Barbara Szczerbinska (DSU)

For LBNE Collaboration

LONG BASELINE NEUTRINO EXPERIMENT

LBNE – Science Collaboration

- **~180 people**
- **Scientific Goals are very broad**
  - Neutrino Mass Hierarchy & CP violation
  - Supernovae
  - Relic Supernovae
  - Proton Decay
  - Neutrino Physics

Water Cherenkov Detector Design Group

- Argonne NL
- Boston University*
- Brookhaven NL
- Caltech*
- Univ. of California, Davis*
- Univ. of California, Irvine*
- Drexel University*
- Duke University*
- Fermi NL
- Lawrence Berkeley NL
- Iowa State Univ.
- Univ. of Hawaii
- Lawrence Livermore NL*
- Univ. of Maryland*
- Univ. of Minnesota
- Univ. of Pennsylvania*
- Rensselaer Poly. Inst.*
- Univ. of South Carolina*
- Univ. of Wisconsin*

* Funded through NSF S4

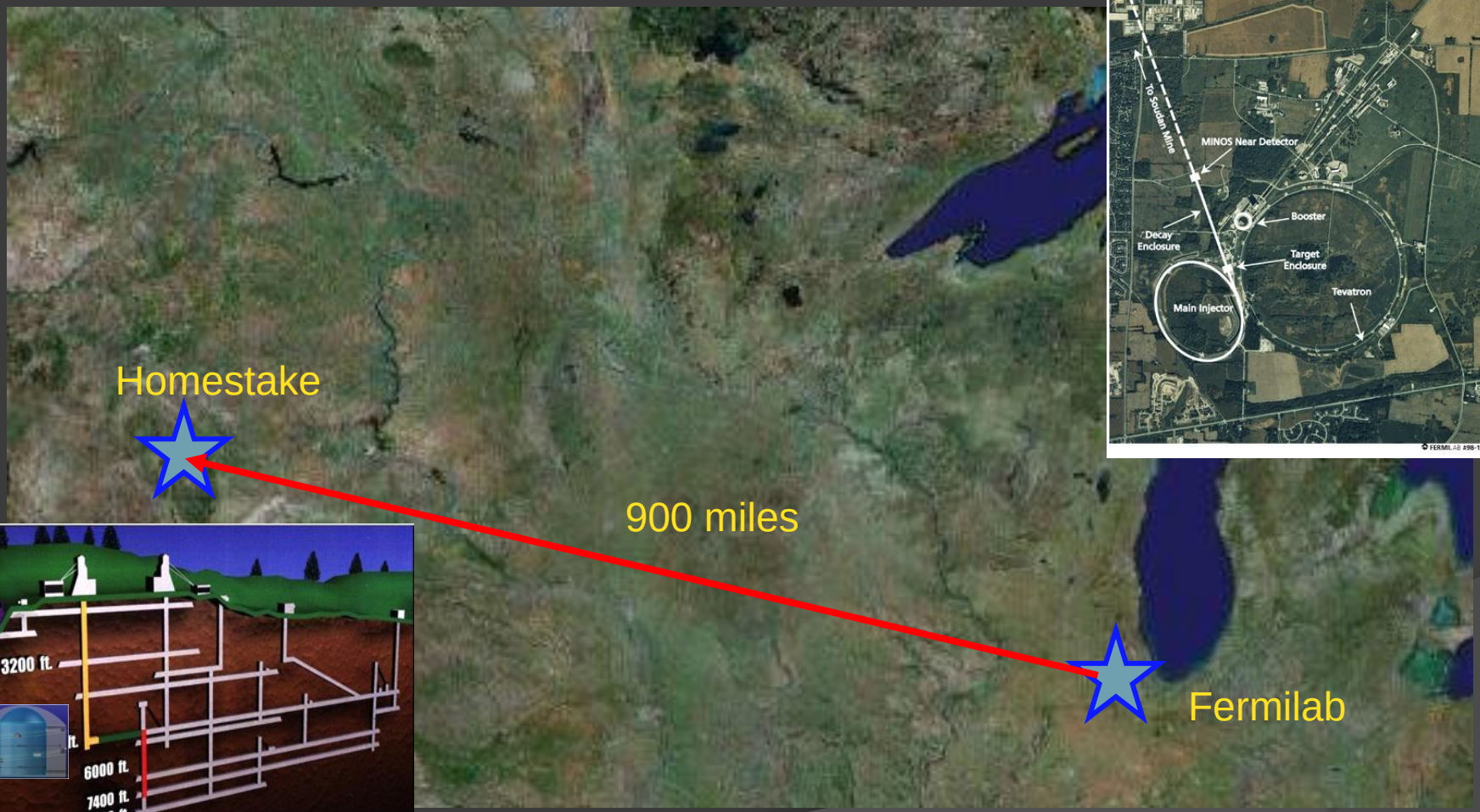
Major Project Components

- **Neutrino Beam. Plan initially for 700 kW beam with potential for up to 2 MW later. Project Office at FNAL.**
- **Near Detector: for characterization of the beam. LANL proposed to have a major role.**
- **Far Detector. Project Office at BNL and S4 proposal from NSF for Water Cherenkov detector development. LAr detector development through FNAL.**

Other Experiment Components

- Electronics: conceptual designs in progress. Would like further international cooperation.
- Water transparency: facilities at UC Irvine, LLNL
- Gadolinium loading: UC Irvine, LLNL, BNL
- Calibrations: specifications being developed
- PMT's: FNAL
- Project Integration: BNL/DUSEL/S4
- Safety: BNL
- Environmental Impact: ANL

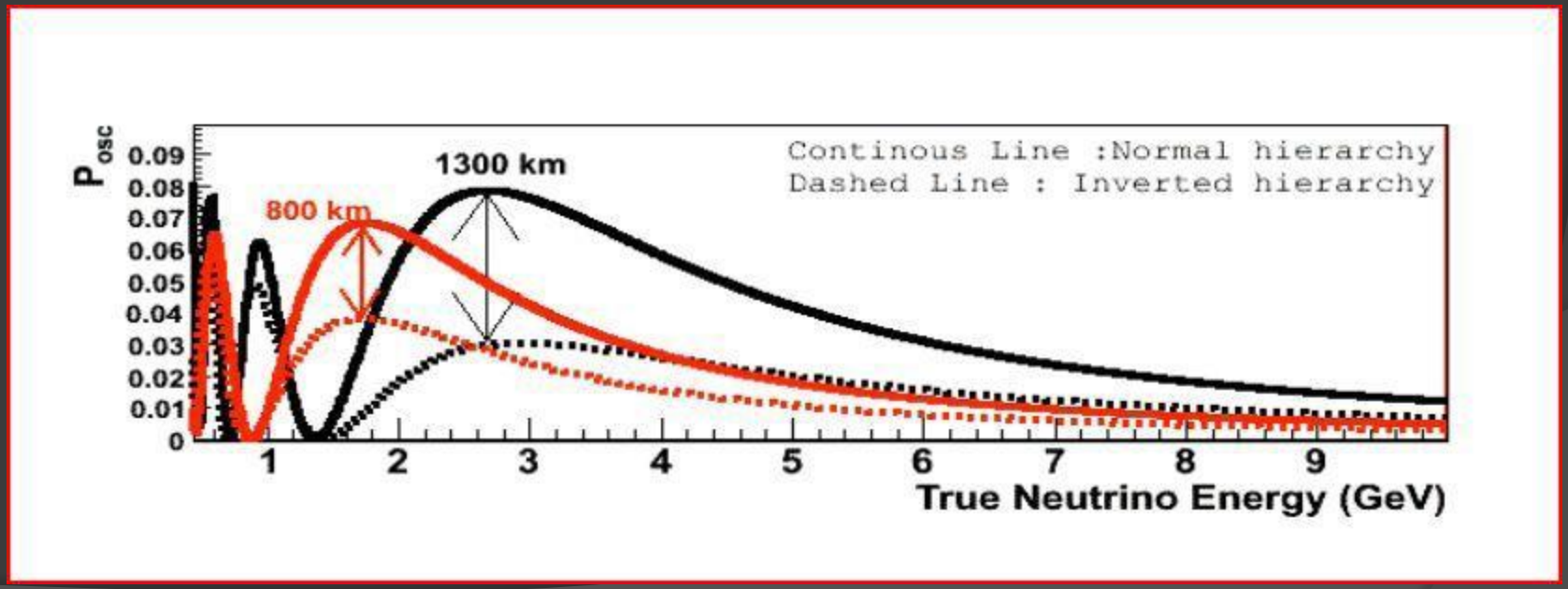
Long Baseline Neutrino Studies

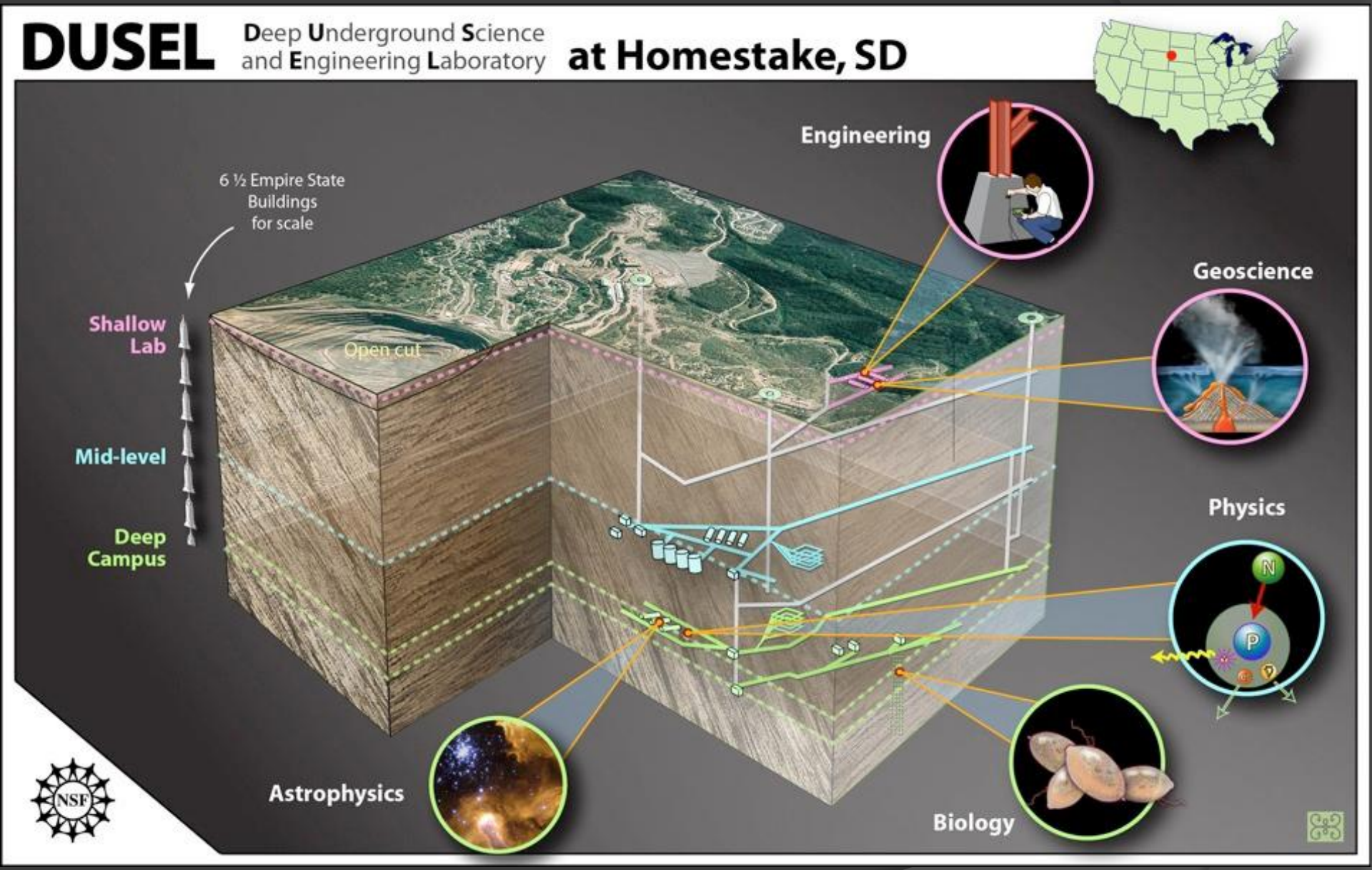


Homestake Mine, Lead SD

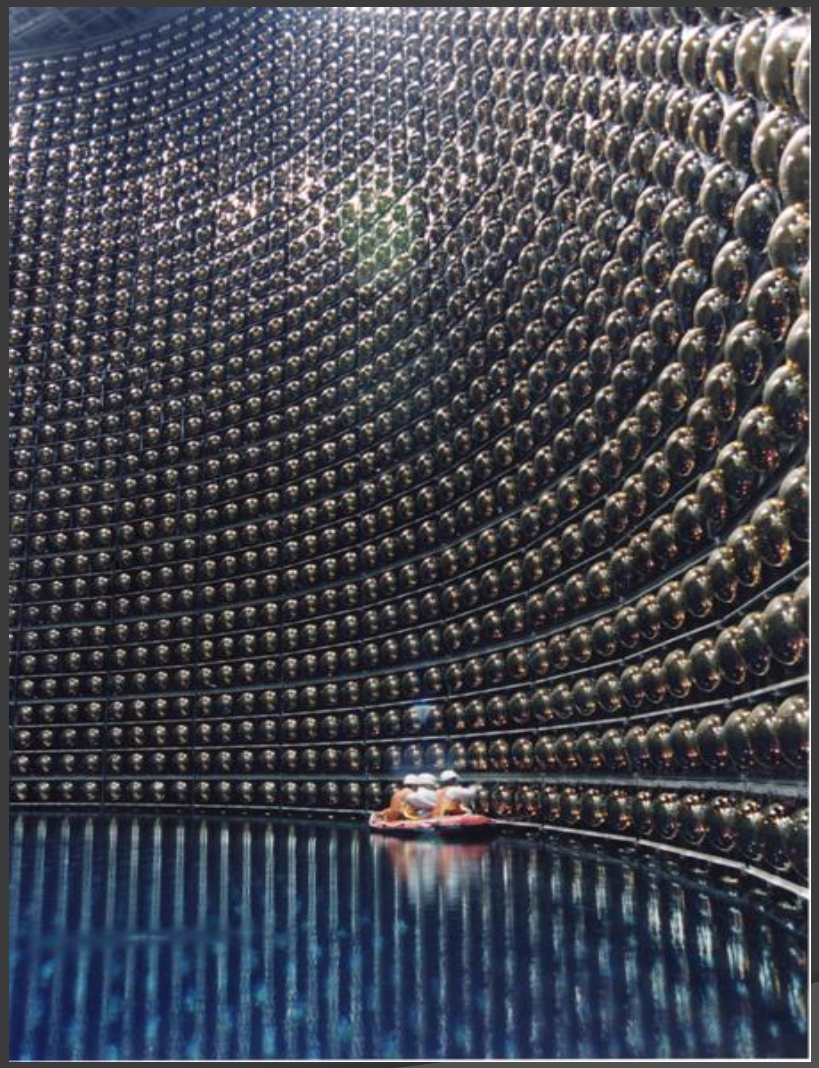
Why DUSEL at Homestake?

- 1300 km distance is significant for determination of neutrino mass hierarchy
- Deep underground site allows rich physics program in addition to LB neutrinos

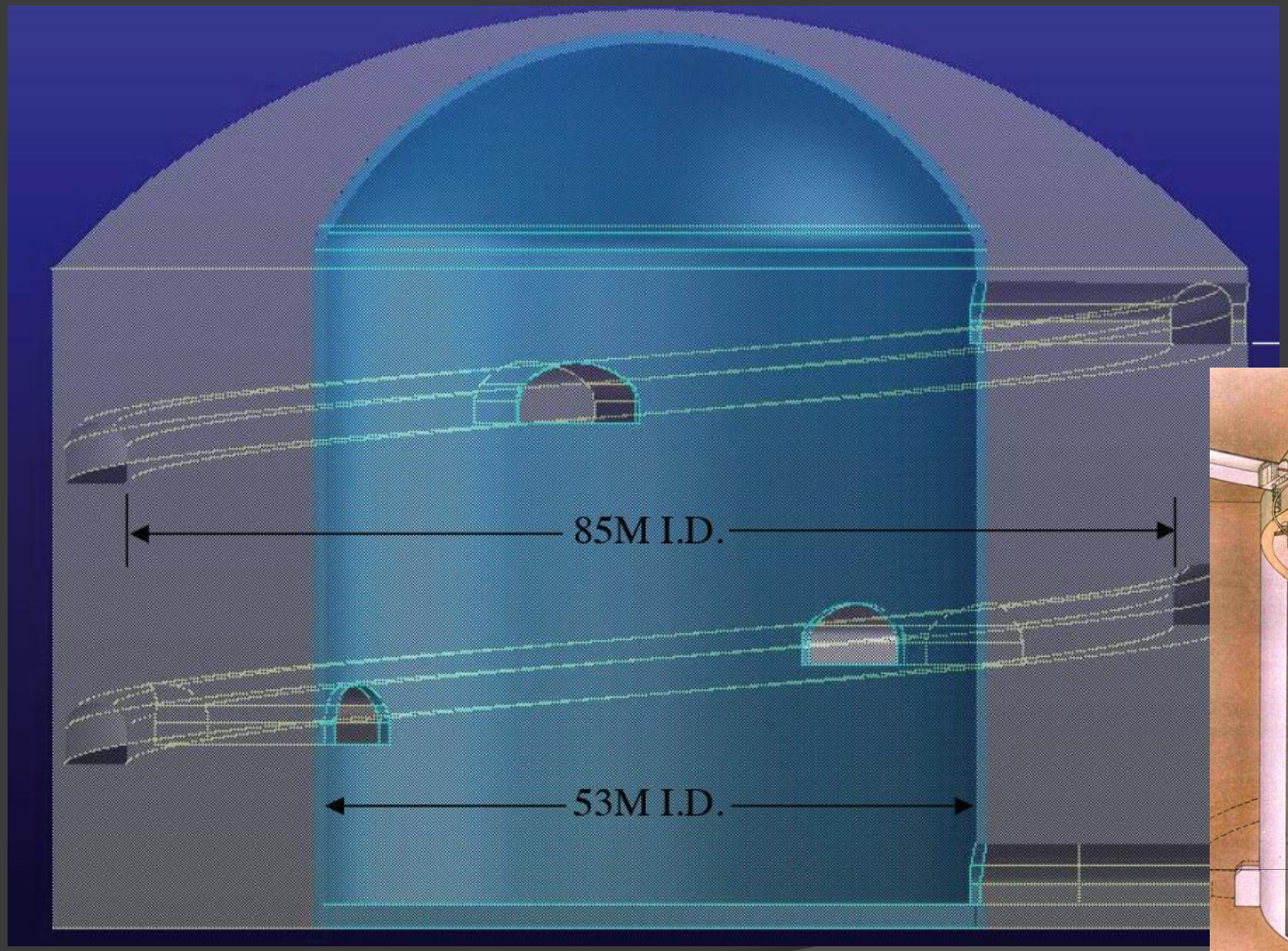


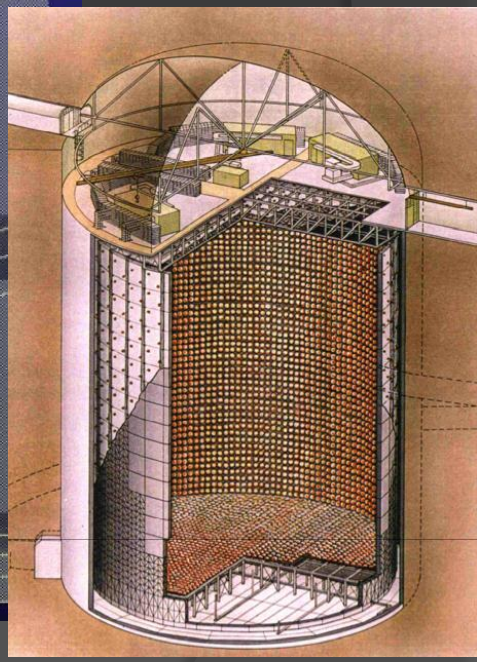

DUSEL
Deep Underground Science and Engineering Laboratory
at Homestake, SD
Engineering
6 ½ Empire State Buildings for scale
Shallow Lab
Open cut
Mid-level
Deep Campus
Geoscience
Physics
N
P
Astrophysics
Biology
NSF

SK, Japan - 50,000 tons…



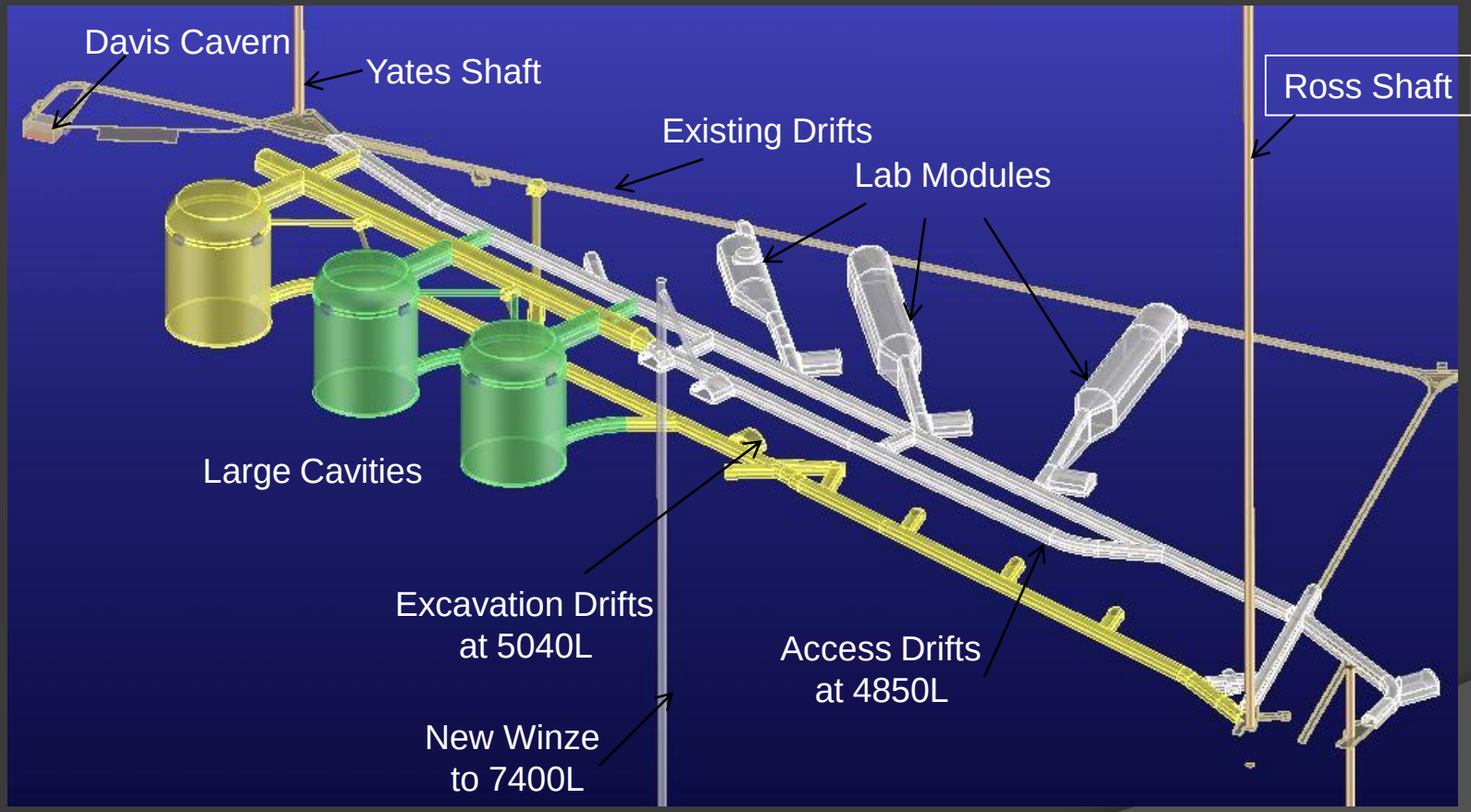
DUSEL - 300,000 tons!



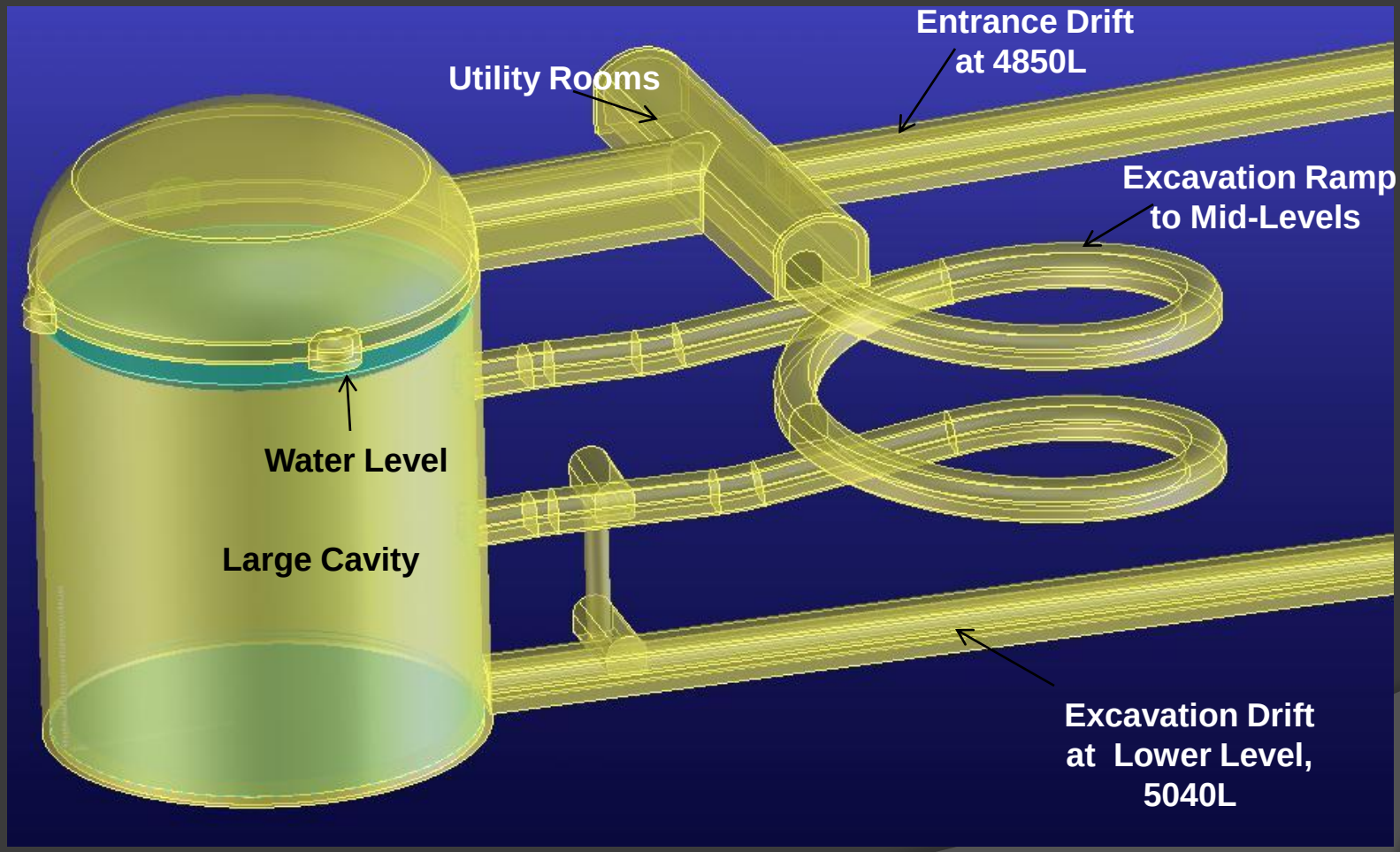


Rock Volume in Perspective

Excavation Plans – 4850L



Large Cavity, Water Cerenkov Detector



Excavation Plans

Large Cavity Excavation Sequencing (LCAB) Stage 1

- Excavate Top Heading Concurrent with Bottom Heading
- Excavation and support needs to proceed sequentially from the center of the cavern out to the perimeter of the cavern.
- The top drift into the center of the cavern should be approximately 5 meters or less in width with the permanent rock support installed as the drift progresses.
- The sequence could be in approximately 5 meter rings or in pie shaped wedges, but always proceeding from the center of the cavern towards the perimeter.

Excavation Plans

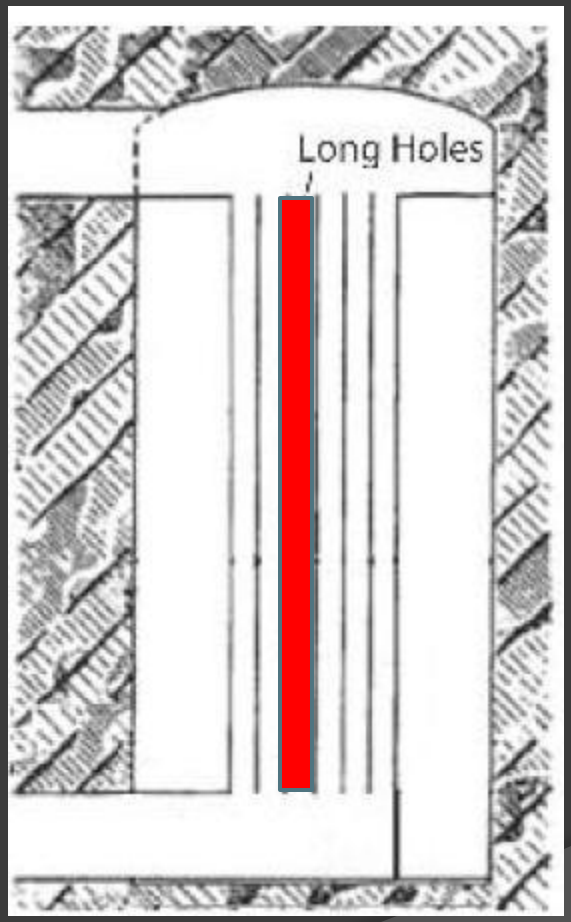
Large Cavity Excavation Sequencing (LCAB) Stage 2

- Excavate Center Borehole
- Borehole dimension –10 –14 ft diameter
- Provides conduit for muck removal as well as relief for blasting

Excavation Plans

Large Cavity Excavation Sequencing (LCAB)Stage 3

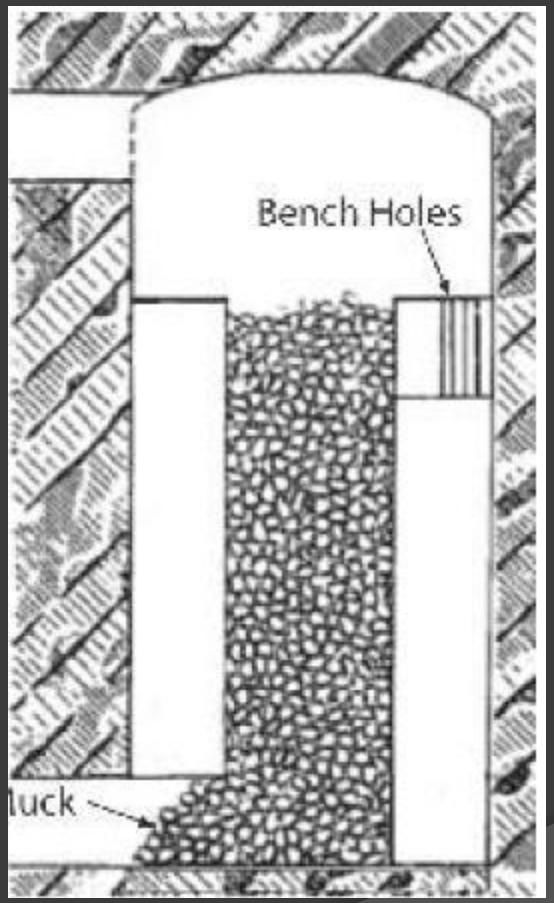
- Long hole drilling and blasting of the center portion of the cavern.
- The dimension of the un-blasted perimeter ring should be determined by numerical modeling of stress conditions and assessment of rock joint patterns.
- The key parameter in defining the perimeter ring is confining the predicted rock fracture resulting from ground relaxation to within the ultimate excavated perimeter of the cavern.
- Other considerations, such as drilling equipment dimensions, may increase the width of the perimeter ring but the minimum width needs to be determined and adhered to.



Excavation Plans

Large Cavity Excavation Sequencing (LCAB)Stage 4

- The perimeter ring is to be excavated in benches deep enough to be reasonably economical but not deep enough to create failure in the surrounding rock mass due to stress relaxation at the cavern wall. It is imperative that the wall excavation support be installed in a timely manner.
- In all of the excavation sequences proper controlled blasting techniques must be employed. The intent of the controlled blasting is to limit the loosening of the remaining rock mass. This maximizes the long term stability of the remaining rock mass under changed stress conditions and decreases the likelihood of rock falls



The Big Hole

- One large cavity is included in the scope of DUSEL. DOE will also cost one cavity.
- Large Cavity Board report: a large 100 kton detector could be built safely and economically. 150 kton cavities may also be possible.
- Three independent cost estimates
- We want 300 ktons total

Schedule

- Initial design and costing complete by Fall, 2010
- DOE CD-1, December 2010
- National Science Board, Spring 2011
- Preliminary Design (~CD-2), end of 2012
- DUSEL construction start, 2013
- Large Cavity construction, 2016-2017 (this could be earlier)

If you are interested in the potential collaboration please, contact the LBNE Collaboration Spokepersons:

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&

Robert Svoboda: rsvoboda@physics.ucdavis.edu

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