A. Denker
*P. Arndt**
*W. Busse**
*H. Homeyer**
*W. Pelzer**
C. Rethfeldt
J. Röhrich

**retired*

Changing from an Ion Beam Laboratory to a pure Therapy Machine

Ionenstrahllabor ISL

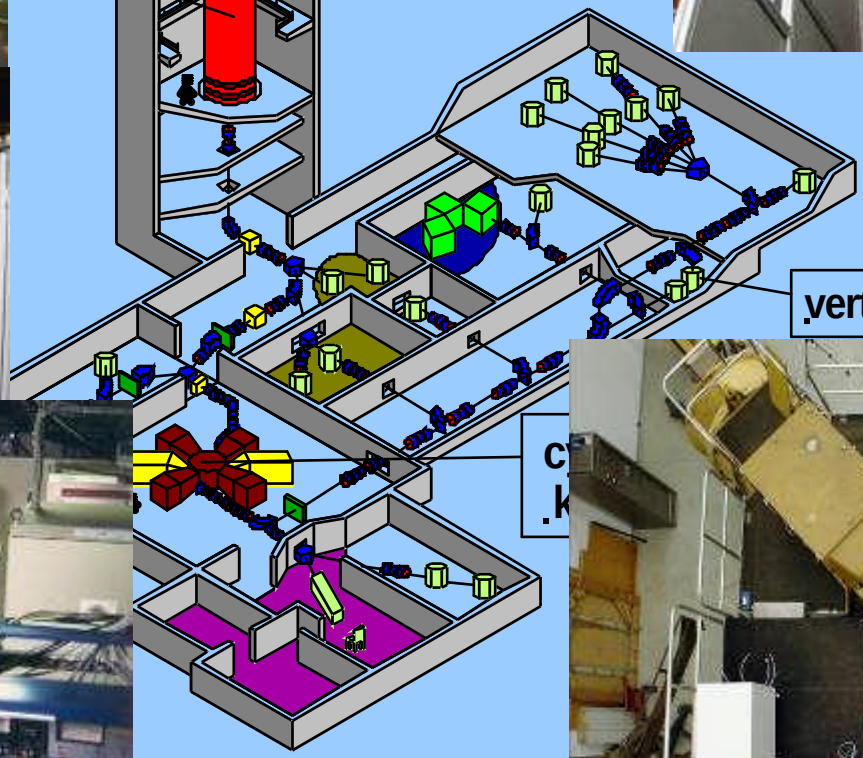
ISL ð Protons for Therapy

ISL: Operation Statistics

Outlook

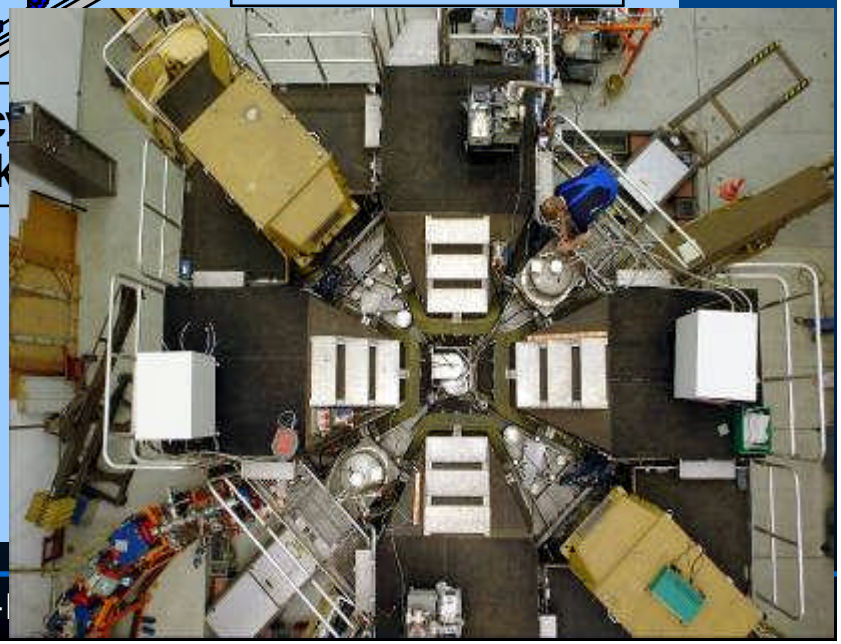
Ionenstrahllabor ISL: Layout

low energy
target area
and
dual beam line



14 dedicated target stations

vertical beam line



- tumor - therapy

ISL: Evaluation and the Result

recommendation of the referees

- "in order to fulfil its mission, a facility with the necessary excellent performance … was very successfully created."
- "We are particularly worried about the understaffing of ISL and, therefore, recommend an increase of staff there, to allow them to increase the available beam time in order to respond to a growing demand in the field of materials modification."

Helmholtz Senate (Sep. 04):
close down ISL until end of 2007

HMI supervisory board (Nov. 04):
close down ISL until end of 2006

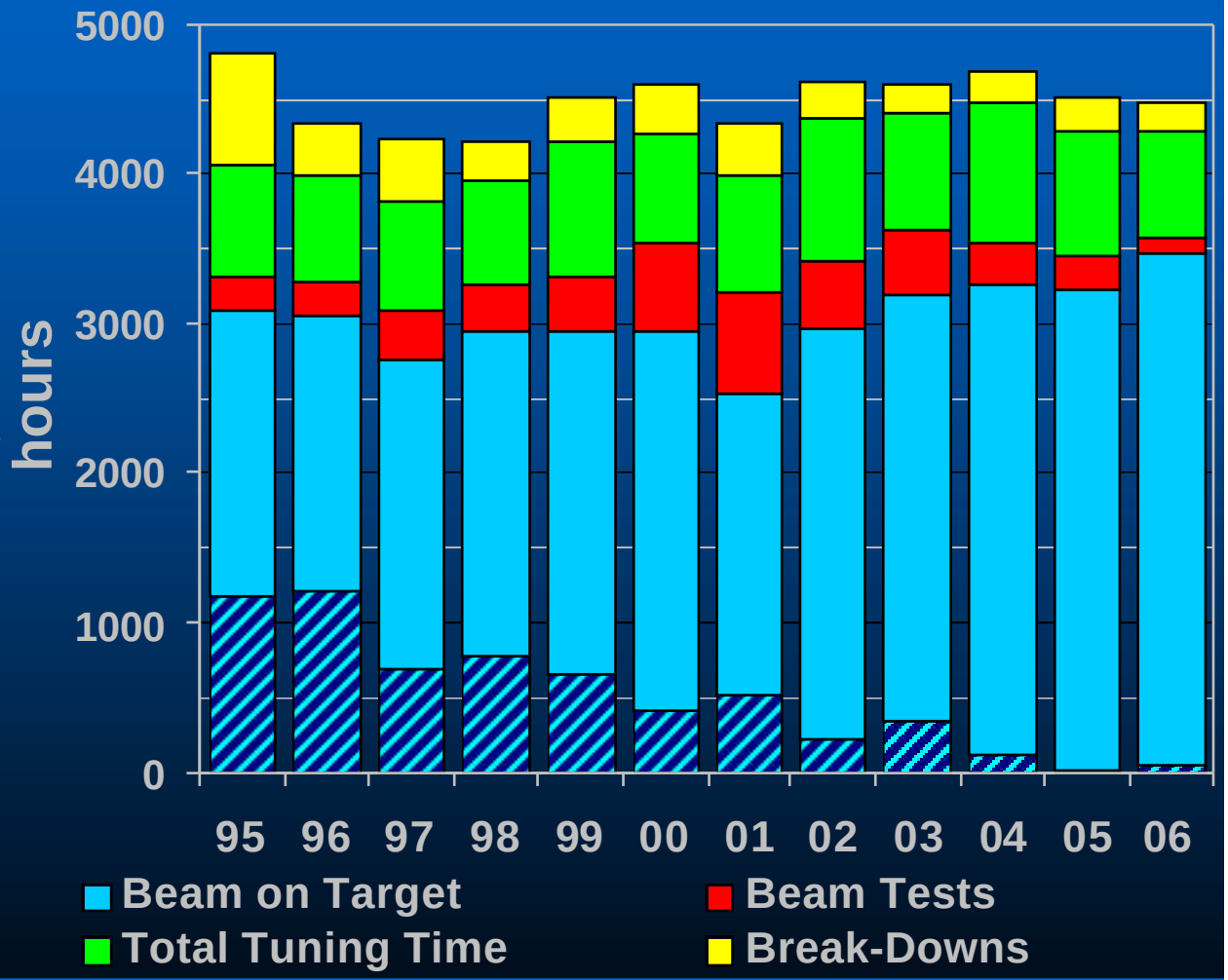
HELMHOLTZ GEMEINSCHAFT

Hahn-Meitner-Institut

- decrease in man-power:
  - Post-Docs and technical staff on temporary positions left
  - people were transferred to other departments
- stop of investments

ISL: Operation Statistics

- available man-power: 4500 h operation hours/year
- since 2002: breakdowns < 5%
- 2006: all time high for beam-on-target
- second ECR source for RFQ
  ð less tuning time
- reduced beam tests in order to fulfil beam requests of users

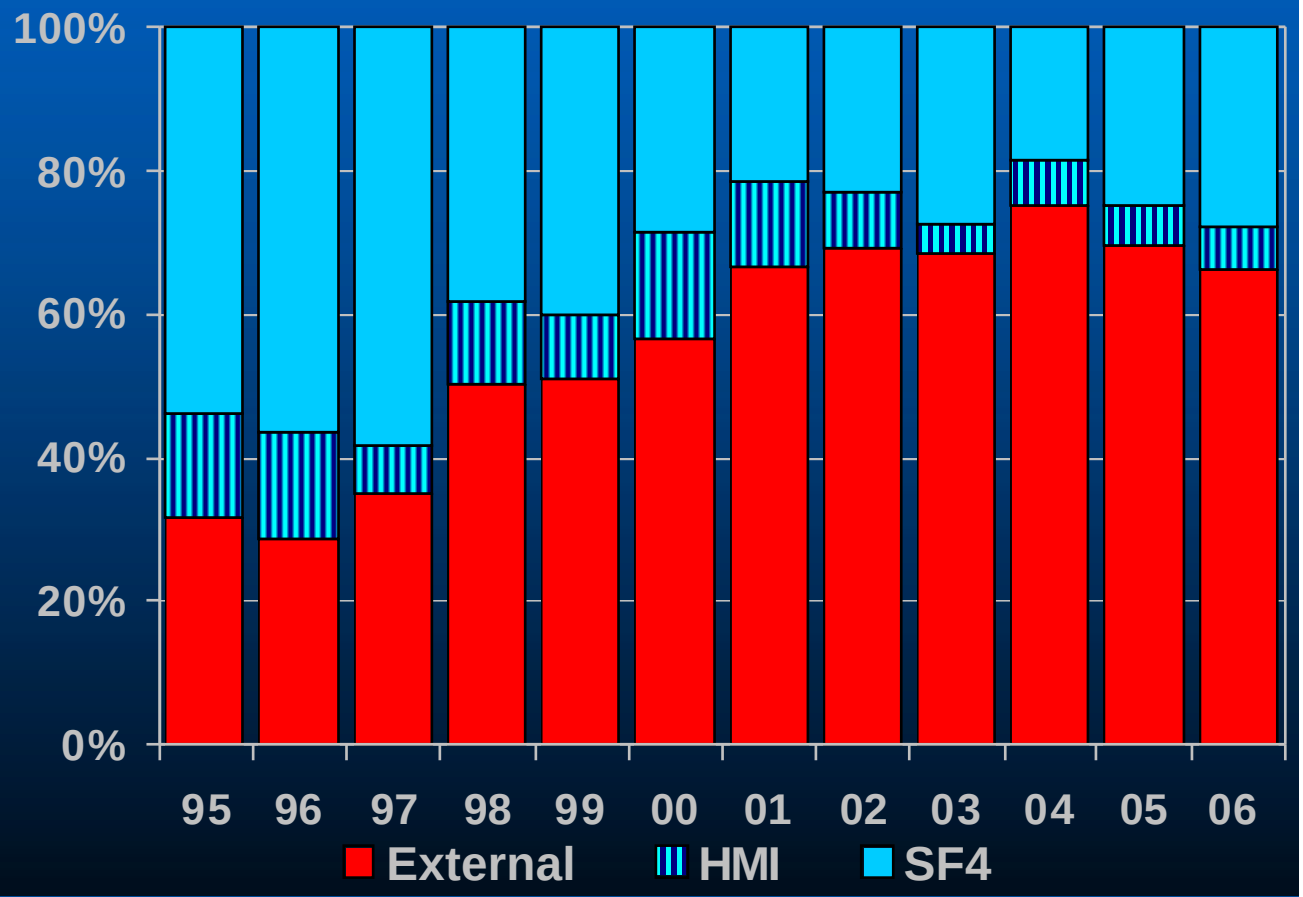


ISL: Breakdowns (< 5%)

- blackouts in the electricity supply (approx. 4/year)
- repair of the electrostatic injection element
- vacuum failure in RFQ

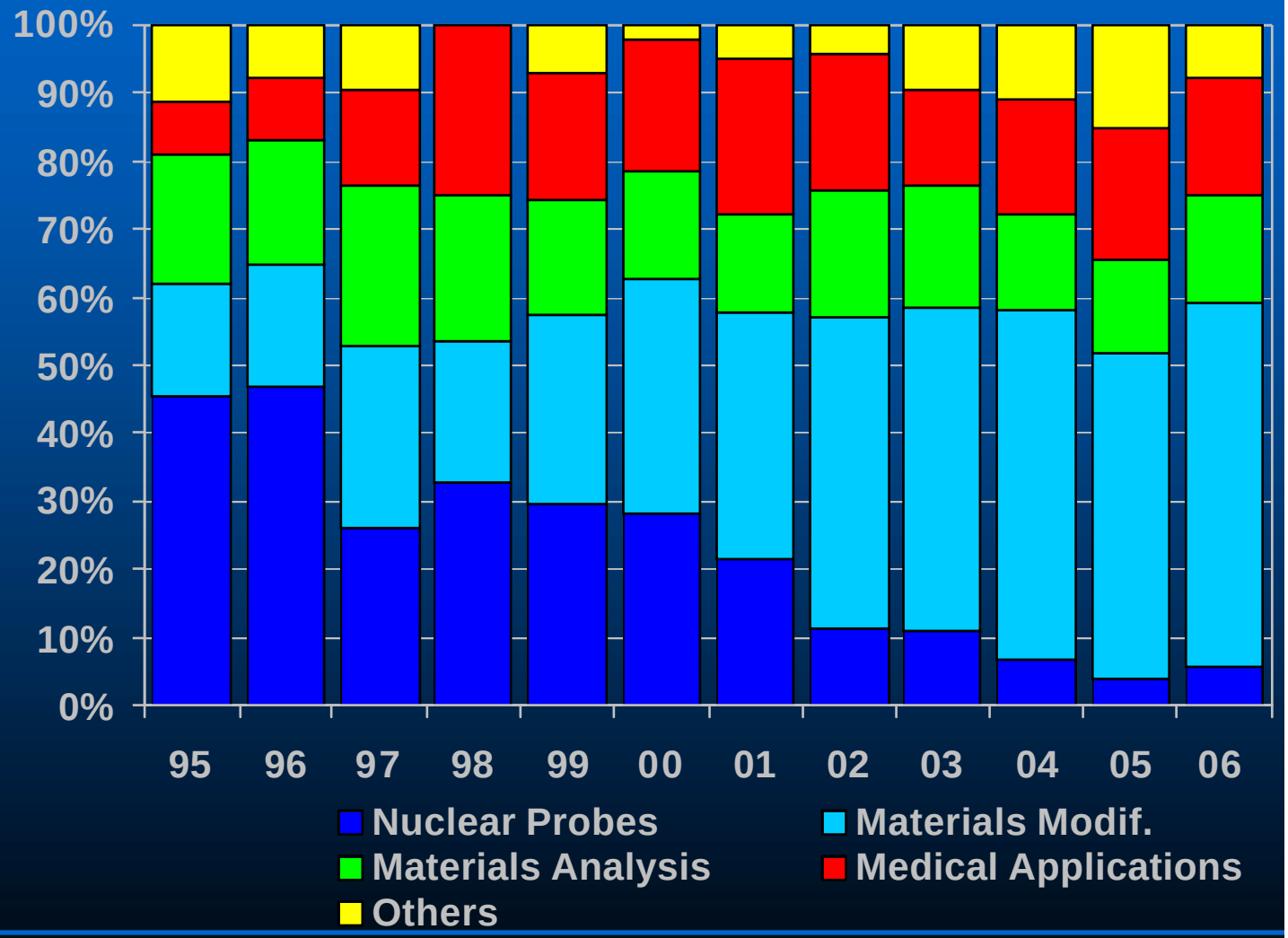
ISL: User Facility

- over past years: ~ 70% outside users
  - 20% medical applications
  - 35% universities
  - 10% research institutes
  - 5% industry

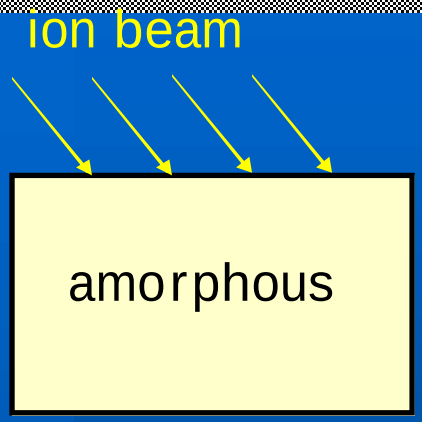


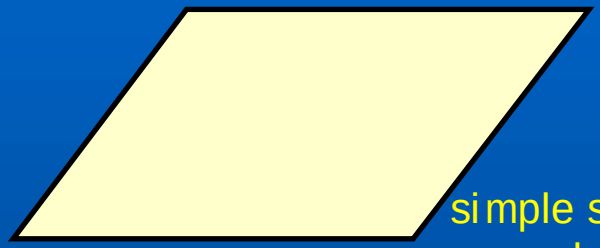
ISL: Share of Research Topics

- materials analysis and medical applications: stable share
- materials modification: increasing demand

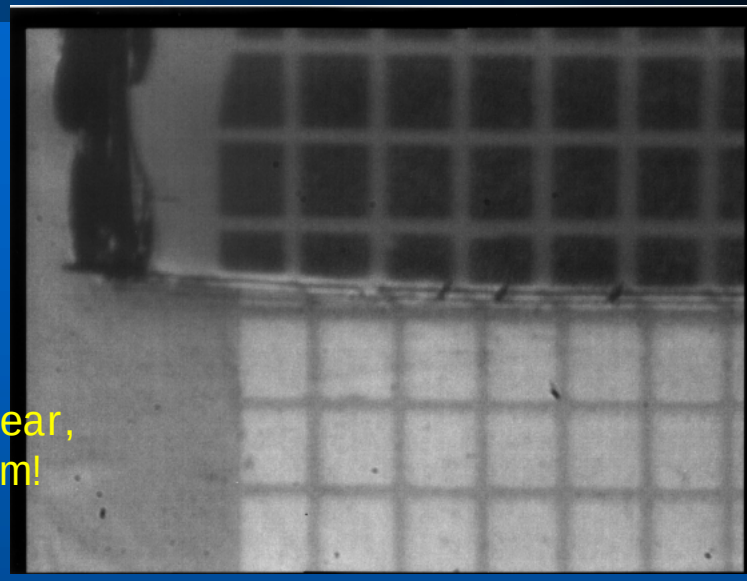


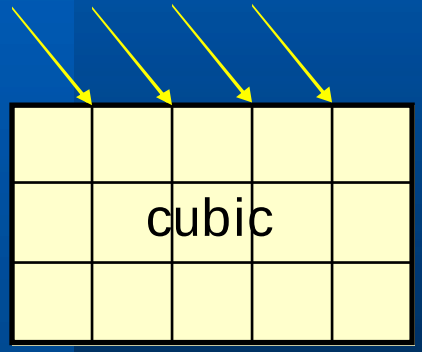
ISL: Research – Materials Modification

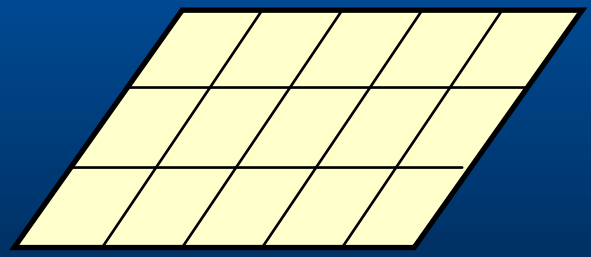




simple shear,
no problem!







simple shear,
large lattice strain
⇒ unacceptable large lattice energy

- in nano-crystalline materials an essential part of the shear motion is coherent crystallite rotation
- only observable with in-situ XRD

ISL: Research – Materials Analysis

- high-energy PIXE: analysis of life-size Roman statue
- measuring on various spots (cast in one process?)
- low straggling – easy positioning
- surprisingly good bronze quality

ISL: Research – Medical Applications

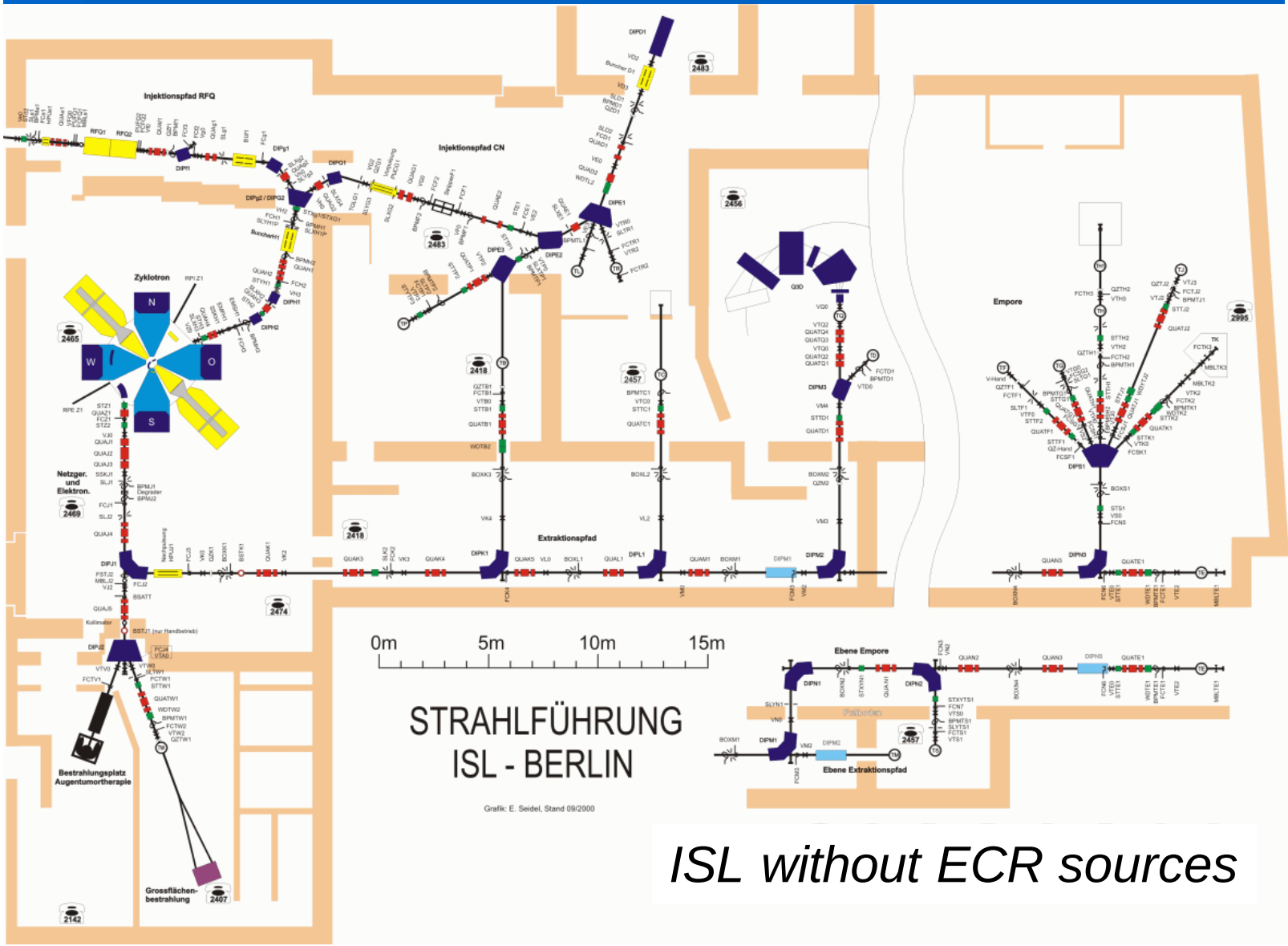
S. Höcht et al, PTCOG 44:
a learning curve in ocular tumour therapy?

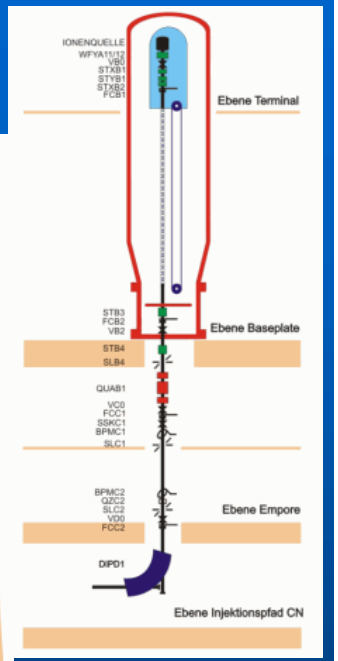
start of treatment in 1998

	tumour control	eye retention
patients recruited 1998-2001	94.6%	91.9%
patients recruited 2001-2004	99.4%	96.2%

ISL ð Protons for Therapy (PT)

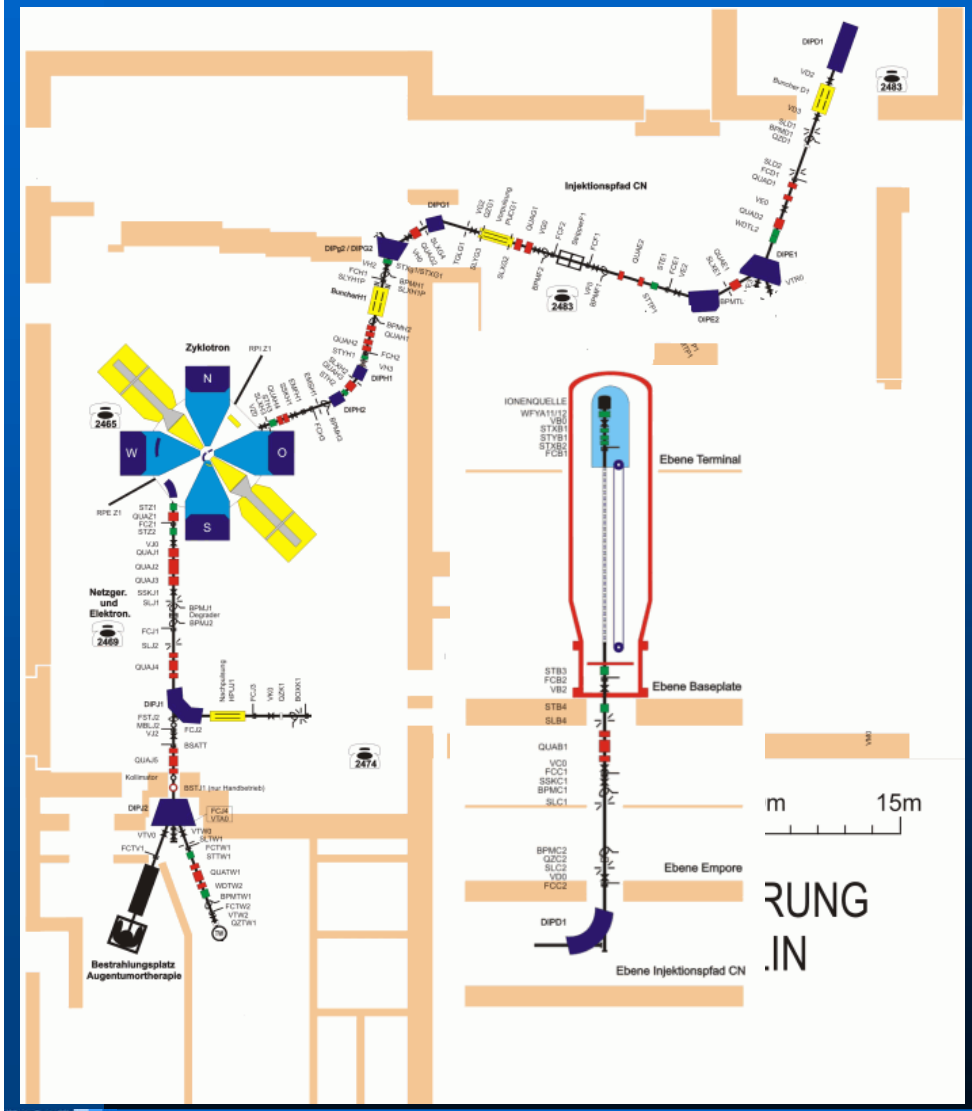
- 27.9.06: planning starts





ISL without ECR sources

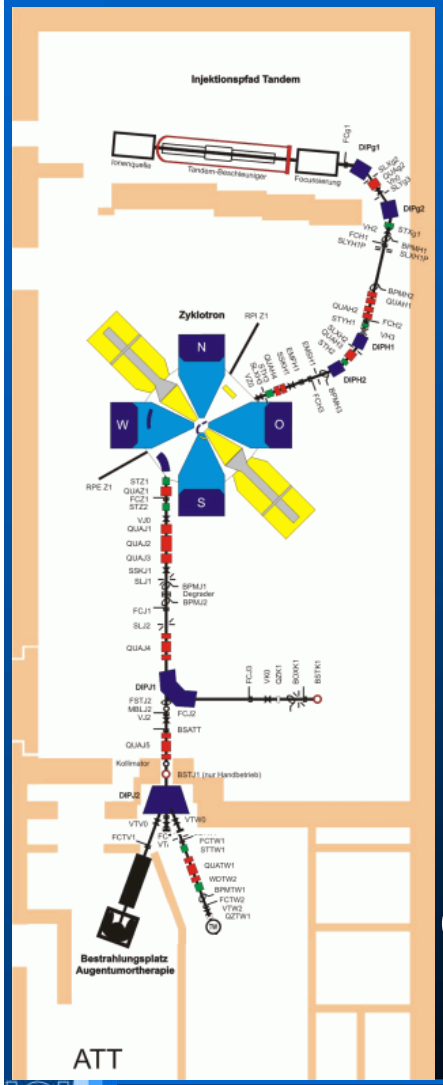
ISL ð PT: Reduction



- man-power from ~20 down to 6.5 (incl. secretary)
- nevertheless: maintain reliability
- reduction of beam lines
- reduction of all cables (power, control system, diagnosis…)

ISL ð PT: installation of a tandetron

- further shortening of beam lines
- less rooms (= reduction radiation safety)
- easy and reliable operation:
  - no moving parts
  - source on “ground potential”
- purchased from BAM (Bundesanstalt für Materialprüfung)



Sept. 07:
dismounting
of the tube
for transport

no interruption
of therapy

ISL ð PT: overview

- 4500 hours/year
- 3 shifts a day (24/24)
- changing ion species and energies

- 14 target stations varying requirements on focusing

- 11 therapy weeks/year
- 2 shifts a day
- H, 68 MeV
  - cyclotron fixed frequency
  - one NMR-probe/dipole
- 2 target stations, identical focusing
  - 1/4 of existing beam line system
  - no target station selection

ISL ð PT: Future of Target Stations?

1. eye therapy: remains
2. PIXE: medical research set-up
3. foil irradiation: Jyväskylä
4. BIBER: KVI Groningen or Jyväskylä
5.+6. in-situ XRD plus irradiation chamber: GSI, Darmstdt
7. electron spectroscopy: BESSY
8. Laserspectrometer: BESSY
9. vertical beamline: lost
10. Q3D spectrometer: Munich ??
11. ERDA chamber Portugal ??
12. in-beam Mößbauer ???
13. β NMR ???
14. recoil implantation ???

Outlook

- until end 2006: normal operation for our users
- Jun 06: patient no. 750
- since Sep. 06: planning for therapy only
  - planning of personnel
  - lay out of the necessary changes
  - 2o.12.06 HMI supervisory board meeting signing of contract
- 2007: transition time
- goal: steady continuation of therapy

Thank you for your attention!