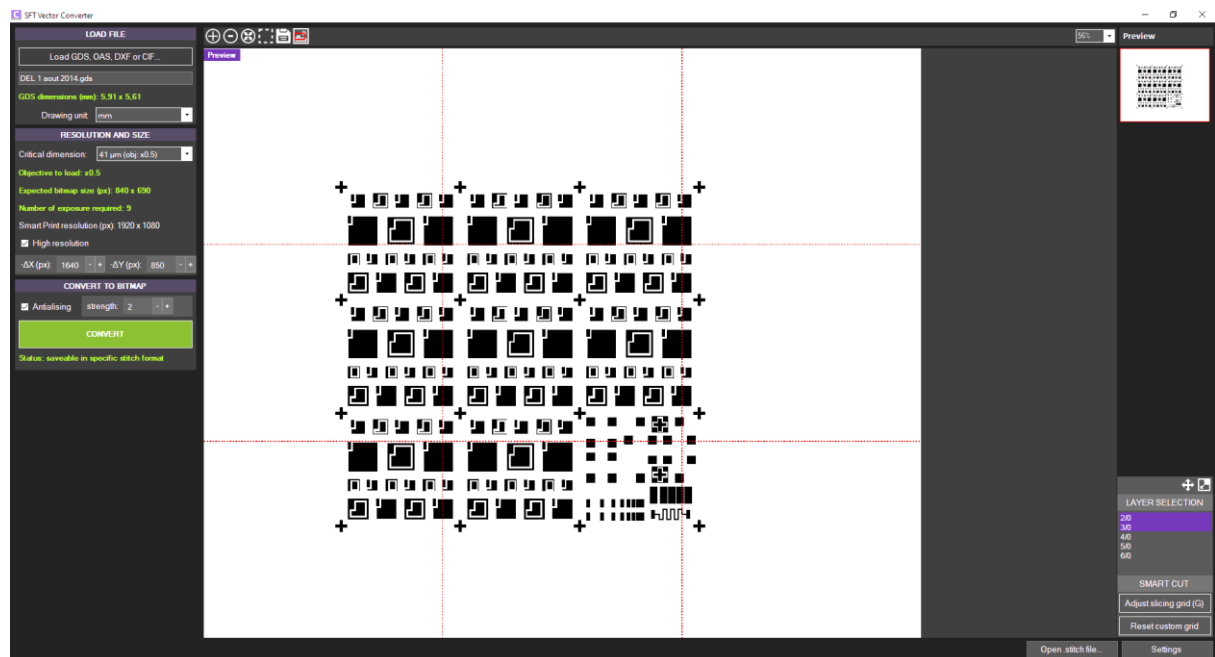


# SFTconverter

V 1.2  
USER'S MANUAL



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## TABLE OF CONTENTS

<b><u>1</u></b>	<b><u>GENERAL INFORMATION</u></b>	<b><u>- 4 -</u></b>
<b><u>2</u></b>	<b><u>REQUIREMENTS</u></b>	<b><u>- 4 -</u></b>
<b><u>3</u></b>	<b><u>INSTALLATION</u></b>	<b><u>- 4 -</u></b>
<b>3.1</b>	<b>MAIN APPLICATION</b>	<b>- 4 -</b>
<b>3.2</b>	<b>THIRD PARTY APPLICATION: KLAYOUT</b>	<b>- 4 -</b>
<b>3.3</b>	<b>APPLICATION SETTINGS</b>	<b>- 6 -</b>
<b><u>4</u></b>	<b><u>USE</u></b>	<b><u>- 7 -</u></b>
<b><u>5</u></b>	<b><u>SETTINGS</u></b>	<b><u>- 10 -</u></b>
<b><u>6</u></b>	<b><u>TROUBLESHOOTING</u></b>	<b><u>- 11 -</u></b>

## 1 GENERAL INFORMATION

### ABOUT

SFTconverter is an autonomous application for Smart Print's users wishing to convert their vector design into a compatible format for Smart Print on their own computer. Its working is similar to the SFTprint vector conversion module. Only Smart Print's users are allowed to install and use this application.

### WORKING PRINCIPLE

Smart Print is a lithography equipment based on light projection through a matrix of pixels. It then requires bitmap files (png, tiff, etc). SFTconverter transforms vector drawings (format: gds, dxf, oas and cif) into compatible and scaled bitmaps.

The conversion is performed in synergy with the open-source application KLayout. It is based on a two-step operation:

- Extract the total dimension of the vector drawing (**its base unit must be  $\mu\text{m}$  or mm**)
- According to the critical dimension value selected by the user, a bitmap file with relevant dimensions in pixels is created. Depending on the bitmap size output and the application settings, the result is either a lossless .png or a .stitch file (Smart Print native format optimized for exposure of big images up to 11 gigapixels)

The module converts **all selected layers in black & white**, as displayed by KLayout.

## 2 REQUIREMENTS

Operating system: Windows 10 (may work for Windows 7 and Windows 8)

Additional software: KLayout 0.24.8 or higher (<http://www.klayout.de/>)

## 3 INSTALLATION

### 3.1 MAIN APPLICATION

Open SFTconverter.zip archive and copy the content at the desired position.

### 3.2 THIRD PARTY APPLICATION: KLAYOUT

#### Step 1: installation

If KLayout is not already installed on the computer, go to <https://www.klayout.de/build.html> and download the latest version for Windows 64 bit with installer. Once download is finished execute the installer in administrator mode by right-clicking on the installer and choosing **Run as Administrator**. When the installation window is opened click on **Install** (Figure 1). Klayout shortcut is installed in the Window menu or can be found by typing "KLayout" in the Windows search field.

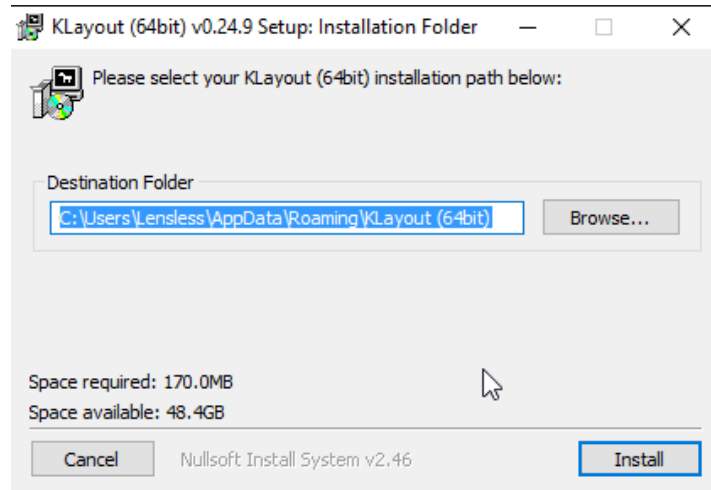


Figure 1 – KLayout installation window

## Step 2: configuration

Run KLayout (first start may be longer because of the initialization index). Go to menu **File → Setup** (Figure 2, left). On the **Settings window**, go to **Display → Background** and uncheck **Show background decoration** (Figure 2, right). Click on **Apply** and then **OK**. Close KLayout.

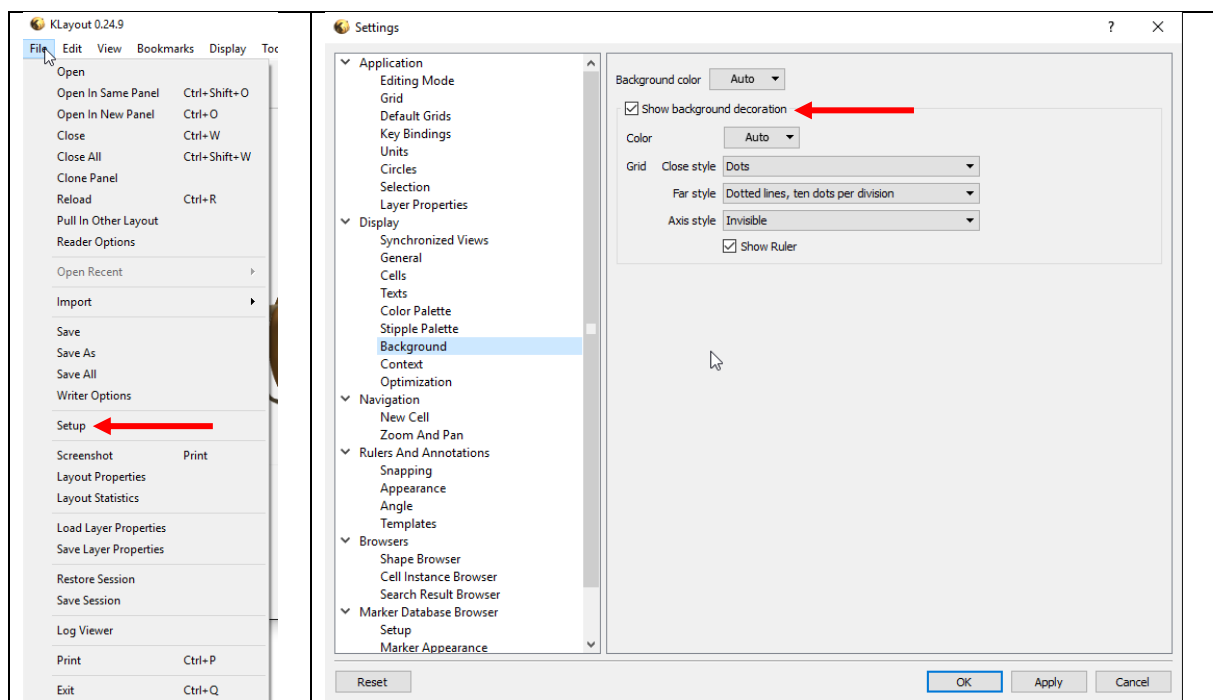


Figure 2 - Configuration of KLayout

### 3.3 APPLICATION SETTINGS

#### Step 1: KLayout linking (only required in case of issue)

Run SFTconverter. If the destination folder of KLayout has not been changed by the user, SFTprint will configure the linking automatically. Else a message will appear asking for KLayout file path.

*If KLayout is not found by SFTconverter:* Go to the setting window by clicking on **Settings**. Then, click on **Define klayout\_app.exe filepath...** (Figure 9). In the **Open** window, find and select the executable file *klayout\_app.exe* (Figure 3).

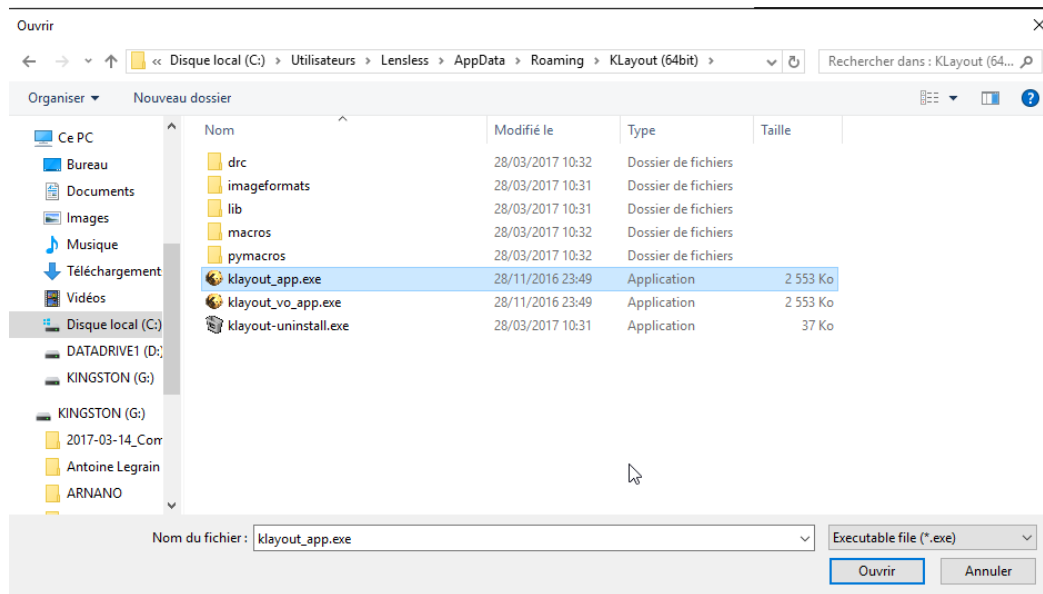


Figure 3 – Folder containing the KLayout executable

#### Step 2: Loading Smart Print calibration parameters

In order to convert successfully vectors into scaled bitmaps, the application needs a calibration file (carac.dat) containing the correspondence between a pixel and its real size after its projection through each Smart Print's objective.

By default, the application will use average values. To improve the size fidelity of lithographed patterns, follow the instruction below:

- On Smart Print's computer (where SFTprint is installed), copy the file **Documents\SFTprint\carac.dat** and transfer it to the destination computer
- On SFTconverter → Settings, click on **Load new "carac.dat" file...** and select the corresponding file

## 4 USE

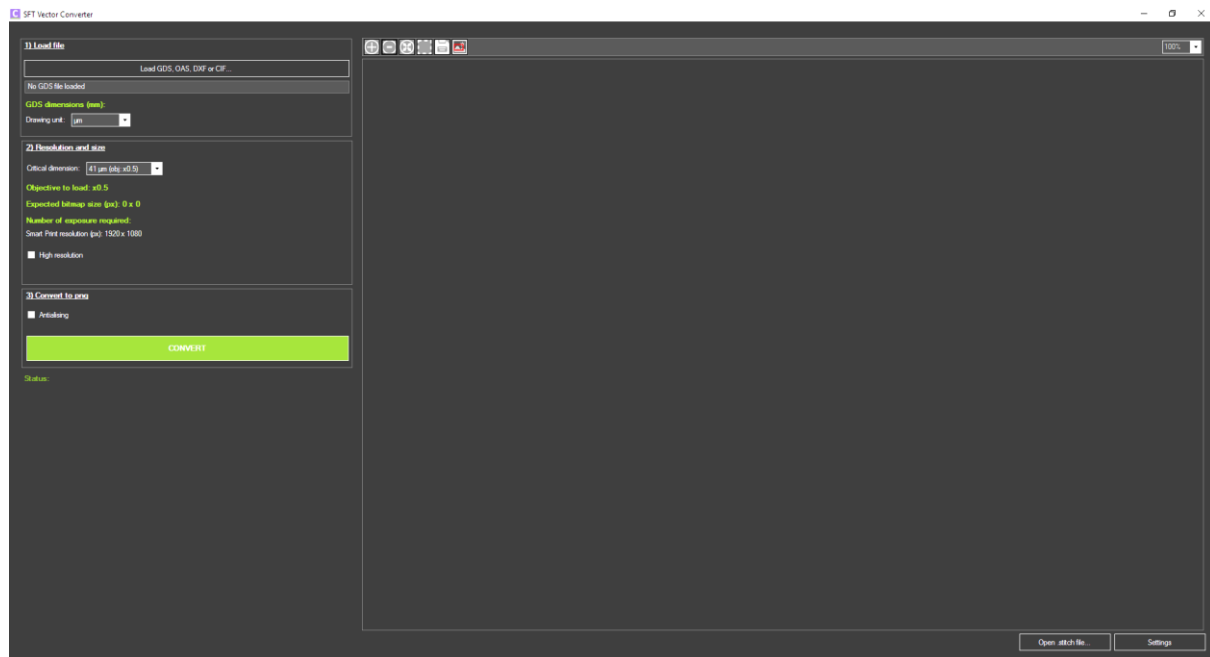


Figure 4 - SFTconverter main window

- Click on **Load GDS, OAS, DXF or CIF...** and select the drawing to convert. The application extracts the drawing size (operation may take a few seconds). Extracted dimensions are displayed in the **LOAD FILE** panel.
- Choose the appropriate base unit: “mm” or “µm”
- Select the critical dimension of your design in the **RESOLUTION AND SIZE** panel. The module calculates on-the-fly the dimension in pixels of the output image and the number of exposures required to make the lithography of the whole drawing and the objective to be used for the lithography. A preview image of the conversion result is also dynamically generated and displayed (Figure 7). The red dashed grid on the preview image shows how the design will be sliced during conversion.
- In the layer panel (Figure 6), select the layer(s) to be converted (for multiple layer selection, hold Ctrl and click on the layer you want to add)
- Check the **High resolution** option to improve the overall quality of the lithography. This option is especially recommended if the patterns are close to the critical dimension
- Check the **Antialiasing** option if a smoothing of the edge is wanted (recommended, especially for complex geometries such as curved structures)
- Click on **CONVERT**. A “save file” dialog box opens. Enter an output filename or keep the predefined filename. When the conversion is done, the output image is displayed in the image viewer on the right side of the window

LOAD FILE

Load GDS, OAS, DXF or CIF...

DEL 1 aout 2014.gds

GDS dimensions (mm): 5,91 x 5,61

Drawing unit: mm

RESOLUTION AND SIZE

Critical dimension: 41 µm (obj: x0.5)

Objective to load: x0.5

Expected bitmap size (px): 840 x 690

Number of exposure required: 9

Smart Print resolution (px): 1920 x 1080

☒ High resolution

-ΔX (px): 1640 - + -ΔY (px): 850 - +

CONVERT TO BITMAP

☒ Antialiasing strength: 2 - +

CONVERT

Status: saveable in specific stitch format

Figure 5 – Vector drawing conversion module – left panel

↕

🖼️

LAYER SELECTION

2/0

3/0

4/0

5/0

6/0

SMART CUT

Adjust slicing grid (G)

Reset custom grid

Figure 6 - Layer panel (moveable)



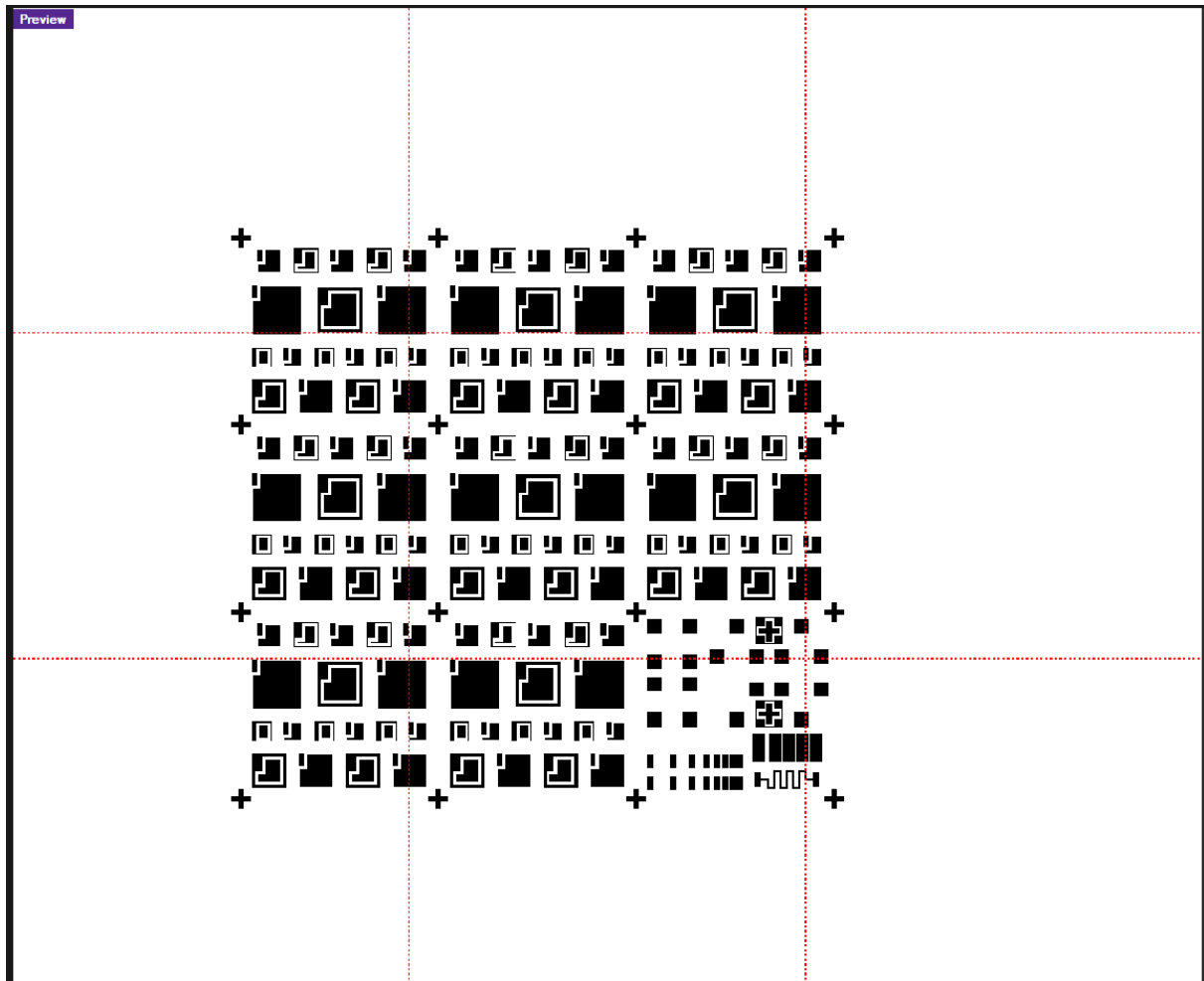


Figure 7 - Example of conversion preview with slicing grid

NOTE about the output format « .png » and « .stitch »:

- If the size of the output image is big (default values: > 10 Mpx or > 2.5 Mpx with antialiasing), « .stitch » will be the output format instead of « .png ». Those limit values can be set in the **settings**.
- Converting in « .stitch » is recommended, especially for big drawings as it records useful design information that will make the lithography simpler.
- If the state before conversion is *saveable as png*, the treatment takes only few tens of seconds. In the case of *saveable in specific stitch format*, the operation can take from few seconds to several minutes depending of the size of the output image.

## CUSTOM SLICING OF THE DESIGN

**Re-positioning.** Sometimes, the slicing grid crosses key patterns on the design. In that case, it can be useful to manually re-position and/or resize the slicing grid. To do so, click on **Adjust slicing grid** in the layer panel (Figure 6) or press G on the keyboard to enable the smart cut mode. The slicing grid is now handled with the mouse. Once the slicing grid is re-positioned at the desired location, click to validate the change and leave the Smart Cut mode.

**Re-scaling.** To adjust the grid size during Smart Cut mode, use the keyboard shortcut described in Figure 8 :

- X and Shift + X to respectively reduce and increase the grid width
  - Y and Shift + Y to respectively reduce and increase the grid height
  - To adjust the width and height faster hold Ctrl when pressing the above key combinations
- The re-scaling operation corresponds in a high-resolution parameter adjustment.

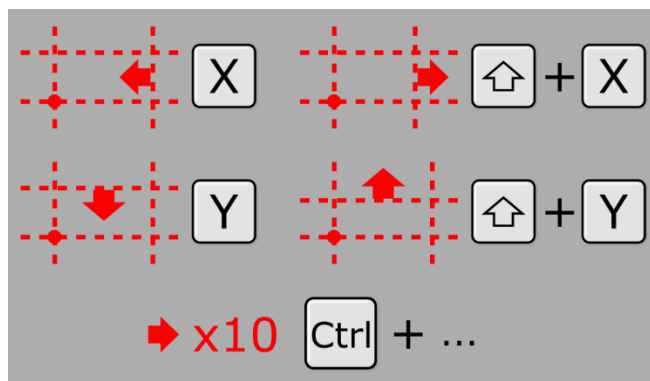


Figure 8 - Smart Cut re-scaling instructions

## VIEW A STITCH FILE

SFTconverter can be used as a stitch file viewer. To load a stitch file click on **Open .stitch file....**

## 5 SETTINGS

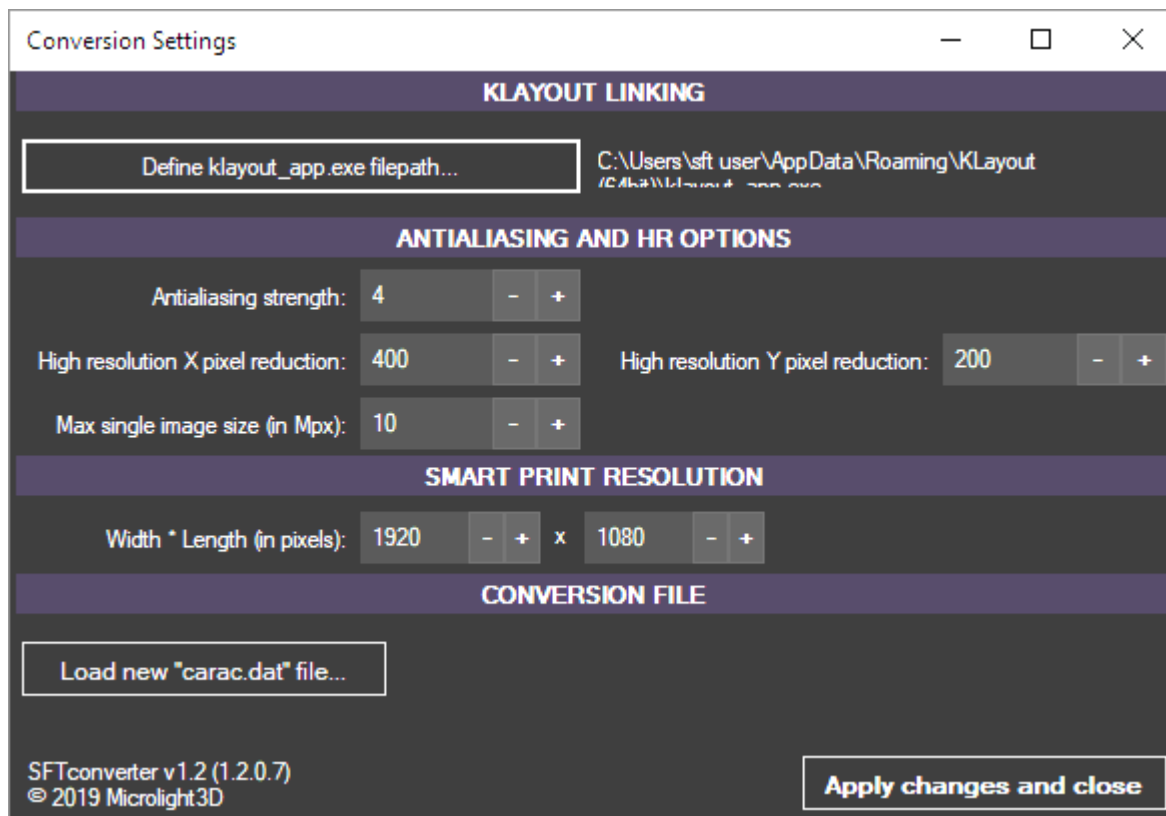


Figure 9 - Setting window

## KLAYOUT LINKING

The application use a third-party open source software (KLayout). To link SFTconverter and KLayout, click on **Define klayout\_app.exe filepath** and select the file *klayout\_app.exe* in the main directory of KLayout.

## ANTIALIASING AND HR OPTIONS

**Antialiasing strength:** allow to adjust the precision of the antialiasing treatment when the option is checked. The higher the value the better the antialiasing is but the conversion will last longer. Recommended range of value is from 2 to 6.

**Max single image size:** when the conversion output image is very big, the conversion module use a file specific format « .stitch » instead of rendering a standard png bitmap. The limit from .png to .stitch output is defined by this parameter (default value = 10 Mpx).

**High resolution X/Y pixel reduction:** when the high-resolution option is checked during a conversion, a stitch image is created with reduced sub-image size compared to the standard resolution (1920x1080) in order to lower to optical geometrical aberration effects. Those parameters allow to adjust the sub-image size reduction

## SMART PRINT RESOLUTION

Define the size (width and height) of the pixel array of the Smart Print projection head.

## CONVERSION FILE

Allows to use a configuration file specific to a defined Smart Print (Size fidelity improved).

## 6 TROUBLESHOOTING

Issue	Possible cause	Fixes
The calculated dimensions of the vector drawing do not correspond to the real values	The dimensions calculated by KLayout had not be taken account by SFTprint (latency problems)	Reload the drawing in the conversion module (button <b>Load gds, dxf, oas, cif</b> )
The output image is blank	<ul style="list-style-type: none"> <li>• Dimension error (refer to the problem above)</li> <li>• The vector file is corrupted or contains unknown elements to KLayout</li> </ul>	Open the vector file in KLayout and check the drawing then save it in .gds from KLayout. If KLayout cannot displays some patterns it means the file is probably damaged. If so, try to save it again from the software used for its creation

A grid is visible on the output image. The patterns are not filled or not black	KLayout is not correctly configured	Follow the Klayout installation instruction above
Conversion failed No conversion	<ul style="list-style-type: none"> <li>• The vector file is corrupted or contains unknown elements to KLayout</li> <li>• KLayout is not correctly installed/configured</li> </ul>	Refer to issue n°2 of that table. If the issue is not fixed, follow the instructions above