Contribution ID: **44** Type: **Talk**

Development of a range telescope for proton CT

Wednesday, September 6, 2017 11:00 AM (20 minutes)

The use of Proton Therapy for cancer treatment demands new and more accurate imaging modalities for treatment planning, based on direct measurements of tissue stopping power instead of tissue density (as in conventional X-ray Computed Tomography) to reduce the errors in converting the latter quantity into the former [1]. The expected benefits of proton CT (pCT) for treatment planning in Proton Radiotherapy are producing great interest worldwide to develop instruments for clinical-quality pCT.

In 2012 a new UK-based collaboration, named PRaVDA (Proton Radiotherapy Verifications and Dosimetry Applications), was formed to develop a fully solid state instrument for pCT [2]. The PRaVDA pCT system, based on Silicon Strip Detectors (SSDs), comprises two sets of trackers to track protons through the patient [3] and a solid-state Range Telescope (RT) to measure the individual proton's residual energy.
Design, assembly, track reconstruction techniques, range calibration and resolution will be shown for the PRaVDA RT. Experimental results obtained at the iThemba LABS clinical proton facility will also be reported together with preliminary results on pCT reconstruction of a test object with tissue substitute inserts.

[1] M.Yang et al. 2012,"Comprehensive analysis of proton range uncertainties related to patient stopping-power-ratio estimation using the stoichiometric calibration,"Physics in Medicine and Biology, vol. 57, no. 13, p. 4095.

[2] G. Poludniowski et al 2015, "Proton radiography and tomography with application to proton therapy", The British Journal of Radiology 88:1053

[3] J. T. Taylor et al 2016, "An experimental demonstration of a new type of proton computed tomography using a novel silicon tracking detector"Med Phys. 2016, Nov;43(11):6129

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Session Classification: Applications in life sciences, biology and medicine: Protons