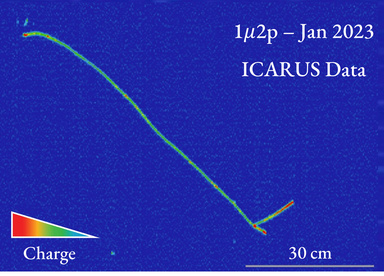

Pandora-based ν_μ disappearance search in the SBN program with 1μNp quasi-elastic like channel

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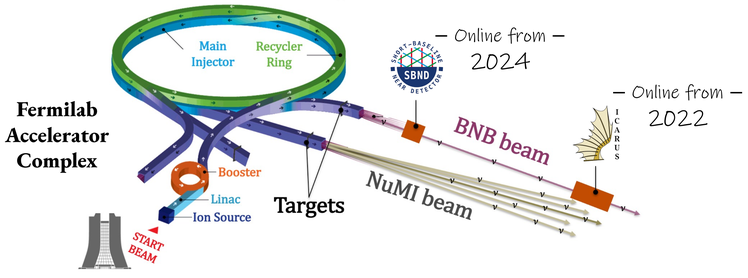
The idea: Short-Baseline Neutrino program

SBN program designed to address the possibility of eV-scale neutrinos from past short-baseline anomalies

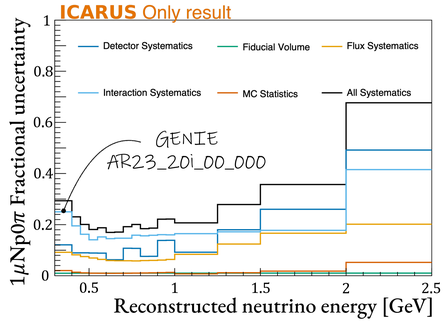
- Near and far detector sampling the same beam (BNB) with equal technology (LArTPC) and target (Ar)
- 110m: SBND constrains neutrino flux and cross section
- 600m: ICARUS measures the oscillated ν spectra
- Strong reduction of correlated systematic uncertainties



The pilot phase: ICARUS only ν_μ disappearance

End-to-end analysis to prove ICARUS' capability and readiness of analysis tools

- ν_μ CC contained interactions with 1μNp0π final state particles
- Analyzed data from 2022-2023 — 1.6· 10^{20} Protons on Target
- Systematics dominated in a single detector measurement



Muon And Protons Large Event selection – 1μNp0π

- Fully contained interaction
- Single muon with 50 cm length
- At least a proton with 50 MeV of kinetic energy
- Charge – scintillation light spatial agreement
- No signal on Cosmic Ray Tagger panels

Efficiency 48.5%
Purity 81.5%
Cosmics 1%

PANDORA

Pattern recognition algorithm selection

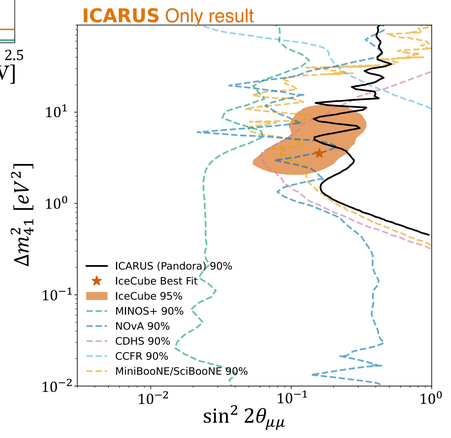
Detector systematics estimated by varying relevant simulation parameters

PROfit

PROfit fitting framework testing 3+1 sterile neutrino model

No evidence of ν_μ disappearance in the studied parameter space

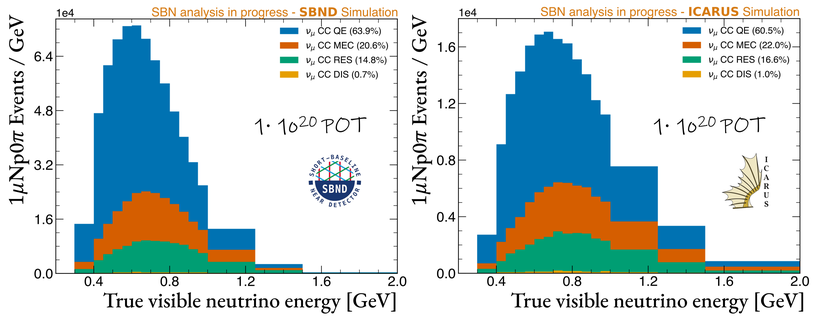
! new arXiv: 2603.22557



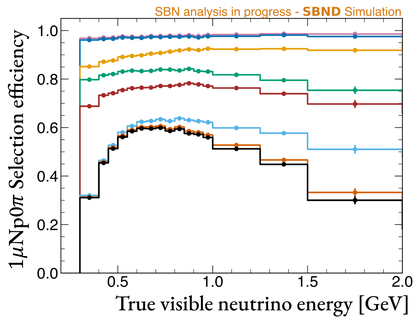
Go big: SBND and ICARUS joint effort

Extend 1μNp0π selection to include SBND data

- Identical final state topology and similar selection
- Visible ν energy defined as $E_{\mu^-} + \sum E_{p^+}$ — Sum of p^+ kinetic and binding energy

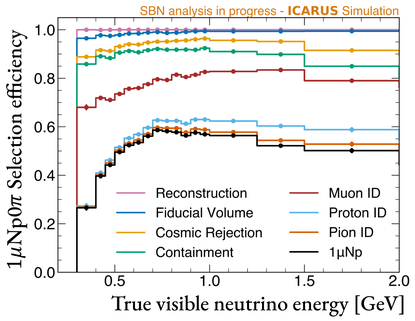


Selection performance and systematic treatment



SBND
Efficiency 55.1%
Purity 83.8%

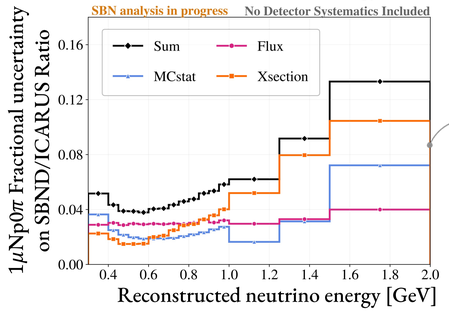
ICARUS
Efficiency 53.4%
Purity 78.0%



Systematics include flux and **interaction model** uncertainties

Work in progress to evaluate **detector** systematics

*All purities and efficiencies are wrt 1μNp0π

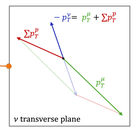


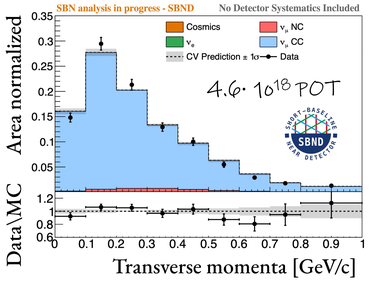
Big systematic constraint = Better oscillation sensitivity!

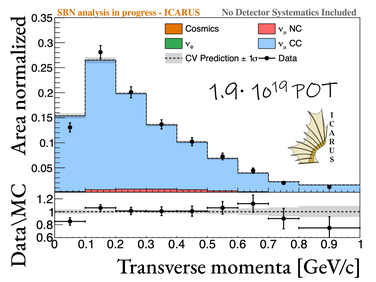
Data – simulation comparison

Using data from simultaneous running periods

- Exploit variables insensitive to oscillation
- Transverse momenta (p_T) tightly coupled to nuclear effects







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