GH Experiment at Larmor

* We have two samples:
  + Ti(50 nm); Fe50Co48V2 (50); Si (50); Fe%0Co48V2 (50); Ni88Mo12 (100); Si substrate (100 mm x 50 mm x 0.78 mm)
  + A non-magnetic blank which is Ni88Mo12 (100 nm): Si substrate (100 mm x 50 mm x 0.78 mm)
* Mount the blank. Critical edge is at roughly 0.01 angs^-1. We want essentially all of the signal to be at k <~ 0.014 angs^-1. If we put this at around lambda = 2 angs we will have k ~ 0.003 angs^-1 at lambda = 10 angs. This should be good enough. Gives an incident grazing angle of 0.255 degs and a beam width of ~0.4 mm (small!!)
* I am not sure whether we should try to set up a scattering angle of 0.5 degrees (i.e. move the detector arm) or which detector to use.
* Establish echo for the blank with flippers perpendicular to the beam.
* The actual sample will need to be pre-magnetized using a field pulse of about 200 G parallel to the long edge of the sample. It should then stay remanently magnetized even though a guide field of ~ 5 G is applied along the short dimension of the sample. Peter Boeni claims that an attempt to magnetize the sample along a direction perpendicular to its easy direction (i.e. along the short dimension of the sample) will result in less than full remanence i.e. probably some diffuse magnetic scattering.
* Note that the magnetized sample will have magnetic poles at either end and that these may produce a diplora field that competes with the guide field. I need to calculate that effect this week. In the worst case we can mount two oppositely magnetized samples back to back (Peter sent two samples) to kill the dipole field near the neutron beam.
* Replace the blank with the sample. We expect the echo polarization to look like:



* In order to see this structure, we are going to need a very tight resolution in kz. I think this needs to be a divergence of at most 0.02 degrees (fwhm ~3 x 10^-4 rads). If we have two slits, each 0.4 mm wide, this implies a separation between the slits of between 1 and 2 m.
* The above plot is basically the cosine of the difference in phase between the two states. The actual GH shift is the derivative of the phase difference w.r.t kz and probably looks something like this:



* The effect of the spin echo is to cancel the phase difference between states introduced before the sample. But note that the states do not overlap at the detector. However, the lateral off-set is very small (~GH x 0.0.0044 = 25 nm max) because of the small incident angle.
* Another way to do the experiment is to do an echo scan. We ought to be able to find an echo current which, at each lambda, will restore full echo polarization. The change in echo current between different lambdas is proportional to the difference in the cosines of the phases of the states.