

# **CONTROL OF THE DOSE DISTRIBUTION IN CHARGED PARTICLE THERAPY**

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The use of ions in radiation therapy aims at improving the selectivity of the irradiation thanks to a favorable depth-dose profile and, in case of heavy ions, to their enhanced radiobiological effect. The treatment modality employing actively scanned pencil beams provides highly conformal dose distributions but is sensitive to uncertainties in the dose calculation, delivery and measurement. In particular, the treatment planning has to evaluate the biological effect of a complex radiation field, using detailed and finely tuned physical and radiobiological models and taking into account different particles and fragments with mixed Linear Energy Transfer. During the treatment, the delivery of the beam has to be controlled in real time and monitored with high accuracy, including any effect due to patient position and motion. Based on the experience gained in the collaboration with the CNAO (Centro Nazionale di Adroterapia Oncologica, Pavia, Italy), the talk will give an overview of recent techniques and trends for the delivery, measurement and verification of the dose distribution in charged particle therapy with scanned ion beams, focusing in particular on the monitoring of the deviation from the planned dose due to patient motion, on the measurement of the beam flux with high intensity pulsed beams and on studies of nuclear fragmentation effects.