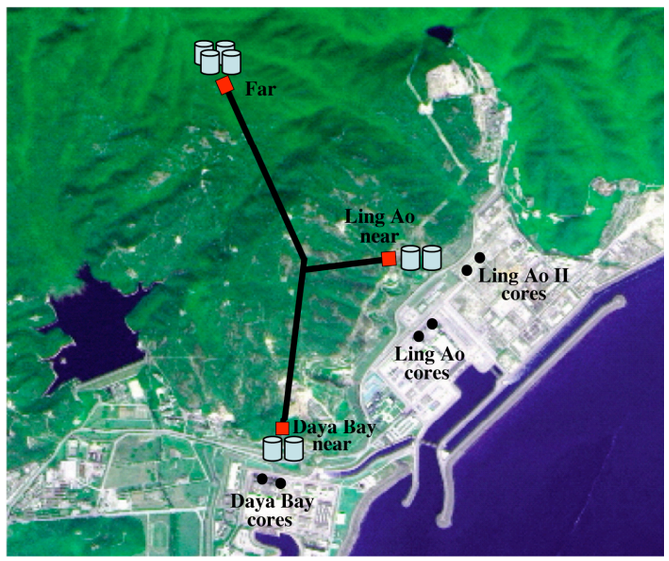
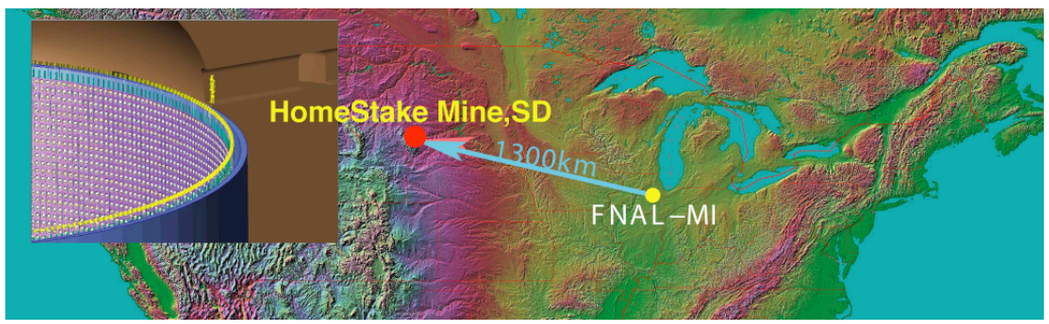
DOE slide for Laurie

2/24/2009

BNL neutrino group

- >10 member group and visitors.
- Leading roles in MINOS, DayaBay and DUSEL.
- Focussed on the next mission in neutrino mixing physics: The 13 mixing parameter, mass ordering, and CP violation.



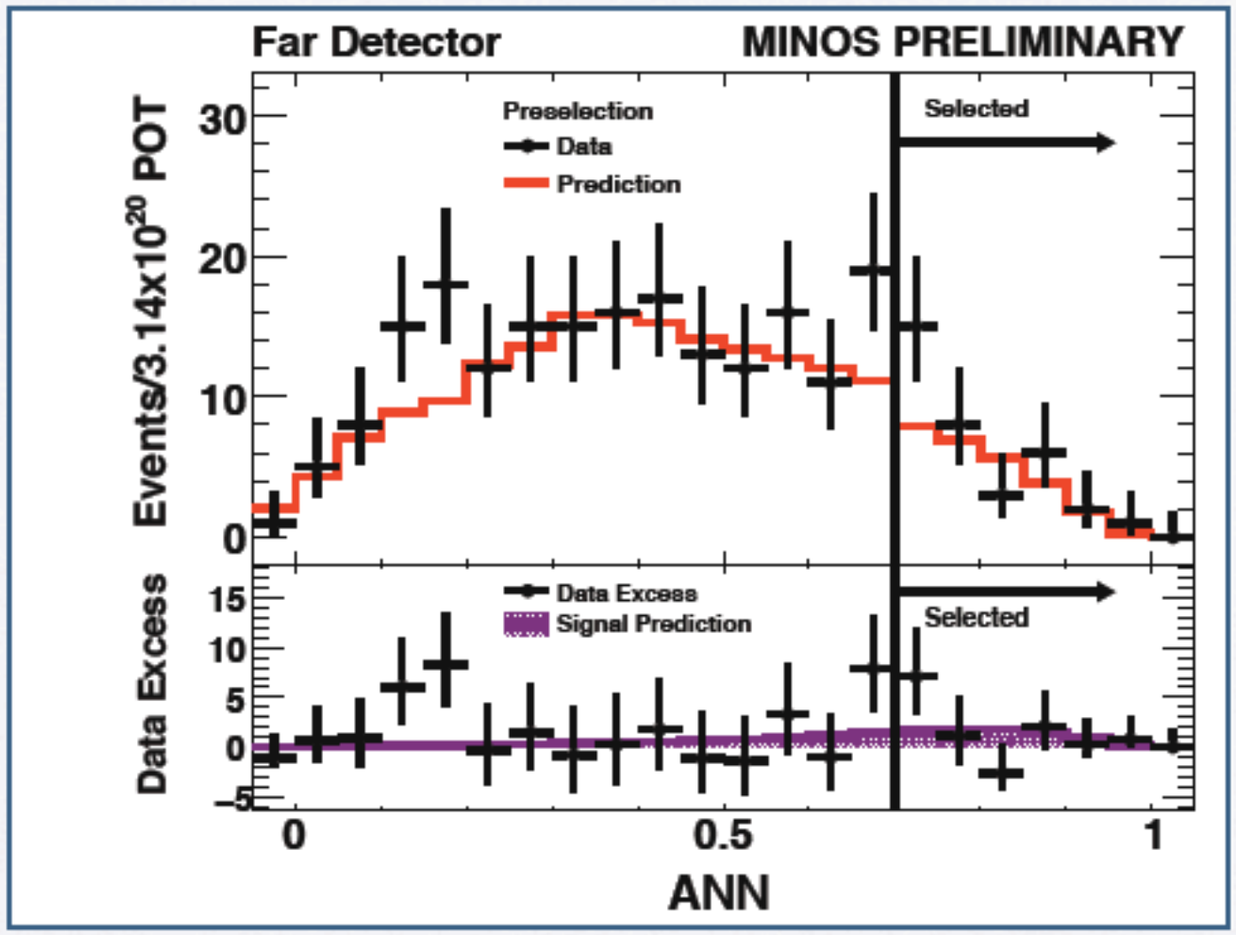


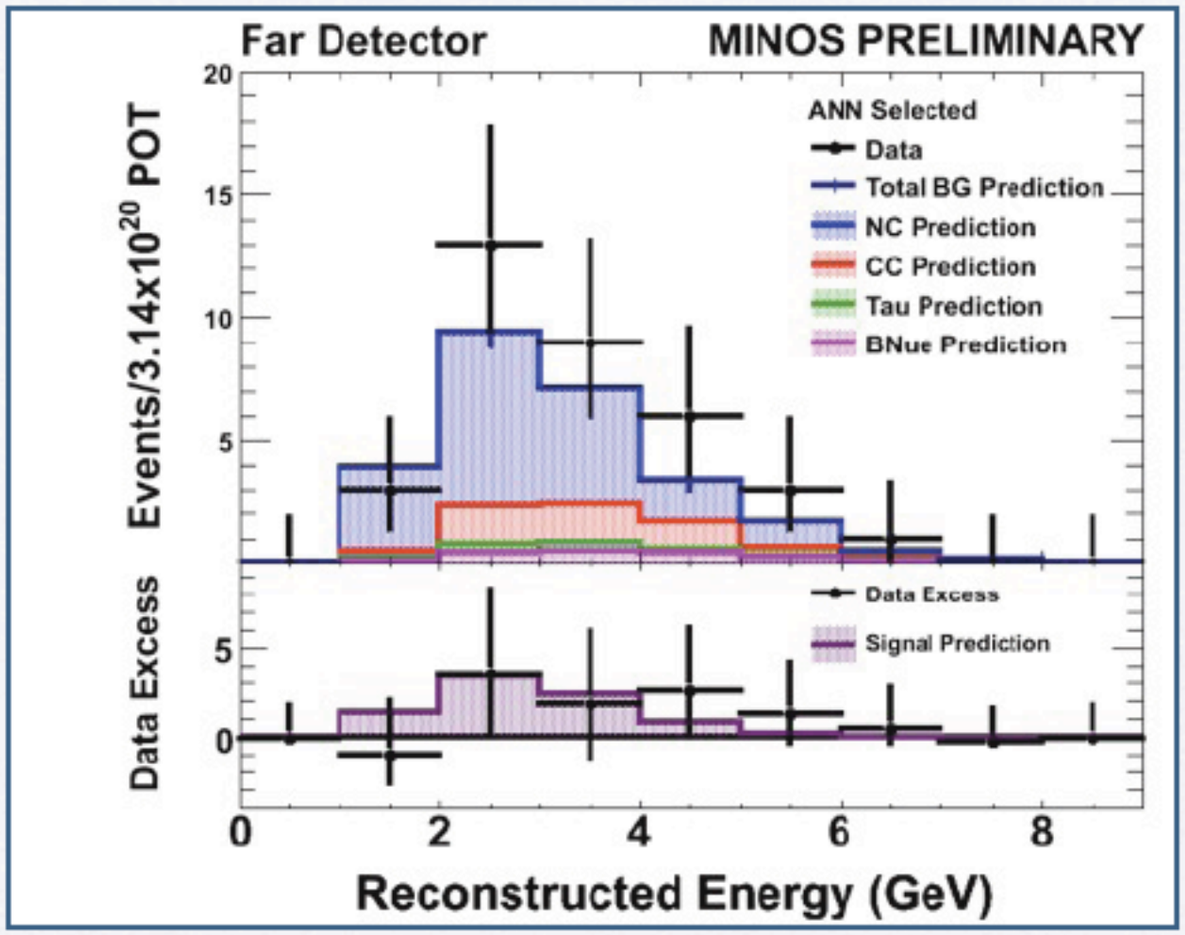
BNL in MINOS

- Responsibility for complete set of beam analysis tools: software, database, beam quality, and normalization of the experiment. (Bishai, Viren)
- Key group outside FNAL for beam simulations (Bishai, Jaffe, Viren)
- Contributions to the antineutrino analysis (Jaffe)
- Leadership and contributions to the electron neutrino analysis. The first phase with 3.14 10^{20} POT is complete. (Diwan, Whitehead, Jaffe, Bishai)
- Twice as much data is already in hand.
- Electron neutrino analysis summary:
    - Difficult analysis because detector has low granularity: 1.4 rad/plane
    - Two independent event selection procedures: ANN (artificial neural network) and LEM (Large em shower library matching).
    - Background is measured in near detector and extrapolated to the far. Systematic errors come from near/far differences.
    - ANN has lower systematics and so is the preferred result. In the

ν_e Selected Far Detector Data

- **We observe a total of 35 events in this sample.**
- **We expect 27±5(stat)±2(sys) events.**





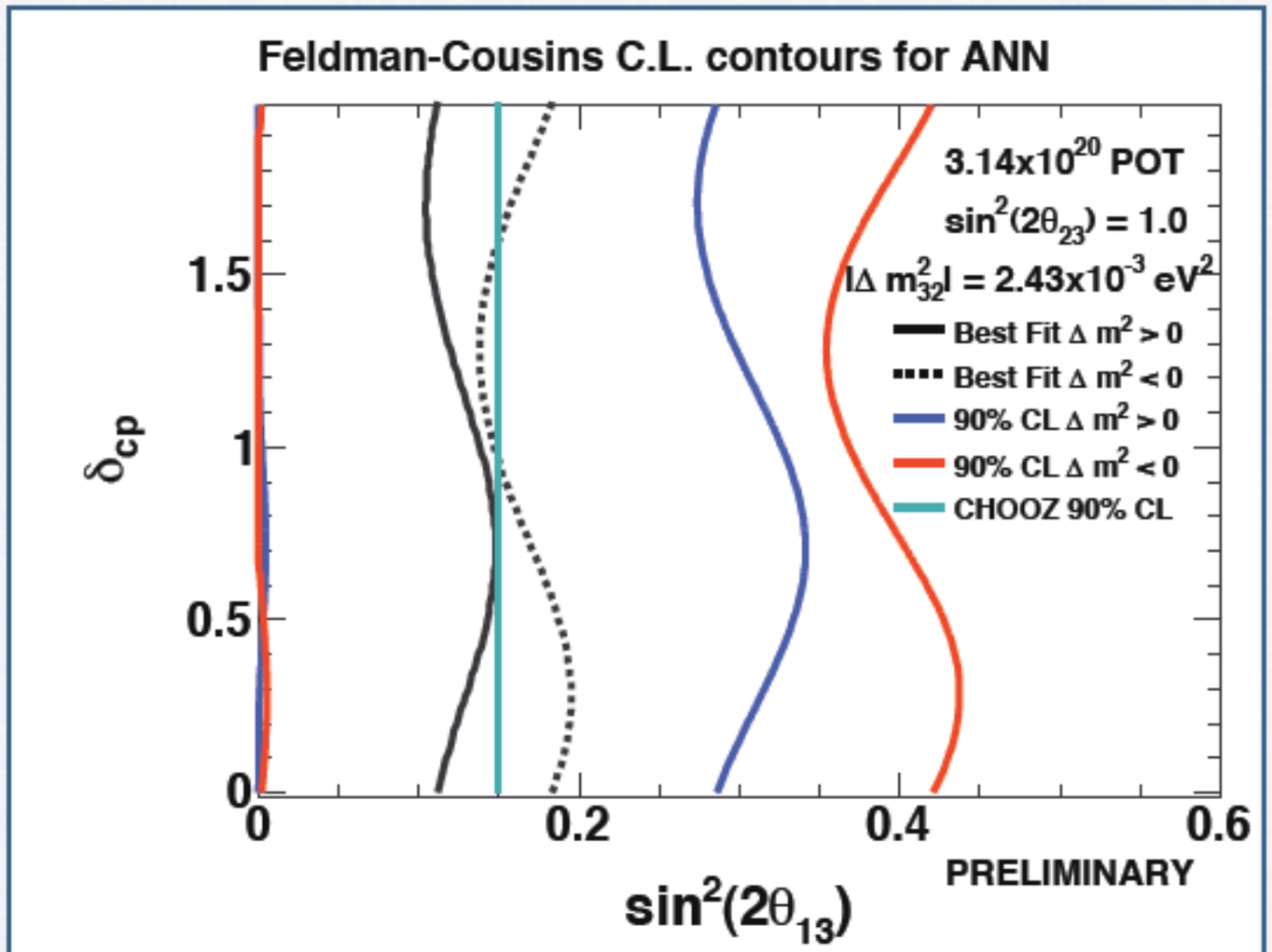
- **If we fit the oscillation hypothesis to our data, we can obtain the signal prediction for the best fit point.**

Results are within 1.5 σ for this selection.

MINOS 90% CL in $\sin^2 2\theta_{13}$

Fitting the oscillation hypothesis to our data

- Plot shows 90% limits in δ_{CP} vs. $\sin^2 2\theta_{13}$
  - for both mass hierarchies
  - shown at the MINOS best fit value for Δm^2 and $\sin^2 2\theta_{23}$ for 3.14×10^{20} POT.
- A Feldman-Cousins method was used.
- Results are for primary selection and primary separation method.



Results are consistent with $\sin^2 2\theta_{13}=0$ at 92% CL.

Future exclusion contours

7.0 x10^{20} POT

- Plot shows 90% future exclusion in δ_{CP} vs. $\sin^2 2\theta_{13}$
  - for both mass hierarchies
  - shown at the MINOS best fit value for Δm^2 and $\sin^2 2\theta_{23}$ for 3.14 x10^{20} POT.
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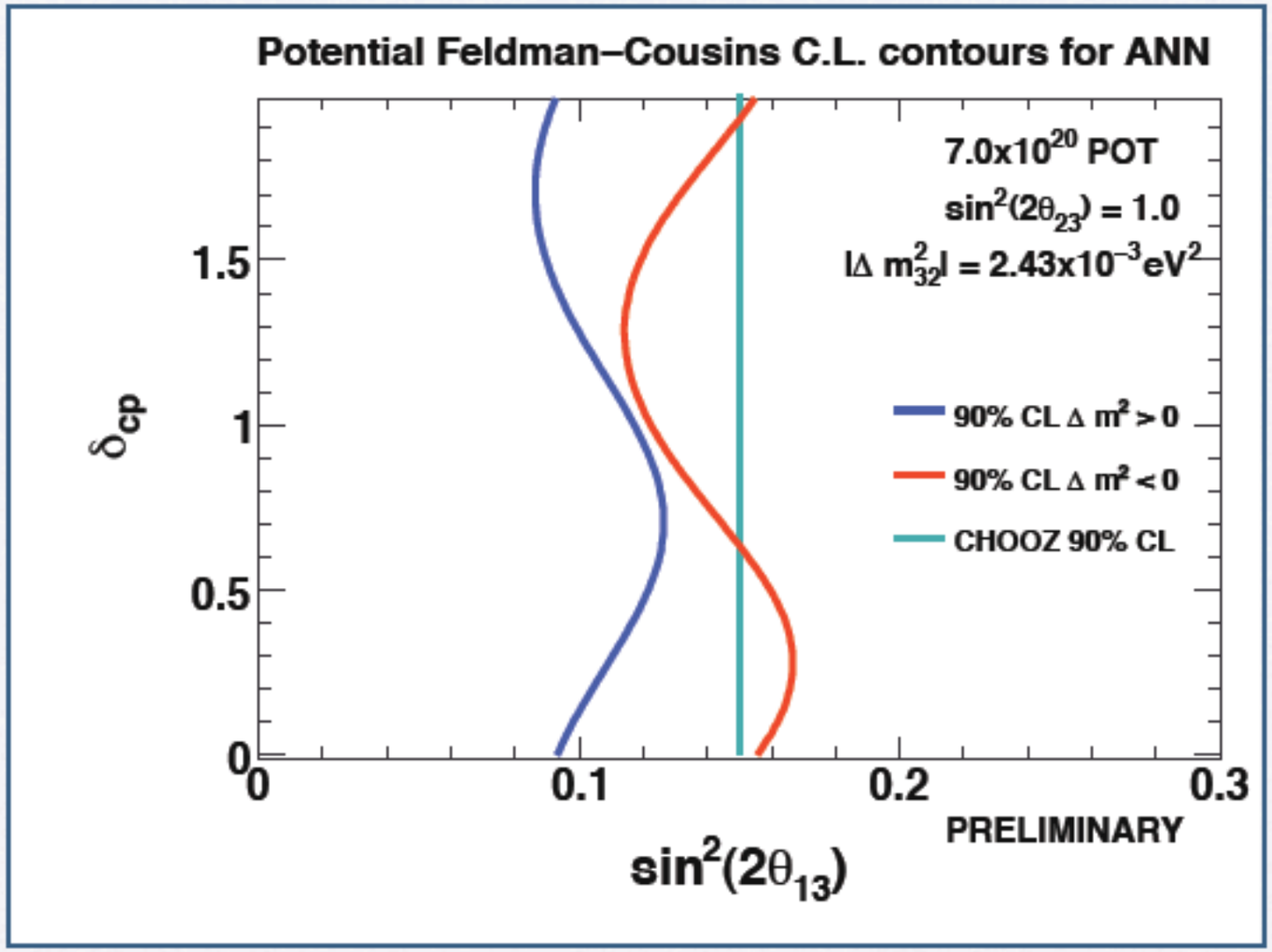
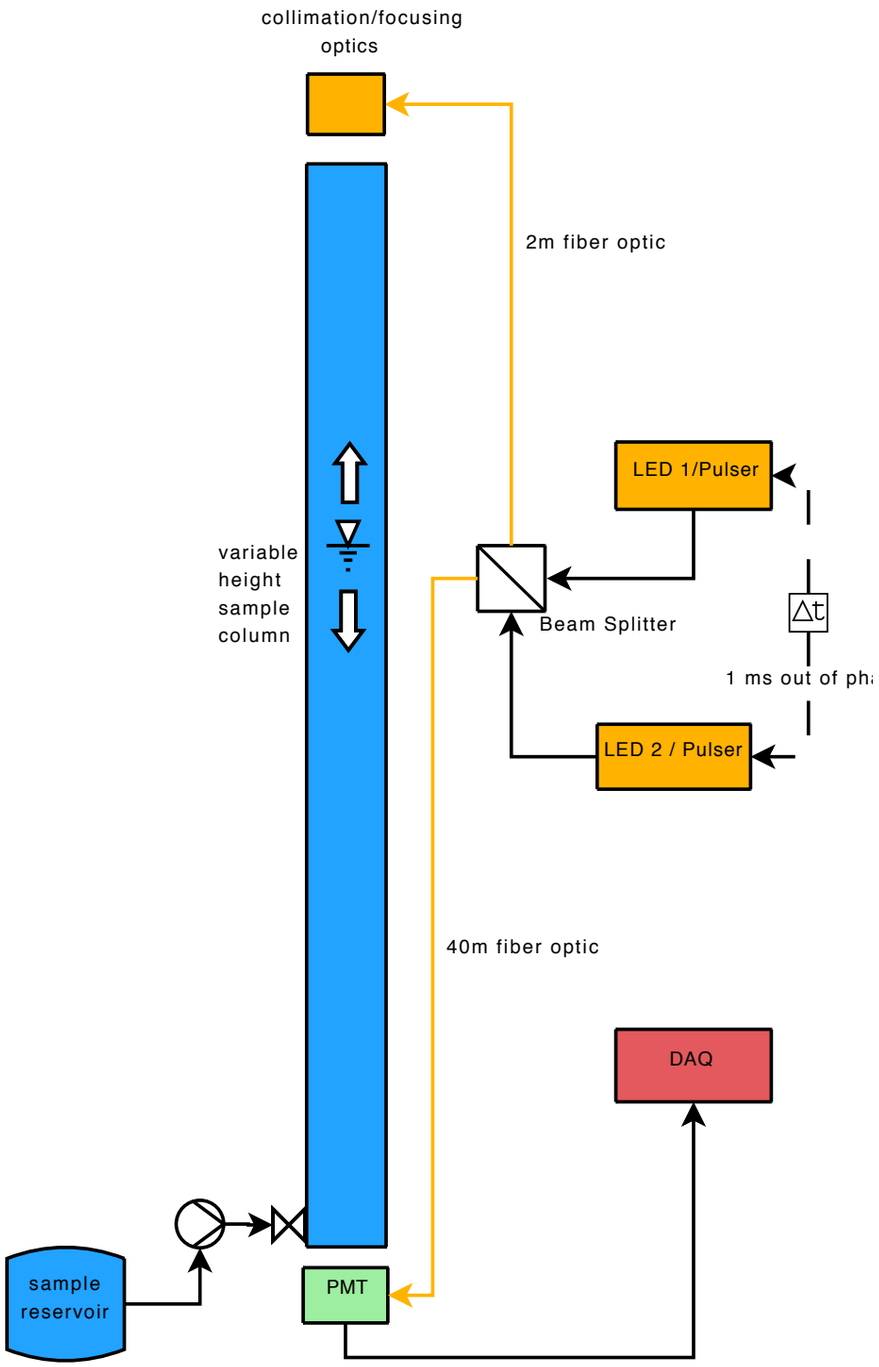


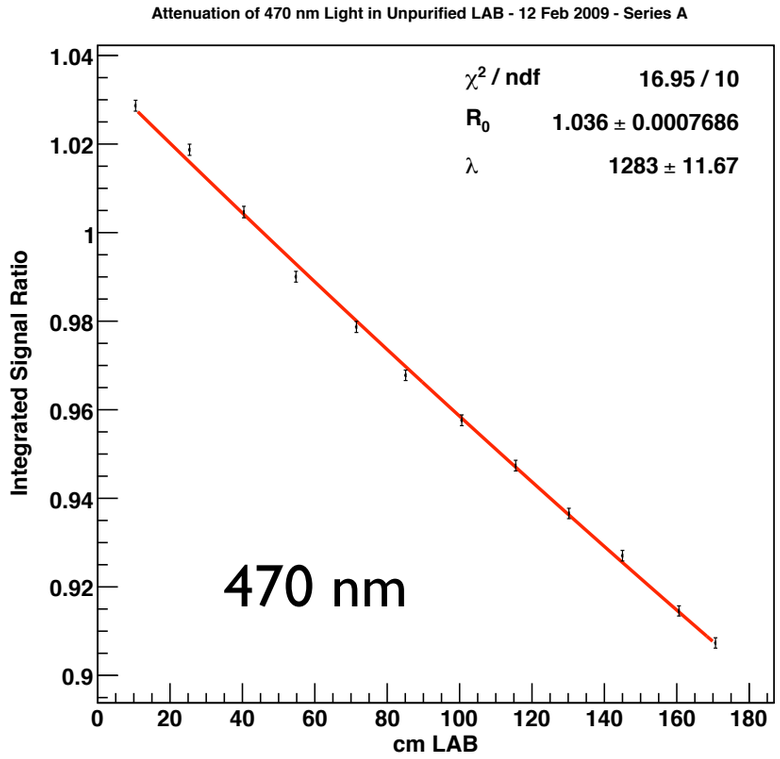
BNL in Dayabay

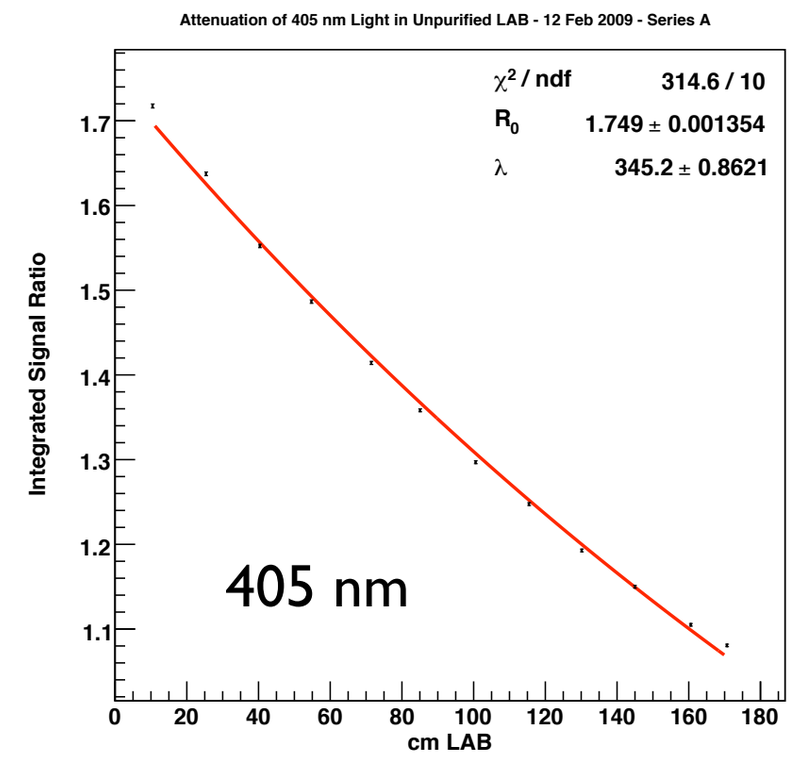
- Laurie, please fill these bullets.

- Important hardware development for Dayabay

Attenuation of light in LS
Collaboration with BNL-Chemistry, and RPI: Yeh, Goett, Diwan



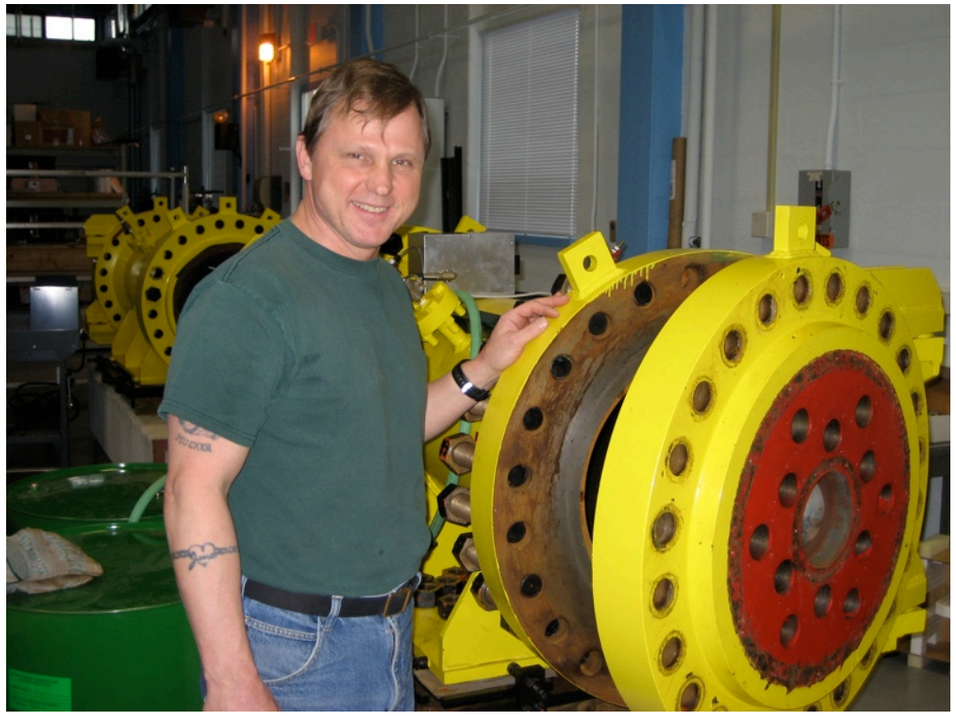


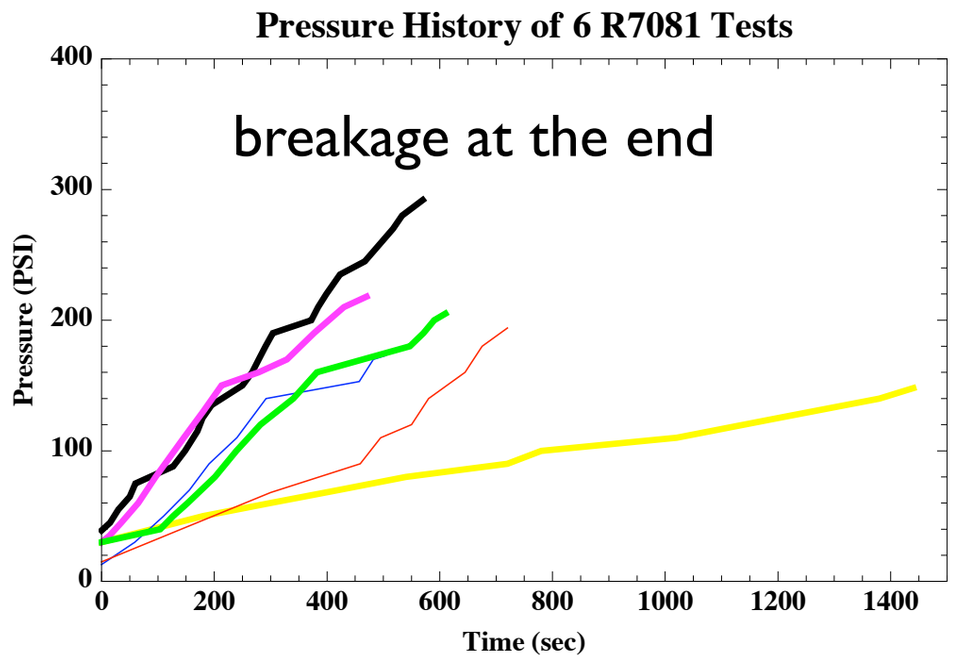


data on unpurified LAB

- High precision(0.1%), high stability system using ratios of time separated pulse heights. Data on multiple wavelengths obtained simultaneously.
- Fit for exponential only, work in progress on effects of scattering, dispersion, surface effects.
- Majority of the hardware funds from LDRD program which is completed, needs support.

Development of pressure testing at BNL (Diwan, Goett, Sexton)





- What have we learned
  - Manufacturers have tubes with very distinct characteristics
  - Failure mode in Hamamatsu hemispherical tubes is at the pins. 7 atm is o.k.
  - Other manufacturers failure may occur at the dome in much more damaging way.
  - Data includes motion picture and recorded pressure pulses.
  - Funded mostly out of LDRD which is finished.

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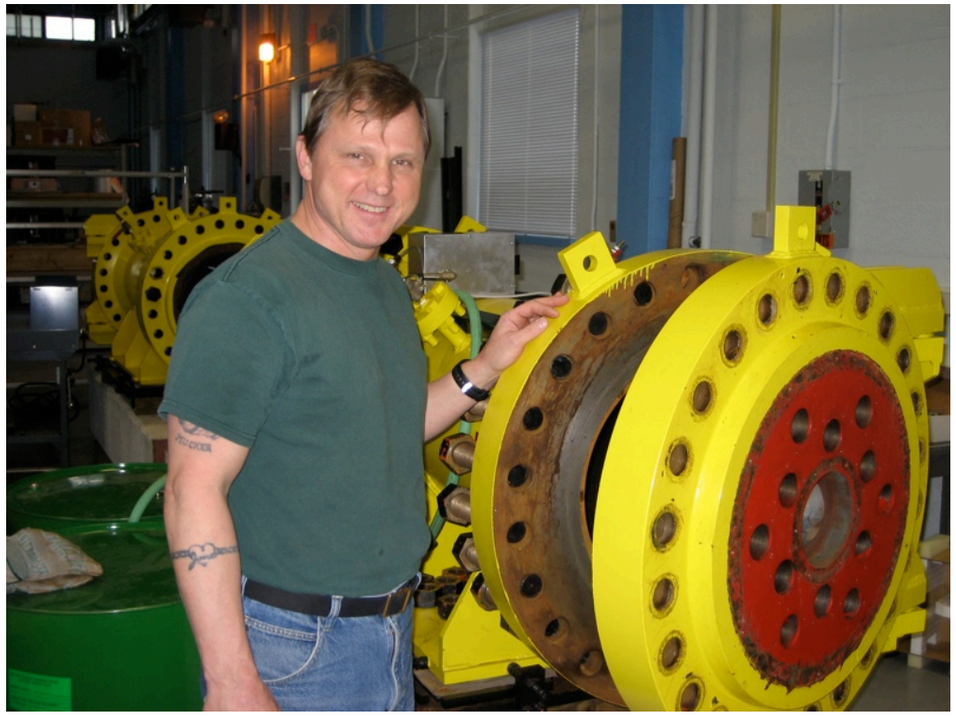

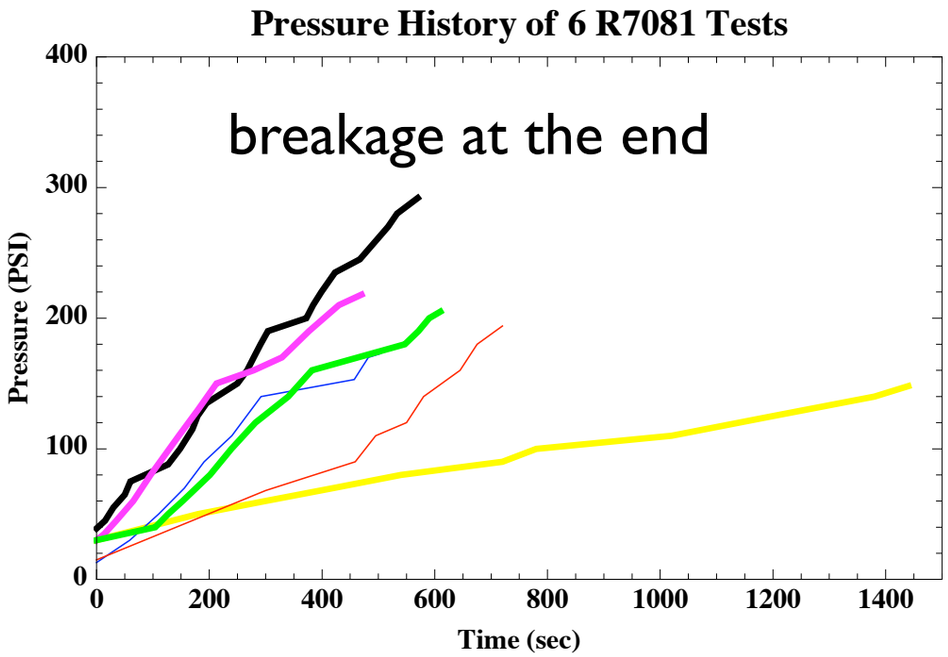

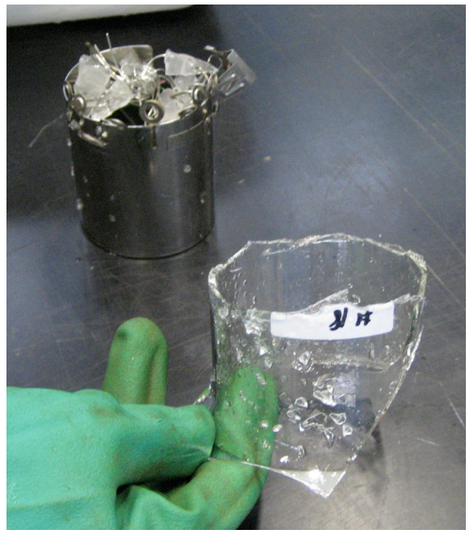

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BNL in DUSEL

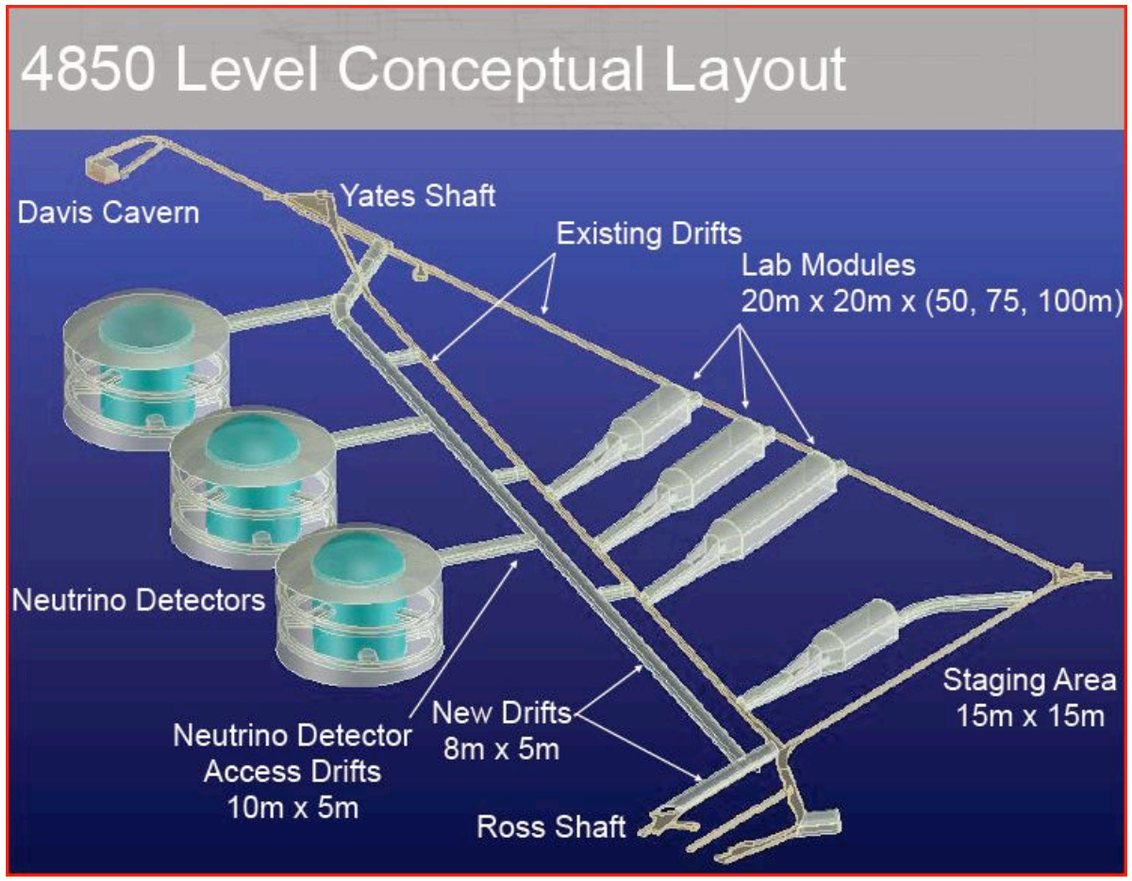
- Long sustained effort to figure out how to measure CP violation in neutrinos.
- 2006-2007 - US long baseline study: coordinators: Diwan, Rameika long paper trail: http://nwg.phy.bnl.gov/fnal-bnl
- 2007 - NUSAG report
- 2008 - P5 report "The panel recommends a world-class neutrino program as a core component of the US program, with the long-term vision of a large detector in the proposed DUSEL laboratory and a high-intensity neutrino source at Fermilab."
- Timeline since mid 2008 on next page. BNL group has had a critical role in all of the above.
- Large part of the effort including some technical effort was supported by LDRD. The LDRD support has ended since this is now considered part of the base mission.

Homestake Water Cherenkov Neutrino Detector Milestones

- Oct. 2008 UDIG workshop at BNL and first collaboration meeting.
- Oct. 2008 Institutional board formed and Interim Executive Board meetings
- Nov. 2008 Collaboration mission statement.
- Dec. 2008 Collaboration Depth justification document completed. BNL-81896-IR, Fermilab-TM-2424-E, LBNL-1348E
- Jan. 2008 report on Cavern excavation design (engineering subcontract from BNL)
- Jan. 2008 Collaboration proposal to NSF (S4 solicitation) for design work.
- Jan. 2008 NSF DUSEL review included review of large cavities.
    - In progress
        - CD0-CD1 organization.
        - Project organization FNAL-BNL-LBL coordination. Project Management Group formed.
        - White paper on physics goals.

BNL support on technical work

- Support for postdocs and physicists during the US long baseline study and calculations that went into the study.
- Support for UDIG workshop and other travel.
- BNL supported Work on photo-multiplier testing, pressure testing, etc.
- BNL supported first engineering study, conceptual layout, and excavation schedule + cost.



Laurenti, FNAL 2008 Aug 1($Millions)

Cavern excavation:	33.1	
Equipment	10.0	
Overhead (10%)	4.4	
Markup(20%)	8.7	
Contingency (40%)	22.8	
Skipping cost ($4/Ton)	2.0	(500 kT)
Disposal ($10/Ton)	5.0	(500 kT)
TOTAL	$86.1M	(1 cavern)