Status and Outlook of the DESY Module

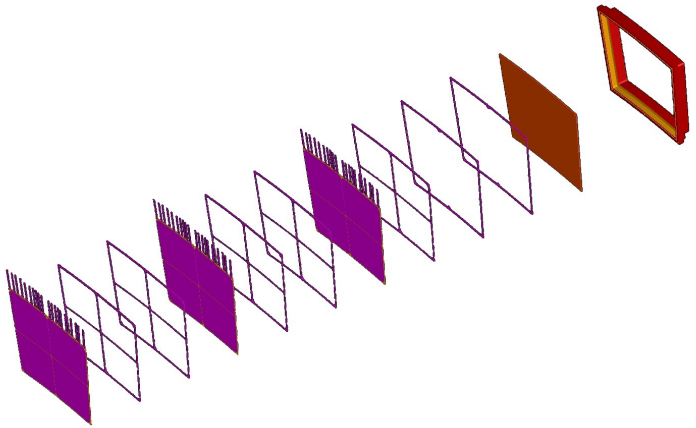
Felix Müller
LCTPC Collaboration Meeting
30.06.2014

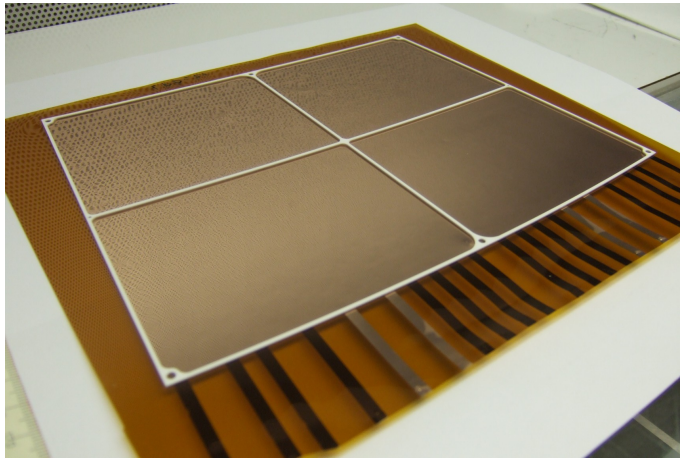
HELMHOLTZ GEMEINSCHAFT

DESY

Current Setup

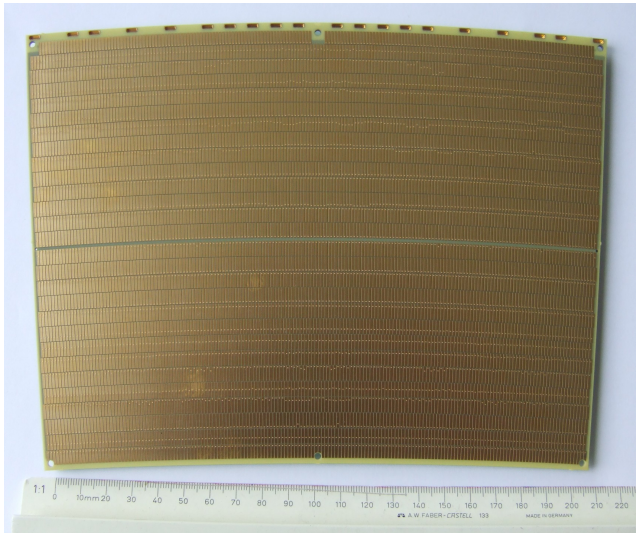
- Triple GridGEM module with an integrated support structure
- Aluminum oxide grid
- Minimal dead space
- Minimal material budget but high stability

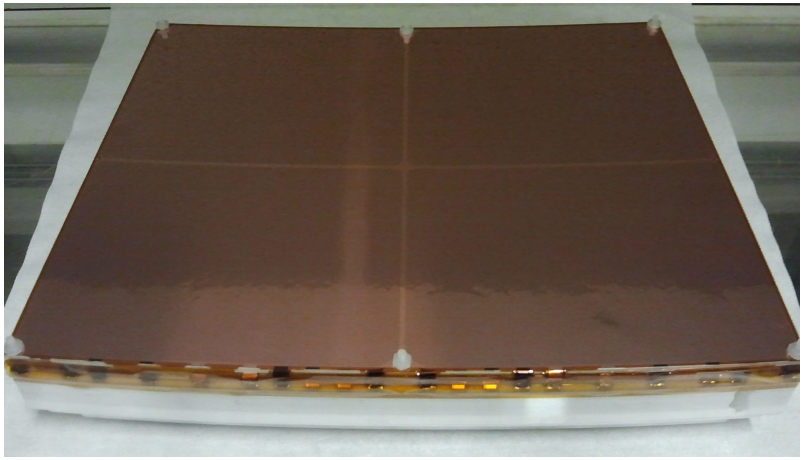


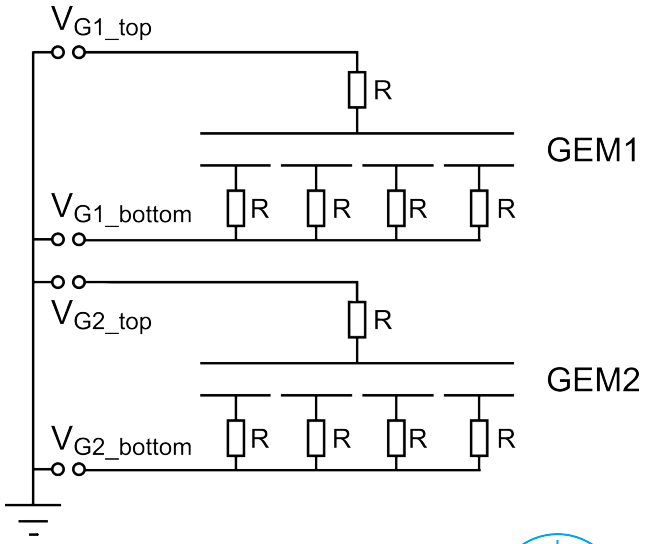


Current Setup

- Bottom of the GEMs divided in four sectors
- Top is not divided to ensure an homogeneous drift field
- Each GEM side is attached to its own channel
- ~4800 pads with a size of 1.25 x 5.85 mm²

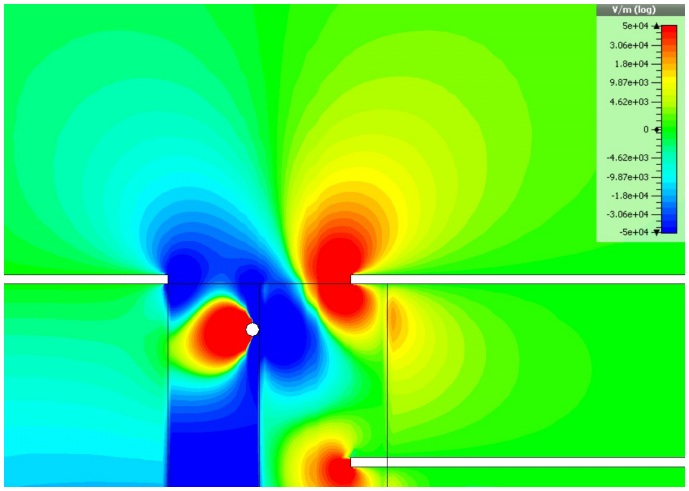


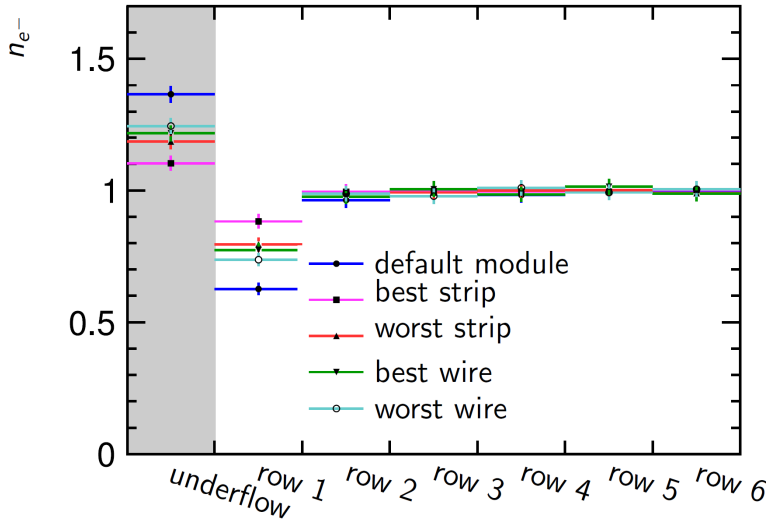


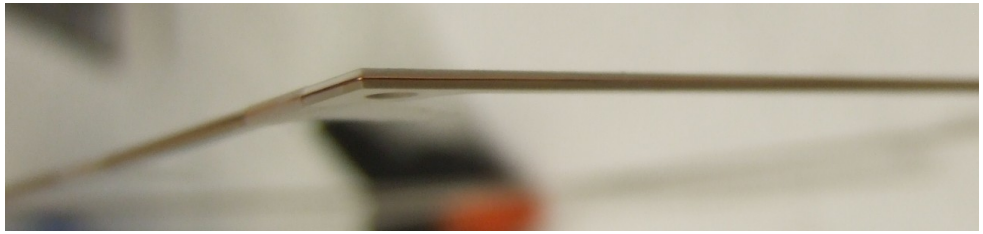


Guard Ring

- Introduce a guard ring to suppress field distortions
- 50 V above the top GEM potential







Performance during Testbeams

- September 2012
  - HV instabilities of the LP
  - Trips of one of the modules causes a chain reaction on the endplate
  - Top most GEM potential went down to ground and a destructive discharge occurred
  - Additional resistors for the termination plates fixed this problem
  - Small gas leakage due to insufficient hollow seam
- March 2013
  - Nearly perfect test beam
  - Gas tight
  - HV stable
  - Lost one sector while trying minimal ion feedback setting at the end (extreme potential settings)

Performance during Laser Test

- November 2013
  - Difficulties reaching the nominal values although it worked well in test box
  - Lost two modules relatively fast
  - Less gain
  - At some point no signal visible anymore after 5 cm drift (leaks and wrong gas excluded!?)

Performance Evaluation

- Good resolution (comparable to best runs of other modules)
  - On many rows
- Field distortions
  - The guard ring increased the charge detection at the border of the module
  - Distortions still visible, but comparable with other modules
  - Difficult to simulate due to the many HV connections and gap sizes
- High voltage
  - Different performances during the tests
  - Lost 3 sectors in 2 test runs
  - If a sector breaks, the whole module is lost due to the current HV distribution scheme (ok for final modules but not really good for prototypes)

Future Working Plan

- Reliability
  - Long term stability measurement: run module in a testbox with a source for a long time (readout necessary) (2014)
  - HV stability
  - Robustness against discharges
- Optimize HV distribution system
  - Better connection to the GEMs
  - Easy compensation of loosing one sector
- Mechanical integration of the module:
  - endplate mounting, calibration, stability, thermal management
- dE/dx performance
  - Optimization of the mechanical support structure for flatness
  - GEM flatness measurements: setup is prepared but modules must be unmounted during the procedure
  - Measure gain distribution: prepare ALTRO readout in our lab

DESY

Possible Next Module Features

- New GEMs
  - Different GEM layouts for the different stages would simplify HV stability
  - Only gaps along phi (no pointing gaps)
- New grid production techniques
  - 3D printing?
  - Automatized and reproducible guard ring attachment
- Gating structure
  - Inside the drift region or at the termination plane?
  - Field cage on the module comparable to AsianGEM necessary?
  - How does this influence the field distortions?
- SALTRO readout
  - Time schedule?
  - Common padplane