

Earth's Field Adjustment

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The type of sensitive magnetic measurements that are performed by our products can be significantly affected by the Earth's magnetic field. This is a DC field, with amplitude of less than 1 Gauss, and with direction dependent on one's location on Earth.

Shb Instruments tools compensate for this field by adding a small DC field component in both the "Norm" and "Tran" direction that is always present. When this compensation is not done properly measurement anomalies will be seen, including asymmetry of the hard axis loop and errors in angular measurements such as dispersion.

Improper adjustment of **Norm** Earth's field compensation can also easily be seen in two modes of instrument operation:

1. When measuring an easy axis loop of a material (e.g. NiFe) that has no exchange field, if the Norm component of Earth's field is not properly compensated for, the loop will be seen to be shifted slightly to the left or right.
2. When aligning a sample to the easy axis by using Tran field, instead of a flat line a "bump" or a "dip" will be seen in the trace if the Norm Earth's field compensation is not properly adjusted.

Note that errors in **Tran** Earth's field compensation are not as easily observed, but proper adjustment of this parameter is just as important.

Note that the adjustment process is in two parts – the Norm and the Tran components of the compensation must each be adjusted.

Once the adjustment is made, it need only be checked infrequently (e.g. once a month), unless the instrument is moved (especially if it is rotated), or something in the environment that may affect the ambient field occurs (e.g. introduction of metallic objects in the vicinity of the tool).

The shbWin software that operates our instruments has a menu entry (Adjustments/Adjust Earth's Field/Adjust...) which will lead one through the process of making the Earth's field adjustments. Because this is designed for users that are unfamiliar with the instrument, it has numerous prompts and can take longer than necessary to complete. Therefore this document presents a quicker and easier summary of the steps to be followed.

The best sample to use for this adjustment is a simple NiFe sample. The steps are as follows:

- Set up the instrument (using Norm field) to display the easy axis loop of the sample, adjusting vertical gain to display a loop of reasonable height. Adjust horizontal drive level to the higher level normally used to display the hard axis

loop, which will result in the width of the easy axis loop being only one to two major divisions.

- Switch the instrument to Tran field. Rotate the sample slightly to flatten the trace, which we define as adjusting until the left- and right-going traces cross the Y-axis at the same point.
- Ideally a flat line will now be seen, but if the Norm Earth's field compensation is not adjusted properly, a bump or dip in the trace will be seen.
- Click the Norm Earth's Field button, and the trace should flatten. If the traces do not now cross the Y-axis at the same point (due to small rotational error of the sample from the easy axis), it will at least be symmetric with respect to the X-axis (i.e. a small bump going one way, and a small dip going the other).
- The Norm component of the Earth's field compensation is now properly adjusted.
- Rotate the sample in either direction by *approximately* 45 degrees. A small angular loop will be seen. This loop may be slightly off center from left to right, which indicates an error in the Tran Earth's field compensation.
- Whether a left-right shift is seen or not, now click the Tran Earth's Field button and the shift should disappear.
- The Tran component of the Earth's field compensation is now properly adjusted.