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Long-Term Stability of SWPCs in Monitoring CF4-Based Gas Mixture in CMS CSC Detectors

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In the CERN CMS experiment, CSC detectors are employed and operated with a gas mixture based on CF4. Since 2016, two Single Wire Proportional Chambers (SWPCs) have been installed along the gas line to monitor the quality of the gas. The first SWPC was positioned immediately after the gas mixer unit, while the second was placed within the gas loop. SWPCs exhibit a high sensitivity to the presence of pollutants, which can emanate from external components or the detector materials themselves. The presence of such pollutants can significantly impact detector performance, potentially leading to aging effects and irreversible deterioration.

Remarkably, the performance of the SWPCs has remained stable over time. Even after nearly seven years of continuous operation, they continue to effectively detect impurities within the gas mixture without exhibiting signs of aging.

In this presentation, we will share the results of recent years' monitoring efforts, along with details of the setup upgrades. Additionally, we will present a study that explores the correlation between oxygen (O2) concentration within the gas mixture, as determined through GC analysis, and the observed decrease in gain in the SWPCs.

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