Tutorial II: Cadence Virtuoso

ECE6133: Physical Design Automation of VLSI Systems
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I. Setup for Cadence Virtuoso

1. Copy the following files into your working directory
   cds.lib
   display.drf
   lib.defs
   .cdsinit (Make sure that the file name is "**.**cdsinit". If you copy this file from a windows machine, the file name will be "cdsinit".)
   calibreDRC.rul
   myDesign.tar.gz
   You will also need the "test.gds2" file you generated during Innovus lab.

2. Type the following commands to source the designated files
   source /tools/software/cadence/ic/cshrc.latest
   source /tools/mentor/calibre/aoi2019/meta137.cshrc

3. Open cds.lib and replace 'your_working_directory' by your working directory as follows. Type the **FULL directory name**. You can get it by **cd** in 'your_working_directory' and typing **pwd** in the console. Leave "myDesign" untouched at the end.
   DEFINE myDesign /your_working_directory/myDesign

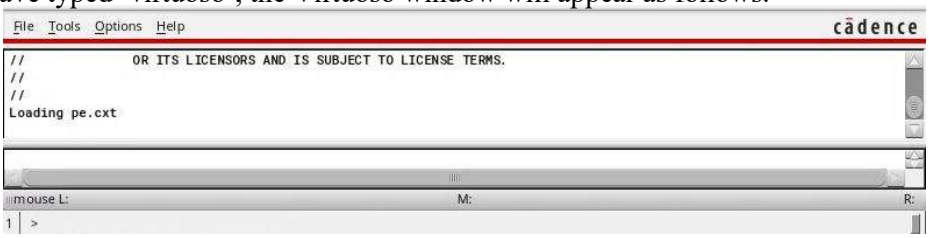
4. Open lib.defs and replace 'your_working_directory' by your working directory as follows. Same as above: type the **FULL directory name**. Leave "myDesign" untouched at the end.
   DEFINE myDesign /your_working_directory/myDesign

5. Uncompress myDesign.tar.gz in your working directory.
   tar -xzf myDesign.tar.gz

6. Run Cadence Virtuoso by typing 'virtuoso'. Make sure to run the command in the same directory as of the **.**cdsinit file.

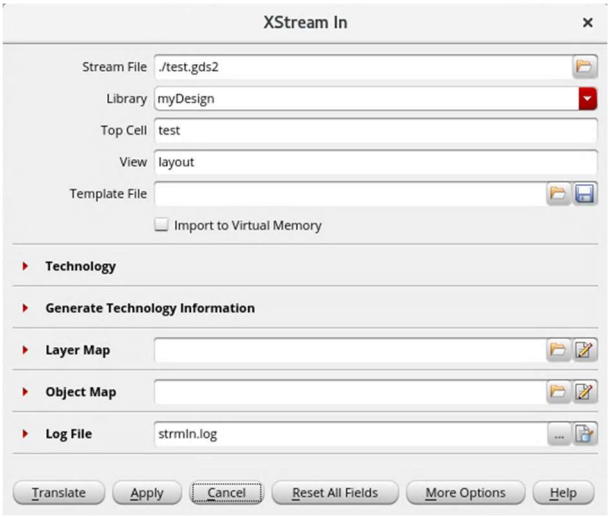
II. Generation of Final Layouts

After you have typed ‘virtuoso’, the Virtuoso window will appear as follows.



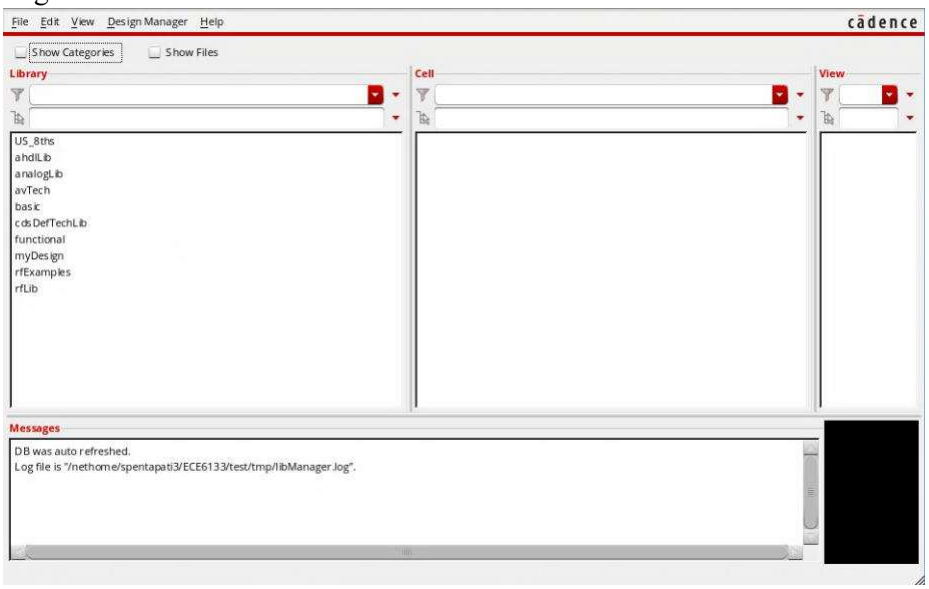
a. Choose 'File' -> 'Import' -> 'Stream...', then 'Virtuoso(R) XStream In' window will appear as follows.

2. Change the file type to “All Files(*)” and choose GDS2 file in ‘Stream File’ (test.gds2 from Innovus lab)
3. Choose myDesign in ‘Library’
4. The top cell is “test” by virtuoso (this is the name we specified in Innovus when saving test.gds2)
5. The window should look as follows

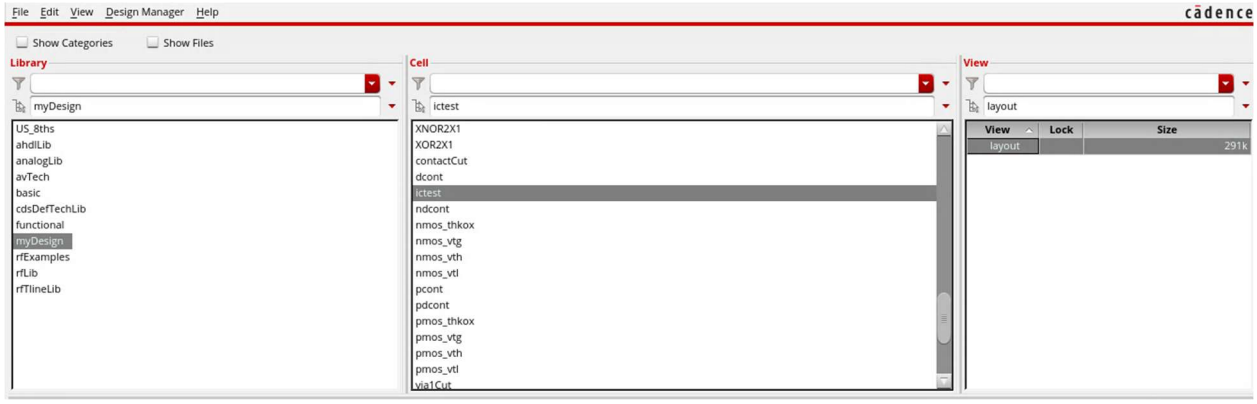
a. 

6. Click 'Translate'. There must not be any error during translation. If you meet warning messages, you can just click ‘No’. (you should have only 1 warning, no error)

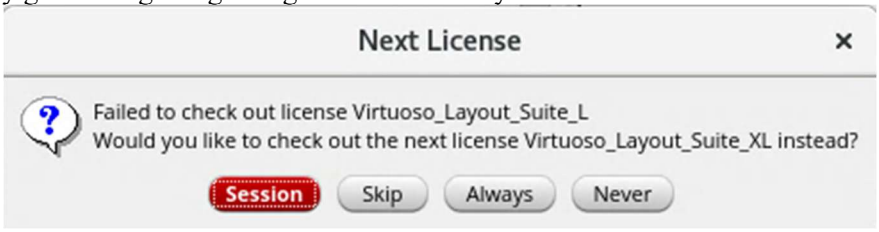
7. Choose ‘Tools’ -> ‘Library Manager…’ in Virtuoso main window which will open the Library Manager window as follows.



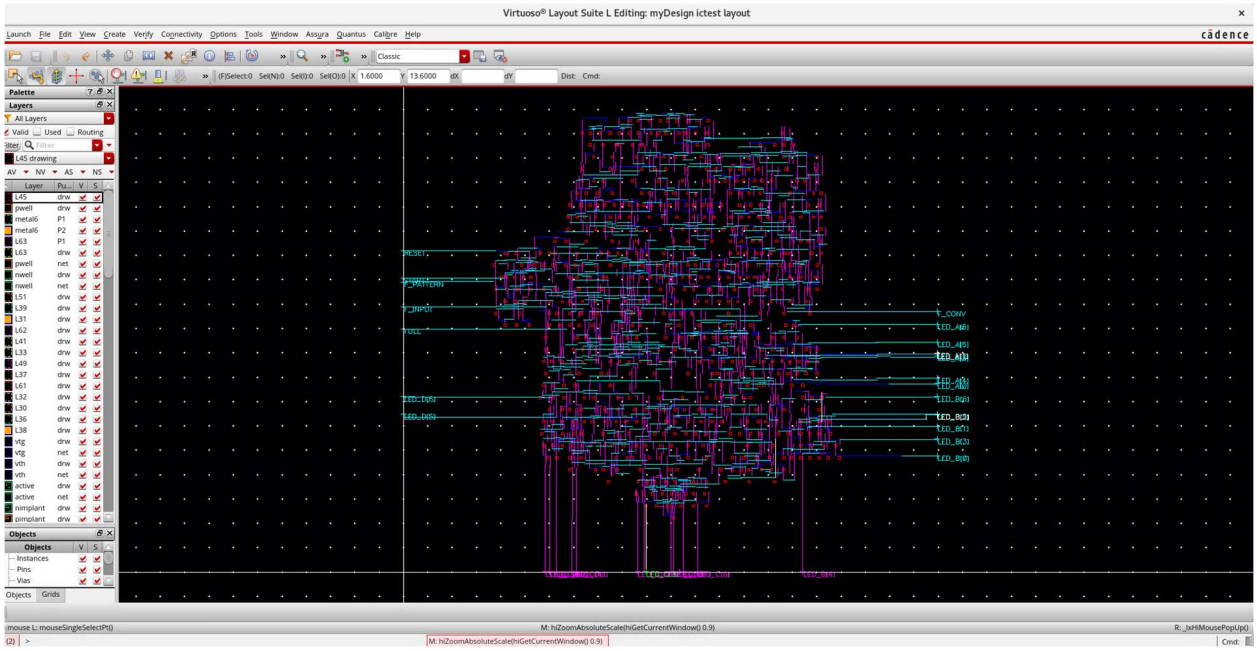
8. Choose ‘myDesign’ in Library column.
9. Choose your design in Cell column (“test”)
10. Double-click ‘layout’ in View column.



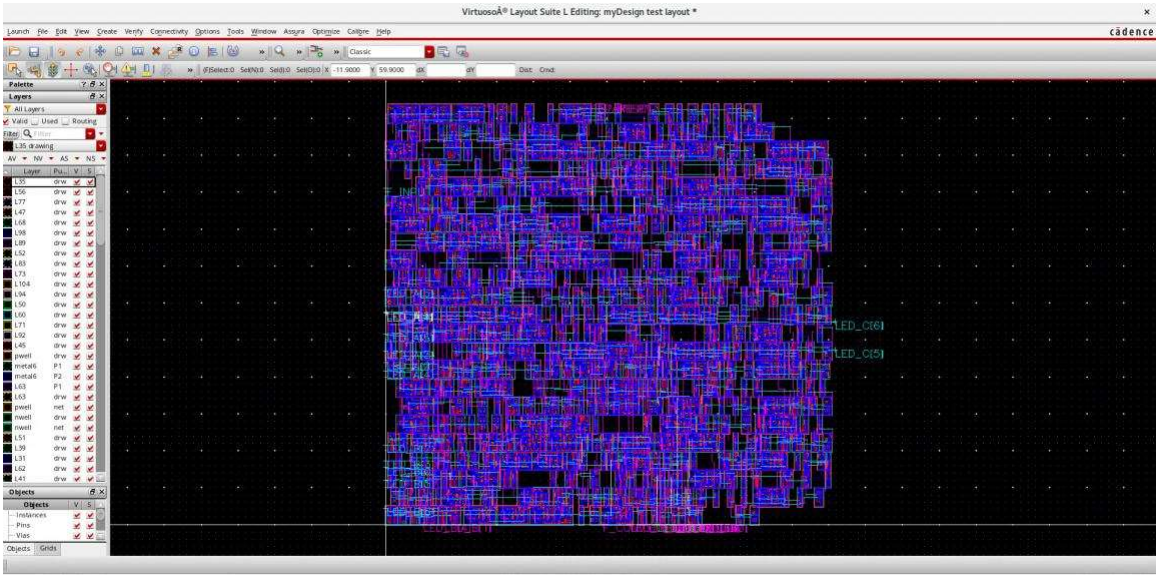
11. You may get messages regarding the unavailability of license. Just click on “Session” every time.



12. Then a layout window will appear. Maximize and zoom-to-fit (by pressing ‘f’ on keyboard) to get a better clarity.



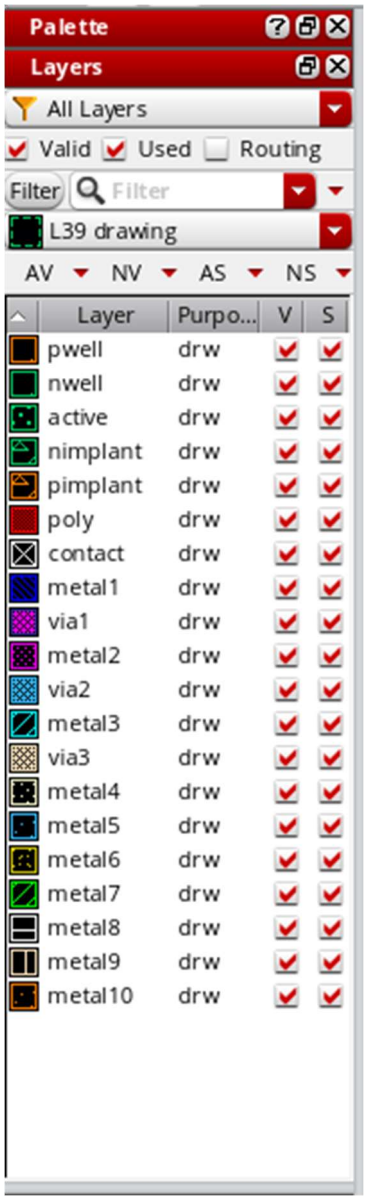
13. The current window shows standard cells and routed metals but you cannot see the details of standard cells. These abstract cells are called standard cell instances. To get a final layout, we need to load standard cells and replace standard cell instances by standard cell layouts. This is called 'flattening'.
    a. To do this, choose ‘Edit’ -> ‘Select’ -> ‘Select All’
    b. Then choose ‘Edit’ -> ‘Hierarchy’ -> ‘Flatten…’ and click ‘OK’ in ‘Flatten’ window with the default settings. Clicking the empty space in design will cancel the selection.



14. Choose 'File' -> 'Save' to save your flattened design.
15. Compare this layout with your encounter layout. Do those look similar?

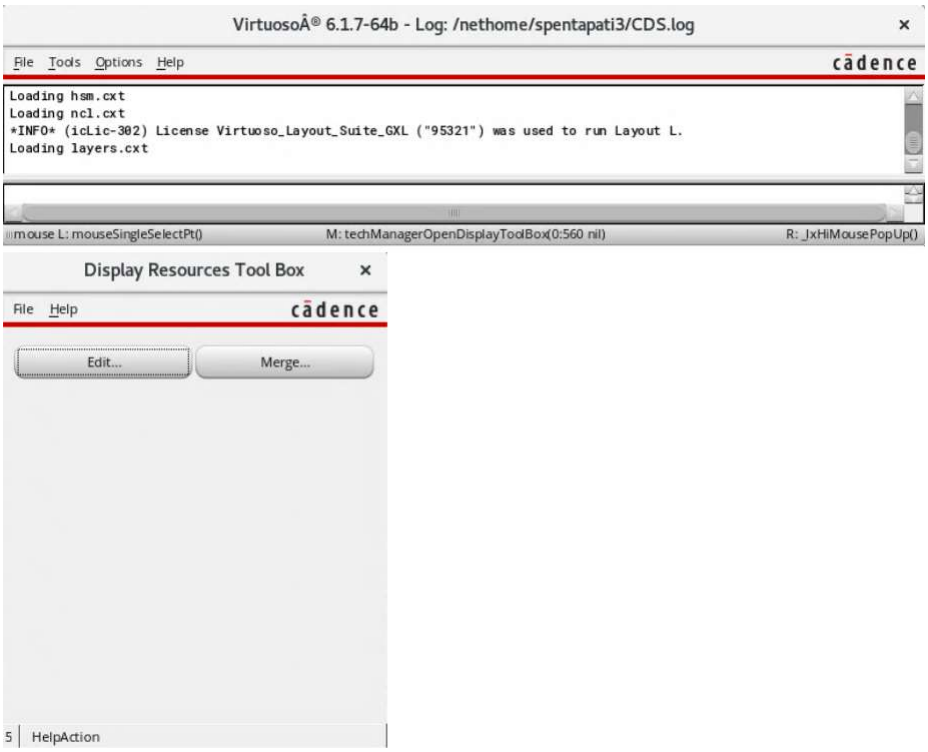
16. **To Capture Screenshots:** Choose 'File' -> 'Export Image...' in the layout editor. Supported formats are bmp, jpg, png, and so on.

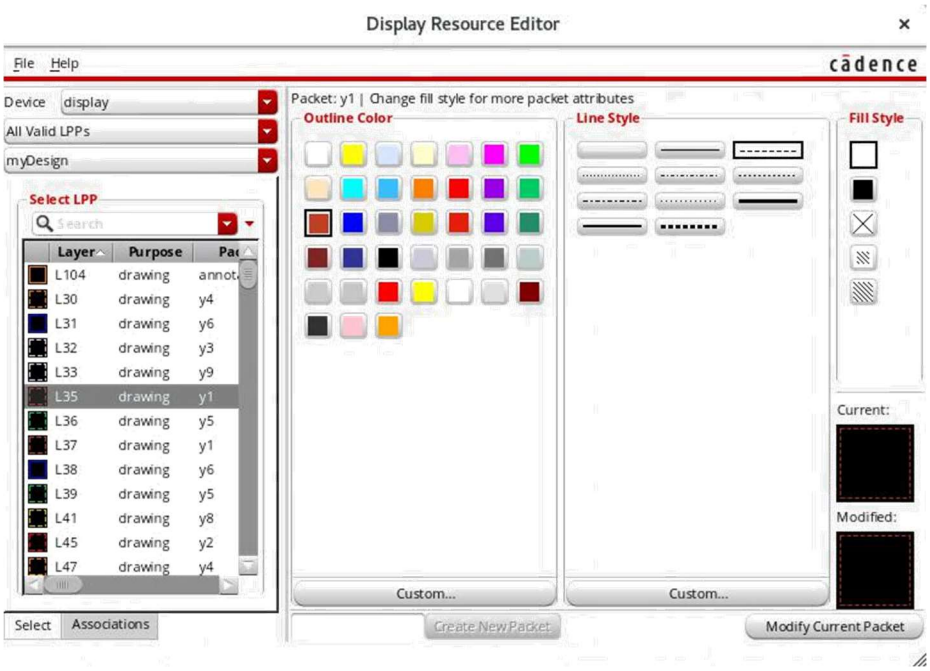
17. **How to View Specific Metal Layers and Via:**
    a. On the left of your screen, there is ‘Layers’ tab. In here you can control visibility of each layers.
        i. If you click 'NV', only the selected layer will be shown
        ii. If you click 'AV', all layers will be shown
        iii. Check the ‘Used’ box in the Layers section to only show the important layers and vias. Then uncheck or check the corresponding visibility box ‘V’ to un-toggle or toggle the visibility of a given layer.



iv. After you toggle visibilities, you can re-draw the layout to apply the changed visibilities. (Choose 'View' -> 'Redraw', or click 'Zoom to Fit' button in the toolbar)

v. Choose 'Tools' -> 'Display Resource Manager' in the main Virtuoso window. When 'Display Resource Tool Box' appears, click Edit, and Display Resource Editor window appears. Choose any metal layer, change 'Fill Color' and 'Outline Color', and click 'Apply'. Redraw the layout to see if the new color was applied well.

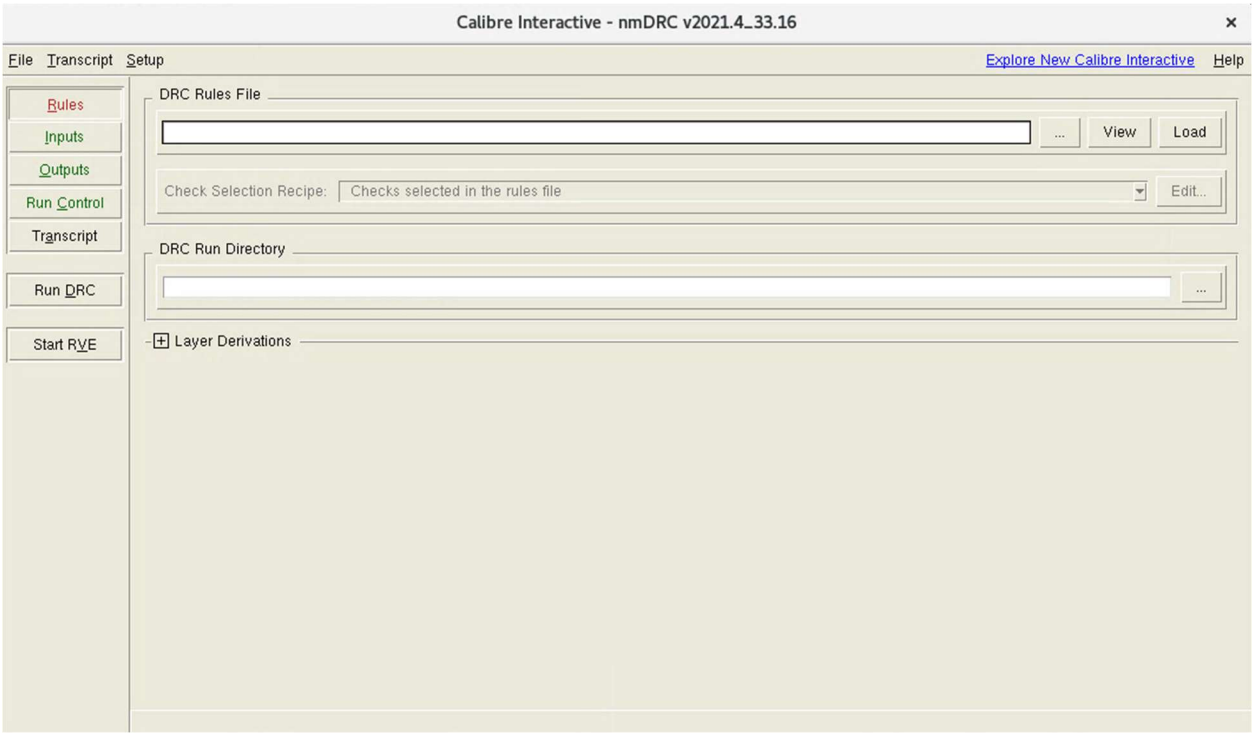




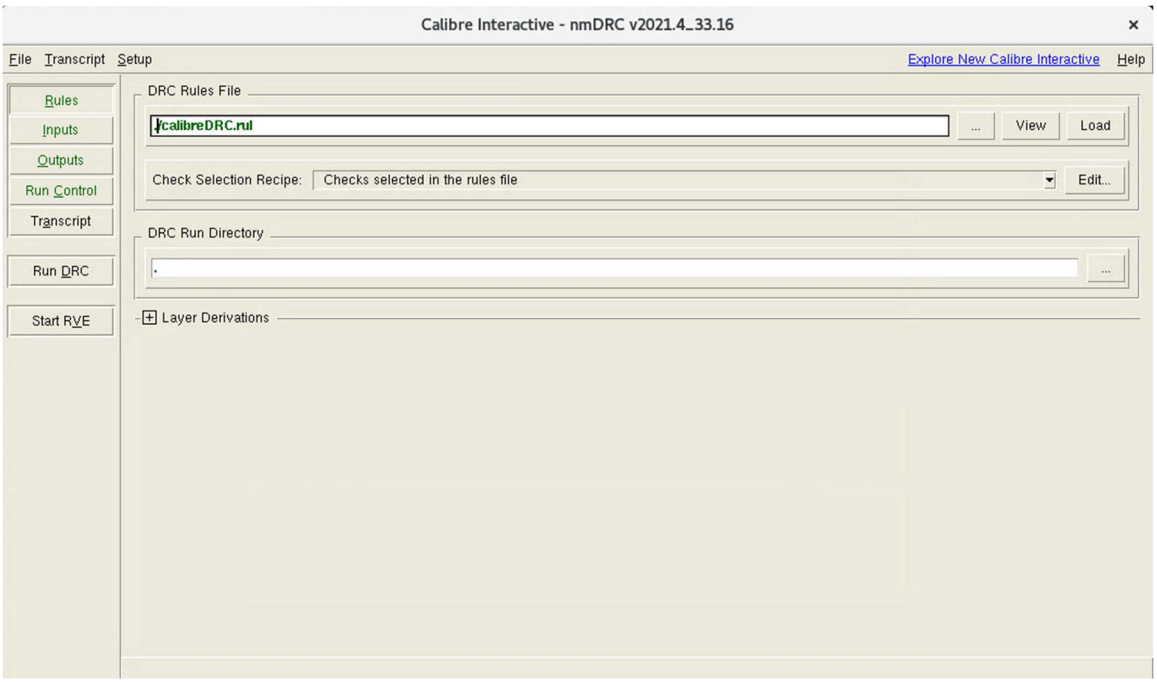
b. Here is the metal layer mapping. You will need this in 'Lab Problem: Generation of final layouts and DRC' section.
    i. L49 - metal 1
    ii. L51 - metal 2
    iii. L62 - metal 3
    iv. L31 - metal 4
    v. L33 - metal 5
    vi. L37 - metal 6
    vii. L39 - metal 7
    viii. L41 - metal 8
    ix. L43 - metal 9
    x. L45 - metal 10
c. Actually each metal layer has two different names. For example, metal 1 layer has two names - 'metal 1' and 'L49'

III. Design Rule Checking (DRC)

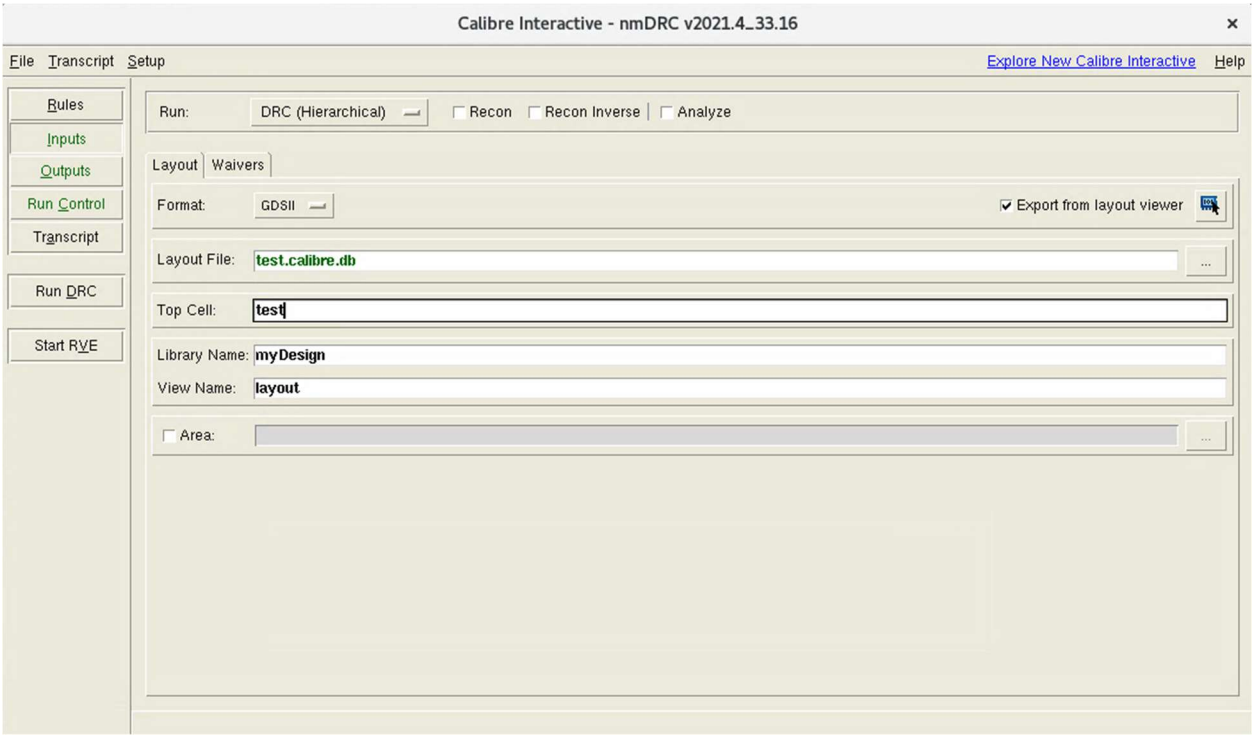
1. After flattening, choose 'Calibre' -> 'Run nmDRC'. Click 'Cancel' in 'Load Runset File' window. The caliber window would then appear (there might be some defaults filled in)



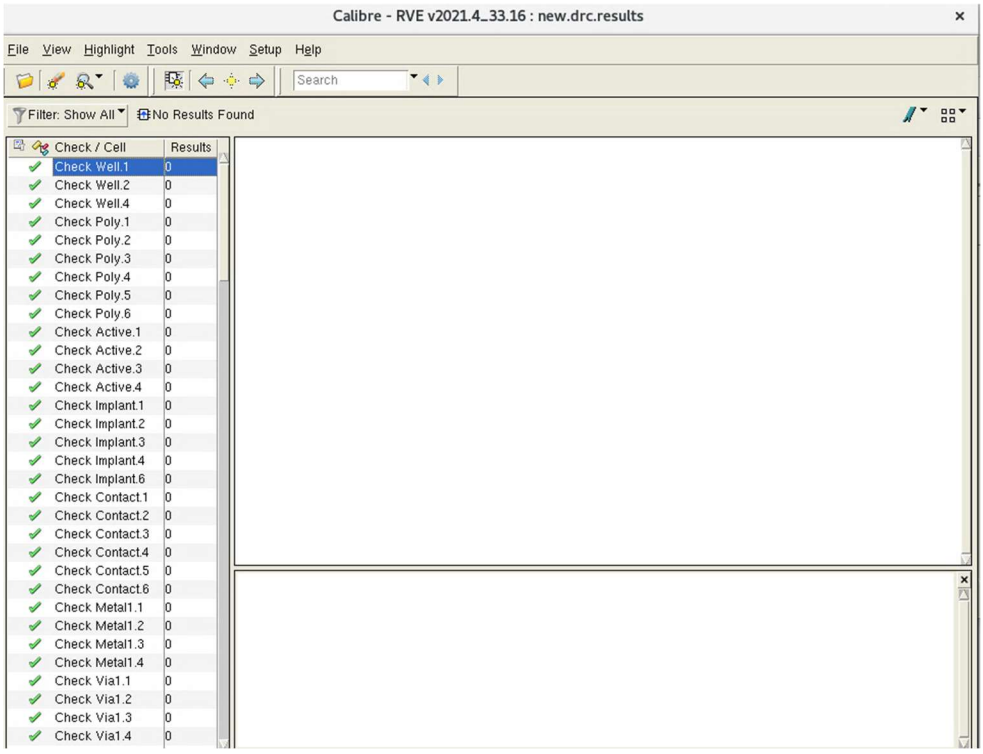
2. For the DRC rules file, select the button with three dots (…) and then select the calibreDRC.rul file. Just check if the “Rules” button on the left turns green. The final window would be like this:



3. DRC Run Directory should already be auto-filled with your current directory. You can leave this as it is. If this is empty, enter your current full directory path in this box
4. Click ‘Inputs’ tab. The window would be auto-filled as follows:



5. Run DRC by clicking 'Run DRC' button
6. When DRC is finished, look at the following window to check the number of DRC violations



7. A check box will be red if it has any DRC violation.
8. Summary of DRC would be stored in *.drc.results and *.drc.summary in your working directory.