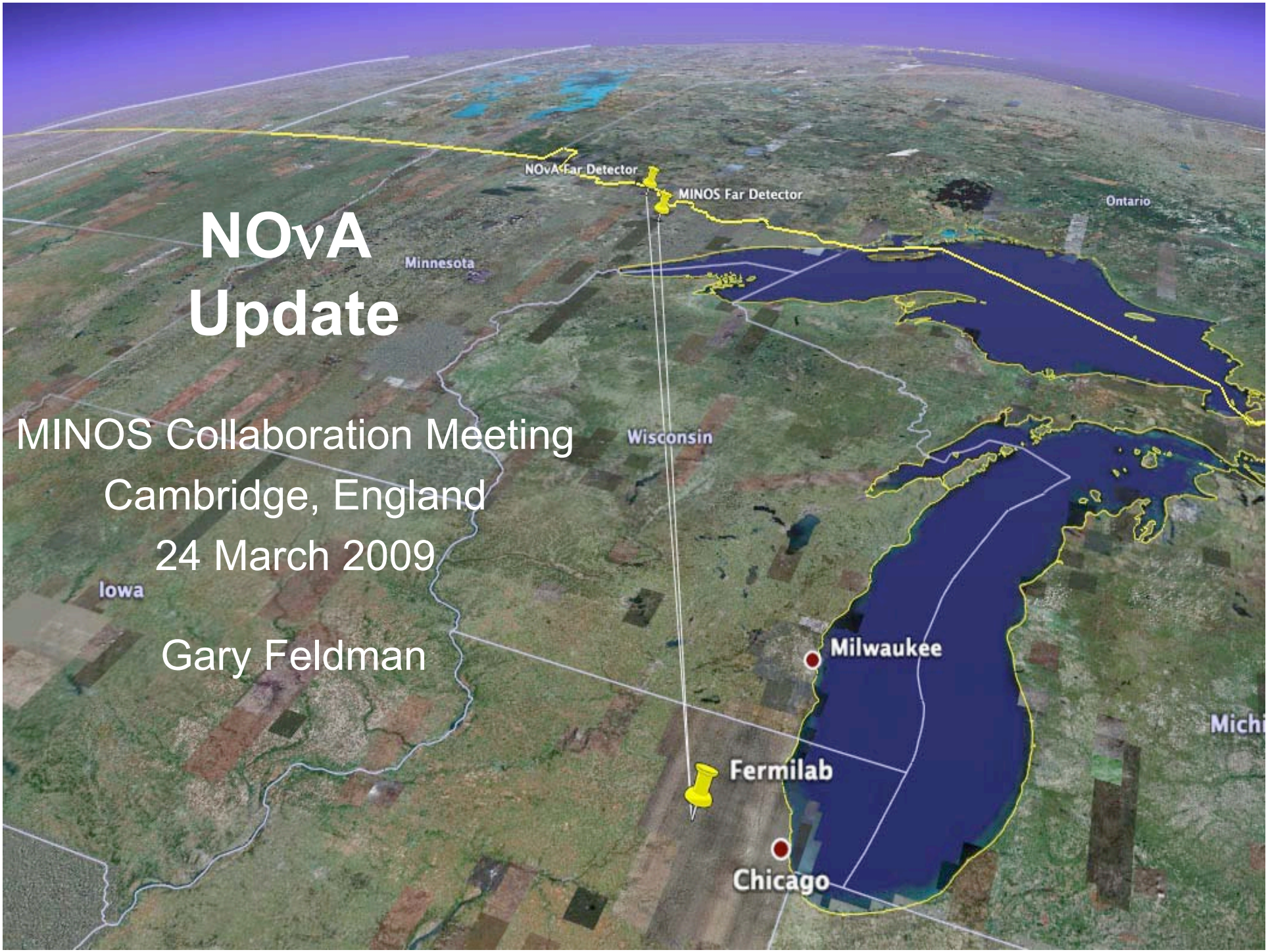
NOνA Update

MINOS Collaboration Meeting

Cambridge, England

24 March 2009

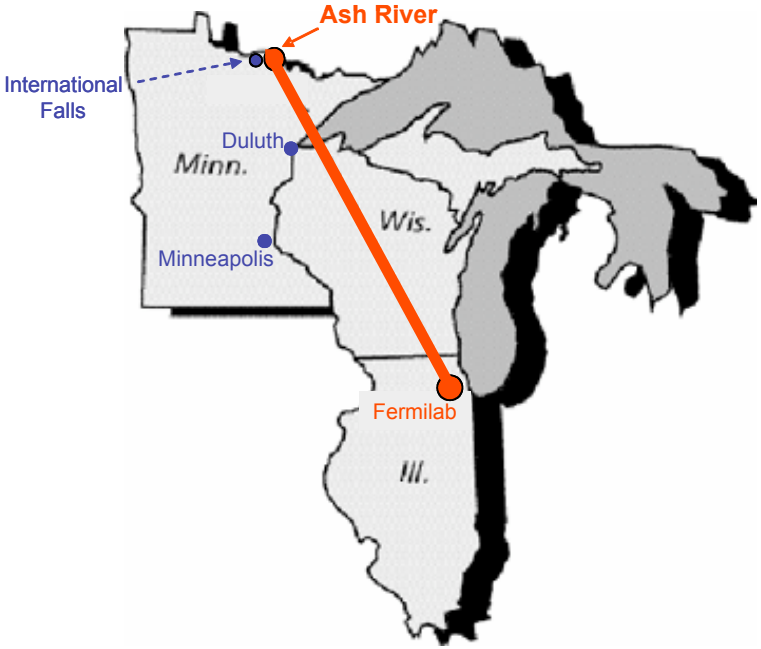
Gary Feldman

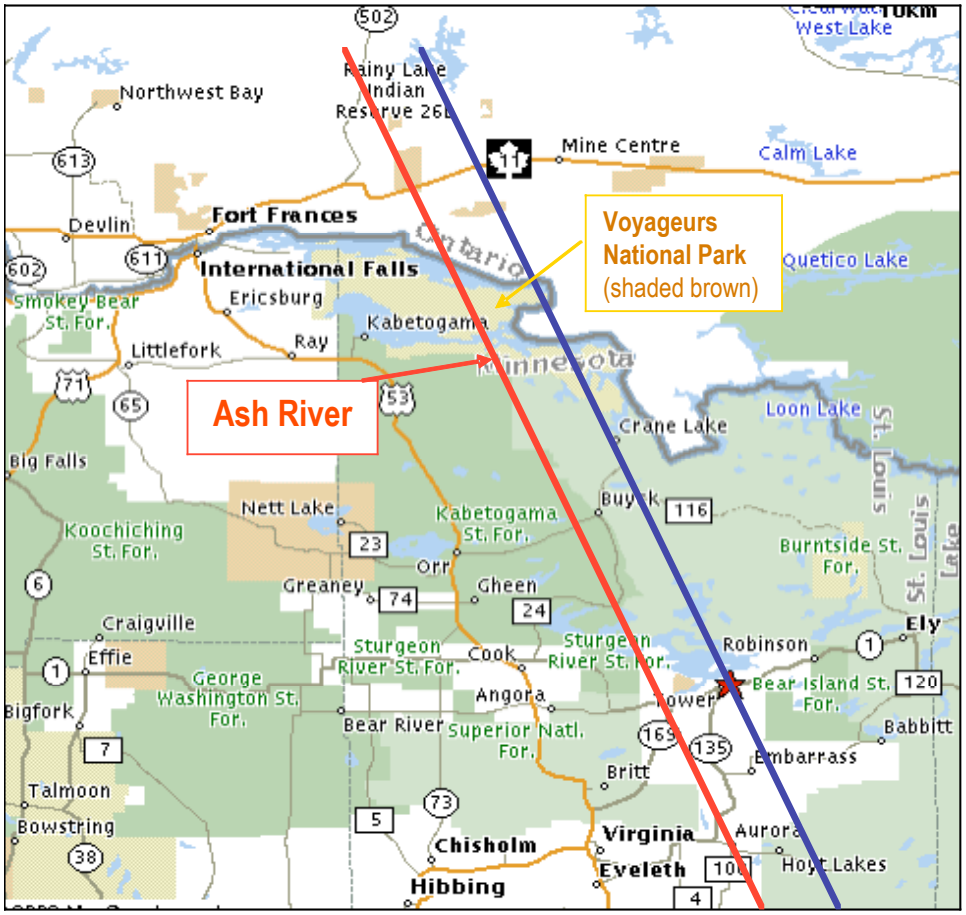


For Newcomers: What is NOνA?

- NOνA is a second-generation experiment on the NuMI beamline, which is optimized for the detection of $\nu_\mu \rightarrow \nu_e$ oscillations.
  - It will give an order of magnitude improvement over MINOS in measurements of ν_e appearance and ν_μ disappearance.
- NOνA is a "totally active" tracking liquid scintillator calorimeter, sited off-axis to take advantage of a narrow-band beam.
- The NOνA project also includes accelerator upgrades to bring the beam power from 400 kW to 700 kW.
- NOνA's unique feature is its long baseline, which gives it sensitivity to the neutrino mass ordering.
- NOνA is complementary to both T2K and Daya Bay.

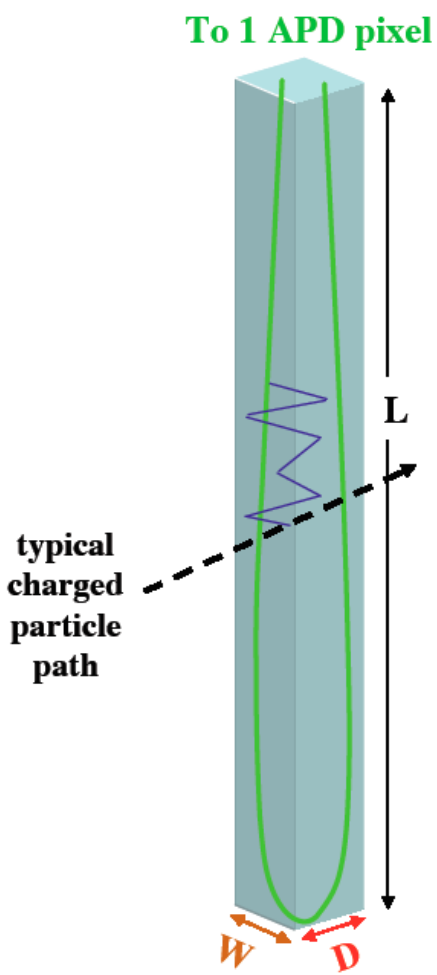
NOνA Site





The Ash River site is the furthest available site from Fermilab along the NuMI beamline. This maximizes NOνA's sensitivity to the mass ordering.

NOνA Basic Detector Element

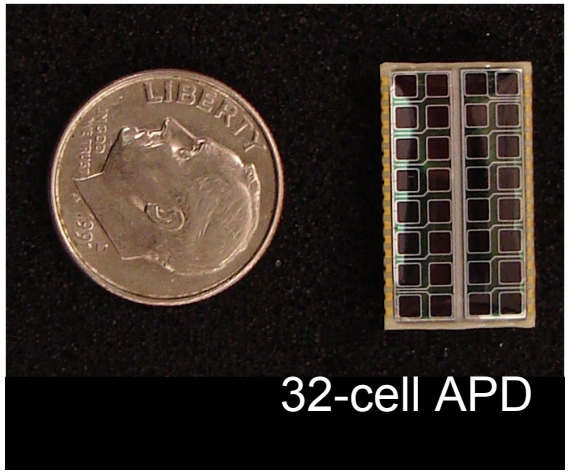


Liquid scintillator in a 4 cm wide, 6 cm deep, 15.7 m long, highly reflective PVC cell.

Light is collected in a U-shaped 0.7 mm wavelength-shifting fiber, both ends of which terminate in a pixel of a 32-pixel avalanche photodiode (APD).

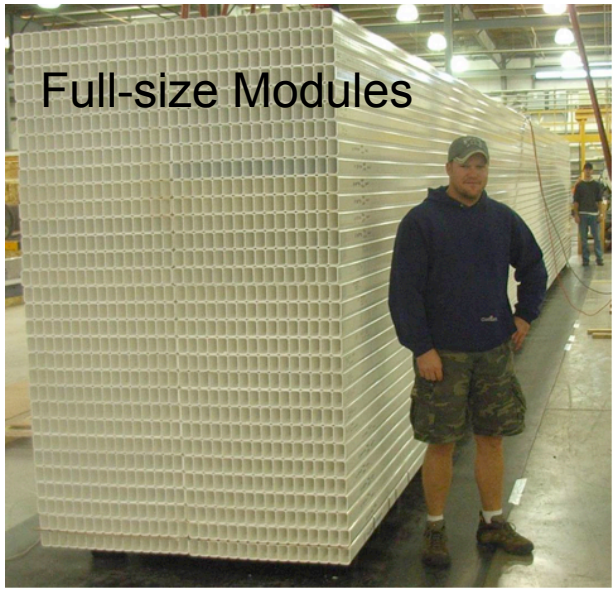
The APD has peak quantum efficiency of 85%. It will be run at a gain of 100. It must be cooled to -15°C and requires a very low noise amplifier.

Fiber Stringing Machine



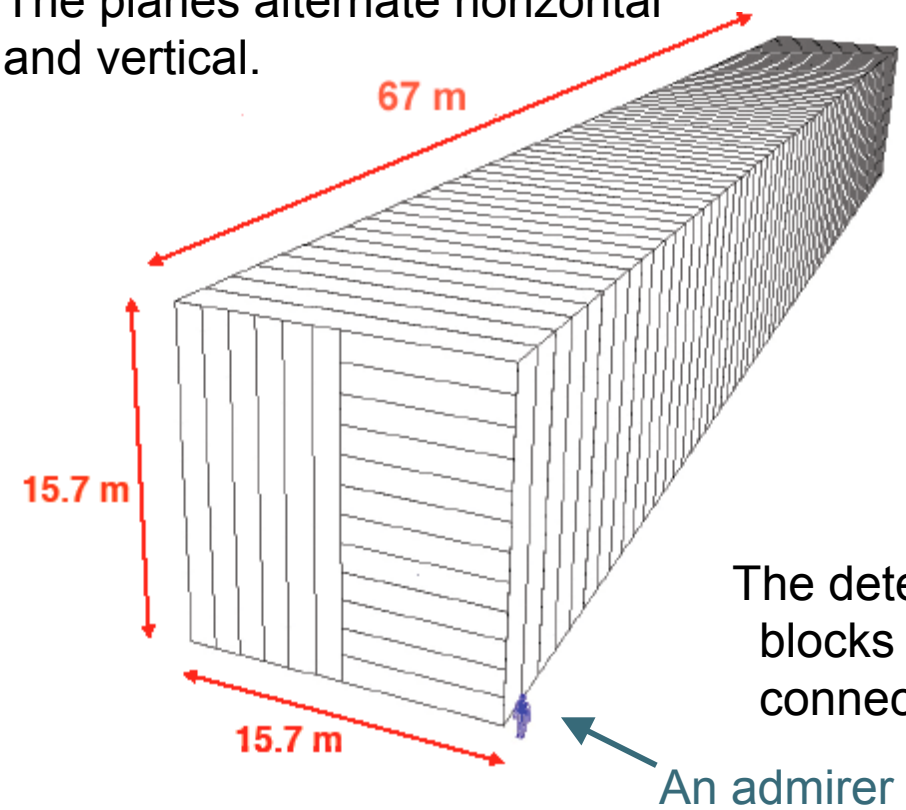
32-cell APD

Far Detector



The cells are made from 32-cell extrusions.

12 extrusion modules make up a plane. The planes alternate horizontal and vertical.



There are 1003 planes, for a total mass of 15 kT. There is enough room in the building for 18 kT, which can be built if we can preserve half of our contingency.

The detector can start taking data as soon as blocks are filled and the electronics connected.

Funding: Bust and Boom

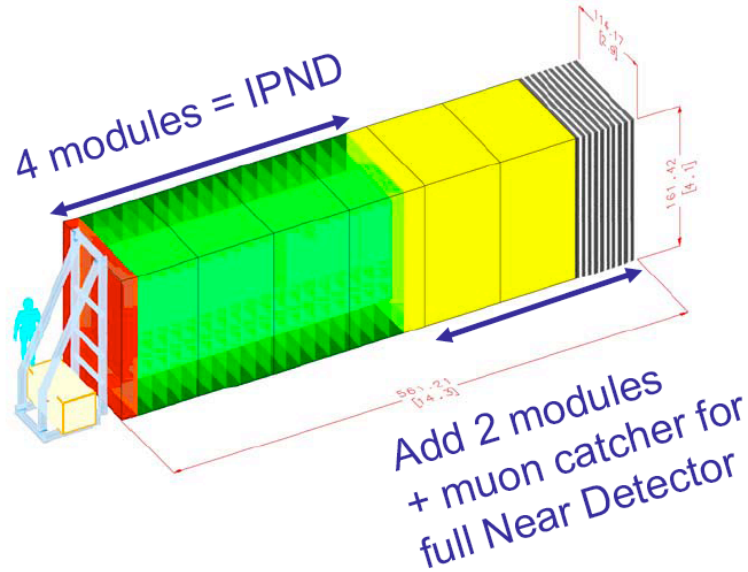
- Dec 2007: FY08 Omnibus Funding Bill zeros NOνA funding.
- July 2008: FY08 Supplemental Bill gives NOνA $9M.
- September 2008: CD-2 approved.
- October 2008: CD-3a approved for $24M.
- October 2008: Continuing Resolution gives NOνA $11M.
- February 2009: ARRA (Stimulus) gives NOνA $50 M with the possibility of another $5 M later.
- March 2009: FY09 Omnibus Funding Bill gives NOνA an additional $17M.
- However, no apparent change in schedule.

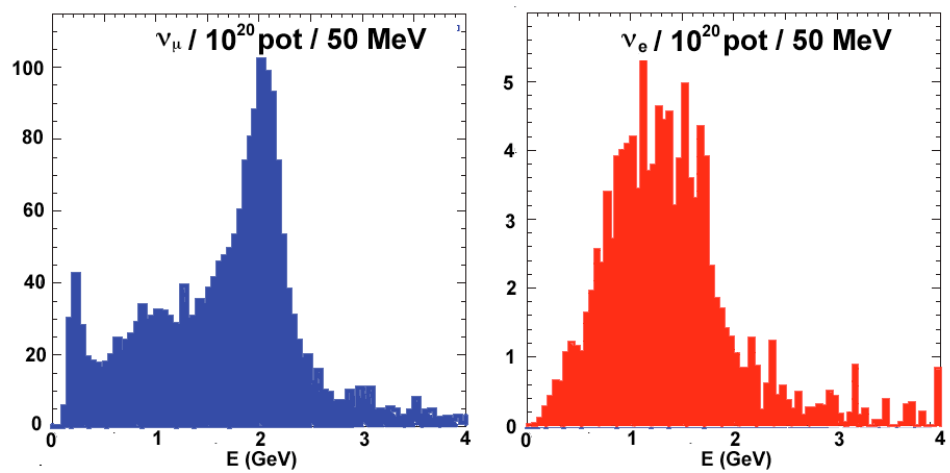
Far Detector Building

- Plan is to go out for bids for the whole building now. Estimate is $43M.
- Land purchase, easements, and wetland permits are complete.
- March 9 – Issued request for proposals.
- April 15 – Proposals due.
- April 28 – Award contract, notice to proceed.
- May 1 – Ground breaking ceremony.

IPND = Near Detector

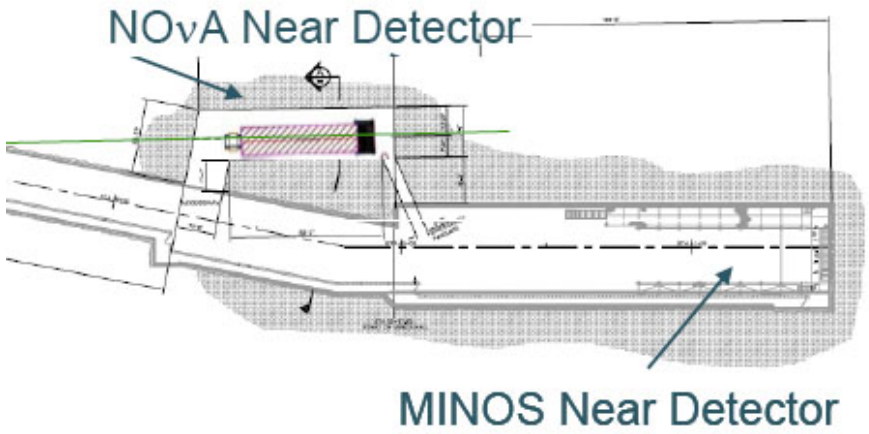
- Discussion of making the full near detector for the Integration Prototype Near Detector.
- Will not fit in the MINOS surface building, so put it outside in a temporary shelter.
- Possible shielding test.
- Running a year from now.
- Trisha Vahle is chairing a calibration task force to set requirements and consider whether a test beam run is necessary.





Near Detector Cavern

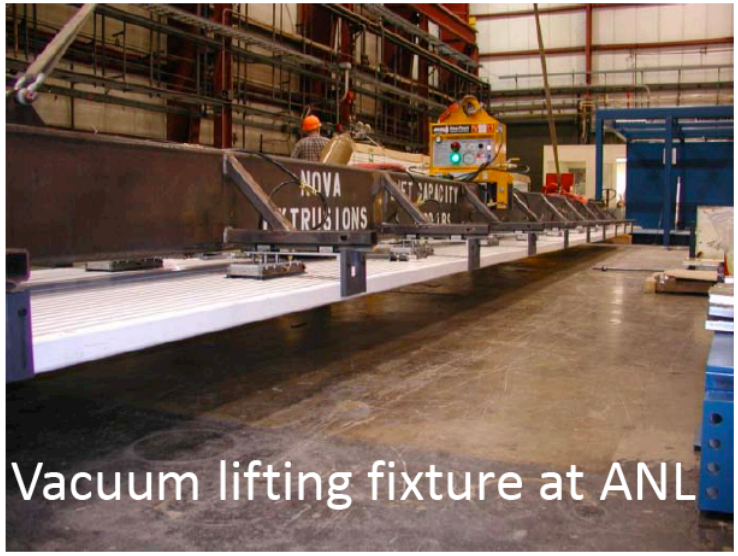
- First estimate for the near detector excavation was $5.3 M (using blasting). This creates a possible bureaucratic problem.
- New estimate is $3.5 M from a different company using a road header (no blasting). The problem disappears, and installed experiments will be happier.



Road Header

Far Detector Assembly

- A critical operation for assembling the far detector is the ability to lift modules from a stack, put them on a gluing station, turn them upside down, apply adhesive, turn them right side up, lift them and place them accurately on the growing block assembly, one every 13 minutes (pipelined).
- A test of this will be the Full Size Assembly Prototype, to be assembled starting next month at Argonne.
- We are now awaiting new pumps for the gluing machine.



Vacuum lifting fixture at ANL

Other Tests and Work

- A full pressure scintillator leak test is underway in C0. No leaks so far.
- A Full Height Engineering Prototype is planned for the CDF pit.
- All other final design work and tests are proceeding.

Schedule Highlights

- Ash River ground breaking — May 1, 2009
- EVMS review — May 11-15, 2009
- DOE CD 3b review — July 21-23, 2009
- IPND operational — March 2010
- Beneficial occupancy far detector building — May 2011
- 10-12 month accelerator shutdown — July 2011
  - Installation of NOνA Recycler components
  - Near detector cavern excavation
- First 2.5 kT operational — August 2012
- Full Far Detector operational — December 2013