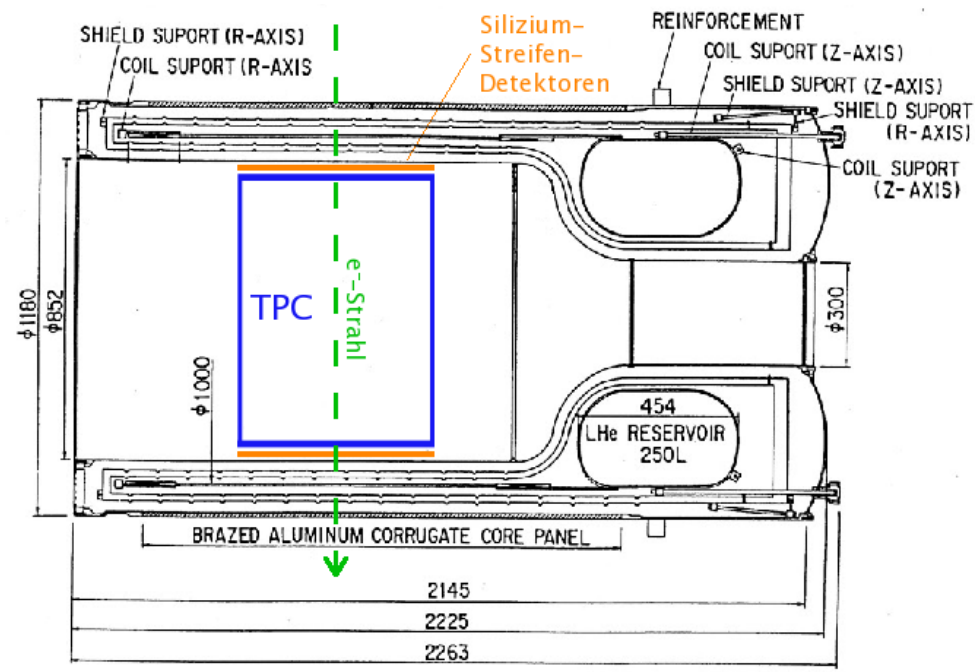
The field cage for the Large TPC-Prototype

DESY FLC TPC Group

Ties Behnke, Klaus Dehmelt, Ralf Diener, Lea Hallermann, Peter Schade

EUDET Setup



BALLOON-BORNE EXPERIMENT WITH A SUPERCONDUCTION MAGNET SPECTROMETER, Akira Yamamoto, KEK, 01.12.94

- infrastructure for TPC R&D, available for many researcher groups
  - ↪ PCMAG was installed in the e^- test beam in December 2006
  - ↪ Large TPC-Prototype: $60\,\mathrm{cm}$ long drift volume, $72\,\mathrm{cm}$ inner diameter

Requirements

- operation in the e^- test beam $\rightarrow$ walls need to be as thin as possible (less than $2\,\%$ of a radiation length)
- homogeneity of the electric field $\Delta E/E < 10^{-4}$

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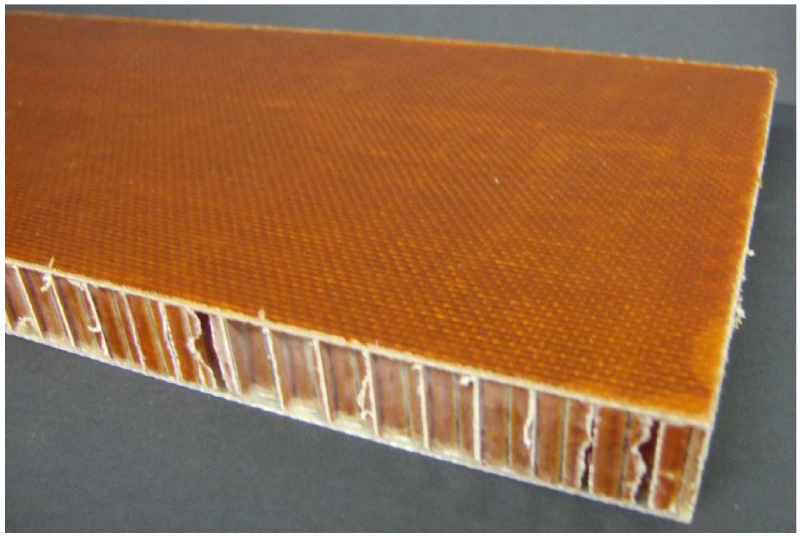

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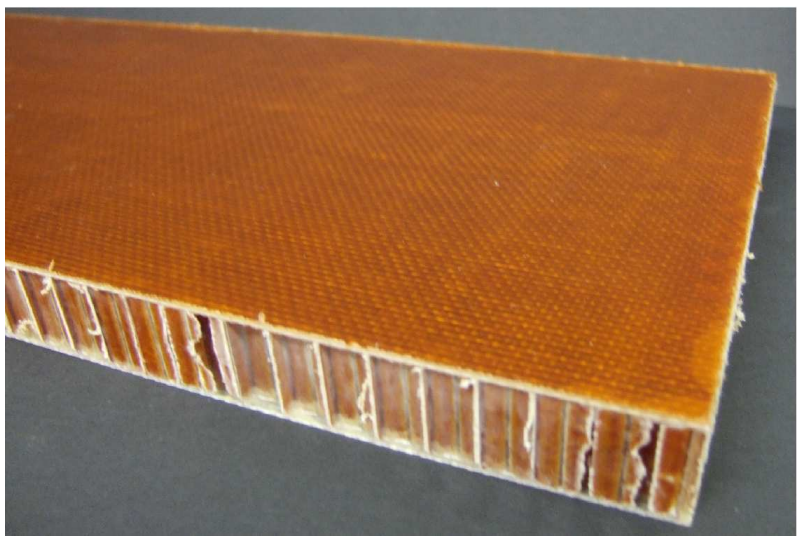
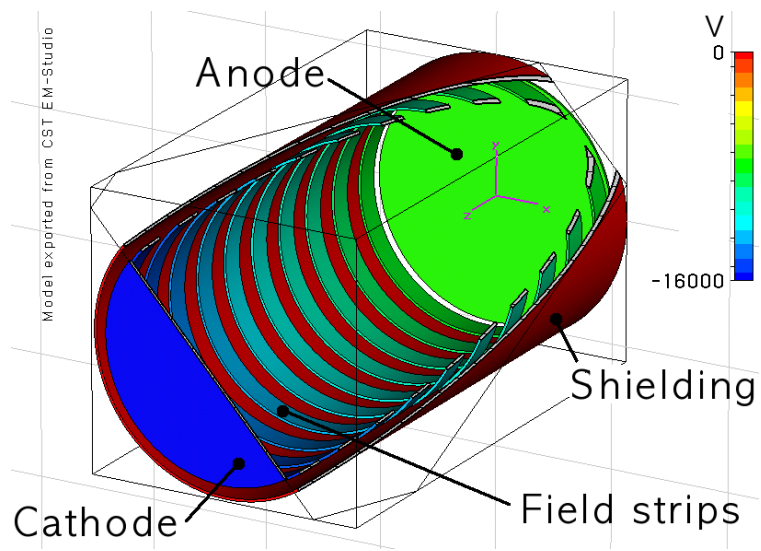


$\longrightarrow$ electrostatic calculations



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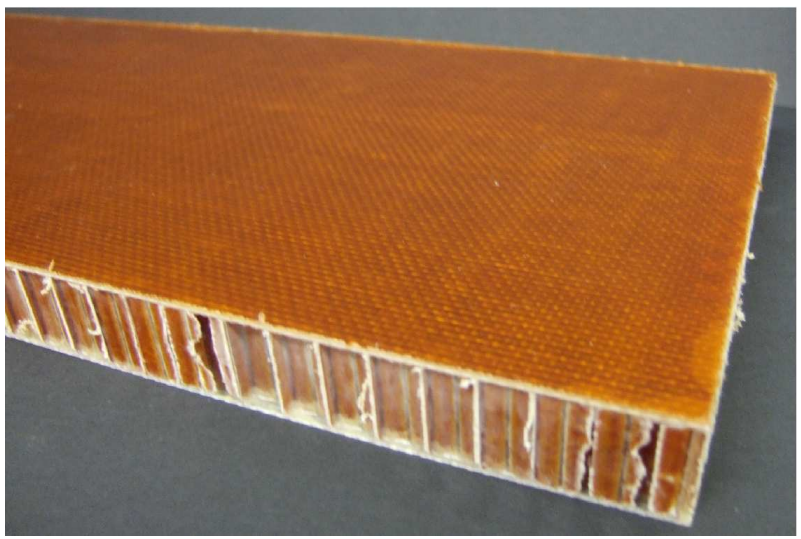

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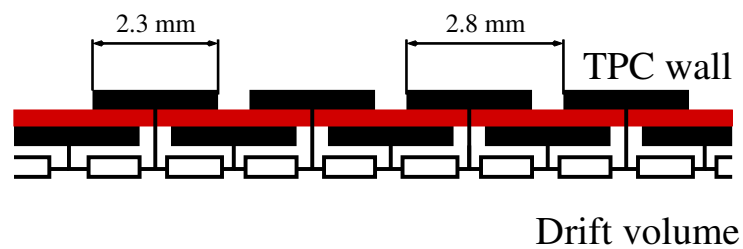
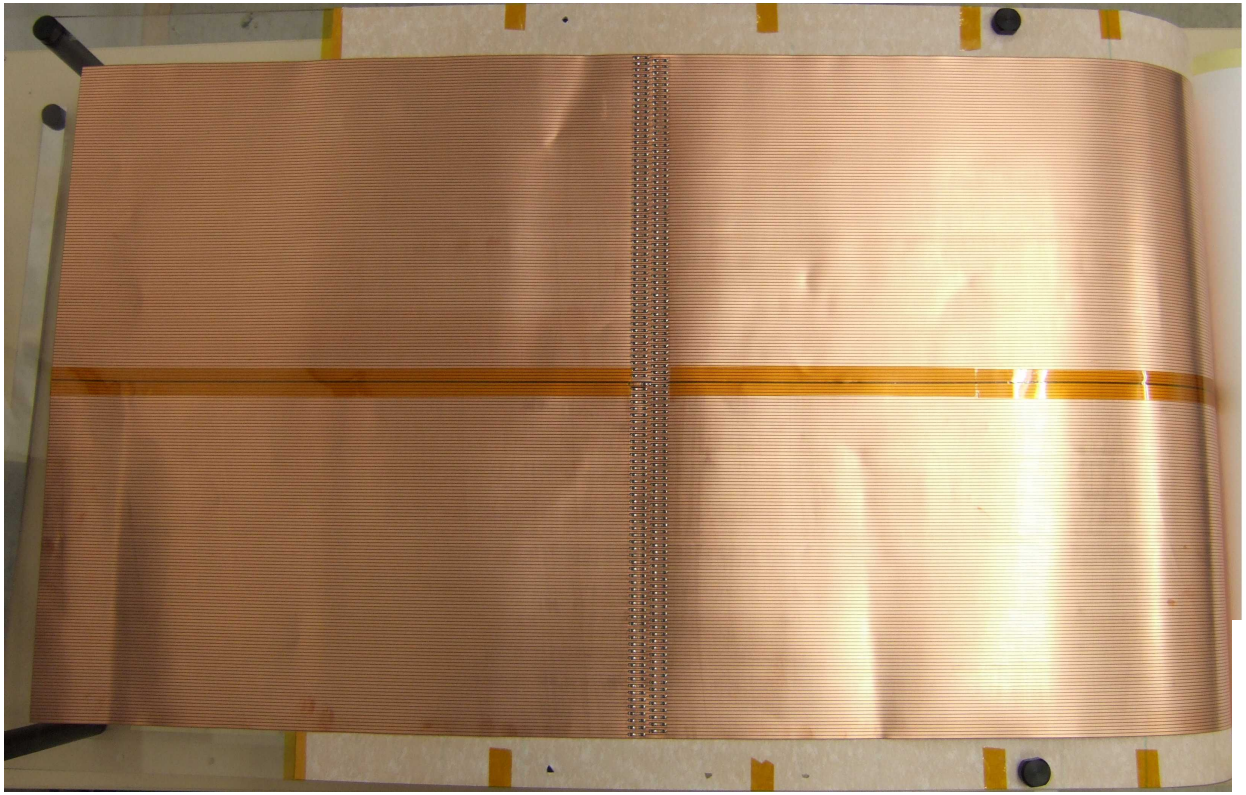
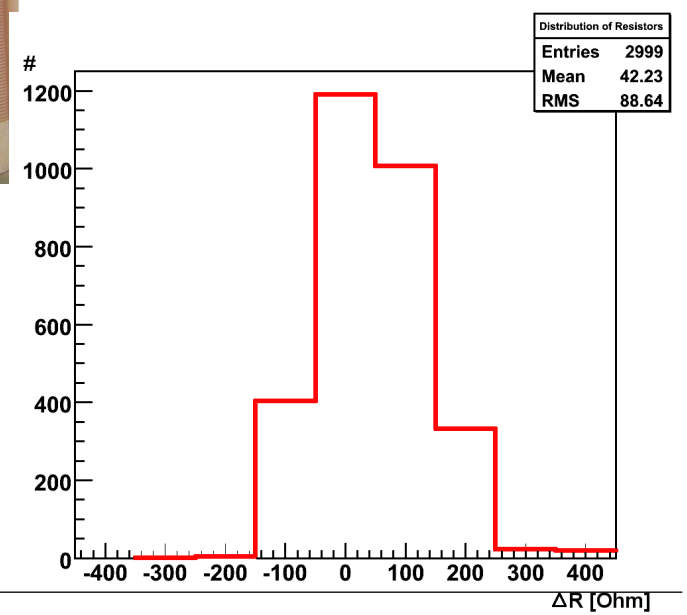


- field- and mirror-strips as inner layer
- parallelism of anode and cathode at $100\,\mu\mathrm{m}$ level

Field strip foil





- flexible circuit board $60\,\mathrm{cm} \times 230\,\mathrm{cm}$
  ↪ combined from two $30\,\mathrm{cm}$ wide pieces
- SMD-resistors: $1\,\mathrm{M}\Omega \pm 0.05\,\%$ sorted
  ↪ foil equipped with $1\,\mathrm{M}\Omega \pm 0.02\,\%$ resistors

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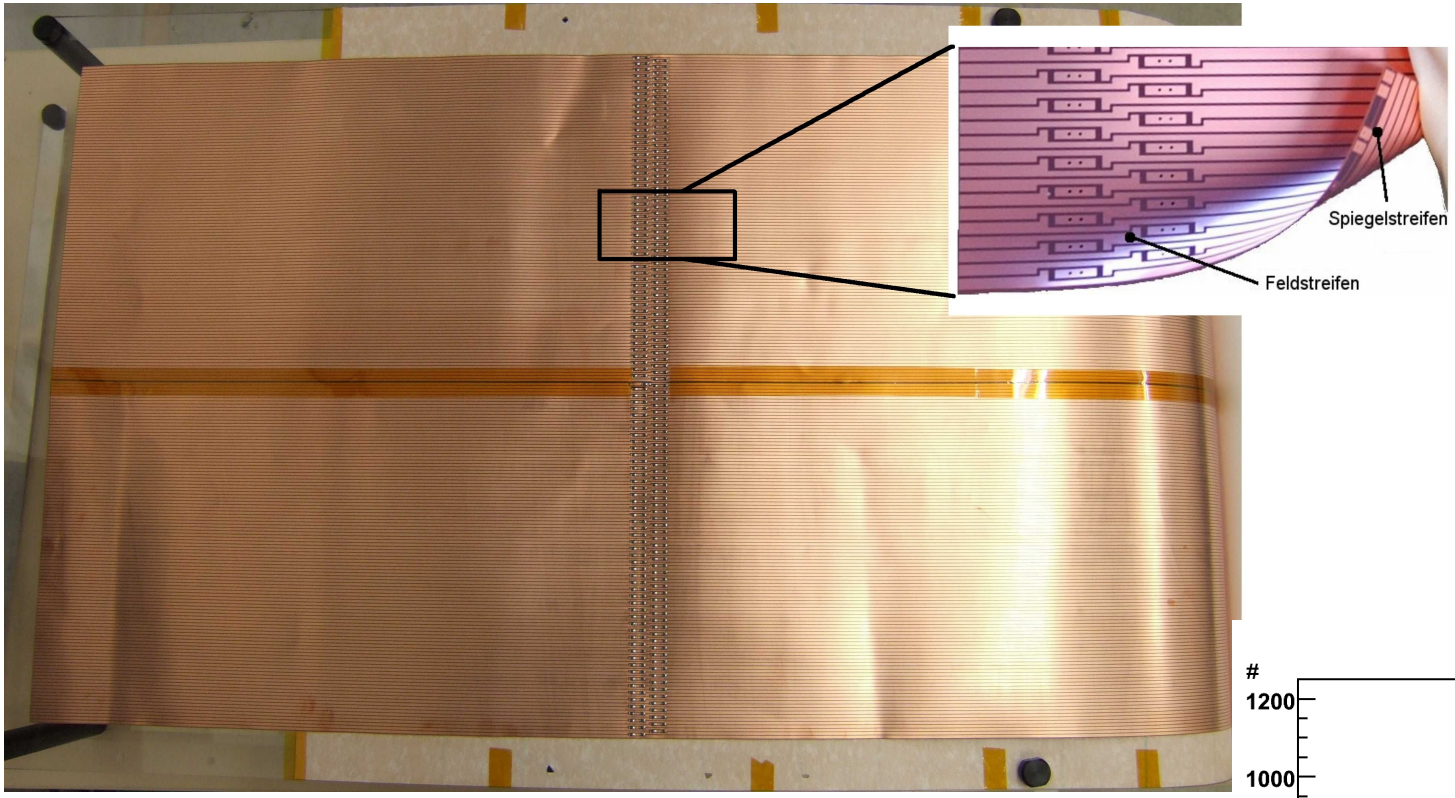

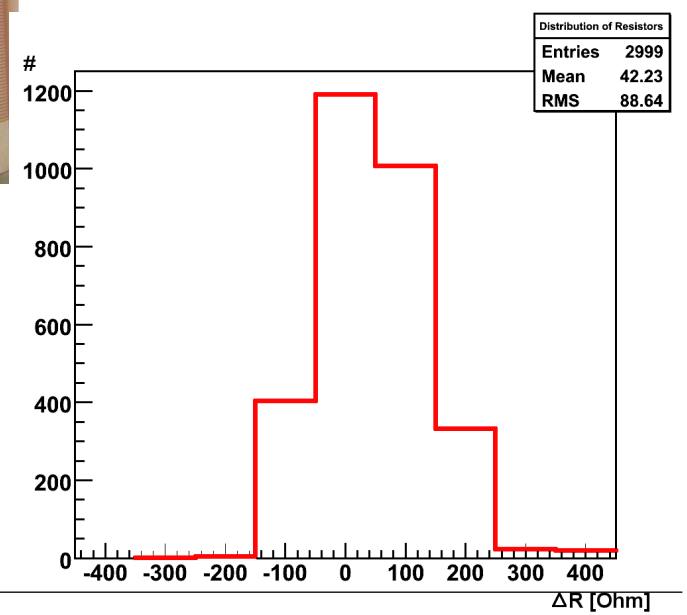

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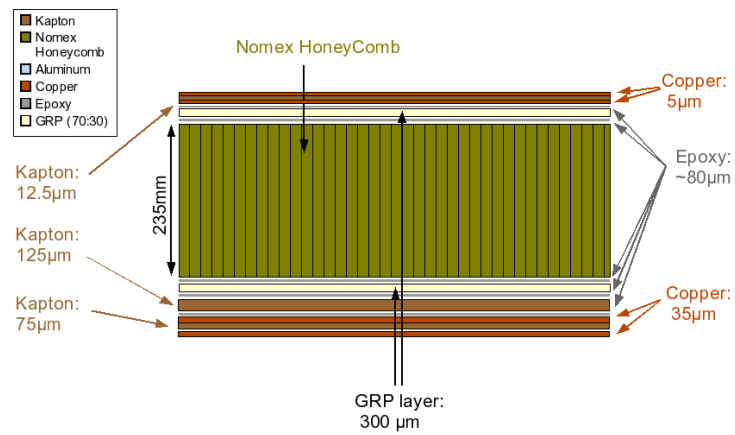
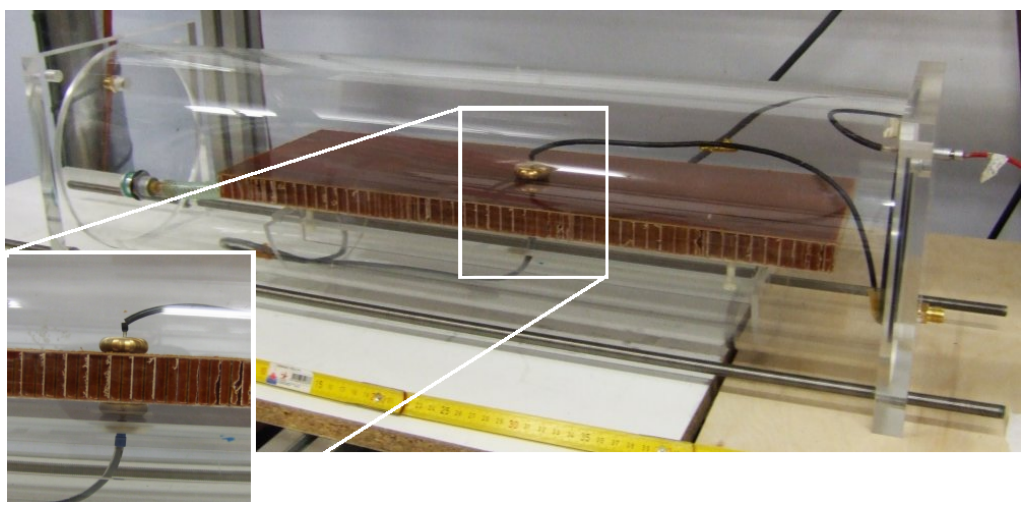
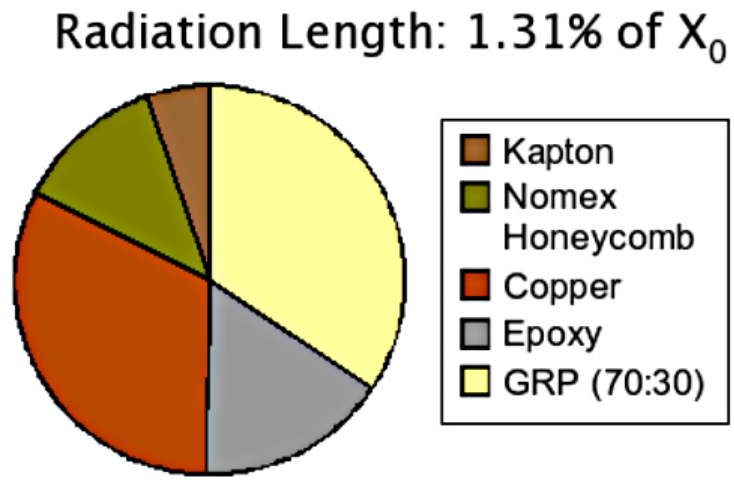
Sample pieces of the wall

- different possible cross sections of the investigated with sample pieces
  - ↪ high voltage tests up to $30\,\mathrm{kV}$
    - → no breakdown in $48\,\mathrm{h}$
  - ↪ mechanical tests
    - → 4-point bending tests
- final layout has $1.3\,\%$ of an radiation length







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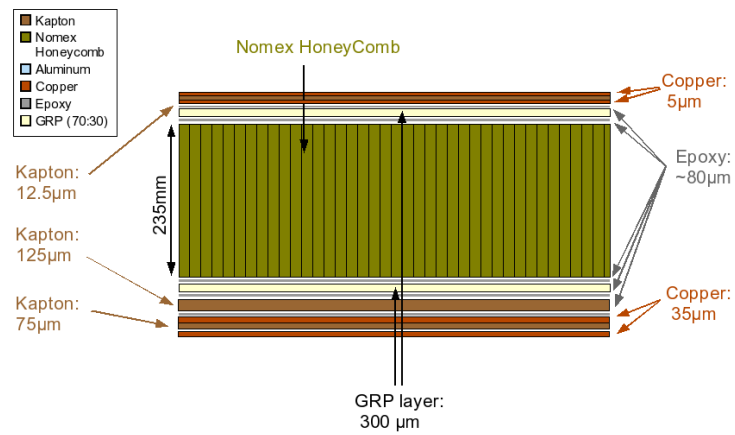

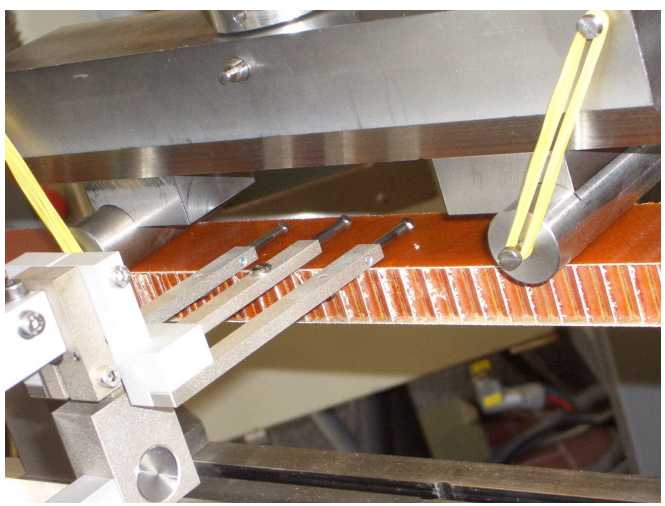

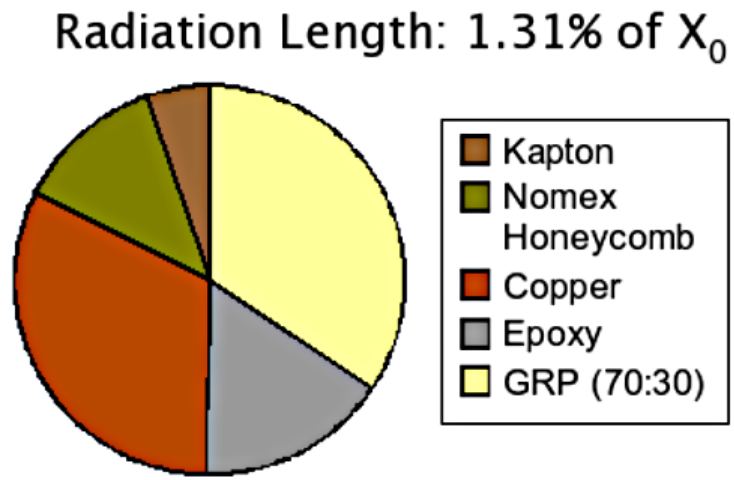

Production of the chamber on a mandrel

- field strip foil will be put as first layer
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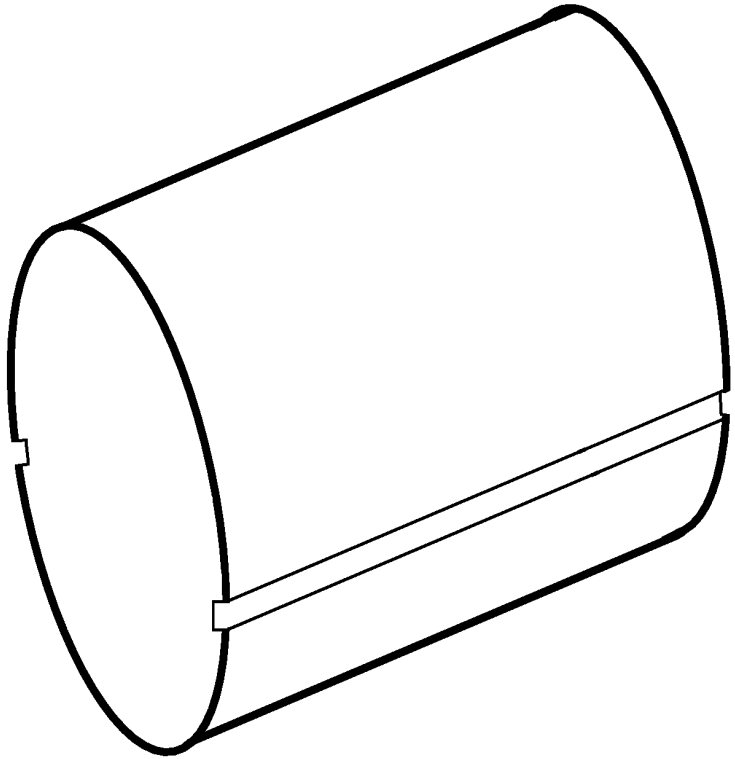

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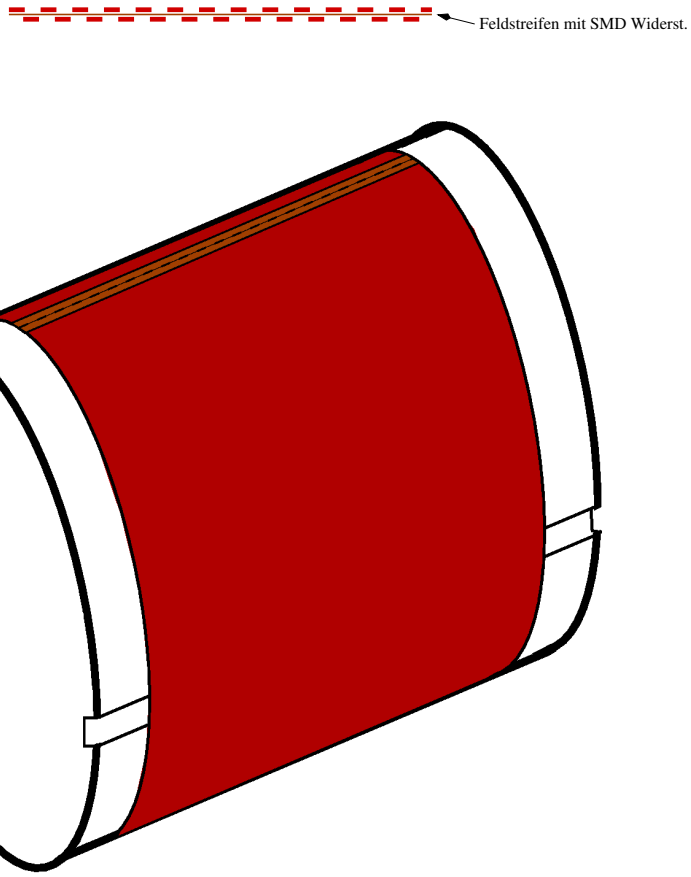

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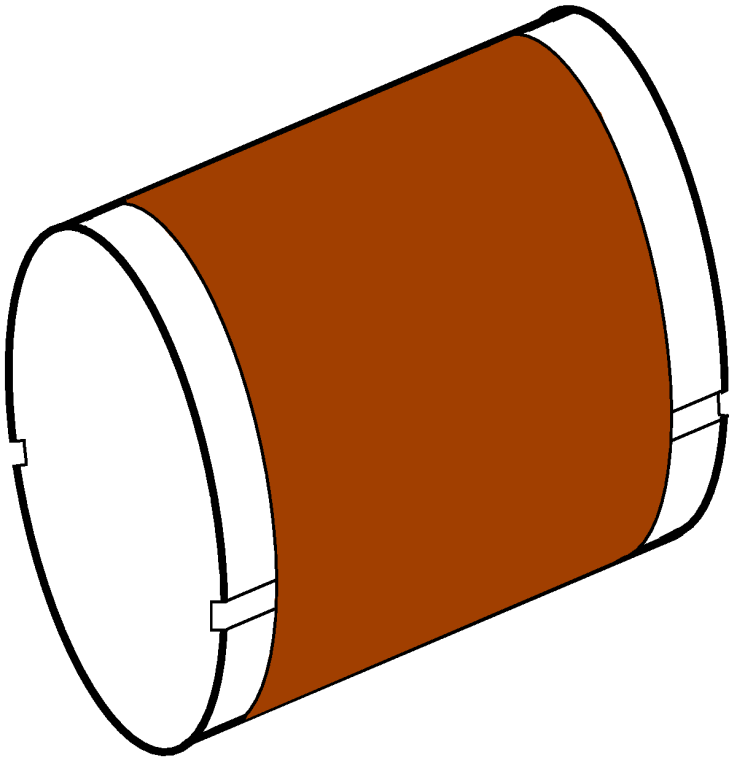

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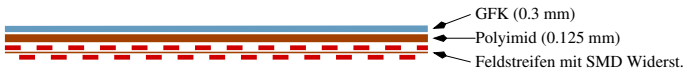

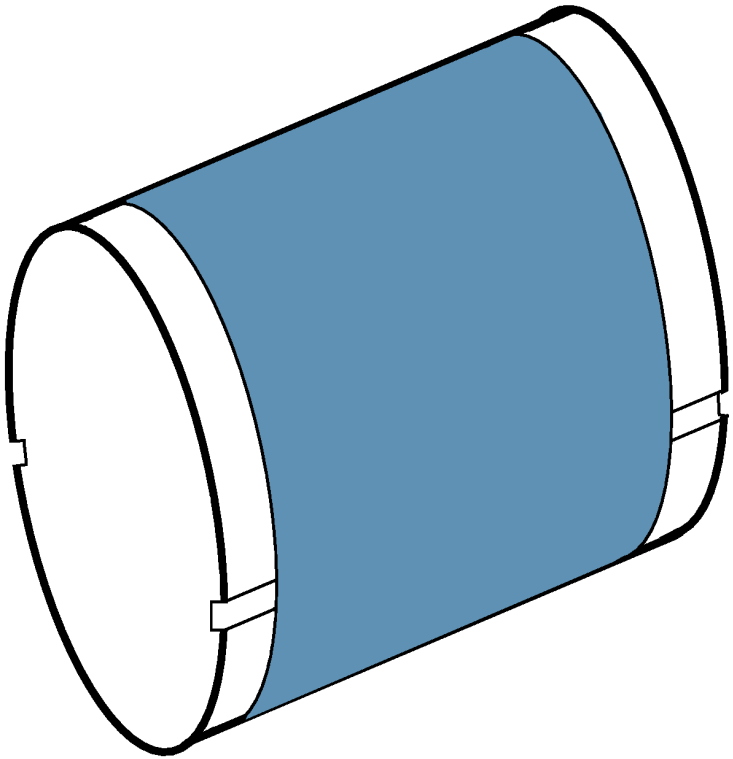

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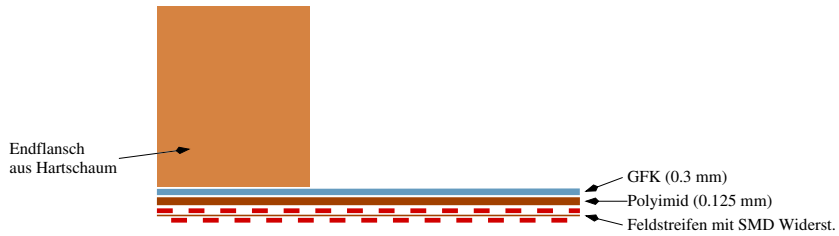

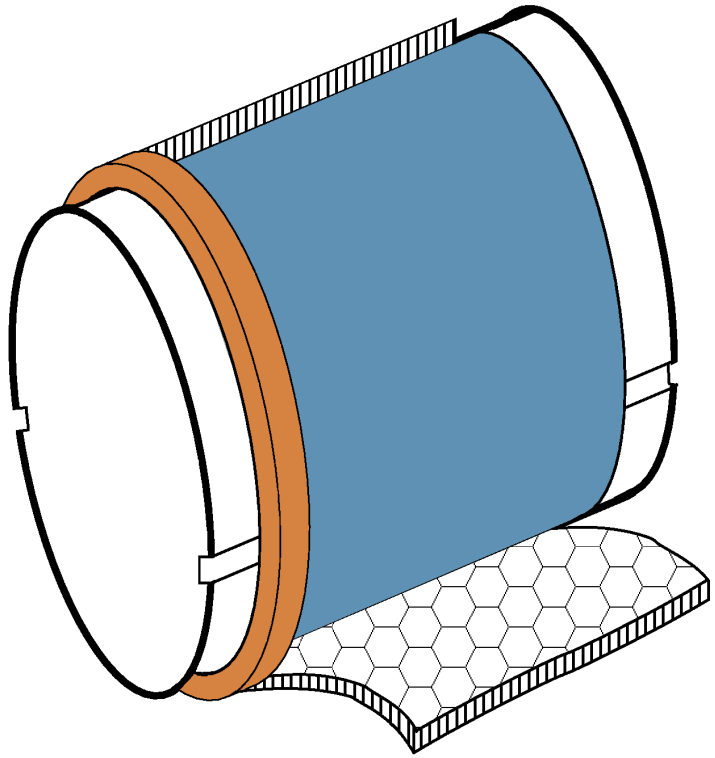

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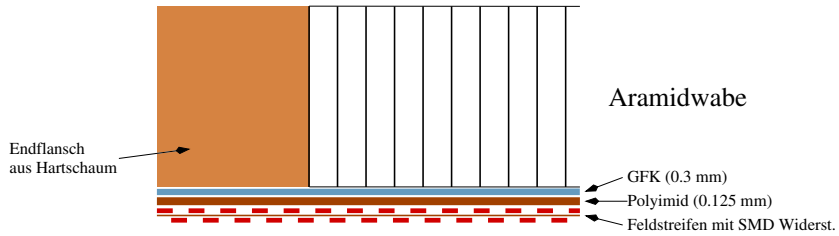

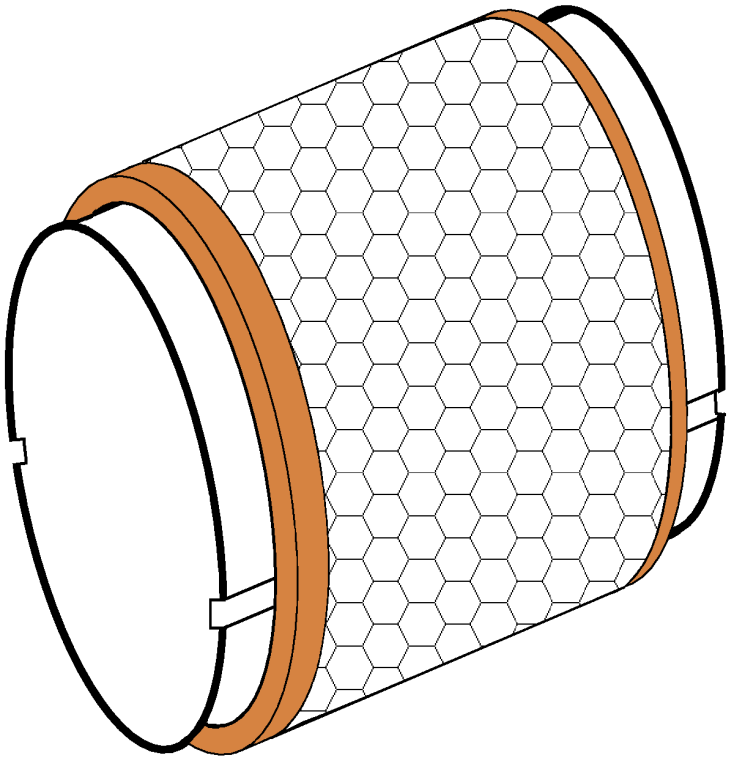

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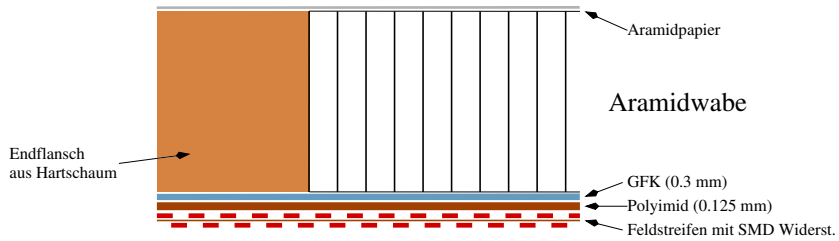

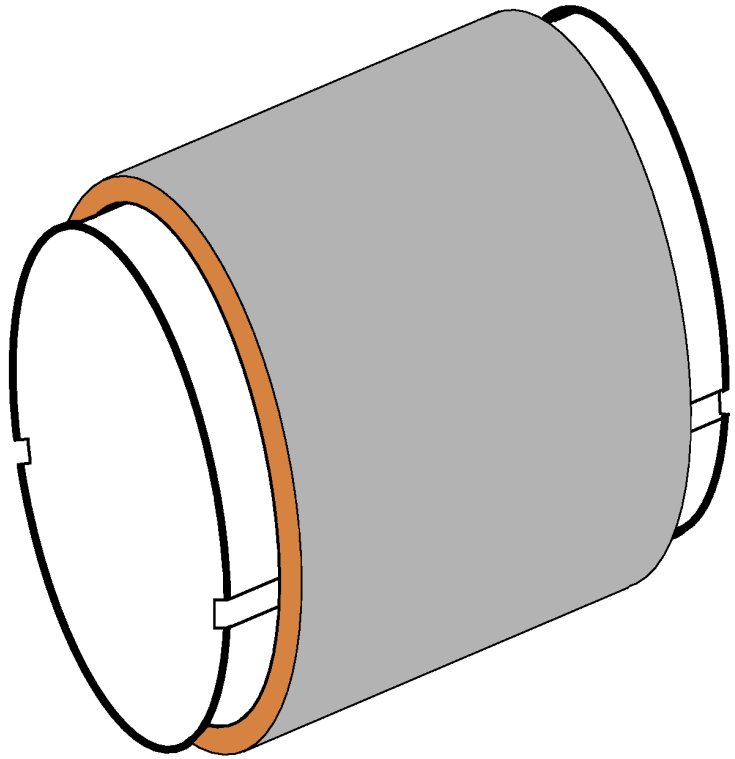

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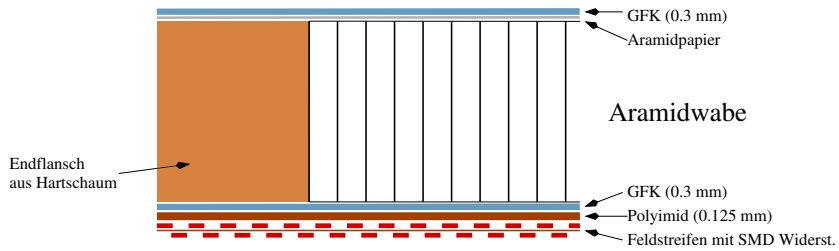

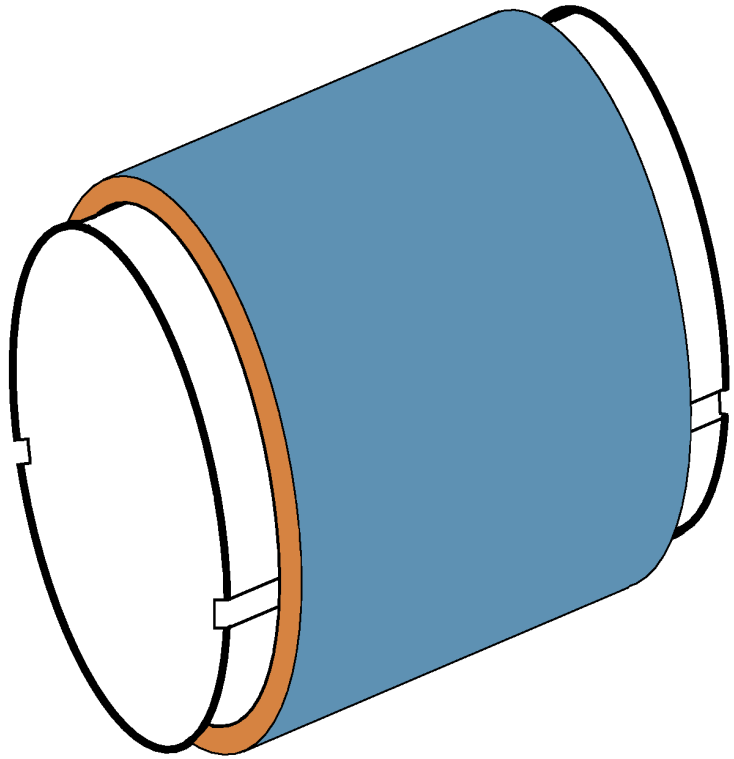

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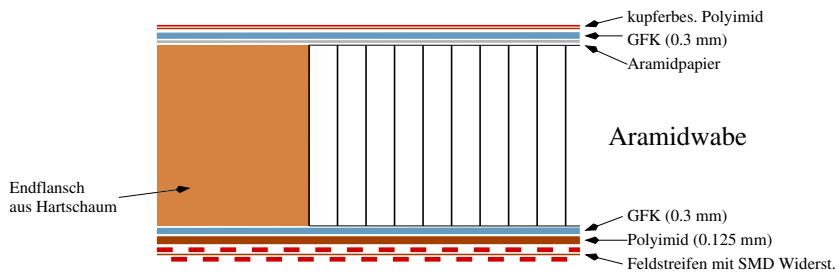

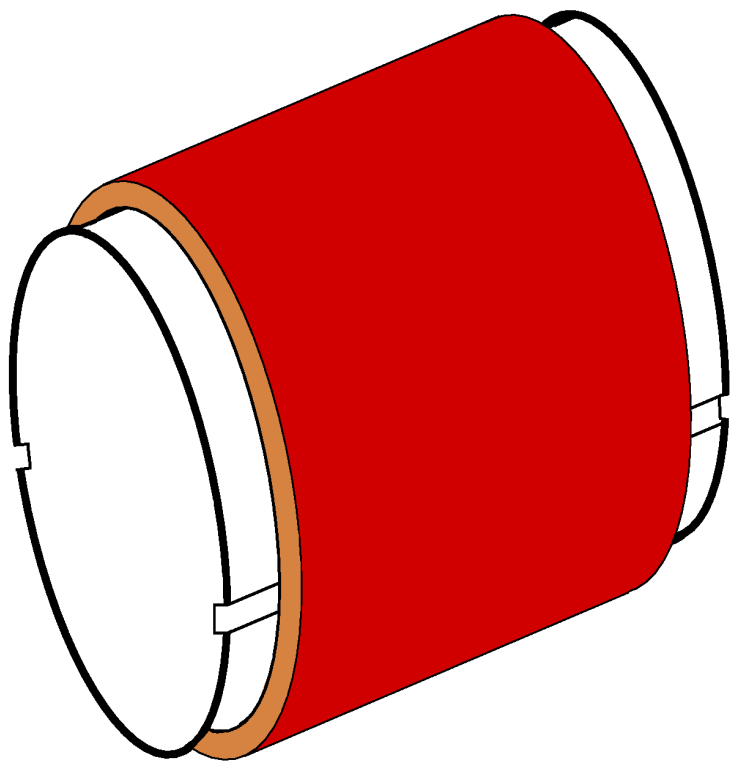

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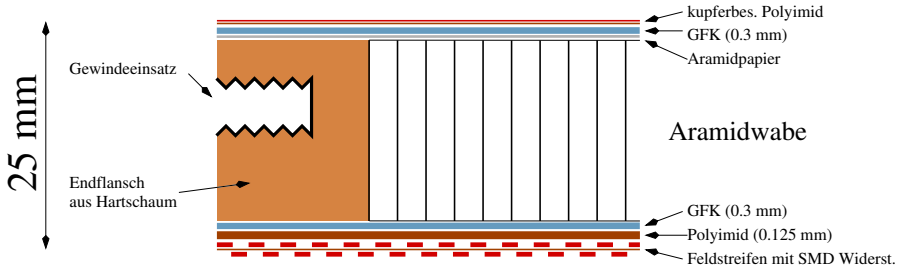
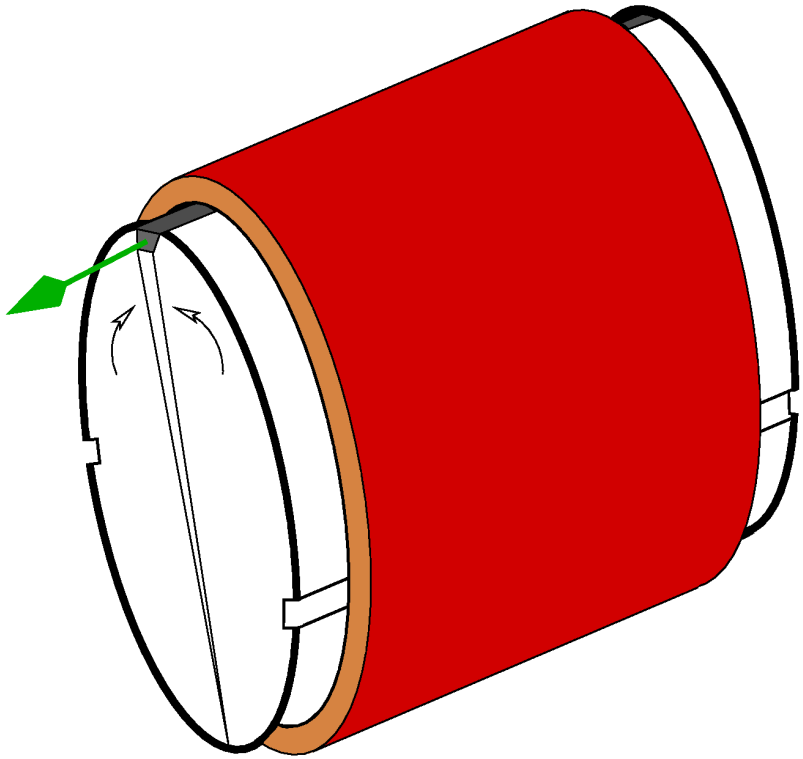
- mandrel has an expansion slot
  ↪ reduction of the diameter





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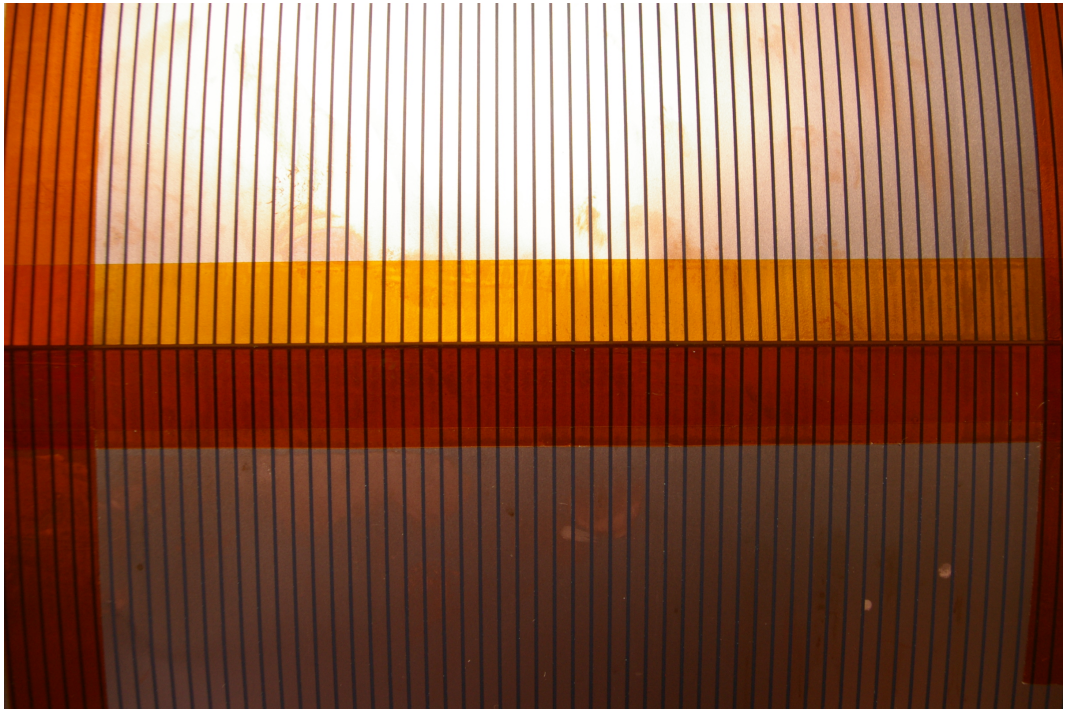

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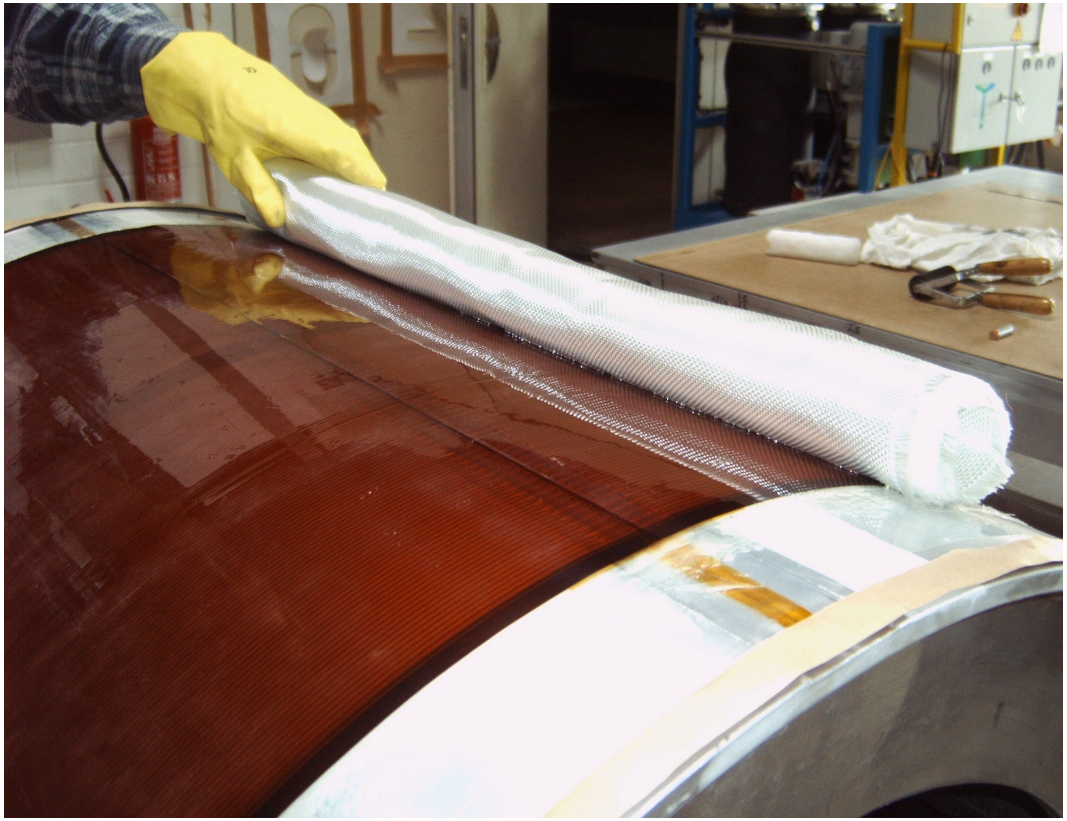

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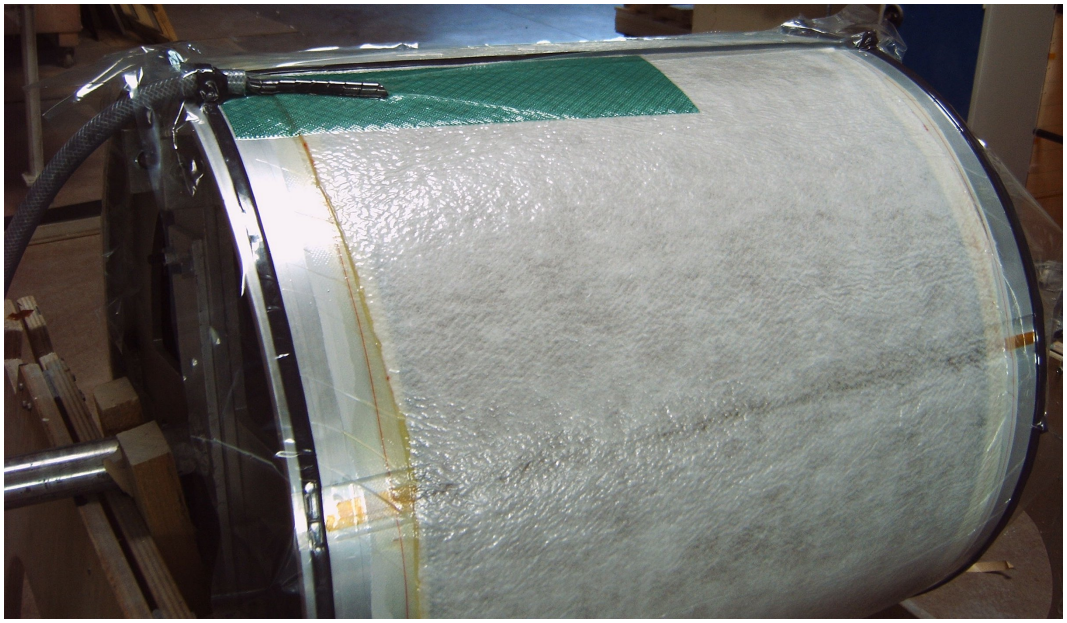

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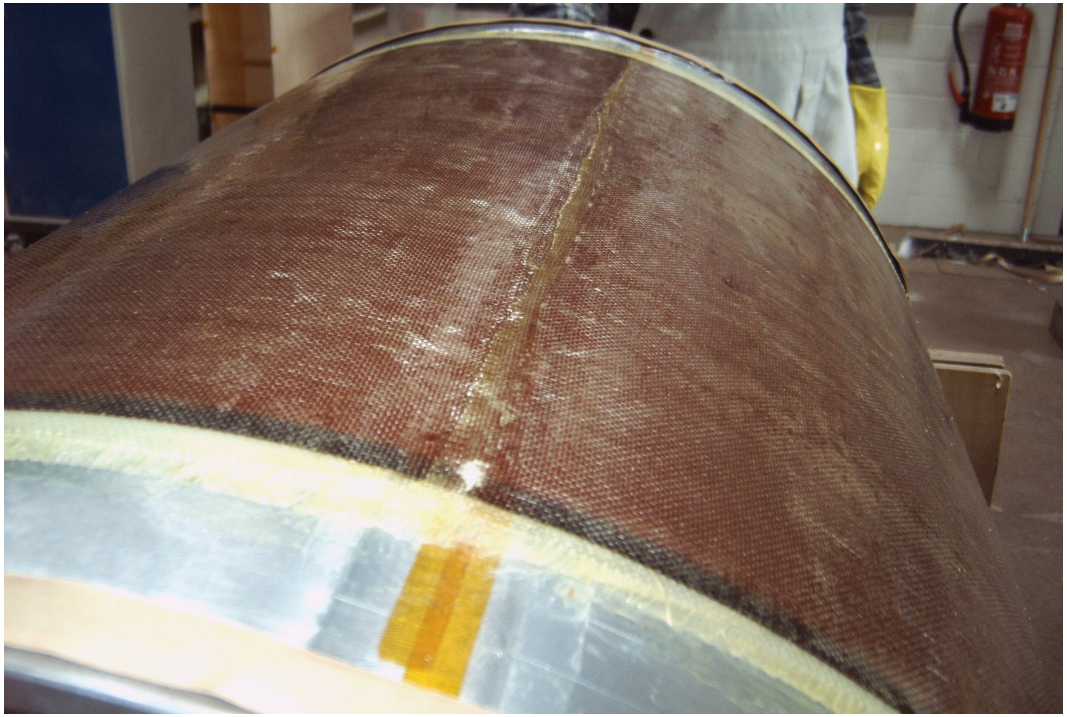

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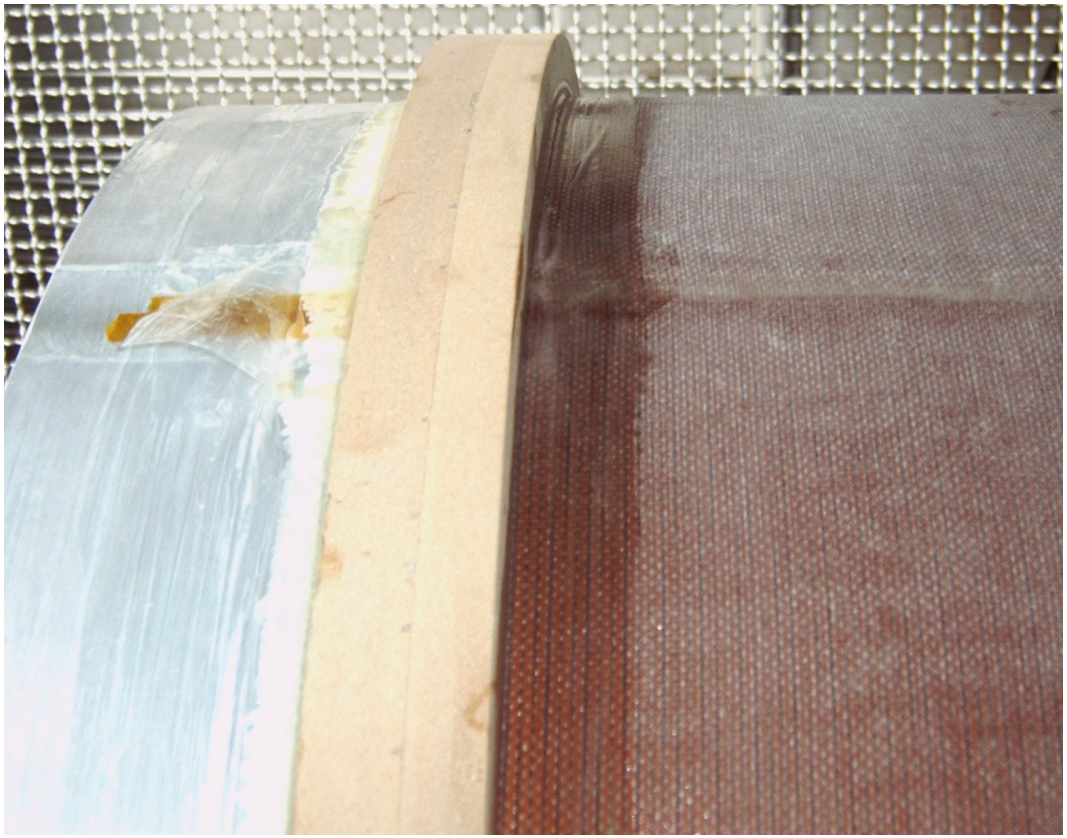

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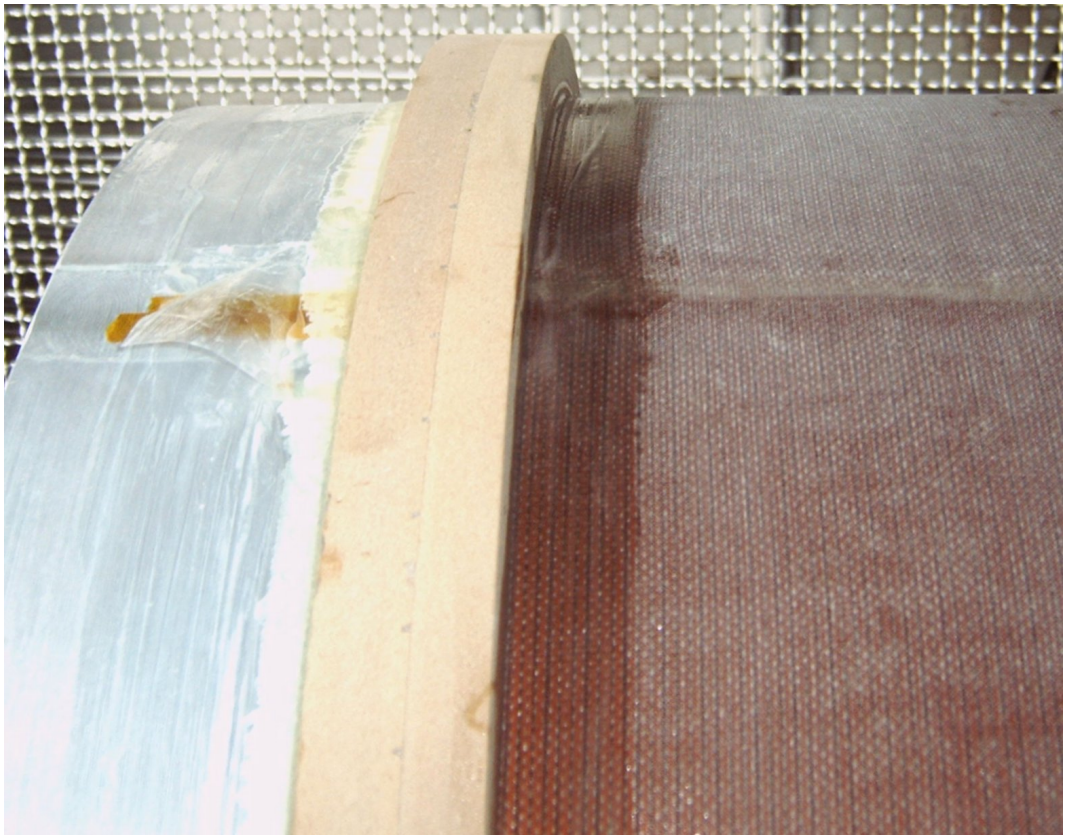

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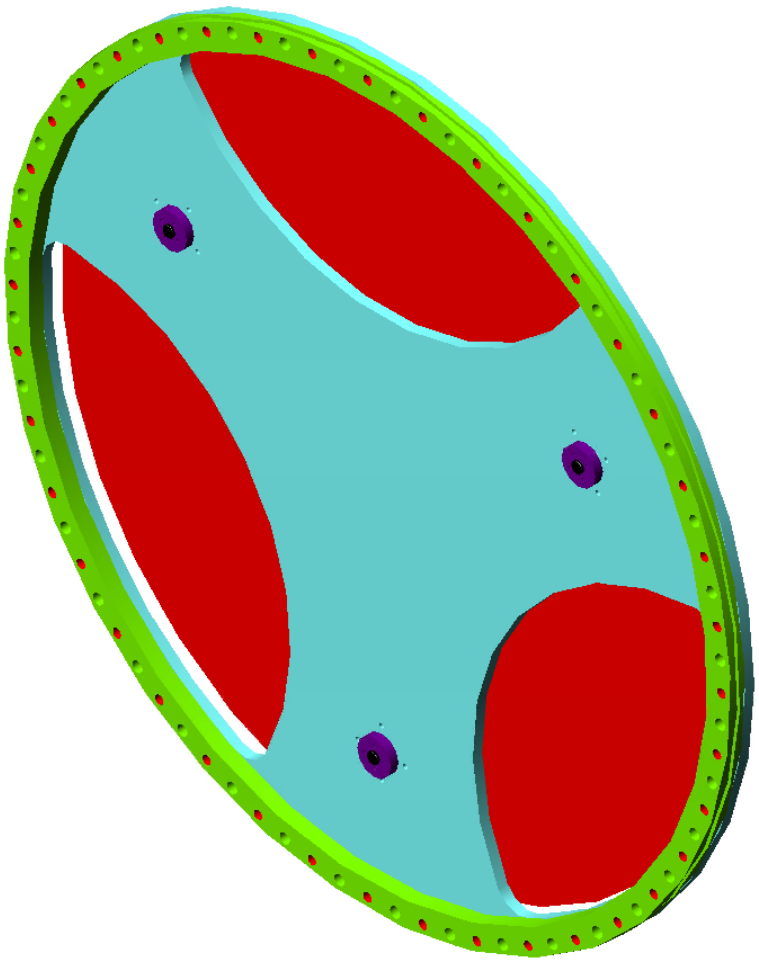
- construction is expected to be finished this week

- field cage will be available at DESY end of June

Construction of a cathode

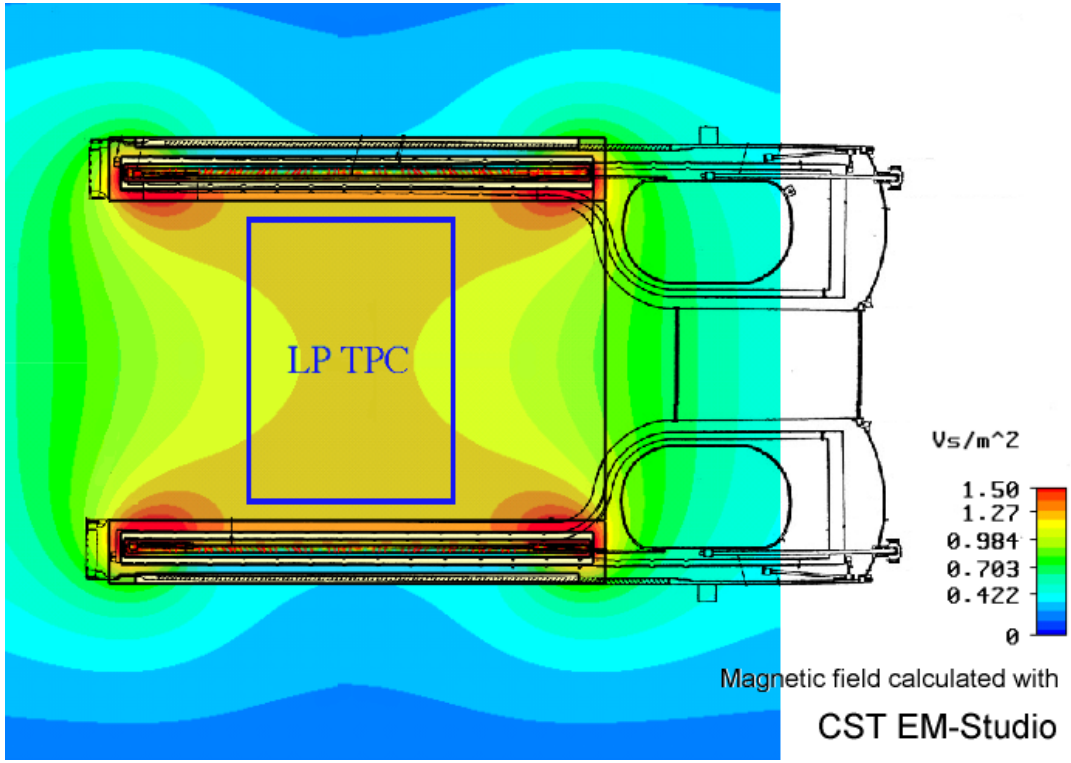
- cathode made of aluminium
  - ↪ electroplated with copper
  - ↪ a pattern can be machined into the surface
- will be mounted on an intermediate flange
- three adjustable screws carry the cathode plate
  - ↪ correct placement of cathode surface
  - ↪ adjustment of parallelism
- cathode plate ready, construction of intermediate flange soon



Conclusion

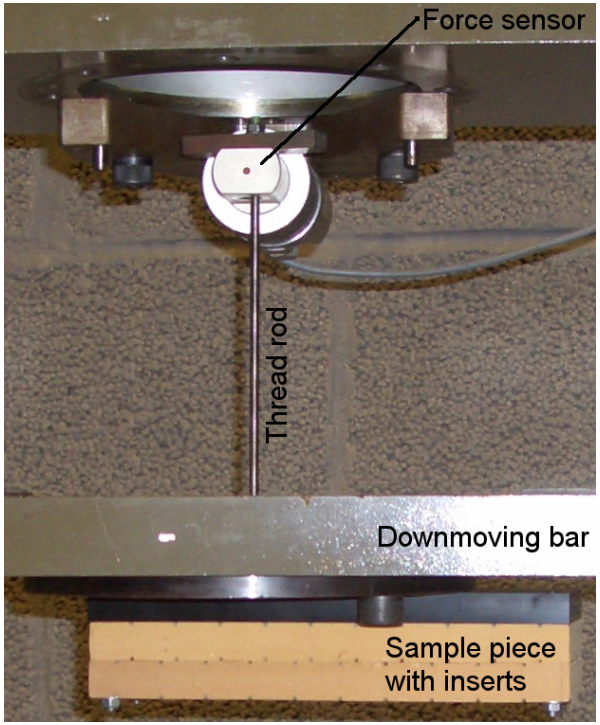
- field cage for a Large TPC-Prototype for the ILC as a part of an EUDET infrastructure
- construction of the chamber ongoing
- a first cathode is under preparation
- chamber available in June
  - ↪ HV-tests
  - ↪ gas tests
- a first anode plate is under construction at the university of Cornell
- measurements in the test beam starting in September

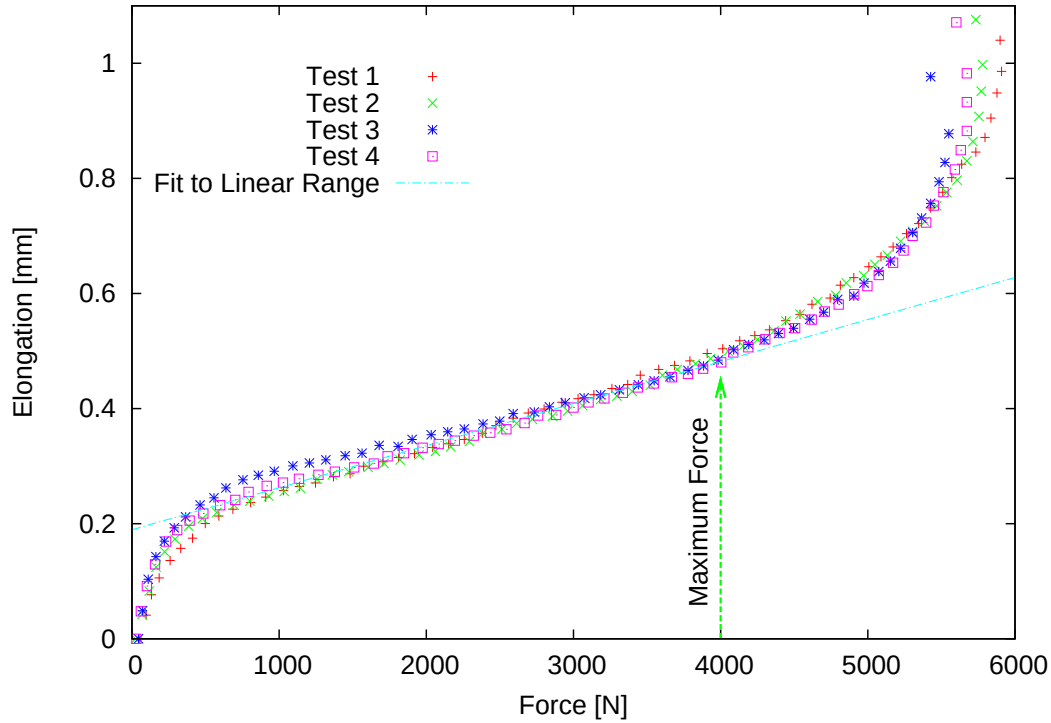
EUDET Setup



- infrastructure for TPC R&D, available for many researcher groups
  - ↪ PCMAG was installed in the e^- test beam in December 2006
  - ↪ Large TPC-Prototype: $60\,\mathrm{cm}$ long drift volume, $72\,\mathrm{cm}$ inner diameter
  - ↪ among others: studies for TPC-operation in inhomogeneous fields planned

Pull out tests of inserts





- force requested to compress the O-ring

  ↪ $1.2\,\mathrm{kN}$ per insert, with safety: $3.6\,\mathrm{kN}$

- self made inserts