Canadian Association of Physicists | Association canadienne des physiciens et physiciennes

Contribution ID: **1824** Type: **CLOSED - Oral (Student, In Competition) / Orale (Étudiant(e), inscrit à la compétition)**

Methods for improving accuracy in interaction vertex imaging

Monday 29 May 2017 14:15 (15 minutes)

Interaction vertex imaging in an imaging method relying on detection of secondary particles created by beam interactions in the target. This method is believed to be viable for tracking dose deposition in patients undergoing heavy-ion radiotherapy. We investigated the impact of two key reconstruction algorithms on image accuracy: a single-particle-and-beam method, as proposed by previous work, and a triangulation approach believed to achieve greater accuracy than previously-examined techniques. Using Geant4, we simulated fragmentation and secondary particle production by a 145 MeV/u 12C beam with Gaussian distribution (FWHM = 5mm) in a water target, collecting data on particles exiting in a forward direction using thin silicon detectors. The best vertex accuracy was observed using triangulation reconstruction with the incoming beam and two coincident secondary particles. Accuracy was further improved by considering only particles detected more than 45 degrees from the beam axis, and with incident energy above 40 MeV for use in the reconstruction algorithm. Under these criteria, reconstructed vertices displayed an error of just over 2mm, with close to 90% directly corresponding to beam interactions in the target. Recent developments include further improvements in accuracy using narrower beams (FWHM = 1mm), and implementation of a human phantom in Geant4 based on CT scan data, in preparation for testing in more medically-relevant scenarios.

Authors: MUECHER, Dennis (University of Guelph); HYMERS, Devin (University of Guelph); BILDSTEIN, V. (University of Guelph)

Presenter: HYMERS, Devin (University of Guelph)

Session Classification: M3-4 Medical Imaging (DPMB) | Imagerie médicale (DPMB)

Track Classification: Physics in Medicine and Biology / Physique en médecine et en biologie (DPMB-DPMB)