

The Large TPC Prototype: Infrastructure/ Status/ Plans

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For the LC-TPC collaboration

- Status of the test beam infrastructure
- Status of the Large Prototype Field Cage and Commissioning work

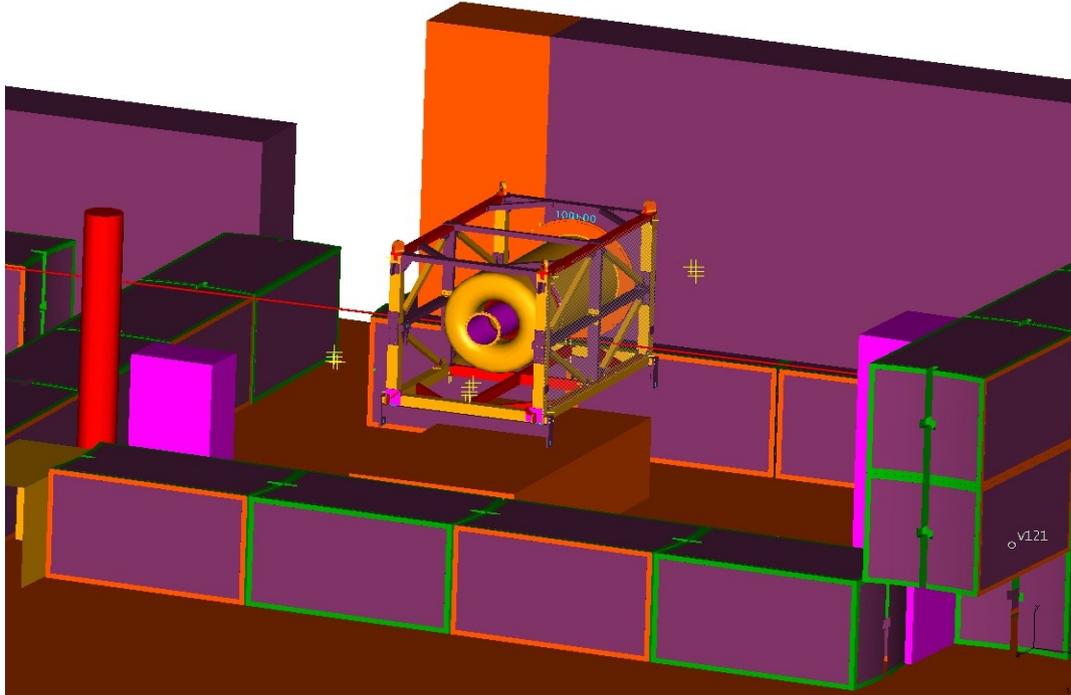
Many thanks to the many contributors to the LP TPC test beam effort
from many different institutes

Goal

Build an infrastructure to do extensive and in depth tests of different gas amplification systems in a TPC

Build a prototype to measure and compare different amplification systems in a TPC for a precision collider experiment at the ILC

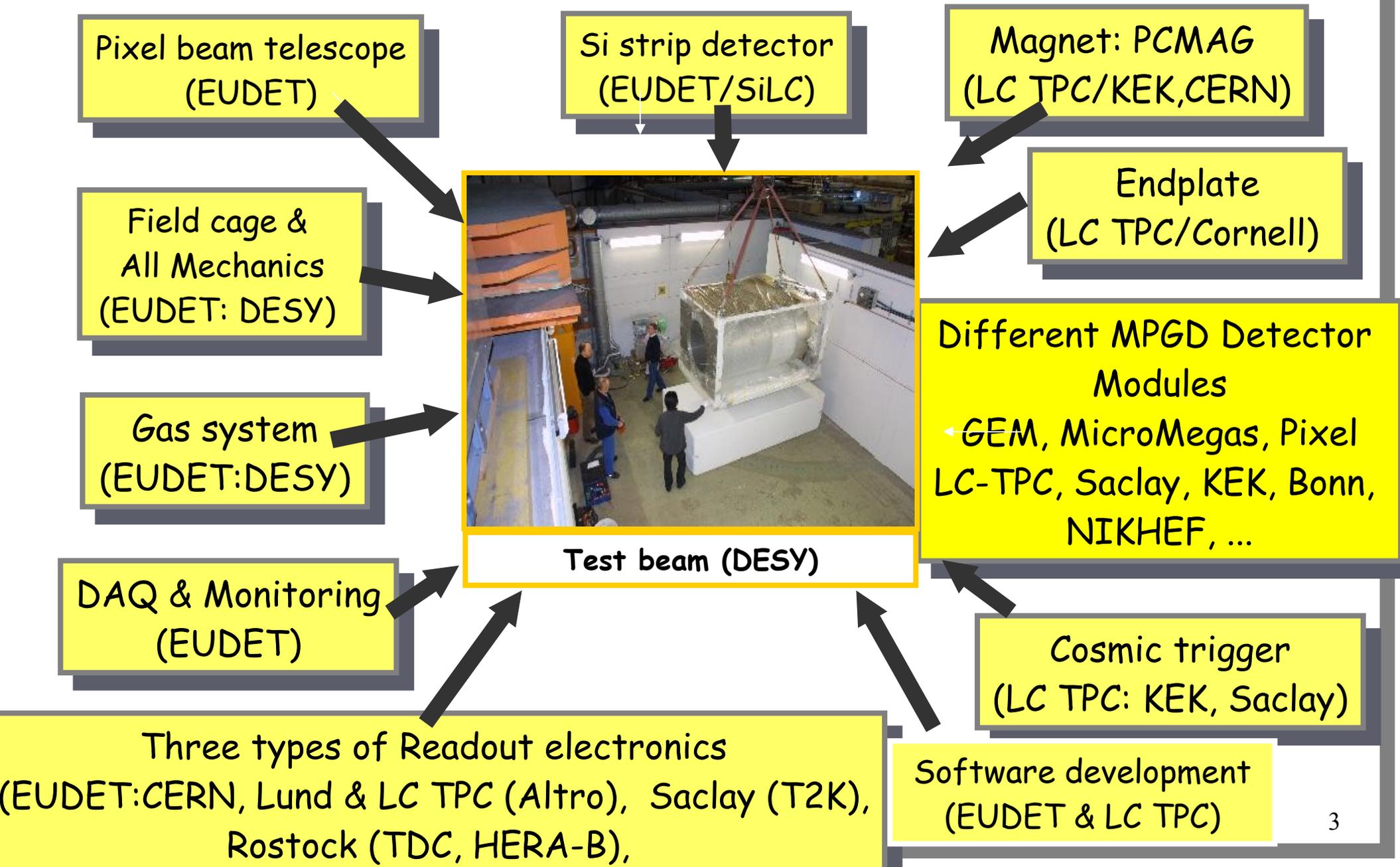
Demonstrate the feasibility of a MPGD TPC in a linear collider experiment



Initial installation and operation in DESY test beam

Possibly move to hadron beam later

LC-TPC facility

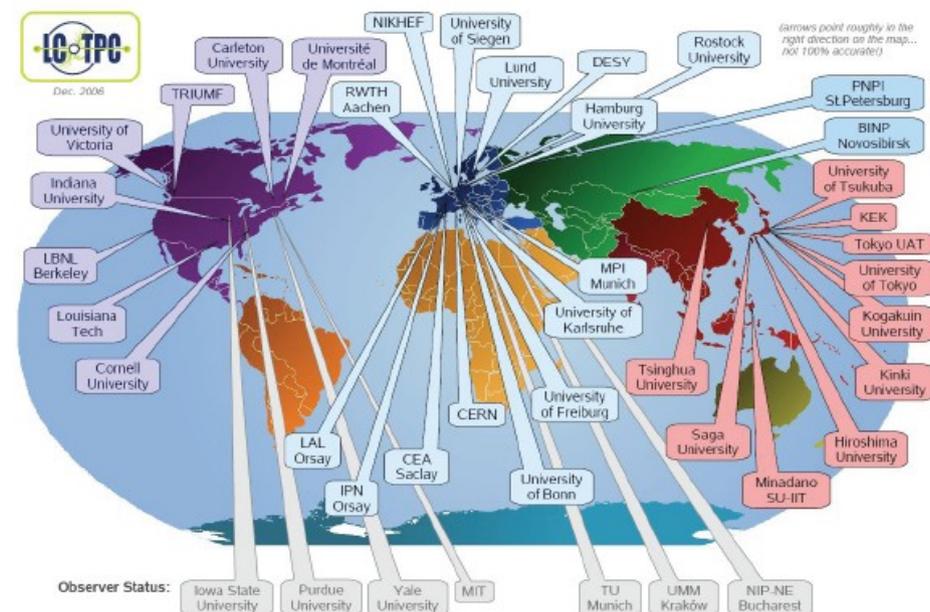


Financial Sources

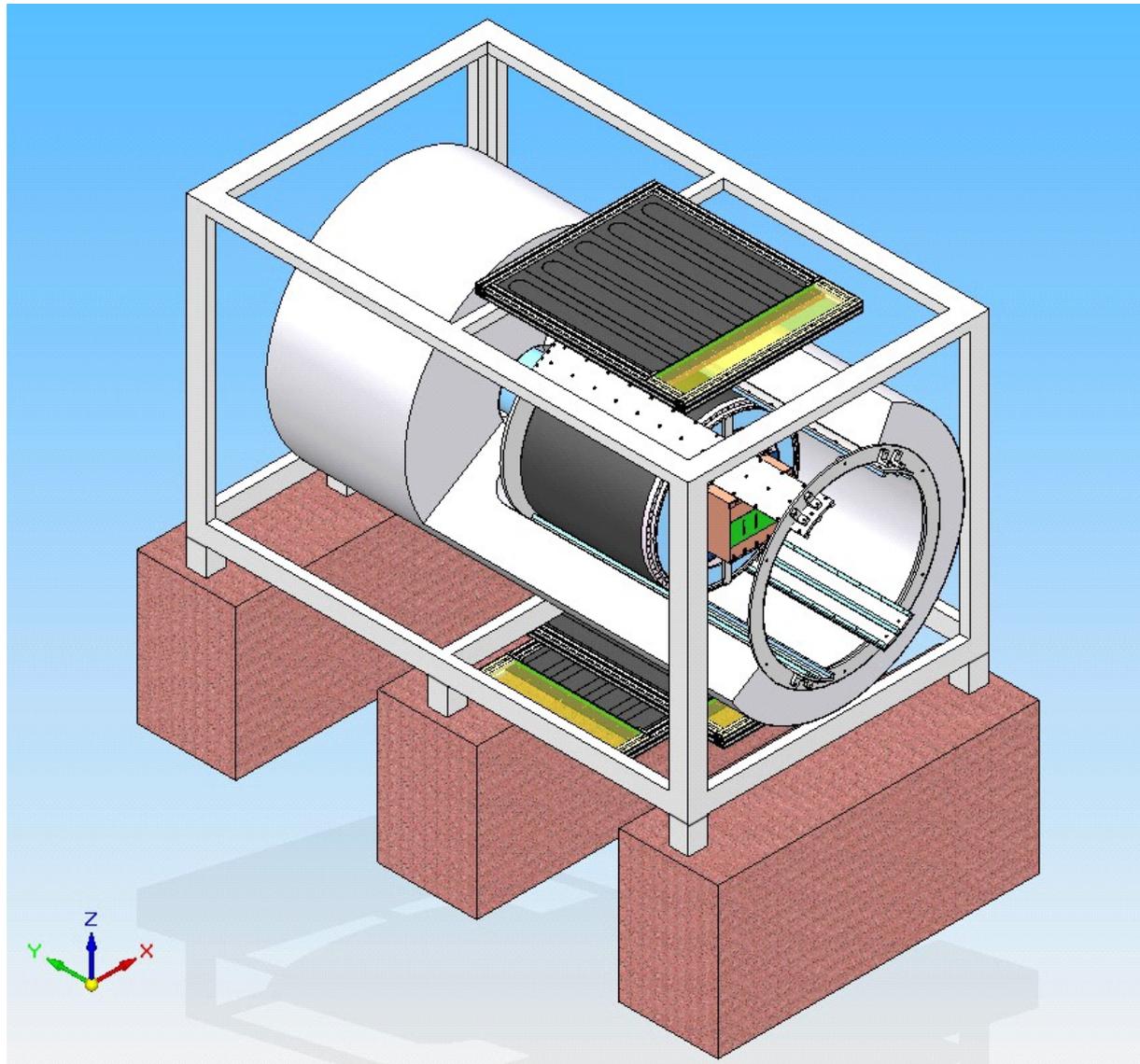
Financing comes from many different sources

- ➔ National funding agencies in many countries
- ➔ European funding (EUDET) for large part of infrastructure
- ➔ Organization and coordination mostly done within LC-TPC

Broad international project



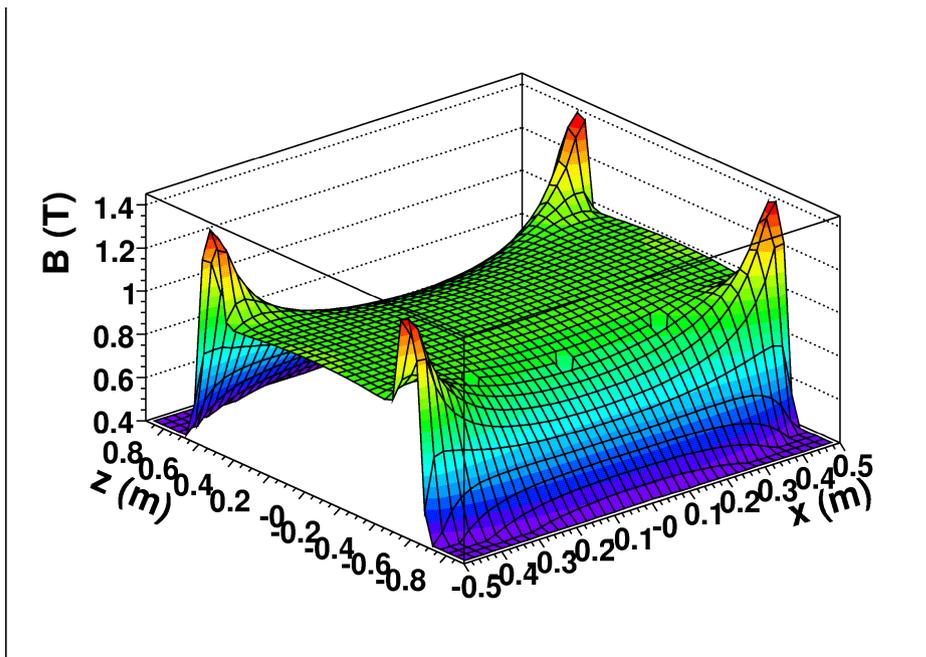
PCMAG: magnet infrastructure



Status Magnet

Test excitations of the magnet successfully done

B-field precisely measured by CERN group (EUDET) and analyzed in Diploma thesis by C.Grefe (Uni HH/ CERN)



Plot of the parametrized
Field in PCMAG,
Based on measurements

Errors $O(10 \text{ G})$ point by point

Problems Magnet

PCMAG was installed at DESY long ago -

Still some problems with the operation of the facility:

- No final safety approval: operating under a temporary permission which means some limitations to the operation
- No integration of the magnet controls into the central LC-TPC controls (yet)
- Expert problem at DESY for the magnet operation (lost the designated person this summer, still looking for a replacement)

Nevertheless: magnet is ready for operation, first cosmics with field expected next week with MicroMegas modules

Status Infrastructure

- Magnet installed and operational
- Movable stage: no ready yet, contract has gone to vendor, expected early 2009
- Stage control: being built
- Slow control available with basic functionality (will be installed in beam shortly)
- Overall beam infrastructure: ready for beam

Beam availability at DESY:

Beam will be available for most of 2009

Some problems with supply of liquid Helium in second half of 2009 due to rebuilding of the DESY Kryo plant: solution is in sight.

For more details: see Ingrid Gregor talk in test beam session

Field Cage

Large Prototype: common project of EUDET and LC-TPC

EUDET:

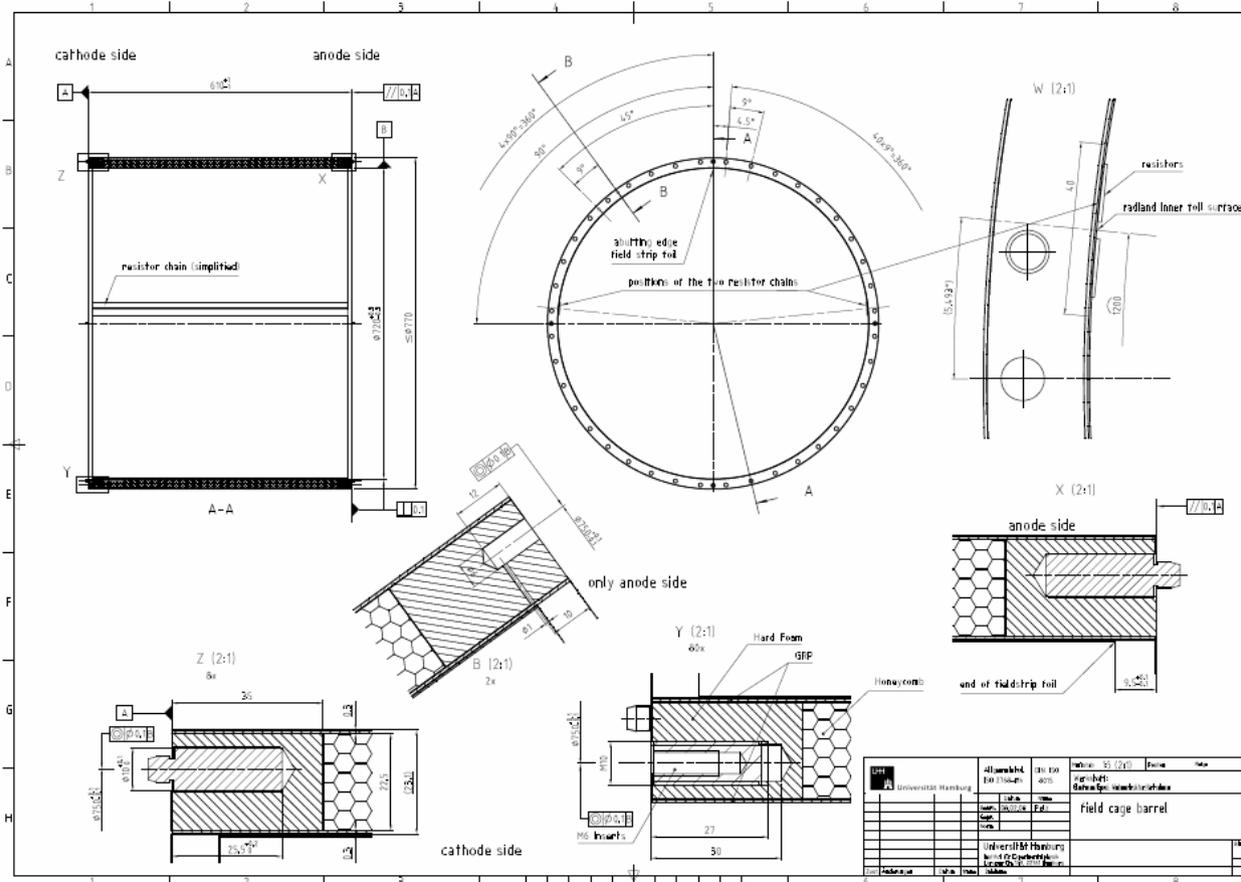
- Low mass field cage
- First level engineering model for the real thing

Endplate: (see talk by Dan later in this session)

Stage 1: high mass endplate to provide support for different readout modules

Stage 2: low mass endplate as engineering model for the real thing

Field Cage Design



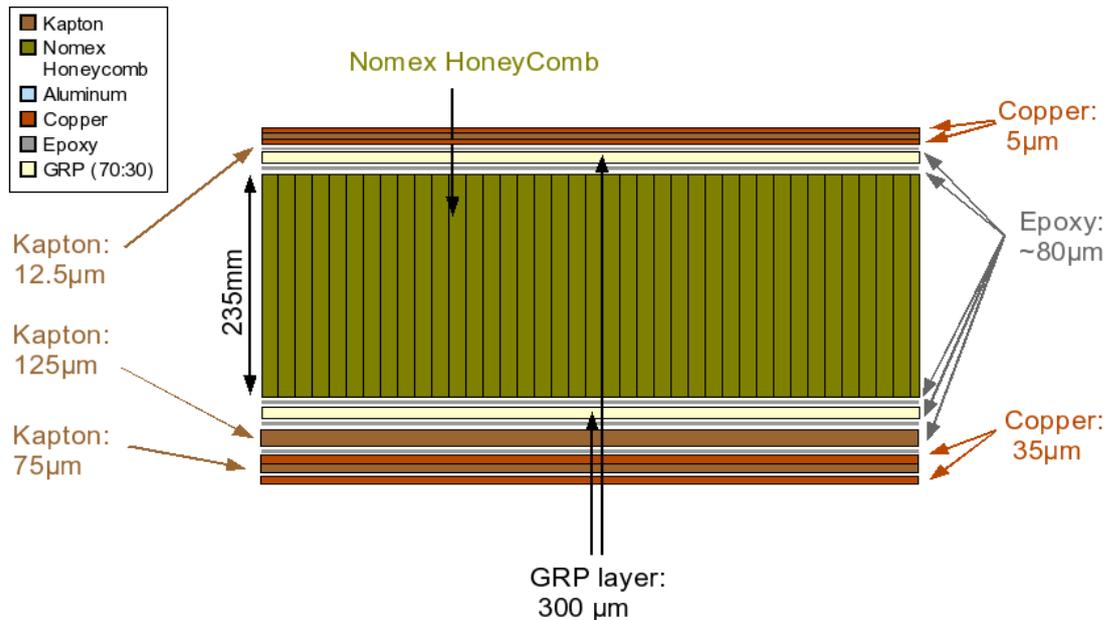
P. Schade, DESY

Size of field cage is optimized for magnet infrastructure
 Outer diameter 770mm, length 610mm (drift approx. 580mm)

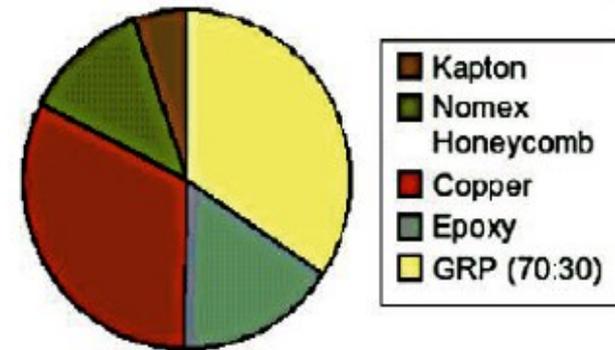
Field cage Materials

Goal: light weight structure

- Minimize multiple scattering in test beam experiment
- Do first level engineering test of light weight structures



Radiation Length: 1.31% of X_0

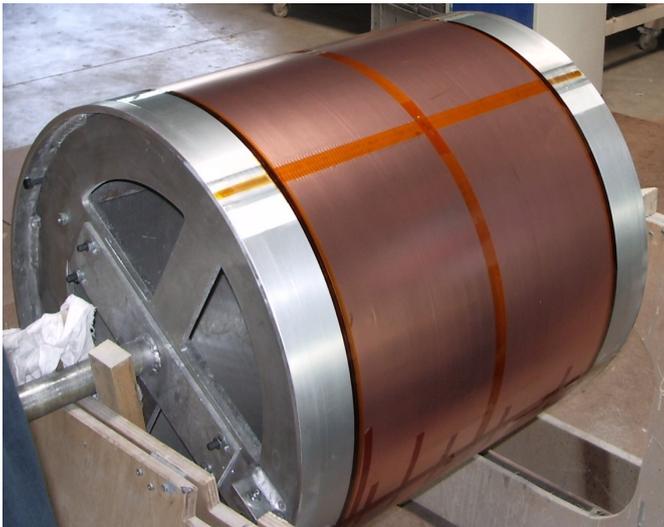


Material budget per wall

Field Cage Construction

Field cage:

designed at DESY (P. Schade), built in industry in close cooperation with DESY



Building the cage on the form in the company

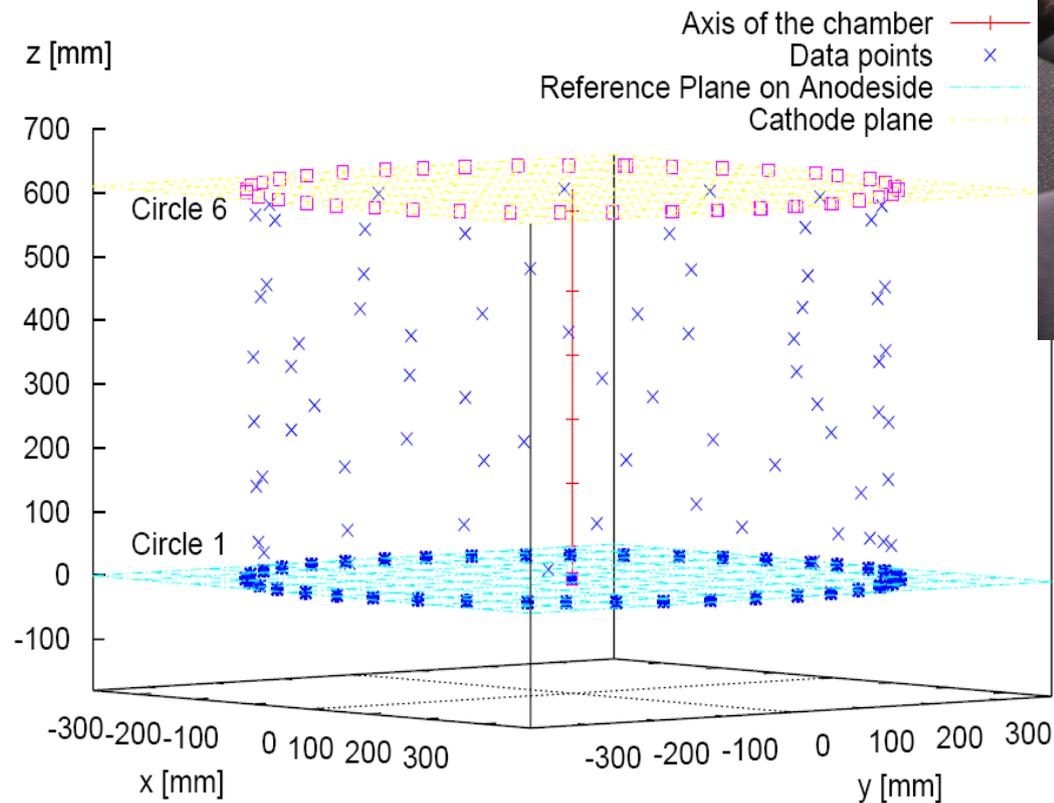


Receiving and testing the field cage at DESY

Significant delays in the building of the field cage due to technical problems in industry

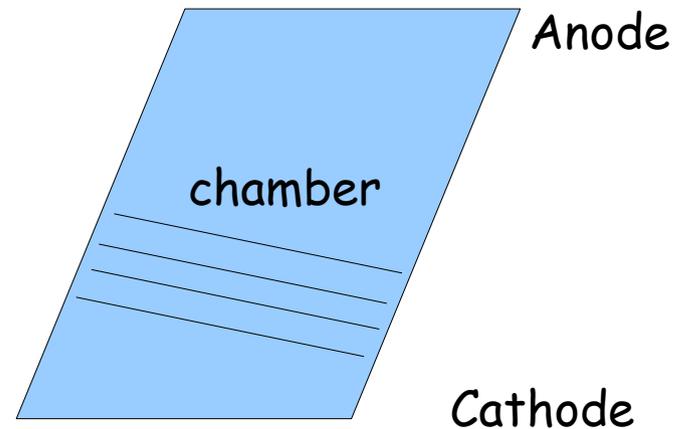
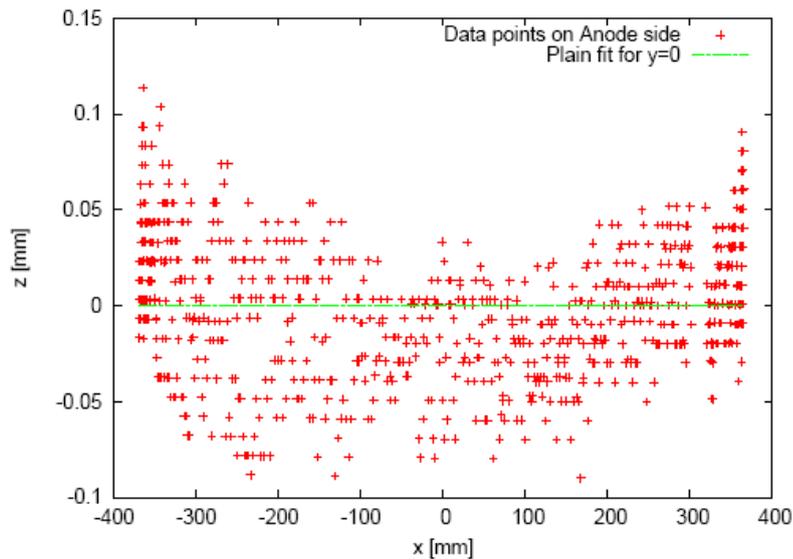
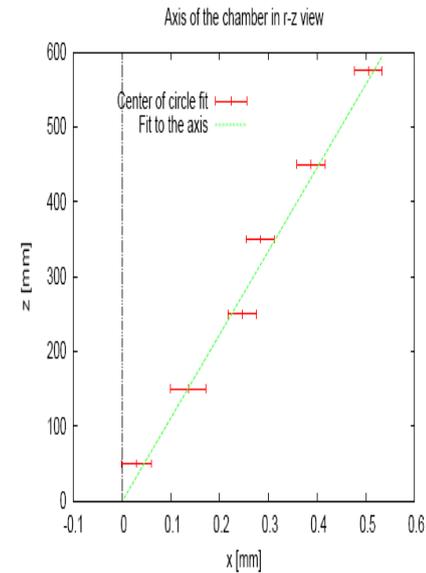
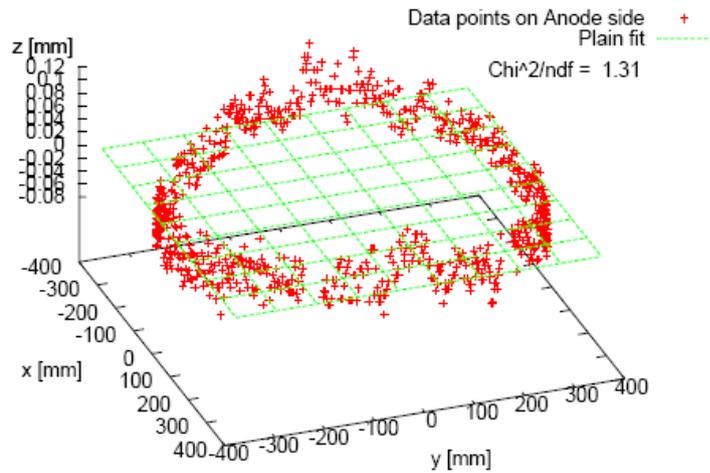
Survey of the field cage

Check the relative precision of endplates to each other and alignment



Intrinsic measurement precision per point: around 20 μm

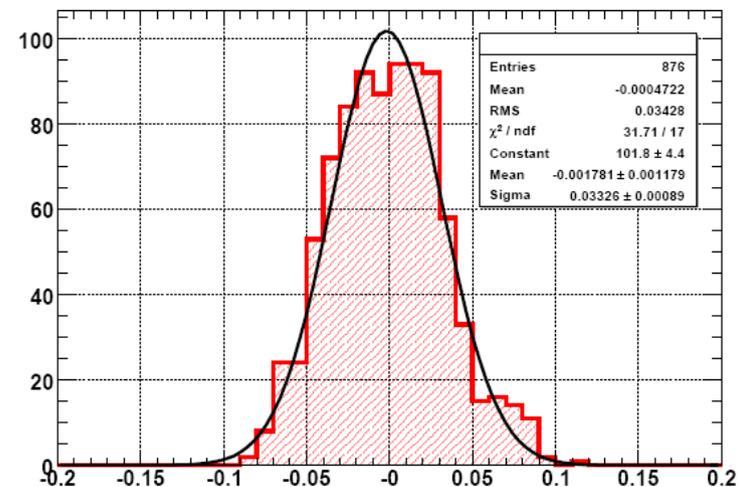
Results of Measurements



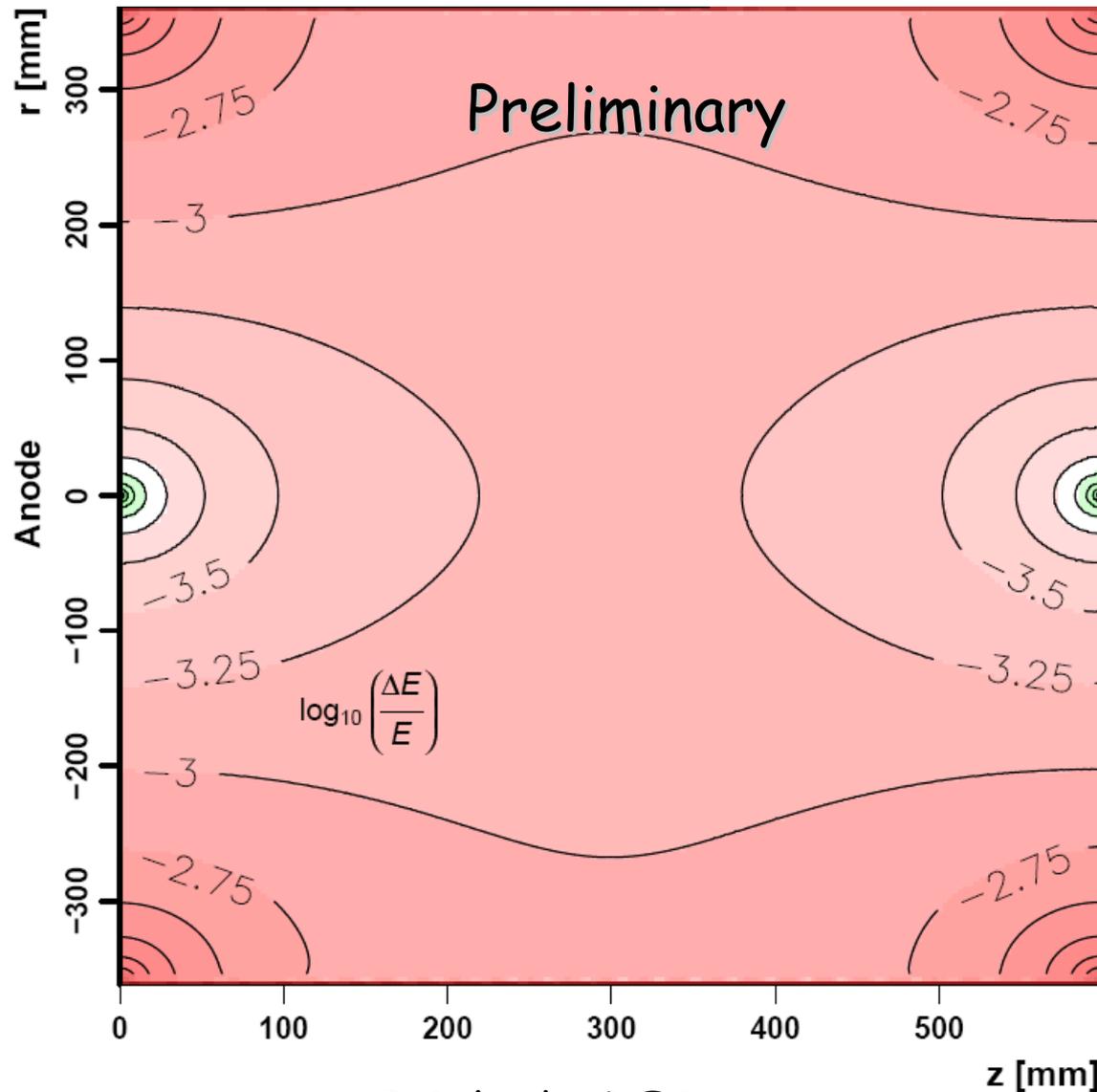
Precision

- Parallelism: better than $10\mu\text{m}$
- Skew angle of field cage: 1 mrad (20% error)
Offset anode - cathode: $(540\pm 40)\mu\text{m}$
- Flatness of anode / cathode surface: approx. $35\mu\text{m}$

Distribution of measured points on the cathode surface relative to fit plane



Impact on Electric Field



Field deviations
relative to the
default value

Precision is
Few 10^{-3}

(have missed the
goal ...)

P.Schade, DESY

Ties Behnke: Large TPC Prototype

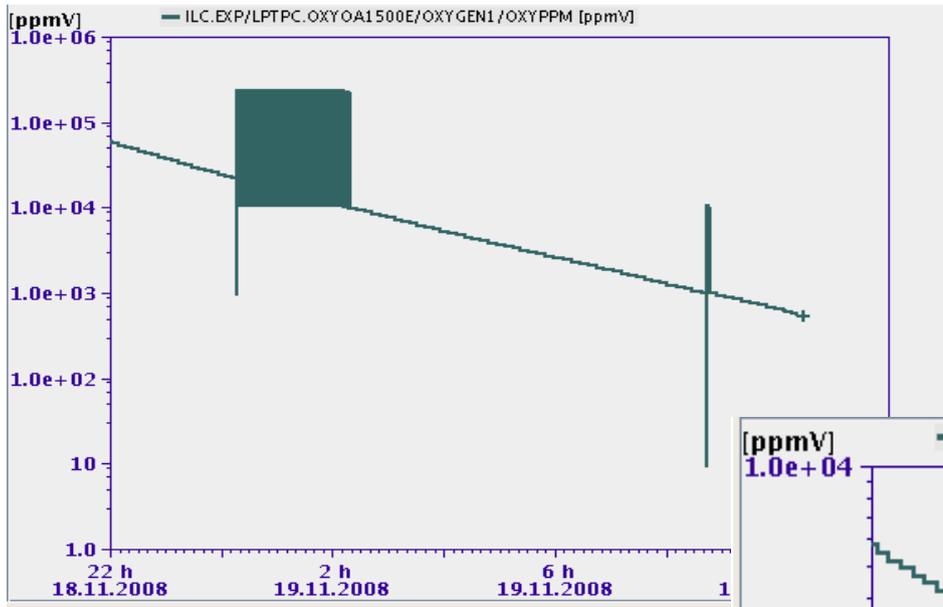
Commissioning

Commissioning of large prototype has started at DESY

- Endplate and cathode have been mounted
- Gas tightness has been established
- HV test are happening

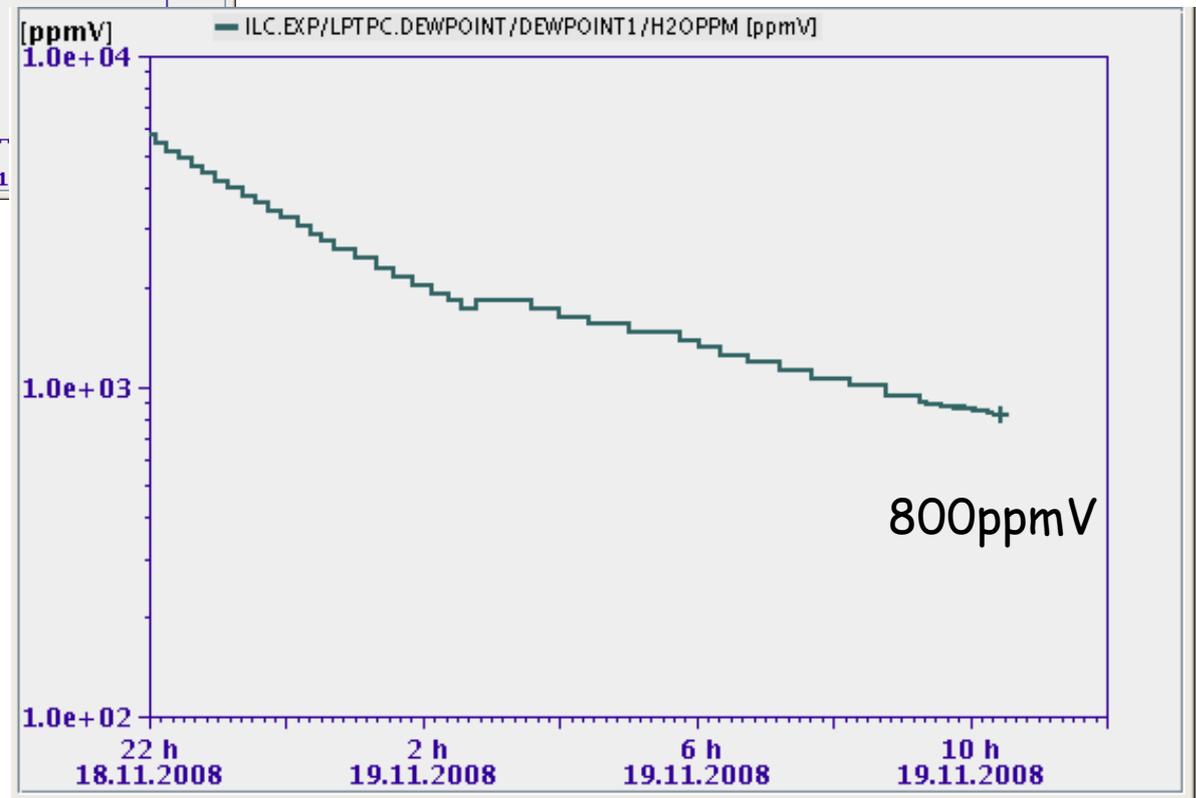
Problems should be sorted out within the next few weeks

Gas Quality



Oxygen content during
Flushing of chamber

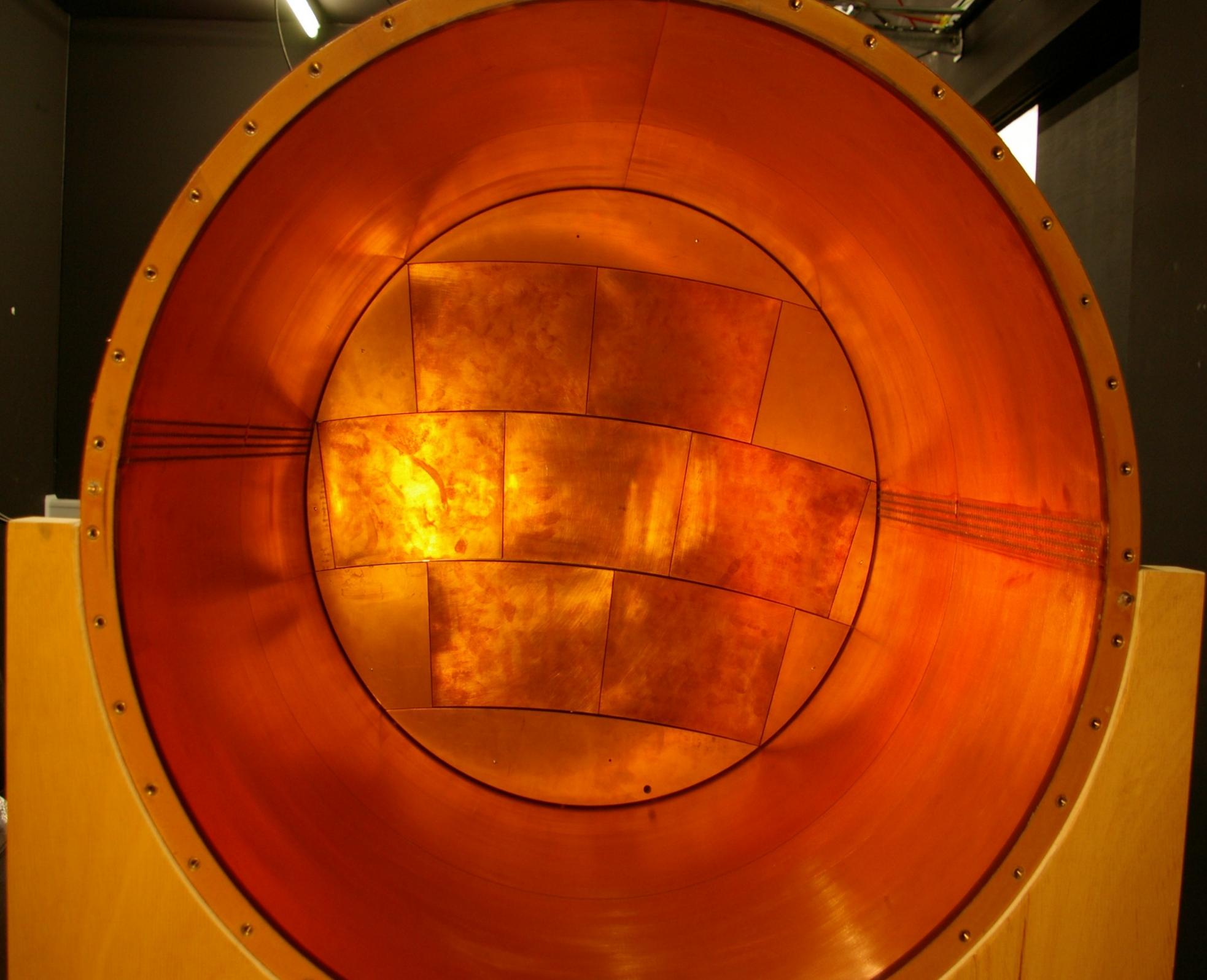
Water content
During flushing



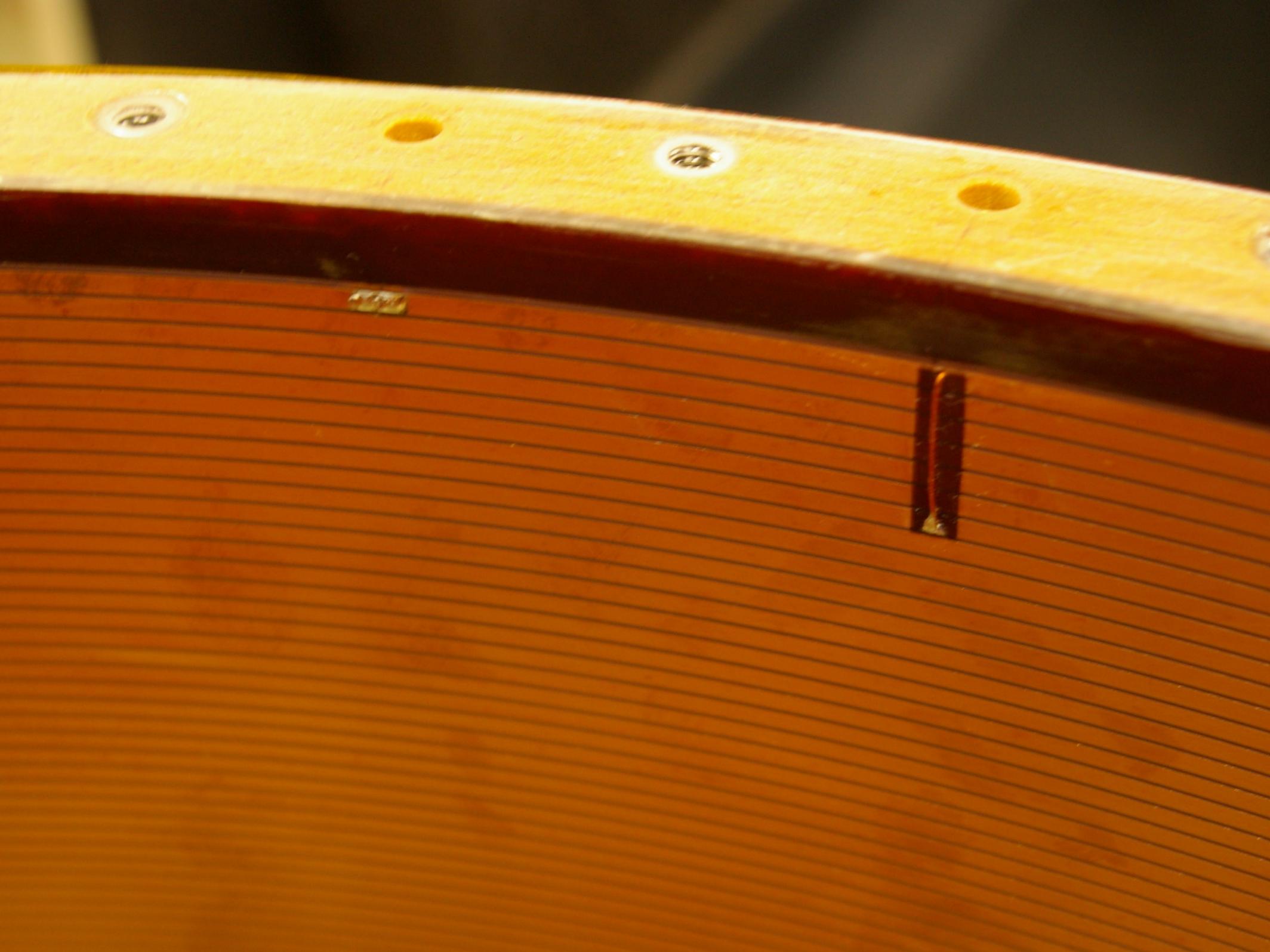
800ppmV



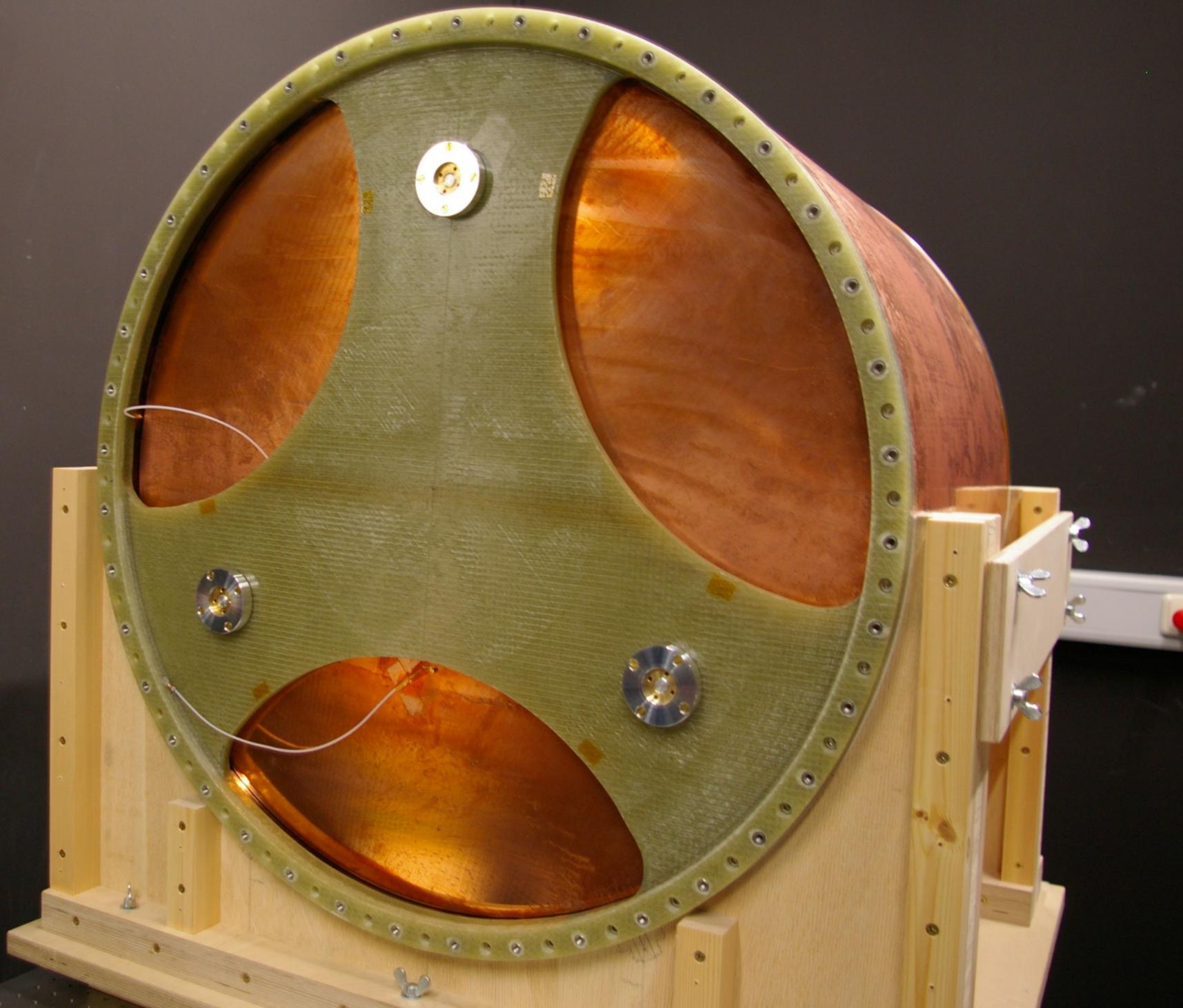


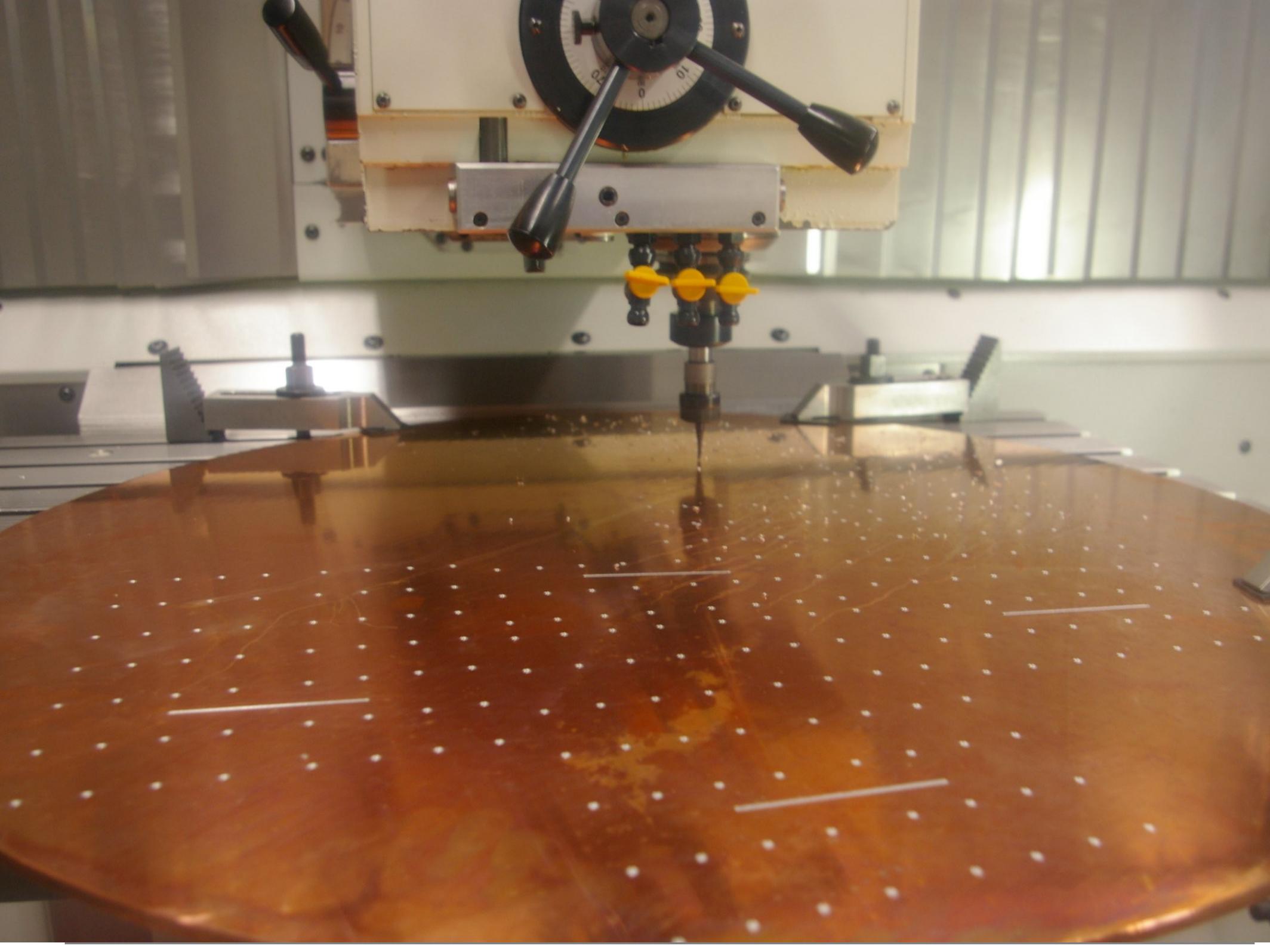












Summary

Test beam infrastructure at DESY is operational

Except for minor issues system is finished

Field cage commissioned and under test

First operation of field cage expected before the end of the year

Many thanks to the different groups
who have made contributions to the setup

This is a truly international effort!