

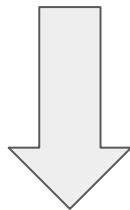
POLA-R v2.0

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Introduction

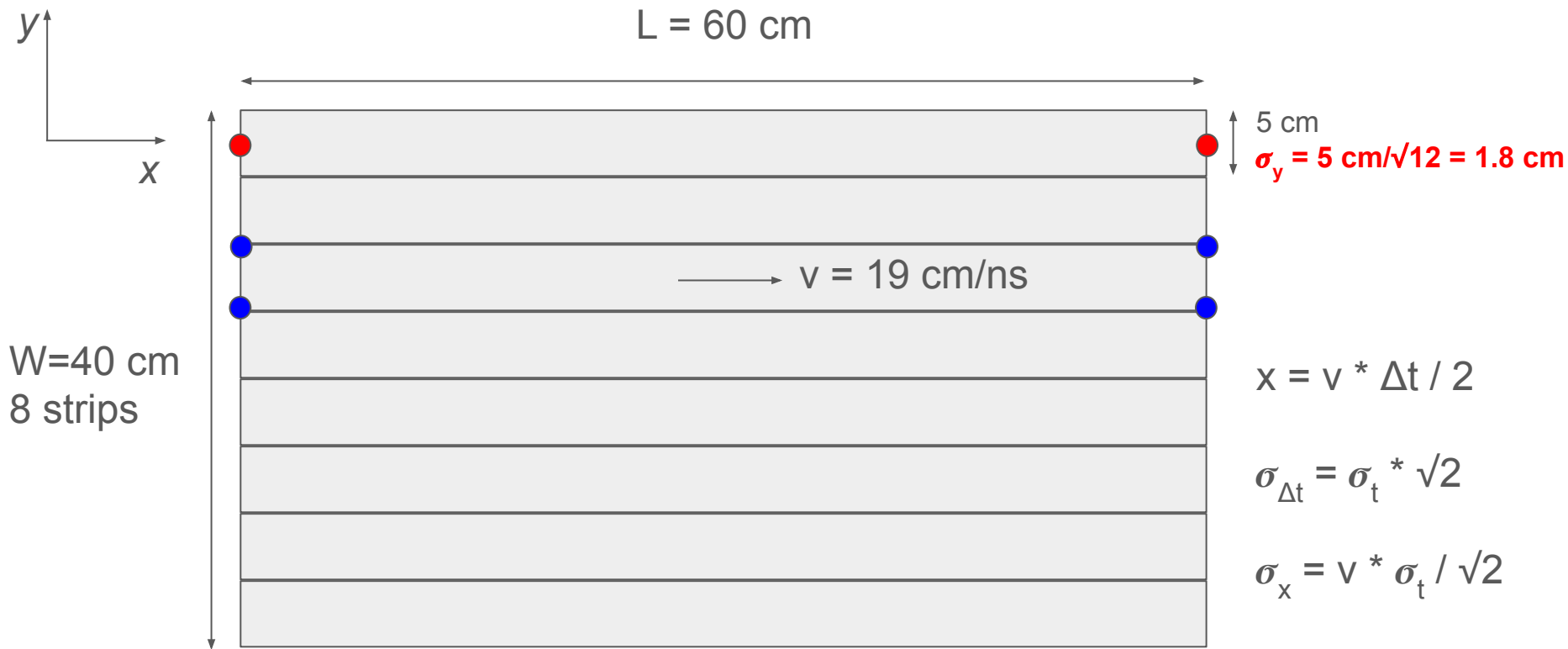
A new version of POLA-R detector is proposed

- to improve tracking and general performances
- to evaluate the possibility to expand in the future the number of “telescopes” of the EEE network



Maintain the idea of 2 planes $O(10)$ cm apart, but replace the 4 scintillator tiles of a plane with 8 scintillator bars

(DISCLAIMER nothing fixed yet!!!)



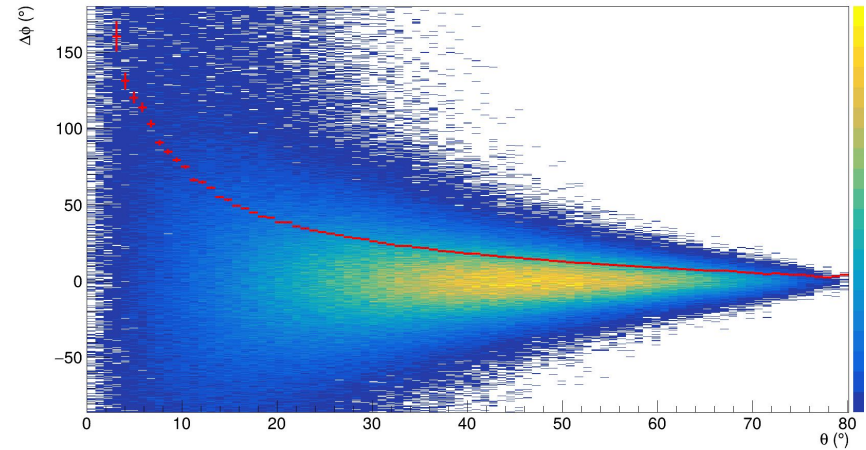
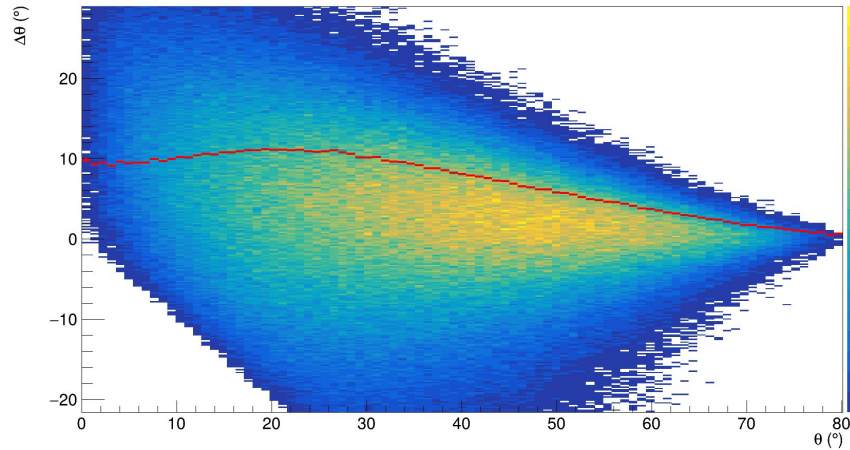
With $\sigma_t = 250 \text{ ps}$ time resolution (CAEN)

4 SiPM per strip (32 channels per plane) $\rightarrow \sigma_x = 2.38 \text{ cm}$

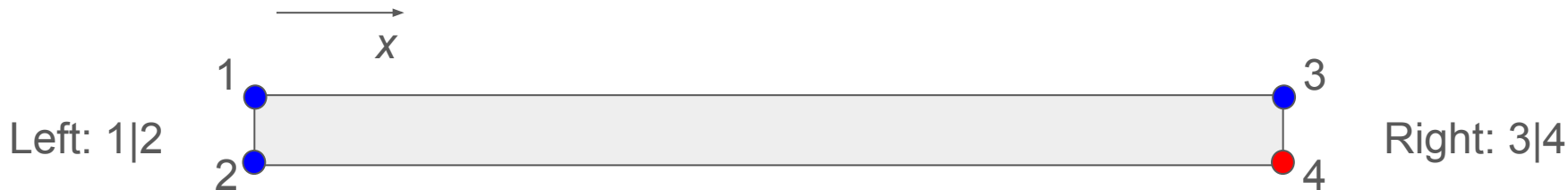
2 SiPM per strip (16 channels per plane) $\rightarrow \sigma_x = 3.35 \text{ cm}$

Simulation results assuming $\sigma_x = 2.38$ cm $\sigma_y = 1.8$ cm

Pointing resolution



Improved efficiency evaluation (4 SiPM for strip)



Assuming an event selection as the AND of the two side (side $\rightarrow$ OR of 2 SiPM) it is possible to estimate from data the efficiency of each SiPM as a function of the position x

Example studying SiPM 4:

By requiring 1,2,3 fired in the same strip it is possible:

- To reconstruct x
- To measure the fraction of events seen also by 4 (vs x)

Differently from previous setting this is a real efficiency under the assumption that strip width is negligible w.r.t. Length (eff. independent of y)

Possible solution for trigger and readout 64 ch



Desktop Setup: Plug & Play

```

*****
// File Format Version 3.2
// Janus Release 3.2.5
// Acquisition Mode: Timing
// Energy Histogram Channels: 4096
// ToA/ToT LSB: 0.5 ns
// Run start time: Tue Oct 24 16:11:22 2023 UTC
*****
//

```

Tstamp us	TrgID	Brd	Ch	ToA ns	ToT ns
49.856	0	00	22	6.5	13.0
		00	52	72.5	19.5
		00	23	74.5	18.5
		00	50	69.5	35.0
		00	13	70.5	30.0
		00	46	73.5	23.5
		00	15	71.0	30.0
		00	44	69.5	33.5
		00	19	71.0	32.5
		00	42	75.5	19.5
		00	17	73.5	28.5
		00	21	75.0	18.5
		00	34	329.0	16.5
		00	40	455.5	8.5
		00	52	550.0	8.5

- 64-ch frontend unit for **SiPM readout** applications housing two [Weeroc Citiroc-1A](#) ASICs
- Part of [FERS-5200](#), the CAEN frontend unit for the readout of **large arrays of detectors** (SiPM, MA-PMTs, Gas Tubes, Si detectors, ...)
- Onboard [A7585D](#) SiPM power supply for sensors biasing
- Acquisition modes**: Spectroscopy (PHA), Counting, Timing with ToT
- Scalability** and **easy-synch**: up to 128 cards (**8192 channels**) can be managed and synchronized by a single [DT5215](#) Concentrator Board, thanks to the optical **TDlink**
- [Janus 5202](#) **open source software** available for board and DAQ control
- Flexibility**: a full range of adapters and cables for **different kind of SiPMs** and sensors **remotization**
- Boxed FERS unit ([DT5202](#)) for desktop use or bare (**A5202**) for customizable mechanical frame

Time res. 250 ps

Proposed time schedule

Short term:

CREF together with INFN-Bologna -> preliminary tests on the performance on a single scintillator bar , 5x60 cm² and four SiPM, with data acquisition via Oscilloscope

Development of readout program, refined trigger implementation, analysis program, interface with EEE database.

Build two planes with 8+8 scintillator bars and tests

Complete a new POLAR detector with a light tight box and mechanical details (check of cooling)

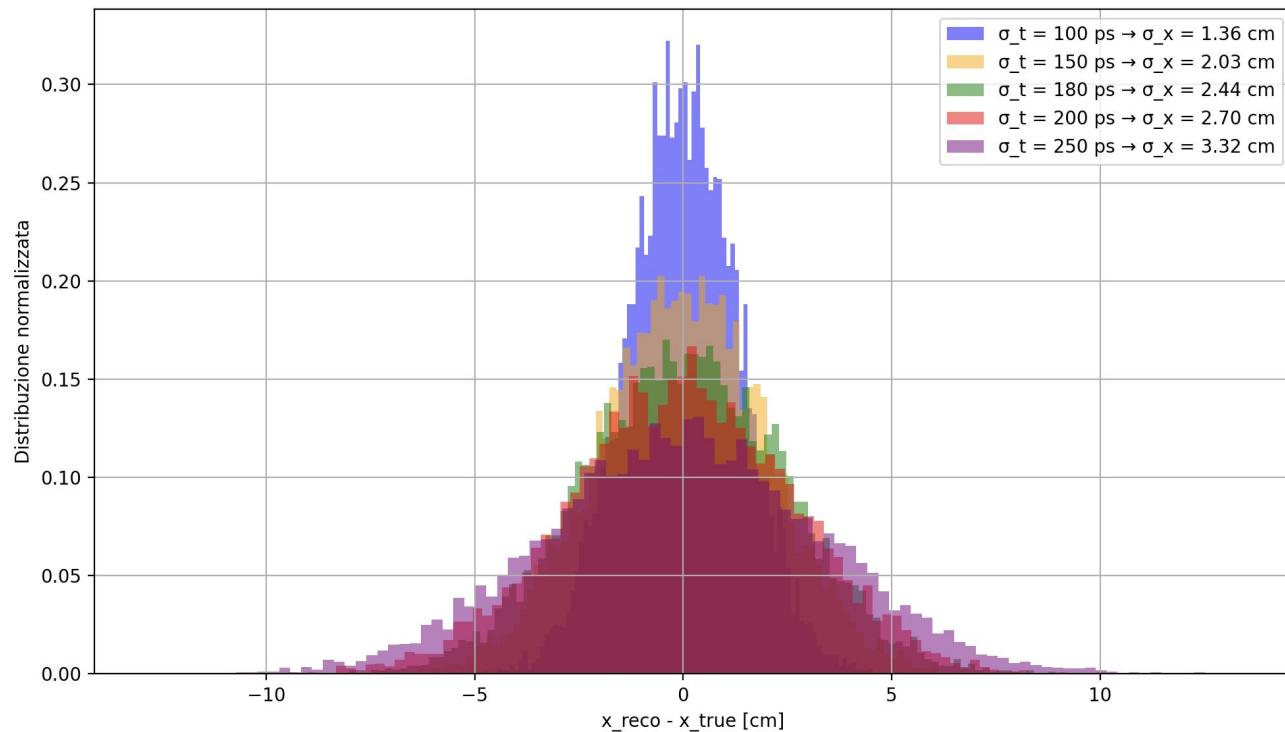
Measure cosmic ray in Bologna and bring it to a school (Lampedusa ?)

Long term:

Possibility to restart the school involvement in “detector construction”, as done at CERN for POLA-R in 2018

EXTRA

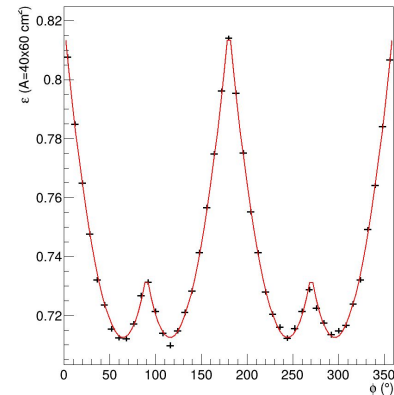
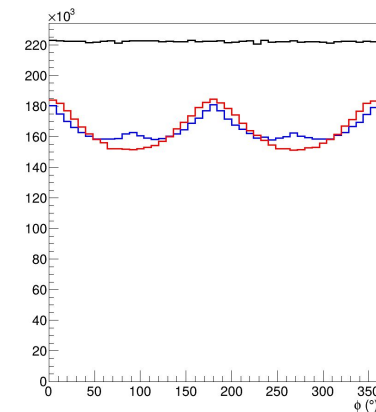
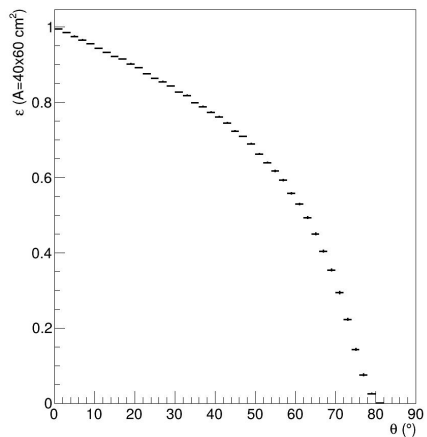
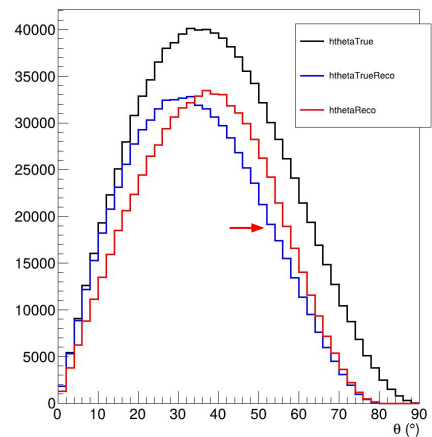
Toy model-resolution rate



Rate atteso ($E > 100$ MeV, 2 piani con efficienza 0.95): 26.86 muoni/s

Effect of resolution on reconstruction

$$dP/d\Omega = 2\pi \cos^2\theta \sin\theta d\theta$$



L = 60 cm
W = 40 cm
d = 11 cm

