

DUNE: preventivi per il 2025

Gruppo di Lecce

Antonio Surdo

Bologna

21-June-2024

Activities in 2023 / 2024

- ✓ PMT-SiPM comparison for the possible refurbishing of the KLOE-ECAL readout was completed
- ✓ Technical paper published on JINST



PUBLISHED BY IOP PUBLISHING FOR SISSA MEDIALAB

RECEIVED: March 4, 2024
ACCEPTED: April 24, 2024
PUBLISHED: June 11, 2024

TECHNICAL REPORT

Study of silicon photomultipliers for the readout of a lead/scintillating-fiber calorimeter

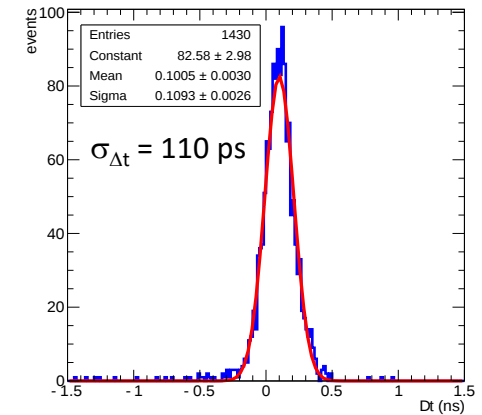
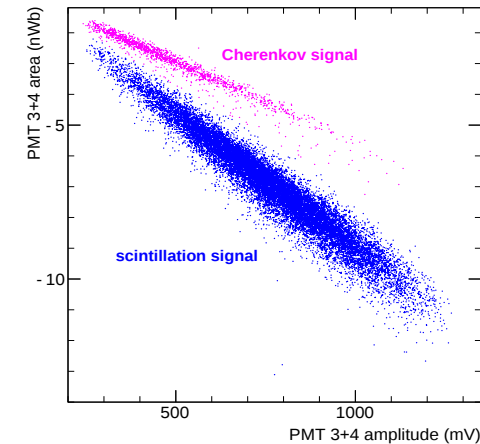
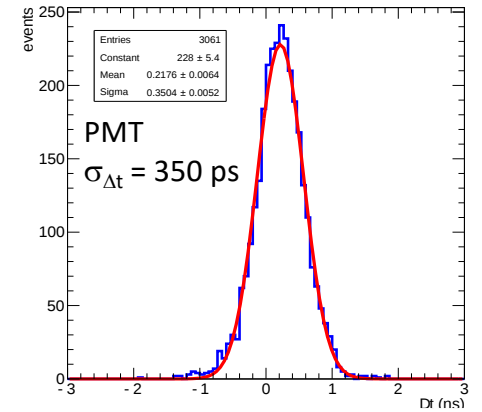
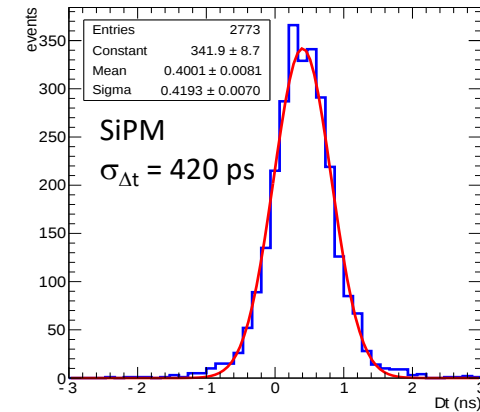
F. Alemanno,^{a,b} P. Bernardini,^{a,b} A. Corvaglia,^b G. De Matteis,^{a,b} L. Martina,^{a,b} A. Miccoli,^b M. Panareo,^{a,b} M.P. Panetta,^b C. Pinto^{a,b} and A. Surdo^{✉b,*}

^aDipartimento di Matematica e Fisica, Università del Salento,
via per Arnesano, I-73100 Lecce, Italy

^bIstituto Nazionale di Fisica Nucleare, Sezione di Lecce,
via per Arnesano, I-73100 Lecce, Italy

E-mail: antonio.surdo@le.infn.it

2024 JINST

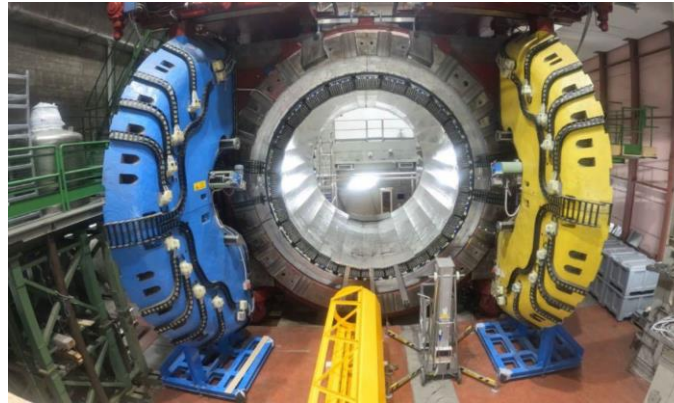


- The SiPM noise requires a cut
=> small reduction of efficiency
- Efficiency and σ_t comparable for SiPM and PMT

Hardware Activities in 2023 / 2024 (contd)

✓ KLOE-to-SAND

Support to ECAL barrel-module extraction operations at LNF



✓ Realization of ARTIC-CRT

Presently assembled and tested in Lab at Lecce

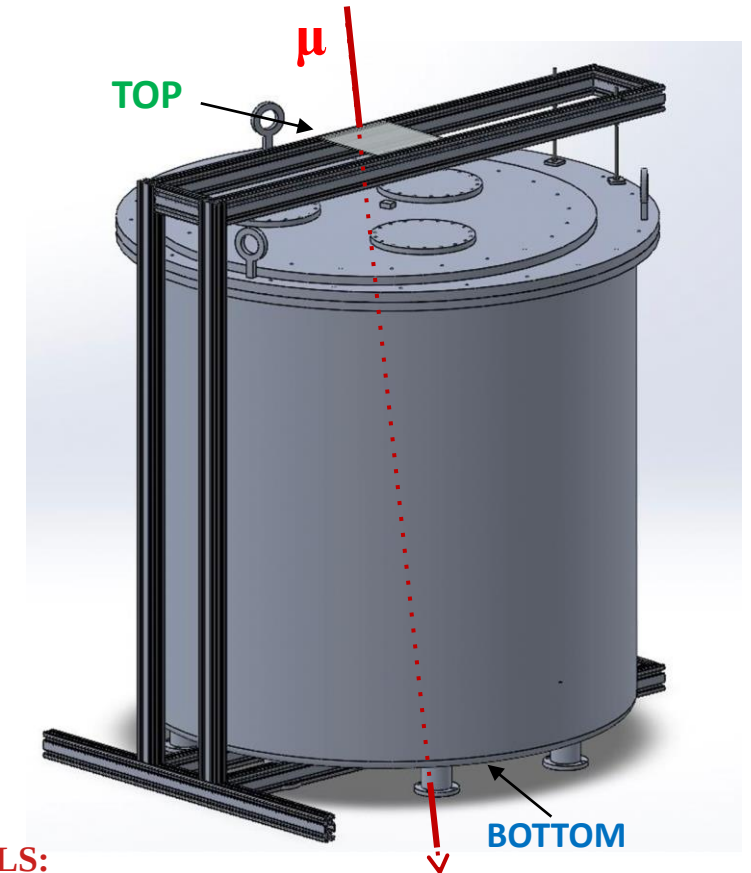
⇒ Commissioning in July

Contributions:

Mechanics (A. Miccoli, S. Maggiore, G. Rizzo, R. ..)

Electronics (A. Corvaglia, M. Panareo)

Detector setup (F. Alemanno, C. Pinto)



CRT GOALS:

- Trigger for the LAr acquisition (fourfold coincidence)
- Two-view tracking to help the LAr event reconstruction

CRT setup @ Lecce



17/05/2024

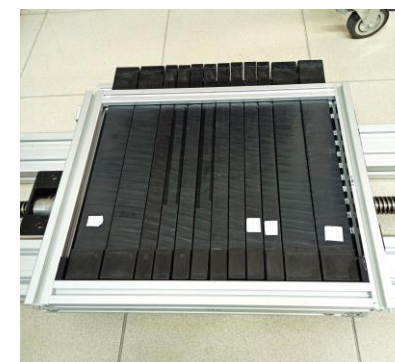


DAQ with TOP-BOTTOM fourfold coincidence

GRAIN WG Meeting - A. Surdo

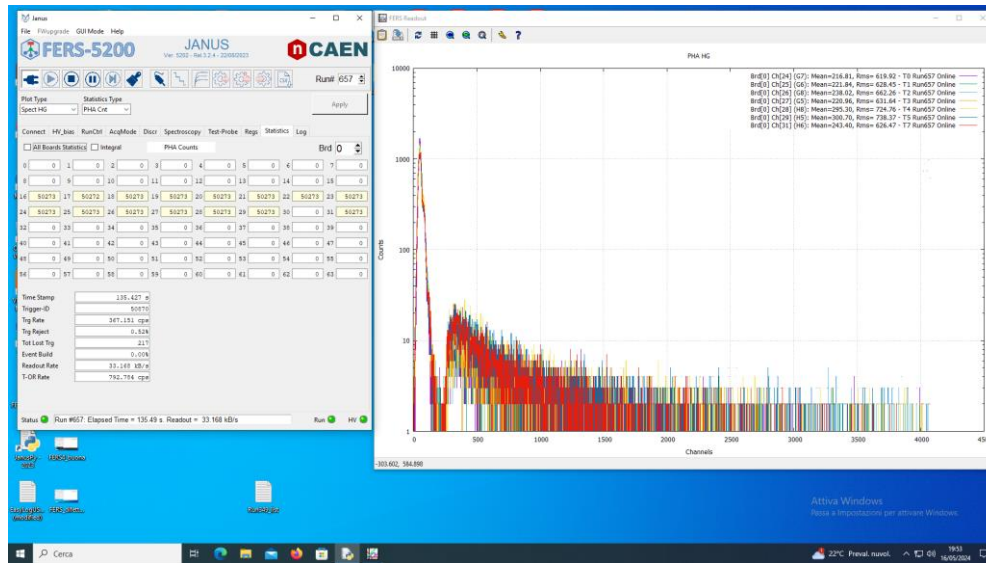


TOP tray

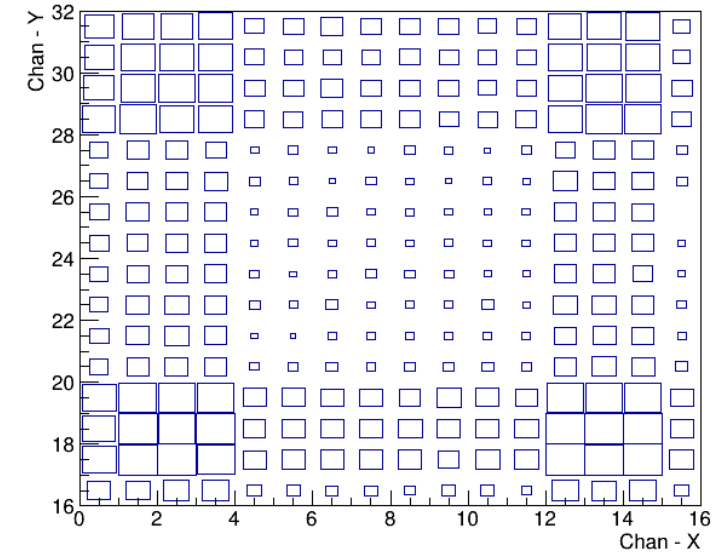


BOTTOM tray

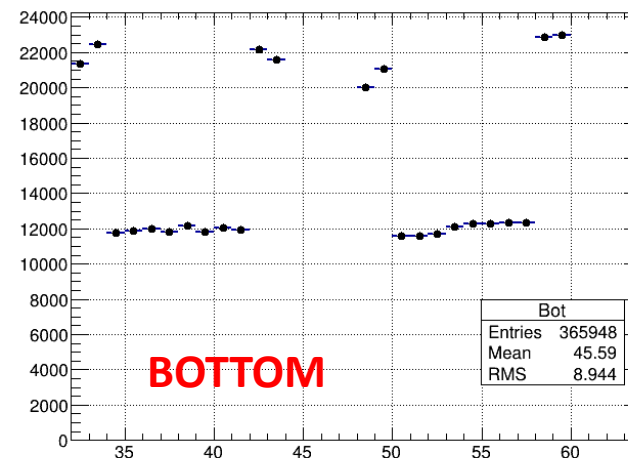
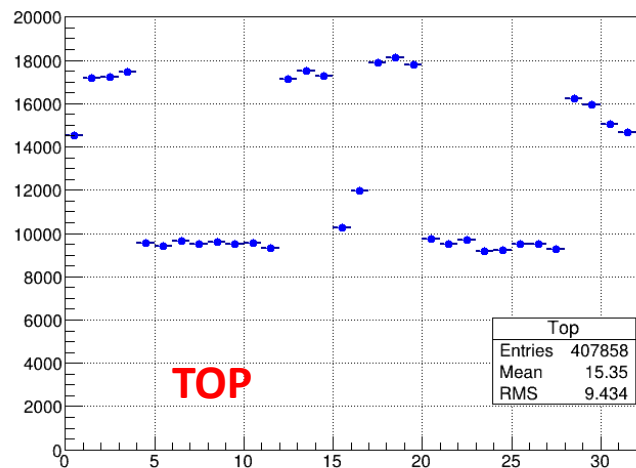
DAQ test on CRT setup @ Lecce



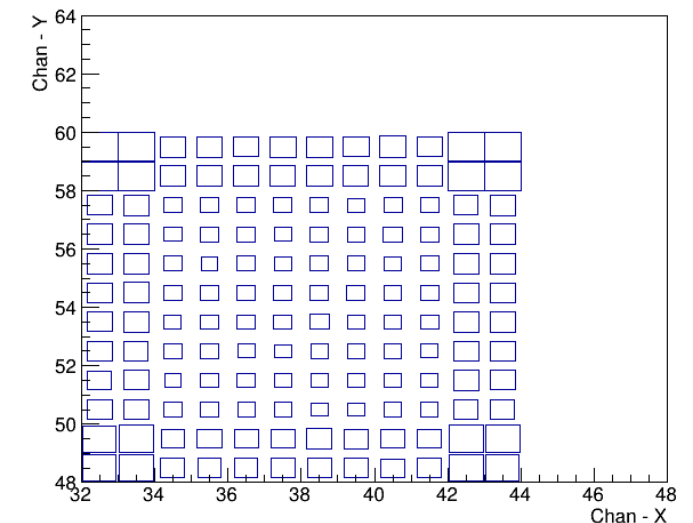
Occupancy: Top_Y vs Top_X



■ TOP-BOTTOM fourfold coincidence: Bar occupancy



Occupancy: Bot_Y vs Bot_X

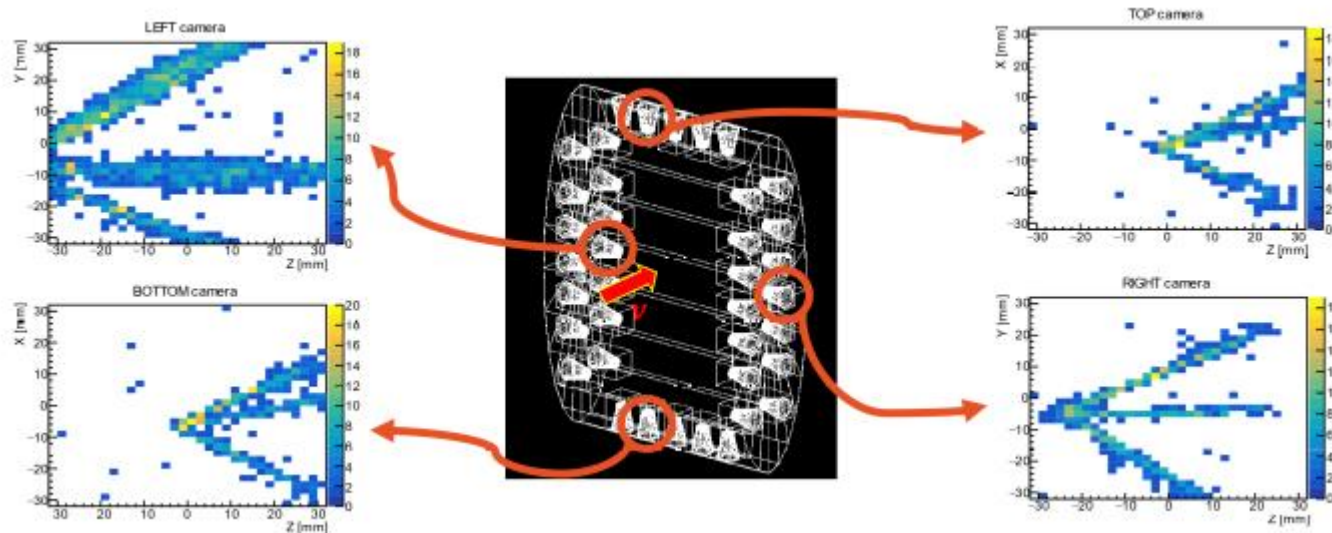


Software Activities in 2023 / 2024

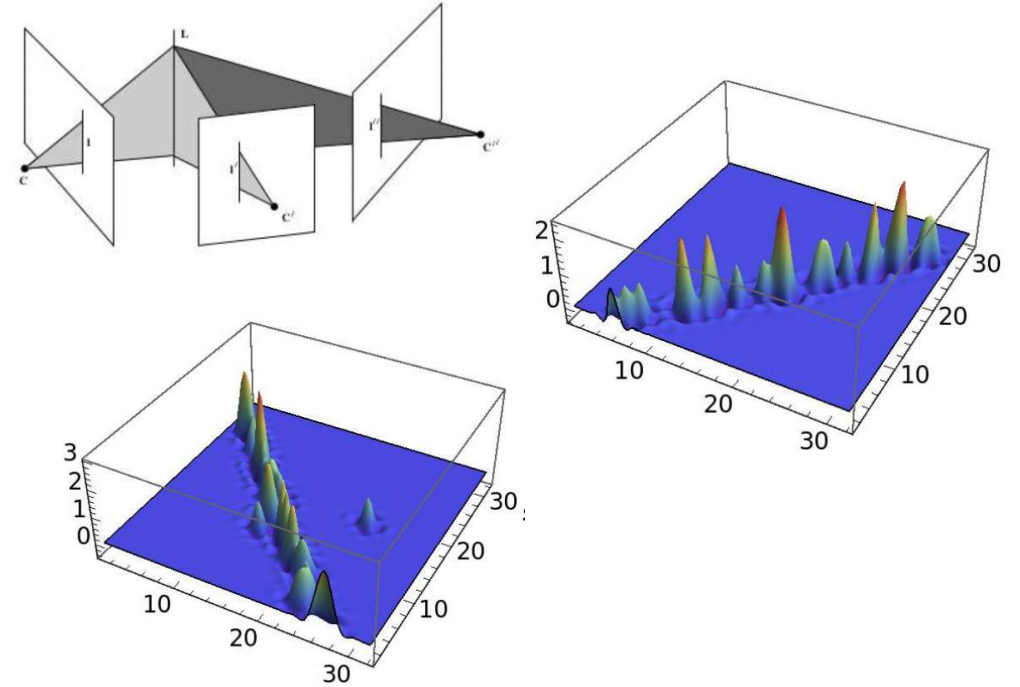
GRAIN (optical readout in LAr)

Definition of algorithms for the 3D reconstruction of neutrino events

Test on the algorithm performances



Triple-View Geometry and image correspondences:
the Trifocal Tensor



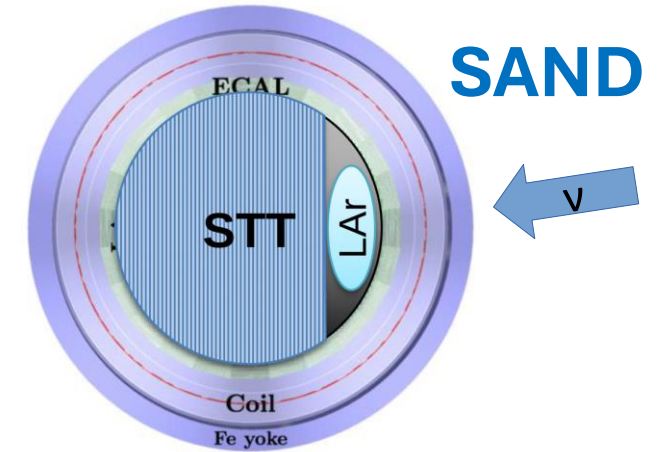
Projective geometry applied to simulated data
(lenses and matrices)

3D reconstruction of light spots (vertices) and
simple tracks

Software activities in progress: ν event reconstruction in SAND

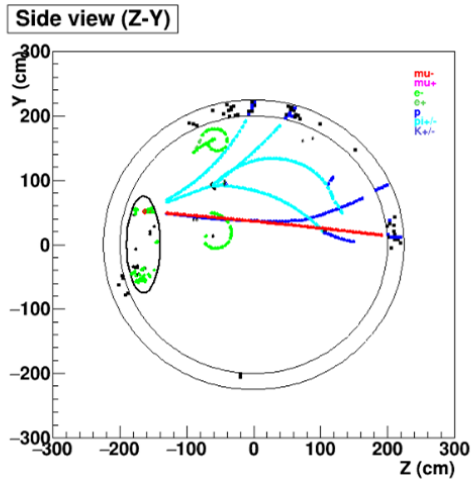
Full reconstruction of ν interaction events:

- ν interaction vertex in SAND
- Id and track reconstruction of particles produced in the interaction
- Reconstruction of energy, flavor and interaction type of neutrino events

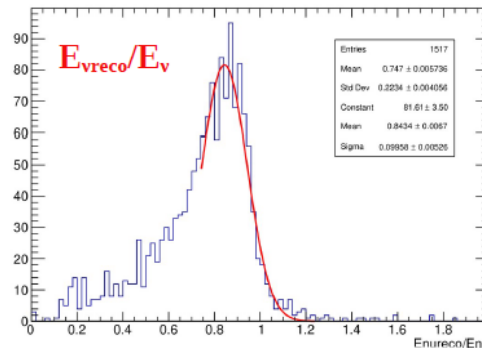


ν_μ interaction in GRAIN

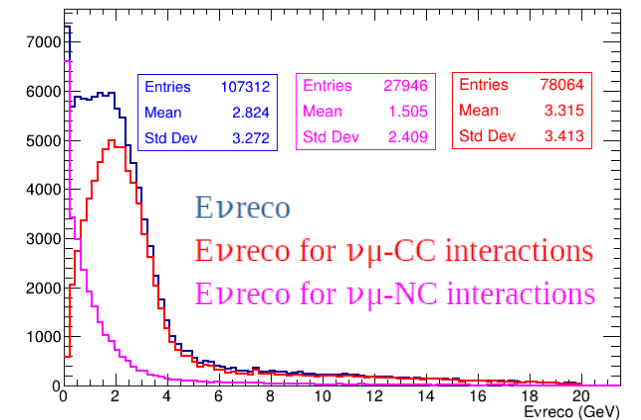
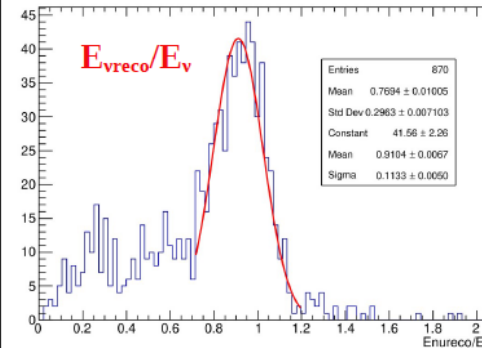
- Characterization of ν interaction events
- Present reconstruction in SandReco



ν_μ -CC interactions in GRAIN

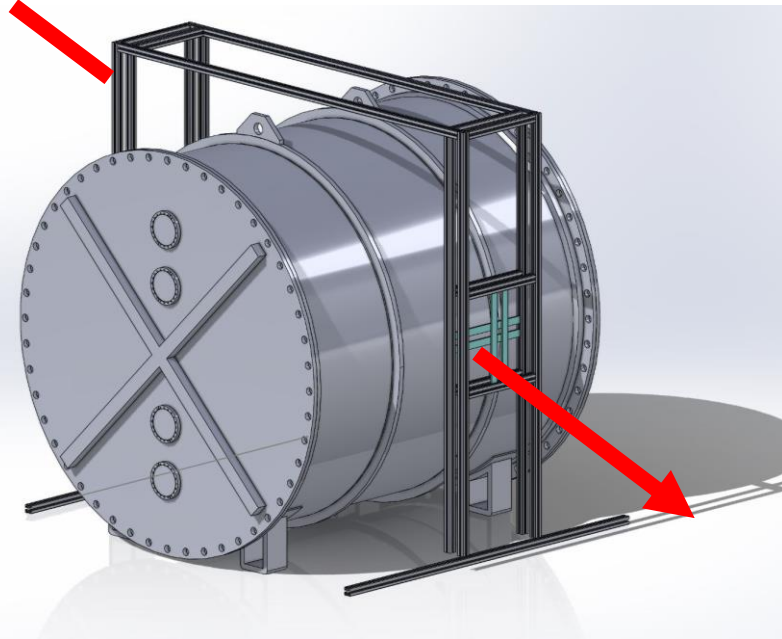


ν_μ -CC interactions in STT



Activities for 2024/2025: CR Tagger for readout of GRAIN prototype @ LNL

Trigger : fourfold
coincidence



Prototype 1:1 at Legnaro

Scintillator bars

Saint Gobain BC-408
thickness 1 cm

Readout with SiPMs

Hamamatsu S14160-6050HS
6 x 6 mm
14331 pixels of 50 μ m pitch

1. 48 x 48 cm²
(8 bars x 4 cm + 8 bars x 2 cm) x 4 planes => **64 channels**
2. 64 x 64 cm²
(8 bars x 4 cm + 16 bars x 2 cm) x 4 planes => **96 channels**

SiPM readout:

1/2 modules CAEN DT 5203/64
6-m CAEN A5261 cables
A5253 header adapter



2025 to-do-list

KLOE-to-SAND

- partecipare allo smontaggio End-cap ECAL di KLOE a Frascati
- acquisizione competenze per il rimontaggio di ECAL a FNAL
- eventuale partecipare ai test con i cosmici sui fototubi dei singoli moduli di ECAL (- software di controllo e monitoring remoto del sistema HV per ECAL in SAND) ?

CRT a Genova e LNL

- installazione del trigger (CRT) con i cosmici su ARTIC a Genova
- integrazione del CRT nella DAQ di ARTIC
- realizzazione dell'analogo CRT per il prototipo 1:1 di GRAIN a LNL (Legnaro)
- test e successiva installazione del CRT a LNL

SAND software

- sviluppo e implementazione algoritmi di ricostruzione «full» degli eventi in SAND
- integrazione nel software complessivo del complesso ND (SAND + TMS + ND-LAr)

Geometria proiettiva

- ripresa e ulteriori sviluppi su algoritmi per l'imaging 3D
- inserimento algoritmi nel software ufficiale della collaborazione

What we need in 2025

Apparati	- profilati REXROTH e lavorazioni meccaniche per CRT-LNL	5.0 k€
	- produzione PCB per lettura SiPM	3.0 k€
	- acquisto (eventuale) di ulteriori SiPM per CRT@LNL	10.0 k€
Consumo	- utensileria, resine per stampante 3D, materiale vario	5.0 k€
Inventariabile	- scheda CAEN A5203 per lettura e alimentazione SiPM per CRT@LNL	8.5 k€ (?)
Missioni	6.0 k€ = 4 persone al meeting al CERN	
	5.0 k€ = 2 persone al meeting in USA	
	3.0 k€ = 2 persone al meeting in Spagna	
	2.0 k€ = 2 trasferte a GE per manutenzione CRT	
	4.0 k€ = 4 trasferte a LNL per installazione CRT	20.0 k€
Pubblicazioni	- prevista pubblicazione di due articoli	2.0 k€
Trasporti	- trasporto materiale a Frascati e Genova	2.0 k€

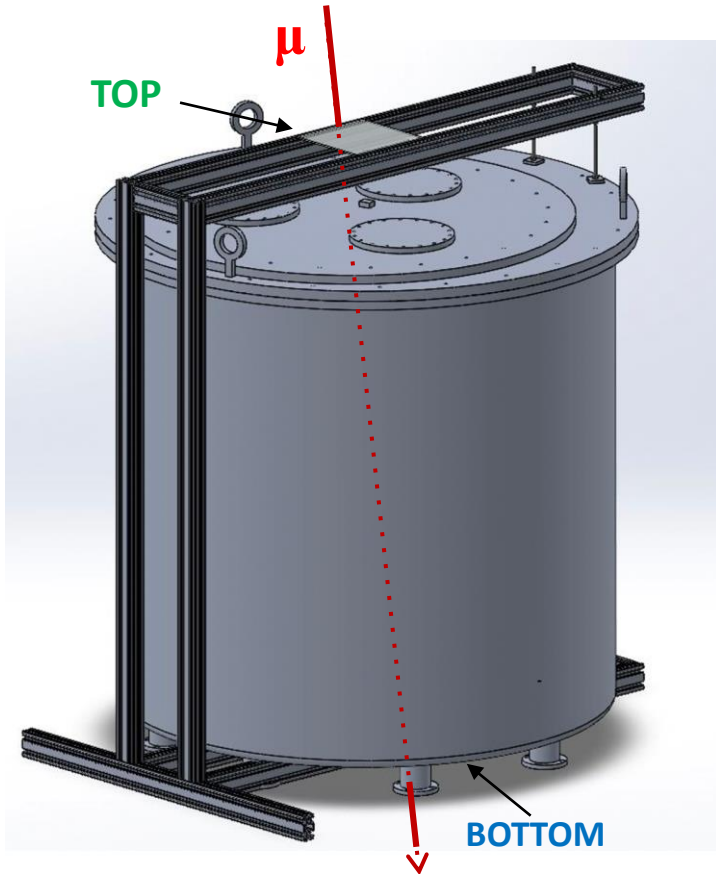
	ANAGRAFICA	FTE
Alemanno Francesca	Assegnista - Unisalento	0.8
Bernardini Paolo	Ordinario - Unisalento	0.0
De Matteis Giovanni	Assegnista - Unisalento	1.0
Leaci Antonio	Ordinario - Unisalento	0.5
Martina Luigi	Associato - Unisalento	0.2
Miccoli Alessandro	Tecnologo - INFN	0.3
Montanino Daniele	Associato - Unisalento	0.3
Panareo Marco	Associato - Unisalento	0.2
Surdo Antonio	Primo ricercatore - INFN	0.5
TOTALE FTE		3.80

Servizi coinvolti nelle attività: **Elettronica, Meccanica**

Setup of Cosmic Ray Tagger (CRT)

CRT GOALS:

- Trigger for the LAr acquisition (fourfold coincidence)
- Two-view tracking to help the LAr event reconstruction



Trigger condition: Fourfold coincidence

CRT DESIGN:

TOP (50 cm x 50 cm active surface)

16 bars x 2 orthogonal planes:

- 8 bars (50 x 4 x 1) cm³
- 8 bars (50 x 2 x 1) cm³

BOTTOM (34 cm x 34 cm)

12 bars x 2 orthogonal planes:

- 4 bars (37 x 4 x 1) cm³
- 8 bars (37 x 2 x 1) cm³



SCINTILLATORS:

Saint Gobain BC-408

READ OUT:

6x6 mm² SiPMs

Hamamatsu S14160-6050HS

14331 pixels and 50 μm pitch



DAQ BOARD

CAEN FERS - DT5202

