CALOR 2018 - 18th International Conference on Calorimetry in Particle Physics
May 21-25, 2018, Eugene, USA

Contribution ID: **8**   Type: **not specified**

A High-Granularity Timing Detector for the Phase-II upgrade of the ATLAS Calorimeter system: detector concept, description and R&D and first beam test results

Thursday 24 May 2018 13:55 (20 minutes)

The expected increase of the particle flux at the high luminosity phase of the LHC (HL-LHC) with instantaneous luminosities up to L ⊠ 7.5 × 1034 cm−2 s-1 will have a severe impact on the ATLAS detector performance. The pile-up is expected to increase on average to 200 interactions per bunch crossing. The reconstruction and trigger performance for electrons, photons as well as jets and transverse missing energy will be severely degraded in the end-cap and forward region, where the liquid Argon based electromagnetic calorimeter has coarser granularity and the inner tracker has poorer momentum resolution compared to the central region. A High Granularity Timing Detector (HGTD) is proposed in front of the liquid Argon end-cap calorimeters for pile-up mitigation and for bunch per bunch luminosity measurements.

This device should cover the pseudo-rapidity range of 2.4 to about 4.0. Two Silicon sensors double sided layers are foreseen to provide a precision timing information for minimum ionizing particle with a time resolution better than 50 pico-seconds per hit (i.e 30 pico-seconds per track) in order to assign the particle to the correct vertex. Each readout cell has a transverse size of 1.3 mm × 1.3 mm leading to a highly granular detector with about 3 millions of readout electronics channels. Low Gain Avalanche Detectors (LGAD) technology has been chosen as it provides an internal gain good enough to reach large signal over noise ratio needed for excellent time resolution.

The requirements and overall specifications of the High Granular Timing Detector at the HL-LHC will be presented as well as the conceptual design. Most recent results on the main R&D will be discussed, with emphasis on the LGAD sensors (sensor optimisation as thickness, dead zone⋯., and radiation hardness) and ASIC. Beam test results of gain, timing resolution and efficiency will be also shown.

Secondary topics

Applications

Primary topic

Fast timing

Author: MORANGE, Nicolas (Centre National de la Recherche Scientifique (FR))

Presenter: MALLIK, Usha (Iowa)

Session Classification: Session 12