

# Senior Design 491 - May1629 - Weekly Report 7

**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:** 10/12/2015

## Summary

## Group Meeting Notes

## Advisor Meeting Notes

From this week onwards, Dr. Hadimani assigned all three of us to perform individual tasks each, with Dylan being working towards Comsol, Aashwatth being working towards SemCAD, and Wentai being working towards coil configuration measurement, based on our background of study.

## Accomplishments

**(by Aashwatth, with support from Wentai)**

- Completed "Halo Coil" simulation, in SEMCAD X tool.
- Starting working towards Triple Halo Coil simulation.
- Gained a better experience with SEMCAD simulation software by practicing two coil designs.
- Able to identify how different magnetic and electric fields corresponds to different head model, shape and position of the coils. This helped us realize a better understanding towards meeting our product specification.

**(by Dylan)**

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## Plans for Next Week

- Start simulating actual "Triple Halo Coil", by taking specifications, and measurement in account (Aashwatth)

- Sending the measurement notes to Dr. Hadimani to order the required the material (Wentai)
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## Pending Issues

- Some of the material needs to be ordered.

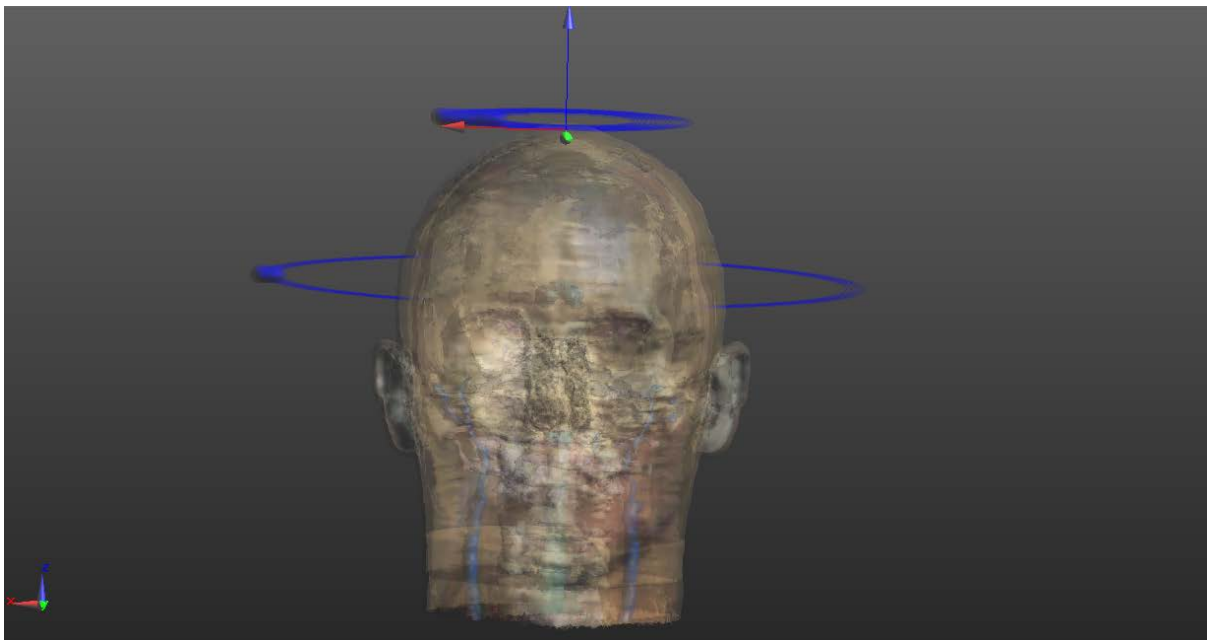
## Individual Hourly Contribution

**(Dylan):**

**(Aashwath, with support from Wentai) :**

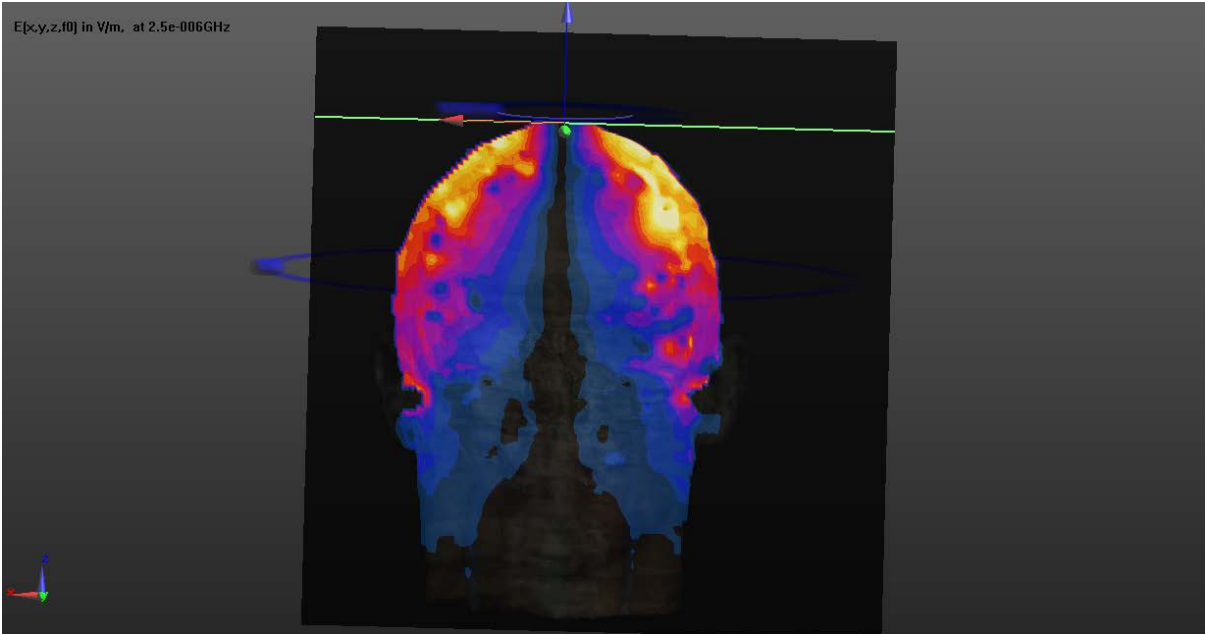
For completing our final training on SEMCAD , we simulated Halo coil on Monday (October 19 2015). The major difference in the Halo Coil is that Halo Coil consists of 14 turns of circular coils with mean diameter 90 mm, along with 5 turns of circular coil with mean diameter 290 mm, circumfering the middle of Head(in this case we used the Duke head model).

**The following is the figure of Halo coil, with duke head model:**

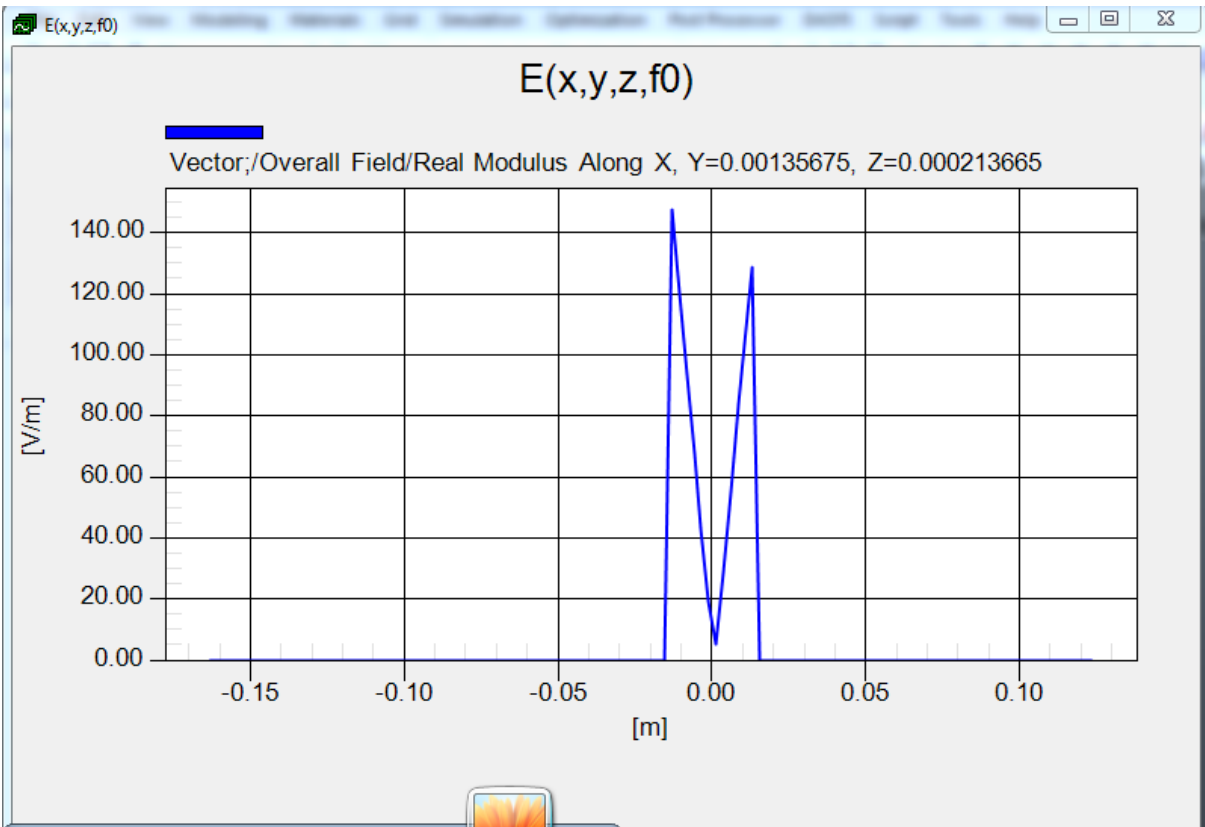


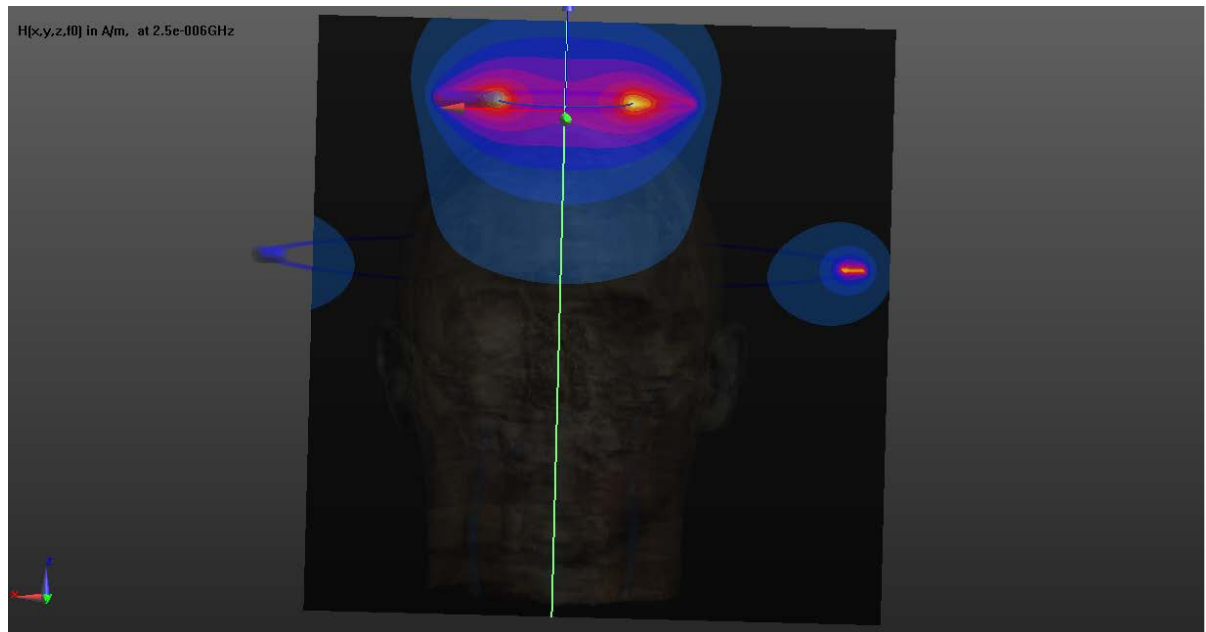
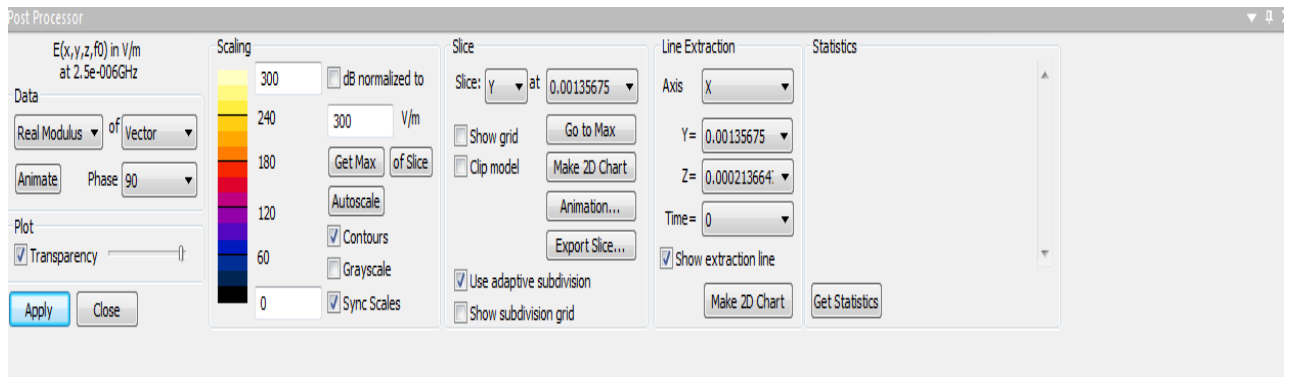
**The following electric and magnetic field graphs were obtained after simulation, along with 2-D charts.**

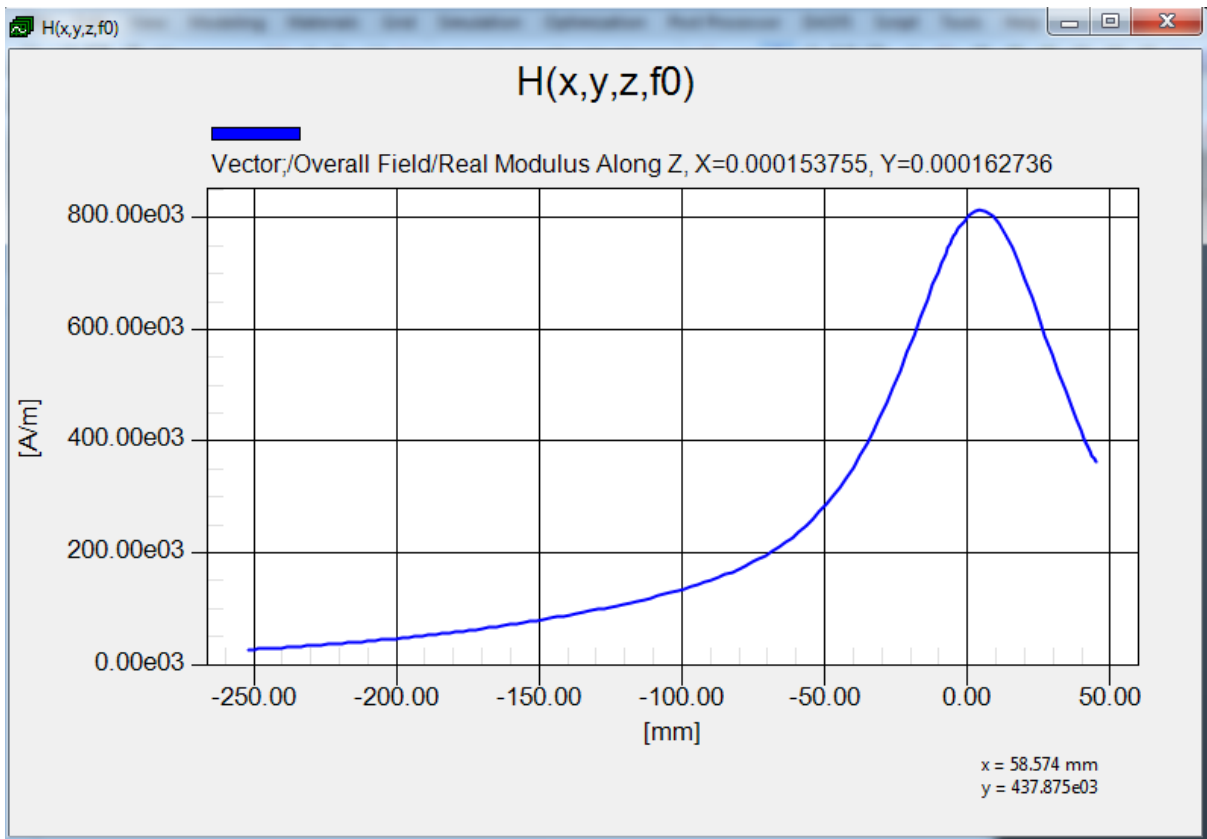
$E(x,y,z,f_0)$  in V/m, at 2.5e-006GHz



$E(x,y,z,f_0)$







Post Processor  
 $H(x,y,z,f_0)$  in A/m at 2.5e-006GHz  
 Data: Real Modulus of Vector  
 Animate Phase 0  
 Plot:  Transparency  
 Apply Close  
 Scaling: 2.25e+006, 1.8e+006, 1.35e+006, 9.01e+005, 4.51e+005, 840  
 dB normalized to 5e+005 A/m  
 Get Max of Slice  
 Autoscale  
 Contours  
 Grayscale  
 Sync Scales  
 Slice: y at 0.000162736  
 Show grid  
 Clip model  
 Use adaptive subdivision  
 Show subdivision grid  
 Line Extraction: Axis Z, X=0.000153755, Y=0.000162736, Time=0  
 Show extraction line  
 Make 2D Chart Get Statistics

<b><u>Name</u></b>	<b><u>Hours this week</u></b>	<b><u>Work</u></b>
Wentai Wang	5.5	SemCAD simulation, Weekly Report
Aashwath Agarwal	9	SemCAD simulation, Weekly Report

Dylan Rasmusson	5.5	
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### **Literature review**

Many group focus on developing Transcranial Magnetic Stimulation (TMS) in last decade. This technique is widely investigated for the treatment of various neurological disorders such as Parkinson's disease. There are many types of TMS coils has been developed such as single coil, figure of eight and Halo coil. However, most of the coil can't make electric and magnetic field in the deep brain regions. P. Rastogi, R. L. Hadimani, and D. C. Jiles get deeper study in Brain TMS coil and developed a novel coil configuration called "Triple Halo Coil". They found out triple halo coil has 10 times in the magnetic field comparing with standard circular coil. (**Wentai**)

This groundbreaking design would prove beneficial to humankind by treating long such diseases such as Parkinson, depression, post traumatic injury, etc. To do this, first of all FEM calculations have to be performed using SemCAD software, by utilising the Standard Anthropomorphic model simulation. In this a heterogeneous head model is implied, instead of homogenous model, as former provides a better study of magnetic field influence in the brain. It also gives us a more accurate precision than homogenous model. (**Aashwatth**)