The Fermilab Strategy

Young-Kee Kim 46th Annual Fermilab Users Meeting June 12, 2013





Fermilab's Vision and Mission

- Fermilab: America's particle physics laboratory
- Vision: inspire the world and enable its scientists to solve the mysteries of matter, energy, space and time for the benefit of all.
- Mission: drive discovery in particle physics by:
 - building and operating world-leading accelerator and detector facilities
 - performing pioneering research with global partners
 - transforming technologies for science and industry.



Support 4,300 users (year 2012: 2,200 onsite users + 2,100 computer users)

Energy Frontier

Countries Collaborating with Fermilab

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2,200 onsite users are from



Intensity Frontier users and CMS users growing

Wilson Hall Space Task Force

Illinois Accelerator Research Center (IARC) New Inititive! Pressing space needs for Fermilab staff and users





Energy Frontier: LHC – CMS and Machine

- Fermilab is the lead lab and intellectual home of the U.S. CMS collaboration.
- Remote Operations Center
- Tier-1 Computing Center
- LPC serves as a resource / physics analysis hub for the U.S. CMS community: >350 users, >100 residents, ~700 computing
- Manage the U.S. upgrade projects
 - CMS detector upgrade
 - . Machine upgrade



Superconductivity leads the way to high luminosity



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Cosmic Frontier

• Dark Energy: Progression SDSS \rightarrow DES \rightarrow DESI \rightarrow LSST



• Dark Matter: CDMS, COUPP, DarkSide \rightarrow Generation 2 expt.



Soudan lab, U.S.





Gran Sasso Lab, Italy

• Pierre Auger and Holometer experiments





Why the Intensity Frontier?





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Intensity Frontier

- XOC
 - Remote Operations Center for Intensity Frontier experiments
 - ~75% designed; construction end ~ summer 2014



- Launched the Intensity Frontier Fellowship
 - <u>http://www.fnal.gov/pub/forphysicists/fellowships/</u>



Science and Facility Roadmap



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Twenty-year term vision

Neutrinos Leading rare Leading vMuons Must do processes program Kaons program **EDMs** nn oscillation **Materials** Energy app. **Project X** Enable μ collider-like: ILC-like: technology proton source VLHC Application alignment ν factory

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Getting there: program this decade



Ten-Year Goals for Fermilab



1. Be the world leader at the Intensity Frontier



2. Be a world leader at the Energy Frontier, at the Cosmic Frontier, and in theoretical particle physics



3. Plays a leadership role in developing the technology for next generation accelerator facilities and in advancing basic understanding



4. Plays a leadership role in developing the technology for next generation detectors and computing facilities



5. Plays a leadership role in applying technologies to society's problems by leveraging state and national investment in the IARC

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LBNE: CD-1 (Dec. 2012) and Next Step

 DOE's CD-1 was needed to attract international collaboration (demonstrate that the U.S. is serious). The CD-1 process did not assume other potential contributions.

 \rightarrow beamline + 10kt surface detector (DOE funding only)

- CD-1 approval document states "If additional domestic or international funding commitments are secured sufficiently prior to CD-2, the DOE LBNE Project baseline scope could be refined before CD-2 to include scope opportunities such as a Near Neutrino Detector complex at Fermilab or an underground location at SURF for the far detector."
- The plan is to put the stage 1 detector underground with contributions from non-DOE.



LBNE: What U.S. offers to the world community

- Neutrino beam
 - accelerator facilities
 - exist now! (up to 700kW)
 - \rightarrow the expanding future accelerator Project X (up to 2.3 MW)
 - beamline
- Baseline
 - great baseline (1,300 km)
- Underground facility
 - an operating underground facility that can host a large detector → expandable



LBNE: Evolution of detectors (Phase 1)

Possible scenario

- Primarily U.S. DOE (but with some other resources) •
 - Construct a beamline
 - Excavate a cavern that can house ~35 kt LAr detector
 - Build a ~5 kt detector



- Country #1 (e.g. India) builds a near detector •
- Region #1 (e.g. Europe) builds > 5 kt detector •



LBNE: Evolution of detectors (Phase 1)

Possible scenario

Primary funding sources	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
U.S. (construction: beamline,	CD-1			CD-2	CD-3							Physics	
underground infrastructure, far detector)													
Europe (construction: far detector)													Physics
India (construction: near detector)												Physics	



- News: efforts towards combining LBNO and LBNE for the U.S. project (together ~700 collaborators now and will grow)
- This is consistent with the 2013 European strategy. This opens the door for CERN and European institutions to partner with U.S.

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Evolution of accelerator facilities

This decade

Next decade



Construction: •NOvA Accelerator Upgrade •Proton Improvement Plan •Muon Campus •Illinois Accelerator Research Center

Accelerator Facilities for Project X, ...



Construction: •Proton Improvement Plan •Muon Campus •Superconducting Accelerator Facilities for Project X, ...



Construction:

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- Project X: CW, multi-MW at 3 GeV, 8 GeV and 120 GeV.
- Neutrino program, Muon program
- Kaon program, EDMs, nn-bar oscillation
 - Materials irradiation, Energy applicatioin

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Campus Master Plan

- 1st master plan
 - > 40 years ago
 - Robert Wilson greatly influenced the design of the entire laboratory site.
- 2nd master plan (June 2013)
 - To ensure that the Fermilab campus evolves in a way that supports the long-term goals; intensity frontier initiatives, facilities, consolidation, centralization, modernization







Continuously produce physics

	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	
Physics: Particle Experiments			Operati	ons (fut	ure expt	s with C	D-0 or hi	igher lev	vel appro	oval)	Data analysis continues				
Intensity Frontier														[∨] : LBNE	
										^μ : Mu2	e				
					^μ : Muon g-2										
					V: NOVA										
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	Not incl	luded ar	e the OR	KA kaor	ı experir	nent wh	ich recei	ved the l	Stage 1	approva	alfrom	Fermilal	o, and ex	perimen	
	such as	nuSTOR	M, prote	on EDM	and neu	tron-ant	ineutro	n <mark>osc</mark> illai	tion exp	eriment.	s which	are curr	ently de	veloping	
	proposals with the encouragement of Fermilab Physics Advisory Committee.														
Energy Frontier										LHC (14	TeV, Lu	m upgra	de): CMS	5	
						LHC (14	TeV): Cl	MS							
	LHC (7-8 TeV): CMS														
	Tevatron: CDF/D0														
Cosmic Frontier													DE: LSS	Г	
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				Dark Matter: Generation 2											
				Dark En	ergy: DE	S									
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Physics: Theory	and ba	sic und	derstar	nding c	of tech	nologie	es								
Theory	Particle	and Pari	ticle Astr	o Theory	/										
Accelerator	Accelera	ator <u>Scie</u>	nce at AS	STA											
Detector	Testbea	m exper	iments												

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