Contribution ID: **67** Type: **not specified**

Constructing Data-Driven Predictions at the Far Detector for NOvA's Neutrino Oscillation Analysis

NOvA, is a two-detector, long-baseline neutrino oscillation experiment located at Fermilab, Batavia, IL, USA. It is designed primarily to constrain neutrino oscillation parameters using ν_μ ($\bar{\nu}_\mu$) disappearance and ν_e ($\bar{\nu}_e$) appearance data. The Neutrinos at Main Injector (NuMI) beamline at Fermilab provides a high purity 900 KW intense beam of neutrinos and anti-neutrinos to NOvA. The NOvA Near Detector, located 100m underground and 1km away from the beam source, observes the un-oscillated ν_μ ($\bar{\nu}_\mu$) and beam ν_e ($\bar{\nu}_e$) event spectrum. The Far Detector, located in Ash River, MN, USA, is 809 km from the ND and records the oscillated ν_e ($\bar{\nu}_e$) and the un-oscillated ν_μ ($\bar{\nu}_\mu$) event spectrum. NOvA uses a data-driven technique called extrapolation to predict the expected number of ν_μ ($\bar{\nu}_\mu$) and ν_e ($\bar{\nu}_e$) events at the Far Detector using the Near Detector data. The use of data from a functionally equivalent Near Detector provides a powerful constraint on the systematic uncertainties in NOvA neutrino oscillation analyses. As NOvA continues to add data statistics, a robust constraint on systematics becomes more crucial for neutrino oscillation analysis. The details of the NOvA neutrino oscillation analysis framework and how it constrains dominant systematic uncertainties using the Near Detector data will be discussed in this poster.

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Session Classification: Poster Session