Contribution ID: **88** Type: **not specified**

Evaluating the Effects of Detector Modeling Uncertainties on Sterile Neutrino Oscillation Sensitivities with the ICARUS Detector

The ICARUS T600 LArTPC detector was refurbished after an initial run at
the underground LNGS labs and is currently taking data within its experimental hall at Fermilab after full commissioning. Regular data taking began in May 2021 with neutrinos from the Booster Neutrino Beam (BNB) and the Neutrinos at the Main Injector (NuMI) off-axis beam. As the far detector of the Short-Baseline Neutrino (SBN) Program, the ICARUS detector's capability in searching for both muon neutrino disappearance and electron neutrino appearance will allow for unprecedented sensitivity to light sterile neutrinos with eV-scale mass. The ultimate sensitivity of the detector to sterile neutrino oscillations depends on the understanding of the detector response and the uncertainties remaining after calibrating the detector model. This poster will review how detector-model-related uncertainties are quantified, evaluated and their impact on expected sterile neutrino oscillation sensitivities using the existing ICARUS data. The work pursued here is broadly applicable to other ICARUS analysis pathways such as neutrino-argon cross-sections and Beyond the Standard Model physics searches. It will finally discuss improvement pathways to reduce the systematic uncertainties to the level needed for the joint sterile neutrino oscillation analysis with the Short Baseline Near Detector (SBND) within the SBN Program.

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