

Invitation to the seminar on

Medical Radiation Physics and Ion-Beam Therapy

by

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Linking dose-averaged LET and clinical RBE in LEM1- and mMKM-based dose systems for carbon ion radiotherapy

Local Effect Model I (LEM1) and modified microdosimetric kinetic model (mMKM) are two mechanistic RBE models used clinically worldwide in carbon ion radiotherapy (CIRT). Because these models are based on different radiobiological assumptions and are associated with different clinical dose systems that use different reference radiation and reference cell lines, direct comparison of treatment plans based on RBE-weighted dose between treatment centers remains challenging.

Dose-averaged linear energy transfer (LET_d) is a widely used descriptor of radiation quality in both preclinical and clinical research. In this seminar, we present an analytical framework that links LET_d to differences in RBE predicted by LEM1- and mMKM-based clinical dose systems. The framework is supported by Monte Carlo particle transport simulations using tools developed within the open-source GATE 10 platform for mixed-field RBE calculations, together with radiobiological modelling performed using the in-house tool PRUDENT. Monte Carlo simulations were performed using IDEAL V2/GATE-RTion V2, which is currently undergoing systematic dosimetric validation for independent dose verification in a clinical setting. In addition, we demonstrate how model-inherent uncertainties can be propagated to quantify LET_d-dependent systematic uncertainties in mMKM-based RBE calculations.

The presented approach may facilitate interpretation and comparison of clinical and research results across centers employing different RBE models.

Tuesday, 16. June 2026, 09:00 am

Zoom: <https://tuwien.zoom.us/j/69660150906?pwd=FQRS8TnWx4hGuNEqjmVLfYostoOXLW.1>

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