

WP9, Instrumentation for Radioactive Beam Environment

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CRISP annual meeting 2013

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9.1 Remote Handling (RH)

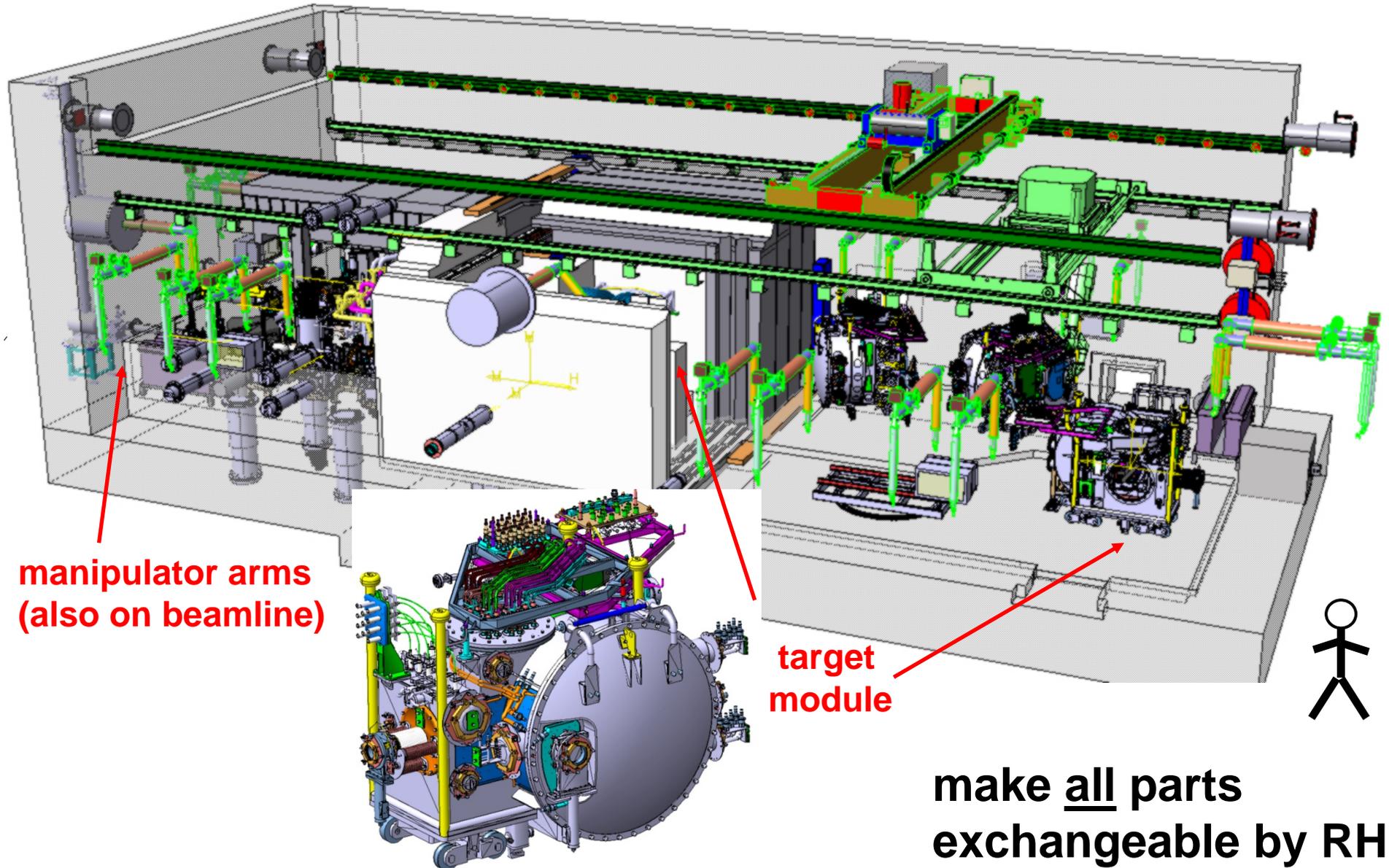
Connection of Supplies by RH

9.2 Survey and Alignment

9.3 Validation of Beam Characteristics

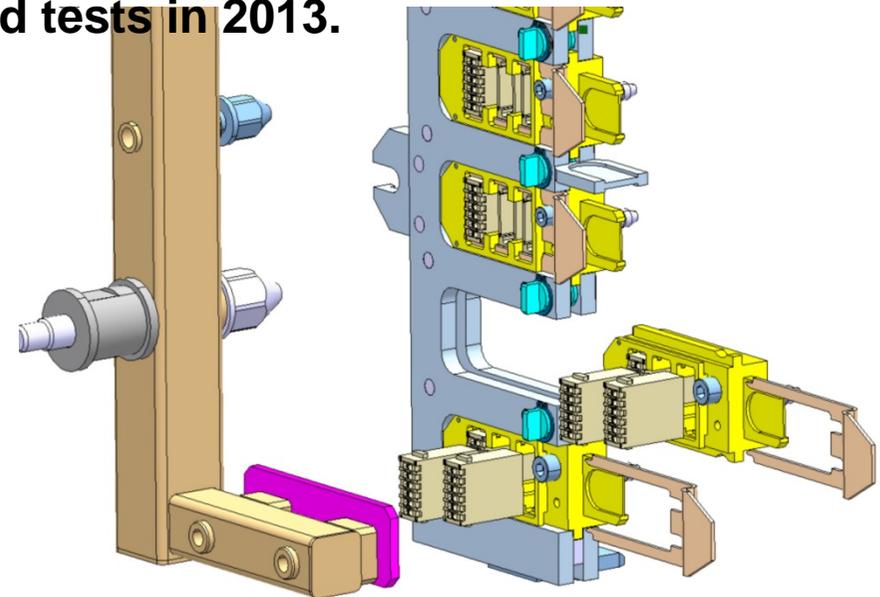
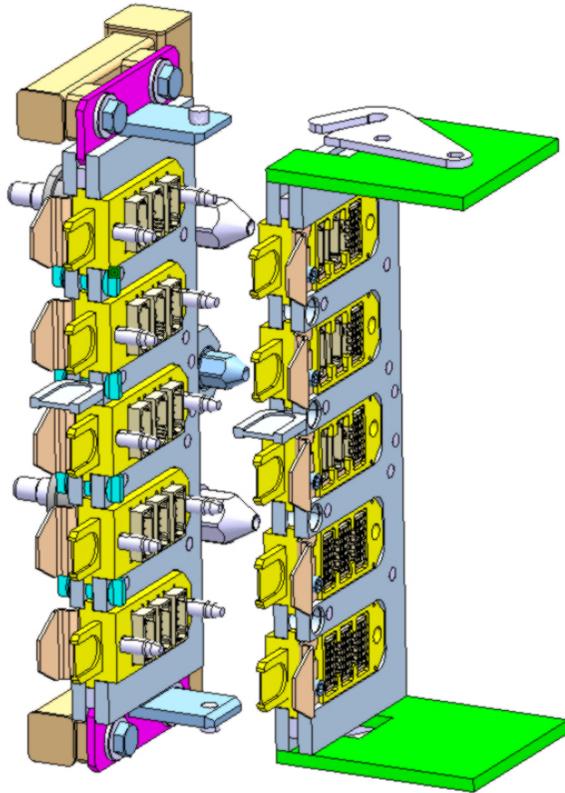
9.4 Vacuum tight radiation resistant sealing

SPIRAL 2, Target Cell



Connectors - GANIL

1. Development and tests of specific connectors for remote handling and multiconnector plate
2. Detailed design finished
3. Technical specification in progress,
4. Consultation before end of 2012,
5. Construction and tests in 2013.



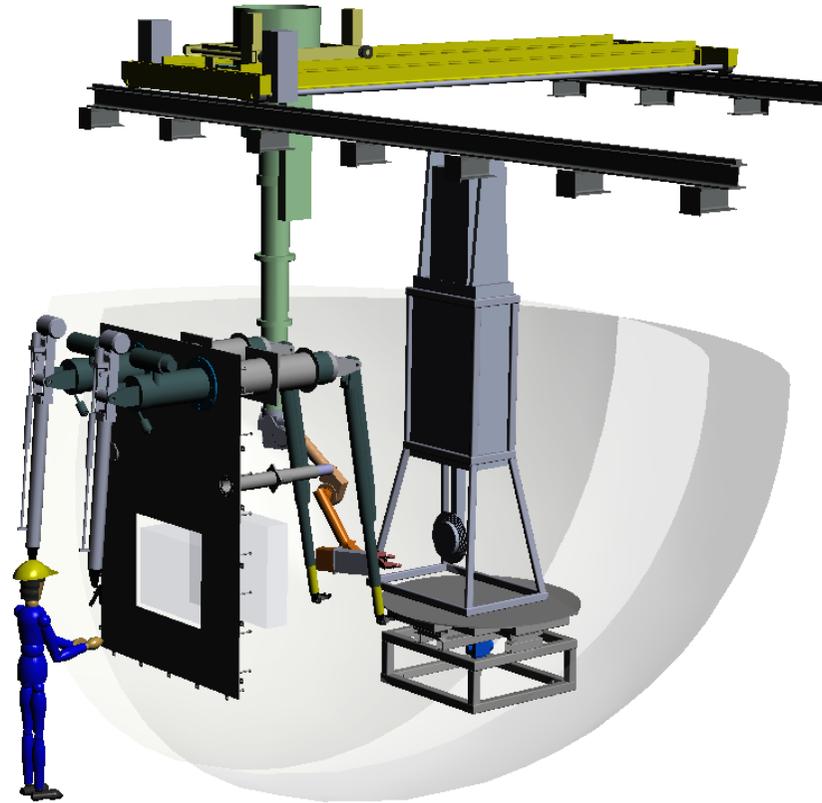
Results:

2012 all done. BUT the consultation was unsuccessful and there were no acceptable propositions from the industry. Therefore the investment foreseen has not taken place. In 2013 we start over with more detailed designs made “in house” for the connectors and we will separate the consultations into subsystems in 2013.

Manipulator Test Stand



test stand production



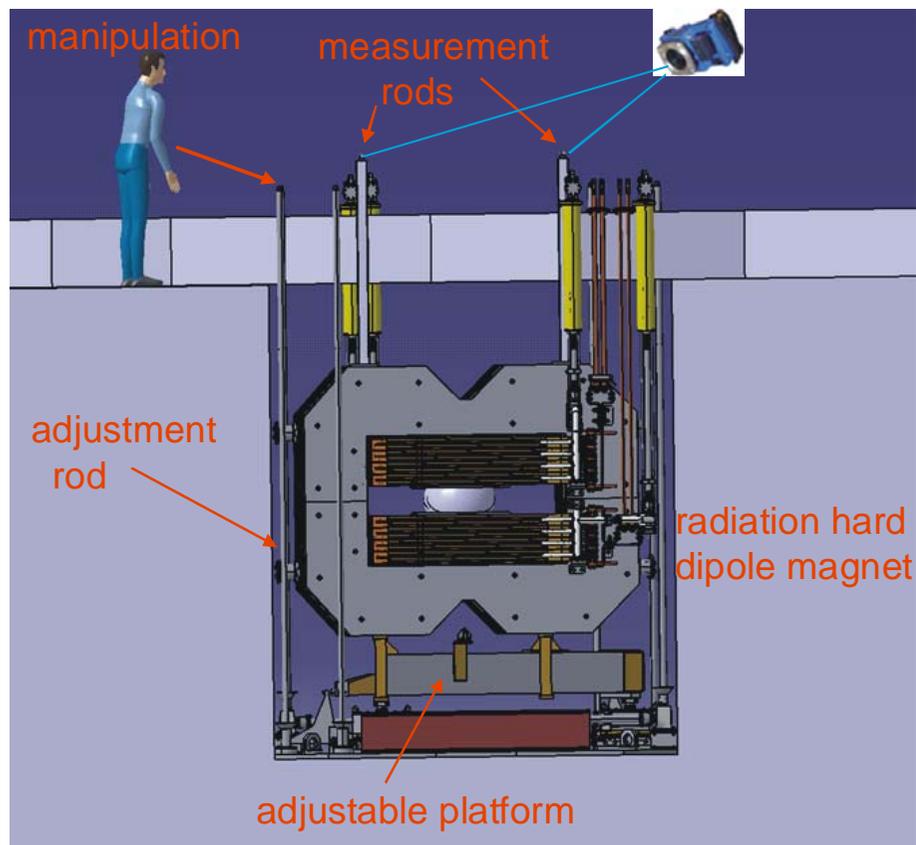
GSI test stand parts ordered, installation June 2013
No test stand soon at GANIL.
SPIRAL2 parts should be tested at GSI.
Virtual test conducted for Spiral 2 target cell.
Simulation software based on ITER experience for GSI.
Work in virtual space on CAD models with added physics / haptics.

9.2 Survey and Alignment

May not give results in time.

Photogrammetry development too slow due to lack of experts.

In Hamburg we asked for changing the task.



Test of mechanical remote alignment at GSI on magnet of 95t, System still has flaws, gets stuck.



9.3 Validation of Beam Characteristics

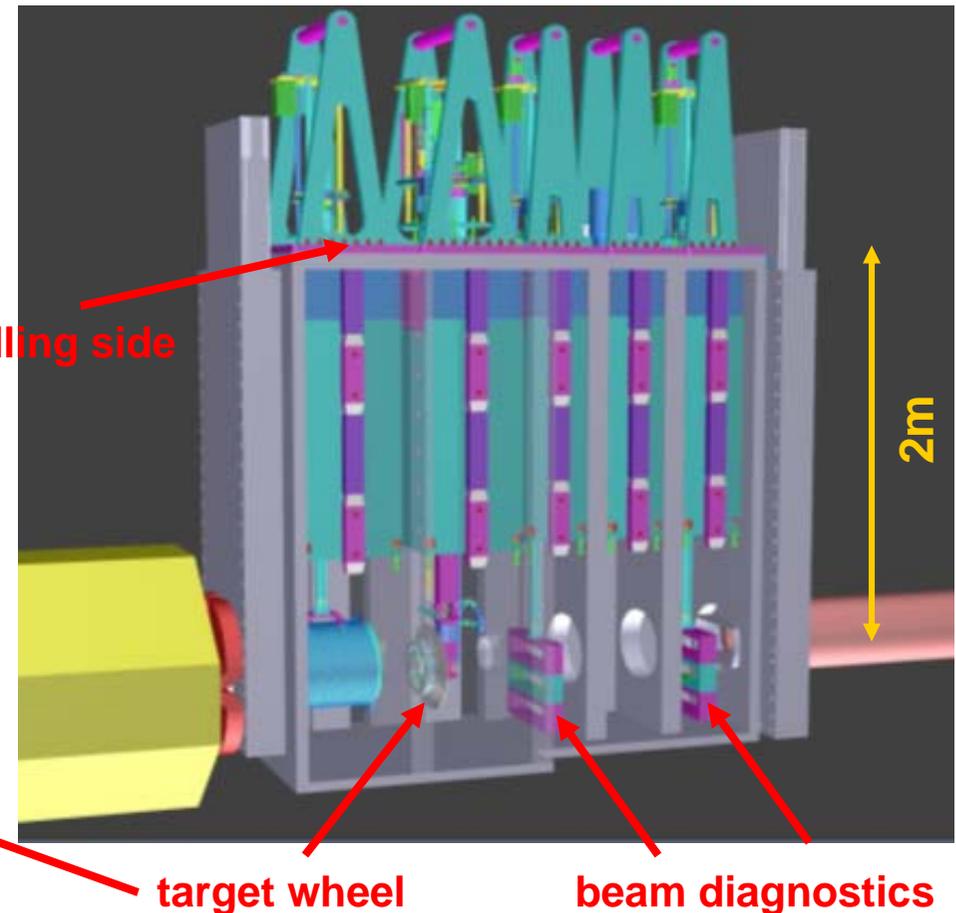
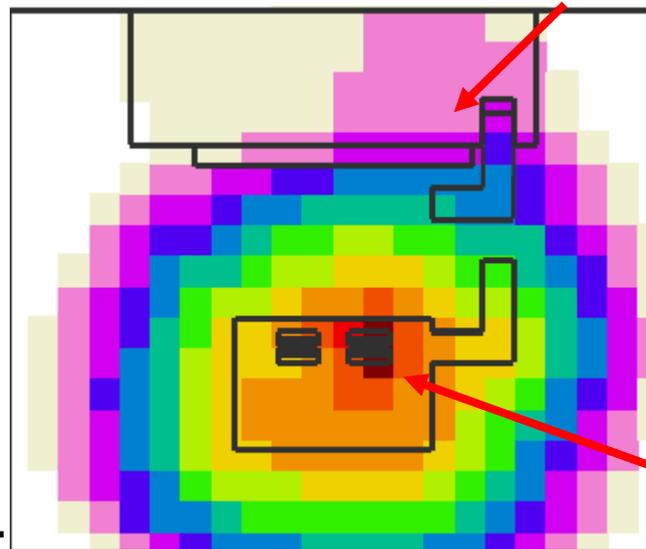
Requirement for beam tuning and beam position monitoring during operation (critical), but also failure detection including radiation.

At GSI still many options:

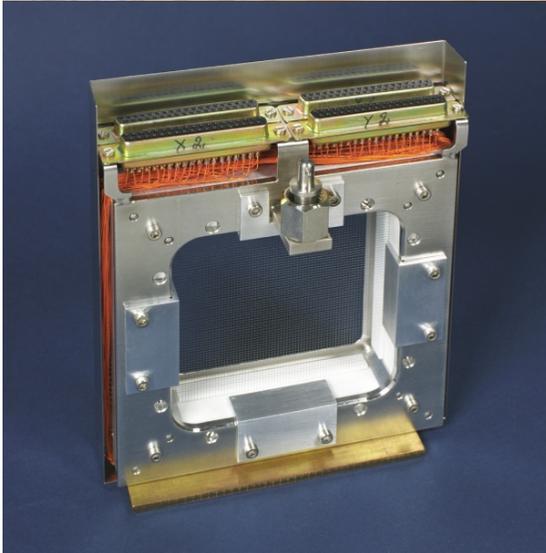
- SEM (current) grids
 - Beam induced fluorescence
 - Infrared camera on hot beam spot
 - Position pickups for pulsed beams
- no space to install all

prompt dose rates, range:
 3×10^4 to
0.03 Gy/h

FLUKA Sim.

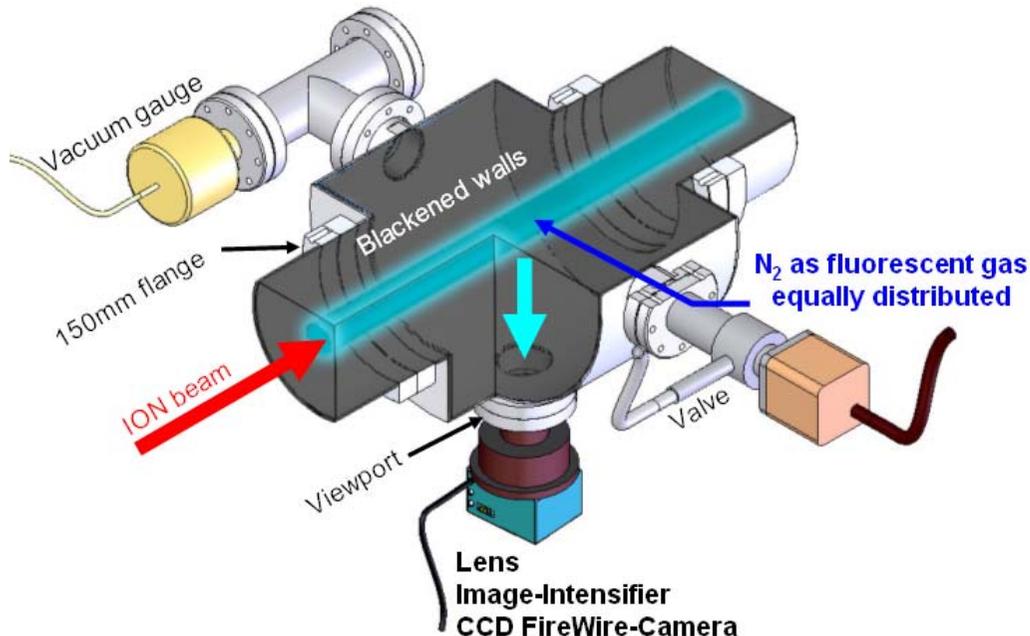


Beam Profile Measurement



Secondary-Electron-Monitor (SEM) Grid

- + Standard tool, compact design
- + Low background level
- o Limited spatial resolution, wire spacing, ok.
- **Melts in high power beams**
- **No constant monitoring, wires disturb**

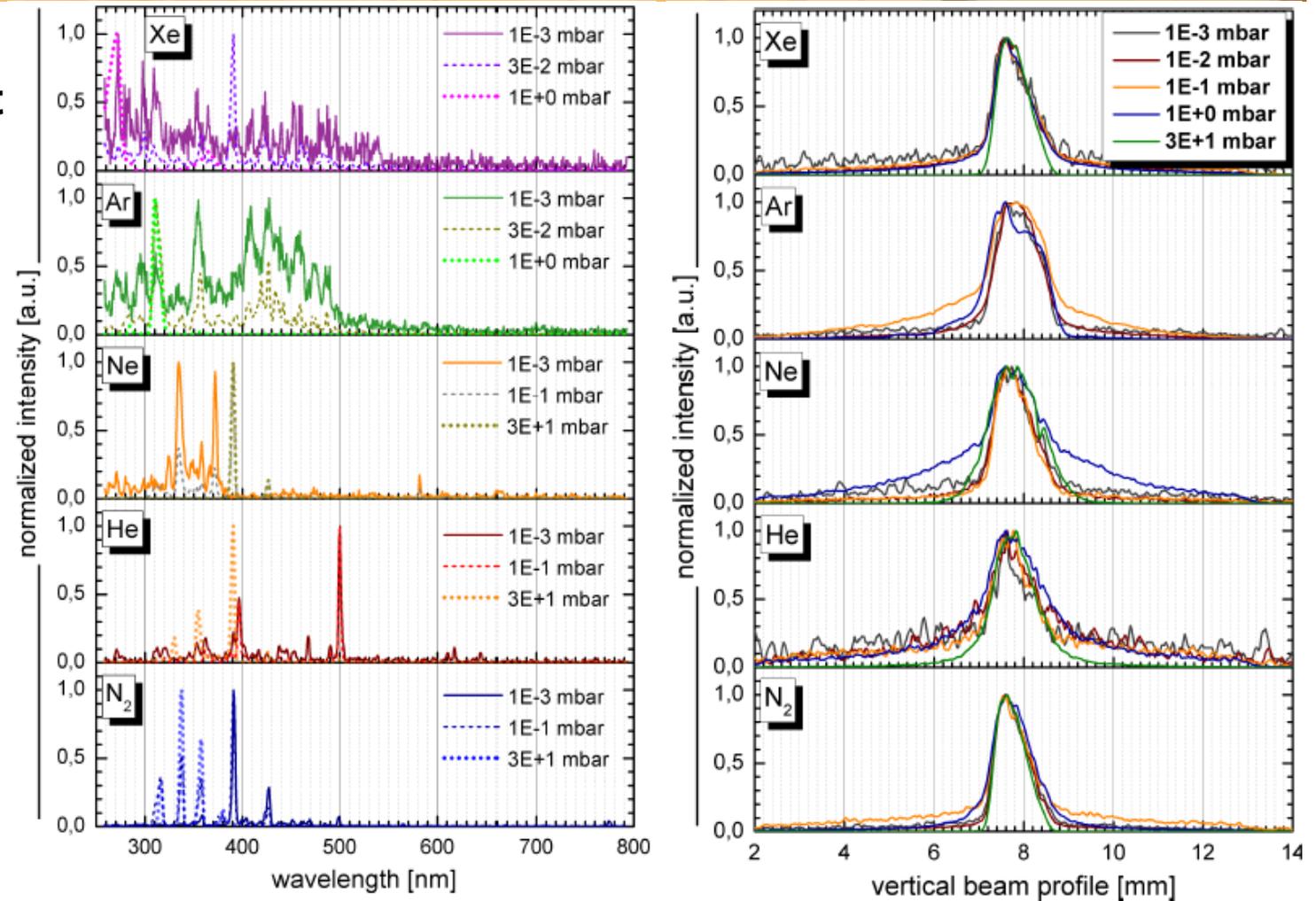


Beam-Induced Fluorescence

- + non destructive
- + fast 2D profile
- **depends much on pressure and gas, needs 10^{11} Ni/s, 10^{-5} mbar for good profile**
- **main problem radiation on camera, light guide**

Beam Induced Fluorescence

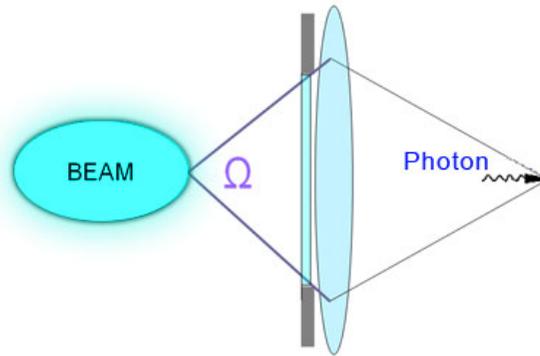
test of different
gases
F. Becker



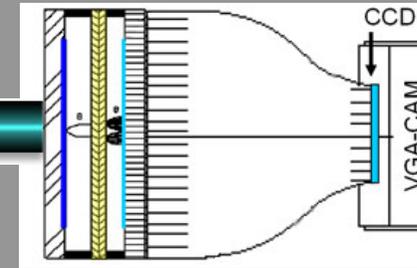
work with N₂ at 391nm or 337nm

Shielding Concept

Fiber-optic image bundle with about 1 million sorted fibers:



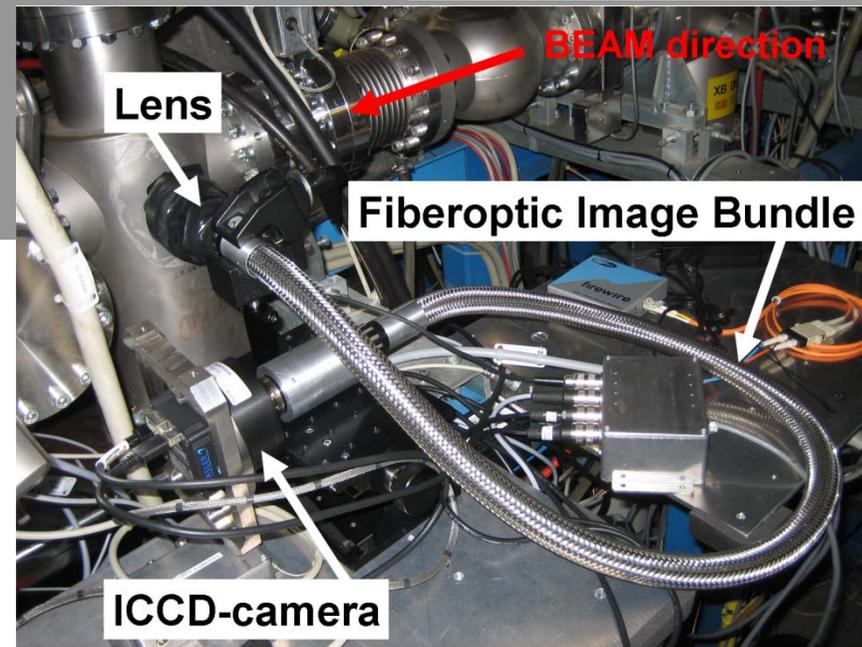
Effective neutron SHIELDING:
Moderation and Absorption



- Commercially available device to reduce background & CCD damage
- Image Intensifier & CCD in shielded area maintaining the solid angle

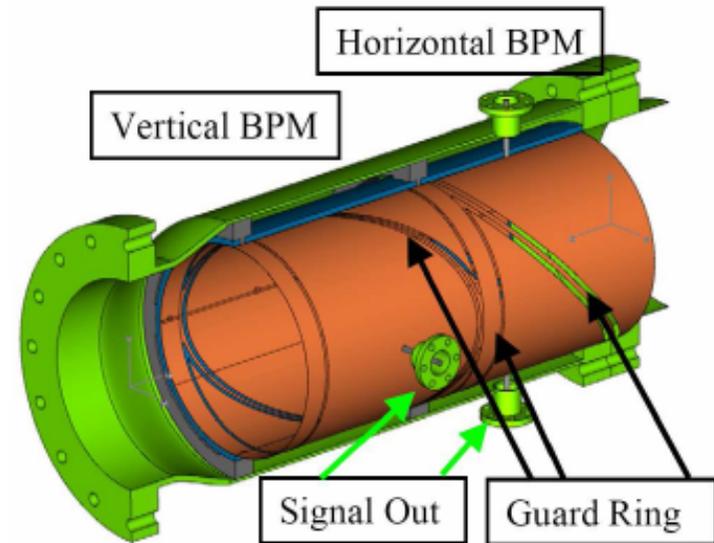
First Results:

- No significant image distortion
- Low scintillation by neutrons and gammas inside bundle



Position Pickups

**For beam with pulse structure,
fast extraction pulses from
synchrotron or also from LINAC
(SIS-18/100 or LINAG)**



Parameters for pickups in FAIR beamlines

Overall length	mm	510
Horizontal aperture	mm	150
Vertical aperture	mm	150
Pick-up bandwidth	MHz	0.04 – 55
Resolution	mm	0.3
Absolute accuracy	mm	1
Min. bunched beam current for given resolution	μA_{rms}	10
Max. bunched beam current	A	150
Gain ranges	dB	-50,-40,-30, -20,-10,0 10, 20, 30, 40, 50, 60
Amplifier dynamic within one range	dB	46



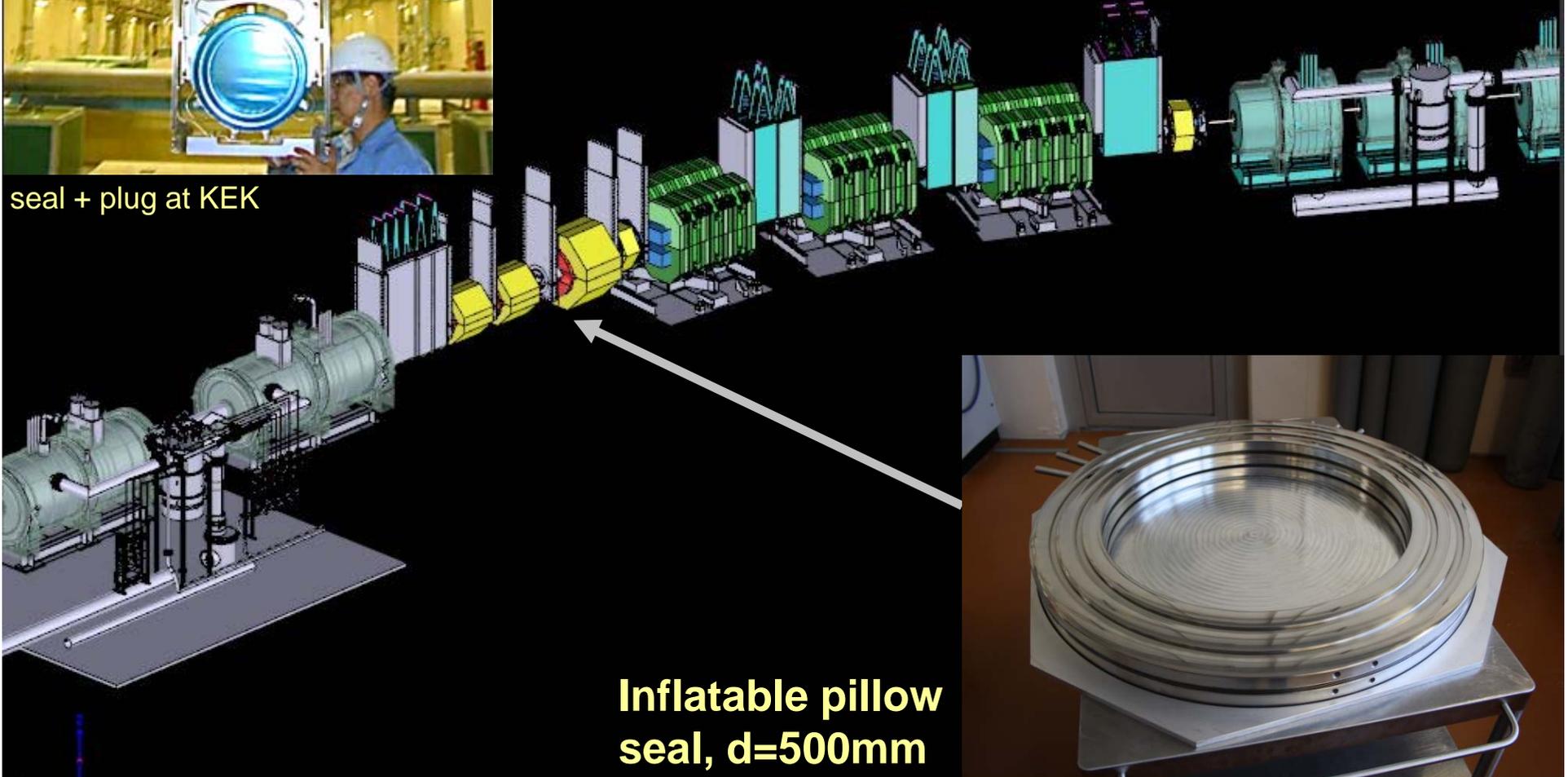
9.4 Vacuum tight radiation resistant sealing

Pillow Seals

requires fine polishing of metal surfaces



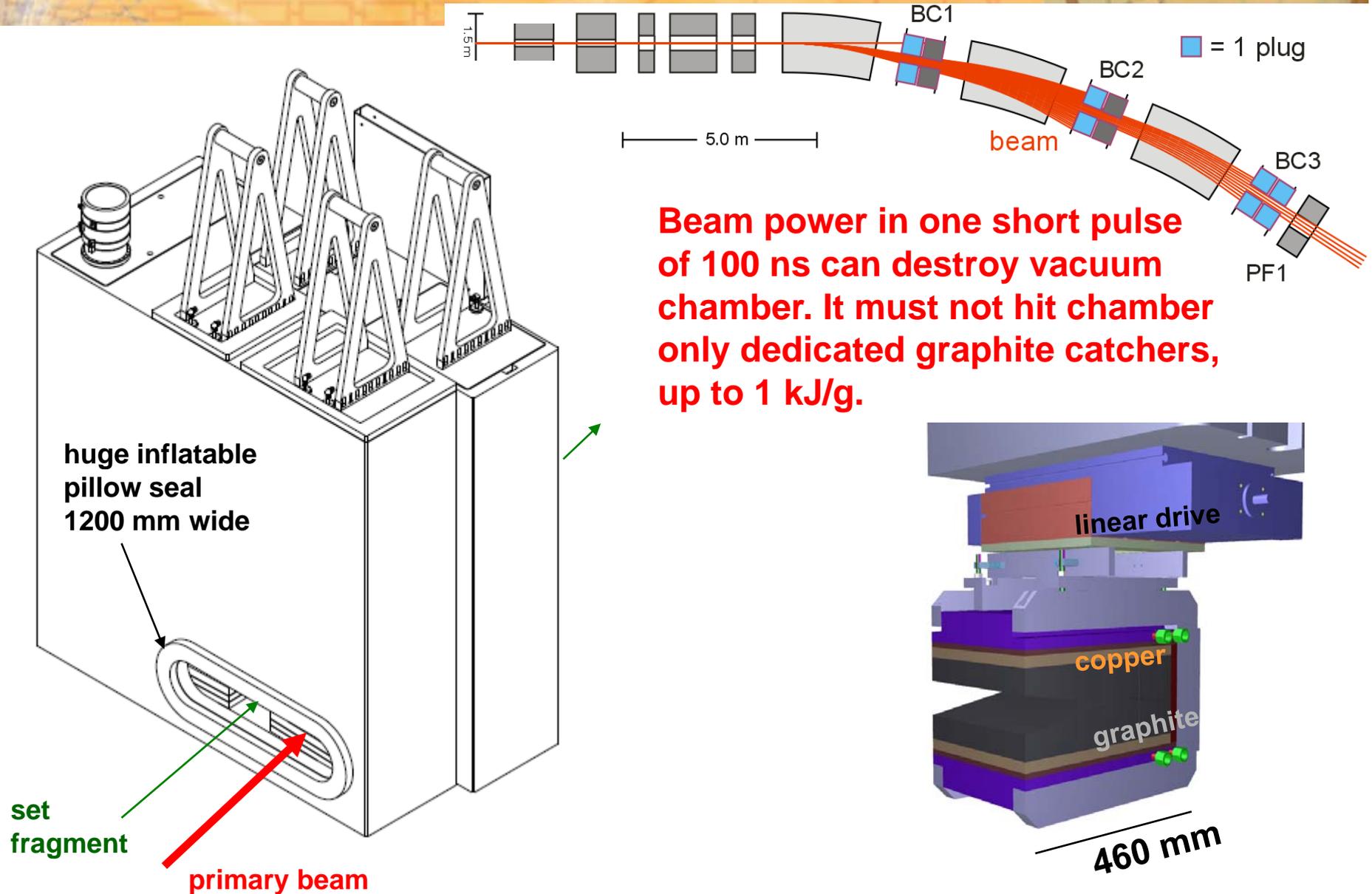
seal + plug at KEK



Inflatable pillow seal, $d=500\text{mm}$

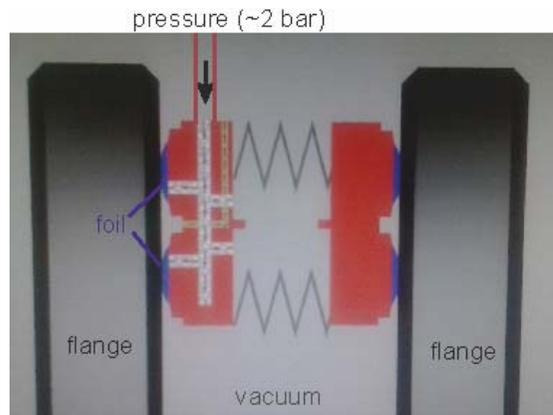


Race Track Shape Pillow Seals near Beam Catchers (width 1200mm)



Beam power in one short pulse of 100 ns can destroy vacuum chamber. It must not hit chamber only dedicated graphite catchers, up to 1 kJ/g.

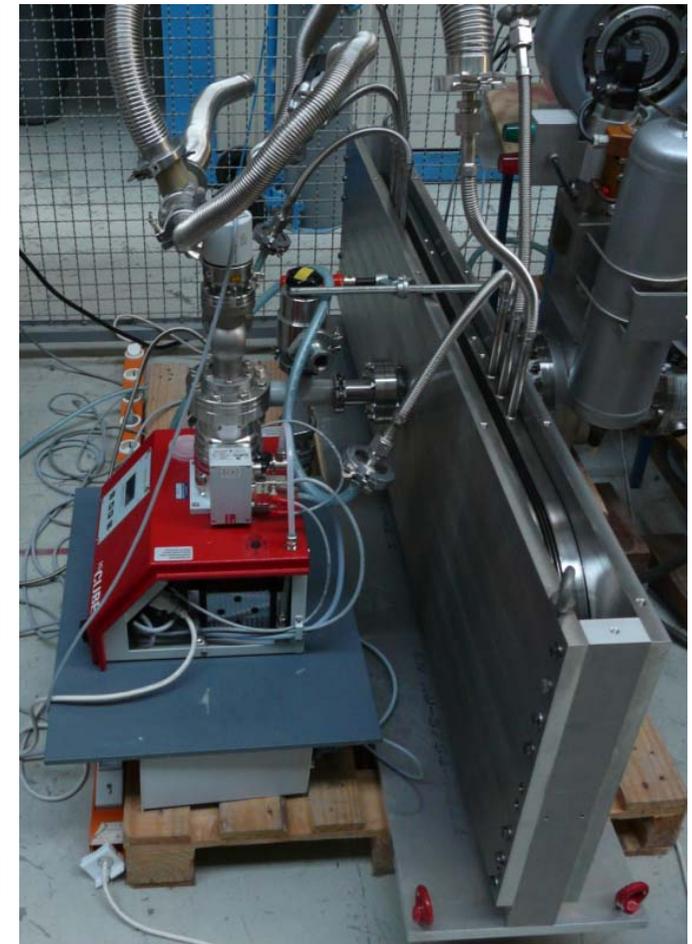
Pillow Seals of Large Size 1200mm x 160mm



principle



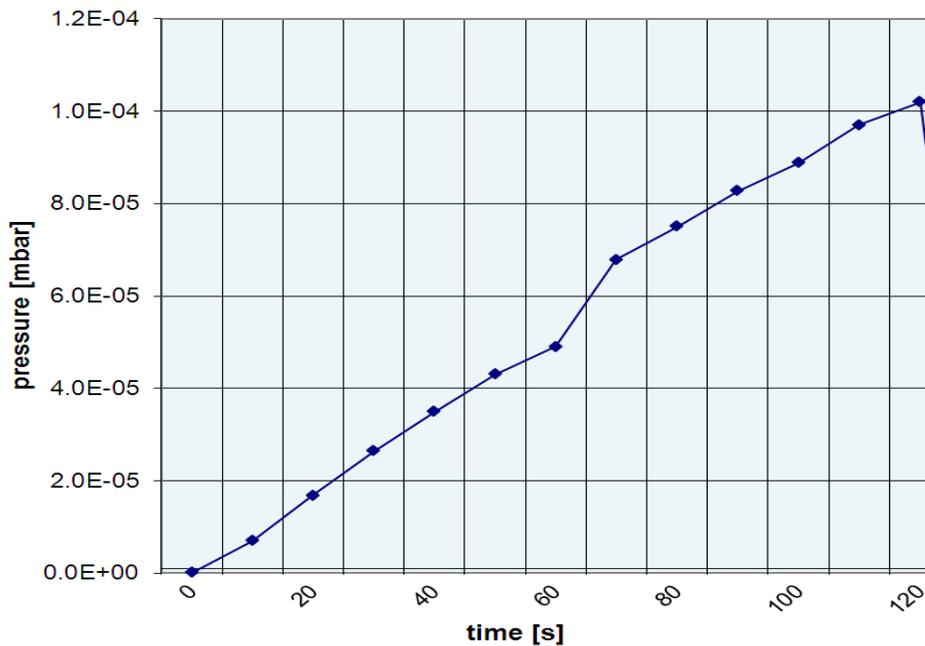
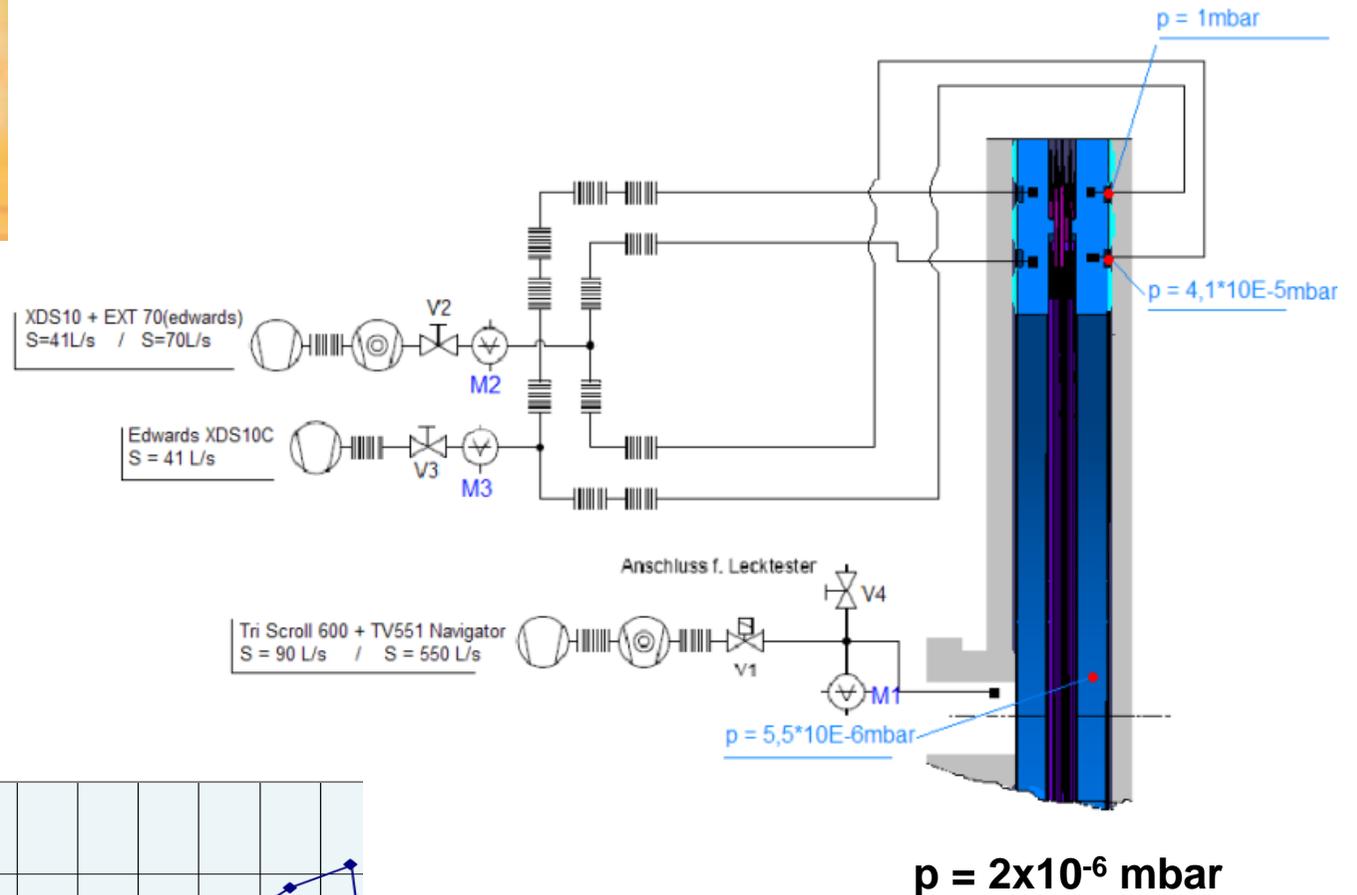
new seal at GSI



test setup

Vacuum Seals Test Stand

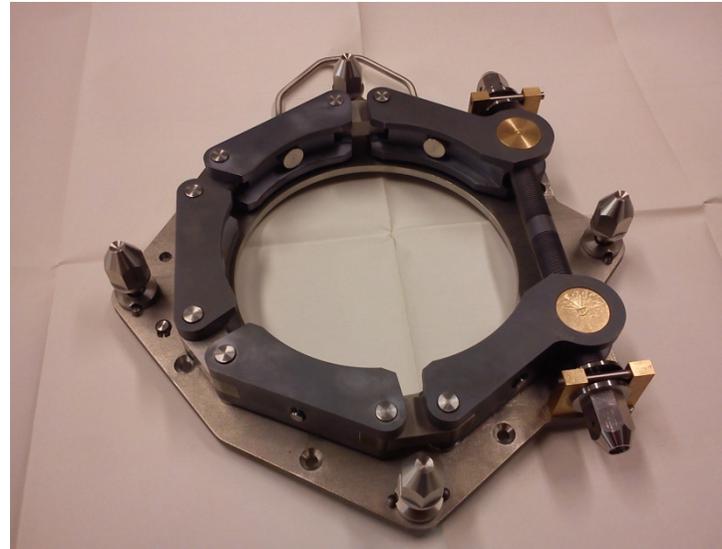
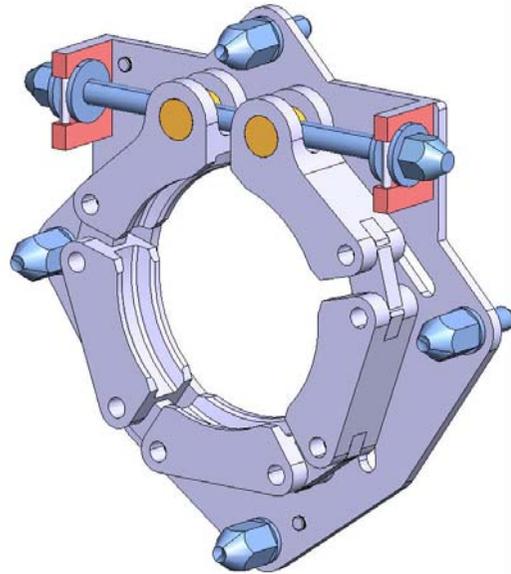
Leak rate: measure pressure increase after closing valve V1 for known volume (12 liter for d=500mm).



Leak rates

for 500mm diameter round seal reached 1.6×10^{-7} mbar l/s
 new 1200mm race track seal still only $\sim 1.4 \times 10^{-5}$ mbar l/s

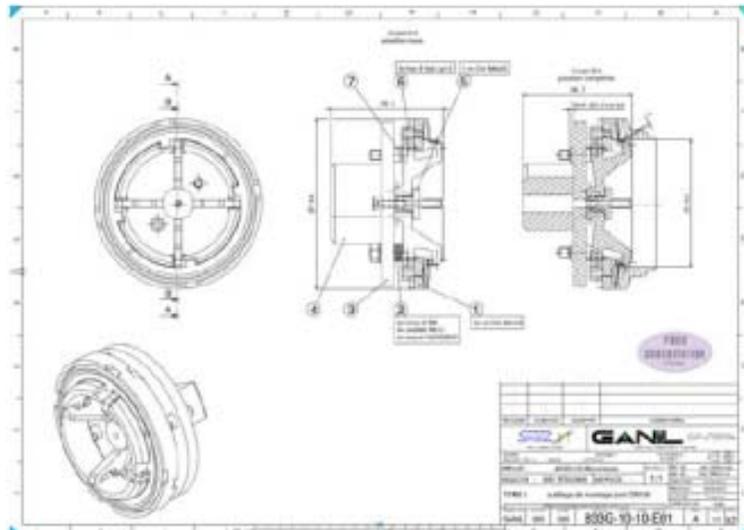
Development for easy exchange of seals designs by GANIL



**Collar clamps
DN100 – DN200
for up to 10^{-6} mbar,
prototype DN140**



**joint, DN40
PSI solution**



a) Dessin de définition de l'outillage



tool for positioning of seal

b) Photo de l'outillage et du joint

People, Finances

GSI

54 person months, problem with matching of man power. Reason: FAIR is considered external project with third party funding by BMBF. Working on FAIR and CRISP not possible.
15 k€ consumables – mainly travel, total max. 235 k€
vacancy not filled yet, 15 applicants

ESS and ILL = 1 person month

**deliverable month 18, solution study
rest month 36 detailed specs**

GANIL

36 person months,
SPIRAL 2 is part of GANIL
but not possible with regular staff.
150 k€ for investments + consum.,
total max. 270 k€

**Key person Mathieu Quiclet left
new in charge Hanna Franberg**

**150 k€ invest.
⇒ pump module
prototype**

