

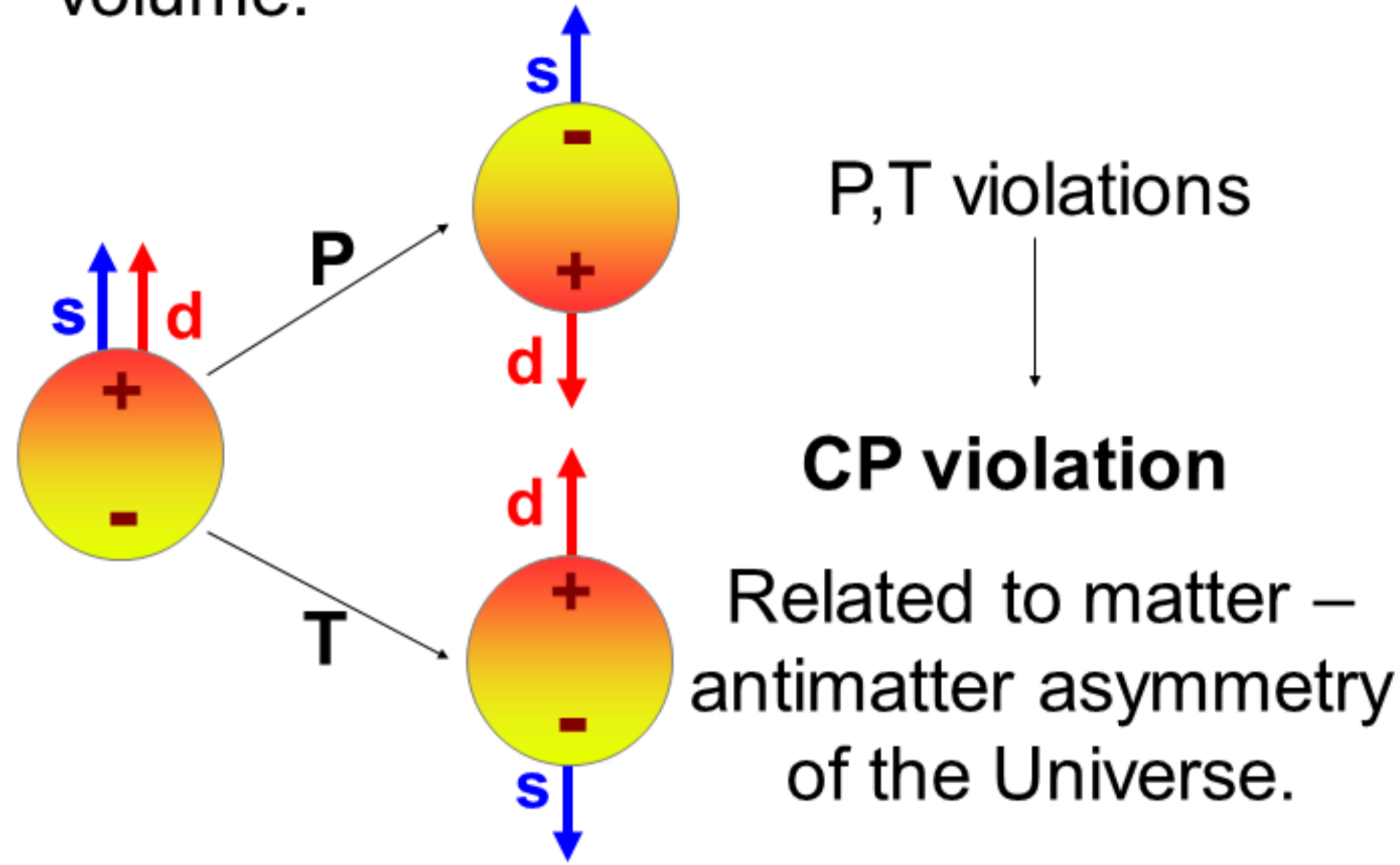
Spin Coherence Time Studies at COSY

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Motivation: Search for Physics Beyond the Standard Model

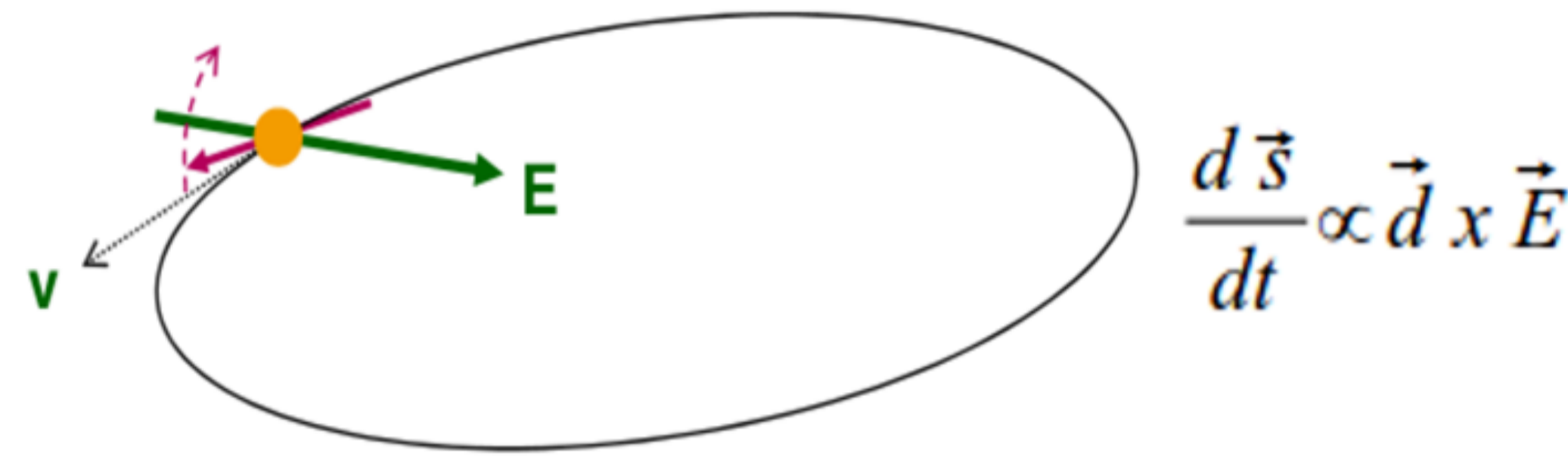
Electric Dipole Moment (EDM)

Charge separation within the particle volume.



Observation of a charged-particle EDM

- Storage ring with a radial electric field.
- Start with spin along velocity.

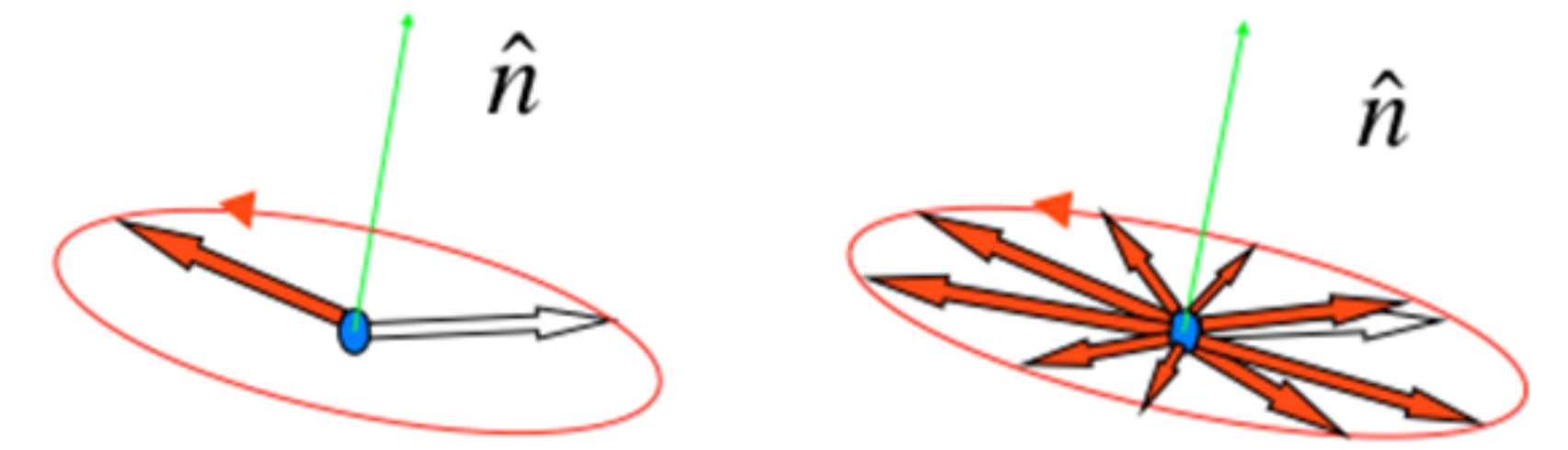


EDM signal = spin precession out of the horizontal plane

Spin Coherence Time

Test of Physics beyond SM requires a sensitivity of 10^{-29} e·cm.

Prerequisite: maintain horizontal polarization lifetime for 1000 s.



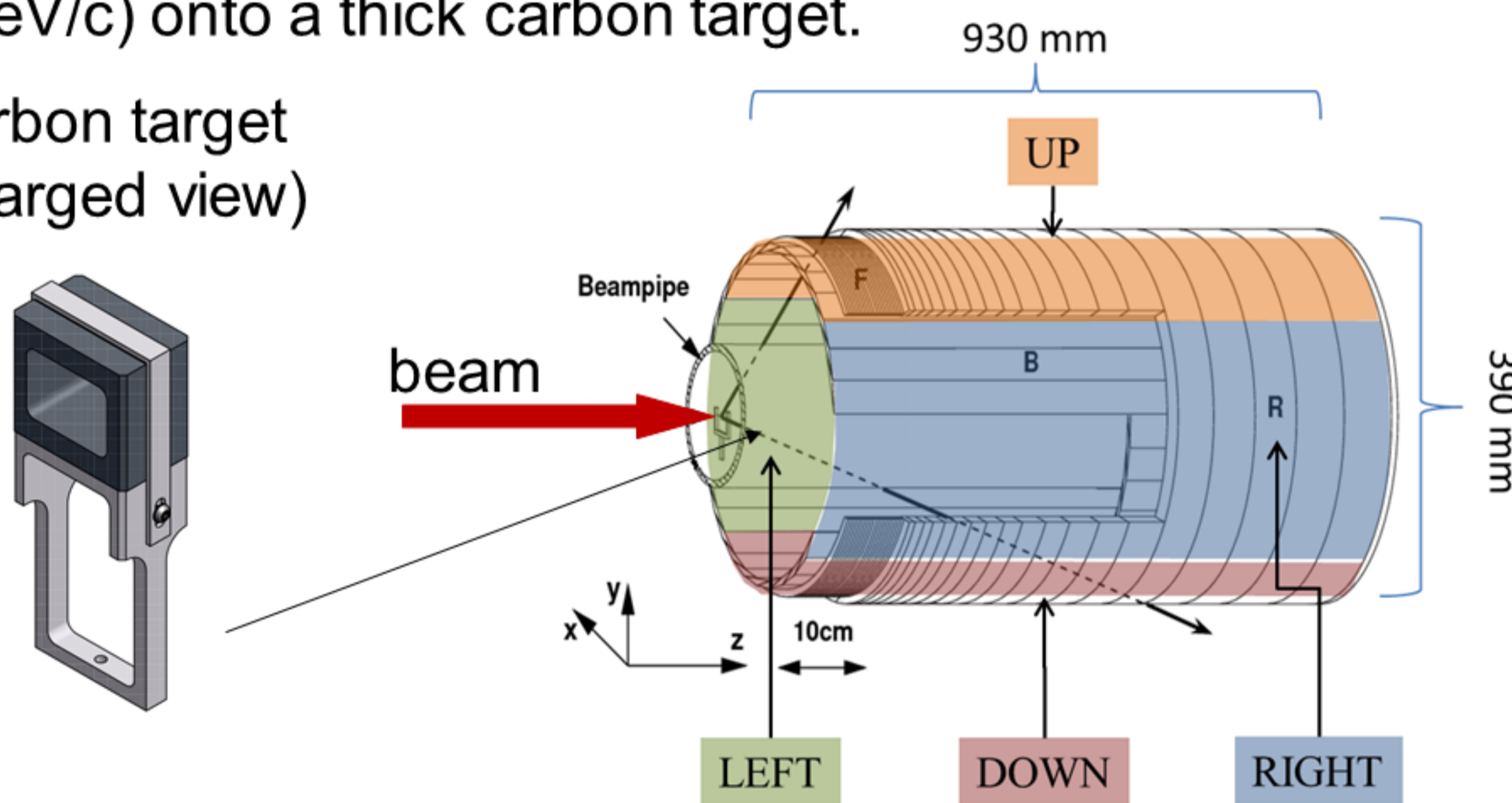
Horizontal polarization lifetime = Spin Coherence Time (SCT)

Experiment: Feasibility Studies at COSY

EDDA polarimeter

Continuous extraction of the polarized deuteron beam (970 MeV/c) onto a thick carbon target.

Carbon target (enlarged view)

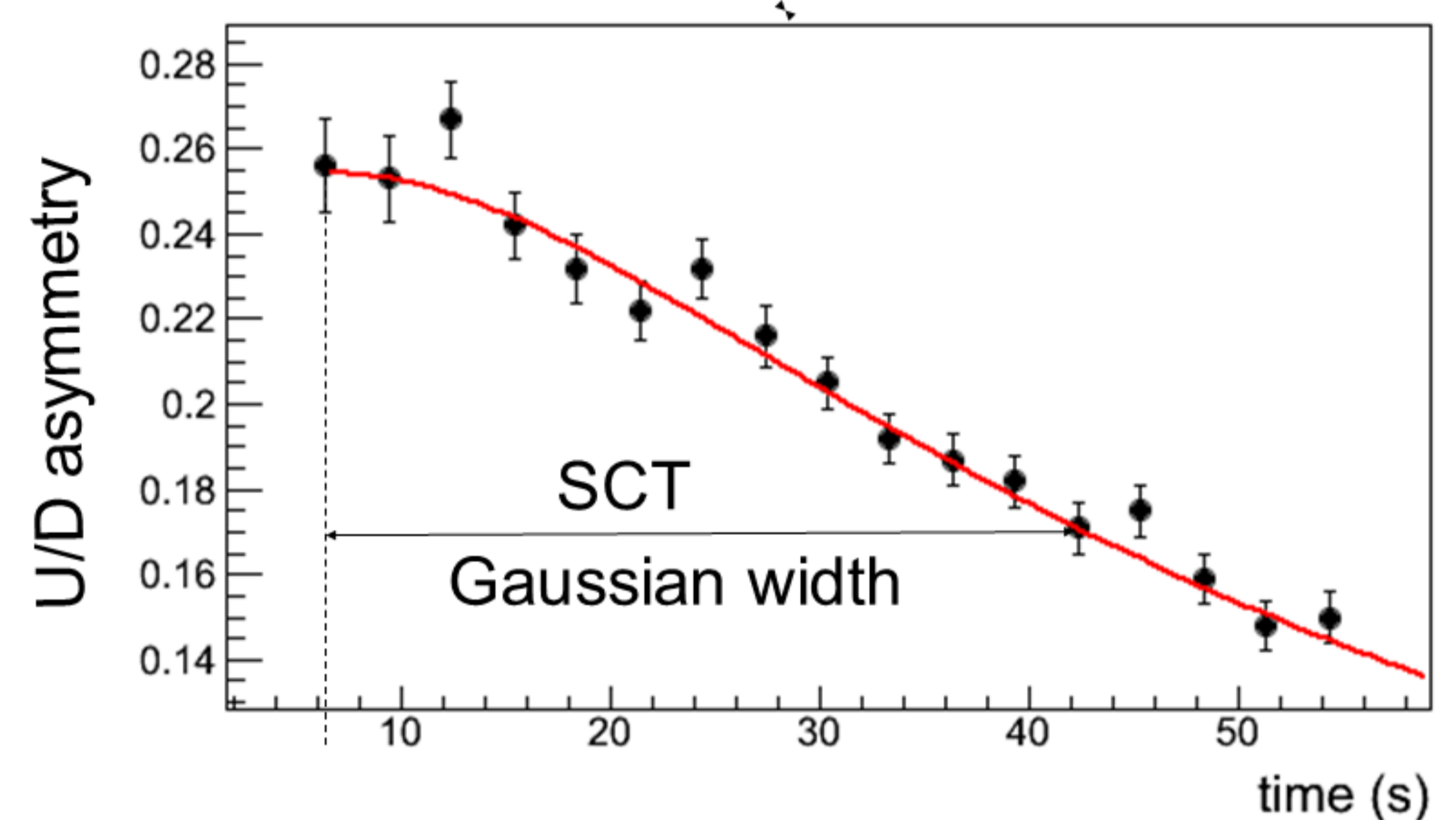


Up/Down (U/D) asymmetry from the deuteron-carbon scattering is proportional to the horizontal polarization.

$$\text{Efficiency} = \frac{\text{Number of detected particles}}{\text{Total number of particles}} \sim 10^{-3}$$

DAQ: new development!

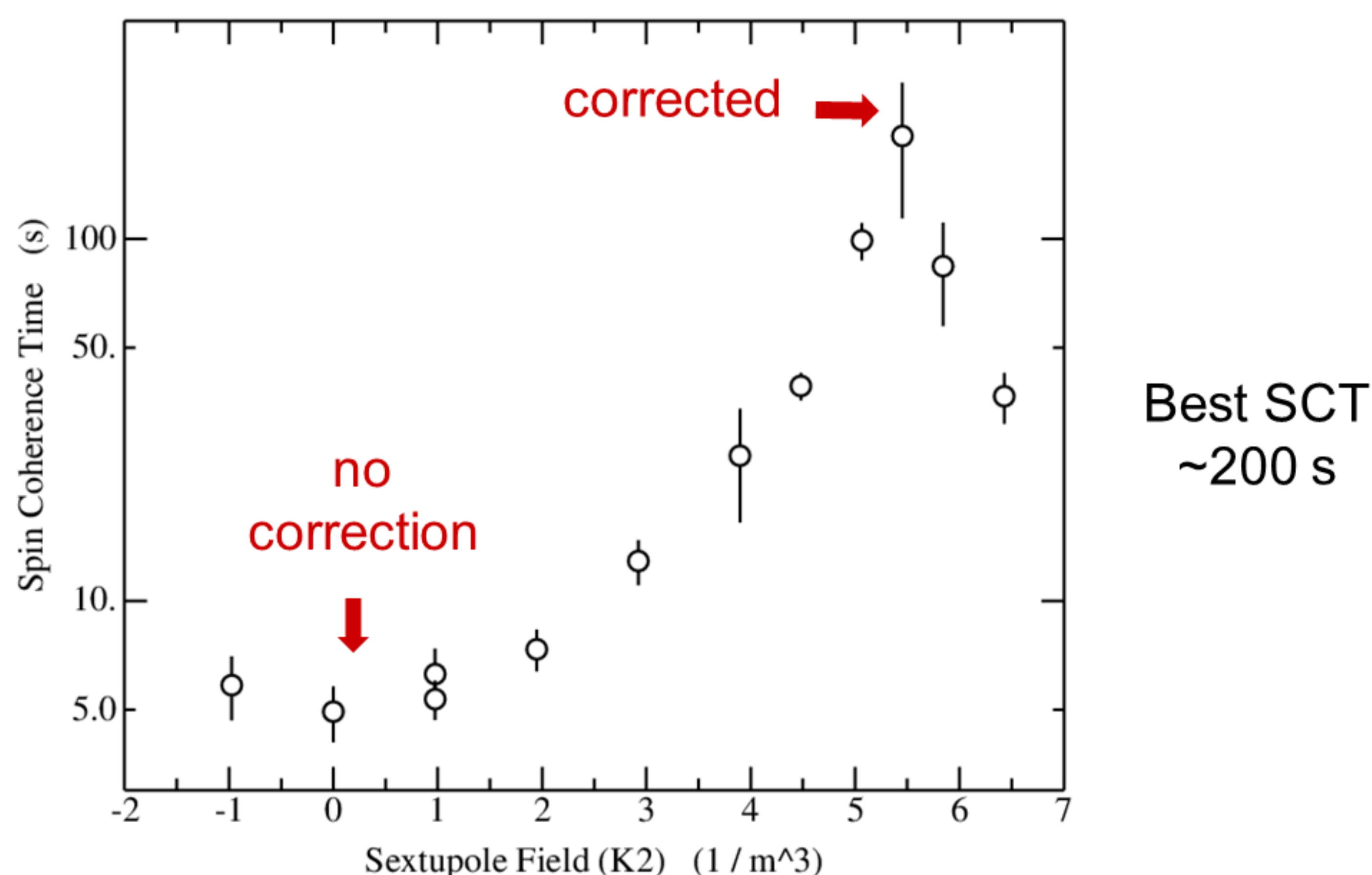
- Spin precesses in the COSY ring plane with a frequency of ~ 120 kHz.
- Dedicated DAQ needed to unfold the polarization precession.



Spin precession frequency known with a precision of $\sim 10^{-7}$

Results

Sextupole fields successfully used to correct differences in spin precession rate arising from oscillations of the particles in the beam.



More studies show:

1. Optimal sextupole setting independent of horizontal beam size.
2. Linear effect confirms models.

