

## **SAM Phantom with Generic Phone: SAR Calculations**

### **Overview/objectives:**

In this LAB, the average peak SAR of the Specific Anthropomorphic Phantom (SAM) exposed to the radiation of a generic mobile phone is calculated.

### **Contents:**

- 1. Introduction: program and configuring the simulation.**
- 2. Procedure: extracting and interpreting the results.**

### **1. Introduction**

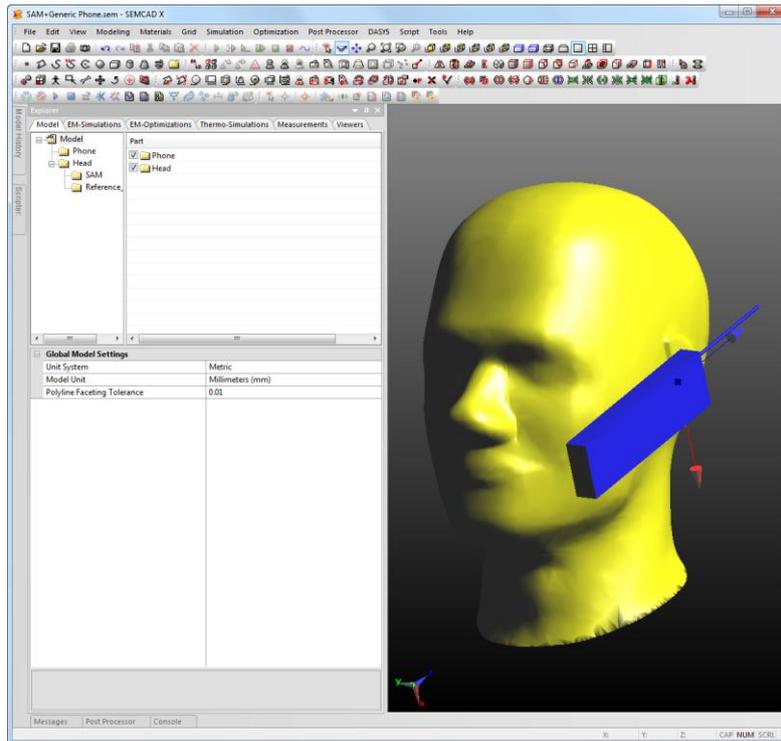
In this LAB we are going to analyze the SAR of the SAM phantom exposed to the radiation of a generic mobile phone. The SAM Phantom has been proposed by the Standardization Coordinating Committee 34 of IEEE (SCC34-SC2) and has also been suggested by CENELEC, prEN 50360.

We are going to use the SEMCAD X modeling and computational tool. SEMCAD X is a 3-D full wave simulation environment, developed and provided by Schmid & Partner Engineering (SPEAG). The software is designed to address the electromagnetic needs of the wireless and medical sectors in terms of antenna design, EMC and dosimetry. For more information see <http://www.semcad.com>.

The numerical method used by the program is the Finite Difference Time. The following steps outline the model generation and the simulation of the generic phone and the SAM Phantom:

- \_ Importing the generic phone model.
- \_ Importing the SAM Phantom.

- \_ Placing the phone in "touch" position.
- \_ Entering the relevant simulation settings and assigning the material parameters.
- \_ Setting up the grid and voxeling the model.
- \_ Running the simulation and extracting the results.



Switch to the simulation mode by clicking on the Simulations tab in the project panel. The simulation settings for the generic phone are already introduced.

### Settings

1. Keep the Excitation mode as Harmonic.
2. Keep the Frequency of the simulation as 900 MHz and the Simulation Time as 10 periods.

### Solid regions

Select the SAM Liquid, and set the Permittivity to 41.5 and the Electrical Conductivity to 0.97 S/m.

## Sources

Keep the parameters for the Edge.

## Lumped elements

Since there are again no Lumped Elements in this project, there are no settings to enter here.

## Sensors

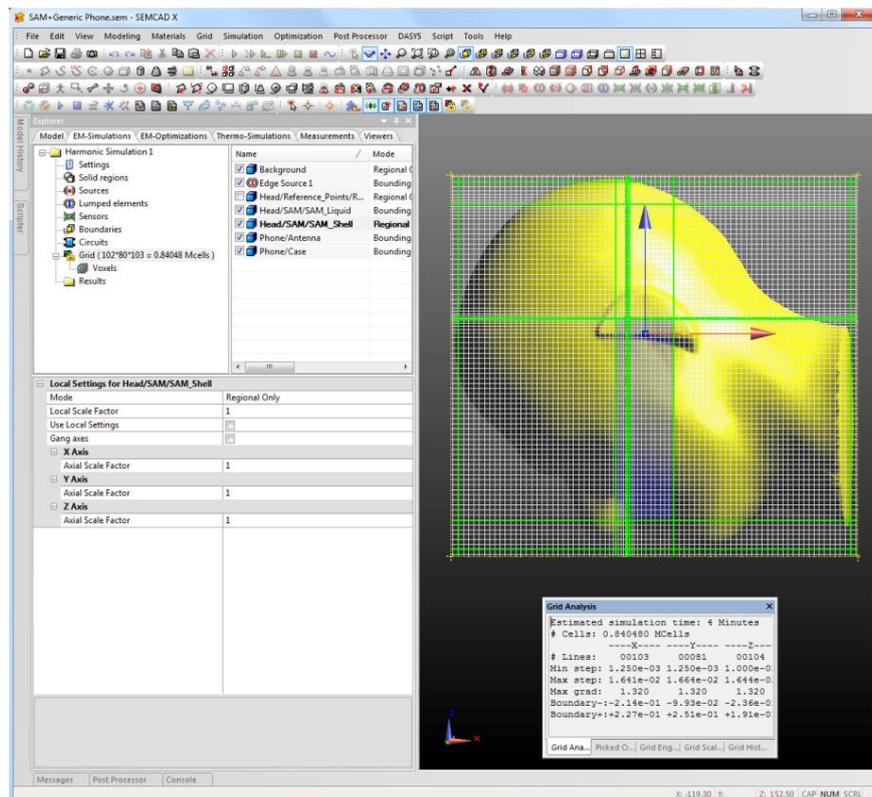
By default all of the relevant sensors should be activated for the harmonic simulation: Overall. Field will record the near field throughout the grid, Far Field will record the far field radiation pattern and Sensor of Edge Source will record the source waveforms.

## Boundaries

Keep the parameters for the Boundaries.

## Grid

Keep the parameters for the grid.



### **Voxels**

Once you have made the grid, you can compute the voxels by right clicking on the icon and selecting Make Voxels. Right click on the icon and then choose View Voxels.

### **Results**

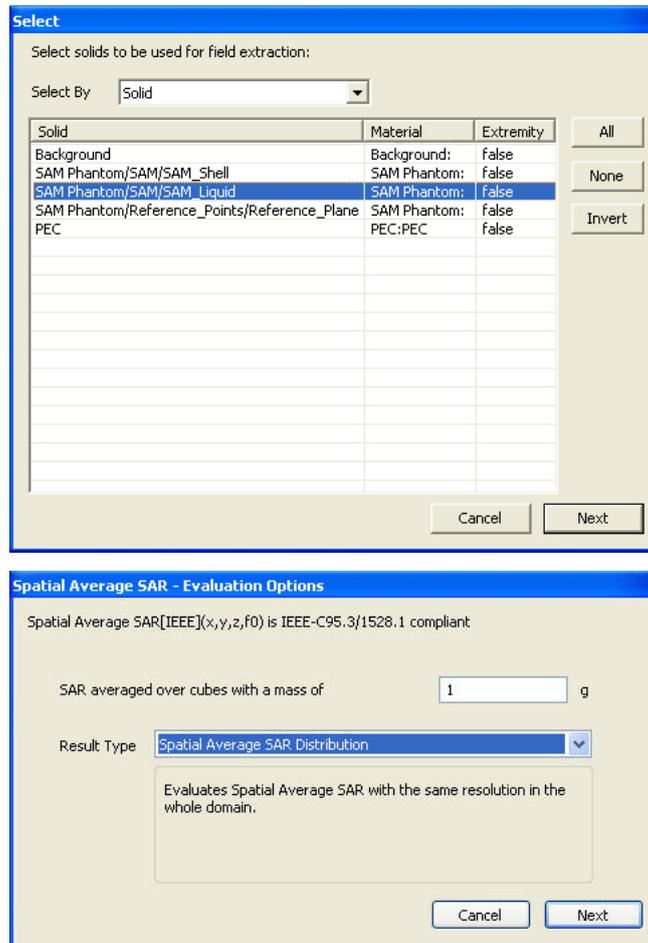
Now that the voxels have been created, it is possible to run the simulation. Either click on the icon or right click on the icon and select Run. Once the simulation is running you will see the simulation log as well as the progress bar and speed printed in the Status Bar. After the simulation has completed you will see that the list of active sensors will appear in the Results part of the simulation tree.

## **2. Realización de la práctica: extracting and interpreting the results**

When the simulation is finished you can find the simulation results in the project tree associated with the sensors we placed in the model. By right clicking on a quantity recorded by a sensor, you can choose a viewer to display the data.

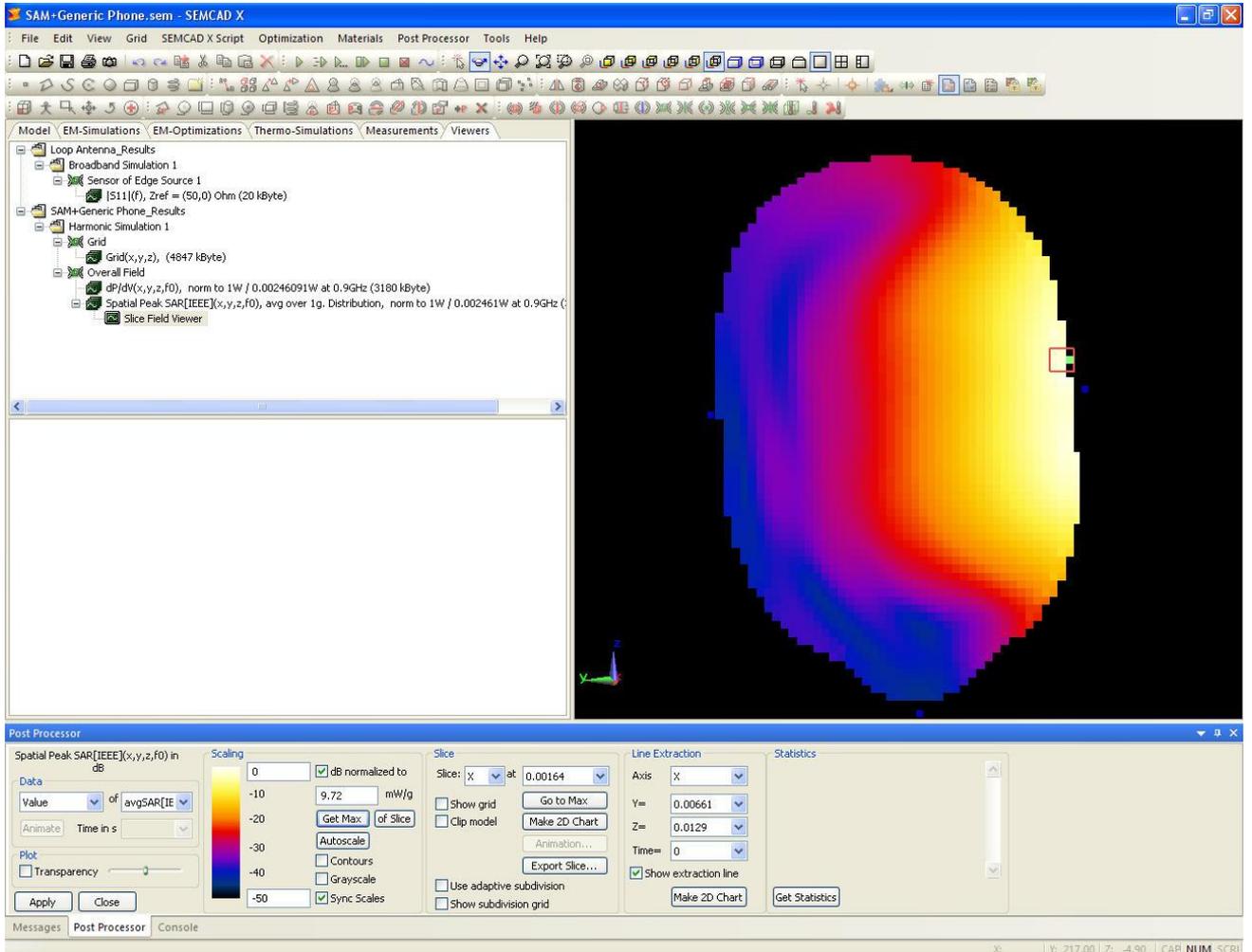
### **2.1- Calculate the SAR values**

In order to calculate the average SAR, right click on the Spatial Peak SAR[IEEE](x,y,z,f0) icon of the Overall Field sensor results in the project tree and select the Slice Field Viewer. Because SAR extractions are so computationally intensive, SEMCAD X light has implemented many SAR averaging algorithms, with each addressing different needs. In general cases, choose Spatial Average SAR Distribution. The SAR distribution can be averaged over an arbitrary mass according to IEEE, but you can leave it to 1 g and click Next. You can normalize the displayed results to an input power of 0.25 W by enabling the normalization checkbox and clicking on Next. Select the solids to be considered for the SAR computation as shown in the next figure. Click again on Next to start the computation.



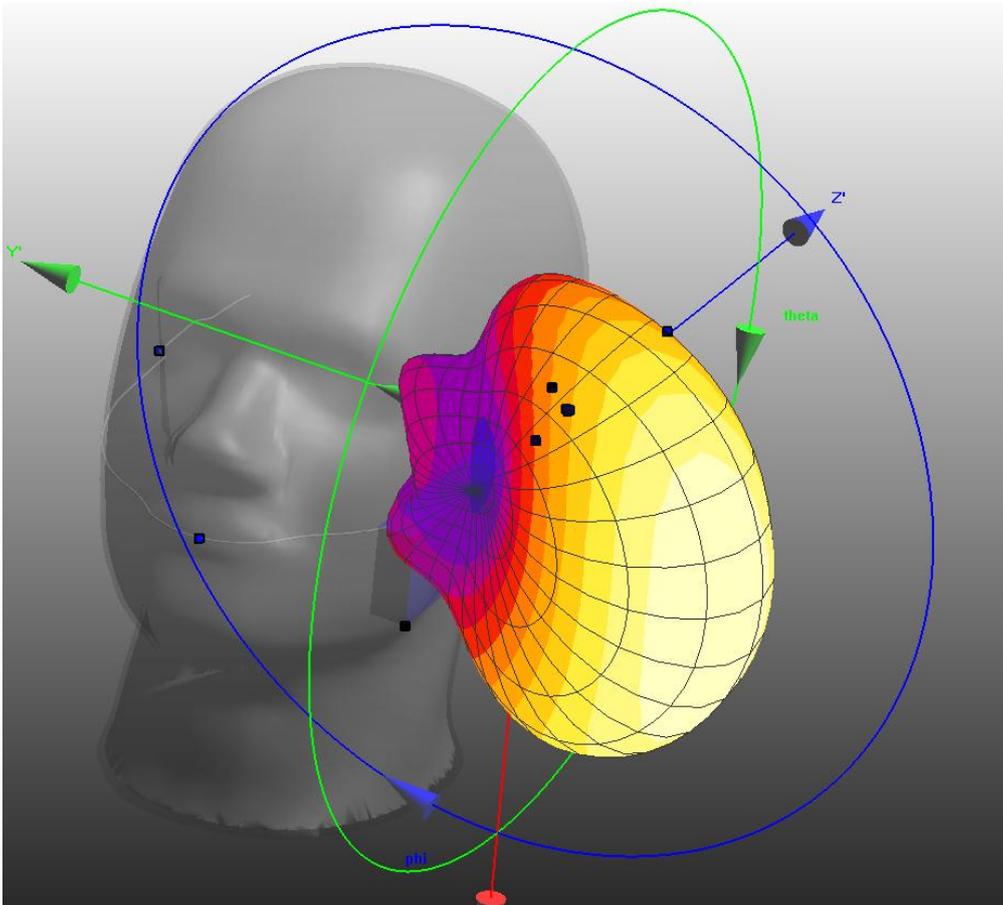
The following figure shows the distribution of the averaged SAR in a cross section of the head along with the necessary settings.

- 1- Look at the 1 g SAR results.
- 2- Determine if your values are within the regulated limits.
- 3- Calculate the spatial average peak SAR for 10 g averaging mass. Compare the results with the 1 g averaged results.
- 4- Move the head 10 mm closer to the cellphone, run the program again and calculate the SAR values again.
- 5- Present your conclusions



## 2.2- Calculate the 3D radiation pattern

The 3D radiation pattern can be displayed using the Far Field sensor and selecting the Spherical Field View. In the dialog window which pops up, the default values do not need to be modified. Present your results.



## References

SEMCAD X by Schmid & Partner Engineering (SPEAG): Tutorial.