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Performance and aging studies for the ALICE muon RPCs

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The ALICE muon trigger (MTR) system consists of 72 Resistive Plate Chamber (RPC) detectors arranged in two stations, each composed of two planes with 18 RPCs per plane. The detectors are operated in maxi-avalanche mode using a mixture of 89.7% $C_2H_2F_4$, 10% $i - C_4H_{10}$, 0.3% SF_6 . A number of detector performance indicators, such as efficiency, dark current and dark counting rate, have been monitored over time throughout the LHC Run2 (2015-18). While the efficiency showed very good stability, a steady increase in the absorbed dark current and counting rate was observed.

Since the end of 2018, the LHC has entered a phase of long shutdown, during which the ALICE experiment will be upgraded to cope with the next phase of data taking, expected in 2021. The MTR is undergoing a major upgrade of the Front-End and Read-Out electronics, and will change its functionalities, becoming a Muon Identifier. However, only the most irradiated RPCs will be replaced during the upgrade. It is therefore important to perform dedicated studies to gain further insights into the status of the detector. In particular, two RPCs were flushed with pure Ar for a prolonged period of time and a plasma was created by fully ionizing the gas. The output gas was analyzed using a Gas Chromatograph combined with a Mass Spectrometer and the possible presence of fluorinated compounds originating from the interaction of the plasma with the detector's inner surfaces has been assessed using an Ion-Selective Electrode station.

This contribution will include a detailed review of the ALICE muon RPC performance at the LHC; the procedure and results of the argon plasma test, described above, are also discussed.

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