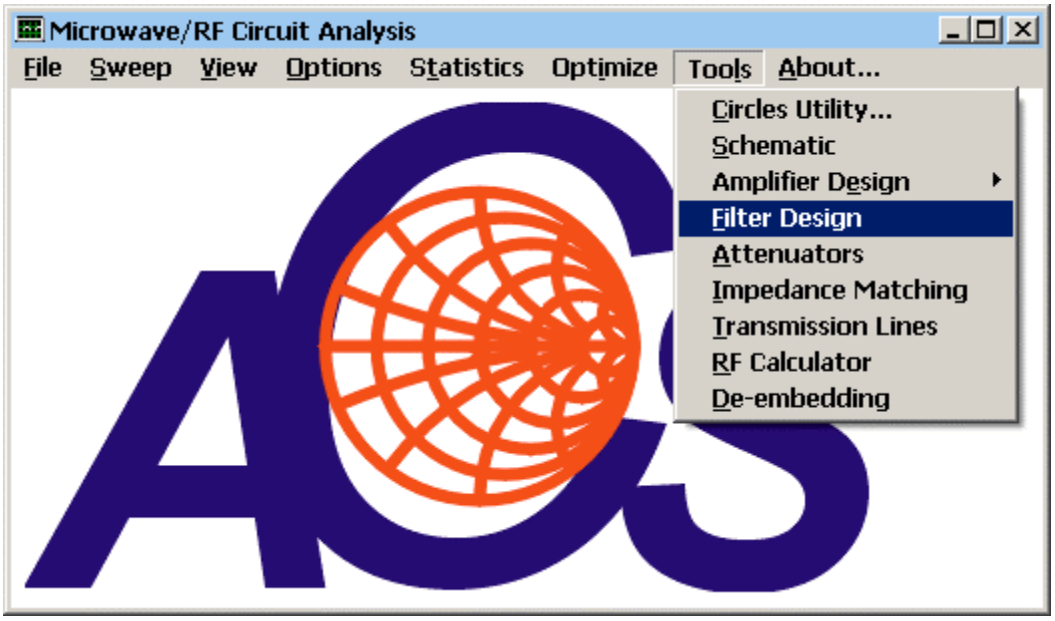
LINC2 FILTER Synthesis

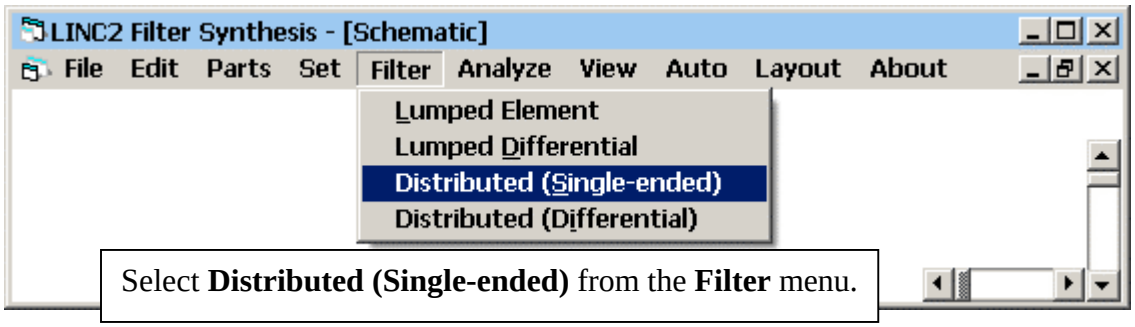


The LINC2 filter synthesis program is started by selecting **Filter Design** from the main LINC2 **Tools** menu as shown above.

The initial filter synthesis process usually generates an ideal electrical schematic. When the schematic (with ideal elements) is converted to a physical layout, non-ideal attributes are often introduced that alter the desired filter characteristics. EM simulation can help the filter designer understand these changes so they can be compensated for in the original design (such as a shift in the frequency specification).

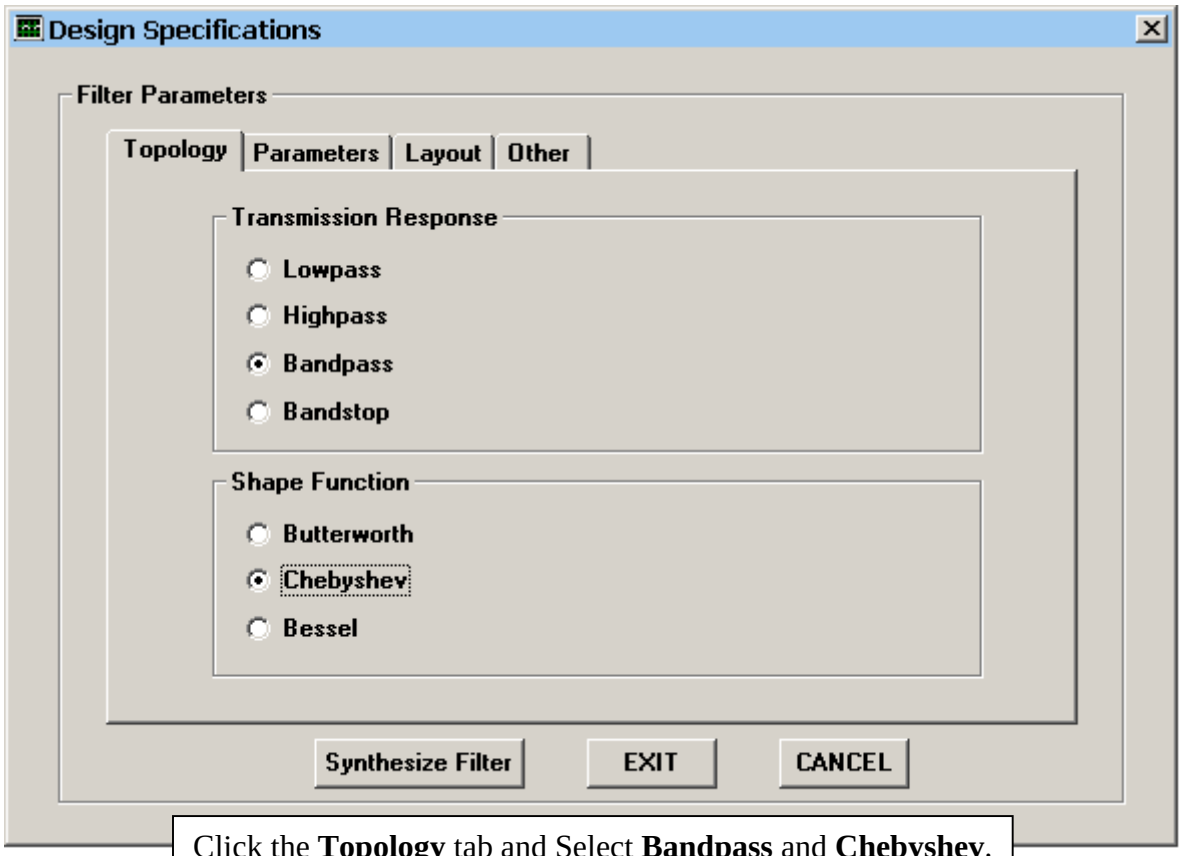
The following example will demonstrate how a 3rd order distributed Chebyshev bandpass (approximately 10 - 12 GHz) filter can be specified, synthesized, and exported to the Sonnet® EM simulator for analysis in a matter of minutes with only a few menu clicks and keystrokes.

First, select **Distributed (Single-ended)** from the **Filter** menu:



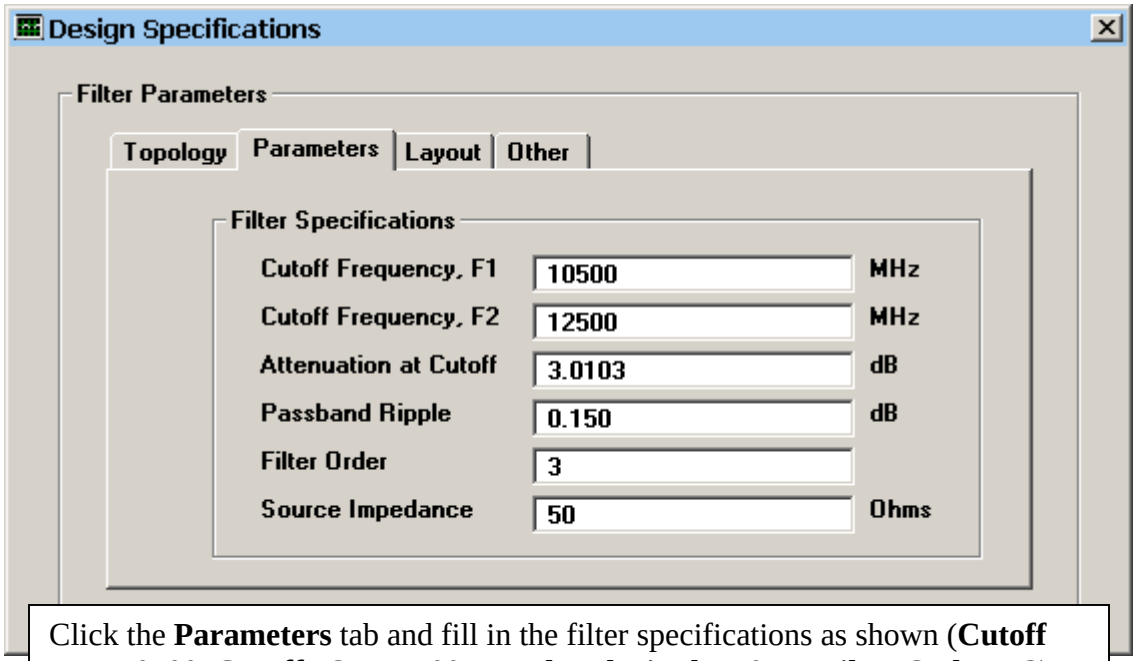
Select **Distributed (Single-ended)** from the **Filter** menu.

Click **Topology** and Select **Chebyshev Bandpass**:

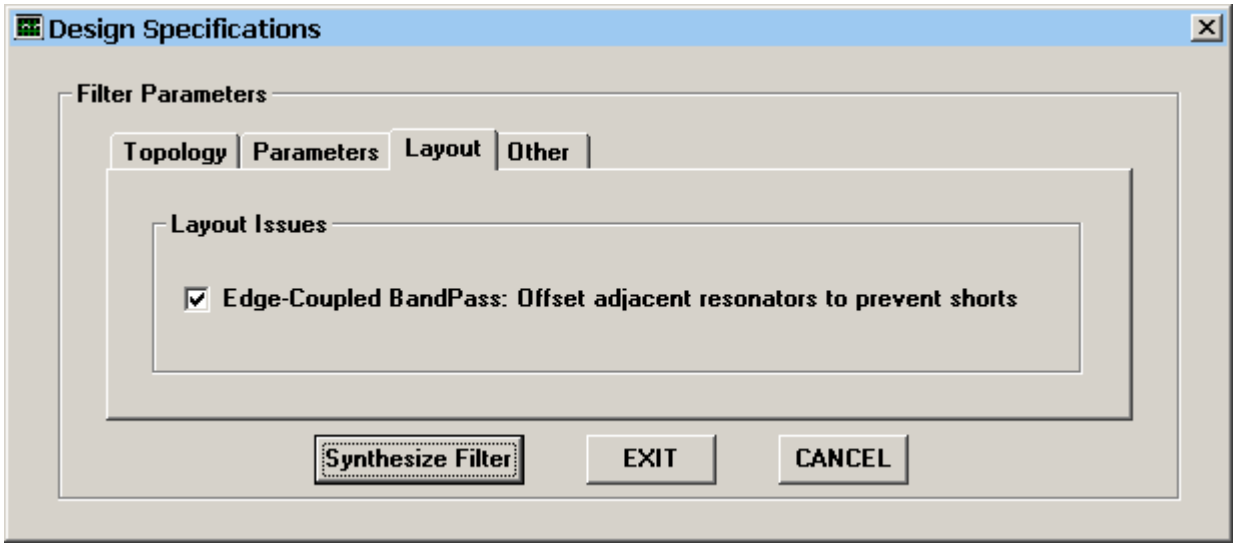


Click the **Topology** tab and Select **Bandpass** and **Chebyshev**.

Enter the detailed filter specifications:

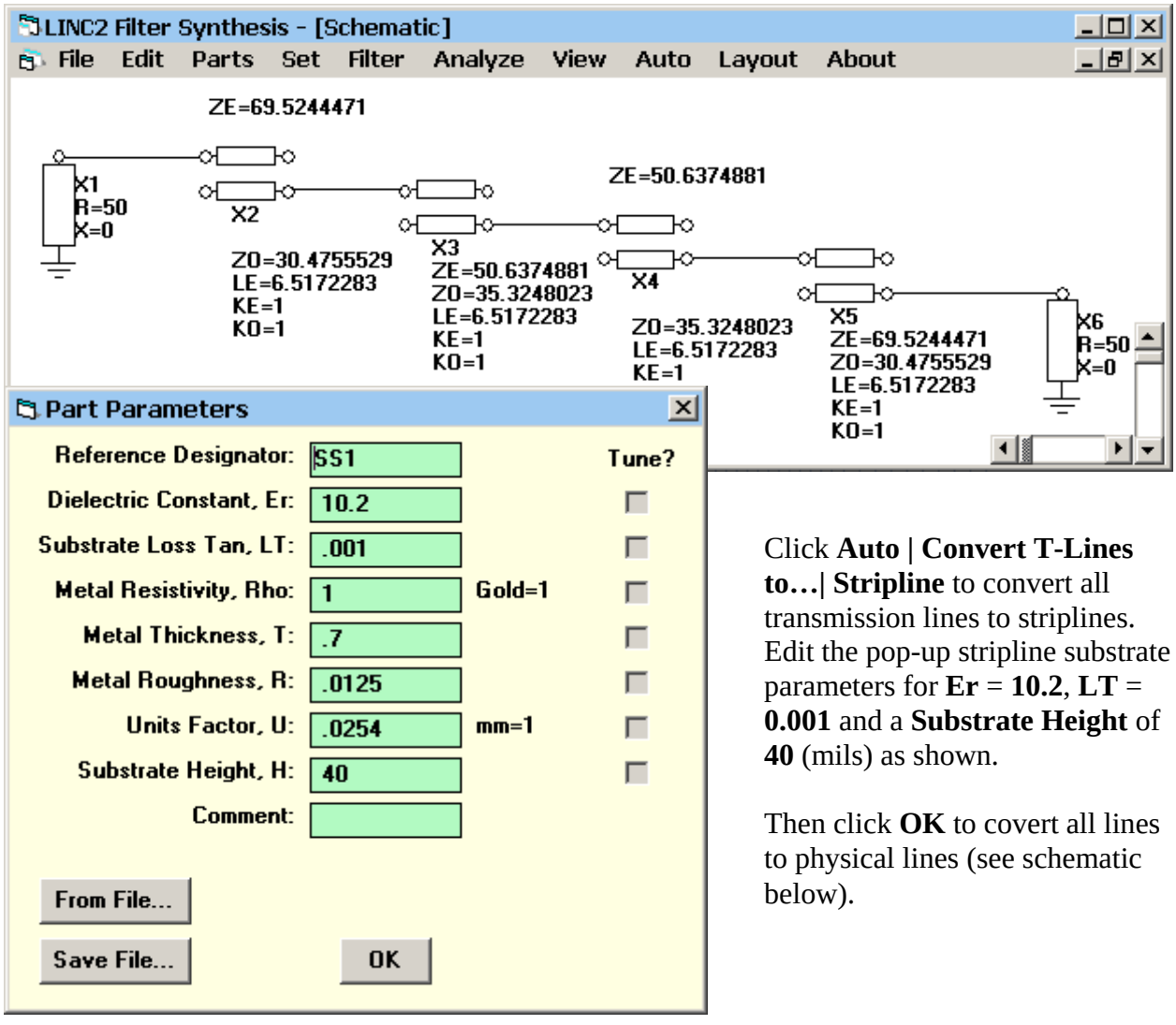


Click the **Parameters** tab and fill in the filter specifications as shown (**Cutoff F1** = 10500, **Cutoff F2** = 12500, **Passband Ripple** = 0.15, **Filter Order** = 3).



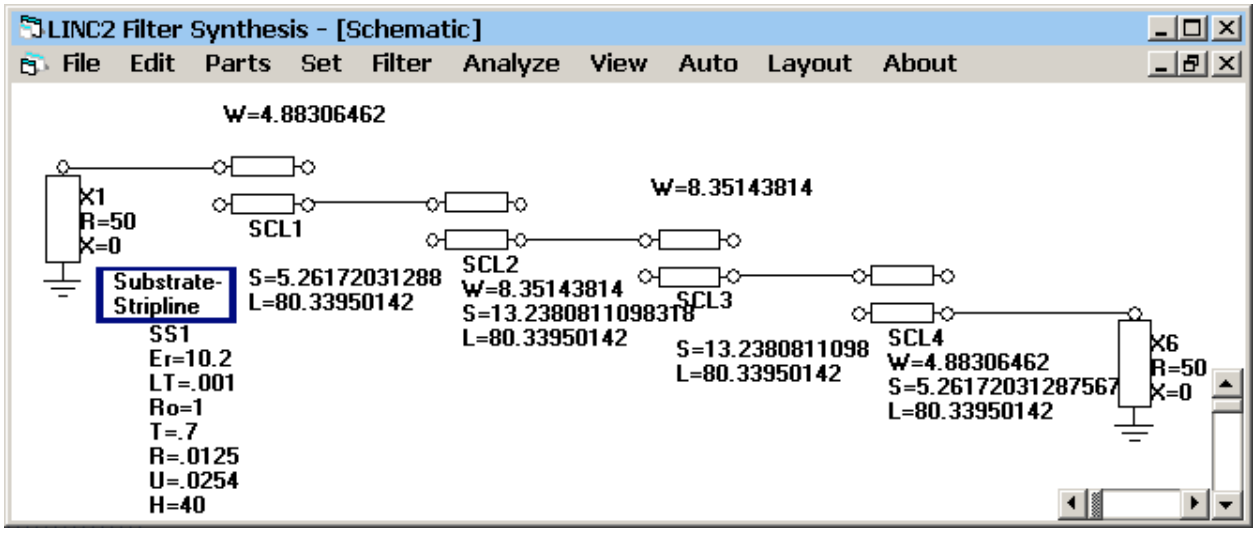
Click the **layout** tab to review any layout issues. Make sure that the check box is checked to address the indicated layout issue.

Click the **Synthesize Filter** button and **Exit** to see the filter schematic (below).

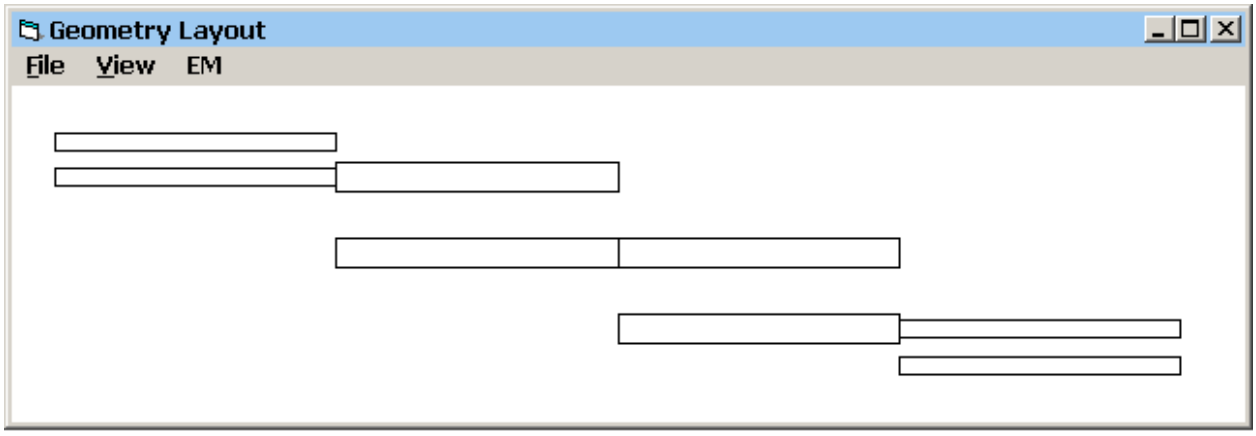


Click **Auto | Convert T-Lines to…| Stripline** to convert all transmission lines to striplines. Edit the pop-up stripline substrate parameters for **Er** = **10.2**, **LT** = **0.001** and a **Substrate Height** of **40** (mils) as shown.

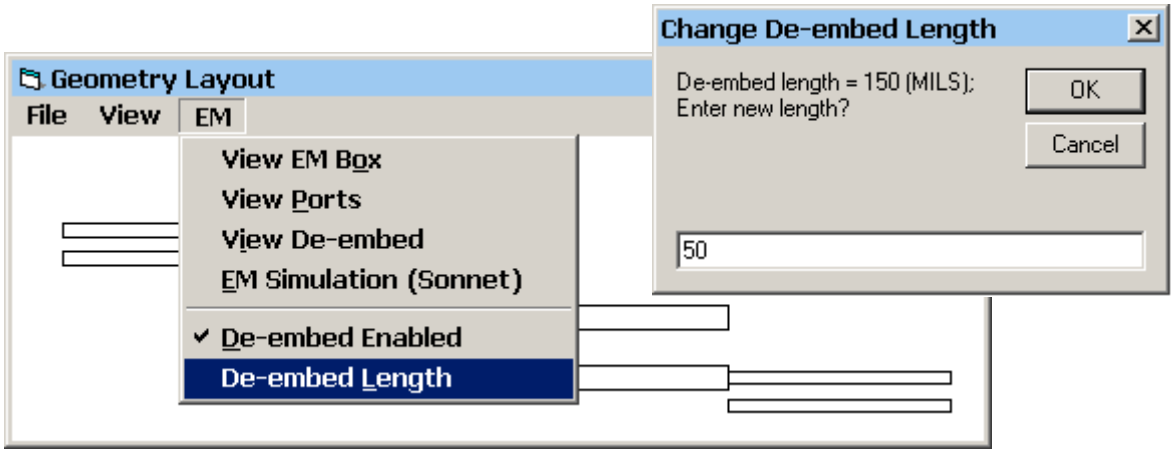
Then click **OK** to covert all lines to physical lines (see schematic below).



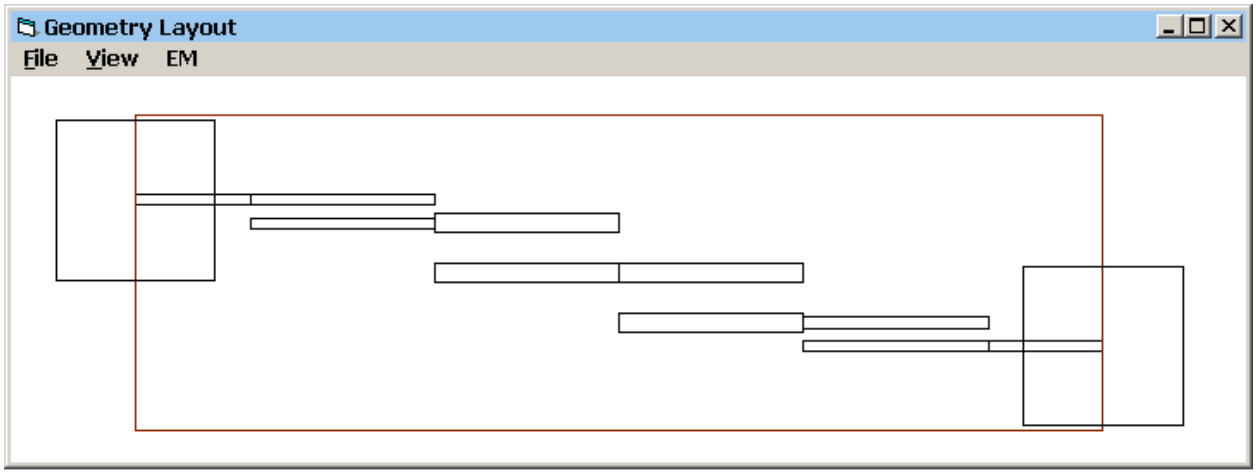
The resulting schematic is converted to all physical T-lines. Click **Layout** to see the layout geometry (below).



For this example, change the default de-embedding length from 150 mils to 50 mils by selecting **De-embed Length** from the EM menu as shown below. Enter 50 and click OK.



You can see the relative amount of de-embedding at each port by clicking **View De-embed** in the **EM** menu. The de-embedding view will look as shown in the figure below:

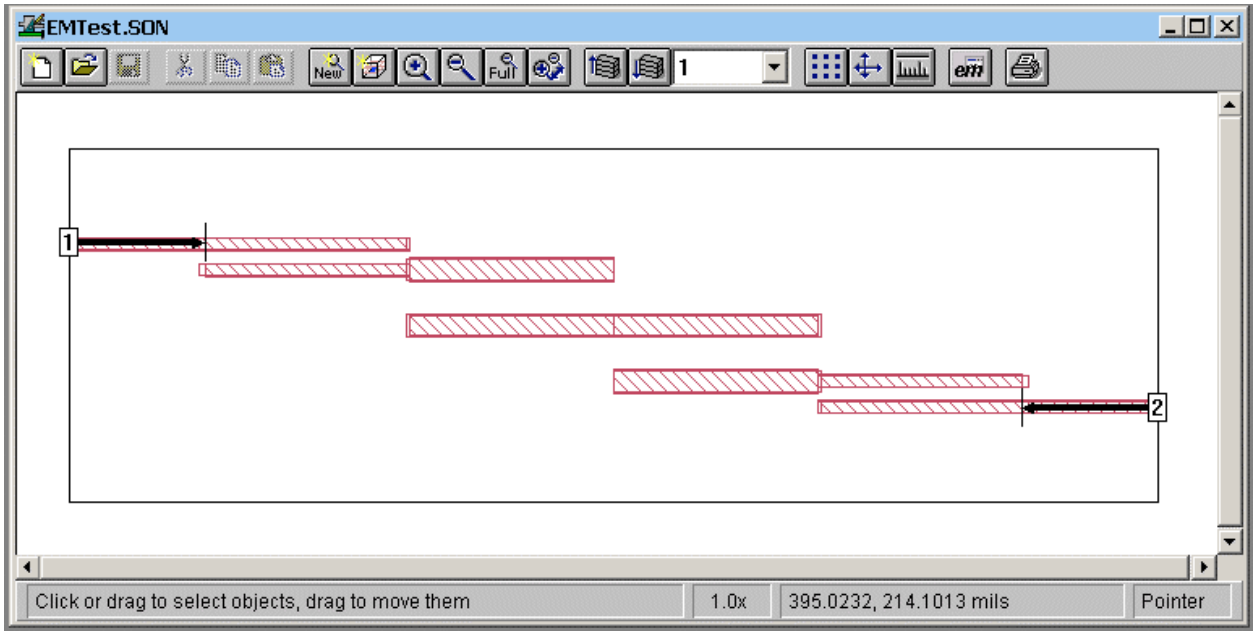


The LINC2 FILTER Geometry Layout

(The square boxes drawn at the vertical sides of the EM box represent each port location).

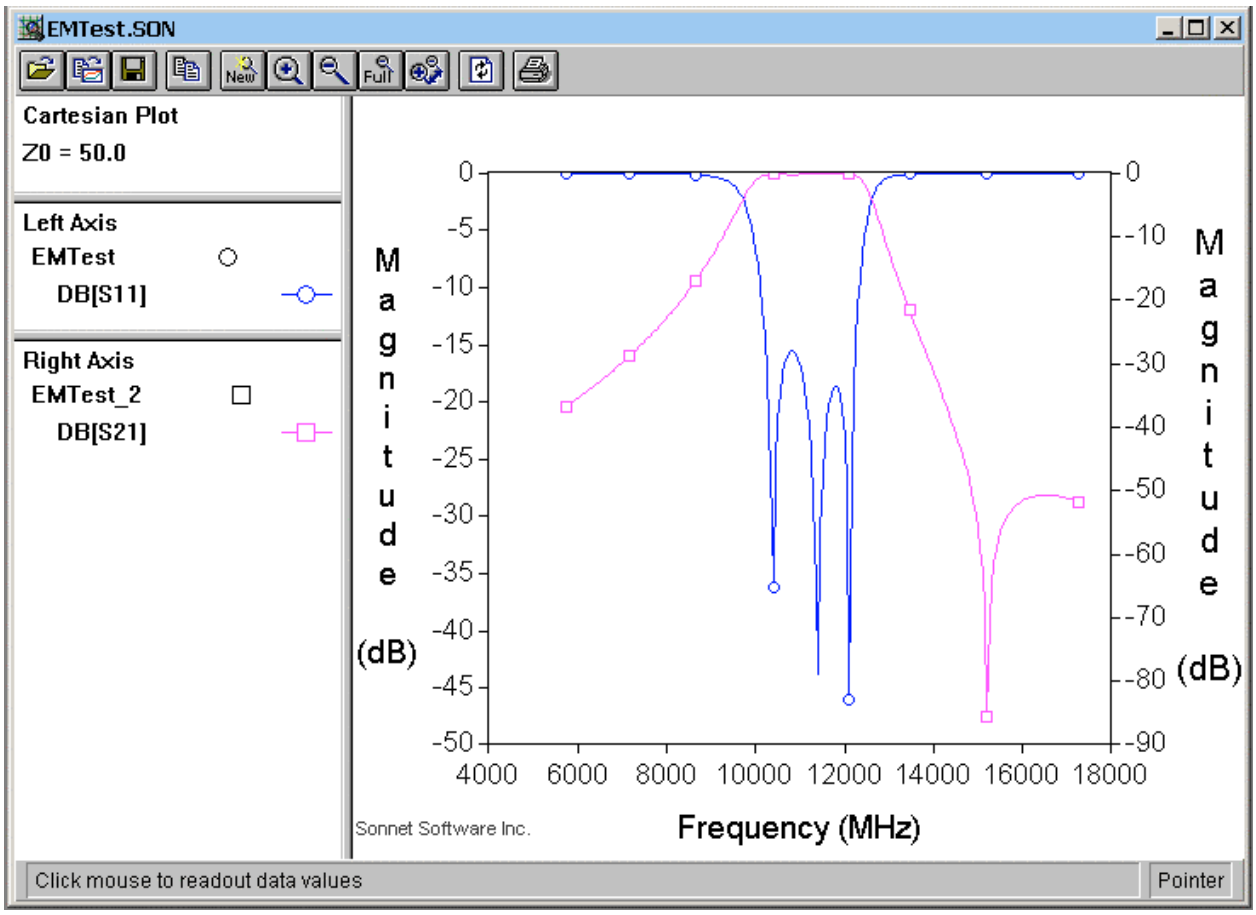
To run the EM simulation, select **EM Simulation (Sonnet)** from the EM menu.

When EM Simulation (Sonnet) is selected, the file EMTest.SON is created and automatically exported to the Sonnet® xgeom project editor ready for analysis. The EM box, metal and substrate layers and frequency parameters are already loaded. The layout in Sonnet® is shown below. Notice the black arrows pointing inward from each port. These represent the 50 mils of de-embedding that was previously selected.



The LINC2 bandpass filter design exported to Sonnet xgeom.

Simply select **Analyze** from the Sonnet® project menu to run the simulation. When the simulation is complete, select **Project | View Response | New Graph** to get the response plots shown below.

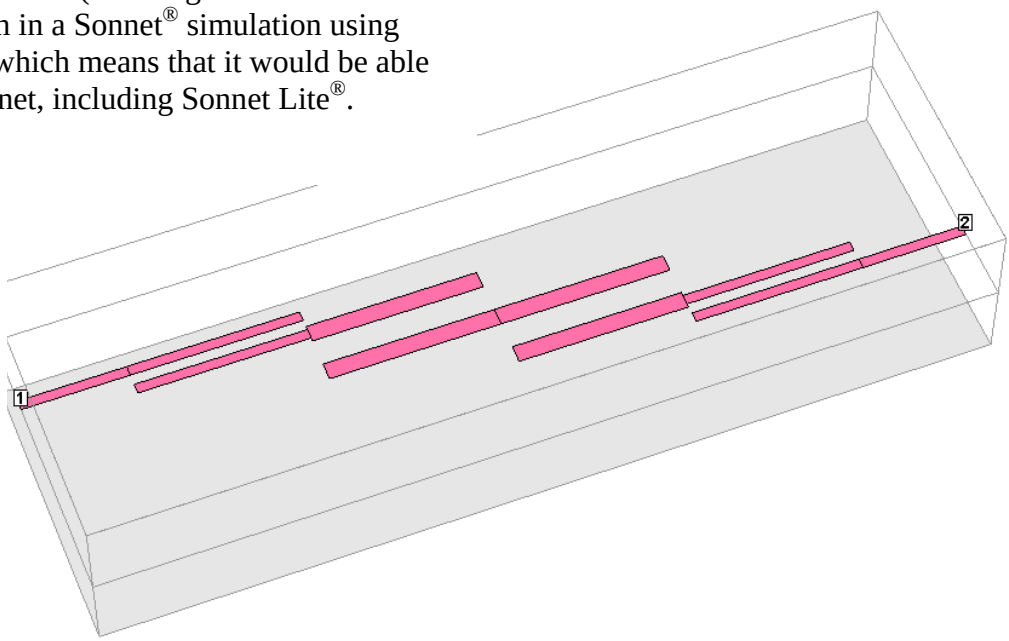


The plot of S21 shows that the filter has the correct bandpass response. The passband extends from about 10 GHz to slightly above 10.2 GHz as designed. The return loss (S11) in the passband is greater than 15 dB.

Because of its small physical size (line lengths are short at 10 GHz), this filter example ran in a Sonnet® simulation using only 3 Mbytes of memory, which means that it would be able to run in all versions of Sonnet, including Sonnet Lite®.

Optional:

Click **View | View 3D** from the Sonnet xgeom **View** menu to see the 3-D physical layout (right).



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