

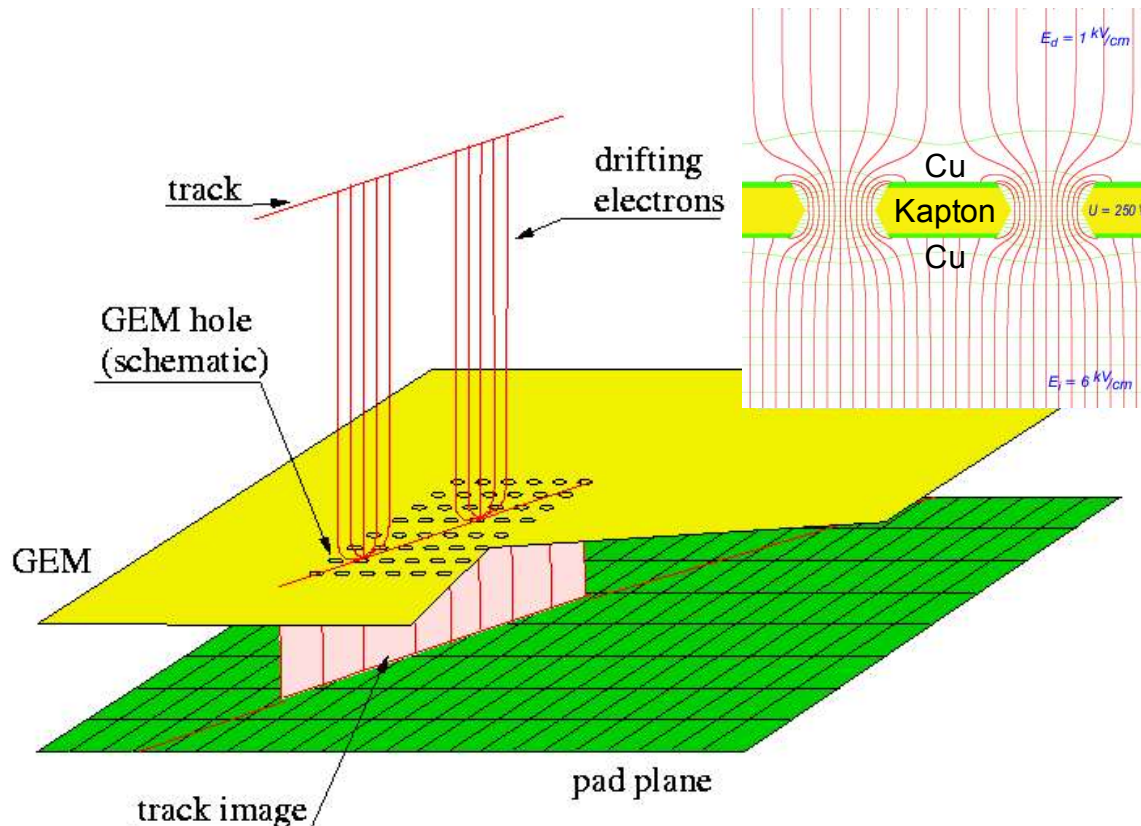
GEM TPC Performance in High Magnetic Fields - First Results -

M. Ball, T. Behnke, M. Hamann, M. Janssen, A. Kaukher,
T. Kuhl, T. Lux, F. Sefkow, B. Voigt, P. Wienemann

Hamburg Zeuthen Linear Collider Meeting
March 19, 2004
DESY Zeuthen

A TPC with GEMs

Idea: Replace wire based gas amplification system of conventional TPCs by **Gas Electron Multipliers (GEMs)**



Advantages:

- Intrinsic ion feedback suppression
- Better double track resolution in drift direction due to absence of slow ion tail
- High gain by using multiple GEM structures
- 2-dimensional symmetry
- Tiny $E \times B$ effects
- Hole spacing of order $100 \mu\text{m}$

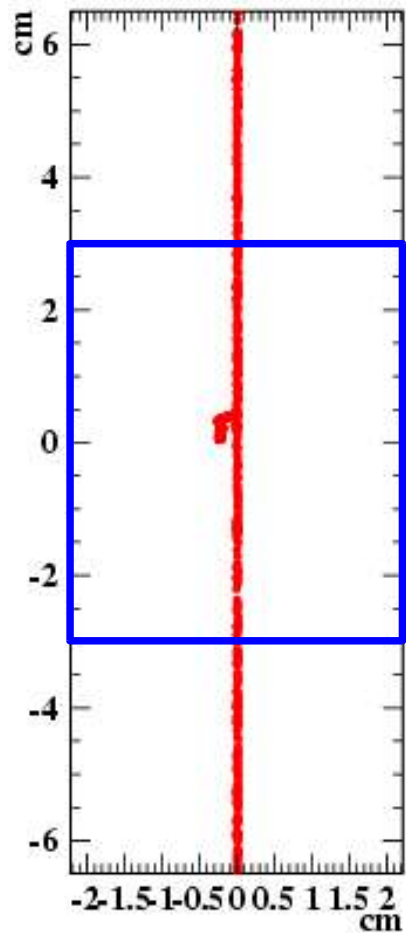
A GEM TPC offers exciting prospects

The New TPC

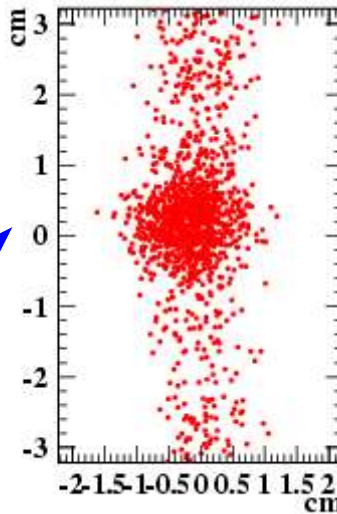


The Impact of Magnetic Fields

Primary ionization cloud:

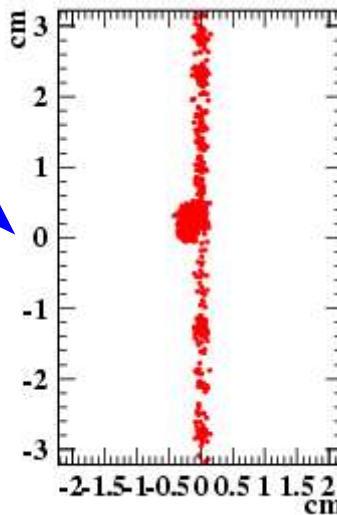
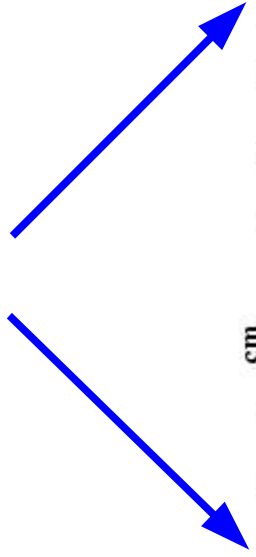
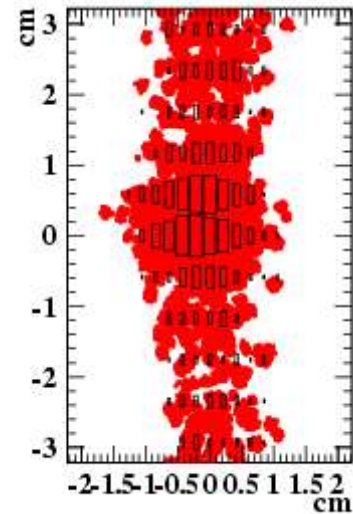


Charge cloud after 1 m drift:

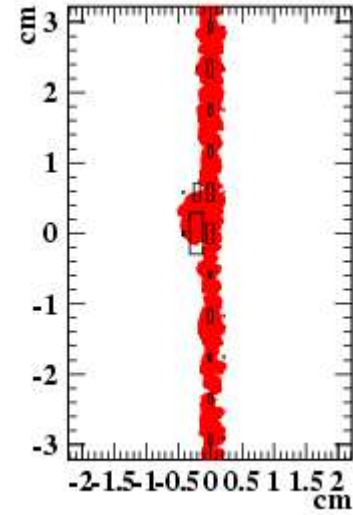


$B = 0 \text{ T}$

Charge cloud on pads:

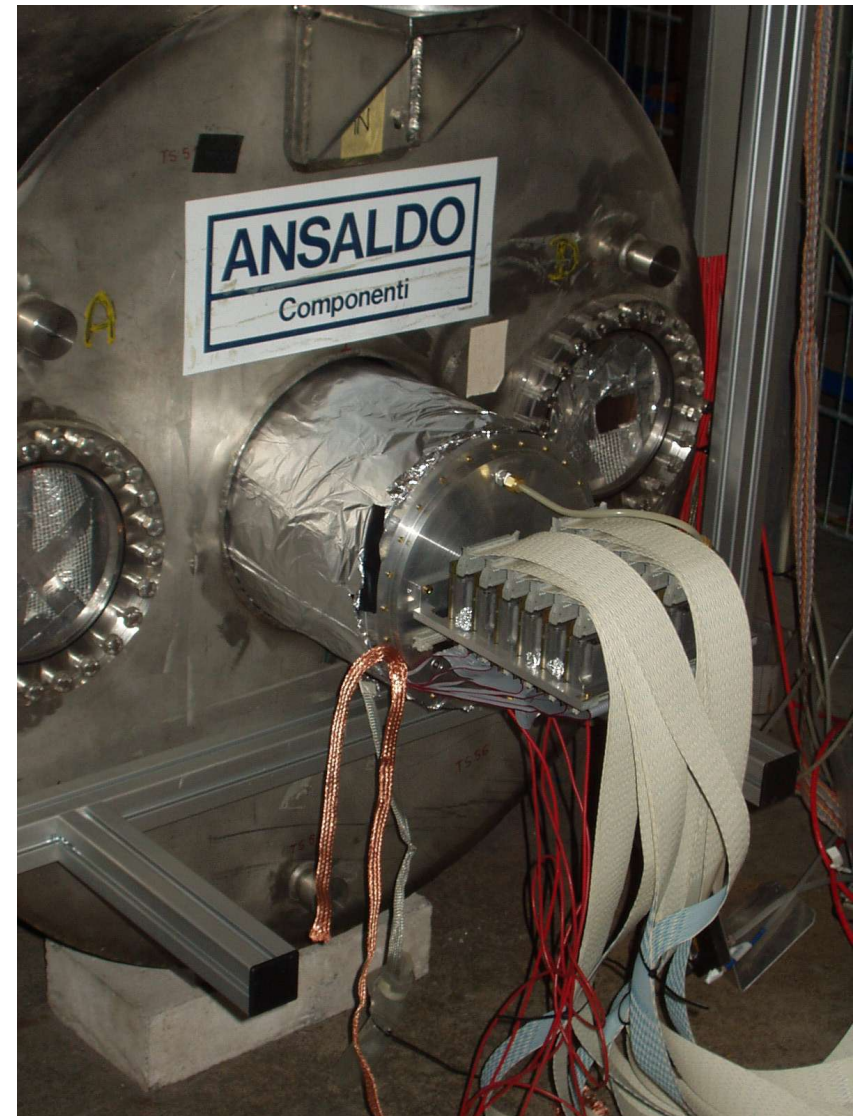


$B = 4 \text{ T}$



The TPC in the DESY 5 T Magnet

- Superconducting magnet
- 5 T maximal field
- 28 cm aperture
- 187 cm cryostat length

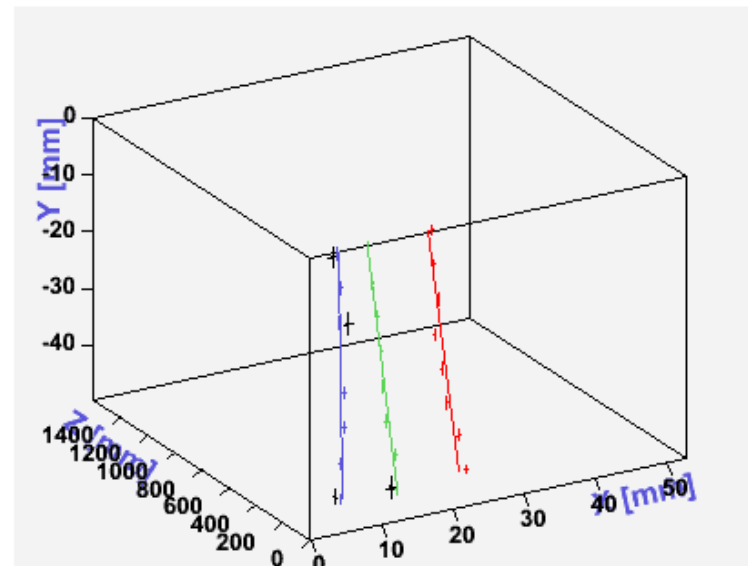
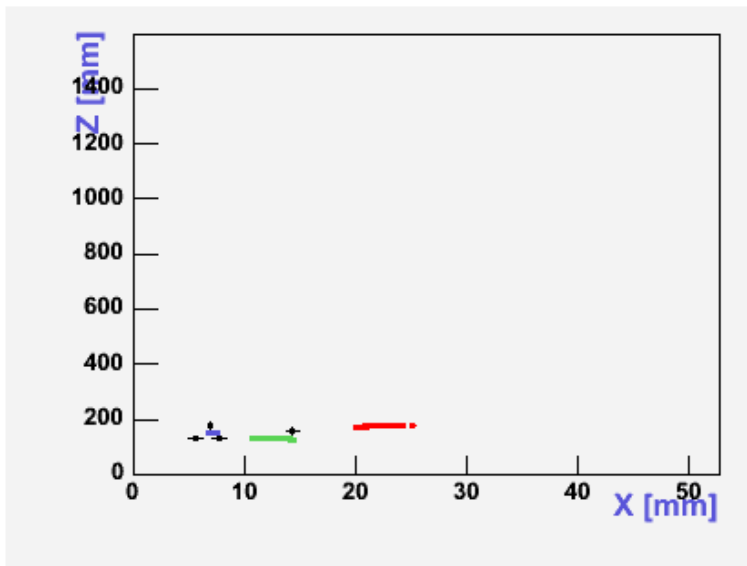
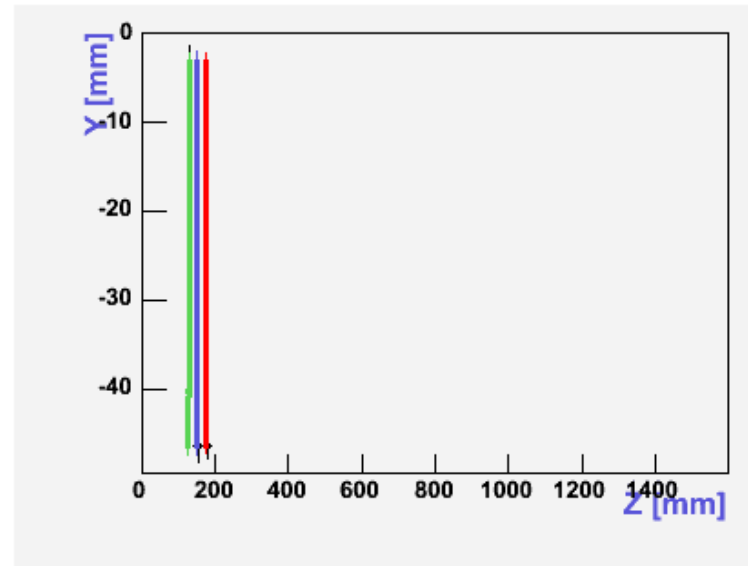
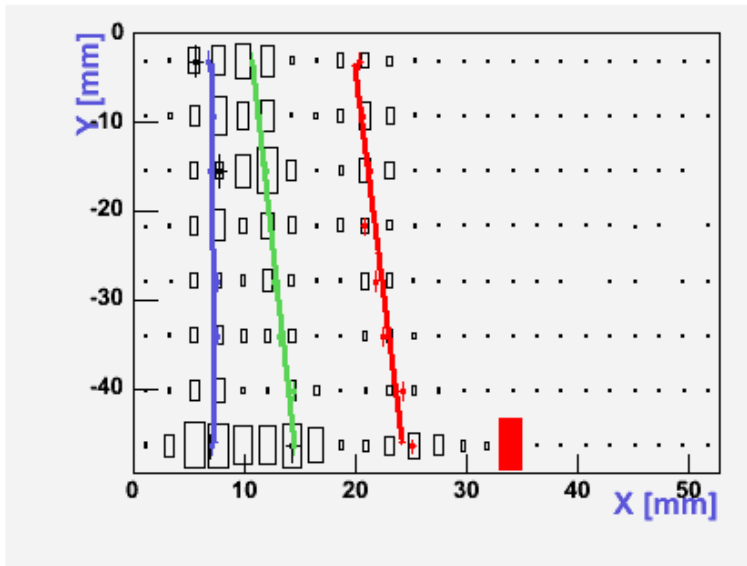


The Data Set

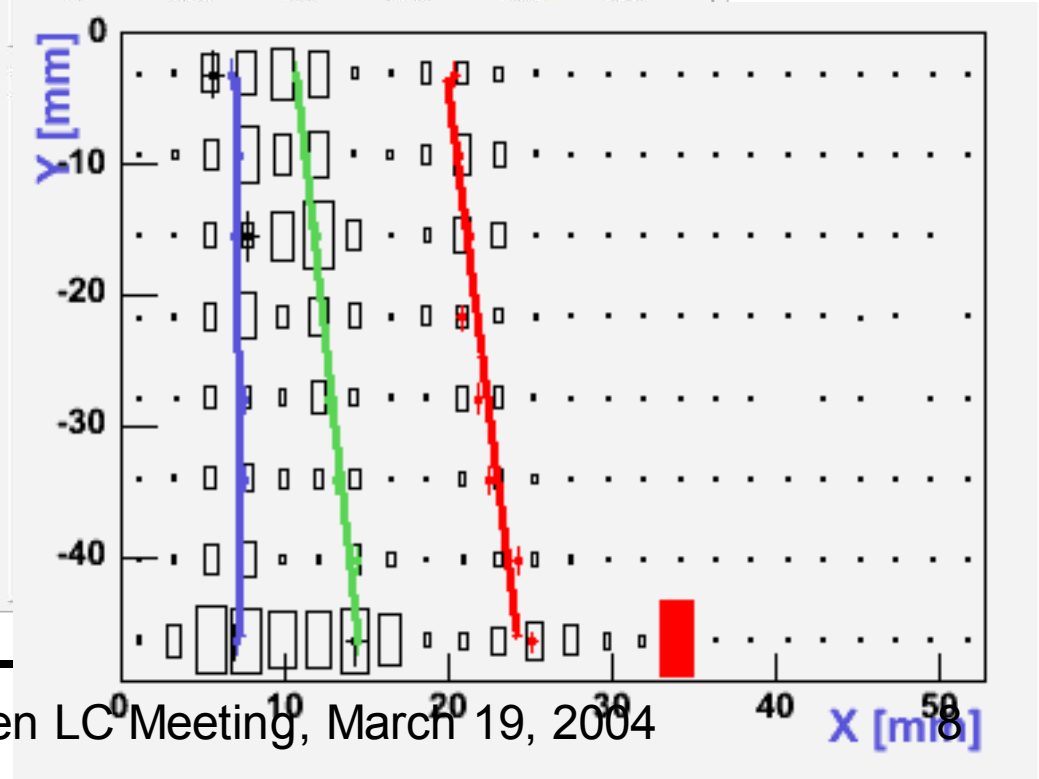
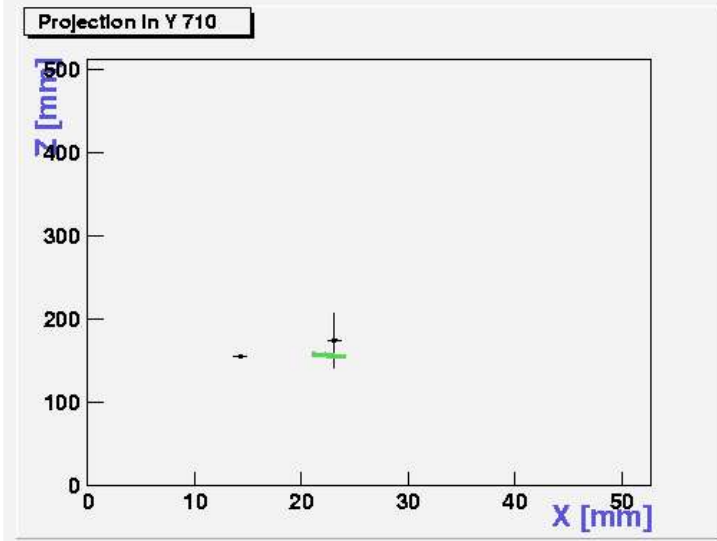
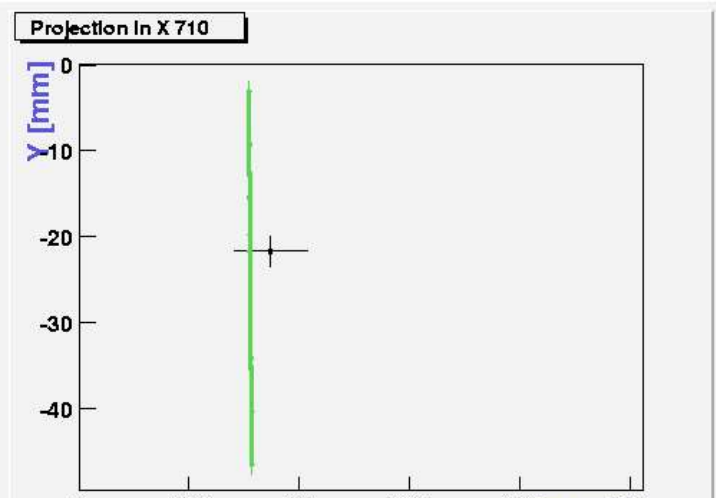
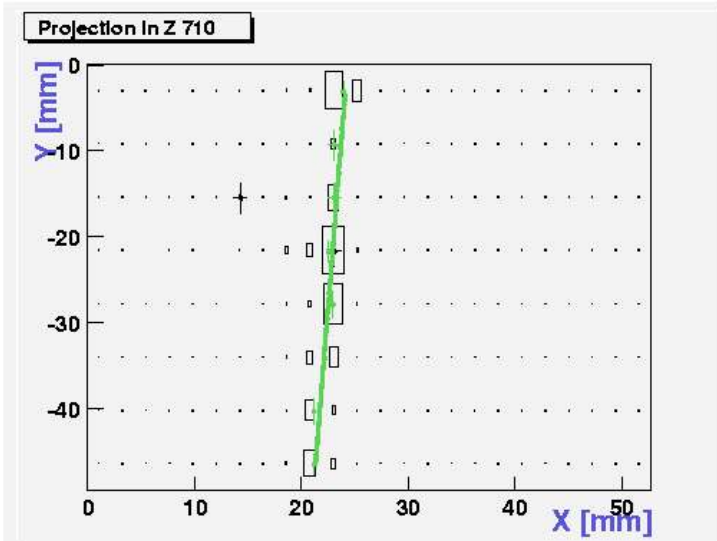
Data recorded and analyzed so far:

- 0 Tesla:
 - 12540 events
 - 11749 single track events (93.7 %)
- 4 Tesla:
 - 10684 events
 - 10619 single track events (99.6 %)

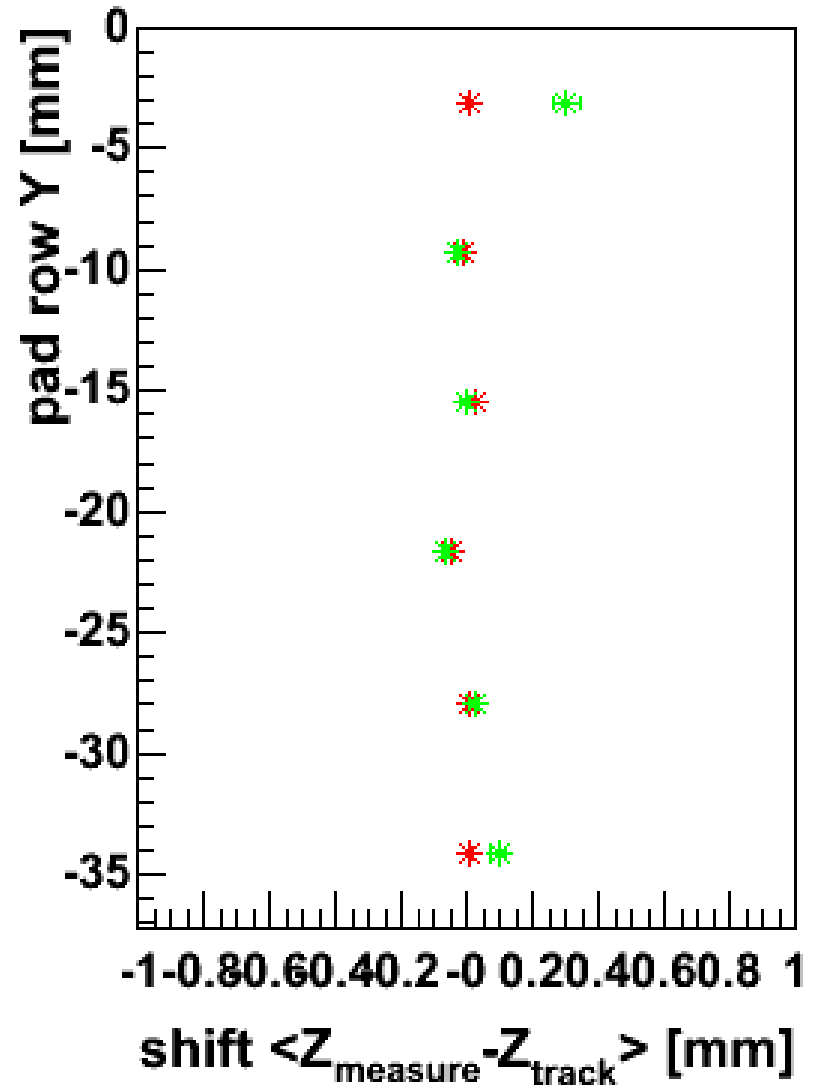
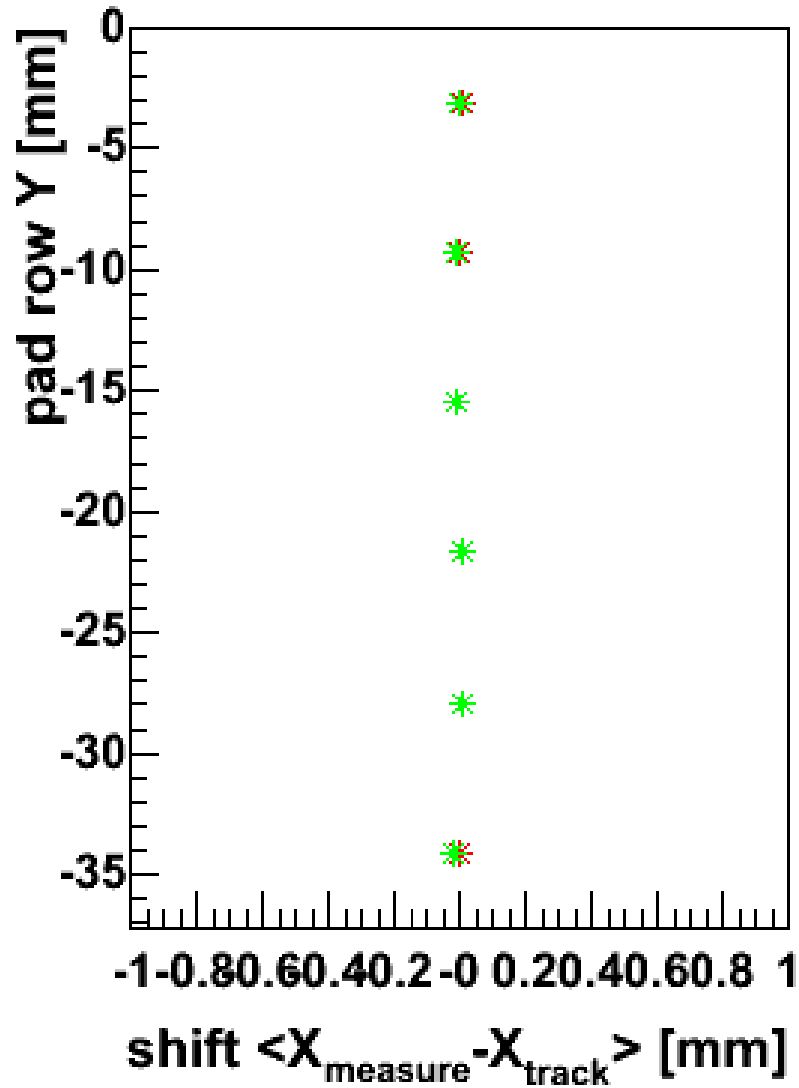
0 T Event



4 T Event

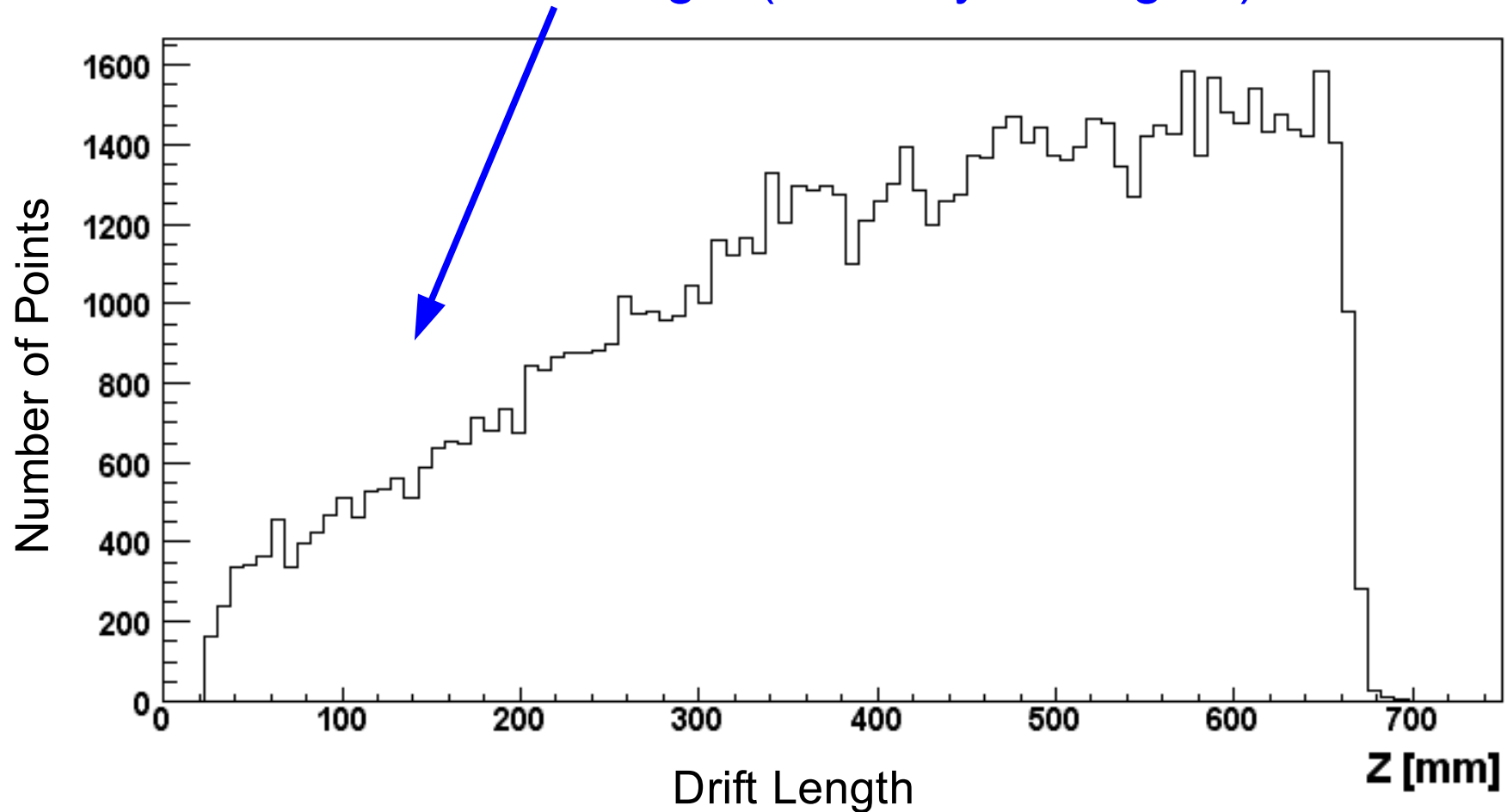


Shifts (4 T, Circle Fit)

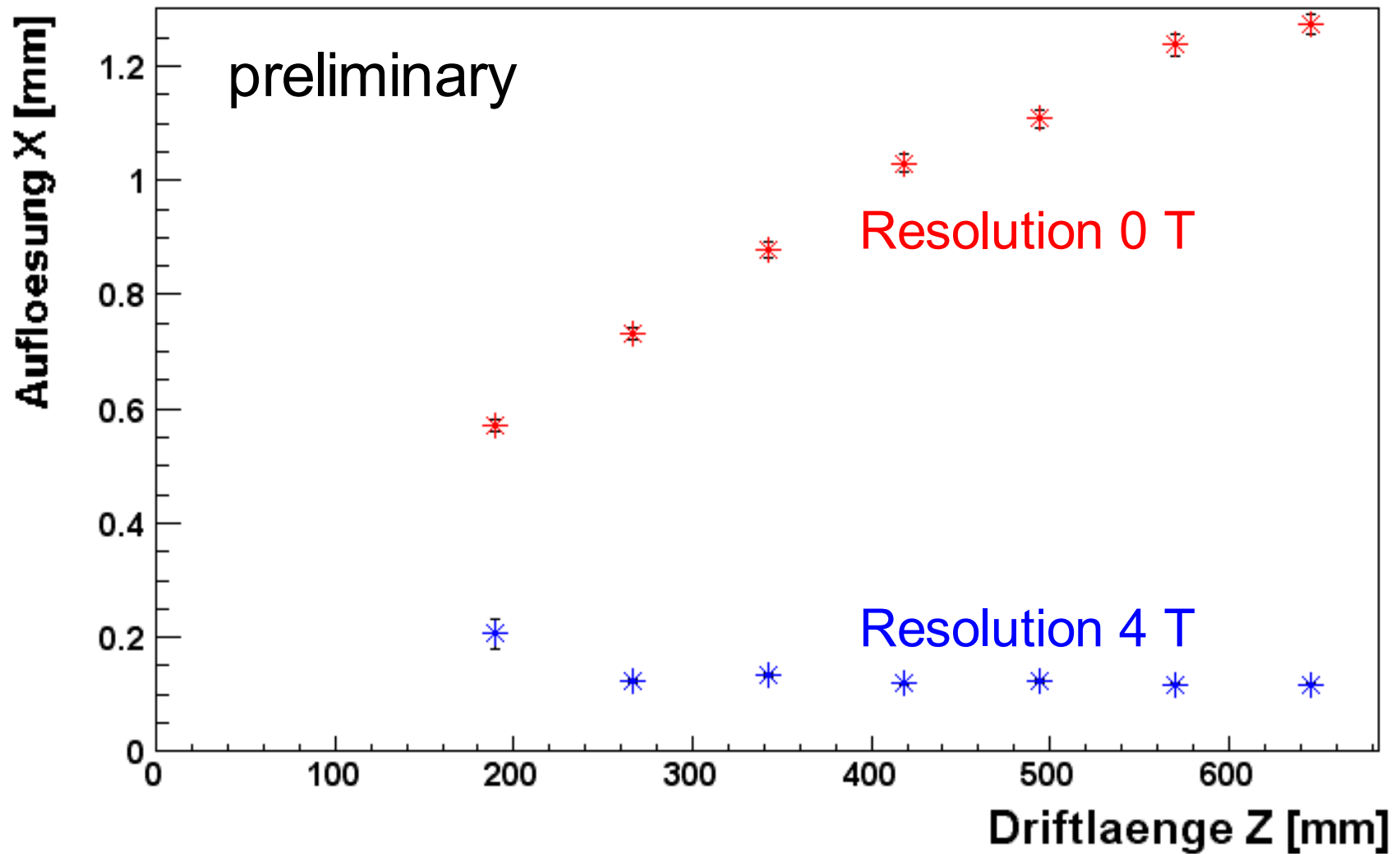


Acceptance

Reduced acceptance for short drift lengths due to limited scintillator length (chimney of magnet)



Resolution



Summary and Outlook

- A nice data set has already been collected
- No severe flaws seen in data
- Unfortunately we lost some time due to GEM accidents. We plan to modify the GEM tower before the next magnet time slot to ensure safer GEM operation.
- Looking forward to additional exciting weeks in the magnet:
 - Measure at 0 T – 5 T in 1 T steps
 - Move chamber to a different position to study effects of magnetic field inhomogeneities
 - Measure with different pad arrangement