L-Edit Tutorial

L-Edit is a program used for mask design. Each file you create will have a number of layers. Each layer corresponds to one mask in your mask set. In a file, you can also create multiple cells. Each cell can be composed of objects containing many layers. Typically, you will have one cell which contains your final layout. You can then design each of your components in other cells and then insert them into the cell containing your final layout. OK, so I know this sounds very confusing, but once you begin using the program you'll see it's not too complicated.

L-Edit is installed on the following computers in the ECI Lab: **ECIPC014**, **ECIPC015**, **ECIPC050**, and **ECIPC071**. These machines are located in the back corner of the lab.

1. Initial Setup

To help you out, I have created a template that includes all the layers you will need, which will be emailed to all of you during the first week of class. Rename the file to something which identifies your group (for example, the last name of one of your group members or your group number). Verify that all the settings are correct by doing the following. Click on the Setup menu and select Design. Click on the Grid tab and enter the following settings:

Major displayed grid: <u>50.00</u> Microns
Suppress grid less than: <u>20</u> Pixels
Minor displayed grid: <u>5.00</u> Microns
Suppress grid less than: <u>8</u> Pixels
Cursor type: <u>Snapping</u>
Mouse snap grid: <u>1.00</u> Microns
Manufacturing grid: <u>0.050</u> Microns

Next, verify that all the layers you want to include are set up correctly. The layers are all shown on the left hand side. Double-click on any of the layers. This should bring up a window showing all your layers. Here you can add or delete layers, rename layers, and change the appearance of each of your layers. Do not change or delete the layers 'Special_layers' or 'Grid_layer'. In the area labeled Import/Export, make sure a GDSII number is entered for each layer you wish to use. If you create a new layer, give it a new GDSII number. You can enter any number you want, but each layer must have a different GDSII number. None of the other settings on this page affect anything we are doing. Next, click on the Rendering tab. Here, you can change the appearance of each of your layers (make sure each layer has its own distinct appearance).

2. Designing a Mask Set

Now you're ready to use L-Edit. First, create your final cell. Under the Cell menu, select New (or just type 'n'), and enter a name for the cell (for your main cell, I would call it something like 'MAIN' or 'FINAL'). Click on the layer you would like to use. By selecting one of the shapes from the menu at the top, you can begin drawing – you will mostly use the rectangle tool. Draw a shape using each layer. To select one of your shapes, select the pointer tool and click on the shape. To move, stretch, or edit a shape, hold down on the Alt key while you click on the shape. You can cut, copy, paste, and delete objects just like in any other Windows program. To hide an entire layer, hold down on the Alt key and click on that layer in the layer menu. To navigate, use the arrow keys ($\leftarrow$, $\rightarrow$, $\uparrow$, $\downarrow$). To zoom in or out, click on the plus (+) or minus (-) key. To move to the center of your cell and display the entire cell within the display window, click on the 'Home' key, located in the upper right hand corner of most keyboards.

Notice that the position of your cursor relative to the center marker of the cell is given in the menus above your cell (move the cursor and you'll see the position change). Now, click on the 'q' key. Notice that the cursor position has reset to [0,0,0]. Now move the cursor, and then click 'q' again, and it switches back to the original mode.

Now, create a new cell, let's call this one 'SHAPE1'. Draw some sort of shape in this cell. Now click on the Window menu and switch back to your first cell. Now go to the Cell menu and select instance (or just type 'i'). Select SHAPE1 and click OK. You will now see an instance of the cell 'SHAPE1' in you main cell. Then go back to the cell SHAPE1 and edit that cell. Then go back to your main cell, and notice that the changes appear in the cell which you have instanced. If you would like to scale the instanced cell to make it larger or smaller, select the cell using the pointer tool and then in the Edit menu select Edit Object(s). This should give you enough info to create a mask design. If you have any other questions or if I have left out some crucial information, please ask.

3. Exporting to GDS (you do not need to do this)

Before a mask can be made, your .tdb file must be converted to a .gds file. The instructor and TA will do this for you, but for your own reference here is how it is done. First make sure none of your layers are hidden (hold down Alt and click on any hidden layers). In the File menu, select Export Mask Data… Set 'Export File Type' to <u>GDSII</u>. The file directory should default to the location of your .tdb file, but you can change it if you like. Click on Export. This should generate a .gds file in the directory you specified. To view the .gds file, first close the .tdb file. Then in the File menu, select Import Mask Data… Under Import file type, select GDSII. In the 'From file:' box, enter your .gds file (or use Browse… to find it). In the 'Use setup file:' box, browse to or enter your .tdb file. Click 'Import'. If you have done the file conversion correctly, you should be able to view your .gds file.