KiCad StepUp tools cheat sheet

1) What StepUp tools are for?

KiCad StepUp tools are a FreeCAD Macro and a FreeCAD WorkBench to help in **Mechanical Collaboration** between KiCad EDA and a Mechanical CAD.
With StepUp it is possible to:
- **load kicad board and parts in FreeCAD and export it to STEP (or IGES)** for a full ECAD MCAD collaboration
- **load** *kicad_mod* **footprint in FreeCAD to easy and precisely align the mechanical model** to kicad footprint
- **convert the STEP 3D model of parts, board, enclosure to VRML with Materials properties** for the best use in kicad
- **check interference and collisions for enclosure and footprint design**
- **design a new pcb Edge with FreeCAD Sketcher and PUSH it to an existing kicad_pcb Board**
- **PULL a pcb Edge from a kicad_pcb Board, edit it in FC Sketcher and PUSH it back to kicad**
- **generate Blender compatible VRML files**

2) Requirements

KiCad StepUp tools need with the following requirements:
- **KiCad Stable Release >= 4.0** or kicad **Nightly Development Builds**
- **FreeCAD** stable release **0.15 4671** or release **0.16 >=6712** or even better **0.17 >=11707**
- a library of STEP 3D models now available as default from KiCad/packages3D

3) How to install StepUp tools

KiCad StepUp tools can be installed as a **FreeCAD Macro** following this How to install FC Macros
Just copy the **kicad-StepUp-tools.FCMacro** file and the **kicad-StepUp-icon.svg** to the FreeCAD Macro folder. The suggested use is through Customize Toolbars and placing the Macro in the **Global Toolbar** of FreeCAD.
KiCad StepUp tools can be also be installed as a **FreeCAD WorkBench** following these instructions:
Simple copy the **kicadStepUpMod** folder to the FreeCAD Mod folder.
If KiCad StepUp tools are installed as a FC WorkBench, then **it will be possible to Open directly from the FC File Menu a** *kicad_pcb* **board file or a** *kicad_mod* **footprint file**.
Recently KiCad StepUp tools have been added to FC WorkBenches, so they can can be installed through the FreeCAD addons installer or starting from FC version 0.17, through the addons manager in the FC Tools Menu. Then StepUp buttons will be available to be customized in FC Toolbars.

4) Configure StepUp tools

To use StepUp tools for converting a *kicad_pcb* Board to a mechanical STEP model you just need to **edit** '*ksu-config.ini*' 3D prefix path assigning it to your **KISYS3DMOD** value,
 'ksu-config.ini' file is in *%Homepath%* (Win) or *$HOME* (OSX & Linux) folder.

```
[prefix3D]
prefix3d_1 = C:\Program Files\KiCad\share\kicad\modules\packages3d\
```

In case of any problem, just delete ksu-config.ini file and restart kicad StepUp tools… a new ini file will be generated; edit then your 3D prefix and re-run the tools

5) Tips

Tips to use StepUp tools at its best
- never use a scale different from 1:1:1 in your 3D models
- configure your [prefix3D] in ksu-config.ini to your KISYS3DMOD path
- use STEP or IGES or VRML or mixed type of models in your board
- use bounding boxes to reduce your STEP board file size if required
- each 3D model must be be a single object (union of parts or compound in FC)
  note: compound may be slower than union, because it needs to re-create a compound after loading the model

6) Useful Video Tutorials ▶

Here some links of StepUp tutorial:
- StepUp: Align Parts to Kicad footprint
- StepUp: converting a KiCad board and Parts to STEP
- StepUp: PUSH & PULL a PCB Edge using FC Sketcher
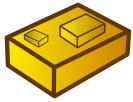There is also a video tutorial made by a user:
- StepUp: Installing, Import 3D model, Exporting the Board
Note: in the video the user is copying all demo files, when in fact it is only needed *kicad-StepUp-tools.FCMacro* file.
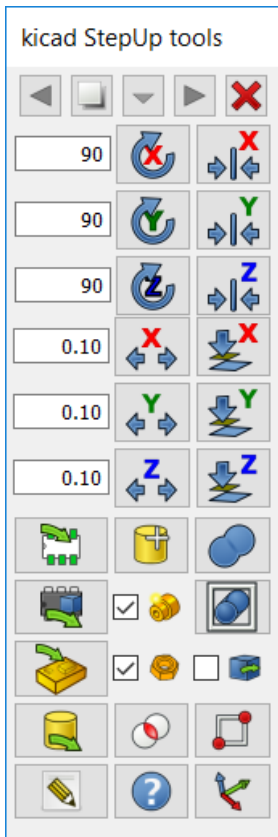
7) Need Help?

KiCad info forum is a great resource:
https://forum.kicad.info/search?q=step

KiCad StepUp tools cheat sheet
https://sourceforge.net/projects/kicadstepup/

The Gui

A brief recap on KiCad StepUp tools buttons.
Note: each button has a Tooltip

kicad StepUp tools

Load 'kicad_pcb' Board
Load a 'kicad_pcb' file into FreeCAD

Import 3D model to be Aligned
Import a 3D STEP model into FreeCAD

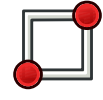**Load 'kicad_mod' Footprint**
Load a 'kicad_mod' footprint into FreeCAD

Export 3D model Aligned
Export a 3D STEP & VRML model back to KiCad

Export selected to STEP
Export selected objects or Board and Parts to hierarchical STEP file

Push & Pull PCB Edge
Read and Write pcb Edge from KiCad into FC Sketcher

Add Reference Axis
Add reference Axis to the FreeCAD design

Check Interferences and Collisions
Check Interference and Collisions in Board Design
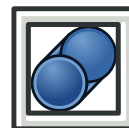
Help
Mini Help inside StepUp tools

Make a Union
Make a Union of Parts

Config Editor
showing the 'ksu-config.ini' content

Make a Compound
Make a Compound of Parts

Option checkboxes

Materials properties
Adding Material to VRML when Exporting a 3D model

Virtual mechanical
Adding Virtual kicad Parts when Loading a 3D model of the PCB

export Board to STEP
Automatically export Board & Parts to STEP after Loading a 3D model of the PCB if checked

Useful Video Tutorials ▶

Here some links of StepUp tutorial:
- StepUp: Align Parts to Kicad footprint
- StepUp: converting a KiCad board and Parts to STEP
- StepUp: PUSH & PULL a PCB Edge using FC Sketcher
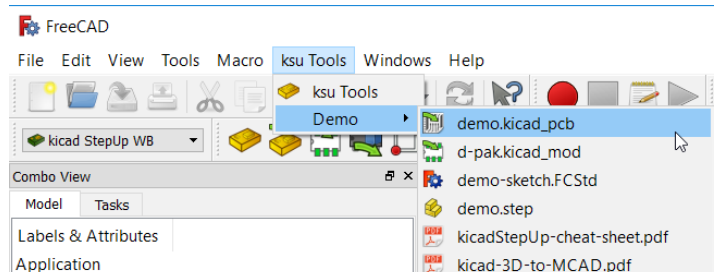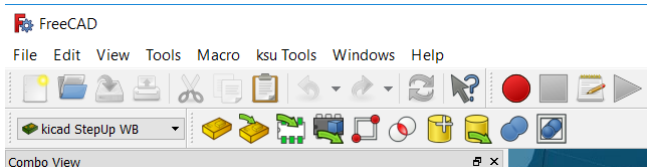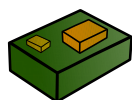
There is also a video tutorial made by a user:
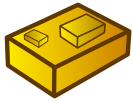- StepUp: Installing, Import 3D model, Exporting the Board

Note: in the video the user is copying all demo files, when in fact it is only needed *kicad-StepUp-tools.FCMacro* file.

The WorkBench

A screenshot on KiCad StepUp WB.
**Demo and Manuals in the StepUp WB Menu**

FreeCAD
File Edit View Tools Macro ksu Tools Windows Help

kicad StepUp WB
Combo View

FreeCAD
File Edit View Tools Macro ksu Tools Windows Help

ksu Tools
Demo ▶
kicad StepUp WB

Combo View
Model Tasks

Labels & Attributes
Application

demo.kicad_pcb
d-pak.kicad_mod
demo-sketch.FCStd
demo.step
kicadStepUp-cheat-sheet.pdf
kicad-3D-to-MCAD.pdf

KiCad StepUp tools cheat sheet

https://sourceforge.net/projects/kicadstepup/

StepUp WorkFlow for 3D models

How to create a 3D model library for KiCad with StepUp tools

Use StepUp tools to Load the Footprint in FC and Align it

3D-model
.FCStd

3D-model
.wrl

*KiCad
pcbnew
3d-viewer*

3D-model
.step

3D CONTENTCENTRAL

GRABCAD
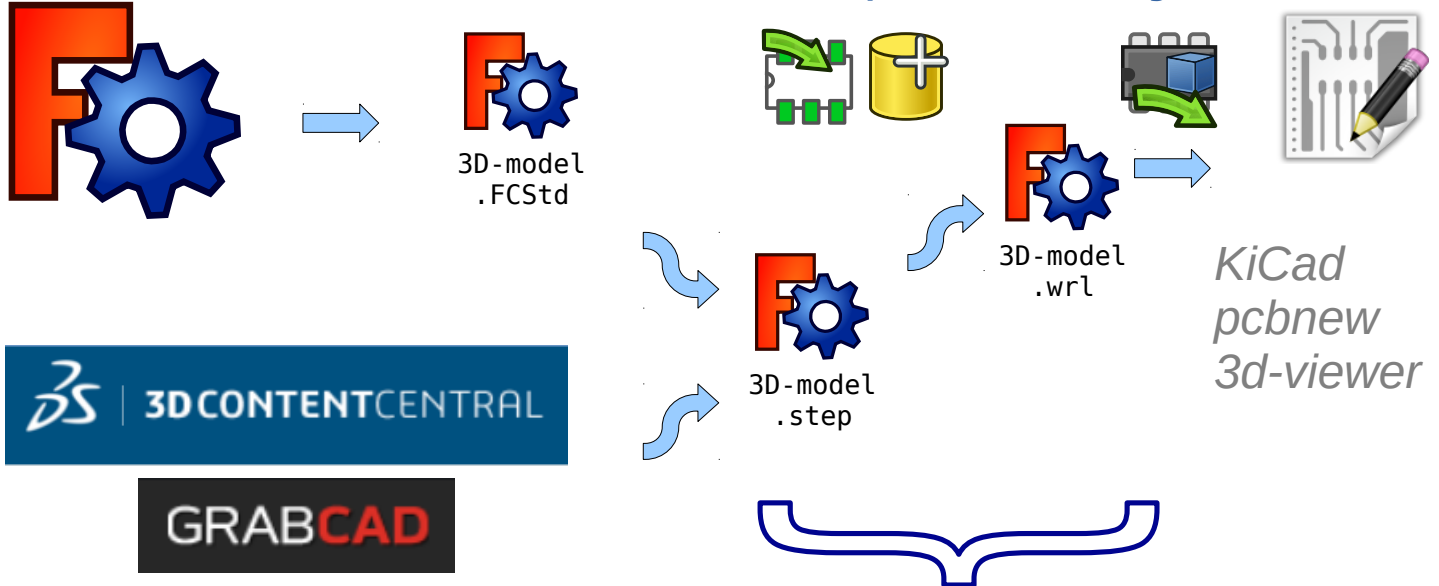
Use FreeCAD or any MCAD sw as 3D designer for a 3D model, or just download a 3D STEP model from on-line libraries

Place the exported models to the KISYS3DMOD folder

Note:
when aligning a 3D model to a kicad footprint,
StepUp takes care of:
- 2D footprint rotation of kicad for the footprint alignment
- vrml model *z* rotation
It is mandatory that the footprint has:
- *x* and *y* of the 3D model rotation set to 0
- x, y and z of the 3D model translation set to 0

The user has to check/modify, if needed, the part of 3D vrml/step model in kicad as following

```
(model path/name.wrl
(at (xyz 0 0 0))
(scale (xyz 1 1 1))
(rotate (xyz 0 0 0))
```
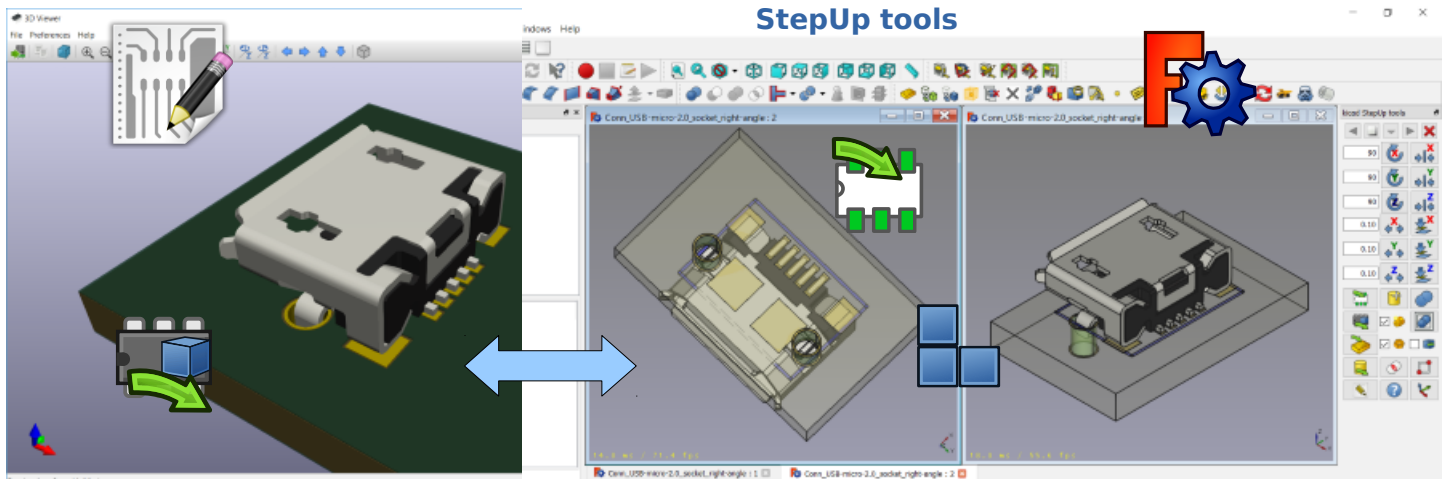
at (xyz 0 0 0) **is mandatory, as much as** scale (1 1 1)
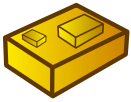rotate (xyz 0 0 z_value) **can have a z rotation value**

Use Assembly2 WB

to align the STEP model to footprint
Assembly2 WB

Video Tutorials ▶

Align Parts to Kicad footprint
Installing, Import 3D model, Exporting the Board

StepUp tools

KiCad StepUp tools cheat sheet

Generating smaller 3D model with bounding boxes

Sometimes the need would be just a 3D MCAD model for analysis or simple space constraints, so a nice detailed component models in MCAD system may be not required or desired;
in that case it is possible to configure the exporter to:
- skip 3D models by name
- skip models with a volume less than an assigned value
- skip models with a height less than an assigned value
And then convert the remaining parts, or all but edge connectors, to bounding boxes
The result 3D MCAD model will have the accuracy of the pcb and assemblies only when needed, maintaining the model light as required.

Configuration file: Blacklist & BoundingBox parameters
ksu-config.ini

[Blacklist]
;; put here your model names that you don't want to load (e.g. smallest ones)
;; separated by a comma (none means all the models will be parsed)
;; (volume=1 means all models with a volume < 1mm^3 will not be included)
;; (height=1 means all models with a height < 1mm will not be included)
;bklist = r_0603,r_0402,c_0402,c_0603
;bklist = height=1.0
;bklist = volume=1.0
;bklist = none
bklist = volume=1.0
[BoundingBox]
;; bounding box option list=>whitelist (not converted to bbox)
;bbox = list dpak-to252,sod80
;bbox = all
;bbox = off default
bbox = list SMA,USB,PushBtn,Header

KiCad StepUp: using bounding boxes for all but connectors and skipping small parts

KiCad StepUp tools cheat sheet

https://sourceforge.net/projects/kicadstepup/
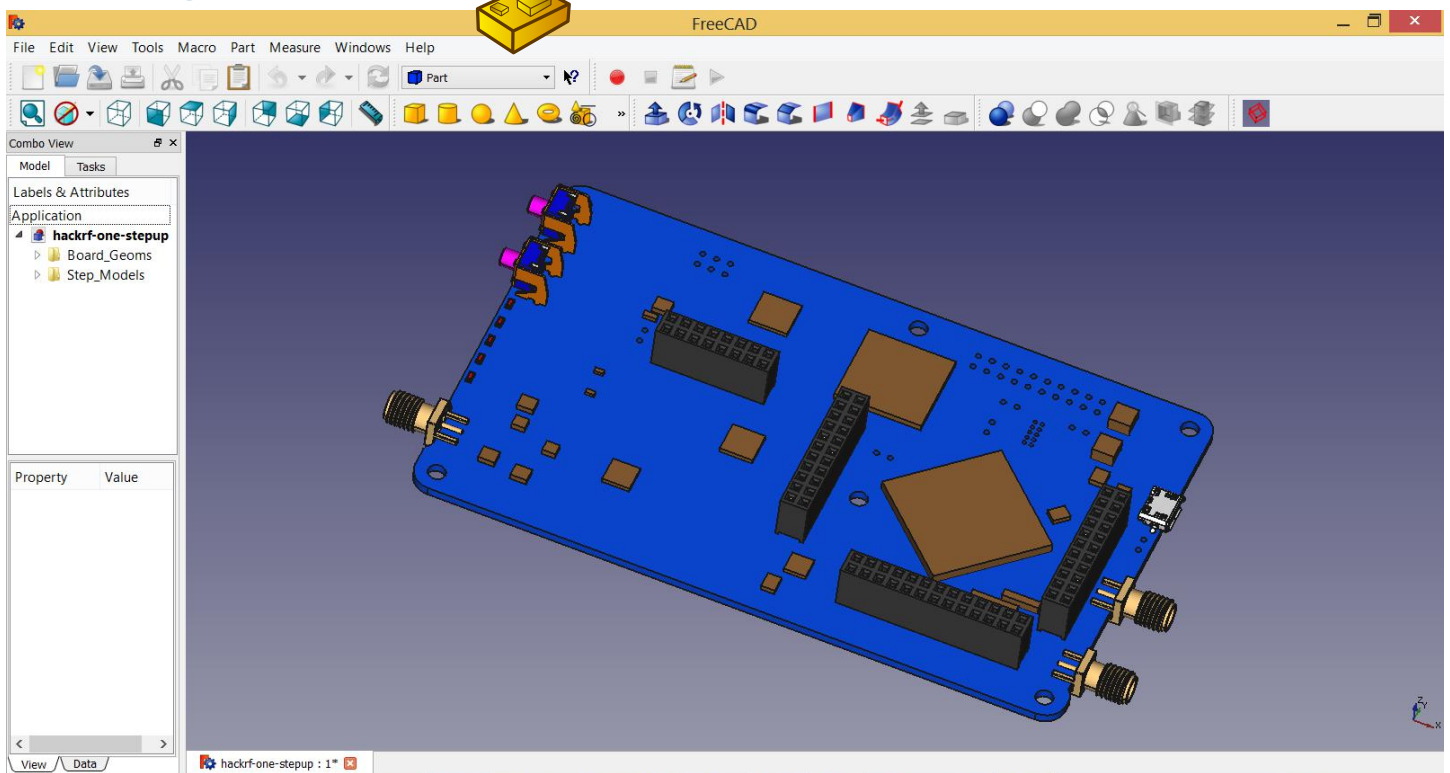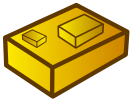
Check for Interference and mechanical constrains

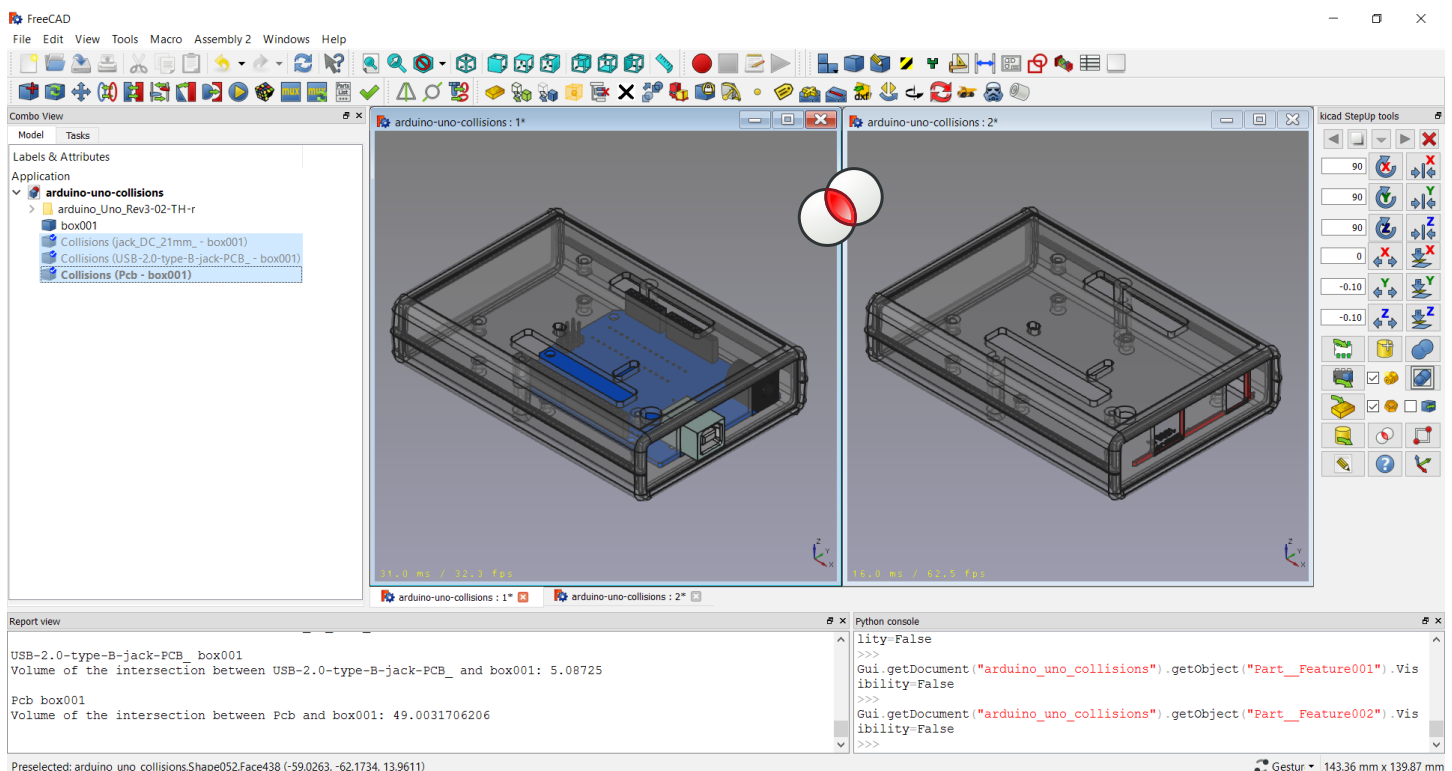With kicad-SteUp-tools it is also possible to detect collisions and check mechanical constrains:
- detect collisions among part pins and drills for footprints
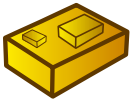- detect collisions for enclosure clearance (between pcb with parts/connectors and enclosure)

Interference checking for Footprints
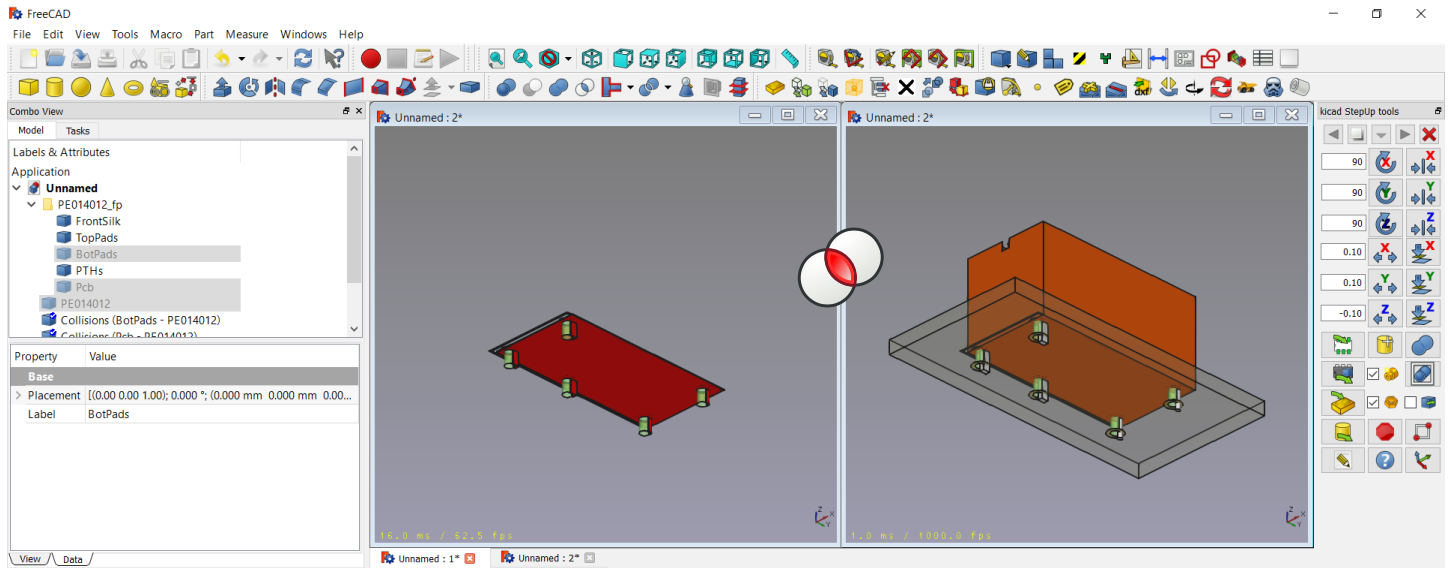

## Interference checking for PCB & Enclosure

StepUp: The Sketcher

With kicad-SteUp-tools it is also possible to use FreeCAD Sketcher to create or modify a PCB Edge.
- **-** create a new PCB Edge in FreeCAD Sketcher and PUSH it to kicad_pcb file
- **-** read a PCB Edge from an existing kicad_pcb file and PULL it to FreeCAD Sketcher
- **-** modify a PCB Edge in FreeCAD Sketcher and PUSH it to KiCad Board

Line, Circles, Arcs are supported and also **Bsplines or Ellipses** are supported and converted to KiCad compatible format
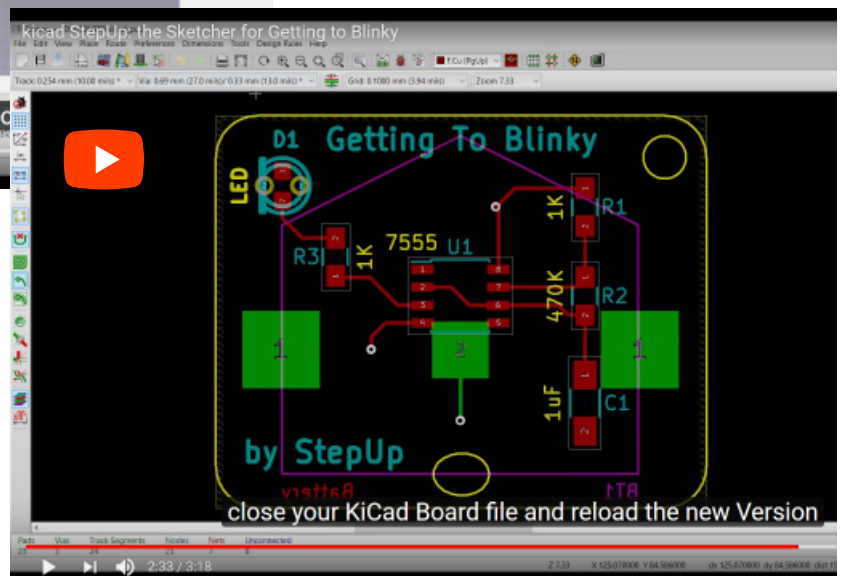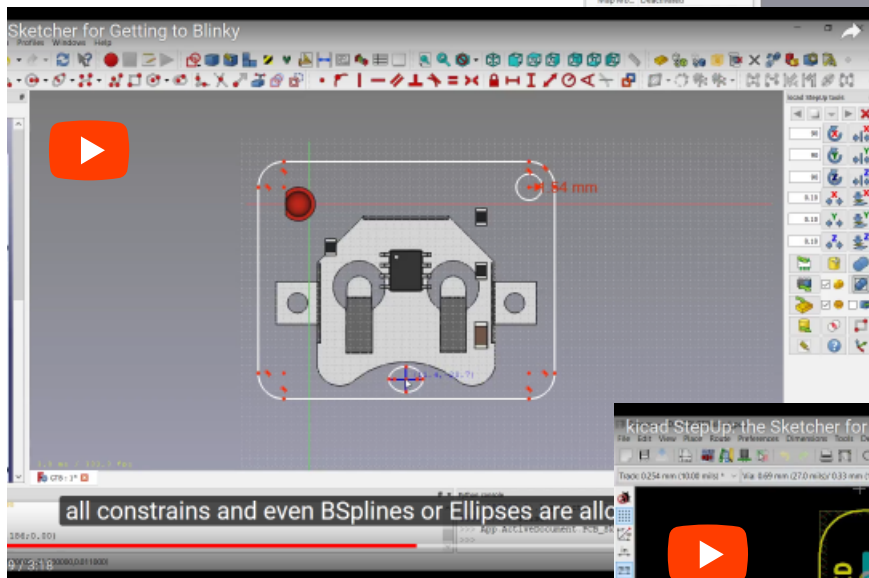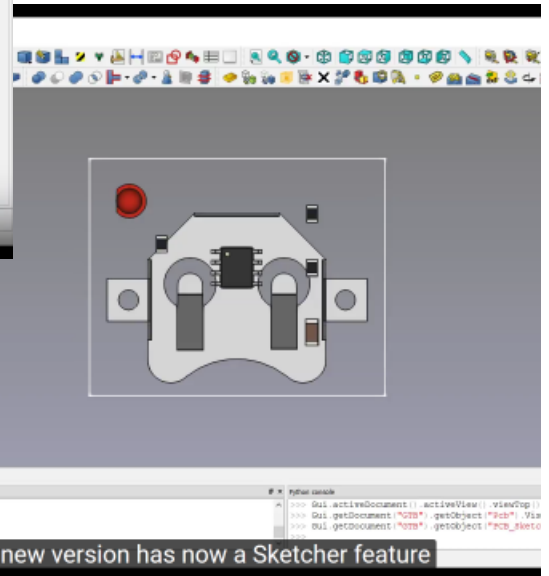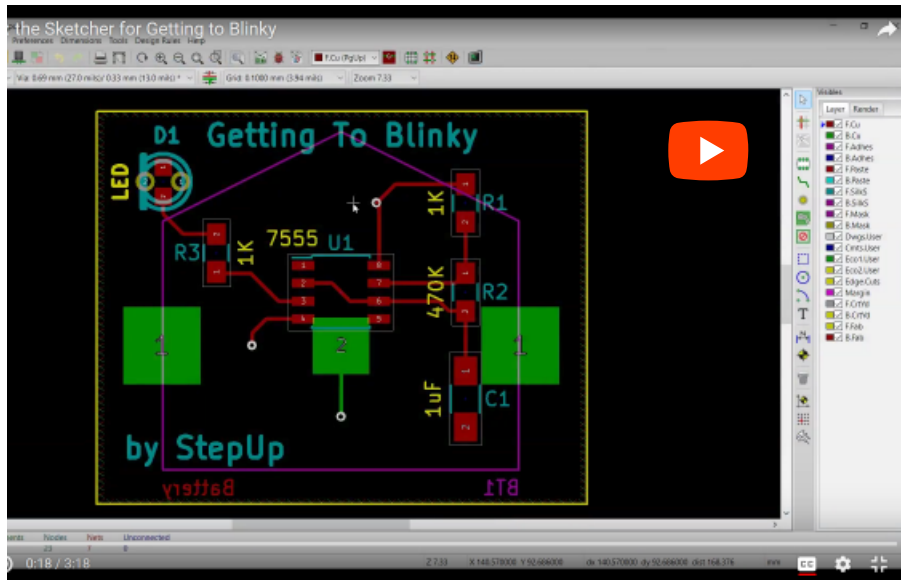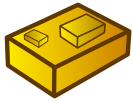

The Sketcher tutorial ▶

PUSH & PULL a PCB Edge using FC Sketcher

Tips

It is suggested to configure *'ksu-config.ini'* file to use **grid origin** and **place a grid origin** to **kicad_pcb** file

```
[Placement]
placement = usegridorigin
```
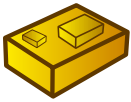
KiCad StepUp tools cheat sheet

Configuration file main parameters

ksu-config.ini

```
;utf-8 coded: do not edit this line
[info]
;; kicad stepup tools config file
;; each line starting with a semicolon is a comment
[prefix3D]
;; put here your kisys3dmod path or 3d model prefix path or 3d alias
;; only two prefixs are allowed; must finish with slash or backslash
prefix3d_1 = C:\Program Files\KiCad\share\kicad\modules\packages3d\
prefix3d_2 = D:\extra3Dpackages
[PcbColor]
;; pcb color r,g,b e.g. 0.0,0.5,0.0,light green
pcb_color = 0.0,0.5,0.0,light green
[Blacklist]
;; put here your model names that you don't want to load (e.g. smallest ones)
;; separated by a comma (none means all the models will be parsed)
;; (volume=1 means all models with a volume < 1mm³ will not be included)
;; (height=1 means all models with a height < 1mm  will not be included)
bklist = none
[BoundingBox]
;; bounding box option list=>whitelist (not converted to bbox)
;bbox = list dpak-to252,sod80
;bbox = all
;bbox = off default
bbox = off default
[Placement]
;; placement options
;placement options: useauxorigin, usebaseorigin, usebasepoint;x;y, usedefault, +autoadjust
placement = usegridorigin
[Virtual]
;; virtual modules to be or not added to board
virt = addVirtual
[ExportFuse]
;; fuse modules to board
;; be careful ... fusion can be heavy or generate fc crash with a lot of objects
;; please consider to use bbox or blacklist small objs
exportfusing = nofuse  #default
[minimum_drill_size]
;; minimum drill size to be processed in mm
;; set 0.0 to process all sizes
min_drill_size = 0.0
[export]
;; export to step
export_to_step = no
[Materials]
;; VRML models to be or not exported with material properties
mat = enablematerials
[compound]
;;allow compound for STEP models
compound = allowed
[sketch_constraints]
;;constraints generated for pcb sketch
constraints = all
```

KiCad StepUp tools cheat sheet

https://sourceforge.net/projects/kicadstepup/

StepUp Credits

kicad StepUp tools author is Maurice https://sourceforge.net/projects/kicadstepup/

IDF import for FreeCAD - Milos Koutny (milos.koutny@gmail.com)
CadQuery module - CadQuery FreeCAD module https://github.com/jmwright/cadquery-freecad-module/
hyOzd freecad macros - https://bitbucket.org/hyOzd/freecad-macros
FreeCAD-PCB - marmni <marmni@onet.eu26>
Kicad semantic parser - "Zheng, Lei" https://github.com/realthunder/fcad_pcb

Copyrights

Risk disclaimer

USE 3D CAD DATA AT YOUR OWN RISK
DO NOT RELY UPON ANY INFORMATION FOUND HERE WITHOUT INDEPENDENT VERIFICATION
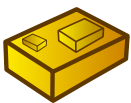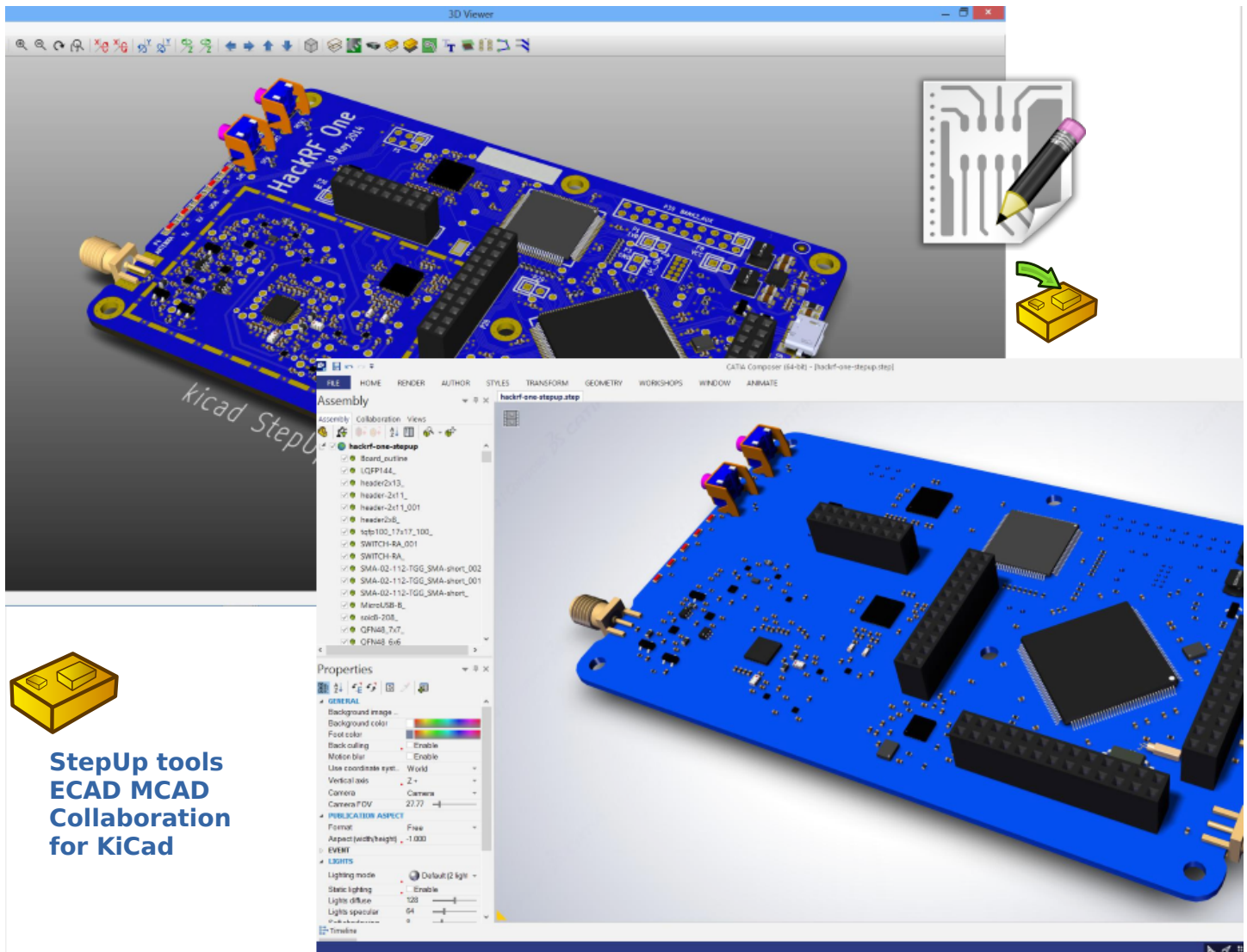
**StepUp tools
ECAD MCAD
Collaboration
for KiCad**