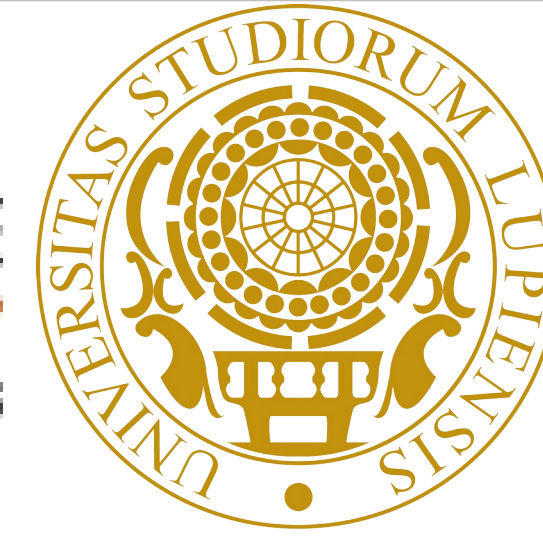


A tile prototype of the Plastic Scintillator Detector for HERD based on long Printed Circuit Board: design and test with ion beams at CNAO

M. Rossella (INFN Pavia) paolo.cattaneo@pv.infn.it on behalf of HERD collaboration

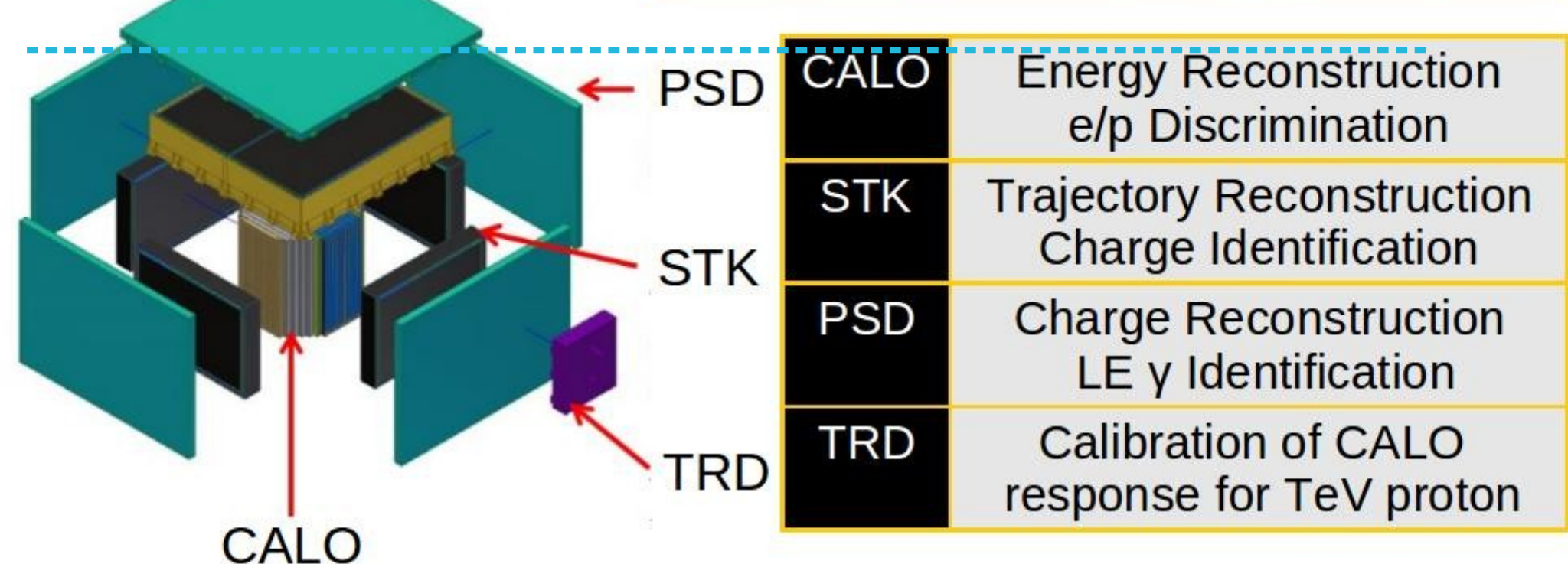
Bari, LNGS, Lecce, Pavia



HERD detector and requirements

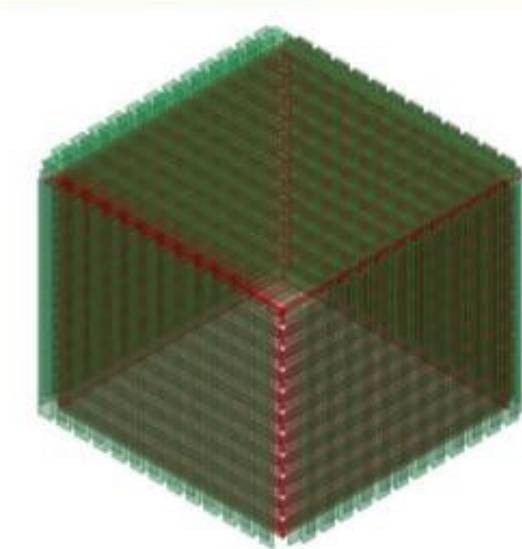
$\sigma_\theta(\gamma)$	0.1° @ 10 GeV		
Z	1 - 26		
σ_z	0.1 - 0.15 e		
e/p	10 ⁶		
		e	p, nuclei
Energy Range		10 GeV - 100 TeV	30 GeV - 3 PeV
Energy resolution		1% @ 200 GeV	20% @ 100 GeV - 1 PeV
Effective area		> 3 m ² sr @ 200 GeV	> 2 m ² sr @ 100 TeV

HERD will be located on the FCC.



HERD Plastic Scintillator Detector (PSD)

Bars or Tiles readout by SiPM



SiPM

- Plastic scintillator bar: 160cm x 3cm x 1cm
- Plastic scintillator tile: 10(5)cm x 10(5)cm x 1cm

PSD Layers

- 1 Top XY
- 4 Lateral XY
- 1 Bottom X

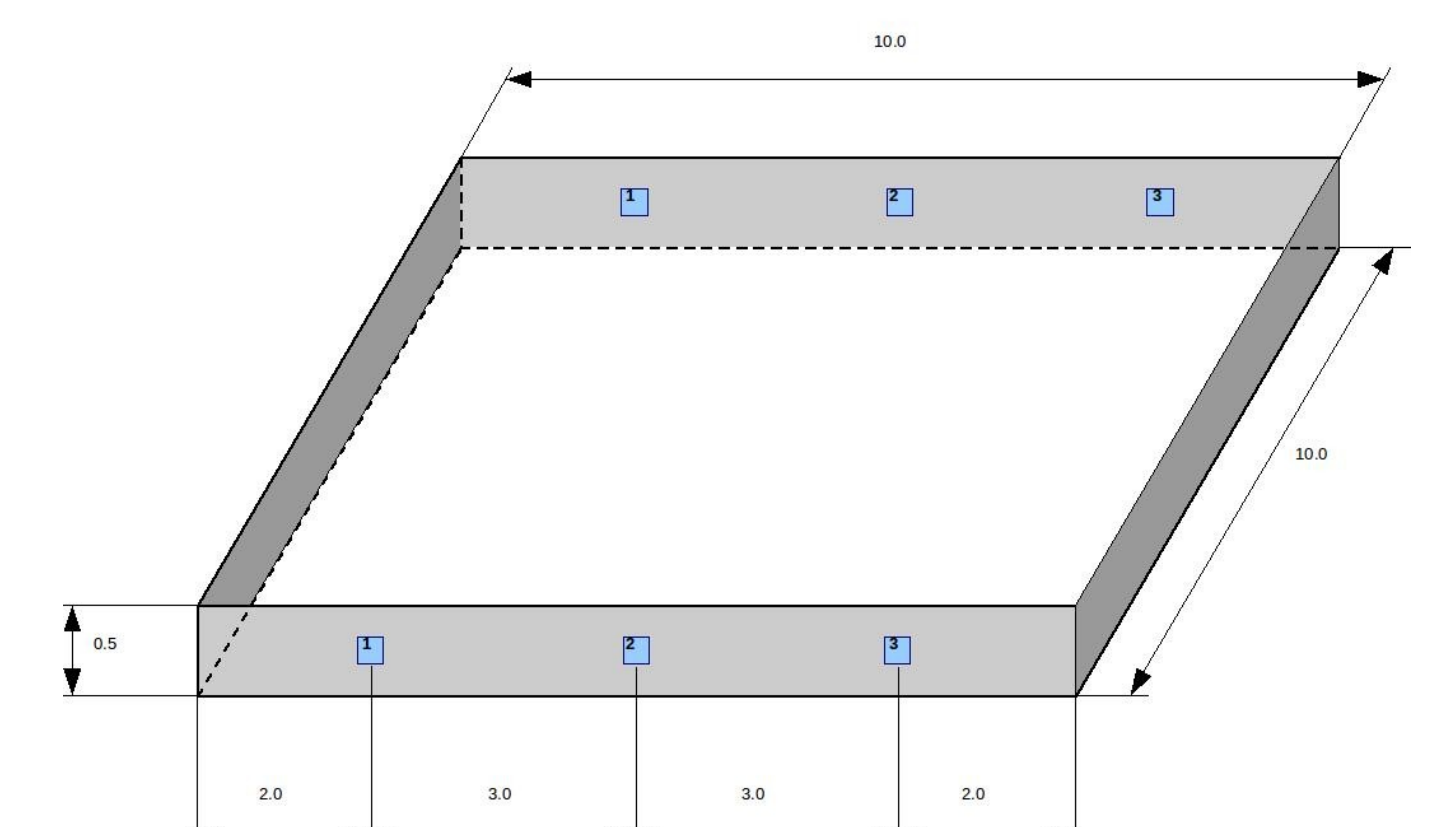
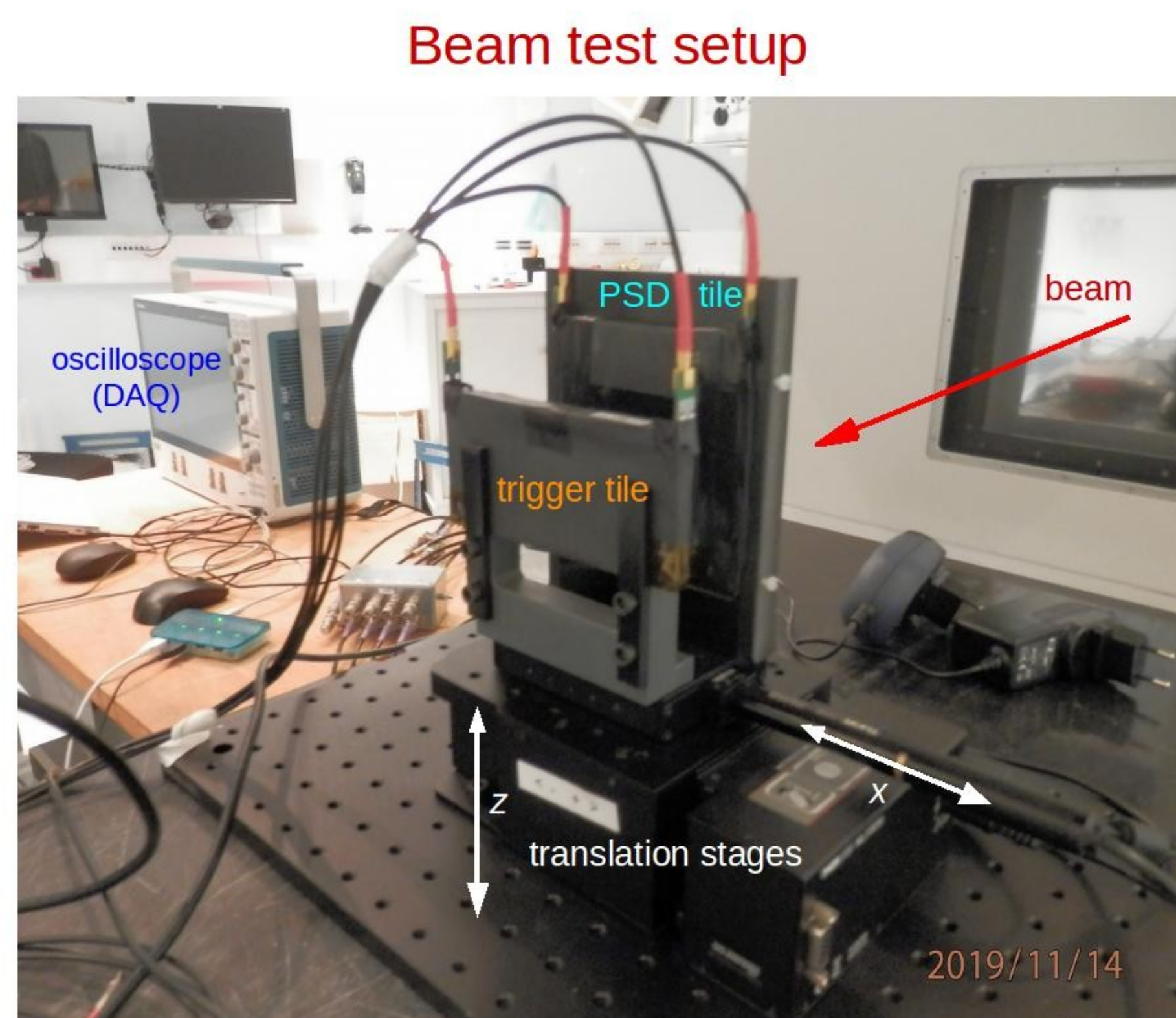
	Advantages
Bars	Lower number of readout channels Simpler mechanics
Tiles	Better id of backscattered particles More powerful trigger

The correct identification of backscattered particles is crucial to avoid:

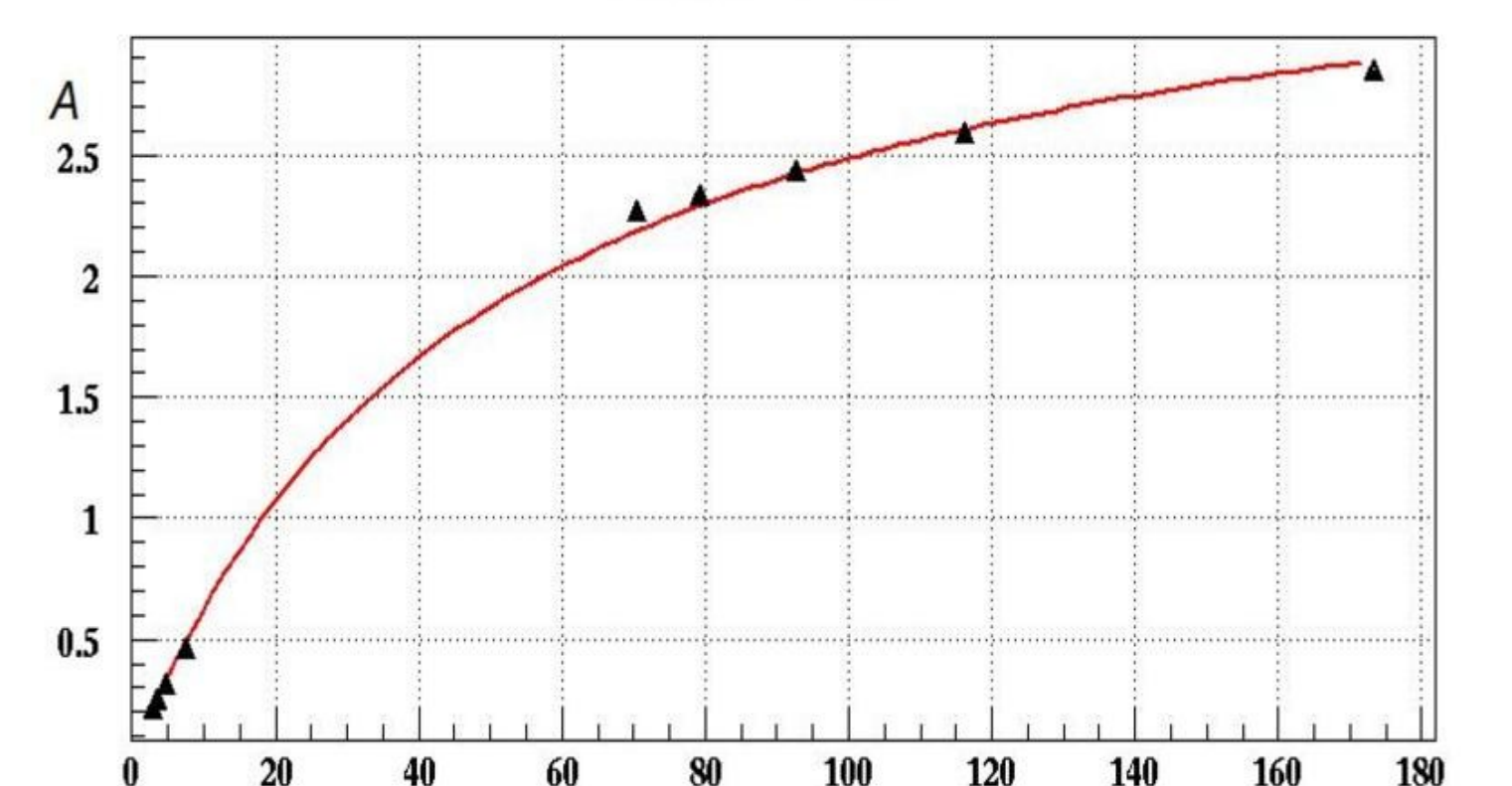
- charge misreconstruction in case of incident charged particles
- self veto in case of incident γ

Beam Test 2019-2020

Test scintillator tile read out by 3+3 Hamamatsu S12572 SiPM (3x3 mm²)



Birks' law



The correlation between the signal amplitude and the dE/dx (Z^2/β^2) is well fitted with a Birks' law

$$A = P_1 \frac{dE/dx}{1 + P_2 dE/dx}$$

$P_1 = 0.0756$
 $P_2 = 0.0204$

Beam Test 2021 The 50 cm long PCB

The PCB 50 cm long PCB read by 5 SiPM 3x3 mm² and 4 1.3x1.3 mm².

Beam test of tile prototype

CNAO provides low energy ion beams (p,C)



Centro nazionale adroterapia oncologica

The synchrotron

