



Contribution ID: 804

Type: **Experimental poster**

Physics and performance of the High Granularity Timing Detector

Tuesday, May 17, 2022 7:00 PM (1 hour)

The expected increase in particle flux in the high-luminosity phase of the LHC (HL-LHC), with an instantaneous luminosity that can reach $L \approx 7.5 \times 10^{34} \text{cm}^{-2}\text{s}^{-1}$, will have a significant impact on the pile-up with potentially 200 interactions per bunch crossing. The performances of electrons and photons, as well as those of jets and missing transverse energy, will be strongly degraded in the end-cap and at the forward region of the detector, where the granularity of the electromagnetic calorimeter is coarser and the momentum resolution of the Inner Tracker (ITk) is poorer. In order to mitigate the pile-up contamination coming from this high luminosity, a High Granularity Timing Detector (HGTD) is proposed in front of the LAr end-cap calorimeters, covering the pseudorapidity region between 2.4 and 4.0. The high granularity and the high-precision timing information will allow to improve the pile-up reduction. It will also improve the forward objects reconstruction, and complement the performance of the updated ITk in the forward region of ATLAS detector. This leads to an amelioration in the jet and lepton reconstruction performances. The ability of the HGTD detector to improve the pile-up jet rejection and the lepton isolation efficiency within the forward region in addition to the physics and performance results is going to be presented.

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Session Classification: Poster Session I

Track Classification: Upgrade & Future Projects