



The NOvA Experiment

BNL-Fermilab Meeting
14 November 2005

Gary Feldman



The NOvA Experiment

(NuMI Off-Axis ν_e Appearance Experiment)

- **NOvA is an approved Fermilab experiment optimized for measuring ν_e appearance with the goal of improving MINOS's $\nu_\mu \rightarrow \nu_e$ measurement by approximately an order of magnitude.**
- **The NOvA far detector will be**
 - a 30 kT “totally active” liquid scintillator detector
 - located 15 mrad (12 km) off the NuMI beamline axis near Ash River, MN, 810 km from Fermilab
- **The uniqueness of NOvA is the long baseline, which is necessary for determining the mass ordering of the neutrino states.**



NOvA Far Detector

“Totally Active”

30 kT:

24 kT liquid scintillator

6 kT PVC

32 cells/extrusion

12 extrusions/plane

1984 planes

Cell dimensions:

3.9 cm x 6 cm x 15.7m

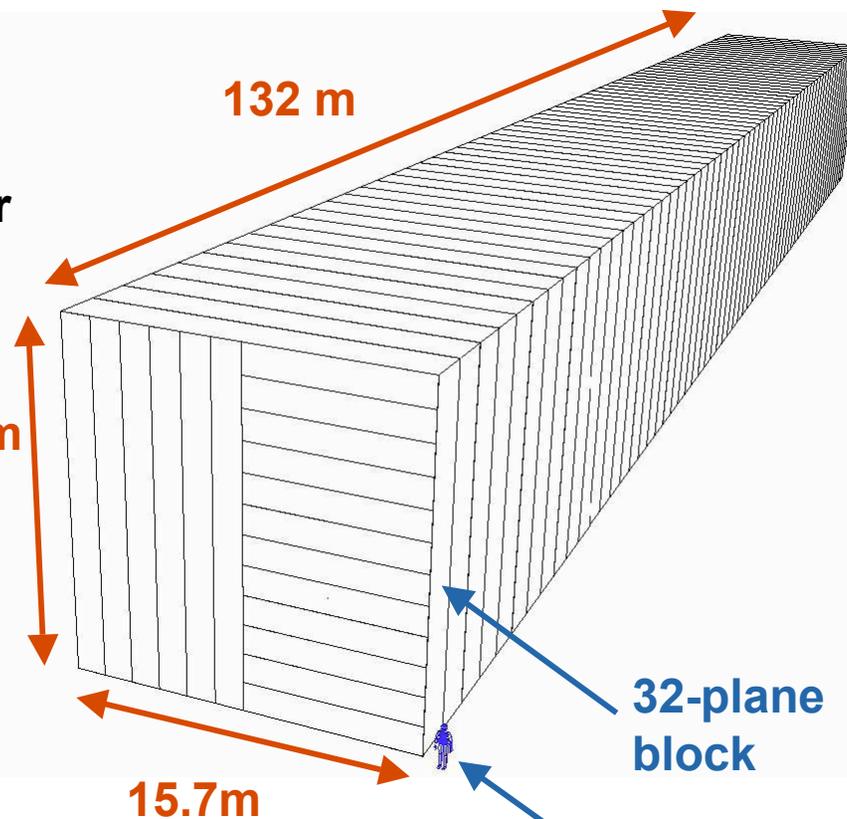
(0.15 X_0 thickness)

Extrusion walls:

3 mm outer

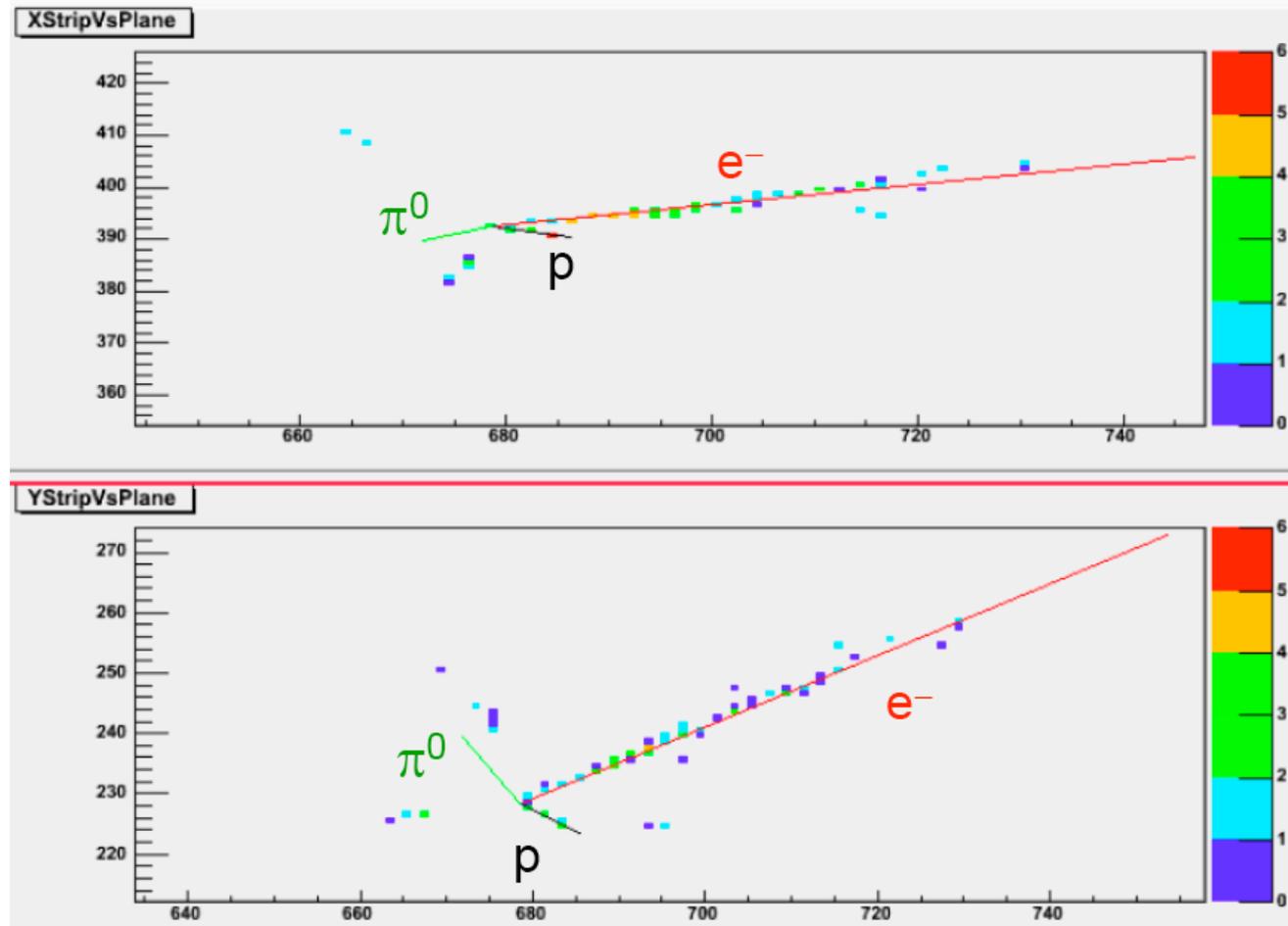
2 mm inner

**U-shaped 0.8 mm WLS
fiber into APD**





1.65 GeV $\nu_e N \rightarrow e p \pi^0$



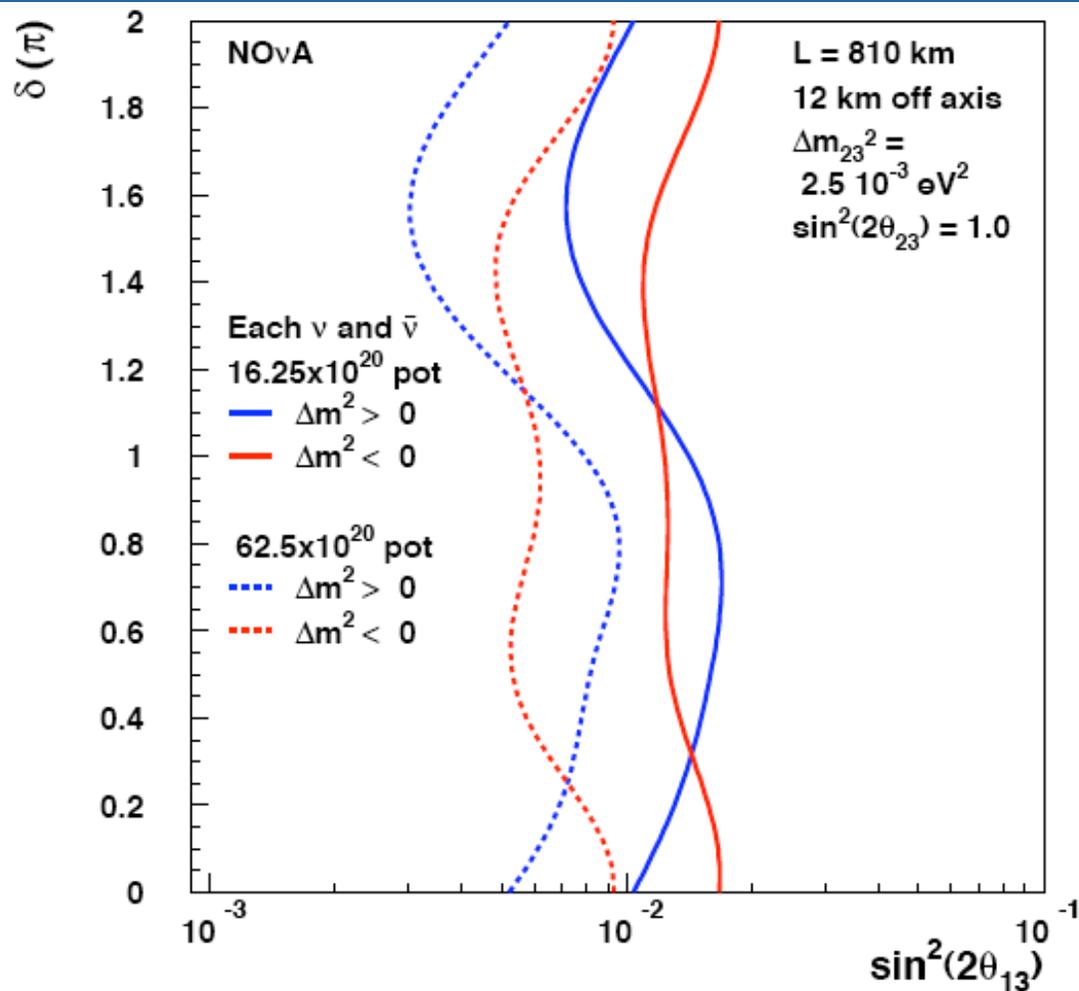


Post-Collider (~2009 and after) Proton Intensity Gains

- **NOvA gains more than a factor of 2 from not having to make antiprotons:**
 - 11/9 more Booster bunches available \Rightarrow **factor of 1.22**
 - Hide Booster filling time by filling the Recycler (2.2 s cycle time x 1.467s) \Rightarrow **factor of 1.50**
 - Lost time from transferring antiprotons \Rightarrow **factor of 1.17**
 - Total gain = $(1.22)(1.50)(1.17) = 2.14$
- **Project 6.5×10^{20} pot/yr**
- **With a new Proton Driver, 25×10^{20} pot/yr**
- **Intermediate scenarios are being investigated**



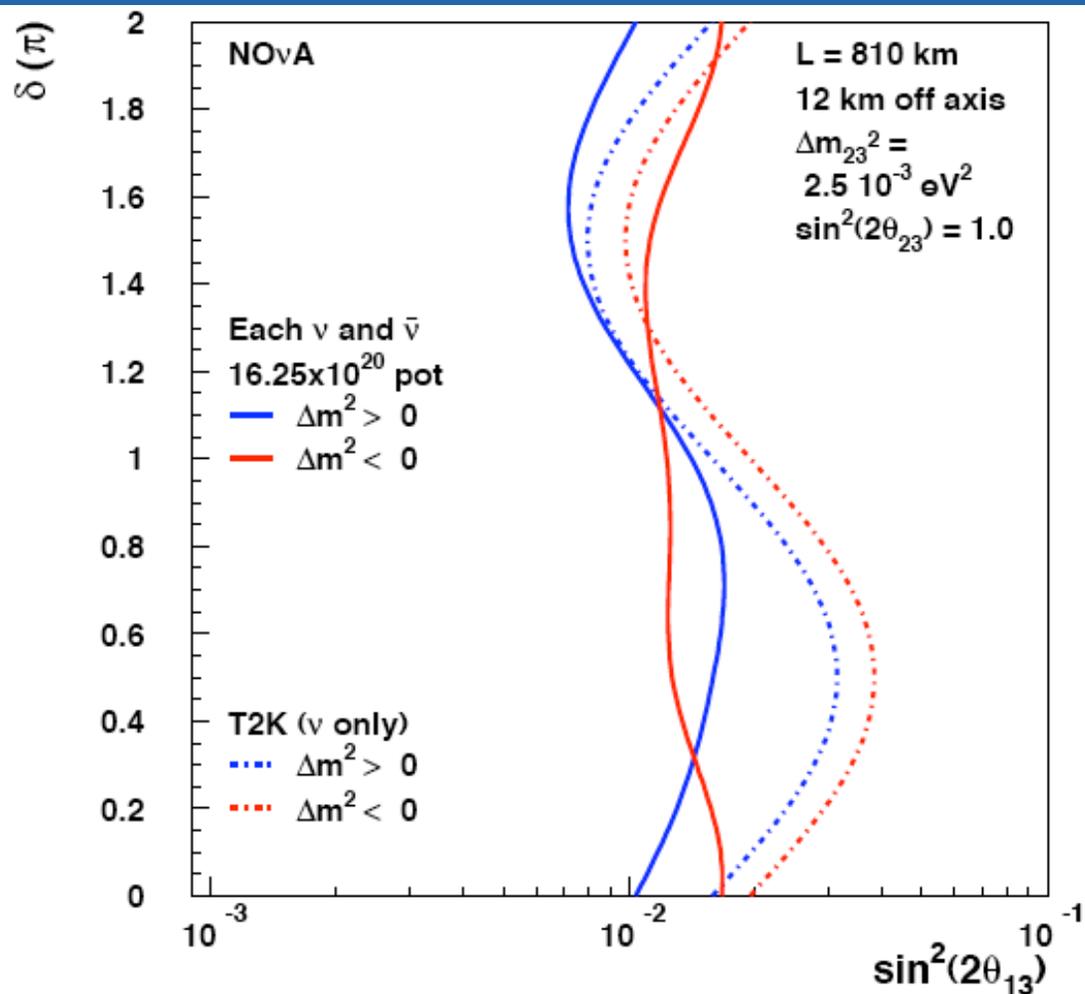
3 σ Sensitivity to $\theta_{13} \neq 0$ Comparison with Proton Driver



2.5 yr each
 ν and $\bar{\nu}$ run



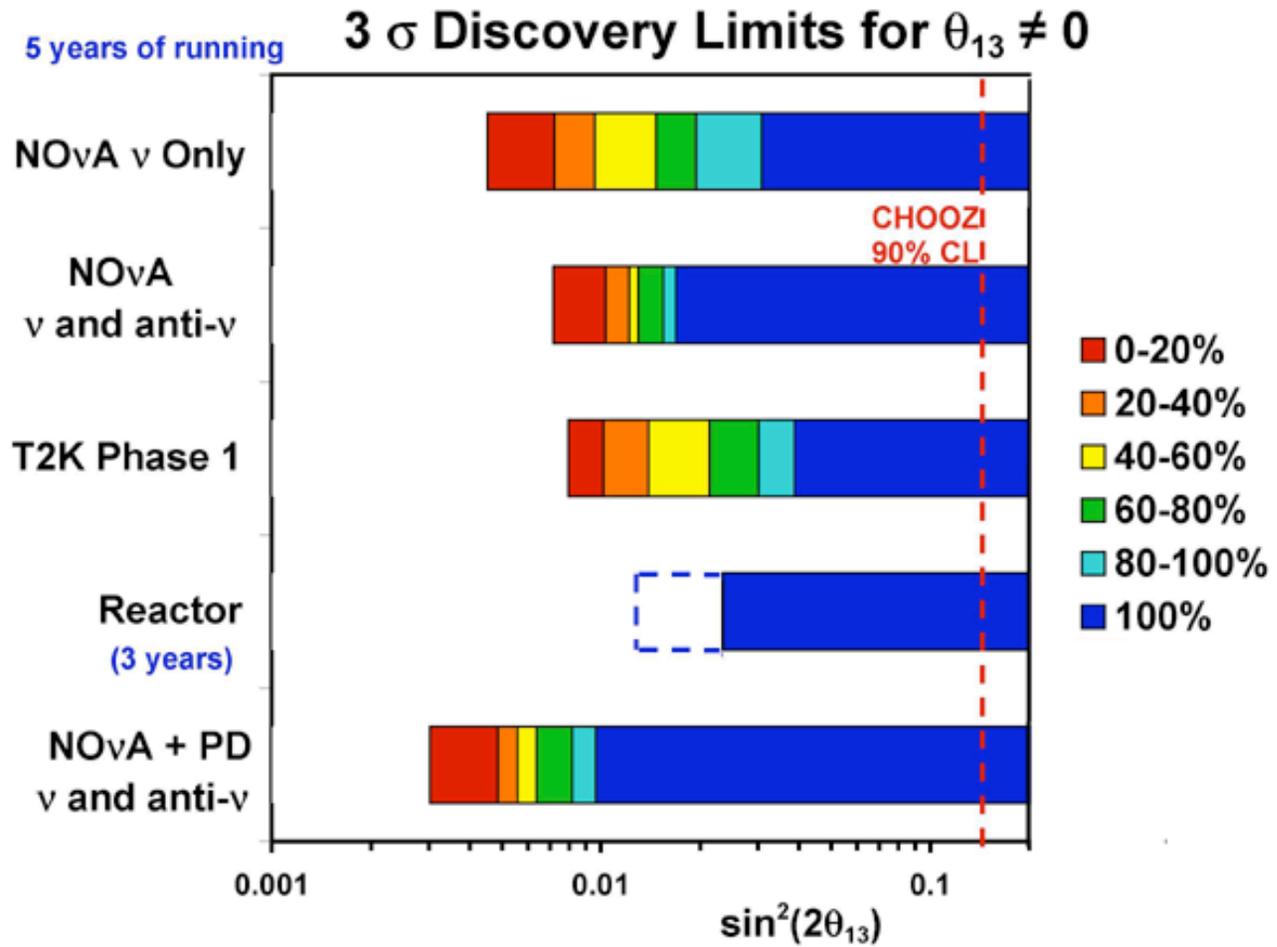
3 σ Sensitivity to $\theta_{13} \neq 0$



2.5 yr each
 ν and $\bar{\nu}$ run



3 σ Sensitivity to $\theta_{13} \neq 0$

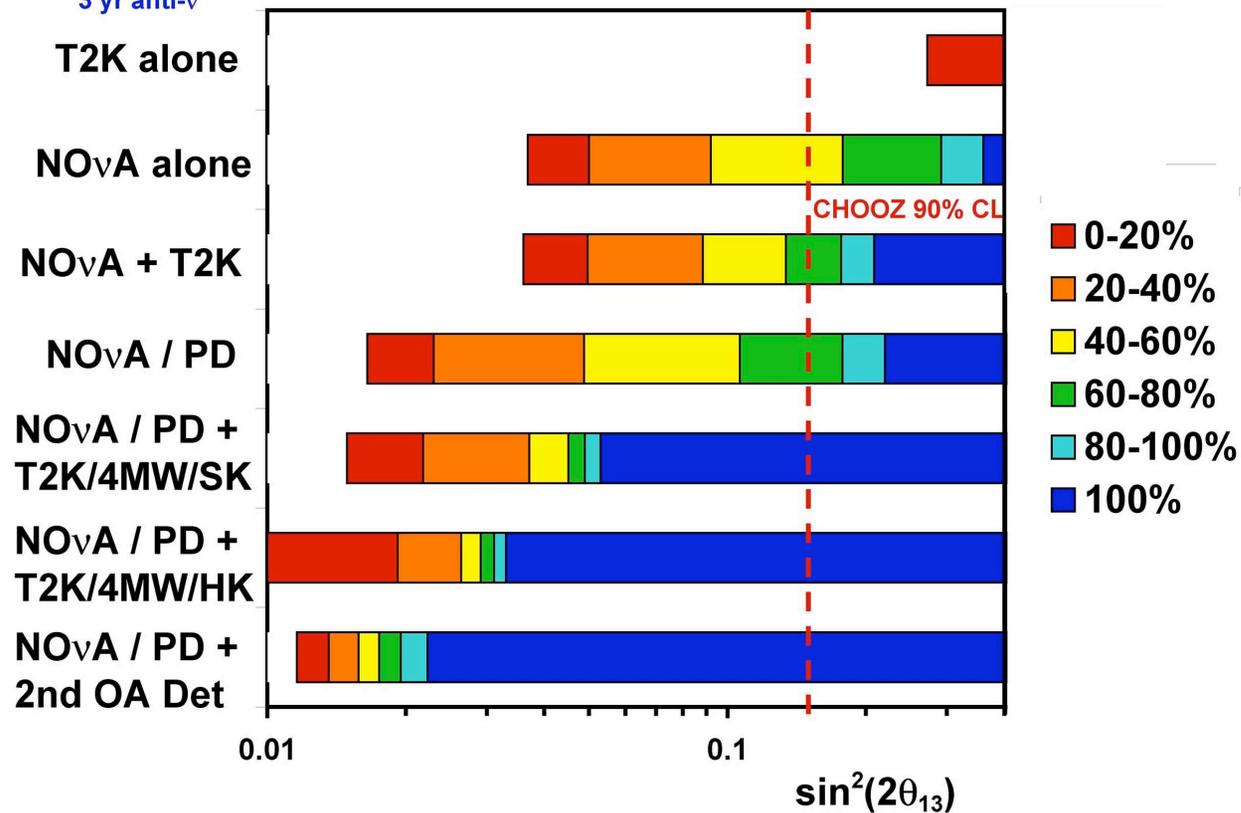




95% CL Resolution of the Mass Ordering: Summary

95% CL Determination of the Mass Ordering

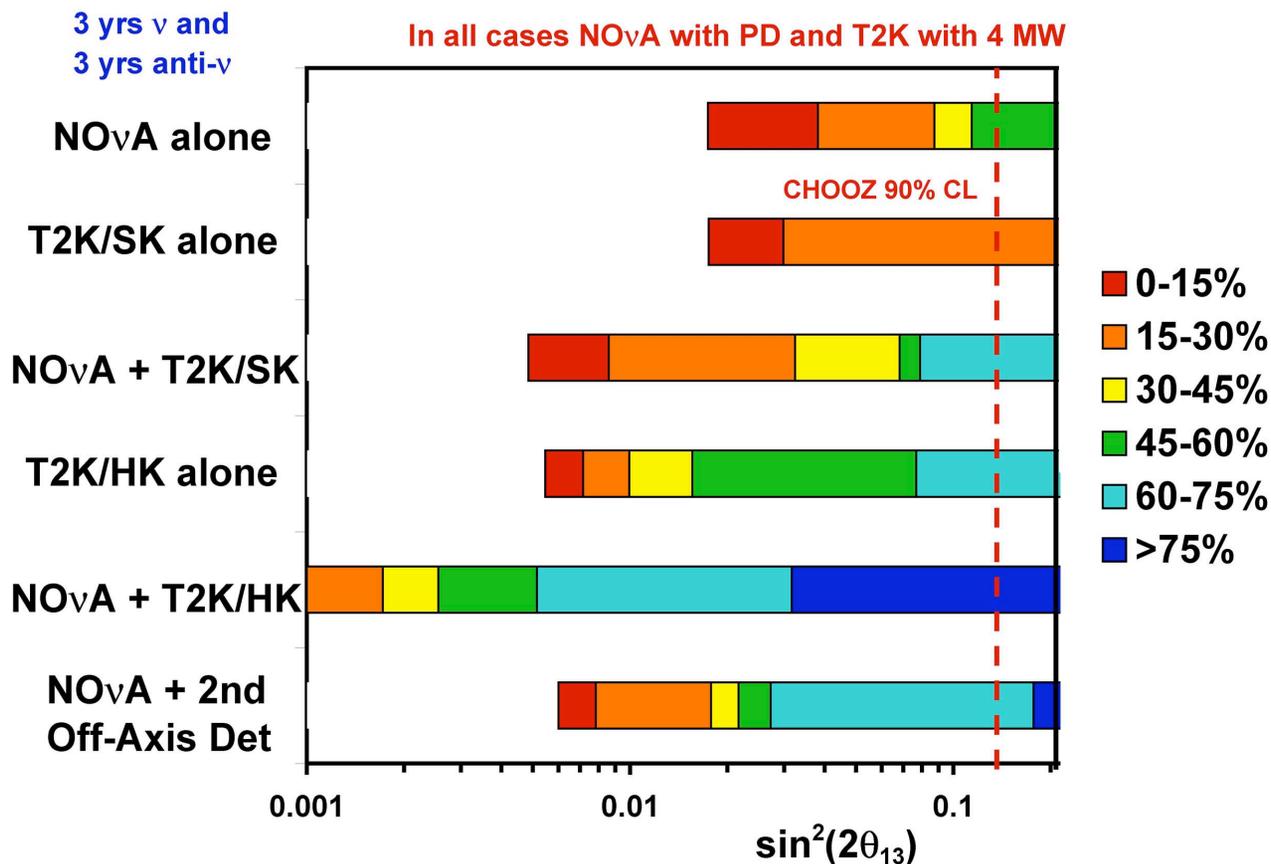
3 yr ν and
3 yr anti- ν





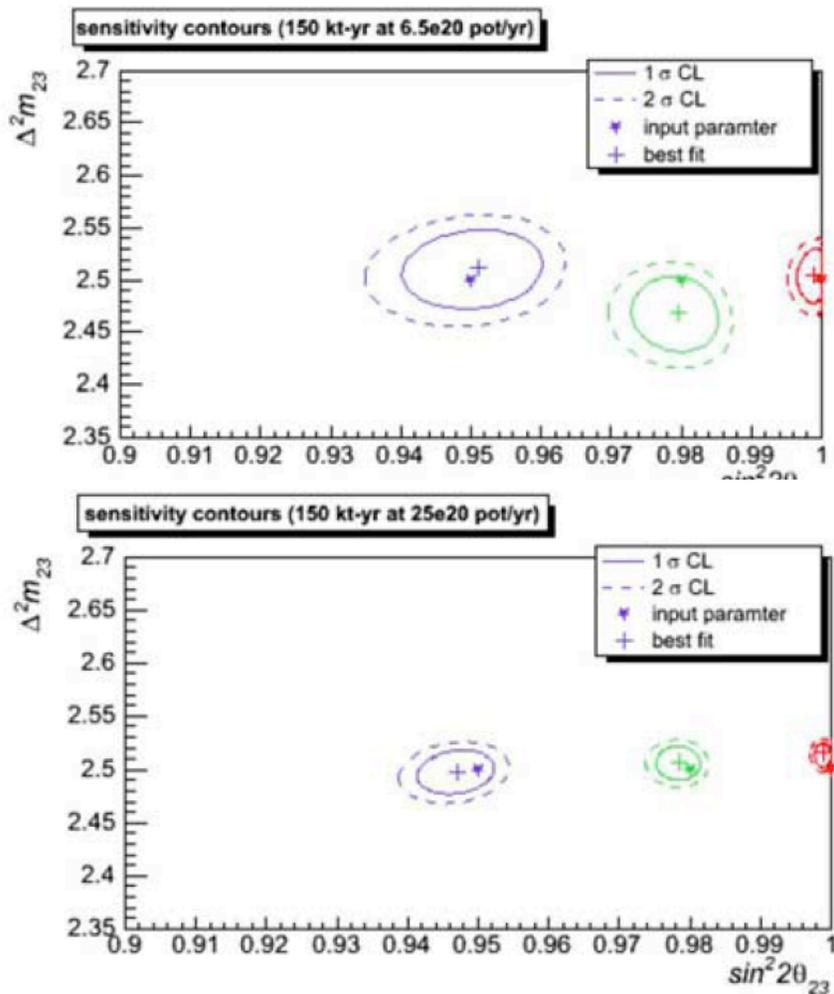
3 σ Determination of CP Violation

3 σ Determination of CP Violation





Measurement of Δm_{32}^2 and $\sin^2(2\theta_{23})$

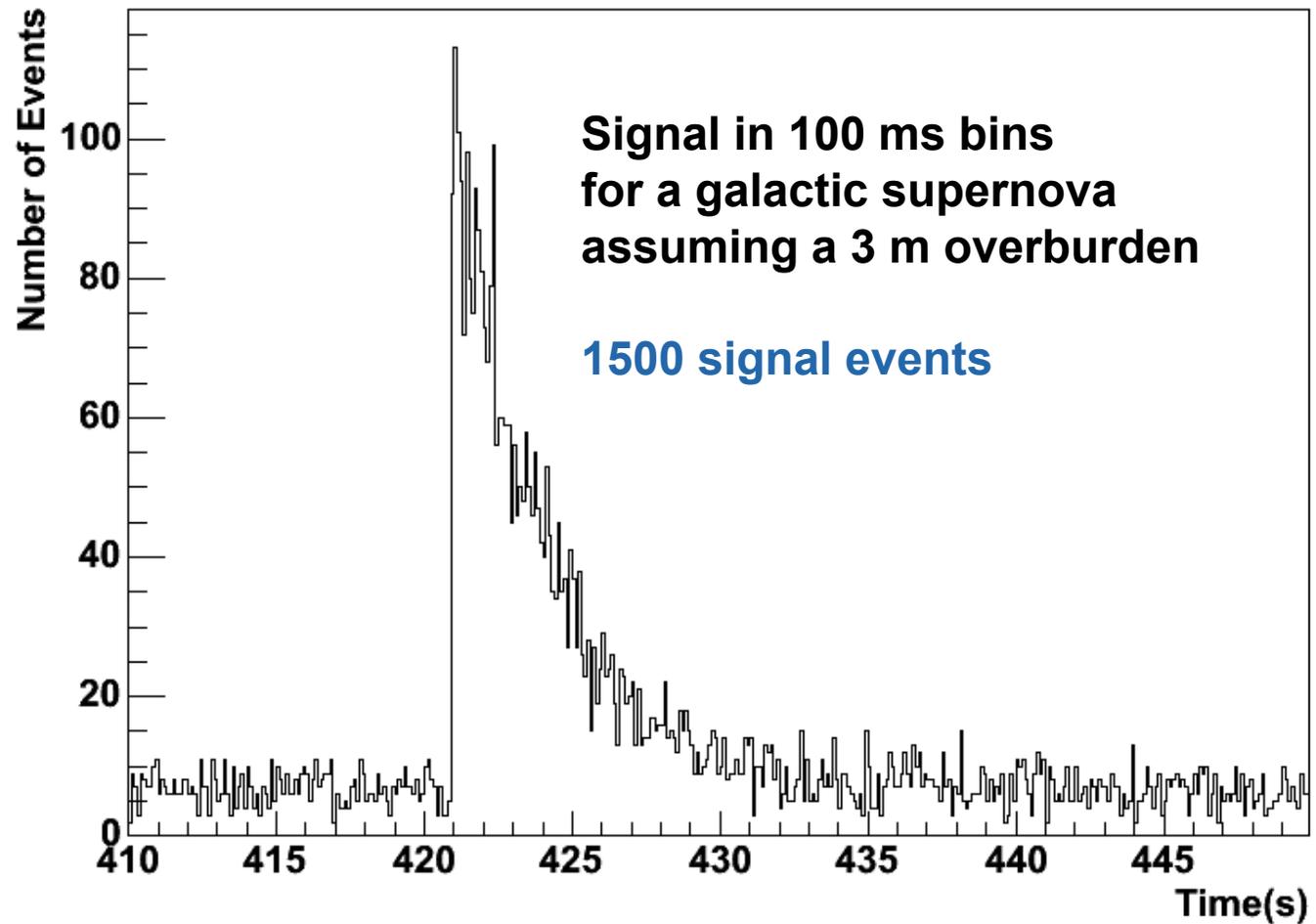


5-year ν run

5-year ν run
with Proton Driver



Sensitivity to a Galactic Supernova





Collaboration Status

- **We now have about 135 collaboration members from 30 institutions.**
- **A group of 5 Italian institutions are now considering joining NOvA.**
- **We are open to additional collaborators.**



Project Organization

- **We have a project office**
 - Project Manager (John Cooper)
 - Deputy Project Manager (Ron Ray)
 - Two Project Engineers
 - Project Chemist
 - Scheduler
 - Financial Expert
 - Documentation Expert
- **8 Level 2 managers on board (possibility of co-managers if new collaborators take a major responsibility)**
- **25 Level 3 managers on board (5 open positions)**



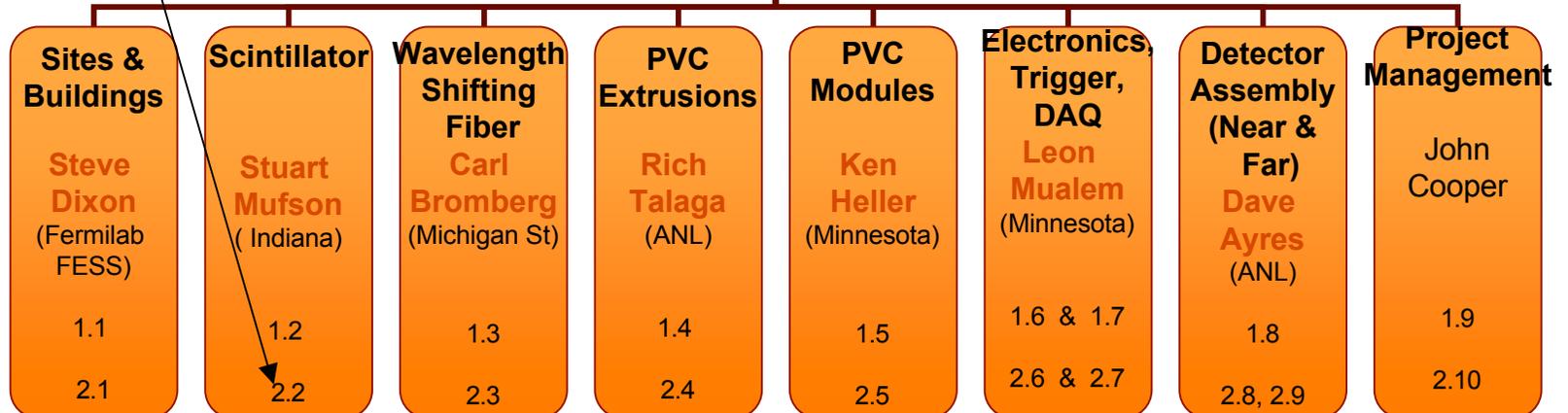
Project Organization

1.x for R&D
2.x for Construction

NOvA Project

John Cooper
Ron Ray
Dave Pushka
John Oliver
Anna Pla-Dalmau
Suzanne Pasek
Bill Freeman
Harry Ferguson

Project Manager
Deputy Manager
Project Engineer, Mechanical
Project Engineer, Electronics (Harvard)
Project Chemist
Budget Officer
Project Scheduler
Documentation & Schedule



Gary Feldman

BNL-FNAL Meeting

14 November 2005

15



Schedule

- **Aiming for a Oct 2007 project start.**
- **CD0 is awaiting Orbach's signature.**
- **We are aiming for a CD1 review in Jan 2006**
 - **Requires a Conceptual Design Report and a preliminary resource-loaded schedule and budget**
- **We are aiming for a CD2 review in Jun 2006**
 - **Requires a Technical Design Report and a final schedule and budget**
- **This is a very aggressive schedule. There is a great deal to be done in R&D, simulations, and engineering design.**