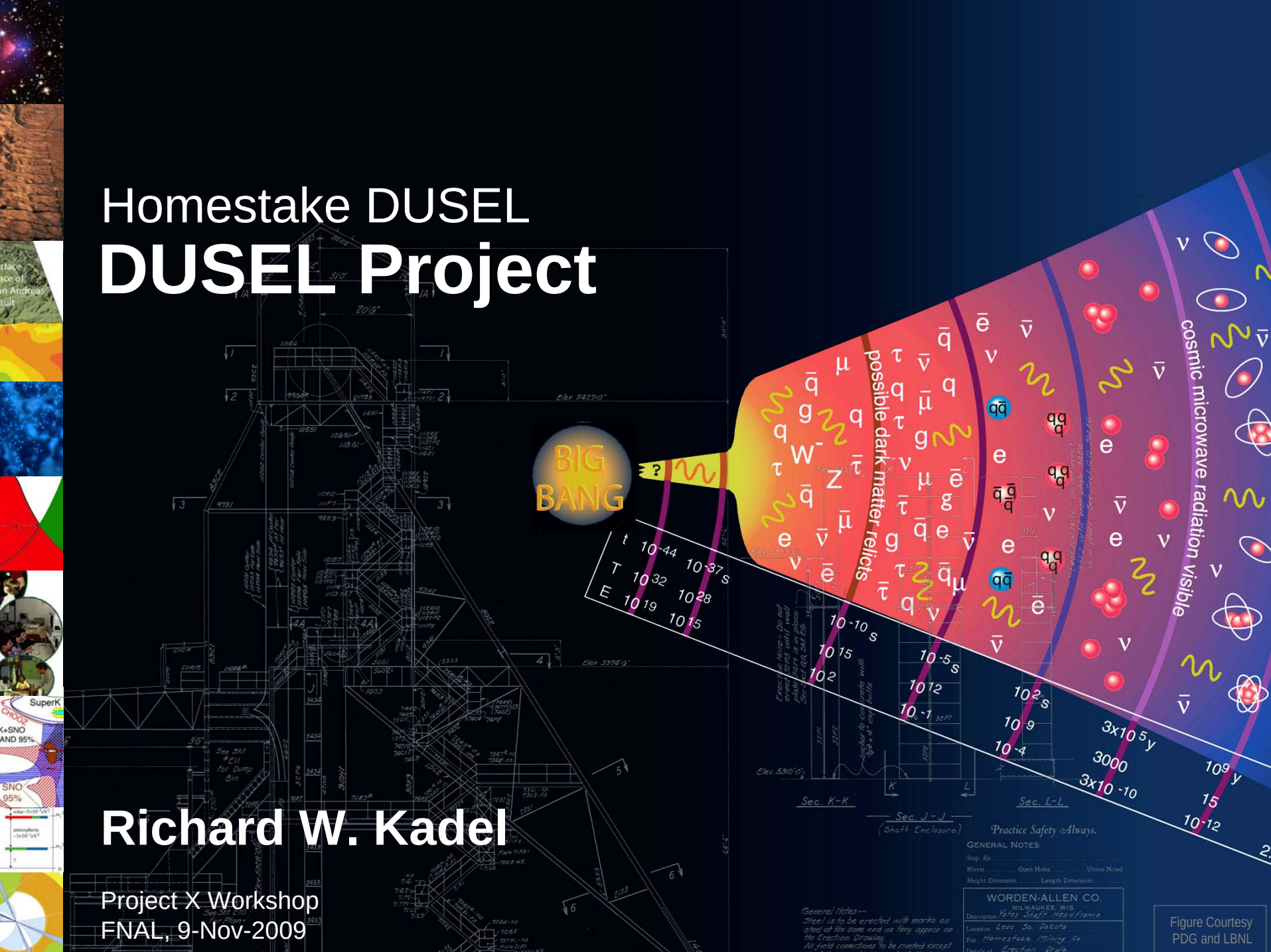
Homestake DUSEL

DUSEL Project



Richard W. Kadel

Project X Workshop
FNAL, 9-Nov-2009

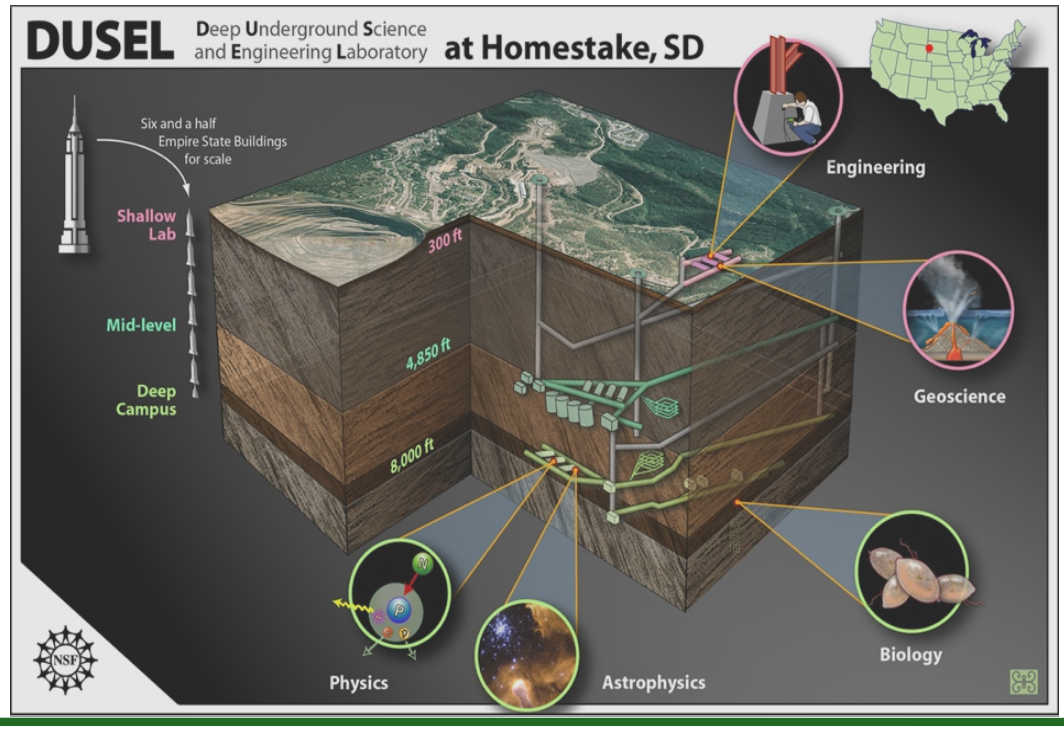
Figure Courtesy
PDG and LBNL

Outline

- DUSEL project goals
- Roles and Responsibilities.
- NSF-DOE cooperation
- User Organizations & DUSEL PAC
- Input & Schedule for Experiments
- Current Geotech Results
- Laboratory Development Contracts
- Schedule

Our Goal

To develop a enduring international underground laboratory with a best-in-world class scientific program of research, education and outreach and do it as quickly and cost efficiently as possible



NSF's DUSEL Project Scope and Definition

- DUSEL will be a **M**ajor **R**esearch **E**quipment and **F**acility **C**onstruction Project
  - Congressional line-item, multi-year construction project (facility and a suite of experiments)
    - MREFC Funds: Facility and Instrument installation and construction, (calibration and pre-operations)
    - Does not fund: Operations, Analysis, Research and Related activities
  - To enter the queue for funding DUSEL requires:
    - National Science Board Approval
      - Mature, vetted, reviewed integrated design package
        - » Facility Design at ~ Preliminary
        - » Experimental Design at ~ Conceptual Level
        - » DUSEL experiments will not be selected: generic experiments

Roles in Developing the DUSEL Design

- DUSEL Project Team (UCB, LBNL, SDSM&T, SDSTA, BHSU)
  - Facility Design
  - Integration of the Science with the Facility
  - Overall Management of the Proposals & MREFC
- Experimental Collaborations (S-4 and others)
  - Scientific Research, Goals, Management of the S-4 awards, Project Management for Instruments
  - Critical R&D
  - Instrument Design
  - Project Plans, Hazard Assessments, ...

DUSEL MREFC Proposal as it will go to the National Science Board

- Facility Design ~ Preliminary Design Level
- Generic Suite of Experiments ~ Conceptual Level or Better
  - (go as far as you can)
- Single Proposal describing the Total NSF capital costs (and other components)
- Discussion of the DOE roles and contributions

The Preliminary Design

The PDR must

- Provide motivation
- What is needed for science goals
- What $$ will be needed
- When will it be done
- How it will be done
- How it will be controlled
- …

Selection of the ISE

- As envisioned now, the MREFC proposal will consist of a facility and a generic suite of experiments
  - permits facility design to continue
  - fixes capital budgets for the suite of experiments and the facility
- Following board approval experiments will be reviewed and selected for construction
  - approval will follow NSF's peer-review guidelines (panel)
  - review will include significant input from the facility team
  - we anticipate DOE involvement in the process

NSF - DOE Relationship Maturing

- Joint Oversight Group (JOG) Established
  - DOE: OHEP, ONP
  - NSF: Physics
- Letter of Intent Presented to OSTP
  - DOE and NSF would Jointly Develop DUSEL Science Programs
  - Project would undergo NSF and DOE (CD) review protocols
- Long Baseline Neutrino Experiment
  - FNAL (Lead Lab & Beam-lines)
  - BNL (Detector)
  - Project Coordination Group Established

DUSEL Research Association (DuRA)

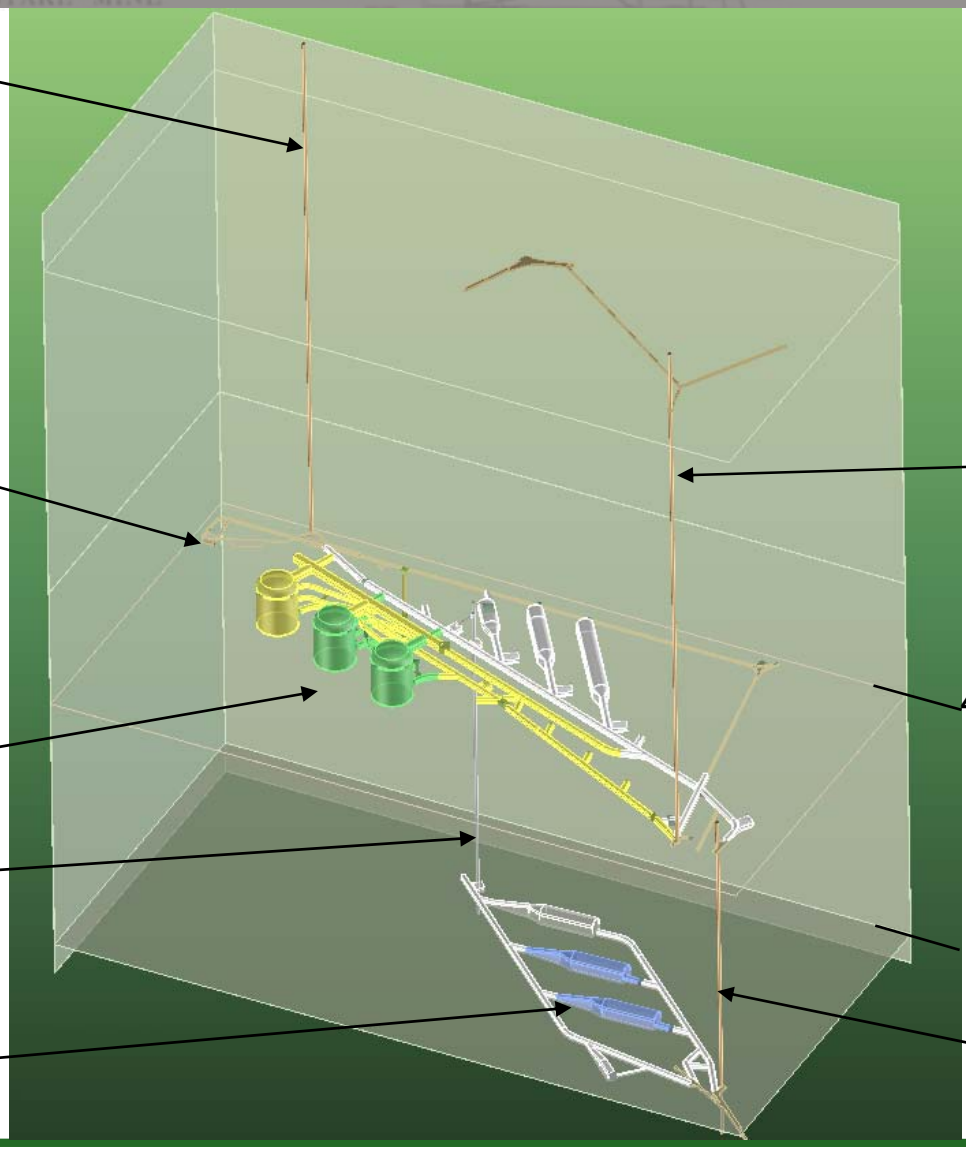
- Model based on traditional User-facility
  - Scientifically driven peer-based experiment selection and monitoring
  - Open Membership in a users' organization
  - Representative Leadership of the scientific collaborations to laboratory management
  - Draft Charter is included in your public folders
- DUSEL Research Executive Committee
  - runs the DuRA on a day-to-day basis
  - elected from the Membership of DuRA
  - propose that DEDC* run DuRA for 1 year

*DEDC=DUSEL Experimental Development Coordinators

Scientific Program Committees

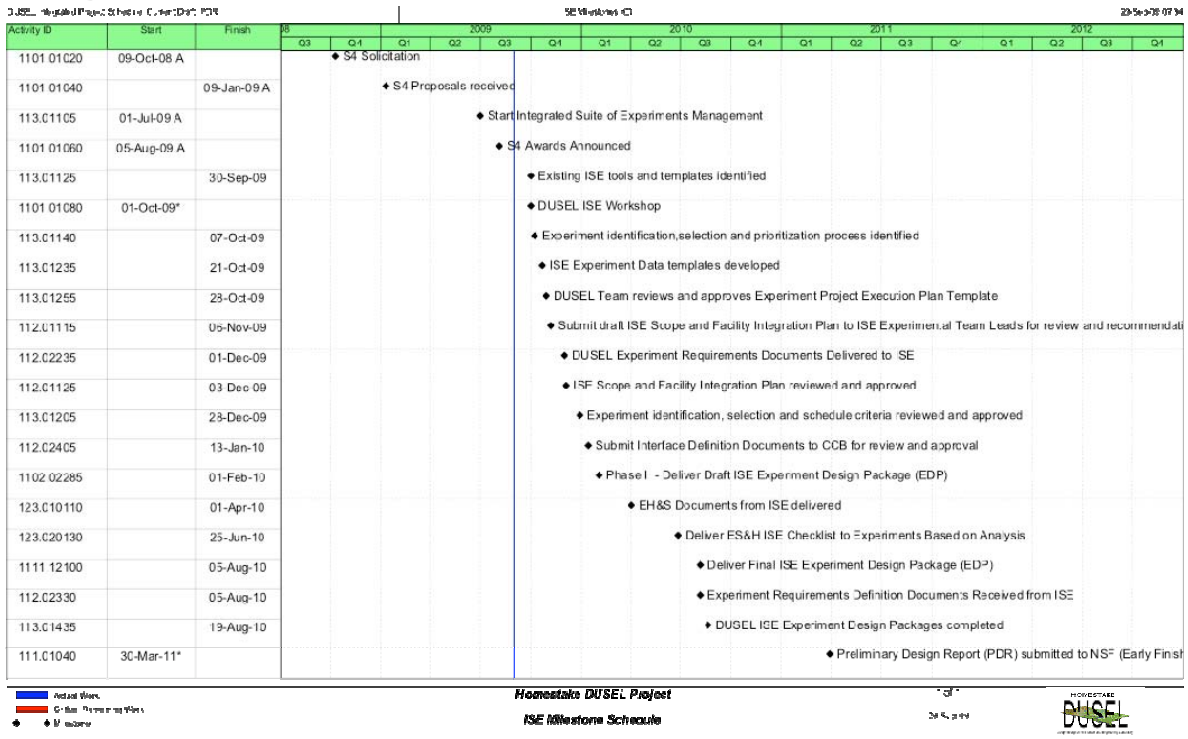
- Sanford Lab PAC
  - will continue to oversee Sanford Science Efforts (early program)
- DUSEL Scientific PAC
  - to reflect the even more diverse science programs at DUSEL
  - to reflect the international participation in DUSEL
  - created to provide scientific, technical, cost, schedule and management advice to the DUSEL directorate

DUSEL Underground Campus Development at 4850L and 7400L, based on our current understanding



Schedule to Develop the Design

- Aggressive Schedule
  - FY2013 construction start
  - Spring 2011 NSB consideration
  - DUSEL Design Package Assembled Summer 2010
  - Input from the instruments by April 2010 (Conceptual level or better)
  - More on this later



DUSEL funding

- Site Selection and three year, $15M Cooperative Agreement in 2007
  - $3M supplement awarded in April
  - Third $5M award received in August
- DUSEL Facility Preliminary Design Proposal
  - Submitted in May, 2009
  - Approved by NSB in September, 2009
  - Awaiting Draft Cooperative Agreement from NSF
- S4 Awards in place ~September 2009
  - 9 Physics, including LBNE
  - 6 Biology Geology & Engineering

Experiment Deliverables – Phase I

Experiment Design Packages (EDP) will be developed in two Phases:

Phase I – CD-1 - PDR Level -Deliverables include:

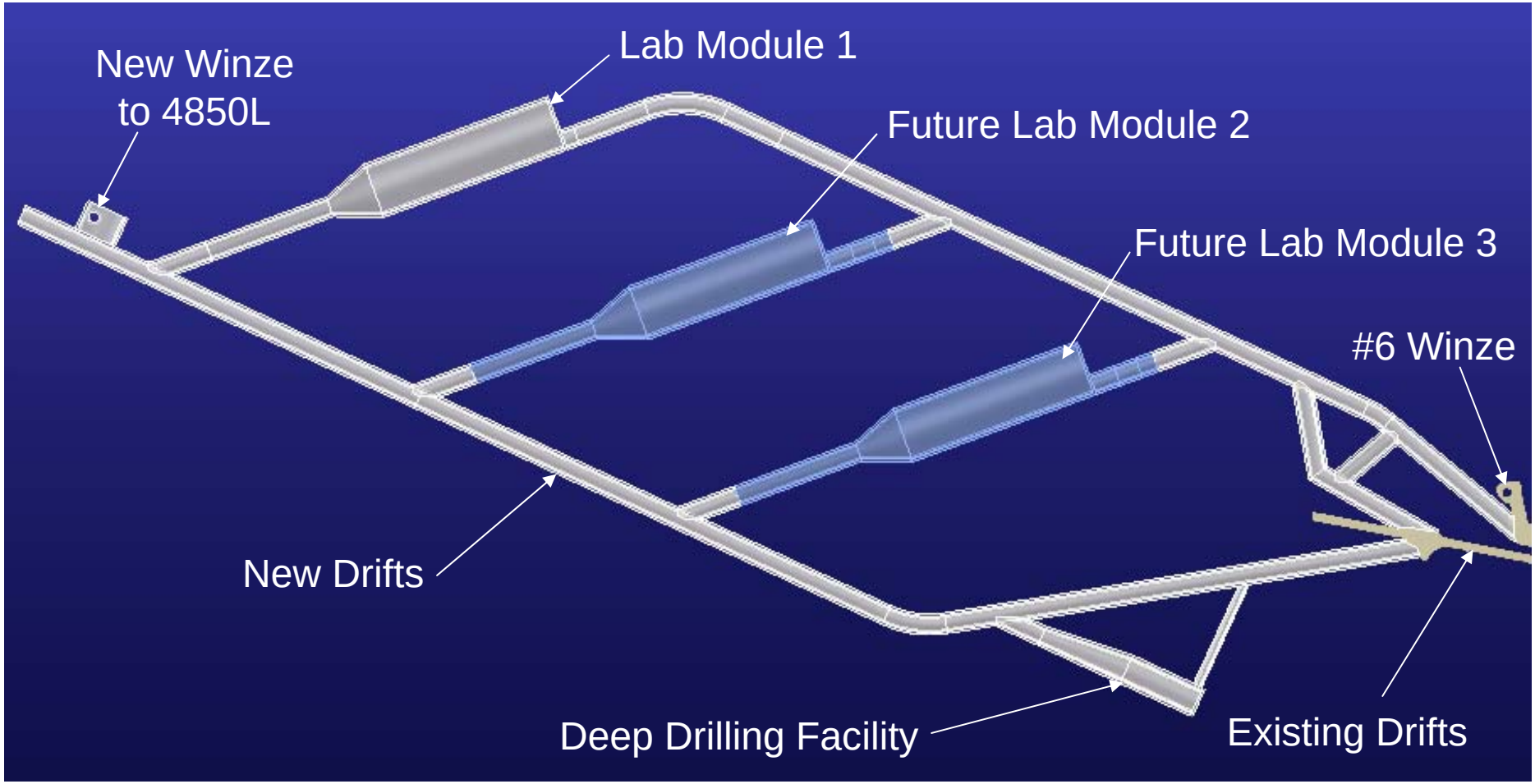
- Preliminary Project Execution Plan
  - Science and Project Objectives
  - Experiment collaboration team roles and responsibilities,
  - **Infrastructure requirements**
  - Work breakdown structure and dictionary
  - Initial cost estimate and range
  - Pre-construction milestones, initial version of construction milestones
  - Preliminary Project Execution Plan
  - **Preliminary hazard assessment, analysis and mitigation plan**
  - Preliminary Risk Assessment

Preliminary Design Deliverables - PDR

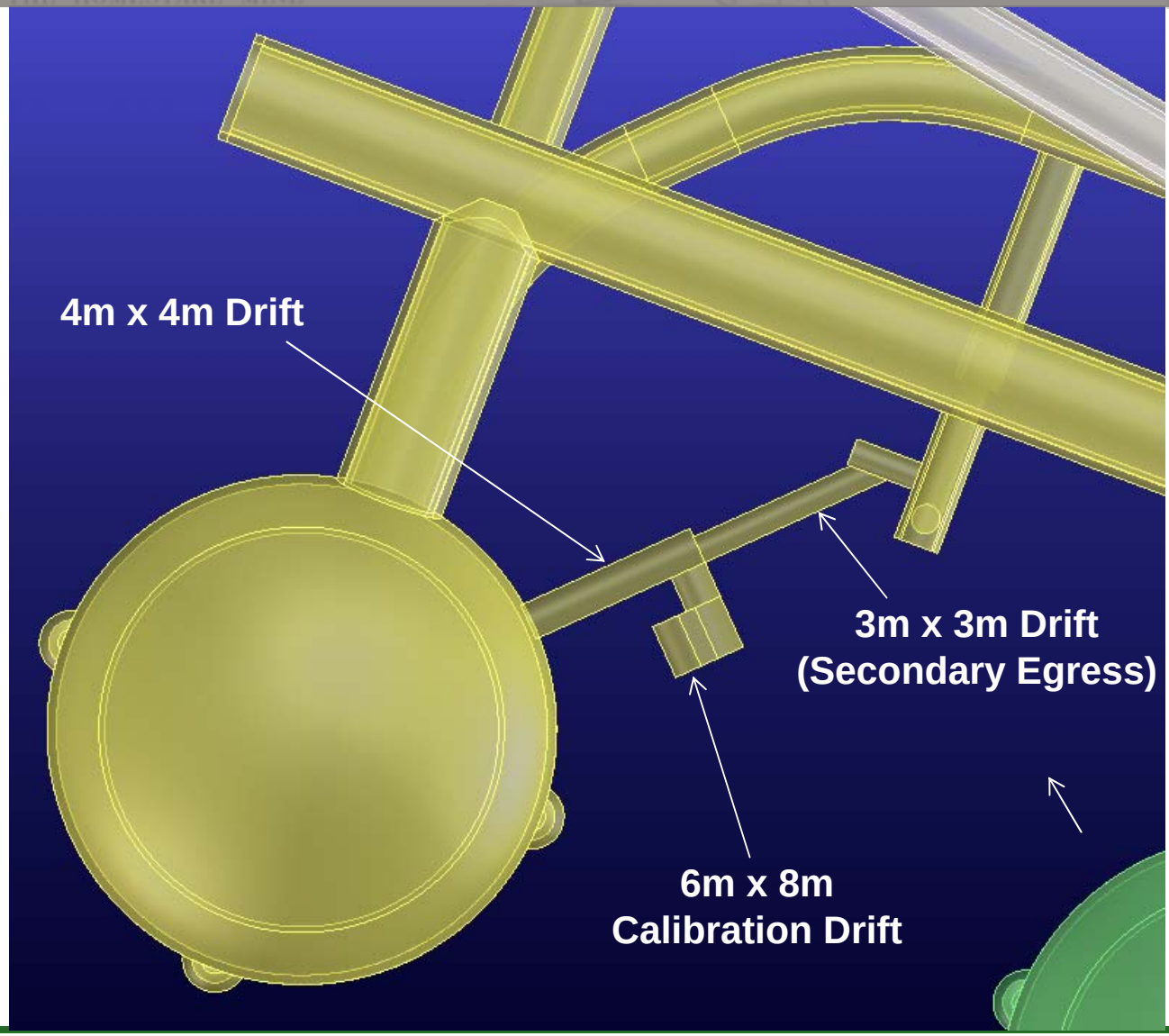
Deliverable	Responsible Party	Schedule
Exp. Design Pkg. template, definition toolbox	DUSEL	10/09
Draft EDP	Experiment	1/10
Draft DUSEL-Exp. Interface doc.	DUSEL	3/10
Review Draft EDP, DEI	Experiment, DUSEL	4/10
PDR EDP	Experiment	7/10
PDR DEI	DUSEL	7/10
Draft PDR	DUSEL	9/10

4850 Level Developmental Baseline for PDR:
Three Lab Modules & First Large Cavity, Plan View

7400 Level Sequential Development:
Three Lab Modules, Plan View



Large Cavity, Water Cherenkov Detector, Plan View Calibration Drift Concept



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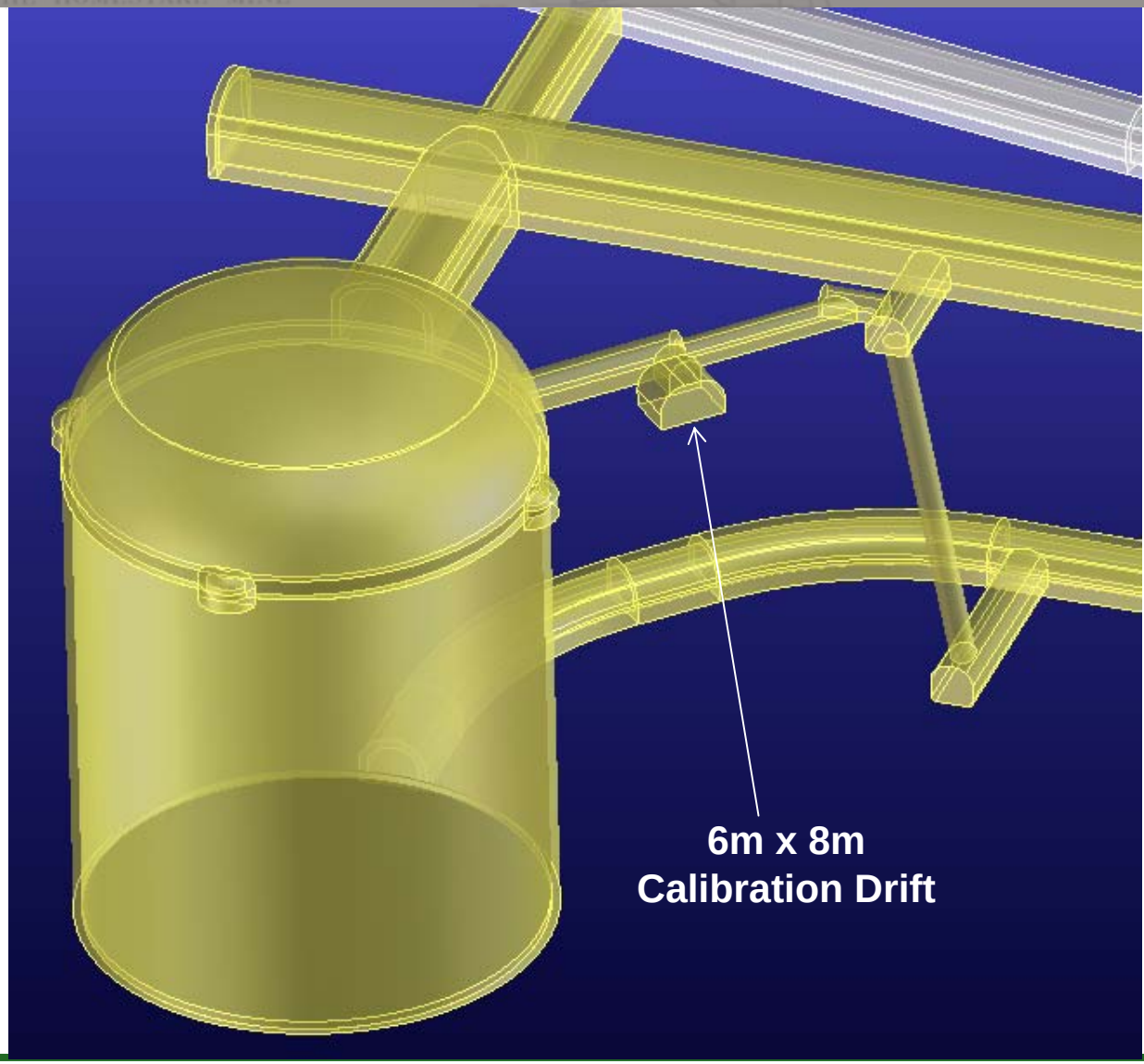
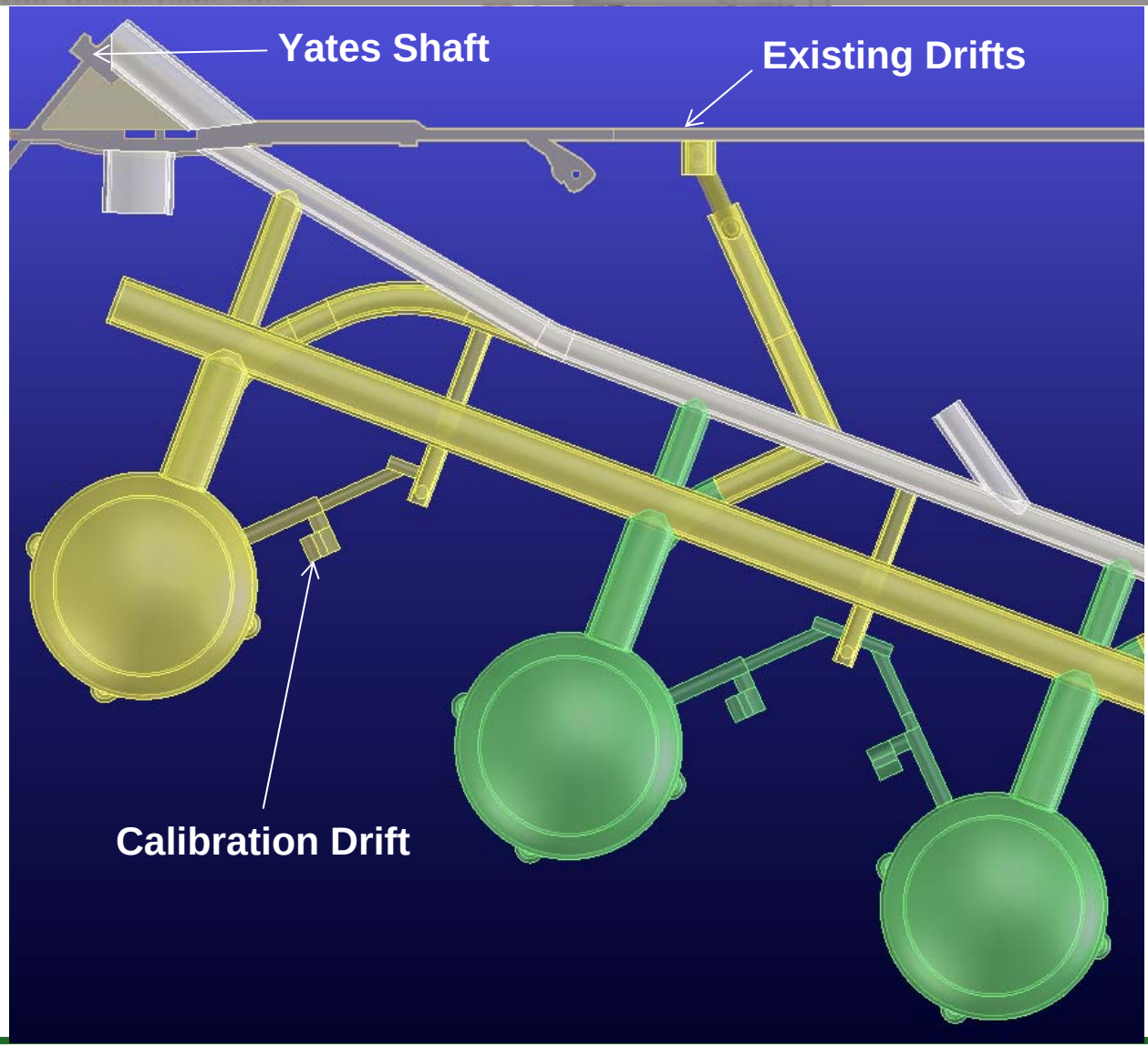


Large Cavities, Water Cherenkov Detectors, Plan View Calibration Drift Concept



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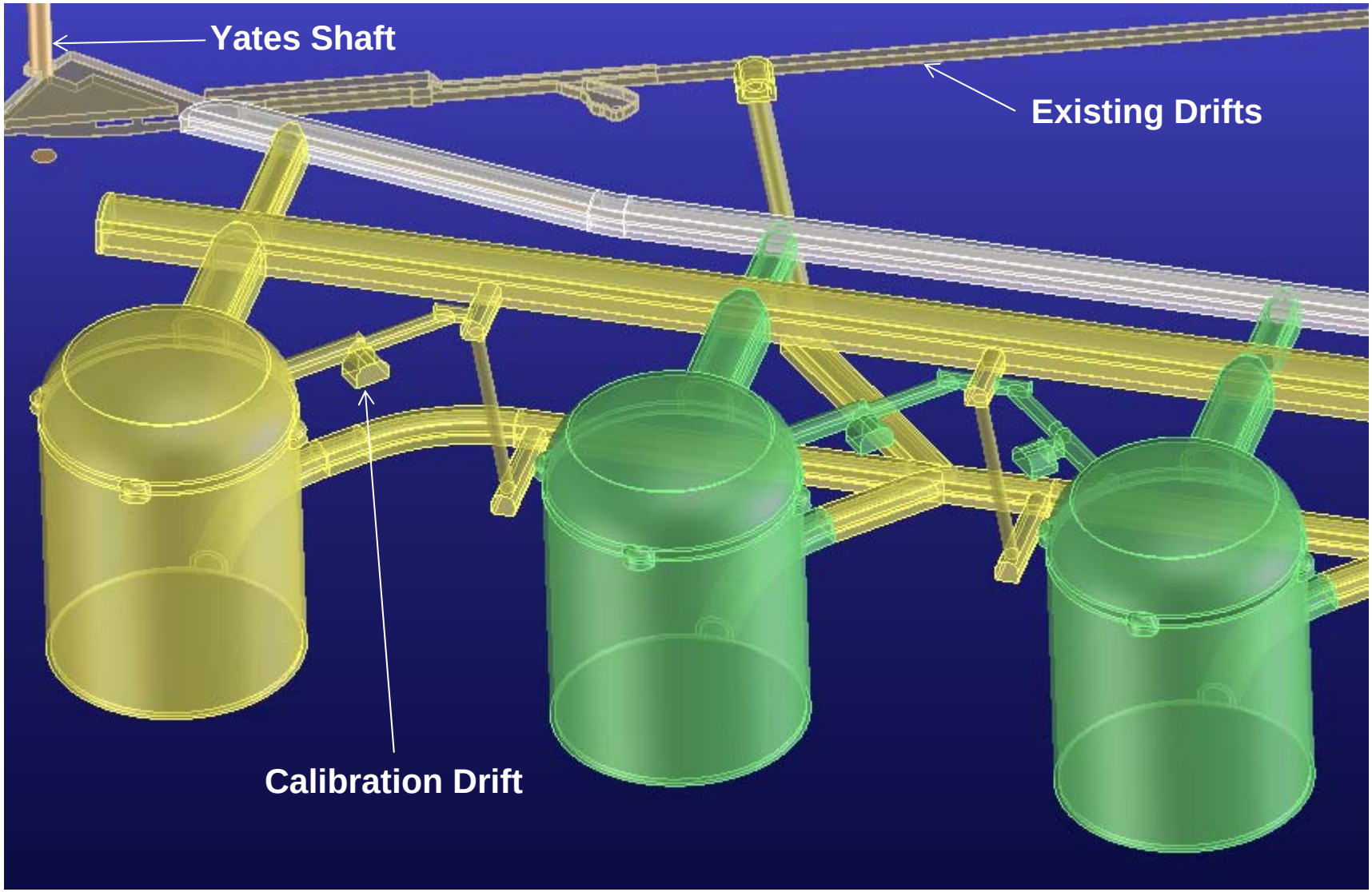
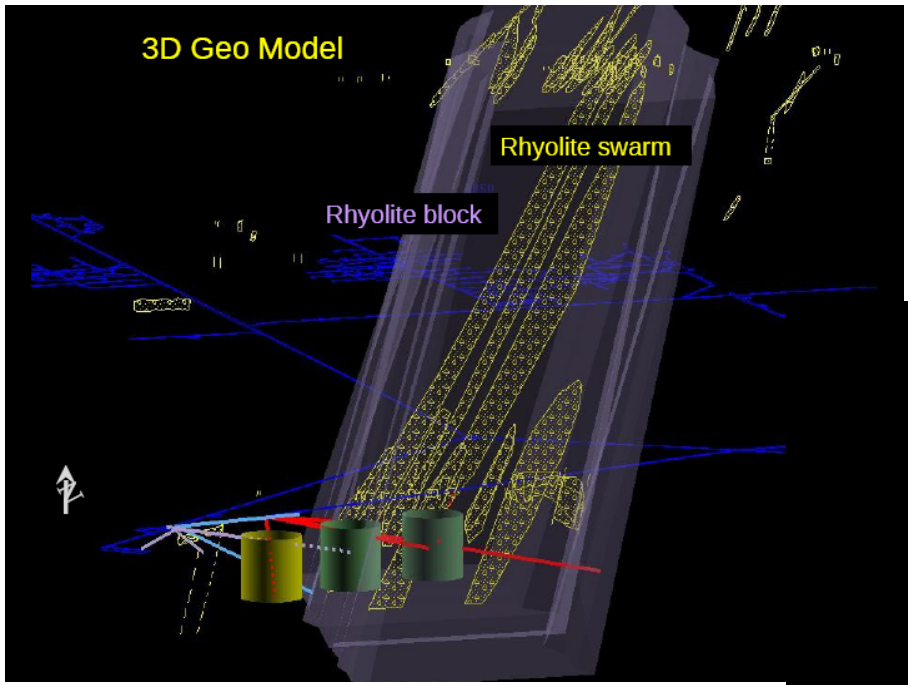
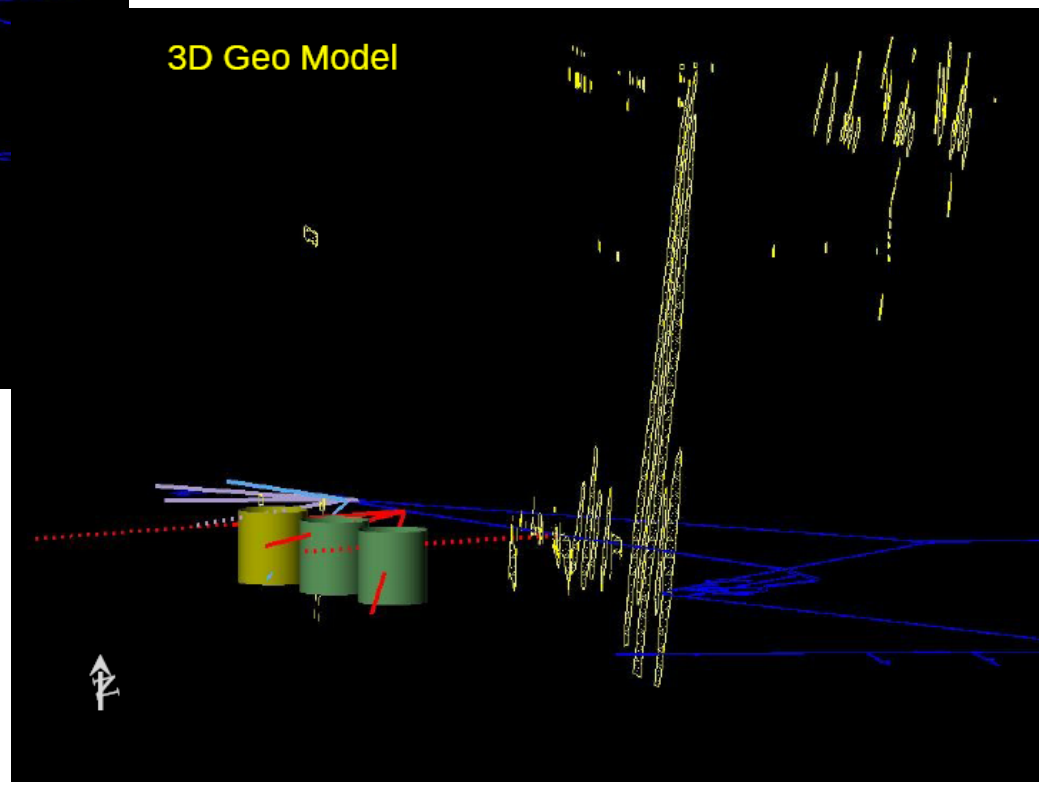
Calibration Drift Concept



Geology: 3D Modeling

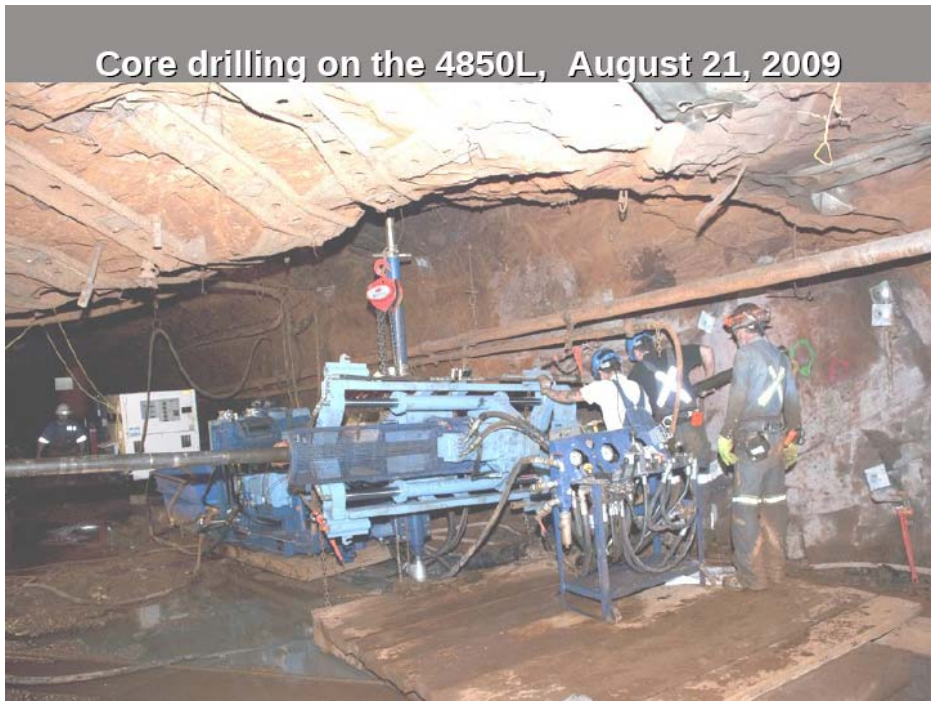


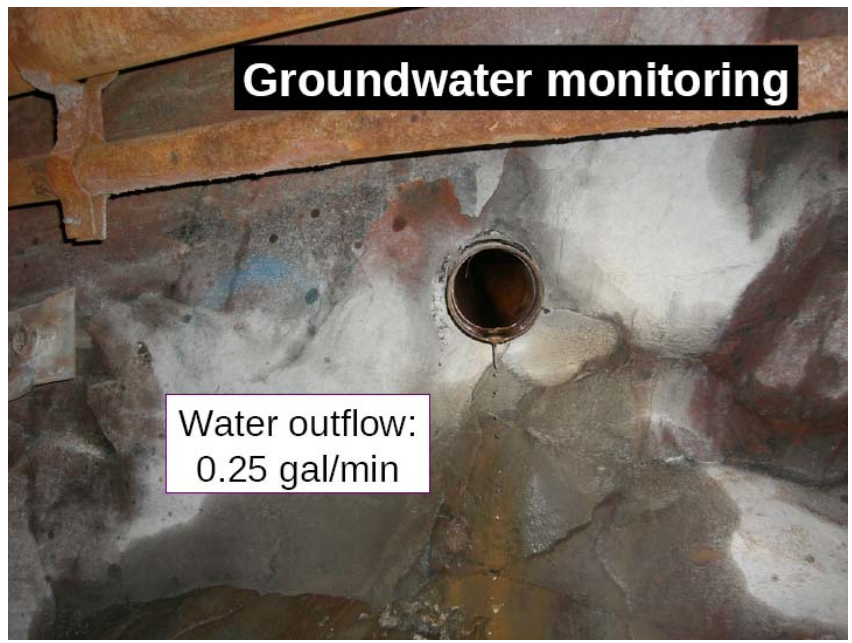
Geology of drifts on 4100L & 4850 Level have been mapped



Mapping data added to 3D Vulcan Data base, data available to users

Drilling Program





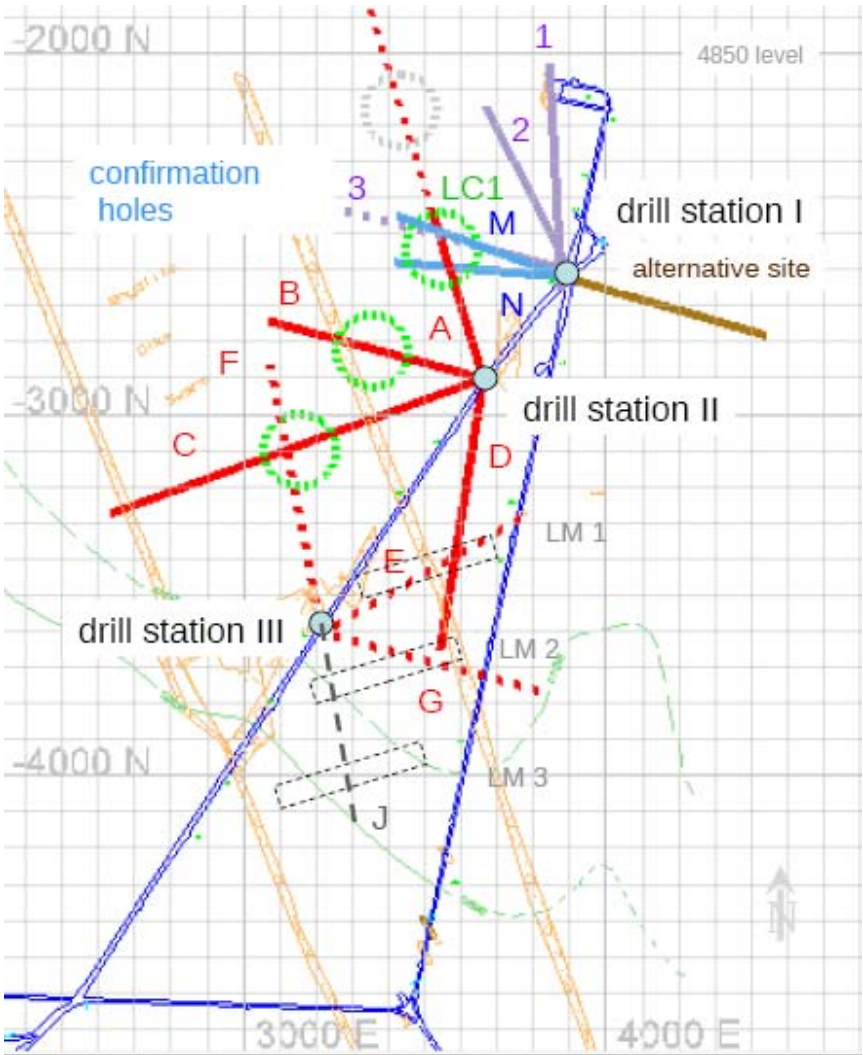
Cores

Cores

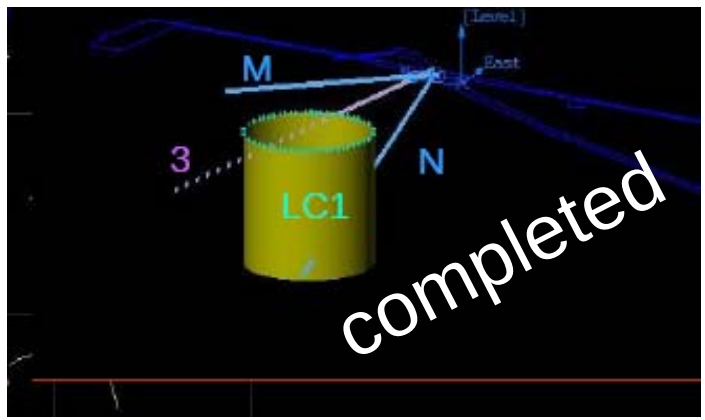
Classic Disking – where is this seen?
(this example from fault NOT AT DUSEL!)

What you don't want to see! Indicates high stress in rock

Drilling Program



Holes 1, 2, & 3 done
(Sanford Lab early Physics program)
M: Done
N: Done
A: postponed.
B: Done
C: ¾ done
D: Done (1300ft, all the way to 3rd lab module)
F & J: next



Overview of Current Contracts

- Site assessment contracts initiated under limited funding to reduce risk
  - Selection process considered each firm's capacity perform design as well

- Three assessment contracts awarded (prime listed)
  - January 2009 – Geotechnical Engineering Services – **RESPEC**
  - March 2009 – Underground Infrastructure – **ARUP**
  - April 2009 - Surface Campus Infrastructure – **HDR CUH2A**

- Four contracts in place for preliminary design;
  - Underground Infrastructure – **ARUP** (amendment)
  - Surface Campus Infrastructure – **HDR CUH2A** (amendment)
  - Excavation Design – **Golder Associates** (new contract)
  - Underground Laboratory Design – **ARUP** (new contract)

BOE – Draft General Underground Project Schedule

	Task Name	Duration
1	Dusel Construction Commences	0 days
2	**SDSTA Science**	**668 days**
3	Develop Lux and Majorana projects	18 mons
4	**Yates shaft**	**4486 days**
5	Temporary rehab 2000L - 4850L	9 mons
6	Yates utilized as emergency egress	59 mons
7	Strip and re-equip shaft	24 mons
8	Yates utilized as Science access	53 mons
9	DC drive upgrade - production hoist	3 mons
10	Install new auxiliary hoist	5 mons
11	**Ross Shaft**	**4294 days**
12	Ross used as primary access shaft	41 mons
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15	Shaft infrastructure rehab	26 mons
16	Ross utilized as Mining shaft	71 mons
17	**No. 5# Egress Shaft**	**2976 days**
18	Install 2nd hand egress hoist	6 mons
19	Strip and re-equip (rope guide)	8 mons
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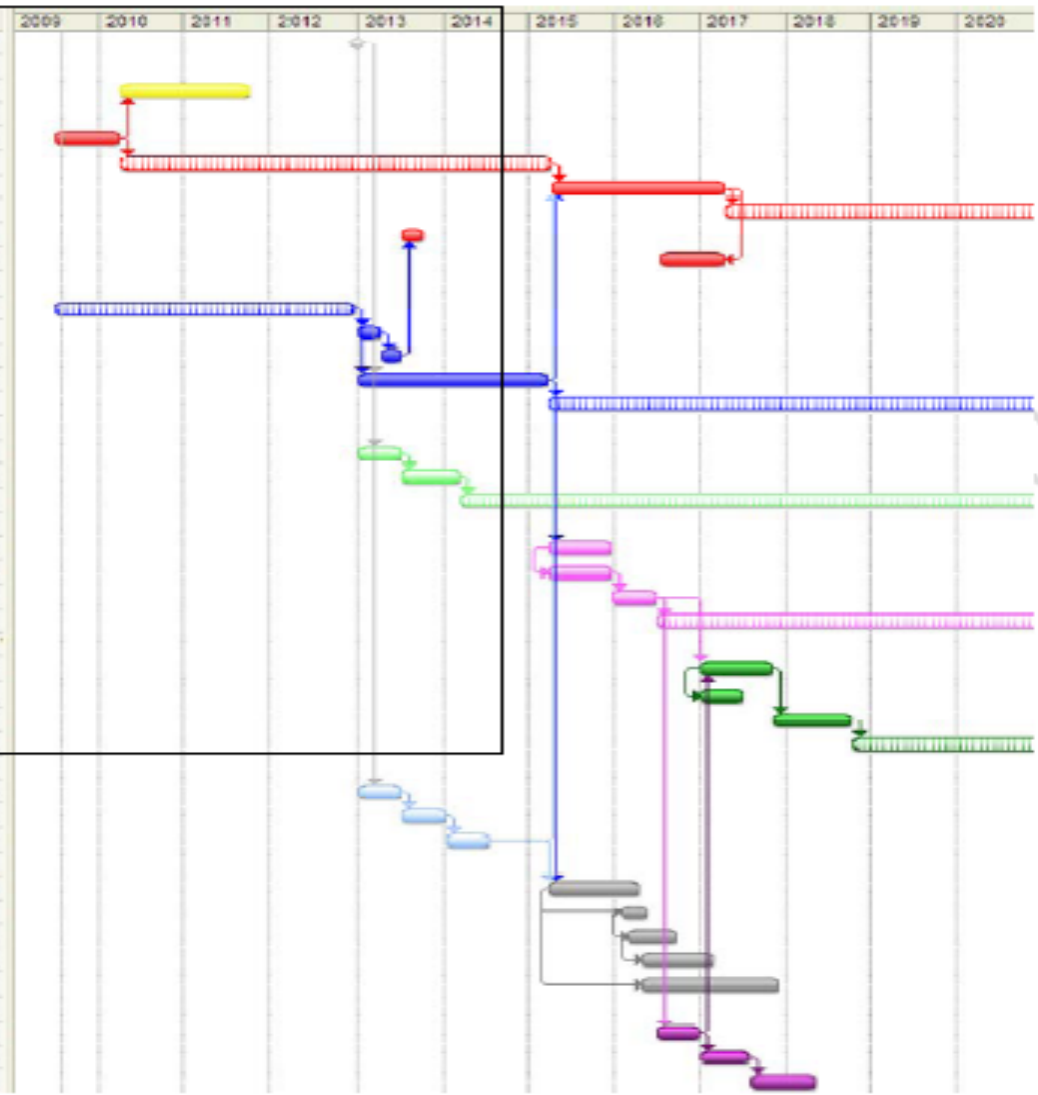

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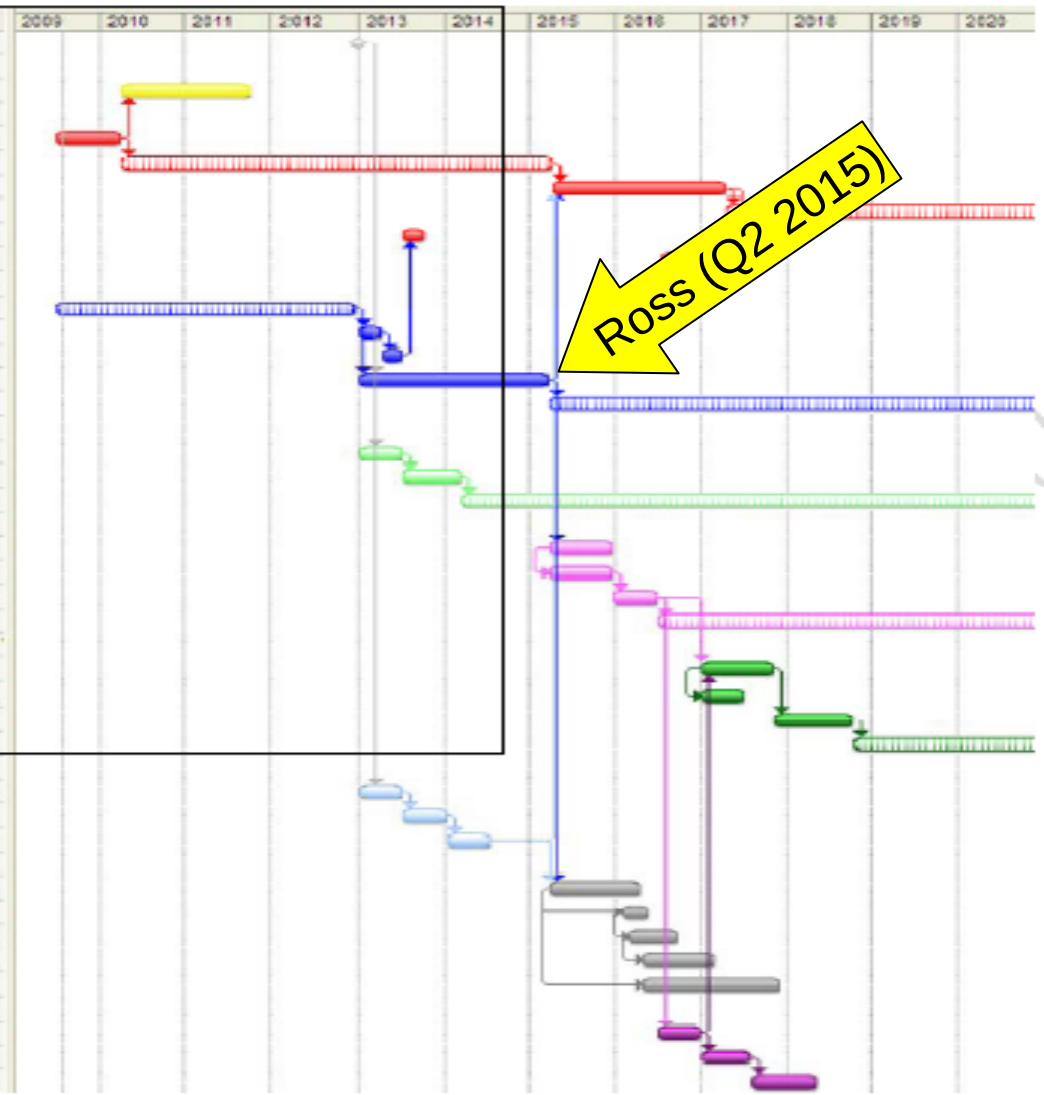

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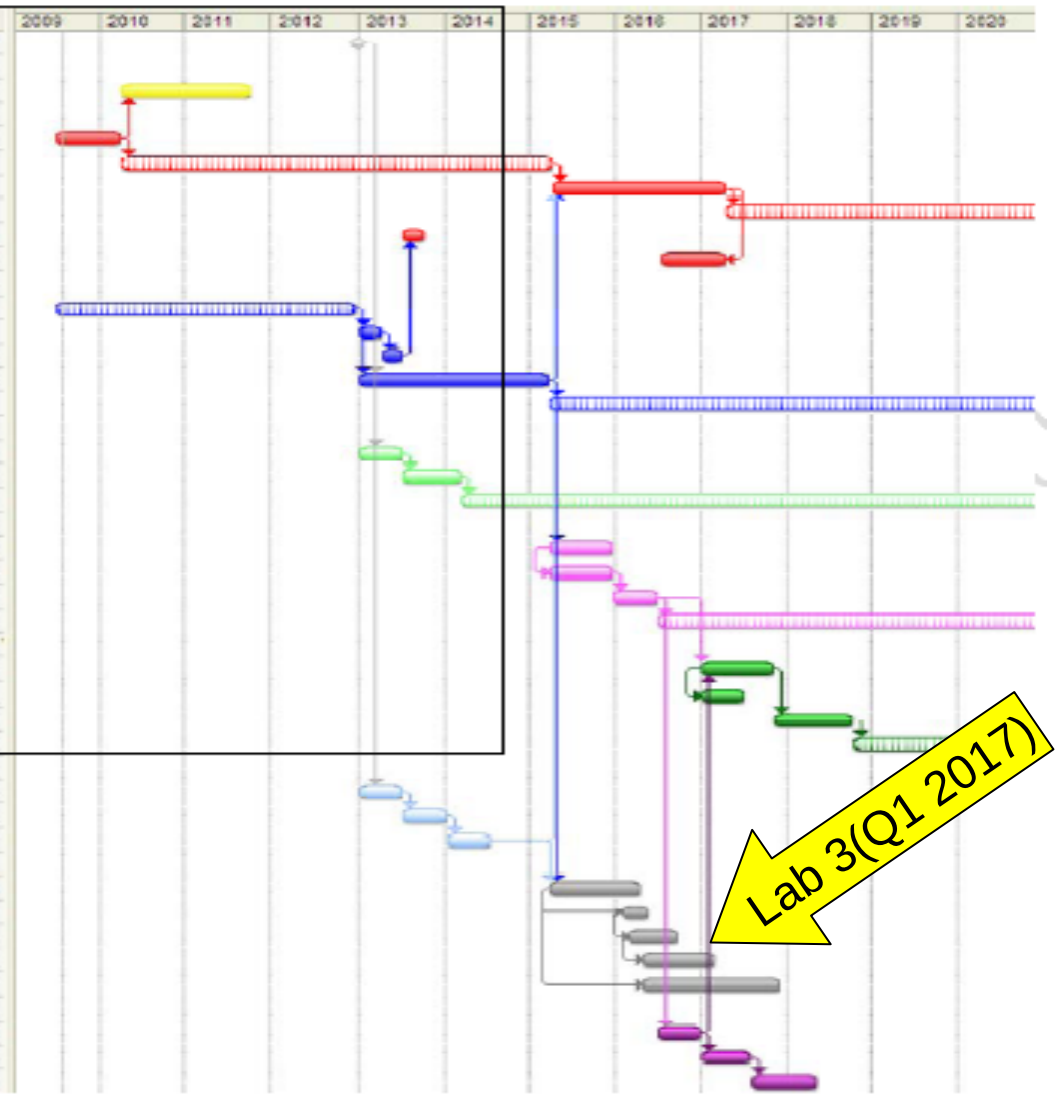

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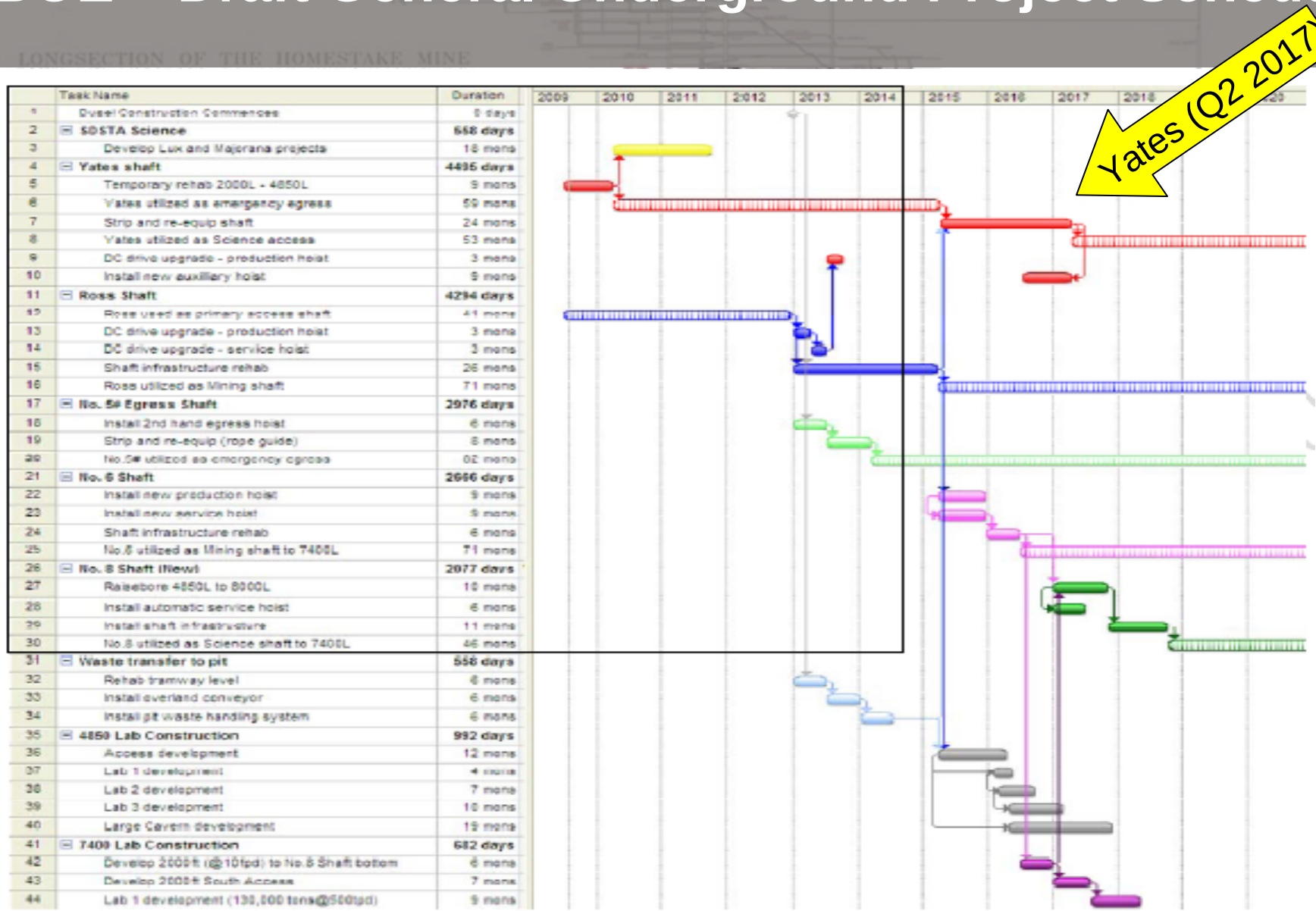

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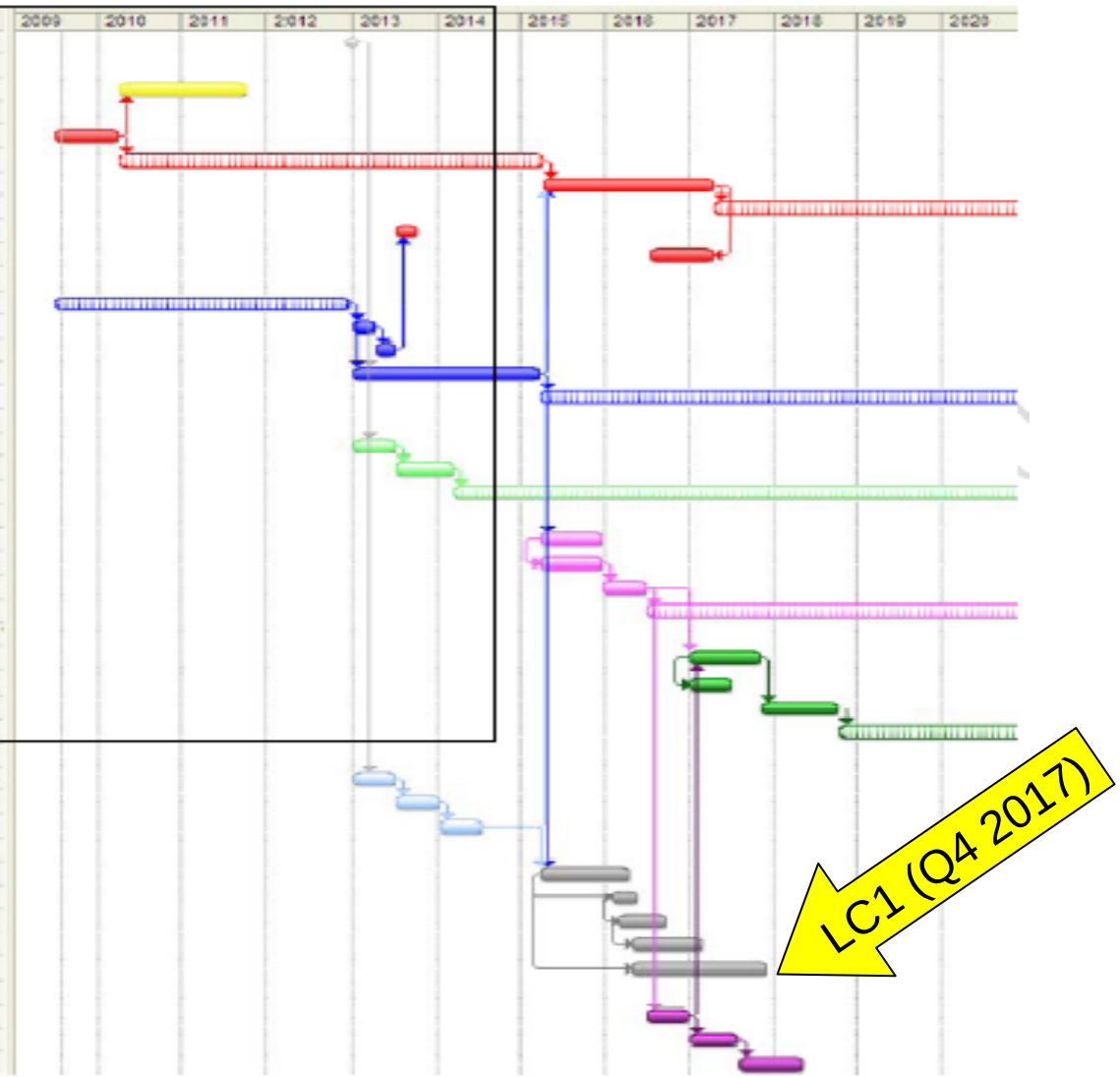
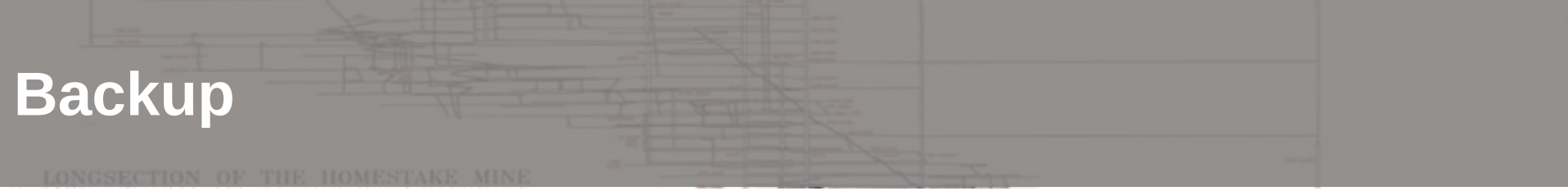


Conclusion

- DUSEL funding [nearly] in place to complete preliminary facility design including a generic set of experiments for Dec 2010.
- One large cavity [~ 100kT] fiducial volume is part of NSF scope
- NSF S4 awards made, including LBNE.
- S4 Experiments Phase I EDP due in Spring 2010
- S4/DUSEL final iteration in Summer 2010
- DUSEL project submitted to NSB Feb. ~ 2011
- DUSEL Construction start 2013.
- This aggressive schedule will require hard work by all.

Backup



Underground Site Assessment Contract

Site Assessment Scope of Work

1. Identify existing, known and unknown conditions
2. Evaluate feasibility for continued use of existing equipment and systems
3. Evaluate the existing conditions related to safety concerns and environmental hazards
4. Determine the requirements to modify, replace, upgrade, abandon or demolish existing infrastructure
5. Provide recommendations for testing and laboratory analysis of material samples as necessary
6. Produce a comprehensive report of the Site Assessment findings and recommendations for infrastructure improvements and budgets to accommodate the planned lab development

Basis Of Estimate Study – BOE - ARUP

Scope of Work

- Detailed Project Cost Estimate Incorporating Results from Site Investigations and Current Lab Development Plans
- Cost Estimate to Include Consideration for:
  - Excavation of new access drifts at all Lab locations, 3 Lab modules at 4850L, 1 lab module at 7400L, and one large cavity at 4850L for the LBNE
  - Alterations and upgrades of facility infrastructure to support underground construction and operations, utilities and services for access to Other Levels and Ramps included in "Laboratory Footprint."
  - Construction and build-out of common facilities, utilities and services including safety systems, monitoring and communications, emergency response and refuge facilities.
  - Construction and build-out of laboratory infrastructure, utilities and services for each laboratory module and Large Detector, customized for defined categories of model experiments.

Preliminary Design and Final Design - ARUP

Scope of Work

Includes design for Underground Support Infrastructure for the development of a mid level campus at the 4850 L consisting of 3 Lab Modules and 1 Large Cavity

Included in Design:

- Utilities from the surface station connection point to all operating levels of the underground laboratory
- Distribution of the utilities along the primary drift at each level to a mutually agreeable termination point
- Conveyance Equipment including Shafts and Hoists
- Potable water for underground construction and permanent underground lab needs
- Waste Water Treatment
- Ventilation including Lab Operation and Construction
- Modifications to Existing Shafts or Drifts
- Coordination of data and voice communications systems and personnel and facility protection systems (e.g.: fire, life safety and monitoring systems)
- Waste Handling Systems
- New Shafts and Winzes as required
- Detailed Design Drawings, Construction Methods and Sequencing Plans, Cost Estimates, Construction Schedules and Risk Analysis

Preliminary Design and Final Design - ARUP

Scope of Work

Includes all design and analyses necessary for construction of underground laboratory facilities and build-out to be ready for installation of experimental equipment.

Included in Design:

- Laboratory design criteria definition for ventilation systems (supply and exhaust air) and utilities such as power, communications, water, waste water, sanitary water, and other utilities provided from the surface.
- Services distribution for utilities such as air, exhaust, water, power, etc, within the laboratories to a termination point within the drift system at the 4,850-foot level at a location mutually agreed with the Underground Infrastructure Consultant
- Detailed Design Drawings, Construction Methods and Sequencing Plans, Cost Estimates, Construction Schedules and Risk Analysis

Preliminary Design and Final Design - Golder

Scope of Work

Includes design for Underground Excavation of new openings and access drifts at the 4850 mid level campus consisting of 3 Lab Modules and 1 Large Cavity

Included in Design:

- Additional geotechnical site investigations and analyses as required to support the site selection, orientation and Design of the new openings and drifts.
- Analysis of rock stability, and design of ground support for new openings and drifts.
- Design floors and surface finishes to prepare the sites for construction and build-out of laboratory infrastructure, and for installation of research equipment and instrumentation.
- Design and recommendations of programs and equipment for long-term monitoring and assessment of stability of the new excavations and for near-term monitoring during construction.
- Detailed Design Drawings, Excavation sequencing plans and schedules, methods determination, cost estimates and risk analysis

Infrastructure Upgrade Plans

Yates Shaft

1. Decommission Existing Service Hoist
2. Convert Production Hoist to Service Hoist and upgrade to 20 Ton capacity
   - Install new drive
3. Install Auxiliary Hoist
   - 10 to 15 man capacity
   - 2 Ton Payload
   - Automated
4. Install New Shaft Furnishings
   - Strip our timber sets and install steel
   - Install new ground support – rock bolts, screen and shotcrete
   - Install Services to support Lab Operation
   - Ducting for Low Radon Air

Infrastructure Upgrade Plans
Yates Shaft General Arrangement