



Working Group Summaries

A1: Solar, Geo and Supernova neutrinos

A2: Neutrinoless Double Beta Decay

A3: Long Baseline Neutrinos, Nucleon Decay and
NNbar Oscillations

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Outline

- The Process to get to a DUSEL MREFC
- Some Issues
- Working group results

The Process

- S1: Defined science and infrastructure needs in site independent way
- S2: Site specific competition to develop CDR for DUSEL
- S3: Single site award to develop technical design for DUSEL facility
- S4: Multiple awards to develop Preliminary Design for initial suite of experiments (ISE)

The Process

- S1: Defined science and infrastructure needs in site independent way
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NSF ⇔ Community conversation here

From the NSF Large Facilities Manual:

The Preliminary Design/Readiness Stage further develops concepts to a level of maturity in which there are:

A fully elaborated definition of the motivating research questions;

A clearly defined site specific scope;

A PDP that addresses major anticipated risks in the completion of design and development activities and in the undertaking of construction;

And an accurate budget estimate that can be presented with high confidence to the NSF Director, NSB, the office of Management and Budget (OMB), and Congress for consideration for inclusion in a future NSF budget request.

Issues for Some Physics Experiments

- Scientific Program is defined for an area but the specific experiments will be defined by the results of the coming generation of results (Dark Matter, $\beta\beta_{0\nu}$)
 - Need to develop and cost two or more experiments
 - Provide a funding envelope that will accommodate the program

Issues for Some Physics Experiments

- Full program goes beyond the scope of DUSEL as initial stage is conceived.

Example – large cavity/mega-detector(s)

Can we introduce concept of a Phase II yet?
(LIGO did at Phase I.)

Can we do geo-engineering for large cavity now?

Can we build one ~ 100 kton module of mega-detector now? (Water or scintillator, use for nucleon decay, solar neutrinos now, neutrino oscillations when beam from Fermilab exists)

A 100 kton container



What we can ask now

Part of scientific program is well defined. Within each area we must ask:

Experiments – which can be specified now?

Collaborations – which are ready for next stage?

Technical readiness – is more R&D needed?

What work is needed to complete project book?

A1: Solar, Geo and Supernova neutrinos

- Science program well-defined:
 - Finish study of solar neutrinos – does neutrino luminosity match photon luminosity?
 - Precise measure of θ_{13} , look for non-standard interactions
 - Supernova neutrinos very useful for SN, neutrino properties – if we get a supernova
 - Geo-neutrinos to understand radioactivity component of earth's heat budget.
- Experiments are in different stages of readiness
 - Some ready with PDR in February 2009 (LENS)
 - Others making progress, but not ready for PDR in 2009
 - Some longer term – need R&D – not ISE

A2: Neutrinoless double beta decay

- Important Experiments – 1 ton experiments (different isotopes: Ge, Xe, Te) to measure rate of $\beta\beta_{0\nu}$. (Multiple isotopes to show that signal is $\beta\beta_{0\nu}$. Matrix element ratios needed to test calculations, constrain mass parameter, ultimately determine mechanism.)
- Experiments ready for ISE, but need R&D for engineering and cost (Other techniques/isotopes on longer time scale)
- Can we start with long lead time items now? (Production of enriched isotopes, storing copper underground to reduce cosmogenic backgrounds?)

A3: Long baseline neutrinos, Nucleon decay and $\bar{N}N$ oscillations

- Large detector for neutrino oscillations and nucleon decay
 - Three options: Water Cherenkov and Liquid argon time projection chamber (300-400 kton H_2O , 100 kton LAr, 50 kton scintillator.)
 - Can only do nucleon decay until Fermilab neutrino beam is built (See A1 WG)
- Collaborations: Need people
- Technical readiness:
 - Need geo-engineering for large cavity
 - Water Cherenkov almost ready, needs cost optimization on PMTs
 - Liquid argon is starting major R&D, will take several years to get to 10 kton, more for larger mass
 - Liquid scintillator ...
- Water Cherenkov close to being able to write project book.
- Question – build large cavity as engineering exercise? Can funding be found for one module of detector? Build more modules with optimum technology later?
- $\bar{N}N$ oscillations needs expert scientific and technical review for scientific validation, review hazards (backgrounds/politics) with reactor.

Summary

- Sound scientific program
- Theme: some experiments in different areas will not be ready to cost on MREFC time scale. How much flexibility is there in the MREFC program? NSF will work on flexibility.