

Update on the G4-Med project and on the Geant4 Advanced Examples for medical applications

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Background: In the past few years, we developed G4-Med, a fully automated benchmarking and regression testing suite of Geant4 for bio-medical applications [2], for validation and performance monitoring.

Material and Methods: The testing suite currently includes 19 tests, from basic physical quantities (e.g. stopping powers, cross sections, dose point kernels) to tests of clinical medical physics applications, such as hadron therapy, brachytherapy, external electron beam therapy and mammography. The tests have been integrated in the geant-val platform [3] and are executed for Geant4 development tags and public releases. The Geant4 results are compared to reference data.

Preliminary results: At the conference, we will show the results of the regression testing of the G4-Med tests with Geant4 11.0, against simulation results obtained with previous Geant4 releases (10.5 and 10.6) and the reference data adopted in each test. Significant improvement has been observed in the multiple scattering and in the modelling of bremsstrahlung (see fig. 1).

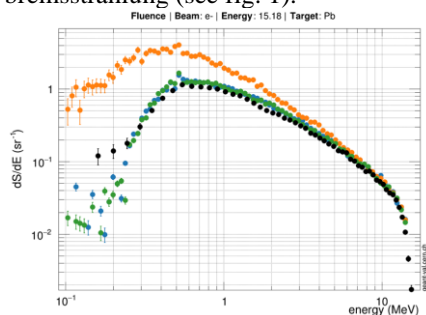


Fig.1: Bremsstrahlung spectrum generated by a 15.18 MeV electron beam incident on Pb. Black dots: reference experimental data, orange: Geant4 10.5; green: Geant4 10.6; blue: Geant4 11.p01.

The talk will conclude with a short summary on the advanced examples of Geant4 for medical physics. Approximately 50% of them are dedicated to medical physics, spanning from dosimetry in X-ray radiotherapy, brachytherapy and hadrontherapy to radiation protection in anthropomorphic phantoms.

References:

- [1] J. Allison et al (2016), NIM A, 835: 186-225.
- [2] P. Arce et al (2021), Med. Phys. 48 (1): 19-38.
- [3] Freyermuth L, et al (2019) EPJ Web Conf. 2019;214:05002