JÜLICH
FORSCHUNGSZENTRUM

Extension of JULICs irradiation capabilities

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ECPM 2017, Legnaro, 21-23-Sep 2017

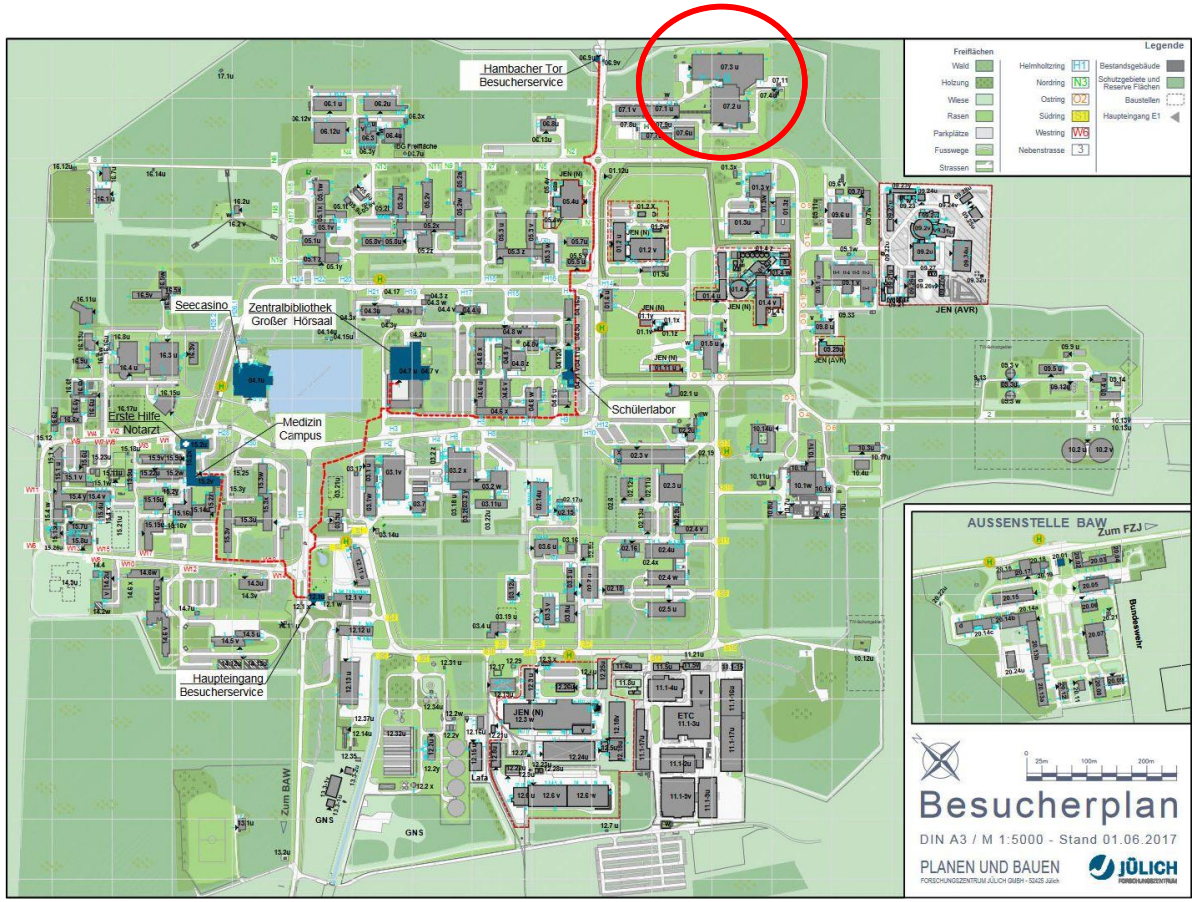
Outline

- Introduction
- Improvements
- Outlook

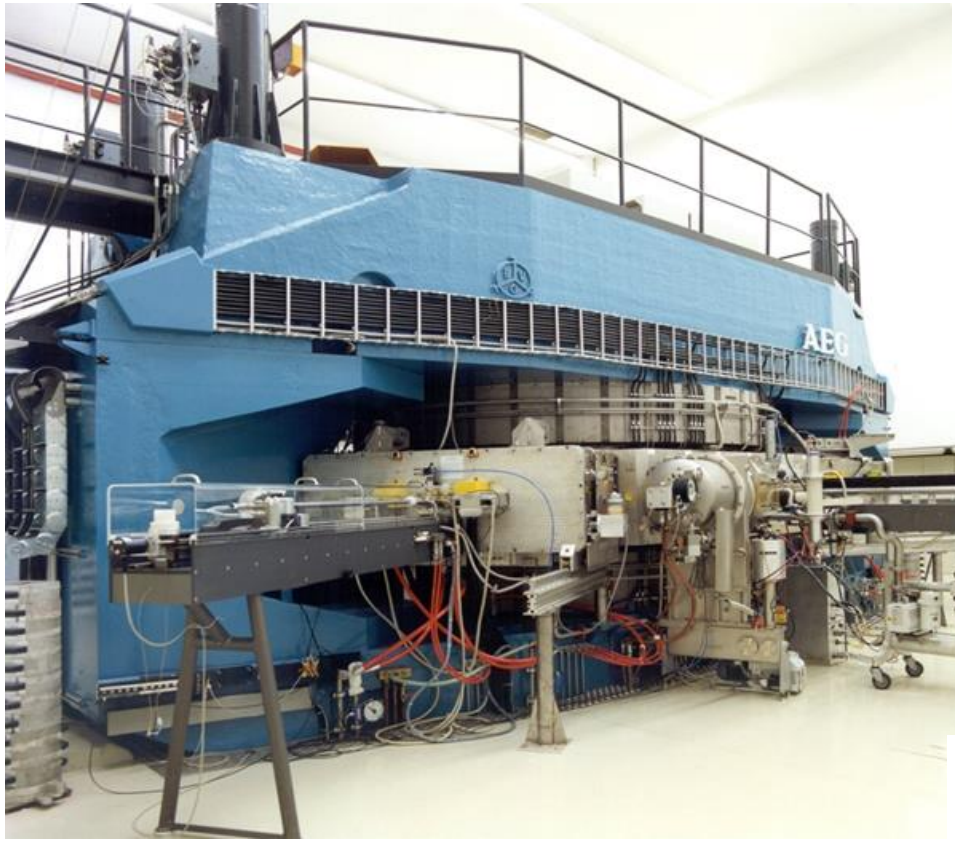
Research Center Jülich

Strategy:

- Information
- Energy
- NeuroScience
- Bioeconomics



JULIC at a glance



Pole diameter 3.3 m / 700 t iron

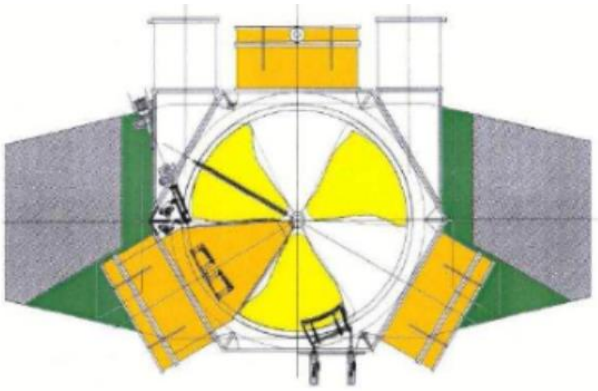
$\langle B \rangle_{max}$ =1.35 T B_{hill} = 1.97 T

20 – 30 MHz (h=3)

22.5-45 MeV/A

2-4.5 keV/A injection

3 ion sources (2 multicusp +pol. CBS)



up to 10 µA

routinely 45 MeV H^- and 75 MeV D^-

JULIC's history

1968 first beam in JULIC
nuclear physics experiments

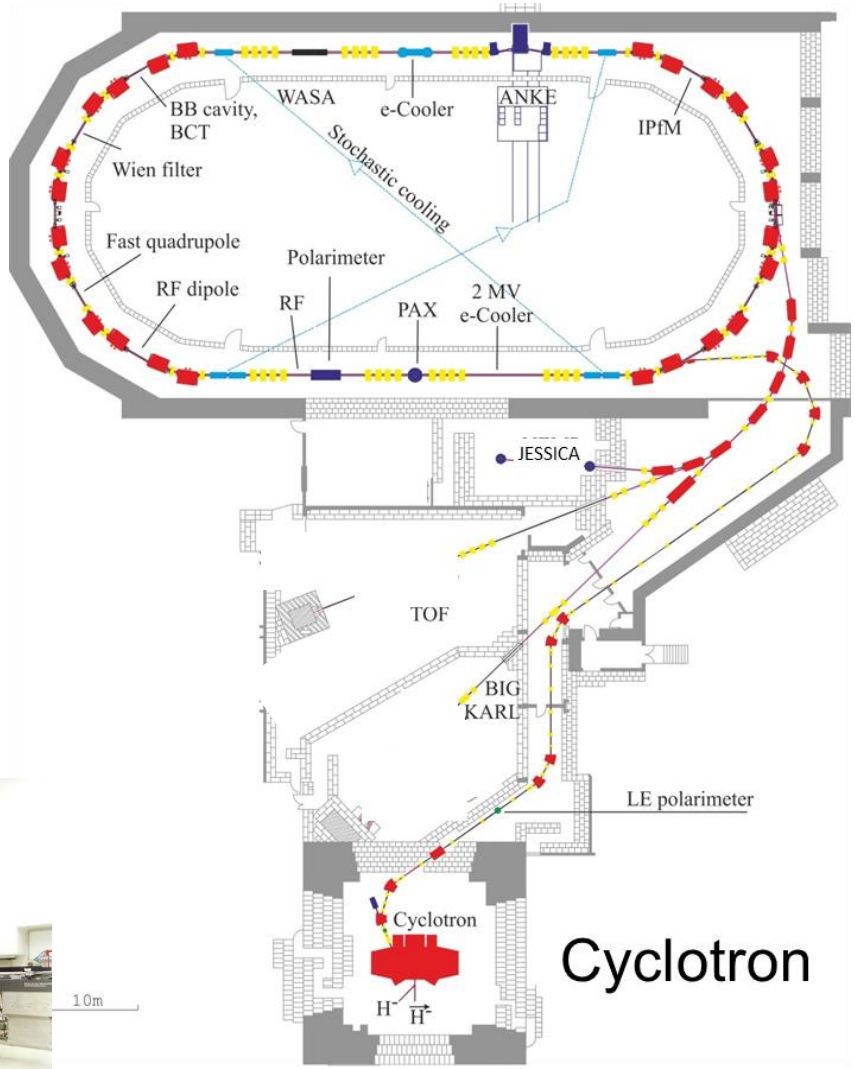
1993 pre-accelerator for COSY
hadron physics experiments
p/d -2,8GeV

~ 290.000 hrs operation

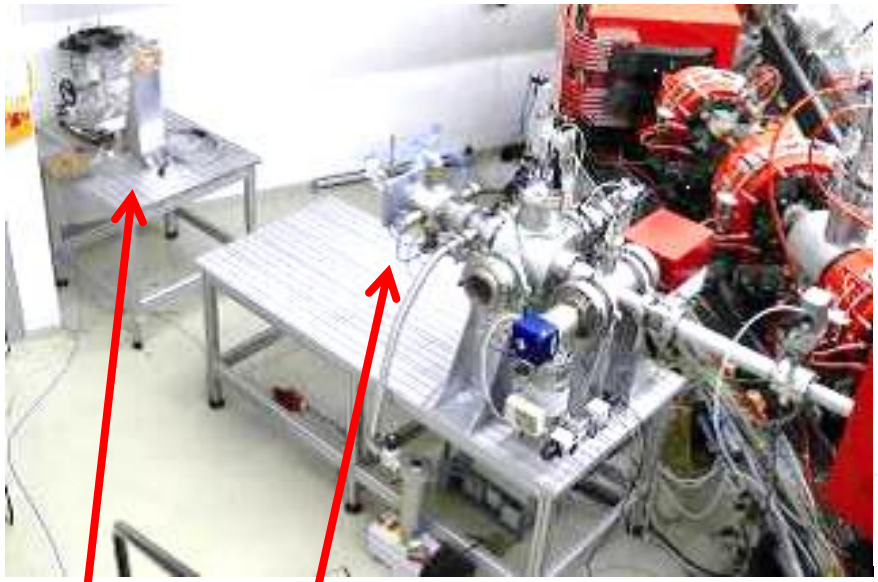
6000 hrs/year (on average)

Irradiation for medical application since 1968

Radiation effect test facility since 2000



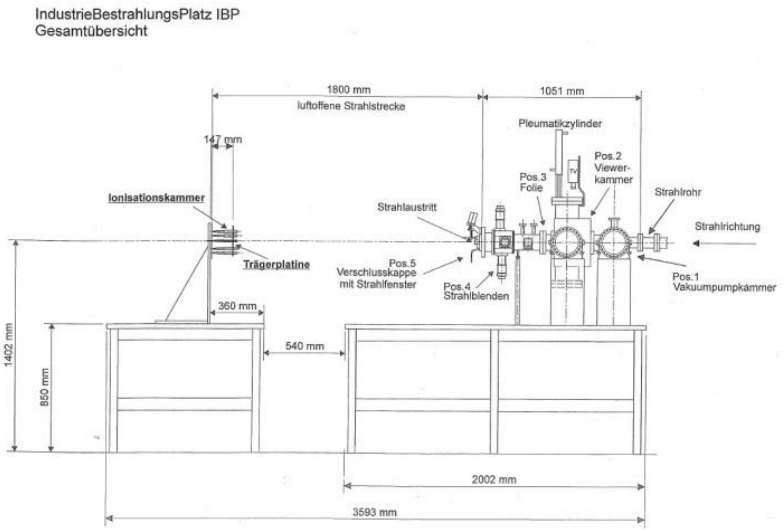
Irradiation station - Beam delivery at JULIC

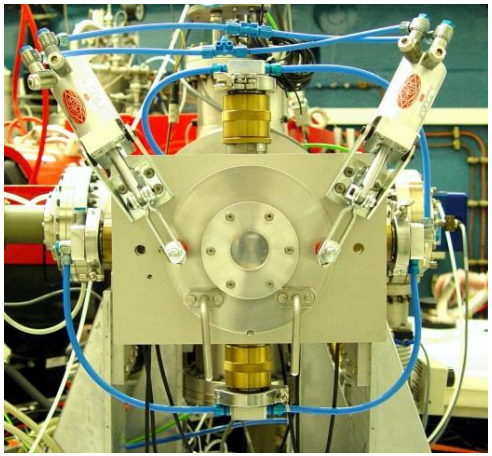


Irradiation facility

Medical Applikation

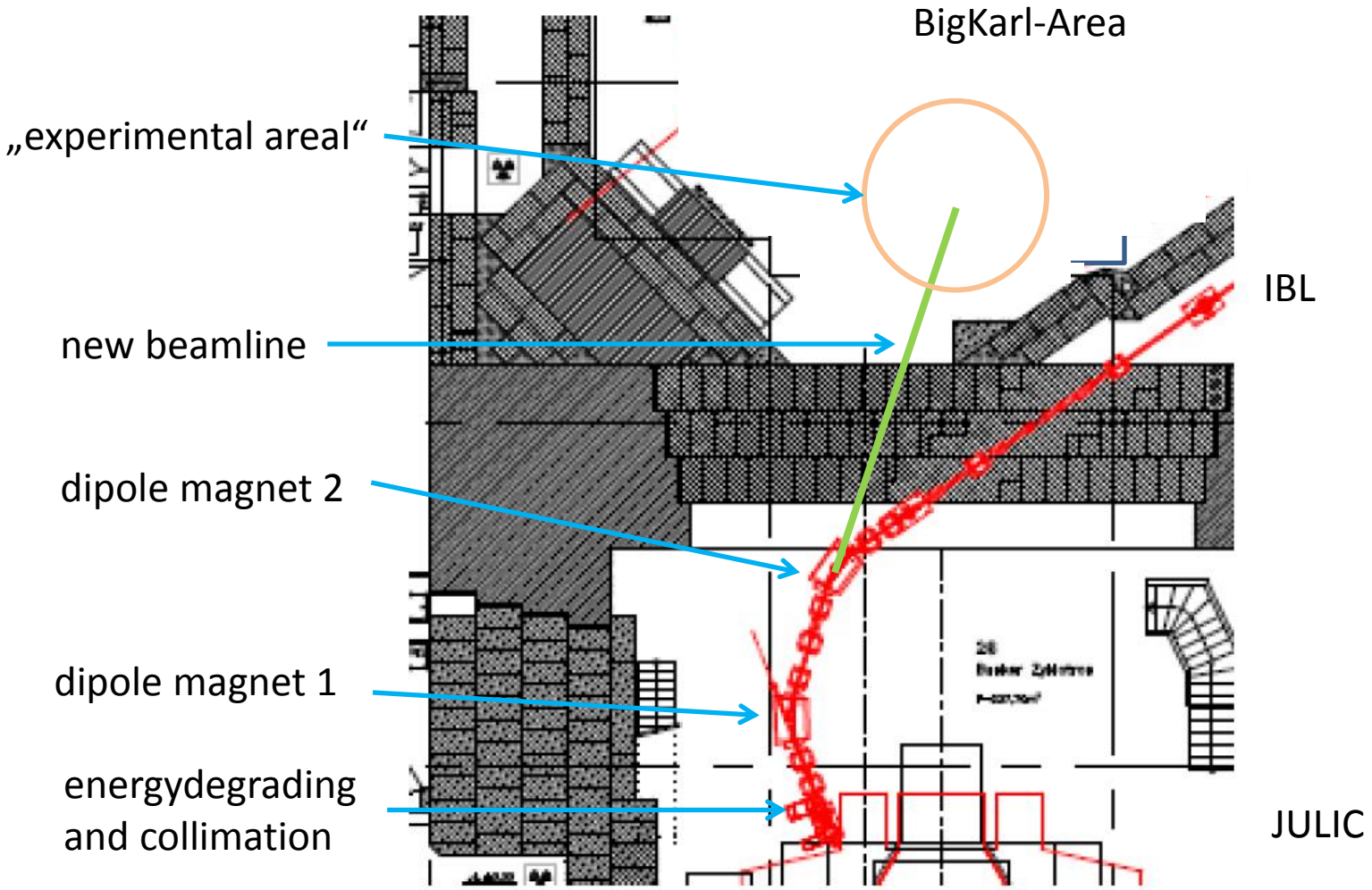
Radiation effect tests





1mm Al-exit window

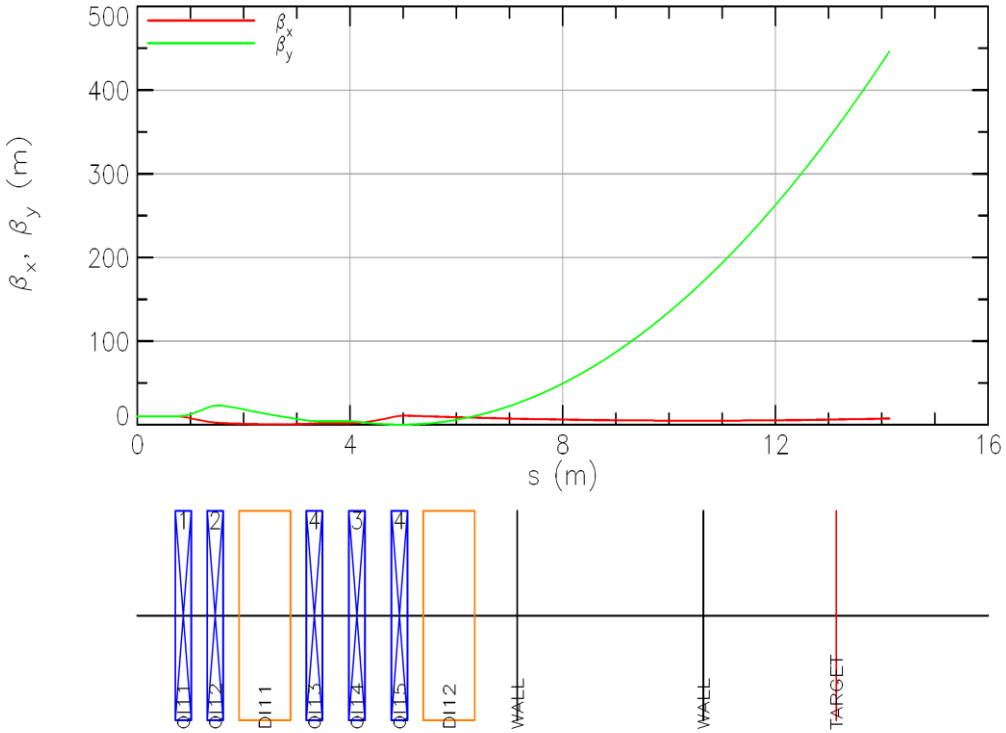
Idea:

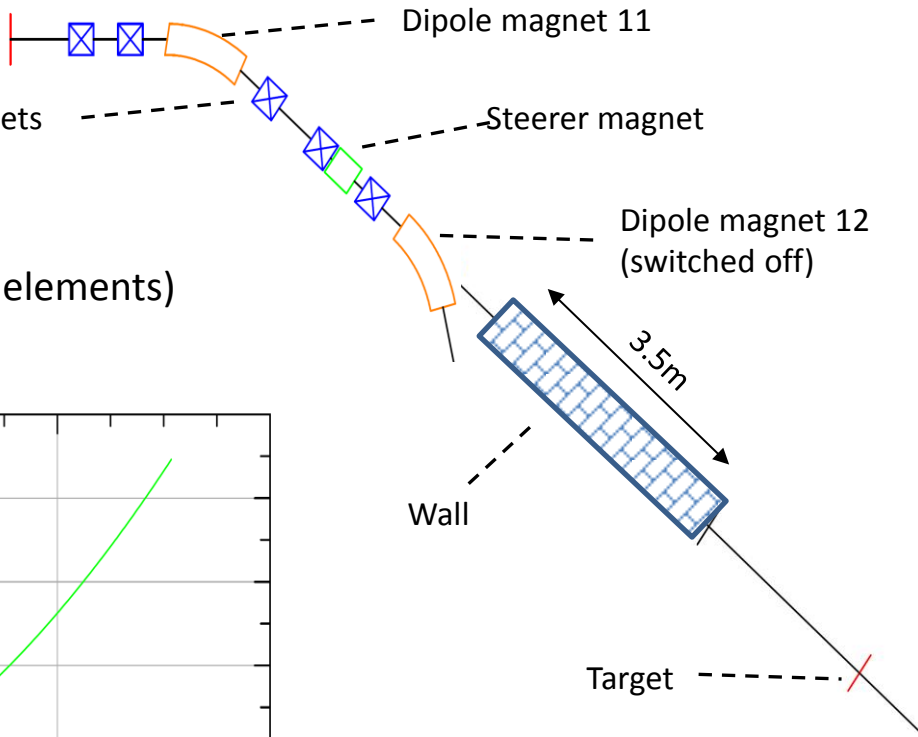


Optics investigations

Setup of beam line

- Set up in BMAD
- IBL up to dipole DI12 (switched off)
- Through wall (~3.5 m without focussing elements)
- $\beta_x = 10$ m, $\beta_y = 10$m at start

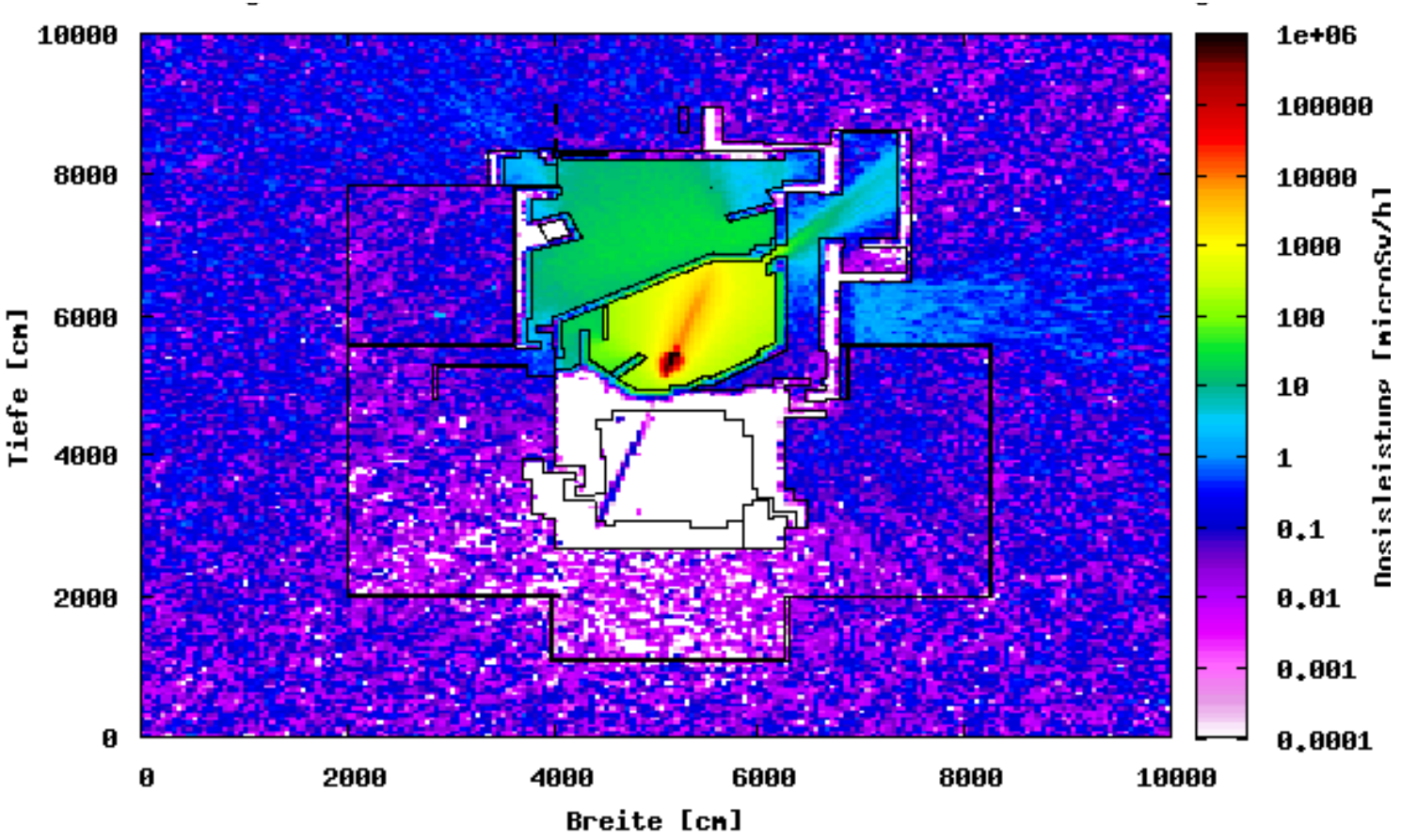




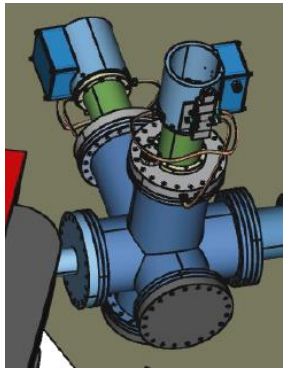
Courtesy C.Weidemann

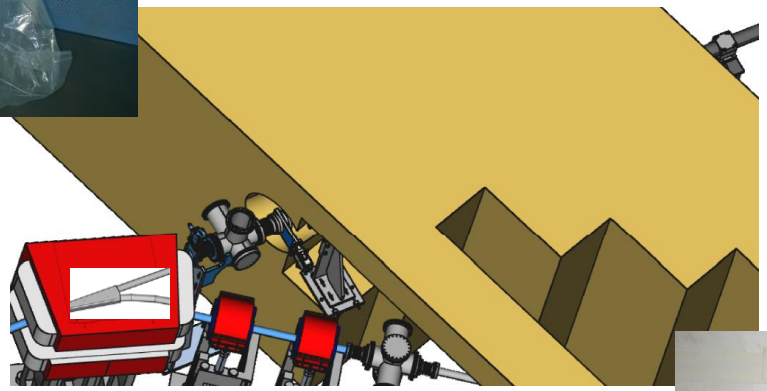
Radiation protection and authorisation

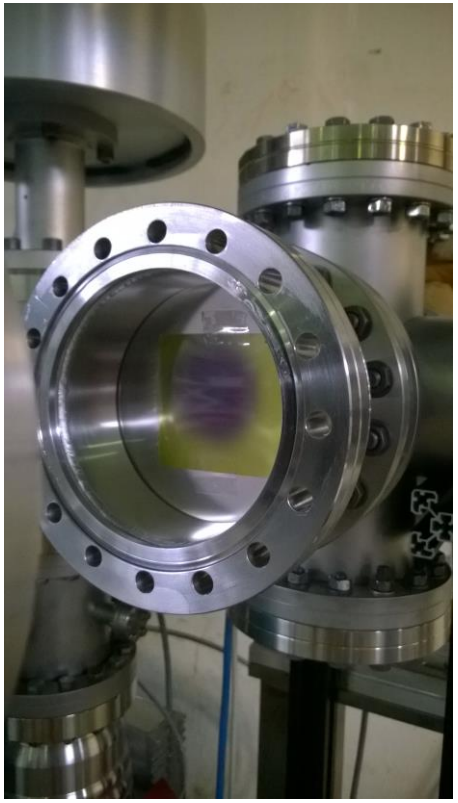
Dose rate (µSv/h) (10nA protons, 45 MeV, JULIC to Big Karl



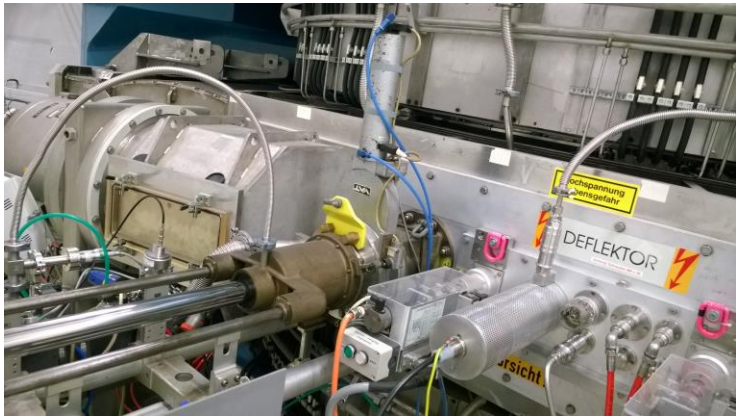
Construction



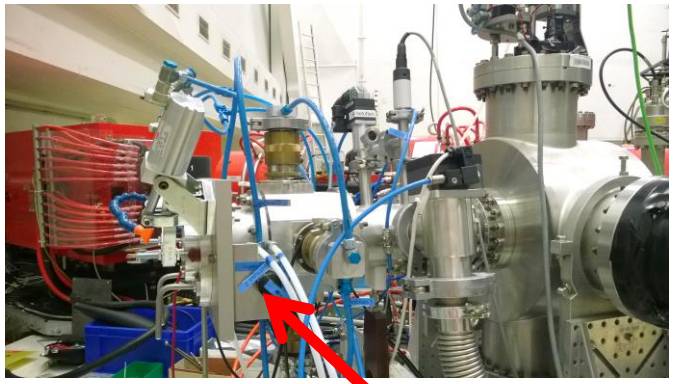




Targetholders

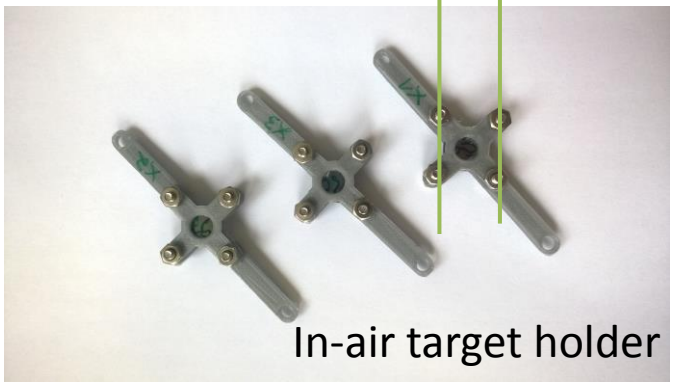


Target inside cyclotron-vacuum chamber

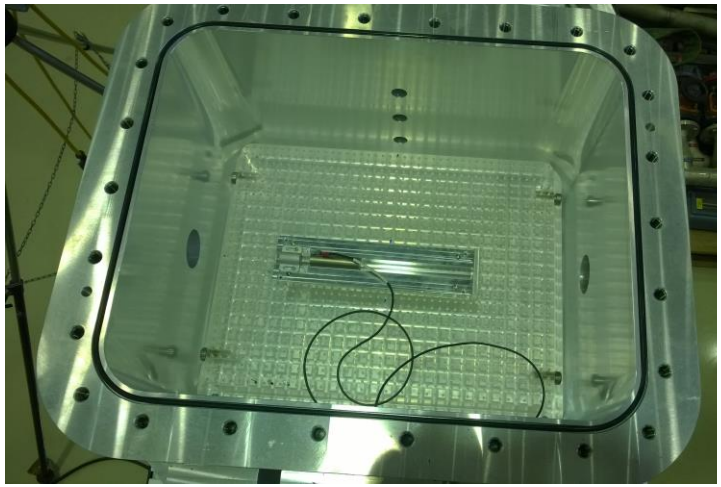


In-vacuum target chamber with cooling

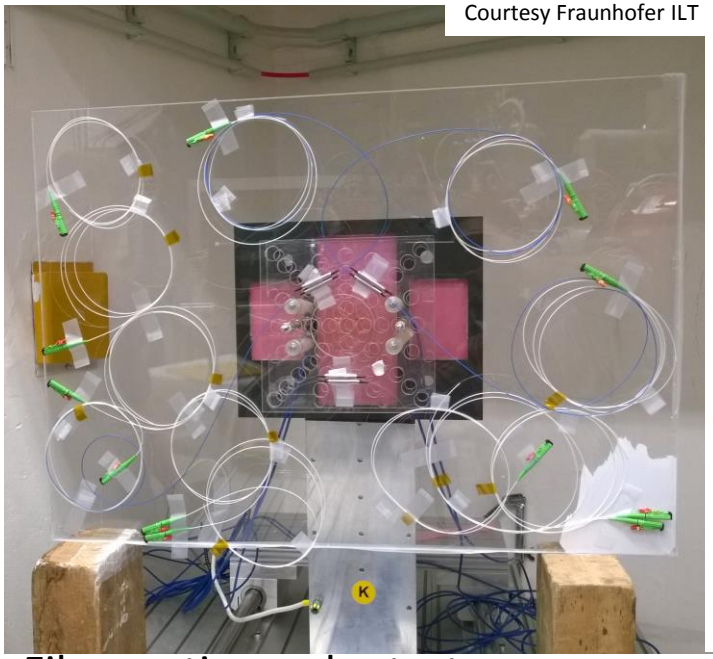
~10 mm



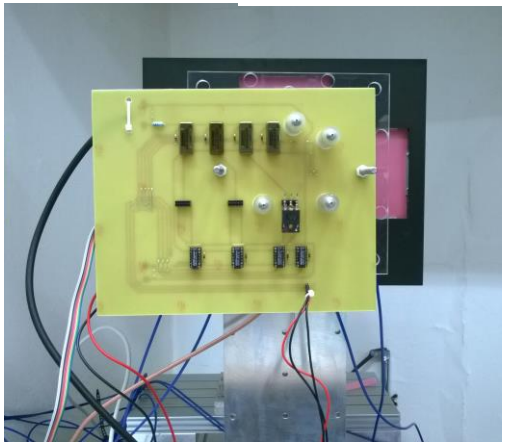
In-air target holder



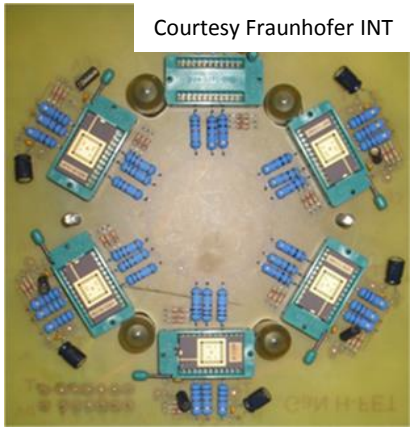
In-vacuum target chamber


Courtesy Fraunhofer ILT

Fiber optics under test


Courtesy Fraunhofer INT

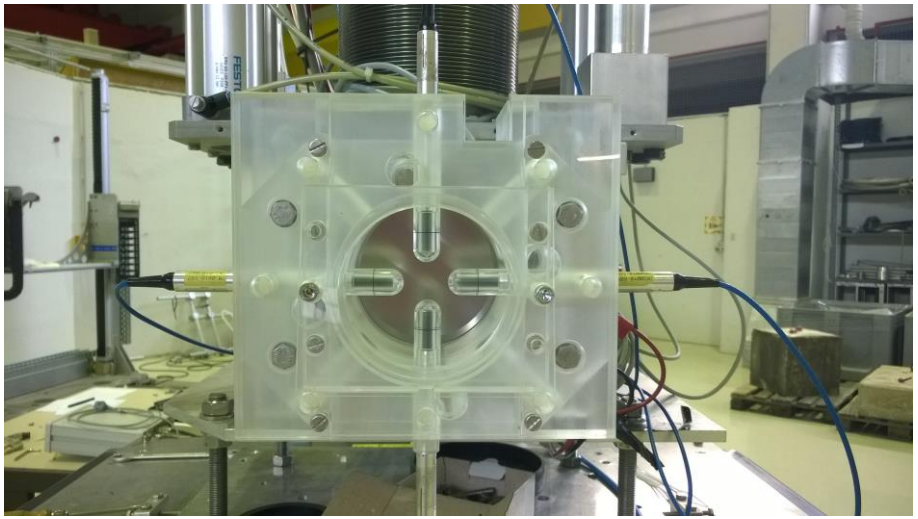
Radiation effect test


Courtesy Fraunhofer INT

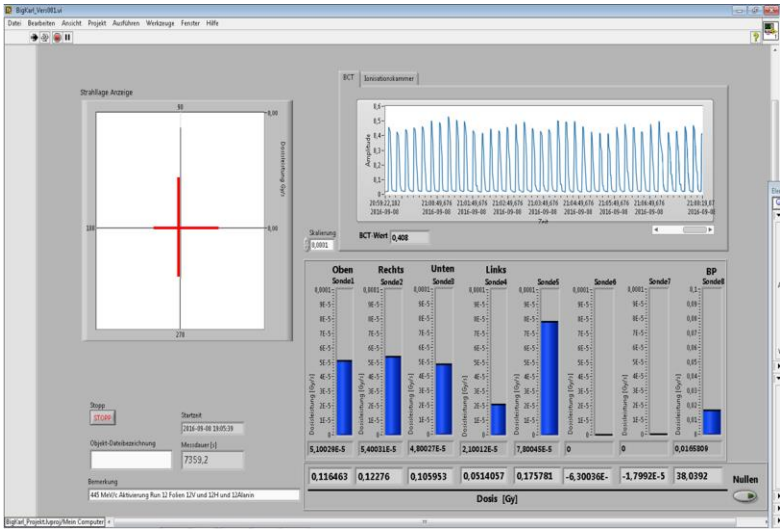
Radiation effect test

New holder for electronic boards

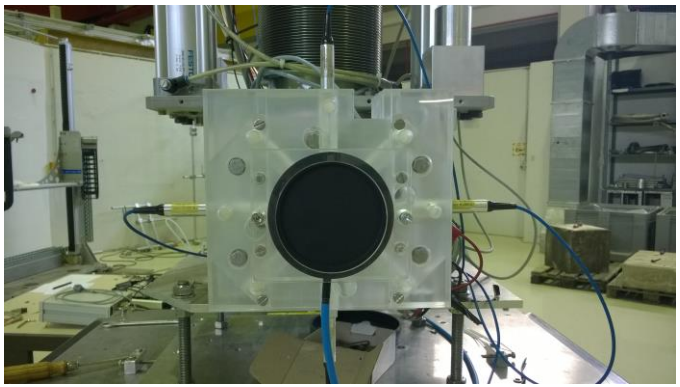
Diagnostics



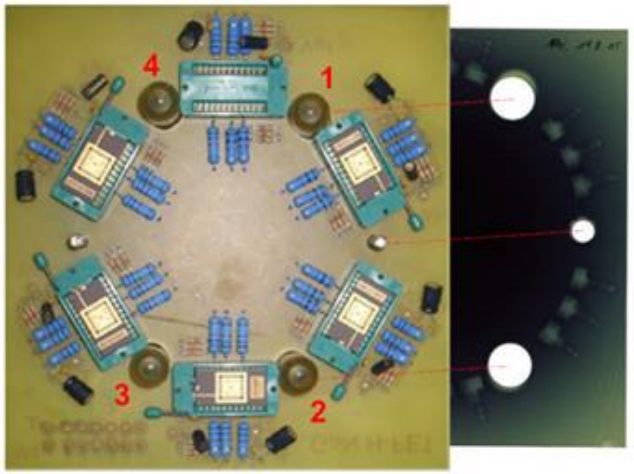
Farmer Ionization Chamber



Beam preparation and control GUI
Labview



BraggPeak Chamber



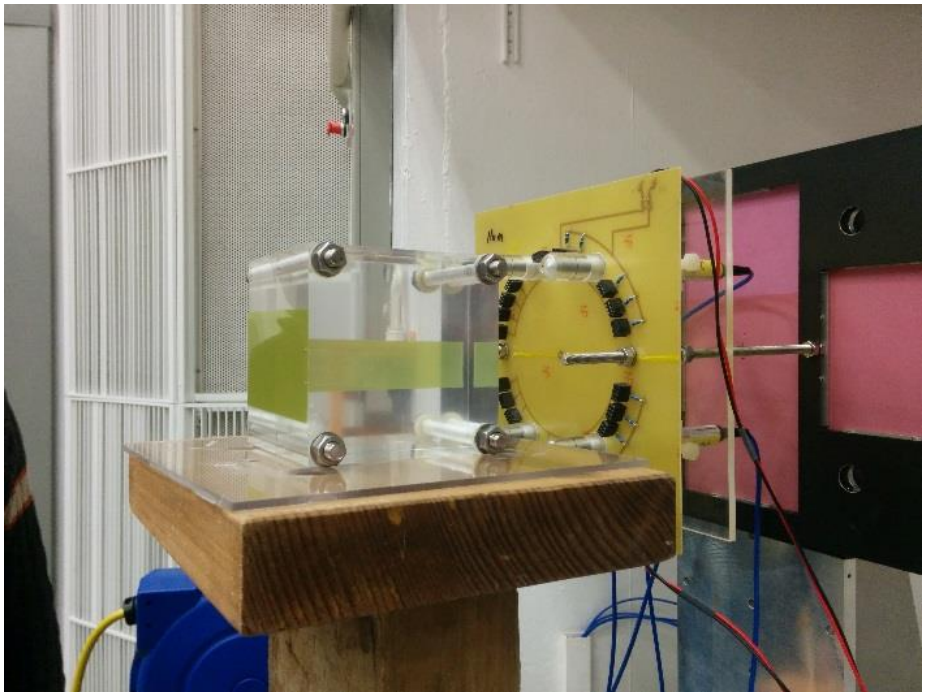
GafChromic films

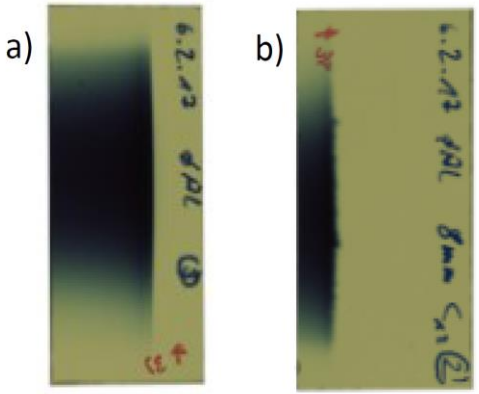
Energy testing

Penetration depth of H^- into a block of acryl

a) Protons, 42 MeV

b) Protons, 25 MeV





Outlook

- „fast“ switching between COSY operation and irradiation
- Installation of new Targetholders
- Fast scanning magnets for homogeneous irradiation
- Discussion if higher currents are really needed?

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Thank you for your attention