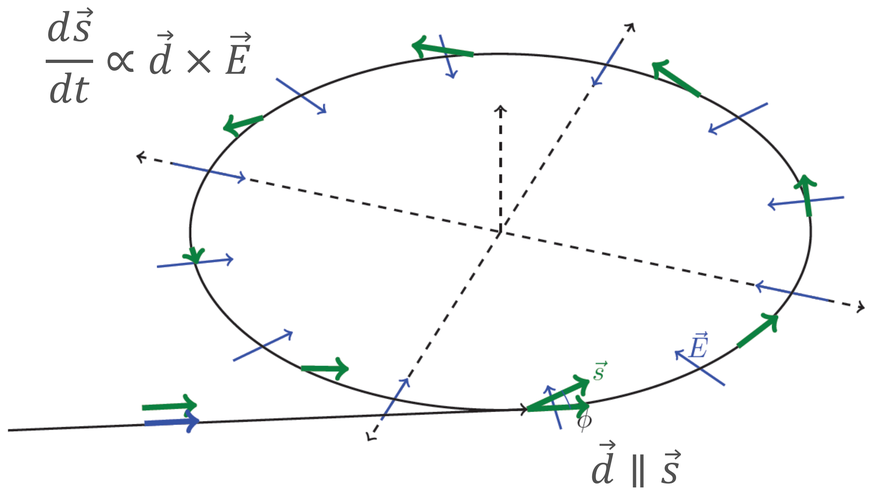
Upgrade of Electronic Systems at COSY

Fabian Hinder (FZJ, RWTH Aachen University)

Search for Charged Particle Electric Dipole Moments (EDMs)

Generic Idea

1. Apply **electric field** $\vec{E}$ to particle in storage ring
2. Due to EDM $\vec{d}$, **spin rotates** out of horizontal plane
3. Measure **vertical polarisation** build up ⇒ EDM $\vec{d}$

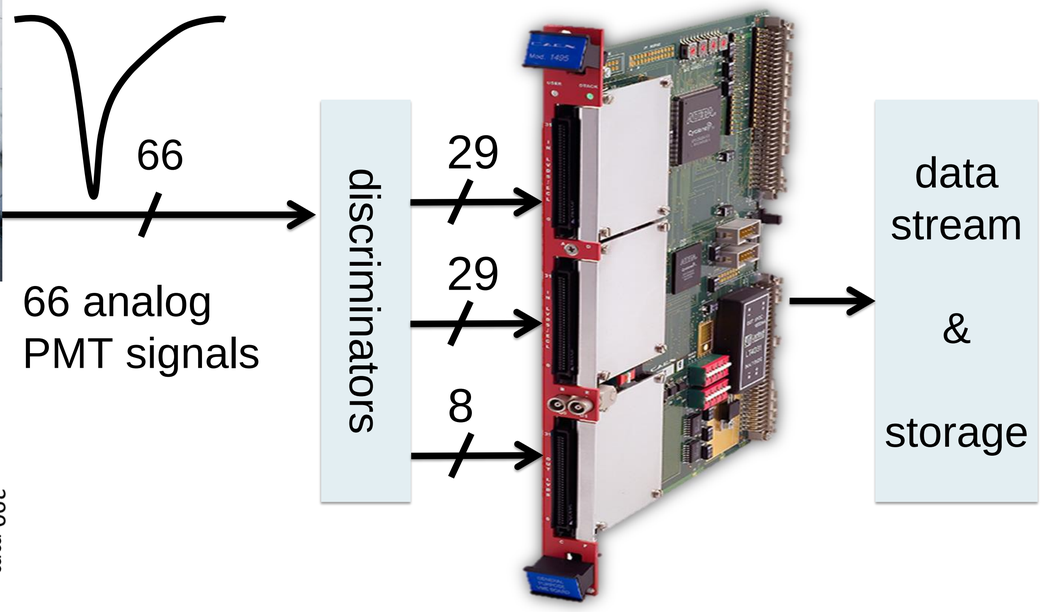


Key Requirements:

- Study systematic effects
- Maximize horizontal polarisation lifetime (→ ~1000 s)

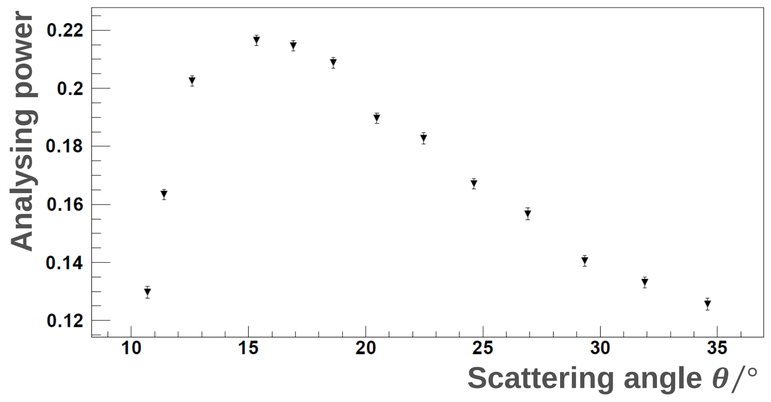
EDDA Polarimeter

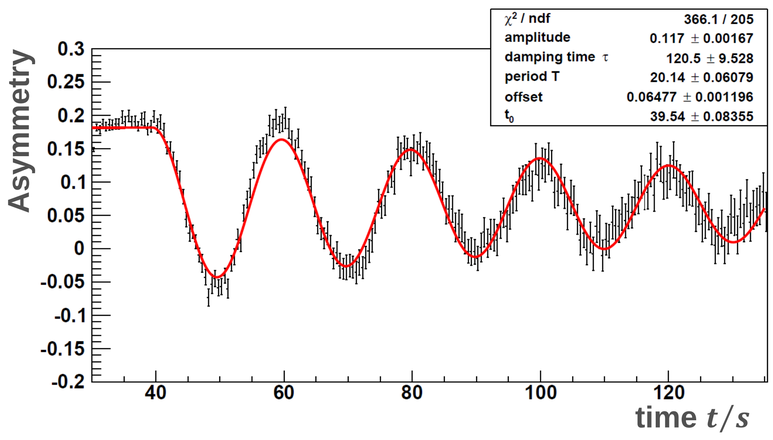
Developed Firmware & DAQ System



Upgraded electronic is installed, running and used for polarisation measurements

Results





Development of new Ultra Precise Beam Position Monitors (BPMs)

One major source of systematic effects

Radial $\vec{B}$ field mimics EDM if:

$\mu B_r \approx d\, E_r$ with $d = 10^{-29}$ e·cm and $E_r = 10$ MV/m

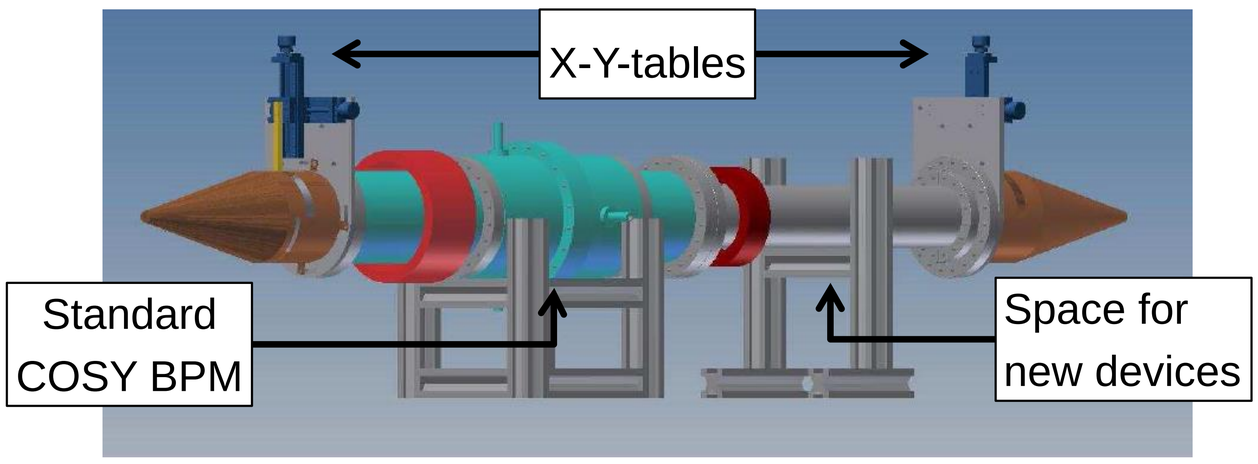
$$\Rightarrow B_r = \frac{dE_r}{\mu} = \frac{10^{-22}\text{eV}}{3.1 \cdot 10^{-8}\text{eV/T}} \approx 3 \cdot 10^{-17}\ \text{T}$$

Solution

Two counter rotating beams

1. Separation of beams sensitive to B_r
2. Compensate separation with BPMs

Development and test of BPMs in a "LAB COSY beam pipe"

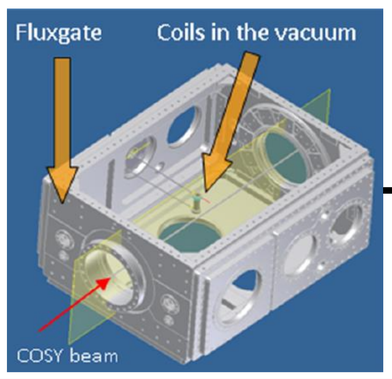


One possible BPM system based on SQUIDs*

Place SQUIDs near beam and measure magnetic field

⇒ Calculate position from magnetic field distribution

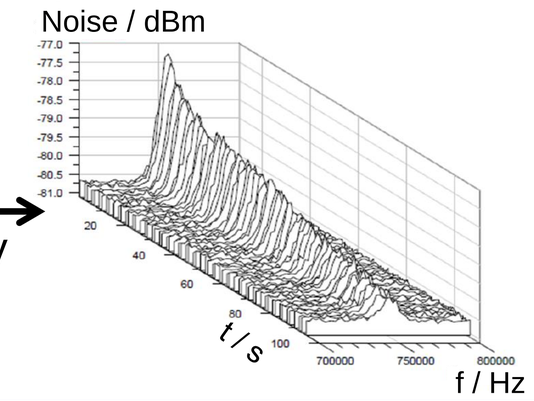
First noise measurements with one pickup coil



COSY signal

revolution frequency

750 kHz



* Superconducting QUantum Interference Device

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