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Qualification of standard pressure sensors for applications in superfluid helium at CERN

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The paper focuses on the qualification process employed to ensure the precision and reliability of radiation tolerant pressure sensors, originally developed to operate within the temperature range of -40℃ to +125℃, in superfluid Helium for CERN cryogenic installations.

The initial stage of the qualification protocols took place at the CERN CryoLab facility. The qualification methodology involves a systematic evaluation of sensor impedance, leak testing, and the characterization of the output signal drift correlated with temperature variations, with a focus on addressing potential vulnerabilities associated with cryogenic temperatures down to 4.5 K. All the steps, including thermal cycling, cryogenic exposure, and pressure fluctuations, were implemented to assess key performance parameters such as sensitivity, response time, and accuracy across a wide temperature spectrum.

The second phase consisted in the installation of pressure sensors in the CERN SM18 magnet cryogenic test facility on upgraded benches for testing the HL-LHC magnets and validate their use in several cryogenic operation conditions down to 1.9 K. Although the sensor's original specification and design did not include operation in immersed liquid helium, the measurement results indicate satisfactory performance. A comparison was made between these results and measurements obtained from sensors at room temperature equipped with capillaries.

The paper will outline the qualification processes and present the measurement outcome of cryogenic pressure sensors in low-temperature environment.

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