NOνA Update

MINOS Week-in-the-Woods

13 June 2009

Gary Feldman

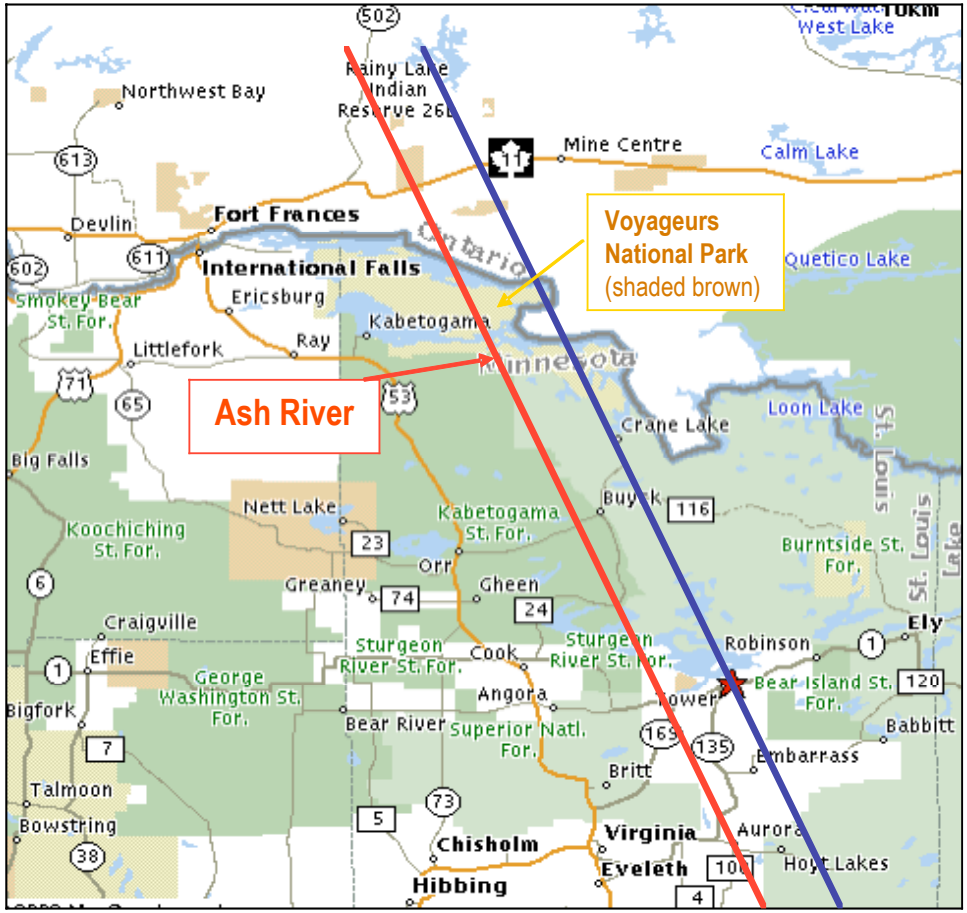
For Newcomers: What is NOνA?

- 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.

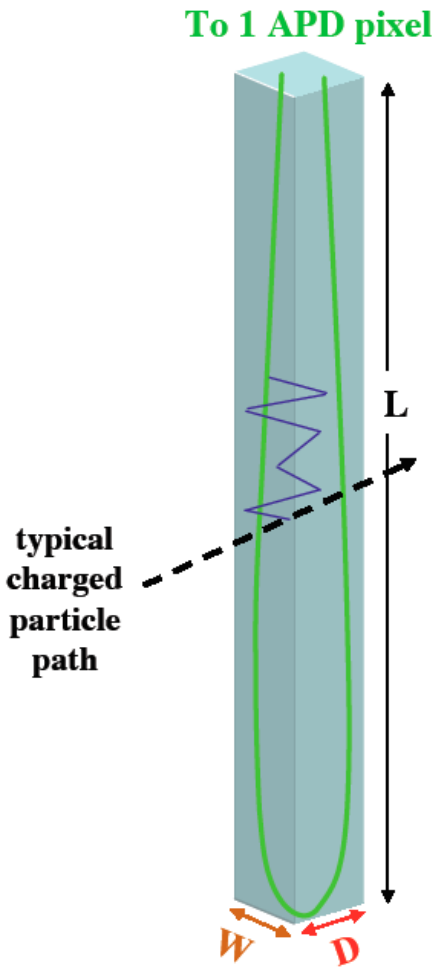
NOνA Site

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

The off-axis beam provides a narrow band beam near the oscillation maximum, giving more signal and less background than an on-axis beam.



NOvA Basic Detector Element

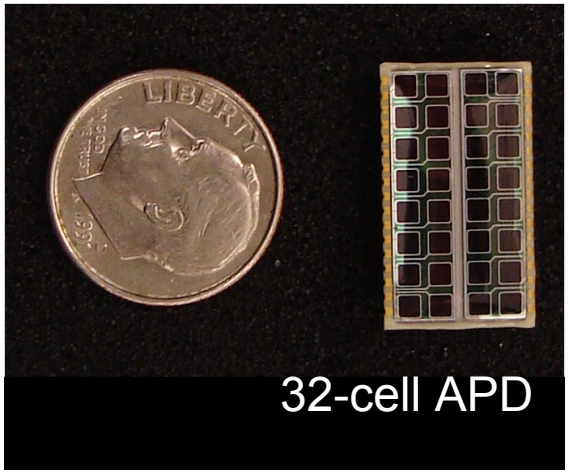


Liquid scintillator in a 4 cm wide, 6 cm deep, 15.7 m long, highly reflective PVC cell.

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).

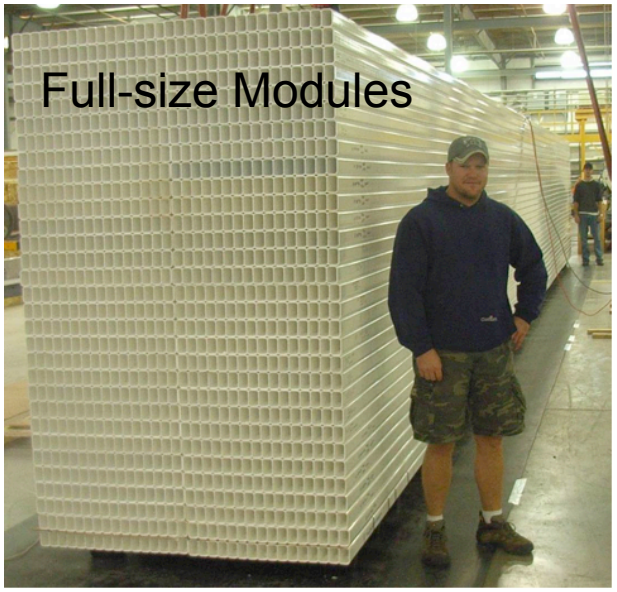
The APD has peak quantum efficiency of 85%. It will be run at a gain of 100. It must be cooled to -15°C and requires a very low noise amplifier.


Fiber Stringing Machine



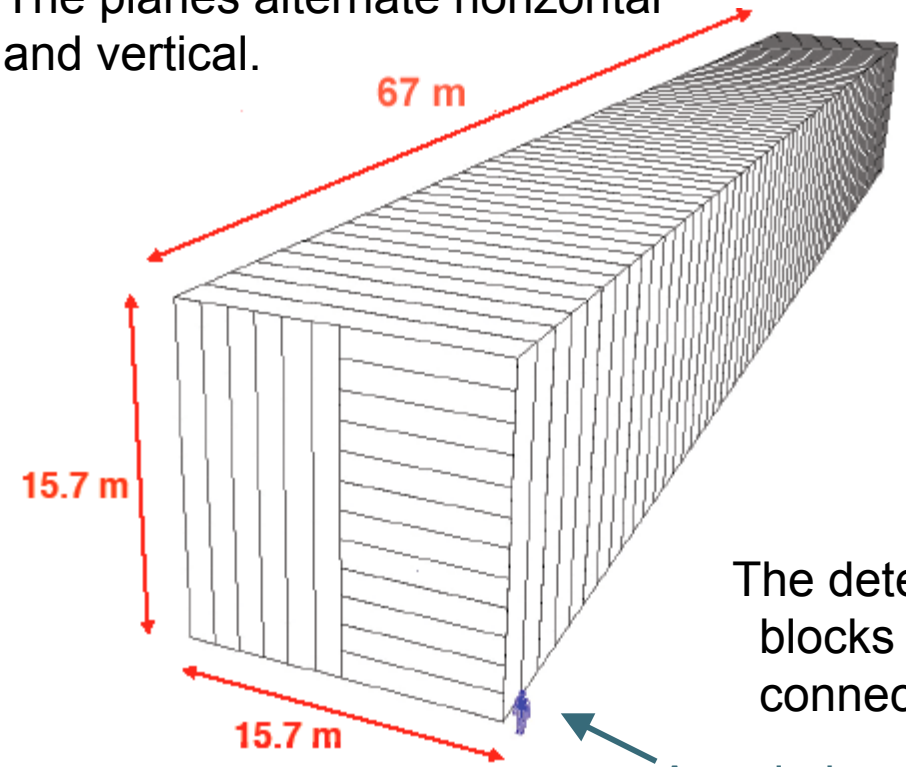
32-cell APD

Far Detector



The cells are made from 32-cell extrusions.

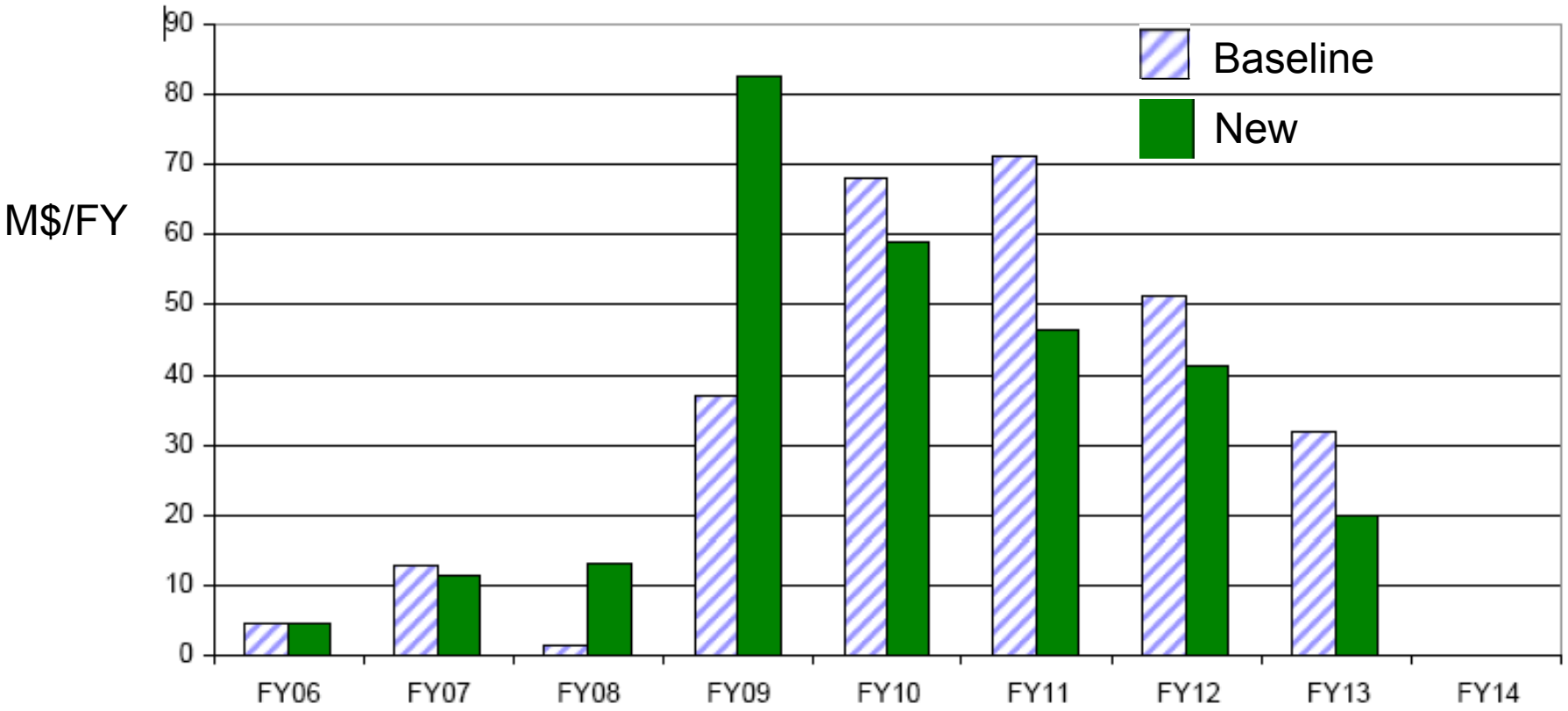
12 extrusion modules make up a plane. The planes alternate horizontal and vertical.



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.

Baseline and New Funding Profiles



Response to New Funding

- Contract to build the whole far detector building instead of doing it in phases.
- Build the full near detector and use it as the Integration Prototype Near Detector (IPND)
  - Requires a new enclosure rather than the MINOS surface building.
- Accelerate procurement of “commodities”:
  - PVC extrusions
  - Wavelength-shifting fiber
  - APDs
  - Kicker parts

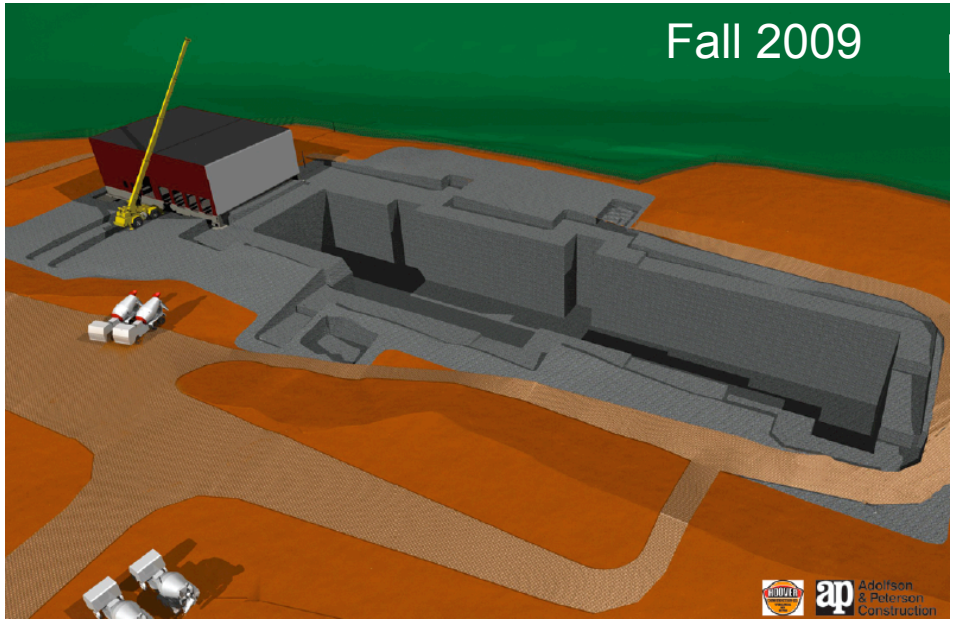
NOνA Ground Breaking
1 May 2009

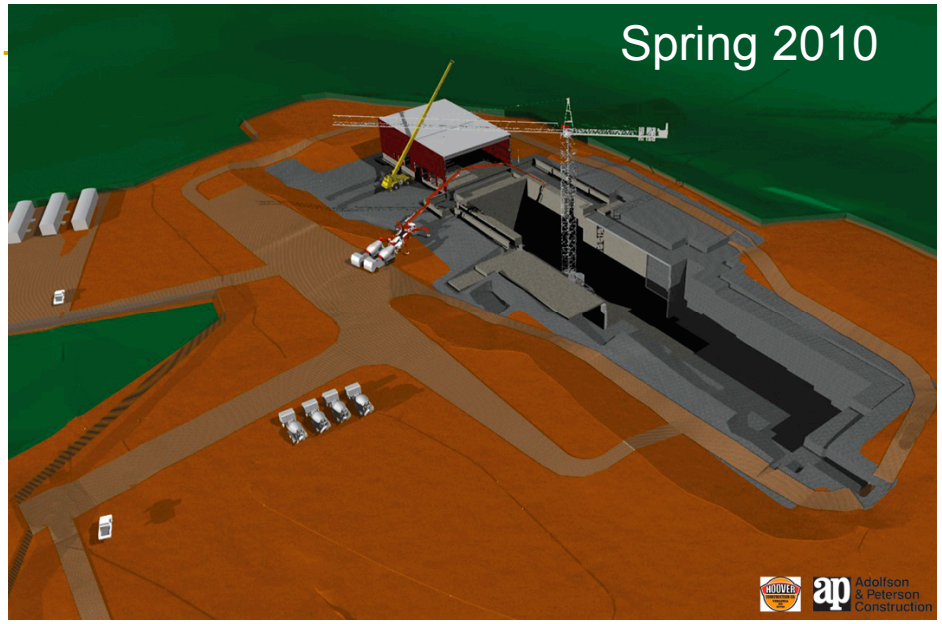

Fermilab Gothic

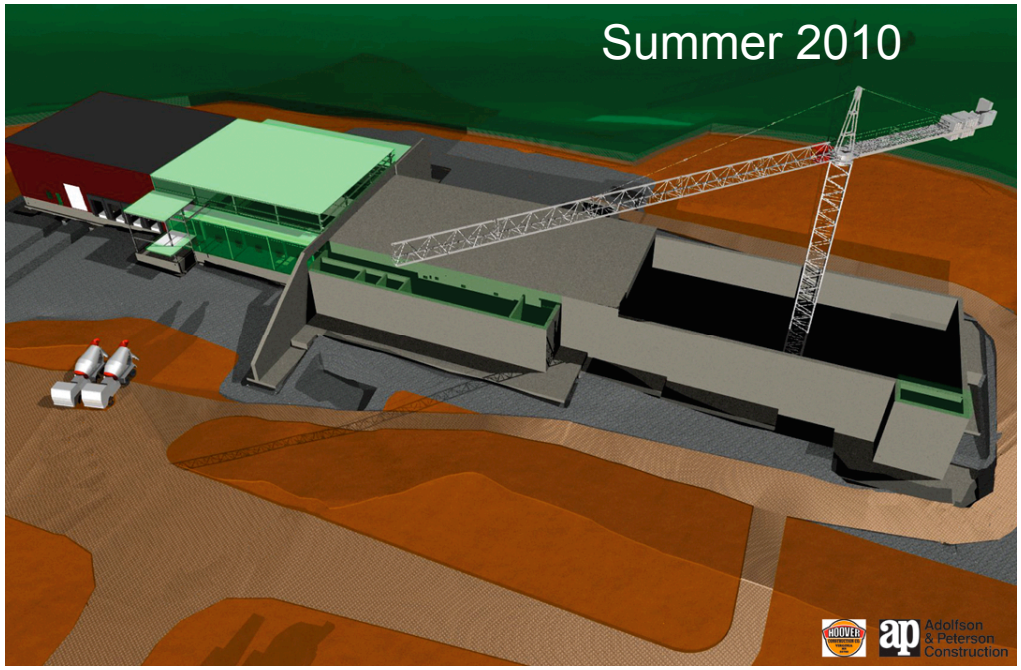

Reception at Orr


NOvA PROJECT
SPECIAL
BBQ BEEF SANDWICH
W/FRIES & CAN OF POP
$ 5.95 +TAX
Jim's Ash Trail Store


Image from Google



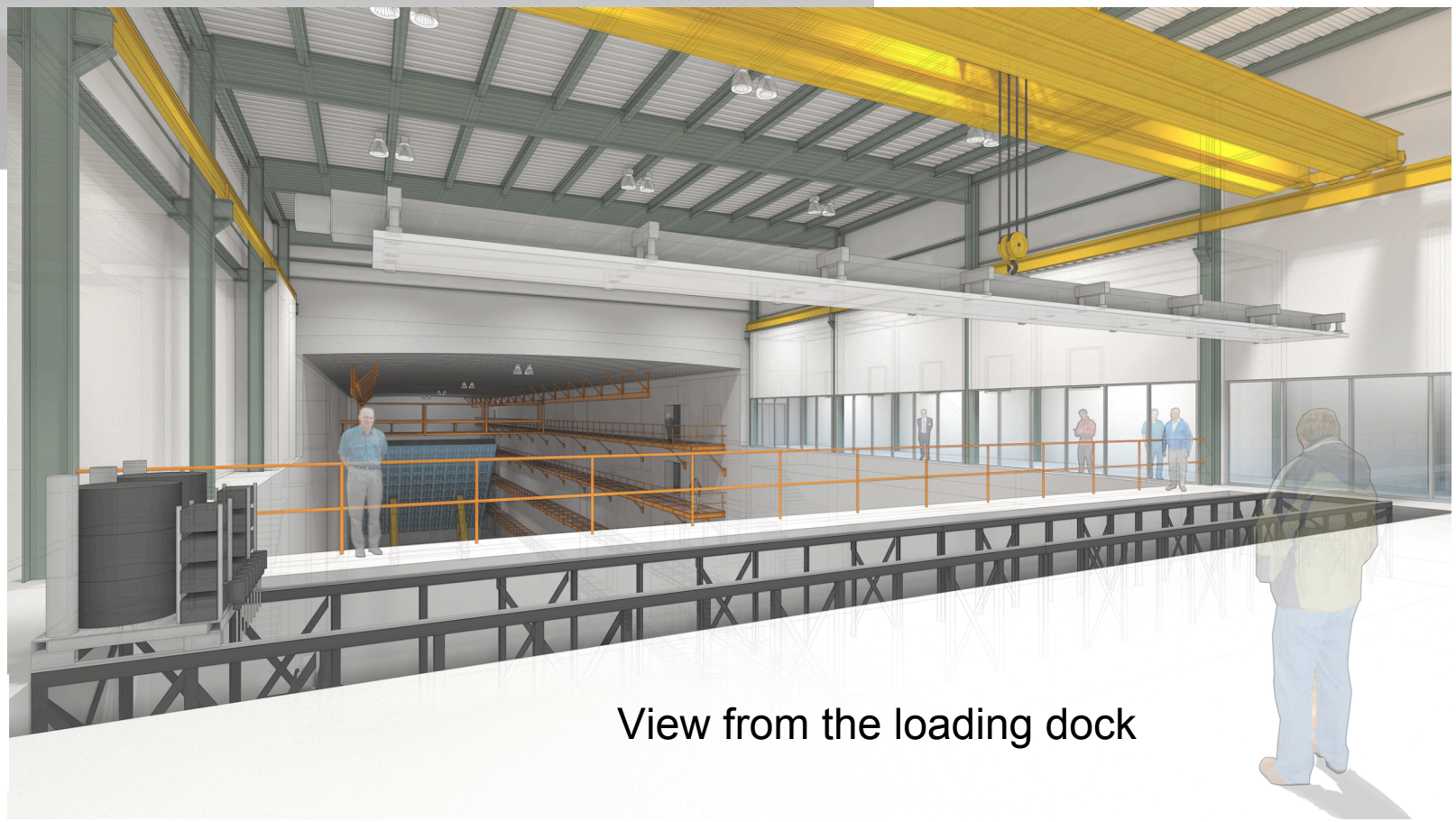




Beneficial occupancy

Assembly area July 2010

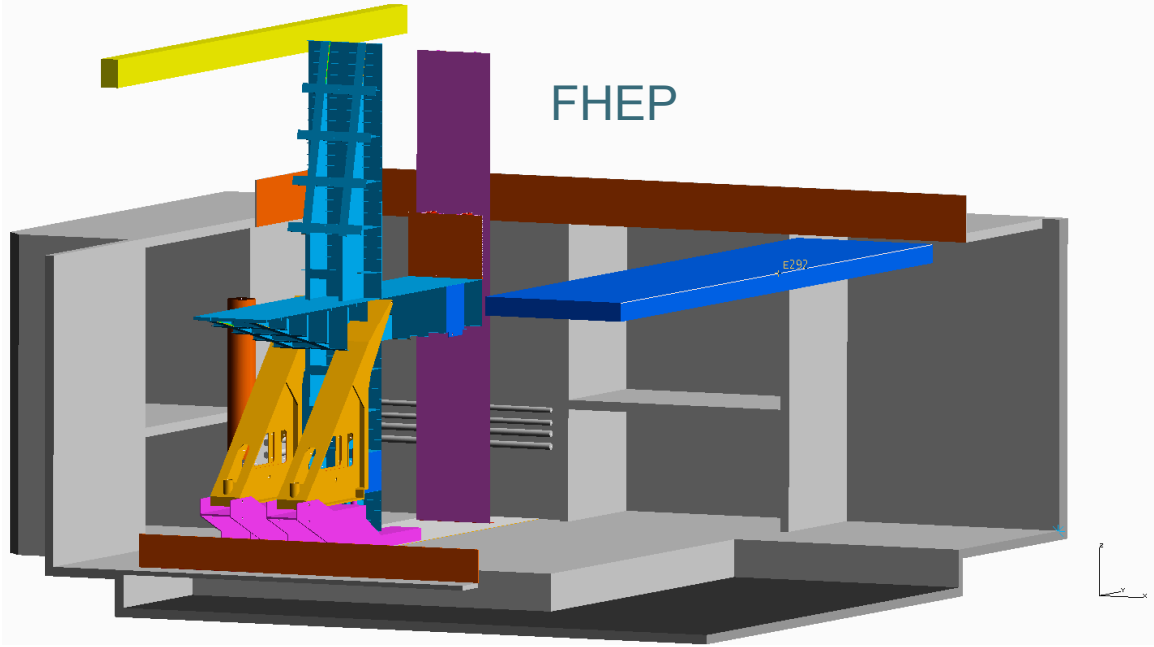
Full building November 2010



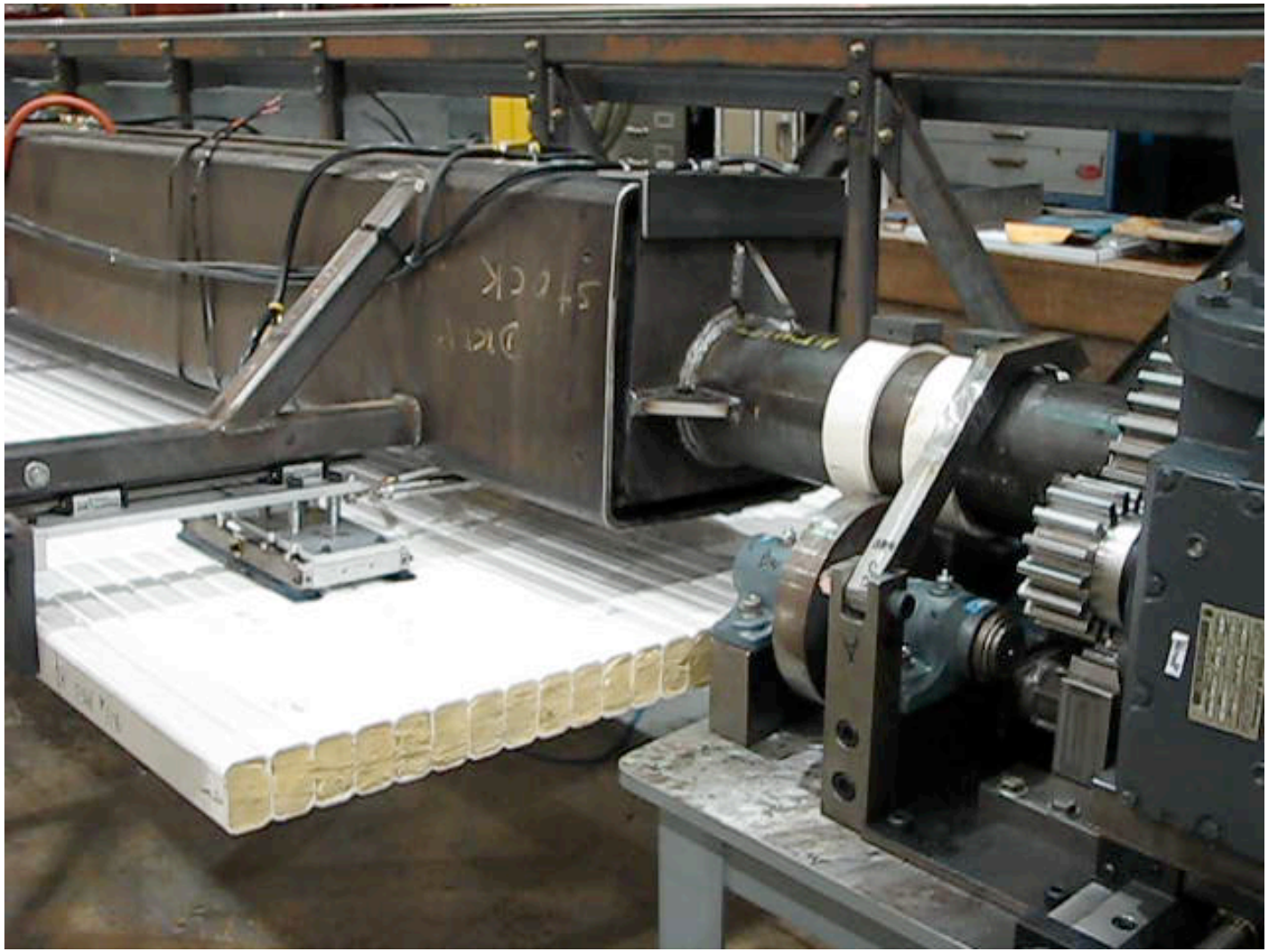
View from the loading dock

Assembly Progress at Argonne

- The current assembly R&D effort is the construction of the Full Scale Assembly Prototype (FSAP) at Argonne.
  - Construction of 6 full size planes for time and motion studies and placement precision.
- Next will be the Full Height Engineering Prototype (FHEP), which will be in the CDF building.
- Then the IPND.



Rotating the module



Adhesive Machine Demo

8 nozzles will be used in production.

Collaboration Standing on the FSAP

Reviews

- The Earned Value Management System (EVMS) review was May 11-15.
  - Technically this is to certify Fermilab. NOνA is just the guinea pig on the treadmill.
  - NOνA did well. The outbrief was effusive with praise. See backup.
  - Scientists' salary compromise: part of EVMS, but not the TPC.
- CD-3b Director's review next week.
- CD-3b DOE review July 21-23.

Probable Schedule

- IPND operational — Spring 2010
- Far detector building complete — Nov 2010
- Start of far detector assembly — Sep 2011
- Start of long shutdown for NuMI upgrades (determined by Collider run) — Oct 2011
- First 2.5 kT operational — Jan 2012
- Full far detector operational — May 2013

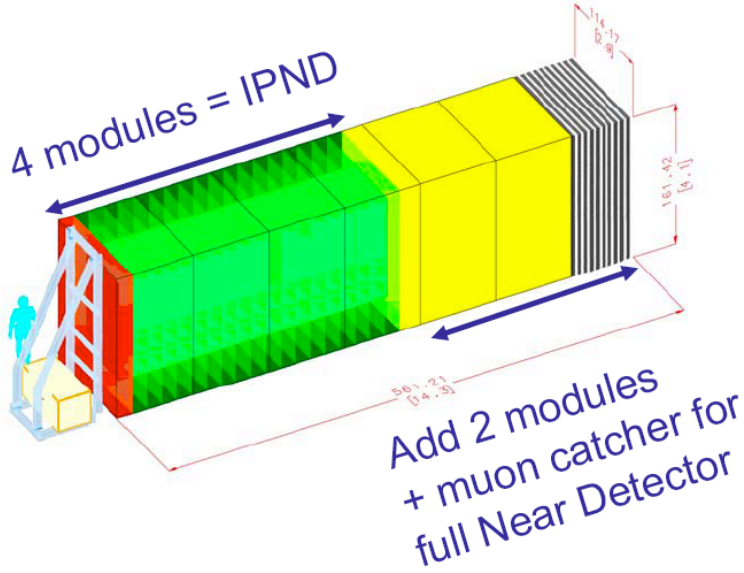
Backup Slides

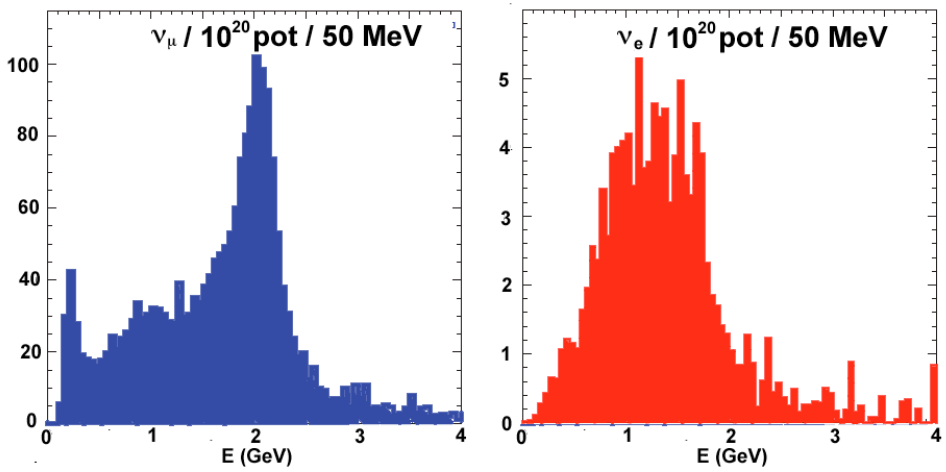
Kudos To FRA!!

- Fostering acceptance and implementation of EVMS that is driven by FRA Leadership across the entire organization
- Deployment of custom developed EVMS tools and publications; e.g. the FRA EVMS Pocket Guide (April 2009)
- Usage of a Project Management Group's (PMGs) concept, dedicated to a project, with regular meetings and participation across all levels of both project and FRA leadership
- Deployment of automation technology across various operational needs that increase consistency, traceability and accuracy in EVMS reporting areas
- Usage of an EVMS Steering Committee concept, with strong commitment and participation of both project and FRA Leadership
- Productive deployment of collaborative scientists as project leaders who support EVMS metrics

IPND = Near Detector

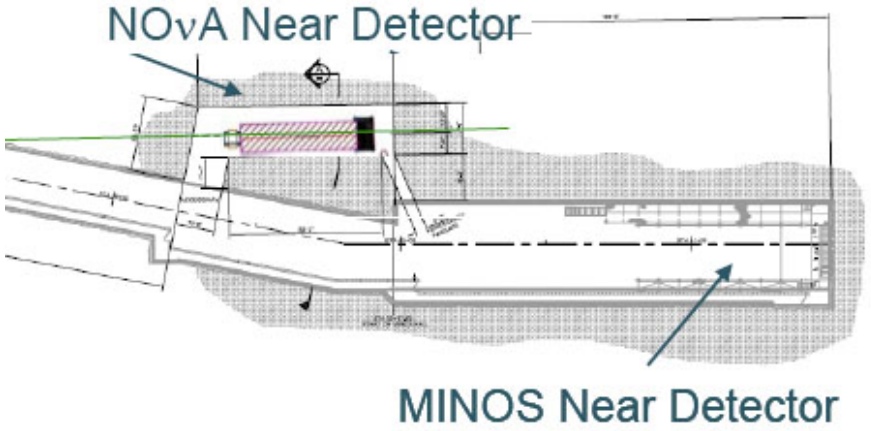
- Discussion of making the full near detector for the Integration Prototype Near Detector.
- Will not fit in the MINOS surface building, so put it outside in a temporary shelter.
- Possible shielding test.
- Running a year from now.
- Trisha Vahle is chairing a calibration task force to set requirements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