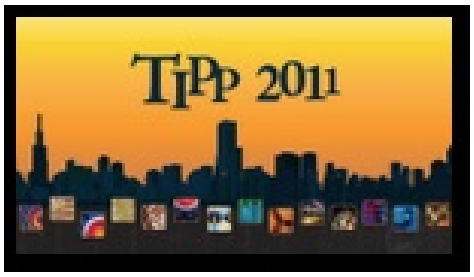

Contribution ID: **184** Type: **Oral Presentation**

Upgrade Design of TileCal Front-end Readout Electronics and Radiation Hardness Studies

Friday 10 June 2011 17:10 (20 minutes)

As a detector of jets of charged and neutral particles, the ATLAS Tile Calorimeter (TileCal) is essential for measuring the energy and direction of the quarks and gluons produced in the collisions at LHC. The TileCal consists of a fine-grained steel matrix with 430,000 "tiles" of plastic scintillator dispersed in the matrix. Optical fibers from the tiles are grouped into 5,000 calorimeter cells, whose signals are detected and recorded by ˜10,000 photomultiplier tubes (PMT) and associated readout electronics.

The TileCal front-end analog readout electronics is to process the signals from ˜10,000 PMTs. Signal from each PMT is shaped with a high sensitivity of 7-pole passive LC shaper and split it to two channels that amplified respectively by a pair of bi-gain clamping amplifiers with a gain ratio of 32. Incorporated with two 40Msps 12-bit ADCs, the readout electronics provides a combined dynamic range of 17-bits. With this dynamic range, the readout system is capable of measuring the energy deposition in the calorimeter cells from ˜220MeV to 1.3TeV with the least signal-to-noise ratio of greater than 20. The digitized data from each PMT are concentrated in the counting room, where the data are further processed with dedicated electronics to perform fully digital trigger and sort the data for physics studies.

The sLHC is planned to increase the design luminosity up to 5x10E34/sec/cm2. It will be important to upgrade the front-end electronics to cope with the higher radiation levels and to take advantage of the latest technology improvements since the time of the original design. The front-end electronics inside detector is required to stand ˜60Krad. As a R&D project, we are currently using the commercially available off-the-shelf integrated circuits with deep-submicron technology to design a prototype of analog readout board associated with this upgrade.

We will present the test results of electronics performance and radiation hardness studies for the newly designed TileCal front-end readout electronics at the sLHC.

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Session Classification: Front-end Electronics

Track Classification: Front-end Electronics