Contribution ID: **273** Type: **Oral**

Enhancing Range Verification Techniques in Proton Therapy through a Hybrid Compton Camera

Wednesday, 29 November 2023 16:45 (15 minutes)

The UCT POLARIS system, a solid-state CZT detector designed for prompt gamma-ray imaging, has shown promise in improving range verification techniques in proton therapy. Nevertheless, limitations in timing resolution and energy range currently restrict its full clinical applicability. In this project, we present a novel approach to address these limitations by integrating the POLARIS detector with a fast-timing 2" x 2" $LaBr_3$(Ce) detector, creating a hybrid Compton camera. While the $LaBr_3$(Ce) detectors offer exceptional timing and energy resolution, along with an extended maximum energy range, the POLARIS detectors exhibit high position sensitivity and excellent energy resolution. To assess the feasibility of this hybrid setup, we conducted source measurements and a pulse-selected 66 MeV proton beam experiment at iThemba LABS.

Accurate tracking of double scatter gamma ray events from the POLARIS detector into the $LaBr_3$(Ce) detector is crucial, making effective background reduction essential to minimize unphysical events. Leveraging the onboard electronics of the POLARIS detector, we can selectively identify single scatter events within the CZT crystals. Additionally, to further reduce background, we employ a cyclotron beam radiofrequency time of flight analysis on the fast time data of the $LaBr_3$(Ce) detector. This analysis enables the identification and selection of gamma-ray events resulting from interactions between the proton beam and the target. By integrating these data reduction techniques and ensuring meticulous time synchronization of the two detector data acquisition systems, we aim to achieve precise tracking of gamma rays across both detectors.

The development of this Compton camera holds potential in enhancing range verification techniques, ultimately paving the way for the advancement of a clinical prompt gamma-ray imaging system. Through this approach, we anticipate strides in the field of proton therapy, offering improved accuracy and efficacy in treatment planning and delivery.

Attendance Type

In-person

Primary authors: JONES, Pete (iThemba LABS); PELLEGRI, Luna (University of the Witwatersrand and iThemba LABS); PETERSON, Steve (University of Cape Town)

Session Classification: Session 4

Track Classification: Applied Nuclear Physics