The Pisa clinical trial Treatment Planning task

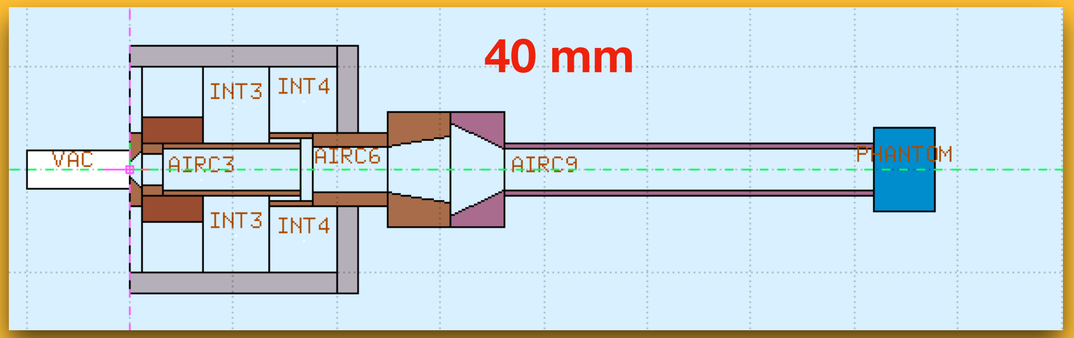
A dose evaluation workflow for FLASH Radiotherapy clinical trial

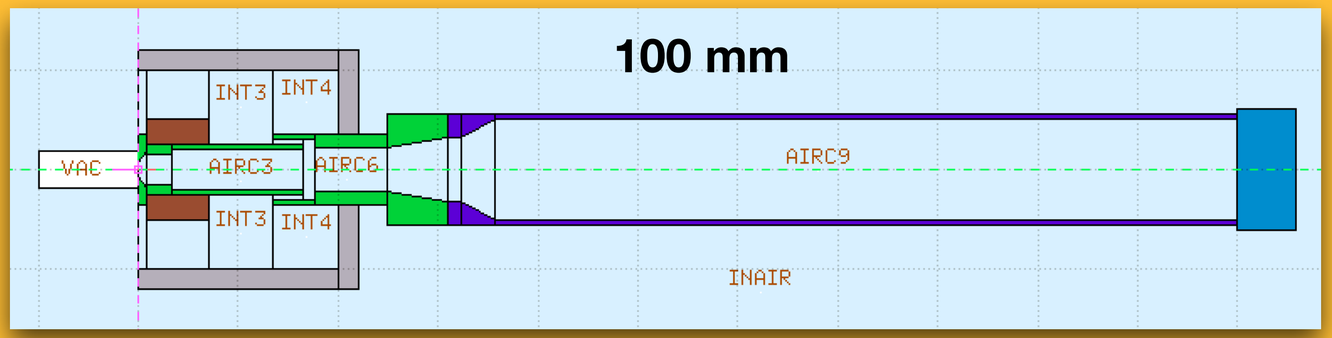
Preliminary step 1: spectra tuning in H_2O

FLUKA simulation:

- ElectronFlash geometry
- Water phantom
- 40 and 100 mm applicators
- Atomic electrons contribution to MCS (*fudgem*)

soiort.com/flash-rt-technology/





Geometry of the ElectronFlash reproduced in FLUKA

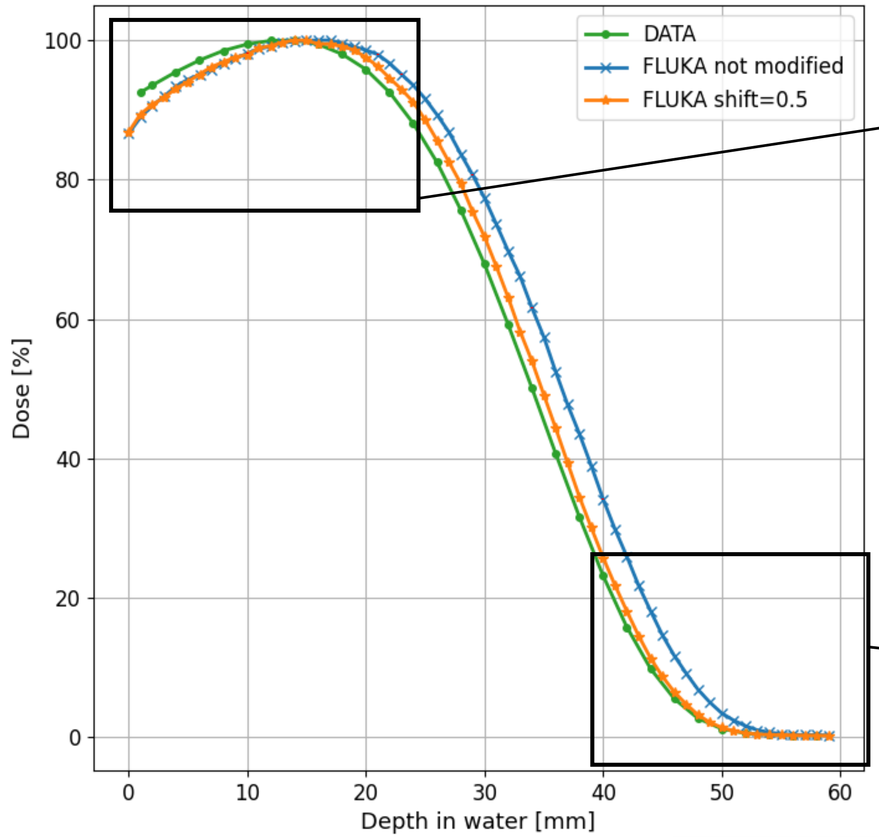
Preliminary step 1: spectra tuning in H_2O - 9MeV 100mm

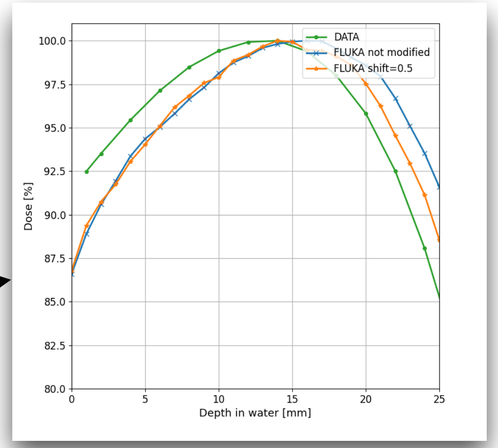
R100 (R50): depth at which the absorbed dose reaches 100% (50%) of its maximum value

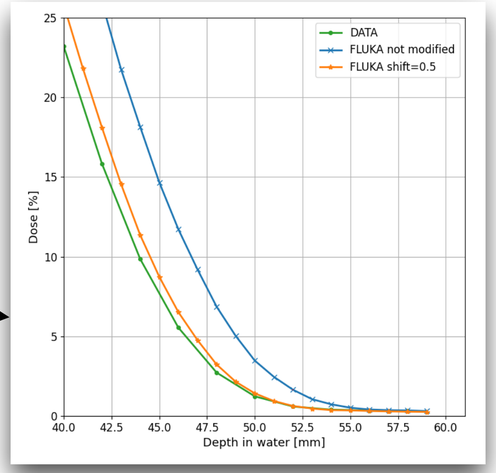
R100 FLUKA (not shifted): (16.00±0.02)mm
R100 FLUKA (shifted): (14.00±0.01)mm
R100 DATA:14mm

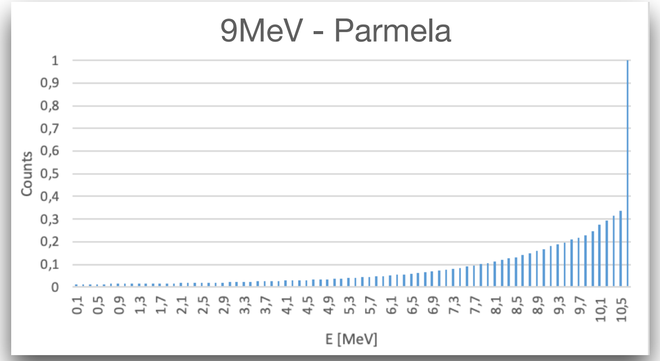
R50 FLUKA (not shifted): (37.00±0.02)mm
R50 FLUKA (shifted): (35.00±0.04)mm
R50 DATA:34mm

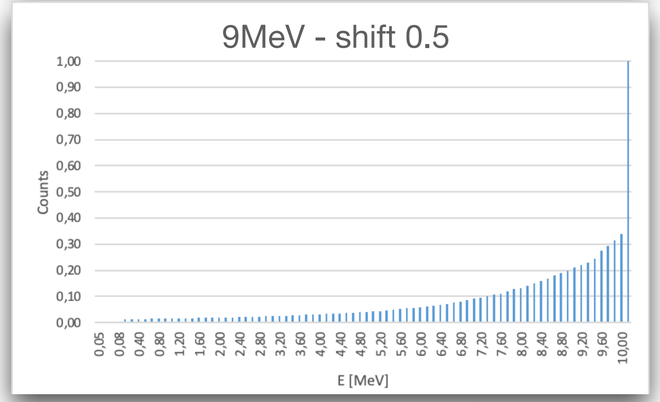
9 MeV-100 mm





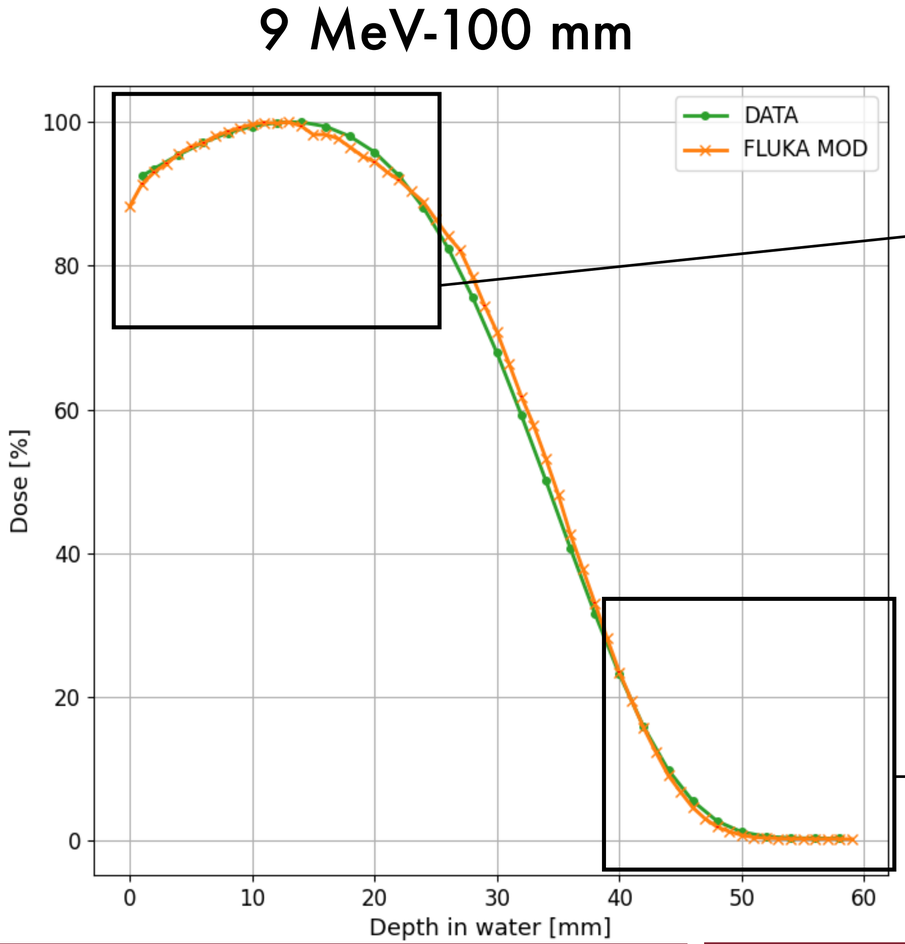


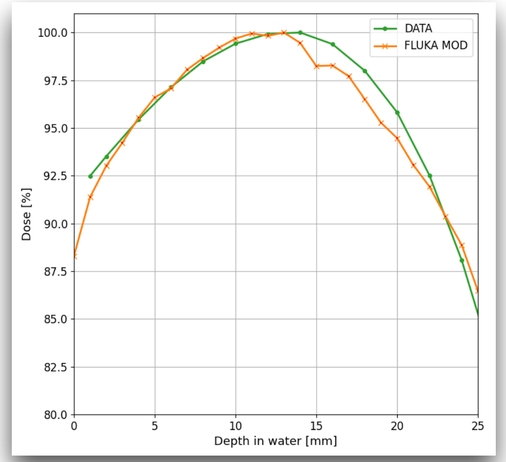


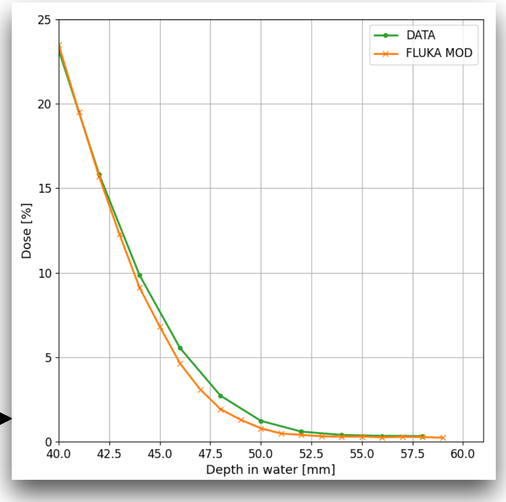


Preliminary step 1: spectra tuning in H_2O - 9MeV 100mm

R100 (R50): depth at which the absorbed dose reaches 100% (50%) of its maximum value

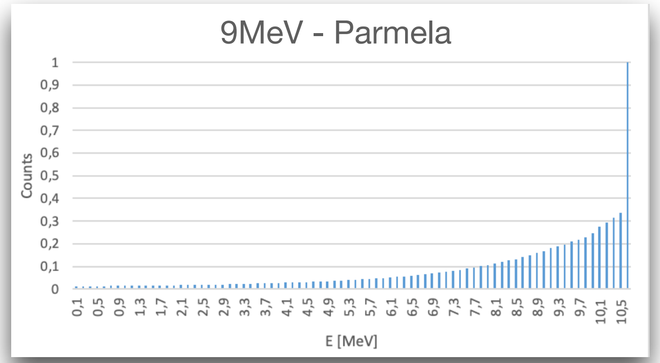


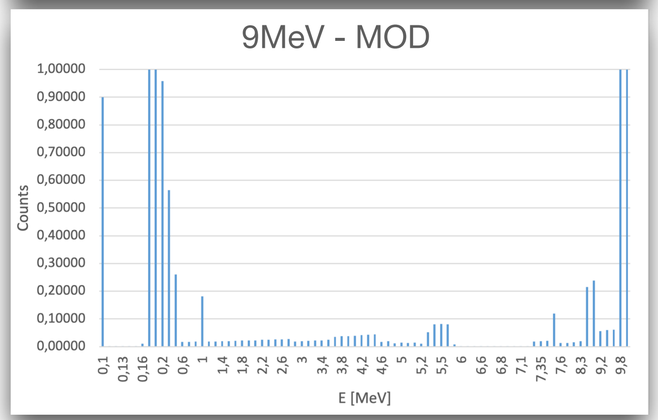




R100 FLUKA: (13.00±0.04)mm
R100 DATA:14mm

R50 FLUKA: (35.00±0.04)mm
R50 DATA:34mm



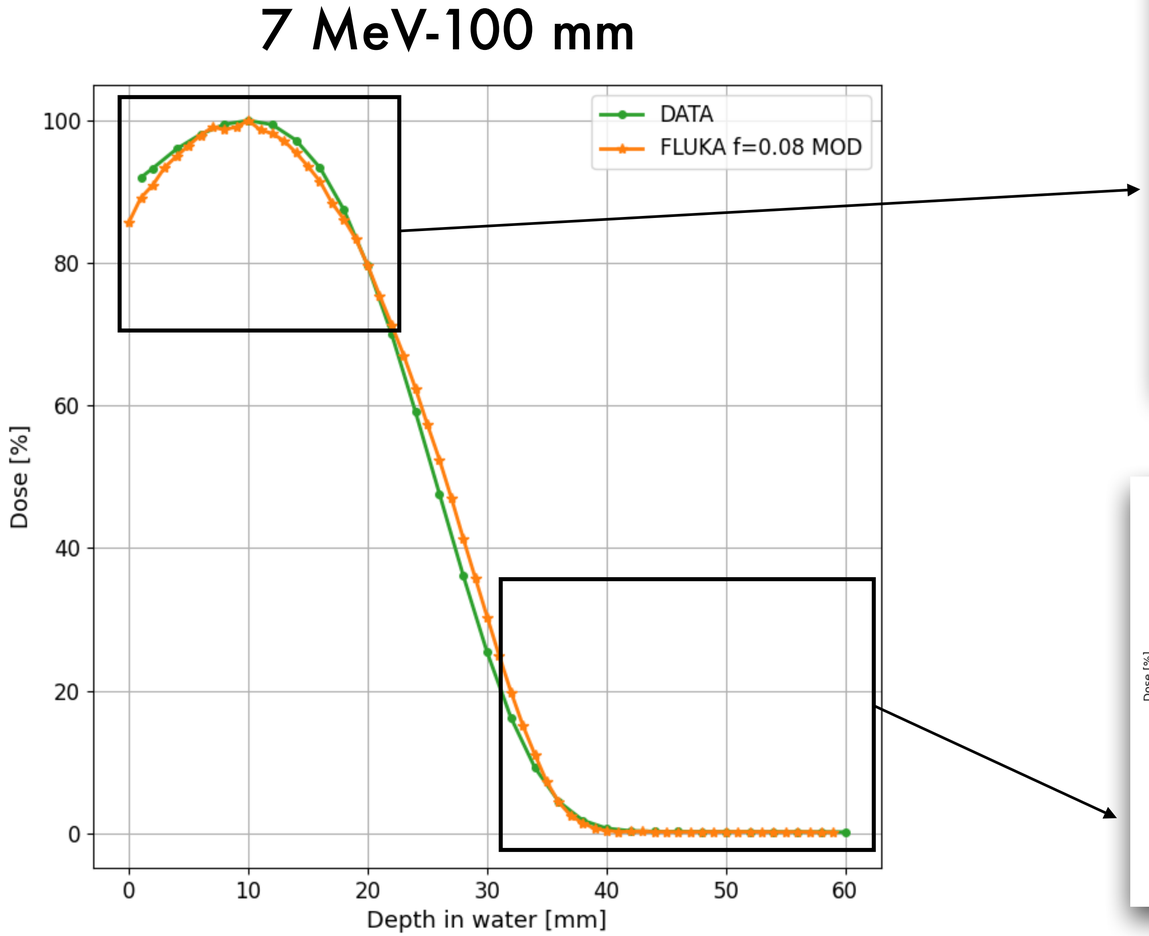


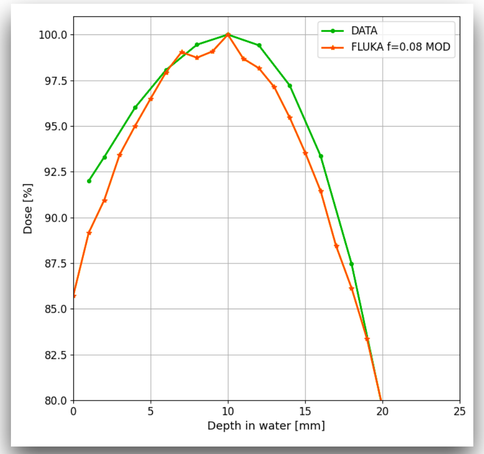
Preliminary step 1: spectra tuning in H_2O - 7MeV 100mm

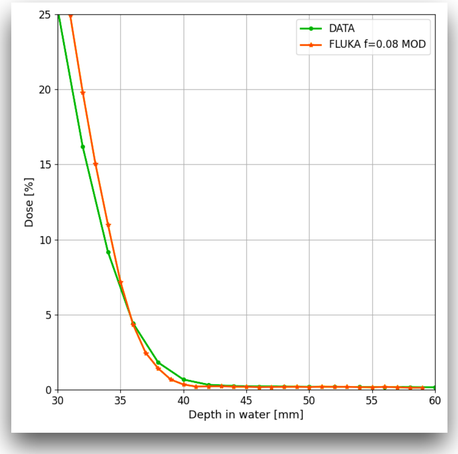
R100 (R50): depth at which the absorbed dose reaches 100% (50%) of its maximum value

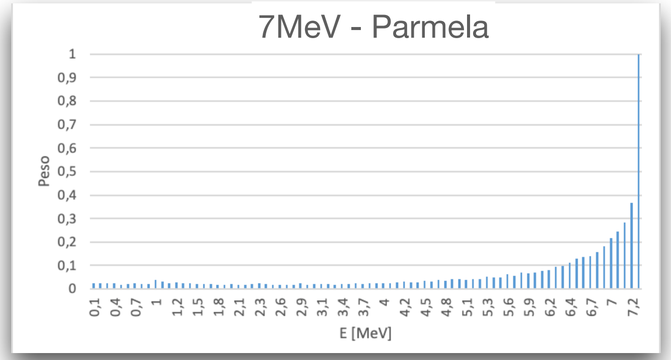
R100 FLUKA: (10.00±0.04)mm
R100 DATA: 10mm

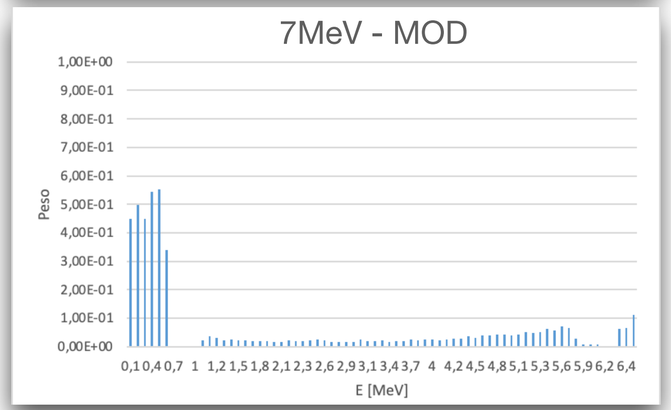
R50 FLUKA: (26.00±0.03)mm
R50 DATA:26mm





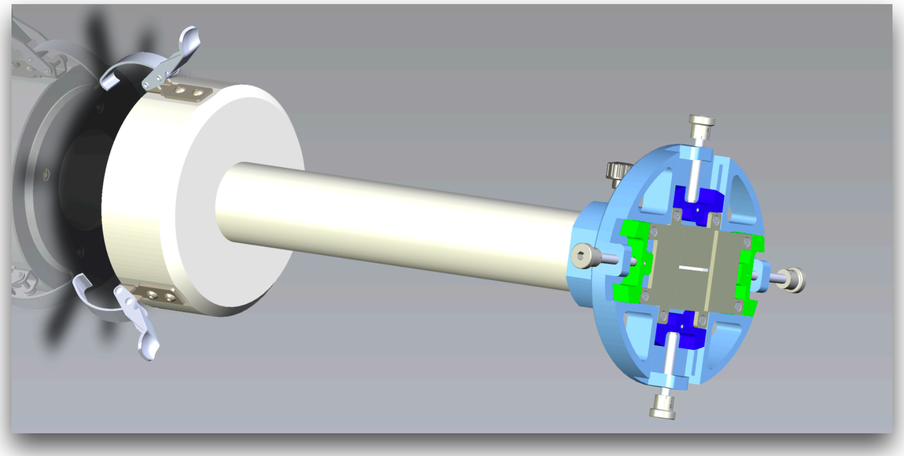


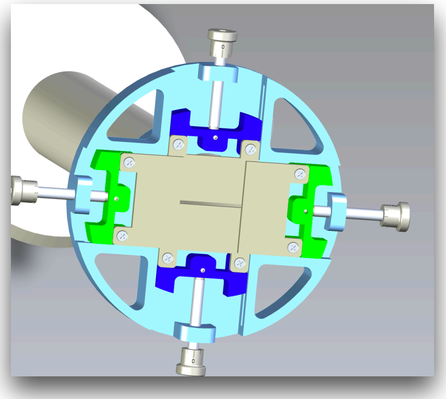


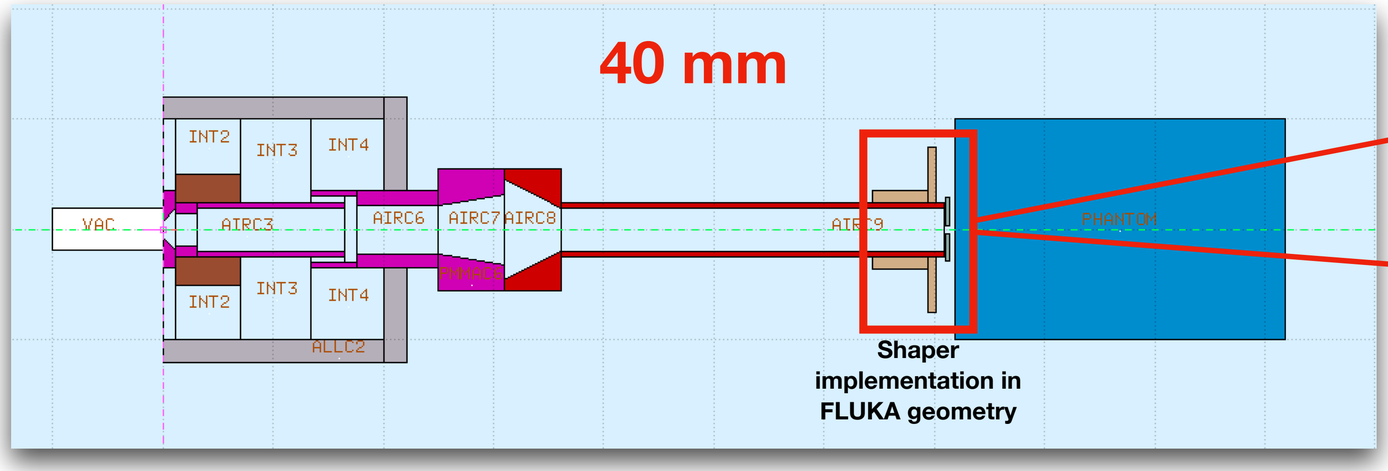


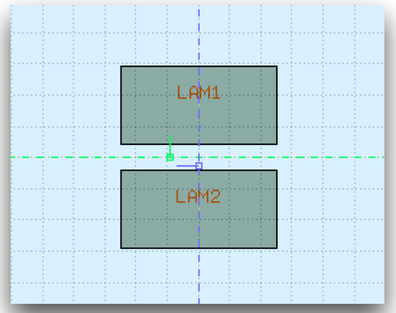
Preliminary step 2 - Shaper simulation

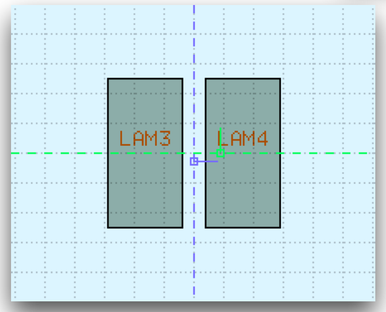
- Nylon supporting structure
- Four 35x50mm sliding tungsten slits
- 40mm applicator
- Water phantom







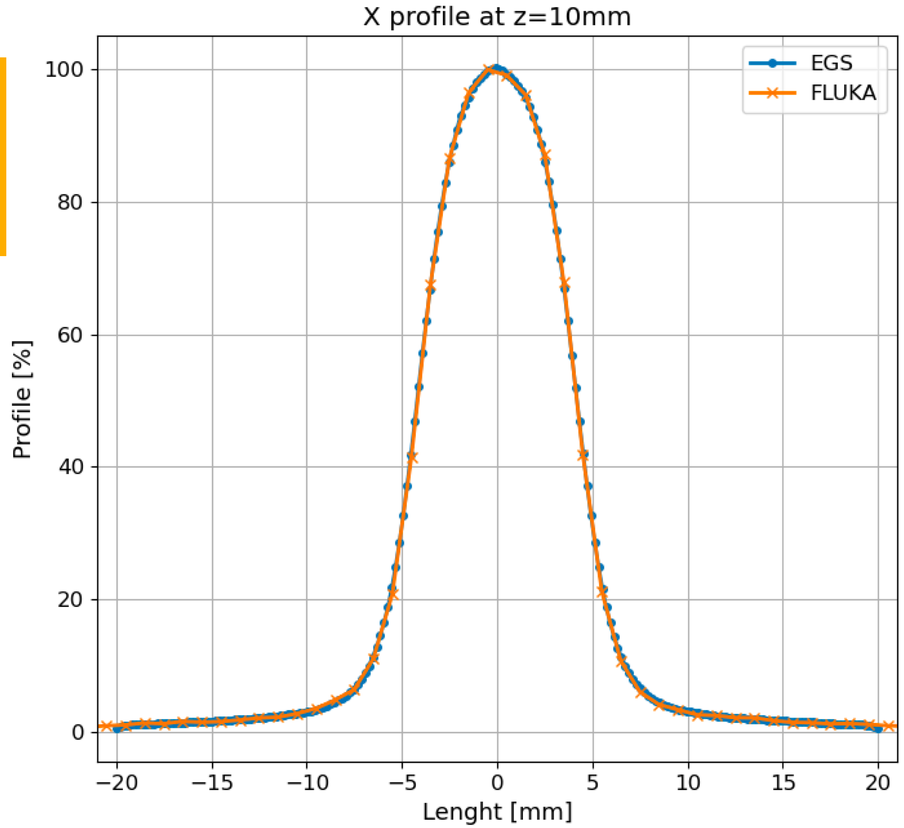


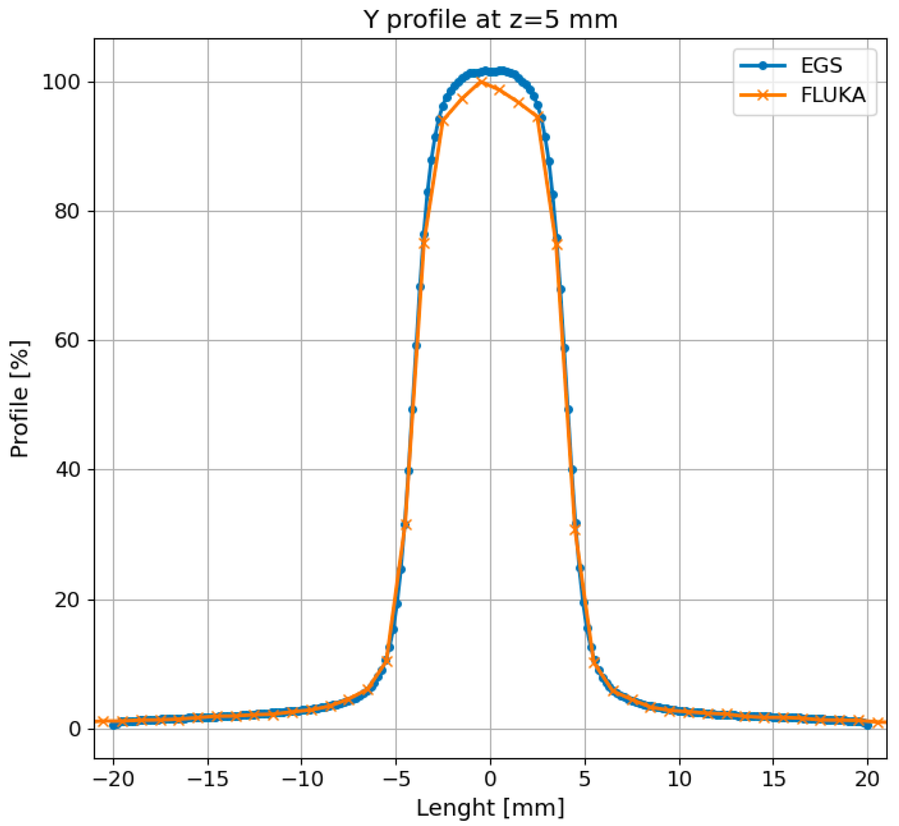


Preliminary step 2 - Shaper and grid simulation

Comparison between Fluka-based and CPFR EGS-based simulated profiles along the two planar directions shows good agreement

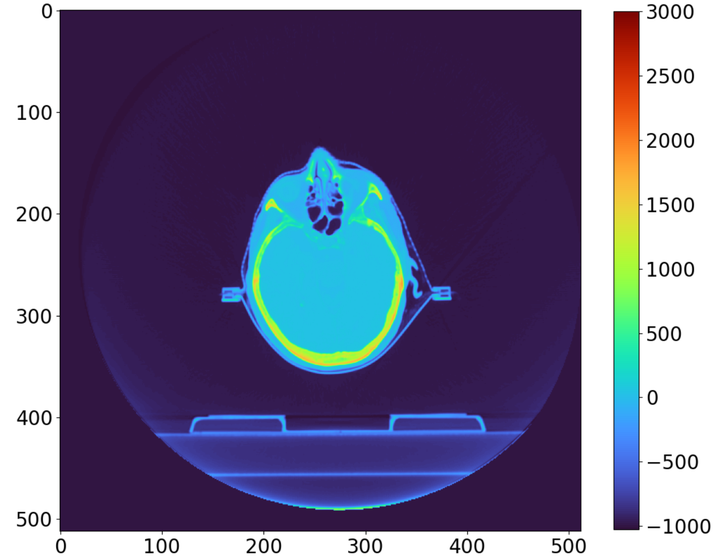
- 9 MeV
- 8x8mm aperture
- Water phantom

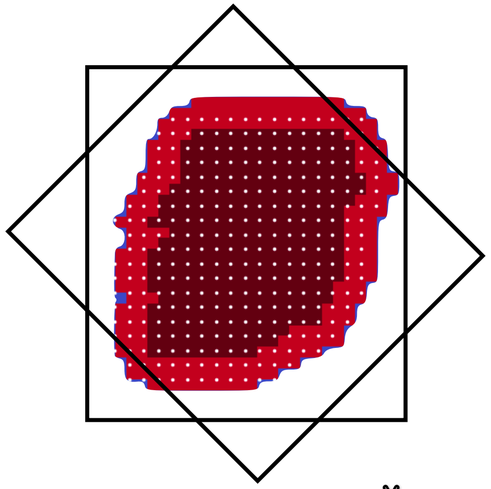




Workflow planning

1. Evaluation of the geometry/orientation of the shaper which maximizes the dose absorbed by the tumor for a given PTV while minimizing the dose to the OARs
2. Simulation of both 7 and 9 MeV electron beams with the chosen shaper setup
3. DVH and dose-map generation allowing for treatment optimization





The final aim of this workflow is to decide the optimal beam energy and shaper geometry to match the PTV coverage requirement minimizing the absorbed dose by OARs

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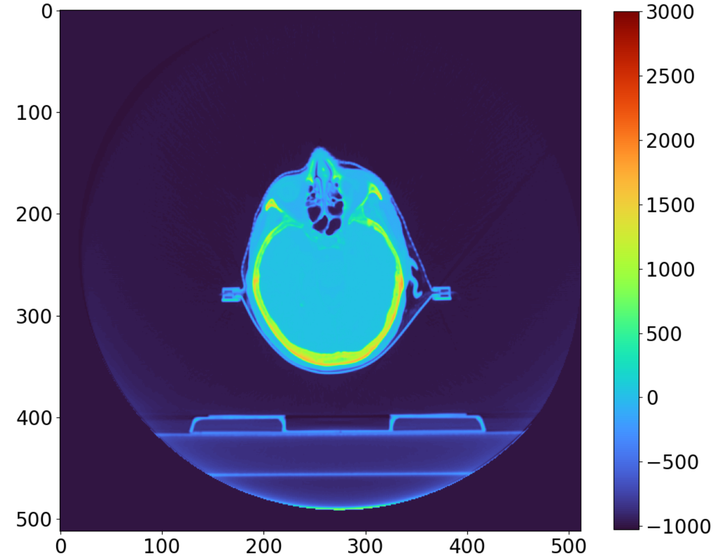

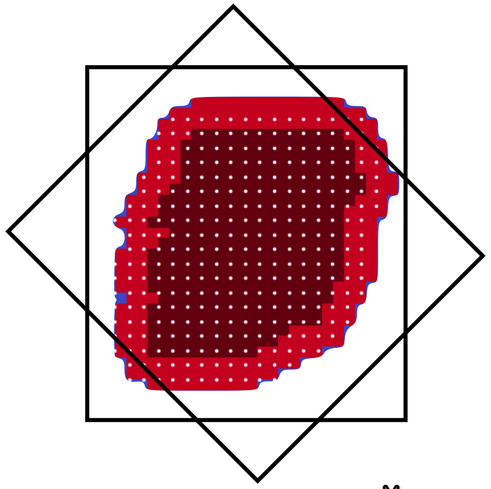

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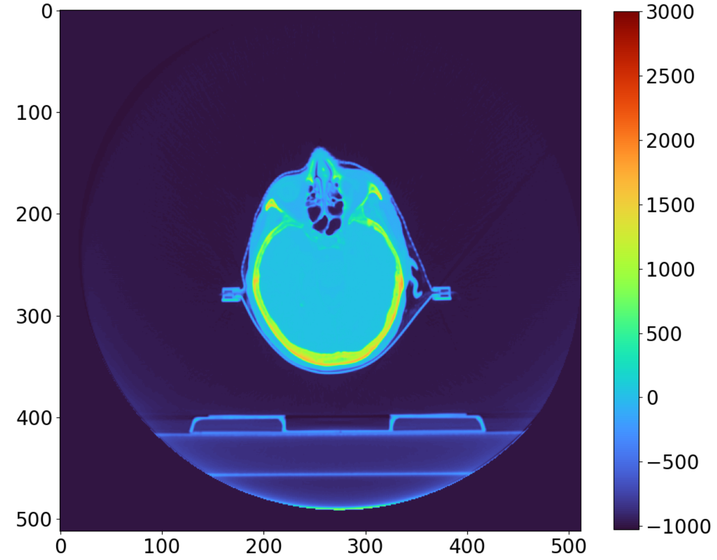

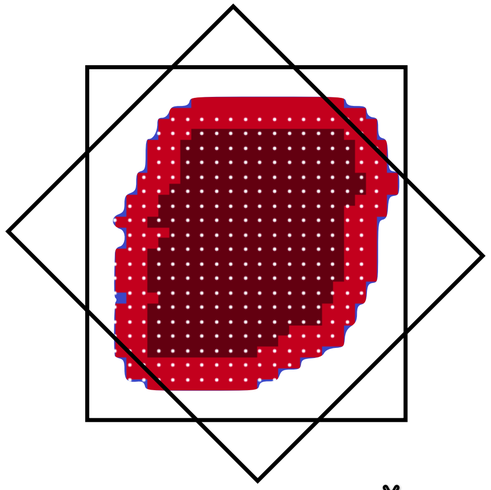

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Thank you!

Spare

Preliminary step 2 - Shaper and grid simulation