

n_TOF italian collaboration meeting
29/05/2024

Status of the PSTIL
array

A. Musumarra



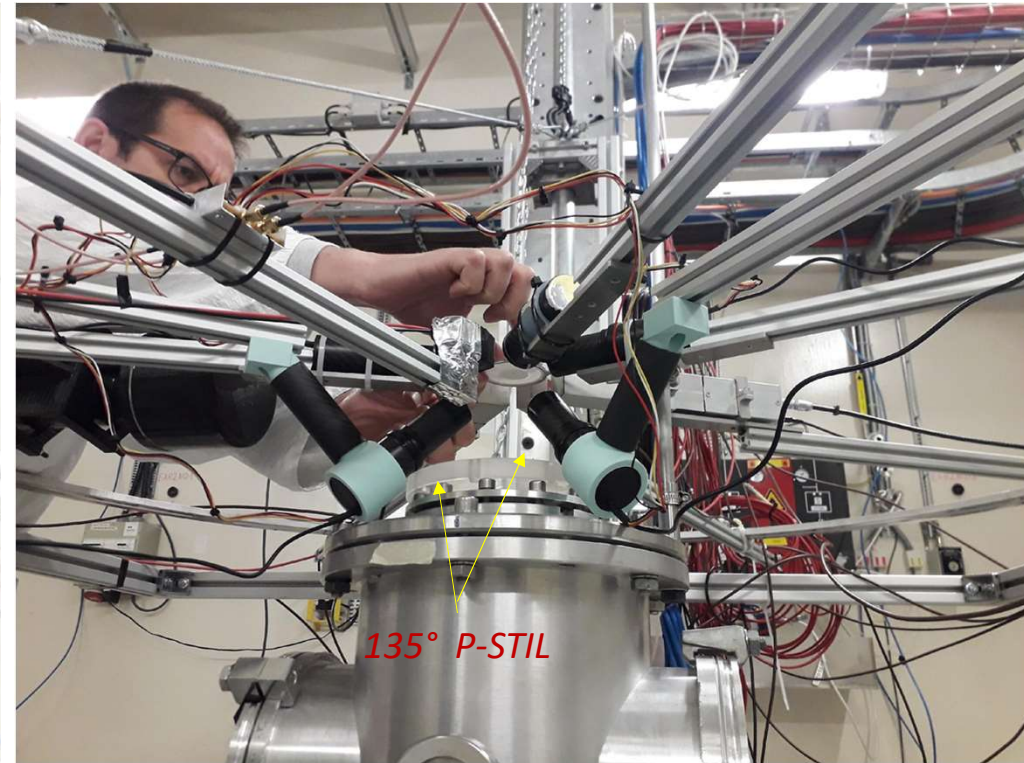
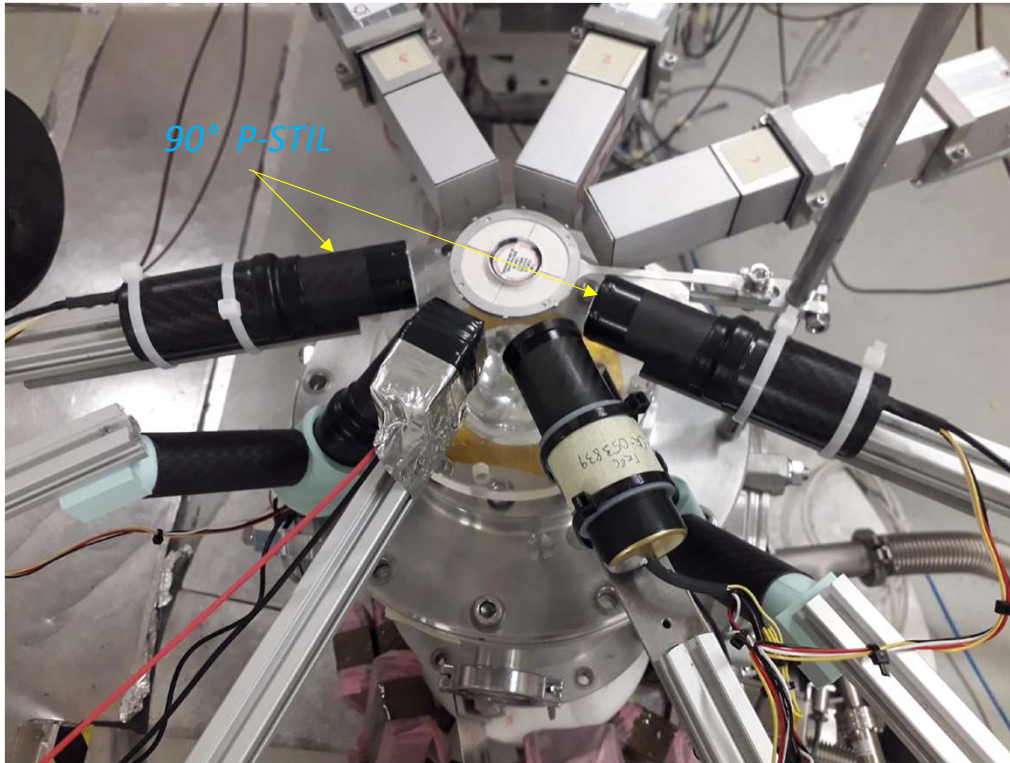
Università
di Catania



Outlook:

- News from analysis about Lol INTC-I-254(2023)
- New Lol INTC-I-274(2024)
- PSTIL characterization (PROTEUS-INRAD)
- Further developments

EAR2 May 2023 set-up



Excitation functions on ^{12}C @ EAR2(1-10 MeV)

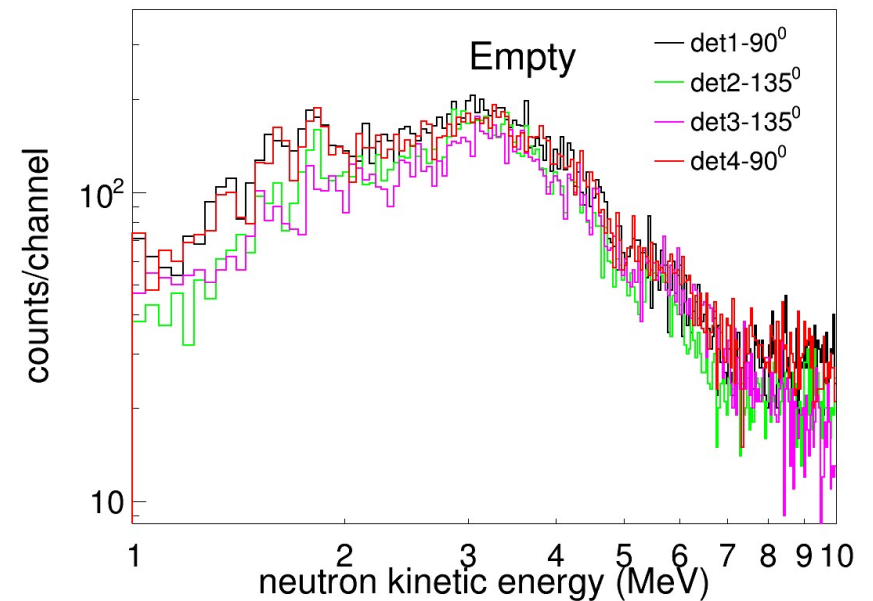
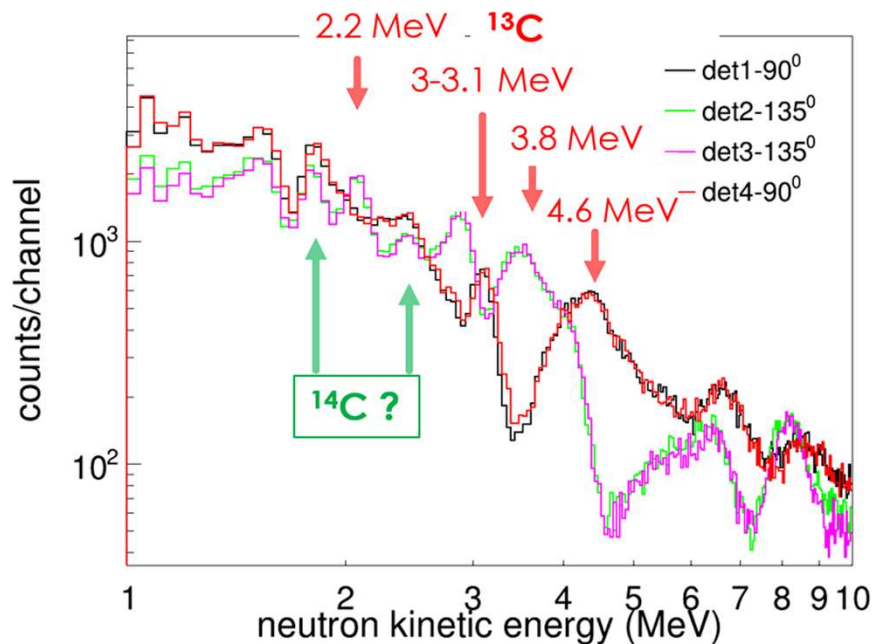
for $n+^{12}\text{C}$ and empty frame at two different laboratory angles, 90° and 135°

Analysis conditions:

Beam high intensity pulses

400 keV threshold to the deposited energy

PSD condition for neutron selection: $\text{amp}/\text{area} < 0.074^*$



By Rudra, Cristian and Maria Grazia

According to the detector angular position:

- Detector responses are in agreement with each other
- Different structures can be observed with the ^{12}C target
- The background (empty frame) is structureless

LoI for elastic and inelastic measurements EAR1@n_TOF – April 2024

Informazioni Discussioni (0) File

Scientific Committee Paper

Report number	CERN-INTC-2024-028 ; INTC-I-274
Title	Response of stilbene scintillator to (n,n) and (n,n') reaction channel in TOF experiments
Project	
Manager/Technical Coordinator	Pellegriti, Maria Grazia; Sahoo, Rudra Narayan
Author(s)	Castelluccio, DM (ENEA-Bologna and INFN-Bologna, Italy) ; Console Camprini, P (ENEA-Bologna and INFN-Bologna, Italy) ; Diakaki, M (National Technical University of Athens, Greece) ; Elme, Z (University of Ioannina, Greece) ; Massimi, C (University of Bologna and INFN-Bologna, Italy) ; Mosti, Marco, M (University of Bari and INFN-Bari, Italy) ; Mucciola, R (INFN-Bari, Italy) ; Musumarra, A (University of Catania and INFN-Catania, Italy) ; Patronis, N (University of Ioannina, Greece) ; Pellegriti, MG (INFN-Catania, Italy) <i>Visualizza tutti i 11 autori</i>
Corporate author(s)	CERN. Geneva. ISOLDE and neutron Time-of-Flight Experiments Committee ; INTC
Series	(Letter of Intent)
Note	Requested protons: $6 \cdot 10^{17}$ protons on target
Submitted by	maria.grazia.pellegriti@cern.ch on 08 Apr 2024
Subject category	Detectors and Experimental Techniques

Email contact(s) : mariagrazia.pellegriti@cern.ch ; RudraNarayan.Sahoo@bo.infn.it ; Oliver.Aberle@cern.ch

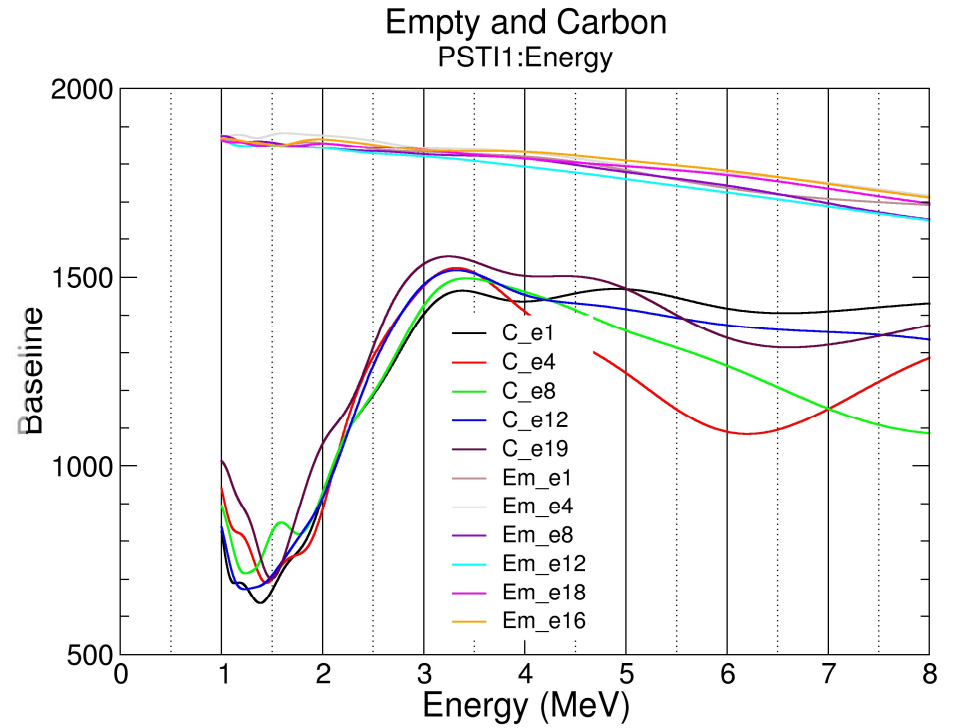
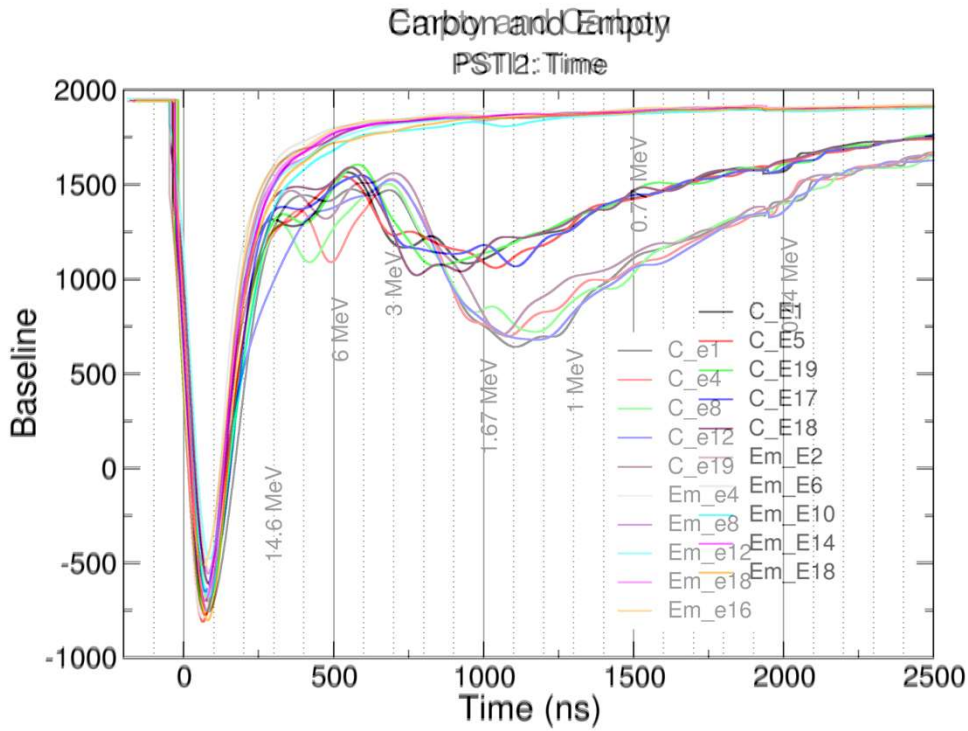
Approved on 23/05/2024 by INTC@CERN
need for an eight detectors cluster

Record creato 2024-04-08, modificato l'ultima volta il 2024-04-08

[Back to search](#)

[Record simili](#)

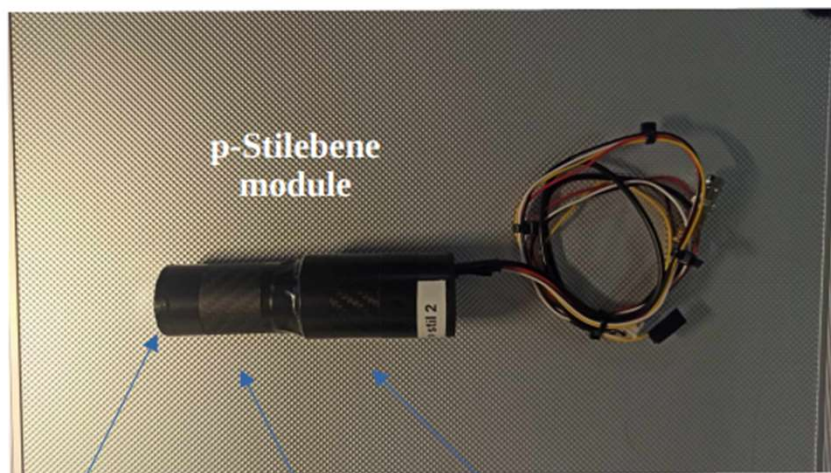
PSTIL-1 baseline



By Rudra and Cristian

We infer that the large headroom of the PM (600-1000 V) allows to maintain linearity

New stilbene crystals from PROTEUS: first tests October 2023



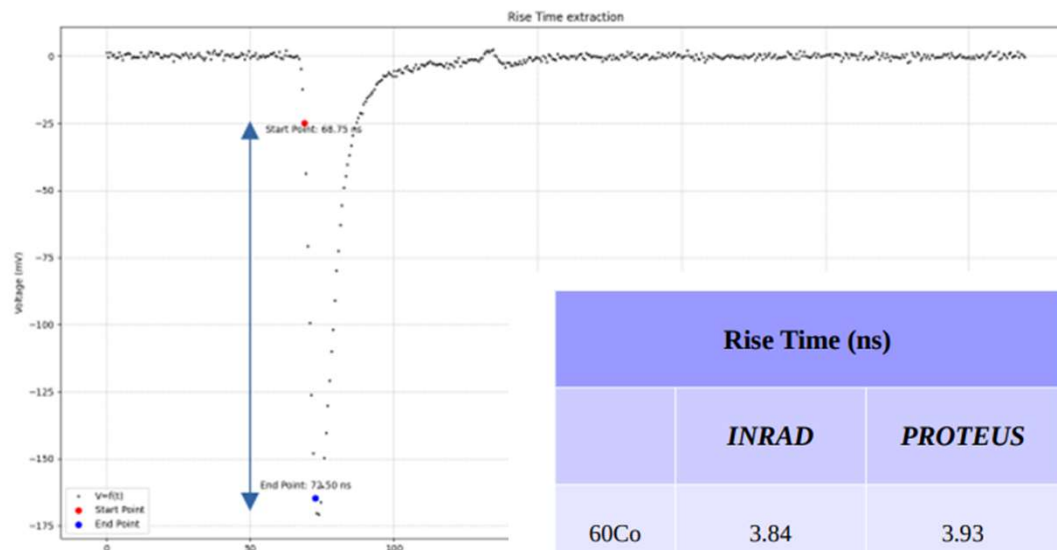
p-Stilbene module

Al window

Stilbene crystal

PMT

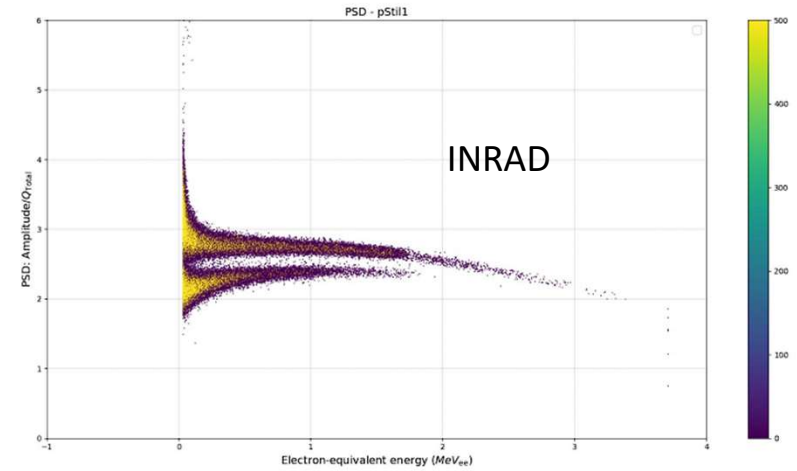
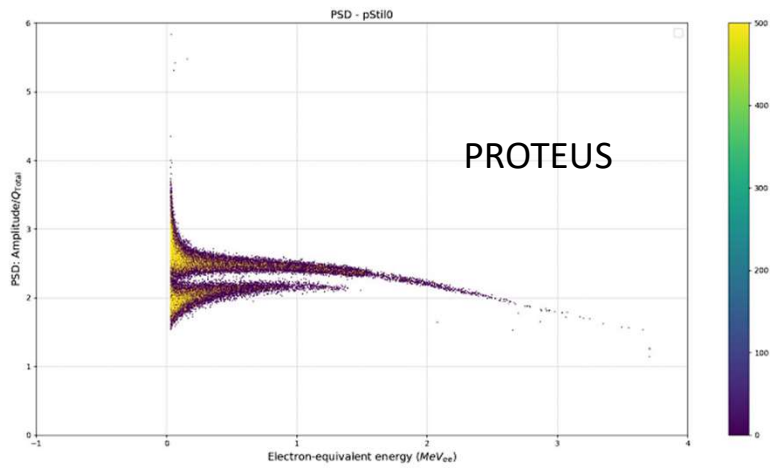
1" x 1" cylindrical **INRAD** p-stilbene detector
 1" x 1" cylindrical **PROTEUS** p-stilbene detector
 Carbon fiber housing
 Aluminium cover in the front window



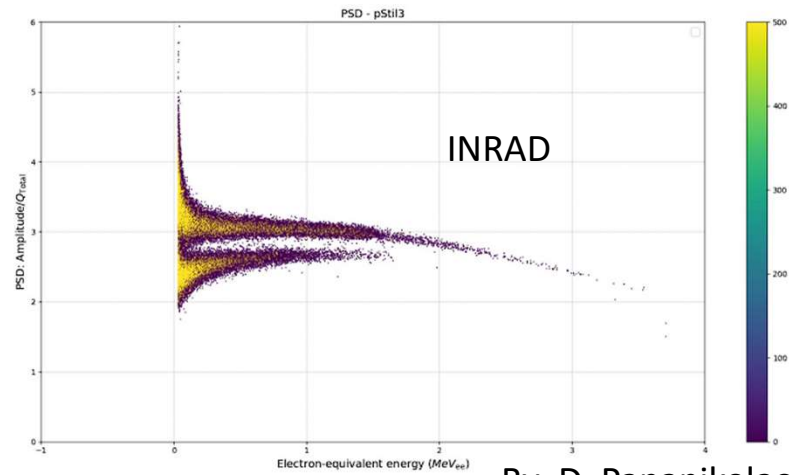
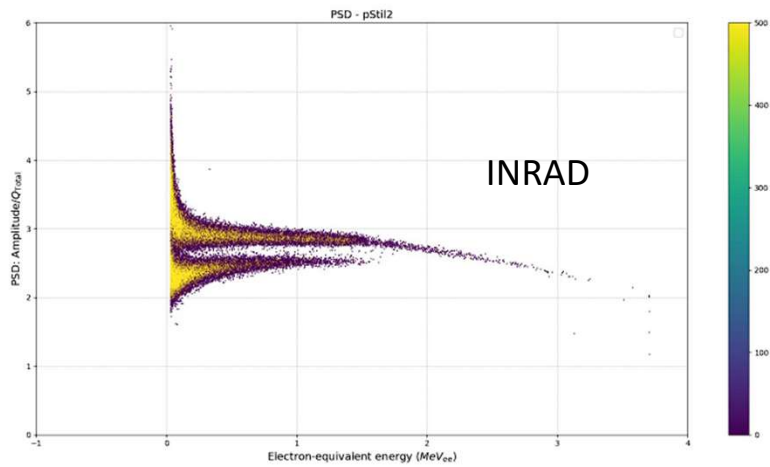
	Rise Time (ns)	
	INRAD	PROTEUS
60Co	3.84	3.93
137Cs	3.87	3.96
Average	3.85	3.94

by Dimitris Papanikolaou

Pulse Shape Discrimination by *Am-Be* n - γ source (600 V HV)

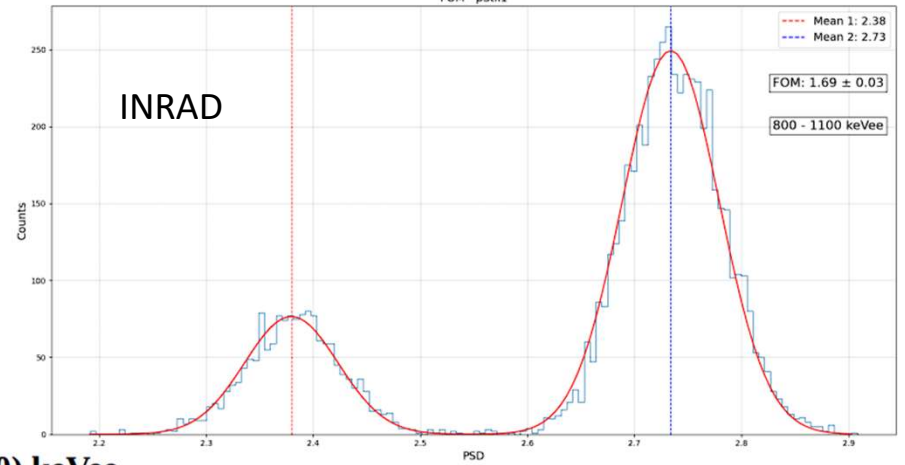
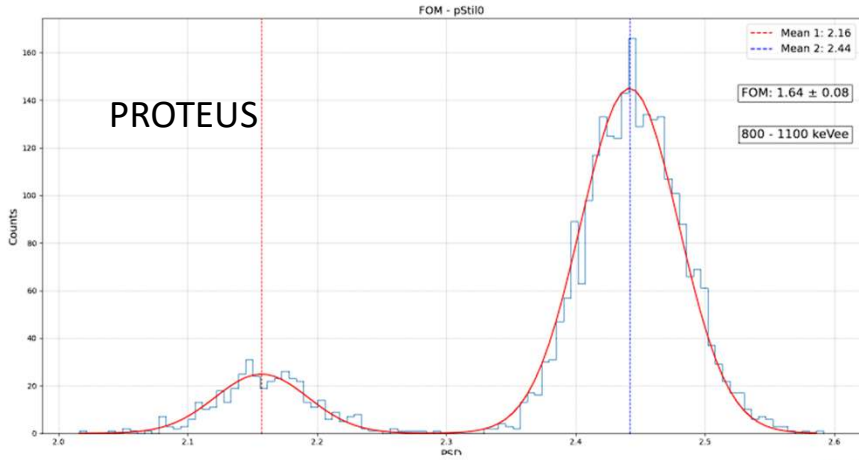
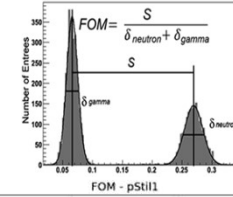


**20 mV
threshold**

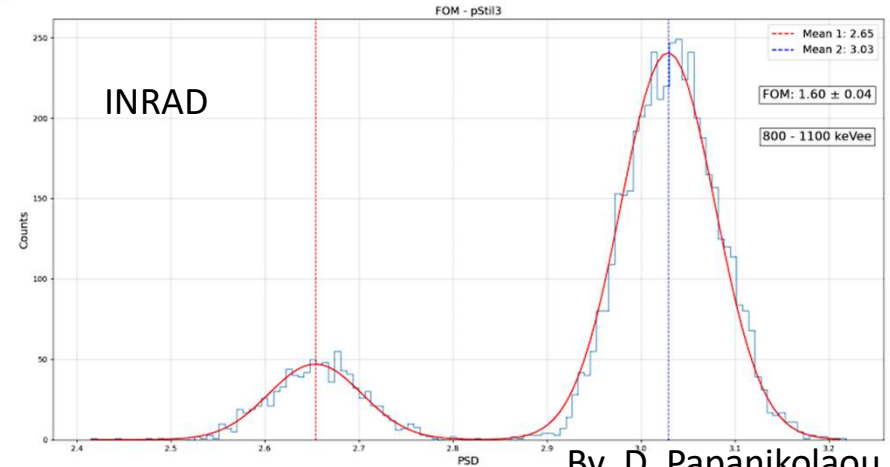
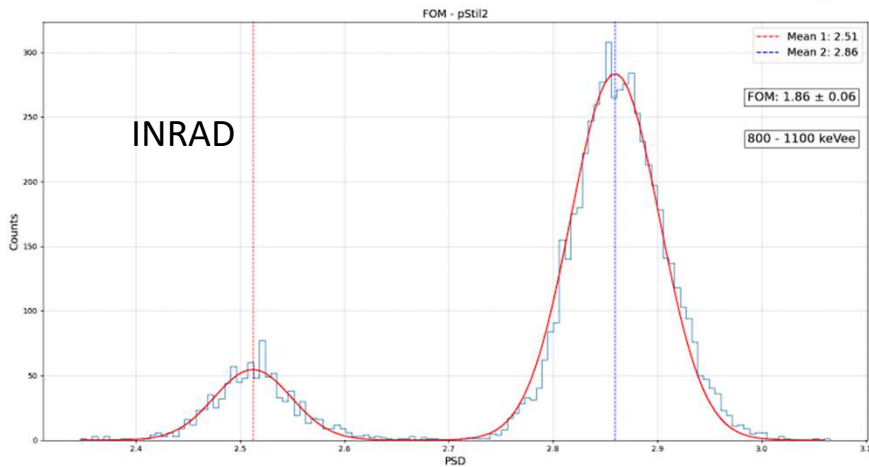


By D. Papanikolaou

PSD ($Pulse\ Height/Q_{tot}$) – FOM

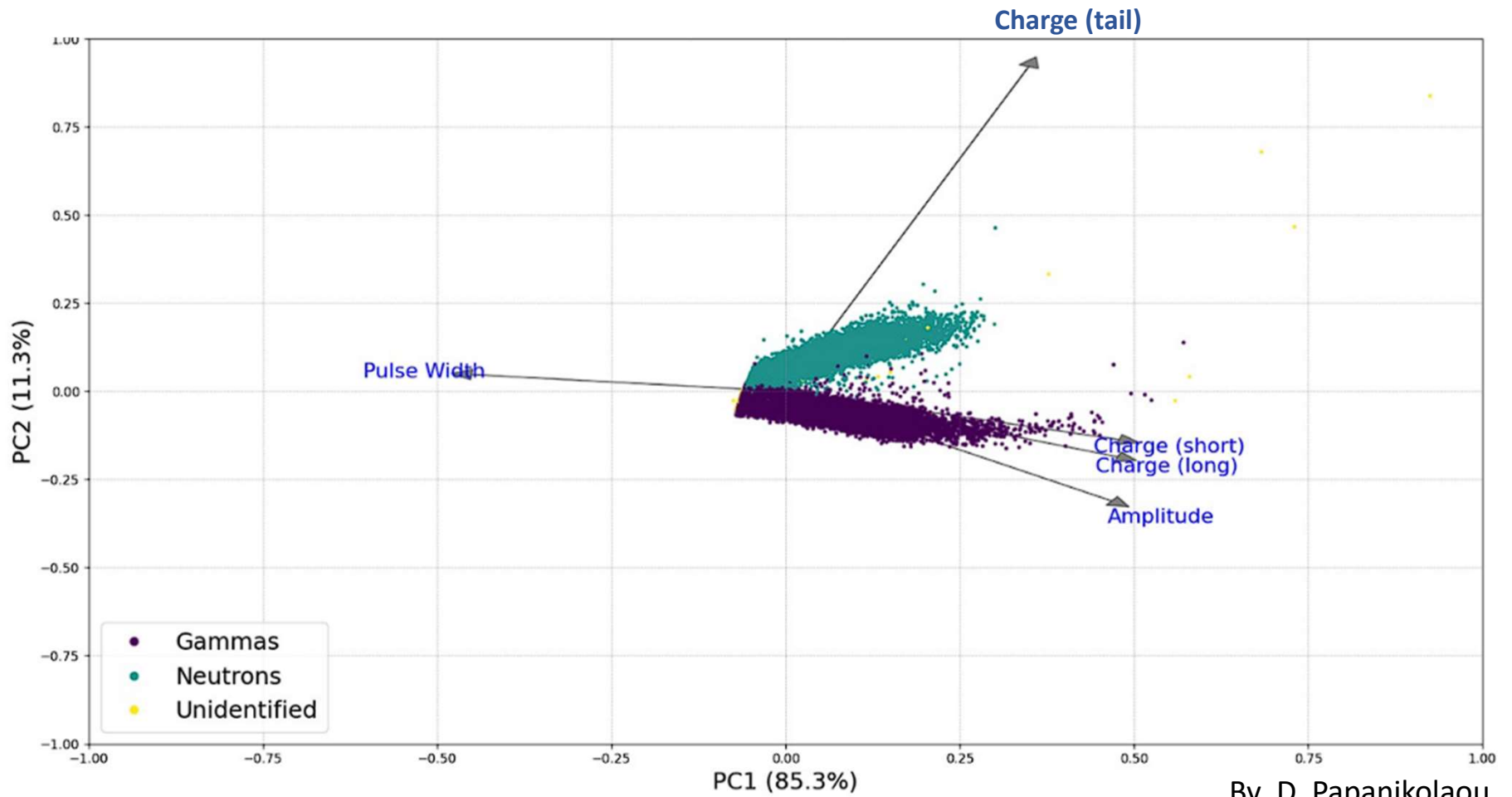


(800 – 1100) keVee



By D. Papanikolaou

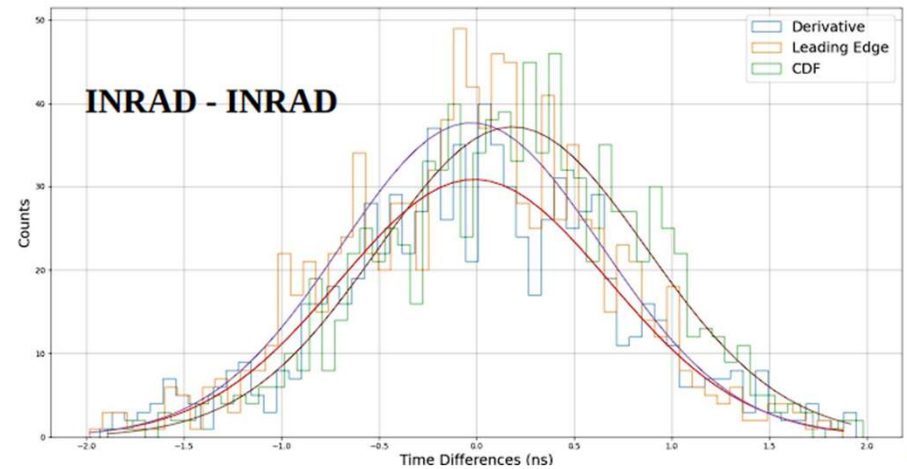
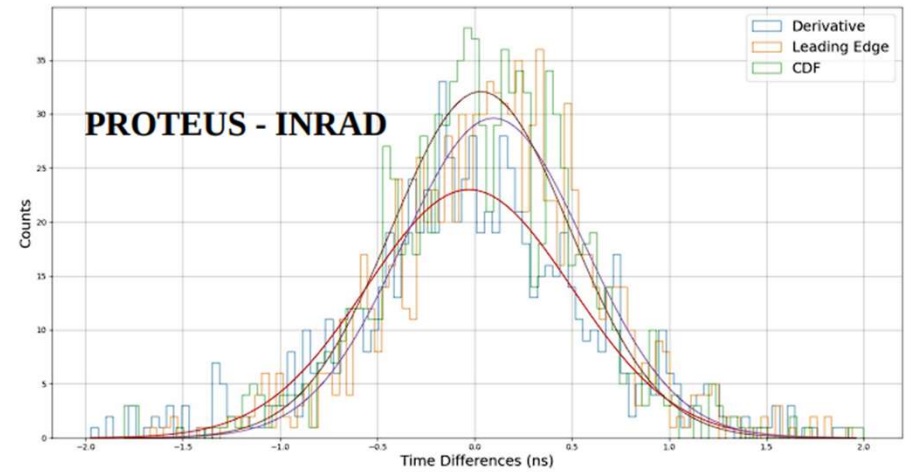
Principal Component Analysis (PCA) by five signal parameters



Time resolution by 60-Co γ - γ coincidence (*preliminary*)

Time Resolution (ns)		
	PROTEUS - INRAD	INRAD - INRAD
Derivative	0.88 ± 0.03	1.15 ± 0.05
Leading Edge	0.78 ± 0.03	1.12 ± 0.05
CDF	0.76 ± 0.03	1.15 ± 0.04

By D. Papanikolaou



Fast counting in EAR 2
needs some new
development....

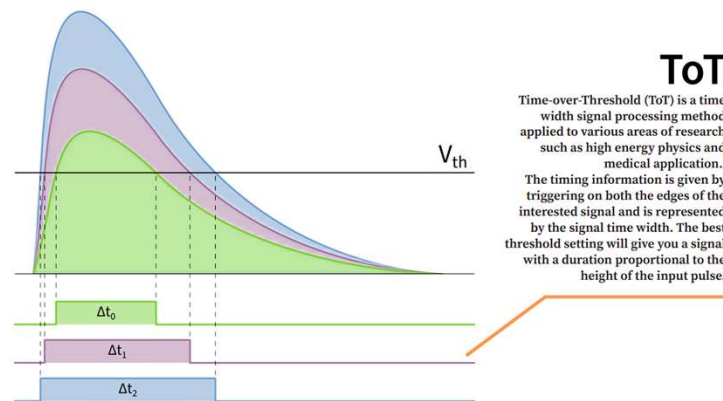
FELIX



2+1 channels

16 channels module in progress

New ultrafast DAQ by ToT SPIN-OFF of POLIMI

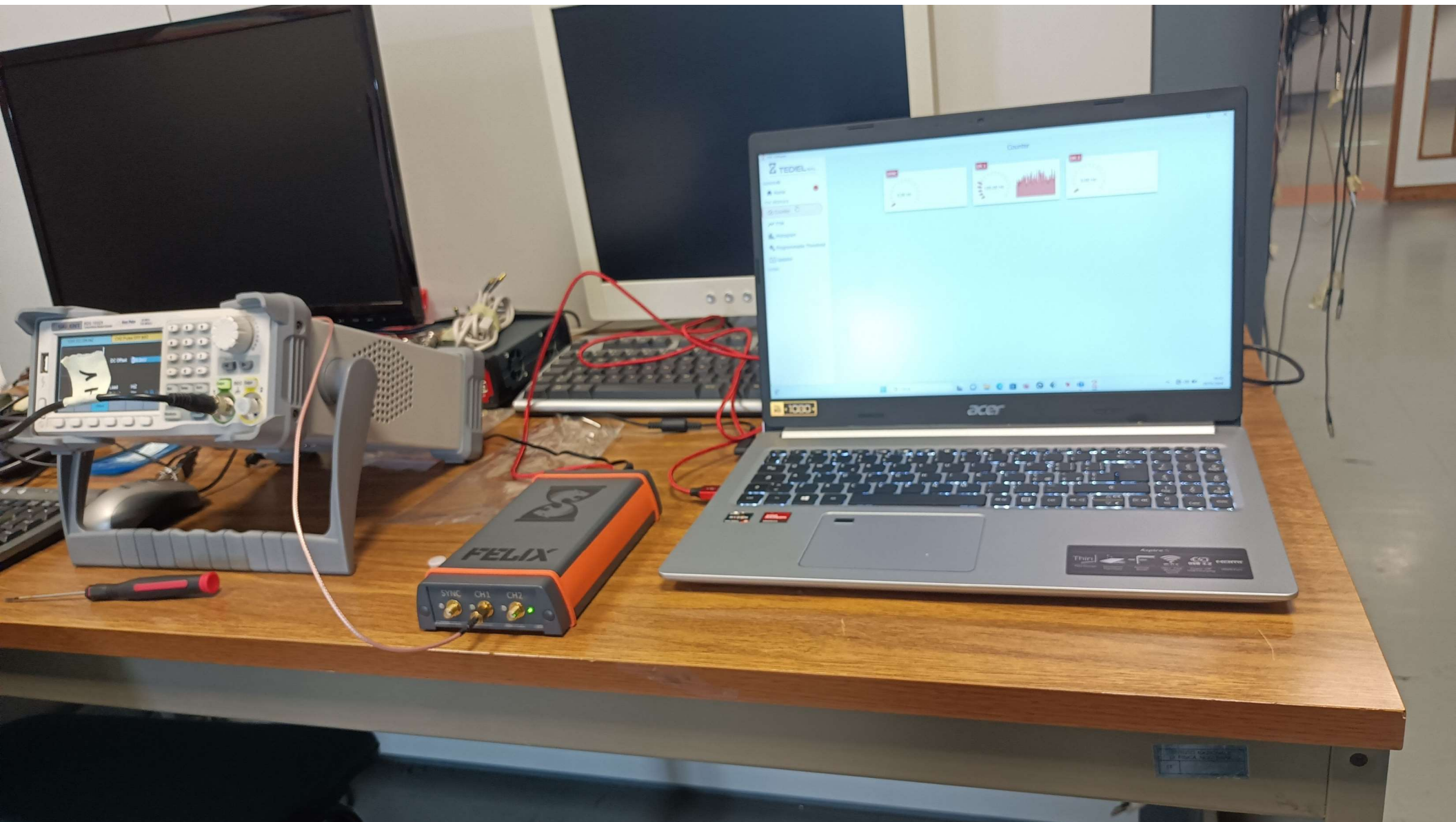


ToT

Time-over-Threshold (ToT) is a time width signal processing method applied to various areas of research such as high energy physics and medical application. The timing information is given by triggering on both the edges of the interested signal and is represented by the signal time width. The best threshold setting will give you a signal with a duration proportional to the height of the input pulse.

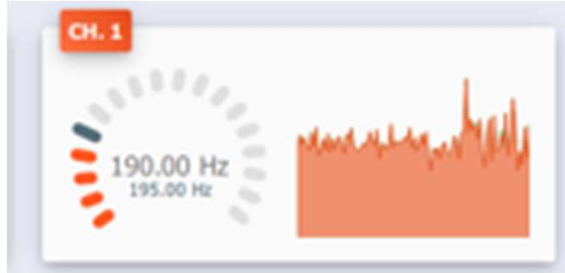
EDU VERSION

Single-Shot Channel Precision	12 ps r.m.s.	< 1 ns r.m.s.	Input Channels	2 + SYNC
Resolution (LSB)	36.6 fs	600 ps	Input Impedance	50 Ω
Dead-Time	12 ns	100 ns	Input Voltage Level	0 V - 3.3 V
Global Measurement Rate	140 Msps	20 Msps	Programmable Threshold Level	0 V - 2.5 V
Channel Measurement Rate	80 Msps	10 Msps	Minimum Pulse Width	1.4 ns
Maximum Sync Frequency	150 MHz		Power Supply	5 V
Absolute INL	< 19 ps		Connector Type	USB-C
Absolute DNL	< 0.8 ps		Size (L x W x H) [mm]	188 X 102 X 37



ToT by ^{137}Cs gamma source

PSTIL-1 (INRAD-STILBENE)



TDC-Software

TEDIEL S.R.L.

GENERAL

- Home
- TDC MODULE
 - Counter
 - TTM
 - Histogram
 - Programmable Threshold

SYNC

Selected 0.00 Hz

1.250 V

CH. 1

Selected 150.00 Hz

0.015 V



- GENERAL
- Home
- TDC MODULE
 - Counter
 - TTM
 - Histogram**
 - Programmable Threshold
 - Updater
- VIEWs

Histogram

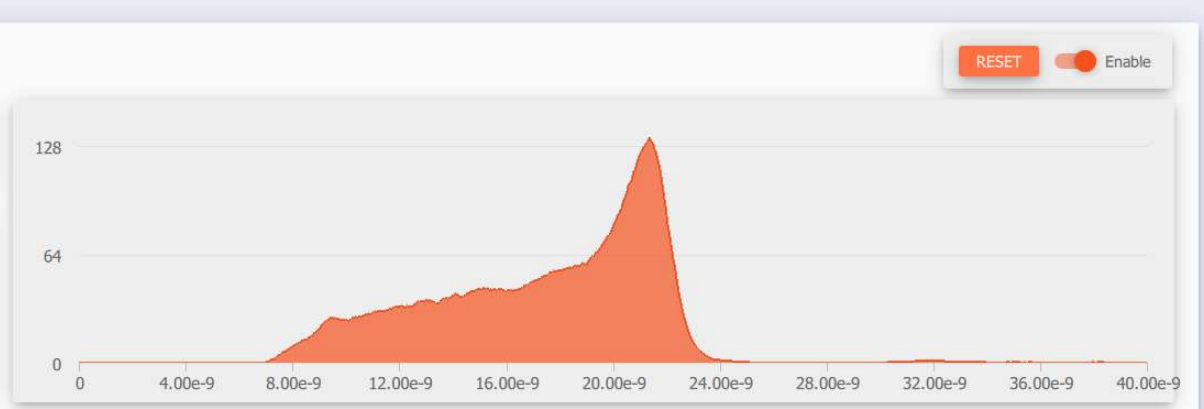
Histogram 0
CH1 F - CH1 R
FSR MAX: 644 ms | NUM BIN: 2^{13}

Histogram 1
CH1 R - SYNC R
FSR MAX: 644 ms | NUM BIN: 2^{13}

Histogram 0

Channel Selector
MeasCH: CH1 F | RefCH: CH1 R

Histogram Configuration
LEFT BOUND: 0 fs | RIGHT BOUND: 40.03 ns
BIN WIDTH: 18.75 ps | REFRESH T: 50.00 ms
MULTI HIT: ACCUMULATE:

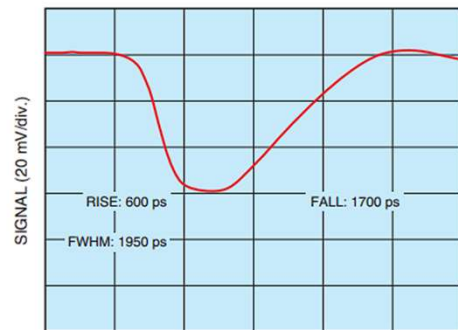


Photomultiplier already at INFN-CT scintillator



H14601-200

■ H14600-100



TIME (1 ns/div.)

Parameter		H14600 / H14601 series				Unit		
Suffix		-100, -103	-200	-01, -04	-20	—		
Input voltage		+4.5 to +5.5				V		
Max. input voltage		5.5				V		
Max. input current *1		3.5				mA		
Max. average output signal current *2		100				μA		
Max. control voltage		+1.0 (Input impedance 1 MΩ)				V		
Recommended control voltage adjustment range		+0.5 to +1.0 (Input impedance 1 MΩ)				V		
Effective area		φ8				mm		
Peak sensitivity wavelength		400	400	400	630	nm		
Cathode	Luminous sensitivity	Min.	80	100	100	350	μA/lm	
		Typ.	105	135	200	500		
	Blue sensitivity index (Blue filter)	Typ.	13.5	15.5	—	—	—	
	Red/White ratio	Typ.	—	—	0.25	0.45	—	
Radiant sensitivity *3		Typ.	110	130	77	78	mA/W	
Anode	Luminous sensitivity *2	Min.	30	40	40	140	A/lm	
		Typ.	105	135	200	500		
	Radiant sensitivity *2*3		Typ.	1.1×10^5	1.3×10^5	7.7×10^4	7.8×10^4	A/W
	Dark current *2*4		Typ.	0.5	0.5	1	10	nA
Max.			5	5	10	100		
Rise time *2		Typ.	0.6			ns		
Ripple noise *2*5 (peak to peak)		Max.	0.2			mV		
Settling time *6		Max.	10			s		
Operating ambient temperature *7		+5 to +50				°C		
Storage temperature *7		-20 to +50				°C		
Weight		32 (H14600 series), 40 (H14601 series)				g		

Noise situation in EAR 1 was extensively investigated by Simone and Nino, a further approach....

EAR1 noise problem:

- We have to face the noise situation in EAR1
- Considering our experience at PALS (Prague)
- P-STIL is inherently a low power device (less than 1 watt/module)

We propose to test a self-powered option (full decoupling from the line):

High power Li-bank (1600-2016 Wh)

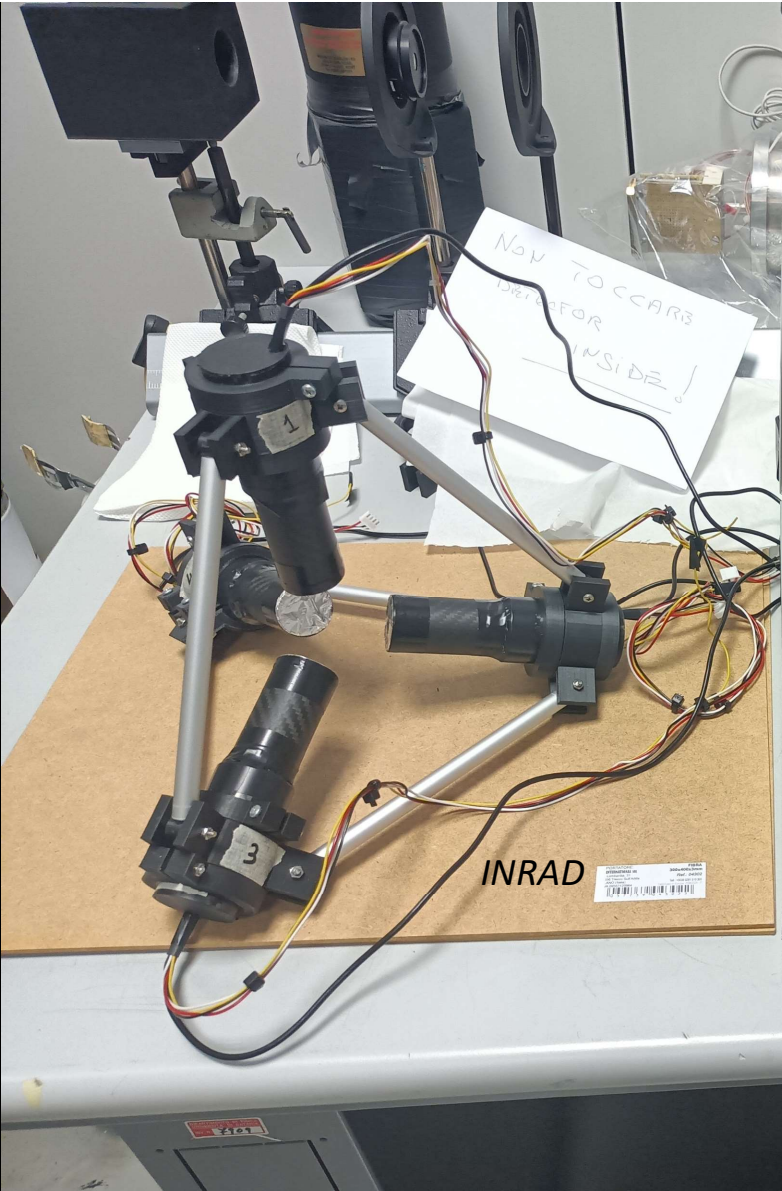
The system has been tested by 60-Co
 γ - γ coincidences (four detector setup)
at INFN-CT

1 week autonomy before recharging

To be tested in EAR1







Now TO CCAR3
FOR INSIDE!

INRAD



PROTEUS

Conclusions and perspectives

- A new array of Stilbene detectors has been characterized at CERN and INFN-CT
- The results look promising, facing the new demanding application before and after LS3@CERN
- The new setup shows very good performances for n -capture reactions
- Implementing n - γ discrimination makes the array suitable also for measuring n - n and n - γ coincidences.
- A new d-Stilbene array by LLNL is in progress (Spanish collaborators)