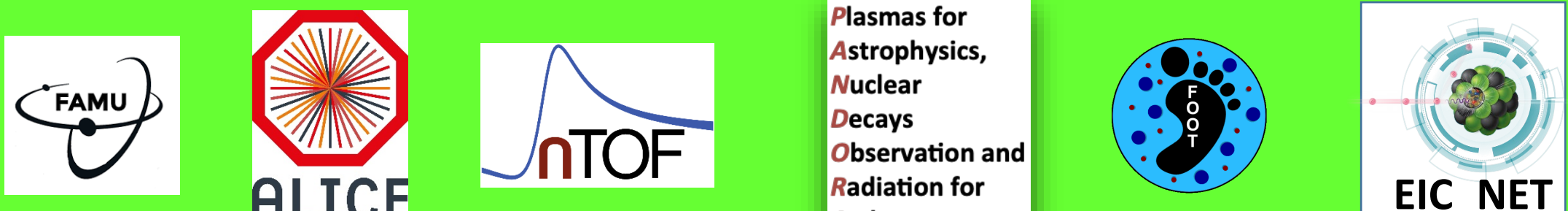


GRUPPO 3: AdS 14/7/2020



FAMU

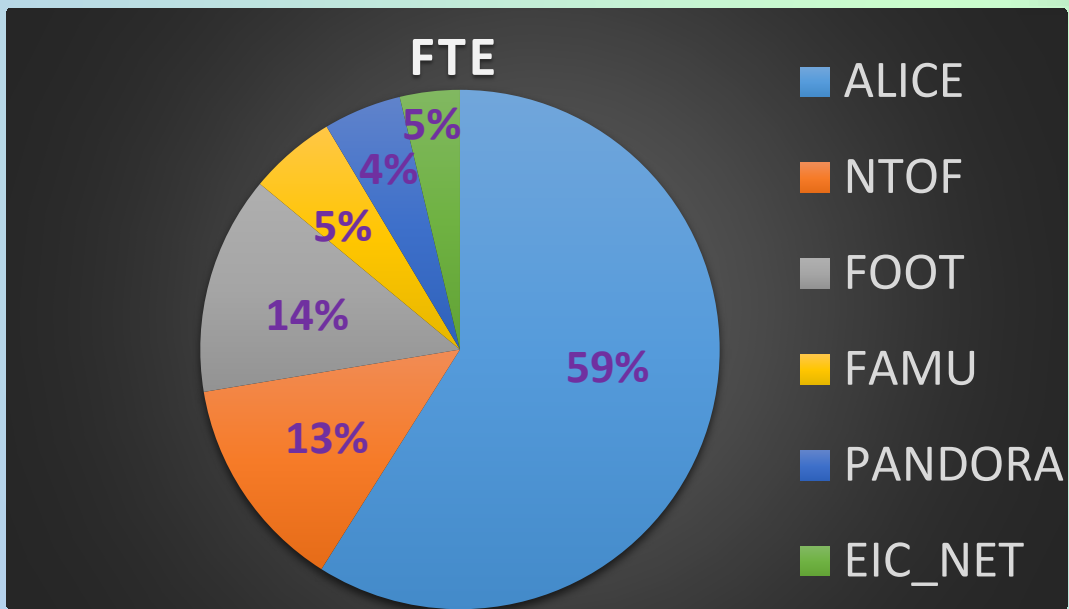
ALICE

NTOF

**Plasmas for
Astrophysics,
Nuclear
Decays
Observation and
Radiation for
Archaeometry**

FOOT

EIC_NET



FTE: 26.8 (2020 27.85)
PERSONE (INFN, UNIV, ENEA): 76

Prof. Mauro Bruno

Un sincero ringraziamento

Una colonna del Gruppo 3: dal 1970 (anno della laurea) fino alla fine

Ricerche in Fisica Nucleare Sperimentale

- ❑ Fissione
- ❑ Fusione
- ❑ Termodinamica nucleare
- ❑ Effetti di clustering
- ❑ Meccanismi di reazione per nuclei pesanti
- ❑ Reazioni nucleari a pochi corpi

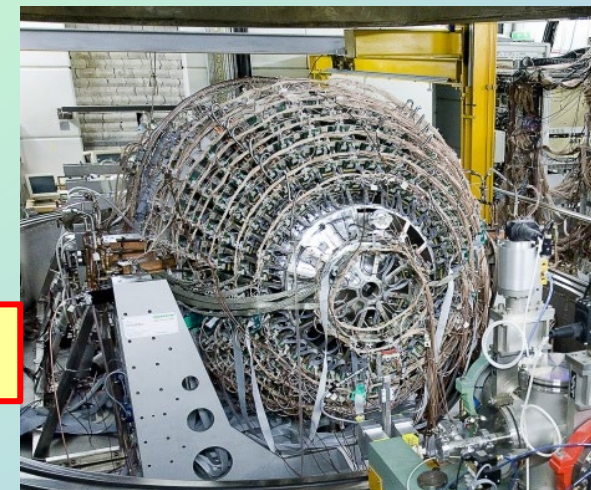
Garfield (InI)



Fazia



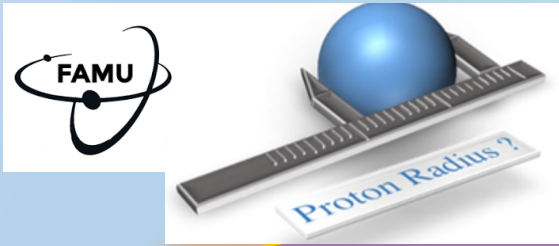
Chimera (Ins)



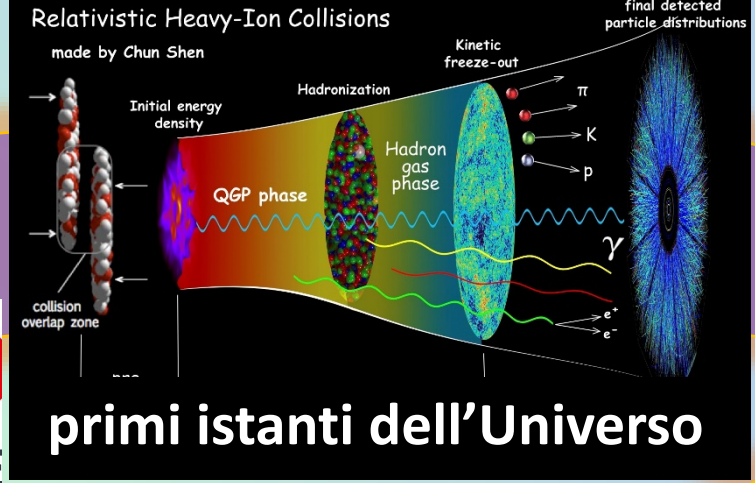
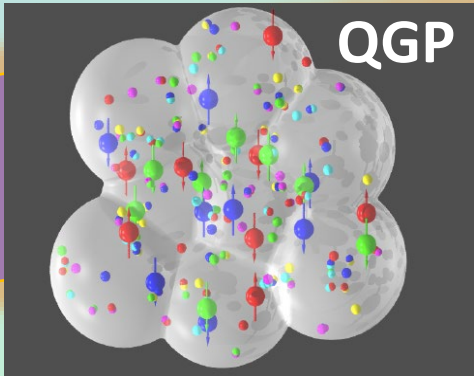
Uno dei fondatori della collaborazione Nuclex

Intensa attività didattica e di formazione di giovani per la fisica nucleare (39 tesi e 8 dottorati)

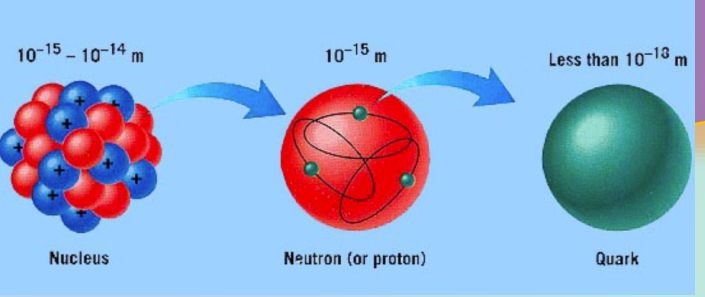
Non disperdere quello che una generazione ci ha lasciato



GR3 a Bologna



primi istanti dell'Universo

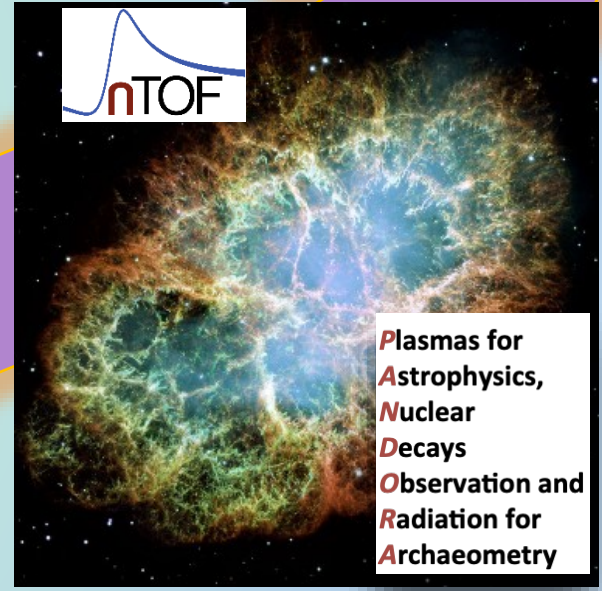


Fisica nucleare ad ampio spettro

- Fisica nucleare di base
- Struttura nucleare
- Transizioni di fase
- Livelli iperfini H

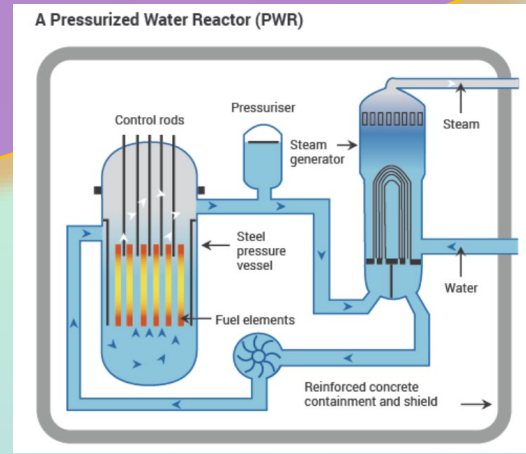
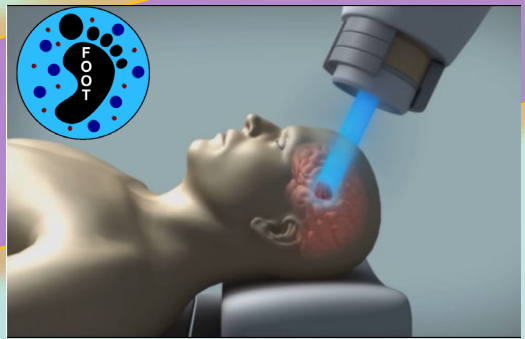
Astrofisica nucleare

- Evoluzione stellare
- Nucleosintesi



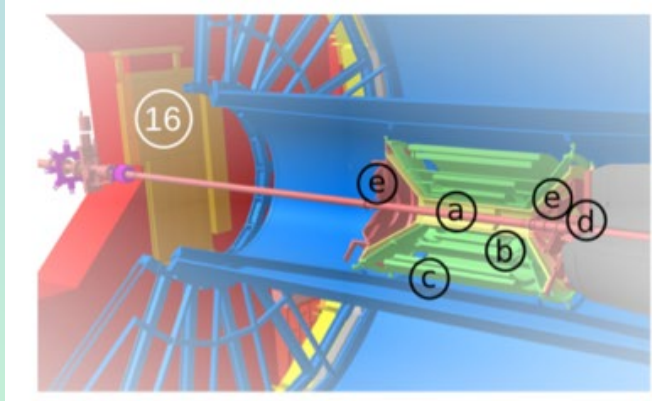
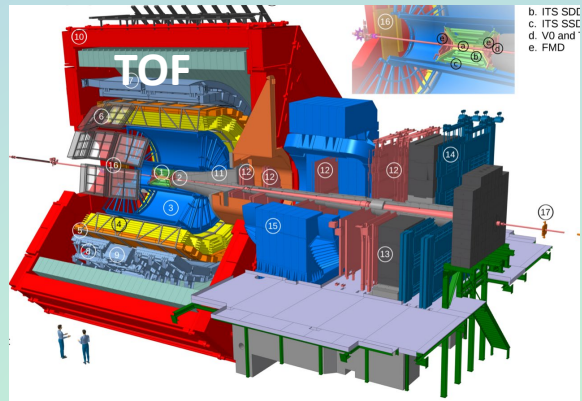
Next QCD frontier

- e^- ion collider



Scopi applicativi

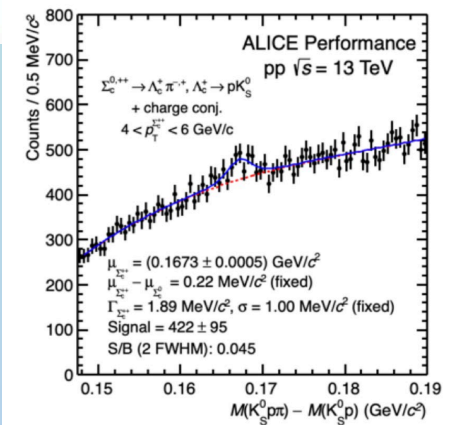
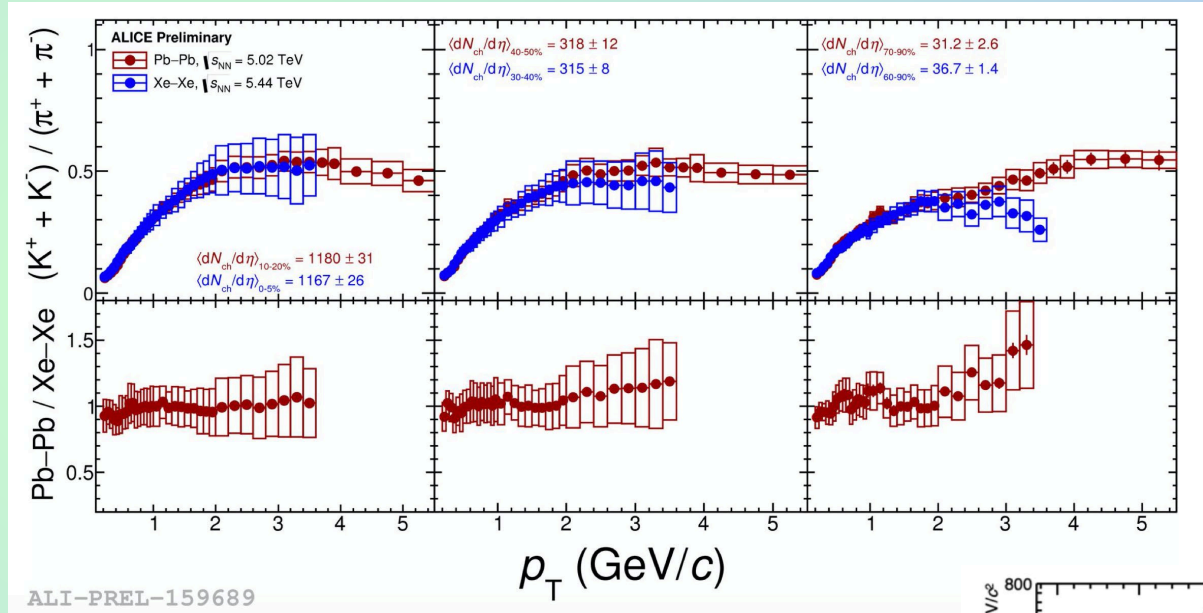
- reattori
- Adroterapia
- Radioprotezione



- a. ITS SPD (Pixel)
- b. ITS SDD (Drift)
- c. ITS SSD (Strip)
- d. V0 and T0
- e. FMD

Attività (update febbraio 2020):

- Rivelatori
 - TOF
 - ITS (Inner Tracking System)
 - R&D
- Analisi (7 papers previsti in 2020)
 - Light & heavy Flavour
 - studio spettri identificati in Xe-Xe
 - canale $\Sigma_c^{++} \rightarrow \Lambda_c^+ \pi^+$, $\Lambda_c^+ \rightarrow pK_s^0$
 - Alice white paper
 - Produzione Λ_c e $\Lambda(1520)$
 - <https://agenda.infn.it/event/21942/contributions/111035/attachments/70833/88595/AdS-ALICE-20200220.pdf>



Bologna:

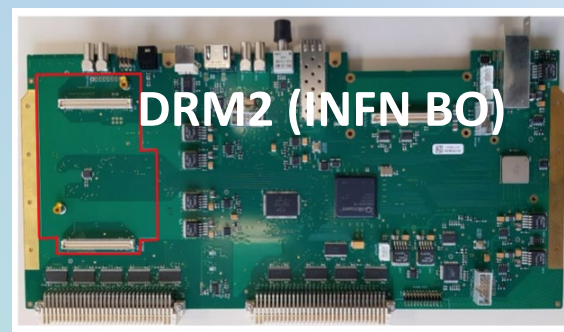
- 15 staff:(4 UniBo, 10 INFN, 1 ENEA) → 15.8 FTE (16.8 in 2020)
- 3 post doc, 3 PhD, 2 Cern Fellows, 2 Master students
- Servizi (elettronica, STG, off. Meccanica,...) grandissimo lavoro!!!



TOF

ALICE

- ❑ Estrazione dei moduli
- ❑ Irradiazione a Trento
- ❑ Sviluppi FW e SW nonostante lockdown
- ❑ Upgrade da remoto Slow Control
- ❑ Installazione (un po' ritardata) schede DRM2



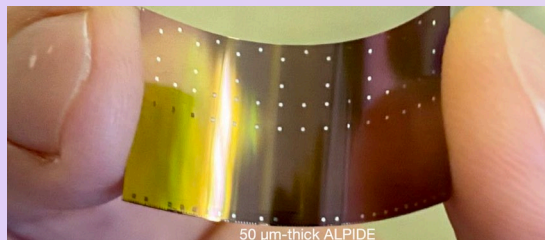
From alice-newsletter (ALICE newsletter) <alice-newsletter@cern.ch> ☆
 Subject The ALICE Newsletter No. 111
 To alice-member (ALICE Collaboration Database Employment Record) <alice-member@cern.ch> ★
 Cc ALICE Spokesperson <alice.spokesperson@cern.ch> ★

03/07/2020, 16:10

• **TOF: the last 2 DRM2 were successfully installed this week. The installation of all 72 TOF crates, with DC/DC and new DRM2 card (housing GBTx link) is finally complete.** This marks the end of a huge effort, lasted for many years, which involved several TOF colleagues in developing new electronics and related firmware & software, doing irradiation tests (either for DRMs or DC/DC components), commissioning of cards, and in the tiring work of dismounting/mounting cards in the pit.

ITS3

- ❑ layer Si (20-40 μm) per LS3



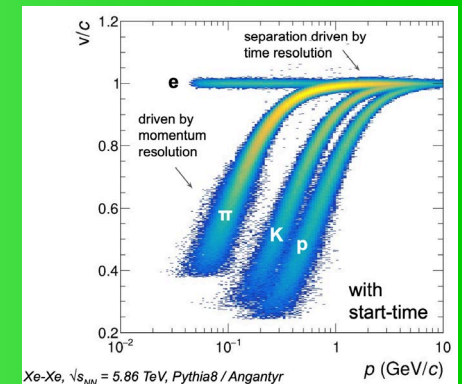
R&D (in ambito AIDA Innova, da approvare)

- ❑ **MRPC** Multigap Res Plate Chamb
 - ❑ materiali \rightarrow risoluzione t
- ❑ **Pico TDC** \rightarrow risoluzione 3 ps (ora \sim 20 ps)



Alice 3.0 (post LS4)

- ❑ Studio timing



FAMU

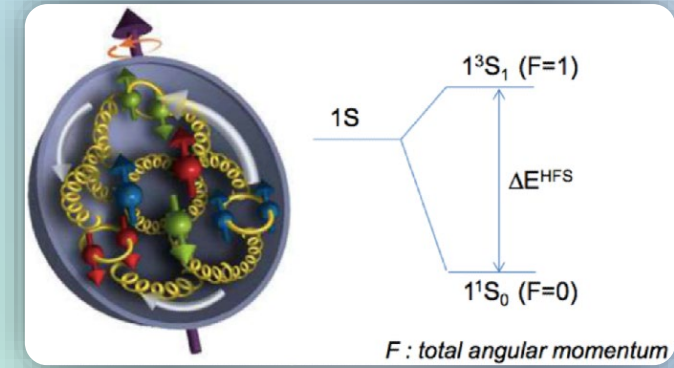
Misura del raggio di Zemach del protone (sensibile sia alla struttura elettrica che magnetica) attraverso la spettroscopia γ del livello iperfine 1s dell'**atomo muonico**

$$m_{\mu} \cong 200m_e$$

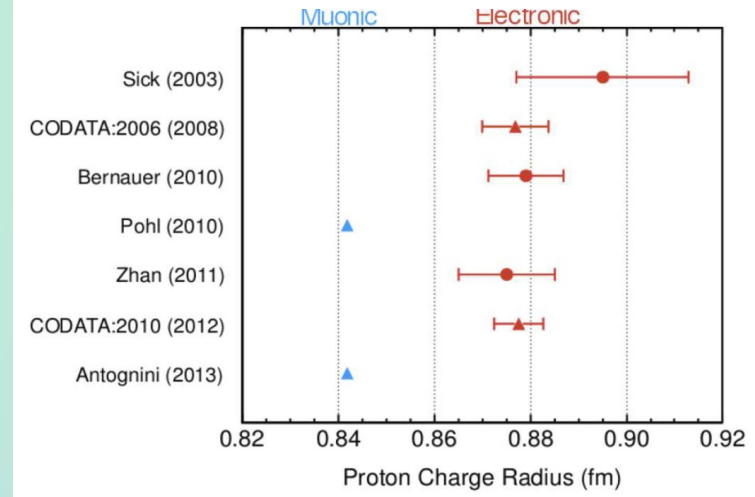
$$r_{\mu} \cong \frac{1}{200} r_e$$



più sensibile alla struttura del protone

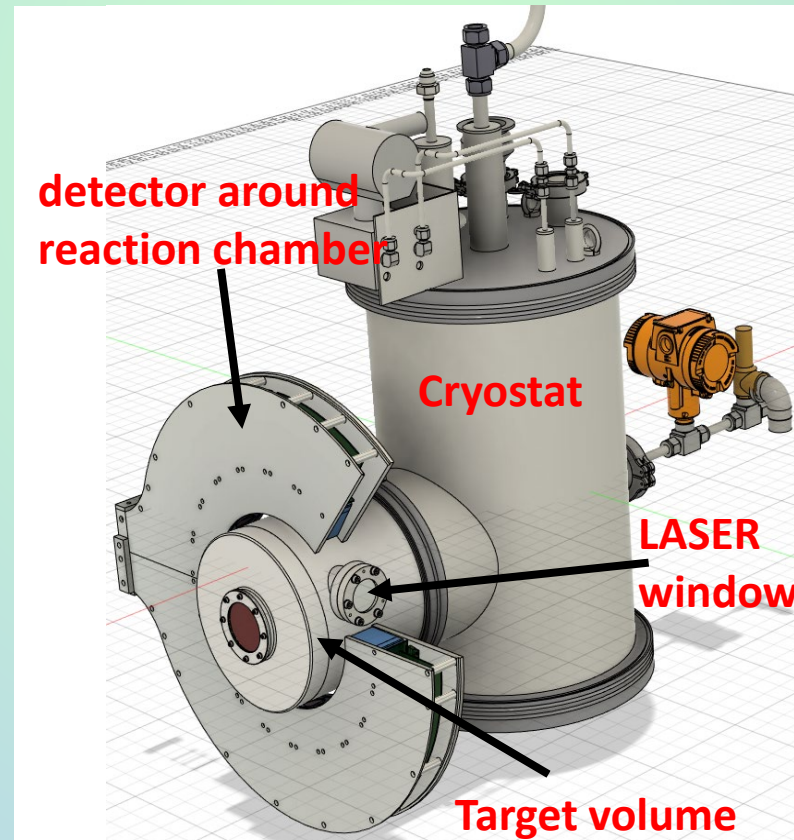


Puzzle del raggio del protone

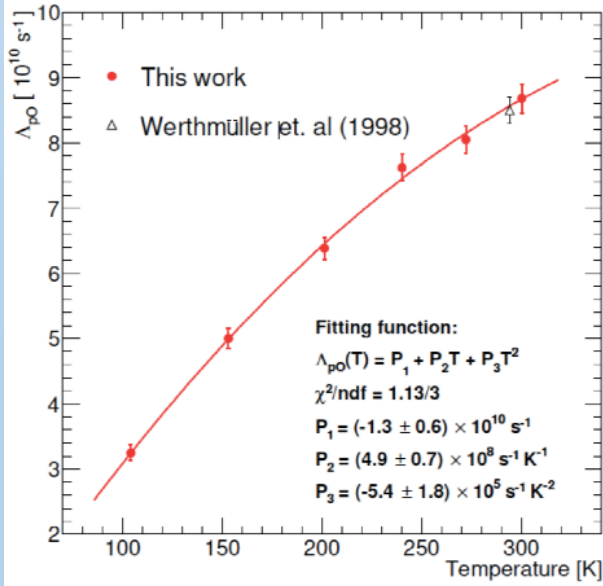


Procedura:

- ❑ miscela H e O
- ❑ $\mu p(\uparrow \downarrow)$
- ❑ Laser $\rightarrow \mu p(\uparrow \uparrow)$
- ❑ μp catturato da O \rightarrow emessi γ
- ❑ Misura tempi dei γ emessi da O



μ transfer rate $\mu_H \rightarrow \mu_O$ in
funzione di T e E_{kin}



Bologna:

❑ Ricercatori 6, FTE=1.45

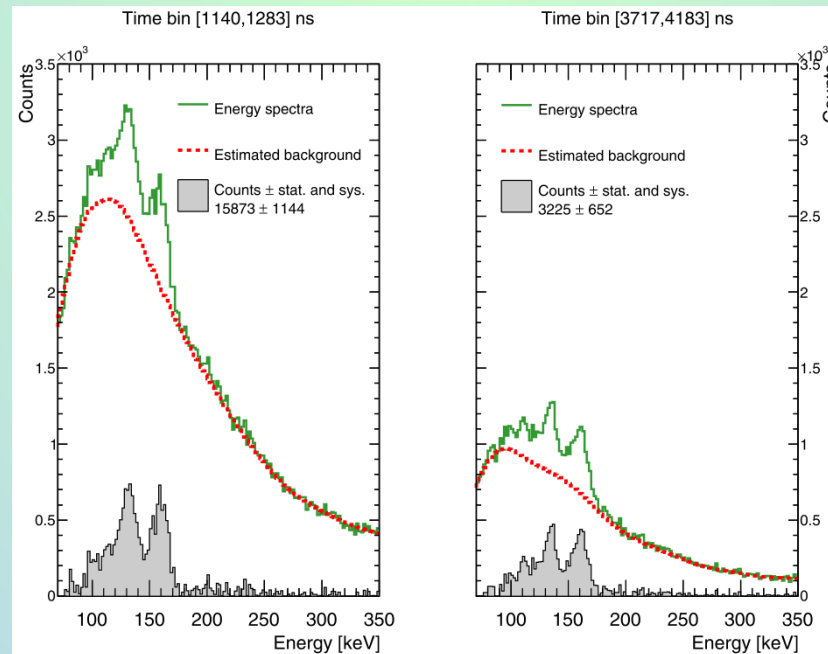
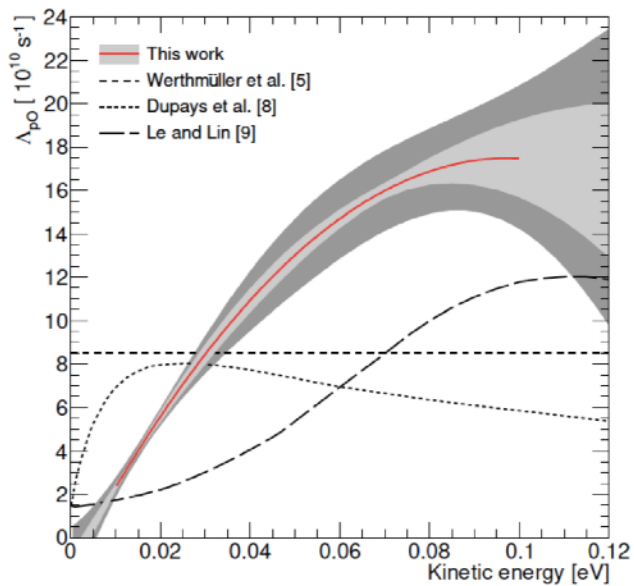
Attività: sviluppo del rivelatore $\text{LaBr}_3:\text{Ce}$

❑ cristalli scintillanti

❑ PM

❑ Signal sampling 1 GS/s

Spettro energetico in due intervalli temporali

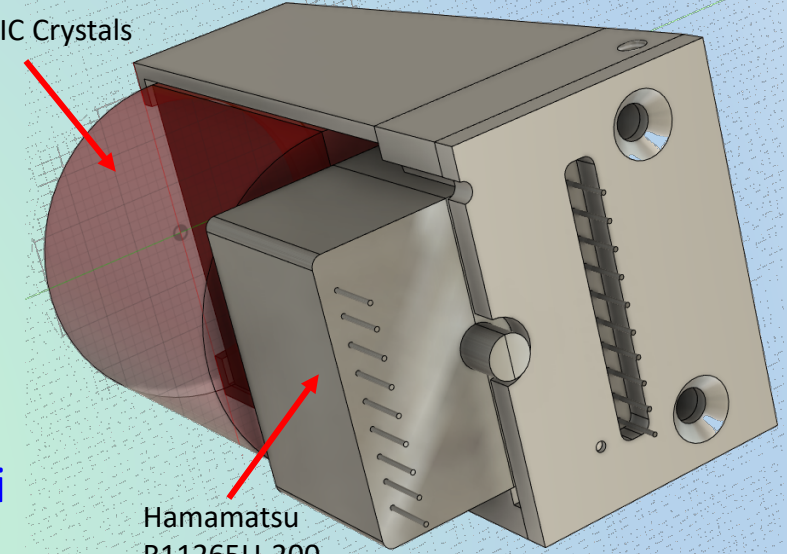


FAMU



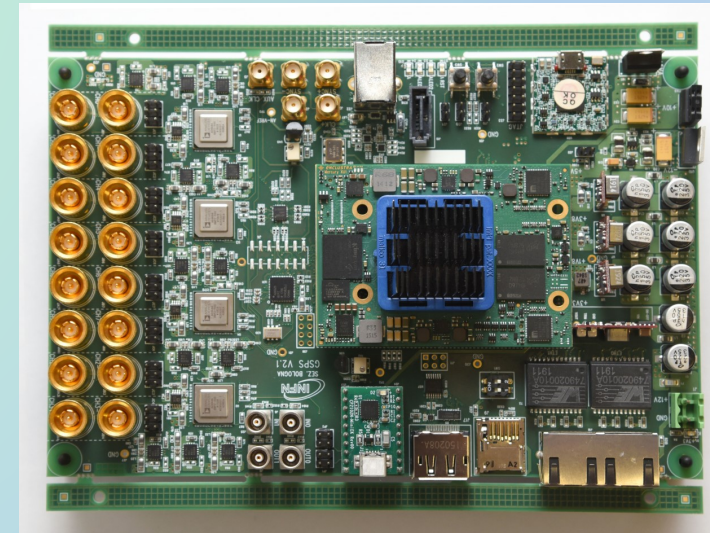
$\text{LaBr}_3:\text{Ce}$

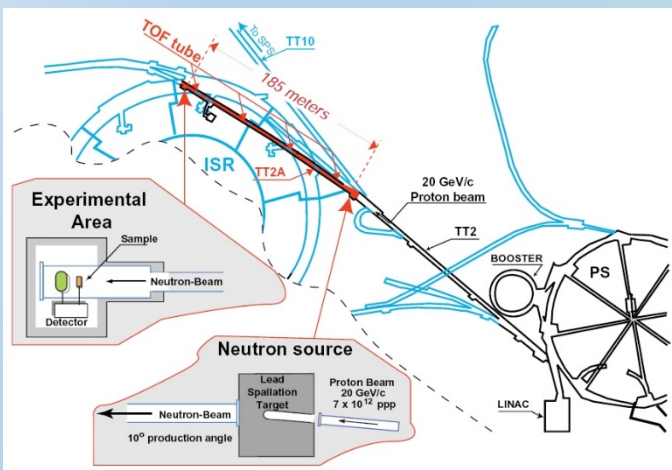
EPIC Crystals



Hamamatsu
R11265U-200

light-tight container





n_TOF



Attività analisi 2020

Studio della sezione d'urto (n, γ) del ^{140}Ce
nucleosintesi del processo-s negli ammassi globulari

Spokespersons:
C Massimi, A Mengoni

Studio della sezione d'urto (n, γ) del ^{154}Gd
nucleosintesi del processo-s nelle giganti rosse

Spokesperson:
C Massimi

studio della sezione d'urto di fissione dell' ^{235}U ad alta energia
($E_n > 200 \text{ MeV}$)
determinazione di uno standard ad alta energia

Tesi di dottorato di Alice Manna

Attività di calcolo e simulazioni

Uso di Cloud@CNAF (che ringraziamo!) per simulazioni per la misura $^{235}\text{U}(n, f)$ e di altri dispositivi. Confronto Geant4 - MCNP

Nicholas Terranova (ex BO)
Patrizio Console Camprini

Calcoli vari di modelli di struttura & reazioni nucleari

A Ventura, A Mengoni

Bologna:

- ❑ **8 membri → 3.6 FTE**
- ❑ Cristian Massimi: **resp. Nazionale**
- ❑ Alice Manna (PhD)
- ❑ Gianni Vannini (ass. senior)
- ❑ Alberto Ventura (ass. senior)
- ❑ Alberto Mengoni (ENEA) **spokesperson**
- ❑ Donato Maurizio Castelluccio (ENEA)
- ❑ Patrizio Console Camprini (ENEA)
- ❑ Antonio Guglielmelli (ENEA)

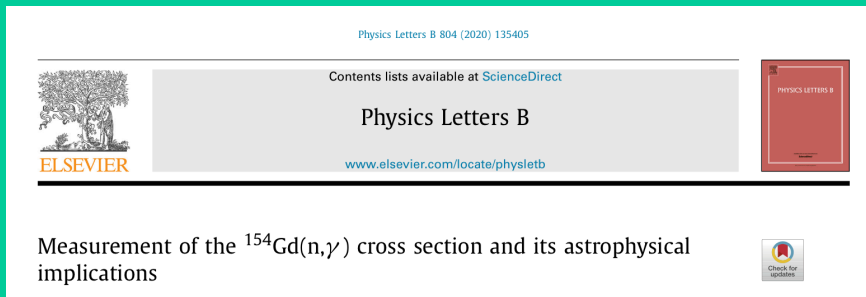
Publicazioni & Tesi: 2019-20

20 articoli di cui 11 su rivista (12 con primo autore INFN)
 1 tesi magistrale
 1 tesi dottorato (fine anno)

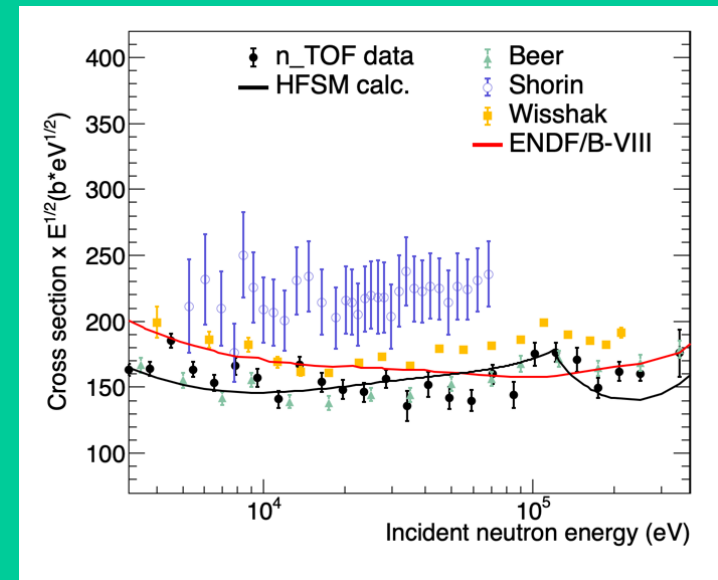
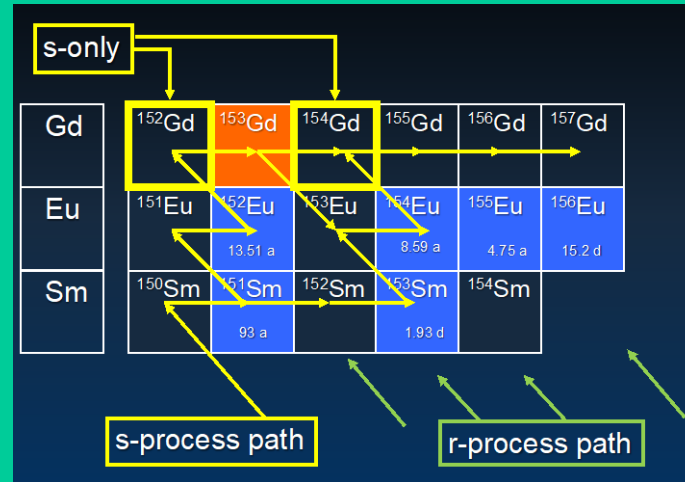
La lista delle pubblicazioni in backup



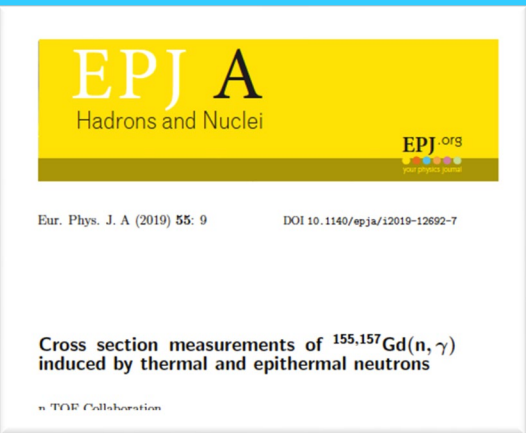
Astrofisica Nucleare: spokesperson & corresponding author: C. Massimi



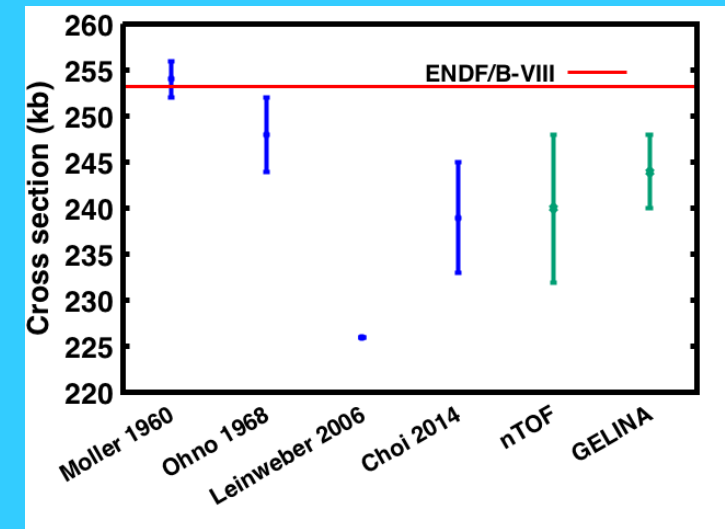
^{154}Gd formato solo dal processo s. La misura ha confermato la sovrastima della sezione d'urto $^{154}\text{Gd}(n,\gamma)$ predetta dai modelli astrofisici



Applicazioni Nucleari: spokesperson & corresponding author: C. Massimi



Sezione d'urto di cattura per il ^{155}Gd e ^{157}Gd , importanti implicazioni nello studio dei reattori Light Water Reactor LWR. → Misura complementare a GELINA → riduzione dell'incertezza!

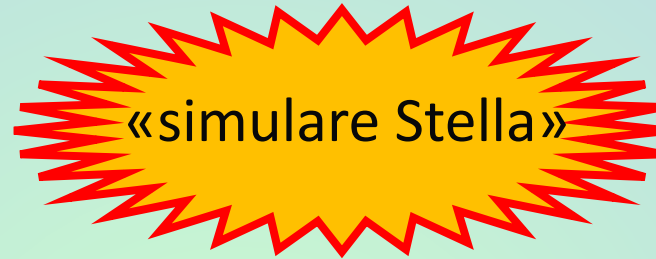
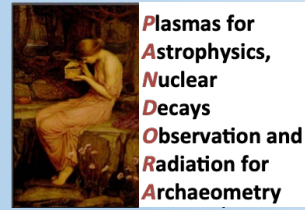


PANDORA

2020

Costruzione Plasma trap & prime misure

2024



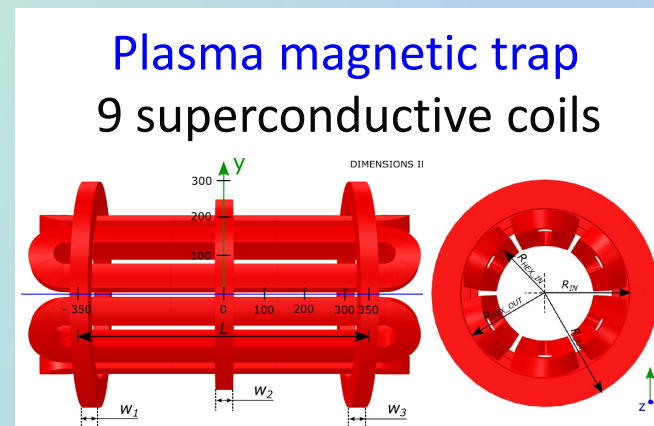
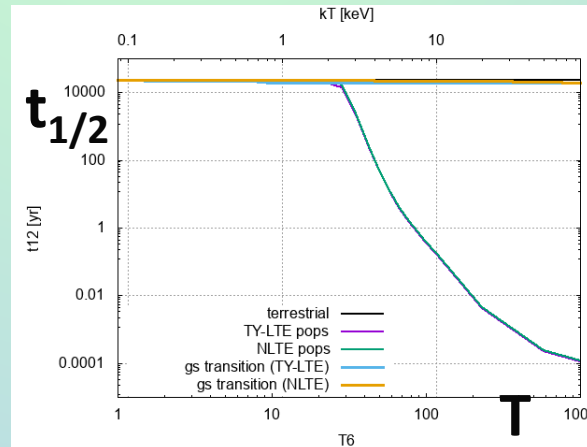
Studiare il comportamento di alcuni nuclei

Ambiente caldo ($T_{e^-} \sim 10^9$ °C) e ionizzato

processi di nucleosintesi delle stelle

Gas nobile ionizzato + isotopo da studiare

Verifica di modelli teorici



Bologna (4 ricercatori, 1.3 FTE):

- Odorici F. (0.5 FTE), resp. Locale
- Cuffiani M. (0.2 FTE)
- Malferrari L. (0.4 FTE)
- Mengoni A. (0.2 FTE)

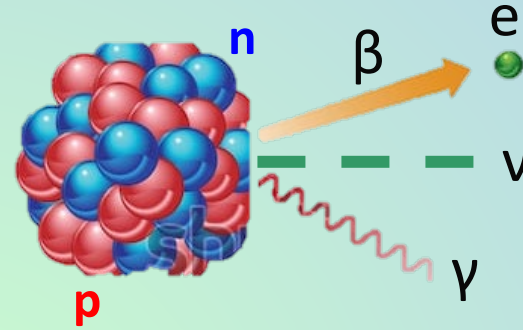
Responsabilità

- Plasma Chamber: (resp. F. Odorici)
 - design, costruzione, controllo
- Modelli teorici (resp. A. Mengoni)
- Analisi dei dati

PANDORA

Isotope	$T_{1/2}$ (yr)	E_g (keV)
^{176}Lu	3.78×10^{10}	88-400
^{134}Cs	2.06	>600
^{94}Nb	2.03×10^4	>700

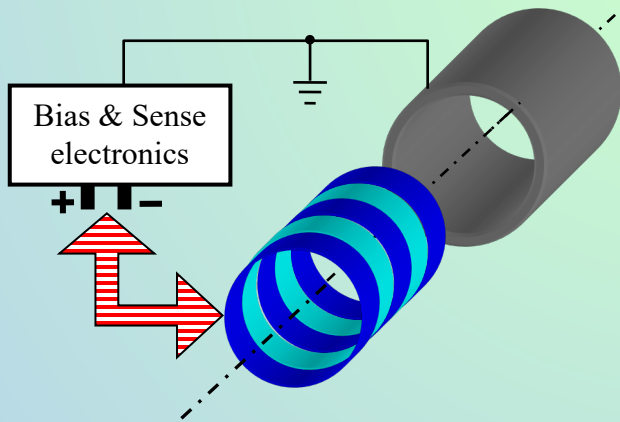
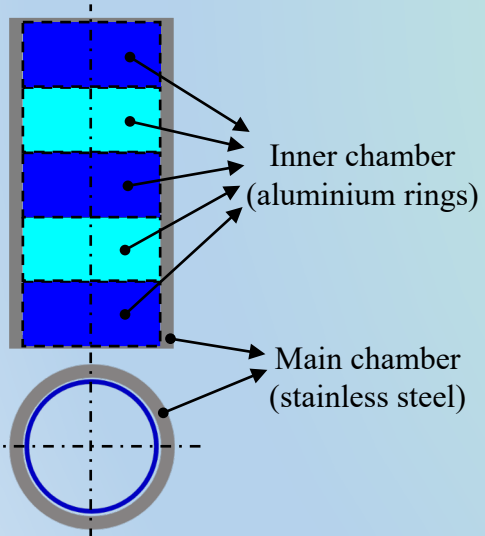
Misurare il tempo del decadimento β



Attese variazioni di $t_{1/2}$ (8-9 ordini di grandezza!)
in un ambiente fortemente ionizzato (plasma)



Può far luce sui processi slow e
rapid di nucleosintesi nelle stelle



Gas nobile of He, Ar, or ... (10^{13} atoms/cm³)
dove è flussato l'isotopo

Rivelato il γ del decadimento β

2020: prototipo dell'Inner plasma Chamber (per covid, i tests sono spostati al 2021)

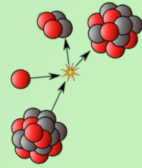
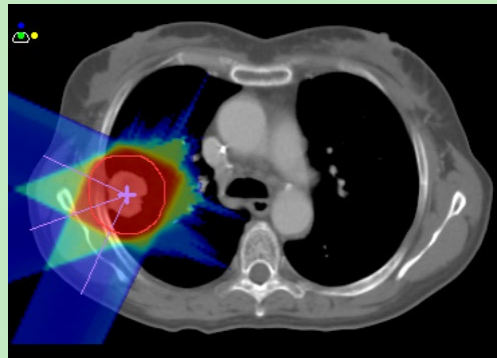
FOOT: FragmentatiOn Of Target



GOAL: pA cross section fragmentation

Nuclear physics

Hadrontherapy

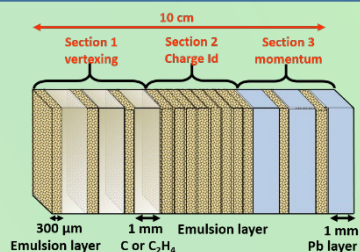
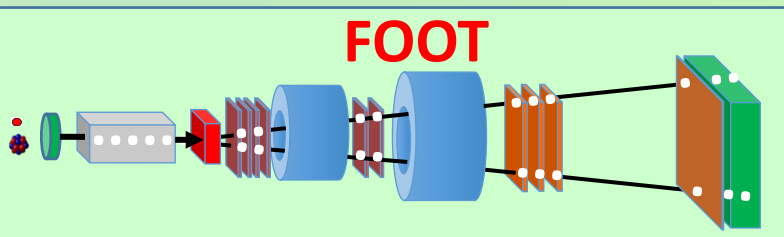


Spacecraft shielding



2 detector setups

FOOT



- SC: ready
- BM: ready
- VTX: test
- ITR: construction
- MSD: test
- Magnet: purchase
- SCN: ready
- CAL: test
- DAQ: development
- EMC: ready

Collaboration

- Accepted end of 2017
- 13 Sections/Labs (National and Internat)
- 100 members, ~45 FTE

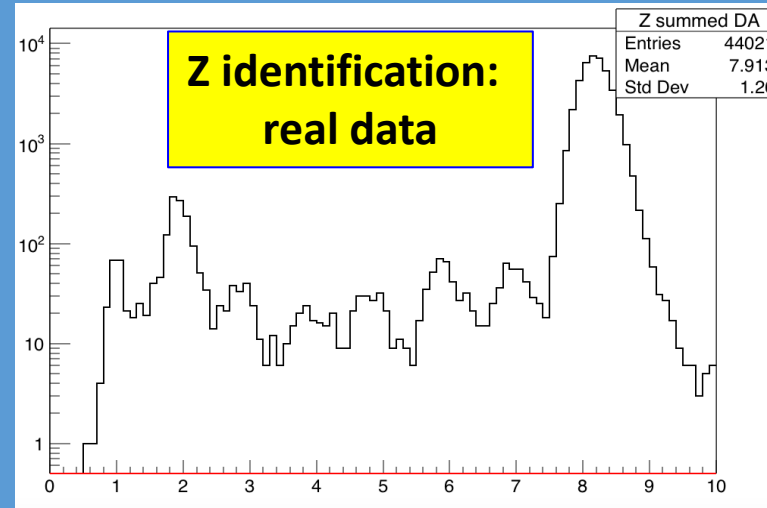
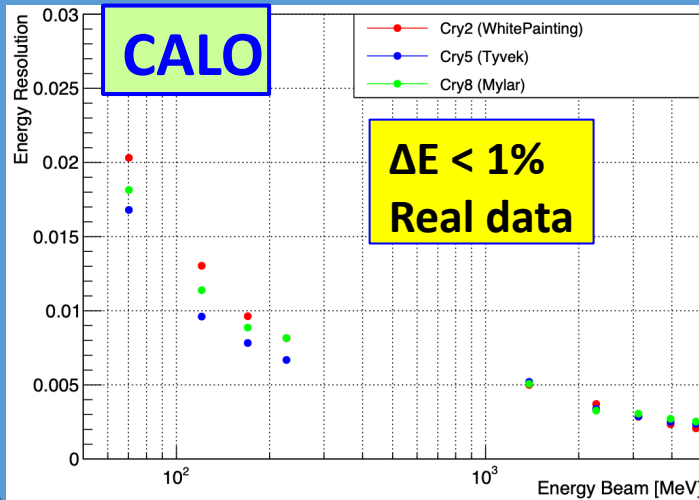
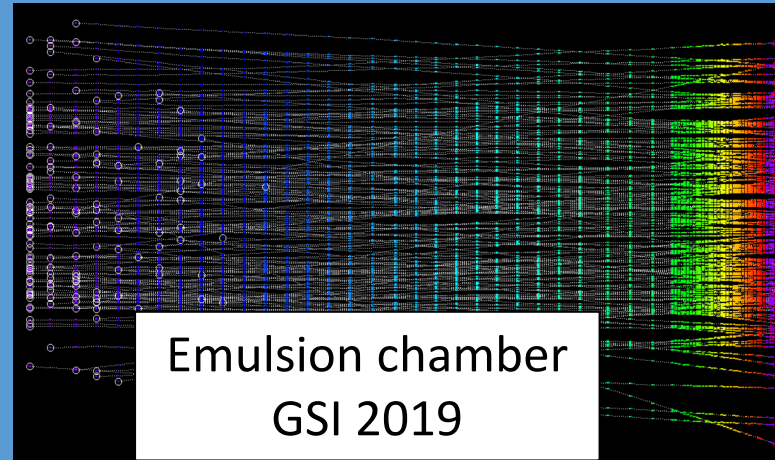
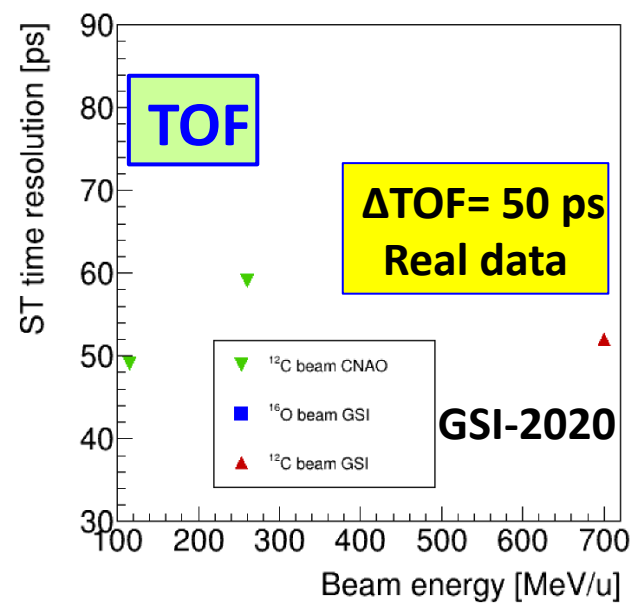
FOOT Status 2020:

- Apparatus simulation in final phase
- Several test beam on parts of detector
- 2020 data taking at GSI
 - Emulsion Chamber (results end of 2020)
- 2019-20: 5 papers published

Bologna:

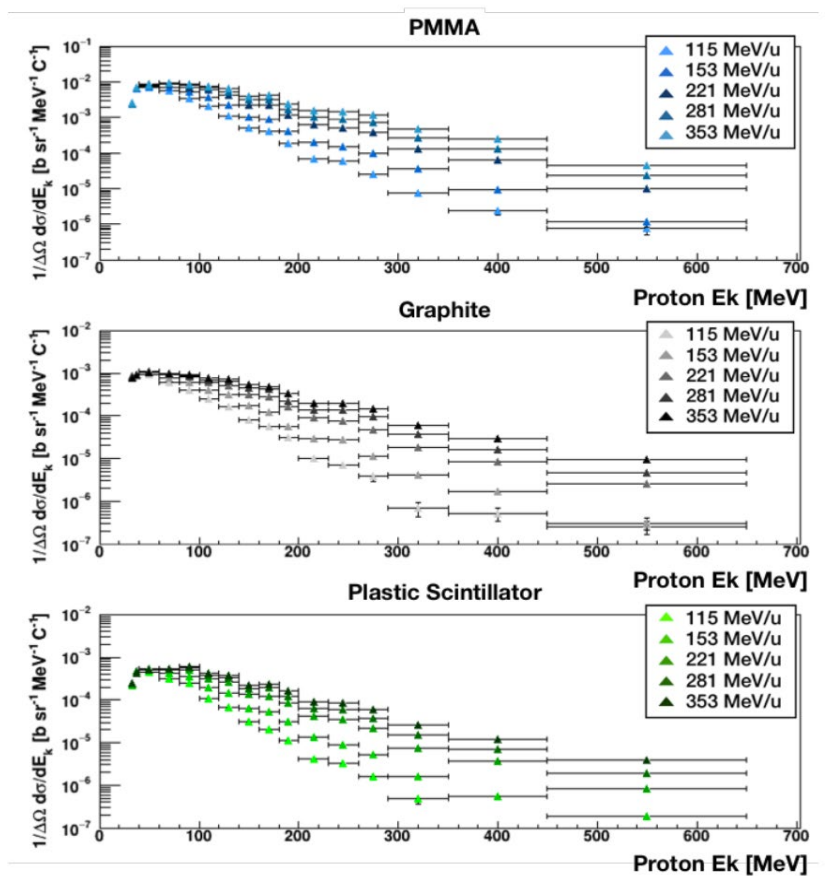
- 10 members: 3.65 FTE (-1.3 vrt 2019)
- M.U: Elettronica (2), Officina (2), Calcolo (1)
- Responsibilities:
 - Physics coordinator
 - Editorial board coordinator
 - TDAQ coordinator
- Win a divulgation project
- > 20 FOOT theses (physics and engineering)

Performance



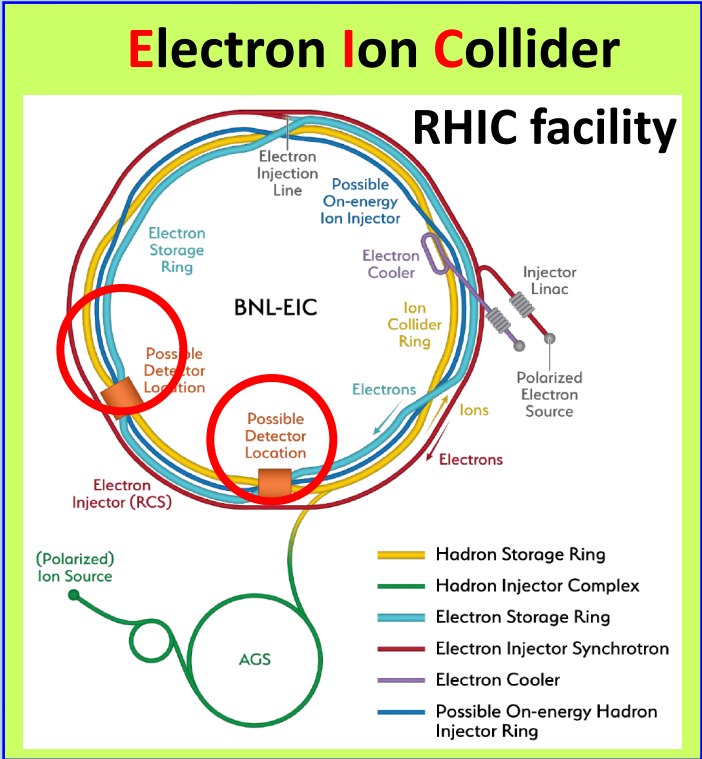
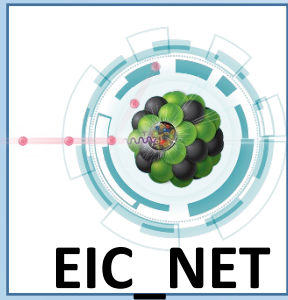
Measurement of ^{12}C Fragmentation Cross Sections on C, O and H in the Energy Range of interest for Particle Therapy Applications.

I. Mattei¹, A. Alexandrov⁶, L. Alunni Soletizi^{21,7}, G. Ambrosi⁷, S. Argirò^{8,9}, N. Bartosik⁸, G. Battistoni¹, N. Belcarì^{10,11}, S. Biondi^{12,13}, M.G. Bisogni^{10,11}, G. Bruni¹², N. Camarlinghi^{10,11}, P. Carra^{10,11}, E. Catanzani^{21,7}, E. Ciarrocchi^{10,11}, P. Cerello⁸, A. Clozza¹⁴, S. Colombi^{15,16}, G. De Lellis^{6,17,32}, A. De Guerra^{10,11}, M. De Simoni^{5,2}, A. Di Crescenzo^{17,6}, M. Donetti^{18,8}, Y. Dong^{1,19}, M. Durante¹⁵, A. Embricaco¹, M. Emde²⁰





EIC_NET



19/12/2019

- Approve mission need

9/1/2020

- BNL as laboratory

5/2020

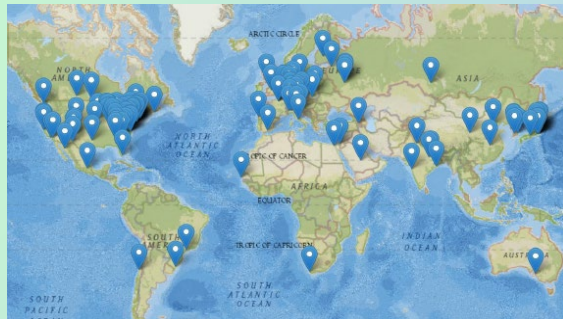
- Submission of Expression of Interest



- PID
- Vertexing
- Readout
- Software

Collaboration

- 1089 people
- 229 institutes
- 31 countries



Italy

- INFN sigla dal 2019
- 10 sezioni + 2 Lab.
- > 40 persone (> 8 FTE)

Bologna

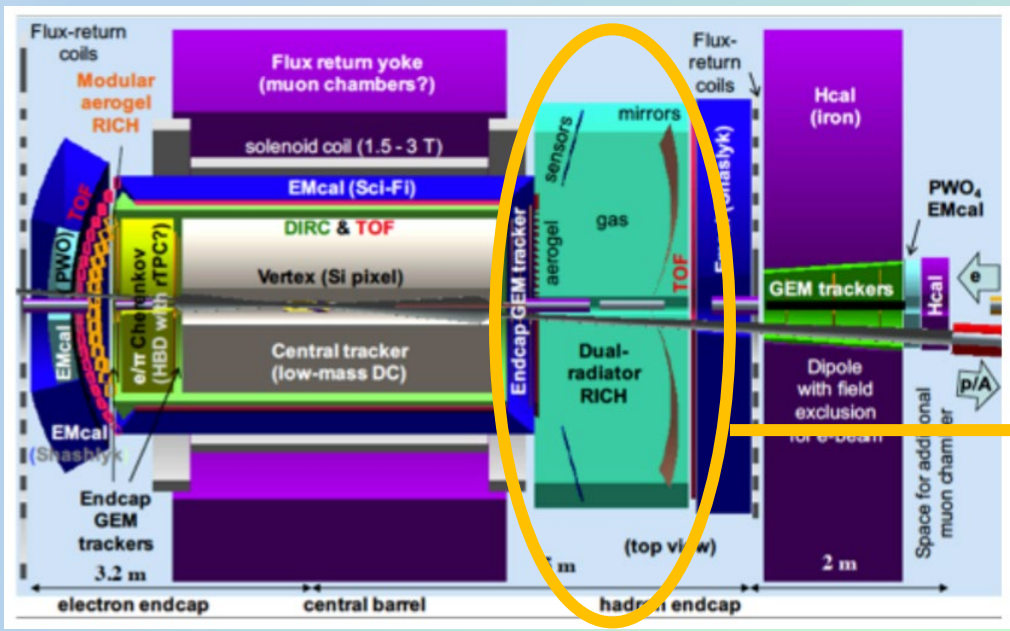
- 5 persone (1.0 FTE)

\sqrt{s} : 20-141 GeV \mathcal{L} up to $10^{34} \text{ cm}^{-2} \text{ s}^{-1}$

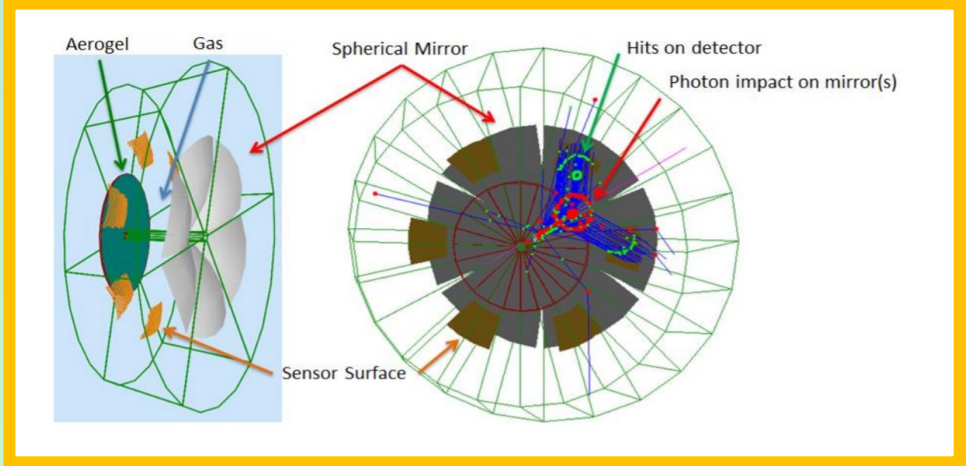


Beams polarized 80%

p-ion
→



e⁻
←

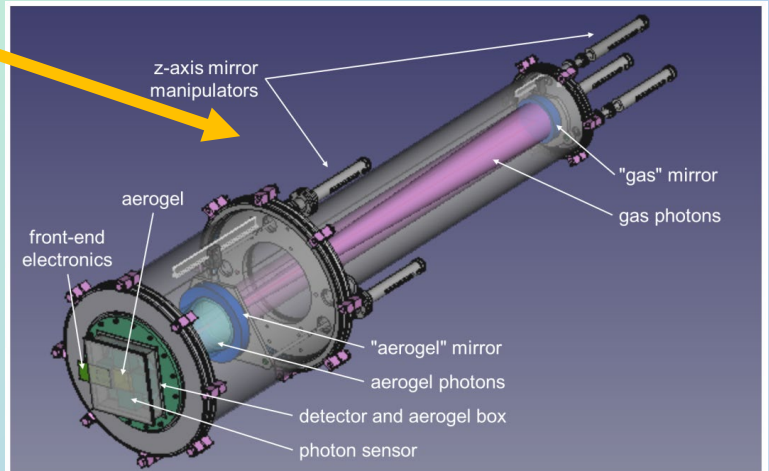
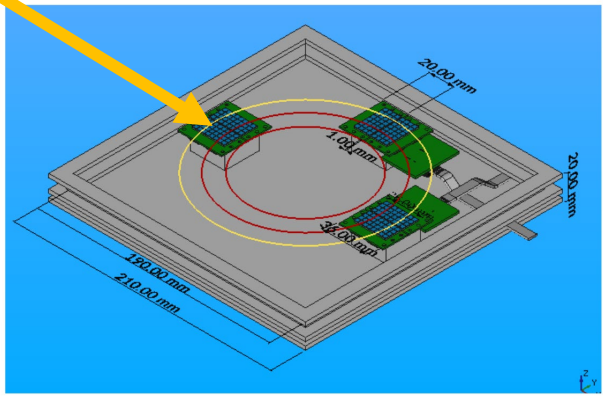


BOLOGNA: Realisation of dRICH prototype (test beam 2021)

- ❑ Design of SiPM boards
- ❑ SiPM studies
 - ❑ Irradiation test (@ Trento)
 - ❑ Annealing at high T ~ 170 °
 - ❑ Operation at low T ~ -40 °
- ❑ DAQ for front-end readout
 - ❑ Front end based on ALCOR
- ❑ Analysis
 - ❑ PID

Dual Radiator RICH (dRICH)

- ❑ Aerogel + gas
- ❑ PID e/π/k/p



Richieste servizi Mesi Uomo

Esperimento	Lab Elettronica	S. Tecnico Gen	Officina	Progettazione	Calcolo
ALICE	7	2	1.5		1
EIC_NET	3	1	0.5		
FAMU	2		2		
FOOT	2		2		1
N_TOF					
PANDORA	0,2		2	3	
TOTALE	14,2	3	8	3	2

GR3 ha attività importanti:

- ❑ Ricerca di base: struttura del nucleo, nucleosintesi, ...
- ❑ Ricerca applicate: reattori, adroterapia, radioprotezione, ...
- ❑ Tecnologie avanzate
- ❑ Tutte proiettate nel futuro

Grazie!

roberto a nome di tutto il Gruppo 3 di Bologna

Backup slides

16. *Gd-155,157 neutron capture cross sections measured at n_TOF (CERN)*
M. Mastromarco, D.M. Castelluccio, G. Clai, A. Manna, C. Massimi, F. Rocchi, on behalf of, n_TOF Collaboration
Il Nuovo Cimento C - EUNPC 2018 **42**, 1–4 (2019) [Open Access](#)
[10.1393/ncci/2019-19136-4](https://doi.org/10.1393/ncci/2019-19136-4)
15. *$^{7}\text{Be}(n,p)^{7}\text{Li}$ Cross Section Measurement for the Cosmological Lithium Problem at the n_TOF Facility at CERN*
L. A. Damone, M. Barbagallo, M. Mastromarco, A. Mengoni, N. Colonna, L. Cosentino, E. A. Mauger, S. Heinz, D. Schumann, R. Dressler, et al. (The n_TOF Collaboration)
Nuclei in the Cosmos XV. Springer Proceedings in Physics, vol 219, 25–32 (2019)
[10.1007/978-3-030-13876-9_5](https://doi.org/10.1007/978-3-030-13876-9_5)
14. *Data for the s Process from n_TOF*
C. Massimi, O. Aberle, V. Alcayne, J. Andrzejewski, L. Audouin, V. Bécarea, V. Babiano-Suarez, M. Bacak, M. Barbagallo, Th. Benedikt, et al. (The n_TOF Collaboration)
Nuclei in the Cosmos XV. Springer Proceedings in Physics, vol 219, 63–70 (2019)
[10.1007/978-3-030-13876-9_11](https://doi.org/10.1007/978-3-030-13876-9_11)
13. *Development of an Ionization Chamber for the Measurement of the $^{16}\text{O}(n,\alpha)^{13}\text{C}$ Cross-Section at the CERN n_TOF Facility*
Sebastian Ullass, Arnd R. Junghans, Andreas Hartmann, Federica Mingrone, Manfred Sobliella, Daniel Stach, Laurent Tassan-Got, David Weinberger
Nuclei in the Cosmos XV. Springer Proceedings in Physics, vol 219, 457–460 (2019)
[10.1007/978-3-030-13876-9_89](https://doi.org/10.1007/978-3-030-13876-9_89)
12. *Measurement of the $^{70}\text{Ge}(n,g)$ cross section up to 300 keV at the CERN n_TOF facility*
A. Gawlik, C. Lederer-Woods, J. Andrzejewski, U. Battino, P. Ferreira, F. Gunsing, S. Heinz, M. Křička, C. Massimi, F. Mingrone, et al. (The n_TOF Collaboration)
Physical Review C **100**, (2019) [Open Access](#)
[10.1103/physrevc.100.045804](https://doi.org/10.1103/physrevc.100.045804)
11. *An alternative methodology for high counting-loss corrections in neutron time-of-flight measurements*
A. Stamatopoulos, M. Diakaki, A. Tsinganis, N. Colonna, F. Gunsing, L. Tassan-Got, M. Kokkoris, A. Kalamara, P. Žugec, N. Patronis, et al. (The n_TOF Collaboration)
Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment **913**, 40–47 (2019) [Open Access](#)
[10.1016/j.nima.2018.10.032](https://doi.org/10.1016/j.nima.2018.10.032)
10. *Cross section measurements of $^{155,157}\text{Gd}(n,\gamma)$ induced by thermal and epithermal neutrons*
M. Mastromarco, A. Manna, O. Aberle, J. Andrzejewski, L. Audouin, M. Bacak, J. Balibrea, M. Barbagallo, F. Bečvář, E. Berthoumieux, et al. (The n_TOF Collaboration)
The European Physical Journal A **55**, 9 (2019)
[10.1140/epja/i2019-12692-7](https://doi.org/10.1140/epja/i2019-12692-7)
9. *On the use of stacks of fission-like targets for neutron capture experiments*
C. Guerrero, J. Lerendegui-Marco, K. Eberhardt, Ch.E. Düllmann, A. Junghans, B. Lommel, C. Mokry, J.M. Quesada, J. Runke, P. Thörle-Pospiech, et al. (The n_TOF Collaboration)
Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment **925**, 87–91 (2019)
[10.1016/j.nima.2019.01.063](https://doi.org/10.1016/j.nima.2019.01.063)
8. *Measurement of $^{73}\text{Ge}(n,\gamma)$ cross sections and implications for stellar nucleosynthesis*
C. Lederer-Woods, U. Battino, P. Ferreira, A. Gawlik, C. Guerrero, F. Gunsing, S. Heinz, J. Lerendegui-Marco, A. Mengoni, R. Reifarh, et al. (The n_TOF Collaboration)
Physics Letters B **790**, 458–465 (2019) [Open Access](#)
[10.1016/j.physletb.2019.01.045](https://doi.org/10.1016/j.physletb.2019.01.045)
7. *Development of a Neutron Imaging Station at the n_TOF Facility of CERN and Applications to Beam Intercepting Devices*
Federica Mingrone, Marco Calviani, Martin Claudio Torregrosa, Oliver Aberle, Michael Bacak, Enrico Chiavari, Elvis Fomasiere, Antonio Penillo-Marcone, Vasilis Vlachoudis, and The n_TOF Collaboration
Instruments **3**, 32 (2019) [Open Access](#)
[10.3390/instruments3020032](https://doi.org/10.3390/instruments3020032)
6. *Measurement of the $^{235}\text{U}(n,f)$ cross section relative to the $^{6}\text{Li}(n,t)$ and $^{10}\text{B}(n,\alpha)$ standards from thermal to 170 keV neutron energy range at n_TOF*
S. Amaducci, L. Cosentino, M. Barbagallo, N. Colonna, A. Mengoni, C. Massimi, S. Lo Meo, P. Finocchiaro, O. Aberle, J. Andrzejewski, et al. (The n_TOF Collaboration)
The European Physical Journal A **55**, 120 (2019) [Open Access](#)
[10.1140/epja/i2019-12802-7](https://doi.org/10.1140/epja/i2019-12802-7)
5. *Exploring neutron channel solutions at CERN/n_TOF for the Cosmological Lithium Problem*
A. Mengoni, L.A. Damone, M. Barbagallo, M. Mastromarco, L. Cosentino, F. Kappeler, N. Colonna, P. Finocchiaro, and The n_TOF Collaboration
Il Nuovo Cimento C - EUNPC 2018 **42**, 1–4 (2019) [Open Access](#)
[10.1393/ncci/2019-19120-0](https://doi.org/10.1393/ncci/2019-19120-0)
4. *Nuclear astrophysics at the n_TOF facility: Some key cases in low mass star evolution and Neutron Star Mergers*
S. Cristallo, D. Vesovi, and The n_TOF Collaboration
Il Nuovo Cimento C - EUNPC 2018 **42**, 1–4 (2019) [Open Access](#)
[10.1393/ncci/2019-19117-7](https://doi.org/10.1393/ncci/2019-19117-7)
3. *Status and perspectives of the neutron time-of-flight facility n_TOF at CERN*
F. Mingrone, C. Massimi, on behalf of, n_TOF Collaboration
Il Nuovo Cimento C - EUNPC 2018 **42**, 1–4 (2019) [Open Access](#)
[10.1393/ncci/2019-19064-3](https://doi.org/10.1393/ncci/2019-19064-3)
2. *A Proton Recoil Telescope for the characterisation of the neutron beam at n_TOF*
A. Manna, S. Amaducci, M. Barbagallo, N. Colonna, L. Cosentino, P. Finocchiaro, S. Lo Meo, C. Massimi, M. Mastromarco, P. M. Milazzo, et al. (The n_TOF Collaboration)
Il Nuovo Cimento C - EUNPC 2018 **42**, 1–4 (2019) [Open Access](#)
[10.1393/ncci/2019-19142-6](https://doi.org/10.1393/ncci/2019-19142-6)
1. *Nuclear data program for Neutron Capture Therapy at the n_TOF facility at CERN*
F. Ogállar, M. Sabaté-Gilarte, P. Torres-Sánchez, I. Porras, J. Praena, J.M. Quesada, T. Wright, S. Bennett, C. Lederer-Woods, S.J. Lonsdale, et al. (The n_TOF Collaboration)
Il Nuovo Cimento C - EUNPC 2018 **42**, 1–4 (2019) [Open Access](#)
[10.1393/ncci/2019-19137-3](https://doi.org/10.1393/ncci/2019-19137-3)

Pubblicazioni n_ToF 2019-2020

Tutti gli articoli, tranne 2, pubblicati in Open Access

2020

20. *The fission experimental programme at the CERN n_TOF facility: status and perspectives*
N. Colonna, A. Tsinganis, R. Vlastou, N. Patronis, M. Diakaki, S. Amaducci, M. Barbagallo, S. Bennett, E. Berthoumieux, M. Bacak, et al. (The n_TOF Collaboration)
The European Physical Journal A **56**, (2020) [Open Access](#)
[10.1140/epja/s10050-020-00037-8](https://doi.org/10.1140/epja/s10050-020-00037-8)
19. *Study of a data analysis method for the angle resolving silicon telescope*
P. Žugec, M. Barbagallo, J. Andrzejewski, J. Perkowski, N. Colonna, D. Bosnar, A. Gawlik, M. Sabaté-Gilarte, M. Bacak, F. Mingrone, et al. (The n_TOF Collaboration)
Journal of Instrumentation **15**, P02011--P02011 (2020) [Open Access](#)
[10.1088/1748-0221/15/02/p02011](https://doi.org/10.1088/1748-0221/15/02/p02011)
18. *Measurement of the $^{154}\text{Gd}(n,\gamma)$ cross section and its astrophysical implications*
A. Mazzone, S. Cristallo, O. Aberle, G. Alaerts, V. Alcayne, S. Amaducci, J. Andrzejewski, L. Audouin, V. Babiano-Suarez, M. Bacak, et al. (The n_TOF Collaboration)
Physics Letters B **804**, 135405 (2020)
[10.1016/j.physletb.2020.135405](https://doi.org/10.1016/j.physletb.2020.135405)
17. *A compact fission detector for fission-tagging neutron capture experiments with radioactive fissile isotopes*
M. Bacak, M. Aiche, G. Belier, E. Berthoumieux, M. Diakaki, E. Dupont, F. Gunsing, J. Heyse, S. Kopecky, B. Laurent, et al. (The n_TOF Collaboration)
Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment **969**, 163981 (2020) [Open Access](#)
[10.1016/j.nima.2020.163981](https://doi.org/10.1016/j.nima.2020.163981)