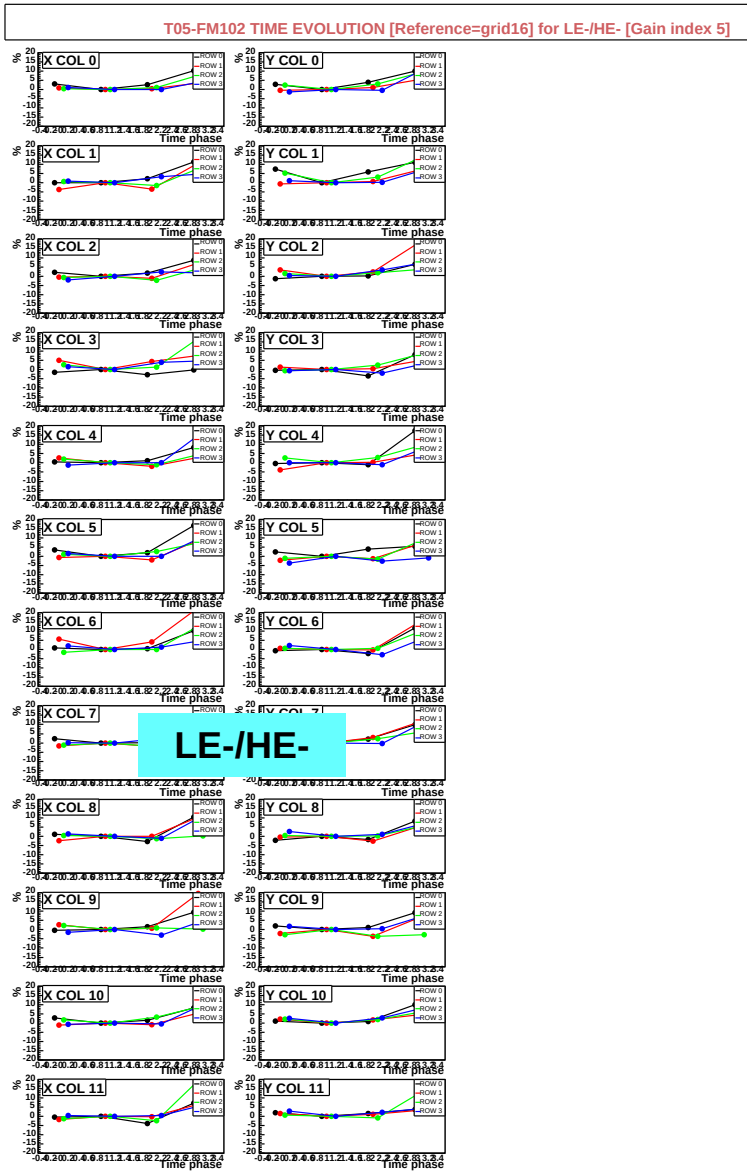


column

rows

4 phases

LE+/HE-



LE-/HE-

Largest variations seen for LE+/LE- (Cf IA workshop 5)

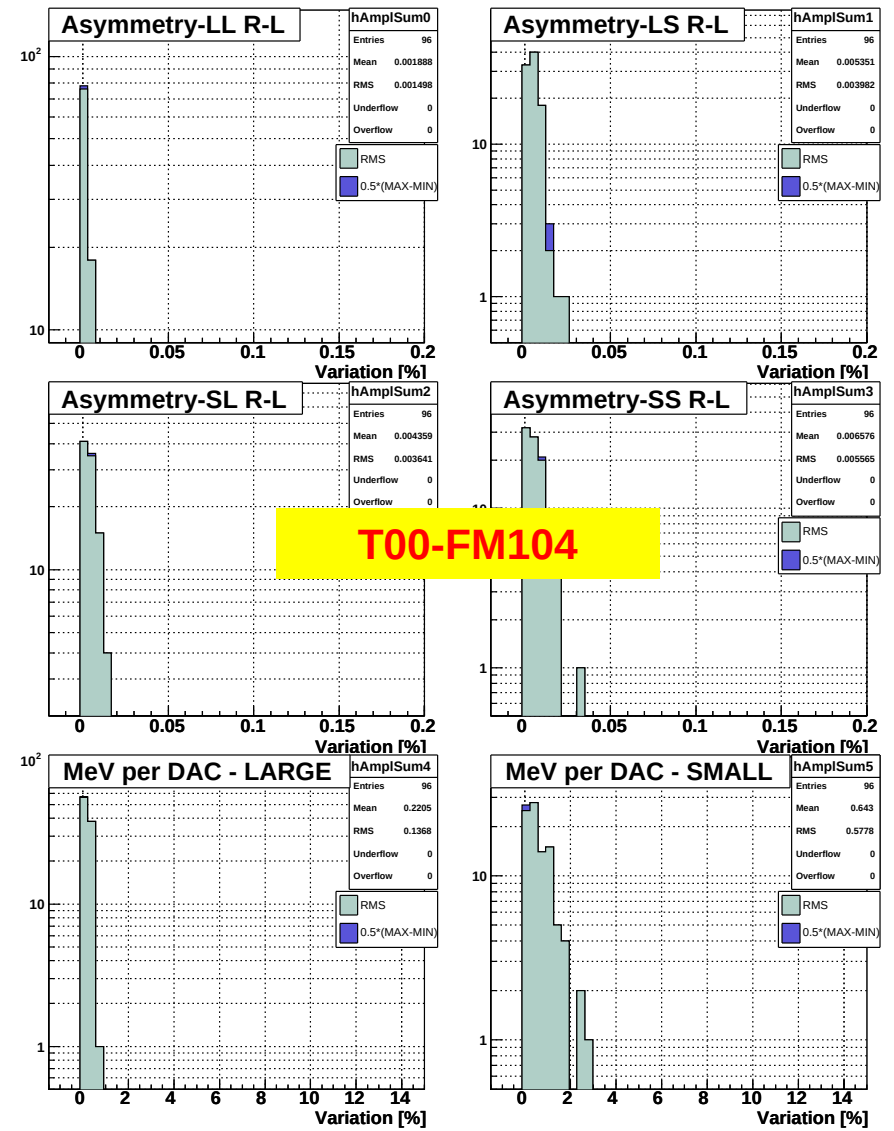
F. Piron & E. Nuss (LPTA)

Trending CAL performance parameters from calibration files 1/5

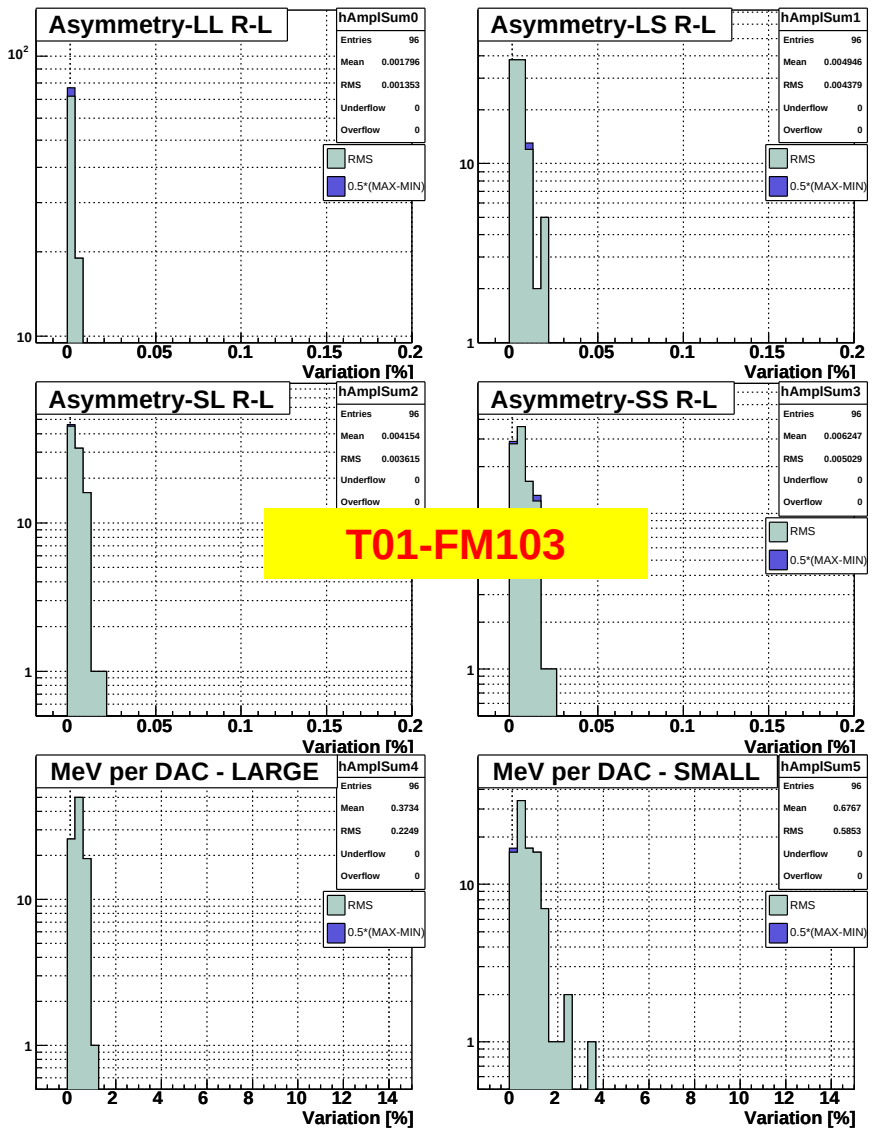
- **What do we trend ?**
  - **Characterize asymmetry functions for small (S) and large (L) diodes: we trend Right-Left amplitude**
  - **Energy calibration: we trend the small and large diode MeV per DAC constant**
- **Which phases ? 8T, 16T**
  - **Only for the 8 first modules so far…**

Trending CAL performance parameters from calibration files 2/5

T00-FM104 TIME EVOLUTION [Reference=16T] summary (all channels)

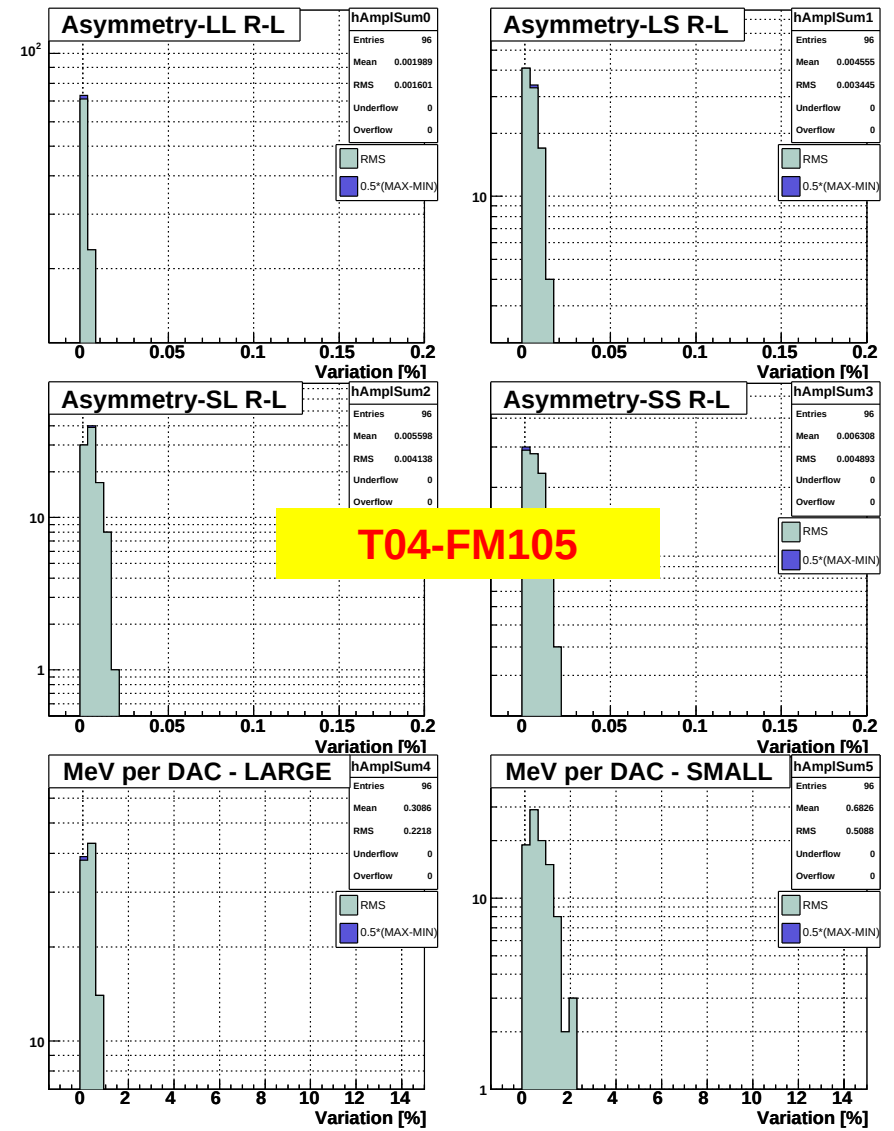


T01-FM103 TIME EVOLUTION [Reference=16T] summary (all channels)

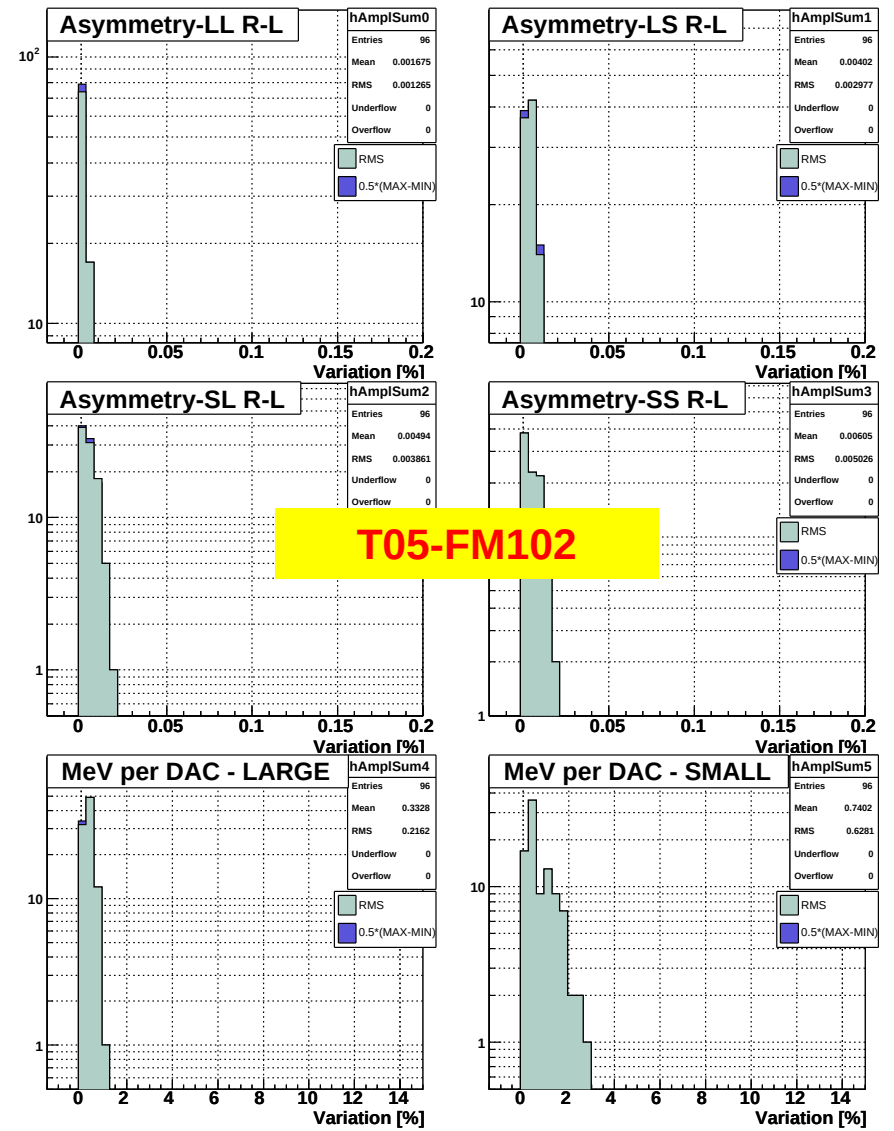


Trending CAL performance parameters from calibration files 3/5

T04-FM105 TIME EVOLUTION [Reference=16T] summary (all channels)

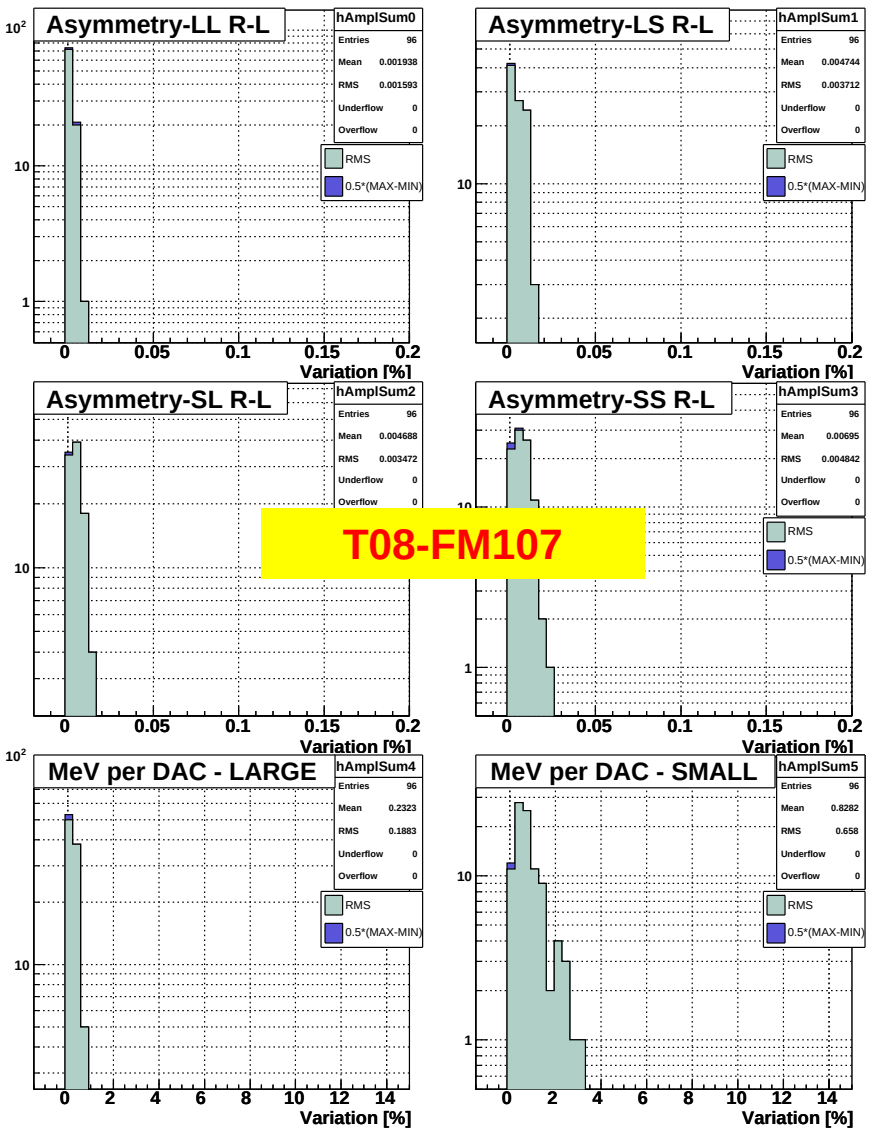


T05-FM102 TIME EVOLUTION [Reference=16T] summary (all channels)

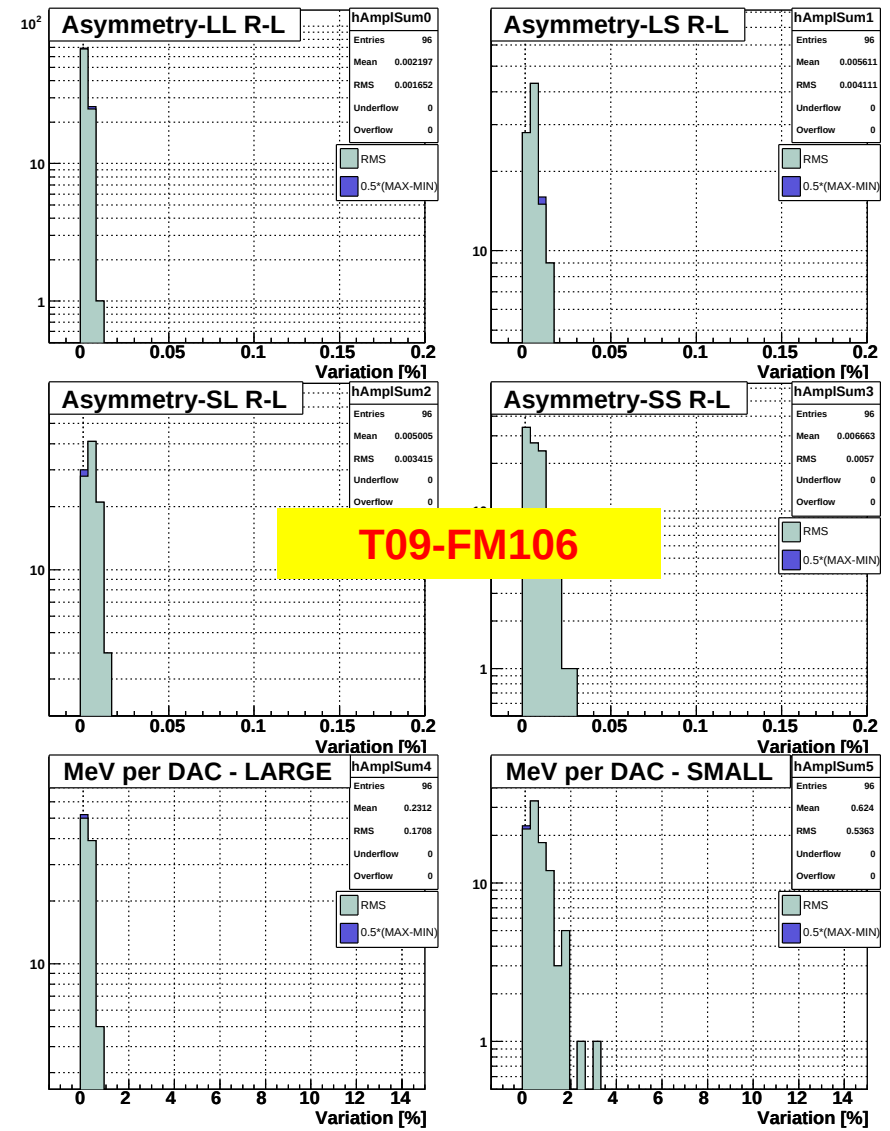


Trending CAL performance parameters from calibration files 4/5

T08-FM107 TIME EVOLUTION [Reference=16T] summary (all channels)

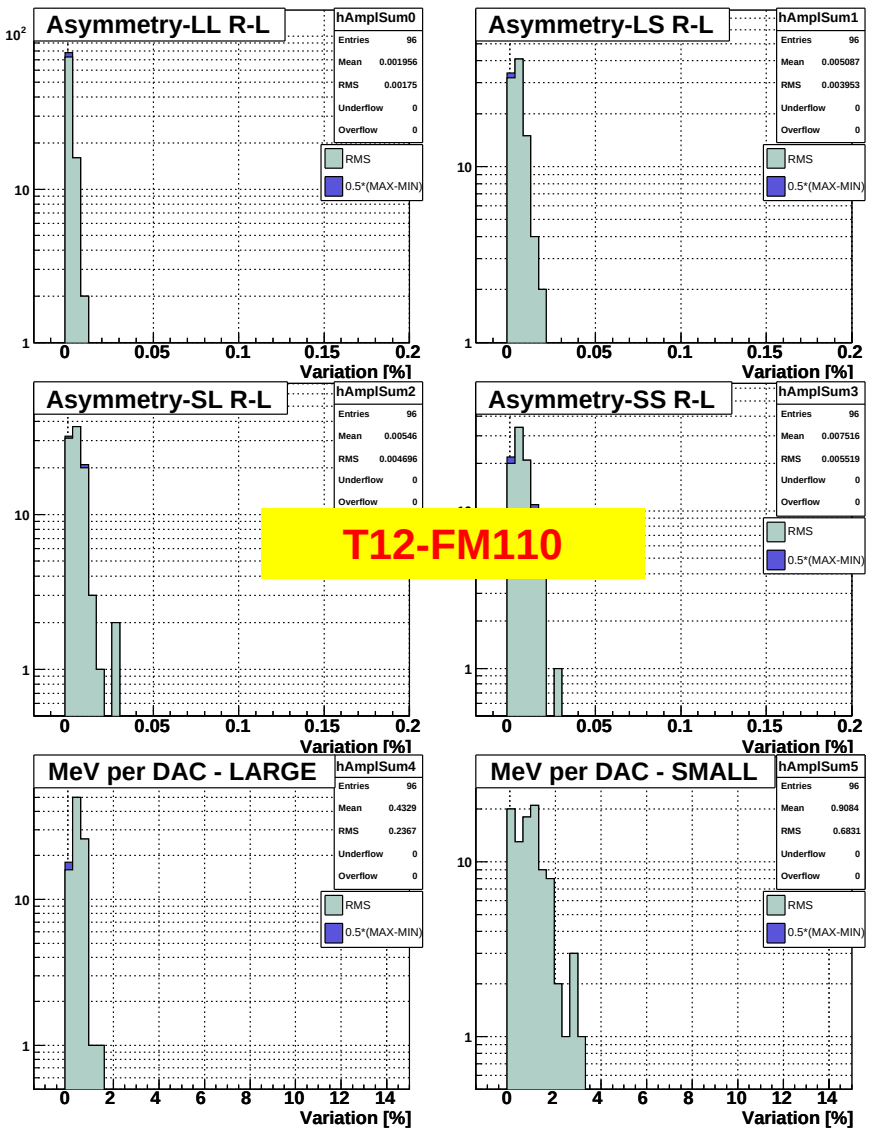


T09-FM106 TIME EVOLUTION [Reference=16T] summary (all channels)

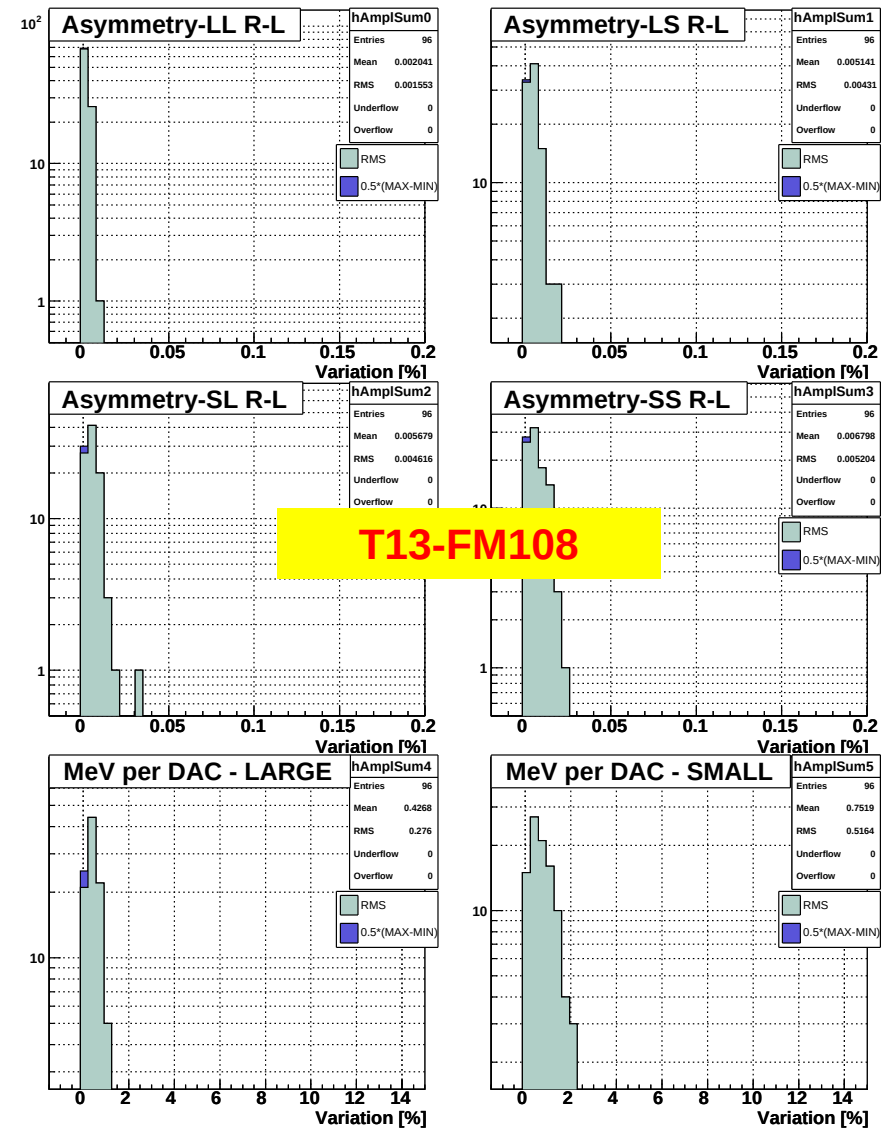


Trending CAL performance parameters from calibration files 5/5

T12-FM110 TIME EVOLUTION [Reference=16T] summary (all channels)



T13-FM108 TIME EVOLUTION [Reference=16T] summary (all channels)



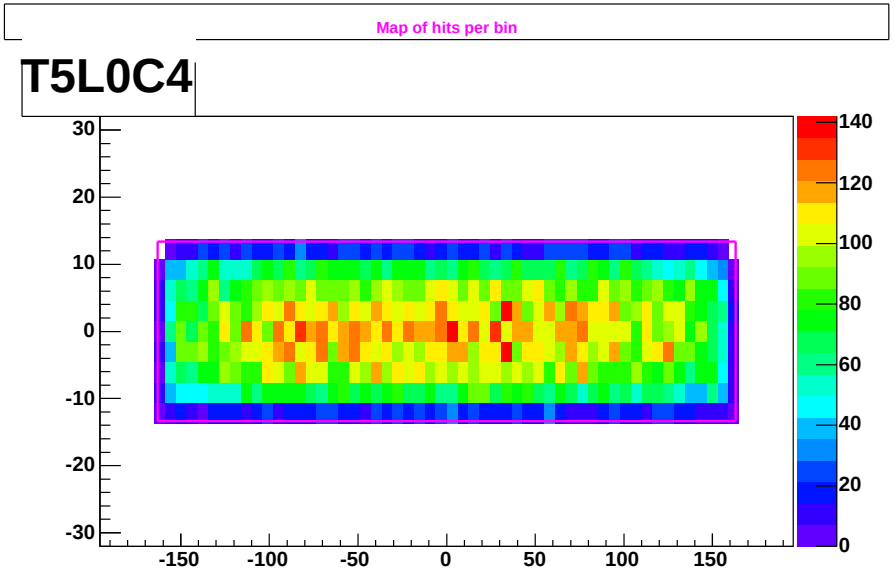
Mapping CAL crystals using TKR extrapolated tracks 1/5

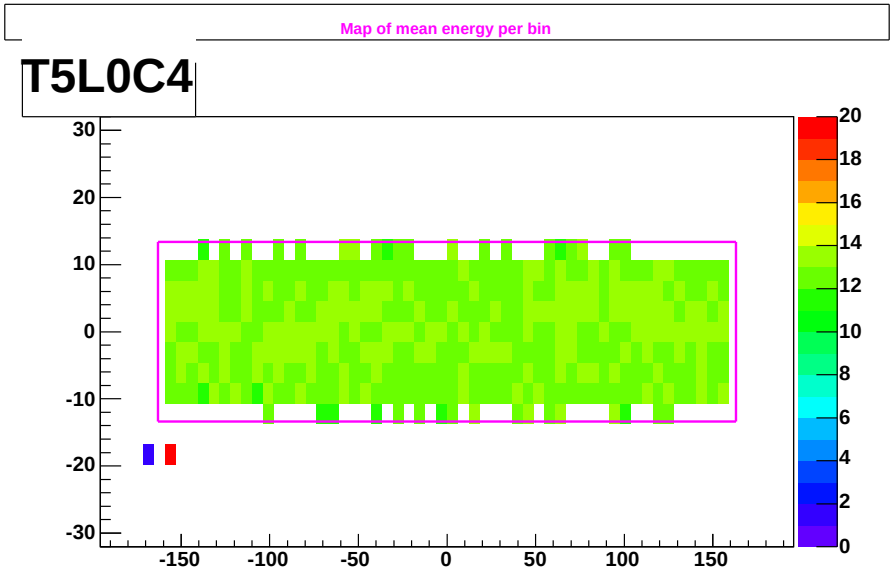
- Data set (Merit and Svac tuples, calib v1r0):
  - 2T : B2 + B10 + B13 = 20h, EM v3r3p0
  - 6T : B2 + B10 + B13 = 20h, EM v3r3p0
  - 8T : B2 + B10 + B13 = 20h, EM v3r3p1
  - 16T : B2 + B13 + B30 = 21h, EM v3r4p6

- Select events (% is given for 2 towers)
  - TkrNumTracks==1 (~80%)
  - >6 hits above 2 MeV in at least one tower (~25%)

- Use TKR extrapolated tracks (Tkr1XYZDir) to define hits in crystals:
  - Top and bottom faces must be crossed (no edges, no glancing hits)
  - Compute vertical equivalent deposited energy through path-length correction

Mapping CAL crystals using TKR extrapolated tracks 2/5





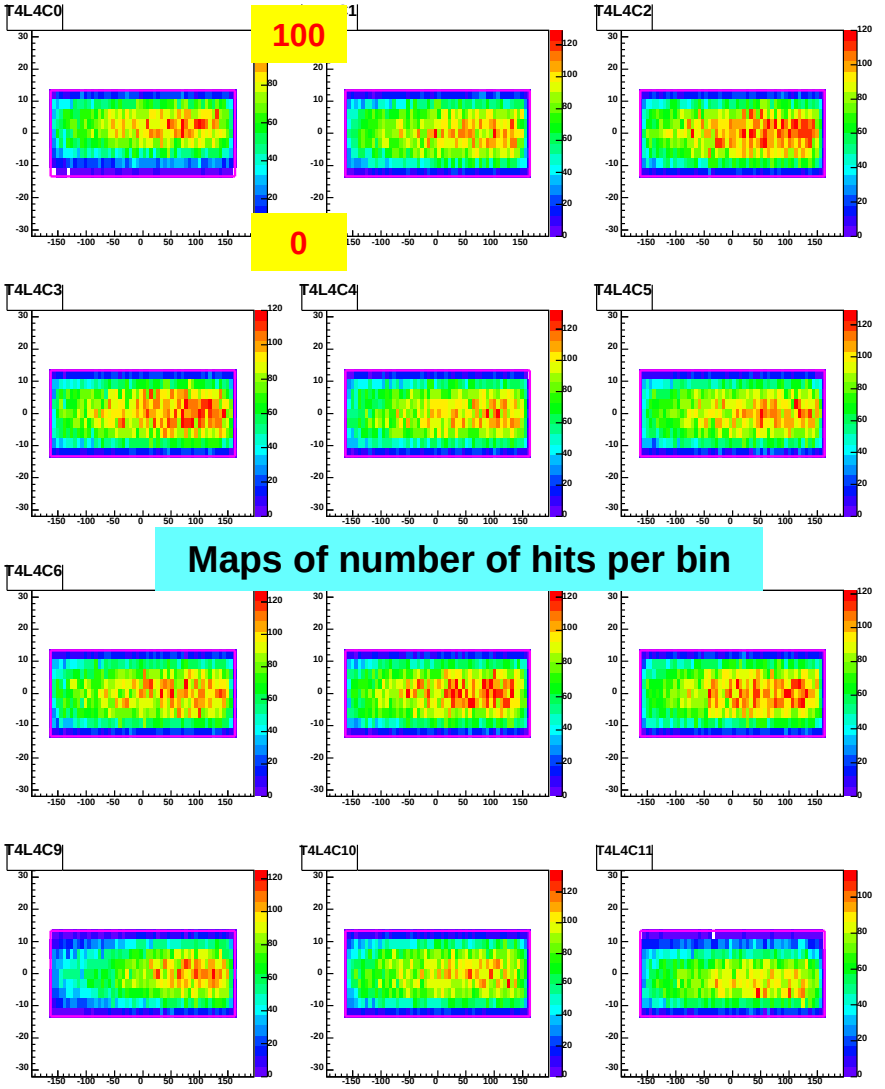
Divide each crystal in 9 (3mm) * 54 (6mm) bins

Map of number of hits per bin

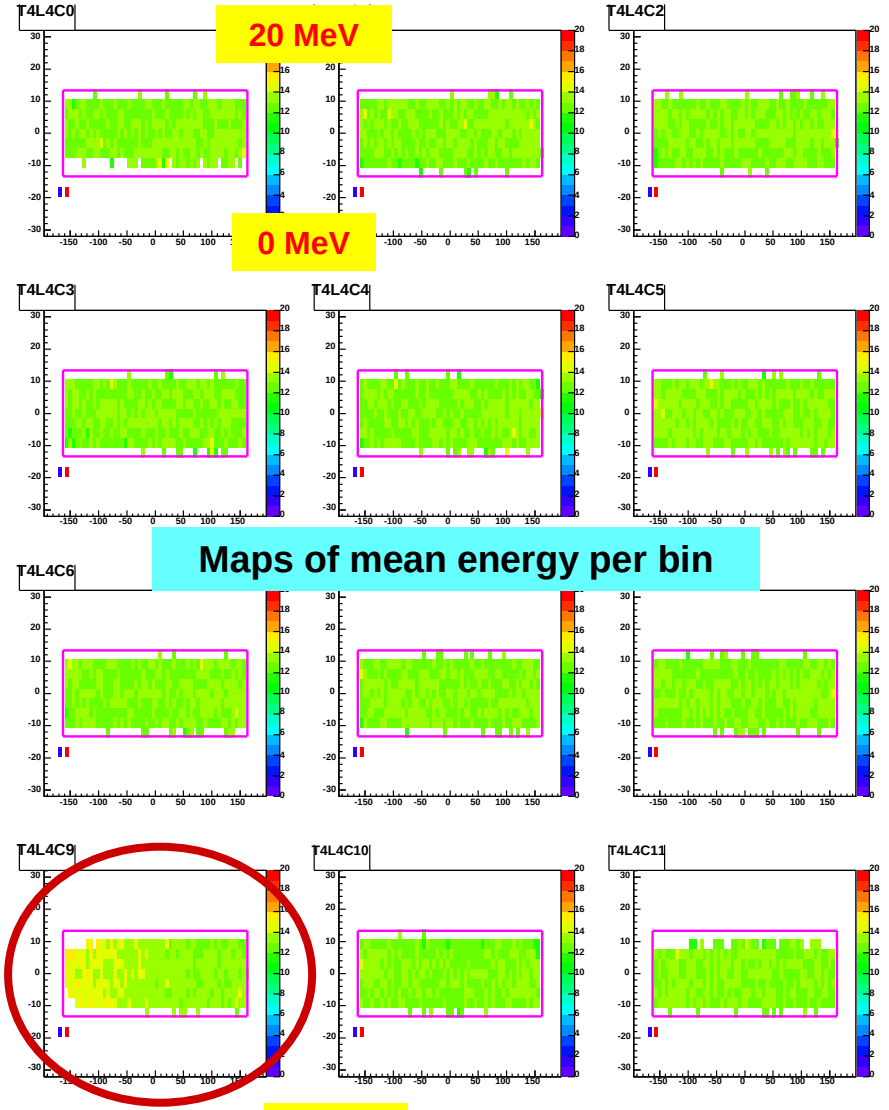
Map of mean energy per bin

Mapping CAL crystals using TKR extrapolated tracks 3/5

Map of hits per bin



Map of mean energy per bin

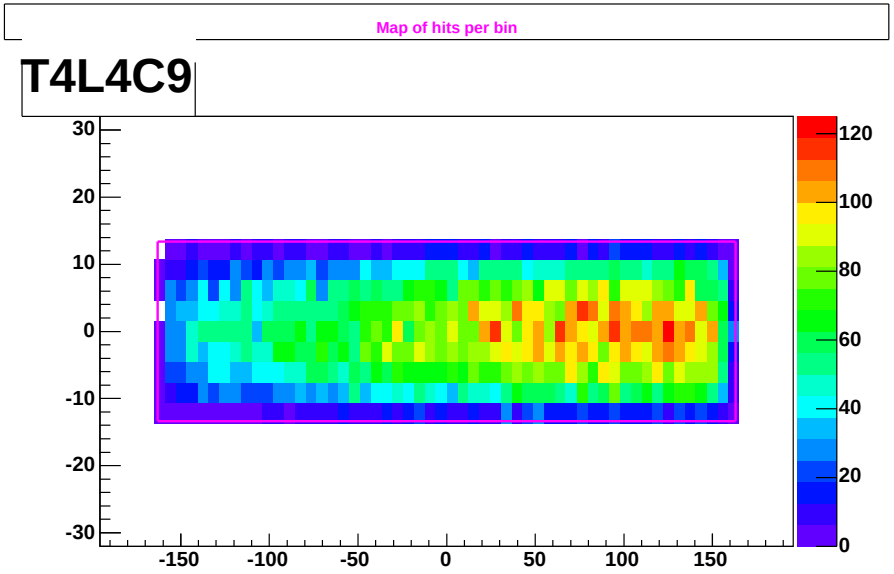


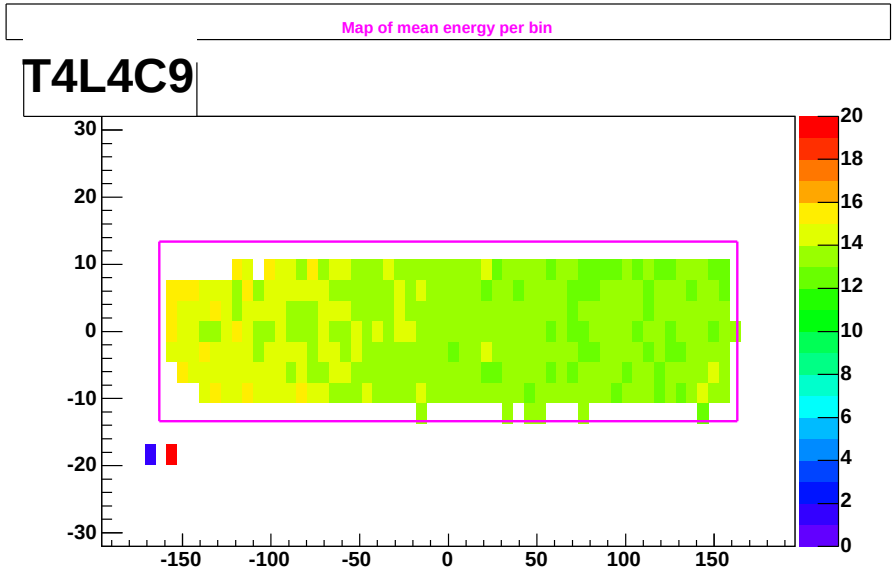
Maps of number of hits per bin

Maps of mean energy per bin

?

Mapping CAL crystals using TKR extrapolated tracks 4/5

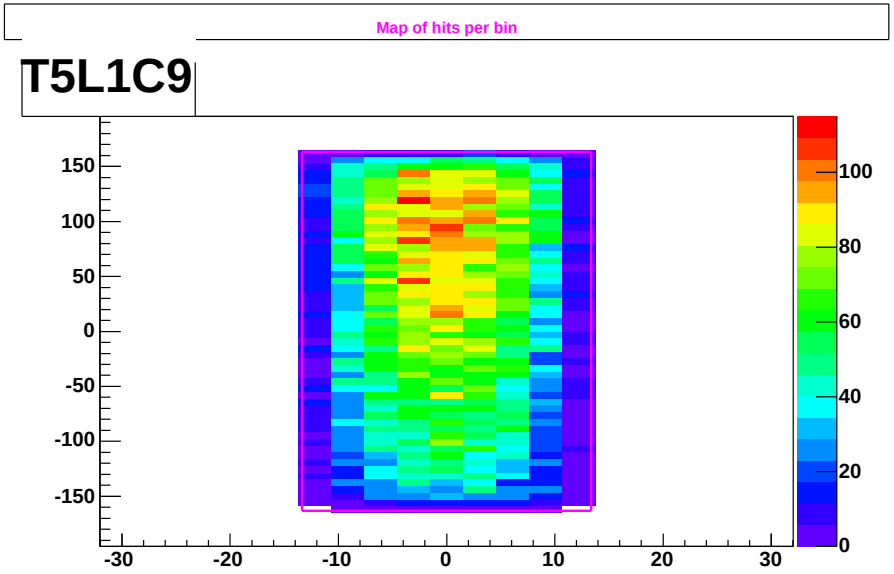


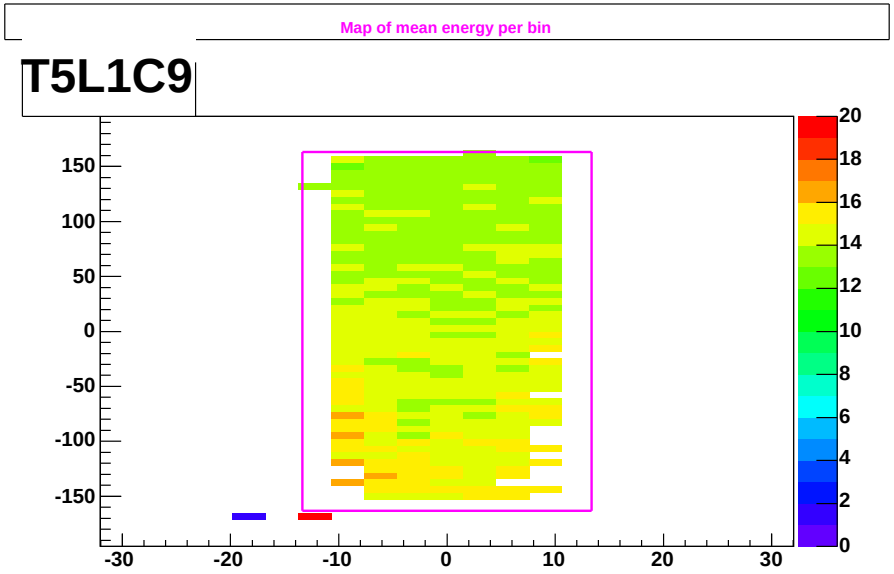


Map of number of hits per bin

Map of mean energy per bin

Mapping CAL crystals using TKR extrapolated tracks 5/5





Map of number of hits per bin

Map of mean energy per bin

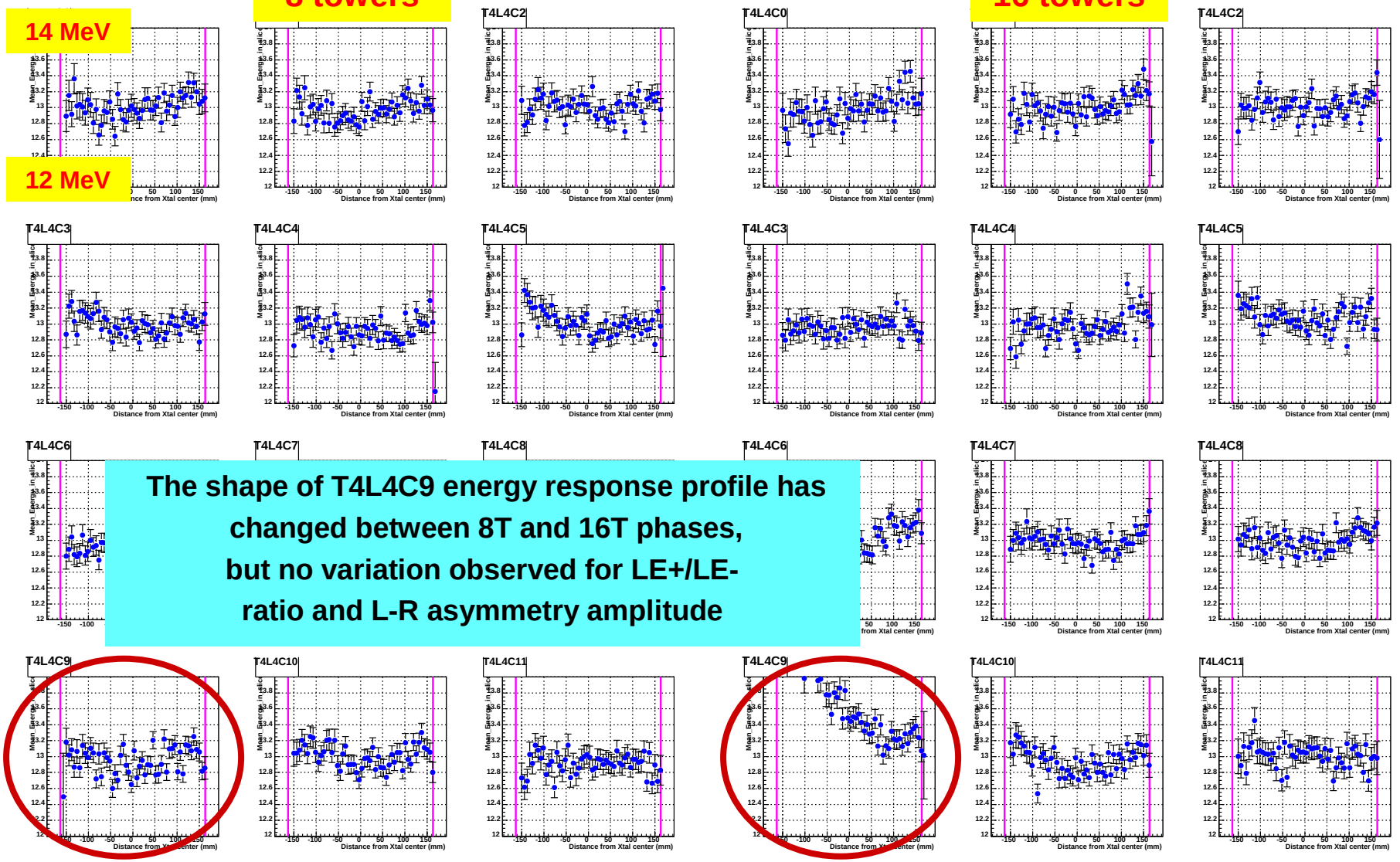
Crystal longitudinal energy response profiles (T4L4 logs)

8 towers

16 towers

14 MeV

12 MeV



The shape of T4L4C9 energy response profile has changed between 8T and 16T phases, but no variation observed for LE+/LE- ratio and L-R asymmetry amplitude

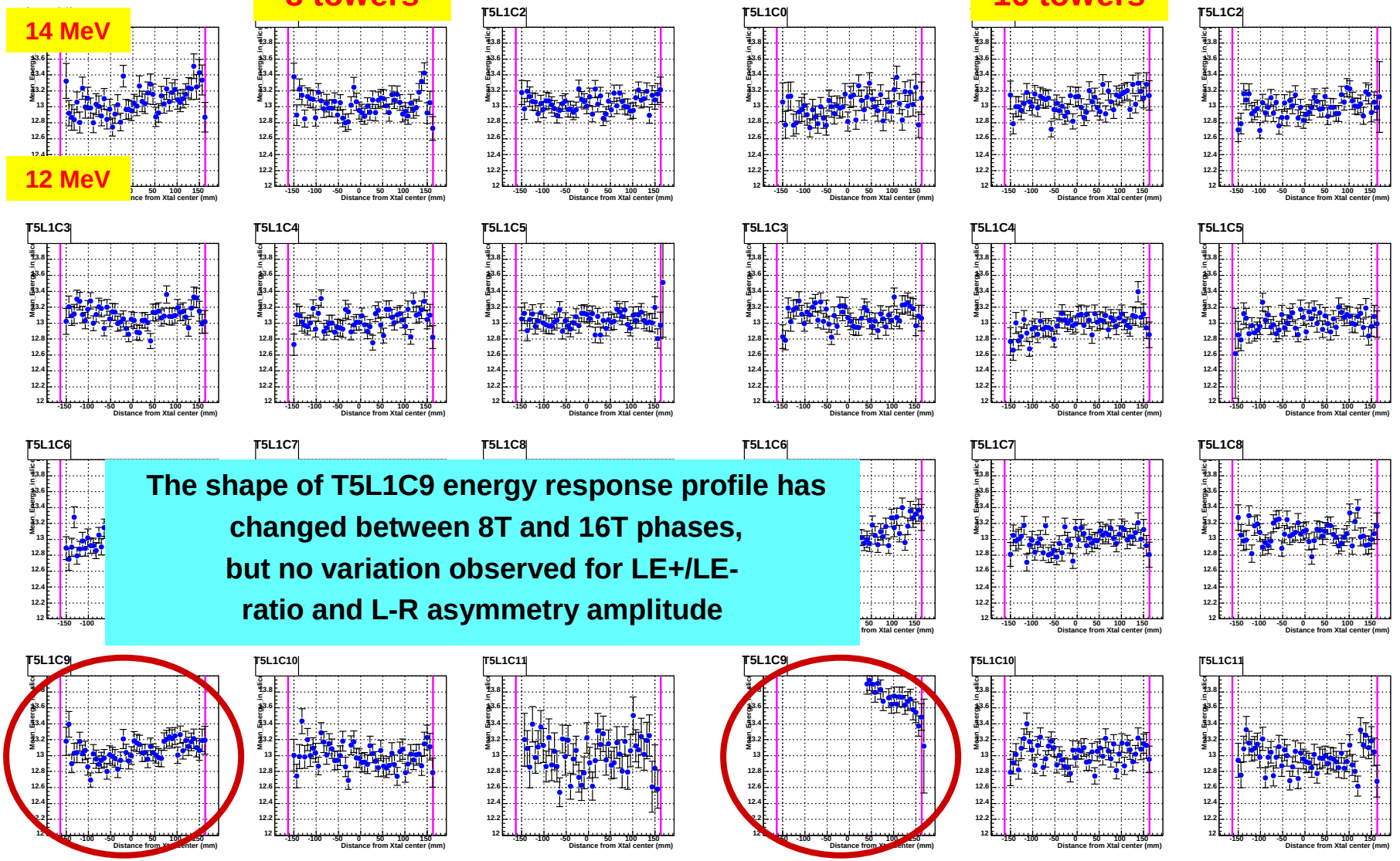
Crystal longitudinal energy response profiles (T5L1 logs)

8 towers

16 towers

14 MeV

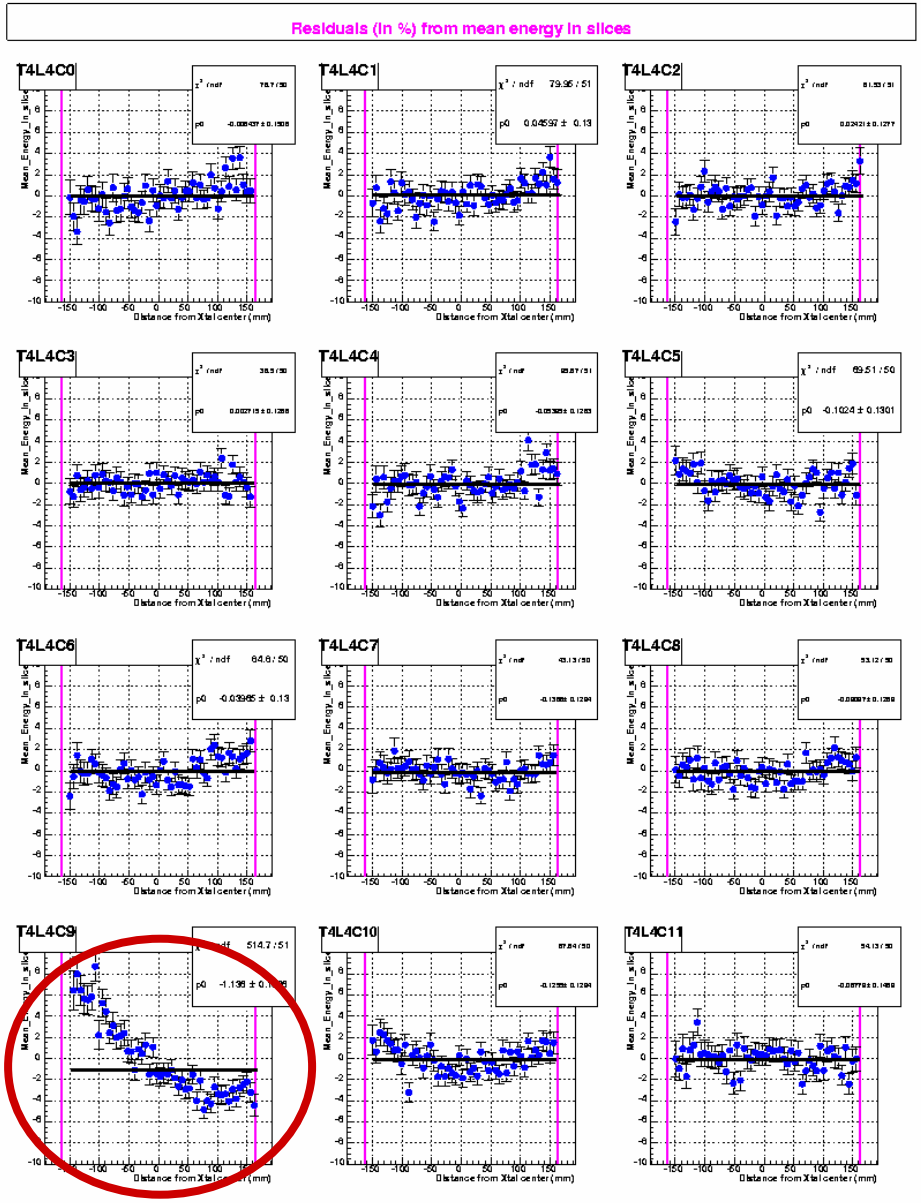
12 MeV



The shape of T5L1C9 energy response profile has changed between 8T and 16T phases, but no variation observed for LE+/LE- ratio and L-R asymmetry amplitude

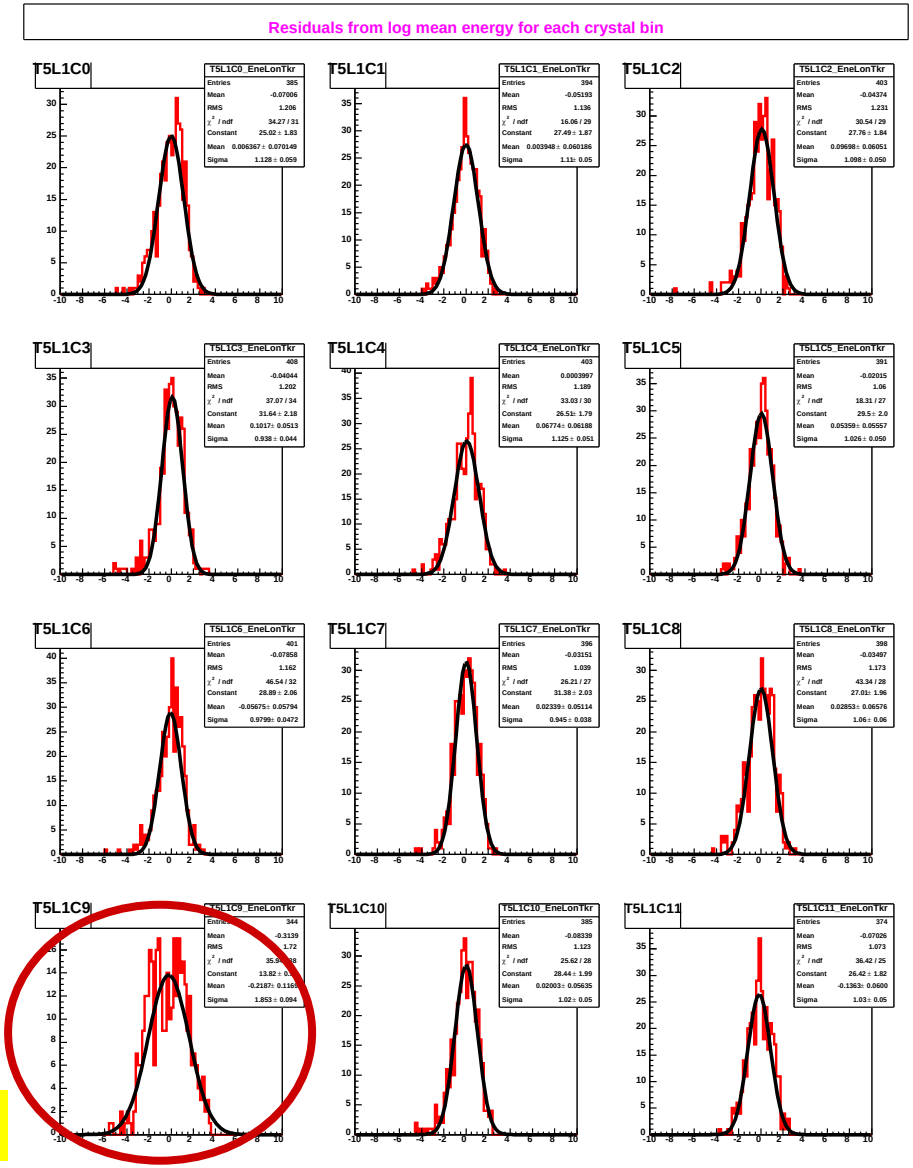
Quantifying inhomogeneity amplitude 1/2

- **Fit longitudinal energy response profile with a constant: χ^2**
  - **Actually fit residuals (not the same stat in all slices)**



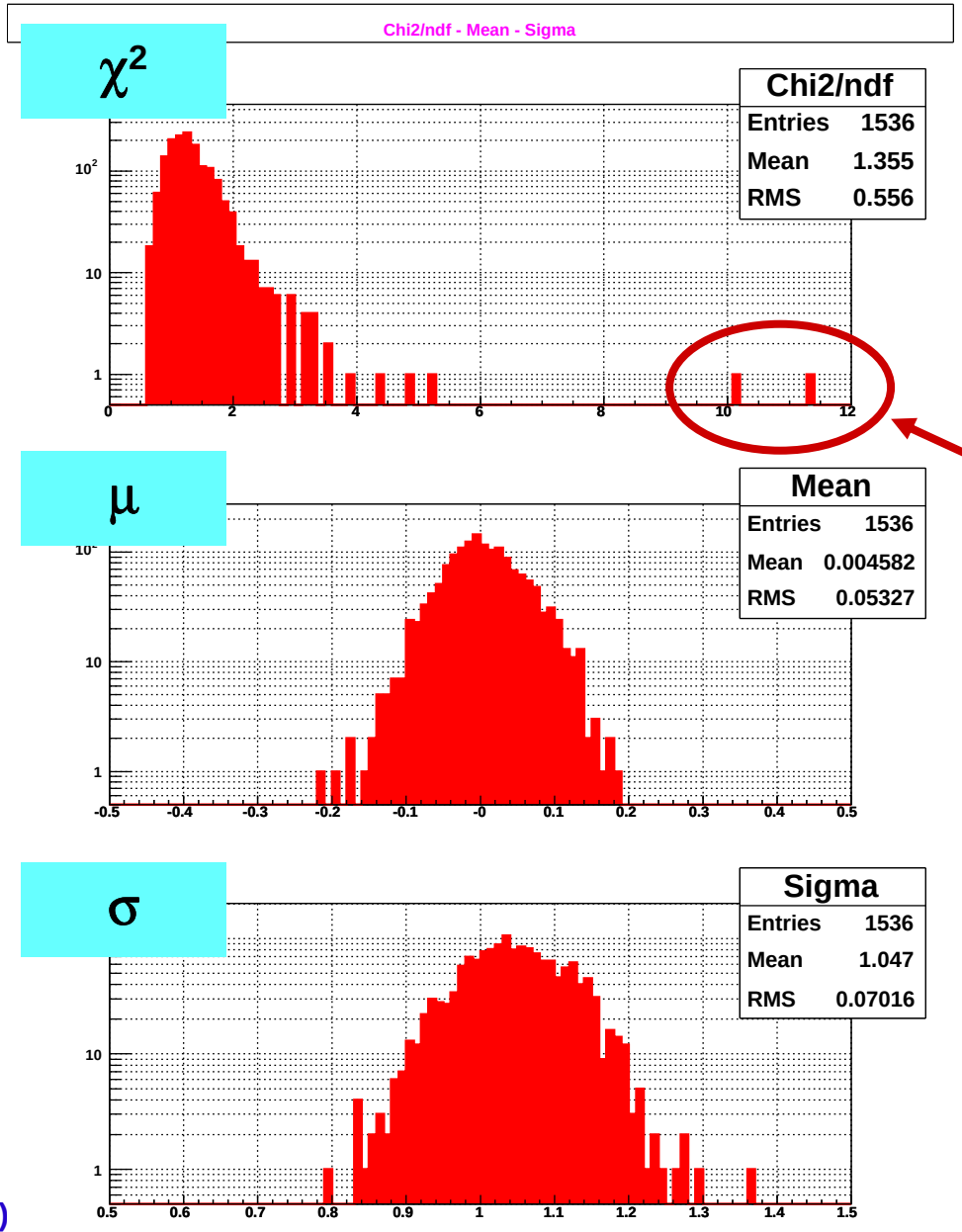
Quantifying inhomogeneity amplitude 2/2

- **Fit distribution of residuals with a gaussian function: expect μ~0 and σ~1**
  - **Here residuals are computed over the 9*54 bins (no slices)**



Calibration pb ?

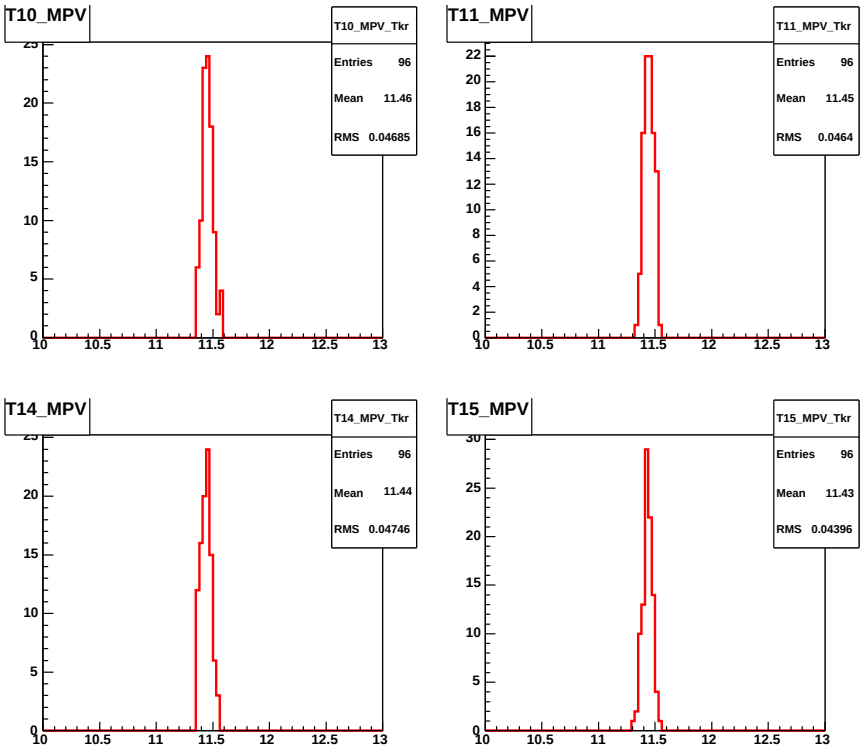
Quantifying inhomogeneity amplitude: results



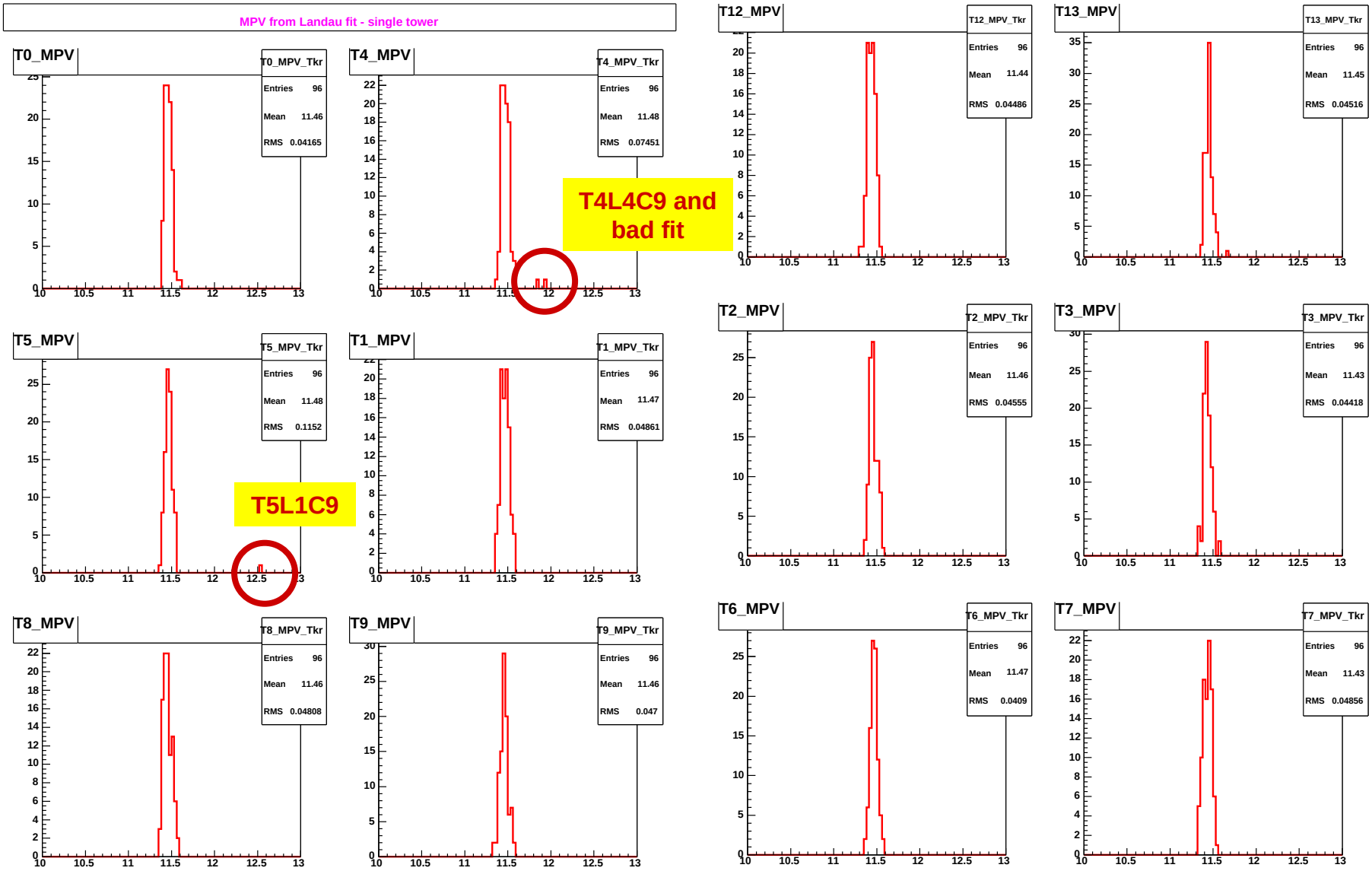
T4L4C9 and T5L1C9

Annex: distributions of MPV's 1/2

- For each log, fit a simple Landau function
  - MPV's slightly different from David's ones since function shape is a bit different
- For each module, plot distribution of MPVs
- <MPV> = 11.46 ± 0.02 MeV



Annex: distributions of MPV's 2/2



Conclusions

- **Trending and crystal mapping show that performances are stable**
  - **Performance trending:**
    - **definition of some parameters has been improved (e.g. asymmetry amplitude)**
    - **some variations observed in LE+/LE- ratio**
  - **Crystal mapping:**
    - **shows flat or very flat energy maps**
    - **2 anomalies found (among 1536 logs…), being investigated**
- **To do:**
  - **Add FM117 to CPT trending**
  - **Add 8 last towers to calibGenCal trending**
  - **Write a note !**