

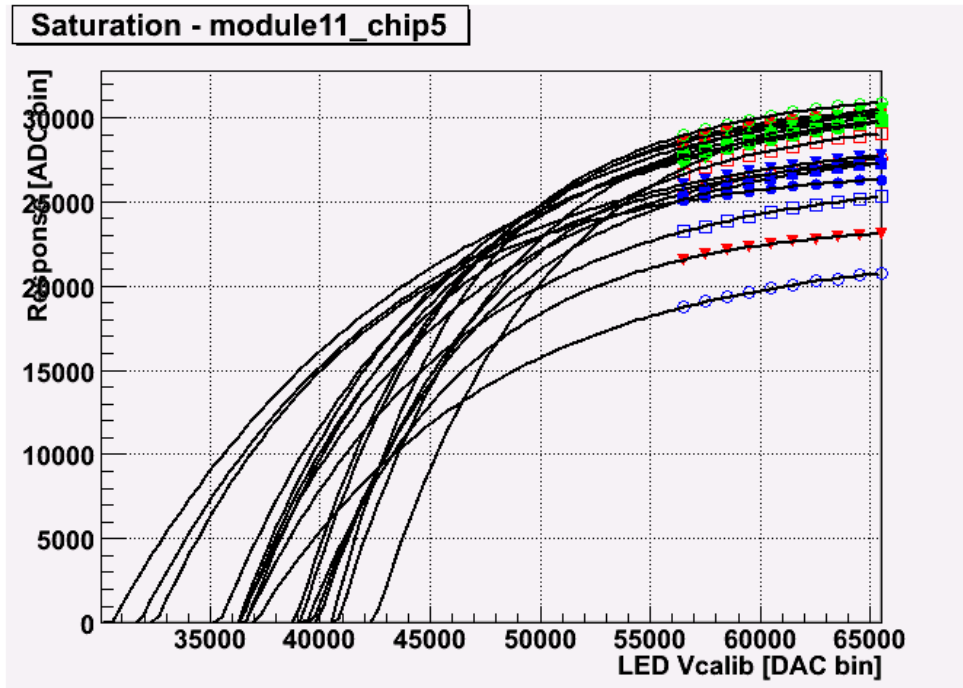
Saturation in V-calib LED scans

CALICE AHCAL – Main Meeting 2010/07/05

Jaroslav Zalesak

- analysis still in progress but gives global results
- FNAL & CERN Vcalib data
- Temperature corrected results
- Analysis improvement (fit ranges)
- New data just being measured (W-AHCAL)

LED V_calib scan



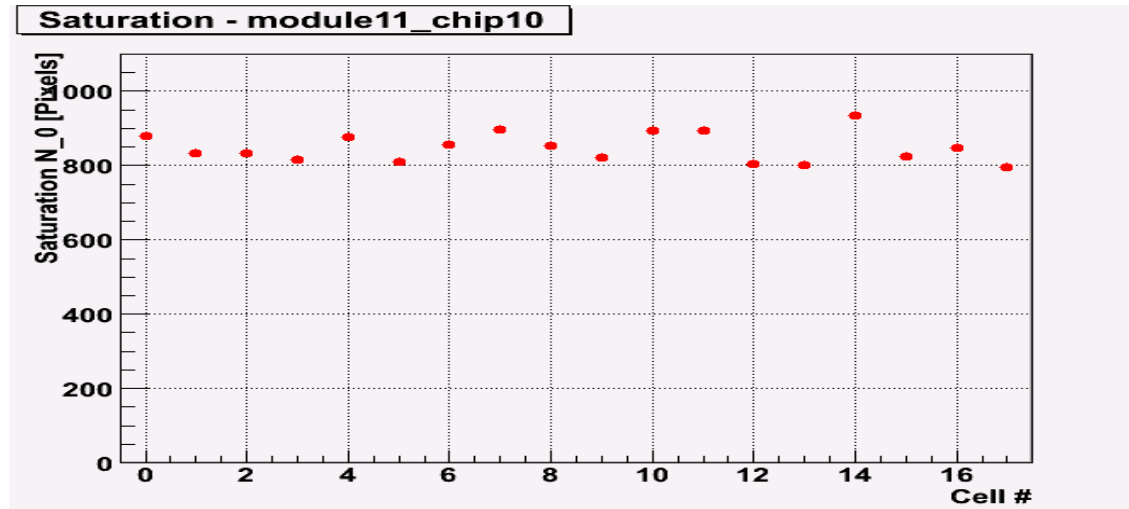
- Runs:
AhcPmLedVcalibScan

FNAL 2008 & 2009
CERN 2007 periods

- Fitted 10 last points
- Improvement
(Sliding fitting window)

- Simple Exponential formula for saturation:
- $F(\text{ADCbins}) = N_0 * [1 - \text{Exp}(-(\text{X} + \text{C}) * \text{B})]$ X in Vcalib (DAC) bins
- Parameter $N_0 \rightarrow$ 'Saturation' (Slope = $B * N_0$, Shift = $-C$)

Calibration in pixels



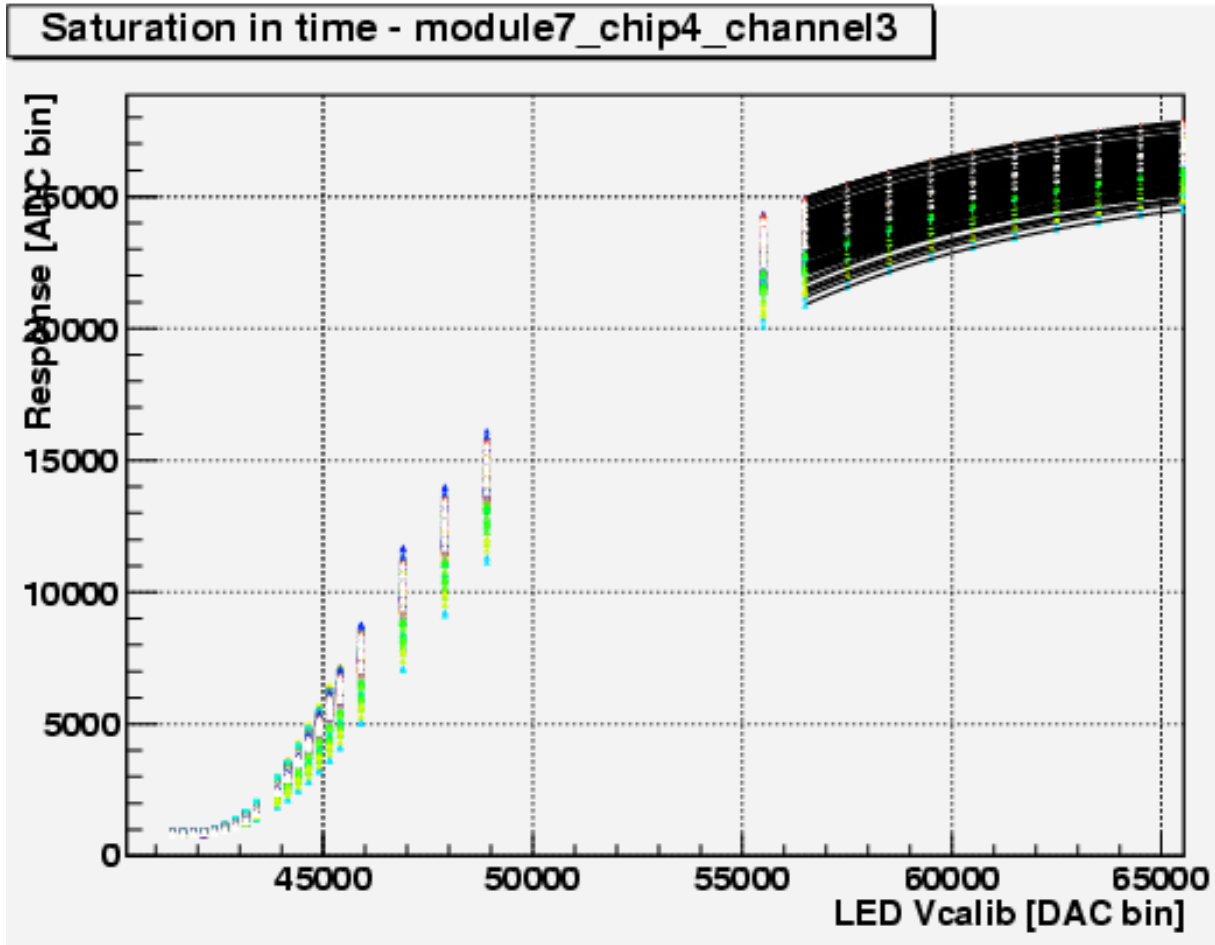
- Simple calibration formula: $\text{Sat}(\text{pixel}) = \text{Sat}(\text{ADC bins}) * \text{IC}(\text{run}) / \text{Gain}(\text{run})$
- $\text{CorrGainT} = \text{GainConst}[\text{Module}][\text{Chip}][\text{Channel}] + \Delta G$
- $\Delta G = \text{GainSlope}[\text{Module}][\text{Chip}][\text{Channel}] * \Delta T$
- $\Delta T = \text{VcalibRunTemp}[\text{Module}] - \text{GainRunTemp}[\text{Module}][\text{Chip}][\text{Channel}]$

- Calibration constants (GainConst+GainSlope) and Temperatures taken from DB with tool "dumpCalib" (2 sets of calib runs for FNAL & CERN, resp.)

Procedure

- Good runs: FNAL 144, CERN 66 (full Vcalib range)
- Good events - curves:
 - Tags: graph, fit function, $\text{Chi}^2(\text{Ndf} \neq 0)$ available
 - Calibration constants, slopes & Temperatures exist in DB for ch.
 - No saturated curves: no ADC saturation + smooth increasing fce
 - Fit parameters lay in (wide) ranges: saturation, shift, slope, errors
 - At least one good fitted curve among run in the groups
- FNAL: 6361 & CERN: 6211 channels (of tot. 7608)
 - sample runs #500722 & #330710: 3783 & 3512 ch.

Performance & Stability



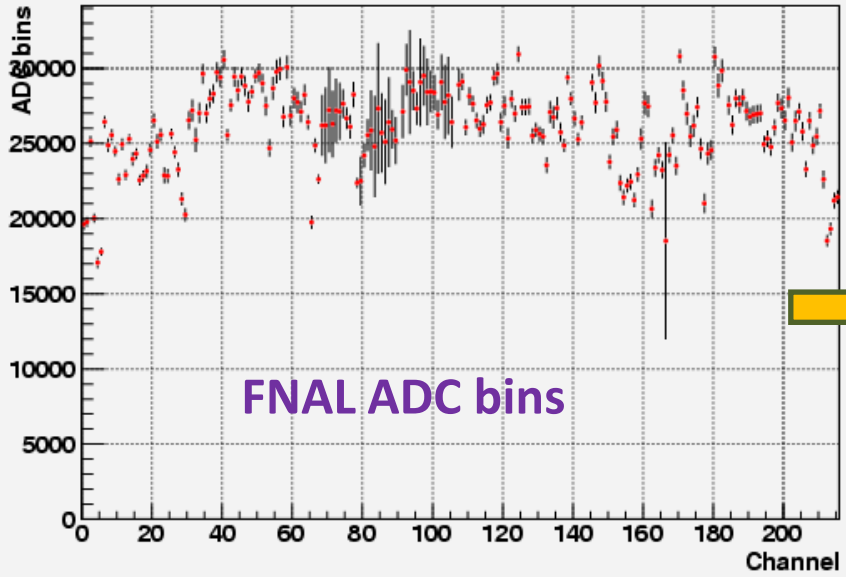
144 fits (FNAL)
for each channel

- for 'good' runs similar behaviour (variations in y-axis scale factors)
- application of Cal & T to have unique curves

Results I: ADCbins, Pixels, PixelsT...

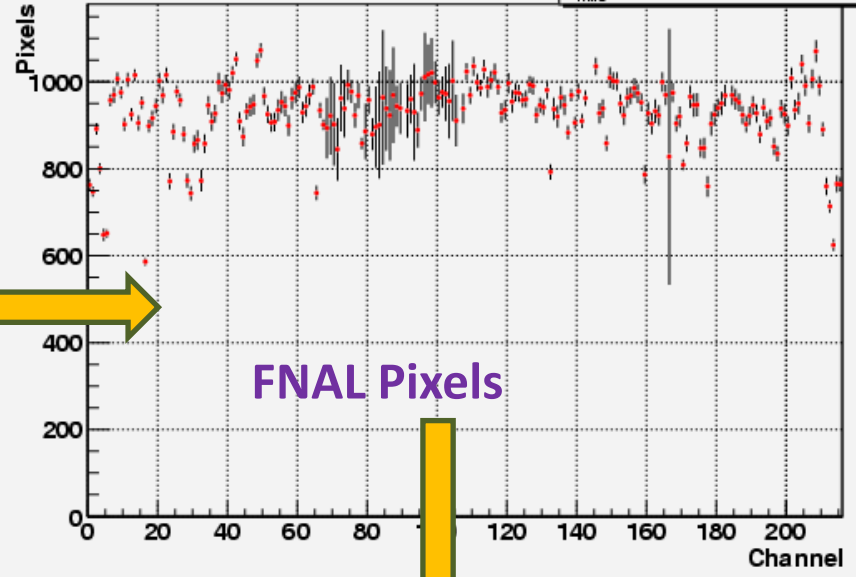
ALL FNAL Vcalib runs, Module 7

hpy1	
Entries	211
Mean	107.1
RMS	61.58



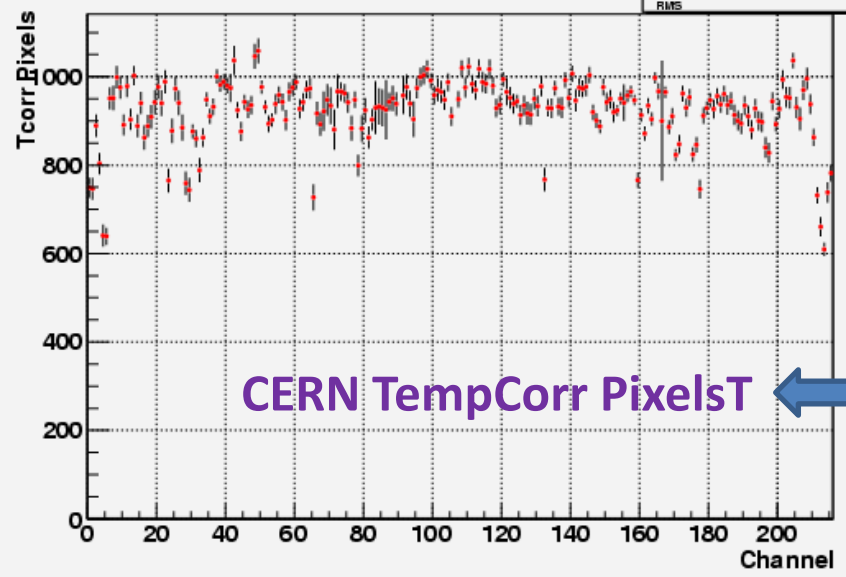
ALL FNAL Vcalib runs, Module 7

hpy1	
Entries	211
Mean	107.1
RMS	61.89



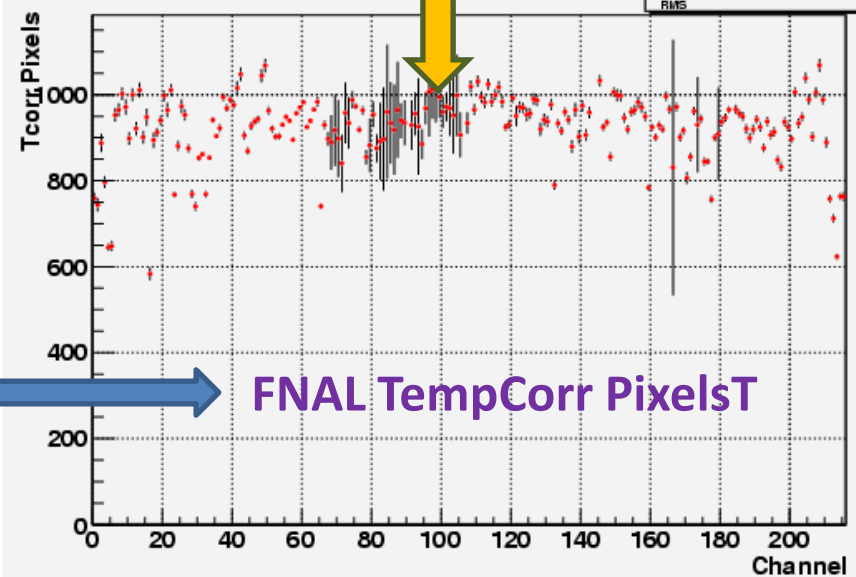
ALL CERN Vcalib runs, Module 7, Temp corr

hpy1	
Entries	214
Mean	107.5
RMS	61.71



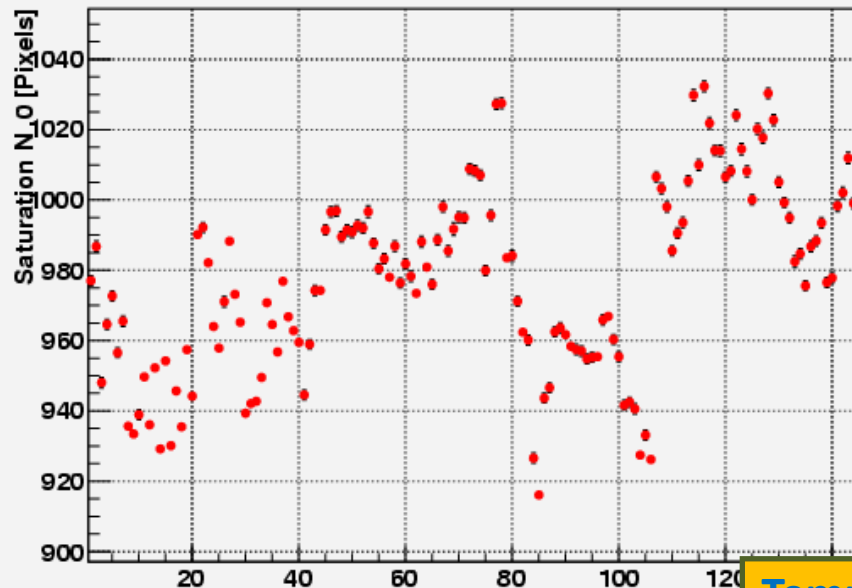
ALL FNAL Vcalib runs, Module 7, Temp corr

hpy1	
Entries	211
Mean	107.1
RMS	61.89

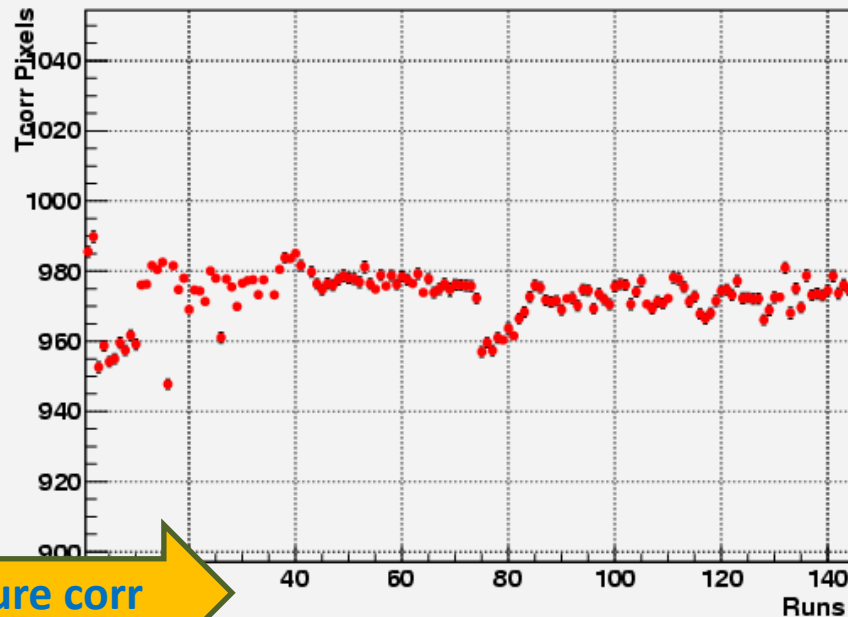


Results II: Temperature correction

Saturation in Time - module7_chip4_channel3

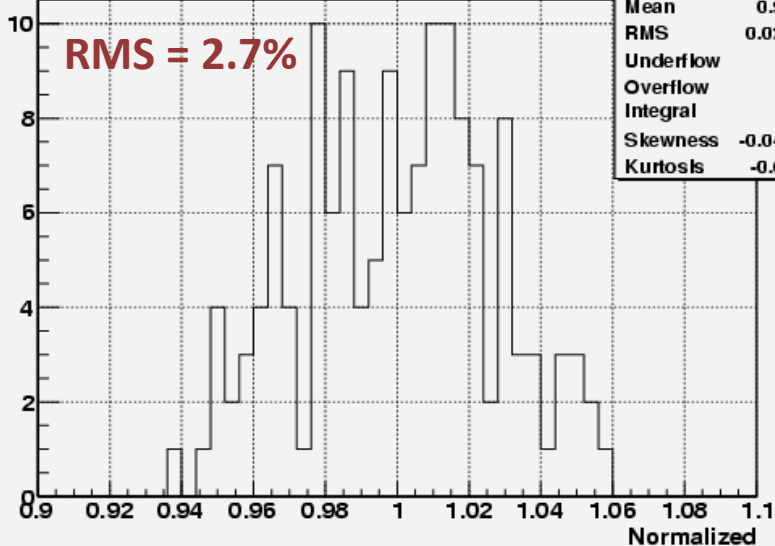


ALL FNAL Vcalib runs, Temp corrected, m07a04c03



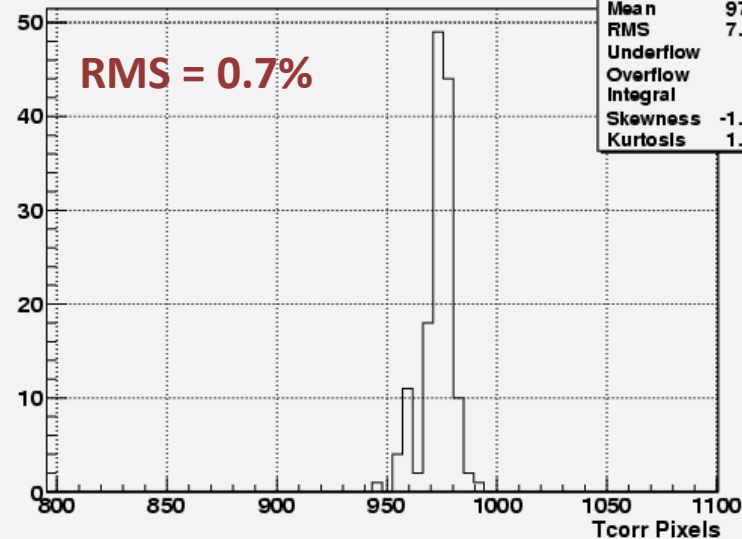
Temperature corr

ALL FNAL Vcalib runs, m07a04c03



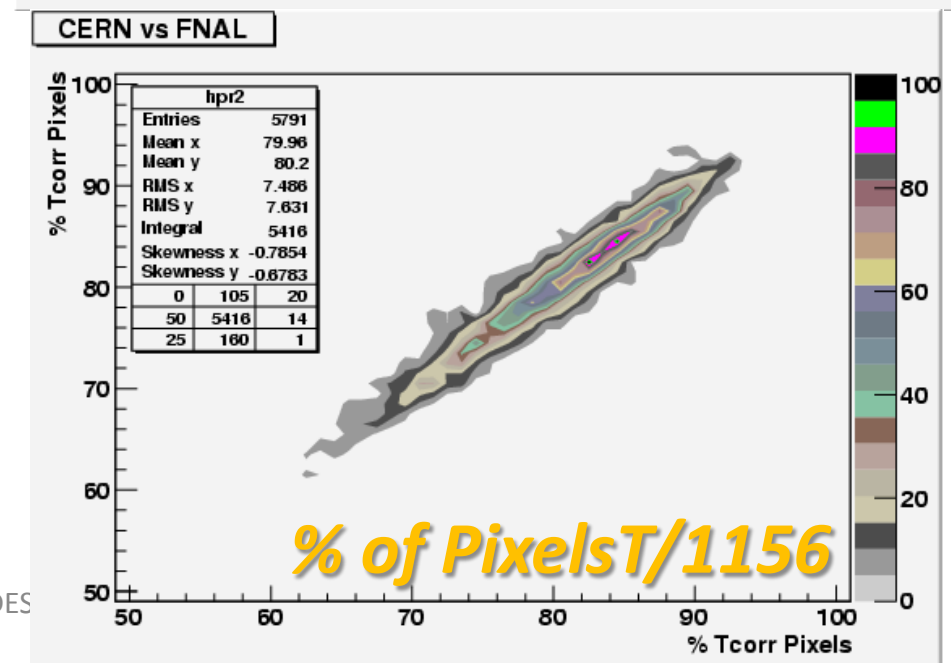
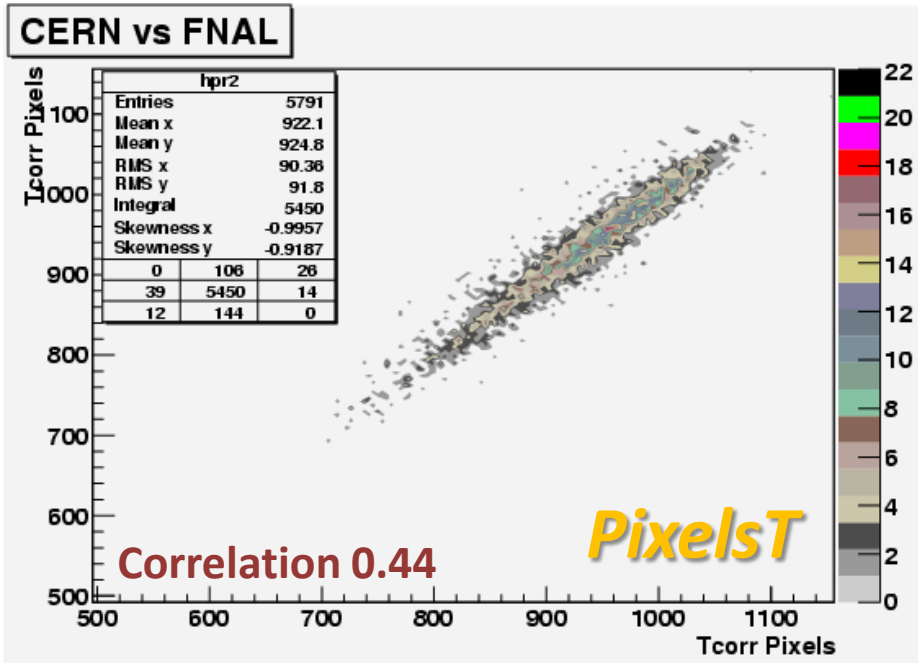
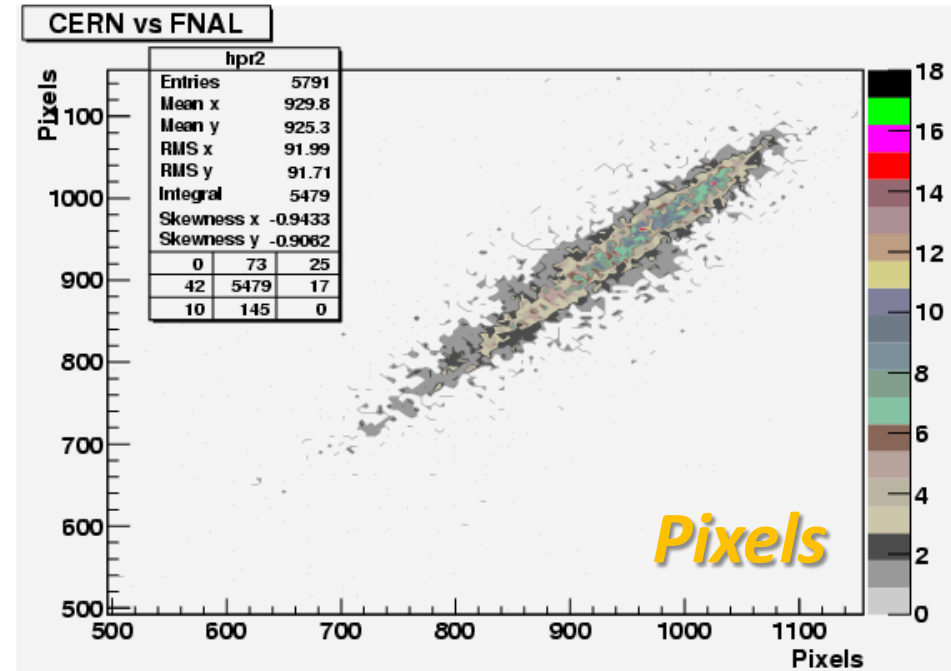
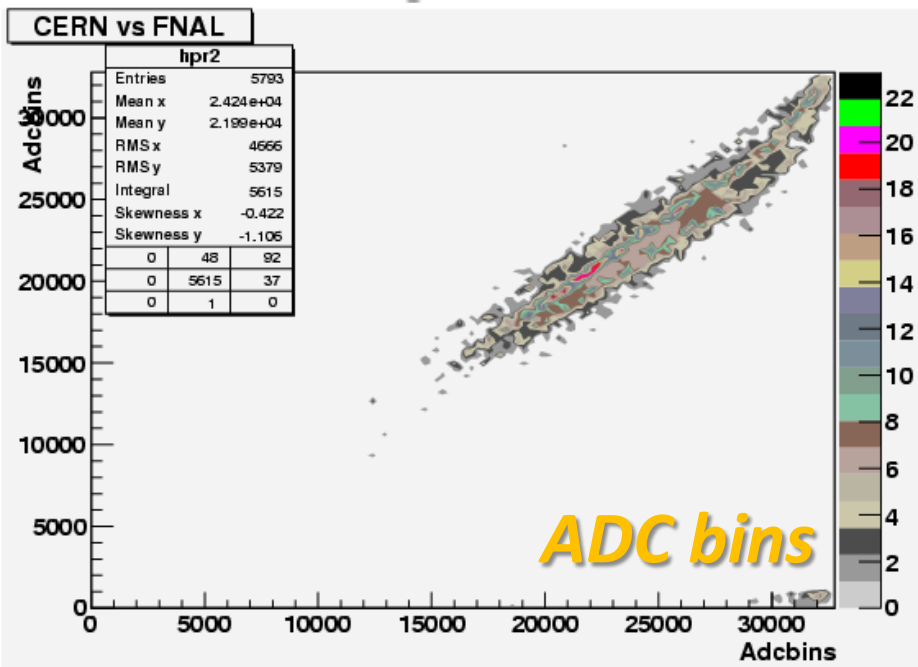
hpy1	
Entries	144
Mean	0.9999
RMS	0.02687
Underflow	0
Overflow	0
Integral	144
Skewness	-0.04459
Kurtosis	-0.6618

ALL FNAL Vcalib runs, m07a04c03



hpy1	
Entries	144
Mean	973.3
RMS	7.186
Underflow	2
Overflow	0
Integral	142
Skewness	-1.012
Kurtosis	1.632

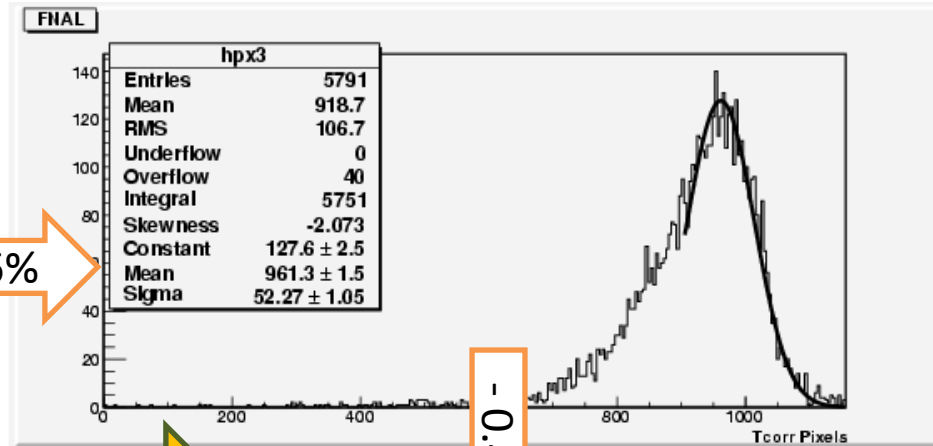
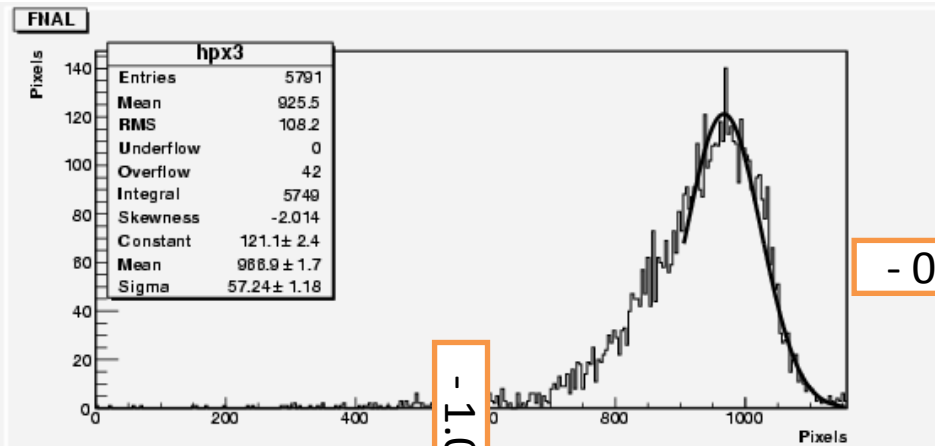
Comparison I: FNAL versus CERN - 2D



Comparison II: FNAL versus CERN - 1D

Pixels FNAL

Pixels Tcorr FNAL

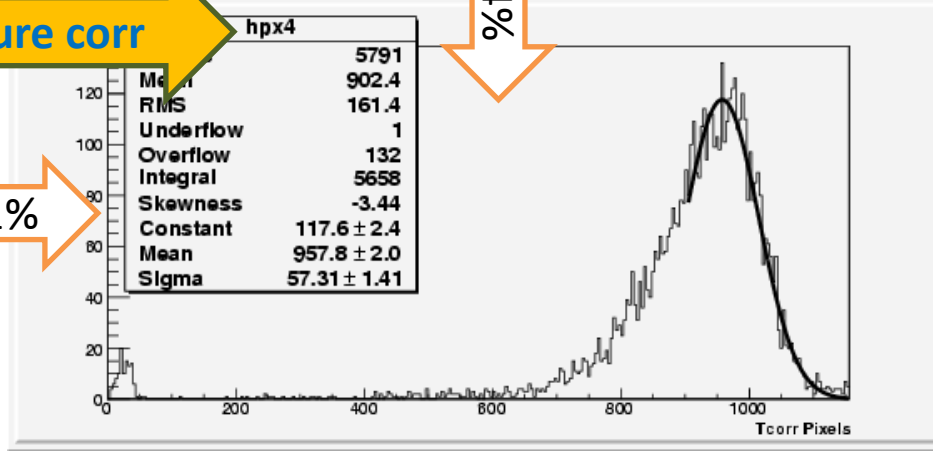
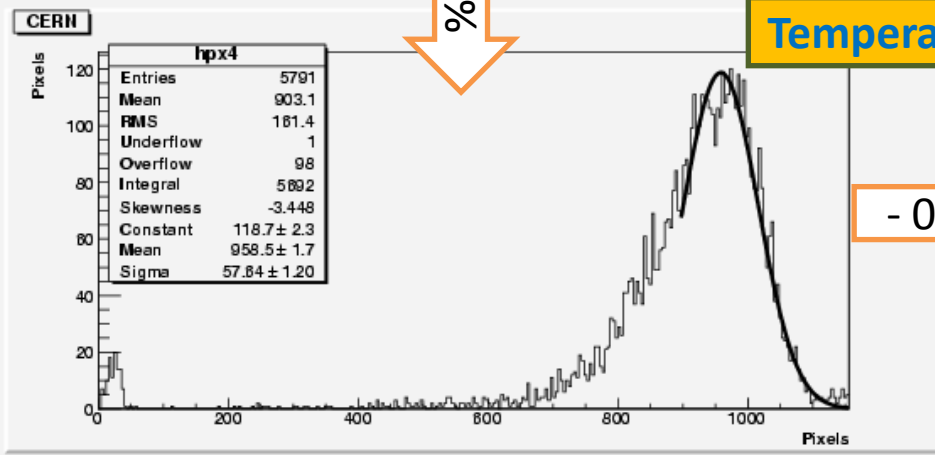


- 0.6%

- 1.0%

- 0.4%

Temperature corr



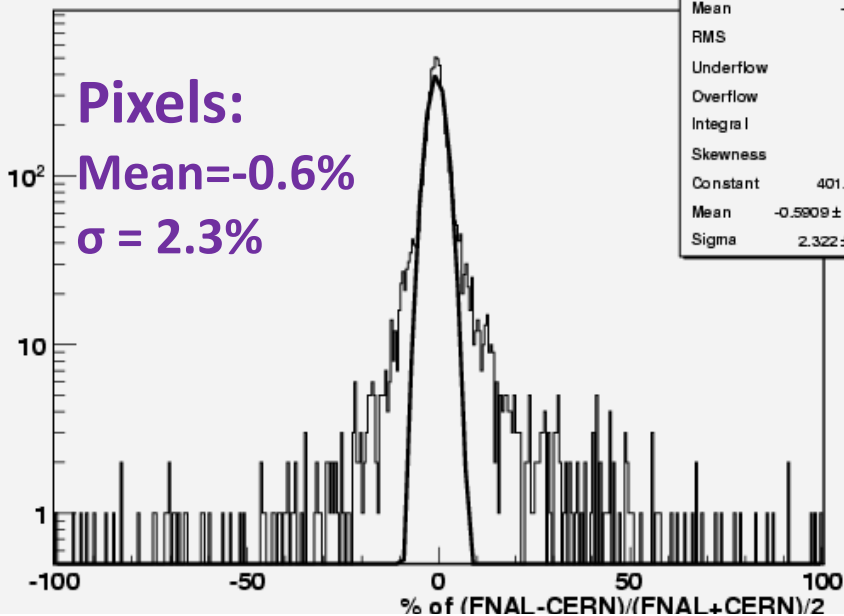
- 0.1%

Pixels CERN

Pixels Tcorr CERN

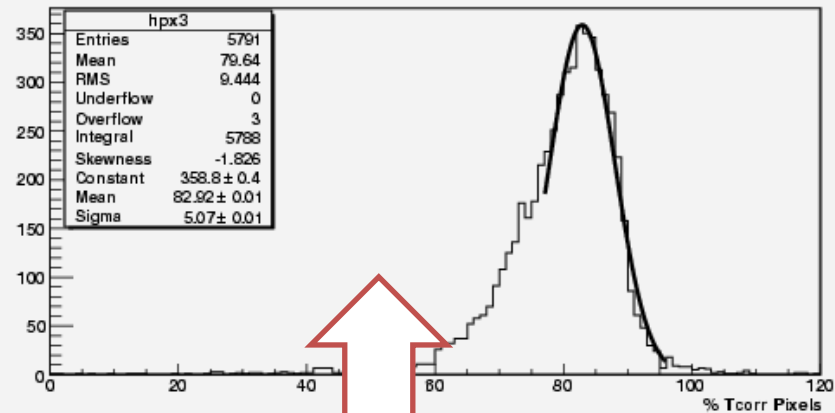
Comparison III: FNAL-CERN Assymetry

Assymetry FNAL-CERN

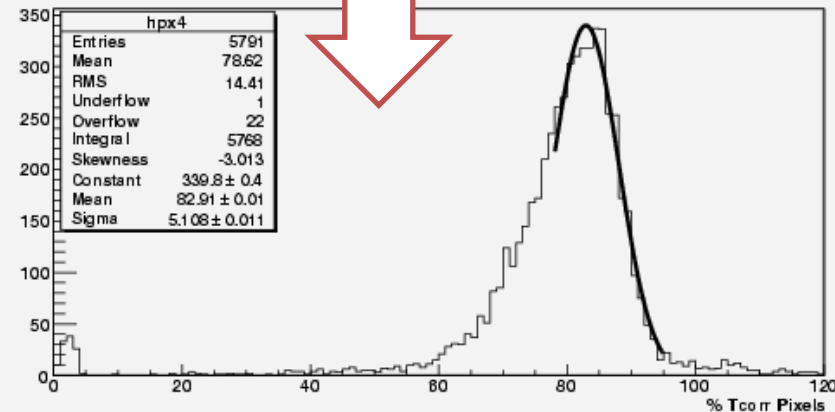


Peak 82.9%, $\sigma=5\%$

FNAL

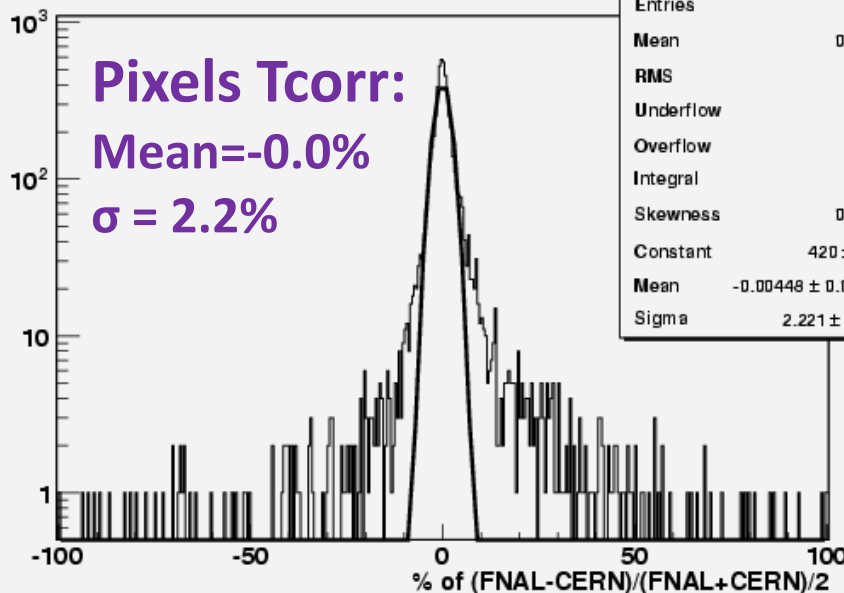


CERN

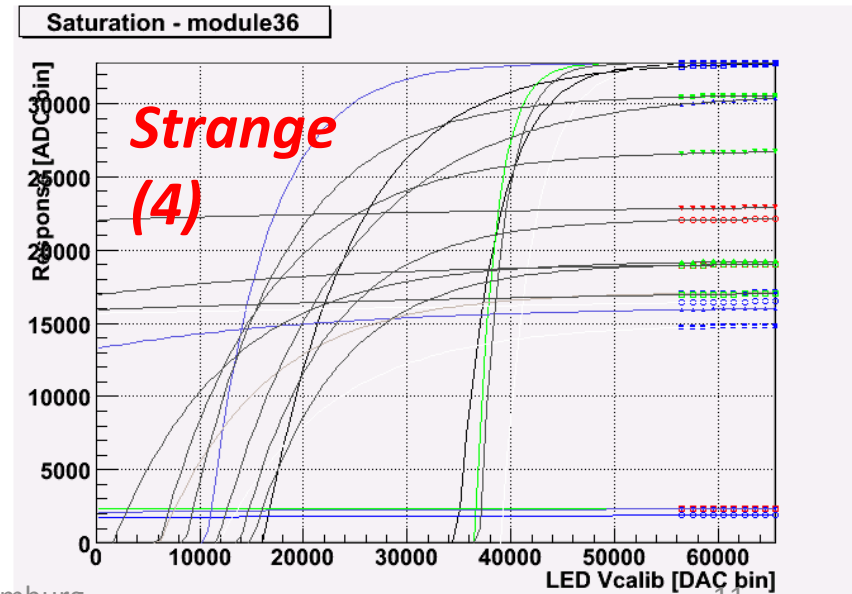
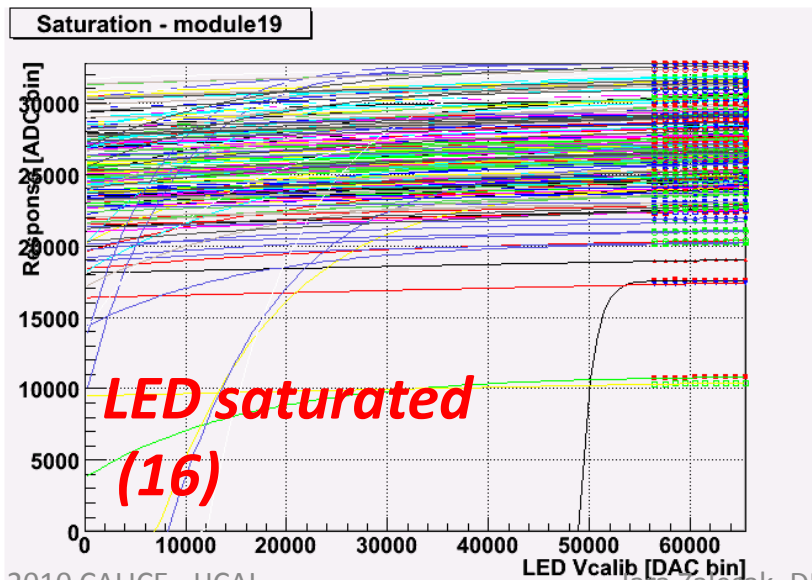
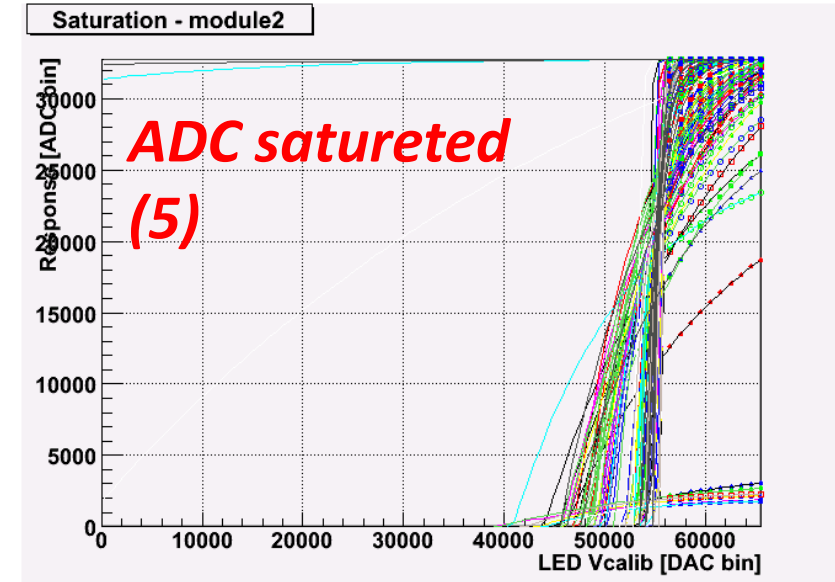
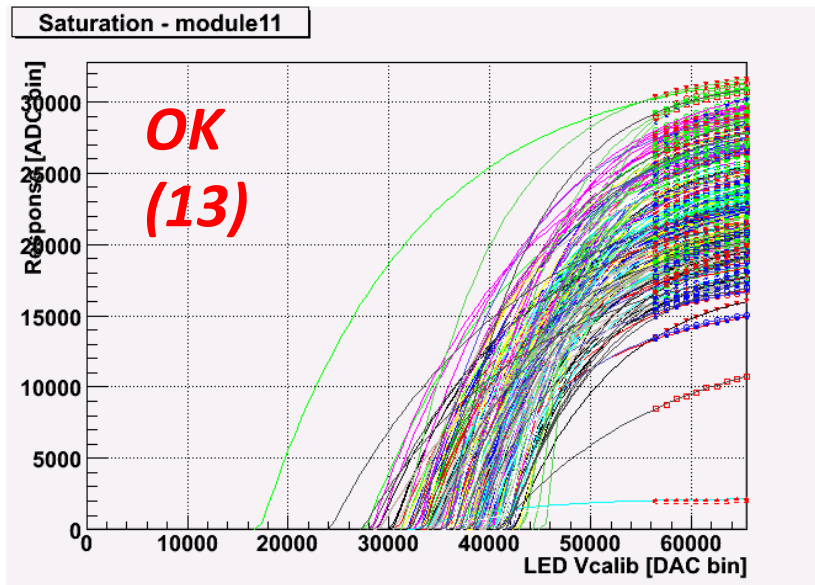


Peak 82.9%, $\sigma=5\%$

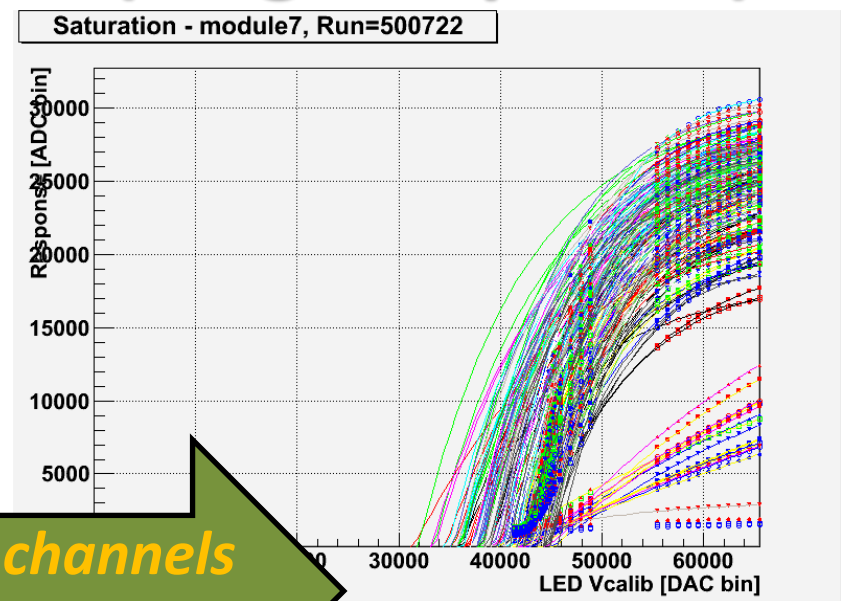
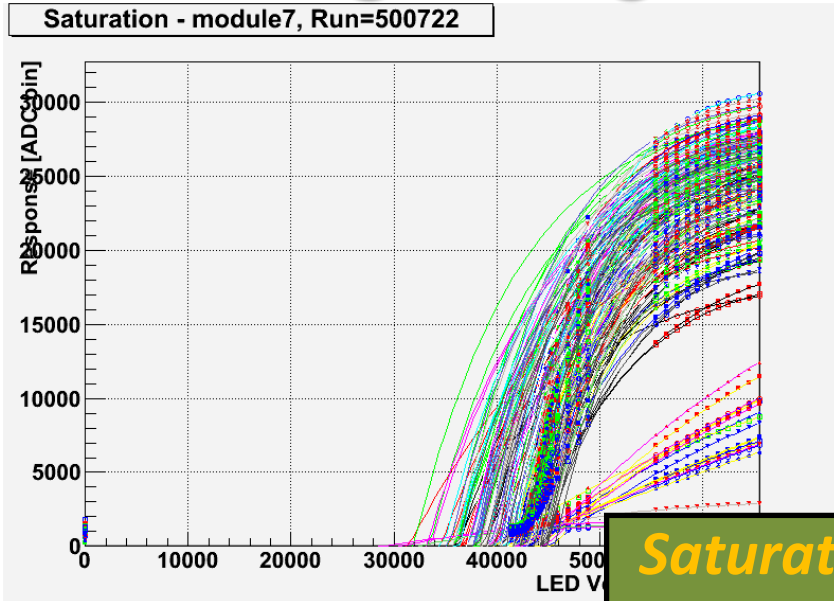
Assymetry FNAL-CERN



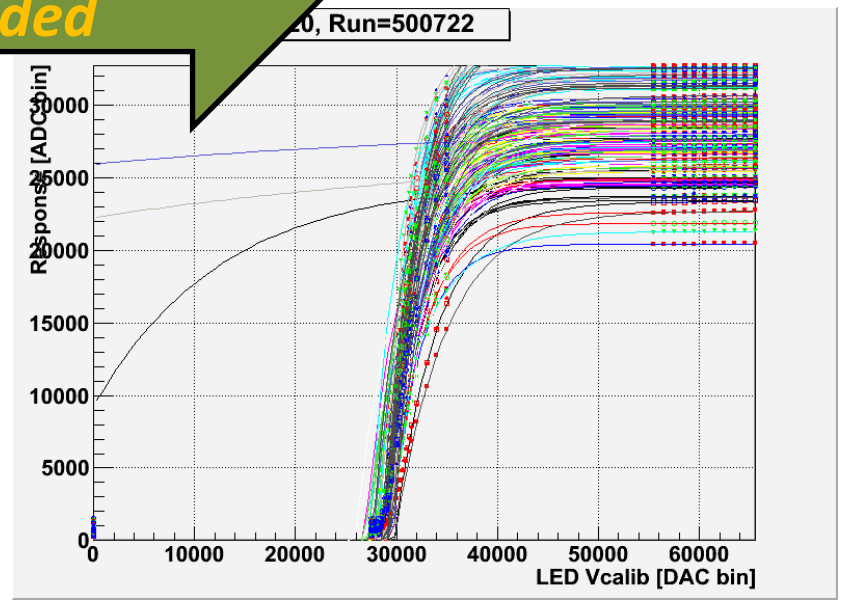
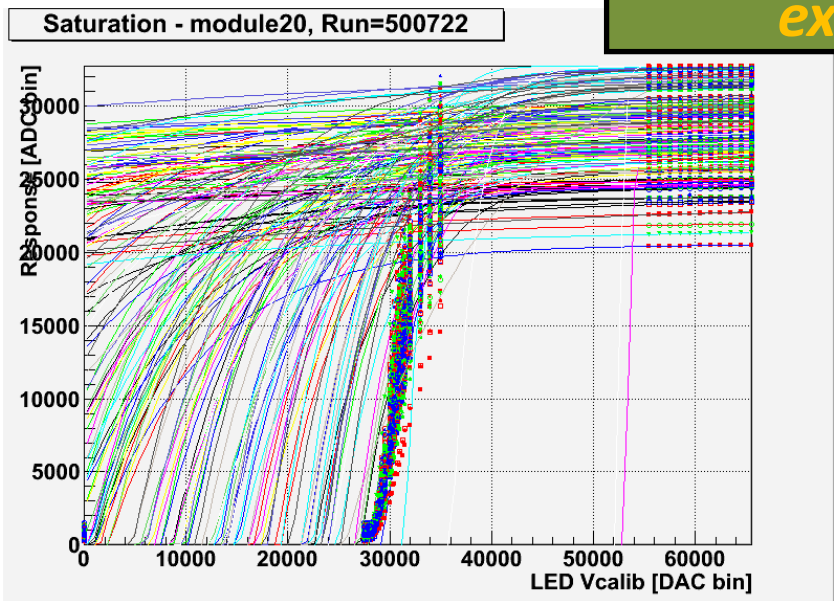
Simple classification of (problematic) modules



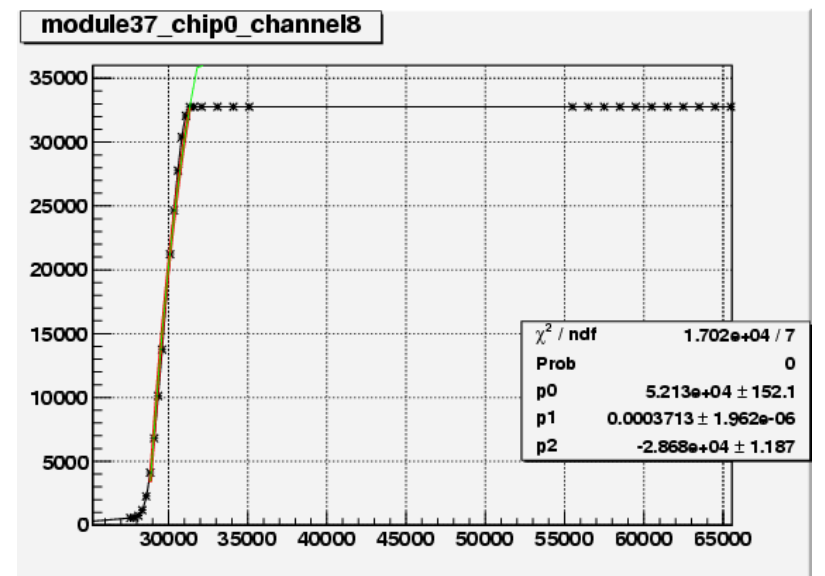
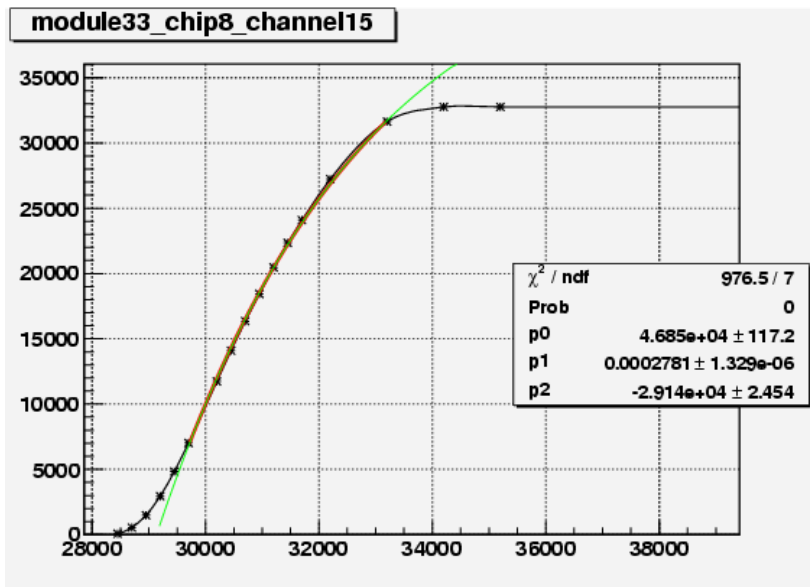
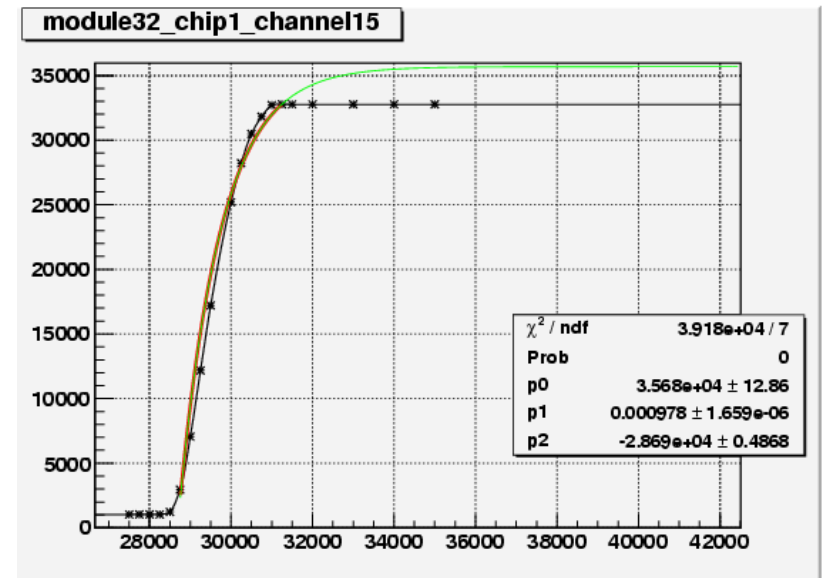
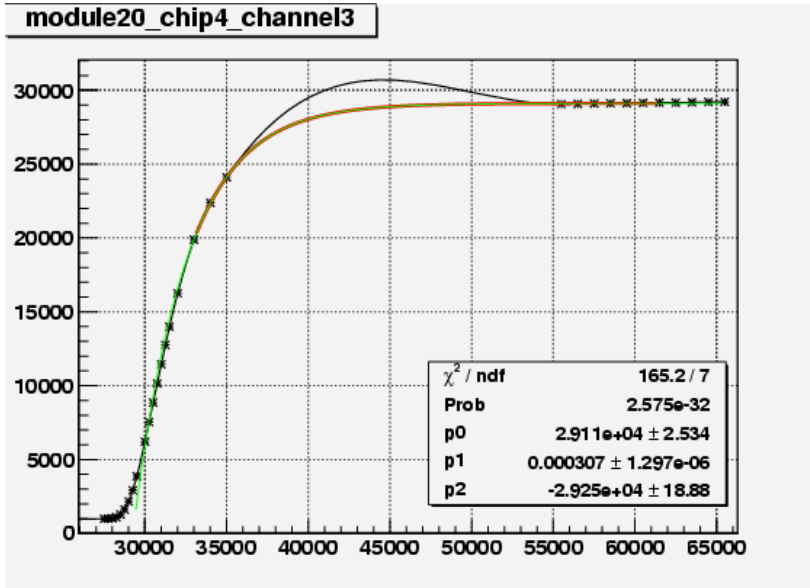
Sliding fitting window (10 good points)



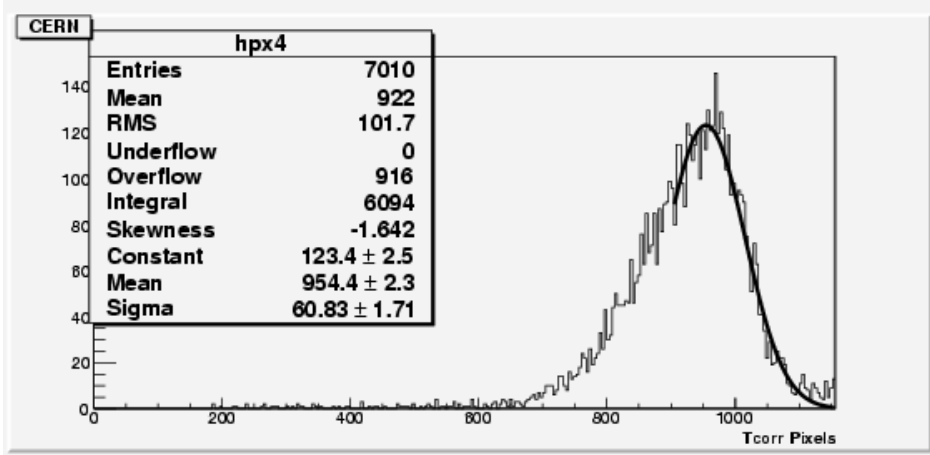
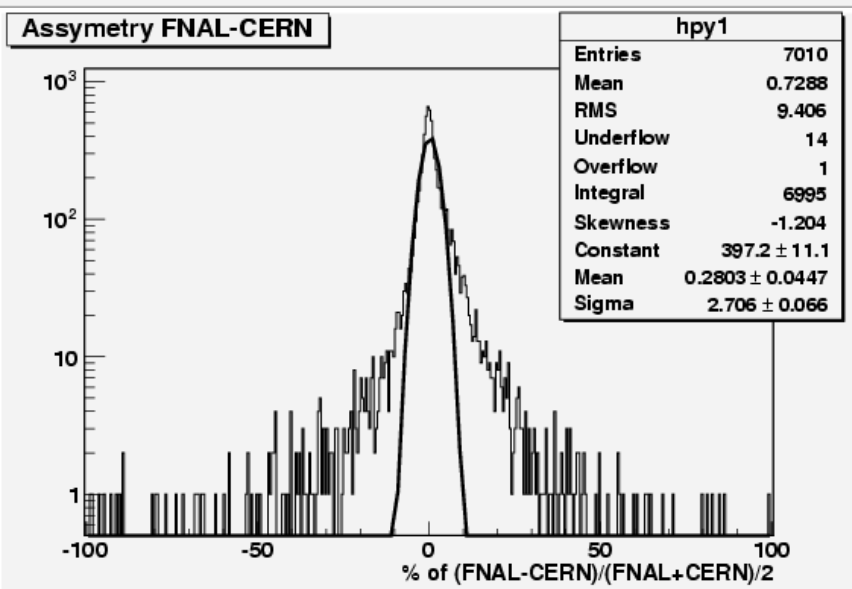
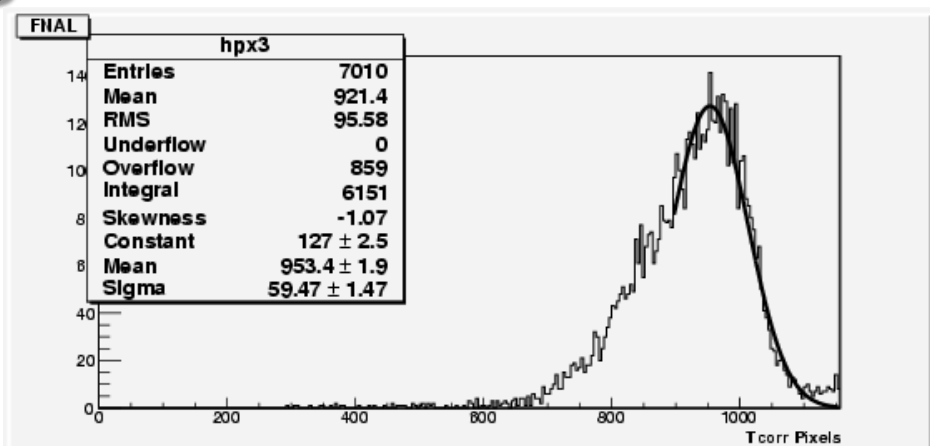
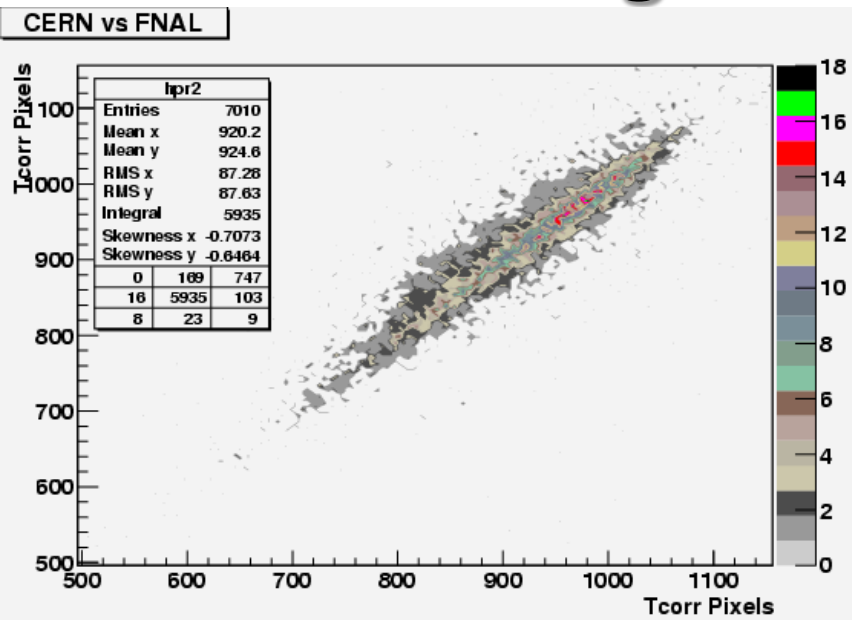
Saturated channels excluded



Sliding fitting window (10 good points)

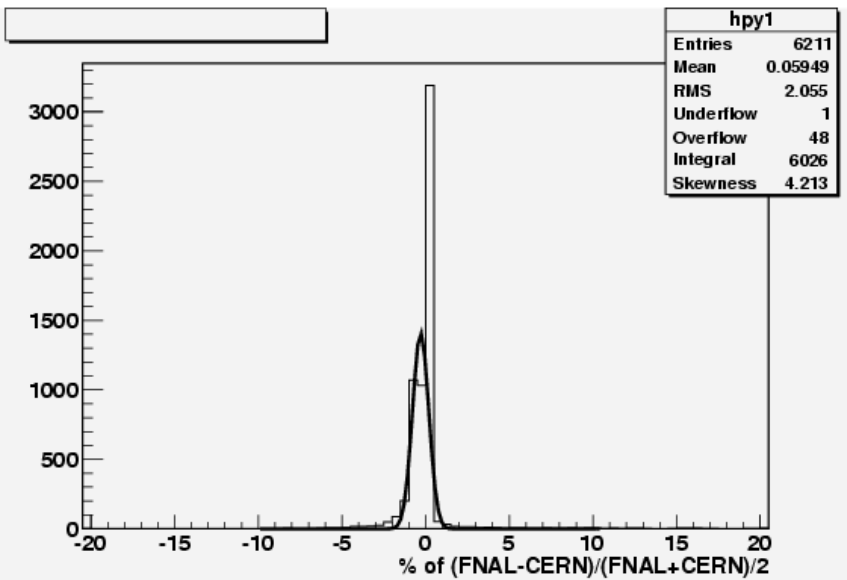
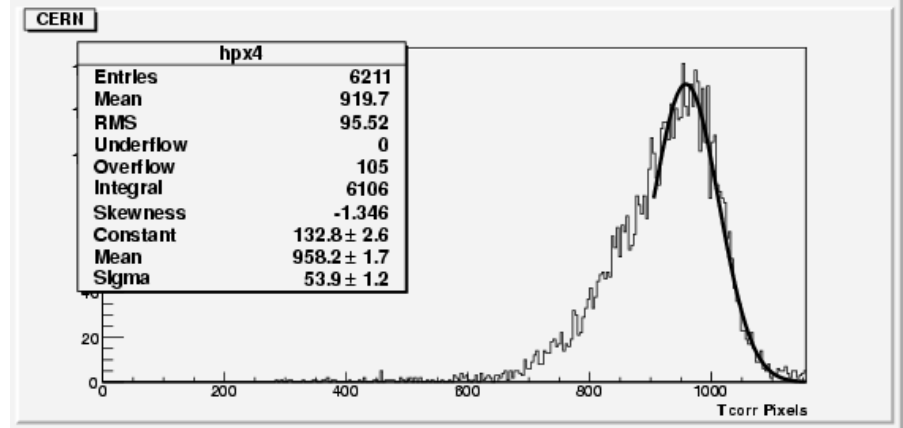
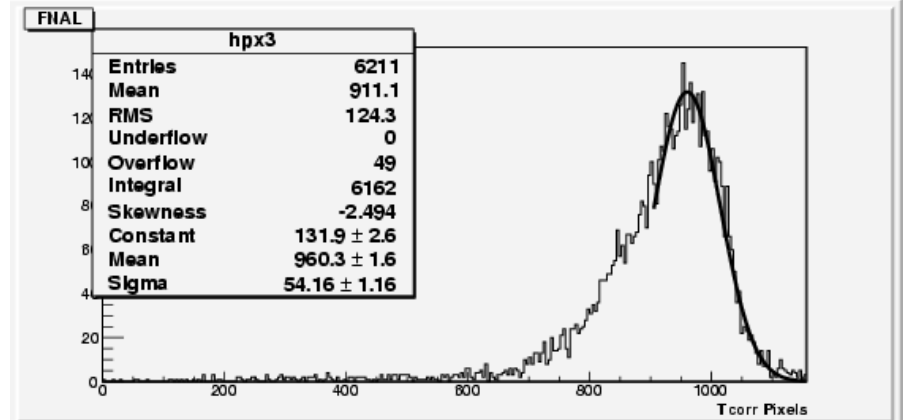
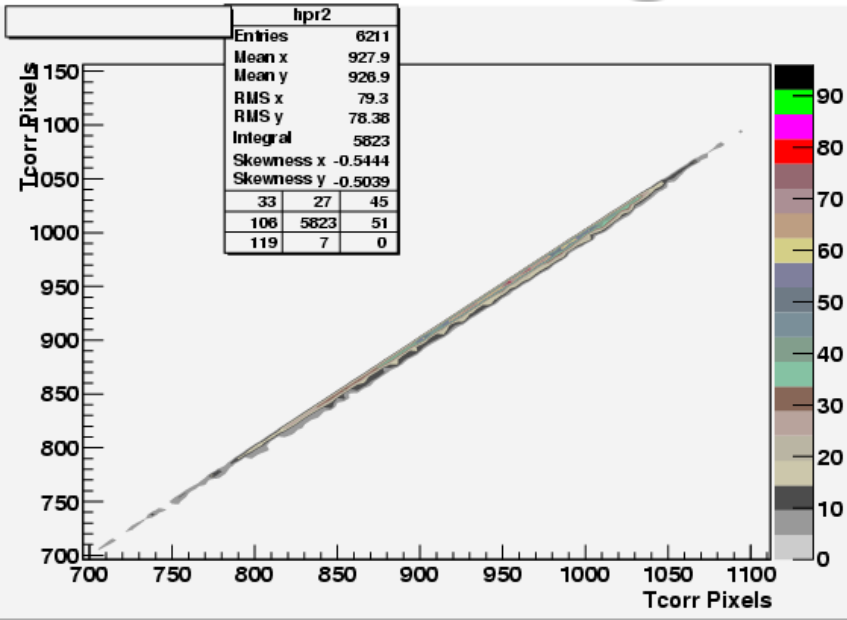


Sliding fitting FNAL vs CERN



Results consists at 82.5%

Sliding fitting FNAL vs FNAL



Results consists at 83%
Difference 0.2%

Conclusion

- Analysis gives global results for SiPM saturation curves over all available PmVcalibScan runs from TB at CERN & FNAL 2007-09
- Performance is improved with averaging of the results over all runs from both periods up to 6360 (84%) ch. after sel. criteria
- The calibration and Temperature correction seem to work very well and improve measured results
- Both data sets FNAL & CERN give consistent results
Most probable value over all channels at level of 83% of 1156px
- Still remaining outliers channels which are not fitted properly

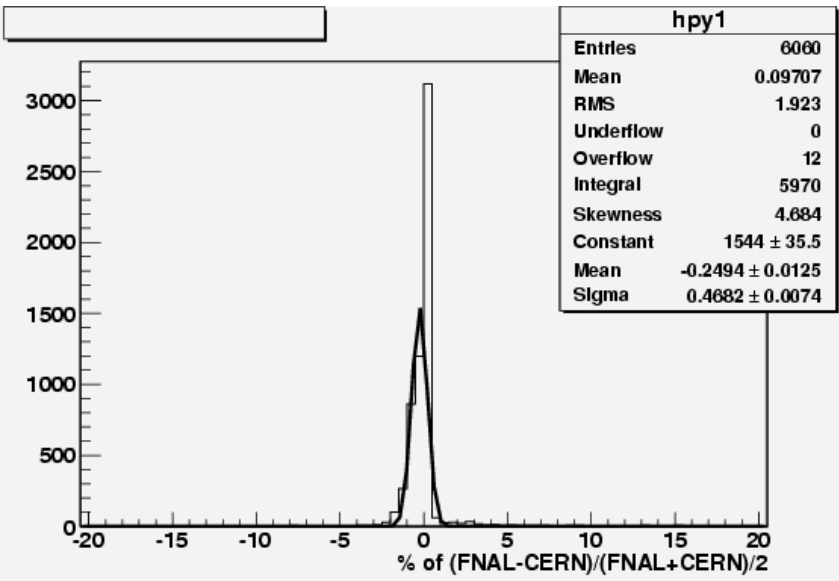
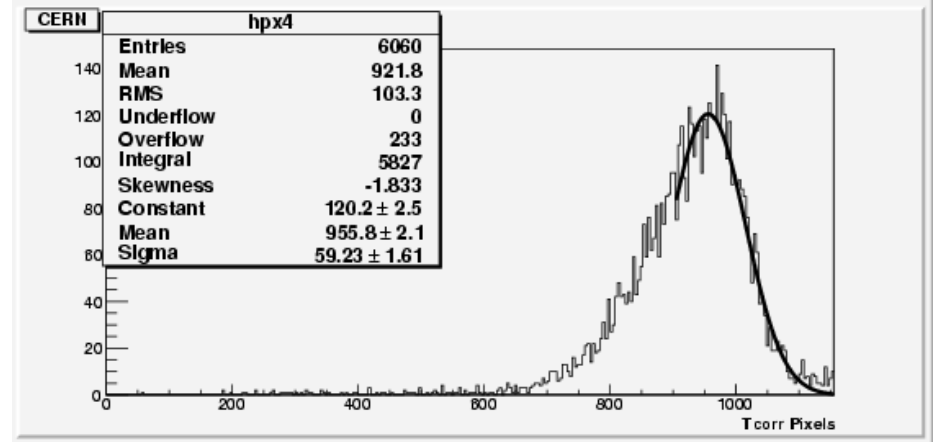
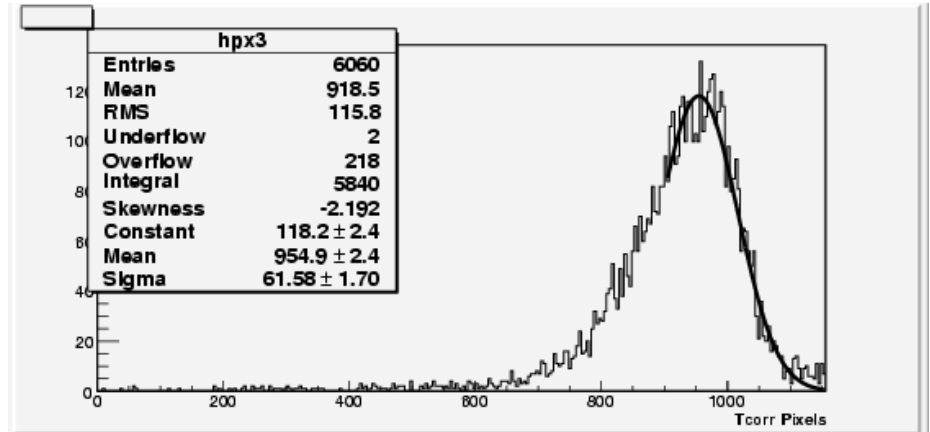
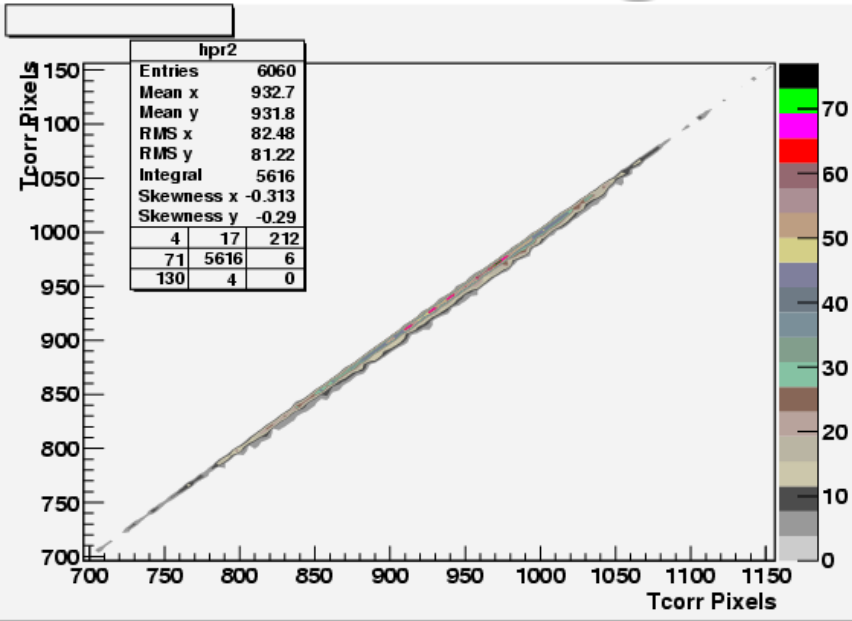
- After applying sliding fitting range get similar results in global

ToDo & Issues

- The measurement of the saturation curves is being done with re-commission of PPT for W-AHCAL 2010 tests at CERN
- Much more data points taken for curves to cover all ranges (154 each 250 Vcalib bins)
- some data are already stored, need to update DB and do gain calibration

BACK UP

Sliding fitting CERN vs CERN



Results consists at 82.6%
Difference 0.1%