Exponential Horn- an example of a COMSOL app

When to use an app

The advantages of using an app are discussed in detail at https://www.comsol.com/comsol-server. Briefly- apps are useful when simulations of a well-defined type need to be run by non-expert users.

An example

We present here an example of a rather simple app performing an antenna simulation. Horn antennas are well-matched to waveguides and provide good directivity. The performance of a particular horn depends on the shape. This app simulates an exponential horn (the horn portion has an exponential shape). The input waveguide is a WR90 waveguide, 0.4 x 0.9 inches in inside dimension, used between 8.2 and 12.5 GHz. Parameters that can be changed by the user are: frequency, length of the flared part of the horn, ratio between the flaring in x and y directions, and the rate of flare in the y direction.
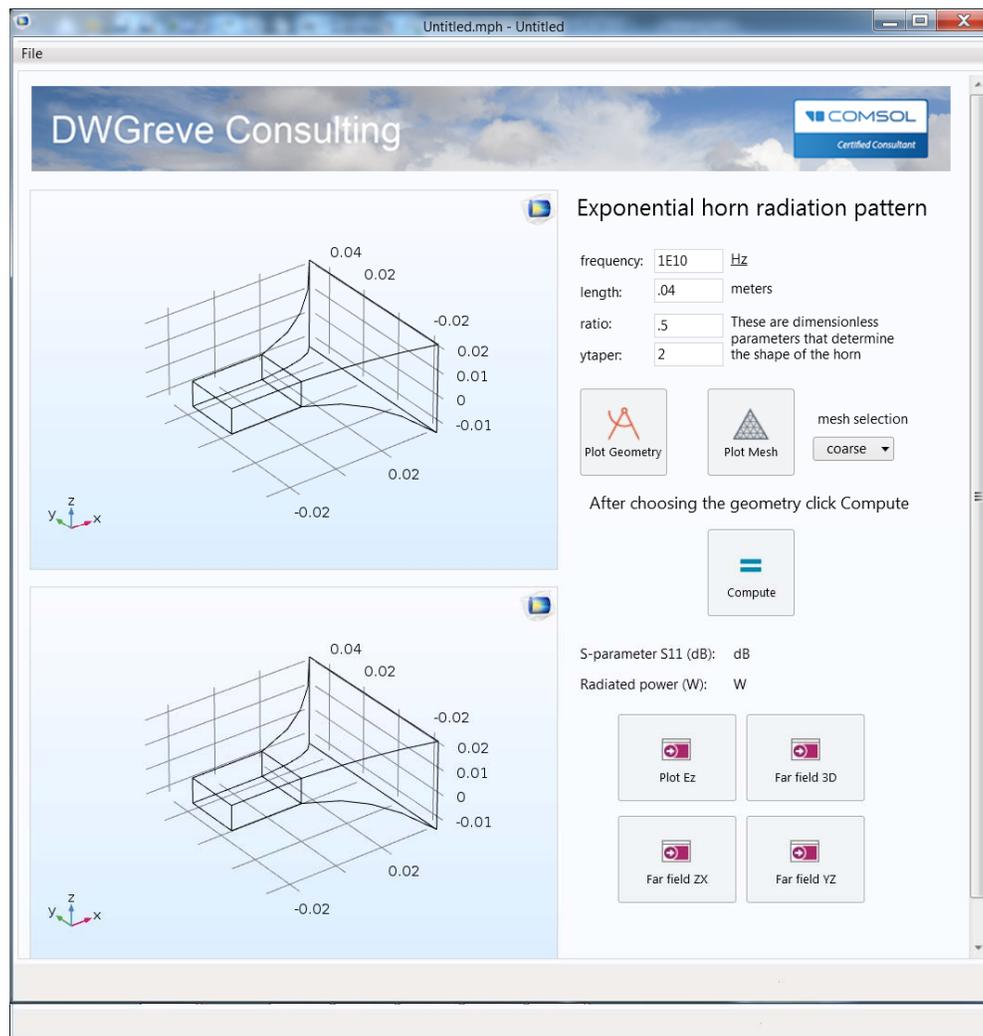
The user selects the parameters and presses the "plot geometry" button to see the appearance of the horn. The user can also view the mesh and choose between a normal and fine mesh, allowing a tradeoff between simulation time and accuracy. When the user is satisfied with the geometry, pressing the "compute" button starts the simulation.

When the simulation is complete the S parameter at the input port, the total radiated power, and the z component of the electric field are automatically plotted.
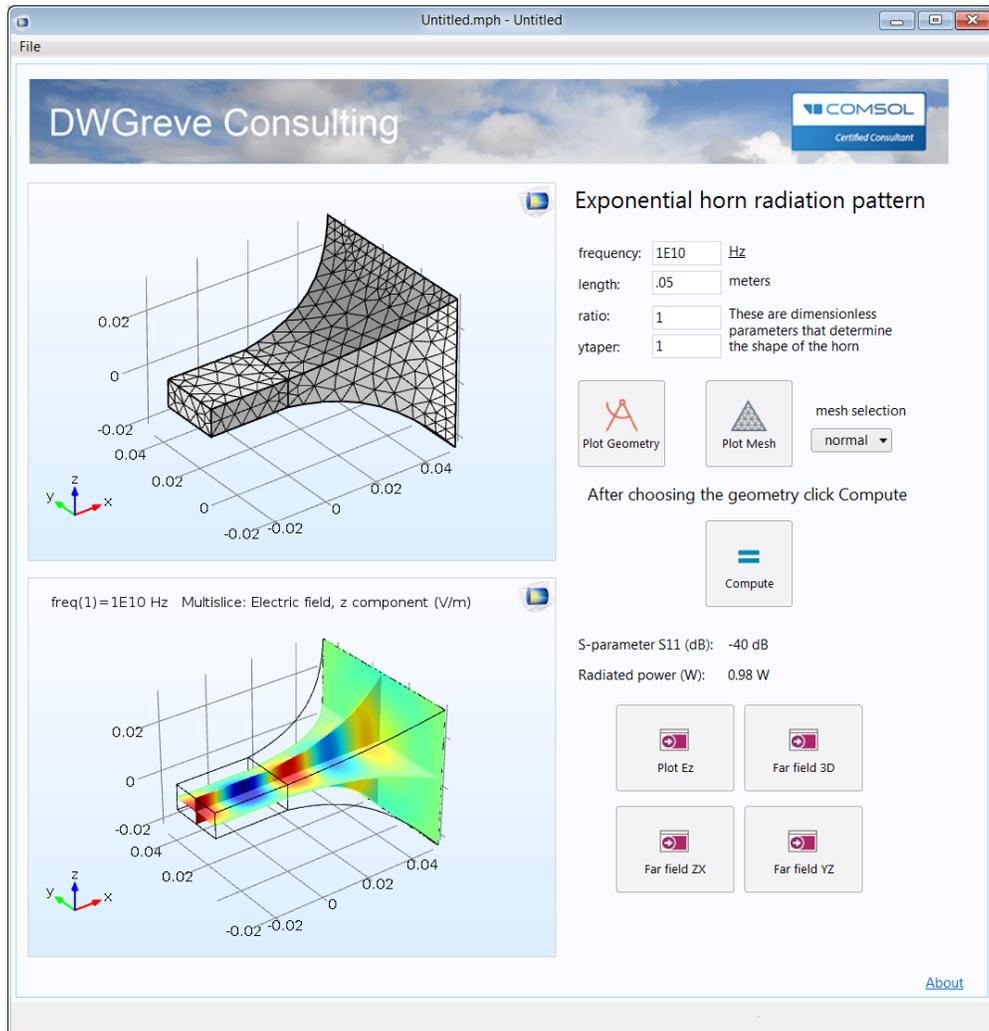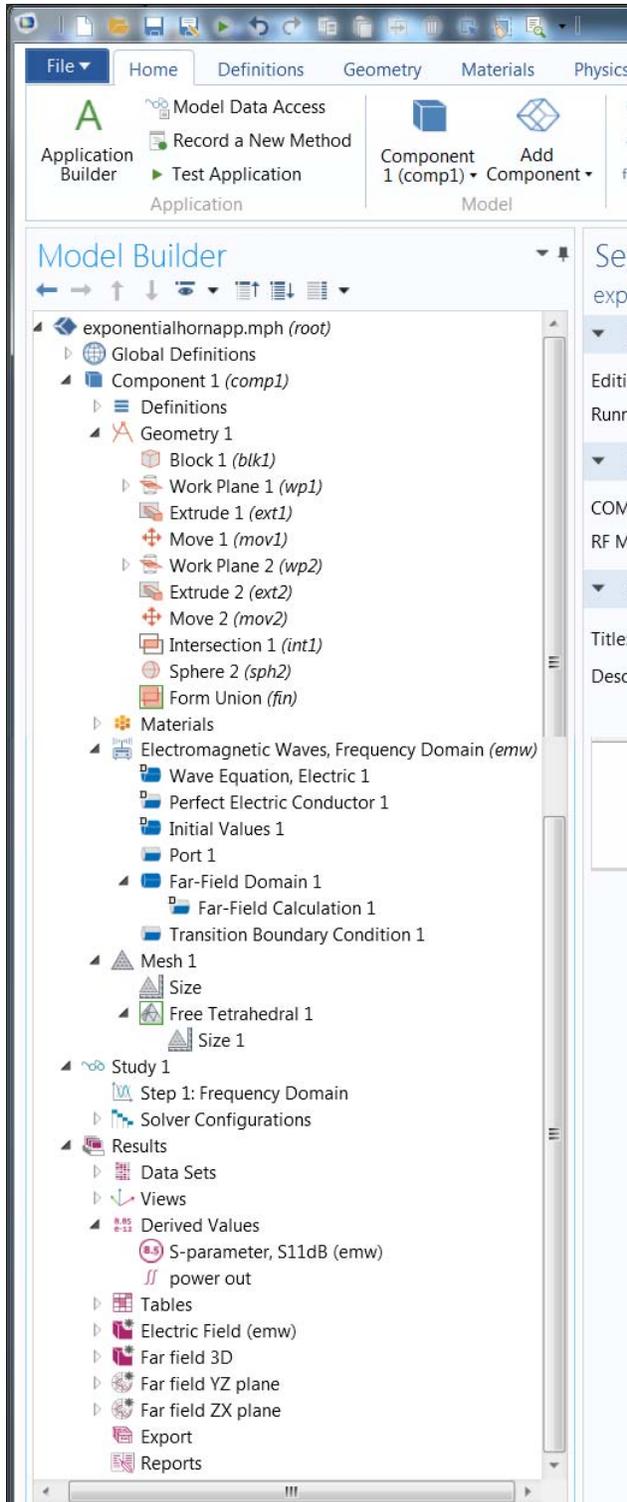

Other output plots can be obtained by selecting one of the other three buttons. Options are shown on the following pages.

1. Far field plot in the ZX or YZ planes (ZX plot shown below)
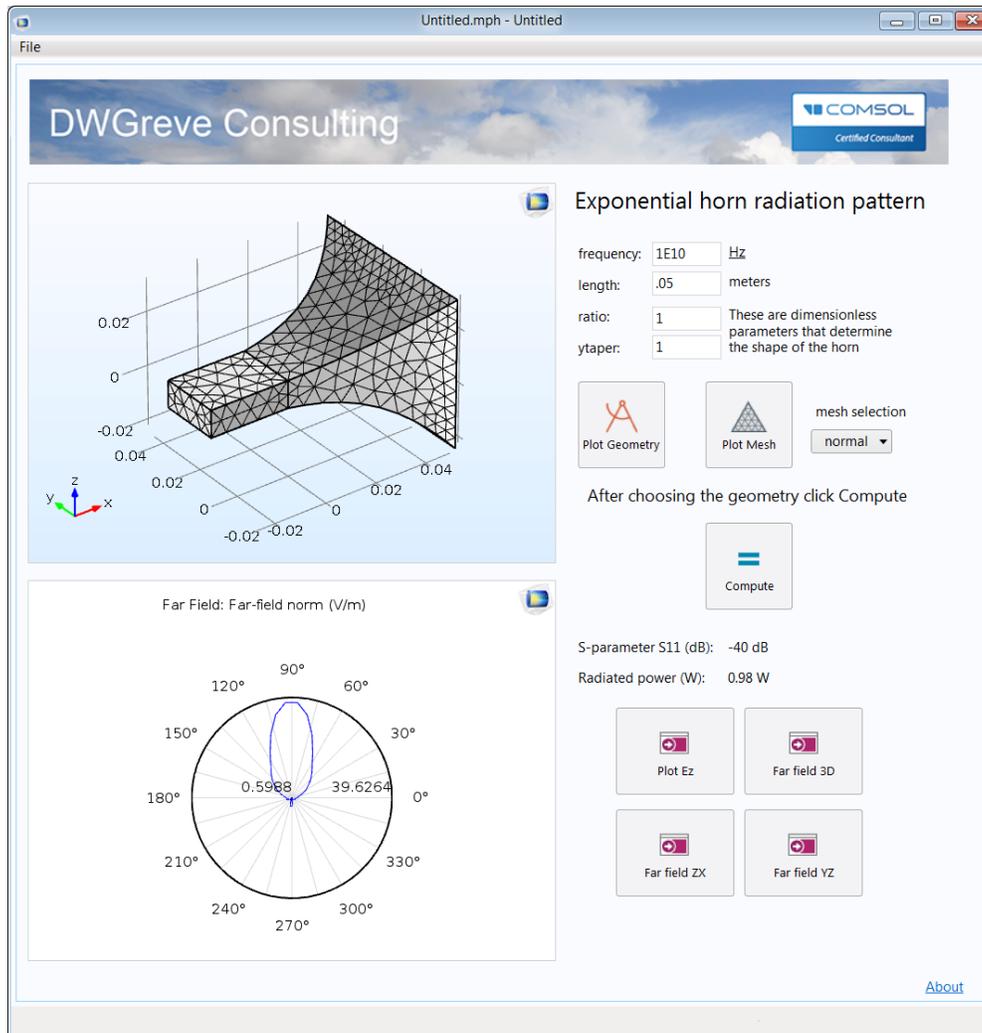
What the user does *not* need to do

Many of the details of the simulation setup are not visible to the user. Below we show some of the details that have been taken care of by the app author.

Building the geometry, including parameterization of the horn shape

Specification of the physics and boundary conditions of the electromagnetic simulation, including the input port and the far-field calculation
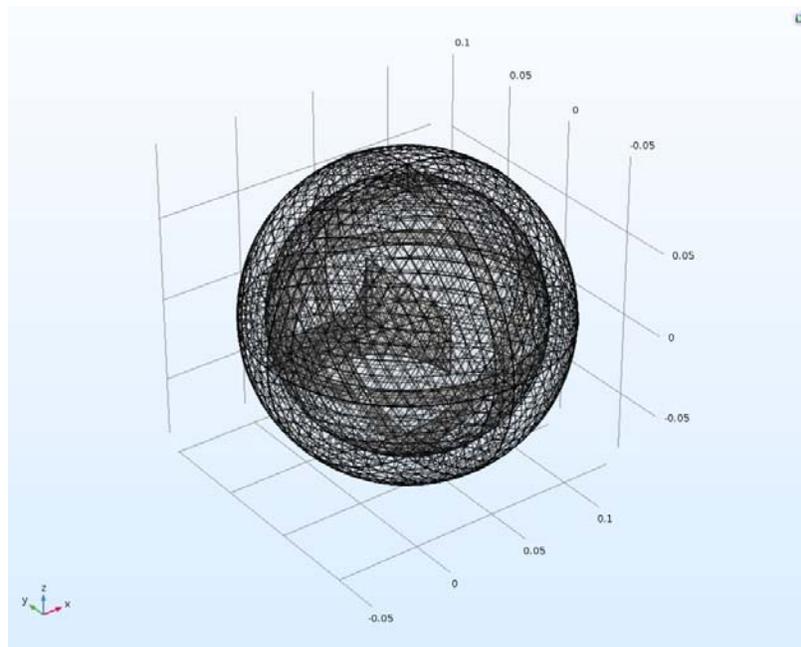
Mesh the simulation domain

Specify a frequency domain simulation

Post-process to extract the S-parameter and the radiated power

Post-process to obtain and plot the far-field radiation pattern

Published for users of Comsol Multiphysics
Copyright DWGreve Consulting, Sedona, AZ 86351
http://dwgreveconsulting.com/

The geometry built by the author, including the far-field domain and the meshing, is shown below.

Conclusions

Using a COMSOL app, many of the details of simulation setup can be done by an expert author. Once the simulation is set up, repeated simulations of the same type can be quickly performed by an engineer without a high degree of expertise in simulation.