A Boradband Eight-Way Coaxial Waveguide Power Combiner

1. Description

We present in this example validated results of an eight-way power combiner's simulation. The model and dimensions of the structure have been set according to [1]. The simulation results show great agreement with the measurements' shown in the same reference. The following figure indicates the main input port at the bottom of the structure and one output port.

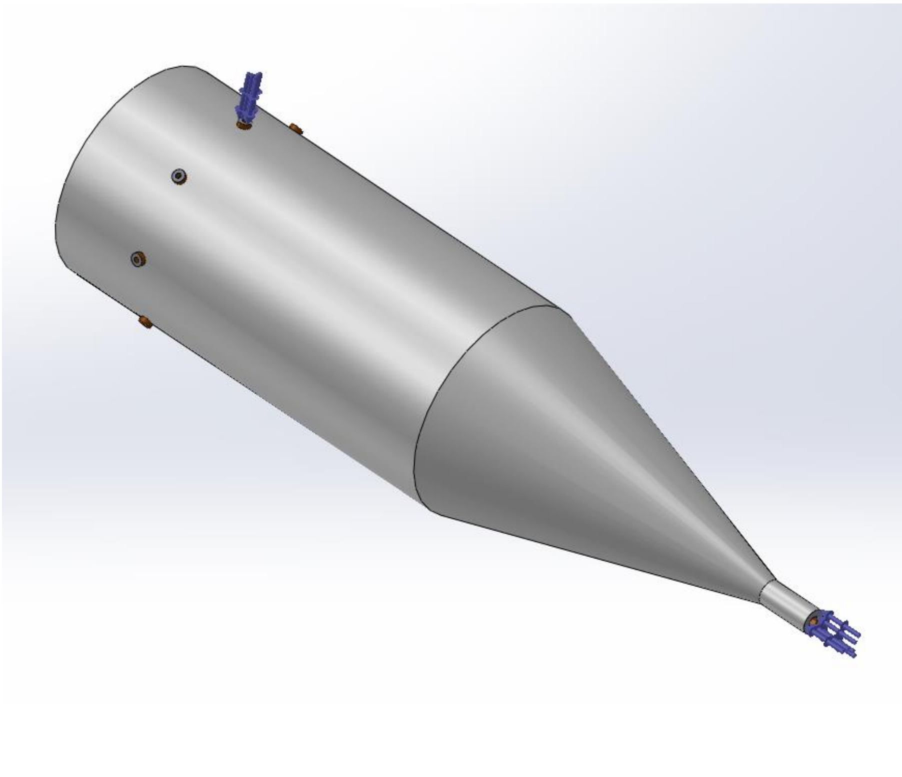


Figure 1: the structure's 3D view in SolidWorks (Input and one output port are indicated)

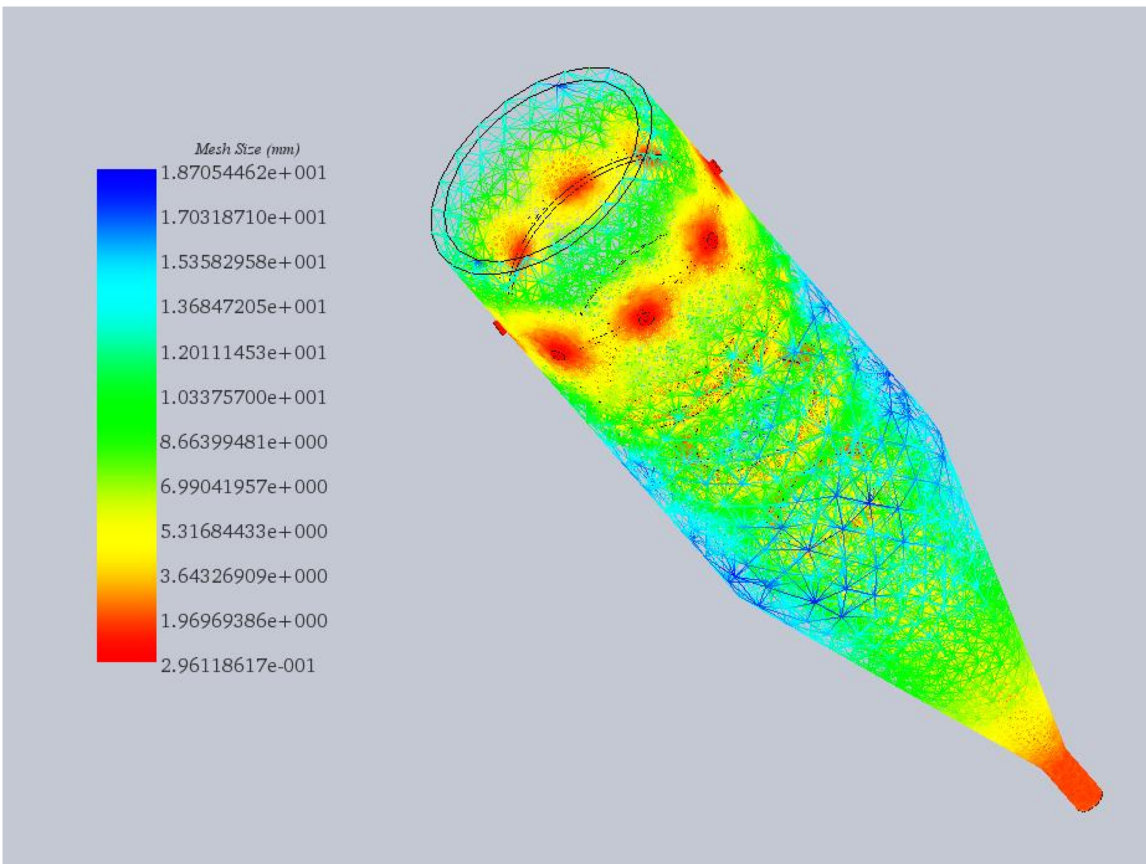
2. Simulation

The Scattering Parameters solver is the most suitable analyzer for such a structure as it offers the aimed variables and frequency responses: Return Loss, Insertion loss, Isolation between the output ports, relative phase shifting between input and output signals… etc. The applied mesh is fine near the discontinuities of the stepped impedance matching section. The transition faces are most crucial areas to the solver: They are in origin of an impedance and geometrical distribution change. Therefore, we must apply a finer mesh to them.

3. Loads/ Restraints

The ports are all applied to the circular dielectrics' faces. We can indicate that the propagation is in TEM mode to the solver for more accurate results. The structure presented above is considered as a vacuum cavity; its outer surfaces are treated as Perfect Electric conductor surfaces.

HFWorks gives the possibility to view the mesh of the structure in a 3D colored chart. The user has full control on the mesh and may make it fine to areas he assumes are crucial. For example, the stepped-impedance coaxial-line matching section



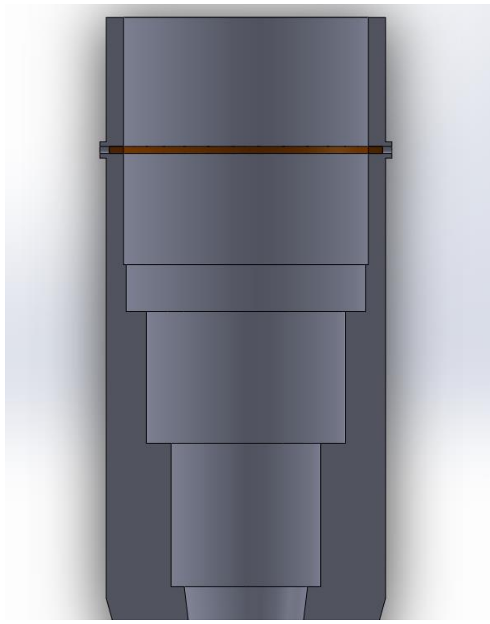


Figure 2: Colored mesh of the structure along side the stepped-impedance coaxial-line matching section

4. Results

To validate the precision of the HFWorks simulator, we ought to compare the simulations' results to measurements [1]. The following figures show the insertion and return losses of the structure from 0.5 to 2 GHz.

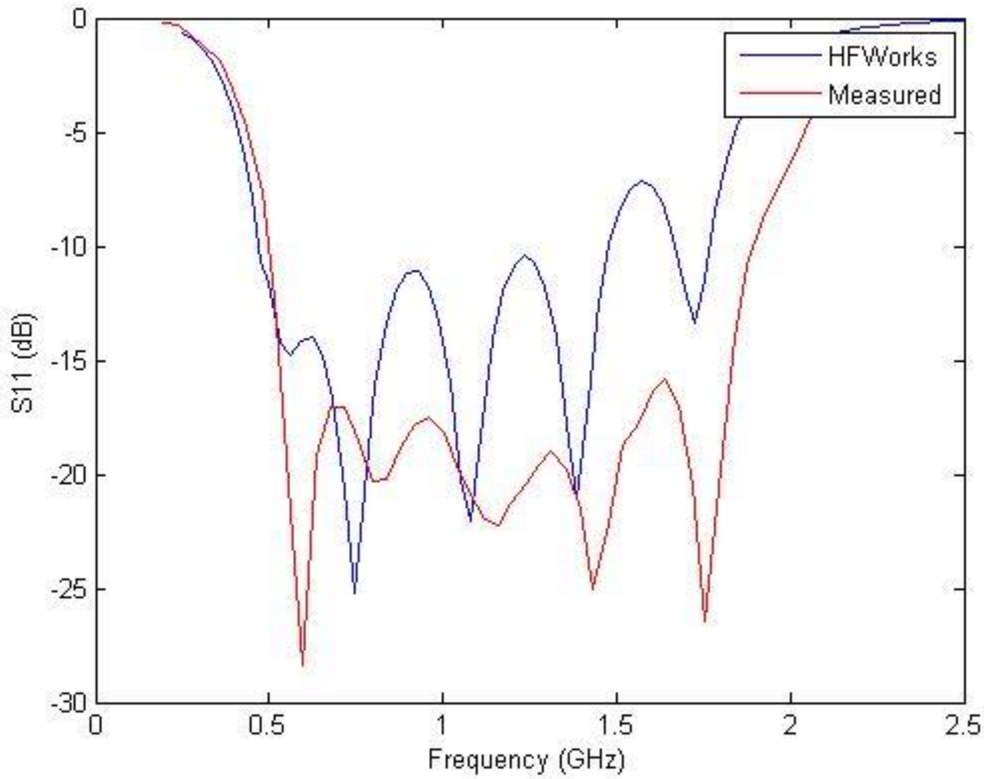
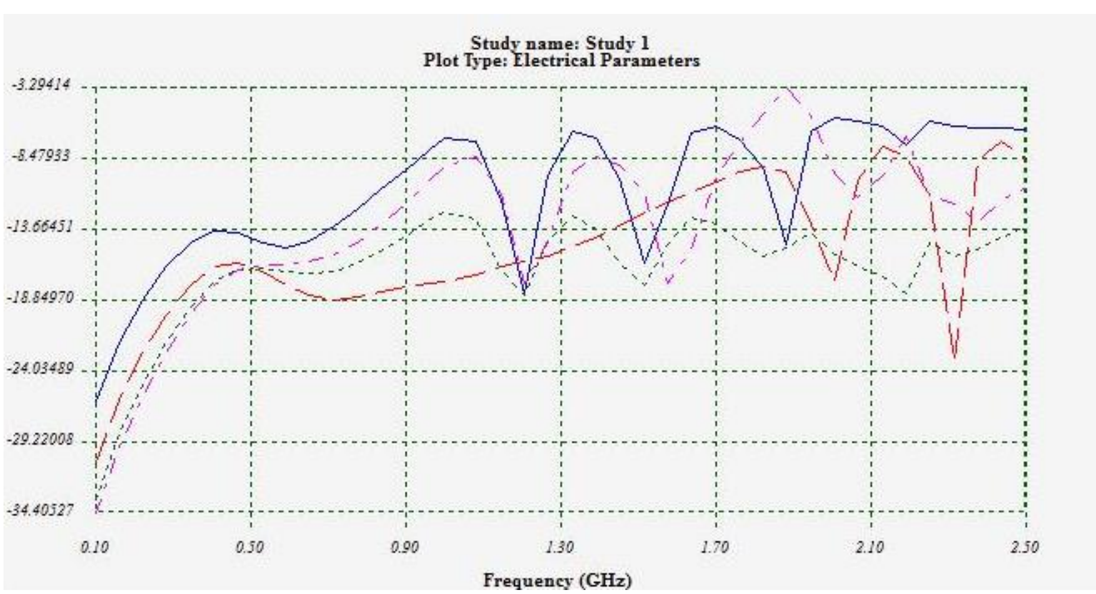


Figure 3: A comparison of the simulated and measured reflection coefficients at the central output port



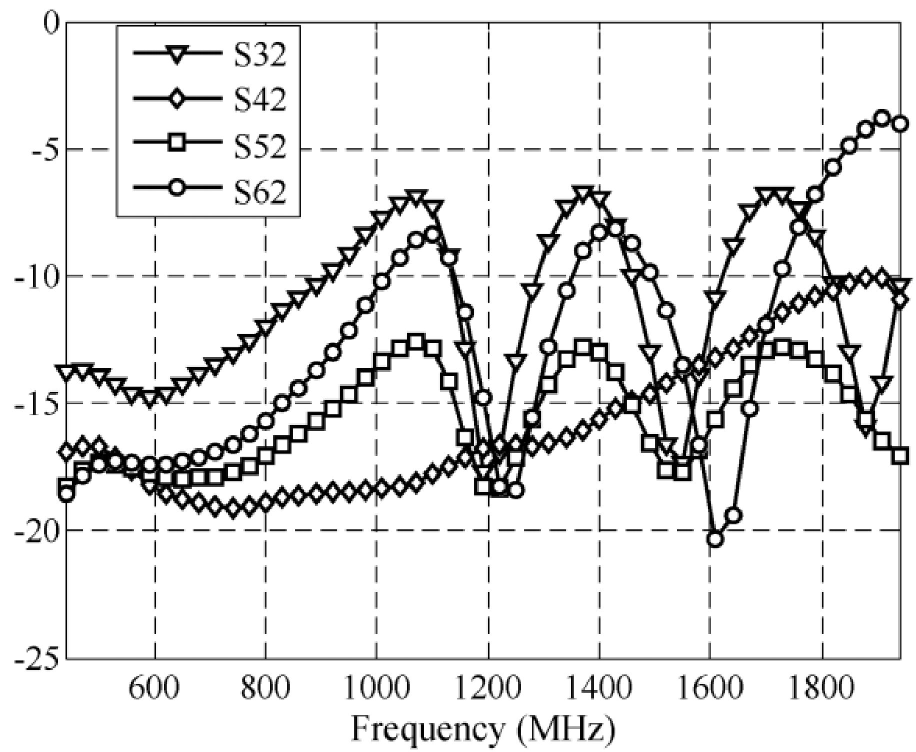


Figure 4: Isolation between the output ports (S32, S42, S52, and S62) (Top: Simulated; Bottom: Measured)

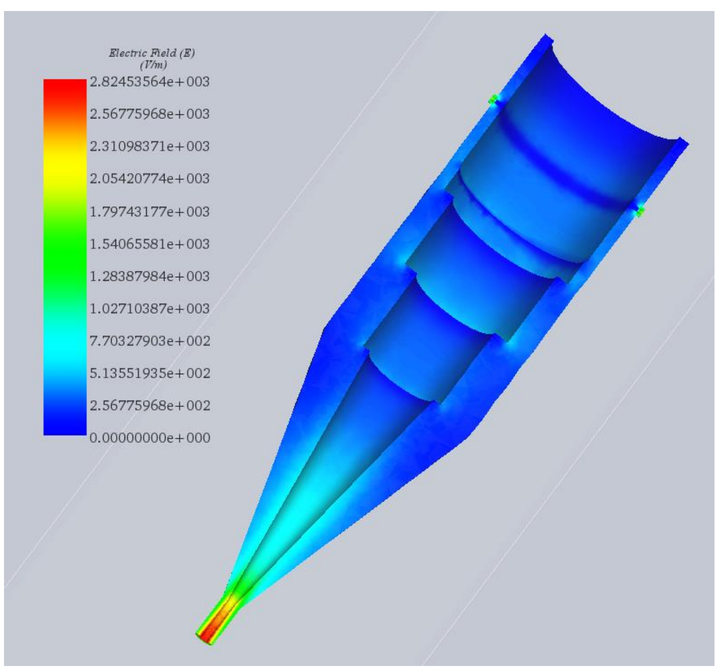


Figure 6: 3D Electric Field Distribution at 1 GHz

5. References

[1] Design of a Broadband Eight-Way Coaxial Waveguide Power Combiner, Mohammad Amjadi and Eslam Jafari, IEEE TRANSACTIONS ON MICROWAVE THEORY AND TECHNIQUES, VOL. 60, NO. 1, JANUARY 2012