

Spin tune mapping at COSY

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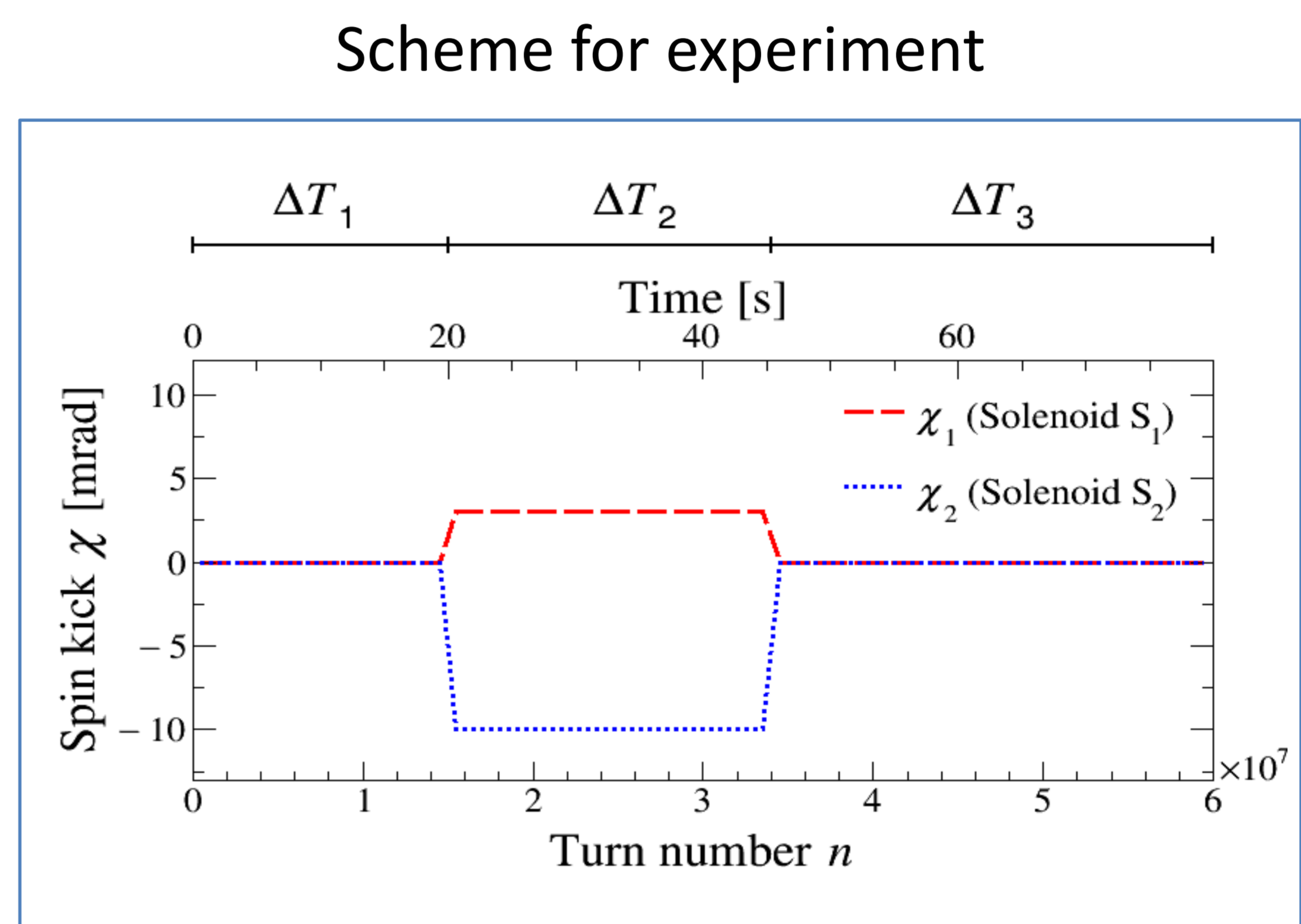
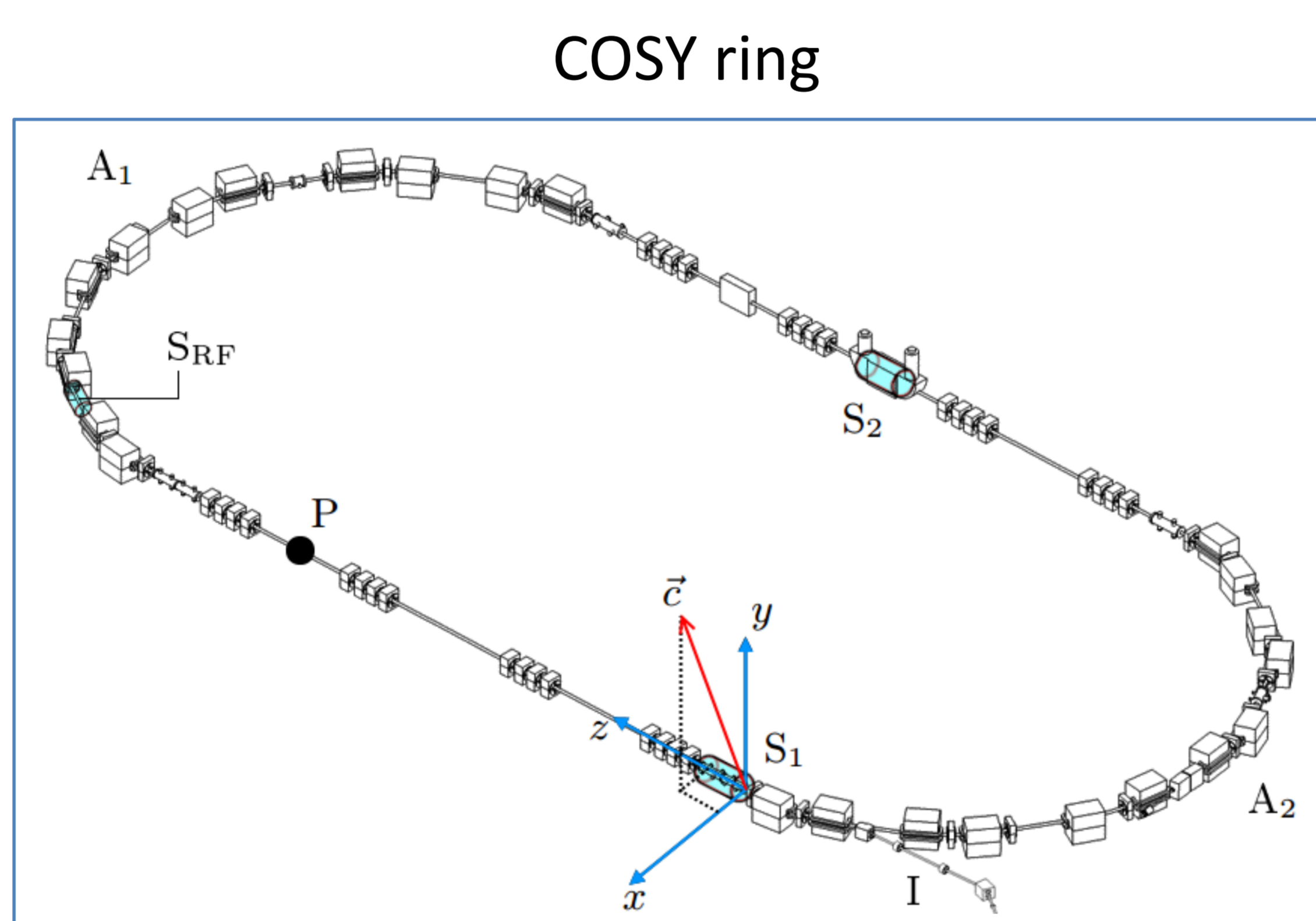
Motivation: Systematics at EDM searches

- Magnetic Dipole Moment of particle is much greater than its Electric Dipole Moment
- High precision spin tune: a tool to quantify the systematic effects due to Magnetic Dipole Moment

Method: Spin tune mapping

- Two solenoids at COSY switched on
- Spin tune map $\Delta v_s(\chi_+, \chi_-)$ consists of the spin tune measurements $v_s(\chi_1, \chi_2)$ on the mesh $\chi_1 \times \chi_2$ of solenoid's spin kicks
- Build the map of spin tune shifts Δv_s

- Arcs (A_1, A_2)
- Solenoids (S_1, S_2)
- Polarimeter (P)



- Solenoids on at ΔT_2
- Solenoids off at $\Delta T_1, \Delta T_3$

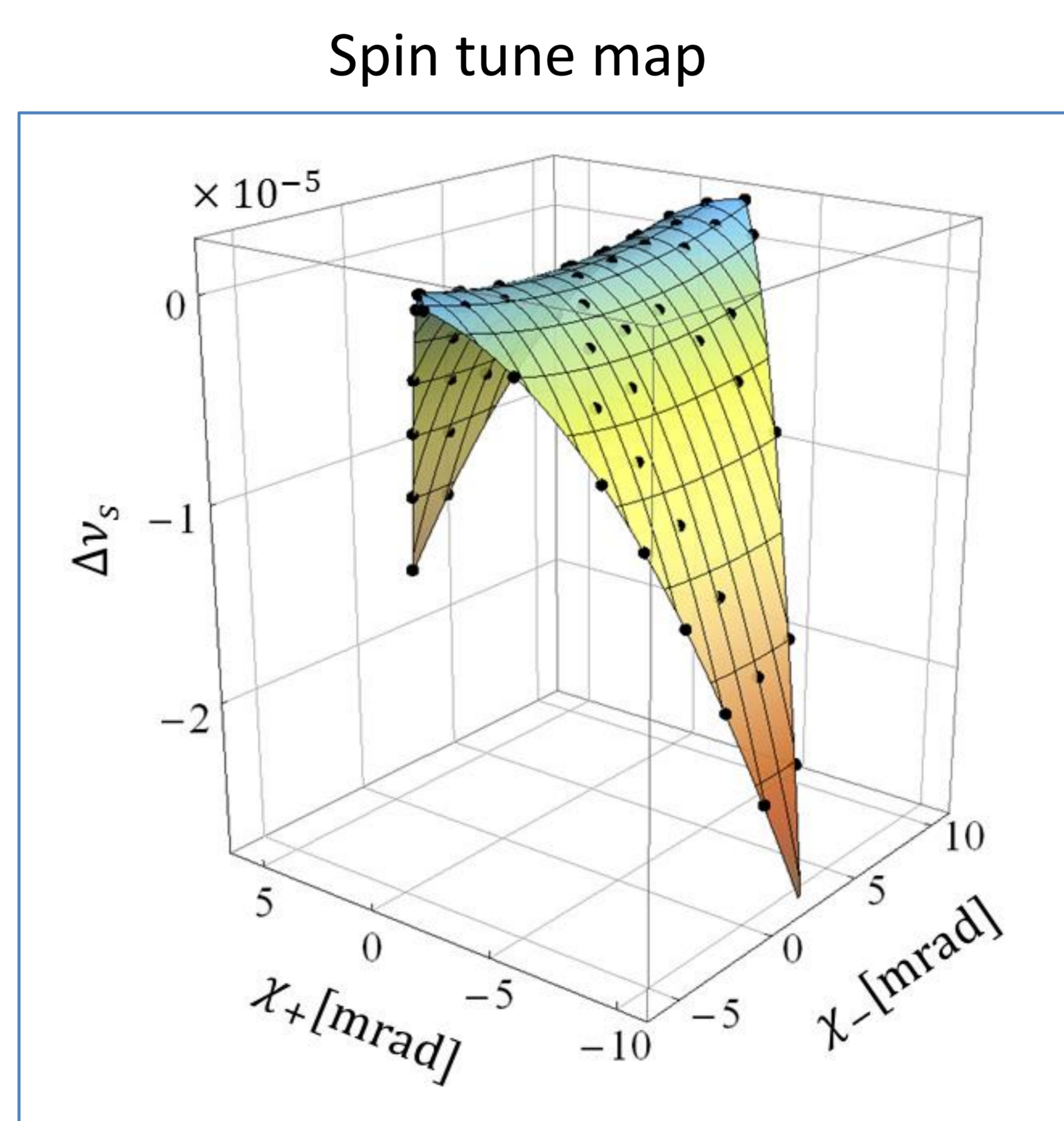
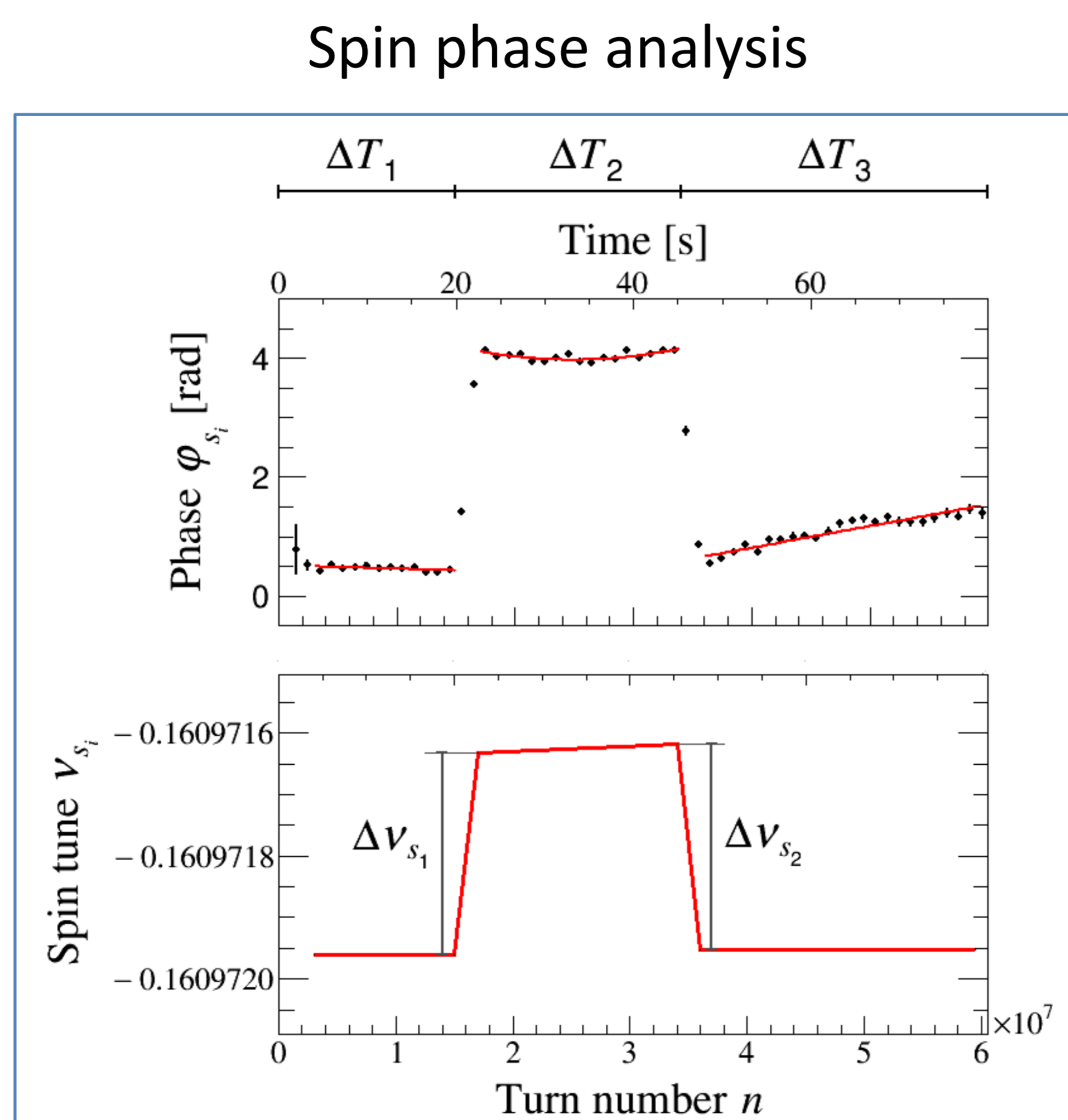
Results: Spin tune map of COSY

- Spin tune shift Δv_s from nominal value v_s is resolved with precision $\delta v_s = 3.2 \cdot 10^{-9}$
- Angular precision **2.8 μrad** to the direction of stable spin axis \vec{c} achieved – very sensitive probe of systematics!

- Deviation of measured spin phase from assumed value

- Spin tune shift

$$\Delta v_s = \frac{1}{2}(\Delta v_{s_1} + \Delta v_{s_2})$$



- A feature: saddle point – non-zero location is a sign of systematic effects

$$\chi_{\pm} = \frac{1}{2}(\chi_1 \pm \chi_2)$$