

A Precise Beam Dynamics Model for the Beam Transport Line within the Gantry 3 Project

AMAS (GFA) & CPT (Cross funded PhD project)

Joint ETH-PSI-UZH PhD Seminar 2015

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August 26, 2015

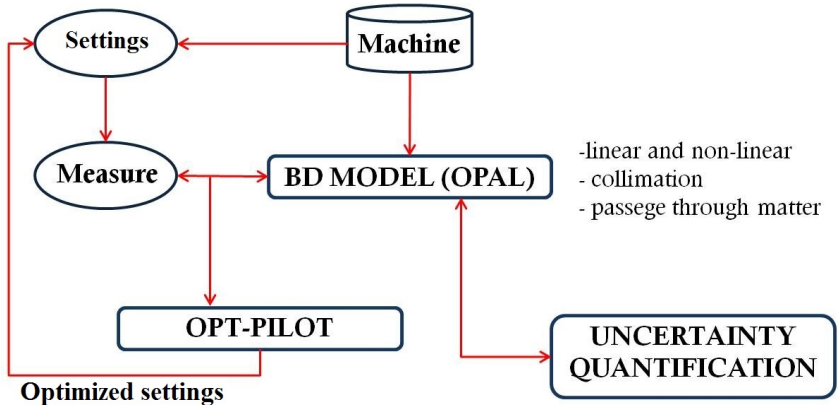


- ① PhD project
- ② PROSCAN facility
- ③ Gantry-3 Project
- ④ Summary

Outline

- 1 PhD project
- 2 PROSCAN facility
- 3 Gantry-3 Project
- 4 Summary

PhD project

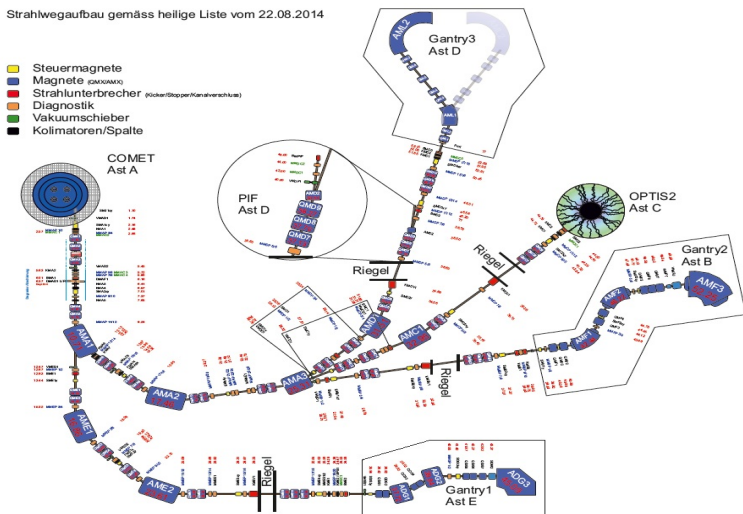


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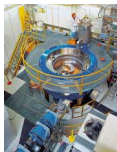
PROSCAN facility

Strahlwegaufbau gemäss heilige Liste vom 22.08.2014



PROSCAN facility: elements

COMET



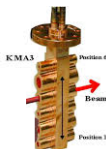
Superconducting cyclotron: 250 MeV

Degrader



6 movable wedges: 230 MeV - 70 MeV

Collimators and foils



Cut and scatter the beam

Gantry



Rotates around the patient

Beam dynamics & Proton therapy

Beam Dynamics

Transport the beam to the target ...

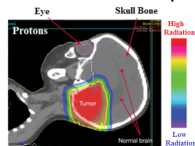
Adjust the beam size ...

Change the energy ...

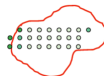
Provide the desired intensity ...
Reliability...

Proton therapy

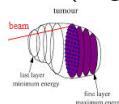
... a tumor inside a patient



... scan the tumor (transversal plane)



... cover the tumor (longitudinal plane)



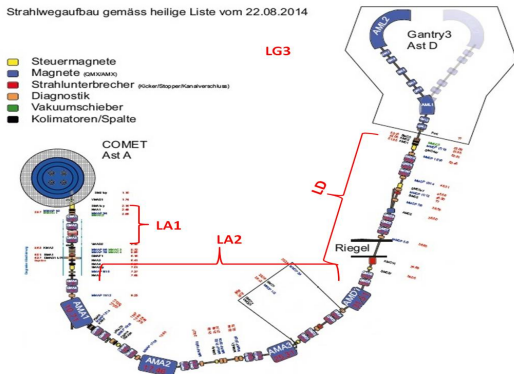
... prescribed dose to the patient
... daily treatment (30 days/patient)

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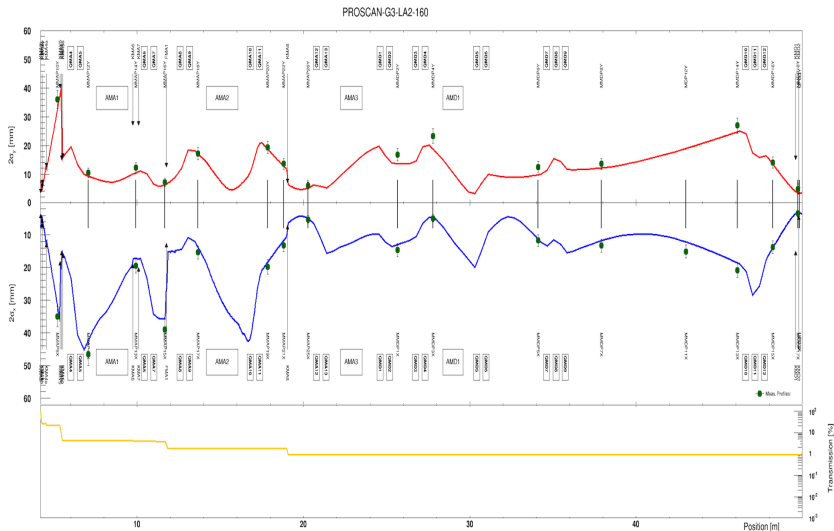
Line toward Gantry 3

Strahlwegaufbau gemäss heilige Liste vom 22.08.2014

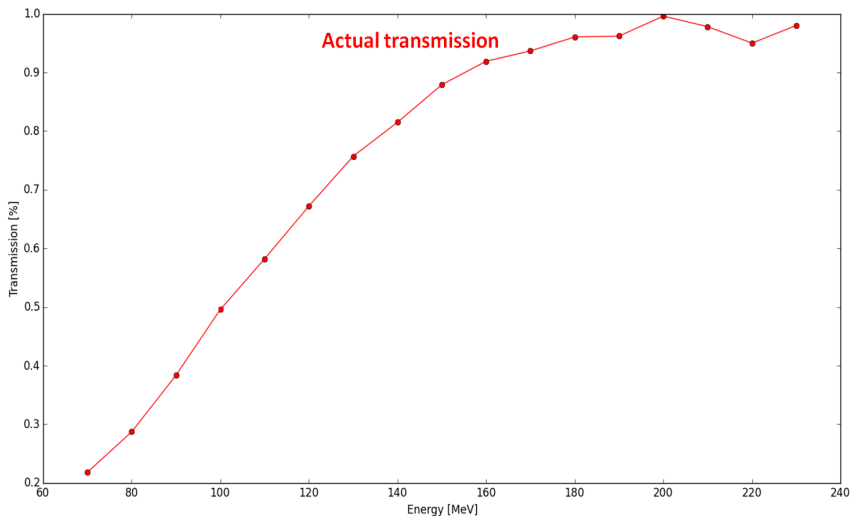


Model → Lattice and degrader are implemented
 → Measurements from the commissioning (Febr./March 2015).

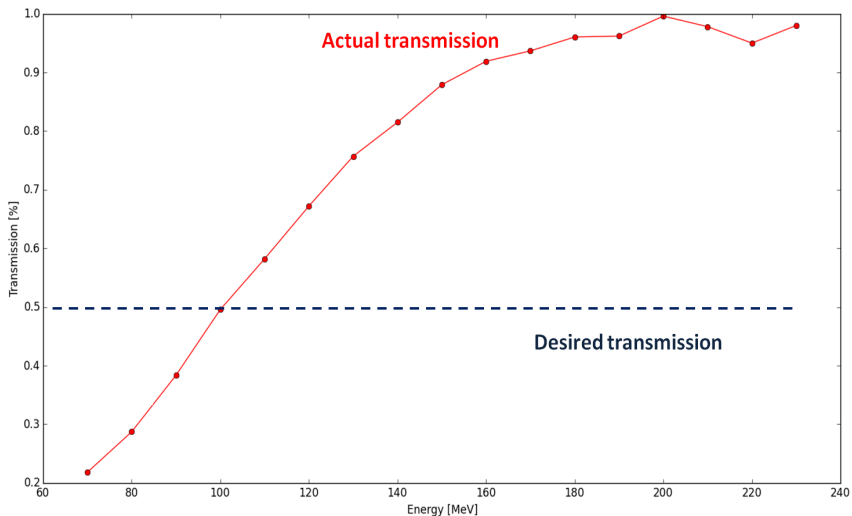
Envelope and transmission for 160 MeV



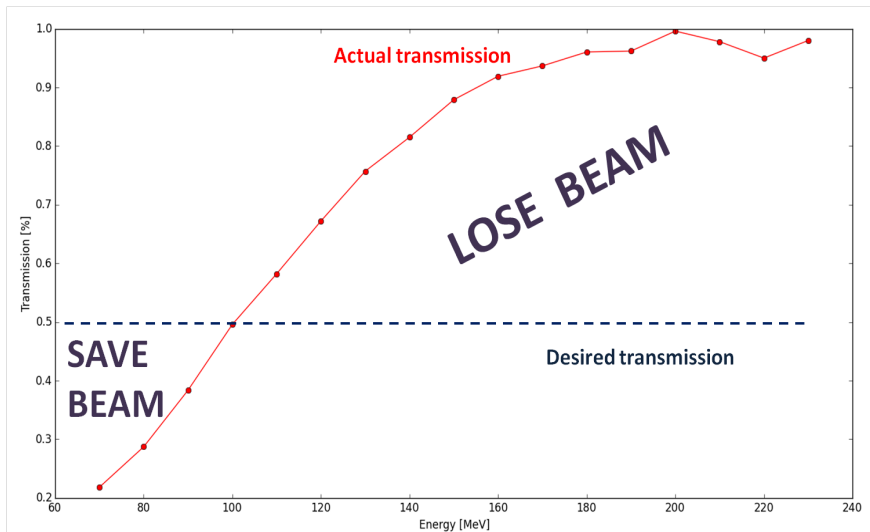
Transmission at the G3 Coupling Point



Transmission at the G3 Coupling Point



Transmission at the G3 Coupling Point



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Summary

- Transport lines towards G2 and G3 are included in the model
- H5root-based tool has been developed for build/run/analyse the model
- Model results are in good agreement with the measurements
- Monte Carlo simulation for the degrader has been performed

For the future...

- Set up the optimizer for obtaining the flat transmission
- Apply the uncertainty quantification principles to the model
- Prepare the model for the G3 commissioning (2016)

Thank you for your attention

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Thank you for your attention