



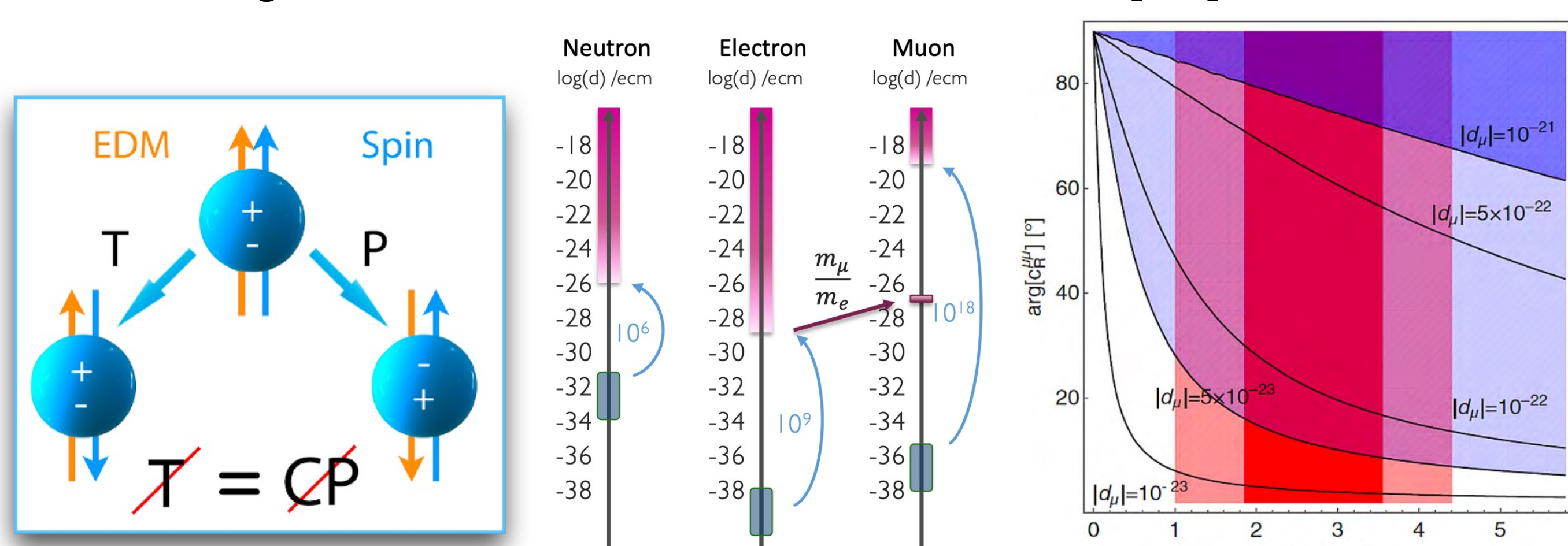
Development of the muon entrance trigger system for the PSI muEDM experiment

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Physical Motivation for muEDM

Why EDM are interesting?

- A search for new physics that is “background-free”, the complementarity to the LHC search
- Hint for the Beyond Standard model
 - Many BSM models predict large EDMs (SUSY, left-right symmetric models, and extended Higgs sectors [1])
- Matter-antimatter asymmetry requires more CP Violation source
 - CP violation exists in the phase in the CKM matrix and the coefficient $\bar{\theta}$ in the SM strong interaction Lagrangian [1], but it's insufficient
 - EDM means T violation, the new CPV source within CPT conservation
 - The muon EDM of SM prediction is small ($\sim 10^{-38} e \text{ cm}$ [2])
- Muon g-2 and EDM are connected in some BSMs [3,4]



The best limit on the muEDM is provided by the BNL muon g-2[5]:

$$d_\mu = (0.0 \pm 0.9) \times 10^{-19} e \text{ cm}, |d_\mu| < 1.8 \times 10^{-19} e \text{ cm} \text{ (95\% C.L.)}$$

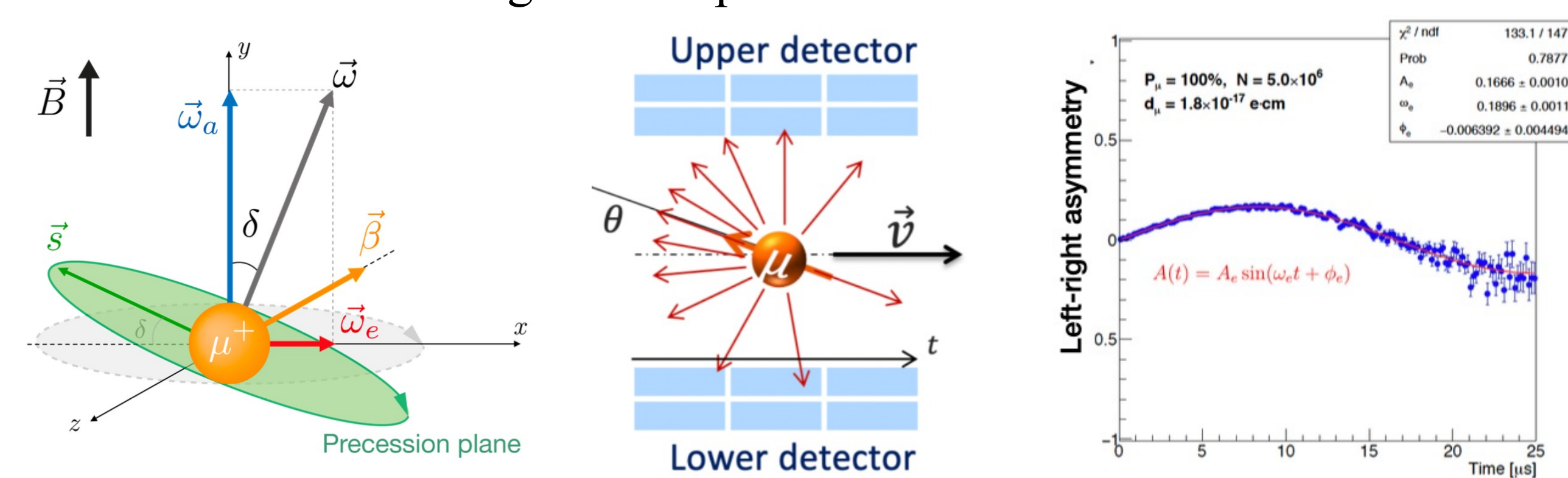
muEDM Experiment At PSI

Experimental devices and detectors

- μ^+ from Pion-decay \rightarrow high polarization $p \approx 95\%$
- Injection through superconducting channel
- Fast scintillator triggers pulse
- Magnetic plus stops the longitudinal motion of μ^+
- Weakly focusing field for storage
- Electrodes provide an electric field for frozen spin
- Pixelated detector for e^+ tracking

Frozen-spin approach, and asymmetry due to EDM measured

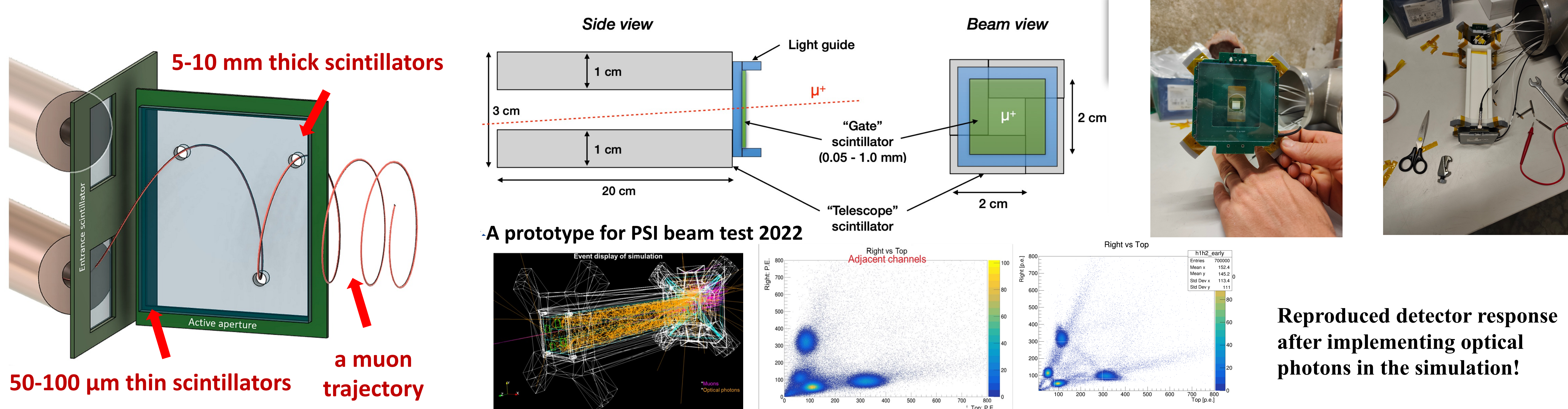
- Freeze g-2 by applying a radial E-field of $\sim a_\mu B c \beta \gamma^2$
- no anomalous precession in the storage plane: $\omega_a = 0$
- EDM causes an increasing vertical polarization



muEDM Muon Entrance Detector: Prototype

Providing a timing signal for muon entrance into storage solenoid and a trigger signal to the pulsed magnetic kicker

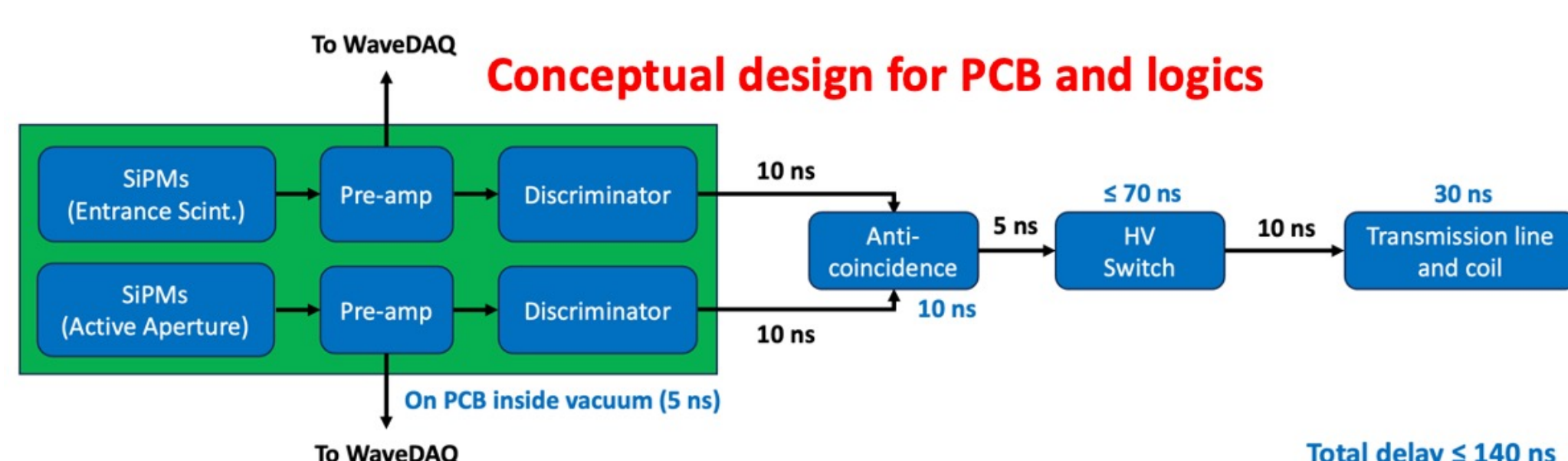
To be fully efficient while keeping at the minimum the multiple scattering of the detected muon



Reproduced detector response after implementing optical photons in the simulation!

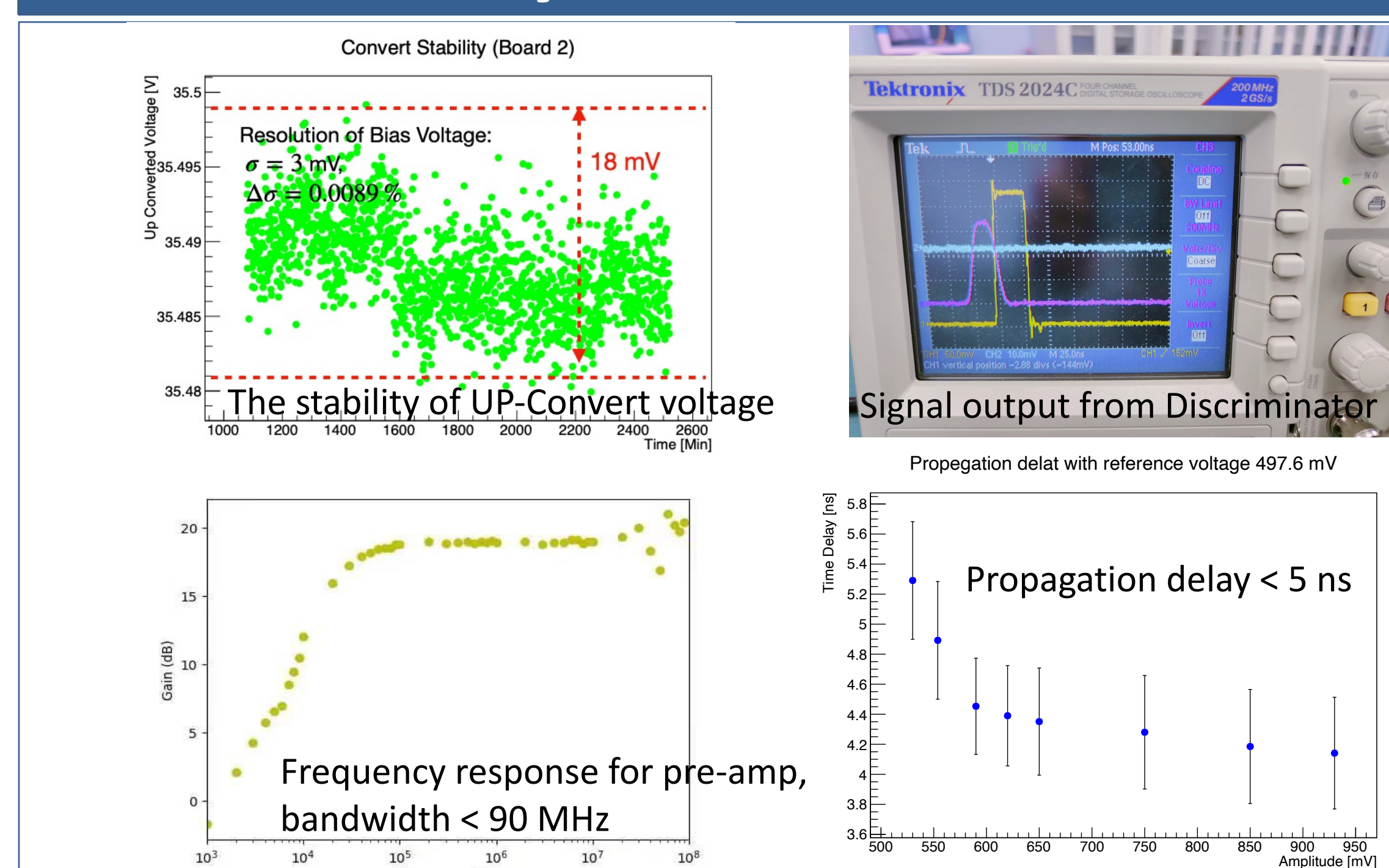
R&D for fast electronics in progress

Strict propagation delay for the electronics of the entrance detector



Testing of PCBs with individual components completed.
Finetuning PCB board with multiple components in progress

Preliminary results for the module



Summary

1. We are developing an entrance detector composed of a gate detector and a telescope detector for the PSI muon EDM experiment
2. The strict propagation delay for the electronics of the entrance detector is not greater than 5 ns
3. The PCBs with individual components were completed, and finetuning at present
4. The UP-Convert and Preamp modules show stability and sufficiently good performance
5. The propagation delay was tested to 4~5 ns for the electronics prototype

References

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