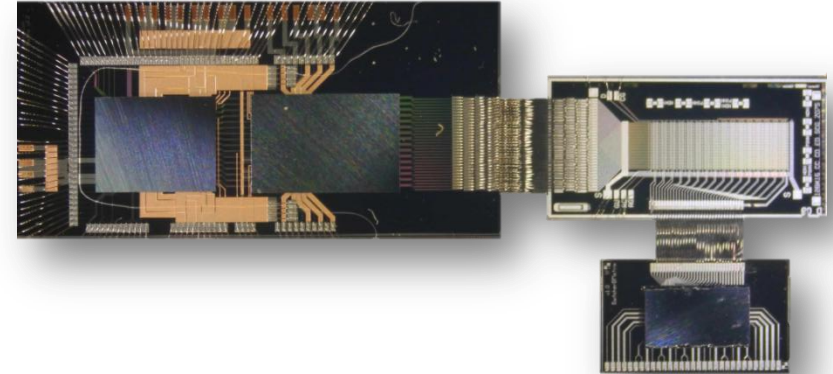


Hybrid 5 sensor optimization

Florian Lütticke, Carlos Marinas, Jan Cedric Hoenig
University of Bonn (Prof. Norbert Wermes)

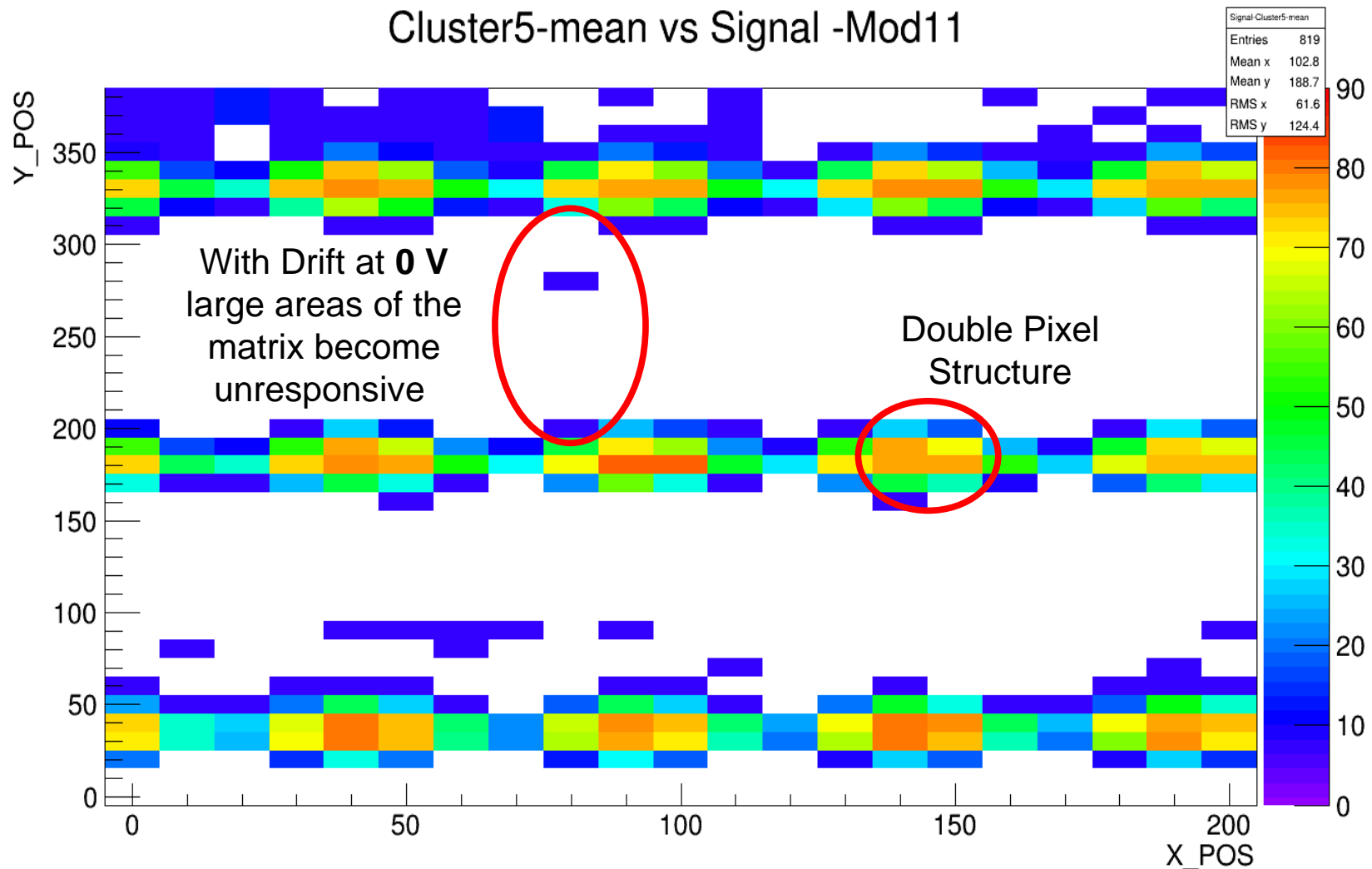


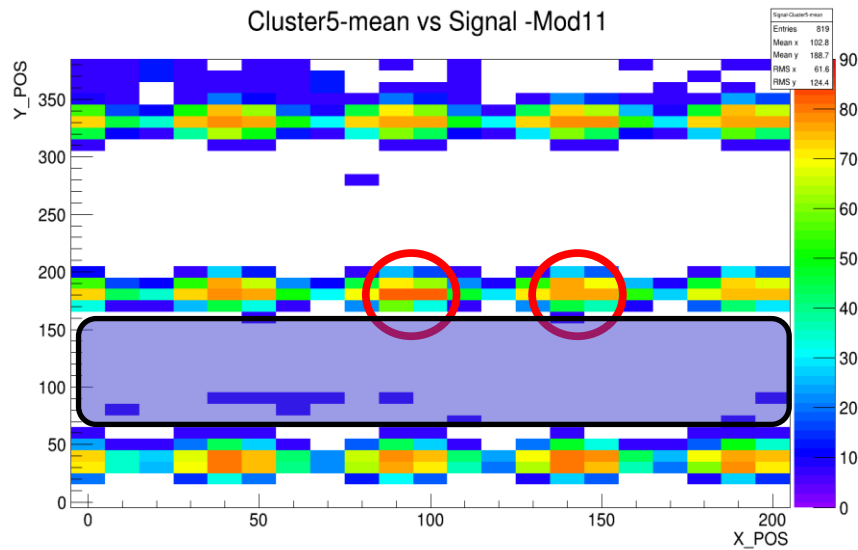


- Voltage scans done with Hybrid 5.0.03
 - All the ASICs + Belle II DEPFET working together
 - Optimization for Signal to noise not sufficient: Use charge collection homogeneity
 - Drift / HV and Clear Gate / Clear Low
 - Each Voltage step requires manual pedestal update
 - Homogeneity scan with Laser, resolution 10 μm
 - 5x4 Pixel region scanned: over 800 scans, each with 4000 laser pulses
 - Measurements done by Jan Cedric Hoenig

Laser scan at HV=20V, Drift=0V

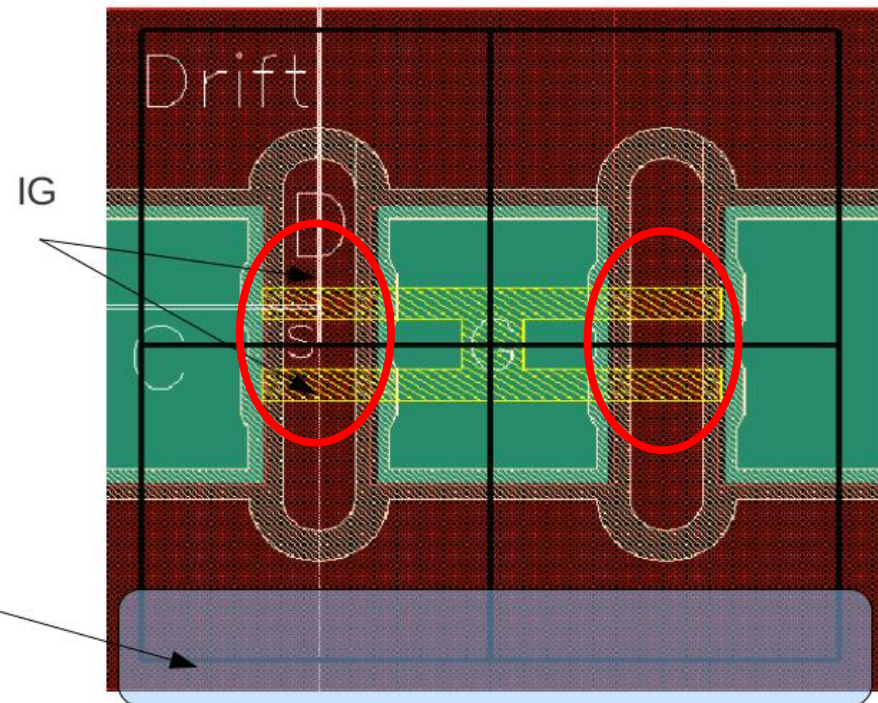
- Bad operation point, but position of internal gate visible!





Pixel Border: Weak lateral drift fields and pixel charge sharing.

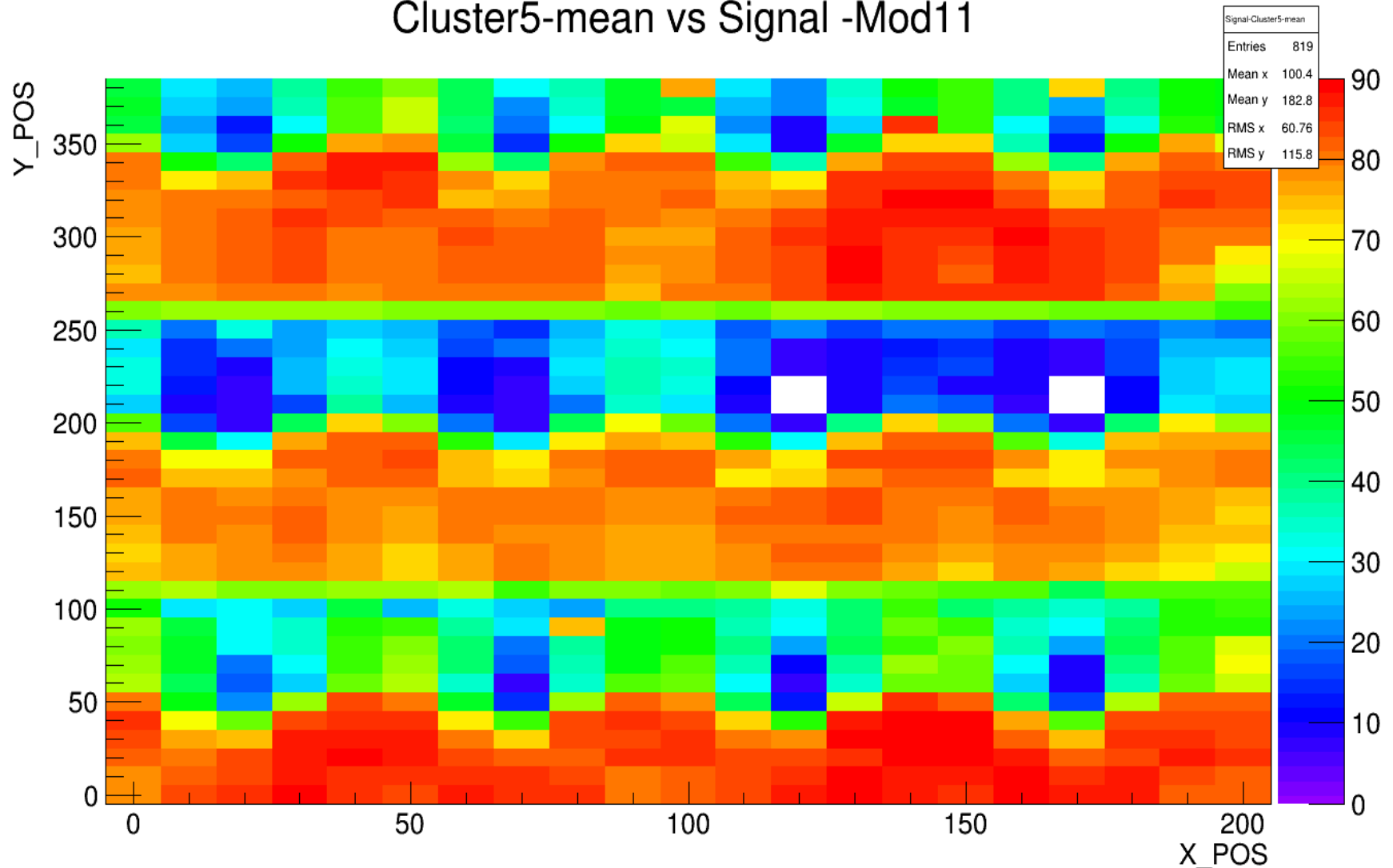
Two DEPFET double pixel structures



Laser scan at HV=22V, Drift=2V

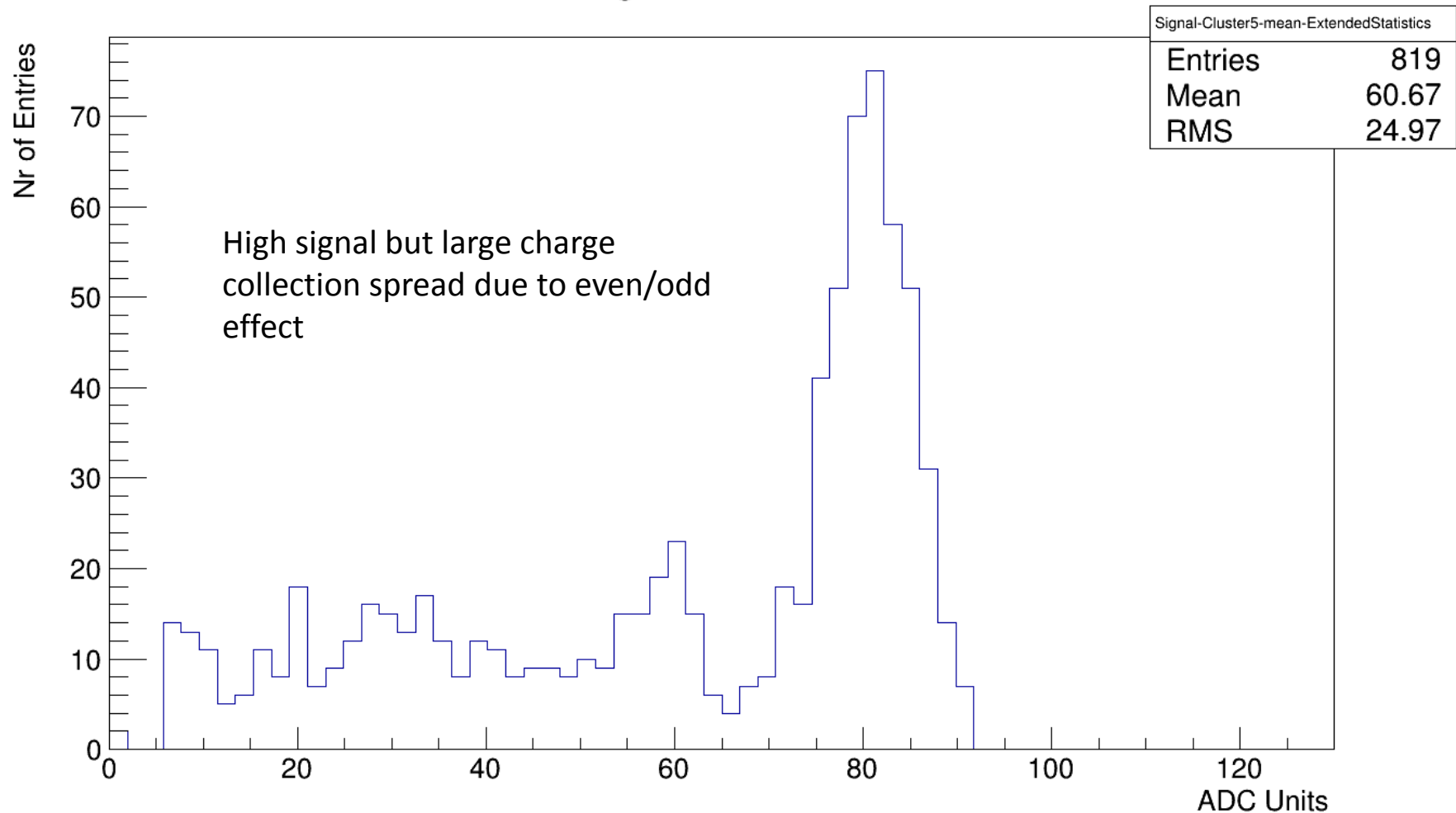
- Even/Odd effect at high HV values, matrix blind in some areas

Cluster5-mean vs Signal -Mod11



- Histogram of Laser signals at different positions

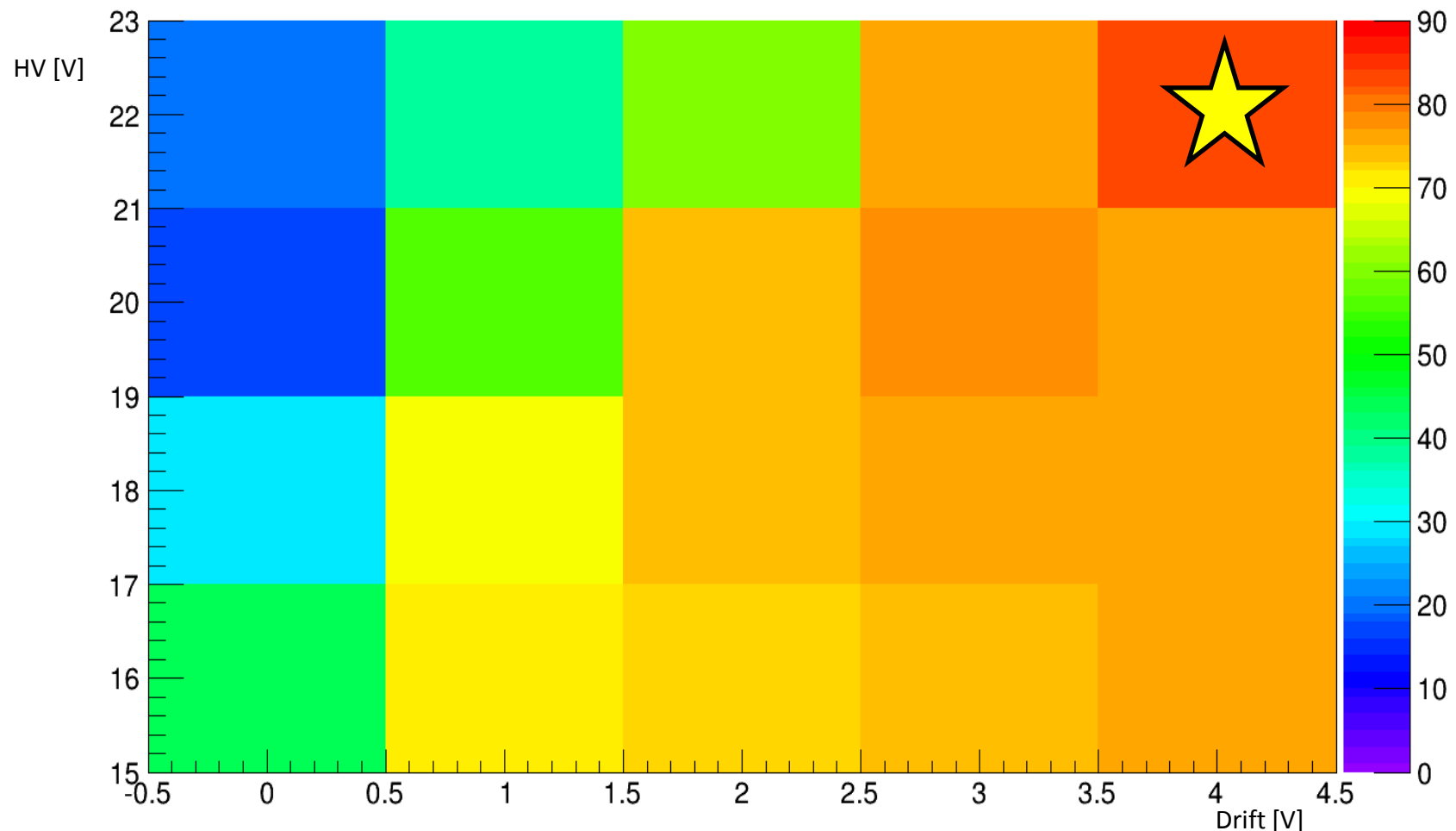
Cluster5-mean vs Signal -Mod11-ExtendedStatistics



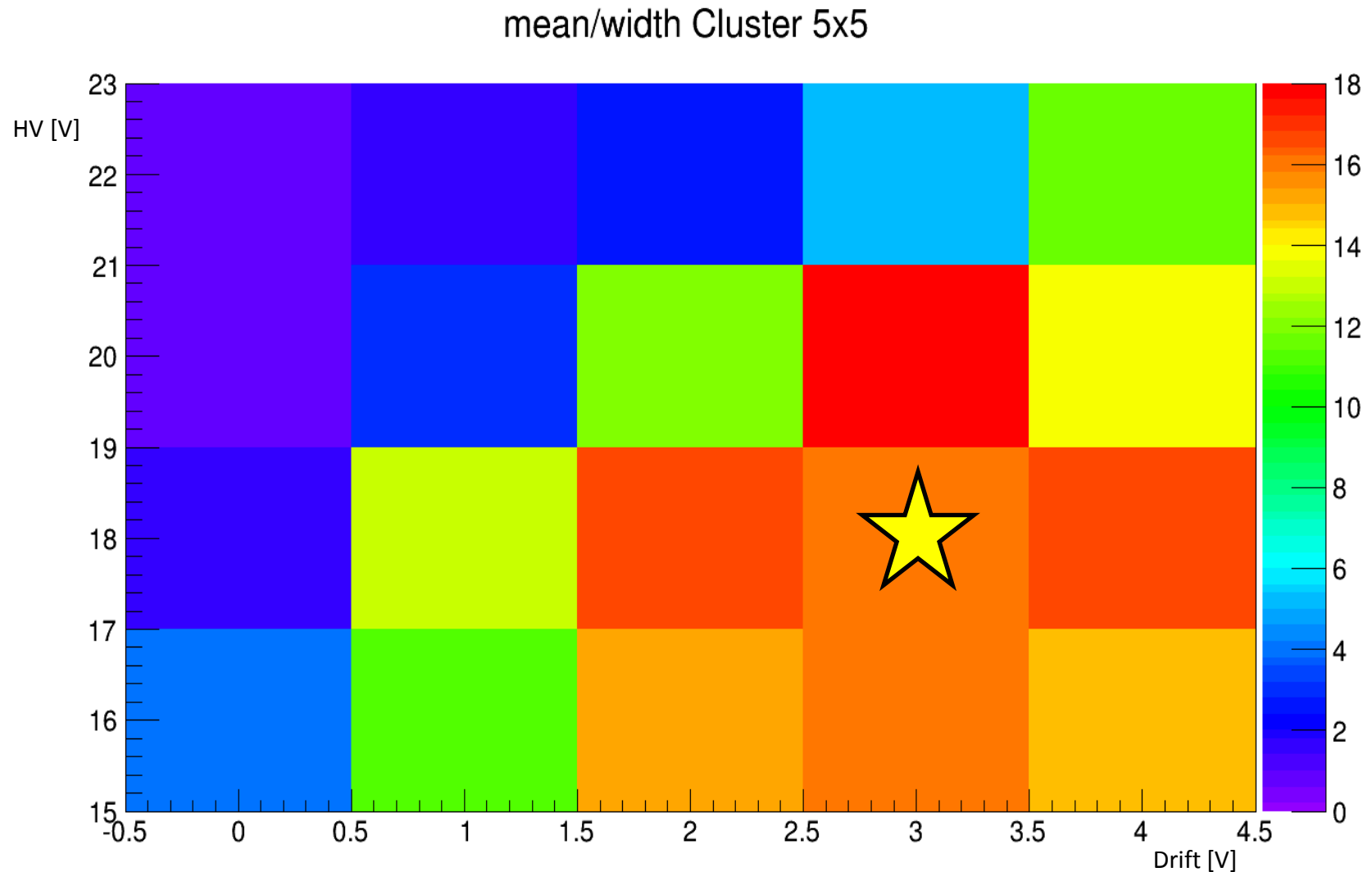
Drift vs HV Laser scan, mean signal value

- Mean cluster value of all scans proposes rather high clear value
- Mean not best figure of merit, homogeneity important. Optimize for mean/RMS

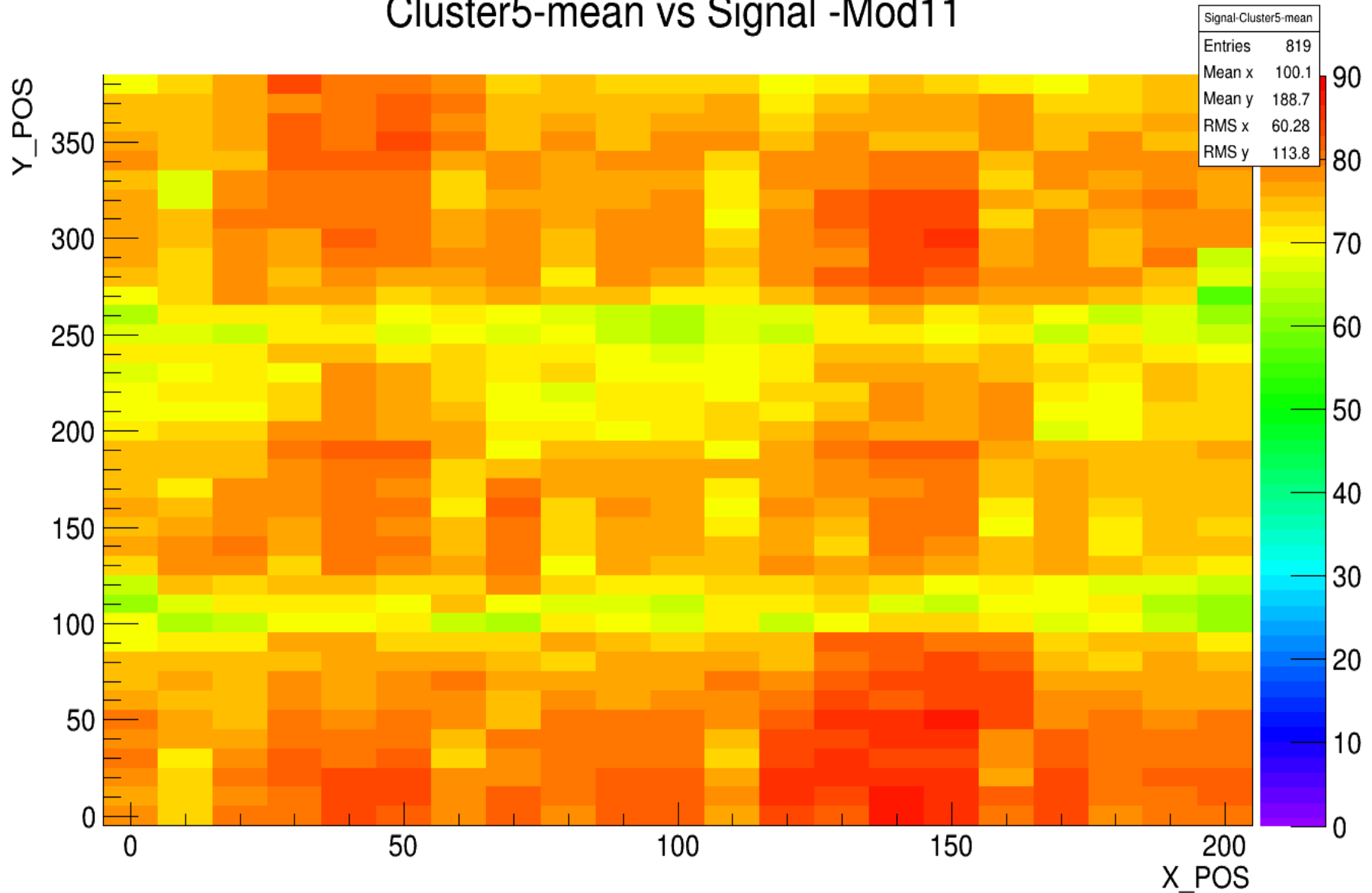
mean Cluster 5x5



- Response more homogeneous at low HV voltages

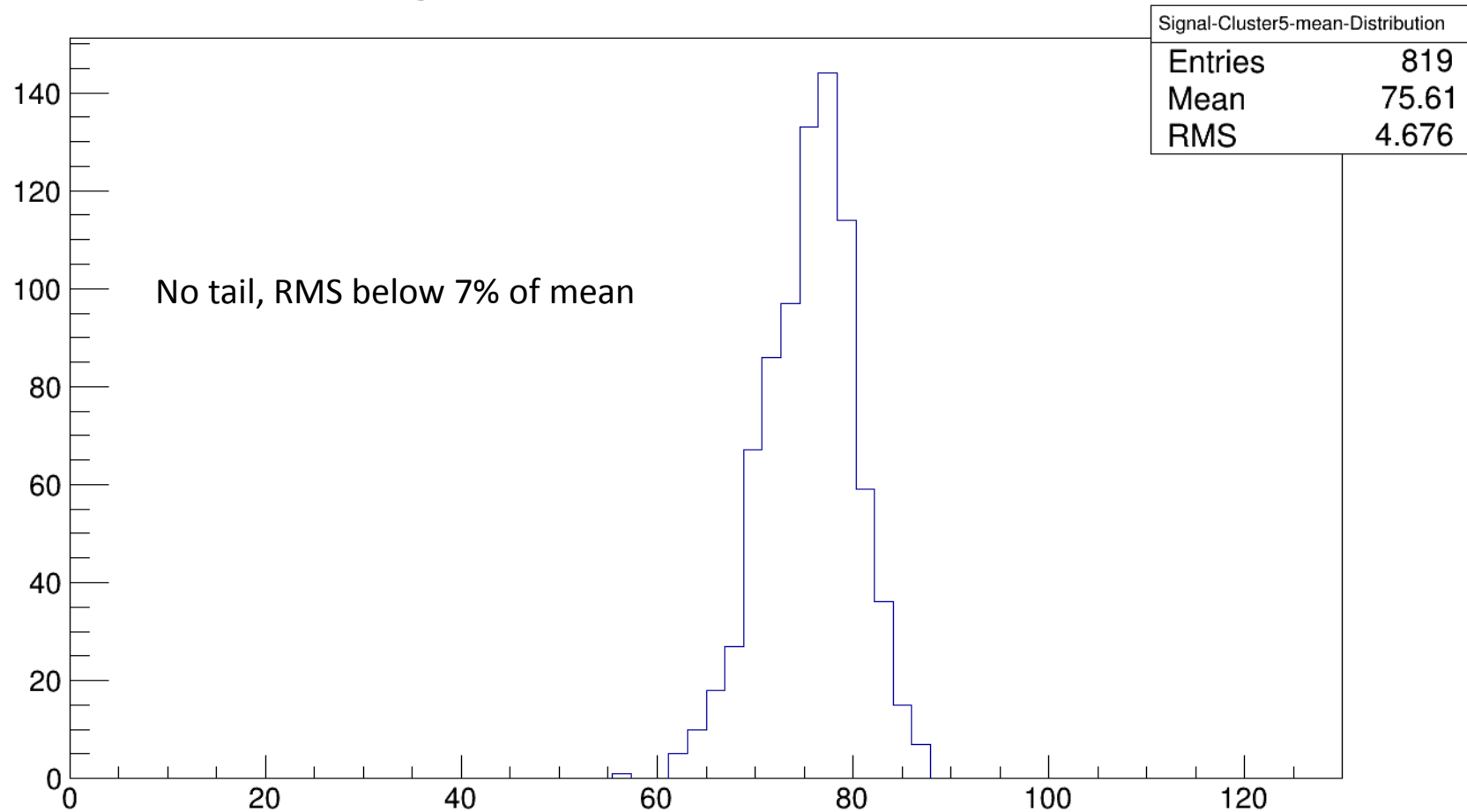


Cluster5-mean vs Signal -Mod11

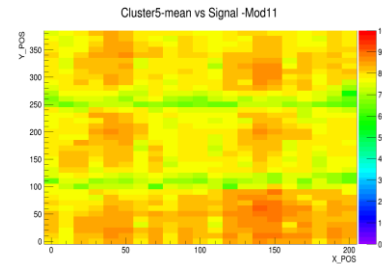


- Much narrower distribution

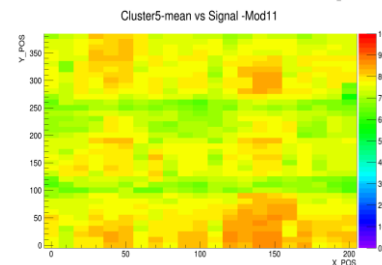
Signal-Cluster5-mean-Distribution



- Same scan for CCG / Clear Low in progress

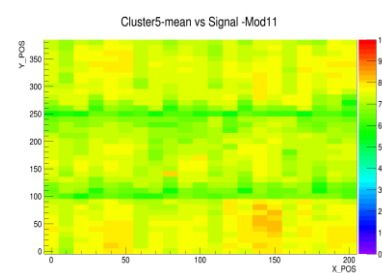
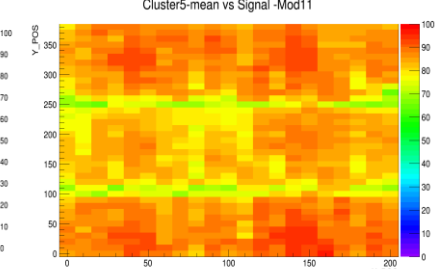
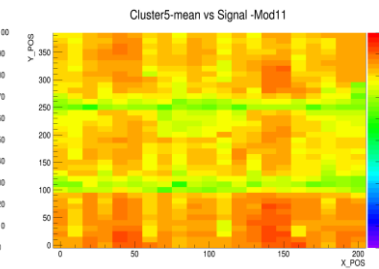
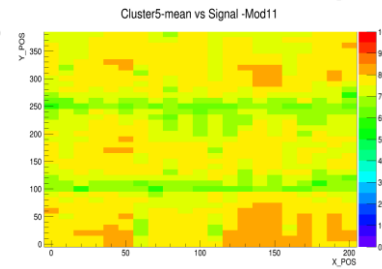
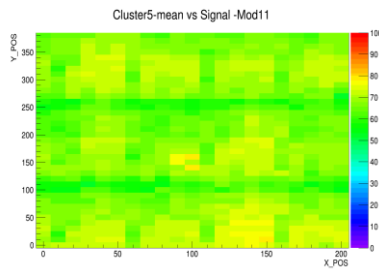


Clear Low 2V wrt Source



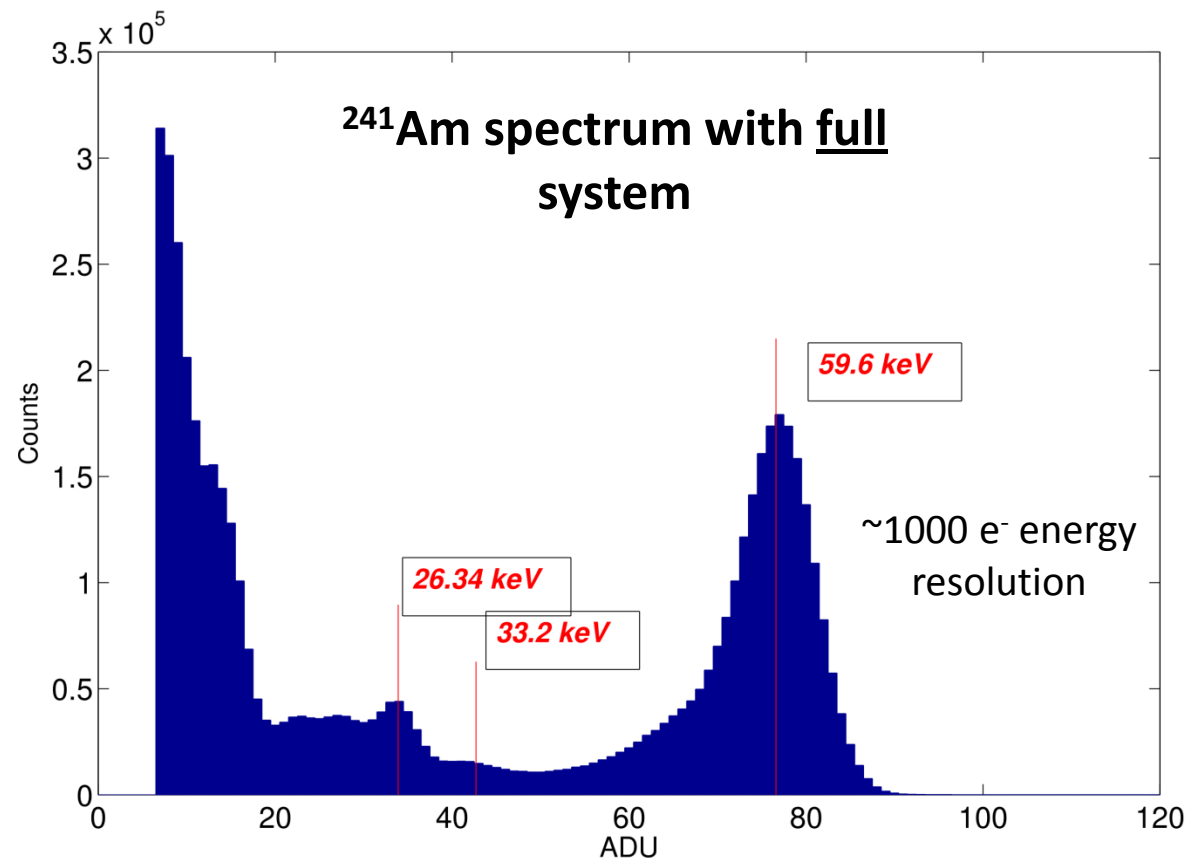
CCG 0 V wrt Source

CCG -4 V wrt Source



Clear Low 5V wrt Source

- Done with Drift 2V and HV 25V (non optimal)
- Triggerless zero suppressed readout
- g_Q approx. 450 pA/electron



- Sensor optimized for quality parameter Mean/RMS
- Laser scan done for Hybrid 5.0.03
 - Drift / HV done
 - CCG / Clear Low is in progress
- Charge collection uniform within 7% RMS
- Absolute source calibration performed: 450 pA/electron
- Optimization still in progress

Thank you for your attention