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PRaVDA –Towards Clinical-Quality Proton CT

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Proton radiotherapy utilises beams of approximately 200 MeV protons to treat cancer. The dose to healthy tissues before and after the tumour can be significantly lower than with conventional x-ray radiotherapy due to the proton Bragg peak. To ensure the dose is delivered to the correct location three pieces of information are essential: the location and size of the tumour; the position of the patient relative the beam; and the stopping powers of the body tissue between the beam entrance and tumour. Currently, stopping powers are inferred via the conversion of Hounsfield numbers, obtained from an x-ray CT scan, leading to a generally accepted uncertainty on the proton range of 3.5%. By measuring the stopping powers directly, via a proton CT (pCT), these uncertainties will be greatly reduced and patient outcomes improved. The PRaVDA consortium is developing an instrument which will acquire a pCT in addition to performing regular QA of the proton beam and in-treatment beam monitoring.
We will outline the methodology of obtaining a pCT, the associated challenges, and the ways PRaVDA aims to overcome these. Particular attention will be paid to the tracking system which uses strip sensors developed by the HEP group at the University of Liverpool, the CMOS devices used to measure the residual proton energy (which incorporate deep wells to allow the use of full CMOS circuitry similar to devices for the ALICE ITS upgrade), and the Geant4 simulation model of the complete system.

Collaboration

PRaVDA - Proton Radiotherapy Verification and Dosimetry Applications http://www.pravda.uk.com/

Primary author: Dr PRICE, Tony (University of Birmingham)

Co-authors: Prof. PHILIP, Allport (University of Birmingham); Mr WALTHAM, Chris (Lincoln University); Prof. PARKER, David (University of Birmingham); Dr POLUDNIOWSKI, Gavin (University of Surrey); Dr TAYLOR, Jon (University of Liverpool); Ms ESPOSITO, Michela (Lincoln University); Prof. ALLINSON, Nigel (Lincoln University); Prof. EVANS, Phil (University of Surrey); Dr MANOLOPOLOUS, Spyros (University Hospitals Coventry and Warwickshire); Prof. GREEN, Stuart (University Hospitals Birmingham NHS Foundation Trust)

Presenter: Dr PRICE, Tony (University of Birmingham)

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