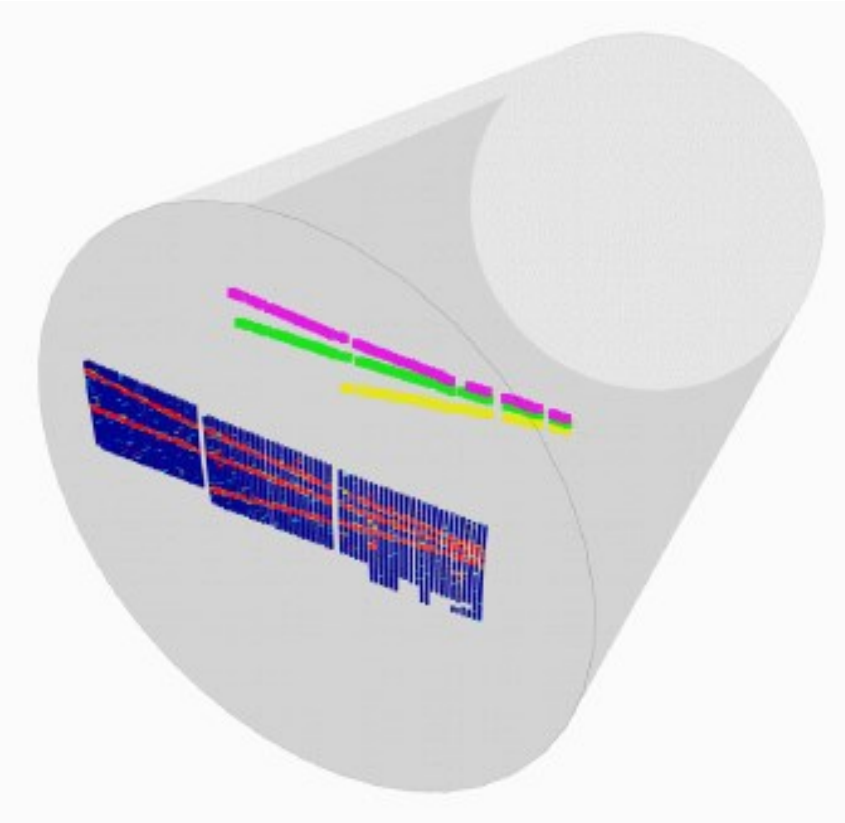


TPC Research

Ties Behnke

Goals of the TPC R&D

- Design a high precision TPC for use at the ILC
- Excellent spatial resolution
  - 50-60 um intrinsic resolution
  - <100um for all drift distances in an ILD TPC
- Excellent double hit resolution
- Good dE/dx capabilities

Ralf Diener (20%)
Oliver Schaefer (10%)
Dimitra Tsionou (100%)

Uli Einhaus
Paul Malek
Oleksiy Fedorchuk

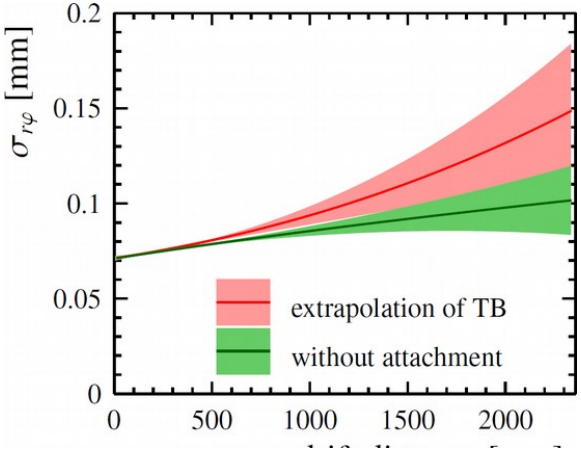
Mengqing Wu
Uwe Kraemer

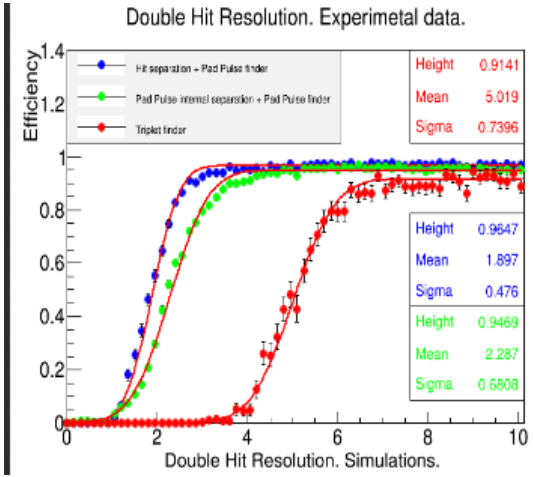
Volker Prahl (20%)
Ole Bach (80%)
Bernd Beyer (75%)

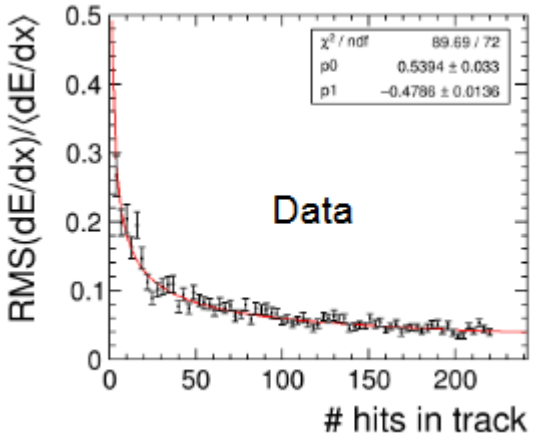
What has been achieved

- Feasibility of GEM TPC has been demonstrated
- Point reoslution (55um) has been demonstrated
- Conceptual design of a compact, light weight module
- Stable operation

- Double hit resolution
- dE/dx resolution

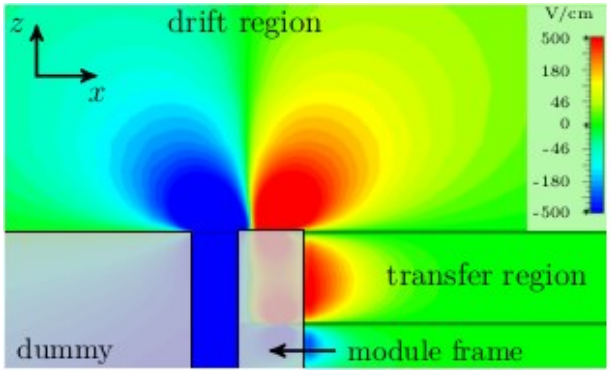


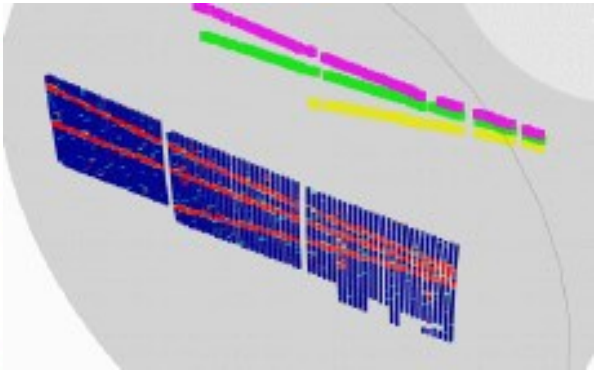


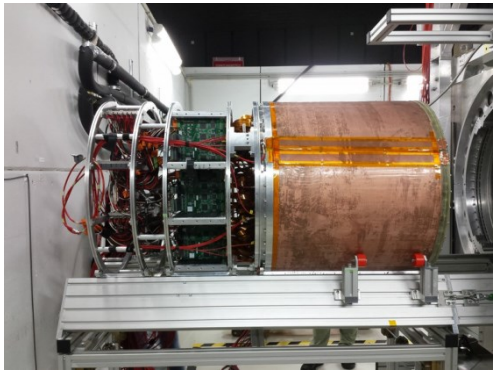


What needs to be shown

- Management of field distortions at a global level
- Overall performance (momentum resolution) including realistic conditions and inhomogeneous fields etc.
- Compactness of readout electronics







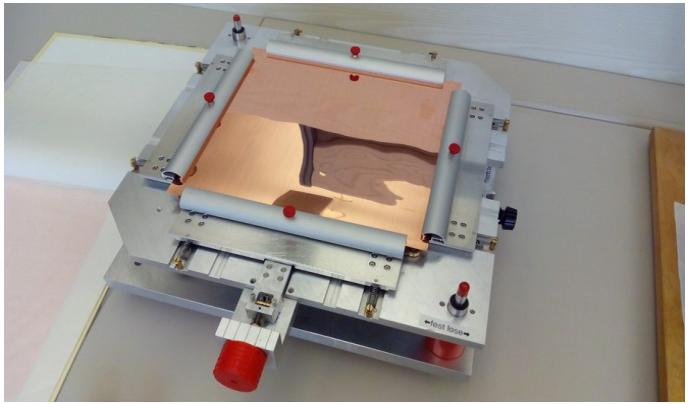
System Demonstration

- Design, built and install an external silicon tracker: needed for ultimate momentum resolution measurements

- Design and build a second generation field cage to higher precision specifications

- Improve further the module design
  - Field shaping and control
  - Gating grid implementation
  - Better quality control and fabrication

- Develop and implement calibration and alignment for ultimate momentum resolution studies.

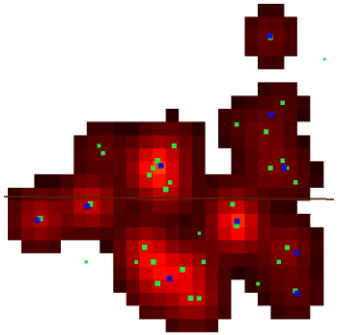


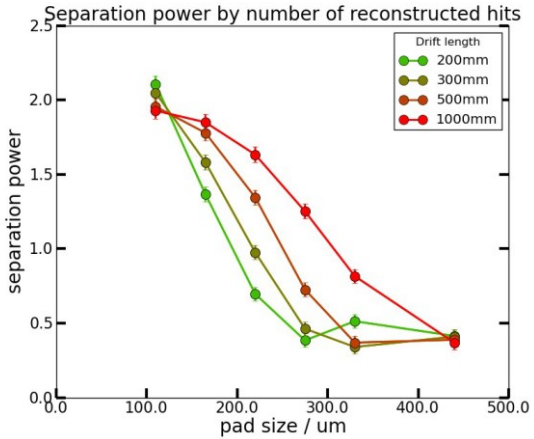
TPC Field Cage

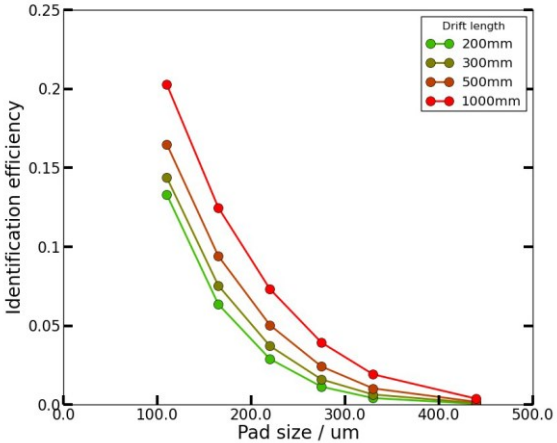
- Material optimzation for light weight construction
- Optimized production method for field cage
- Improved electrical properties, improved cathode and connection details

R&D Developments (DESY)

- Alternative GEM types and materials?
- Highly granular system
  - O(0.5mm) pads with pixel-chip readout
  - Optimization of reconstruction algorithms for highly pixelated readout







Where to go

If ILC comes:

Push for an excellent TPC in ILD, prepare for technology choice
really pick up on large TPC design etc

If ILD does not come soon/ does not come:

Finish the R&D with a final system demonstration (2-3 years from now)

Applications for the TPC outside the ILC

CEPC?
T2K upgrade: interested in our technologies
DUNE? Different technology, might still be interesting
other, smaller experiments? ESS neutron oscillation experiment? Others?