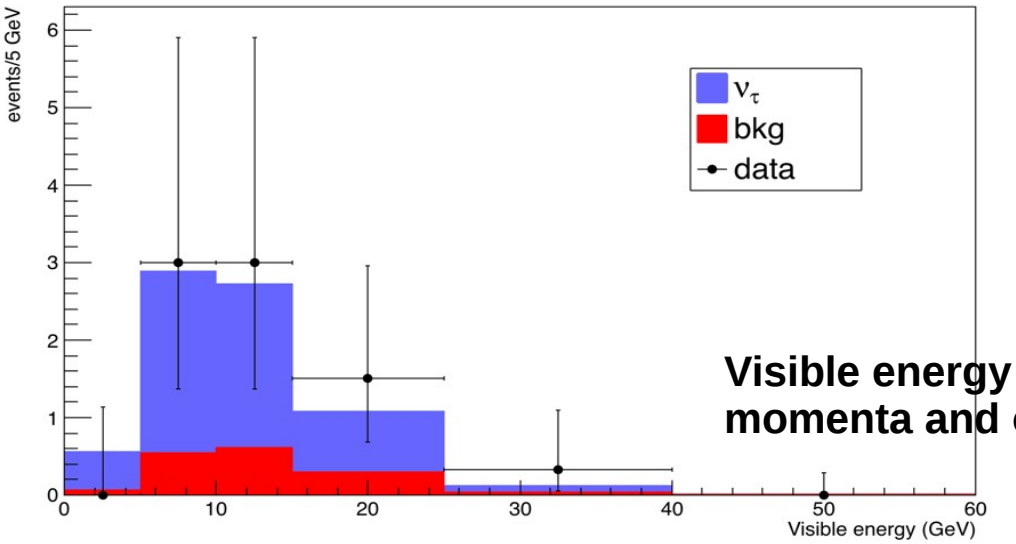
Preventivi Gruppo II

A. Paoloni

Consiglio di Laboratorio

2 Luglio 2018

OPERA final results

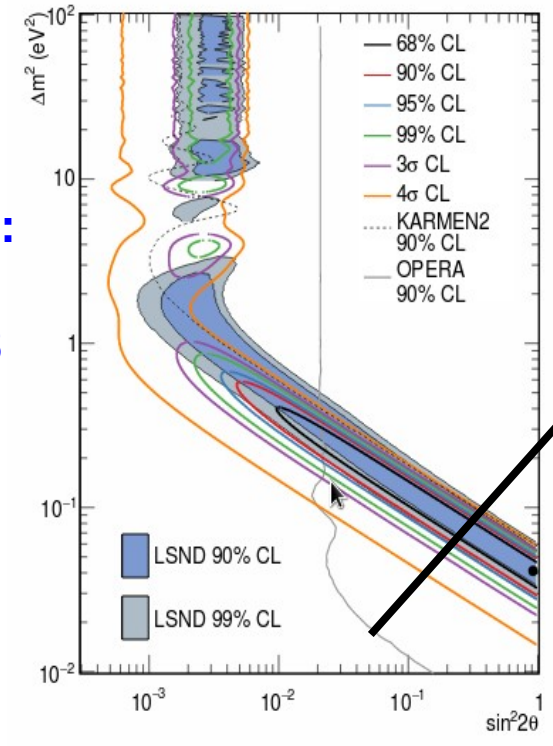


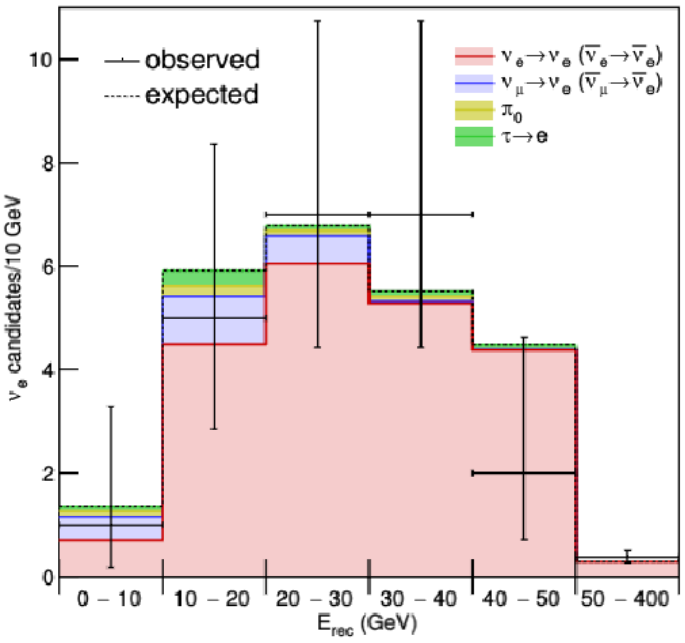
Phys. Rev. Lett. 120 (2018) 211801
looser cuts and Multi-Variate classifier (BDT)
10 τ sample
No oscillation hypothesis excluded at 6.1 σ
ν_τ CC Cross section measurement at 30%

Visible energy = Sum of charged particle momenta and of γ ray energy.

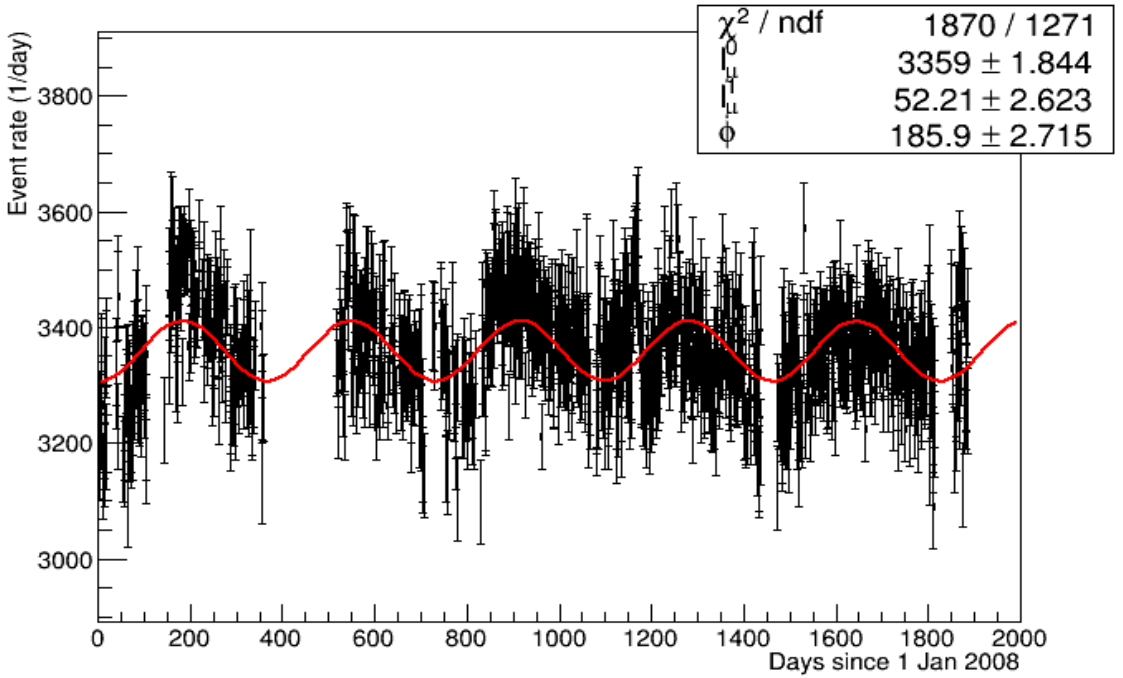
Exclusion from OPERA final paper on $\nu_\mu \rightarrow \nu_e$: arXiv:1803.11400, Accepted by JHEP.

Sterile neutrino search in $\nu_\mu \rightarrow \nu_e$: Miniboone paper arXiv:1805.12028





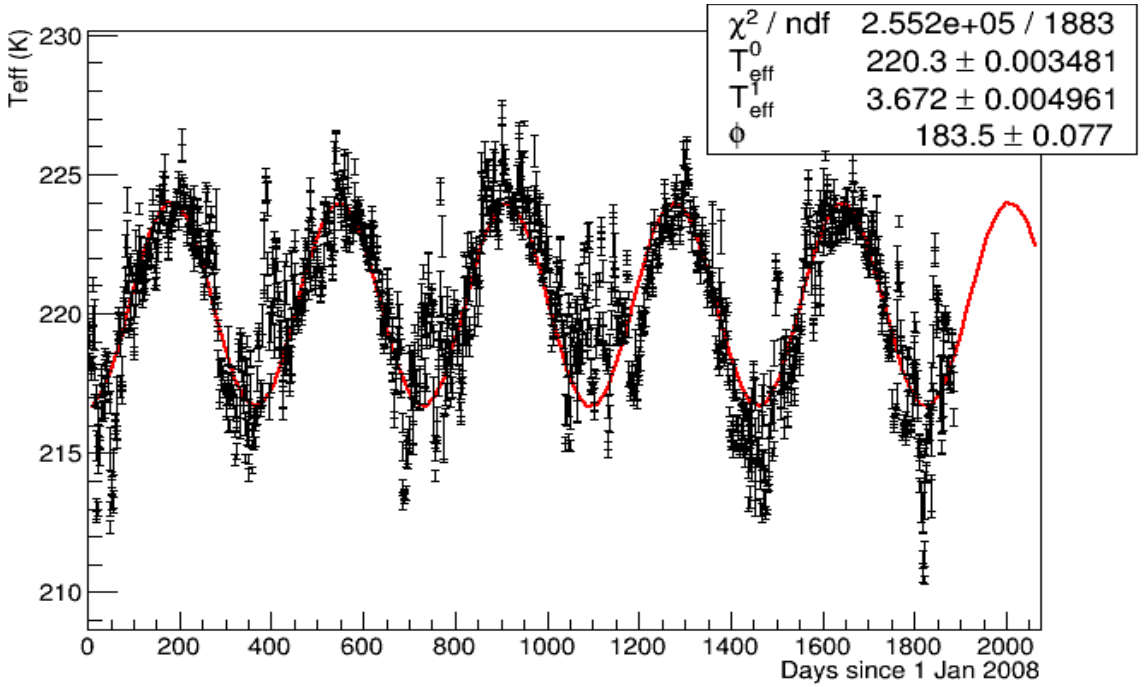
OPERA publication in progress



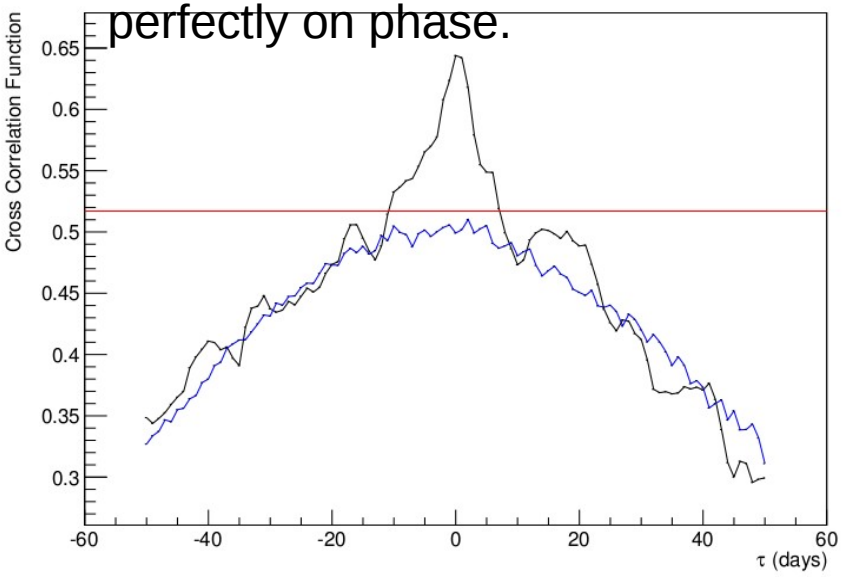
Single muon flux I_μ and effective atmospheric temperature, T_{eff} (average temperature weighted by production probability of TeV muon) fitted with:
$A(t) = A0 + A1 \cos(2\pi/T(t-\phi))$
(period T fixed at 365 days).

$$\Delta I_\mu / I^0_\mu = \alpha_T \, \Delta T_{eff} / T^0_{eff} \, .$$

α_T (OPERA) = 0.95 ± 0.04

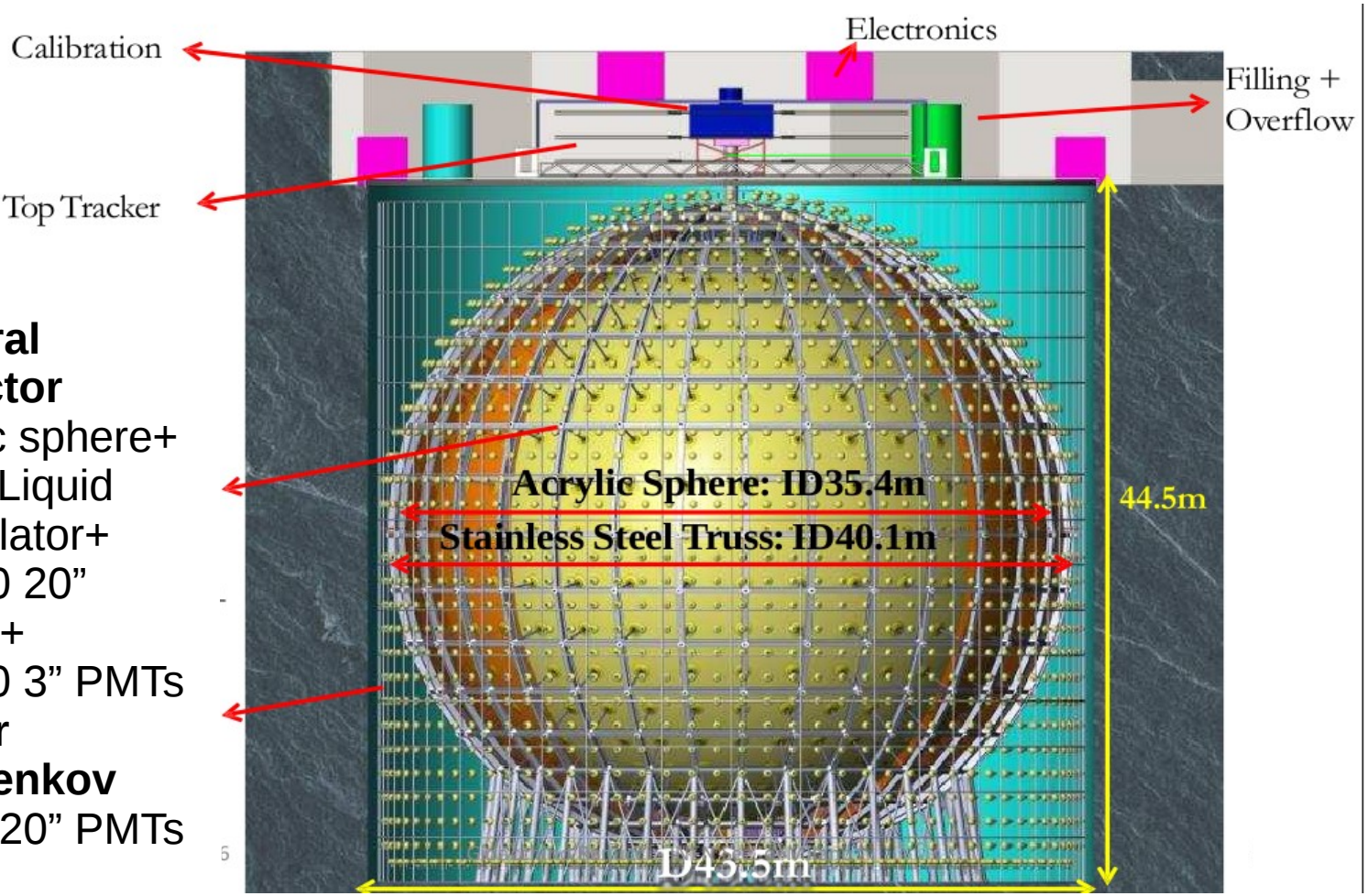


Both periodic and short-term effects perfectly on phase.



JUNO experiment

Oscillation experiment: anti-ν_e disappearance for mass hierarchy measurement.
50 km baseline from 2 nuclear power plants (power=26-36 Gw).



Central detector
Acrilic sphere+
20 kt Liquid scintillator+
17000 20” PMTs+
25000 3” PMTs
Water Cherenkov
2000 20” PMTs

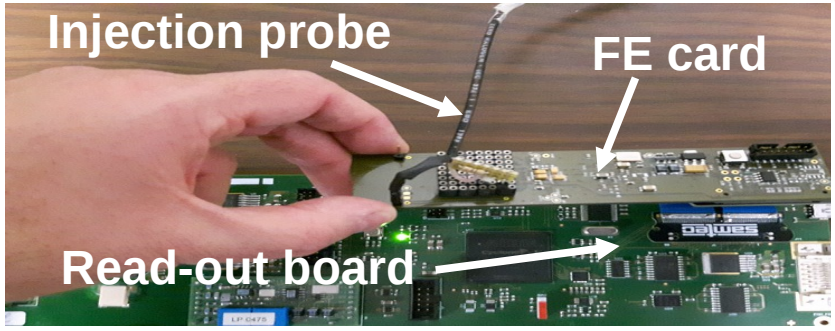
International collaboration: China, Pakistam, Thailand, France, Germany, Italy, Belgium, Cech republic, Slovakia, Finland, Russia, Brazil, Chile.
INFN groups: Milano, Milano Bicocca, Padova, LNF, Roma3, Perugia, Ferrara, Catania (57 persone, 27 FTE).

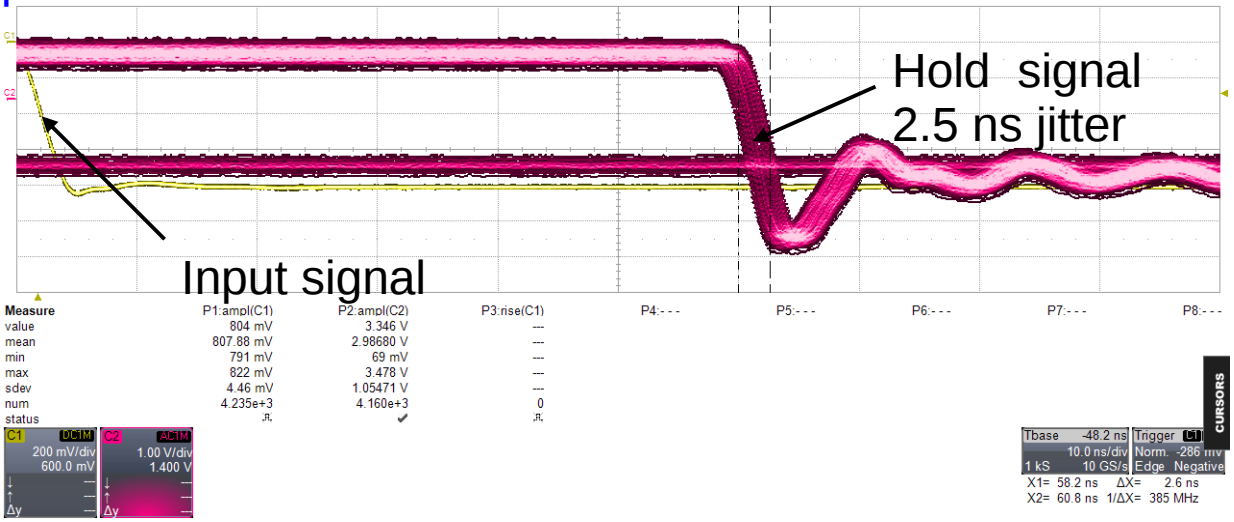
JUNO status

Civil engineering: scavato il tunnel di accesso sotterraneo. Inizio dello scavo della sala.
Inizio presa dati prevista nel 2021.
Test di purificazione dello scintillatore a Daya Bay anche il prossimo anno.
Test PMTs da 20 pollici: 10000 (su 20000) gia' consegnati e sotto test a ZhongShan.

Una importante novita': e' stata approvata la realizzazione di un near detector per misurare con altissima precisione (1% @ E=1 MeV) lo spettro degli antineutrini da reattori.
Due opzioni aperte: Scintillatore liquido + PMTs da 3 pollici (Prospect) o SiPM freddi (di interesse INFN per FBK e NOA).
Avvio di un'attivita' di R&D. Gruppo LNF interessato (criogenia) in sinergia con Roma3 (elettronica).

Elettronica del Top Tracker (FE card on + Read-out Board + Concentrator):
FE card and Read-out Board congelate. Effettuati test congiunti con successo.
Seconda meta' del 2018: test con i primi prototipi di concentratore (a proseguire nel 2019) e ordine di 1000 Read-out board (600 kEuro) tramite l'accordo quadro CAEN.
Nel 2019 test a campione delle ROB prodotte.





JUNO requests

Anagrafica gruppo LNF: A. Paoloni (100%), A. Martini (40%), M. Cordelli (30%?), G. Felici (10%), G. Delle Monache (10?), L. Votano, L. Trasatti.

Richieste alla CSN2:
Missioni: 25 kEuro (t.b.c.) per meetings, turni PMTs/Daya Bay, test elettronica a Strasburgo.
Apparati: 350 kEuro per seconda tranche ordine Read-Out Boards.
Consumi: 10 kEuro per ripristino linea freddo per R&D sul near detector + test ROB a campione.

Richieste ai LNF:
Supporto tecnici in linea con anni passati.
Servizio elettronica: 1 mu per supporto test elettronica Top Tracker.
Servizio criogenia: 1-2 mu per supporto per test R&D.
Progettazione: disegno CAD del near detector ?

CUORE/Darkside

I laboratori di Frascati forniscono un contributo tecnico-ingegneristico ai due esperimenti.
CUORE e' in presa dati dallo scorso anno, e l'attivita' prevista per il 2019 e' essenzialmente turnistica (presa dati e manutenzione) e partecipazione ai meetings di collaborazione.
In **Darkside** il nostro gruppo si occupa delle problematiche ingegneristiche generali legate all'integrazione dell'esperimento, da un punto di vista prevalentemente meccanico (implementazione di un modello CAD 3D con il massimo dettaglio possibile e verifica dell'eventuale presenza di problematiche e/o interferenze di tipo meccanico-funzionale).

Anagrafica CUORE: A. Franceschi (51%), T. Napolitano (51%), C. Ligi (51%).

Anagrafica Darkside.DTZ: A. Franceschi (39%), T. Napolitano (39%).

The JEM-EUSO International program

1. **EUSO-TA:** *Ground detector installed in 2013 at Telescope Array site (Utah): currently operational. Future option for AUGER site*

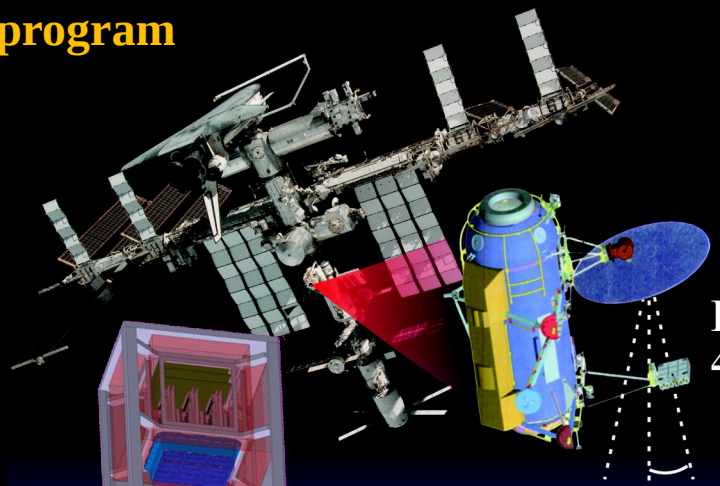
2. **EUSO-BALLOONS:** *1st balloon flight from Timmins, Canada (French Space Agency) Aug 2014; NASA Ultra long duration flight: SPB April 2017; NASA SPB-2 planned for 2020*

3. **TUS (Tracking Ultraviolet Setup)** *Russia (launched 2016 on Lomonosov satellite)*

4. **MINI-EUSO (2019):** *Precursor on International Space Station. Approved by Italian and Russian Space agencies*

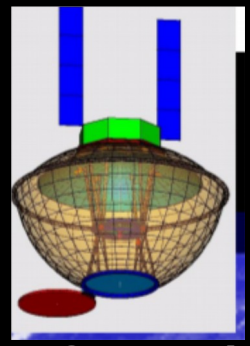
5. **K-EUSO (2022):** *on ISS Approved by Russian Space Agency – Phase A+*

6. **POEMMA (2025+):**
NASA twin free-Flyer: UHECR and cosmogenic neutrinos
Probe Of Extreme Multi-Messenger Astrophysics
Selected as a NASA Study Phase – Proposal/CDR in preparation

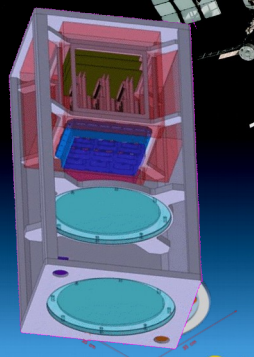


K-EUSO 400km (2022)

14°



POEMMA



MINI-EUSO (2017) 400 km

TUS (2016)

40 km

EUSO-BALLOON (2014)
EUSO-SPB (2017)
EUSO-SPB2 (2020)

UHECR

Fluorescence

Cherenkov

EUSO-TA (2013)

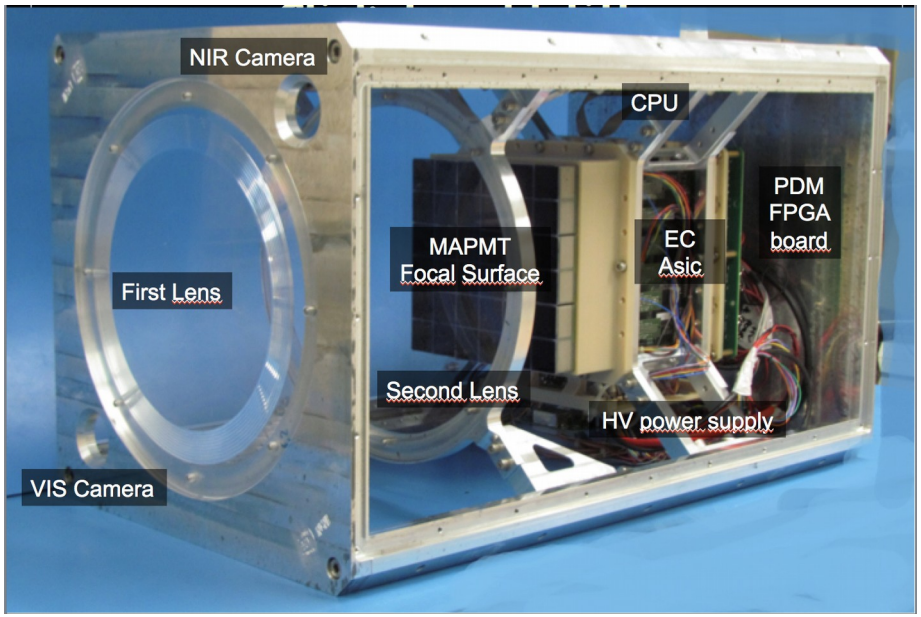
115km

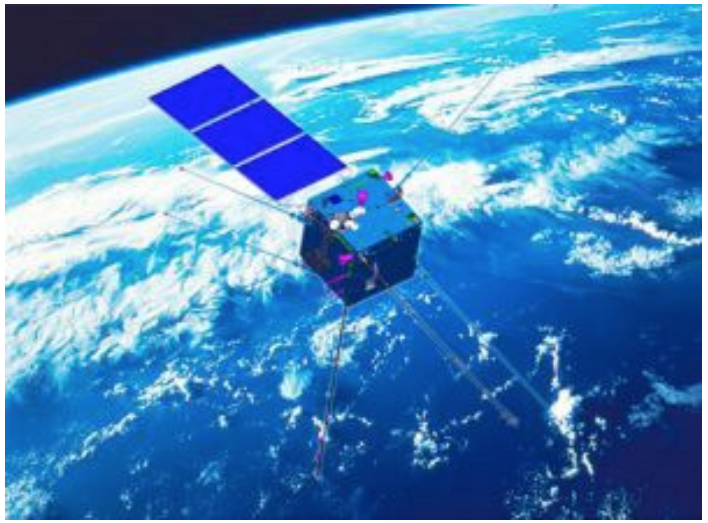
JEM-EUSO collaboration 16 Countries, 93 Institutes, 351 people

Sebbene il programma internazionale JEM-EUSO prosegua sulle linee appena descritte, la Commissione Scientifica Nazionale II INFN lo scorso Settembre ha deciso, a maggioranza dopo votazione, di chiudere la sigla JEM-EUSO-RD a partire dal 2019.

Tuttavia, le attività, finanziate da ASI e INFN, relative alla missione **Mini-EUSO**, il cui lancio è previsto nella Primavera del 2019, saranno in ogni caso svolte nel corso del 2019, con un supporto INFN che è stato richiesto alla Commissione II. L'approvazione di queste richieste (da inserire sotto le Dotazioni) avrà anche un impatto sull'attribuzione degli FTE del gruppo.

Mini-EUSO Engineering/Qualification Model @ LNF SPCM





LIMADOU-CSES

Chinese Seismo-Electromagnetic Satellite

ASI INFN INGV project
Chinese National Space Agency
China Earthquake Administration

Main Scientific Objectives:

- Measurement from space of magnetospheric perturbations and correlations with seismic phenomena
- Interactions between Magnetosphere, Ionosphere and Earth

Instruments on board CSES Satellite:

- Magnetic Spectrometer
- Electric Field Detector
- High Energy Particle Detector
- Magnetic Field Detector
- Low-frequency e.m. wave detector

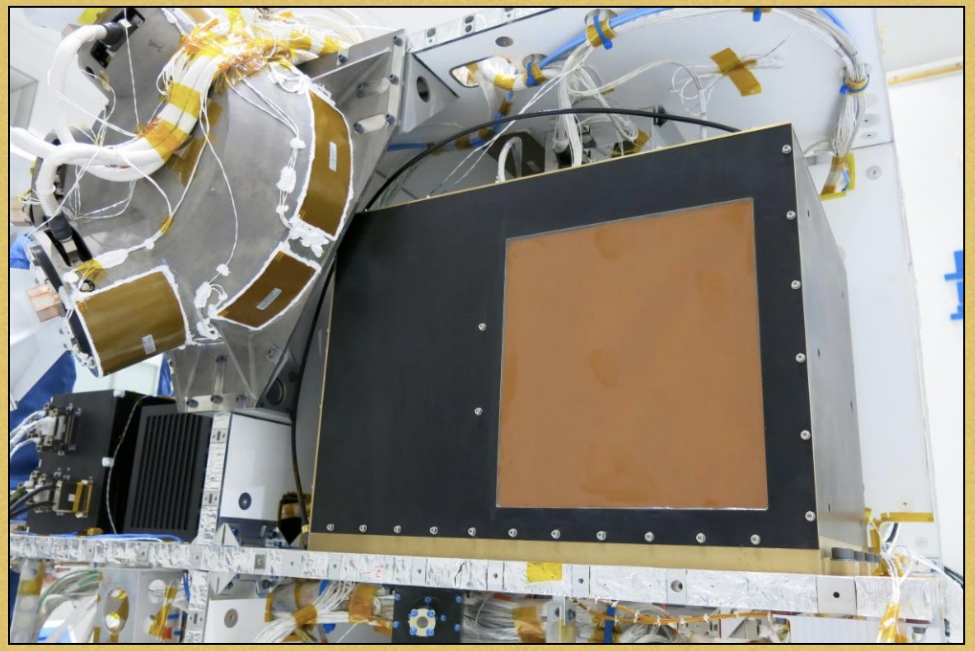
Launched 2 February, 2018

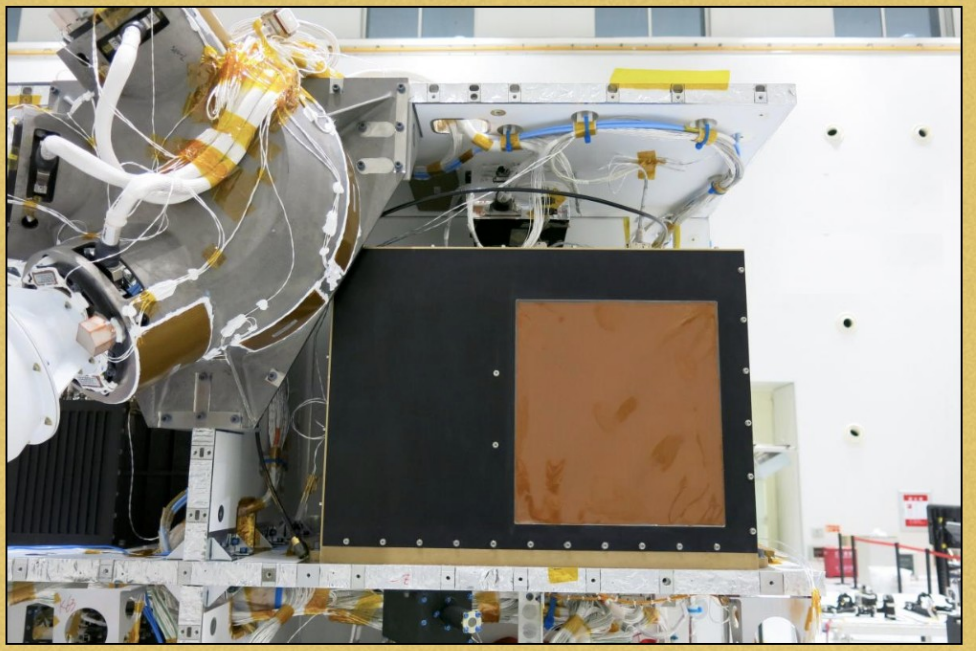
Jiuquan Satellite Launch Center, Gansu (Inner Mongolia)

Bologna
LNF (M.Ricci, B.Spataro, Assegnista)
Perugia
Roma Tor Vergata
Trento
UniNettuno Roma
INGV

China Earthquake Administration
Chinese National Space Agency

Richieste 2019 in preparazione





HEPD-FM on CSES Satellite

Parameter	Value
Energy range	Electron: 3-100 MeV
	Proton: 30-200 MeV
Angular resolution	<8°@ 5 MeV
Energy resolution	<10% @ 5 MeV
Particle Identification	>90%
Maximum Omni-directional Flux	10^7 cm^{-2}s^{-1}sr^{-1} (accepted by trigger before pre-scaling)
Operating temperature	-10 °C - + 35 °C
Mass (including electronics)	< 43 kg
Power Consumption	< 43 W
Scientific Data Bus	RS-422
Data Handling Bus	CAN 2.0
Operation mode	Event by Event
Life span	> 5 Years

Main parameters of HEPD

MoonLIGHT-2

INFN-CSN2 experiment: Test Gravity in the Solar System

INFN-Frascati, Open Lab Council, 2 July 2018

Italian Participants:

INFN − LNF ……. 7.1 FTE

INFN/University − Padova …….1.5 FTE

INFN/University − Naples (from 2019) …… 2.2 FTE

USA Participants:

University of Maryland (UMD) at College Park, MD

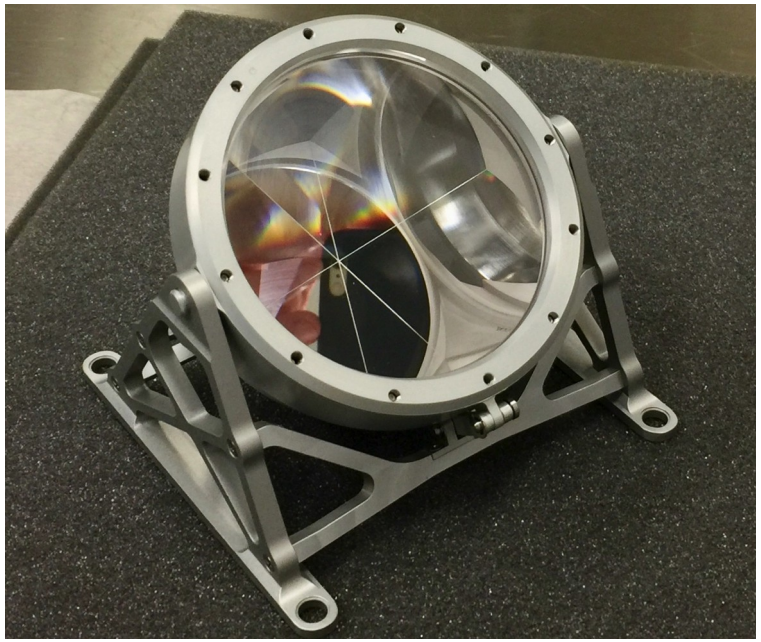
Harvard-Smithsonian Center for Astrophysics (CfA), Cambridge, MA

Partner Space Agencies:

Moon, landers/rovers: work & missions

Work

- **INFN-LNF:** MoonLIGHT (photo) & micro (next slide) laser retroreflectors. Physics analysis, test of General Relativity
- **INFN/Univ-Padua:** laser ranging detectors, electronics & ToF @ASI-Matera
- **ASI-Matera:** ground lunar laser station. Joint Lab with LNF
- **INFN-Naples:** new physics of gravity, physics analysis with LNF



Missions

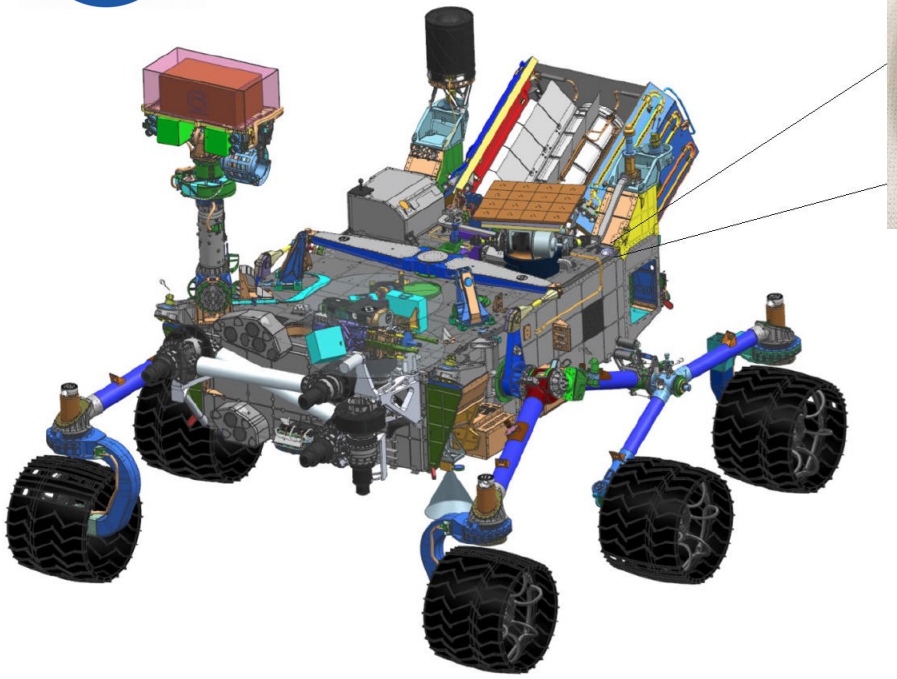
- **NASA Calls !** 1 per year from 2018, for commercial & its own flights
- **CNSA, China:** Chang'E program
- **Astrobotic 1** (USA, commercial)
- **Moon Express 1** (USA, commercial)
- **TeamIndus** (India ⊔ USA, commerc.)

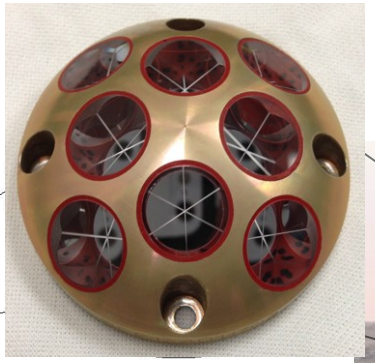
Mars General Relativity & geodesy with Italian microreflectors

NASA: **InSight (5 May 2018)** Lander, Mars 2020 Rover

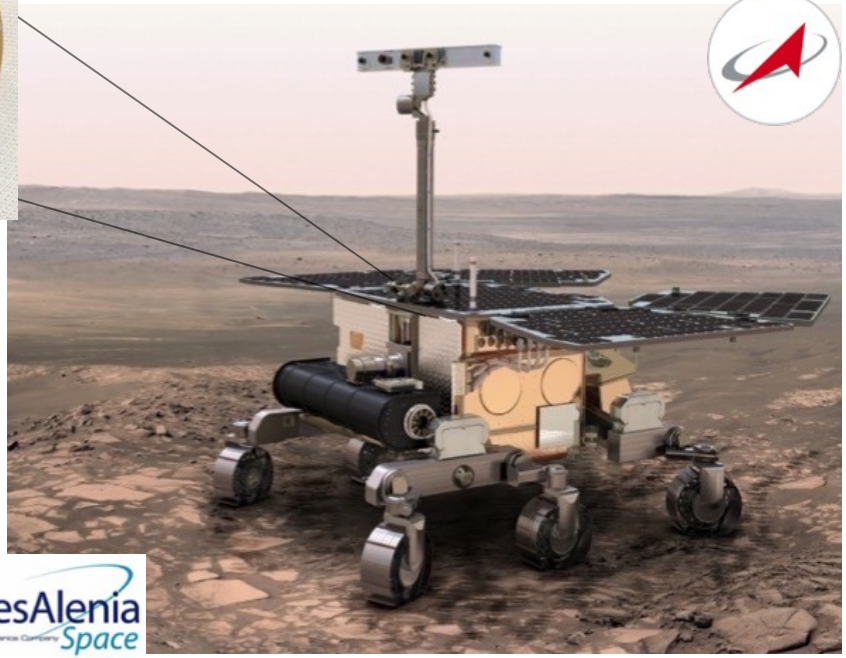
ESA-ASI: Schiaparelli 2016 Lander, ExoMars 2020 Rover

NASA Mars 2020





ESA-ASI ExoMars 2020



Prelim. requests to LNF & Personnel, 2019

- Requests to LNF Support Services (man-months):
  - SPCM: 7; Automation: 4; DT: 4; Cryo: 1; Laser: ½; Electr install: ½
- LNF Personnel (FTE, %: tot = 7.1)
  - S. Dell'Agnello 60%
  - L. Porcelli 60%
  - G. Delle Monache 50%
  - O. Luongo 60%
  - M. Mauro 60%
  - M. Muccino 60%
  - M. Tantalo 50%
  - M. Tibuzzi, L. Salvatori, C. Mondini: 50% / each (tot = 150%)
  - R. March 60%
  - G. Bellettini 50%
  - R. Vittori 30%
  - G. Bianco 20%

Dotazioni

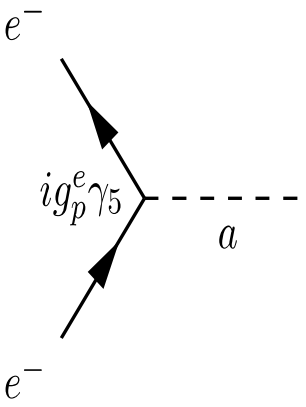
La CSN2 finanzia le dotazioni sulla base dei FTE ricalcolati eliminando gli afferenti alle altre CSN e gli associati dipendenti di altri enti (che non siano l'universita' o che non abbiano l'incarico di ricerca).
Per Frascati questo significa 12 FTE invece di 16 FTE (stime sulla base dei preventivi 2018).
A questi si aggiungono i finanziamenti delle sigle sotto dotazione, di cui si tiene una contabilita' separata.

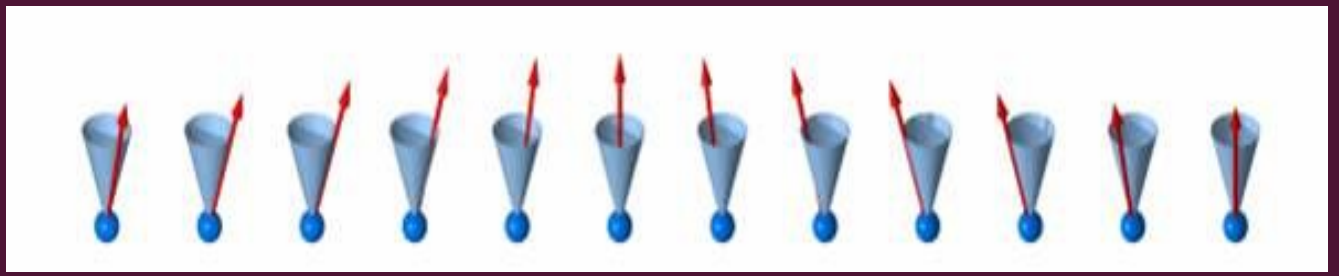
Schema di finanziamento
Missioni: 300 Euro*FTE + 1 kEuro/referaggio + 2 kEuro (coordinatore)
Consumo: 100 Euro*FTE
Inventario: 400 Euro*FTE
Pubblicazioni: 500 Euro
Organizzazione eventi: 1000 Euro

Finanziamento 2018 (buon riferimento)
Missioni: 8000 Euro
Consumo: 1500 Euro
Inventario: 5000 Euro
Pubblicazioni: 500 Euro
Organizzazione eventi: 1000 Euro

STATUS OF QUAX R&D

SEARCHING FOR GALACTIC AXIONS THROUGH MAGNETIZED MEDIA





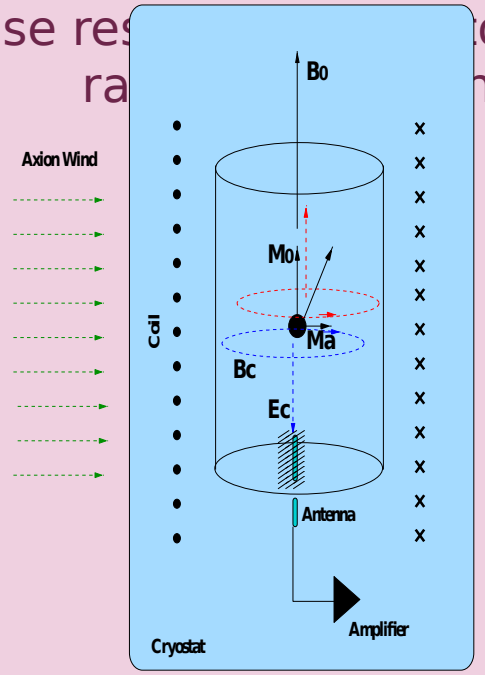
QUAX: QUEST FOR AXIONS

arXiv:1806.00310

Quax Experimental Scheme

Use Electron Spin Resonance to absorb energy from Axion Wind and re-emit it as *e.m.* radiation.

Use res[illegible]o avoid ra[illegible]ng.

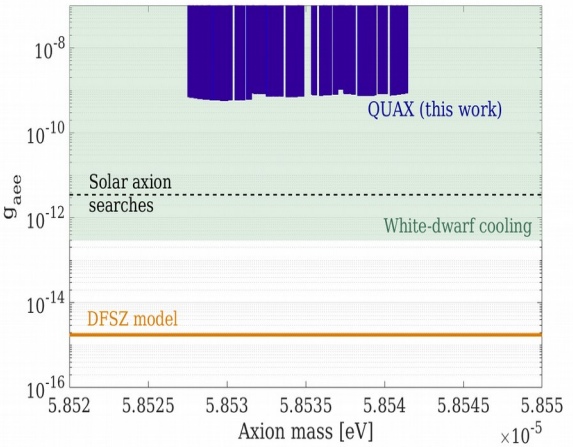


Sensitive to axion-electron coupling!

$$\lambda_a = \frac{h}{mv_a} \gg L_{detector}$$

Barbieri et al. Phys. Dark Univ. 15 (2017) 135

First result with a "ferromagnetic" haloscope!

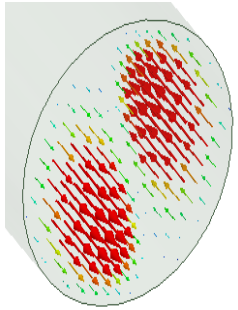


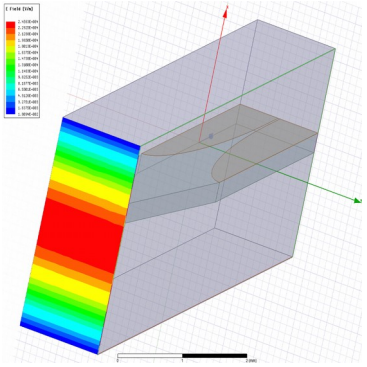
Pilot Experiment in arXiv:1806.00310	
B [T]	0.5
N. of GaYIG Sphere (diameter =1 mm)	5
n_s [spin/m^3]	2.1×10^{28}
τ_{min} [μs]	0.11
Frequency [GHz]	13.98
Cu-cavity Q (mode TM110)	50,000
T_{cavity} [K]	5.0

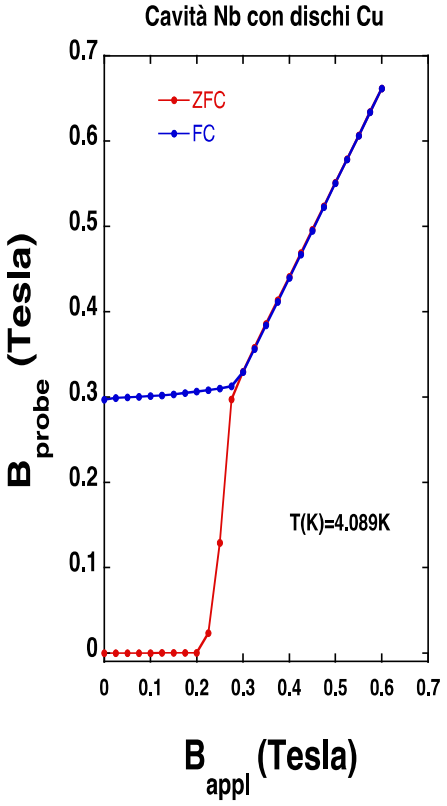
SUPERCONDUCTIVE RESONANT CAVITIES

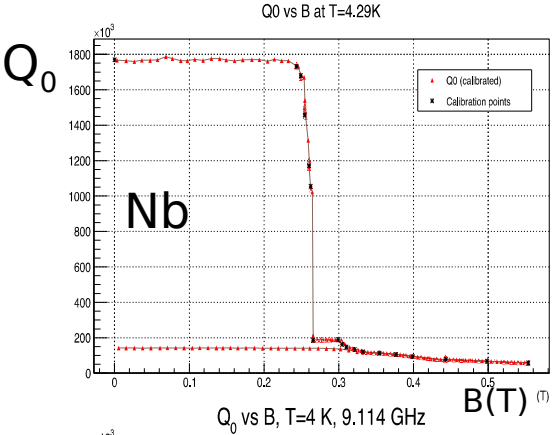
- Nb, NbTi and MgB_2 Superconductive cavities under test at LNF.

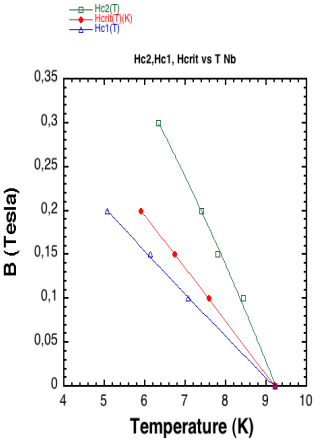
RF Simulations | B field measurements | Measurement of Quality factor vs B and T

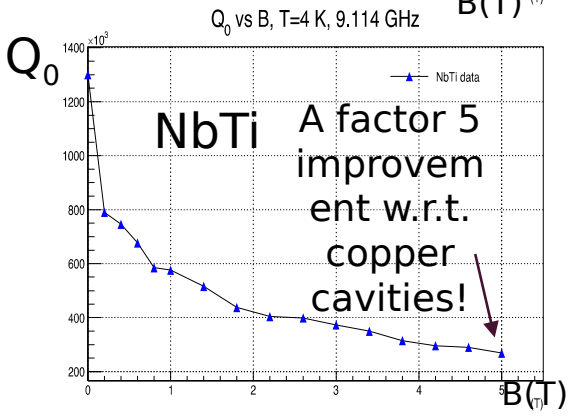


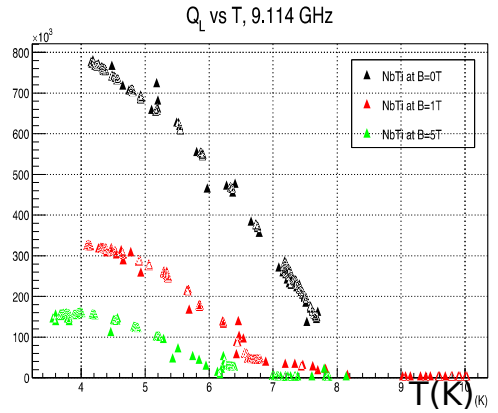






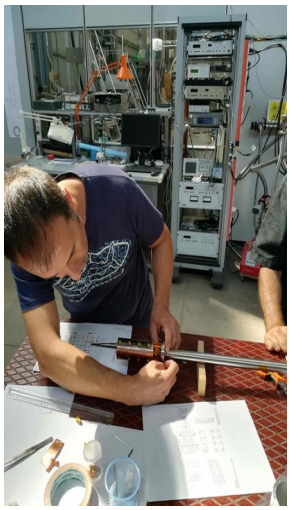


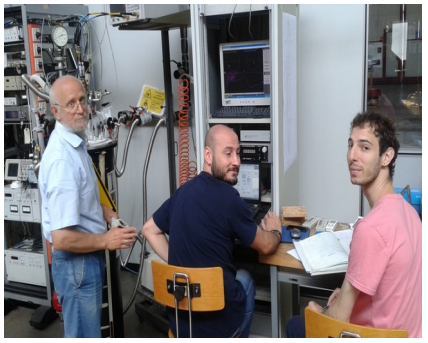




ANAGRAFICA

QUAX - LNF		FTE 2018	FTE 2019*
Claudio Gatti	R	1	0.5
Daniele Di Gioacchino	R	1	0.5
Carlo Ligi	T	0.5	0.2
Giuanluca Lamanna (Pi)	R	0.2	0.2
David Alesini	PT	0.2	0.1
Simone Tocci	Borsista	-	-
Alessio Rettaroli	Laureando	-	-





ico: M.Iannarelli, G.Pileggi, G.Papalino, F. Tabacchioni (INAF).

'anno prossimo invariate o rimodulate in base alla approvazione degli altri progetti (SIM

vvisori, dipende da approvazione SIMP e da come procede KLASH