

A closed-circuit gas system for RPC detectors

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The NeuLAND detector for R3B at FAIR will detect high-energy neutrons and will be based on timing resistive plate chambers. Current RPC detectors for timing purposes often use a common gas mixture, composed of 85% Reclin-134a, 10% sulfur hexafluoride, and 5% isobutane, which allows the operation of the detector under optimal conditions. Each gas has a series of advantages and disadvantages, which will be briefly listed. Reclin-134a and sulfur hexafluoride are potent greenhouse gases with high to very high global warming potentials, respectively. The long-term release of these gases to the atmosphere must therefore be avoided. Due to the considerable gas volume involved in the NeuLAND detector, a closed-circuit gas recirculation system is proposed for this purpose, consisting of a main circuit with a gas scrubber for the removal of eventual impurities in the gas, a condensation circuit for the recovery of the gas mixture, an injection circuit for the supply of fresh gas, and an on-line gas-analysis system based on a quadrupole mass spectrometer. This closed-circuit system will be presented, and its various subsystems will be described in detail.

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