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Estimation of contribution of gaseous tritium source rear wall to tritium beta-spectrum in search for sterile neutrinos by Troitsk nu-mass experiment

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The goal of the Troitsk nu-mass experiment is a search for sterile neutrinos in the tritium beta decay. The decay electrons are produced in the windowless gaseous tritium source, WGTS. The magnetic field in the source is formed by a set of solenoids. Electrons produced at large pitch angles to the magnet axis are trapped. Electrons at small angles can leave the WGTS for the spectrometer or in the opposite direction, for the rear wall. The spot of electrons escaping from the WGTS to the rear wall increases in diameter due to the fringe field. These electrons may scatter on the vacuum pipe and at some combination of scattered angle and final energy, may return to the WGTS and reach the spectrometer and detector. This contamination modifies the original tritium spectrum. We calculate the scattered electron distribution in GEANT4 framework and then apply energy and angular cuts to select the electrons that can reach the detector. The relative contribution of such electrons is 4-5 orders of magnitude less at the edge of the original spectrum at 17-18.5 keV, but reaches 2% at 11 keV. The experimental spectrum fits well with a correction for this contribution. The study of the rear wall contribution, its magnetic field and material configuration is critical for the TRISTAN project, the follower of the KATRIN experiment.

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