

Theme: Physics

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The feasibility of a commercial flat-panel detector for the routine quality assurance for a pencil beam scanning proton and heavy-ion delivery system

Xue Ming, Yinxiangzi Sheng.

Shanghai Proton and Heavy Ion center, Shanghai, China

Background / Aims:

To explore the feasibility to perform routine quality assurance (QA) using the commercial flat-panel detector device for a pencil beam scanning (PBS) proton and carbon-ion delivery system.

Subjects and Methods:

The SphnixCompact device is capable of performing QA for spot sizes, positions, homogeneity and range analysis with acquiring and analyzing data in myQA platform (IBA-dosimetry). Both proton and carbon-ion beam were measured respectively of the focus size analysis (13 samples, proton energy: 221.07 MeV/u, carbon-ion: 432.12 MeV/u), range analysis (3 samples), laser-radiation coincidence (1 sample), and homogeneity (1 sample) using this 2-dimentional scintillation detector.

Result:

The data acquisition was illustrated as Figure 1. The position deviations of the 13 samples of focus analysis were -0.2 to 0.4 mm/0 to 0.6 mm of the proton/carbon-ion beam compared to the planned position values. The absolute deviations of the sigma value were 0.16 to 0.46 mm and -0.04 to 0.22 mm of the proton and carbon-ion spot while the relative deviations were 4.7% to 13.4% and -3.0% to 15.0% compared to the nominal sigma values. The homogeneity was 1.0% and 1.7% of the proton and carbon-ion beam respectively. The laser-radiation coincidence would be 0.1 mm/-0.5 mm along the left-to right axis and 2.4 mm along the anterior to posterior axis of the proton and carbon-ion beam.

Conclusion:

Routine QA of a proton and heavy-ion delivery system, including the focus size, range, laser-radiation coincidence and homogeneity analysis, could be finished within a single physical plan with the application of SphnixCompact. More data are expected to explore the best response conditions and trend analysis for the implementation of this scintillation detector.

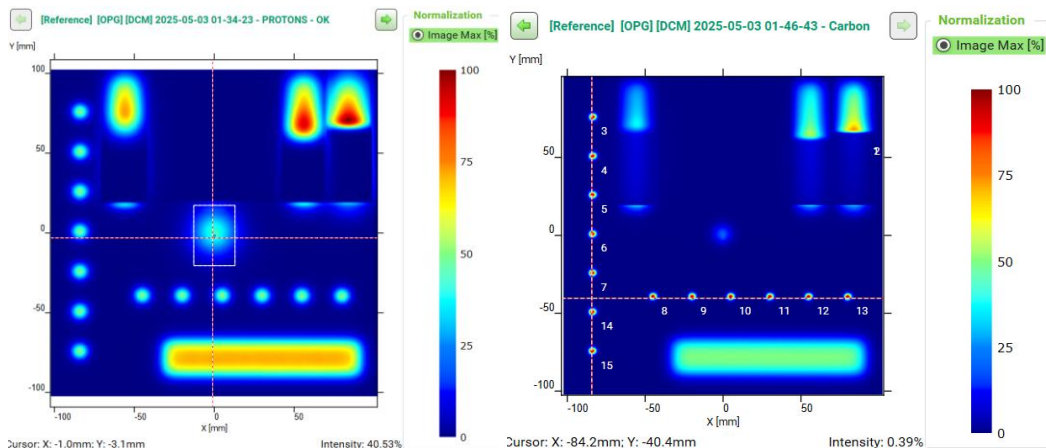


Figure One: The data acquisition of the proton and carbon-ion beam using the 2-dimensional scintillator detector for the focus, range, laser-radiation coincidence and homogeneity analysis