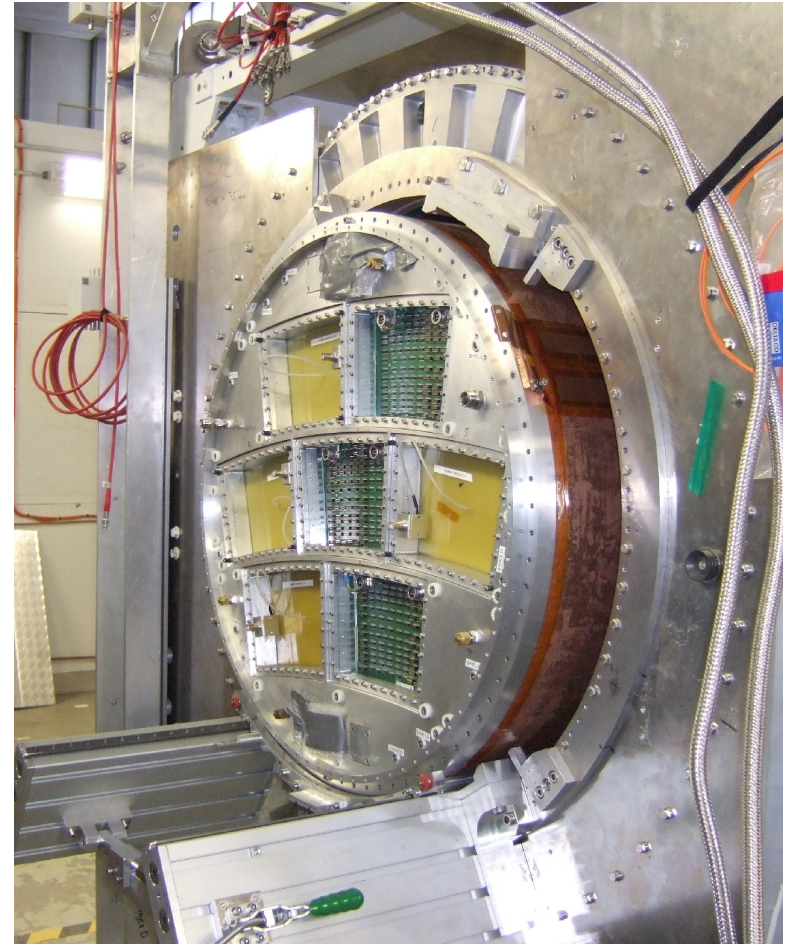
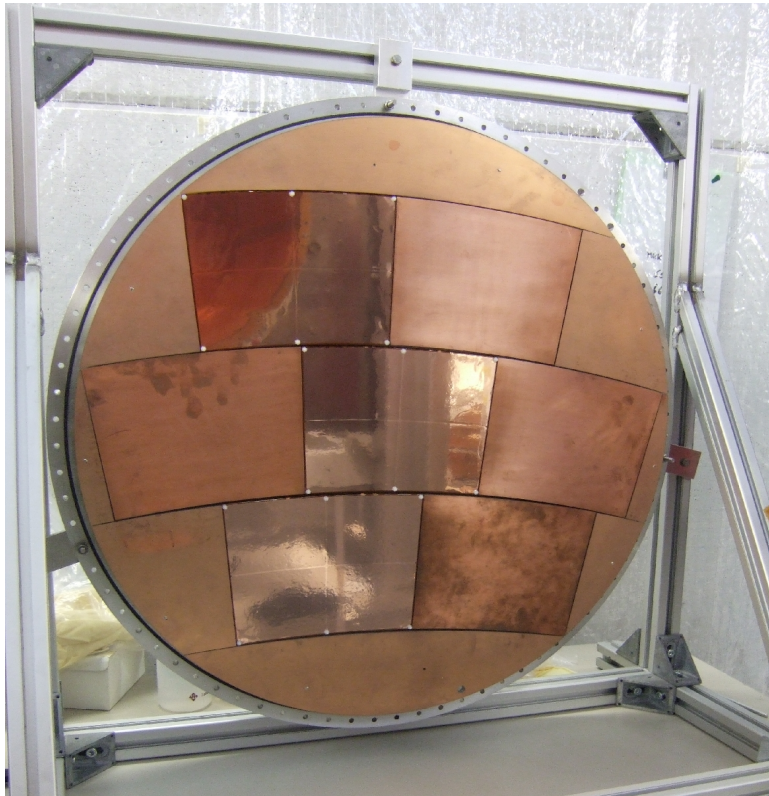


3 DESY GridGem-Modules Test Beam

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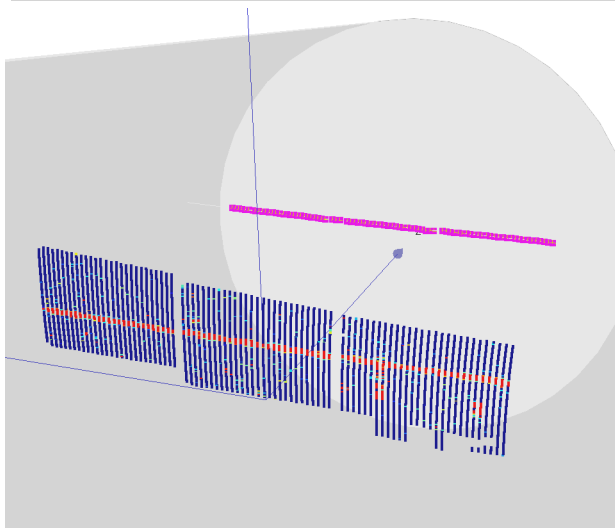
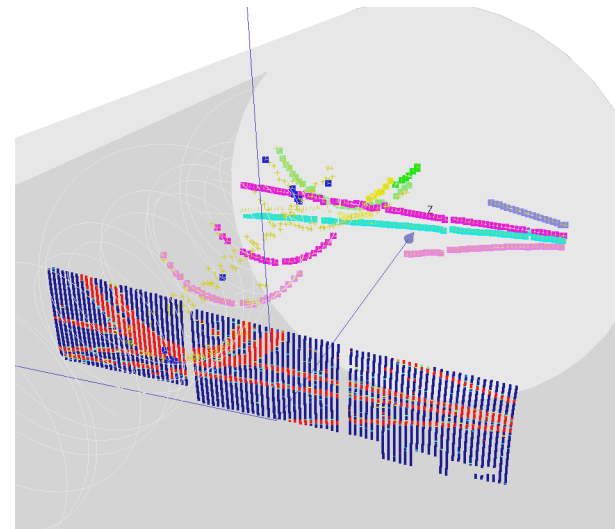
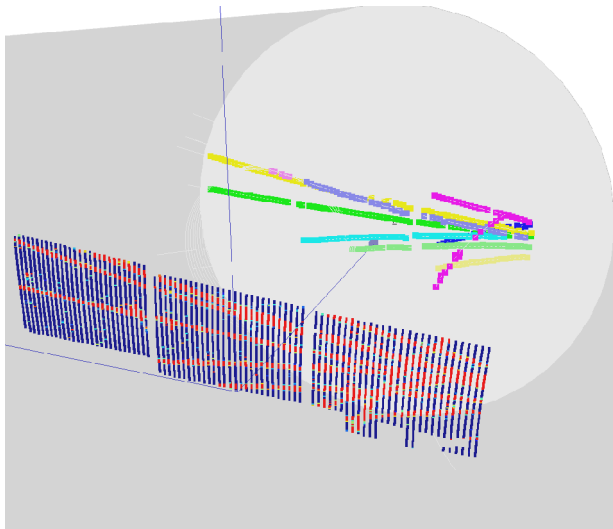
Test Beam Setup

- 3 DESY GridGEM Modules
- ALTRO electronics
- Readout half of the three modules
- ~7200 channels along the beam profile



Typical Events

- CED event display (standard Marlin event display)



Test Beam Campaign

- 25.02 start of the assembling of the setup
- 28.02 First test runs proofed stable behavior of the system
- Working point was determined
 - Guard Ring was set to 50 V above top GEM potential

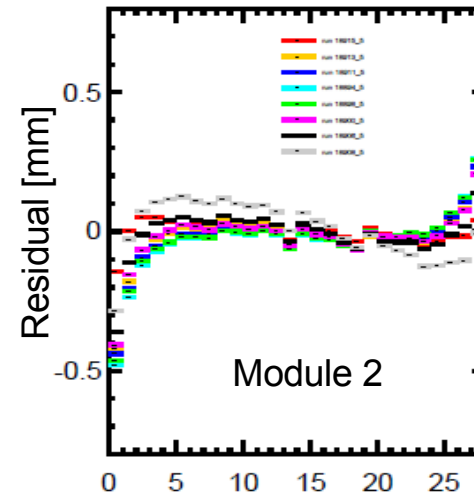
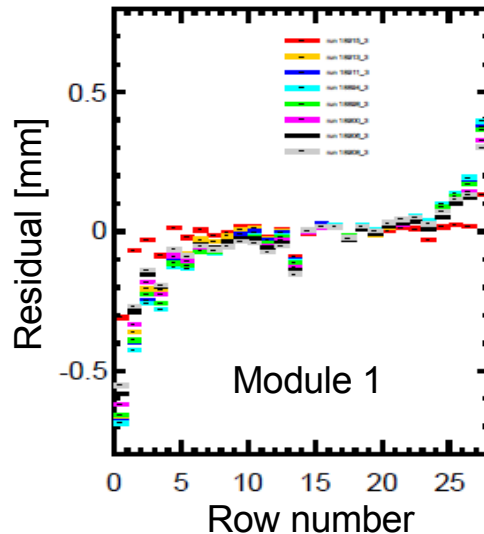
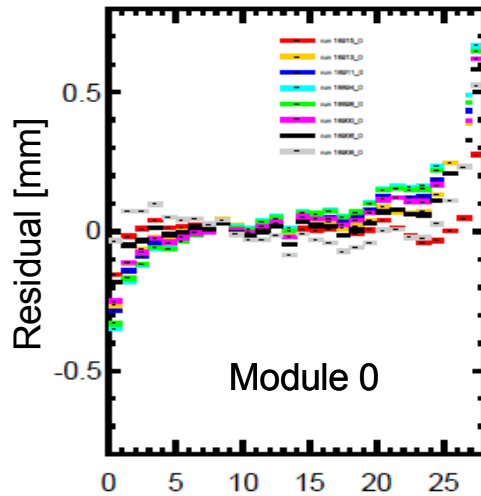
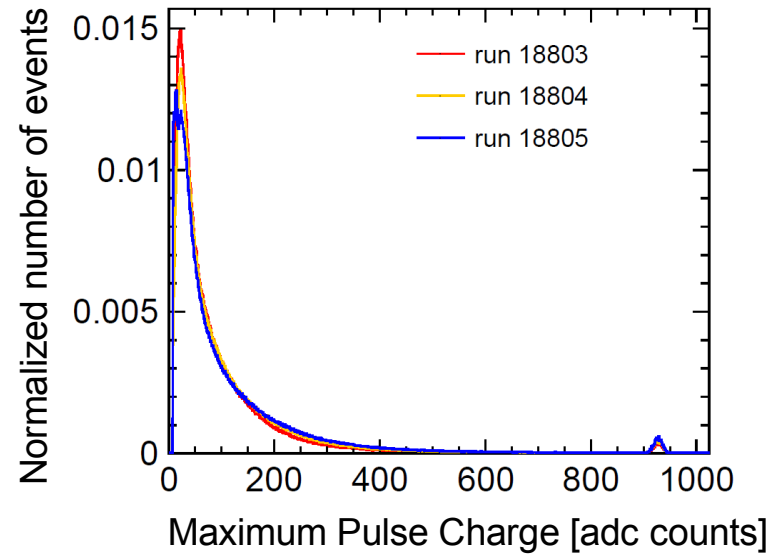
B=0T	
Drift field	240 V/cm
transfer fields	1500 V/cm
Induction field	3000 V/cm
First GEM	250 V
Second GEM	250 V
Third GEM	260 V

B=1T	
Drift field	240 V/cm
transfer fields	1500 V/cm
Induction field	3000 V/cm
First GEM	250 V
Second GEM	250 V
Third GEM	255 V



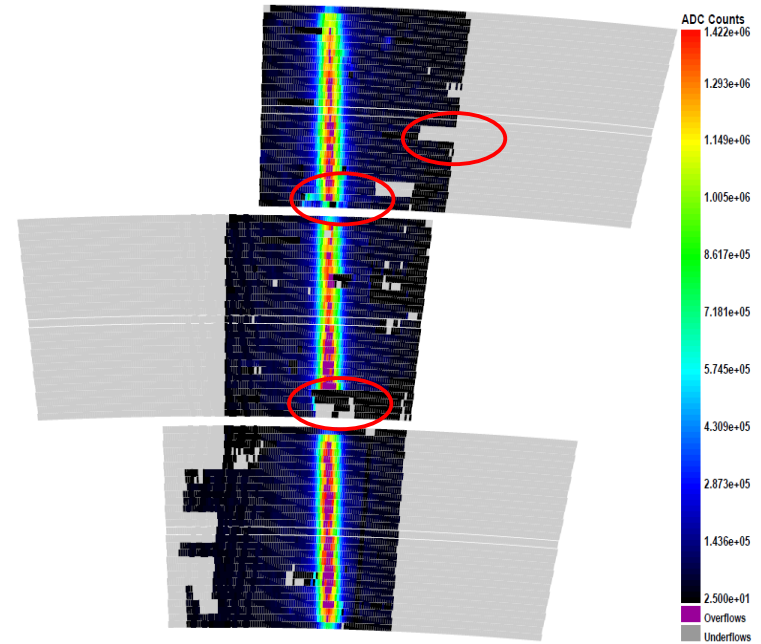
Working Point Determination

- Threshold: less than 1% of the pulses in over-range



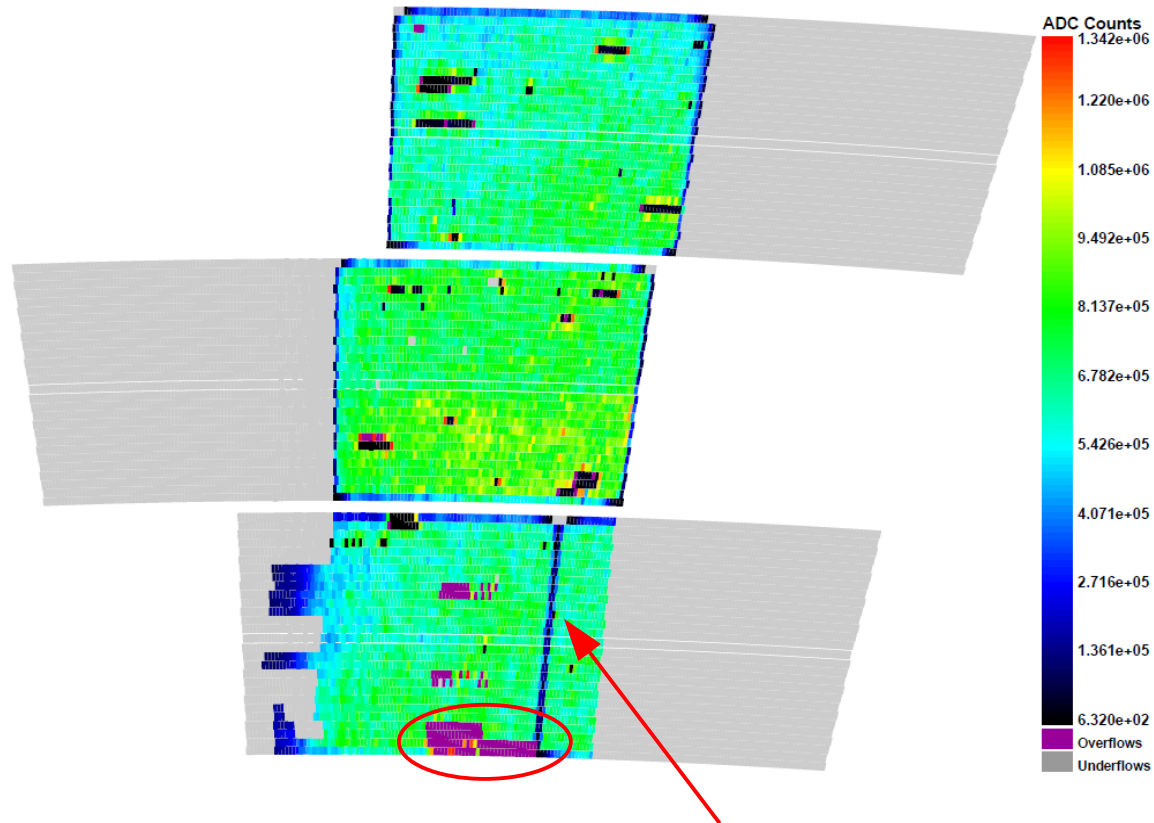
First Problems

- Several dead connection on the module
- Interesting regions were also affected
- Locking bar for the ALTRO cables created insufficient force
- Decision to modify the bars
- Reassembly of the hole setup



Reassembled System

- Less dead connection
- Some noise connections (red circle)
 - Pulse analysis can cope with the noise



Ceramic grid

Measurements

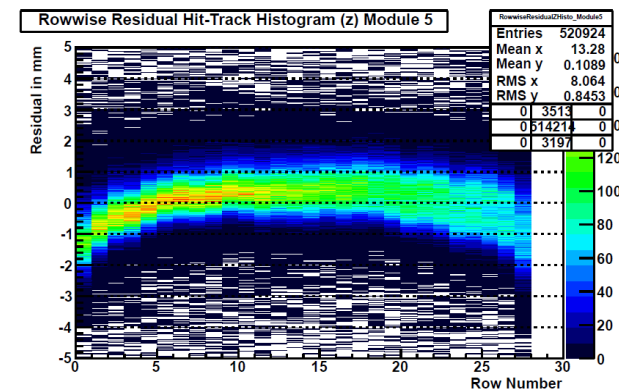
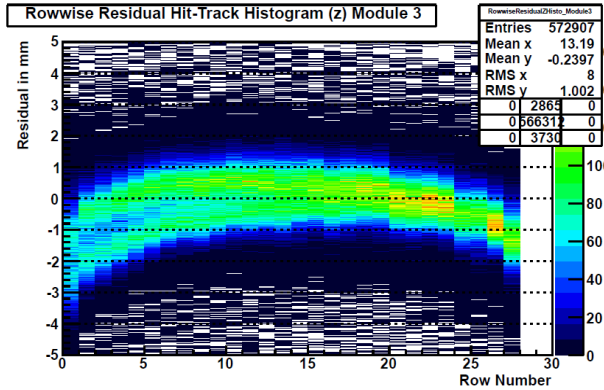
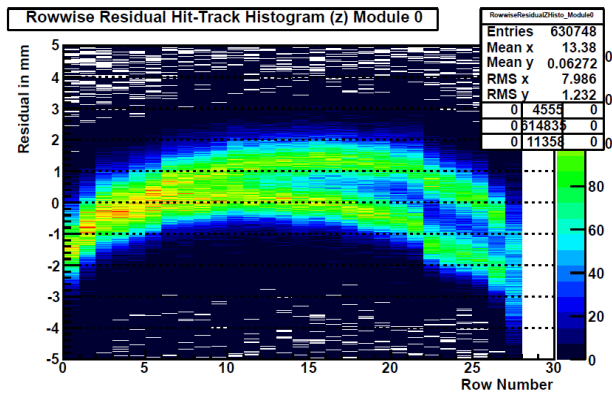
- Drift distance scan, $B=0,1\text{T}$, 17 z-positions
- Pad board scan, $B=0,1\text{T}$, 8 positions
- Phi scan, $B=0,1\text{T}$, $\text{phi}=-13.5,-9,-4.5,0,4.5$, $Z=10,40\text{cm}$
- Theta scan, $B=0,1\text{T}$, $\text{theta}=-15,-10,-5,0,5,10,15$, $Z=10,40\text{cm}$
- Drift distance scan with 130 V/cm drift field , 17 z-positions
- Drift distance scan with 4 different shaping times , 7 z-positions
- Beam Momentum scan, in steps of 1 GeV and 5.6 GeV

- $\sim 3.5\text{ M}$ events



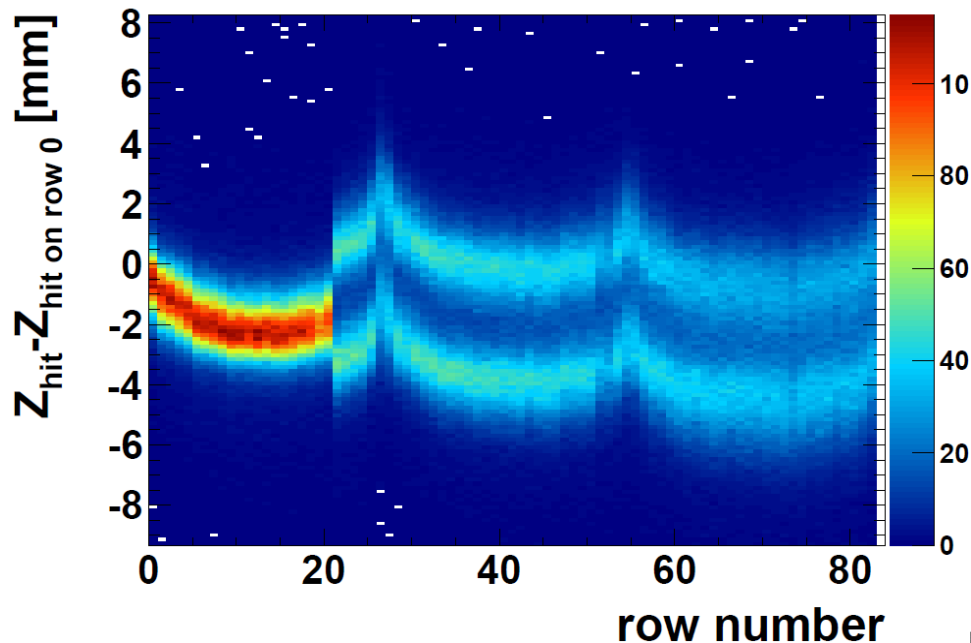
Clock Synchronization

- Observation: Longitudinal residuals split at the border of the modules



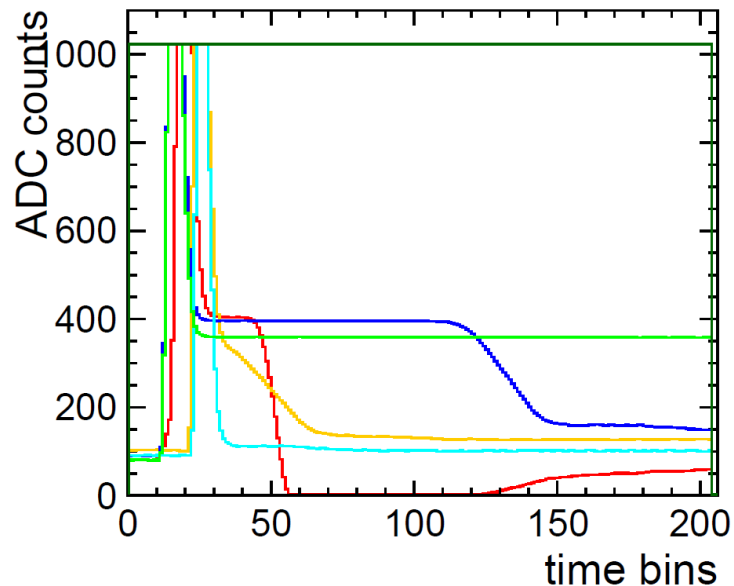
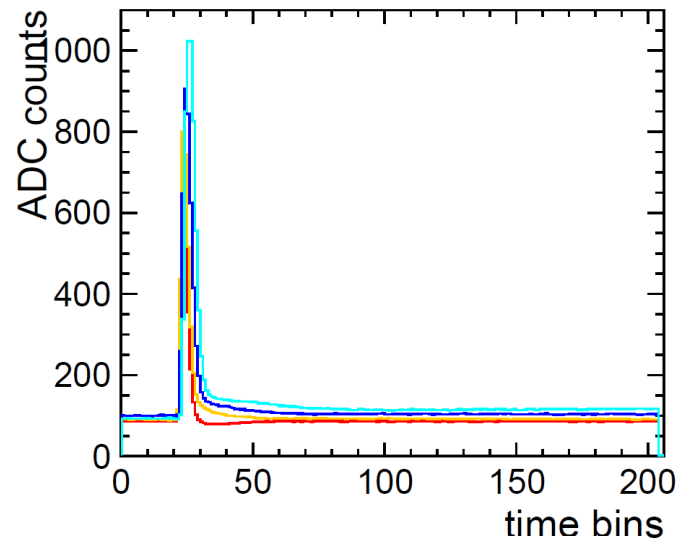
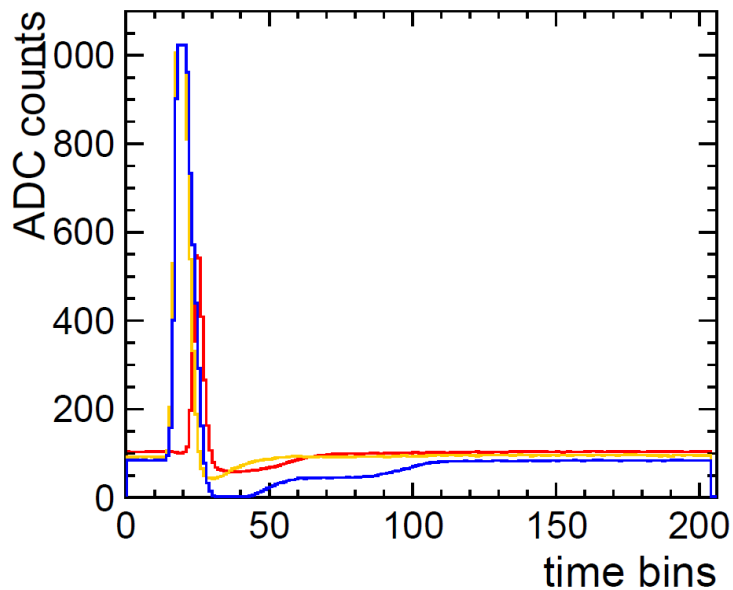
Clock Synchronization

- Current firmware does not synchronize the sampling clock (20 MHz) and system clock (40 MHz) between different RCUs
- Two possible states
- During start up of the system the synchronization is randomly chosen for each RCU
- 25 ns shift in time possible when using several RCUs



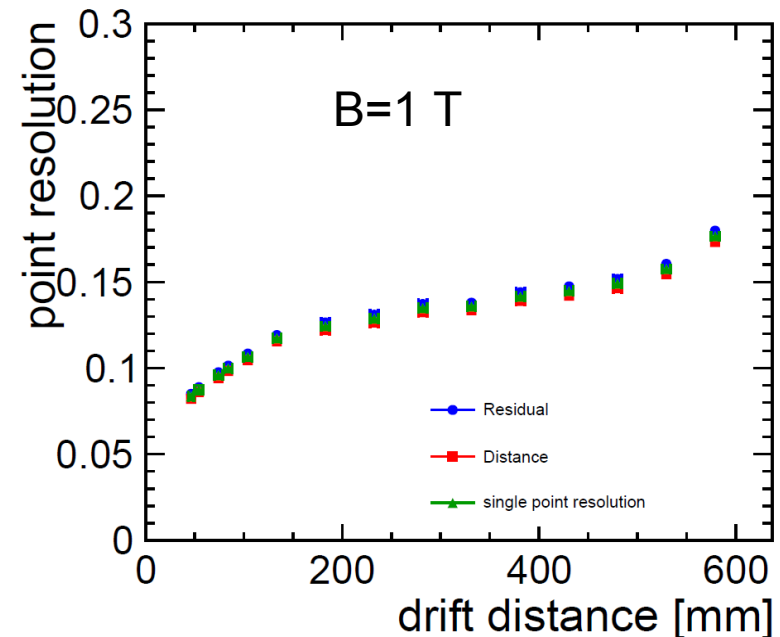
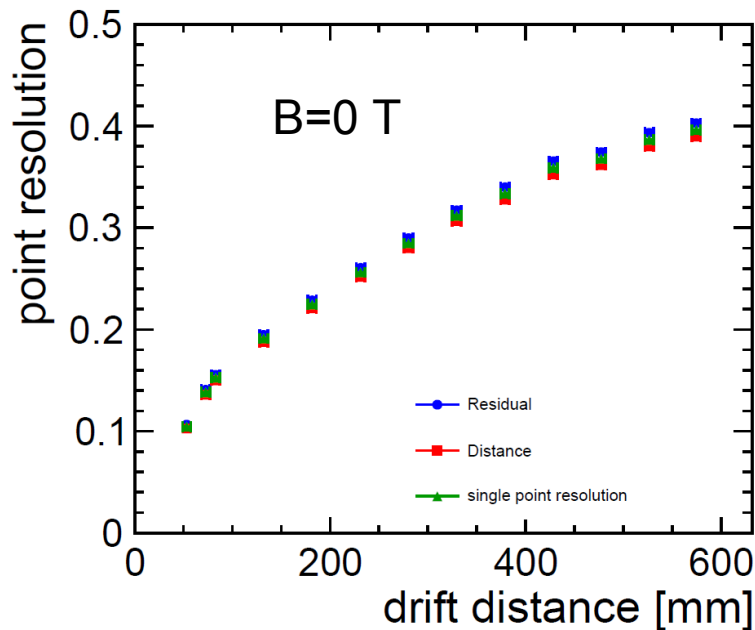
Pulse Level Analysis

- We have pulses with
 - A shoulder
 - An undershoot
 - A tail which end in a plateau
- Start new analysis on pulse level



Transverse Point Resolution

- Track finding and fitting with CLUPATRA
 - Kalman filter based on Kaltest
 - Same software as used for the ILD simulation studies
- Point Resolution for $B=0$ T shows the expected behavior
- Point Resolution for $B=1$ T displays a rise at large drift distances



End of Beam Tests

- Measurements with GEM settings for minimal ion feedback
- Several trips of the HV
 - No clear indication from the HV supply, where the trips happened
 - Shields and dummies showed trips
 - One GEM broke after several trips
- Also standard setting couldn't be reached anymore
 - > end of the test beam campaign
 - > recheck of the anode end plate



Conclusion

- Very successful test beam with three DESY GridGEM Modules
 - GEMs and field cage being very stable with standard settings
- First analysis shows very nice preliminary results
 - But also problems with the pulses and the clock synchronization
- A lot of work still to come to analyze the data in detail

- I want to thank everybody who helped before, during and after the test beam

