

Virtuoso Quick Guide

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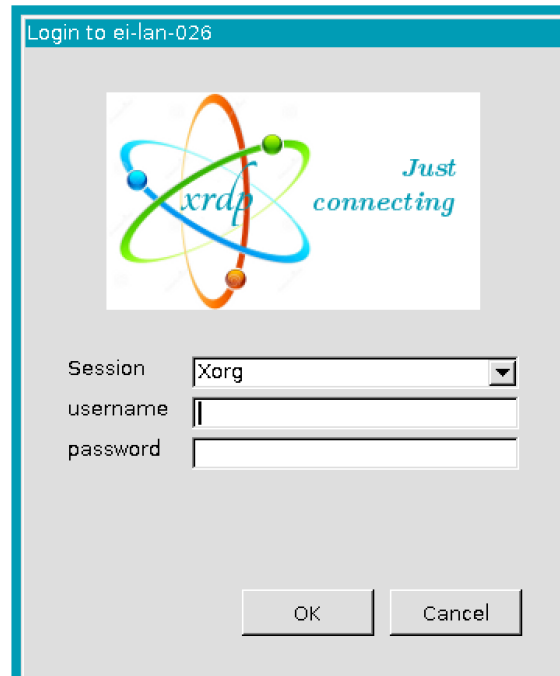
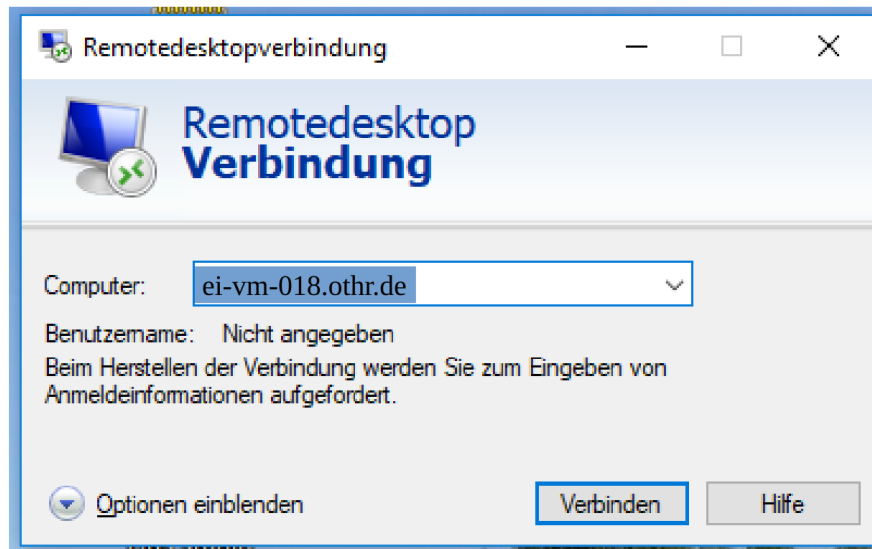
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1 test start

1.1 Log in

You can log in to the computer ei-vm-018.othr.de via Remote Desktop with your university account.

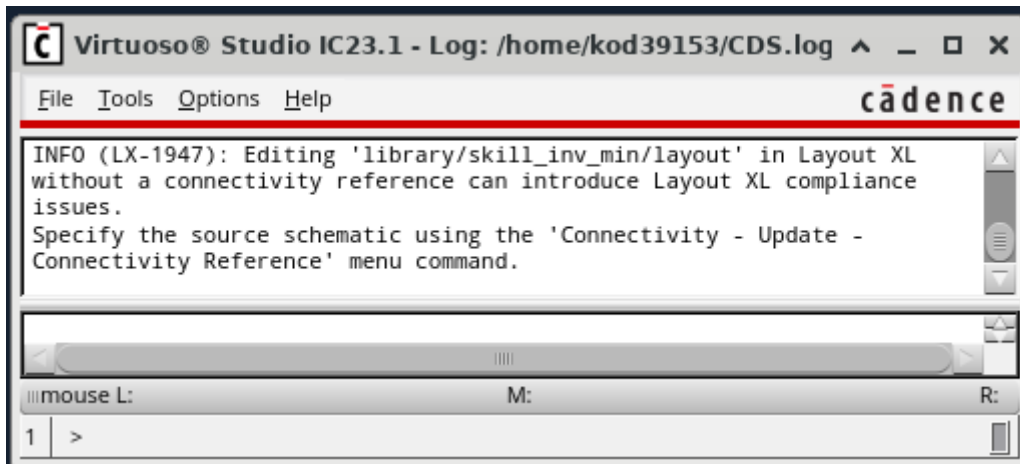
1. VPN
2. "Rem



1.2 Calling Virtuoso

1. Open Linux Terminal (right-click on the desktop => "Open Terminal Here")
2. Type in the command: virtuoso

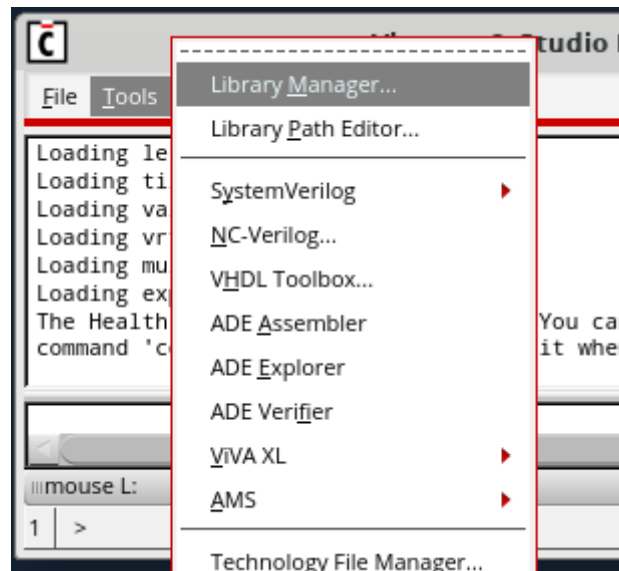
Virtuoso Control Panel appears:



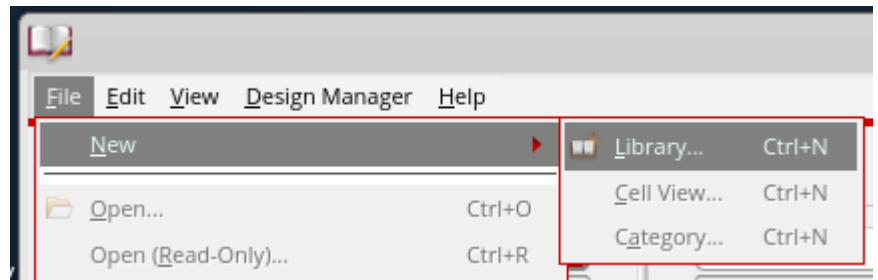
1.23 Establishment of a work library

A working library must be set up at the beginning of the internship. This library will remain in place throughout the internship:

Virtuoso Control Panel:



In the Library Manager:



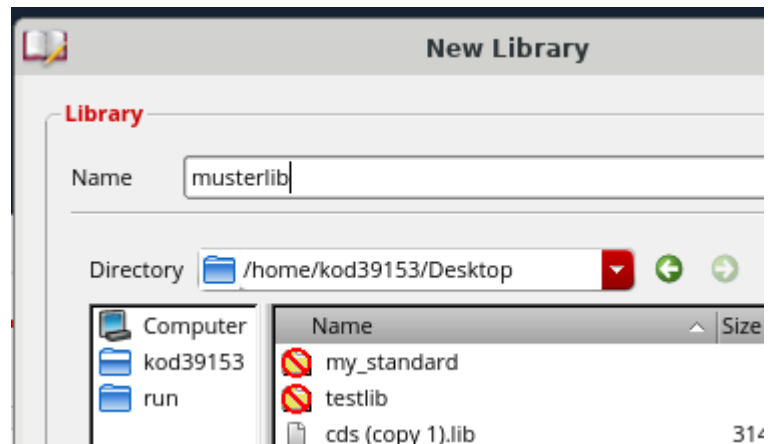
Window appears:

Enter the desired name of the library:

Library with the same name must not yet exist!

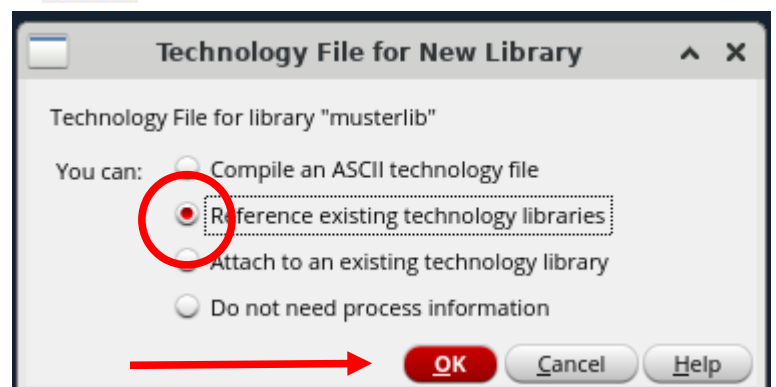
So not "psi"

Here: "musterlib"



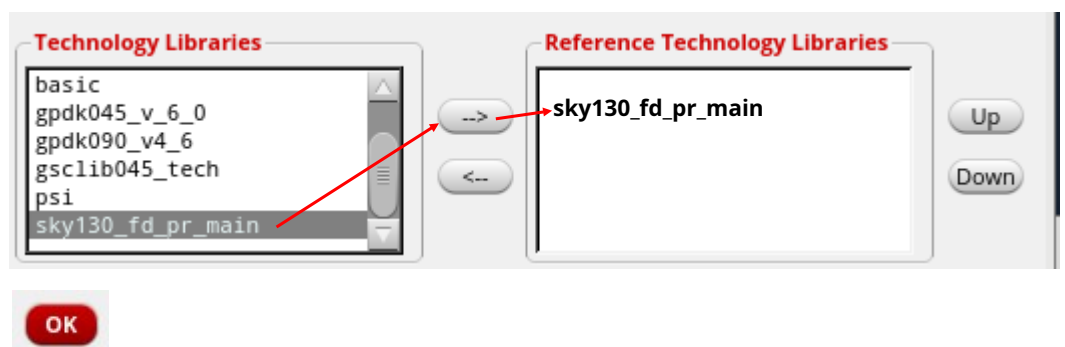
After "ok" the following window appears:

Information as shown:



After "ok" appears following window:

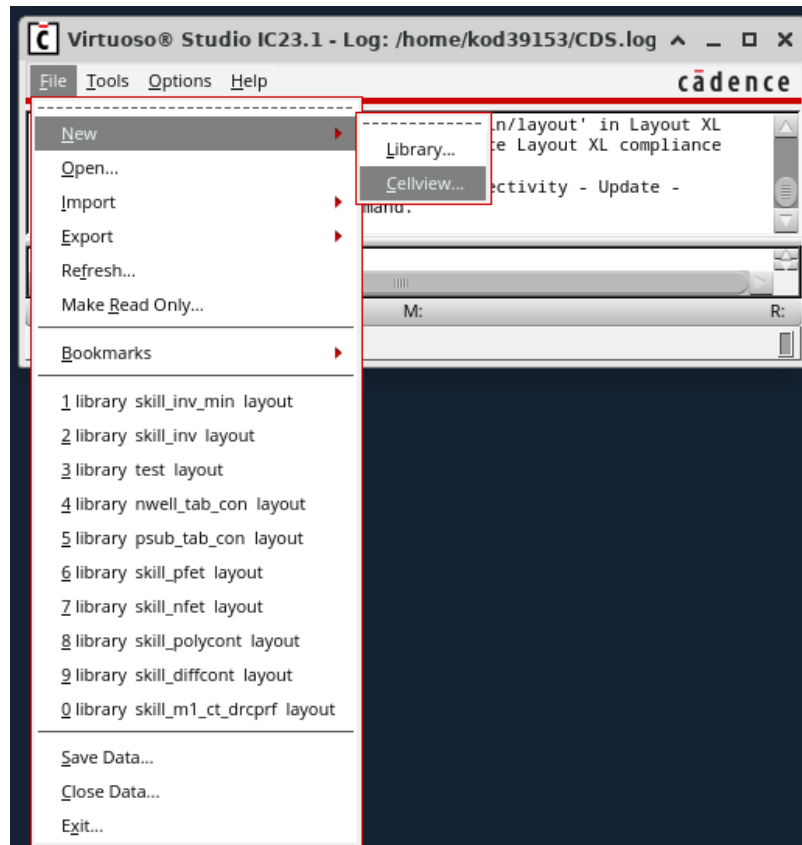
Technology Library choose:



Exit Library Manager:

File/Exit

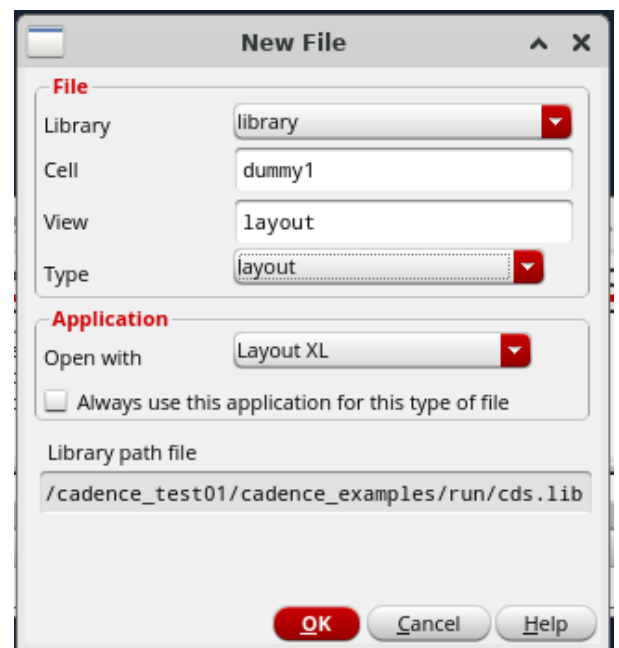
Back in the Virtuoso control panel: With "File" you can create a new cell or open an existing one:



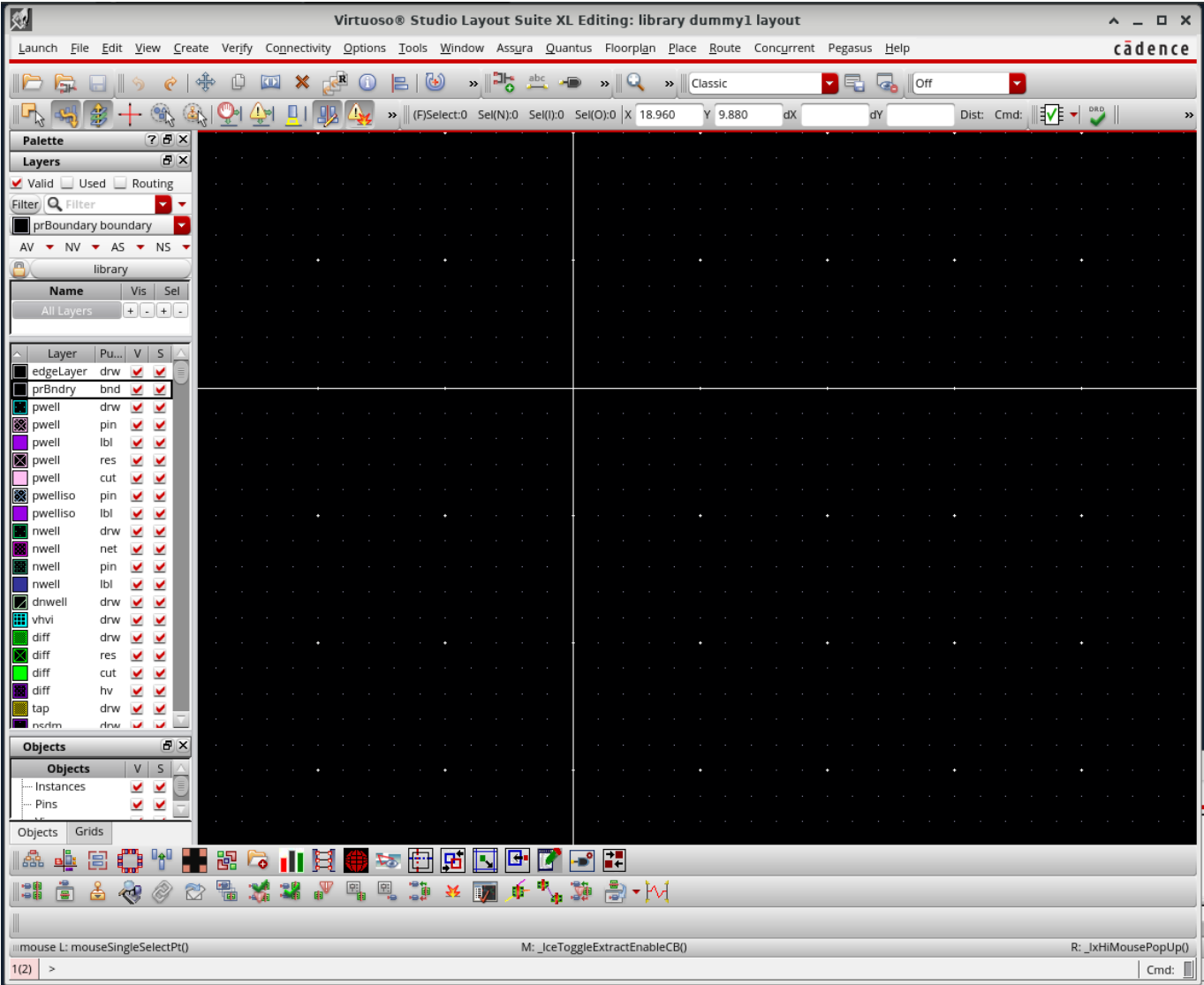
Here: New cell is opened, window appears:

If a layout is to be created:

- Select the library name
- Select Type Layout
- Enter the desired cell name
- OK



GUI window Layout XL appears:

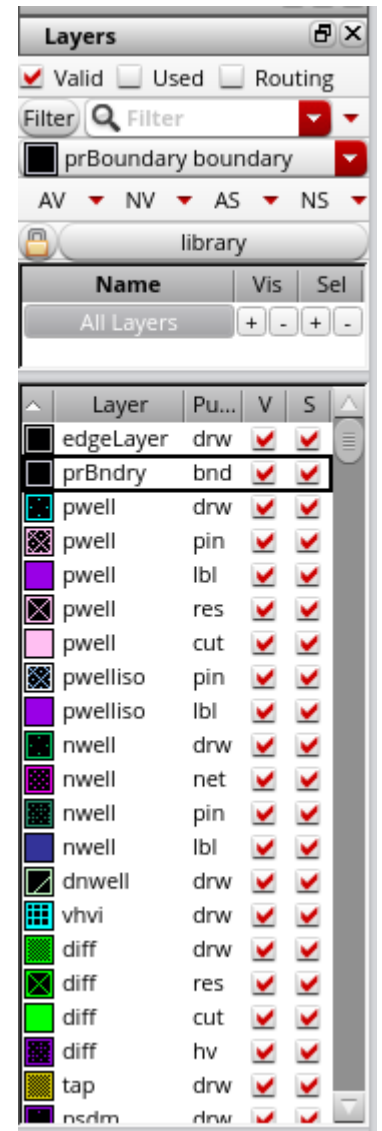
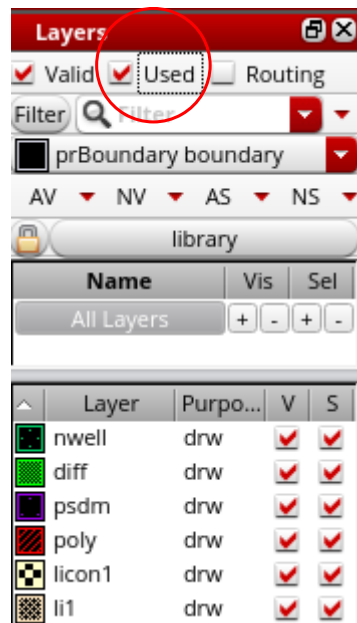


2. Working with layers

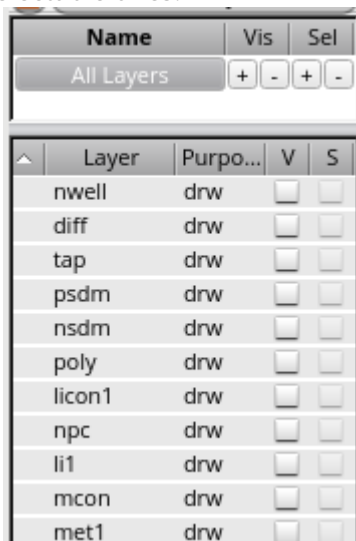
Layer window:

If there are no objects in the current drawing, all available layers are displayed (there are many).

If objects already exist, you can use "Used" to display the layers used:

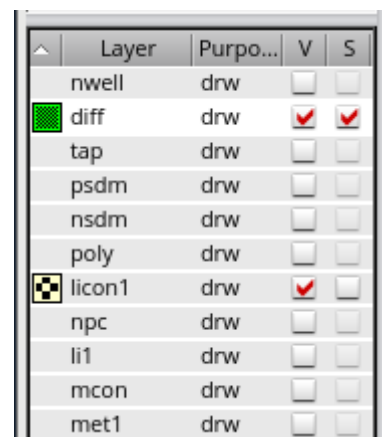


With "V" you can switch the visible layers on and off, with "S" you can switch the selectable ones:



Here all layers are switched off, ie no layer is displayed and none is selectable

The individual layers are controlled via the buttons, with "V" and "S" all displayed layers:



Here the layer "diff" is visible and selectable, the layer "licon1" is only visible but not editable.

3. Basic drawing commands

3.1 Procedure for executing a command:

- If necessary: Select target layer
- Select command
 - About keyboard shortcut
 - Via /Main Menu/Edit
 - Selected command is displayed at the bottom right
- Parameterize command (if necessary)
 - About F3
- Execute command
 - Mouse action

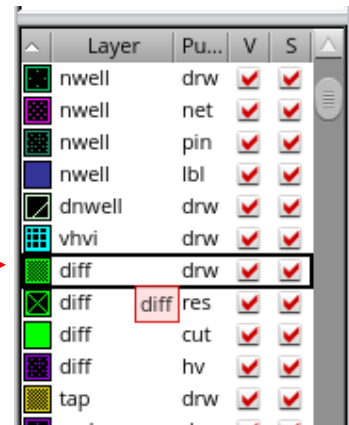
Undo a command: Keyboard shortcut u The currently active command is retained when u is pressed

3.2 Drawing a rectangle (shortcut R)

Set drawing layer:

Here: Rectangle in Layer diff / drawing should be drawn.

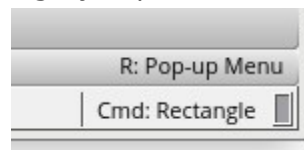
Click in the corresponding line in the layer window, the line is marked with a black rectangle



Command selection via keyboard shortcut:

Position the mouse over the drawing layer, press R on the keyboard

Selected command is displayed at the bottom right:

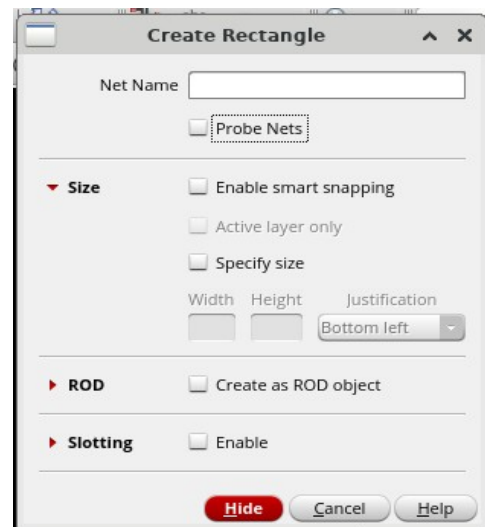


Parameterize command: Press F3

Parameter window appears

No input is required here, but you could specify a network name or set the size of the rectangle (but you can then be done with the mouse)

If the window is disturbing, you can make it disappear with "Hide"



Execute command:

With mouse (LMB):

2 mouse clicks

First mouse click starts rectangle (e.g. lower left corner) Second mouse click ends rectangle (e.g. upper right corner)

Do not stay on the mouse button!

Command remains active until it is terminated (with Escape) or another command is activated.

This means that any number of rectangles can be drawn without reselecting the command.

3.3 Deleting a drawing object (shortcut "del")

Command selection via keyboard shortcut:

Position the mouse over the drawing layer, press the "Delete" key. The

"Delete" command will be displayed at the bottom right.

Parameterization with "F3" would be possible, but usually not necessary (try it out!)

Delete single object:

Move the mouse pointer over the object (do not

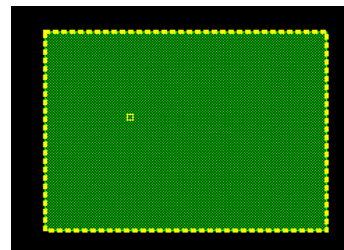
press), the object is selected (yellow frame)

Click to delete object (undo with "u")

Delete group of objects:

Drag rectangle around group with LMB (hold

LMB), group will be deleted



3.4 Shortcut commands for screen clipping

f	Fit all Display of the entire drawing Zoom
z	in Use LMB to drag the rectangle over the desired section, the section will be displayed
shift z	Zoom out Reduce scale

3.5 Ruler (Shortcut k)

"Ruler", tool for grid-accurate drawing

Command selection via keyboard shortcut:

Position the mouse over the drawing layer, **k** Press the key

"Ruler" command is displayed at the bottom right

Parameterization with "F3" would be possible, but mostly not necessary.

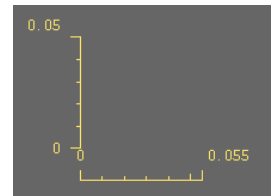
However, an additional window for parameterization can be opened with the RMB, where other settings are possible (try it out!).

Ruler on layer without drawing objects:

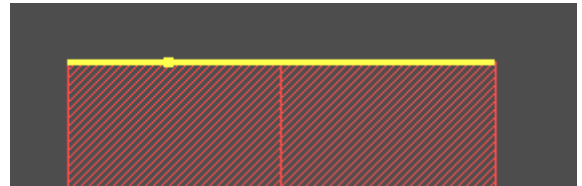
Mouse click LMB starts Ruler, next mouse click LMB ends Ruler (do not stay on LMB!).

Mouse movement up: Vertical ruler

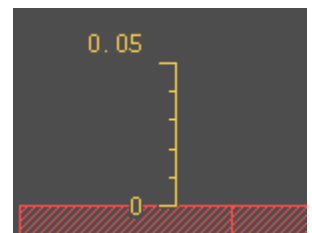
Mouse movement to the right: Horizontal ruler



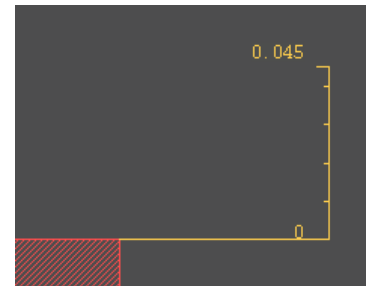
Ruler on layer with drawing objects: Place mouse pointer near an edge, edge is detected:



Ruler is automatically created perpendicular to the edge (mouse movement away from the edge):



Ruler can be moved at right angles to create dimension lines



3.6 Move (Shortcut m) Moving drawing objects

Command selection via keyboard shortcut:

Position the mouse over the drawing layer, **m** Press the key

"Move" command is displayed at the bottom right

Parameterization with "F3":

Setting the possible directions of movement:



* Moving individual objects:

Click on the start and stop point, do not hold LMB

* Movement of multiple objects:

Select a group of objects: Draw a rectangle around the group (LMB, hold LMB)

Click on the start and stop point, do not hold LMB

3.7 Instance (Shortcut i)

Inserting cells

Command selection via keyboard shortcut:

Position the mouse over the drawing layer, **i**-

Press button

"Instance" command is displayed at the bottom right.

Selection window appears:

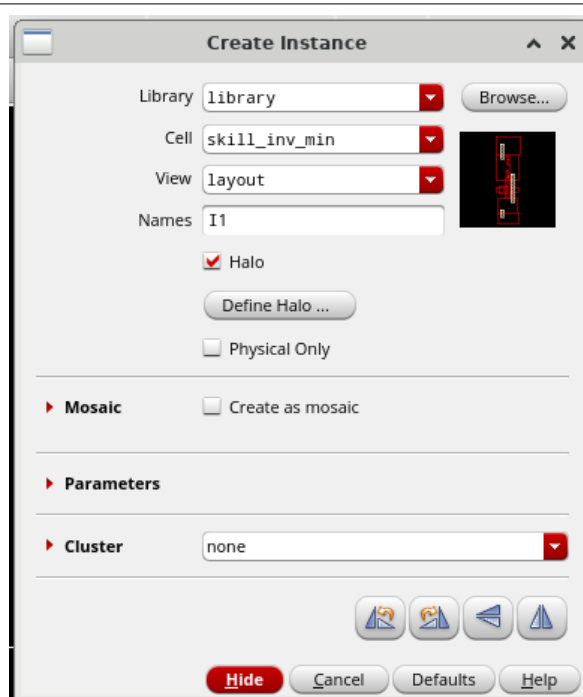
Select library Select view (layout or symbol)

Select cell (must be present in library)

Position cell with mouse

If only the cell outline is displayed:

Position the mouse pointer on the cell,
press shift-f: All layers become visible



3.8 Wire (Shortcut p)

Wiring in the layout

Command selection via keyboard shortcut: **p**

Position the mouse over the drawing layer, Press the key
"Wire" command is displayed at the bottom right

Application:

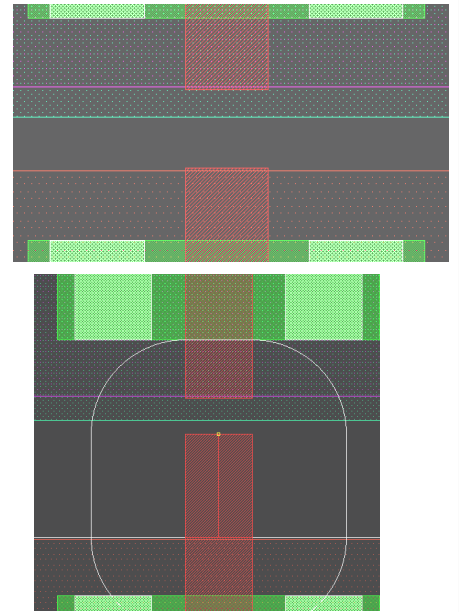
E.g. connecting 2 poly lines:

Place LMB in the middle of the lower poly line. Click on the poly edge and drag the mouse pointer upwards. The poly line is drawn according to the mouse pointer: Double-click to finish.

Level is automatically detected, only works with wiring levels.

Ensure a secure connection (let the layers overlap!)

Cables with multiple corners are also possible.



3.9 Commands without shortcuts (accessed via main menu)

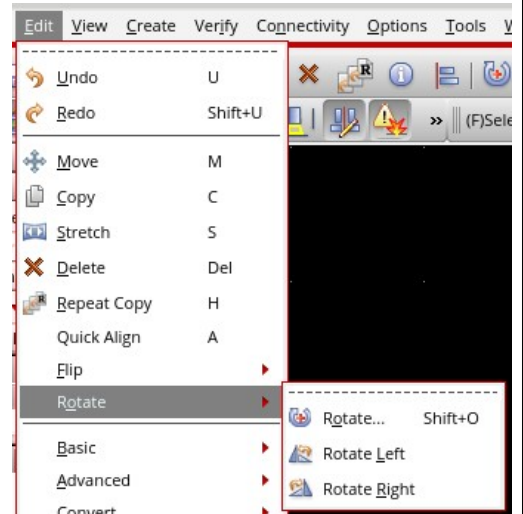
3.9.1 Rotate (No Shortcut)

Rotate cell

Call via main menu:

Edit/Rotate

Select Rotate Left or Rotate Right, click cell



3.9.2 Stretch (No Shortcut)

Stretch rectangle

Call via main menu:

Edit/Stretch

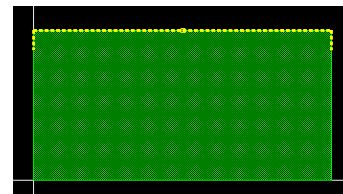
Select edge (LMB on edge) Selected

edge is highlighted yellow Drag

edge with LMB

1. Click starts movement

2. Click ends movement



3.9.3 Flatten: Make cell flat (resolve hierarchy)

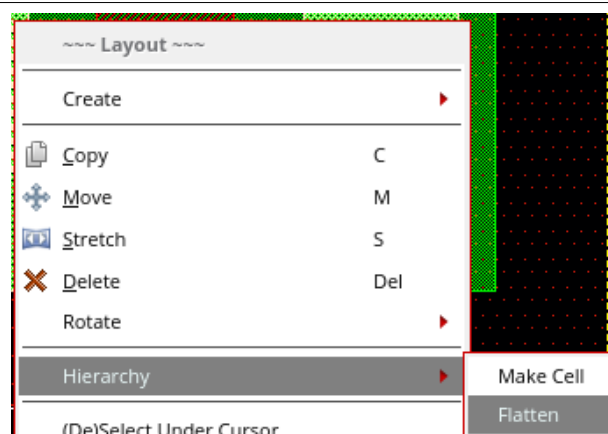
Mouse pointer on cell

Press RMB

Menu appears:

Hierarchy/Flatten

Cell is divided into individual rectangles.



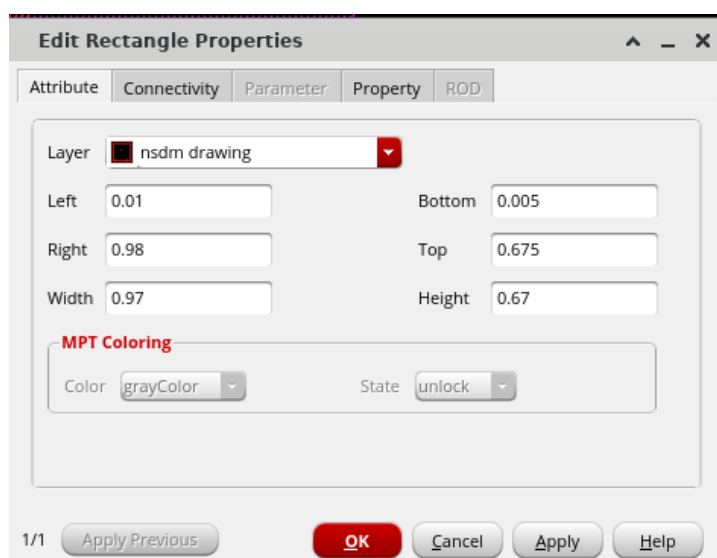
3.9.4 Move object to another layer

Select rectangle with mouse click LMB

Click on object with RMB

Selection window appears:

Enter the new desired layer under
"Layer"



3.9.5 Export layout to graphic file

Main menu:
File/Export Image

Window appears

White background

Layout can be Graphic file on hard drive saved or to the clipboard be copied.

Clipboard

Export Image (window 11)

Export Region

- ☒ Visible area
- ☐ Entire design
- ☐ Selected area:

Size

- ☒ Scale exported region by: 1.00x
- ☐ Custom: ☐ Maintain aspect ratio
- Width: Height:

Appearance

- ☒ Full color ☐ Monochrome ☐ Bi-color ☐ Transparent background
- Background: Foreground:
- Swap background and foreground colors

Halos

- Style: ☒ Gradient ☐ Flat ☐ Scale with image size

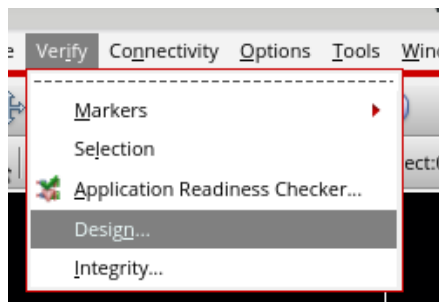
Output

- Name: Type: PNG
- ☒ Close dialog after saving image
-
-

4 Performing a Design Rule Check

Start DRC:

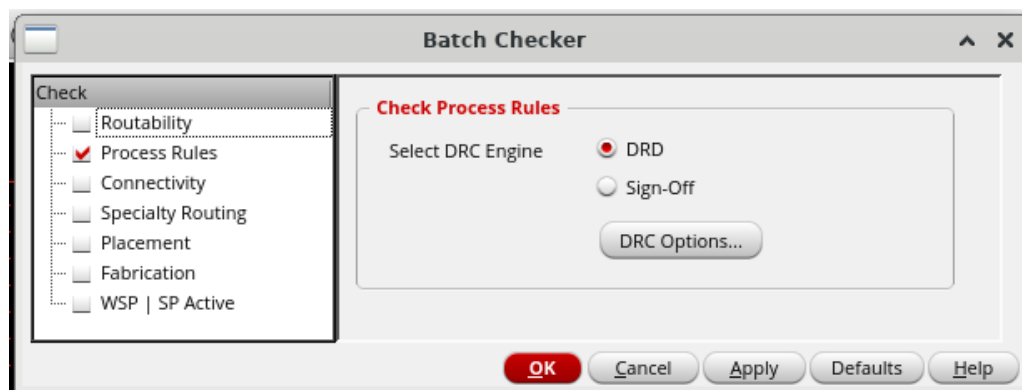
In the main menu:



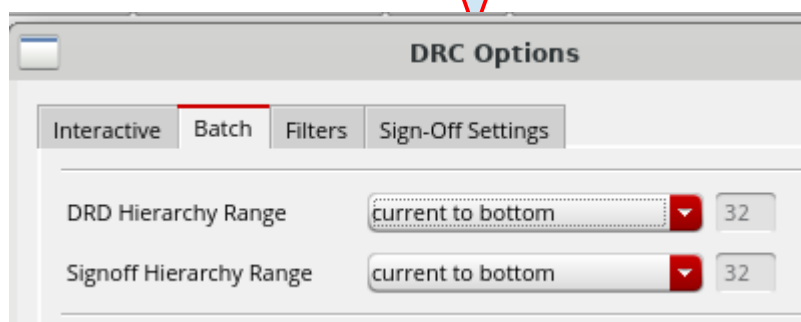
Window appears:

"Process Rules" must be checked,

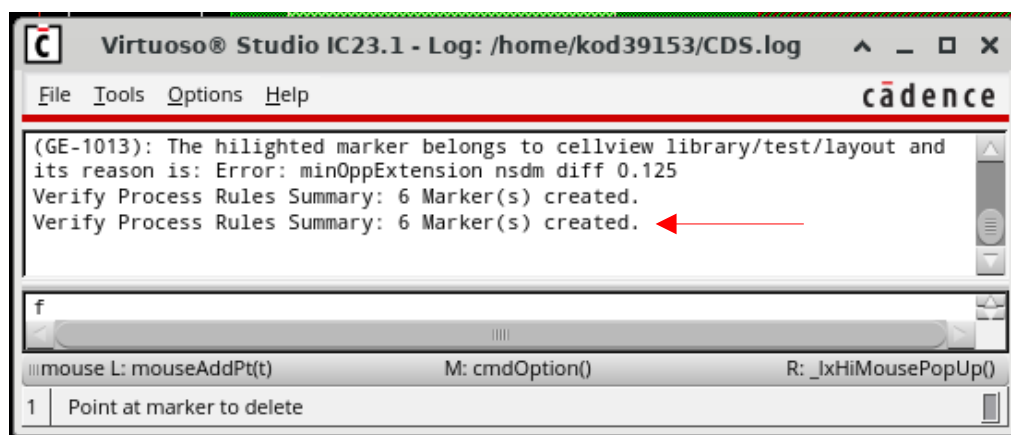
"OK"



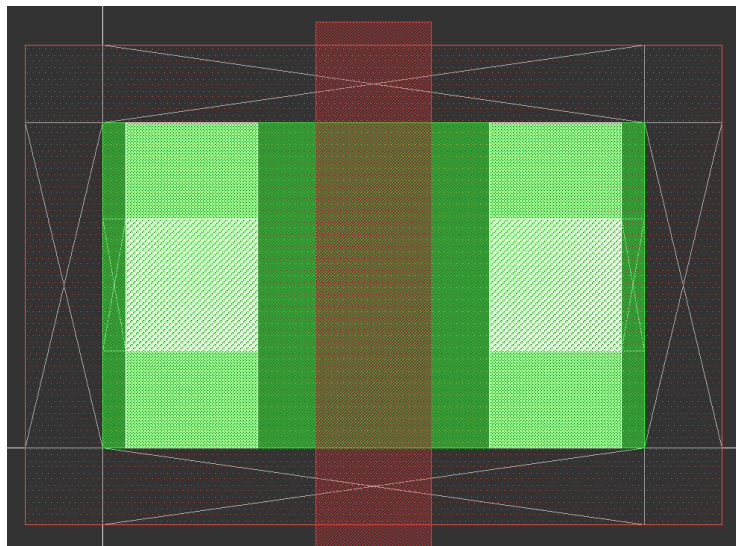
Under "DRC Options" the settings shown below must be selected, otherwise levels in inserted cells will not be taken into account.



In Virtuoso Control Panel, the number of markers = number of DRC violations displayed.
Here: 6 markers, i.e. 6 design rule errors



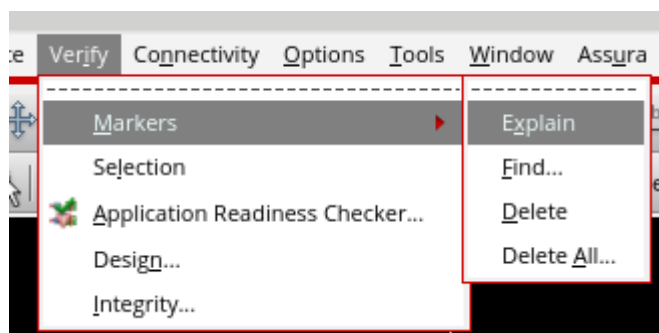
"Markers" (white X) are drawn in layout.
Here 6 markers, so



Find out the type of DRC error:

In the main menu:

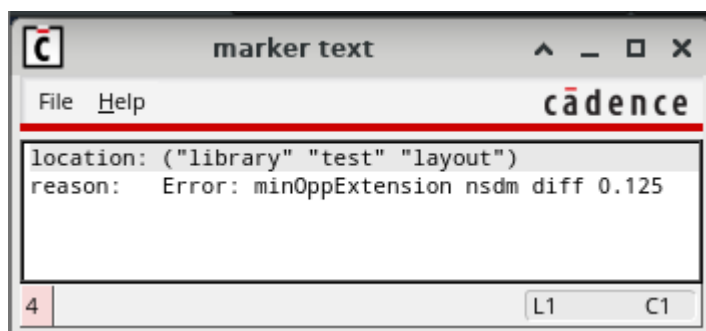
Verify/Markers/Explain <Enter>



Then click on the marker in the layout with the mouse, a window with explanation appears:

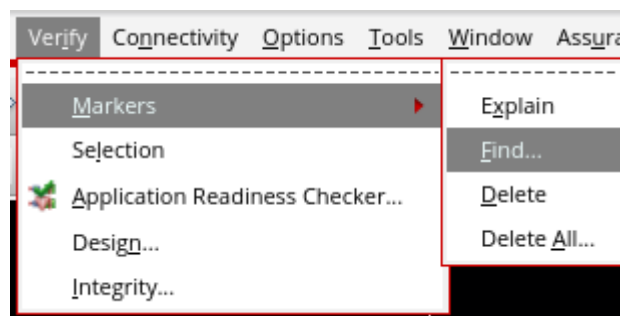
Explanation:

The minimum overlap of nsdm over diff is 125nm, this was below (can be tracked with Ruler).



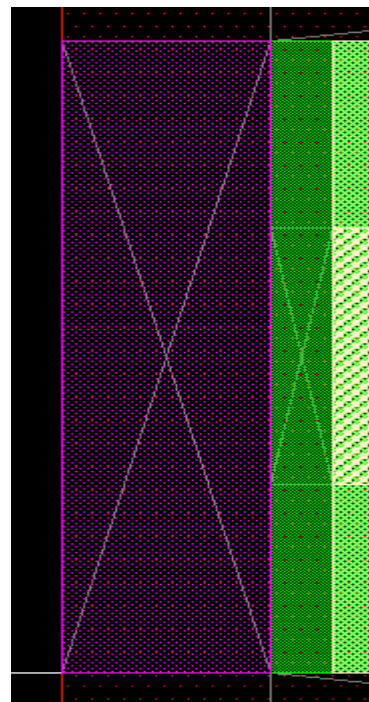
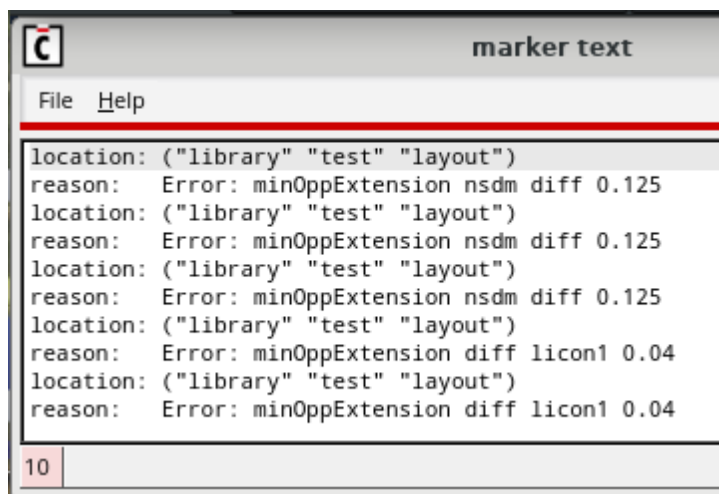
Often easier when there are many errors:

Verify/Markers/Find <Enter>



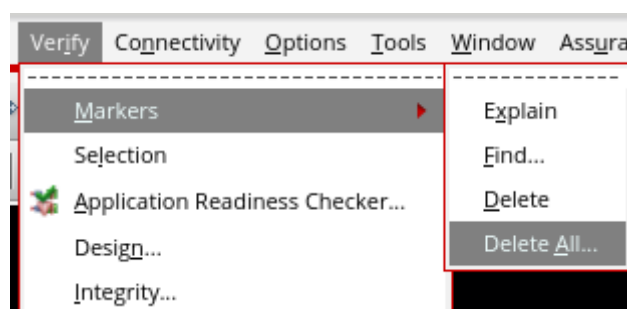
Adjacent window appears:

With "Previous" and "Next" you can navigate through the errors, in the window "marker text" shows the design rule that has been violated
In addition, the corresponding marker will turn purple marked.



Deleting markers in the layout:

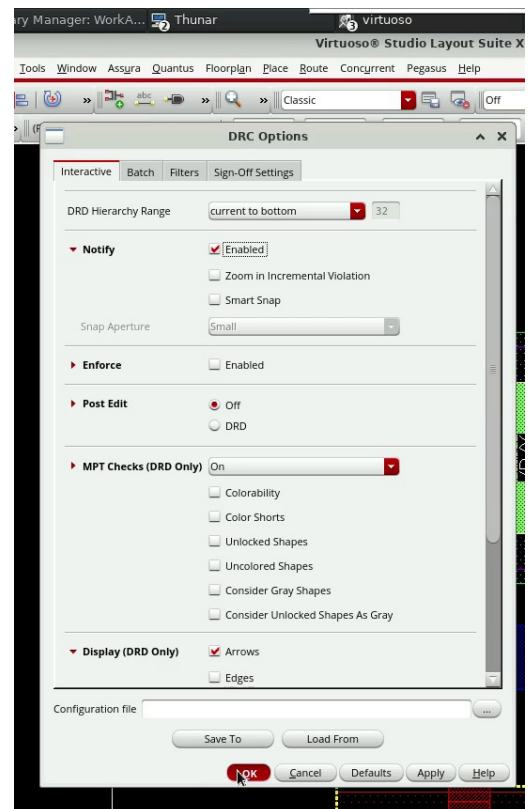
Main menu:



4.2 Online Design Rule Check

Main menu: Options/DRC

Fill in the window as shown



4.3 Pegasus DRC

Main menu: Pegasus/Run DRC wait ...

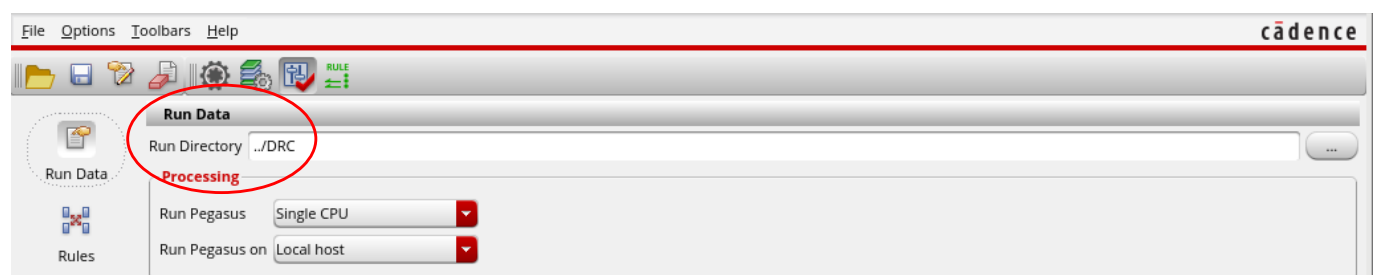


appears

Enter run directory:

On the left, "Run Data" must be pressed

Run Directory: Any writable directory, must be created beforehand



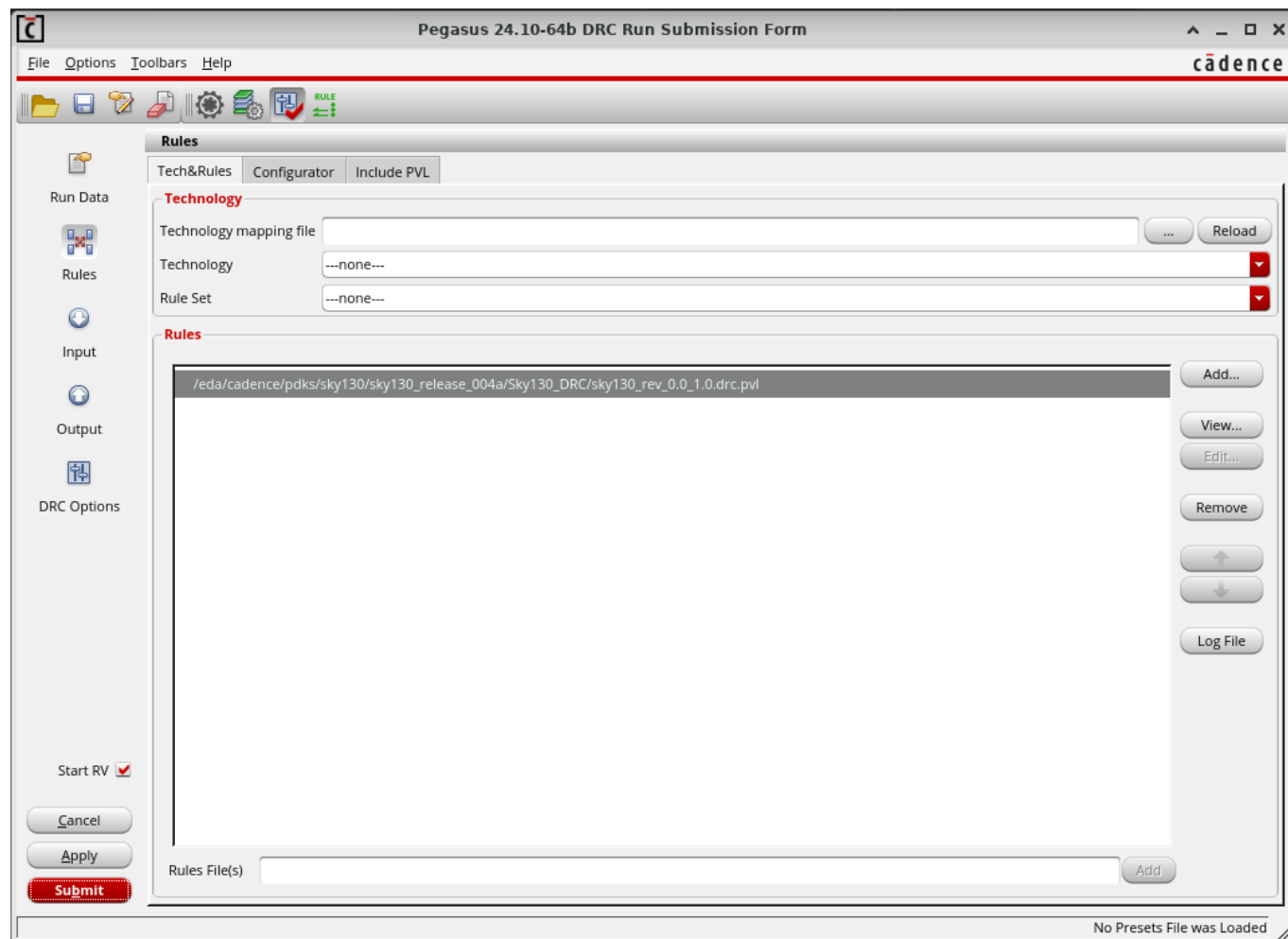
Afterward:

Press "Rules" on the left, the window below appears.

If there is nothing in the "Rules" box, enter the following file name in "Rules File(s)" below:

/eda/cadence/pdks/sky130/sky130_release_004a/Sky130_DRC/sky130_rev_0.0_1.0.drc.pvl Save with "Add" (of course, only applies to the current OTH installation)

Otherwise: "Submit":



After a short wait, the "Pegasus Results Viewer" appears. The display is fairly self-explanatory.

Clicking on errors in the "Results Viewer" highlights errors in the layout

5 Copying Cellviews to other libraries

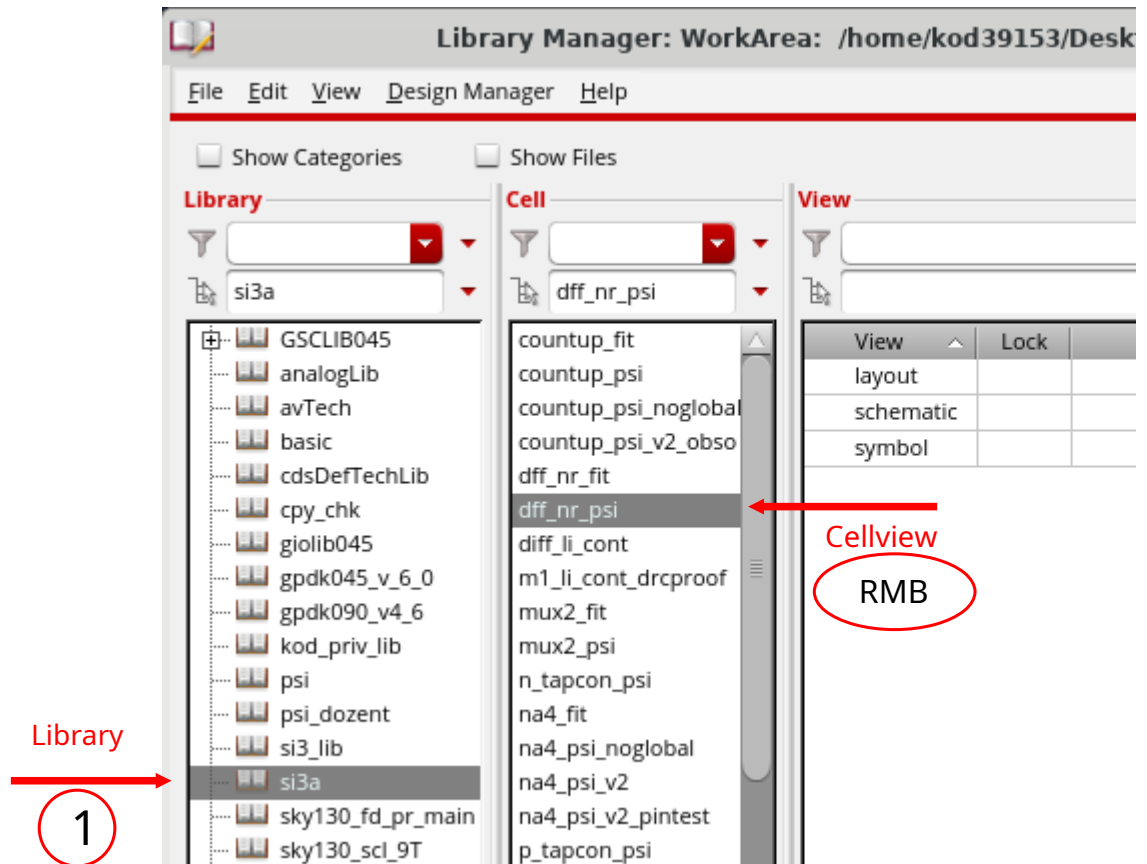
Please ensure that all copied cells receive the file path of the target library!

Example: A cell named "dff_nr_psi" is to be copied from the "si3a" library to the "psi" library. All subcells whose file paths need to be adjusted are also to be copied.

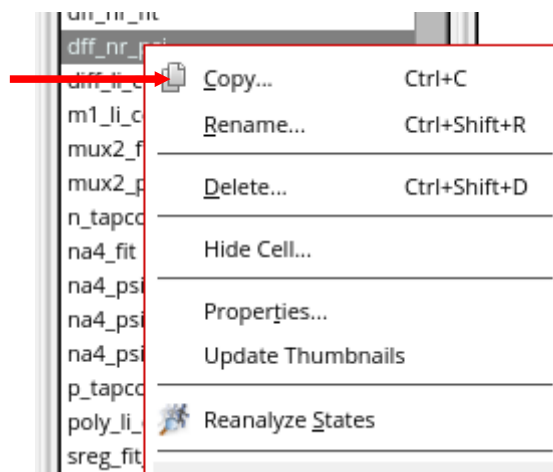
In the Virtuoso Control Panel: File/Tools/Library Manager:

Library
choose:

Right-click on
desired
Cellview delivers
next
Window:



"Copy"

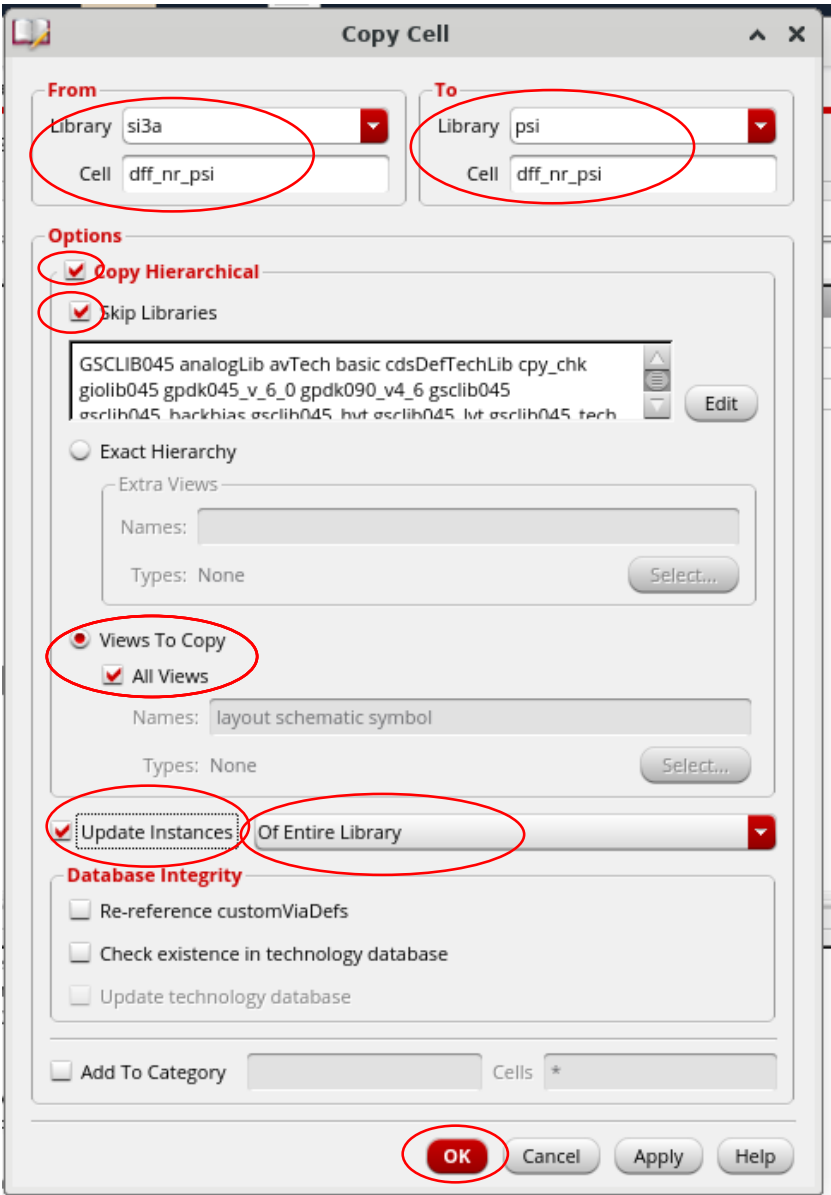


Fill out the "Copy" window as follows:

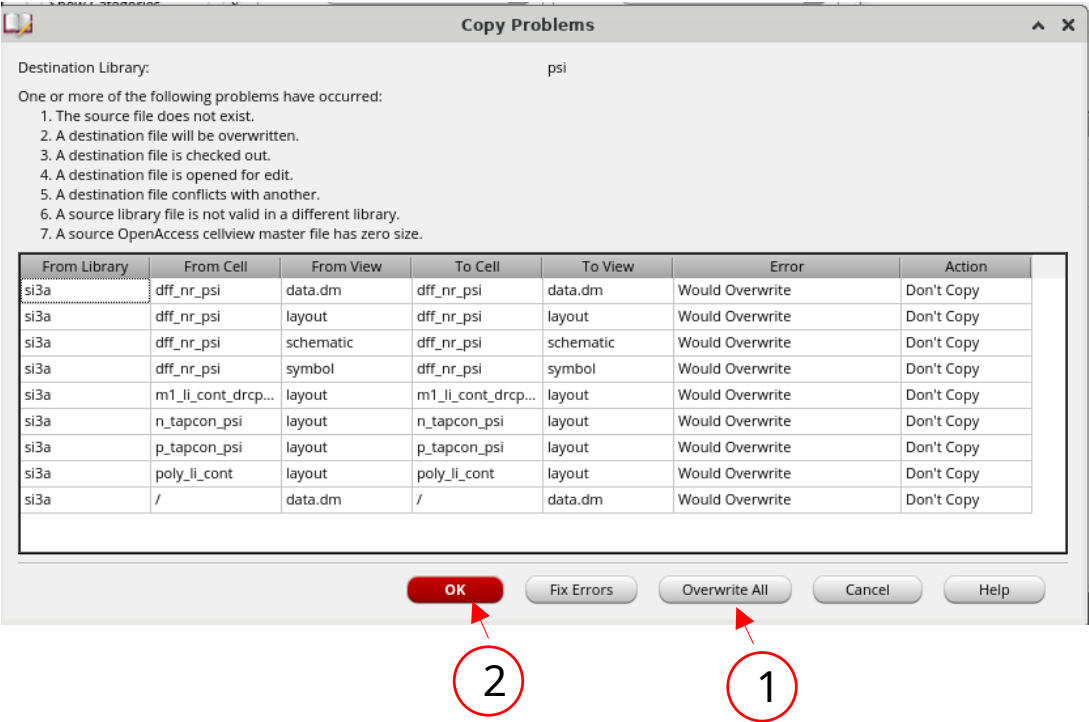
Danger !
All cells with the same name in the target library will be overwritten!

If the target library is empty, this is not a problem. Otherwise, you should always work with the latest version of all cells anyway, so there is no problem with that either.

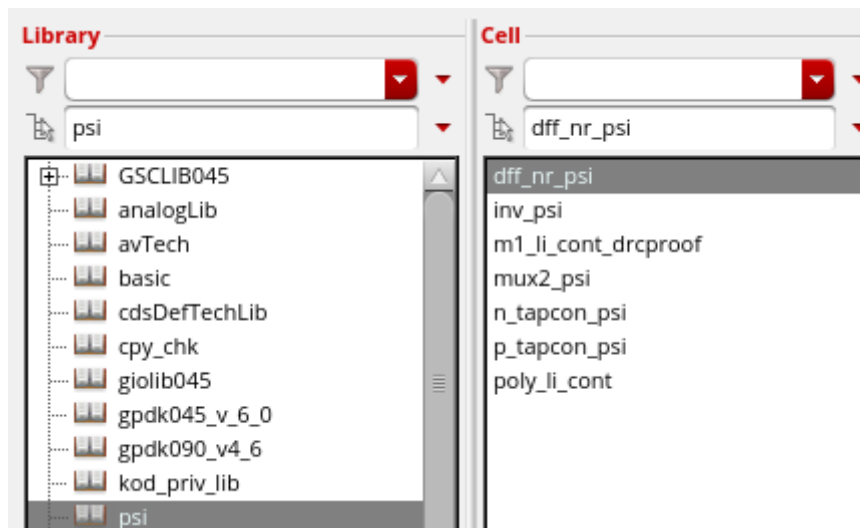
Not only the selected cell is copied, but also all subcells!



Next window:
"Overwrite All" is ok!



Contents of "psi" after copying:



After copying, the correct path should be checked using some examples using the "Property" function!

6 Overview of commands

6.1 Layout Editor

Shortcuts:

and	Undo: Undo a command
R	Rectangle: Draw a rectangle
del	Delete (Del key !): Delete a drawing object
f	Fit all: Display the entire drawing
z	Zoom in: Zoom in
shift z	Zoom out: Zoom out
k	Ruler: Ruler
shift k	Delete all rulers
m	Move: Move drawing objects
i	Instance: Place cell
p	Wire
e	Copy display options (e.g. grid settings)
c	Show cell interior
shift f	Hide cell interior
ctrl f	

Menu commands: /Edit/...

Edit/Rotate:	Rotate cell
Edit/Stretch:	Stretch rectangle
Edit/Hierarchy/Flatten :	Flatten the cell
Edit/Basic/Properties	Layer: Move object to another layer (select first)

6.2 Schematic Editor Commands

i	Instance: Place cell
f	Fit all: Display the entire drawing
del	Delete (Del key !): Delete a drawing object
c	copy
[Zoom Out
]	Zoom In
w	Wiring components
p	Place external connection:
l	Place label

Move component:

Mouse pointer on component until yellow rectangle appears, move with LMB pressed

Create symbol for circuit: Main menu:

Create/Cellview/From Cellview

Fill out the form (self-explanatory)