

Demonstration of LGADs and Cherenkov gamma detectors for prompt gamma timing range verification of proton therapy

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The great potential for precision dose delivery with proton therapy remains to be fully exploited, largely due to uncertainties in range that require conservative treatment margins. Analysis of time distributions from prompt gamma-ray emissions offers a means to precisely verify the range in real time and shrink treatment margins, thus increasing effectiveness and reducing toxicity.

We demonstrate a prototype prompt gamma timing system to detect proton range shifts, based on Low Gain Avalanche Detectors, used to time incoming protons, and Cherenkov detectors, to time the outgoing prompt gammas. Using this system, we are able to detect range shifts induced in a PMMA phantom with about 1 mm precision consistently with several LGAD pixels and 3 different Cherenkov detectors. These detector concepts deliver promising performance and are suitable for scaling to intense particle rates and backgrounds in realistic clinical environment.

Field

Systems and applications

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