IMPROVING **NOvA's STERILE NEUTRINO SEARCH** WITH **THE BOOSTER NEUTRINO BEAM**

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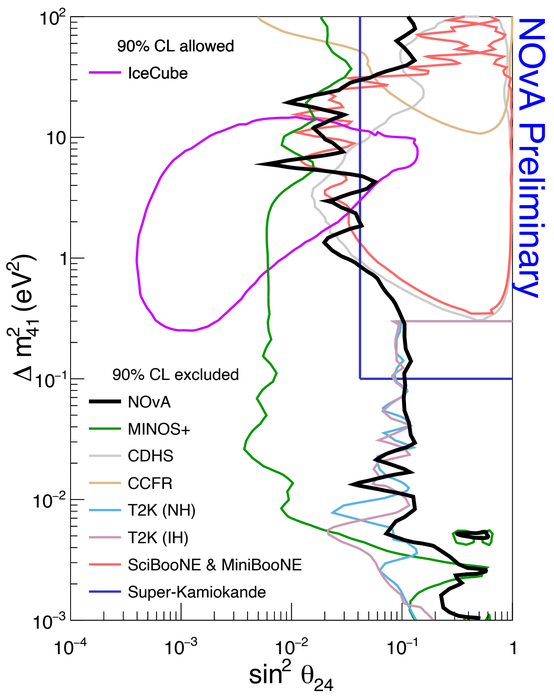
INTRODUCTION

Neutrino Beam



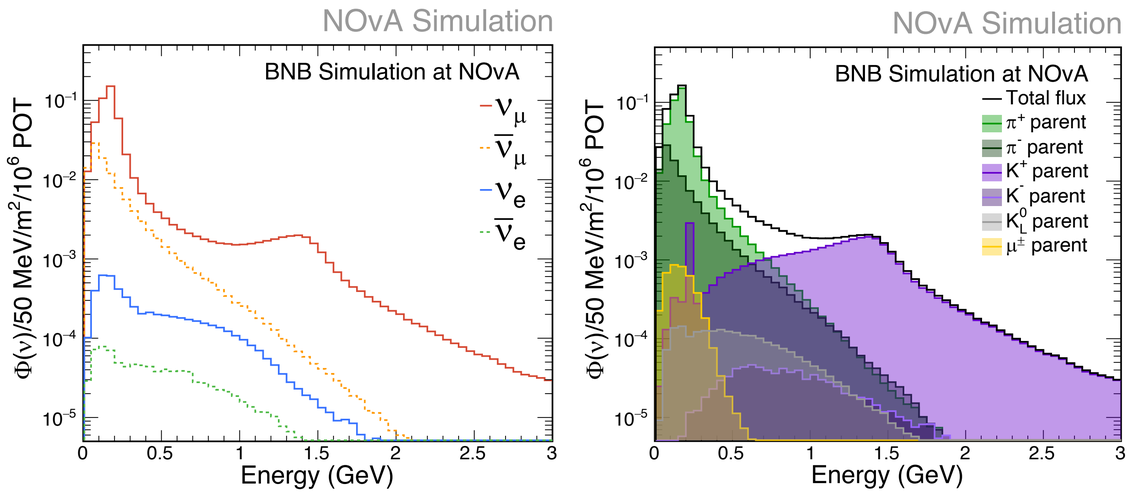
NOvA's sterile neutrino search uses
$\nu_\mu CC$ disappearance and
NC disappearance

High-statistics ND →
$\Delta m^2_{41} \gtrsim 0.5\ eV^2$
is systematically limited

Introduction of second beam (BNB) can break degeneracy of oscillation parameters & uncertainties

BNB data taken since 2015
but not yet used for analysis

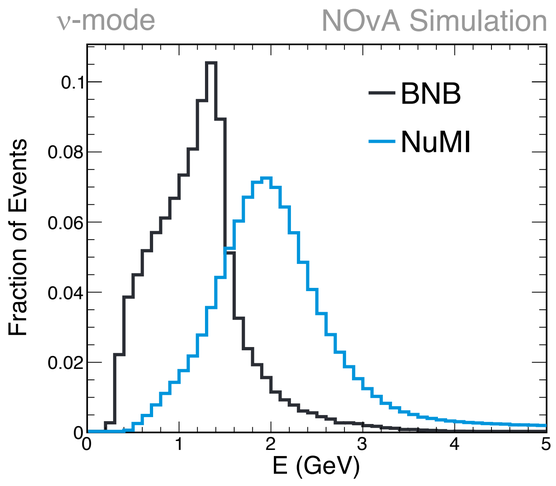
BNB SIMULATION AT NOvA

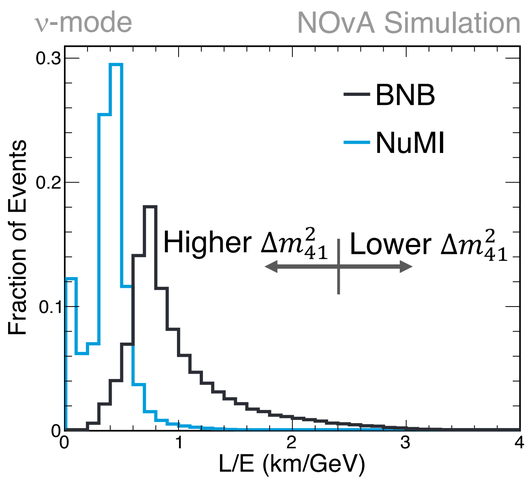


The MiniBooNE flux files* [1] are used to **generate a flux prediction for the NOvA Near Detector**. Highly off-axis → dual peak structure because of decay kinematics of π versus K

Above 1 GeV, we have a beam which is 92% pure ν_μ

SIMULATION RESULTS





	NuMI	BNB
Power (kW)	~800	~35
Protons per pulse	5×10^{13}	5×10^{12}
Repetition rate (Hz)	< 1	5
Proton energy (GeV)	120	8
Off-Axis Angle (°)	~0.8	~9.24

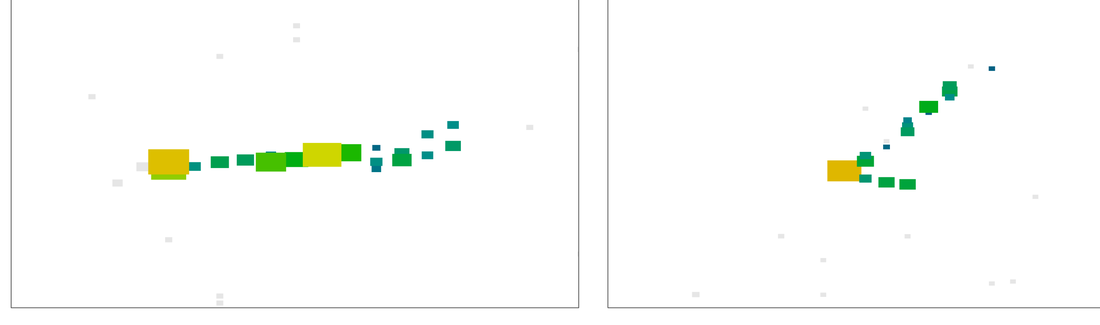
The BNB is lower energy than NuMI

Higher L/E values →
sensitivity to lower Δm^2_{41}

NOvA's current reconstruction is focused on NuMI peak, around 2 GeV and **efficiency falls off below around 0.5 GeV**

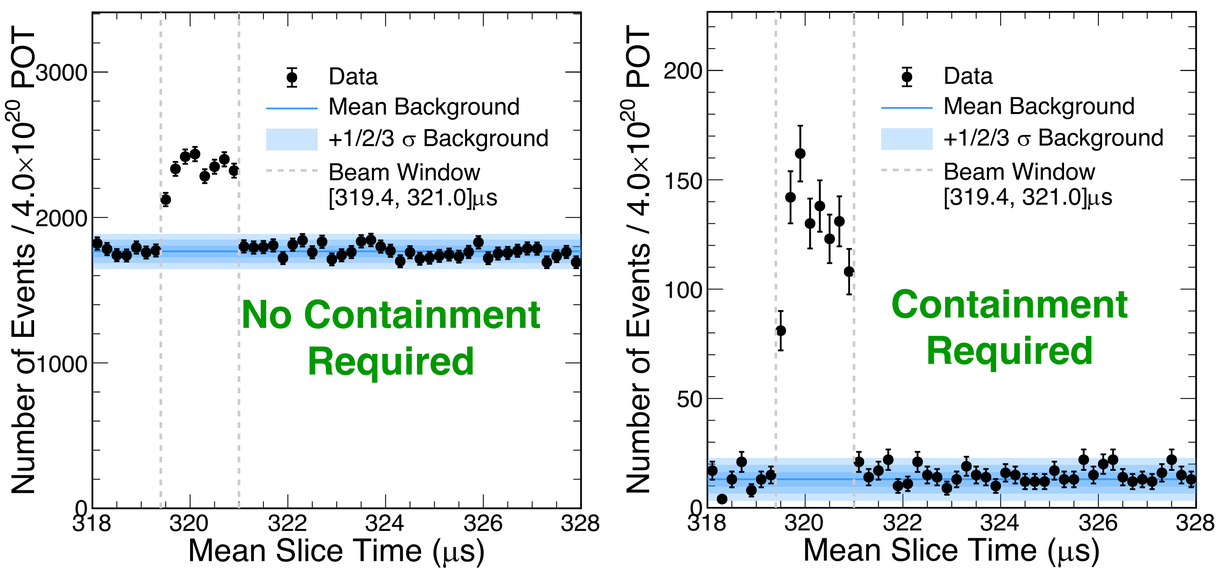
Requiring good event quality and basic containment results in a predicted ~4500 events in current dataset

Above 1 GeV, around 93.5% of neutrinos come from **kaons**



FIRST LOOK AT DATA

The beam window arrives 319.4 μs after the start of the readout window, with the expected length of 1.6 μs



Low rate of BNB neutrinos means cosmic rays are a significant background, even though we are 100 m underground.
Requiring containment removes vast majority of cosmic rays.

Example event displays from NOvA ND BNB data

SUMMARY

The NOvA experiment has been taking data from the Booster Neutrino Beam since 2015

This data can be used to enhance our sterile neutrino search, and we are in the process of developing this sample

ALSO SEE

Poster #475 by **Stella Haejun Oh and Shivam Chaudhary**
"*Constraining Cross Section and Beam Systematics for Future NOvA Sterile Neutrino Search*"

REFERENCES

[1] MiniBooNE Collaboration, Phys.Rev.D 79 (2009), 072002

*We would like to thank the MiniBooNE collaboration for access to their flux files, and to MiniBooNE computing nodes

@novaexperiment

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