



Towards the EDM Polarimetry

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B. Lorentz*

CBAC 2017 #7 | Exp. No.: E002.5

▪ Introduction

- Future goals: Polarimeter at ANKE target station

▪ Latest Results

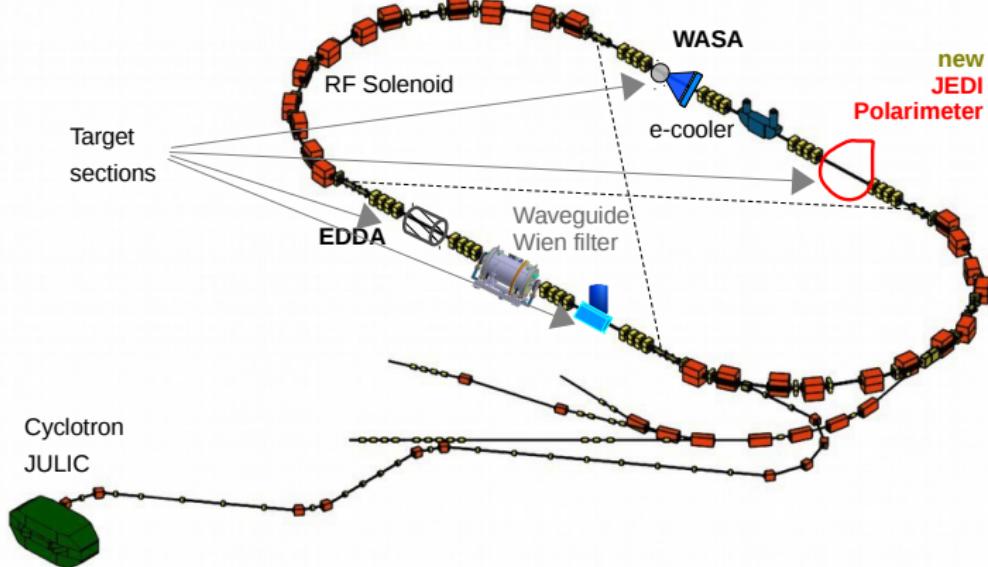
- Hardware test, Software development, DAQ optimization, G4 Simulation, GEM, Voltage supply, ...

▪ Proposed Beam Time

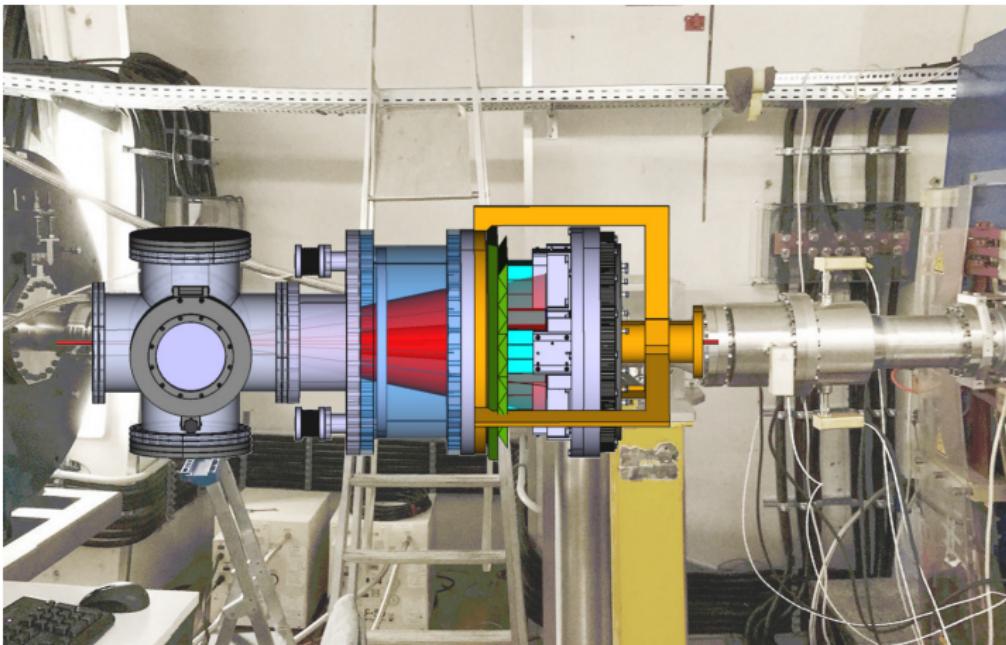
- Further DAQ improvements, GEM, Total cross-section measurement, ...

Polarimeter Setup @ COSY

Plans for 2018



Internal Polarimeter Prototype of the Calorimeter Part



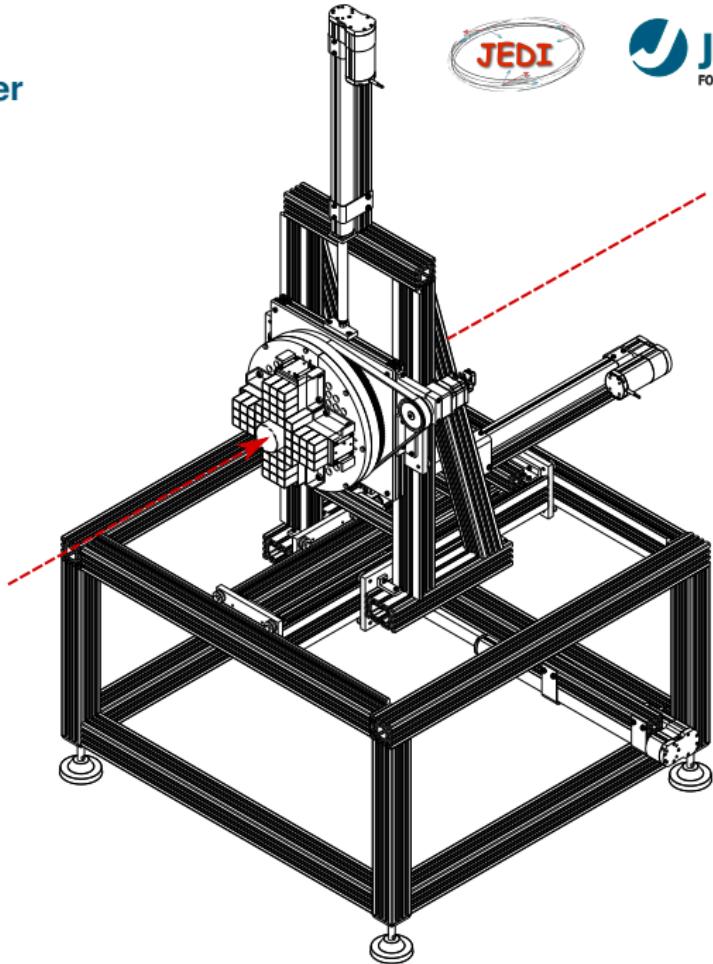
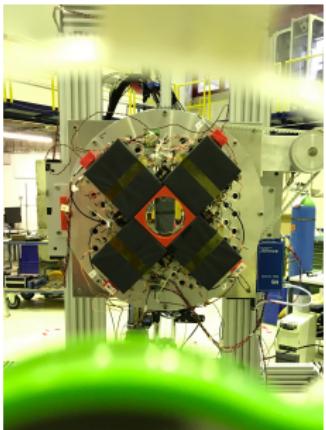
Latest Results

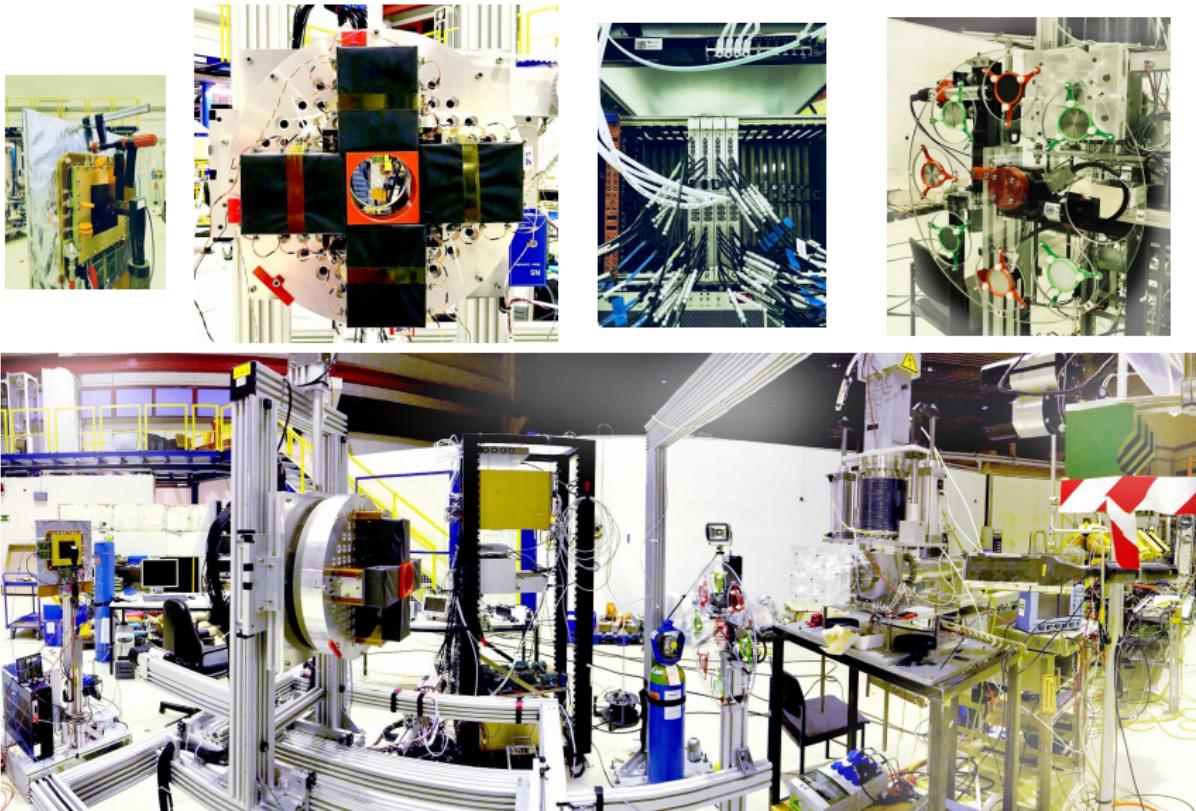
- Hardware test, Software development, DAQ optimization,
G4 Simulation, GEM, Voltage supply, ...

Beam time (ended today morning)

New Setup

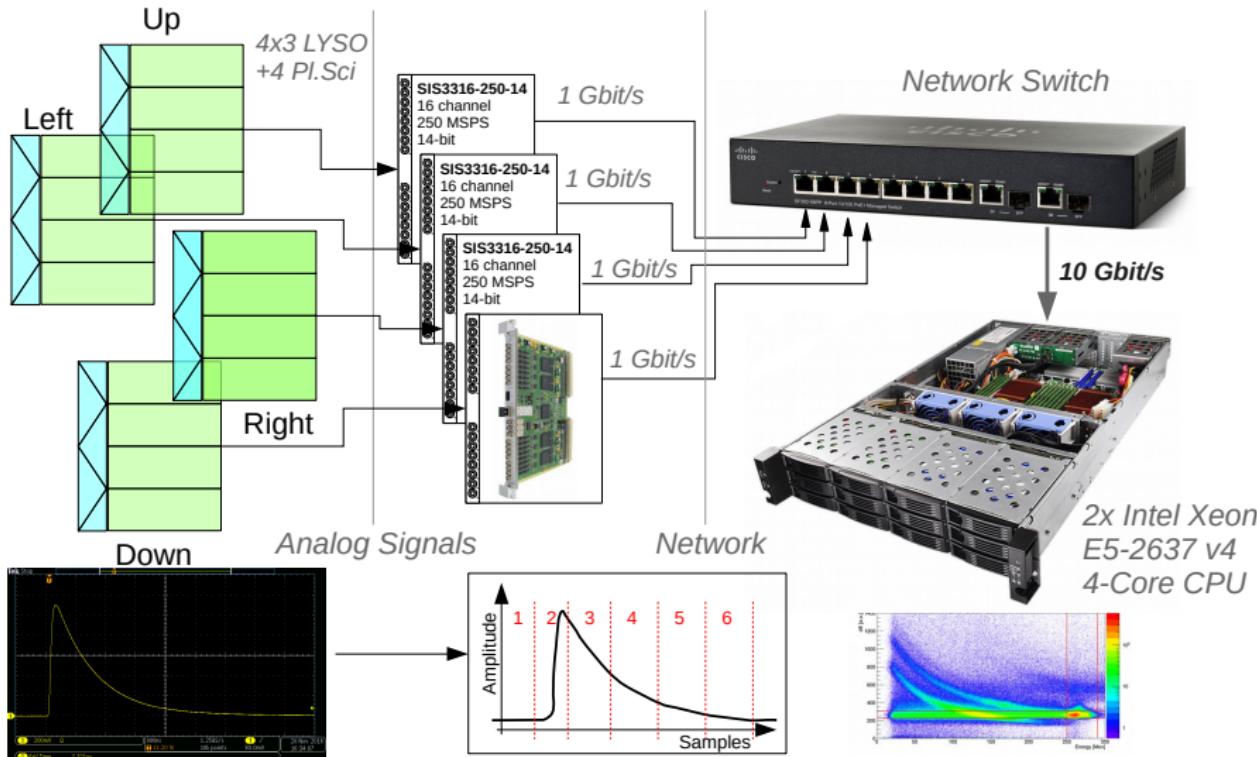
Test setup for polarimeter





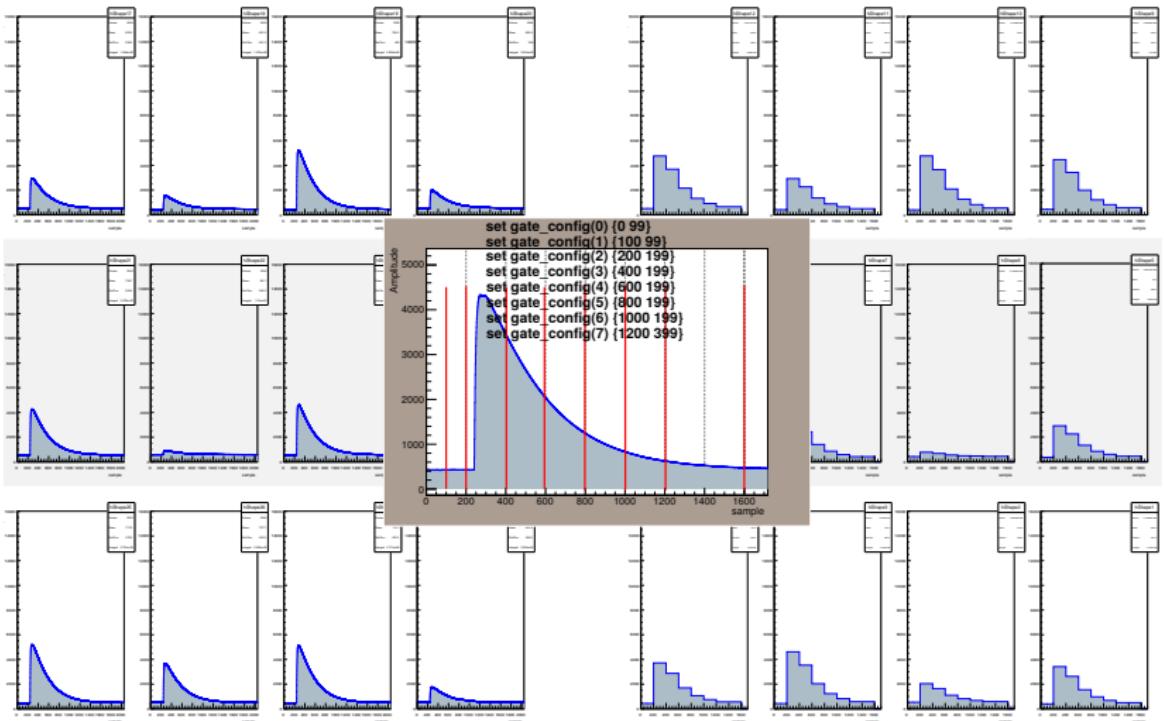
Data Acquisition System

Flash ADC Based System



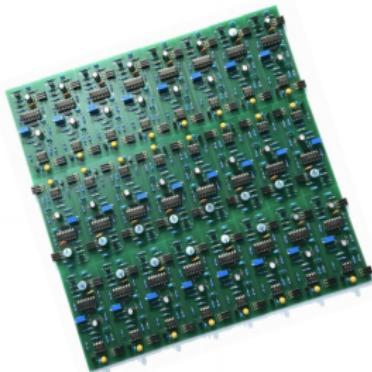
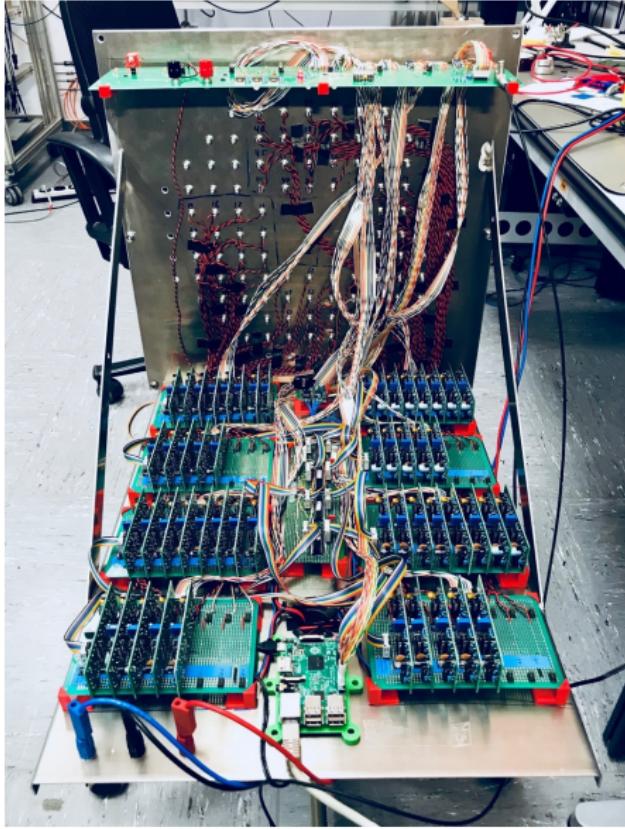
Signal Shapes

Full signal shape vs 8 accumulator/integral region



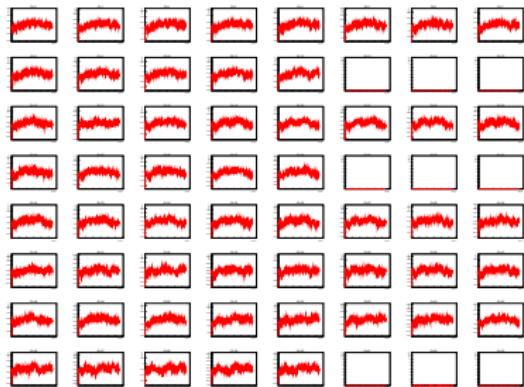
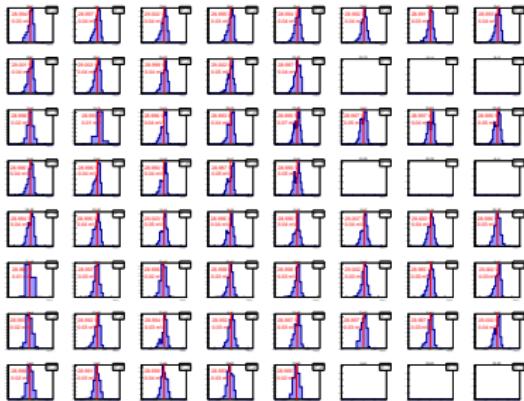
SiPM Voltage Supply

Very Good Long Term Stability $\sim 1\mu V_{pp}$



Voltage Monitoring

Monitoring of all channels



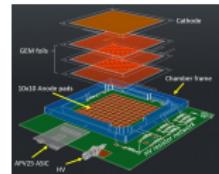
Inelastic Cross-Section Measurement

Beam particle loss measurement

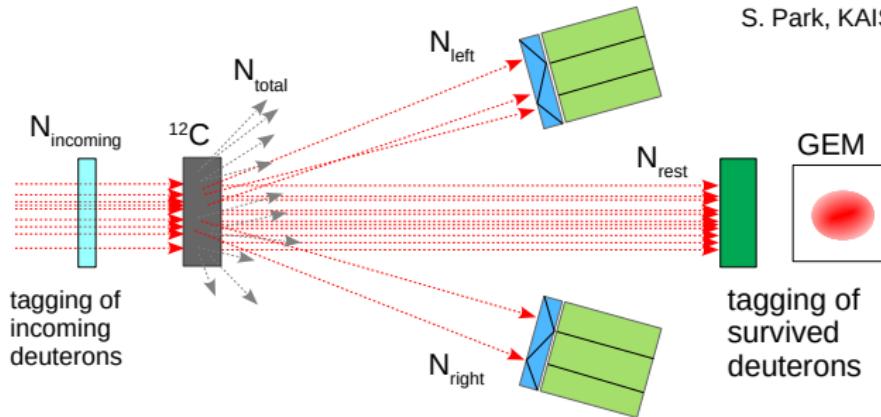


$$N_{\text{lost}} = N_{\text{scattered}} + N_{E\text{loss}} + N_{\text{acc}} \quad (1)$$

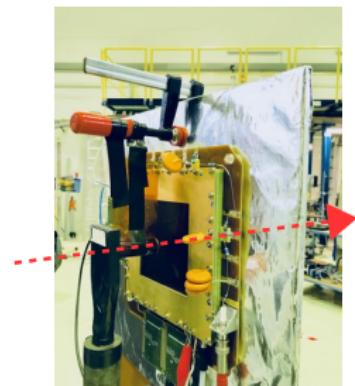
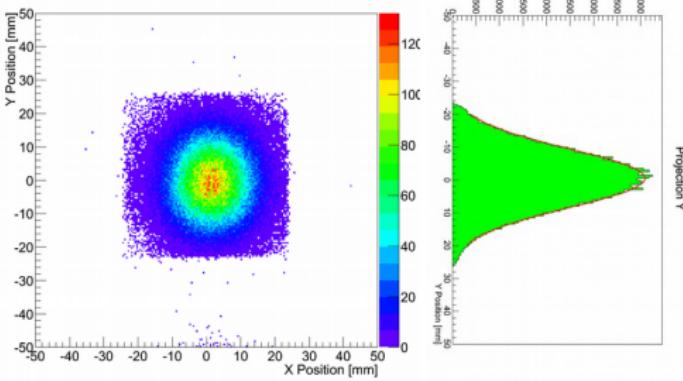
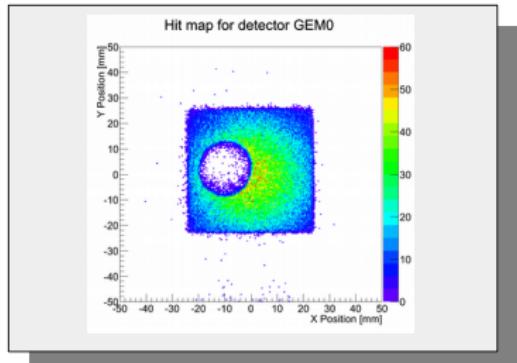
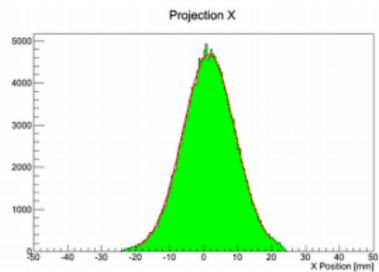
$$N_{\text{lost}} = N_{\text{scattered}} + N_{dE} + N_{\text{acc}}$$

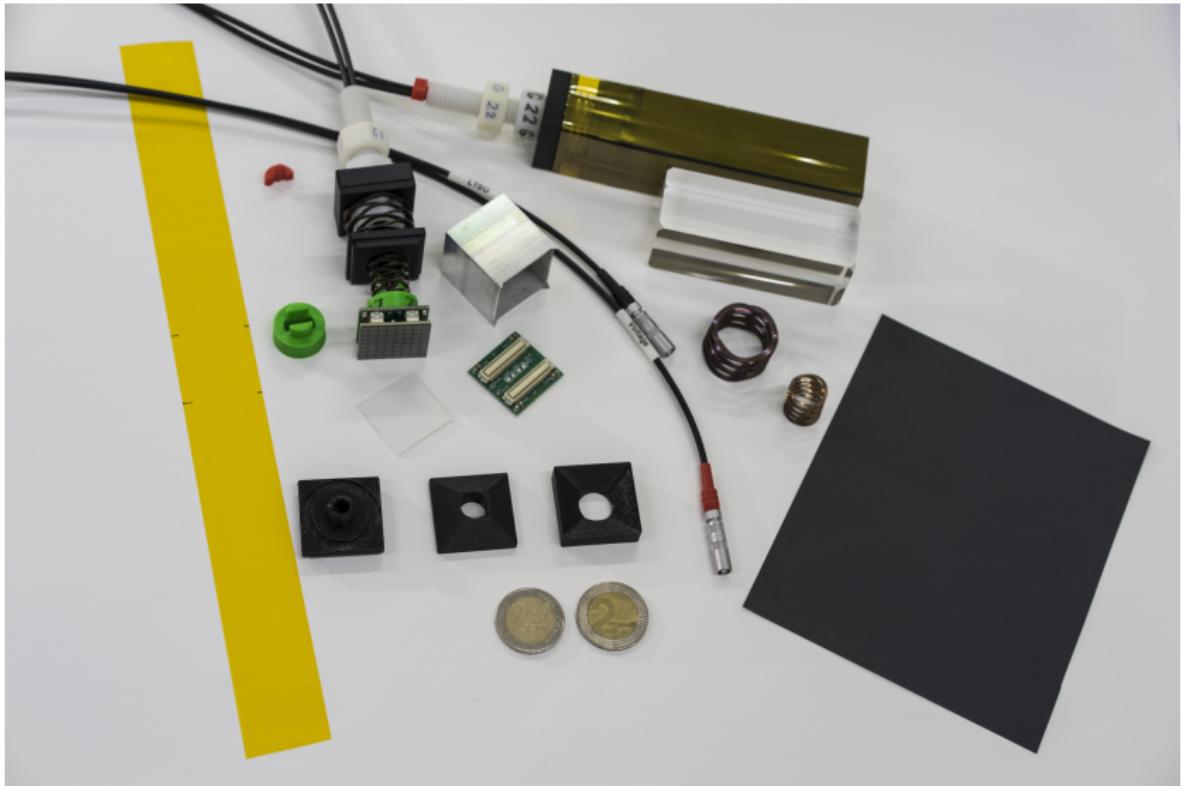


S. Park, KAIST



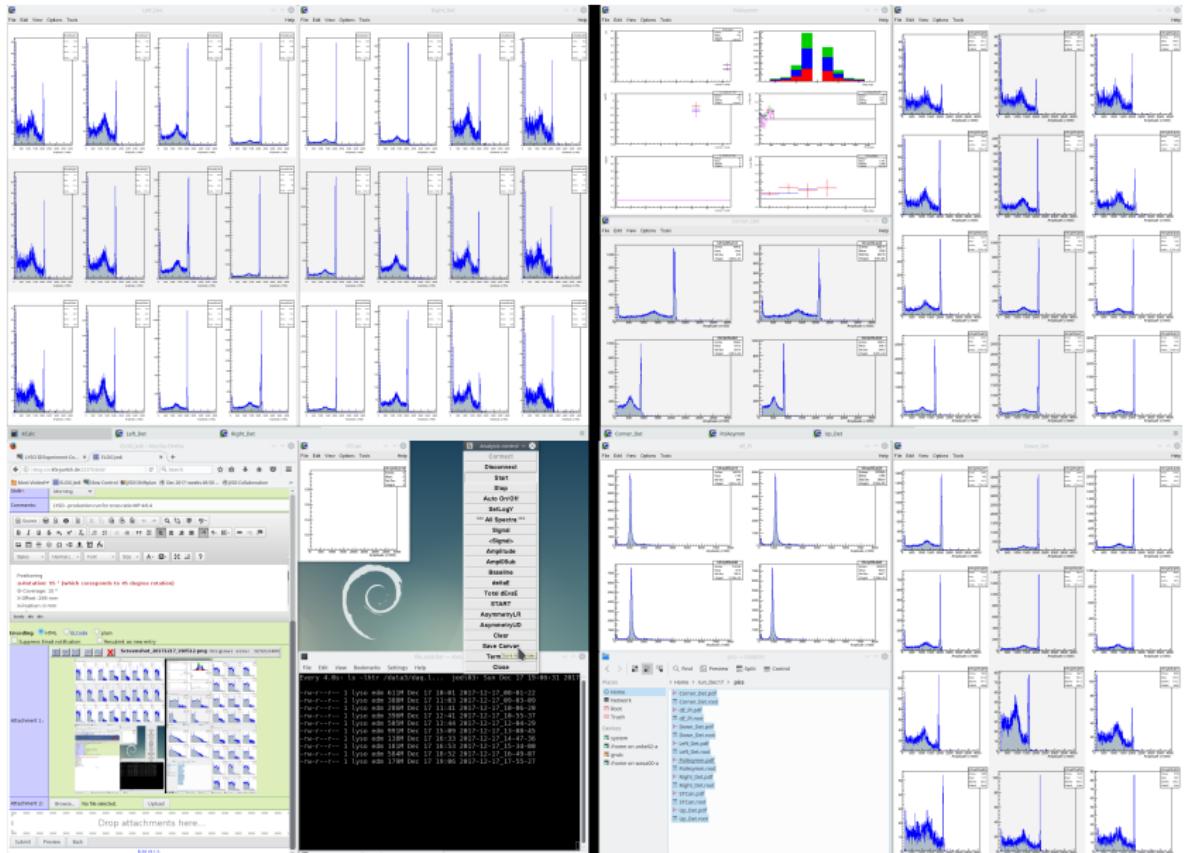
$$N_{\text{scattered}} = L \times \sigma_{\text{tot}} = N_{\text{el}} + N_{\text{inel}} = N_{\text{incoming}} - N_{\text{rest}}$$





Online Monitoring System

Monitoring of all amplitudes



Slow Control system

Controls all movements



Firefox File Edit View History Bookmarks Tools Window Help 01:11:39 100% Sun 17 Dec 21:10 irakli Q

LysO III Experiment Control raspI02.kfp.kfa-juelich.de

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LYSO III Experiment Status

Actuators

a-Rotation:	online
Start Counter:	online
Target Driver:	online
X-Axis:	online
Y-Axis:	online
Z-Axis:	online

Positioning

a-Rotation:	55 °
Ø-Coverage:	15 °
X-Offset:	299 mm
X-Position:	0 mm
Y-Offset:	268 mm
Y-Position:	0 mm
Z-Offset:	0 mm
Z-Position:	0 mm

Target

Active Target:	Silicon
Start Counter	

Status: out of the beam

Voltage: 0 V

Position Control

Position Control

Ø-Coverage: 15 [10 ° - 20 °] Set

X-Position: 0 [-299 mm - 263 mm] Set

Y-Position: 0 [-268 mm - 311 mm] Set

Z-Position: 0 [0 mm - 570 mm] Set

Target Control

Empty Target	Nickel
Carbon	Tin
Aluminum	Silicon
Magnesium	Polyethelene

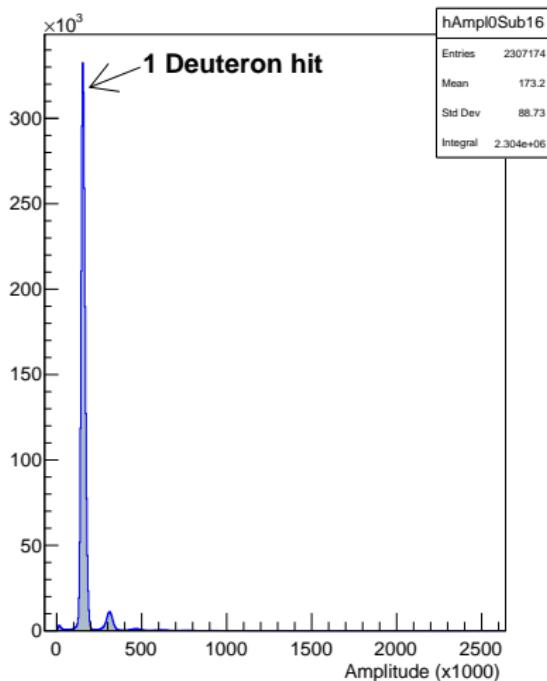
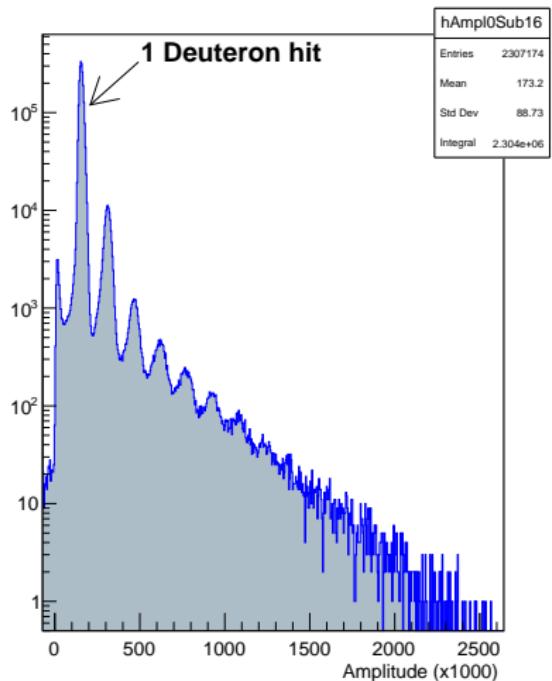
Start Counter

Position: Move Start Counter In

Voltage: 0 [0 V - 1200 V] Set

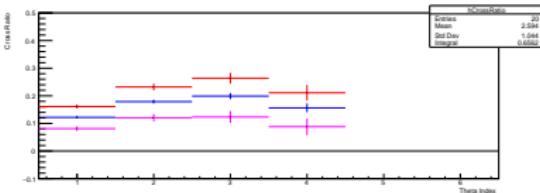
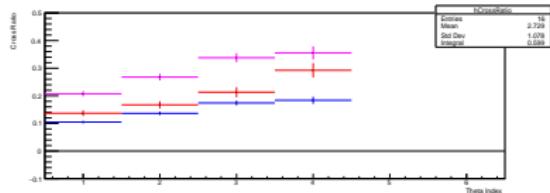
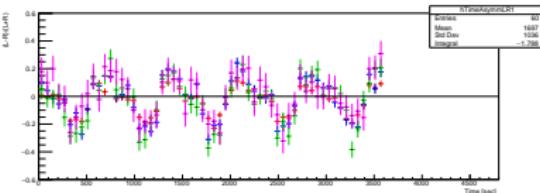
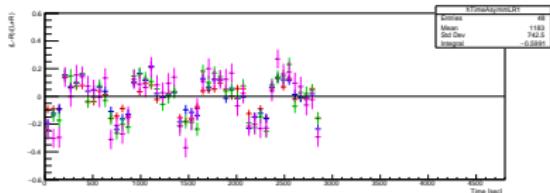
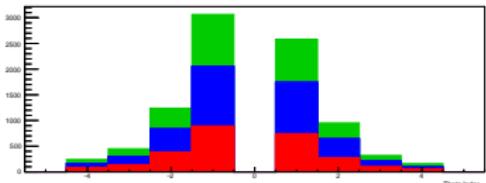
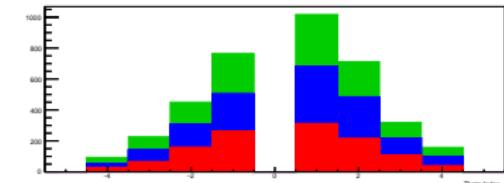
Start Counter

Clearly seen deuteron pile-ups



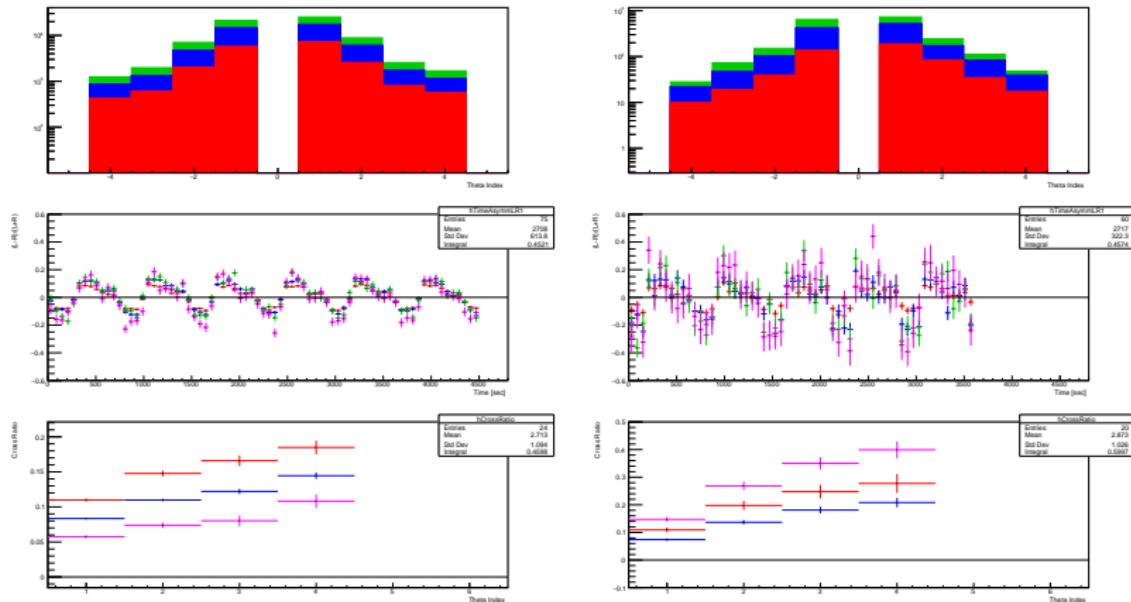
Asymmetry

Carbon at $\Theta_{max} = 10^\circ$ and $\Theta_{max} = 15^\circ$



Asymmetry

Different target materials (left Nickel; right Tin)



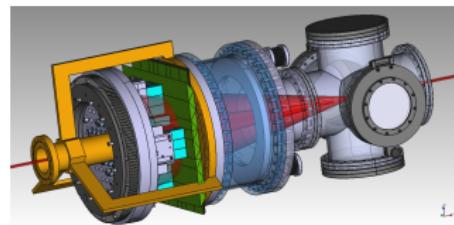
Acknowledgment

People contributing to the experiment



- Mechanics: N. Giese, M. Maubach, G. D'Orsaneo & D. Spölgen
- Electronics: Tanja Hahnrats-von der Gracht & T. Sefzick
- DAQ & FEE: D. Mchedlishvili, & P. Wüstner
- G4: G. Macharashvili, P. Maanen & N. Lomidze
- **Ms & Bs: O. Javakhishvili, M. Gagoshidze, & D. Kordzaia**
- **PhD: F. Müller, D. Shergelashvili, H. Jeong & S. Basile**

- We just finished one more very successful beam time
- Mechanical support & slow control shows excellent performance (except rotation)
- New DAQ system reached its maximum designed data transfer of 400 MB/s
- We have assembled and tested new LYSO and SiPM vendors **in total 48+4 Modules**
- Next major step is to install a tracking system made with the triangular scintillator bar



Beam Time

LYSO module / DAQ / Software optimization



COSY Beam Time Request

For Lab. use	
Exp. No.:	Session No.
E2.5	7

- Extracted beam (BIG KARL)
- Polarized deuterons
- Energies of $T_d =$
100, 200, 270, 300 MeV
- Low count rate
 $\sim 1 \div 50 \text{ kHz}$
- **2 Week Beginning of 2018**
(pure measurement time)

Collaboration:

JEDI

Towards the EDM Polarimetry

Spokespersons for the beam time:

Irakli Keshelashvili (Jülich)
Bernd Lorentz (Jülich)
David Mcchedlishvili (HEPI TSU)

Spokespersons for the collaboration:

Jörg Pretz (Jülich)
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Total number of particles and type of beam (p,d,polarization)	Kinetic energy (MeV)	Intensity or internal reaction rate (particles per second)	
Extracted beam of polarized deuterons	100, 200, 270, 300 MeV	minimum needed	maximum useful
Experimental area	Safety aspects (if any)	Earliest date of installation	Total beam time (No.of shifts)
LYSO crystals at external BIG KARL area	none	1 st April 2018	2 weeks (+ MD)