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LPG sensor technology for environmental monitoring: from the laboratory to the detector

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For the Inner Tracker (ITk) detector of the ATLAS experiment at CERN the environmental monitoring is essential for optimal operative conditions. A constant relative humidity monitoring is required in fifty different points inside the ITk detector, where the dew point is lower than -60°C.
In this context, Fiber Optic Sensor (FOS) technology based on Long Period Grating (LPG) and Fiber Bragg Grating (FBG) have been combined to provide a unique sensing device. The FBG sensors are a consolidated technology that can provide relative humidity and temperature monitoring over a wide range. However, with intrinsic sensitivity of 1% RH and accuracy of 2% RH, they fail to detect relative humidity with satisfactory precision when it goes below 10%. In this range, the very high sensitivity of LPG sensors to relative humidity enables its accurate measurement. This device must be installed in an ad-hoc package that guarantees its protection against damages while leaving unchanged its response and performance. Moreover, a customized multiplexing system has been developed to continuously and simultaneously monitor the fifty measurement points inside the ITk detector with a single optical fiber interrogator.
The talk will focus on the engineering aspects that led to the development of the final device for environmental monitoring in the ATLAS ITk detector.

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