Fermilab ICARUS Group Activities and Interests

ICARUS Collaboration Meeting

13 May 2018

Fermilab – Host Lab Role for ICARUS

- As host laboratory Fermilab has responsibilities to support the operation of the SBN Program including the SBN detectors. These are independent of the contributions of the Fermilab scientists and postdocs who contribute as members of the ICARUS collaboration

- Operation of the accelerator complex and booster neutrino beamline including providing necessary signals from the beamline to experiment for timing etc

- Oversight of activities in regard to Environment, Safety and Health

  – Provide support for carrying out safety reviews and obtaining necessary Operational Readiness Clearances

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Fermilab – Host Lab Role for ICARUS

- Operational support through Neutrino Division Technical Support Dept. (ND/TSD)
  - Technical support for installation and maintenance
    - E.g. crane operation and logistics for transport of materials on-site
  - Responsibility for operation of the detector cryogenic systems
    - 24/7 on-call support by cryogenic engineers and technicians
    - necessary periodic maintenance such as pump overhauls
    - supply of LN2 and LAr to maintain operation of the detector
  - Technical support for operation of the Remote Operation Center West (ROC-West)
  - Support of operations by the Experiment Liaison Officer (ELO)
    - responsible for identifying necessary technical resources to solve problems on the experiment

- Computing support provided by the Scientific Computing Division (SCD)
  - Networking, storage and computing to ensure the safe storage and processing of data for physics analysis, Monte Carlo and calibration samples
  - Support for online computing systems, networking, and DAQ
  - Management and support for common software (elog, databases, etc.)
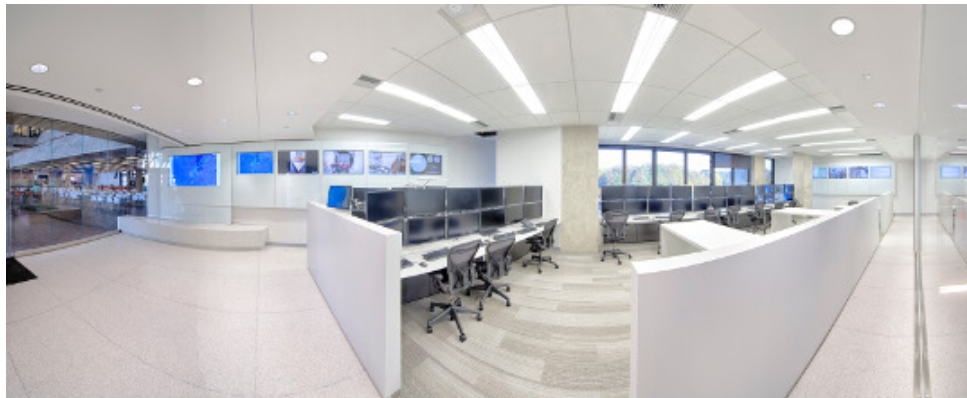
Fermilab Scientists on ICARUS

- Scientists: three senior and five early career
  - Cat James, Gina Remeika, Peter Wilson, Minerba Betancourt, Angela Fava, Wesley Ketchum, Anne Schukraft, Joseph Zennamo

- Post-docs
  - One active post-doc (Simone Marcocci)
  - Number expected to increase soon as paired to early career scientists

- Summer students
  - 6 in 2017: high-school, grad & teachers
 - 8 in 2018: high-school, undergrad, grad & teachers

Activities so far (1)

- TPC readout electronics
  - collaboration with development at CERN test-stand

- Detector grounding and AC distribution
  - design and installation of AC distribution system
  - collaboration with design of grounding scheme and installation of impedance monitor

- CRT
  - installation of bottom CRT panels, complete with readout electronics
  - design of side CRT

- Data acquisition / online
  - co-convening of SBN DAQ and data pre-processing working group
  - design, test and installation of White Rabbit network for timing distribution
  - development and tests of DAQ software for TPC and PMT readout
  - contribution to design of trigger architecture/distribution

Activities so far (2)

- Slow controls
  - co-convening of SBN slow control working group
  - design and development of remote control of inner sensors
  - development and test of remote controls of wire biasing distribution
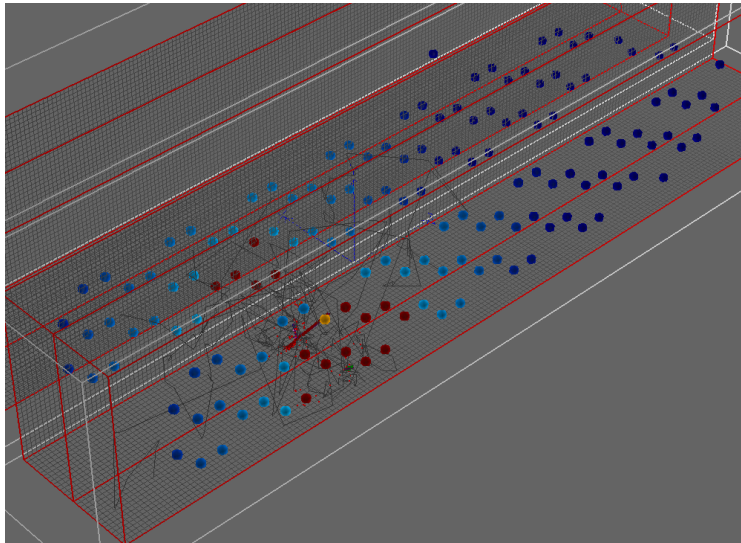
- Software development
  - Integration with common *LArSoft* environment
  - TPC and PMT readout simulation
  - Oscillation analysis framework

Activities of Interest:
Detector Development and Tests

- Improvement of timing and beam signals distribution through White Rabbit.

- Contribution to trigger development (including software for higher level trigger) and integration with DAQ.

- Upgrade of wire electronic test bench to production configuration for testing performance of wires DAQ.

- Racks outfitting & safety review.

- Database design and programming for detector installation, operation and maintenance.

- Integration of the slow control software for the several sub-systems in a coherent picture.

- Tests of DAQ throughput and customization of event builder software.

- Development of run control tools.

- Software for online monitoring and logging.

Activities of Interest:
Installation and Commissioning

- Installation
  - chimneys, crosses and flanges, including external cabling of TPC and PMT
  - CRT bottom and side panels
  - completion of power distribution and detector grounding
  - racks
  - trigger system
  - networking design and deployment
  - additional hardware for slow controls installation and cabling

- Pre-commissioning
  - connectivity & noise/grounding tests (including design of the procedure)
  - wire biasing tests
  - tests of DAQ, slow control and timing/trigger distribution
  - tests of cryogenics equipment, control system, data logging and display

- Detector commissioning
  - wire biasing & readout
  - trigger & timing
  - CRT (and integration with TPC and PMT systems)
  - data taking!

Activities of Interest: Detector Operations

- Detector operation
  - run coordination
    - organization of experts on call
    - interface with Fermilab services and infrastructures
  - TPC calibration
    - periodic calibration with test-pulses (if applicable)
  - Measurement and monitoring of trigger efficiency
  - Online event selection for neutrinos from Booster and (off-axis) NuMI
    - Monitor timing, interaction vertex positions, track angles and length

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Activities of Interest:
Simulation and Reconstruction

- Event Simulation: BNB and NuMI
  - Neutrino event generators and Geant4 simulation
  - CRT
    - Geometric layout and signal simulation
    - Reconstruction of CRT detector signals
  - Light simulation and detector response
- Reconstruction and calibration with cosmic rays
- Event Reconstruction: BNB and NuMI
  - Light reconstruction
  - Track reconstruction
  - Interaction vertex reconstruction
  - Particle identification
  - Electromagnetic shower identification and reconstruction
  - Event classification

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Activities of Interest: Physics Analysis

- ν_e appearance and ν_μ disappearance
  - Oscillation analysis framework
  - Event selections
  - Background studies
  - Systematics (in particular detector related)
  - Oscillation fits

- ν_e and ν_μ cross section measurements with NuMI beam
  - Cross section analysis framework
  - Neutrino flux predictions and constraints
  - Event selection
  - Background constraints
  - Systematics

- Exotic searches
  - E.g. heavy sterile neutrinos with late arrival time

Backup

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SBN program support people

Program Coordinator – *Peter Wilson*

Deputy Coordinator – *Cat James*

Program Engineer – *Barry Norris*

Program Electrical Coordinator – *Linda Bagby*

Program Integration Engineer – *Andy Stefanik*

ICARUS Installation Coordinator – Aria Soha

Transport Logistics – *Michael Dinnon*

Administrative Support – *Etta Johnson*

ES&H Coordinator – *Angela Aparicio*

Technical Coordinators:

SBND – *Brian Rebel*

ICARUS – *Claudio Montanari,*

      Angela Fava - deputy

Infrastructure – *Cat James*

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