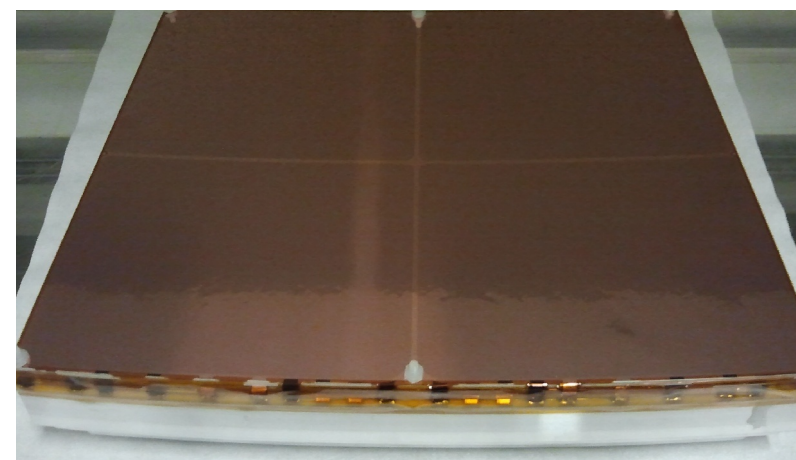
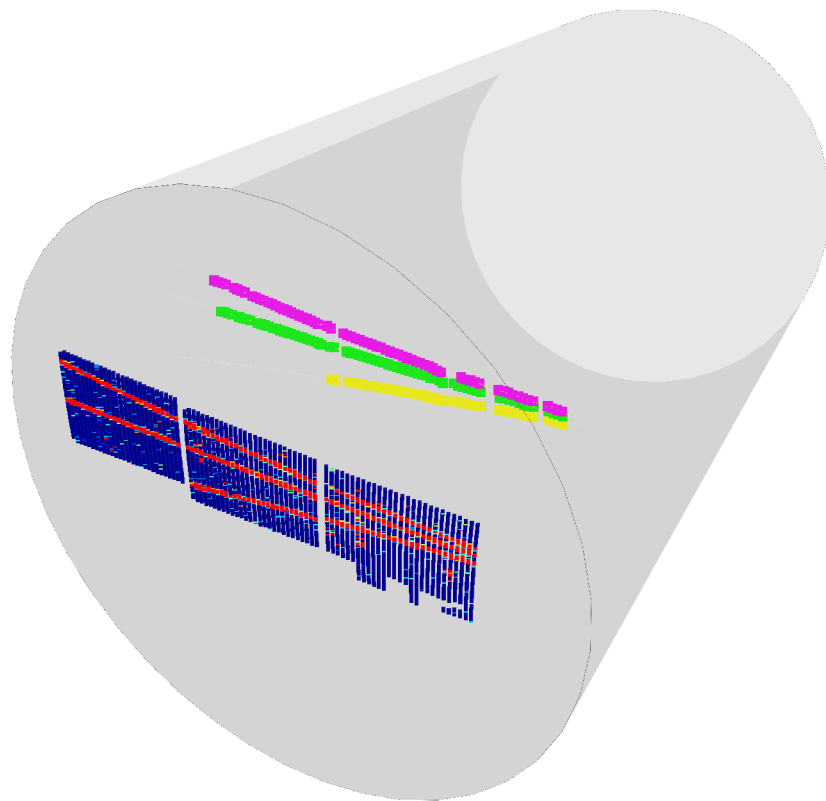
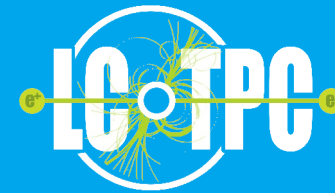


DESY GridGEM Module



Ralf Diener
LCTPC Collaboration Meeting 2016

➤ Goals:

- Minimal material budget
- Maximal sensitive area
- Minimal gaps

➤ Integrated, self supporting GEM/ceramics structure

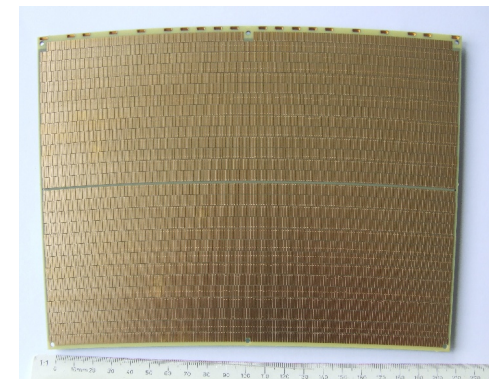
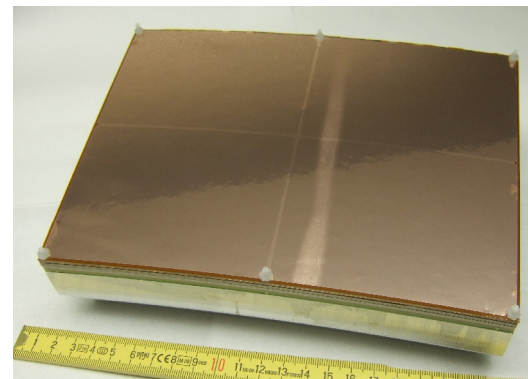
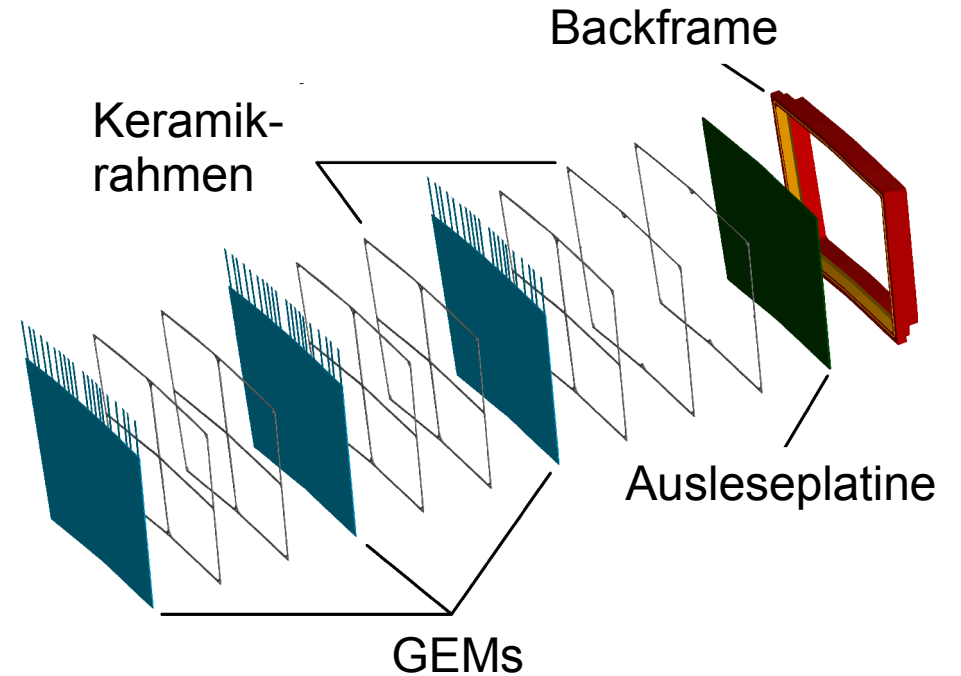
- Stack of 3 GEMs on thin ceramic frames

➤ Size, shape as planned for ILD TPC endplate

- Area $\sim 17 \times 23 \text{ cm}^2$

➤ Padplane

- 28 rows
- Pad size: $1,26 \times 5,85 \text{ mm}^2$

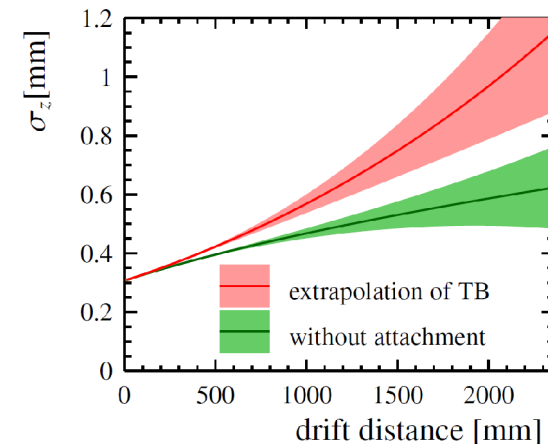
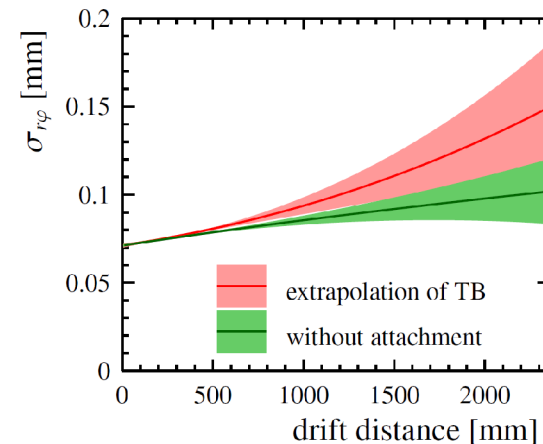
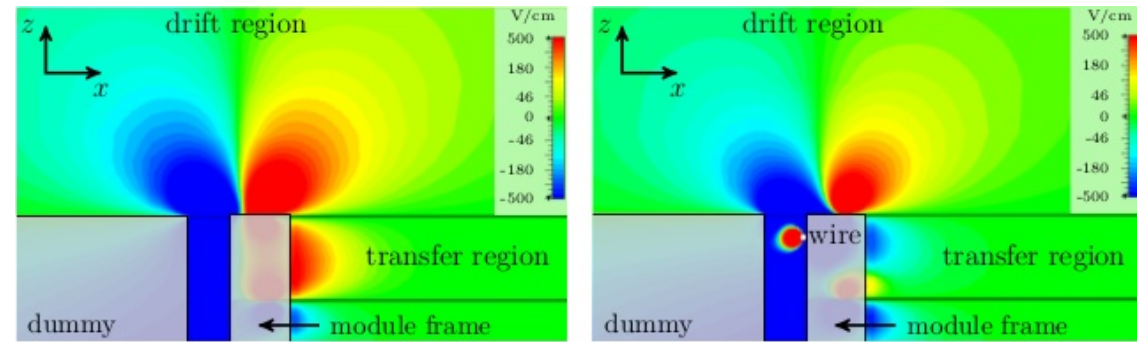


- Last module iteration worked well during testbeam effort in 2013
 - HV stable during testbeam
 - Guard ring reduced field distortions significantly
 - Alignment procedure established
 - Excellent hit efficiency > 99.5%
 - Point resolution requirements in z and r_{φ} reached

- R&D and goals for new iteration

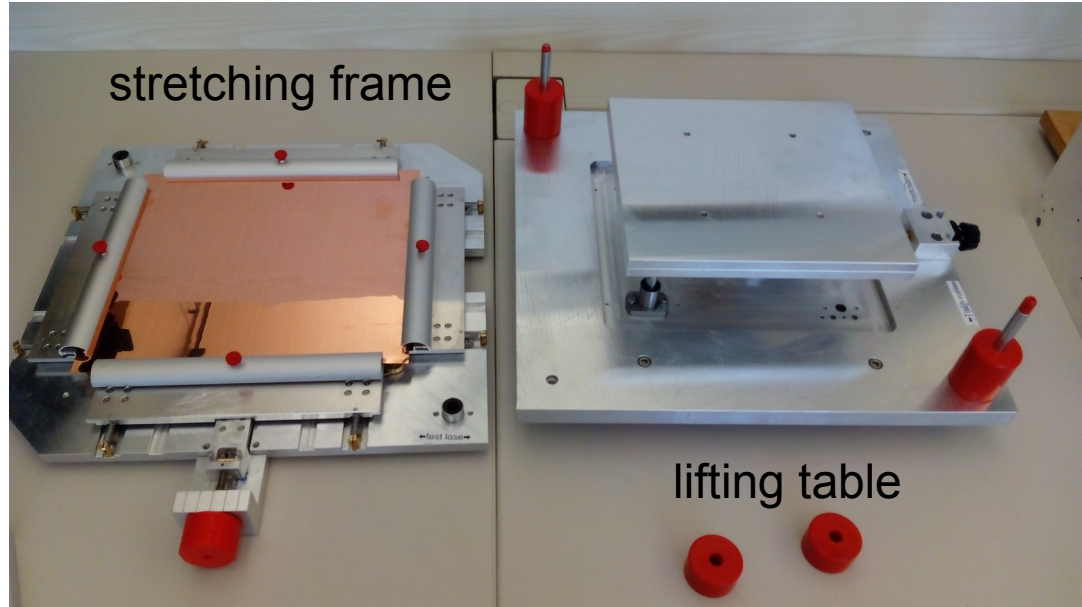
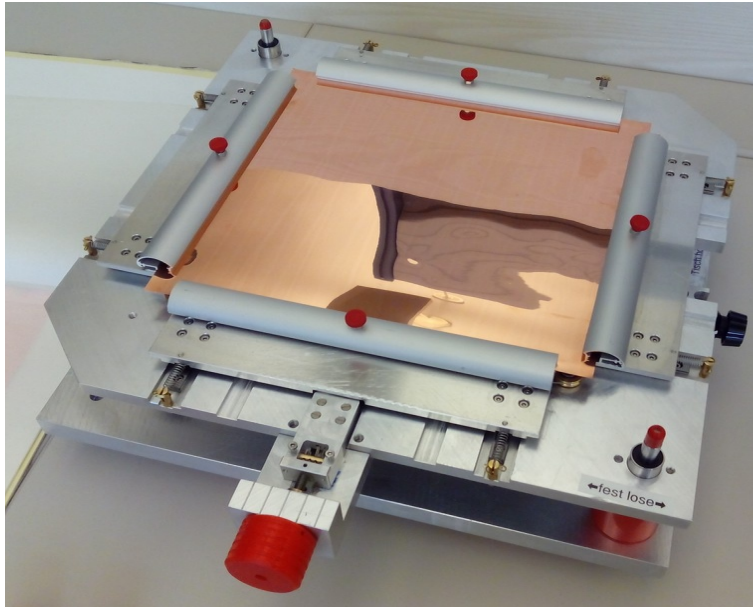
- Improved, reproducible production techniques
- Controlled, improved GEM flatness
- Optimized guard ring
- Revised mechanics and drawings
- Long term HV stability → see Oleksiy's presentation

- Long term: include gating GEM (design prepared to do so)



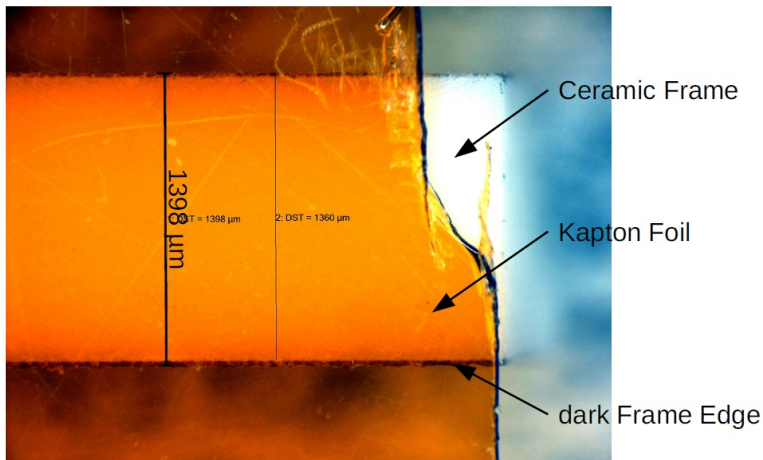
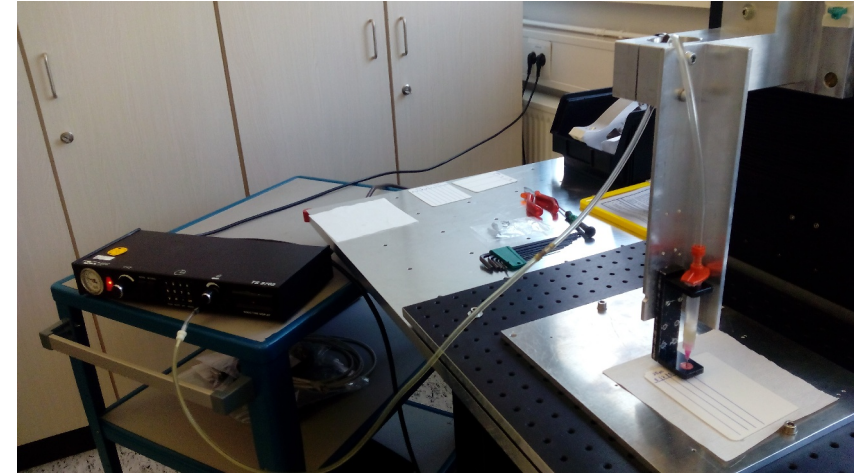
➤ GEM mounting in ceramic frames

- Before done by manual stretching on aluminum form and fixing by tape
- New, flatter aluminum form for flatness measurements produced
- New GEM mounting tool for controlled, reproducible construction

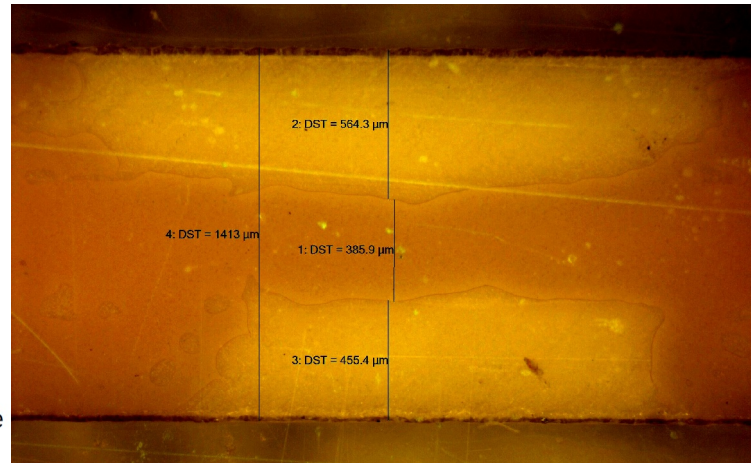


- Low force stretching of GEM foils during mounting, controlled merging of GEM and frame for gluing

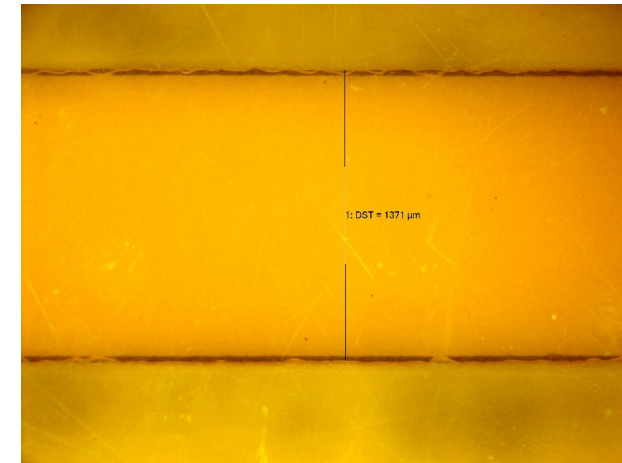
- Repeated/extended previous gluing tests
 - Different glues, table speeds and syringe pressures
 - Result: Stycast 1266, 10mm/s speed, 10psi



Schematics without glue

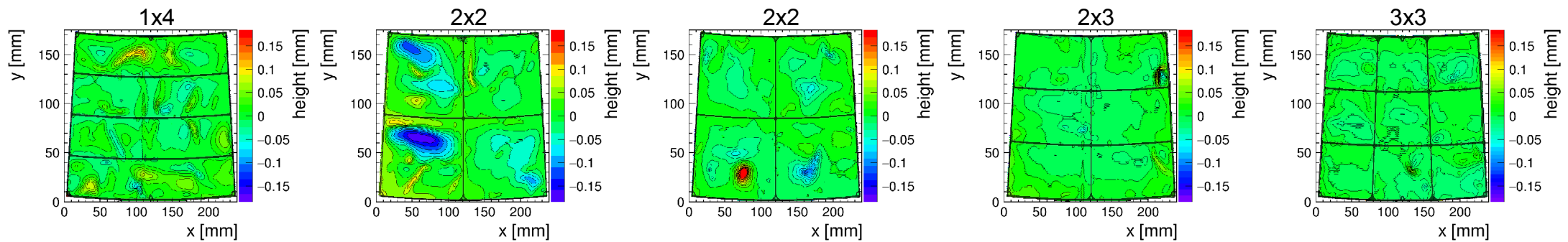
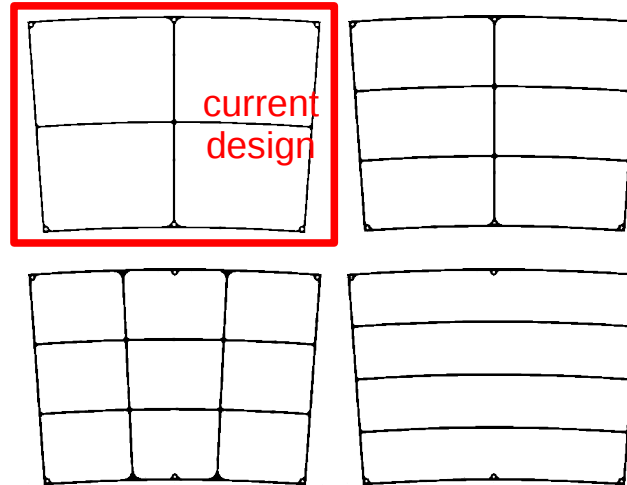


Example showing result using too high speed

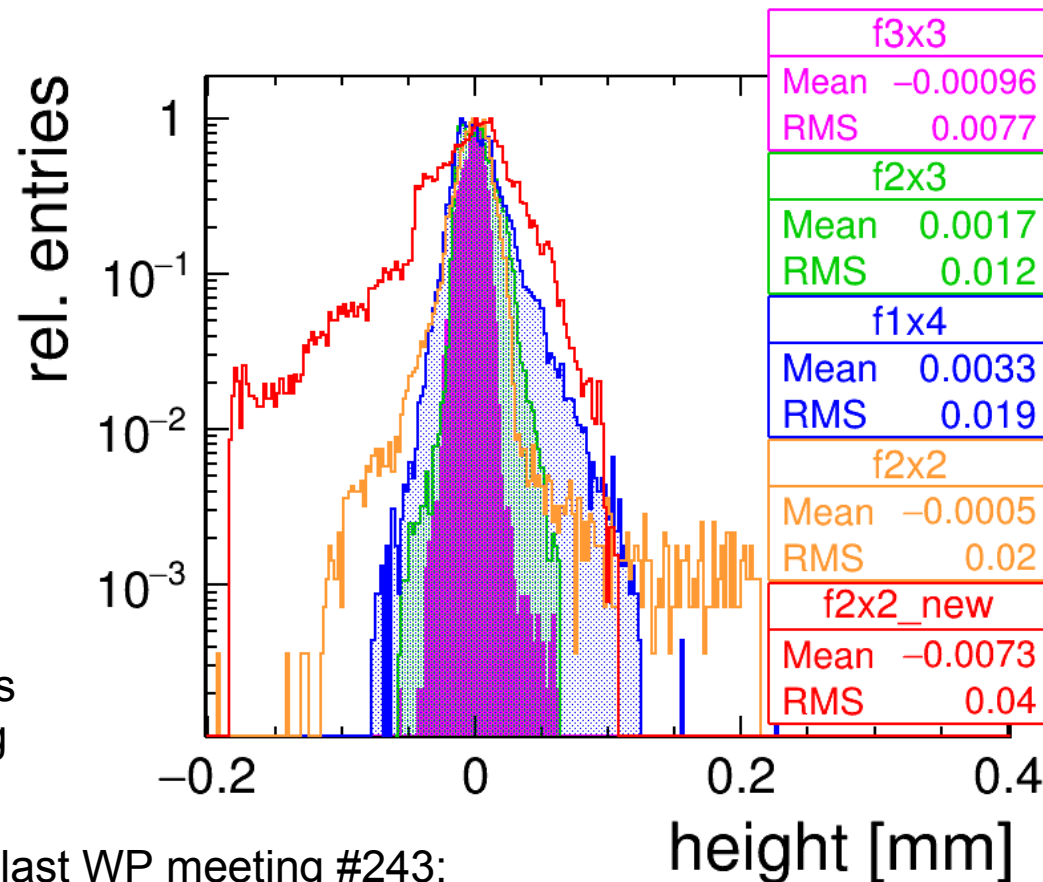


Final settings

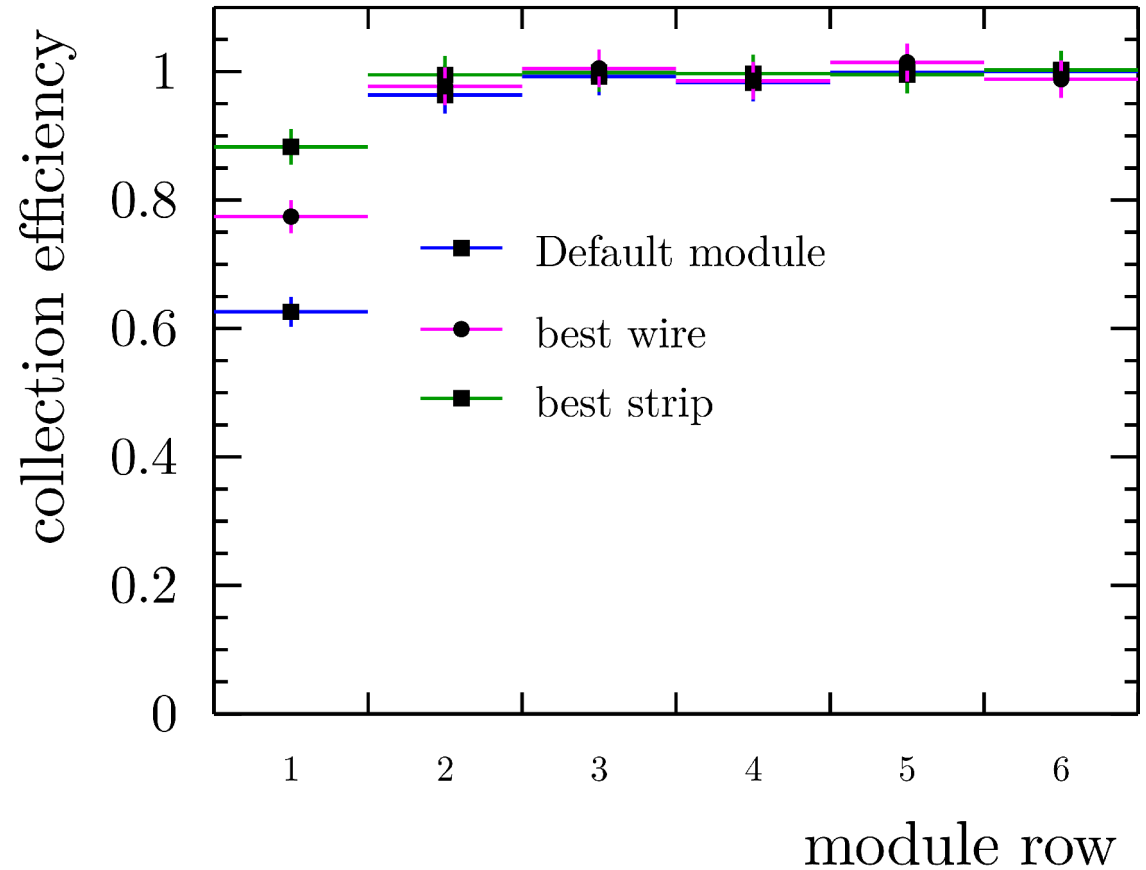
- Study of four different frame geometries regarding GEM flatness using aluminium frames



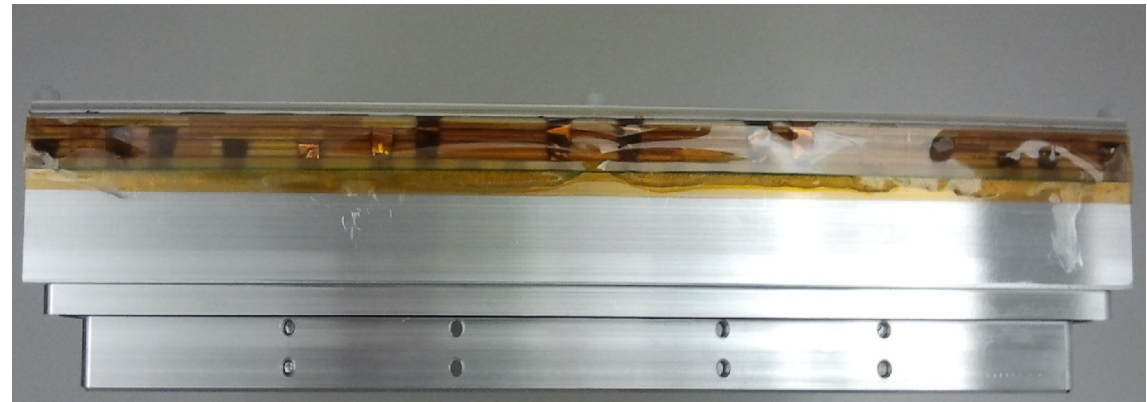
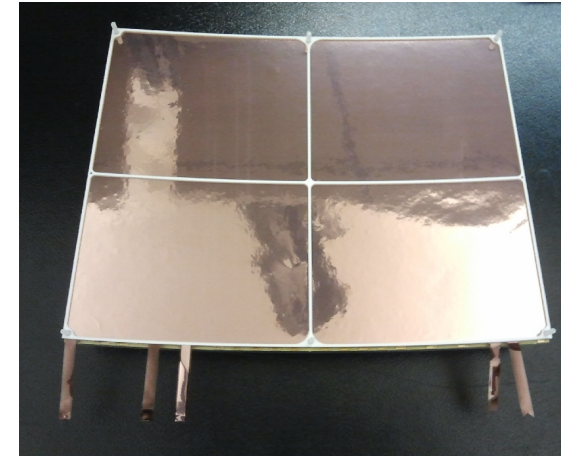
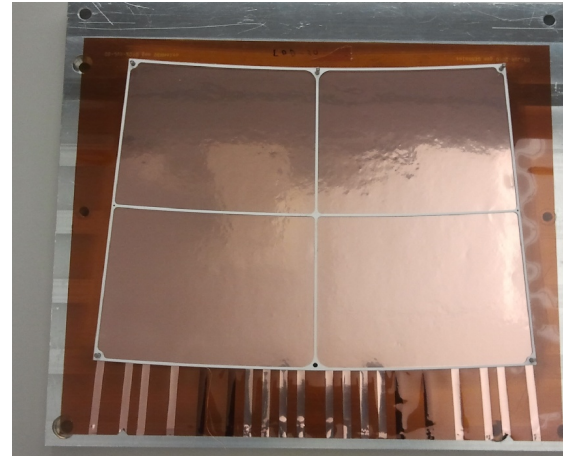
- Variation for same geometry can be bigger than between different geometries
 - e.g. 2x2 **old** and **new**
- No clear preference for one frame geometry
- Gathering more statistics by repeating takes too long for the current test beam preparations
→
Established 2x2 design will be used for this module iteration
- More intense tests planned on flattening GEM foils by overstressing with large force before mounting
- More on flatness studies in Paul's presentation in last WP meeting #243:
<http://agenda.linearcollider.org/event/7083/>
- Remark: study of impact of gaps on ILD TPC performance would be interesting as input to decide future frame designs



- New ceramics supplier
- Plates and cutting from same company
- Guaranteed flatness: 0.3%
- Possibility to produce guard ring as a strip directly onto a frame
- Frame design ready, ordering in progress

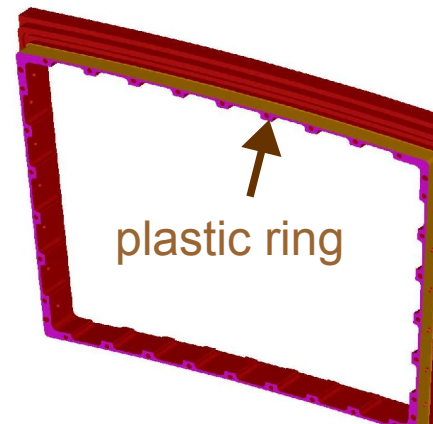
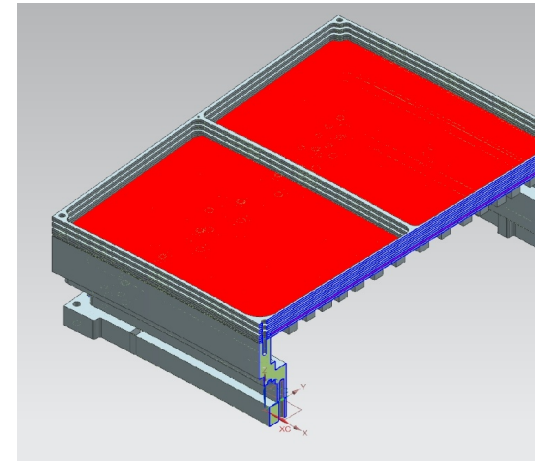
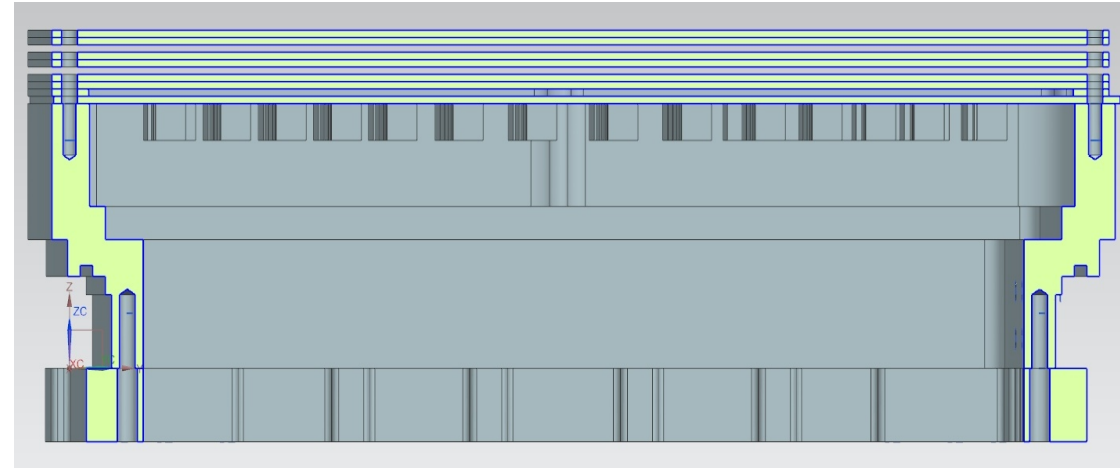
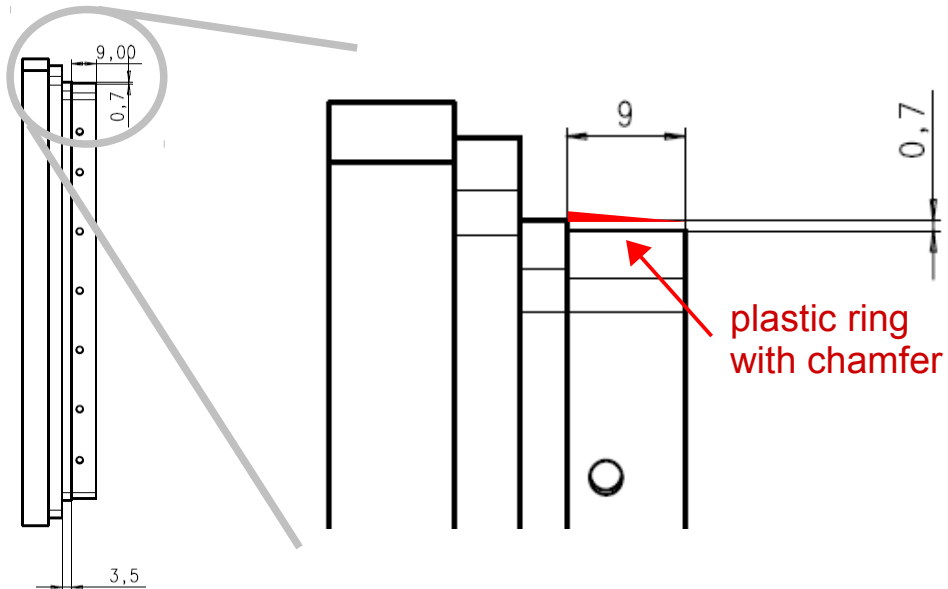


- Adjusted GEM foil design
 - Before, all 3 foils with the same layout
- Now HV supply lines separately for each foil
 - Avoids sharp edges from cutted HV lines
 - Saves some insulation by Kapton tape
- Fixed mismatch in frame/foil drawings: perforation did go under the ceramic frame → adjusted according to gluing tests
- Topmost GEM: more area coverage of the copper coating
- Design to be finished this week



- Adjusted and reviewed design/drawings of all components (backframe, pad plane, frames, GEMs)
 - Detected small offsets of different parts in previous drawings which have been corrected

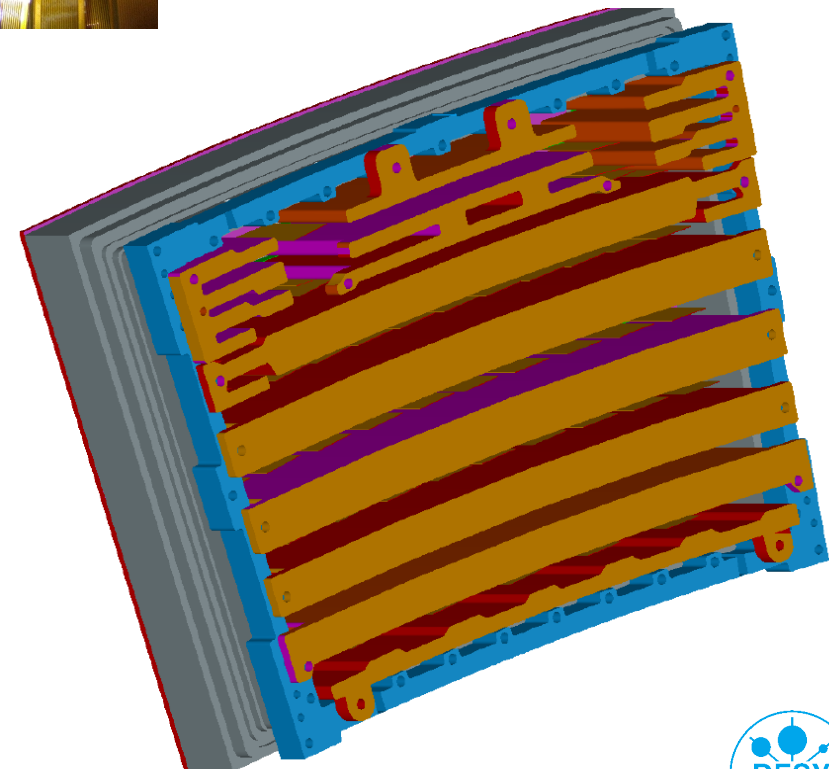
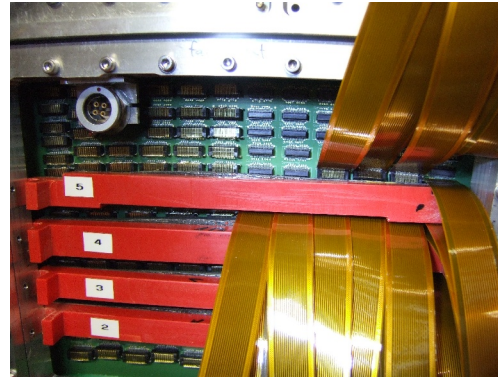
- Introduced plastic ring at backframe for easier insertion into endplate without aluminum abrasion



- ALTRO plug holding clamps
 - Old design did not perfectly fit
 - Did not hold plugs reliably in place
→ loss of readout channels
 - Applied pressure to pad plane
→ spoiled gas tightness at glueing
between pad board and backframe

- New design ready
 - Fastened by same screws as mounting bracket
 - Made with rapid prototyping printer (lightweight)
 - Nearly zero force on the pad board
 - Next step: tests with samples

- Pad board adjustment to be able to include HV protection (see Oleksiy's presentation)
 - Board design ready
 - Ordering in progress



- Testbeam measurements planned for Sep. 12th to October 3rd this year
 - Tight schedule due to delivery times and testing

- Measurement Plan (not only testbeam):
 - Standard LCTPC test beam agenda +
 - more beam momentum scans: at different drift positions and magnetic fields
 - more angle scans: at different drift positions (>2)
 - larger angle coverage in angle scans
 - Double hit/track studies (with target)?
 - Distortions studies using laser?
 - dE/dx (calibration with pulsing GEMs and/or source)?
 - Long term HV stability tests

- New GridGEM module under development including improvements based on experience with the previous iteration
- Designs and construction techniques are being / have been improved
- Improved GEM flatness and distortion control
 - Long term HV stability not covered here
- Time is tight, but we are still on schedule for our testbeam in September