

Lab-Tools (nano-science) - simple Hall Probe Magnetic Field Sensor

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Here are some details on a new low-cost magnetic field sensing Hall probe, with Graphical User Interface (GUI), that Lab-Tools has just created :

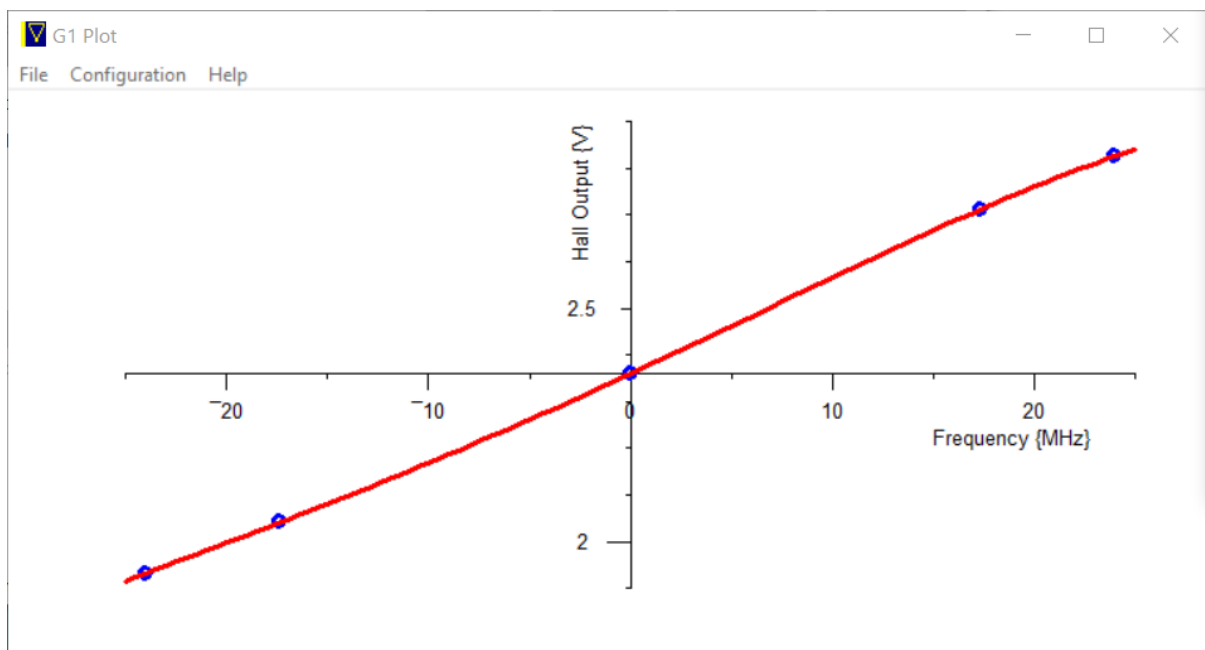
I have made a simple single axis Hall probe using the CYSJ362A series Hall-effect element that Peter Blümmler pointed to, used, as Peter did, with a Raspberry Pi 4B and WaveShare AD-DA board.

Because angle is so important in a single-axis sensor, I super-glued it flat on a short flat piece of plastic. I just used ribbon cable (also super-glued to the plastic stick) to connect it to the WaveShare connector.

I have now calibrated it using two NMR magnets, measuring the proton NMR frequencies using a time-domain NMR spectrometer (at the same time, to avoid temperature field shifts) as 17.326 MHz and 23.995 MHz respectively, which gives 0.40693 T and 0.56356 T respectively. By reversing the sensor, one also gets the negatives of those fields as well, at lowered Hall voltages, which helps make the calibration more accurate; the averaged measured readings were :

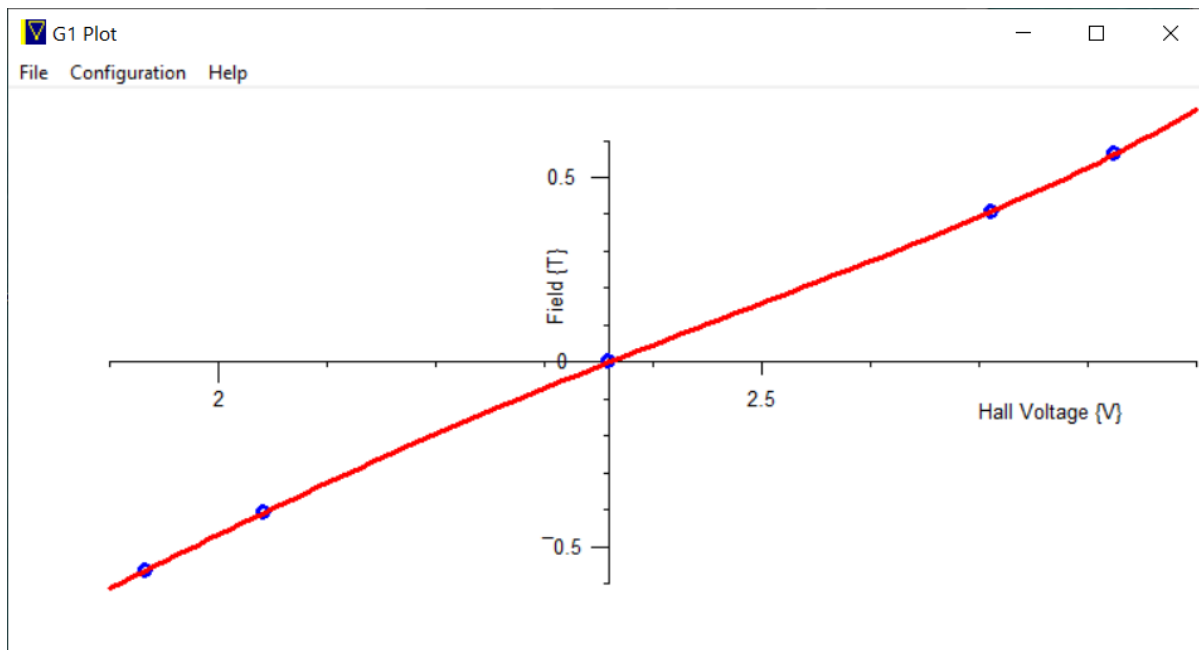
Frequency {MHz}	Field {T}	Hall Voltage {V}
-23.995	-0.563561	1.932753
-17.326	-0.406929	2.041997
0	0	2.359885
17.326	0.406929	2.7115
23.995	0.563561	2.8256565

The measured voltages in the 17.3 MHz magnet, and earth's field, were pretty linear, but by 24 MHz were starting to curve over a bit. All the points were well fitted by a quartic curve :



The following diagram shows the corresponding calibration plot, again with quartic fit, for the Field as a function of measured Hall Voltage; the quartic fit parameters, for this sensor, are :

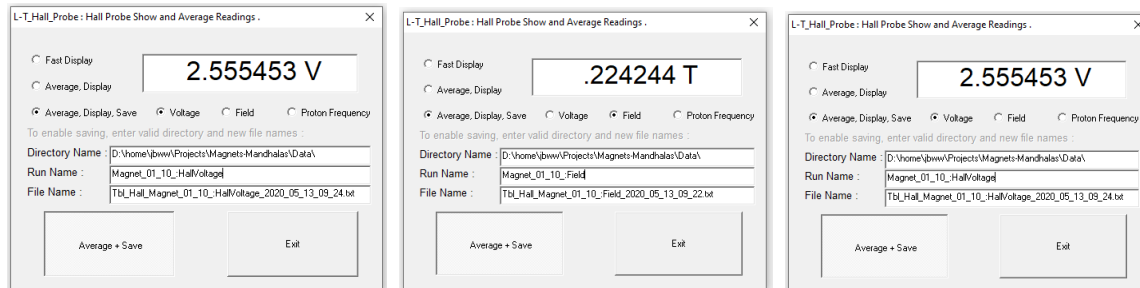
9.99006339224458 -24.449747085604 18.5628169343443 -5.81081142841526 0.667392166790486 :



The temperature stability of this sensor is quite good - the output definitely does vary with temperature, but not enough to cause visible scatter on the above calibration plots. Making measurements with the sensor reversed helps mitigate against this.

Here is the Graphical User Interface as the design currently stands;

Here it is with the initial Hall voltage display, and using the calibration for this particular sensor we immediately get the field, and hence (so far for Protons only), the NMR frequency :



I hope someone finds this new device useful,

Cheers,

Dr. Beau Webber