



# NBI2012 - 8th International Workshop on Neutrino Beams & Instrumentation

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Summary Talk



# NBI2012 - Keeping the promises

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# NBI2012 – Keeping the promises

- ▶ we promised in our poster a Geneva under **snow**

**NBI 2012**   
6<sup>th</sup>-10<sup>th</sup> of November 2012  
CERN, Geneva, Switzerland 

**8<sup>th</sup> International Workshop on  
Neutrino Beams and Instrumentation**

Regional Liaison	Local Organizing Committee
S. Childress (FNAL)	M. Calviani
J. Hlyen (FNAL)	I. Efthymiopoulos (co-chair)
T. Ishida (KEK)	F. Girard-Madoux
E.D. Zimmerman (Univ. of Colorado)	E. Gschwendtner (co-chair)
	O. Hansen
	C. Lazaridis
	M. Meddahi
	M. Morer-Olafsen
	A. Pardons
	H. Vincke

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.... instead, we had a beautiful weather **during the week**, an excellent sunny day for the excursion, and only rain today!!

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# NBI2012 - Participation

► Thanks to all of you for coming to CERN/Geneva!



Maison Cailler - Broc  
09/11/2012



# NBI2012 – Participation

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Participants	
Europe	27
Americas	14
Asia	7
<b>Total</b>	<b>48</b>



Maison Cailler - Broc  
09/11/2012



# NBI2012 - Program

8th International Workshop on Neutrino Beams & Instrumentation (06–November 10, 2012)

indico.cern.ch/conferenceOtherViews.py?confid=193710&view=nicecompact

8th International Workshop on Neutrino Beams & Instrumentation (06–November 10, 2012)

Europe/Zurich English Login

8th International Workshop on Neutrino Beams & Instrumentation from Tuesday, November 6, 2012 (08:00) to Saturday, November 10, 2012 (18:00)

Legend: Sessions (blue), Talks (grey), Breaks (pink)

	Tuesday, November 6, 2012	Wednesday, November 7, 2012	Thursday, November 8, 2012	Friday, November 9, 2012	Saturday, November 10, 2012
AM		08:30 Welcome - Edda Gschwendtner (CERN) (until 09:00) (Room Georges Charpak (Room F))	08:45 Targets - Patrick Huhr (Fermilab) (until 10:30) (BE Auditorium Meyrin)	08:45 Radiation Protection issues - Samuel Robert Childress (Unknown) (until 10:15) (Room Georges Charpak (Room F))	09:30 Remote handling - James Hylon (Unknown) (until 11:30) (Filtration Plant)
	08:30 Welcome from NBI 2012 - Ilias Efthymiopoulos (CERN) Edda Gschwendtner (CERN)	08:45 Radiation damage studies on graphite and beryllium - Nick Simos (Brookhaven National Laboratory)	08:45 Slides	08:45 CNGS operation and environmental issues - Heinz Vincke (CERN)	09:30 Remote handling experiences at NuMI - Patrick Hurh (FNAL)
	08:40 Welcome - Steve Myers (CERN)	09:05 Recent experience with NuMI graphite targets and dumps - James Hylon	09:05 Slides	09:05 NuMI experience with Tritium - James Hylon	09:50 T2K remote handling - Tetsuro Sekiguchi (KEK)
	08:50 Opening presentation - Konrad Elsener (CERN)	09:25 Performance and operational feedback of T2K graphite target - Takeshi Nakadaira (HIGH ENERGY ACCELERATOR RESEARCH ORGANIZATION, KEK)	09:25 Slides	09:25 T2K radioactive drainage treatment - Yuichi Oyama (KEK)	10:10 Remote handling activities at CERN - Jean-Louis Grenard (CERN)
	09:00 Projects Status and Overview - Ilias Efthymiopoulos (CERN) (until 10:30) (Room Georges Charpak (Room F))	09:45 CNGS target operation and modified design - Marco Calviani (CERN)	09:45 Slides	09:45 T2K radioactivity in the exhaust air - Taku Ishida (IPNS, KEK)	10:30 Lessons learned from WANF dismantling - Ans Pardons (CERN)
	09:00 T2K Operation summary (earthquake recovery+beamline survey) - Takanobu Ishii (KEK)	10:05 Discussion	10:05 --- Coffee break ---	10:00 Discussion	10:50 Targets for SuperBeams - Chris Densham (STFC Rutherford Appleton Laboratory)
	09:15 NuMI Operation summary 2005-2012 - Samuel Robert Childress	10:30 --- Coffee break ---	11:00 Targets - Marco Calviani (CERN) (until 12:30) (BE Auditorium Meyrin)	10:15 --- Coffee Break ---	11:10 Discussion
	09:30 MiniBOONE Operation summary - Eric D. Zimmerman (University of Colorado)	11:00 High intensity beam test of beryllium for target and beam window - Brian Hartsell (Fermilab)	11:00 Slides	10:35 Radiation Protection issues - Heinz Vincke (CERN) (until 11:35) (Room Georges Charpak (Room F))	11:30 --- Coffee break ---
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	10:00 Discussion	11:40 HiRadMat: a facility at CERN for material and assembly testing - Ilias Efthymiopoulos (CERN)	11:40 Slides	10:55 Target chase, decay and absorber cooling for LBNE - Alberto Marchionni (Univ. + INFN)	11:50 Summary talk
	10:20 Practical Issues for NBI 2012 - Ans Pardons (CERN)	11:55 Granular target and tests at HiRadMat - Nikolaos Charitonidis (Ecole Polytechnique Federale de Lausanne (CH))	11:55 Slides Video	11:15 ACTIVIZ material database - Chris Theis (CERN) Helmut Vincke (CERN)	12:10 Next NBI announcement - Alberto Marchionni (Univ. + INFN)
	10:30 --- Coffee break ---	12:10 Granular target and tests at HiRadMat - CFD Simulations - Chris Densham (STFC Rutherford Appleton Laboratory)	12:10 Slides Video	11:35 --- Quick lunch break ---	
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Americas	21
Asia	11
<b>Total</b>	<b>56</b>

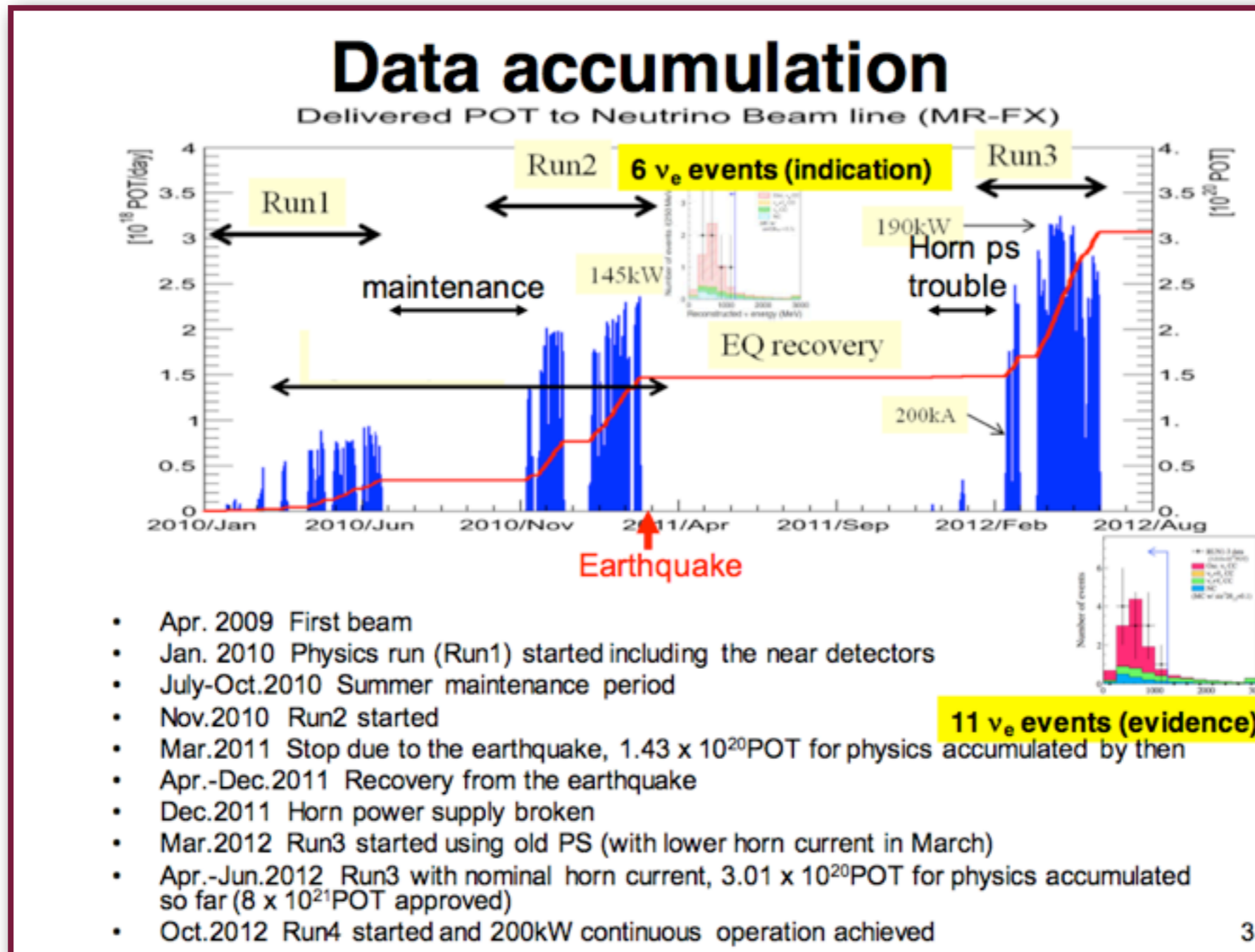
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# From NBI2010 → NBI2012

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- ▶ T2K produced excellent results with  $\theta_{13}$  measurement



- ▶ ..and an impressive recovery in record time from the earthquake !

## Recovery around Target Station





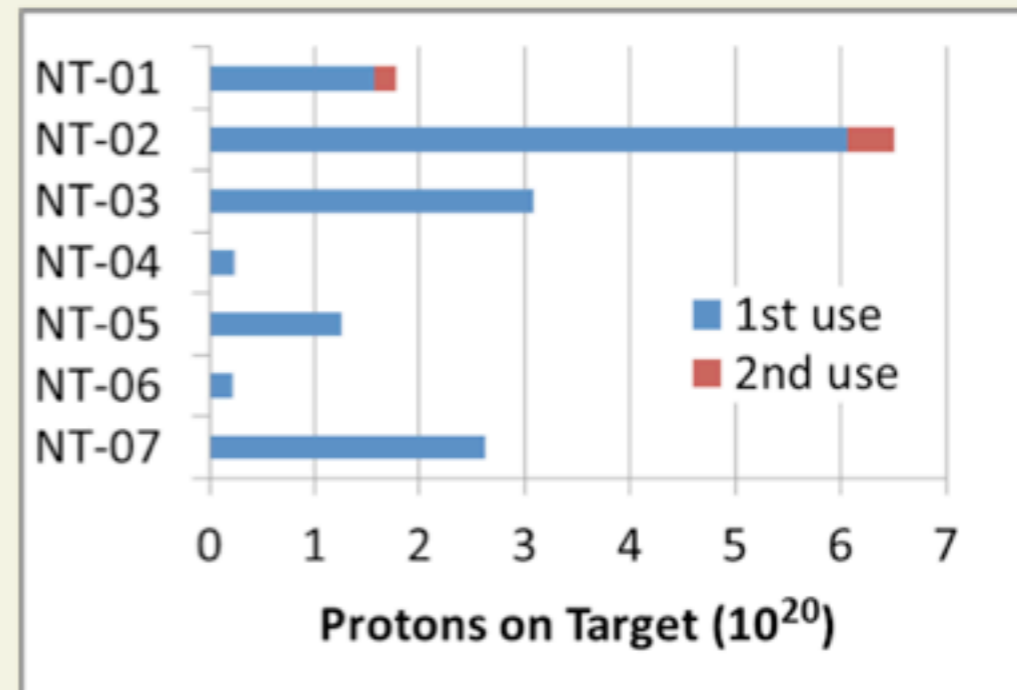
▶ Facing challenges with the targets but also smooth running: **1.6 10<sup>21</sup> int.pot**

## FY 2010 : Tritium Mitigation & Great Uptime

Total POT in FY 2010 = 3.19 x10<sup>\*\*20</sup>

## FY 2011 : Year of the Targets (Five) & PB Cables

- Oct: NT04 -> NT05
- Mar: NT05 -> NT06
- May: NT06 -> NT01
- July: NT01 -> NT02
- July: PB Dipole cables ground fault; Sump pump & alarm failure.
- Sep: NT02 -> NT07



Total POT in FY 2011 = 2.21 x10<sup>\*\*20</sup>

## Ten Years of Successful MiniBooNE Running and Results!

- Neutrino mode:  $6.5E20$  POT
- Antineutrino mode:  $11.3E20$  POT
- Special horn runs:  $0.3E20$  POT
- 10 oscillation papers
- 12 cross section and flux papers
- 1 detector and 1 supernova search paper
- 17 PhD thesis
- The experiment has achieved its run and physics goals!

## Further Neutrino/Antineutrino Running: Worthwhile?

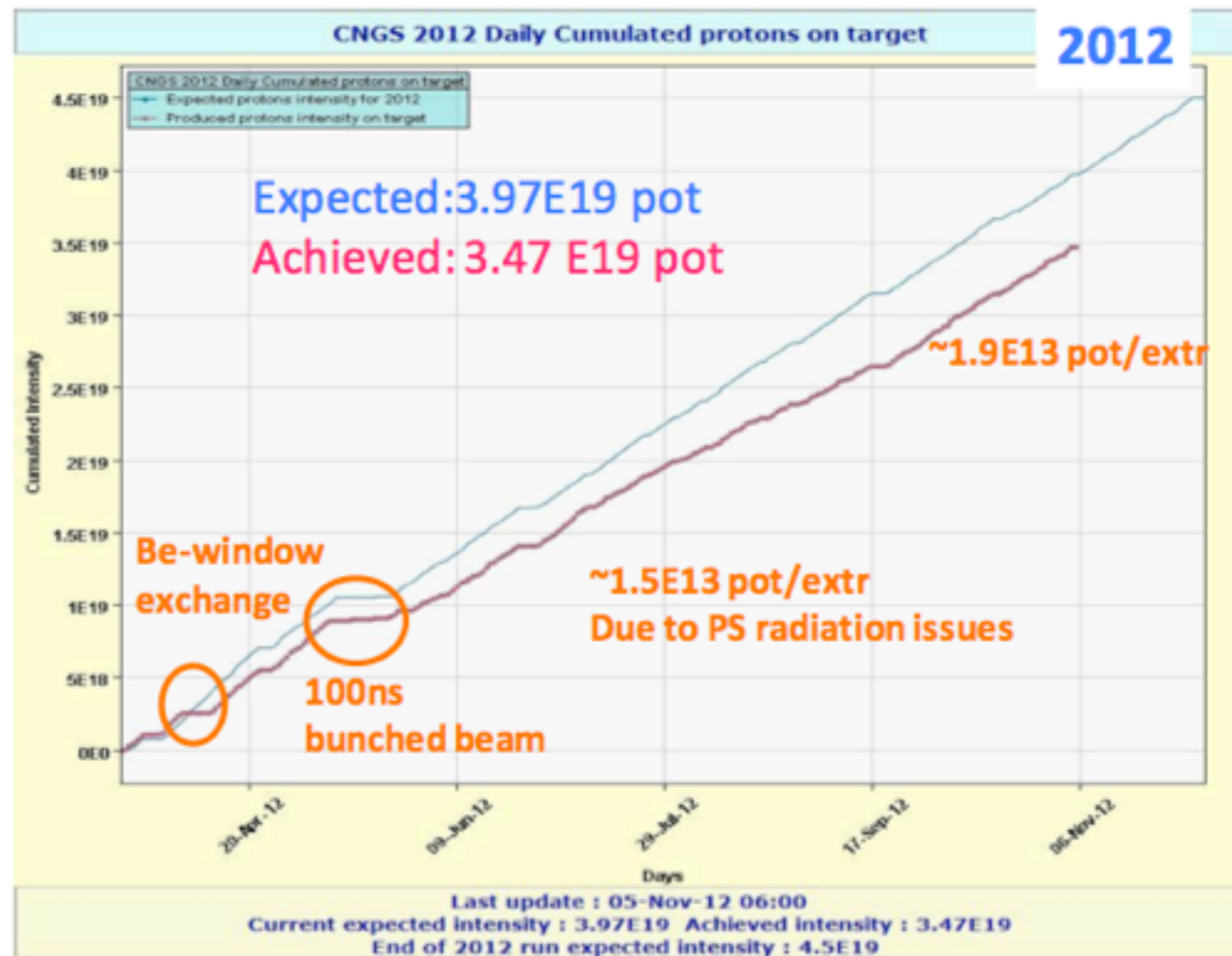
- The Booster Neutrino Beam will be used again for MicroBooNE and possibly other projects. Is it worth taking more MiniBooNE data with the current detector to increase statistics?
- Neutrino mode: probably not. We are reaching systematic limits.
- Antineutrino mode: possibly. We are still statistics limited, but many years would be required to double the data set.
- There are possible new configurations that would address some systematic issues.



## Total Integrated Intensity since CNGS Start in 2006

CNGS approved for  $22.5E19$  pot  $\rightarrow$  i.e. 5 years with  $4.5E19$  pot/yr  
 $\rightarrow$  Expect  $\sim 10 \nu_\tau$  events in OPERA  $\rightarrow 2 \nu_\tau$  candidates published

Protons on target/year	
2006	0.08 E19
2007	0.08 E19
2008	1.78 E19
2009	3.52 E19
2010	4.04 E19
2011	4.84 E19
2012	3.47E19
<b>Total (today)</b>	<b>17.81 E19</b>



By end 2012:

$\rightarrow$  Expect  $\sim 18.3E19$  protons on target

$\rightarrow$  81% of approved pot



# My 3min Highlights

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Date

I. Efthymiopoulos – CERN





# New Projects

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## ▶ Fermilab:

- ▶ Numi upgrade (700kW) - NoVA
- ▶ LBNE
- ▶ NuSTORM

## ▶ Japan:

- ▶ J-PARC+HK, J-PARC+LAr@Okinoshima
- ▶ Beam power upgrade 275kW --> 750kW by 2017

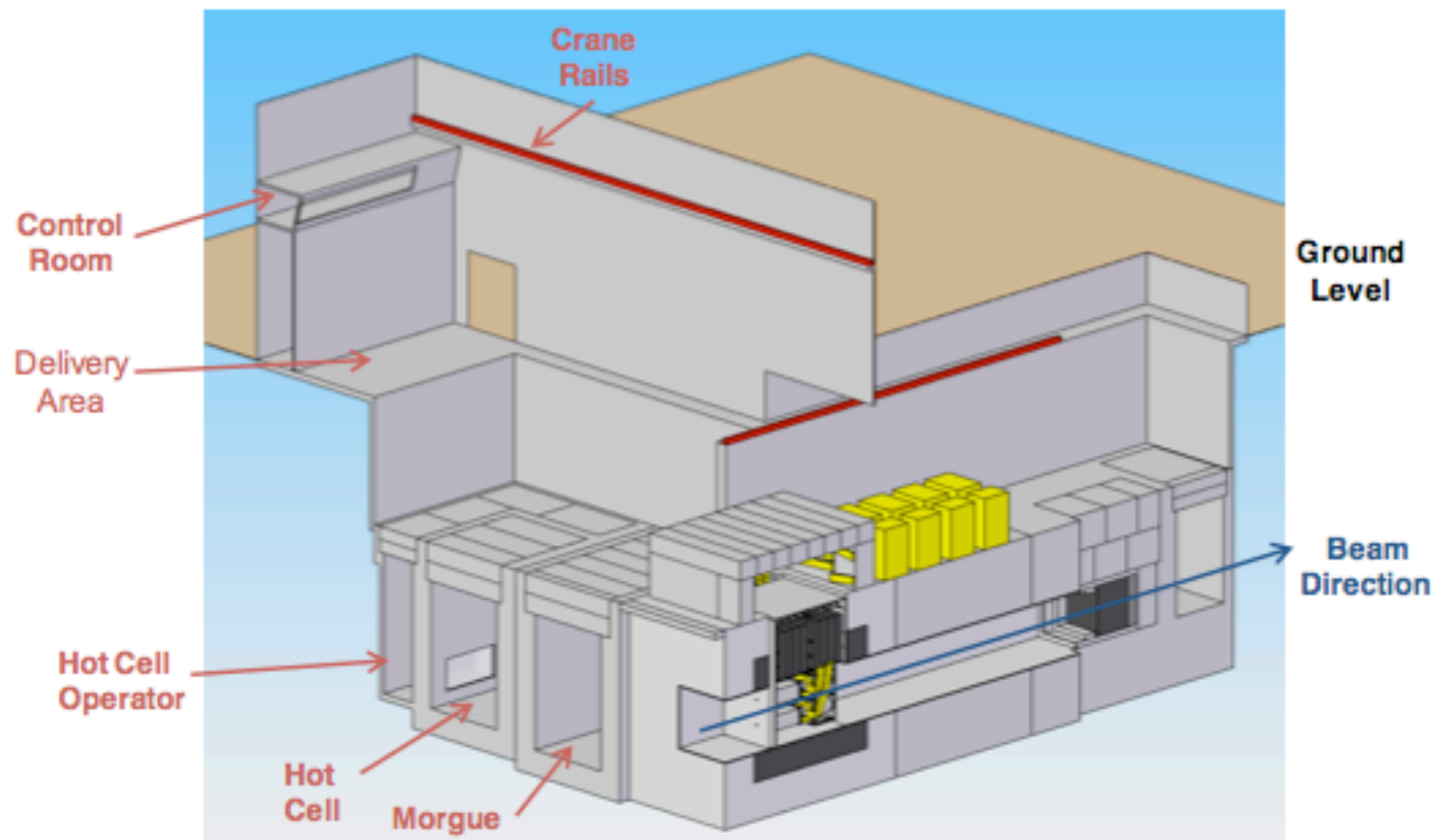
## ▶ Europe/CERN:

- ▶ LBNO
- ▶ Short-baseline

# Third generation target station design

## Remote Handling

- Gantry crane covers helium vessel, morgue, hot cell and delivery area
- Second, smaller crane to move power supply units
- Pit to reduce radiation shine while moving horns
- Two assemblies of four horns will be used – one is running while the other is being repaired

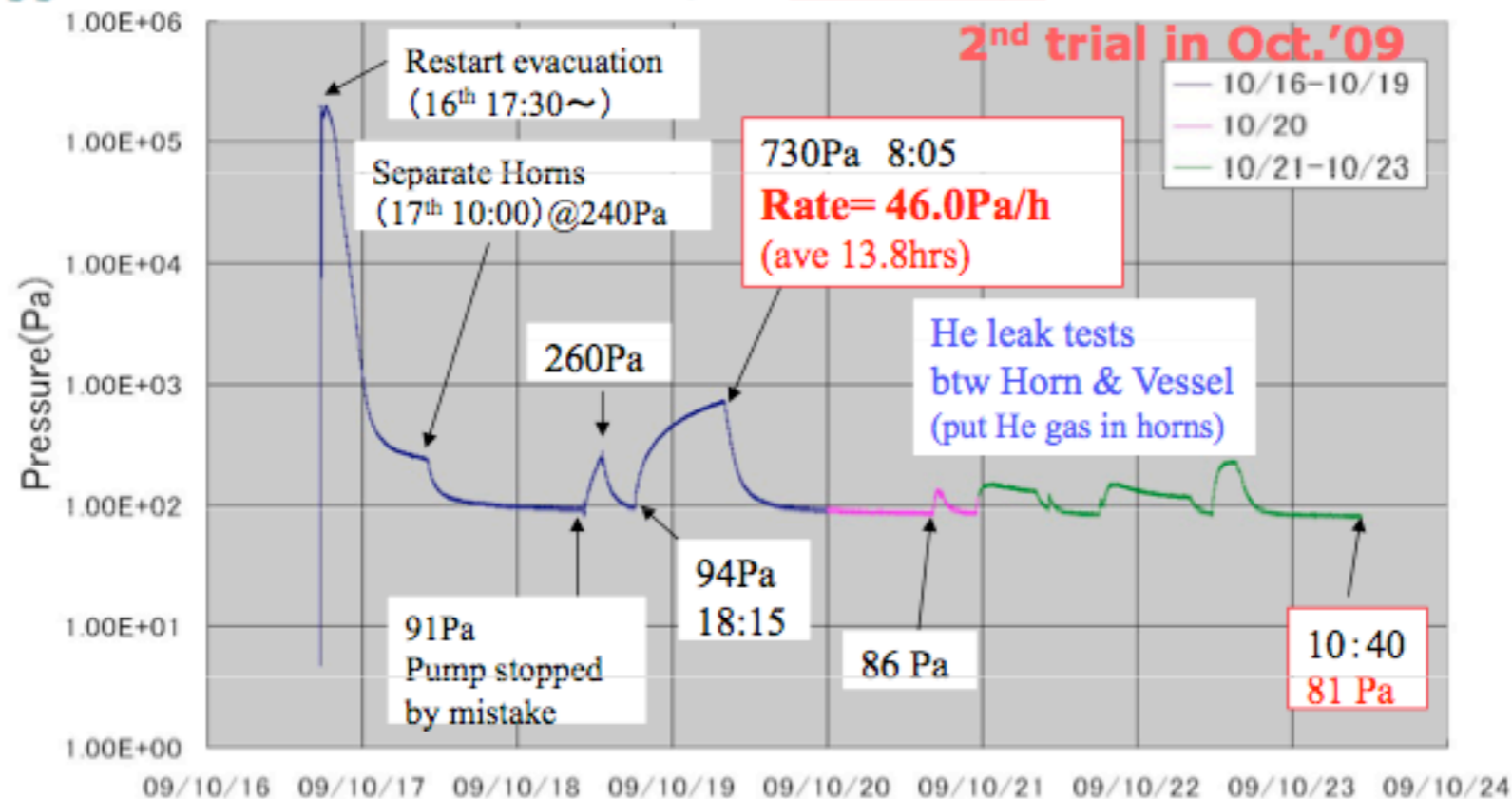




## Evacuation for He filling [Oct.2009]

Ishida et al.  
J-PARC/KEK

- 1<sup>st</sup> experience to evacuate with full-setup
  - ◆ All horns & iron/concrete shield blocks, feed-through / piping.
- Vacuum saturated at 80~90 Pa in a week.
- The leak at BD was NOT fixed. At most  $10^{-2} \sim 10^{-1} \text{ Pa} \cdot \text{m}^3/\text{s} = 1 \sim 10 \text{ ppmO}_2/\text{d}$
- Aggravation rate was 43~46 Pa/h:  $20 \text{ Pa} \cdot \text{m}^3/\text{s}$



Ver. 2.3 [Nov.07]

NBI2012, CERN, Geneva, Switzerland, 6<sup>th</sup> - 10<sup>th</sup> November 2012

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# The RaDIATE Collaboration

## RaDIATE Collaboration

- **R**adiation **D**amage In **A**ccelerator **T**arget **E**nvironments
- From the MOU:
  - The Participants intend for the research program to include those activities which develop **a better understanding of radiation damage mechanisms** and the associated thermal and mechanical properties response for materials of interest to future high power proton beam target facilities.
- Enlisting the aid of fission and fusion power materials experts as well as current researchers in the accelerator domain
- Initial Collaborators: FNAL, BNL, STFC, PNNL, Oxford

P. Hurh

# Granular target test - HiRadMat@SPS

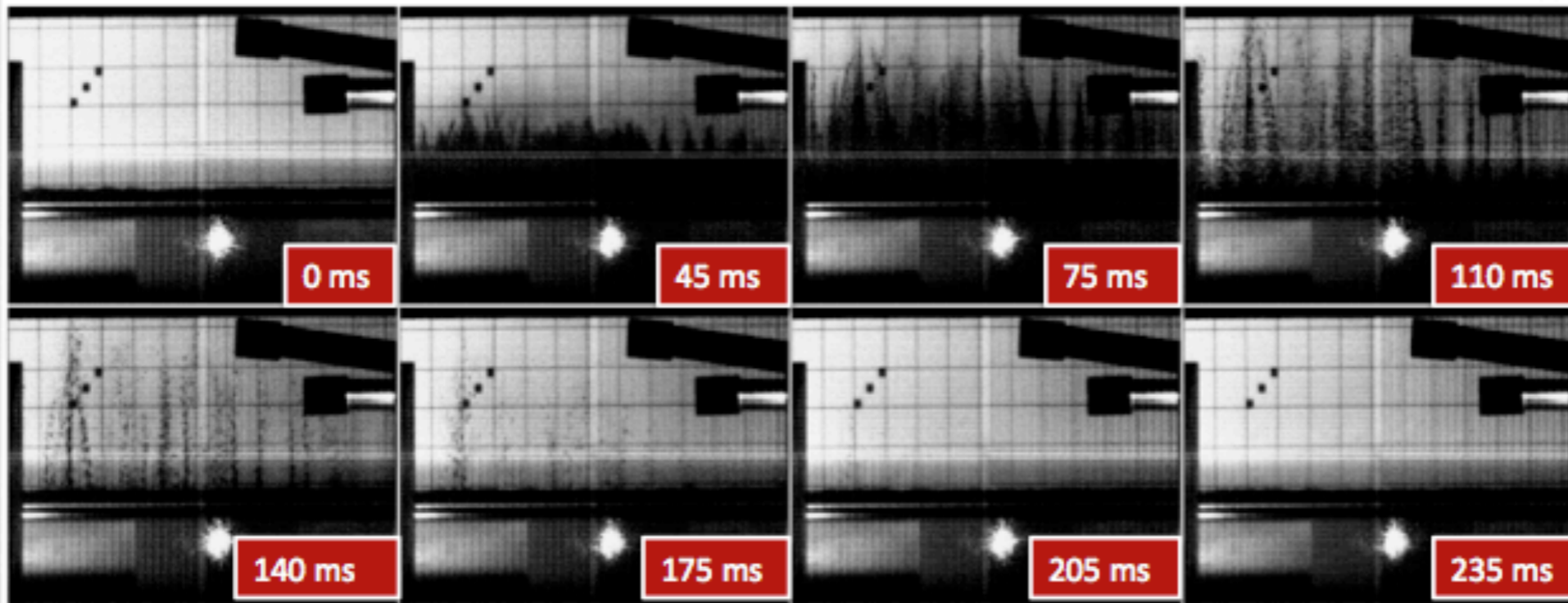


## First observations from the HRM-10 tungsten powder experiment at HiRadMat

*N. Charitonidis [CERN, EPFL], I. Efthymiopoulos [CERN], C. Densham, O. Caretta, M. Fitton, P. Loveridge, T. Davenne & Joe O'Dell [RAL-STFC]*

File Name 31MAY20\_5fps.avi  
File Size 286MB (299,712,880 Bytes)  
Resolution 768x480  
Play Time 00:00:54

**$2.64 \times 10^{11}$  protons @ 440 GeV/c**

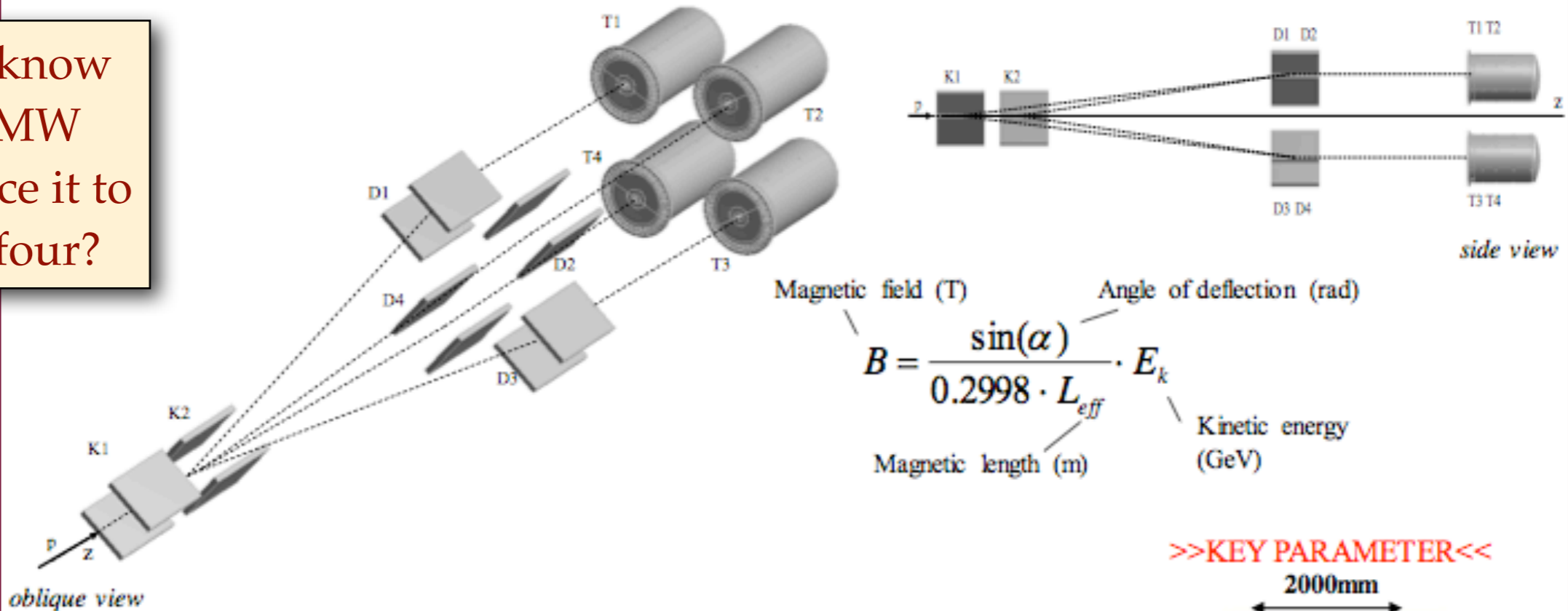




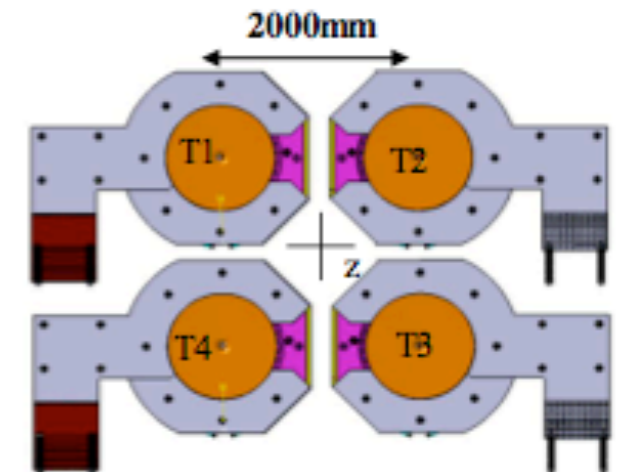
## SY: Principle



We believe we know how to make 2MW beams, so reduce it to two instead of four?



>>>KEY PARAMETER<<<



- Use of 2 bipolar kickers (or bipolar pulsed magnets):  $\pm 45^\circ$  rotation wrt the z axis
- K1 (K2) deflects to D1 and D3 (D2 and D4)
- Need of 1 compensating dipole per beam line (1 angle for each target): Apply a symmetry in the system



# NBI2012 - My summary

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## NBI2012 – My summary

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- ▶ Lot of experience gained in operating the present generation of beams
  - ▶ on equipment: targets, horns, beam windows, hadron stop, decay pipe
  - ▶ on infrastructure: radiation issues, tritium handling, ventilation systems, layout, remote handling





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  - ▶ on infrastructure: radiation issues, tritium handling, ventilation systems, layout, remote handling
- ▶ The new beam lines would represent new challenges
  - ▶ increased beam power, failures rate of equipment, fatigue, corrosion, remote handling
  - ▶ tests of materials/equipment would be crucial : RaDIATE, HiRadMat, remote handling, radiation studies and dose prediction tools



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Exciting times ahead, the NBI workshops would be as interesting and needed as ever for information and experience exchange



# NBI2012 - besides presentations...





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# NBI2012 – besides presentations...





# NBI2012 - Last words

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  - ▶ the **Regional Liaisons** for helping to setup and interesting and well balanced scientific program

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# NBI2012 – Last words

- ▶ Many thanks to :
  - ▶ **Edda** (co-chair)
  - ▶ the members of the **LOC** for taking care of the organization logistics and social program
  - ▶ the **Regional Liaisons** for helping to setup and interesting and well balanced scientific program
- ▶ I hope you enjoyed your stay and the workshop at CERN !

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6<sup>th</sup>-10<sup>th</sup> of November 2012  
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**8<sup>th</sup> International Workshop on Neutrino Beams and Instrumentation**

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S. Childress (FNAL)	M. Calviani
J. Hlyen (FNAL)	I. Efthymiopoulos (co-chair)
T. Ishida (KEK)	F. Girard-Madoux
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Good luck to our US colleagues for the next NBI

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