

Activities and funding

Lecce group, 2023/24

Antonio Surdo

DUNE Italy - Referees meeting
6 September, 2023

ACTIVITIES in 2023

SAND/ECAL Extraction of the KLOE wire chamber



SAND/ECAL Efficiency and time resolution have been compared for SiPM and PMT
The SiPM noise requires a cut => Reduction of SiPM efficiency
Efficiency and time resolution are comparable for SiPM and PMT
The substitution of PMT with SiPM is disfavoured

SAND/GRAIN Projective geometry applied to simulated data (lenses, matrices)
3D reconstruction of light spots (vertices) and simple tracks

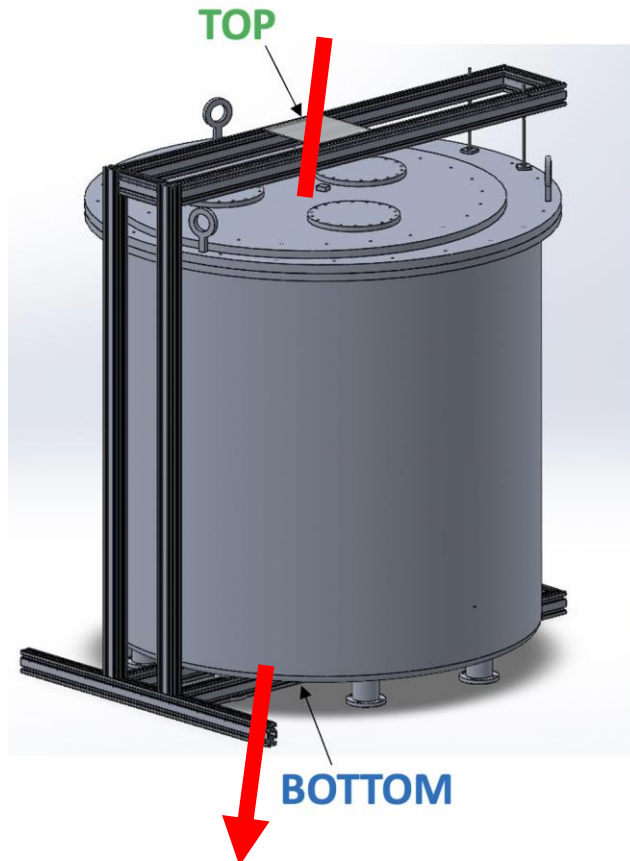
SAND/GRAIN Design of the Cosmic Ray Tagger for ARTIC
Test of scintillator bar performance and SiPM readout for CRT

ACTIVITIES in 2024

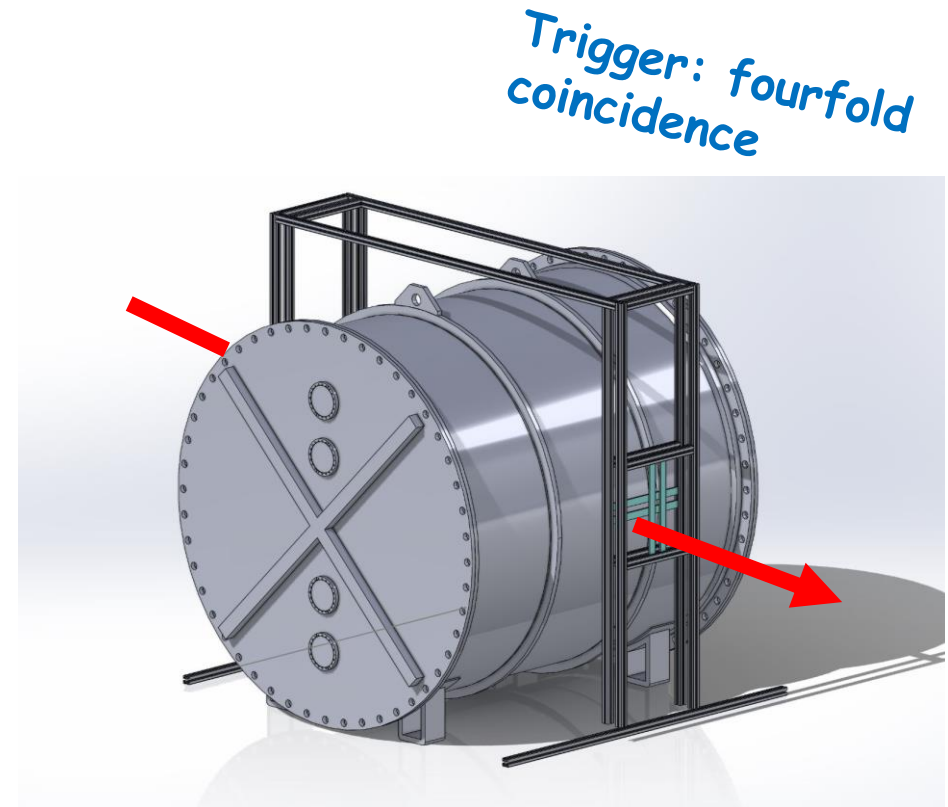
- SAND/ECAL** **Contribute to KLOE dismounting and PMT test at LNF**
- SAND/GRAIN** **Improve the reconstruction algorithms for simulated neutrino events**
Introduce the algorithms in the DUNE official software
Application of the method to real events in ARTIC and 1:1 prototype
- SAND/GRAIN** **Test and commissioning of the CRTs for ARTIC and 1:1 prototype**
- SAND** **Contribute to the implementation of reconstruction algorithms**
exploiting all informations from the different elements of SAND
(GRAIN, Tracker, ECAL)

CR Taggers for optical readout in LAr (GRAIN)

Two double planes made of plastic scintillator bars



ARTIC in Genoa



Prototype 1:1 in Legnaro

CR Taggers for optical readout in LAr (GRAIN)

Scintillator bars

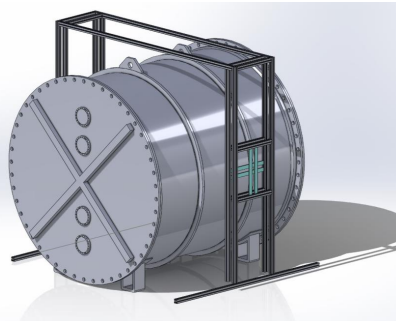
Saint Gobain BC-408
thickness 1 cm

Readout with SiPMs

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



TOP (8 bars x 4 cm + 8 bars x 2 cm) x 2 planes
 BOTTOM (4 bars x 4 cm + 8 bars x 2 cm) x 2 planes } **56 channels**



(8 bars x 4 cm + 8 bars x 2 cm) x 4 planes => **64 channels**

SiPM readout:

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





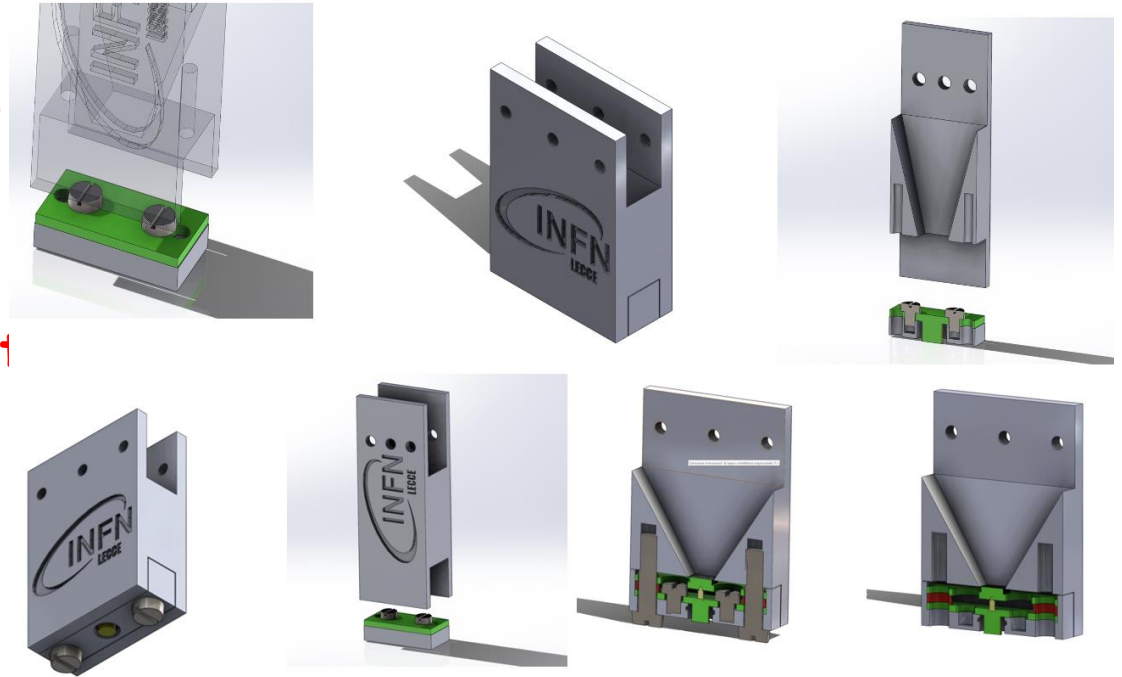
Verified: 1 SiPM / bar is enough

Test in progress

optimize the light collection
optimize the SiPM/bar coupling
checks on 6-m CAEN cables

To do

design of PCB for SiPM readout



APPARATI

Sistema di trigger e tracciamento (CRT) per ARTIC e per il prototipo a LNL:	
profilati REXROTH e lavorazioni meccaniche	10.0 KEuro
5 lastre (50 cm x 50 cm x 1cm) di scintillatore Saint Gobain BC-408	5.5 kEuro
produzione PCB per lettura dei SiPM	5.0 KEuro
130 cavi per connessione SiPM-scheda (sub-judice all'offerta)	20.0 kEuro

CONSUMO

Utensileria, resine per stampante 3D, materiale vario per la meccanica dei CRT 7.0 Keuro

MISSIONI

Meeting Generale di Collaborazione al CERN - 4 persone	6.0 KEuro
Meeting Generale di Collaborazione a FNAL - 2 persone	5.0 KEuro
Meeting Italiano - 4 persone	4.0 KEuro
Trasferte a Genova per installazione CRT di ARTIC	3.0 KEuro
Trasferte a Legnaro per installazione CRT sul prototipo	3.0 KEuro
Turni a LNF per smontaggio KLOE e test dei fototubi di ECAL	6.0 KEuro

INVENTARIO

- 2 schede CAEN DT5203 per lettura e alimentazione SiPM,
64 canali per prototipo a LNL e ARTIC a Genova 15.0 KEuro
- Stampante 3D SLA/resina per strumentazione barre scintillanti 3.0 KEuro
- Riga ottica della Micron SRL per setup del CRT in ARTIC 1.0 KEuro

PUBBLICAZIONI

- Prevista pubblicazione di due articoli sulle attività svolte per ECAL e GRAIN 2.0 KEuro

TRASPORTI

- Invio materiale a Frascati, Genova e Legnaro per ECAL e GRAIN 3.0 KEuro

Anagrafica

Alemanno Francesca	<u>Assegnista - Unisalento</u>	0.80
Bernardini Paolo	<u>Ordinario - Unisalento</u>	0.60
De Matteis Giovanni	<u>Assegnista - Unisalento</u>	0.70
Leaci Antonio	<u>Ordinario - Unisalento</u>	0.50
Martina Luigi	<u>Associato - Unisalento</u>	0.20
Miccoli Alessandro	<u>Tecnologo - INFN</u>	0.20
Montanino Daniele	<u>Associato - Unisalento</u>	0.30
Surdo Antonio	<u>Primo ricercatore - INFN</u>	0.50
TOTALE FTE		3.80

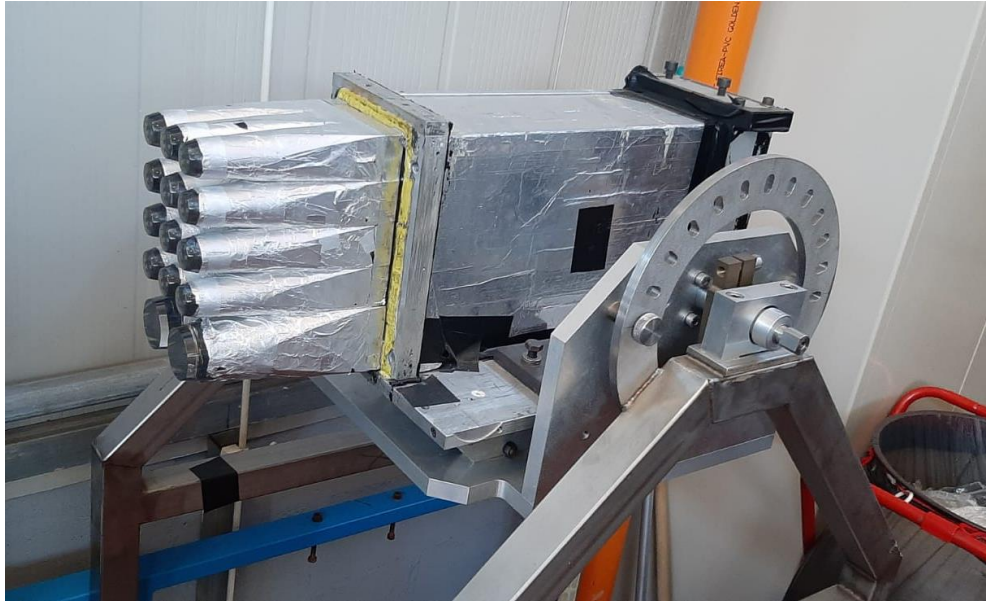
Ulteriori richieste

Officina meccanica e servizio CAD 4 mesi-uomo

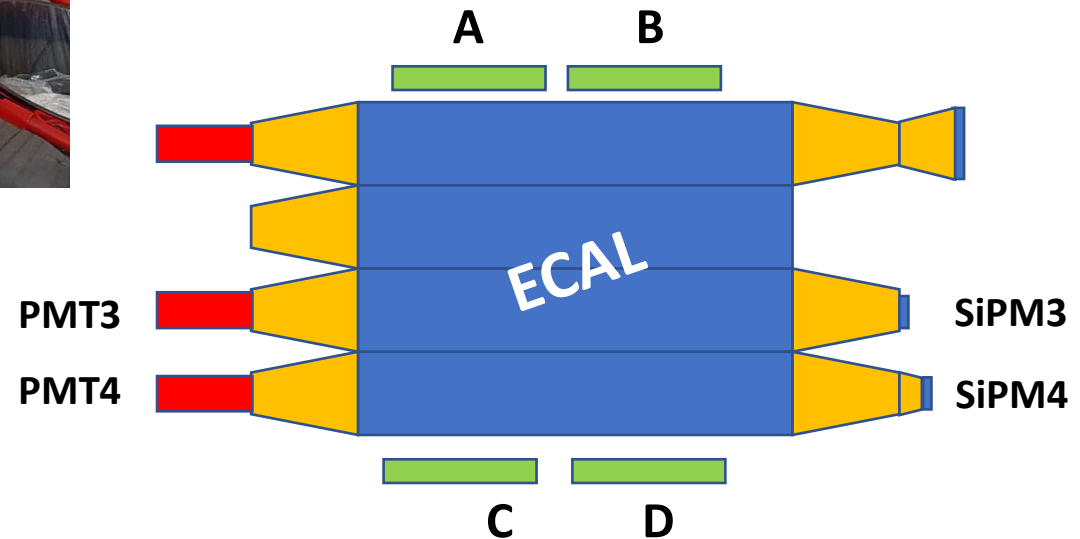
Laboratorio di elettronica 4 mesi-uomo

BACKUP

Efficiency measurement setup

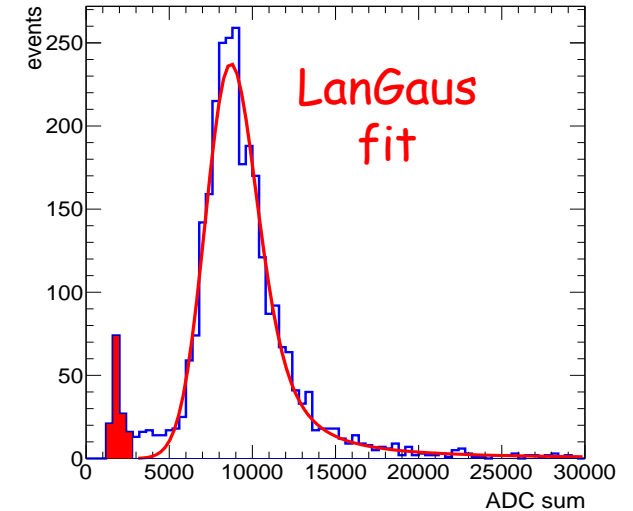
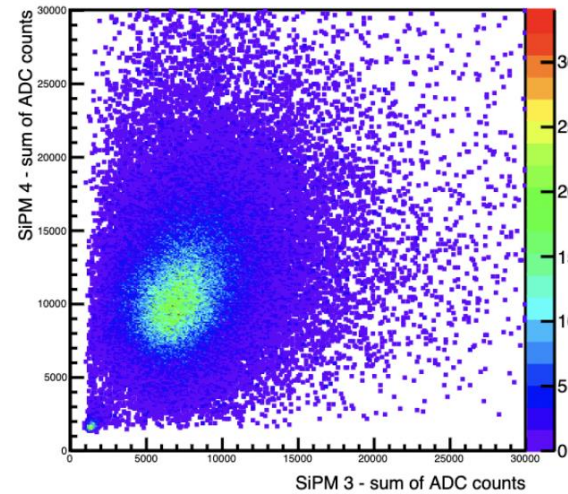
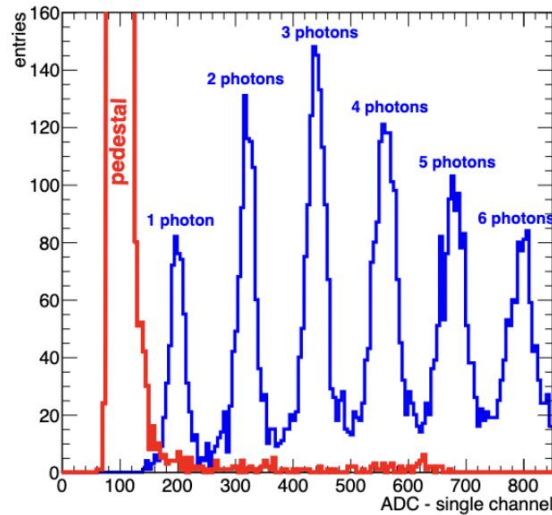


external trigger
(A OR B) AND (C OR D)
for cosmic rays



SiPM vs PMT - efficiency

the SiPM efficiency is reduced because of noise removal



$E_{PMT} (%)$

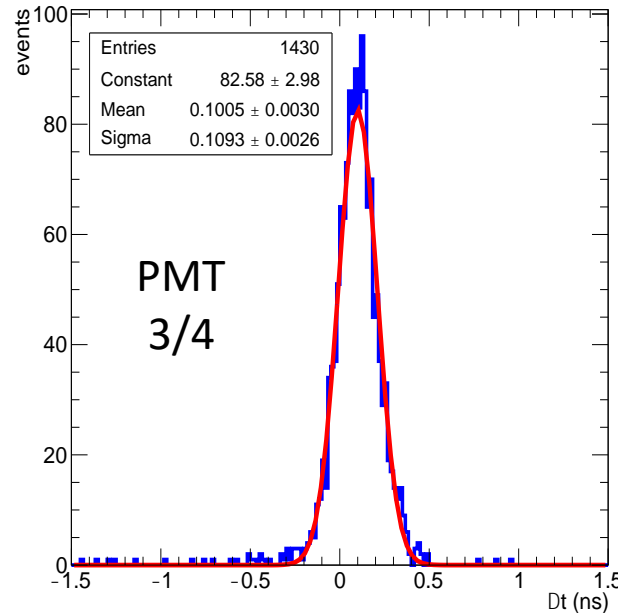
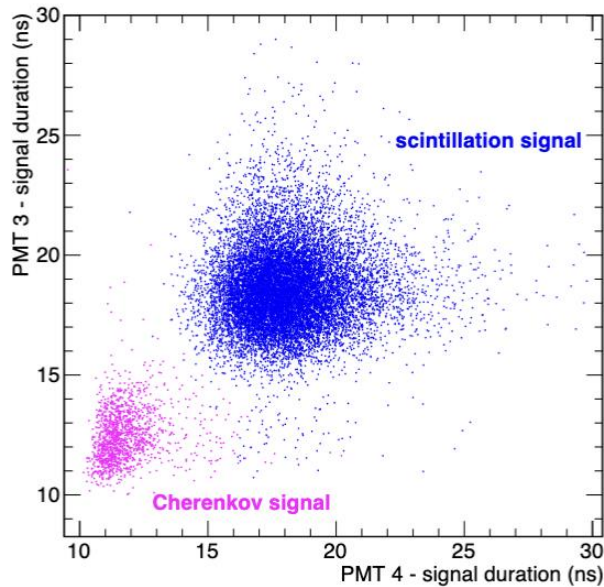
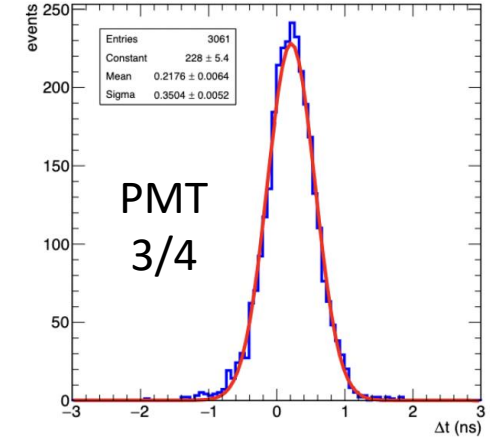
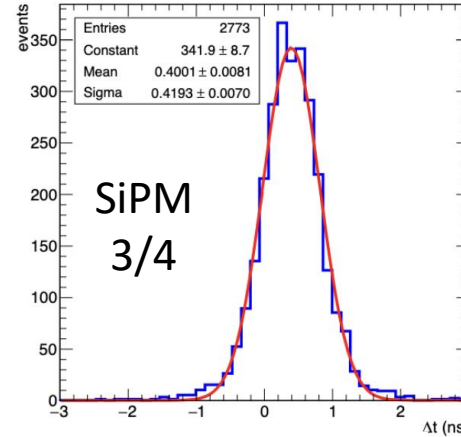
$E_{SiPM} (%)$

$92.06^{+0.14}_{-0.15}$

$90.82^{+0.22}_{-0.23}$

SiPM vs PMT - time resolution

	$\sigma_{\Delta t}$ (ns)	$\sigma_{single\ channel}$ (ns)
two channels of SiPM 3	0.372 ± 0.008	0.244 ± 0.006
two channels of SiPM 4	0.341 ± 0.008	0.220 ± 0.005
channels of SiPMs 3 and 4	0.419 ± 0.007	0.257 ± 0.005
PMT 3 and 4	0.350 ± 0.005	0.197 ± 0.004



Cherenkov light from Winston cones
 $\sigma_{\Delta t} = 109\text{ ps}$