

Neutrinos in the Neighborhood: The LBNE Project

(LBNE: Long-Baseline Neutrino Experiment)

Greg Bock

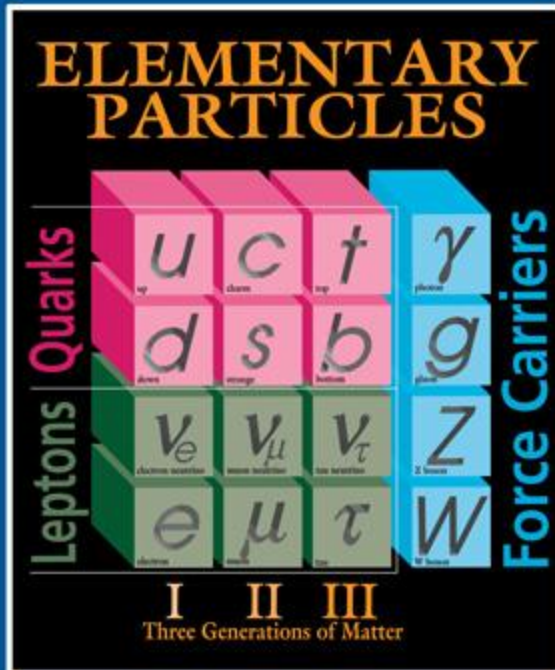
Fermilab

May 27, 2010

What is a neutrino?

- Neutrinos—sometimes called the ghost particles—are very hard to detect
- Every second, tens of trillions of neutrinos fly through your body—and you don't feel it
- Neutrinos come from the sun, bananas, nuclear reactors
- Neutrinos may hold the key to answers to many questions about the nature of our universe
- Particle physicists use the Greek symbol “nu” for neutrinos





Neutrino Mysteries

How did the universe come to be?

What happened to the antimatter?

How did the universe evolve?

What role did neutrinos play?

Are neutrinos their own antiparticles?

Are neutrinos the reason we exist?

Recent neutrino milestones at Fermilab

- 2000: Discovery of tau neutrino at Fermilab (3rd type of neutrino)
- 2005: Launch of the MINOS neutrino experiment with Speaker of the House Dennis Hastert
 - Experiment sends beam of neutrinos 475 miles to Minn.
 - Goal: learn more about neutrino masses, oscillations
- 2006: MINOS announces neutrino mass result
- 2007: MiniBooNE: Evidence against 4th neutrino
- 2009: Groundbreaking for NOvA neutrino experiment in Minnesota
 - same beam from Fermilab, different detector in Minn.



MINOS

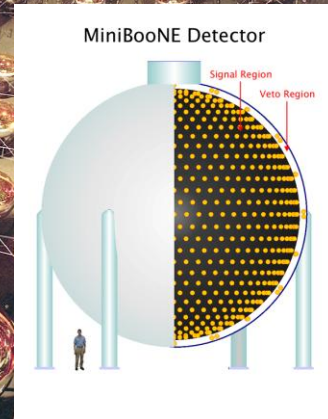
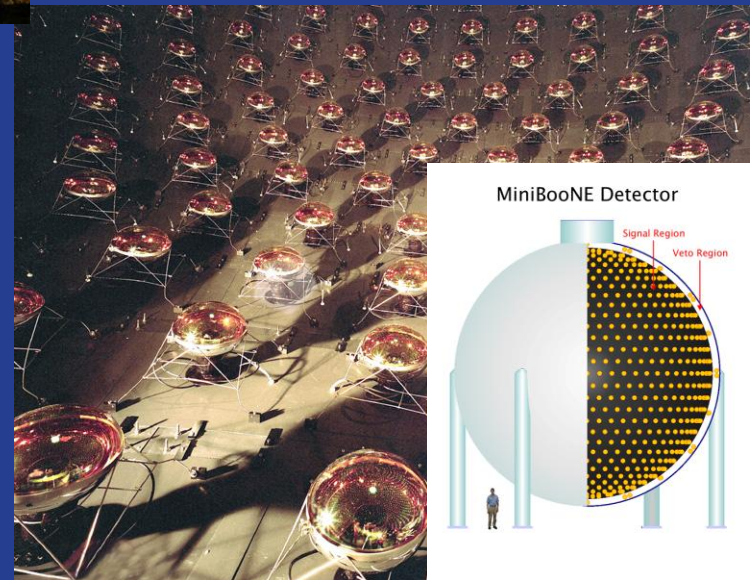


NuMI

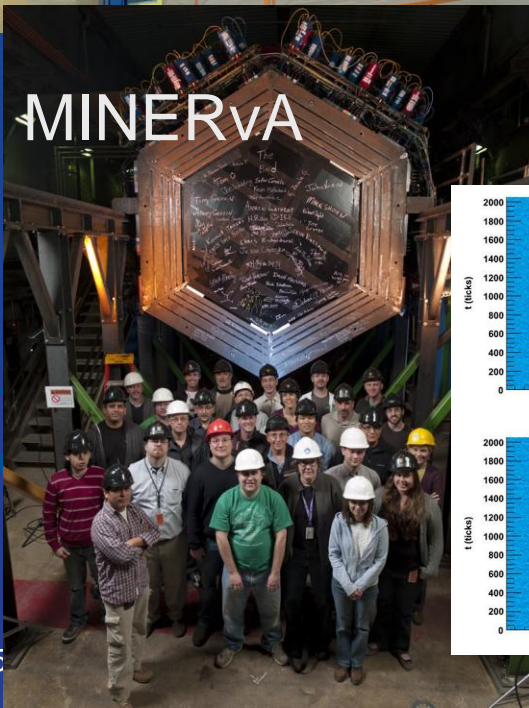


NOvA

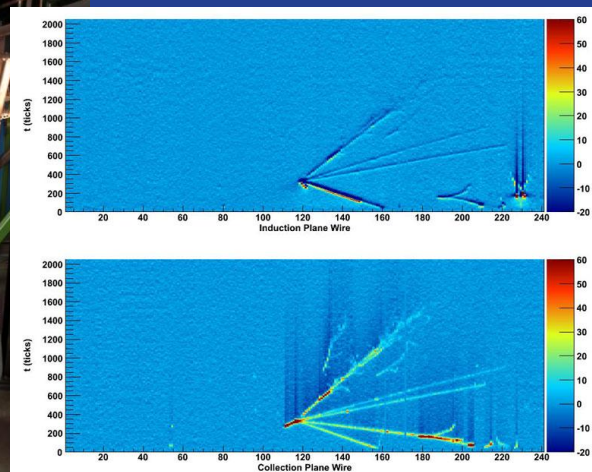
MiniBooNE



MINERvA



ArgoNeuT



Next step: LBNE

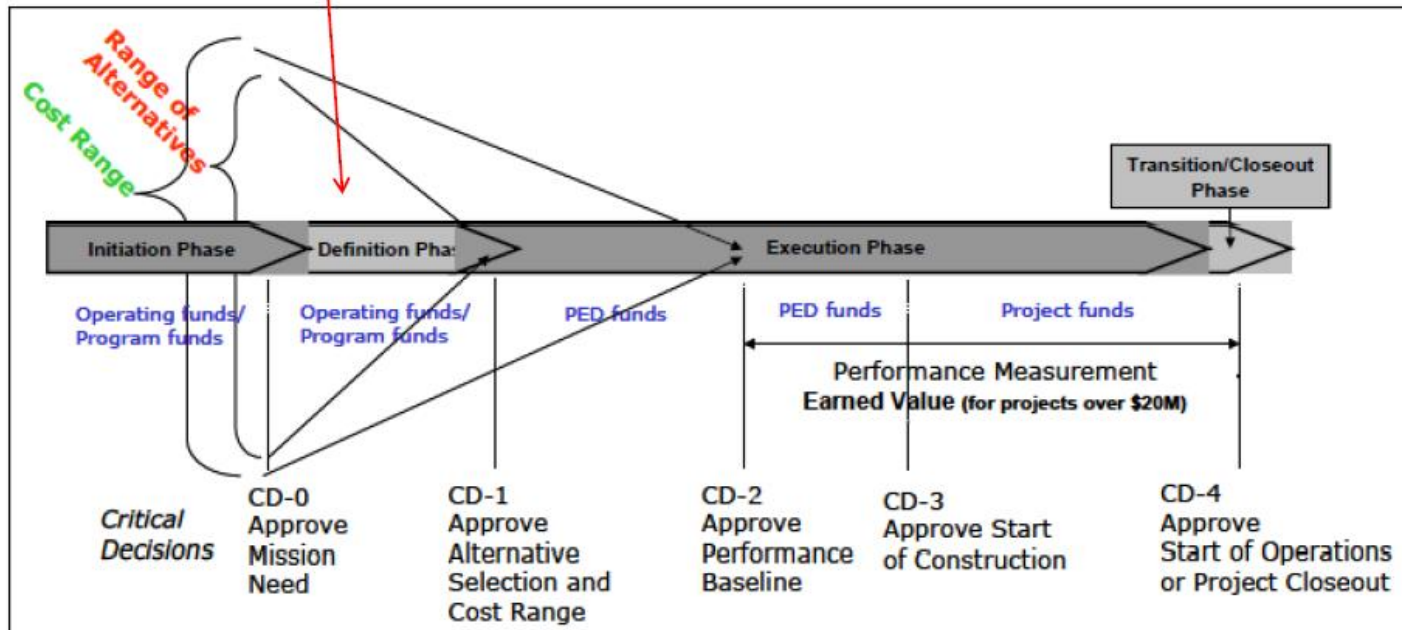
About the proposed LBNE project

- LBNE -- Long-Baseline Neutrino Experiment
- Proposal to build a new experiment that looks for matter-antimatter asymmetry among neutrinos
 - Send neutrinos more than 800 miles through the Earth
 - Proposal: send beam to Lead, South Dakota
- LBNE is similar to but more advanced than MINOS

LBNE Project Life Cycle & Approvals

LBNE is at this point

DOE Project Process



LBNE SCHEDULE 8-Jan-10

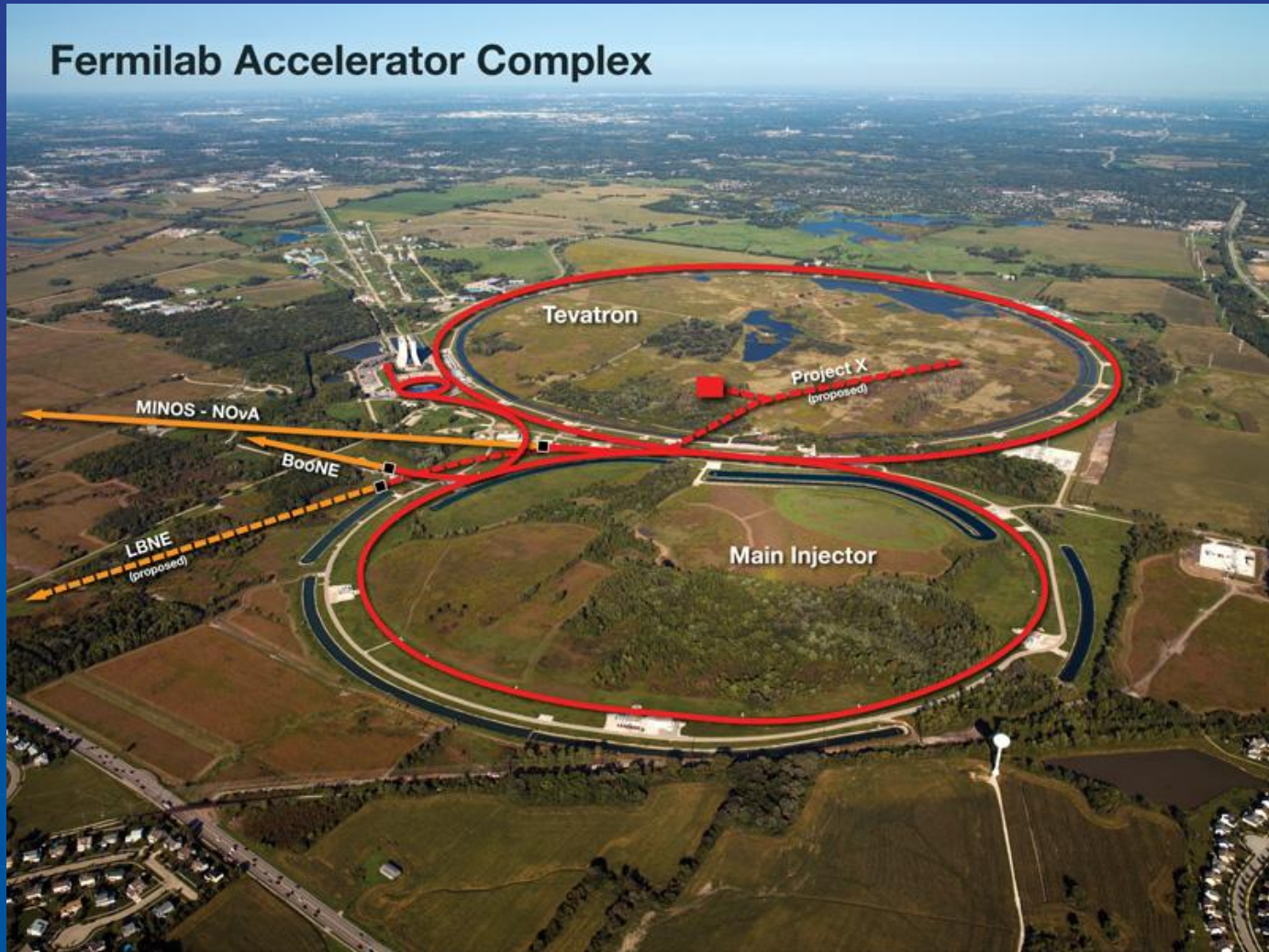
Spring 2011

2013

2014-15

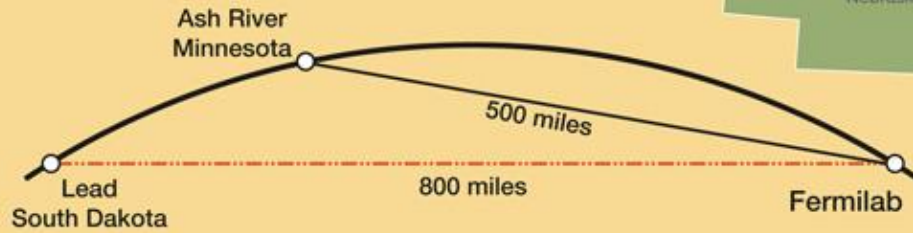
2020+

Fermilab Accelerator Complex

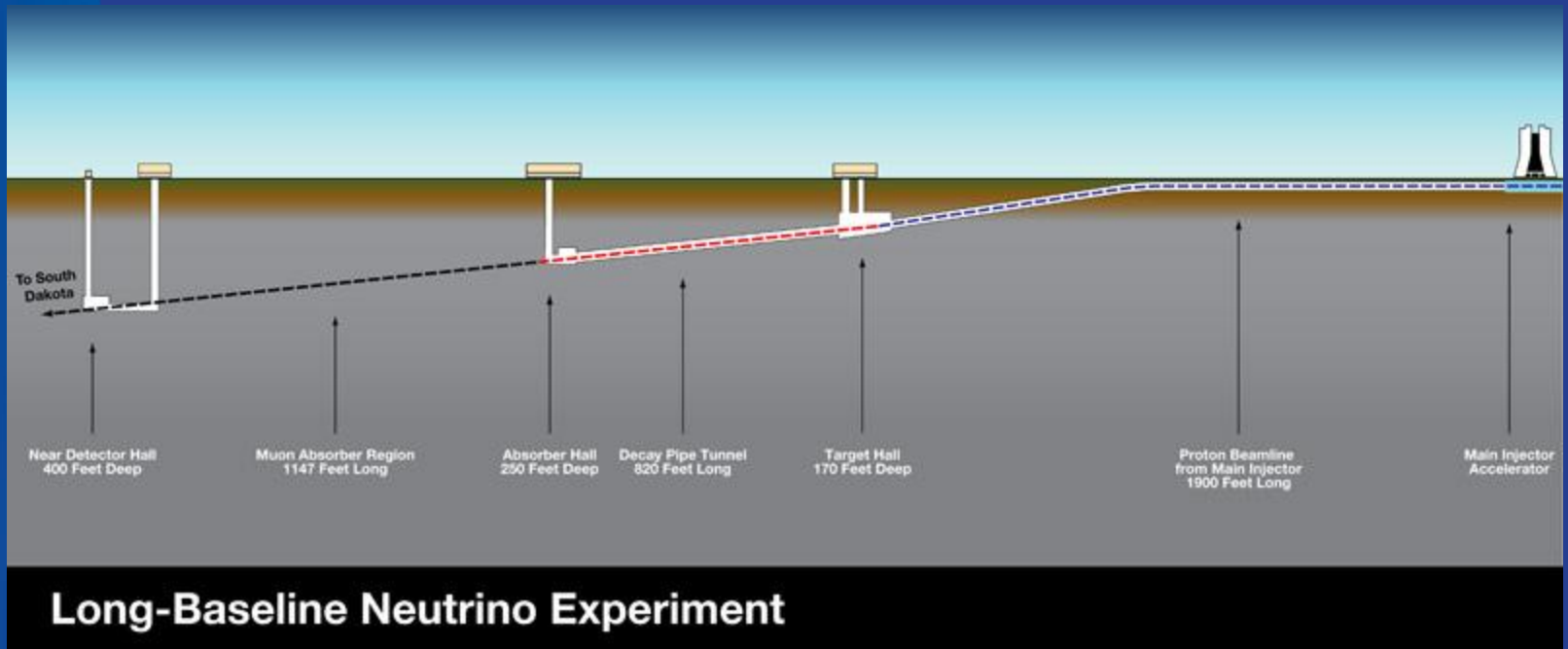


Straight Through the Earth

MINOS	Soudan Mine, MN	2340 ft deep
NOvA	Ash River, MN	Surface level
LBNE	Homestake Mine, SD	4850 ft deep



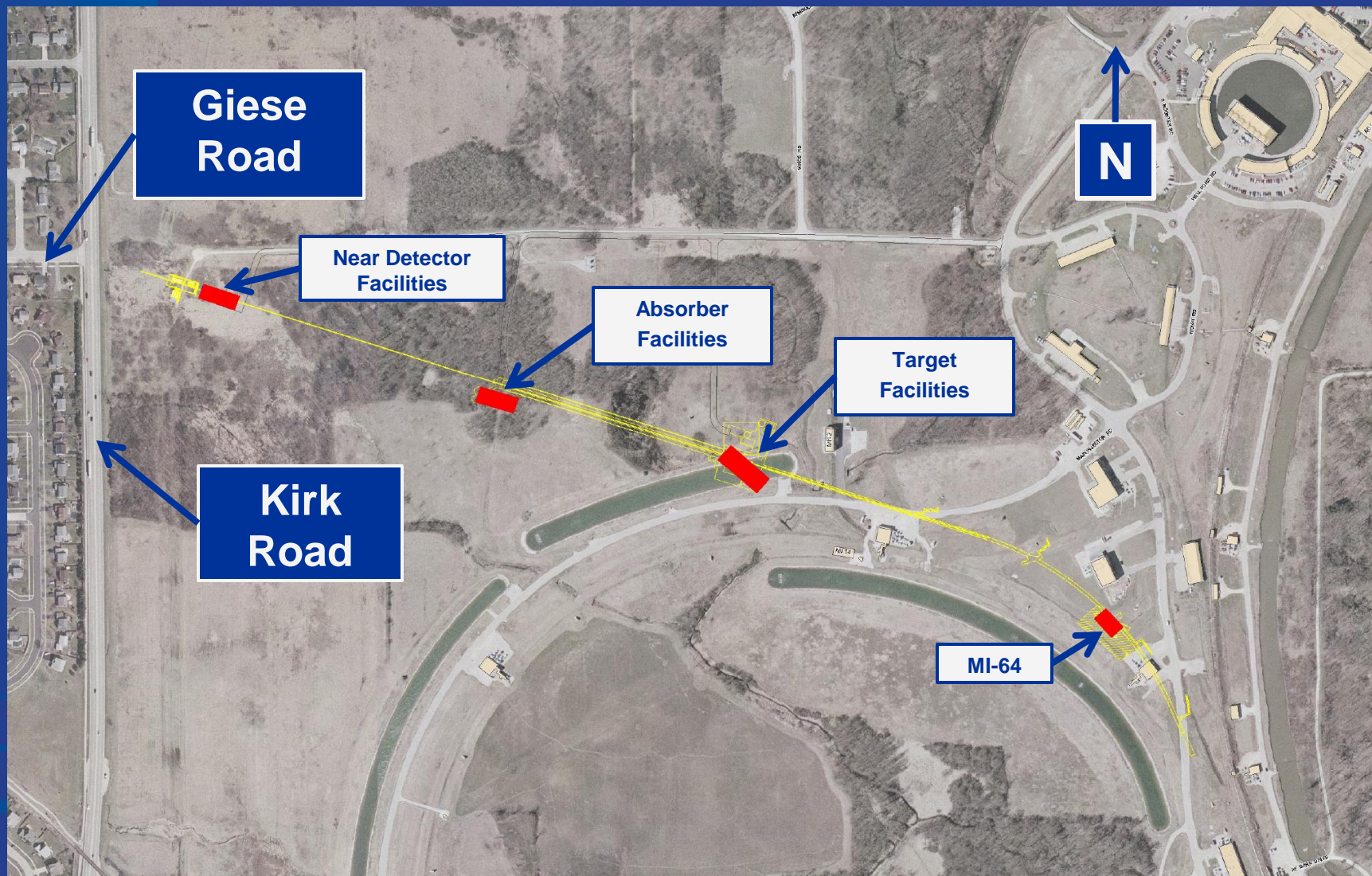
Proposed LBNE facility at Fermilab



Proposed LBNE Location / Alignment



Proposed LBNE Facilities





BIRD'S EYE VIEW AT GIESE ROAD / KIRK ROAD

What drivers on Kirk Road would see



KIRK ROAD - LOOKING NORTH

Red color of building represents worst-case scenario regarding visibility of project.

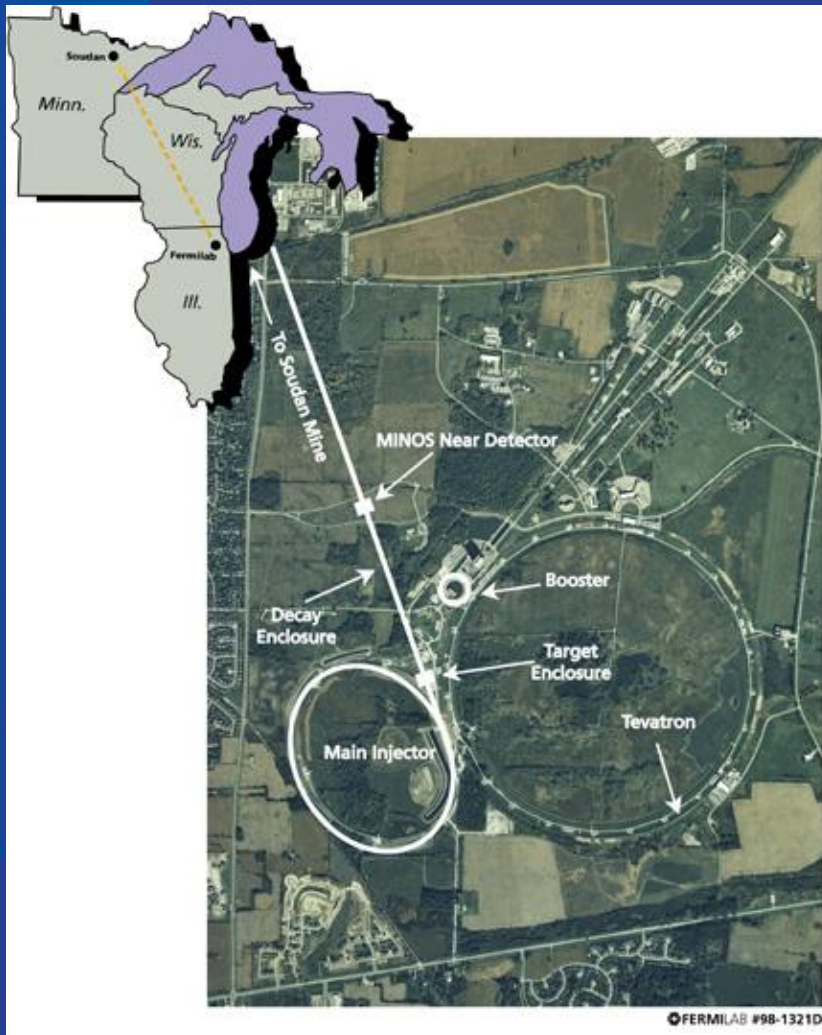
What our neighbors would see



GIESE ROAD - LOOKING EAST TOWARD FERMILAB

What will our
neighbors think?

We have had a similar project before



- NuMI construction: 2000 – 2004
- Very similar, but not as close to Kirk Road as LBNE will be
- Overall no major complaints, but several lessons learned
- LBNE will be more challenging as it will be closer to our neighbors

Overview of concerns neighbors may have:

1.) Construction

- Environmental impact
- Location
- Construction duration
- Work at night
- Construction noise
- Vibration
- Construction lights
- Construction traffic
- Dust control
- Water treatment
- Building design and color

2.) Operation

- Groundwater
- Tritium
- Building security
- Tours

Input needed on all these items!
Others issues may exist!
Please let us know!

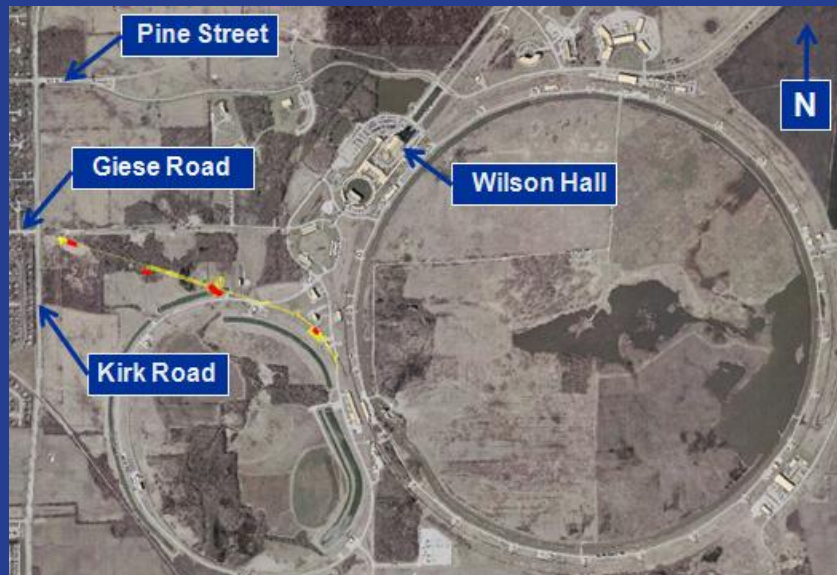
1.) Construction issues

Issue: environmental impact

- The National Environmental Policy Act, established in 1970, applies to everything that we do here at Fermilab.
- NEPA established a framework to ensure that environmental factors receive the same consideration as others in decision making for activities involving federal funding, land or permits.
- NEPA requires that a review of potential environmental consequences be conducted for proposed projects that fall under its guidelines, often referred to as a NEPA Review.

Issue: location

- Construction site is close to neighboring community: “construction site across the street”
- Visual impact remains after construction is done
- Will neighbors get the wrong impression that we are “shooting” at our neighbors?



Issue: construction duration

- Construction will last longer than, say, the construction of a new house in the neighborhood

WORK	DURATION
Site work	~ 1 year
Underground Excavation	~ 3 years
Buildings and Underground Outfitting	~ 1.5 years
OVERALL PROJECT	~4 years

} Overlap

Issue: work at night

- Currently planning for two 10-hour shifts for blasting
- By using two shifts, can reduce overhead cost, accomplish work faster and shorten overall project duration
 - 3rd shift used for maintenance work, no blasting
 - May or may not have regular weekend work

Issue: construction noise

- Construction surface operations will have normal construction noise
 - trucks and machinery, horns, etc., but will work to restrict hours during which they are used.
- Underground excavation will be drill & blast method
 - Blast design will be with noise control in mind
 - Noise is difficult to mitigate completely
 - Sirens before & after blasting
 - Blast noise/overpressure will occur and can travel into the subdivision, depending on weather conditions (direction of wind, density of cloud coverage)
- Are exploring amount of blast monitoring to be done at the site boundary and in the community

NuMI building construction (2003)



NuMI excavation, including drill and blast



- During NuMI/MINOS construction, we learned (the hard way) that dense clouds can reflect noise straight into the neighborhood

Issue: vibration

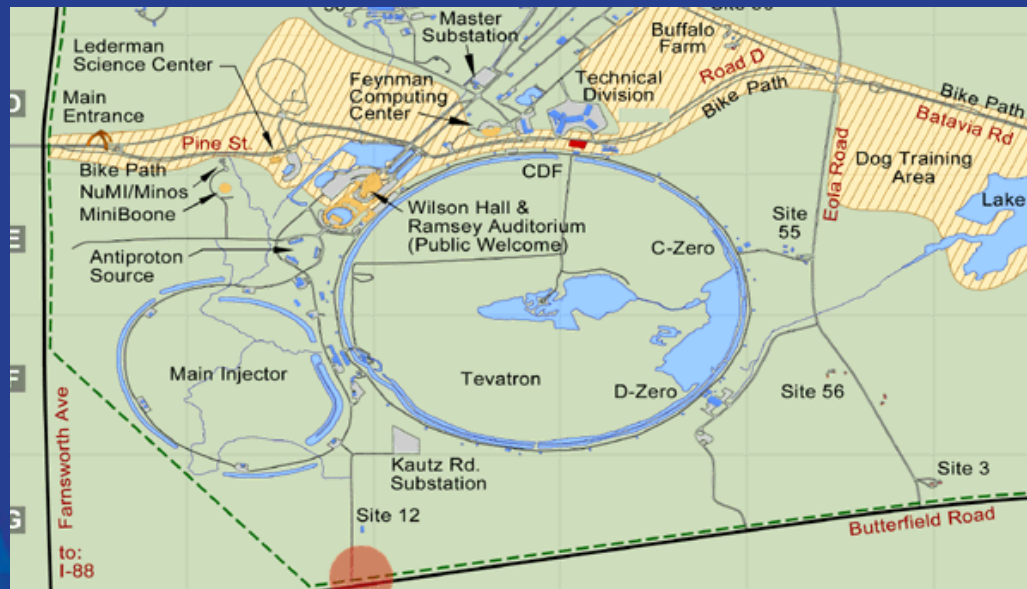
- Nearby neighbors are expected to sense vibrations due to blasting, but we expect no damage to result from this work
- Could include pre-construction inspection of closest structures for recording existing cracks (or how should we handle this?)
- Still exploring how to monitor vibration on site and in neighboring areas
- Vibration monitors used during NuMI construction even picked up dog running in neighbor's garden

Issue: construction lights

- Will have flood lights on all night
 - Security
 - Non-blast-work perhaps all night
- Will direct contractors to aim lights away from Kirk Road
- During NuMI/MINOS construction, we installed drapes in a neighbor's bedroom

Issue: construction traffic

- We expect to reopen Kautz Road construction entrance on Butterfield Road, same entrance as used for NuMI Project
- Need to communicate with those neighbors, too



Issue: dust control

- Will use water trucks to mitigate dust blowing

Issue: water treatment

- Will make sure that water pumped out of construction site has right pH value and water quality before being discharged or used as cooling water on the Fermilab site
- Discharges require a permit by the Illinois Environmental Protection Agency
- Question at last meeting: Radon in rock?
- Answer: Radon is gas and is short-lived. Radon is only a problem when confined in large amounts inside a building

Issue: building design and color

- Buildings near the Main Injector will have similar appearance to existing MI buildings on the Fermilab site
- Near Detector Service Building design concept is under discussion. Input from CAB is welcome.



Example: MINOS building near Pine Street



2.) Operation issues

Issue: groundwater

- Project will continue to pump water out of the LBNE tunnels, like we do for NuMI tunnels
- Will make sure that water pumped out of construction site has right pH value and water quality before being discharged or used as cooling water on the Fermilab site
- Water level in upper bedrock aquifer may drop to some extent; still under study;

Issue: tritium (^3H)

- Tritium is a weakly radioactive isotope of hydrogen with a half life of 11 years
- Radiation emitted by tritium cannot penetrate skin
- Earth's atmosphere contains low levels of tritium
- Health risk when digested in significant quantities over large period of time
- Government agencies set limits on amount of tritium that can be emitted
- Fermilab reports tritium discharges to the Illinois Environmental Protection Agency

Tritium at Fermilab

- Smashing protons into other particles produces small amounts of tritium
- In the case of NuMI and LBNE, the tritium is being pumped out of the tunnels and into the ponds on the Fermilab site
- Regulatory limit: 2000 picocuries per millimeter
- Average levels of tritium detected in ponds on Fermilab site in 2005: 3-4 pCi/ml
- Average levels today: 1-2 pCi/ml
- Link to information on tritium at Fermilab is on the Fermilab home page and points to:
<http://www.fnal.gov/pub/about/community/IndianCreek.html>

Ponds and creeks on Fermilab site



Result of work with 2005 Citizens Task Force:

Fermilab is committed to

- go beyond merely satisfying the regulatory limits;
- keep the tritium discharges as low as reasonably achievable;
- keep the public fully informed;
- engage the public in the establishment of goals and formulation of plans.

We've created a 2-page handout that provides basic information about tritium at Fermilab

We realize: ponds can leak and overflow.

- In November 2005, during regular testing of water at the site boundary, we detected low levels of tritium in Indian Creek. We informed our neighbors immediately and newspapers reported on the incident.

Fermilab: No cause for alarm

Small amounts of tritium found in Indian Creek

By Andre Salles
STAFF WRITER

BATAVIA — Staff members from Fermilab trudged through the falling snow Thursday, delivering letters to every home in the Savannah subdivision on Aurora's northeast side, alerting residents to the presence of radioactive materials in Indian Creek.

But don't be alarmed, officials

"Never in 30 years of testing the creek have we seen any sign of tritium," Jackson said. "We immediately retested to confirm what we were seeing."

Tritium forms naturally in the upper layers of the atmosphere and is usually only harmful if ingested in large quantities, according to the Environmental Protection Agency. In large amounts, it increases the risk of cancer, but the EPA Web site calls tritium one of the least dangerous of radioactive materials, since it emits weak radiation and leaves the body quickly.

According to Jackson, tritium is a by-product of Fermilab's normal particle accelerator opera-

News

A2 Friday, March 24, 2006 The Beacon News DA

Fermilab cautioned over tritium release

By Andre Salles
STAFF WRITER

BATAVIA — The Illinois Environmental Protection Agency has issued a permit violation notice to Fermi National Accelerator Laboratory regarding radioactive materials found in Indian Creek last year.

However, officials at Fermilab say there is no reason for alarm and that levels of that material have remained below detectable levels for months.

Small amounts of tritium, a radioactive isotope of hydrogen, were discovered in December 2005 by lab staff performing routine environmental tests, according to Judy Jackson, Fermilab's public relations director. The leak was traced to a pipe connecting two cooling pools.

to report the discovery of tritium in the creek, which violates their National Pollution Discharge Elimination System permit.

"We never listed tritium before because we'd never seen any," Jackson said. "Because it is a by-product of our operations, it should be on our official permit."

The IEPA notice also states that Fermilab is in violation of groundwater quality regulations and systems reliability rules. Fermilab has 30 days to present a written response to the state agency, detailing the steps the lab has taken to return to and remain in compliance.

"We have the same goals as the IEPA," Jackson said. "We're looking forward to working with them to ensure that our operation is not harmful to Illinois waters."

Jackson is quick to point out that, through the violation notice

Issue: building security

- For safety reasons, building will be locked to prevent unauthorized people from entering
- Proximity to Kirk Road and neighborhood could increase chance that people will try to enter the building or that people gather outside building to “hang out.”

Opportunity: tours, public information

- Educational opportunities: Can offer tours while neutrino experiment is in operation
- But underground safety requirements limit the number of participants
- NuMI: After the completion of the construction, we invited 2000 nearby households to a tour: 200 people signed up!
- Today: Frequent underground tours for college students, but rarely for general public

Communication with the public

- Communications with neighbors during the NuMI construction seemed satisfactory, but the LBNE construction will be more challenging as it is closer to the neighbors
- Communication tools used for NuMI:
 - Presentation at City Council and Kane County Council meetings
 - Letters to neighbors
 - Hotline (received about 20 phone calls in 2 years)
 - Town hall meetings
 - Tours for neighbors when project complete
- Need to communicate earlier and seek input
- Recommendations from CAB important!