

Status of the HGTD sensors upgrade

Thursday, 30 October 2025 16:20 (20 minutes)

The Large Hadron Collider (LHC) will begin its high-luminosity upgrade at the end of 2026, with an expected luminosity increase of 7.5 times and an average vertex density along the z-axis of 1.5 per mm, posing significant challenges to detector radiation hardness and ATLAS tracking performance. The HGTD, a key detector providing timing information, relies heavily on its core component, LGAD. LGAD is a silicon sensor with a thin multiplication layer capable of providing 50 ps resolution. It is segmented into a 15x15 matrix with 1.3x1.3 mm² pads, read out via solder bumps by a dedicated front-end chip (ALTIROC). LGAD, a critical part of the detection system, directly impacts the progress of the HGTD project. Currently, final production is proceeding as planned. Sampling per pad tests were conducted on pilot batch wafers, categorizing main sensors into four types—A, B1, B2, and C—based on current and voltage conditions. IME's probecard test data shows that all A-class sensors meet the standards, while some B1 and B2 chips satisfy A-class criteria after per pad testing, indicating improved yield rates for LGAD sensors per wafer. Additionally, CV tests on pilot batch main sensors met requirements, and IV and CV tests on QC-TS structures were also successful. Process quality control (PQC) studies on production QC-TS structures confirmed that V_{gl} meets wafer acceptance criteria, with good correlation between V_{gl} and V_{bd} . Irradiation test (IT) studies were completed to test radiation resistance, confirming that all wafers passed the acceptance criteria. Finally, beam tests were conducted on LGAD + ASIC assemblies.

Primary authors: Prof. COSTA, Joao Guimaraes (IHEP); Prof. 梁, 志均 (IHEP); Prof. 赵, 梅 (IHEP); 张, 田园; Mr 孙, 维益 (IHEP); Mr 柯, 超逸 (IHEP)

Presenter: 张, 田园

Session Classification: Parallel 1: Upgrade

Track Classification: Upgrade