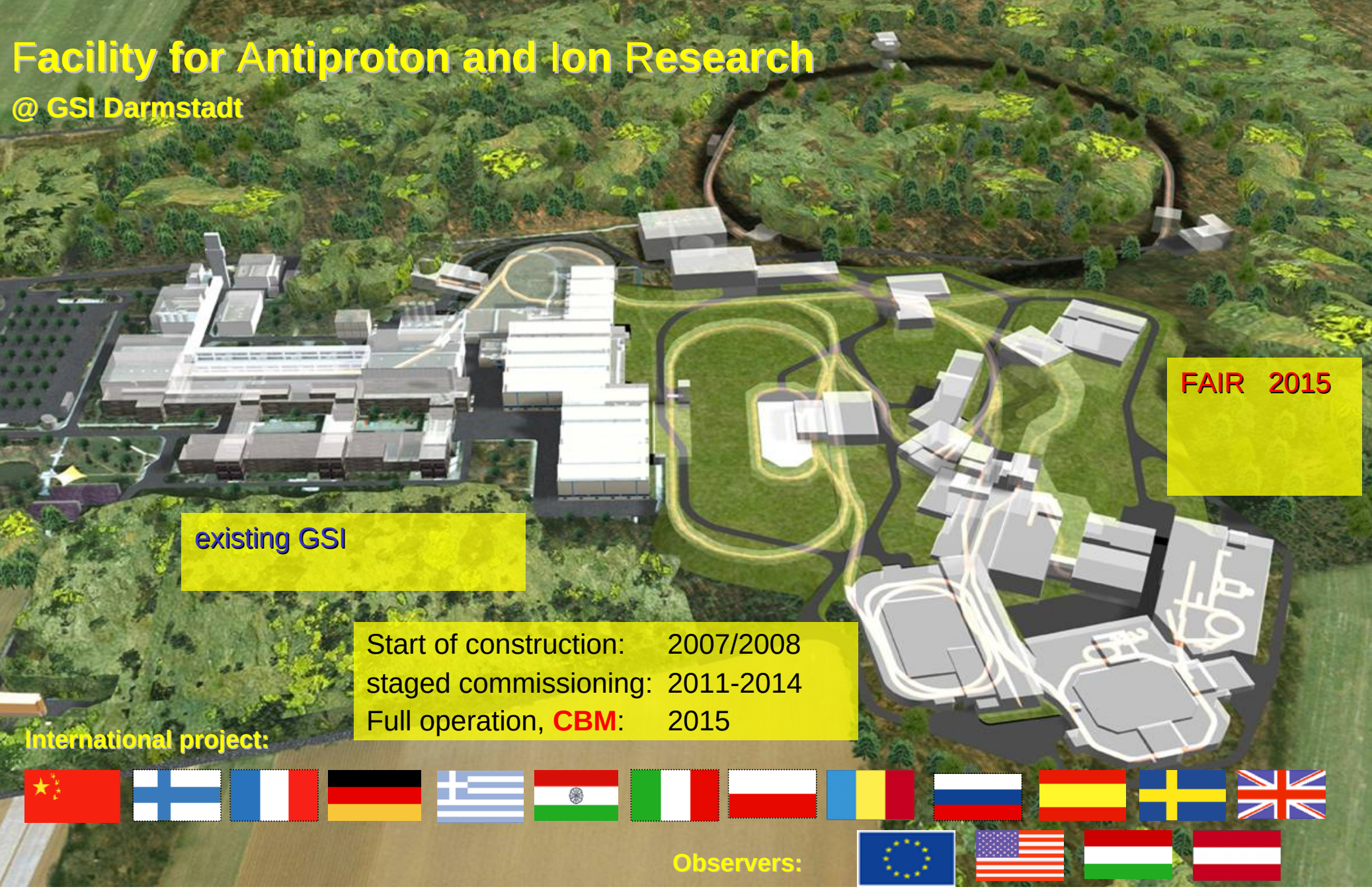
GSI Detector Laboratory

Environment,
Technologies
and
Engagements

Facility for Antiproton and Ion Research

@ GSI Darmstadt

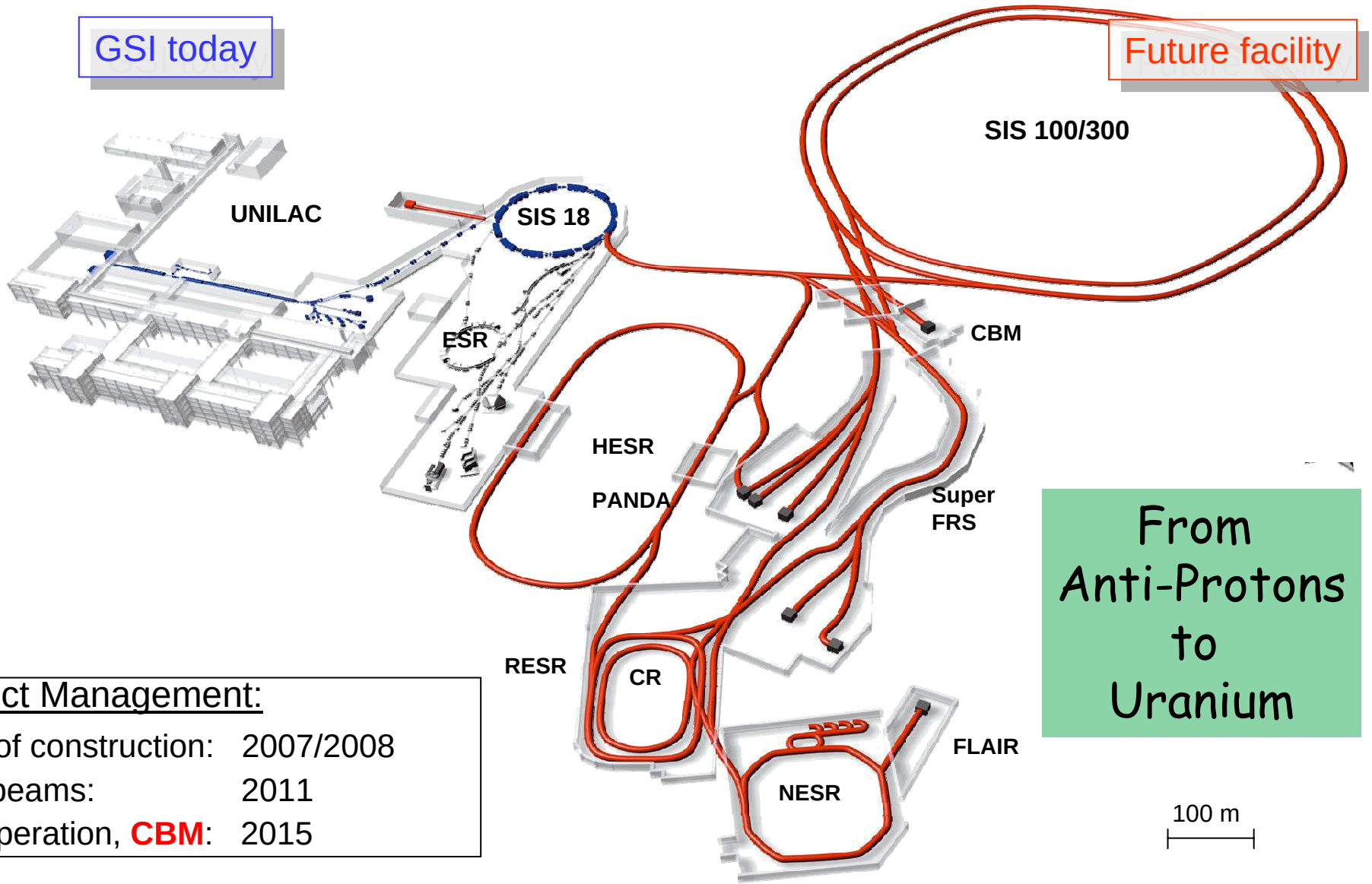


Start of construction: 2007/2008
staged commissioning: 2011-2014
Full operation, **CBM**: 2015

International project:

Observers:

FAIR - Facility for Antiproton and Ion Research



From Anti-Protons to Uranium

Project Management:

Start of construction:	2007/2008
First beams:	2011
Full operation, **CBM**:	2015

The GSI Detector-Laboratory

Fundamental R&D, Prototyping, Production and Maintenance

Traditional expertise and heavy weight upon gas detectors:
From beam monitors, wire grids and MWPC to TPC, RPC and medical applications

Fundamental detector R&D and application development for
CVD diamond detectors, single crystal and poly crystalline.

Future FAIR oriented strategic expansion into Silicon strip detector system integration. Large investments planned until 2009

Particular challenge with seamless integration of high density front-end electronics into high rates detector front-end systems

People and resources:

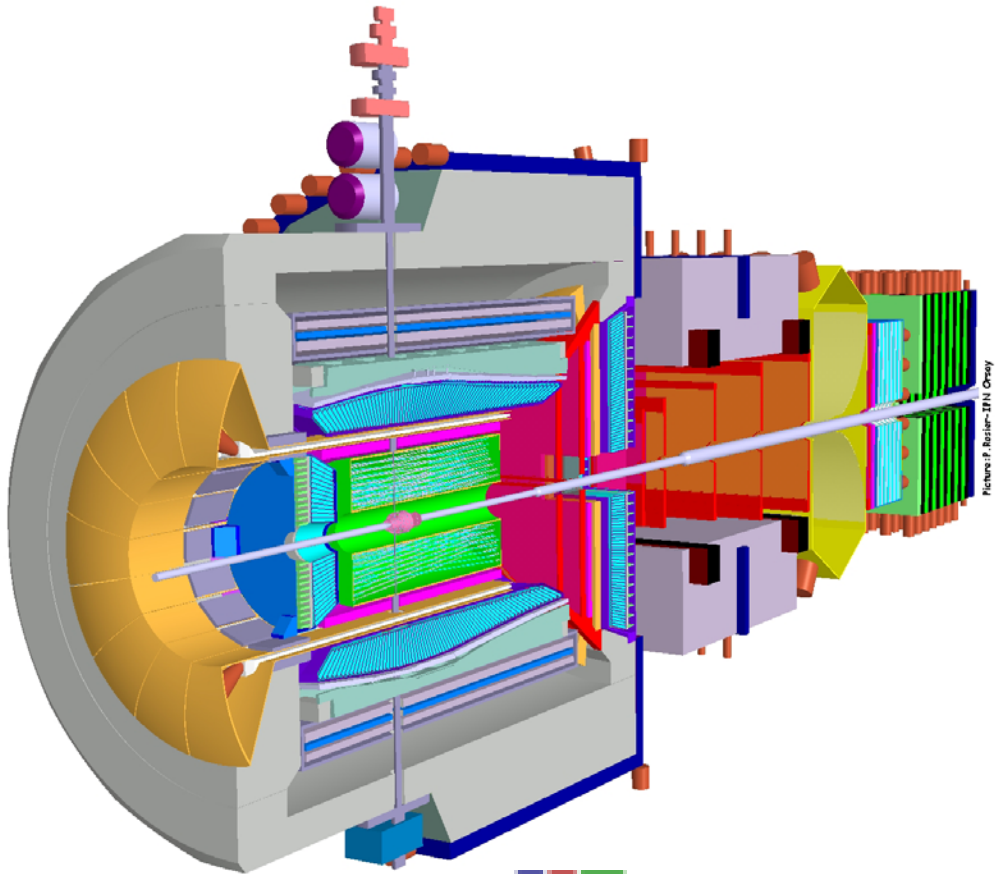
- 11 staff technicians, engineers and physicists
- two PhD students
- 12 student workers
- 2 to 3 international guests
- 1300 m^2 laboratory space
- Large prototyping CNC mill

Operation

- Inter collaborative involvement in several experimental endeavors.
- Independent funding
- Infrastructure responsibilities
- Research liberties
- Availability of lab space for external groups
- Close cooperation with university groups

PANDA

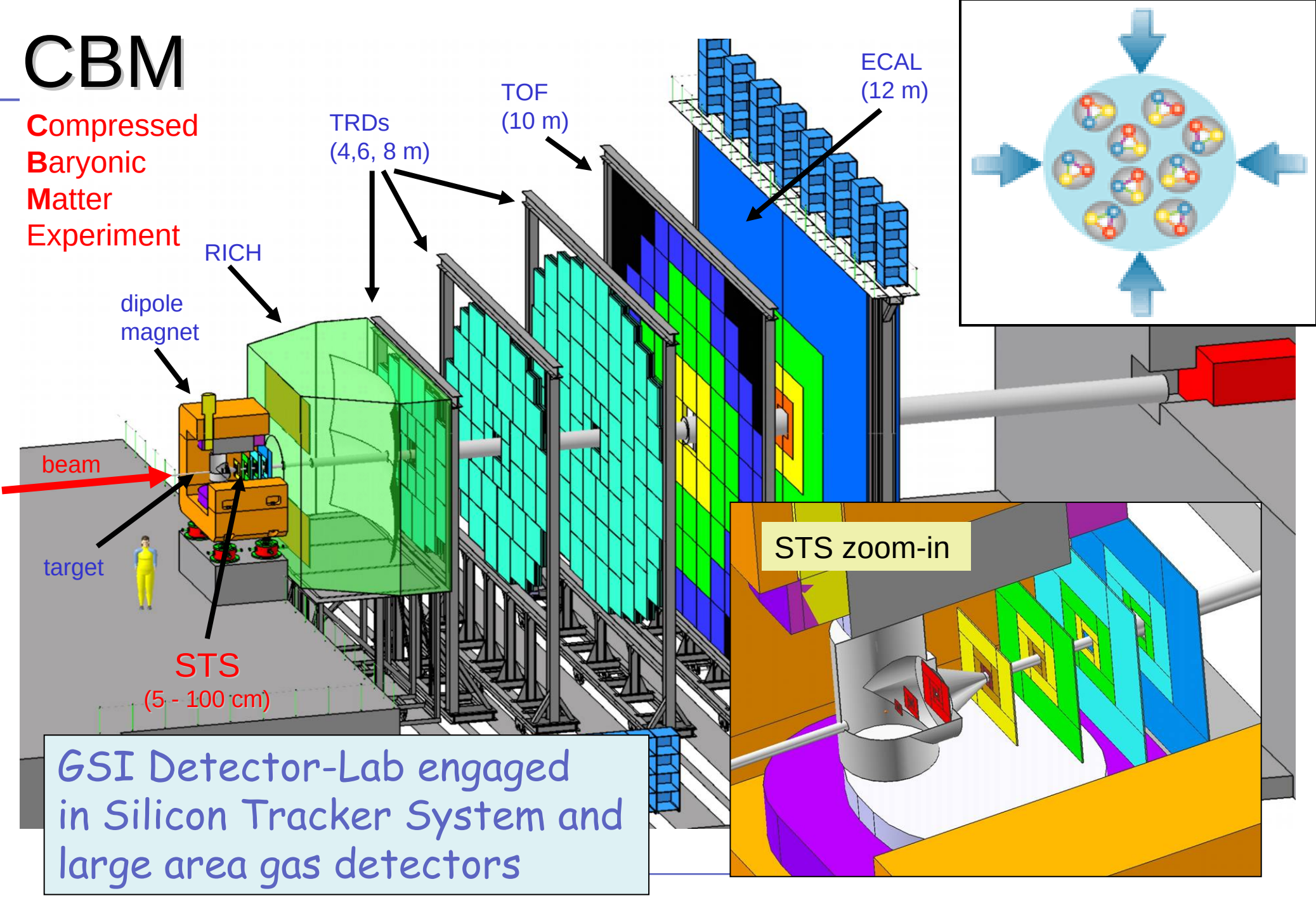
Interactions of Anti-Protons with nucleons and nuclei



- Universal detector system
- Most technologies involved
- GSI detector-lab engaged in TPC and Silicon Tracker

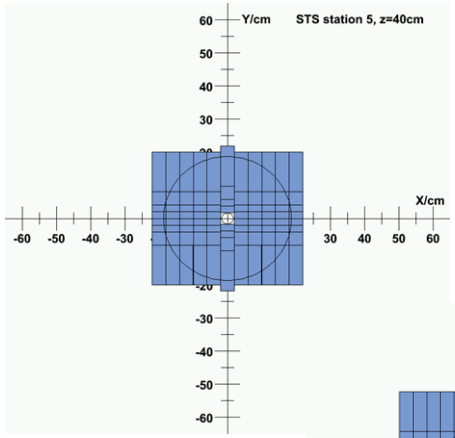
CBM

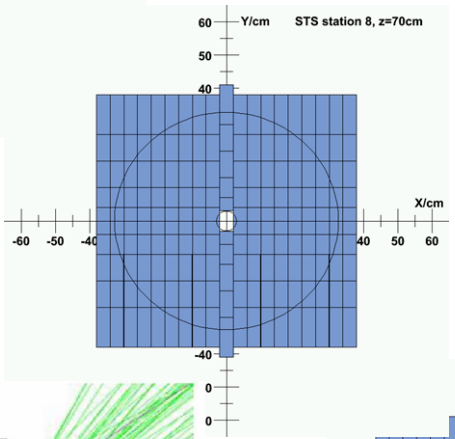
Compressed
Baryonic
Matter
Experiment

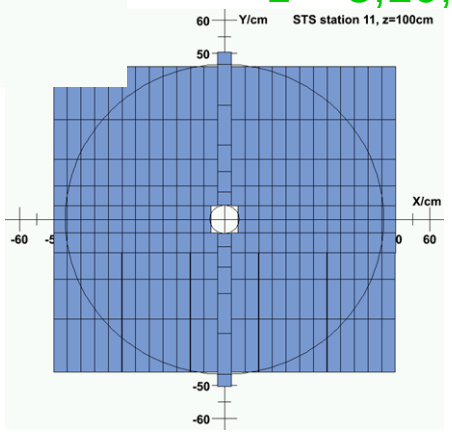


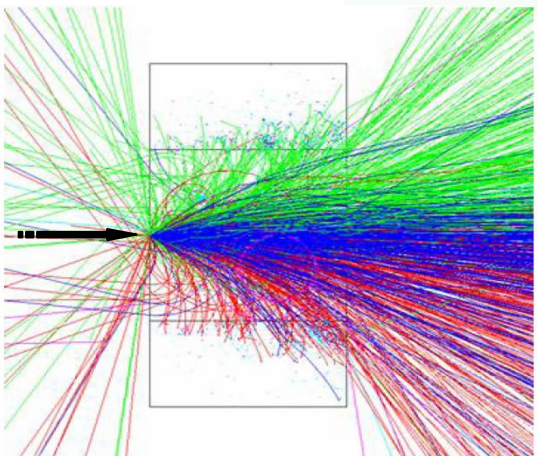
GSI Detector-Lab engaged in Silicon Tracker System and large area gas detectors

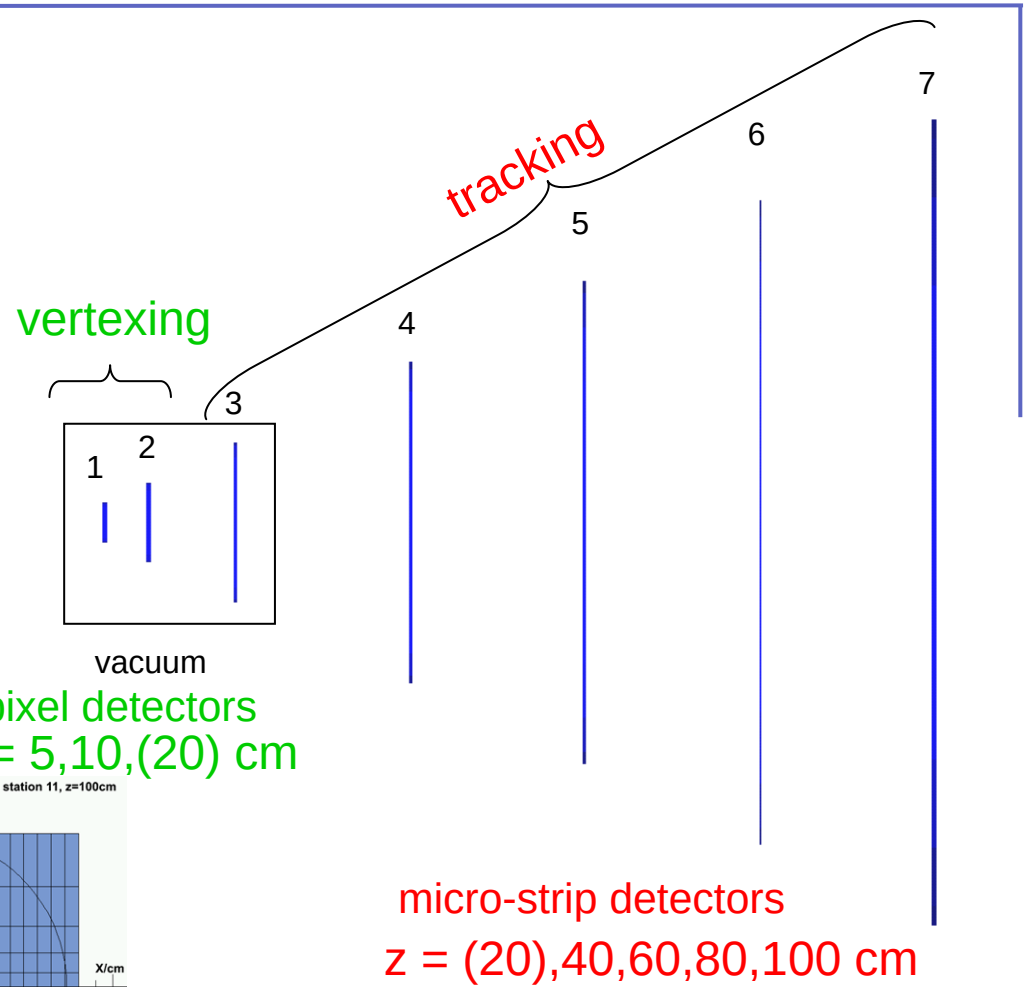
CBM Silicon Tracking System STS











Si-Sensor Design: R&D with CIS Erfurt, Germany:

(http://www.cismst.de/english/frameset.html)

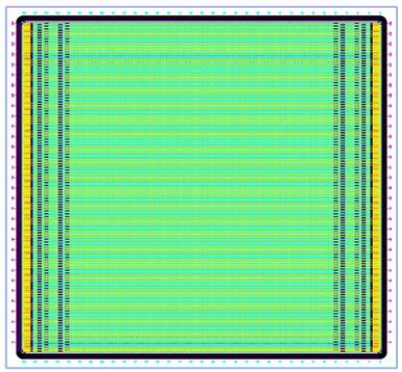
CBM: Opportunity to participate in reseach project of CIS (focus on rad hard detectors).

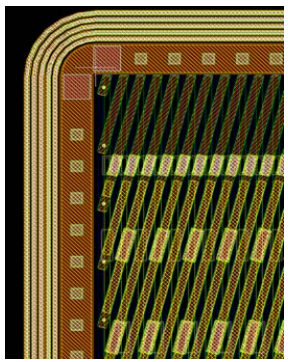
CBM sensor prototypes as "test objects".

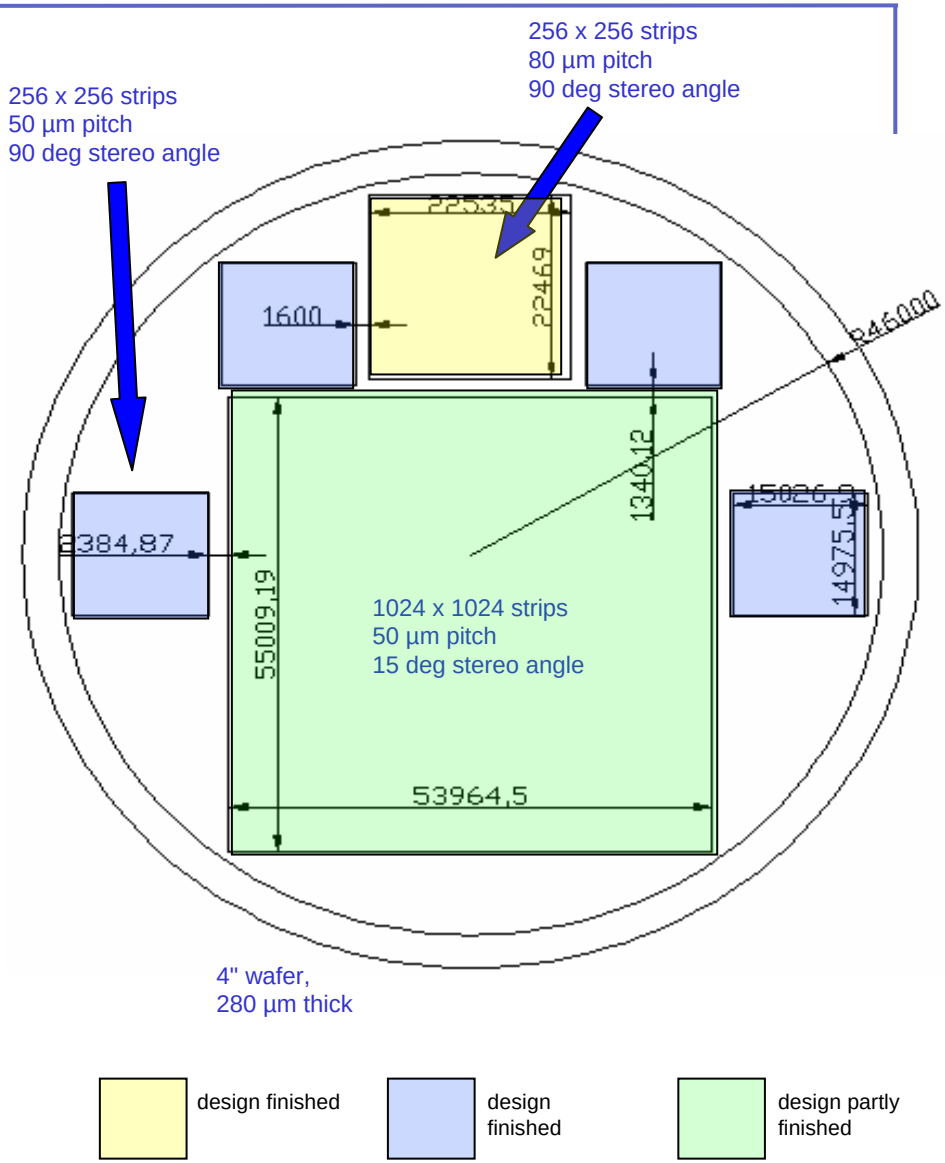
Sensor design: finished 10/2006.
Mid 2007: batch of ~ 20+ wafers.

Plenty of sensors for a variety of tests of r/o electronics and detector concept.

Set up Silicon labs at GSI + other institutes.
Test beam + telescope at GSI.



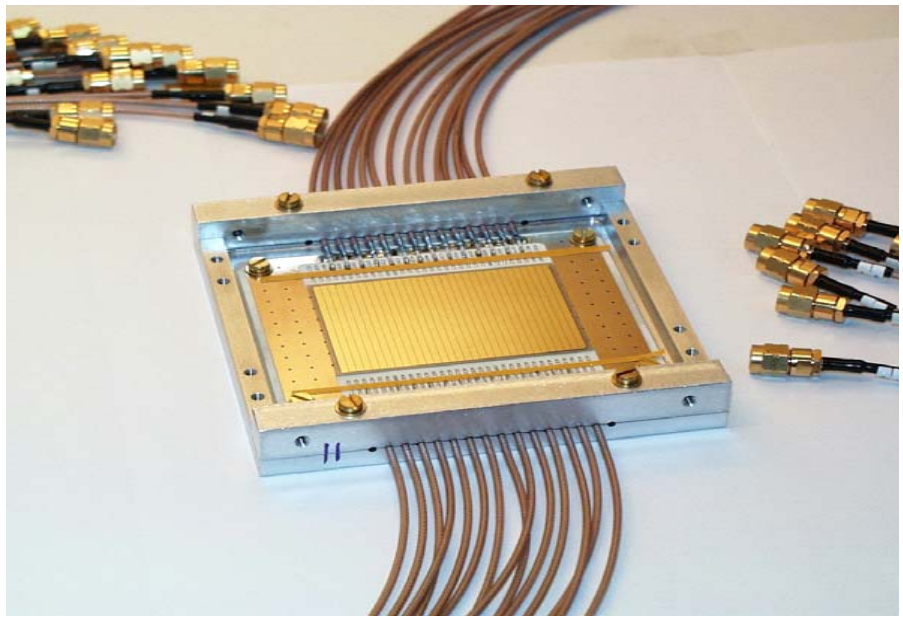




Poly Crystalline CVD Diamond Detectors

The world-wide largest CVD-Diamond Detector in Use !

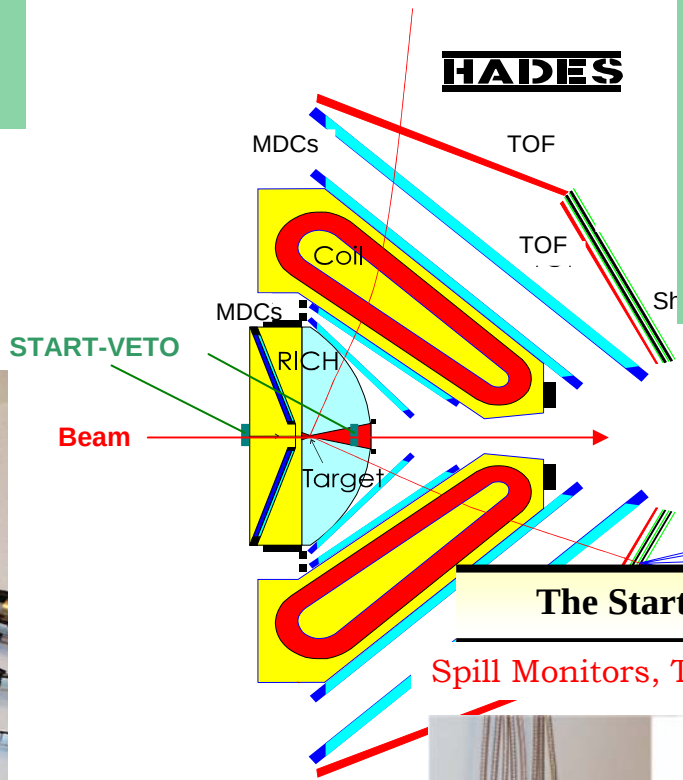
Poly Crystalline-D Focal Plane Detector for GSI Cave A



A = 60 x 40 mm² ⇒ 32 strips, 1.8 mm pitch

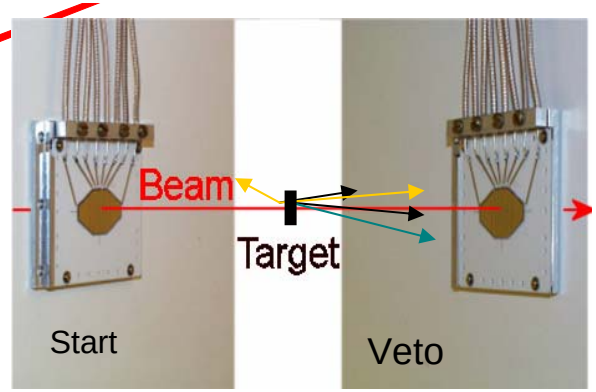
d_D = 200 µm C_{str} = 16.3 pF

Time-Zero ToF at HADES



The Start-Veto Device

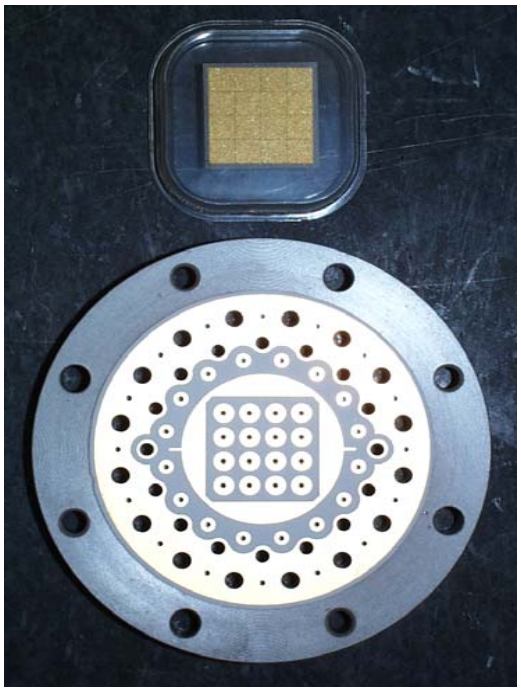
Spill Monitors, T0, ToF Detectors

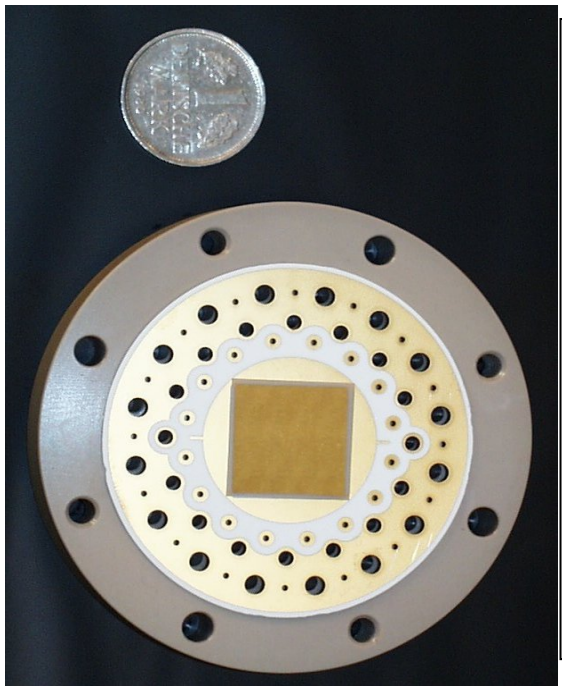


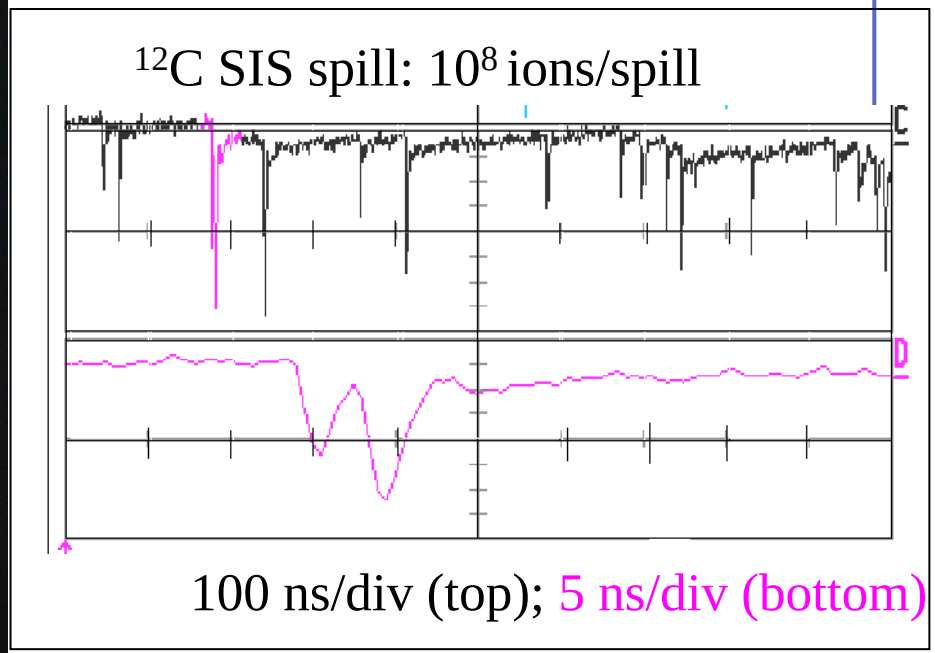
2 Octogones A ≈ 25 x 15 mm
d_D = 100 µm

Diamond Detectors for Tumor Therapy with 12C Ions

PC-D Position-Sensitive Carbon-Ion Dosimeters







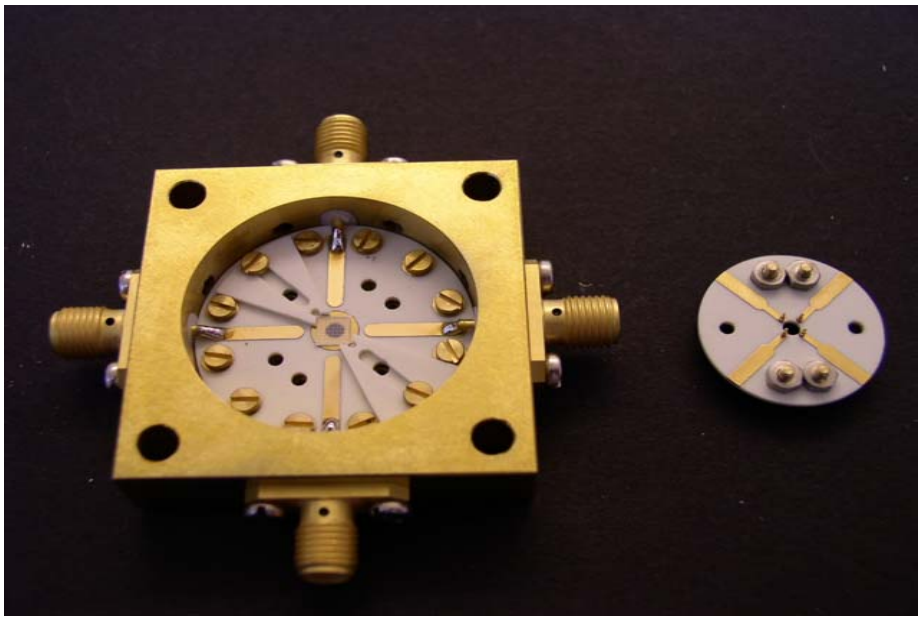
Single-Particle Readout:

Precise Fluence Measurements F [ions/cm^2]

$\Rightarrow$ Applied Dose = (ΔE/ion)*(F/dr)

Single Crystal- CVD Diamond Detectors

for Spectroscopy and Timing

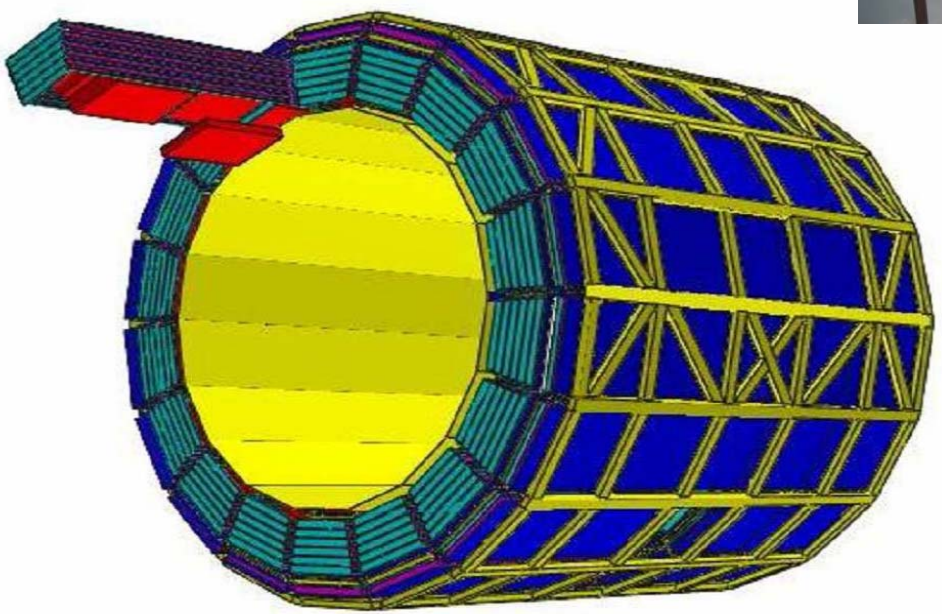


exceptional radiation hardness properties

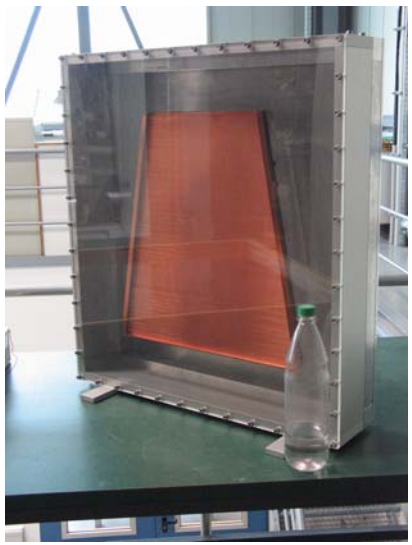
Gas Detectors and Wire Chambers at GSI Detector-Lab

- Various drift chambers for HADES and FOPI at GSI
- Large scale production of ALICE TRD chambers
- R&D and production of ALICE TPC ROC-chambers

Wire grid assembly and inspection



ALICE TRD

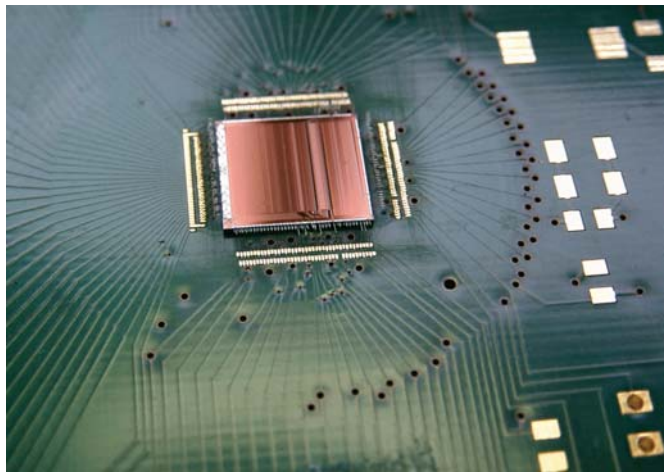


ALICE TPC ROC

n-XYTER, a Novel FEE-Chip Architecture Cast in Silicon

Architectural Solution for CBM and PANDA.
Towards the development of the dedicated CBM-XYTER front-end ASIC for many FAIR applications.

- A Self-Triggered Detector Readout ASIC
  for High-Density and High-Rate Time and Amplitude Measurement
- 128 channels @ 50 µ pitch
- Self Triggered
- Free running



At the GSI Detector-Lab:
Direct access from chip design into detector prototyping applications.

DETNI

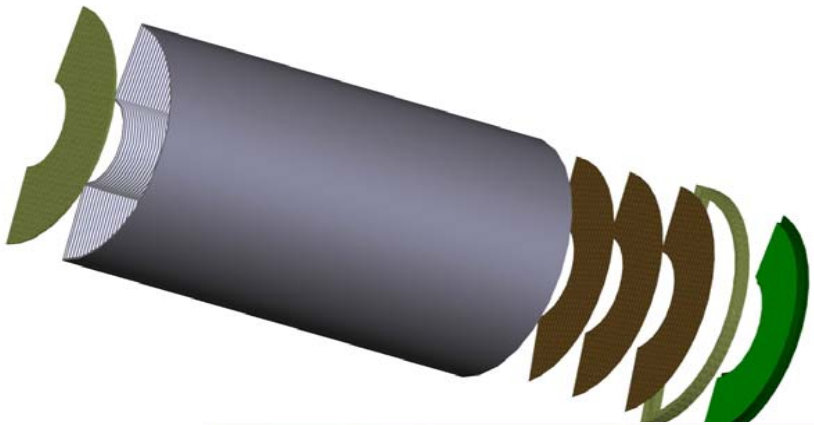
nmi3

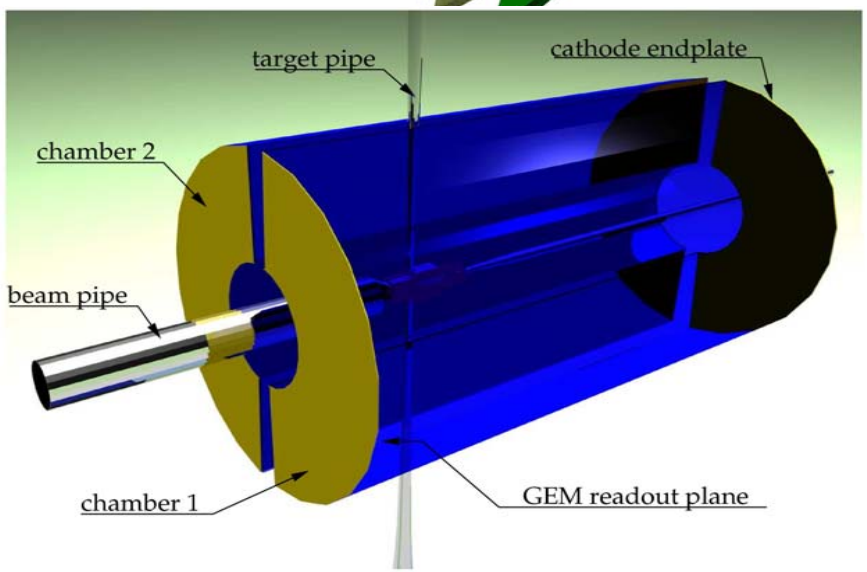
n-XYTER was developed for neutron applications within EU FP-6 NMI3

Development of a TPC for FOPI (GSI)

The prototype development for the PANDA TPC

Parameter	Value
Length (cm)	150
Inner radius (cm)	15
Outer radius (cm)	42
Drift field (V/cm)	400
Gas	Ne/CO_2 (90/10)
Electron drift velocity (cm/μs)	2.8
Pad size	2 mm x 2 mm
Channels	100.000

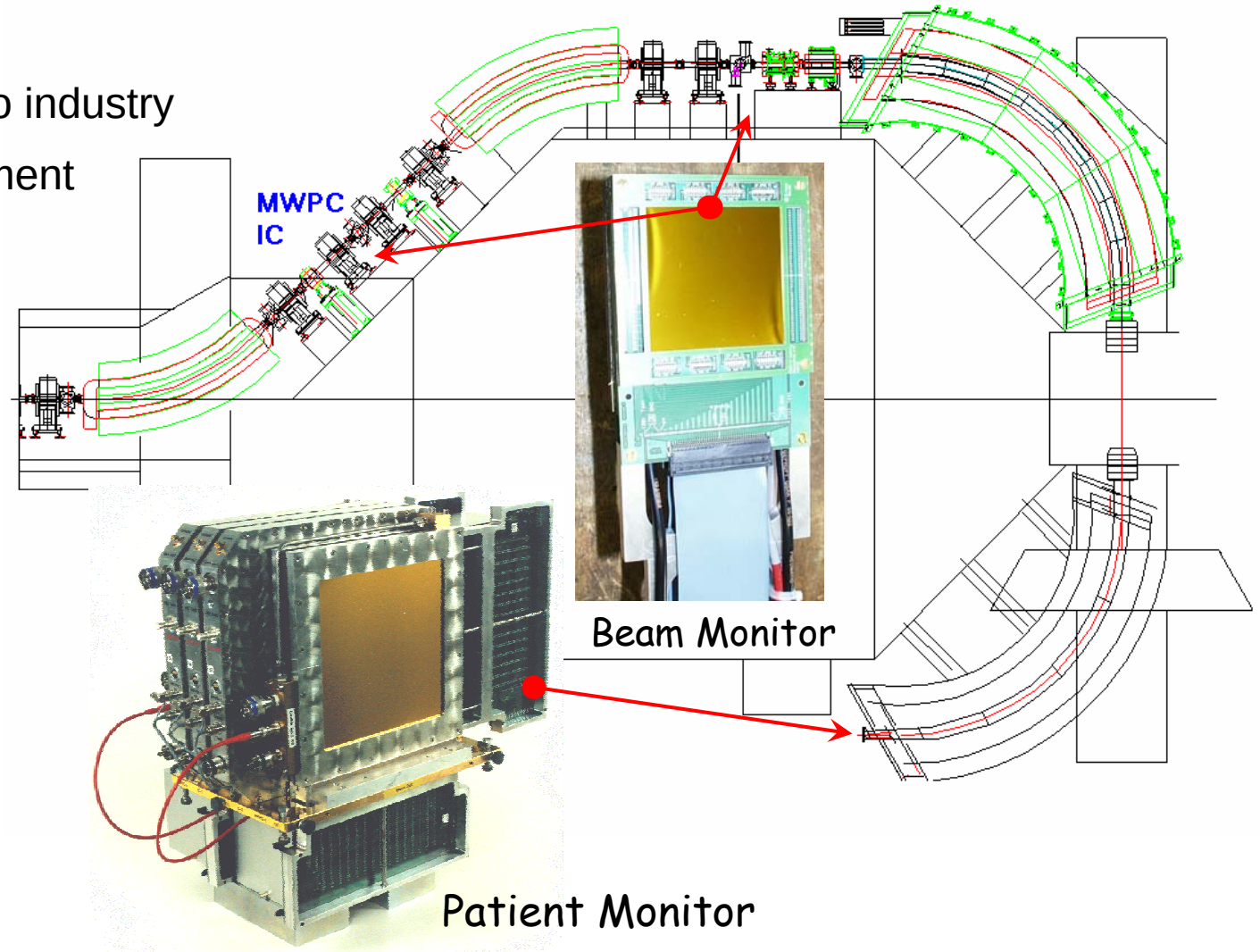




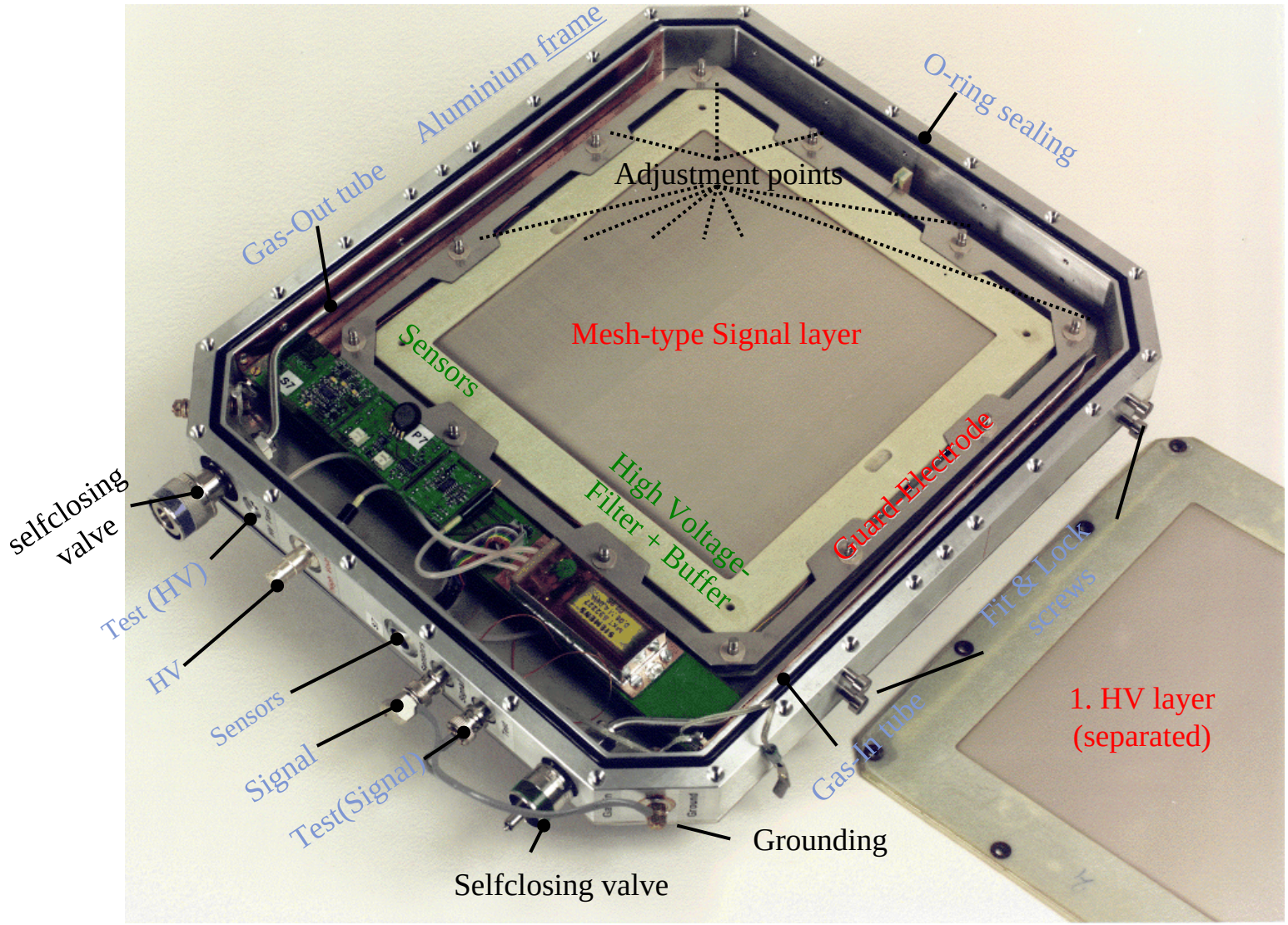
DETECTOR-LAB:
Challenging project with first large scale employment of n-XYTER FE technology

Detectors for Heavy Ion Therapy

- Deep engagement and various detector developments at the detector lab for the ion therapy project
- Technology transfer to industry
- QS and risk-management



The PPIC Design (II)



Summary

- The GSI detector laboratory will face many exciting challenges during the research and construction phase of FAIR till 2015
- GSI provides a truly international, very interactive environment for research and development.
- Visiting scientists at the detector-lab will unavoidably interlink with other experimental groups and projects at GSI as well as several universities in direct neighborhood: Heidelberg, Darmstadt, Mainz, Frankfurt, Giessen, Marburg, Darmstadt and others.
- In house Seminars fill the weekly schedule at GSI
- Several developments will need to be realized in close collaboration with industrial partners.