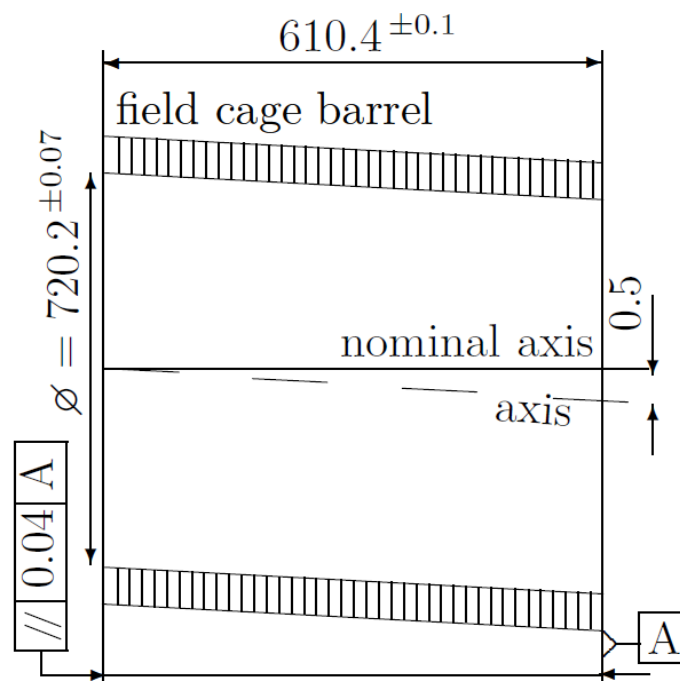


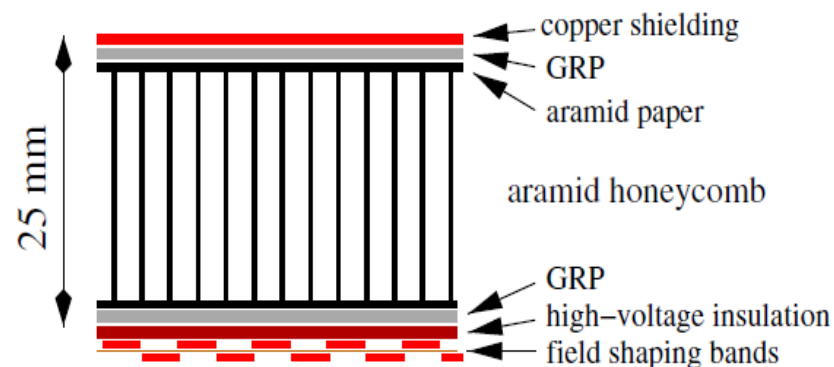
# Large TPC Prototype Field Cage

LCTPC Collaboration Meeting – 01.07.2014  
R. Diener, Ole Bach, Bernd Beyer, Volker Prah

- Second version of LP field cage in progress
- This time build in-house
  - To reach needed precision
  - To gain experience (also aimed towards ILD TPC)
- Design changed only marginally



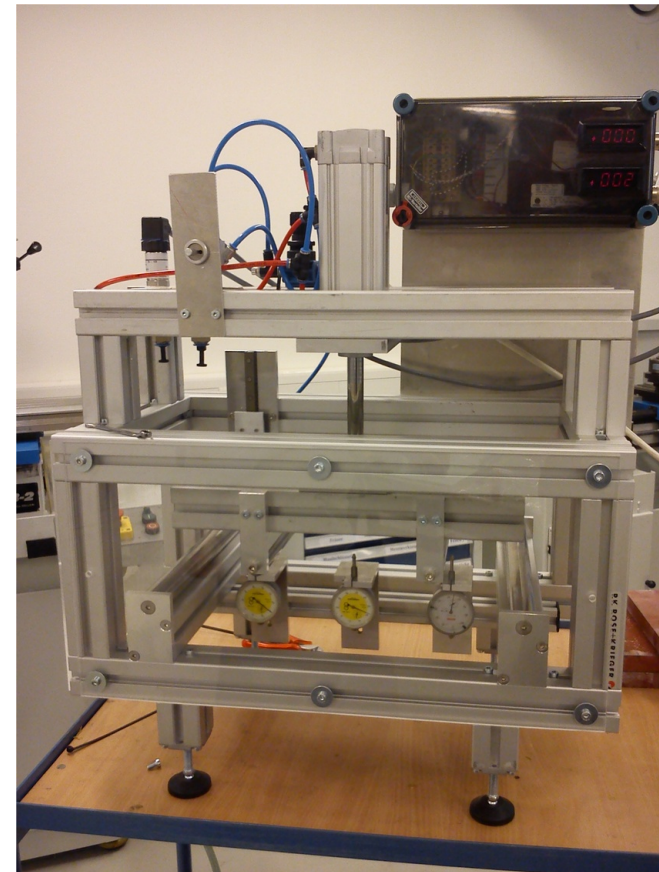
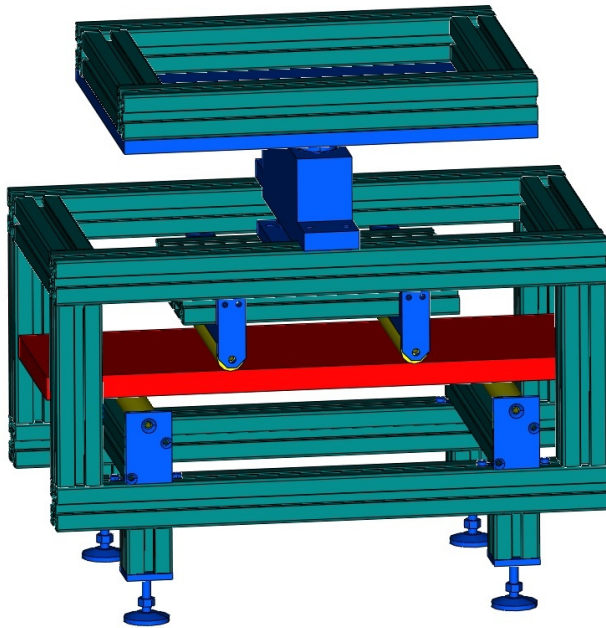
- Several wall sample pieces:
  - Honeycomb/GRP and honeycomb/Nomex paper
  - Different epoxy glues and thicknesses
  - Vacuum box:



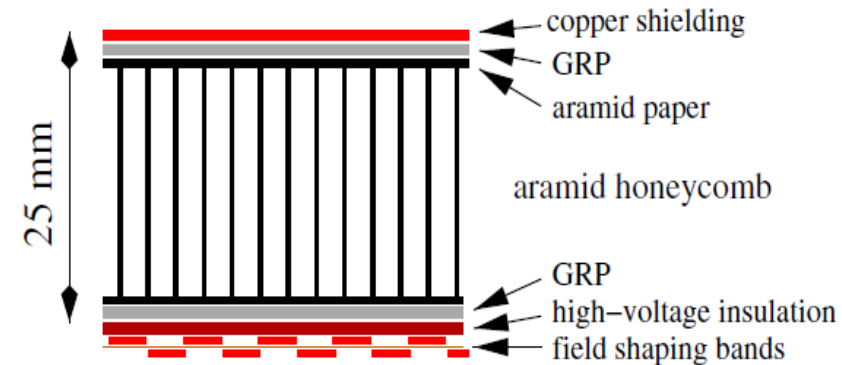
Glue	Viscosity [mPa*s]	Hardener	Viscosity [mPa*s]
Spabond 125	2600000	Standard	
Ay 130-1	20.0-35.0	Hy 991	20.0-60.0
Aw106	30.0-50.0	Hy 953	1.9-2.2
Epoxid L	700	Hardener L	320

- Tests of sample pieces
  - Optical inspection of gluing (hollow seams)
  - Layer tear off strength, bending stability
  - HV tests

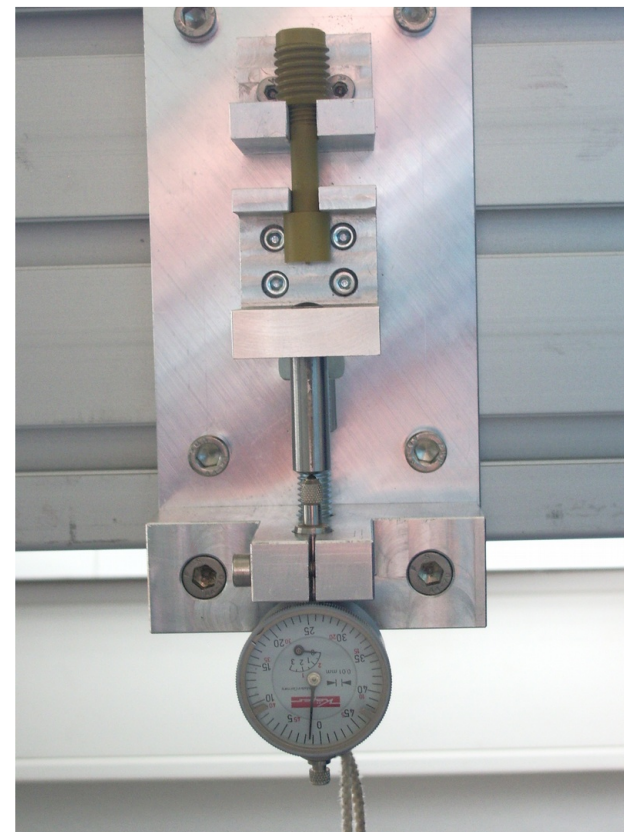
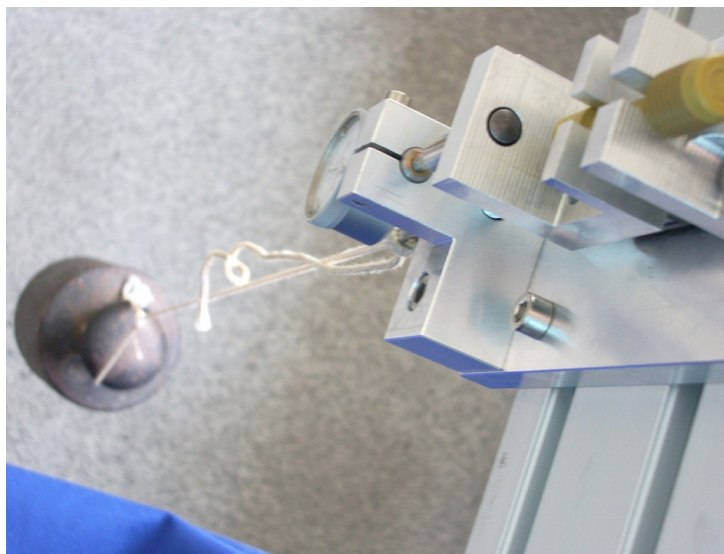
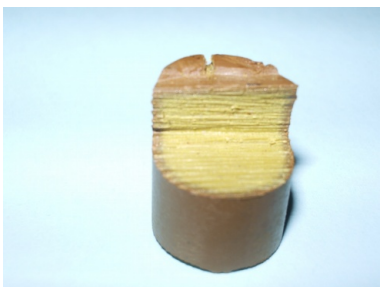
- To test mechanical strength of sample pieces a bending tool has been built
- Force is applied by air pressure pump via two rolls onto the piece under test
- Bending measured by micrometer meters



- For LP - Goal: 1%  $X_0$  per wall,  
current:  $\sim 1.25\% X_0$   
*(or more?: honeycomb not only Nomex  
but covered with phenolic resin, estimation  
of glue thicknesses optimistic)*
- Possible improvement:  
replace GRP by Nomex paper
  - GRP:  $X_0 = \sim 13-15 \text{ cm} \rightarrow 0.4\% X_0$  (for 600 $\mu\text{m}$  layer)
  - Nomex:  $X_0 = \sim 30 \text{ cm} \rightarrow 0.1\% X_0$  (for 300 $\mu\text{m}$  layer)
  - Mechanical Stability?
- Minimal glue to minimize radiation length  
*(epoxy  $X_0 \sim 30-40\text{cm} \rightarrow \sim 0.03\% X_0 / 0.1\text{mm}$ )*



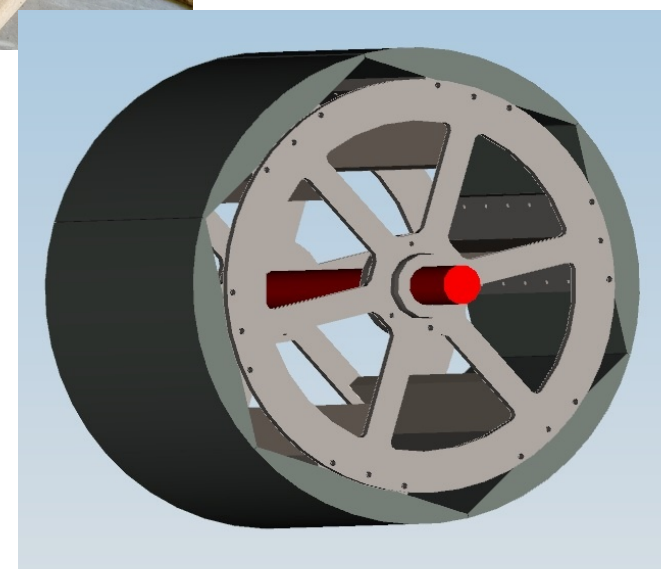
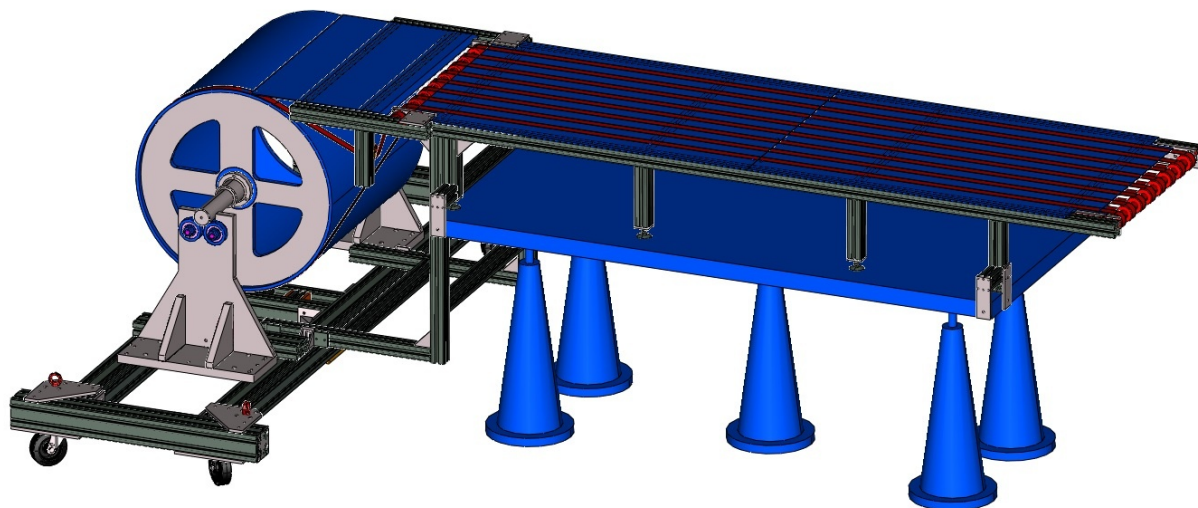
- Replace steel inserts and screws in field cage end flange by Torlon
- Save radiation length:
  - Stainless steel:  $X_0 = 1-2$  cm
  - Torlon (4301):  $X_0 = 28-29$  cm
- Strength tests ongoing
- Outgassing?  
(not too important since outside gas volume)



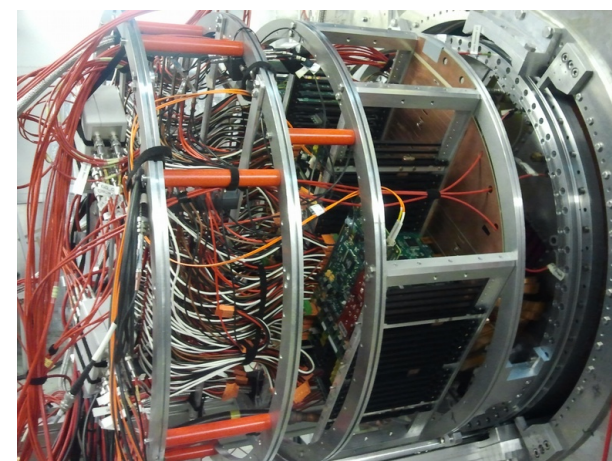
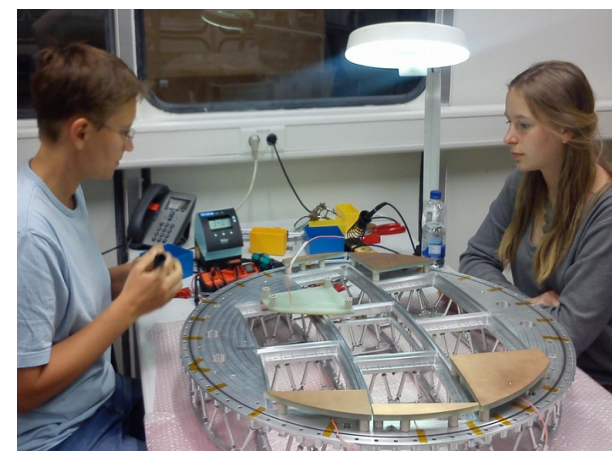
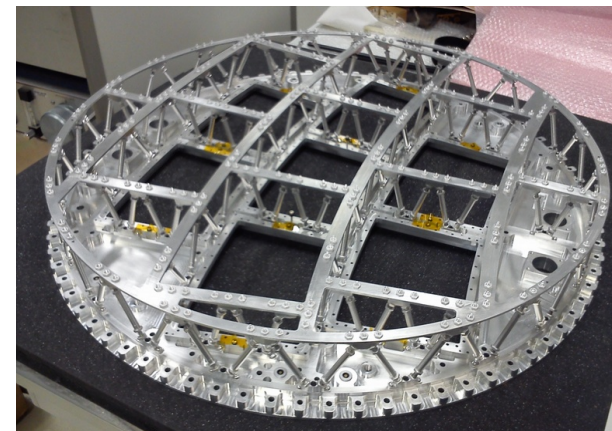
- Old mandrel not reusable
- New one needs to be designed
- Design not yet finally decided



- Planning for production tools, i.e. gluing station



- Current LP1 endplate
  - Delivers precision but not material budget: 16.9%  $X_0$  (~2x too large, goal: 8%)
- New LP1.5 space-frame design
  - 7.5%  $X_0$  material budget
  - Same stability
- Has been measured in survey department
- Equipping with termination plates including HV connectors and plugs done (10M $\Omega$  resistors included)
- Missing: gas connectors and HV connectors for 1st/7th strip
- A new holding ring has to be build: current one too wide for new design





- First real use in February testbeam
- In general: positive reactions
- Few things to improve:
  - Horizontal movement range
  - Stability of boom (bending by module weight)
  - Adjustment to space-frame endplate  
*(so far seems possible without too many modifications)*
  - Debris?

