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# GATE/Geant4 simulation and validation of a clinical prototype 226 MeV proton therapy beamline

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## Résumé

A beam model of the prototype ProteusONE in Nice was built using the GATE Monte Carlo framework and beam data library measurements, avoiding the nozzle modeling. The beam model was validated against spot maps, pristine and spread-out Bragg peak measurements in water. In presence of heterogeneities, a systematic and innovative methodology based on proton radiography and WET measurements is described to validate the GATE beam model in heterogeneous and anthropomorphic phantoms.

The experimental Bragg peaks and optical parameters are reproduced within clinical tolerances in water. A gamma analysis (3 % / 3 mm) was used to compare 2D dose distributions from MC simulations, treatment planning system (TPS) and scintillator measurement in case of interfaces and show also good agreement. WET measurements of different tissue equivalent materials using a multi-layer ionisation chamber system were compared to the simulated values. Proton radiography simulations of heterogeneous and anthropomorphic phantoms provide 2D dose maps that are compared to 2D scintillator measurements and the gamma index analysis shows that more than 95

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