

# Senior Design 491 - May1629 - Weekly Report 2

**Advisor:** Dr. Ravi Hadimani

**Project:** Development of "Triple Halo Coil" for Deep Transcranial  
Magnetic Stimulation

**Client:** Dr. Ravi Hadimani / Dr. David Jiles

**Members:** Wentai Wang  
Aashwatth Agarwal  
Dylan Jagger Rasmusson

**Date:** 9/14/2015

## Summary

The goal of this week's meeting was to establish our understanding of Transcranial Magnetic Stimulation (TMS). We were to read, not in great depth, some of the book on TMS that Dr. Hadimani provided for us. We then discussed what we interpreted as important to our role in the development of the Triple Halo Coil.

## Group Meeting Notes

### **Discussion about Transcranial Magnetic Stimulation**

We discussed two important principles that are responsible for the effectiveness of TMS. The first is Faraday's Law, which means that a change in a magnetic field through conductive material will cause a voltage (emf) to be induced in the conductive material. Second is Lorentz's Law, which states that a charged particle moving with some velocity through both an electric field and a magnetic field, will have a force acting upon it relative to both fields.

In the case of the Halo Coil, alternating current is put through the coils to produce electromagnetic fields. These fields are directed towards certain parts of the brain, and by Faraday's and Lorentz's laws, the neurons of the brain will be effected by these fields.

### **Importance of Depth and Locality**

The geometry of two specific coils were discussed. The Circular Coil and the Figure-of-Eight Coil. The geometry of these coils have

opposite downsides and upsides. Specifically depth and locality. Depth describes how deep into the brain the magnetic fields can effectively penetrate, and locality describes how the magnetic fields effect specific parts of the brain while not effecting others. The geometry of the figure-of-eight coil allows for the use of destructive interference, resulting in higher locality but lower values of depth. On the other hand, the circular coil does not implement destructive interference so it has lower locality, but higher values of depth.

### **Our Goal**

The goal of our improved design of the Halo Coil is to improve both locality and depth, and hence derive or implement a triple halo coil, which would consist of three halo coil joined together, with a cross pattern. With success our design will be able to treat deep brain neurological disorders with great accuracy, while avoiding the potentially damaging effects of a coil with low locality.

### **Individual Work**

There are three different things we as individuals will take responsibility for. The first is running simulations of the effects the magnetic fields will have on the human brain. Second is the design of the simulated coil, along with the thermal/structural integrity of the design. Finally, there is the programming that needs done for the power supply. (Details are still unspecified and will be updated as they are given to the team)

## **Advisor Meeting Notes**

Dr. Ravi Hadimani was out of town so we were unable to have a meeting with him. However, we were able to make with Ms. Priyam Rastogi, our sub-advisor.

## **Accomplishments**

- Improved our understanding of TMS
- Pinpointed focal points of our design improvements
- Determined the goals of design

## **Plans for Next Week**

- Further our understanding of TMS

- Determine the work we will be doing as individuals
- Determine our individual work

### Pending Issues

- Group email must still be created
- Meeting with Dr. Hadimani, as he will be out of country for the next week

### Individual Hourly Contribution

<u>Name</u>	<u>Hours this week</u>	<u>Work</u>
Wentai Wang	4.5	Reading, Meeting Discussion
Aashwatth Agarwal	5	Reading, Meeting Discussion
Dylan Rasmusson	5	Reading, Meeting Discussion, Weekly Report