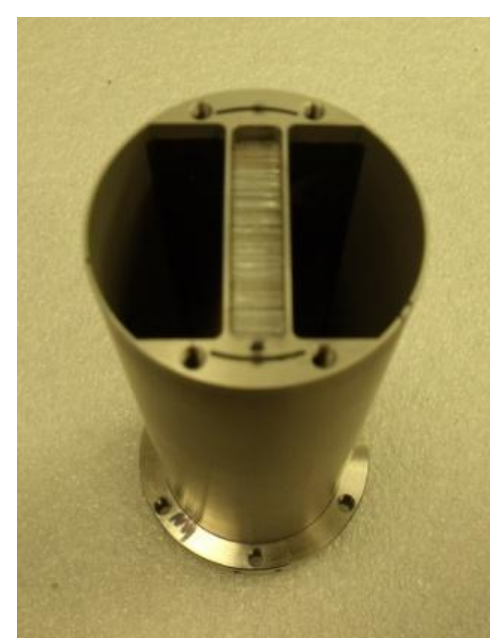# HySpec: new spectrometer is hosting users and preparing for polarization analysis

Barry Winn[a], Uwe Filges[b], V. Ovidiu Garlea[a], Melissa Graves-Brook[a], Mark Hagen[a,c], Peter Jiang[a], Michel Kenzelmann[b], Larry Passell[d], Stephen M. Shapiro[d], Xin Tong[a], Igor Zaliznyak[d]

At its core, a Direct Geometry Spectrometer..

Fermi chopper, 30-420 Hz

	(m)
L1	37.2
L2	3.6
L2*	1.8
L3	4.5

	(deg)
Horizontal Acceptance	60
Vertical Acceptance	15
Vertical Divergence*	4.7

Hybrid Spectrometer:

the high-flux, coarse energy resolution, cold neutron choice among SNS direct geometry spectrometers[1]

..using features of a Triple Axis Spectrometer:

-Vertical Bragg focusing
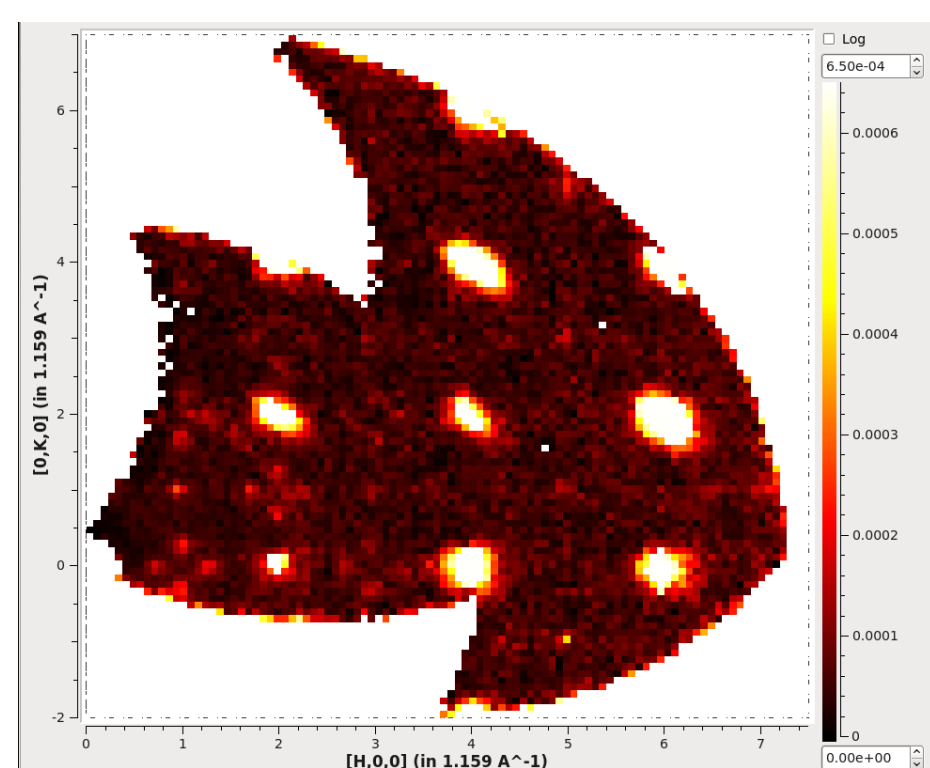-Variable final flight path
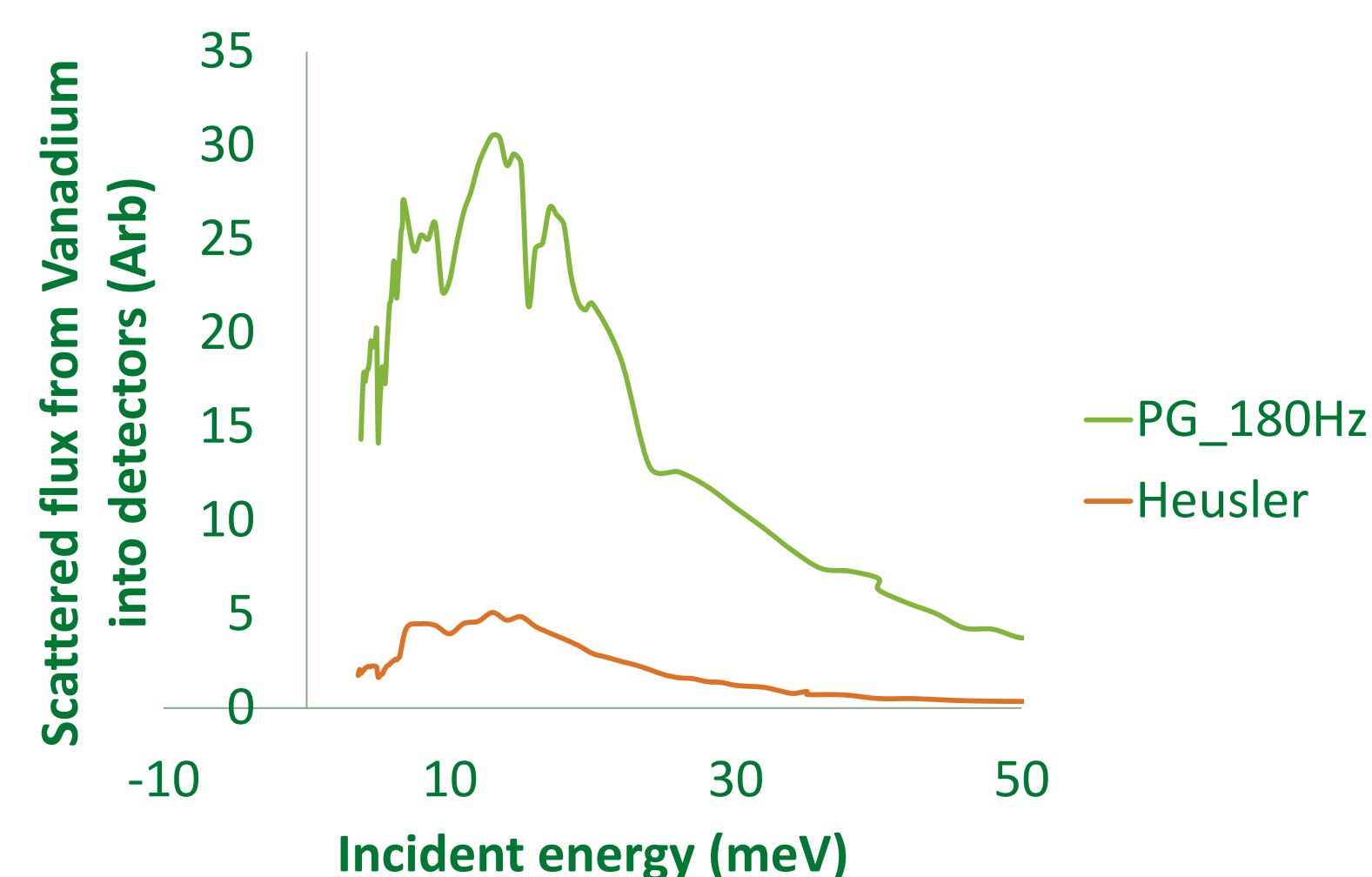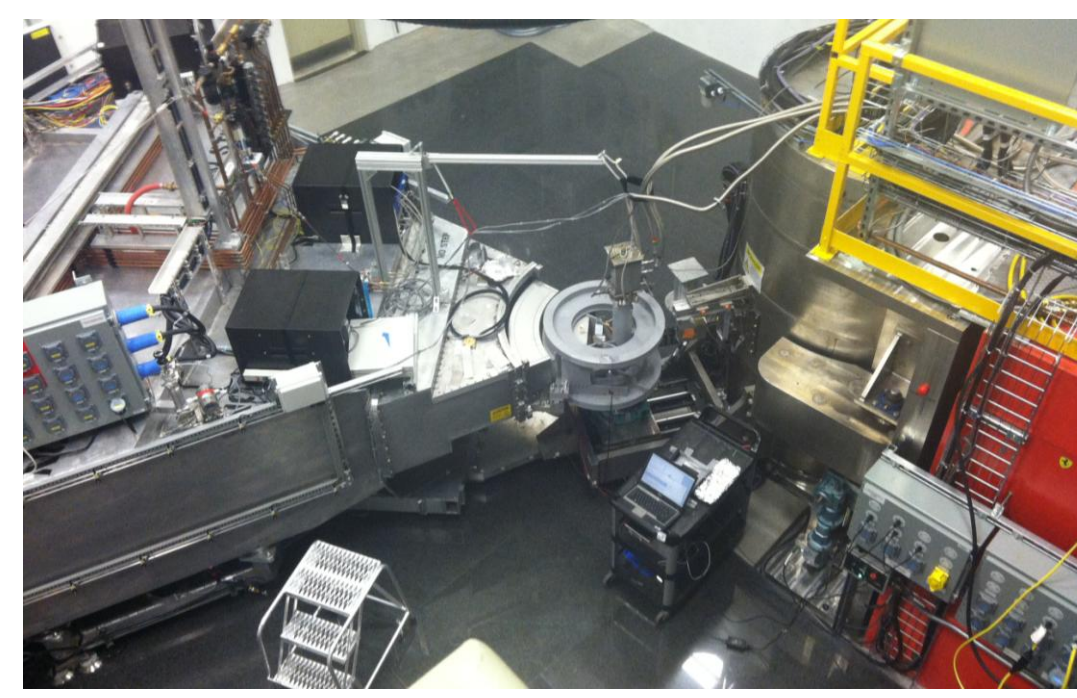
| Intensity at 15 meV, 180 Hz (n/s/cm^2/MW)	4.20E+05
Elastic Resolution (FWHM)	2-5% Ei
Incident Energy Range (meV)	3.8-50

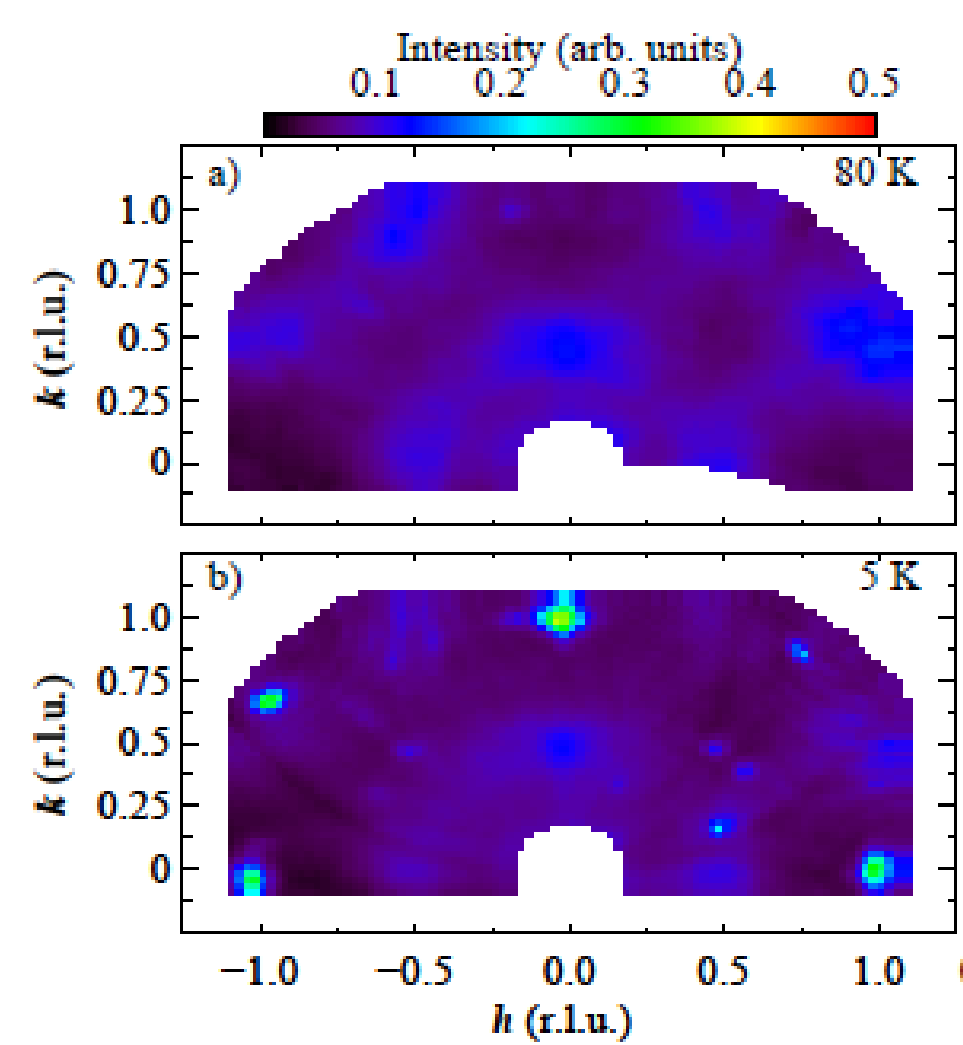## User Program with unpolarized neutrons

HOPG vertical focusing

	User Experiments
Spring 2013	6
Fall 2013	17
Spring 2014	16

Combining data sets at different detector vessel positions is trivial using Mantid[8]. $La_{1.75}Sr_{0.25}NiO_4$ data measured[9] at detector angle ranges 5-65° and 60-120°.
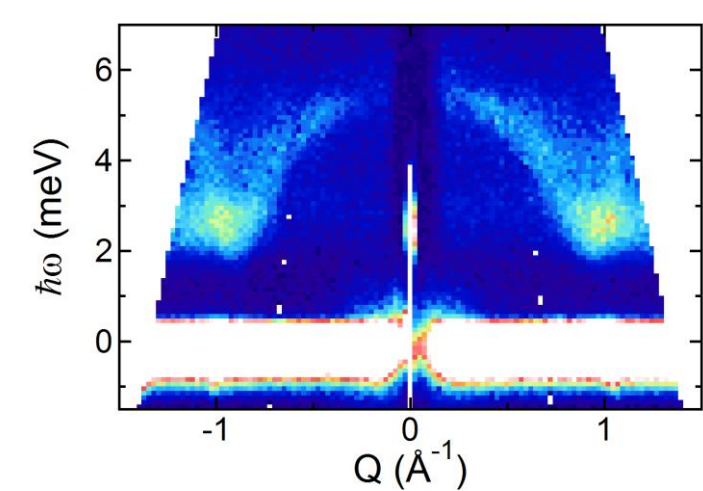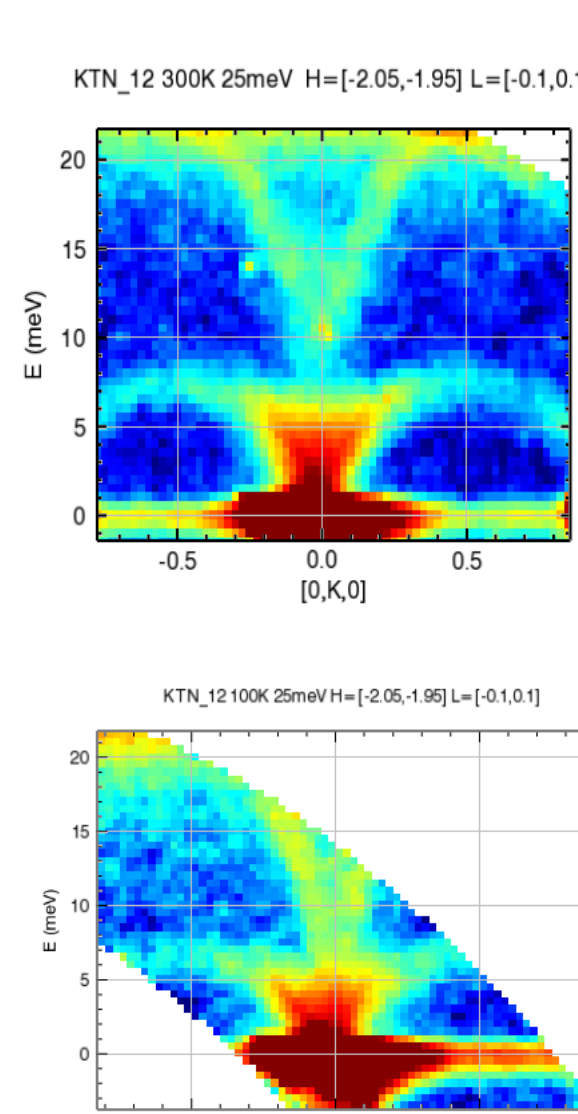
Detector vessel range -30° to 30° is used to measure $CrCl_2$[1]
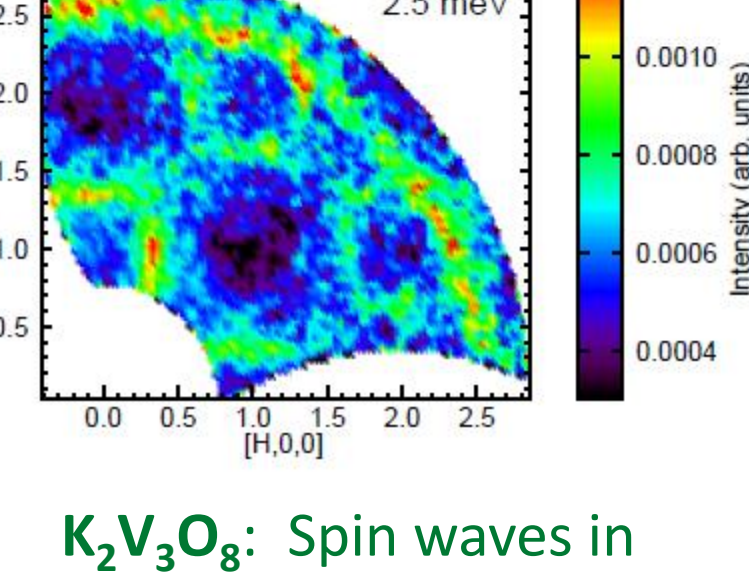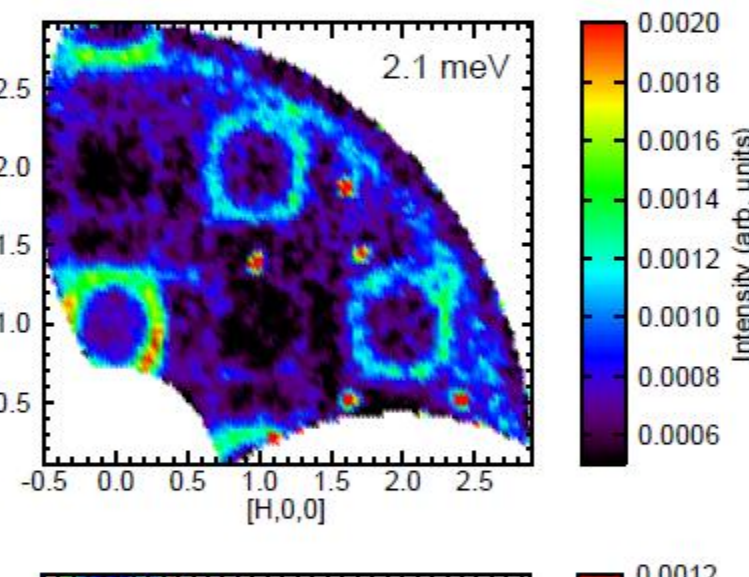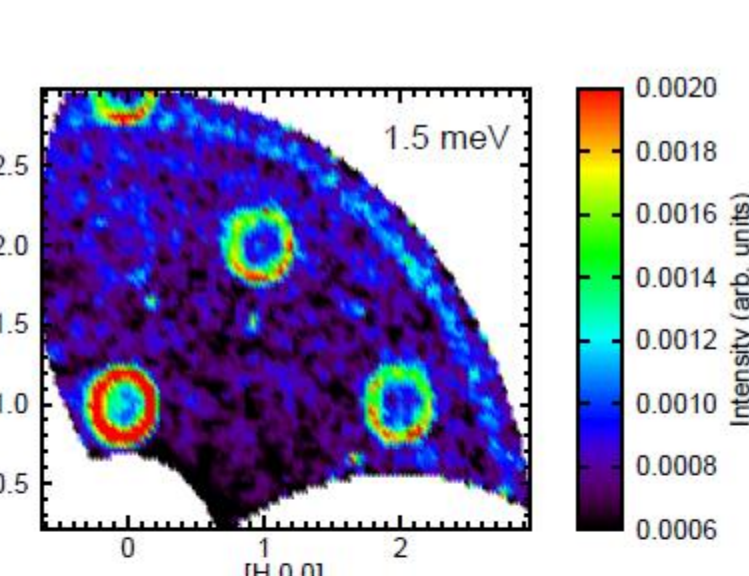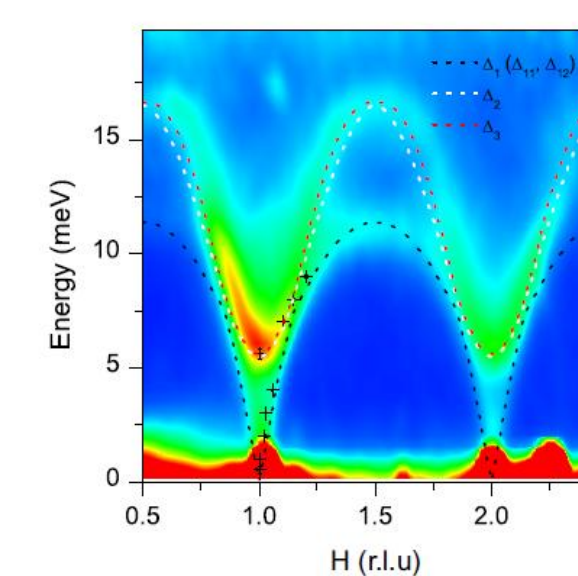

$Fe_{1.09(1)}Te$: symmetry forbidden (1,0,0) & (0,1,0) reflections below ~60 K reveal presence of bond-order wave transition, suggesting ferro-orbital coupling[3]

$Y_{0.7}Lu_{0.3}MnO_3$ at 4K: dotted lines show calculated spin wave dispersion with magnetoelectric coupling in this multiferroic[2]

$KTa_{0.88}Nb_{0.12}O_3$: TO branch softening[4]

$K_2V_3O_8$: Spin waves in S=1/2 square lattice antiferromagnet[5]
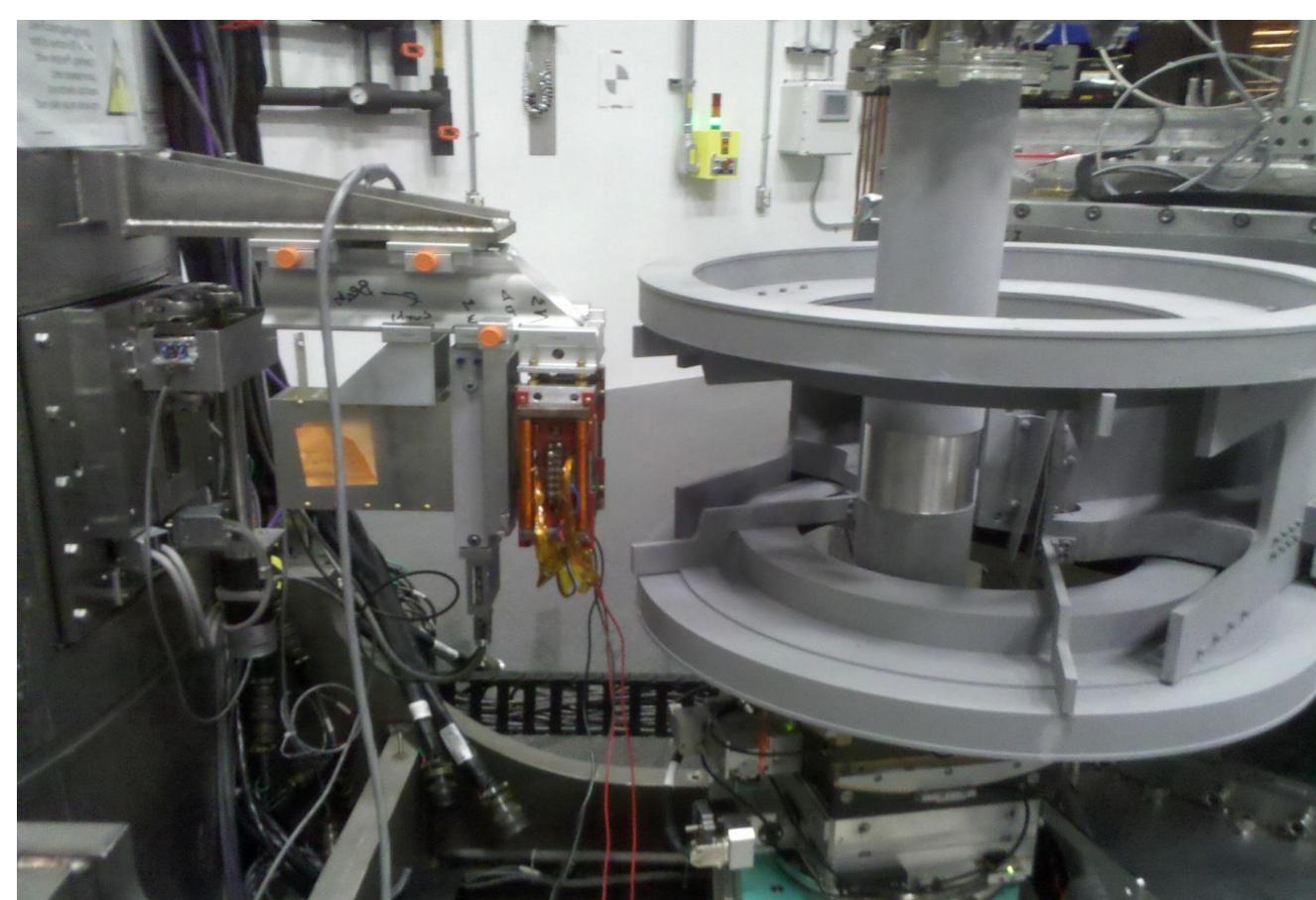
Commissioning and Development with Polarized neutrons

Heusler vertical focusing and polarizing

Incident beam flipping ratio at 15 meV	
with Mezei flipper	23
with high T_c cryo flipper[6]	32

Polarization Analyzer option 1: ^{3}He Analyzer Cell Spin-Exchange Optically Pumped
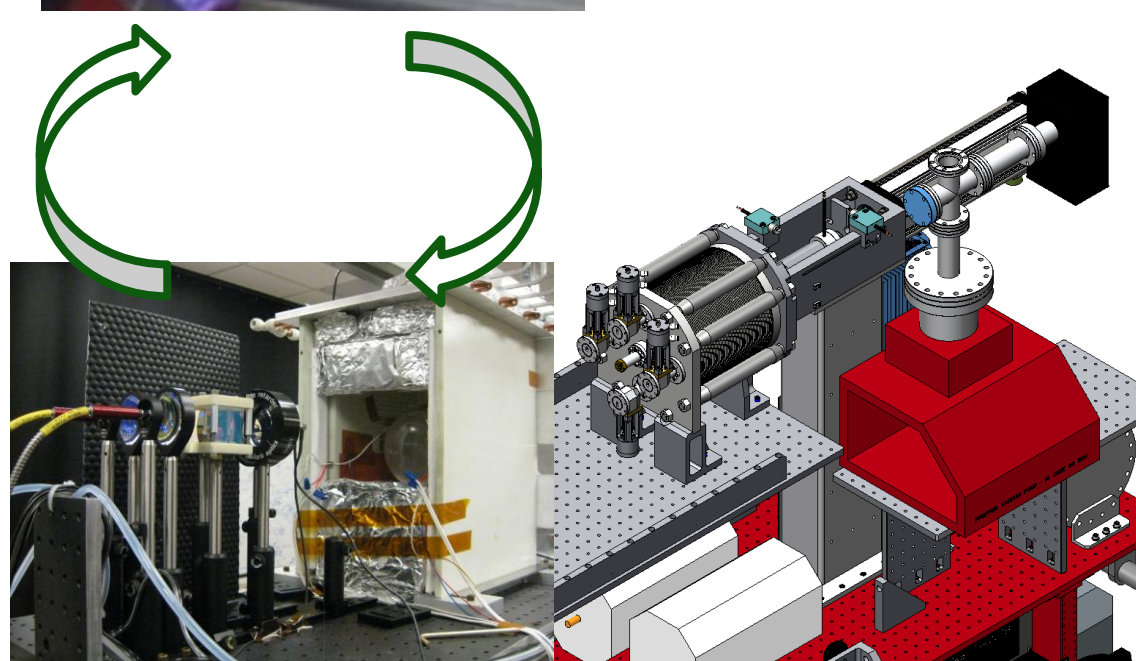
Aberration-corrected coils centered on sample, uniformity to 3E-5 cm⁻¹

Drop-in analyzer cell commissioning with neutrons, NIST banana cell and RF flipping
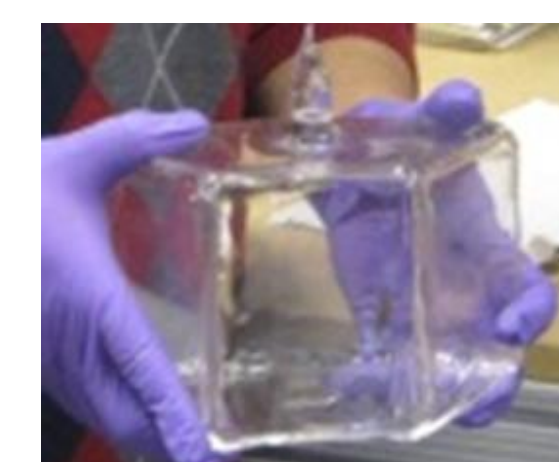
SEOP station attached to detector vessel, with mechanical transfer of polarized gas to optimum shape quartz wide-angle cell[7]

Status: all parts delivered, assembly and offline testing underway

Polarization Analyzer Option 2: Polarizing Supermirror array

Status: Remanent field array ready to ship from PSI. Magnetizer delivered and tested at HYSPEC.

[1] RSI **85**, 045113 (2014)
[2] PRB **89**, 144417 (2014)
[3] PRL **112**, 187202 (2014)
[4] O Delaire et al in prep
[5] M Lumsden et al in prep
[6] T. Wang et al, accepted, IOP, Neutron optics & Detectors
[7] RSI **84**, 065108 (2013)
[8] http://dx.doi.org/10.5286/SOFTWARE/MANTID
[9] J. Tranquada et al; acquired May 2014

U.S. DEPARTMENT OF ENERGY | Office of Science