Gantry Design for Proton and Carbon Hadrontherapy-Facilities

EPAC 2006, Edinburgh, 27th of June 2006

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  - Layout
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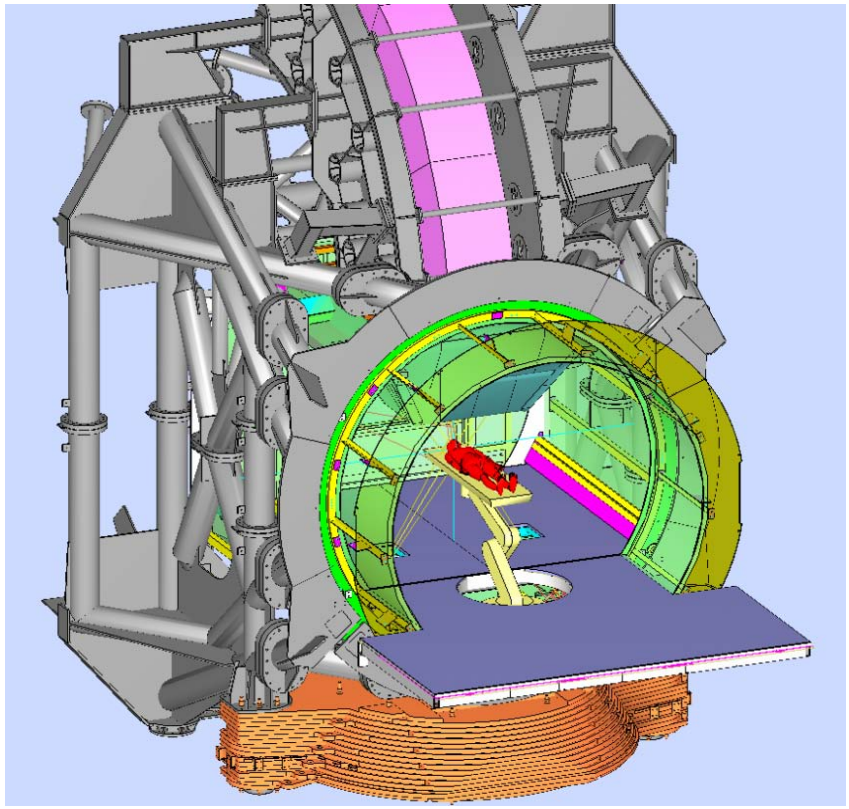
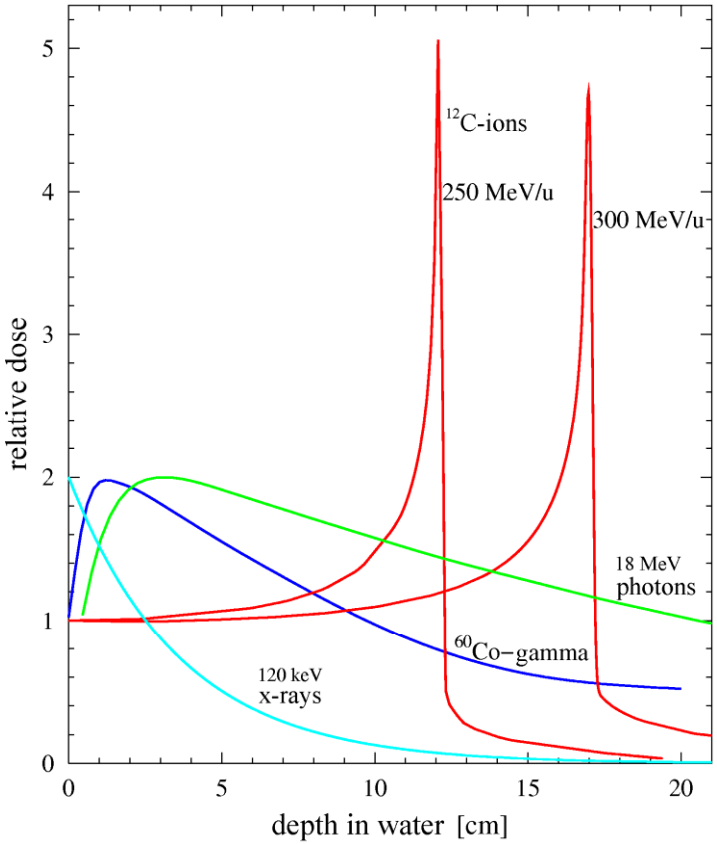
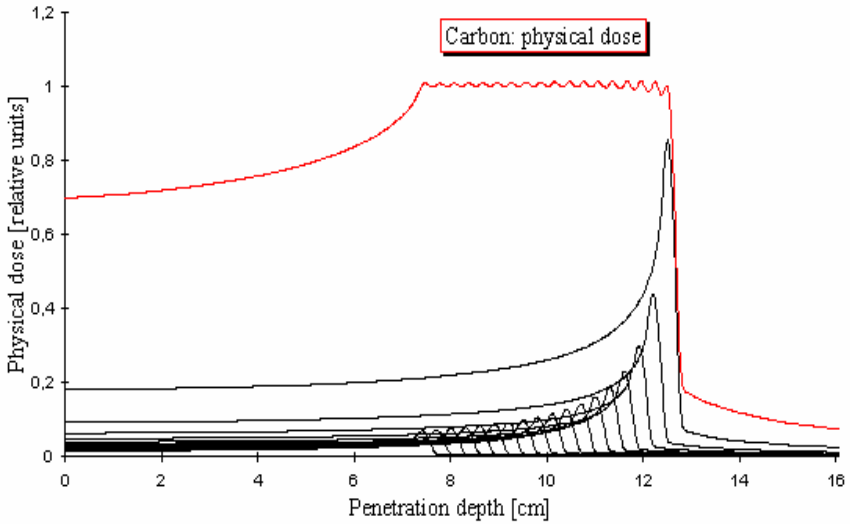
- Outlook for Carbon Gantries



MT AEROSPACE

Superior Dose Depth profile compared to photons

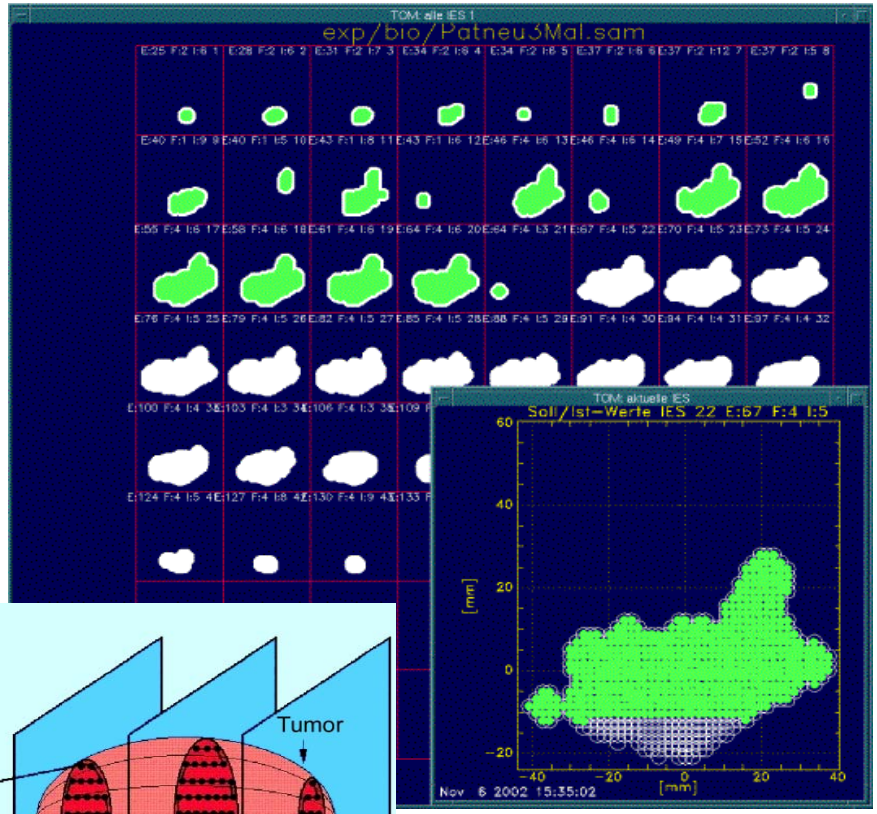


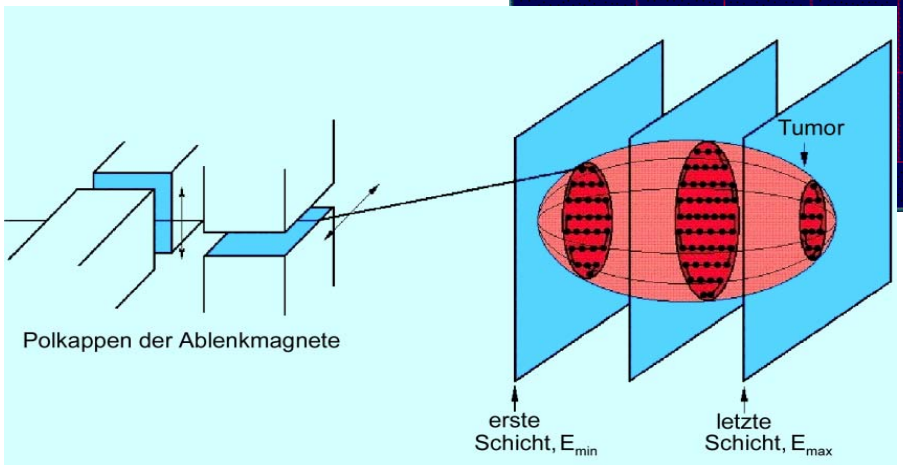


- **Sequential treatment**
  - **Irradiation with different energies => slicing of the tumor in isoenergetic planes**
  - **Intensity variation per plane to get flat dose distribution**

Hadrontherapy: Lateral Scanning

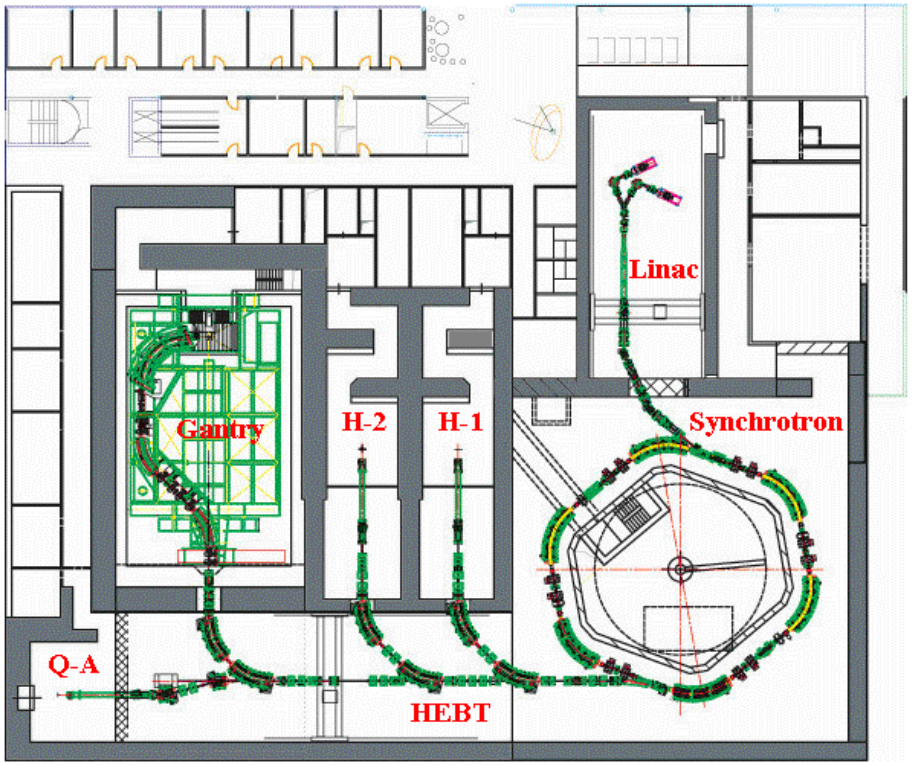
- **Rasterscan treatment used at GSI**
  - **Horizontal and vertical scanning of each isoenergetic slice with fast scanner magnets**
  - **Energy, intensity and beam size variation from slice to slice**





Hadrontherapy: Facility Layout

- ECR sources for O, C, He or H ions
- LINAC, Synchrotron or cyclotron
- Several treatment stations



- Oral presentations at EPAC
  - K. Noda, NIRS on HIMAC Facility
  - S. Rossi, CNAO on Developments in Hadrontherapy
- Poster presentations at EPAC on HICAT project
  - M. Maier, GSI, on LINAC Commissioning
  - A. Reiter, GSI, on Beam Diagnostics for HICAT and CNAO
  - R. Cee, HIT, on LINAC Beam Simulations

Gantries: Principle Layouts

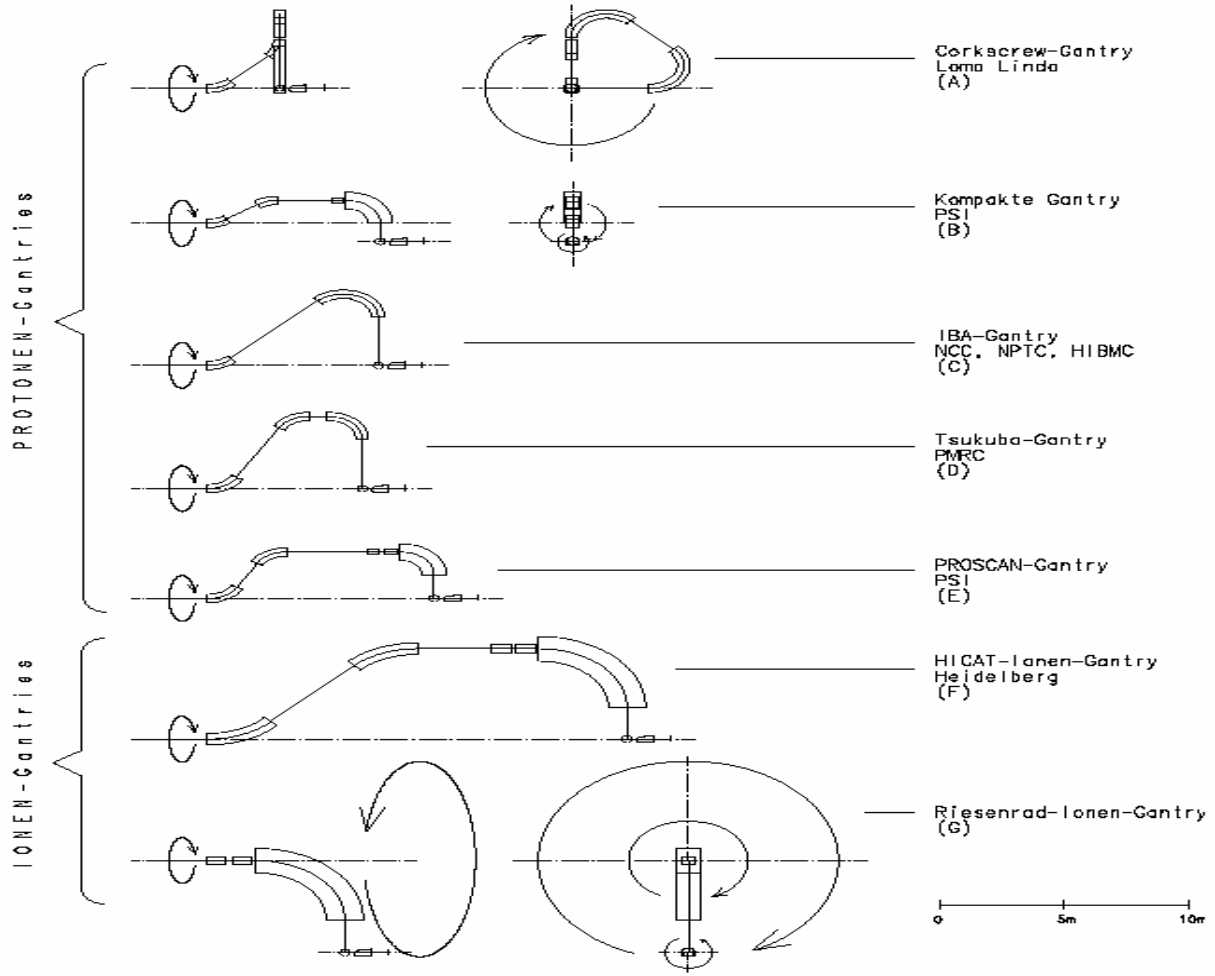
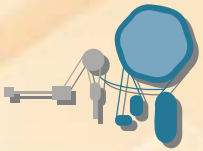
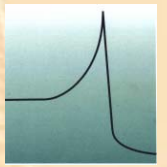


Abbildung 1: Grafische Darstellung verschiedener Protonen- und Ionen–Gantries.



Gantries: Proton Examples

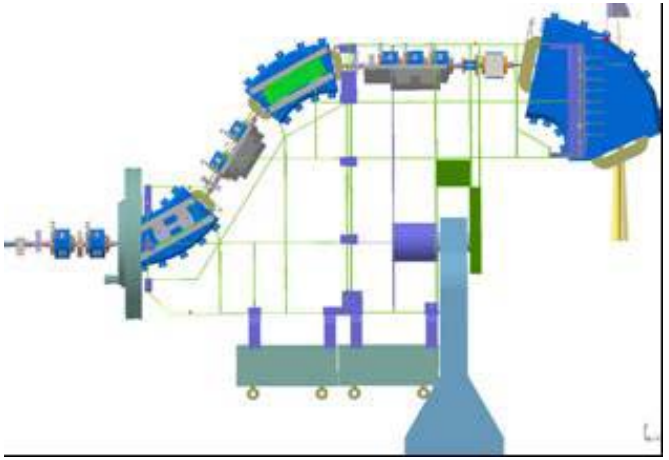


Country	Japan	Japan	Japan	Japan	Switzerland	Germany	Switzerland
Town	Hyogo	Chiba	Tsukuba	Shizuoka	Villingen	München	Villingen
Number	2	2	2	2	1	4	1
Status	operation	operation	operation	operation	operation	validation	assembly
Type	isocentric	isocentric	isocentric	isocentric	excentric	isocentric	isocentric
energy	230 MeV	235 MeV	250 MeV	235 MeV	230 MeV	250 MeV	230 MeV
length	9.5 m	10.7 m	9 m	9 m	10.2 m	10.1 m	11.6 m
Radius	4.8 m	5.0 m	5 m	4.8 m	1.4 m	5.0 m	3.2 m
number dipoles	2	2	3	3	3	2	3
number quads	7	9	6	4	7	7	7

Gantries: Proton Examples

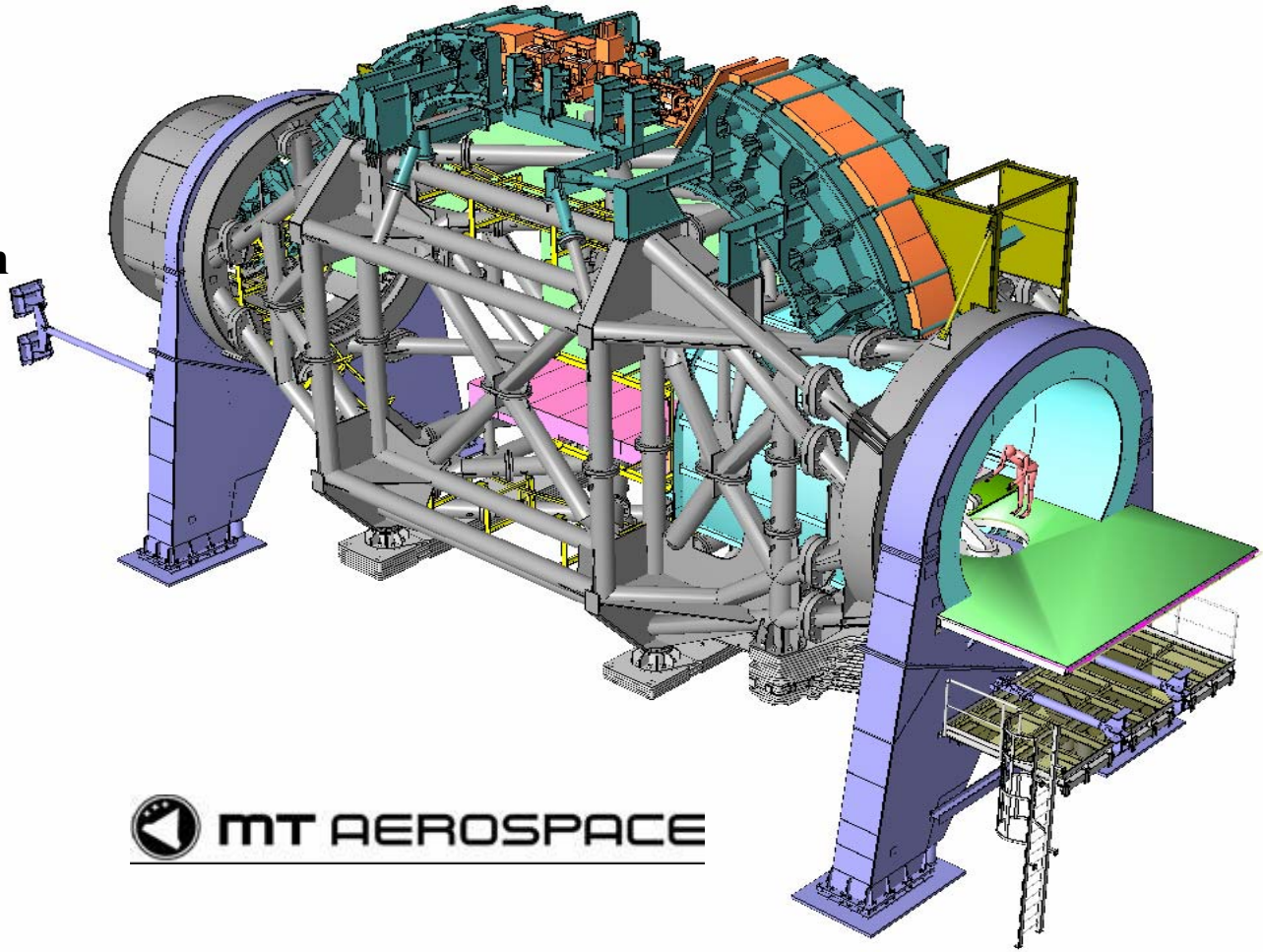
Mitsubishi

PSI



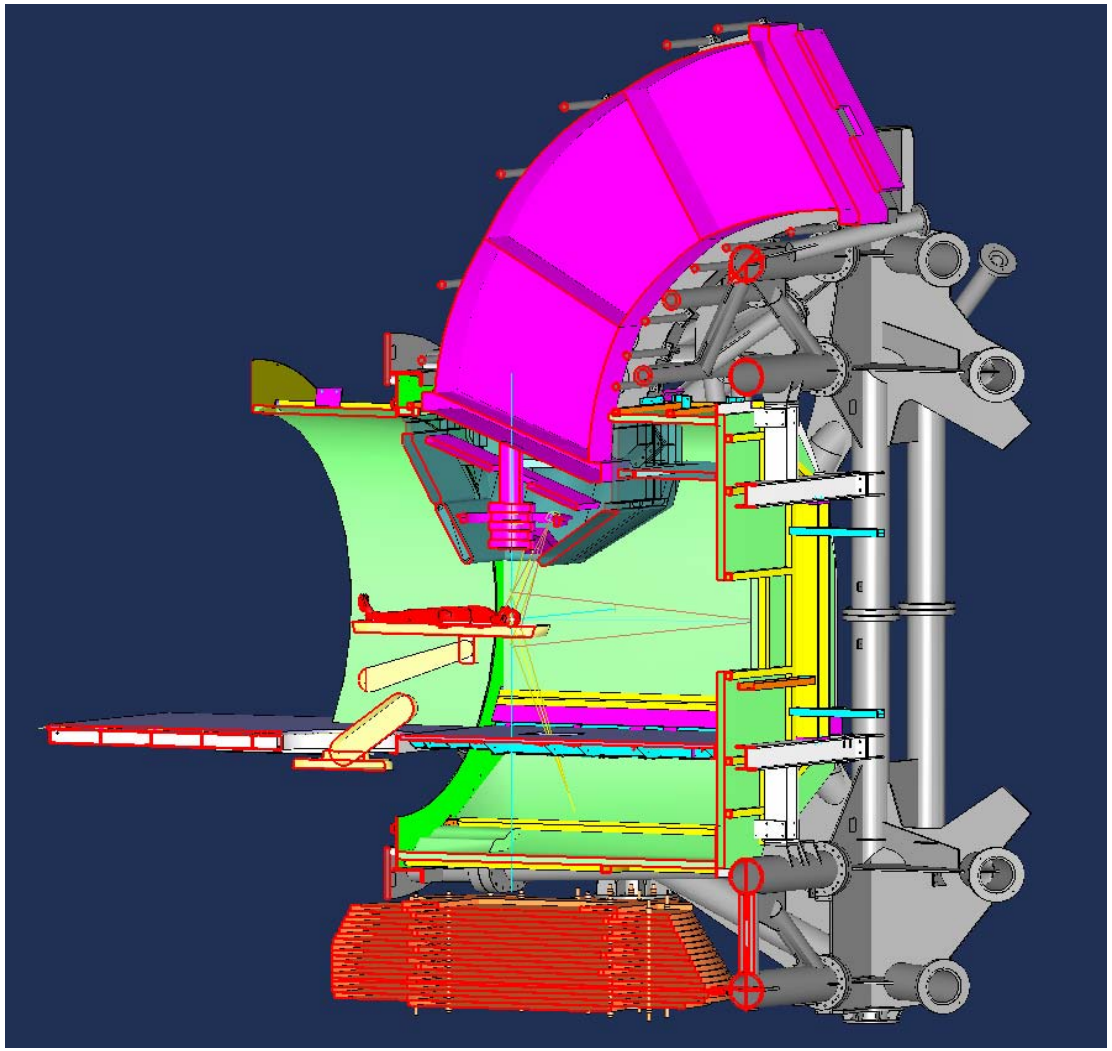
The HICAT Carbon Gantry: Layout

- Raster scanning included
- ± 180 degree rotation
- max. 3°/s
- 145 t of beam transport components
- total rotating weight 570 t
- weight of room fixed components: 130 t



The HICAT Carbon Gantry: Layout

- **Patient environment fixed together with Siemens Medical Solutions**
- **goal for beam reproducibility in the isocenter: ± 0.5 mm**



The HICAT Carbon Gantry: Status

- **Preassembly of main structure in Egypt**

The HICAT Carbon Gantry: Status

- **Delivery of Supporting Structure to the Gantry Room in Heidelberg**

Outlook for Carbon Gantries

Country	Germany	Japan	France	EU?
Town	Heidelberg	Chiba	Lyon	?
Number	1	1	1	1
Status	assembly	design	TDR	design study
Type	isocentric	isocentric	isocentric	?
energy	430 MeV/u	400 MeV/u	430 MeV/u	?
length	19.0 m	16.9 m	13.2 m	?
radius	5.6 m	7.1 m	3.8 m	?
number dipoles	3	3	3	?
number qpoles	8	7	8	?

Acknowledgement

- **To the partners participating the HICAT Gantry**
  - **MT Aerospace, GSI (namely R. Fuchs), HIT GmbH, Heidelberg University Hospital and Siemens Medical Solutions**
- **Colleagues providing information to Gantries**
  - K. Noda, NIRS
  - E. Pedroni, PSI
  - M. Bajard, ETOILE
  - D. Krischel, ACCEL
  - T. Furusato, MITSUBISHI
  - J.M. Lagniel, GANIL