

MC simulations on grid infrastructure with GATE-Lab

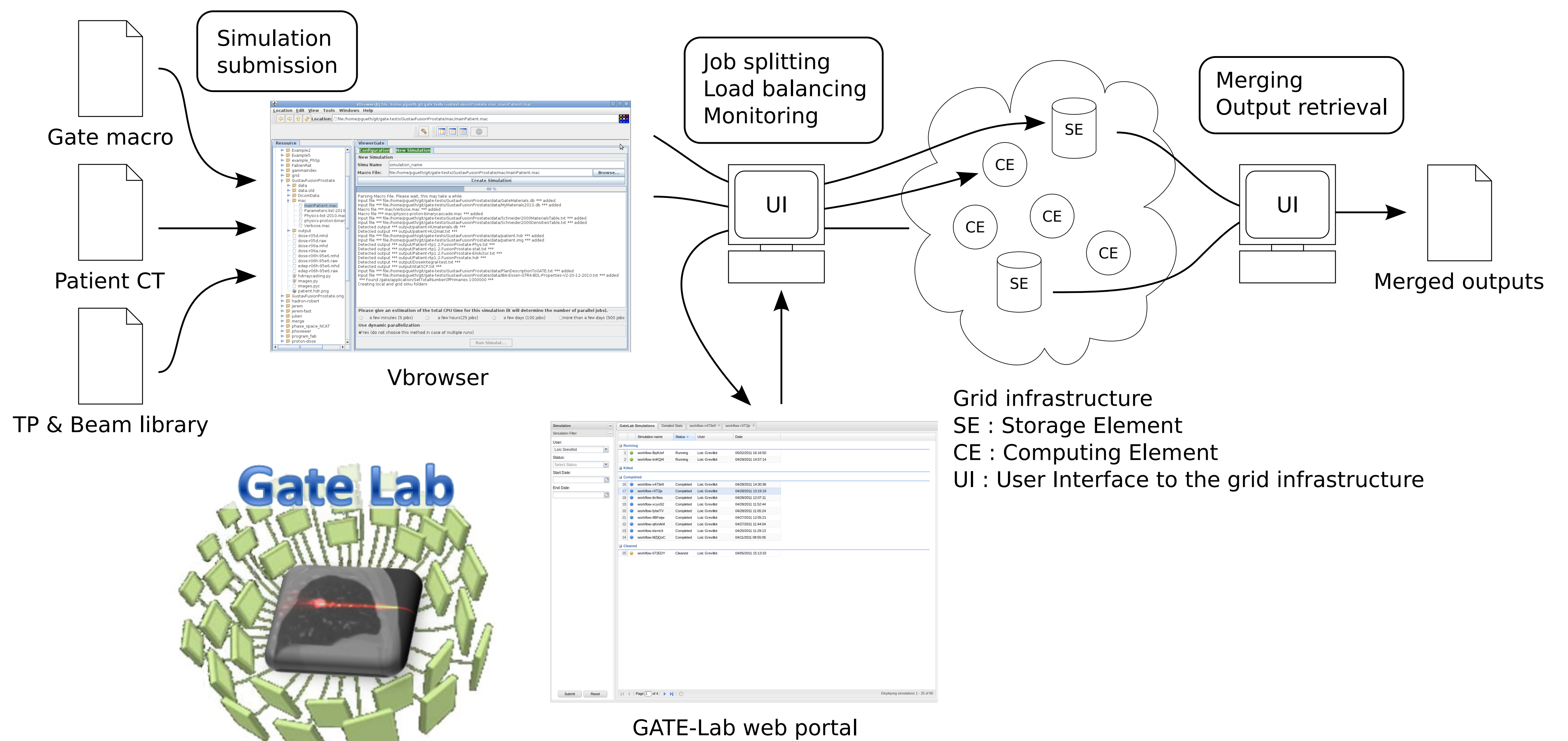
GATE v6 [Jan11]

- multi-purpose MC code
- Geant4 based
- patient geometry (CT)
- TP (Treatment Plan) irradiation
- realistic sources & imaging devices
- highly compute-intensive
- straightforward parallelization

Grid computing

- important amount of computing resources
- usability gap between users and platform

GATE-Lab is a user friendly platform which allows users to launch **Gate** simulations on the EGI grid infrastructure and local clusters.



speed up MC simulations for hadrontherapy R&D

Versatile outputs

- dose & deposited energy map
- phase space
- production and stopping rate
- filter on type, energy, direction ...

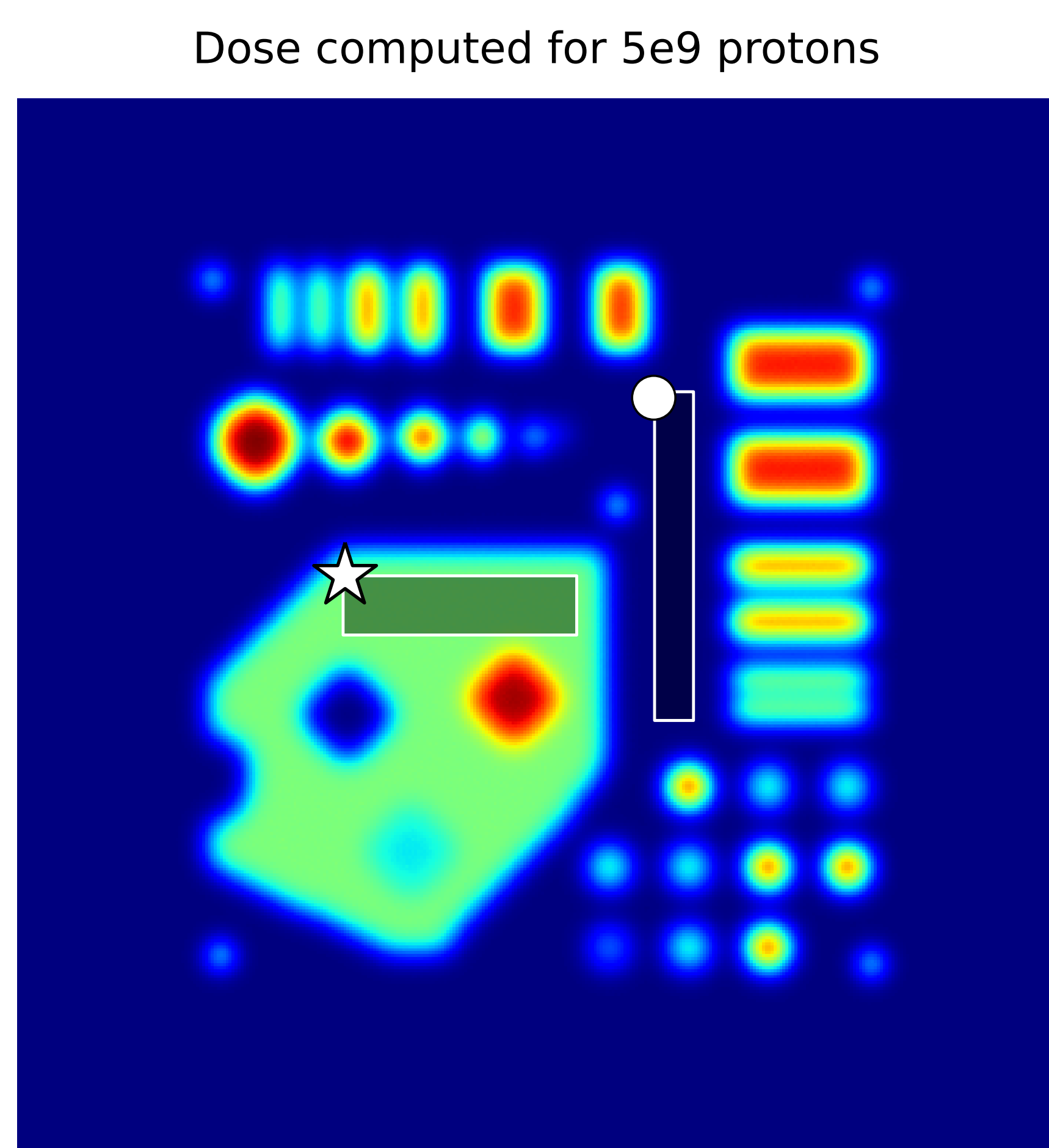
GATE-Lab Features

- user-friendly web interface
- flexible output formats
- automatic deployment & merging
- dynamic load balancing [Pop10]
- error handling / job resubmission

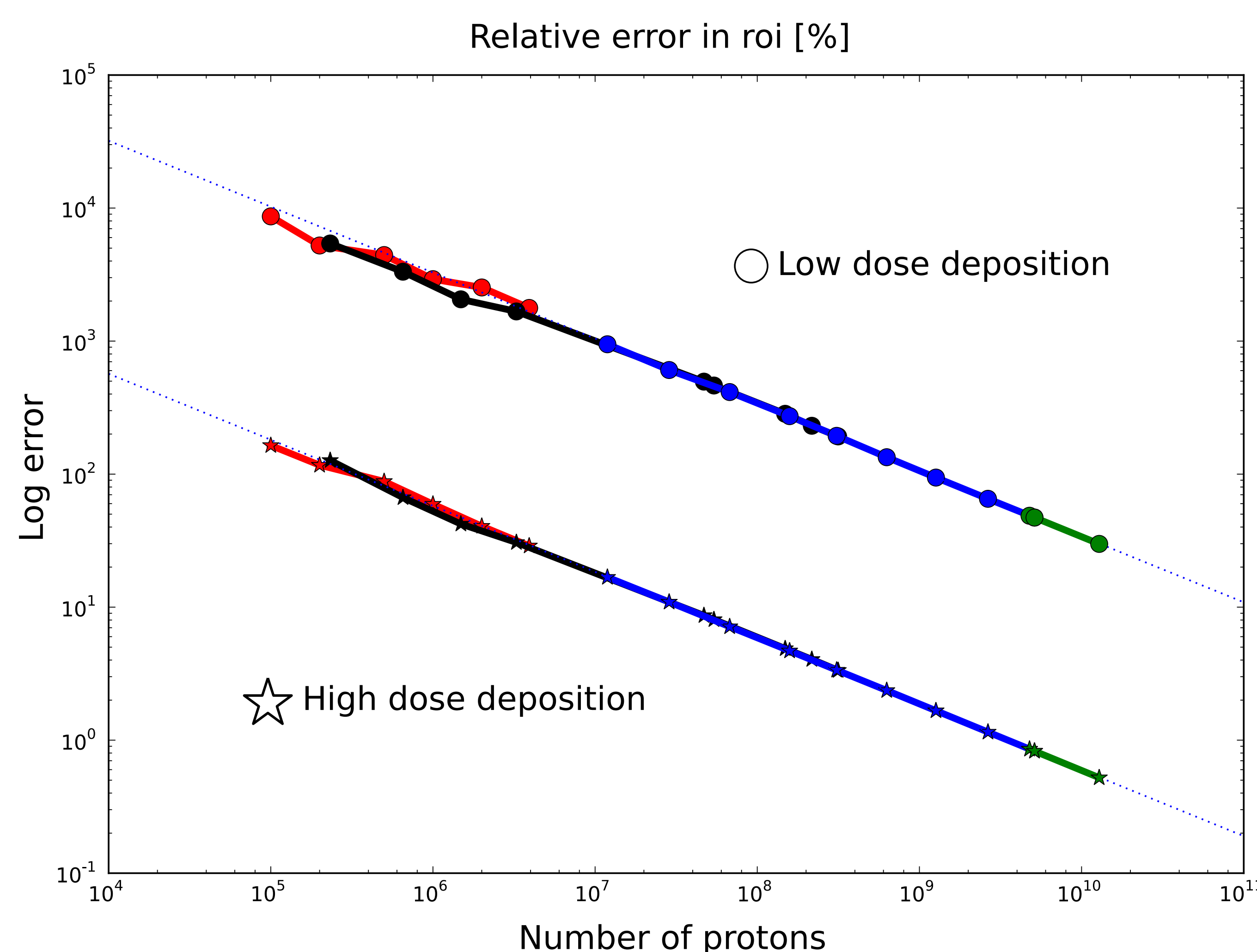
Quality assurance

- robust & simple macro description
- tested releases & physic lists
- dose validated versus TPS [Grevillot10]
- flexible source & geometry description

Active scanning proton test pattern from TP



IBA test pattern



- Pencil Beam Scanning (PBS)
 - TP generated with Xio (Elekta)
 - IBA test pattern
 - realistic source
 - 3000 spots
 - 120 MeV to 180 MeV proton TP
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- 2.5 cGy \rightarrow 5⁹ protons
 - 0.8% uncertainty in 0.125 mm³
 - 2 months on 1 CPU
 - 7h20 with 250 grid jobs
 - deployment and merge included

189 times faster than simple CPU simulation

Perspectives

- private cluster deployment
- large phsp management (>2GB)

References

- [Pop10] S. Camarasu-Pop, et al. Dynamic partitioning of GATE Monte-Carlo simulations on EGEE. *Journal of Grid Computing*, 8(2):241–259, 2010.
- [Grevillot10] L. Grevillot, et al. Optimization of GEANT4 settings for Proton Pencil Beam Scanning simulations using GATE. *NIMB*, 2010.
- [Jan11] S. Jan, et al.. GATE V6: a major enhancement of the GATE simulation platform enabling modelling of CT and radiotherapy. *Physics in Medicine and Biology*, 56:881, 2011.