Model Construction

Start the project wizard with new project.

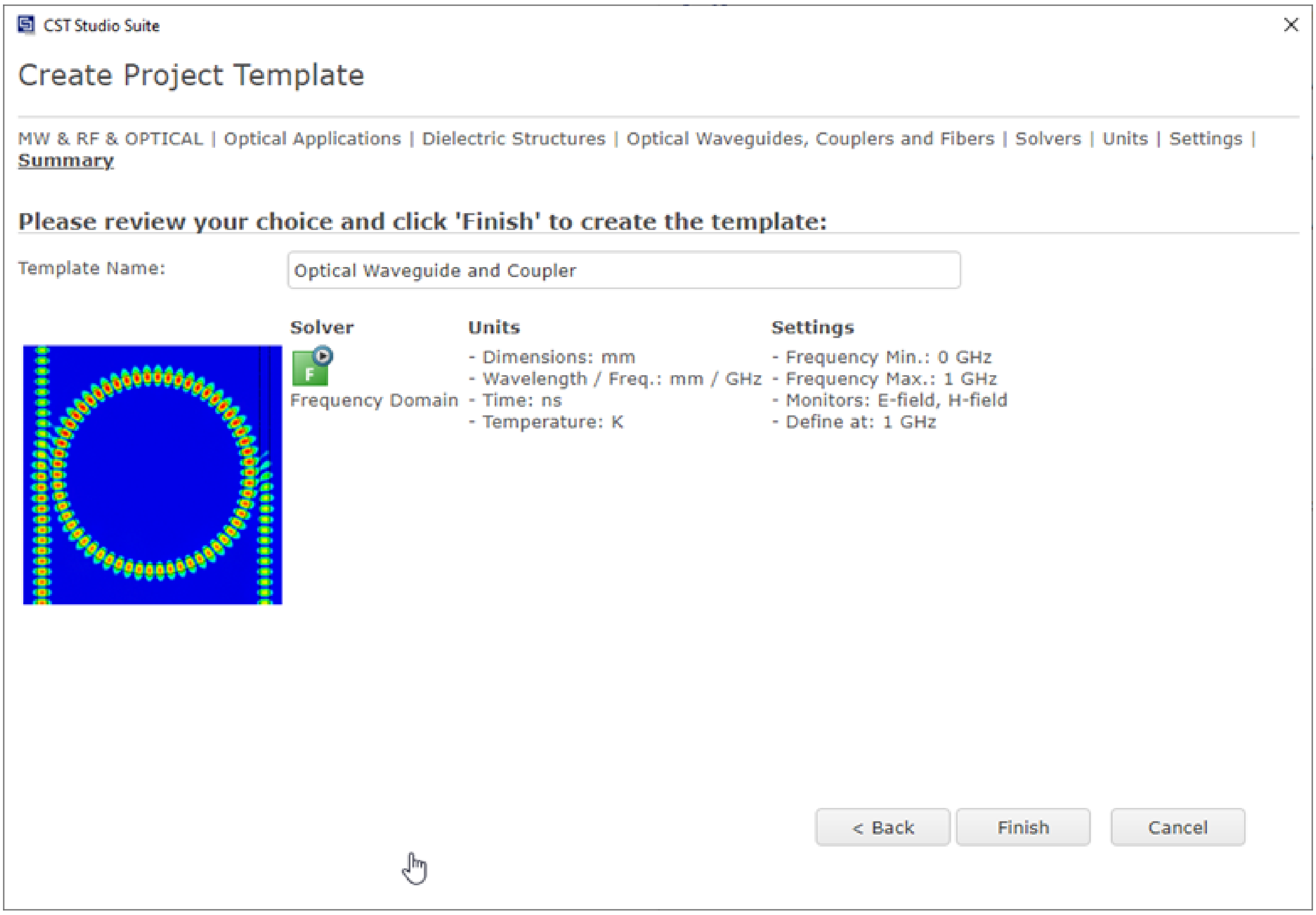


Figure 7: Project template definition

We start with the first vacuum region. The background material is *Normal.* Define a block with the dimensions shown in Fig. 8.

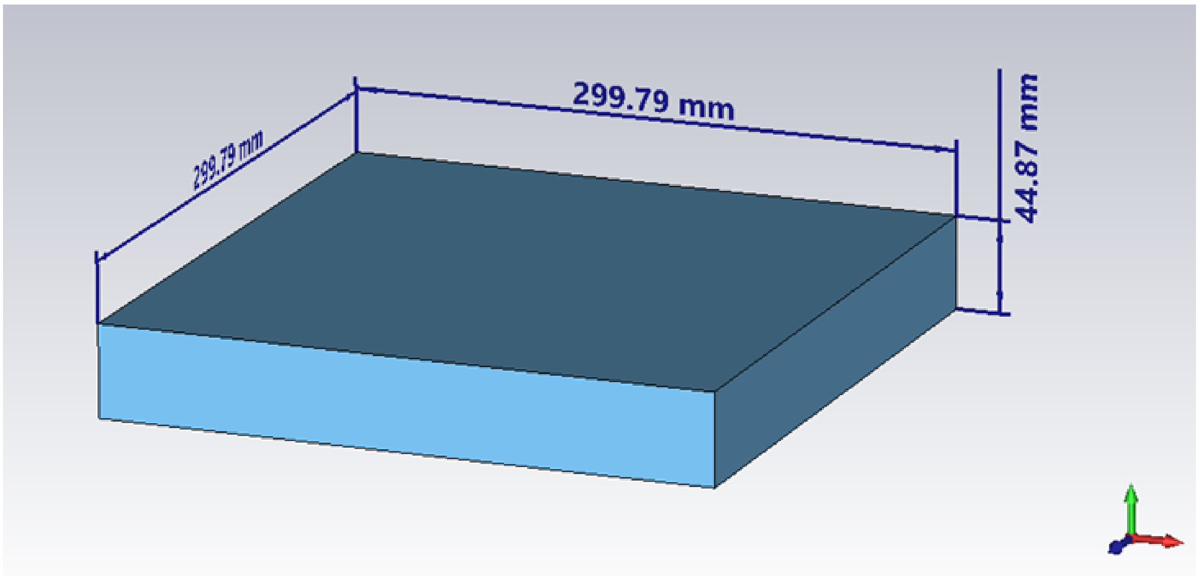


Figure 8: Definition of the first vacuum block.

By using the pick operation together with extrude, create the dielectric region, with a length of 299.79 mm. Create a new material with parameterized permittivity. The permittivity (epsilon) of the dielectric material should be parameterized as “eps”, with an initial value of 4.

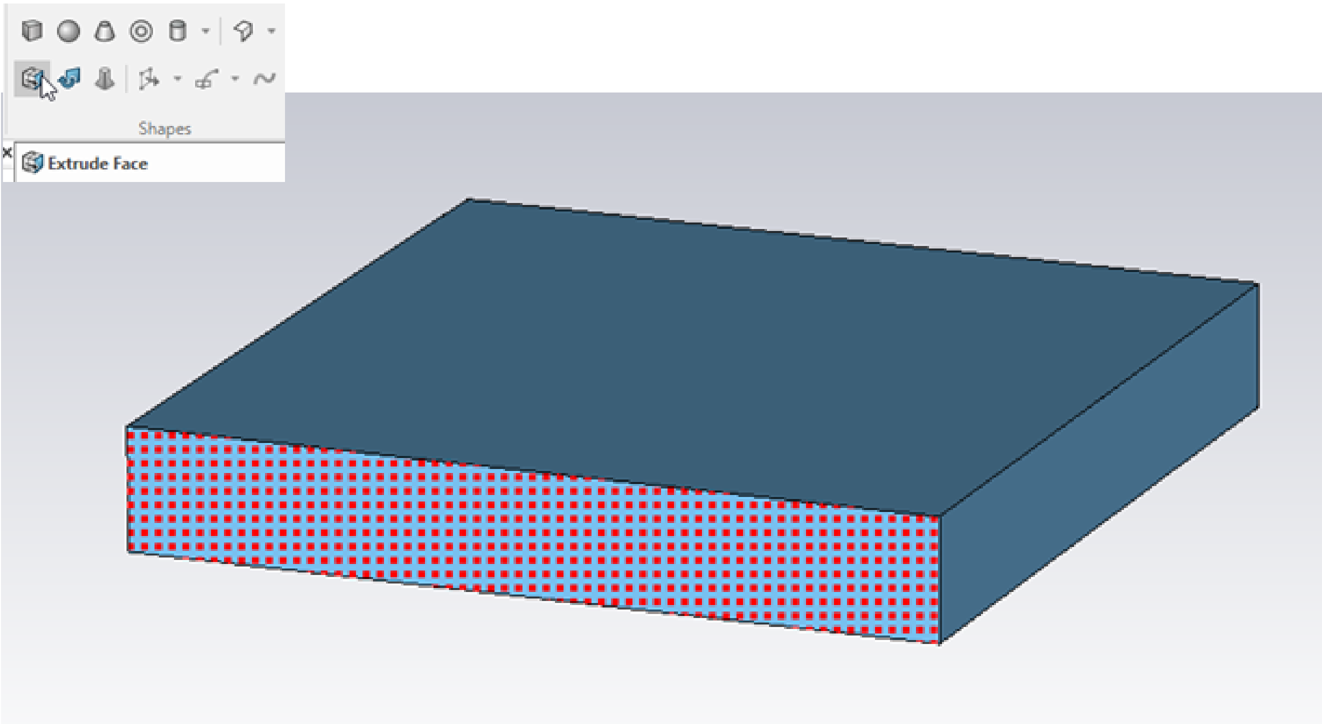


Figure 9: The extrude operation.

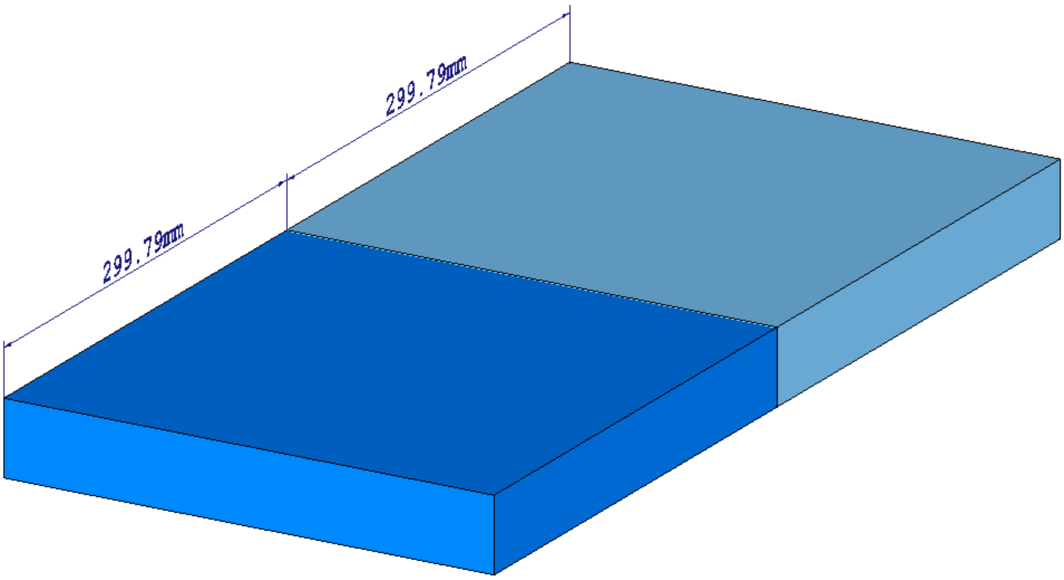


Figure 10: The extruded dielectric slab.

Repeat the extrude operation to create the second air region.

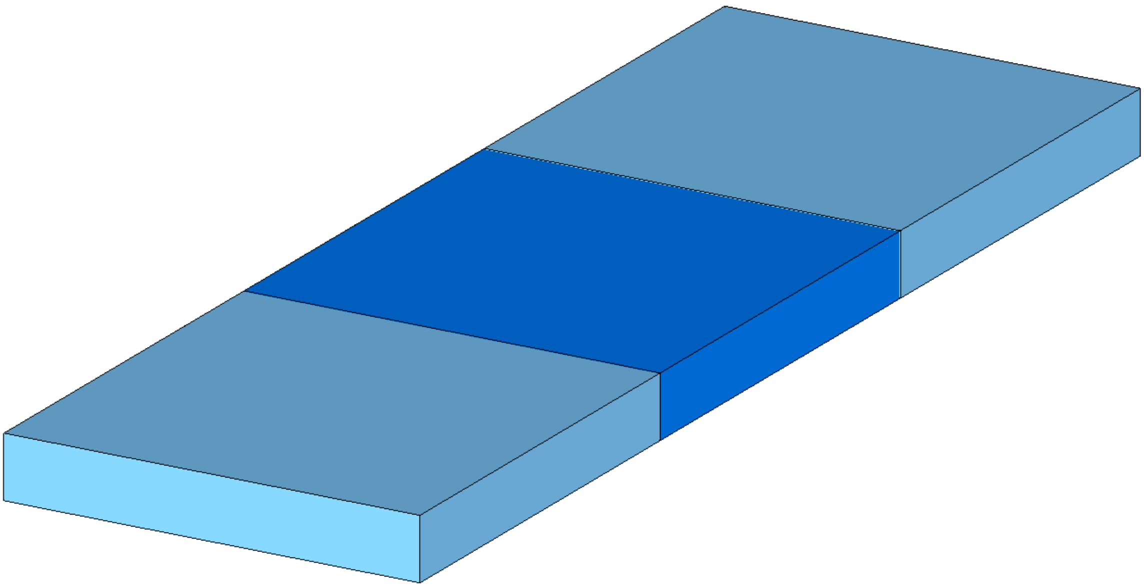


Figure 11: The finished model.

To create the waveguide ports to excite the model, pick the end faces of the model, and select "Waveguide Port" on the simulation ribbon.

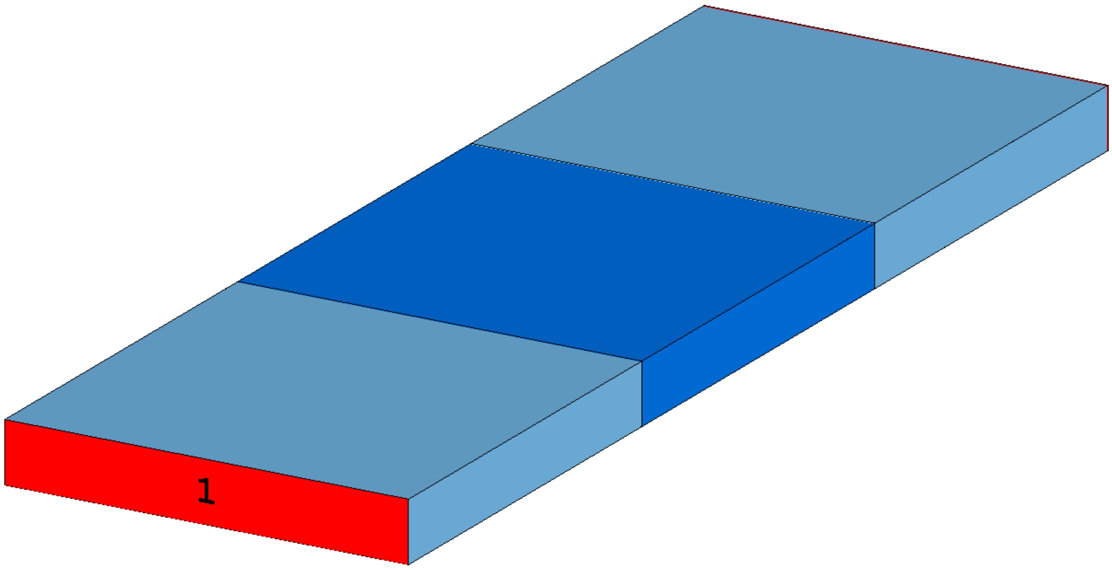
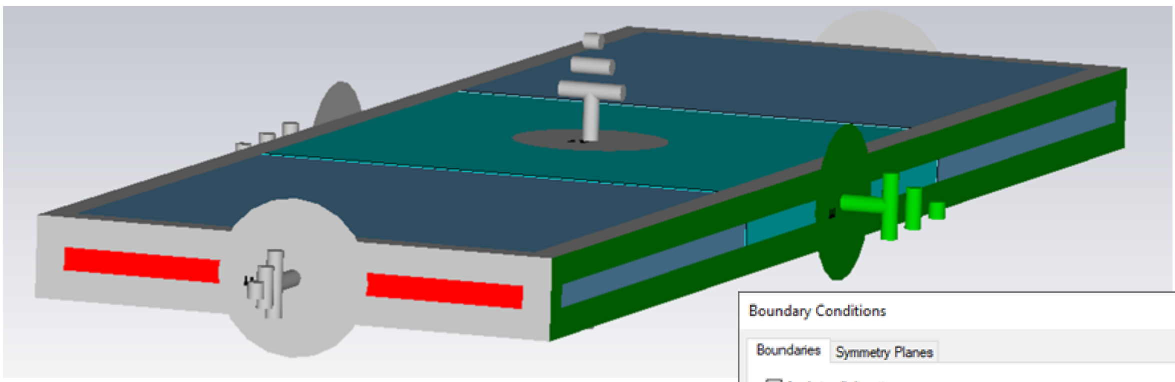


Figure 12: The model, with waveguide ports.

Below we discuss how to generate a TEM mode using waveguide ports.

Mimicking a Plane Wave with wave guide ports

The idea is to generate TEM mode (Both E and H field only have component transversal to the direction of propagation). This can be achieved by using proper boundary conditions (Fig. 13). This will enforce a TEM mode such that the magnetic field vectors only point in the y-direction, and the electric field vectors only point in the x-direction.



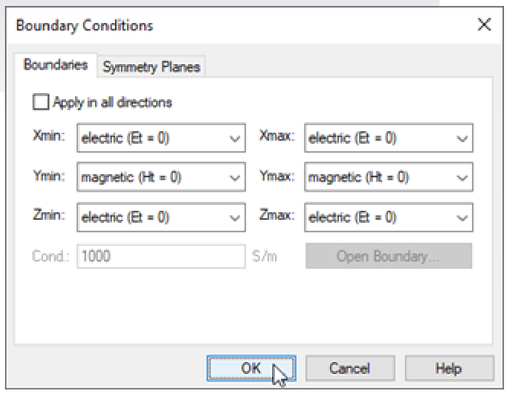


Figure 13: TEM boundary conditions.

And then we have our TEM mode:

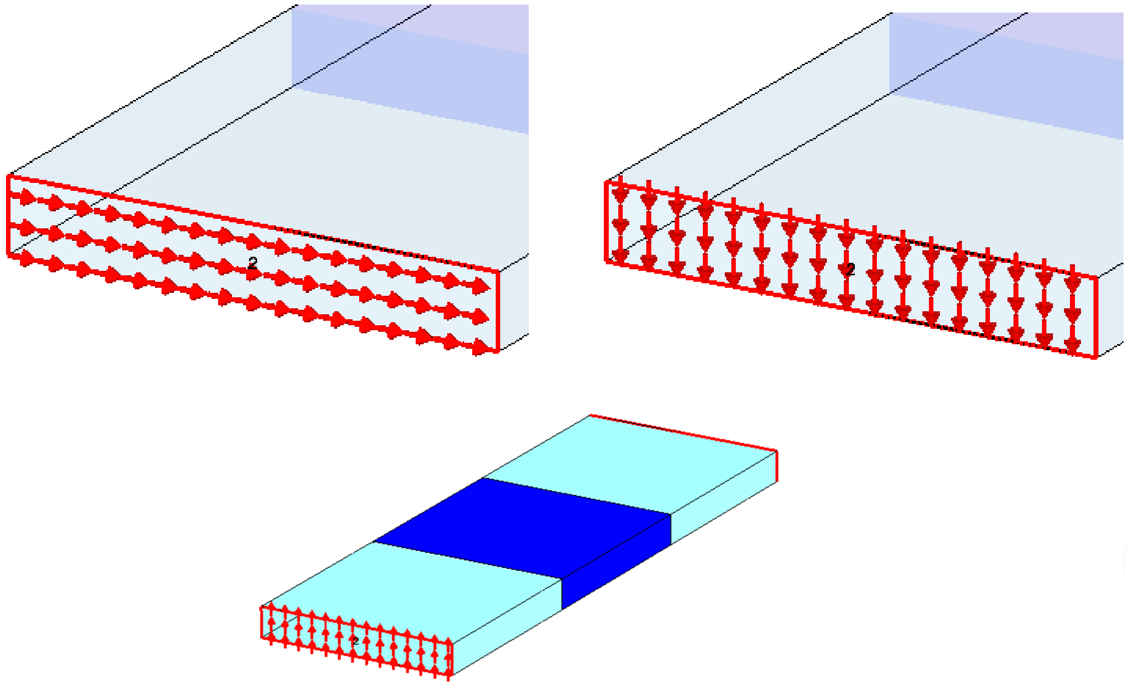


Figure 14: Port mode simulation, showing the E-field (left) and H-field (right).

Post Processing Templates Setup

Here we show how to set the Post Processing Templates in order to obtain the amplitude and phase of the reflection coefficient. On the “Post Processing” ribbon, select “Template Based Post Processing”, and then find “0D or 1D Result from 1D Result” under the “General 1D” category.

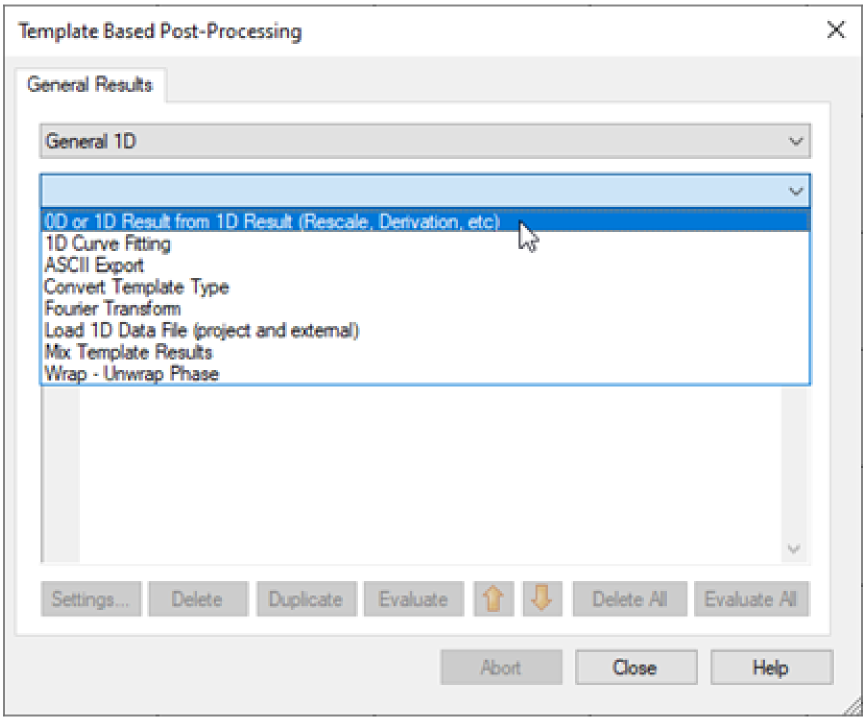


Figure 15: Template Based Post-Processing Dialog

The two templates are almost identical. Specify a 0D result, “Y at Given x”, evaluated at x=1 (where “x” is the frequency). Use the “S-Parameters\S1,1” result – to find the phase, click “Ph”, while to find the magnitude, click “Mag”.

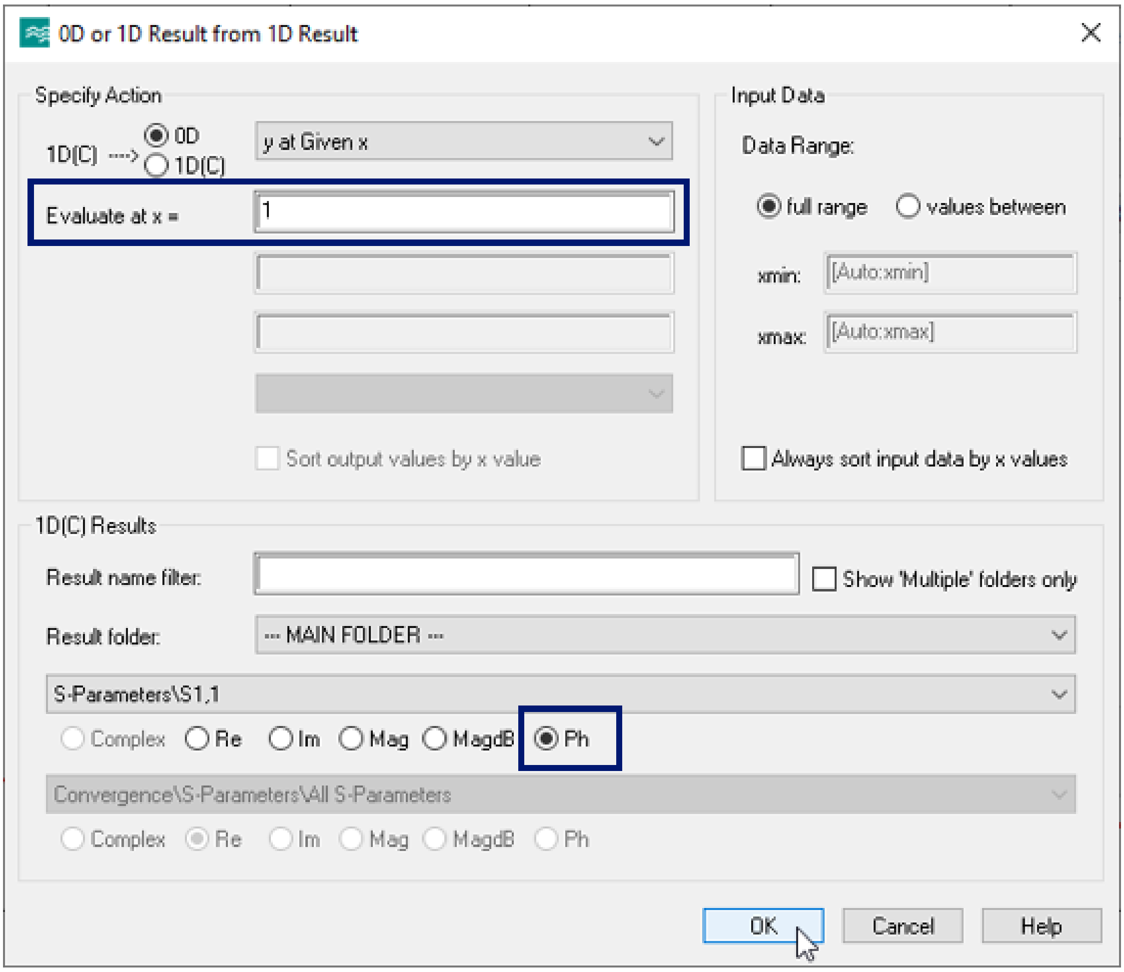


Figure 16: Template to calculate the phase of the reflection coefficient. Note that the “Ph” radio button is selected.

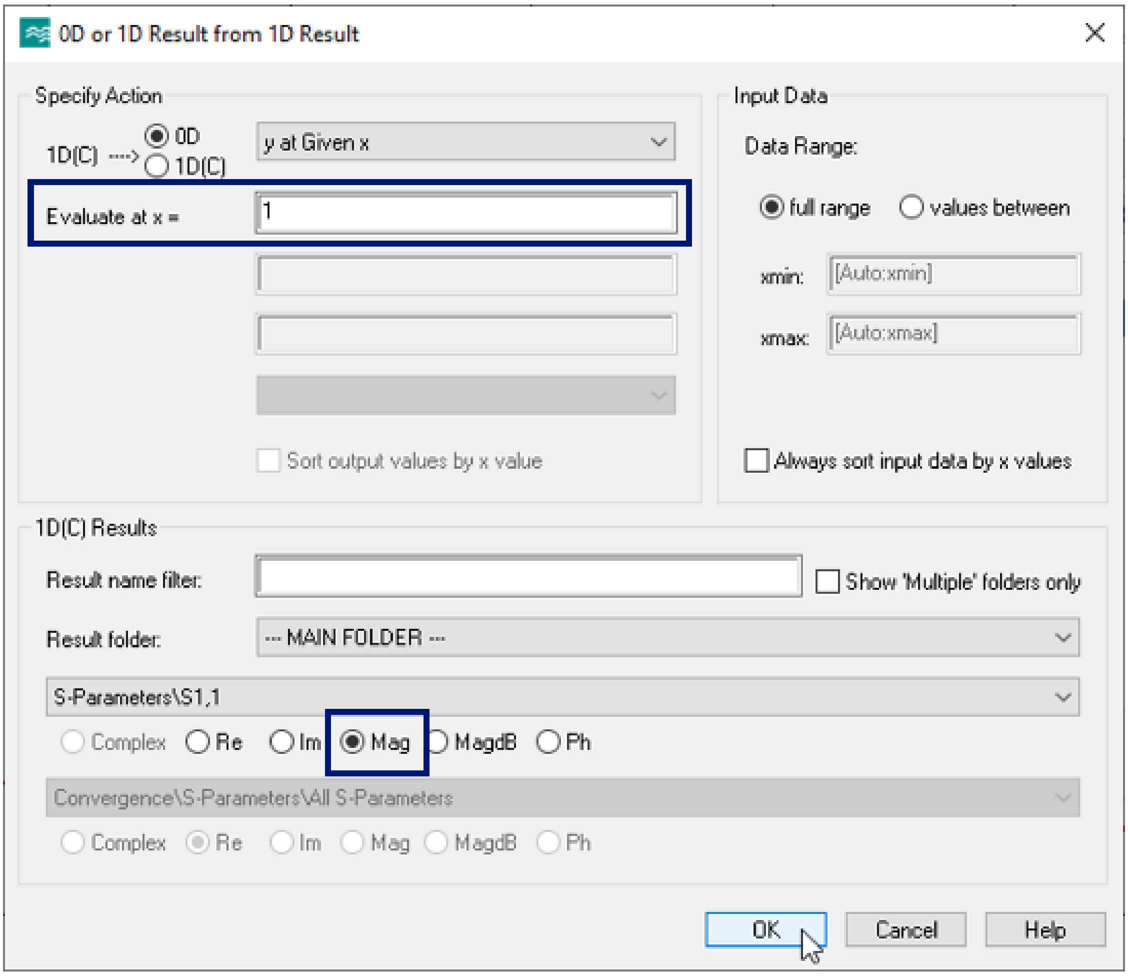


Figure 17: Template to calculate the magnitude of the reflection coefficient. Note that the "Mag" radio button is selected.

Simulation

The model is simulated with the frequency domain solver. For this example, we do not need to carry out a broadband sweep. Instead, we simulate only at the single point 1 GHz. A parameter sweep is used to vary the permittivity ("eps") of the dielectric slab. To produce the graph shown in Fig. 4, the parameter sweep runs from 1 to 10, with 0.25 intervals.