



The HERD activities in Lecce

G. Marsella on behalf of Lecce group

Roma, July 1, 2019

HERD-DMP: Attività Lecce

2019:

Studio segmentazione PSD per ottimizzare la lettura con SiPM e garantire range dinamico per identificazione Z da 1 a 26

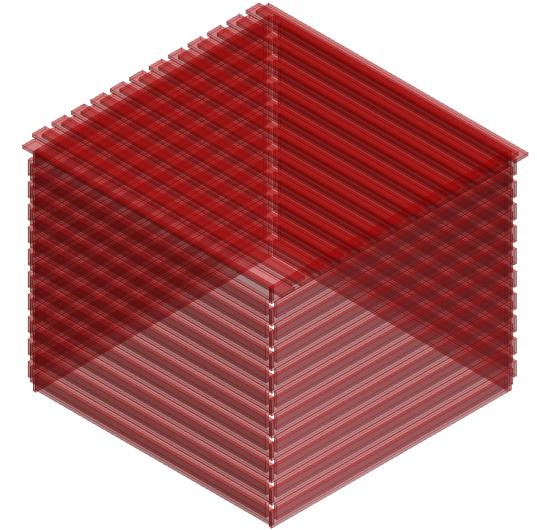
- Studio MC per ottimizzazione geometria e rivelatore
- Allestimento stazione di test per lettura SiPM
- Studio range dinamico di varie configurazioni
- Studio sistema unico per lettura digitale dei vari rivelatori

Trigger
DAQ

Richieste servizio elettronica : 30% tecnologo
6 mesi uomo

The HERD PSD plastic scintillator detector

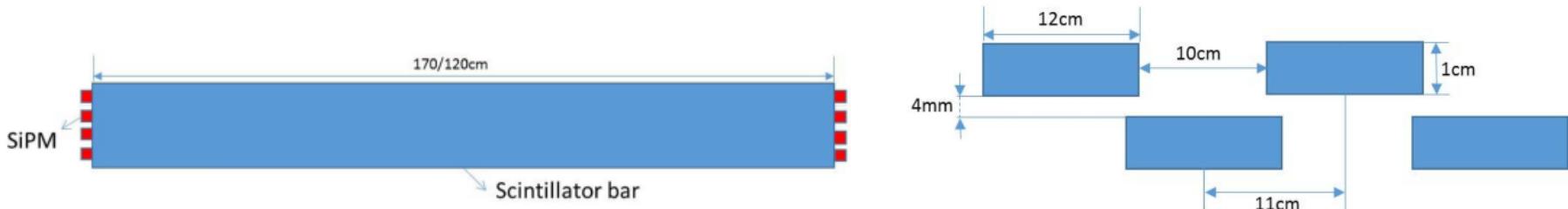
- Low energy gamma identification
- CR identification by Charge Measurement
- Design
 - 1 X/Y layer on top and 4 lateral sides
 - X layer for LE photon trigger
 - X & Y layers for Z measurement and e/ gamma discrimination
 - 1 X layer on bottom side
 - SiPM + IDE3380 ASIC
 - Low & high range to cover Z=1-26
 - Redundancy SiPMs



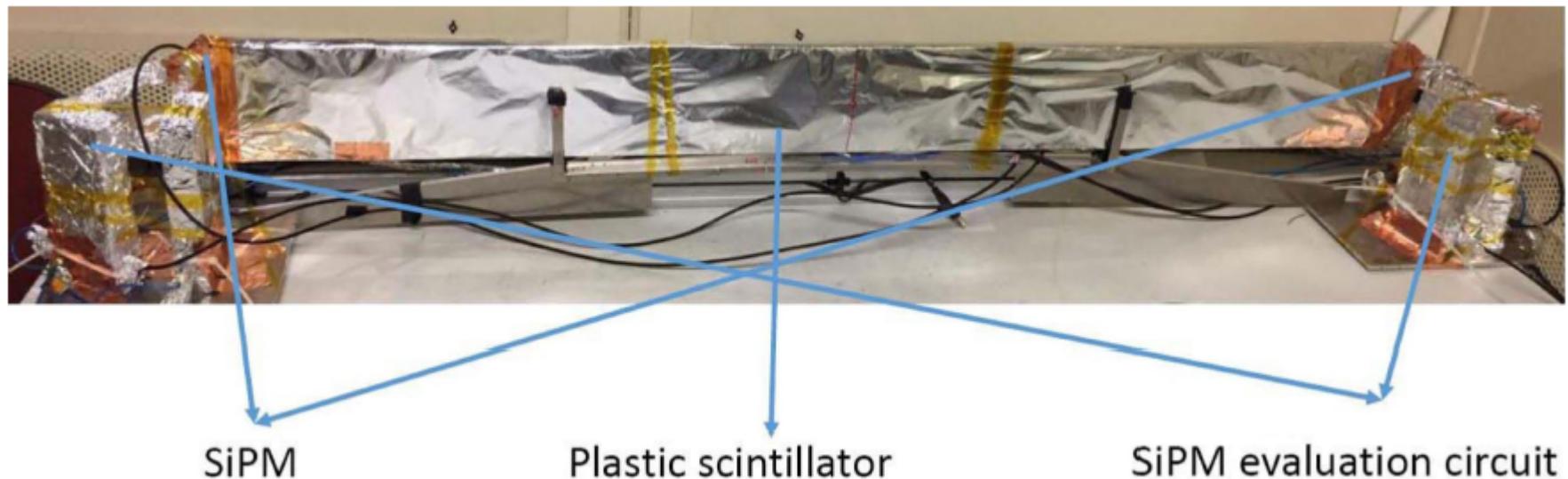
Bars vs Tiles layout
resulting from the
optimization of efficiency /
mechanics / no. channels
and backsplash effects

Alternative approach: tile geometry

The HERD PSD plastic scintillator detector

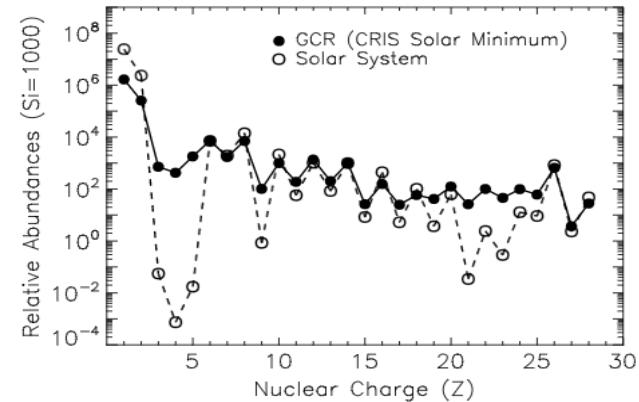
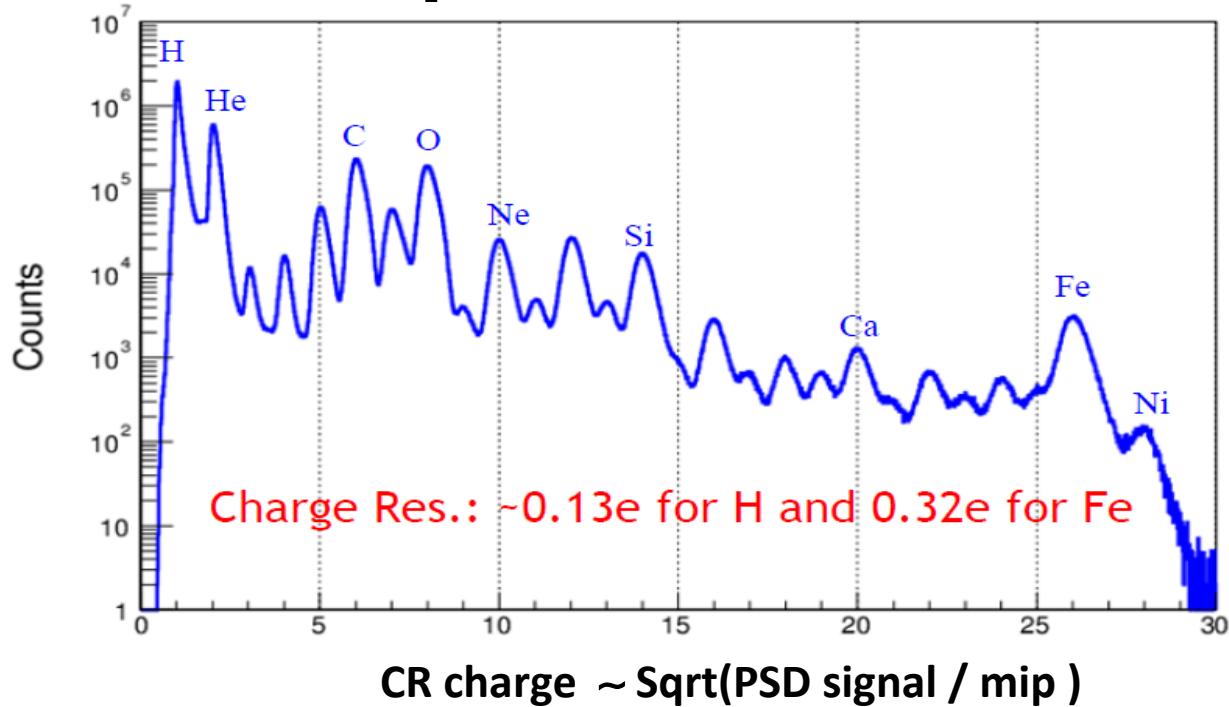


At each end of PS, 4 redundant SiPMs attached to readout as 2 low range signals and 2 high range signals

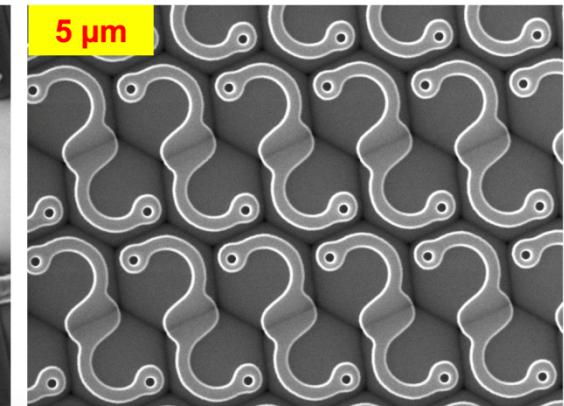
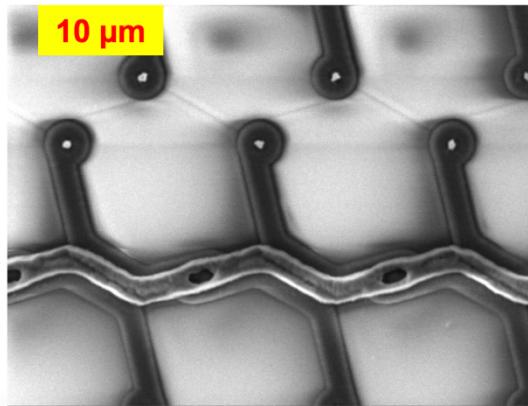
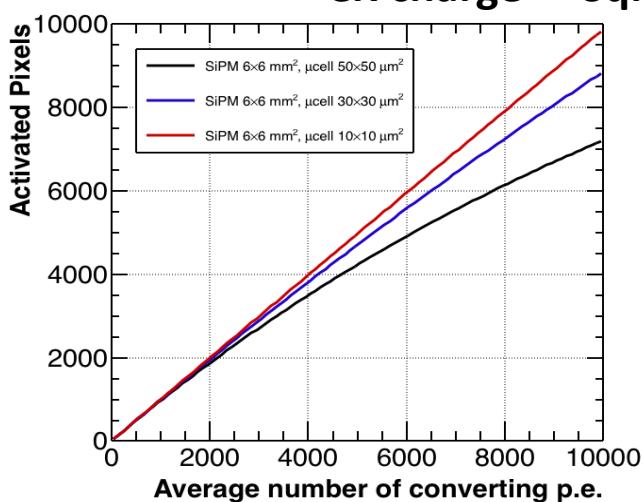


The HERD PSD

plastic scintillator detector

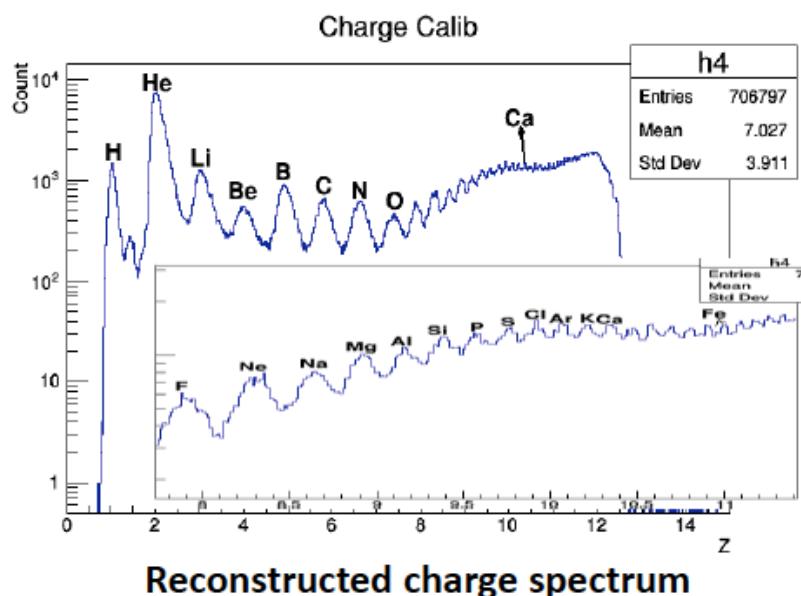


← DAMPE
preliminary results



Need a dynamic range ~10³

First prototype of PSD



Small sipm dynamic range degrade the performance of charge resolution of charged particle with $Z > 10$.

Updated PSD prototype

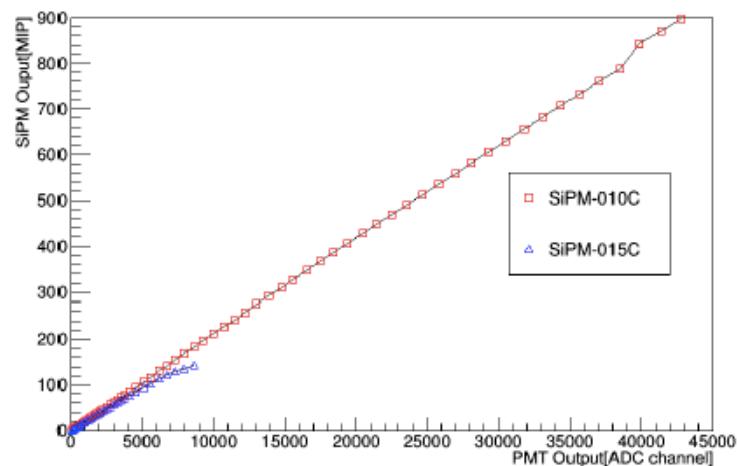
Chinese

PSD prototype with two different dimensions are designed



Two types of SiPM used as low and high channels to extend dynamic range.

SiPM	Low range	High range
Type	S12751-015C	S12572-010C
Effective area	3mm^2	3mm^2
Pitch size	15 μm	10 μm
PDE@425 nm	25%	10%
Gain	$2.3\text{e}5$	$1.35\text{e}5$
Z	1-6	5-26



Dynamic range of low and high channel

PSD New idea

- Plastic scintillator bar: $160\text{cm} \times 3\text{cm} \times 1\text{/cm}$ 0.5cm
- Plastic scintillator bar: $160\text{cm} \times 3\text{cm} \times 1\text{/cm}$ 0.5cm

Double dynamic range

readout chain should cover more than 2 decades,
taking into account the quenching effect in the plastic
scintillator.

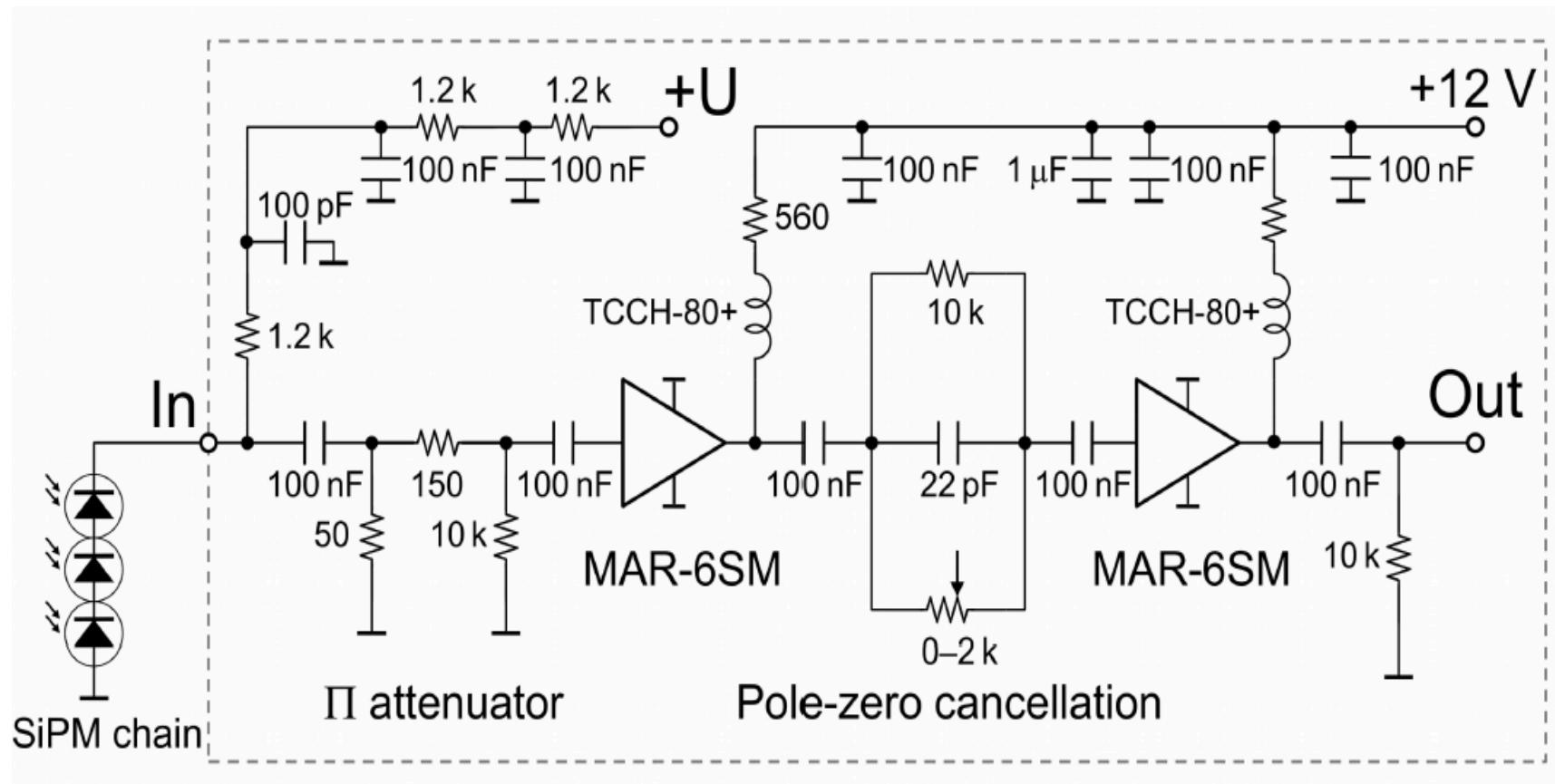
HERD-DMP: Attività svolte



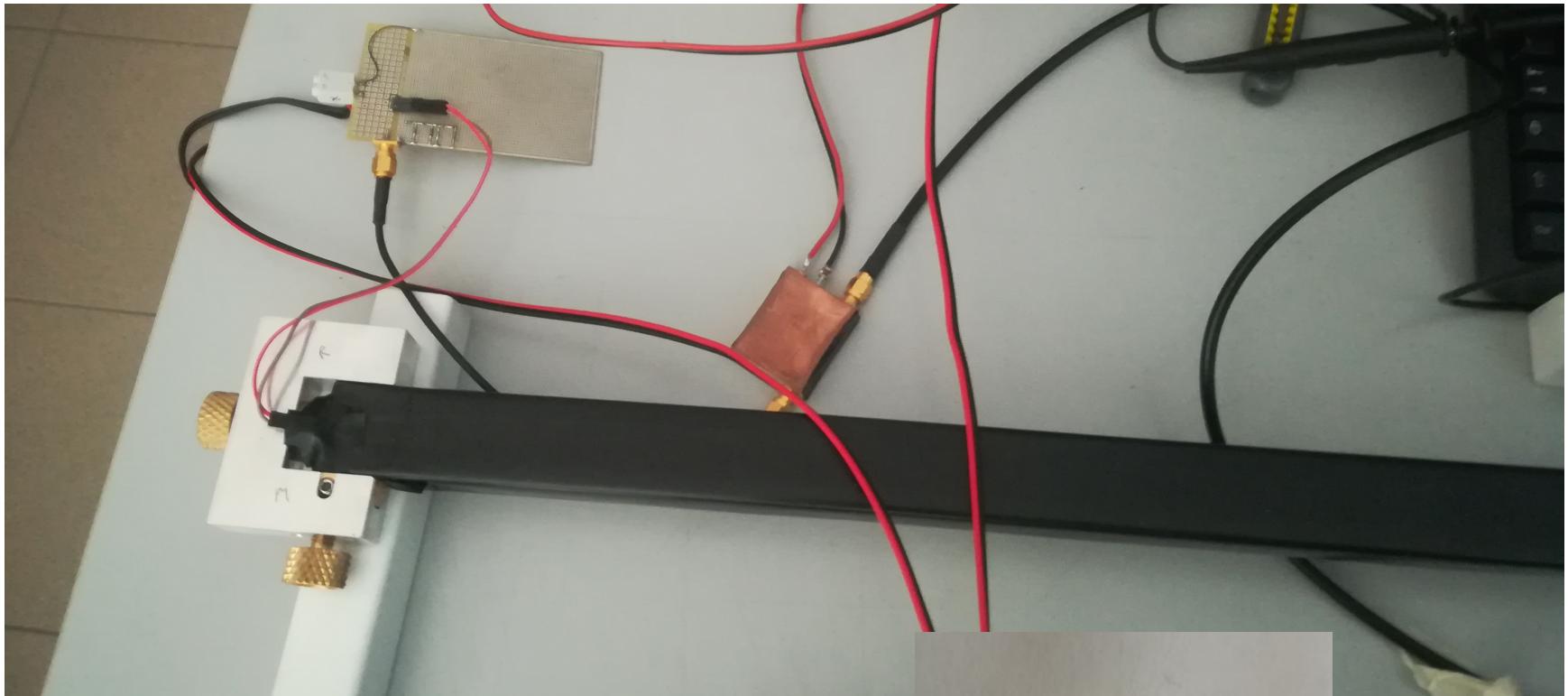
- Studio Barre PSD
 - Allestito Set-up per test SiPM
 - Test Barre + SiPM
 - MC
 - Installato MC su macchine Lecce
 - Run primi elettroni
- Mancano Scintillatori, SiPM e sistemi di lettura

Lettura SiPM

Half of this circuit realized – not sufficient for single PE

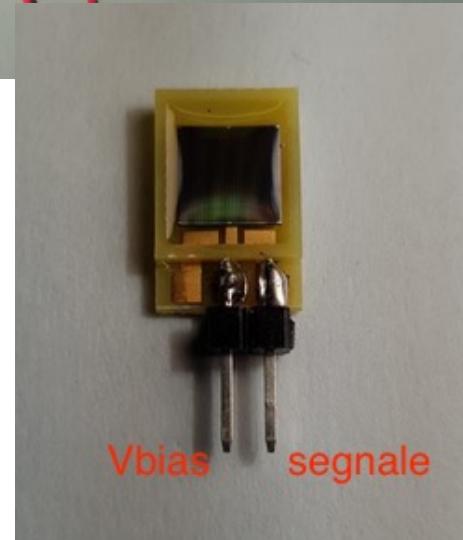


Test Set-up



1 bar 1x1x70 cm³

1 SiPM CTA 6x6 mm² ($V_b = 26.5$ V)



Materiale a disposizione

Scintillatori realizzabili

Con gl scintillatori EPIC CRYSTAL di BARI si possono assemblare

1 tile 100x100x10 mm³

1 tile 100x100x5 mm³

Con gl scintillatori EJ-200 di PAVIA si possono assemblare

1 barre 1000x20x10 mm³ + 1 barra 1000x60x10 ?

1 tile 100x100x5 mm³

Con gl scintillatori EJ-200 del GSSI si possono assemblare

1 barre 500x20x10 mm³

+1 barra 500x120x10

1 tile 100x100x10 mm³

+1 barra 500x60x10

GSSI

Scintillatore EJ-200 (Eljen Technology)

<https://eljentechnology.com/products/plastic-scintillators/ej-200-ej-204-ej-208-ej-212>

1 pz. 500x500x10 mm

Possibili Assemblaggi per BTF

Barre

Ognuna delle 2 barre realizzabili potrebbe essere equipaggiata sui 2 estremi con due SiPM per lato

2 SiPM AdvanSid ASD-NUV3S-P-40 (40 um 3x3 mm) - GSSI

Come riferimento e controllo con quanto montato sulle Tile

2 SiPM HAMAMTSU mod. S12572-015C (15 um 3x3 mm) -GSSI

Per verificare l'effetto di celle più piccole

In totale per due barre

4 SiPM AdvanSid ASD-NUV3S-P-40 (40 um 3x3 mm) - GSSI

4 SiPM HAMAMTSU mod. S12572-015C (15 um 3x3 mm) -GSSI

Anagrafica

Ricercatori						
	Nome	Età	Contratto	Qualifica	Aff.	%
1	Bernardini Paolo		Associato	Prof. Associato	CSN II	70
2	De Benedittis Antonio		Associato	Dottorando	CSN II	100
3	Di Santo Margherita		Associato	Dottorando	CSN II	100
4	Marsella Giovanni		Associato	Prof. Associato	CSN II	40
5	Perrone Lorenzo		Associato	Prof. Associato	CSN II	20
6	Surdo Antonio		Dipendente	Primo Ricercatore	CSN II	70
Numero Totale Ricercatori					6	FTE: 4.0

Tecnologi						
	Nome	Età	Contratto	Qualifica	Aff.	%
1	Creti Pietro		Dipendente	Primo Tecnologo	ELETTRONICA	30
Numero Totale Tecnologi					1	FTE: 0.3

Tecnici						
	Nome	Età	Contratto	Qualifica	Aff.	%
Numero Totale Tecnici					0	FTE: 0.0

+ 6 mu servizio elettronica

Richieste

- ME 50 kEuro ??
- MI 8 kEuro ??
- Consumi 3.5 (5-6 k) kEuro (dischi, SiPm, Scint.) ??
- Invent. 6.0 kEuro (lettura SiPm) ??
- PS: Liberare SJ per missioni 2019!