STRONG-2020 ANNUAL MEETING (2022)

WP 30: JRA12 – SPIN FOR FAIR

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JRA12 – SPIN FOR FAIR: MOTIVATION

- Development of an efficient method for polarizing antiproton beams at FAIR

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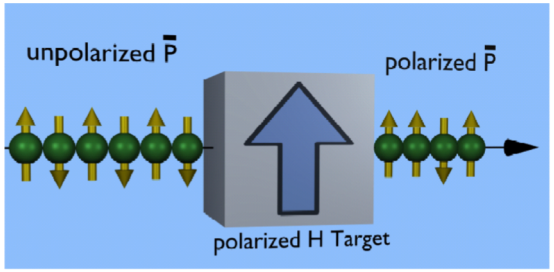
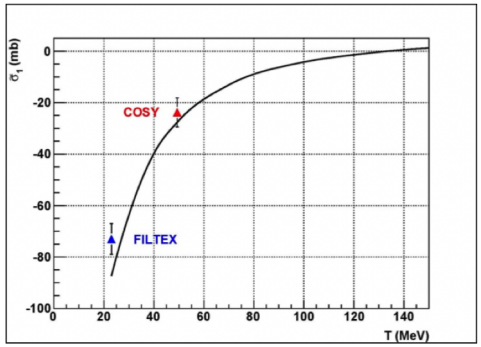
  - ✓Spin filtering of protons with transverse polarization performed at COSY





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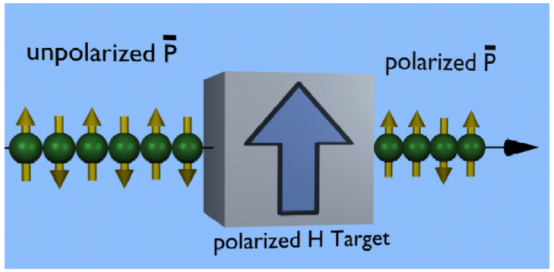
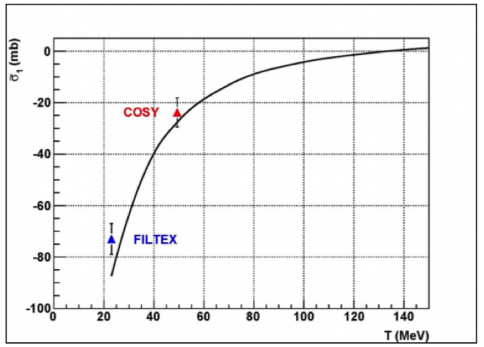
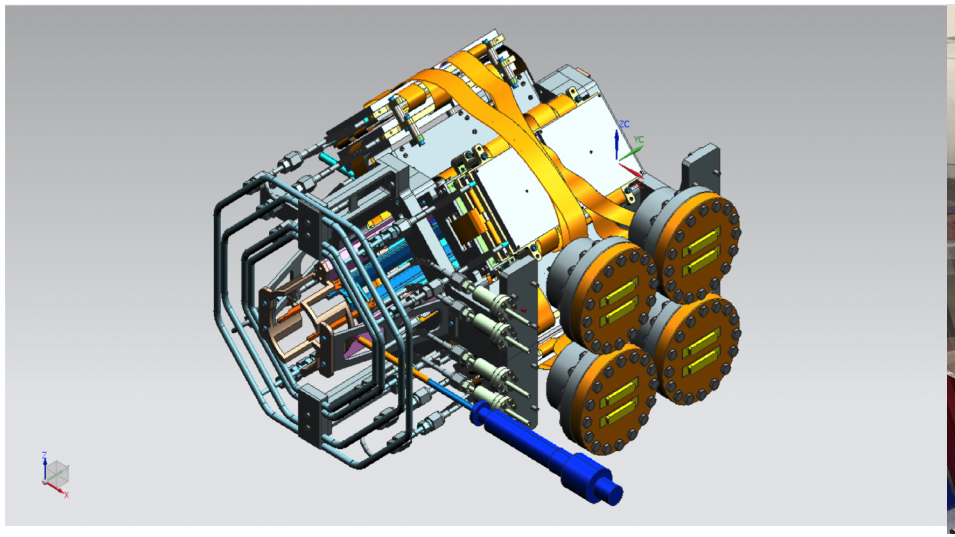
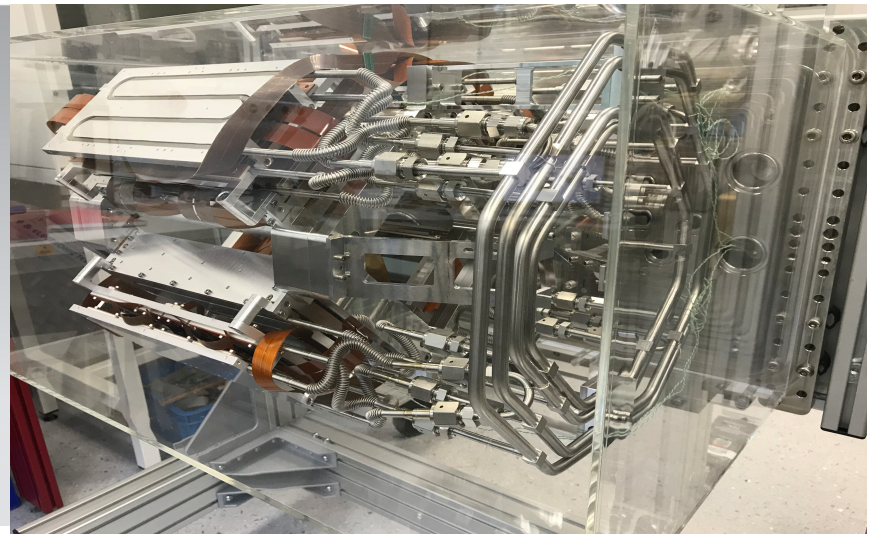




- Test with longitudinal polarization needed to complete the measurement
  - Full determination of the p_{bar}- p cross section
  - Experimental Storage Ring at FAIR

PAX DETECTOR

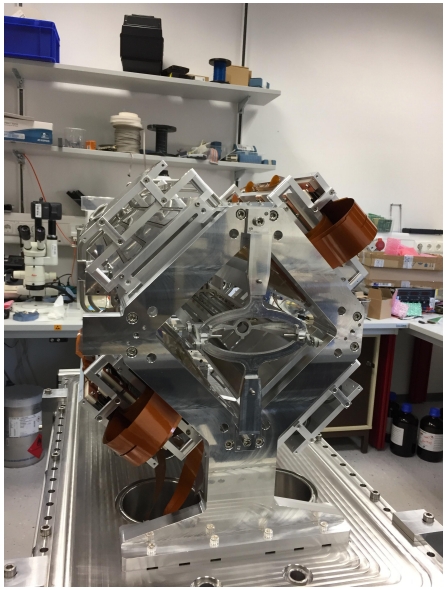




- Multi-purpose silicon vertex detector installed around the storage cell for:
  - p-p (p_{bar}-p) elastic
  - p-d elastic
  - Deuteron breakup
- Energy 30-200 MeV

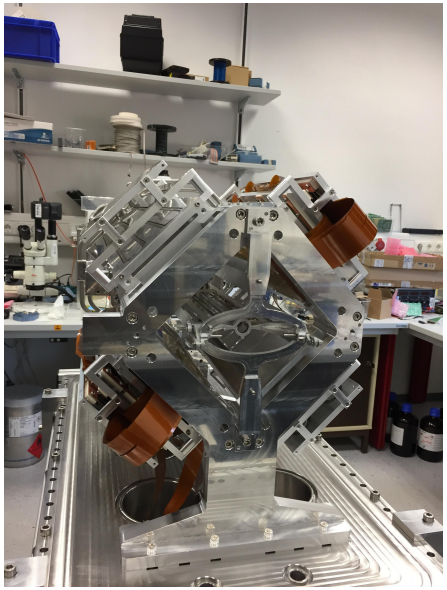
PAX DETECTOR

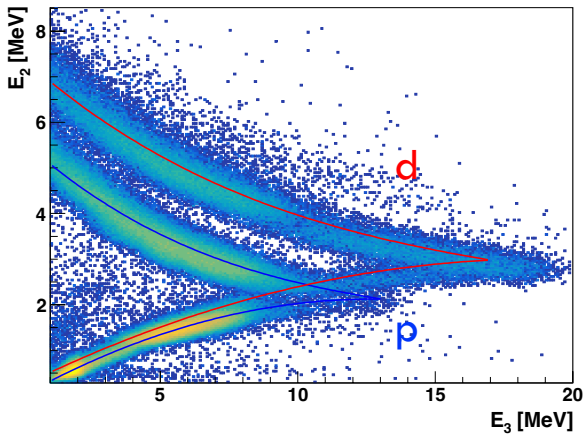
- Installed at PAX section for commissioning with 2 quadrants
- Unpolarized p beam vs. polarized d target

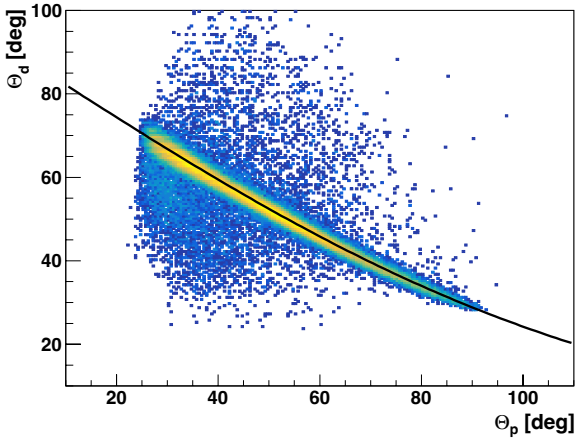


PAX DETECTOR

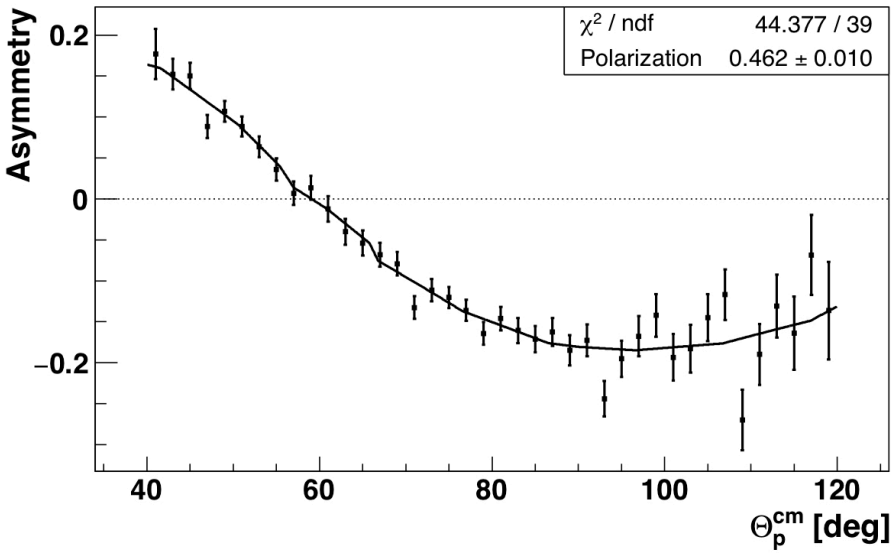
- Installed at PAX section for commissioning with 2 quadrants
- Unpolarized p beam vs. polarized d target
- Identification of p-d elastic events

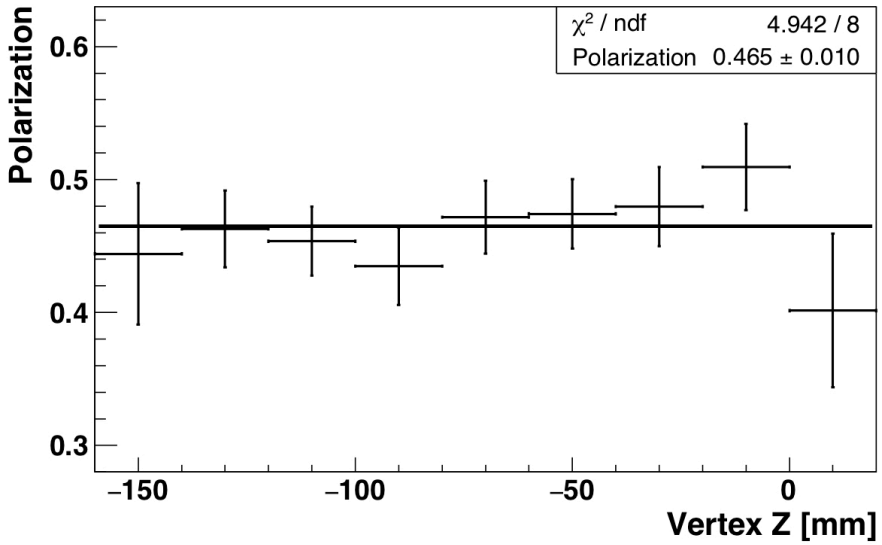






TARGET POLARIZATION

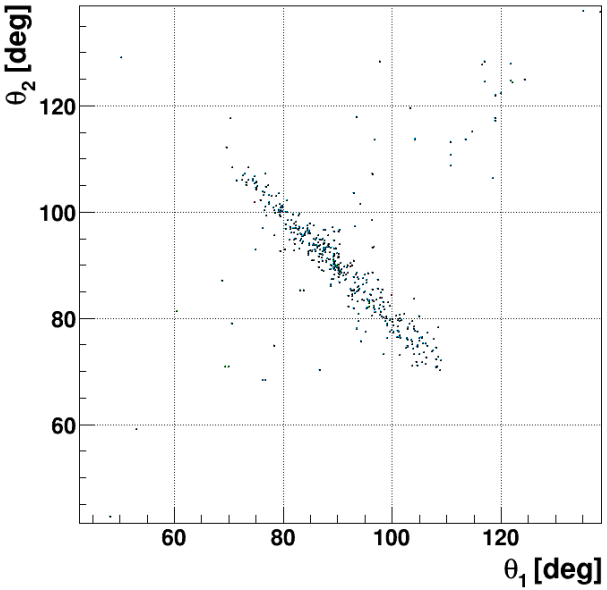


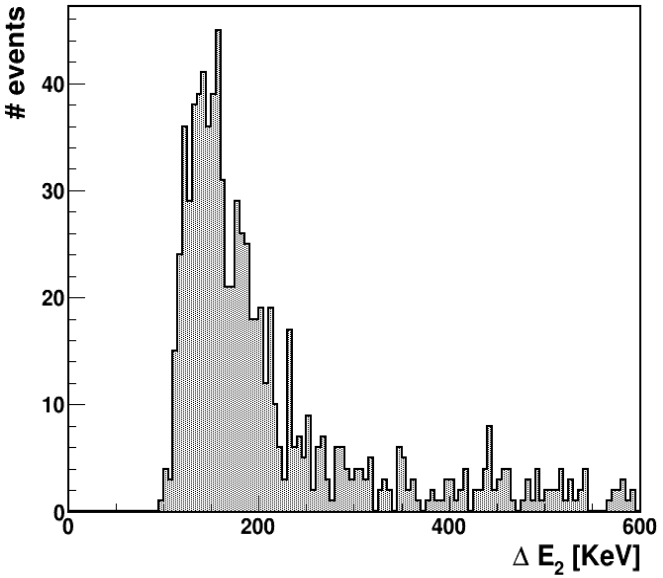


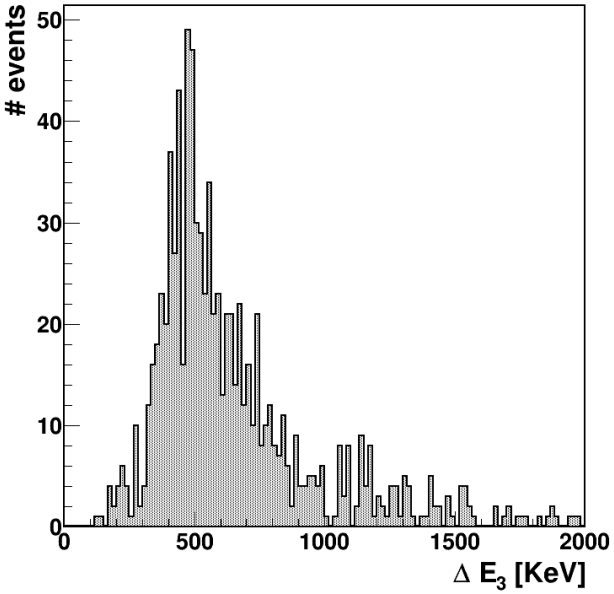
$$\langle Q \rangle = 0.462 \pm 0.010$$

COSMICS DATA

- 4 quadrants assembled!
- Test bench for cosmics data acquisition set up in IKP







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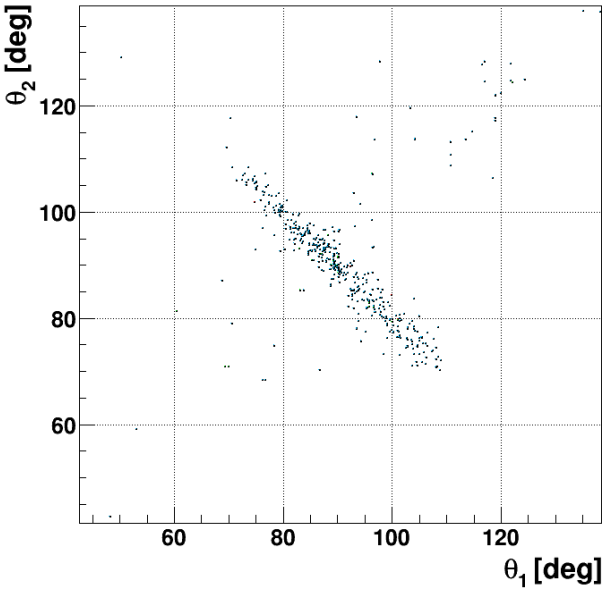
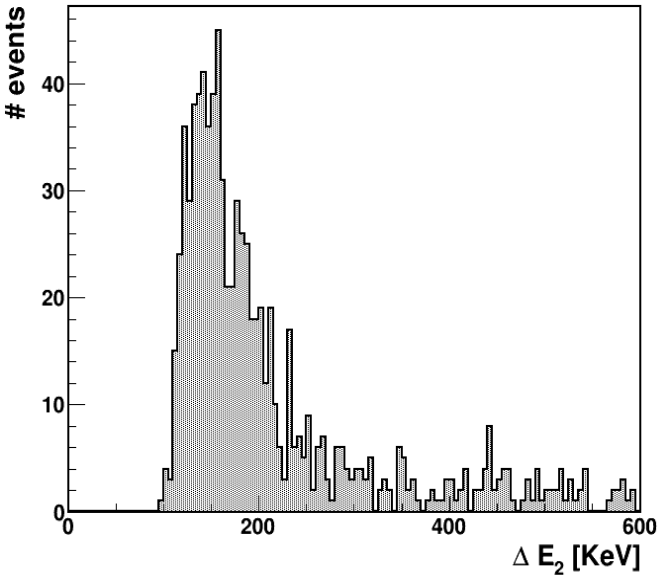
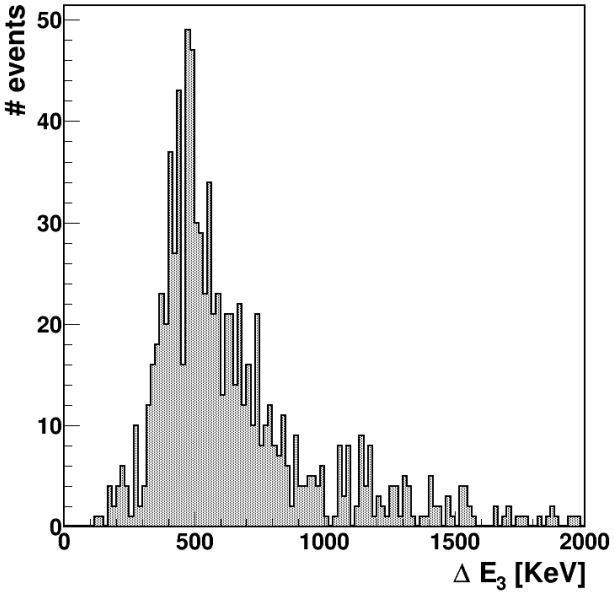


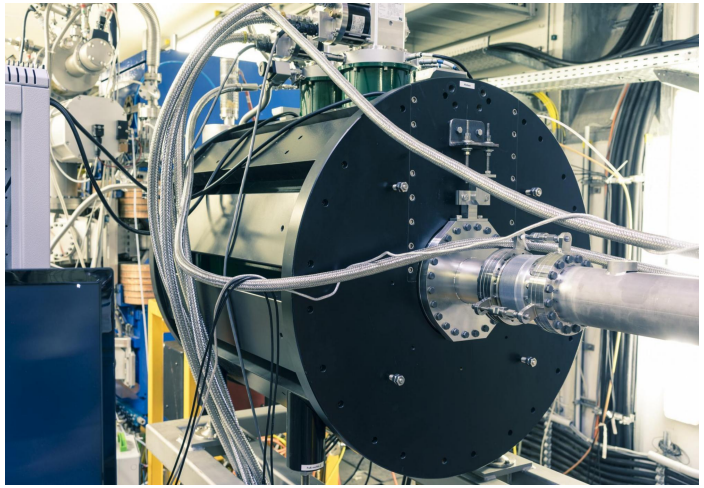


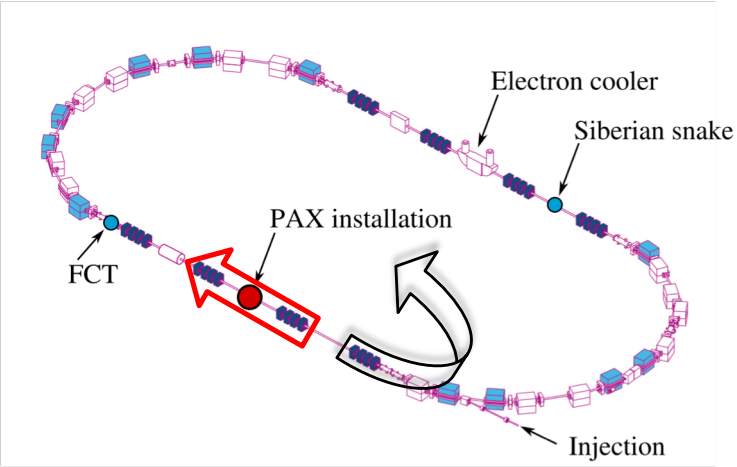


Full commissioning needed!

Problems: budget restrictions + energy crysis

SIBERIAN SNAKE

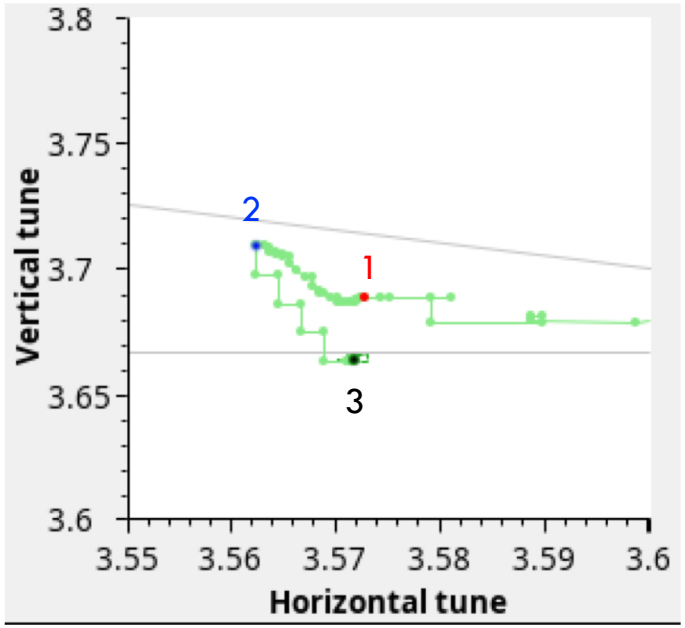


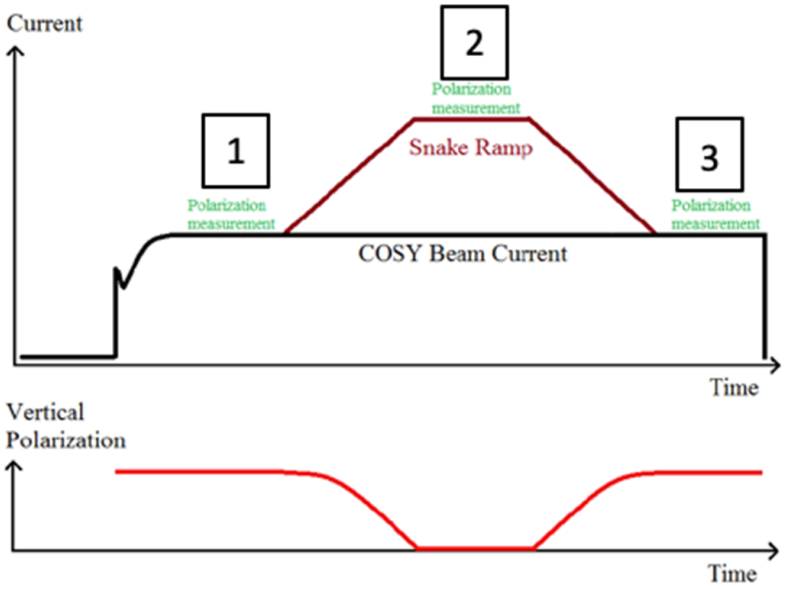


- Installed in COSY @ ANKE place
- First commissioning beam time in March 2020
- Will provide longitudinal polarization at PAX section

SIBERIAN SNAKE

- Tune shift observed during Snake ramp





(3.573; 3.688) ⟶ (3.562; 3.709) ⟶ (3.572; 3.664)

SIBERIAN SNAKE

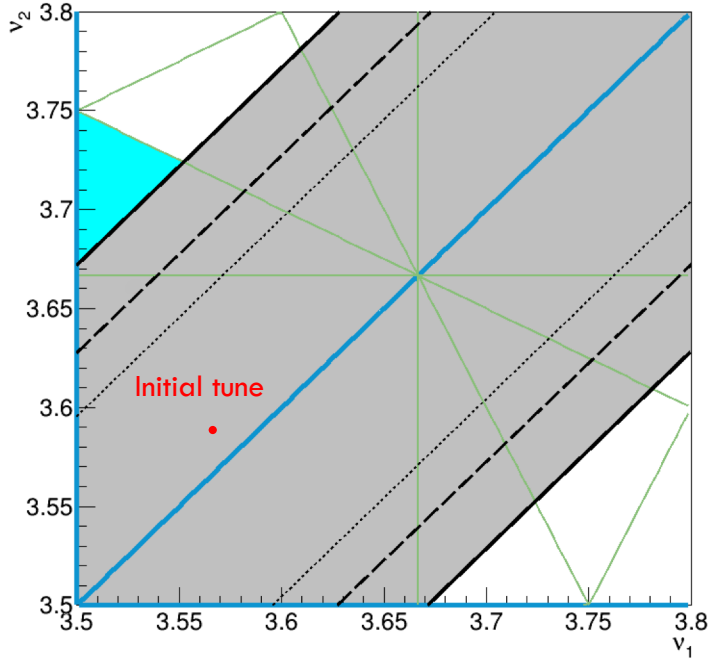
The snake high field introduces a phase space coupling

- Tune split appears

$$\Delta\nu_{min} = \frac{gB_{Sol}L}{4\pi|B\rho|}$$

- Tunes near the resonance

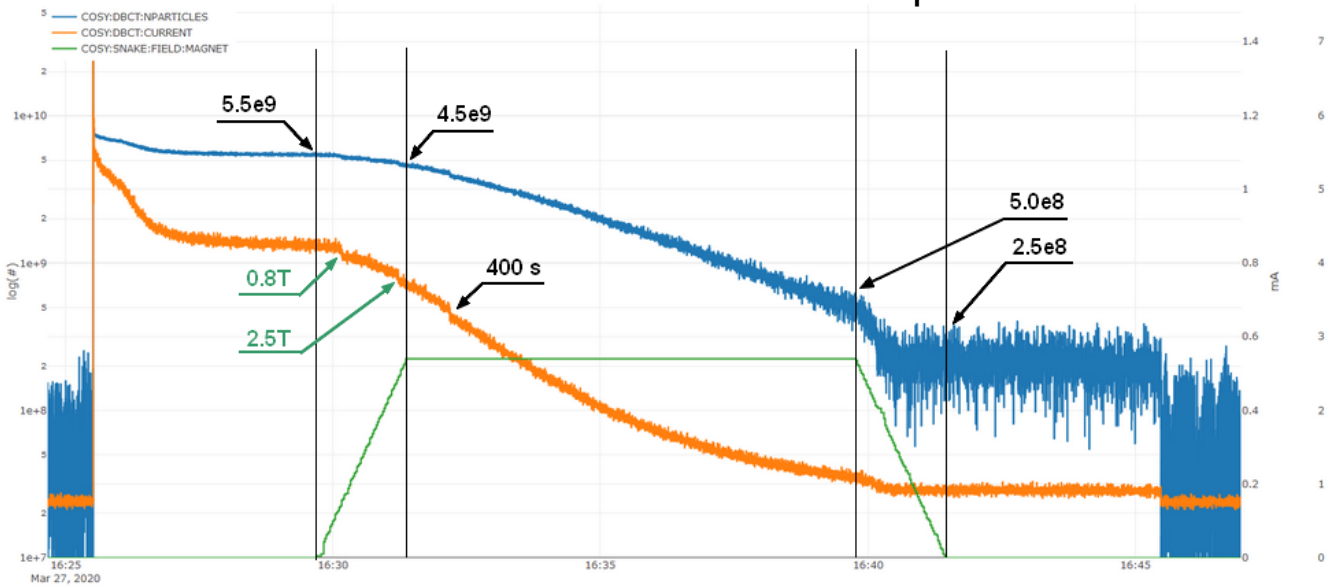
$\nu_x - \nu_y = 0$ cannot be reached while the solenoid is on



…. 1.5T
---- 2 T
__ 2.7 T $\Delta\nu_{min} = 0.167\ (0.172\ model)$

SIBERIAN SNAKE

Initial Tunes: $\nu_x = 3.572$; $\nu_y = 3.688$
Flattop @ 2.7 T
MQU1/MQU5 and MQU2/MQU6 used to compensate the tune shift
~2.5e08 particles survive after ramp-down



Jump	B_{Sol}	MQU 1,5	MQU 2,6	MQU 4
I	0.0 T	123%	-23%	185%
II	0.0 T – 1.5 T	-23%	-8.5	0.0%
III	1.5 T – 2.4 T	-90%	11%	0.0%
IV	2.4 T – 2.7 T	-15%	0.0%	0.0%

CONCLUSIONS

- MS70: Detector commissioning
  - ✓ Commissioned in COSY with 2 assembled quadrants
  - ✓ First measurement of target polarization
  - ✓ 4 quadrants completed and assembled; first cosmics data
  - ➢ Full commissioning needed
- MS71: Snake commissioning
  - ✓ First commissioning beam time performed in March 2020
  - ✓ Compensation of the tune shift induced by the solenoid
  - ➢ Second beam time requested
- MS72: Measurement of target and beam polarization
  - ✓ First measurement of target polarization with the PAX detector
  - ➢ Second beam time needed to perform the beam polarization measurement
- MS73: Predictions for spin-filtering with longitudinal polarization
  - ✓ Simulations performed

CONCLUSIONS

- The PAX detector is fully assembled and functioning on a test bench in IKP, where data from cosmics has been collected and analyzed.
- Discussion on how to decouple the tunes phase space when the siberian snake is on is ongoing.
- Due to IKP budget restrictions, and to the ongoing energetic crysis, it's not forseeable when the beam time needed for completing the detector and snake commissioning can take place.
- For the same reasons, at the moment it's not possible to determine whether a further extension would be useful.