A feasibility test run for the MUonE project

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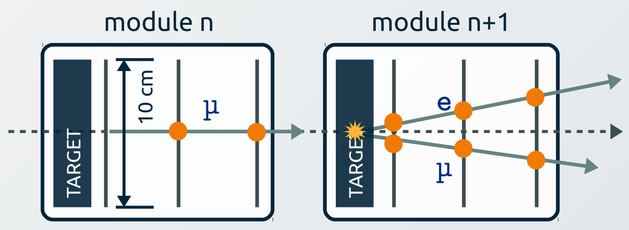
1. A long standing discrepancy

Modern measurements of the muon anomalous magnetic moment g-2 stand more than 3-4σ away from the Standard Model prediction: **hint of new physics?**

To solve the intriguing puzzle, the **MUonE project** aims to measure the Hadronic Leading Order (**HLO**) contribution to the muon g-2 by scattering high energy (150 GeV) muons off the atomic electrons of a low-Z target through the elastic process **μ+e → μ+e**

The experiment will exploit the kinematical correlation of the μ - e collision → need for **precise measurements in a as thin as possible detector**



A modular target is foreseen in the final setup, consisting of 60 low-Z layers each sandwiched in layers of Si-microstrip detectors

2. The 2018 feasibility test

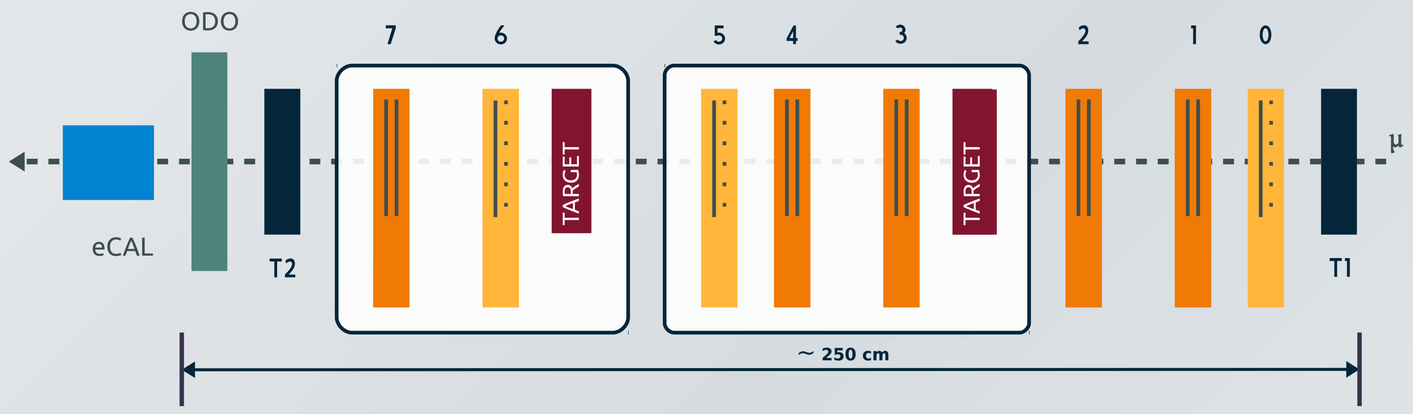
CERN SPS-M2 beam satisfies the requirements (**Eμ=150 GeV, 1.3x10⁷ μ/s**) ad hoc for such a measurement

A statistical uncertainty of ~0.3% can be achieved on μ-HLO after **two years** of data taking on a high energy muon beam with adequate intensity

The setup is controlled remotely by the experimental lab at **Insubria University**, **Como** (IT)

The feasibility test employed a reduced version of the MUonE modular setup, while retaining all its essential elements (tracking, triggering and PID detectors). It is composed by:

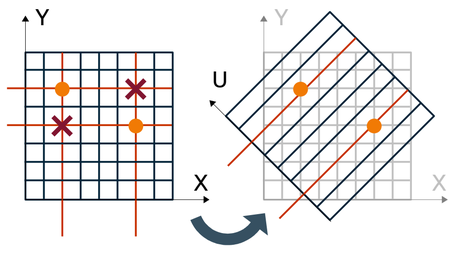
- **16** single side **AGILE silicon** microstrip **detectors** (1-8), coupled in XY, UX or VY pairs (a "box module")
- **2** 0.5 cm thick **carbon targets** (T1&T2), sandwiched between two boxes
- 2 **plastic scintillators** (S1&S2), used as system trigger (in coincidence with the SPS spill)
- A 8-channel scintillating bars **hodoscope** (ODO), to study the time evolution of the muon beam
- An electromagnetic **calorimeter** (eCAL), to separate e from μ

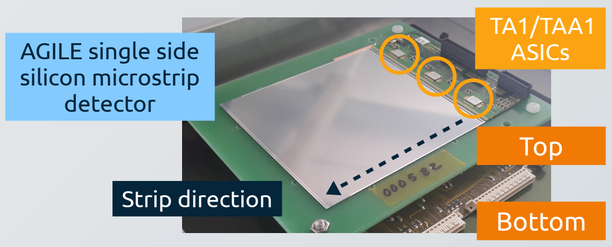


3. The Silicon detectors

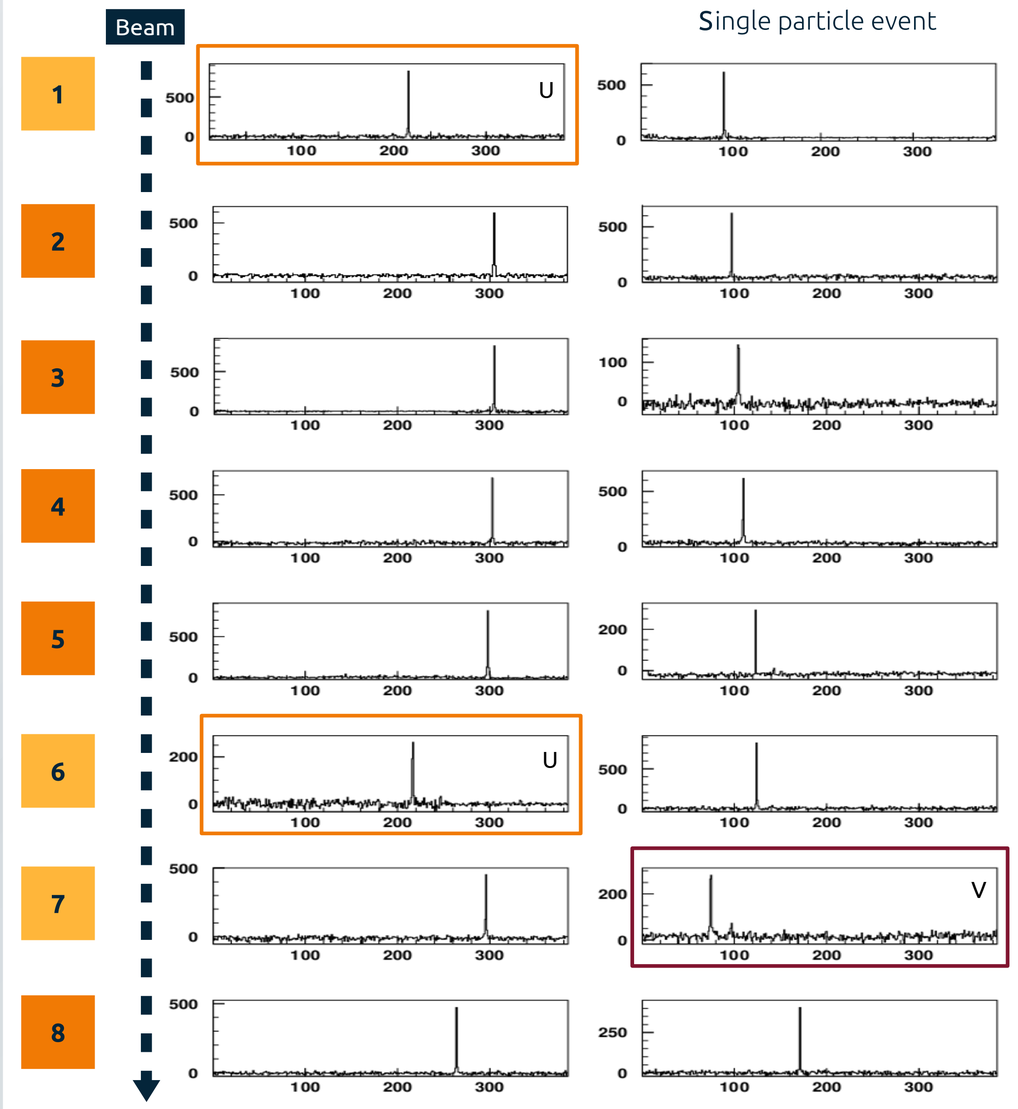
To disentangle double tracks, three module boxes are equipped with **stereo detectors** (±45°)

XU (box 1) & XU (box 6) & VY (box 7)





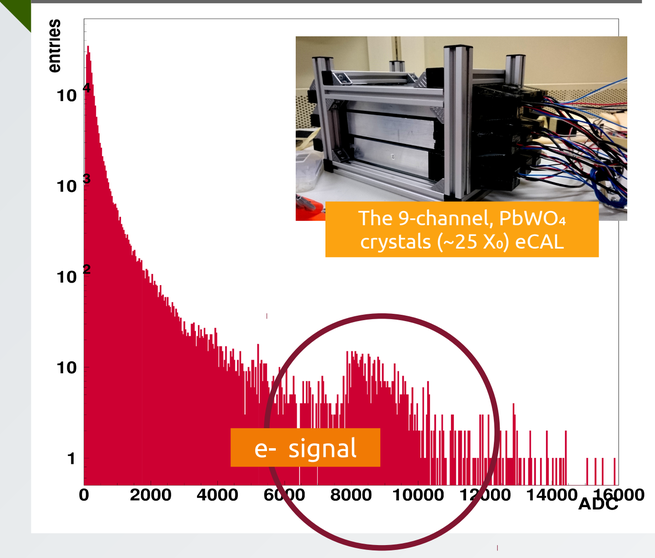
Type		HAMAMATSU silicon microstrip detector
N. of channels	-	**384** (3x128)
Size	-	9.5x9.5x0.041 cm³
Strip pitch	-	**121μm** (physical) **242μm** (readout)
Spatial resolution	-	Floating strip scheme + analogue readout mode: **~ 40μm**
Bias voltage	-	**36V**
Readout electronics	-	**3 ASICs** (TA1/TAA1)



4. The DAQ system

- **ASIC** part: preamplifier, CR-RC² shaper, Sample&Hold circuit
- **Repeater**: configuration settings for detectors and ASICs
- **ADC**: digitization of the signal, data storage, communication with VME
- **VME readout board** & **Waveform digitizer**: data to PC
- **DAQ program**: trigger selection, calibration routines, pedestal run
- **Online data processing**: ASCII production, remote monitoring tools

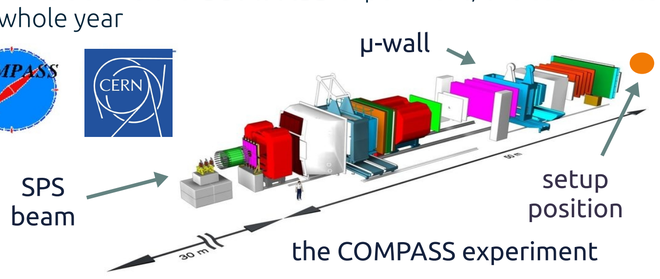
5. Particle ID

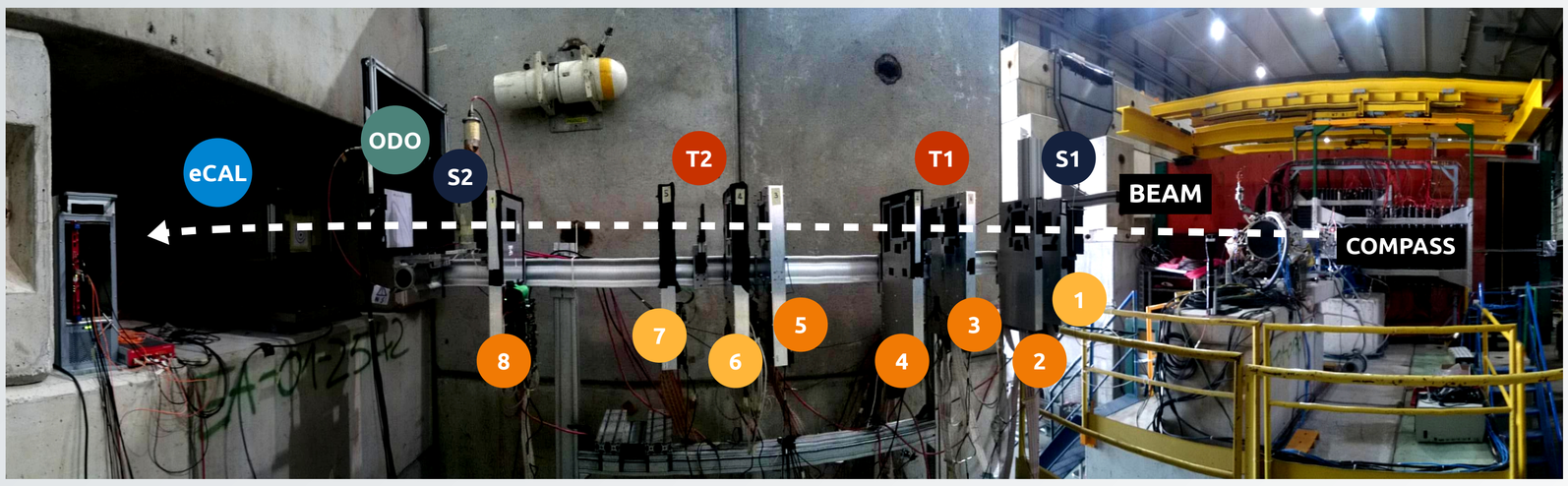


The 9-channel, $PbWO_4$ crystals (~25 X_0) eCAL

6. Where we work

In April - May 2018 at the CERN North Area (**SPS**) a reduced experimental setup was installed, running parasitically on the beamline behind the **COMPASS** experiment; the test will last the whole year





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