INFN-LNF/Cs CSN5
Continuing R&D Projects

Consiglio di Laboratorio LNF - Preventivi 2018

Simone Dell'Agnello, CSN5 LNF/Cs Coordinator

INFN-LNF – June 30, 2017

CSN5 News

- CSN5 Calls, 5th edition
  - Open to all themes, deadline July 19, 2017
  - Three proposals, presented separately
- CSN5 Grant for young researchers, also 5th edition
  - Deadline July 12
- Next CSN5s
  - Rome (INFN Presidency) July 24-26
  - Firenze Sep. 25-29

Continuing R&D projects

Name	R&D Area	Resp (Nat, Local)	FTE
SL-COMB	Accelerat	E. Chiadroni (N)	7.6
SL-EXIN	Accelerat	G. Di Pirro (L)	2.8
MICA	Accelerat	R. Cimino (N)	4.8
DEMETRA	Accelerat	C. Marcelli (L)	2.1
New Reflections	Interdiscipl	S. Dell'Agnello (N)	3.7
ARDESIA	Detec/Elec	A. Balerna (L)	1.8
E-LIBANS	Detec/Elec	R. Bedogni (L)	1.5
CYGNUS-RD	Detec/Elec	Mazzitelli (L)	1.0
MPGD-Next	Detec/Elec	G. Bencivenni (L)	2.1
VOXES (end: 7/2018)	Detec/Elec	A. Scordo (Grant Y.)	2.0

SL_COMB

Coord. Naz.: E. Chiadroni (LNF)

Sezioni proponenti:

LNF (Resp. Loc.: E. Chiadroni), Roma1 (Resp. Loc.: A. Mostacci), Roma2 (Resp. Loc.: A. Cianchi)

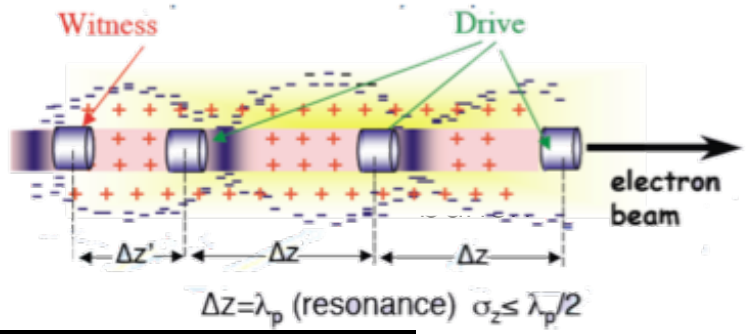
Lecce (Resp. Loc.: A. Lorusso)

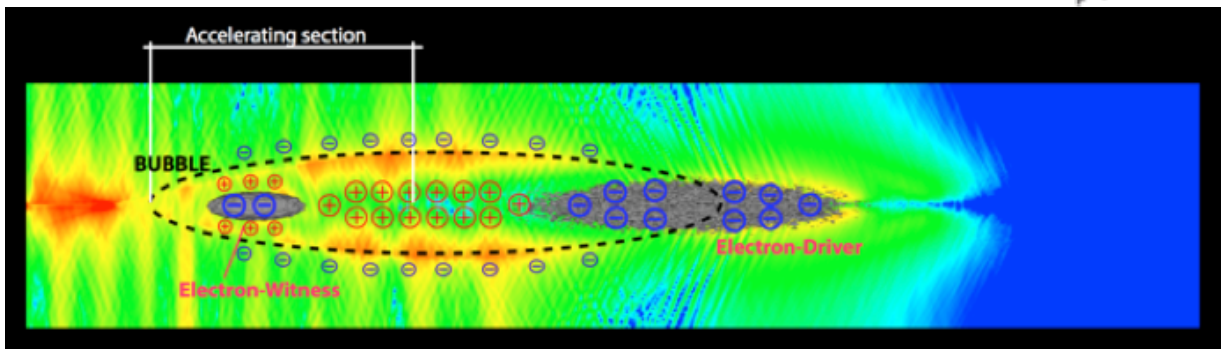
Napoli (Resp. Loc.: R. Fedele)

The Experiment

- The experiment called SL_COMB aims at the acceleration of high brightness electron beams by resonant plasma wakefields

  - A train of driver bunches, separated by a plasma wavelength (~ps time scale), resonantly excite a plasma wake, which accelerates a trailing witness injected at the accelerating phase





- A train of high brightness bunches with THz repetition rate, so-called comb beam, is properly generated at the photo-cathode, and manipulated through the velocity bunching technique, in order to be injected in a H2-filled plasma discharge capillary

Milestones 2018

- Single beam interaction in the plasma => 31-03-2018
- Start-to-end simulations with multi-bunch drivers operation to increase the transformer ratio => 30-04-2018
- Witness energy gain measurement in single driver plus witness interaction into the plasma => 30-06-2018
- Study of beam extraction after plasma acceleration, with the aim of beam quality preservation => 31-07-2018
- Experimental characterization of plasma lenses for beam extraction => 31-10-2018
- Experimental characterization of plasma-based devices for focusing, acceleration and extraction => 31-12-2018

Richieste FTE ai Servizi DA

- Linac 0.2
- Diagnostica
- Magneti 0.2
- RF 0.2
- Vuoto 0.5
- Laser
- Meccanica 0.5
- Impianti
  - Fluidi
  - Elettrici

Richieste Finanziarie alla CSN5

INVENTARIO

- Plasma Diagnostics
  - Acoustic pulse-receivers 10 keuro (iva inclusa)

COSTRUZIONE APPARATI

TOT. 26 keuro

- Unified cover of the plasma chamber
  to host three capillaries (final focus, acceleration and extraction)
  6 keuro (iva inclusa)

CONSUMO

- Capillaries 5 keuro (iva inclusa)

MISSIONI

- Collab. con UCLA/DESY – Conferenze 5 keuro

MICA (2ND YEAR OF 3)
MITIGATE INSTABILITIES IN CIRCULAR ACCELERATORS

- Predict the behaviour of future circular accelerators in terms of beam stability given the increase of beam intensity leading to undesirable collective effects, triggered by self-induced em fields, which may play an important role in the machine performance.
- Put together several competences available at INFN to fully qualify materials to be compliant with operational parameters of such future accelerators.
- Create an INFN network able to completely perform theoretical and experimental studies on collective effects.
- New: (WP7): "Feasibility study of potential use of DAΦNE for advanced R&D accelerator studies"

R. Cimino (Local And National Responsible) **R. Larciprete**, **C. Milardi**, **S. Guiducci**, **M. Zobov**, **D. Alesini**, **A. Di Trolio**, **A. Drago**, **S. Caschera**, **M. Angelucci** (Eurocircol), **L. Gonzalez** (Eurocircol), **E. La Francesca**, **B. Spataro**, **S. Bini**, **A. De Santis**, **A. Lidl**, **V. Lollo.**

17 People involved @ LNF for a total of ~ 4 (6) FTE (4.8 currently in DB)

Maria Rosaria Masullo (INFN-Na, 1.5-2. FTE): Local Responsible

Mauro Migliorati (INFN Rm1 2-2.5 FTE): Local Responsible

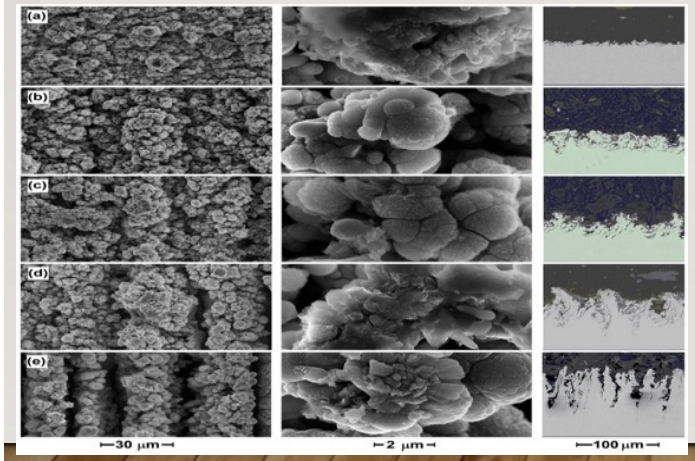
MICA IS ORGANIZED IN WP'S:

WP	TITLE	UNITS INVOLVED	RESPONSIBLE
WP1	Surface properties of Carbon and Cu Surfaces for HL-LHC	LNF-INFN CERN	R. Larciprete
WP2	Vacuum stability at FCC-hh	LNF-INFN CERN	R. Cimino
WP3	Synchrotron radiation material studies	LNF-INFN CERN	R. Cimino
WP4	Impedance simulations and beam dynamics studies	Rome1-INFN Na-INFN CERN	M. Migliorati
WP5	Impedance Study and measurements of materials in real condition	Na-INFN Salerno-INFN Rome1-INFN	M.R. Masullo
WP6	Feedbacks for FCC-ee	LNF-INFN CERN	A. Drago
WP7 New (proposed)	Feasibility study on potential use of DAΦNE for advanced R&D accelerator studies	LNF-INFN CERN RM1	C. Milardi

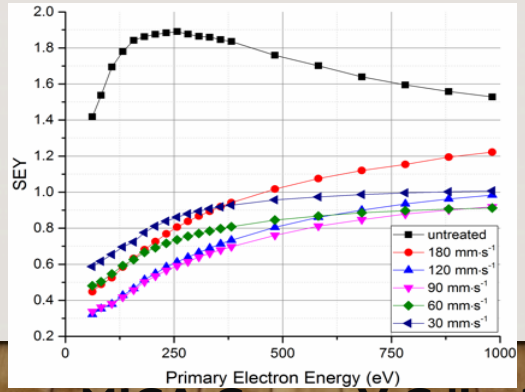
WP7 (new)	Feasibility study of potential use on DAΦNE for advanced R&D accelerator studies	LNF Rome I CERN	C. Milardi

Proposed Activity 2018

- Analyze the ongoing international R&D programs at the forefront of research in advanced particle accelerators
- Study the possibility of using parts of the DAFNE accelerator complex as qualified test bench facility
- identifying 'hot' topics to be investigated with dedicated experiments.
- doing preliminary preparatory tests
- A first already considered activity concerns the newly proposed LASER treated surface to be used as active e-cloud moderator.
- In this context vacuum chamber surface will be: laser treated and qualified in terms of:
  SEY coefficient, desorption properties (also stimulated), impedance etc



laser treatment for e⁻cloud mitigation



MICA: Requests to Comm.V (2018)

WP1 and WP2: Apparata & consumable & Mobility

To upgrade the existing **LT Manipulator** and contribute to a C- electron beam evaporator.

WP3: Consumable & Mobility

To machine tests samples and perform experiments in EU.

WP4: Mobility.

To perform impedance measurements and to take part to relevant meetings.

WP5: Mobility & Consumable. To optimize telescopic set up for impedance measurements and to take part to relevant meetings.

WP6: Mobility

To take part to relevant meetings on Feedbacks systems.

WP7: Mobility & Consumable. To take part to relevant meetings and get new materials to be analysed before testing them in the machine.

DEMETRA (3rd year/3)

DiElectric and METallic Radiofrequency Accelerator

G. Sorbello (LNS)
Coordinatore Nazionale
LNS + 3 unita'
LNF/UniROMA1/Sez.Torino

The project concerns R&D breakthroughs of

Metallic RF Linear Accelerator (WP1)

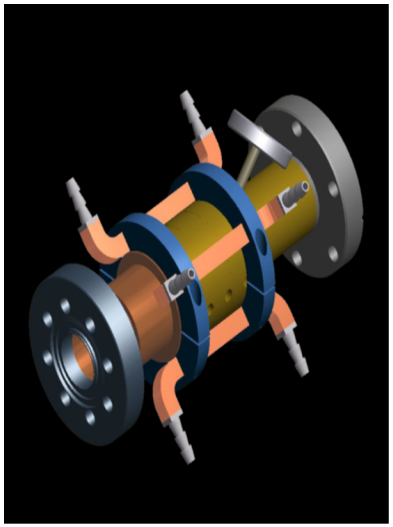
Dielectric Laser Linear Accelerator (WP2)Linear accelerators are better because of the lack of synchrotron radiation emission and the improved emittance and luminosity. Moreover, for future linear accelerators high gradients and compact accelerating structures are necessary.

An efficient acceleration to reduce power consumption is also mandatory.

LNF - Demetra (in progress 2017)

- Completato lo studio e.m. di strutture di tre celle ad elevato gradiente accelerante in geometria "open structure".
- Completato lo studio e.m. di un sistema di alimentazione mediante mode launcher a piu' porte con componente quadrupolare ridotta e relativa rete di distribuzione della potenza
- Studio di coating innovativi (MoO_3, VO_2, etc.) per aumentare la resistenza al breakdown e diminuire la dark current (primi risultati di caratterizzazione – in progress)

Manufacturing Single Cell Standing Wave Accelerating cavity joined by Electron Beam Welding (EBW) for high power test at SLAC, 1C-SW-A2.75-T2.0-EBW-Cu-Frascati-#1



3D model

Before assembly

Pre-welding measurements: Excellent vacuum tightness

Assembled before welding

Manuscripts….. work in progress

[1] V.A. Dolgashev, G. Gatti, Y. Higashi, O. Leonardi, J.R. Lewandowski, A. Marcelli, J. Rosenzweig, B. Spataro, S.G. Tantawi, D.A. Yeremian, High power tests of an electroforming cavity operating at 11.424 GHz, J. Instr. 11 (2016) P03010
[2] G. Gatti, A. Marcelli, B. Spataro, V. Dolgashev, J. Lewandowski, S.G. Tantawi, A.D. Yeremian, Y. Higashi, J. Rosenzweig, S. Sarti, C. Caliendo, G. Castorina, G. Cibin, L. Carfora, O. Leonardi, V. Rigato and M. Campostrini, X-band accelerator structures: on going R&D at the INFN, Nucl. Instr. Meth. Phys. Res. A 829, 206-212 (2016) http://dx.doi.org/10.1016/j. nima.2016.02.061i
[3] M. Migliorati, E. Belli, G. Castorina, S. Persichelli, B. Spataro, M. Zobov, Collective effects issues for fcc-ee, eeFact2016 (in press)
[4] A. Brynes, G. Castorina, O. Frasciello, A. Marcelli and B. Spataro, Studies of geometric wakefields and impedances due to collimators, INFN-16-10/LNF, June 30, 2016
[5] A.D. Cahill, A. Fukasawa, R. Pakter, J.B. Rosenzweig, V.A. Dolgashev, C. Limborg-Deprey, S. Tantawi, B. Spataro, G. Castorina, RF design for the TOPOGUN photogun: A cryo-normal conducting copper electron gun- High Brightness Beam Workshop 2016 (Cuba, l'Avana March 28, 2016) submit to NIM A (2016)
[6] J.B. Rosenzweig, A. Cahill, V. Dolgashev, C. Emma, A. Fukusawa, R. Li, C. Limborg, J. Maxson, P. Musumeci, A. Nause, R. Pakter, R. Pompili, R. Roussel, B. Spataro, and S. Tantawi, Next Generation High Brightness Electron Beams From Ultra-High Field Cryogenic Radiofrequency Photocathode Sources, submit. to Phys. Rev. Special Topics - Accelerators and Beams (2016)
[7] G. Castorina, A. Marcelli, F. Monforte, S. Sarti, B. Spataro, An analytical model for evaluating the properties of metallic coatings, Cond. Matter (2016) doi:10.3390/condmat1010012
[8] Augusto Marcelli, Bruno Spataro, Giovanni Castorina, Wei Xu, Stefano Sarti, Francesca Monforte and Giannantonio Cibin, 'Materials and breakdown phenomena: heterogeneous molybdenum metallic films' Condensed Matter 2, 18 (2017); doi:10.3390/ condmat2020018
[10] V.A. Dolgashev, G. Gatti, Y. Higashi, O. Leonardi, J.R. Lewandowski, A. Marcelli, J. Rosenzweig, B. Spataro, S.G. Tantawi, D.A. Yeremian, 'High power tests of an electroforming cavity operating at 11.424 GHz', Journal of Instrumentation 11, P03010 (2016) doi:10.1088/1748-0221/11/03/P03010
[11] Giovanni Castorina, Augusto Marcelli, Francesca Monforte, Stefano Sarti, Bruno Spataro, 'An analytical model for evaluating the properties of metallic coatings", Condensed Matter 1, 12 (2016) doi:10.3390/condmat1010012, Proceedings 13th Conference on Atomically Controlled Surfaces, Interfaces and Nanostructures ACSIN 2016 (9-14 October 2016) Rome
[12] Alex Brynes, Giovanni Castorina, O. Frasciello, Augusto Marcelli and Bruno Spataro, 'Studies of geometric wakefields and impedances due to collimators', INFN-16-10/LNF, June 30, 2016
[13] G. Gatti, A. Marcelli, B. Spataro, V. Dolgashev, J. Lewandowski, S.G. Tantawi, A.D. Yeremian, Y. Higashi, J. Rosenzweig, S. Sarti, C. Caliendo, G. Castorina, G. Cibin, L. Carfora, O. Leonardi, V. Rigato and M. Campostrini, 'X-band accelerator structures: on going R&D at the INFN', Nuclear Instr. Meth. A 829, 206-212 (2016)
[14] C. Bonavolonta' , M. Valentino, M. de Lucia, M. Ambrosio, C. Aramo, S. Macis, I. Davoli, G. Castorina, F. Monforte, B. Spataro, M. Scarselli, S. Lupi and A. Marcelli, Characterization of the transport properties of MoO3 films on copper', INFN-17-13/ LNF.

DEMETRA

FTE LNF

INFN/LNF	FTE : 2.0	
G. Castorina	100 %	Assegno di Ricerca LNF
G. Della Ventura	40 %	Associato LNF
A. Marcelli	30 %	LNF Primo ricercatore
B. Spataro	30 %	Associato LNF

FTE collaborazione

INFN/LNS	FTE ~ 2
INFN/Sez. Univ. Sapienza	FTE ~ 1
INFN/Sez. Torino	FTE ~ 1

DEMETRA is the first accelerator experiment to be reviewed by the MAC (Variola et al), as a help to the CSN5

New Reflections

Laser retroreflectors/ranging in the whole solar system

CSN5 Interdisciplinary Experiment (2016-2018)

INFN-LNF

S. Dell'Agnello (RN) for the SCF_Lab group

INFN-Napoli

G. Esposito (RL), E. Battista, A. Grado

INFN-TIFPA

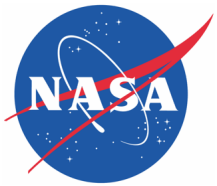
W. Burger (RL), A. Miotello, R. Cecchetto

(3 Tecnici: C. Manea, N. Bazzella, C. Testari)

Preventivi INFN-CSN5 2017

Preliminary
SCF_Lab requests (m.u.) for
NEW-REFLECTIONS (CSN5) &
MoonLIGTH-2/CSN2 (CSN2)

Divisione Tecnica Spcm	6.00
Elettronica	5.00
Impianti Elettrici	1.00
Servizio Criogenia	2.00
Servizio Dt Impianti Fluido	1.00
Servizio Laser	1.00



Laser Microreflector for Asteroids/Comets

COSPHERA = COmet/asteroid SPHErical micro-Reflector Array

Passive, very small/light, omnidirectional, lifetime of decades

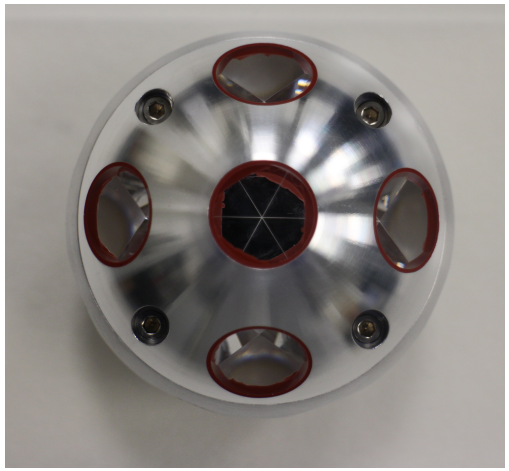
HERITAGE: ExoMars, 1/2”, microreflectors, ~5 cm size, ~75 gr

HORIZON2020 programs:

Space Surveillance and Tracking (SST), Space Situational Awareness (SSA)

Laser-tracking supports retrieval, redirection, deflection (directed forms of energy and interceptors)

Mass/geometry, materials and mechanical model

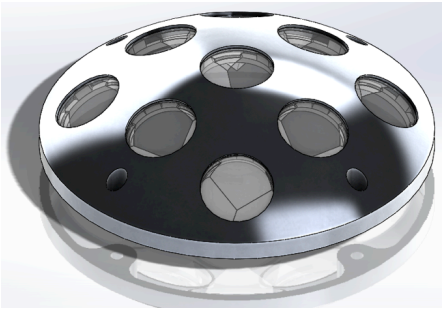


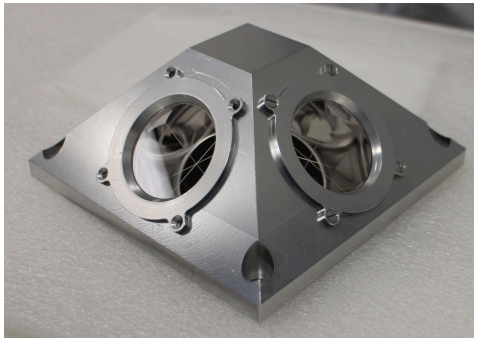
Laser retroreflectors for Phobos/Deimos

- **PANDORA**: Phobos ANd DeimOs laser Retreflector Array
- Reconstruct Phobos-Deimos orbits → focii of orbits is the Mars center of mass → additional test of General Relativity at 1.5 AU
  - PPN g (spacetime curvature), PPN beta
  - Gdot/G (gravitational constant), $1/r^2$ force law at 1.5 AU
- PEP (Planetary Ephemeris Program) of CfA
- Physics reach: similar to INRRIs on Mars
- Next: constrain Non-Minimally Coupled gravity or "$f_1(R)+f_2(R)$", replacing dark matter/energy

Phobos/Deimos surface reflectors

- PANDORA: Phobos ANd DeimOs laser Retroreflector Array
  - Reconstruct Mars center of mass to improve test of General Relativity and of non-minimally coupled (NMC) gravity
- GR test improvements with an MGN in the long term:
  - PPN gamma (Sun-Mars); try also beta (Sun-Mars-Jupiter)
    - Shapiro time delay with Viking landers in the 1970s
  - Gdot/G, $1/r^2$ law at 1.5 AU
  - SW: PEP (Planetary Ephemeris Program) by Shapiro, Chandler
  - Ex. Improvement over current Mars ephemeris ~100-50 m





INRRI: Time/Accuracy	Accuracy on β-1	Accuracy on γ-1	Accuracy on $\dot{G}/G$
10 years / 10 m	1.7 x E-04	7.2 x E-04	3.8 x E-14
10 years / 1 m	3.7 x E-05	1.6 x E-05	1.4 x E-14
10 years / 10 cm	7.4 x E-07	3.2 x E-06	2.9 x E-15
Best accuracy now Data *Analysis group*	**1 x E-04** Lunar Laser Ranging *JPL, Harvard-INFN*	**2.3 x E-05** Cassini *Bertotti et al*	**9 x E-13** Lunar Laser Ranging *JPL, Harvard-INFN*

ARDESIA

ARRAY of DETECTORS for SYNCHROTRON RADIATION APPLICATIONS

Goal: Development of a modular detector based on arrays of Silicon Drift Detectors (low-noise, high resolution and count rates) for X-ray synchrotron radiation applications.

The ARDESIA collaboration

- Politechnico and INFN-Milano, Italy
- INFN-LNF, Frascati, Italy
- Fondazione Bruno Kessler – FBK, Trento, Italy

2015

- design and production of SDD arrays and readout electronics
- development of the project of the first basic detection module (4 channels)

2016

- realization of the mechanical and vacuum parts of the 4 channels detector (started)
- electronic tests of the first 4 channels SDD detection modules (on going)
- test with conventional sources (on going) and with synchrotron light at LNF

2017

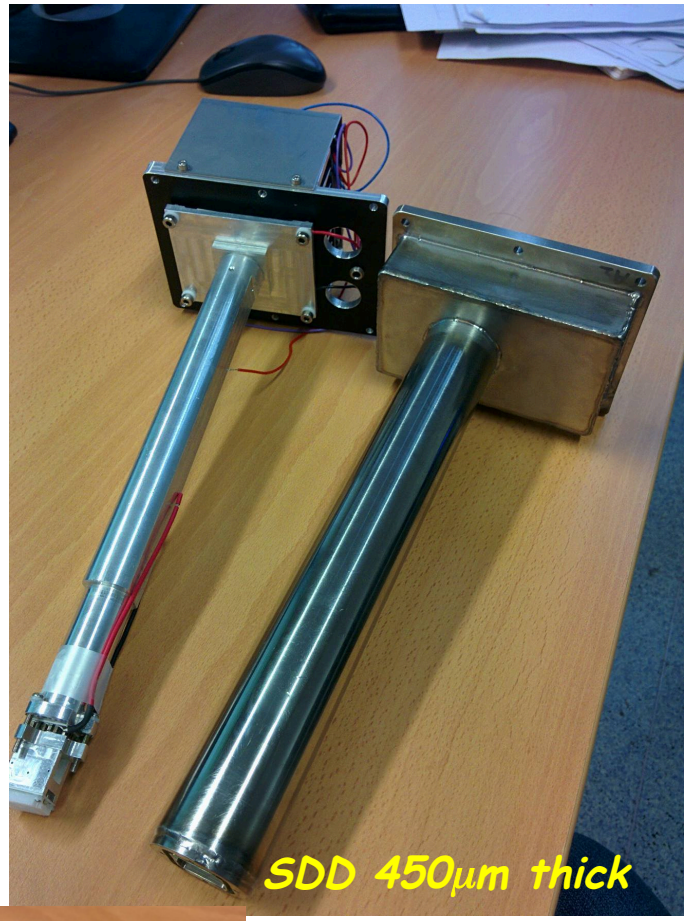
- experiments with the synchrotron light at LNF and ESRF
- new production of SDDs (with thicker silicon - 1mm)
- development of detectors based on more modules

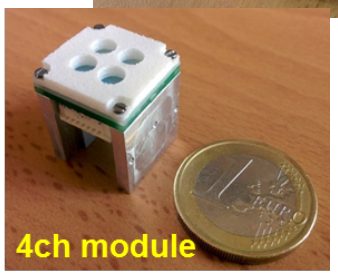
2018 1 year extension for new 4x4 detector characterization and developments

Project funded by INFN CSN5 (2015-2017)

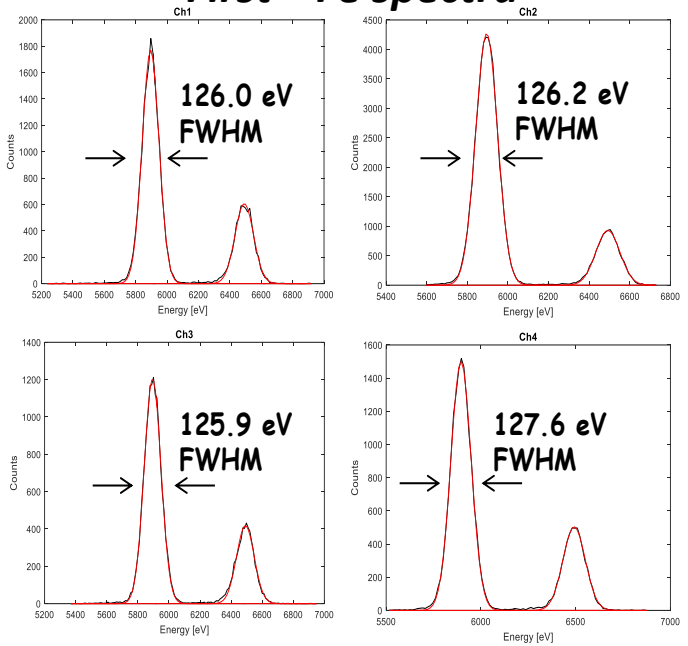
http://ardesia.lnf.infn.it/index.php/en/

ARDESIA SDD detector

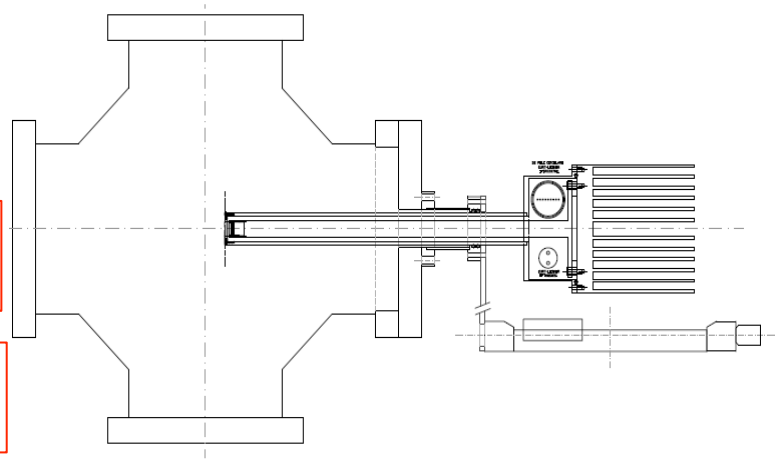




First ^{55}Fe spectra



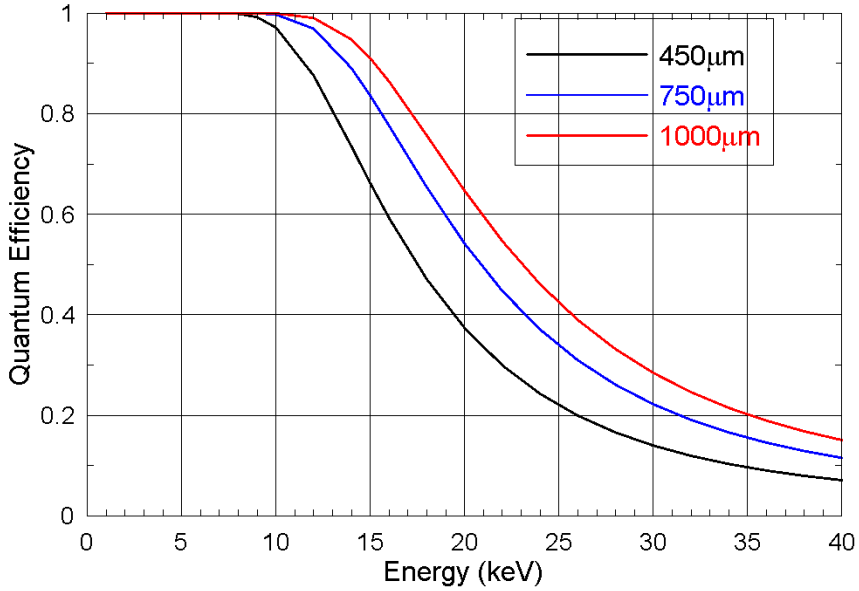
4×25mm² area, 1.6 μs peaking time, T=-29°C



Installation on the experimental SR chamber

First tests at DAΦNE between the end of June and July 2017

Development of thicker SDDs to increase the efficiency over 15 keV

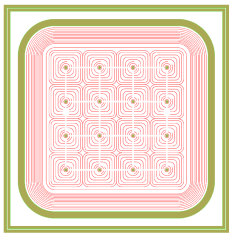


Development of thicker 2 x 2 SDDs matrix and new 4x4 SDDs matrix.

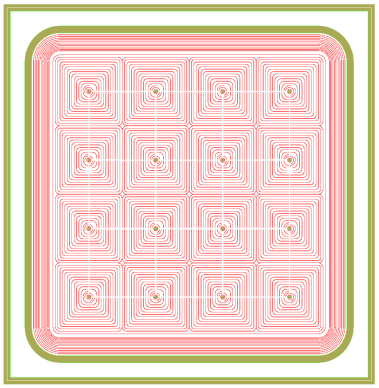
CSN5 – SJ funds given at the end of May 2017- More time needed realize new SDD and to perform tests.

Upgrade to 16 channels SDDs matrix

New 4x4 SDD chips expected to fit into actual 2x2 ARDESIA detector

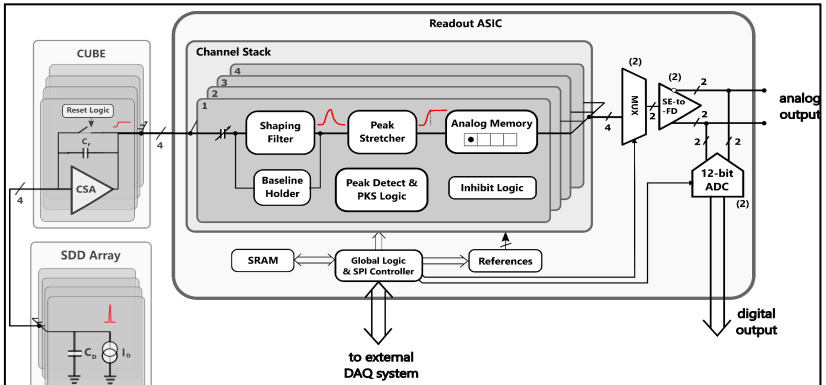


4x4 (1mm² SDD)

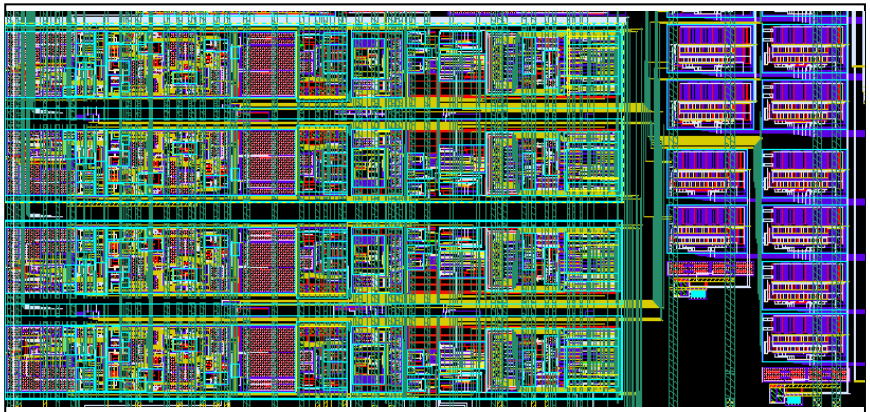


4x4 (4mm² SDD)

Run for new ASIC system



ASIC block diagram.



Layout of the 4-channel block of the ASIC prototype.

CSN5 – SJ funds given at the end of May 2017- More time needed realize new SDD and to perform tests.

- **INFN-Milano (Carlo Fiorini, Resp.Naz.)**

Ruoli e compiti: modulo di rivelazione, elettronica integrata, sviluppo del DAQ, supporto alla sperimentazione nelle applicazioni, misure di spettroscopia e supervisione del disegno e della produzione di matrici di rivelatori Silicon Drift Detectors.

- **INFN-LNF (Antonella Balerna, Resp. Locale).**

Questa unità comprende : DAFNE-Luce

Ruoli e compiti: contributo alla realizzazione del rivelatore parte vuoto e maschere, sperimentazione rivelatori per spettroscopia X (bassa temperatura, stabilità linearità, bassa radioattività, ecc.), istallazione di moduli di rivelazione presso le linee di luce di sincrotrone DXR1 (LNF) e LISA (ESRF) e conduzione di esperimenti di caratterizzazione.

- **INFN-TIPFA (Claudio Piemonte, Resp. Locale)**

Ruoli e compiti: produzione delle matrici di rivelatori Silicon Drift Detectors presso FBK a Trento.

Partecipazione LNF nel 2017

A. Balerna (Primo Ricercatore)	0.8FTE
S. Mobilio (PO)	0.9FTE
C. Vaccarezza (Primo Tecnologo)	0.1 FTE
Totale	**1.8 FTE**

Richiesto il supporto del Servizio Luce Di Sincrotrone coinvolto nel progetto ARDESIA- rivelatore per applicazioni linea DXR1-Soft X DAFNE-L.

Richiesta fondi 2018 parte LNF

Missioni – 4 kEuro 2 persona 2 viaggi 1 settimana (misure test ARDESIA (ESRF))

Consumo – 4 KEuro modifiche camera misura e per installazione nuovo rivelatore 4x4

Inventario – in attesa di offerte di schede per Digital Data Processing per sistema 4x4

CL Preventivi
30 Giugno 2017

e_LiBANS

e_Linac Based Actively-monitored Neutron Sources

2016-2018

Acceleratore Elekta SL 24 MV + complesso foto-convertitore e moderatore termico

In collaborazione con DF-UNITO e ELEKTA spa

ANNO 2018

LNF (2 FTE)

R. Bedogni (R. Loc.) 0.5 FTE
O. Sans (Ass.) (0.5 FTE)
M. Treccani (Ass.) (0.5 FTE)
J.M. Gomez-Ros (Ass.) 0.5 FTE

Torino (≈ 4 FTE) Resp. Naz. M. Costa
Milano (≈ 1 FTE) Resp. Loc. A. Pola
Trieste (≈ 1 FTE) Resp. Loc. G. Giannini

E_LIBANS

Premesse

Il Dipartimento di Fisica Univ. di Torino ha messo a disposizione un bunker + sala controllo per ospitare un Elekta SL 24 MV (e-linac ospedaliero *usato e ricondizionato*)

Obiettivi

•Progettare, realizzare DUE convertitori (γ,n) - moderatori che, accoppiati alla testata del e-Linac, permettano di ottenere campi intensi (> 10^7 cm^{-2} s^{-1}) di neutroni termici (convertitore termico) ed epitermici (convertitore EPI-termico).

•Sviluppare e caratterizzare diagnostiche attive di neutroni termici ed epitermici (radiation hard, gamma insensitive, space resolved), per equipaggiare i convertitori.

•Eseguire la caratterizzazione metrologica dei campi prodotti, in spettro e quantità radiometriche / dosimetriche, al fine di poter offrire condizioni di test-beam molto ben conosciute.

Users potenziali

Settori industriale, aerospazio, bio-medico, beni culturali

E_LIBANS

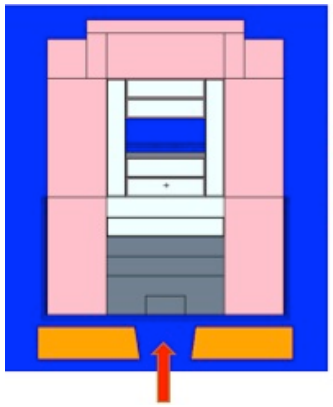
Attività

Completate 2017

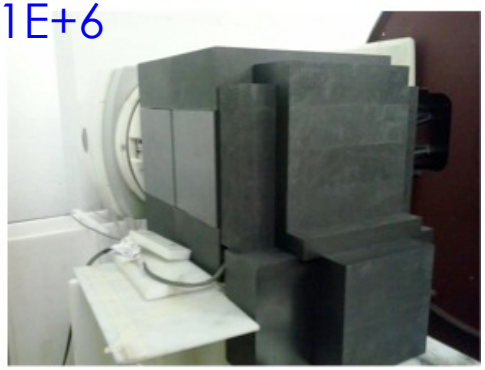
- ✓ **Testata termica "di fattibilità" da 1E+6 $cm^{-2}s^{-1}$**
  Realizzata, collaudata, misure neutroniche completate in termini di fluenza termica e spettro energetico
- ✓ **Diagnostiche neutroniche radiation resistant (Task LNF)**
  Standardizzate e calibrate: TNRD, SiC, vented ion chambers
- ✓ **Risultati presentati a NEUDOS13 (Maggio 2017)**

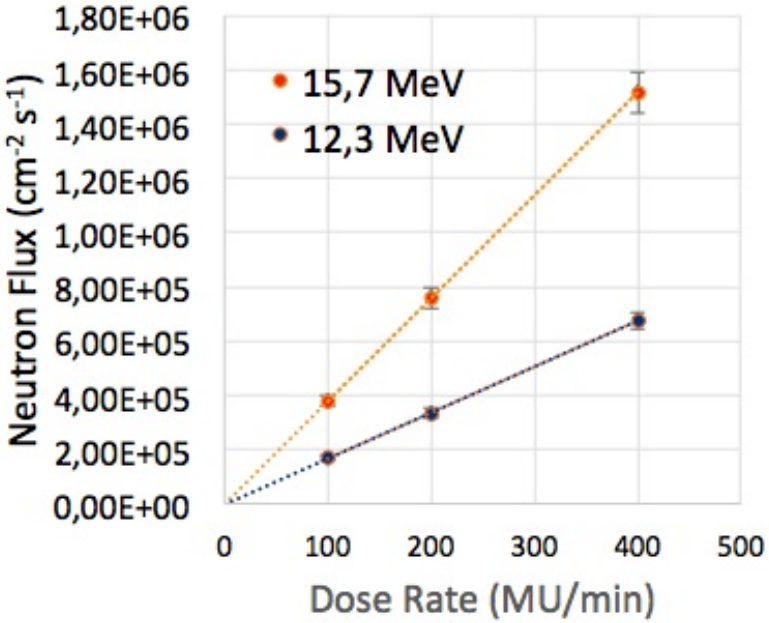
In progress 2017

- ✓ Testata termica alto flusso
- ✓ Progettazione testata epitermica



Testata 1E+6





Attività previste 2018

- Disegno e realizzazione testata epitermica
- Messa a punto diagnostiche epitermiche (Task LNF)

E-LIBANS Frascati, Richieste 2018

Alla CSN 5 16 k€

6 k€ Missioni
10 k€ Consumo

Ai SERVIZI LNF (one-year basis)

2 MU Officina meccanica
2 MU Reparto Progettazione e stampa 3D

E_LIBANS

CL Preventivi
30 Giugno 2017

CINE

Compact system for Industrial Neutron Radiography

Proposta di grant CSN5

Proponente: Angela di Fulvio

(Attualmente Assistant Res. Scientist – Univ. Michigan)

Unità LNF	A. DI Fulvio, R. Bedogni, O. Sans (Ass.), M. Treccani (Ass.)
Ente esterno 1	ENEA Frascati Fast Neutron Generator, A. Pietropaolo
Ente esterno 2	UniMichigan, Prof. S. Pozzi

Premessa: la radiografia a neutroni termici è fondamentale in campo industriale ma è limitata a grandi impianti con costi elevati ed accesso limitato (reattori, acceleratori)

Obiettivo: Grazie a

- Le nuove geometrie di termalizzazione dei neutroni già sviluppate in NEURAPID (e caratterizzate da una migliore efficienza di trasporto rispetto a quelle tradizionali)
- L'impiego di una macchina compatta (e-LINAC oppure generatore di N portatile)

si intende realizzare un prototipo di moderatore, collimatore e sistema di immagine da applicare a impianti esistenti (presso enti collaboranti) per dimostrare la fattibilità di una radiografo neutronico "portatile, da impianto" ad elevata fruibilità.

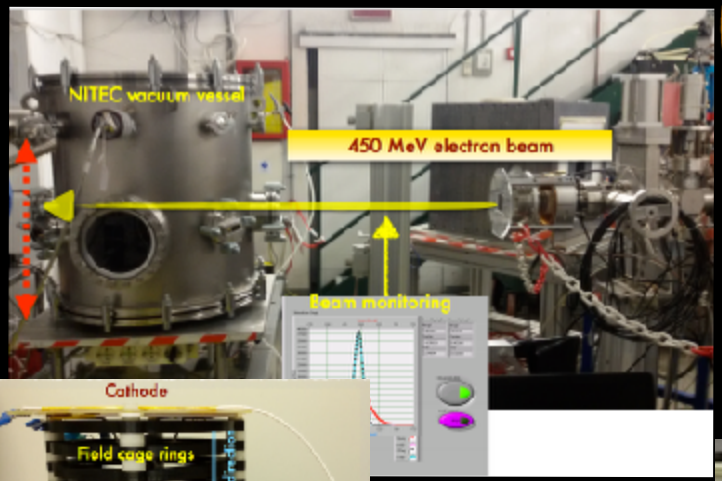
Richieste ai LNF

1 MU Officina meccanica

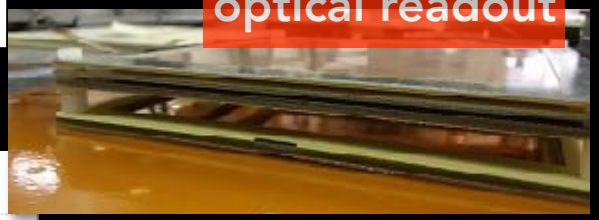
1 MU Reparto Progettazione e stampa 3D

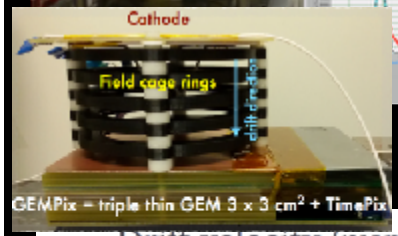
CYGNUS-RD: SVILUPPO DI UNA TPC PER LA RIVELAZIONE DI MATERIA OSCURA

in production

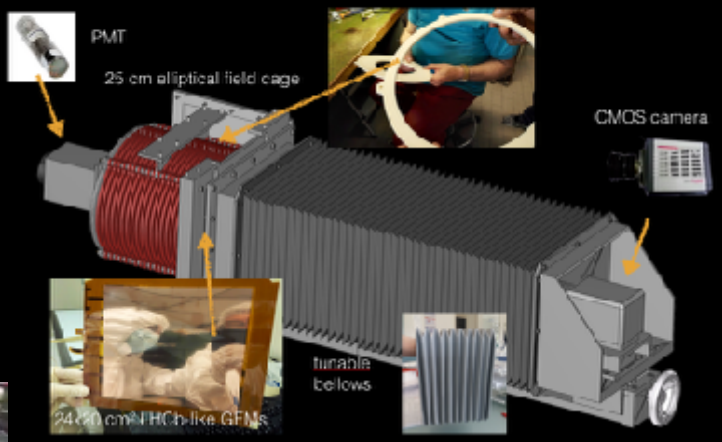


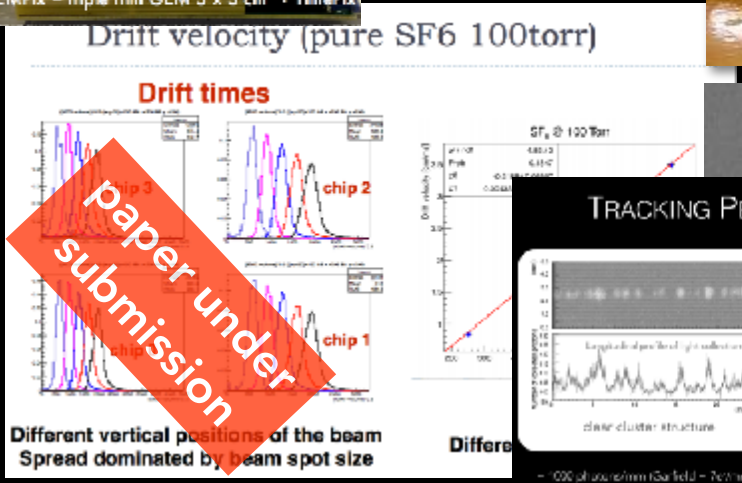
progress in optical readout



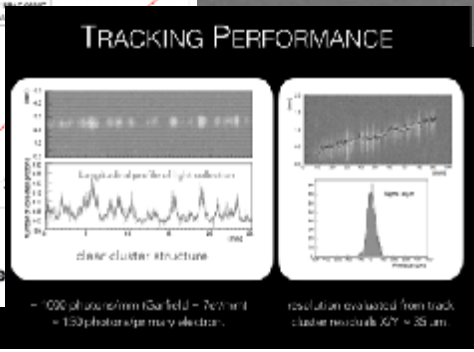


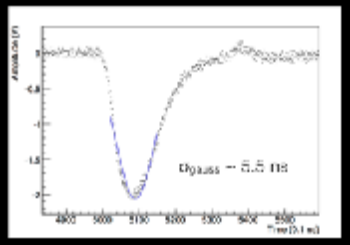
THE 0.2 PROTOTYPE

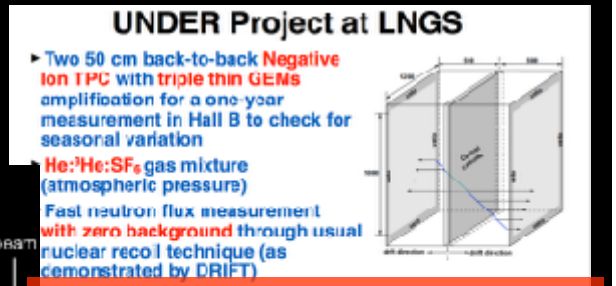




paper under submission







audition @ CSN2 in Jul.
audition @ LNGS in Oct.
proposal for 2019

ATTIVITÀ PREVISTA NEL 2018

— Test intensivi del prototipo con volume di 30 litri con:

- neutroni;
- fasci di mip al CERN;
- fasci di protoni o ioni (Trento, CNAO);
- Ion gun - Comimac (Grenoble);
- Facility di $1m^3$ per vari readout (kamioka);

— (RM1) Studio diverse miscele di gas basate su SF_6, CF_4, He e dell'effetto di impurezze (O_2, H_2O…);
— (RM1) Simulazione gas ed interazioni particelle pesanti;
— (LNF) Integrazione sistema di monitoraggio del gas;
— (LNF) Sviluppo del sistema di acquisizione;

CHI SIAMO (2018)

Per ora sono coinvolte nel progetto persone dalle sezioni di RM1 e LNF

RM1	PINCI (RN, RL)	0.3 FTE	1.5 FTE
	CAVOTO	0.2 FTE	
	RTD (*)	0.2 FTE	
	DI MARCO	0.2 FTE	
	RENGA	0.3 FTE	
	VOENA	0.2 FTE	
	MARAFINI	0.1 FTE	
LNF	MAZZITELLI (RL)	0.8 FTE	1.0 FTE
	TOMASSINI	0.2 FTE	
	BARACCHINI	0.0 FTE(*)	

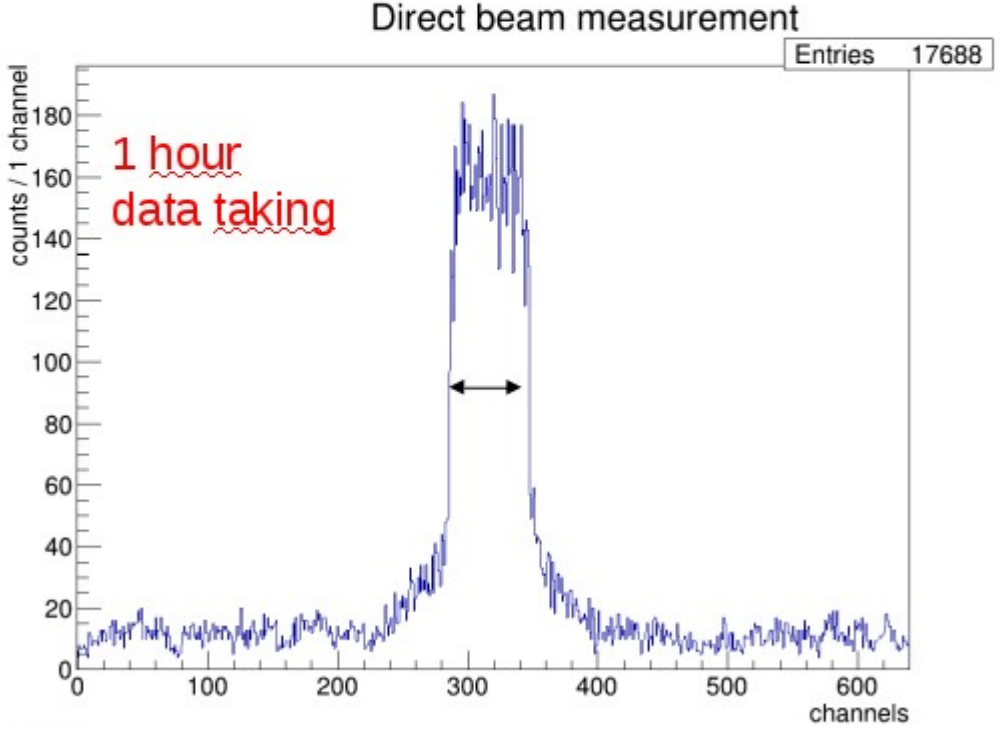
RICHIESTE 2018

	LNF		Tot
Missioni	Test ioni/neutroni + meetings + Conferenze	7 k€	7 k€
Consumo	Fornitura gas	3 k€	15 k€
	Prototipo & vessel upgrade	2 k€	
	Integrazione sistema di monitoraggio del gas	10 k€	
Inventariabile	Digitalizzatori e logica	5 k€	5 k€
			27 k€

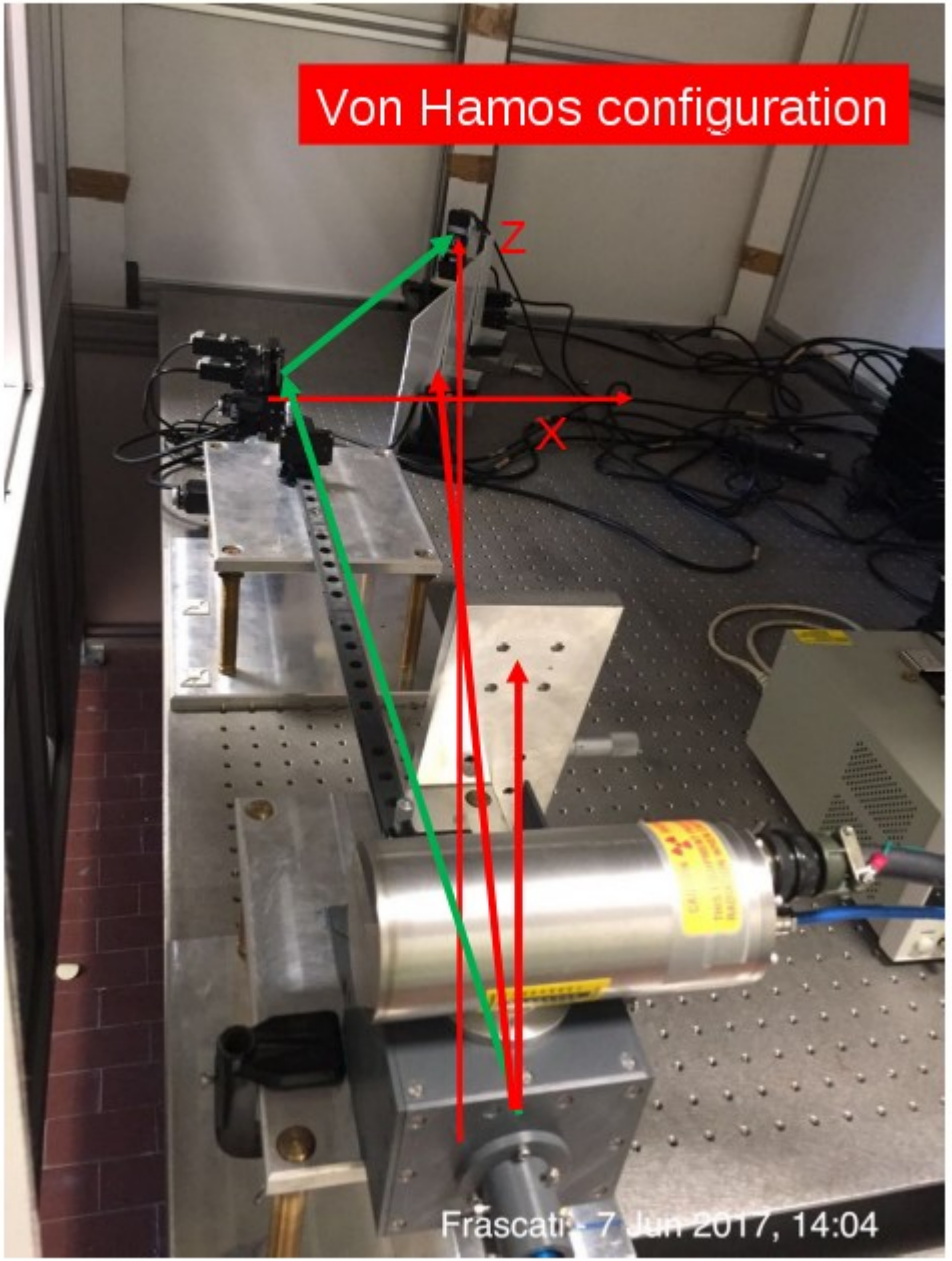
First spectrum with Cu Kα lines

First measurement conditions:

206,7 mm ρ, 100 μm thickness, 9.6 cm^2 surface
XZ opening angle : $\Delta\theta = 0.2°$
Beam on HAPG is 3 mm (X spread)
$\theta_B = 13.28°$ ($K\alpha_1$ line = 8047,78 eV)

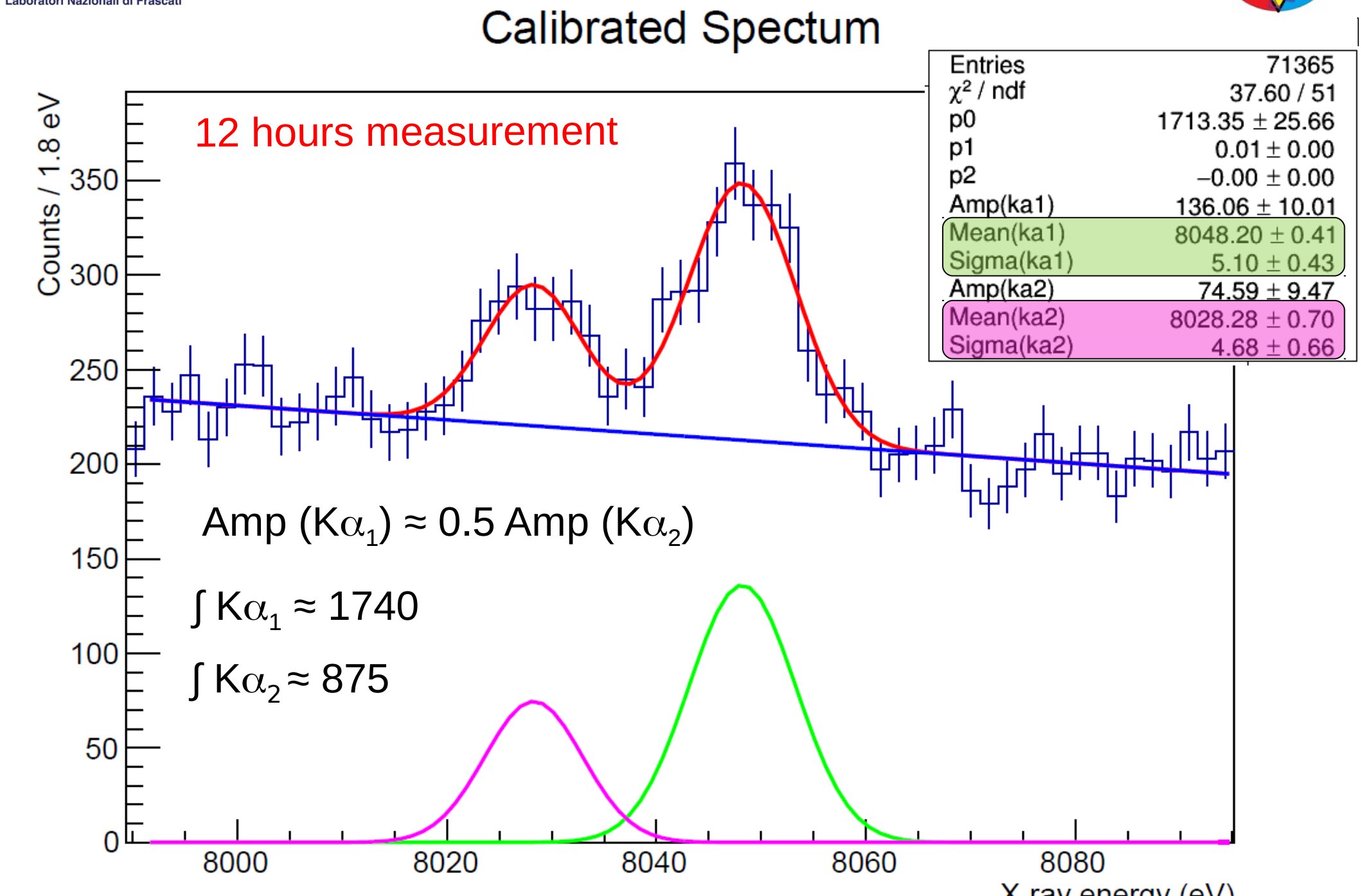


X spread ≈ 60 channels
(60 x 50 μm = 3 mm)



INFN Istituto Nazionale di Fisica Nucleare
Laboratori Nazionali di Frascati

First spectrum with Cu Kα lines (before alignment optimization)



First spectrum with Cu Kα lines (after alignment optimization)