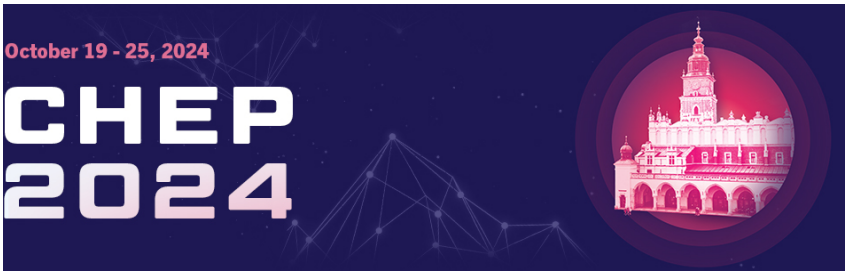

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Development of the platform for simulation of spatial distribution for therapeutic dose in Dose-3D phantom

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Reconfigurable detector for the measurement of spatial radiation dose distribution for applications in the preparation of individual patient treatment plans [1] was a research and development project aimed at improving radiation dose distribution measurement techniques for therapeutic applications. The main idea behind the initiative was to change the current radiation dose distribution measurement methods used in preparing individual plans for radiotherapy. To this end, a prototype of a fully three-dimensional filled with 3D-printed plastic scintillators [2] was designed and built to measure the spatial distribution of radiation dose in real time for treatment planning.
In parallel with the construction of the phantom, software tools for dose simulation and data analysis are being developed. The Monte Carlo simulations developed for the Dose-3D project were a crucial part of its success. These simulations were used to create data reflecting the apparatus used in the test beam on our simulation platform called G4RT. This simulation data was instrumental in optimizing the Dose-3D detector cell and ensuring the proper calibration of the prototype phantom. It was also used in the design and planning of the test beam, taking into account the effects of beam reflection from the therapeutic table and beam absorption at depth in phantom.
From the software architecture point of view our work presents a novel approach leveraging the Geant4 toolkit. Unlike existing software solutions that are predominantly designed for standard geometries or applications, our proposed toolkit offers unparalleled flexibility, enabling researchers and practitioners to rapidly implement and model custom geometries configurations and experimental scenarios with precision. Additionally, it details the modifications made to the instance of the G4IAEAphspReader library that we use.

[1] M. Kopeć, et al. A reconfigurable detector for measuring the spatial distribution of radiation dose for applications in the preparation of individual patient treatment plans. Nuclear Inst. and Methods in Physics Research, A 1048 (2023) 167937

[2] D. Kulig, et al. Comparison of cell casted and 3D-printed plastic scintillators for dosimetry applications Radiation Protection Dosimetry, Volume 199, Issue 15-16, October 2023, Pages 1824–1828,

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