Møller Polarimeter Status

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What has to be done?

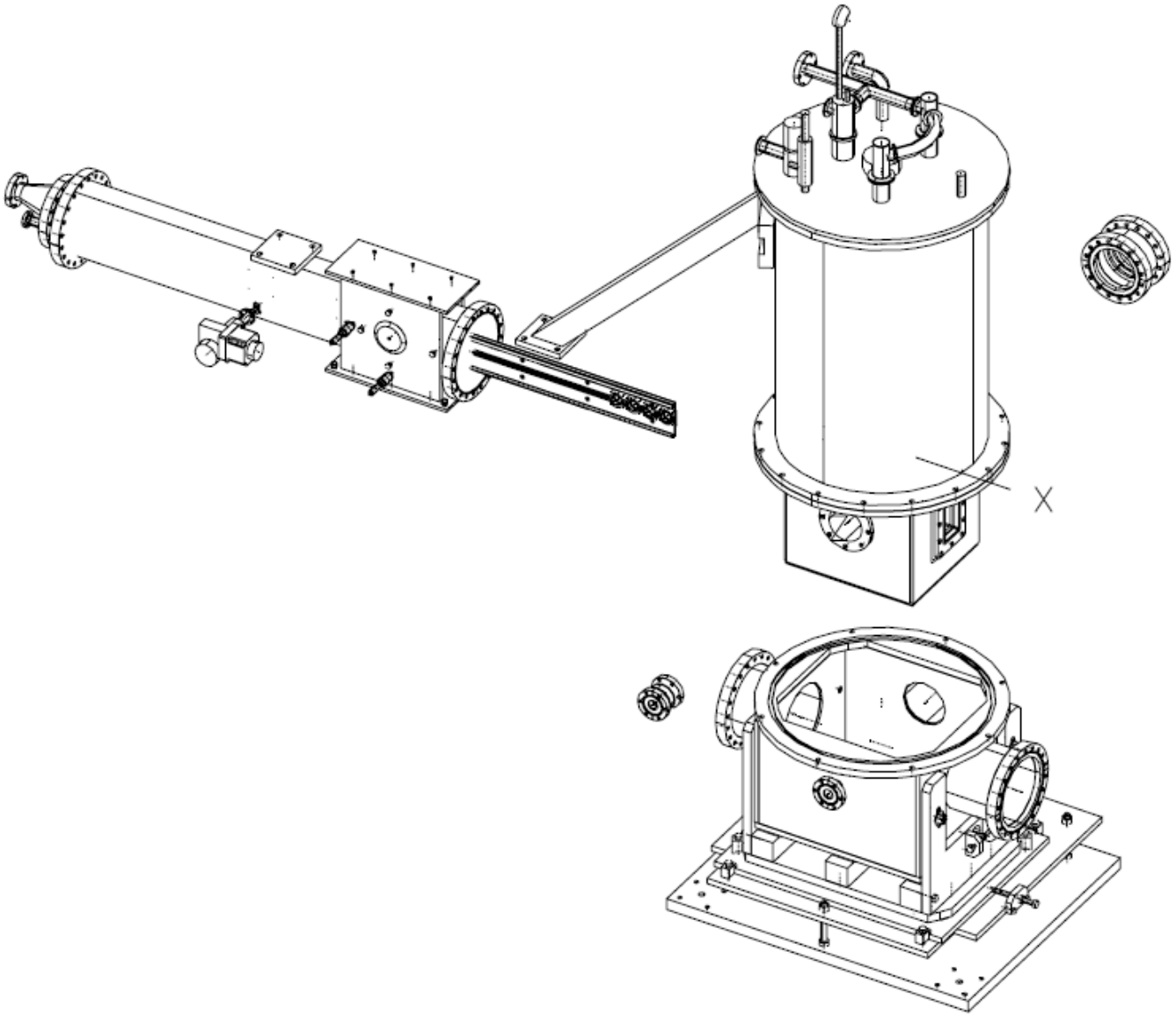
1. Polarized electron target "brute force" 3T (100% target magnetization?)

2. Segmented aperture detector (higher rate)

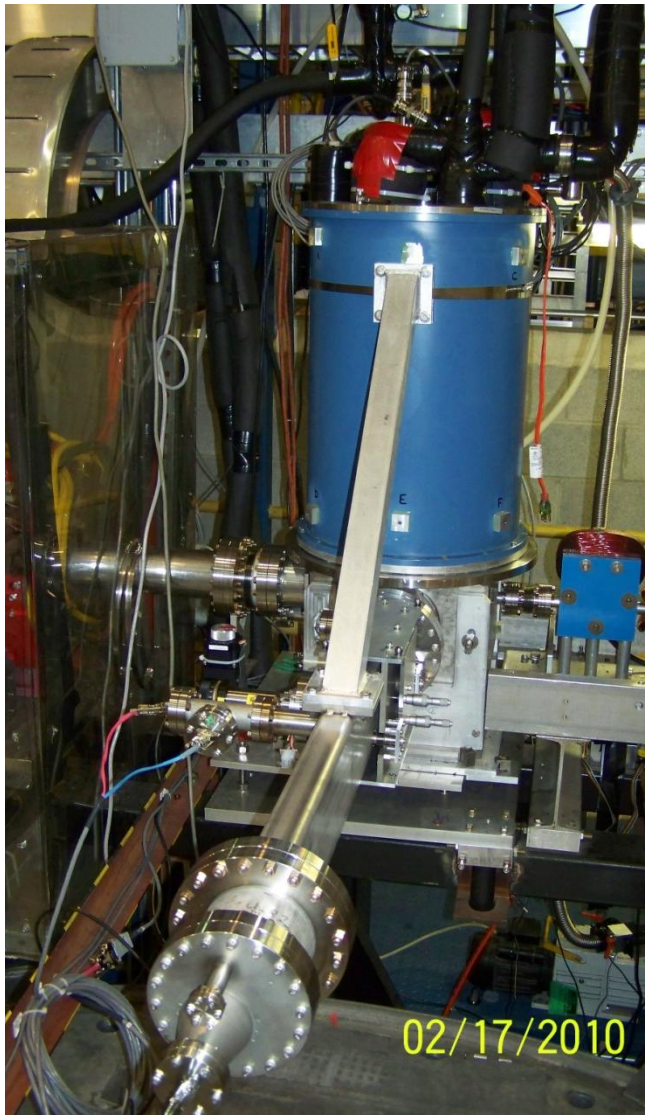
3. Introduce a beam duty cycle (reduce heating)

4. New fast DAQ based on FADC (higher rate, smaller dead time, more information etc.): Brad, Mindy, Ahmed

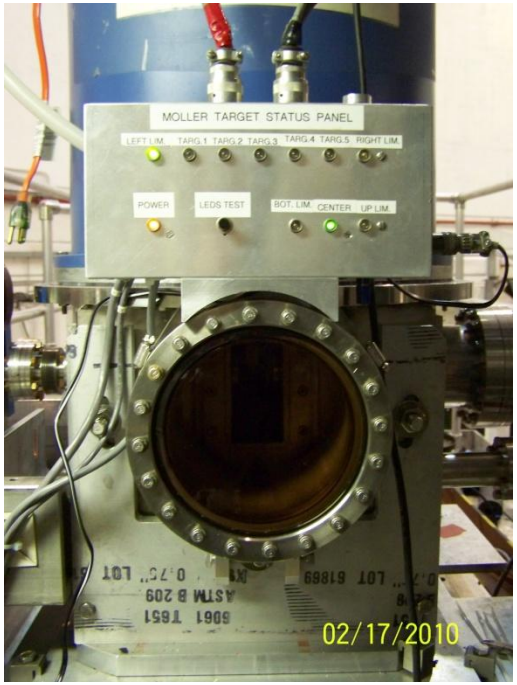
New Møller Target Design

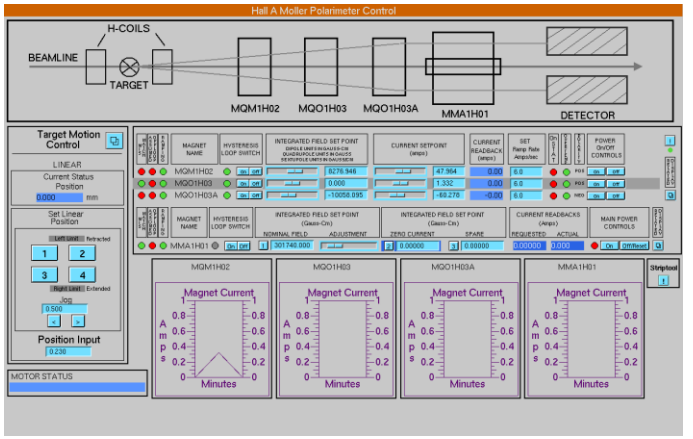


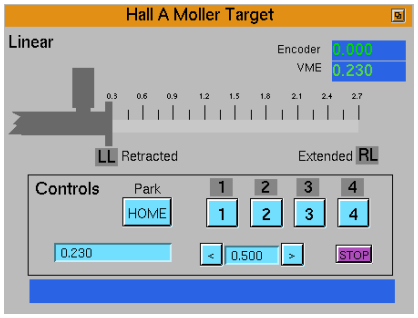
Møller Target Area



MCC motor control code was upgraded
Motor movement was tested
Encoder was tested
FSD was tested
Have to repeat the test with 3T filed







Superconducting Magnet

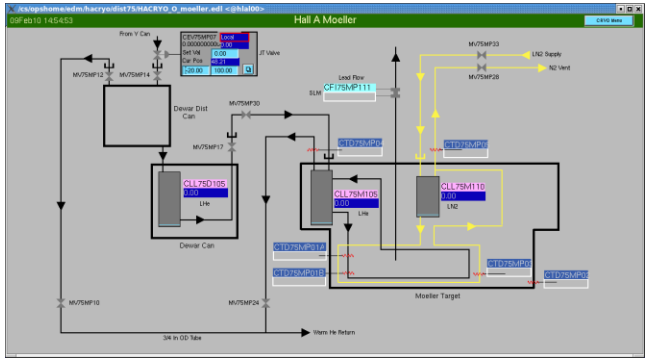
After reconstruction:

- *Better alignment*
- *Lager N2 outlet diameter*
- *Better IR shield*
- *More N2 and He temperature and level sensors*
- *Vacuum and cooling tests were done*
- *Field mapping was done*
- *Alignment was done*
- *LN2 automatic refill*
- *Cryo system control is ready*
- *Magnet power control is ready*
- *Magnet power cable is not connected*
- *LHe line is not ready*

Waiting for cryo test in the Hall

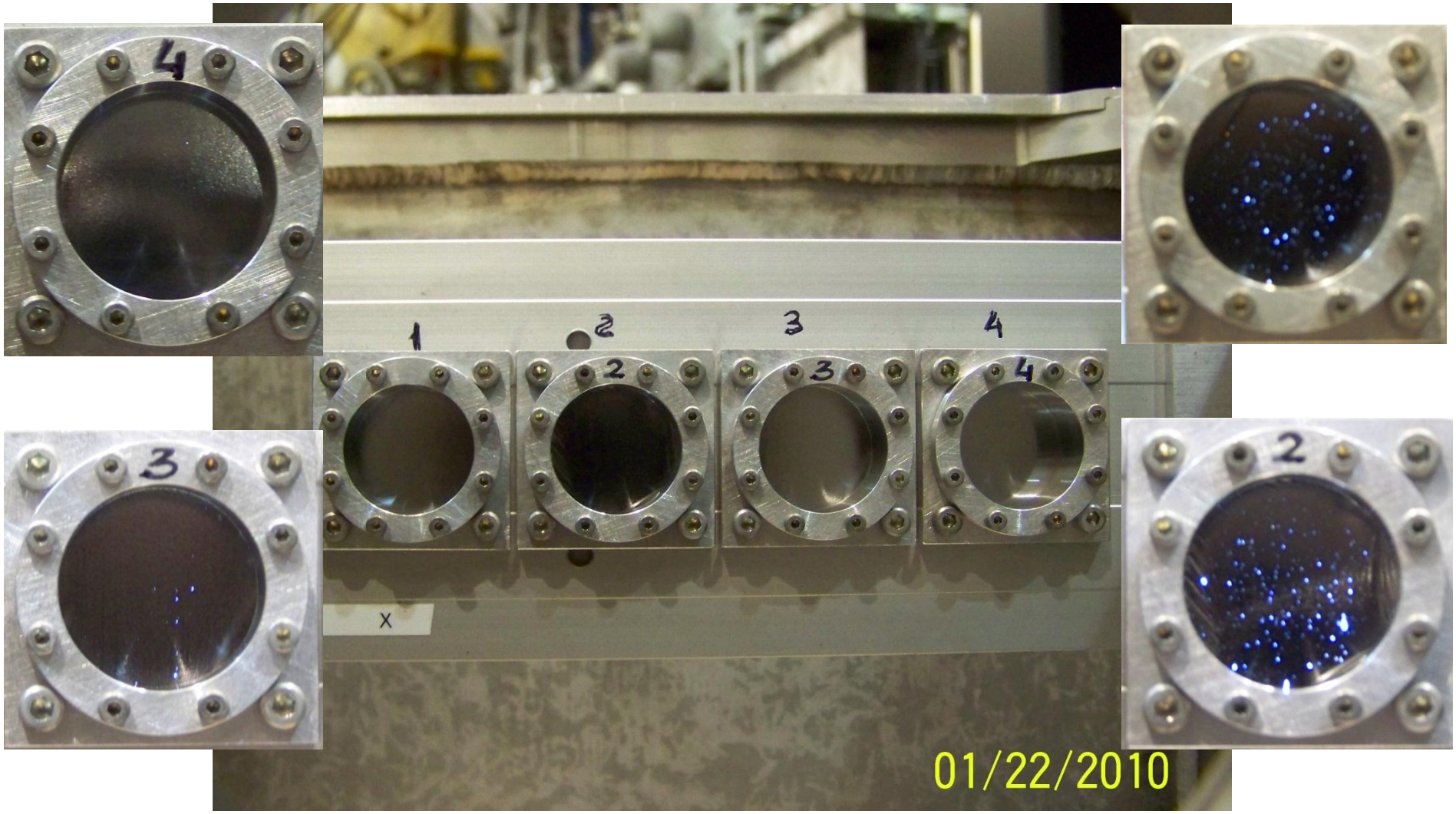
Superconducting Magnet

- LHe manual refill:
  ~5 days with magnet OFF
  ~2 days with magnet at 4T
- check and refill LHe with any controlled access to the Hall
- 45min for magnet ramp up
- 45min for magnet ramp down
- software polarity switch (but 1.5hours to change polarity)



~1hours for Møller settings +
~1hours to restore the beam parameters

Target Foils

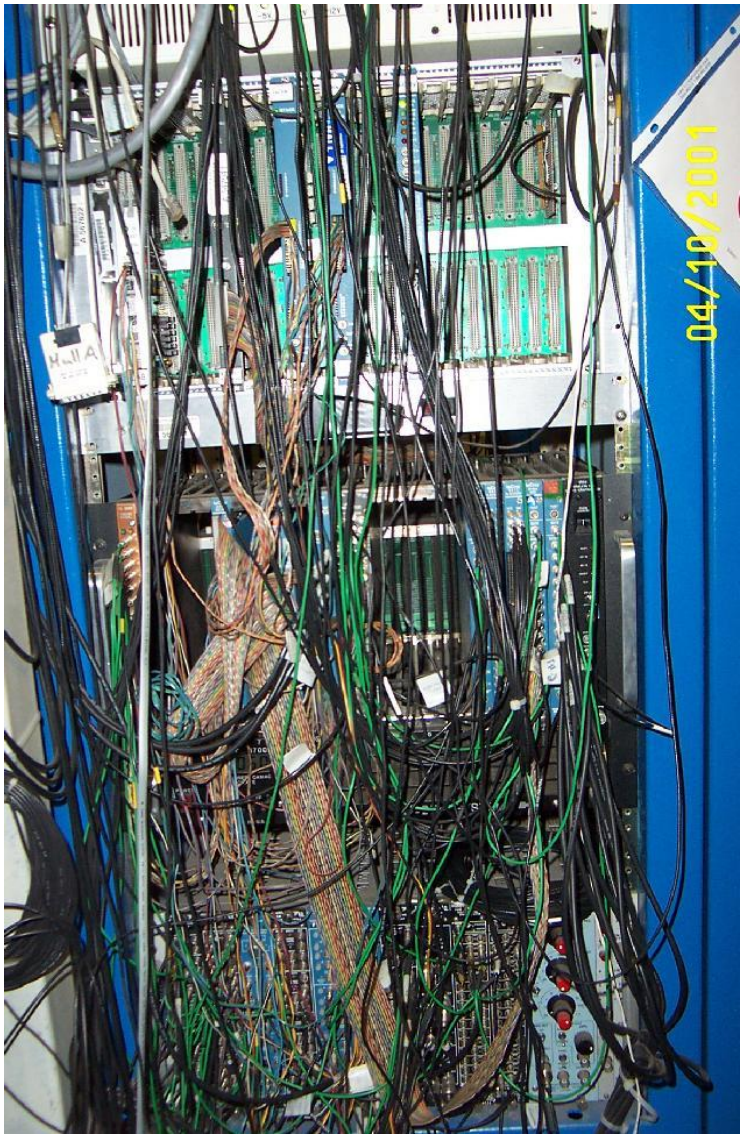


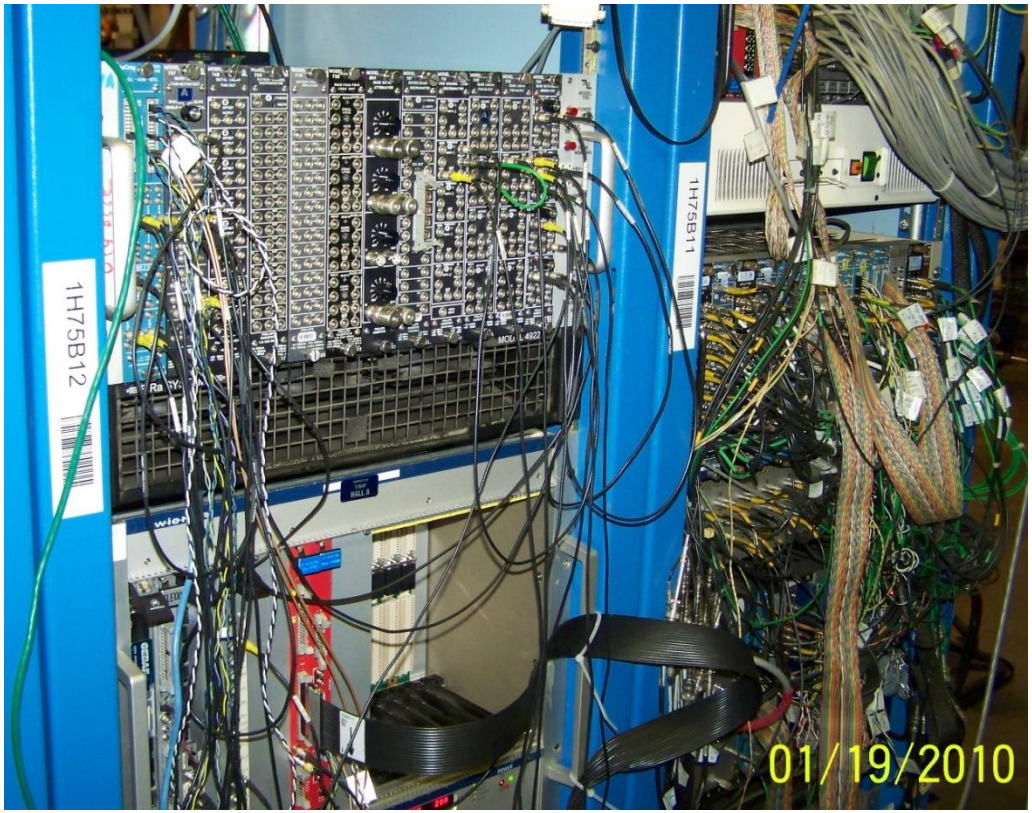
Targets: pure Fe foils 1-1μm, 2-1μm, 3-4μm, 4-12μm

Segmented Aperture Detectors

Will be installed next week

Old and New Møller DAQ





For PREX old and new DAQs will be working in parallel

Measurement at High Current Beam

Measurement at high beam current 0.5μA→50μA?

Reasons:

- no laser phase dependence (fully open slit) ≥5μA;
- working beam position fast-feedback ≥5μA;
- working energy fast-feedback ≥5μA;
- no bleed through effect (time by time check)

≥5μA is "high current beam"

Problems:

- target heating;
- detector counting rate

Measurement with CW Beam

25K heating $\longrightarrow$ 0.3% target depolarization

Heating by 1.5μA CW:

$\Delta T \sim 22K$ (no raster)

$\Delta T \sim 12K$ (raster $1 \times 1 mm^2$)

Measurement with CW Beam

25K heating ⟶ 0.3% target depolarization

Heating by 1.5μA CW:

ΔT ~ 22K (no raster)

ΔT ~ 12K (raster 1×1mm²)

For PREX:

Raster 1×0.5mm² and 3μA CW (<5μA):

ΔT ~ 30K

1μm /3μA ~1hour (0.3%stat error)

4μm /3μA ~20min (0.3%stat error)

12μm/1μA ~20min (0.3%stat error)

~2hours

Measurement with User Mode

"User mode" - a few ms pulse for each 30ms helicity window

For PREX:

Raster 1×0.5mm^2 +

10ms of 30ms helicity pulse (30Hz)

(or ~3ms of ~8ms helicity pulse 120Hz)

1μm / 10μA beam: ~45min for 0.3% stat.er.

Measurement with Beat Frequency Mode

Micro-suppression (the beat frequency)

M. Poelker Phys.Rev.ST Accel.Beams 10:053502,2007 or J Musson JLAB-ACE-07-693, Jun 2007. 3pp.

Pre-buncher must be off ⟶ **INVASIVE!!!**

Fast energy feed-back is not available!

by Eugene: n=4 (500MHz/4=125MHz)

For PREX: n≥10 (500MHz/10=50MHz)

Measurement with Beat Frequency Mode

Micro-suppression (the beat frequency)

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Pre-buncher must be off ⟶ **INVASIVE!!!**

Fast energy feed-back is not available!

by Eugene: n=4 (500MHz/4=125MHz)

For PREX: n≥10 (500MHz/10=50MHz)

For test only:

Raster 1×0.5mm^2 +

n=10(micro-suppression) +

10ms of 30ms helicity pulse ("user mode"):

-1μm target/50μA beam: ~1.5hours for 0.3% stat.er.

-4μm target/25μA beam: ~45min for 0.3% stat.er.

-12μm target/10μA beam: ~35min for 0.3% stat.er.

~3.5hours

Møller Run for PREX

Møller settings (+magnet ramp up): ~1hour

Raster 1×0.5mm²

CW: (low current <5μA)

1μm /3μA ~1hour (0.3%stat error)

4μm /3μA ~20min (0.3%stat error)

12μm/1μA ~20min (0.3%stat error)

Target thickness and condition systematic

CW: ~2hours

"User mode": (high current >5μA)

10ms of 30ms helicity pulse (30Hz)

1μm / **10μA** beam: ~45min for 0.3% stat.er.

"User mode": ~1hour

Restore PREX beam settings: ~1hour

Total: ~5hours

Systematic Error

Variable	Hall C	Hall A	
		Present	Upgrade
Target polarization	0.25%	1.8%	0.5%
Target angle	0.0%	0.5%	0.0%
Analyzing power	0.24%	0.3%	0.3%
Levchuk effect	0.3%	0.2%	0.3%
Target temperature	0.05%	0.0%	0.02%
Dead time	?	0.3%	0.3% !
Background	?	0.3%	0.3% !
Others	0.1%	0.3%	0.5% !
Total	0.47%	2.0%	~1.0%