Contribution ID: **151** Type: **Poster**

Cold Temperature Characterization of Ring Triplets based on RD53a readout chip

Wednesday 29 June 2022 17:41 (1 minute)

After ten years of massive success, the Large Hadron Collider (LHC) at CERN is going for an upgrade to the next phase, The High Luminosity Large Hadron Collider (HL-LHC) which is planned to start its operation in 2029. This is expected to have a fine boost to its performance, with an instantaneous luminosity of 5.0×1034 cm-2s -1 (ultimate value 7.5×1034 cm-2s -1) with 200 average interactions per bunch crossing which will increase the fluences up to more than 1016 neq/cm2, resulting in high radiation damage in ATLAS detector [1]. To withstand this situation, it was proposed to make the innermost layer with 3D silicon sensors, which will have a radiation tolerance of more than 1×1016 neq/cm2 with a TID of 9.9 MGy [2]. From the Final Design Review of November 2019, it was decided that the whole innermost layer (L0) will be made with 3D sensors. The Endcap part (ring part) will be made with 50 × 50 1E sensors, which will be jointly produced by FBK and SINTEF. To house these sensors, Ring Triplets will be made at the INFN Genova, and Milan, Italy. To achieve this future goal, six ring triplets have been already made in Genova with planar sensors and RD53a readout chip. Among them, three triplets have been tested in cold temperature setup for the first time at the University of Trento, cooling them down to -350C to check the possibility of starting up at such a cold temperature (Fig. 1(a)). At the conference, we will report on triplet cold test procedure in detail, with results from first three triplets, including IV characteristics at -250C. The chips were trimmed and tuned at cold temperature with suitable bias voltage on the sensors, to evaluate performance appropriately. A threshold scan (Fig. 1(b)), and ToT scan were done to check the response of chips towards tuning at cold temperature. An analog-injection crosstalk based disconnected-bump scan was done to check bump bonding quality (Fig. 1 (c)), an X-ray scan was done to check hits per pixel, as well as backup discbump scan results (Fig. 1(d)). All the results fulfill the ATLAS ITk requirements for the QA/QC process.

Primary authors: SAMY, Md Arif Abdulla (Universita degli Studi di Trento and INFN (IT)); SULTAN, D M S (Universita degli Studi di Trento and INFN (IT)); DALLA BETTA, Gian Franco (Universita degli Studi di Trento and INFN (IT))

Co-authors: LAPERTOSA, Alessandro (INFN e Universita Genova (IT)); GARIANO, Giuseppe (INFN e Universita Genova (IT)); GEMME, Claudia (INFN Genova (IT))

Presenter: SAMY, Md Arif Abdulla (Universita degli Studi di Trento and INFN (IT))

Session Classification: Poster