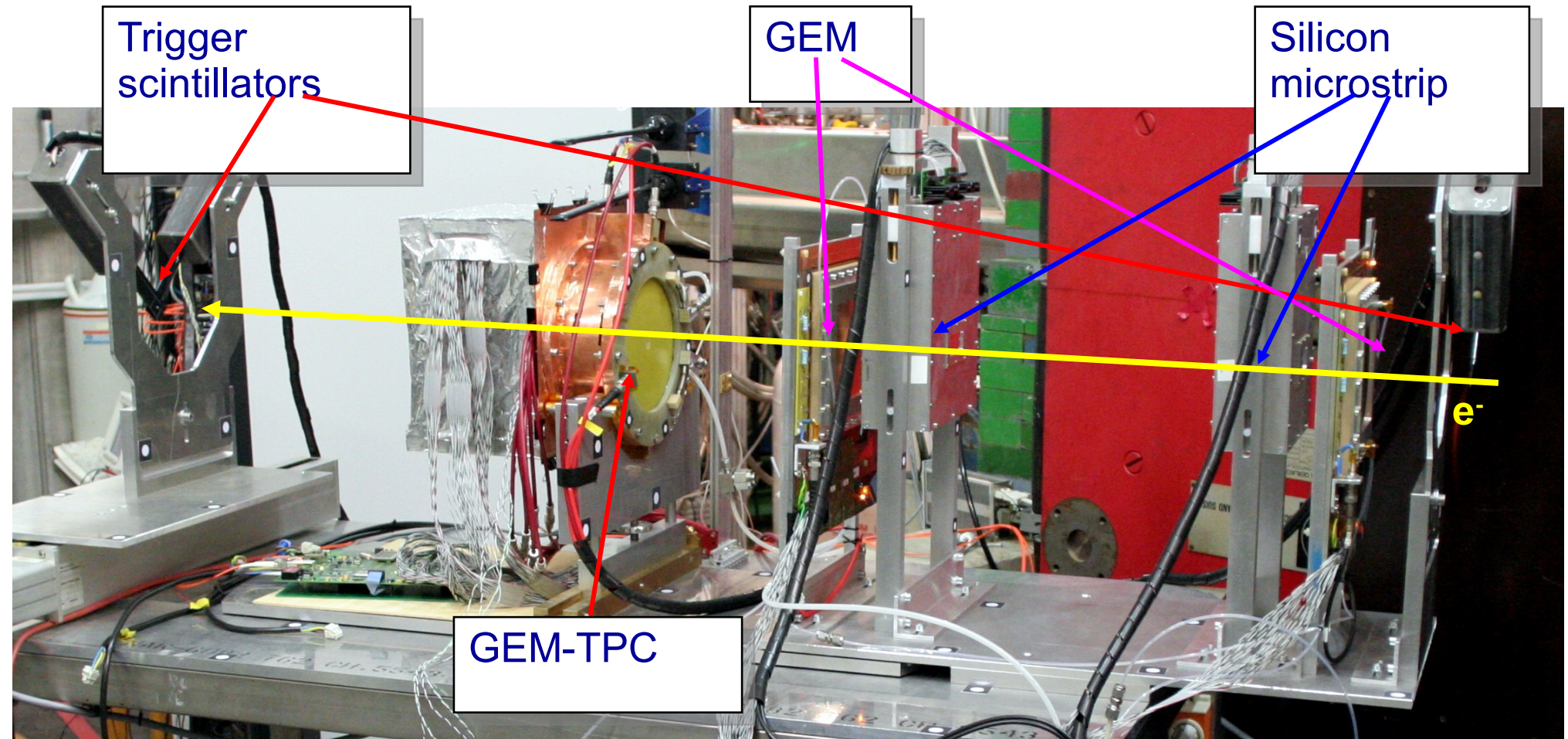


Test of the TPC at ELSA with sparse readout

Maxence Vandembroucke, TUM E18,
for the GEM-TPC collaboration

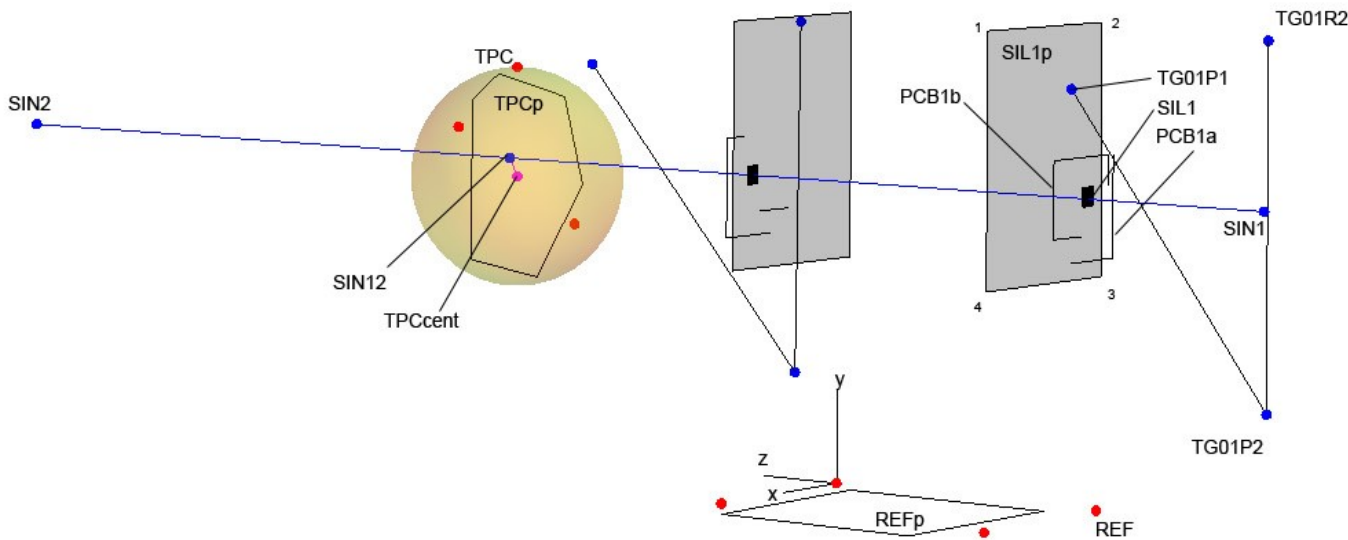
XXX.PANDA meeting, Jülich, 08-09-2009

- GEM-TPC test bench
- Geometry and photometry
- Results of the tracking telescope
- GEM-TPC front end electronics
- First results of the TPC with a full sparse readout
- Conclusions and outlook

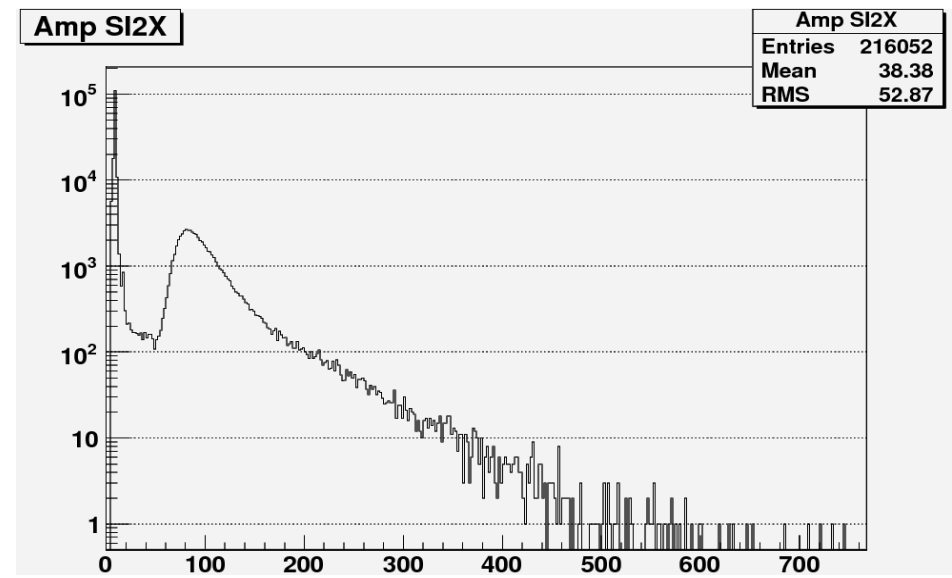
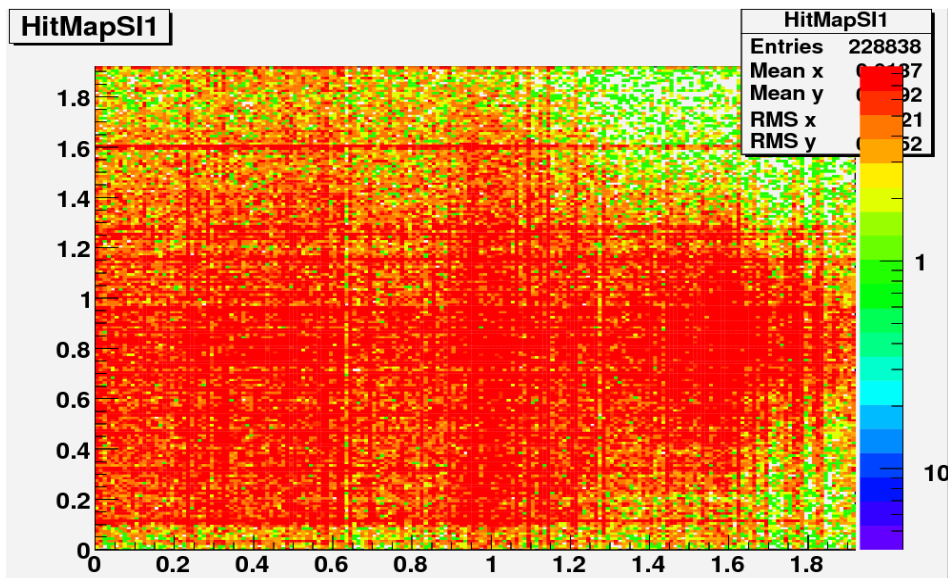
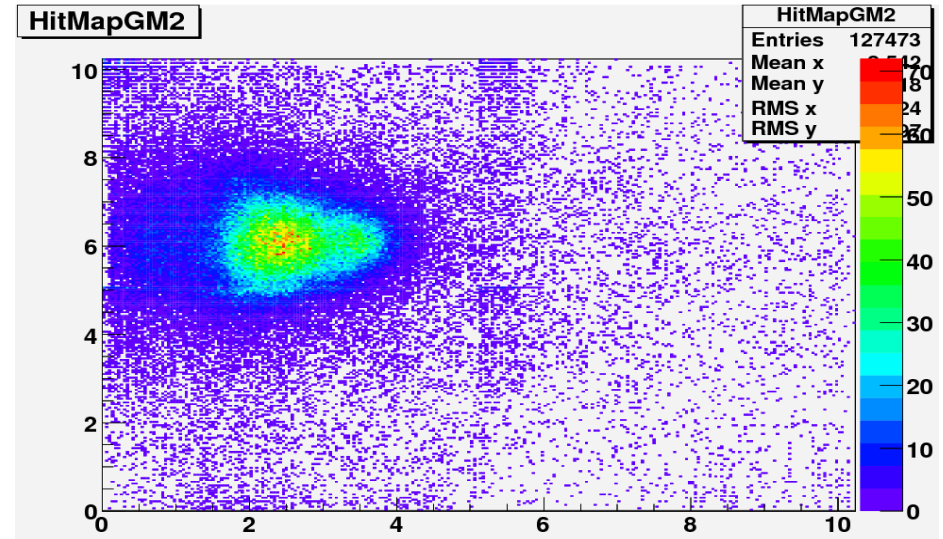
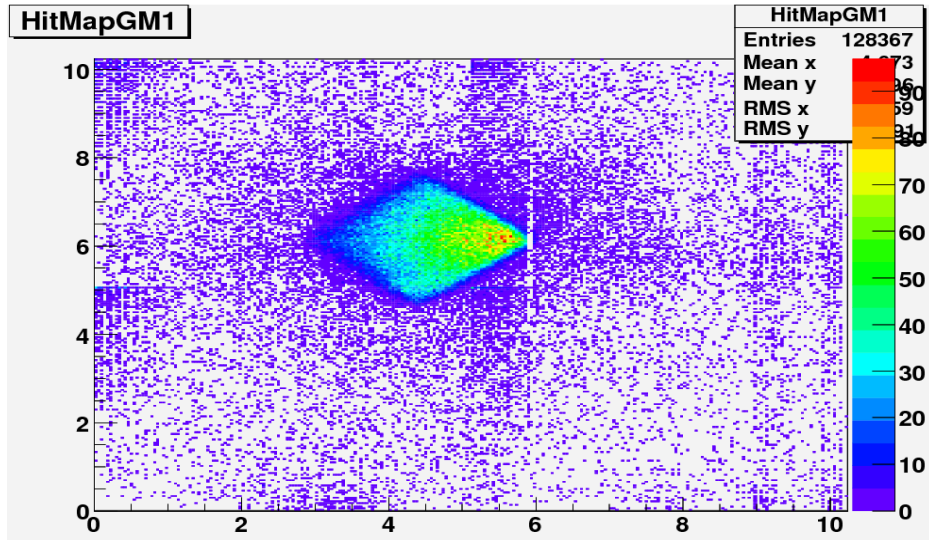


- Tracking telescope consisting of 2 GEM detectors and 2 Silicon detector
- Small GEM-TPC on a orientable support
- Setup rearranged to minimize multiple scattering

- 3D geometry created using the software Photodeler and pictures from several angles
- Given a reference length it calculates the relative positions of the different points
- Final alignment done with tracks

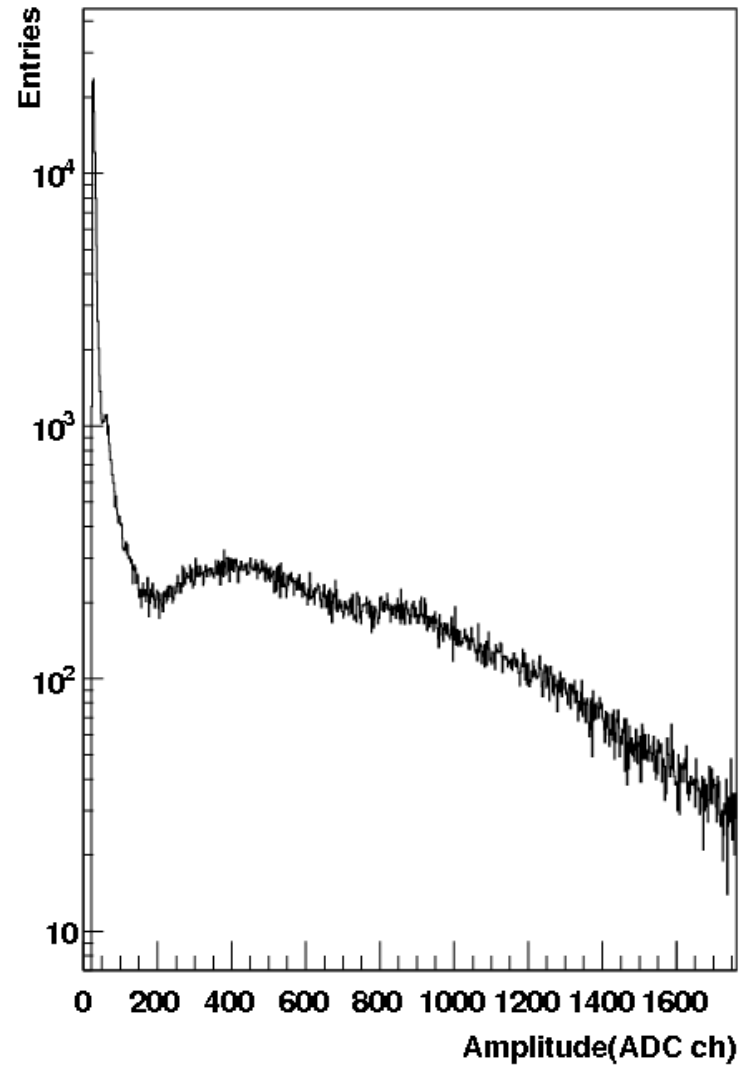


Thanks to Alexander Schmah and Alexander Prehn for doing these measurements

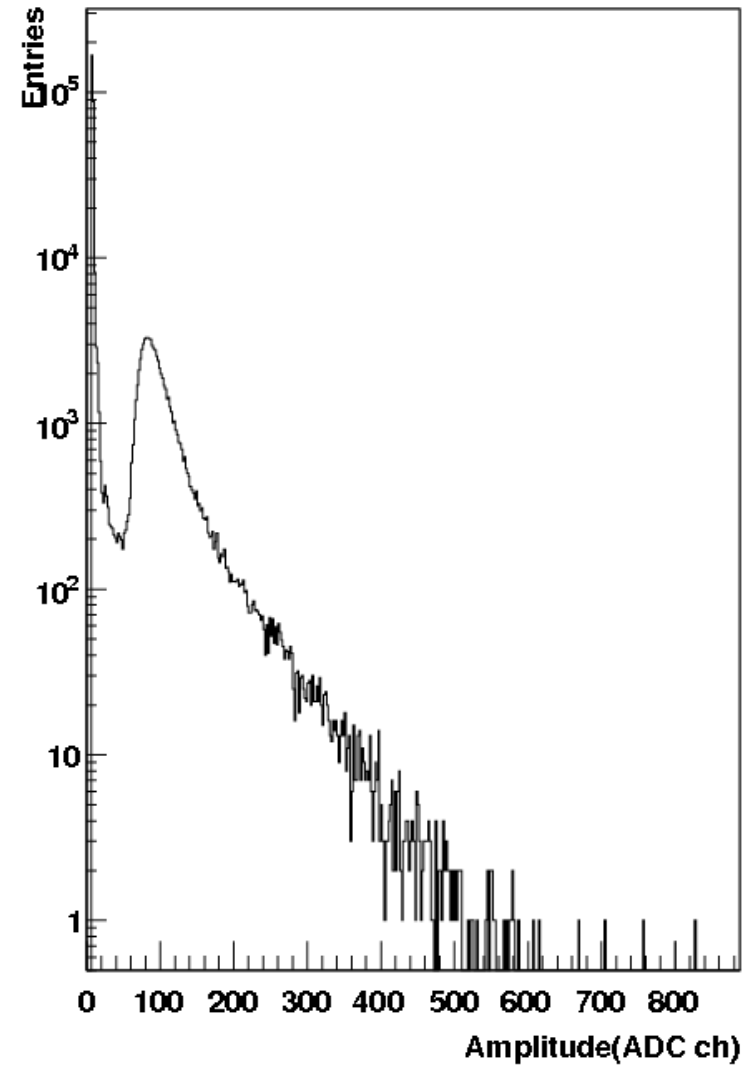


- Cluster amplitude of the tracking telescope

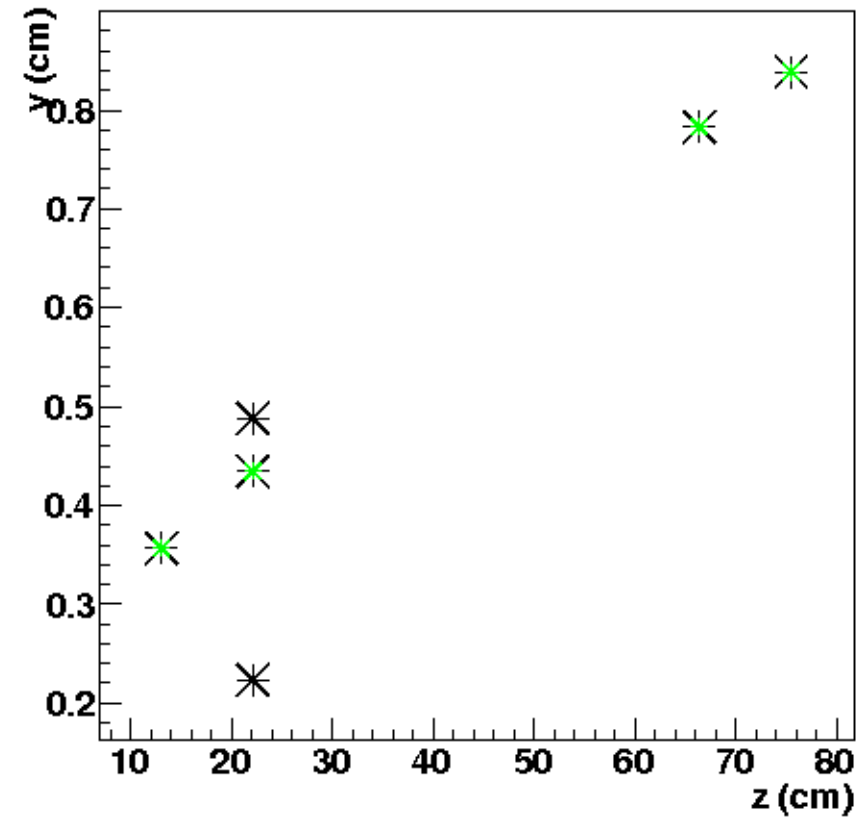
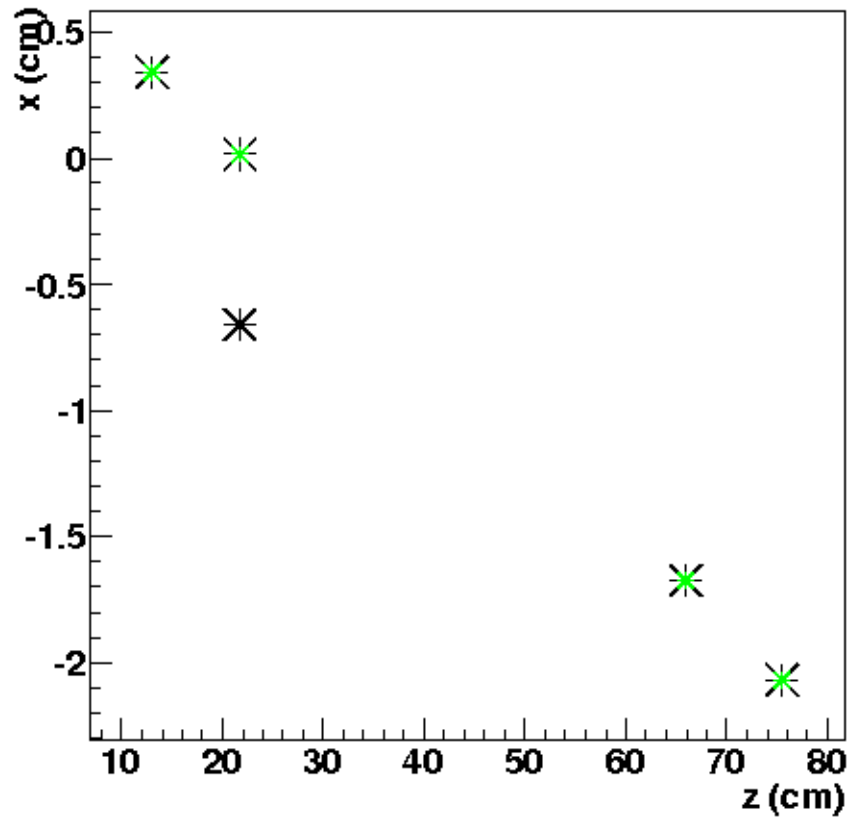
GM01X amplitudes



SI01X amplitudes



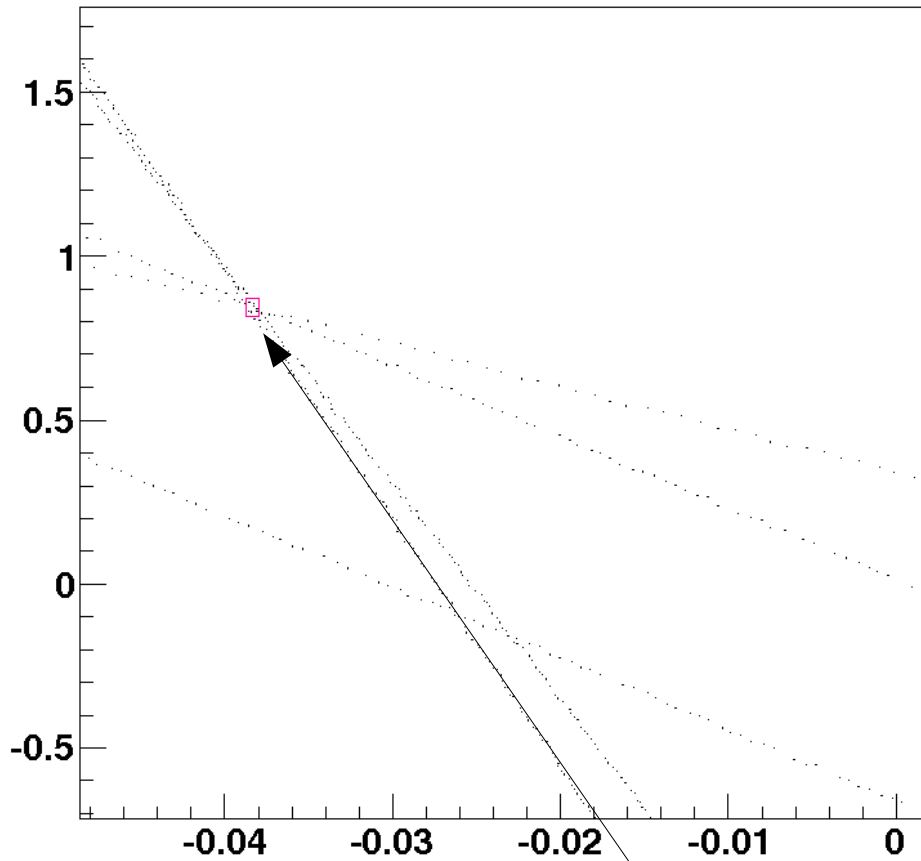
- The Fast Hough Transform is used for pattern recognition. Cf. Felix Boehmer talk in the computing session yesterday
- The black spots are the clusters in the event, the ones colored green are used for one track



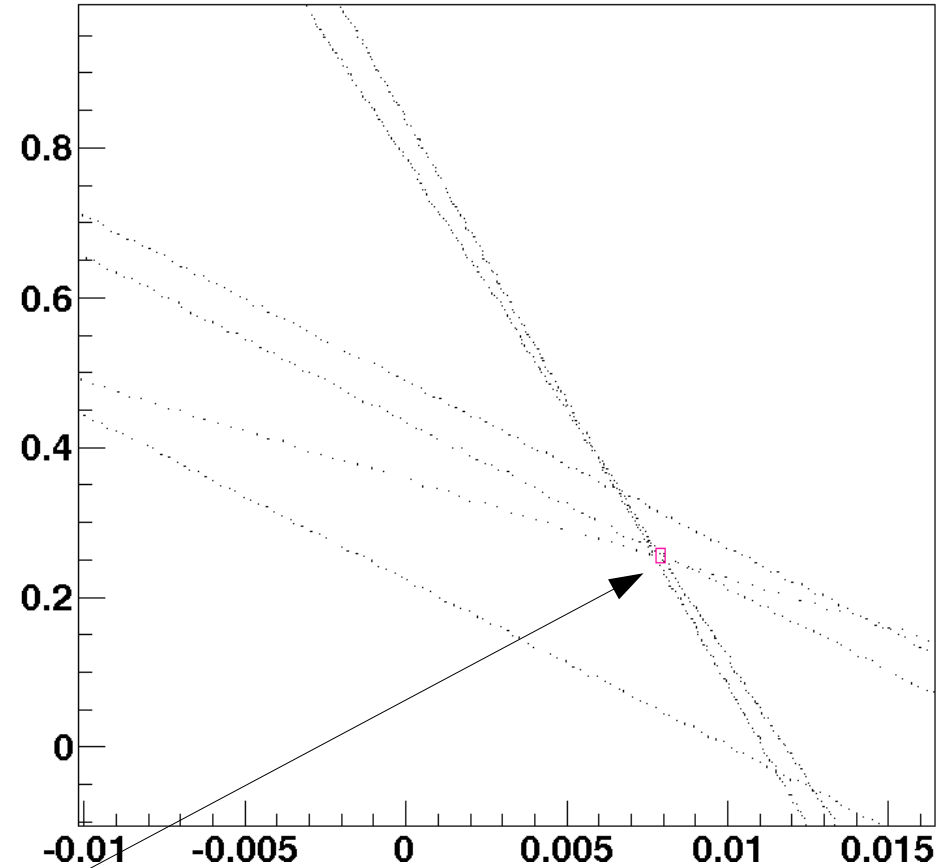
Results from S. Doerheim

- Here you can see the hough space for the event shown on the last slide

houghspaceXZ



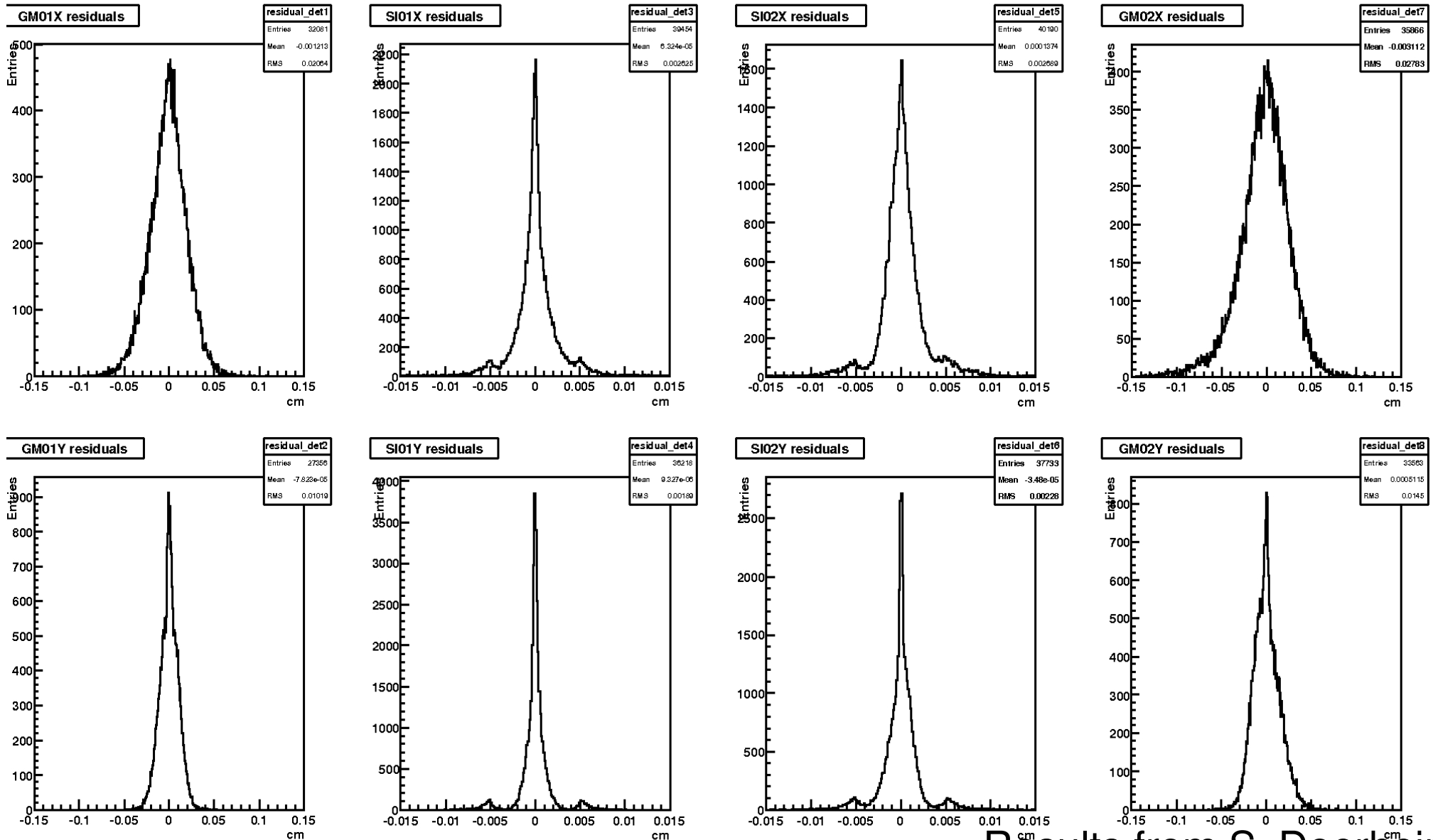
houghspaceYZ



Maxima

Results from S. Doerheim

- Residuals of $\sim 25\mu\text{m}$ for the Silicons and $\sim 200\mu\text{m}$ for the GEMs



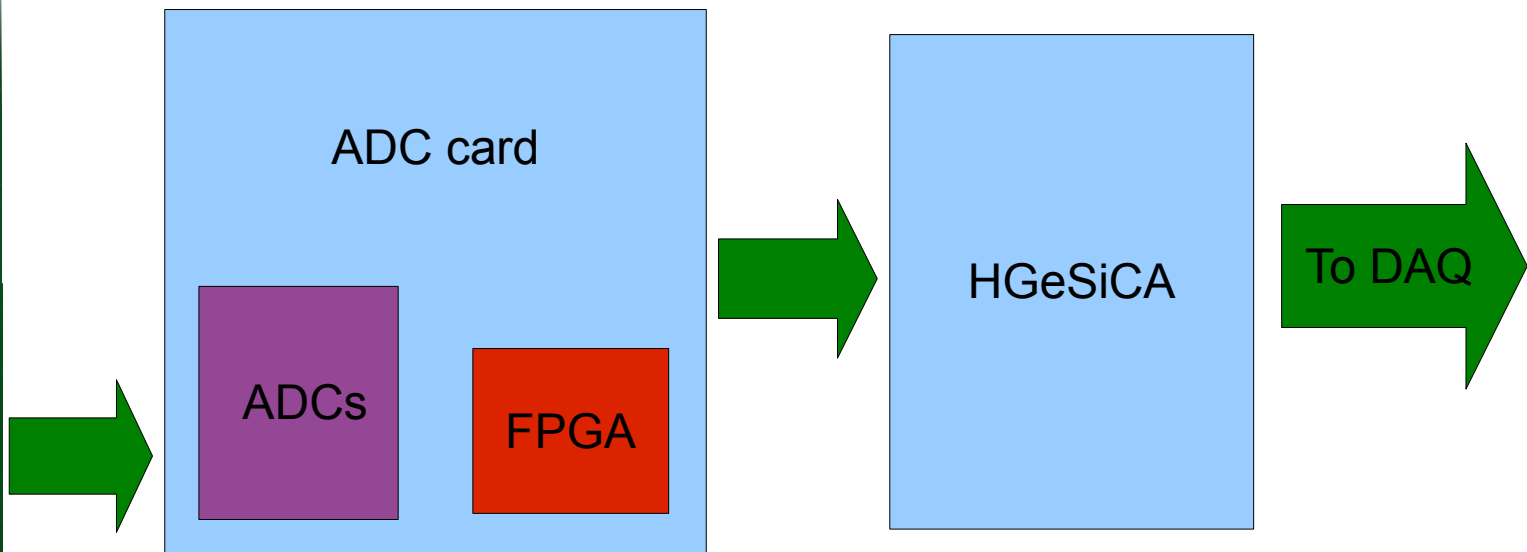
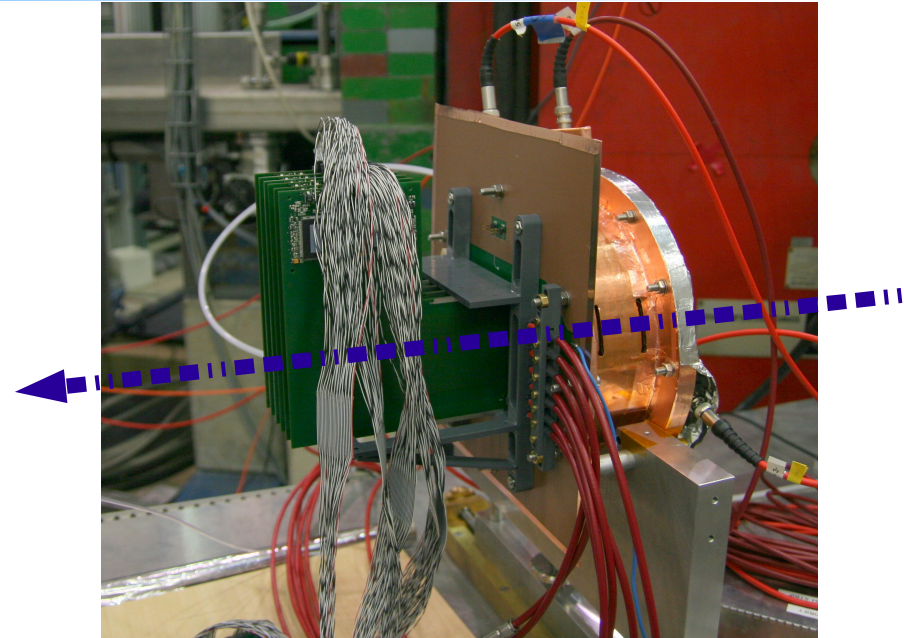
Results from S. Doerheim

Front-end cards :

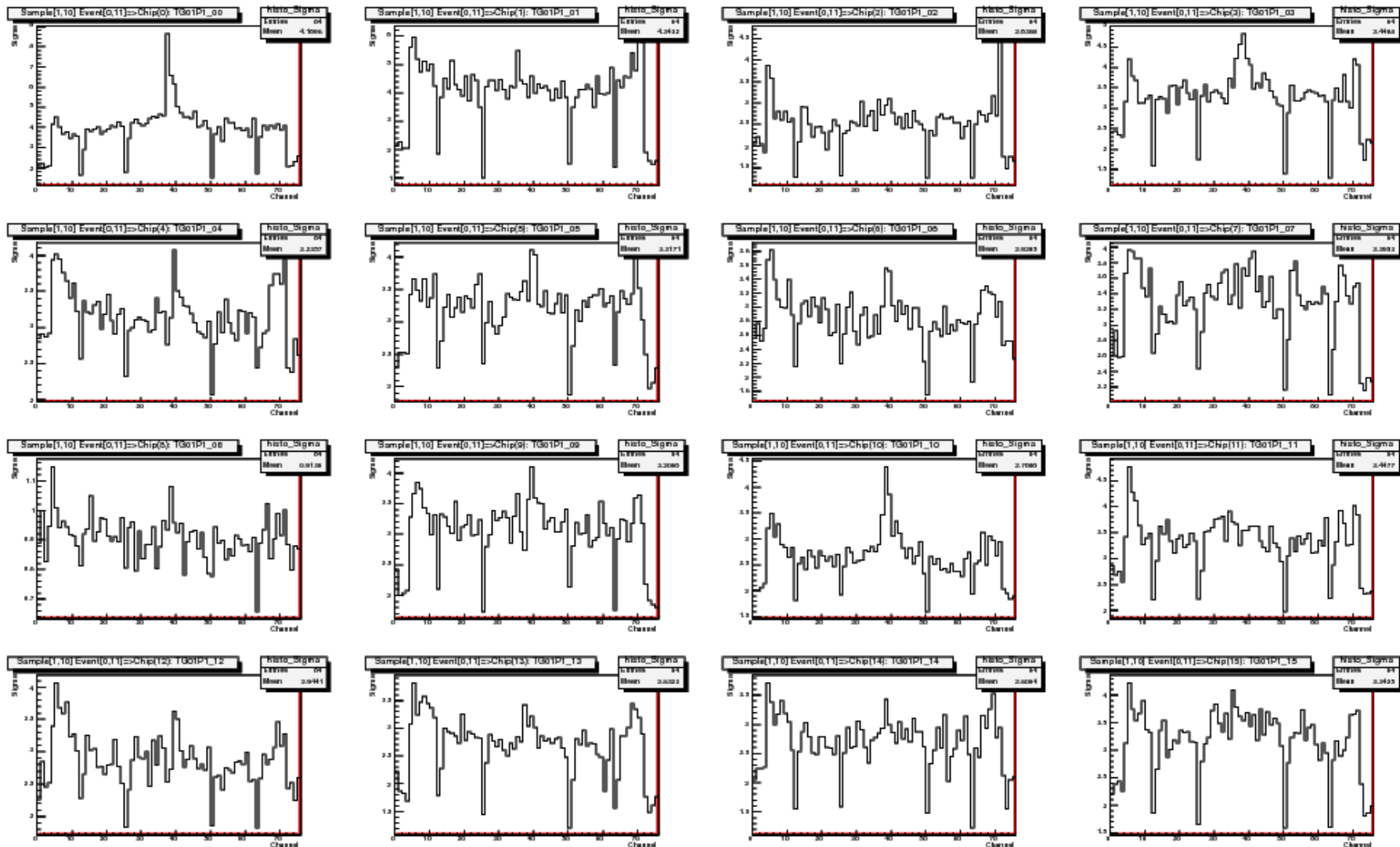
- 4xT2K chips
- 256 channels
- L-shaped to place chips outside of beam

Acquisition setup :

- 6 T2K LCards
- 2 ADCs
- 2 data concentrators (HGeSiCA)

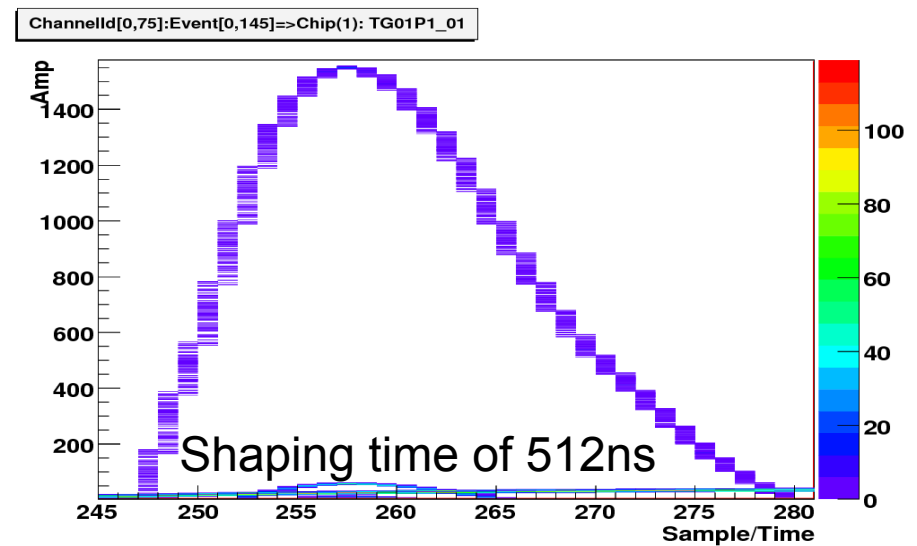
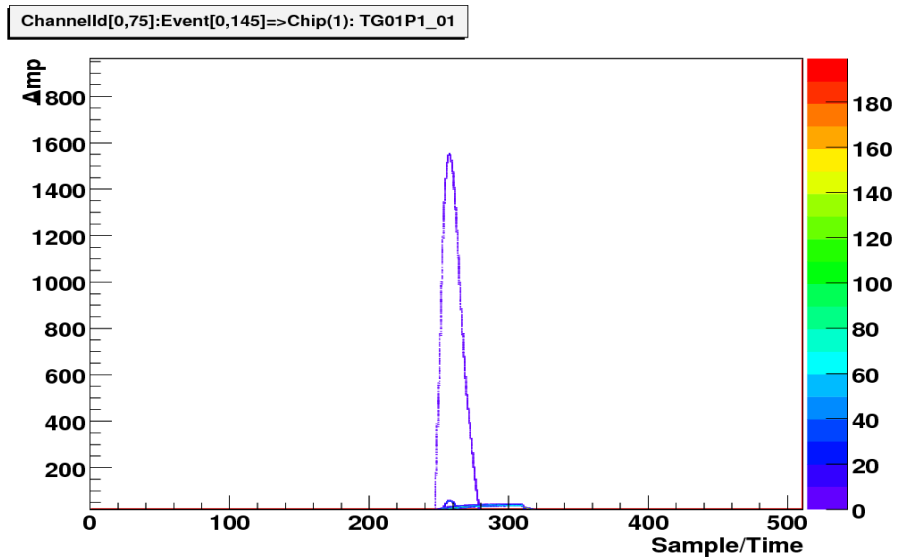


- 16 T2K chips noise measurement using the new latch-all mode firmware

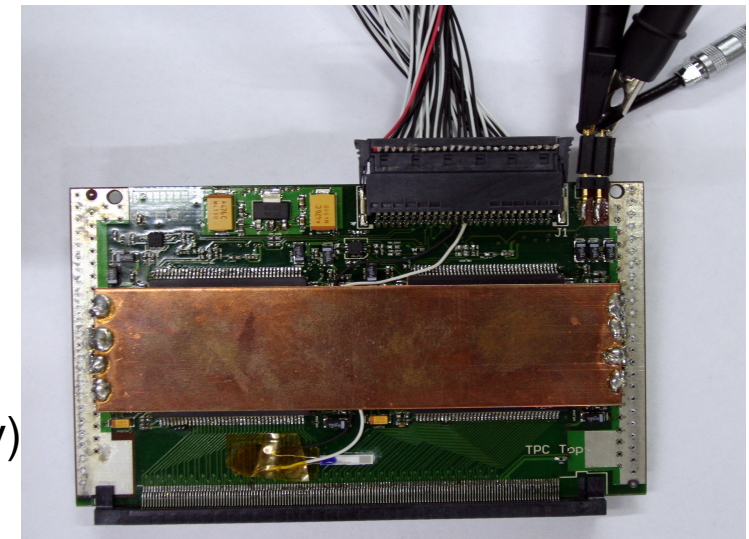


- Good noise performance (1200e-)

- Sparse readout test with an injected pulse

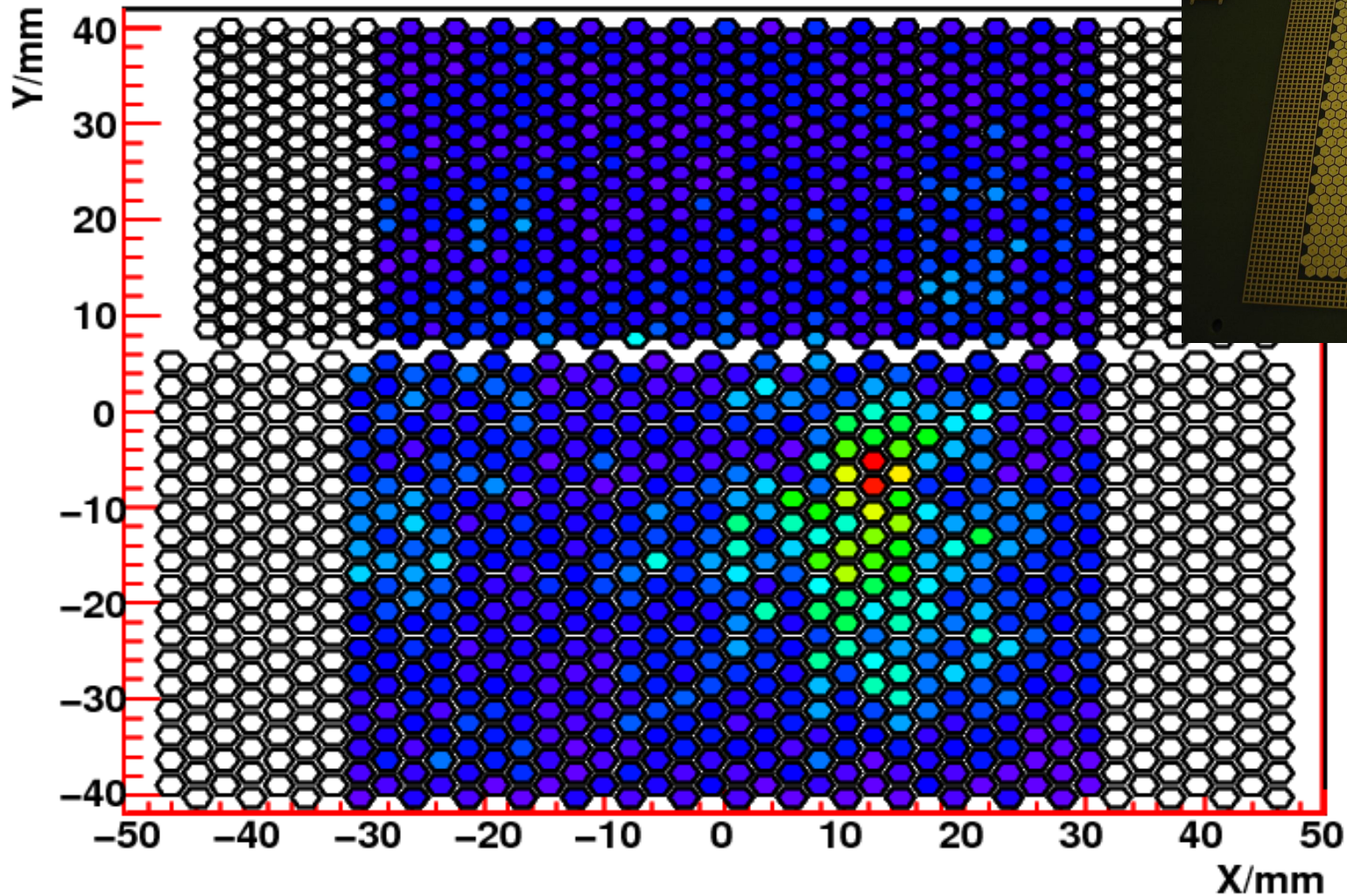


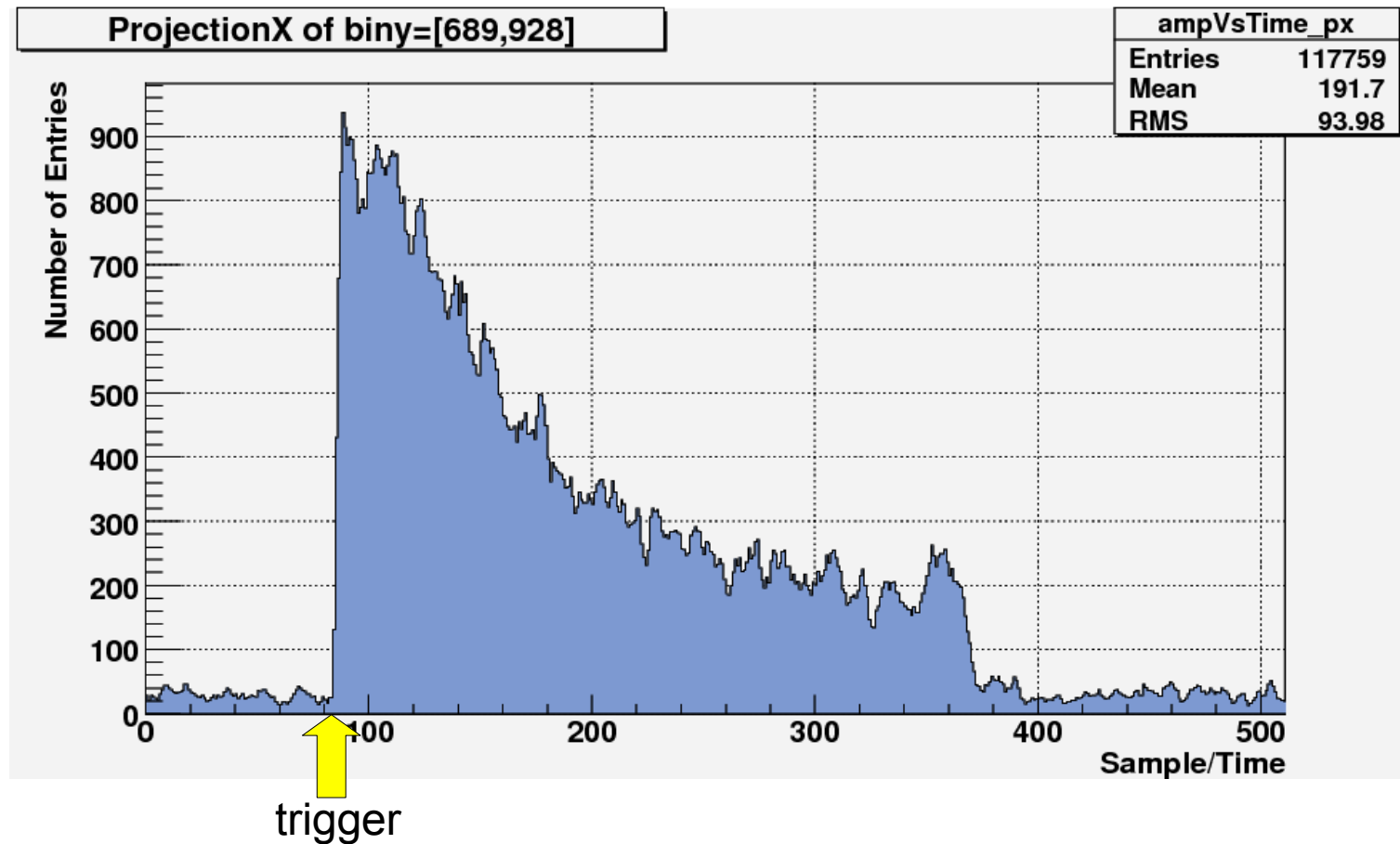
- Full sparse mode working and tested
- Dead time for data readout
- Occupancy max of 1Kw/chip due to ADC memory size
 - Not a problem for the test bench (about 100 value/ev)



- Beam profile using the online decoding program

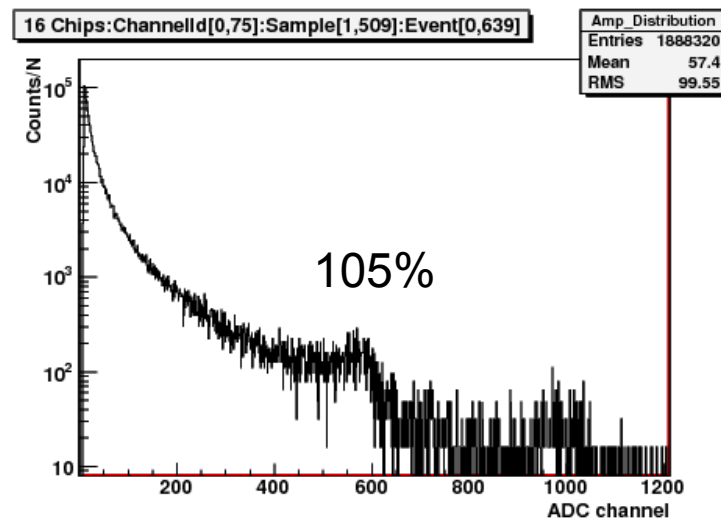
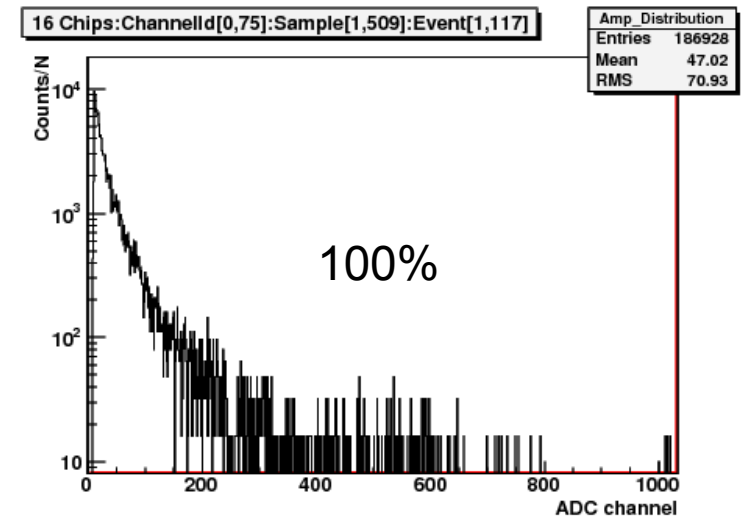
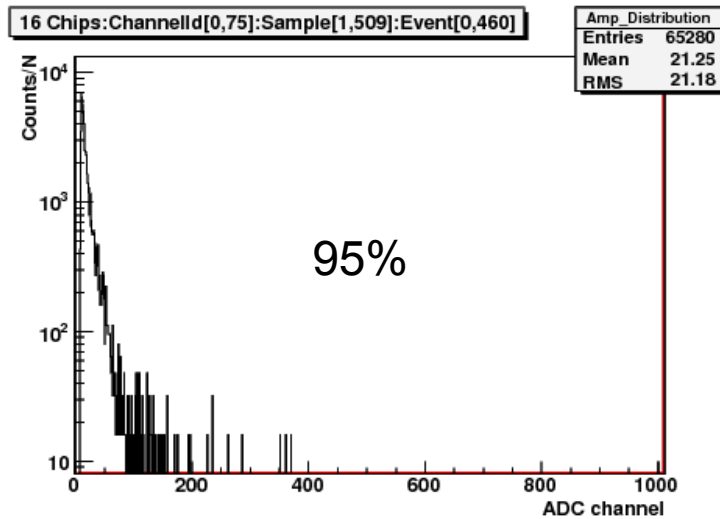
2D Beam Profile, Event[5, 177]





- Trigger correlated signals
- Drift time of 286 samples => $14.3\mu\text{s}$ as expected

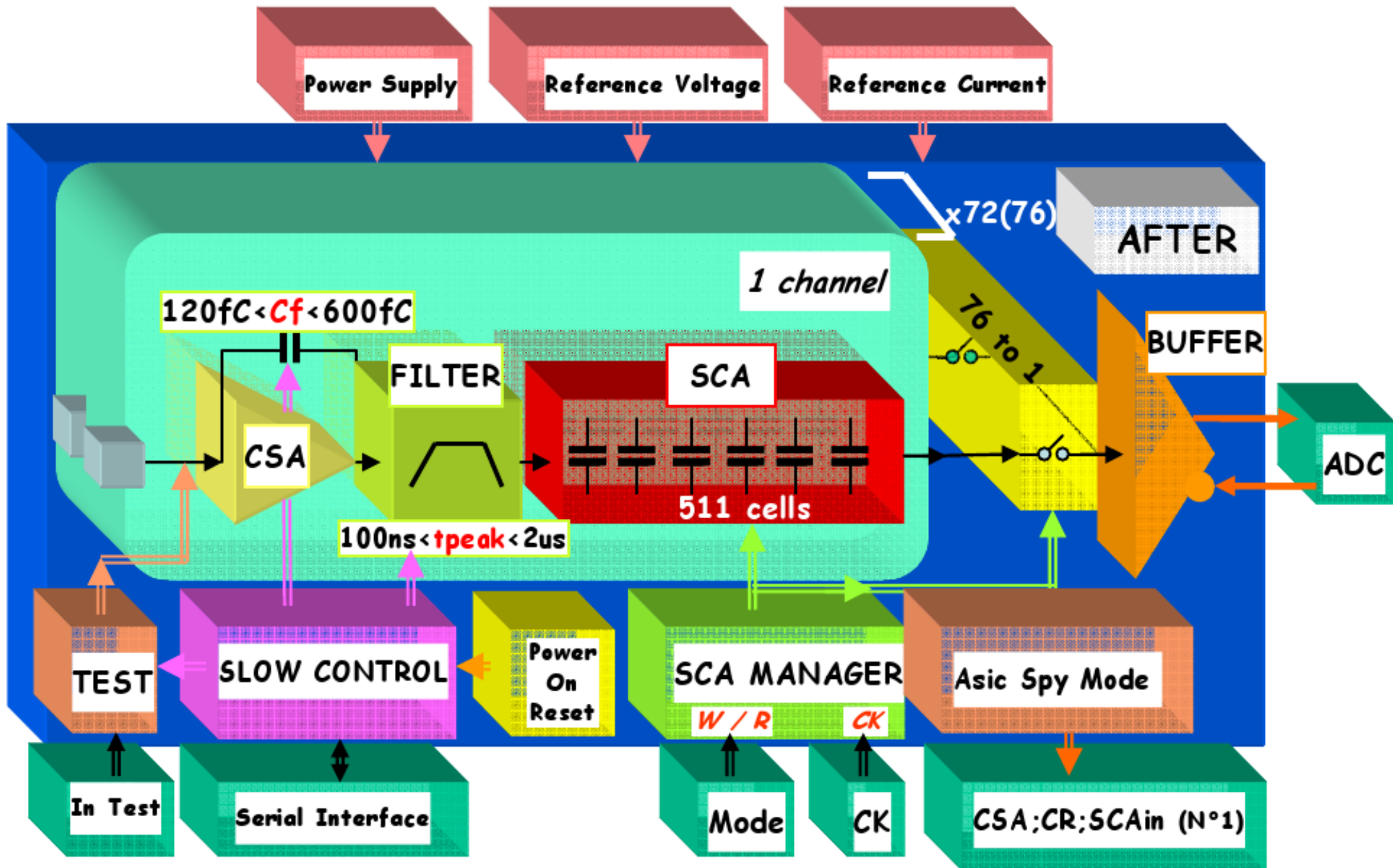
- Gain scan from 95% to 105% of the GEM amplification high-voltage
- Signals amplitude in ADC channel (5.5pC/ADC ch.)



- Fully working tracking telescope
- Geometry file from photometry
- Track reconstruction working
- TPC sparse readout working
- Test data taken during Summer :
 - Gain scan
 - Drift field scan

- TPC data analysis with the pandaroot framework
- Ongoing data taking :
 - Shooting the beam through the thicker cathode
 - Gaz test (Ar/CO₂ 90/10, Ne/CO₂)
 - Different angle between the beam and the pad plane
 - Small/big pads resolution
- Replacement of the cathode (?)
- Measurement of ion backflow





SCA : Switched Capacitor Array