Contribution ID: **232**　　　　　　　　　　　　　　　　Type: **Oral Presentation**

R&D on detector of next generation for the Proton Computed Tomography

Friday, 10 June 2011 14:50 (20 minutes)

This talk presents the design and latest test results of a first proton CT scanner currently under test at Loma Linda University Medical Center in Loma Linda, CA in collaboration with Northern Illinois University. With 18 CsI crystals and 8 planes of silicon strip X and Y detectors, we reached a data acquisition rate of almost 200 kHz which is our projected limit. The first reconstructed images of a phantom target will be presented and discussed. The results of these tests demonstrate that a new generation pCT scanner is necessary for clinical operation. In order to reconstruct an image with 1% density resolution for head size phantoms, our current setup would require about an 8 hour scan time. Clinical scan times for pCT irradiation should not exceed 10 minutes, typical for traditional X-ray CT scanners. In addition, the detector area (9 x 18 cm) of the current tracker is too small for a full head scan.

To meet such demanding time constraints, we proposed a scintillator based pCT detector. A scintillating fiber detector tracker with fiber pitch of ˜1 mm and a proton range detector with 3 mm scintillating plates are currently under development at Northern Illinois University. The design of the optical readout system which utilizes Silicon Photomultipliers (SiPM) for both detector subsystems will be presented. The first light yield measurements of the detector elements illuminated with a 250 MeV proton beam will also be reported.

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Session Classification:　Instr. for Medical, Biological and Materials Res.

Track Classification:　Instrumentation for Medical, Biological and Materials Research