

3.1-P25. SAUNA III Detector Studies

The design requirements for the SAUNA III radio-xenon measurement system pose several challenges for beta-gamma detector development. SAUNA III shall use nitrogen as carrier gas rather than helium as in the current SAUNA. It shall be capable of collecting 4 atmospheric air samples per 24 hours and achieve a sample minimum detectable concentration (MDC) of better than 0.3 mBq/m³ and for ¹³⁵Xe better than 1.0 mBq/m³. This shall be achieved using two beta-gamma coincidence counters. To reach the specified system MDC using a detector of sensitivity comparable to the current SAUNA, the xenon sample counted by the detector will need to be considerably larger than in the current SAUNA, and increased electron energy straggling effects must be expected. To maintain or preferably somewhat improve the detector sensitivity despite the increased xenon volume and the change of carrier gas, various electron detector geometries have been studied using the Monte Carlo code Geant4. Other avenues of development for the SAUNA III beta-gamma detectors include suitable methods for coating of detector cells to avoid gas memory effects, study of possible impact of such coating on detector resolution and methods to automatically detect and correct for changes in detector response functions over time.

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