

# Møller Polarimeter Upgrade

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For Parity collaboration meeting, Dec 2006

# 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%
<b>Total</b>	<b>3.6%</b>	<b>2.1%</b>

# Proposal for PREX

Requirement for the systematic error:  $\sim 1\%$  at **850 MeV**, **50  $\mu\text{A}$**

## Hall C Møller, present

- Foil at  $90^\circ$ , 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

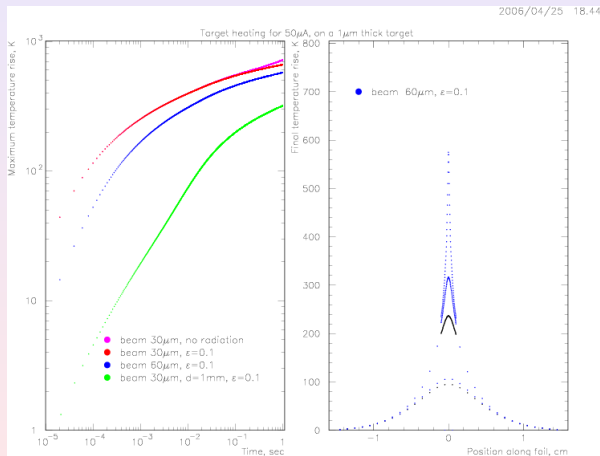
## Restrictions for high beam current

- 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

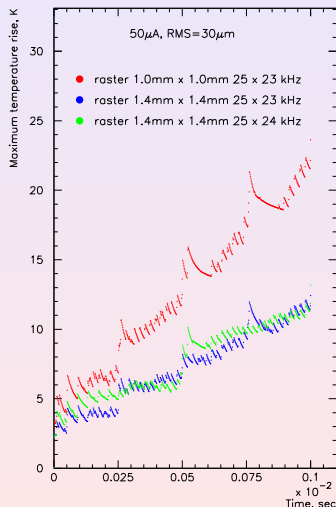
Raster  $\sim 1.4 \times 1.4 \text{ mm}^2$ ,  $25 \times 24 \text{ kHz}$

## 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 $\mu\text{A}$	50 $\mu\text{A}$
Target thickness	12 $\mu\text{m}/\sin 20^\circ$	1 $\mu\text{m}$
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?