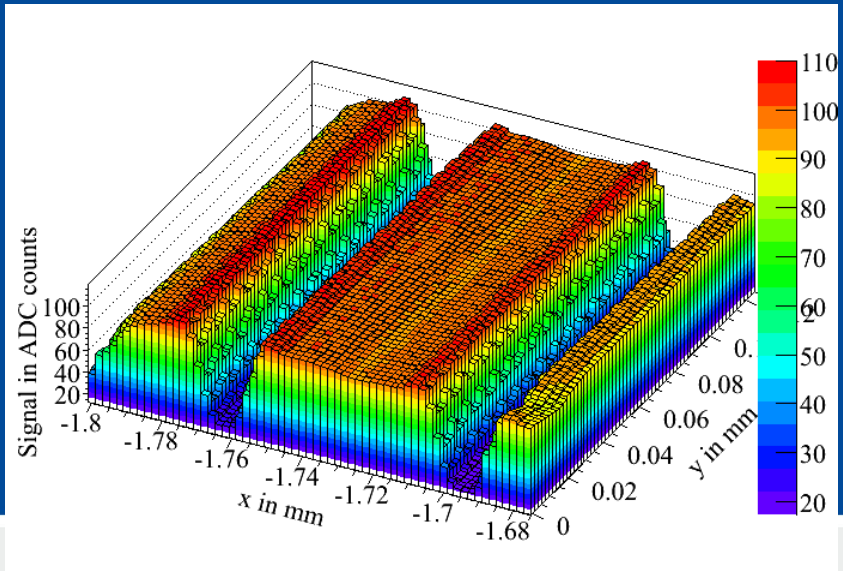
Status of the ALiBaVa Systems in Freiburg

M. Breindl, M. Köhler, U. Parzefall, J. Preiss,
M. Walz, L. Wiik



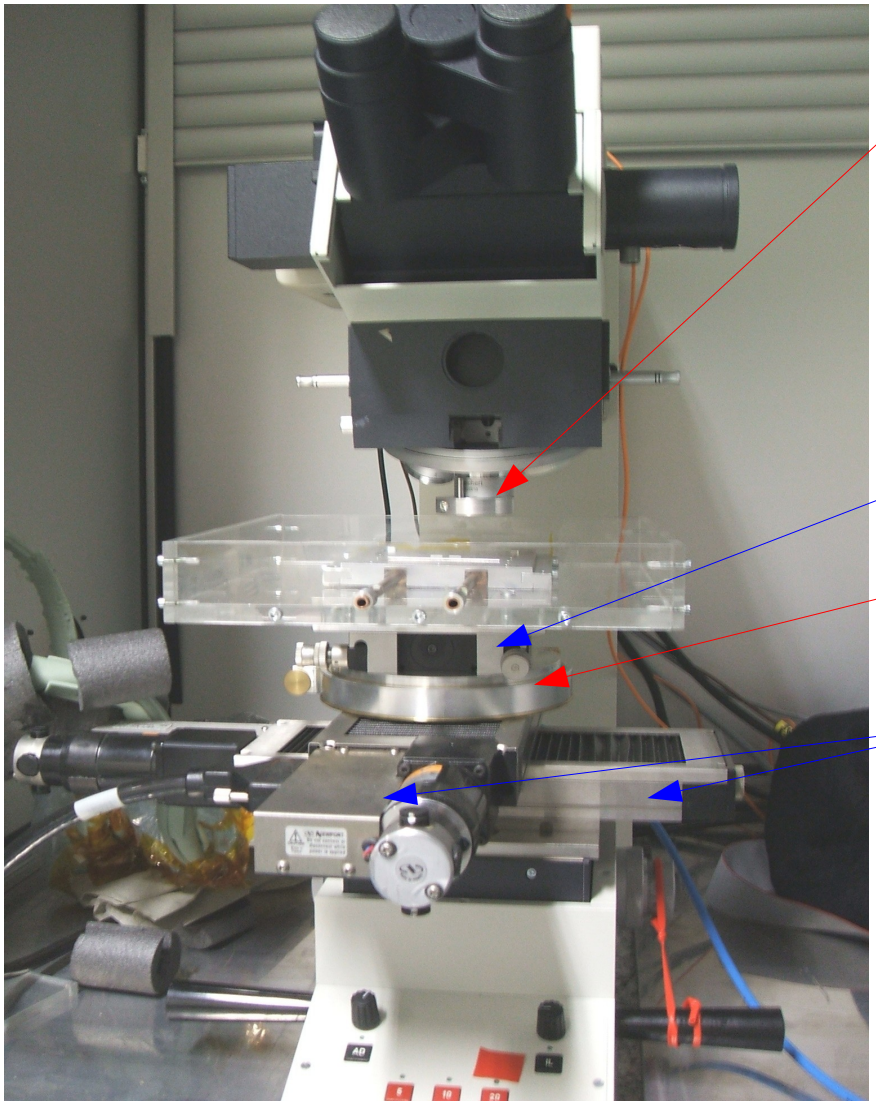
UNI FREIBURG

Outline

UNI FREIBURG

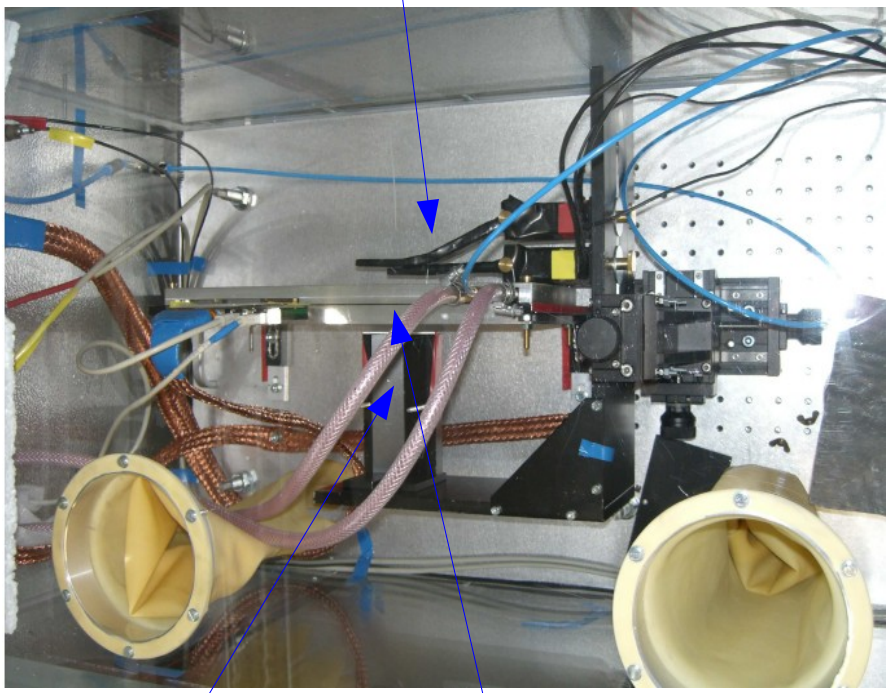
- What do we have in Freiburg?
- Space resolved laser measurements
- Source measurements
- New cooling system
- Current problems
- Further plans and outlook

Laser Setup



- Infrared laser
- λ = 972 nm, E = 1.27 eV
- Laserfocus: σ = 2.1 µm 68% intensity in 4.2 µm
- Tilting table
- Rotation table
- Linear stages for movement in x,y direction
- Measure relative signal on detector

Radioactive Source Setup



- ^{90}Sr source
- Activity: ~ 2 MBq
- $E(\beta^-)_{max}$ = 2.28 MeV
- System in a freezer
- Min. sensor temp: -15 °C

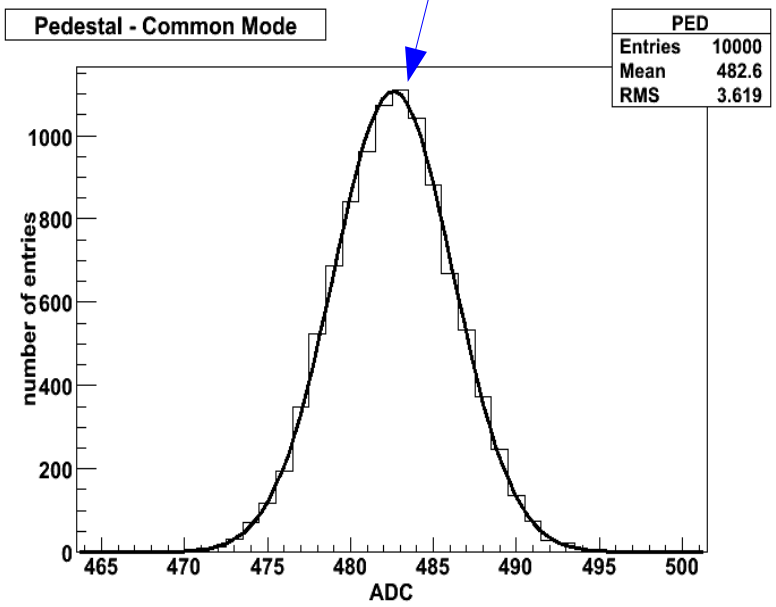
Pedestal and Noise at 80V

ATLAS SCT Endcap Detector (n-type)

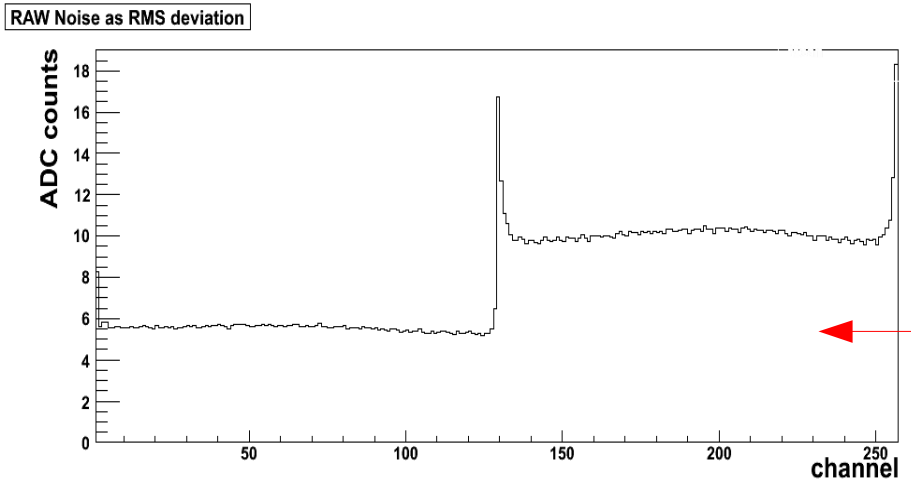
Albert-Ludwigs-Universität Freiburg

6 cm strip length

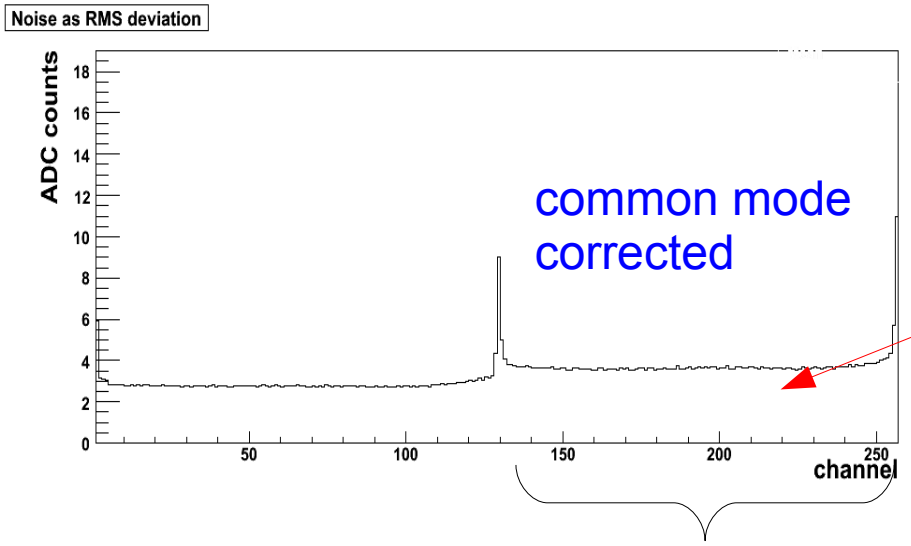
common mode corrected pedestal data for channel 200 with a Gaussion fit



Noise for Each Channel



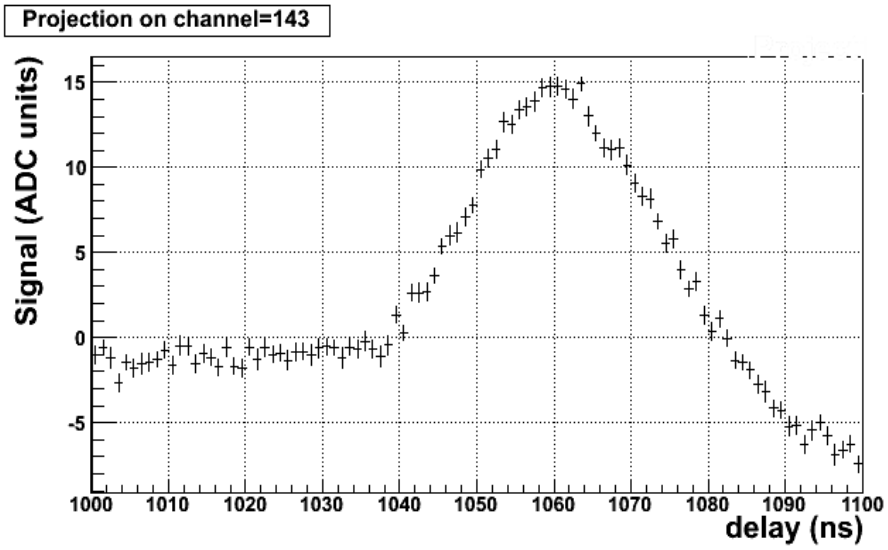
noise is about 9 ADCs

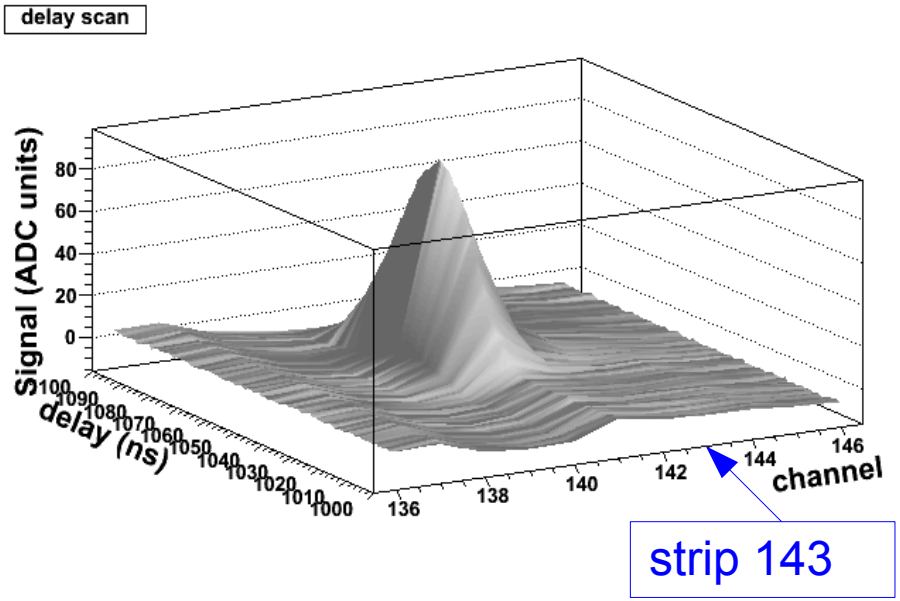


noise is about 3.5 ADCs

bonded Chip

Laser Measurements





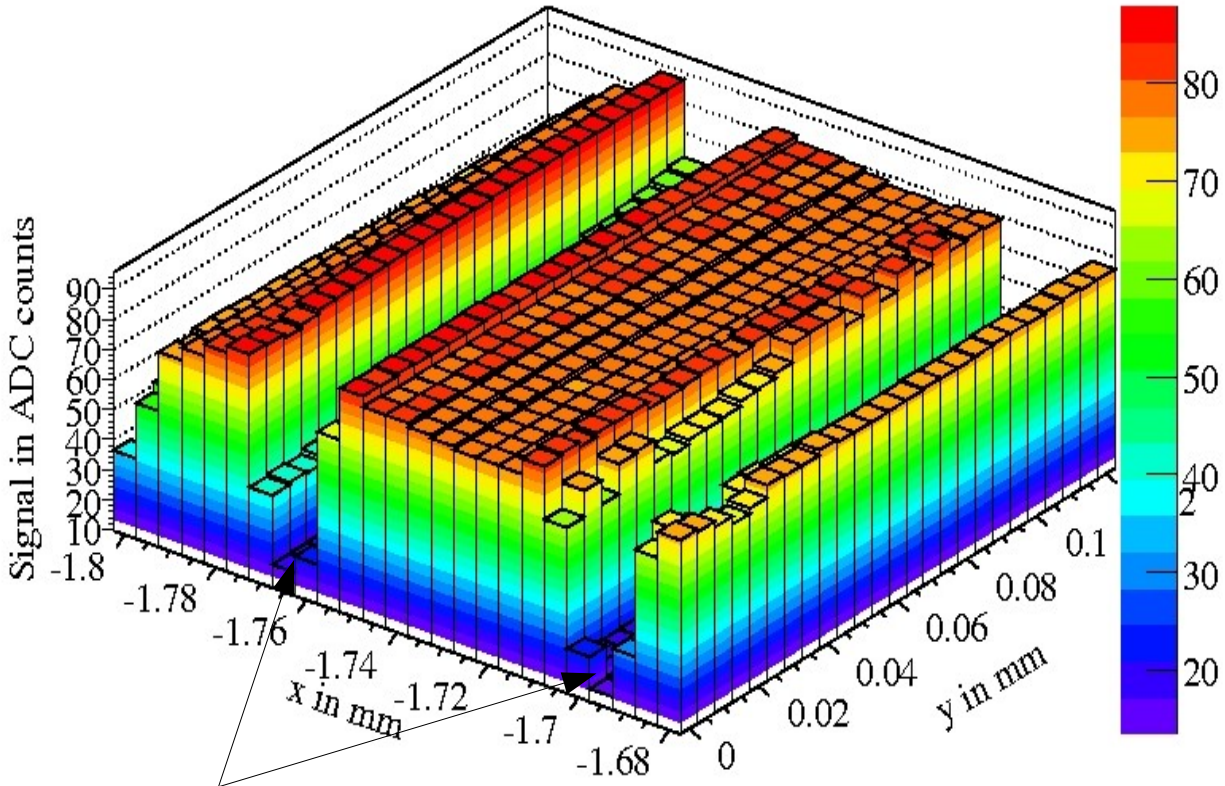
Delay Scan

- Delay between laser trigger and read out
- Delay can be varied in 1 ns steps
- Our delay: 1060 ns

Space-Resolved Laser Measurement
ATLAS SCT Endcap Detector (n-type)

Albert-Ludwigs-Universität Freiburg

- Step size: 5 µm, bias voltage: 40 V
- Pitch ~60 µm (wedge shape)
- Thickness: 285 µm, 6 cm strip length

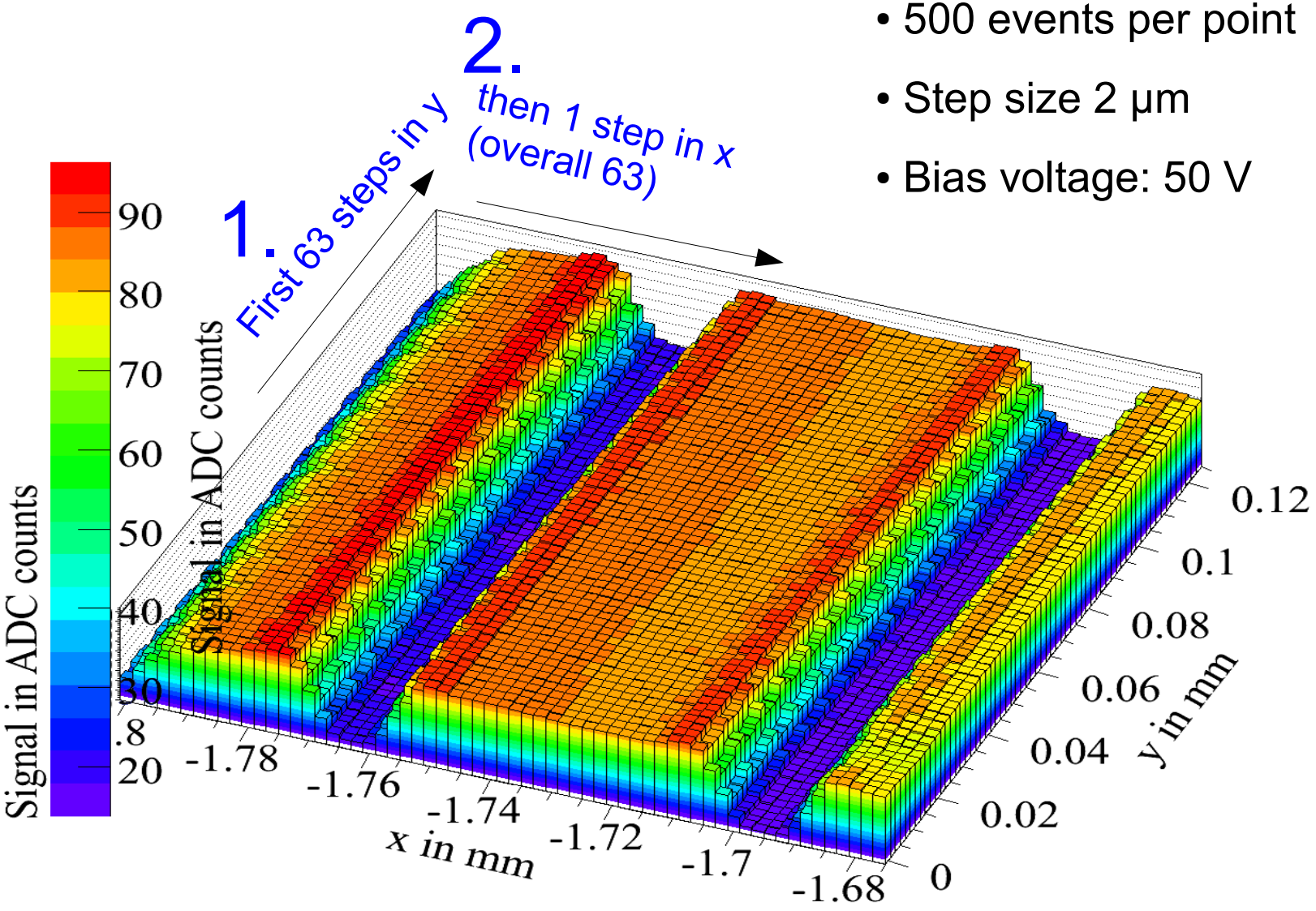


- Depletion voltage: 60 - 80 V
- Signal is common mode corrected and pedestal subtracted
- Strips are clearly visible, due to laser reflection
- 500 events per point

Space-Resolved Laser Measurement

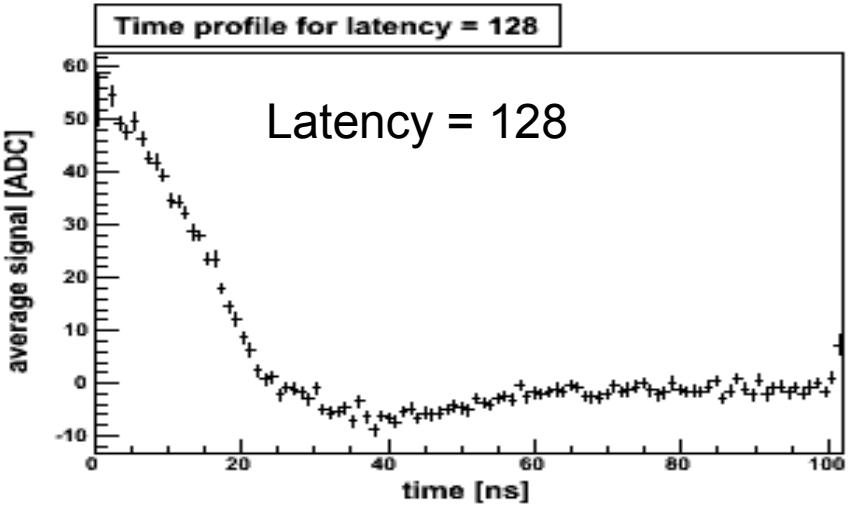
ATLAS SCT Endcap Detector (n-type)

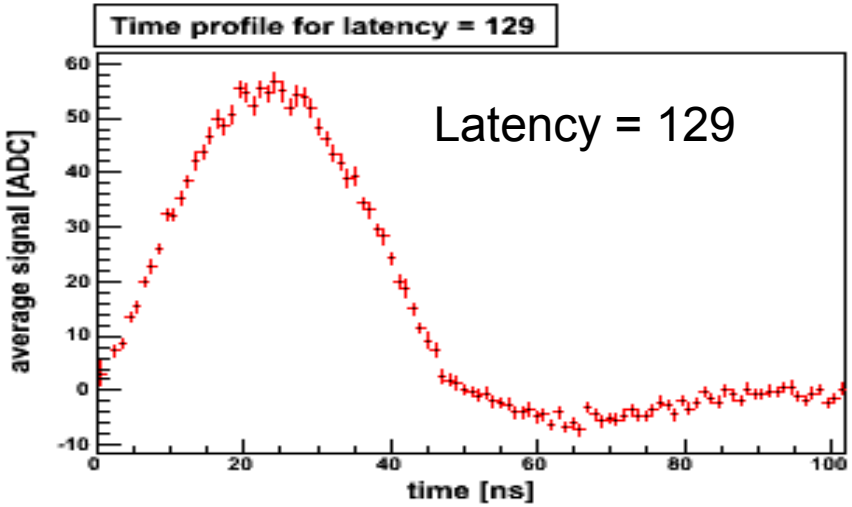
Albert-Ludwigs-Universität Freiburg

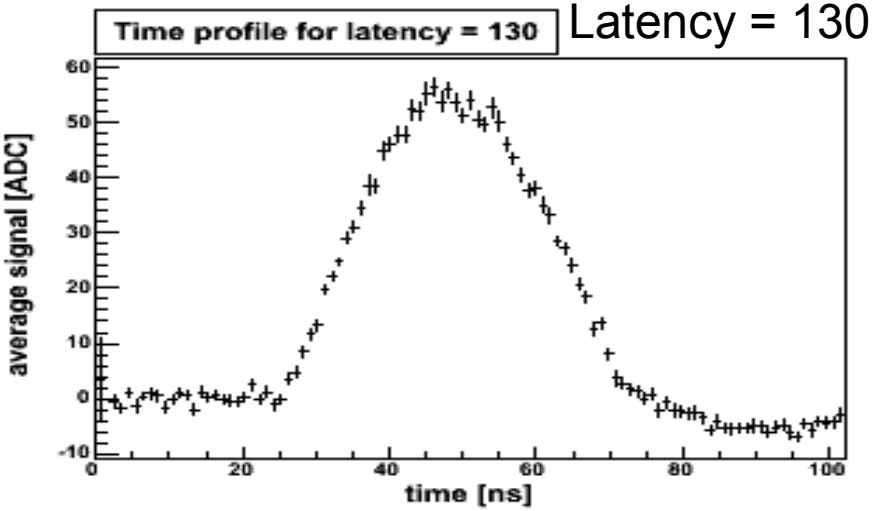


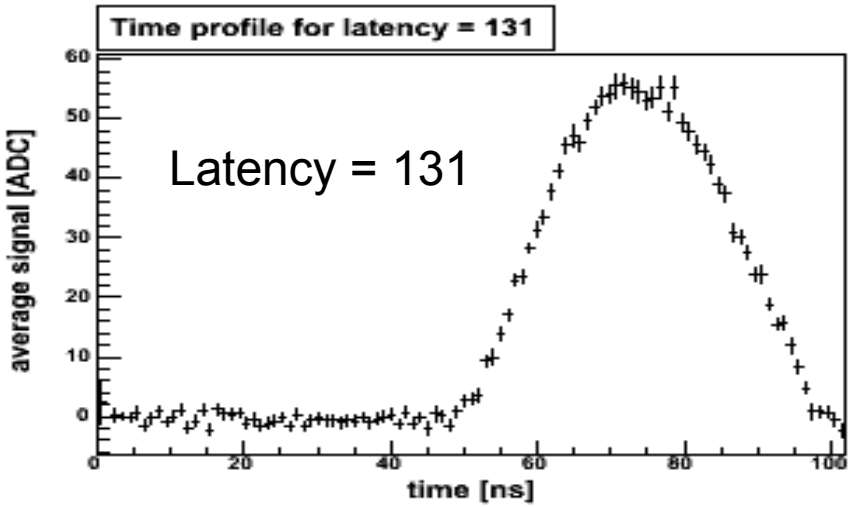
- 500 events per point
- Step size 2 µm
- Bias voltage: 50 V

Source Setup
Time Profile for Different Latency Bins









Default latency = 128
Best latency in our case = 129 because full baseline and peak visible

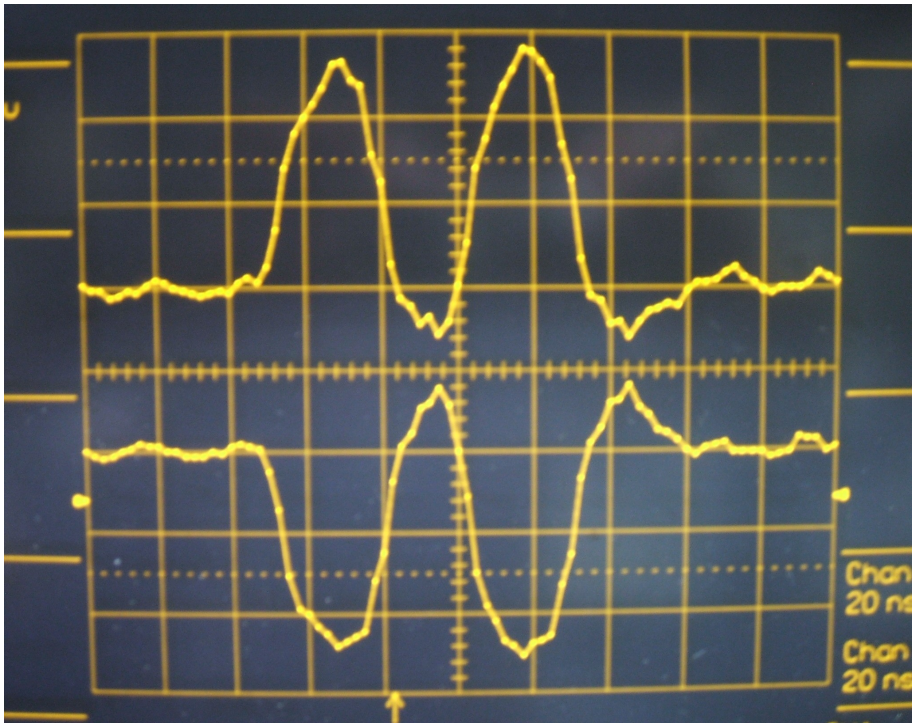
ALiBaVa Testpulse Shape Reconstructed by Using External Delay Boxes

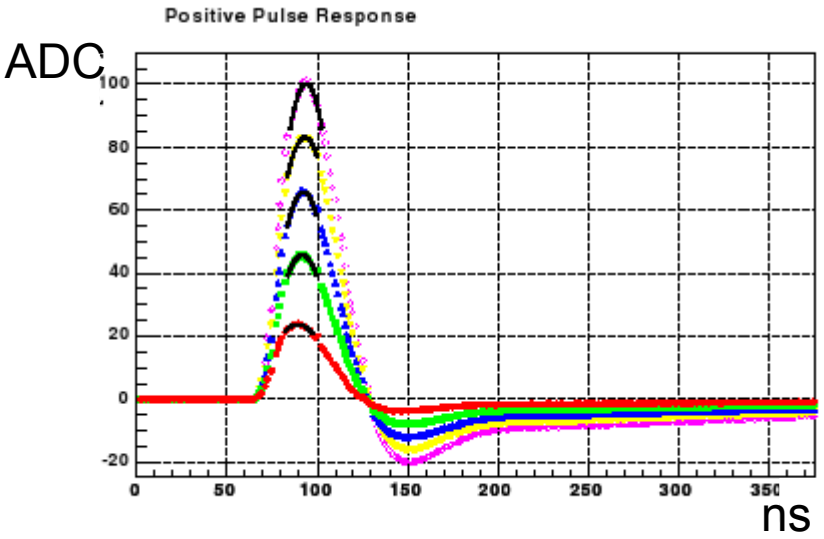
Delayed only the test pulse

Differential testpulse sent from motherboard to daughterboard twice → two peaks

Default calibration runs done in 1 ns steps, also without delay for comparison

Chip 0 unbonded, chip 1 bonded to strip sensor

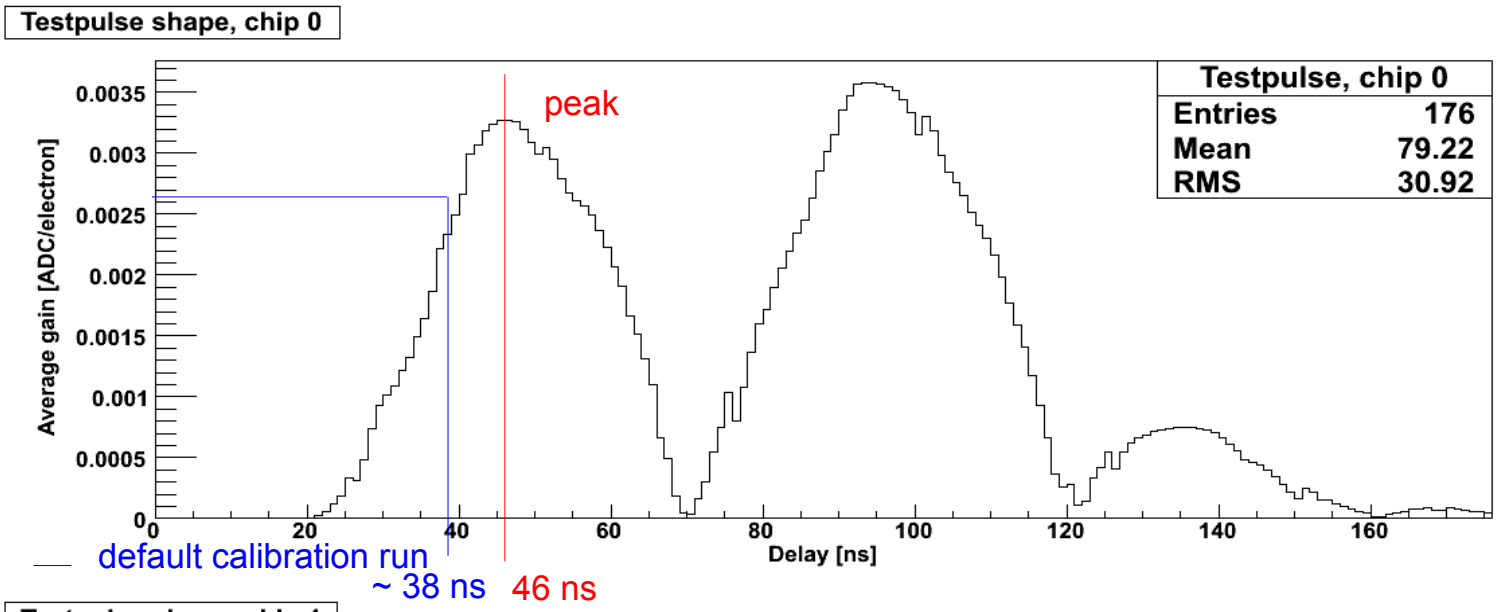


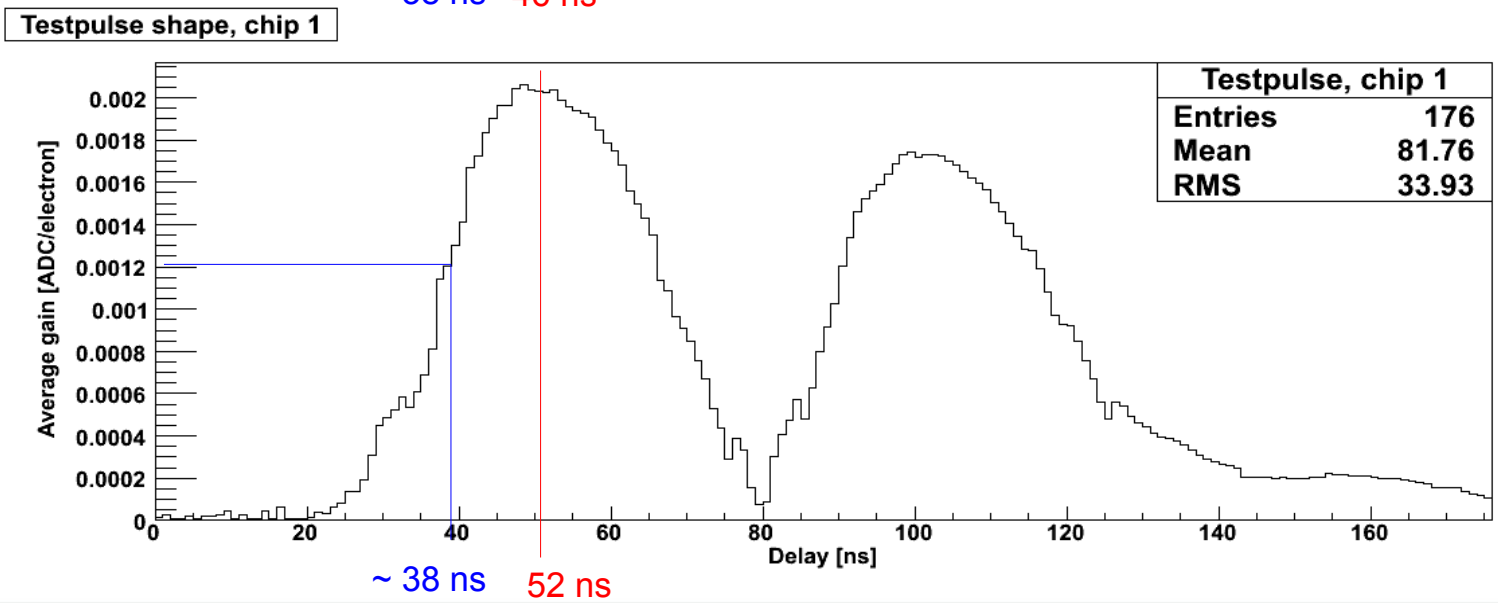


From Beetle reference manual

ALiBaVa Testpulse Shape Reconstructed by Using External Delay Boxes

Albert-Ludwigs-Universität Freiburg





Gain of standard calibration run:
chip 0: **0.0026** ADC/e$^-$
chip 1: **0.0012** ADC/e$^-$

~ at 38 ns

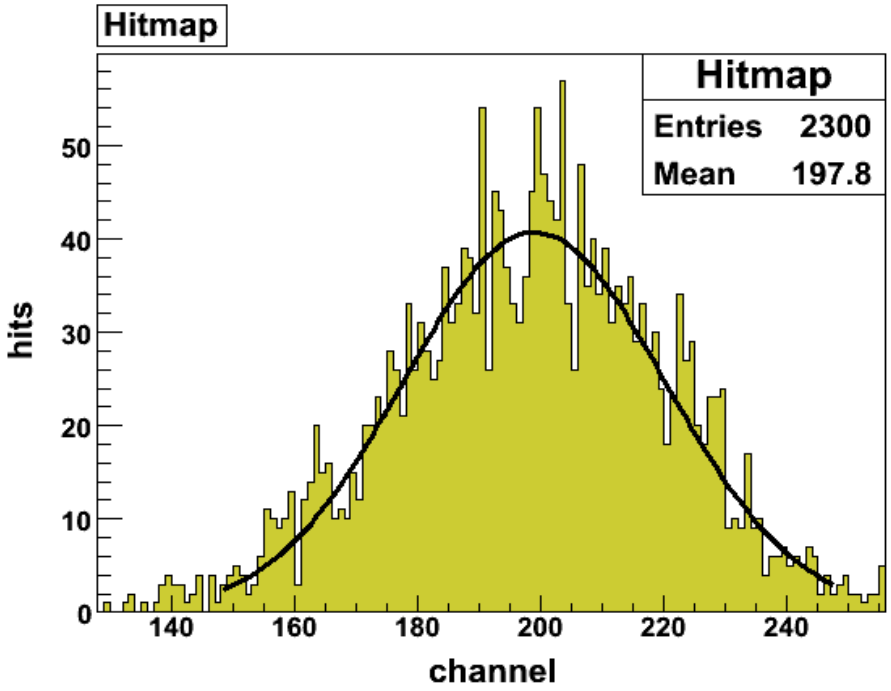
→ Clearly off peak

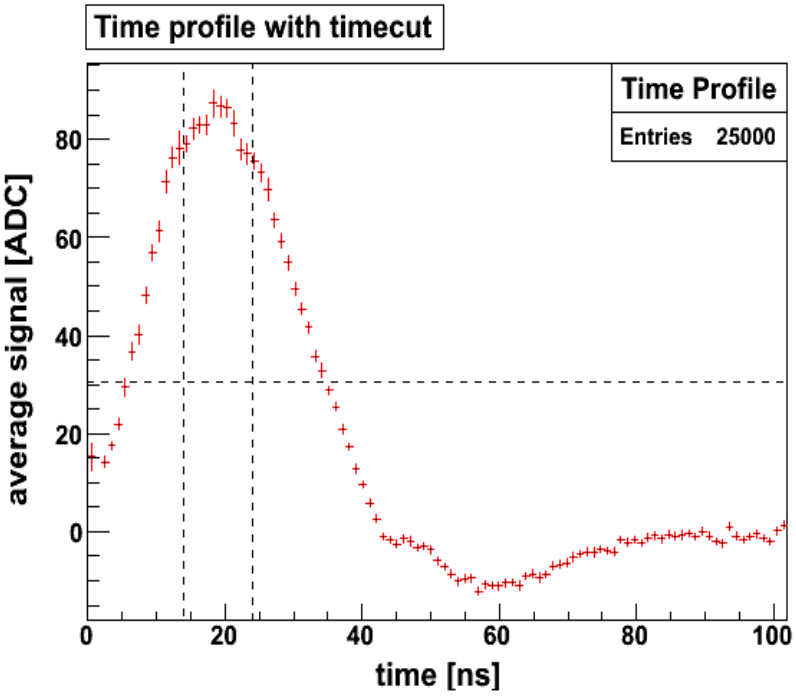
Already a delay of ~ 6 ns between the two beetle chips.
Delay between peak and default calibration run:

chip 0: ~ 8 ns
chip 1: ~ 14 ns

Source Setup
Hitmap and Time Profile
Albert-Ludwigs-Universität Freiburg

- Distance between source and detector: ~3 cm
- Szintillator size: ~ 4 mm
- Bias voltage: 250 V
- Time cut: 14 to 24 ns

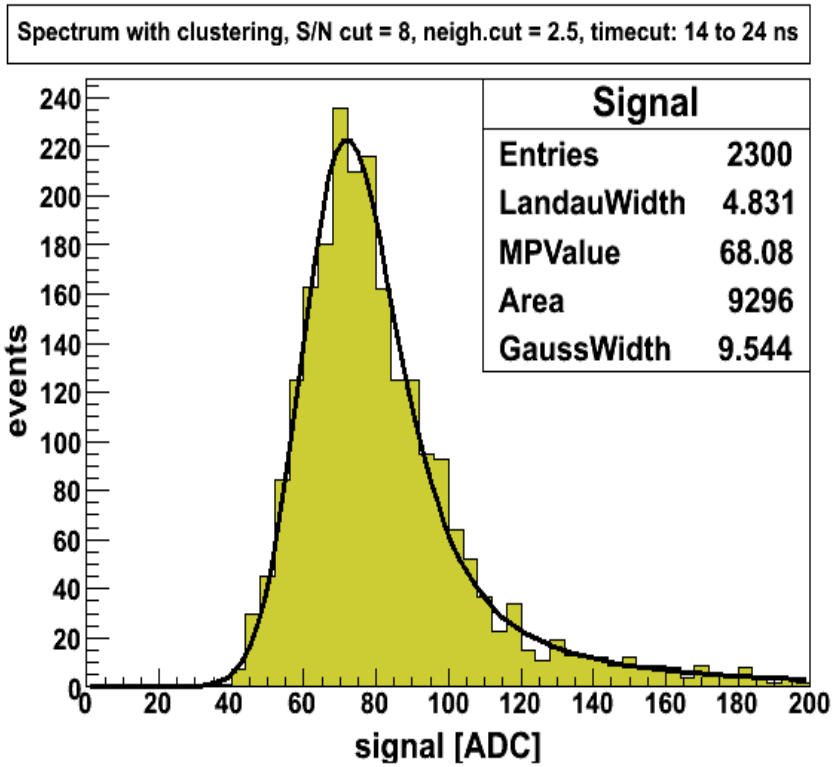


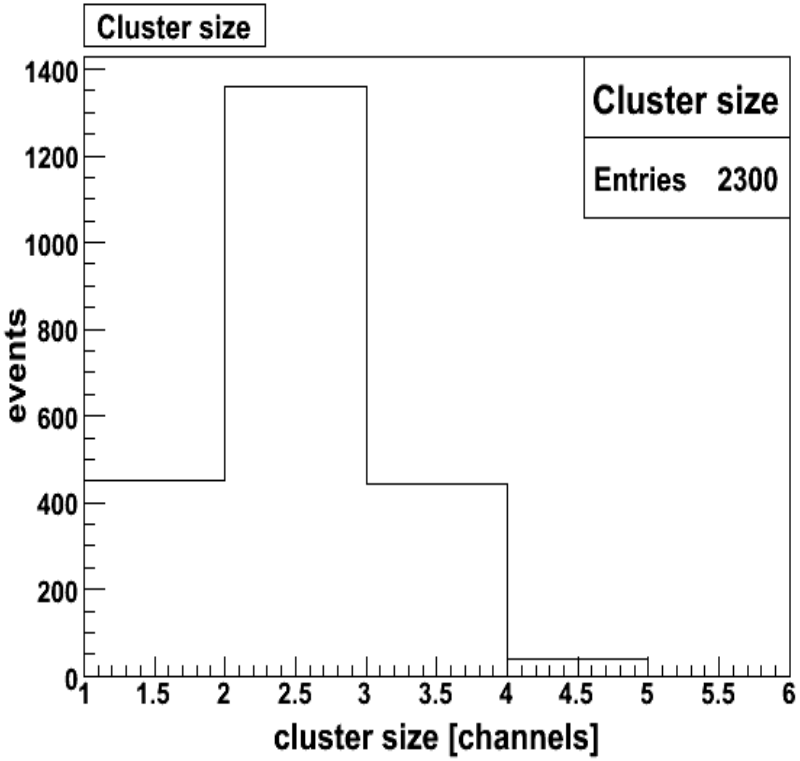


Source Setup
Spectrum with Clustering
Albert-Ludwigs-Universität Freiburg

UNI FREIBURG

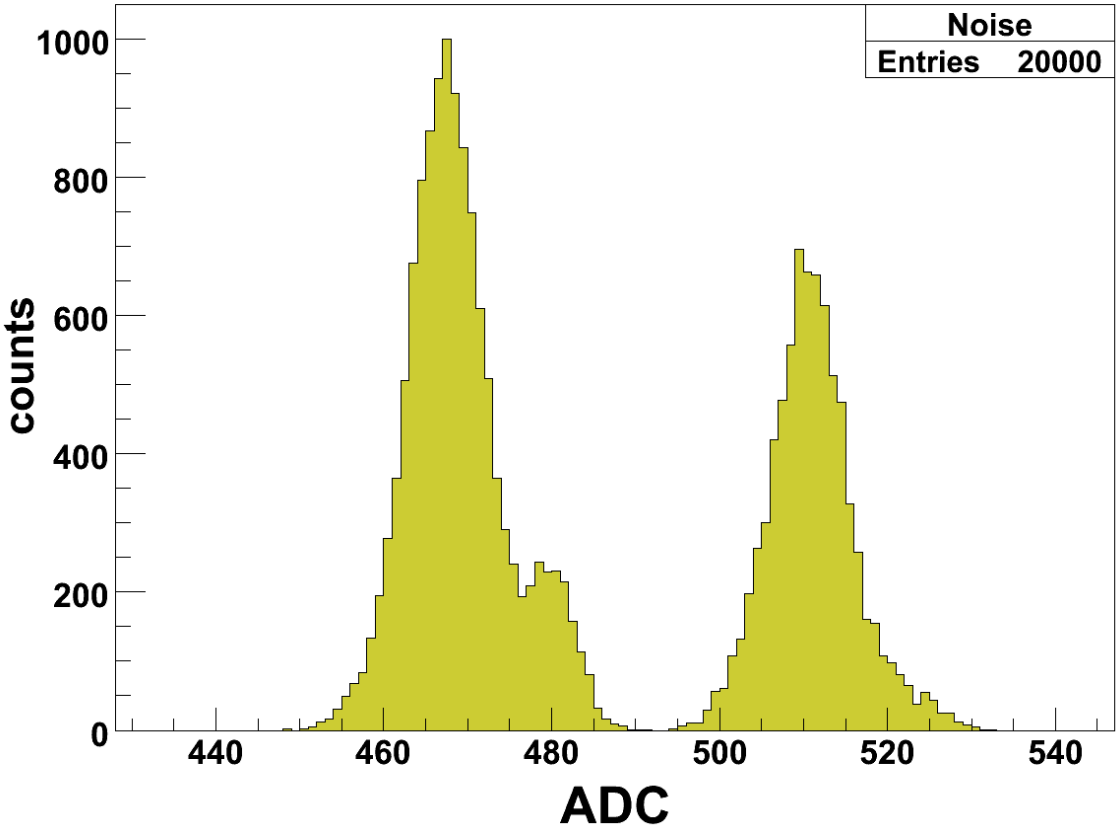
Signal/Noise Cut
- Seed cut: 8
- Neighbour cut: 2.5





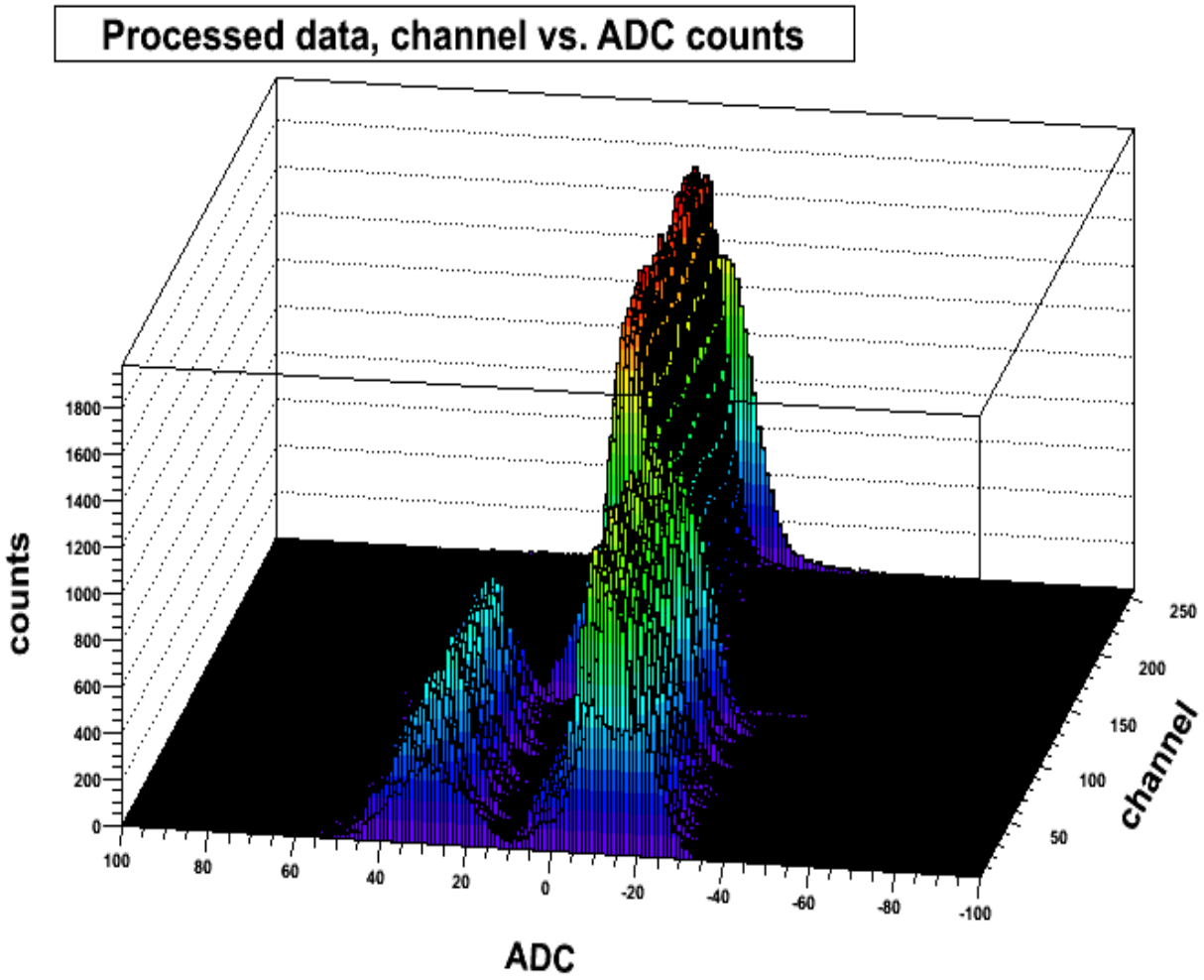
Strange Signal Behaviour
Pedestal Run @ -4.5°C and 100 V

- Projection for one channel (56)
- The mean pedestal for other chip is ~440 ADCs
- RAW data
- At least two peaks
- Also visible @ -15°C



Strange Signal Behaviour
Pedestal Run @ -4.5°C and 100 V

Albert-Ludwigs-Universität Freiburg



- Common mode corrected
- Pedestal subtracted
- Double peaks are seen at bonded and unbonded chips on 3 different DBs
- Only on the left chip (channels 0 - 127) on the board
- Not seen at room temp.

Has anyone else checked for this?

Cooling at the Laser

- The achieved temp. at the sensor is about -15°C
- We've ordered a new cooling system based on liquid nitrogen to achieve temperatures at the sensor below -40°C
- This new system can also be used at the source setup

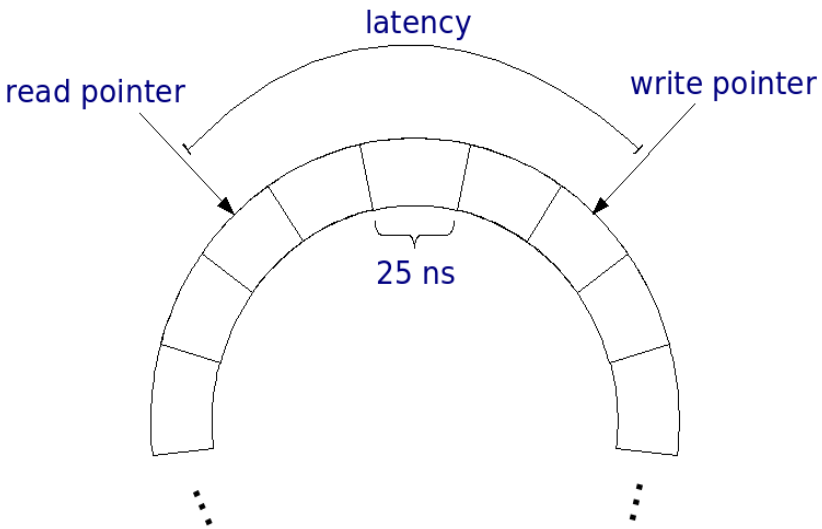
Further Plans

UNI FREIBURG

- Write ALiBaVa plugin(s) to do voltage scans
- Work on double peak problematic
- Do space resolved laser measurements with unirradiated and irradiated detectors
- Install the new cooling system
- Measure high irradiated detectors
- Construct a safety switch off taking the dew point into account

Backup

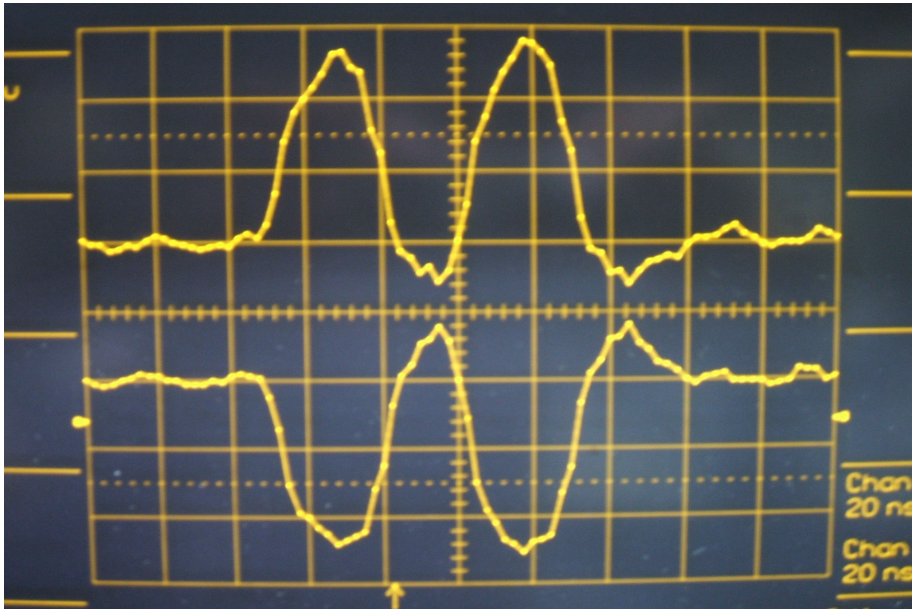
Backup
Source Mode: Ringbuffer

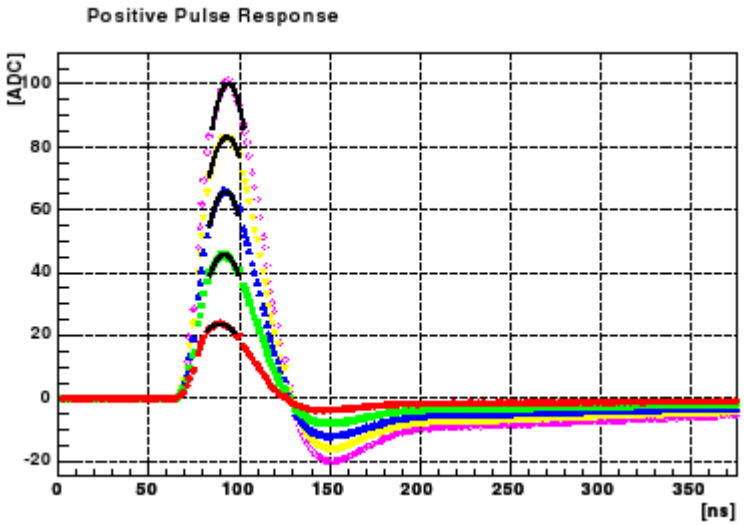


- 40 MHz readout clock
- Data written in pipe with 187 bins – each of which has a length of 25 ns
- Latency has to be the time difference between read and write pointer.

ALiBaVa Testpulse Shape Reconstructed by Using External Delay Boxes

- Differential testpulse sent from motherboard to daughterboard twice → two peaks
- Measured latency bins 128 to 122, delay 0 to 25 ns
- Real delay = (latencymax-latency)*25-delay
- Real delay 0 ns = latency 128 / delay 25 ns; real delay 175 = latency 122 / delay 0 ns
- Default calibration runs done in 1 ns steps, also without delay for comparison
- Average gain for both beetle chips, respectively, plotted versus real delay
- Chip 0 unbonded, chip 1 bonded to strip sensor

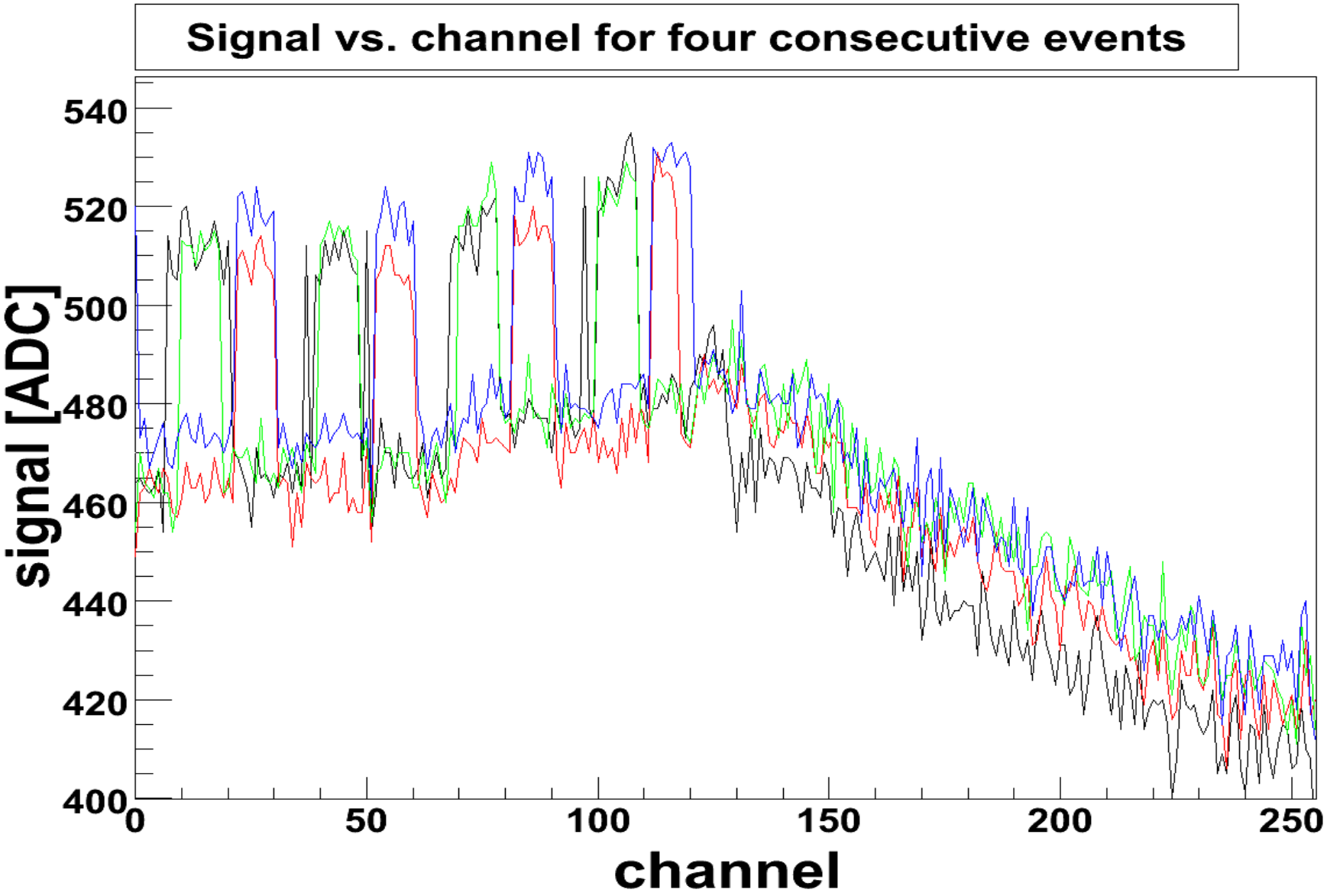




From Beetle reference manual

Strange Signal Behaviour
Pedestal Run @ -4.5°C and 100 V

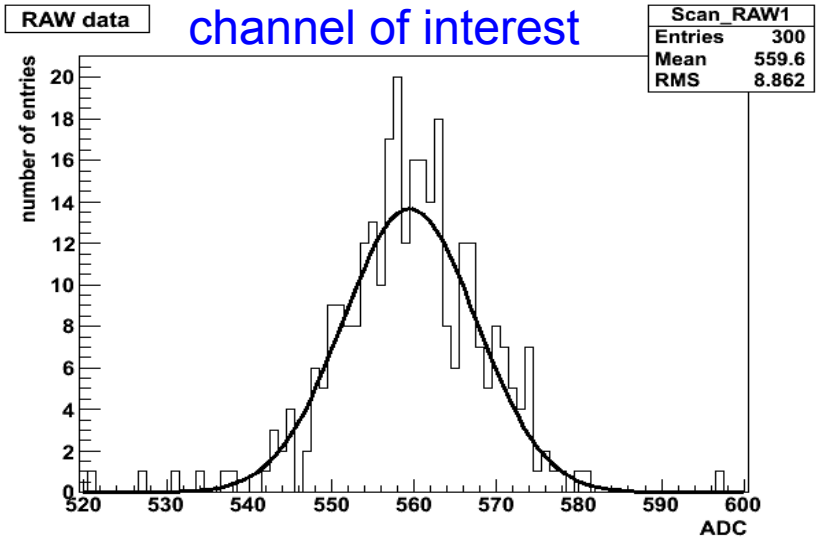
Albert-Ludwigs-Universität Freiburg

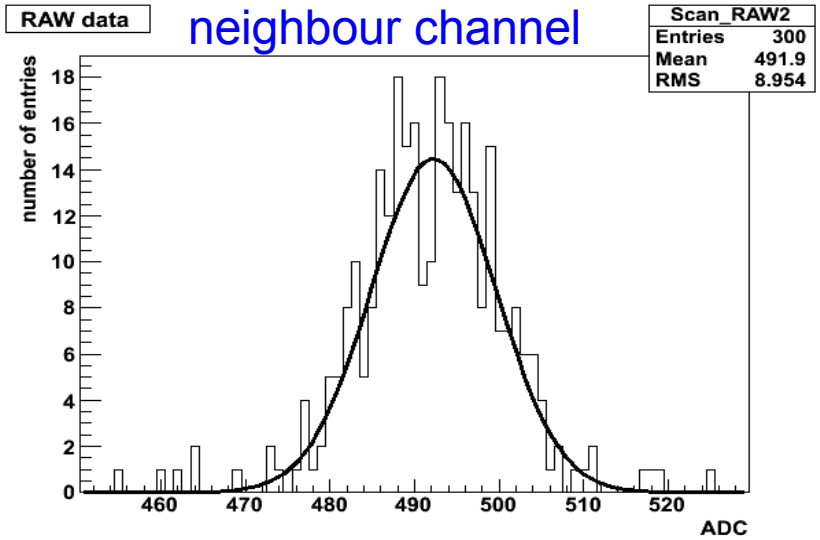


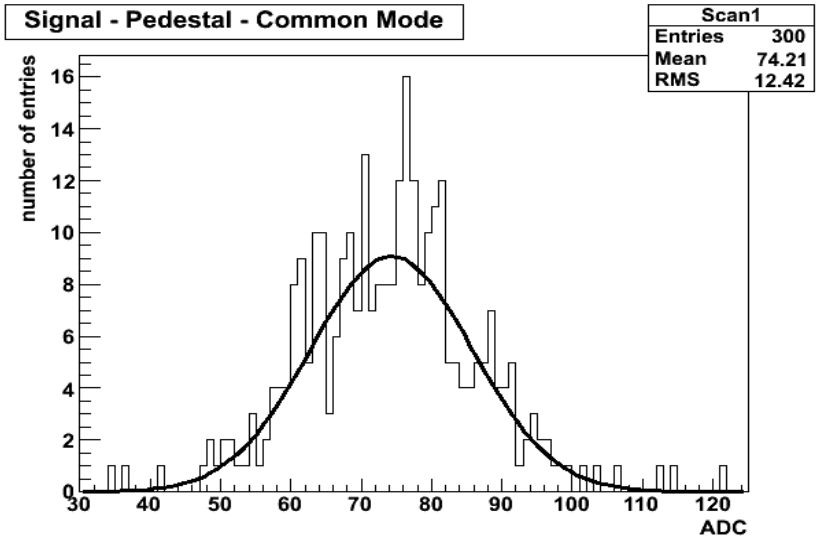
Space-Resolved Laser Measurement

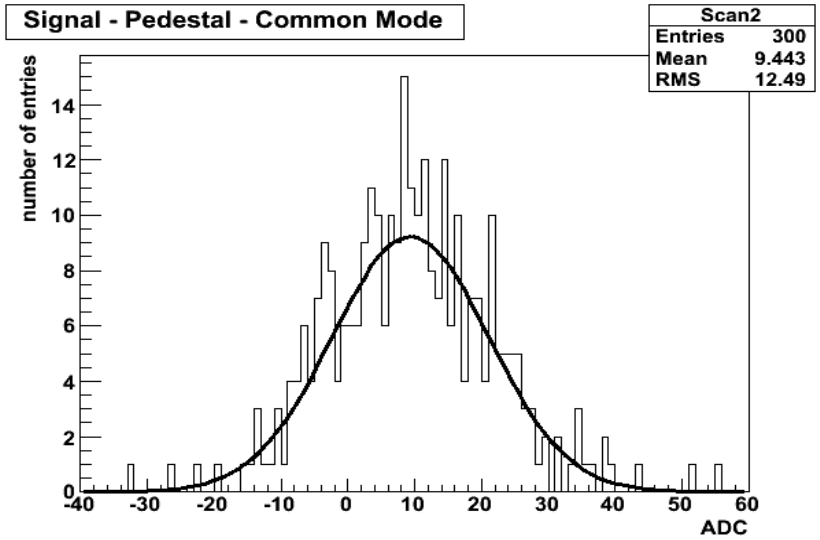
One Point of the Scan (300 Events) in More Details

Albert-Ludwigs-Universität Freiburg

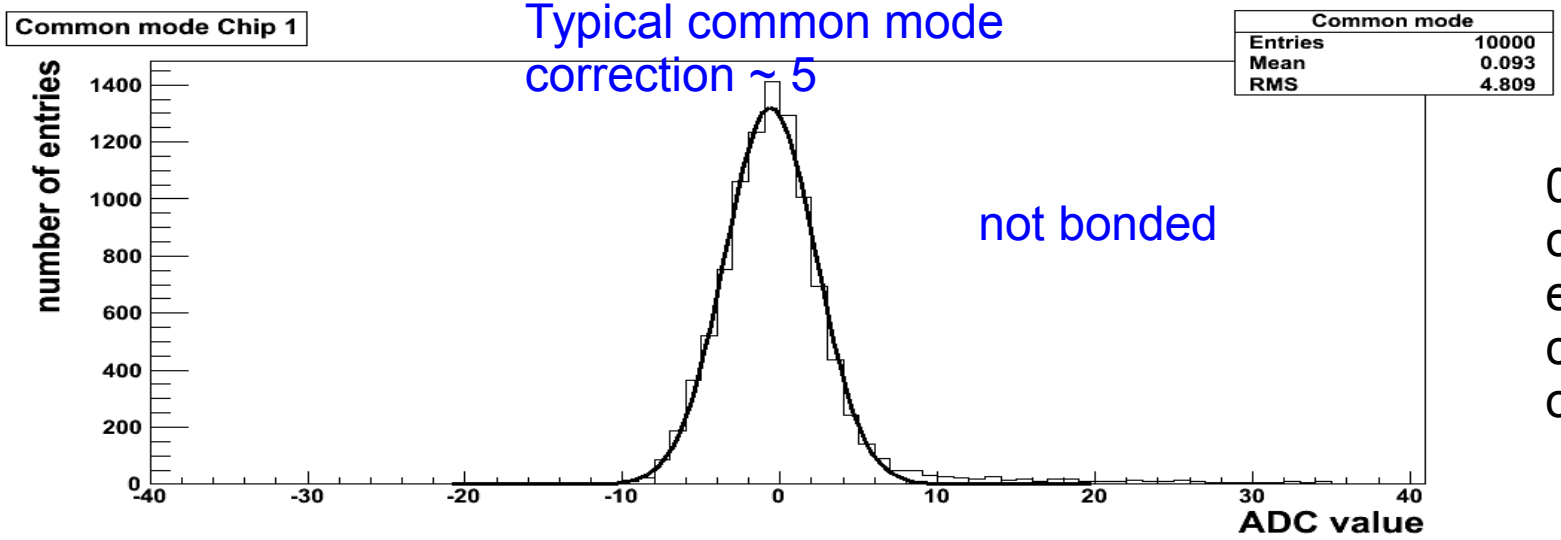


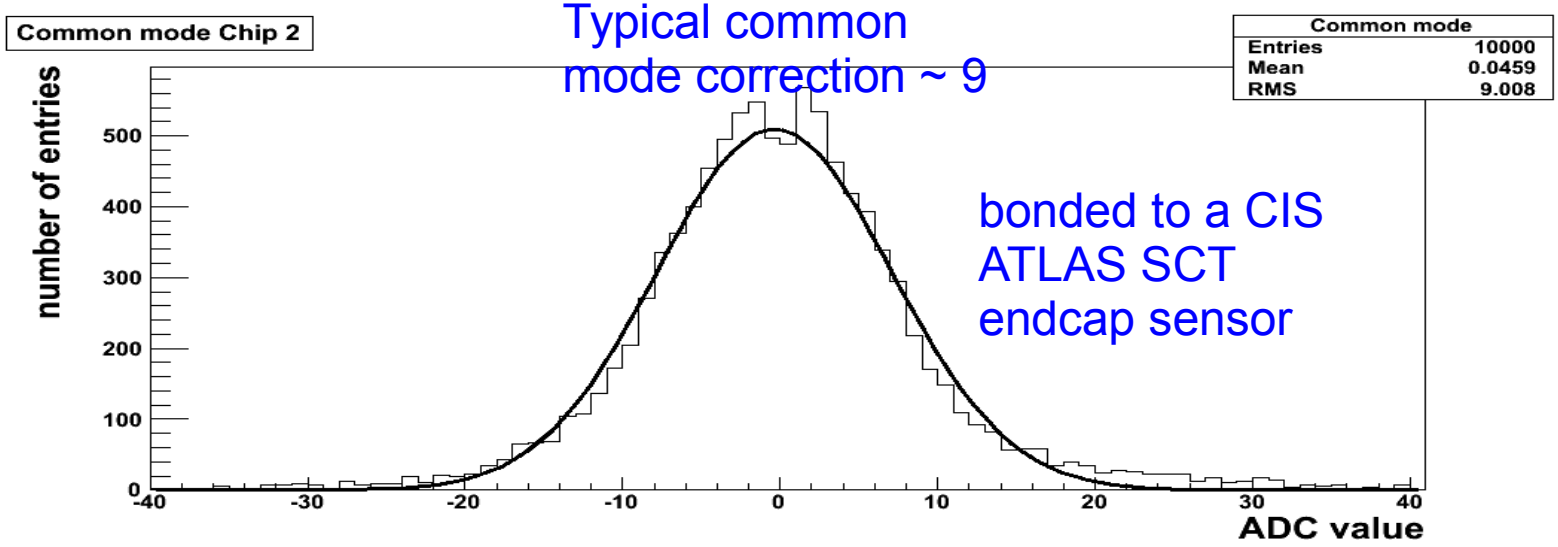






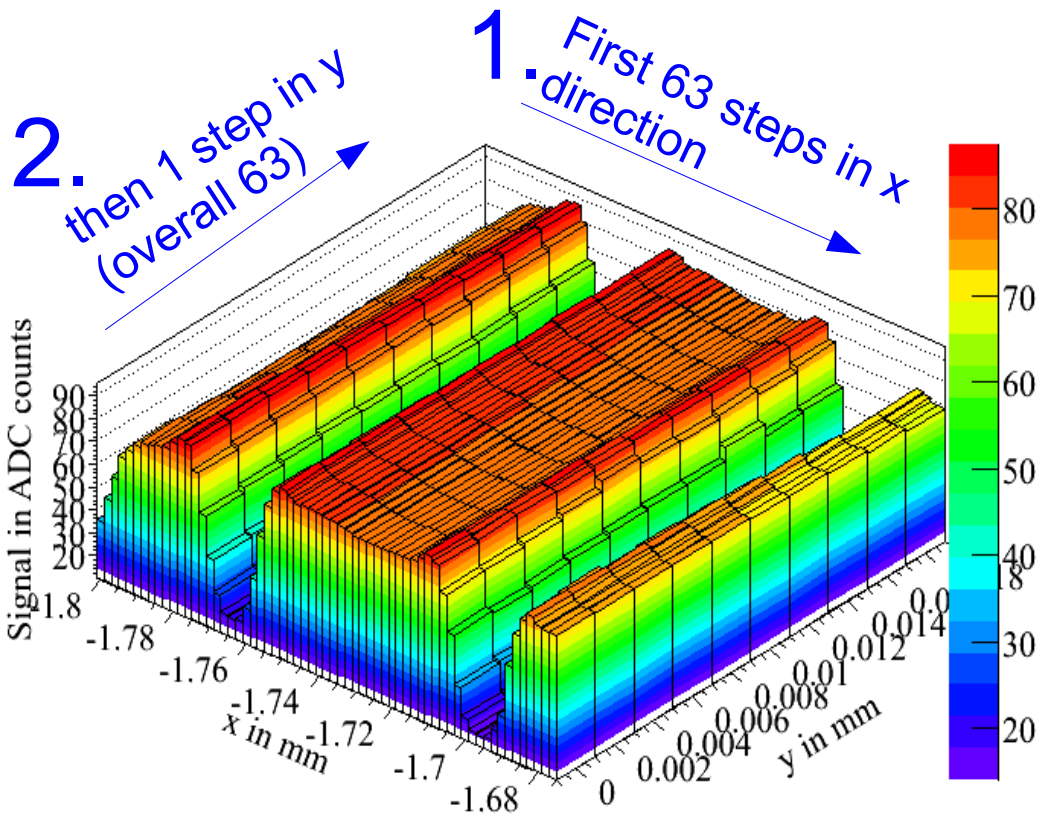
Common Mode





0'th order correction: for every event and chip mean value over all channels.

Space Resolved Laser Scan



- 2 µm step size
- 50 V bias voltage
- To check systematic
- Change scan direction
- No systematic anymore