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## **Investigating the effect of gas aging on detector performance for the development of a new gas circulation system for ACTAR-TPC at GANIL**

Recent advancements in active target detectors, enabling the detection gas to act as a target for nuclear reactions, have provided a significant boost to the exploration of nuclei near the drip lines and the exotic nuclear phenomena associated with them. ACTAR-TPC at GANIL is a novel detector of such kind that can construct a 3-D mapping of the decay or reaction products from two-dimensional projection of the tracks and electron drift time. In such kind of detection technique which is based on the gas-filled detection chamber, gas purity is a key factor in ensuring optimum detector performance and their lifetime. The recycling of detection gas becomes significantly important to minimize operational costs, in the case of using expensive gases like deuterium ( $^2\text{H}$ ), tritium ( $^3\text{H}$ ), helium-3 ( $^3\text{He}$ ), xenon ( $\text{Xe}$ ), etc. Another significant concern is the use of greenhouse gases (GHG) like  $\text{CF}_4$ ,  $\text{SF}_6$ ,  $\text{C}_3\text{F}_8$ , etc in certain experiments to achieve the physics interest of the study. This amplifies the importance of gas recycling considering the environmental consciousness. However, the quality of the recycled gas after cleaning must be satisfactory to achieve the defined optimum performance of the detector. Aiming to the development of an advanced gas regulation system, a comprehensive study is underway to investigate the effect of gas aging on detector performance. Characterization of gas filters was carried out to ensure their efficiency and determine their suitability for adoption in gas recycling. In this presentation, important methodologies employed in the studies will be discussed and the corresponding results will be presented.

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