SBN Joint Working Groups

SBN Oversight Board Meeting

Fermilab, March13th 2020

Ornella Palamara

SBN Joint Working Groups

❏ **SBN DAQ and Data Pre-Processing** *[conveners: Bill Badgett, Angela Fava, Wes Ketchum, Sandro Ventura]*
  - ❏ *Scope*: Identify areas of common effort on **trigger, data acquisition and data pre-processing**, and coordinate activities in those areas.

❏ **SBN Slow Controls** *[conveners: Sowjanya Gollapinni, GeoffS avage]*
  - ❏ *Scope*: Develop a **control system** based on hardware and software interfaces as much as possible identical for the two detectors.

❏ **SBN Cosmic Ray Tagger** *[conveners: Umut Kose, Igor Kreslo, Minerba Betacourt]*
  - ❏ *Scope*: Review the **CRT production status and the installation plans** for the two detectors, develop common CRT **DAQ and data output format** (together with the SBN DAQ WG), develop **common CRT monitoring.**

❏ **SBN Analysis** *[conveners: Daniele Gibin, Ornella Palamara]*
  - ❏ *Scope:* Implement a **multi-detector** simulation, the reconstruction algorithms/tools and the analysis tools for the **SBN oscillation analysis**.

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❑ SBN Analysis Infrastructure *[conveners: Wes Ketchum, Joseph Zennamo]*

❑ Evolution of the former SBN Data Management Group

❑ *Scope:* Management of SBN production and data resource, analysis data format and software, data-driven simulation software, beam and detector-external interaction simulations.

SBN DAQ and Data Pre-processing

❑ **A lot of progress as we approach data-taking in SBN-FD (ICARUS)**

- ❑ ICARUS shifters now continually run the DAQ system on subset of detector (during the fill) to monitor noise

- ❑ *artdaq*-based DAQ software in consistent use with no major problems

Common SBN Run Control GUI fully supporting data-taking

- ❑ Common online monitoring tools working and providing immediate information on noise/waveforms/etc.

  - ❑ Uses offline tools for decoding data

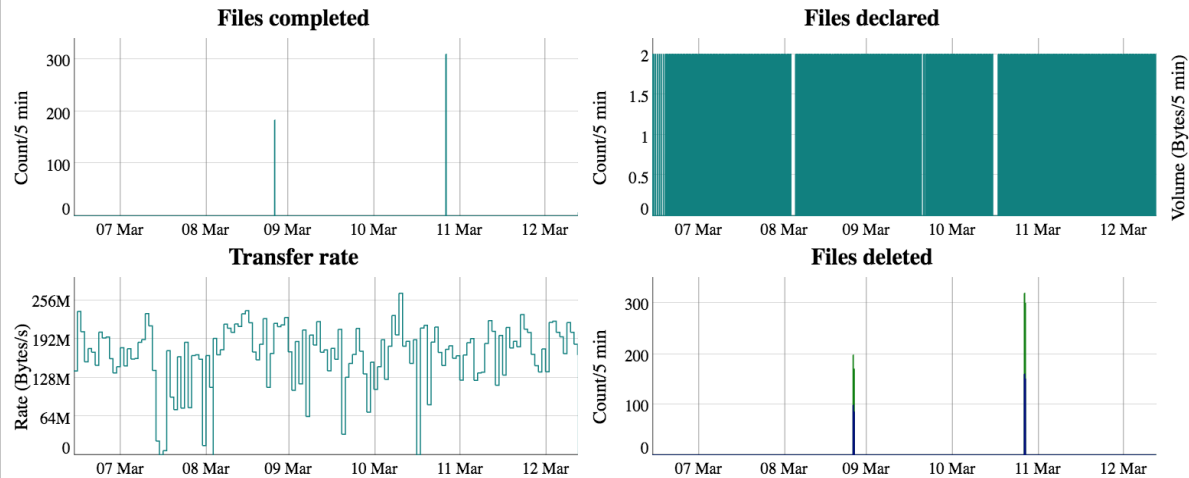**SBN**
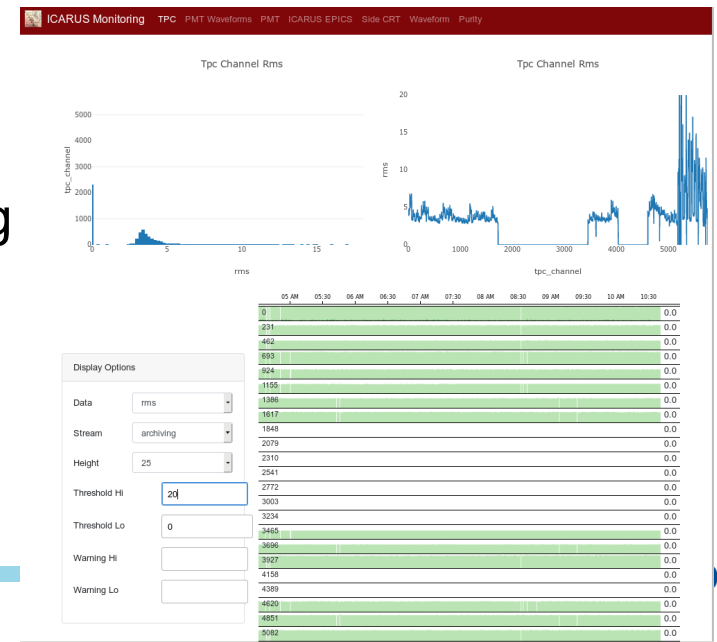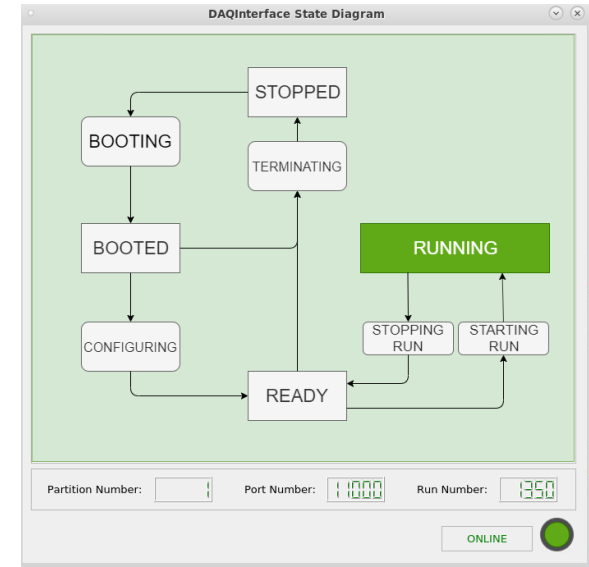
SBN DAQ and Data Pre-processing, continued

❑ Operations setup in ROC-W

    ❑ Testing to be ready for remote shifting ASAP

    ❑ Designing interfaces that can lead to shared operations procedures/infrastructure

SBN DAQ and Data Pre-processing, continued

FTS status for icarus-fts-icarus-evb01

Generated at 2020-03-12 09:15:50 CDT (update)

- ❑ File transfers from SBN-FD to FNAL tape storage is working/accessible for analysis
  - ❑ Common infrastructure, building off work from SBND-VST
  - ❑ Now implementing automated file transfers to offsite locations (CNAF)
- ❑ Other common areas continue to make progress and near testing in production
  - ❑ Event-by-event database info
  - ❑ Software-based trigger inhibiting
 - ❑ Full inclusion of common CRT DAQ

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SBN Slow Controls

Sub-system	Hardware Contact	Hardware Choice/Manufacturer	Software Protocol
Photon Detection System (PDS)	Robert/Bill	CAEN SY5527 HV, CAEN WV8100VME005	Various protocols for CAEN for EPICS; N2 levels in LAr come from Cryo IFIX
Ground Monitoring	Linda	Similar to uB, custom-built	low-level protocols into EPICS
GPS Timing	Bill	GNSSource-2500	low-level protocols into EPICS
Power Distribution Units (PDUs)	Bill	Schneider Electric rack PDU	NetSNMP to EPICS
CPU hardware monitoring	Wes/Bill	KOI computers; Super-micro parts	IPMI to EPICS
Cameras	Steve Hahn	Axis	custom controls provided by VMS services
Purity Monitors	Trevor N / Anne	same as uB/ICARUS	follow uB model
DAQ Servers (CPU load, memory etc.)	Wes/Bill	KOI computers; Super-micro parts	Grafana to EPICS
DAQ Status	Wes/Bill	—	InfluxDB to EPICS
Cryo Status	Trevor N.	Fermilab Cryogenics	IFIX to EPICS
Beam Status	Tom K.	BNB/NuMI	IFBeamDB to EPICS

❑ Beam status

❑ Cryogenic status

   ❑ IFIX-based system working for ICARUS

   ❑ To be developed for SBND (IGNITION-based)

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SBN Cosmic Ray Tagger

Starting the commissioning of side SBN-FD CRT

- Two walls from side SBN-DF CRT have been installed

- Readout electronics have been installed for both walls
  - Reading 600 channels (20 FEBs)

- Taking cosmic data!

- Exercising the DAQ and analyzing the data collected

- Optimizing configurations (thresholds as well as equalizing the gains, etc)

- Modules for the top CRT to be Fermilab soon

- Full side CRT and top CRT to be installed after filling

Charge Spectra: all FEBs
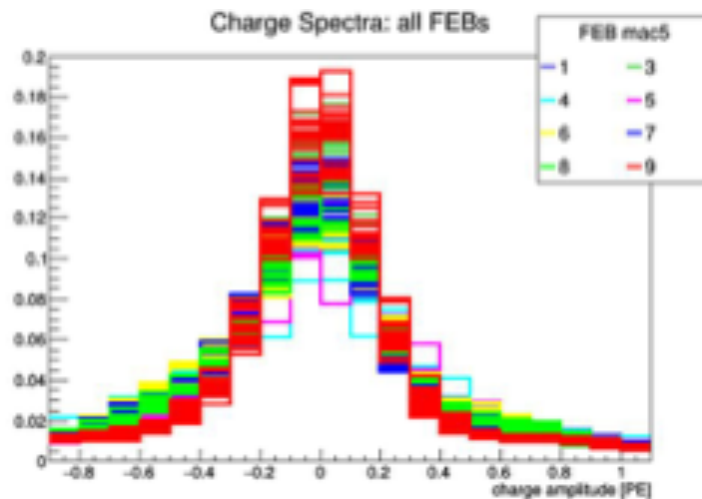
SBN Cosmic Ray Tagger

SBN-ND: CRT Bottom layer installed (Sept. 2019)
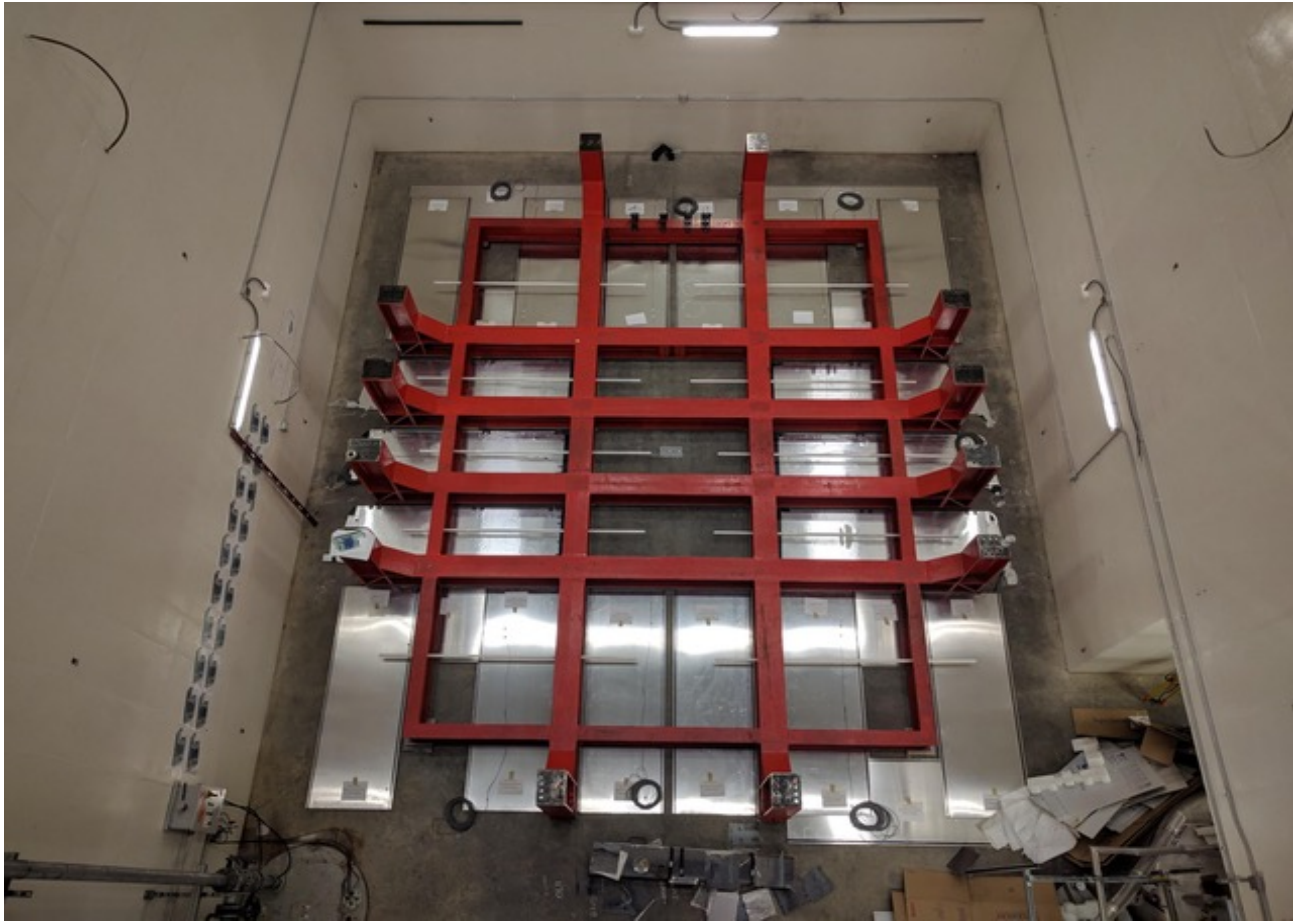
SBN Analysis WG

❑ Work toward **updating the projections of expected physics capabilities of the SBN program** using full simulation and reconstruction

  ❑ Include <u>updated reconstruction efficiencies, performances, systematic effect and background rejection</u> from a full MC simulation of the detectors.

❑ SBN Analysis Group wiki page https://cdcvs.fnal.gov/redmine/projects/sbn-analysis-group/wiki

❑ "Report on the SBN Analysis Working Group" presented by Daniele Gibin at the PAC meeting on January 15th 2020

SBN Analysis Report at the January PAC meeting

Approaching real data...

- The time scale for the oscillation analysis is determined by smooth and well understood operation of Near and Far detectors

- Real data are fundamental to assess the detector performance and understanding and quantifying the experimental systematics

- We are approaching a turning point for the SBN program with the start of the operation of the Far detector

  - The commissioning of the detector and then the collection of the neutrino interactions from the neutrino beams will have priority

  - The selection and reconstruction of the neutrino interaction will be pursued with real data, driving and tuning the tools currently being developed on MC simulations

- The Near detector will become available in the following year

SBN Analysis Report at the January PAC meeting

❑ Main topics, progress on

   ❑ Oscillation sensitivity studies (with 3 fitters, CAFANA, VALOR, SBNFit)
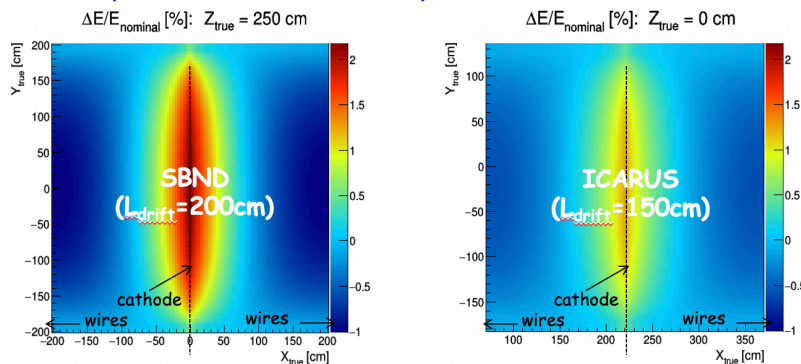
      ❑ Comparison with the proposal

      ❑ Modern era: new GENIE model

   ❑ Detector systematics

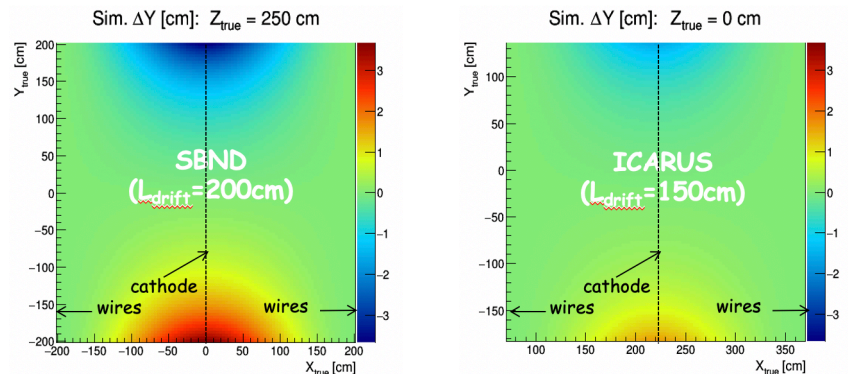   ❑ Event selection and reconstruction and background rejection

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SBN Analysis Report at the January PAC meeting

BNB $\nu\mu$CC event (Eν=1.17 GeV)

31 cm
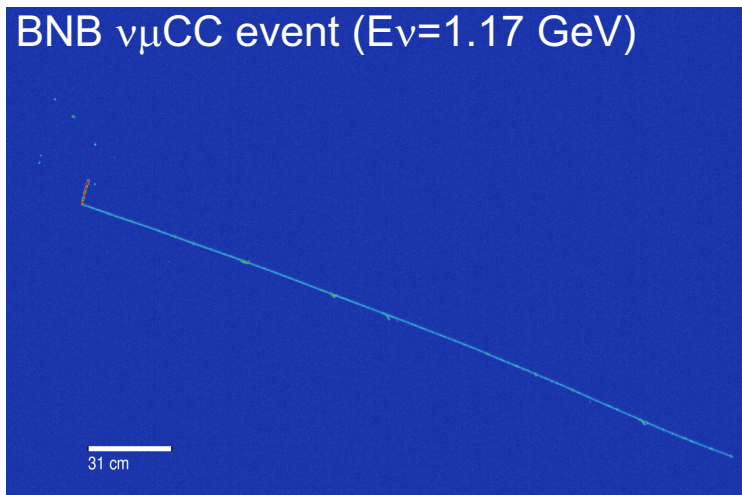
BNB $\nu\mu$CC event (Eν=1.24 GeV) and overlapping cosmics

47 cm

BNB νeCC (Eν=670 MeV)

22 cm

BNB $\nu\mu$NC (Eν=530 MeV)

11 cm
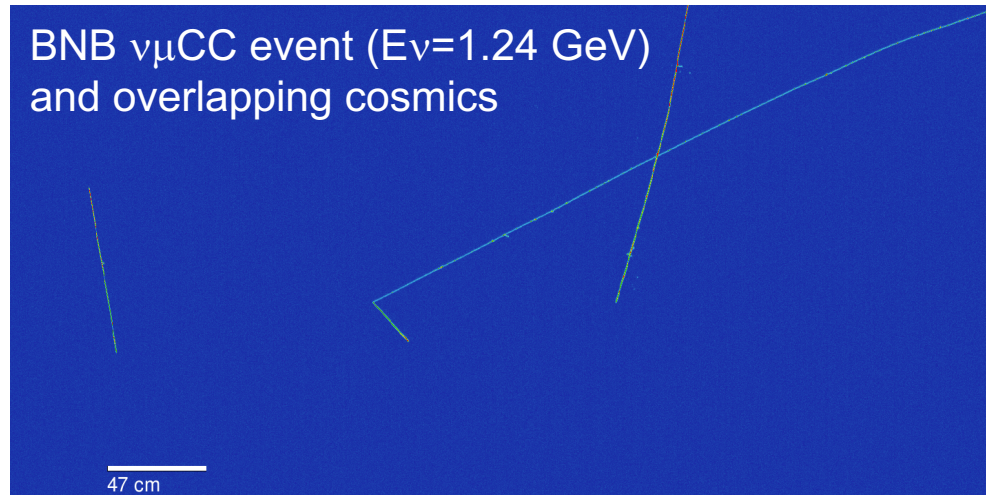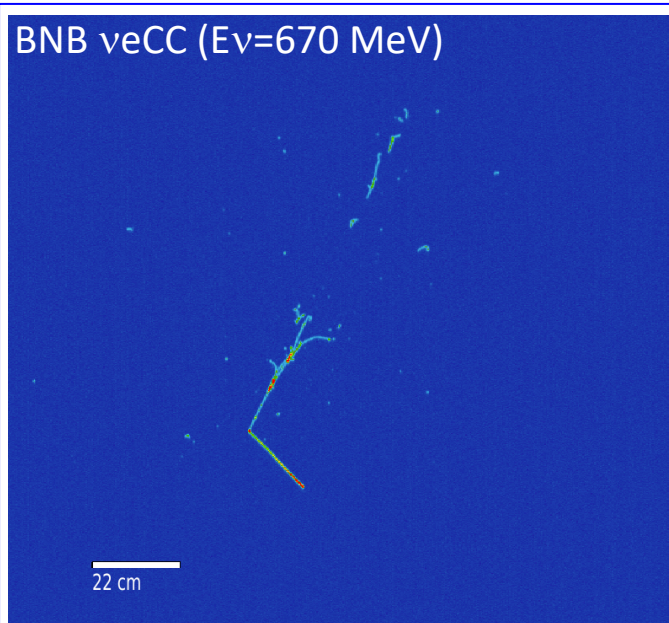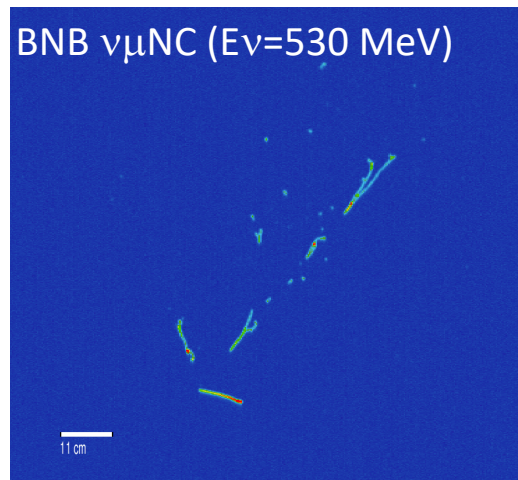
BNB νeCC (Eν=1.13 GeV) and overlapping cosmics

25 cm

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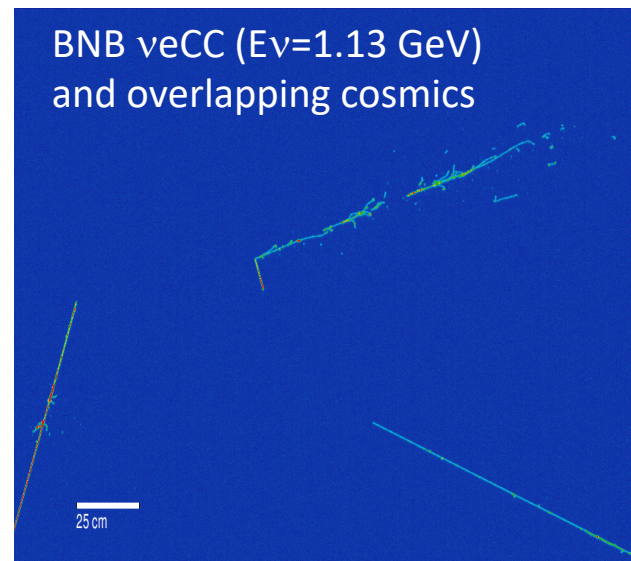
# SBN Analysis Report at the January PAC meeting

Rejection of cosmic with TPC and CRT: SBND case

- First stage Pandora: a topological event reconstruction in the TPC
- Second stage: CosmicID mixing TPC traking/calorimetry and CRT information

- 88% unambiguosly tagged as cosmic by Pandora
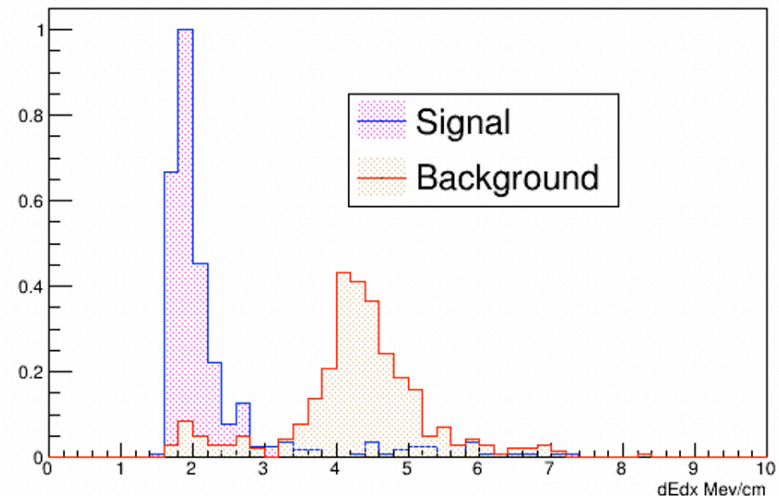
- of the remaining 96% rejected by CosmicID

- In total 99.5% of the cosmic μ are rejected

I stage

II stage
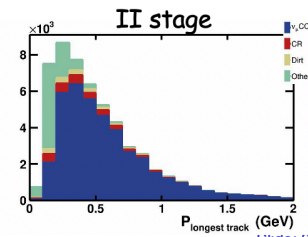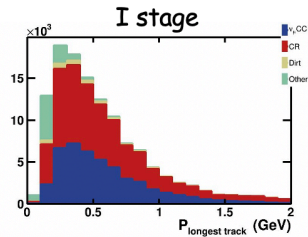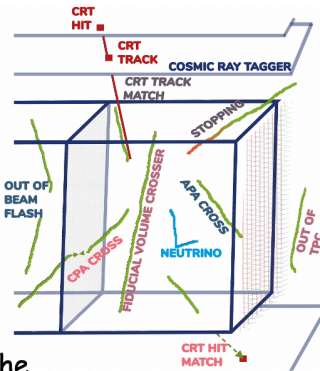
e-γ separation

- promising results with the present stage of the reconstruction tuning:
~90% electron efficiency
~90% γ rejection
for well reconstructed ν vertex

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O. Palamara | SBN-OB Meeting

V SBN Analysis Workshop

Monday, March 23rd - Friday March 27th 2020

❑ Originally planned to be in person at Cern on March 25-29

❑ Re-planning now, to be hold remotely on Zoom

    ❑ Plenary sessions (with updates from the groups, discussions, and tutorials) during the working time windows that are in common between US and Europe

    ❑ Working sessions in different locations for the rest of the day

        ➢ *March 23rd : presentation by the WG conveners of the present status of the WG activities and of the goals for the workshop*

        ➢ *March 24th: Updates from the WGs and 2 general discussions*

            ➢ *SBN software infrastructure (organized by Wesley K. and Joseph Z.)*

            ➢ *Event displays (organized by Marco and Umut K.)*

        ➢ *March 25th: Updates from the WGs and general discussion on the studies and results related to Space Charge effects (managed by the Event Selection and the TPC simulation WG conveners)*

        ➢ *March 26th: Updates from the WGs and general discussion dedicated to studies and tools for the detectors commissioning*

        ➢ *March 27th : Final presentations from the WG with the results obtained and the next steps*

DRAFT AGENDA

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ν SBN Analysis Workshop

❏ Work in parallel in 3 Working Groups

   ❏ Oscillation

   ❏ Event selection

   ❏ Systematics

❏ Software tutorial sessions

   ❏ LArSoft and sbncode

   ❏ Oscillation fitters

   ❏ SBN analysis with Python3

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SBN Analysis Infrastructure

❑ Co-convener (Joseph Zennamo) named
  ❑ Working with pre-existing convener Wes Ketchum

❑ Initial joint SBN milestones identified
  ❑ April: updated assessment of computing and data resources over next 3 years
    ❑ To be presented to FNAL SCD in May
  ❑ May: integrated software release structure with online and offline
    ❑ Supports ICARUS online monitoring and commissioning needs
    ❑ Major focus on effort around SBN Workshop this month
  ❑ Fall 2020: Large-scale production to test ICARUS and SBND simulation data production
  ❑ Winter-spring 2021: Full infrastructure in place for high-statistics SBN-wide production and analysis

❑ Now working with collaborations to identify critical tasks and available effort

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