Anagrafica

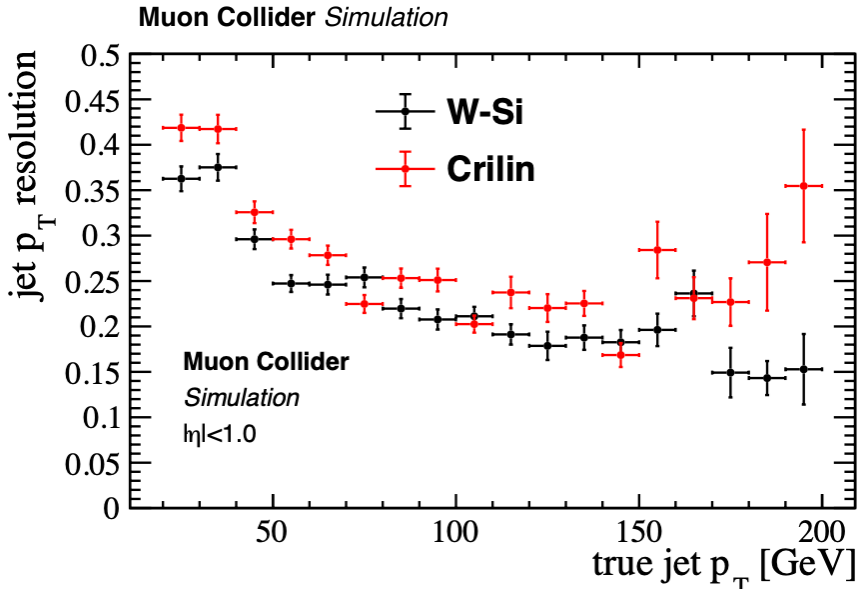
cognome	nome	note	profilo	perc
Cantone	Claudio		Tecnologo	20%
Cemmi	Alessia		Scientifica Dipendenti altri enti	25%
Colao	Francesco		Scientifica Dipendenti altri enti	20%
Di Sarcina	Ilaria		Scientifica Dipendenti altri enti	25%
Happacher	Fabio	+ 10% su PRIN_20229TBY8B in sinergia con RD_MUCOL	Primo Ricercatore	10%
Li Voti	Roberto		Scientifica Università	30%
Sarra	Ivano	+ 20% su PRIN_20229TBY8B in sinergia con RD_MUCOL	Tecnologo	20%
Scifo	Jessica		Scientifica Dipendenti altri enti	25%
Soleti	Stefano Roberto		Scientifica Enti stranieri	50%
Verna	Adriano		Scientifica Dipendenti altri enti	25%

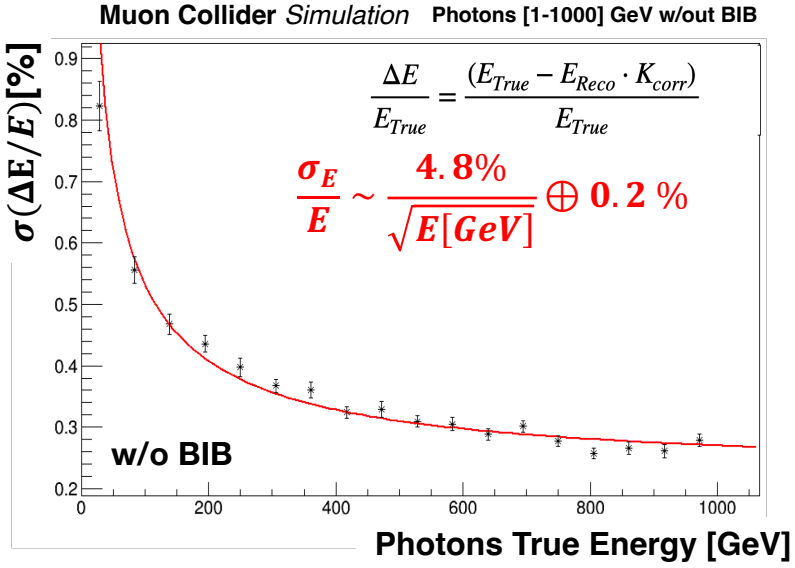
Active Staff Members without Assigned FTE:

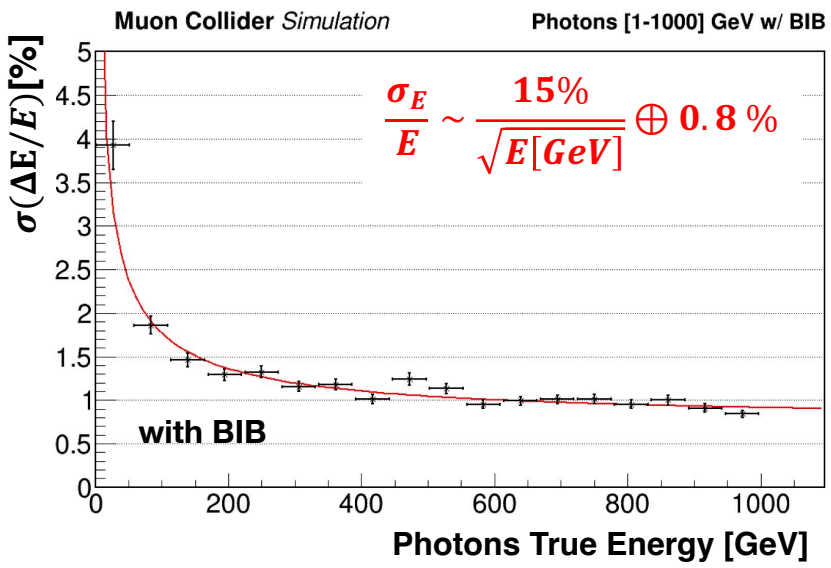
- Vittoria Ludovica Ciccarella – Laureanda Roma1 / Dottoranda Roma1(2025)
- Elisa Di Meco – Dottoranda Tor Vergata
- Ruben Gargiulo – Dottorando Roma1
- Eleonora Diociaiuti – LNF
- Daniele Paesani - LNS

Simulated performances

- ECAL barrel with Crilin technology implemented in the Muon Collider simulation framework
  - Including **digitization** from real test-beam waveforms + BIB rejection with timing and longitudinal hit position
  - 5 layers with 45 mm length, 10 X 10 mm^2 cell area → **21.5 X_0**
  - **In each cell:** 40 mm PbF_2 + 3 mm SiPM + 1 mm electronics + 1 mm air
- Design optimized for BIB mitigation: with 4.5 cm layers, BIB energy is integrated in large volumes → reduced statistical fluctuations of the BIB energy deposit
- Crilin 5 layers competitive wrt W-Si 40 layers → **factor 10 less in cost** (6 vs 64 Mchannels)



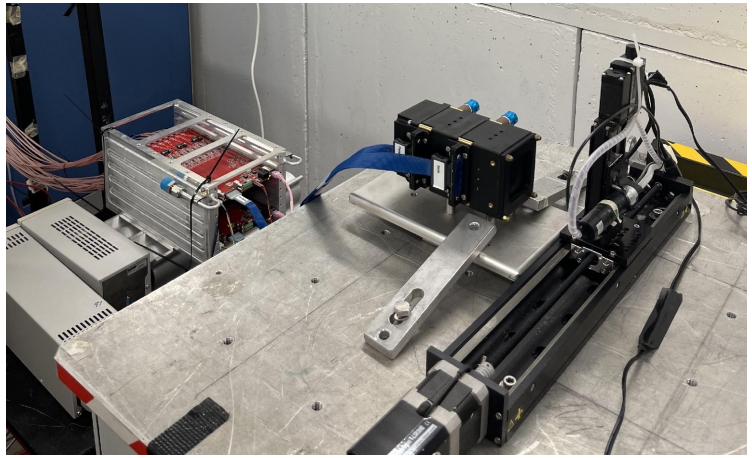


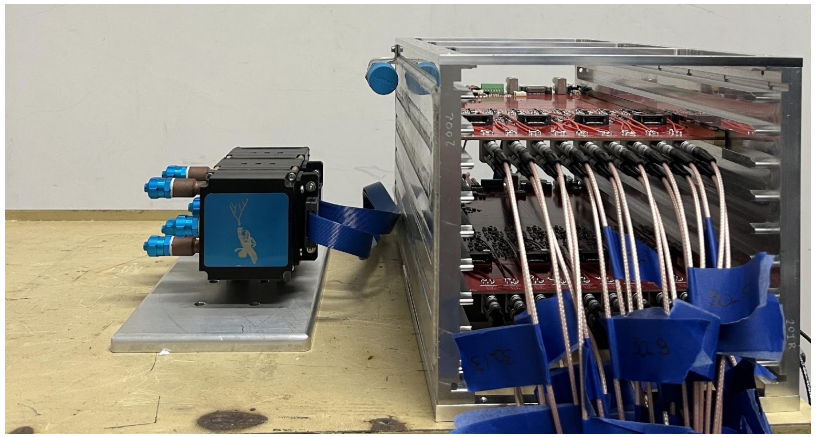


Beam test @ BTF

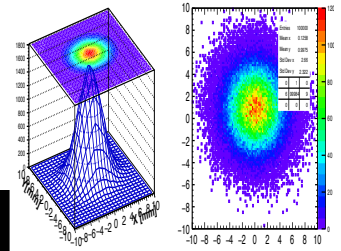
BTF, April 2024

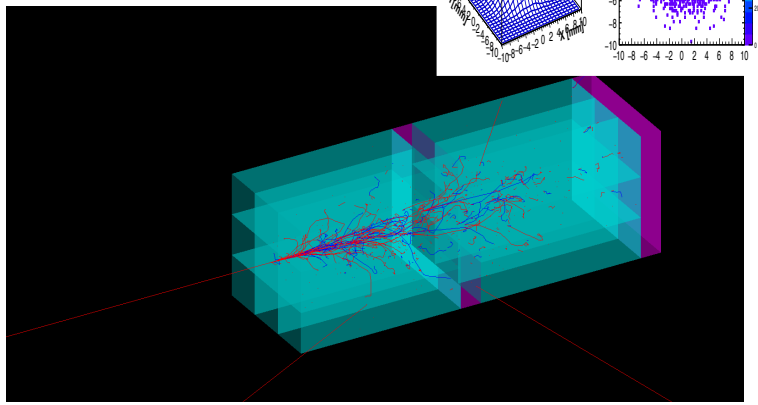
- Study of the LY loss of one layer of Proto-1 after Gamma ray irradiation
- Beam: 450 MeV electrons with multiplicity 1
- Beam centered on a different crystal at each run



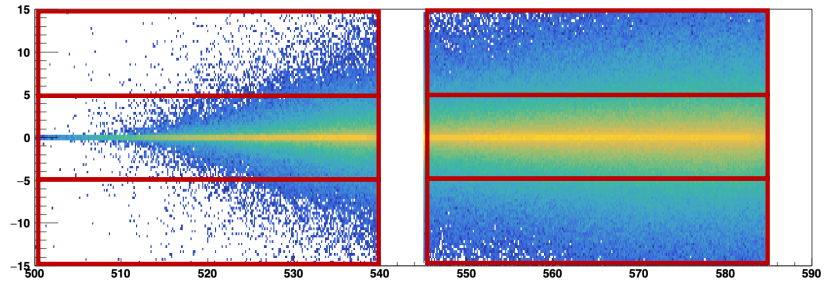


Monte Carlo

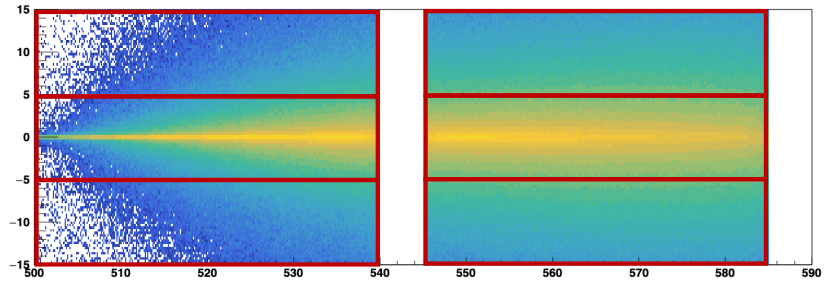




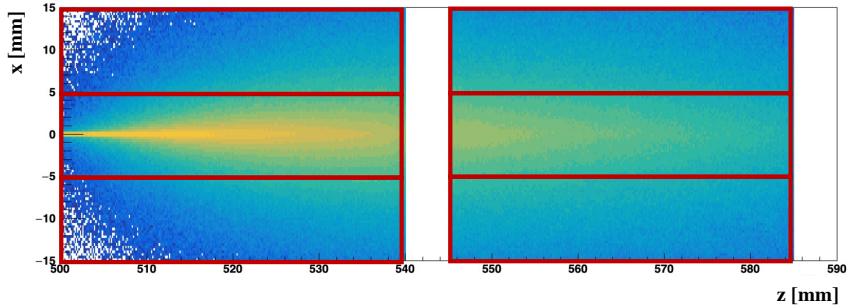
100 GeV



10 GeV



0.5 GeV

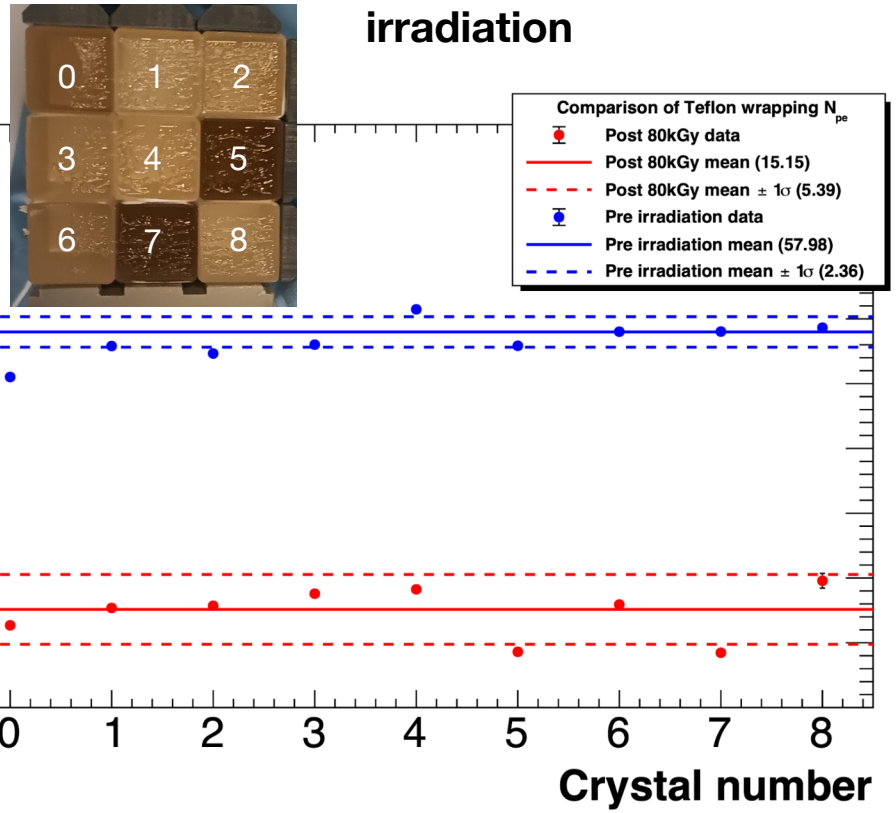


Beam test @ BTF: crystals

- Crystals tested with two different wrapping, Teflon and Mylar, up to 80 kGy, with same SiPMs
- LY loss evaluated through variation in number of photo-electrons

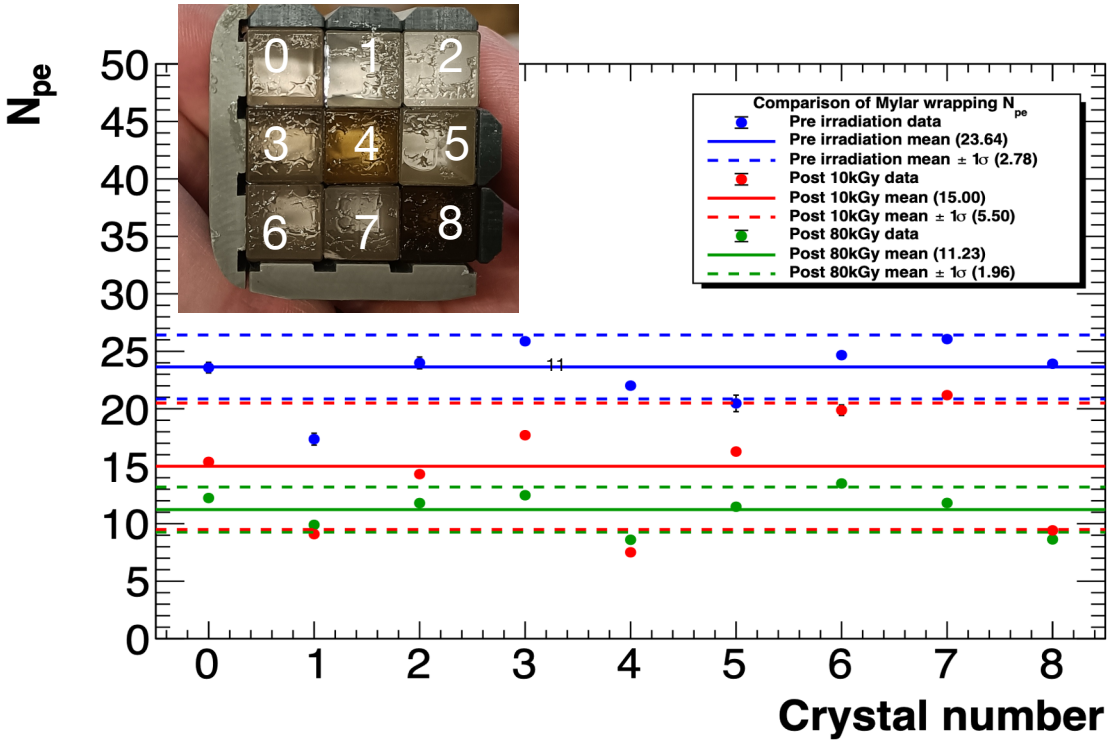
Teflon wrapping

Mean Npe values of PbF_2 pre and post 80 kGy irradiation



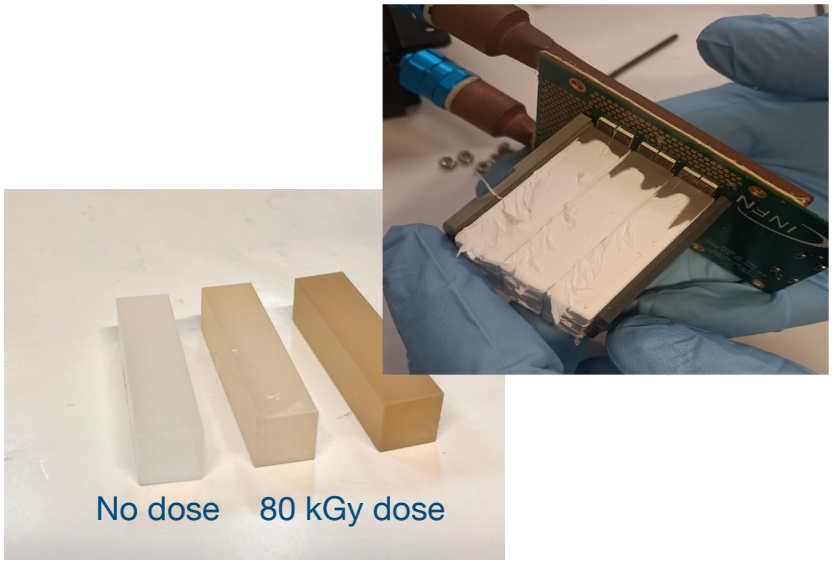
Mylar wrapping

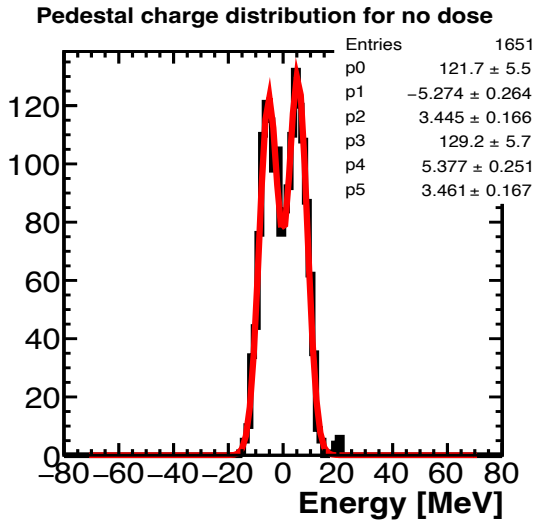
Mean Npe values of PbF_2 pre, after 10 kGy and after 80 kGy irradiation

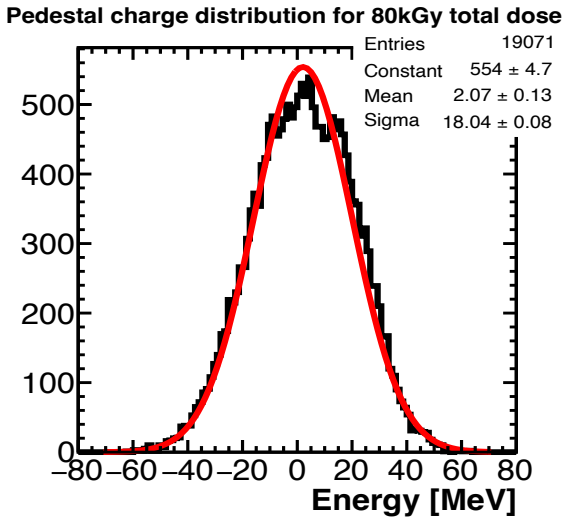


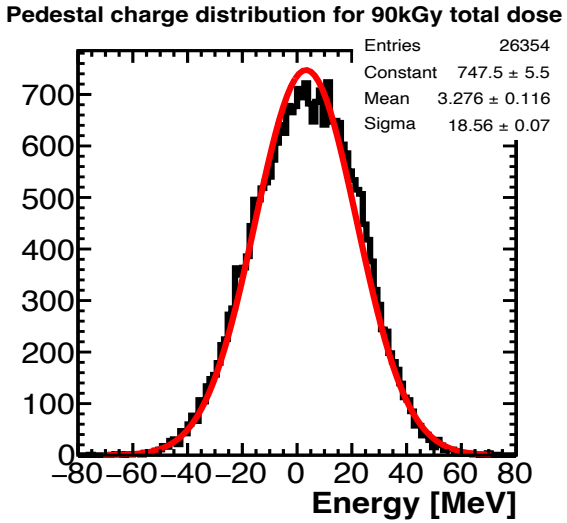
Beam test @ BTF: considerations

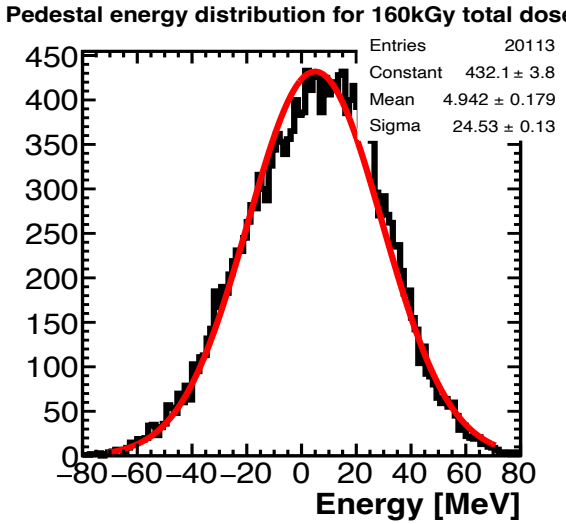
- Considerable variability in crystals' response to radiation, despite SICCAS claiming use of high-purity (>99.9%) PbF_2 powder for crystal growth
- Transparency loss was uniform length-wise in the crystals
- Teflon was damaged and brittle
- SiPM dark counts increases significantly with the absorbed dose
- Good operation after extreme TID (16 times MuCol) at low energies :)
- **New tests planned to evaluate SiPMs PDE loss and optical grease degradation to disentangle LY losses due to crystals / SiPM**
  → 3.5 keur





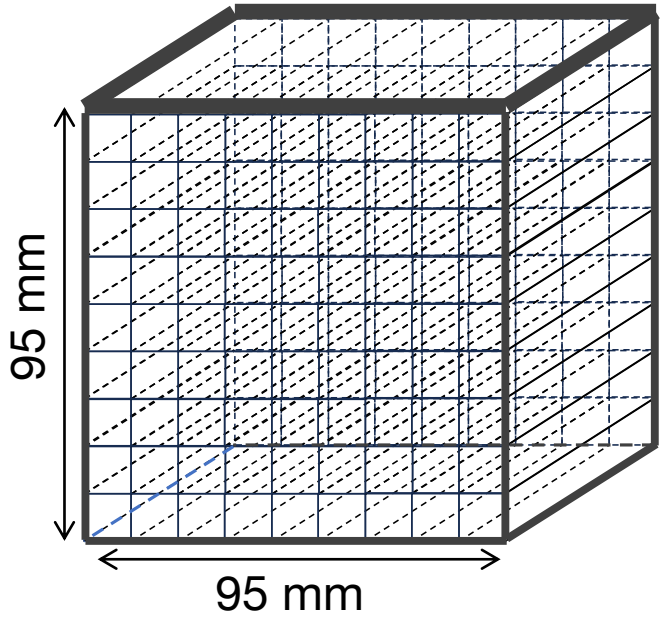


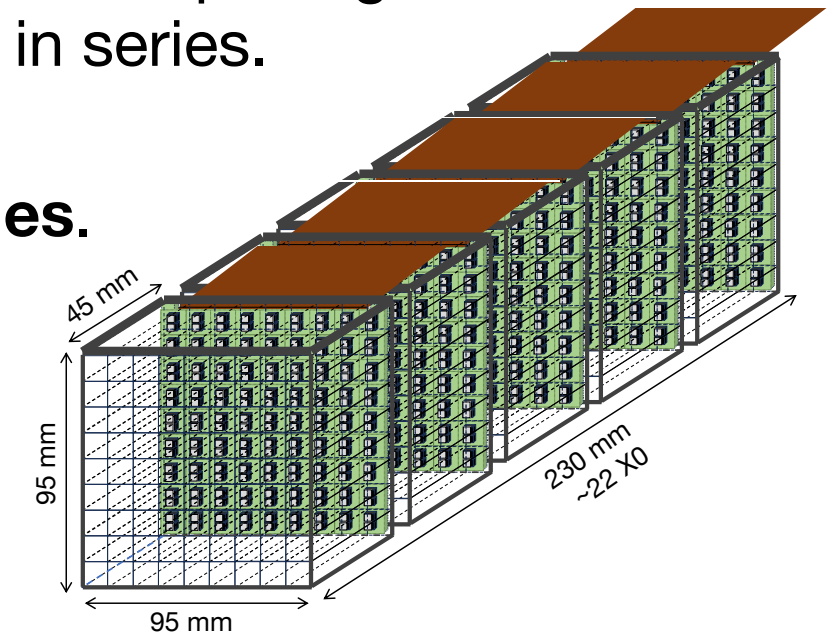


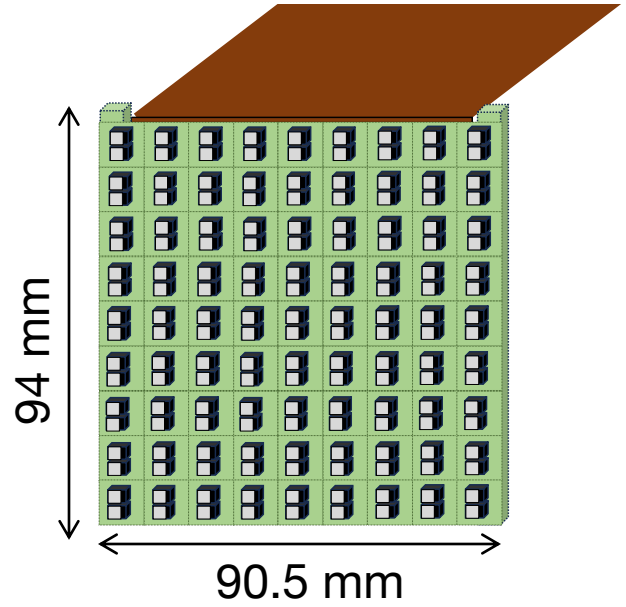


Crilin Module Prototype
9x9 crystals/layer – 5 layers

1. **Aluminum matrix to hold the crystals**:
   1. 50-100 μm thickness between crystals
   2. Thicker (~ 2mm) in the external envelope with microchannels for cooling
2. **Kapton strip for polarization and output signal**:
   1. Handles polarization and output signals for each channel of two SiPMs in series.
3. **Connectors at the back of the 5 assembled modules.**







PRIN - Abbiamo fondi per:

- Riempire gli 81x5 cristalli e 81x2x5 SiPM
- Elettronica per 100 canali 5x5 cristalli per layer con qualche aiuto dalla commissione:
  - Cavi 3 keuro
  - A5818 4.5 keuro (SJ)

ELETTRONICA (soluzione-0 per PRIN da estendere per DRD6)

1. Mezzanine per fornire Vbias ai SiPM (un bias ogni 9 SiPM), amplificazione veloce a ~ 1m dal calorimetro
2. Abbiamo bisogno di una risoluzione temporale <50 ps e di una risoluzione sulla carica <1%
3. Ogni mezzanina contiene 3 moduli da 9 canali → tot. 27 canali a mezzanine → tot. 4 mezzanine **~15keur**
4. 2 board di flash adc CAEN v2745 (4 Vpp – 125 Ms/s) + un canale fast ogni 9 per timing con flash adc CAEN v1742 (2 Vpp – 5 Gs/s) **~35keur**

Soluzione con asic

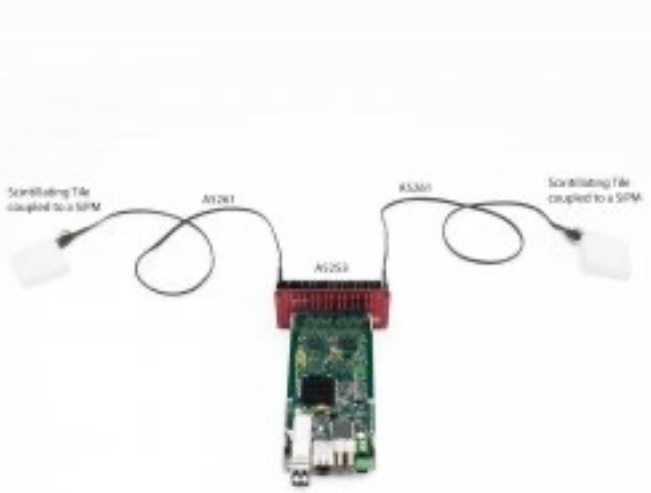
- Adattare un asic esistente per fare timing con ToT + ADC lento per la carica. Con un asic si potrebbero leggere i ~400 canali del prototipo senza sovraccarico di flash adc.
  - Proposta di uno studio di fattibilità dell'applicazione di un asic ed eventuale realizzazione della board di interfaccia.
  - ~~10 keur su Torino~~ → board asic
  - ~~5 keur su LNF~~ → board di interfaccia

Vedi slide successiva

CAEN A5204 (https://www.caen.it/products/a5204/)

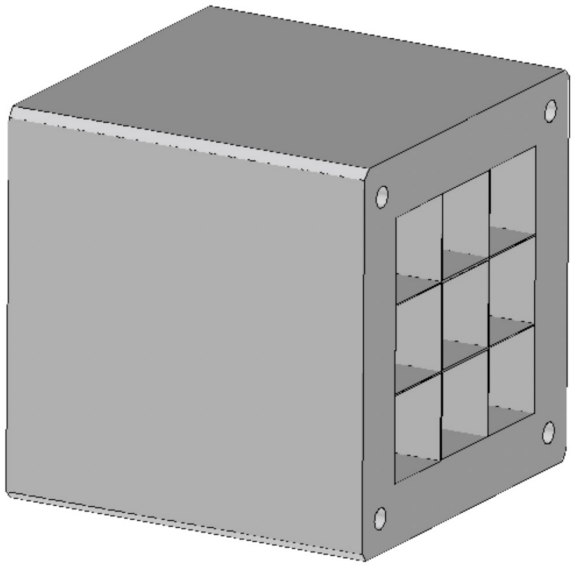
- La CAEN ha in sviluppo (pronta per la distribuzione a gennaio 2025) una board che farebbe al caso nostro:
  - 64 chs, chip radioroc, acquisizione con pico TDC ed ADC
  - Costo 9 keur su Torino/inventariabile
  - 3 keur adattatore A5253 e integrazione meccanica su LNF/consumi

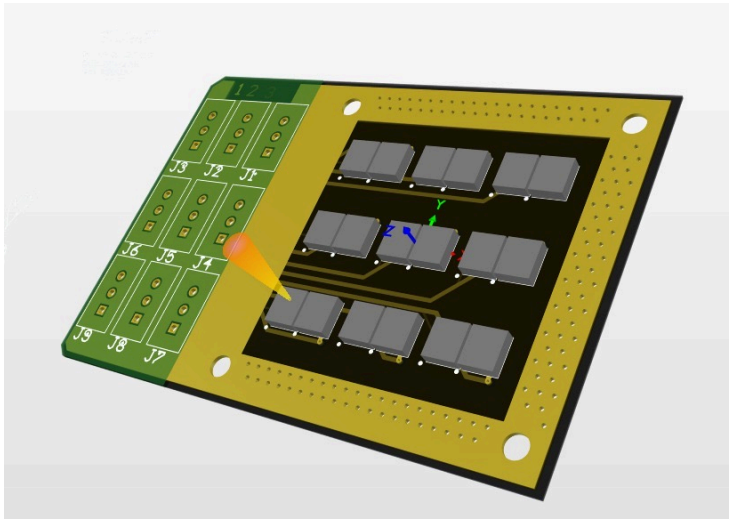
Front view

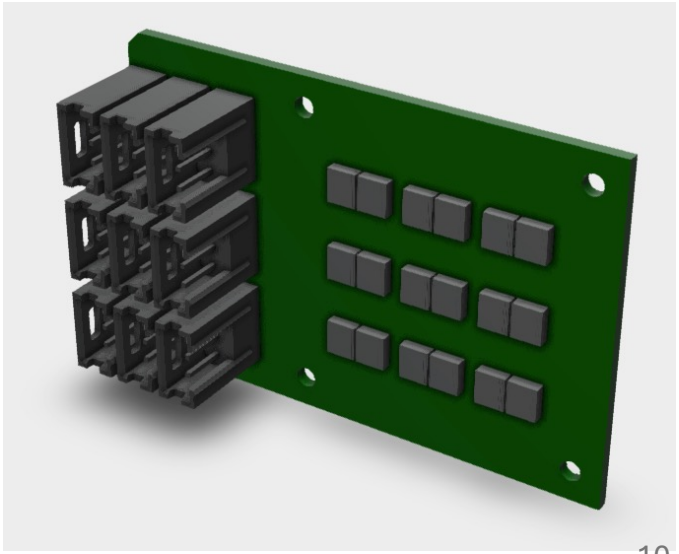


- Stiamo sviluppando la una nuova matrice 3x3 per provare:
  - meccanica definitiva con 100 um Al o Cu per separazione tra i cristalli
  - la board di elettronica
  - L'elettronica di acquisizione (alla Proto-1 per il FEE, V1742 come digitizer) che poi sostituiremo con la board CAEN per confronto

- Test beam al CERN parassitando CMS o con richiesta sottomessa al PS week 45 (richiesto lo sblocco del SJ missione di 6 keur)

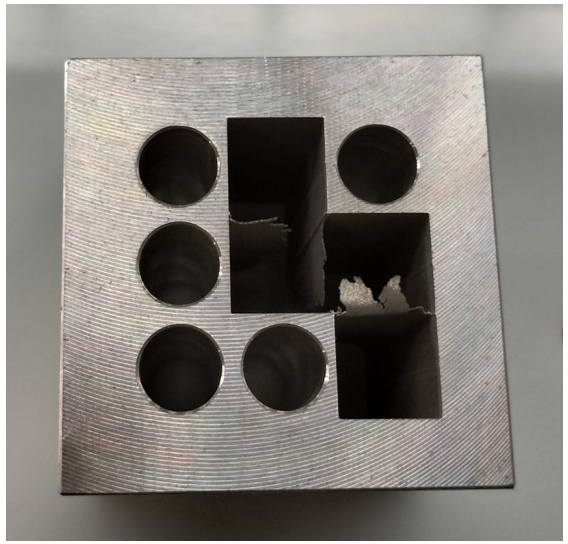


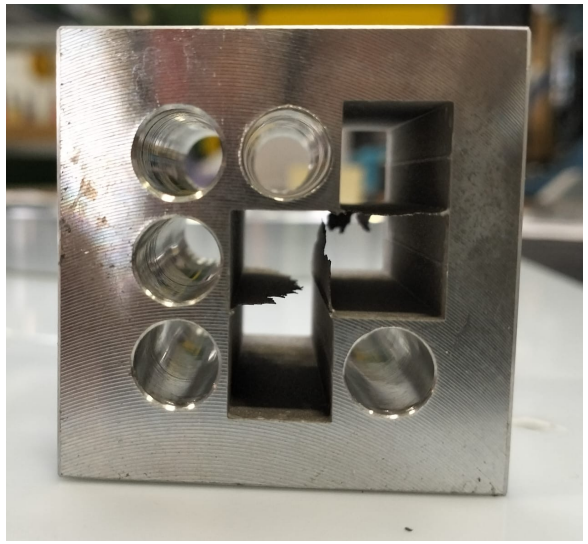




Richiesta aggiuntiva a settembre

- Non riusciamo a costruire la matrice con separazione O(100 um) con la macchina ad elettroerosione a filo di Ferrara.





- Stiamo vagliando 2 tecniche:
- Stampa 3D al Gran Sasso (da Settembre) in acciaio inox
- Elettroerosione a tuffo da ditta esterna, richiesta: 3 keuro di extra cost

RICHIESTE 2025		keuro	SJ
Consumi	Test irraggiamento con laser blu cristallo+SiPM e SiPM da solo a Casaccia fino a 80kGy	3.5	
	Scheda interfaccia mezzanine con board con asic TOPHIR2	5 → 3	
	Cavi interfaccia tra connettori sul kapton e mezzanine (x125 canali)	3	
Inventariabile	Modulo caen A5818 controllo digitizer		4.5
Missioni	Metabolismo 3.9 FTE	20	
	Test beam CRILIN al CERN ed attività correlate di integrazione con HCAL		10
	Conferenze e riunioni in preparazione prossima Strategy	5	

DRD6 Tak3
350 chs to acquire with respect
PRIN expectation of 100 chs

RICHIESTE DRD Crilin		keuro
Consumi	Mezzanine boards	40
Inventariabile	Moduli CAEN V2745 64ch x 4board	80

Institute 1 : INFN-LNF, Frascati (Italy)
Institute 2 : INFN-Padova, Padova (Italy)
Institute 3 : INFN-Torino, Torino (Italy)
Institute 4 : INFN-Trieste, Trieste (Italy)
Institute 5 : HZDR, Dresden (Germany)
Institute 6 : DIPC, San Sebastián (Spain)