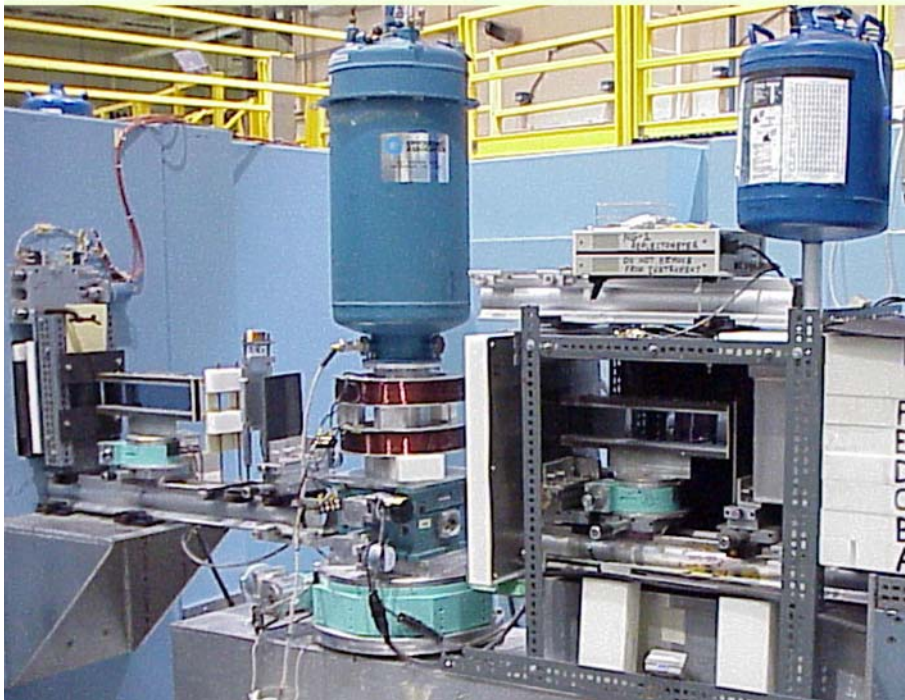
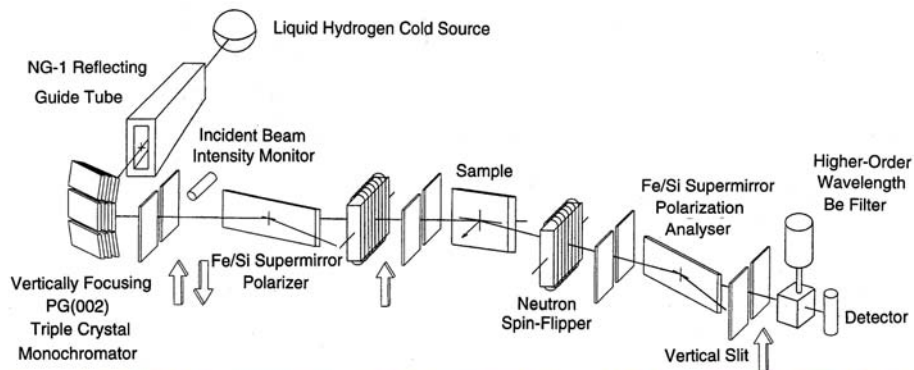


Experimental Setup for Polarized Beam



In the experimental setup, neutrons of wavelength 4.75 \AA selected by a pyrolytic graphite monochromator are incident upon an Fe/Si supermirror which reflects only one of the two neutron spin states. After passing through a spin flipper made of flat Al coils, the neutrons are scattered from the sample through a second spin flipper and then reflected from an analyzing supermirror into a ^3He detector. The polarization of the neutrons is maintained by magnetic guide fields applied perpendicular to the scattering plane along the entire flight path. The polarizing efficiencies of the front and rear supermirrors and the front and rear flippers are typically $> 95\%$.

Four cross sections can be measured. The data can be understood within the context of kinematic theory, which is directly applicable only at scattering angles well above the critical angle. For neutrons polarized perpendicular to the scattering wave vector Q_z , the non-spin-flip (NSF) and spin-flip (SF) intensities are described by:

NSF (Non-Spin Flip)

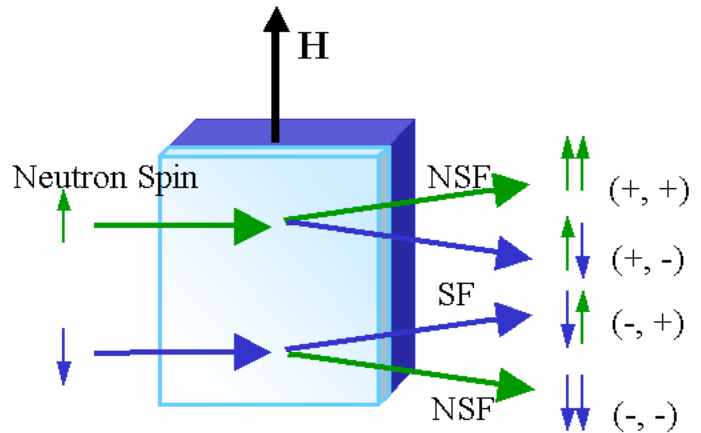
$$I_{(++)} \propto \sum_j |(b_j + C \mu_j \sin \phi_j) e^{iQ_z z_j}|^2$$

$$I_{(--)} \propto \sum_j |(b_j - C \mu_j \sin \phi_j) e^{iQ_z z_j}|^2$$

SF (Spin Flip)

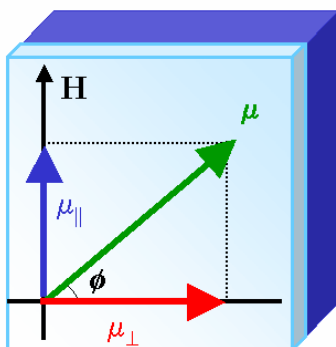
$$I_{(+-)} \propto \sum_j |C \mu_j \cos \phi_j e^{iQ_z z_j}|^2$$

$$I_{(-+)} \propto \sum_j |-C \mu_j \cos \phi_j e^{iQ_z z_j}|^2$$



where b_j is the scattering density of the j th plane and z_j is the position of the j th plane. The parameter μ_j is the average in-plane moment of the j th plane and ϕ_j is the average angle between μ_j and the guide field. C is a constant.

The difference between the NSF (+ +) and (- -) intensities is related to the component of the sample moment parallel to the direction of the applied field H , while the SF (+ -) and (- +) scattering is sensitive to the component of the magnetization perpendicular to the applied field.



By fitting all four cross sections simultaneously, one can extract the magnitude and orientation of the moment projection μ in the growth plane as a function of depth.