

Møller Polarimeter Upgrade

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Outline

- 1 Current Status
- 2 Proposal for PREX

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Current Status

In 2005-2006 many measurements have been done with several foils. Analysis is in progress.

The goal for the systematic error

Variable	Error	
	OLD	Present
Target polarization	3.5%	2.0%
Target angle	0.5%	0.5%
Analyzing power	0.3%	0.3%
Levchuk effect	0.2%	0.2%
Dead time	0.3%	0.3%
Total	3.6%	2.1%

Proposal for PREX

Requirement for the systematic error: $\sim 1\%$ at **850 MeV**, **50 μA**

Hall C Møller, present

- Foil at 90° , saturated at **4 T** $\Rightarrow \sigma_{\mathcal{P}_T} = 0.3\%$
- Beam current $< 5\mu\text{A}$

Hall C Møller upgrade

- Round foil \Rightarrow a band
- Fast beam kicker $\sim 2\text{ mm}$ deflection
- Beam current $> 50\mu\text{A}$

Proposed Hall A upgrade

- Hall C target clone, using the spare Hall C magnet
- Round target foil $\sim 1\ \mu\text{m}$ thick
- Pulsed beam, $> 1\text{ ms}$ per pulse, at **30 Hz**
- Fast raster
- Detector/electronics upgrade

Systematics $< 1\%$

Problems

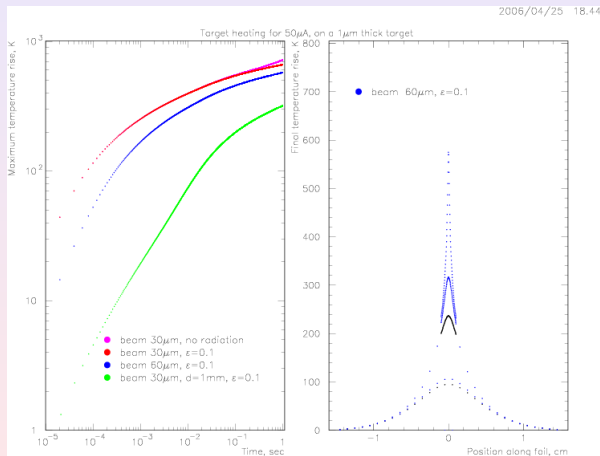
Restrictions for high beam current

- Foil heating should $\Delta T < 50\text{K}$
- Counting rates should not be much higher than now

Target heating

Numerical solution

- Beam
- Conductivity
- Radiation



Target heating with the real raster

Conditions

Beam $50 \mu\text{A}$, $\sigma_X \sim 30 \mu\text{m}$,
1 ms pulses at 30 Hz

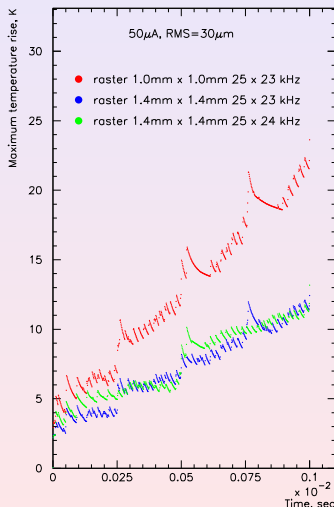
Raster $\sim 1.4 \times 1.4 \text{ mm}^2$, $25 \times 24 \text{ kHz}$

Results

- In pulse $\Delta T_{max} \sim 12 \text{ K}$
- Average, by 30 Hz $\Delta T_{max} \sim 12 \text{ K}$
- Total $\Delta T_{max} \sim 24 \text{ K}$ - acceptable!

Issues

- Beam optics for this raster



Counting rates

Instantaneous rates

	OLD	NEW
Beam current	0.3 μA	50 μA
Target thickness	12 $\mu\text{m}/\sin 20^\circ$	1 μm
Ap.counter's rate	2 MHz	($\times 4.75$) \sim 7.5 MHz

Modifications

- Close the collimator: single rates $\times 0.5$, coincidence $\times 0.3$
- Electronics upgrade: pulses 8 ns \Rightarrow 3.5 ns

Statistical accuracy

Duty cycle 3% \Rightarrow 1% in \sim 30 min

Project summary

Target

- Build a new target chamber for the coils and the target
- Build the cryo supply system
- Build a movable frame for the target foils

Detector, electronics

- New aperture counters
- Discriminator \Rightarrow 300 MHz NIM, add remote controls
- New PLU
- Coincidence units \Rightarrow 250 MHz NIM

Beam line

- Find the optimal optics for the raster
- Additional correctors?