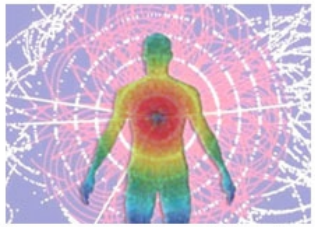
Evaluation of Late Toxicity Risk for RT Patients through Geant 4 Simulation of X-Ray Dose Deposition: The GHOST project.



Geant Human Oncology Simulation Tool

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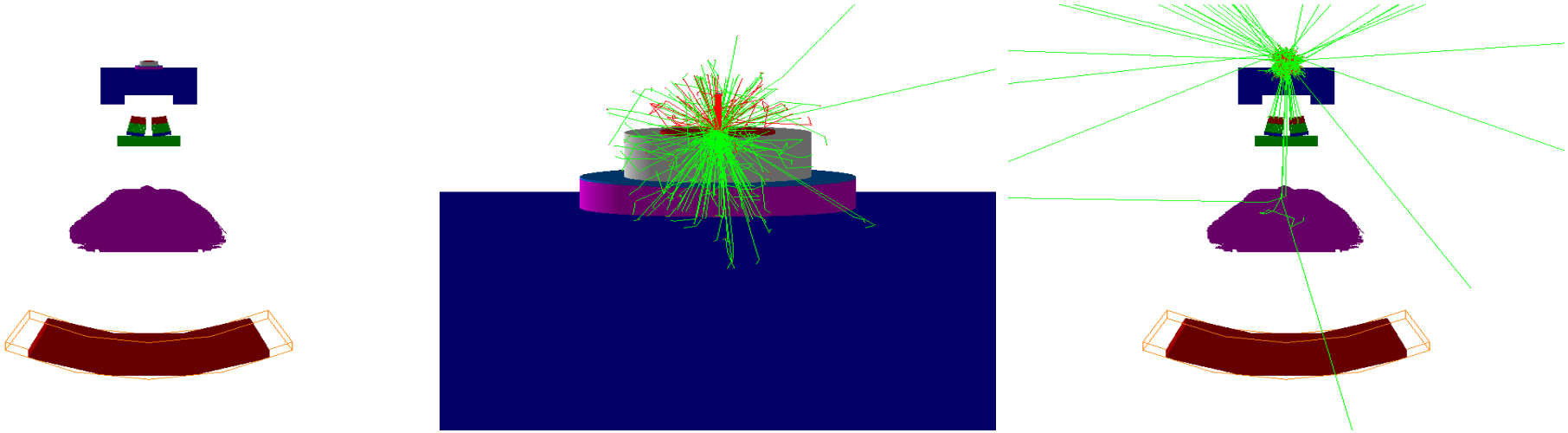
- Introduction.
- Simulation of radiotherapy treatment beam on the grid.
- Conclusions.

Radiotherapy and High Energy Physics

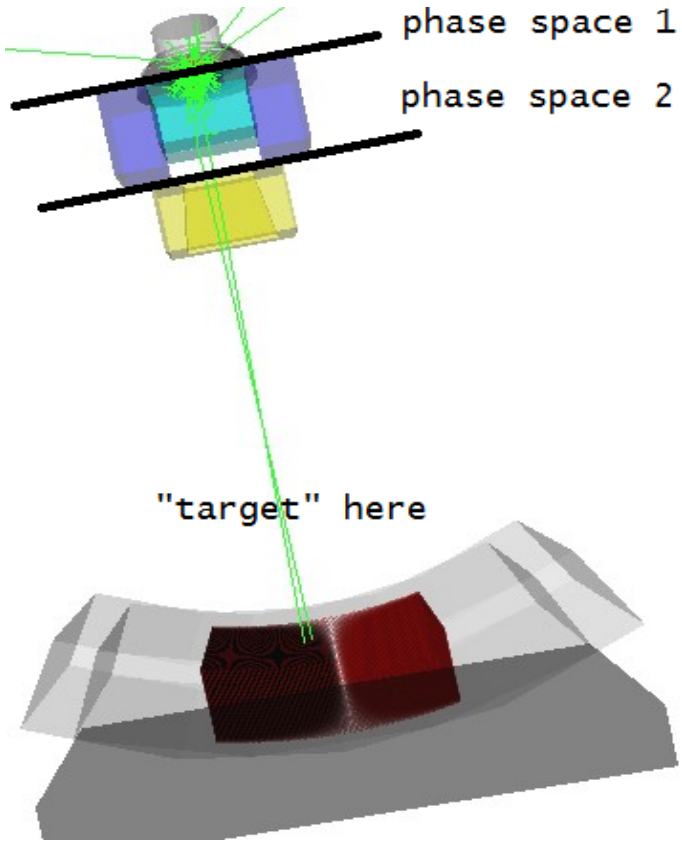
- External beam radiotherapy (EBRT) uses particle beams to destroy hard to reach tumours in patients $\rightarrow$ dedicated linac machines (MeV beams).
- Key is to optimise radiation dose delivery: maximize dose to tumour, minimize dose to surrounding, healthy tissue.
- Built-in planning system allow to estimate dose delivered from direct photons (in-field) and find what is the best beam configuration. Does not say much about dose from scattered X-rays (off-field).
- GHOST project: simulate dose deposition over whole patient during entire treatment $\rightarrow$ risk to develop second cancers.

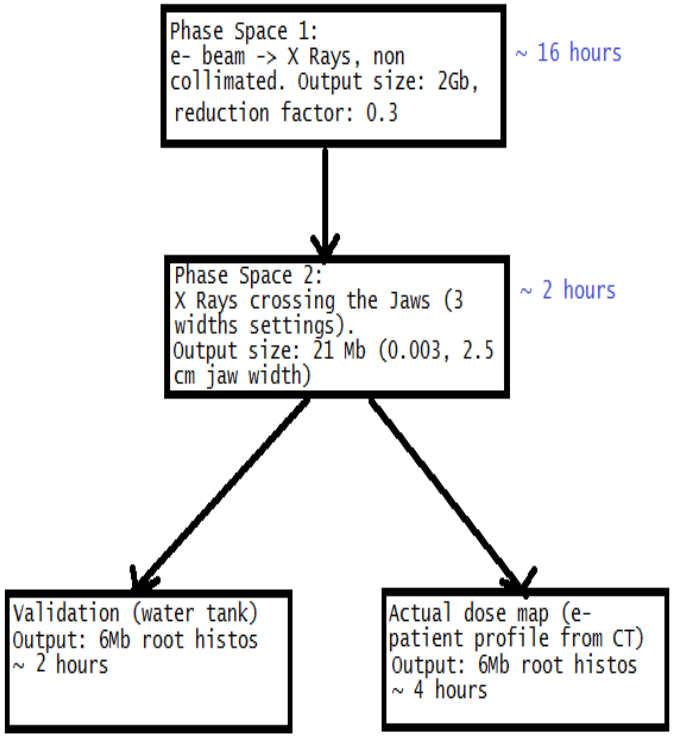
Why using the grid?



- G4 simulation is very CPU intensive.
- Beamline design: only a small fraction of input electrons provide MeV X-Rays actually reaching the patient.
- MC process: need large amount of statistics for accuracy.
- ”Grid validation” stage: more a computing challenge than a data storage challenge.

Grid processing strategy





- Grid job submission: Dirac v6r11p24 and v6r13, VO: GRIDPP
- All intermediate files kept on storage element. Final output small enough to fit on output sandbox
- Production mode: only last element of the chain

Single job anatomy.

- Input sandbox: job steering, small auxiliiary files (detector geometry, movement sequence, etc...)

- Input data (from Storage Element): G4 software tarball ($\sim$ 600 MB), phase space files.
  All input data files need to be physically downloaded to the work area.
  Software tarball is inflated at the beginning of the job, small overhead (15 mns).

- Output data: phase space file (when applicable), dose cube (duplicate).

- Output sandbox: dose cube$\rightarrow$ ROOT histograms.

Challenges met.

- Past grid experience: just needed a quick refresher on new tools (Dirac).
- First tried Dirac v16r11p24 (”old” Dirac), was pretty happy with selection of sites and storage available.
- Also tried ”new” Dirac: currently only site available to GRIDPP VO is Imperial College, not ideal for production.
- CVMFS: Had a very extensive debugging session with Catalin, still can’t solve the problem which seems to be an authentication problem . Sticking to relocatable software tarball in SE for the moment.

Status and Conclusions

- Currently at the ”Grid validation” stage.
  Promising results with limited statistics

- Full production: expect mostly CPU usage.
  Would be nice to have more sites listed in ”new” Dirac for redundancy.

- Stand by initial resource usage estimates provided to Jeremy.