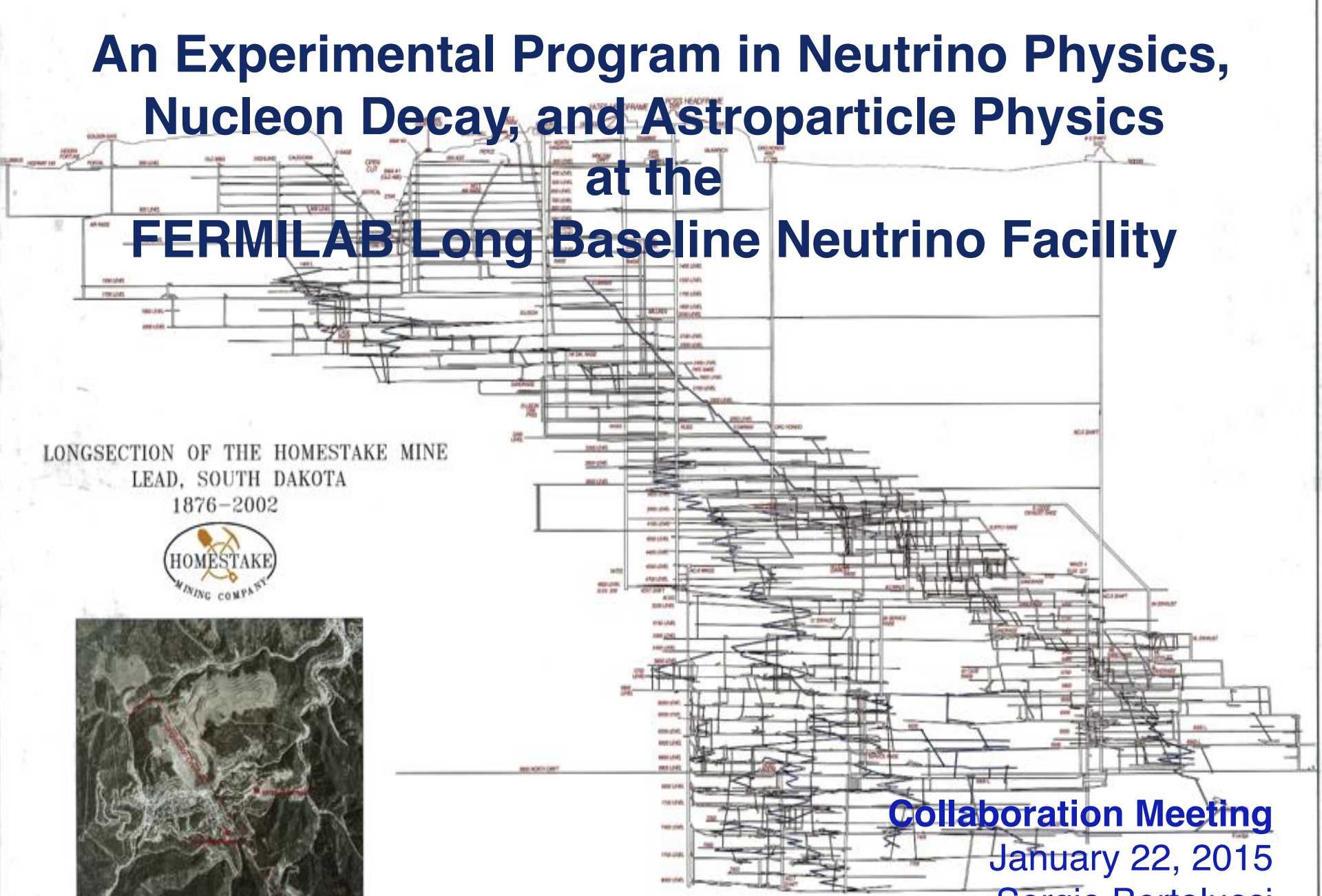
An Experimental Program in Neutrino Physics, Nucleon Decay, and Astroparticle Physics at the FERMILAB Long Baseline Neutrino Facility



Collaboration Meeting
January 22, 2015
Sergio Bertolucci
CERN

From the P5 Report

Recommendation 12 : In collaboration with international partners, develop a coherent short- and long-baseline neutrino program hosted at Fermilab.

The minimum requirements to proceed are the identified capability to reach an exposure of at least **120 kt*MW*yr by the 2035 timeframe**, the far detector situated **underground** with cavern space for expansion **to at least 40 kt LAr fiducial** volume, and **1.2 MW beam power upgradable to multi megawatt** power. The experiment should have the demonstrated capability to search for **supernova (SN) bursts** and for **proton decay**, providing a significant improvement in discovery sensitivity over current searches for the proton lifetime.

From the European Strategy Document

f) Rapid progress in neutrino oscillation physics, with significant European involvement, has established a strong scientific case for a long-baseline neutrino programme exploring CP violation and the mass hierarchy in the neutrino sector.

CERN should develop a neutrino programme to pave the way for a substantial European role in future long-baseline experiments.

Europe should explore the possibility of major participation in leading long-baseline neutrino projects in the US and Japan.

ELBNF

A merger of all previous efforts and any other interested parties to build, operate, exploit

- a (staged) 40 Kt LAr detector, at the SURF site, 1300 Km from FNAL
- An high granularity/high precision near detector

exposed to a 1.2 MW, tunable ν beam produced by the PIP-II upgrade at FNAL by 2024, evolving to a power of 2.3 MW by ~ 2030.

A 25+ years Physics Program

On the beam:

- Perform a comprehensive investigation of neutrino oscillations to:
  - test CP violation in the lepton sector
  - determine the ordering of the neutrino masses
  - test the three-neutrino paradigm
- Perform a broad set of neutrino scattering measurements with the near detector

Exploit the large, high-resolution, underground far detector for non-accelerator physics topics:

- atmospheric neutrino measurements
- searches for nucleon decay
- measurement of astrophysical neutrinos (especially those from a core-collapse supernova).

- A large community, with an impressive amount of experience…
- …trying to become a single collaboration

ELBNF LOI Signatures* from 142 Institutions

UFABC
Alabama
Alfenas
Aligarh Muslim
APC - Paris
Argonne
ASCR
Atlantico
Banaras
Bartoszek Engineering
Bern
Bhabha
Boston
Brookhaven
Brown
Budker
California (Berkeley)
California (Davis)
California (Irvine)
California (Los Angeles)
Caltech
Cambridge
Campinas
Catania
CBPF
CERN
Charles University
Chicago
Ciemat
Cincinnati
Cinvestav
Colima
Colorado
Colorado State
Columbia
COMSATS IIT
CTU
Dakota State
Delhi
DESY
Drexel
Duke
ETHZ
Feira de Santana
Fermilab
Goias
Gran Sasso
Guwahati
Hamburg
Harish-Chandra
Hawaii
Houston
Huddersfield
Hyderabad
Idaho State
IFAE
IFC
IIT
Indiana
Institute for Nuclear Search
Iowa State
IPM
IPNL Lyon
IPPP Durham
Jammu
JG Boissevain Design
Kansas State
KEK
Koneru Lakshmaiah
Lancaster
LAPP
Lawrence Berkeley National Lab
Liege
Liverpool
London UCL
Los Alamos National Laboratory
Louisiana State
Lucknow
Manchester
Maryland
Max Planck MPP
MIT
Michigan State
Milano
Milano & INFN Bicocca
Minnesota
Minnesota (Duluth)
Napoli
NCBJ
Nehru
New Mexico
NIKHEF
Northern Illinois
Northwestern
Notre Dame
Observatorio Nacional
Ohio State
Order of Engineers Genoa
Oregon State
Oxford
Ozark Integrated Circuits Co
Padova
Panjab
Pavia
Pennsylvania State
Pisa
Pittsburgh
Princeton
Punjab
Rochester
Saclay
SLAC
STFC Rutherford Appleton
Sheffield
Sofia
South Carolina
South Dakota
SD School of Mines & Technology
SURF
South Dakota State
Southern Methodist
Stanford
Stony Brook
Sussex
Syracuse
Tennessee
Texas (Arlington)
Texas (Austin)
Tubitak
Tufts
VECC
Virginia Tech
Warwick
Warsaw
Washington
Wichita State
William and Mary
Wisconsin
Wroclaw
Yale
Yerevan
York

Signatures on the LOI for ELBNF

- As of 11 Jan 2005 nominal deadline there were 503 signatures
- They will form the basis of the new ELBNF collaboration
- Signers represent:
  - 142 Institutions*
    - 69 US Institutions
    - 73 non-US Institutions
  - 23 Countries
- Signing the LOI remains open for additional members at least through the 22-23 Jan meeting

*includes Indian & Czech groups which intend to join

Countries represented":

Armenia, Belgium, Brazil, Bulgaria, Canada, Columbia, Czech Republic, France, Germany, India, Iran, Italy, Japan, Mexico, Netherlands, Pakistan, Poland, Russia, Spain, Switzerland, Turkey, UK, USA

" Color coded by continent

Governance and Relations with the Host Lab

- ELBNF will follow a model derived from the CERN LHC, which clearly separates the ownership of the experiment (International Collaboration) from the ownership of the facility (Host Lab)
- Collaboration and Host Lab rights and obligation are regulated by MoU's
- A strong Experiment - Facility Interface Group (EFIG) is key.

The IIEB

An Interim International Executive Board was formed to

- steer the process of the formation of ELBNF
- draft a governance model
- to foster the submission of an LOI to the PAC
- etc..

Documents available at
https://web.fnal.gov/project/iiEB/Pages/iiEB-home.aspx

It will dissolve as soon as the Collaboration IB will be set-up.

Goals of this meeting

- Agree on a minimal level of organization and governance
- Set a prioritized roadmap to the CDR
- Launch spokesperson selection process
- Form the relevant Working Groups to make progress before the full organization is in place, and to provide a way for individuals/groups to get involved in R&D efforts, CDR writing and other collaboration activities
- Define dates of next meetings

A large R&D program

- To optimize the TPC single phase technology, beyond what was done by ICARUS, MICROBONE, LARIAT and LBNE
- To prove the potential of a 2 phases LAr TPC
- To gain experience on new techniques for light detections in LAr
- To calibrate the response to hadrons and leptons
- To learn how to deal with all nu-e possible topologies
- To optimize the detector modularity and integration process
- To gain experience on membrane cryostats construction
- To learn the cryo-techniques necessary at the multi kt scale
- To exercise and learn about data automatic reconstruction and large data set handling (PBytes)

ELBNF Contributed talks
7-9 pm on 7th & 8th floors

Parallel Session 2 *2h0'* (Racetrack WH 7XO)

Photon Detector Design *15'*
Speaker: Dr. Denver Whittington (Indiana University)

Structure of experiment and the Facility/Experiment divide *15'*
Speaker: Dr. Vitaly Pronskikh (Fermilab)

SiPM R & D *15'*
Speaker: Yujing Sun (University of Hawaii)

Coordination of R & D for ELBNF *15'*
Speakers: Prof. Jaehoon Yu (University of Texas at Arlington), Dr. Zelim
Laboratory)

Photo Detector Simulation and Reconstruction *15'*
Speaker: Dr. Alexander Himmel (Duke University)
Material: **Slides**

A High Resolution ND for ELBNF *15'*
Speaker: Dr. Roberto Petti (University of South Carolina)

The ARGONCUBE Approach *15'*
Speaker: Antonio Ereditato (BERN)

Parallel Session 1 - Hornet's Nest - WH 8XO *2h0'*

Physics Opportunity with sub-GeV Dark Matter *15'*
Speakers: Dr. Amir Farbin (University of Texas at Arlington), Animesh C
Arlingrton), Prof. Jaehoon Yu (University of Texas at Arlingto

Software and Computing Organization *15'*
Speaker: Dr. Maxim Potekhin (Brookhaven National Laboratory)

ELBNF Systematics *15'*
Speaker: Elizabeth Worcester (BNL)

Simulation and Analysis Tools *15'*
Speaker: Dr. Daniel Cherdack (Colorado State University)

Modeling Nuclear Effects in Precise Oscillation Experiments *15'*
Speaker: Dr. Artur Ankowski (Virginia Tech)
Material: **Slides**

Supernova Neutrino Theory Overview *15'*
Speaker: Alexander Friedland (Los Alamos National Lab)

Neutrino Beam Optimization *15'*
Speaker: Dr. Laura Fields (Northwestern University)

Optimization of Experimental Design Parameters *15'*
Speaker: Mary Bishai (Brookhaven National Laboratory)

In summary

- No time to idle
- Decisions on the civil engineering at SURF will have to be taken soon and considering the implications, the experiment should be giving it maximum attention.
- ….and let's find a more imaginative name for our experiment!

THANK YOU