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P2.37: Experimental and simulation study of near-field coded-mask imaging for proton therapy monitoring

Wednesday, June 28, 2023 5:18 PM (1 minute)

I will present the results of testing the coded-mask imaging technique for monitoring the range of proton beams during proton therapy. The objective was to investigate the performance of experimental imaging setups, each consisting of a structured tungsten collimator in the form of a Modified Uniformly Redundant Array (MURA) mask and a LYSO:Ce scintillation detector of fine granularity with 1.36 mm pitch. The focus was on 22Na and 137Cs point-like source reconstruction.
The setups featured masks of different patterns and different detectors enabled the reconstruction of either only longitudinal or together with lateral coordinates of the hit position. Consequently, one of the tested setups allowed 1D image reconstruction and the other 2D. Additionally, Monte Carlo simulations of a larger 1D-imaging setup of the same type as one of the prototypes were conducted to assess the feasibility of reconstructing a realistic source distribution. A series of measurements with 22Na and 137Cs sources were performed to test the setups performance of near-field gamma imaging. The images of point-like sources reconstructed from the two small-scale prototypes data using the MLEM algorithm provided experimental proof of principle for the near-field coded-mask imaging modality in both the 1D and 2D modes.
The simulation of the full-scale 1D setup with realistic source distribution yielded a mean distal falloff retrieval precision of 0.72 mm, demonstrating that the proposed full-scale setup is competitive with the knife-edge-shaped and multiparallel slit cameras investigated by other groups. The results of this study indicate that coded-mask imaging is a viable option for proton therapy monitoring, with relatively fast image reconstruction times of several seconds on a desktop PC using CPU.
I would like to give an oral presentation.

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