

Status and new developments for the Medical Linac Example

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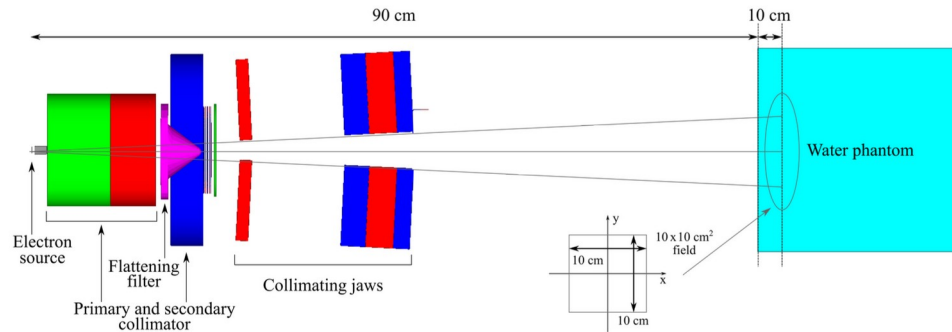


CENTRO NAZIONALE
PROTEZIONE DALLE RADIAZIONI
E FISICA COMPUTAZIONALE

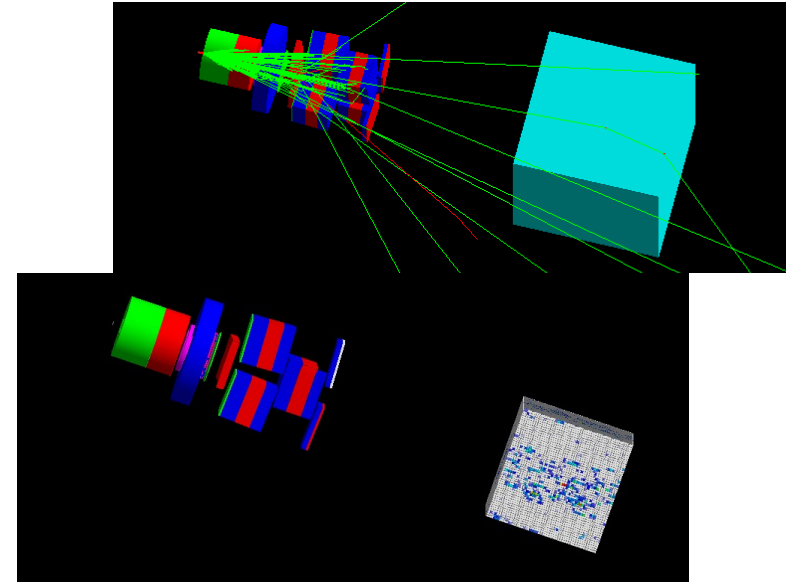


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Medical Linac example

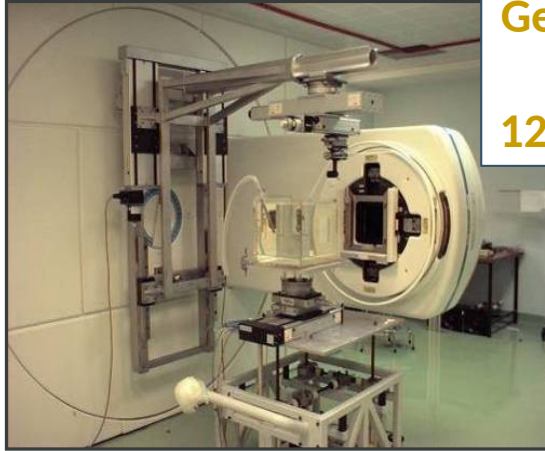


```
/physics/addPhysics  
/DetectorConstruction/Acc/fieldSide  
/DetectorConstruction/Phantom/phantomSide  
/DetectorConstruction/Acc/sourceToSkinDistance  
/PrimaryGenerator/gunMeanEnergy  
/PrimaryGenerator/gunStdEnergy  
/PrimaryGenerator/gunRadius
```

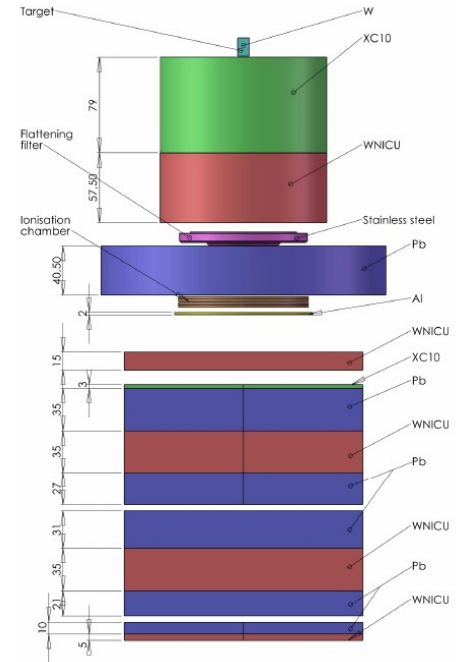


MT mode
Command-based scoring mesh

The accelerator



General Electric Saturne 43 linac,
photon mode,
12 MeV e^- source nominal energy



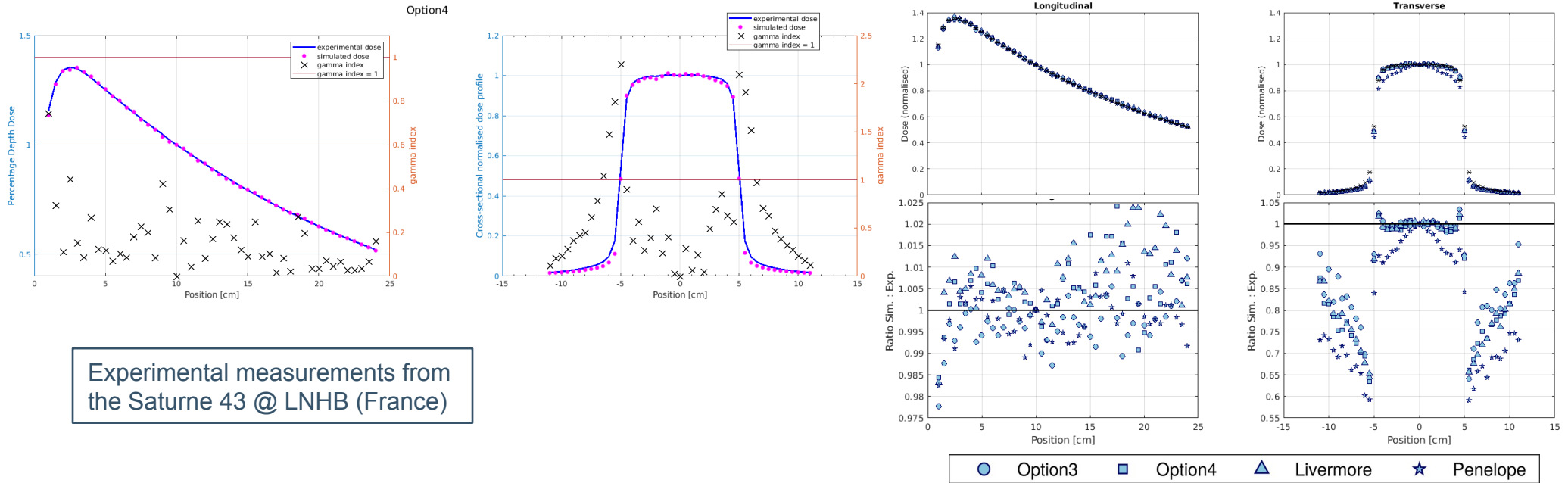
EURADOS Report 2020-05

B. Caccia, V. Blideanu, M. Le Roy, H. Rabus, R. Tanner: **“A model validation scheme for Monte Carlo simulations of a medical linear accelerator: geometrical description and dosimetric data used in the “Linac Action”**”, Neuherberg, October 2020.

<https://doi.org/10.12768/9rvp-fq82>

Tuning of the electron source with Option4

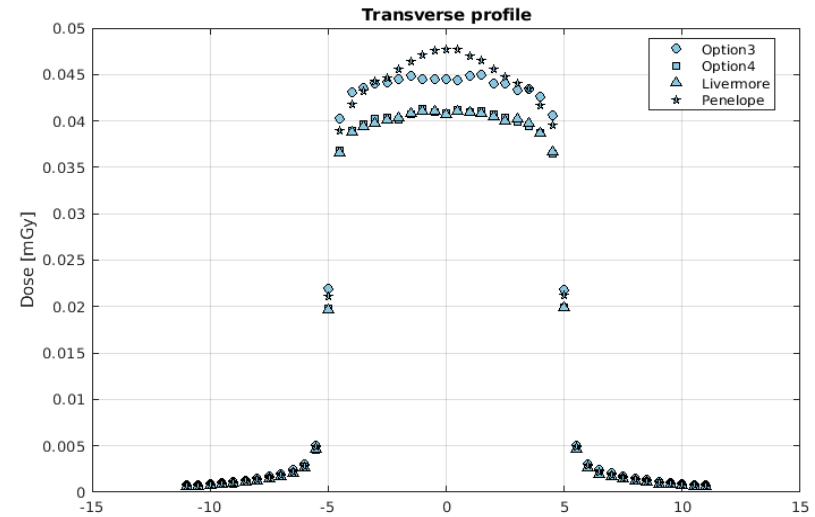
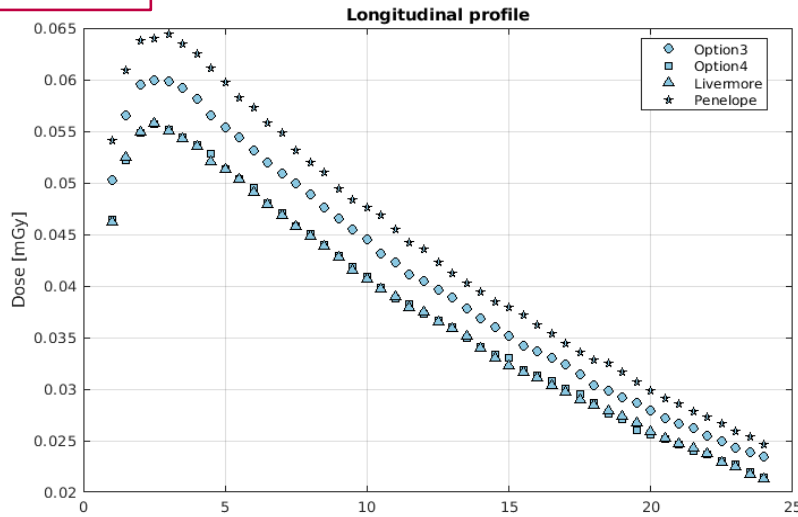
Tuning of the e⁻ source (with gamma index): 12 MeV nominal → 11.6 MeV



Experimental measurements from the Saturne 43 @ LNHB (France)

EM constructor comparison, absolute profiles

11.6 MeV e⁻



Differences w.r.t. option4

Longitudinal (first 10 cm of depth):

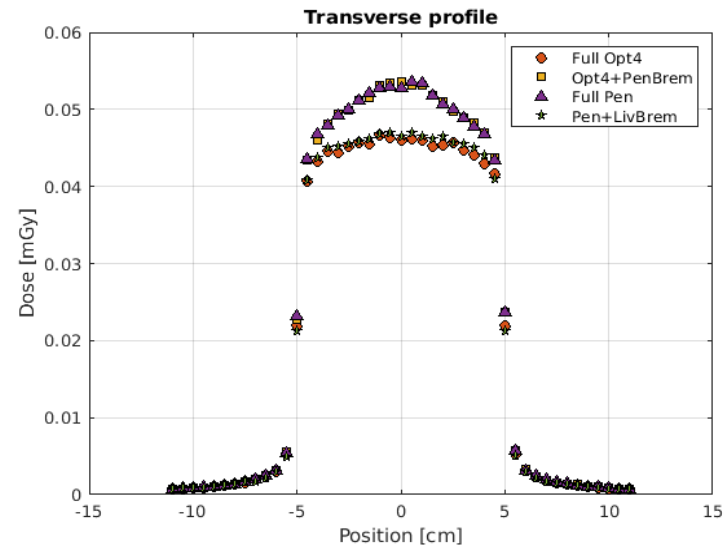
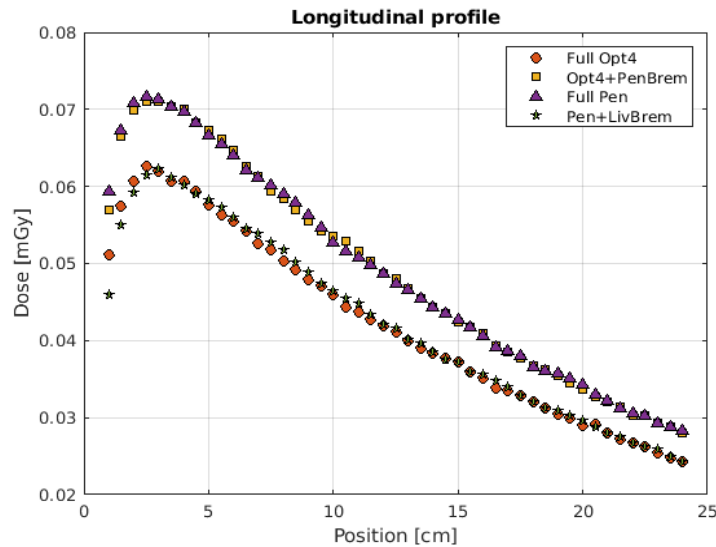
- Livermore ~1%
- Option3 6-10%
- Penelope 15-16%

Transverse (in-field):

- Livermore ~1%
- Option3 7-11%
- Penelope 6-17%

EM constructor comparison, absolute profiles

Bremsstrahlung models



12.0 MeV e⁻

● Full Option4 ■ Option4 + PenBrem ▲ Full Penelope ★ Penelope + LivBrem

Summary & future developments

Done:

- Example rewritten making it more user friendly.
- Implemented a real accelerator, MT, and a command-based scoring mesh.
- Validated with experimental data.
- Included in Geant-val.

To do:

- Investigate the impact of EM constructors on the dose profiles.
- Optimization to improve computational load.
- Removal of the Flattening Filter via macro file in order to easily switch from photon to electron mode.