Contribution ID: **449** Type: **Oral Presentation**

Development and Qualification of a Fiber Optic Sensor Package for ITk Environmental Monitoring

Tuesday 8 July 2025 11:10 (20 minutes)

The High-Luminosity Large Hadron Collider requires precise environmental monitoring in the ATLAS Inner Tracker to prevent water condensation that could damage detector electronics. This study focuses on the development and the performance of Fibre Optic Sensor packages. Each package is made up of a Long Period Grating sensor and two Fibre Bragg Grating sensors for accurate temperature, dose and relative humidity measurements in a harsh radiation environment [1]. Extraction of the relative humidity (and Dew point) involves the decoupling of the effects of the measured temperature and radiation dose which requires compensation to be accurate. The temperature and relative humidity measurements may depend on location in the 2D (temperature, relative humidity) plane, as indicated by some measurements. This could be an effect of the packaging or a systematic physics effect of the FOS sensors. Calibration studies were performed to assess any possible dependency of temperature calibration on relative humidity in order to determine whether it arises from real sensor sensitivity or external factors such as packaging constraints. Calibration protocols were extended, and compensation algorithms refined to improve measurement accuracy. We present the outcome of the made Fibre Optic Sensor package and compensation methodology to ensure stable ATLAS Inner Tracker conditions for the High-Luminosity Large Hadron Collider era.

[1] L. Scherino et al., "Fiber optic sensors in the ATLAS Inner Detector," Nucl. Instrum. Methods Phys. Res., Sect. A, vol. 1029, p. 166470, 2022, doi: 10.1016/j.nima.2022.166470.

Apply for student award at which level:

PhD

Consent on use of personal information: Abstract Submission

Yes, I ACCEPT

Primary author: UNWUCHOLA, Doomnull (University of the Western Cape)

Co-authors: CASSIM, Abdool (University of johannesburg); MAQABUKA, Bongani (University of johannesburg); LEEUW, Lerothodi (University of the Western Cape); TRUONG, Loan (University of johannesburg); Prof. CONNELL, Simon (University of johannesburg); MAPEKULA, Xola (University of johannesburg); CONNELL, matthew (University of johannesburg)

Presenter: UNWUCHOLA, Doomnull (University of the Western Cape)

Session Classification: Applied Physics

Track Classification: Track F - Applied Physics