Laboratori Nazionali del Sud: Status and Pespectives

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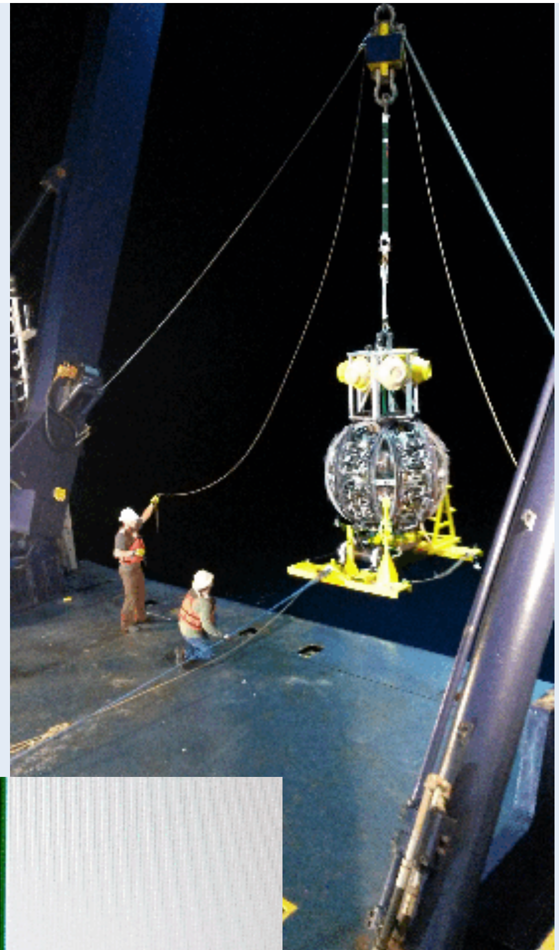
INFN – Laboratori Nazionali del Sud, Catania, Italy

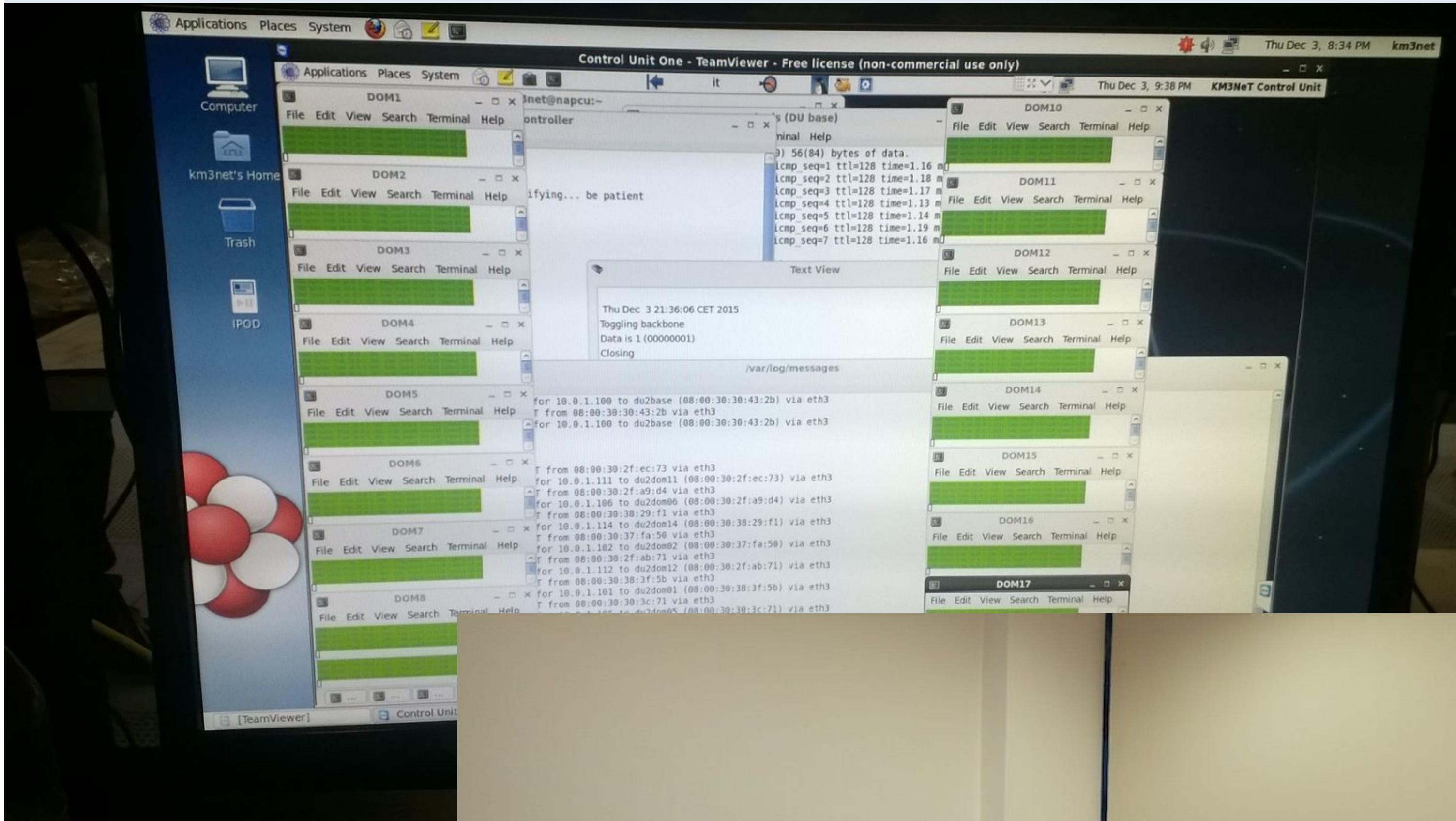
Piano Triennale 2016-18
Catania Dec. 3-4, 2015

Km3NeT Integration sites:

Nikef, Erlangen, Naples, Catania, Tulon, and Athens

Now DU2 on Fugro AT installed at CapoPassero site




Applications Places System
Thu Dec 3, 8:34 PM km3net
Control Unit One - TeamViewer - Free license (non-commercial use only)
Thu Dec 3, 9:38 PM KM3NeT Control Unit
Computer
km3net's Home
Trash
IPOD
DOM1
DOM2
DOM3
DOM4
DOM5
DOM6
DOM7
DOM8
DOM10
DOM11
DOM12
DOM13
DOM14
DOM15
DOM16
DOM17
File Edit View Search Terminal Help
Text View
Thu Dec 3 21:36:06 CET 2015
Toggling backbone
Data is 1 (00000001)
Closing
/var/log/messages
[TeamViewer]
Control Unit


SPECTRUM

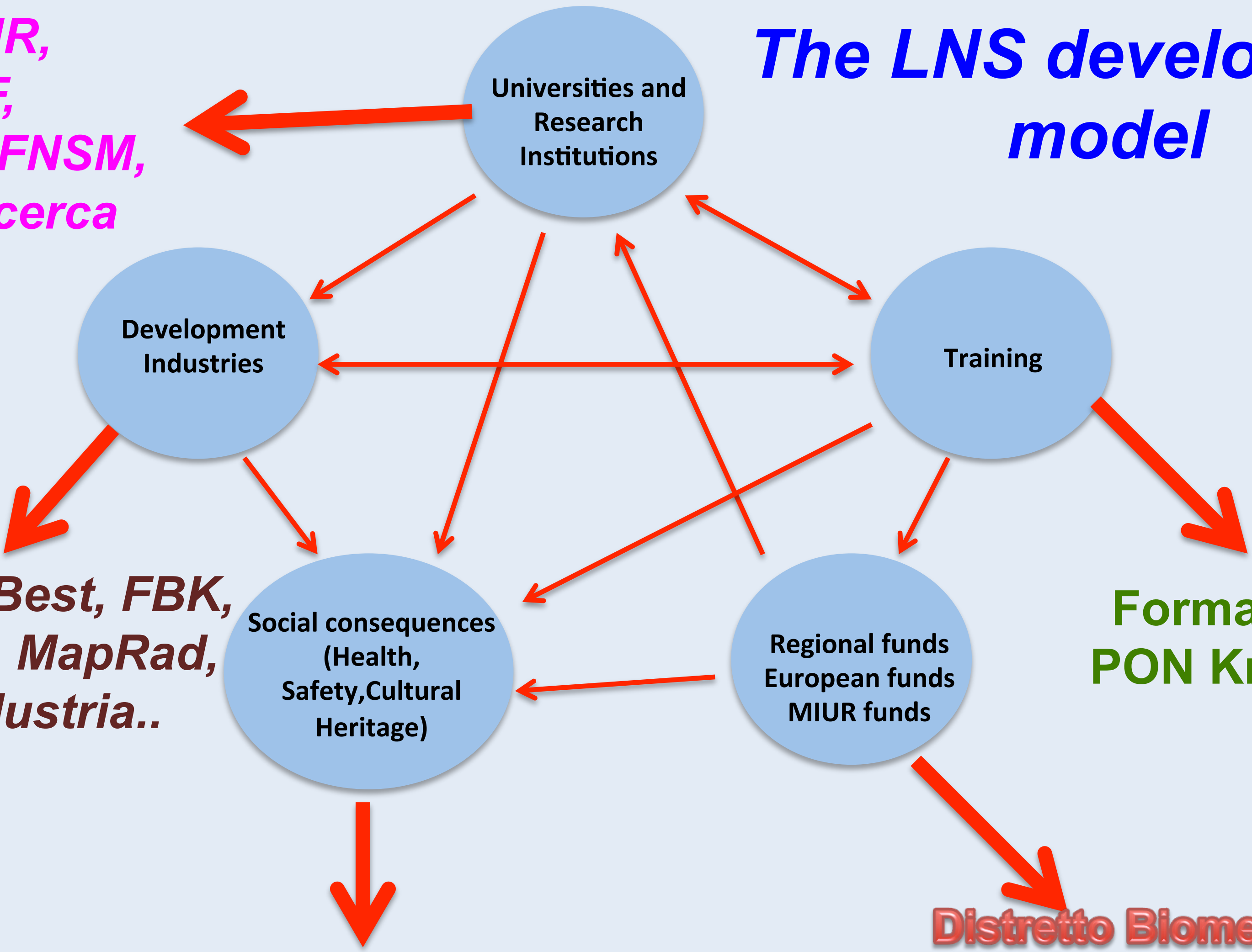
I Laboratori Nazionali del Sud dell'INFN

Laboratori Nazionali del Sud (LNS) is the most southern laboratory of INFN and with the wider spectra of research acitivies. Founded in 1976, nowdays are constituted by 250 people (104 permanent staff) including researches, technicians, doc and post-doc, undergraduate, etc. LNS are an advanced technological and research pole in Italy. Budget 11 M€ per year (exc. Salaries)

The research and development activities find applications in medicine, biophysics, photonics and cultural heritage. About 400 external users per year.

The LNS development model

Uni CT, CNR, INGV, INAF, ISPRA, CSFNSM, Catania Ricerca



STM, IBA, Best, FBK, Caen, IMT, MapRad, Confindustria..

Formazione
PON Km3NeT

- CATANA: 300 patients, 95% success
- LANDIS: Coll. with CNR-IBAM (Misurata Coins, Dead Sea Scrolls…)
- Radioactive Waste Management: Sogin
- Enviromental Radioactivity Lab
- Radiobiology Lab

Distretto Biomedico
Dstretto del Mare
Distretto Beni Culturali
PON-POR Projects
FIRB/SIR-Prin
H2020

Distribuzione dei finanziamenti annuali dell'INFN

Anno		Fondi Funzionamento	Fondi esperimenti				Totale
			CSN 2	CSN 3	CSN 4	CSN 5	
2014	Assegnazione iniziale (k€)	5.150,00	199,00	525,00	35,00	355,50	**6.264,50**
	Assegnazione totale	6.302,00	197,50	502,88	39,01	214,20	**7.255,59**
	Impegno (k€)	5.092,98	197,38	495,27	37,91	213,28	**6.036,82**
	Residuo (%)	19,18	0,06	1,51	2,82	0,43	**16,80**
2013	Assegnazione iniziale (k€)	5.288,00	16,00	268,00	26,50	301,50	**5.900,00**
	Assegnazione totale	5.341,43	14,23	284,78	39,35	272,90	**5.952,68**
	Impegno (k€)	5.320,88	14,22	284,54	39,31	270,07	**5.929,01**
	Residuo (%)	0,38	0,09	0,08	0,10	1,04	**0,40**
2012	Assegnazione iniziale(k€)	5.069,60	348,50	515,00	31,00	316,50	**6.280,60**
	Assegnazione totale	5.217,53	128,50	509,50	43,10	319,50	**6.218,13**
	Impegno (k€)	5.074,85	123,88	501,21	41,71	314,11	**6.055,76**
	Residuo (%)	2,73	3,60	1,63	3,22	1,69	**2,61**

NOTA:

1) il residuo del 2014 si riferisce a una quota di finanziamento dedicata a interventi della Divisione Tecnica per il rifacimento della cabina elettrica, non impegnata entro il 31 dicembre 2014 e riassegnata per il 2015;

Finanziamenti relativi a progetti particolari (Quosta ESFRI sul FOE e Progetti Premiali), espressi in k€.

Anno	ESS	ELI_NP	ASTROFISICA NUCL. MIUR	INFN-E	IRPT MIUR	Totale
2014	1.045,92	178,23	1.384,46	43,73	610,00	**3.262,33**
2013	573,43	72,00	2.953,82	40,00		**3.639,24**
2012	593,00	80,00	2.986,00	38,00		**3.697,00**

Finanziamenti relativi a terzi (PON, POR, UE, FIRB, ...) espressi in k€. Nelle note sono riportati i periodi di riferimento.

Anno	kM3Net-Italia	AISHA	Emso.Medit	Ensar	Firb 1	Firb 2	TENDER ESA	Totale
2014				59,86				59,86
2013		1.279,61	2.860,00	114,58			60	4.254,19
2012	20.800,00			148,58	359,20	258,00		21.565,78

Finanziamenti complessivi espressi in k€.

Anno	Fondi INFN	Altri fondi	Fondi EU	Totale
2014	7255,59	3262,33	59,86	**10577,79**
2013	5952,68	3639,24	4254,19	**13846,11**
2012	5541,89	3697,00	21565,78	**30804,67**

LNS and Regional Strategy

We are part of 3 new "Distretti Tecnologici" (Technological District) togheter with the sicilian universities (Palermo, Catania and Messina), CNR, INGV, ENEA, SME and large companies (STM, Fidia, Alenia, Farmitalia, …)

Distretto Biomedico: Prototype of Ion Gantry for Hadrontherapy (LNS, CNR-IBAM, Catania Univ, Cometa. Hitec2000, C3SL, Unico)

Distretto del Mare: application of submarine acoustic detectors for marine hazard (LNS, INGV, ENEA, Wass Alenia, SME consortium)

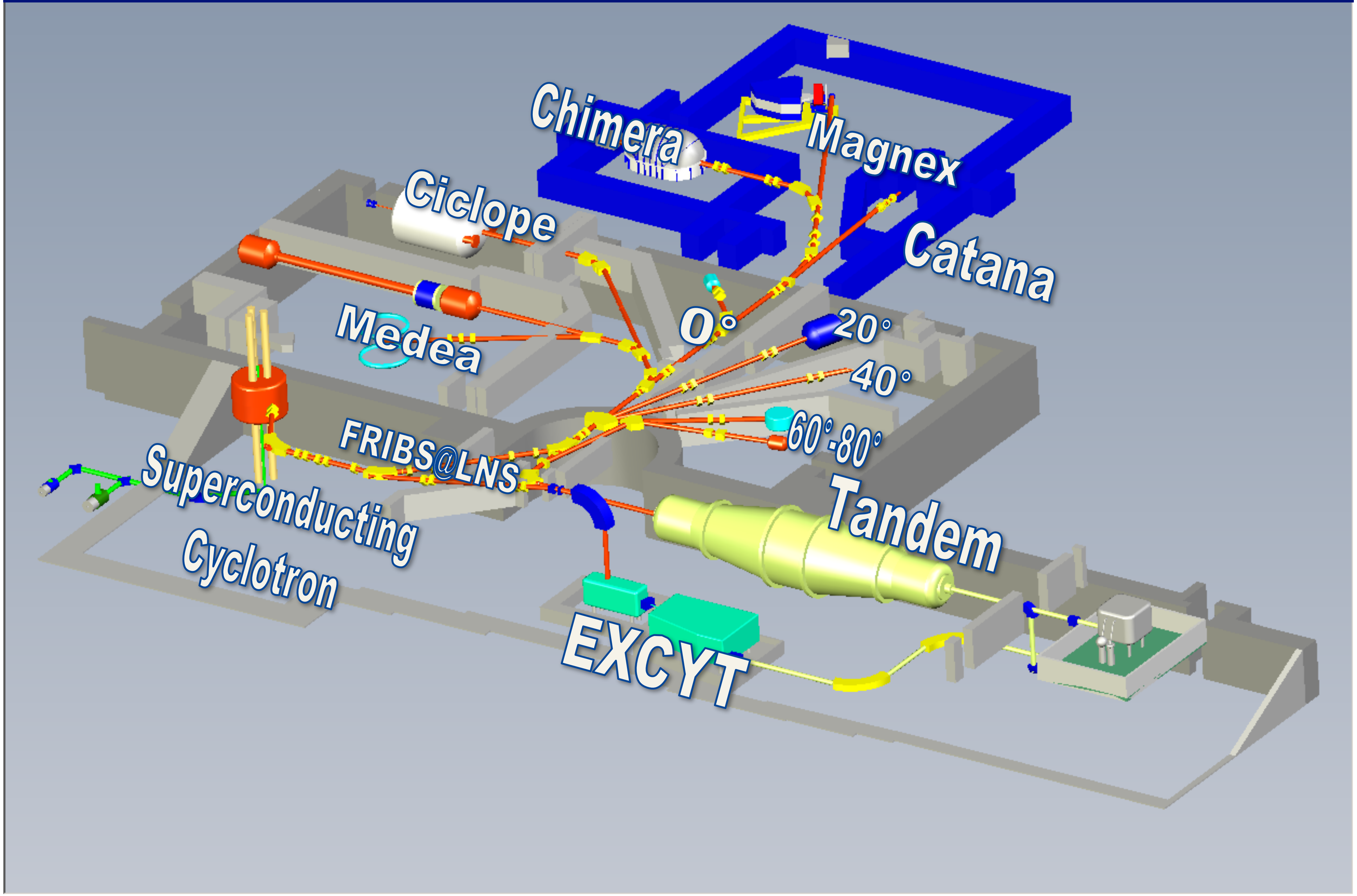
Distretto Beni Culturali: application of nuclear technology at cultural heritage (Coirich, CNR)

INFN-LNS is component of the Catania Ricerche consortium together with CNR, Catania Univ. Farmitalia and Camera di Commercio of Catania.

Energy Saving at LNS: A New LNS (POR 1.820 M€ in 2015 and 20% as INFN)

We are going to sign specific agreement with Assessorato Attività Produttive

LNS lay-out: accelerators and experimental halls



Accelerator equipment for ion beam production

450 KV injector
2 sputtering sources

↑
Superconducting ECR source SERSE

Normal conducting ECR source CAESAR
↓

LNS experimental resources upgradining for excellence researches in Nuclear Astrophysics, with stable and radioactive beams (Progetto Premiale)

Radioactive Ion Beams + Virtual Neutron & Trojan Horse

=

LNS is the first lab where it is possible to study reactions between neutrons and instable nuclei, both for Nuclear Astrophysics and Nuclear Structure and Reaction Mechanism Studies

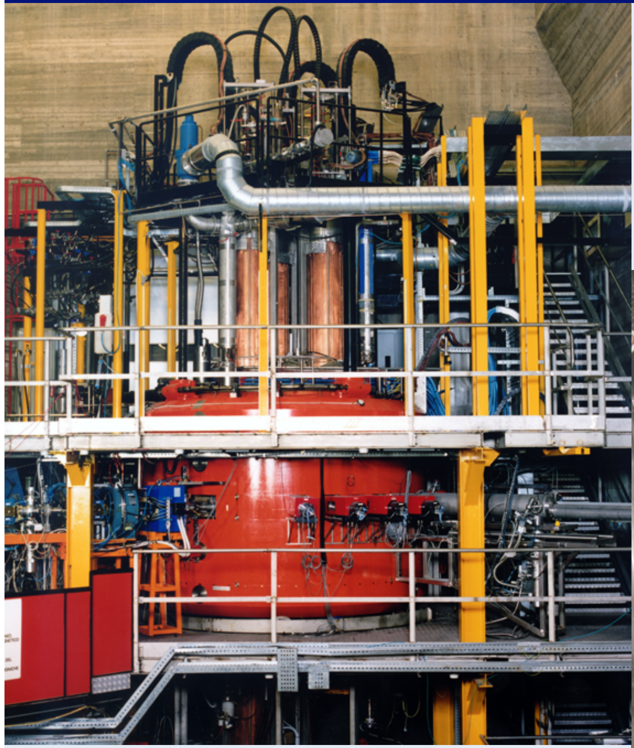
The aim of this project is to perform "bare" nucleus cross sections measurements of key astrophysics reactions in the astrophysics energy range and thermonuclear fusions reactions that concern the fusion energy production.

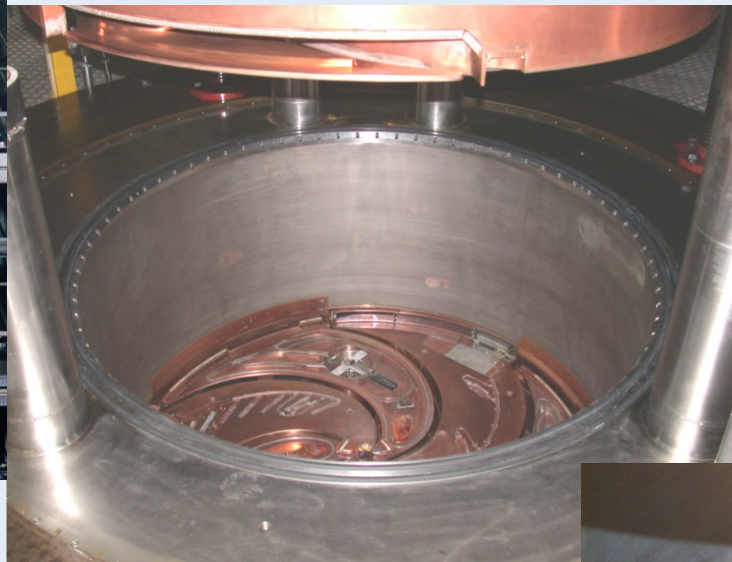
For example, to know the $^{10}B(p,\alpha 0)^{7}Be$ cross section it is crucial to understand the natural B usability as clean fuel but even to study the nuclear reaction chain in the Sun.

The LNS Superconducting Cyclotron

$(T/A)_{max} = K_{bending} (Q/A)^2$ ~ 25 AMeV Au^{36+}

$(T/A)_{max} = K_{focusing} (Q/A)$ 80 AMeV fully stripped





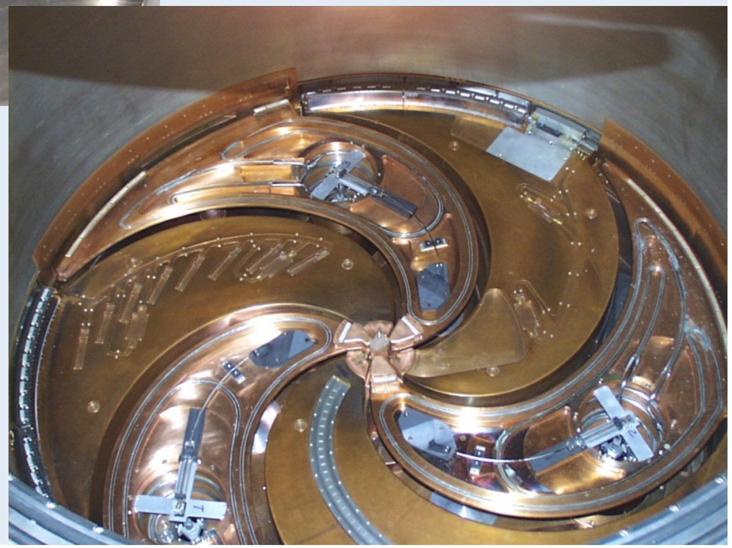
In operation since 1992

Bending limit	**K=800**
Focusing limit	**Kfoc=200**
Pole radius	**90 cm**
Yoke outer radius	**190.3 cm**
Yoke full height	**286 cm**
Min-Max field	**2.2-4.8 T**
Sectors	**3**
RF range	**15-48 MHz**

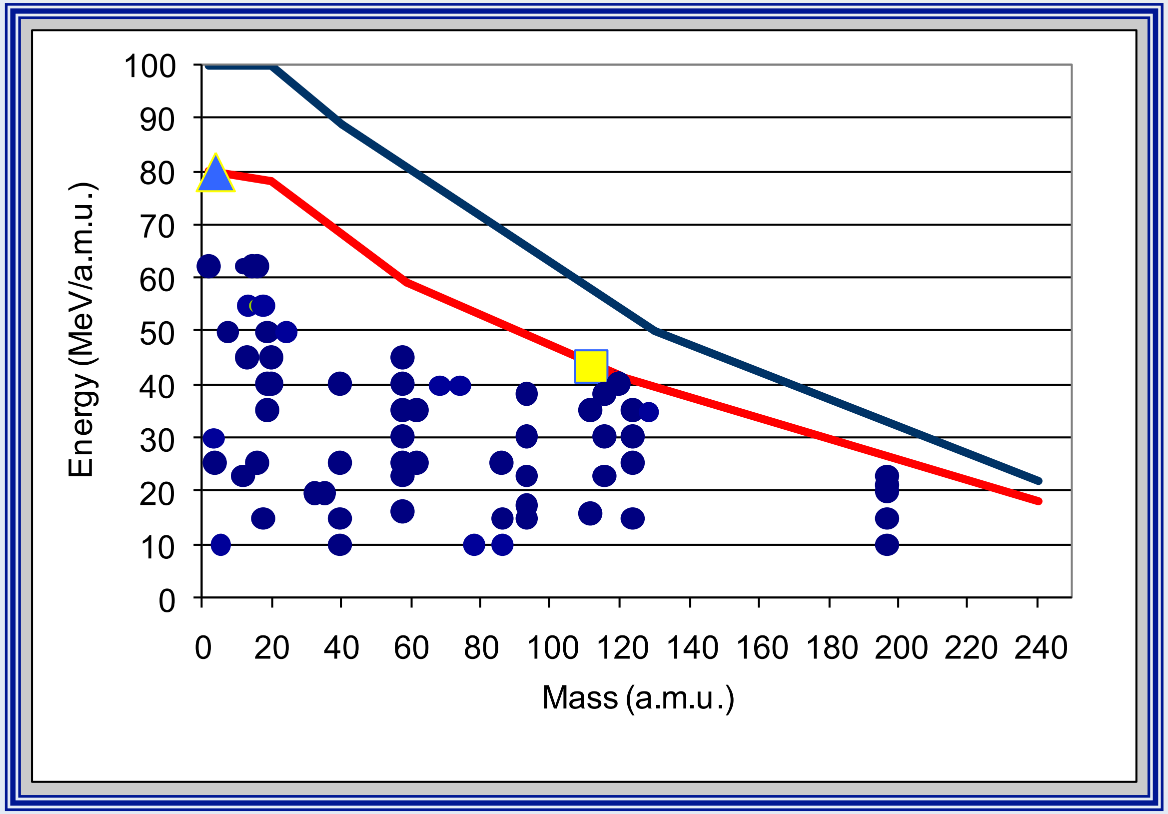
Versatility (performance)

Reliability (protontherapy)

High intensity (radioactive beams)



Superconducting Cyclotron developed beams



^{4}He 80 AMeV

^{112}Sn 43.5 AMeV

In red beams with intensity 10^{12} pps

^{A}X	E (AMeV)
H_2^+	62,80
H_3^+	30,35,45
$^{2}D^{+}$	35,62,80
^{4}He	25,62,80
He-H	10, 21
^{9}Be	45
^{11}B	55
^{12}C	23,62,80
^{13}C	45,55
^{14}N	62,80
^{16}O	21,25,55,62,80
^{18}O	15,55
^{19}F	35,40,50
^{20}Ne	20,40,45,62
^{24}Mg	50
^{27}Al	40
^{36}Ar	16,38
^{40}Ar	15,20,40
^{40}Ca	10,25,40,45
^{42,48}Ca	10,45
^{58}Ni	16,23,25,30,35,40,45
^{62,64}Ni	25,35
^{68,70}Zn	40
^{74}Ge	40
^{78,86}Kr	10
^{84}Kr	10,15,20,25
^{93}Nb	15,17,23,30,38
^{107}Ag	40
^{112}Sn	15.5,35,43.5
^{116}Sn	23,30,38
^{124}Sn	15,25,30,35
^{129}Xe	20,21,23,35
^{197}Au	10,15,20,21,23
^{208}Pb	10

The ββ decay

1) 2ν double β-decay

1) Does not distinguish between Dirac and Majorana

2) Experimentally observed in several nuclei since 1986

2) 0ν double β-decay

Neutrino has mass

Neutrino is Majorana particle

Violates the leptonic number conservation

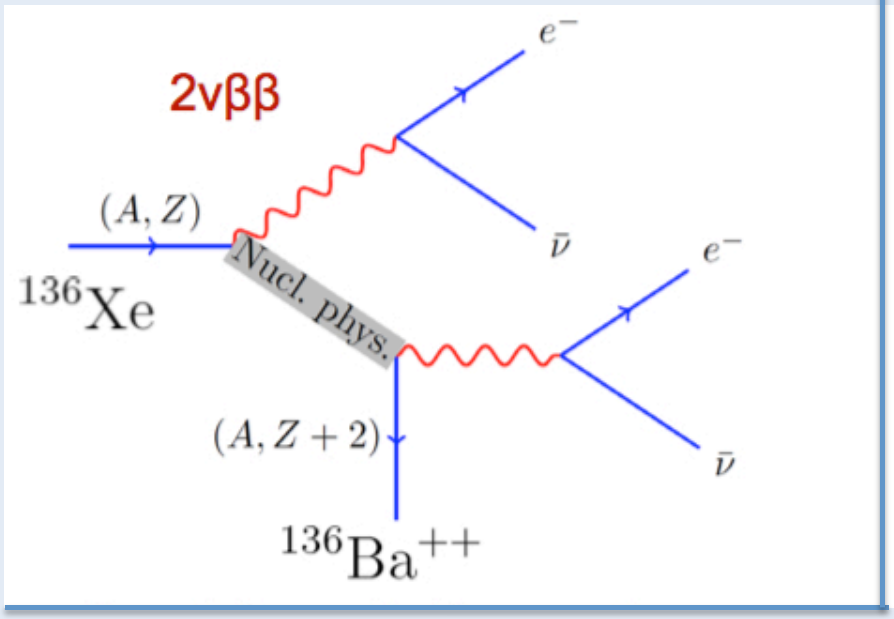
Experimentally not observed

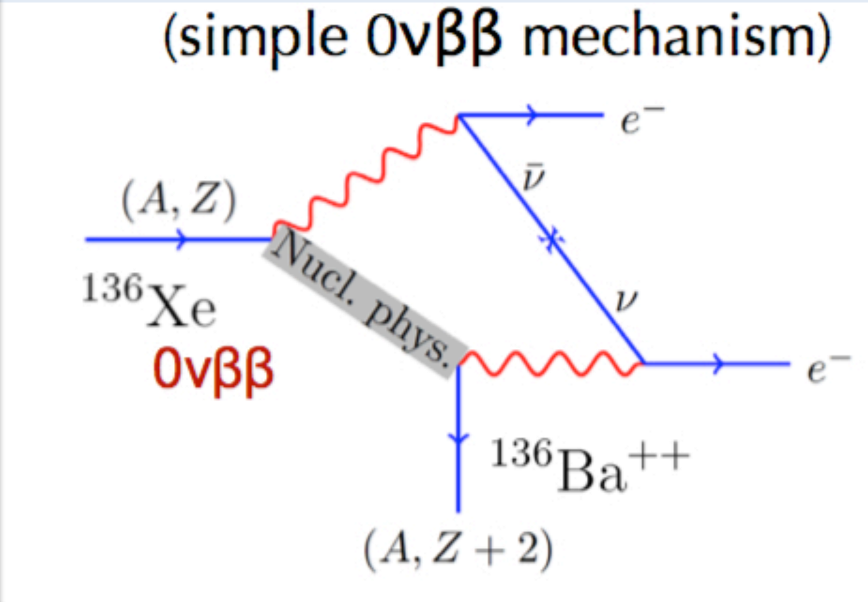
Beyond the standard model

ν and anti-ν can be distinguished

ν and anti-ν are the same

Physics case demanding high intensity: double β decay





$$1/T_{1/2}^{0\nu}(0^+ \rightarrow 0^+) = G_{01}\left|M^{\beta\beta 0\nu}\right|^2 \left|\frac{\langle m_\nu \rangle}{m_e}\right|^2$$

A lot of new physics inside

$$\langle m_\nu \rangle = \sum_i \left|U_{ei}\right|^2 m_i e^{i\alpha_i}$$

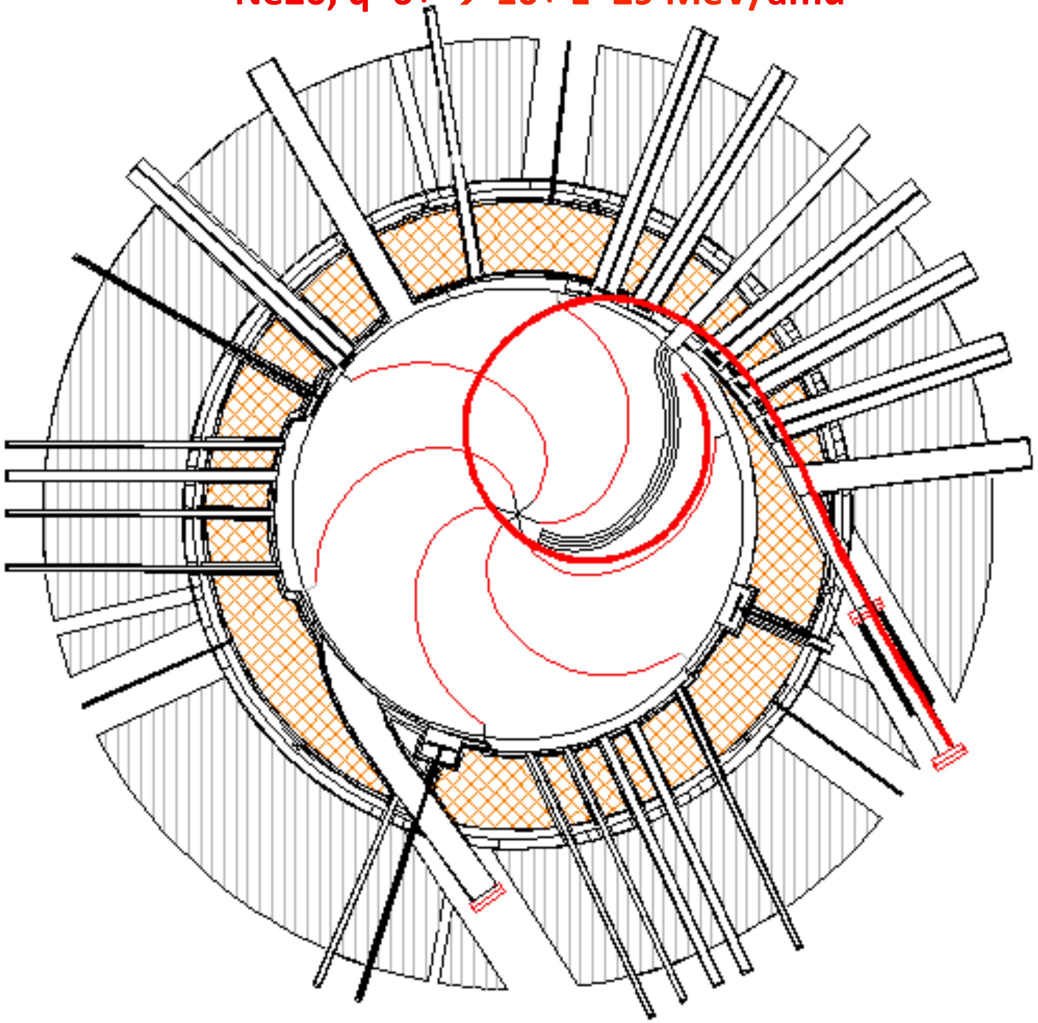
but one should know **Nuclear Matrix Element** (NME)

$$\left|M_\varepsilon^{\beta\beta 0\nu}\right|^2 = \left|\left\langle 0_f \left\| \hat{O}_\varepsilon^{\beta\beta 0\nu} \right\| 0_i \right\rangle\right|^2$$

Major upgrade of LNS facilities

- The **CS** accelerator current upgrade (from 100 W to 5-10 kW);
- The **MAGNEX focal plane** detector will be upgraded from 1 khz to 100 khz
- The **MAGNEX** maximum magnetic **rigidity** will be increased
- An **array of detectors for γ-rays** measurement in coincidence with MAGNEX will be built
- The **beam transport line** transmission efficiency will be upgraded from about 70% to nearly 100%
- The **target** technology for intense heavy-ion beams will be developed

Extraction by stripping: high efficiency



Extraction by stripping is based on the reduction of magnetic rigidity of the accelerated ion, caused by an increase of charge state or decrease of mass, after crossing a thin carbon foil (stripper).

For light ions at high energies the charge state fraction for q=Z after a stripper with thickness bigger than the equilibrium thickness is >99%

Beam types – expected intensities

Ion	Energy	Isource	Iacc	Iextr	Iextr	Pextr
	MeV/u	eμA	eμA	eμA	pps	watt
^{12}C q=4+	18	400	60 (4+)	90 (6+)	$9.4 \cdot 10^{13}$	3240
^{12}C q=5+	30	200	30 (4+)	45 (6+)	$4.7 \cdot 10^{13}$	2700
^{12}C q=4+	45	400	60 (4+)	90 (6+)	$9.4 \cdot 10^{13}$	8100
^{12}C q=4+	60	400	60 (4+)	90 (6+)	$9.4 \cdot 10^{13}$	10800
^{18}O q=6+	20	400	60 (6+)	80 (8+)	$6.2 \cdot 10^{13}$	3600
^{18}O q=6+	29	400	60 (6+)	80 (8+)	$6.2 \cdot 10^{13}$	5220
^{18}O q=6+	45	400	60 (6+)	80 (8+)	$6.2 \cdot 10^{13}$	8100
^{18}O q=6+	60	400	60 (6+)	80 (8+)	$6.2 \cdot 10^{13}$	10800
^{18}O q=7+	70	200	30 (7+)	34.3 (8+)	$2.7 \cdot 10^{13}$	5400
^{20}Ne q=4+	15	600	90 (4+)	223 (10+)	$1.4 \cdot 10^{14}$	6690
^{20}Ne q=7+	28	400	60 (7+)	85.7 (10+)	$5.3 \cdot 10^{13}$	4800
^{20}Ne q=7+	60	400	60 (7+)	85.7 (10+)	$5.3 \cdot 10^{13}$	10280

Superconducting Cyclotron upgrade: Technical Design Report

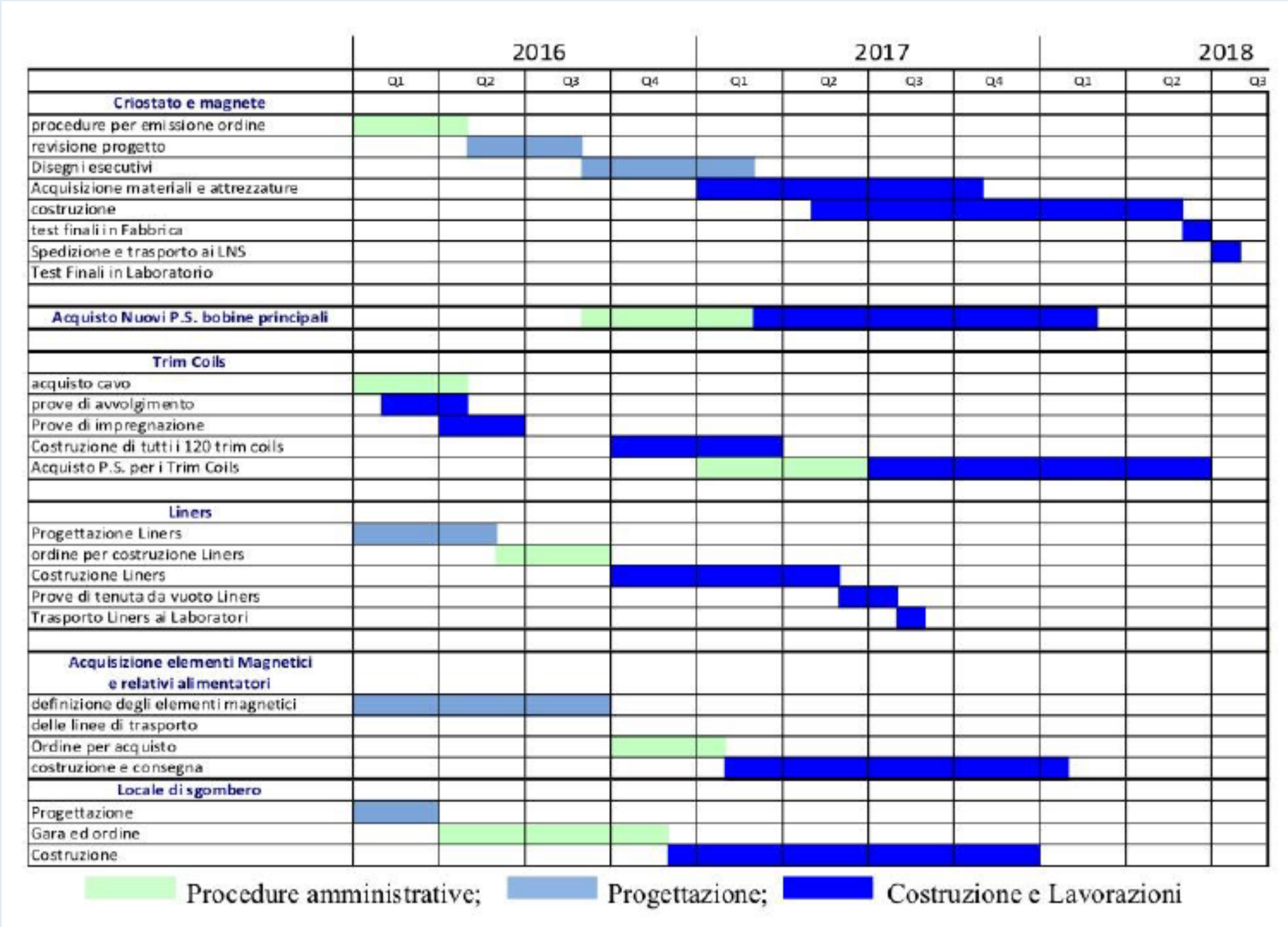
A Technical Design Report has been presented to the INFN MAC on November 12

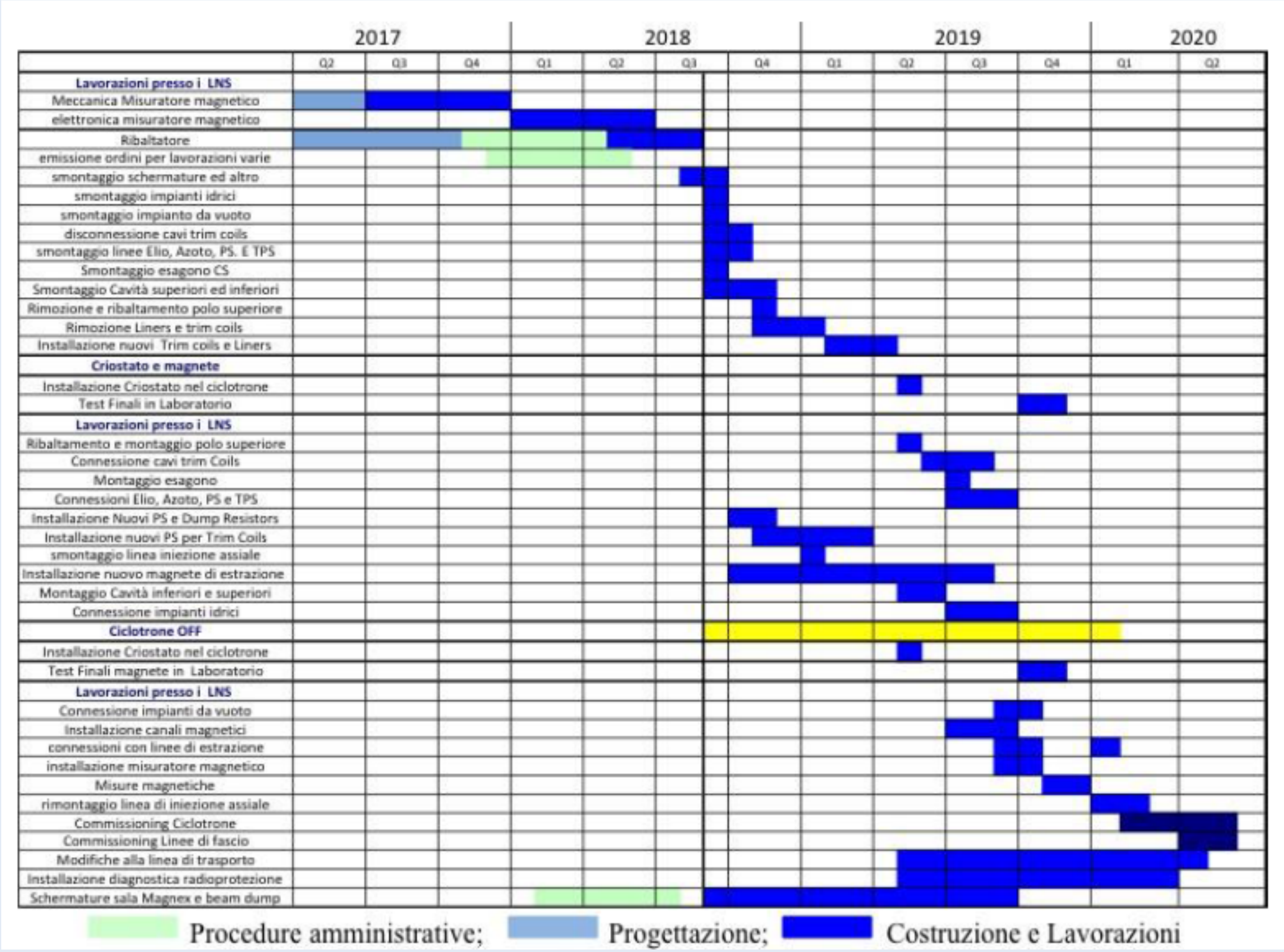
- Technical and functional analysis of the Superconducting Magnet (Cryostat and superconducting coils) produced by ASG Superconductors, Genova – Estimated costs and time schedule

- First technical choices of the modifications to be introduced:
  - extraction by stripping
  - magnetic channels
  - liner
  - pumping system
  - RF
  - trim coils
  - beam line
  - power supplies
  - radioprotection
  - logistic aspects

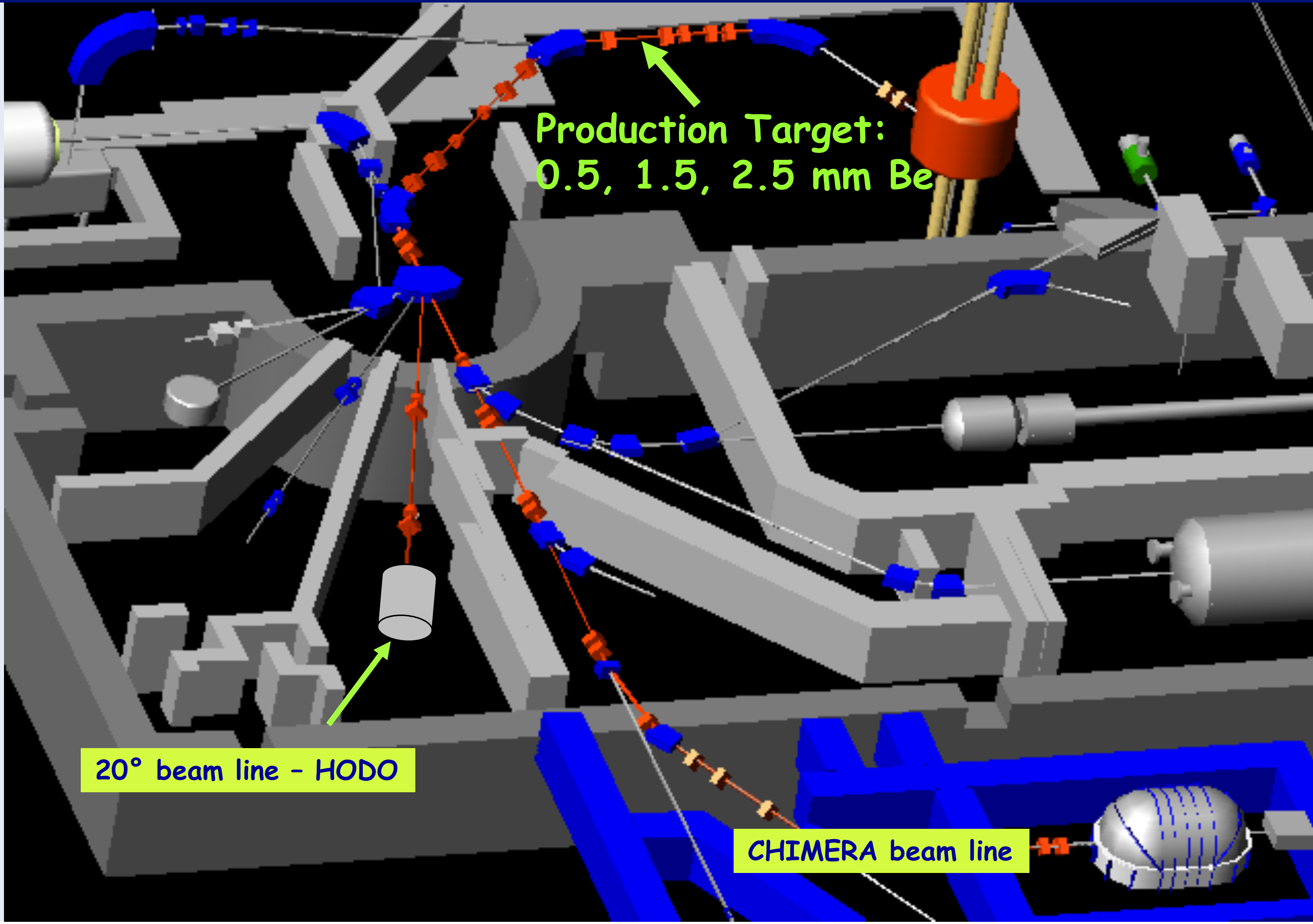
  Estimated costs and time schedule

capitolo	dettaglio	keuro	parziali keuro
Allegato 3	Magnete+Criostato	4078	5094
	torretta Criogenica	1006	
	QDS	10	
1.1	camera estrazione per stripping	40	39.6
	movimentazione stripper	30	
	controlli e diagnostica	16.8	
1.2	modifiche meccaniche al deflettore	10	39.6
	controlli e diagnostica per il nuovo deflettore	29.6	
1.3	canali magnetici nuovo canale	20	110
	canali magnetici canale esistente	30	
	controlli e diagnostica canali magnetici	60	
2	manifattura nuovo liner	350	390
	lucidatura e pulizia in bagno con utlrasuoni	25	
	verifica dimensionale	4	
	prova da vuoto	2.5	
	trasporto assemblaggio	8.5	
3	vuoto cs	90	224
	vuoto nuova linea di estrazione	134	
4	modifiche ai dee	10	40
	raffreddamento sistema RF	30	
5	trim coil avvolgimenti	360	881
	TC convertitori	450	
	quadro elettrico e linee	40	
	concentratore allarmi e pc	31	
6	N° 1 Dipolo 90°	229	1265
	N° 1 Switching magnet	188	
	N° 2 Dipoli 45°	298	
	N° 2 Dipoli 10°	120	
	N° 8 Quadrupoli	176	
	N° 2 Quadrupoli	54	
	vuoto	200	
7	TPS	13.1	55.6
	Beam losso monitor	42.5	
8	Alimentatori bobine principali	100	420
	Alimentatori della linea di fascio	320	
9	monitoraggio per neutroni e gamma in sala CS	60	967
	sistema di sicurezza sala CS e locali attigui	100	
	schermatura ECR	10	
	impianti idrici per il raffreddamento acqua CS	156	
	monitoraggio per neutroni e gamma in sala Magnex	90	
	Modifiche al sistema di sicurezza	50	
	schermature	421	
	impianti idrici per il raffreddamento beam dump o altro in sala Magnex	80	
10	ribaltatore	250	836.15
	nuova impalcatura per il nuovo magnete di estrazione	25	
	meccanica protezione vitoni	15	
	interfaccia camera pulita	15	
	movimentazione schermature	12.3	
	manpower esterno per smontaggio/rimontaggio	150	
	locale di sgombero	368.85	
		TOTALE	**10361.95**


2016
2017
2018
Q1
Q2
Q3
Q4
Q1
Q2
Q3
Q4
Q1
Q2
Q3
Criostato e magnete
procedure per emissione ordine
revisione progetto
Disegni esecutivi
Acquisizione materiali e attrezzature
costruzione
test finali in Fabbrica
Spedizione e trasporto ai LNS
Test Finali in Laboratorio
Acquisto Nuovi P.S. bobine principali
Trim Coils
acquisto cavo
prove di avvolgimento
Prove di impregnazione
Costruzione di tutti i 120 trim coils
Acquisto P.S. per i Trim Coils
Liners
Progettazione Liners
ordine per costruzione Liners
Costruzione Liners
Prove di tenuta da vuoto Liners
Trasporto Liners ai Laboratori
Acquisizione elementi Magnetici
e relativi alimentatori
definizione degli elementi magnetici
delle linee di trasporto
Ordine per acquisto
costruzione e consegna
Locale di sgombero
Progettazione
Gara ed ordine
Costruzione
Procedure amministrative;
Progettazione;
Costruzione e Lavorazioni


2017
2018
2019
2020
Q2
Q3
Q4
Q1
Q2
Q3
Q4
Q1
Q2
Q3
Q4
Q1
Q2
Lavorazioni presso i LNS
Meccanica Misuratore magnetico
elettronica misuratore magnetico
Ribaltatore
emissione ordini per lavorazioni varie
smontaggio schermature ed altro
smontaggio impianti idrici
smontaggio impianto da vuoto
disconnessione cavi trim coils
smontaggio linee Elio, Azoto, PS. E TPS
Smontaggio esagono CS
Smontaggio Cavità superiori ed inferiori
Rimozione e ribaltamento polo superiore
Rimozione Liners e trim coils
Installazione nuovi Trim coils e Liners
Criostato e magnete
Installazione Criostato nel ciclotrone
Test Finali in Laboratorio
Lavorazioni presso i LNS
Ribaltamento e montaggio polo superiore
Connessione cavi trim Coils
Montaggio esagono
Connessioni Elio, Azoto, PS e TPS
Installazione Nuovi PS e Dump Resistors
Installazione nuovi PS per Trim Coils
smontaggio linea iniezione assiale
Installazione nuovo magnete di estrazione
Montaggio Cavità inferiori e superiori
Connessione impianti idrici
Ciclotrone OFF
Installazione Criostato nel ciclotrone
Test Finali magnete in Laboratorio
Lavorazioni presso i LNS
Connessione impianti da vuoto
Installazione canali magnetici
connessioni con linee di estrazione
installazione misuratore magnetico
Misure magnetiche
rimontaggio linea di iniezione assiale
Commissioning Ciclotrone
Commissioning Linee di fascio
Modifiche alla linea di trasporto
Installazione diagnostica radioprotezione
Schermature sala Magnex e beam dump
Procedure amministrative;
Progettazione;
Costruzione e Lavorazioni

FRIBS@LNS: in Flight Radioactive Ion BeamS



Beams developed at FRIBS@LNS

primary beam	beam	intensity (kHz/ 100W)
18O 55 AMeV	16C	120
setting 11Be	17C	12
	13B	80
	11Be	20
	10Be	60
	8Li	20
18O 55 AMeV	14B	3
setting 12Be	12Be	5
	9Li	6
	6He	12
13C 55 AMeV	11Be	50
setting 11Be	12B	100
36Ar 42 AMeV	37K	100
setting 34Ar	35Ar	70
	36Ar	100
	37Ar	25
	33Cl	10
	34Cl	50
	35Cl	50
20Ne 35 AMeV	18Ne	50
setting ne18	17F	20
	21Na	100
70Zn 40 AMeV		
setting 68Ni	68Ni	20

Beams to be delivered in 2014-2015 to approved experiments

^{16}C (CHIMERA)

^{68}Ni (CHIMERA)

^{8}He (CHIMERA) new

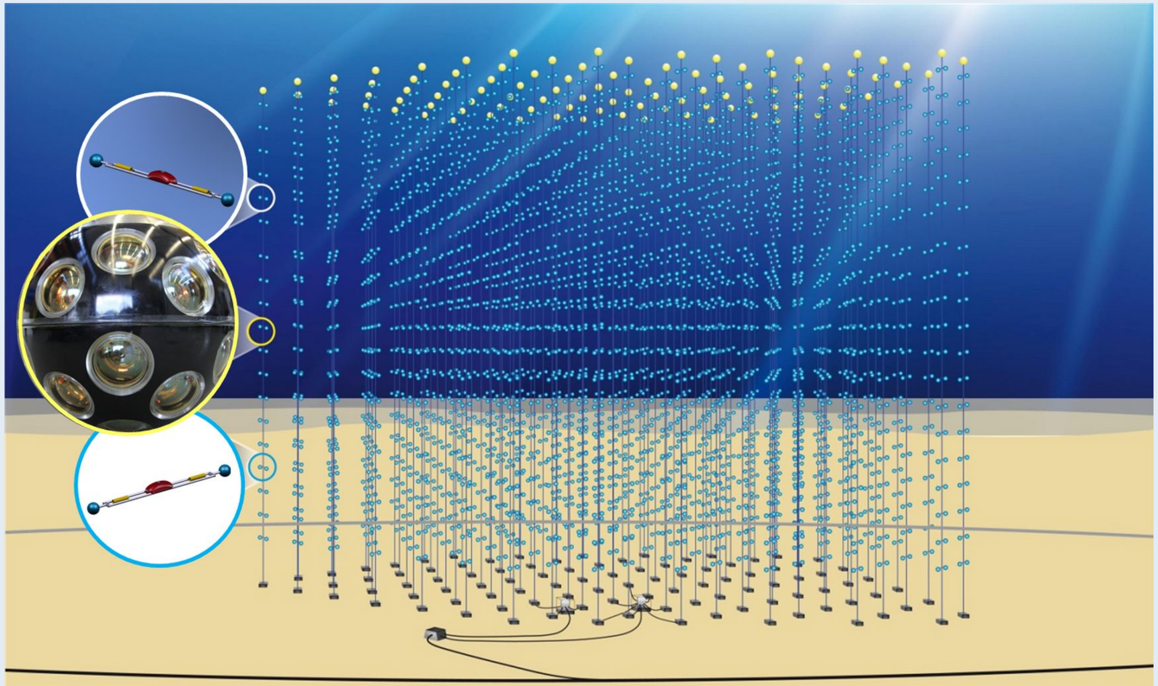
^{14}Be (test experiment) new

^{38}S (MAGNEX) new

Unique facility in Europe

The giant-scale detector KM3NeT

Faintness of neutrino fluxes and small interaction probabilities oblige to use large natural target such as sea-water: a volume of 5 km^3 of seawater will be instrumented with optical detectors.



5 building blocks
120 Detection Units (DU)
750 m DU height
180m DU distance
5 km^3 volume
Budget 210 M€

KM3NeT-It is funded by INFN since 1999 (NEMO)
In 2012 the project was awarded with a PON grant of 21 M€

KM3NeT is a EU funded ESFRI Infrastructure since 2006.
INFN leaded the Prparatory Phase

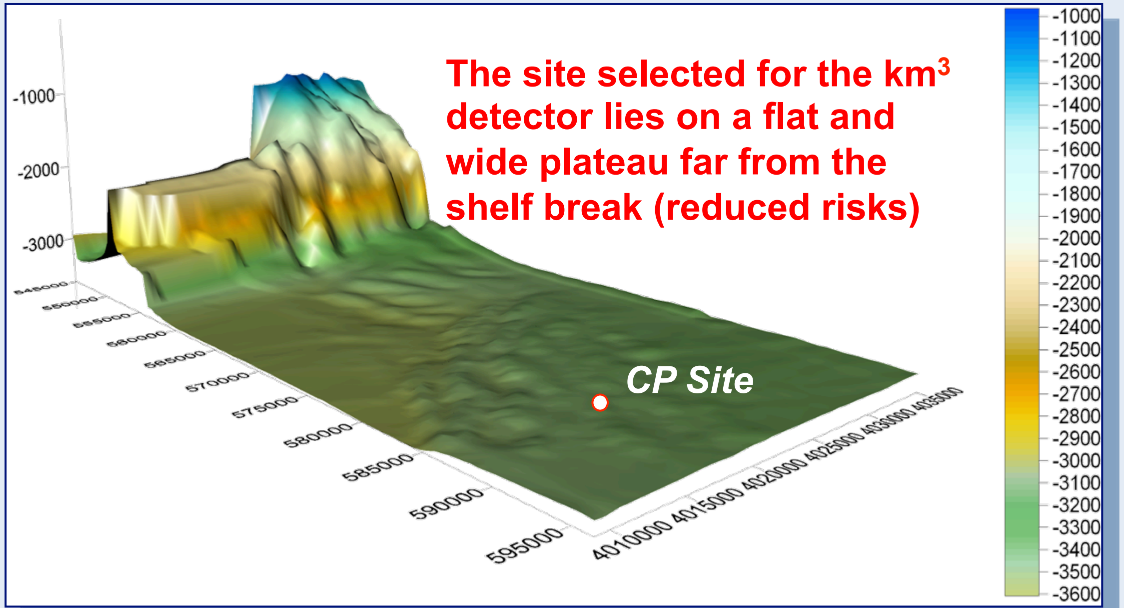
News

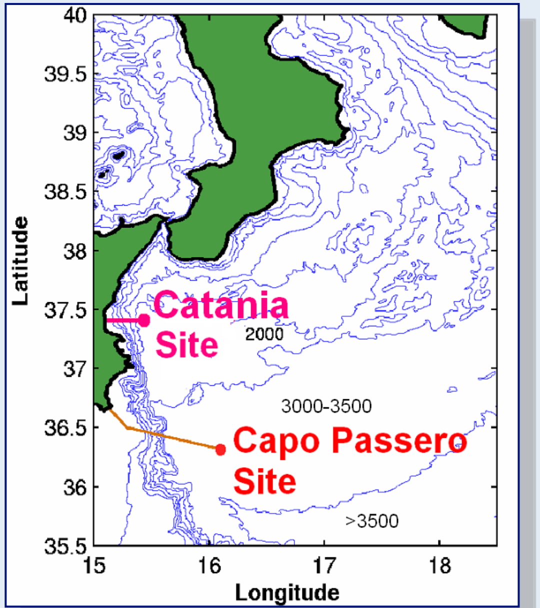
- ESFRI road map 2016 on-going
  - hearing 8 September 2015, Brussels
  - final verdict December 2015
- Interest from Hyper-K
  - will present draft Memorandum of Understanding
    for co-operation to RRB on 23 November 2015
- New web pages coming up soon
  - stay tuned

The Capo Passero Site

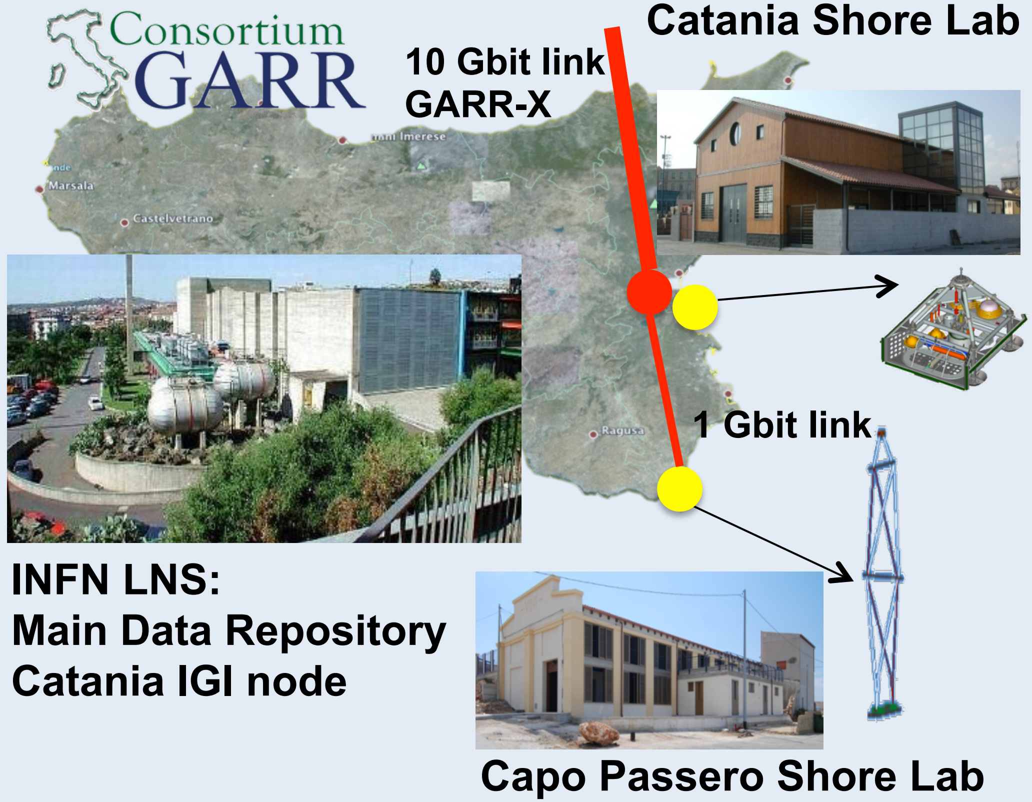
More than 30 naval campaigns seeking deep sea sites in the Mediterranean Sea. Capo Passero is an optimal site.

- ***Depth >3500 m, 90 km distance from the shore***
- ***Excellent water optical properties ($L_a \approx 70$ m @$\lambda = 440$ nm)***
- ***Optical background from bioluminescence extremely low***
- ***Deep sea water currents are low and stable (3 cm/s avg, 10 cm/s max)***
- ***Wide abyssal plain: large extension of the detector***





Capo Passero: optical fibre link from deep-sea to LNS



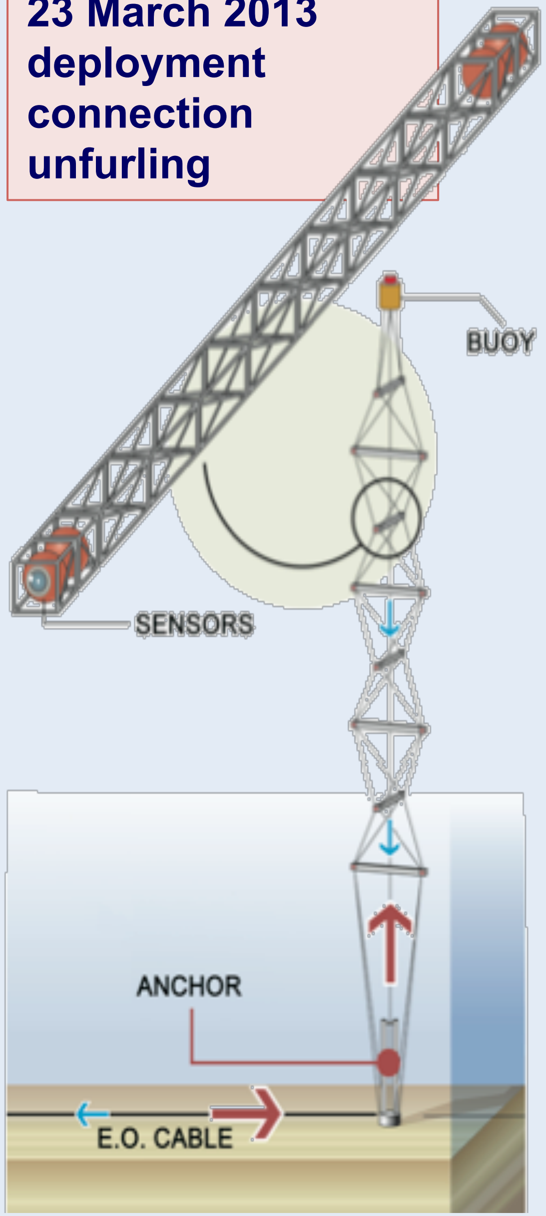
INFN is a main partner of GARR and of the Italian GRID-computing Infrastructure

Capo Passero is the first KM3NeT site with direct optical fiber high speed connection from deep-sea to a node of the European GRID-computing Infrastructure

INFN Catania is a major site of the Italian GRID

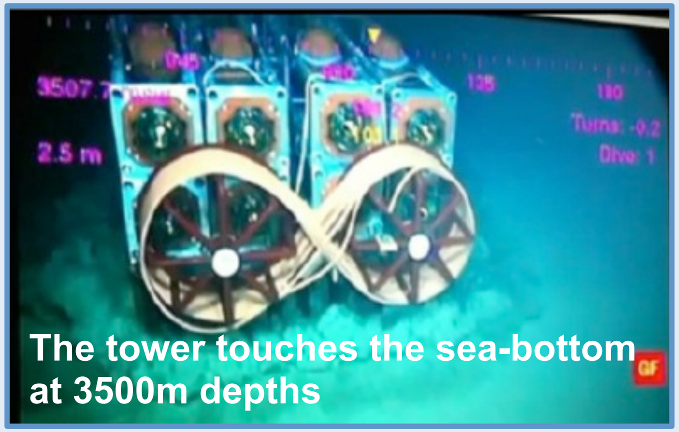
The KM3NeT Tower Prototype

23 March 2013
deployment
connection
unfurling



- 8 floors, 8 m bars, vertical dist. = 40 m, H_{tot} = 450 m
- 32 OM, 12 hydrophones , 2 OAM (opto-acoustic modules)
- CTD, DCS, transmissometer, laser beacon, acoustic beacon

The tower on the "Nautical Tide"

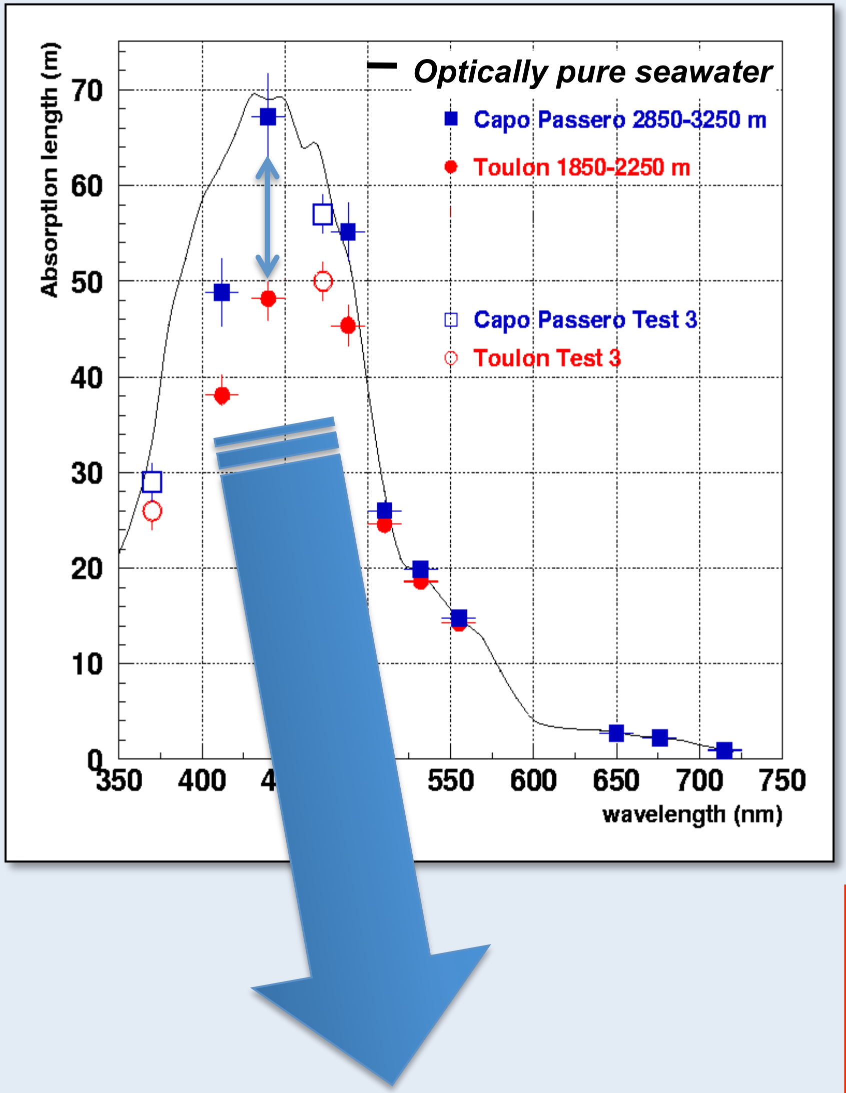


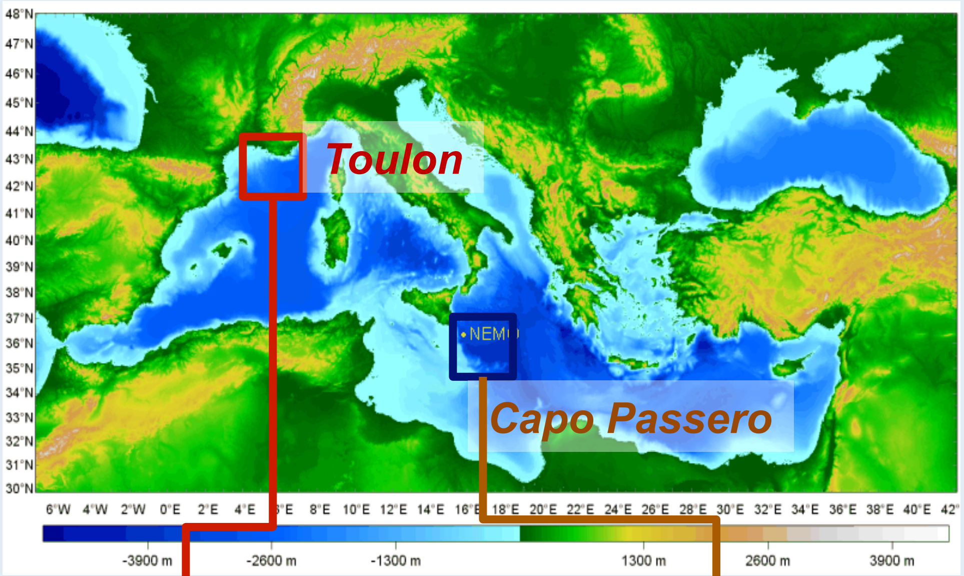
The tower touches the sea-bottom at 3500m depths

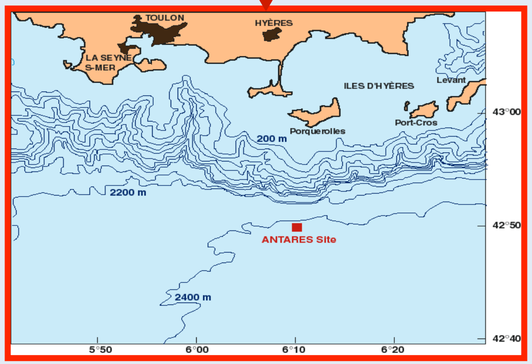
The OM: 10" Hamamatsu R7081, Front End Module, Time Calibration, LED beacons

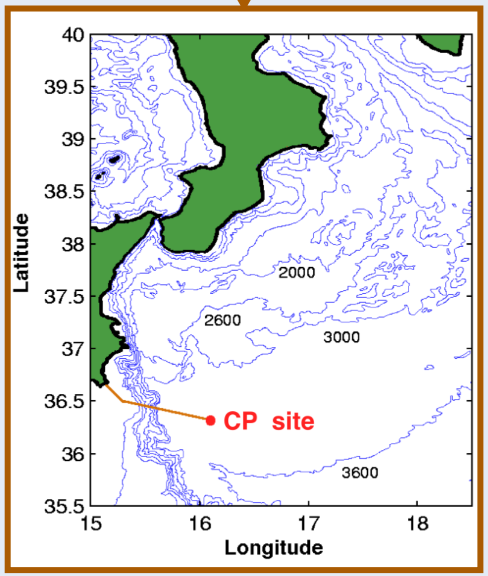
Hydrophones: acoustic positioning and bioacustics (INFN/SMID/NATO)

Light Absorption lenght



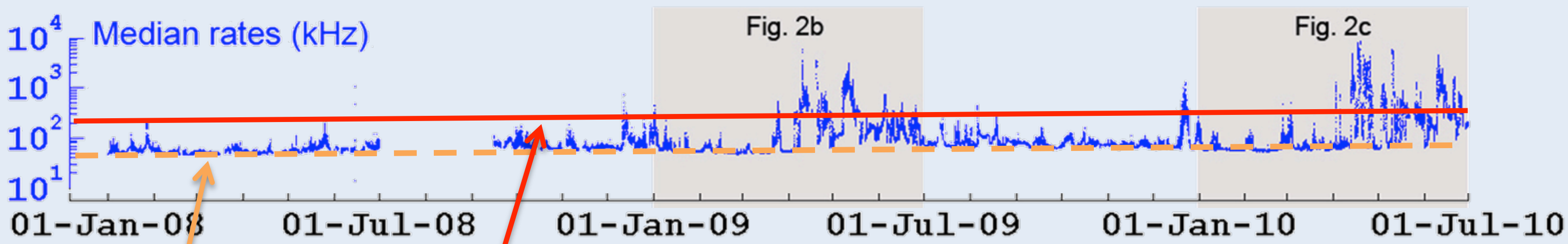






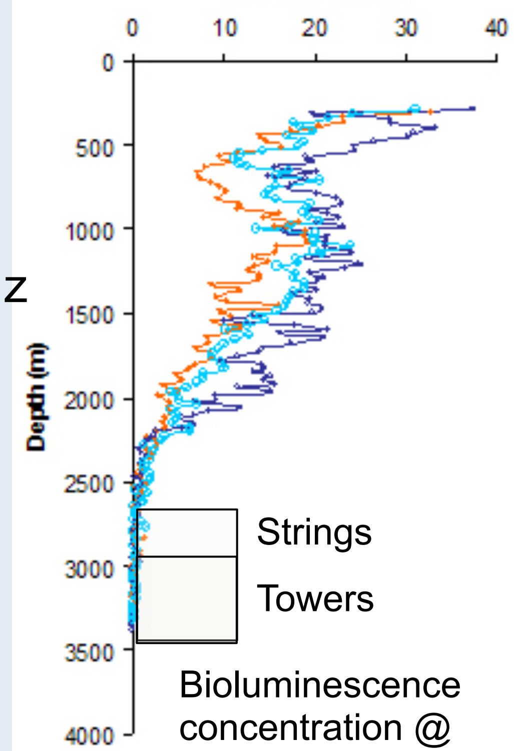
C.P. waters 30-40% more transparent than Toulon ones @lambda Cherenkov

Optical Background median rates at ANTARES and Capo Passero site



Median rate Above 200 kHz: ANTARES DAQ is switched off

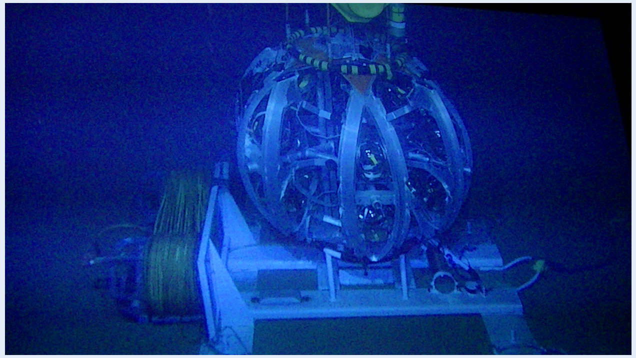
Capo Passero median rates never exceed 70 kHz

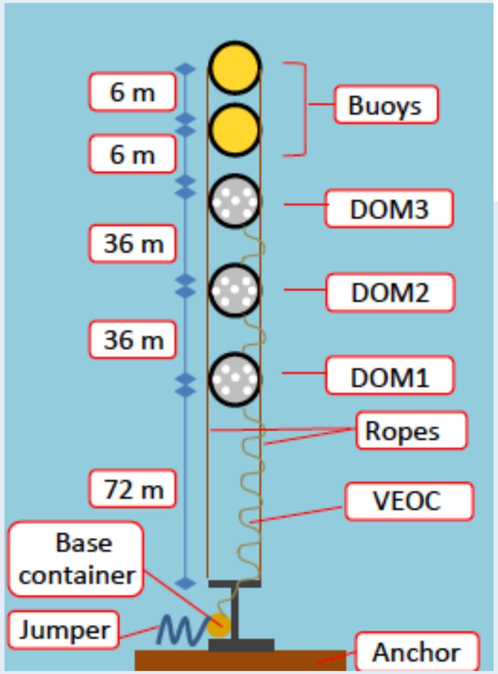


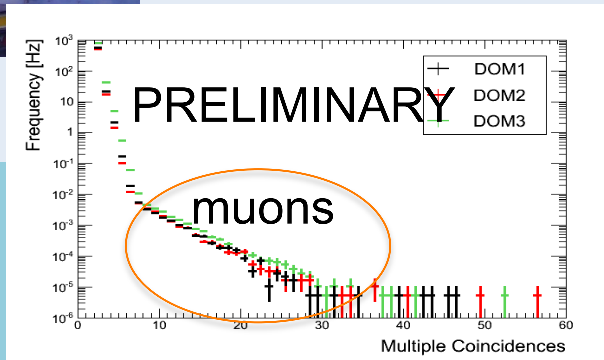
Bioluminescence concentration @ CP

The demonstrators

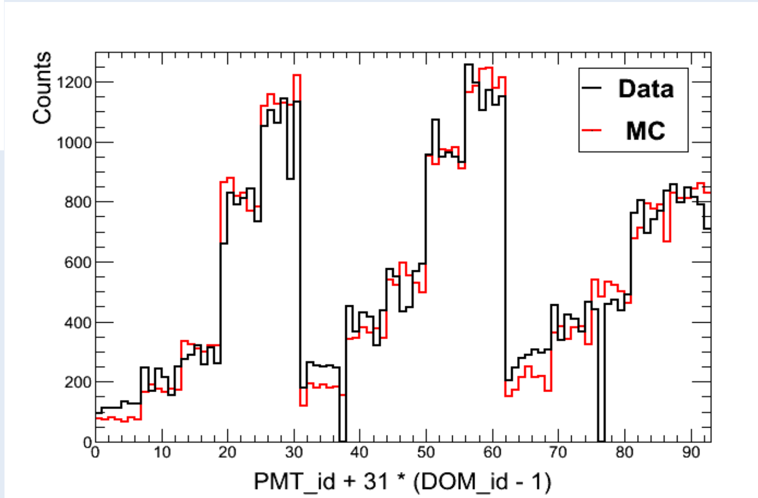
The PPM DU: deployed May 2014 at Capo Passero Site



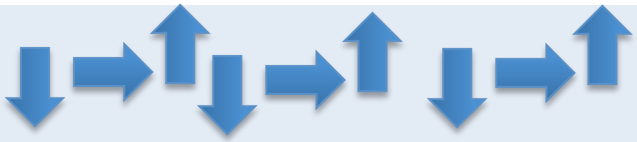




Same as per PPM-DOM

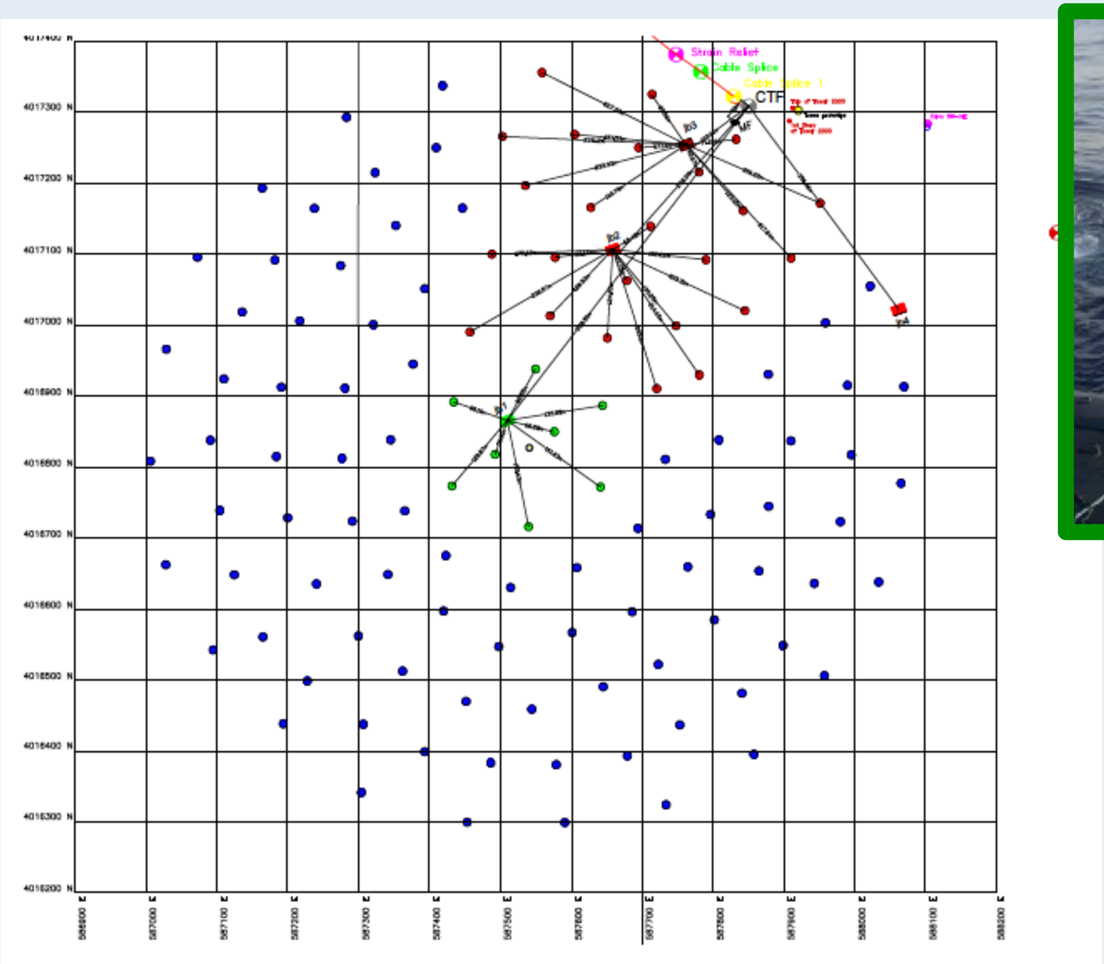


PMT Orientation



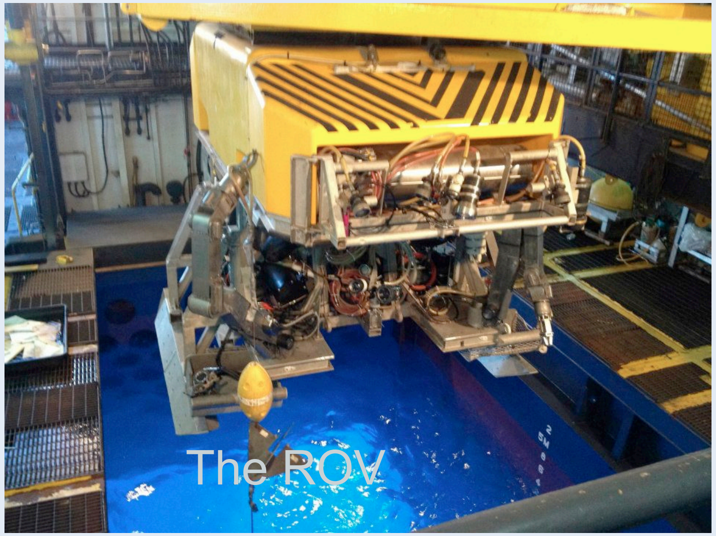
KM3NeT Installation Plan

→ Site full Survey (05/2014) Area Clearance (11/2014) 1 DU (11/2014)
→ 8 **Detection Units 2015** 26 Detection Units in 2015
A full Building Block before 2020



Sea Operation: deployment and connection

The DSV Nautical Tide


The ROV

Tower Deployment April 2013


PPM-DI Deployment May 2014

Phased implementation

Phase	Total costs [M€]	Primary deliverable	Status
1	31	Proof of feasibility of network of distributed neutrino telescope ***26 strings+8 Towers in Capo Passero*** ***7 strings in Toulon***	***Funded***
1.5	+(50:60)	Measurement of neutrino signal reported by IceCube ***2 building blocks (> IceCube)***	***Letter of Intent***
2	+(130:160)	Neutrino astronomy ***6 building blocks***	ESFRI road map

INFN

Km3NeT perspectives

- **For the completion of the Full Building Block:**
  10 M€ per year in 2015-2019
  Possible Source: EU Regional Funds.

- **FOE: 1 M€ per year in the next 5 yrs as contribution for infrastructure management and temporary position personnel**

International Framework:

- **Greek site is out!**

- **French site will be devoted to ORCA (insidede Km3NeT coll.)**

- **Italian site is the unique for High Energy neutrino telescope (ARCA)**

- **Km3Net collaboration is moving to a more stable organization (finally)**

- Diffuse flux from the Galactic plane:
  - New model for cosmic-ray propagation in Galaxy (uses spatially dependent diffusion coefficient)
  - Explains different measurements and resolves seeming inconsistencies
  - Predicts neutrino flux in reach for measurement with ARCA
- Point-source searches with cascade events
  - Angular resolution ~2° – point source analysis feasible
  - 4π sky coverage

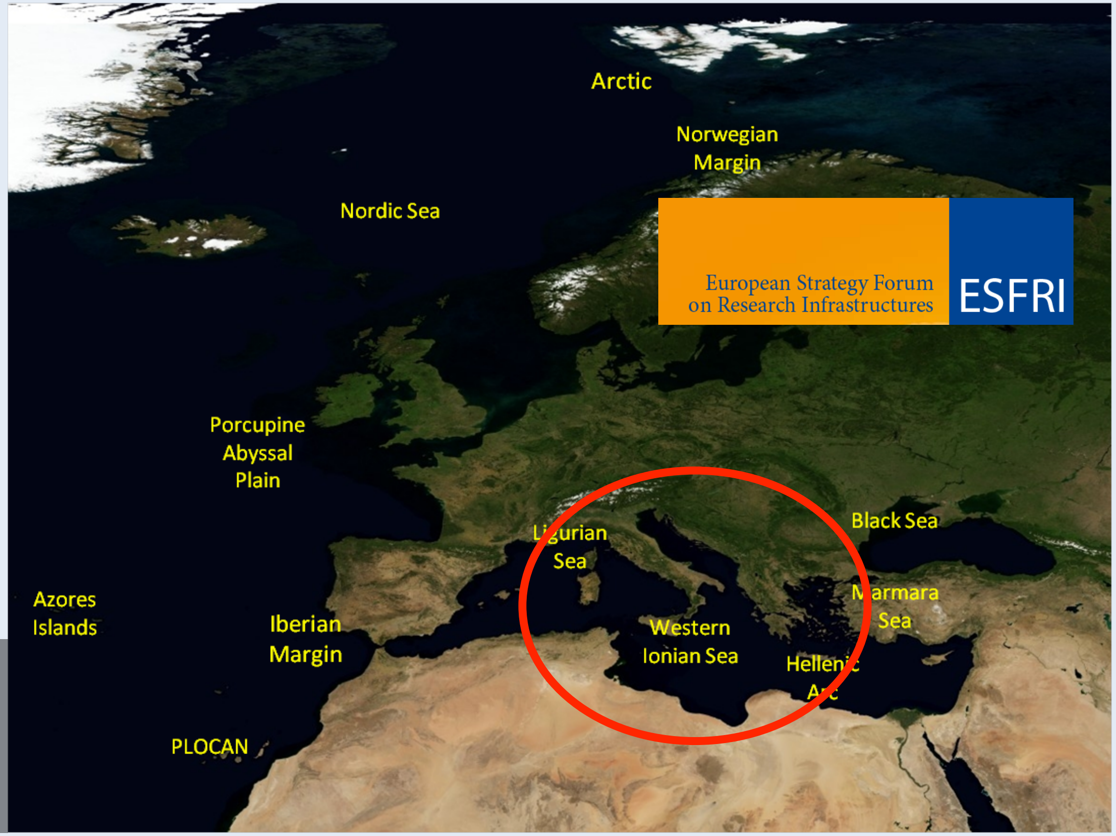
- Physics capabilities of ARCA will provide exciting results after one (diffuse flux) to few (point sources, Galactic plane) years
- The ARCA Letter of Intent is essentially finished, waiting for feedback from you
- ARCA Phase-1 will provide discovery potential and an important test bed for detector operation and data analysis

KM3NeT and EMSO

Common efforts with the Earth and Sea Science Community

Real Time Environmental Monitoring

Toulon, Sicily and Hellenic: sites of common interest for KM3NeT and EMSO

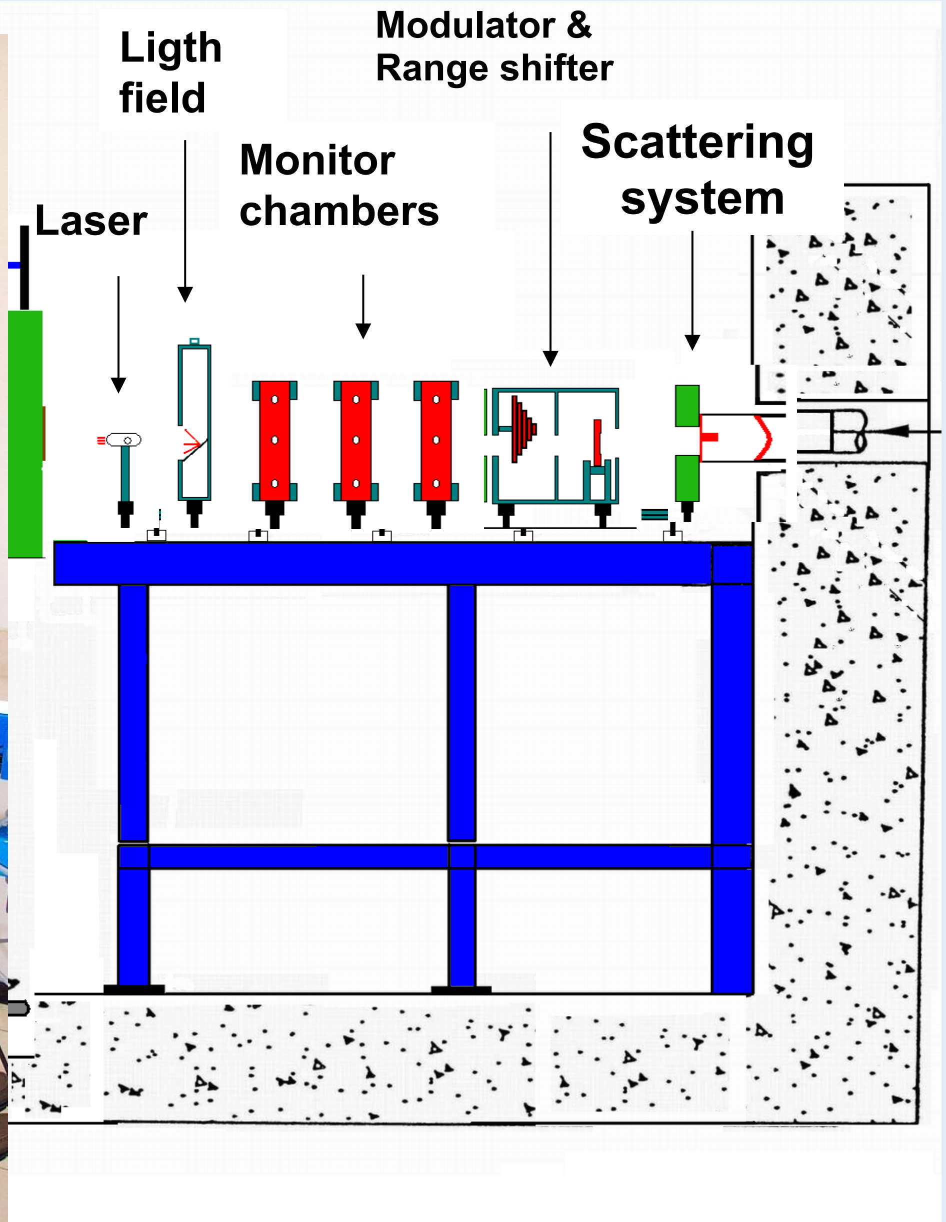


Oceanography (water circulation, climate change):
Current intensity and direction, Water temperature, Water salinity ,...

Geophysics (geohazard):
Seismic phenomena, low frequency passive acoustics, magnetic field variations,...

Biology (micro-biology, cetaceans,...):
Passive acoustics, Biofouling, Bioluminescence, Water samples analysis,...
In Sicily coordination between Catania, Porto Palo, Capo Granitola and Palermo (INFN, INGV, CNR and university of Catania and Messina.

CATANA proton therapy beam line



SOPRAVVIVENZA		
Total Number of patients	293	
Deaths	6	
	Metastatis	5
	Other	1
Eye retention rate	95 %	
Surviving	98 %	
LOCAL CONTROL	95 %	

Applications for Cultural Heritage

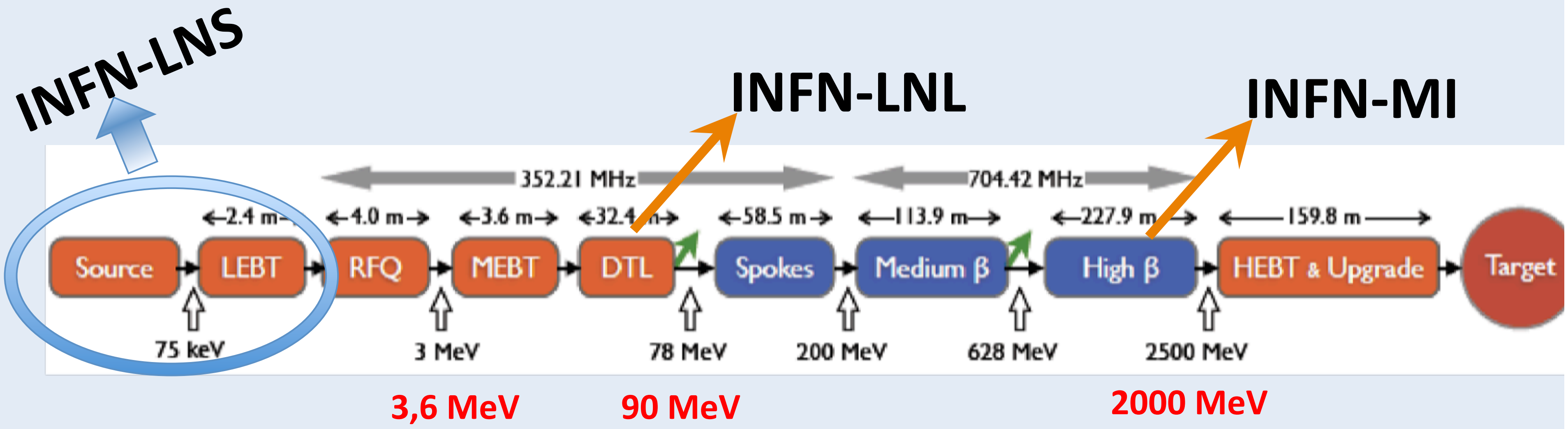
LANDIS (in colaboration with CNR-IBAM) is mainly engaged in the technological development of innovative instrumentation and new methods for the non-destructive characterization artistic and archaeological material of interest in the field of Cultural Heritage. The techniques employed at LANDIS are available in portable version and are mainly based on the use of X-ray beams and charged particles.

The LANDIS instrumentation used at Paolo Orsi Museum (Sr)

Activities in Sicily

- *Sicilian local Superintendeces Soprintendenze (Catania, Siracusa, Enna);*
- *Archeological Museums (Paolo Orsi Archeological Museum of Siracusa; Salinas Archeological Museum of di Palermo; Archeological Museum of Caltanissetta and Gela)*

ESS - The INFN contribution



INFN has been involved in the Design Update phase (2011-12), for several components of the LINAC, and it is involved in the next phase, aimed to the construction of prototypes :

- The Proton source
- The LEBT
- The Drift Tube Linac
- The Superconducting elliptical cavity @ high energy section

ELI (Extreme Light Infrastructure)

new type of European large scale laser infrastructure specifically designed to produce the highest peak power (10 PW) and focused intensity;

- ELI-Beamlines (Czech Rep.)
- Ungary
- Romania
- tbd

ELIMAIA | X-ray sources | Exotic physics | ...

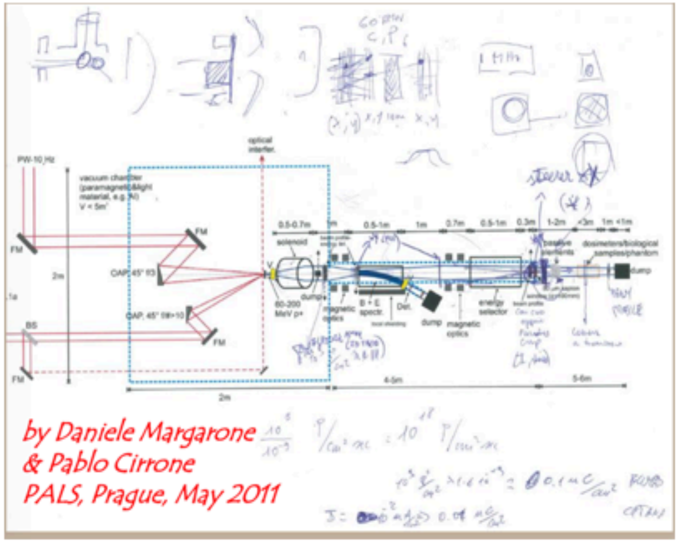
ELIMAIA:

ELI Multisiplinary Applications of laser-Ion Acceleration

- ELIMAIA is an ELI-Beamline facility
- ELIMED ELI-Beamlines MEDical applications
  - is the transport beamline of ELIMAIA will transport and measure laser-driven ions for multidisciplinary applications

ELIMAIA - ELIMED story

2011



2012

Fyzikální ústav
Akademie věd ČR, v. v. i.

INFN

Memorandum of Understanding for a scientific and technologic collaboration towards medical applications at ELI Beamlines

Between the

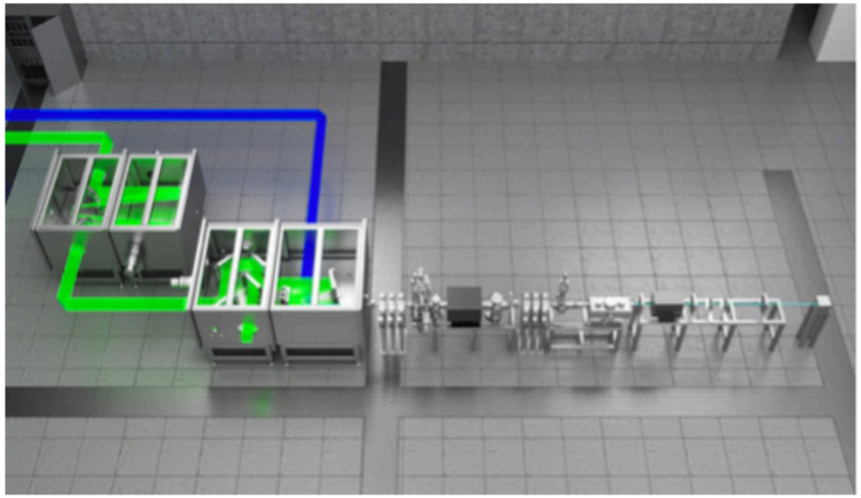
Eli-Beamlines, Institute of Physics of AS CR, public research institution (FZU),
Prague, Czech Republic

Laboratori Nazionali del Sud

4. WORK SUBJECT-MATTER; WORK SCOPE

4.1. The Contract concerns the design, assembling, performance optimization, and delivering to the Client at the Client's Place of Business of a complete transport beamline and a number of dosimetric endpoints that will enable the users to apply laser-driven ion beams in multidisciplinary fields in accordance with this Contract (hereinafter the *"System"*). Furthermore, the scope of this Contract mainly encompasses (i) various training services to be provided to the Client's personnel in compliance with Article 13 of this Contract (ii) a royalty free licence, if any according to Article 14, to use the System for the purposes of the use of the ELI-Beamlines Project after completion and (iii) the possible realization of the Additional System, subject to the exercise of the Call Option right by the Client under par. 4.6 (the System and the other parts of the works/services are hereinafter referred to as the *"Works"*).

2013



-5 DIC. 2014

Signed in Prague on 8/12/2014	Signed in Rome on ________
On behalf of: Fyzikální ústav AV ČR, v. v. i.	On behalf of: INFN, Instituto Nazionale di Fisica Nucleare
Signature:	Signature:
Name: Prof. Jan Řídký, DrSc.	Name: Prof. Fernando Ferroni
Title: the Director	Title: the President

ISTITUTO NAZIONALE DI FISICA NUCLEARE
IL PRESIDENTE
(Prof. Fernando Ferroni)

end 2014

Conclusions

- LNS has a scientific program well defined based on 3 pillars: Nuclear Physics and Accelerators, Km3NeT and Applied Physics.
- LNS has a governing system growing up in a well structured context applying modern concepts of scientific management.
- LNS has not a quality control system. We are starting for doing that!
- LNS requires an increment of personnel for the CS upgrading.

Thank you

INFN LNS