

# Charged current single pion production on SBND

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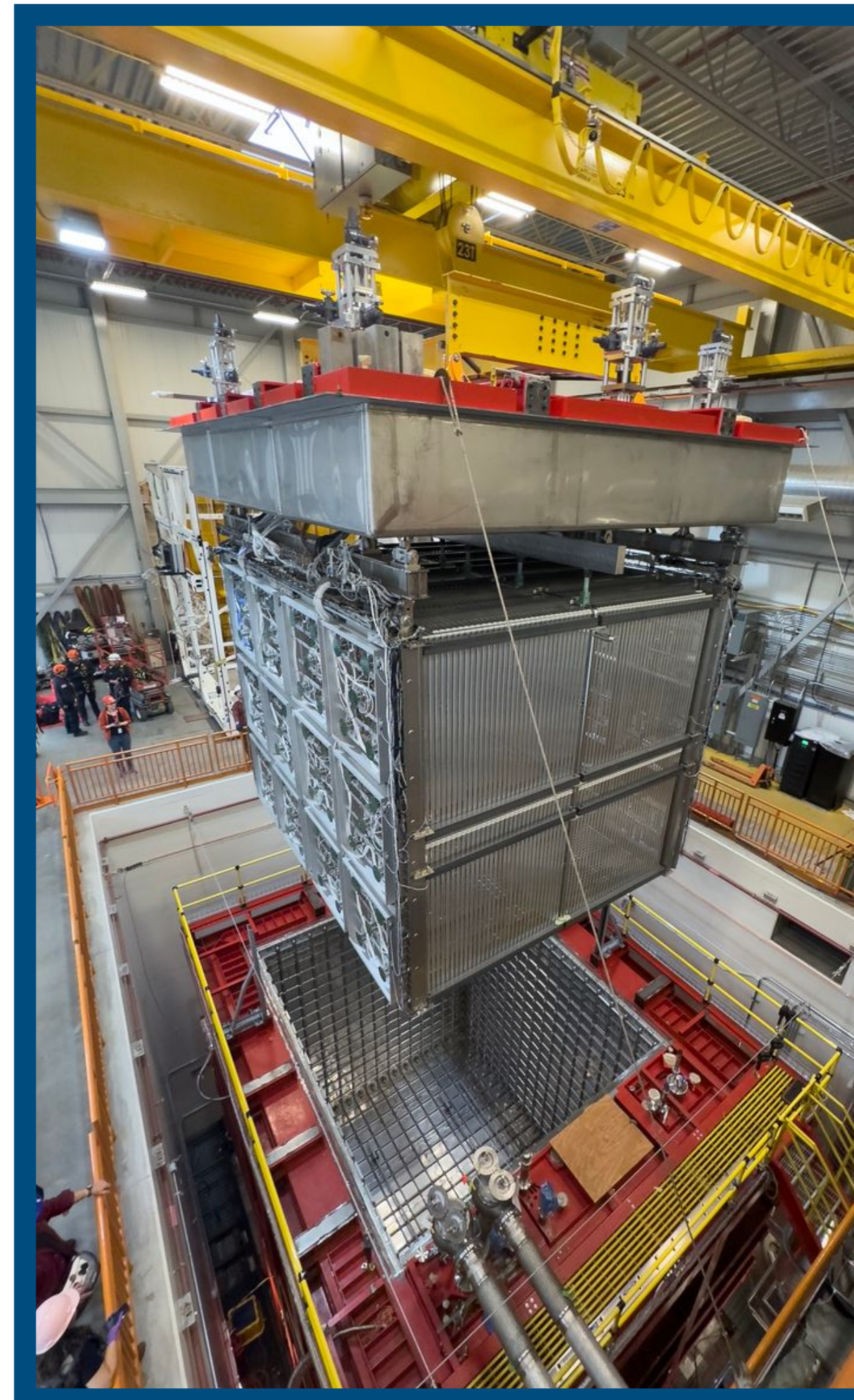
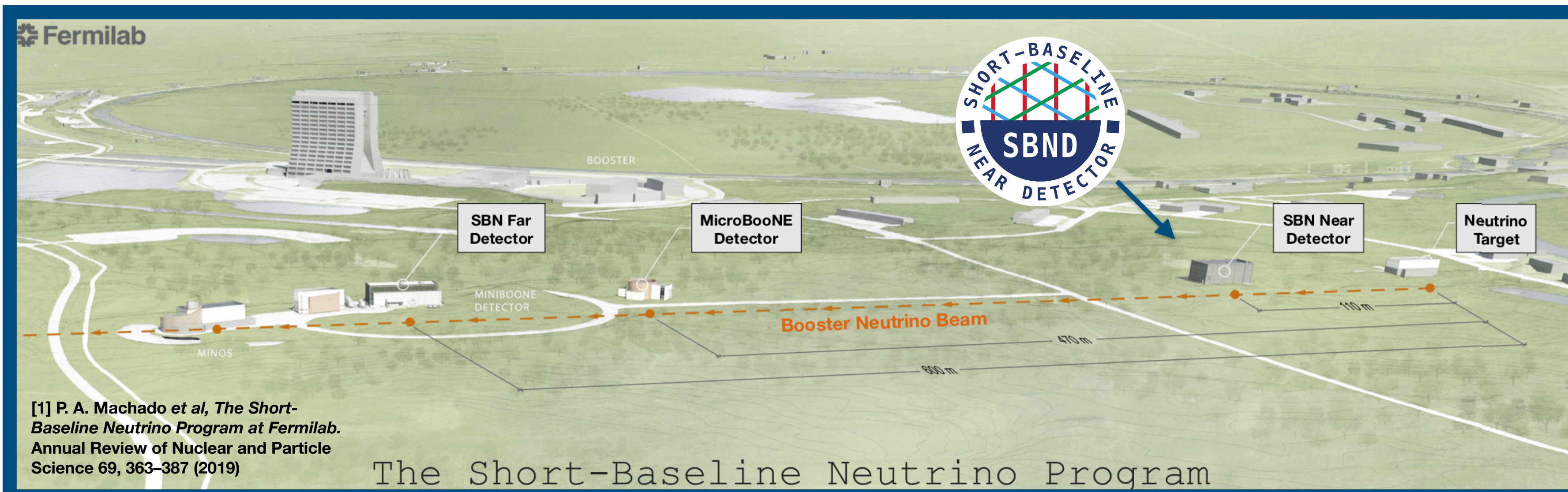


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## The Short-Baseline Near Detector

The **Short-Baseline Neutrino** program [1] (SBN) is a 3 detector experiment along the **Booster Neutrino Beam** (BNB) designed to investigate MiniBoone anomalies in neutrino oscillations

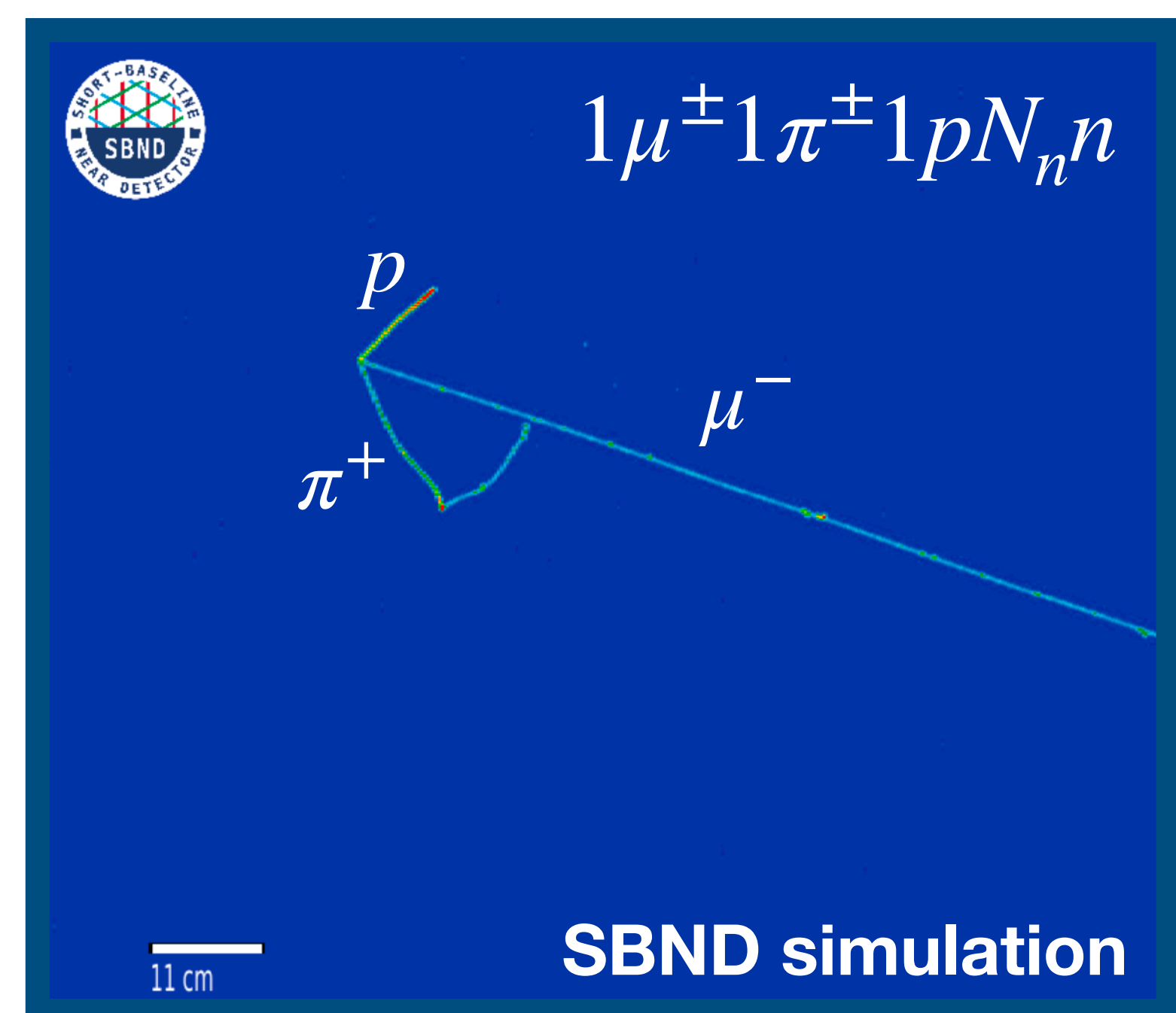
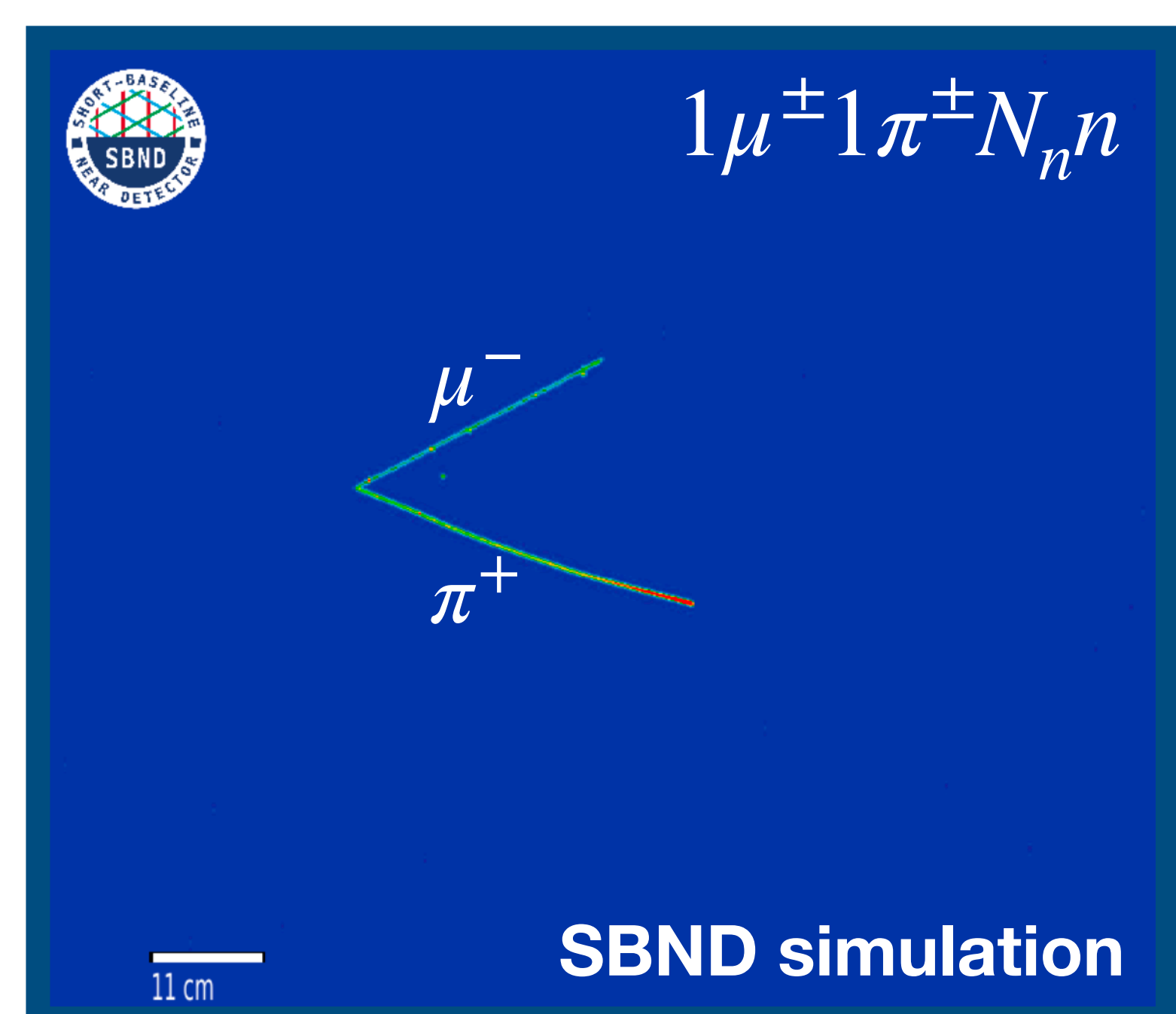
The **Short-Baseline Near Detector** (SBND), currently in commissioning, is a 112 ton active volume **Liquid Argon Time Projection Chamber** (LArTPC) located 110 m from the BNB target



Rich physics program due to proximity to the target:

- High precision measurement of the unoscillated BNB Flux
- Largest neutrino neutrino-argon interactions dataset
- Exclusive and Inclusive **cross-section measurements**
- Beyond Standard Model (BSM) searches of particles produced in the neutrino beam

## Event topology



## Charged Current single pion production on SBND

**Charged Current Single Pion** production (**CC1π**) is a muon-neutrino CC interaction with 1 charged pion. Exclusive channels of interest:

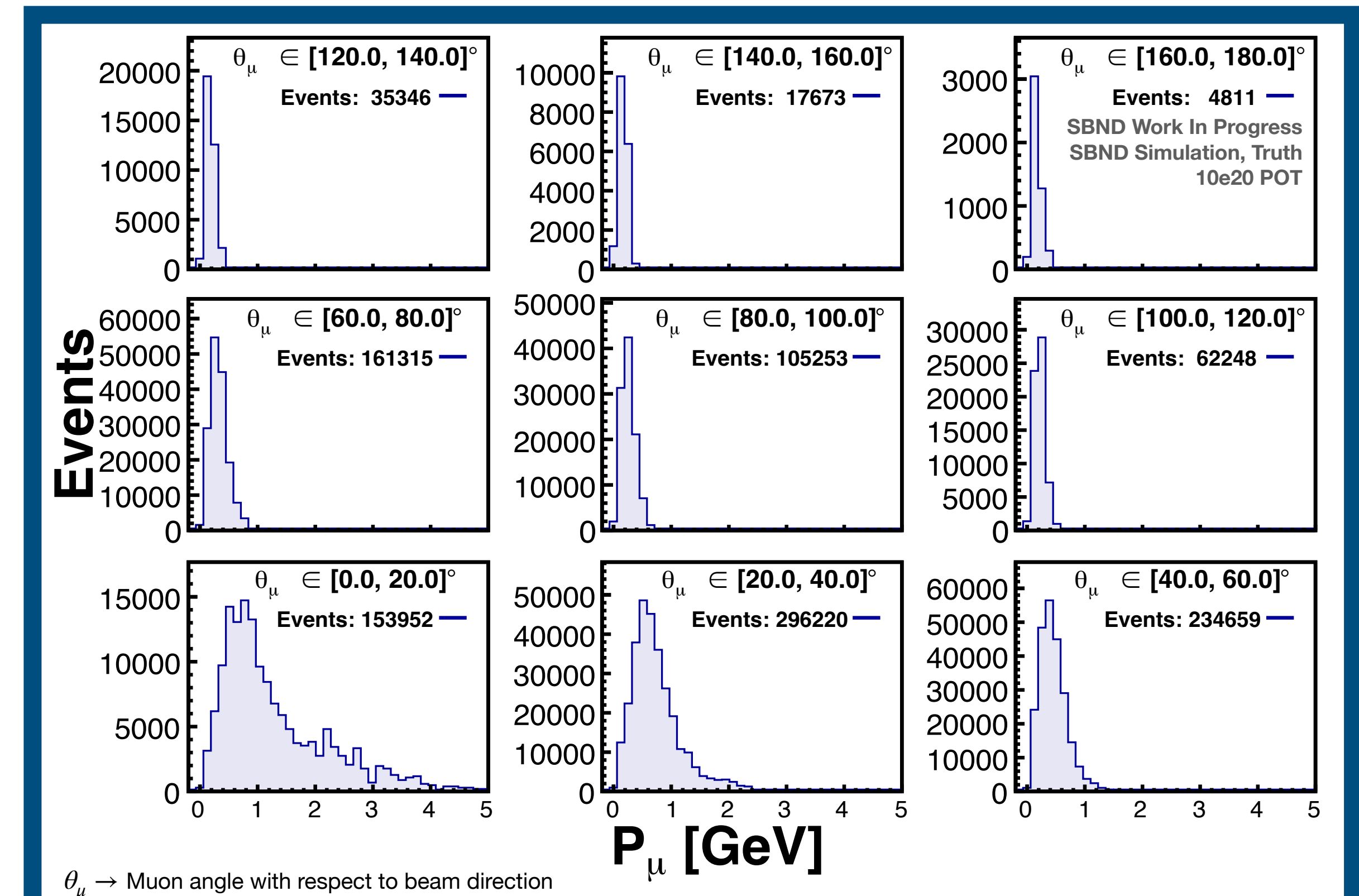
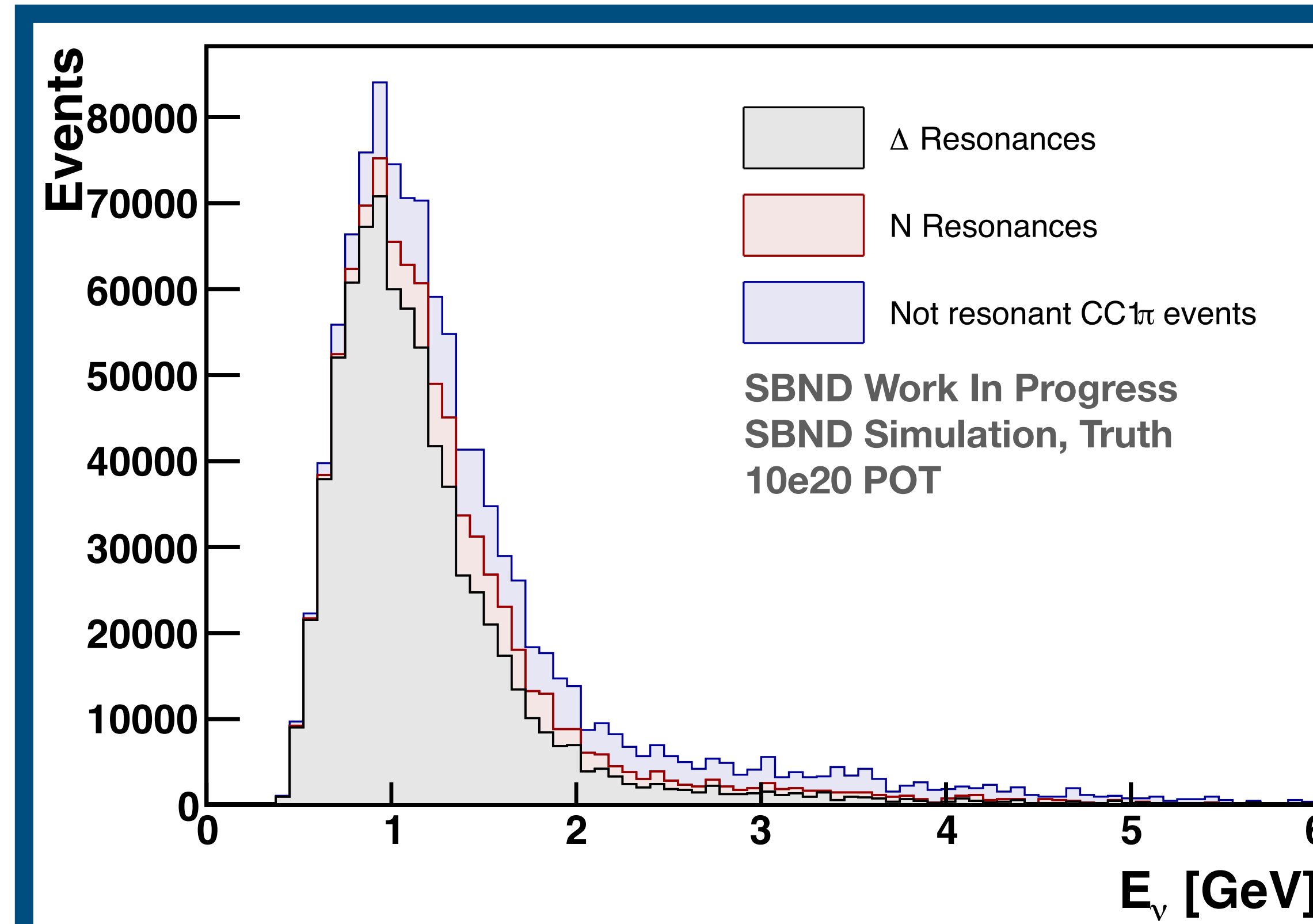
- **NCC1π**: Only charged particles are the  $\mu$  and  $\pi$
- **$\Delta$ -like CC1π**: The event contains exactly 1 proton

$$\text{CC1}\pi = 1\mu^\pm + 1\pi^\pm + N_p p + N_n n + X$$

SBND expects over 6.2 million neutrino events with **around 1 million CC1π** events.

This will enable the first **double differential cross-section** measurement of this channel in Ar and a deep study of resonant processes.

## 3 years exposure double differential cross-section capabilities



## Preliminary reco event selection: 2 months of data

Using current SBND reconstruction tools a **preliminary selection** is in place

- No cosmic-like events
- Reconstructed vertex inside Fiducial Volume (FV)
- More than 1 track
- 2 particles similar to a muon (*muon-like*)

Cut	Signal	Background	Efficiency	Purity
Initial Sample	72,693	2,135,482	100 %	3.29 %
Cosmic removal	70,154	561,013	96.51 %	11.11 %
Fiducial Volume	52,723	350,142	72.53 %	13.09 %
More than 2 tracks	41,319	144,334	56.84 %	22.26 %
2 muon-like particles	26,695	27,901	36.73 %	48.9%

**Preliminary result  
2 months of data**

**27000 events  
49% Purity  
37% Efficiency**

## $\mu$ energy distribution after selection

