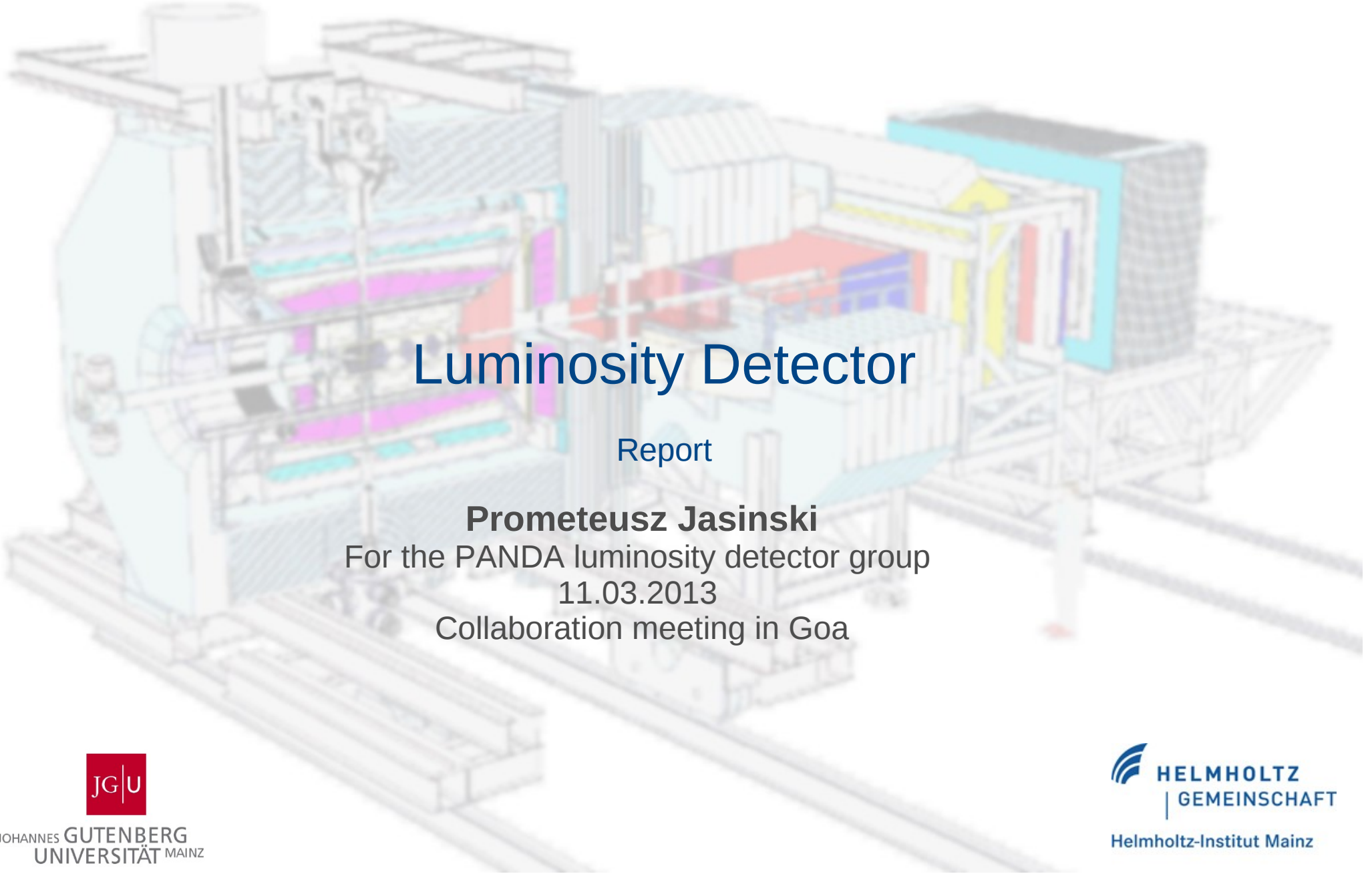


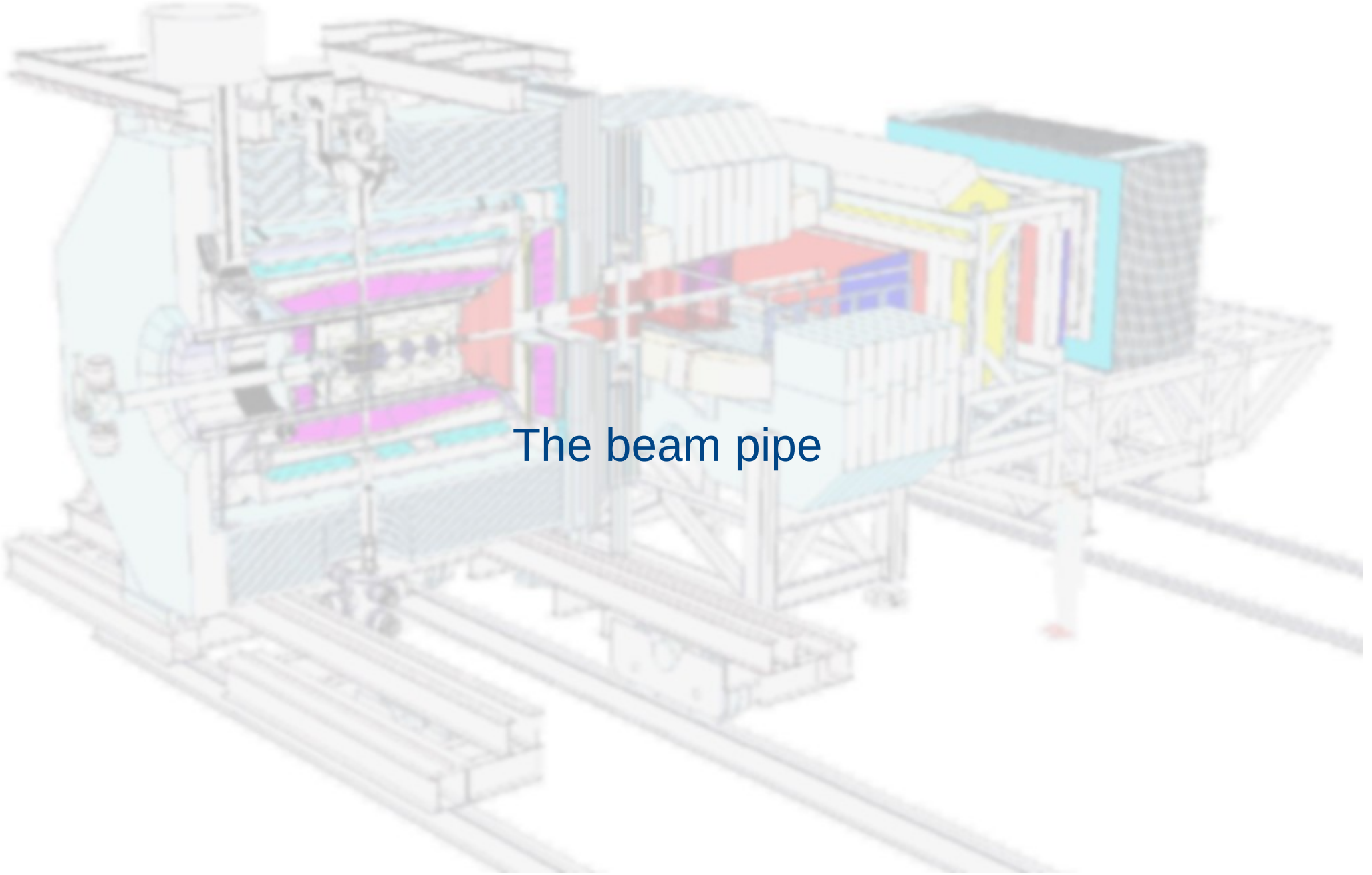
Luminosity Detector

Report

Prometeusz Jasinski
For the PANDA luminosity detector group
11.03.2013
Collaboration meeting in Goa

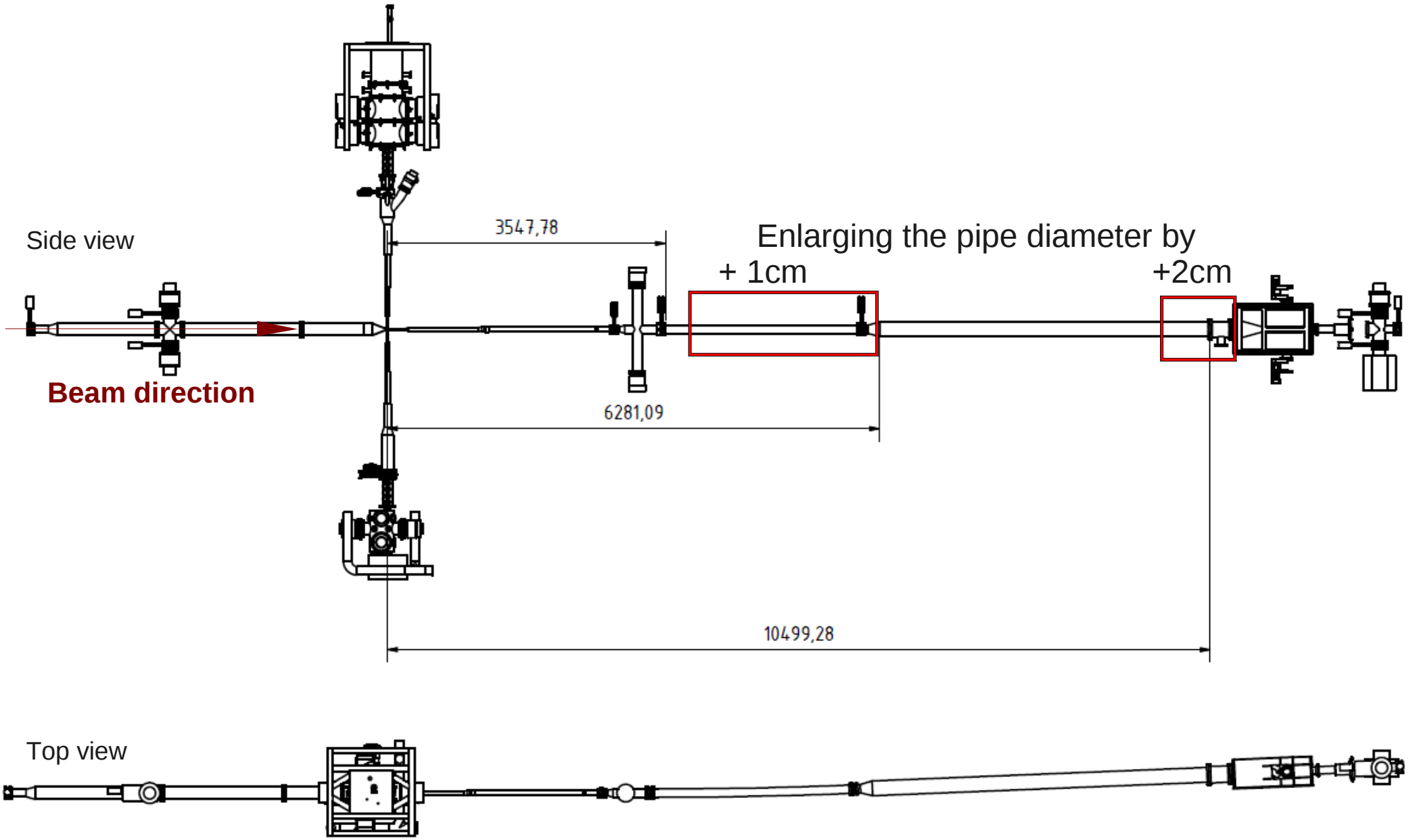
JOHANNES GUTENBERG UNIVERSITÄT MAINZ

HELMHOLTZ GEMEINSCHAFT
Helmholtz-Institut Mainz

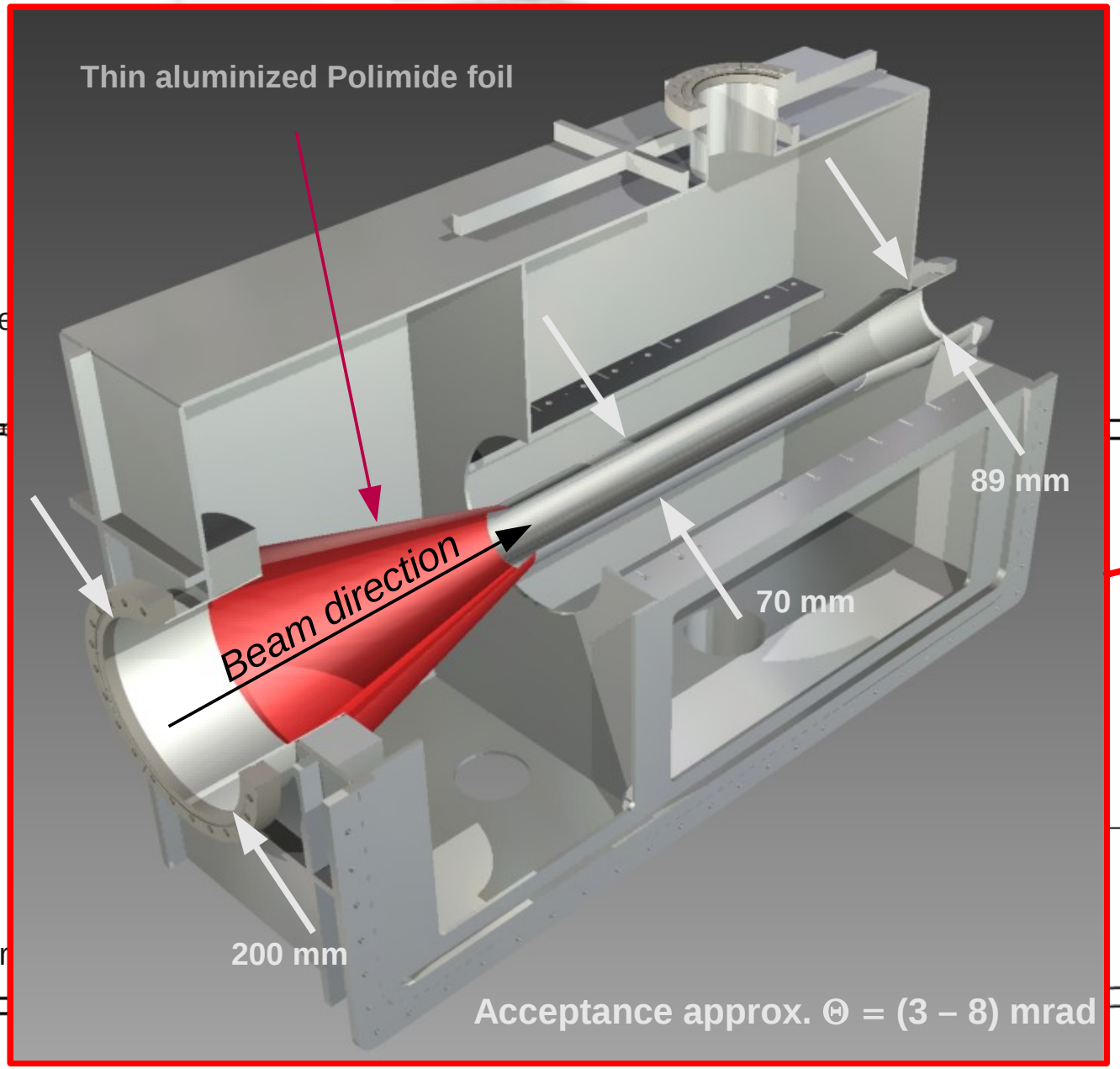


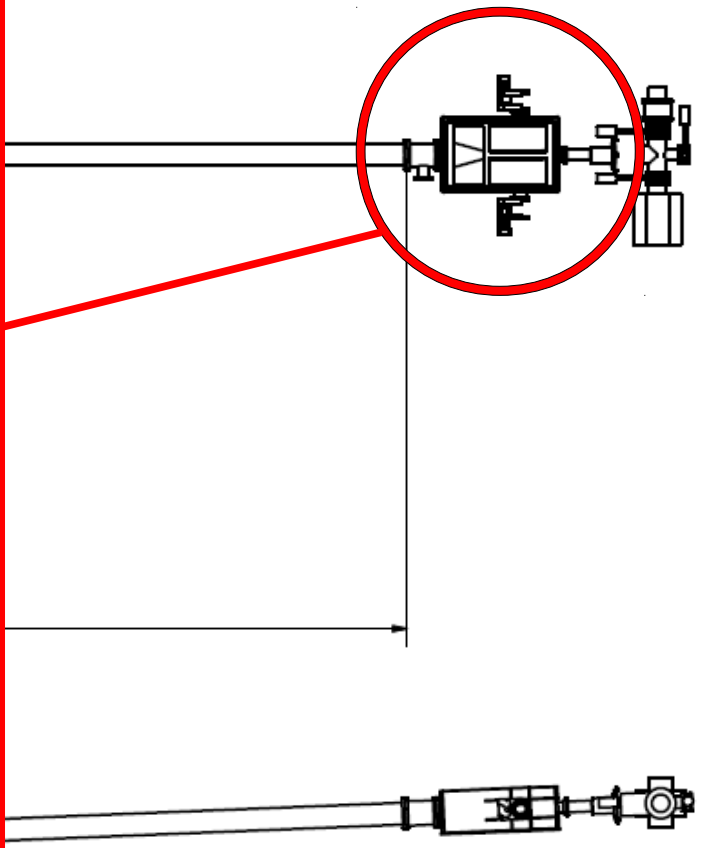
The beam pipe

Modifications to the beam pipe



Beam pipe dimensions in the detector region

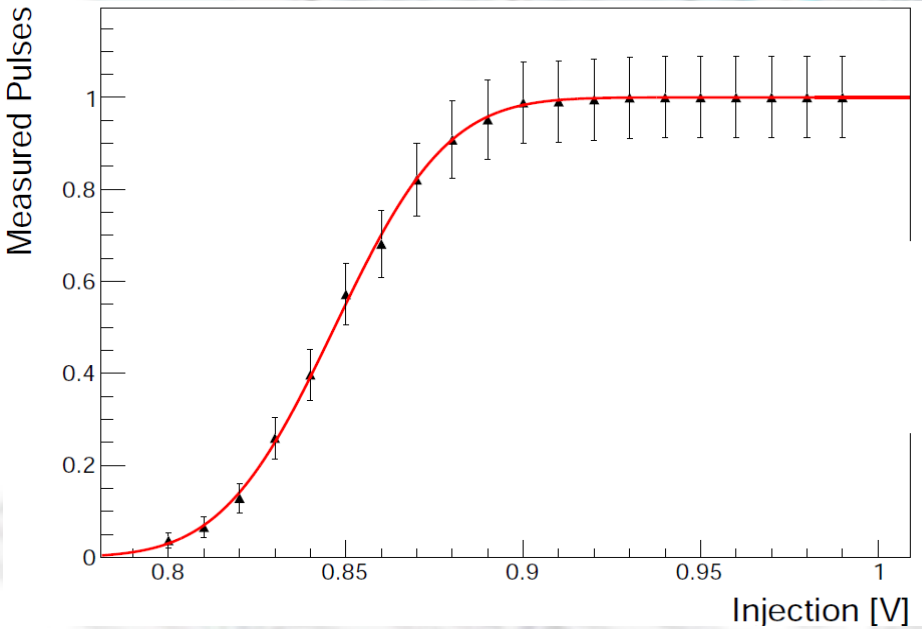




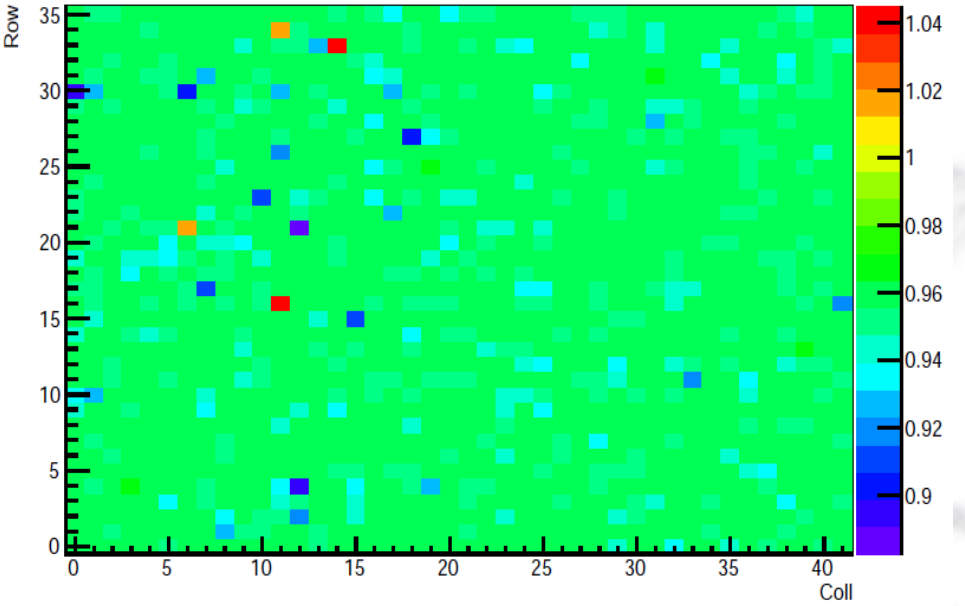
HV-MAPS

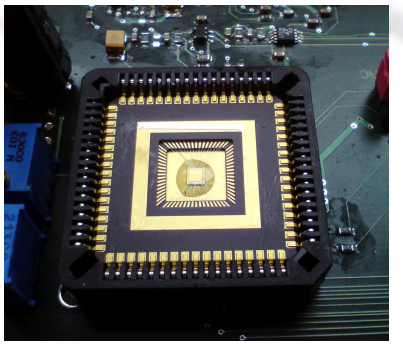
Measurements with the muPix2 prototype

S curve for elektronik pulses

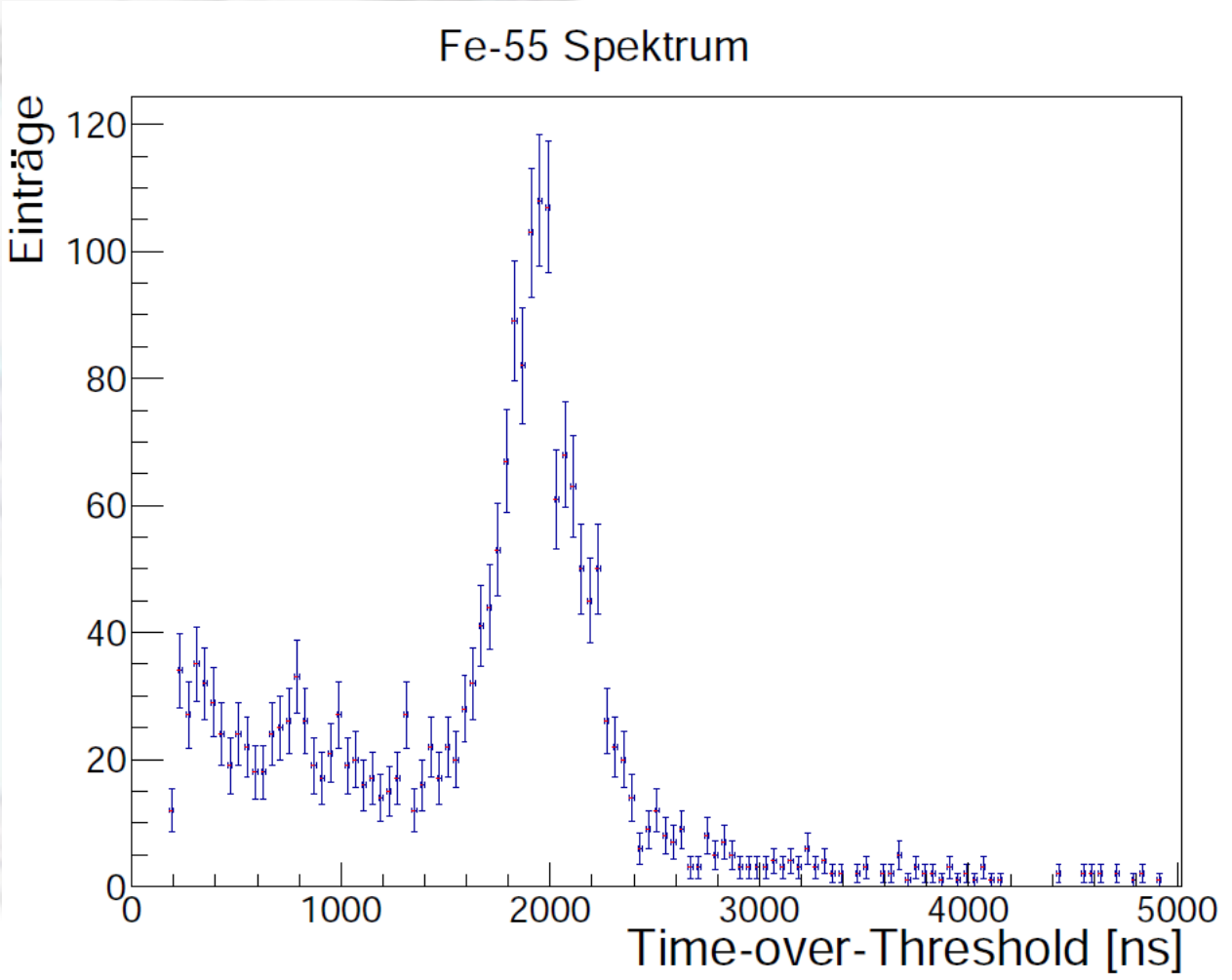


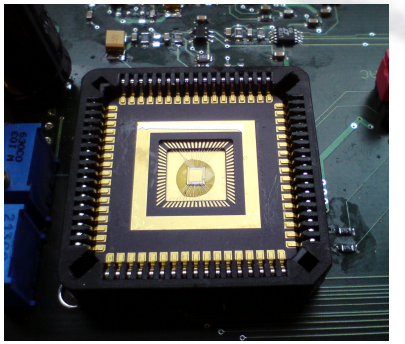
normalized pulserate after theshold scans

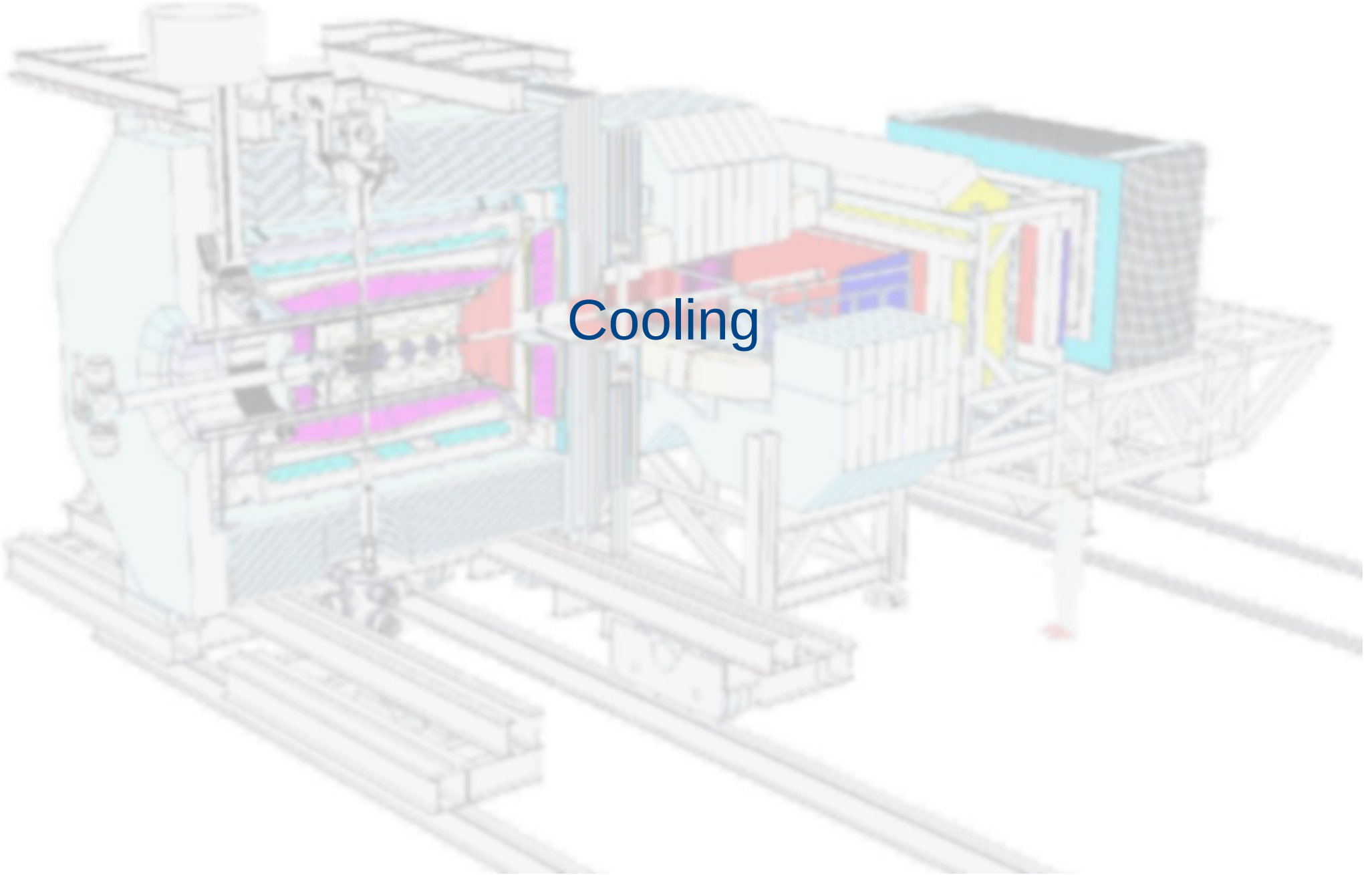




Measurements with the muPix2 prototype







Cooling

Cooling studies of HV-MAPS

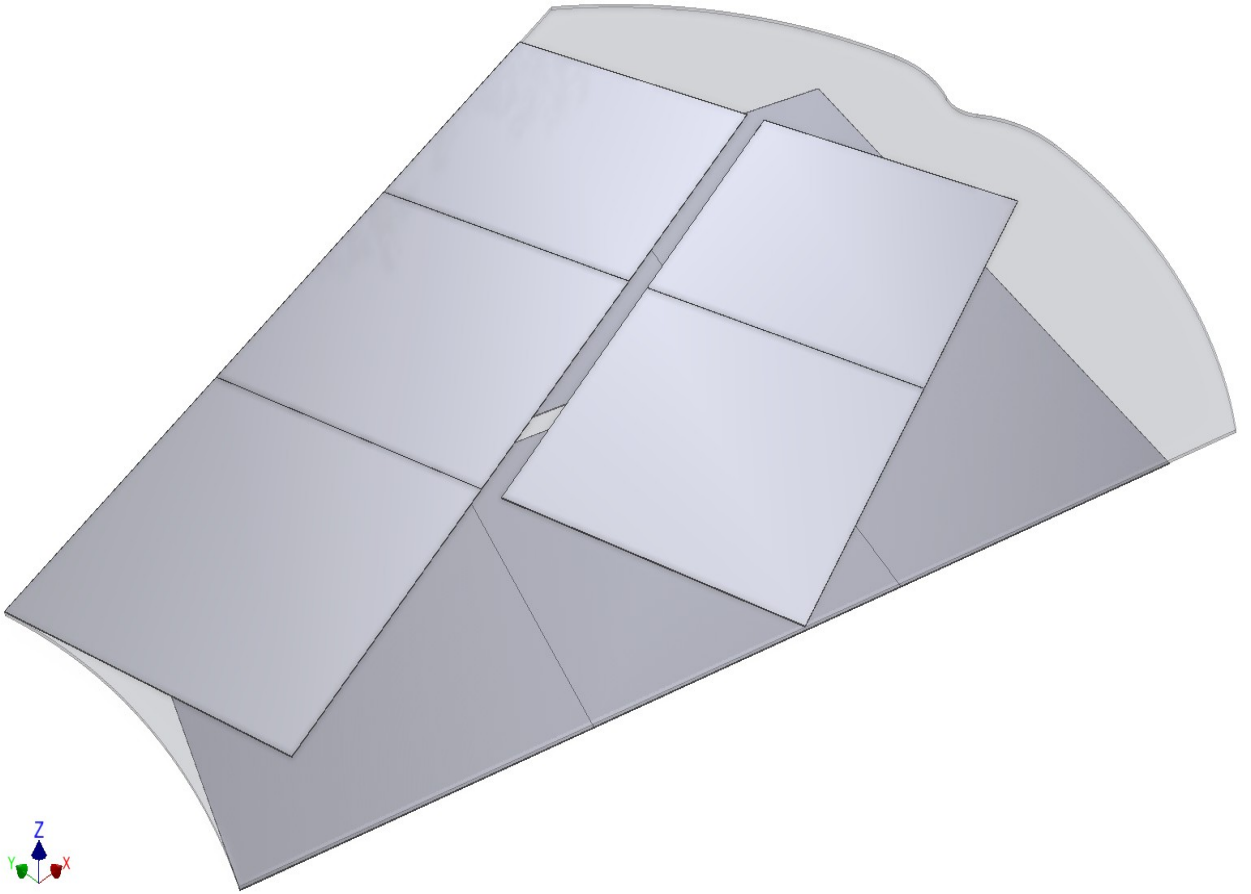
2 x 2 cm² sensors

2 and 3 in a row on one die

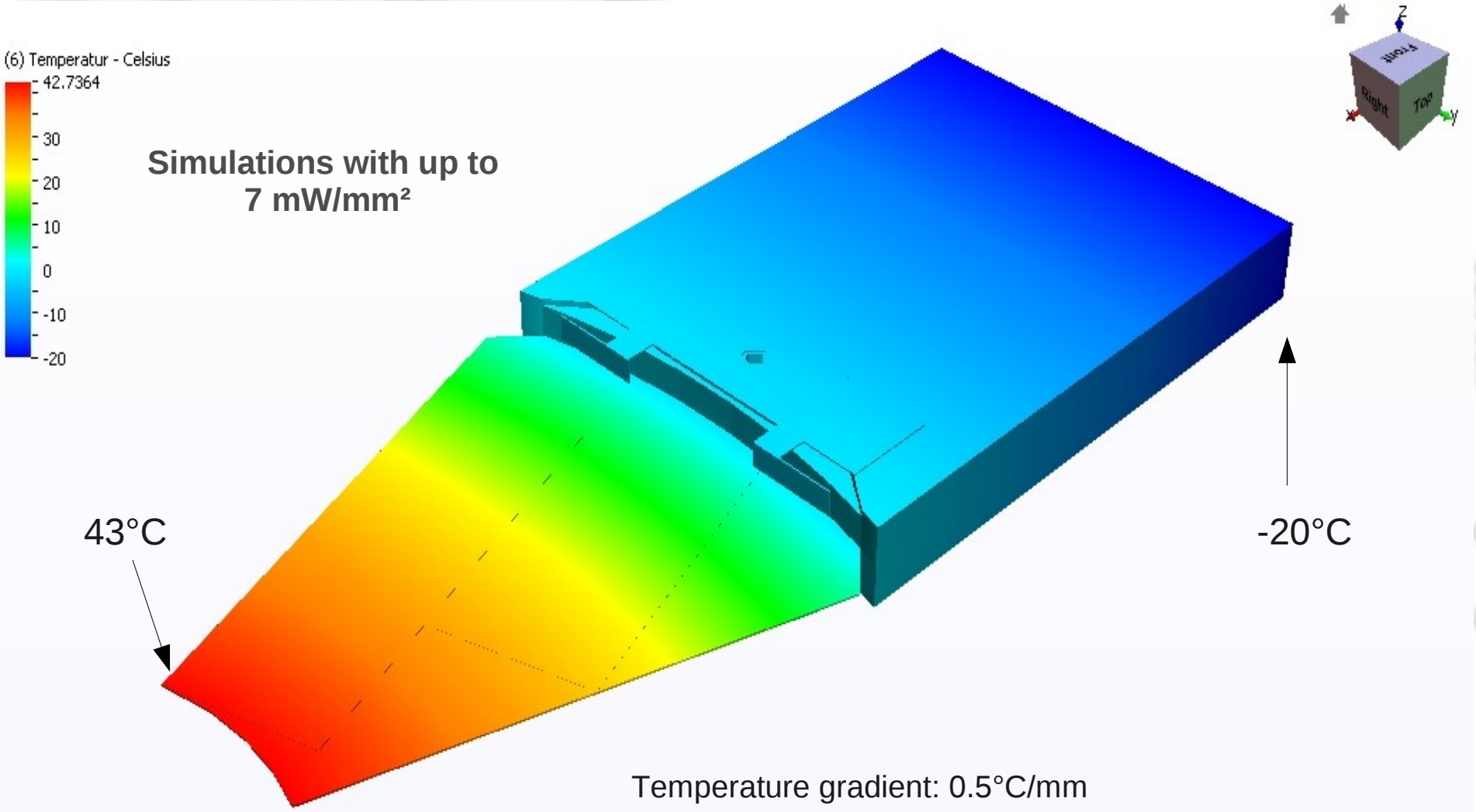
Operated in vacuum

Power consumption:
Design goal 1 mW/mm²

Glued on both sides of a
200µm thick CVD-Diamond

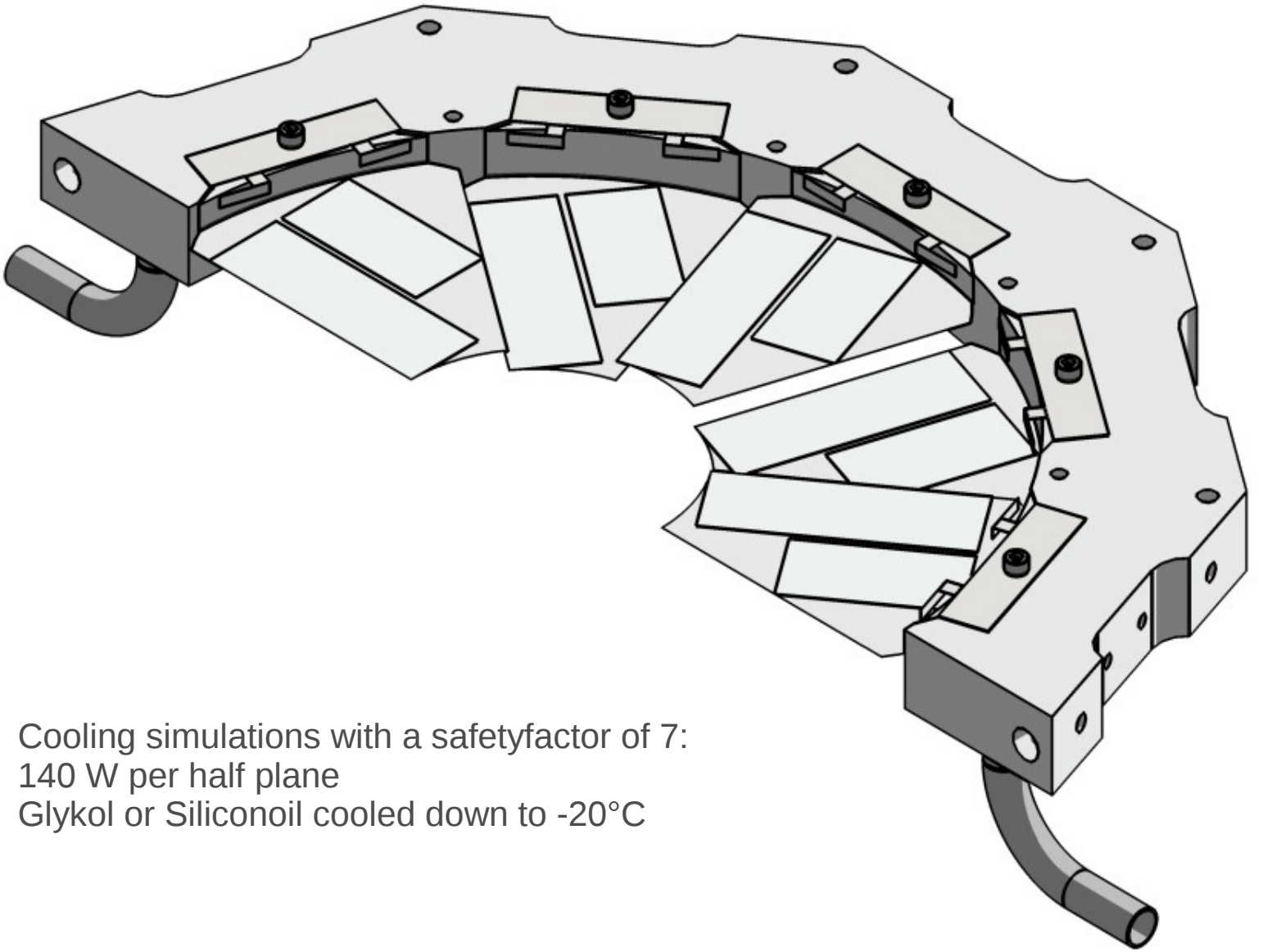


Simulationen der Kühlung



Real tests in vacuum under preparation

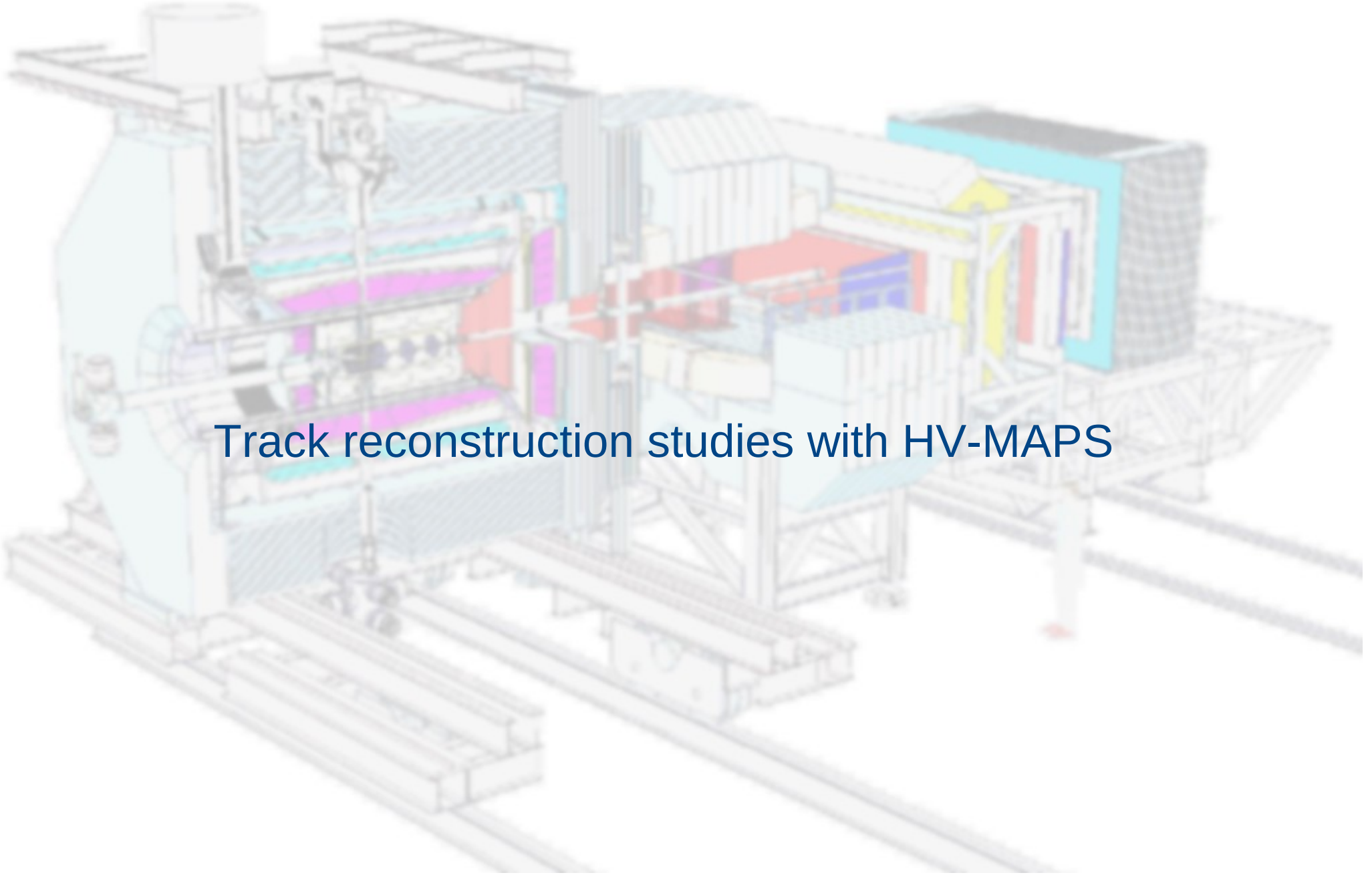
The heat sink and support



Cooling simulations with a safetyfactor of 7:
140 W per half plane
Glykol or Siliconoil cooled down to -20°C

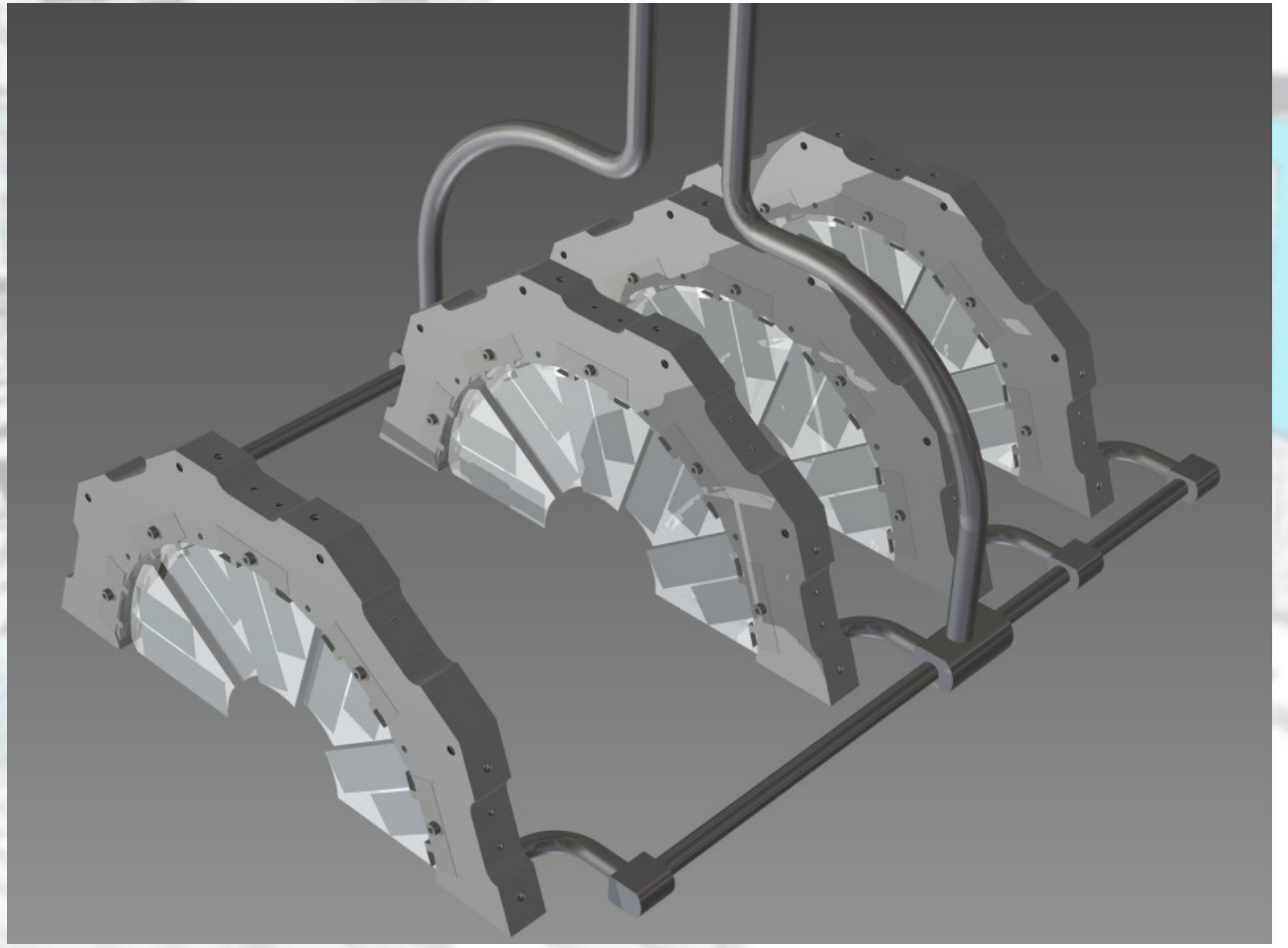
Melting studies in preparation

Workshop produced special bend jig and the mold
Melting aluminum will be done in a vacuum furnace at Jülich



Track reconstruction studies with HV-MAPS

Track reconstruction studies with HV-MAPS

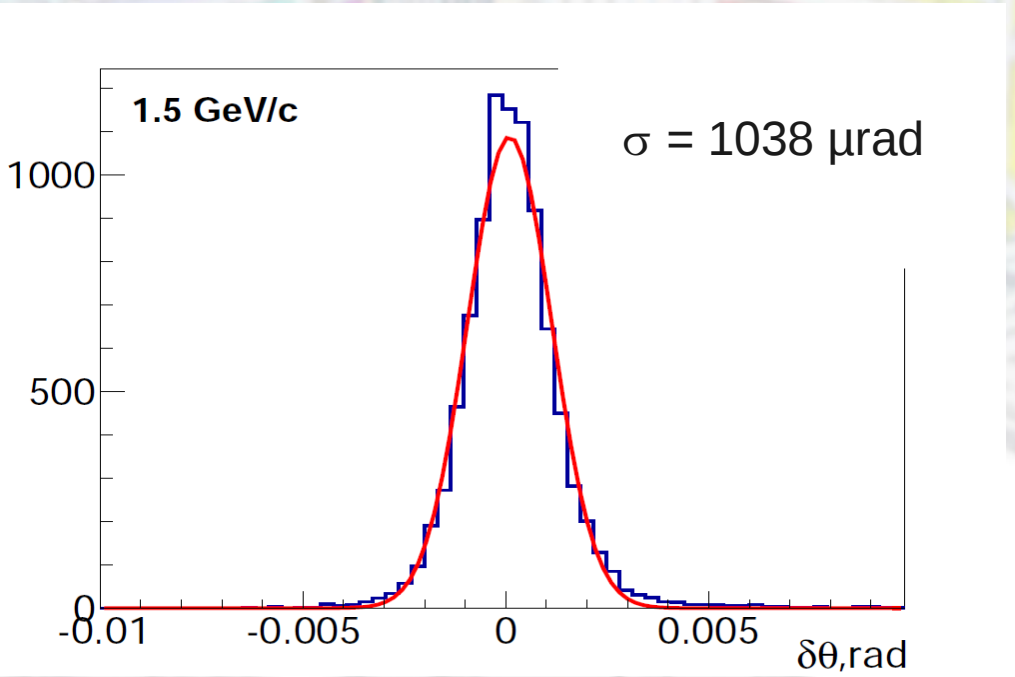


4 Planes with a distance of 20-10-10 cm in respect to each other

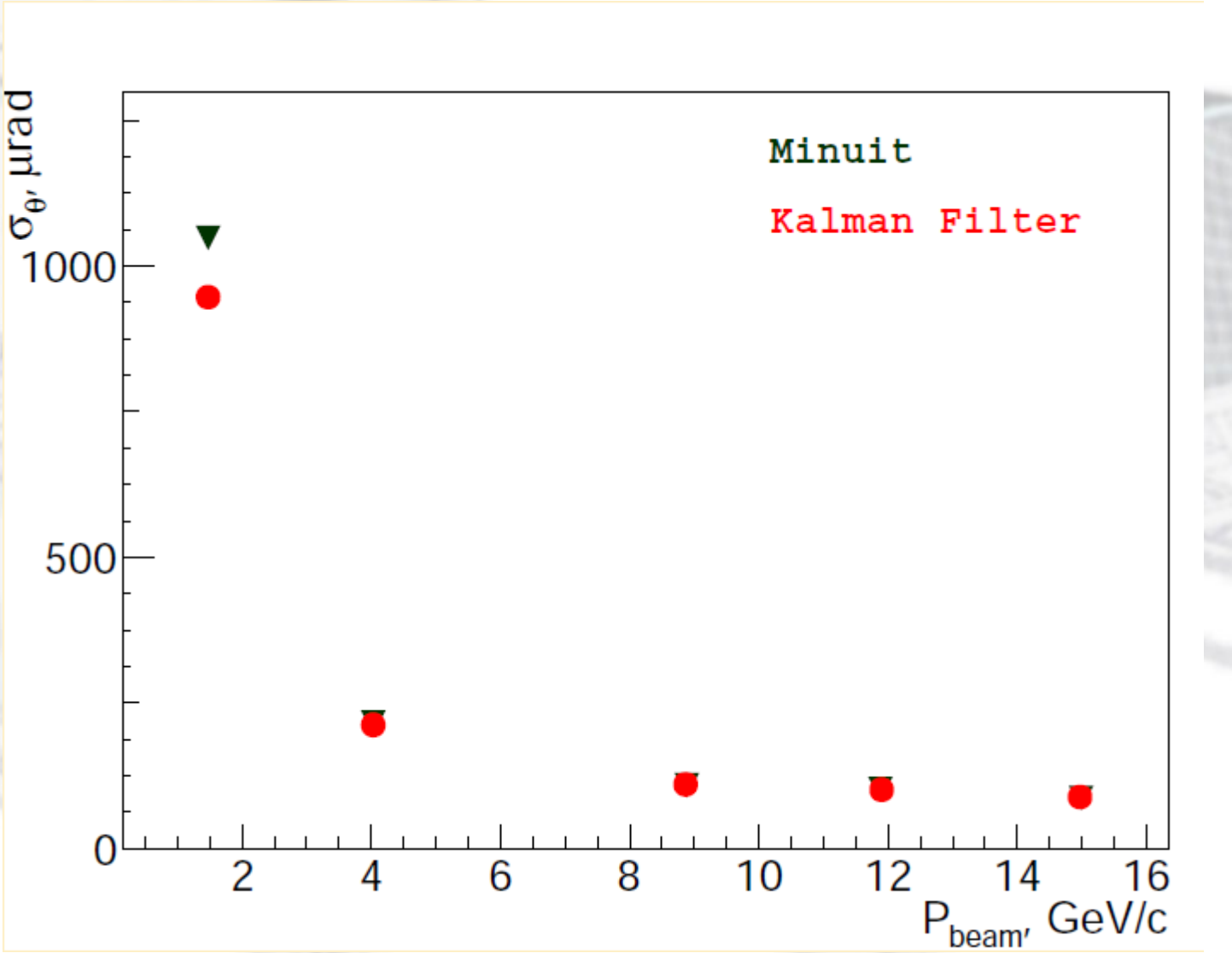
Effective Radiation Length

component	material	thickness	effective X/X_0 [%]
cone support	kapton	20μm	0.027
RF-Shielding	aluminum	10μm	0.022
transition region			**0.049**
flex-cable	kapton	50μm	0.0175
HV-MAPS	silicon	50μm	0.053
cooling disc	CVD-diamond	200μm	0.165
HV-MAPS	silicon	50μm	0.053
flex-cable	kapton	50μm	0.0175
one plane			**0.306**
total			**1.273**

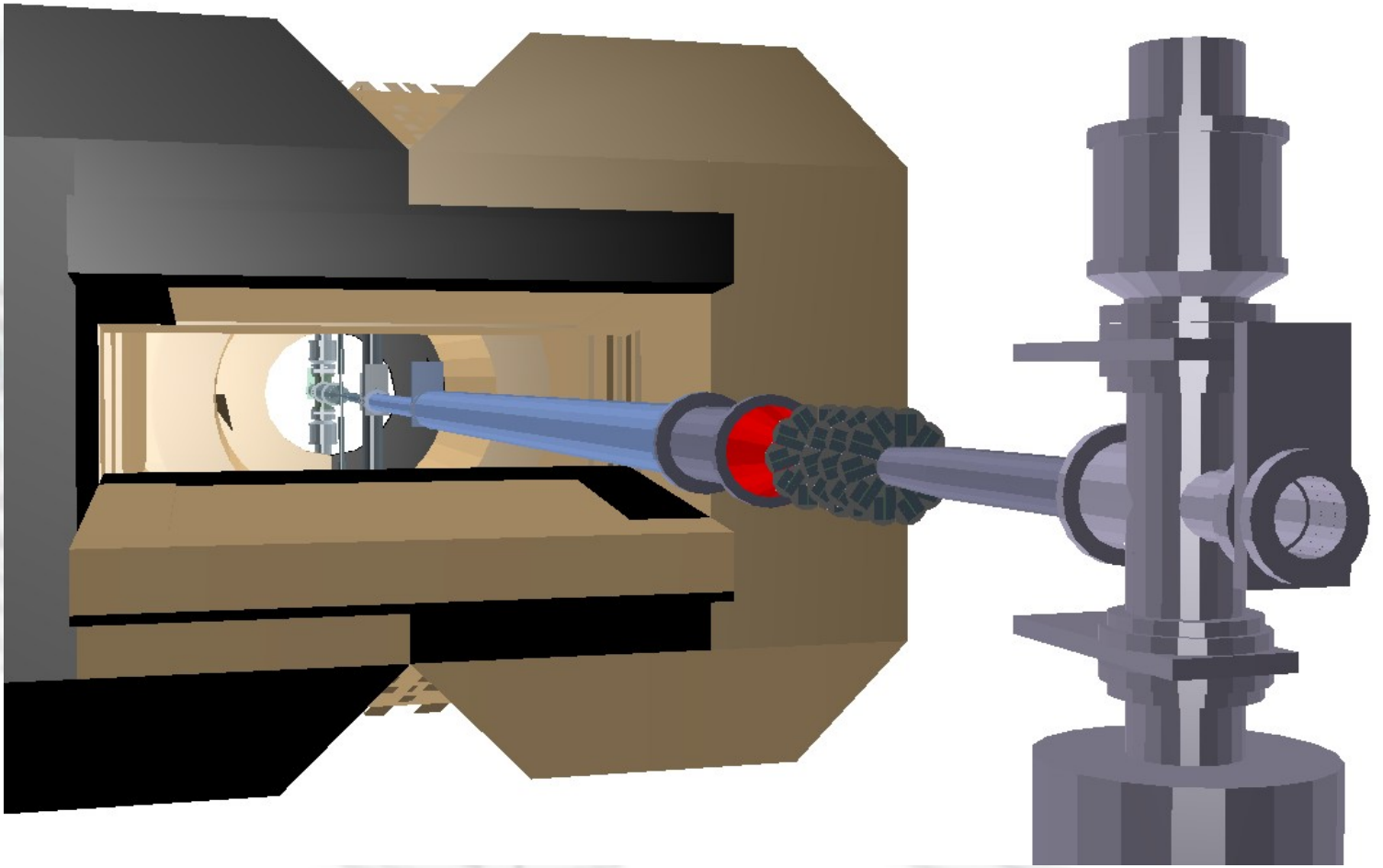
Detector resolution



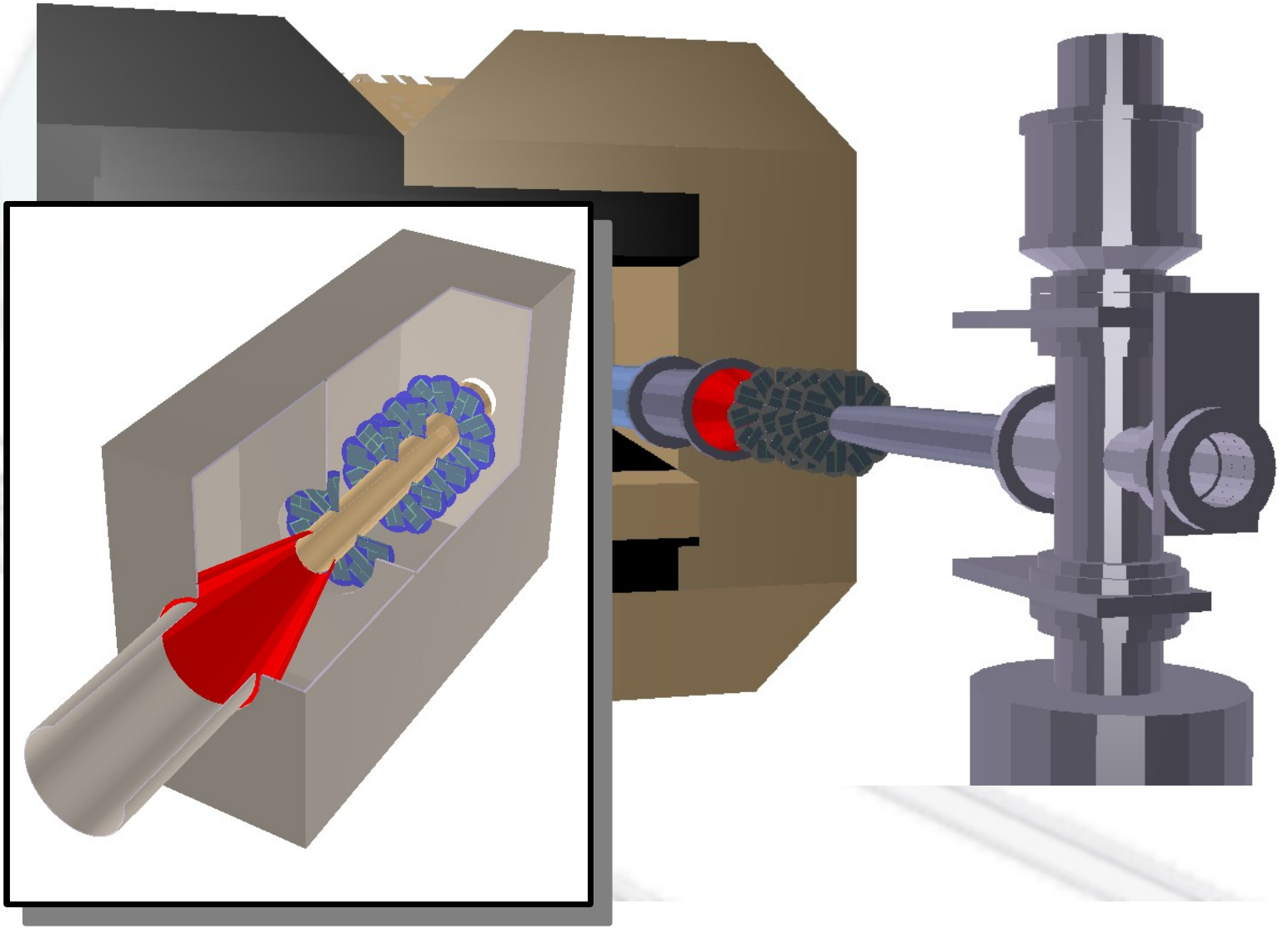
Detector resolution



Further studies with PANDAROOT

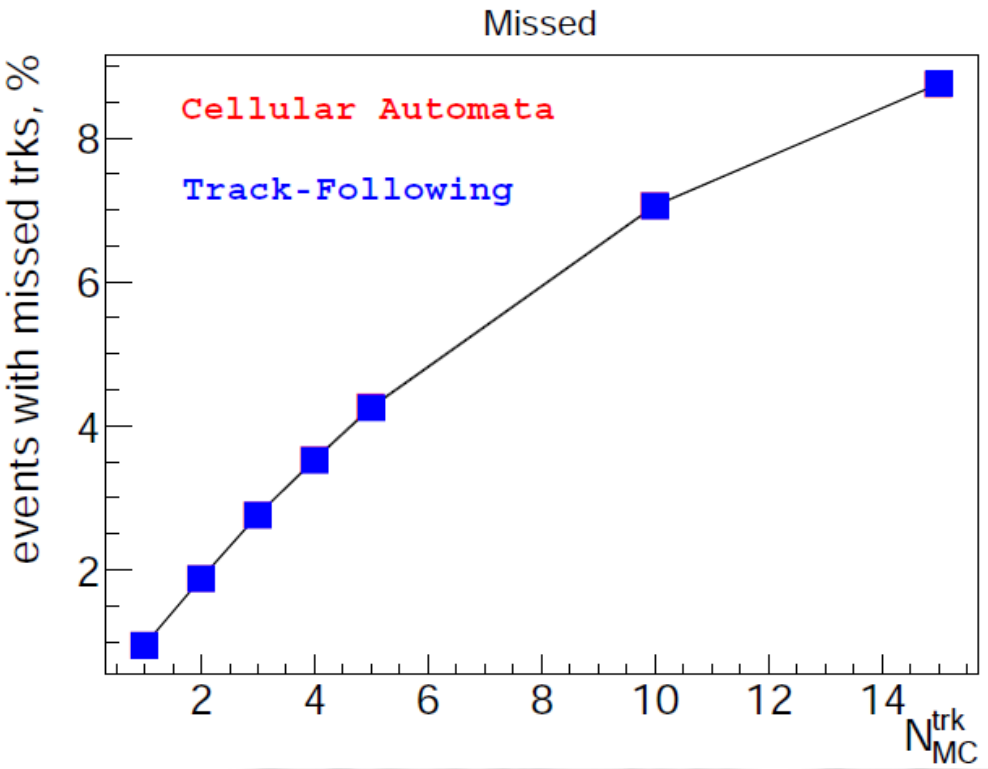


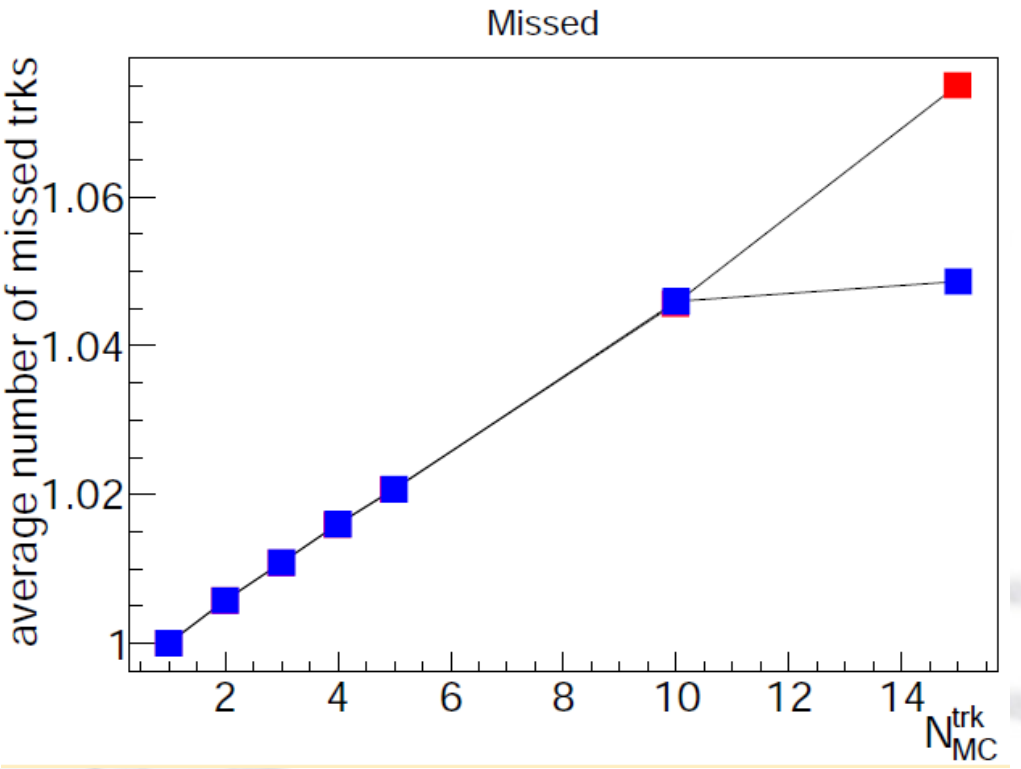
Further studies with PANDAROOT



Track reconstruction: Track multiplicities

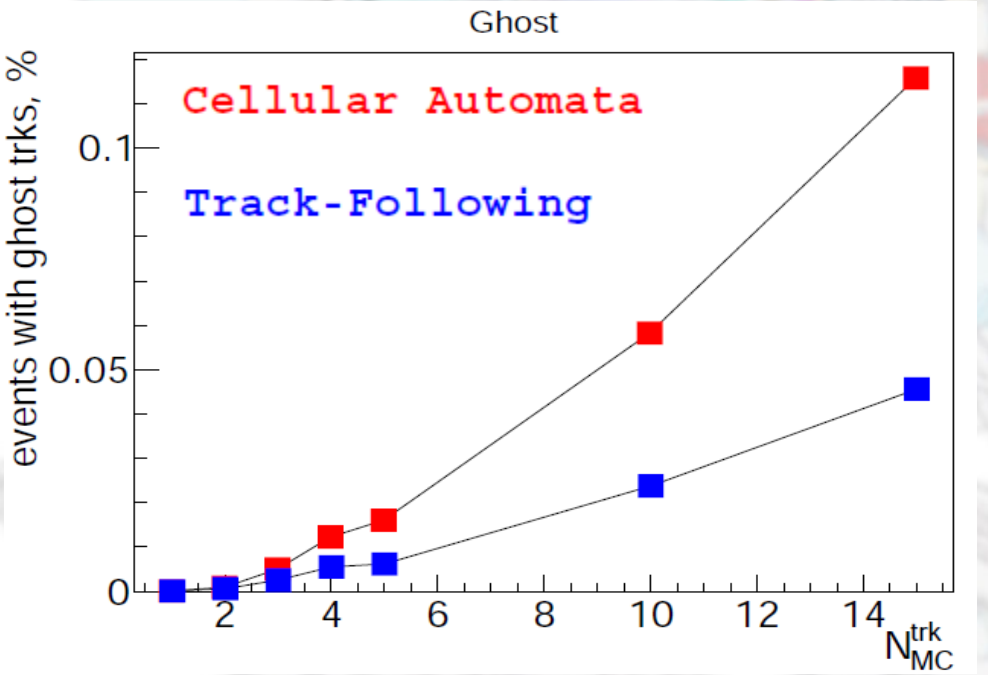
15 GeV/c

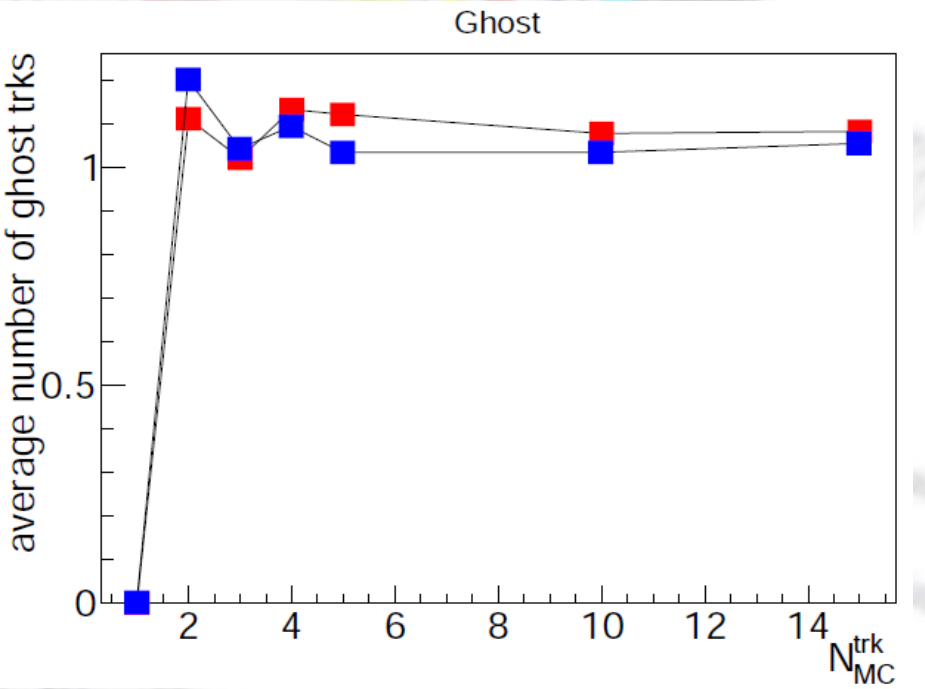




Track reconstruction: Track multiplicities

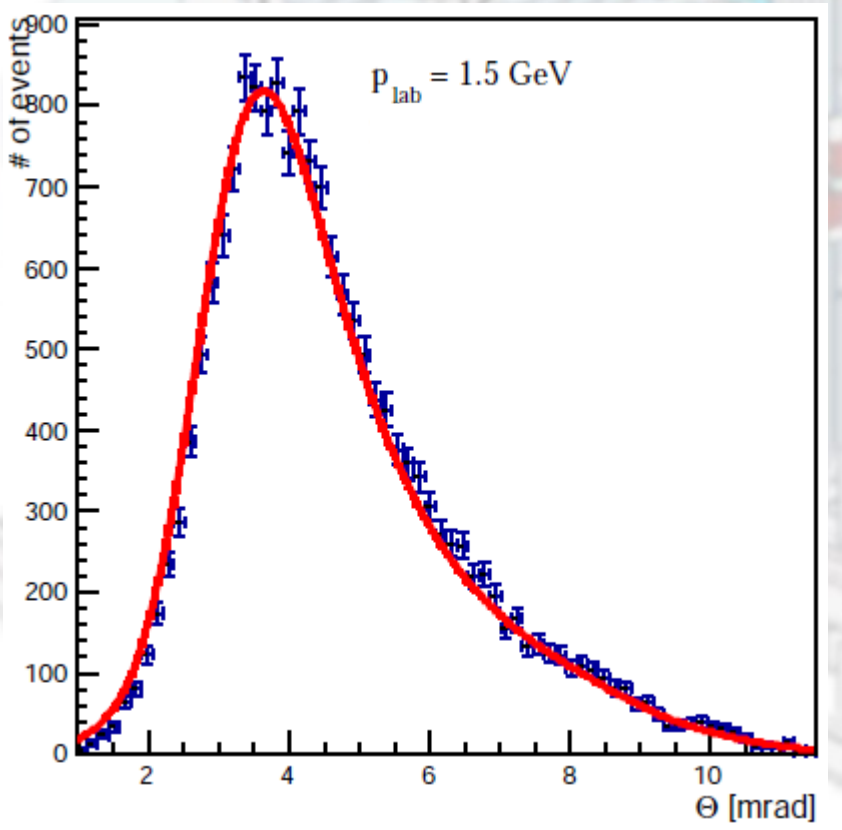
15 GeV/c

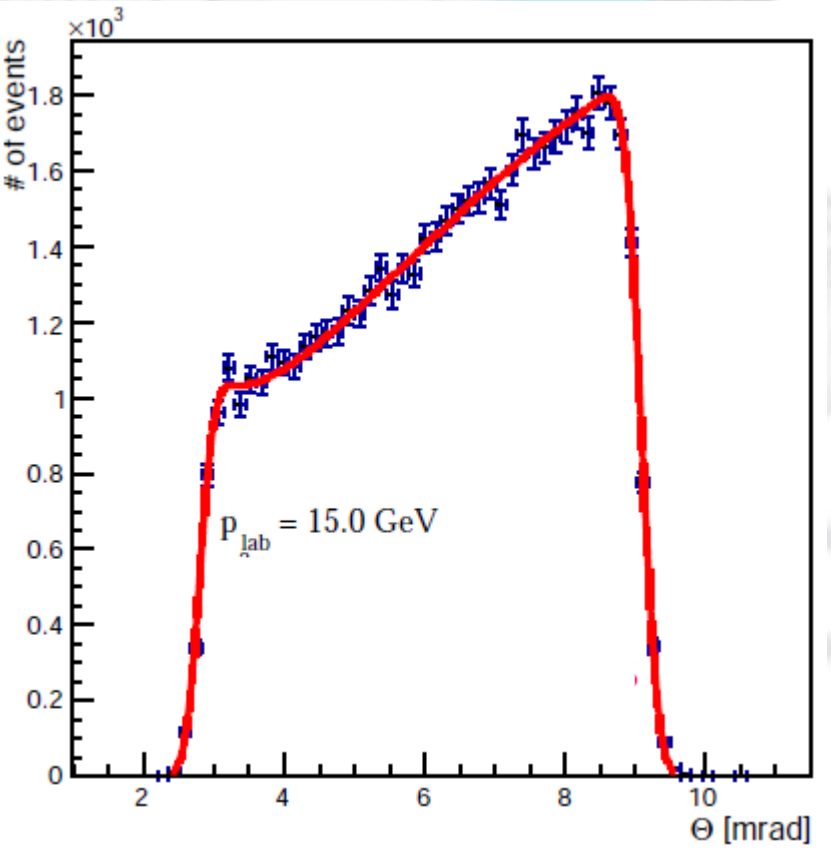




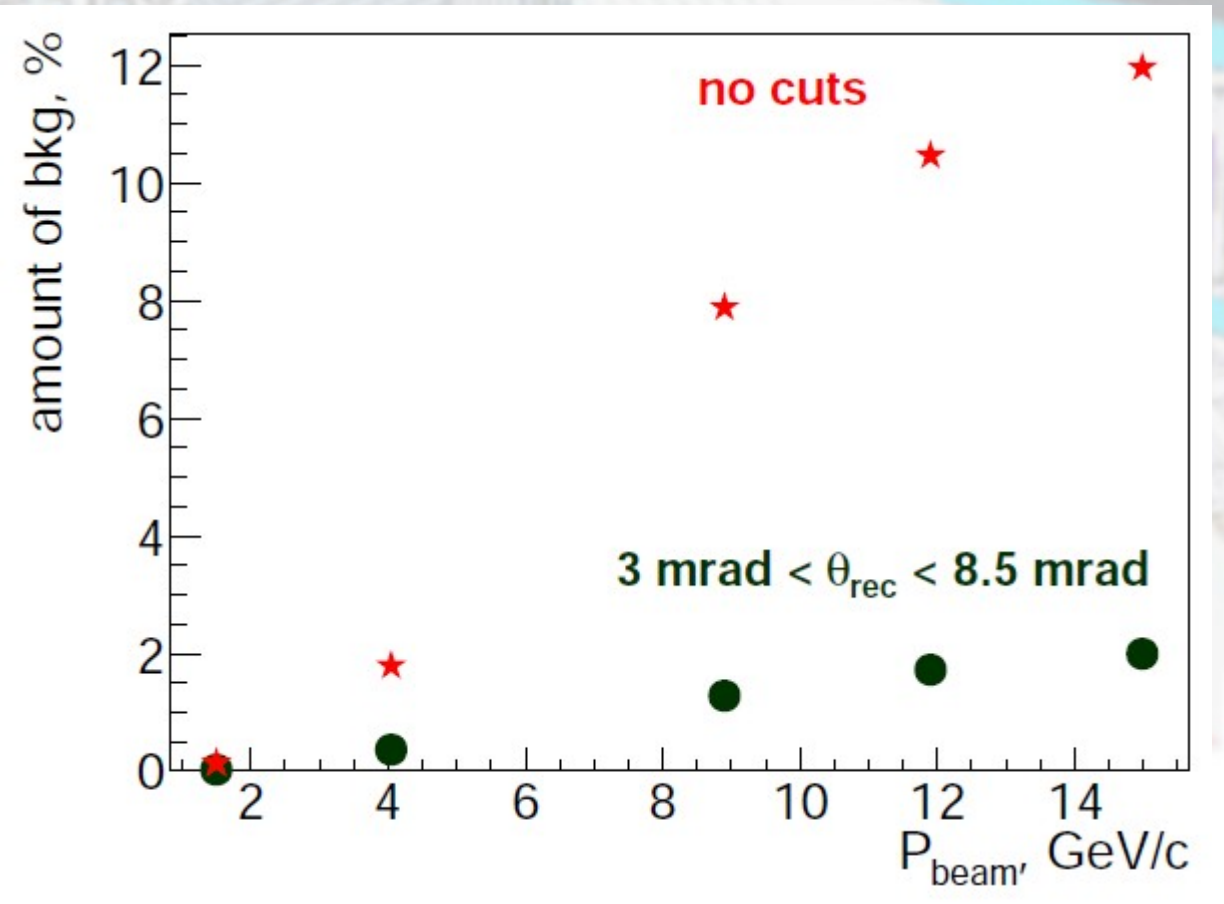
Fitting the luminosity

Angular distributions after reconstruction



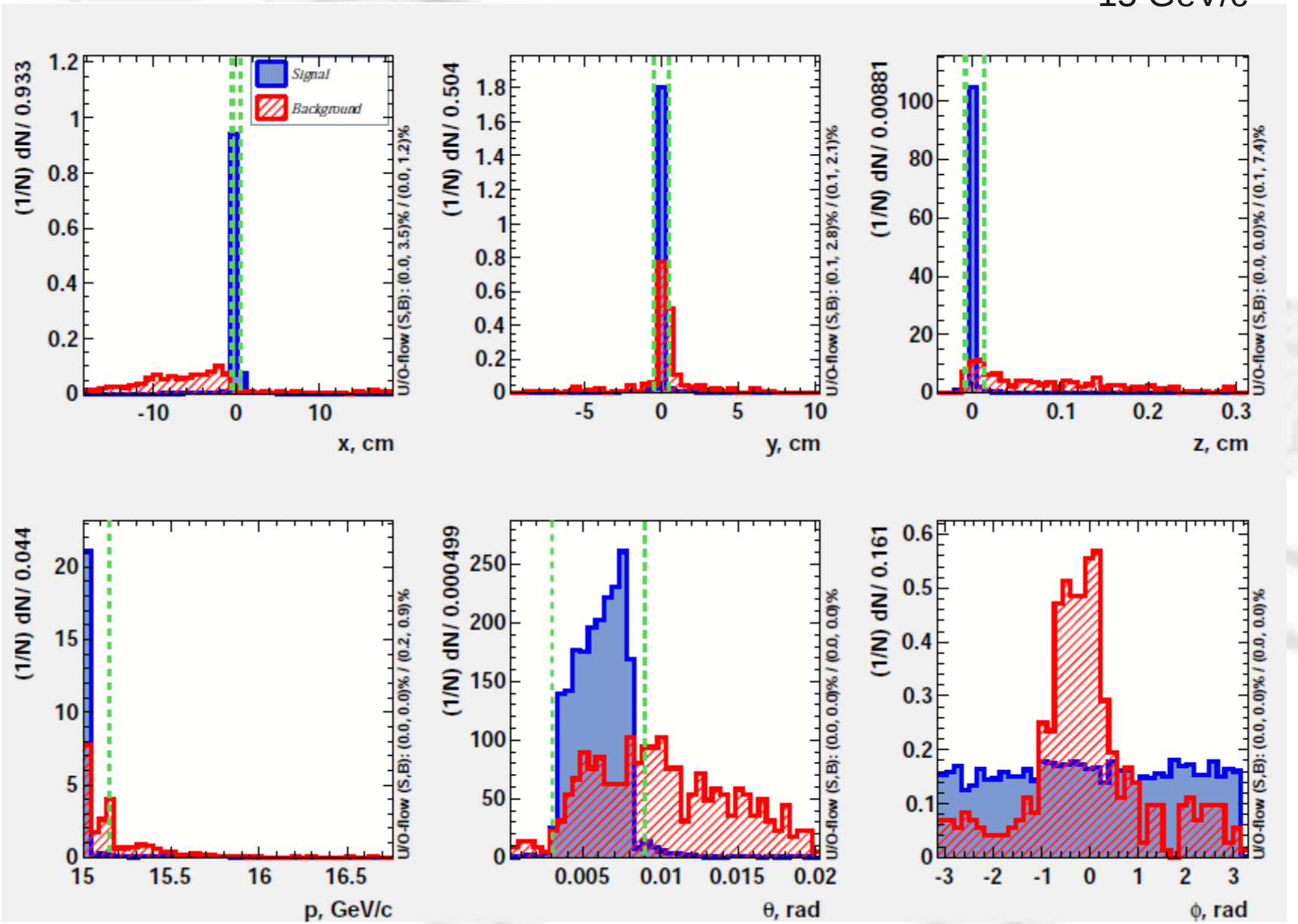


Background studies



Background studies

15 GeV/c

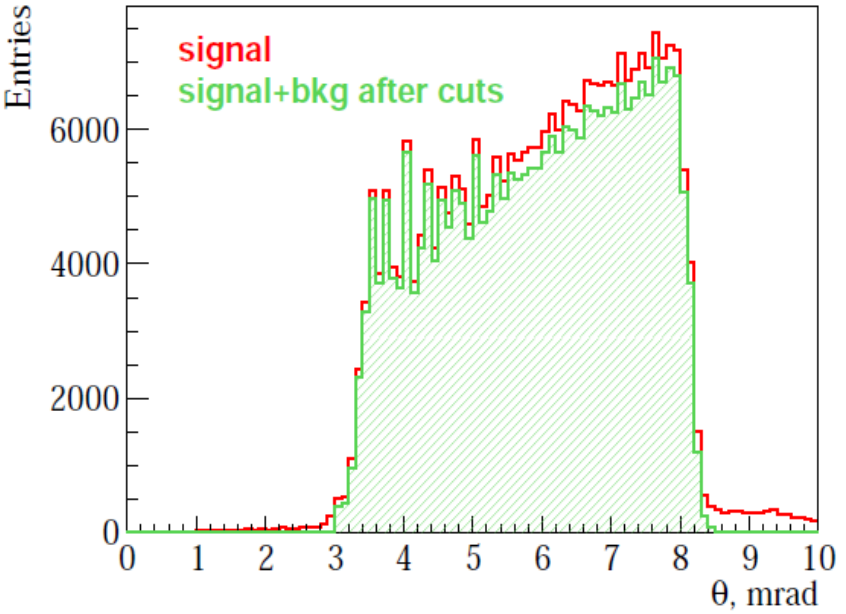


Background studies

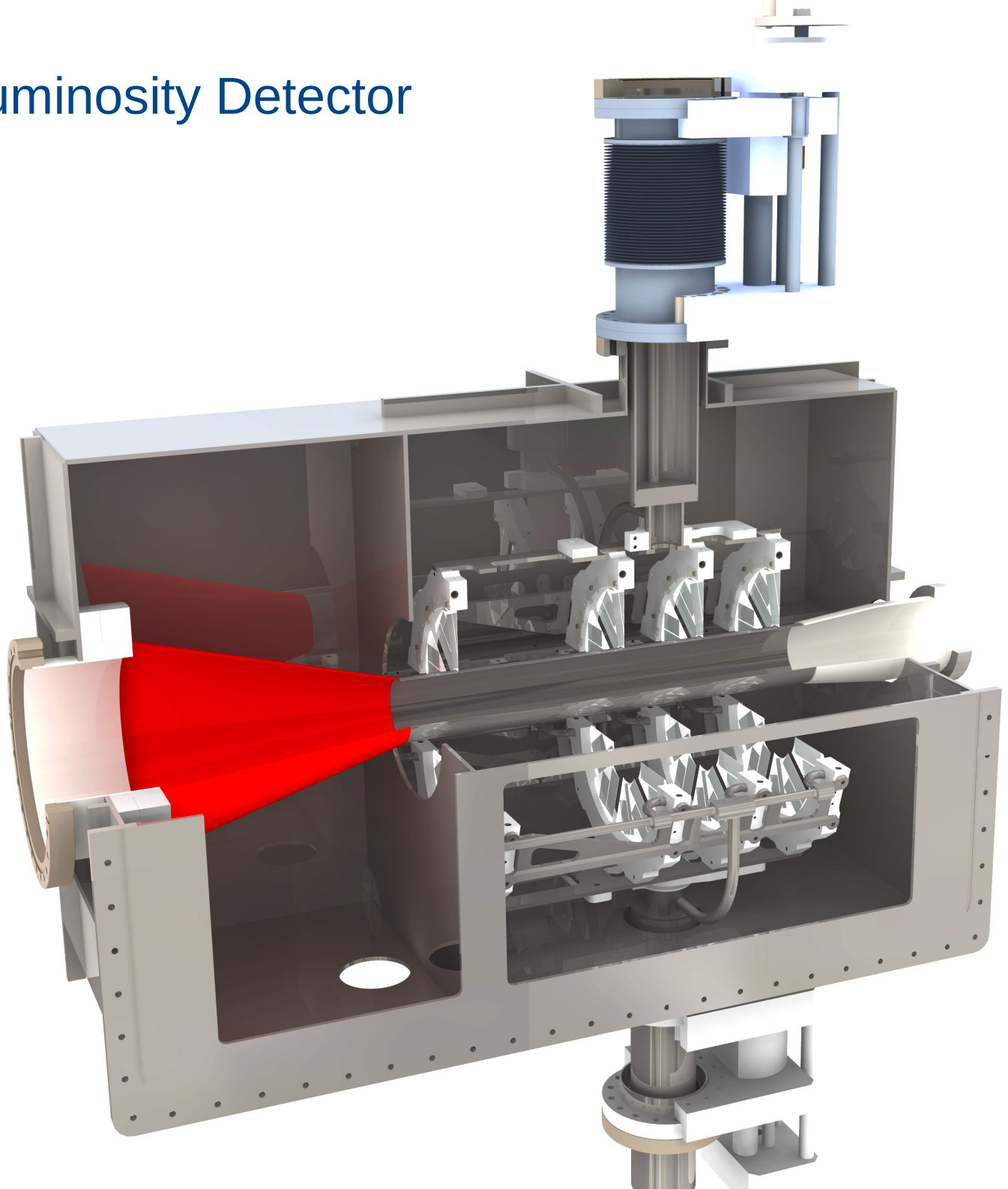
- $3\ mrad < \theta < 8.5\ mrad$
- $|X_{PCA}| < 5\sigma_X^{sig}$
- $|Y_{PCA}| < 5\sigma_Y^{sig}$
- $|Z_{PCA}| < 5\sigma_Z^{sig}$
- $0.99 \cdot p_{beam} < p < 1.01 \cdot p_{beam}$

cut	bkg/sig, %	sig, %
All	0.2	91.2

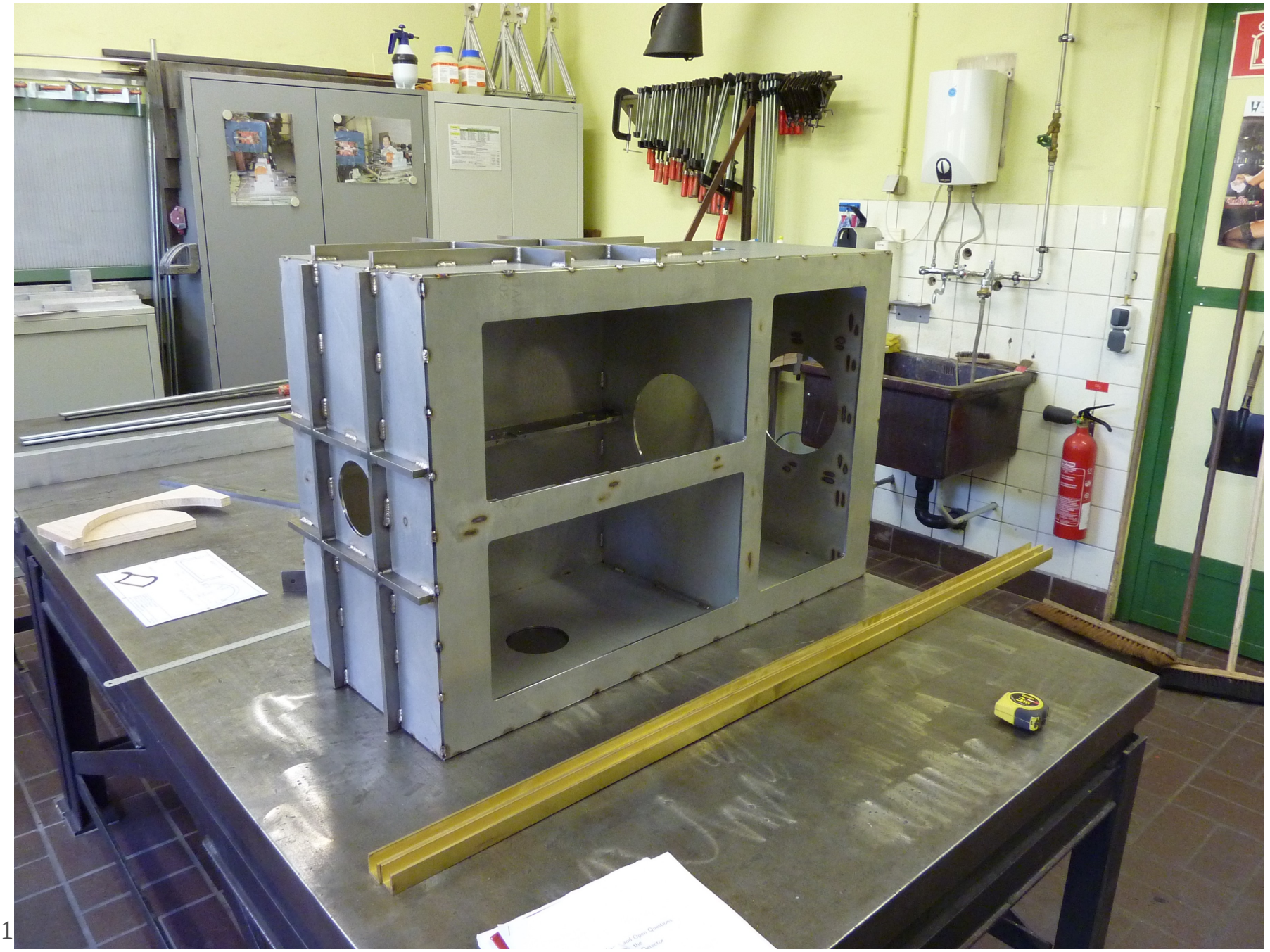
15 GeV/c



The Luminosity Detector



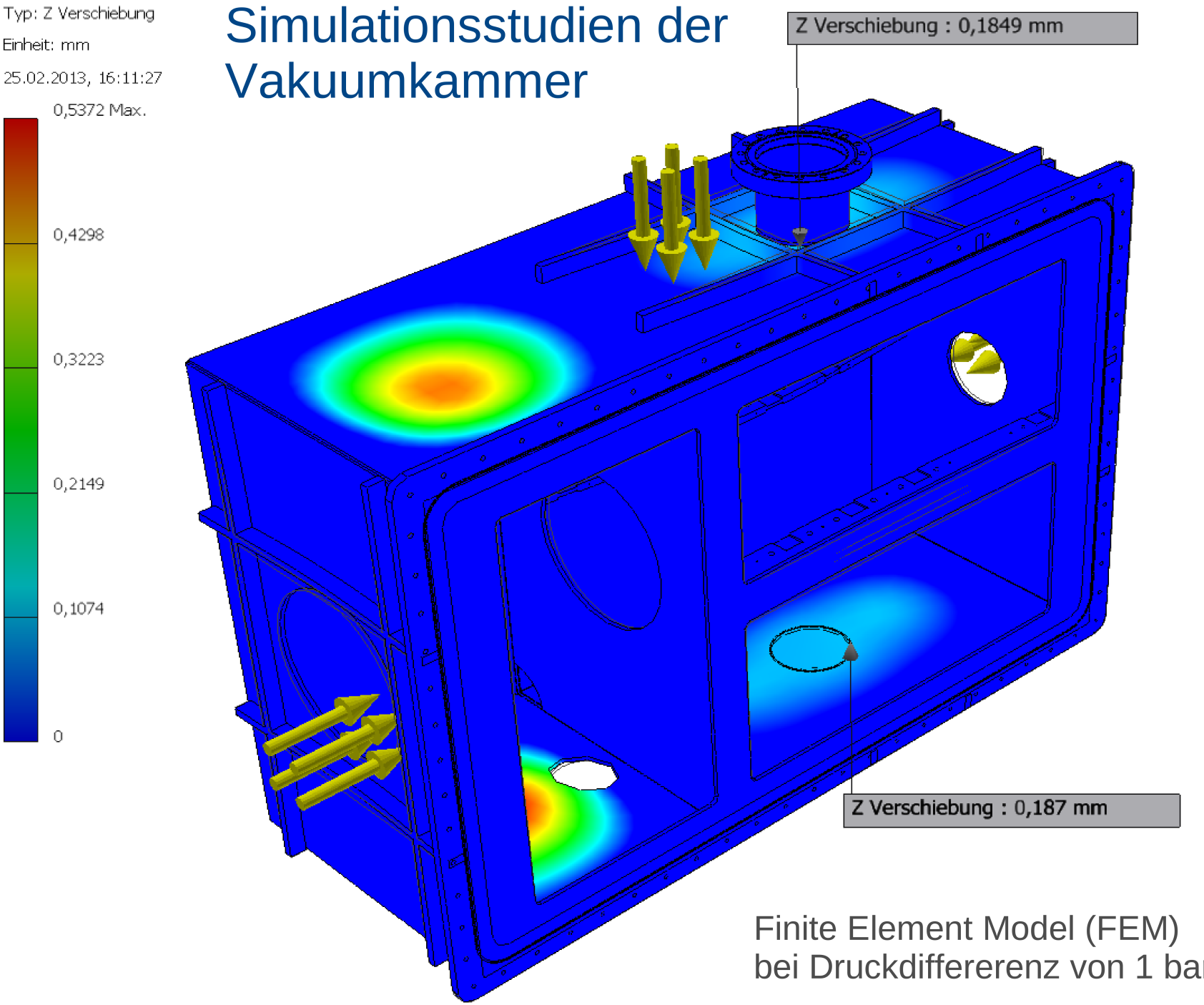
Recent progress on the prototype



Recent progress on the prototype

Thank you

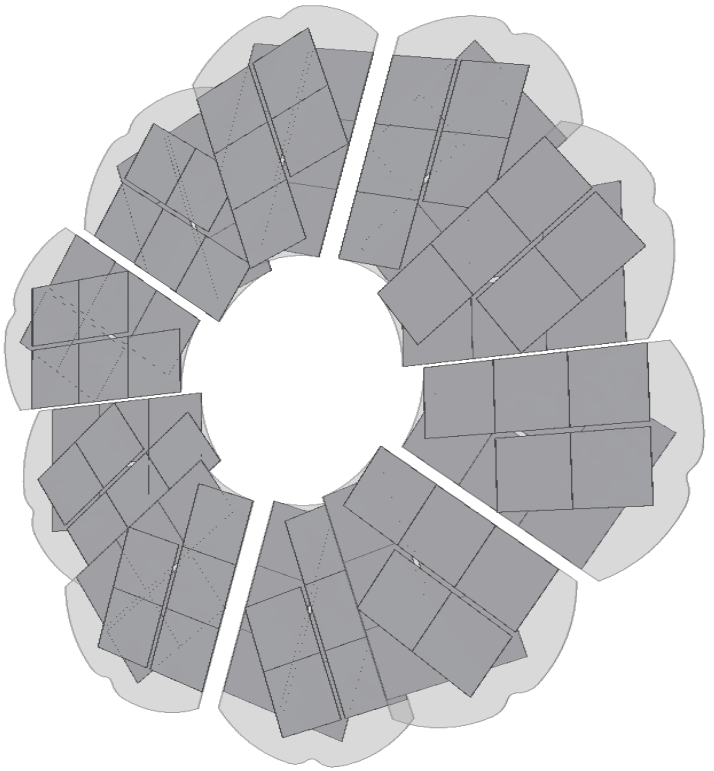
Simulationsstudien der Vakuumkammer

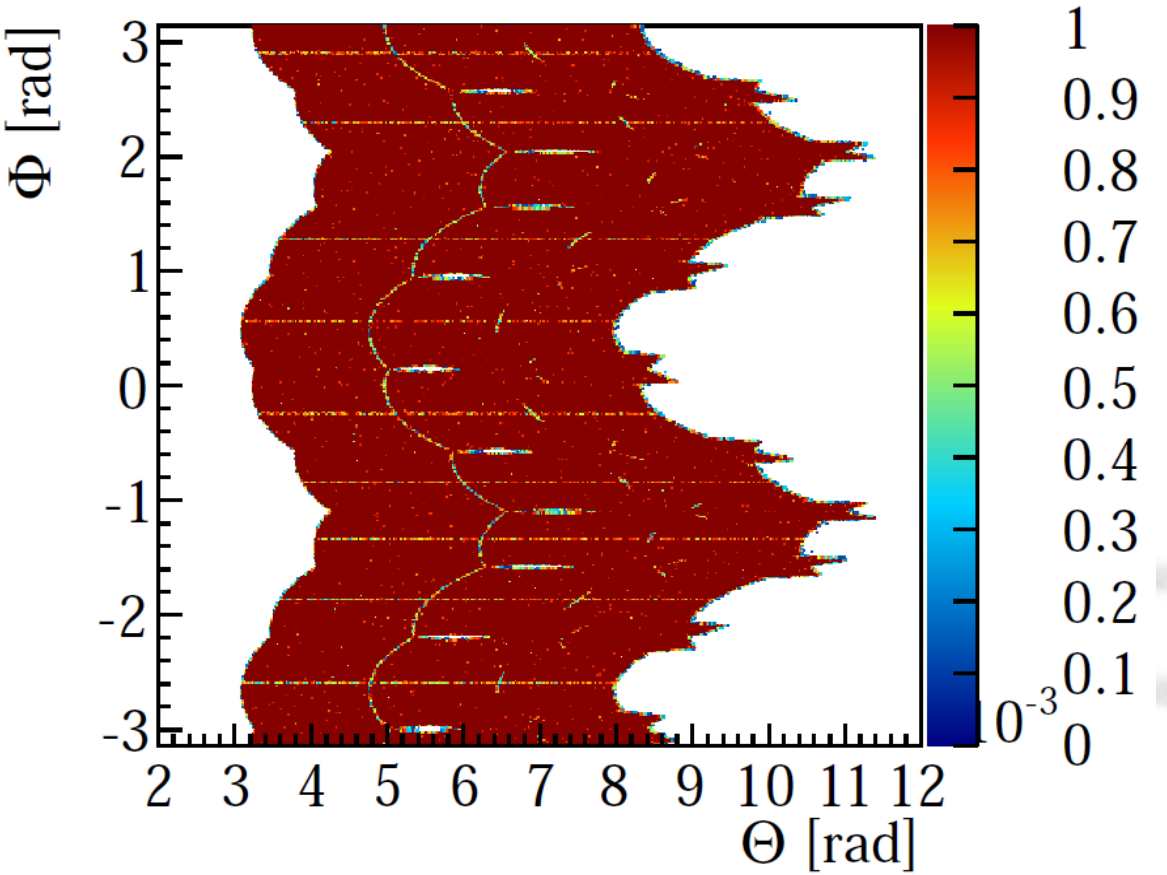


Finite Element Model (FEM)
bei Druckdifferenz von 1 bar

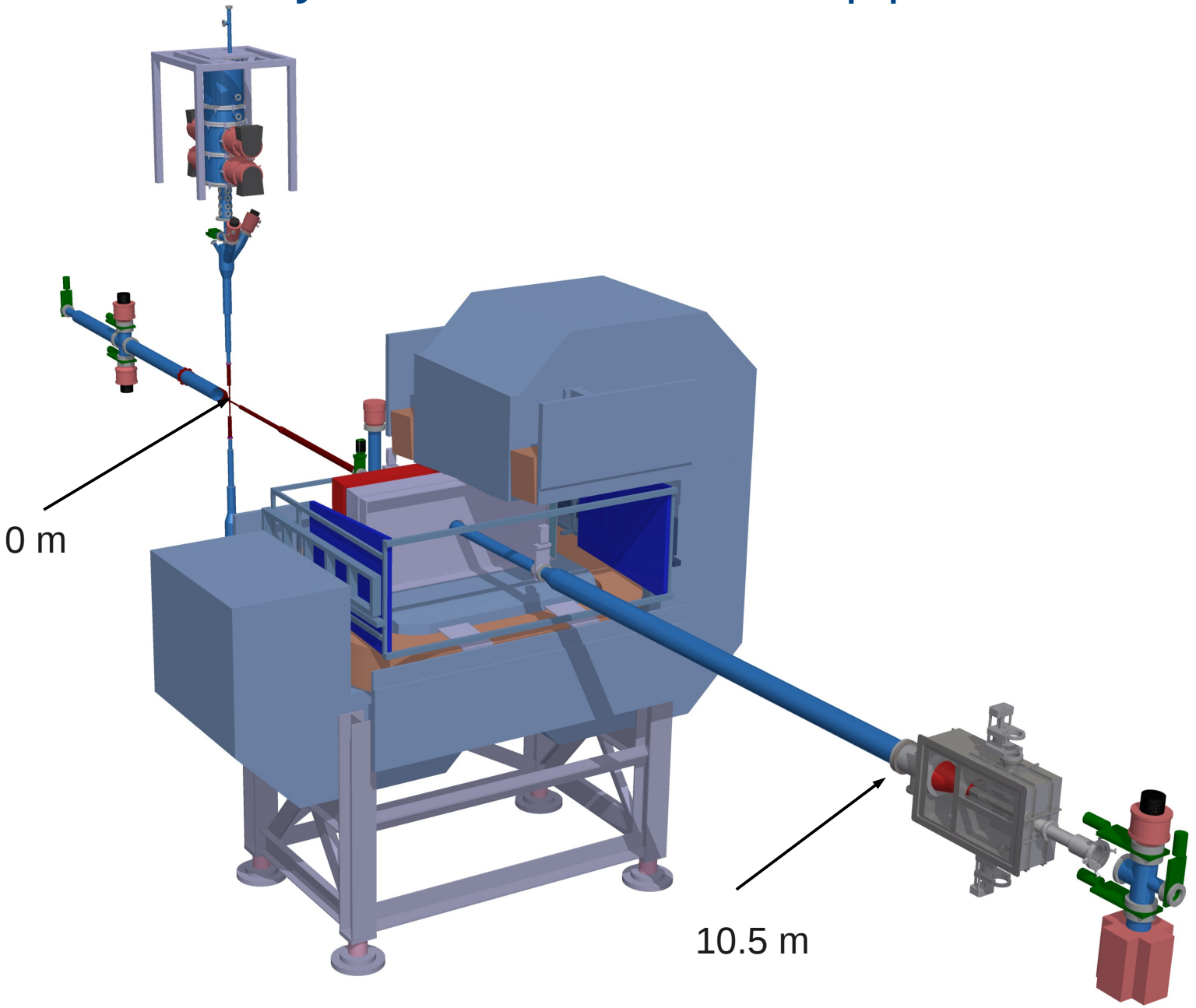
Geometrische Akzeptanz

Akzeptanz bei 1.5 GeV/c Strahlimpuls





The luminosity detector in the beam pipe



Beampipe and the simplified luminosity detector are available on EDMS
To do: design of a support + check space for forward muon tracker

Cooling stations for cooling liquids

Huber Unistate 425 w

versus

Cooling power @-20°C

1.9 kW 2.2kW

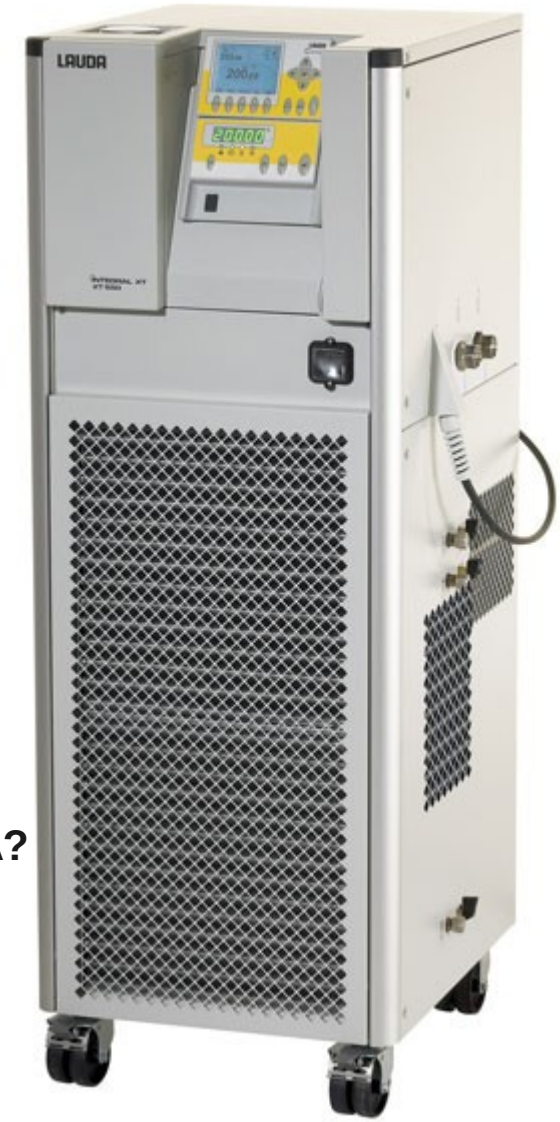
max. pumping speed

105 l/min 45 l/min

max. pumping pressure

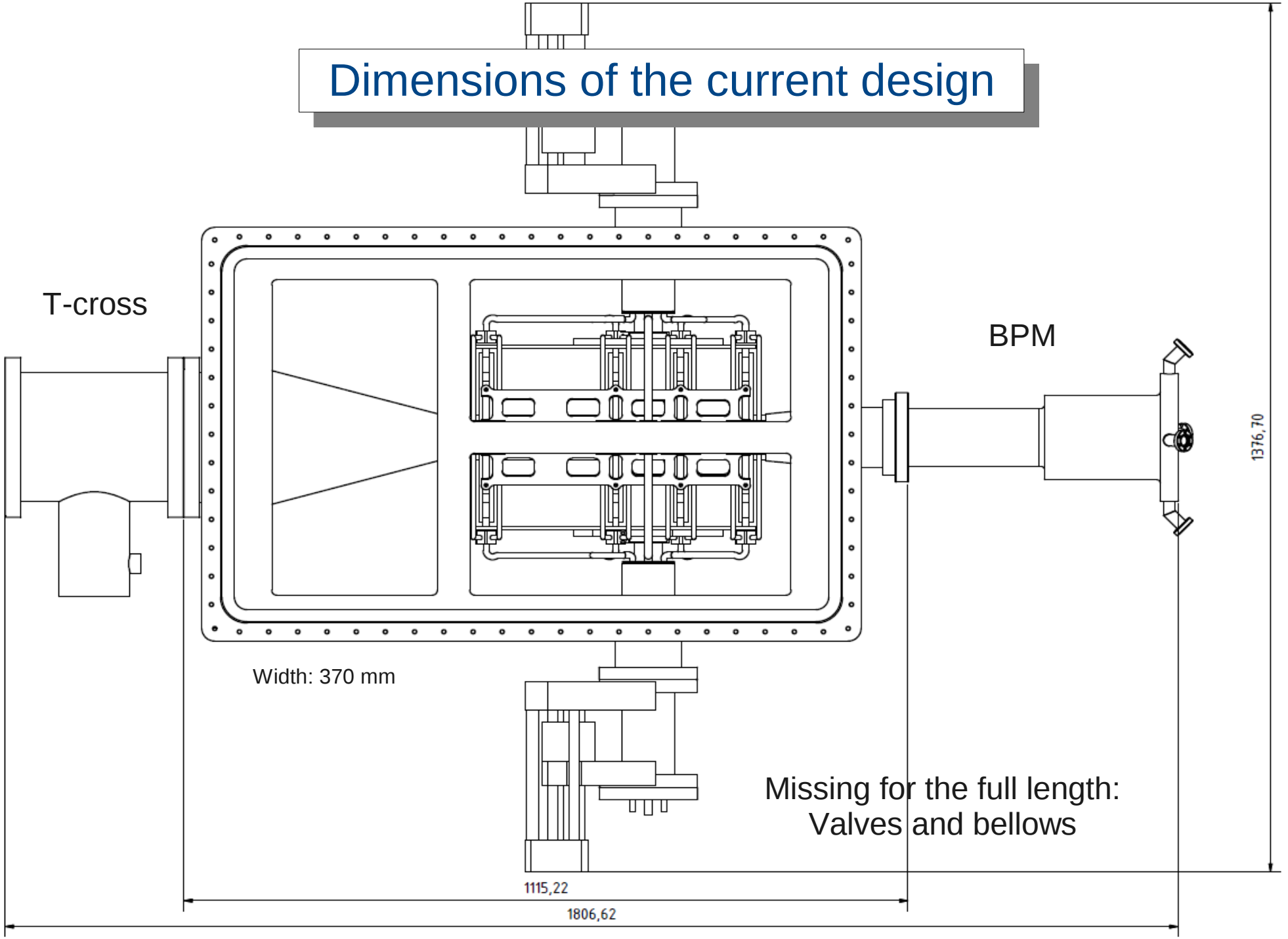
1.5 bar(requested for more) 2.9 bar

Where can we place one of those at PANDA?
(water cooled and radiation protected)



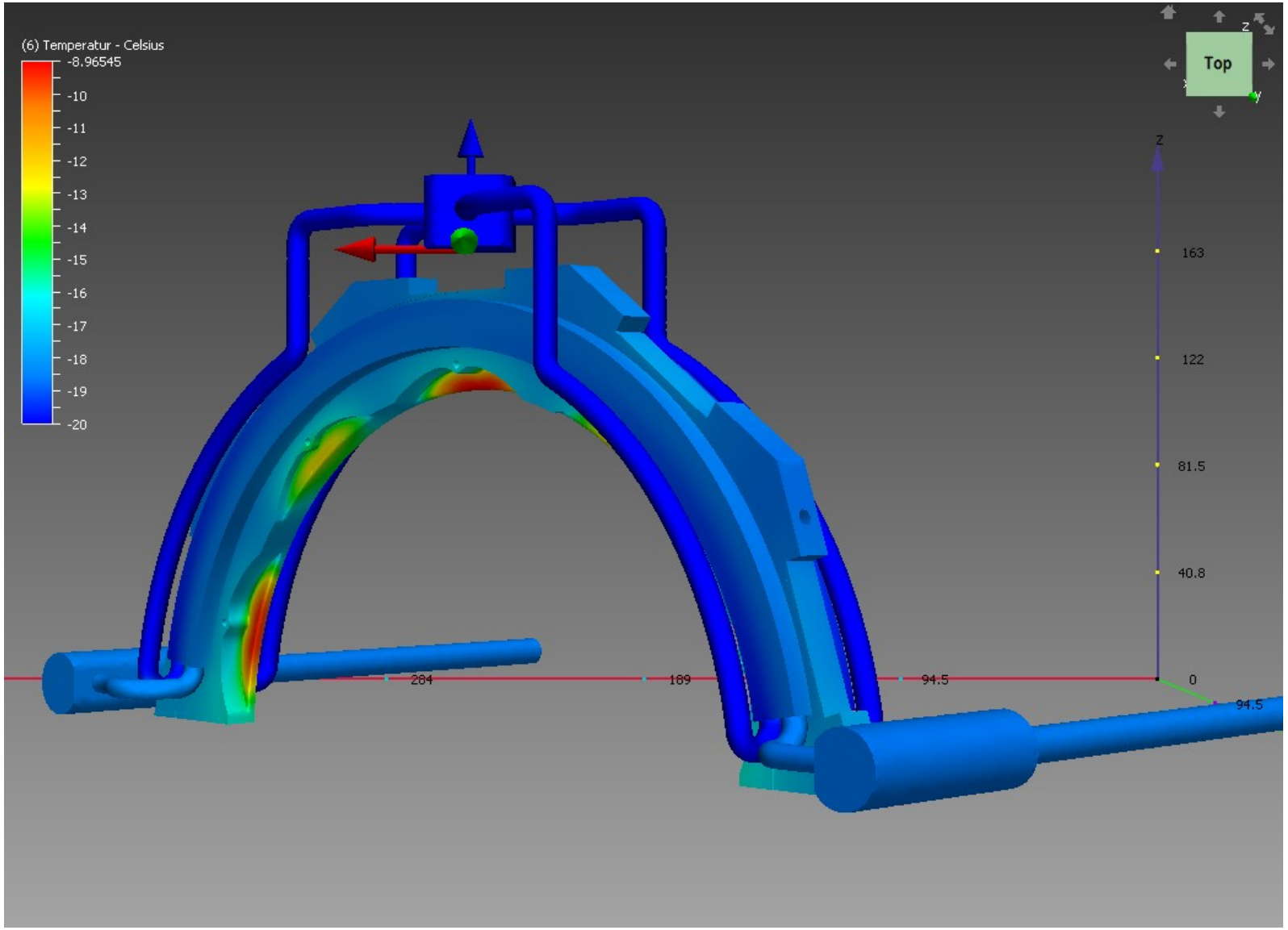
Lauda XT 550 (W)

Dimensions of the current design



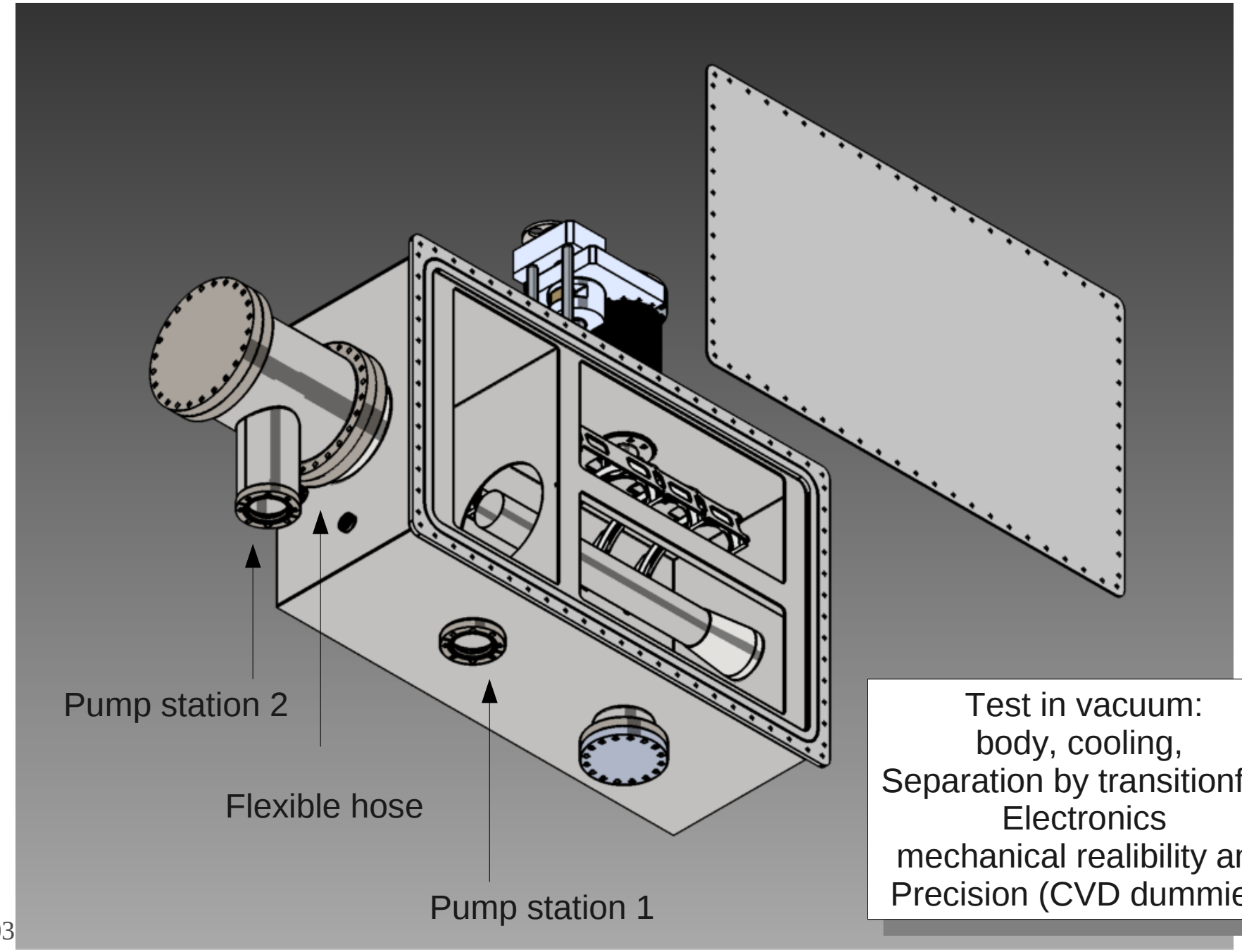
Missing for the full length:
Valves and bellows

Temperature distribution on one plane half



Cooling task will be taken over by a new PhD student. Prototype tests in preparation.

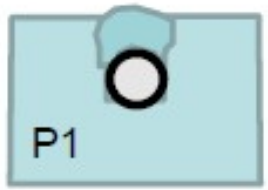
The LUMI prototype



Test in vacuum:
body, cooling,
Separation by transitionfoil,
Electronics
mechanical realibility and
Precision (CVD dummies)

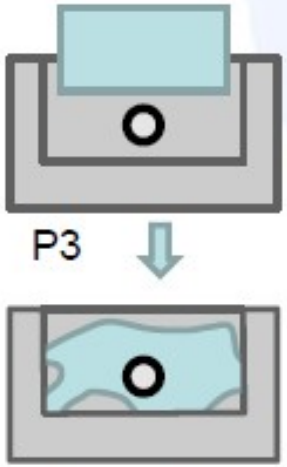
bverlaat@nikhef.nl

The biggest fun we had:
"Baking cookies"



Welding tube inside

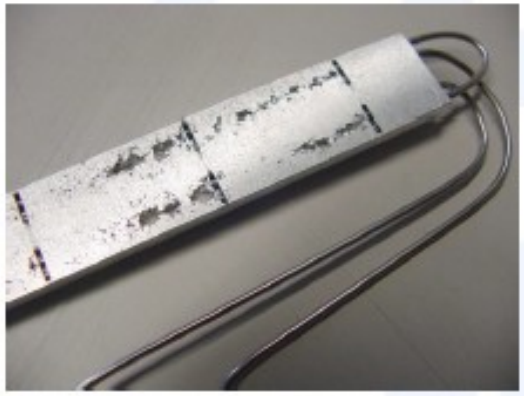
Melting in a copper mold



Melting in a SS mold with inert gas

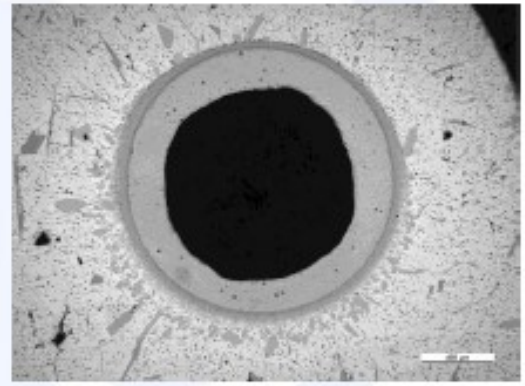
- Question was: Can we melt aluminum cooling blocks around a stainless steel pipe?
  - As Aluminum crimps more we must get a nice crimp contact though?

Prototype 4: Mg vapor bubbles due to vacuum



Prototype 5: Vacuum melting / pressurized freezing.. Perfect!

Applied vacuum method bonded SS to Alu by diffusion of Fe into Al



Result of vacuum baking:
A: Perfect contact around the pipe, B: perfect contra shape of the mold

- Aluminum cookie recipe:
  - Take a stainless steel tin and fill with aluminum blocks or bars (AlMg4,5Mn)
  - Melt aluminum under vacuum <1e-3 mbar at 700ºC for 1.5 hour
  - Apply 1 bar Argon pressure for 10 minutes
  - Switch of oven and let cool down.
  - Remove cookies from the mold and machine

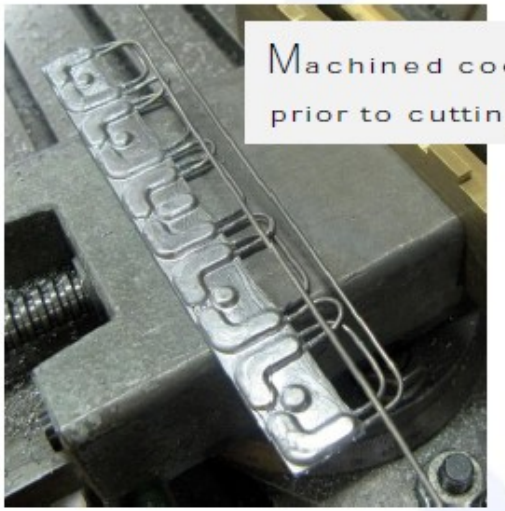
“The cookie bakery”

The bakery oven

Serial production baking

A bare cake

A sliced cake



Machined cookie prior to cutting

Tube bend jig

Mold detail

Magic pen to stop “super fluid aluminum”

A delicious aluminum cake!