CUMEC CSiN300 KLayout Manual

CUMEC PDK GROUP

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Document Level: (For Engineering & Quality Document)

☑ Level 1 - Manual ☐ Level 2 – Procedure/SPEC/Report ☐ Level 3 - Operation Instruction

Security Level:

☑ Security 1 - Confidential ☐ Security 2 - Restricted ☐ Security 3 - Internal

Document Change History

Doc. Rev.	Tech Dev. Rev.	Effective Date	Author	Change Description
1.0.0	1.0.0	2021-04-19	PDK Group	Initiate

Title: CUMEC CSiN300 KLayout Manual

1 Purpose:

This document provides readers how to install CUMEC CSiN300 Process Design Kits (PDKs) on KLayout platforms and draw a *.gds layout based on the CUMEC CSiN300 PDK - KLayout. This document also provides the CUMEC CSiN300 – KLayout Functions built on the open source software – KLayout open source package – SiEPIC. The usage of other functions integrated on SiEPIC tools can be found via https://github.com/lukasc-ubc/SiEPIC-Tools.

2 Scope:

- The intended audience for this document is: CUMEC CSiN300 PDK - KLayout users.
- The CUMEC CSiN300 PDK – KLayout Functions include: Fixed Cells, Parameterized Cells (PCells) and path-to-waveguide.
- To use the CSiN300 PDK - KLayout, the support of software environments and configurations are needed.
- **Note:** this document only provides how to use Fixed Cells and PCells, please check the CUMEC Technology Handbook for more details.

3 Requirements:

- Software Requirements:

Item	Recommended Specification
OS	Microsoft Windows 10 (64 bit)
KLayout	0.26.4 (Windows platform 64 bit, recommended)
SiEPIC Tools	0.3.62 (recommended)
Python	3.7.3 (Windows x86-64, recommended)

- **Note:** the CUMEC CSiN300 PDK are developed on KLayout 0.26.4 and SiEPIC Tools 0.3.62. Users should carefully check the version of software and packages, otherwise the CUMEC CSiN300 PDK could not work correctly.

4 Nomenclature: NA

5 Reference: NA

6 Responsibility: CUMEC PDK Group

7 Introduction of CUMEC CSiN300 PDK - KLayout

7.1 Installation of CUMEC CSiN300 PDK in KLayout

7.1.1 Purpose

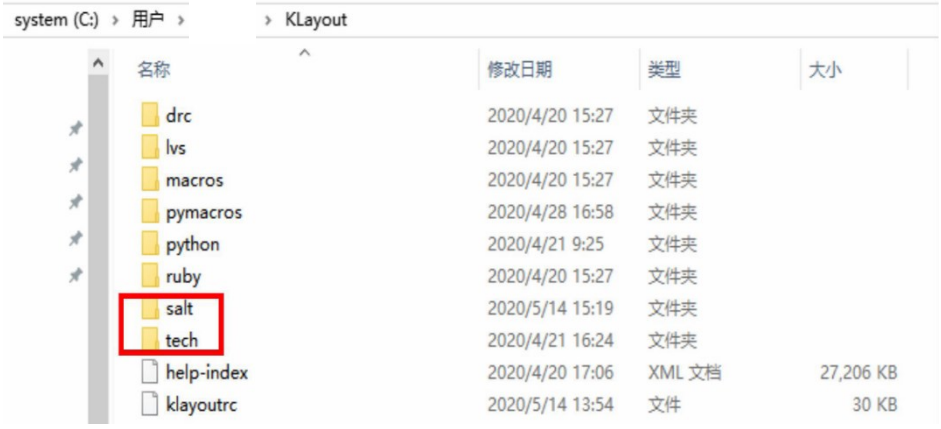
This part helps users install <CUMEC CSiN300 PDK KLayout> in KLayout. Before the installation, users should know that the PDK is established on the open source software KLayout and its open source package SiEPIC Tools. If users have already installed the SiEPIC Tools, there is no need to install them. Just make sure the version is correct.

The <CUMEC CSiN300 PDK KLayout> contains the following two folders: <salt> and <tech>. The <salt> folder contains the SiEPIC Tools (0.3.62) and its dependent packages 'Python packages for KLayout 1.1' and 'Windows Python packages for KLayout 1.1'. Users could copy these files or install these packages in KLayout through 'Tools - Manage Packages'. The <tech> folder contains the <CUMEC_CSiN300> folder.

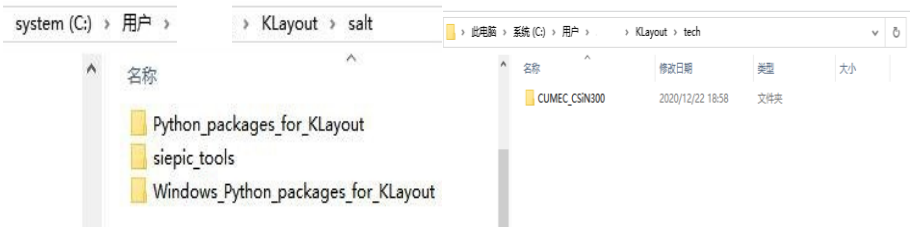
7.1.2 Guides

Follow the instructions of installation of KLayout and install KLayout under "C:\" (recommend).

The CUMEC CSiN300 PDK KLayout contains the following folders: <salt> and <tech>. Copy the two files to the 'C:\User\local_user_name\klayout\'. If these two folders don't exist, try to create these folders yourselves.



The contents of <salt> and <tech> folders contain the following folders.



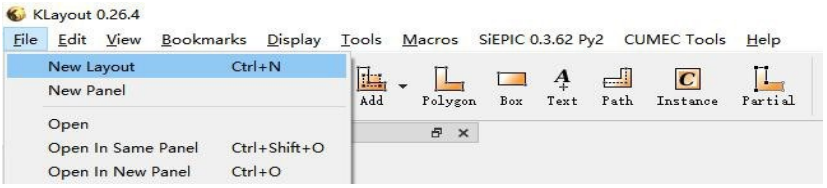
7.2 **Fixed Cells**

7.2.1 Purpose

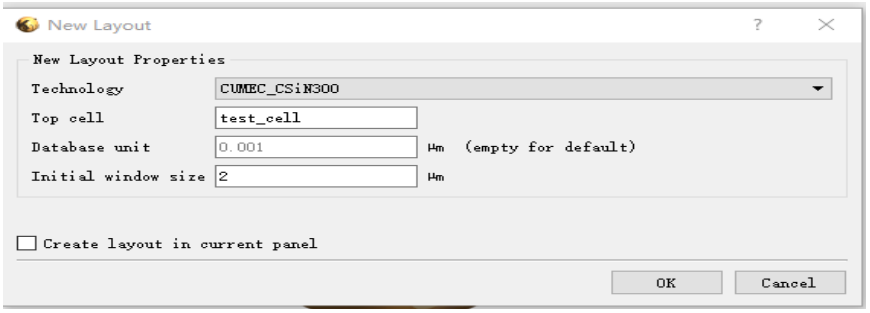
The CUMEC CSiN300 PDK - KLayout contains a series of Fixed Cells for users to draw devices. Some of the Fixed Cells are provided in a black box way. The behavior properties of the Fixed Cells can be found in the device list of the Handbook. For the CUMEC CSiN300 PDK users, the Fixed Cells can be directly used and the performances are guaranteed.

7.2.2 Guides

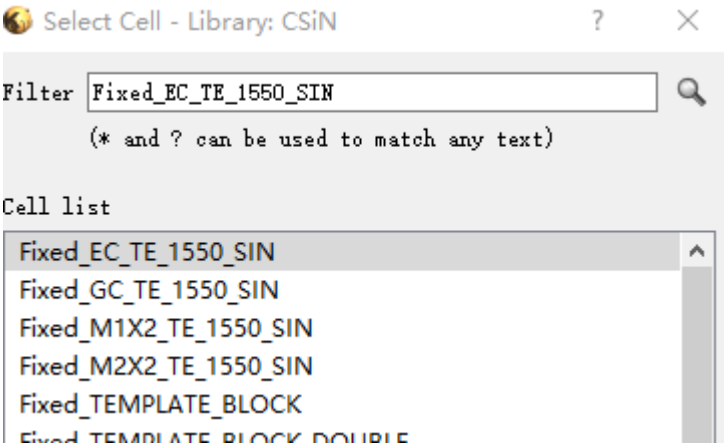
Run KLayout (Editor) in edit mode. Click File and New Layout to create a new layout



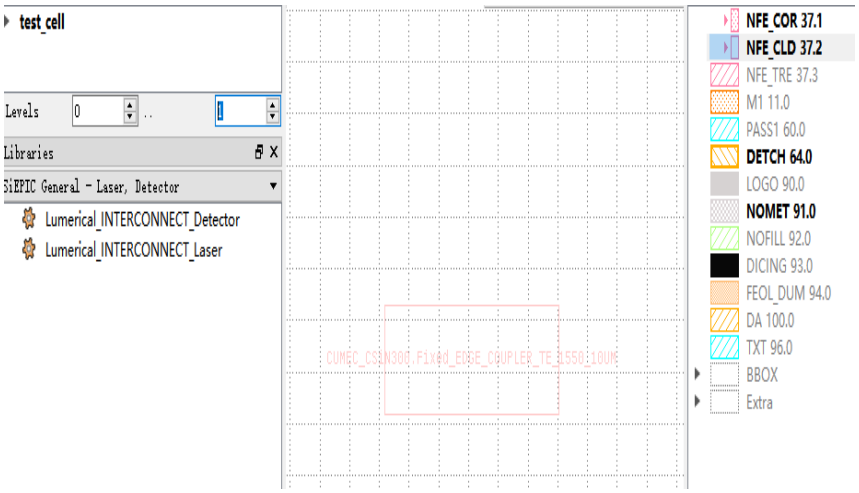
Select Technology: CUMEC_CSiN300, input topcell name with test_cell and press OK



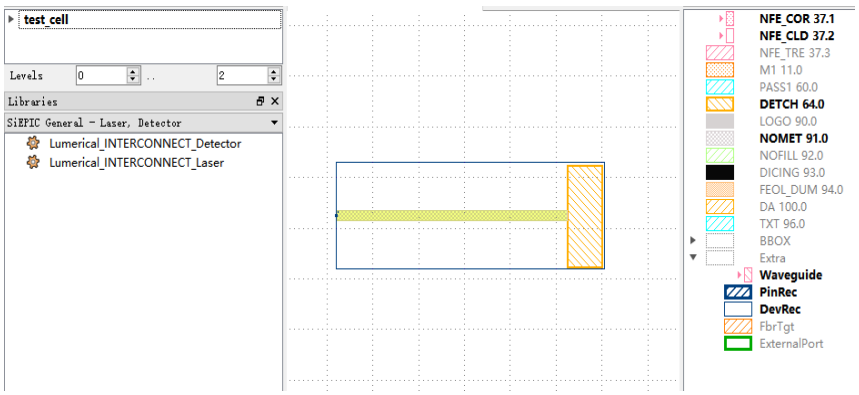
Press Instance and select Cell “Fixed_EC_TE_1550_SIN” and press OK



Left click somewhere in the white panel. Press “ESC” and hot key “F” on your keyboard



Left click “Levels” until the layout image appears Now the EC_TE_1550_SIN layout is generated



7.3 **Parameterized Cells (PCells)**

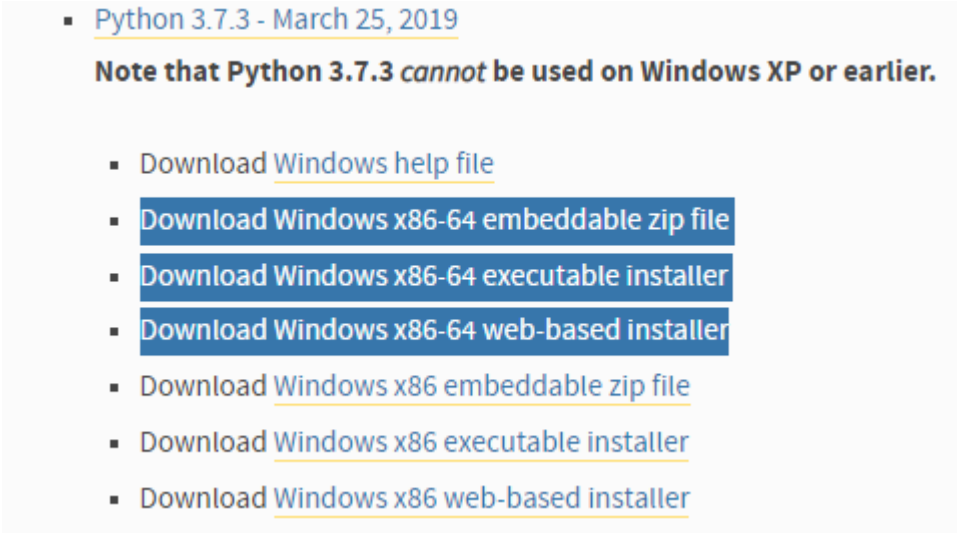
7.3.1 Purpose

The CUMEC CSiN300 PDK - KLayout contains a series of predefined parameterized cells (PCells) for users to draw devices in a flexible way. It's important to note that the parameters only describe the properties of layout model, but not the properties of circuit model, i.e. users should calculate the performances of defined PCells manually. And users should pay much attention to modify the parameters, or the layout could not be generated correctly in some cases. For more details of PCells, please check the <Technology Handbook>.

To run these PCells, a third-party Python is needed. Users could follow three steps for the correct configurations: 1. download and install Python (3.7.3, recommended); 2. configure the Python path and PCell path through 'CUMEC Tools SIN - PDK Configuration '; 3. use these PCells. It's important to note that users only need to configure step 2 once, and When KLayout starts, the relevant configuration will be automatically loaded.

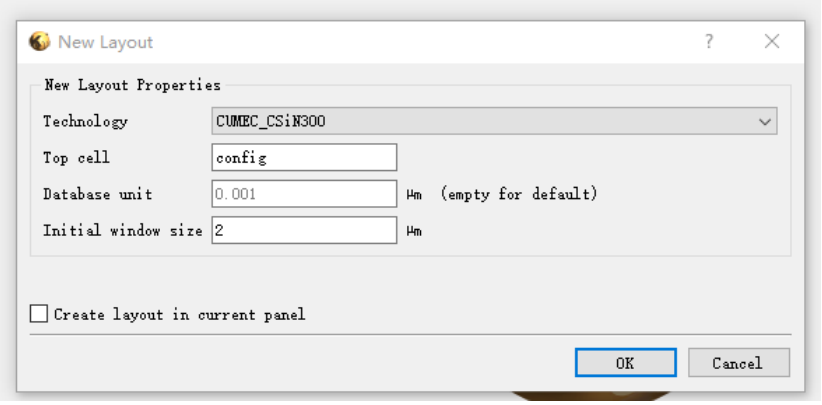
7.3.2 Guides for Step 1 - download and install Python

Users could download and install Python through:
https://www.python.org/downloads/windows/
A version of 3.7.3 x86-64 is recommended.

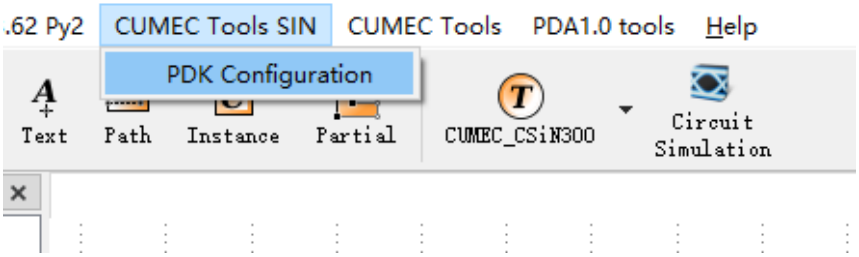


7.3.3 Guides for Step 2 - Configure Python and PCell path

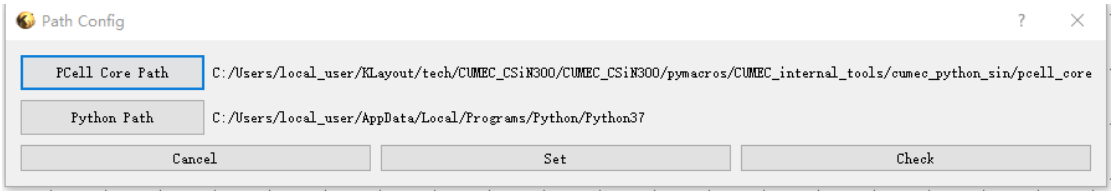
Open KLayout and select Technology ‘CUMEC_CSIN300’ and Press OK



Click ‘CUMEC Tools SIN - PDK Configuration’ from the main menu



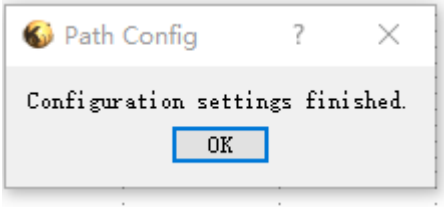
Click ‘CUMEC Tools SIN - PDK Configuration’ from the main menu



Click ‘PCell Core Path’ to select the specified folder as shown above

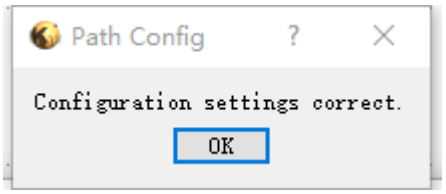
Click ‘Python Path’ to select the Python you installed before

Then Click button ‘Set’



And Click button ‘Check’

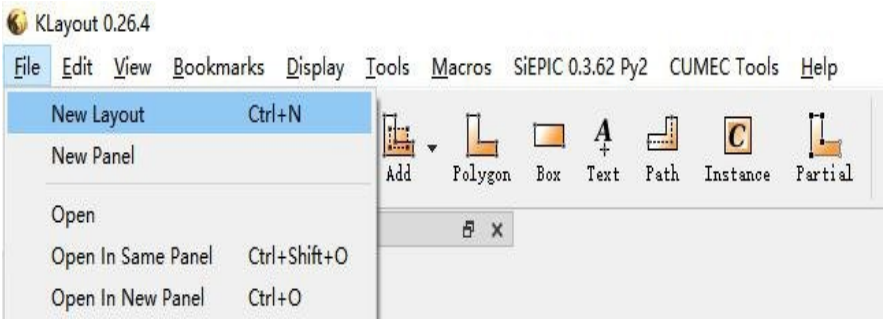
If both Paths are correct, the dialog box should be



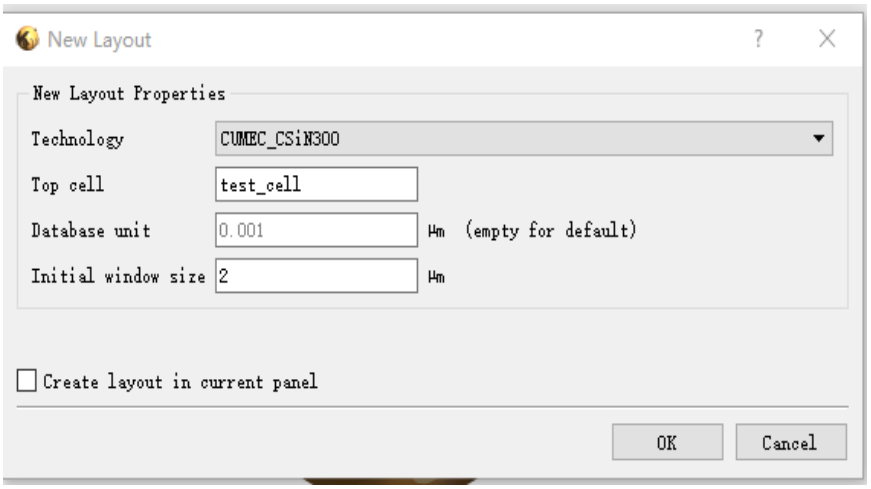
Restart the KLayout to make these settings take effect

7.3.4 Guides for Step 3 - Use PCells

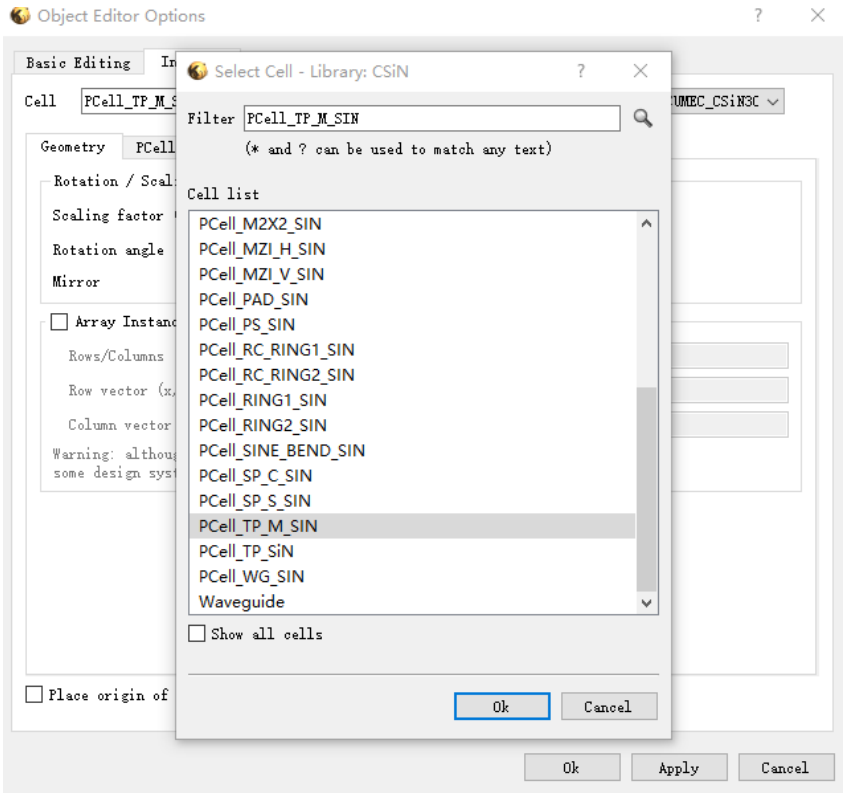
Run KLayout (Editor) in edit mode and Click File and New Layout to create a new layout.



Select Technology: CUMEC_CSiN300, Technology: CUMEC_CSiN300, Input “topcell name”: test_cell Press OK.

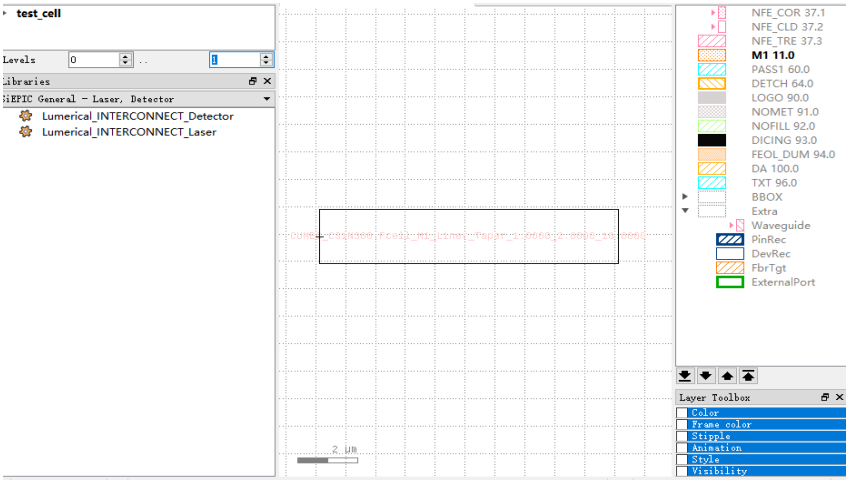


Press Instance and select Cell PCell_TP_M_SIN”, then press OK.

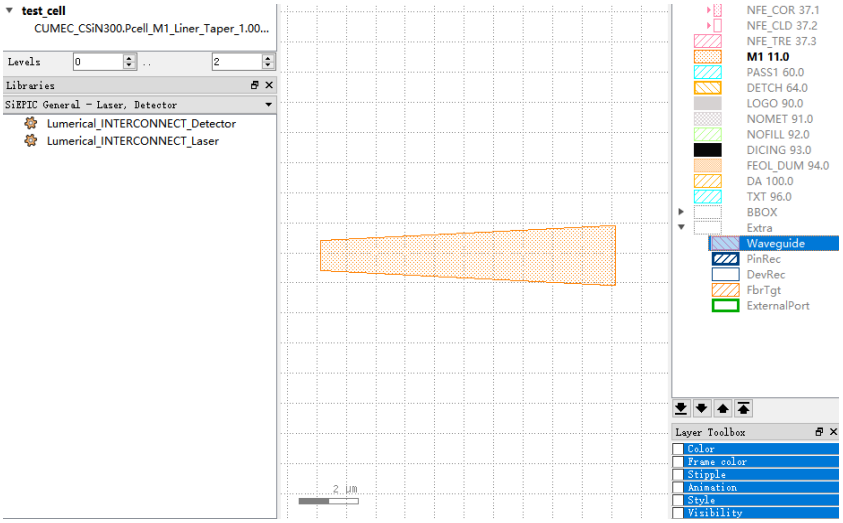


Wait for several seconds according to the pcell you selected.

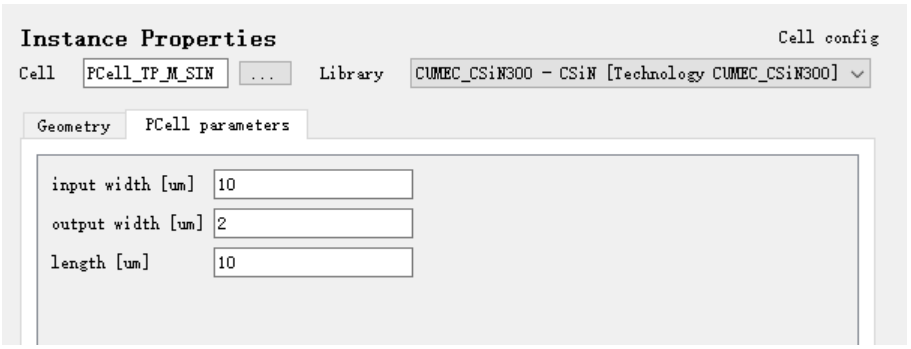
Left click somewhere in the white panel. Press “ESC” and hot key “F” on your keyboard.



Left click “Levels” until the layout image appears Now the M1_Linear_Taper layout is generated.



Double click somewhere in the PCell_TP_M_SIN layout. Modify the “input width [um]” by 10, Press OK and wait for layout generation.



7.4 **Path to Waveguide**

7.4.1 Purpose

The CUMEC CSiN300 PDK - KLayout contains a special function: path to waveguide. This function helps designers quickly draw the connected waveguides between two optical ports from different devices manually and provides automatic ports alignment. The waveguide types are also pre-defined. It should be noted that this function only works on devices with special labels such as CUMEC CSiN300 Fixed cells and PCell devices. Generally, this function does not support user-designed devices.

Table1. CUMEC Pre-designed Waveguide Type

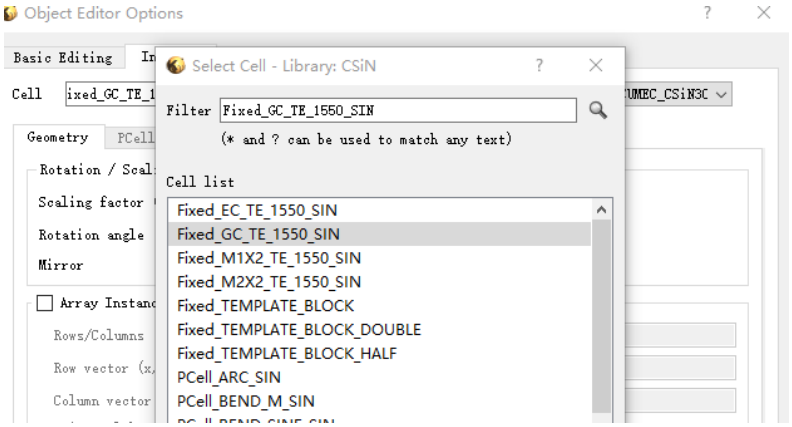
Waveguide Type	Specification
Strip	SWG1000_CTE R50
Strip	SWG1000_CTE R100

7.4.2 Guides

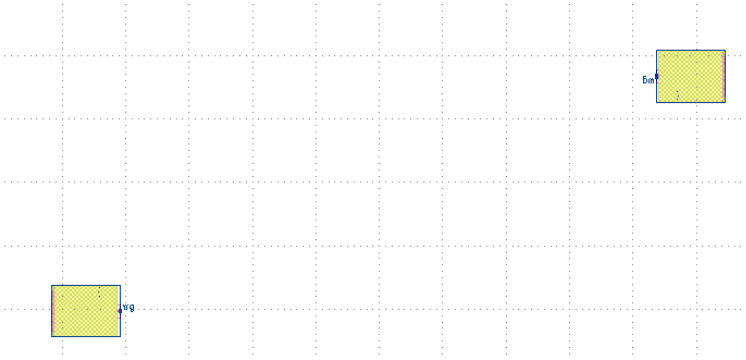
Open a new layout and select technology “CUMEC_CSiN300”

Enter topcell name “test_pathtowg”

Select Fixed_GC_TE_1550_SIN from “Instance”



Repeat the above steps to add another grating

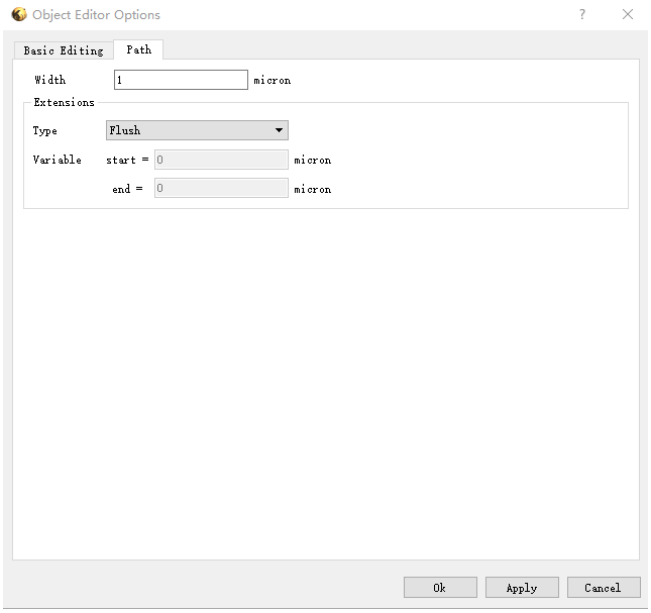


Click somewhere in the white panel set the “Levels” to 3.

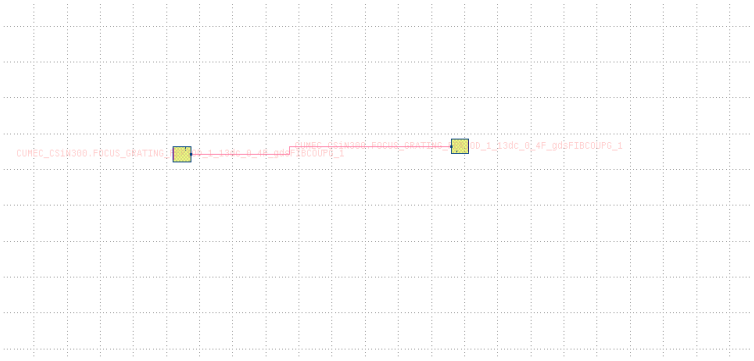
Click Layers “NFE_COR 37.1” or any other layers.

Press “Path” or hot key “P”.

Select Type “Flush” Press OK.

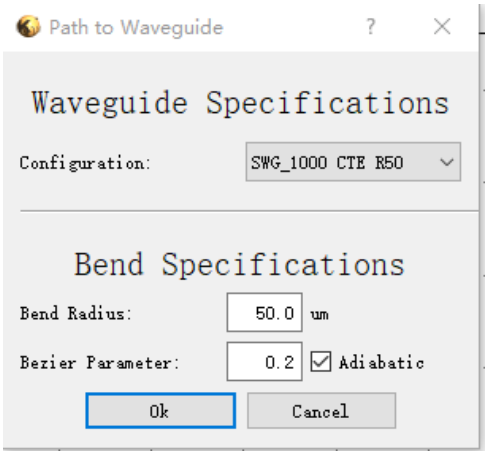


Draw a path near the two top ports of two Gratings.

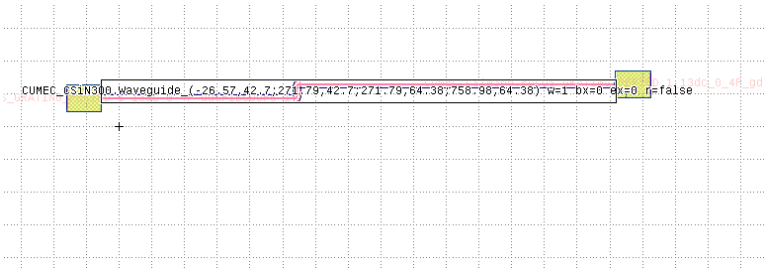


Single click the path to make it selected and Press hot key “W” or “2”

Change configuration to “SWG_1000 CTE R50” and Press OK



Automatically generate one waveguide



Note: Please pay attention to modify the “Bend Specifications” to avoid generating waveguides that violate design rules check (DRC)