



U.S. DEPARTMENT OF  
**ENERGY**

Office of  
Science

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# Plan to go forward

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27 September 2014

# Time Constraints

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- PAC Proposal Due – Dec 21, 2014
- Start Detector installation summer 2017

# Proposed for PAC Proposal Document

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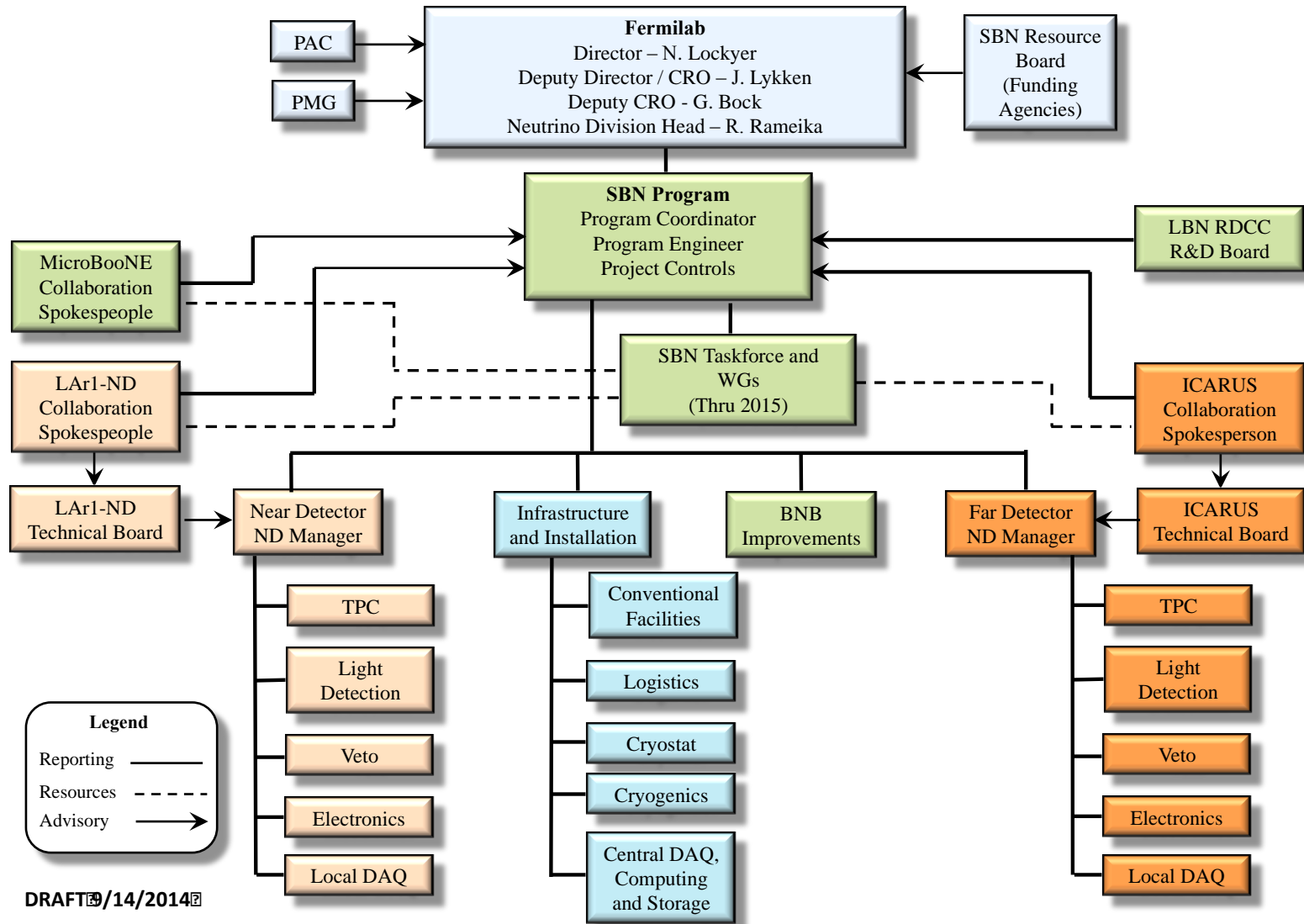
- October:
  - Designated authors write parts of document in parallel
    - Part 1 Physics – Dave/Alberto?
    - Part 2 LAr1 Conceptual Design – Ornella?
    - Part 3 Icarus Conceptual Design – Claudio?
    - Part 4 Infrastructure – Barry/Johan/Steve?
    - Part 5 BNB – Zarko?
    - Part 6 Coordination/Schedule – Peter/Marzio?
    - **Drafts due: Oct 31**
  - Specialized working meetings
    - BNB Upgrades, etc
- Nov 15-16? - SBN Proposal Meeting – where (FNAL...)?
- Nov 21 – Complete Proposal ready for review by members of the collaborations
- **Dec 21 - Proposal Submission Deadline**
- **Jan 14-16 - PAC Meeting**

# Evolution of Working Groups

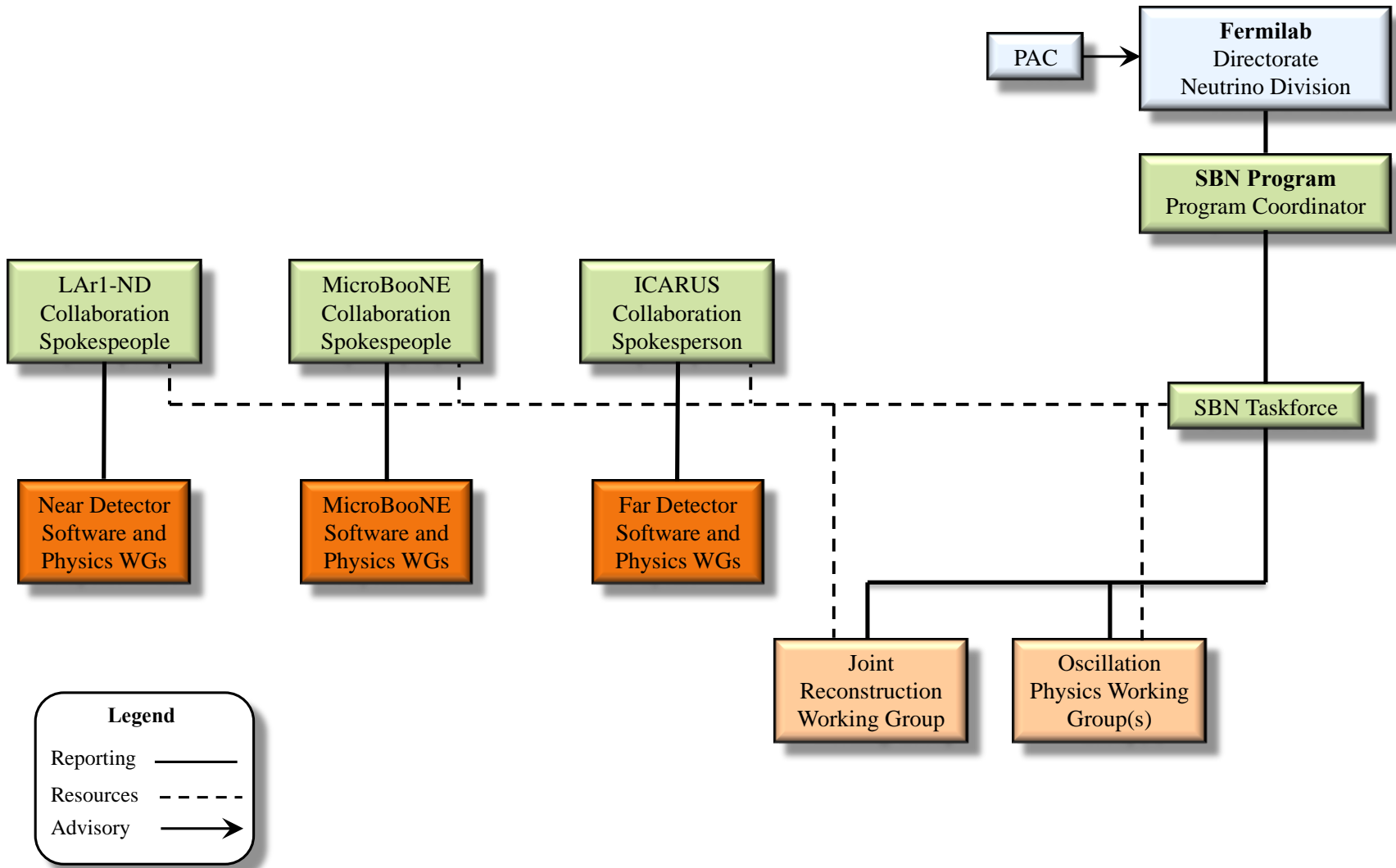
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- WG 1 and 2 -> Oscillation Physics Analysis Group
  - Meetings in October to answer critical questions for proposal
- WG 3 – Facilities
  - Concentrate on final design requirements, far detector by November?
- WG 4 – Cryogenics/Cryostats
  - Start design by CERN/Fermilab team, need final specifications for cryostats
- Create BNB Upgrade working group
  - Zarko as convener
  - Virtual meeting in early October
- Create Joint SBN Reconstruction group?
  - October: Name conveners
  - Initiate activities after PAC meeting

# Proposed Detector Organization (2015-2018)



# Science Collaboration – Example 1: First Step



# PAC Report Excerpts

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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

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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  $\nu_\mu$  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

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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

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*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

# Goals for the Next Two Days

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- 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

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