Data-driven Techniques for $\nu_e$ Signal and Background Predictions in NO$\nu$A

Shiqi Yu,¹ Tomas Nosek²

¹Argonne National Laboratory / Illinois Institute of Technology
²Charles University, Institute of Particle and Nuclear Physics

Heidelberg, 4–9 June, 2018
Background Decomposition

Neutrino Mode

Beam $\nu_e$ constrain

Decomposition Result

Michel

Constrain $\nu_\mu$ by inspecting Michels

$\pi^+ \rightarrow \nu_\mu + \mu^+ \rightarrow e^+ + \nu_e + \bar{\nu}_\mu$

Anti-neutrino Mode

Proportional Decomposition

- All components sized proportionally by any Data/MC discrepancy in each analysis bin
Signal Prediction

- Functionally identical detectors
- ‘Extrapolate’ ND to predict FD
- ND $\nu_\mu$ CC $\rightarrow$ FD $\nu_e$
- ND $\nu_e$ CC $\rightarrow$ FD bkg
- Reducing impact of systematic uncertainties, flux and cross-sections

\[
\text{FD Bkg. Prediction} = \frac{\text{ND Decomposed}}{\text{ND Uncorr. MC}} \times \text{FD MC}
\]

\[
\text{FD Sig. Prediction} = \frac{\text{FD MC}}{\text{ND MC}} \times \text{ND } \nu_\mu \text{ data}
\]