Contribution ID: **279** Type: **Poster Presentation**

Monte Carlo simulation of secondary gamma production during proton therapy for dose verification purposes – Part II

Tuesday, 8 July 2014 17:10 (1h 50m)

Abstract content
   (Max 300 words)
Formatting &
Special chars

The accelerated protons used in proton therapy are used to kill the cancer cells, but can damage normal tissue as well. Consequently, any uncertainty in the dose delivery during proton radiotherapy will strongly affect the success of overall treatment. In recent years, the detection of scattered (prompt) gammas produced within the patient from inelastic nuclear collisions of the treatment protons with nuclei found in the body has been proposed for online treatment verification. The aim of this work was to simulate these discrete prompt gammas using Geant4 (v9.6.02), a Monte Carlo radiation transport code. A primary component of the simulation was to get the physics modelled properly. Geant4 provides several models for low energy proton inelastic nuclear reactions: the binary cascade (BIC) model, the precompound (PRECO) model and the intra nuclear cascade (INCLXX) model. In order to increase the accuracy of our prompt gamma simulations, an appropriate sampling of the three models is required. The suitability of these models for discrete gamma emission from excited state of 16O, 12C and 14N nuclei was tested by comparing simulated inelastic gamma production cross section data against available experimental data in the energy range 0 to 200 MeV. Among these physics models, the precompound model (with the Fermi breakup activated) was found to be the most suitable for producing reasonable prompt gamma spectra. With the physics modelled appropriately, two Geant4 proton therapy models (pencil beam and passive scatter beam) were used to investigate the prompt gamma production from a water phantom. 200 MeV protons were simulated for both models and the prompt gamma energy spectrum was acquired using a LaBr3 detector actively shielded by a BGO detector. Time-of-flight (TOF) techniques were used to eliminate the scattered gammas from the beam line element and the secondary neutrons from the target. These Geant4 simulations are mimicking a set of measurements to be completed this year and a comparison between the measured and simulated results will follow.

Apply to be
 considered for a student
   award (Yes / No)?

Yes

Level for award
 (Hons, MSc,
   PhD)?

PhD

Main supervisor (name and email)
and his / her institution

Dr Steve Peterson

**Would you like to
 submit a short paper
 for the Conference
 Proceedings (Yes / No)?**

Yes

Primary author: Mr JEYASUGITHTHAN, Jeyasingam (University of Cape Town)

Co-author: Dr PETERSON, Stephen (University of Cape Town)

Presenter: Dr PETERSON, Stephen (University of Cape Town)

Session Classification: Poster1

Track Classification: Track B - Nuclear, Particle and Radiation Physics