

A PERSONAL VIEW-POINT

1. Have collaborated and worked at Fermilab since 1987
 - ✓ E706 - 1987 -1991
 - ✓ D0 – 1992 -1997 and 2004 – end....
 - ✓ MINOS – 1997 – 2006 and MINOS+ (will make application)
 - ✓ NOvA – 2002 – 2006 and 2012 (26th April 2012 onward.....)
 - ✓ MIPP too.
 - ✓ LBNE - 2010 onward
2. The laboratory needs to have a long term vision – not just an experiment
3. Yesterday, Steve Holmes and Bob Tschirhart presented it very succinctly
4. *Project-X and experiments associated with it at the Intensity Frontier (2 MW or more beam power) is the future of Fermilab and HEP on US soil*
5. *The larger international community is looking up to US HEP leadership to provide this opportunity and they will participate*

INDIAN INSTITUTIONS & FERMILAB COLLABORATION - 2006

Memorandum of Understanding
between
US Universities & Accelerator Laboratories
and
Indian Universities & Accelerator Laboratories
concerning
Collaboration on R&D for Various Accelerator Physics and High
Energy Physics Projects
 January 9, 2006

1. Introduction

1.1 General Description

This Memorandum of Understanding (MOU) establishes a collaboration framework between various US and Indian Accelerator Laboratories and Universities, hereinafter referred to as the "Parties", to pursue coordinated R&D in areas of mutual interest pertaining to accelerator and high energy physics projects. This agreement between the Parties is made to further the objectives of any existing national and international collaborations, and shall not alter those collaborations. This MOU between the Parties is not a legal contractual obligation on the part of any of the institutions that are a party to the agreement.

1.2 Objective

The objective of this MOU is to document the terms under which work of the Parties is to be performed.

1.3 Scope

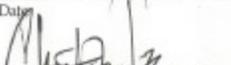
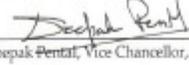
This MOU covers work to be performed by the Parties in the furtherance of the goals of the collaborations and the specific R&D tasks within the topics of collaboration.

1.4 Initial List of Participating Institutions

The following is a list of the Institutions that are a party to the collaboration. The Parties agree that after mutual consultation, they would favorably consider admitting new partner institutions from the USA and India who want to contribute towards the objective of this Agreement.

4.2 Approvals

The following concur in the terms of this Memorandum of Understanding:

 Piermaria Oddone, Director, FNAL Date: 1/9/05	 Vinod C. Sahni, Director, CAT Date: March 8, 2006
 Jonathon Dorfman, Director, SLAC Date: 1/23/06	 Bikash Sinha, Director, VECC Date: March 9, 2006
 Christoph Lechner, Director, TJNAJ Date: 1/18/06	 Amit Roy, Director, IUAC Date: March 9, 2006
 Maury Tigner, Director, Newman Lab Date:	 S. Bhattacharya, Director, TIFR Date: April 17, 2006
Date:	 S. Banerjee, Director, BARC Date: March 14, 2006
Date:	 Deepak Pant, Vice Chancellor, DU Date: April 10, 2006
Date:	Date:

8

0100006

Accelerator collaboration progressing well

ON NEUTRINOS - 2009



Fermi National Accelerator Laboratory
P.O. Box 500 • Batavia, IL • 60510-0500
630-840-3211 (phone)
630-840-2900 (fax)

Director's Office

November 08, 2009

Prof. Brajesh Chandra Choudhary
Department of Physics & Astrophysics
University of Delhi
Delhi - 110 007, India

Prof. Sanjib Mishra
Department of Physics and Astronomy
University of South Carolina
Columbia, SC- 29208

Dear Prof. Choudhary and Prof. Mishra,

Fermilab's program for the next decade includes investigation of physics at the intensity frontier while vigorously participating in energy frontier physics at LHC and the cosmic frontier. With the energy frontier moving from the Fermilab-Tevatron to the CERN-LHC, a significant fraction of our Indian collaborators will shift to LHC.

Scientists from US and Indian institutions have been collaborating on high energy physics experiments at Fermilab since 1985. Together we have made valuable contributions to the Fermilab program. Recently we have developed strong accelerator collaboration with the Indian Department of Atomic Energy laboratories. This collaboration is making considerable progress in contributing to the proposed Project-X R&D and SRF infrastructure. We have been exploring the possibilities of expanding this collaboration to the intensity frontier physics at Fermilab. I would like to seek your help, as a member of neutrino experiments at Fermilab and with ties to physics community in India, in establishing neutrino collaboration with Indian institutions.

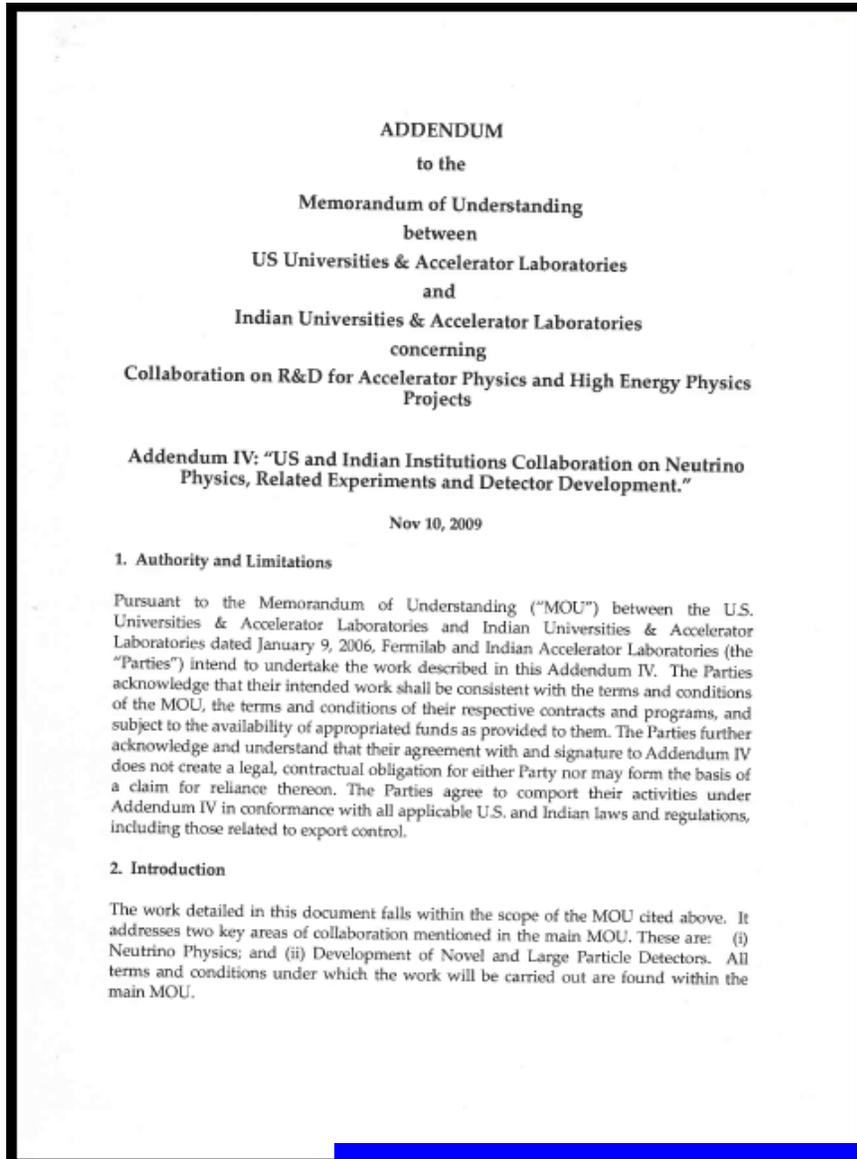
I am requesting you to work with Shekhar Mishra, Fermilab, in developing this collaboration. While working with the management of the respective Fermilab experiments, you would serve as the Technical Project Managers for the work that would be carried by Indian institutions collaboration.

Thank you,

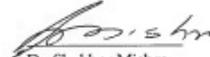
Sincerely,

Piermaria J. Oddone,
Laboratory Director

IIFC - vP - 2009 ONWARD



The following concur on the terms of this Memorandum of Understanding Addendum:

 Dr. Amit Roy Director IUAC	10 Nov, 2009 Date	 Dr. Piermaria Oddone Director, Fermilab	11/16/09 Date
 Dr. Vinod Sahni Collaboration Coordinator DAE, India	Nov 10, 2009 Date	 Dr. Shekhar Mishra, Collaboration Coordinator, Fermilab	11/12/09 Date
 Prof. Brajesh Choudhary, Technical Project Manager University of Delhi, India	10 Nov 2009 Date	 Prof. Sanjib Mishra Technical Project Manager University of South Carolina, Columbia	12 Nov 09 Date

Collaborating Institutions:

1. Banaras Hindu University, Varanasi
2. Cochin University of Science & Tech., Cochin
3. University of Delhi, Delhi
4. IITG, Guwahati
5. IITH, Hyderabad
6. Jammu University, Jammu-Tawi
7. Hyderabad University, Hyderabad
8. Panjab University, Chandigarh
9. More Institutions to join.

**Funded
\$2.2M**

DEVELOPMENTS DURING – 2011

Coordination Committee and Working Groups for Project-X
 Mustansir Barma, Director TIFR
 Pier Oddone, Director Fermilab
 May 25th, 2011

Mustansir Barma

Pier Oddone

The purpose of this note is to inform colleagues who are interested in experiments with Project X at Fermilab that we are appointing a Coordination Committee to guide the India-US collaboration in these experiments. The Coordination Committee will consist of 3 members each from India and the U.S. respectively. This Coordination Committee is charged with gathering inputs and coordinating a possible physics collaboration plan involving both sides. It would carry out this task by interacting closely with six working groups, each of which would include members from both sides. The Coordination Committee will send a periodic report to the directors of TIFR and Fermilab.

The members of the Coordination Committee and the Working Groups are listed below.

Coordination Committee

Prof. Shashi Dugad, TIFR,
 Collaboration Coordinator

Dr. Shekhar Mishra, Project-X,
 Collaboration Coordinator

Prof. Amit Roy, IUAC,
 Project-X Physics Program

Dr. Robert Tschirhart,
 Project-X Physics Program

Dr. P. Mohanakrishnan, IGCAR,
 Nuclear Energy Program

Dr. Robert Plunkett, Fermilab,
 Neutrino Program

Working Groups

Working Group	Indian Members	US Members
Neutrino Physics	Prof. Brajesh Choudhary , Delhi University Prof. Raj Gandhi ,HRI	Prof. Sanjib Mishra, USC Dr. GERALYN Zeller, Fermilab
Rare Processes	Prof. Rahul Sinha , IMSc Prof. Tariq Aziz , TIFR	Dr. Brendan Casey, Fermilab
Nuclear Physics	Prof. A.K. Jain , IIT, Roorkee Dr. R.K. Choudhary , BARC Dr. Ushasi Datta Pramanik , SINP	Dr. Jerry A. Nolen, ANL
Nuclear Energy	Dr. B.K. Panigrahi , IGCAR	Dr. Y. A. Mohamed Gohar, ANL
Detector and Electronics Development	Dr. P. Sugathan , IUAC Prof. S.K. Gupta , TIFR	Dr. Marcellinus Demarteau, ANL
Particle Production and Hyper-nuclei Experiment	Prof. Radhay Shyam , SINP Dr. Amber Chatterjee , BARC	Dr. Rajendran Raja, Fermilab

A proposal has been submitted to the Indian Science Management for funding during next two 5 yrs cycle.

MORE ON INDIS-US COLLABORATION – July 2011



U.S. DEPARTMENT OF STATE

U.S.-India Science, Technology and Innovation Cooperation

Office of the Spokesperson

Washington, DC

July 19, 2011

Discovery Science: The United States' Department of Energy and India's Department of Atomic Energy signed an Implementing Agreement on Discovery Science that provides the framework for India's participation in the next generation particle accelerator facility at Fermilab.

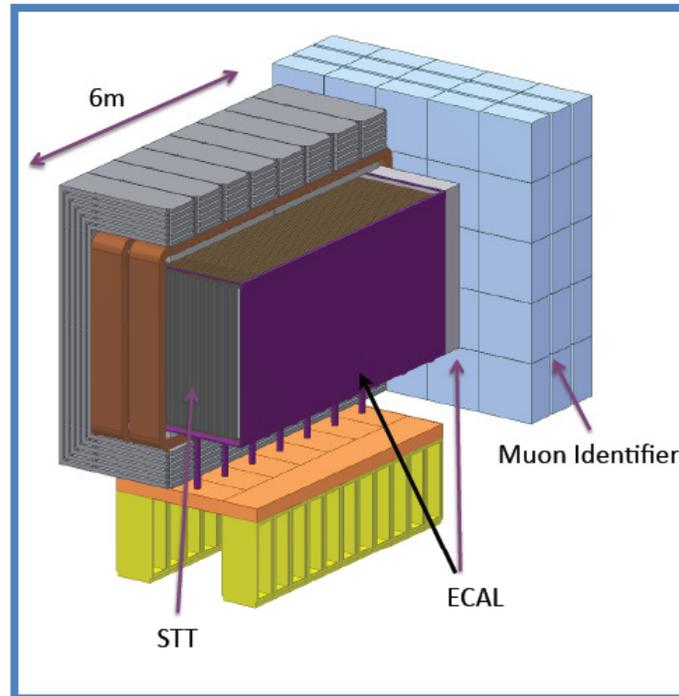
<http://www.state.gov/r/pa/prs/ps/2011/07/168740.htm>

India-DAE & USA-DOE are negotiating details of Accelerator and Physics Collaboration that includes Neutrino Physics and Detector for LBNE.

GUIDELINES FROM THE FUNDING AGENCIES

- **The program should be Physics Rich**
 - ✓ Compelling Neutrino Physics
 - ✓ Physics of Near Detector (LBNE) - Rich Physics – ~50 PhDs
 - ❖ Participation by Experimentalists / Engineers
 - ❖ Exploration by theorists due to richness of the program
- **Indian contribution should be significant and should have DAE-DST ownership (and should be in the range \$50M)**
 - ✓ Design, built, and operate Magnet + ECal + Muon system or some combination of them.
- **Contribution should have synergy with interest and expertise in India and with INO program**
 - ✓ Expertise exists in magnet design, scintillator (for ECal and/or muon), and RPC (muon) detectors and SiPM (Ecal) readout
 - ✓ Complements INO physics program
- ***Participation in LBNE-ND fits the bill in all respects. This has been proposed in next 5(10) year DAE budget plan. Will know the reality soon.***
- ***INO Physics reach will be strengthened by the precision measurement of cross-sections and particle multiplicity using LBNE-ND.***

PERSONAL VIEW ON LBNE ND - HIResM ν & LBNE PHYSICS



Various Formats for ND

- ✓ Cadillac Design
- ✓ Toyoya Corolla Version
- ✓ Nano Version

Vision for LBNE:

1. Long baseline – for broader physics
2. Large Detector – Underground – Beam + Sky
3. High Beam Power - for precision
4. Hi-resolution ND – physics + systematic
5. ***A facility not just an experiment – even if it can be only done in multiple phases***