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Hybrid Compton-PET imaging for ion-range monitoring in hadron therapy

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In this contribution I will present a summary of the research that we are doing at the Gamma-Ray Spectroscopy and Neutrons Group of IFIC (CSIC-UV) aimed at developing a new gamma-ray imaging methodology for enhanced accuracy ion-range verification in hadron-therapy treatments.
Two of the most promising methodologies for in-room real-time ion-range monitoring are positron-emission tomography (PET) and prompt-gamma imaging (PGI). Owing to the prompt-nature of the emitted radiation, range verification via PGI is well suited for real-time monitoring [Ler22], whereas PET imaging can provide tomographic and functional information relevant to study physiological processes and tumor response.
The method that we have implemented is based on the hybrid combination of both PGI and PET within the same system [Bal22], thus exploiting the advantages of them both. This is accomplished by means of an array of four Compton cameras in a twofold front-to-front configuration operating in synchronous mode. A summary of proof-of-concept experiments performed at CNA-Sevilla and at HIT-Heidelberg will be presented. I will finish my presentation with a short outlook about our future plans.

[Ler22] J. Lerendegui-Marco et al., "Towards machine learning aided real-time range imaging in proton therapy", Sci Rep 12, 2735 (2022). https://doi.org/10.1038/s41598-022-06126-6

[Bal22] J. Balibrea-Correa et al., "Hybrid in-beam PET- and Compton prompt-gamma imaging aimed at enhanced proton-range verification", The Eur. Phys. Jour. Plus, Volume 137, Issue 11, article id.1258 (2022) https://doi.org/10.1140/epjp/s13360-022-03414-y

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