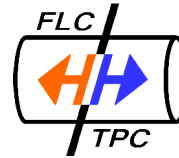


Ralf Diener



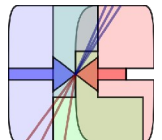
The LCTPC Large Prototype : status and plans



Universität
Hamburg



- **Fieldcage**
- **Infrastructure**
- **Time Schedule**



bmb+f - Förderschwerpunkt
Elementarteilchenphysik
Großgeräte der physikalischen
Grundlagenforschung



The Large TPC Prototype Setup

- Large TPC prototype:
 - Build inside EUDET project
 - Fit into 1T PCMAG
(already installed at DESY HH testbeam area)
 - Additional Si-Strips
as hodoscope

The Large TPC Prototype

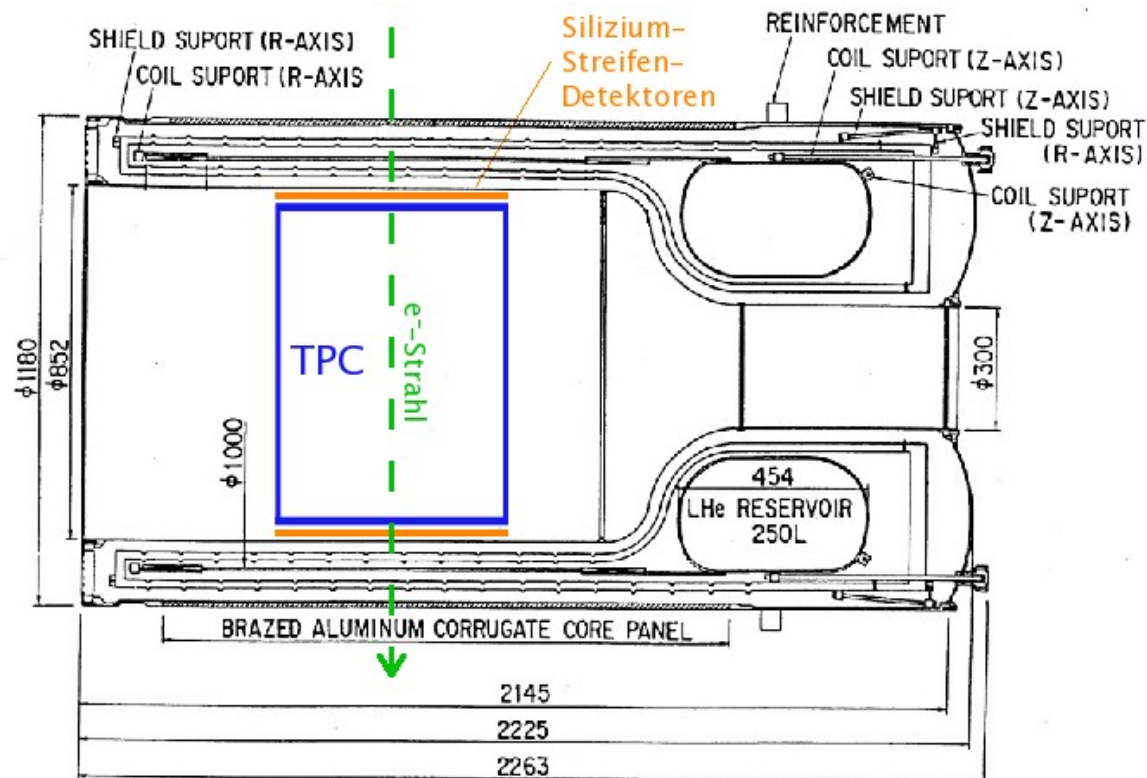
1. Large Prototype

- a) Drawings
- b) Wall Structure
- c) HV Tests
- d) Mechanics
- e) Fieldstrip Foil
- f) Field

2. Infrastructure

- a) Magnet
- b) Hodoscope

3. Schedule

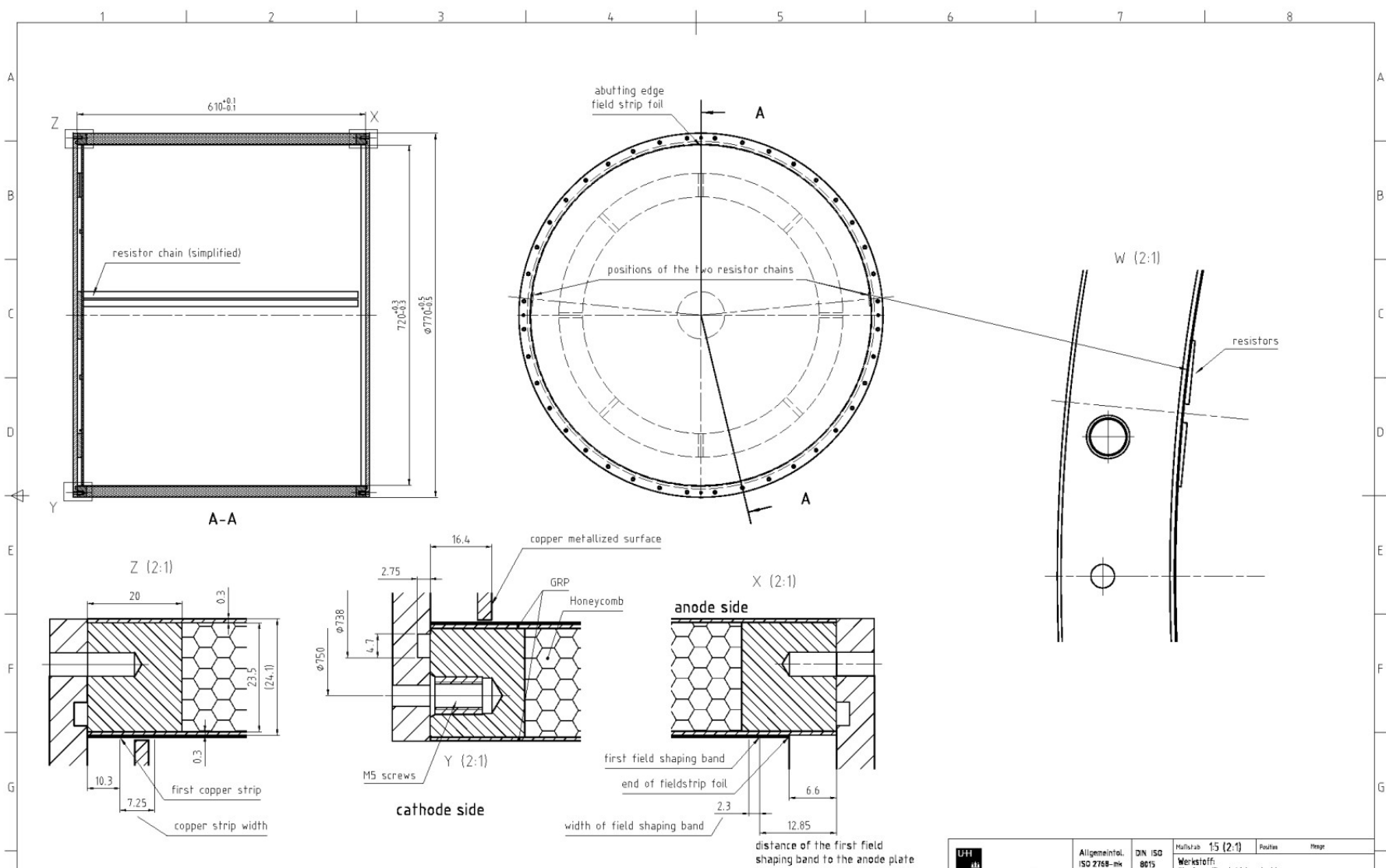




Latest Technical Drawings of LP Fieldcage

The Large TPC Prototype

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- Design nearly ready, only small details open:
 - Inserts: Helicoil or Endsat-S?
 - Screws: 5 or 6mm?
 - O-ring groove dimensions?

Universität Hamburg	Allgemeintitel: ISO 2768-mk	DIN ISO 8615	Maßstab: 1:5 (2:1)	Position:	Menge:
	Datum: 19.10.07	Name: Pelz	Werkstoff: Glasfaser/Epoxy, Webstruktur		
Universität Hamburg Institut für Experimentelle Physik Luruper Ch. 149, 22761 Hamburg			field cage barrel		
Zuerst Änderungen	Datum	Name	Zeichner	Blatt	BK
6	1	7	8		

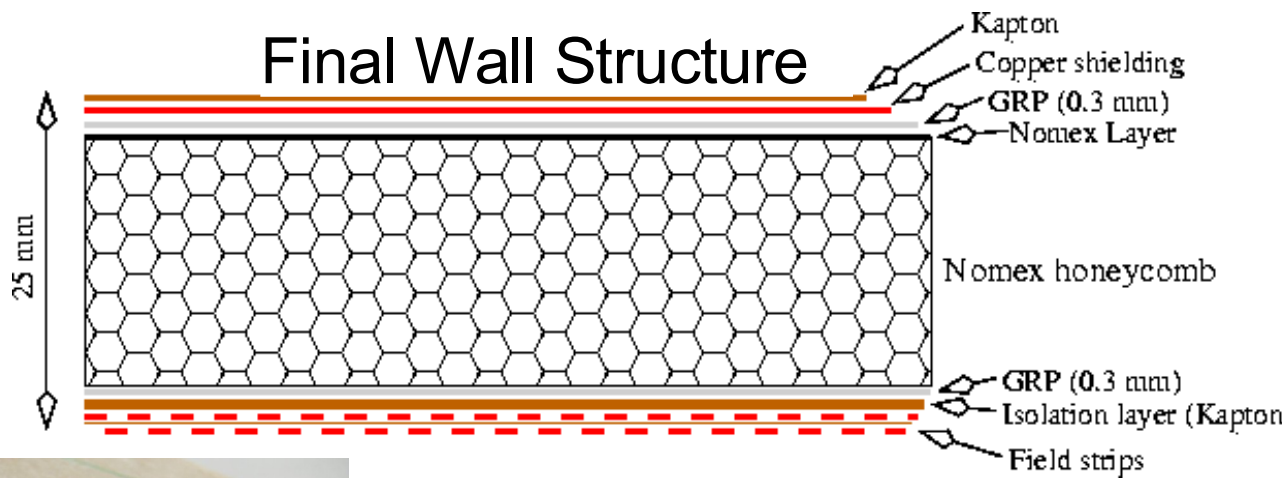




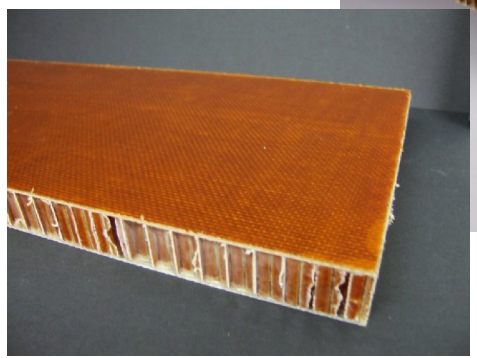
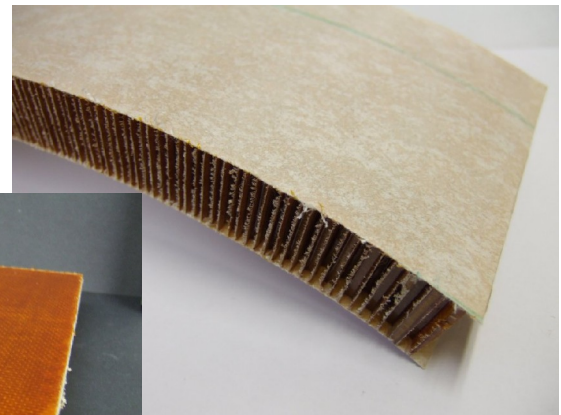
Fieldcage Wall

Wall cross section:

- shielding
- honeycomb with GRP layers
- field strips

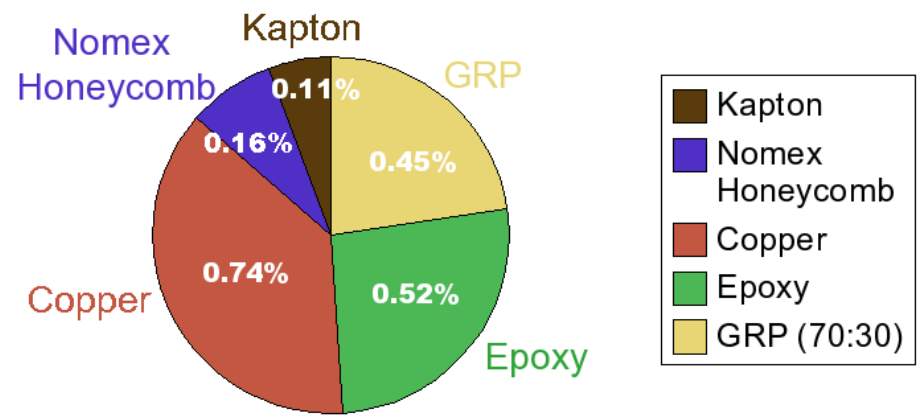


Test Samples



- Estimation of radiation length of the fieldcage wall is below 2% X_0
- LP: 4.45%
(2 walls + 72cm TDR or P5 gas)
- Final TPC: 4.85%
(2 walls + 130cm TDR or P5 gas)

Radiation Length in % of $X_0 = 1.98\%$



Material	Rad length [cm]	Thickness	% of X_0
Kapton	28.57	4x75 μ m = 0.0300cm	0.11
Nomex Honeycomb	1430.00	2.3cm	0.16
Copper	1.43	3x 35 μ m = 0.105cm	0.74
Epoxy	19.40	~1000 μ m = 0.1cm	0.52
GRP (70:30)	13.31	2 x 300 μ m = 0.06cm	0.45

some numbers are estimations!

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3. Schedule

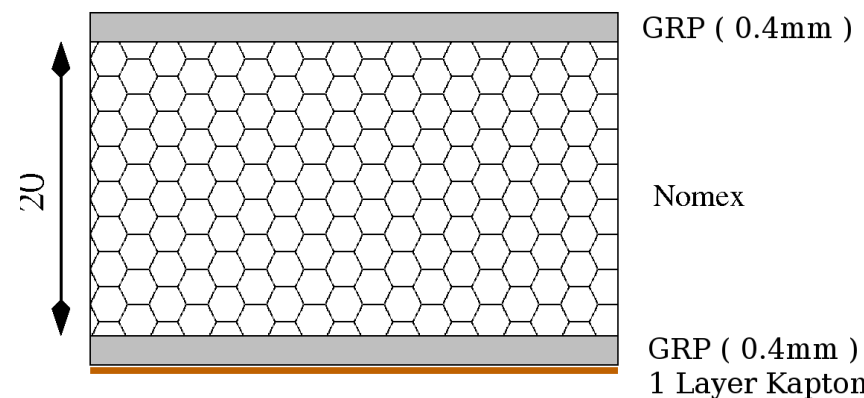
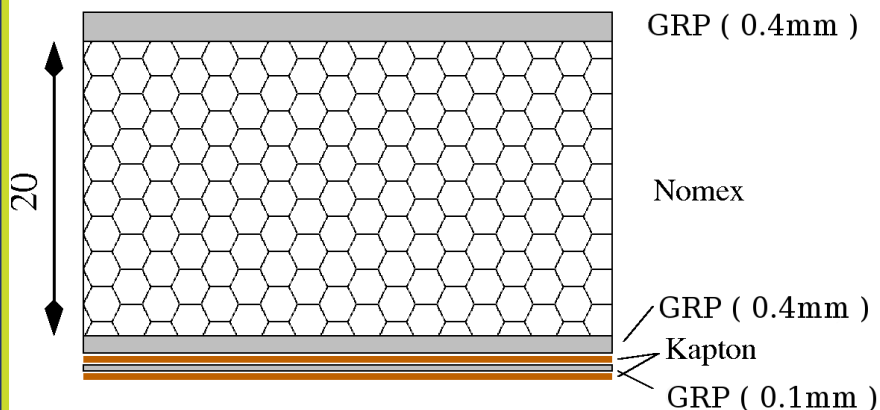
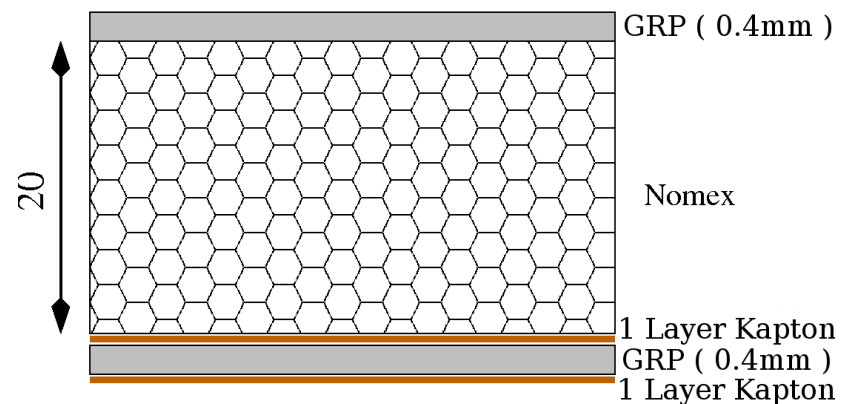
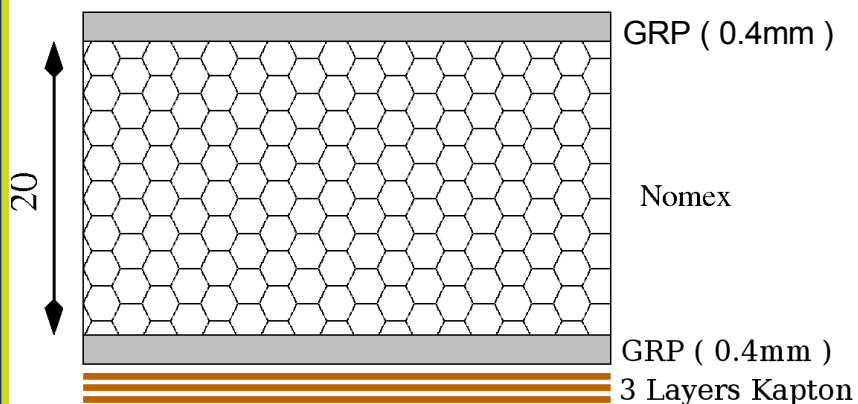
Ralf Diener,
Hamburg University





Fieldcage Wall Test Samples

- Sample pieces with different cross sections available:
 - to test high voltage (HV) stability? (partly done)
 - to test mechanical stability (presumably this week)
 - to test manufacturing procedures
 - one experience: gluing of Kapton on Kapton problematic → air bubbles

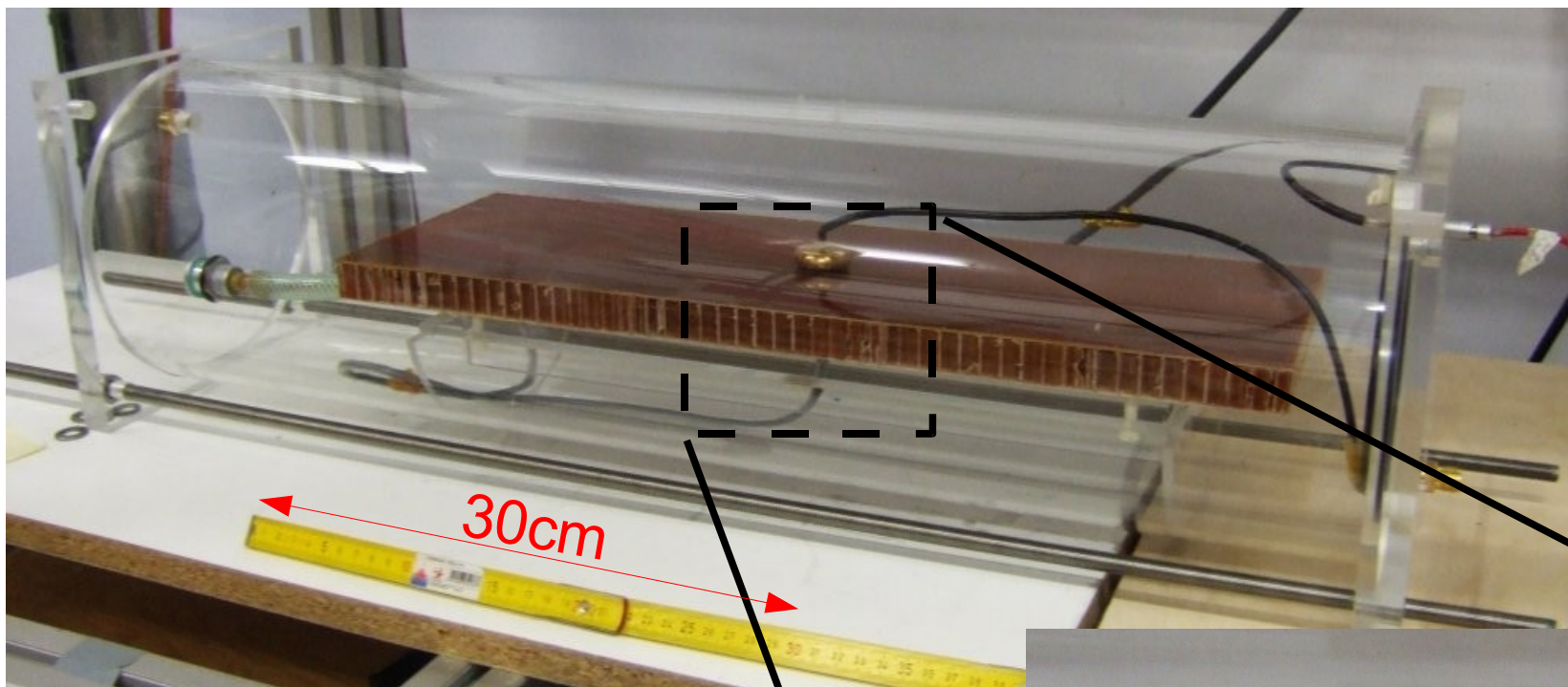




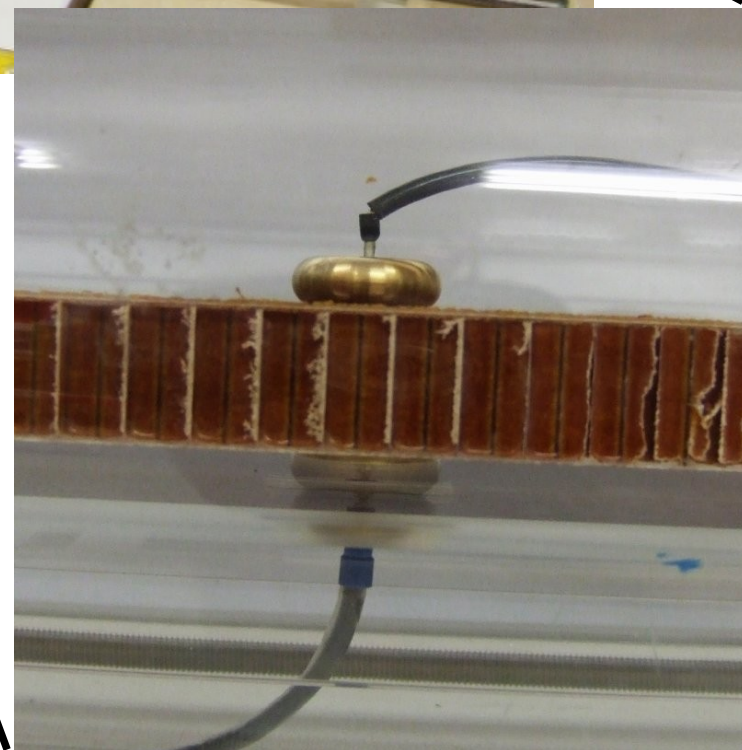
HV Tests of Fieldcage Wall

The Large TPC Prototype

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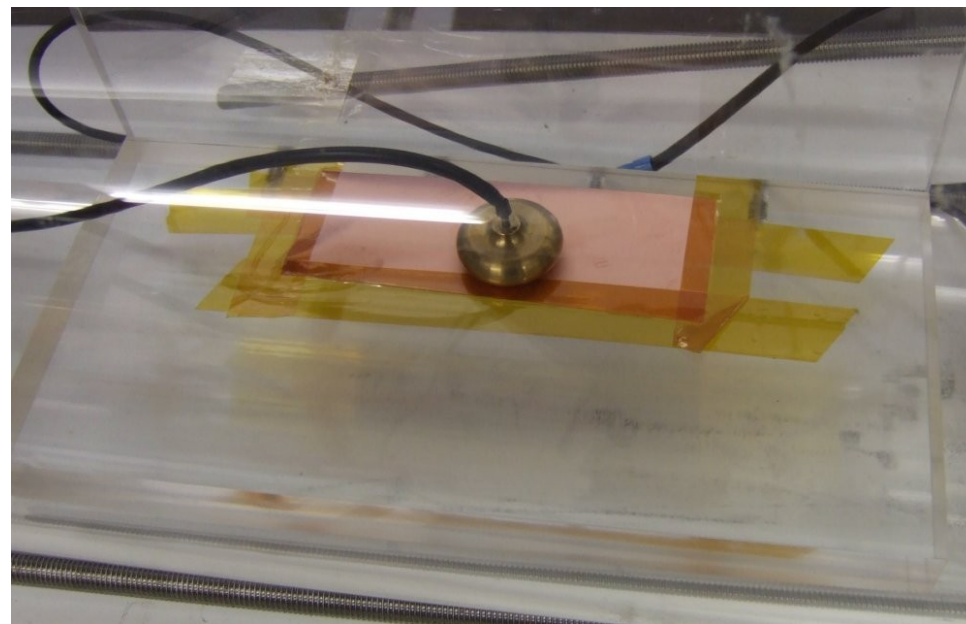
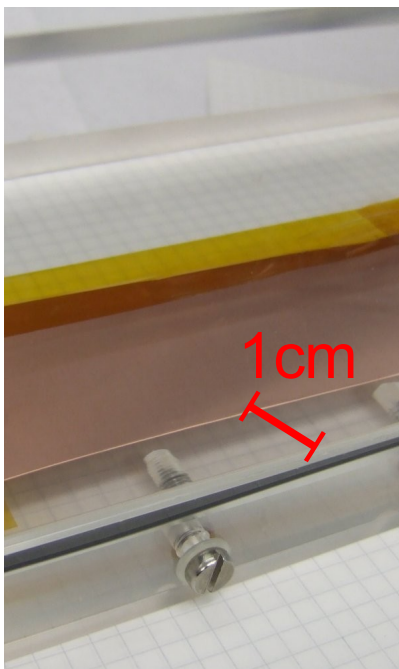
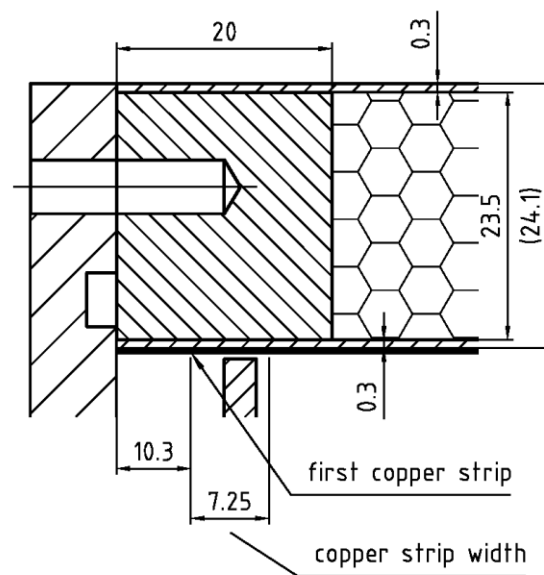
- Each sample piece tested up to 24kV including overnight test
- Every piece passed the test without breakdown
- This/next week: test up to 30kV





HV Tests of Fieldcage/Endplate

- Tested HV stability at cathode to fieldcage corner with simplified setup (Plexiglas model)
- Passed the test up to 30kV without breakdown during some hours (in air)



The Large TPC Prototype

1. Large Prototype

- Drawings
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3. Schedule

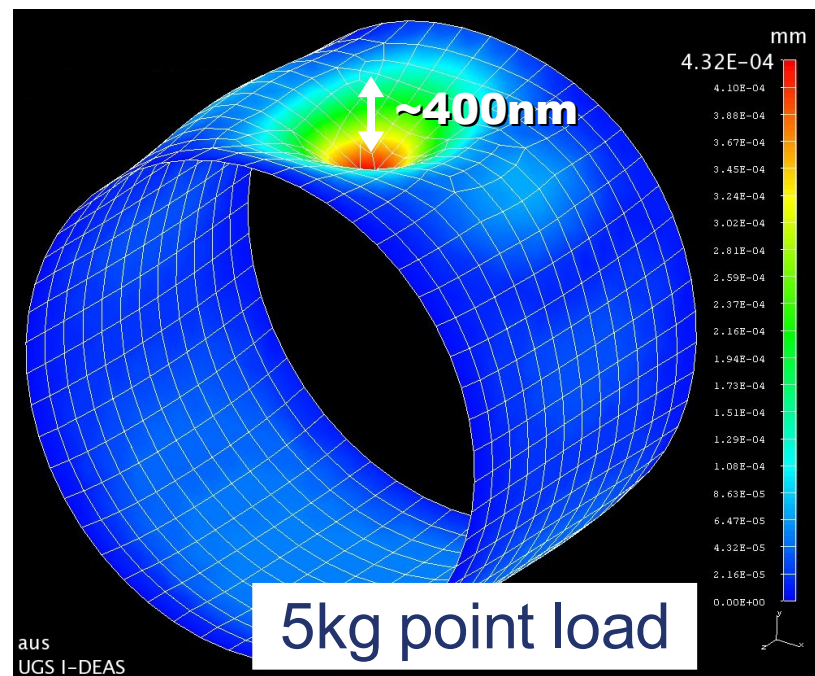
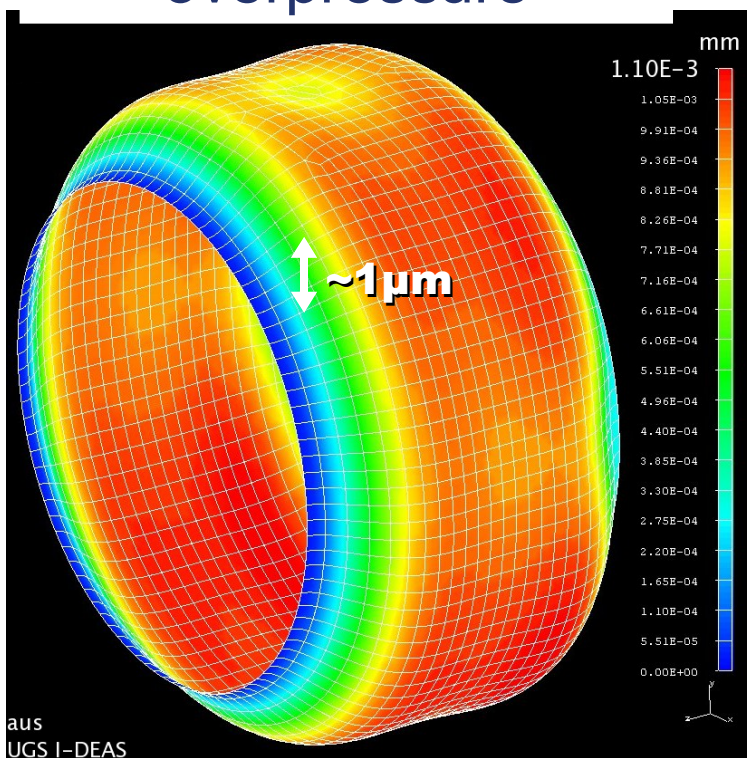
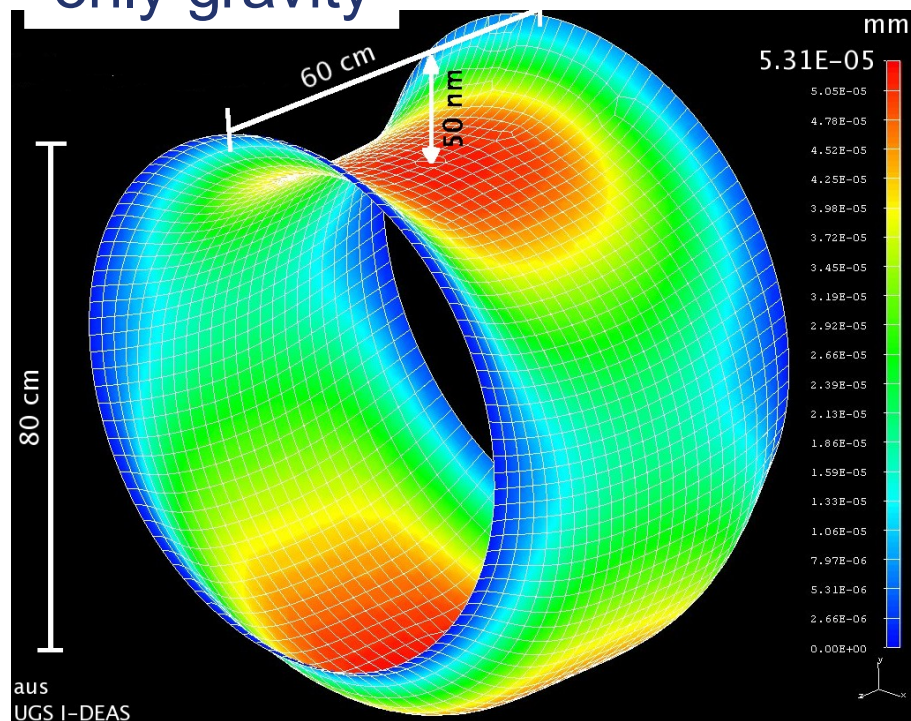


Mechanical Stability

- Simulation show that wall structure is mechanically stable
- Only small deviations under normal conditions
- Mechanical test of sample pieces to validate calculation input

gravity and 100mbar overpressure

only gravity



The Large TPC Prototype

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Ralf Diener, Hamburg University

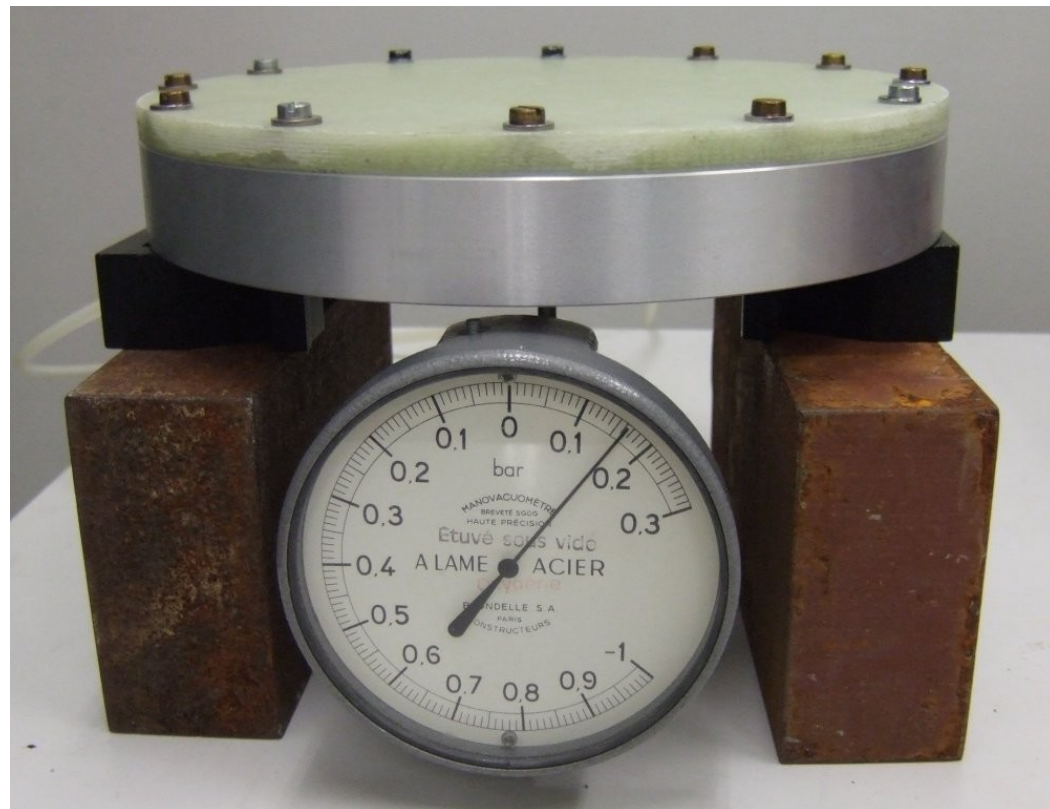
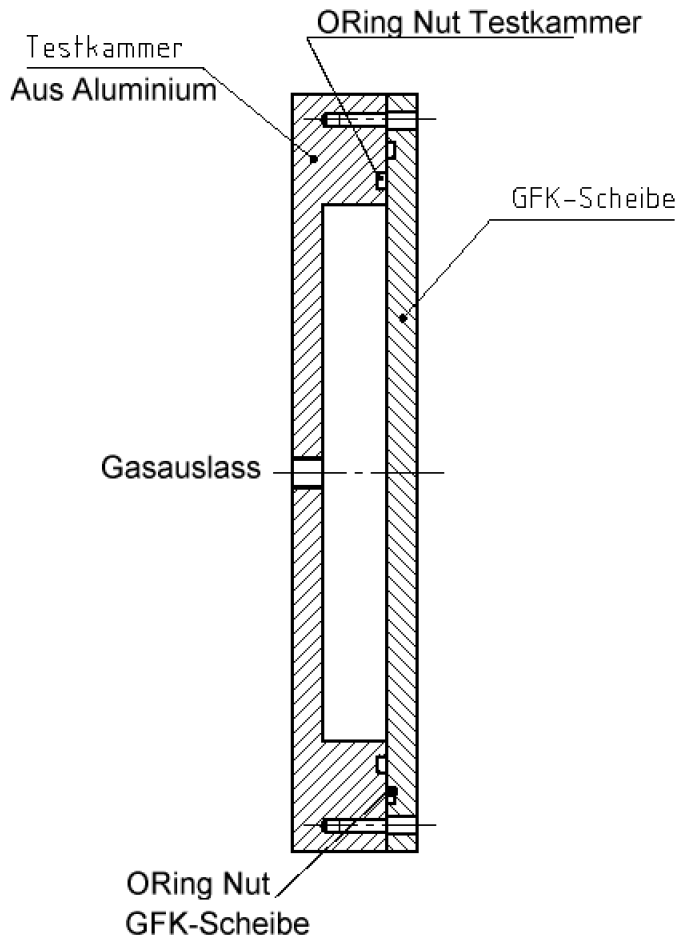




Gas Tightness Tests

The Large TPC Prototype

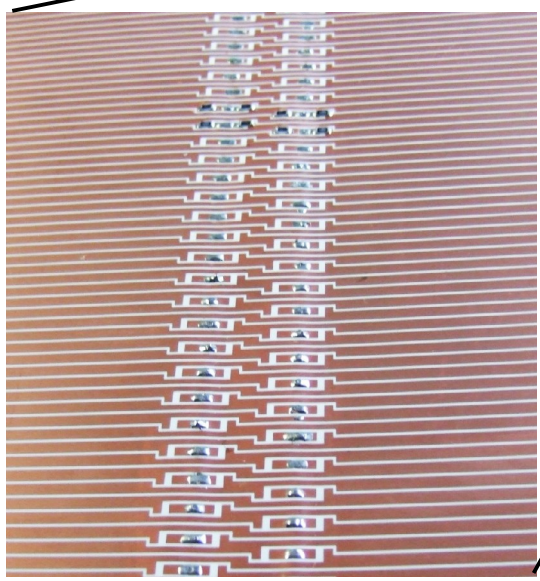
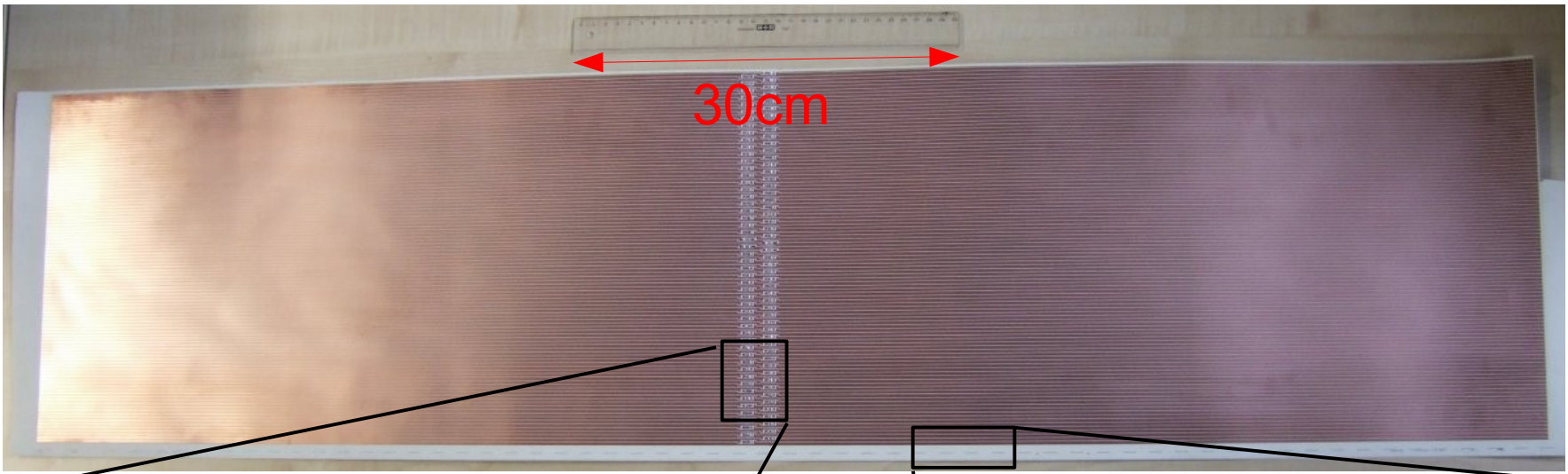
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- O-Ring Groove can be in GRP endplate or Aluminum chamber
 - Overpressure of 160mbar still kept after two weeks with O-ring in GRP plate
 - Test with O-ring in Aluminum chamber started this week (should in principle work better)

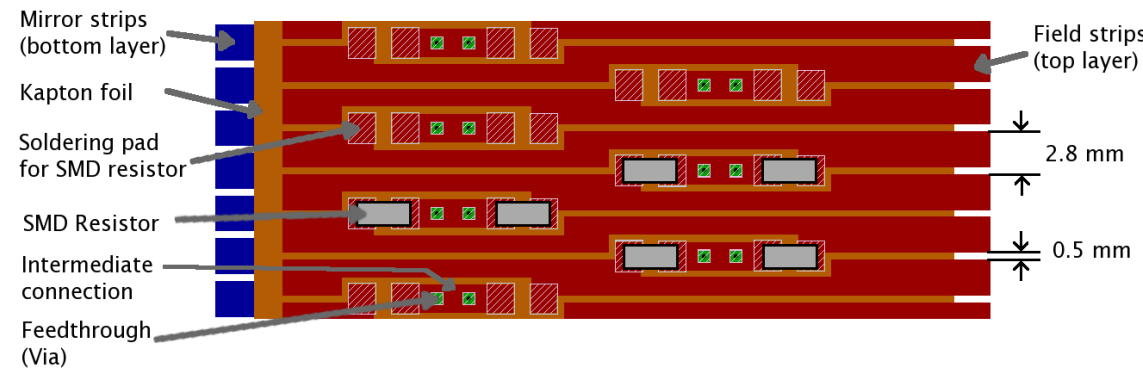


Sample Piece of the Fieldstrip Foil



- Produced in two layers that are glued together

- ~100V between two strips possible in operation



The Large TPC Prototype

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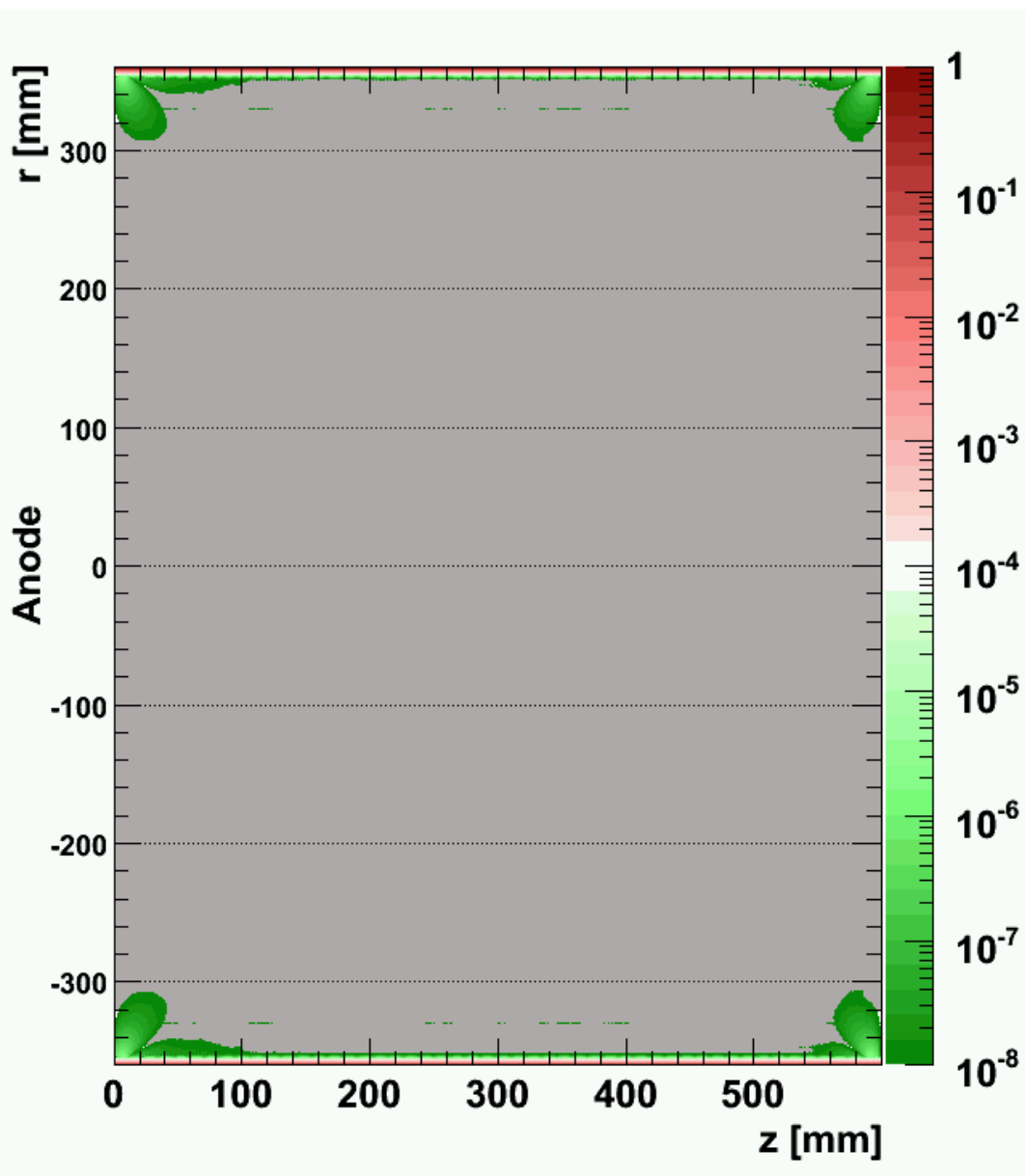
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Field Calculations

- Field deviations with mirror strips and strip layout shown before



Shown:
 $\Delta E / E_{\text{nominal}}$

Goal:
 Deviations
 below 10^{-4}

 = Value below Accuracy Limit

The Large TPC Prototype

1. Large Prototype

- Drawings
- Wall Structure
- HV Tests
- Mechanics
- Fieldstrip Foil
- Field

2. Infrastructure

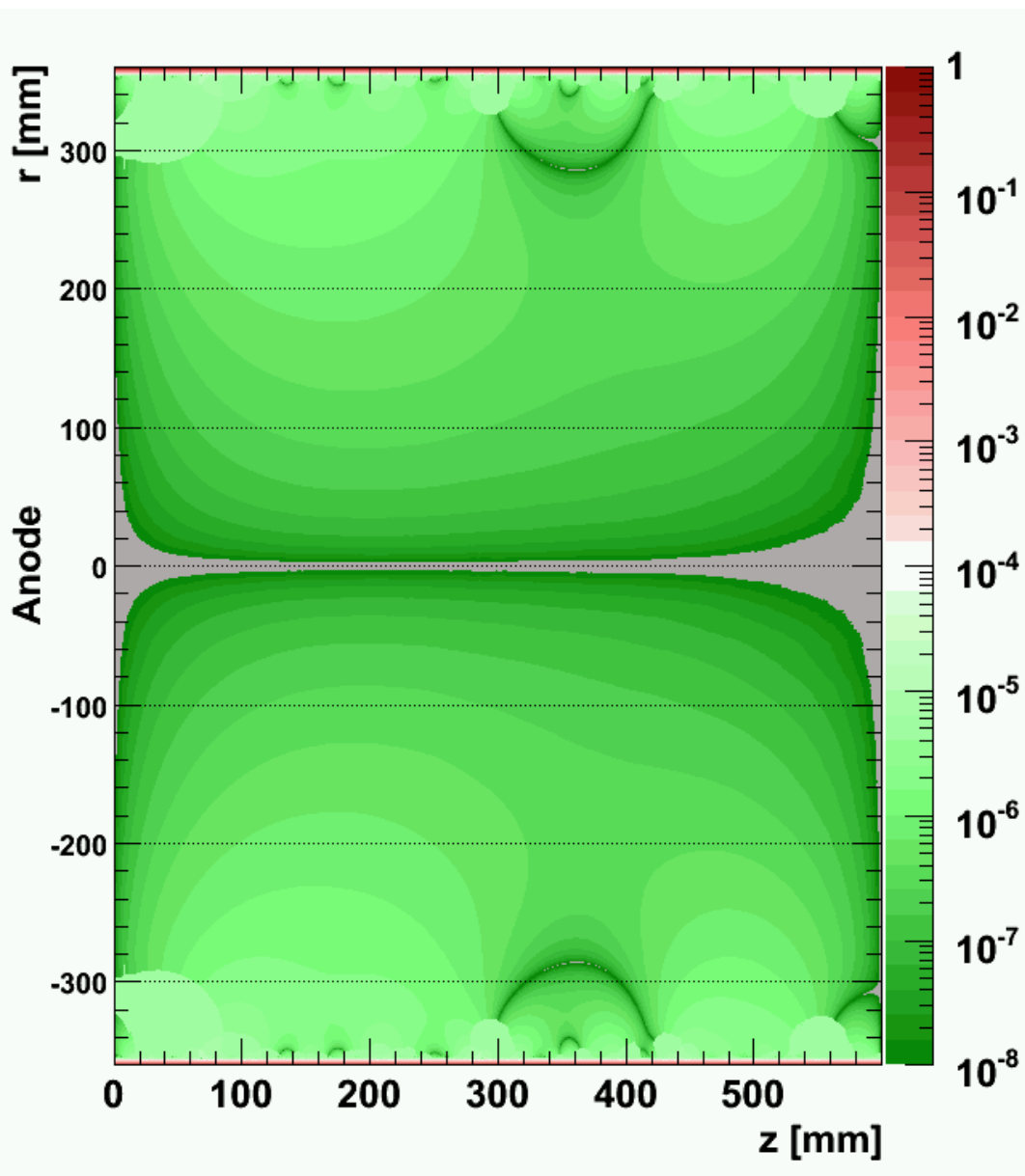
- Magnet
- Hodoscope

3. Schedule



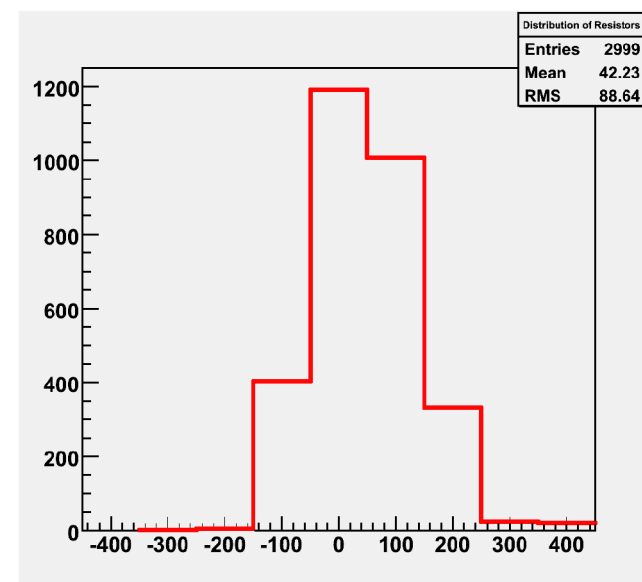
Field Calculations

- With non-perfect resistors: $1\text{M}\Omega \pm 0.2\text{‰} (=200\Omega)$



Shown:
 $\Delta E / E_{\text{nominal}}$

Goal:
 Deviations
 below 10^{-4}



 = Value below Accuracy Limit

The Large TPC Prototype

1. Large Prototype

- Drawings
- Wall Structure
- HV Tests
- Mechanics
- Fieldstrip Foil
- Field

2. Infrastructure

- Magnet
- Hodoscope

3. Schedule



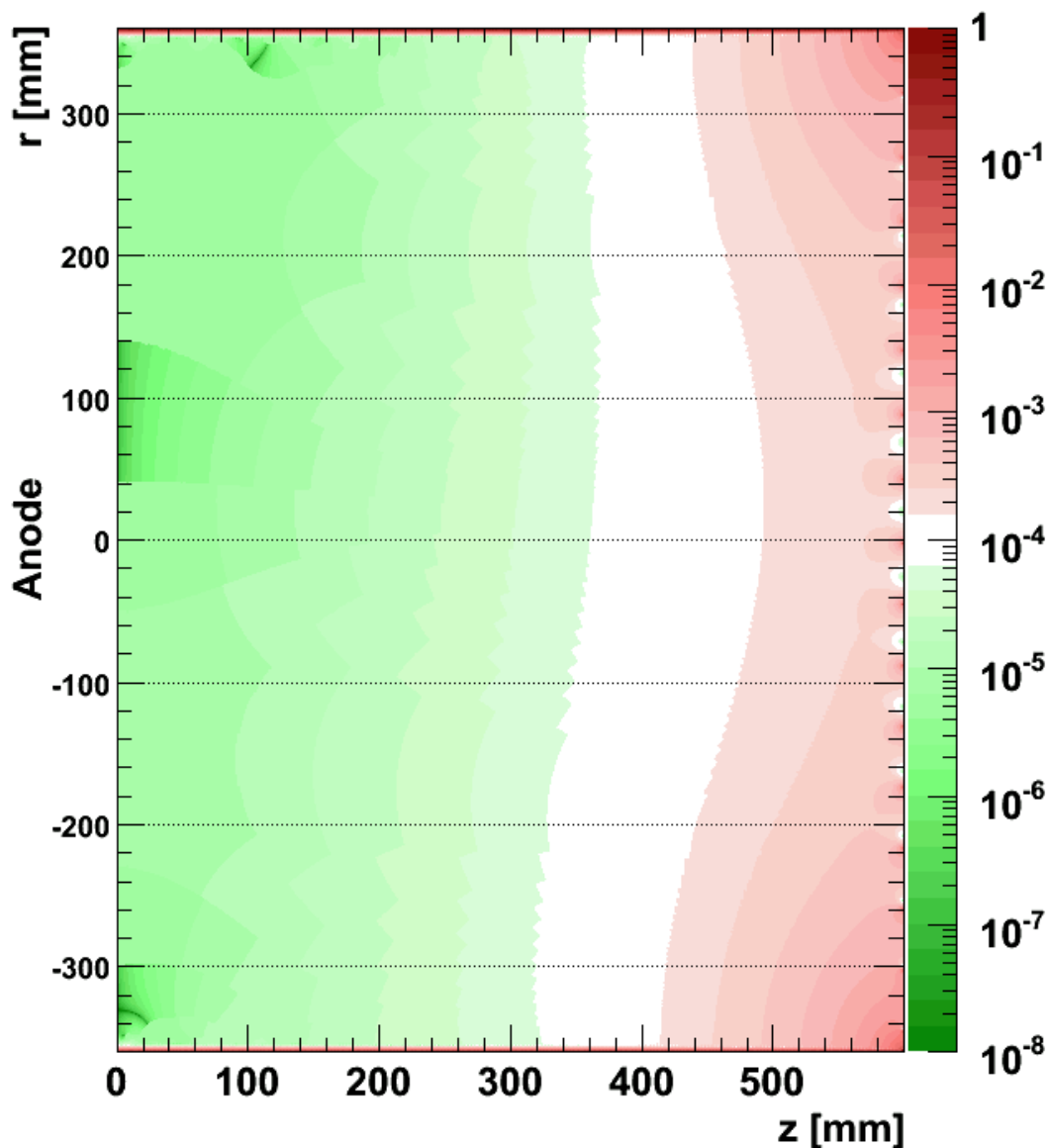
Field Calculations

- With non-perfect resistors and tilted cathode

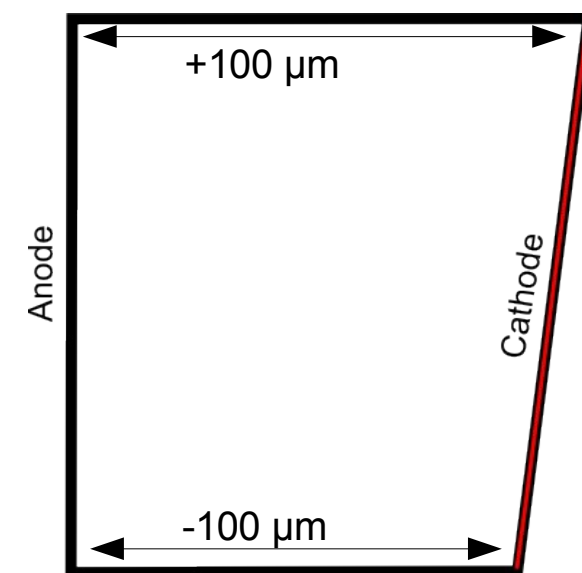
(manufacturing accuracy)

Shown:
 $\Delta E / E_{\text{nominal}}$

Goal:
 Deviations
 below 10^{-4}



■ = Value below Accuracy Limit



The Large TPC Prototype

1. Large Prototype

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3. Schedule



The Large TPC Prototype

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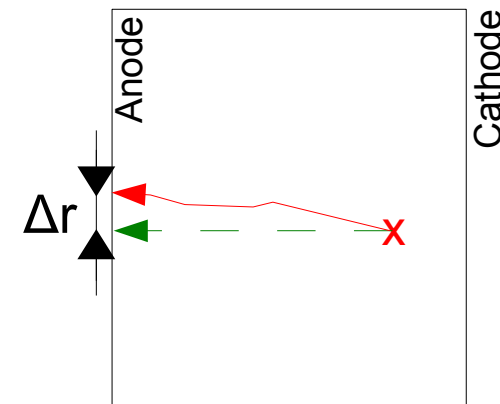
2. Infrastructure

- a) Magnet
- b) Hodoscope

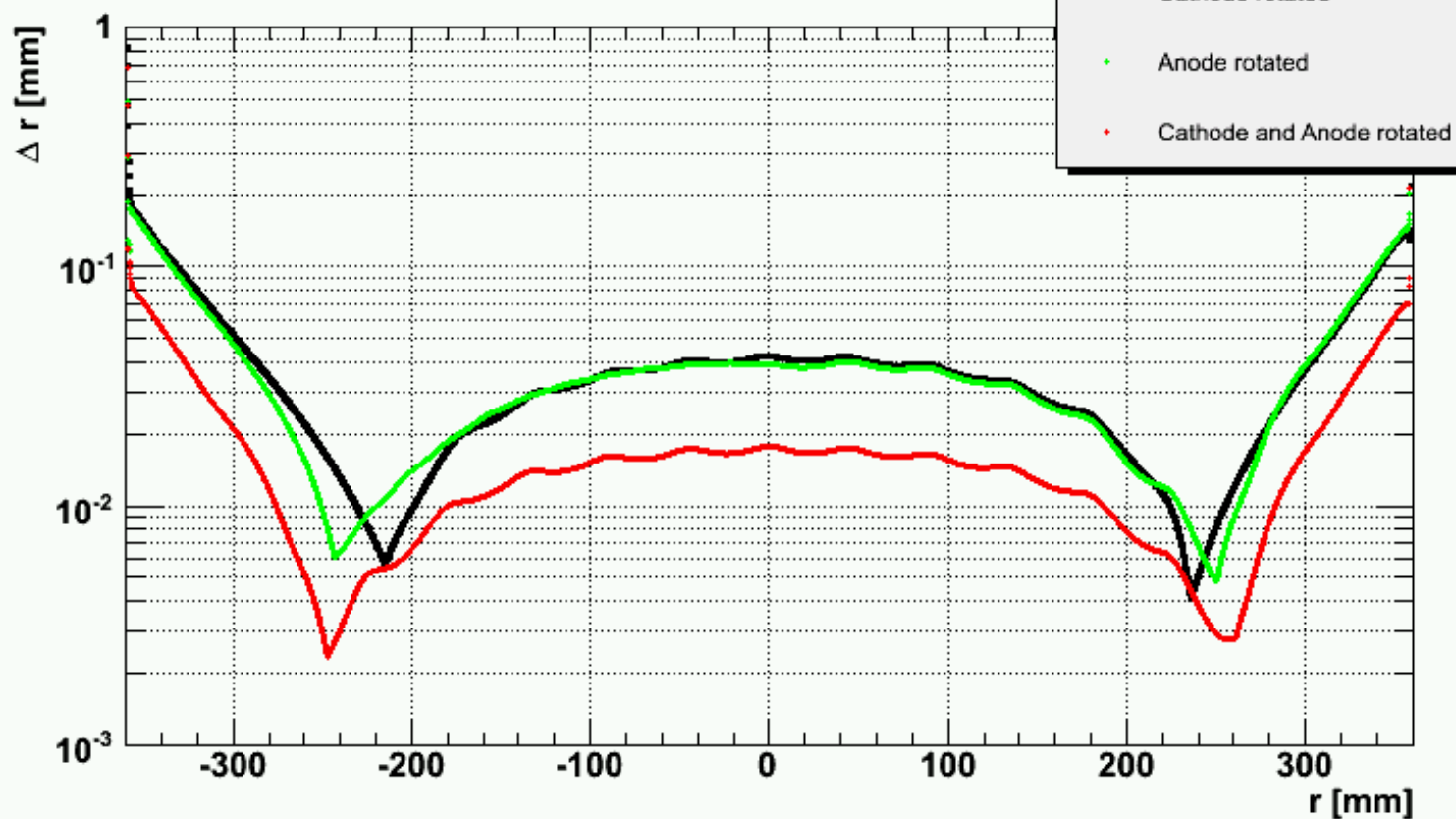
3. Schedule

Field Calculation: Effect without Magnetic Field

- Maximal Displacement in the central area well below $40 \mu\text{m}$
- At the edges: up to $100 \mu\text{m}$
- Should be corrected in reconstruction
- Calculation with magnetic field on the agenda



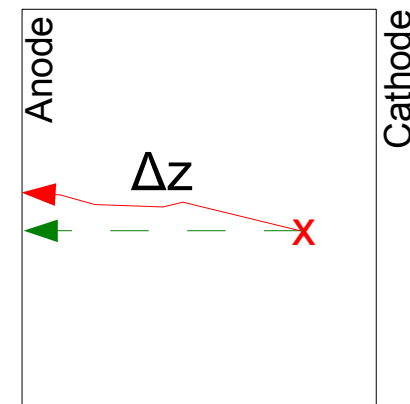
Radial displacement



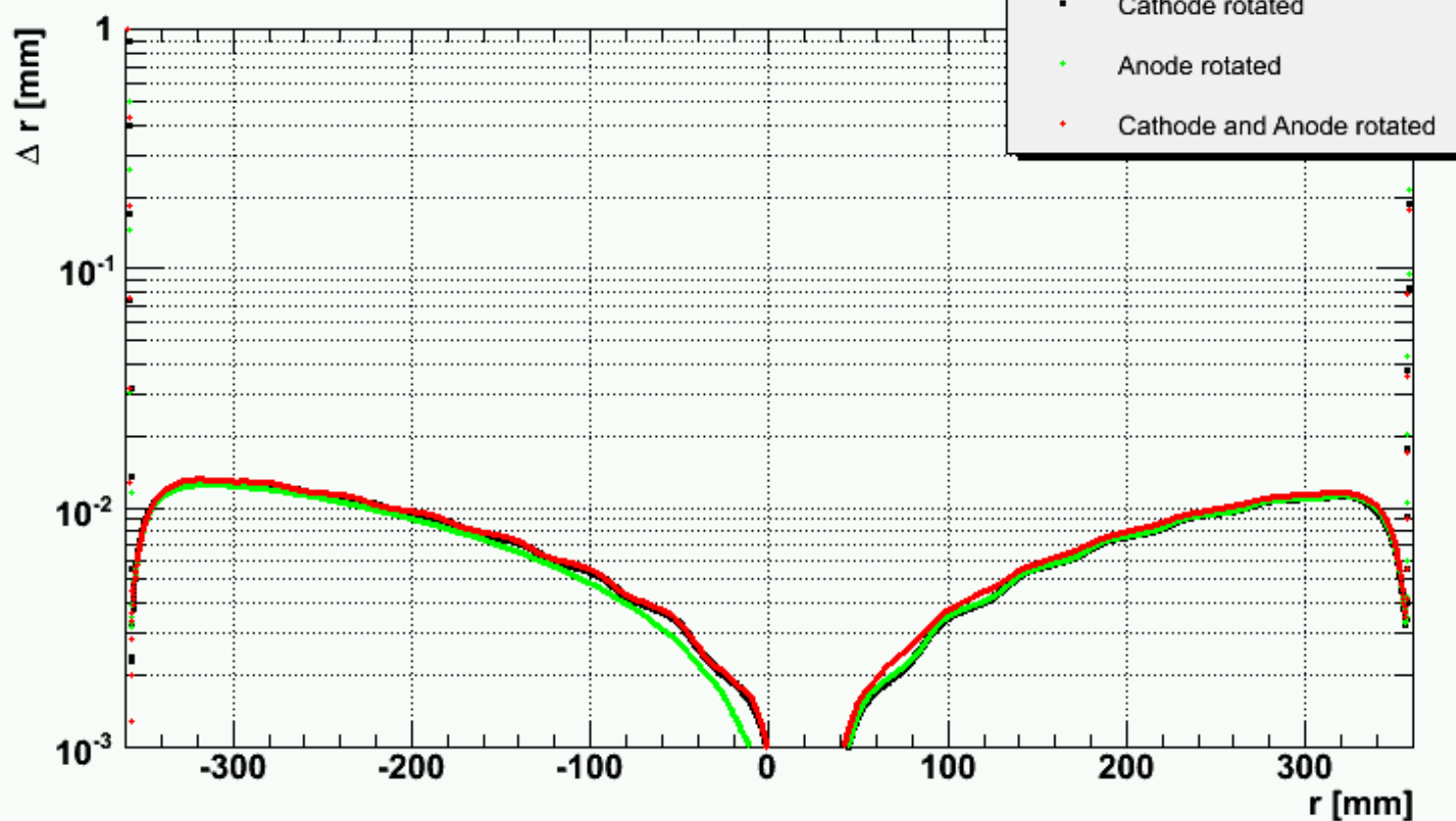


Field Calculation: Effect without Magnetic Field

- Maximal Displacement below $10\mu\text{m}$
- Calculation with magnetic field on the agenda



Longitudinal displacement



The Large TPC Prototype

1. Large Prototype

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2. Infrastructure

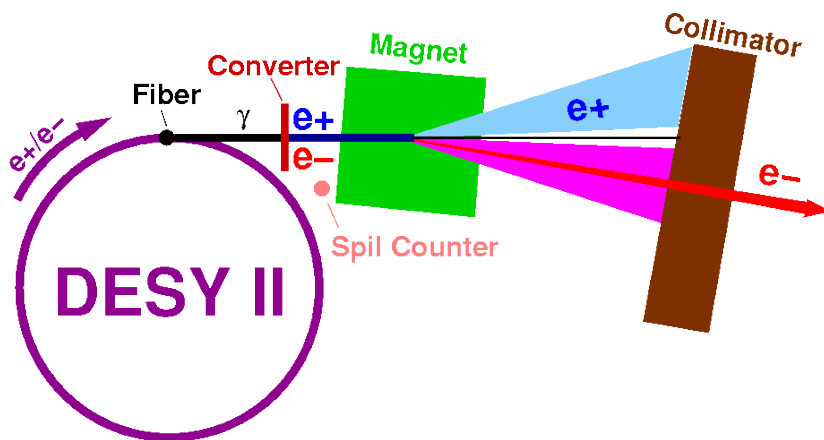
- Magnet
- Hodoscope

3. Schedule



Infrastructure at DESY

- Testbeam: electrons (1-6 GeV)

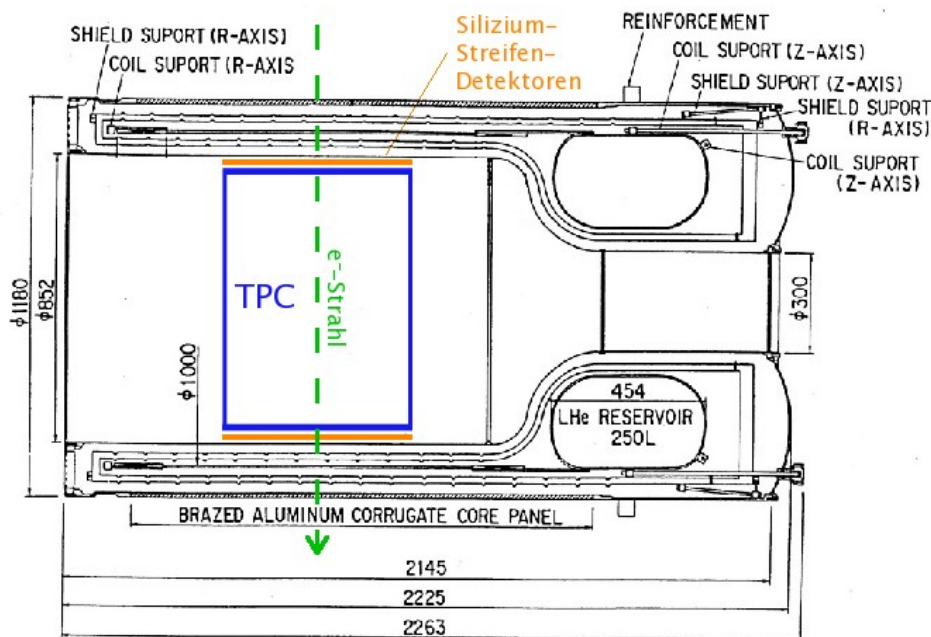


- PCMAG:

- Magnetic field up to $\sim 1.25T$
- Installed at DESY and successfully operated
- Additional safety modifications ongoing



- Sketch of TPC prototype in PCMAG



- Lifting table will be installed



The Large TPC Prototype

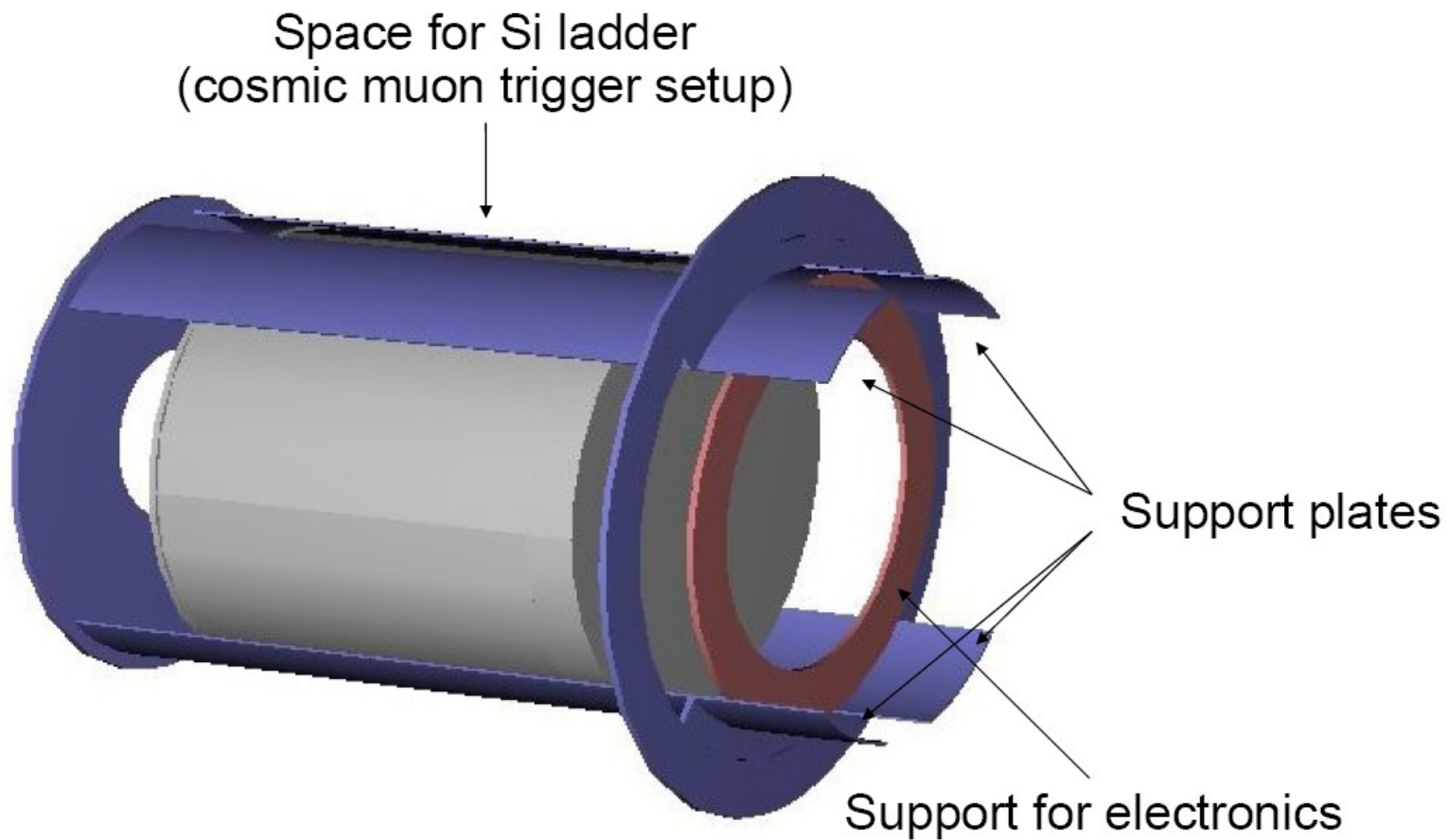
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Support Structure

The Large TPC Prototype

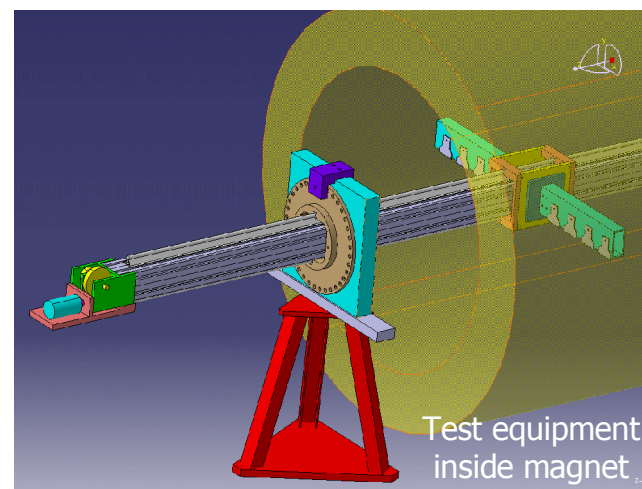
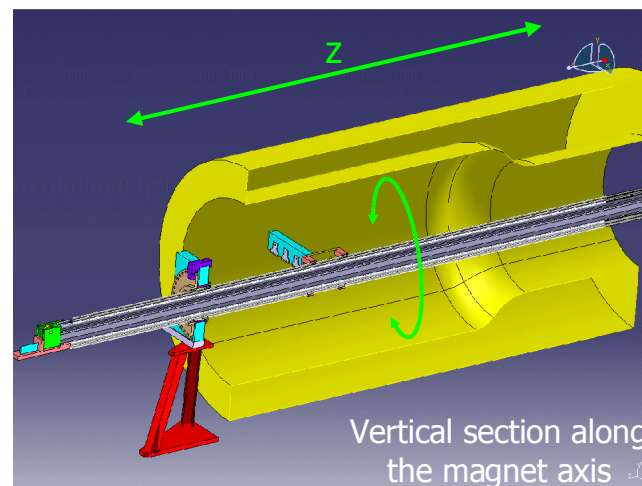
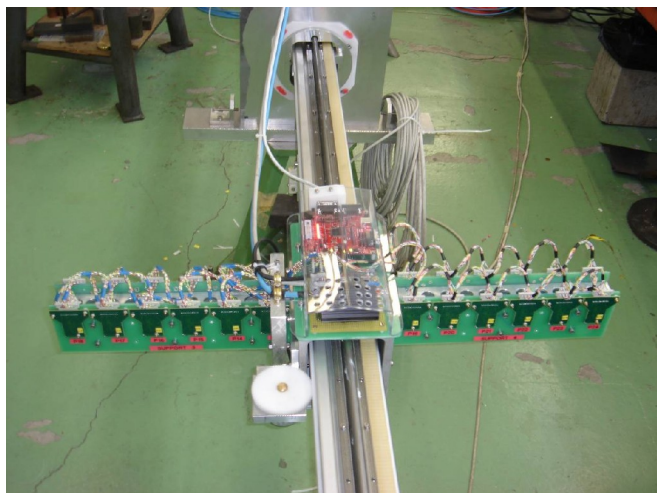
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PCMAG Field Map

- Production of a magnet field map:
Measurement finished (July 07)



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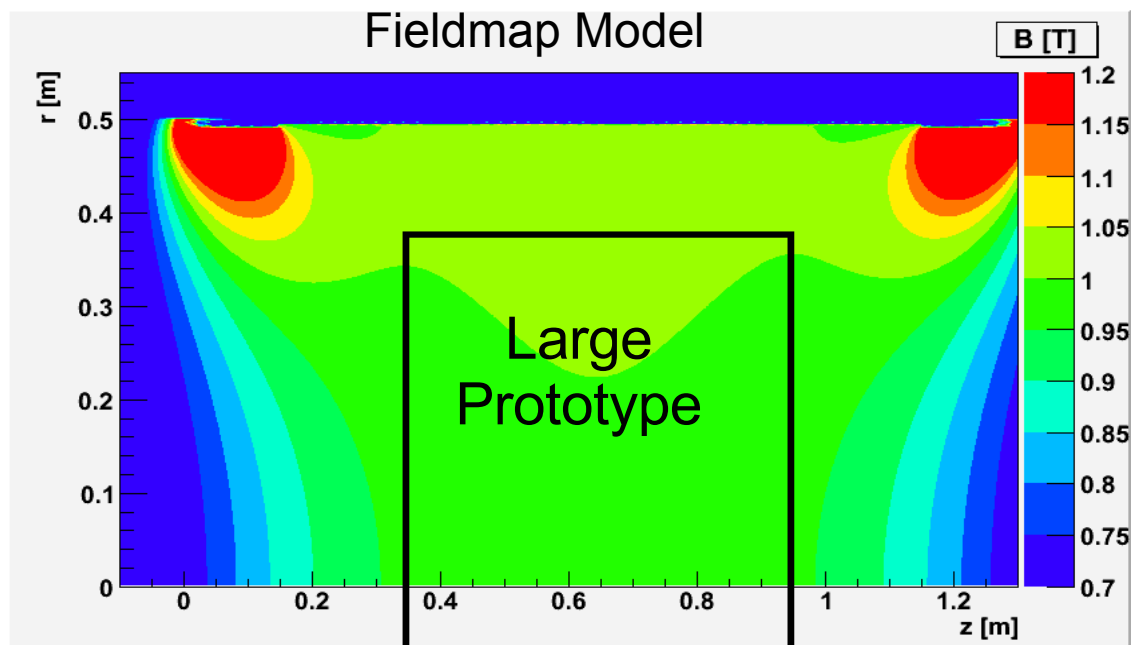
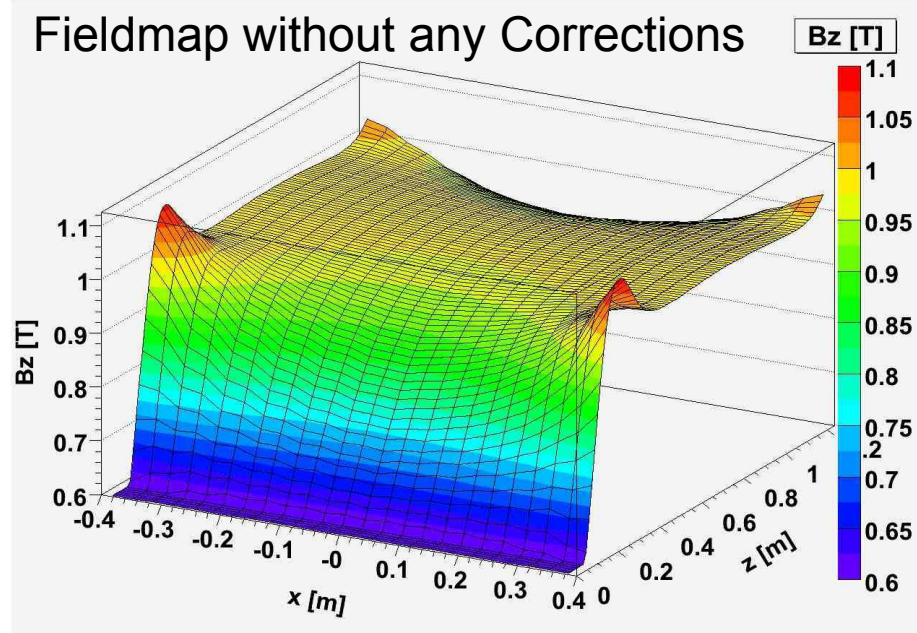
Ralf Diener,
Hamburg University





PCMAG Field Map

- Data analysis ongoing
- Plan: fieldmap finished by end of year or beginning of next year



The Large TPC Prototype

1. Large Prototype

- Drawings
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- Field

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- Hodoscope

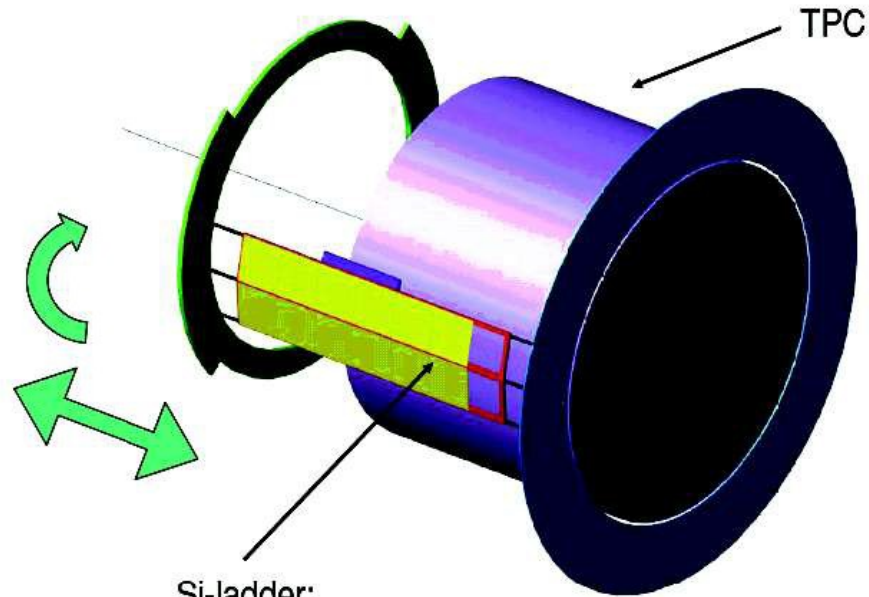
3. Schedule



Hodoscope

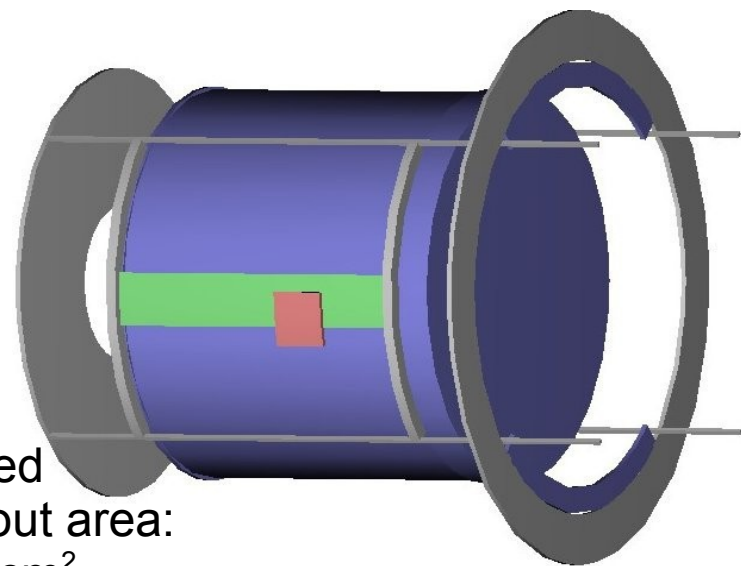
The Large TPC Prototype

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Si-ladder:
 10-12 μm in $r\phi$
 20 μm in z

- Silicon hodoscope:
 - should be “rotatable”
 - design details of support structure still under discussion
- Sensors already available
- Time constraints only allow CMS front-end and readout electronics
- New readout chip (LPNHE Paris) foreseen for the future



Limited readout area:
 38.4 cm²

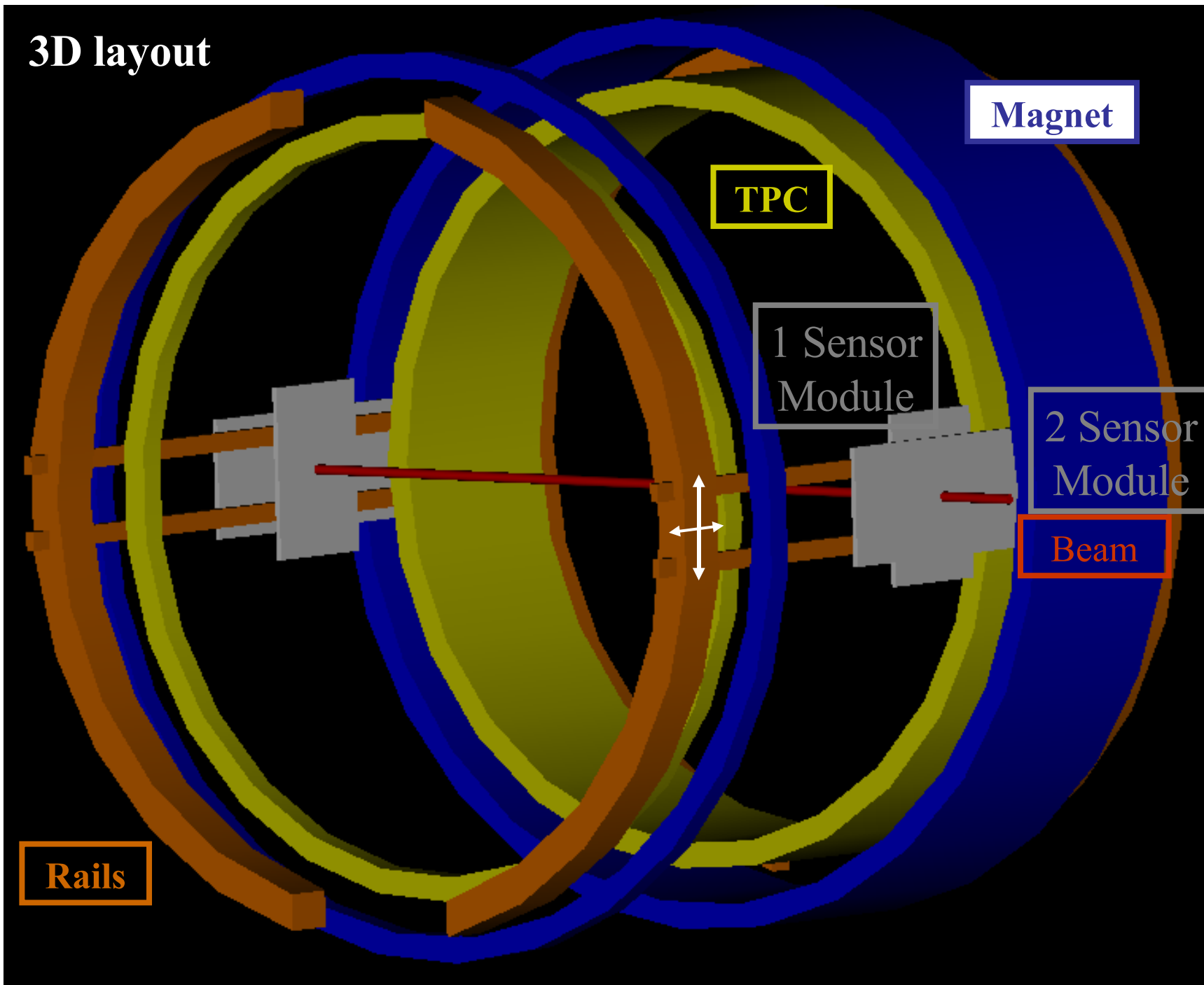
pitch	resolution	
	pitch	sigma
[μm]	[μm]	[μm]
120	35	
80	23	
50	14	
50*	10	

* with intermediate strips



Hodoscope

3D layout



The Large TPC Prototype

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Current Time Schedule

End October (this week):
Fieldstrip foil at DESY

Until end of
October: soldering
of resistors on foil

December: simple
Cathode ready

Until mid November:
production of field cage

Beginning of Dec.:
field cage at DESY

Testbeam T24
starting July
2008



2007

2008

November: trigger
hardware in France
for testing

Dec. / Jan.:
magnet field
map ready

Jan./Feb. :Silicon hodoscope
support structure ready,
begin of installation

Jan./Feb.: Trigger setup at
DESY testbeam

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