Installation during the SPS Tesbeam, Sept. 2017

MCH Upgrade SPS Testbeam

MCH Upgrade Weekly meeting

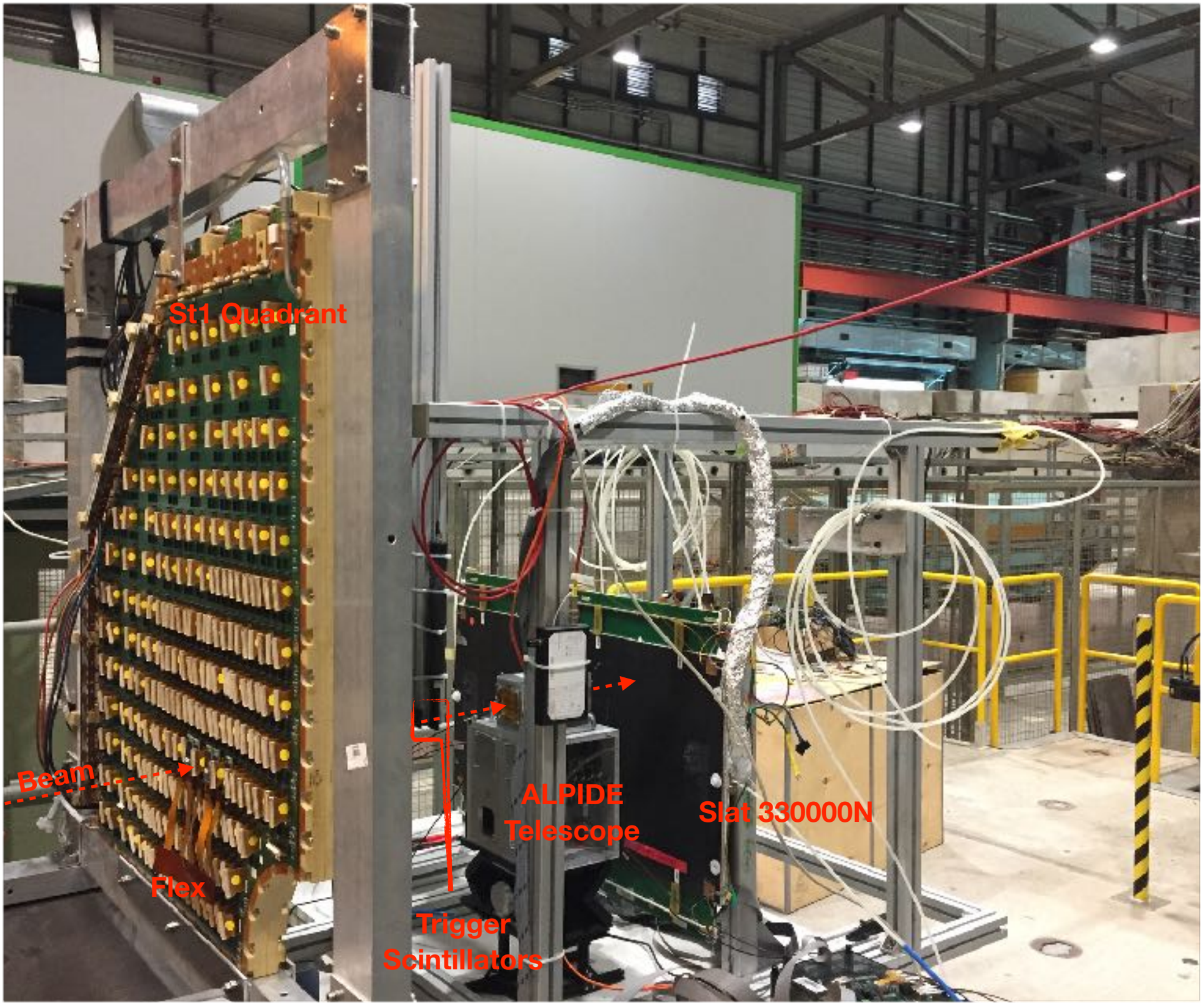
Oct. 24th 2017

A. Baldisseri

CEA Saclay

Irfu

The SPS setup in Sept. 2017

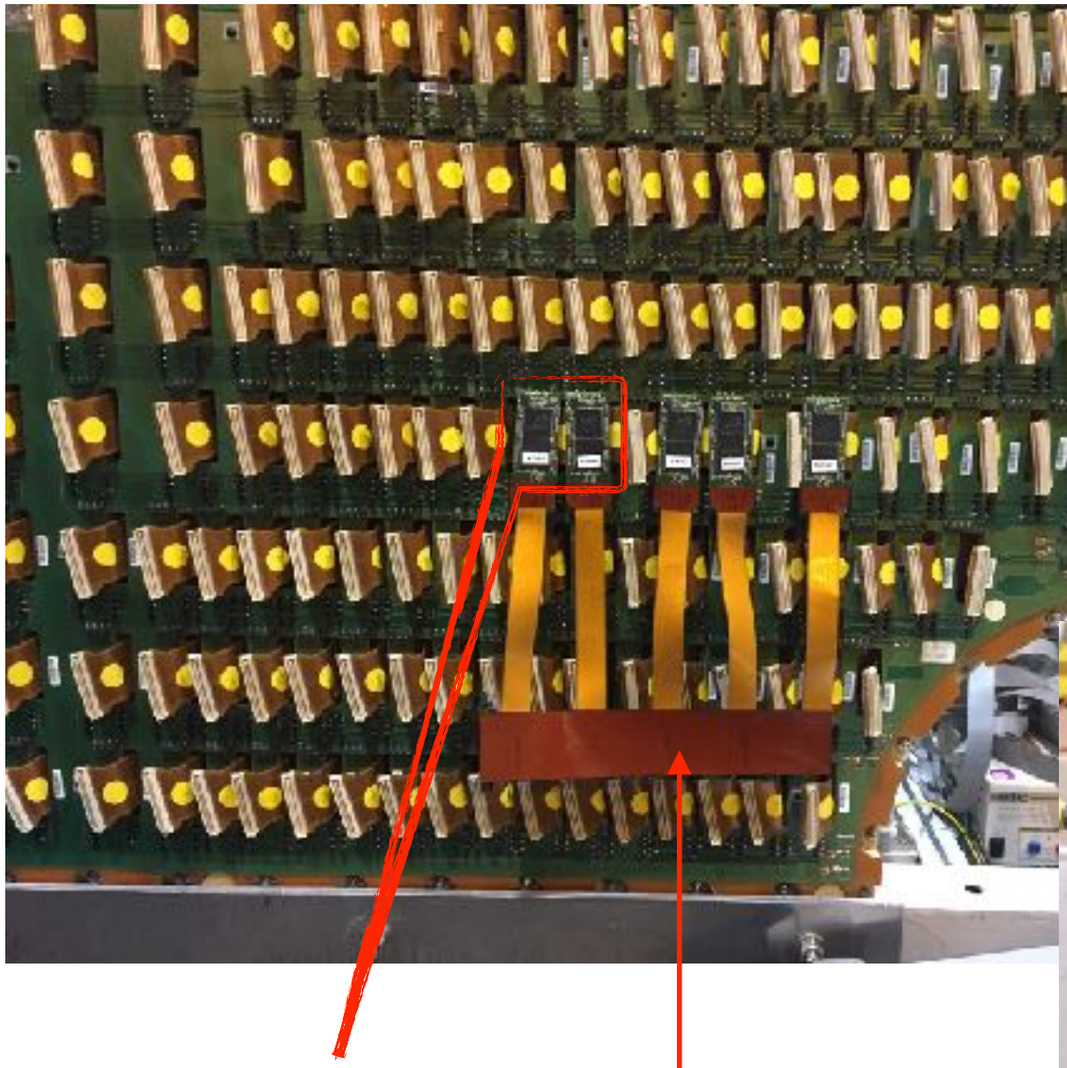


The SPS setup

- MCH CPC
  - Slat 330000N: Largest pads: 0.5 x 10 cm^2 (bending)
  - Station 1 Quadrant: Smallest pads: 0.42 n 0.63 cm^2 (bending)
- DAQ
  - Programmable card which distribute the trigger to both systems (ALPIDE & DATE)
  - Two flex cables: Slat (1 DS345-v2 card), Quadrant (2 DS12-v1 cards)
  - 1 SOLAR board, GRORC and DATE DAQ
- ALPIDE Pixel Telescope
  - 7 planes with 1 ALPIDE chip per plane (3 x 1.5 cm^2)
  - 1024x512 (X×Y) sensitive pixels. Sizes: 29.24 μm × 26.88 μm (X×Y).
- SPS Beam @ H6: 120 GeV μ

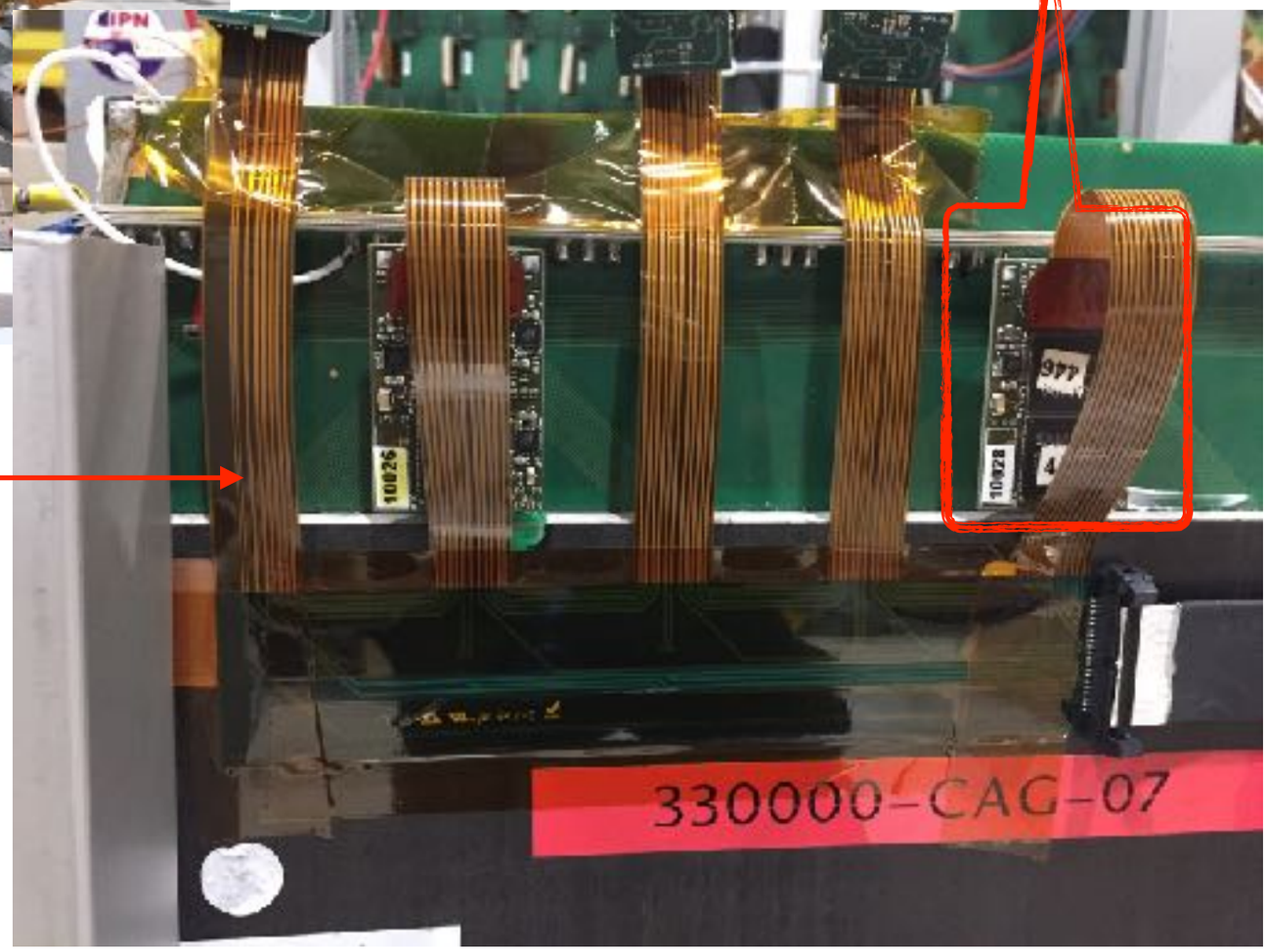
The DualSampa cards

St1 Quadrant



Slat 330000N

DS345-v2



Testbeam status

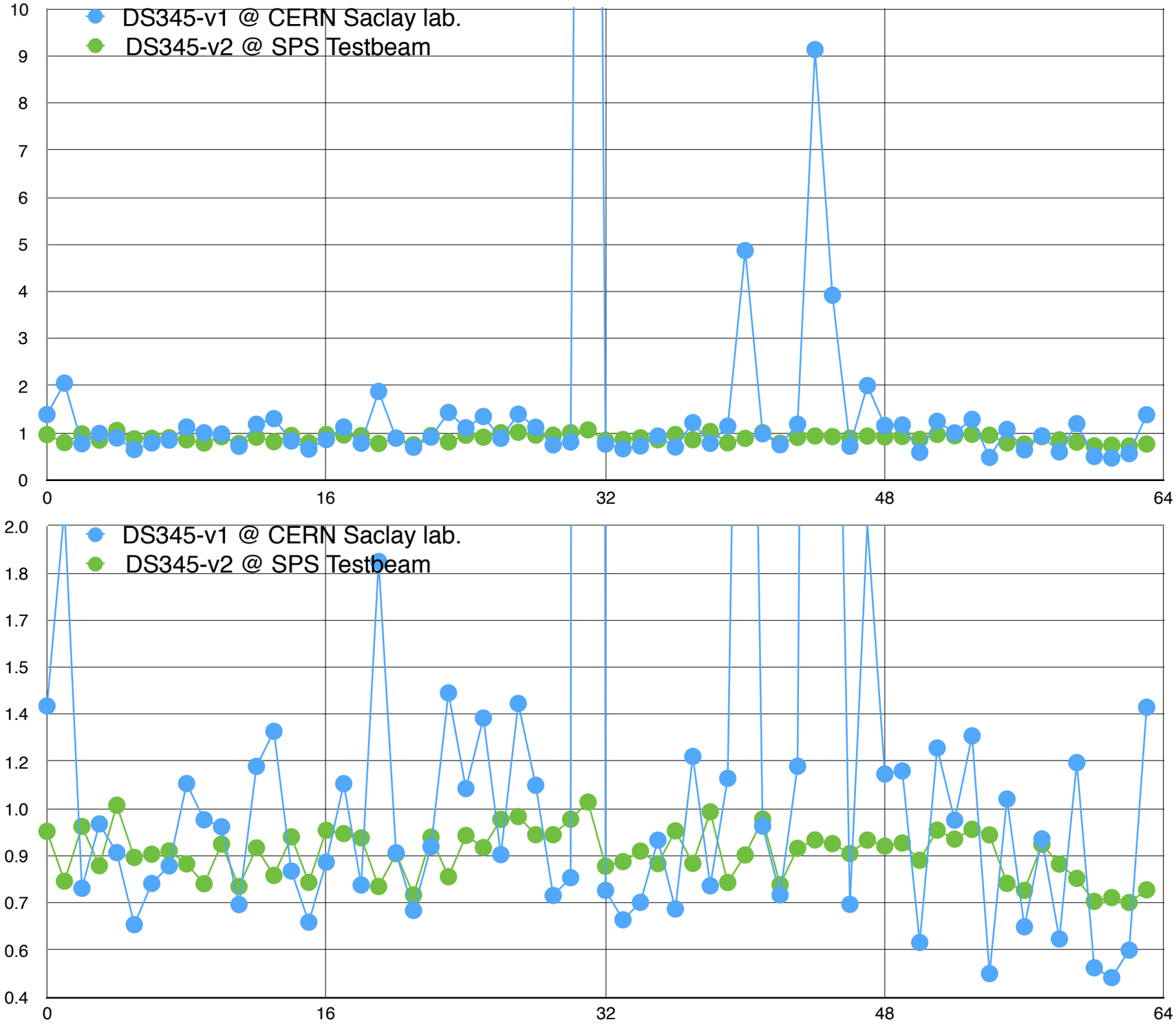
- Gas
  - Pre-mixed bottles (Ar:CO_2 80:20)
- HV
  - Nominal: 1650 V (some test with other values)
- Noise
  - DS345-v2: Almost nominal (<1 channel)
  - DS12-v1: Spikes due to routing issues (should be corrected for v2)
- Zero suppression threshold & charge sum
  - 3 channels (most of the time), 2 and 4 also tested
  - Charge sum validated
- DAQ
  - SOLAR & DATE readout stable
  - Track matching between Pixel telescope and CPC => OK

SAMPA « nominal » configuration

- MCH configuration: 4 mv/fC, peaking time 300 ns, ADC clock 10 MHz
- Pedestals runs
  - TWLEN 0x9, ACQEND 0x8 => ~1 μs time window, 9 data per SAMPA packet
  - We have one time window per DATE event
- Physics runs
  - TWLEN 0x63, ACQEND 0x62 => ~10 μs time window
  - PRETRG 50 => 5 μs trigger delay (max 19.2 μs)
  - DPCFG 0x200 => **BC3 filter** enable (BC2 also tested)
  - ZSCFG 0x7F => 3 pulses above threshold, 3 pre-samples, 7 post-samples
  - ZSTHR 0x0C => 3 channels threshold (2 and 4 also tested)
  - VACFG 0x20 & 0x24 => with/without **« charge sum »**
- ALPIDE Telescope
  - 7 planes in coincidence: one cluster per plane
  - Noisy pixels suppressed

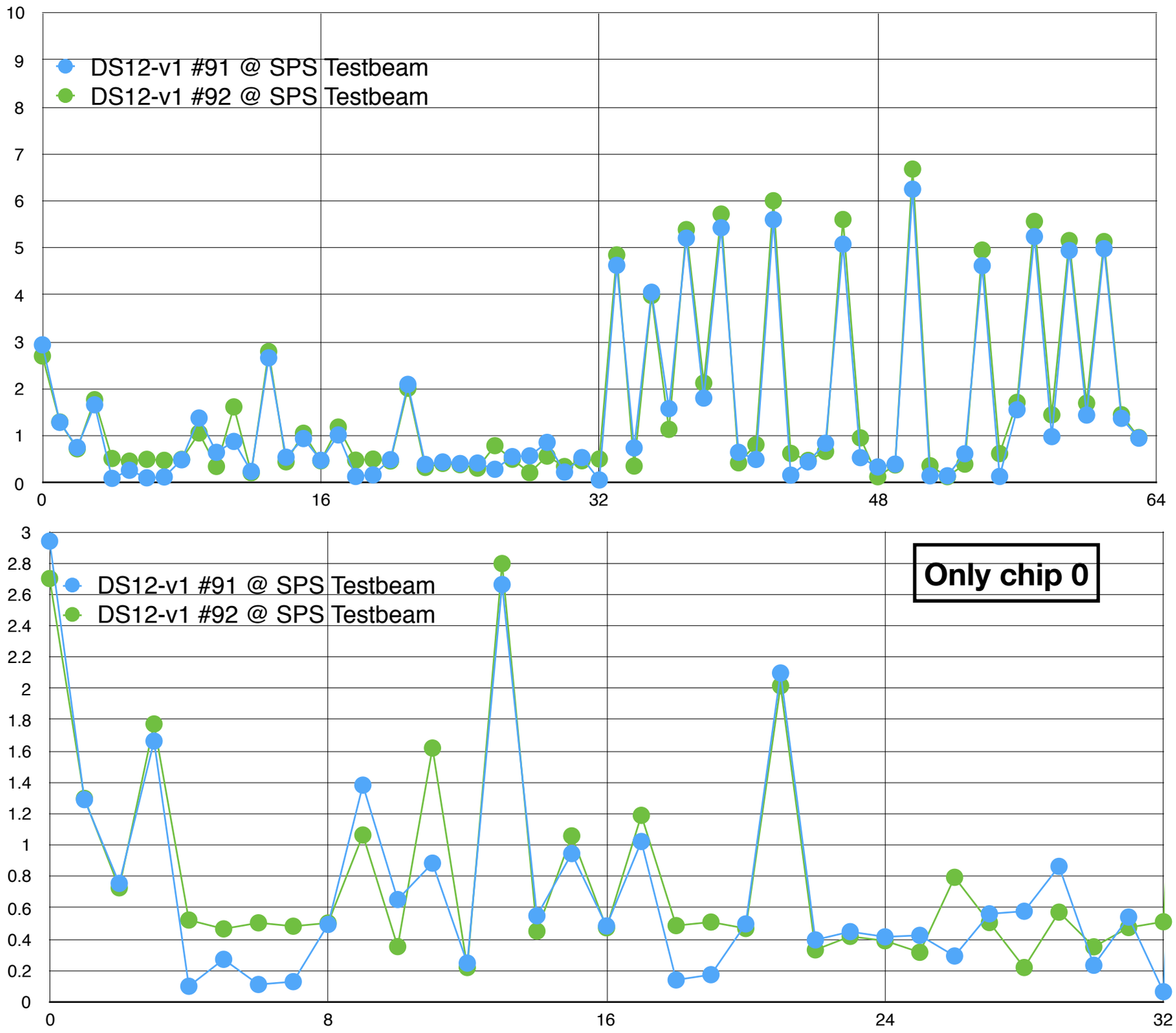
Slat Noise

- Noise spikes corrected for DS345-v2 wrt DS345-v1



Quadrant Noise

- Noise DS12-v1: 2 cards used (#91 and #92)



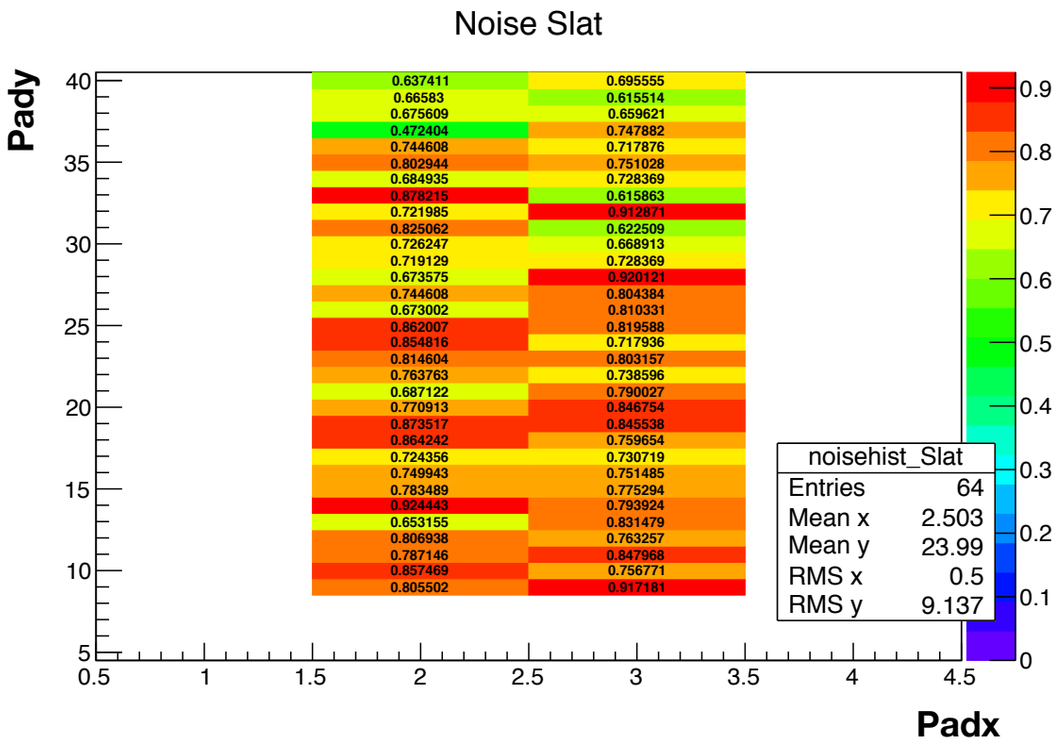
Results @ 1650 V for Slat and Quadrant
Threshold 3 channels, >= 3 samples

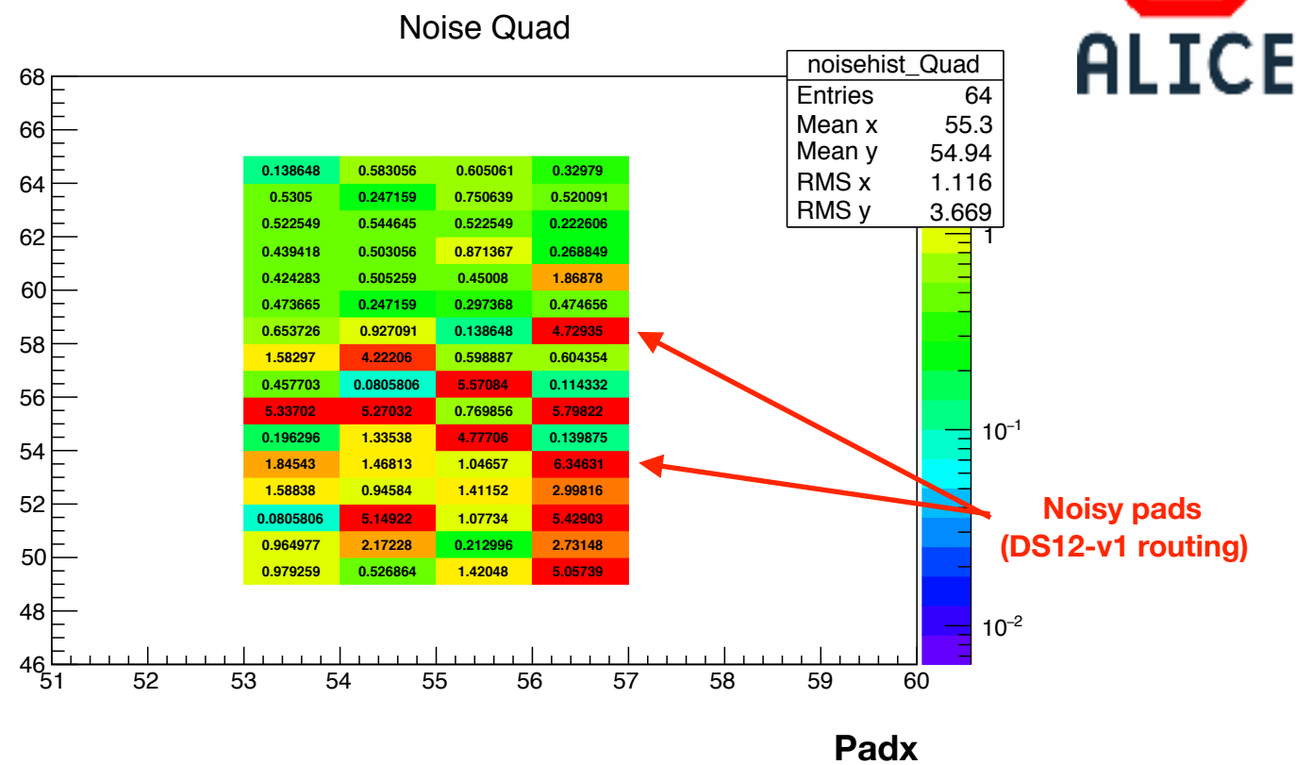
Charge sum ON

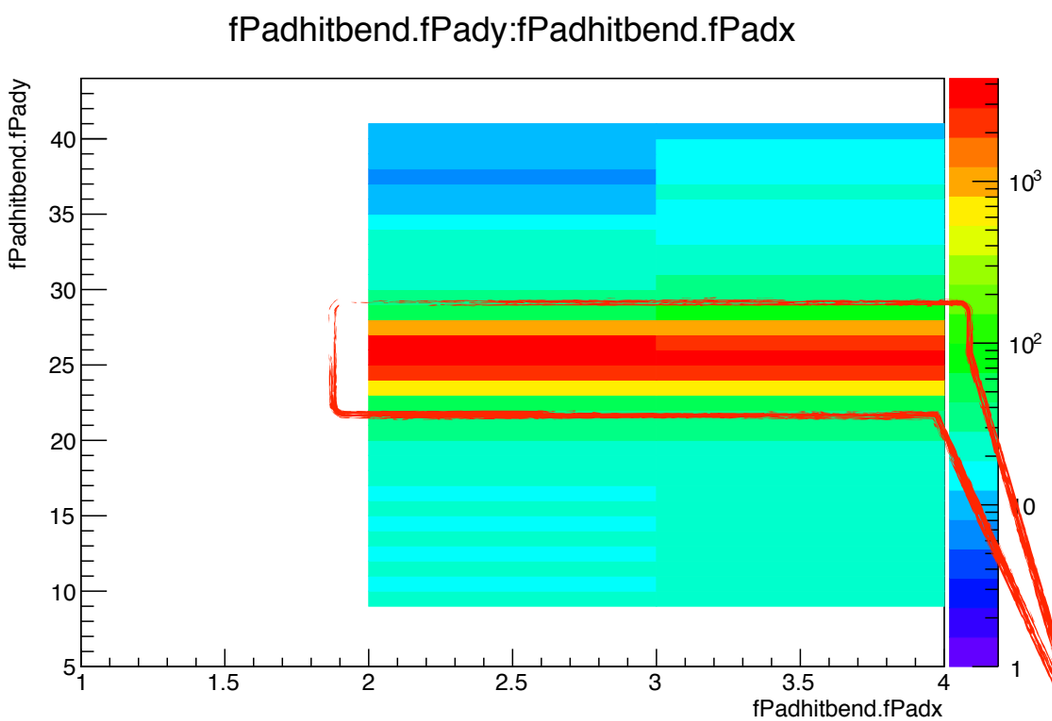
(runs 1036-1039)

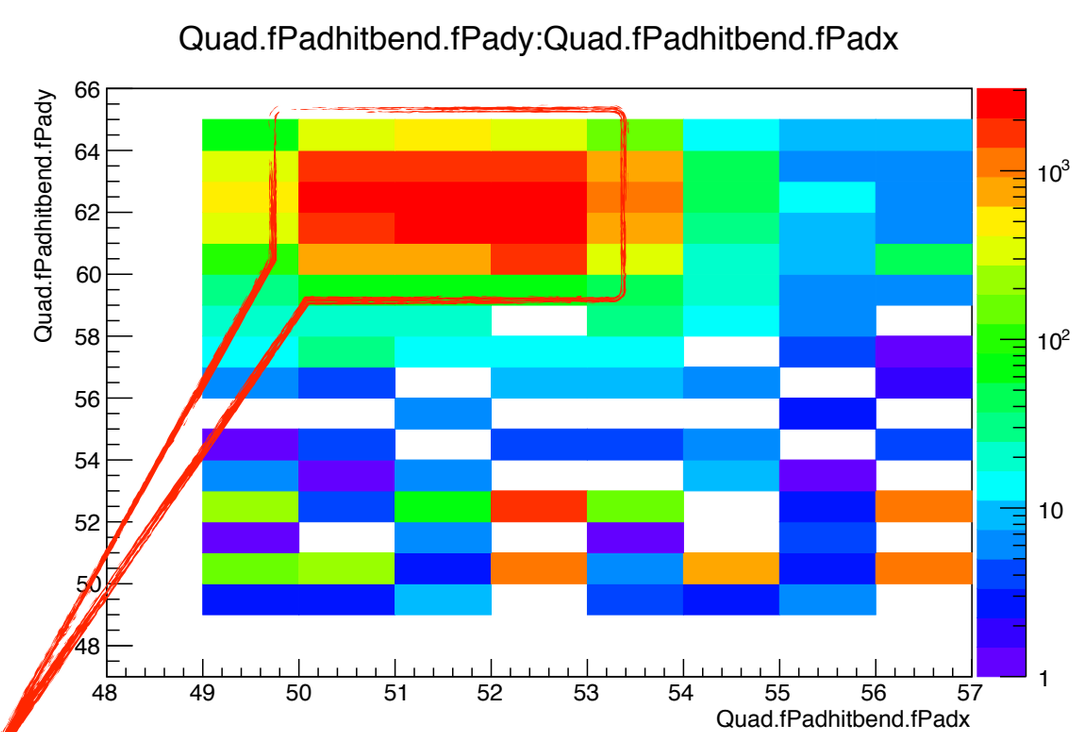
Beam hit map

Noise (CERN Saclay lab)



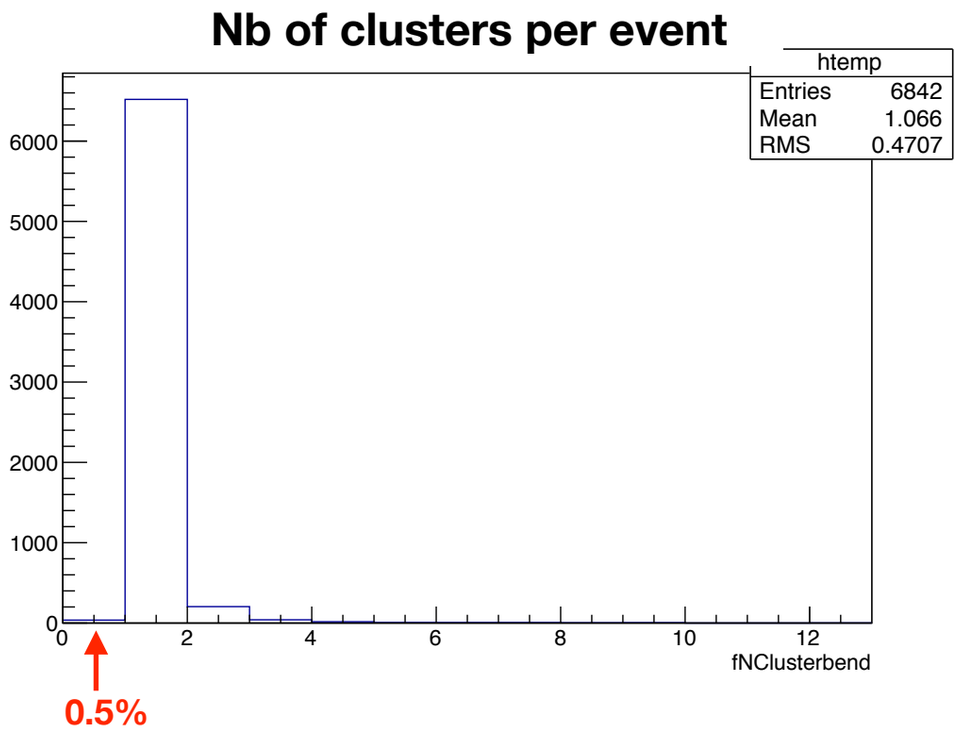


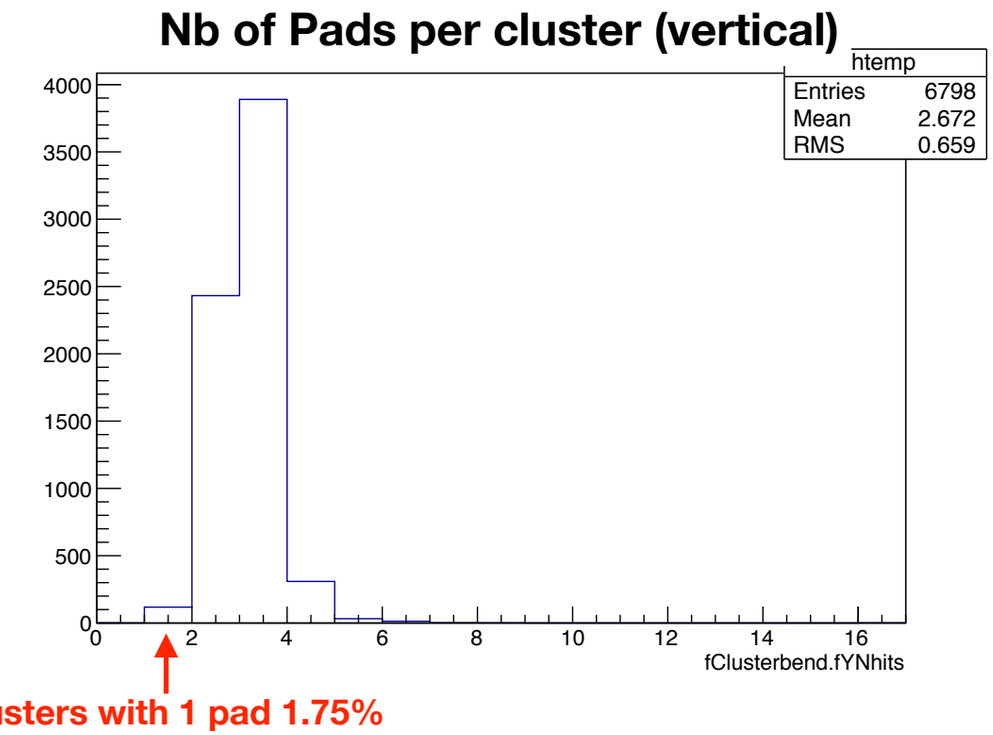


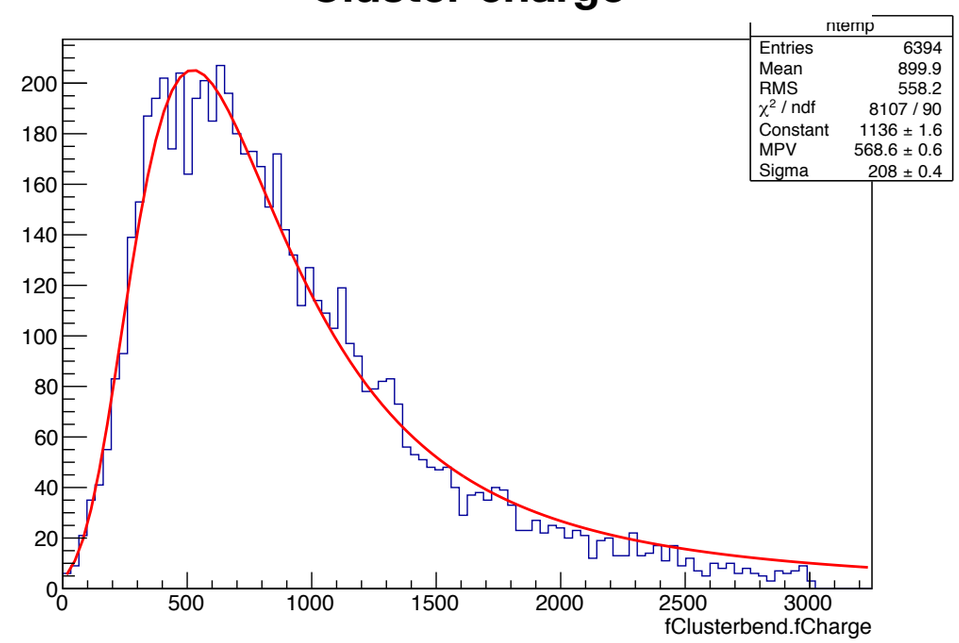


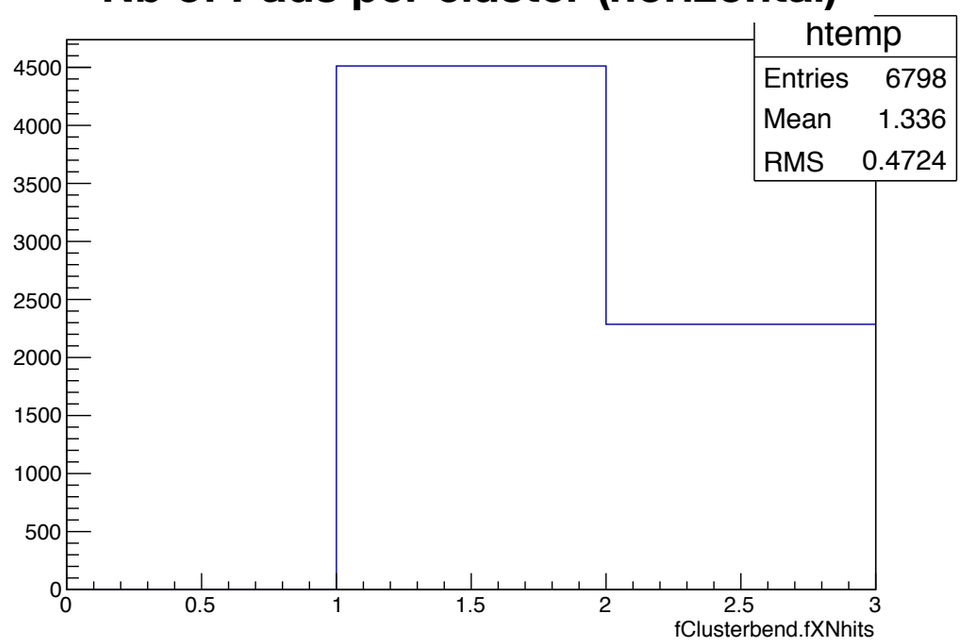
Beam location

Slat Clusters

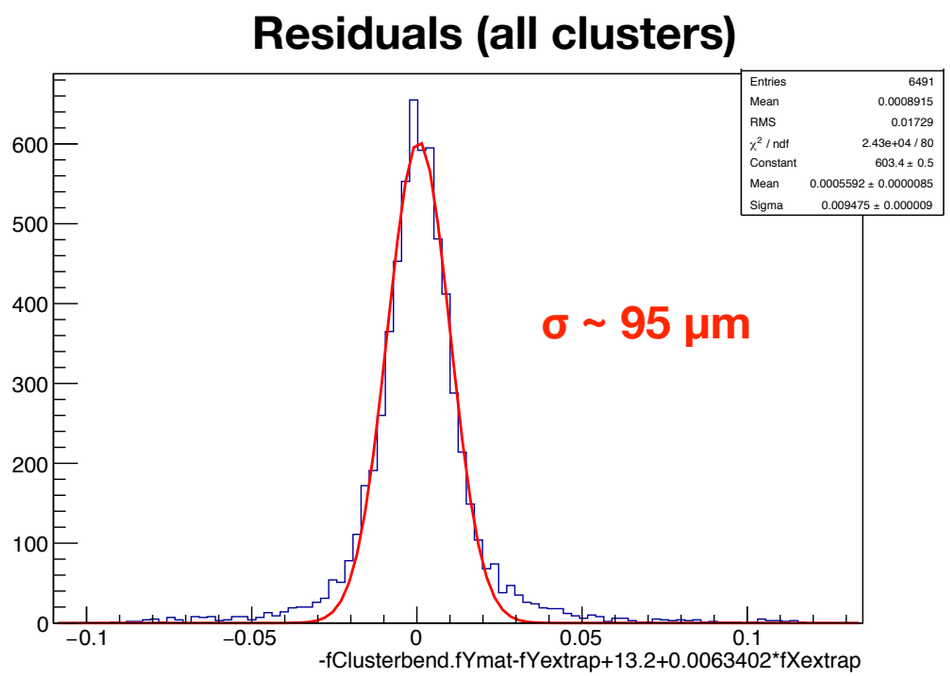


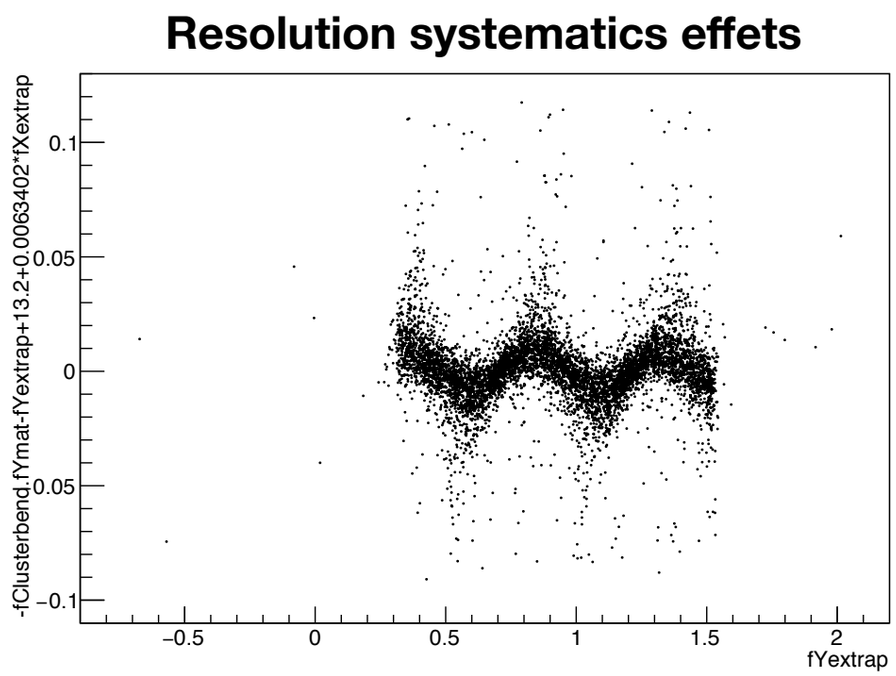


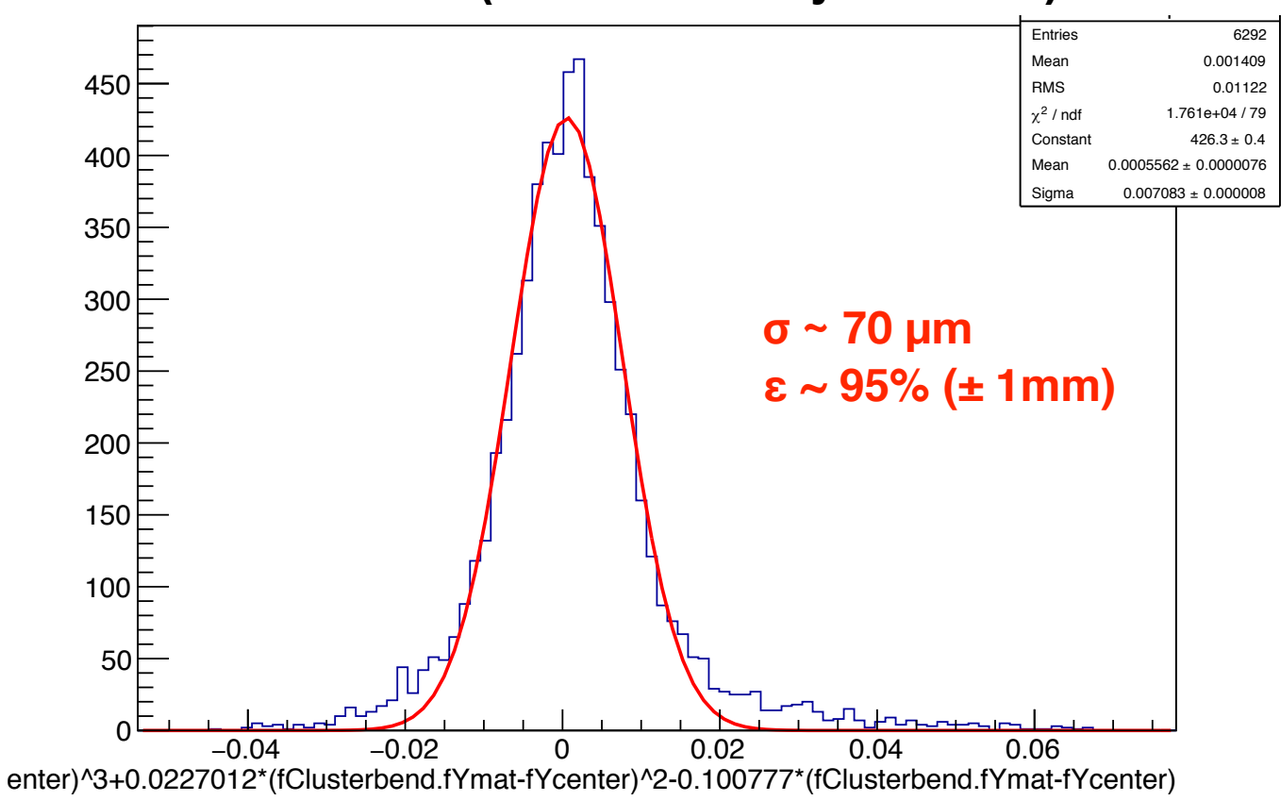




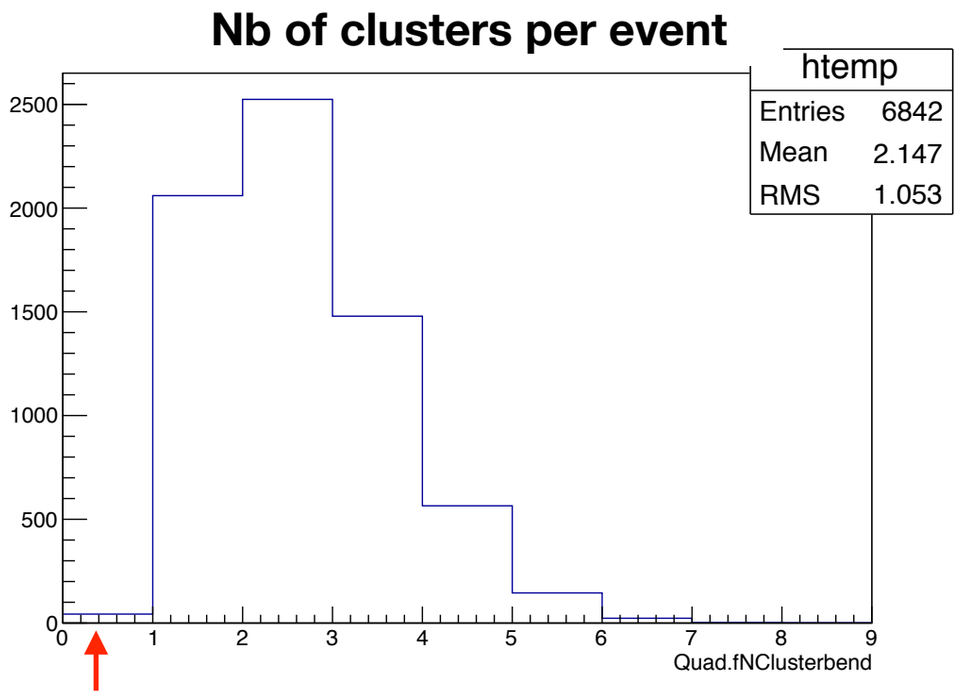
Slat Resolution

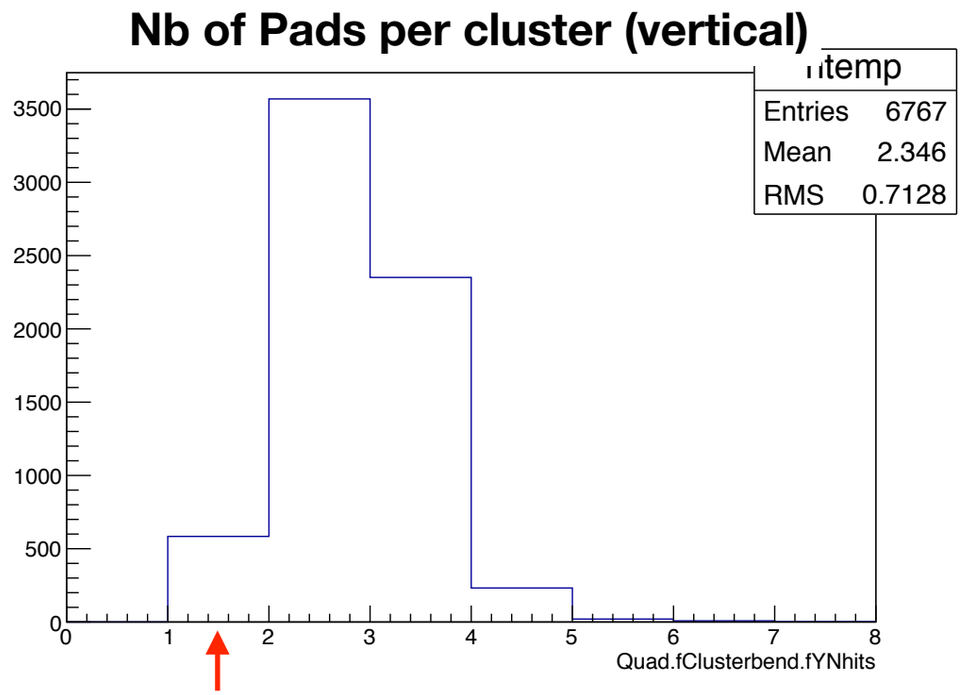


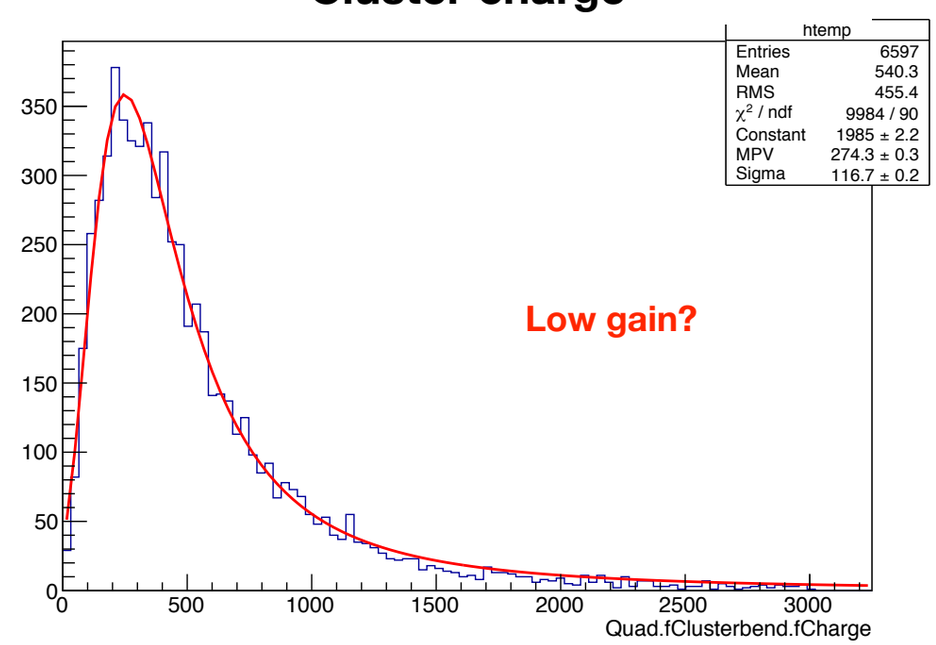


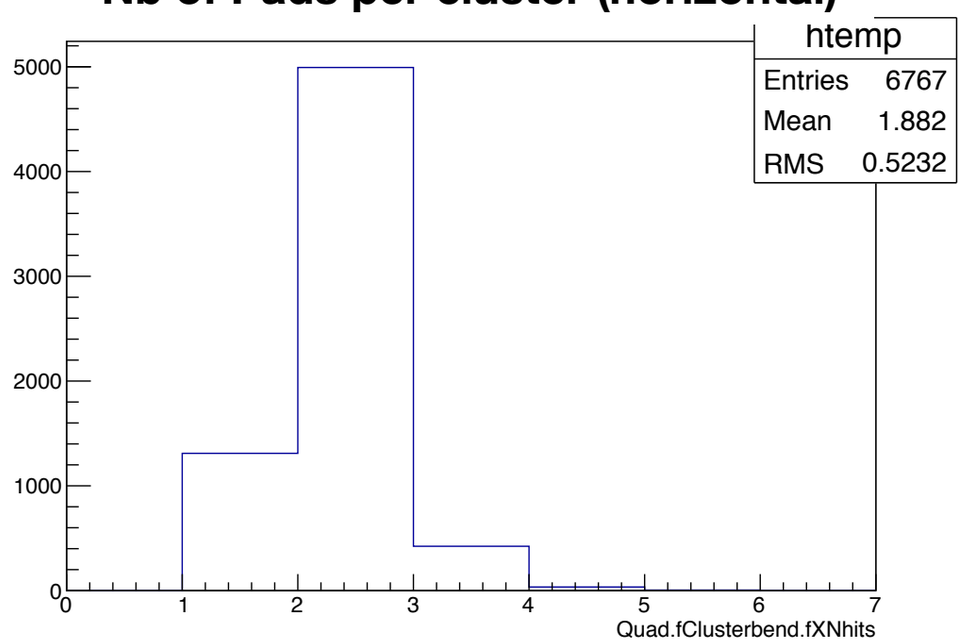


Quadrant Clusters

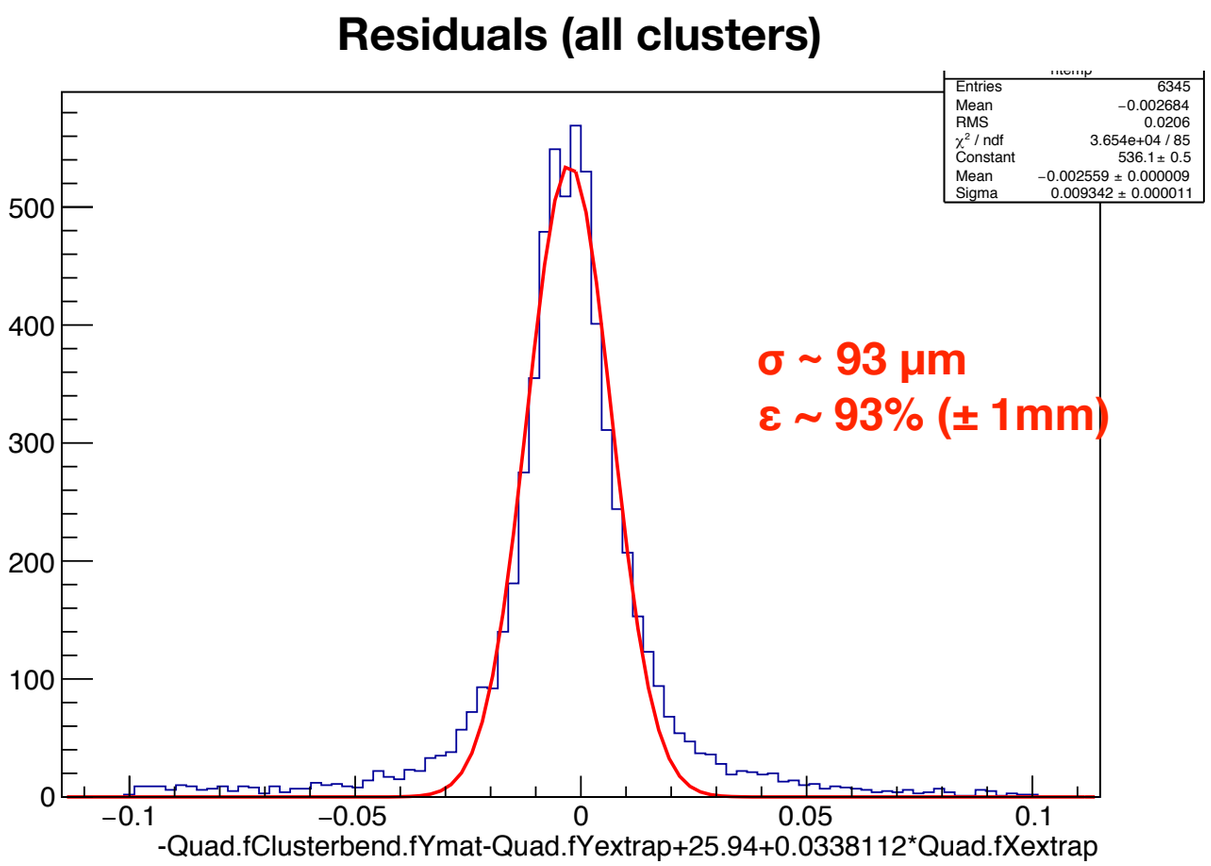


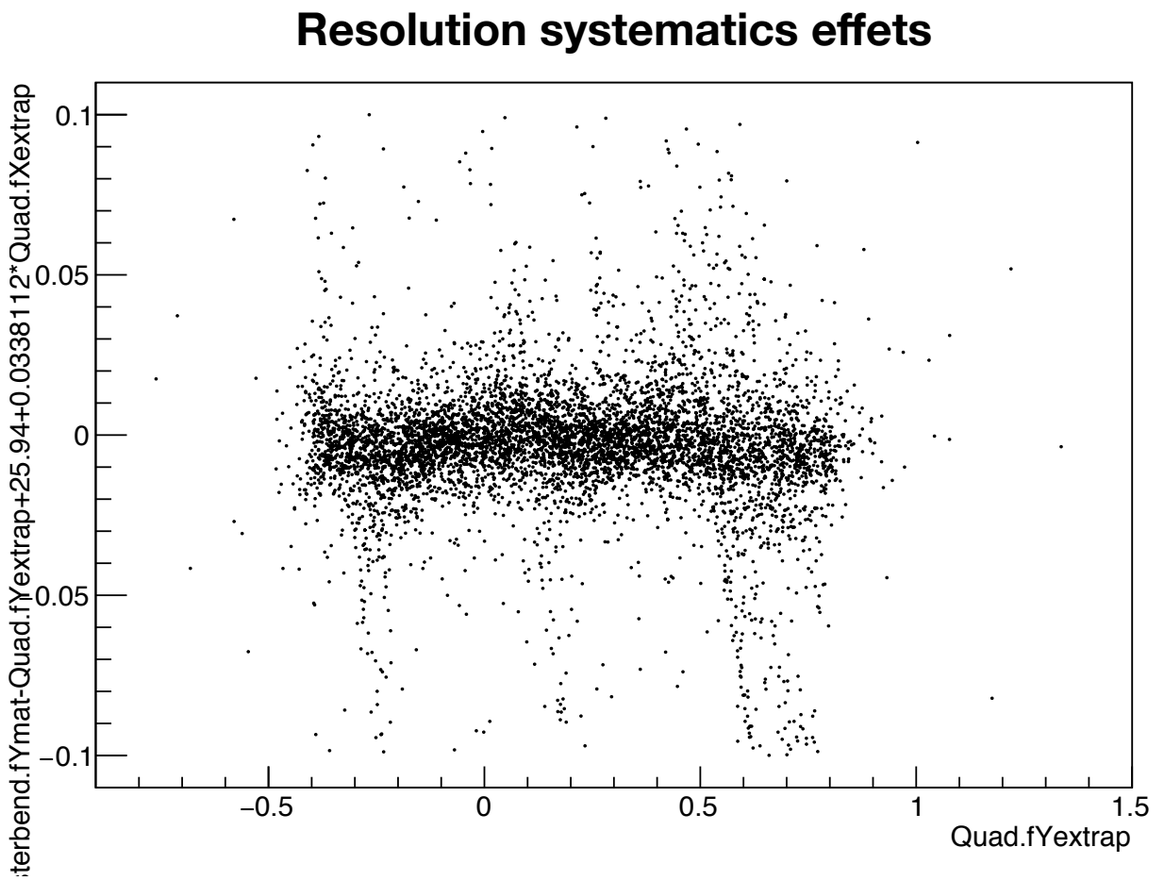






Quadrant Resolution



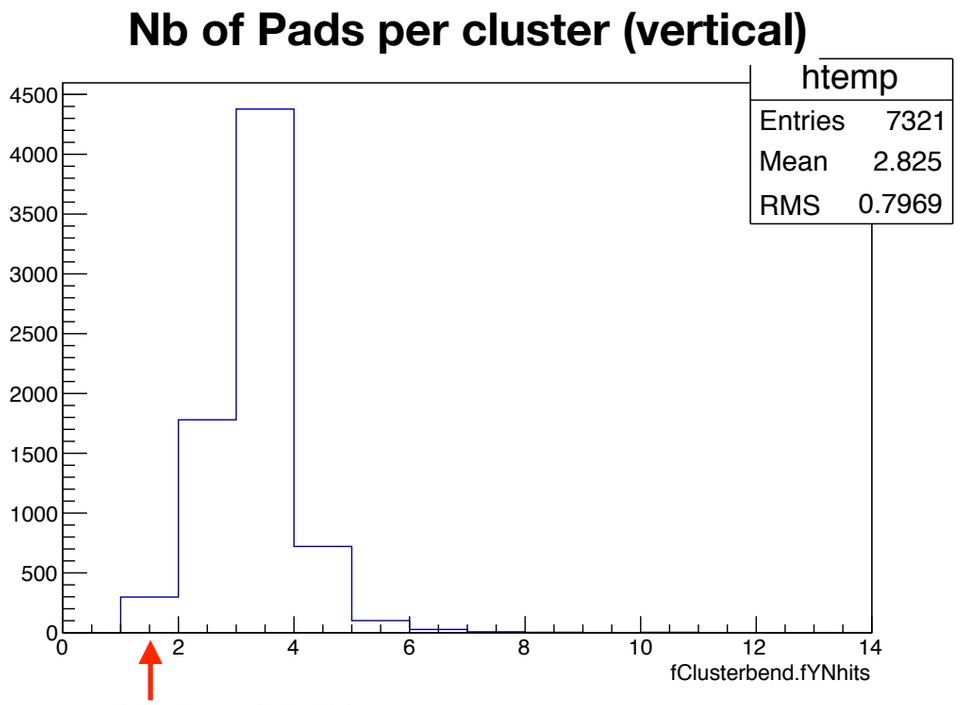


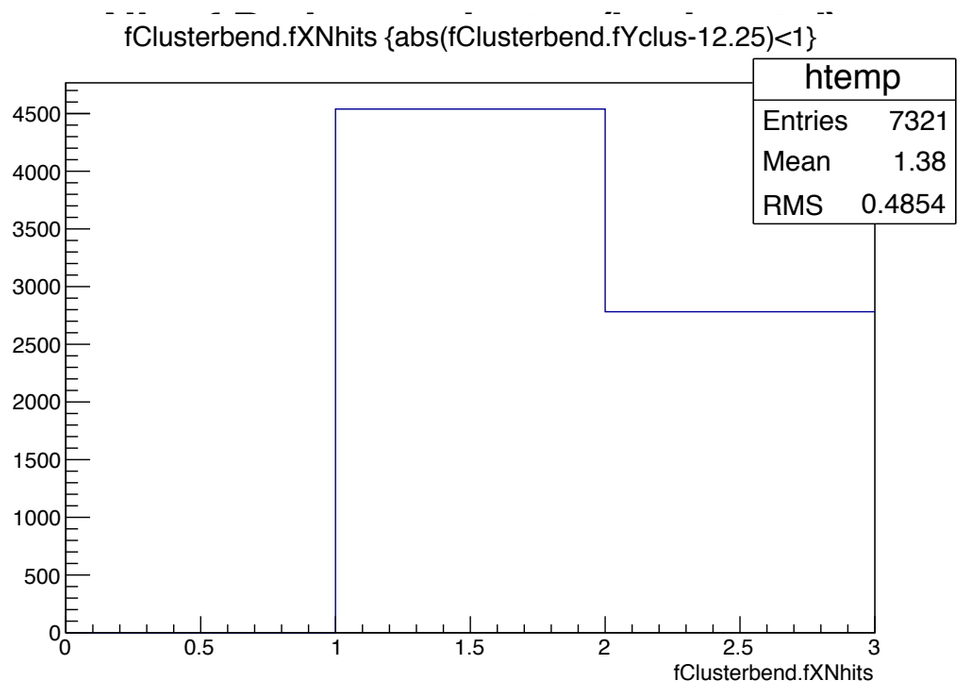
Results @ 1650 V for Slat and Quadrant
Threshold 2 channels, >= 3 samples

Charge sum OFF

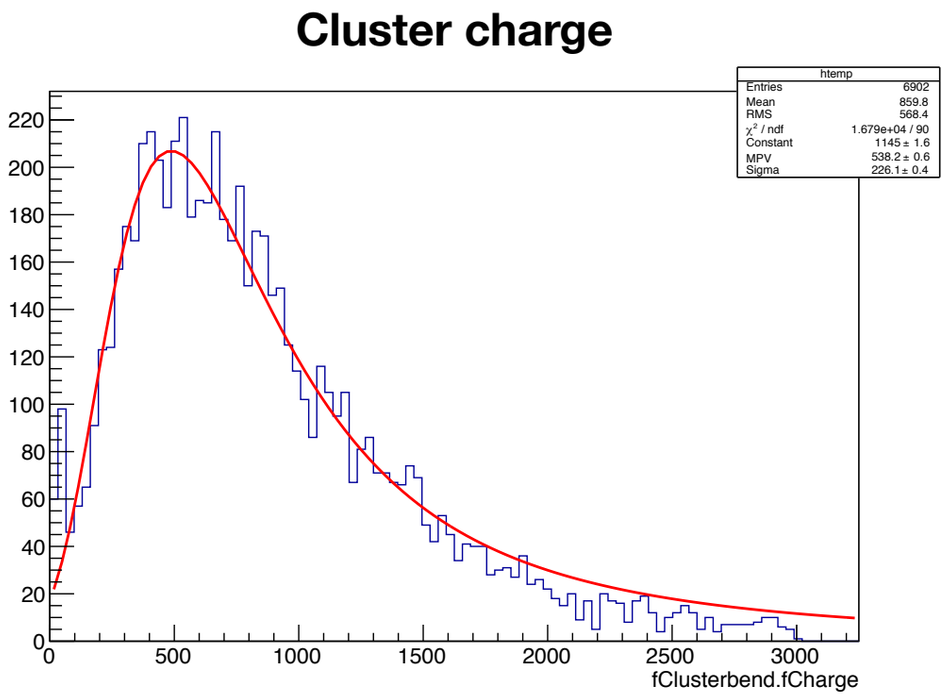
(runs 1013-1016)

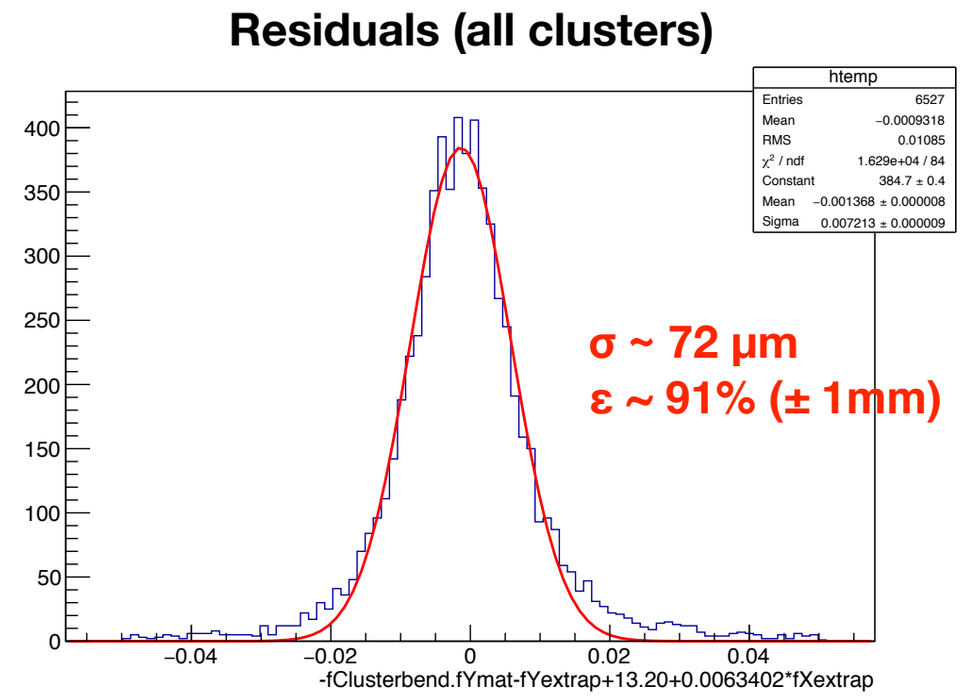
Slat



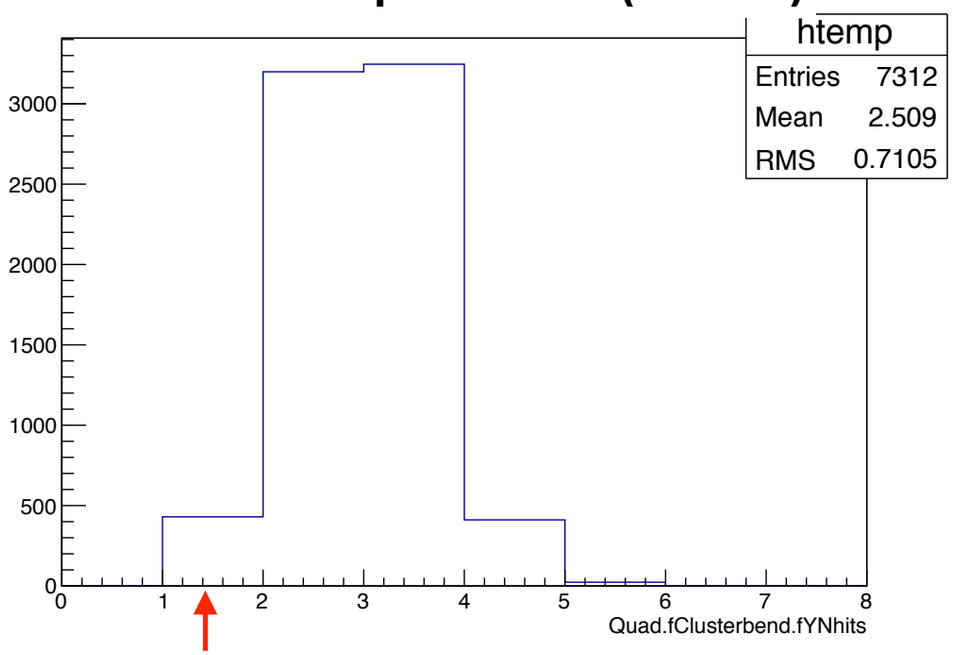


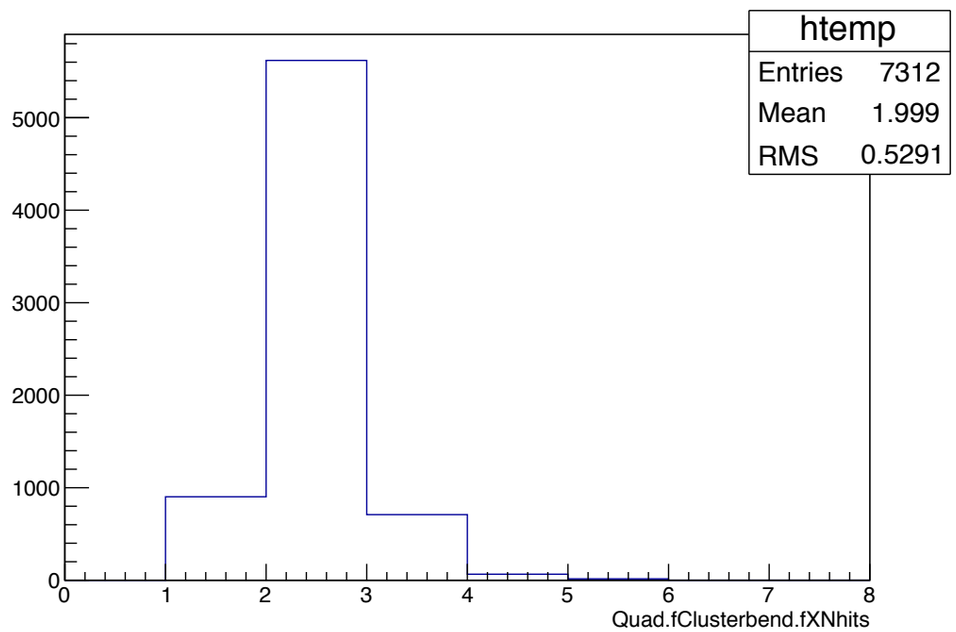
Clusters with 1 pad 4.1%



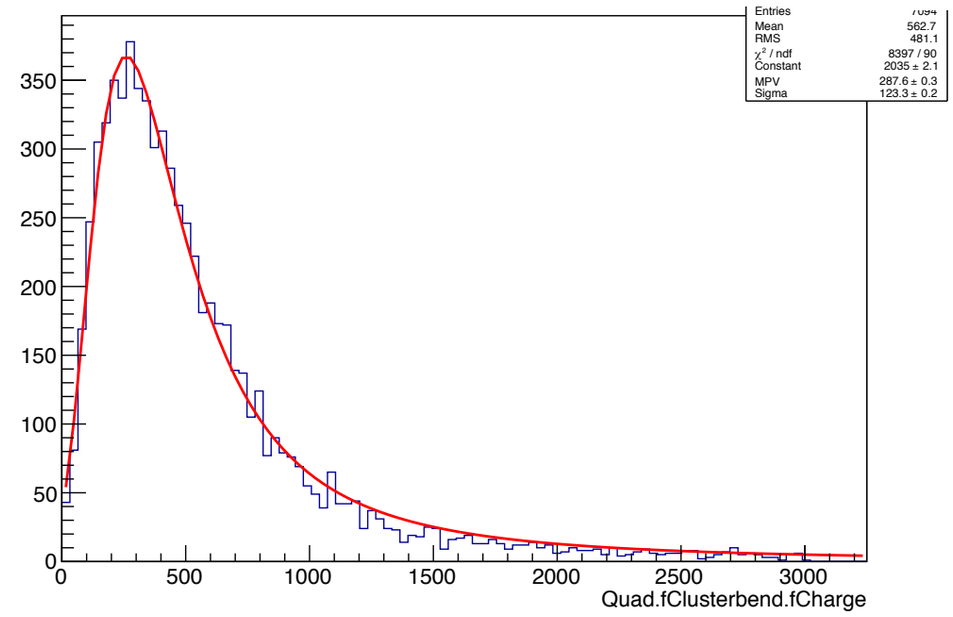


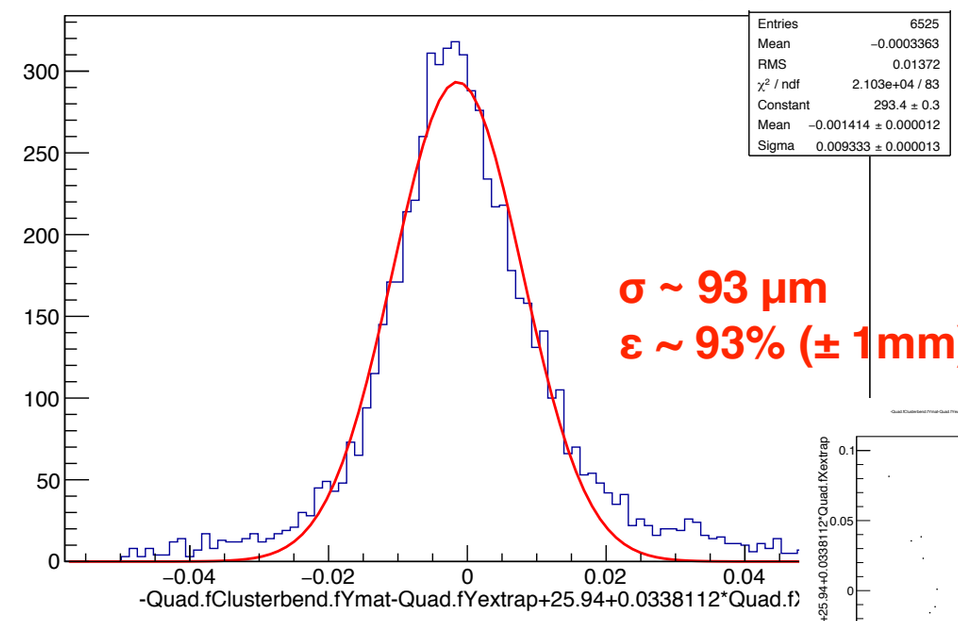
Quadrant



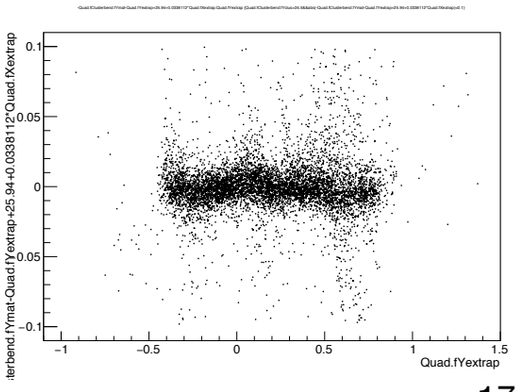


Clusters with 1 pad 5.9%





σ ~ 93 μm
ε ~ 93% (± 1mm)

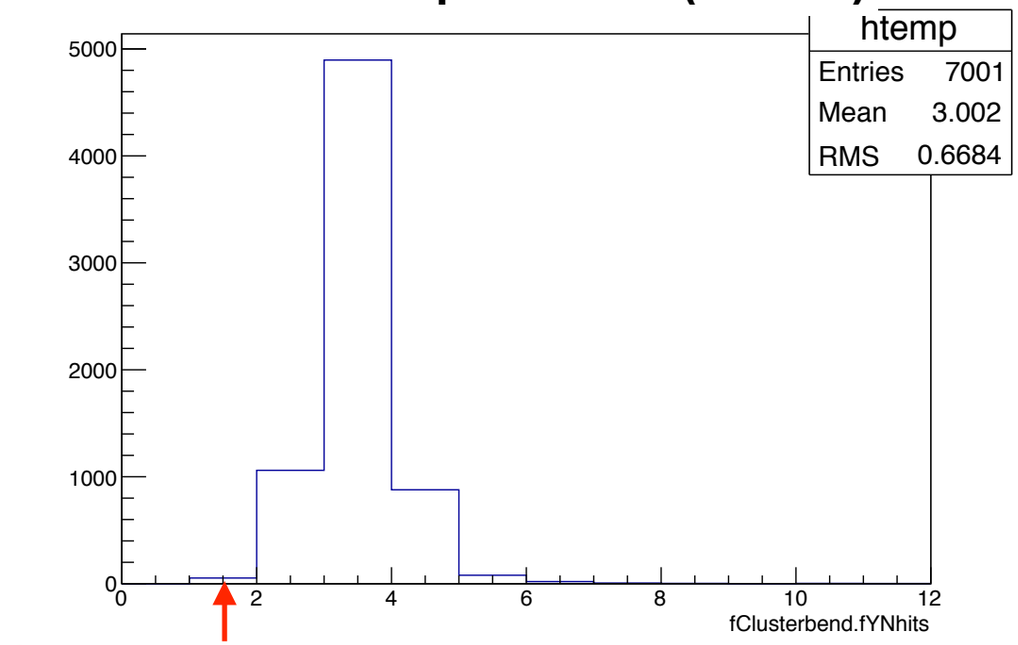


Results @ 1700 V for Slat and Quadrant
Threshold 3 channels, >= 3 samples

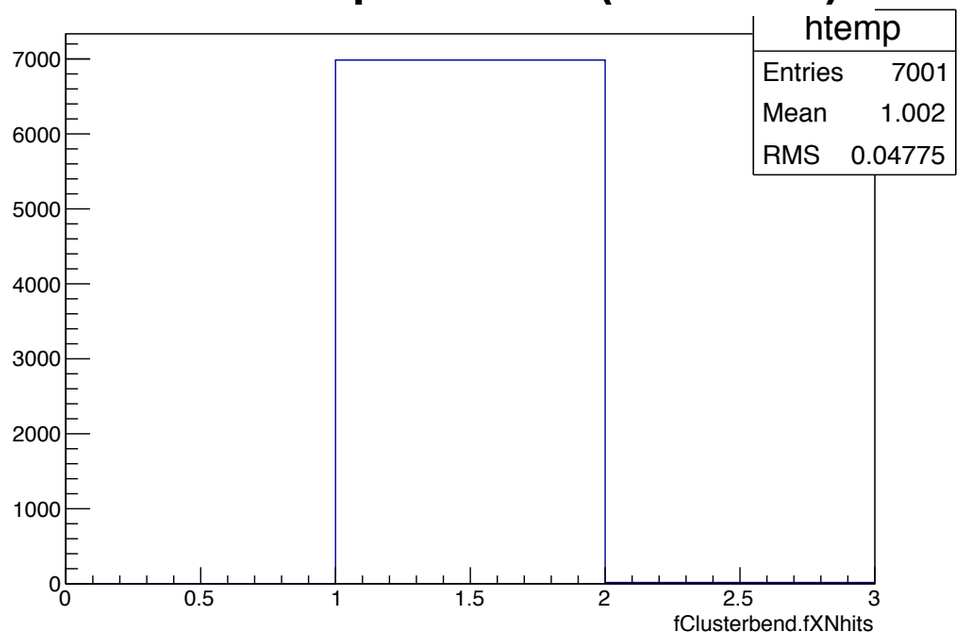
Charge sum OFF

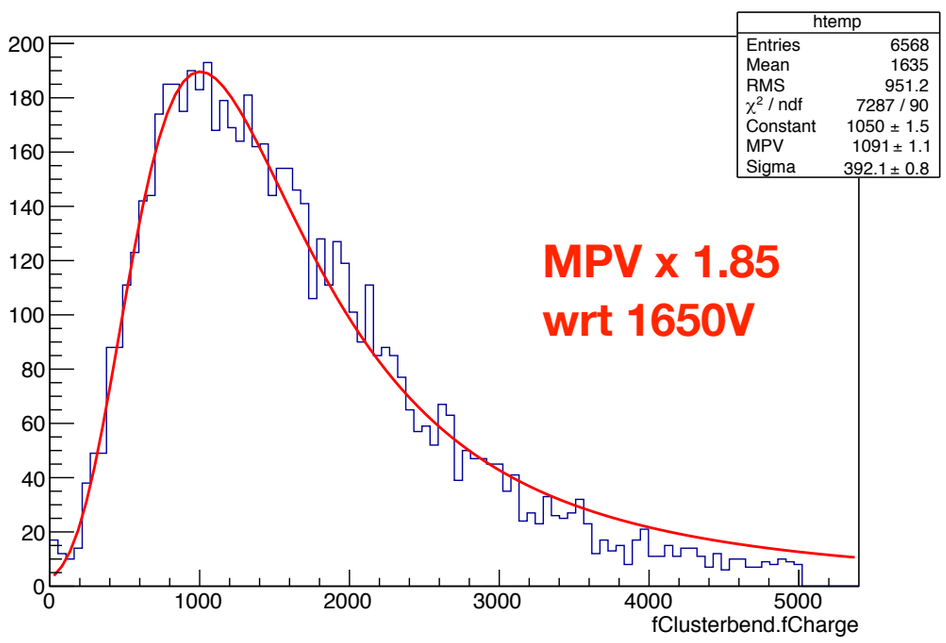
(runs 966-971)

Slat

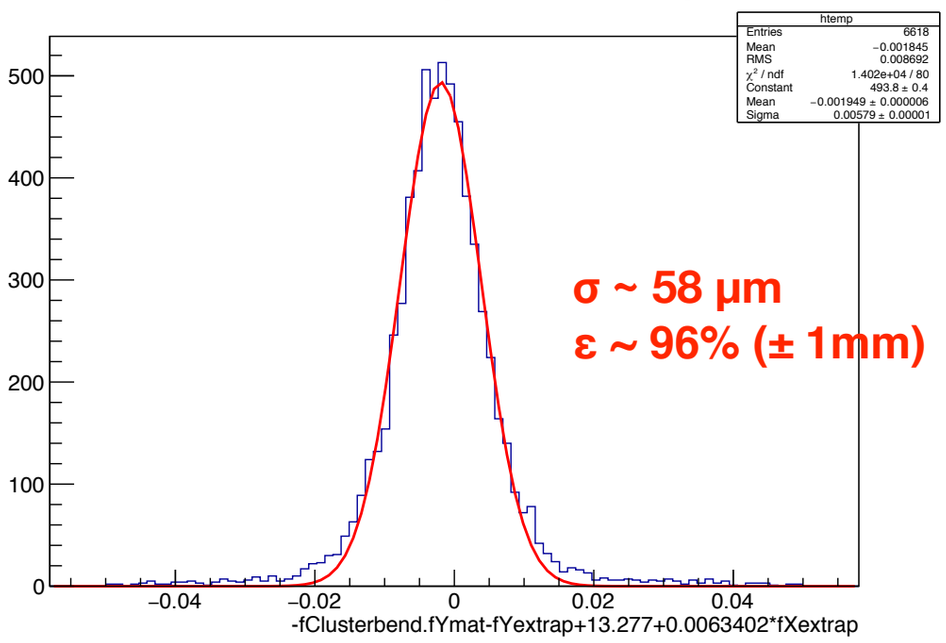


Clusters with 1 pad 0.76%



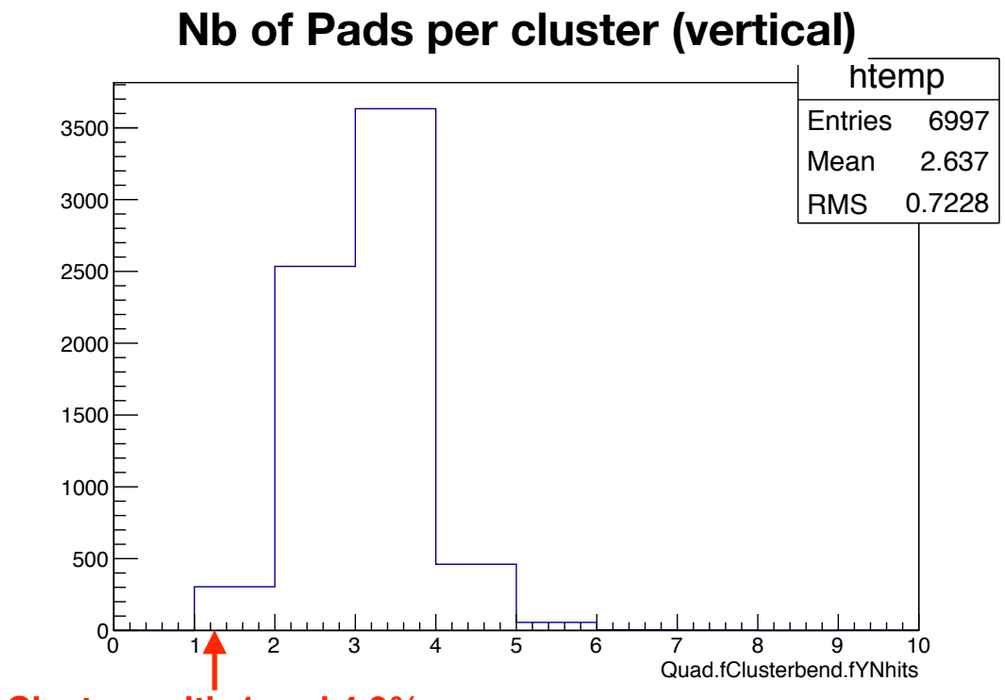


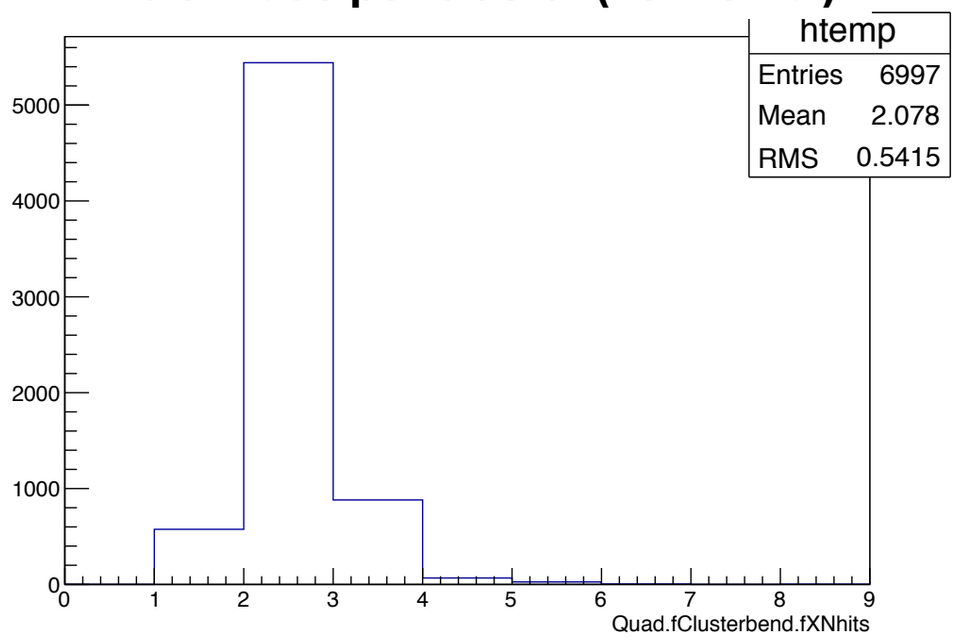
MPV x 1.85
wrt 1650V

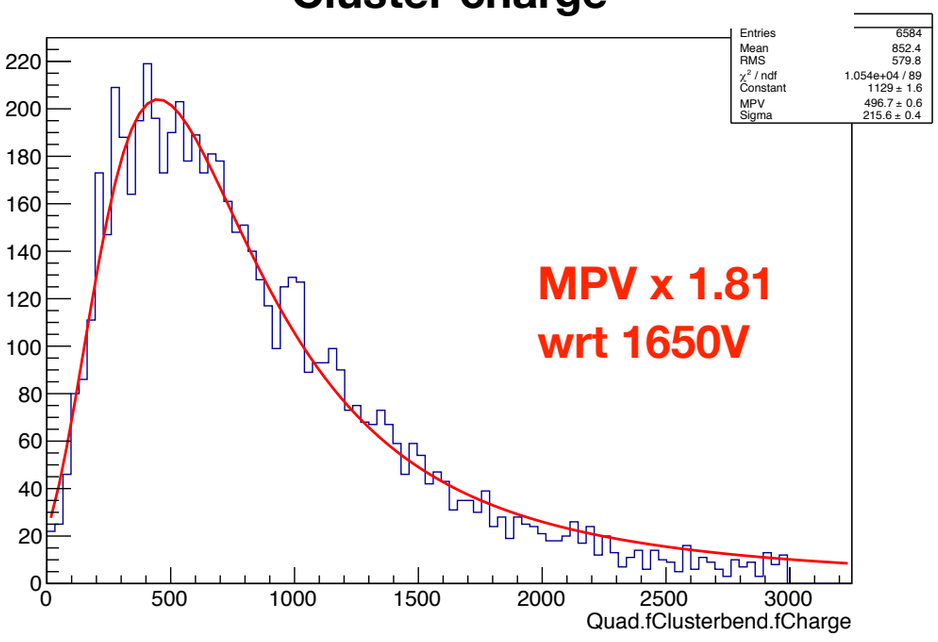


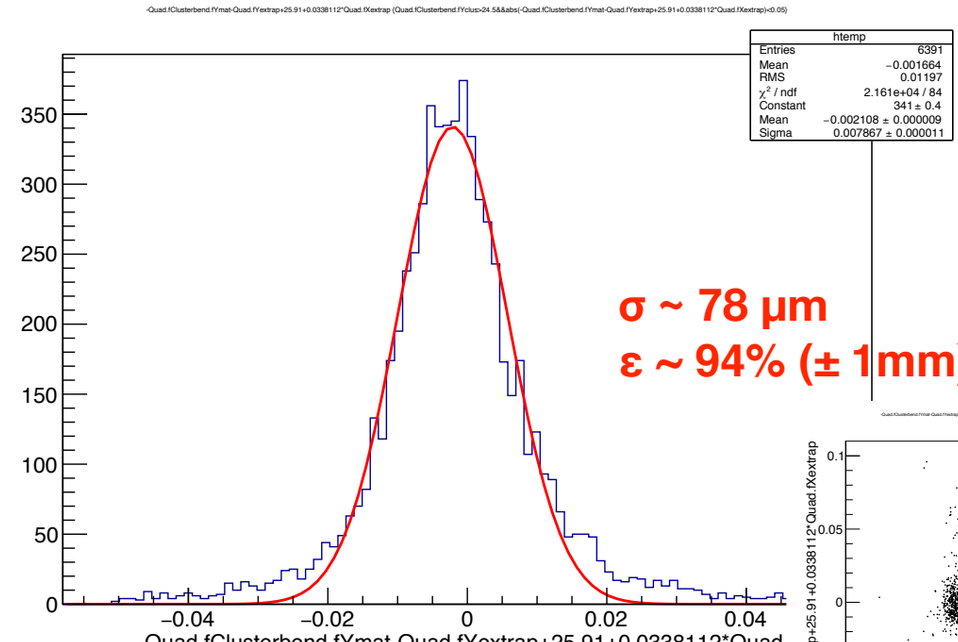
σ ~ 58 μm
ε ~ 96% (± 1mm)

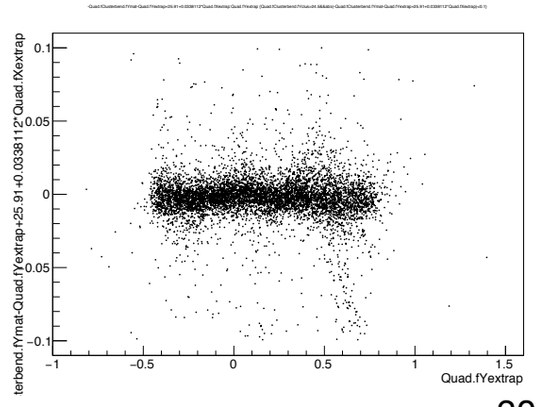
Quadrant


Nb of Pads per cluster (vertical)
htemp
Entries 6997
Mean 2.637
RMS 0.7228
Quad.fClusterbend.fYNhits
Clusters with 1 pad 4.3%


Nb of Pads per cluster (horizontal)
htemp
Entries 6997
Mean 2.078
RMS 0.5415
Quad.fClusterbend.fXNhits


Cluster charge
Entries 6584
Mean 852.4
RMS 579.8
χ² / ndf 1.054e+04 / 89
Constant 1129 ± 1.6
MPV 496.7 ± 0.6
Sigma 215.6 ± 0.4
MPV x 1.81
wrt 1650V
Quad.fClusterbend.fCharge


Residuals (all clusters)
htemp
Entries 6391
Mean −0.001664
RMS 0.01197
χ² / ndf 2.161e+04 / 84
Constant 341 ± 0.4
Mean −0.002108 ± 0.000009
Sigma 0.007867 ± 0.000011
σ ~ 78 μm
ε ~ 94% (± 1mm)
-Quad.fClusterbend.fYmat-Quad.fYextrap+25.91+0.0338112*Quad.

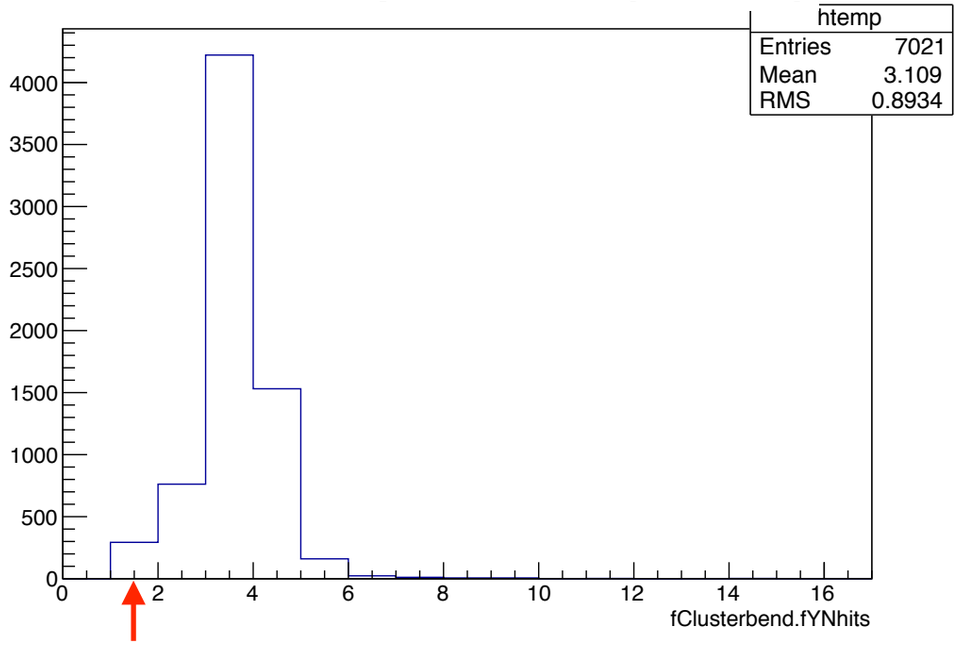

Quad.fYextrap

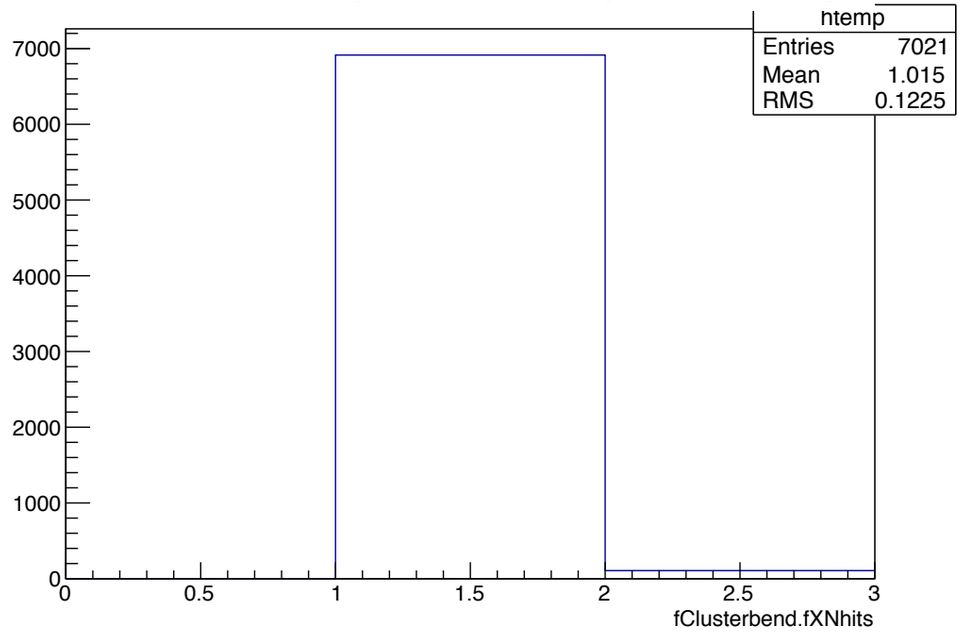
Results @ 1700 V for Slat and Quadrant
Threshold 2 channels, >= 3 samples

Charge sum OFF

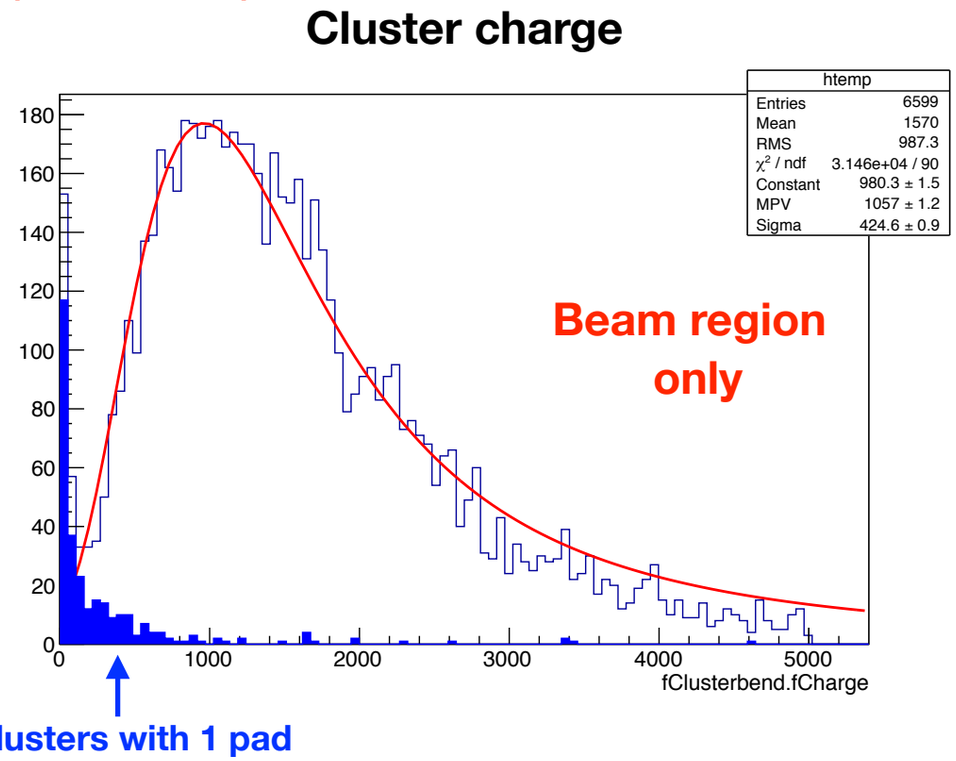
(runs 972-977)

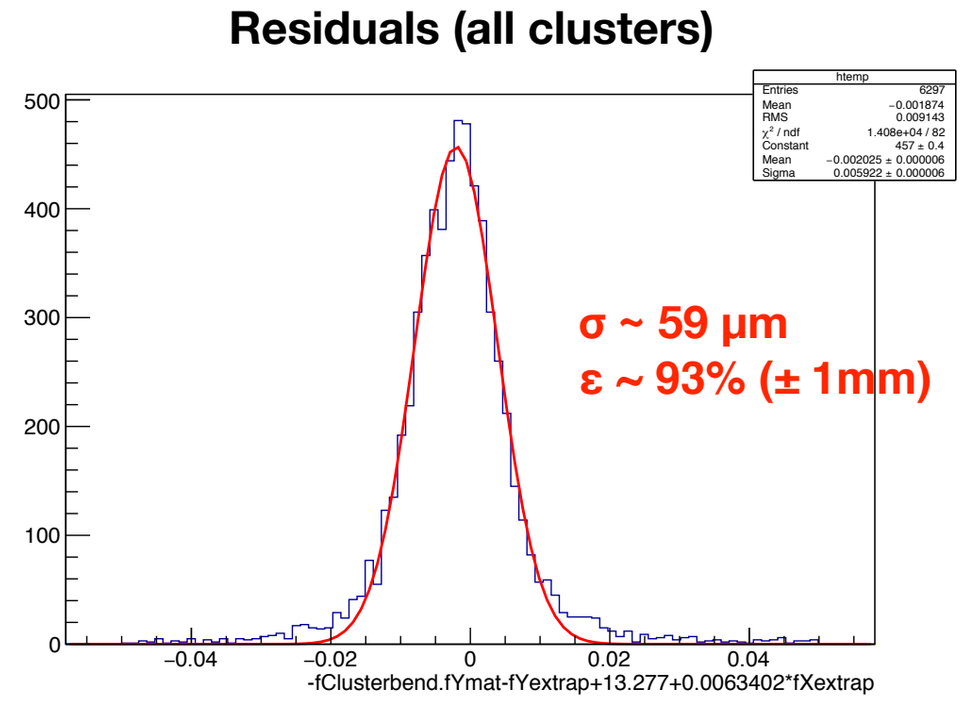
Slat



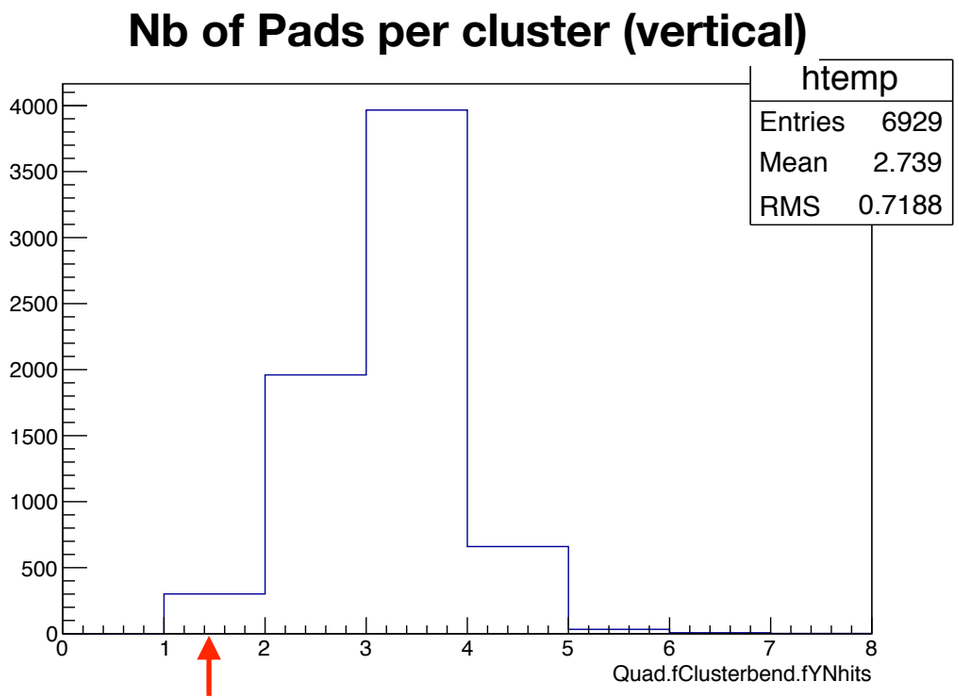


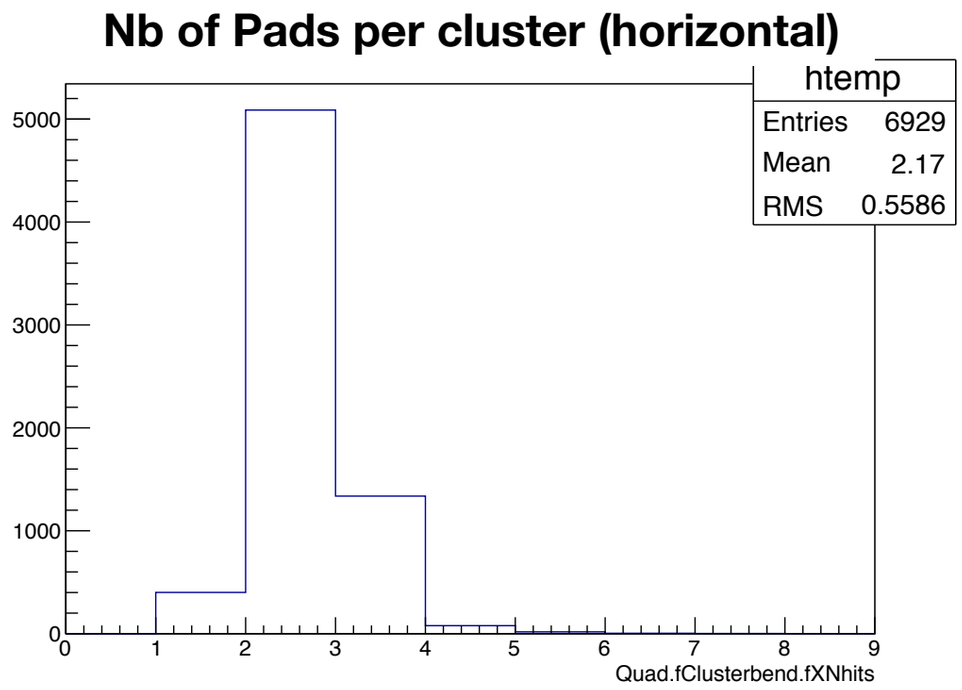
Clusters with 1 pad 4.2% (include noise)



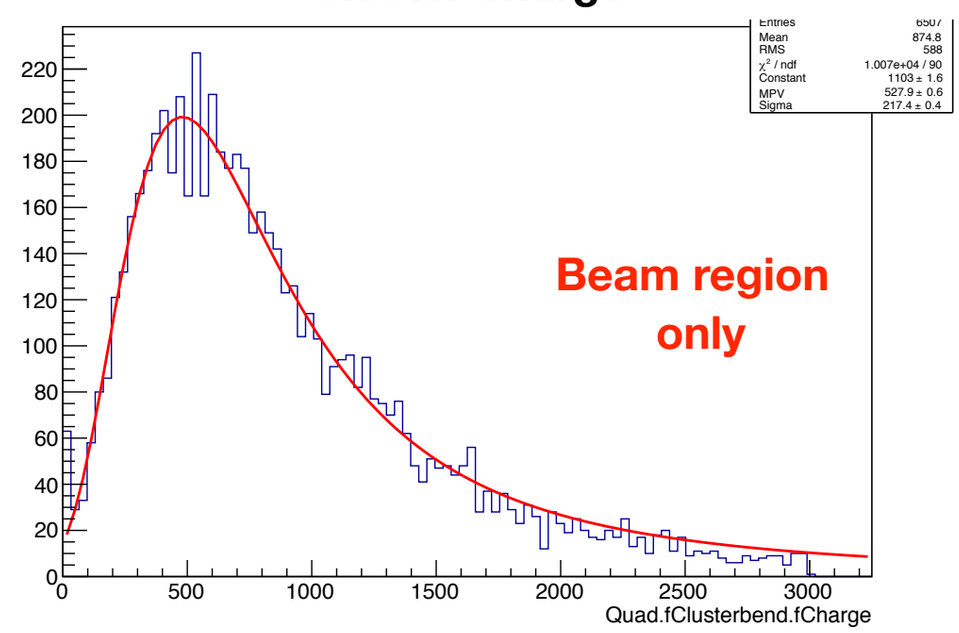


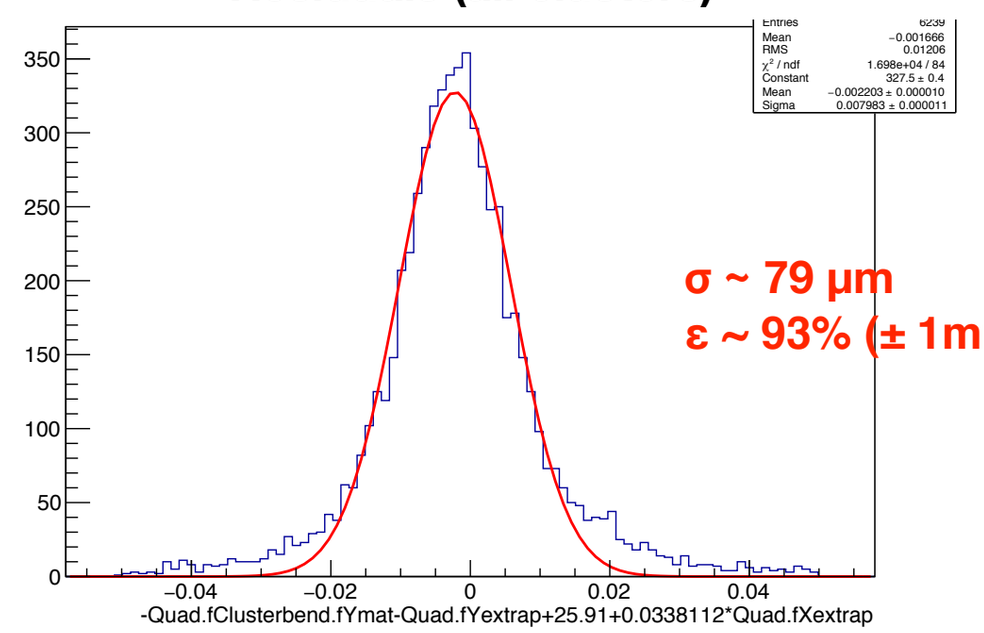
Quadrant





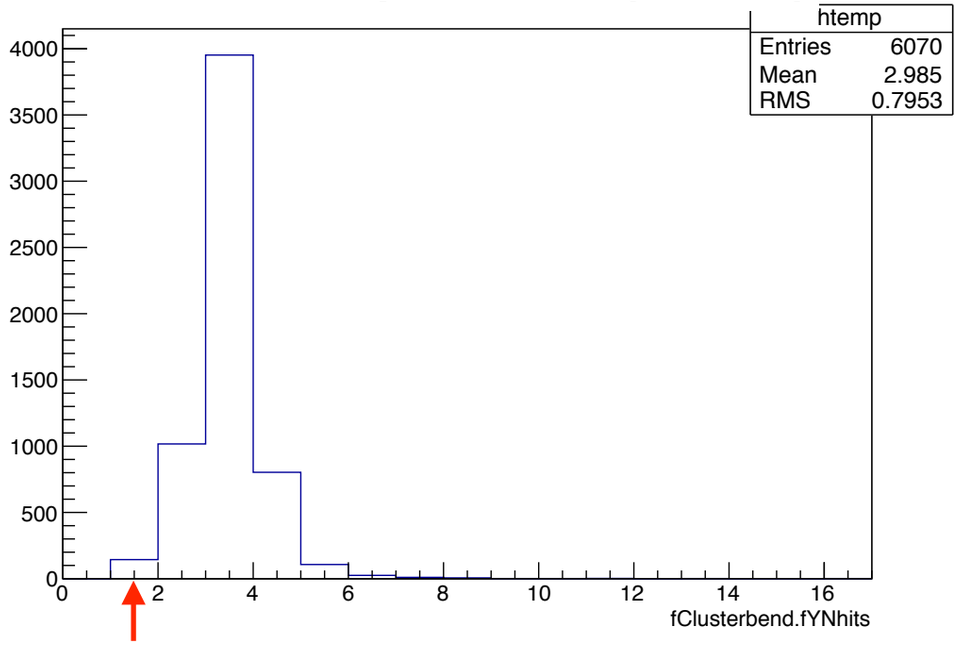
Clusters with 1 pad 4.3%
(include noise)

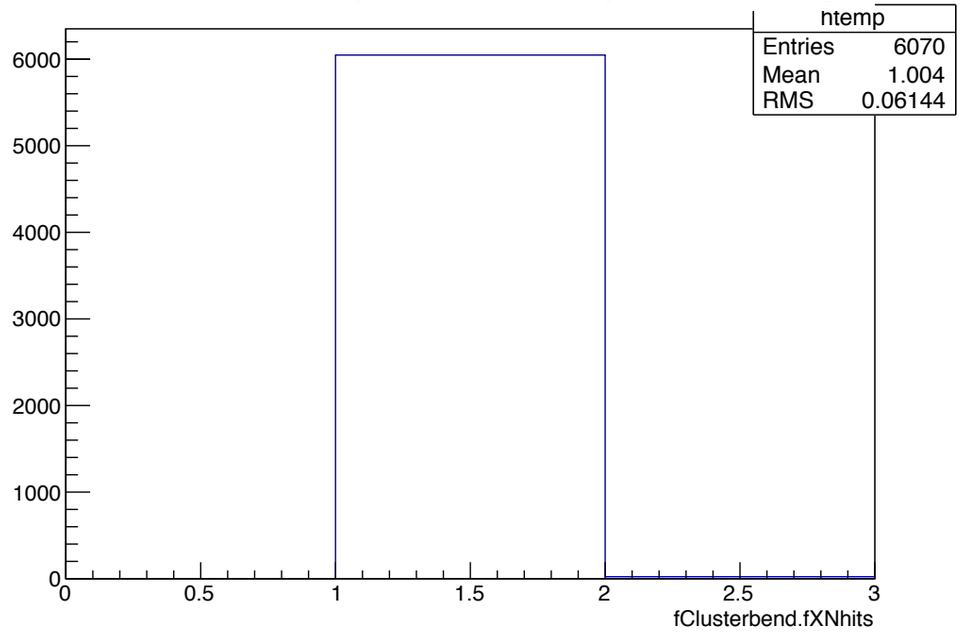




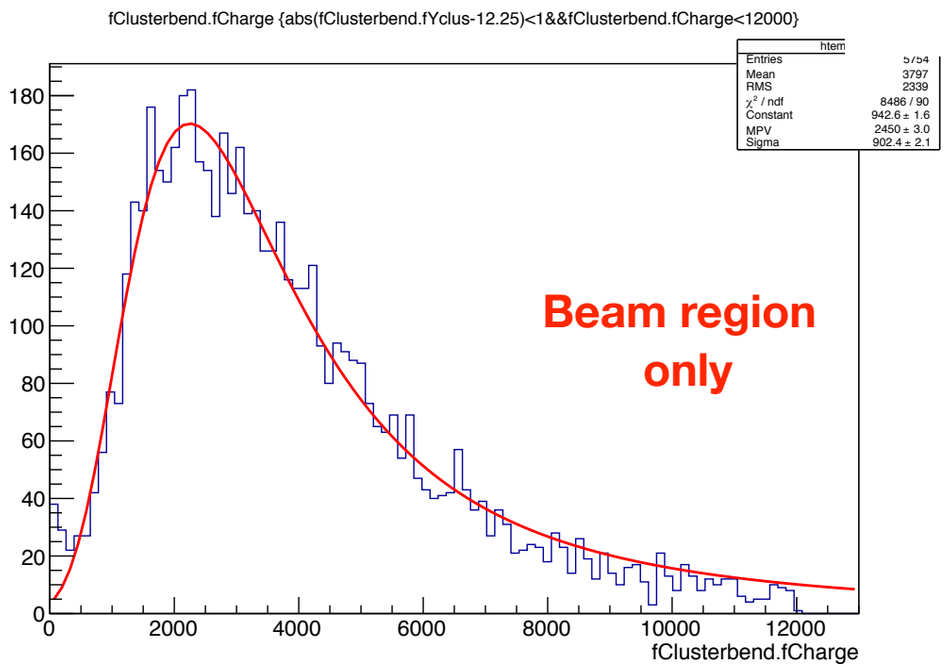
Results @ 1650 V for Slat and Quadrant
New electronics 11 mV/fC
Threshold 8, 5 channels, >= 3 samples
Charge sum OFF
(runs 950-953)

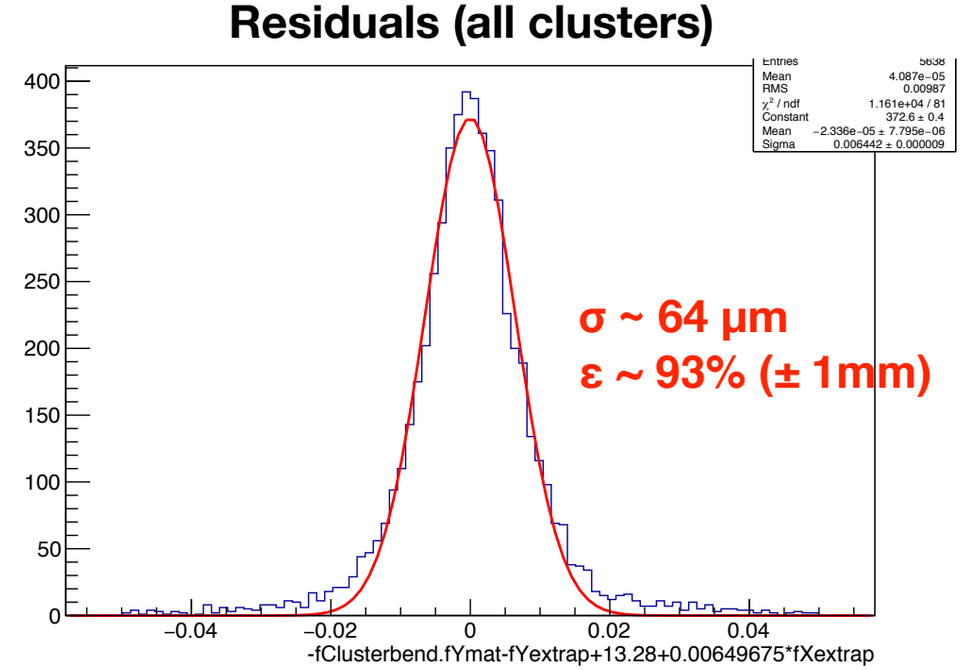
Slat



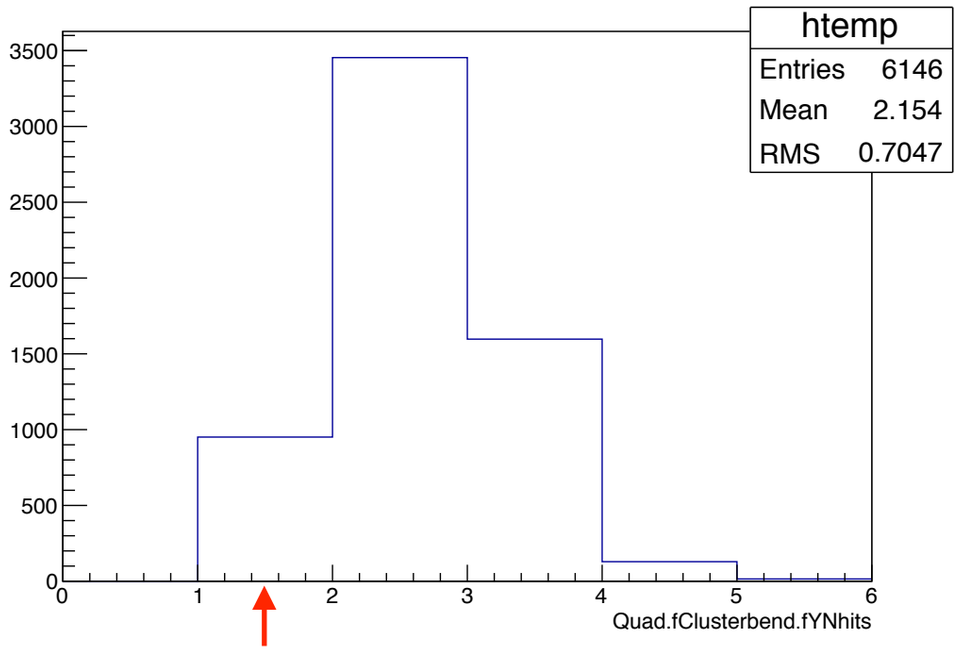


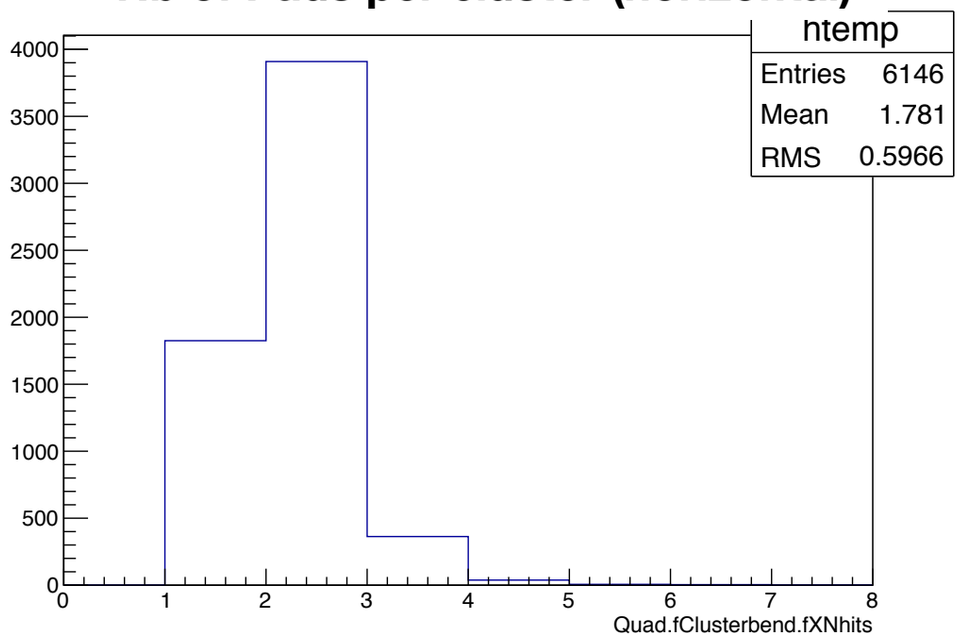
Clusters with 1 pad 2.4% (include noise)



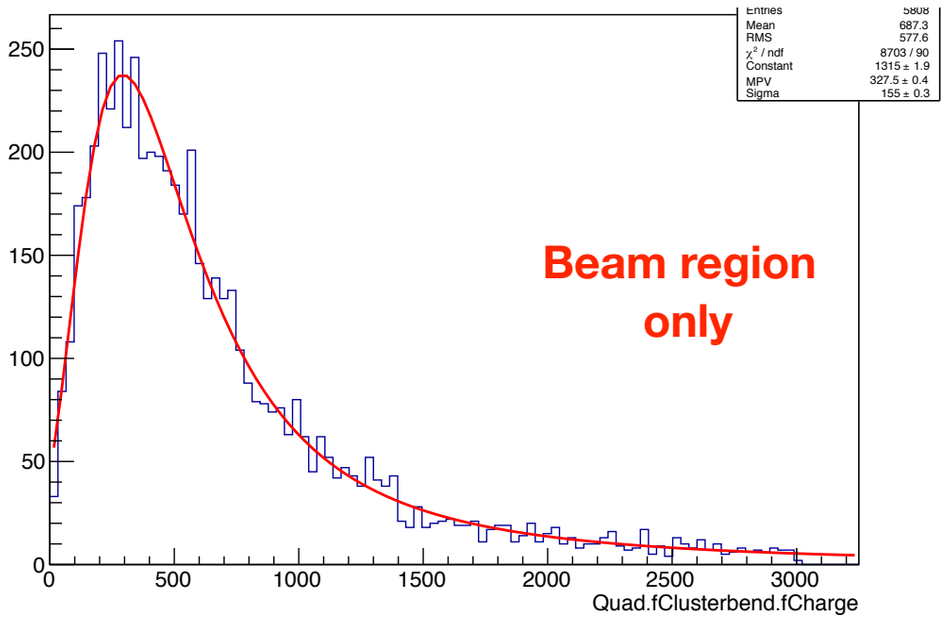


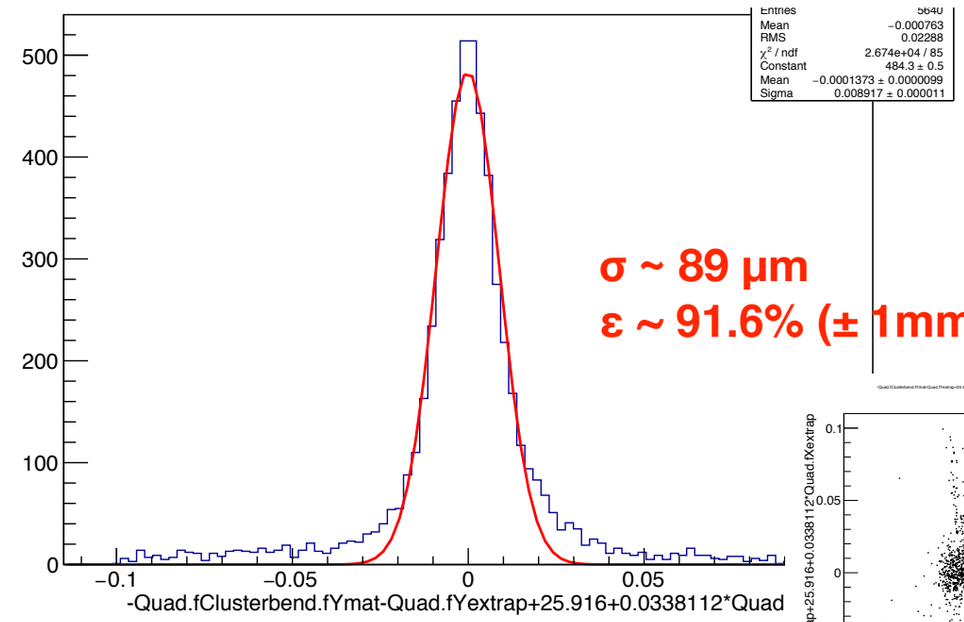
Quadrant

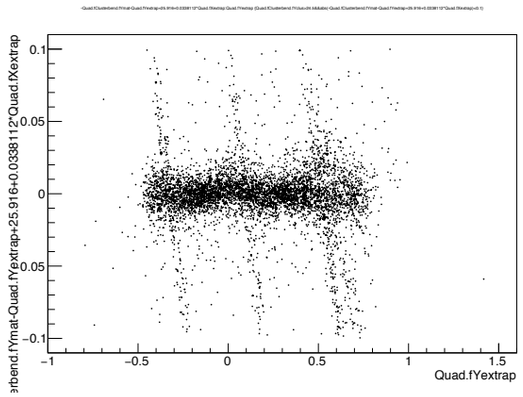




Clusters with 1 pad 15.4% (include noise)







Summary

			Slat				Quadrant			
	HV (V)	Thres (ADC ch)	MPV (ADC ch)	YNhits (%)	Res (μm)	Eff (%)	MPV (ADC ch)	YNhits (%)	Res (μm)	Eff (%)
	1650	3	568	1.75	70	95	274	8.6	93	93
	1650	2	538	4.1	72	91	287	5.9	93	93
	1700	3	1049 (x1.8)	0.76	58	96	497 (x1.8)	4.3	79	94
	1700	2	1057	4.2	59	93	527	4.3	79	93
New electronics →	1650	8/5	2450	2.4	64	93	327	15.4	89	92

- Satisfactory results for the Slat @ 1650 V: Res ~ 70 μm & ε ~ 95%
- Issue with the gain of the Quadrant => poor resolution & efficiency
  - Gas flow? HV supply? Same construction as the ones in the cavern?
- Gain for both detectors x1.8 for 50 V => OK
- Threshold 3->2 => Not a real improvement
- New electronics
  - Really 11 mV/fC? It looks like 17 mV/fC (4*2450/568)
  - More dynamics. The threshold can be better tuned but no sensible gain.

The detectors should have a good gain