

Commissione II

A. Paoloni

Consiglio di laboratorio
2 Luglio 2013

Highlights

Attività di CSN2 presso i laboratori

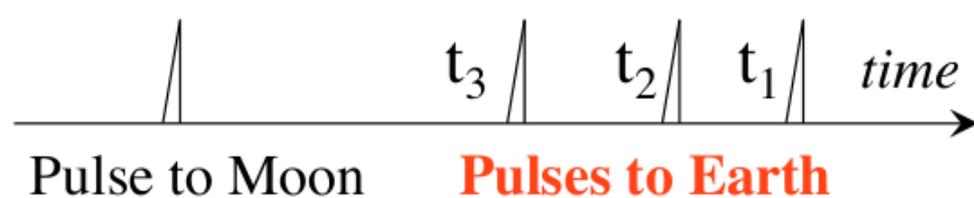
Neutrino physics (mainly at LNGS)					
BOREXINO	ICARUS	MARE-RD	NESSIE-RD	OPERA	T2K
Search for rare processes (mainly at LNGS)					
CTF-RD-DARK	CUORE	DAMA	GERDA	LUCIFER-RD	LVD
XENON					
Study of the cosmic rays by ground based and underwater experiments					
ARGO-YBJ	AUGER	CTA-RD*	KM3*	MAGIC	
Study of the cosmic rays by experiments in the space					
AMS2	FERMI	GAMMA400-RD	JEM-EUSO-RD	WIZARD	
Search for gravitational waves					
AURIGA	LISA-PATHFINDER	RARENOISE-DTZ	ROG	VIRGO	VIRGO-ADV
General physics					
G-GRANSASSO-RD	GGG	HUMOR*	MAGIA	MICRA	MIR
MOONLIGHT2-DTZ*	PVLAS				

Lo scorso anno: 14 FTE (30 persone).

Gli FTE dovrebbero aumentare del 40% con l'apertura della sigla Moonlight2.

Dettaglio Anagrafica per il 2014 (preliminare)

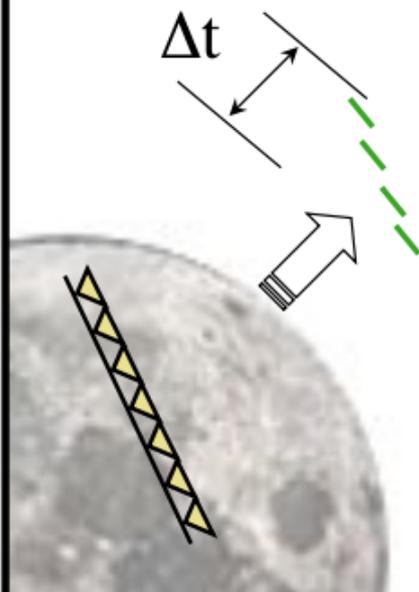
Group	Researcher FTE (pers)	Technologist FTE (pers)	Technicians FTE (pers)
OPERA	2.7 (5)	0 (0)	2.5 (4)
Nessie-RD	0.5 (2)	0 (0)	0 (0)
ICARUS	0.2 (3)	0 (0)	0.5 (1)
CUORE	0 (0)	1.6 (3)	0 (0)
KM3	1.4 (2)	0.6 (1)	0.5 (1)
JEM-EUSO-RD	2.4 (4)	0.4 (2)	0 (0)
Wizard (PAMELA)	1.8 (4)	0 (0)	0 (0)
ROG (Nautlius)	2.2 (5)	0 (0)	1.3 (3)
Moonlight-2	4 (6)	2 (3)	1.4 (3)



Apollo or Lunokhod

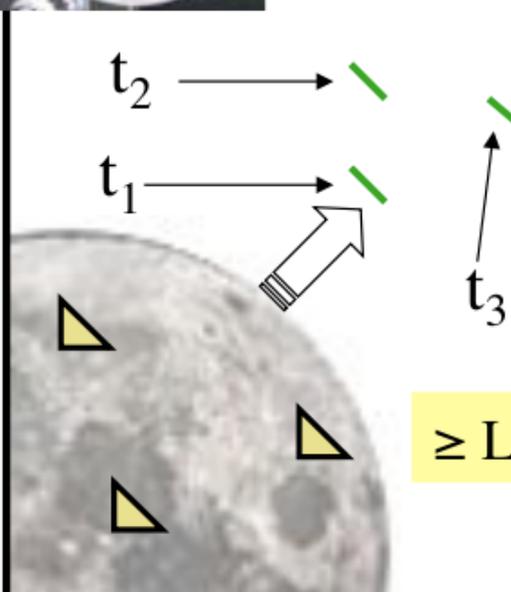


MoonLIGHT/LLRRA21



**Back to Earth:
unresolved, wide
pulse due to lunar
librations**

**≥ Arrays of many
small CCRs**



**Back to Earth:
short resolved
pulses despite
librations**

≥ Large, single CCRs

Mission opportunities [Pole/Equator/Limb site]



- **Commercial Launches** with SpaceX Falcon 9 missions (2 successful dockings to ISS); MoonLIGHT approved:
 - **Moon Express [E], 1st flight: end 2014**
 - **Astrobotic [E]: 2015**
 - **Moon Express, Commercial-ILN [P, E, L]: >2015**
- **Space Agency launches**:
 - **SELENE-2 (JAXA), [P]; signed scientific agreement: 2017**
 - **Chandrayaan-2 Lunar Lander (ISRO) [P]; negotiating: 2015**
 - **LGN (NASA) [P1, P2, L or P, L1, L2]: 2018**
- **LunarCubeSats**
 - **Promoted by NASA-GSFC; transfer from GEO**

JEM-EUSO

Responsabile nazionale: M. Ricci (P. Picozza rimane PI della collaborazione)

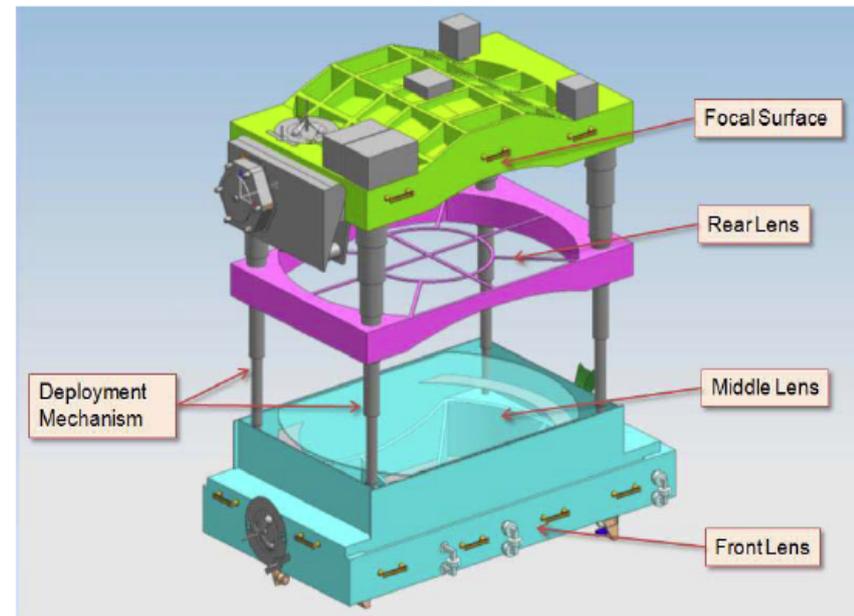
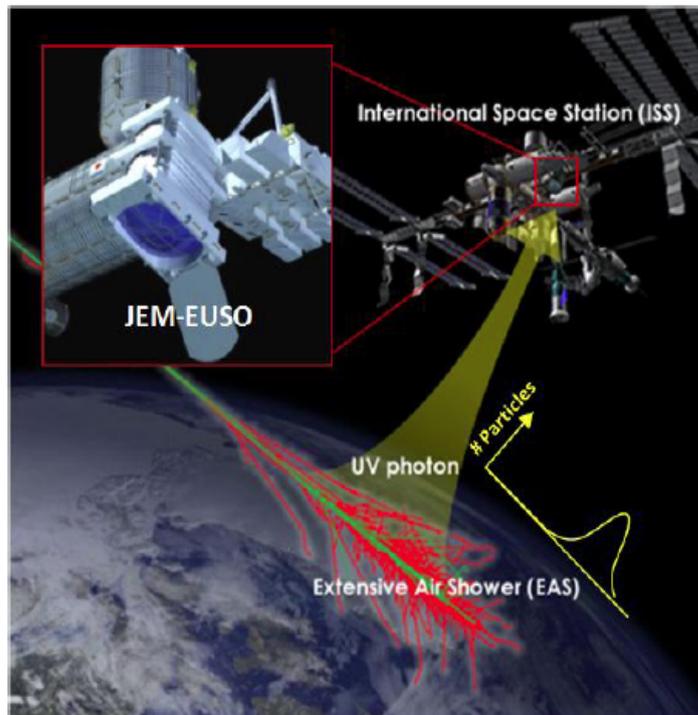
JEM-EUSO main features

Method: fluorescence (full calorimetric)

Large field of view: $\pm 30^\circ$ thanks to double sided spherical Fresnel lenses

At 400 km (ISS): $2 \cdot 10^5 \text{ km}^2$ (nadir mode) up to 10^6 km^2 (tilted mode)

No need for stereo: $400 \text{ km} \gg$ shower length (TPC with a drift velocity = c)



Road Map to JEM EUSO

1) *EUSO Balloon campaign*

2011/6 Approved by CNES

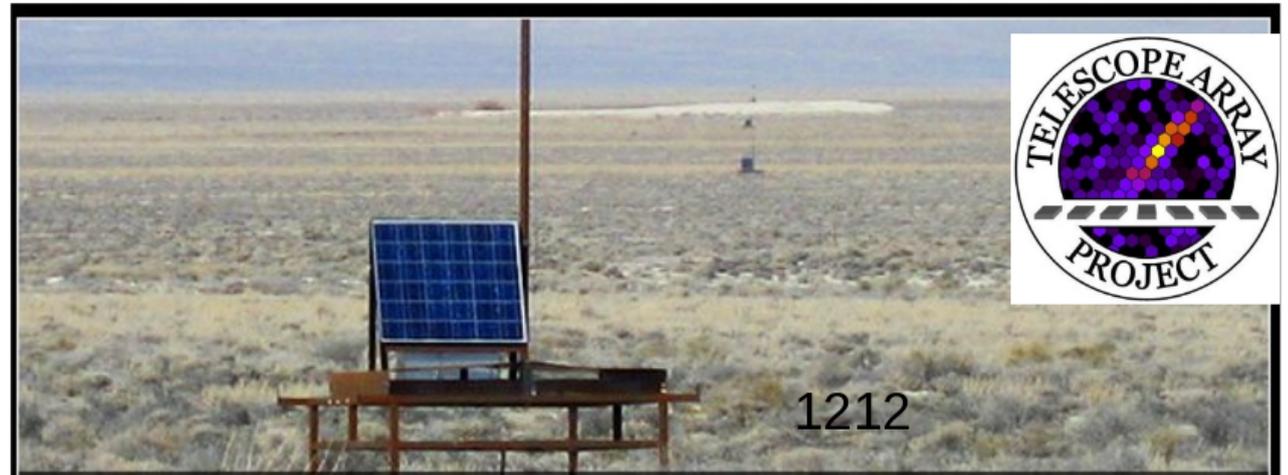
2014 first of three launches



2) *Cross-calibration tests at Telescope Array site, Utah*

Collaboration with ICRR, Institute of Cosmic rays, Tokyo University, Kashiwa campus

Installation Winter 2012



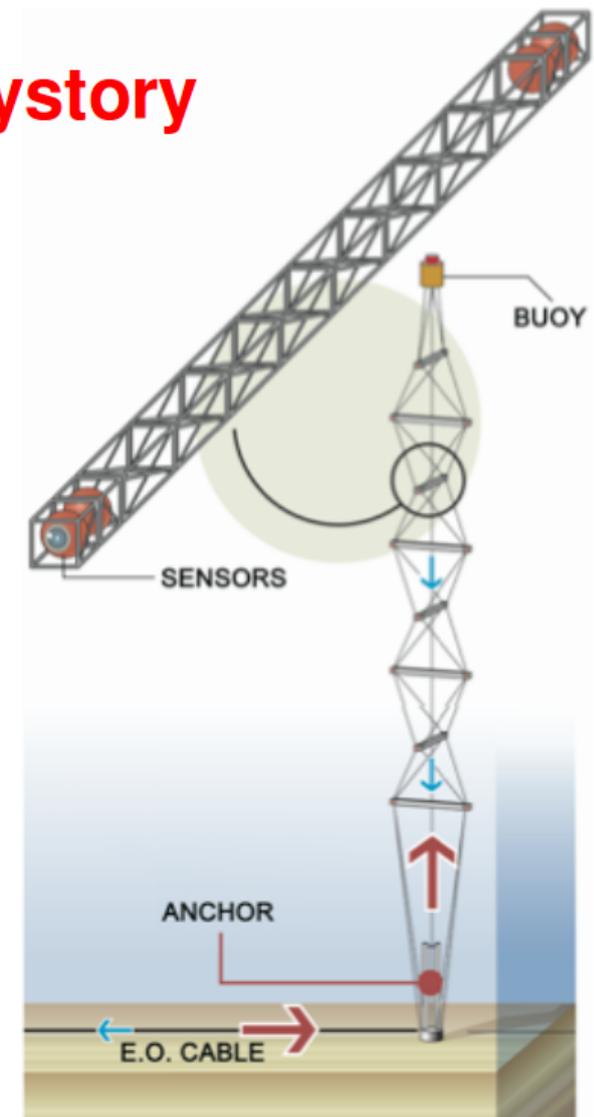
NEMO-Phase2 Tower deployment: short history

November 2012

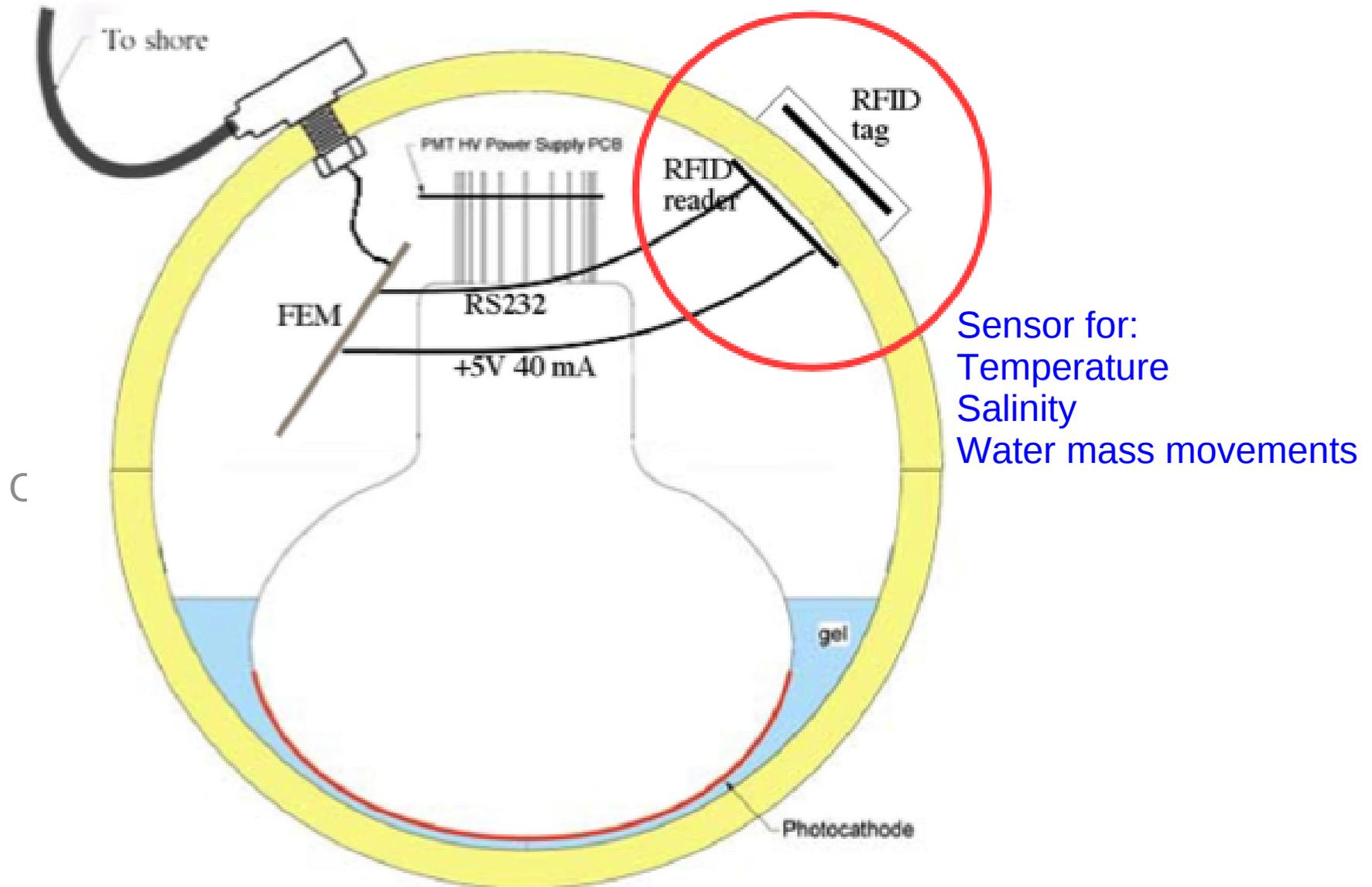
- Teliri (MECMA) + INFN/INGV ROV: during a pre-inspection of the site, at 3500m depths, the ROV umbelical cable burned and the ROV was lost. Tower Deployment operation not even started.

23 March 2013

- Campaign with FUGRO vessel (Nautical Tide) +ROV: **successful NEMO-Phase2 Tower deployment, connection and start of data taking**

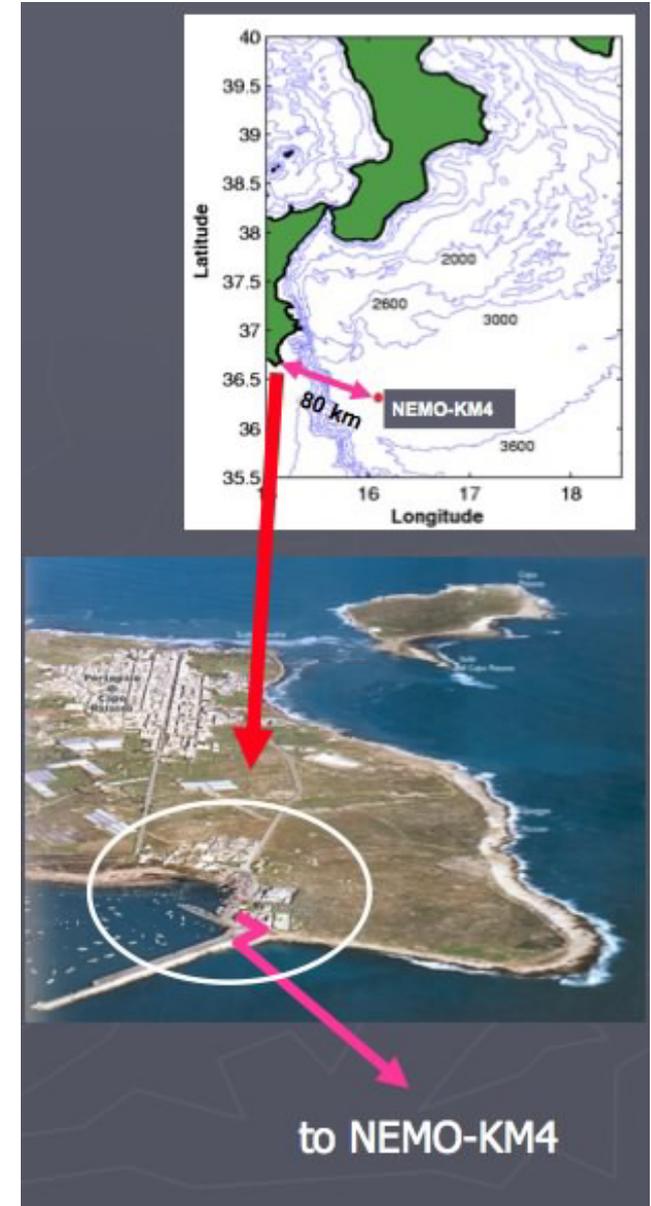


Optical Module with PORFIDO probe schematic



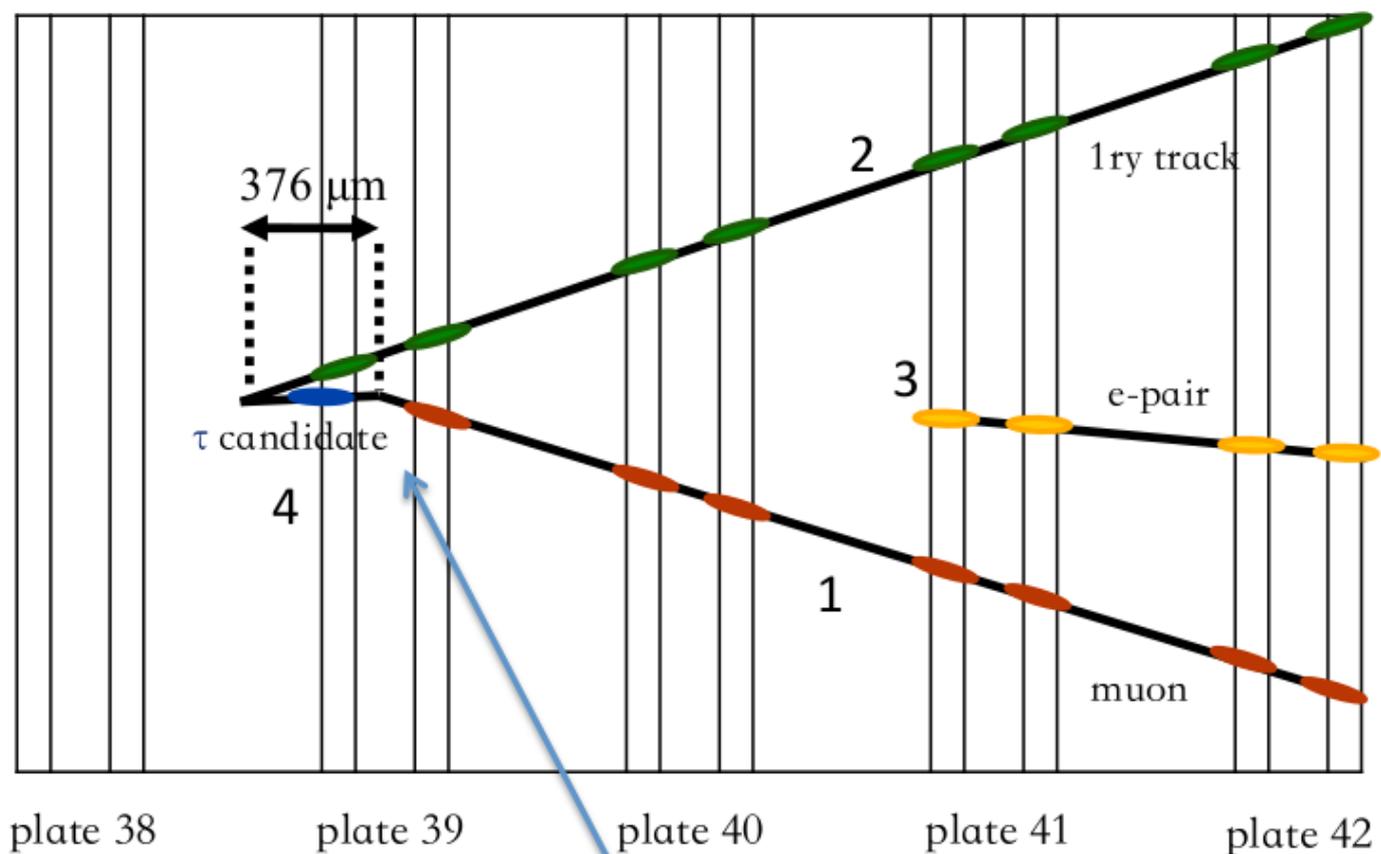
4 PORFIDO probes on the Phase 2 tower

- Working at 3500 m depth!
- 12 more on Phase 3 (0.001 °C)



$\tau \rightarrow \mu$ candidate brick analysis and decay search

Third τ candidate located



Decay in the plastic base

Charge determination of the muon

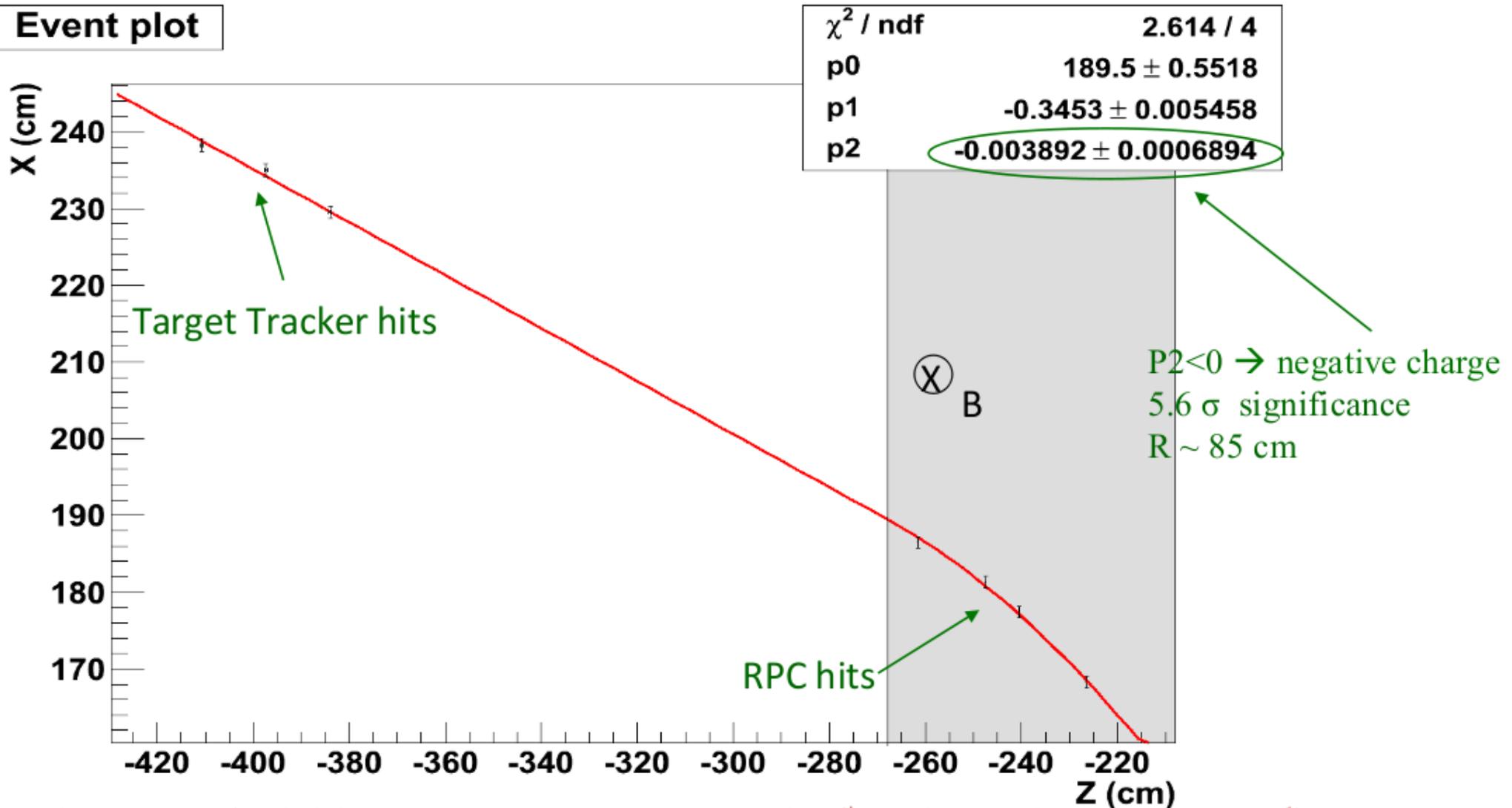
Muon momentum: 2.8 GeV (range)

Charge measurement based on TT and RPC hits

Fit function:

$$X(z) = p_0 + p_1 \times (z-z_0) + p_2 \times (z-z_0)^2 \quad \text{for } z > z_0, \text{ start of magnetized region}$$
$$X(z) = p_0 + p_1 \times (z-z_0) \quad \text{for } z < z_0$$

Event plot



P-value = 0.063% (probability to reconstruct a μ^+ stopping in the 7th iron layer with $p_2 < -0.00389 \text{ cm}^{-1}$)

Statistical considerations

Extended sample

	Signal	Background	Charm	μ scattering	had int
$\tau \rightarrow h$	0.66	0.045	0.029		0.016
$\tau \rightarrow 3h$	0.61	0.090	0.087		0.003
$\tau \rightarrow \mu$	0.56	0.026	0.0084	0.018	
$\tau \rightarrow e$	0.49	0.065	0.065		
total	2.32	0.226	0.19	0.018	0.019

3 observed events in the $\tau \rightarrow h$ and $\tau \rightarrow 3h$ and $\tau \rightarrow \mu$ channels

Probability to be explained as a background = 7×10^{-4}

This corresponds to 3.2σ significance of non-null observation

Likelihood-based analysis: 3.5σ significance

4σ within reach

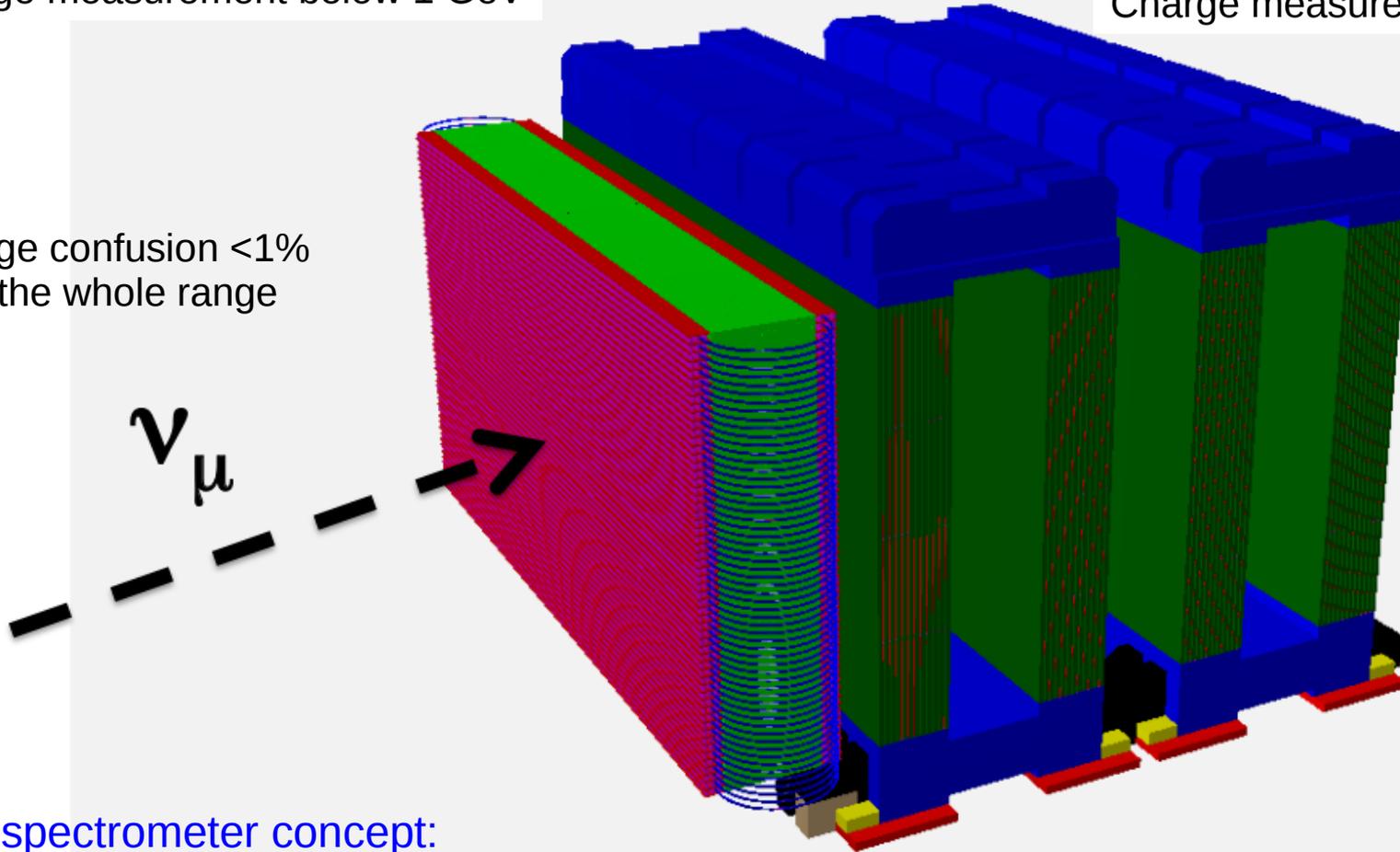
Nessie muon spectrometers:

- 1) Measure ν_μ disappearance (near + far site)
- 2) Constrain un-oscillated neutrino flux at high energy
- 3) Measure muon charge (important in anti- ν_μ run)

Air Core Magnet (ACM):
Charge measurement below 1 GeV

Iron Core Magnet (ICM) + RPCs:
Momentum measurement at 5% (range)
Charge measurement above 1 GeV

Charge confusion <1%
over the whole range



Far site

New spectrometer concept:

- 1) Two ICMs with OPERA top and bottom yokes
- 2) iron slabs as high as 4/7 (3/7) of OPERA slabs

Full recovery of OPERA iron. New production needed only for top and bottom yokes of near site.

Requests at LNF

CUORE.DTZ @LNF

Resp. A. Franceschi

A. Franceschi, T. Napolitano
Divisione Tecnica

+

C. Ligi
Divisione Acceleratori

Impegno CUORE LNF.DTZ 2013-2015

Responsabilità del gruppo LNF:

Coordinamento Ingegneria:

Ultrapulizia Rame

Meccanica Criostato

Schermature Piombo

Installazione Apparati

Integrazione Apparato Sperimentale

Installazione Detector

Wiring Criogenico e Detector

Anagrafica CSN2		2013	2014	2015
A.Franceschi	(Dir. Tecnologo)	60%	70%	30%
C.Ligi	(Tecnologo)	40%	20%	10%
T.Napolitano	(Tecnologo)	60%	70%	30%

Richieste CIF a fine progetto (stima al 2 luglio 2013)

II semestre 2013 (Progetto/Installazione Apparati)

SPCM-Reparto Progettazione: ≈ 12 m.u.

I semestre 2014 (Progetto/Installazione Apparati)

SPCM-Reparto Progettazione: ≈ 10 m.u.

II semestre 2014 (Installazione Detector)

SPCM-Reparto Progettazione: ≈ 10 m.u.

I semestre 2015 (Fine installazione – Eventuali code)

SPCM-Reparto Progettazione: ≈ 5 m.u. (?)

Gruppo ROG

La presa dati con Nautilus dovrebbe durare fino all'entrata in funzione di Virgo Advanced (2015 ?).

Nessuna richiesta ai servizi generali.

Tecnici LNF :

M. Iannarelli	40 %
R. Lenci	50 %
E. Turri	40 %

Moonlight2 requests to LNF

Per la realizzazione di due prototipi di riflettore richiesti per il 2014:

- **SPCM 3 mu officina**
- **SEA 1 mu automazione**

JEM-EUSO requests to LNF

Per il prototipo del PDM (Photo-Detector Moduel) richiesto per il 2014 l'impegno dell'SPCM (A. Franceschi, T. Napolitano), nella misura di:

- **Progettazione 1 mu**
- **Meccanica 2 mu**

Per gli anni successivi queste richieste potrebbero aumentare proporzionalmente alla decisione di assumersi la responsabilita' dell'integrazione di tutti i 137 PDM del piano focale e di parte dell'integrazione finale del piano focale.

Possibile interesse anche per l'utilizzo delle facilities del laboratorio:

- **BTF (test di fluorescenza)**
- **Dafne-light (caratterizzazione ottica e calibrazione)**

OPERA requests to LNF

CNGS data taking stopped in 2012.

Emulsion analysis (including brick extraction, handling and development) expected to continue during all 2014.

Strategy for 2014: decrease external contracts (brick treatment will be not continue) and use of INFN technicians. This will result in a cut of the CF (400 kEuro, 1/3 by INFN).

Decommissioning expected to start in 2015 (~2 years required).

Requests for 2014:

SSE – 2 mu (A. Cecchetti) coordinamento interventi meccanici e manutenzione dell'apparato. Studio e pianificazione della procedura di smontaggio di OPERA.

SEA – 1 mu (U. Denni) supporto infrastrutture laboratorio di scanning LNF.

Tecnici:

A. Mengucci – turni di Brick Handling, assistenza a sviluppo emulsioni, controllo gas system, ripristino facilities di test degli RPC.

M. Ventura – assistenza Brick Handling e sviluppo emulsioni, turni di scanning e verifica marcatura a raggi X delle emulsioni tramite microscopio, ripristino facilities di test degli RPC.

N. Intaglietta (30%) - turni di scanning

T. Tonto (20%) - supporto informatico laboratorio di scanning LNF.

Requests for 2015: depending on decommissioning.

Nessie requests to LNF

Scientific approval by CSN2

Submitted to CTS (INFN Technical Scientific Committee)

CENF (CERN Neutrino Facility) approval by CERN ?

Nessie experiment approval by INFN ?

Intallation required to end before start of 2017

Critical to define common schedule with OPERA decommissioning.

In case of approval, 1 FTE required to SSE (involved also in OPERA decommissioning)