A Polarimetry concept for the EDM experiment at COSY



Paul Maanen JEDI Collaboration | Physics Institute III B, RWTH Aachen University DPG Frühjahrstagung March 27, 2015



Introduction

Detector concept

Simulation studies

Summary & Outlook

March 27, 2015 A Polarimetry concept for the EDM experiment at COSY 2/15 Paul Maanen



Design goals for an EDM polarimeter

- EDM search in storage rings: Let Electric Dipole Moment (EDM) interact with fields, wait for polarization change.
- Current candidate method for EDM search implicates a linear buildup of polarization with time at $\Delta P = O(10^{-6}/1000s)$
- Design goals for polarimeter:
 - Large FoM
 - Minimal influence on beam
 - High sensitivity to systematic effects
 - Good long term stability and reproducibility



Nuclear scattering polarimetry

- Nuclear scattering cross section for scattering of polarized particles: $\sigma(\theta, \phi) = \sigma_0(\theta) \cdot (1 + P_y A_y(\theta) \cdot \cos(\phi))$
- Measure left-right asymmetries in cross section: $P_y = \frac{1}{A_y} \frac{L-R}{L+R}$
- May need to also include up, down to account for tensor polarization.
- Currently using dC scattering at 270 MeV







Target choice



- Carbon was chosen as working choice.
- Large analysing power, high elastic cross section
- Most other target also favor forward region.















Readout Concept



- Triggerless readout: Use waveform digitizers and read out every on every crossing of beam and target.
- Use FPGA-based online analysis; could provide data for feedback system.





First Step 4x12=48 LYSO 4x15=60 BGO

Final Version LYSO & BGO



March 27, 2015 A Polarimetry concept for the EDM experiment at COSY 9/15 Paul Maanen





Simulation studies (cont'd)



• Elastically scattered deuterons retain almost complete beam energy.



Simulation studies (cont'd)



- Break-up has almost no analyzing power, so discard it.
- Protons and neutrons from break-up are energetically well separated.

 \implies Complete stop of particles provides good signal separation.

• Inelastic reactions carry some analysing power, so maybe keep these.



Simulation studies (cont'd)





Simulation studies



March 27, 2015 A Polarimetry concept for the EDM experiment at COSY 13/15 Paul Maanen





Summary & Outlook

- We have a candidate layout for JEDI polarimeter.
- Crystals and electronics have been ordered for hardware tests.
- Will explore gain from tracking capabilities.
- Work on mechanical setup in progress.
- By the end of 2015, first prototype test is expected ...

Thank you for your attention

Any questions?

