

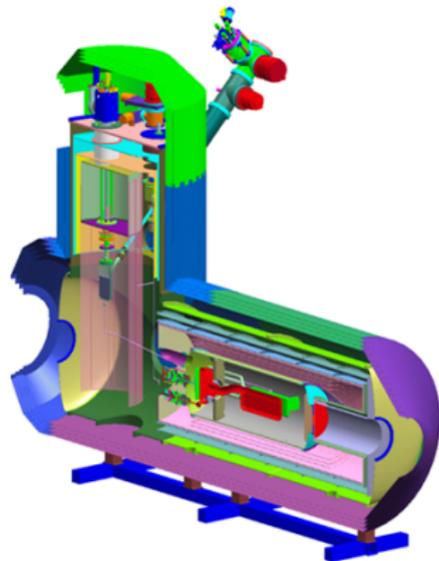
Neutron Guide Studies

C. Crawford, G. Greene, W. Korsch, R. Redwine

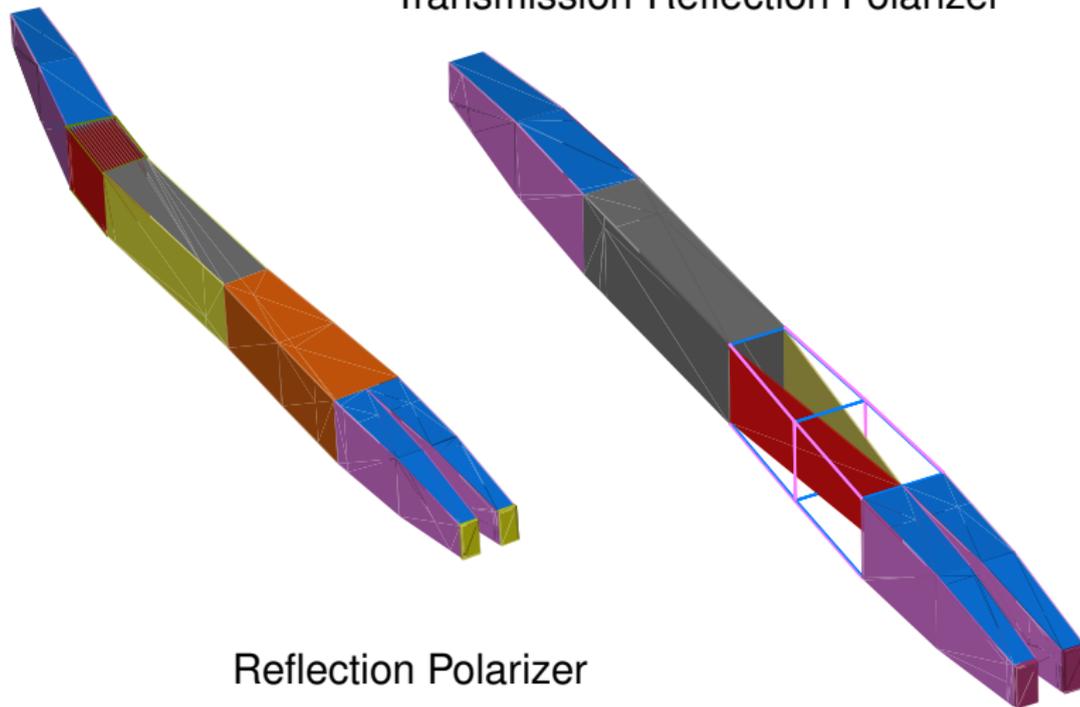
Duke, EDM Collaboration Meeting
May 21, 2008

UK UNIVERSITY OF KENTUCKY

EDM



Transmission-Reflection Polarizer



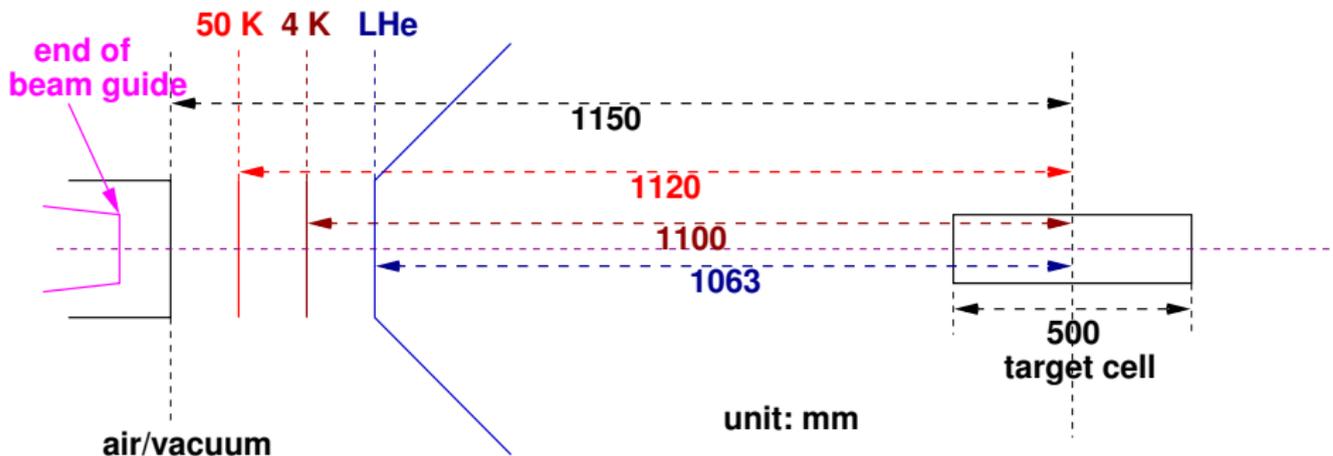
Reflection Polarizer

One year ago (Chicago Meeting)

- ✗ $T = T_L + T_R$
- ✗ Neutrons traced to the center of L^4He target, i.e. 55 cm behind end of guide (used a simple rectangular area)
- ✗ losses: $T_{end\ of\ guide}/T_{target\ center} \approx 1.47$ (T/R), ≈ 1.37 (Bender)
(Note: Polarizing sheets increase divergence)
- ✗ Extend beam guide closer to target?

comment	T	P	$T \cdot P$	ratio
T/R (no Si)	0.392	0.97	0.380	1.92
T/R (w/ 0.775 mm Si)	0.301	0.96	0.290	1.46
Bender	0.208	0.95	0.198	1.00

Distance between end of beam guide and target cells is increased
 (earlier optimizations: $d = 55$ cm, **now $d \approx 120$ cm!!!**)



New Idea: Combine Reflection Polarizer and Splitter

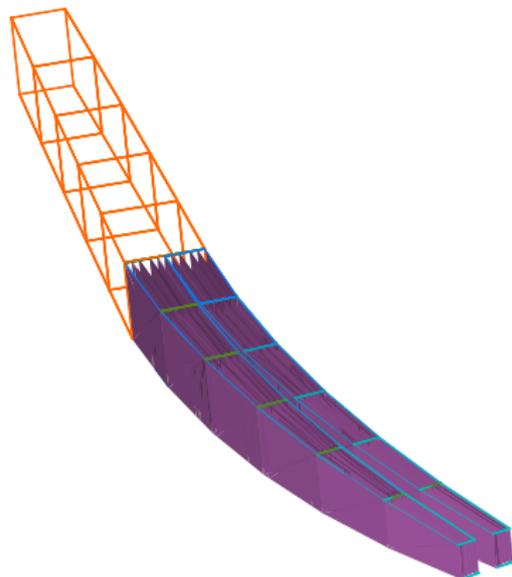
Idea: Chris Crawford

After weeks of work

GEANT4 model:

- Advantages
 - Better focussing properties?
 - Can also be used without magnetic sheets.
 - . . .
- Disadvantages
 - Possibly more background
 - . . .

Basic goal: Study focussing effect on beam.

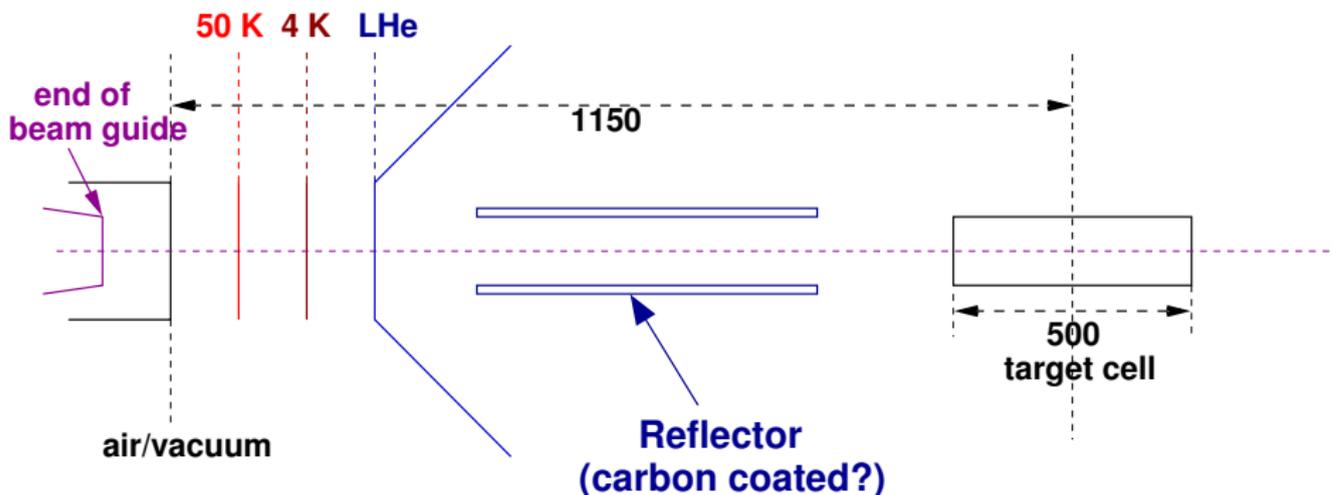


- optimize splitter shape
- optimize number and position of sheets
- optimize length of sheets
- add horizontal sheets ???

Complete optimization should be finished within **one month**.

Additional Option (Necessity?)

Add a reflecting segment inside the L⁴He vessel (non-magnetic, non-conducting).



SMOKE and Mirrors (No joke)

Idea: Use **S**urface **M**agneto - **O**ptic **K**err **E**ffect to determine magnetization in magnetic super-mirrors.

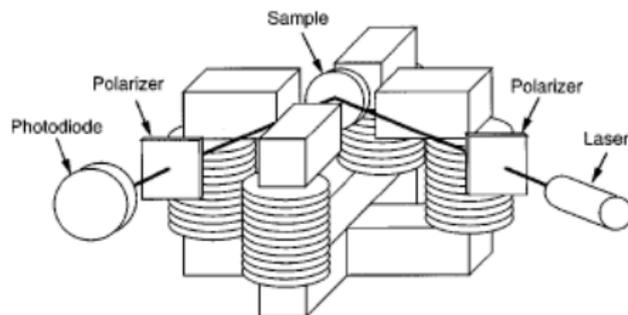


FIG. 2. Schematic drawing of a SMOKE setup.

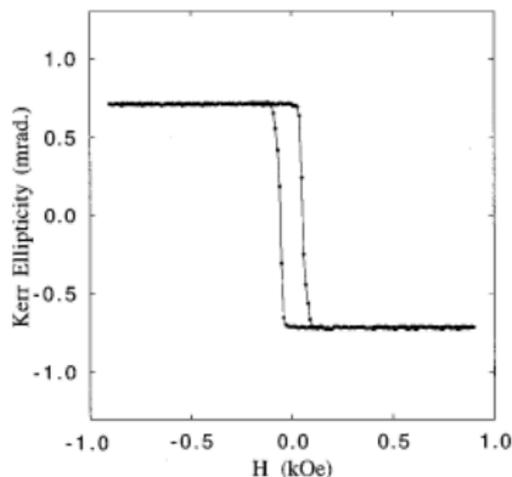


FIG. 3. A SMOKE loop taken from a 6 ML Fe film grown on a Ag(100) substrate.

Z. Q. Qiu, Rev. Sci. Instrum., 71, 1243 (2000)

- Try to find a signal using a FeCoV super-mirror ($2.5'' \times 10''$, $m=2$). Gift from Swiss Neutronics.
- Try to test different magnetization procedures:
 - magnetize only a fraction of the surface (Peter Boeni (Swiss Neutronics): domain propagation?)
 - vary magnitude of B-field
 - vary pulse length

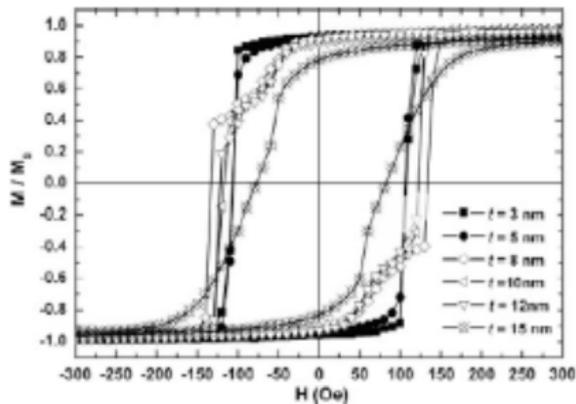
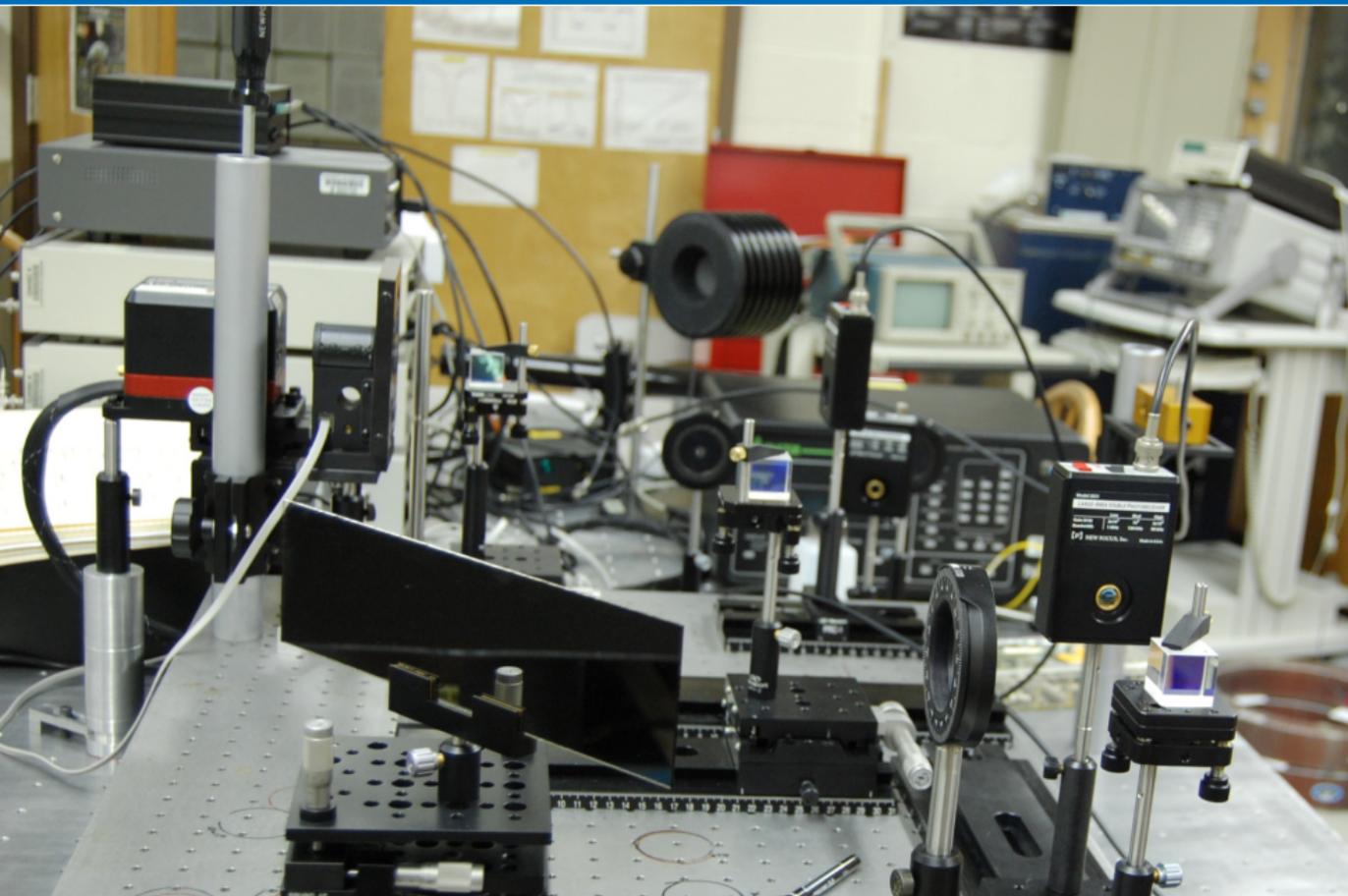


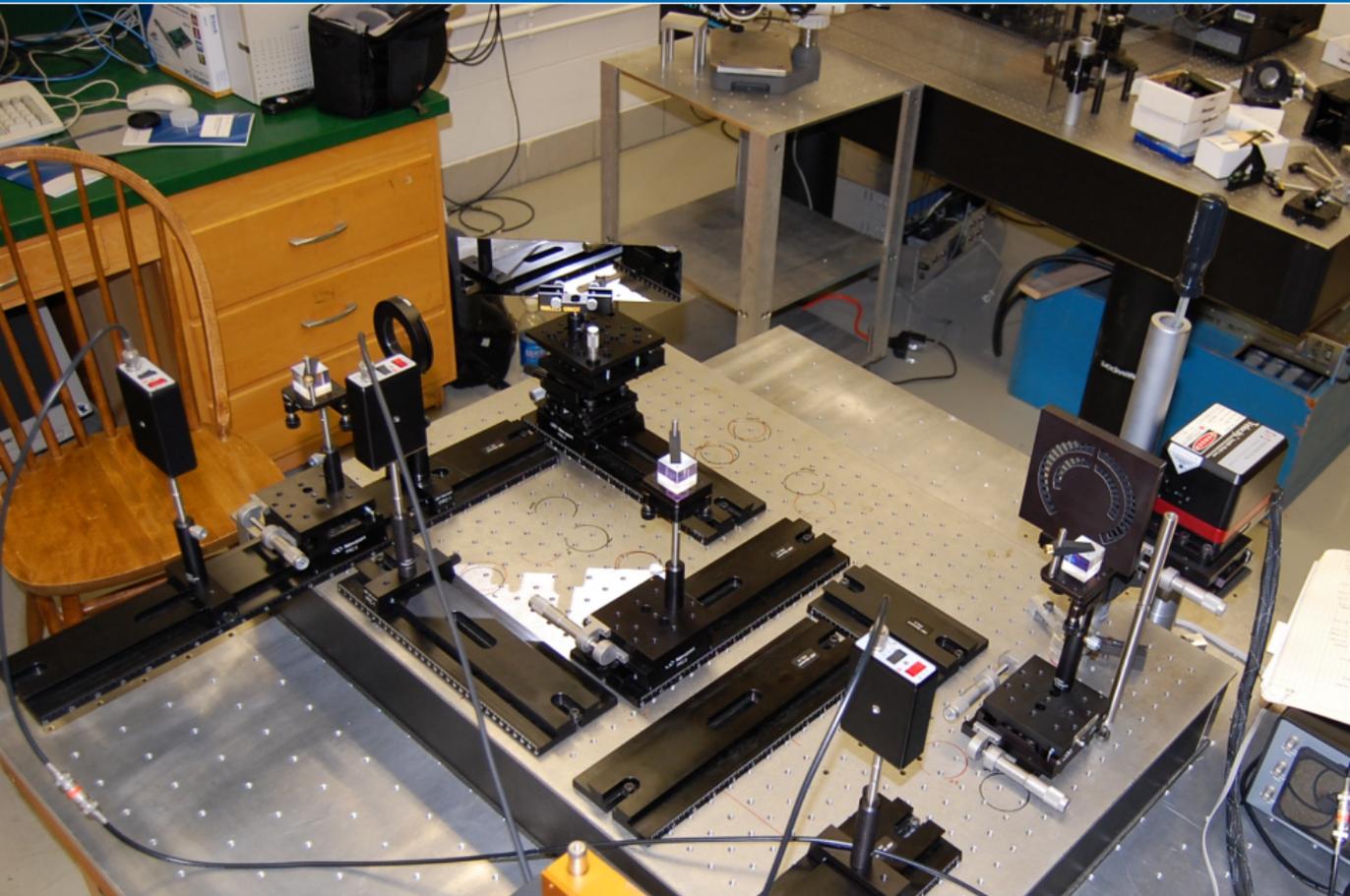
Fig. 1. The M - H loops of Ti/FeCoV multilayers for various Ti spacer layer thicknesses.

Graduate students: G. Phelps, M. Kalita

Experimental Setup at UKy



Experimental Setup at UKy



- Need to re-optimize neutron guide focussing.
- Geometry of "Bent Splitter System" in GEANT4.
- Optimal geometry will be determined within a month.
- First SMOKE setup ready (\Rightarrow determine magnetization of polarizing super mirrors).
- Magnet development in progress.