Preventivi 2020 : Gruppo II

Alberto Garfagnini

Consiglio di Sezione, Padova, 10 luglio 2019

Istituto Nazionale di Fisica Nucleare

CTA/MAGIC

M. Mariotti

Padova CTA/MAGIC group (2019- 2020) anagrafica

Magic = 10 firme, CTA = 14 firme Tot_FTE = 12

Mose' Mariotti
group leader

Alessandro de Angelis PO

Michele Doro
PA

Eugenio Bottacini
RTDB

Elisa Prandini
RTDA

Riccardo Rando
RC

Manuela Mallamaci
postdoc

Ruben Lopez
postdoc

Simona Paiano
Assegno

Denis Bastieri
PA

Giovanni Busetto
PO

Giampiero Naletto
PA

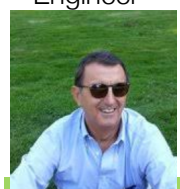
Alessia Spolon
PhD

Cerdic Perennes
Pos doc

Luca Foffano
PhD

Elisa bernardini
PA

Adriano Pepato
Engineer



Sandro Ventura
Ricercatore

Daniele Corti
Electronic

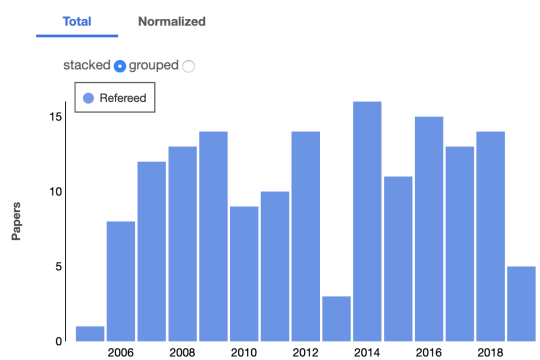
Technical supporters 2

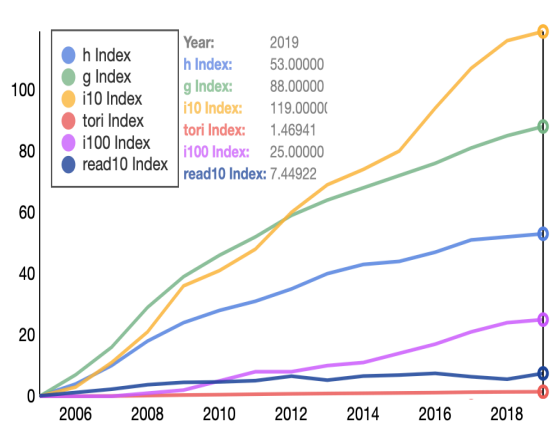
MAGIC recent scientific results and highlights

- Magic gode di ottima salute, al momento, grazie alla mauntenzione e cmprensione dello strumento, possiede la migliore sensibilità ed affidabilità di sempre!

- Possiede una rilevante ed eccelente produzione scientifica testimoniata da indicatori bibliometrici,

	Totals	Refereed
Number of papers	158	158
Normalized paper count	1.0	1.0





h-index

The H-index is the largest number H such that H publications have at least H citations.

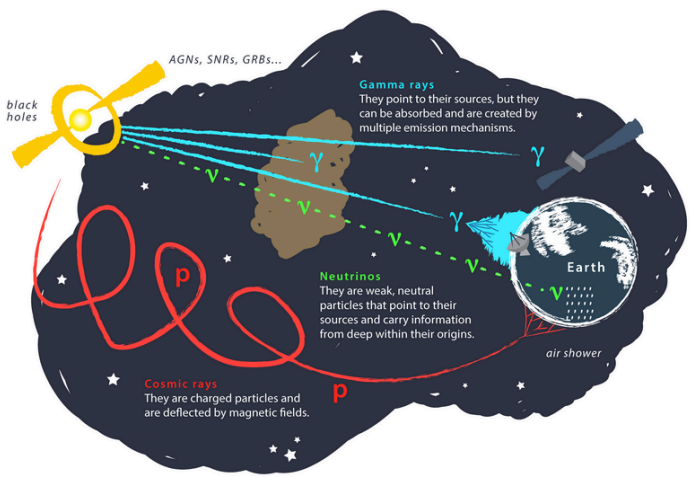
i100-index

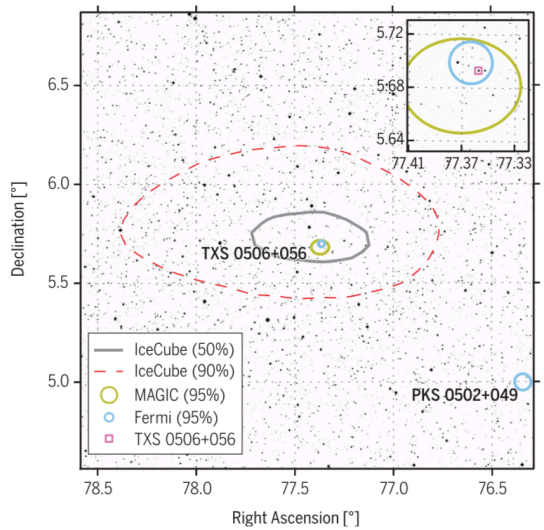
The i100-index is the number of publications with at least 100 citations.

MAGIC recent scientific results and highlights

Nel 2018 rilevante la misure della controparte gamma al TeV in un follow-up di allerta neutrino da icecube, che ha sancito la prima probabile “sorgente” di neutrini cosmici

MAGIC 2018: TRANSIENTS #1 – THE BLAZAR TXS0506+056





MAGIC recent scientific results and highlights

Nel 2019, per la prima volta osservato un GRB da terra: dati di altissima qualità in regime quasi “background free”. Molte sorprese: press release e in progress (nature paper results under embargo)

MAGIC 2018: TRANSIENTS #2 – GRB 190114C

[Previous | Next | ADS]

First time detection of a GRB at sub-TeV energies; MAGIC detects the GRB 190114C

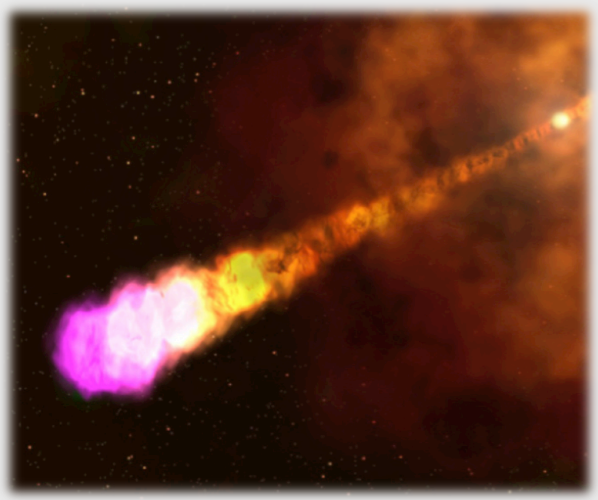
ATel #12390; *Razmik Mirzoyan on behalf of the MAGIC Collaboration*
on 15 Jan 2019; 01:03 UT
Credential Certification: Razmik Mirzoyan (Razmik.Mirzoyan@mpp.mpg.de)

Subjects: Gamma Ray, >GeV, TeV, VHE, Request for Observations, Gamma-Ray Burst

Referred to by ATel #: 12395, 12475

Tweet

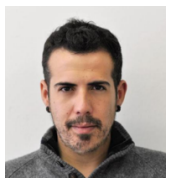
The MAGIC telescopes performed a rapid follow-up observation of GRB 190114C (Gropp et al., GCN 23688; Tyurina et al., GCN 23690, de Ugarte Postigo et al., GCN 23692, Lipunov et al. GCN 23693, Selsing et al. GCN 23695). This observation was triggered by the Swift-BAT alert; we started observing at about 50s after Swift T0: 20:57:03.19. The MAGIC real-time analysis shows a significance >20 sigma in the first 20 min of observations (starting at T0+50s) for energies >300GeV. The relatively high detection threshold is due to the large zenith angle of observations (>60 degrees) and the presence of partial Moon. Given the brightness of the event, MAGIC will continue the observation of GRB 190114C until it is observable tonight and also in the next days. We strongly encourage follow-up observations by other instruments. The MAGIC contact persons for these observations are R. Mirzoyan (Razmik.Mirzoyan@mpp.mpg.de) and K. Noda (nodak@icrr.u-tokyo.ac.jp). MAGIC is a system of two 17m-diameter Imaging Atmospheric Cherenkov Telescopes located at the Observatory Roque de los Muchachos on the Canary island La Palma, Spain, and designed to perform gamma-ray astronomy in the energy range from 50 GeV to greater than 50 TeV.



Attività 2020: MAGIC

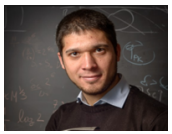
Presa Dati

- 2+1 turni di pesa dati

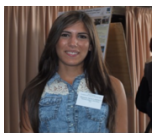


Analisi dati partecipazione ai Gruppi scientifici

- AGN Physics working group

- Astroparticle and fundamental


EB member


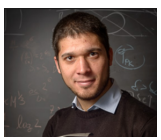

CB member

- Galactic


CONVENOR


- Transient: neutrino, GRB, GW

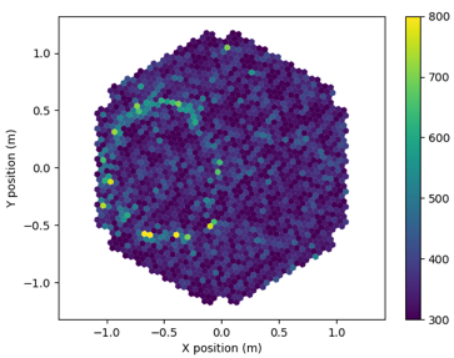

Neutrino PI

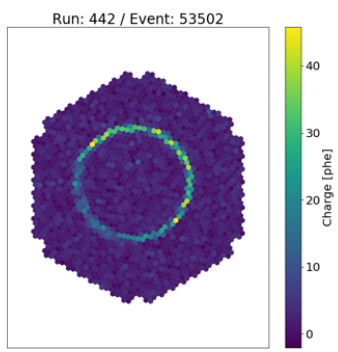
CTA-LST Status/activity

- LST in commissionig: turni di messa a punto e inizio presa dati
- Workshop sul software ed analisi di LST a Padova organizzato dalla sezione presso LNL. Rubèn Lopez responsabile e coordinatore software ed analisi di LST.
- Graduale aumento qualità dei dati: presa dati sistematica con shifts: nella prima fase seguendo le osservazioni MAGIC

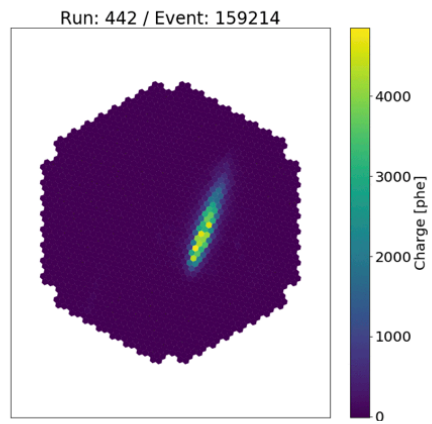
Dicembre 2018



Aprile 2019

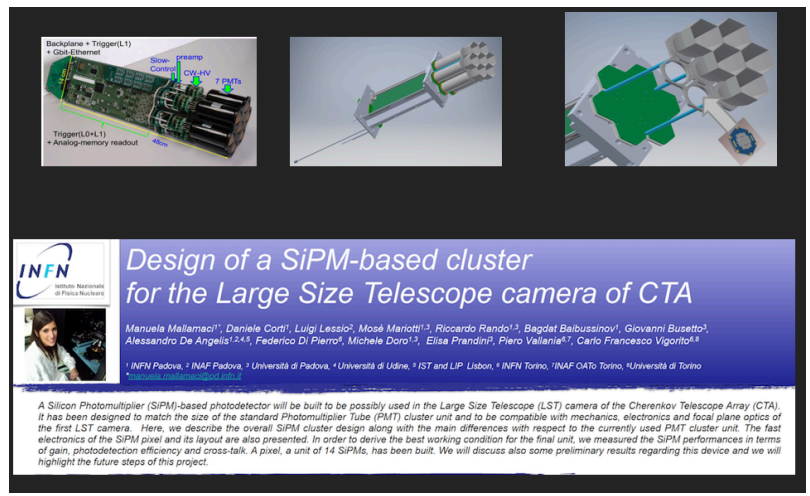


Maggio 2019



CTA-LST activity 2020

- In preparazione gare per i prossimi 3 telescopi: INFN PD meccanica funi, INFN TS-UD Calibration box,
- Richieste economiche PD 2020: Funi e meccanica ancillare per funi, completamento del cluster R&D a SiPm, Presa dati nel sito ed analisi combinata con dati MAGIC



Richieste finanziarie servizi di Sezione 2020

Struttura	A carico dell'INFN									
	missioni	consumo	altri_cons	trasporti	manutenzione	inventario	licenze-SW	apparati	spservizi	TOTALI
BA										
CT										
GSGC										
NA										
PD	66.00	24.00			4.00		12.00		170.00	31.00	**307.00**

RICHIESTE Servizi di Sezione CTA 2020

LE 2 mU

- Sviluppo e produzione schede per interfaccia per clusetr SiPm — 2,0 mese/uomo

Bellato 4 mU

- Nuova versione PCB sensori SiPm LST (sviluppo produzione e test) — 2.0 mese/uomo
- Montaggio dei pixel nel cluster LST e test funzionali del sistema — 2,0 mese/uomo

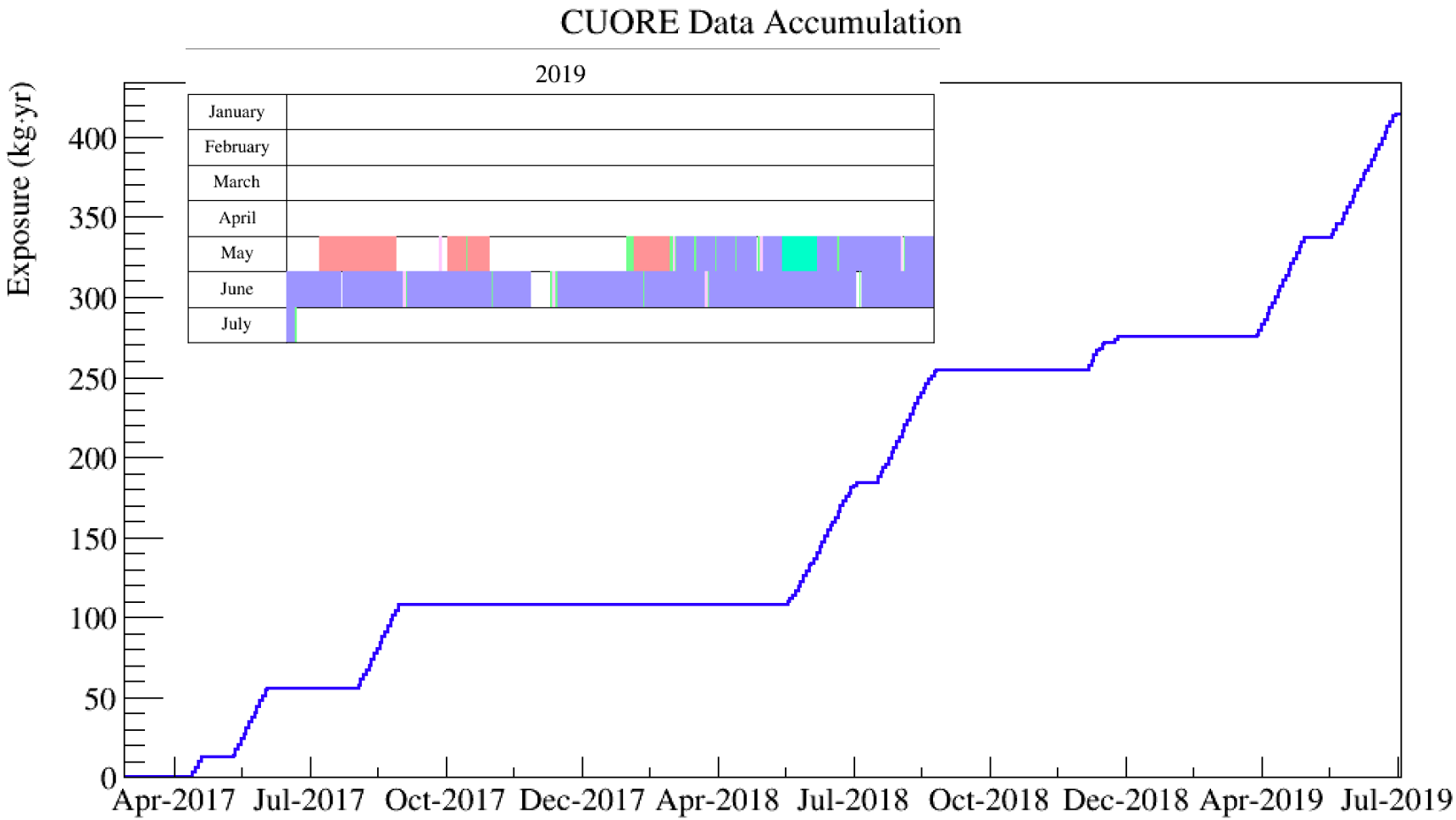
OM 3.5 mU

- Supporto manutenzione specchi MAGIC — 1.5 mese/uomo
- Supporto per realizzazione meccanica dei cluster SiPm LST — 1.0 mese/uomo
- Supporto realizzazione meccanica "ancellare" Funi — 2.0 mese/uomo

UT 3 mU

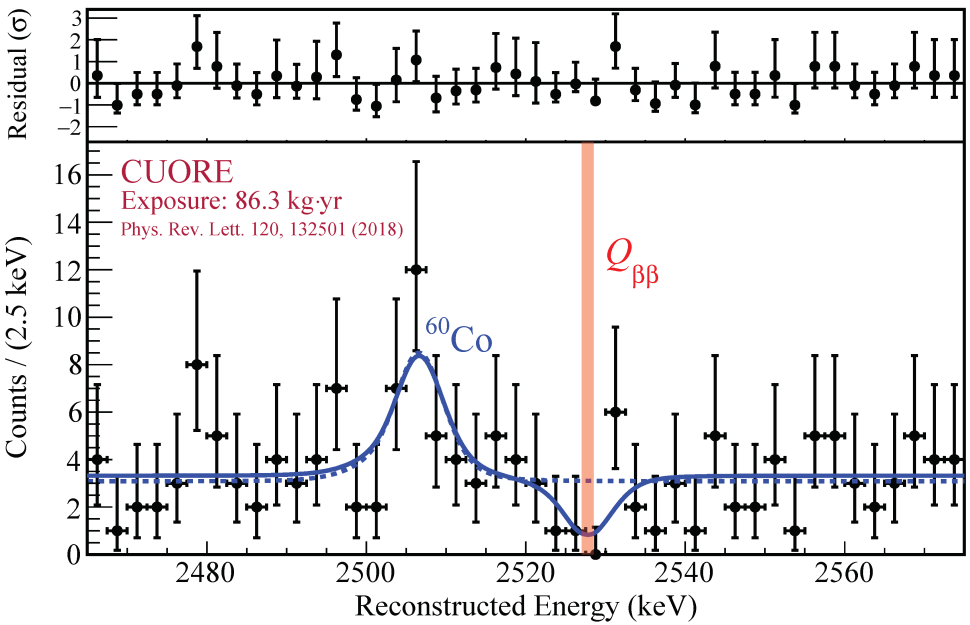
- Supporto Gara acquisto funi, produzione meccanica "ancellare" Funi — 2.0 mese/uomo

Cuore2019: finalmente un buon duty time, si parte per i 5 anni di data taking da specifiche di progetto (tranne 7keV) Risolti i molteplici problemi della DCS che limitavano il duty time e mettevano in pericolo il criostato.



CUORE nuovi risultati sotto embargo TAUP 2019, da aprire la scatola «unblind», ci sono però i vecchi.

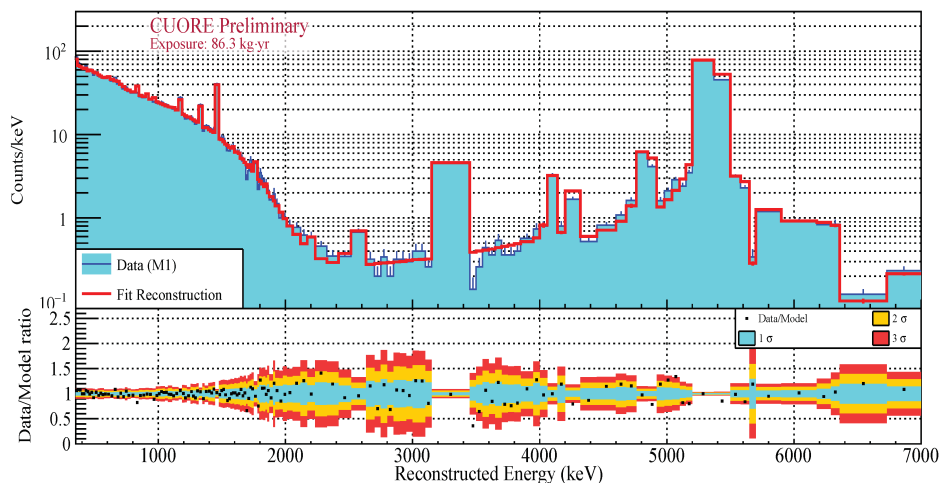
BACKGROUND Model EXCELLENT!!



Up: reconstructed 208Tl 2516 keV line in the calibration spectrum with residuals with data points (black) and the reconstructed line-shape (red). The dotted blue lines are the components of the line shape corresponding to different physical processes.

Down: the best fit in the ROI. The value of the Q*bb* is marked in

Top: M1L0 spectrum (blue) and the fit to the spectrum, built out of different simulated background components (red). The variable binning has been chosen to contain peaks into a single bin to avoid dependence on details of the peak shape while having good resolution of the model in the continuum region.
Bottom: ratio of the data and reconstructed model with 1*s*, 2*s* and 3*s* error bars. The continuum is well described while we have moderate disagreement in the heights of a few peaks.



- Optimum Trigger (OT) has been successfully implemented in CUORE;
- The algorithm can be used either online or on data already on tape;

Antonio Branca 30% september

1)talk CUORE EPS-hep 2019 july
2)Poster OT Taup 2019

- The software tools needed to apply the trigger offline (retriggering software) have been updated to allow retriggering of a data-set in few hours (6/7 weeks of data can be retriggered in about 8 hours);
- The OT is applied for the data production for TAUP results:
  - All data-sets that were acquired with the standard derivative trigger have been retriggered in few days;
  - New data will be retriggered at the closing of each data-set;
- The OT data allow to lower the energy threshold:
  - Detection efficiency is obtained from pulser events, but also a new method based on fake injected pulses has been implemented;
  - Studies are ongoing to determine the best analysis energy thresholds exploiting pulses shape parameters;
  - ➢ neutrino-less double beta decay analysis:
    - Threshold from 150 keV, used for PRL-2018 result, down to 40 keV;
    - Background contribution from Compton scattering in more than one crystal will be discarded;
  - ➢ Dark-Matter and low-energy nuclear processes: require thresholds of at least 10 keV;

Cupid-RD finito, alle prossime CNS2 si chiede apertura sigla, che in qualche anno si fonderà con CUORE, di seguito informazioni dal pre-CDR di luglio 2019, in corso di review finale

CUPID (CUORE Upgrade with Particle IDentification) starts from the CUORE technical expertise, material selection, background model, and excellent energy resolution, and combines it with the capability to eliminate the backgrounds fromαparticles using scintillating crystal. In addition, the high Q-value of 0νββ in 100Mo naturally suppresses the gamma backgrounds by over an order of magnitude, compared to CUORE. We demonstrate that the scintillating bolometer technology based on Li2MoO4 crystals highly enriched in100Mo is scalable to ton-scale isotopic masses. An experiment deployed in the existing CUORE cryostat would have a discovery potential covering the entire inverted hierarchy region of neutrino masses.

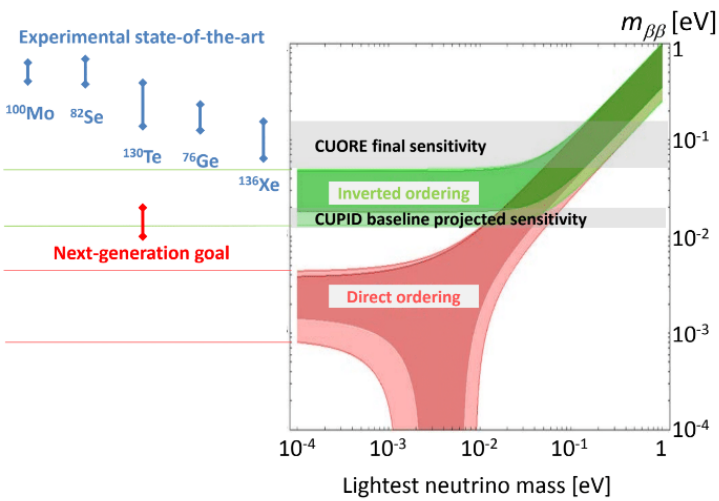


Figure 2: The effective Majorana mass $m_{\beta\beta}$ as a function of the lightest neutrino mass provides the parameter space typically used to compare $0\nu\beta\beta$ decay experiments. The experimental state-of-the art and the goal of next-generation experiments are shown on the left. The final sensitivity of CUORE and the projected sensitivity of CUPID baseline are also reported.

Table 1: Main parameters of the conservative baseline CUPID detector design.

Parameter	Baseline
Crystal	Li_2MoO_4
Crystal size	⌀50 mm× h50 mm
Crystal mass (g)	308
Number of crystals	1534
Number of light detectors	1652
Detector mass (kg)	472
^{100}Mo mass (kg)	253
Energy resolution FWHM (keV)	5
Background index (counts/(keV·kg·yr))	10^{-4}
Containment efficiency	79%
Selection efficiency	90%
Livetime	10 years
Half-life limit sensitivity (90%) C.L.	1.5×10^{27} y
Half-life discovery sensitivity (3σ)	1.1×10^{27} y
$m_{\beta\beta}$ limit sensitivity (90%) C.L.	10 – 17 meV
$m_{\beta\beta}$ discovery sensitivity (3σ)	12 – 20 meV

Richieste economiche Cuore-Pd 2020

Anagrafica: Ric. 0,5/2 FTE: AB e ML(non firmatario) Tecn. 0.6/1 FTE: LT

a Novembre 2018 AB fa finito il suo biennio nel Vetting Board

Capitolo	*Descrizione*	Parziali Richiesta	SJ	Totale Richieste
MISSIONI	**1.** Turni presso LNGS 2 FTE	8.00		
	2. 2 meeting di collaborazione in Italia + riunioni PI	2.00		
	3. Meeting di analisi dati	2.00		
	4. 1 meeting di collaborazione all'estero (USA)	2.00		
	5. Conferenza estero	2.00		
	6. Attività sperimentale sala C e studio di mercato di nuovi refrigeratori x CUPID sala A (Leiden, Oxford, Blueforce)	5.00		
				21.50
CONSUMO	**1.** Flussostato per He3, gadget per pannello DU	2.00		**2.00**

Non si richiede attività di servizio

Totale richiesta 23,5 k€

Dune:
- 1069 collaborators from 177 institutions in 31 countries
- 578 faculty/scientists, 184 postdocs, 109 engineers, 198 PhD students

Major achievement in 2018: ProtoDUNE performances
Major milestone in 2019: FD TDR completed (including ND CDR summary)

Planning for the first detector module to be SP and the second to be DP ('2+1+1 model' with 3rd module SP and 4th 'module of opportunity').

Start of Detector 1 Installation: August 2024
Start of Detector 2 Installation: August 2025
Start beam operations in 2026

Sigla INFN: Nu_at_FNAL, resp. naz. S. Bertolucci

- Impegno per il Near Detector (utilizzo di KLOE, magnet plus EM)
- Impegno per il Far Detector (Photodetection)
- Impegno per SBN (responsabilità del top CRT, Cosmic Ray Tagger, analysis contribution)

➔ **APPROVED by DUNE-DOE-INFN in the last days !!!**

Preventivi in corso di elaborazione.
Richieste ai servizi – Padova : 1 mese off.mecc. per installazione CRT a FNAL

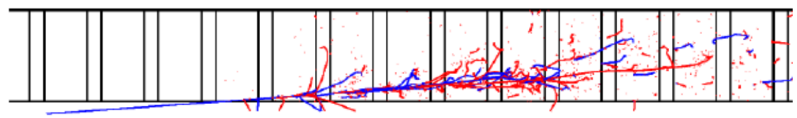
ENUBET

This project has received funding from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme (grant agreement No 681647).

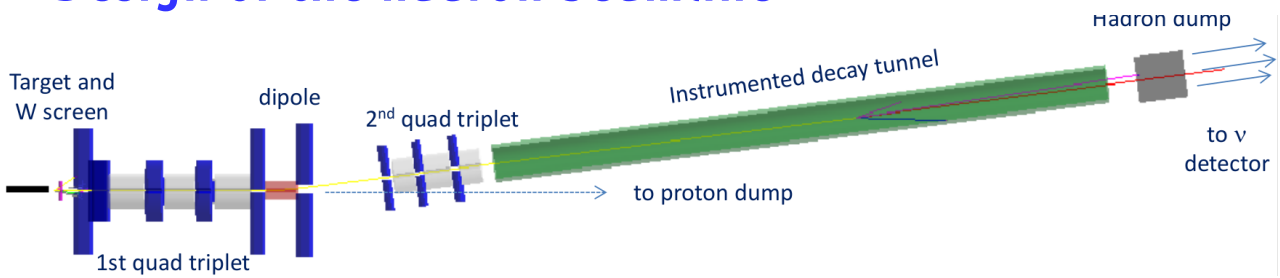
http://enubet.pd.infn.it

- Instrumented decay tunnel
- $K^+ \rightarrow e^+ \nu_e \pi^0 \rightarrow$ large angle e^+
- ν_e flux prediction = e^+ counting
- % level precision on ν_e flux

R&D for the instrumentation of the decay tunnel



Design of the hadron beamline



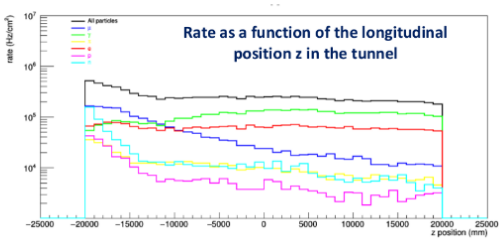
ERC Cons. Grant (2016-2021) [ENUBET, PI: A. Longhin, UNIPD (host)+INFN]
Grant MIUR – Bando FARE (2017-2021) [NuTech]
NEW! Approvazione come esp. CERN "Neutrino Platform" [NP06/ENUBET]

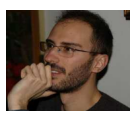
The ENUBET collaboration

60 physicists,
12 institutions

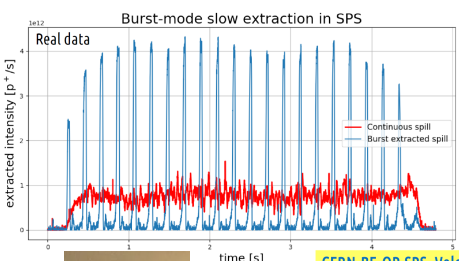
INFN-PD

Contributo **cruciale**: coordinamento (PI), simulazione del tunnel instrumentato, della beamline (2 art. 36), sviluppo di sistemi di estrazione dei protoni al CERN/SPS e sviluppo di digitizer custom (1 PhD).

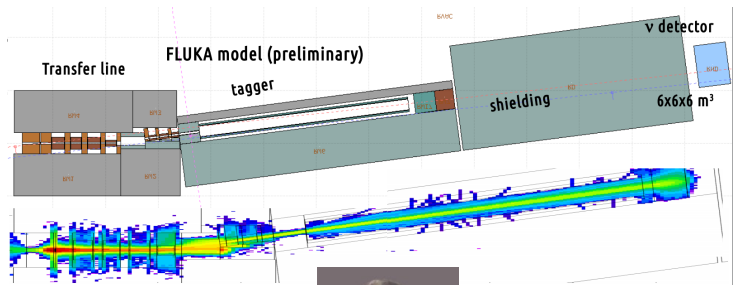


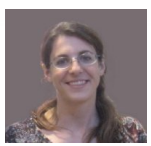


F. Pupilli



M. Pari





G. Brunetti

ENUBET-Padova, anagrafica

- Il progetto e' **interamente** finanziato da **ERC**

- sigla di supporto in **CSN2 (ENUBET_2)** per piccole spese
  1) non previste nel Grant Agreement (i.e. missioni laureandi, PhD)
  2) inventariabili per cui EU rifonde una frazione del costo corretta per ammortamento a fine progetto (difficile da rendicontare).

- **Gruppo e anagrafiche:**

  - **EU (time-sheets)**: A. Longhin (70%), F. Pupilli (100% art. 36 ENUBET), G. Brunetti (100% art. 36 ENUBET), G. Collazuol (10%).
  - **ENUBET_2**: E. Conti (40%), F. Dal Corso (30%), M. Mezzetto (10%), M. Pari (PhD, 70%)

2019 highlights

2019 highlights /4

Riconoscimento nella CERN Neutrino Platform

Proposta sottomessa alla Neutrino Platform Call nel Dicembre 2018:

- ✓ Sviluppo della tecnologia dei fasci monitorati (ENUBET) e taggati (NUTECH) grazie all'expertise della divisione acceleratori CERN (proton extraction, transfer line, beam dump, target area)
- ✓ Valutare implementazione al CERN con ProtoDUNE-Single/Double Phase
- ✓ Coagulare l'interesse della comunità (soprattutto T2K/HK e DUNE) per un esperimento short baseline dedicato alle sezioni d'urto e alla riduzione delle sistematiche nei fasci long-baseline

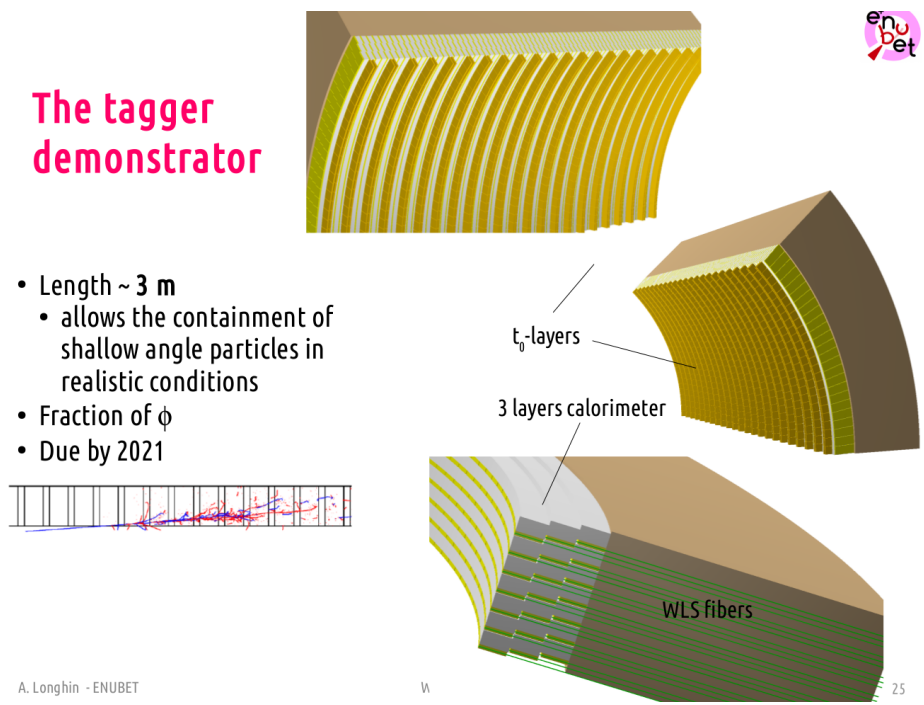
- ✓ Proposta:
  CERN-SPSC-2018-034 ; SPSC-I-248 (31/10/18).
- ✓ Approvazione SPSC e Research Board:
  - 1/2019 e 3/2019
- ✓ Memorandum of Understanding:
  - in progress

The physics case of the **ENUBET** project and the exciting possibilities of a tagged neutrino beam are recognized by the SPSC. The committee recognizes the technological development for a neutrino beam without a horn using a quadrupole-based solution, and appreciates the close collaboration of the ENUBET collaboration with the CERN accelerator sector. The SPSC supports the proposed programme, and welcomes the opportunity to continue reviewing the experiment; test-beam requests will be considered via the standard annual procedure. **The Research Board approved the participation of ENUBET in the Neutrino Platform, with reference NP06, on the understanding that**

Attivita`/richieste 2020

- Completare il **design della beamline**
- **Update delle physics performance** includendo il **monitoraggio dei muoni** e la risoluzione energetica intrinseca (10%) dei fasci narrow band
- **Prototipo ingegnerizzato** del dimostratore. Test beam a **FNAL**.
- **Procurement** del materiale per il dimostratore e **design meccanico**

- **Servizio progettazione** per il dimostratore: **3-6 m.u.** (da contatti preliminari di persona)
- **Officina meccanica** (prototipo intermedio per test beam): **2 m.u.**
- **Preventivi CSN-II 2019**
  Missioni: 3 kEUR (PhD)



ET_Italia: Sezione di Padova

Attività ET_Italia: le attivita' hardware per il 2020 saranno prevalentemente concentrate sulla caratterizzazione e per sostenere la candidatura del sito **Sos Enattos** (Sardegna). Padova in questo non e' coinvolta. La scelta del sito si dovrebbe fare nel 2021-22

Attività Sezione di Padova

Studio del caso scientifico

- Cosmologia
- Popolazione e modelli

Enhabling tecnologies

- Misura dell' assorbimento (a 1550 nm) dei substrati in Si a temperature criogeniche.

Richiesta economica 2019

5 keuro: mono cristalli di silicio ad alta purezza ed ottiche per 1550 nm

Richiesta alla sezione

- Officina meccanica: 1 mesi uomo

ET_Italia: Anagrafica Sezione di Padova

S. Matarrese	PO-Unipd	10%	M. Mapelli	PA-Unipd	10%
N. Bartolo	PA-Unipd	10%	U. Di Carlo	PhD-Unipd	10%
M. Liguori	Ric-Unipd	10%	N. Giacobbo	PhD-Unipd	10%
D. Bertacca	RTDA	10%	M. Pasquato	Astrofit-fellow	10%
M.Peloso	PA-Unipd	10%	M. Spera	MC-fellow	10%
G.Orlando	PhD-Unipd	10%	A.Ballone	Post Doc	10%
A. Ganz	PhD-Unipd	10%			
J.P.Zendri (**)	PRic-INFN	40%	L. Conti	Ric –INFN	20%
G. Ciani	RTDB	20%	M. Bazzan	Ric-Unipd	20%
C. Lazzaro	RTDA	20%	M. Pegoraro	Tecn. INFN	10%

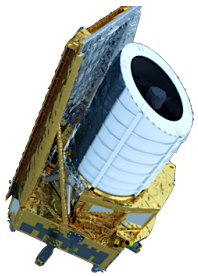
Cosmologia

Hardware

Popolazioni

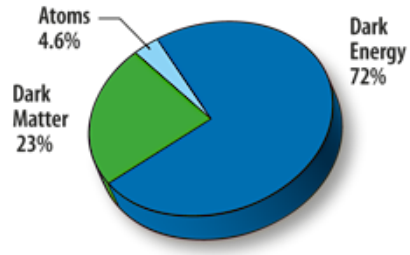
(**) Resp locale

TOTALE 2.6 FTE



Euclid Space Mission

Dark Energy Study



Euclid è una missione spaziale ESA di classe-M dedicata allo studio:

- origine dell'espansione accelerata dell'Universo
- Dark Energy e Gravita su larga scala

Status missione:

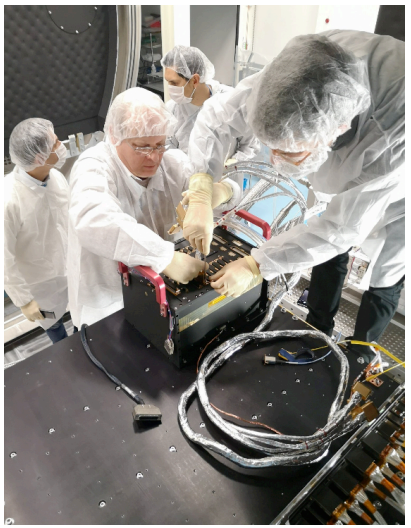
- completamento degli strumenti NISP e VIS, consegna ritardata a feb. 2020
- **lancio alla fine del 2022**, critico per fine contratto del lanciatore Soyuz
- 6 anni di presa dati

Rinnovato **contratto ASI 2019-2022** (2 RTD x 3 anni) per attività di integrazione e validazione (AIV) elettronica calda dello strumento NISP

Padova →
- **AIV** electronica calda NISP
- Analisi dati per studio **Dark Energy**
- Coordinamento **calcolo** in ambito INFN

NISP: Integrazione e validazione Warm Electronics

[E.Borsato, S.Dusini, F.Laudisio, A.Renzi, C.Sirignano, S.Ventura]



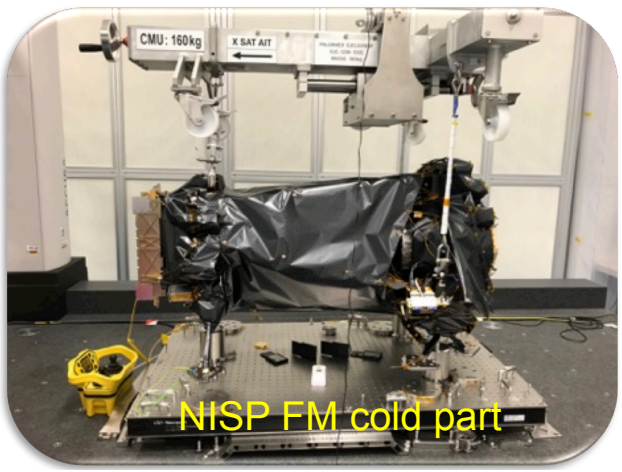
Integrazione di NISP-EM (Engineering Model) con test a LAM (Marsiglia) in Termo-Vuoto (TV). Aprile

- Importante contributo Italiano (INFN e INAF) per integrazione elettrica, Test-scripts, esecuzione test
- Problemi durante EMC →Test aggiuntivo sett. prossima

Integrazione e Validazione NISP Warm Electronics FM

- Due ulteriori mesi di ritardo nella consegna di DPU FM
- Per assorbire parte del ritardo molta dell'attività è spostata a LAM
- 3 campagne di test
  - Validazione WE ASW FM [resp. INFN]
  - NISP quasi-FM TV per la caratterizzazione dell'ottica e dei rivelatori (Ott. 2019) [supporto]
  - NISP FM TV test finali di performance dello strumento (Gen.-Feb. 2020) [supporto]

Molta pressione per il mantenere la scadenza Feb. 2020 (era Dic 2019)



Euclid analysis: Dark Energy

Padova

- Co-leadership del work package Euclid WP3 del Scientific Working Group di cross-correlazione con CMB [Alessandro Renzi]
- Validazione algoritmi per il calcolo del Power Spectrum Galassie [Alessandro Renzi]
- Studio dei vuoti cosmici come tracer per Dark Energy, gravità modificata, masse dei neutrini, Giovanni Verza PhD student, relatrori Chiara Sirignano e Alessandro Renzi

Coordinamento tra sezioni

- WG di fisica tra le sezioni INFN (Bo, Ge, Mi, Pd) che partecipano a Euclid (coord. Luca Stanco)
- Riunioni bi-settimanali:
  - Voids-lensing cross correlation,
  - Voids and Large Scale Structure (LSS)
  - LSS-CMB cross correlation.
  - Supporto a OU-SPE (ricostruzione spettri NISP)
- Collaborazione con SISSA sui Vuoti Cosmici

Calcolo per analisi dati Euclid

Risorse calcolo **HPC/MPI** per le attività di analisi

A. **Cluster ZEFIRO** (INFN-Pi): **small/medium size HPC** cluster con High-speed low-latency comunication per **sviluppo e ottimizzazione dei codici ibridi MPI/OpenMP**
   - Development and validation of the **Power Spectrum** code for galaxy clustering.
   - Development of the cross-correlation estimator and likelihood using Planck CMB and Euclid galaxies for neutrino parameters estimation.
   - Development of a full 3D power spectrum including Redshift Space Distortions and likelihood of the neutrino parameters estimation.
   - 128 CPU con 2048 computational cores, 8 GB RAM/core, ~ 300 TB disk
B. **CINECA**: **simulazioni N-body** cosmologiche di medie dimensioni
   - Almeno 1000 cores, ~8 GB RAM/core, high-speed low-latency comunication
   - 3.5 M core x hour/year
   - ~500 TB disk storage per 3 – 4 anni (post processing e analisi)

Anagrafica e Richieste

Anagrafica Padova stabile a **4.8 FTE**: PHD student Fulvio Laudision → Giovanni Verza

Nome	Contratto	Qualifica	Aff. CSN	Percentuale
Bartolo Nicola	Associato	Prof. Associato	4	10
Benevento Gianpaolo	Associato	Dottorando	4	10
Bertacca Daniele	Associato	Ricercatore DFA	4	10
Dusini Stefano	Dipendente	Ricercatore INFN	2	70
Karagiannis Dionysios	Associato	Assegnista	4	10
Liguori Michele	Associato	Ricercatore DFA	4	10
Matarrese Sabino	Associato	Prof. Ordinario	4	10
Naletto Giampiero	Associato	Prof. Associato	2	10
Renzi Alessandro	Dipendente	Ricercatore INFN	2	100
Sirignano Chiara	Associato	Ricercatore DFA	2	70
Stanco Luca	Dipendente	Dirigente Ricerca	2	60
Ventura Sandro	Dipendente	Primo Tecnologo	2	10
Verza Giovanni	Associato	Dottorando	2	100
Totale				4,8

L.Stanco: resp. Nazionale

A.Renzi: Co-lead Euclid WP3 (SWG)

C.Sirignano: Euclid Diversity Committee

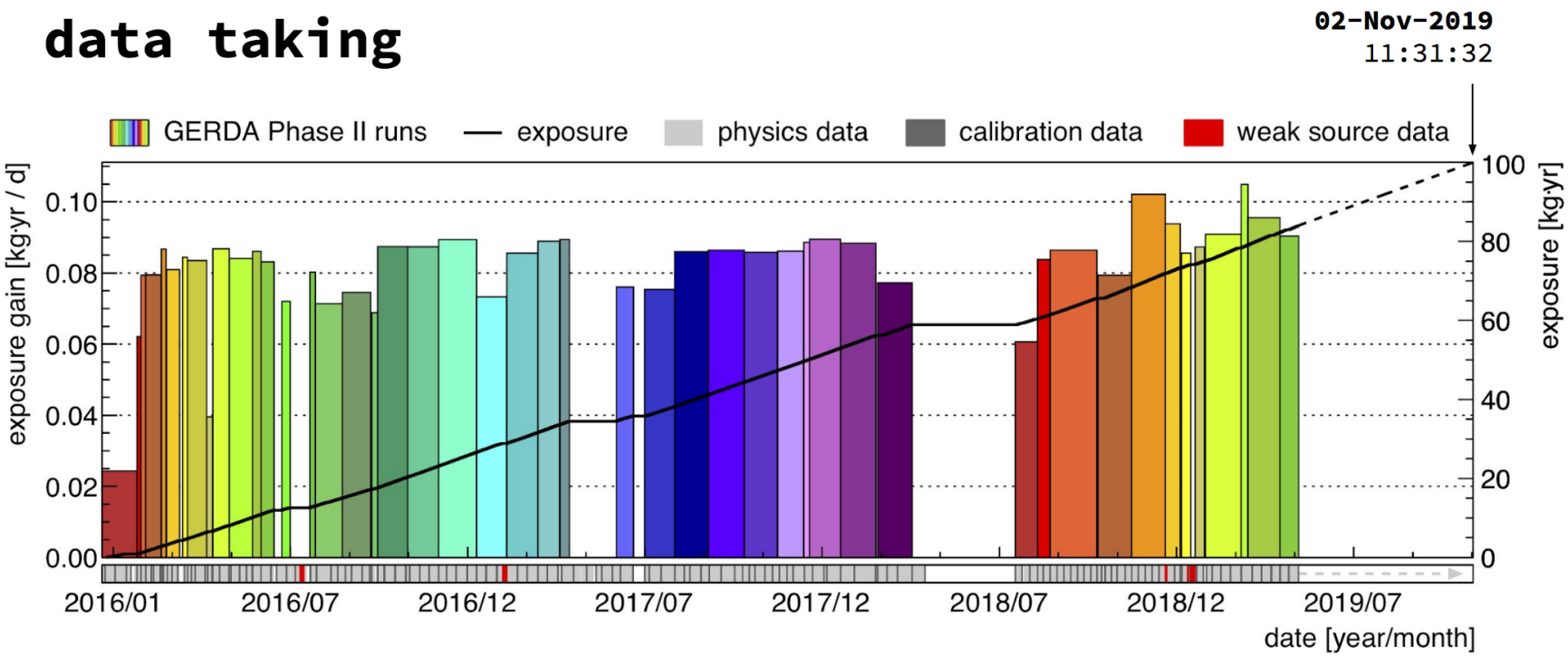
S.Dusini: NISP Deputy AIV Manager e Deputy NISP Test Manager

A **livello nazionale Euclid cresce** anche quest'anno con ingresso del gruppo di **Ferrara e Torino**

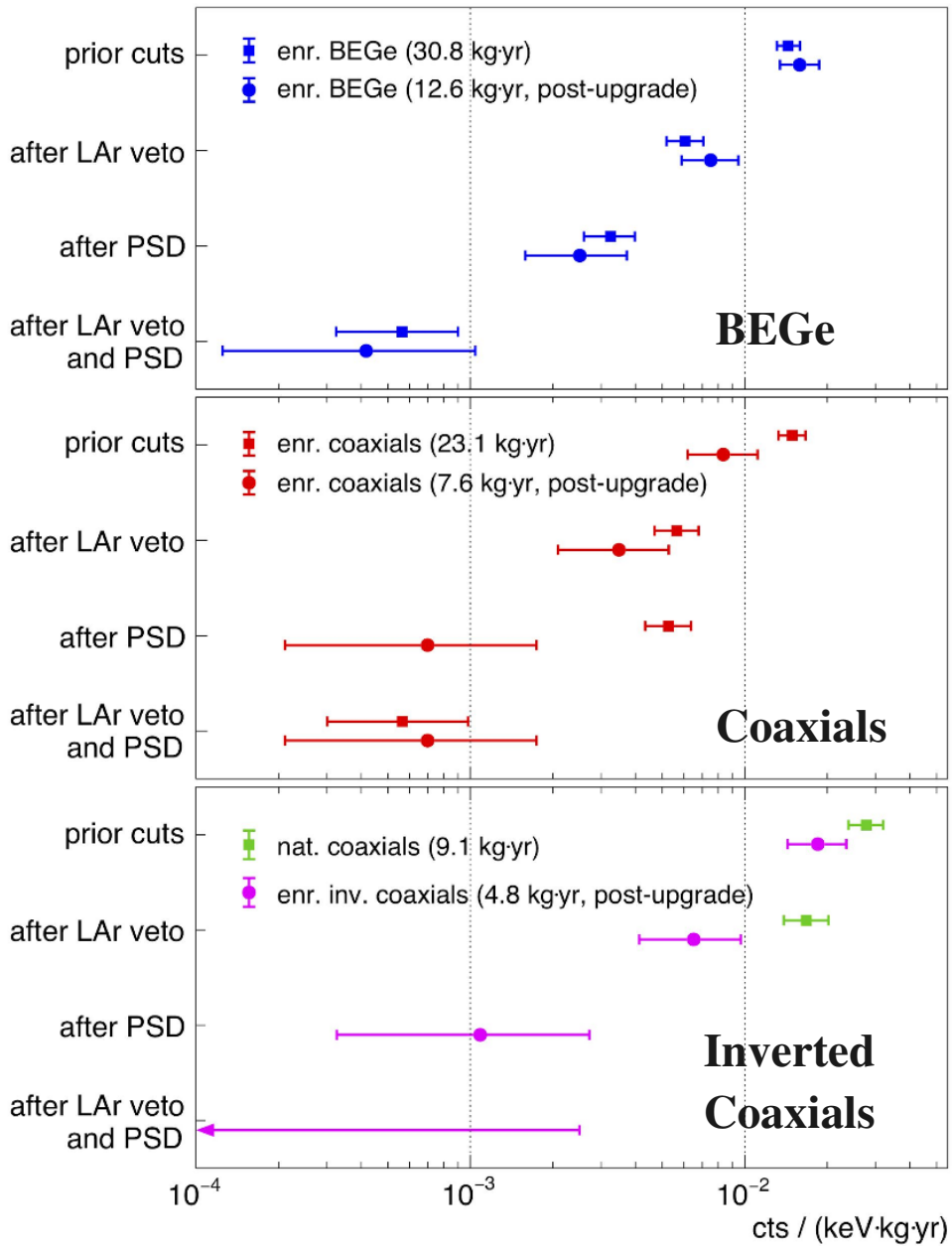
Richieste finanziarie:

- Calo attività NISP anche se coda test NISP-FM (2020), supporto integrazione e test satellite (fino a 2022), commissioning in volo (2023).
- Cresce il peso delle attività di analisi (workshop, comunicazioni a conferenze)

GERDA Fase II



- La presa dati sta procedendo in maniera regolare
- Si prevede di raggiungere l'esposizione prevista di 100 kg·yr ai primi di novembre di quest'anno
- A partire da gennaio 2020 l'infrastruttura di GERDA passerà a LEGEND-200



GERDA Fase II

- BEGe e Coassiali:
  BI < 10^{-3} cts/keV·kg·yr
- I nuovi rivelatori (Inverted Coaxial) mostrano BI in linea con i BEGe
- La pubblicazione finale dei dati di GERDA verrà fatta in primavera del prossimo anno
- Fra breve verranno pubblicati i dati mostrati a NEUTRINO 2018

LEGEND-200

- **Inizio commissioning ottobre 2020**
- La quantità di Ge arricchita nell'isotopo ^{76}Ge necessaria per raggiungere i 200 kg è già acquisita
- La produzione dei cristalli (Inverted Coaxial) è iniziata
- I primi diodi verranno prodotti in agosto 2019
- Definiti il FE e il preamplificatore per i diodi
- finalizzato il LAr veto
- In gennaio 2020 primi lavori per l' integrazione tra rivelatori-FE-preamplificatore-DAQ all' interno del setup di GERDA (cioè in condizioni reali).

Attività di Padova nel 2020

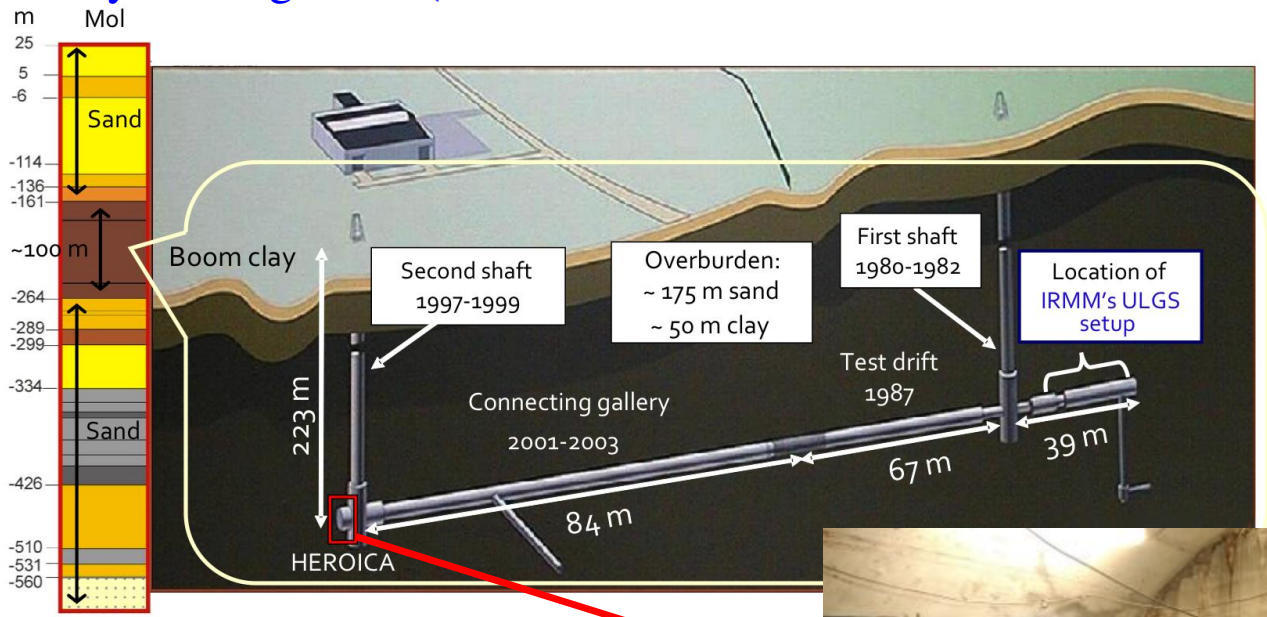
GERDA

- analisi dati (background modelling, majoroni, ….)
- vari duties all'interno della Collaborazione

LEGEND-200

- lavori sul DAQ, slow control
- partecipazione ai tests sui nuovi rivelatori (Inverted Coaxial) ad HADES (Belgio)
- sviluppo di MC
- vari duties all' interno della Collaborazione

HADES (High Activity Disposal Experimental Site)
Facility Underground (a Mol, vicino al sito della Canberra di Olen).



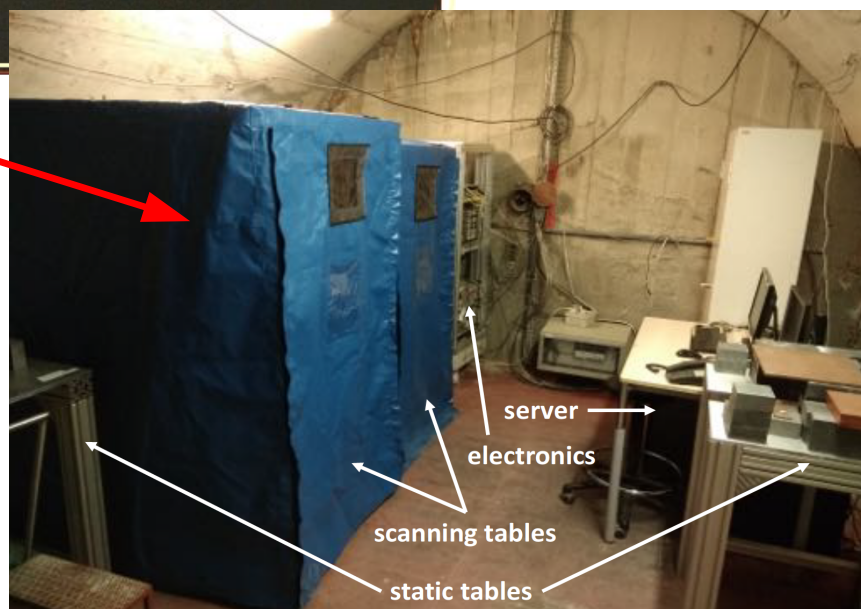
HADES è sotto la direzione dell'ente SCK-EN

Setup sperimentale in HADES:

2 tavoli per lo scanning della superficie laterale dei rivelatori

+

2 tavoli per lo studio delle prestazioni in termini di pulse shape discrimination



Richieste finanziarie

Missioni	31.0 keuro
Consumo	4.0 keuro
Inventario	10.0 keuro
Apparati	250.0 keuro

Richieste ai Servizi della Sezione

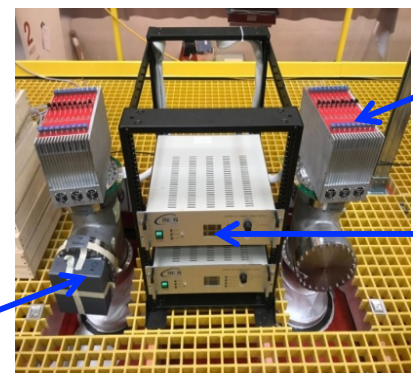
Officina Meccanica	0.5 m.u.
Progettazione Mecc.	0.5 m.u.
Officina elettronica	0.5 m.u.
Calcolo e reti	2 m.u.

Anagrafica

Bettini A.	PO	0%
Brugnera R.	PA	70%
Garfagnini A.	PA	30%
Lippi I.	INFN	60%
Pertoldi	dottorando	100%
Sada C.	PA	60%
Von Sturm K.	Assegnista	100%

ICARUS: Technical status -1

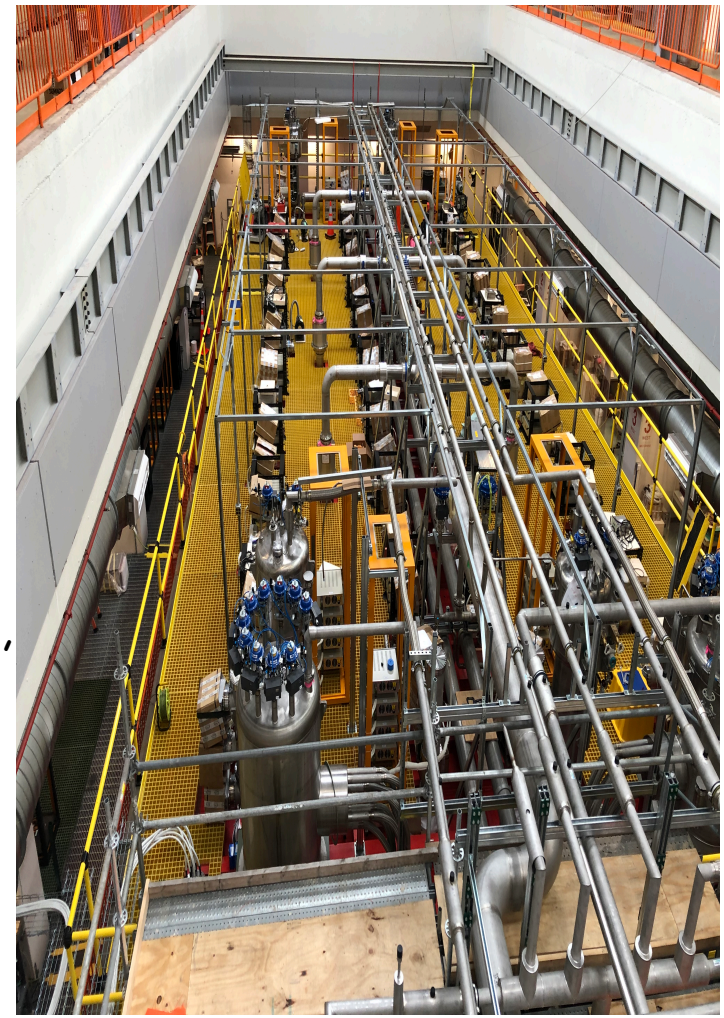
- Progress since January 2019:
  - ✓All flanged connections, ports, valves, feedthrough flanges on top of two cold vessels were installed and tightened.
  - ✓All internal connections of wire chambers, PMTs, HV system, optical fibers, and slow controls verified before the tightening
  - ✓After closing all the apertures, when the internal volumes became dark, all PMT turned on & checked for functionality.
  - ✓All TPC FE readout electronics (mini-crates, CAEN boards and power supplies) installed and verified. Internal connections were verified for a third time together with the external ones (preliminary noise measurements).



Slide# : 1

Technical status -2

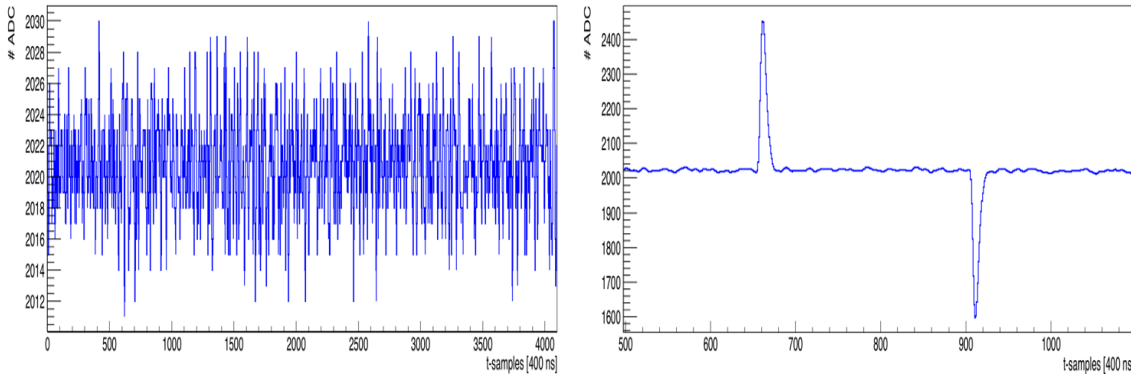
- ✓ North part of side CRT was installed.
- ✓ All cryogenic equipment & transfer lines installed, welded and pressure tested, with exception of collector lines from the chimneys to gas recirculation units (under construction).
- ✓ Argon vent lines from magnetic safety valves from overpressure automatic valves installed;
- ✓ Strain gauges located on sides of cold vessels connected; readout system installed and operated.
- ✓ After installation of flanged connections, ports, valves and Ar cryogenic & purification equipment, the two cold vessels tested at 350 mbar overpressure.
- ✓ Both cold vessels are under vacuum pumping since 3 weeks. Leak detection & repair is in progress.



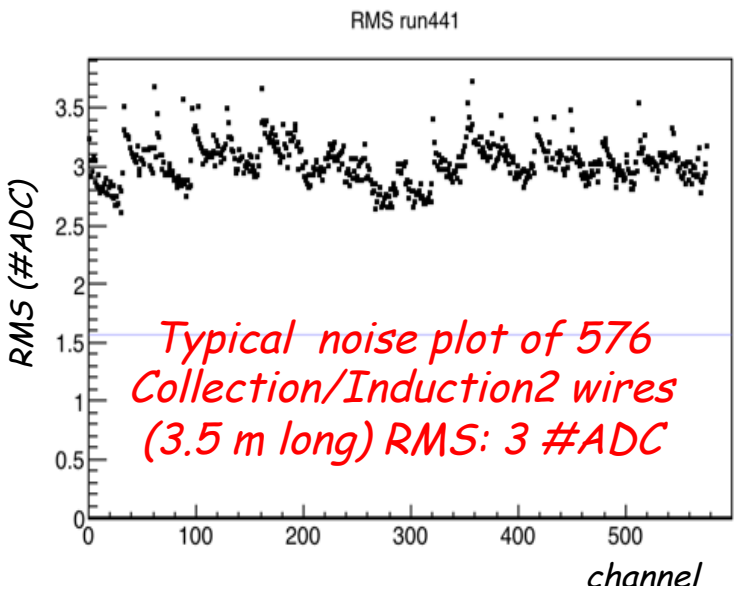
Behavior of cold vessels, as measured by strain gauges, in agreement with finite element analysis calculations.

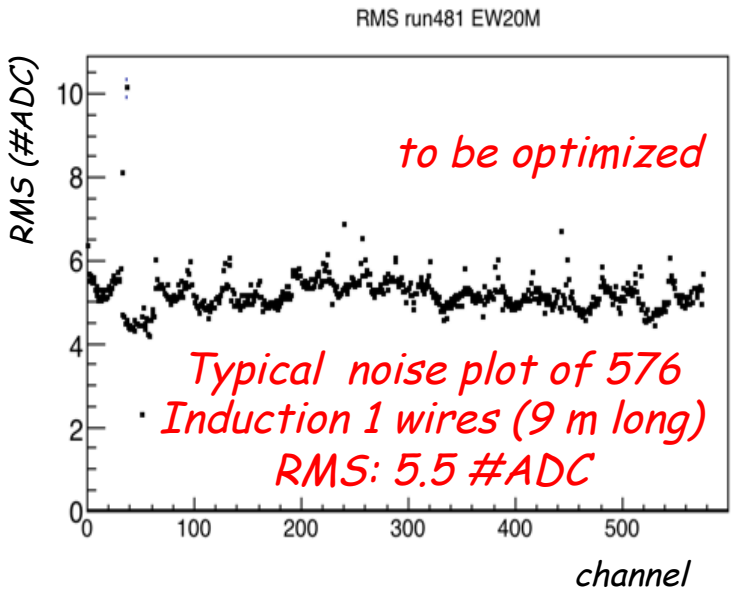
TPC electronics: Vertical Slice test

- A full TPC vertical slice performed on all 96 feed-through flanges injecting test pulse at far end of chamber wires and reading out the signals by A2795 on the other end to evaluate overall performance.



Typical baseline noise and test pulse shape (board 1, ch 37, Collection wire): RMS: 3.1 #ADC





DAQ/Trigger electronics: technical status

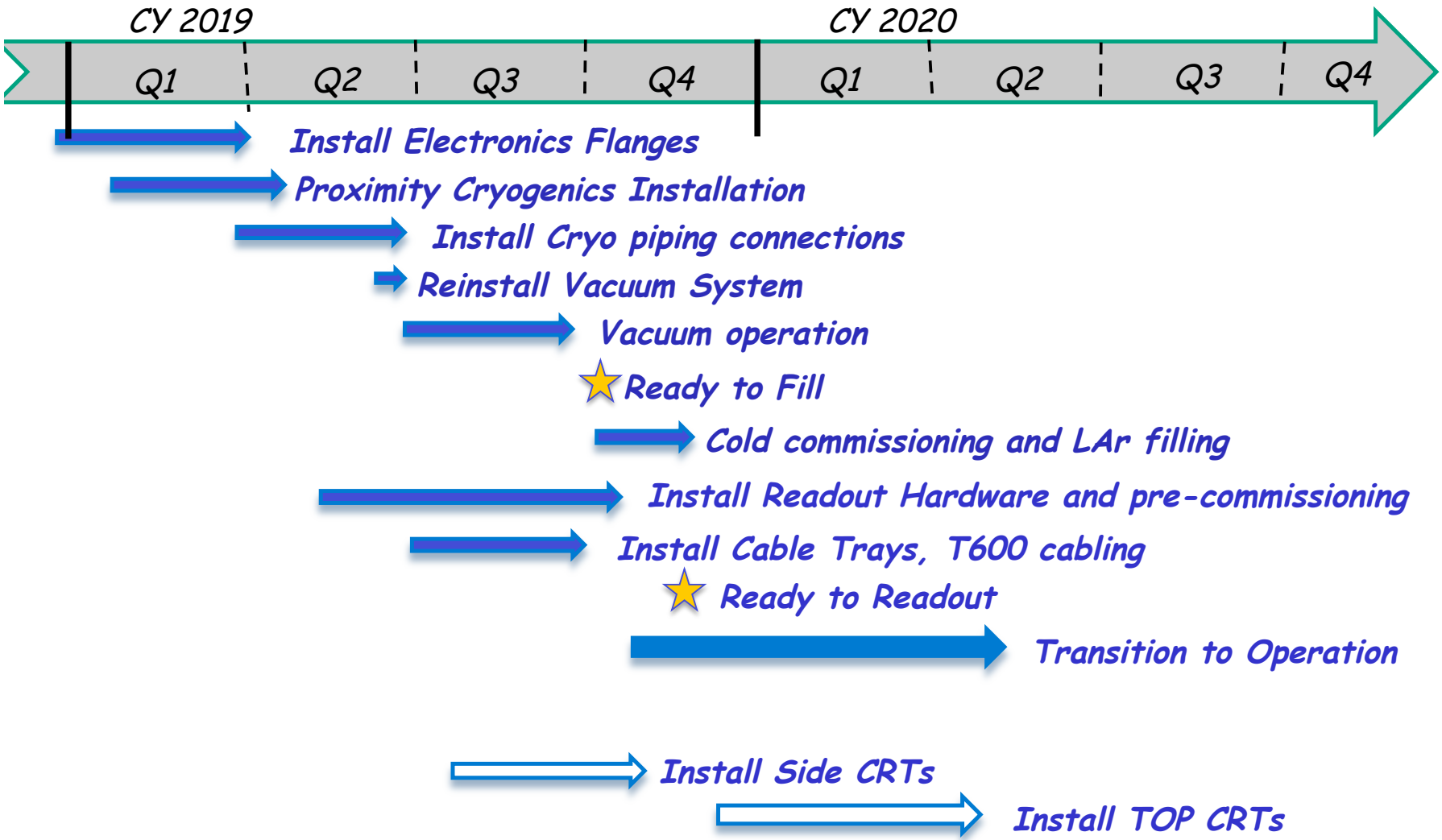
- ICARUS Trigger/DAQ at FNAL rely on architecture already deployed at LNGS: a waveform recording of TPCs/PMTs signals, triggered by scintillation light in coincidence with Early Warning of p beam extraction, synch by White Rabbit.

- *DAQ read-out based on CAEN A3818 optical links and PCI express:*
  - TPC + PMT+ CRT signal read by 30 PCs, each hosting 2 CAEN A3818;
  - 54 + 6 spare A3818 boards for TPC /PMT delivered to FNAL;
  - Delivery of 30+5 spare PCs HP ProLiant DL 380 model and associated connecting fibers expected by July.

  Slice tests already performed with one development server with 1 A3818 to receive data via optical links: the on-line already supports 5 Hz data acquisition!

- *Trigger system based on NI PXIe instrumentation:*
  - PXIe-8135 CPU, a SPEXI board and 3 NI PXIe-7820R boards with FPGA for Trigger Logic implementation: under test at CERN/FNAL;
  - VHDL codes for generating TT-Link, clock and gate opening, tested at FNAL;
  - LabVIEW driver for SPEXI hardware is in preparation/test.

ICARUS-T600: detailed plan-timeline



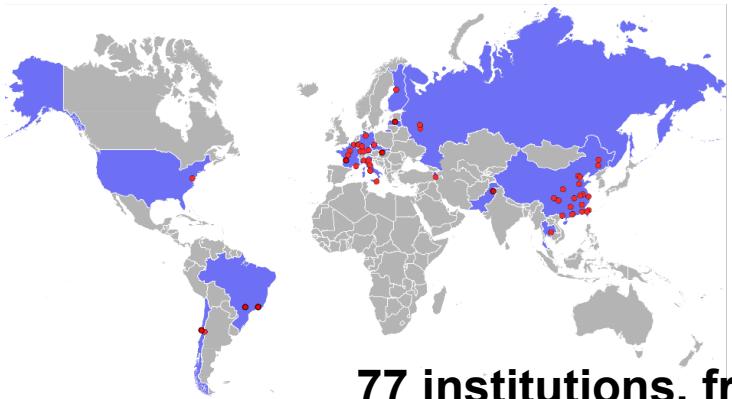
ICARUS financial requests for 2020

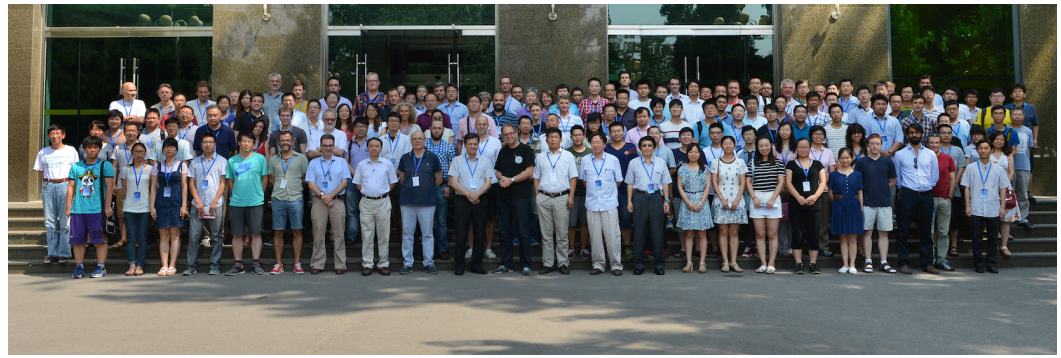
Phys. + Techs:
10 people, 7.6 FTE

OM: 2 MU at FNAL
OE: 2 MU at FNAL, 3 MU at Pd
Calcolo: 2 MU (test data transfer)

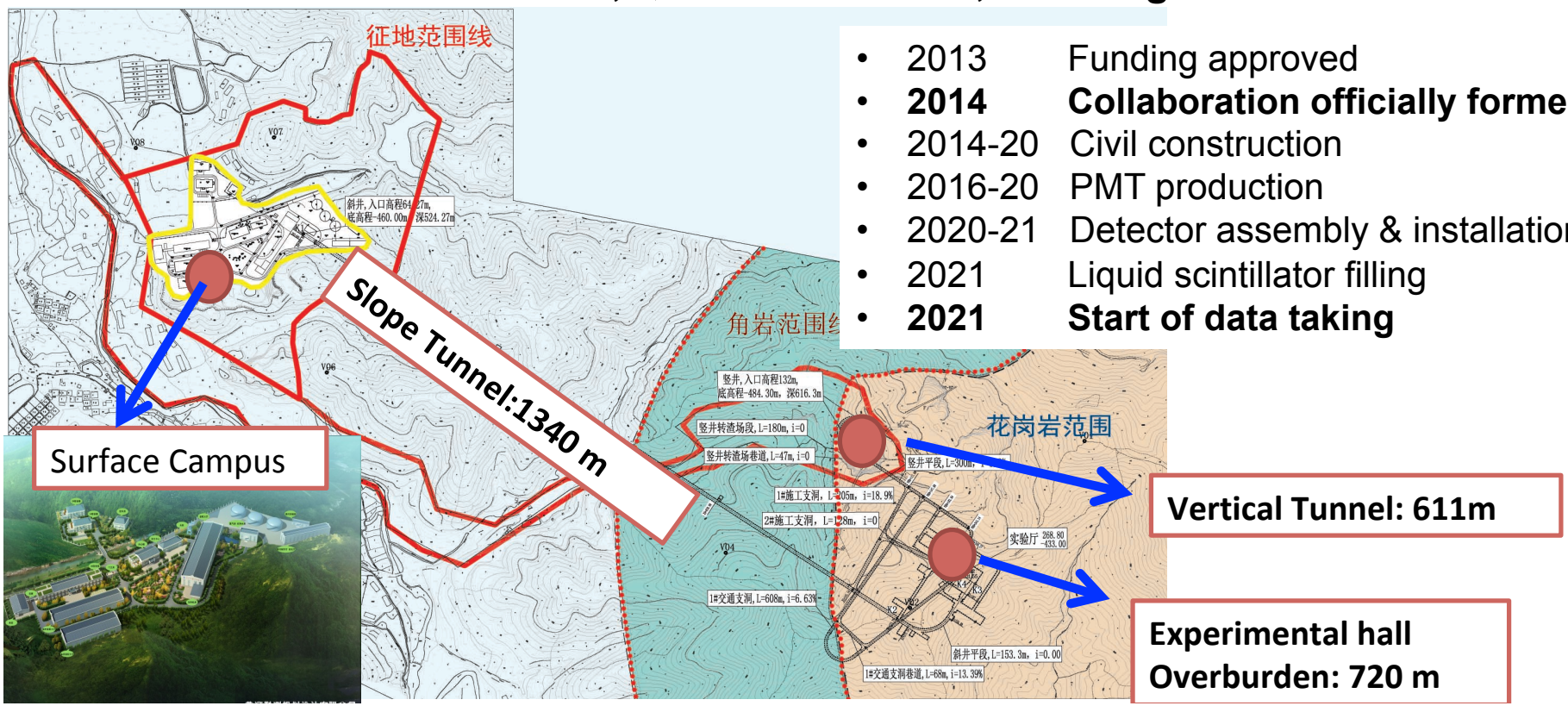
items	
Consumo: manutenzione elettronica	20 k€
Liquidi criogenici LNL	15 k€
Trasporti materiali FNAL via CERN	15 k€
Costruzione apparati: 700 preamp boards (8 ch)	18 k€
Inventario: 2 PCs local analysis	5 k€
SP Servizi: mechanics workshop	2 k€
Total	**75 k€**

Missions at FNAL	
T600 post-commissioning/ calibration 2 MU	11 k€
On site expert, T600 maintenance 4 MU	22 k€
110 shifts 5.5 MU	30 k€
Participation to: SBN Oversight Board, Dir. Review Coll. Meetings,	10 k€
Total	**73 k€**





77 institutions, from 17 countries, counting 629 scientists



- 2013 Funding approved
- **2014 Collaboration officially formed**
- 2014-20 Civil construction
- 2016-20 PMT production
- 2020-21 Detector assembly & installation
- 2021 Liquid scintillator filling
- **2021 Start of data taking**

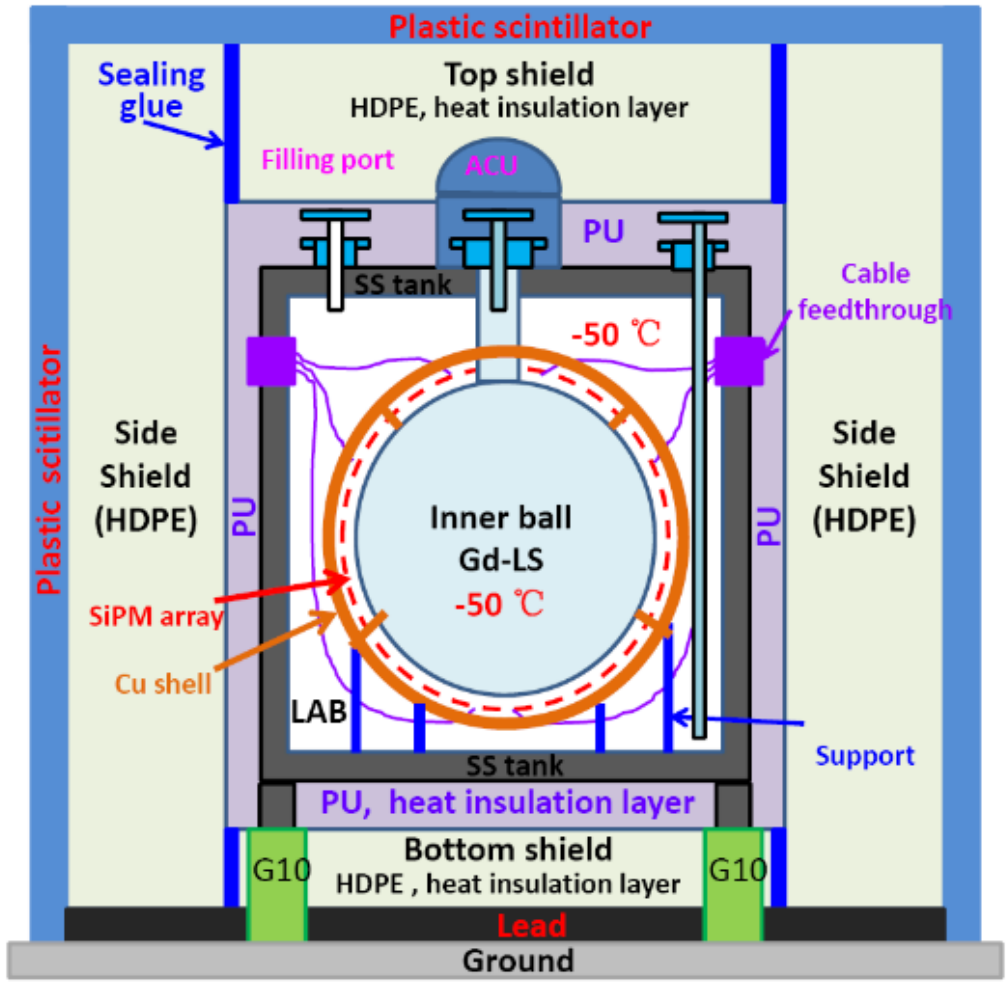
JUNO TAO

Goal : to measure the reactor neutrino spectrum
(NMH measurement should not be affected by fine structures of the spectrum)

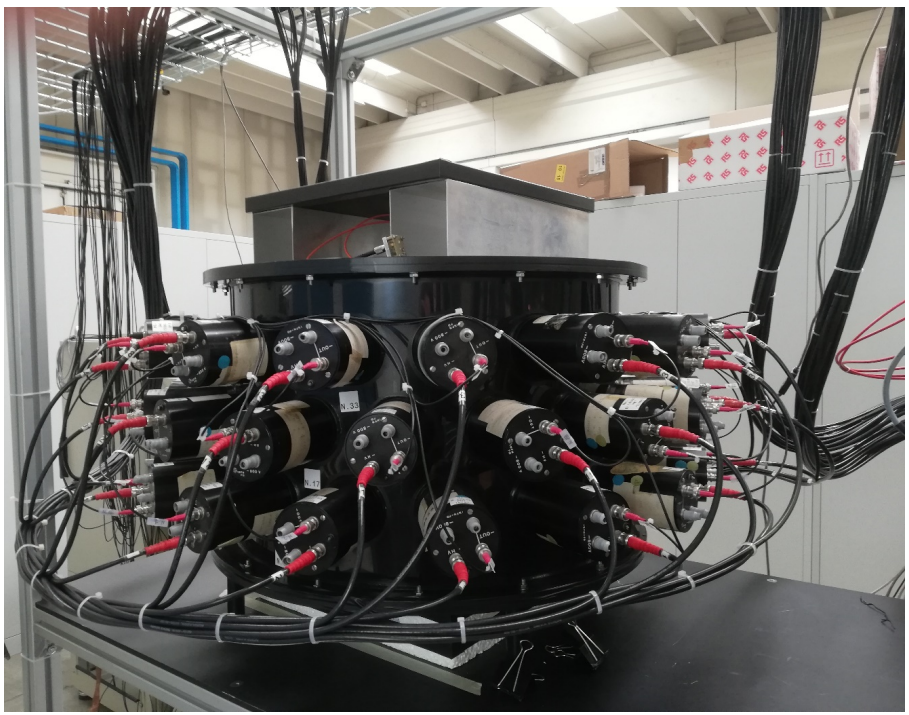
Detector concept :
Gd-loaded LS @-50°C+ SiPM
700k/year @ 40m from Taishan
20x JUNO 6-year data in 3 year
Energy resolution: 1.5%/√E

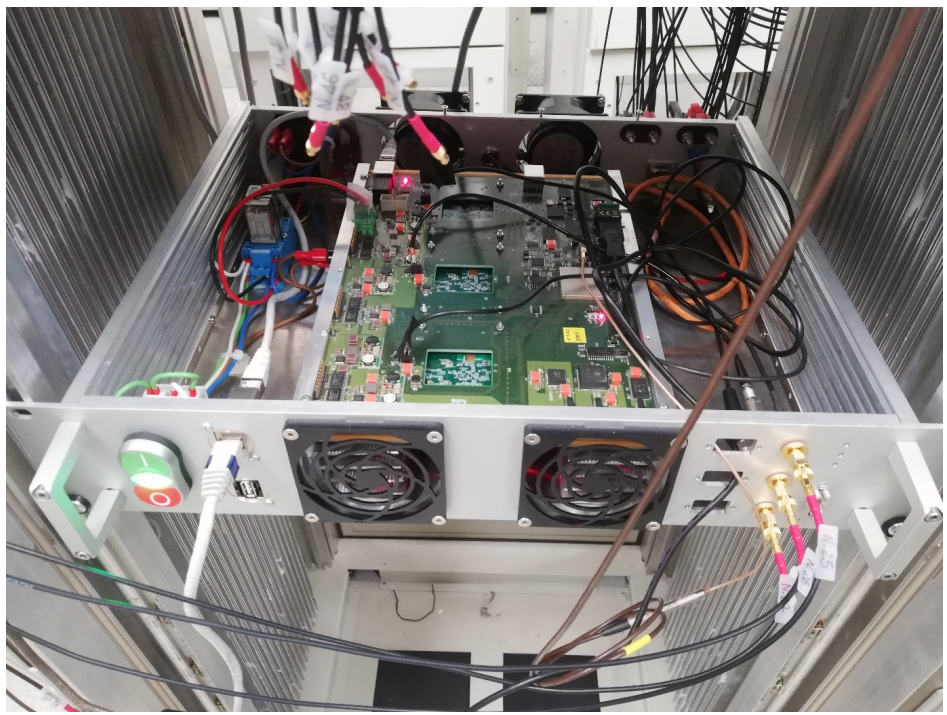
Status:
Design and R&D on the way:

- LS works in -50°C
- SiPM & its readout electronics
- Mechanical design
- Measured onsite muon/neutron flux
- Prototype a low temperature LS detector



- first integration tests (full electronics chain: PMT ➜ DAQ) in Legnaro, beginning of July 2019
- 8 PMT connected and continuously read out
- the system will be used for verifying the long tern stability of the electronics





8 PMT connected to the 3 GCU | Trigger on threshold, BEC provides the OR of the 8 channels
Data acquired and stored on 5th of July (data taking 20 minutes)

Attività 2020

- completamento dei test verifica elettronica e di integrazione
- test di lunga durata: misura delle prestazioni e affidabilità dell'elettronica
- sviluppo firmware della GCU (L3 a Padova: A. Bergnoli)

Anagrafica : 6.6 FTE (Preliminare)

A. Bergnoli	70%	R. Brugnera	30%	S. Dusini	30%
A. Garfagnini	70%	A. Giaz	100%	I. Lippi	40%
F. Marini	100%	M. Mezzetto	10%	F. H. Sawy	100%
C. Sirignano	30%	L. Stanco	30%		
M. Bellato	10%	F. Dal Corso	20%	C. Fanin	20%

Richieste 2020 - CSNII

Missioni	80 k	Consumo	10 k
Trasporti	10 k	Inventariabile	10 k
Costruzione Apparati	2 M		
[Gara GCU]			

Richieste 2019 - Servizi Sezione

O. Meccanica	4 mu	realizzazione test facility elettronica
S. Elettronica	24.0 mu	sviluppo firmwareelettronica e sistema di test

Quantum Science and Technology

PAPER

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Towards quantum communication from global navigation satellite system

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[2] Istituto Nazionale di Fisica Nucleare (INFN)—sezione di Padova, Italy
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Our research was partially funded by the MoonLIGTH-2 project of INFN.

National coordinator: Dr. Simone Dell'Agnello

GNSS orbit tasted at 20000km: GLONASS spacecrafts

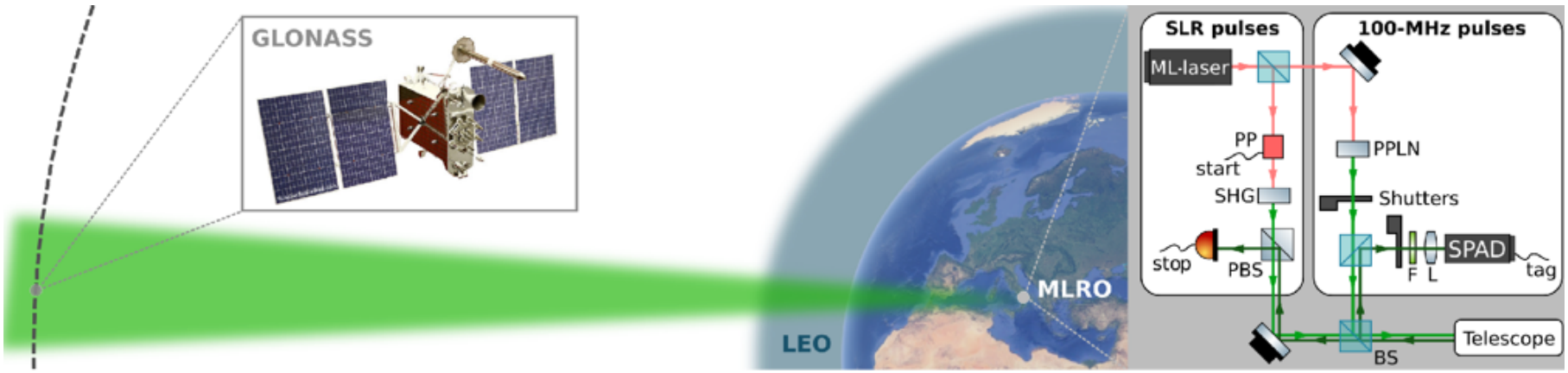
two GLONASS terminals equipped with an array of corner-cube retroreflectos (CCRs), namely Glonass-134 and Glonass-131 (Space Vehicle Number: 802 and 747, respectively)

The targeted GNSS satellites are part of different generations, GLONASS-K1 for Glonass-134 and GLONASS-M for Glonass-131, both equipped with a planar array of CCRs, with circular and rectangular shape respectively

Their CCRs are characterized by the absence of coating on the reflecting faces, such that the light is back reflected by total internal reflection (TIR). This implies a far field diffraction pattern (FFDP) which is quite different from the simple Airy disk given by a circular aperture

GLONASS returns summary

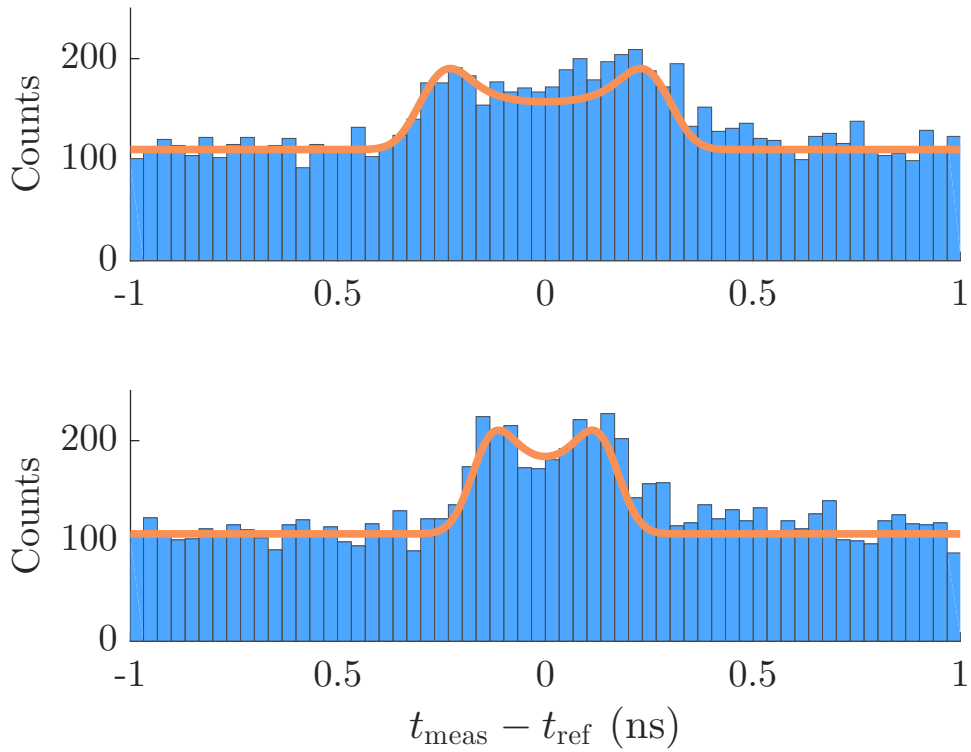
Satellite passage	Slant distance (km)	Detector	$\overline{R}_{\rm det}$ (Hz)	SNR	$\overline{\mu}_{\rm sat}$	$l_{\rm down}$ (dB)	$l_{\rm rec}$ (dB)
Glonass-134	19,500	SPAD	58	0.53	15	62.1	11.8
	20,200	SPAD	59	0.41	16	62.5	11.8
Glonass-131	20,250	SPAD	27	0.43	15	62.6	14.8
		PMT	6	0.21	16	62.6	21.8



L. Calderaro et al. *Towards Quantum Communication from Global Navigation Satellite System*, **Quantum Sci. Technol. 4 015012** (2019).

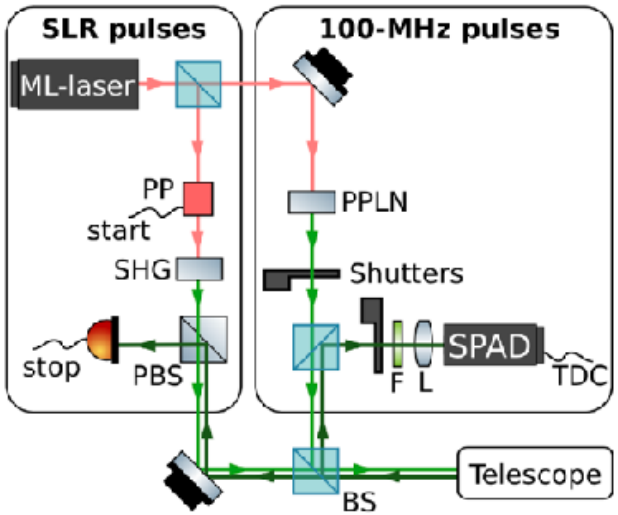
GLONASS temporal footprint

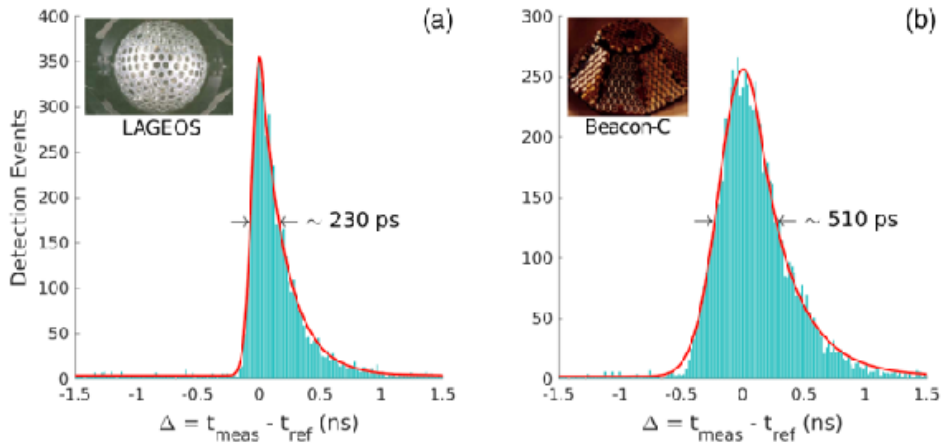
The incident angle of the beam on the array: 9 deg and 5 deg



L. Calderaro et al. *Towards Quantum Communication from Global Navigation Satellite System*, **Quantum Sci. Technol. 4 015012** (2019).

Temporal resolution *in the single photon* ***time tagging reduced to 230 ps over 7000km***





Research Article Vol. 36, No. 3 / March 2019 / Journal of the Optical Society of America B B59

Journal of the Optical Society of America B OPTICAL PHYSICS

Sub-ns timing accuracy for satellite quantum communications

Costantino Agnesi,[1,2] Luca Calderaro,[1,2,3] Daniele Dequal,[4] Francesco Vedovato,[1,2,3] Matteo Schiavon,[1,2] Alberto Santamato,[1] Vincenza Luceri,[5] Giuseppe Bianco,[4] Giuseppe Vallone,[1,2] and Paolo Villoresi[1,2,*]

[1]Dipartimento di Ingegneria dell'Informazione, Università degli Studi di Padova, via Gradenigo 6B, 35131 Padova, Italy
[2]Istituto Nazionale di Fisica Nucleare–sezione di Padova, Padova, Italy
[3]Centro di Ateneo di Studi e Attività Spaziali "G. Colombo," Università degli Studi di Padova, via Venezia 15, 35131 Padova, Italy
[4]Matera Laser Ranging Observatory, Agenzia Spaziale Italiana, Matera, Italy
[5]e-GEOS SpA, Matera, Italy

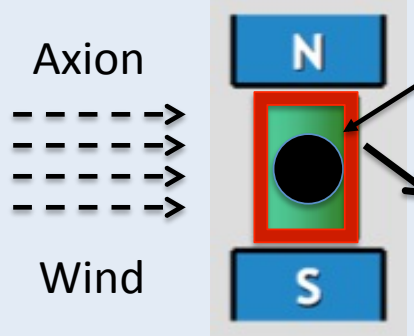
A 100-MHz pulse train is used to test the detector system temporal resolution. The **silicon single photon avalanche detector (SPAD - Micro-Photon-Devices Srl), with ≈ 50% quantum efficiency, ≈ 400 Hz dark count rate and 40 ps of jitter**.

The time of arrival is tagged with **1 ps** resolution (quTAG TDC from qutools GmbH)

The **evident tail** is the actual limitation for the temporal resolution, and is due to the design of the active part of the detector.

A novel design is available by MPD.

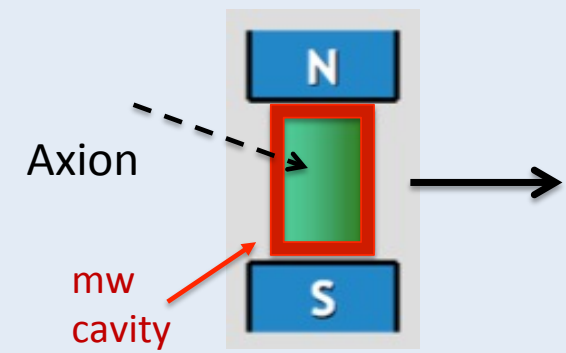
- Detection of **cosmological axions** through their **coupling to electrons or photons**
- **Electron coupling**: **Due to the motion of the solar system** in the galaxy, the axion DM cloud acts as an **effective RF magnetic field** on electron spin exciting magnetic transitions in a magnetized sample and **producing rf photons**



Expected rf power

$$P_{\text{out}} = \frac{P_{\text{in}}}{2} = 8 \times 10^{-26} \left(\frac{m_a}{2 \cdot 10^{-4}\,\text{eV}}\right)^3 \left(\frac{V_s}{1\ \text{liter}}\right) \left(\frac{n_S}{10^{28}/\text{m}^3}\right) \left(\frac{\tau_{\text{min}}}{10^{-6}\,\text{s}}\right) \text{W},$$

- **Photon coupling**: **DM axion** are converted into **rf photons** inside a **resonant cavity** immersed in a **strong magnetic field**



Expected rf power

$$P_{\text{a}} = 1.85 \times 10^{-25}\,\text{W} \left(\frac{V}{0.036\text{l}}\right) \left(\frac{B}{2\,\text{T}}\right)^2 \left(\frac{g_\gamma}{-0.97}\right)^2 \times \left(\frac{C}{0.589}\right) \left(\frac{\rho_a}{0.45\,\text{GeV cm}^{-3}}\right) \left(\frac{\nu_c}{9.067\,\text{GHz}}\right) \left(\frac{Q_L}{201000}\right)$$

Activity in the laboratory

Refurbishing of a **Low Power Dilution Refrigerator** completed

First tests of a **Josephson Parametric amplifier (JPA)** @ 100 mK

- Expected T_{noise} ~ 0.5 K

New **in-house procedure for production of YIG spheres** up to 2.5 mm diameter

Coupling of a **superconducting cavity loaded with YIG sphere** achieved

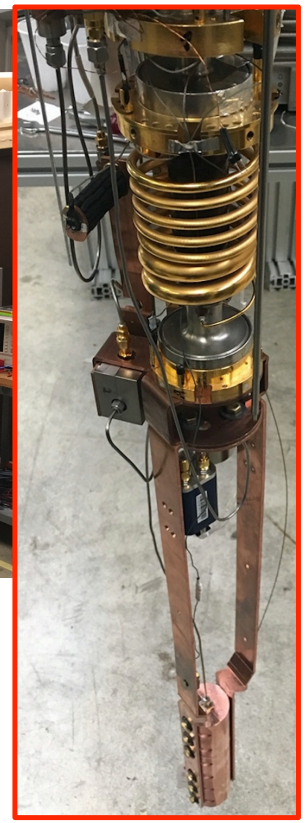
New **photonic cavities** on the way

Calibration scheme with laser input

Refurbishing of a **High Power Dilution Refrigerator** under way

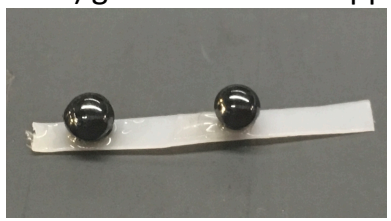
New high field (8 T) magnet to be delivered

Dilution system



Dilution insert with rf electronics and cavity

Home made YIG spheres (ϕ = 2 mm) glued on teflon support

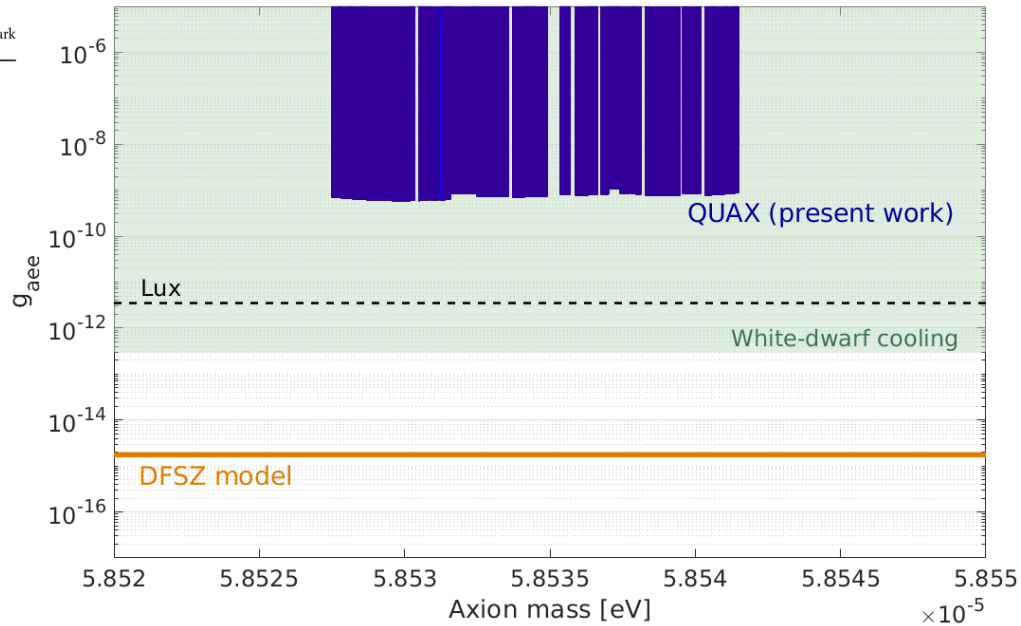


QUAX limit on axion electron coupling

Eur. Phys. J. C (2018) 78:703
https://doi.org/10.1140/epjc/s10052-018-6163-8
THE EUROPEAN PHYSICAL JOURNAL C
Regular Article - Experimental Physics

Operation of a ferromagnetic axion haloscope at $m_a = 58\,\mu\text{eV}$

This is the first limit in the parameter space { m_a, g_{aee} } obtained from an experiment searching for axions as the main Dark Matter component (Haloscope)



Limit is still poor but:	**2018**	**QUAX expected 2019**	**QUAX (final)**
• Material volume	2.6 mm^3	**42 mm^3**	10^5 mm^3
• System total noise temp.	15 K	**0.5 K**	counter (T_{eff} <1 mK)
• Relaxation time	0.1 ms	**0.3 ms**	2 ms

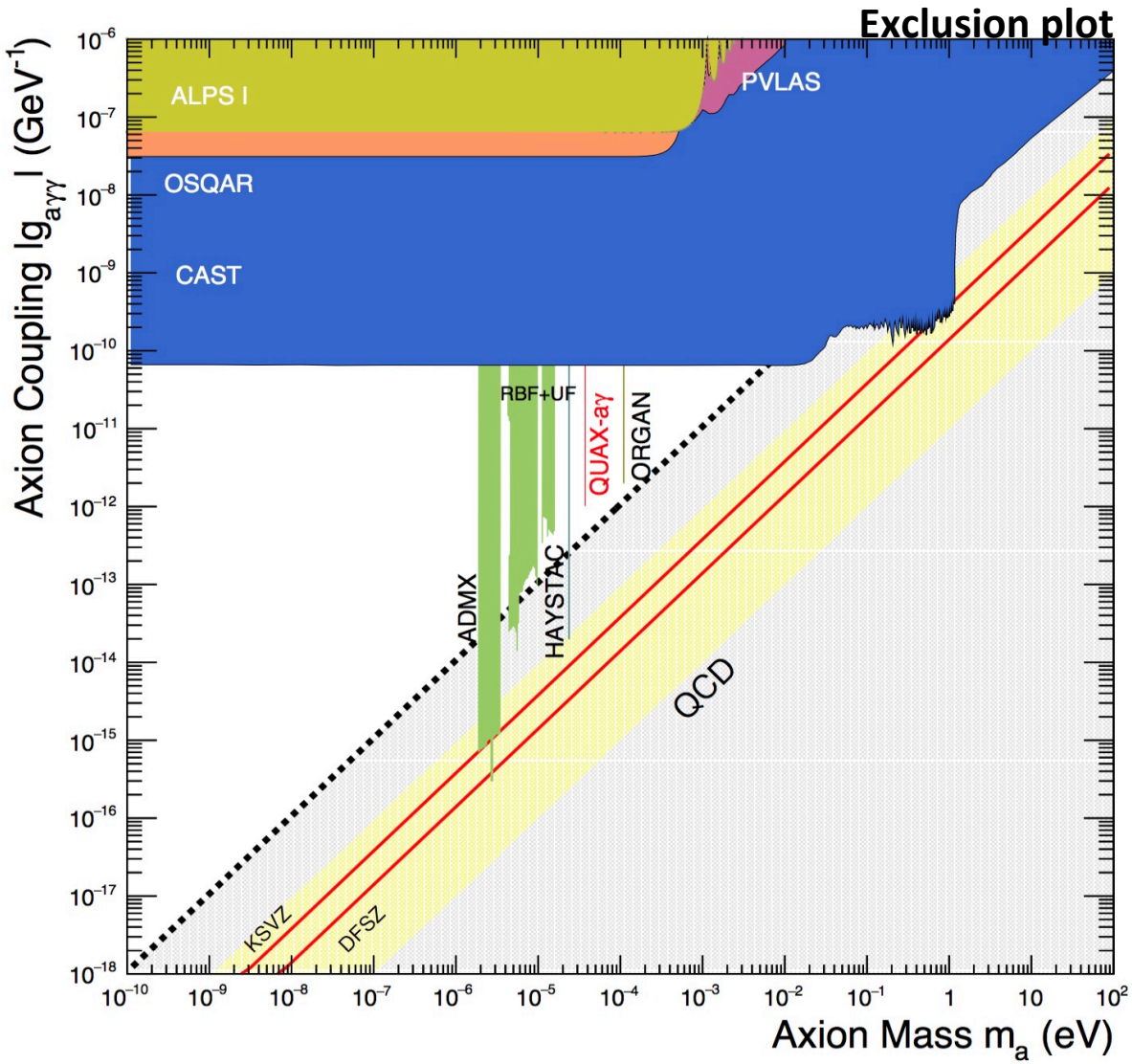
The set-up with 10 YIG spheres giving 42 mm^3 of volume already mounted and tested at 4 K

First results on axion-photon coupling

Results obtained by the QUAX-aγ set-up are competitive with other experiments

Just appeared on **Phys Rev D rapid comm.**

Starting from 2020 **QUAX-aγ** will start **a search with mass scanning** employing the **Josephson Parametric Amplifier** and a **higher Q cavity**



QUAX 2020

PD activity for 2020:

- New Set-up for axion photon coupling on **Large Cooling Power Diluition Unit**
- Zapphire Copper Cavity with tuning and scanning device **[$Q = 10^6$]**
- Integration of the **Josephson Parametric Amplifier in the ultra - low temperature (<50 mK) cryogenic system [T_{noise} @ Quantum Limit]**
- Test with High Magnetic Field **[8 Tesla]**

Sezioni INFN partecipanti all'esperimento: **LNL, Padova, LNF, Napoli, Trento**

Resp. Naz.: **Giovanni Carugno**

Partecipazione PD : G.Carugno 50%, C.Braggio 40%, R.Di Vora 100%, A.Pepato 40%, L.Taffarello 40 %, M.Pegoraro 20%

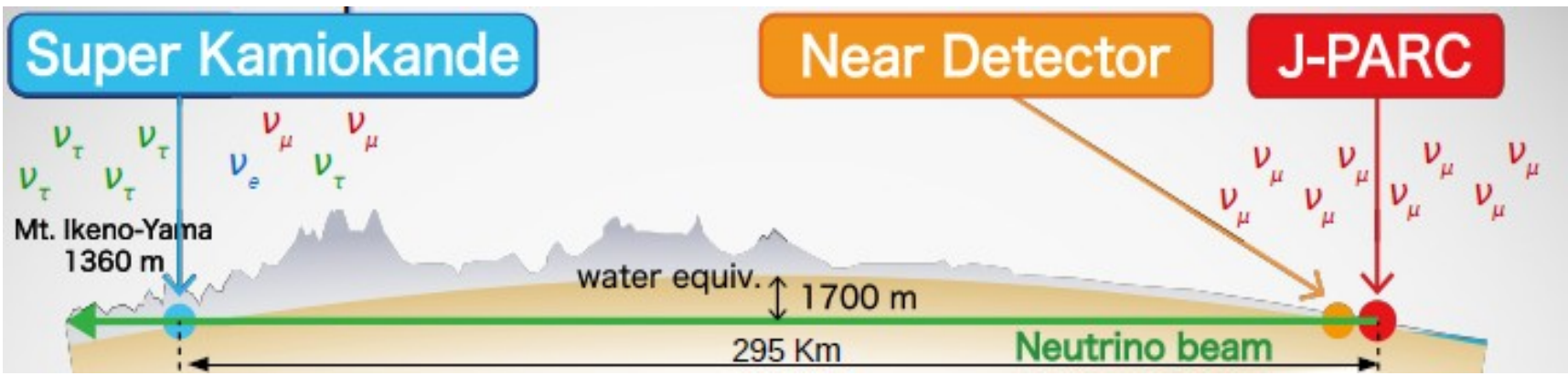
Totale: 2.9 FTE

Richieste 2020 PD: **90 KE**

Richieste Servizi: 12 M.U. O.M. , 8 M.U. O.E. , 2 M.U. U.T.

Prospettive esperimenti T2K & SuperKamiokande

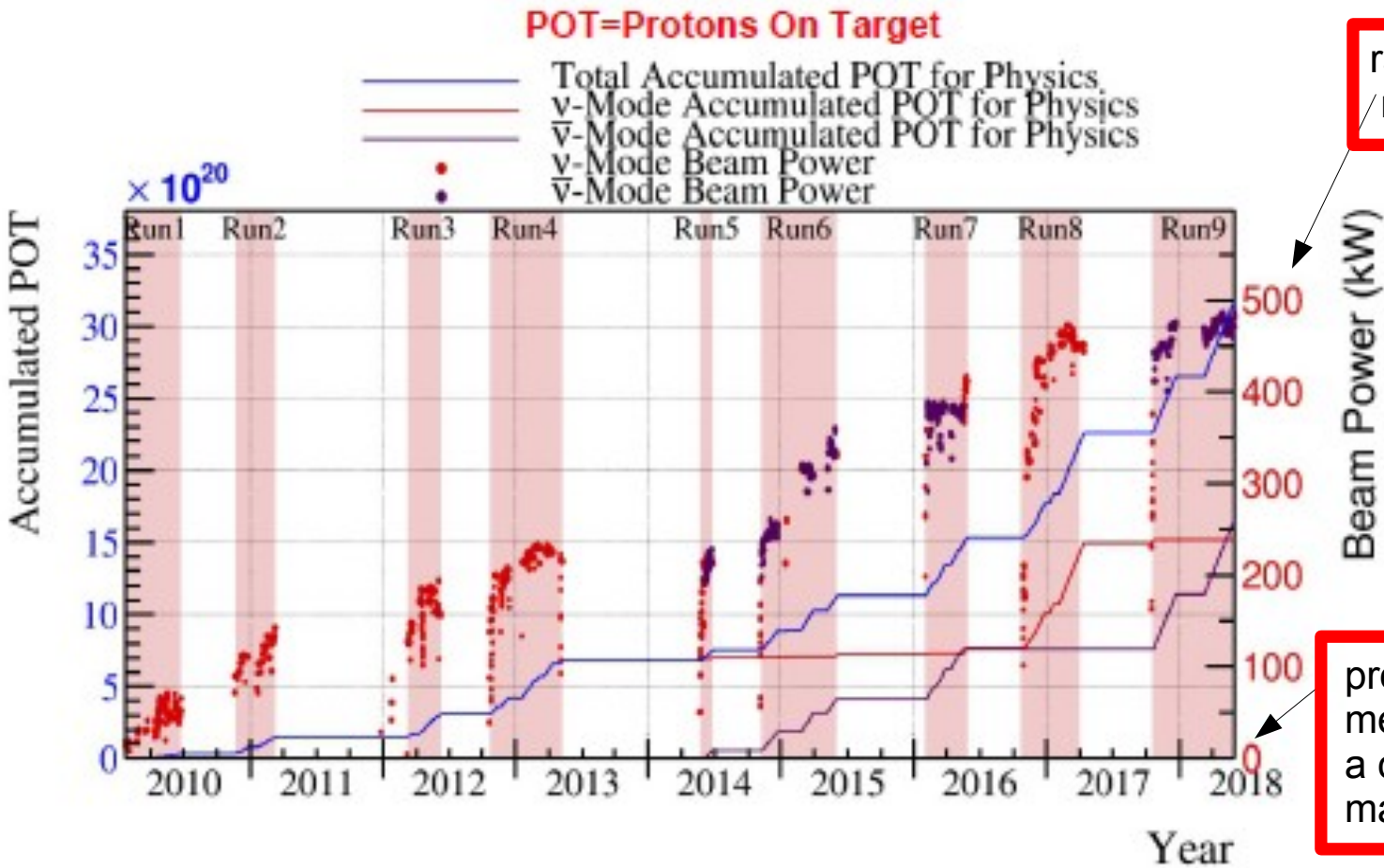
G.Collazuol – CdS INFN PD - 2019/7/10



L'attuale gruppo locale

Staff: **G.C.** (T2K&SK), **M.Laveder**(T2K), **A.Longhin**(T2K), **M.Mezzetto** (T2K)
Post-doc: **M.Lamoreux** (INFN Fellini, T2K&SK), **N.Ospina** (Assegnista J, SK)
Dottorandi: **F.Iacob** (T2K&SK), **M.Pari** (T2K) / Laureandi: **M.Menotti** (T2K upgrade)
Supporto Tecnico per T2K-upgrade: **G.Cogo**
In stretta collaborazione per T2K-upgrade @ LNL: **M.Cicerchia, F.Gramegna, T.Marchi**

Protons on Target



raggiunti 500kW nel 2018

problemi nei primi mesi del 2019 a causa di un magnete main ring

23 Jan. 2010 – 31 May 2018

POT total: 3.16×10^{21}

ν-mode 1.51×10^{21} (47.83%)

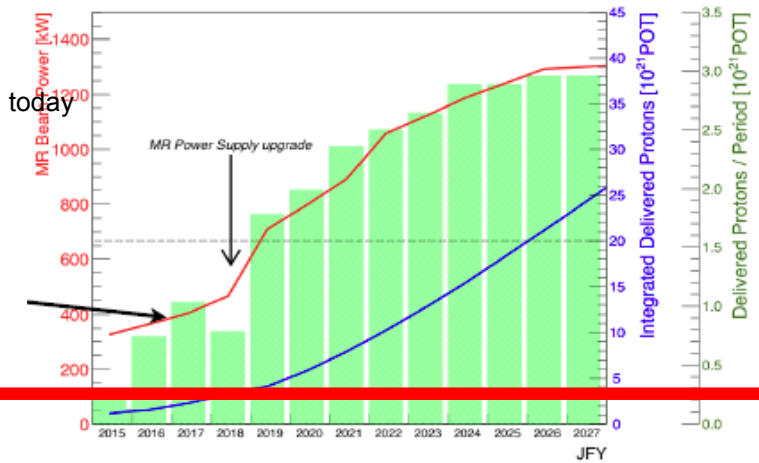
$\bar{\nu}$-mode 1.65×10^{21} (52.17%)

Prospettive → T2K-II

Beam and Near Detector upgrade

T2K-II extension proposal (arXiv:1609.04111):
- Aim at 3σ CPV sensitivity or CPC exclusion (w/ favorable param.)
- Accumulate 20×10^{21} pot by 2026 (x3 original T2K program)

Mandatory (for high stat)
- High Intensity Neutrino beam
→ **Accelerator/Beam-line Upgrade** approved
→ gradual increase of power to 1MW (1.3MW) by 2021 (2026)



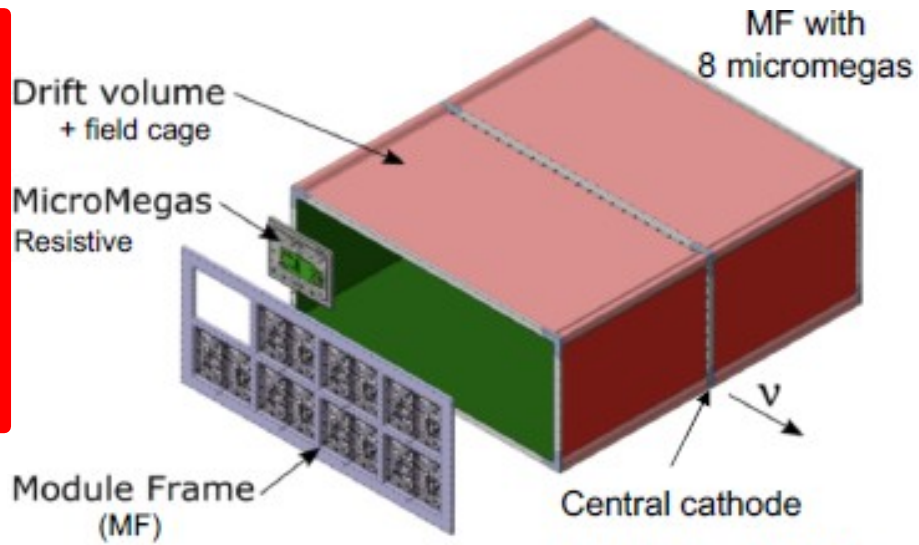
Mandatory (at high stat)
- Reduce detector systematics to 4% & cross-section model dependence
→ **Near Detector Upgrade** → TDR 2018 → Approved by JPAC and SPSC

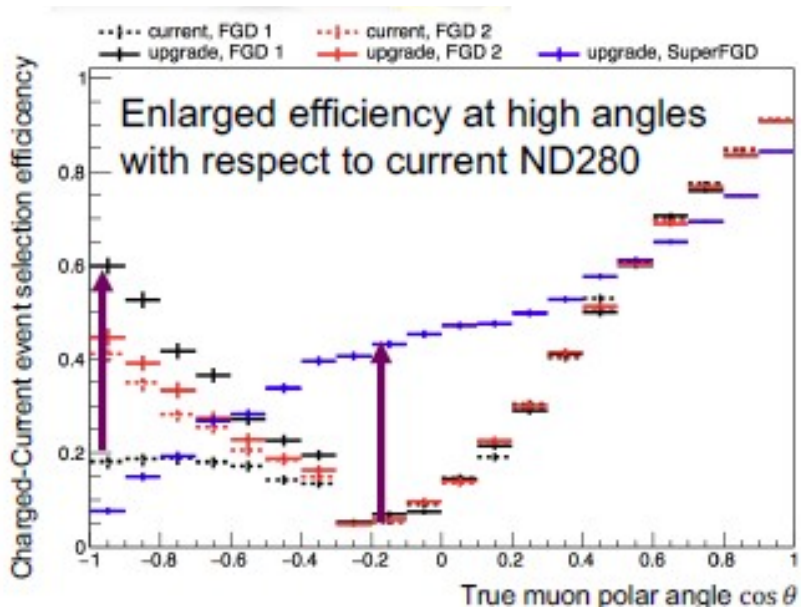
Near Detector Upgrade - HATPC

Importante coinvolgimento INFN Pd in costruzione delle TPC orizzontali (High Angle TPC):

→ **coordinamento progetto** HA-TPC (G.Collazuol)

→ disegno e **costruzione Field Cage** con INFN-LNL e INFN-Ba





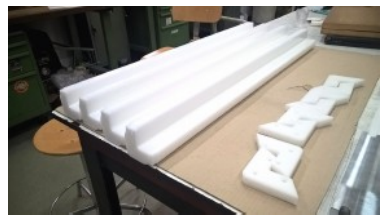
Parameter	HA-TPC Value	V-TPC
Overall x × y × z (m)	2.0 × 0.8 × 1.8	0.85 x 2.2 x 1.8
Drift distance (cm)	90	
Magnetic Field (T)	0.2	
Electric field (V/cm)	275	
Gas Ar-CF_4-iC_4H_{10} (%)	95 - 3 - 2	
Drift Velocity $cm/\mu s$	7.8	
Transverse diffusion ($\mu m/\sqrt{cm}$)	265	
Micromegas gain	1000	
Micromegas dim. z×y (mm)	340x420	340x360
Pad z × y (mm)	10 × 11	7x10
N pads	36864	124272
el. noise (ENC)	800	
S/N	100	
Sampling frequency (MHz)	25	
N time samples	511	

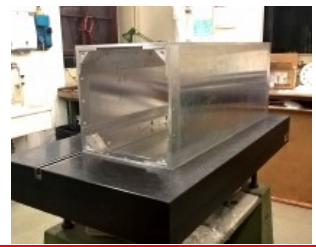
HATPC prototipo

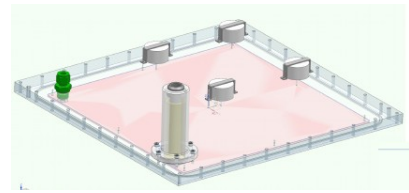
(1) Preparazione MOLD → INFN Bari

(2) Produzione parti strutturali in POM-C, catodo e rifinitura MOLD @ officina meccanica INFN Pd

(3) Produzione @ NEXUS (Barcellona), supporto IFAE

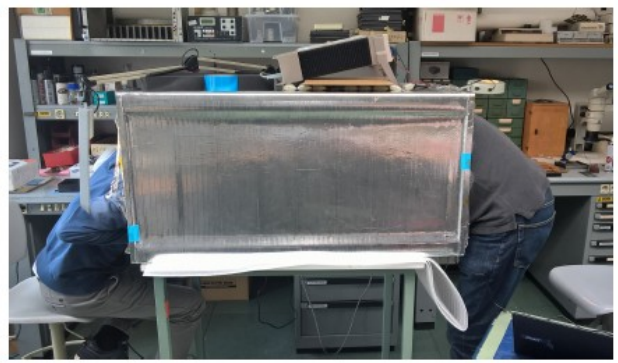




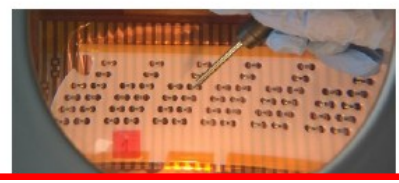


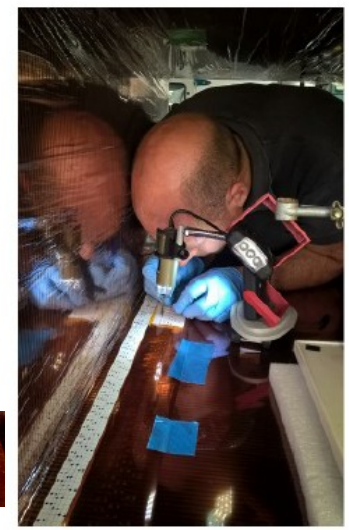
(4) Fresatura di precisione Flange @ officina LNL

(5) Assemblaggio, test elettrici e gas in laboratorio a LNL (gruppi T2K PD e LNL)



No relevant issues in soldering + gluing → 1.5 days



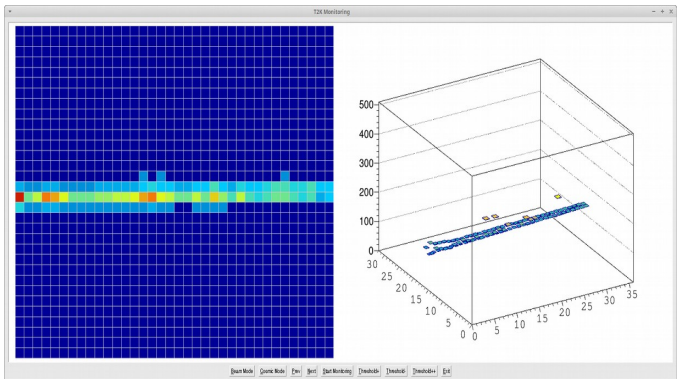


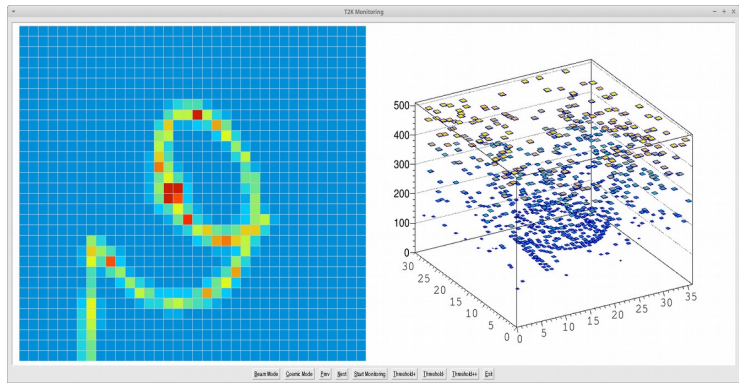
/10

HATPC attivita` 2019/20

Test Beam @ DESY June 2019

→ new RMM Resistive type Micromegas (charge sharing) → OK





Test Run @ CERN w/ Cosmics, since July 2019

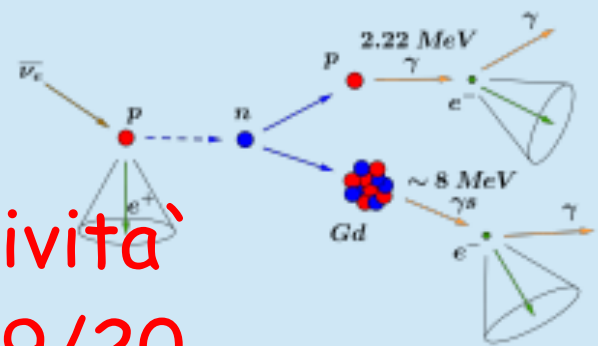
→ new prototype Field Cage + new RMM = complete HA-TPC validation

→ Attivita` 2020 → costruzione e test 2 HATPC

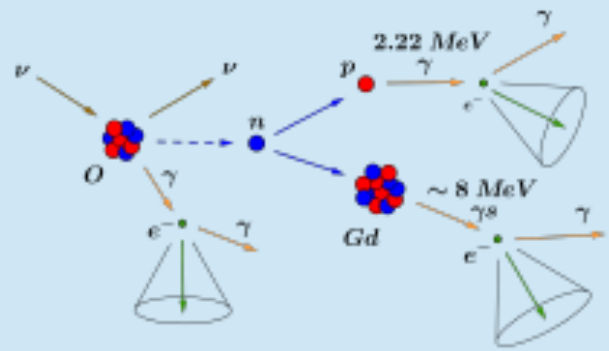
Attivita` 2019/20

NCQE neutron multiplicity

- **SK-Gd project**: load SK with Gadolinium sulphate to produce detectable 8 MeV gamma cascade by neutron capture.
  - **Signal**: Inverse Beta Decay (IBD), detected by prompt positron signal + delayed radiative neutron capture on Gd. Analysis target: Supernova Relic Neutrinos (SRN).
  - **Background**: Neutrino-Oxygen neutral current quasi-elastic (NCQE) interactions, induced by atmospheric neutrinos, mimic the prompt+delayed signal pattern of IBD induced by SRN.



Signal



Background

Attivita` 2019/20

PhD student currently working on **NCQE-events neutron multiplicity** analysis (T2K-SK group):

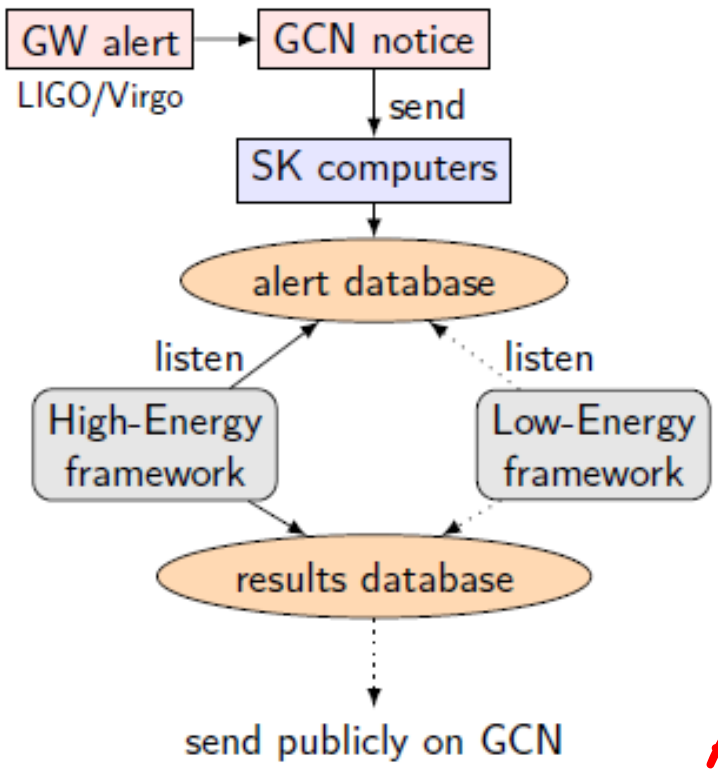
- Well controlled NCQE events induced by triggered neutrino beam of T2K experiment.
- Nowadays neutron capture on **Hydrogen** (2.2 MeV hardly detectable gamma, advanced hit PMTs pattern recognition with **neural network**).
- Future perspective: adapt neutron tagging analysis and techniques developed for Hydrogen-capture to the **Gadolinium**-capture case, as soon as SK-Gd starts.

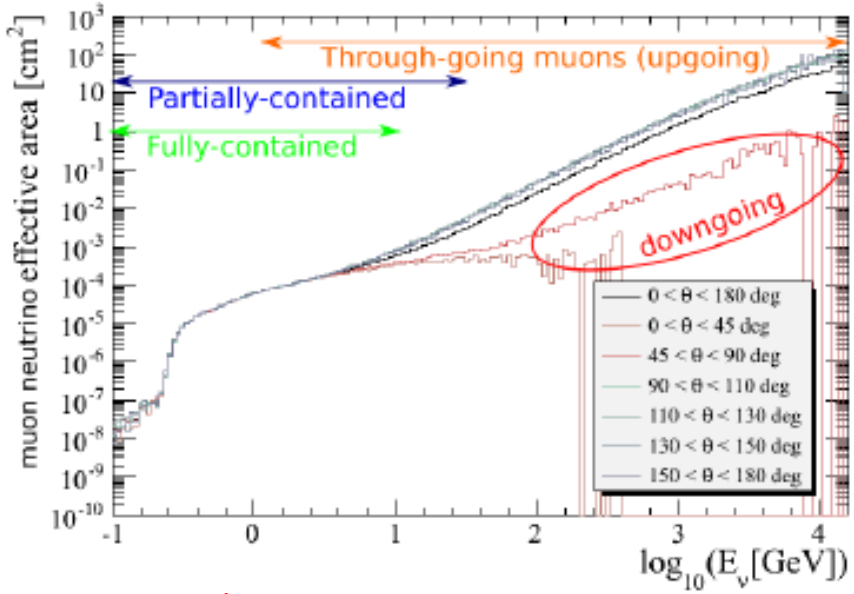
Fabio Iacob, INFN Padova, 2019/06/24 2

Astrophysics with Super-Kamiokande

Search for neutrinos in Super-Kamiokande in coincidence with transient astrophysical events (GW, ν, γ...)

- One postdoc (FELLINI fellow) currently working on the development of the automatic process for follow-up of alerts with SK High-Energy samples ($E = 10^{-1} - 10^{6}$ GeV). Ongoing internal tests with public GW O3 alerts.





Attivita` 2019/20

Anagrafica e Richieste 2020

Anagrafica 2019

G.Collazuol 60% (+10% ENUBET)
N.Ospina (PD) 60%
F.Iacob (PhD) 90%
M.Pari (PhD) 30% (+70% ENUBET)
G.Cogo (Assegno Tecn.) 80 %

M.Laveder 60%
A.Longhin 30% (+70% ENUBET)
M.Mezzetto 80% (+10% ENUBET)
M.Lamoreux 100% FELLINI

Totale FTE = 4.9 T2K-SK + 1.0 T2K-FELLINI + 1.6 ENUBET

Richieste 2020

Missioni interne 4k€
Missioni estero 80k€
- shifts e meetings T2K & SK
- test prima HA-TPC at DESY

Costruzione apparati 90k€
- HA-TPC Field Cage (FC) finali

Consumabile 10k€
- RMM ed elettonica TPC

Richieste Servizi Sezione 2020

- U.Tecnico (principalmente G.Cogo) 9 mu per disegno & controllo produzione FC
- O.Meccanica: 2 mu per parti strutturali in termoplastica FC
- S.Elettronica: 2 mu per test parte elettrica FC

Virgo: alcuni risultati scientifici

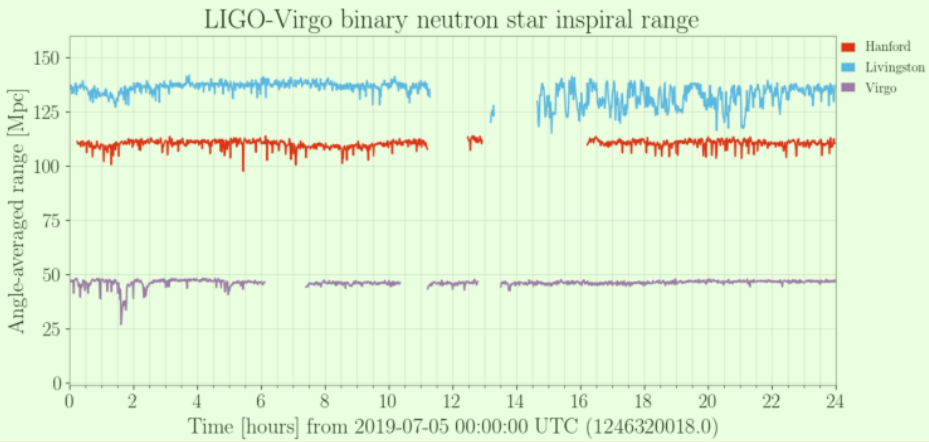
GWTC-1 (risultati di O1&O2 su Compact Binary Mergers):

- 11 confirmed detections (FAR < 1/30 days, p_astro > 50%)
- 10 BBHs (4 previously unpublished)
- 1 BNS

arXiv:1811.12907

- Began on April 1st 2019
- Duration : 1 year
- First run with open public alerts : https://gracedb.ligo.org/
- Alerts sent out if a detection meets the FAR threshold of < 1/2 months

Ad oggi durante O3:
21 public alerts
3 retractions



During O3, about 3dB squeezing routinely injected in AdV:
Squeezing level > 2.5 dB: 72.5% of the total time
determinante il contributo di Virgo Pd

Virgo – Pd : attività sperimentale 2020

- R&D per EPR squeezing :
  coherent control loops: PLLs
  Sensors for Mode matching (lente elettro-ottica)
  Actuators for Mode matching (telescopio motorizzato)
  Sensors for auto-alignment: deflettore elettro-ottico

- R&D coating
  dettagli nella slide successiva

- R&D nonequilibrium thermal noise

- commissioning di Frequency Dependent Squeezing

- attività sperimentali per Frequency Dependent Squeezing saranno (forse) finanziate da EGO come AdV+ project (pending decision by EGO council 18-19 Jul)

R&D on coating

- **Coating Resarch and Developement (CRD).** Research on new materials with low thermal noise for fabrication of new mirrors for Virgo. Preparatory work for O5.
- **Mode Matching (QNR)** Research on new techniques for measurement and control of the mode mismatch between optical beams and cavities. Crucial for SQZ.

  Study of nanocrystals formation in SiC (nanoSiC) The idea is to determine a protocol to produce dispersed crystals with nanometric size in an amorphous SiC matrix, a material which could be potentially be used for test masses coatings.

per questa ricerca il gruppo di Vigo-Pd cresce ulteriormente grazie alla partecipazione di G. Maggioni (0.1FTE) di UniPd

Analisi Pd/Tn - Attività per il 2020

- **Run O3**
  - **Burst All-Sky Short Duration Generic Transients Signals**
    - Contributo all'analisi con cWB e alla scrittura articolo
  - **Burst All-Sky Long Duration Generic Transients Signals**
    - Analisi con cWB e contributo alla scrittura articolo
  - **IMBBH (Intermediate Mass Binary Black Holes)**
    - Contributo all'analisi con cWB
  - **Stellar Mass BBH & eBBH**
    - Analisi burst cWB e contributo alla scrittura degli articoli
  - **Analisi con cWB per il follow-up segnali GW**
    - Supporto low-latency per follow-up elettromagnetico
    - Analisi post-merger di segnali gravitazionali da BNS
- **Supporto e Sviluppo pipeline cWB per Run O3/O4**
  - **Supporto ai gruppi che uilizzano cWB per ricerche del Run O3**
  - **Supporto Detector Characterization per Virgo**
    - Shifts per Run O3
  - **Aggiornamento della pipeline per Run O4**
    - miglioramento degli algoritmi di ricerca e infrastruttura della pipeline (CNAF)

ASTRO AND POPULATIONS @ VIRGO PD:

Staff: Michela Mapelli (40%)

Postdocs: Yann Bouffanais (40%), Mario Spera (50%)

TOPICS in 2020:

* CONTRIBUTION TO MASS SPECTRUM AND RATE ESTIMATION for O3 IN THE FRAME OF THE POP&RATE LIGO-Virgo GROUP (Spera, Mapelli, Bouffanais)

* CONTRIBUTION TO THE STUDY AND ASTROPHYSICAL CHARACTERIZATION OF S190521g AND OTHER POSSIBLE MASSIVE BBH CANDIDATES (Mapelli)

*DEVELOPMENT OF A NEW BAYESIAN ANALYSIS FRAMEWORK FOR RATE DEPENDENCE WITH REDSHIFT (Bouffanais, Mapelli)

REQUESTS in 2020:

* travel expenses to participate in Virgo weeks (Bouffanais, Mapelli)
* 3 M CPU hours at CINECA (to be requested to Punturo – Cosmai)

Richiesta

richiesta economica in via di definizione, anche in coordinazione con Virgo-Italia.

Le richieste ai servizi della sezione dipendono dal programma scientifico e quindi anche dalla richiesta economica e sono in fase di valutazione

ricercatori	FTE
Bazzan	60
Bouffanais	40
Ciani	80
Ciolfi	50
Conti	80
De Pietri	50
Lazzaro	80
Mapelli	40
Spera	50
Vardaro	80
Vedovato	100
Zendri	60

+1PhD student

servizi	mesi persona
off. meccanica	in valutazione
off. elettronica	in valutazione
uff. tecnico	in valutazione

Potrebbero esserci alcune modifiche sugli FTE indicati.

tecnologi	FTE
Pegoraro	20