Discussion SBND-DUNE

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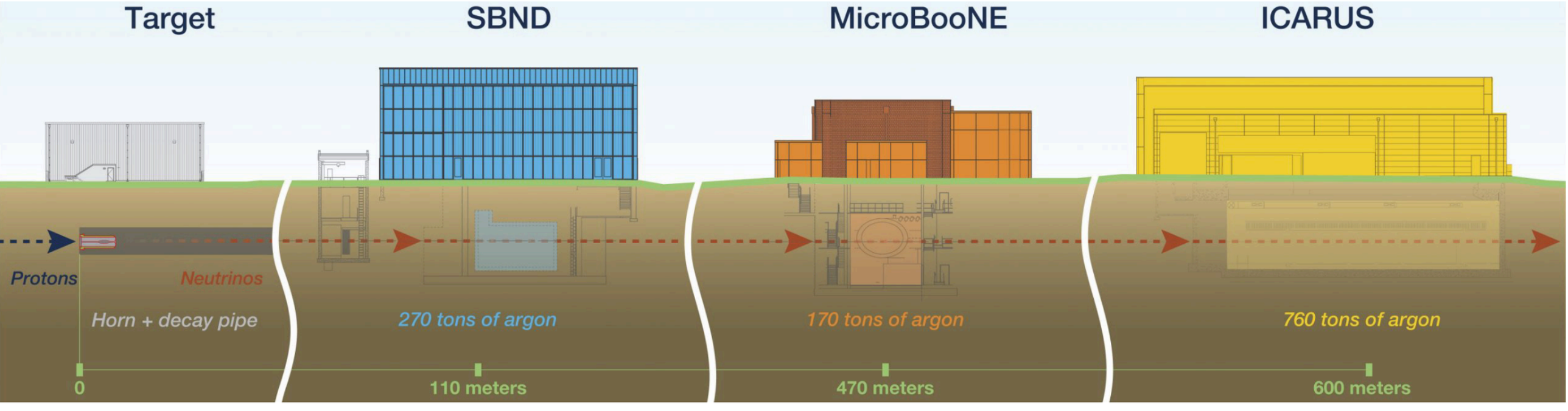
25 Mars 2026

SBND @ FERMILAB



One of three LArTPC of the Short Baseline Neutrino program @ Fermilab

Physics program

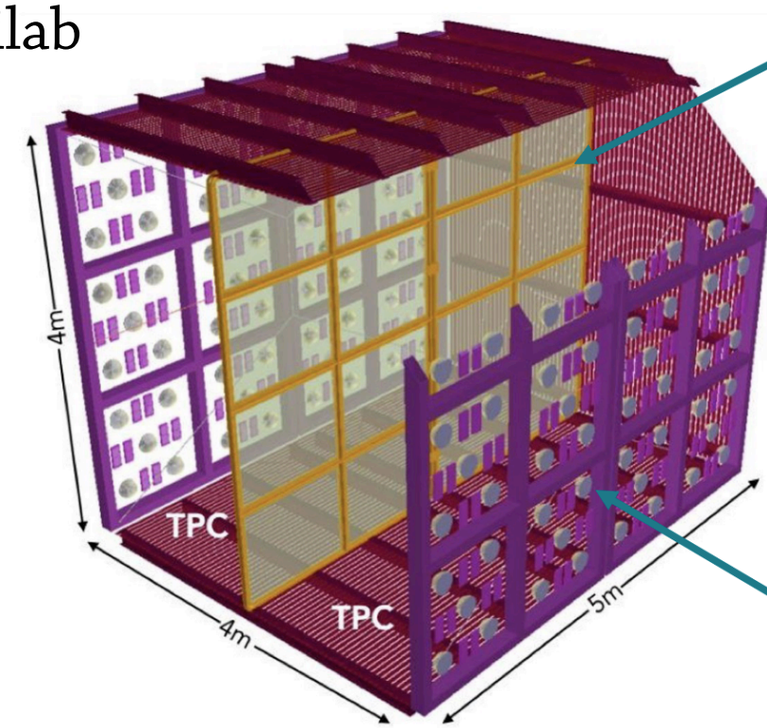
> Measurements of neutrino-argon cross sections with large statistics from BNB flux

> Resolve sterile neutrinos at the eV mass-scale through both appearance and disappearance oscillation channels.

> BSM searches

There is an interest from a few of us to join SBND

-> Today's discussion concern the strategy



↳ 4×5×4 m^3 HD-like LArTPC surrounded by CRT panels

Cross Section

> Expected 2 millions νμ CC and 15,000 νe-CC interaction / year
Plan to collect up to 10 million interaction until BNB shutdown

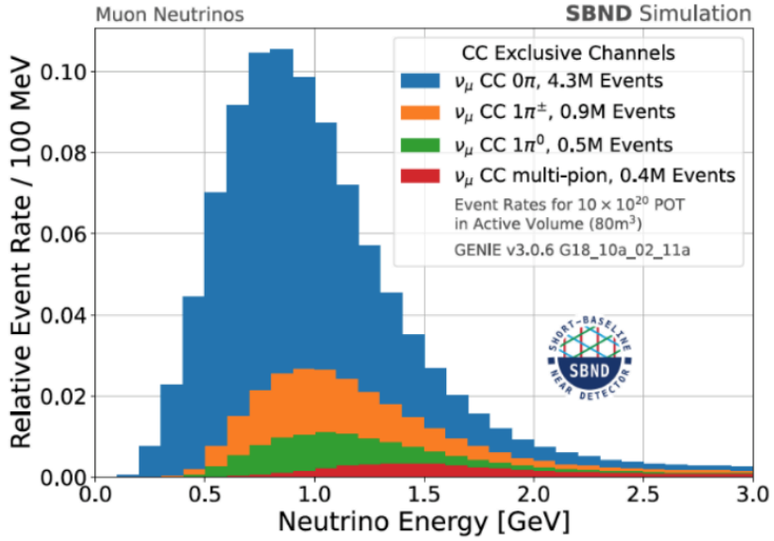
> SBND data has substantial overlap with the DUNE kinematic phase space.

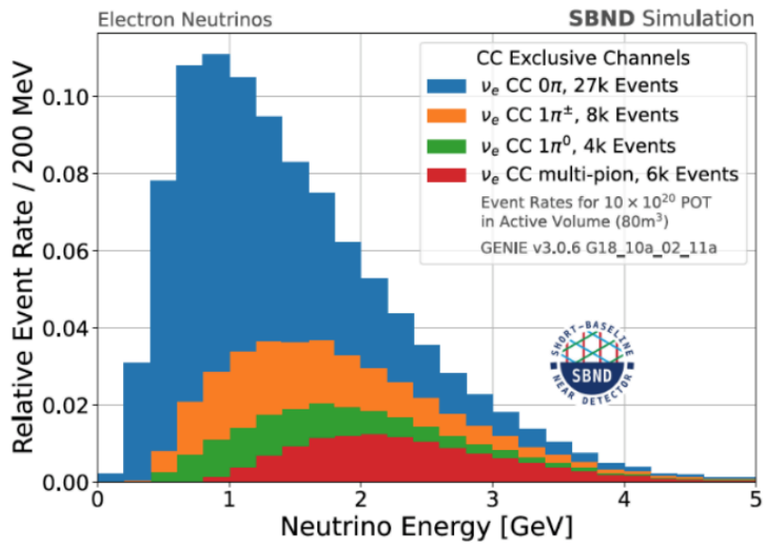
> BNB flux peaks around DUNE 2nd oscillation maximum

> First cross section measurements presented (νμ & νe CC inclusive, NC π^0,...) NuPhys26, WIN25

Interest for DUNE-France :

- Link with ProtoDUNE beam data
- Possible collaboration within IN2P3

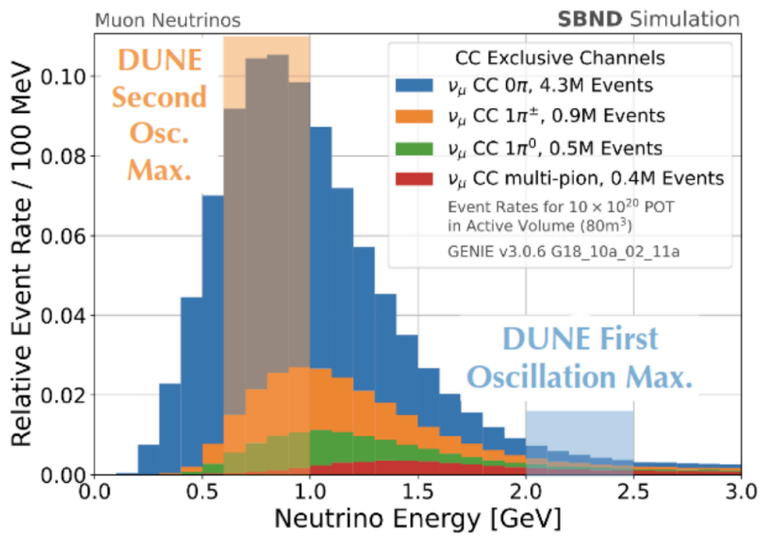


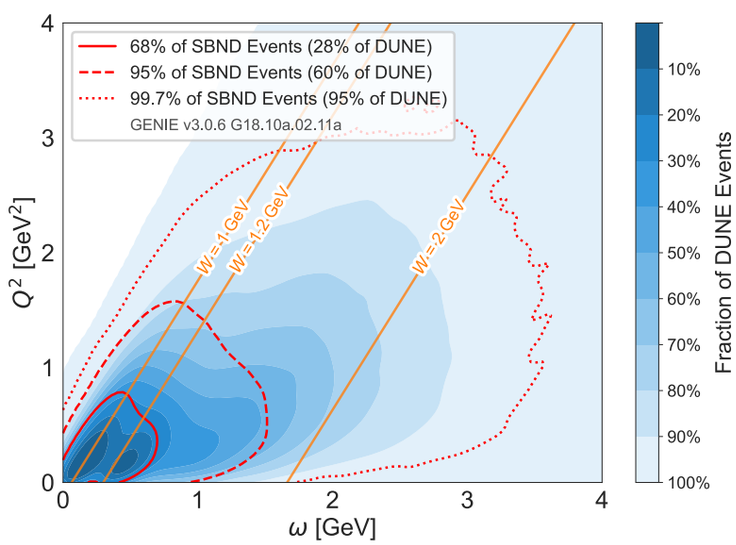


SBND/DUNE Flux & νμ-CC (Q^2, ω) phase

List of possible SBND measurements

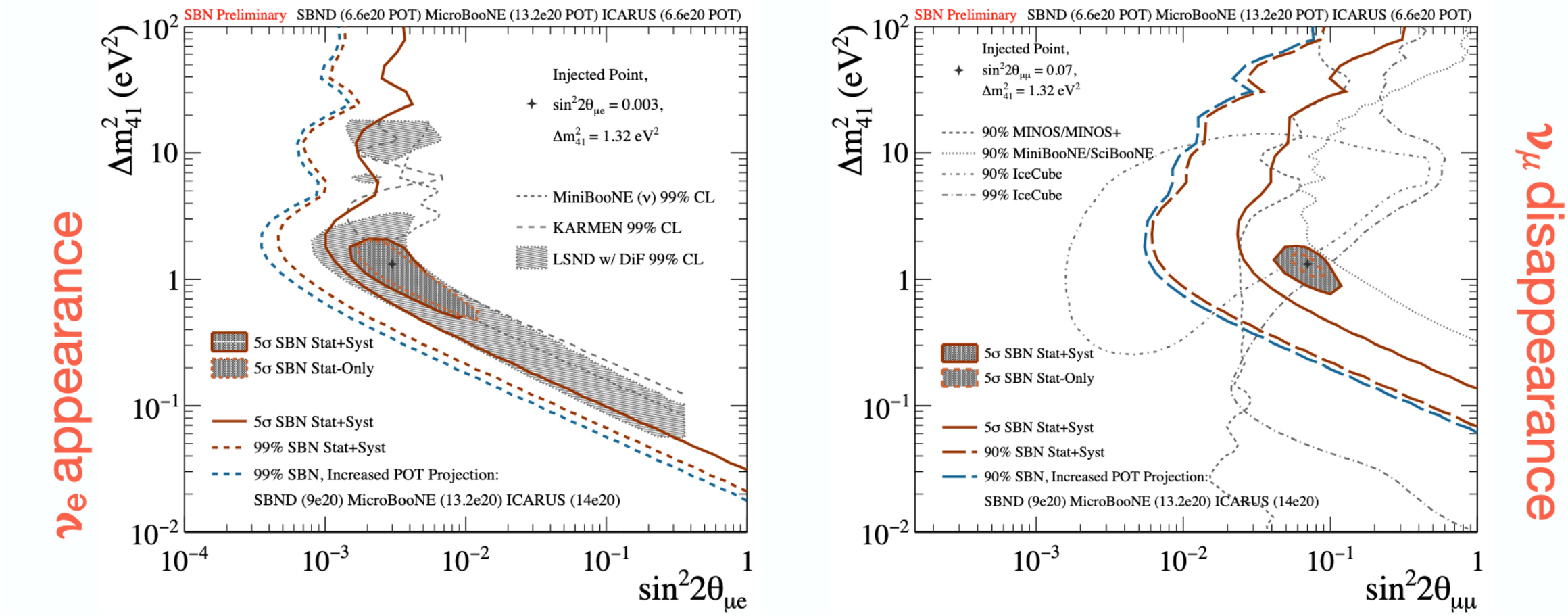
- ν_μ CC 2p 0π
- ν_μ CC 1π^0
- ν_μ CC SIS
- $\bar{\nu}\mu$ CC QE hyperon
- production (Λ0, Σ0, Σ−)
- Cluster production (deuterium, tritons, alphas)
- Neutrino-electron elastic scattering
- Muon Decays at Rest (μDAR)
- Giant resonances





Oscillation

SBN sensitivities for 6.6 e20 POT on the **BNB** target as per SBN proposal.



—> model-independent search for baseline-dependent anomalies with νμ & νe channels in CC & NC interactions

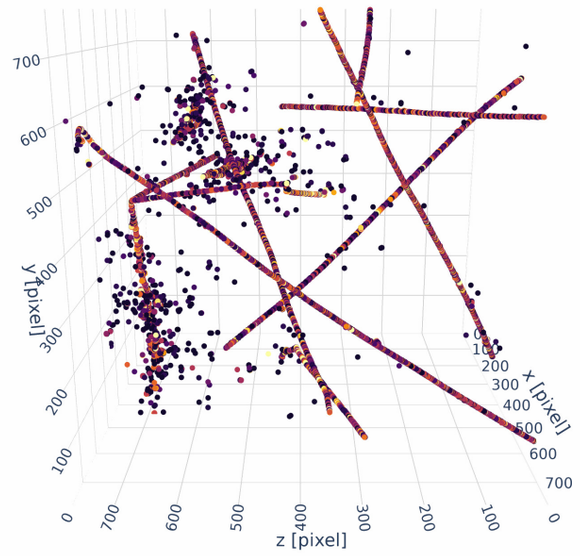
Interest for DUNE-France

> Get expertise in oscillation fitter with data

> Work on systematics (esp. detector systematics) and their correlation

Other topics

Reconstruction & SPINE



<u>SPINE is being used to reconstruct SBN data</u>

> Impressive results in terms of efficiency & purity compared to Pandora(?)

> Current efforts to implement SPINE in (Proto)-DUNE reconstruction

↳ Interest for DUNE-France

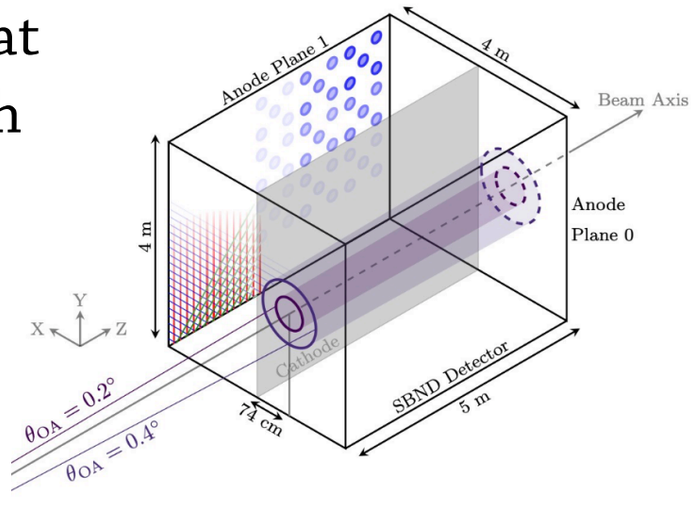
- Bridge the gap from protodune to the far detector

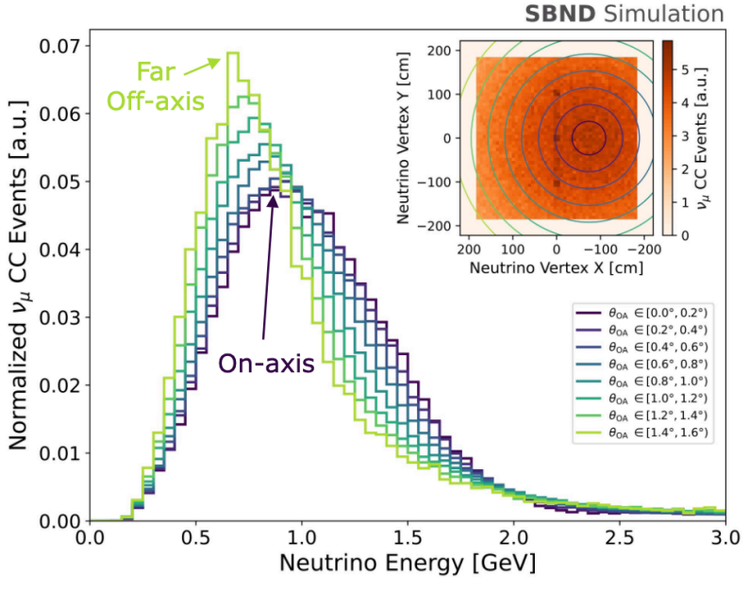
ICARUS		ν_μ CC	ν_e CC	ν_μ CC-π^0
Efficiency	Non-ML	49.0 %	7.7 %	15 %
	SPINE	**77.2 %**	**70.9 %**	**72 %**
Purity	Non-ML	76.4 %	27.5 %	51 %
	SPINE	**91.3 %**	**77.3 %**	**83 %**

SBND-PRISM

SBND is so close to the beam target that the detector sees the neutrino flux with an off-axis angle up to 1.6°

->Possibility for energy-dependent measurements





More Inputs

> I will be appointed at PPC lab this summer for 2 years, where I'll be joining SBND.
> Got green light from IN2P3 !
> PPC lab will be appointed a postdoc position as well in the same period

> Jaime got a UChicago-CNRS PhD funding to use SBND reconstruction performance on neutrino events to assess DUNE physics potential (2026-2029)

> DUNE-France / SBND workshop foreseen in Fall 2026 at UChicago