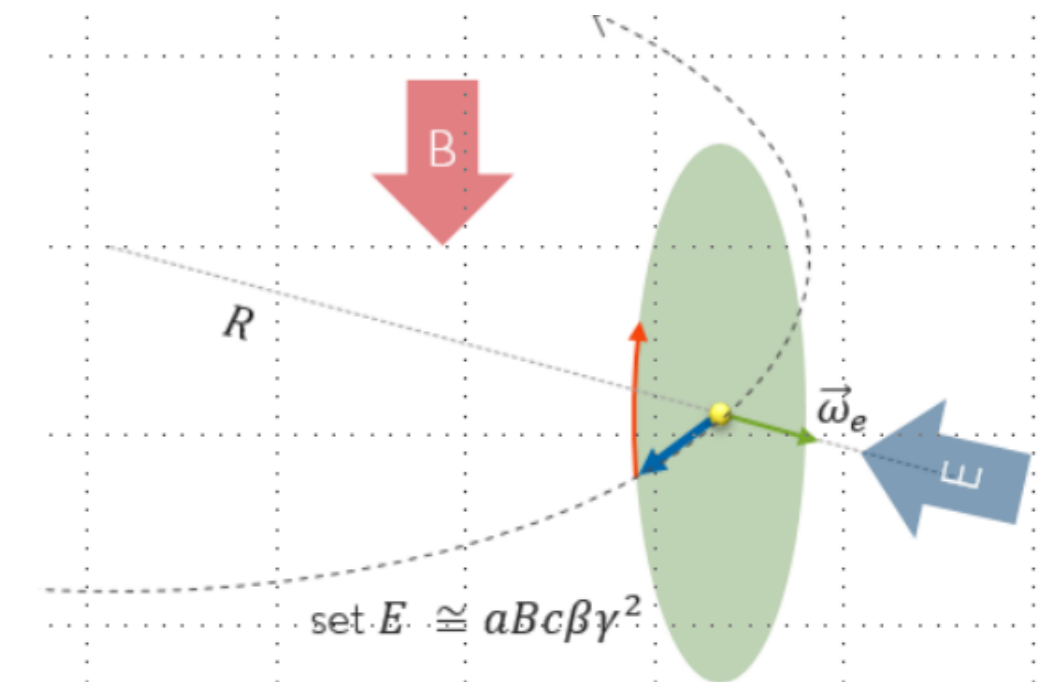
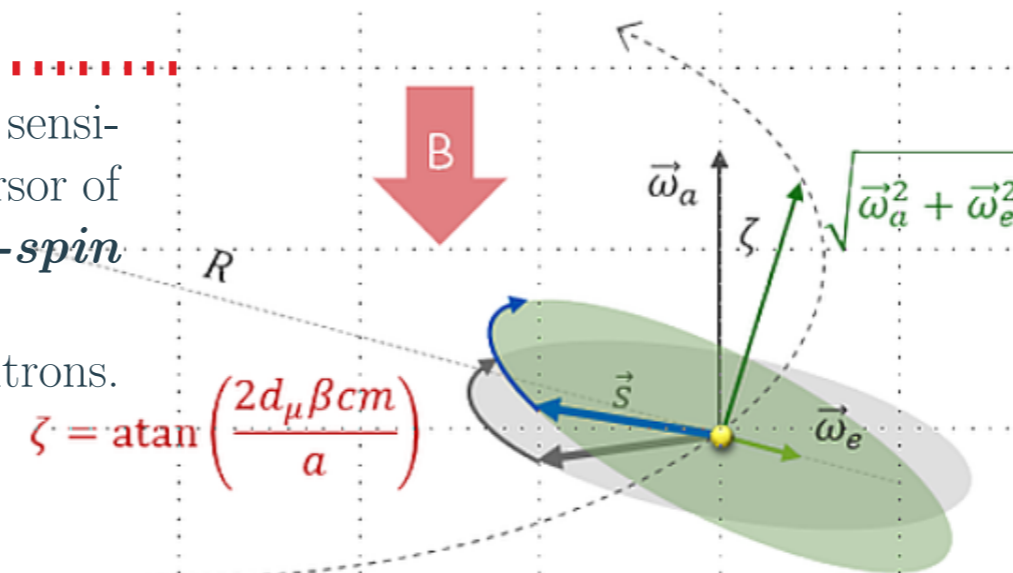


The muEDM experiment

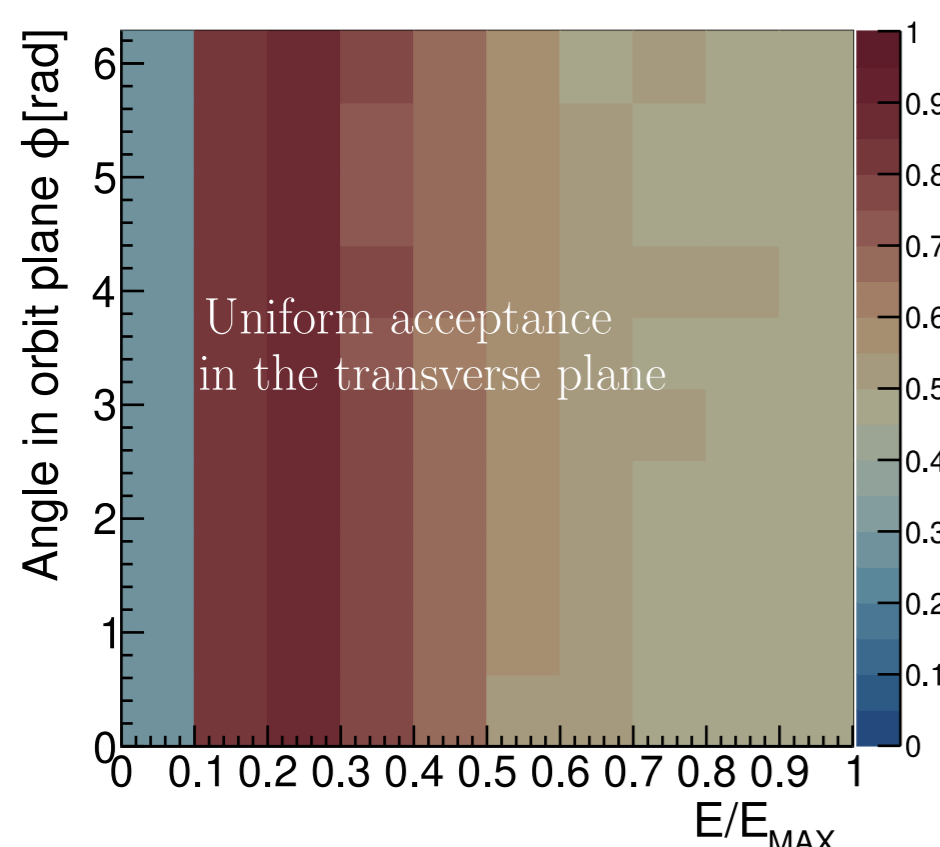
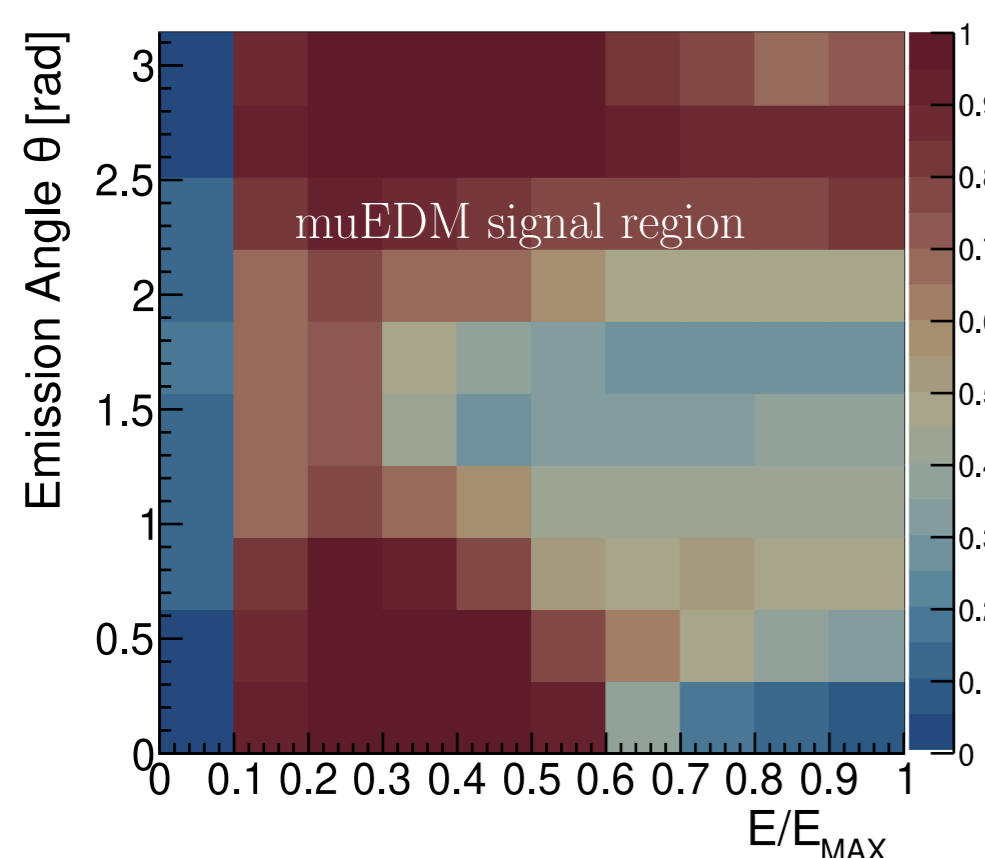
The muEDM experiment at Paul Scherrer Institute is designed to reach an unprecedented sensitivity on the electric-dipole moment of the muon (muEDM): $d_\mu < 6 \times 10^{-23} e\cdot\text{cm}$. A precursor of the experiment is being built to demonstrate the potentials of the newly proposed **frozen-spin technique** to measure the muEDM and will be operational in 2026 [1]. The tracker is the detector devoted to measuring the **up-down asymmetry** of the decay positrons.



Detector's Monte Carlo simulation

The detector's acceptance and resolutions of the kinematical variables are evaluated through a GEANT4 [2, 3] Monte Carlo simulation using a tracking algorithm built from GENFIT [4] tool.

2D Detector acceptance: momentum & polar angles θ & ϕ



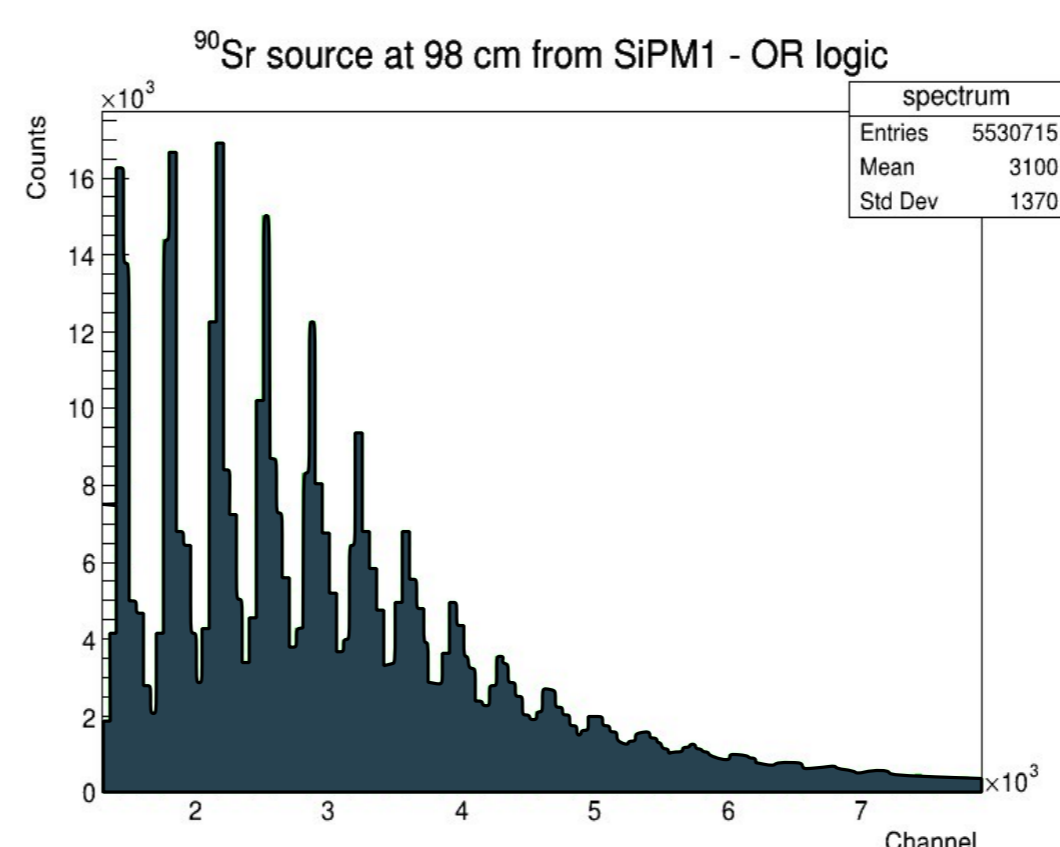
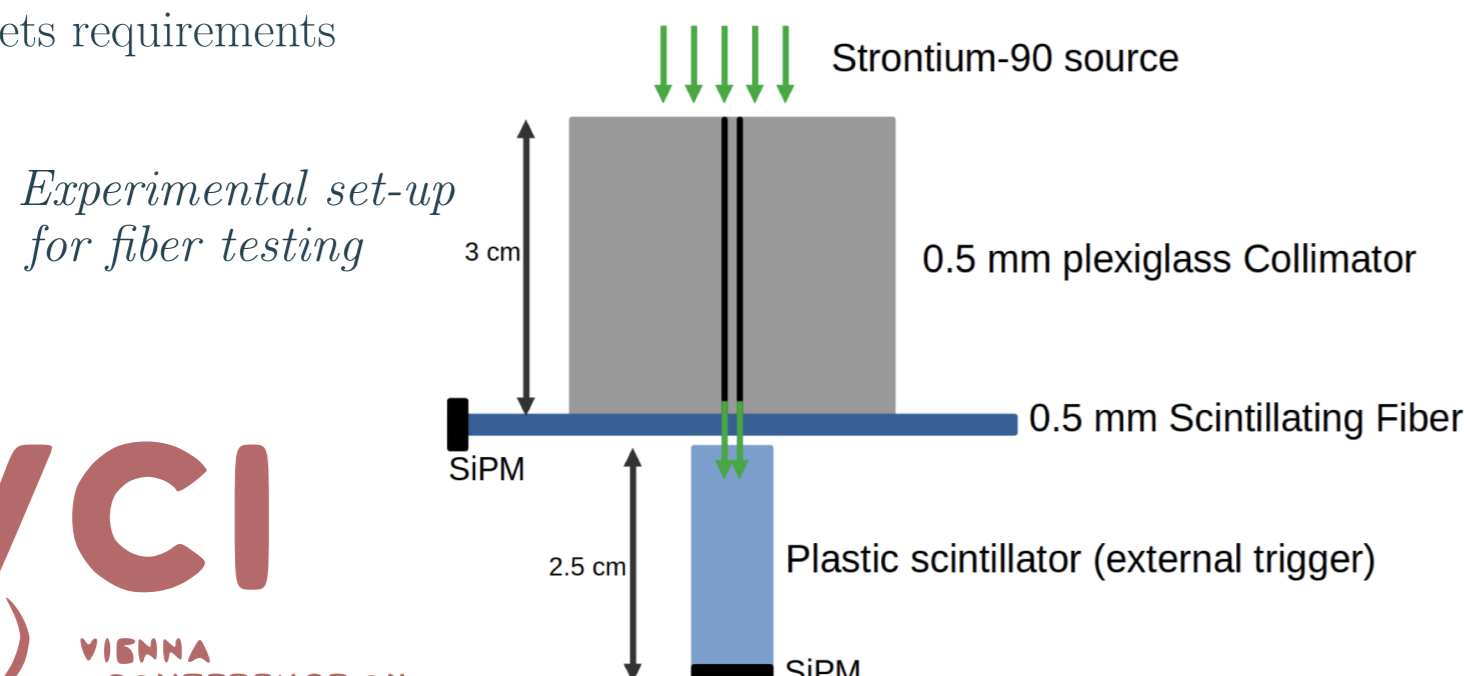
Performances in line for conducting the muEDM Phase-I measurement

Variable	Resolution
σ_p/p	0.05
σ_θ	10-30 mrad
σ_ϕ	10 mrad

Lab tests

Lab tests with a $\text{Sr}^{90} e^-$ source on a $500 \mu\text{m}$ fiber coupled to SiPM readout with the FERS board.

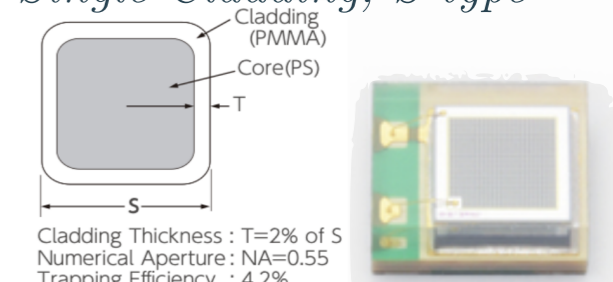
- ≥ 70% detection efficiency with single-end readout
- No significant attenuation along a 1 meter long fiber
- Meets requirements



A scintillating fiber tracker

- Fast detector against pile-up
- Tolerant against 3T magnetic field: SiPM coupling
- Highly segmented: ≈ 8000 fibers with $500 \mu\text{m}$ ϕ
- Compact & versatile

Kuraray SCSF-78, Square Single Cladding, S-type



Hamamatsu 13360-1350 PE
1.3 × 1.3 mm² 50 μm

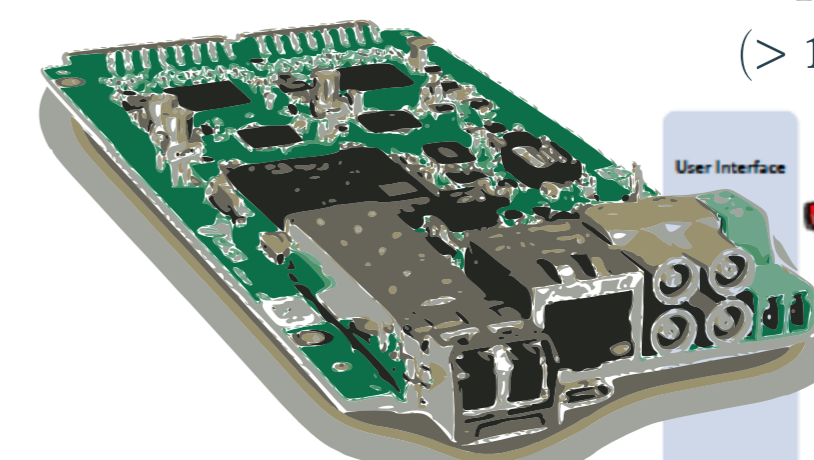
The detector geometry

- Stereo configuration for 1 mm 3D resolution of the mu coordinate
- 30 planes with $3 \times 10 \text{ cm}^2$ active area made of two layers of orthogonal fibers will be arranged in a clock-like configuration to optimize the measurement of $(g-2)_\mu$

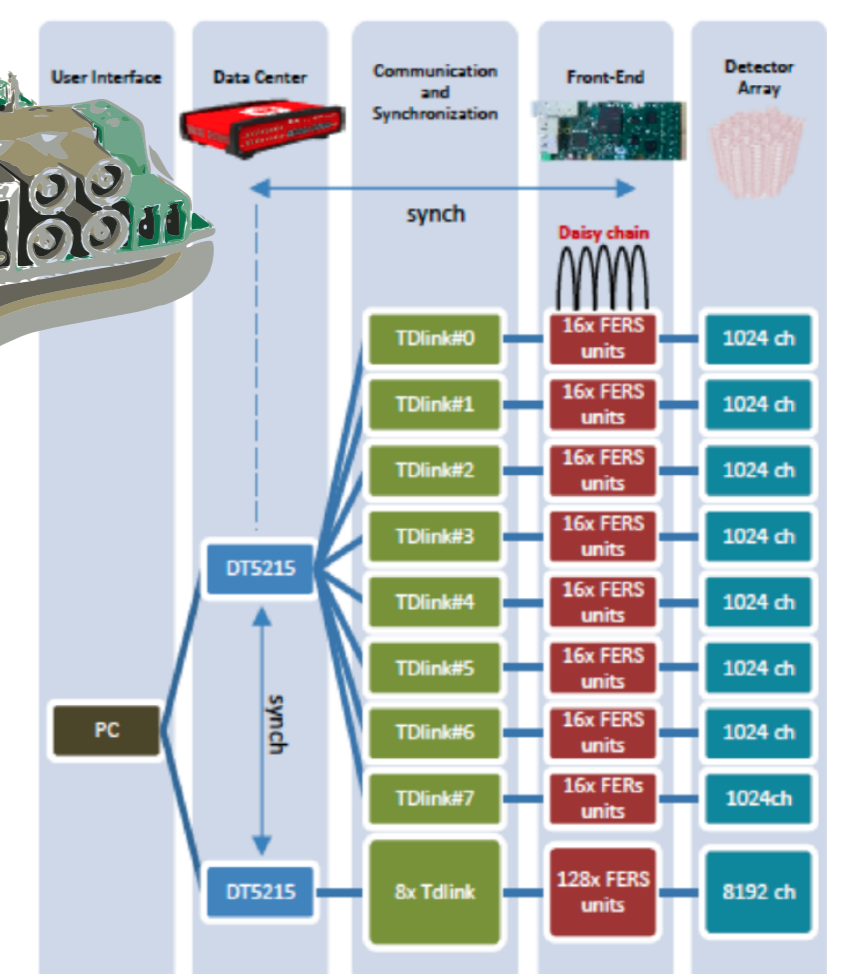
- 4 cylinders with axes parallel to the magnetic field and placed at different radii ($r = \{2.0, 2.4, 3.6, 4.0\} \text{ cm}$) each one composed of two layers of fibers arranged in a stereo configuration, compose a module optimized to measure the muEDM

Read out

- 4 fibers / SiPM: ≈ 2000 readout channels
- CAEN FERS A5200 board:
 - 64 read-out channels per board with MPPC powering
 - Scalable to large arrays
 - 200 ps resolution
 - ToT & multi-hit detection (> 100 kHz readout)



CAEN FERS A5200 board



References

- "Geant4—a simulation toolkit". In: *NIMA* 506.3 (2003), pp. 250–303. issn: 0168-9002.
- J. Allison et al. "Recent developments in Geant4". In: *NIMA* 835 (2016), pp. 186–225. issn: 0168-9002.
- Johannes Rauch and Tobias Schlüter. "GENFIT—a generic track-fitting toolkit". In: *JP: Conference Series*. Vol. 608. I. IOP Publishing, 2015, p. 012042.
- A. Adelman et al. *A compact frozen-spin trap for the search for the electric dipole moment of the muon*. 2025. arXiv: 2501.18979 [hep-ex].