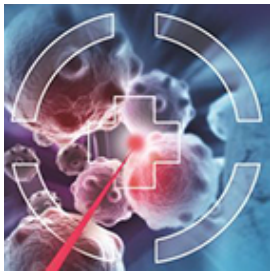

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Uncertainty Quantification Analysis and Optimization For Proton Therapy Beam Lines

Friday, 6 September 2019 10:30 (30 minutes)

Since many years, proton therapy is used as an effective treatment solution against deep-seated tumors. A precise quantification of sources of uncertainties in each proton therapy aspect (e.g. accelerator, beam lines, patient positioning, treatment planning) is of extreme importance to increase the robustness of the dose delivered to the patient.
Together with Monte Carlo techniques, a new research field called Uncertainty Quantification (UQ) has been recently introduced to verify the robustness of the treatment planning. We apply here, for the first time, UQ methods to identify the typical errors in transport lines of a cyclotron-based proton therapy facility and analyze their impact on the properties of the therapeutic beams. The potential of UQ methods in developing optimized beam optics solutions for high-dimensional problems is also demonstrated. Sensitivity analysis and surrogate models offer a fast way to exclude unimportant parameters from complex optimization problems such as the superconducting gantry project studied at Paul Scherrer Institut in Switzerland.

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