Contribution ID: **2** Type: **Presentation at the conference**

TOPAS MC and Eclipse TPS Validation for Department of Clinical and Radiation Oncology, Faculty Hospital of Žilina

Wednesday 11 September 2024 17:20 (20 minutes)

Accurate dose computation is critical in radiotherapy (RT) to ensure that the calculated dose aligns with the delivered dose, directly impacting clinical outcomes. This paper presents a comparative analysis of photon beam simulations using the Eclipse Treatment Planning System (TPS) (Varian Medical Systems, Palo Alto, CA, USA) and TOPAS Monte Carlo (MC) (Tool for Particle Simulation, Monte Carlo). The objective is to incorporate Monte Carlo simulations into educational methodologies by precisely defining simulation parameters and comparing these findings with clinical calculations performed at the Department of Medical and Radiation Oncology Hospital of Žilina. Monte Carlo simulations provide a fundamental understanding of ionizing radiation transmission from the source to the patient, which enhances RT accuracy. This study evaluates the dosage profiles and percentage depth doses calculated by TOPAS MC and Eclipse TPS. Our results demonstrate that TOPAS MC can accurately replicate clinical scenarios and align well with Eclipse TPS outcomes. These positive outcomes indicate that TOPAS MC is reliable for simulating medical cases. The incorporation of TOPAS MC into educational frameworks represents a significant advancement in our field. By offering detailed and accurate simulations of ionizing radiation, it bridges the gap between theoretical knowledge and clinical practice. This not only enriches the learning experience but also has the potential to revolutionize the precision of RT planning and execution. Such advancements inspire optimism for improved patient outcomes and the quality of cancer treatment.

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Session Classification: Session 3 - Computer Models and Simulations

Track Classification: Computer Models and Simulations