Karlsruhe Institute of Technology

FreeCAD based McCad

Simple User Mannual

Ver 0.1

Karlsruhe Institute of Technology

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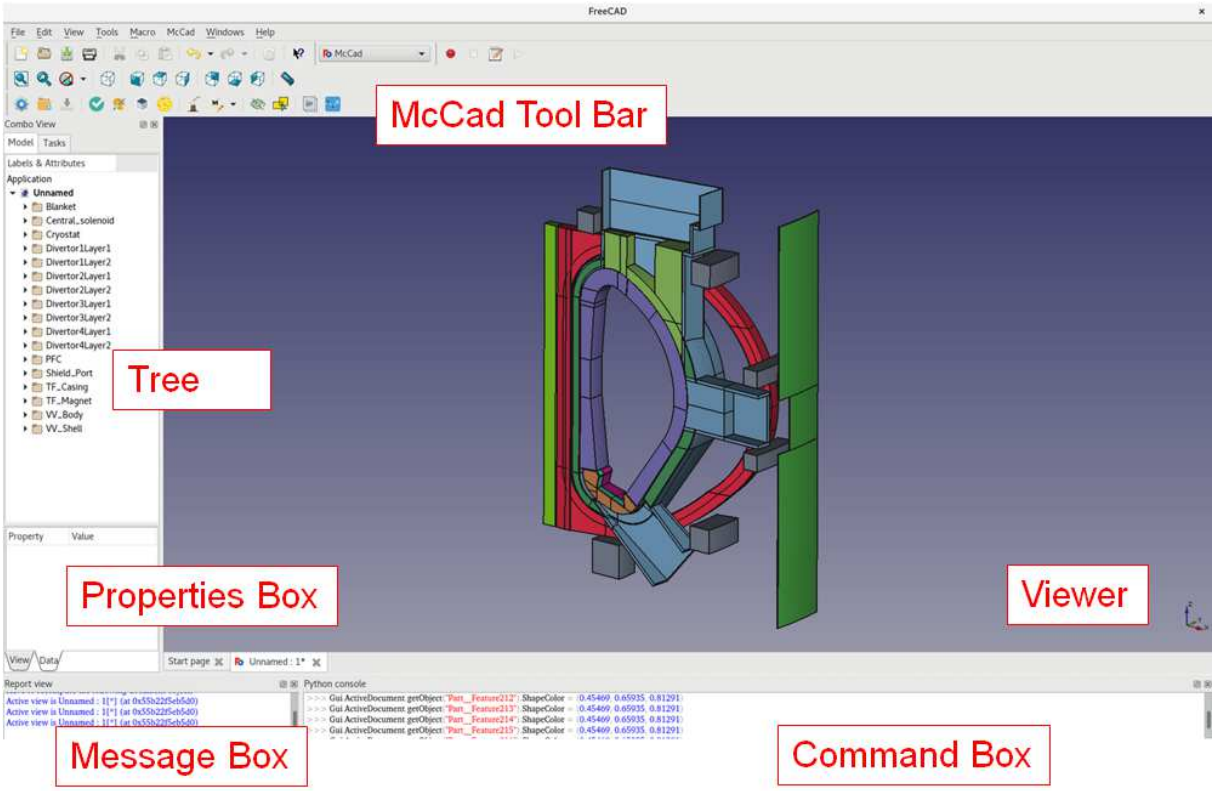
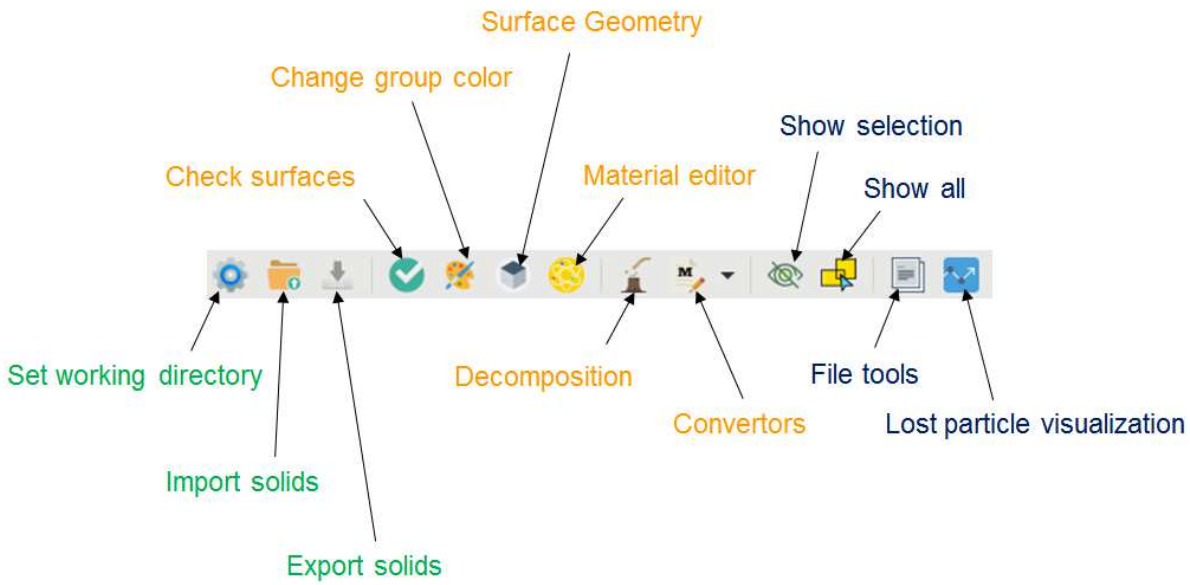
1. Introduction of McCad Module

Open the FreeCAD and choose the McCad module, the McCad related interface, including the tools and functions are add into the menu and toolbar.



Currently, the main developed functions of McCad include:



- Set working directory
- Import step files
- Save geometry model
- Checking surface
- Surface equation

- Decomposition
- Conversion
- Lost particle
- Merge files

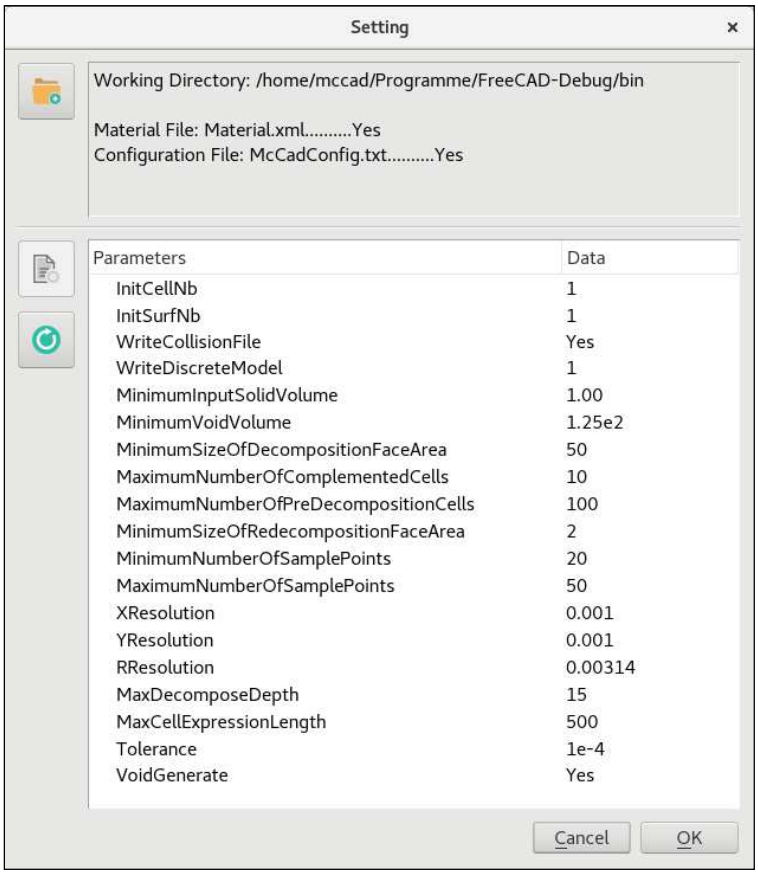
A complete CAD-MC conversion processing will be introduced. However, some other function, e.g. Decomposition is still being updated, which have not been integrated in this version so far.

2. Functions and complete CAD-MC conversion of McCad

Step1. Set the working directory

In the new McCad, a working directory is required by each project for storing the necessary files. E.g. the project file, geometry model, configuration and materials and final output file.

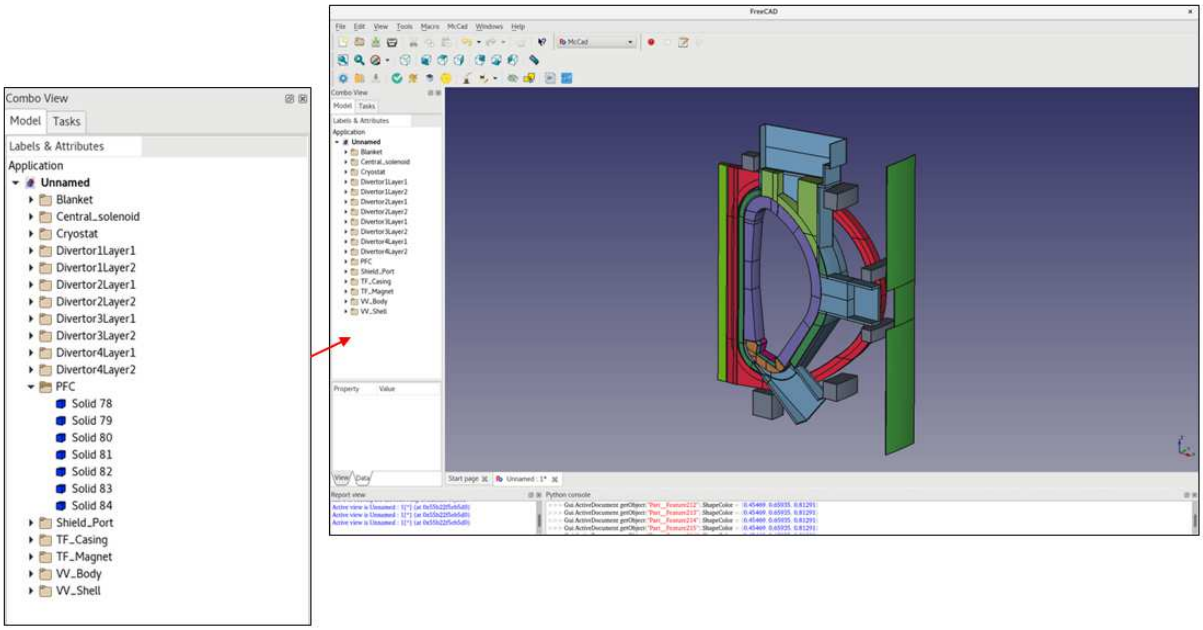
When a new project is created, the first step is to select a file folder as working directory. If the file folder has already configuration file and material file, they will be loaded and shown in the parameter list. If it is empty, click the file button to create configuration file and the default parameters.



When the working directory is set, other buttons on the toolbar are enabled.

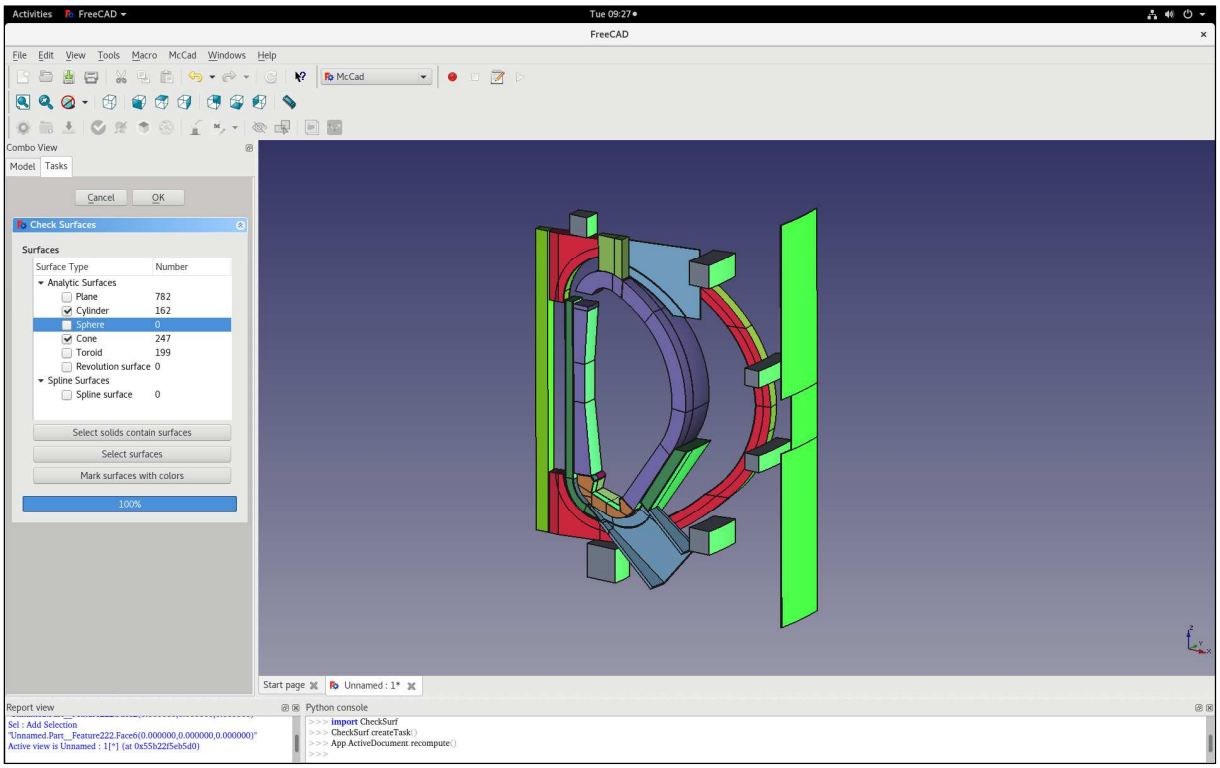
Step2. Import Step files

Normally, the CAD engineering model has to be simplified with other CAD software before the conversion, e.g., SpaceClaim, and then the model is saved into a group of steps according to the different components and materials. Load function reads step files and creates groups to store the solids. And the solids in the groups can be moved by drip and drop.



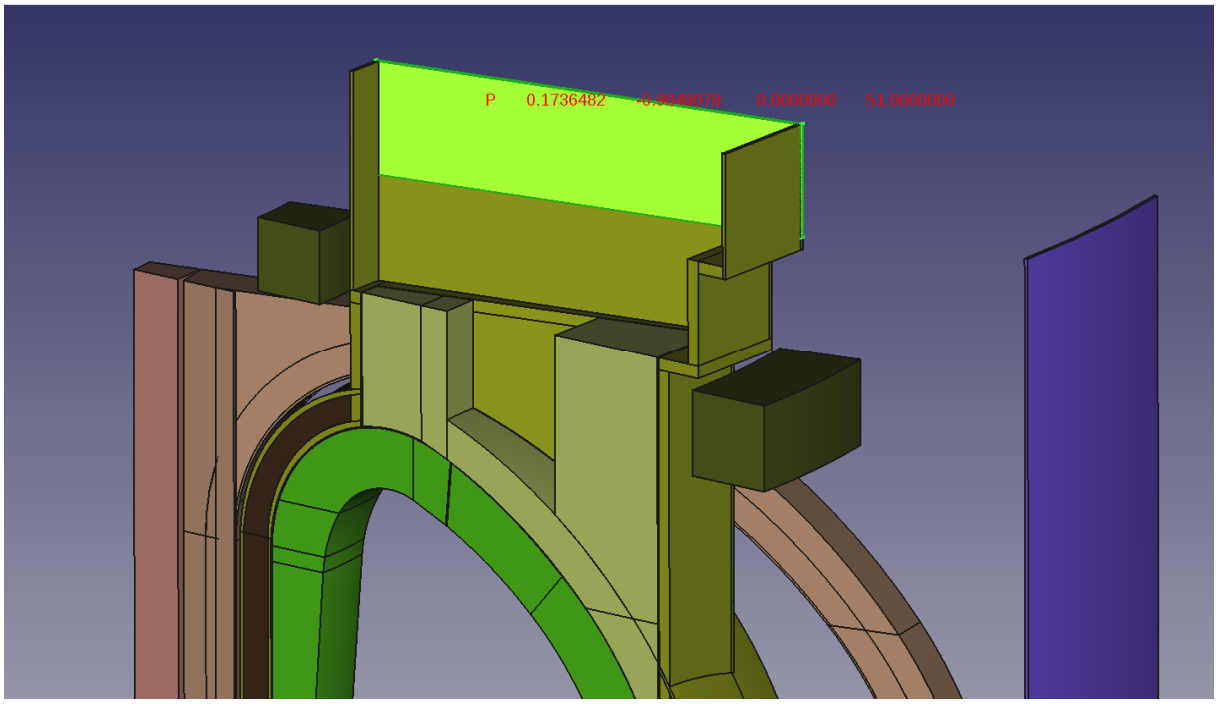
Step3. Check the surfaces

This surface checking function checks the boundary surfaces in the model, which can be used for searching spline surfaces. Select the different type of surfaces on the list, and the solids with these surfaces will be shown in the viewer, and the surfaces are highlighted.



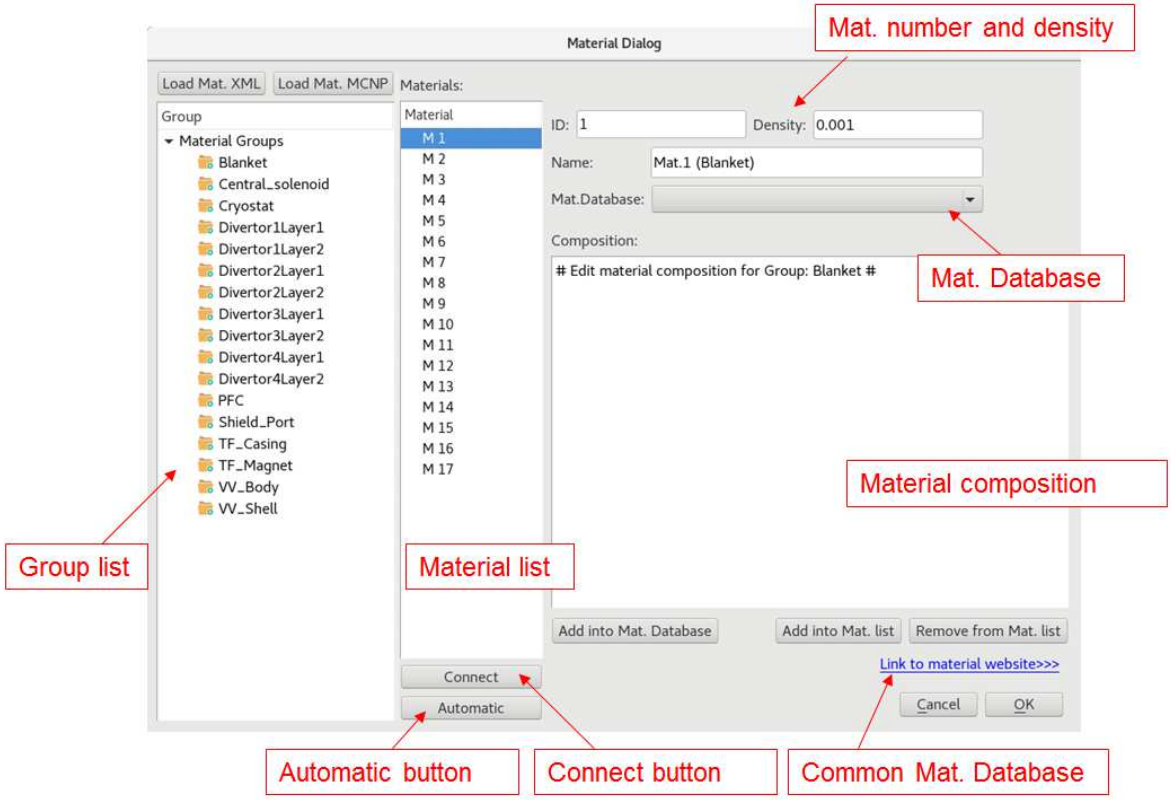
Step4. Surface equations

Click the surfaces on solid and show the MCNP equation of surface. Currently, only MCNP surface equation is developed, and it is easy to extend for adapting Tripoli or other MC codes.



Step5. Assign materials

Material editor is used for editing and assigning material onto the different groups and the solids in these groups. At first, the groups of model are loaded and displayed in the group list. Secondly, add a new material by giving the name, density and composition. Then select the group and material, click "Connect" button, the material is assigned to this group and the solids included. Another option for assign material is: Click "Automatic" button to create materials automatically and assign to the corresponding group rapidly. Although these materials are not real, it can be modified or replaced directly in the output file. In addition, the existing material xml file or MCNP file can be read as well and extracted the materials inside. (MCNP file function is not completed).

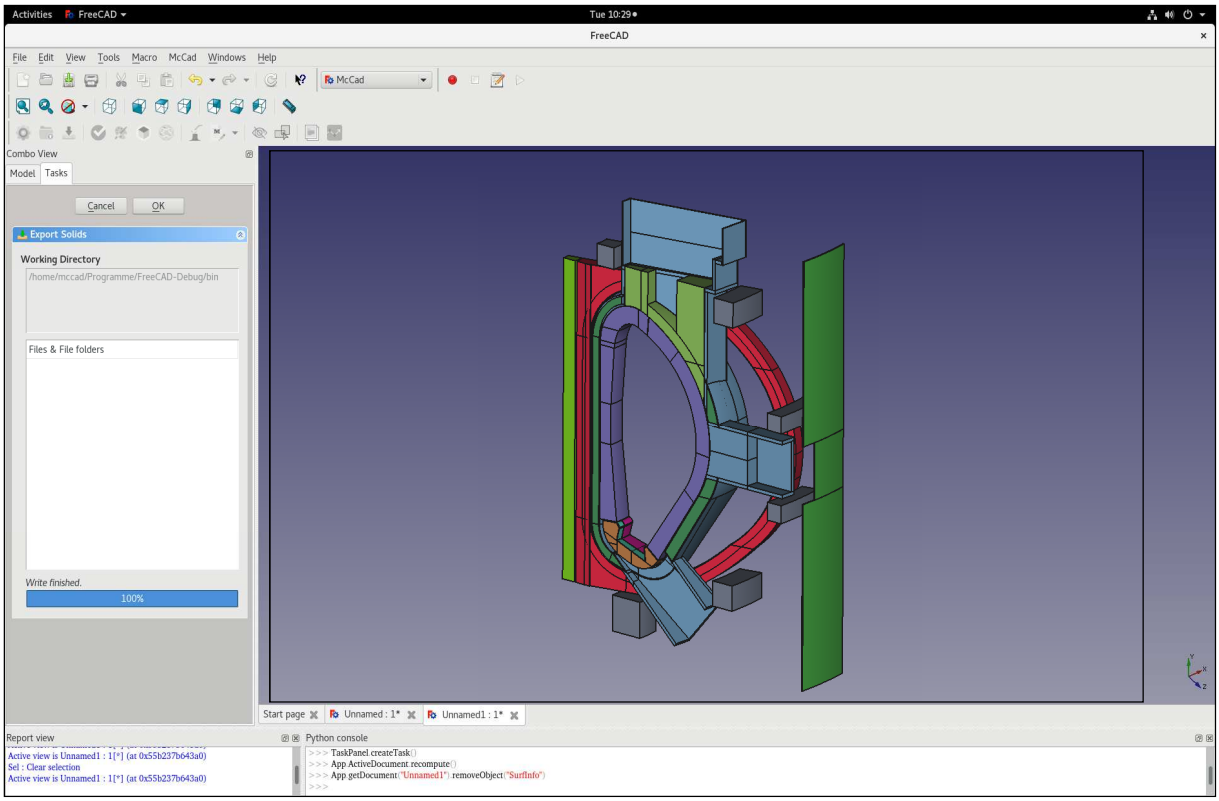


Save the materials as an XML file in the working directory, during the conversion, the material numbers and densities are assigned to the cells and material cards are generated.

Furthermore, there are some other functions are being planned. Database: The common used materials can be stored and chosen directly next time. Web database: The materials can be uploaded to sever and to be managed. It means the users can share their different materials.

Step6. Save the step files

Save the model in the viewer as a step file for conversion. The sequence of solids in the groups will be resorted and named.



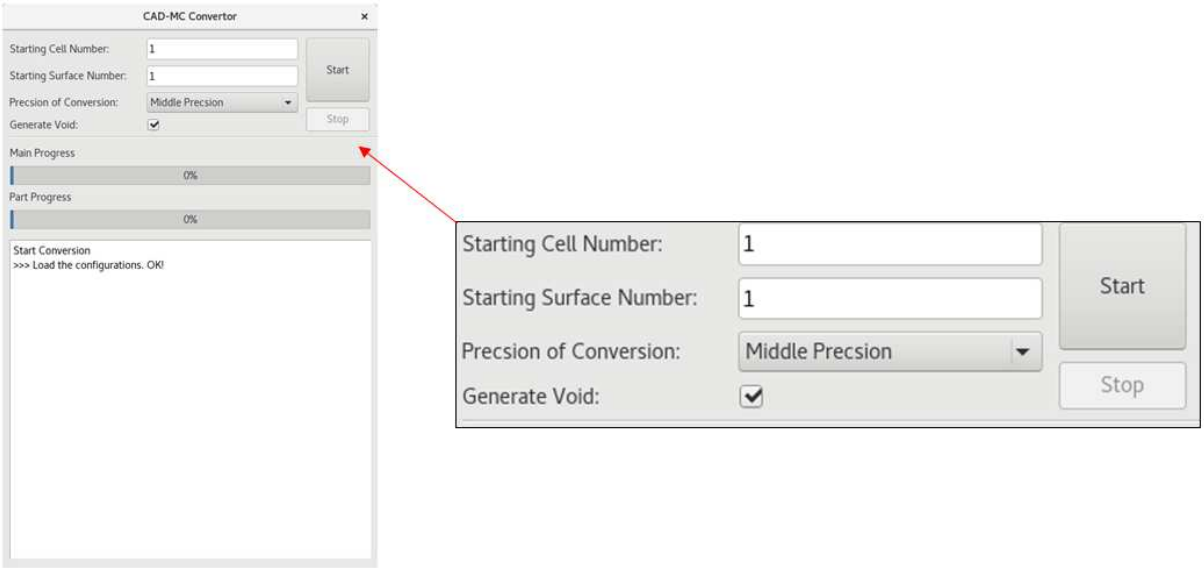
Step7. Decomposition

The model will be decomposed into a set of convex solids. (Not completed)

Step8. Conversion

Conversion supports MCNP or Tripoli convertor currently. Set the initial cell number and surface number, choose the precision which is used for void generation. If the model is simple, low precision is enough. Normally, in order to guarantee the accuracy of generated void description, high precision is recommended, but the conversion speed will be reduced. If the model has already solids representing the void space, uncheck the void generator, and the conversion speed will be fast.

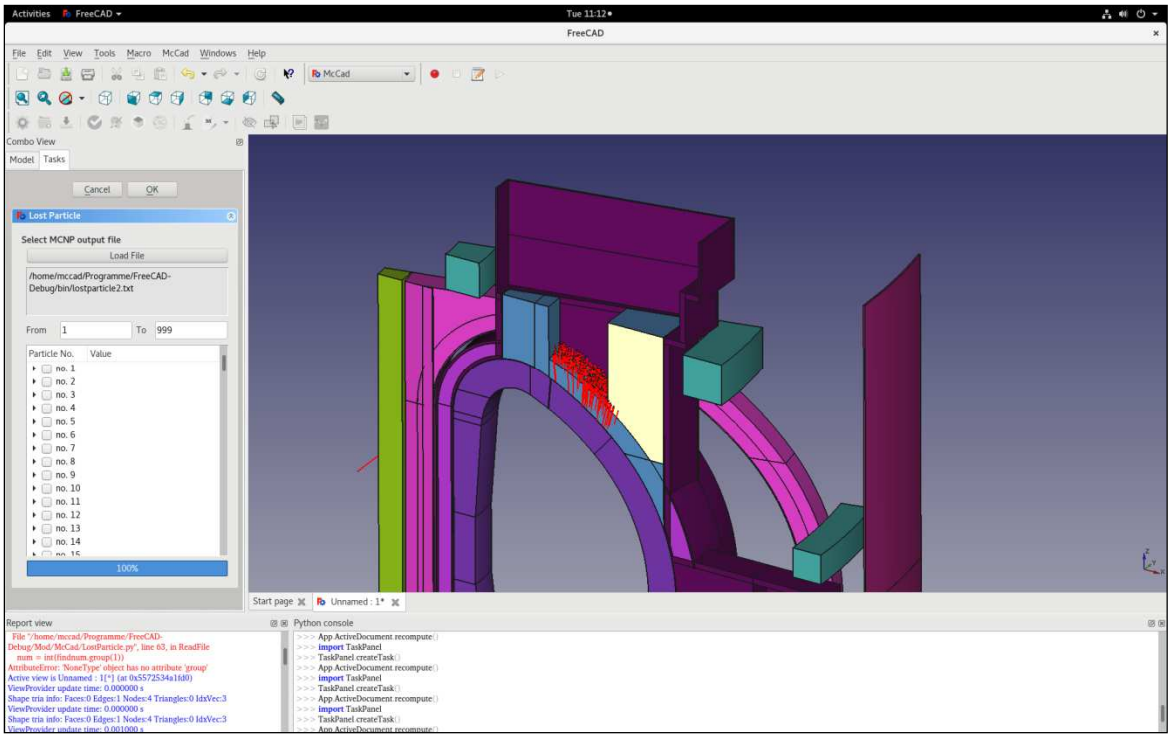
Click “Start” button, run the conversion. When the conversion is finished, the output file will be saved into the working directory and opened.

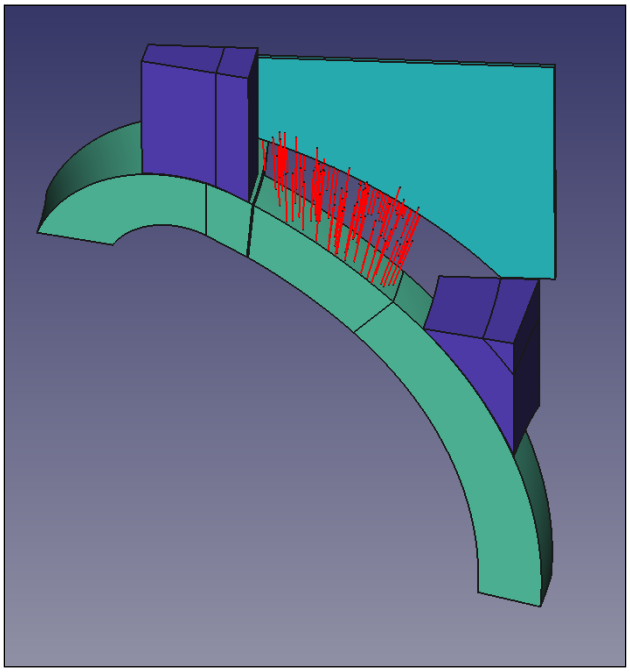


Step9. Show lost particles

The converted input geometry could be calculated with MCNP. If there are geometry errors, the particles will be lost there. In order to locate the problem area, the output files of MCNP calculation is read and some lines are drawn for representing the lost particles.

The lost particles can be selected and displayed partially or completely. Sometimes the number of particle is too large and it will be time consuming to display huge amount particles in the viewer.





Step10. Merge files

The function is developed for merging two MCNP files. In order to improve the efficiency of conversion and reduce the number of void cell generated, some model has components with complicate inner structure can be converted with two steps. First, the model with empty component (without inner structure) is converted with void filling, and then the detail inner structure of these component is converted without void filling. There are two files are generated, file1 and file2. Then delete the empty components in the file1 and integrated with file2. The repeated surface and surface number will be merged. (Being integrated)