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GAS JET BASED ONLINE BEAM MONITORING FOR ADVANCED PROTON THERAPY FACILITIES

Abstract: Proton therapy holds great promise in cancer treatment due to its precise dose conformity and minimal impact on organs at risk (OARs). However, quality assurance remains a challenge amidst the increasing global adoption of proton therapy facilities. Emerging accelerators like LhARA, which deliver high dose rates for the innovative FLASH treatment modality, demand new diagnostic methodologies. Established techniques like SEM Grid and Ionization chambers, despite offering high resolution and reliability, respectively, at conventional dose rates fails maintain it in FLASH regime. Most of the instruments can perturb the beam and lack real-time feedback, posing substantial challenges for quality assurance, especially in FLASH therapy.

This study introduces the gas jet monitor as a non-invasive solution that leverages the ionization and emission from the interaction between the gas curtain and the beam to measure beam profile without disturbing it. The gas jet monitor, equipped with a fast-response detection system requiring less integration time, enables online monitoring and reduces pre-clinical calibration time, thereby enhancing treatment efficacy. To optimize its application for proton beam dosimetry, parameters such as sensitivity to detect single bunch ions and jet density need optimization along with experimental validation. The gas jet monitor presents a promising solution to overcome the limitations of conventional diagnostic techniques, paving the way for advancements in novel treatment facilities using FLASH therapy.

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