

Oscillation Working Group Workshop Plans: “Topic 4”

Elizabeth Worcester, Joseph Zennamo

Workshop Kickoff

July 25, 2023

Big Picture Goal for Workshop

- Over the past ~6 months we have developed a vision for the first SBN oscillation analysis, including a very long list of tools/analyses that are required to implement this plan
- Simultaneously, many individual efforts are in progress, including reconstruction and selection tools, event selections, systematics studies, and fitting studies
- With a few exceptions, these activities have been ~independent – the (useful and interesting) work is proceeding independently from the plan, with significant potential for divergence among the various efforts
- Big picture goal for the workshop is to develop tools and systems that facilitate a coordinated effort among SBND and ICARUS and among various ongoing algorithm/analysis efforts and establish consensus regarding priorities and use of these tools going forward

Introductions

- Oscillation Working Group Conveners:
 - Elizabeth Worcester (she/her, SBND/ICARUS)
 - Joseph Zennamo (he/him, SBND/ICARUS)
- Assorted experts:
 - CAFAna (selection and fitting): Jacob Larkin, Elizabeth Worcester
 - Cosmic rejection: Anna Heggstuen, Francesco Poppi, Jack Smedley
 - POT accounting: Gray Putnam, Filippo Varanini, Joseph Zennamo
 - SBNFit: Georgia Karagiori, Ibrahim Safa
 - Trigger: Gianluca Petrillo, Joseph Zennamo, Jacob Zettlemyer
 - VALOR: Rhiannon Jones
- Communication
 - Slack #oscillation (discussion)
 - Email list: sbn-osc@fnal.gov (announcements)



See these folks for
info on correct
samples topic by topic

Analysis Pieces w/ specific to-dos - I

- Analysis infrastructure (software, simulation, data handling, etc):
 - In general outside the scope of “topic 4” but an ongoing source of concern for implementation of our plan
 - To do: Understand and document POT accounting, including background normalization schemes, including potential SBND-ICARUS differences and sources of uncertainty (idea – compare known cosmic rate with simulated and observed rates)
 - To do: Create single source SAMWeb list of relevant samples
 - To do: Consider August production needs
 - To do: Consider data collection plans for both experiments (special)
 - To do: Consider prospects for data-driven cosmic simulation
- Calibration & Reconstruction
 - “Topic 1” includes signal processing
 - “Topic 2” includes SBND-ICARUS algorithm sync
 - To do: Identify and document (with event displays where possible) reconstruction failures/shortcomings that lead to poor reconstruction of high-level quantities used in the selection or analysis and/or that contribute to background

Filippo Varanini
Laura Paulucci,
Will Foreman, Lynn Tung

Analysis Pieces w/ specific to-dos - II

- Cosmic rejection algorithms:
 - At least four algorithms exist, with different levels of availability at CAF level, different levels of availability in SBND and ICARUS, and very different levels of validation with data
 - To do: implement and test each matching algorithm at CAF level
 - Includes implementation and/or re-tuning of algorithms for both detectors if needed
 - To do: evaluate impact of cosmic rejection criteria on selected sample
 - Is phase space sculpting different?

Anna Heggstuen
Francesco Poppi
Lynn Tung
Shweta Yadav
Leo Aliaga

Analysis Pieces w/ specific to-dos -

Jacob Larkin
Jacob Zetlemoyer
Will Foreman
Lynn Tung

- Event selection
 - Several selections exist with different target samples and efficiency definitions
 - To do: Implement existing selection algorithms in CAFAna
 - To do: Understand trigger impact on efficiency (trigger emulation for MC)
 - To do: Implement beam quality cuts (and efficiencies for MC)
 - To do: Define updated “default” selection for input to fitters
 - To do: Agree on common definitions for efficiency to facilitate apples-apples comparison of selection algorithms
 - To do: Develop software for standard suite of plots for evaluation/presentation of selections (sequential efficiency, n-1 efficiency, final spectra (including sub-samples to show))
 - To do: Develop software for standard suite of plots for data/MC comparisons

Analysis Pieces w/ specific to-dos -

Steven Gardiner
Rhiannon Jones
Jacob Larkin
Mun Jung Jung
Laura Paulucci

- Systematics:
 - “Topic 3” focused on defining suites of systematics
 - For the analysis, we need to make sure we have tools for implementation and study of the impact of these systematics
 - To do: implement updated flux systematics list (only change is removal of SciBooNE constraint)
 - To do: implement updated interactions systematics list
 - To do: develop tools within the fitting frameworks to propagate detector systematics to analysis
 - To do: develop tools to evaluate trigger-level systematics
 - To do: develop tools to evaluate analysis-level systematics

Analysis Pieces w/ specific to-dos - V

- Fitting

- Significant past work validating fitting frameworks, but mysteries remain
- To do: Document and understand level of overfitting in current frameworks and how this is impacted by additional detector systematics
- To do: Develop suite of standard plots showing systematic variation in spectra pre- and post-fit and systematic pulls
- To do: Study “mock data” generated with alternative generator(s)

Rhiannon Jones

Mun Jung Jung

Jacob Larkin

Elizabeth Worcester

Shweta Yadav

Leo Aliaga