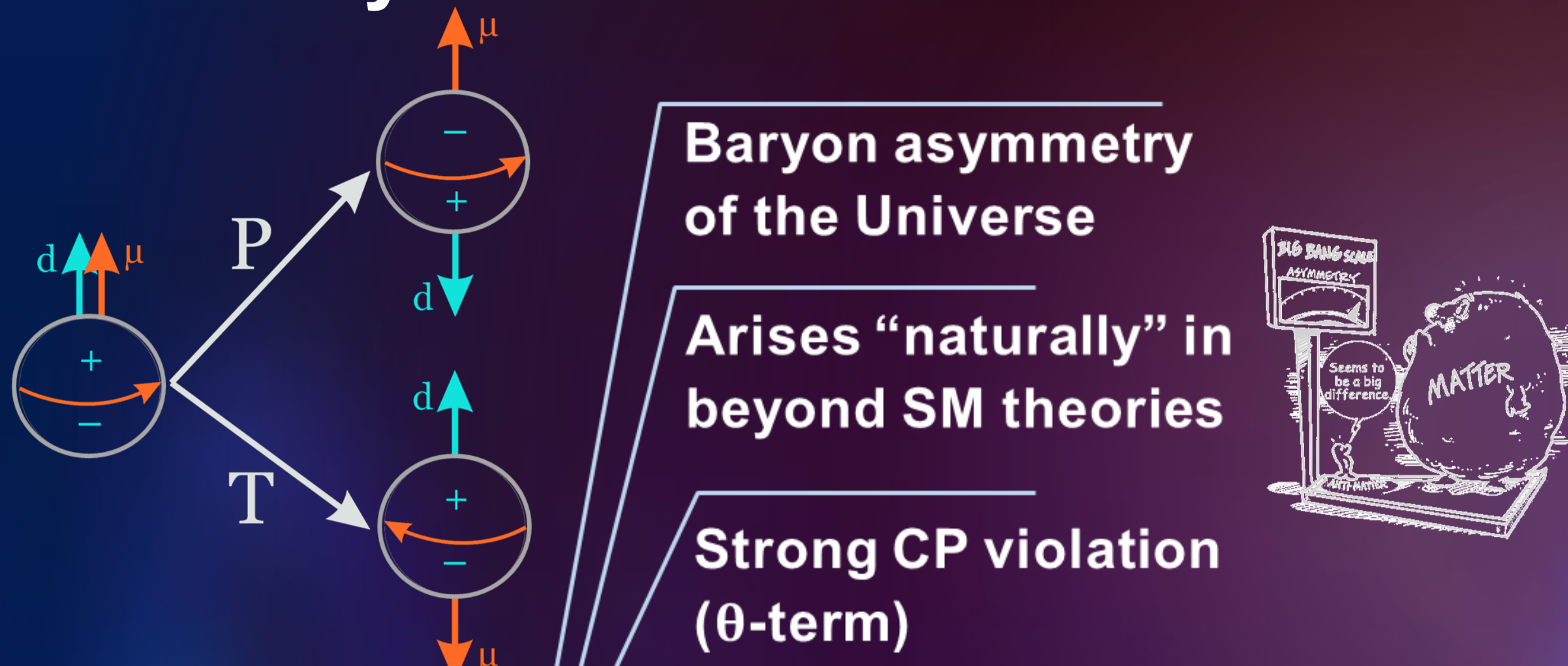




## Why measure muon EDM?



Baryon asymmetry of the Universe

Arises "naturally" in beyond SM theories

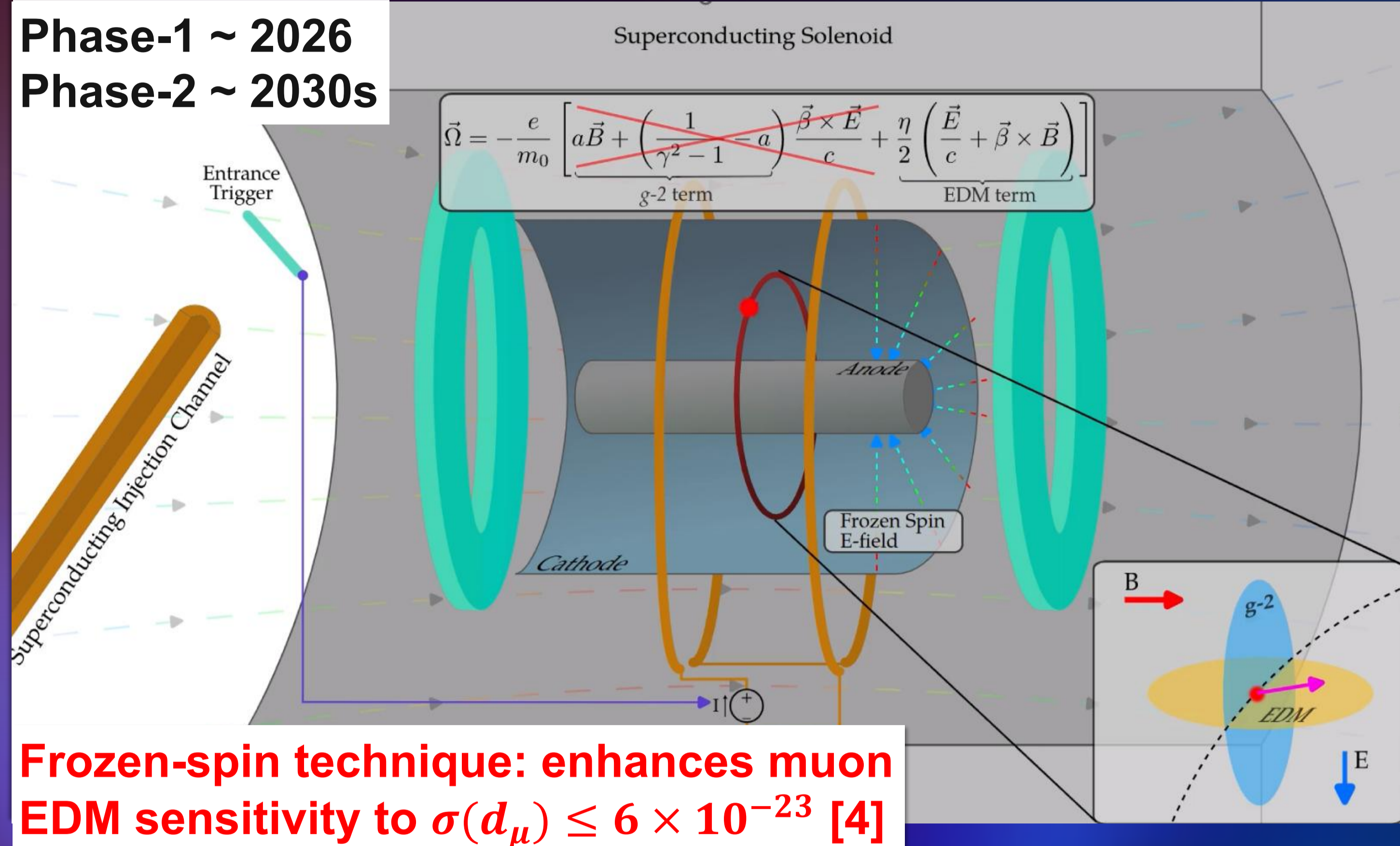
Strong CP violation ( $\theta$ -term)



EDM is a CP-violating, quantum observable:

- Standard Model-background free,  $d_{\mu}^{SM} \sim 10^{-38}$  e·cm [1]
- Sizeable in new physics models,  $d_{\mu}^{BSM} \sim 10^{-23}$  e·cm [2]
- Current limit at  $d_{\mu} = 1.8 \times 10^{-19}$  e·cm [3]

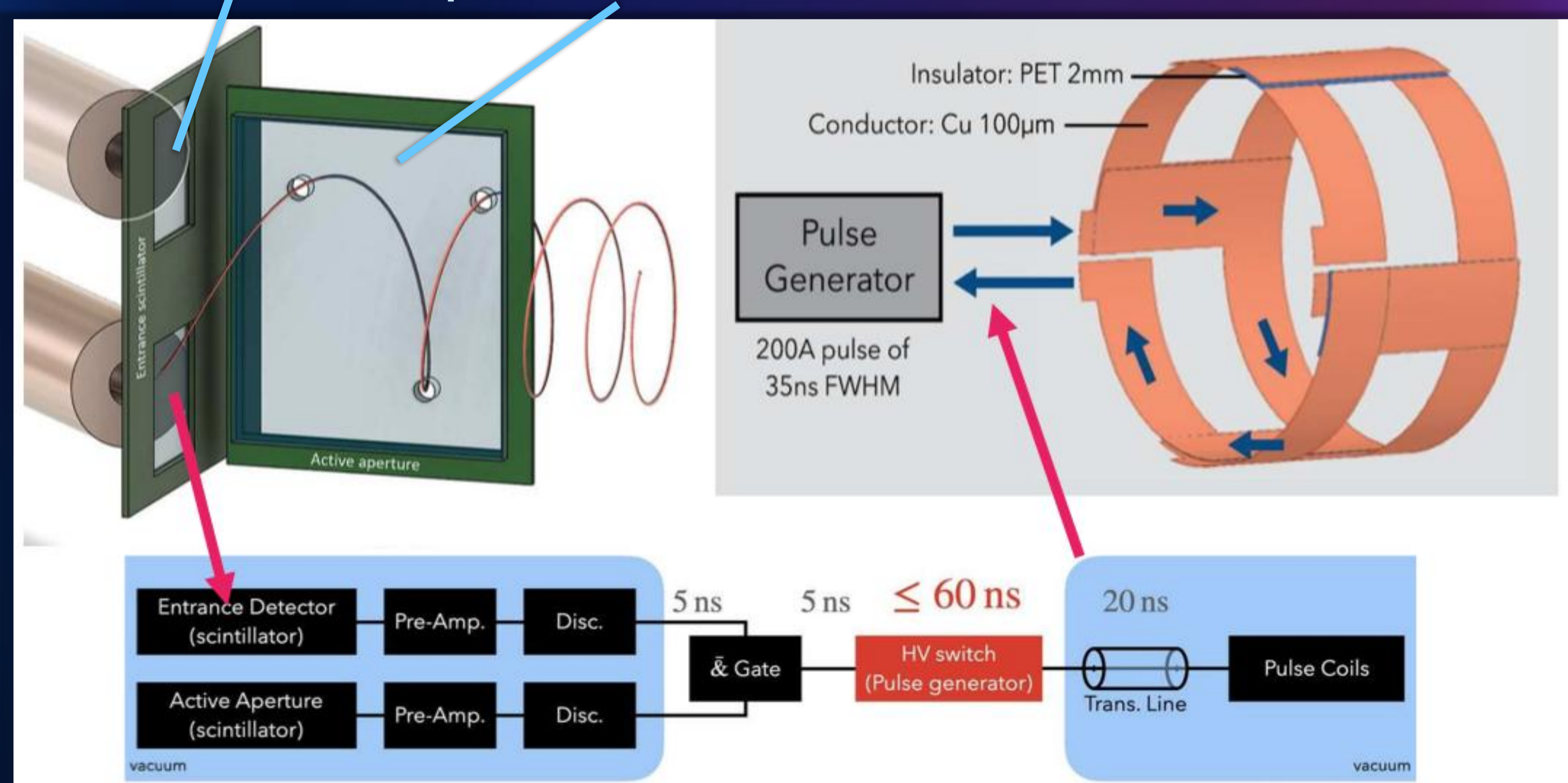
## muEDM experiment at PSI



**Frozen-spin technique: enhances muon EDM sensitivity to  $\sigma(d_{\mu}) \leq 6 \times 10^{-23}$  [4]**

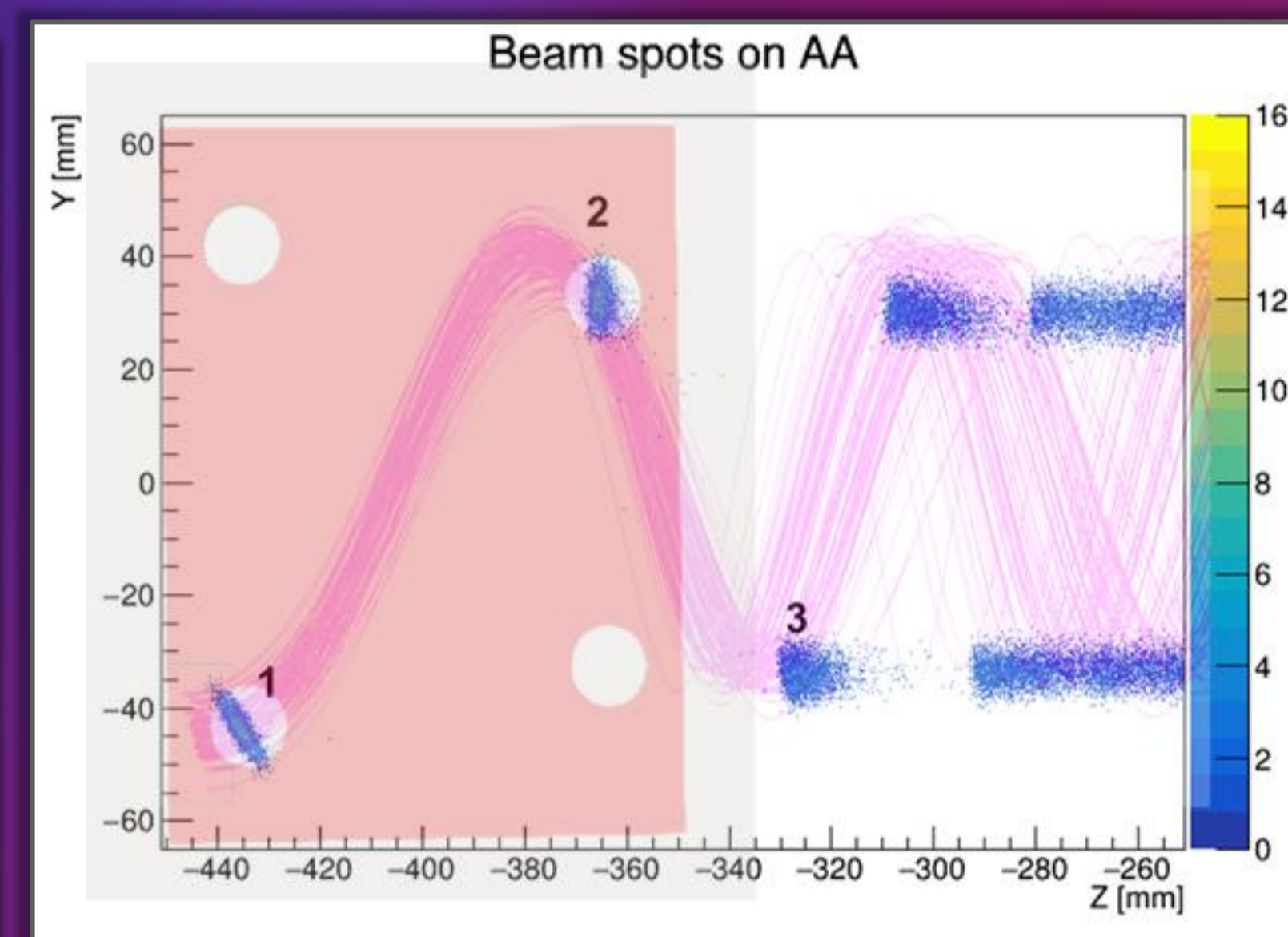
## Muon Trigger Detector

Gate: 100  $\mu$ m thin scintillators  
Aperture: 5 mm thick



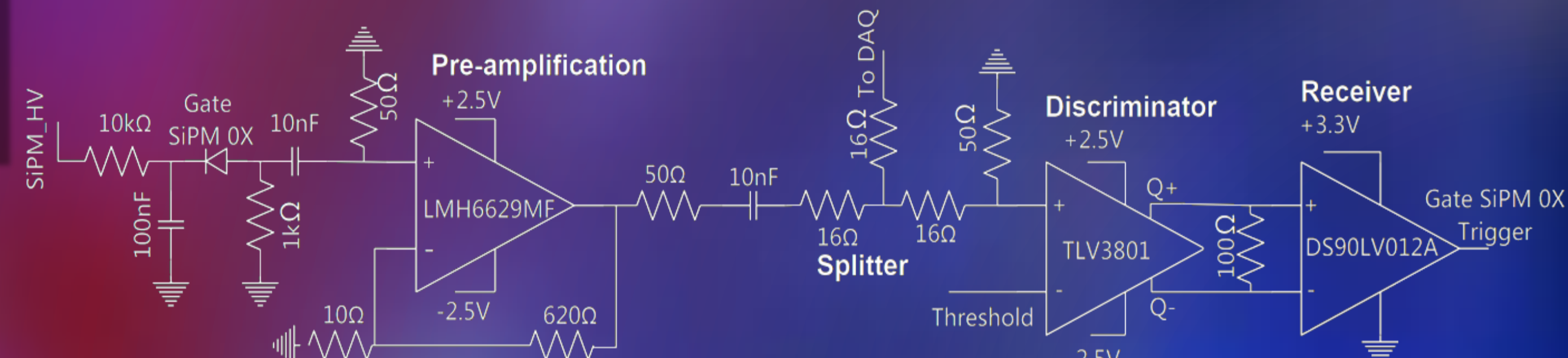
**Fast and precise detector:**

- activate pulse kicker field for muon storage
- Plastic scintillator + SiPMs for fast timing
- Trigger by Gate in anti-coincidence with Aperture



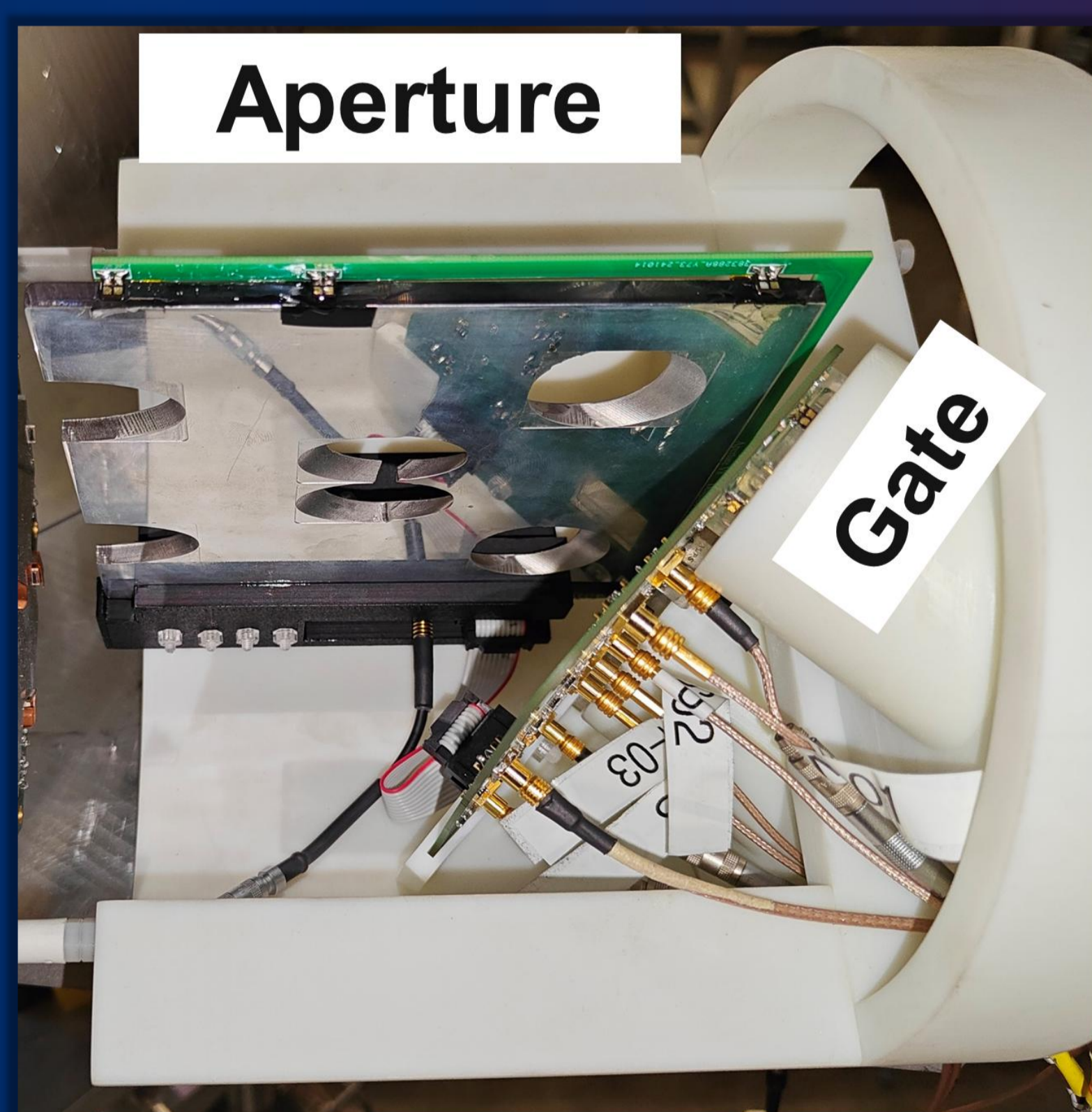
- Aperture geometry based on storable beam phase space
- **Precisely** selects storable muons to activate pulse kicker

Fast electronics readout:

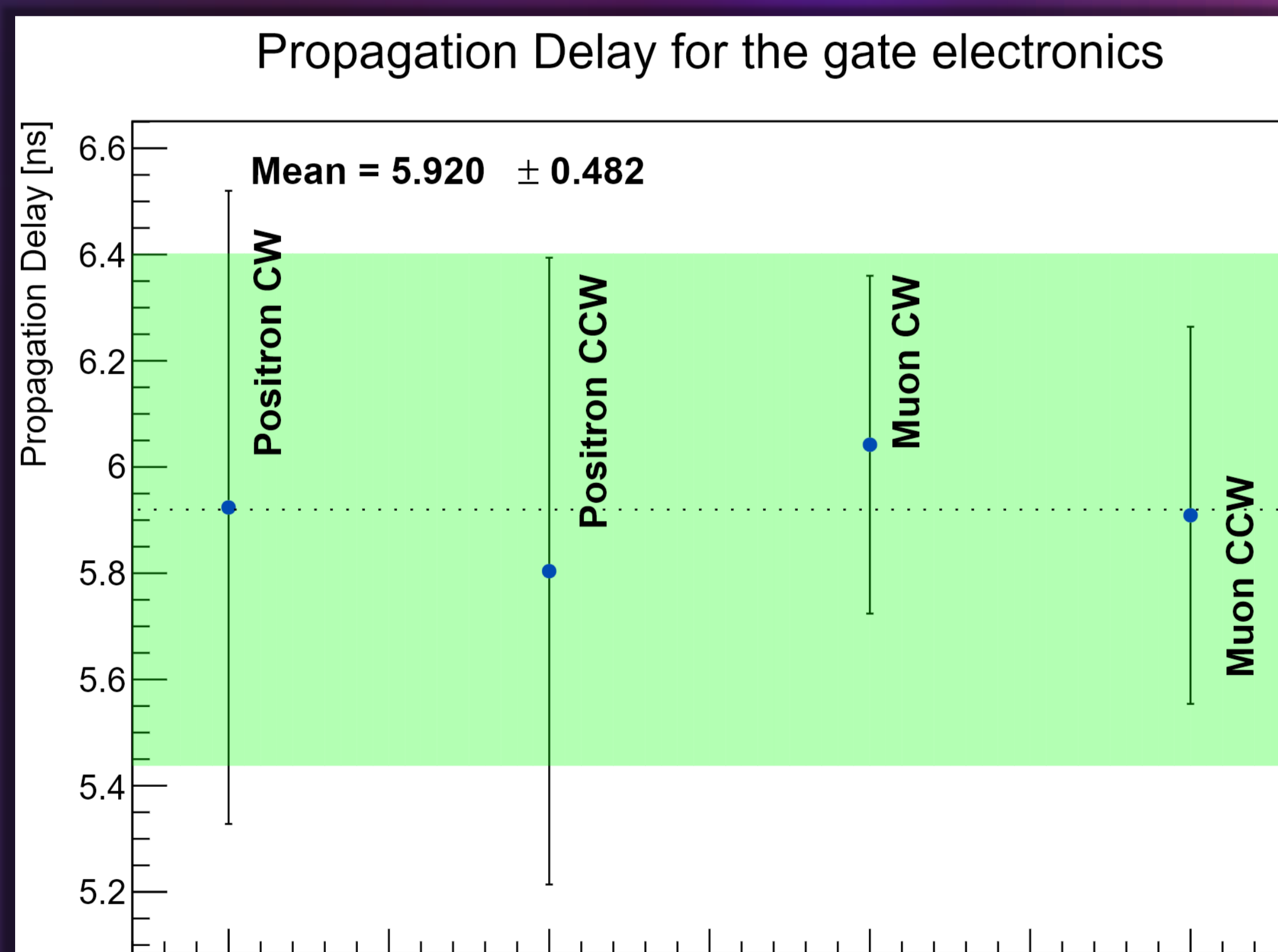


- Dedicated anti-coincidence circuit design
- **Fast** electronics producing LVTTTL signal

## Prototype in magnetic field @ PSI $\pi E1$ $\mu^+$ test beam

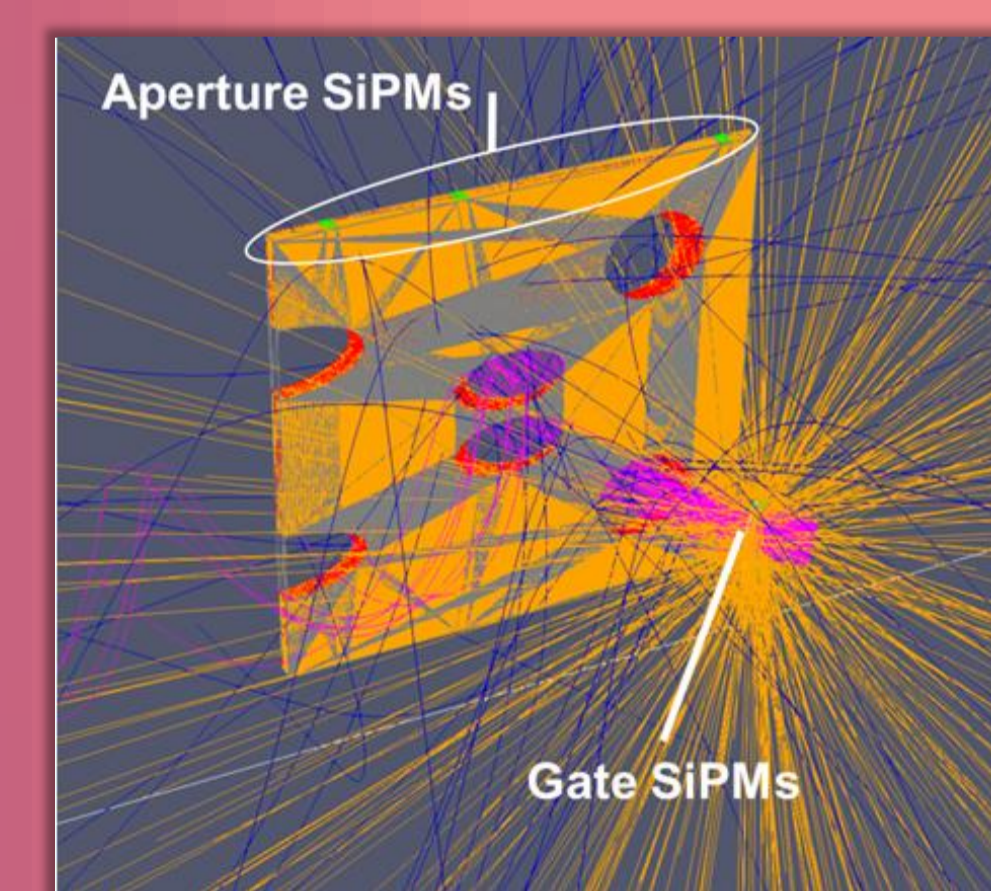


Trigger Detector installed at the  $\pi E1$  test beam



Fast electronics satisfying trigger timing requirement [5]

$\mu^+$   
 $e^+$   
Opt. phot.



	Measurement Data		Optical Simulation	
Aperture	1.69	2.20	0.56	2.51
Aperture	74.90	21.19	72.14	25.80
	Exit Hit	No Exit Hit	Exit Hit	No Exit Hit

Detector response validated with Geant4-based simulation

**Summary** We developed a fast and precise muon trigger detector for PSI's muEDM experiment. The prototype was tested at the  $\pi E1$  muon beamline, with preliminary results demonstrating the  $\leq 6$  ns trigger signal delay. Measured event topologies show strong agreement with Geant4 simulation, indicating robust understanding of the detector response.

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- [2] A. Crivellin, *et al.*, *Phys. Rev. D* **98**(2018) no.11, 113002
- [3] G. W. Bennett, *et al.*, *Phys. Rev. D* **80** (2009), 052008
- [4] A. Adelmann, *et al.*, *arXiv:2501.18979*
- [5] T. Hu, *et al.*, *arXiv:2502.11186*