The MedAustron Project
Conception and Current Status

Thomas Schreiner – Michael Benedikt

PEG MedAustron – CERN

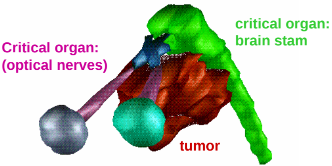
February 11, 2013

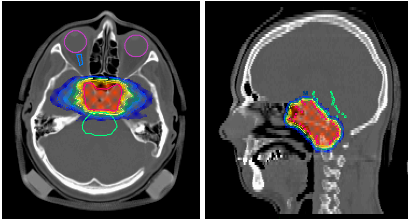
Radiation Therapy

- aim:
  - highest dose to target volume, to damage tumor cells
  - spare healthy tissue and critical organs from high doses

⇒ match dose exactly to tumour shape

- radiation types
  - conventional therapy: photons, electrons
  - ion-beam therapy: protons, light ions





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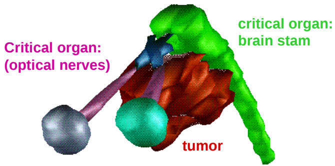

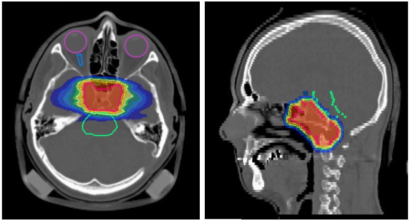

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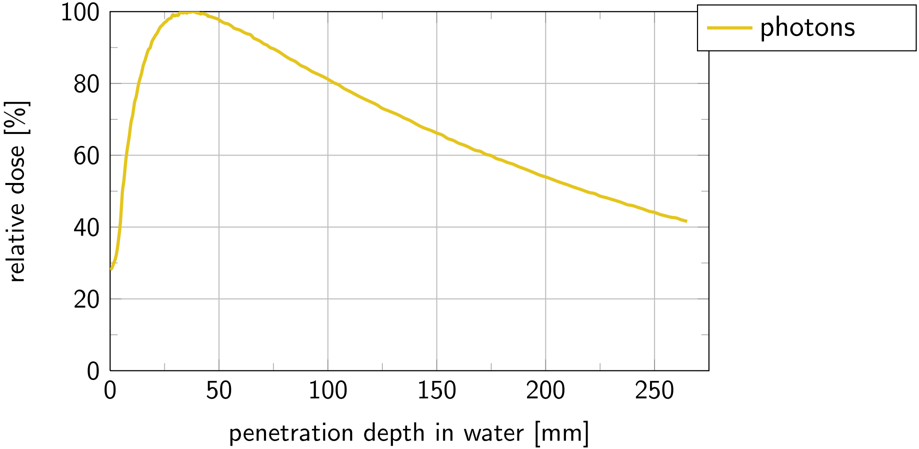
Dose Distribution in Water



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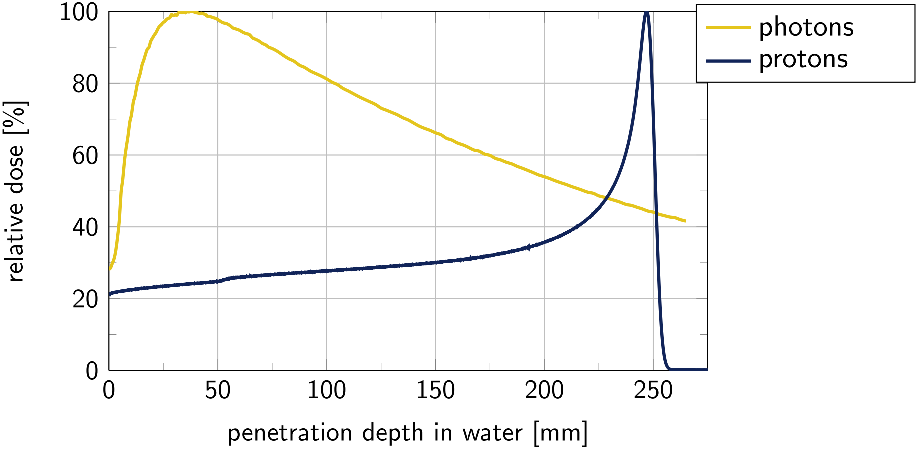

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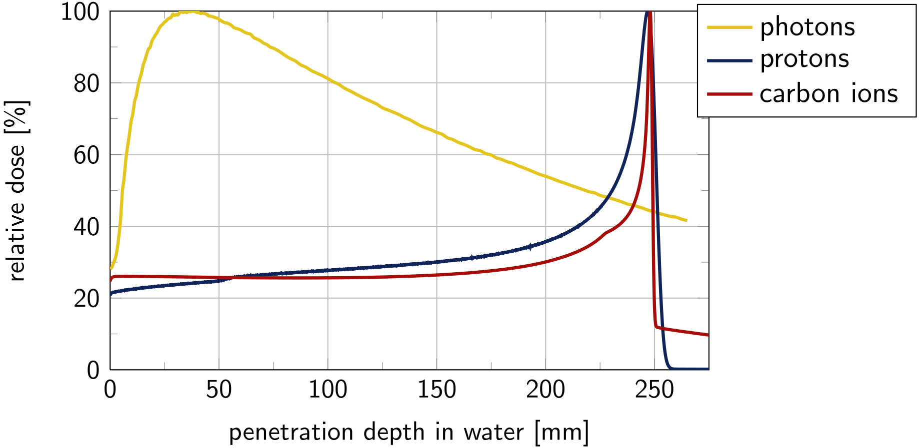

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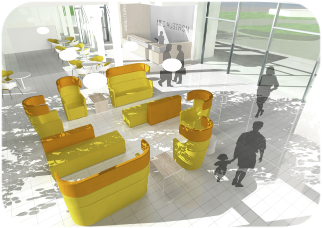
Centre for Ion-Beam Therapy and Research

- radiation therapy and clinical research
  - protons and carbon ions
  - 24 000 single fractions per year
    corresponds to about 100 patients/day
    corresponds to about 1200 patients/year
  - three medical irradiation rooms
  - two shift operation from Monday to Friday

- non-clinical research
  - protons and light ions
  - one irradiation room dedicated for non-clinical research
  - labs for non-clinical purposes



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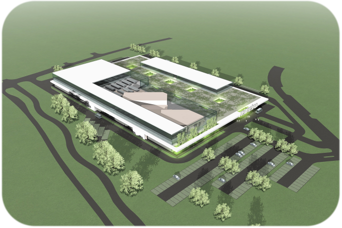

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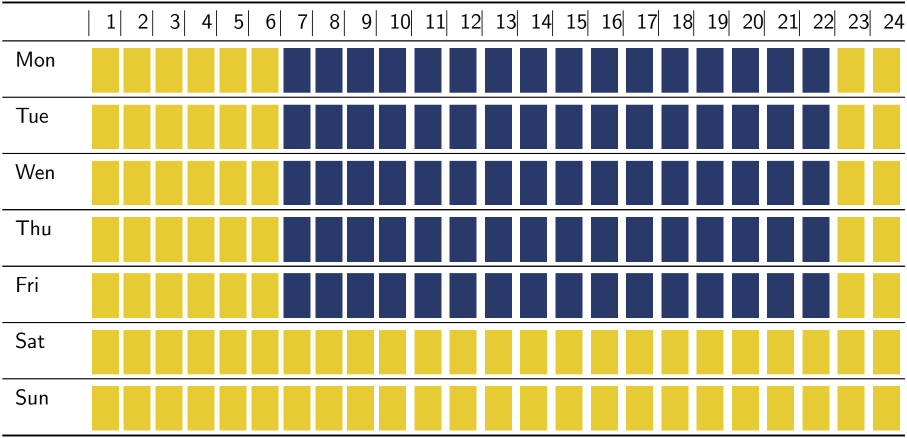
Distribution of Beam Time



Non-Clinical Research: Mon – Fri 10:00 p.m. – 6:00 a.m. & Sat – Sun 0:00 a-m.– 12:00 p.m.

Clinical (Research)Operation: Mon – Fri 6:00 a.m.– 10:00 p.m.

Beam Parameters for Non-Clinical Research

particles:	protons	carbon ions
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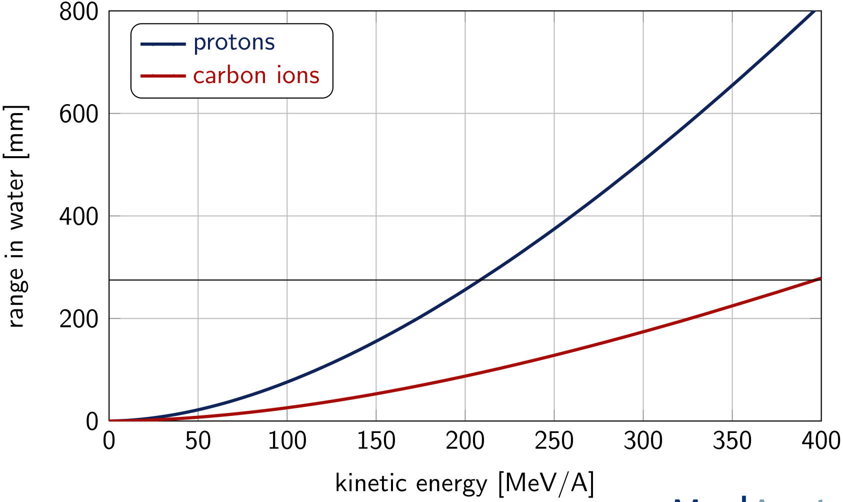

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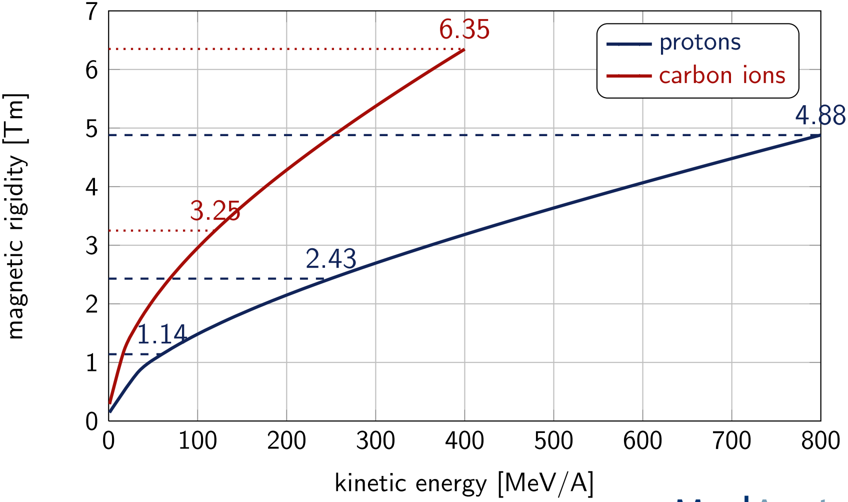

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beam delivery active scanning	horizontal-vertical fast scanning magnets energy variation with synchrotron	

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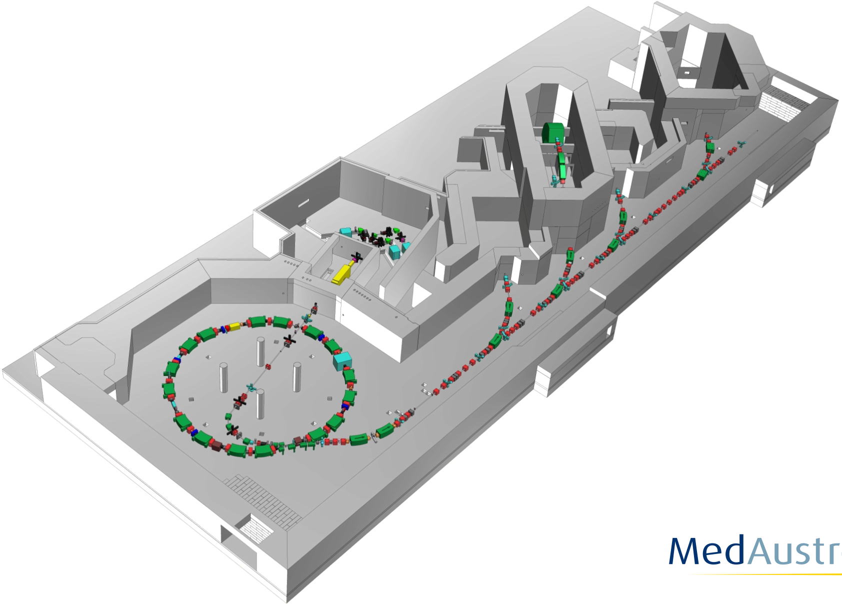
Accelerator Layout



Realisation Strategy – Flexibility for Operation

- injector area with sources accessible during operation
  - allows tuning of source in parallel to operation, change of ion type, etc.
- injector design allows for installation of up to five different ion sources
  - flexibility in the provision of different ion types for medical operation and research
- variable iso-centre optics for irradiation room for non-clinical research
  - allows parallel installation of several experiments
- fully exploit synchrotron capabilities to increase proton beam energy to 800 MeV for non-clinical research with limited additional effort
  - world-wide unique for comparable centres

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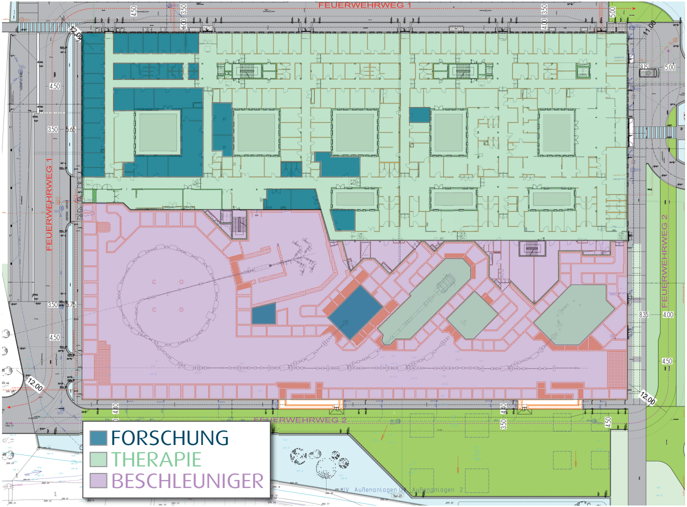
Facility

Conventional construction:

administration, research, and medical area

Radiation protection:

accelerator and four irradiation rooms



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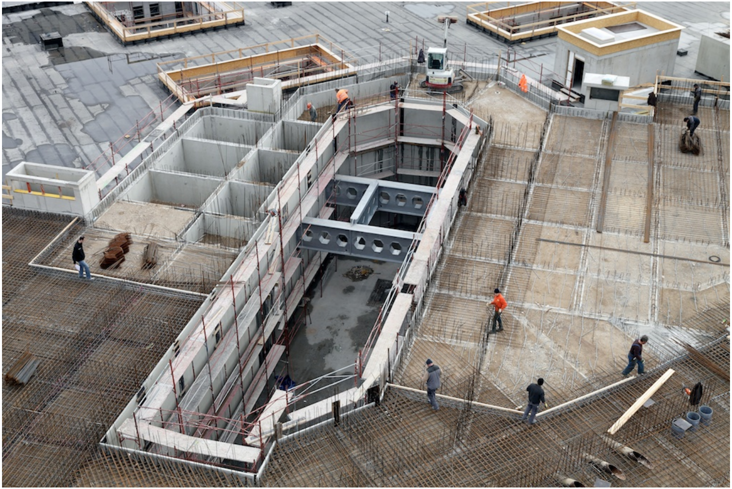
Sandwich Construction – March 2012



- using ground excavation for radiation protection

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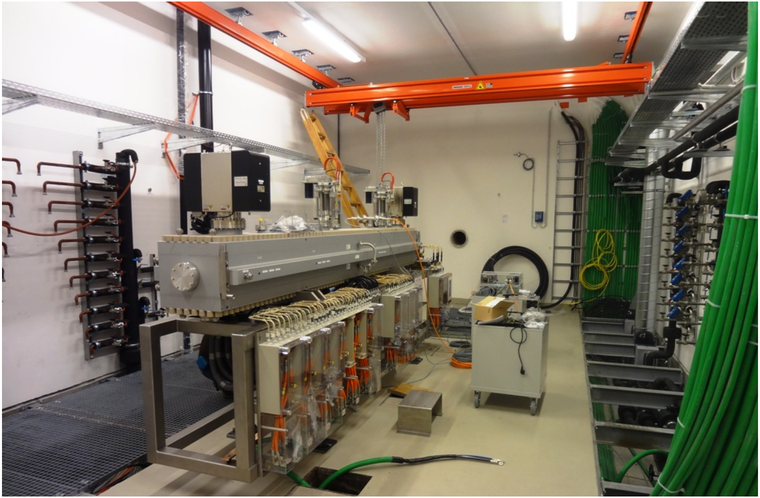
Injector Hall with Ion Sources

Injector Bunker with Injector Linac



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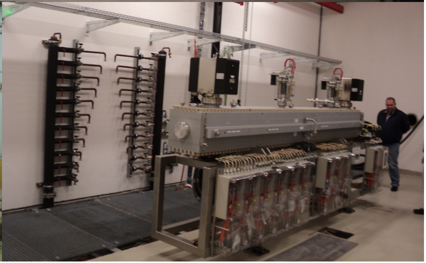
Synchrotron Hall and Main Bending Magnet



Power Converter Hall and Linac RF Amplifier

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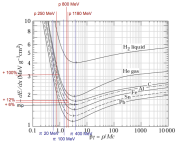
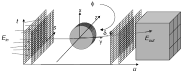
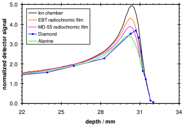
Main Non-Clinical Research Areas

- **Experimental Physics:**
  - detector development and test
  - proton scattering experiments
  - high-energy proton-computed tomography

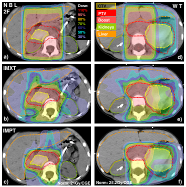




- **Medical Radiation Physics:**
  - basic and applied dosimetry
  - dose calculation and optimisation
  - treatment planning and plan evaluation



- **Radiation Biology:**
  - radiation induced mechanisms of cell death
  - research on biomarkers and bioimiging



- **Education and Training**

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Irradiation Room

- one fixed horizontal beam line
- variable isocentre over 5 metres adjustable, installation of several experiments – two isocentres
- removable nozzle for the first isocentre
- same equipment as in the medical irradiation rooms for the first isocentre, i. e. laser, positioning and imaging system
- circuit points for pressurised air and demineralised water
- electrical sockets and power supplies
- room size approximately 8 m $\times$ 12 m, i. e. 96 m^2

- local control room with control console enabling visual monitoring and display of accelerator parameters

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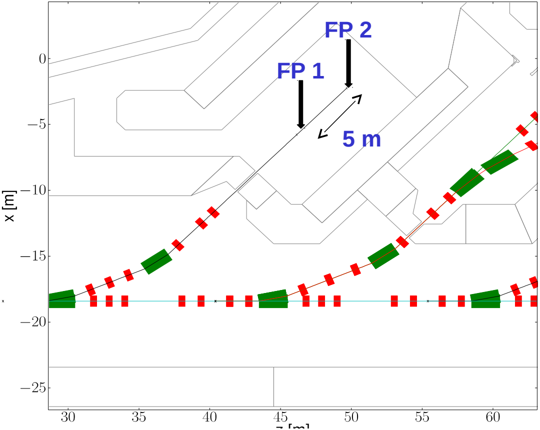

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Specific Rooms for Experimental Physics

- cooling-down room
  - storage of activated material after irradiation
  - $\sim 28\ m^2$

- preparation room
  - partial installation of experiments and preparation tests outside of the irradiation room
  - $\sim 28\ m^2$

- storage room
  - safe-keeping of external experimental equipment, material and devices
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Overall Project Schedule

- Dec 2010: environmental impact assessment
- March 2011: first stone laying
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- Oct 2012: moving to the new building





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– 2013: accelerator installation and commissioning
– 2014: medical trial operation
– 2015: first patient treatment
– 2016: facility ready for non-clinical research
– 2016: full operation – up to 1200 patients/year

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Summary

- MedAustron will be a “state-of-the-art” centre for ion-beam therapy and non-clinical research centre in Austria
- project is based on international collaborations with experienced partners for the conception and construction
- collaboration with CERN is an excellent example for technology transfer and essential for project progress
- construction phase started with accelerator components and civil engineering – initial operation end of 2015

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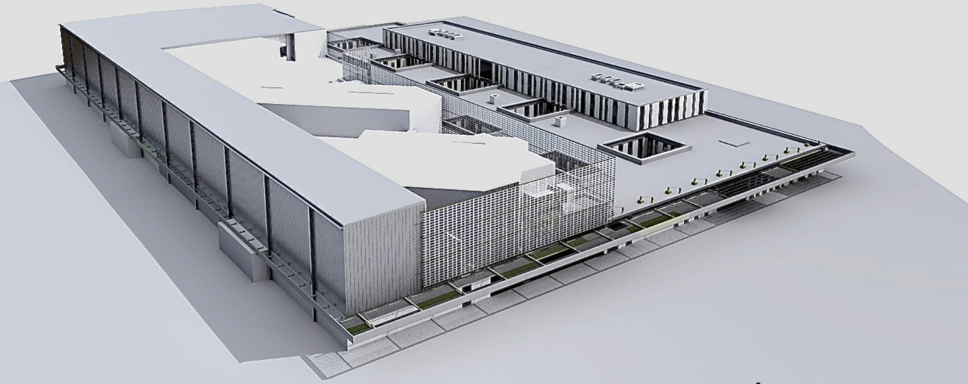
Thank you for your attention!



www.medaustron.at

Excursion to MedAustron on **Wednesday 2:00 p.m.**

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