

STRONG-2020

HORIZON 2020

Annual Meeting 2024

**Transnational Access to COSY**

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# Plan of presentation



**COSY Infrastructure**

**EU-supported Activities**

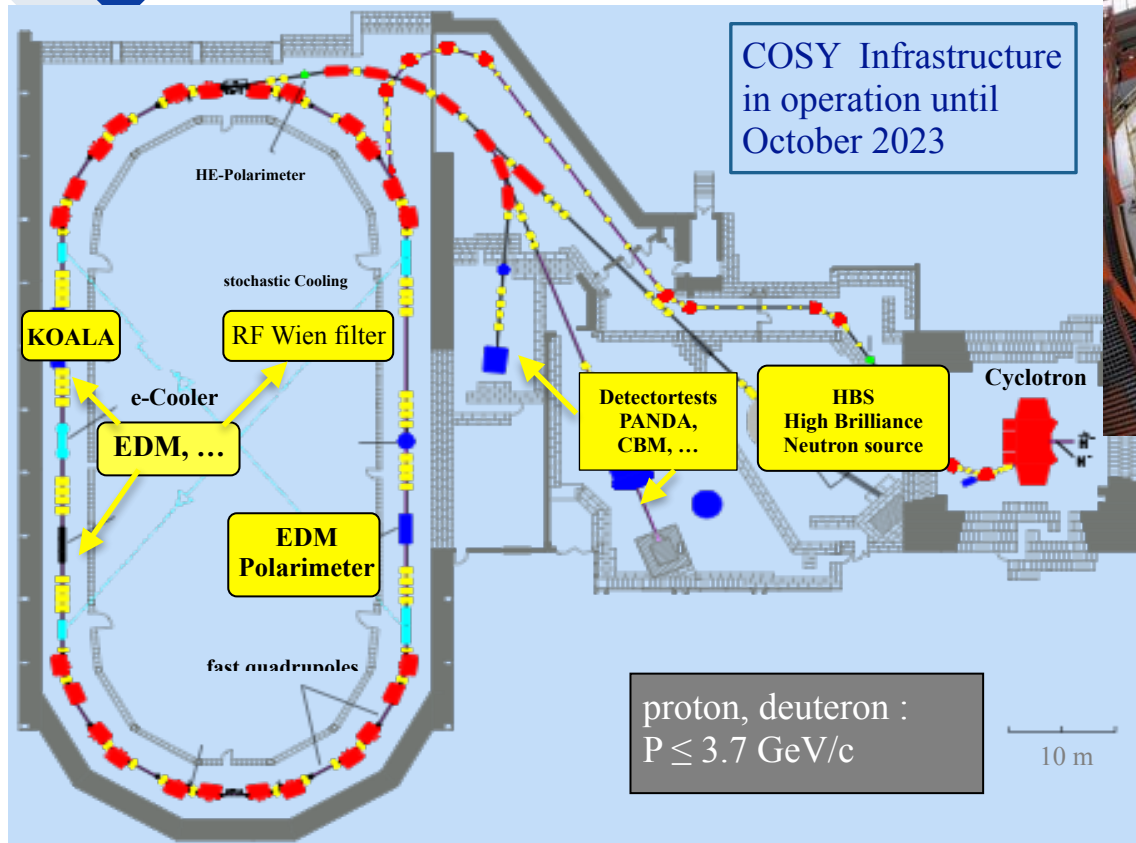
- EDM
- Detector Tests

**Further Activities**

**Achievements in view of WP TA1**

**COSY Operation**

# TA1 - Transnational Access to COSY



Cyclotron  $< 300 \text{ MeV/c}$

Cooler-Synchrotron COSY  $< 3.7 \text{ GeV/c}$

$5 \cdot 10^{10}$  stored p, d unpolarized, polarized

phase space cooling

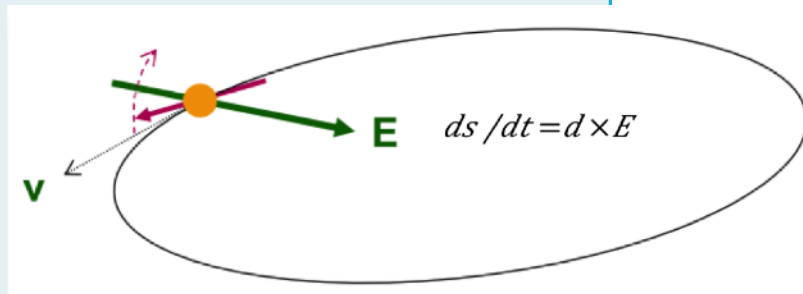
internal, external target stations

# Main Activities: EDM (Electric Dipole Moment) Measurement (JEDI collaboration)

principle: horizontal polarized beam ;  
electric field → buildup of vert. pol.

careful preparations required

- beam based alignment
- long spin coherence time ( $\geq 1000$  s achieved for d)
- precise polarimetry
- phase locking of spin precession to RF Wien filter
- multi bunch operation (pilot bunch without RF field)
- ...



## Beam-based alignment

Measurements of EDM

in storage rings requires  
extreme precision in all tools.

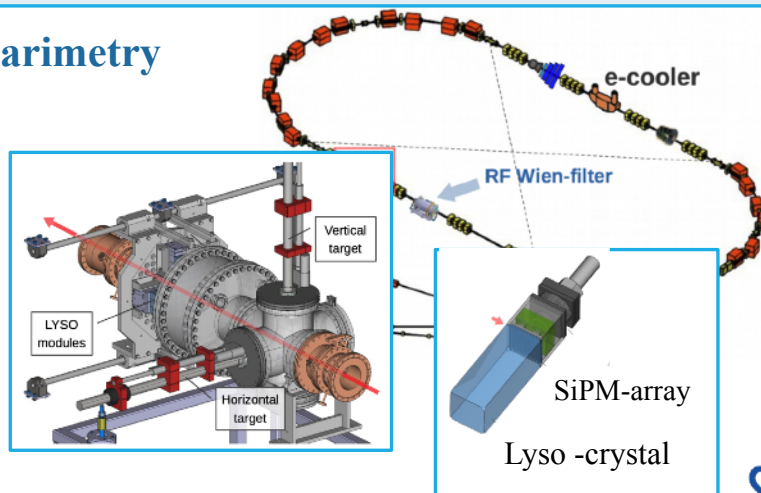
⇒ optimized orbit (center of quadrupoles)

orbit correction base on BPM measurement

⇒ BPM calibration via beam-based alignment  
(orbit change vs quadrupole strength)

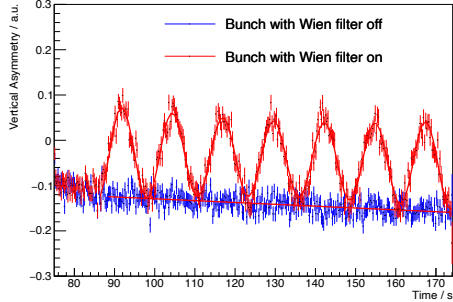
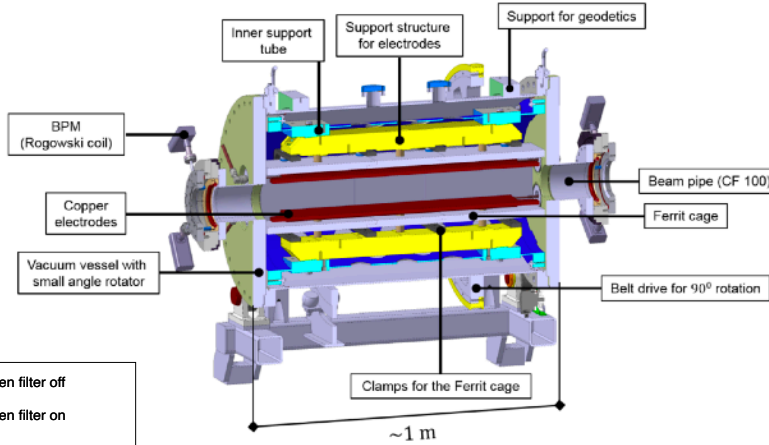
⇒ improvement of orbit

## EDM Polarimetry

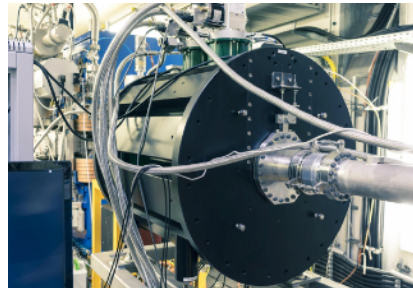


# EDM Measurement

**RF Wien filter:**  
horizontal E-field,  
vertical B-field  
operates on  
spin precession  
frequency  
(phase-feedback)



**Siberian Snake**  
superconducting  
solenoid

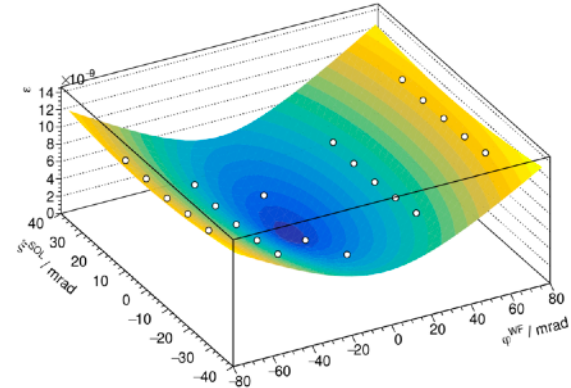


## EDM measurement:

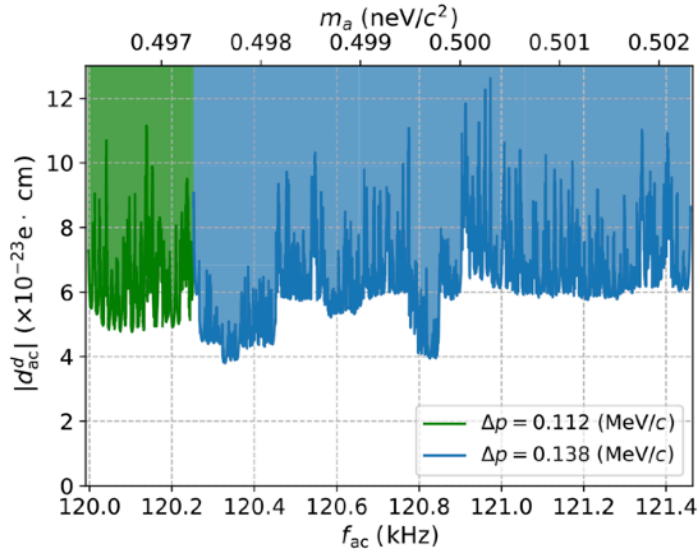
determine invariant spin axis  
(which will be tilted by EDM)

variation of RF Wien filter rotation angle  
→ tilt in x  
solonoidal field (Siberian Snake)  
→ tilt in z

measure strength of polarization build up



# EDM Measurement



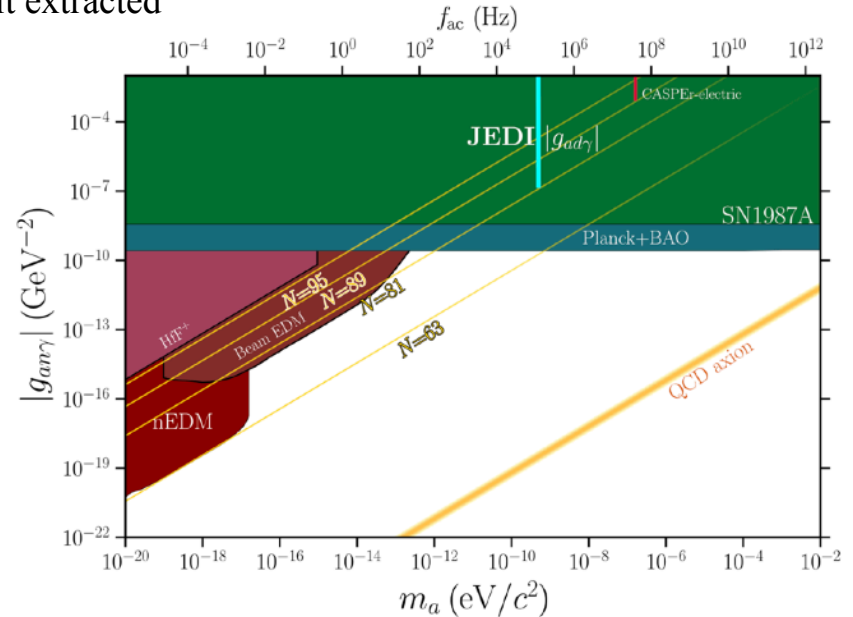
## Search for axion like particles (ALP)

coupling to axion field  $\rightarrow$  oscillating EDM

resonance of EDM oscillation and spin precession frequency  
 $\rightarrow$  accumulation of polarization

measurement performed by ramp of beam momentum  
 (spin precession frequency)

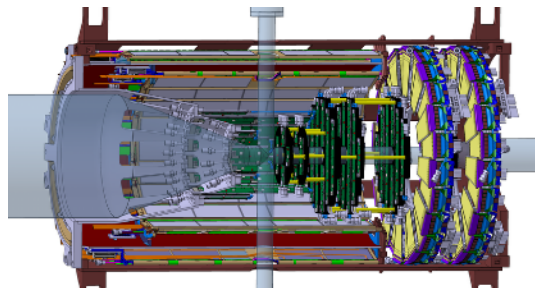
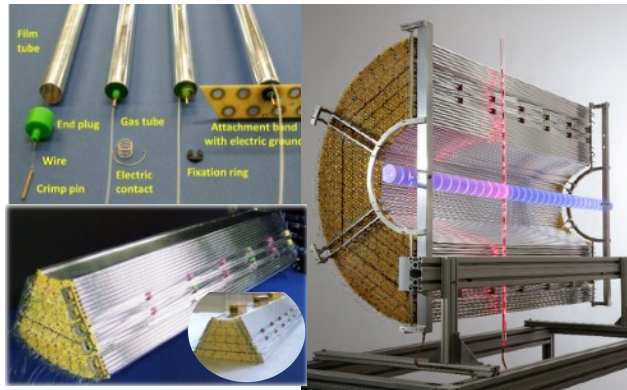
$\rightarrow$  no ALP resonance observed  
 upper limit extracted





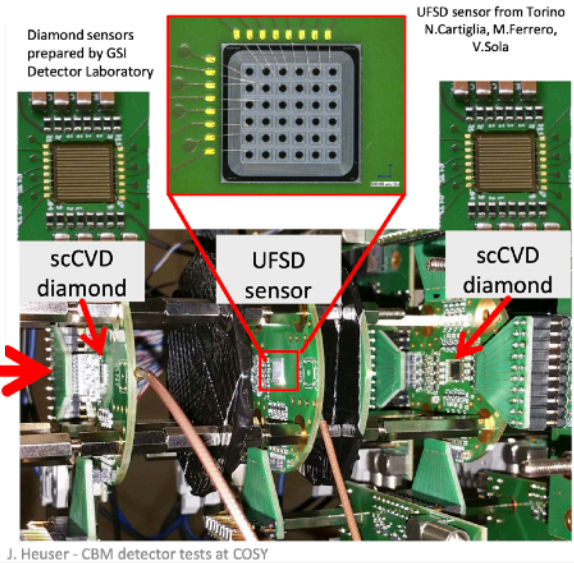
# Detector Tests

## Straw-tubes for PANDA



PANDA  
Si- $\mu$ strip,  
Si-pixel

## CBM beam telescope



J. Heuser - CBM detector tests at COSY

Charged particle tracking detectors for  
FAIR phase-0 and early science

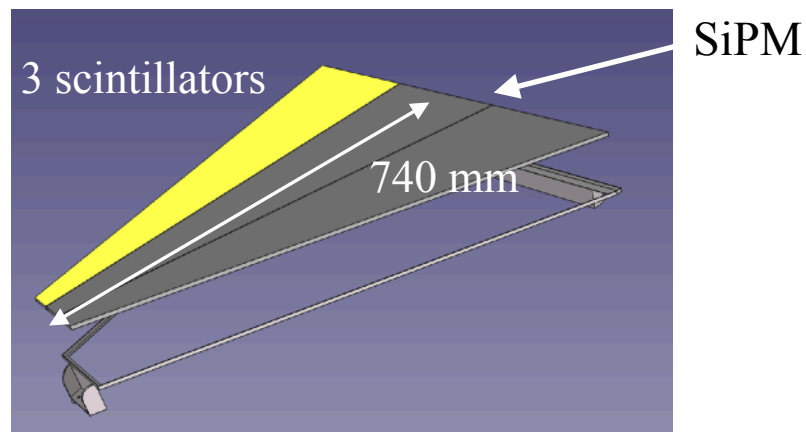
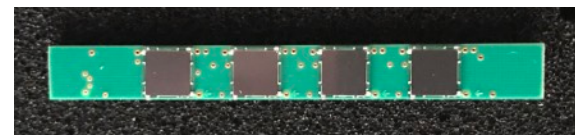
Si-microstrip, ALPIDE Si-pixel,  
GADAST scintillation crystals, GEM TPC

# Detector Tests

## HADES Inner-TOF Detector



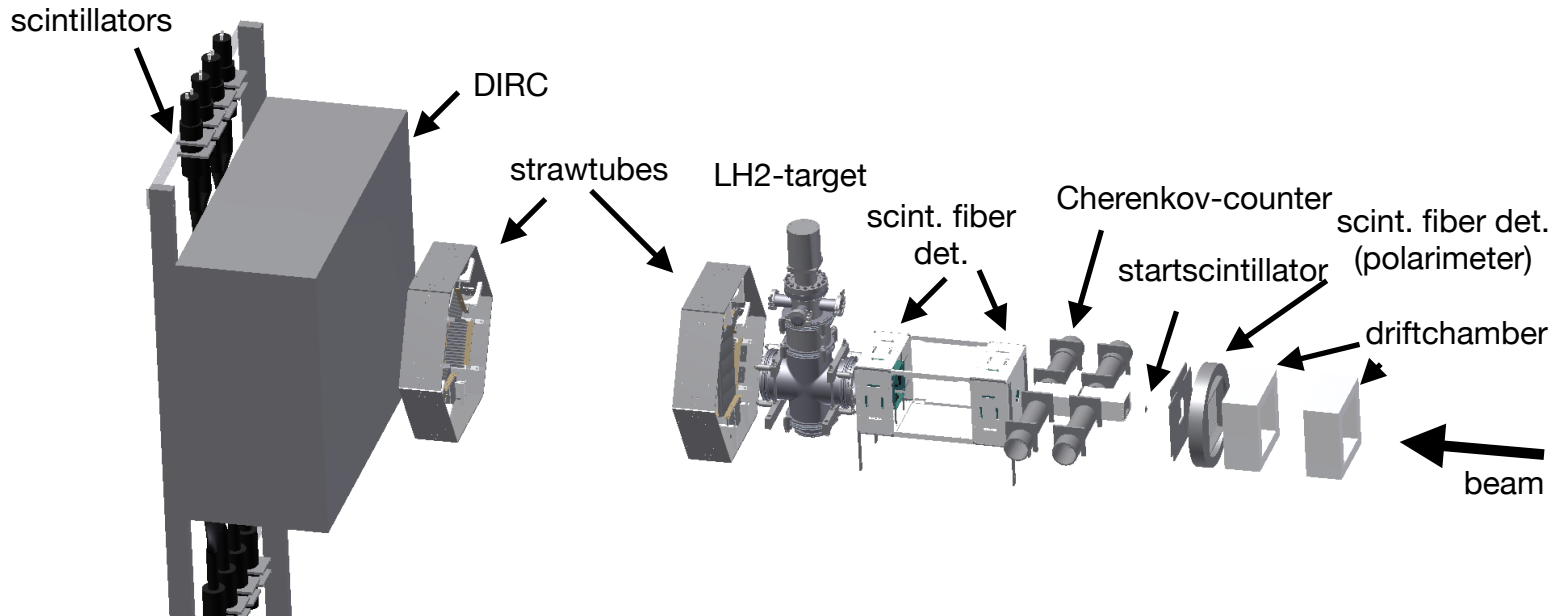
12 SiPM (6x6 mm<sup>2</sup>)  
at each scintillator





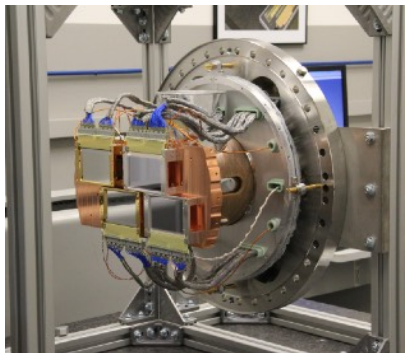
# Detector Tests

Test of detection system for polarization studies of produced antiprotons at CERN  
(Analyzing power measurement of pp-elastic scattering in the CNI-region  
with polarized beam (1.95 GeV/c) at COSY)



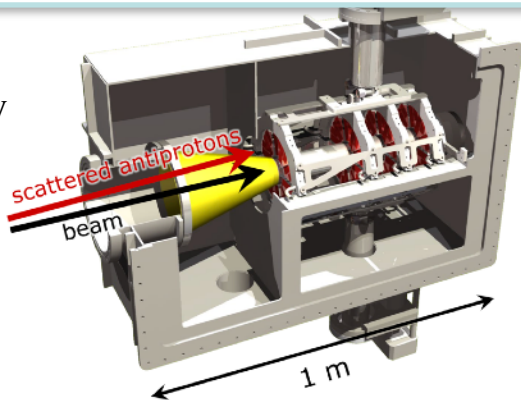
## Further Activities

KOALA  
elastic pp  
Si-, Ge-  
stripdetector

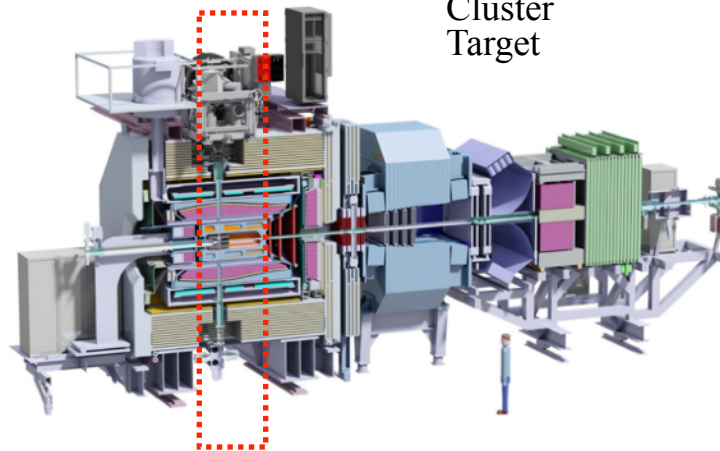


PANDA  
Luminosity  
Detector

MuPix  
sensors

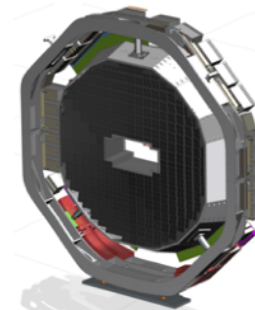


PANDA  
Cluster  
Target



PANDA  
EM-calorimeter  
forward endcap

lead tungstate  
crystals





## Further Activities



### Accelerator studies

injection studies  
beam studies  
orbit feedback  
electron cooling  
stochastic cooling  
Palmer pickup  
knock out (KO) extraction

### Cyclotron beam

Irradiation studies  
    electronic components  
    sensors, SiPM  
JUSPARC  
High Brilliance Neutron Source HBS



## Achievements in view of WP TA1



Deliverables	whole project duration	estimation (GA)	achieved
provided access hours	1976	1600	124 %
number of users	145 (AT, CZ, ES, GE, IT, PL, RO, UK)	112	130 %
number of user days	1746	672	260 %

COSY operation hours in the project duration: 19500 hours

# COSY Operation

30 years operation with high reliability of up to 95%  
delivery of up to about 7500 operation hours per year

