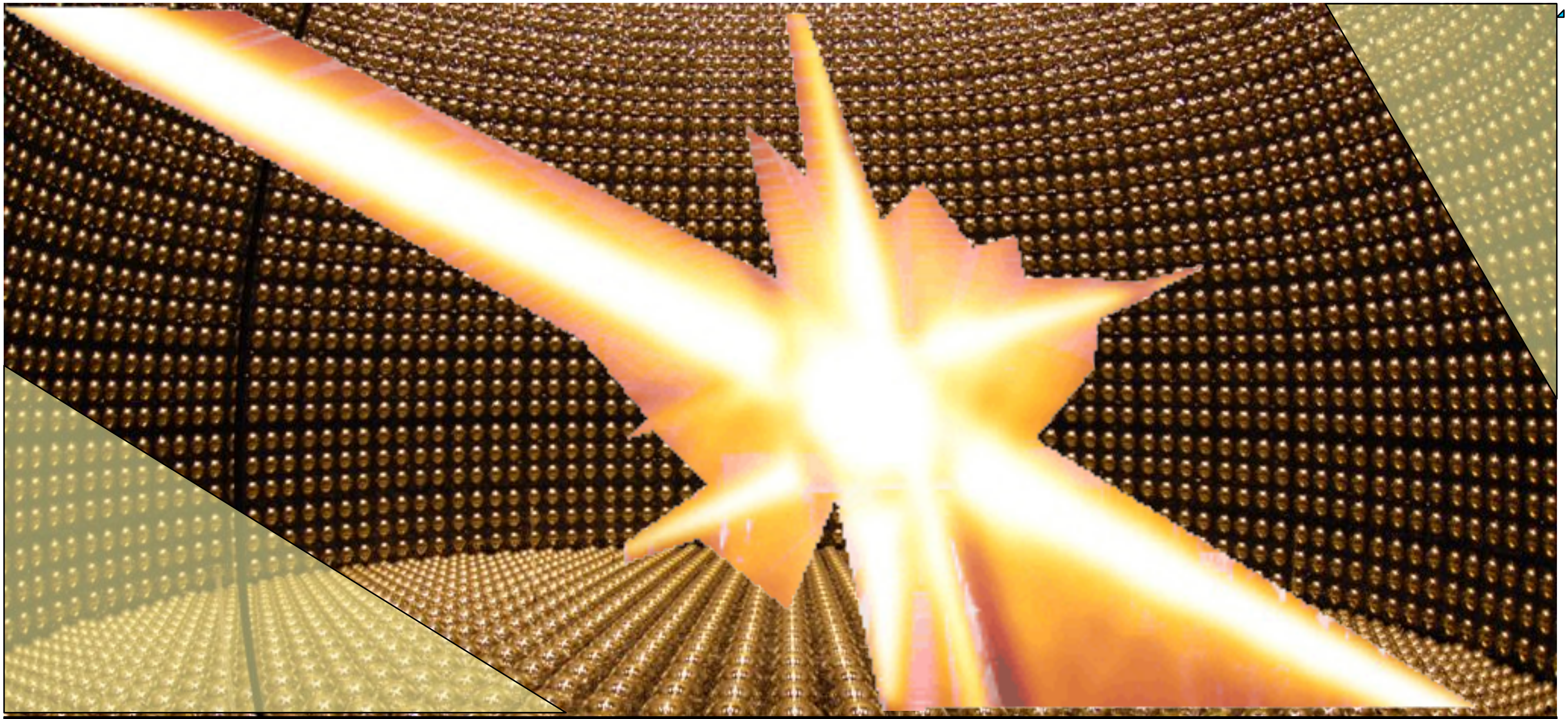
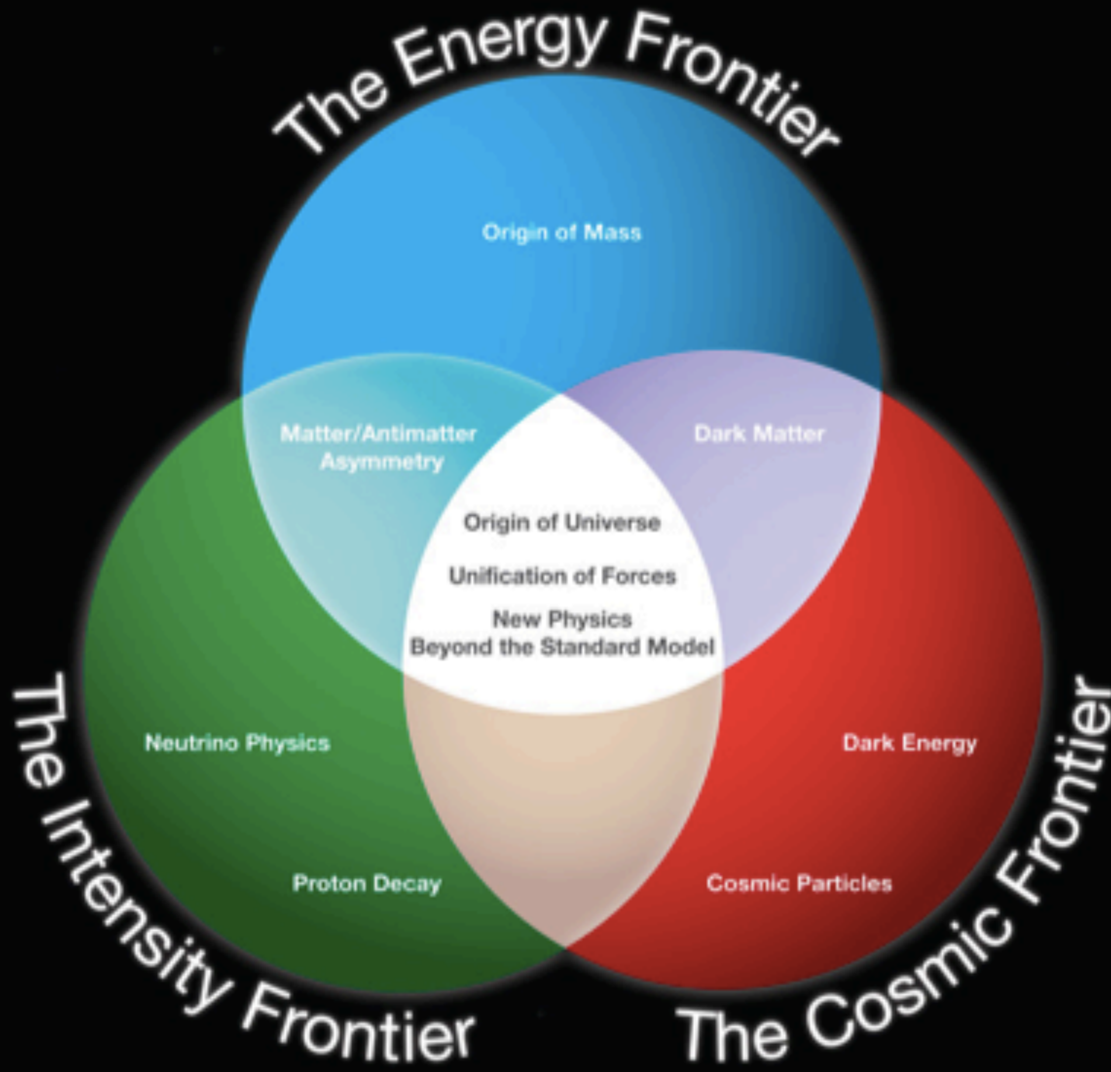


Report from the Intensity Frontier

(With Emphasis on Neutrinos)

Kate Scholberg, Duke University

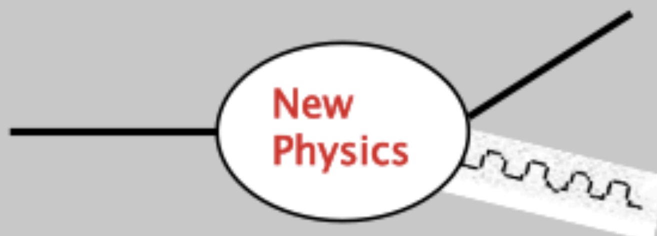
The Three Frontiers



2008 P5 Report

What is the Intensity Frontier?

- Exploration of Fundamental Physics with high luminosity and/or large sensitive detectors
- Precision measurements that indirectly probe quantum effects



- Must use multi-pronged approach to search for new physics
  - Direct Production
  - Precision Measurements
  - Rare and Forbidden Processes
  - Fundamental Properties of Particles

J. Hewett

Charge from DOE HEP

To: J. Hewett & H.Weerts August 8, 2011

Particle physics is frequently characterized as addressing three frontiers in fundamental science; the energy, intensity, and cosmic frontiers. Intensity frontier experiments are those that search for new phenomena by probing rare processes or performing extremely precise measurements of known processes. The facilities that enable this program often require intense particle beams and precision detectors. Searches at the intensity frontier are complimentary to those of the other two frontiers and are part of a three-pronged experimental program that is needed to explore the quantum universe.

The Office of High Energy Physics wishes to identify the most exciting opportunities to carry out experiments on the intensity frontier for our future planning. I request that you organize a workshop to:

- identify these opportunities,
- explain what can be learned from such experiments,
- determine which experiments can be done with current facilities and technology,
- determine which experiments require new facilities or new technology to reach their full potential, and
- produce a final report documenting the results of the workshop

The workshop will be inclusive and open to as wide as possible representation from the entire field of particle physics as well as closely related fields, so that the best ideas can be identified and evaluated by a broad cross-section of the community.

We expect the workshop to be held in the Washington, DC area later this year. We would like to receive the workshop report within 2 months of the close of the workshop. This report will be a valuable document to assist our office in developing an implementation plan that addresses the compelling science of the Intensity Frontier, and hopefully will also serve as a valuable resource and reference for the community.

Simple goals:

1. Document (in one coherent document) the physics /science opportunities at the Intensity Frontier.
2. Identify experiments and facilities needed for components of program
3. Demonstrate that community is interested/ wants to do the Intensity Frontier physics
4. Educate the community

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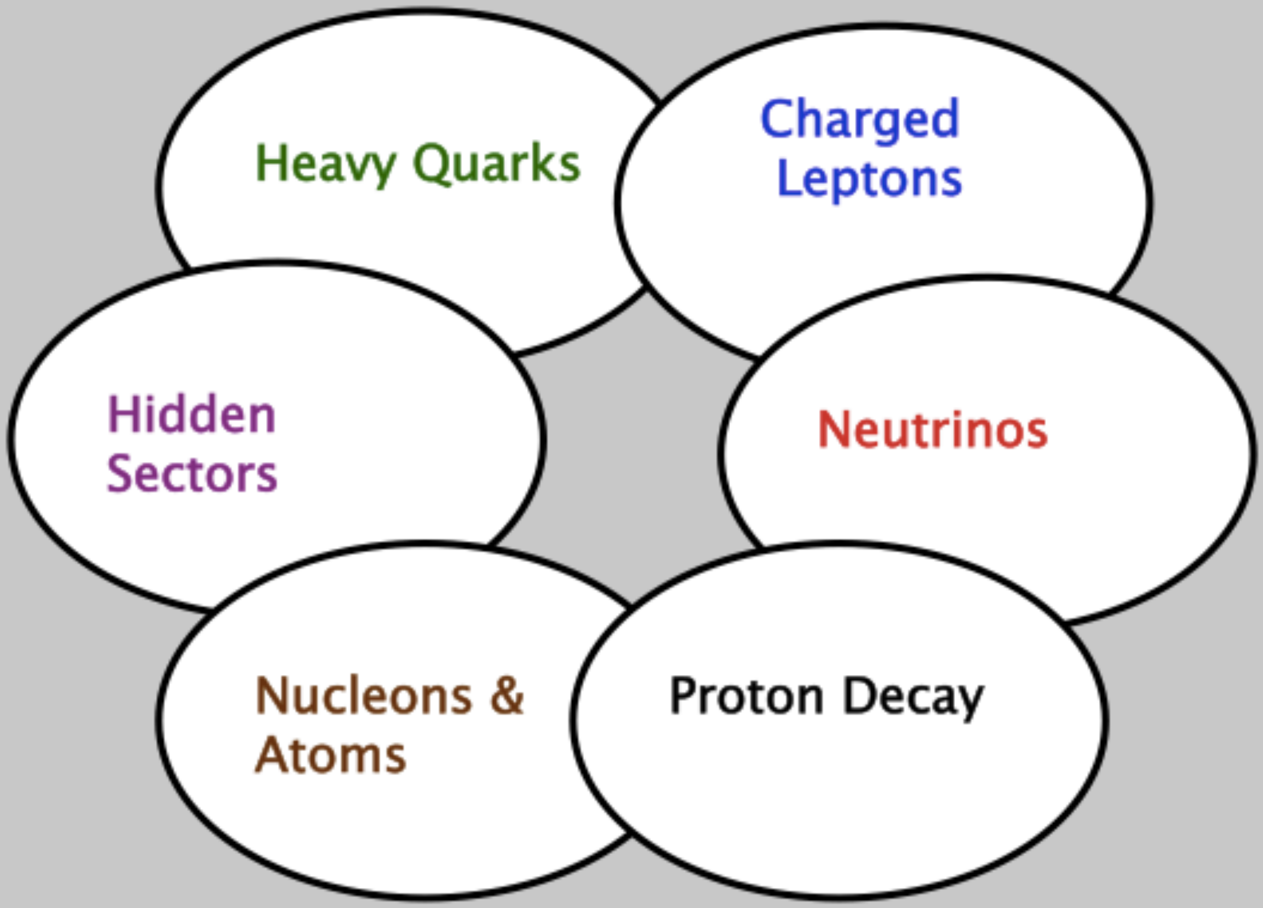
***Not* a ranking or prioritization exercise...**

Simple goals:

1. Document (in one coherent document) the physics /science opportunities at the Intensity Frontier.
2. Identify experiments and facilities needed for components of program
3. Demonstrate that community is interested/ wants to do the Intensity Frontier physics
4. Educate the community

What is the Intensity Frontier?

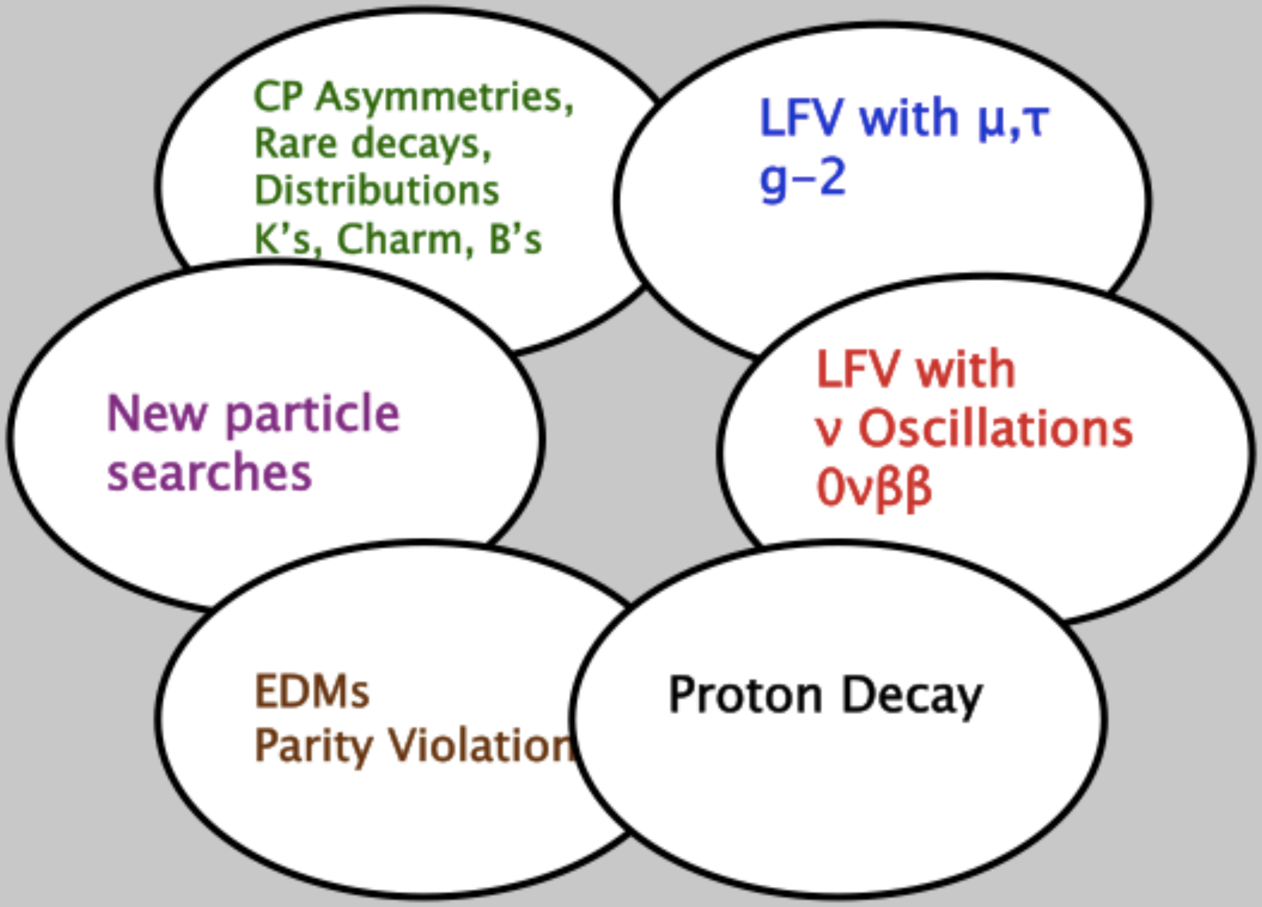
The Intensity Frontier is a broad and diverse, yet connected, set of science opportunities



J. Hewett
SLAC
NATIONAL ACCELERATOR LABORATORY

What is the Intensity Frontier?

The Intensity Frontier is a broad and diverse, yet connected, set of science opportunities



J. Hewett

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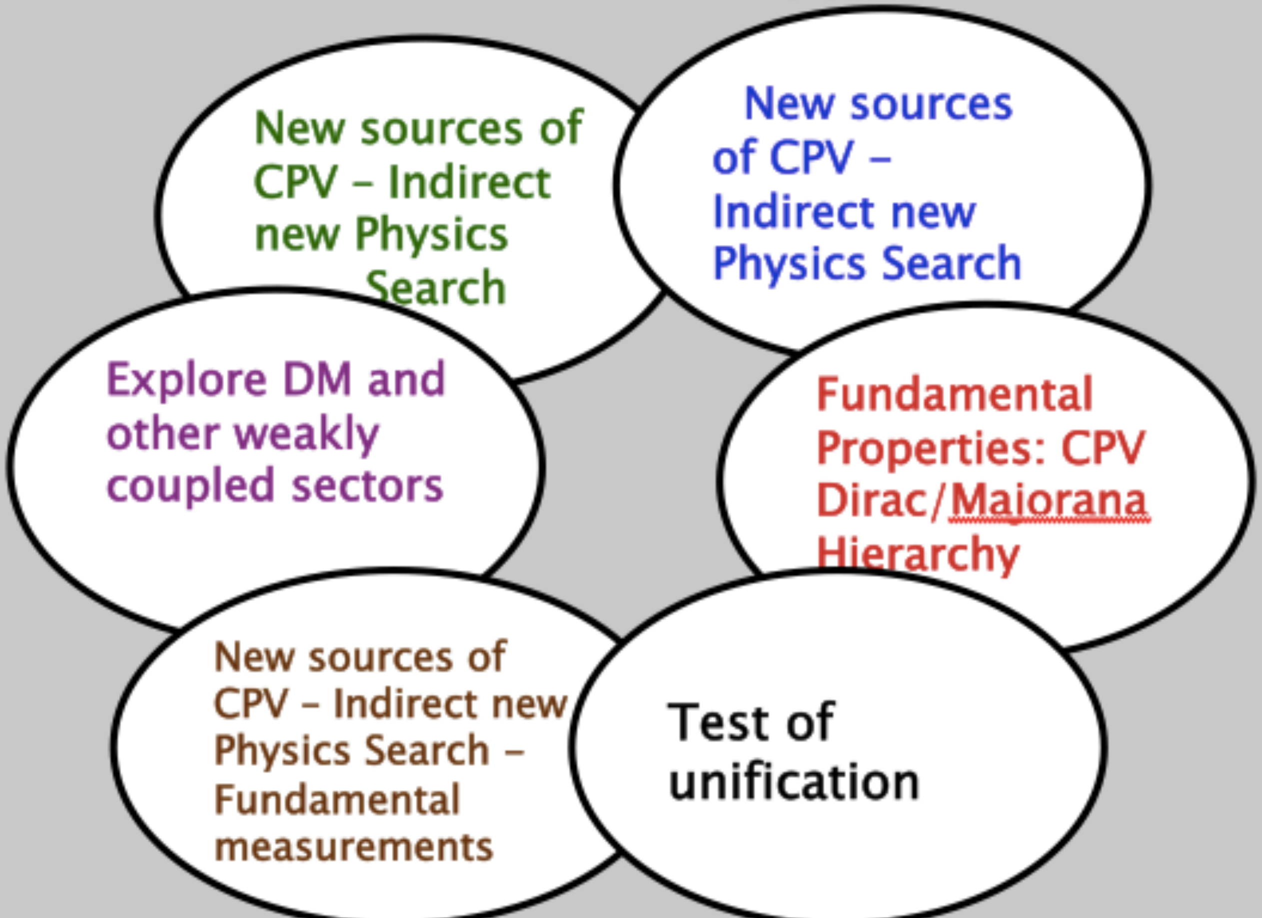


J. Hewett

I will focus on this topic, although there is huge interest and excitement in the other topics as well

Working group name	Description
Heavy Quarks	Study of rare processes and CP violation in strange, charm, and bottom quark systems
Charged Leptons	Study of rare processes and precision measurements of the properties of the muon and tau leptons
Neutrinos	Physics opportunities associated with neutrino oscillations and neutrinoless double beta decay
Proton Decay	Proton lifetime
New Light, Weakly Coupled Particles	Searches for new weakly coupled forces and associated light particles
Nucleons, Nuclei, and Atoms	Searches for new physics utilizing precision measurements of the properties of nucleons, nuclei and atoms

Working Group Conveners

Overall conveners: JoAnne Hewett & Harry Weerts

Topic	Experiment	Theory	Observer
Heavy Quarks	Joel Butler, Jack Ritchie	Zoltan Ligeti	Ritchie Patterson
Charged leptons	Brendan Casey	Yuval Grossman	Aaron Roodman
Neutrinos	Sam Zeller, Kate Scholberg	Andre deGouvea	Kevin Pitts
Hidden Sector Photons, Axions & WISPs	John Jaros	Rouven Essig	Juan Collar
Proton decay	Chang-Kee Jung	Carlos Wagner	Chip Brock
Nucleons, Nuclei & Atoms	Zheng-Tian Lu	Michael Ramsey-Musolf	Wick Haxton

IF Neutrino Working Group

Conveners:

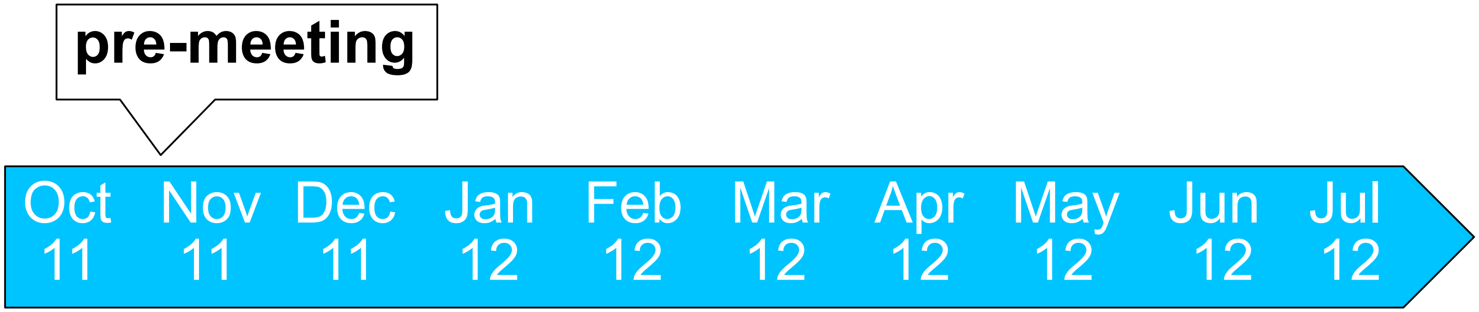
André de Gouvêa, Northwestern University
Kate Scholberg, Duke University
Kevin Pitts, UIUC ('Observer')
Sam Zeller, Fermilab

http://if-neutrino.fnal.gov

- 120 participants at pre-meeting on Oct 24 2011 (on very short notice); 23 5-minute talks: many new ideas!

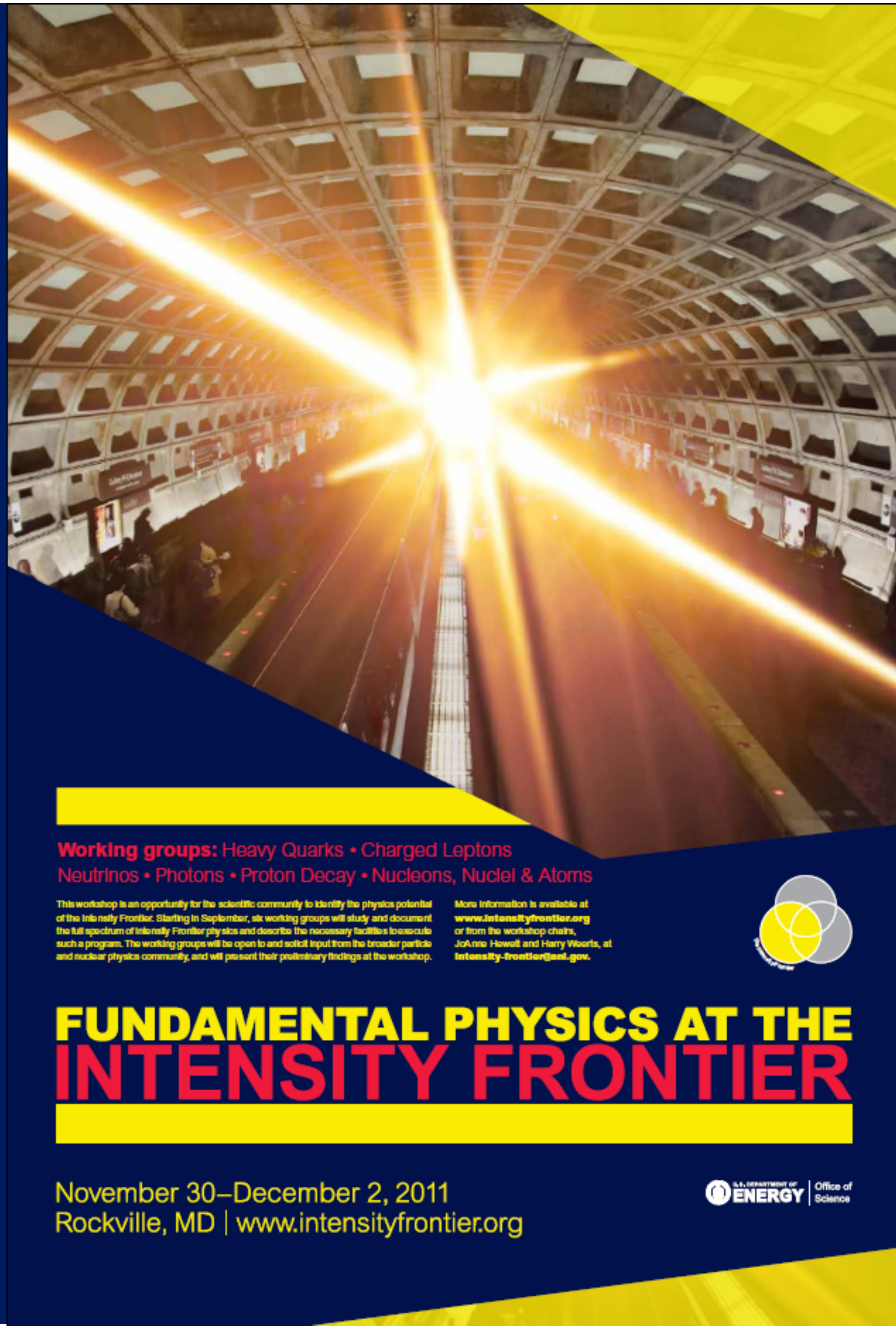
- 19 'one pagers' submitted, discussion on blog & email

- 1.5 day parallel session w/ 31 talks + panel discussion (including joint session with proton decay)

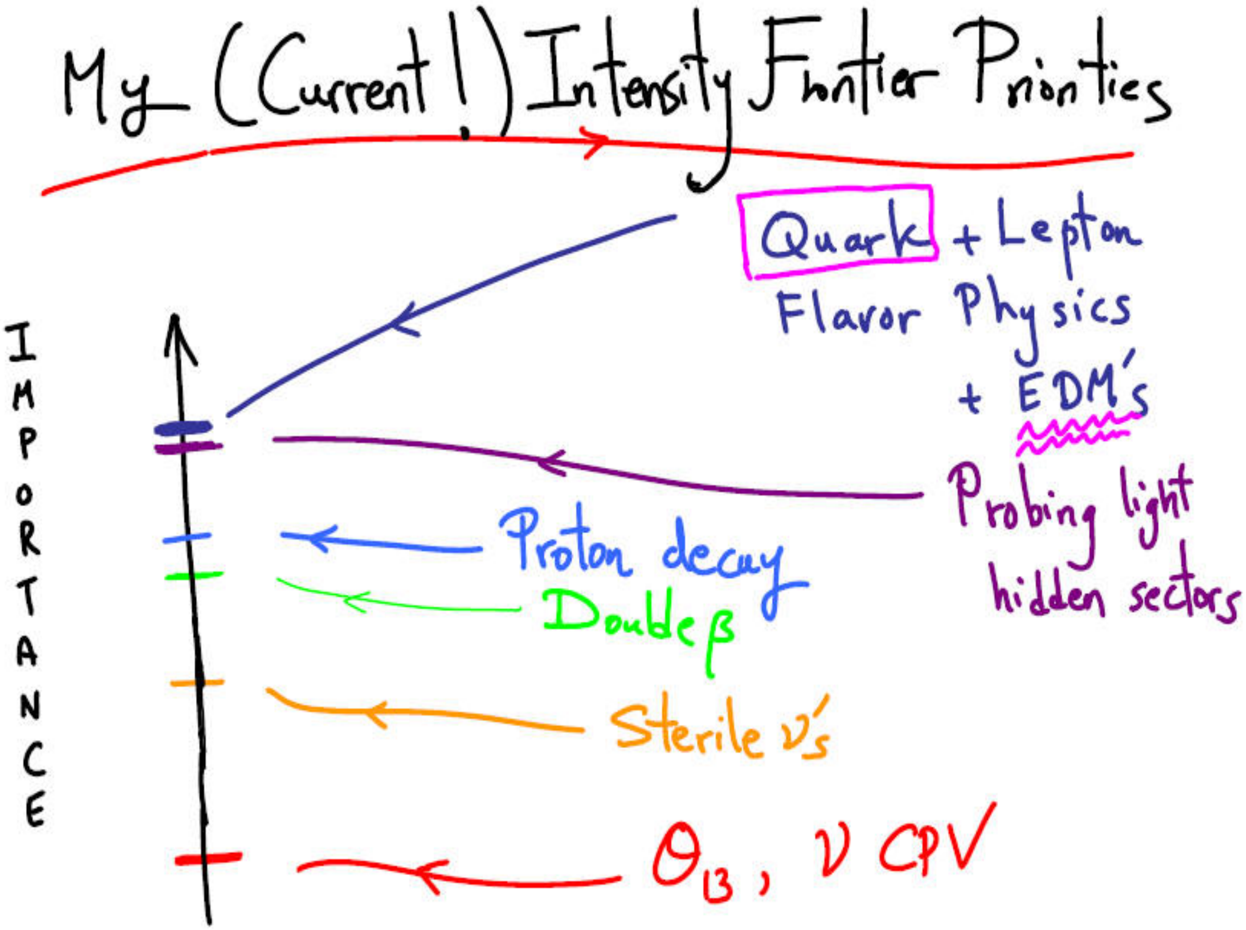

pre-meeting
Oct 11
Nov 11
Dec 11
Jan 12
Feb 12
Mar 12
Apr 12
May 12
Jun 12
Jul 12

Lots of ideas!

NOvA with more exposure	*PATTERSON, Ryan*	*CDF Building 327 - The Big Room, Fermilab*	14:00 - 14:05
Idea of an 8 GeV LBNE beam	*NELSON, Jeffrey*	*CDF Building 327 - The Big Room, Fermilab*	14:06 - 14:11
Connection between neutrino CP violation and leptogenesis	*KAYSER, Boris Kayser*	*CDF Building 327 - The Big Room, Fermilab*	14:12 - 14:17
Neutrino/antineutrino systematics and CP Violation	*MORFIN, Jorge G.*	*CDF Building 327 - The Big Room, Fermilab*	14:18 - 14:23
DAEdALUS beam source	*ALONSO, Jose*	*CDF Building 327 - The Big Room, Fermilab*	14:24 - 14:29
Physics with DAEdALUS	*KARAGIORGI, Georgia*	*CDF Building 327 - The Big Room, Fermilab*	14:30 - 14:35
Supernova neutrinos	*FRIEDLAND, Alex*	*CDF Building 327 - The Big Room, Fermilab*	14:51 - 14:56
Measuring coherent neutrino NC elastic scattering	*YOO, Jonghee*	*CDF Building 327 - The Big Room, Fermilab*	14:57 - 15:02
Neutrino physics with dark matter detectors	*KOPP, Joachim*	*CDF Building 327 - The Big Room, Fermilab*	15:03 - 15:08
Neutrino physics and astrophysics with IceCube fill-ins	*ROTT, Carsten*	*CDF Building 327 - The Big Room, Fermilab*	15:09 - 15:14
New detector at the South Pole receiving accelerator neutrinos	*TANG, Jian*	*CDF Building 327 - The Big Room, Fermilab*	15:15 - 15:20
Hadro-production measurements for NuMI and LBNE	*KORDOSKY, Mike*	*CDF Building 327 - The Big Room, Fermilab*	15:56 - 16:01
Absolute flux measurement using neutrino-electron scattering	*TIAN, Xinchun*	*CDF Building 327 - The Big Room, Fermilab*	16:02 - 16:07
Neutrino scattering on hydrogen and deuterium	*CHRISTY, Eric*	*CDF Building 327 - The Big Room, Fermilab*	16:08 - 16:13
Upgrading MINERvA for future runs: challenges in DAQ and light yield	*PERDUE, Gabe*	*CDF Building 327 - The Big Room, Fermilab*	16:14 - 16:19
Identification of muon, electron neutrinos and antineutrinos at Project-X	*MISHRA, Sanjib*	*CDF Building 327 - The Big Room, Fermilab*	16:20 - 16:25
Neutrino scattering in a narrow band beam	*TAYLOE, Rex*	*CDF Building 327 - The Big Room, Fermilab*	16:26 - 16:31
Rare kaon decay measurements with a magnetized liquid argon detector	*LEE, Kevin*	*CDF Building 327 - The Big Room, Fermilab*	16:32 - 16:37
New experiment to verify/refute OPERA results on neutrino speeds	*SCHMITT, Michael*	*CDF Building 327 - The Big Room, Fermilab*	17:13 - 17:18
A beam dump neutrino experiment to search for new physics	*LOUIS, William*	*CDF Building 327 - The Big Room, Fermilab*	17:19 - 17:24
Search for sterile neutrinos with a radioactive source at Daya Bay	*HEEGER, Karsten*	*CDF Building 327 - The Big Room, Fermilab*	17:25 - 17:30
A proposal for BooNE	*MILLS, Geoffrey*	*CDF Building 327 - The Big Room, Fermilab*	17:31 - 17:36
Alternative oscillation models	*KATORI, Teppei*	*CDF Building 327 - The Big Room, Fermilab*	17:37 - 17:42



515+ attendees!



Arkani-Hamed

Nima ‘insulted θ_{13}’ ??

-H. Schellman

Note unspecified scale and suppressed zero...!

Enormous range of activity, with neutrino oscillations & CPV having major role

Expt. Type	ν_e disapp	ν_μ disapp	$\nu_\mu \leftrightarrow \nu_e$	ν_τ app[1]	Examples
Reactor	√√	–	–	–	KamLAND, Daya Bay, Double Chooz, RENO
Solar[2]	√√	–	√	–	Super-K, Borexino, SNO+, LENS, Hyper-K (prop)
Supernova[3]	√√	√	√√	–	Super-K, KamLAND, Borexino, IceCube, LBNE (prop), Hyper-K (prop)
Atmospheric	√	√√	√	√	Super-K, LBNE (prop), INO (prop), IceCube, Hyper-K (prop)
Pion DAR	√	–	√√	–	DAEδALUS
Pion DIF	–	√√	√√	√	MiniBooNE, MINERνA[4], MINOS(+, prop), T2K NOνA, MicroBooNE, LBNE (prop), Hyper-K (prop)
Coherent ν–A[5]	–	–	–	–	CLEAR (prop), Ricochet (prop)
μ DIF[6]	√	√√	√√	√	VLENF, NuFact
β Beam	√	–	√√	–	

It's vital to *test the PMNS paradigm*, and explore avenues for new physics

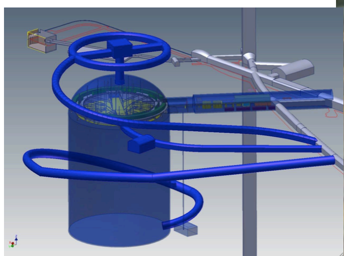
Expt. Type	$\sin^2\theta_{13}$	$\text{sign}(\Delta m^2_{31})$	δ	$\sin^2\theta_{23}$	$\lvert\Delta m^2_{31}\rvert$	$\sin^2\theta_{12}$	Δm^2_{21}	NSI	ν_s
Reactor	⋆⋆⋆	⋆	–	–	⋆	⋆⋆	⋆⋆	–	⋆⋆
Solar	⋆	–	–	–	–	⋆⋆⋆	⋆	⋆⋆	⋆⋆
Supernova	⋆	⋆⋆⋆	–	–	–	⋆	⋆	⋆⋆	⋆⋆
Atmospheric	⋆⋆	⋆⋆	⋆⋆	⋆⋆	⋆⋆	–	–	⋆⋆⋆	⋆⋆
Pion DAR	⋆⋆⋆	–	⋆⋆⋆	⋆	⋆⋆	⋆	⋆	–	⋆⋆
Pion DIF	⋆⋆⋆	⋆⋆⋆	⋆⋆⋆	⋆⋆	⋆⋆	⋆	⋆	⋆⋆	⋆⋆
Coherent ν–A	–	–	–	–	–	–	–	⋆⋆⋆	⋆⋆
μ DIF	⋆⋆⋆	⋆⋆⋆	⋆⋆⋆	⋆⋆⋆	⋆⋆⋆	⋆	⋆	⋆⋆	⋆⋆
β Beam	⋆⋆⋆	–	⋆⋆⋆	⋆⋆	⋆⋆	⋆	⋆	–	⋆⋆

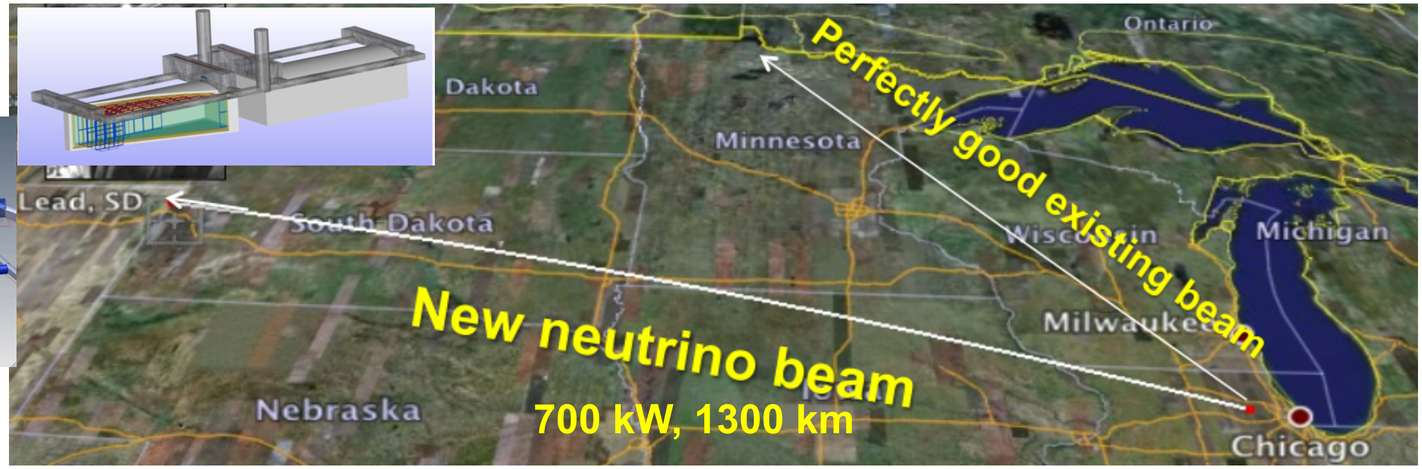
*** very significant contribution from current or proposed experiment

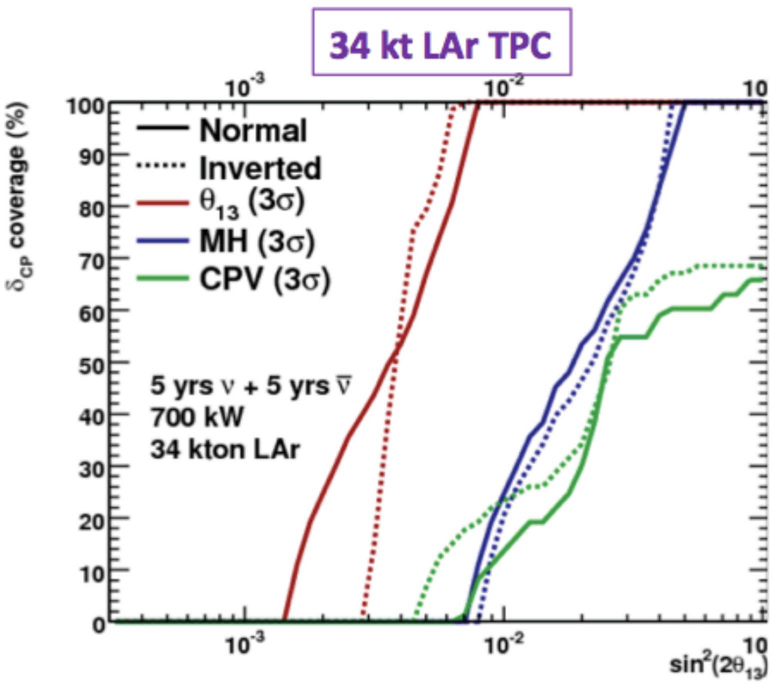
** interesting contribution from current/proposed, or significant from next-next generation

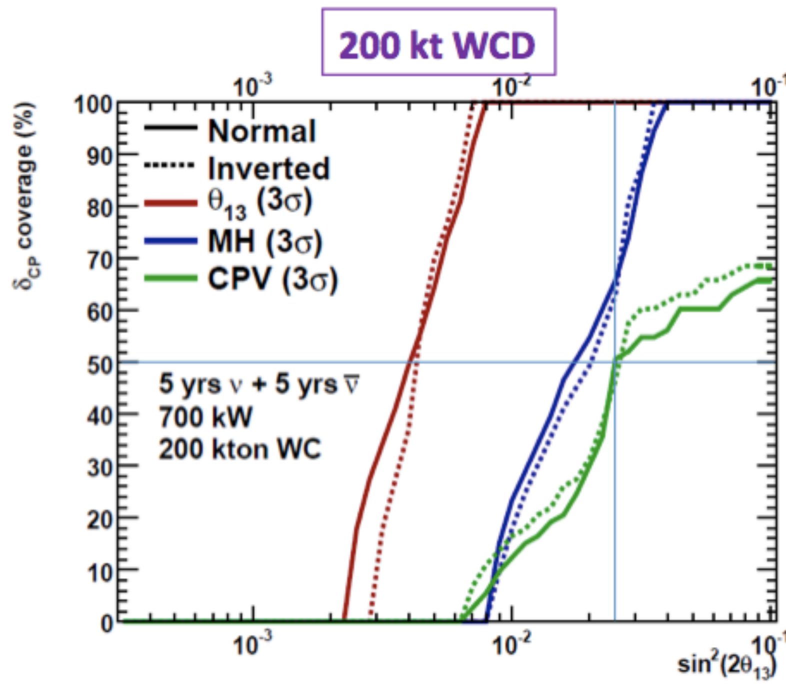
* marginal from current/proposed, interesting from next-next

LBNE at the time of the December workshop

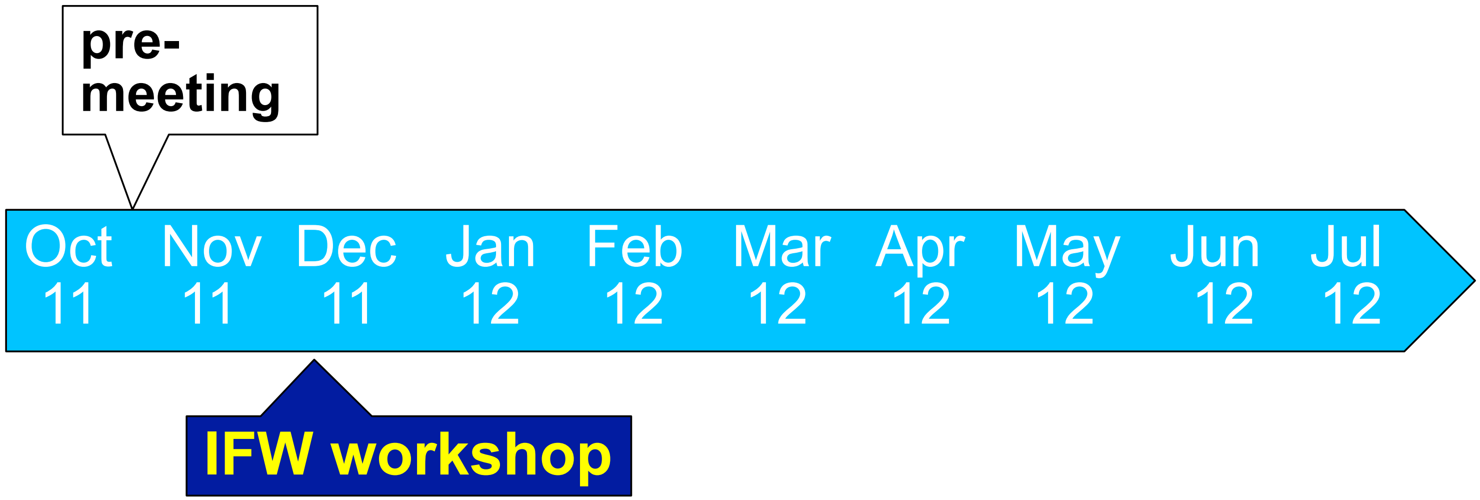








Similar oscillation sensitivities (by construction)



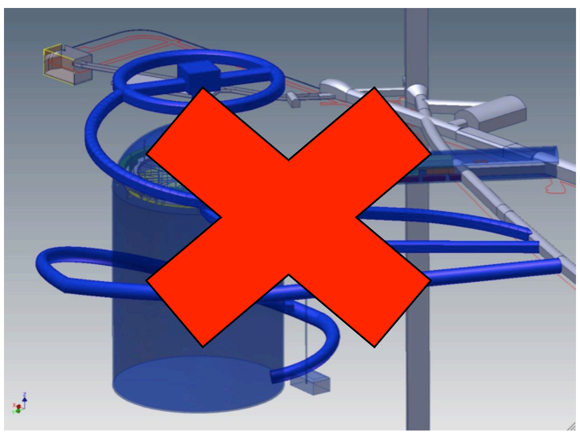
A lot has happened since then...

pre-meeting

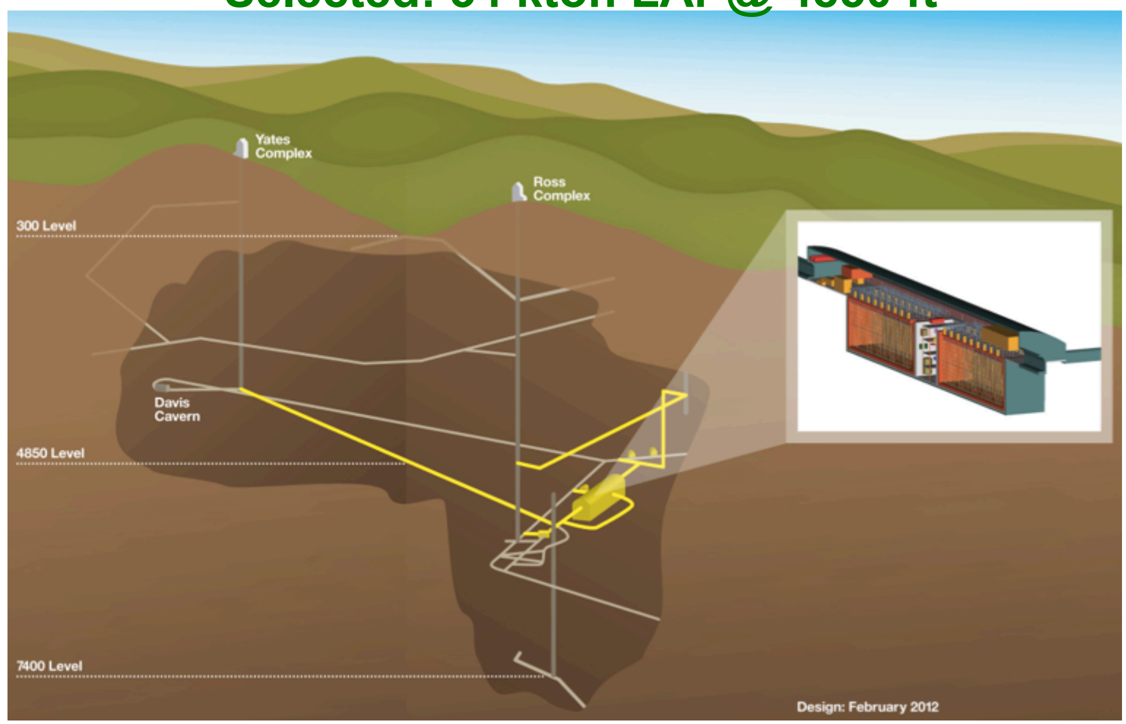
LBNE selects LAr

Oct 11 | Nov 11 | Dec 11 | Jan 12 | Feb 12 | Mar 12 | Apr 12 | May 12 | Jun 12 | Jul 12

IFW workshop

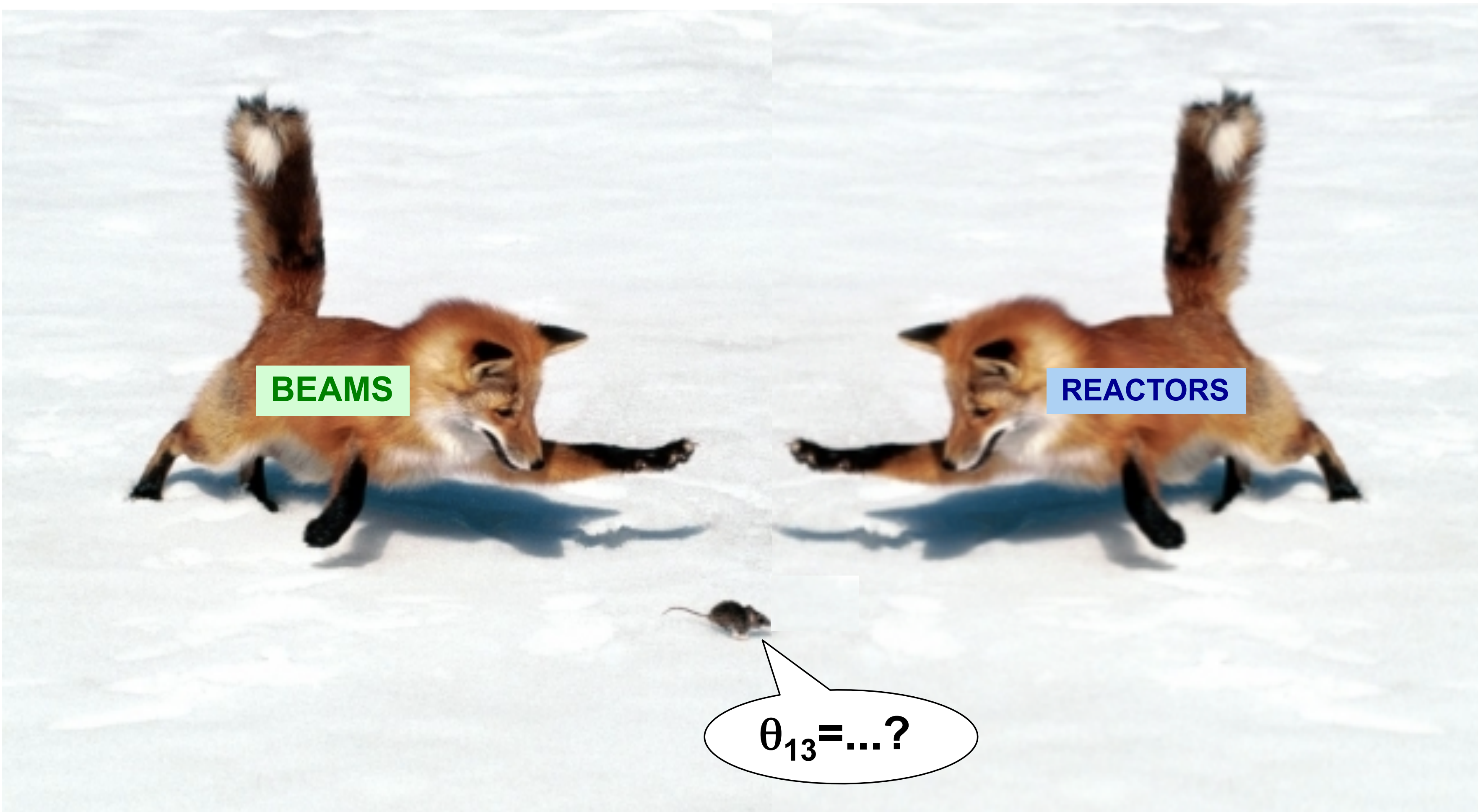


Selected: 34 kton LAr @ 4850 ft

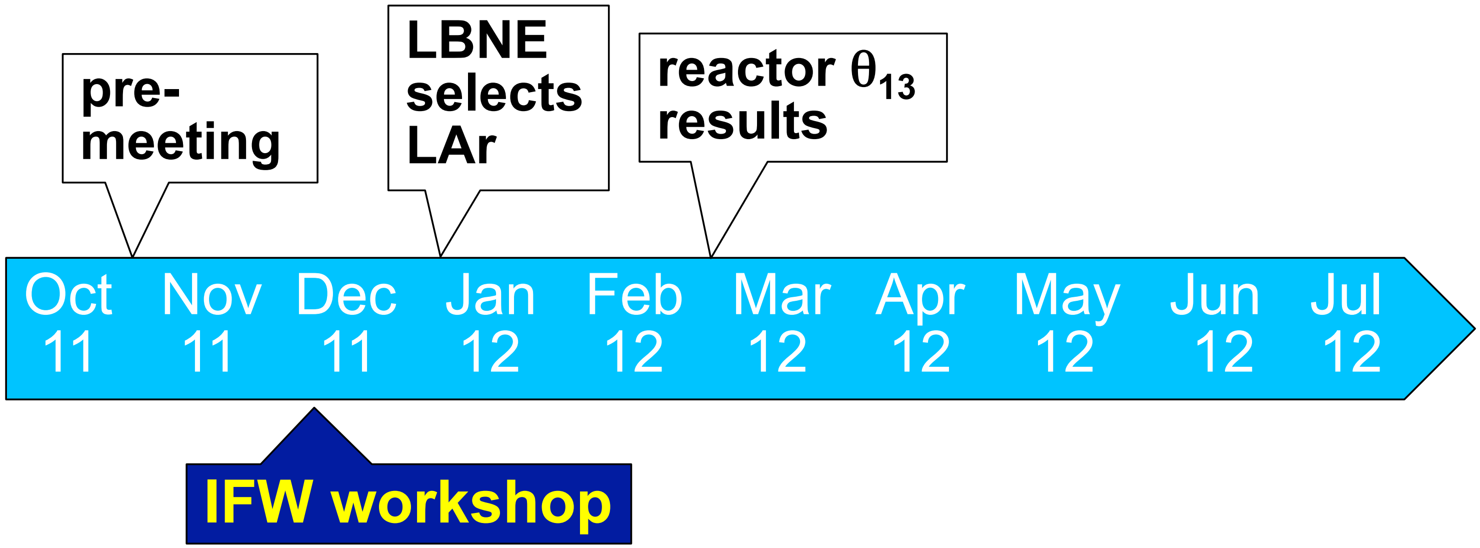


My slide from the December workshop:

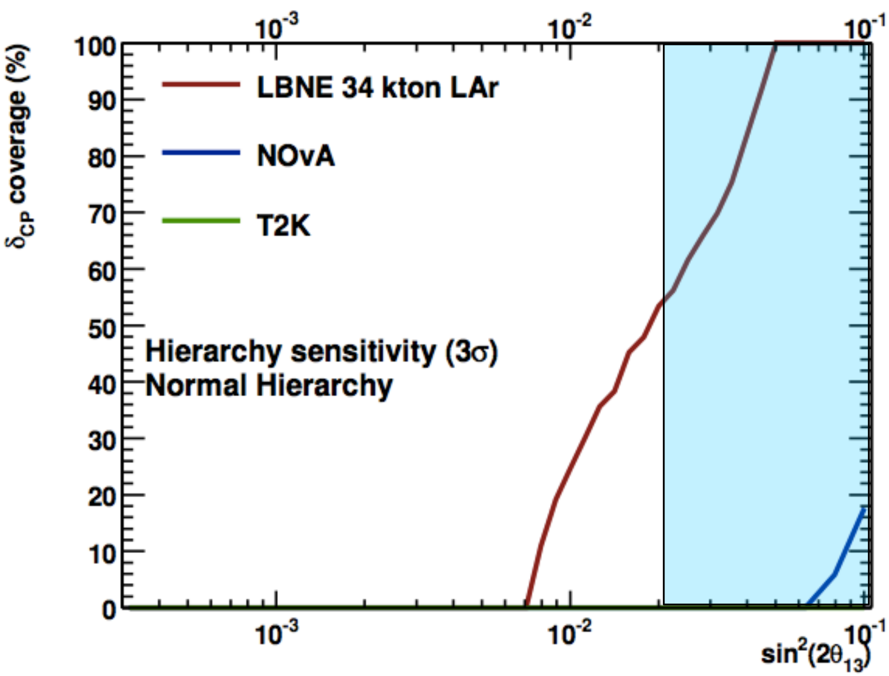
We’re closing in on the answer...

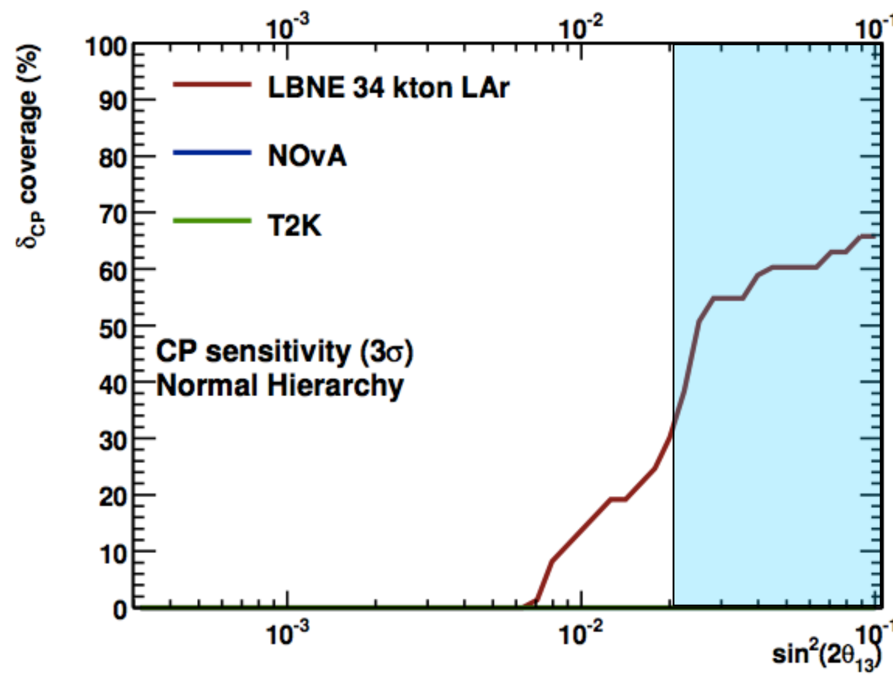


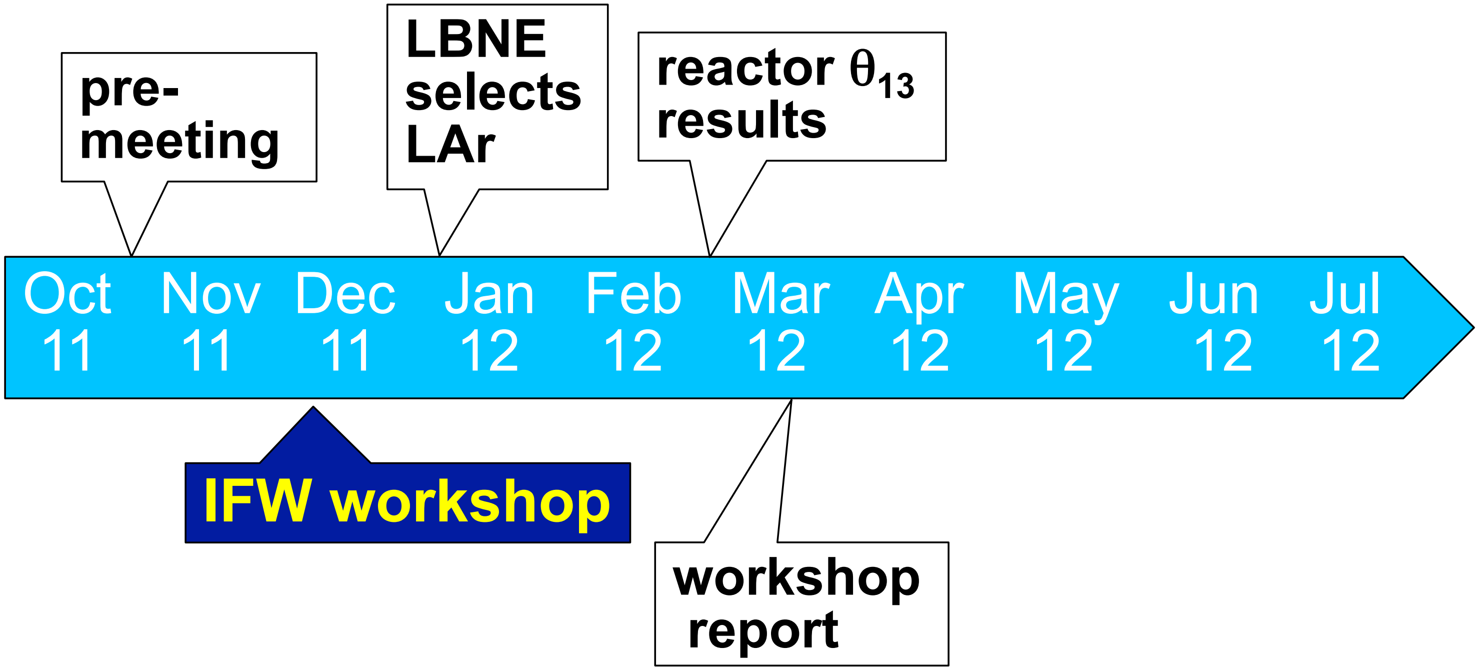
But now we know θ_{13} is **LARGE!**



This is generally good news for sensitivity







arXiv.org > hep-ex > arXiv:1205.2671

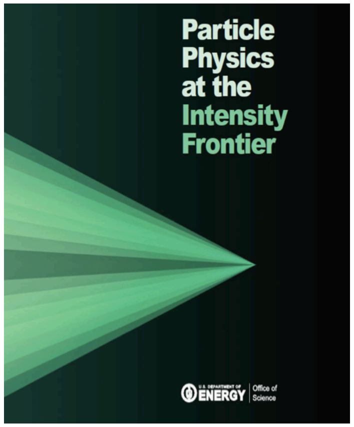
High Energy Physics – Experiment

Fundamental Physics at the Intensity Frontier

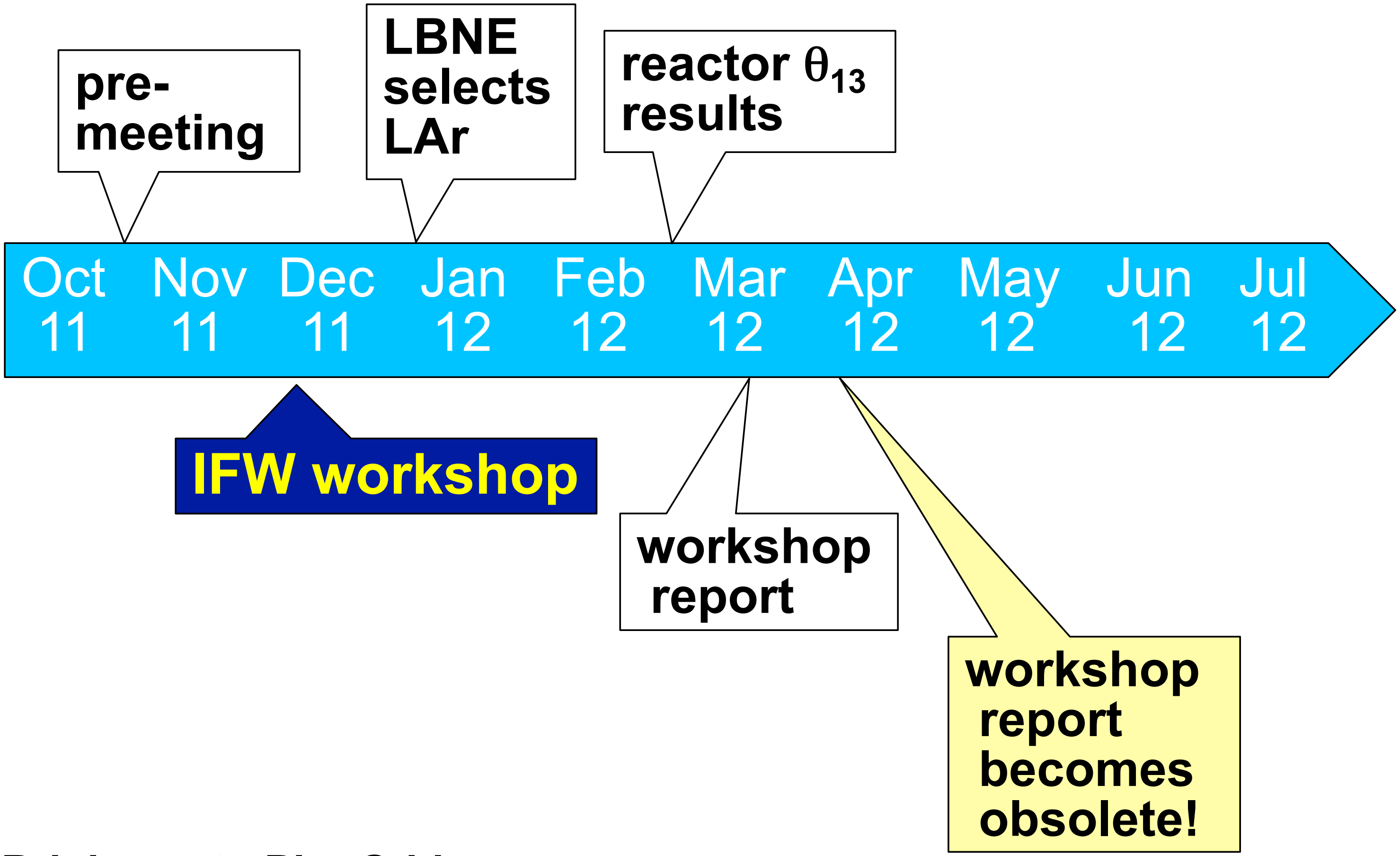
J.L. Hewett, H. Weerts, R. Brock, J.N. Butler, B.C.K. Casey, J. Collar, A. de Gouvea, R. Essig, Y. Grossman, W. Haxton, J.A. Jaros, C.K. Jung, Z.T. Lu, K. Pitts, Z. Ligeti, J.R. Patterson, M. Ramsey-Musolf, J.L. Ritchie, A. Roodman, K. Scholberg, C.E.M. Wagner, G.P. Zeller, S. Aefsky, A. Afanasev, K. Agashe, C. Albright, J. Alonso, C. Ankenbrandt, M. Aoki, C.A. Arguelles, N. Arkani-Hamed, J.R. Armendariz, C. Armendariz-Picon, E. Arrieta Diaz, J. Asaadi, D.M. Asner, K.S. Babu, K. Bailey, O. Baker, B. Balantekin, B. Baller, M. Bass, B. Batell, J. Beacham, J. Behr, N. Berger, M. Bergevin, E. Berman, R. Bernstein, A.J. Bevan, M. Bishai, M. Blanke, S. Blessing, A. Blondel, T. Blum, G. Bock, A. Bodek, G. Bonvicini, F. Bossi, J. Boyce, R. Breedon, M. Breidenbach, S.J. Brice, R.A. Briere, S. Brodsky, et al. (403 additional authors not shown)

The Proceedings of the 2011 workshop on Fundamental Physics at the Intensity Frontier. Science opportunities at the intensity frontier are identified and described in the areas of heavy quarks, charged leptons, neutrinos, proton decay, new light weakly-coupled particles, and nucleons, nuclei, and atoms.

Comments: 229 pages
Subjects: **High Energy Physics – Experiment (hep-ex)**; High Energy Physics – Phenomenology (hep-ph)
Report number: ANL-HEP-TR-12-25, SLAC-R-991
Cite as: arXiv:1205.2671v1 [hep-ex]



Plus glossy brochure



Dr. Brinkman to Pier Oddone:

> Based on our considerations, we cannot support the LBNE project as it is currently configured. This decision is not a negative judgment about the importance of the science, but rather it is a recognition that the peak cost of the project cannot be accommodated in the current budget climate or that projected for the next decade.
>
> In order to advance this activity on a sustainable path, I would like Fermilab to lead the development of an affordable and phased approach that will enable important science results at each phase.

LBNE Reconfiguration

http://www.fnal.gov/directorate/lbne_reconfiguration

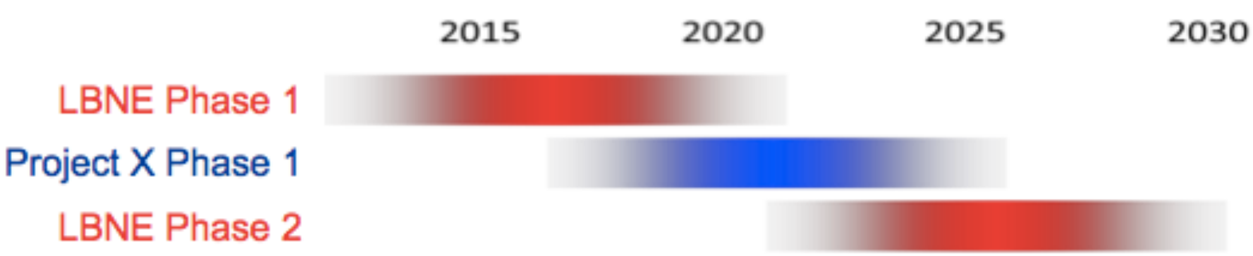
Interim Report of Reconfiguration Steering Committee, June 2012: 3 viable options

- Using the existing NuMI beamline in the low energy configuration with a **30 kton** liquid argon time projection chamber (LAr-TPC) **surface detector** 14 mrad off-axis at Ash River in Minnesota, **810 km** from Fermilab.

- Using the existing NuMI beamline in the low energy configuration with a **15 kton** LAr-TPC **underground (at the 2,340 ft level) detector** on-axis at the Soudan Lab in Minnesota, **735 km** from Fermilab.

- Constructing a new low energy LBNE beamline with a **10 kton** LAr-TPC **surface detector** on-axis at Homestake in South Dakota, **1,300 km** from Fermilab.

Preferred option



Phase 1 Option		15 kton Soudan (underground)	30 kton Ash River (surface)	10 kton Homestake (surface)
Phase 1 Science Capabilities assuming 6×10^{21} protons on target or 10 years with 700 kW	Mass Hierarchy: fraction of δ_{CP} at 3σ	0.17 (0.38)	0.47 (0.50)	0.81 (1.00)
	CP Violation: fraction of δ_{CP} at 3σ	0.05 (0.23)	0.27 (0.55)	0.27 (0.45)
	Resolution of δ_{CP} $\delta = 0, 90^\circ$	$23^\circ, 30^\circ$ ($14^\circ, 26^\circ$)	$18^\circ, 29^\circ$ ($13^\circ, 25^\circ$)	$17^\circ, 30^\circ$ ($12^\circ, 25^\circ$)
	Proton Decay $p \rightarrow K\nu$ 90% CL in 10 years	1×10^{34} years	No	No
	Number of observed neutrinos from a supernova explosion at a distance of 10 kiloparsecs	1,300	No	No
	Atmospheric neutrinos Mass Hierarchy in 10 years	$1.5\,\sigma$	No	No
	Precision Measurements: $\sigma(\theta_{13})$ for $\delta=\pi/2$ Neutrino $\sigma(\theta_{23})$ Anti neutrino $\sigma(\theta_{23})$ Neutrino $\sigma(\Delta m_{31}^2)$ ($10^{-3}eV^2$) Anti neutrino $\sigma(\Delta m_{31}^2)$ ($10^{-3}eV^2$)	 0.60° 1.1° 1.3° 0.036 0.055	 0.40° 0.74° 1.1° 0.035 0.050	 0.40° 0.69° 0.97° 0.025 0.040
Phase 1 Risks	Work in progress	Geotechnical studies for the underground detector	Cosmic ray backgrounds in a surface detector	Cosmic ray backgrounds in a surface detector

With these options, LBNE CD1 review planned for Oct/Nov 2012

All non-beam physics lost;
cost to go underground is +$135M

Where to next?

Glen Crawford, Research Director, DOE OHEP
HEPAP March 2012

- **DOE with community input will develop a high-level Intensity Frontier strategic plan based on**
  - Workshop report
  - Budget projections
  - Programmatic and cross-cutting concerns (NP, NSF,...)
  - This is NOT a list of projects and priorities (yet) but instead a vision for the detailed scientific opportunities
- **Turning the strategic vision of the Workshop report into an executable plan with options**
- **One main challenge will be to take a diverse but connected set of science topics and develop a simple coherent story (a la Higgs)**
  - Matter-antimatter asymmetry is the big pole in the tent
  - However there are important "secondary" messages :
    - Developing a comprehensive understanding of the lepton sector
    - Discovering the undiscovered laws of nature

my highlights

Jim Siegrist, Associate Director, DOE OHEP
HEPAP March 2012

- **We need to continue to develop the science case and planned program on all 3 frontiers. We need more projects in the pipeline than we have budget to be certain the funding directed out of the program onto construction will not be lost.**
- **Plan for 'Snowmass' in summer 2013 to assess our program (neutrino and LHC results available for guidance)**
- **We need active participation of our community in the development of the science case, with lab leadership in the background. DOE and NSF agree on this approach.**
  - This is an inversion of the "traditional" HEP modus operandi
  - The HEP community needs to own the science case, and sell the science case
- **For the intensity frontier, DOE/NSF plan to work with DPF to continue the development of the science case started at the December workshop.**
  - FNAL will lead work on research infrastructure improvements to support that science case.

Jim Siegrist, HEPAP March 2012

Intensity Frontier Issues

- **Science case development – see IF workshop talks yesterday**
  - **Continued community engagement a must**
  - Theorists need to engage in development of the program here
- **Generally, need more protons on target at FNAL to support the intensity frontier program.**
  - FNAL looking at options here
- **Program internationalization**
  - International contributions to our intensity frontier efforts will help stabilize our program

Jim Siegrist, HEPAP March 2012

Beyond P5

- **The P5 Framework is a solid foundation, but**
  - Some of the recommendations have been overtaken by events
  - Budgets have generally been on the lower end of plans
- **We do NOT want to give up that foundation or "re-open" project prioritization at this time**
- **Instead we want to evolve and strengthen the P5 plan**
  - From a better understanding of the science opportunities
  - Using new and improved input data
    - Including the current budget environment
- **We believe this is crucial for a successful Snowmass meeting and the future US HEP program**
  - Community leadership in developing the science plan is more important than ever.
  - When DPF calls, the funding agencies will respond

Common theme here:

Need community engagement, including international community

Pierre Ramond, DPF Past Chair,
HEPAP March 2012

Community Summer Study 2013 (July 29-August 10 2013)
not **in Snowmass CO (venue TBD soon)**

www.snowmass2013.org

More Frontiers... and lots of overlaps

Energy Frontier: Raymond Brock (Michigan State), brock@pa.msu.edu,
Michael Peskin (SLAC), mpeskin@slac.stanford.edu

Intensity Frontier: JoAnne Hewett (SLAC), hewett@slac.stanford.edu,
Harry Weerts (ANL), weerts@anl.gov

Cosmic Frontier: Jonathan Feng (UC Irvine), jlf@feng.ps.uci.edu,
Steve Ritz (UC Santa Cruz), ritz@scipp.ucsc.edu

Instrumentation: Marcel Demarteau (ANL), demarteau@anl.gov,
Ron Lipton (FNAL), lipton@fnal.gov
Howard Nicholson (Mt. Holyoke), hnichols@mtholyoke.edu

Frontier Facilities: William Barletta (MIT), barletta@mit.edu,
Murdock Gilchriese (LBNL), mggilchriese@lbl.gov

Computing Frontier: Two conveners,TBA,

Education and Outreach: Marge Bardeen (FNAL), mbardeen@fnal.gov,
Dan Cronin-Hennessy (UMn), hennessy@physics.umn.edu

Special Advisor: Chris Quigg (FNAL), quigg@fnal.gov

Pierre Ramond, HEPAP March 2012

CPM2012 outcomes:

no detailed writeup but a brief summary from each frontier to ensure success of the Snowmass planning exercise

Subgroups hold focused meetings between CPM2012 and Snowmass

"Snowmass" Meeting outcomes:

A writeup of some 25-30 pages for each of the five frontiers

Summary

Past ~9 months have been "interesting"!

Exciting new results,
lots of ideas for the future

LBNE reconfiguration:
Can we vastly enrich the program by
finding resources to go deep?

New ideas?
Can we come up with a coherent story and plan?

Community input needed
(including international community):
CPM 2012 and "Snowmass" 2013

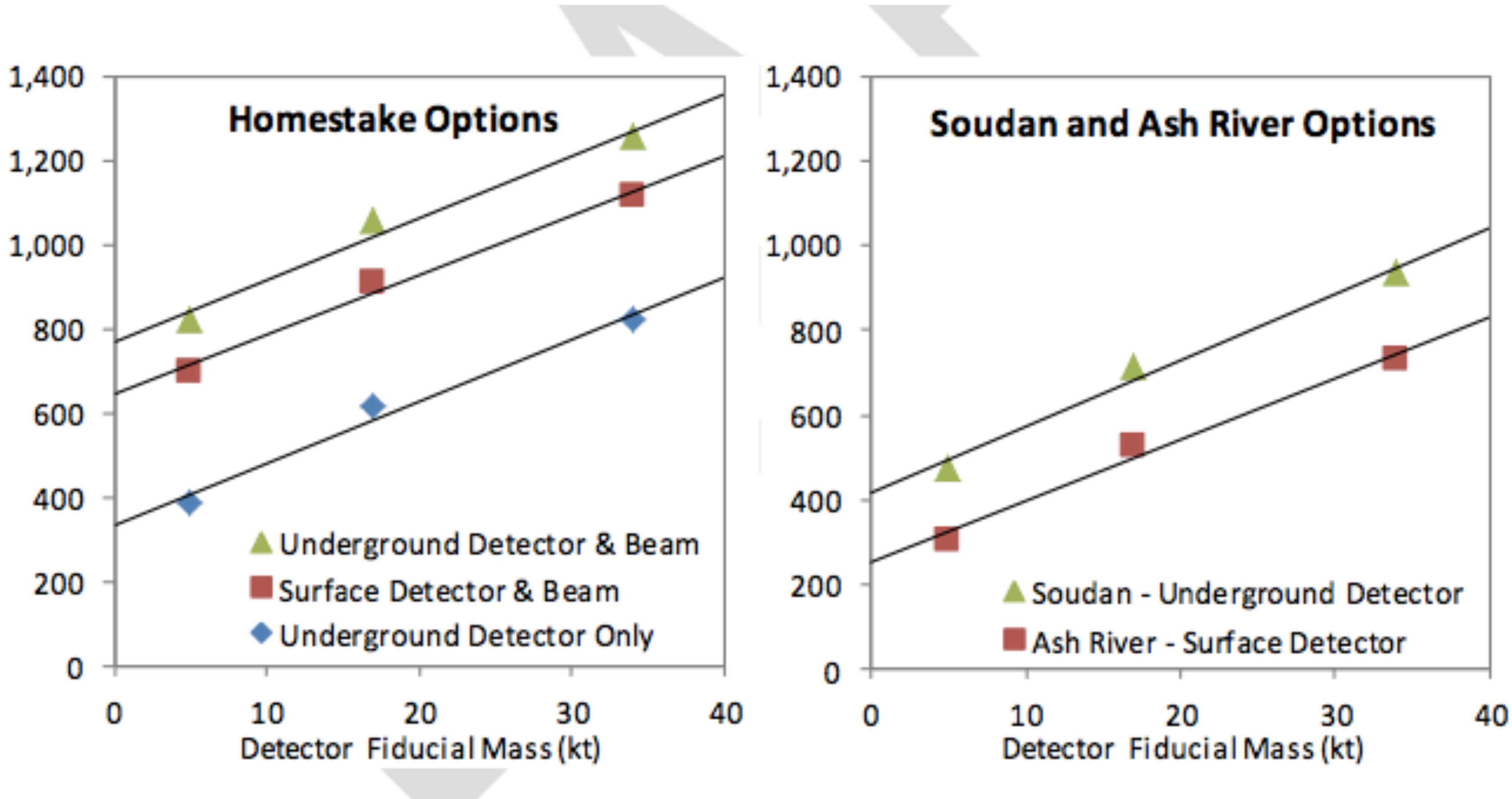
The best hunting may be underground...

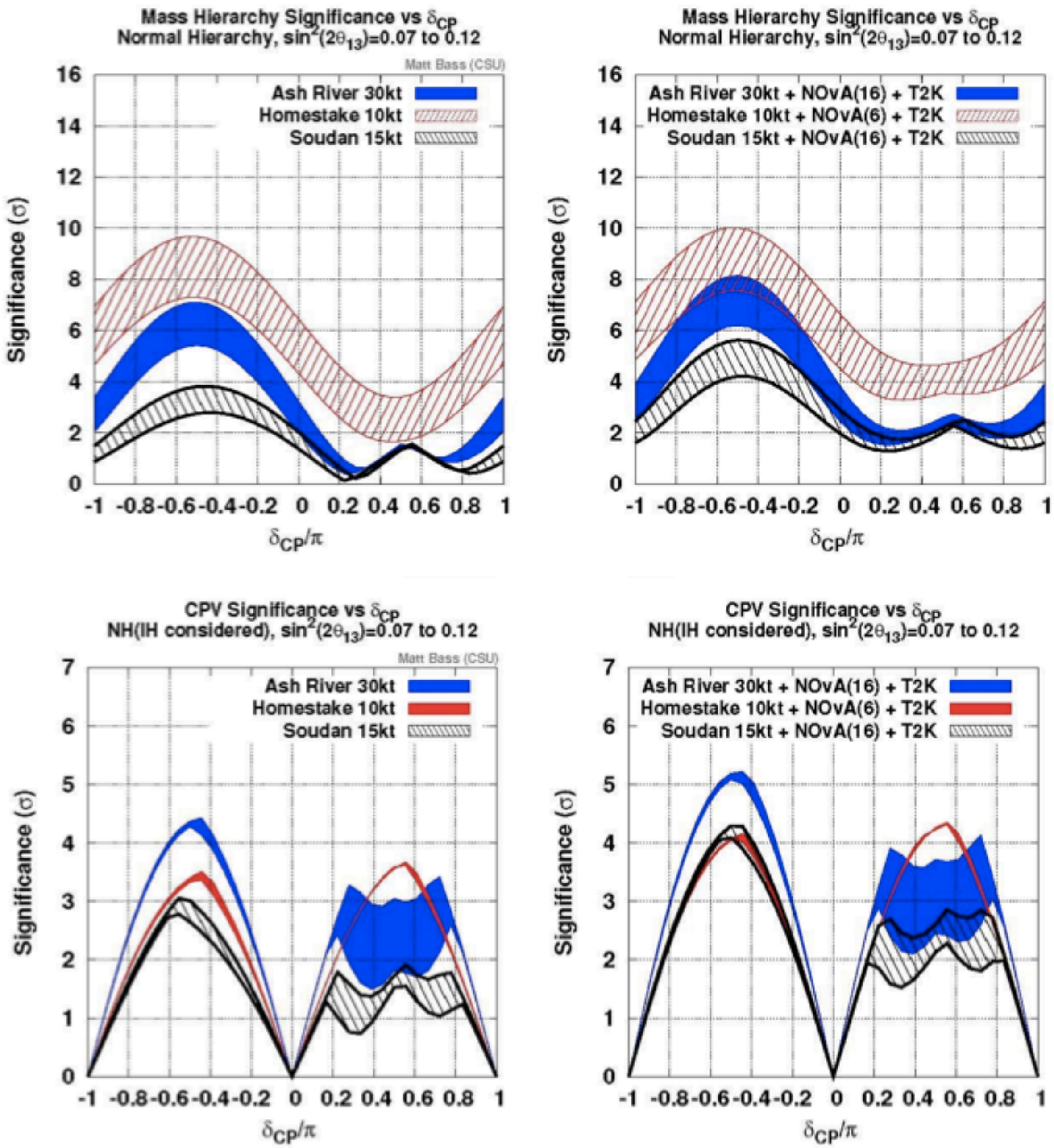
Backups/Extras

Comparison of Phase 1 Options

Homestake	Soudan	Ash River
• Excellent mass ordering reach. Good CPV reach with no *a priori* knowledge of ordering. • Explicit reconstruction of oscillations due to long distance and broad band. • Potential for underground physics, but would cost ~15% more. Possible delay until Phase 2. • Clear Phase 2 path. Beam upgradable to full Project-X intensity, underground lab available. • Surface could be ~10% more expensive than other options. Possible CR muon risk on surface.	• Broadest Phase 1 physics program. Includes both beam and underground physics. • CR muon background risk mitigated • Weaker beam physics based program due to shorter baseline and on-axis beam. • Existing beam, but not upgradable to full Project X intensity without significant investment. • Phase 2 could include additional mass at Soudan or Ash River.	• Best Phase 1 CPV sensitivity for current value of θ_{13} in combination with T2K and NOVA results. • Excellent mass ordering sensitivity in half the δ_{CP} range. • No potential for underground physics in Phase 1. • Possible CR muon risk on surface. • Existing beam, but not upgradable to full Project X intensity without significant investment. • Phase 2 could include additional mass at Soudan or Ash River

Cost of LBNE reconfiguration options





Mass Hierarchy Significance vs δCP
Normal Hierarchy, sin²(2θ13)=0.07 to 0.12
Matt Bass (CSU)
Ash River 30kt
Homestake 10kt
Soudan 15kt
Significance (σ)
δCP/π
Mass Hierarchy Significance vs δCP
Normal Hierarchy, sin²(2θ13)=0.07 to 0.12
Ash River 30kt + NOvA(16) + T2K
Homestake 10kt + NOvA(6) + T2K
Soudan 15kt + NOvA(16) + T2K
Significance (σ)
δCP/π
CPV Significance vs δCP
NH(IH considered), sin²(2θ13)=0.07 to 0.12
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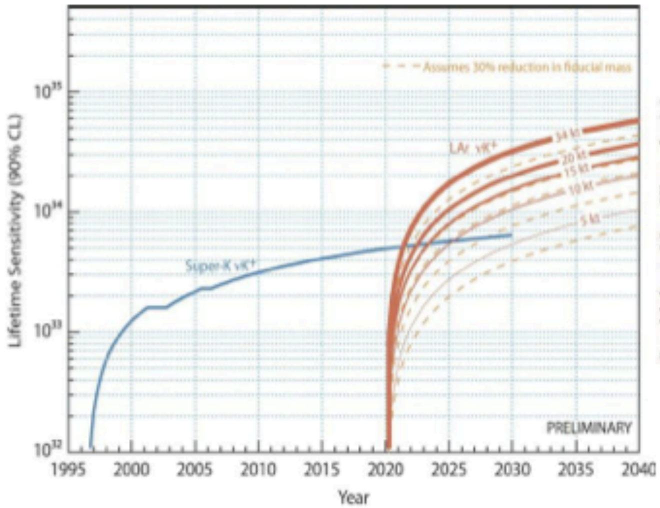
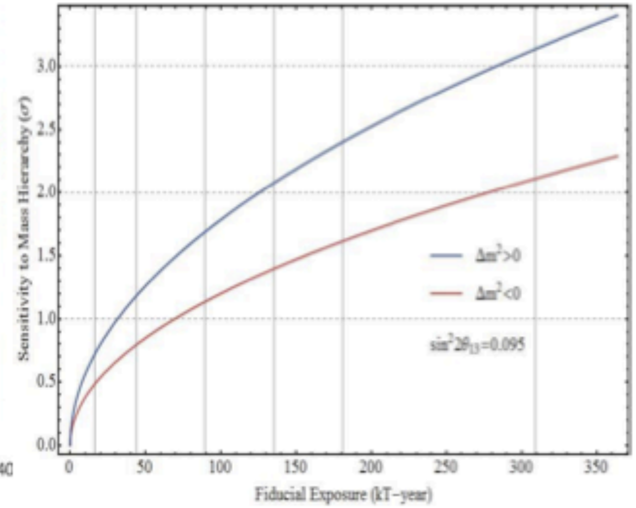
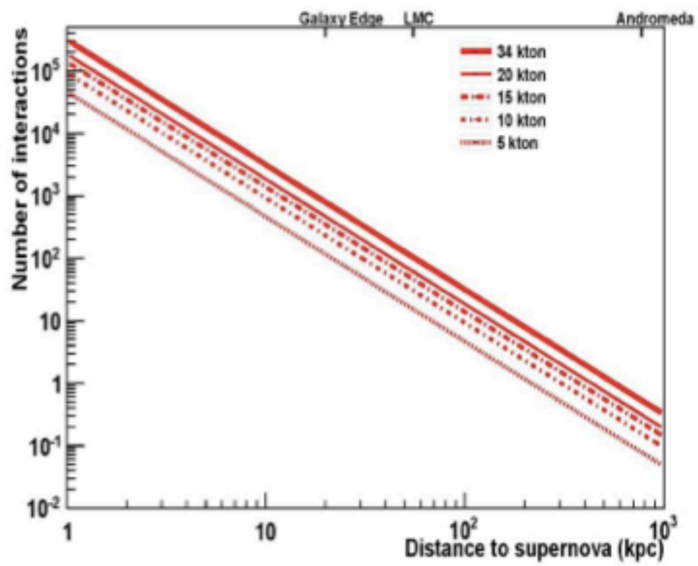
Significance (σ)
δCP/π

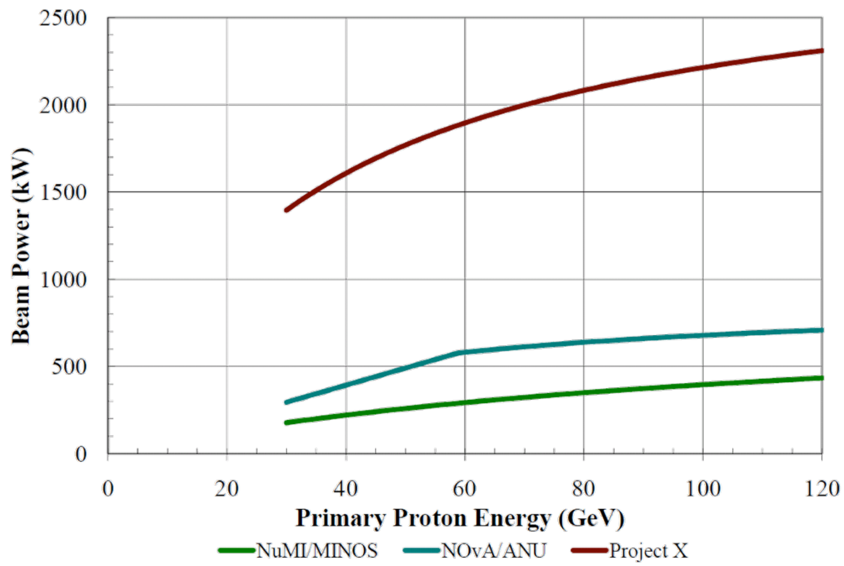
Non-beam physics, possible underground



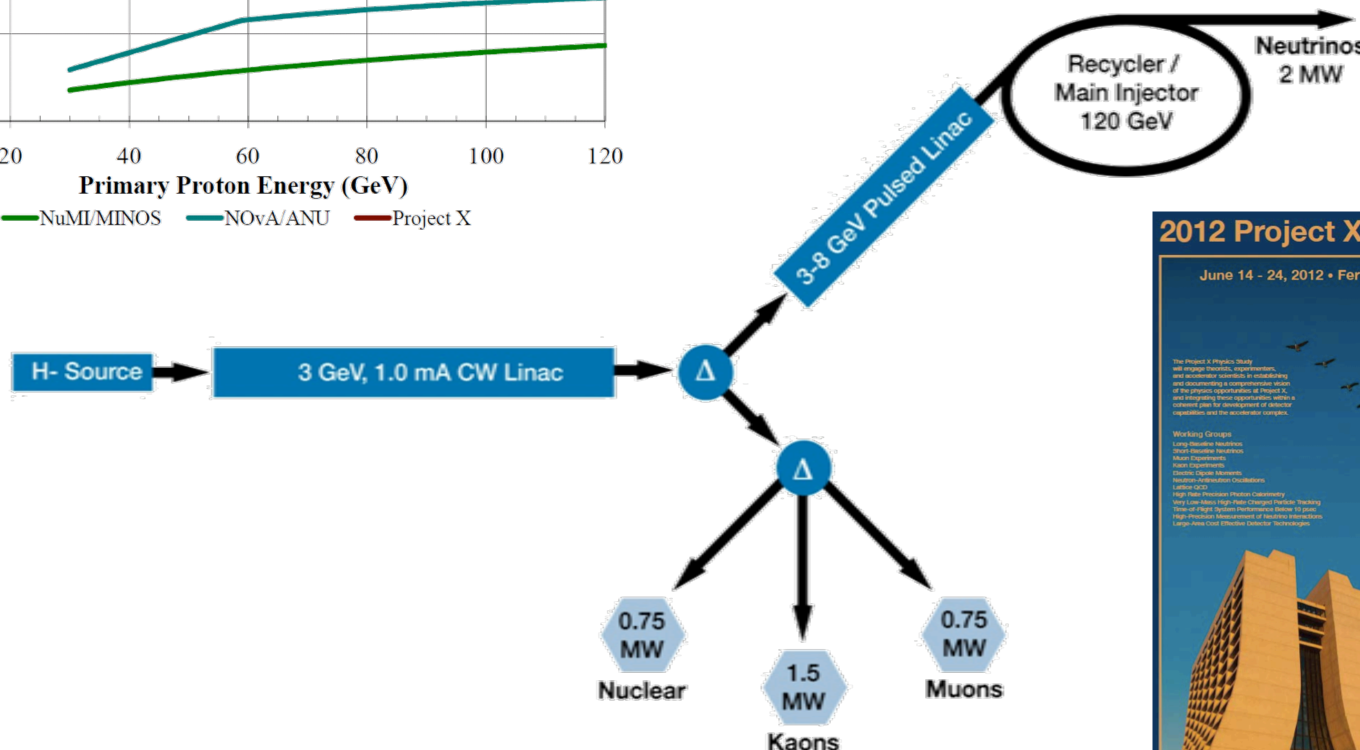




Project X



More protons for Fermilab for multiple purposes, including a high-intensity neutrino beam



Message from the DOE

In 2008 HEPAP through the work of its P5 subpanel laid out a compelling strategic vision for the future of High Energy Physics.

Given recent exciting results at all the HEP scientific frontiers, and the ongoing evolution of budget projections and project plans, it is prudent to revisit the HEPAP/P5 plan with an eye towards examining the science options that have been put forward as well as emerging opportunities.

As a first step in this process, we need a strong scientific case that covers the range of opinion in the community. We would like to understand if our opportunities enable programs that are capable of achieving most or all of the scientific goals as the program considered in the 2008 roadmap, or whether some modifications to those goals and plans are needed.

To that end, a planning process that carefully considers the science opportunities and trade-offs involved, and can clearly elucidate the pros and cons of the various options, would be extremely valuable input for updating the HEP strategic plan.

Jim Siegrist,
Associate Director, Office of High Energy Physics
Office of Science, U.S. Department of Energy