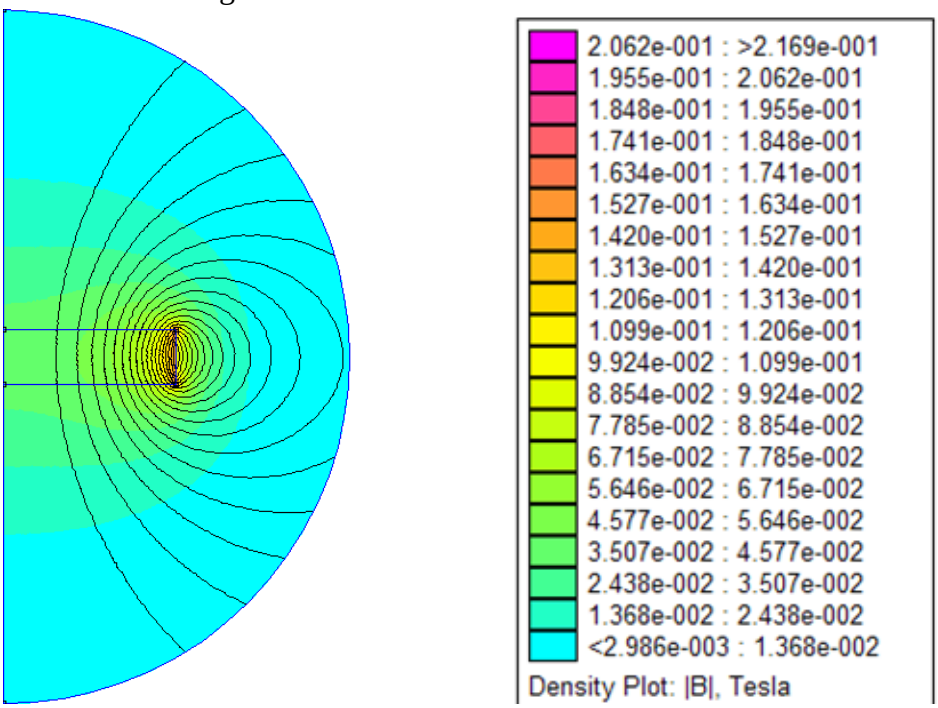
The Effect of Adding a Steep Plate on a Permanent Magnet
… B-Field Info for the Beakman's Motor Project

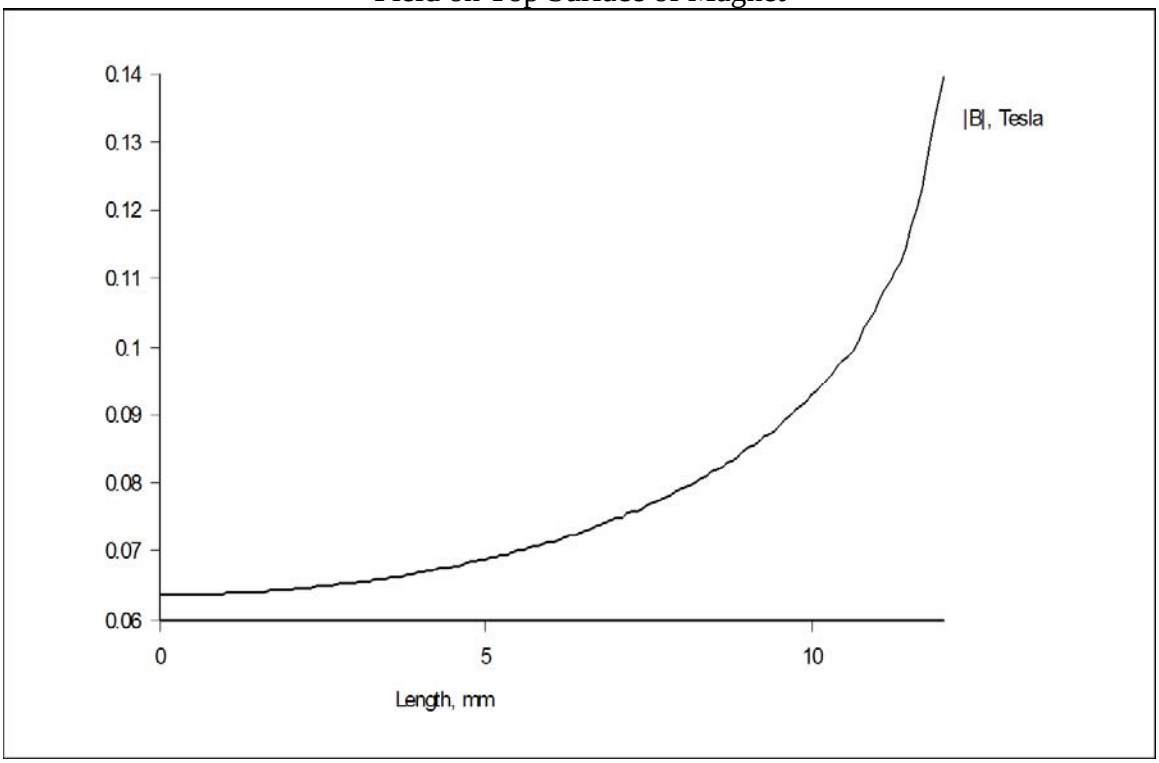
We have used two types of inexpensive ceramic magnets in this project, rings and disks.

Most recently, we have almost exclusively used disks. The field structure for such a magnet can be easily found using FEMM and a few simple measurements with a Gaussmeter. For a single, isolated magnet 25mm in diameter and 4mm thick, the field structure looks like the figure below from FEMM.

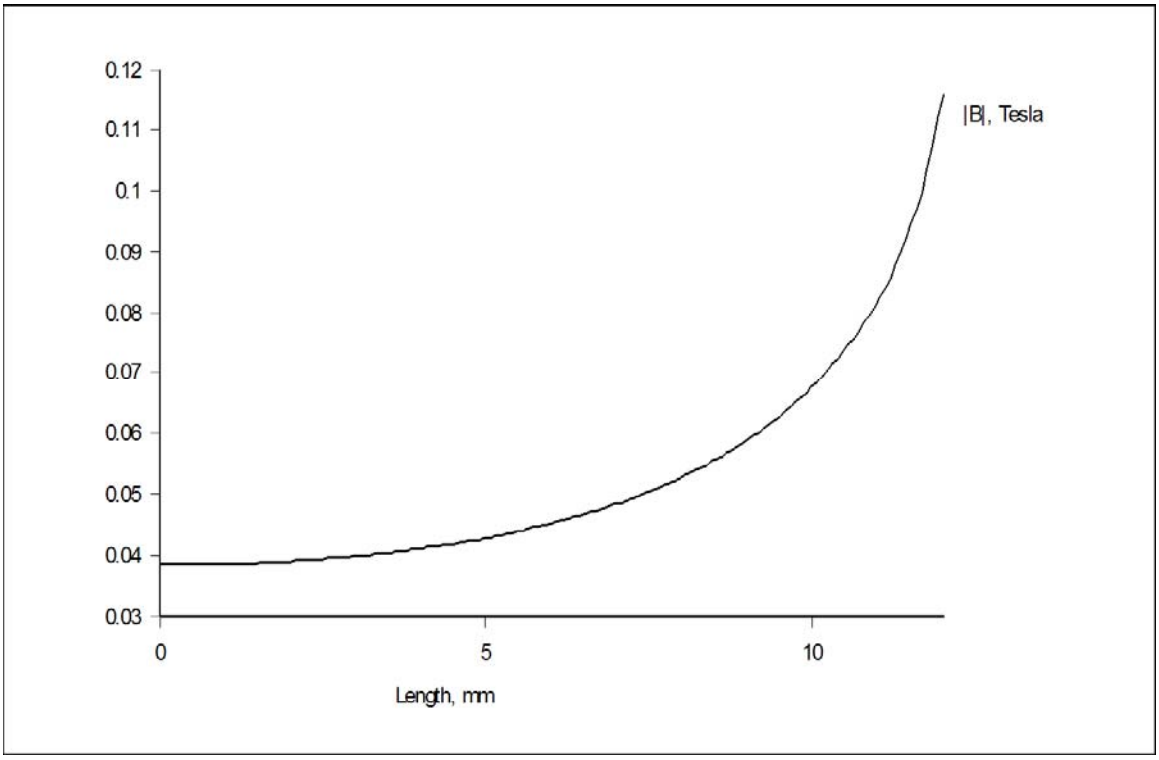


Note that the magnitude of the B field is approximately 0.04 Tesla, on axis, at the top and bottom surfaces. This is consistent with Gaussmeter measurements. A plot showing the magnitude of B as a function of radius for this case is shown at the bottom of the next page. Note that the field increases in magnitude at larger radii. This is also confirmed with measurements. For the Beakman's motor, the magnet is attached to a steel battery, so the field shown is not quite correct. To roughly simulate the addition of the battery, a flat steep plate is added to the bottom of the magnet, which does provide a small, but significant, increase in magnetic field, as shown on the next page. Thus, motor performance will be better if the magnet is attached to something steel like the battery.

Field on Top Surface of Magnet



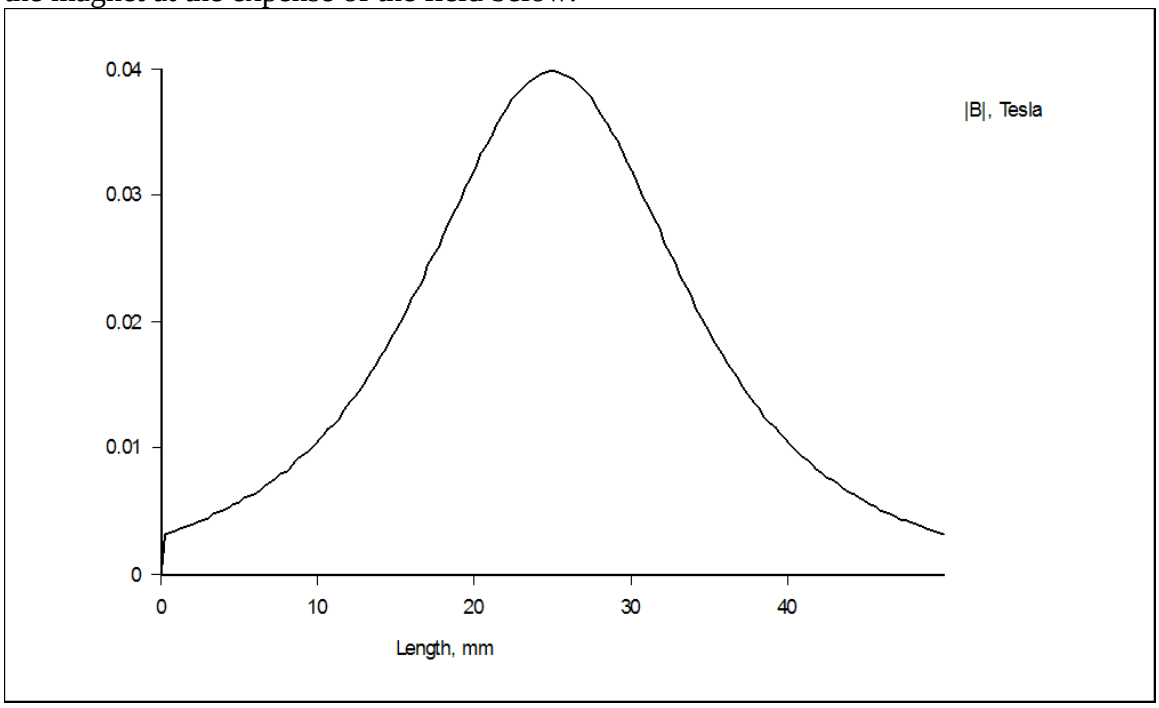
With a Steel Base Plate



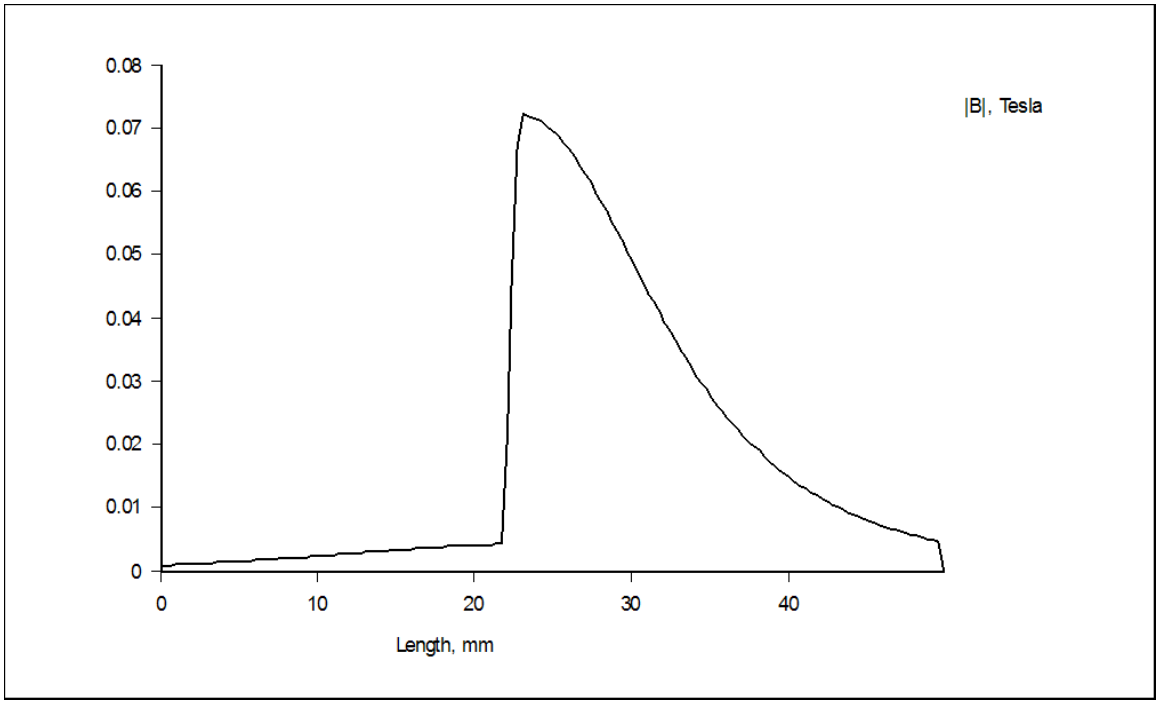
With No Steel Base Plate

Field on Magnet Axis

To see how the magnetic field changes with distance, the field along the z-axis can also be plotted. Note that the steel plate produces a large magnetic field in the region above the magnet at the expense of the field below.

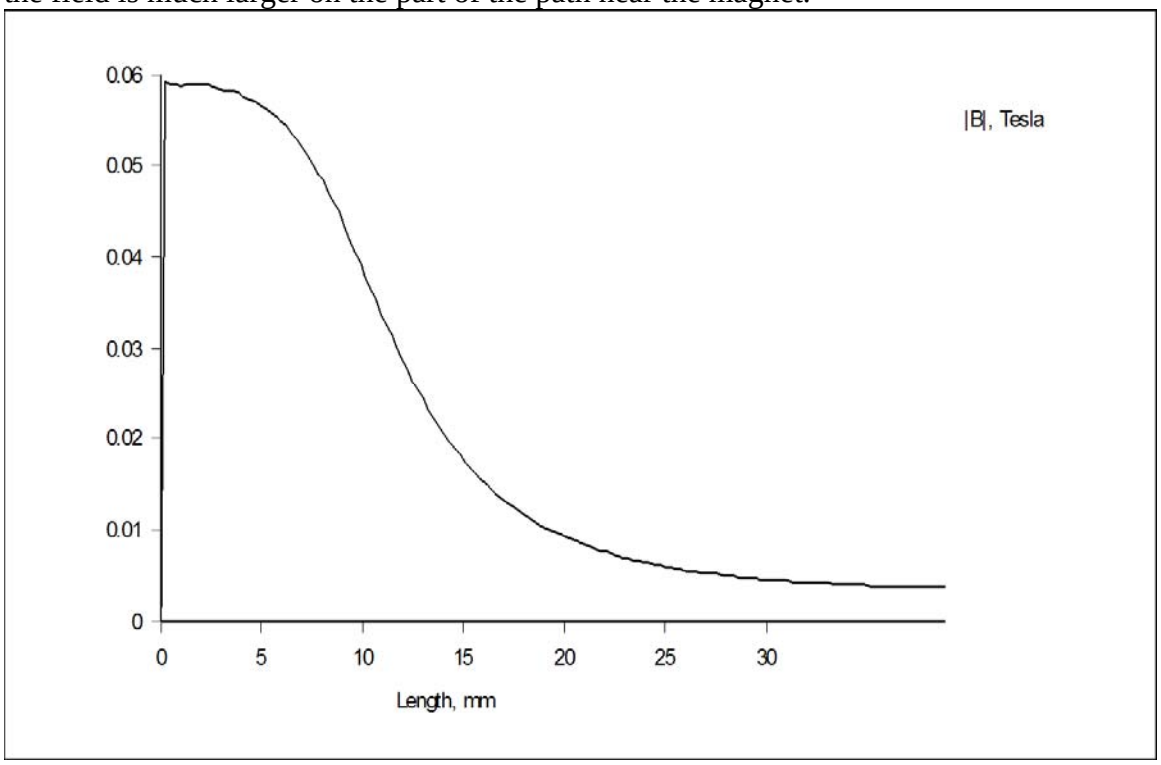


For No Steel Base



With a Steel Plate Base

To better see the field in the region where the motor coil is located, the field magnitude is plotted on a circular path that roughly corresponds to the edge of a typical coil. Note that the field is much larger on the part of the path near the magnet.



B magnitude on Circular Path Followed by Coil