

- **SBN/ICARUS** (ref. slides Sergio)
- **DUNE-ND-SAND**
 - **GRAIN**
 - **Data Analysis**
 - **STT**
 - **«KLOE-to-SAND»**
- **DUNE – FD- PDS**

NB. contributo alle slides di tutti i membri del gruppo
Mie scuse per mix inglese/italiano

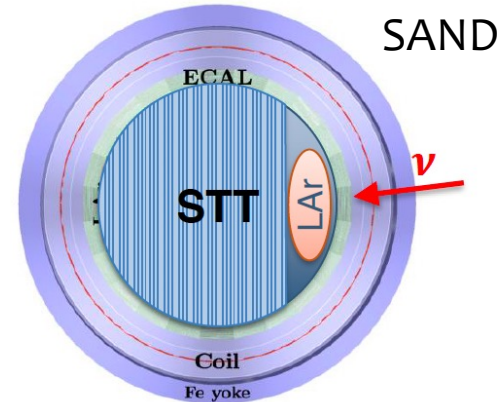
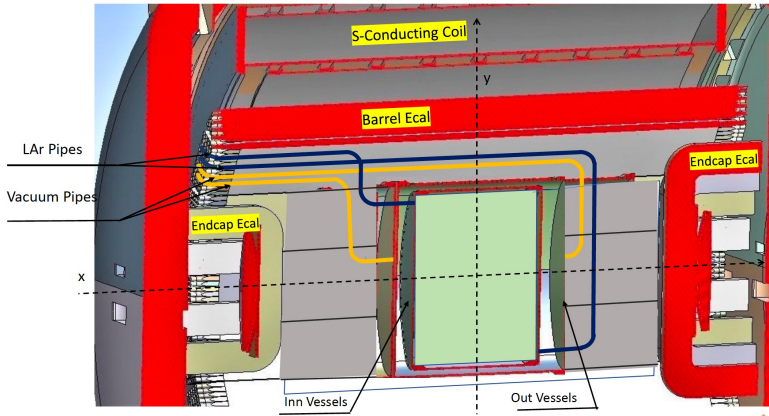
ANAGRAFICA PREVENTIVI INFN 2023 : S. Bertolucci, A. Cervelli, V. Cicero, L. Degli Esposti, D. Di Ferdinando, A. Gabrielli , C. Guandalini, M. Guerzoni , G. Ingratta, G.Laurenti, I.Lax, M. Lolli, N.Mauri, N. Moggi, E. Montagna, A. Montanari, A. Paladino, G. Pancaldi, L. Pasqualini, L.Patrizii, V. Pia, G. Piazza, F. Poppi, M. Pozzato, A. Ruggeri, S. Serra, G. Sirri, M. Tenti, V. Togo, N. Tosi, R. Travaglini, C. Valieri, S. Zucchelli

15 Fisici, 5 Tecnologi, 5 Dottorandi , 8 Tecnici

14. 7 FTE (fisici+tecnologi) + 1.3 FTE sigle sinergiche (ENUBET/AIDA-INNOVA/PRIN2017/PRIN2020)

Supporto Servizi Sezione

2023	
Servizio Elettronica	15 M.U.
Servizio Tecnico Generale	25 M.U.
Servizio Progettazione Meccanica	20 M.U.
Servizio Officina Meccanica	10 M.U.



GRAIN Working Group in SAND Conveners: Lea Di Noto, Alessandro Montanari

Activities in Bologna

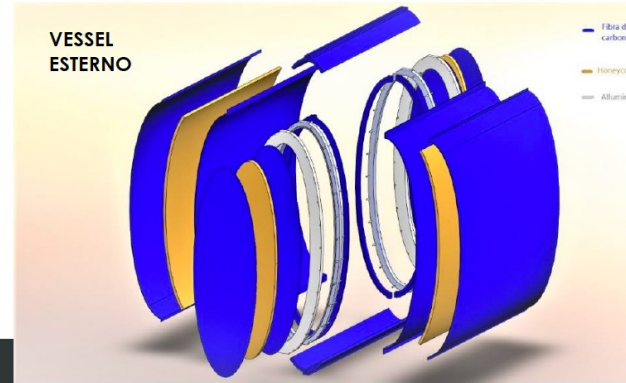
- Cryostat Mechanical Design
- Detectors and Optics for VUV scintillation light
- Cryogenic readout electronics
- Reconstruction with Coded Aperture masks
- Camera demonstrator : Tests at room temperature and in Argon cryostat (ARTIC-Genova)

GRAIN – Mechanical Design

Internal and External Vessels

VOLUME FIDUCIALE DI 1 TONN. ARGON LIQUIDO
VESSEL INTERNO (dim.1456X475X1500 mm) MAT. AISI 316 LN (SI EVITANO TRANSIZIONE TERMICHE PER LE TUBAZIONI DI PASSAGGIO DELL'ARGON) . RISPETTO DELLE NORME ASME(ASME VIII Div. 2 Ed. 2017). SUI RECIPIENTI IN PRESSIONE (S = min (YS/1.5; UTS/2.4)

VESSEL ESTERNO (dim 2340x2200x830mm): CF-PLY HONEYCOMB-AL (COVER)
SUPERISOLAMENTO: 20 strati di Mylar alluminato (MLI shield) ambo le parti, ogni foglio separato da una rete di poliestere.

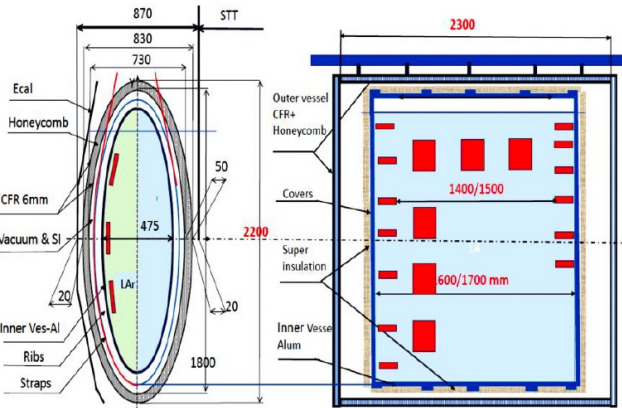


Technatics data sheet for HELICOFLEX HN20. The table lists various technical specifications:

Property	Value
Material	Aluminum
Material thickness (mm)	1.5
Production standard (EN)	EN 10183
Production standard (ISO)	ISO 10241
Reference standard (DIN)	DIN 15213
Reference standard (ISO)	ISO 10241
Reference standard (EN)	EN 10183
Reference standard (ISO)	ISO 10241

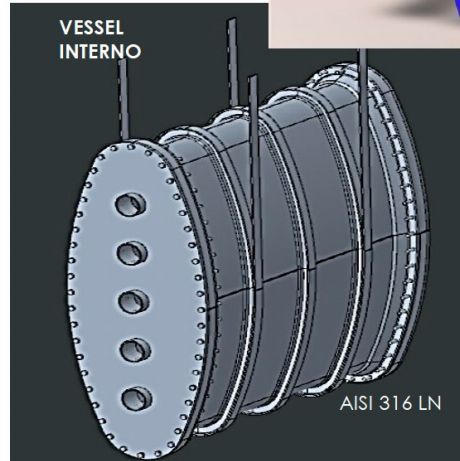
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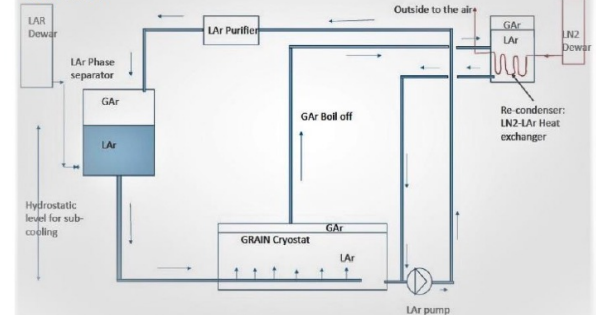


Grain Cryo 1 ton Lar fiducial volume - tentative dimensions

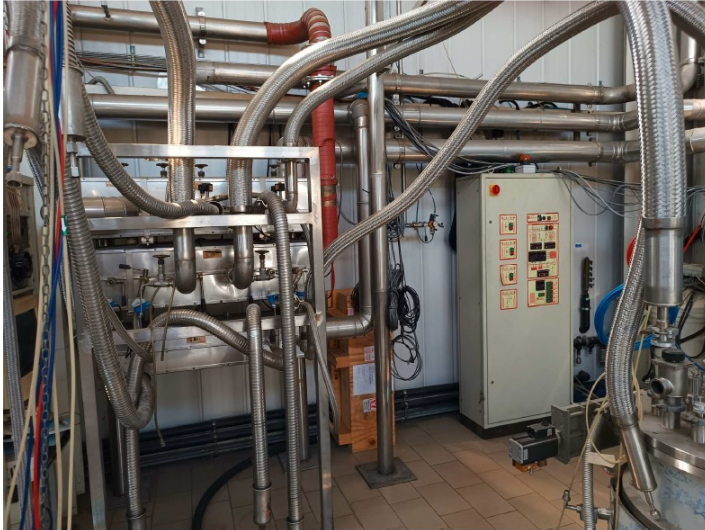
VESSELS INTERNO ED ESTERNO-SCHEMI



IMPIANTO ALIMENTAZIONE ARGON



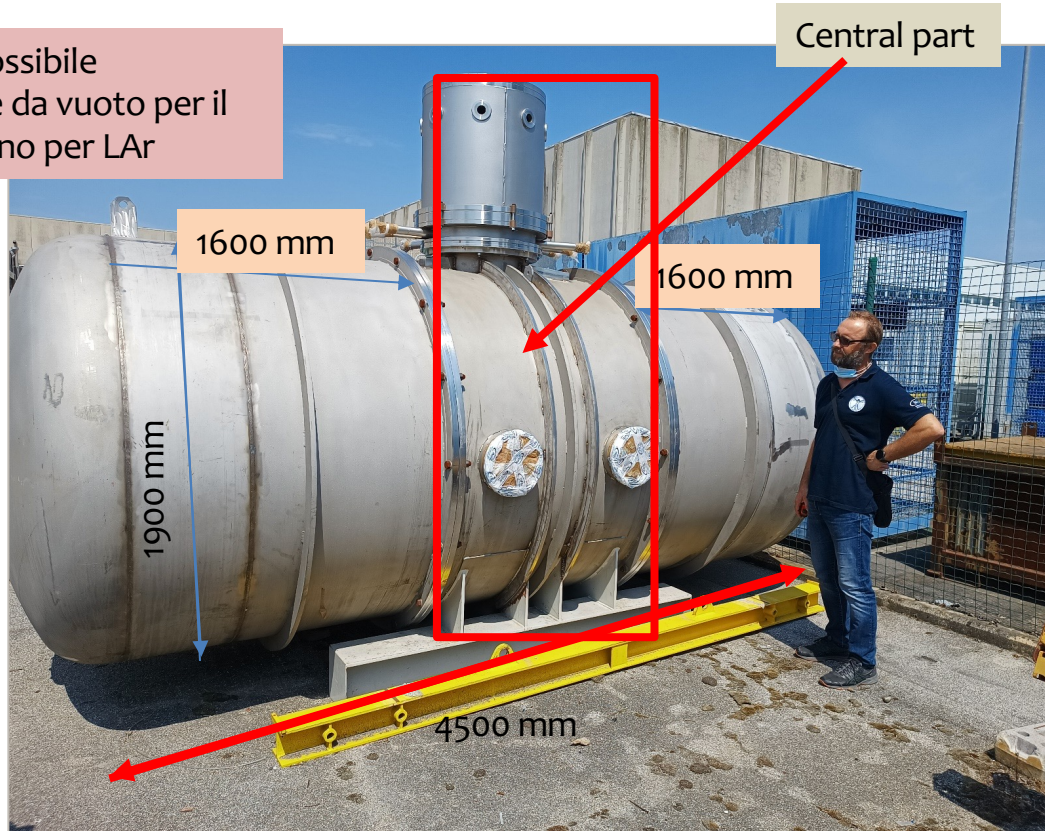
Test in Criogenia : competenze /spazi / infrastrutture a LNL (ref. Ruggero Pengo LNL)



Refurbishing laboratorio a LNL (sicurezze, impiantistica, controllo)

Progettazione e realizzazione impianto Criogenico

AURIGA: Possibile contenitore da vuoto per il vessel interno per LAR



If we remove the central part the length will be $1600 + 1600 = 3200$ mm. Diameter 1900 mm

@R. Pengo - LNL

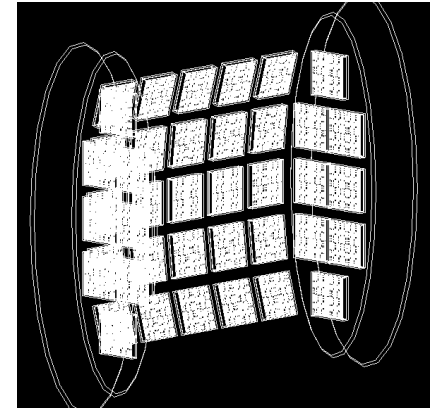
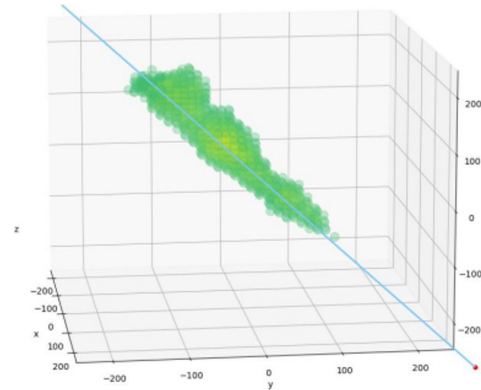
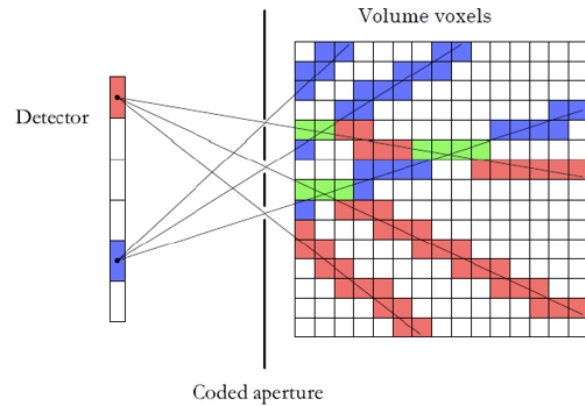
		Richieste (k€)	SJ (k€)
apparat	SAND/GRAIN 1- Analisi FEM del progetto meccanico definitivo del criostato a LAr - 2- Analisi FEM preliminare del progetto meccanico del vacuum vessel in fibra - Anticipabili a 2022	40.00	0.00
	SAND /GRAIN Realizzazione Inner Vessel secondo design definitivo. SJ allo stato di avanzamento del progetto	100.00	0.00
	SAND/GRAIN progettazione proximity cryogenics (anticipabile a 2022)	25.00	0.00
	SAND/GRAIN proximity cryogenics (LAr pump, phase separator, purifier)	0.00	150.00
	SAND/GRAIN Vacuum Vessel temporaneo per i test da eseguire nell'inner vessel ai LNL. Possibilita' di riutilizzo vessel di AURIGA	30.00	0.00
	SAND/GRAIN Sistema da vuoto (pompe , sensori vuoto,...) per il vacuum vessel- Da utilizzare sia per il temporaneo vacuum vessel (ref. voce in questi preventivi) che per il vacuum vessel definitivo	40.00	0.00
	SAND/GRAIN - sistemazione laboratorio a LNL (sistemi di sicurezza, impiantistica, controllo) per test su prototipo full scale dell'inner vessel di GRAIN. Anticipabile a 2022	35.00	0.00

GRAIN: Optical Readout

Use **scintillation light** to reconstruct the tracks

Imaging device is a **matrix of SiPM** + a “coded mask” (pattern of holes) in front of sensors

3D reconstruction (voxels) : finding the most probable light sources



Layout of coded aperture mask detectors in GRAIN inner volume.

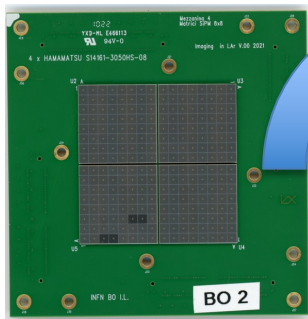
GRAIN: Camera demonstrator

Small scale prototype to test the technique:

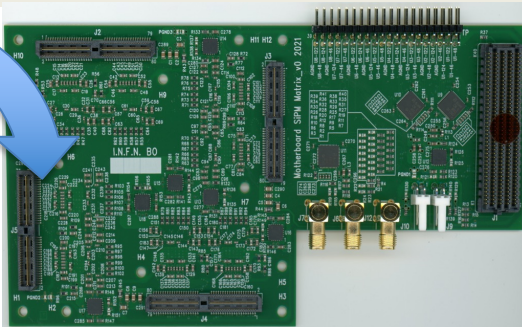
Sensor Matrix: Hamamatsu 16x16 (SiPM size 3x3 mm²)

Cold frontend electronics : 8 x ASIC (32ch, “ALCOR” from INFN Torino) = 256 ch

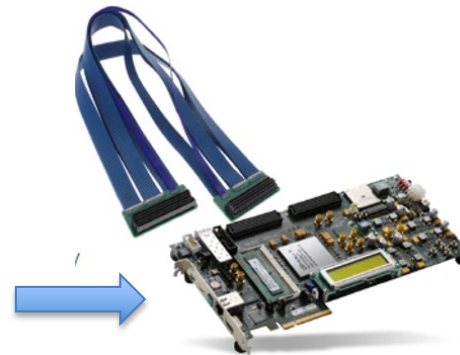
Readout: DAQ with FPGA on demo board



Matrix of SiPMs on a mezzanine board



Motherboard with 8 ASIC (256 ch)



Xilinx FPGA

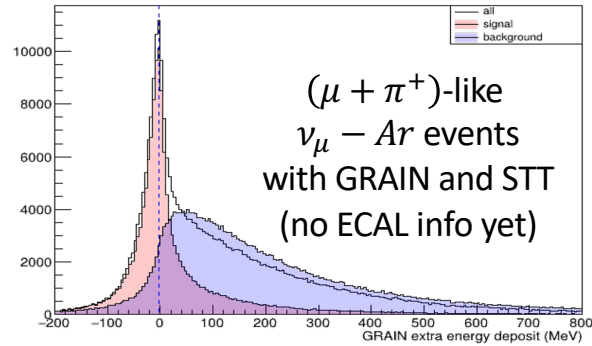
Tests in LAr (ARTIC) (ref. slide Lea Di Noto)

GRAIN – richieste per readout prototype and tests

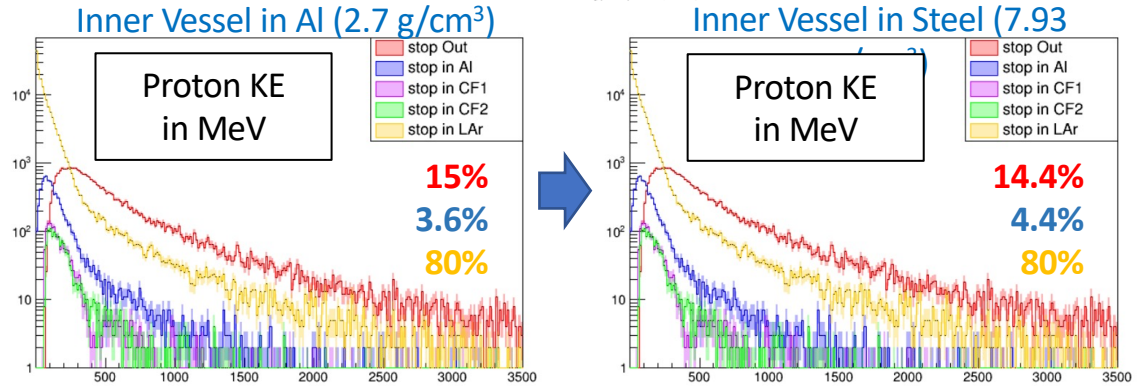
		Richieste (k€)	SJ (k€)
apparati	SAND/GRAIN Demo board FPGA Xilinx VC707 per cold demonstrator	7.00	0.00
	SAND/GRAIN Modifica al chip ALCOR - SJ allo stato di avanzamento del progetto di readout (risultati cold demonstrator in ARTIC)	0.00	30.00
consumo	CONSUMABLES SAND/GRAIN parti meccaniche per supporto delle matrici	1.00	0.00
missioni	TURNI SAND/GRAIN: Tests in ARTIC 4 turni da 1 settimana x 2 persone= 8 settimane -uomo a Genova	8.00	0.00

Data Analysis

Study of **SAND performances** and definition of the **GRAIN physics case**



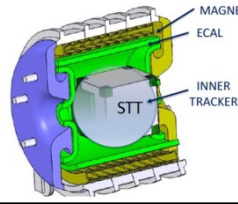
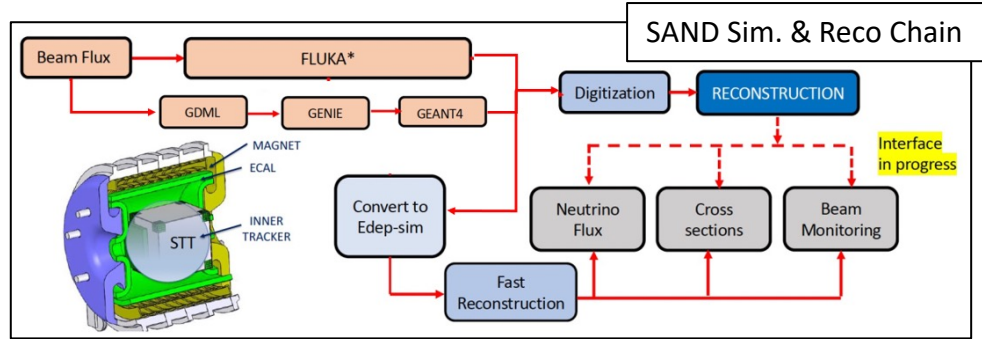
Study of the **stopping power** of the **GRAIN cryostat** (Al vs SS)



Development **SAND full event reconstruction**

- **2022 computing resources:**
3000 HS; 510 TB (DISK); 35 TB (TAPE)
- **2023 resources increment:**
375 TB (DISK)

CNAF



missioni	Richieste (k€)	SJ (k€)	
TURNI Integrazione analisi SAND nel framework di DUNE - 1 settimana x 2 persone a FNAL		4.00	0.00

SAND – STT

ref. Progress Report 2022 – Ref. Slide Fabrizio Raffaelli

Working Group formalizzato nei mesi scorsi

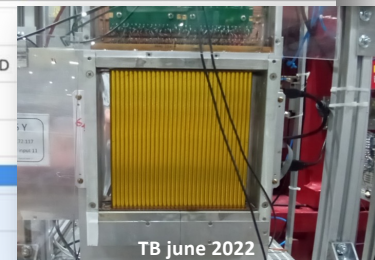
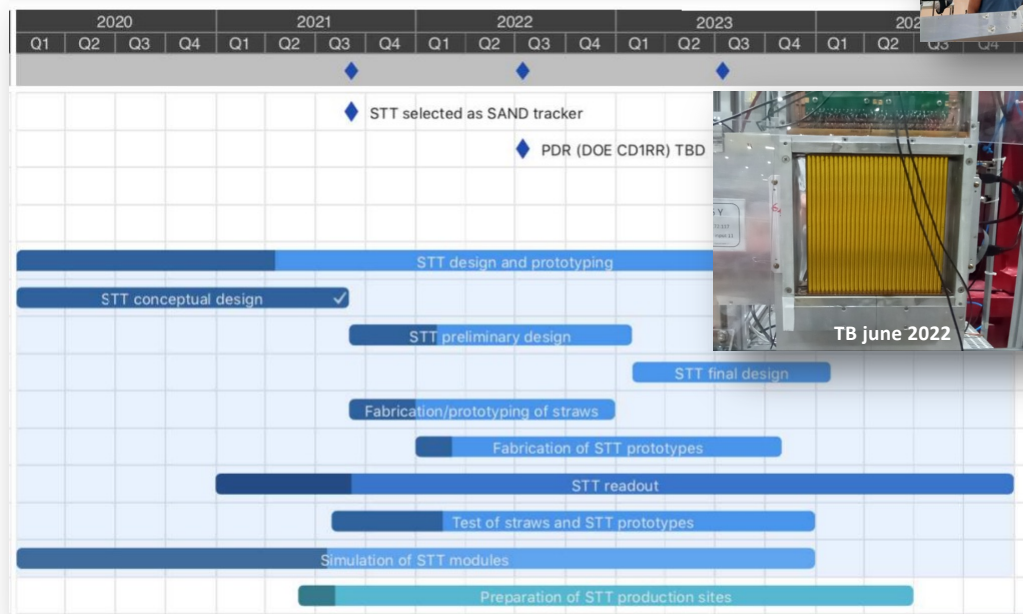
- STT preliminary design entro fine 2022/ inizio 2023
- STT final design entro fine 2023
- Procurement/costruzione dal 2024

Bologna coinvolta in

- Progettazione
- Test e validazione dei Prototipi (in particolare full-scale)
- Elettronica

STT WORKING GROUP

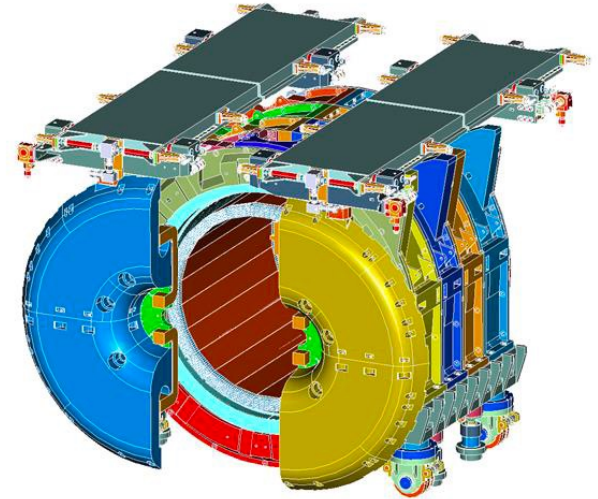
- ◆ Activities related to the *design and construction of the STT for SAND*, the assigned goals being the completion of the detector installation and its readiness for operation.
- ◆ Initial WG chairs: G. Sirri, S. Di Falco, R. Petti
- ◆ Dedicated *mailing list DUNE-ND-SAND-STT*



UofSC

apparati	Richieste (k€)	SJ (k€)
SAND/STT 800 straws 5 mm diametro prodotte da Lamina Tech per realizzazione un prototipo 1200mm x800mm (ref. realizzazione frames in preventivi Pisa).	10.00	0.00
SAND/STT - Sistema di readout e distribuzione alta tensione per prototipo 1200mmx800 mm	25.00	0.00

- Partecipazione SAND-ECAL Working Group
- Contributo allo smontaggio
- Contributo Creazione nuovo archivio disegni KLOE
- Trasposizione disegni KLOE su CAD3D
- ...



Richieste

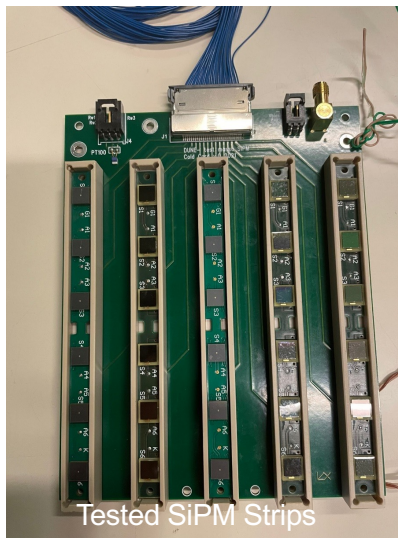
		Richieste (k€)	SJ (k€)
missioni	TURNI SAND/ECAL : Smontaggio KLOE/Ecal 8 settimane-uomo a LNF	7.00	0.00

Activities on Photosensors for DUNE FD

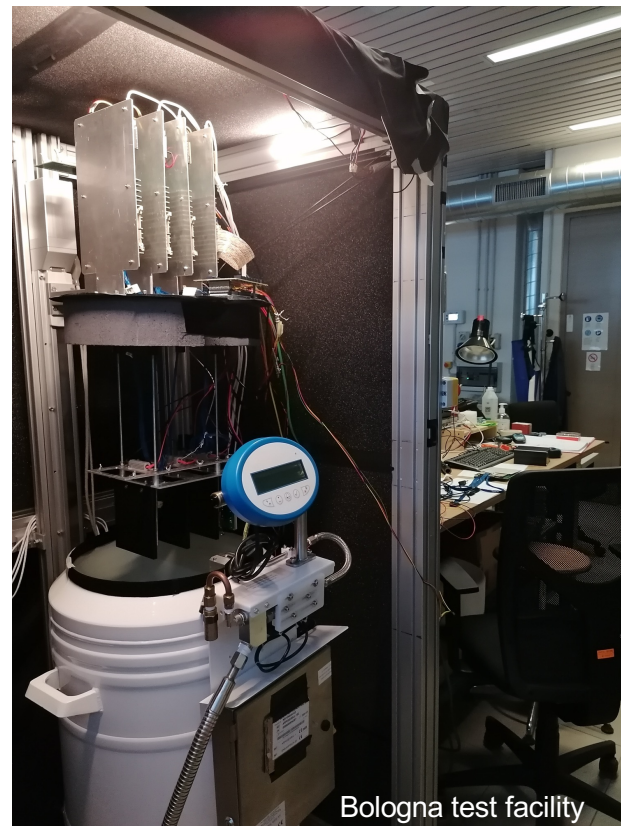
- Bologna and Ferrara: Test Mass Facility design and construction (ref. slides Francesco e Luca T.)
- System allowing thermal cycles and tests of 120 SiPM in parallel
 - ~4000 SiPM tested to be used in ProtoDUNE2
 - 4 more (cloned) facilities to be installed in other labs: to test 290000 SiPMs



Bologna Cryo Lab



Tested SiPM Strips



Bologna test facility

		Richieste (k€)	SJ (k€)
consumo	CONSUMABLES: PDS/HD/SIPM Sistema test di massa: Fornitura LN2 - operazione del sistema di test di massa nel 2023 (25 refill Dewar 250 l)	10.00	0.00
	CONSUMABLES PDS/HD/SIPM Sistema Test di Massa : Manutenzione ordinaria della facility	2.00	0.00
	CONSUMABLES : PDS/HD/SiPM Sistema Test di Massa: Materiale per stoccaggio temporaneo e imballaggio SiPM	1.00	0.00
missioni	TURNI - PDS Presa dati ProtoDUNE SP Run II - 3 mesi-uomo	12.00	0.00
	TURNI-PDS Allestimento facility test di massa a Praga, Granada, Milano - 1 settimana x 1 persona x lab x 1keuro	3.00	0.00

...e infine

	Richieste (k€)	SJ (k€)
CONSUMABLES Fondo economale a FNAL (fondo per tutti i gruppi ad esclusione di Roma2)	30.00	0.00
MEETING - DUNE 3 Collaboration Meetings 1 settimana x 7 persone (incluso spokesperson) - CERN: 7 k Euro -FNAL : 14 kEuro -SURF : 16 k Euro	37.00	0.00
MEETING DUNE : Meetings Spokesperson in aggiunta ai general meetings	20.00	0.00