ADVANCED CYCLOTRON SYSTEMS

Ontperforming the field

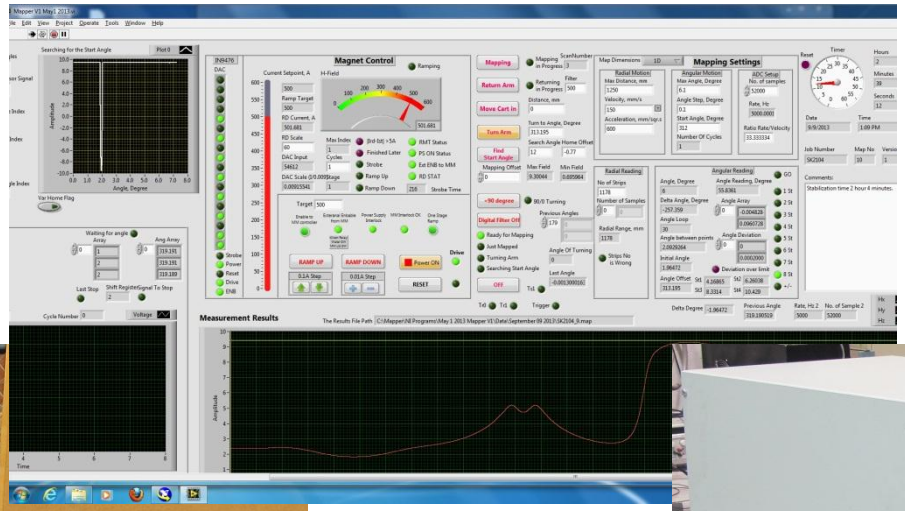
Cyclotron Magnet Mapper

Mechanical and Measurement Specifications

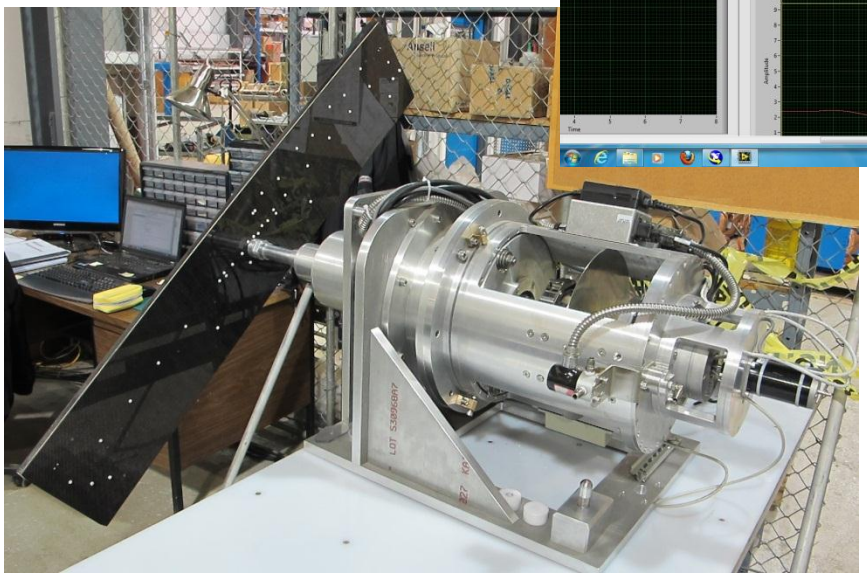
- Magnetic field accuracy: $5* 10^{-5}$ T (in hills)
- Azimuthal, radial resolutions: 0.0005°, 25 µm
- Magnetic field range: 0.4 – 2.2 T
- Scanning speed: 75 – 500 mm/s
- Duration of 360° measurement: 70 min (at 150mm/s)
- Number of samples per scan: 52000

Main Mapper Components

Mapper Software based on LabVIEW 11.0

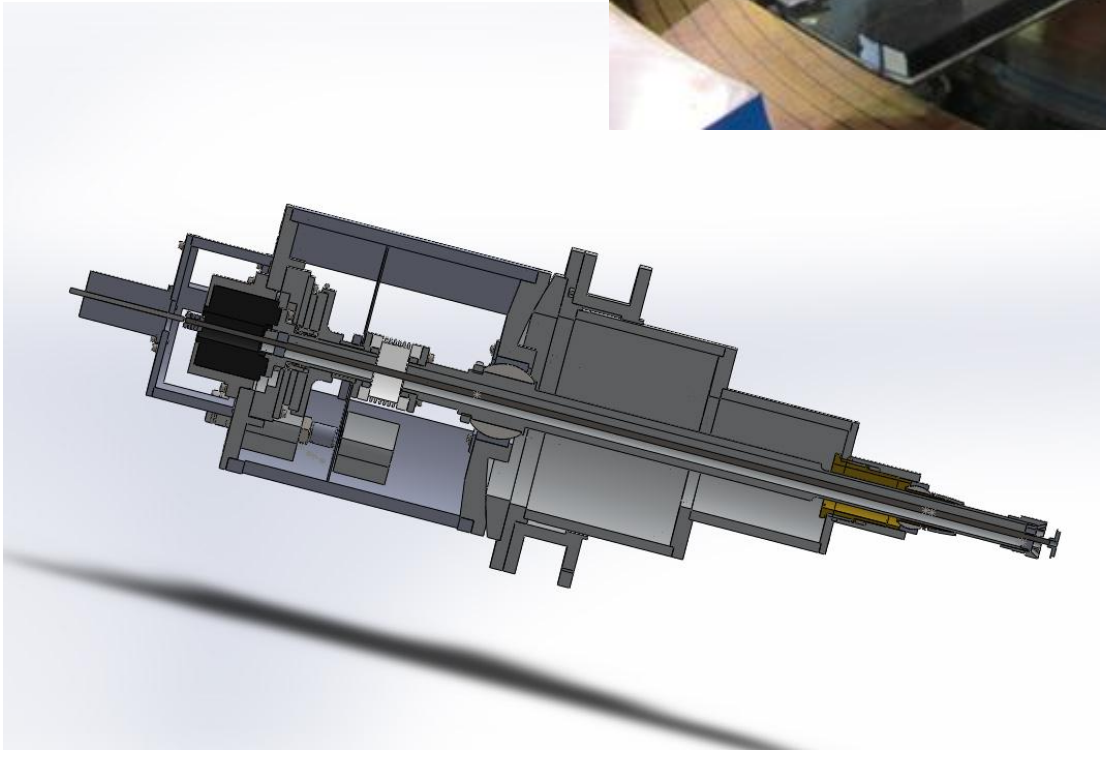


Mechanical Motion Device

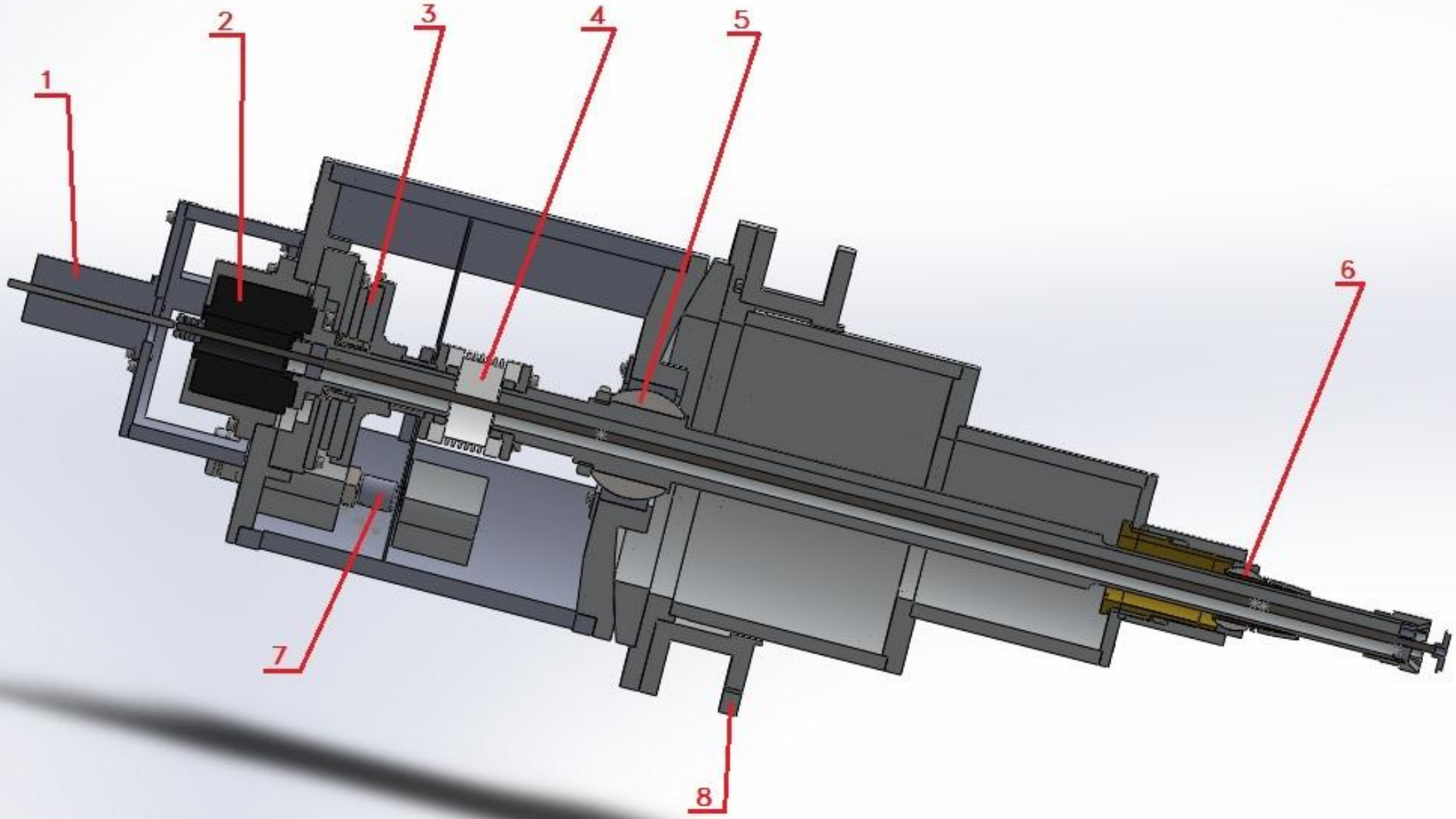


Data Acquisition and Control System

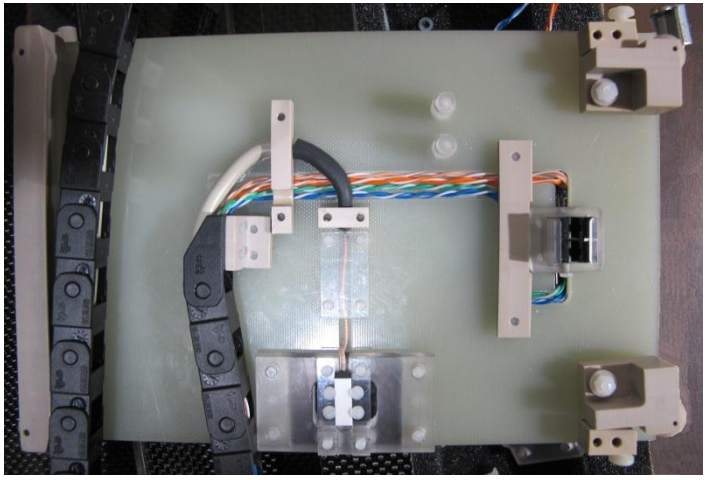
Mechanical Motion Device Design



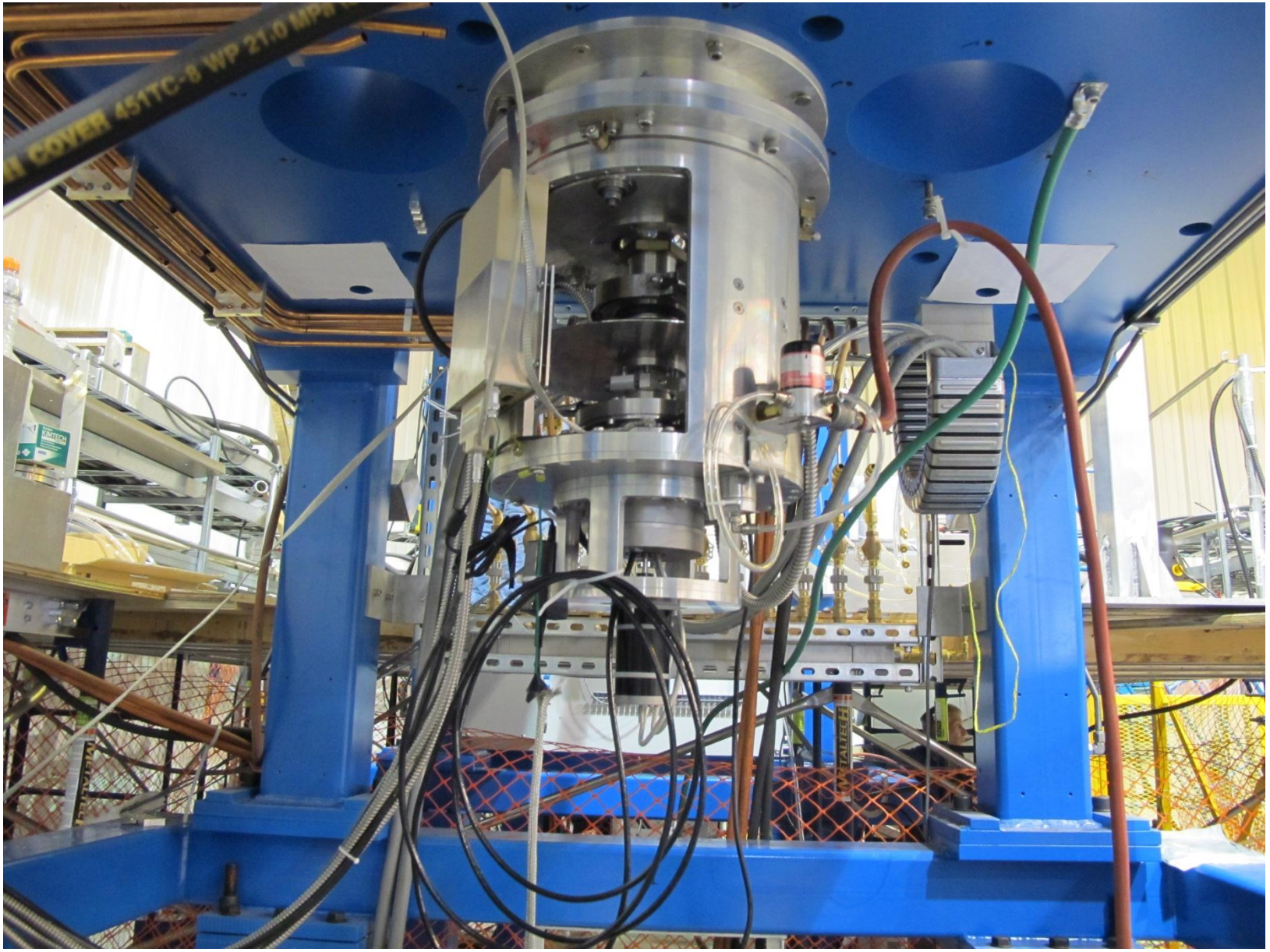
Shaft Assembly



HP Arm Assembly

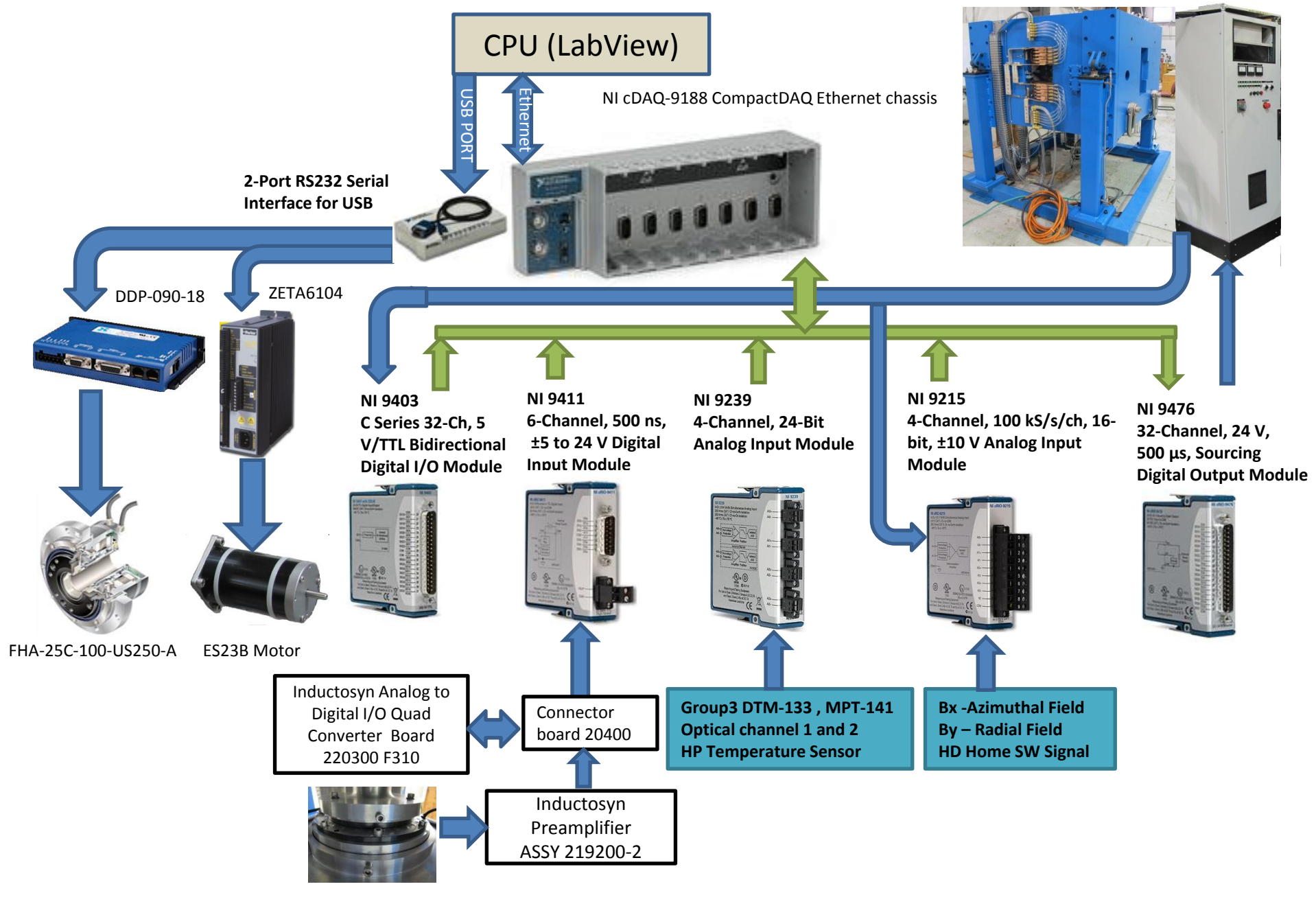


Mechanical Motion Device



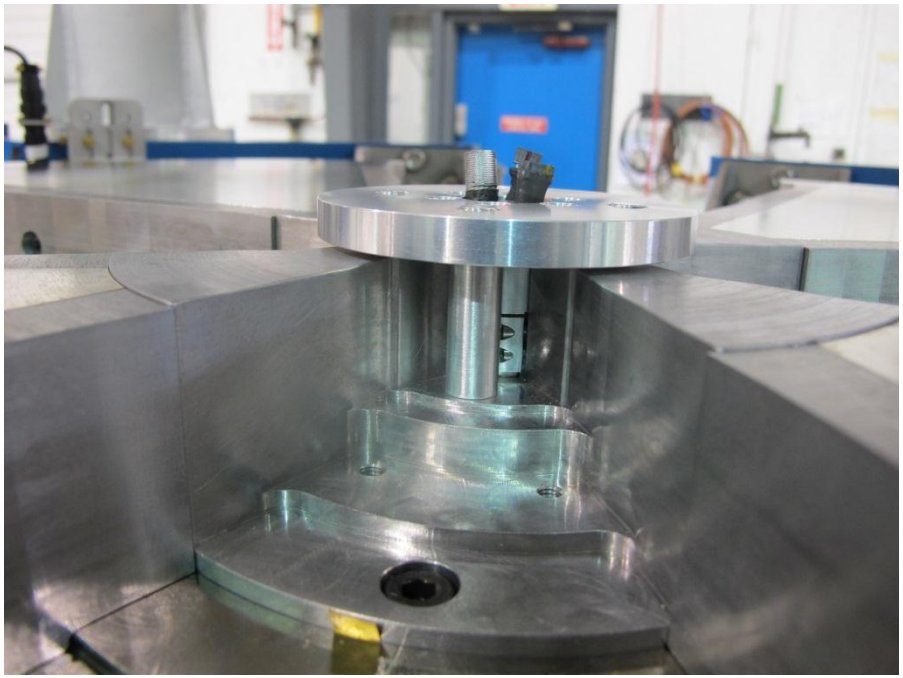
Data Acquisition and Control System

Data acquisition and control system diagram



Mapper’s LabView program

Hall Probe Arm Alignment and Height Adjustment



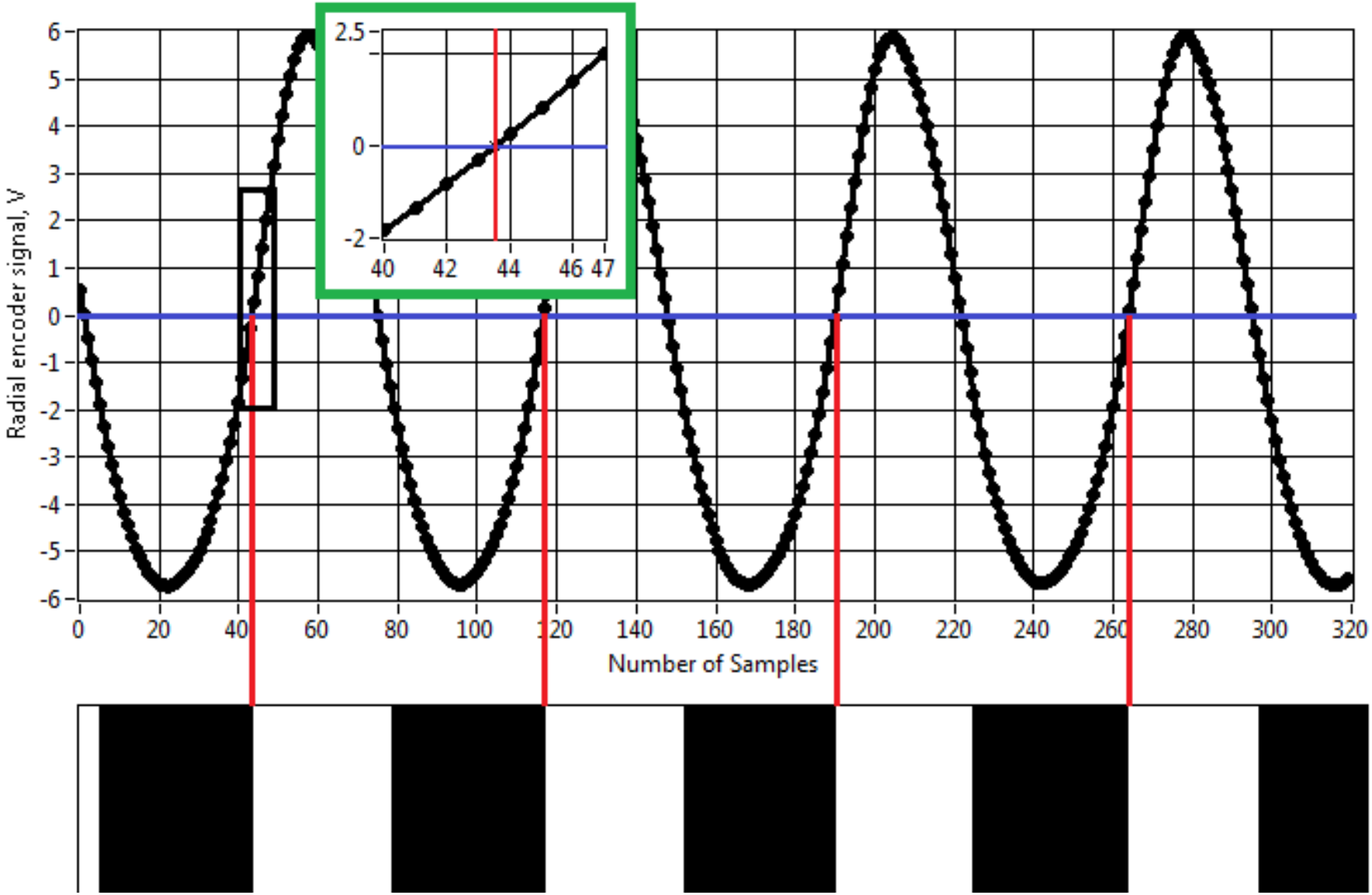
Height Adjustment: the HP arm template inserted into the main shaft of the mapper

Arm Alignment:
Use of the dial gauge

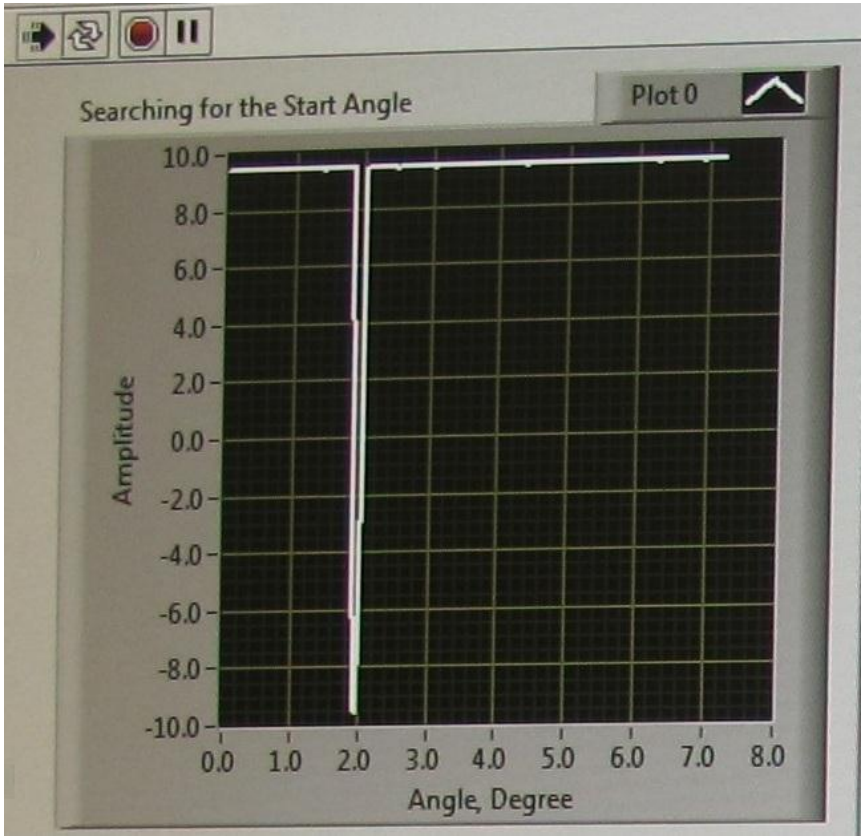
Arm Angle Reading

Inductosyn Alignment

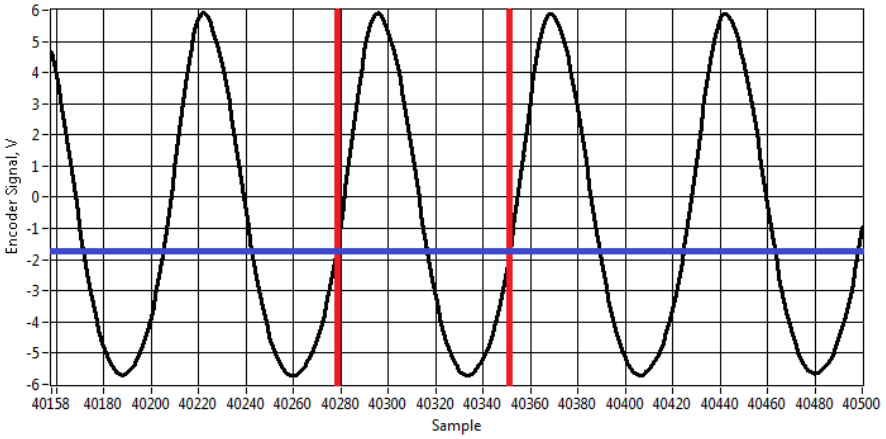
The Interpolation of Magnetic Field to the Strip Edge

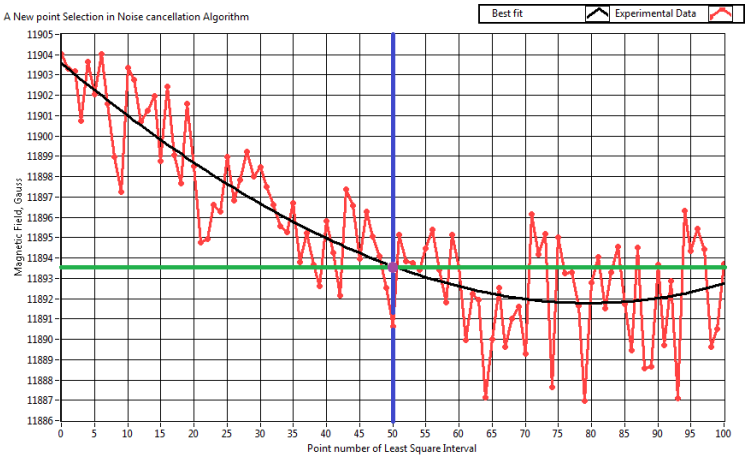


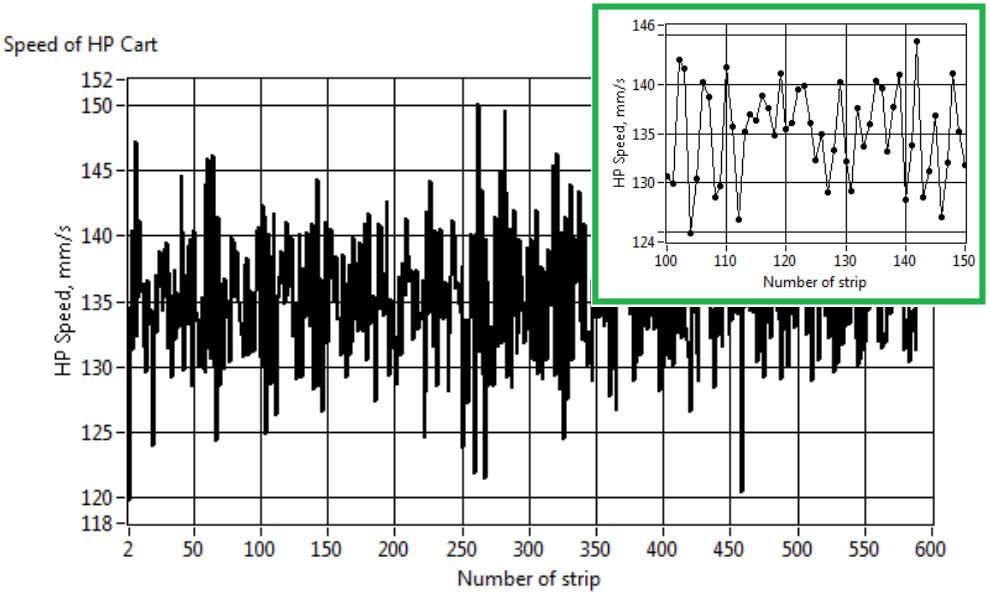
Home Angle Sensor

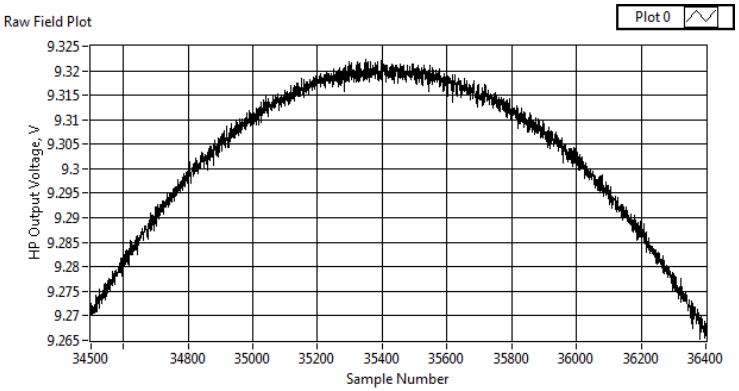


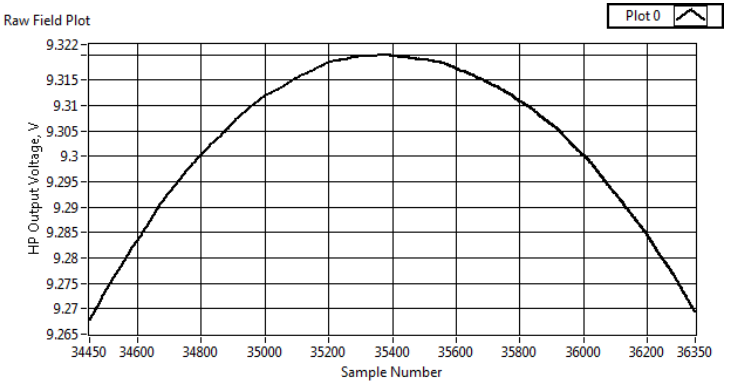
HP Noise Cancellation







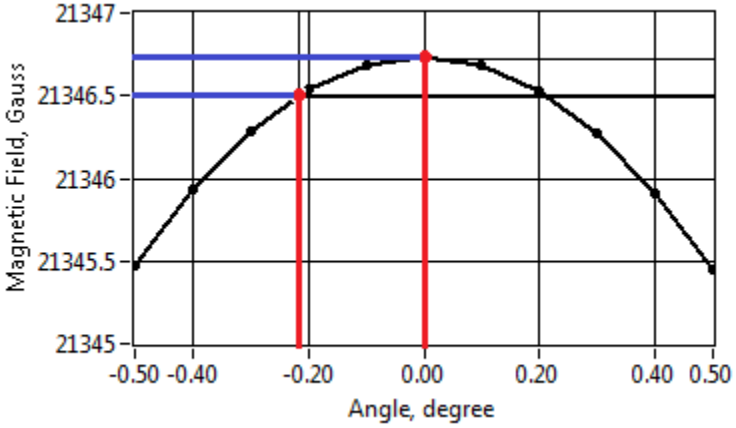




$$v = \frac{2mm}{N_{smp} * 0.2\ ms}$$

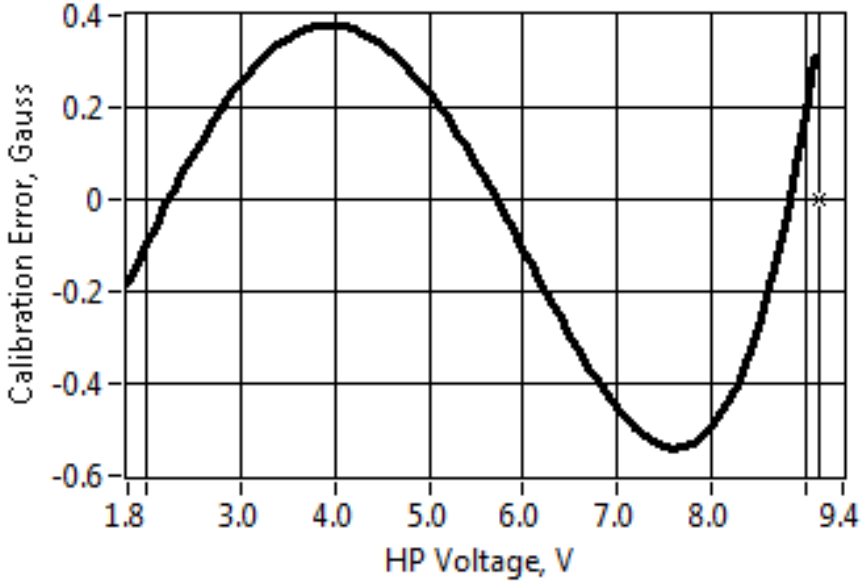
Simulation of results has shown less than 20 mGauss error

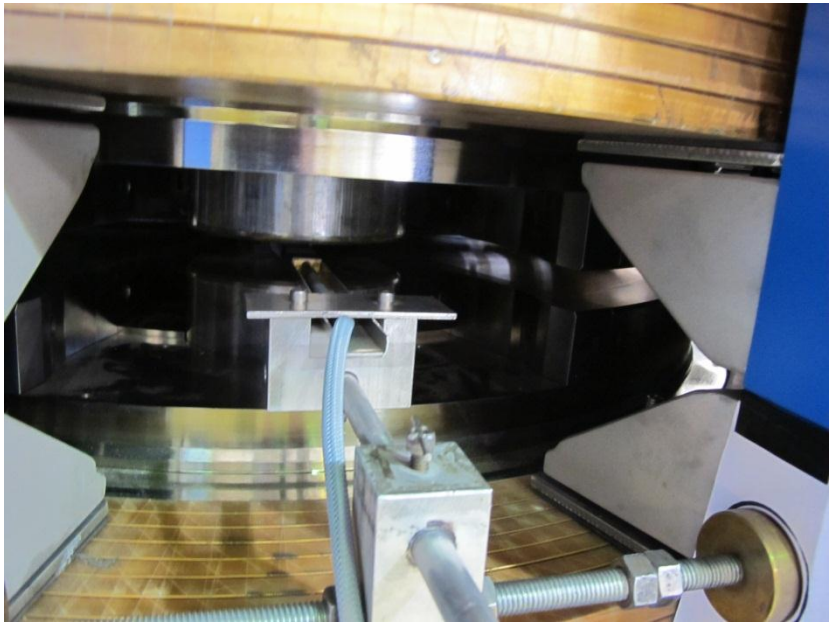
Calibration

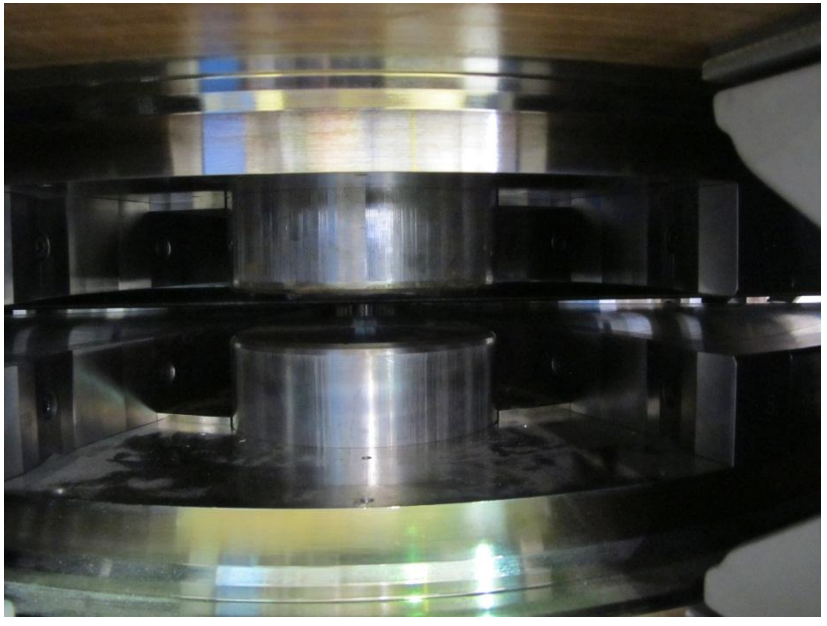


- ΔB_z= 0.2 G corresponds to $\Delta 0.22\ degree$ that corresponds to ± 1.3 mm tolerance in azimuthal direction
- ΔB_z= 0.5 G corresponds to ± 2 mm tolerance in azimuthal direction

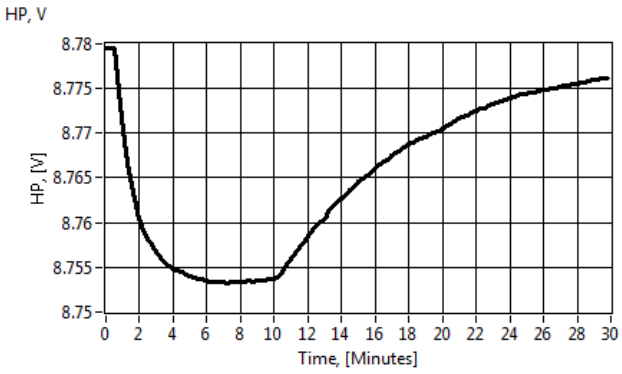
Comparison of two calibrations

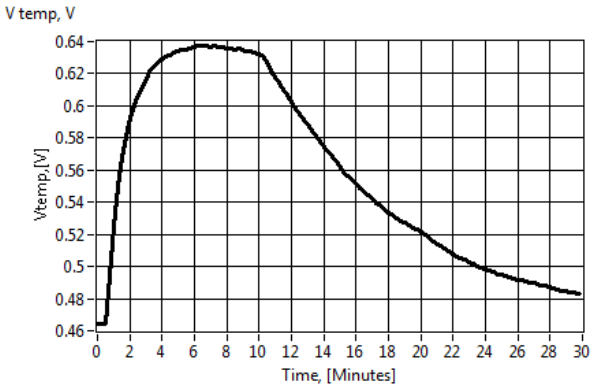


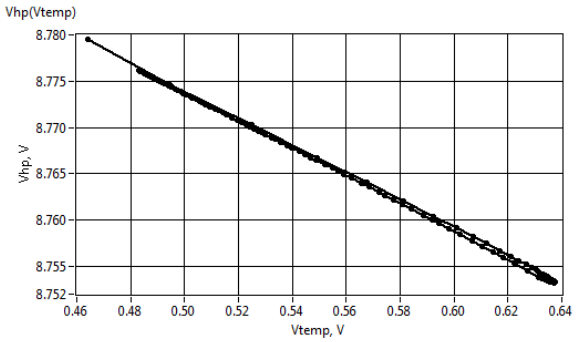




Calibration of Group3 HP Temperature Sensor

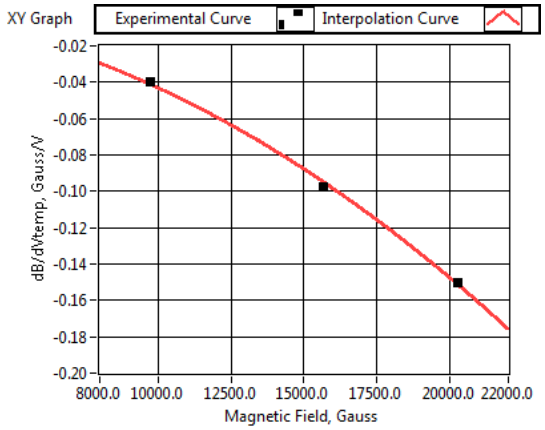




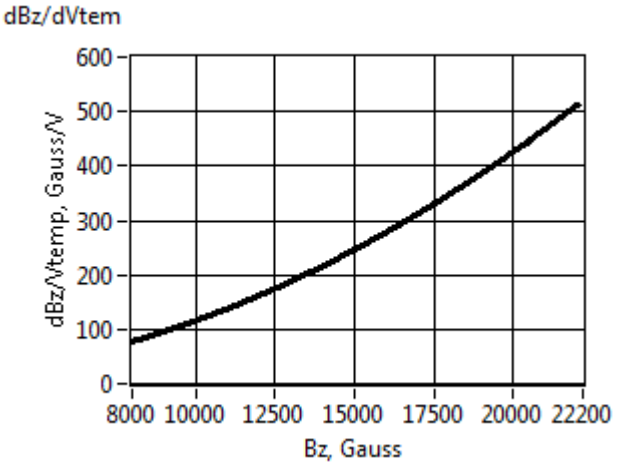


$$\Delta V_{corr}\left(B, V_{temp}\right) = \frac{dV_{hp}}{dV_{temp}}(B)\left(V_{temp\ initial} - V_{temp}\right), \text{ or}$$

$$\Delta B_{z\ corr}\left(B, V_{temp}\right) = \frac{dB_z}{dV_{temp}}(B)\left(V_{temp\ initial} - V_{temp}\right)$$



Where $\frac{dV_{hp}}{dV_{temp}}(B)$ and $\frac{dB_z}{dV_{temp}}$ are the Calibration Coefficients



The field corrections are calculated as:

$V_{hp\ corr} = \Delta V_{corr} + V_{hp}$, or

$B_{z\ corr} = \Delta B_{z\ corr} + B_z$

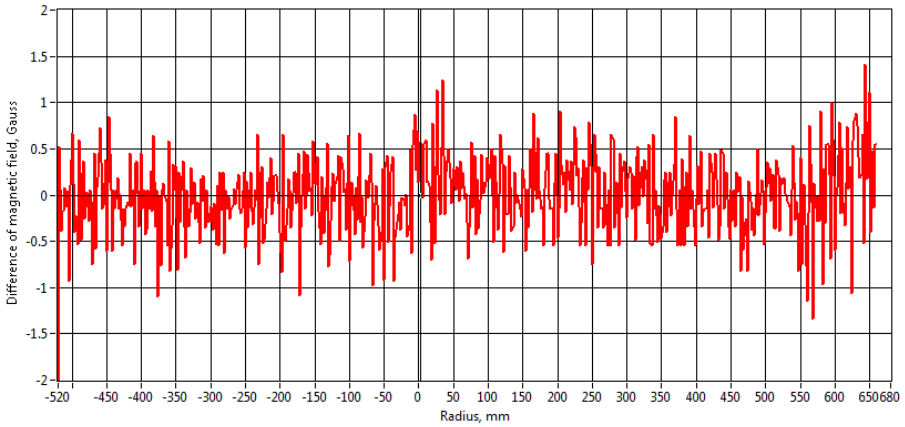
Error Check Using the Comparison of Different Scans

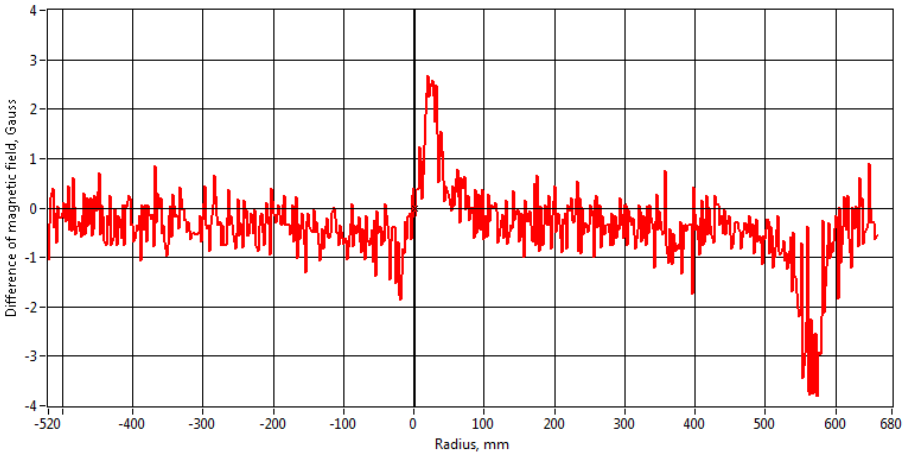
- Difference of two scans along the symmetry line of the hill that were taken from different maps.

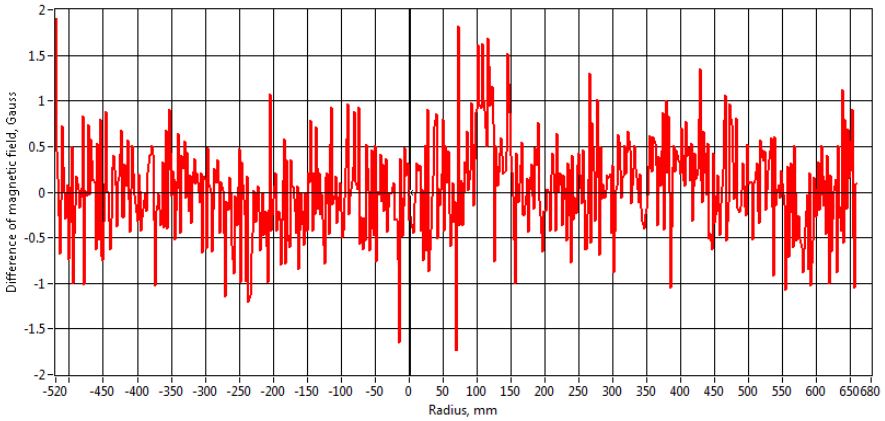
$$\frac{dB_z}{dr} = 210\ G/mm$$

- Difference of 24 degree scans, (high azimuthal gradient field) that were taken from different maps

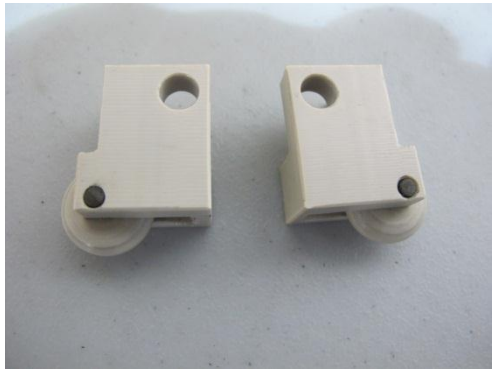
$$\frac{dB_z}{d\theta} = 1980\ G/\text{degrees}$$

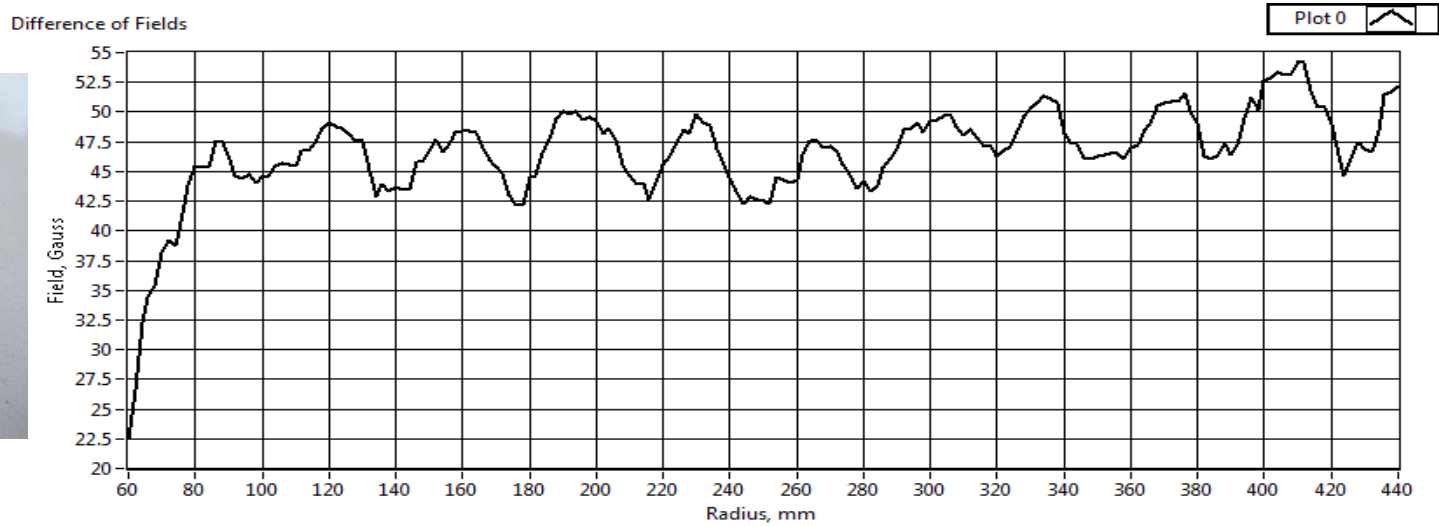


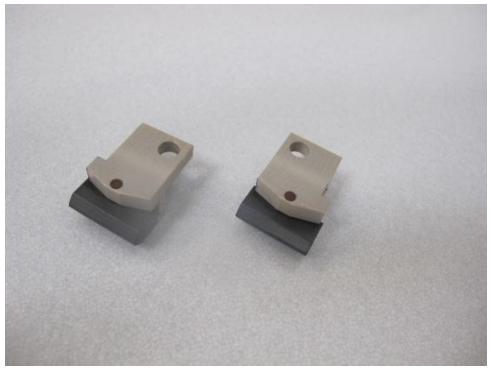


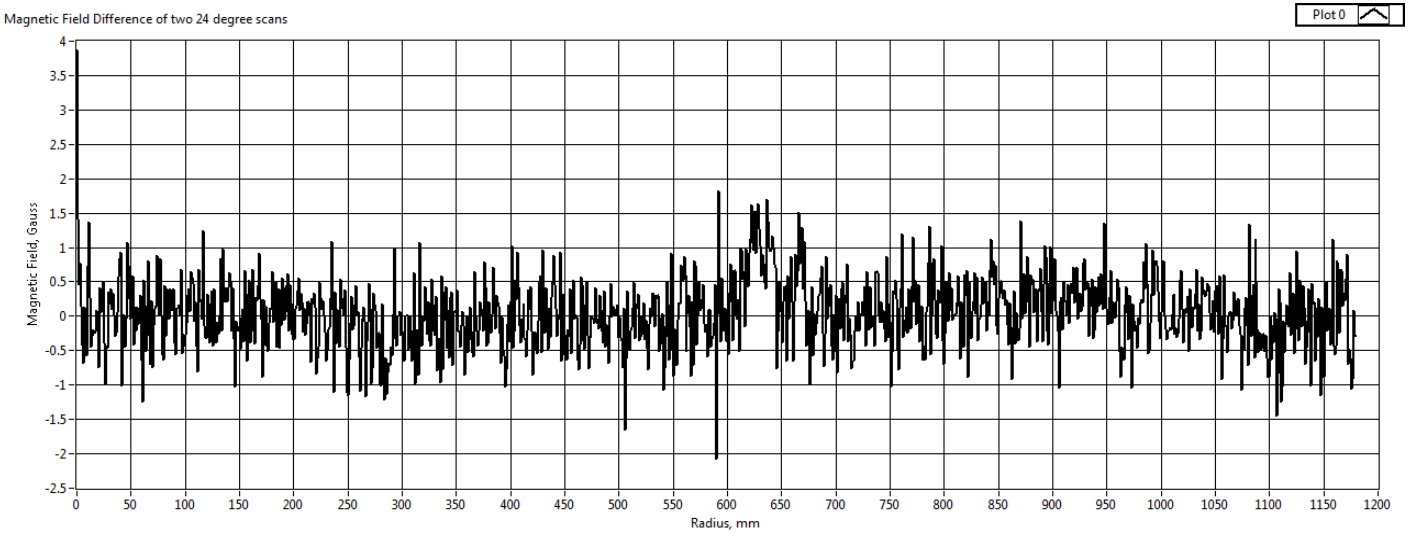


Mechanical Azimuthal Oscillations as Error Source





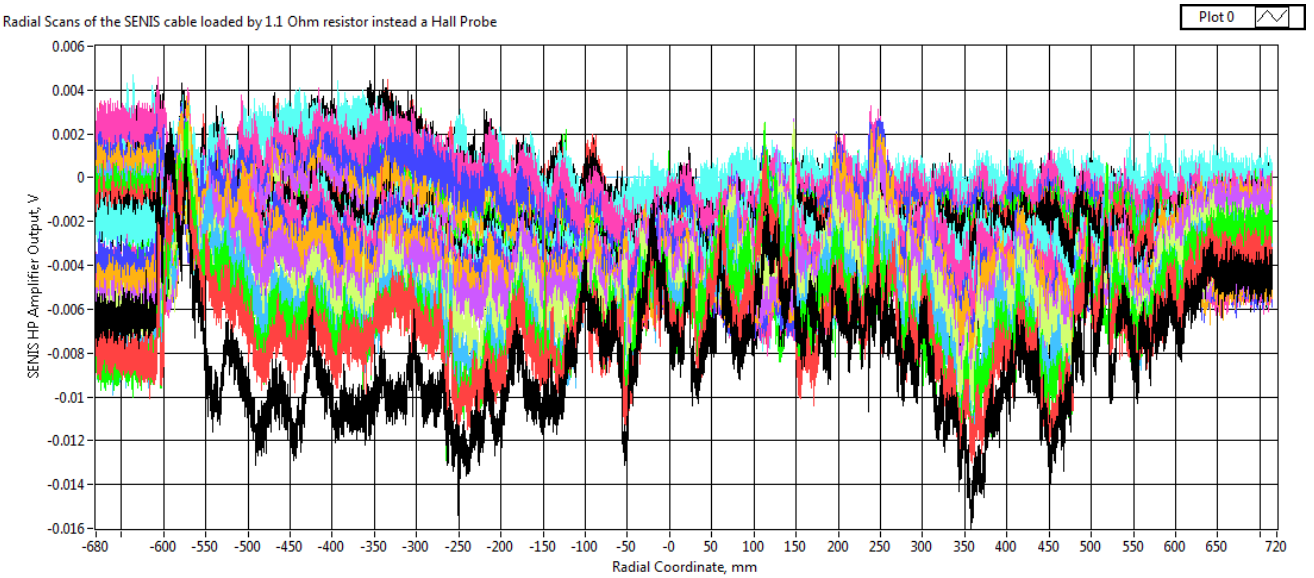




HP Cable Errors Caused by Bending

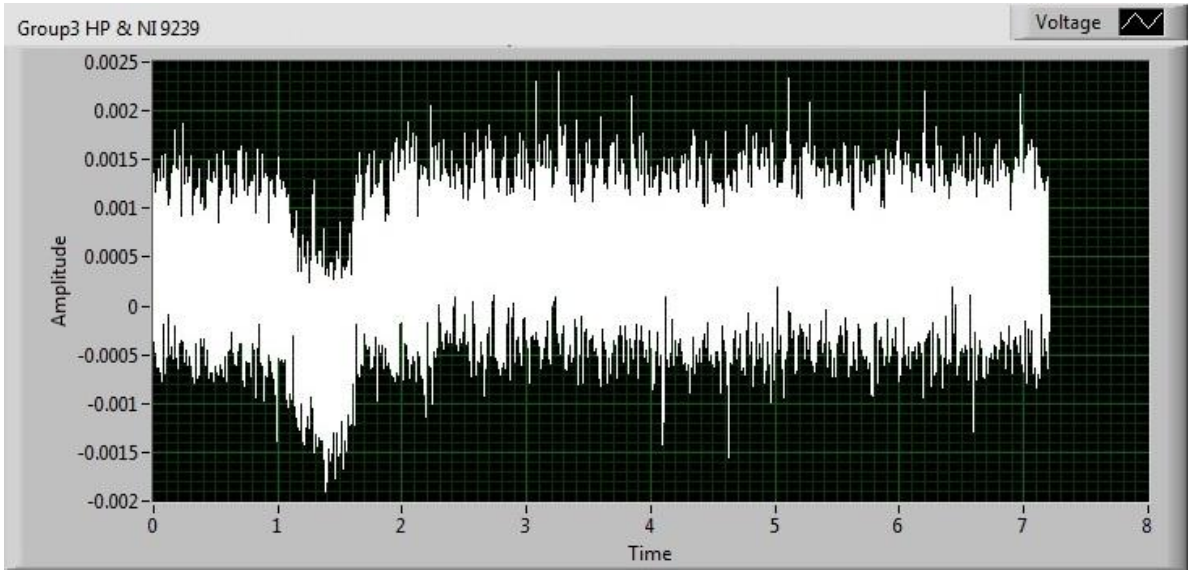
SENIS HP cable loaded by 1.1 Ohm equivalent to HP resistor.

Max Voltage 14 mV corresponds to 45 Gauss

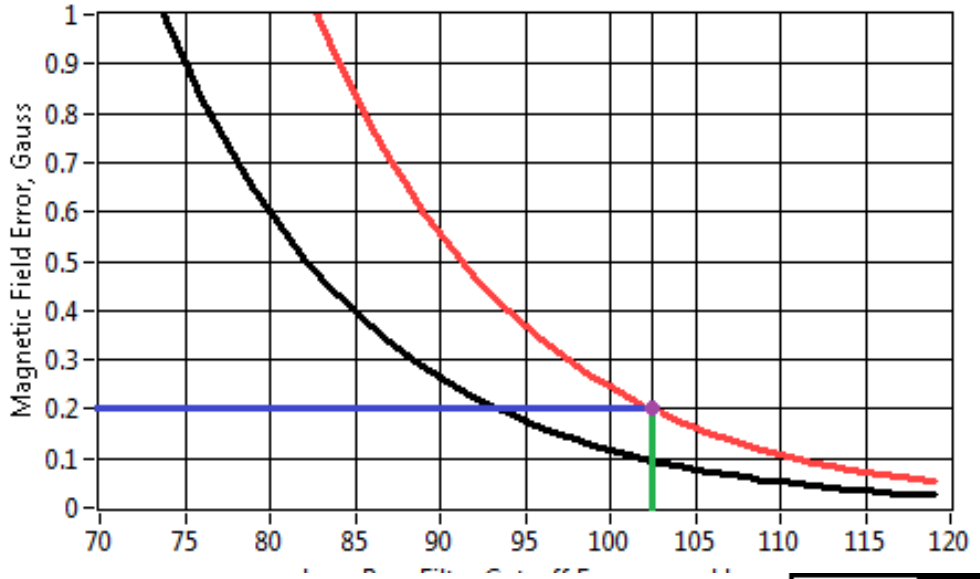


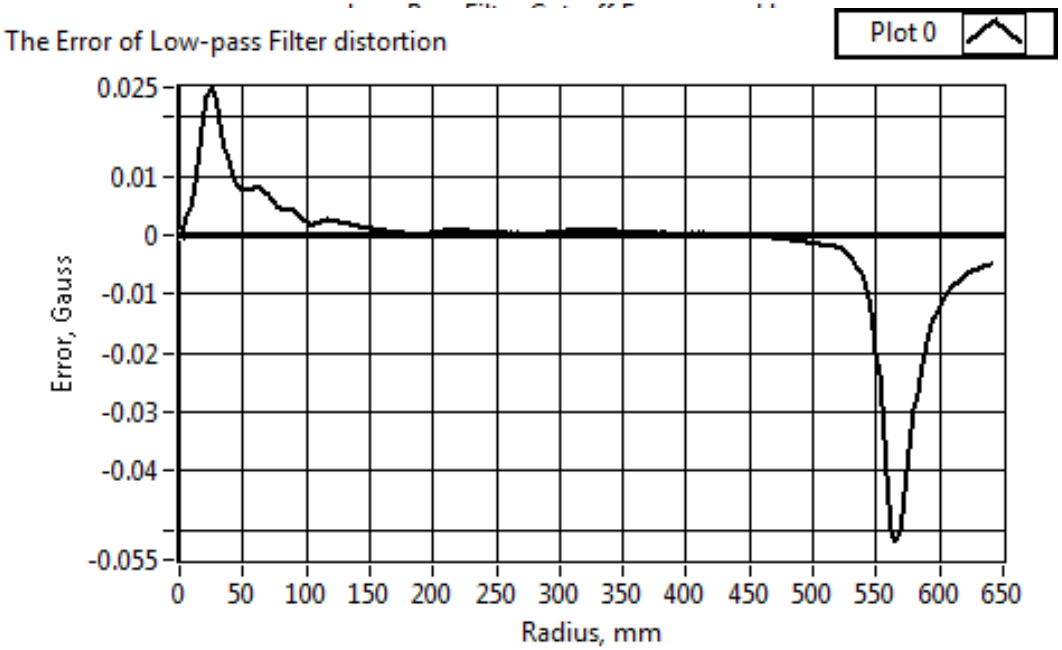
The Group3 cable loaded by 1.1 Ohm resistor moving along the TR-24 cyclotron magnet.

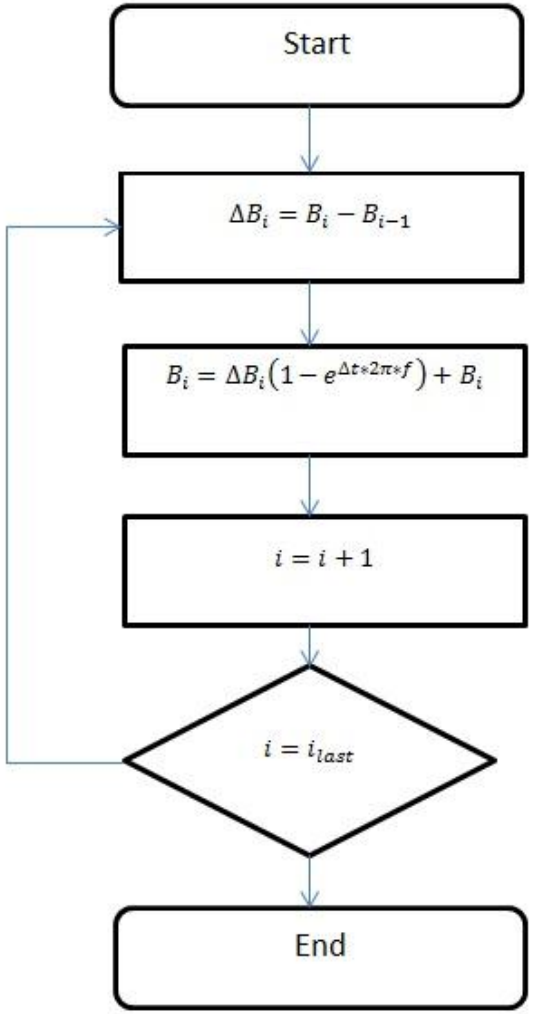
Max Voltage signal equivalent to 3.5 Gauss



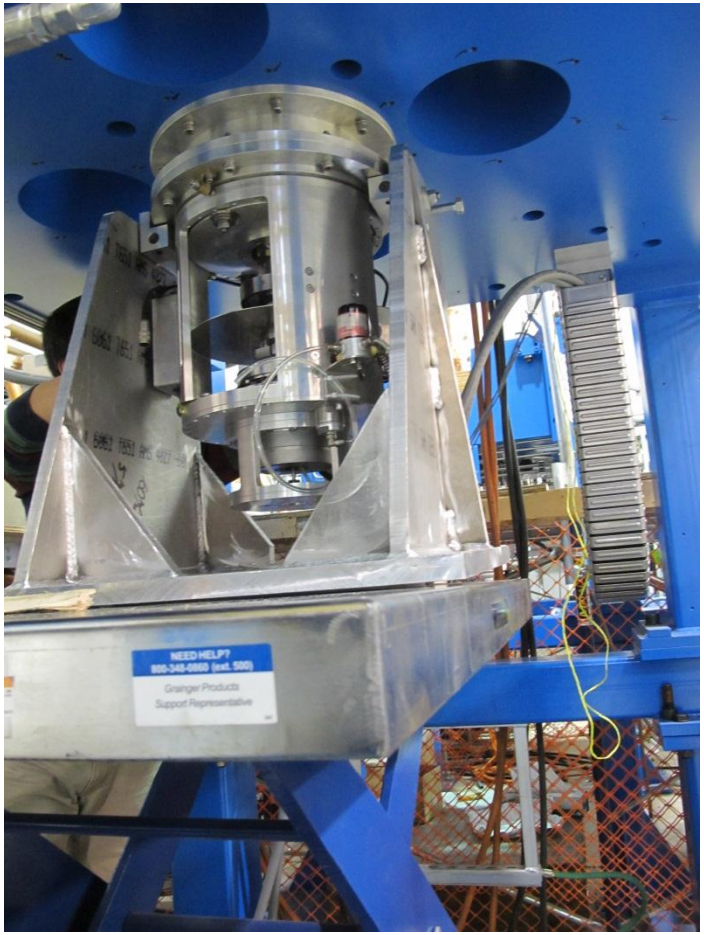
Dynamic Errors Caused by the Low-pass Filter







Mapper Lift


NEED HELP?
800-345-0860 (ext. 500)
Grainger Products
Support Representative

THANK YOU