The Design of a Versatile Ultralow Field MRI Machine

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Magnetic Resonance Imaging (MRI) Machines are used throughout the world to conduct non-invasive diagnoses. MRI machines, however, require a lot of capital and power as well as a special room to house the machine. In this project we are trying to prove a concept for a smaller, less powerful, and versatile machine which can be adjusted to the necessity of the patient. This would allow for quicker and cheaper diagnoses if a stronger one is too costly. To demonstrate this, we have built a model that is able to produce a stable field as well as a gradient in the field strength. We used a Hall Effect Sensor as well as an ultrasonic sensor to measure field strength over position across of our main coil and we were able to create a relatively stable main field around 0.001-0.0012 Tesla (T). This means that the field is about fifty times stronger than earth's magnetic field. Another part of a MRI machine is the gradient coil that adjusts the main field so that an image can be created. Our magnet, manages to change the field by 0.004-0.006 T in the x and y directions as well as 0.003-0.004 T in the z direction. Therefore, with the additions of shielding, a low-field could be used to create images due to its relative homogeneity.