



U.S. DEPARTMENT OF
ENERGY

Office of
Science

Workshop Goals

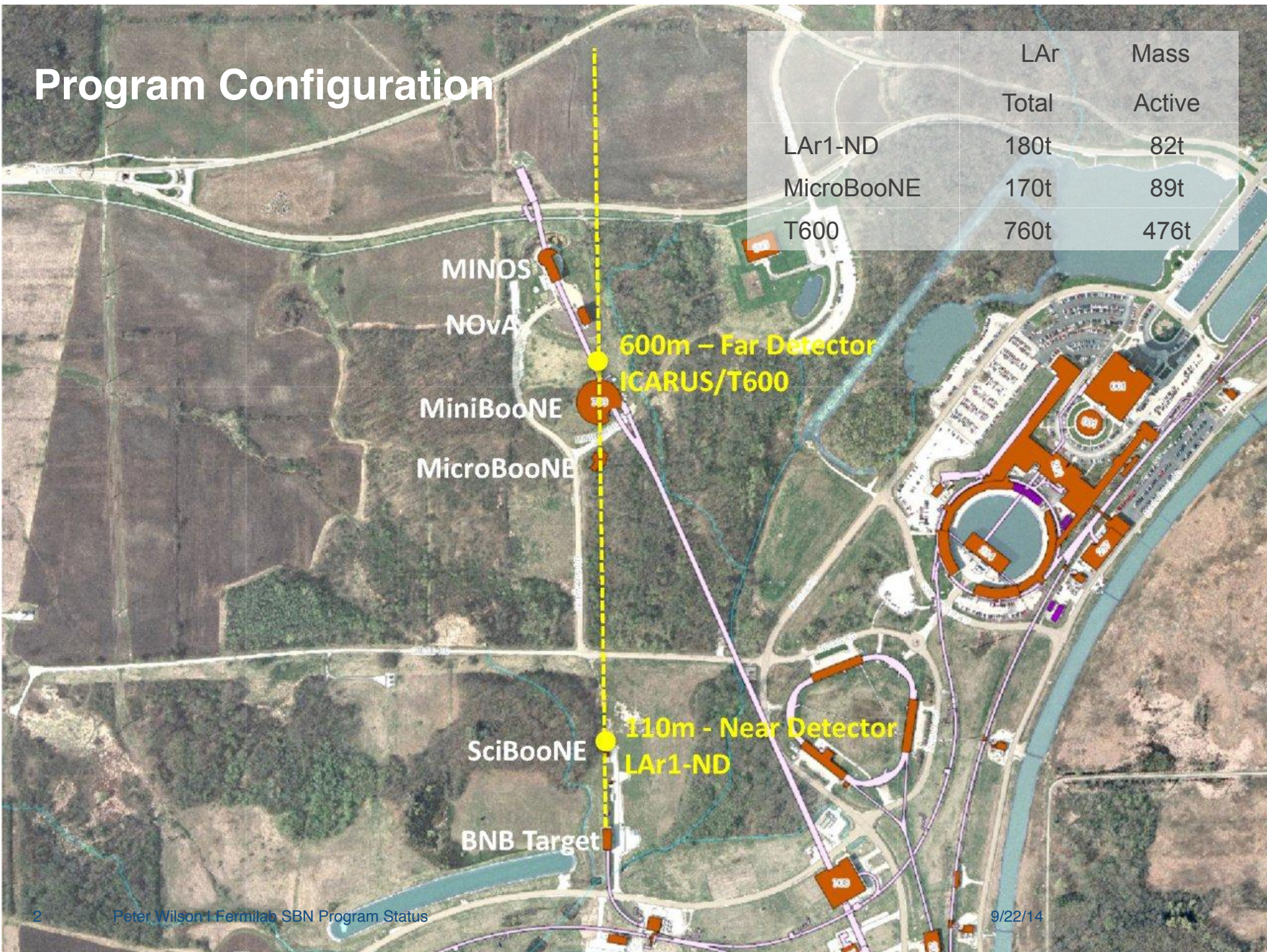
Peter Wilson

SBN Program Coordinator

26 September 2014

Program Configuration

	LAr	Mass
	Total	Active
LAr1-ND	180t	82t
MicroBooNE	170t	89t
T600	760t	476t



PAC Report Excerpts

The committee notes that the burden of proof for any claim for observing neutrino oscillations associated with sterile states is very high. Furthermore, a definitive program must be able to provide robust conclusions if the excess is due to unknown photon production mechanisms or deficiencies in our understanding of neutrino-nucleus interactions. The committee would like to see a detailed analysis of the added value of the three-detector program for clarifying the accelerator anomalies that some interpret as evidence for sterile neutrinos. **This analysis should not only be in terms of sensitivities to a 3+1 scenario, but should also include a discussion of what would be learned in more general terms by having all three detectors in scenarios where, for instance, MicroBooNE has observed an excess of photons, an excess of electrons, or no excess whatsoever by the start of data-taking of the other two detectors.**

PAC Report Excerpts - cont

The committee also appreciates the first steps towards a rigorous sensitivity study that are the basis for demonstrating the robustness of the proposed program. **As this effort proceeds to a full proposal, the following uncertainties and issues and their impact in interpreting an excess of photons or electrons and the ν_μ disappearance analysis should be studied and quantified in detail:**

- neutrinos produced from out-of-target particle production that may introduce significant differences in the neutrino flux at the near and far sites.
- detector performance and systematics, including those arising from the differences between the three detectors.
- neutrino cross sections and interaction modeling
- cosmogenic backgrounds, including coincident cosmic muons and neutrons.
- beam-induced neutrons.

Efforts of WG 1 and 2 focused on these issues

PAC Report Excerpts - cont

The committee also notes the following issues:

- The coordination of the LAr1ND construction and ICARUS installation presents a schedule risk. **The laboratory should ensure that the appropriate coordination is in place, either through the SBN program coordinators or other appropriate mechanism.** The role of NESSIE should also be clarified.
- **The three collaborations have yet to reach an agreement regarding access to data from the three detectors or coordinating the overall analysis effort. A formal plan towards this end should be developed before the proposal is submitted.**
- With the differing detector technologies in the SBN program and uncertainties in the configuration of the LBNF detectors, the alignment of the R&D effort for the SBN program with the LBNF is uncertain and should be further clarified. The relation to other LAr R&D efforts at Fermilab and elsewhere should also be articulated.
- The Booster Neutrino Beamline is currently minimally instrumented with effectively no monitoring downstream of the production target. The need and benefit of additional appropriate instrumentation should be considered.

PAC Recommendation

The committee recommends that Fermilab assists the collaborations in tackling the above issues by providing necessary resources and manpower, including consultation with outside experts and facilitating further cooperation and collaboration between the three experiments. MicroBooNE is already funded and proceeding, and CERN has provided resources through the WA104 project to refurbish and move ICARUS, which also has support from INFN, so the PAC would be pleased to see Fermilab provide resources for LAr1-ND detector R&D (which has now received NSF funding) to move ahead (perhaps by designating it a Test experiment) in preparation for the submission of a proposal.

- LAr1-ND given status of test (T-1053) plus funding under R&D program
- Planning for facilities continues for both detectors

SBN Working Groups

- Four Working Groups formed to address key issues for optimizing the experiment configuration for the conceptual design of SBN program.

1. Cosmic Backgrounds

- Impact of cosmic showers on oscillation searches
- Mitigation strategies
- Conveners: Paola Sala, Michele Weber

2. Neutrino Flux and Systematics

- Optimization of detector location (eg near at 100m, 150m, or 200m?)
- Possible optimization of BNB for higher flux/proton on target
- Conveners: Daniele Gibin, Ornella Palamara

3. Detector Building Configuration and Siting

- Building requirements
- Cost and schedule: fit in budget for GPPs (far detector \$10M, near detector \$3M)
- Conveners: Alberto Scaramelli, Peter Wilson

4. Cryostat and Cryogenic System Design and Integration

- Design of cryogenics including possibility of standardized cryogenics systems for near and far detectors.
- Optimization of near detector design such as cryostat dimensions.
- Conveners: Claudio Montanari, Barry Norris

Post PAC Meeting:
WG 1 and 2 meet jointly
focused on addressing key
issues for Proposal.
Discussions today and
tomorrow.

WG 3: Report from Steve
Dixon

WG 4: Cryogenics
workshop last two days.
Report from Barry/Johan

Additional WGs?:

- Reconstruction – discussion tomorrow
- BNB improvements – report from Zarko today

Schedule and Milestones

- Goal: detectors ready for data taking in Spring 2018.
- Detailed schedule not yet prepared, presented here is a first pass at high level milestones
- Construction of buildings and cryostats are on critical path
- Preparation of proposal and CDRs must proceed quickly to define requirements for buildings and cryogenics systems

High Level Milestones

Milestone	Date
Submission of a detailed SBN proposal for peer review	Dec 2014
Final CE requirements ready final building design	Dec 2014
Near detector cryostat engineering study contracted	Jan 2015
T600 at CERN, refurbishing starting	Dec 2014
Cryogenic plants proposal submitted for peer review	Mar 2015
LAr1-ND technical proposal submitted for peer review	Mar 2015
Ground breaking for far detector building	May 2015
Cryogenics procurement plans released and active	Sep 2015
Ground breaking for near detector building	Oct 2015
LAr1-ND cryostat procurement contract issued	Dec 2015
Buildings ready, utilities installation start	Oct 2016
Start cryostat assembly for near detector at Fermilab	Oct 2016
T600 ready at CERN for transport	Nov 2016
T600 detector arrives at Fermilab	Mar 2017
Start LAr1-ND detector installation	Apr 2017
Start cryogenic plant commissioning	Aug 2017
LAr1-ND and T600 installed	Sep 2017
Start detectors cooling and commissioning	Nov 2017
Start data taking with beam	Apr 2018

Draft Outline for SBN Proposal

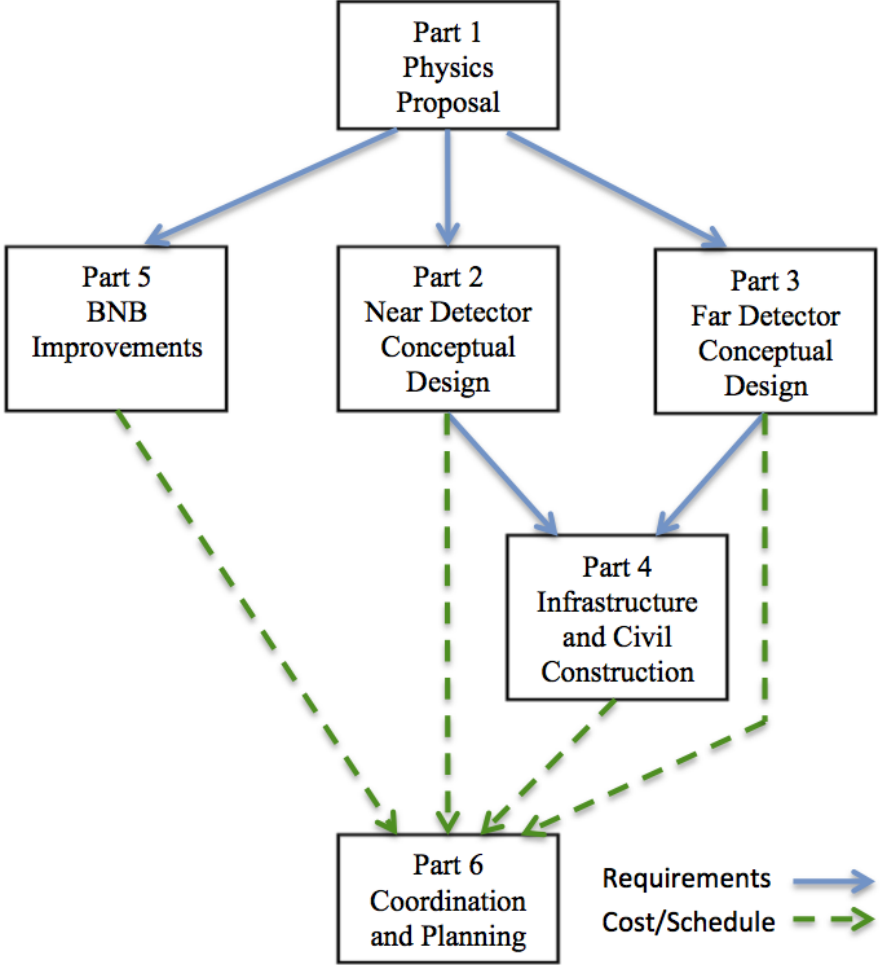


Diagram of Requirements Flow

Proposed Schedule to PAC Meeting

- Sept 26-28 - SBN Working Meeting at CERN
- October/November
 - Specialized working meetings
 - WG 1/2
 - BNB Upgrades?
 - Reconstruction?
 - Prepare draft sections of document (ND design, FD design,...)
- Nov 14-21 - SBN Proposal Meeting (~3 days)
- Dec 5 – Proposal draft ready for review by members of the collaborations
- Dec 21 - Proposal Submission Deadline
- Jan 14-16 - PAC Meeting

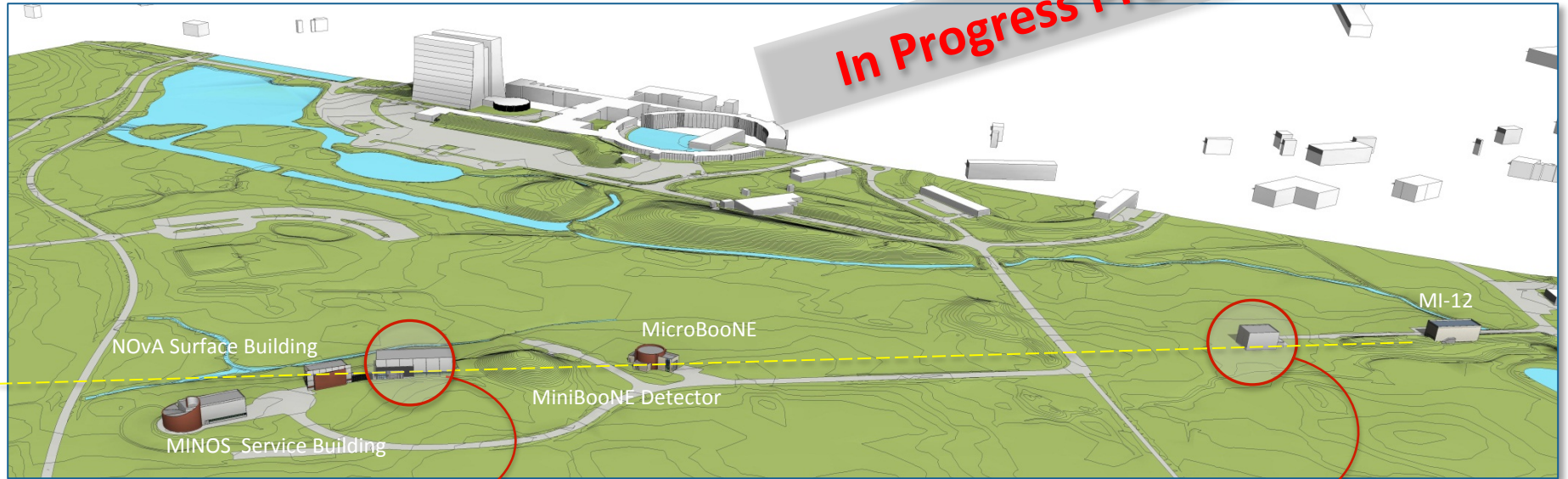
Goals for the Next Two Days

- Focus on components of PAC Proposal
 - Proposed detector configurations (e.g. size of near detector)
 - What are the requirements on the detector systems?
 - Possible beam improvements
 - Physics reach of the proposed configuration
 - Answers to PAC questions (e.g. systematics)
- What questions are still unanswered?
- What is the path to answering them for the proposal?

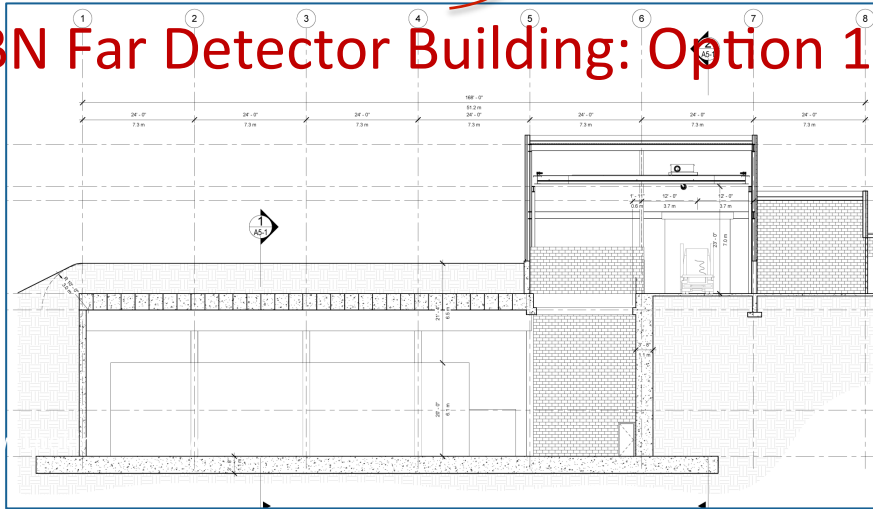
Backup Materials

Aerial View from West

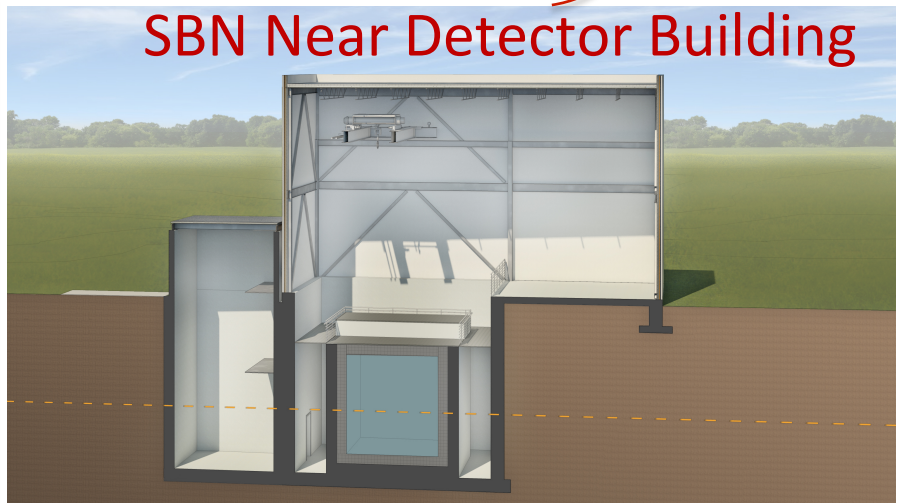
In Progress Preview



SBN Far Detector Building: Option 1



SBN Near Detector Building



Fermilab Experiment Schedule

Fermilab Program Planning

Fermilab Accelerator Experiments' Run Schedule

12-Feb-14

		FY 2014				FY 2015				FY 2016				FY 2017			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Neutrino Muons	B	MiniBooNE-DM		<small>μBooNE</small>		MicroBooNE			MicroBooNE			MicroBooNE					
		OPEN		g-2		g-2			g-2			g-2					
		OPEN				OPEN			OPEN	Mu2e		Mu2e					
Neutrino Program	MI	MINOS+				MINOS+			MINOS+			MINOS+					
		MINERvA				MINERvA			MINERvA			MINERvA					
		NOvA				NOvA			NOvA			NOvA					
SY 120	MT	FTBF - MTest				FTBF - MTest			FTBF - MTest			FTBF - MTest					
	MC	OPEN	FTBF - MCenter			FTBF - LArIAT			FTBF - LArIAT			FTBF - MCenter					
	NM4	SeaQuest	SeaQuest			SeaQuest			SeaQuest			SeaQuest		OPEN			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

- RUN/DATA
- STARTUP/COMMISSIONING
- INSTALLATION/COMMISSIONING
- M&D (SHUTDOWN)
- INSTALLATION & RUNNING

Anticipate mid-year maintenance shutdowns of 6 week + 2 weeks commissioning
 NOvA CD-4 end of Nov 2014, MicroBooNE first beam for commissioning July 2014
 MicroBooNE "installation" start defined as time when BNB target reinstalled.
 g-2 and Mu2e installations defined as starting when buildings ready.
 Continued MINERvA & MINOS+ running through FY07 assumed - to be reviewed