

# Heidelberg DWL66fs Laser Writer

## Cornell Nanoscale Facility

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The Heidelberg Instruments DWL66fs is a direct write pattern generator. At CNF, the DWL66fs accepts 5", 0.090" thick) Cr on quartz mask plates. The unit has interchangeable write heads that determine the resolution and the speed of patterning. The smallest usable feature sizes are 2.5 microns and 0.8 microns with the 10mm and 4mm write heads, respectively.

The DWL66fs system consists of the main system unit, a Windows XP-based PC for running job files, a Linux-based PC for data conversion, and a pattern generator (located in the service area). The system is equipped with an alignment system, including front-to-backside alignment, as well as a gray-scale exposure mode. The tool accepts files of various formats, but for best results we encourage using the semiconductor standard GDSII format.

### GUIDELINES:

1. Mask writing is the default mode, wafer direct-write with Staff assistance.
2. Changing to a 4mm write head: Email manager and backup one week in a advance to request changeover to the 4mm write head. Changeover will be based on staff availability and will not occur on Friday or weekends. Changeover will be for overnight writes. Staff time and additional tool time will be applied to the user account.
3. 10mm write head – 2.5 micron nominal resolution at  $20\text{mm}^2/\text{min}$
4. 4mm write head – 0.8 micron nominal resolution at  $3.3\text{mm}^2/\text{min}$

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# 0. Quick Guide: DWL66fs Mask Making

1. Transfer GDSII files via CNF Lab Transfer Share into the gdsii directory
2. Use the **Frame Generator** to create a barcode (for the steppers) or label (for contact)
3. Using the **XConvert** DWL66fs conversion program, read in your GDSII *pattern* file
4. Choose the correct write head, mirror and rotate the data (don't mirror backside contact masks)
5. Create a job file
6. Transfer job file
7. Repeat steps 3-6 for your GDSII *frame* file
8. Turn laser ON
9. Load job files in the job template
10. Check the Auto Unload and Laser Shutdown options, then click Load button
11. Load mask
12. Close the door, WAIT until the door is *fully closed*, then move the stage under the lens
13. Focus, find Center of the plate, Expose
14. Unload mask when exposure finishes, close the chamber door
15. **Make sure that the LASER is OFF when finished – LOG OUT**
16. Develop using the Hamatech and etch Cr using the Hamatech or the Trion RIE

# 1. Pattern Conversion

## CAD Guidelines:

1. Use only GDSII files
2. Origin of CAD pattern corresponds to the center of the mask
3. CAD feature dimensions represent feature dimensions on the wafer – use the **XConvert** software for scaling stepper masks
4. Drawn Layer represents removed Cr
5. Use **LayoutBEAMER** (for more information see CNF Computing resources) to perform CAD layer inversions. All Boolean operations must be done within the CAD package.

## Transferring files to the Linux computer:

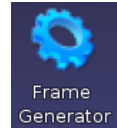
Linux conversion computer login and password are both **convert**

1. Using the CNF windows PCs navigate to the lab transfer share **V:** drive. Place GDS file under **V:\Heidelberg DWL66fs**. Alternatively, using CNF SunRays, copy the GDS file to **/cnflab/Heidelberg DWL66fs**.
2. Using the DWL66fs convert computer: double click on the **Lab\_Transfer\_Share** desktop icon.
3. Right click on the file you wish to transfer.
4. Choose **Copy To** then click on **Home Folder** then **gdsii** then **Copy Here**.

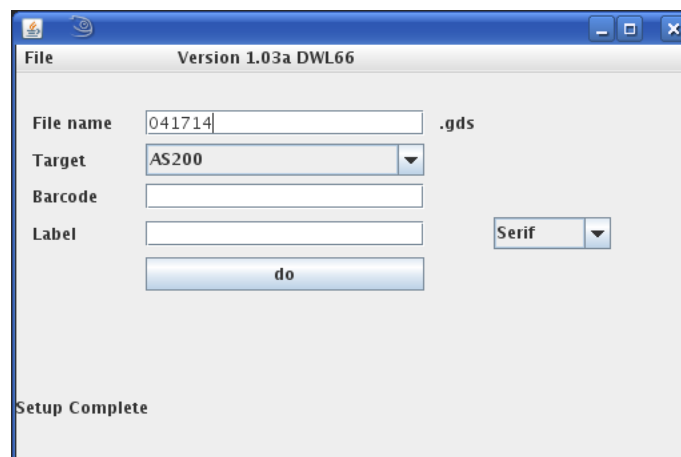
# 1.1 PATTERN CONVERSION

## 1.1.1 Frame Generation

The **Frame Generator** program will create a GDSII file that will have a label for contact aligners, or fiducial (reticle alignment) marks for both the AS200 i-line and the 5X g-line steppers. The following marks are generated for the steppers: RMS, Insitu, barcode, label and 5X reticle marks.



Using the Linux conversion computer, double-click on the **Frame Generator** icon.



1. **File name** field will already contain the date. You must use the following naming convention: **Today'sDateNameLXframe** where **X** represents the lithography level number. For example: 0222514jctL0frame would represent that the frame for lithography level 0 of the mask was converted on February 22, 2014. **DON'T USE** spaces, special characters, etc.
2. Select **Target** - **AS200** for a stepper mask, or **Contact** for a contact mask. (**Note:** ASML masks cannot be exposed on the DWL66fs.)
3. Input a **Barcode** – 10 Characters maximum – using only letters and numbers. If you leave this field blank a random code will be generated.
4. Input a **Label** – 10 Characters maximum – using only letters and numbers. Do not change default font.
5. Click **do**

The frame template file will be saved under the **/home/convert/gdsii** directory. Click **File**, then **Close** to close the **Frame Generation** application.

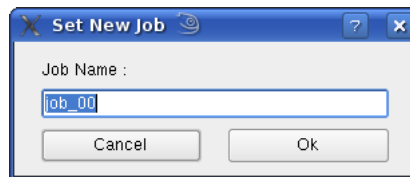
## 1.1.2 Pattern Conversion



1. To start the pattern conversion software, double click on the **XConvert** icon.

The **GUI HIMT CONVERT ... 2.21** menu will appear.

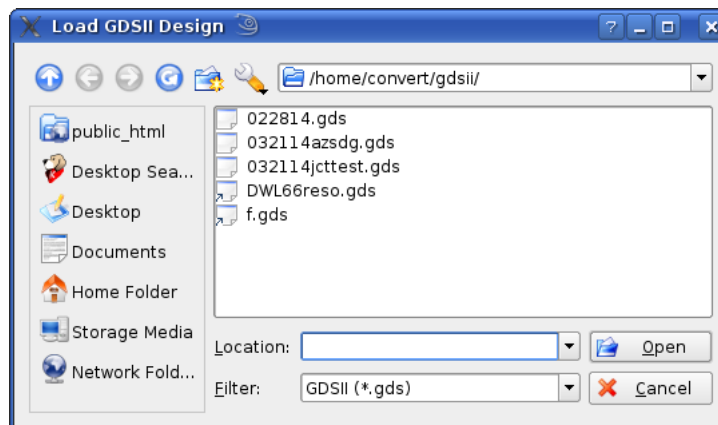
2. Select **File / New job**. The **Set New Job** window will appear. For job name use **Today'sDateNameLX**. For example: 022514jct11 would represent that lithography level 1 of the mask was converted on February 25, 2014. Click **Ok**.



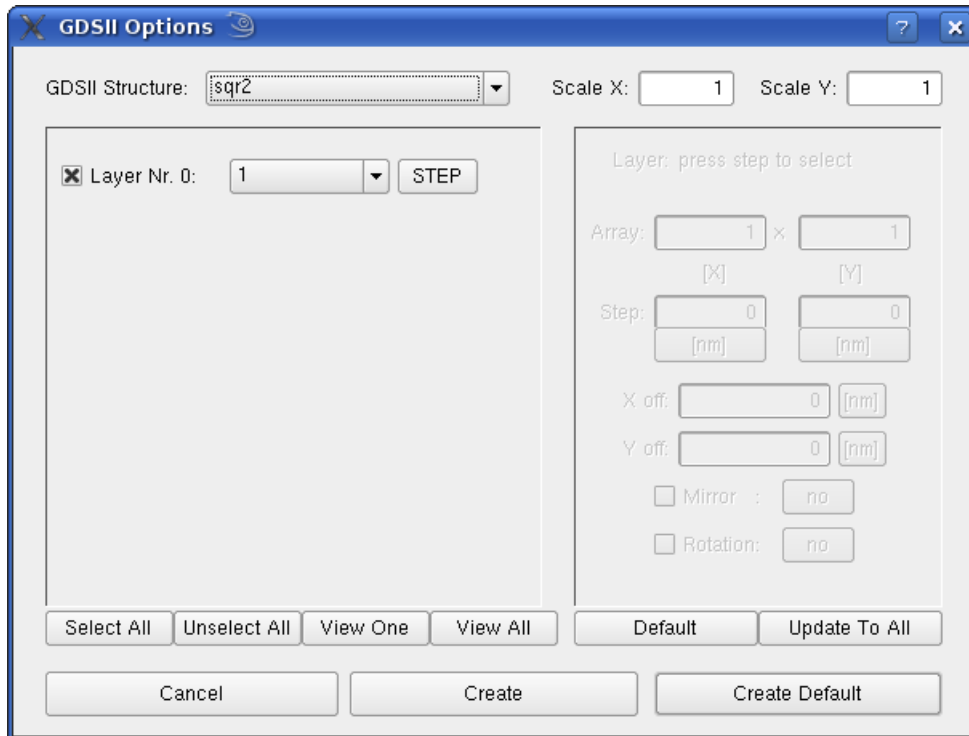
3. The **GUI HIMT Convert** window will expand to display job parameters, and the **Main Status Window** for your job will appear. Click **Add**, then **GDS II** within the **Source File** submenu:



The **Load GDSII Design** window will appear:



4. Choose your GDSII pattern design file and click **Open**. The **GDSII Options** menu will appear:

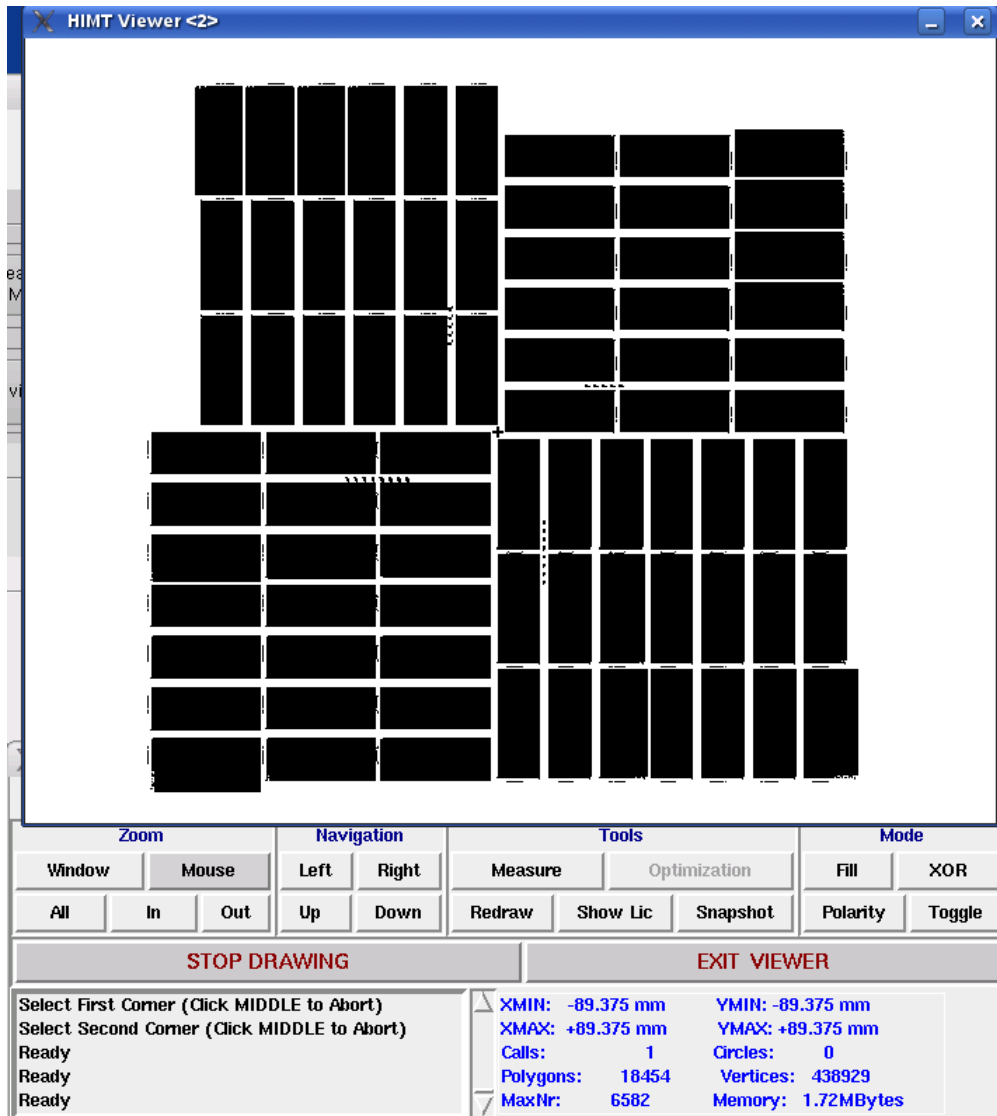


5. Choose the top level GDSII Structure (GDSII Cell) of your pattern file. For **Frame Generator** files for **stepper** masks *make sure* to select **labelBC**, for **contact** masks select **frame**. The **Scale** for both X and Y should be set to 1 for **contact** masks and *all Frame Generator* files, or 5 for **stepper** masks. **Unselect All** layers (use the button below the layers – or uncheck manually), then check *only* the layer(s) you wish to convert. NOTE: Layer Nr. 0, 1, 2, 3, 4, etc are NOT GDSII layer numbers! GDSII Layer numbers are displayed in the field directly to the left of the **STEP** button.

6. Click **Create Default**.

7. View and check your pattern. Click **PREVIEW** button to view your pattern.

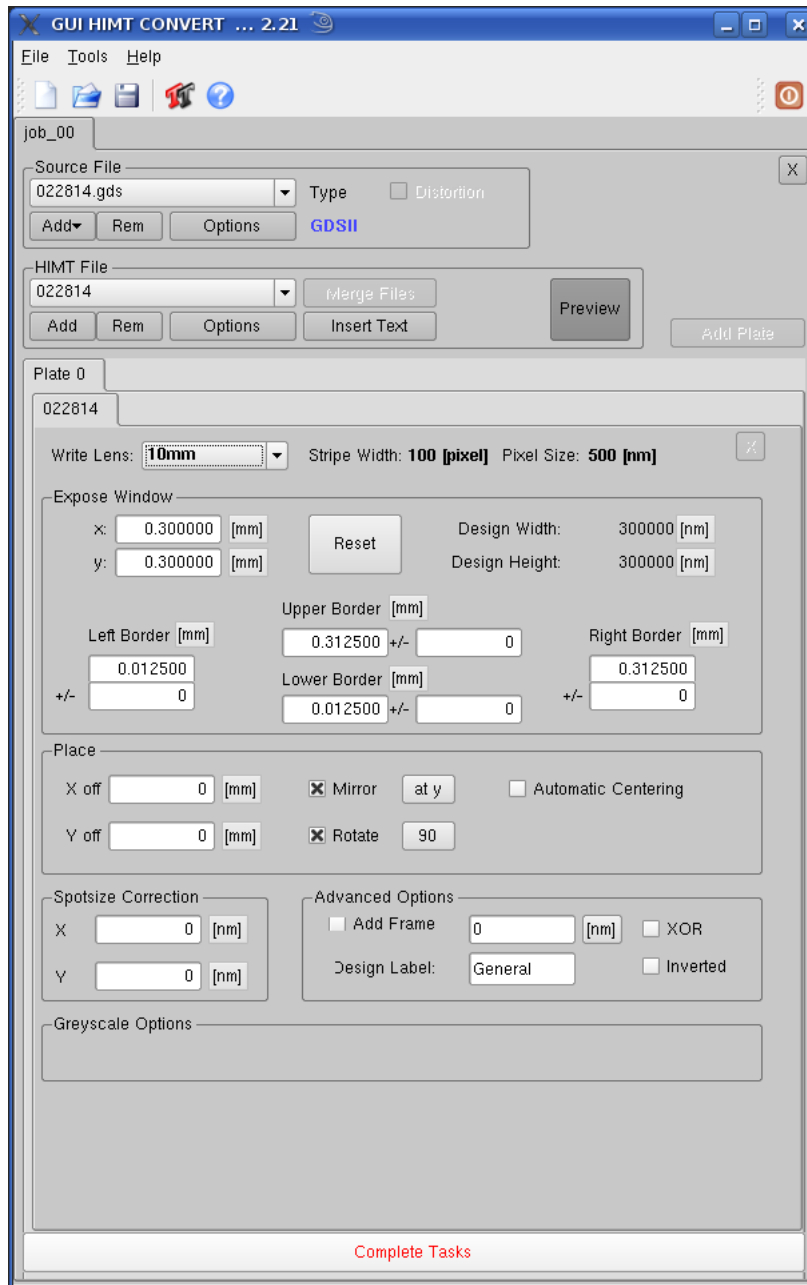




Click **Mode / Fill** within the viewer. All exposed features will be solid black. Click **Zoom / Mouse**, then click left button on spot to zoom in, right to zoom out, and middle to stop zooming.

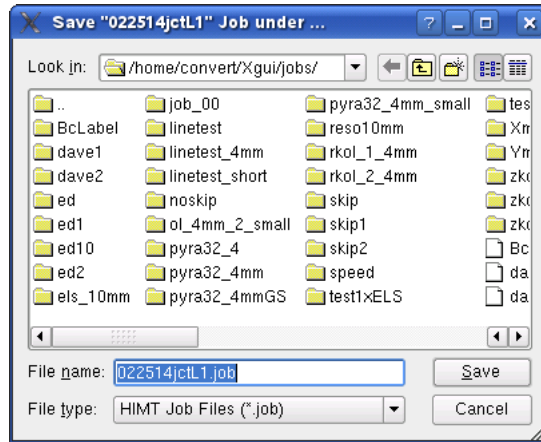
**NOTE:** The pattern is not yet mirrored and will be mirrored in a later step. Check the pattern extents (**XMIN**, **XMAX**, **YMIN** and **YMAX** values directly under the **EXIT VIEWER** button), as well as details of the pattern. Exit viewer.



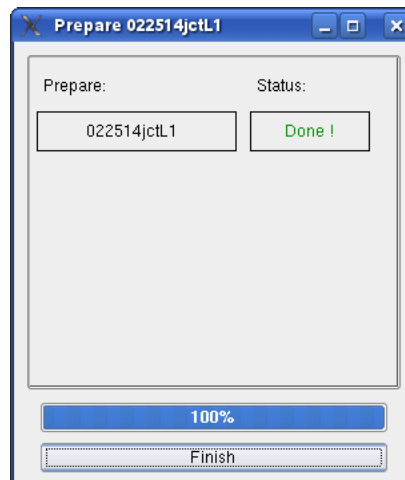


8. Change **Write Lens** to **10mm**. (**GS** lens indicates Gray-scale exposure.)

Within **Place** select **Mirror / at y**. If you are exposing a **stepper** mask, for *both* the data file and the **Frame Generator** file select **Rotate / at 90**. Click **Complete Tasks**. The **Save Job** menu will appear:



9. Click **Save**. Use the same naming convention as described previously (**Today'sDateNameLX**, should be the default). **Prepare** menu will then appear. NOTE: this step may take some time. Click **Finish** when completed.



10. The **FTP Transfer** box will appear. Click **Transfer**, wait for it to complete, then click **Close**. In the **GUI HIMT Convert** window, click **Clear Tasks** at the bottom, then click the X box in upper right to close the job.

11. Repeat steps 2 - 10 for the frame file you previously generated. For steppers, in the **GDSII Options** menu click **GDS Structure** and *make sure* to select **labelBC**. There are reticle marks in cell **labelBC** that are needed by the steppers, so *make sure* you select it. For contact masks, select **frame**.