A photograph of a modern building at dusk. The sky is a mix of pink, orange, and purple. The building has a prominent glass-enclosed section. In the foreground, there is a snow-covered area with a ramp and some vehicles parked. The text "NOVA @ Ash River" is overlaid in the center of the image.

NOVA @ Ash River

Experiment Status and Computing Overview
Interactomes March 2012



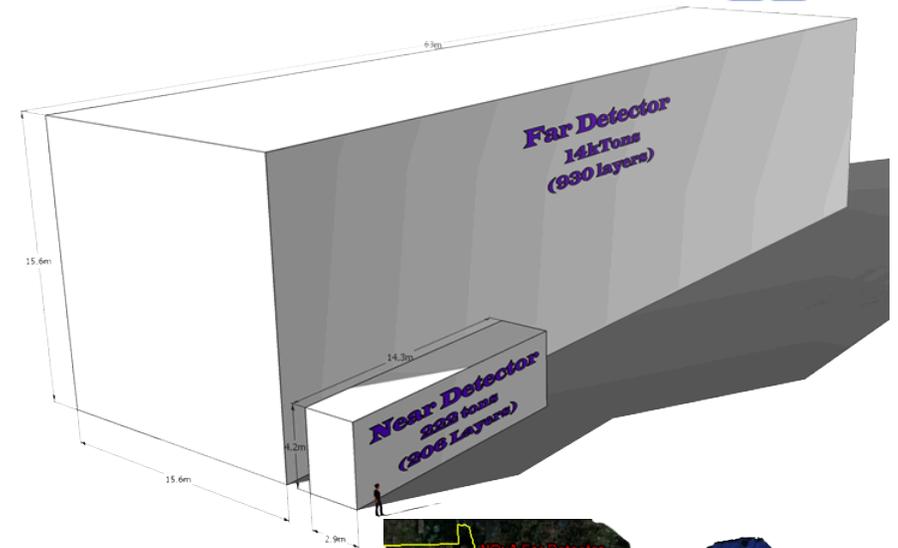
NOvA Overview



- NOvA is a second generation accelerator based neutrino oscillation experiment, optimized for detection of the oscillations:

$$\nu_{\mu} \rightarrow \nu_e \quad \text{and} \quad \bar{\nu}_{\mu} \rightarrow \bar{\nu}_e$$

- NOvA is:
 - A 15 kton, “totally active”, far site detector
 - A 222 ton near detector, utilizing an identical detector technology and geometry
 - An upgrade of the FNAL NuMI beam intensity from 320 kW to 700 kW
- Both detectors are “totally active”, highly segmented liquid scintillator calorimeter designs (70% active volume)
- The detectors are placed 14mrad off the primary beam axis to achieve narrow ν energy spectrum, peaked at 2GeV.
- The far detect is located on a 810km baseline between Chicago and Northern Minnesota at the first oscillation maximum



Baseline: Fermilab to Ashriver, MN

Dist: 810km

Angle: 14mrad from primary beam axis



Nova, θ_{13} & Daya Bay Result



- Daya Bay recently reported¹ a non-zero (and large) measurement of θ_{13}

$$\sin^2 2\theta_{13} = 0.092 \pm 0.016 \pm 0.005$$

- This is fantastic for NOvA because it:
 - Puts resolution of the *mass hierarchy* within the NOvA sensitivity
 - Gives reach to constraining δ_{CP} over a significant portion of the parameter space
 - Allows for further measurements of θ_{13} with ν 's and $\bar{\nu}$'s
 - Effectively opens up all the core physics



Ash River



- Ash River is a small town in northern Minnesota
 - Nearest major town is International Falls (\approx 1 hour away)
 - Mainly tourism driven
 - Fishing, Ice fishing, snowmobiling
- Getting to Ash River
 - Fly into Duluth and drive (3hrs)
 - Fly into Int. Falls (spring/summer) and drive (1hr)
 - Drive from FNAL \approx 10-12hr
- The site is remote
 - Any type of hardware or materials need to be driven in from Duluth
 - Alternative is to shipped directly to the site (3 days via FedEx)

The NOvA house



NOvA has a house @ Ash River (on the river)

- 3 bedroom w/ kitchen, dining etc...
- Can be booked for any personnel doing work on NOvA
- Best option for visiting Ash River

The Ash River Area

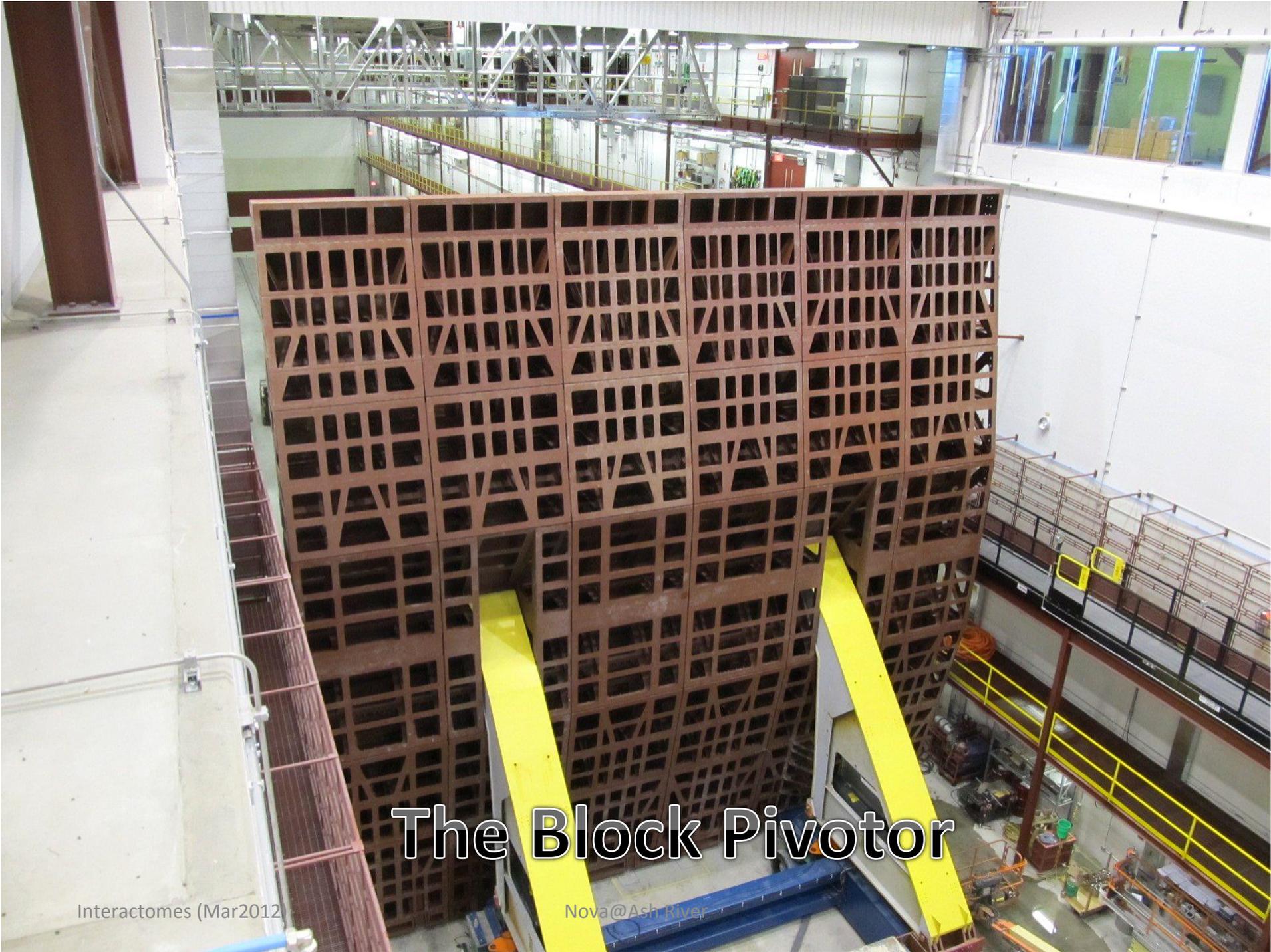




Experiment Update



- Last piece of major equipment, the block “pivotor”, was assembled last week.
- This device is the platform on which the planes of the detector are built
 - The planes are built horizontally
 - The device then rotates them 90 into the vertical and pushes them into their final position
- This clears the way for the start of detector construction



The Block Pivotor

Interactomes (Mar2012)

Nova@Ash River



Construction Start



- First shipment of detector modules is ready
- Laying the first detector plane is scheduled to start April 1
- Assembly rate estimate is 2 planes per day
 - A block is 32 planes



Computing @ Ash River



- Core Services
 - Networking
 - Wireless Access
 - Control Room Computing
 - Computing Farms



Interactomes (Mar2012)

- Data Acquisition
 - Custom Hardware
 - Timing systems
 - DAQ Software



Nova@Ash River



Ash River Networking



Wide Area Connectivity

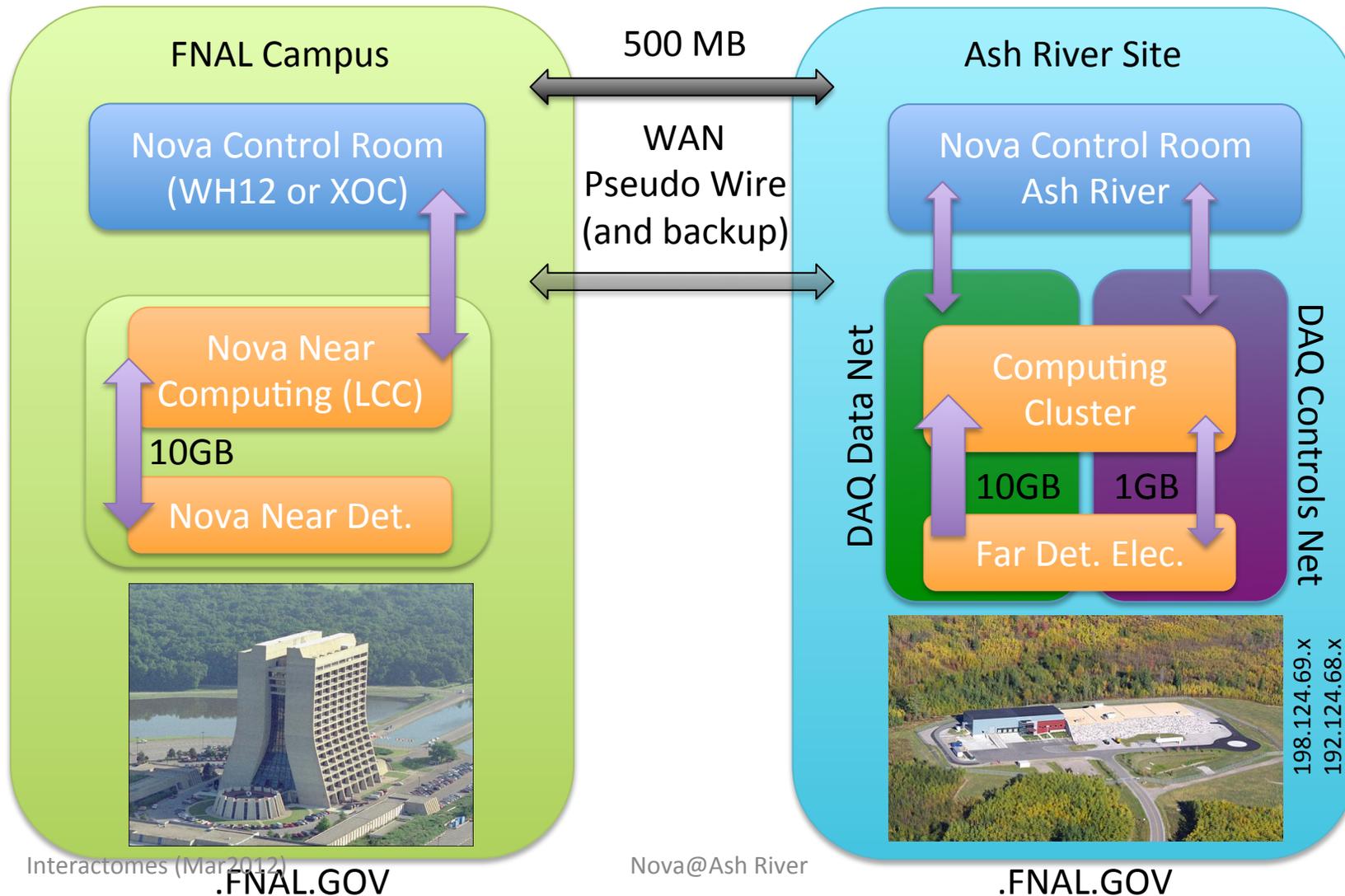
- We have tried to make Ash River appear like part of the FNAL network and .fnal.gov domain.
- This has included establishing a pseudo-wire connection between FNAL and the far site
 - The current bandwidth of the WAN is 500 Mb/s with upgrades planned to 1 Gb/s and 10 Gb/s over the course of the experiment
 - This has been tested both by the networking group and by the experiment.
 - The network appears to be stable and the limited number of problems that were seen early on have been identified and remedied

Local High Speed DAQ Network

- For DAQ and Controls traffic we have in excess of 1000 network ports that need to be connected and routed at Ash River
 - These include:
 - Data concentrators (≈200 units with 2 ports each)
 - Computing farm (≈200 nodes with 2 ports each)
 - Timing systems
 - Computing center infrastructure (PDUs, term servers)
 - Controls room workstations
 - Power supplies



NOvA FNAL/Ash River Network





NOvA Networking



- We are structuring the network so that all traditional .fnal.gov services will work transparently at Ash River
- These include:
 - Strong authentication (kerberos)
 - Network monitoring (mrtg etc...)
 - Cluster monitoring and administration (FEF ganglia, puppet etc...)
 - FNAL wireless (fgz)
- Our goal is to make it possible to work with Ash River as if we were working with any other computing center on site



Control Room Computing



- Nova maintains two (2) control rooms
 - **Primary** Control Room is in Wilson Hall (WH12)
 - **Secondary** Control Room is at Ash River
- Both control rooms use an identical designs and hardware
- Both control rooms use “generic” workstations to achieve fault tolerance through flexibility and redundancy
 - Any machine can assume any roll
 - Multiple machines can assume the same roll
 - We want to achieve 24x7 operations but without having to require 24x7 support



NOvA Computing Center (NCC)



- First week of March 2012 we deployed the first 1/3 of the computing resources at Ash River
- Included:
 - 72 DAQ/trigger nodes (1152 cores, 75 TB buffer disk)
 - 3 sata raid arrays (75 TB)
 - Network switches
 - Racks, term servers, KVMs etc...
- All of the hardware was initially tested, assembled and configured at FNAL (LCC)
 - Transplanted to Ash River
 - Network was remapped
 - Systems were brought up

Seth Graham (system configuration)
Andy Rader (network configuration)





Support for Ash River



- Currently we are trying to draft a full support model for Ash River
- This will include
 - Control Room Computing
 - Nova Computing Clusters
 - DAQ & Controls Networking
 - WAN Connectivity
 - Custom Electronics
 - Custom DAQ software
 - Production databases
- Currently there is a new draft MOU that is being worked on with the NOvA project office that addresses these topics



NOvA Far Detector Network Overview

Notes:

- 1) Routers will share virtual ip x.y.z.1 as the default gateway for Vlans 817, 718, 719.
- 2) DAQ switches will use routed interface for network management.
- 3) Remote access via dialup.
- 4) Optically isolated.
- 5) WLAN security to be determined.
- 6) DCS uplinks are balanced between the two routers.

