Contribution ID: **2** Type: **not specified**

Low Gain Avalanche Detectors for the ATLAS High Granularity Timing Detector: laboratory and test beam Campaigns

Wednesday, 21 February 2024 10:10 (20 minutes)

Low Gain Avalanche Detectors for the ATLAS High Granularity Timing Detector: laboratory and test beam Campaigns

The High Granularity Timing Detector (HGTD) is designed for the mitigation of pile-up effects in the ATLAS forward region and for bunch per bunch luminosity measurements. HGTD, based on Low Gain Avalanche Detector (LGAD) technology and covering the pseudorapidity region between 2.4 and 4.0, will provide high precision timing information to distinguish between collisions occurring close in space but well-separated in time. Apart from being radiation resistant, LGAD sensors should deliver 35 ps time resolution per track for a minimum-ionising particle (40 ps per hit) at the start of lifetime, increasing to 50 ps per track (70 ps per hit) at the end of HL-LHC operation. Each readout cell has a transverse size of 1.3×1.3 mm2 leading to a highly granular detector with about 3 millions of readout electronics channels. A dedicated ASIC for the HGTD detector, ALTIROC, is being developed in several phases producing prototype versions of 2×2, 5×5 and 15×15 channels. HGTD modules are hybrids of the LGAD and ALTIROC connected through flip-chip bump bonding process.

Several test beam campaigns have been conducted at DESY and CERN SPS H6 beamline in 2022. The performance of irradiated Carbon-enriched LGAD sensors from different vendors has been studied. This talk covers the promising results in terms of collected charge, time resolution and hit efficiency of LGADs. A time resolution of < 70 ps is observed in most cases for highly irradiated sensors (2.5e15 neq/cm^2), while integrating timing information to the EUDET system allows for a surface resolution of less than 50 μm. First module prototypes of 15×15 arrays with a pad size of 1.3×1.3 mm2 for the HGTD project have been tested from different manufacturers. Their performance with charged-particle beams before irradiation is evaluated. The triggering architecture, picosecond synchronisation scheme and analysis logic will also be presented as well as application-specific electronics and components. A summary of the results from LGAD-only and hybrids will be presented.

Primary author: Dr NIKOLIC, Irena (Cern)

Presenter: HITI, Bojan (Ijs)

Session Classification: LGAD 1