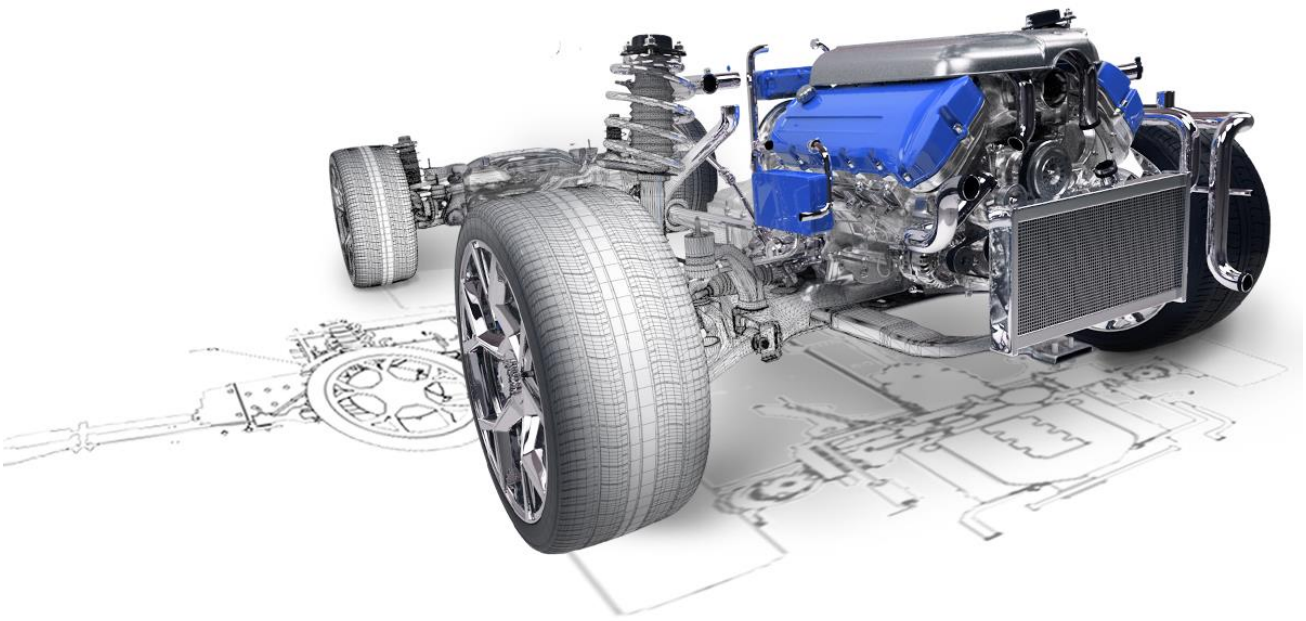


ZW3D From Entry to Master

Electrode Design

Contents

Electrode Design

For the plastic mold design electrode design always is an inevitable topic. ZW3D provides the corresponding module with full function for it.

Key Points:

- ✧ Insert parent core or cavity part
- ✧ Automatic way to create electrode
- ✧ Manual way to create electrode

1.1 Insert parent core or cavity part

1.1.1 Electrode Ribbon Toolbar

Following is the independent tool bar for the electrode module:

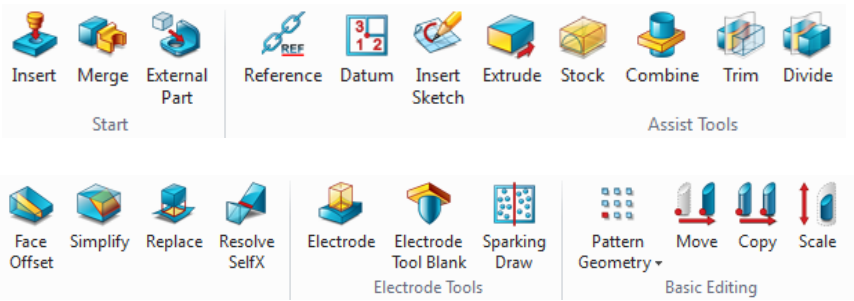


Figure1 Electrode design module

Actually, most of the commands in this module come from other modules like the “Shape” module. But since those commands are frequently used when designing electrode so that intergrate them together into the eletrode design module and provide an integrated interface for users to apply more efficiently.

1.1.2 Various Methods for Inserting Parent Part

Normally the electrode needs to reference to the parent core or cavity part. As we can see in the start column of this ribbon tool bar, there are different tools used for inserting the parent part.

Next let's firstly take a look at these tools in the Start column.

Insert: It is same as the command insert in assembly. It is used to insert the parent core or cavity part into current file. The inserted parent part will become a component of current file.

Merge: It is same as the merge command in assembly. It is used convert the component or subassembly as a local shape or component. After merging it will create an associative relationship with the parent file which means the current file has referenced the original file and will be recorded into history tree. As follows:

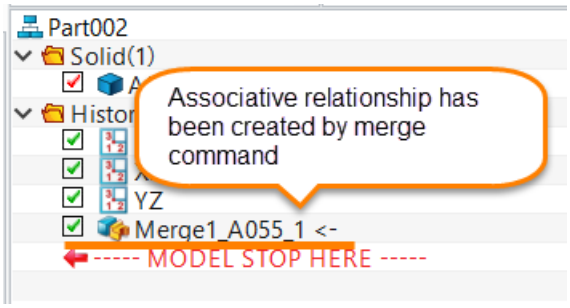


Figure2 Merge command

External part: This command allows to create various associative copy from the external part as follows:

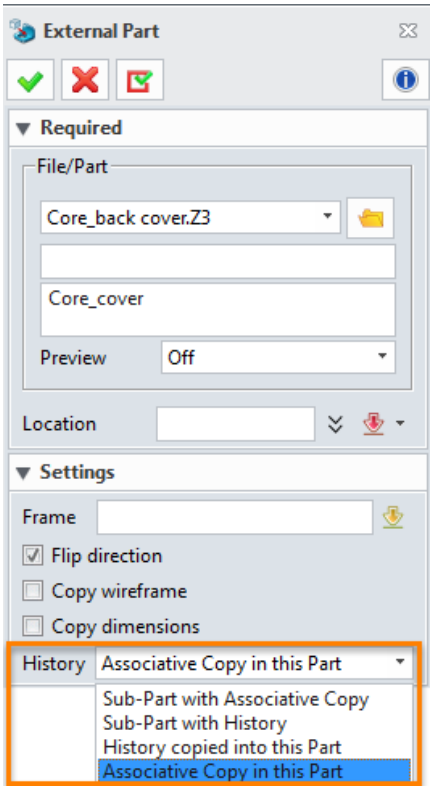


Figure3 Selectively choose relationship with external part

The explanation for these types:

Sub-part with associative copy - (Default) it creates a sub-part with a copy of the geometry of the external part. The history of the sub-part has an "Associative Copy" operation that imports the external part geometry. When the parent part is regenerated, the sub-part does not re-import unless you activate it and regenerate its history or right-click it and select the "sub-part regeneration" command to set the “Auto Regen” Flag. When "Auto-Regen" is enabled for the sub-part, its history will be regenerated every time its parent part is regenerated. By default, "Auto-Regen" is disabled for a new sub-part.

Sub-part with history - It creates a sub-part with a copy of the full history of the external part. It means the user has a local copy of the external part's history to edit, but that history is still isolated from the parent part's history.

History copied into this part - It copies the history of the external part into the active part and appends the external part's history to the end of the active part's history. Imported history operations are renamed as needed so they do not conflict with pre-existing operations in the active part. This option can be used in place of "sub-part with history" if you do not want the imported part separated as a sub-part.

Associative copy in this part - It adds an "Associative Copy" operation to the history of the active part that imports the geometry of the external part. Each time the active part is regenerated, a new copy of the external part will be imported into the active part. If the external part cannot be found, the "Associative Copy" operation will fail.

Next let’s start from an empty file as follows:

STEP 01 Create a new empty file and name it as “Electrode for back cover”

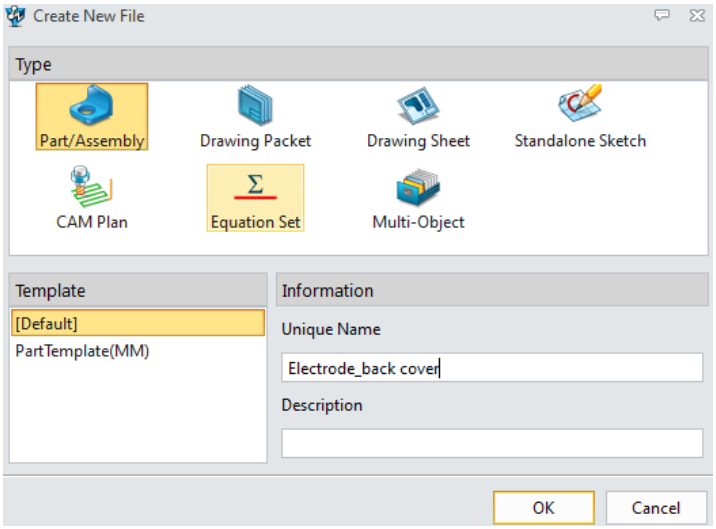


Figure4 Create new empty file for electrode design

STEP 02 Then insert the parent part "**Core_back cover.z3**" as follows:

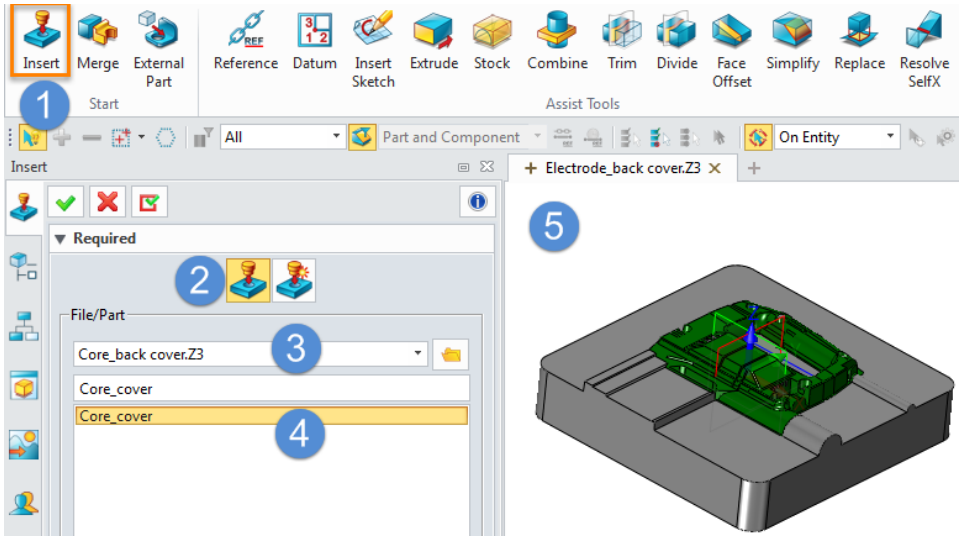


Figure5 Insert Z3 file as electrode design parent part

STEP 03 Merge the inserted parent part

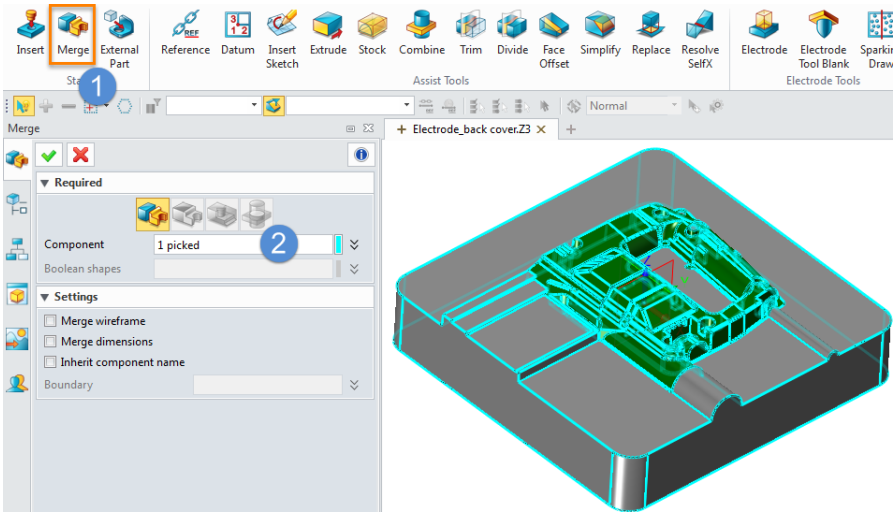


Figure6 Merge the inserted part

By the 2 steps we have created the associated relationship between the electrode file and the inserted part. That means any change happen in the parent part also will affect the electrode side.

STEP 04 Analyze the inserted part we can find there are a lot of slots and open pocket need to create an electrode. Following is the indicator for the positions where need to add electrode:

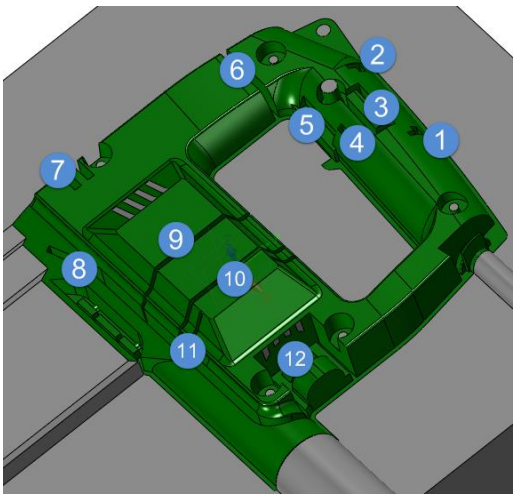


Figure7 Electrode position indicator

Because most of the electrodes can use the same way to finish so here let's take position 1, 7, 12 as example to explain how to use the electrode tool to finish them.

1.2 Automatic Way to Create Electrode

1.2.1 Create Electrode at Position1

STEP 01 Zoom in the position 1 and then choose the "Electrode" command to create electrode shape as follows:

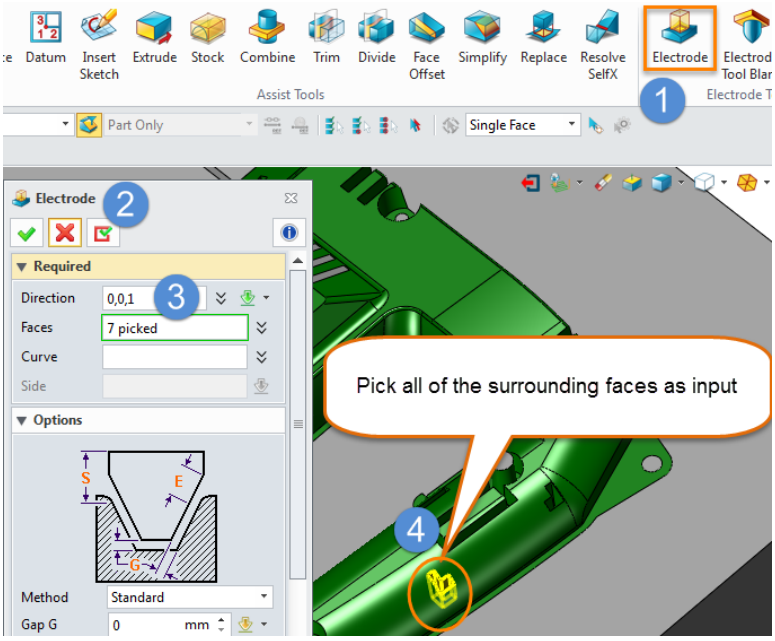


Figure8 Create electrode shape at position 1

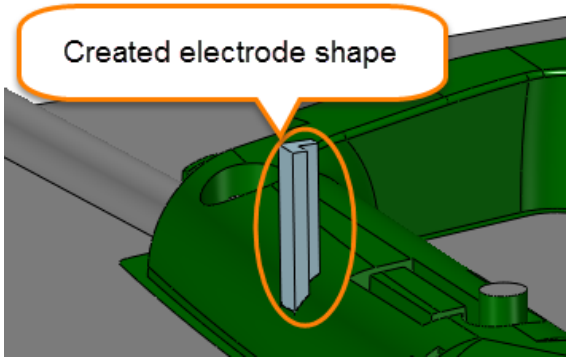


Figure9 Created electrode at position 1

STEP 02 Add blank for the new electrode shape as follows:

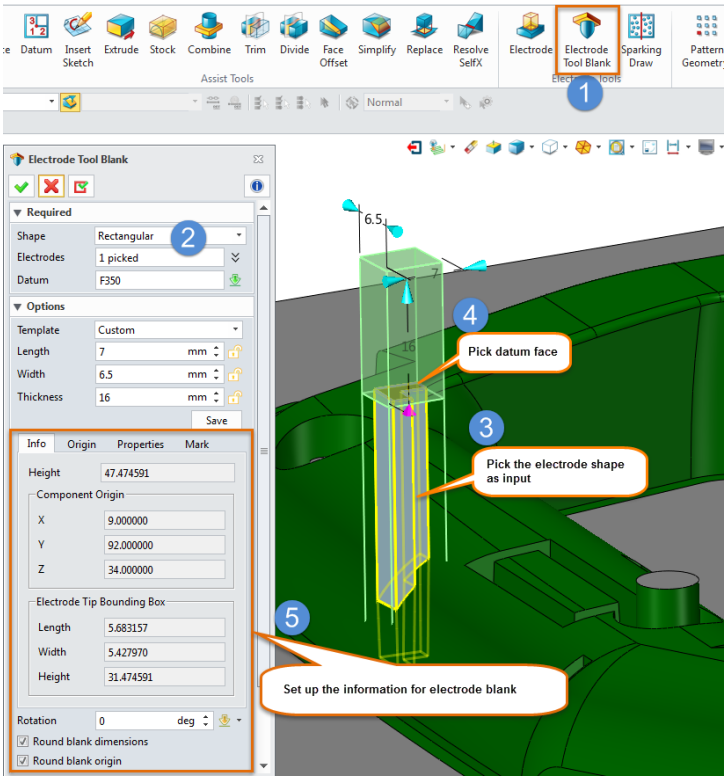


Figure10 Add blank

Details for the information:

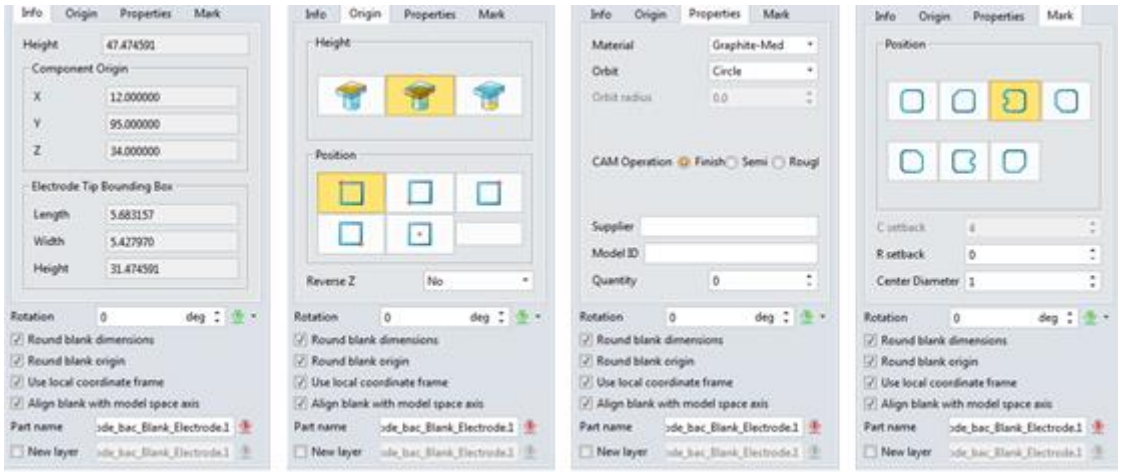


Figure11 Information for electrode blank

Info:

Component Origin, X, Y, Z

The current X, Y and Z coordinates of the origin of the blank (refer to the figure above).

Electrode Tip Bounding Box, Length, Width, Height

The Length, Width and Height of the bounding box surrounding the electrode tip (relative to current datum and rotation).

Rotation

this is used only when **Shape** is set to **Rectangular** (see **Required Inputs** above). This allows you to rotate the blank about the Z axis of the datum.

Round blank dimensions

checking this option will force the blank dimensions to round up to the nearest 1/8 if the units are set to inches. For mm units, it will round up to the nearest 0.5mm + 1mm.

Round blank origin

Check this box, the blank is adjusted such that the origin's x, y coordinates are rounded to the nearest millimeter, or to the nearest 0.05 inch when using inch units. Rounding the blank's origin does not change the electrode's position with respect to the coordinate system.

Use local coordinate frame

Check this box, the blank's component origin and center coordinates are defined with respect to the local coordinate frame that is active when the electrode blank feature is created or regenerated. When this option is unchecked, or if there is no local coordinate frame, the component origin and center coordinates is defined with respect to the electrode's global coordinate system.

Align blank with model space axis

Check this box, it will re-align blank with model space axis.

Part Name

this allows you to specify a name for the new component that will be created (default = Part name + electrode name + "blank"). Automatic name checking and correction is used so you do not need to keep modifying this field for a part with multiple electrodes.

New layer

Check this box to input the electrode tool blank created into the right specified layer. If this layer is not in the current part, it will use the same name to create a new layer.

STEP 03 Change the basic dimension of the blank, origin type and mark size as follows:

i. Set up dimension as follows:

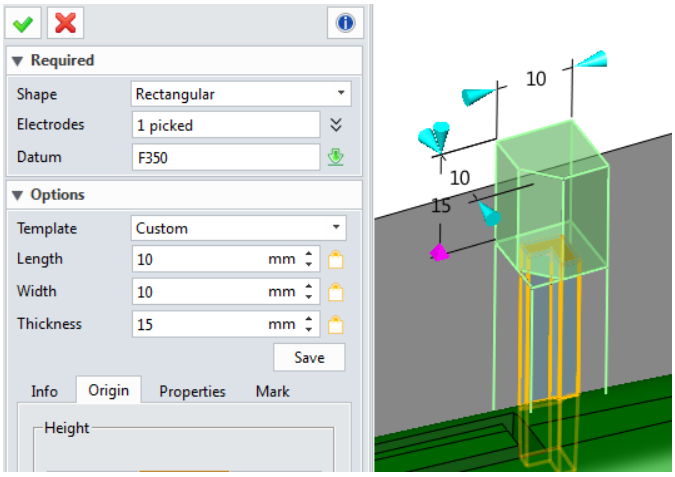


Figure12 Dimension for electrode blank at position 1

ii. Set up the electrode blank 's origin and mark as follows:

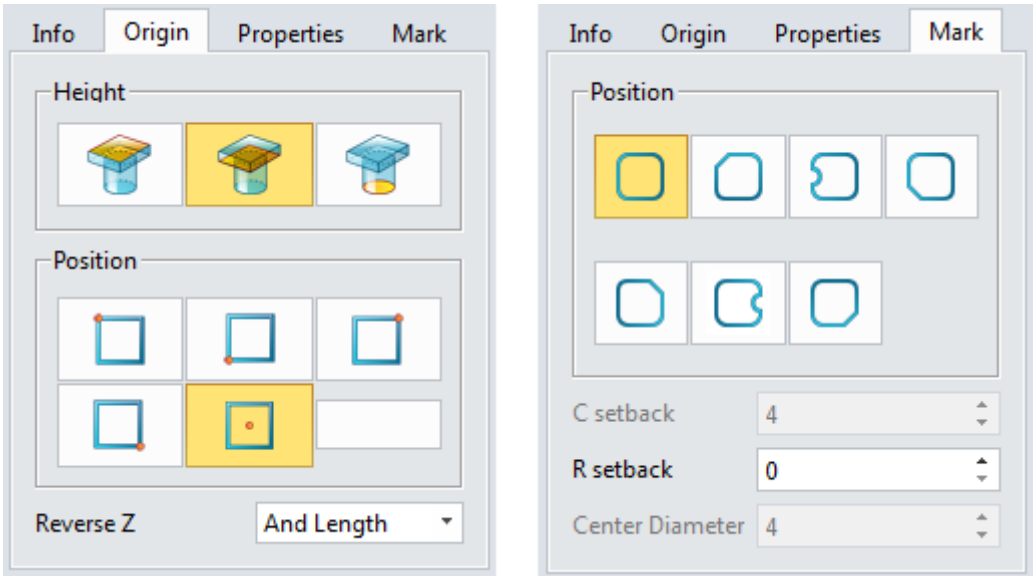


Figure13 Origin and Mark setting

STEP 04 Set up the shape's color as brown and then we can get the following result:

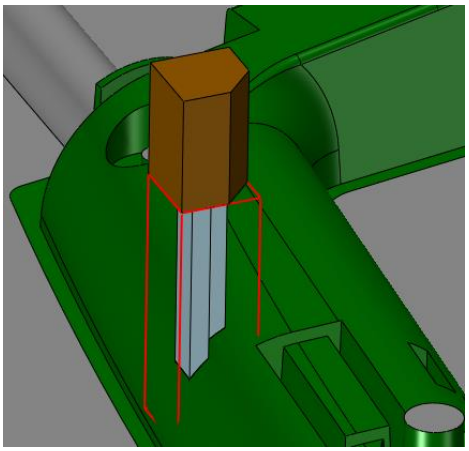


Figure14 Finished Electrode blank

Note: *After adding the blank, the electrode part will be turned into a component of this file as follows:*

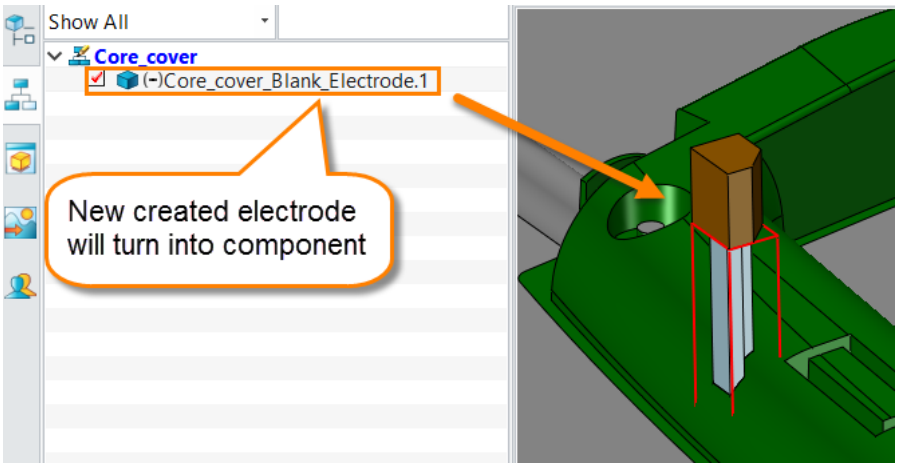


Figure15 New electrode component

Meanwhile it will be listed in the object manager list as follows:

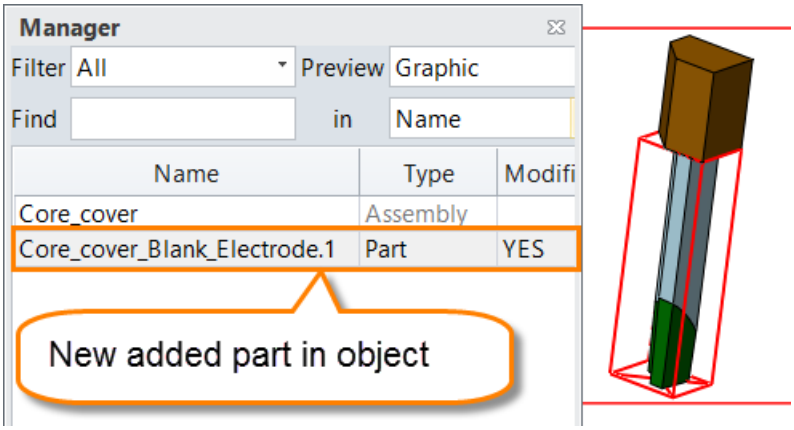


Figure16 New created file for electrode

1.2.2 Create Electrode at Position7

STEP 01 Zoom in position 7 and check the region. It is not a closed region but an open region. So we need some auxiliary curves. Create curves at the bottom as follows:

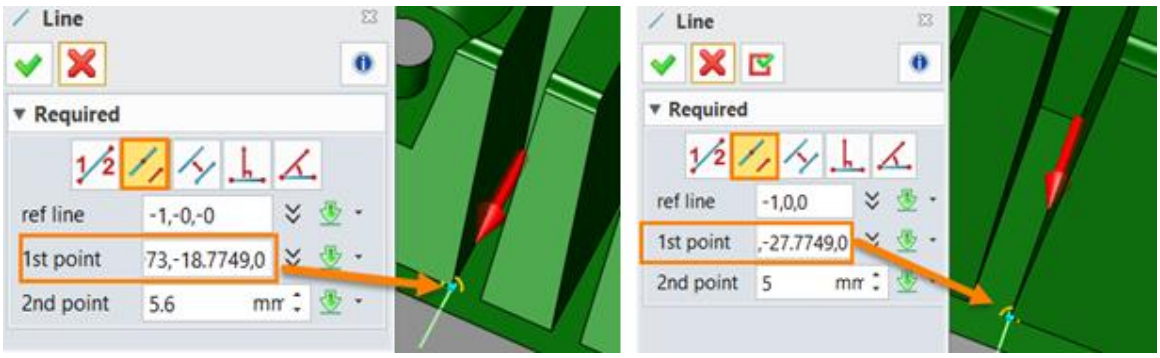


Figure17 Create auxiliary curves

STEP 02 Trim the curves and connect them

i. Trim the curve

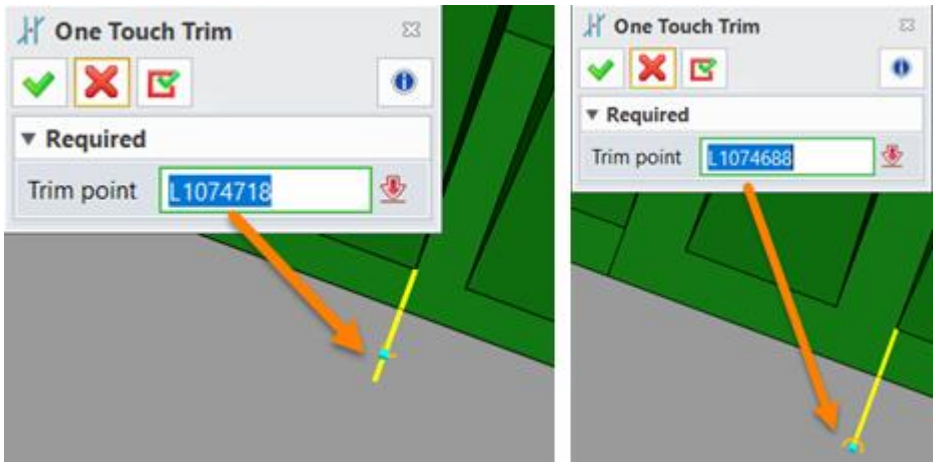


Figure18 Trim the curves

ii. Connect the curve

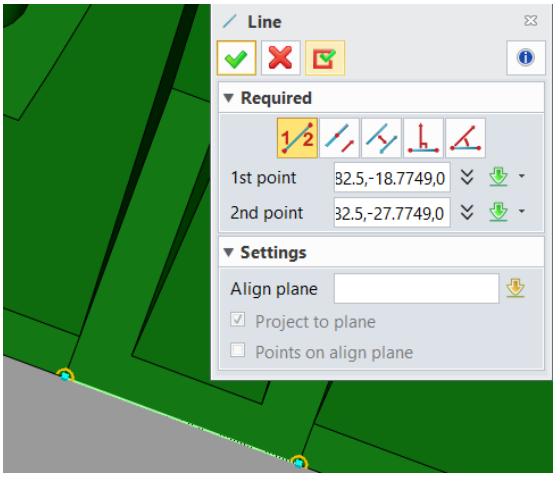


Figure19 Connect the curves

STEP 03 Create the corresponding electrode as follows:

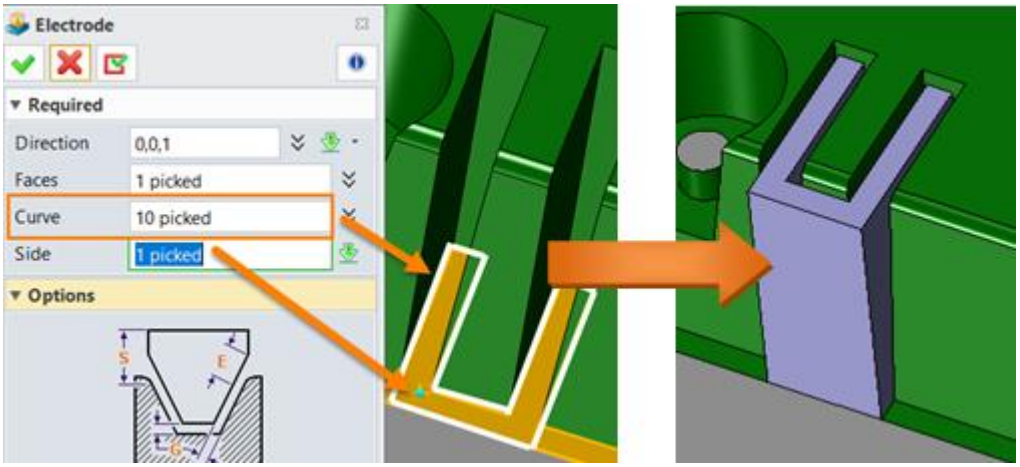


Figure20 Create electrode at position 7

STEP 04 Replace electrode face as follows:

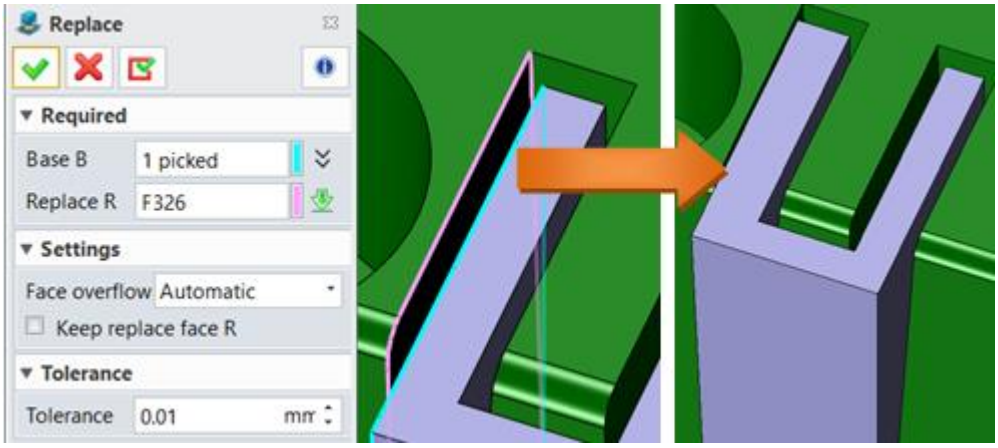


Figure21 Replace electrode face

Repeat the same command to replace other related face to the shape as follows:

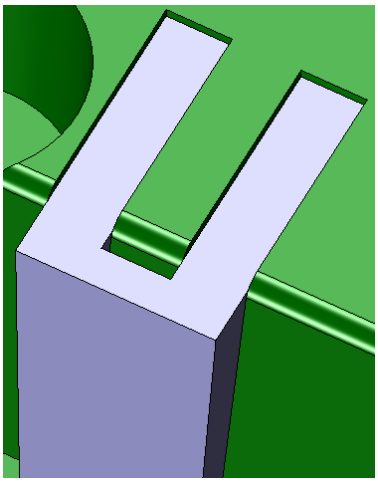


Figure22 Replace electrode face to shape face

STEP 05 Offset electrode face

i. Offset top face

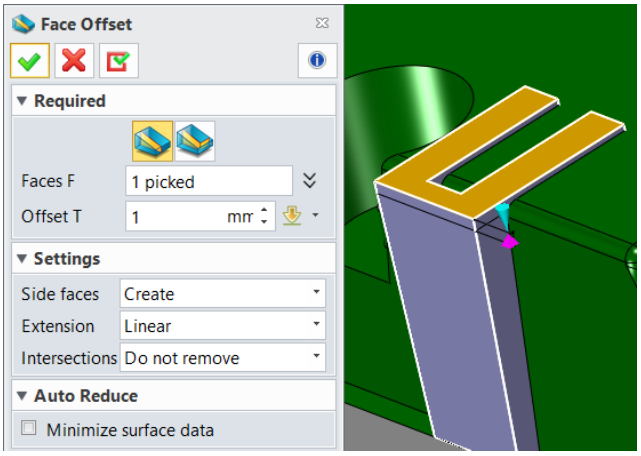


Figure23 Offset top face

ii. Offset side face

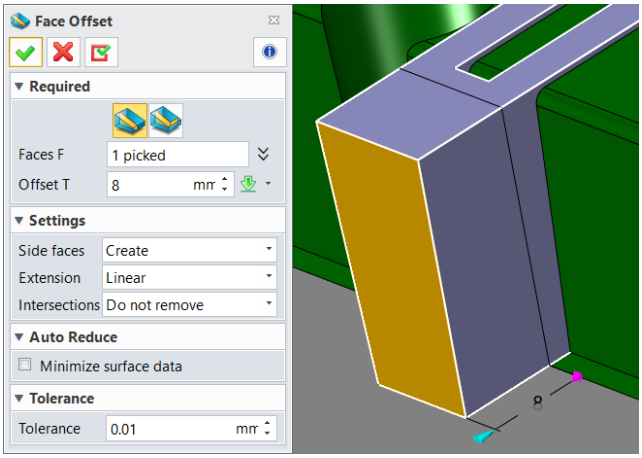


Figure24 Offset side face

iii. Offset slot face for fillet space

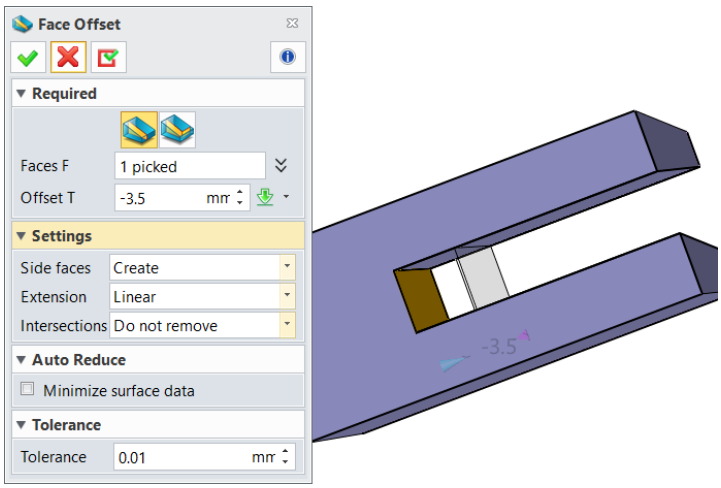


Figure25 Offset slot face

iv. Fillet at the slot bottom edge

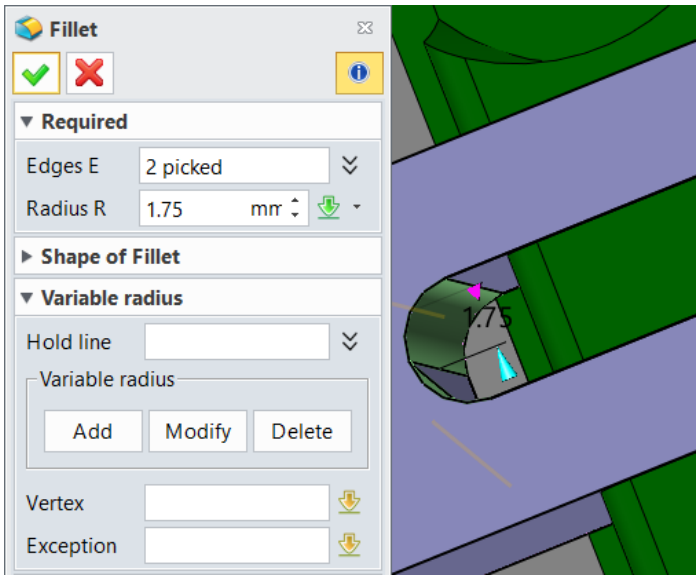


Figure26 Fillet slot edges

STEP 06 Add the blank for the electrode as follows:

i. Dimension of blank

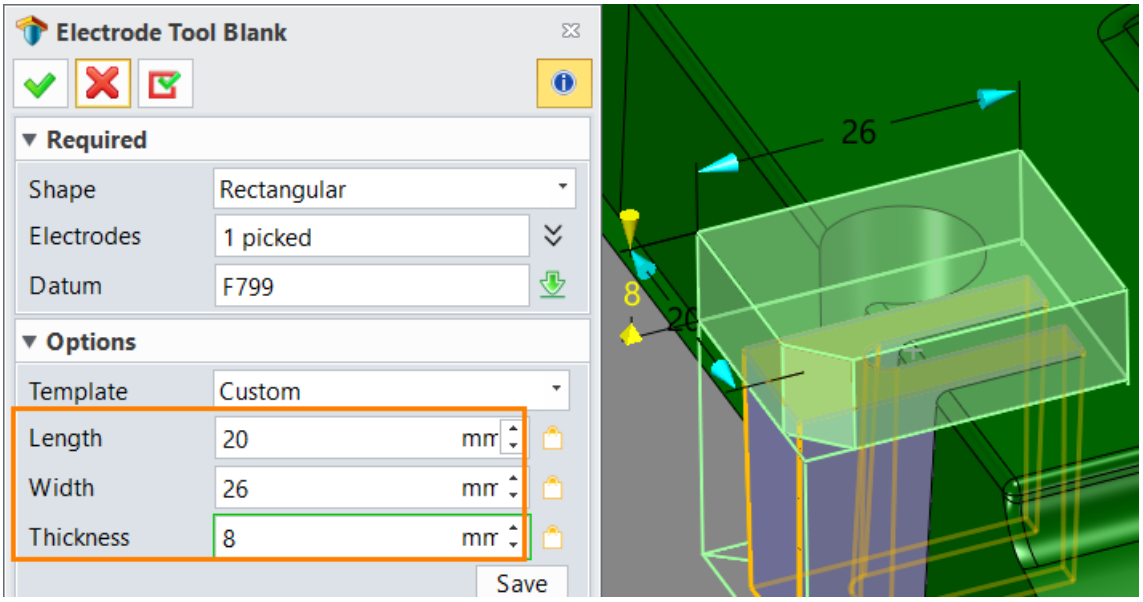


Figure27 Dimension for electrode blank at position 7

ii. Origin and Mark

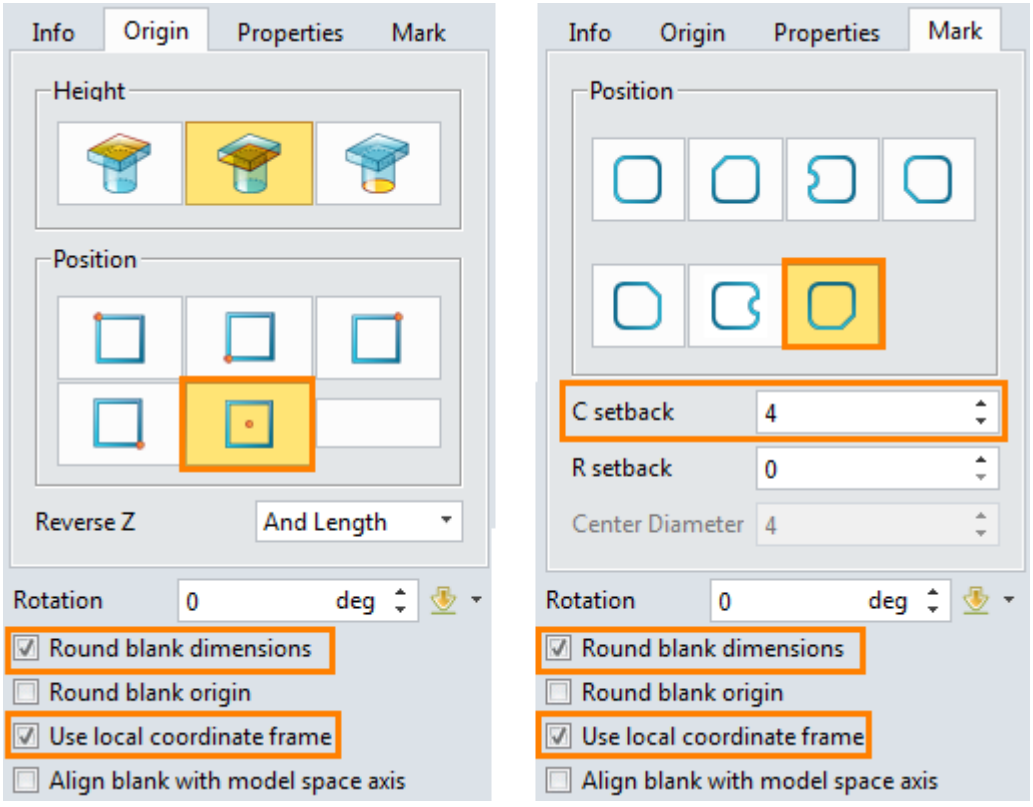


Figure28 Origin and Mark for electrode blank at position 7

STEP 07 Confirm it and set up the color for it, then we can get the following result:

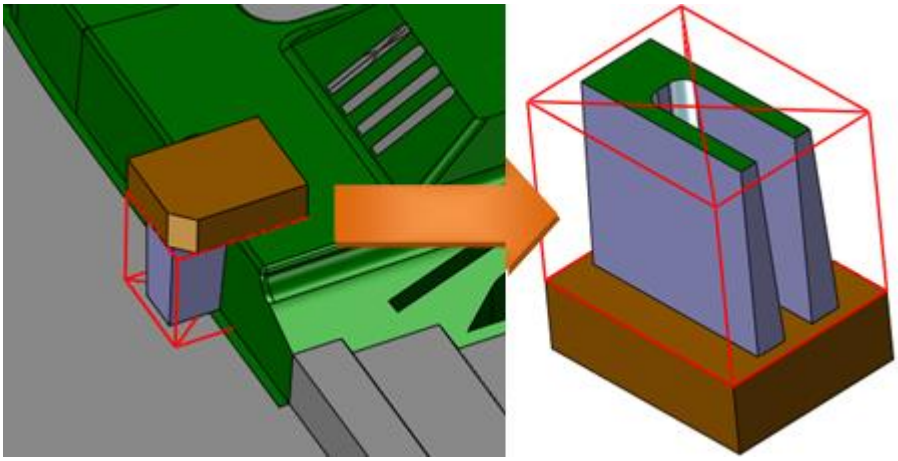


Figure29 Electrode at position 7

1.2.3 Create Electrode at Position8

STEP 01 Also this region is an open pocket so that we need to create some auxiliary curves as follows:

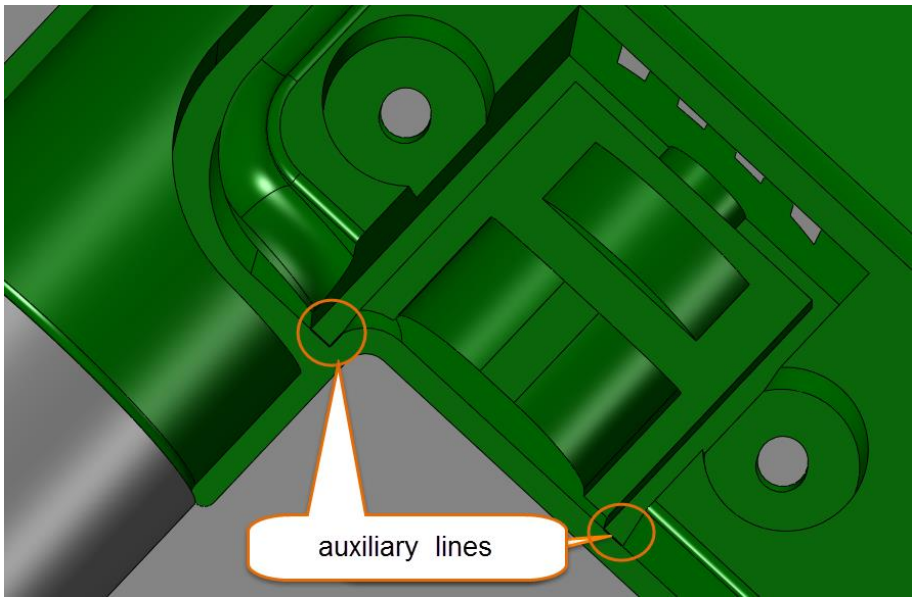


Figure30 Auxiliary lines at position 8

STEP 02 Pick the curves as follows:

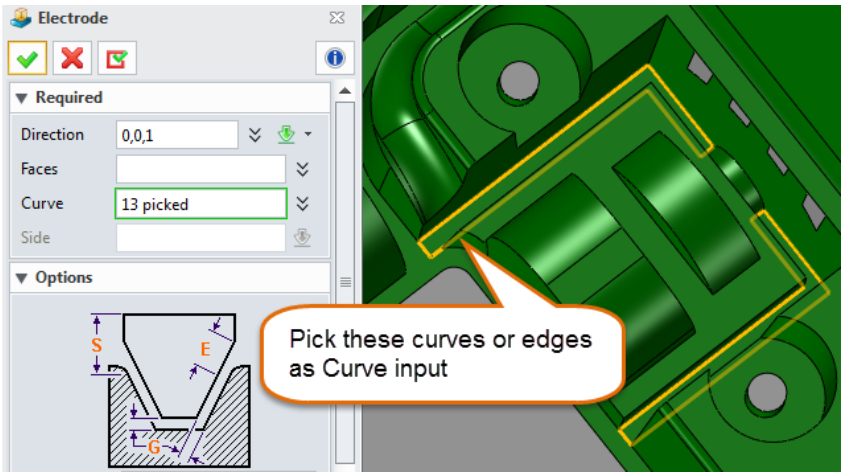


Figure31 Pick curve

STEP 03 Choose the bottom face:

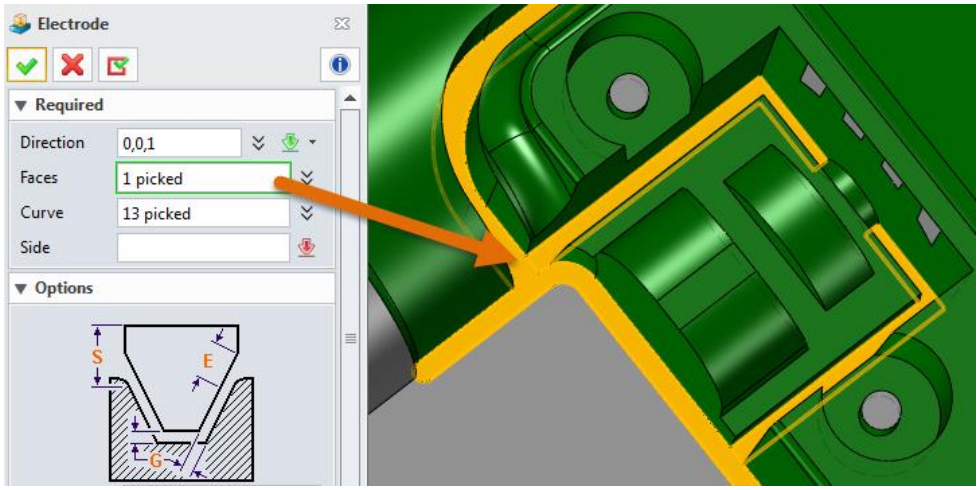


Figure32 Pick face

STEP 04 Determine sides to keep:

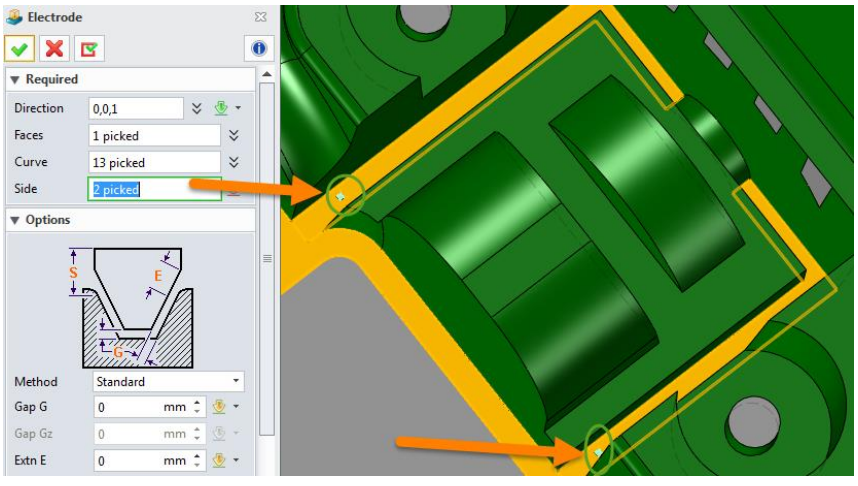


Figure33 Pick the side point for electrode creation

STEP 05 Confirm the command and then we can get the following result:

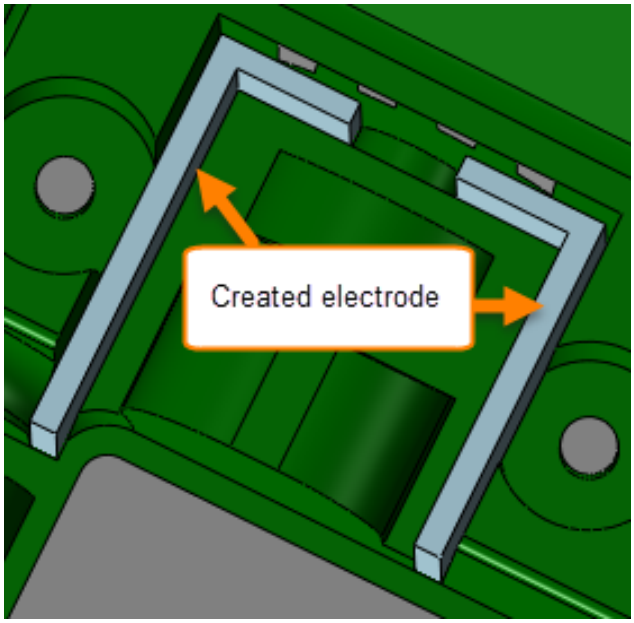


Figure34 Electrode at position 12

Since the side wall of the pocket has draft angle,here the shape we got is vertical

Therefore, we can use “Replace Face” command to make the electrode shape match to the side wall’s draft angle.

STEP 06 Replace the side face of electrode to side wall of the core part

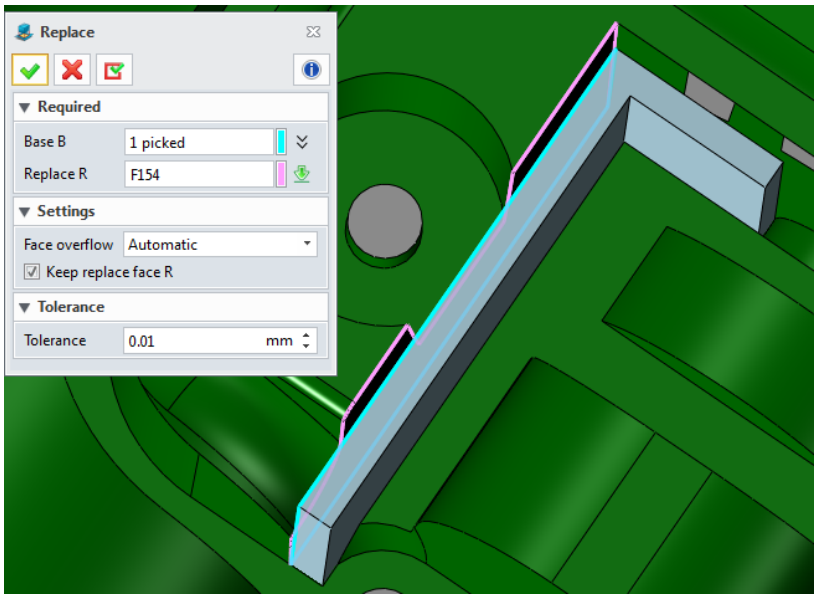


Figure35 Replace face to side wall

STEP 07 Confirm it and we can get a new shape with draft angle on its side face

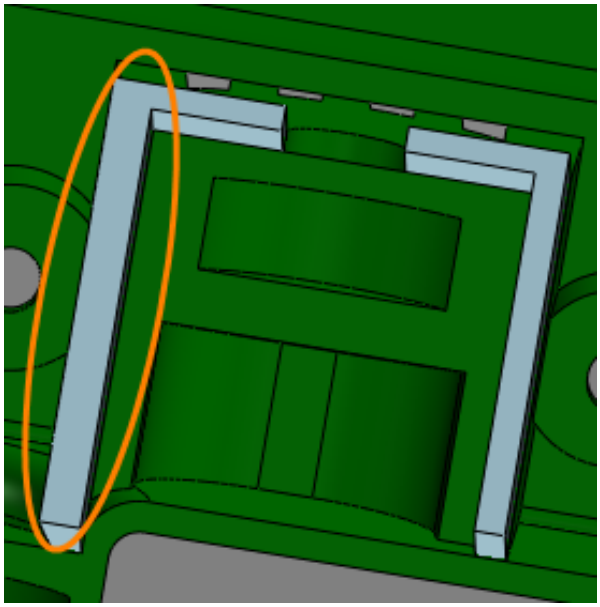


Figure36 New shape with side draft angle

STEP 08 Repeat the “Replace face” to other side faces of the electrode shape, then we can get a new electrode shape as follows:

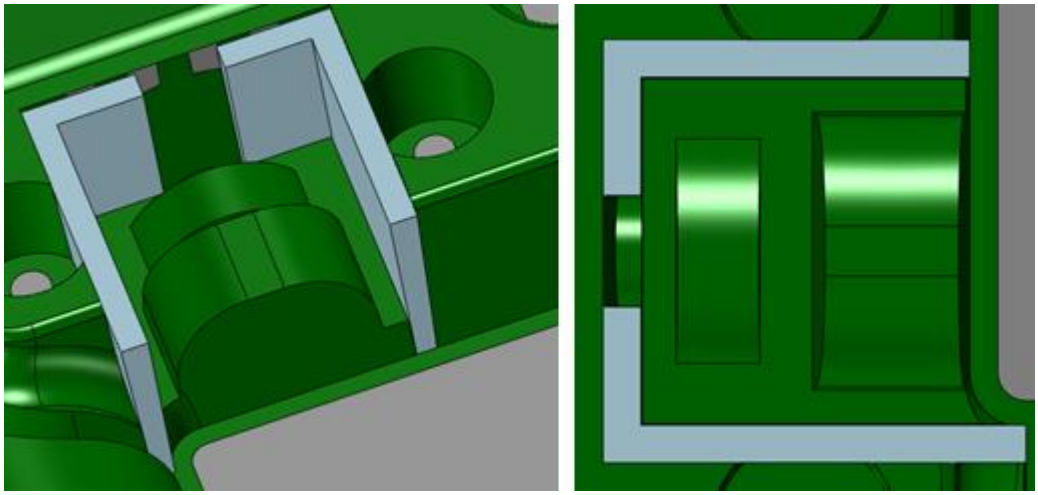


Figure37 New electrode shape with draft angle

STEP 09 Offset the top face of electrode as follows:

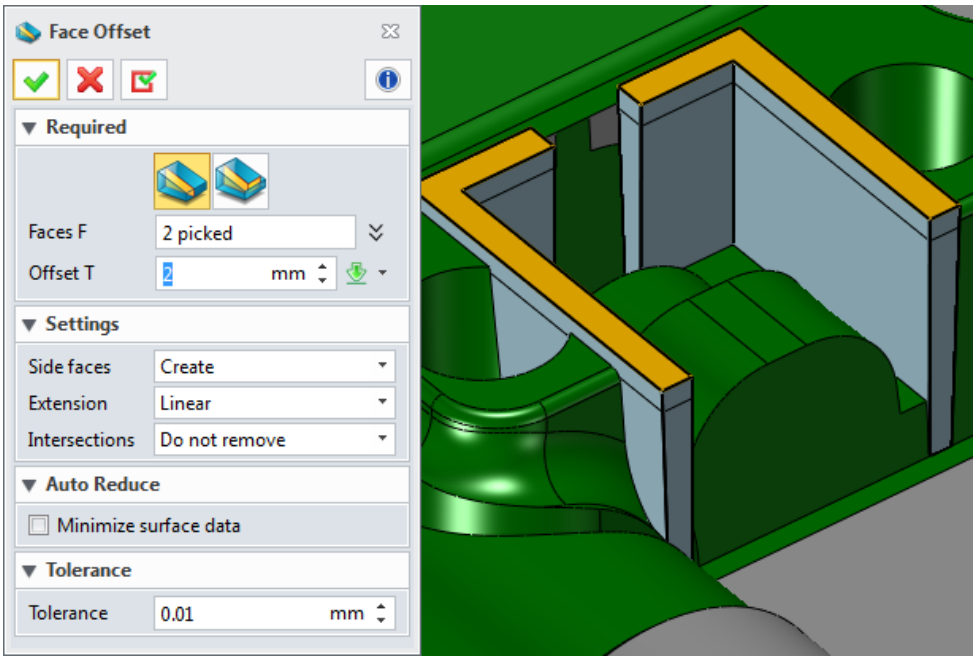


Figure38 Offset top face of electrode

STEP 10 Add blank for electrode by a suitable size and the same mark as form blank then we can get the following result, and then save the finished file.

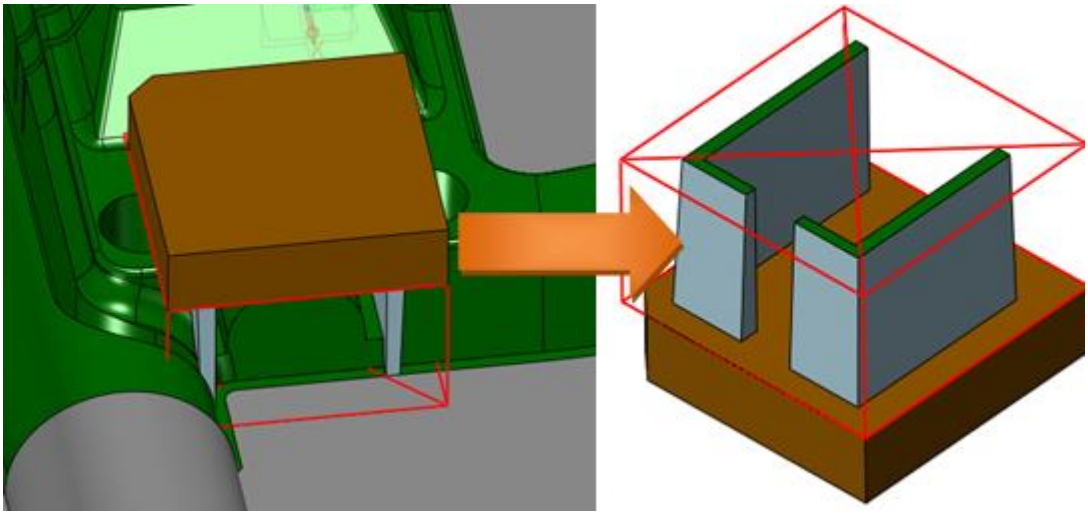


Figure39 Add blank for electrode at position 12

1.2.4 Create Sparking Drawing for the Electrodes

After completed the electrode design, then we can go to create the sparking drawing for them

STEP 01 Choose the sparking drawning command in the ribbon tool bar as follows:

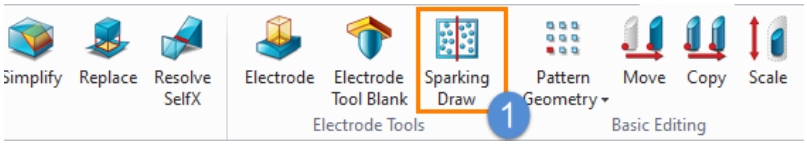


Figure40 Sparking Drawing command

STEP 02 Choose workpiece and electrode to create sparking drawing as follows:

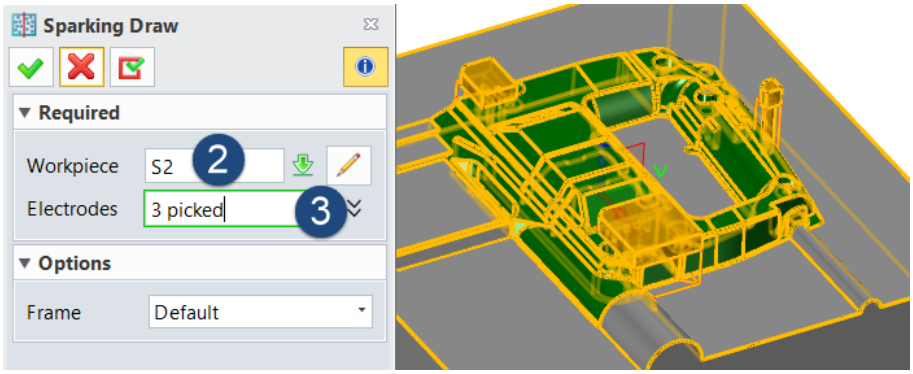
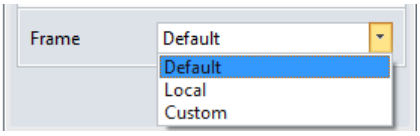


Figure41 Create sparking drawing

Information for Frame



Default: using the assembly's default frame as the original reference, in other words the electrode's origin will be calculated based on the world coordinate system

Local: using the local created frame as the original reference

Custom: it requires input a point as the original reference and the X Y will be in accordance with the default frames.

STEP 03 Here let's use the default frame in the middle of the part and we can get the following sparking drawing:

i. General drawing of all the electrodes

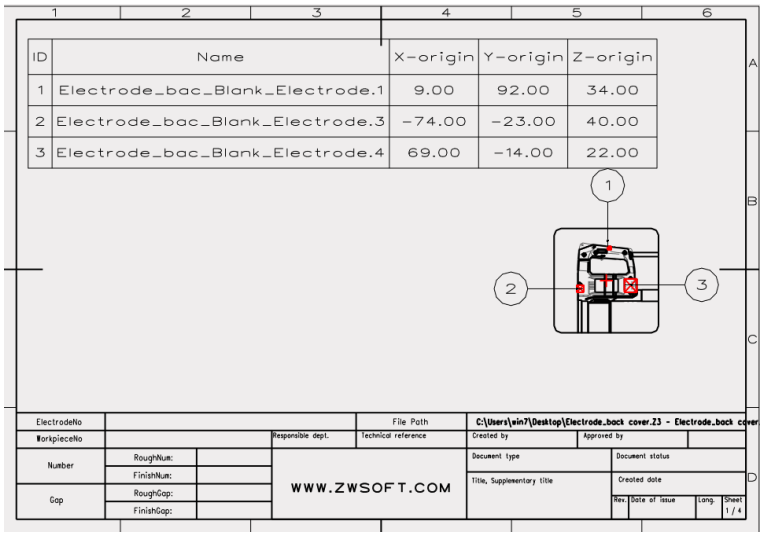


Figure42 Create sparking drawing

ii. Besides the general drawing each electrode also has the corresponding detailed drawing as follows:(Switch by the sheet icon in the bottom)

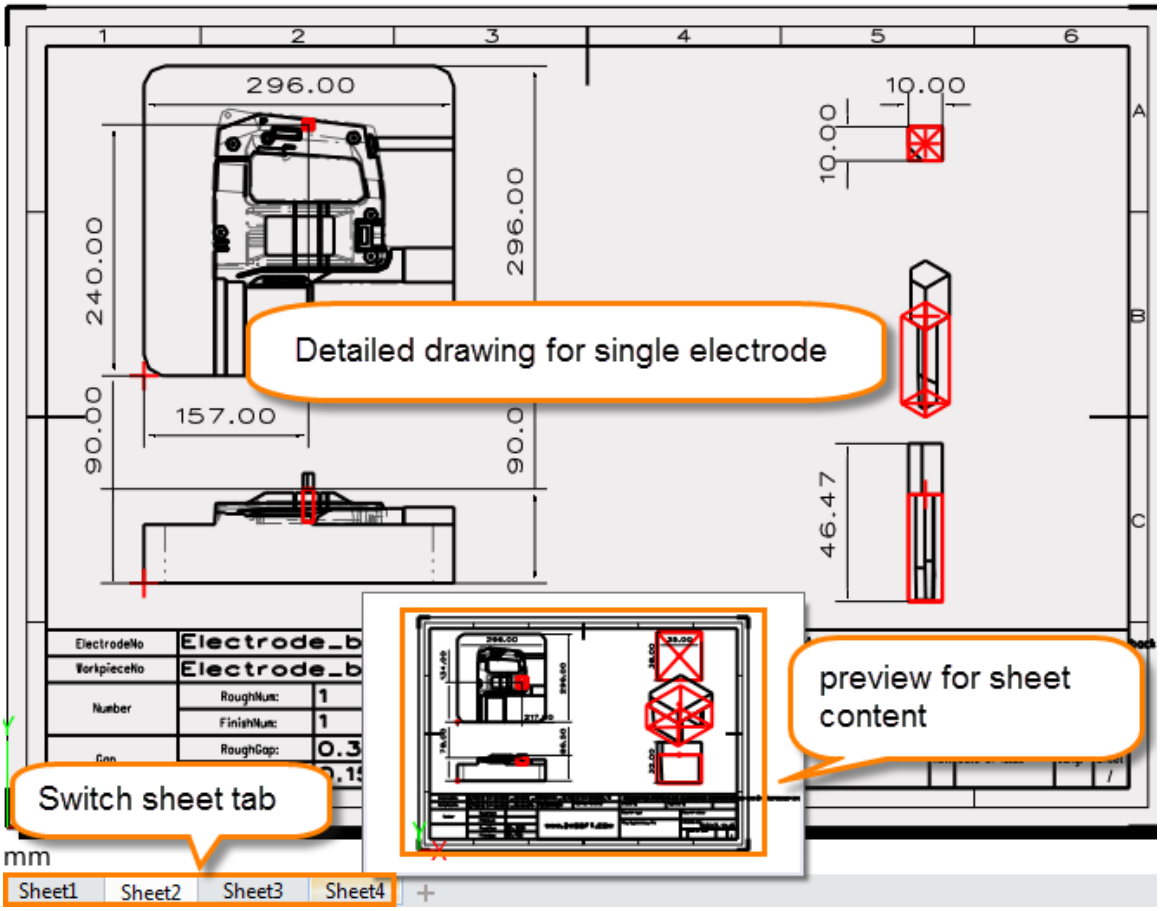


Figure43 Individual sparking drawing of each electrode

After finishing the drawing we can export it as DXF/DWG or PDF for the workshop.

Finally save the file.

1.3 Manual Way to Create Electrode

Besides the automatic tool for electrode creation we also can find different tools in electrode module for creating electrode. All these tools are using the basic modeling command to help create electrode shape under some cases. For differentiating the manual tool, we can name them as manual tools. As follows:

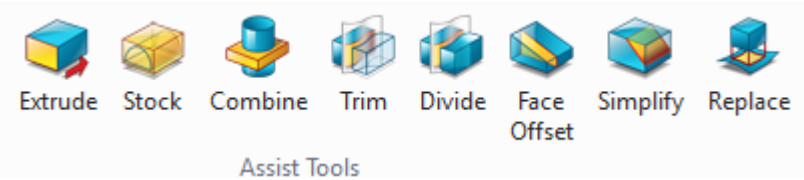


Figure44 Manual tools for electrode

Among these tools the Trim and Replace commands are used frequently very much, they can almost be used in every case. Therefore, in this chapter it is very necessary to take a real example to explain how to use these 2 manual tools in details.

Next let's create an empty file and name it. And then insert the example file "**Manualway_1**" into the newly created empty file. As mentioned in above chapter we can merge the part into the file. The file is as follows:

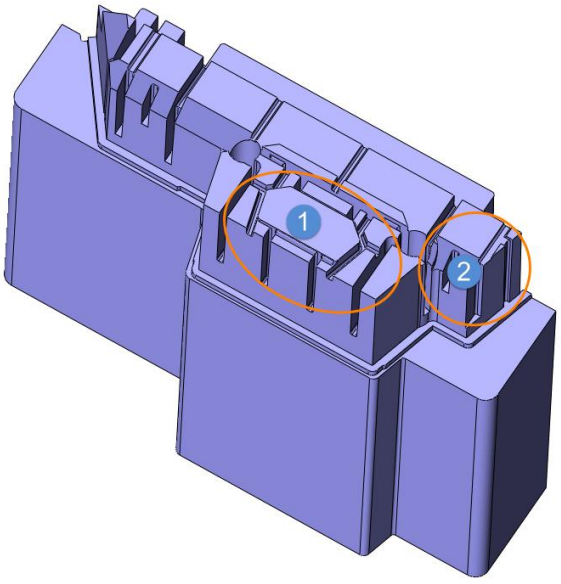


Figure45 Example part "ManualWay_1"

After analyzing the part, we can find there are a lot of narrow and tiny slots and opened deep pockets. Those features need to use electrodes for machining since normal tool is hard to cut. So we will create the electrodes for these features. However, most of the features are similar thus we can take some of them as examples to show how to create it by the manual tools.

Here let's take the following 2 group of features as example to explain in detail.

1.3.1 Create Electrode for Feature Group1

STEP 01 Create a stock as follows:

i. Choose stock command

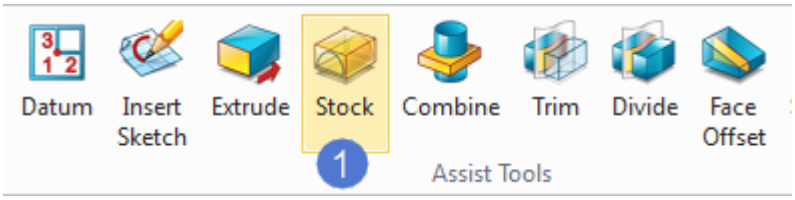


Figure46 Stock command in Ribbon tool bar

ii. Set up the "Filter" as "Face"

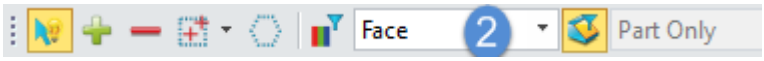


Figure47 Set up filter as "Face"

iii. And then go to pick the face as input

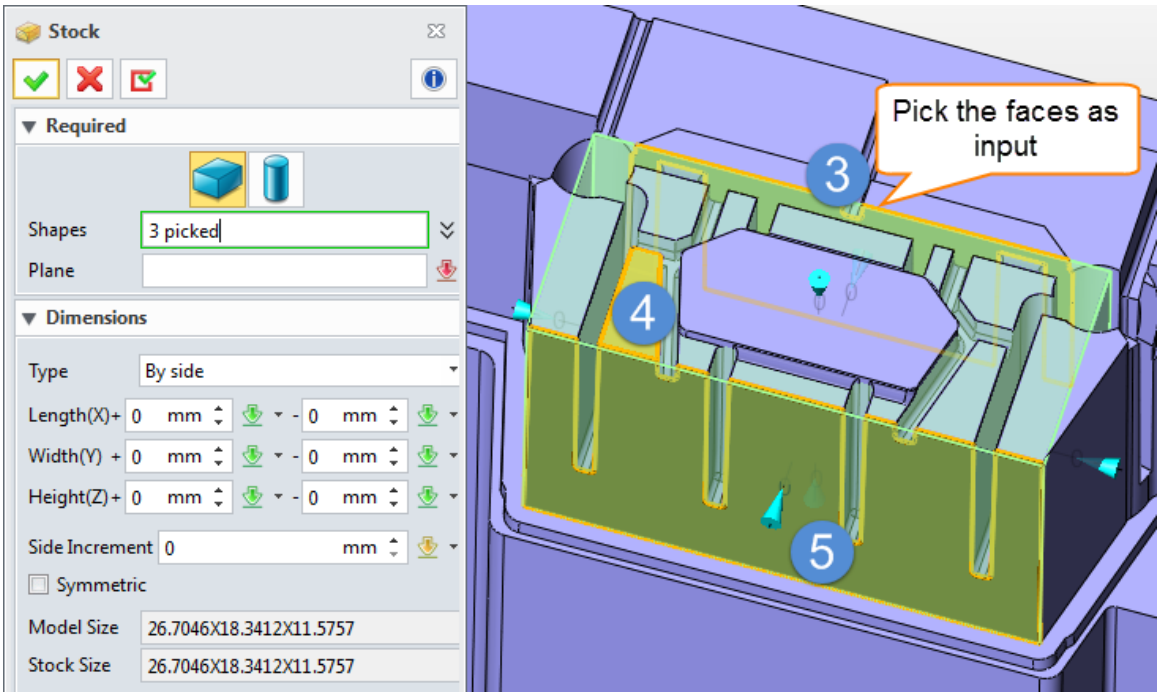


Figure48 Pick faces as inputs

iv. After we can get a stock as follows:

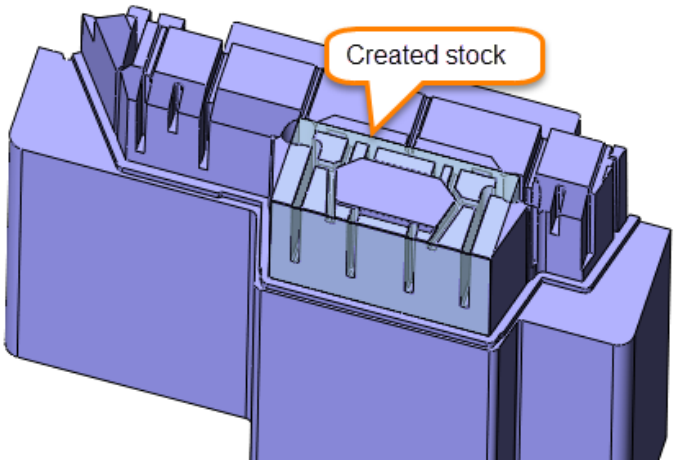


Figure49 New created stock

STEP 02 Modify the stock by “Replace” and “Trim” command as follows:

i. Replace the back face as follows:

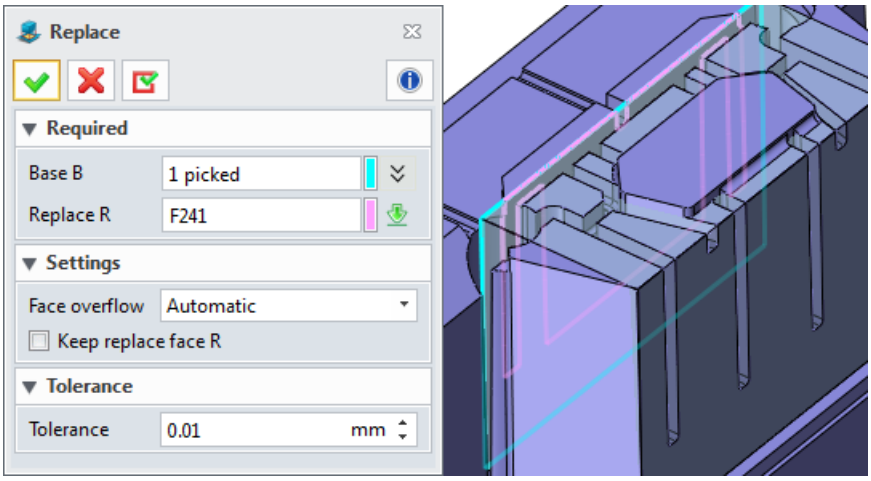


Figure50 Replace the back face

ii. Trim the front face as follows:

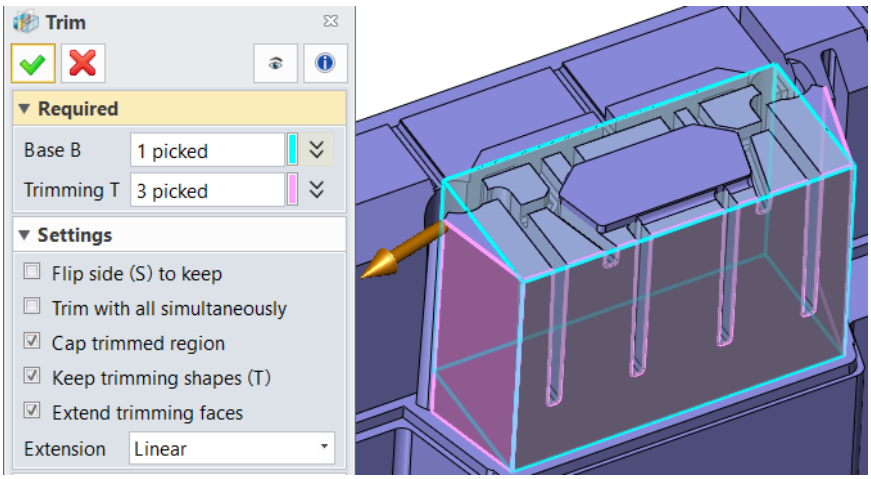


Figure51 Trim the front face

STEP 03 Combine the stock with the part to create the electrode working shape

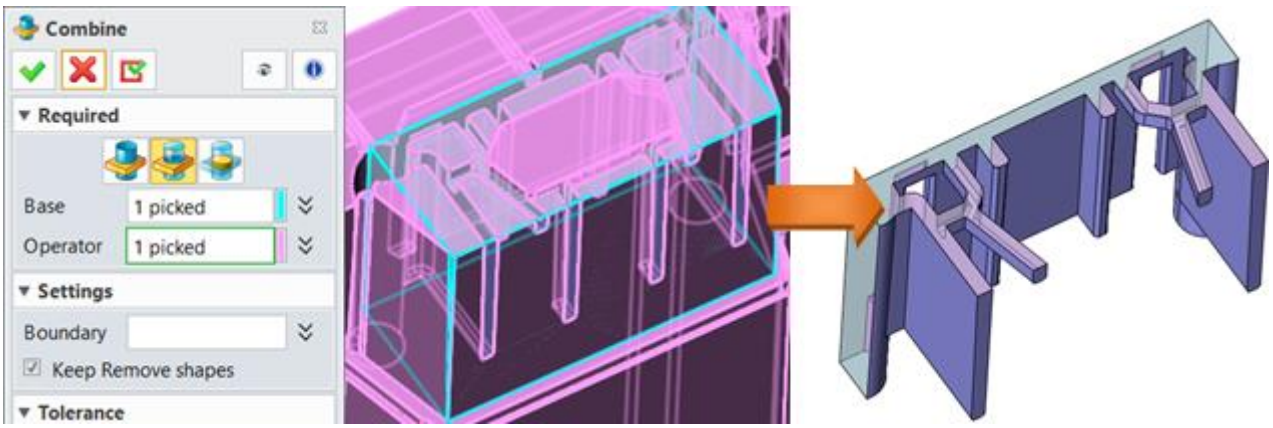


Figure52 Electrode working shape by combine

STEP 04 Trim away the unnecessary part as follows:

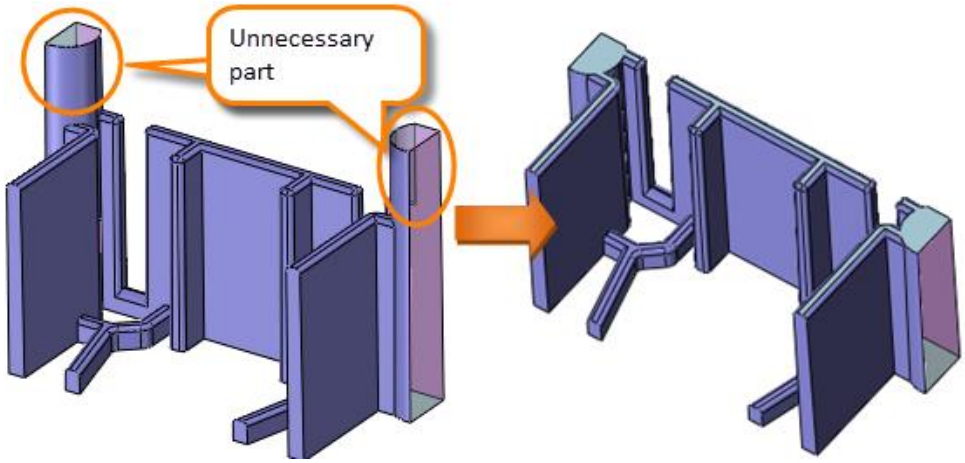


Figure53 Trim away the unnecessary part

STEP 05 In order to let the eletrode machine easier we can modify it as follows:

i. Extend the top face of electrode shapes

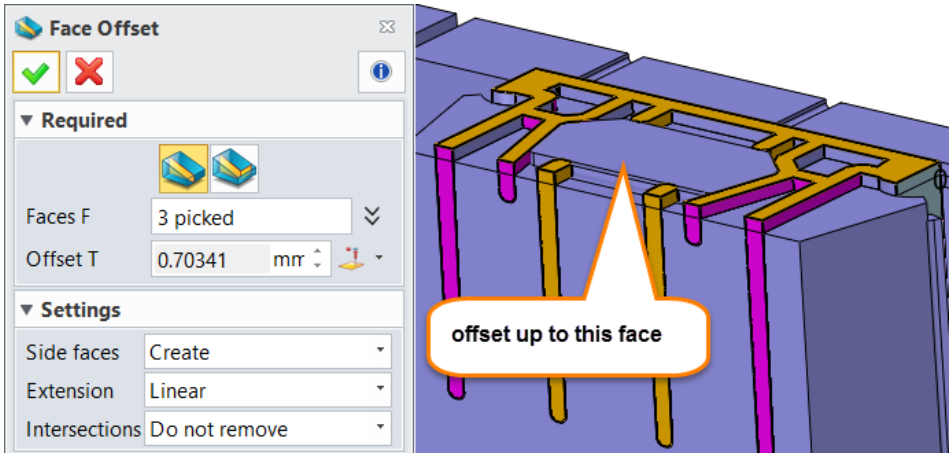


Figure54 Extend the top face of electrode shape

ii. Extend the side face by 2 mm

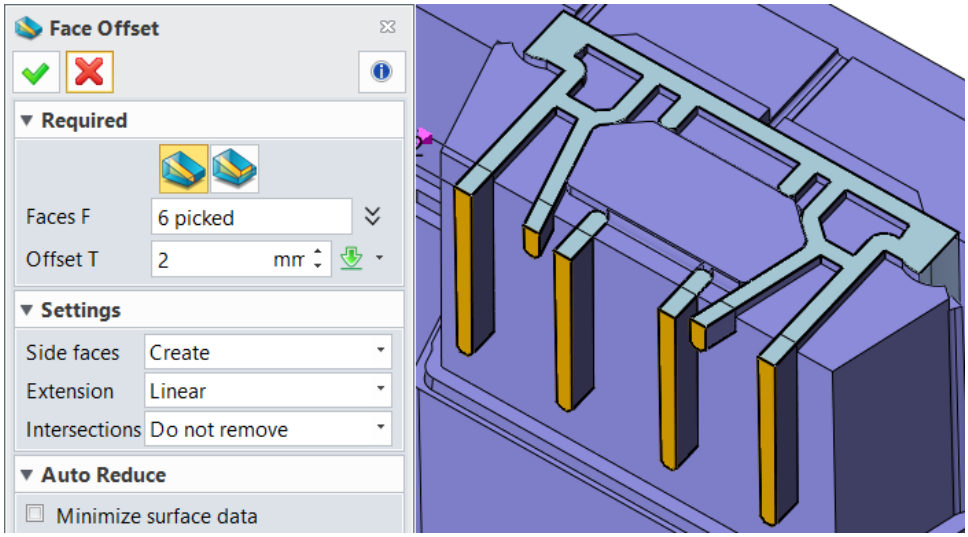


Figure55 Extend side face of electrode shape

iii. Divide the whole electrode shape as several simple ones

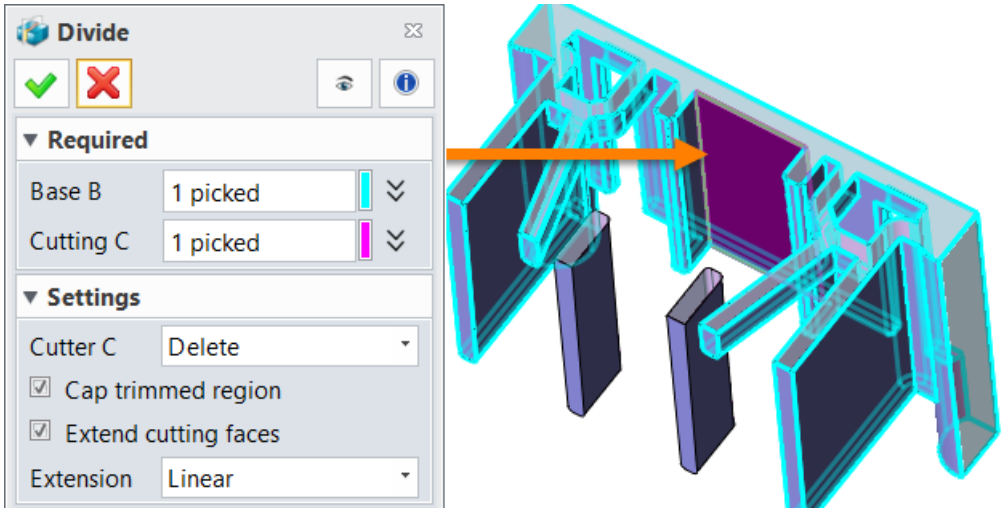


Figure56 Divide the electrode shape

iv. Then we can get the divided shapes as follows:

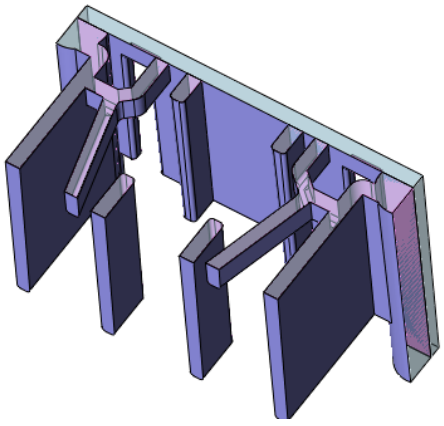


Figure57 Divided the electrode shape

v. Continue to divide the shapes into left and right side

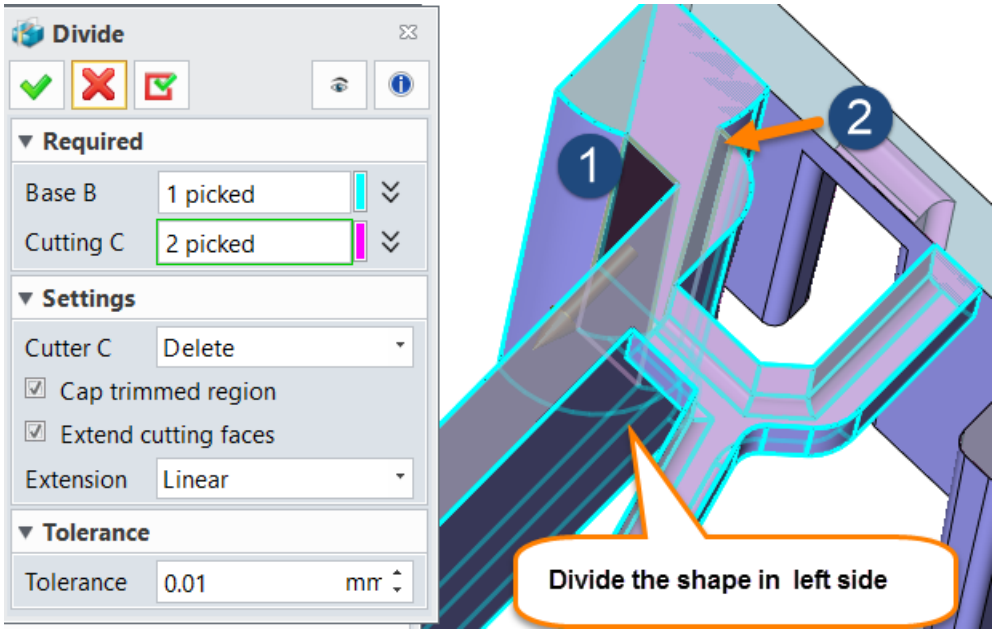


Figure58 Divide shape in left side

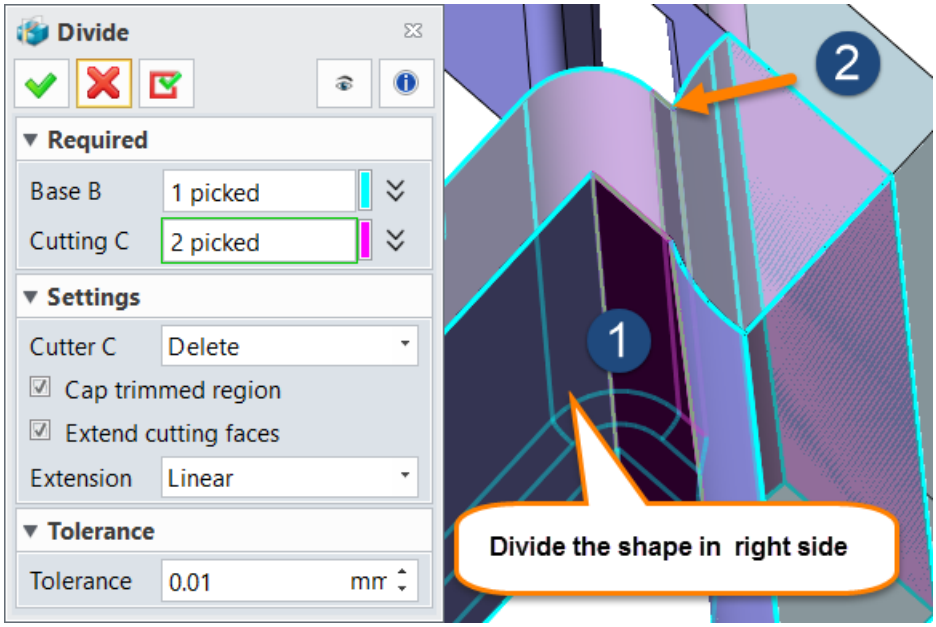


Figure59 Divide shape in right side

vi. Then erase the unnecessary shapes as follows:

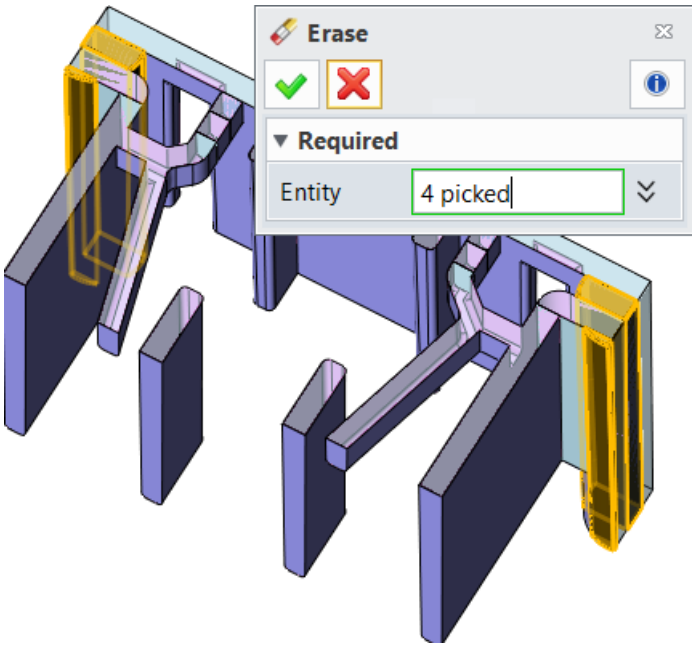


Figure60 Erase the unnecessary shapes

vii. Modify the specified shape

1) Step 1:Highlight the target

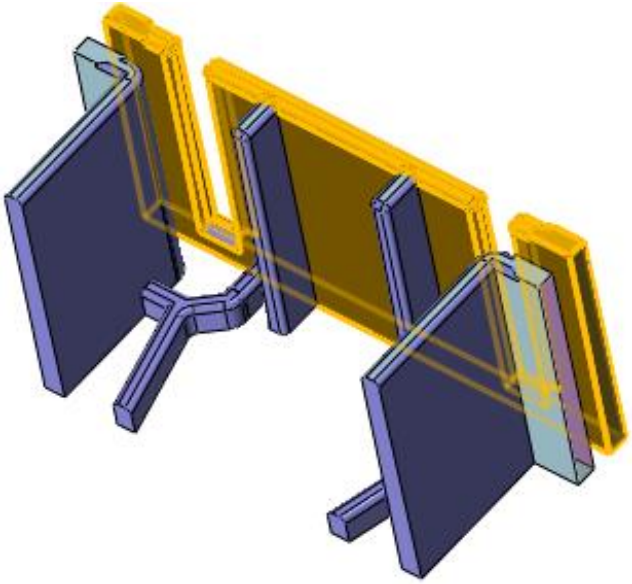


Figure61 Highlight target shape

2) Step 2 : Replace the corner as follows

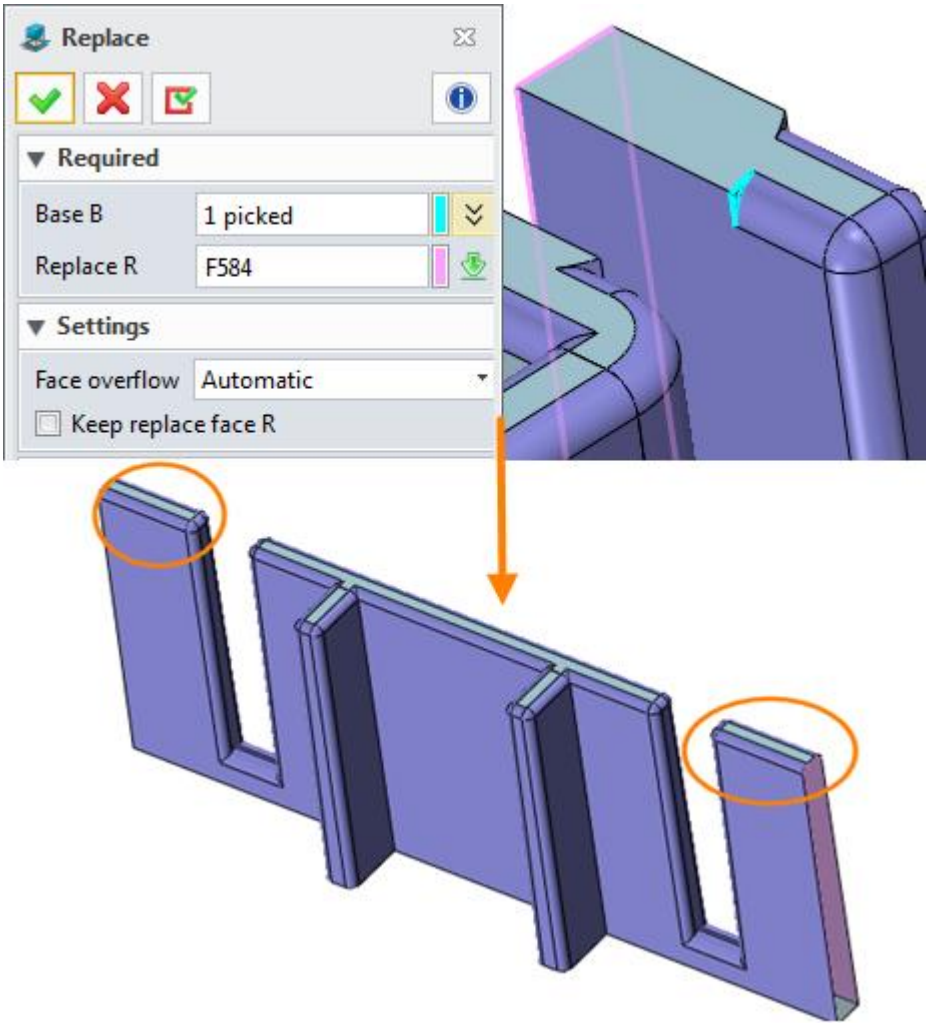


Figure62 Replace corner face

viii. Continue to remove some unnecessary parts from the shape

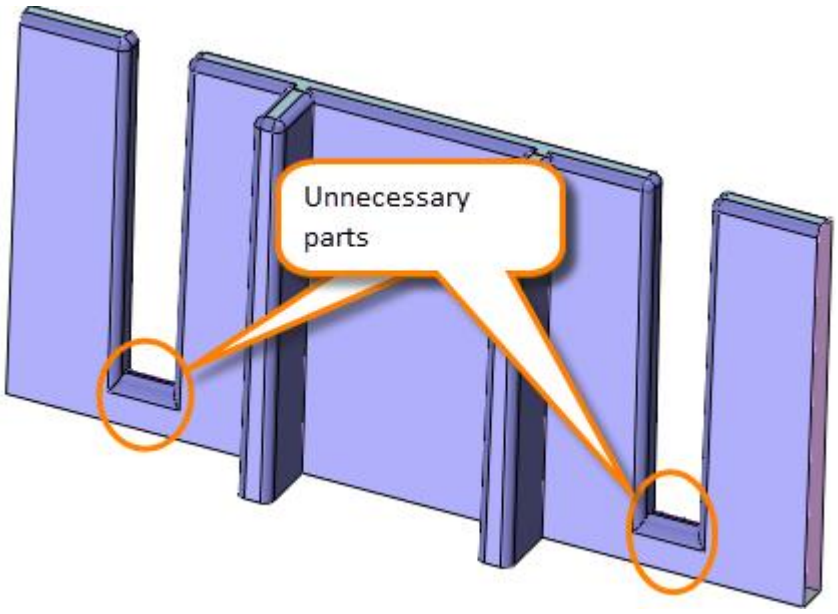


Figure63 Unnecessary parts

1) Divide by faces as follows:

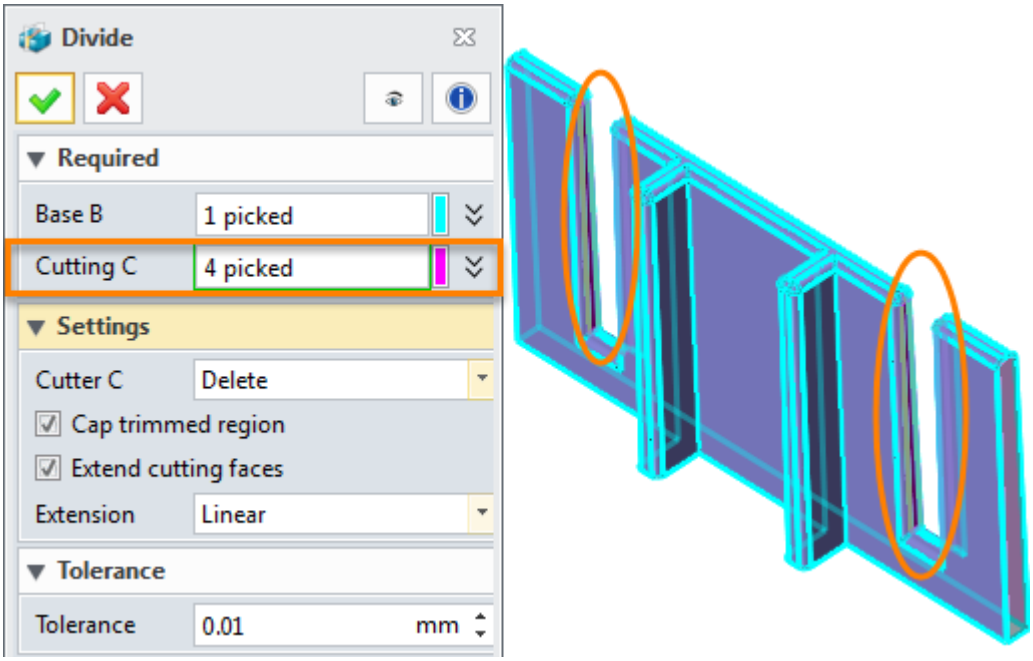


Figure64 Divide by faces

2) Then delete the middle shapes as follows:

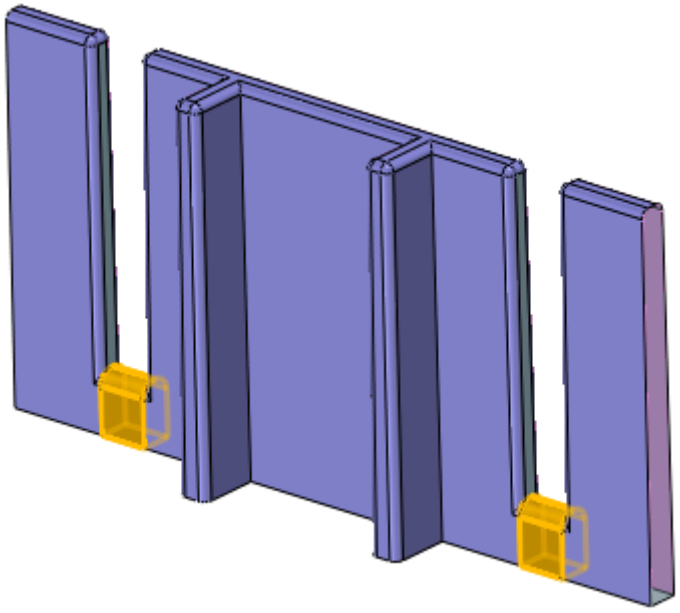


Figure65 Delete the middle parts

3) Trim the corner on bottom as follows

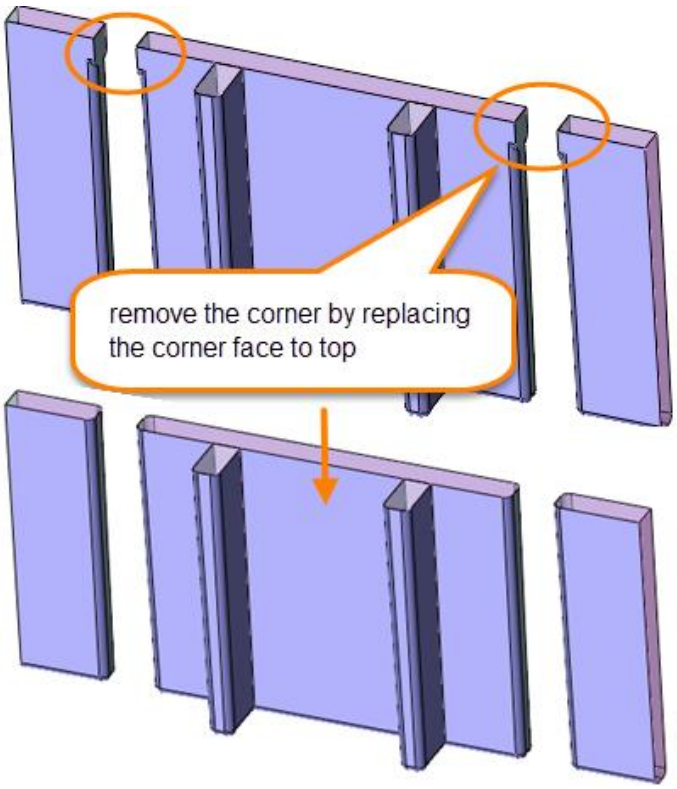


Figure66 Trim the corner on bottom

ix. Modify other shapes by simplify command as follows:

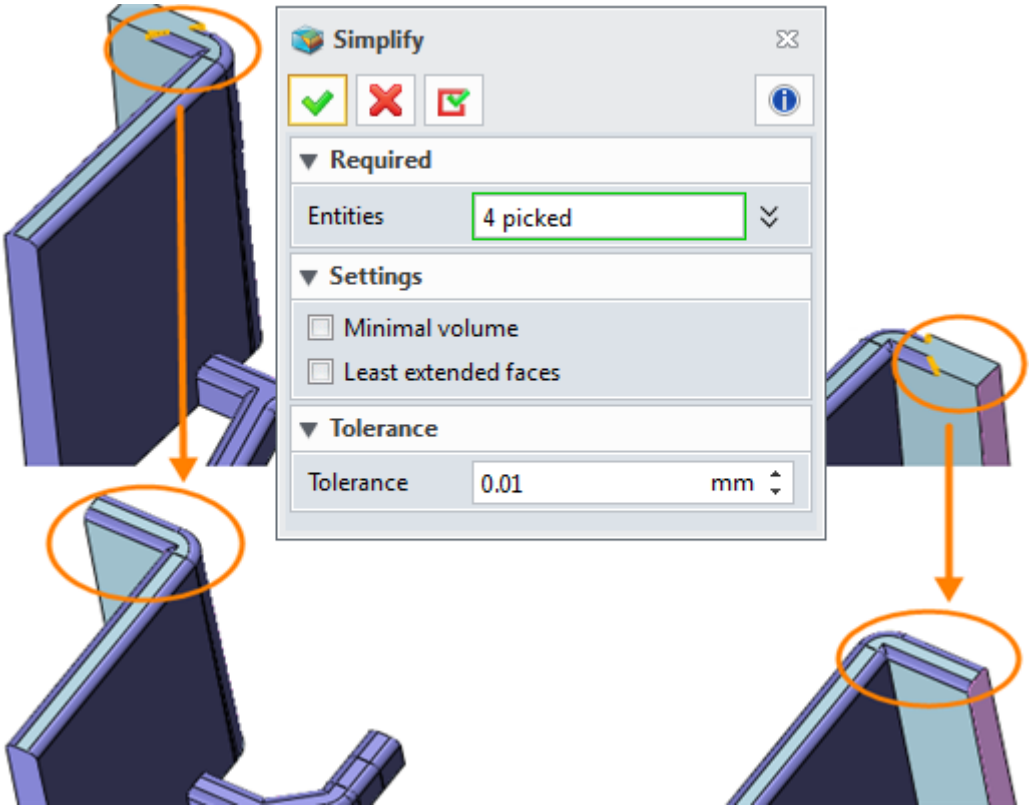


Figure67 Simplify the shapes

x. Group the electodes by different color as follows:

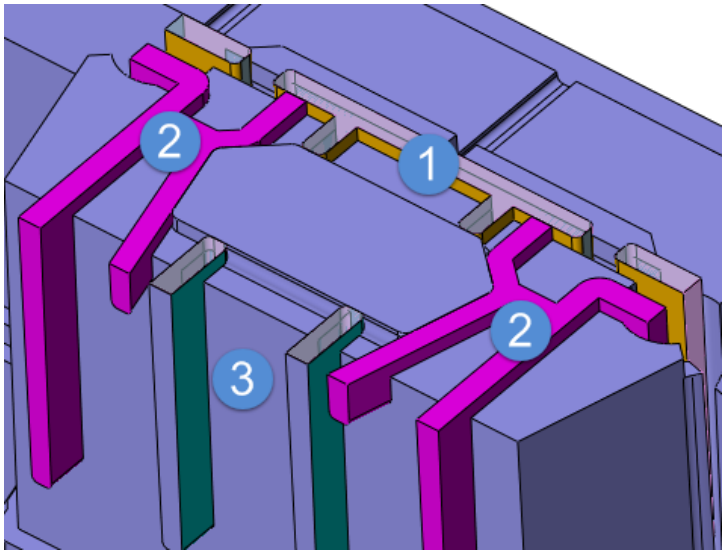


Figure68 Group the electrode by different color

Since the electrode's thickness is too small (about 1.2 mm) thus it is very necessary to stiffen it by adding some stiffer. Next let's add it to each electrode group.

STEP 07 Add stiffer for electrode group 1

i. Offset the top face by 1 mm again as follows:

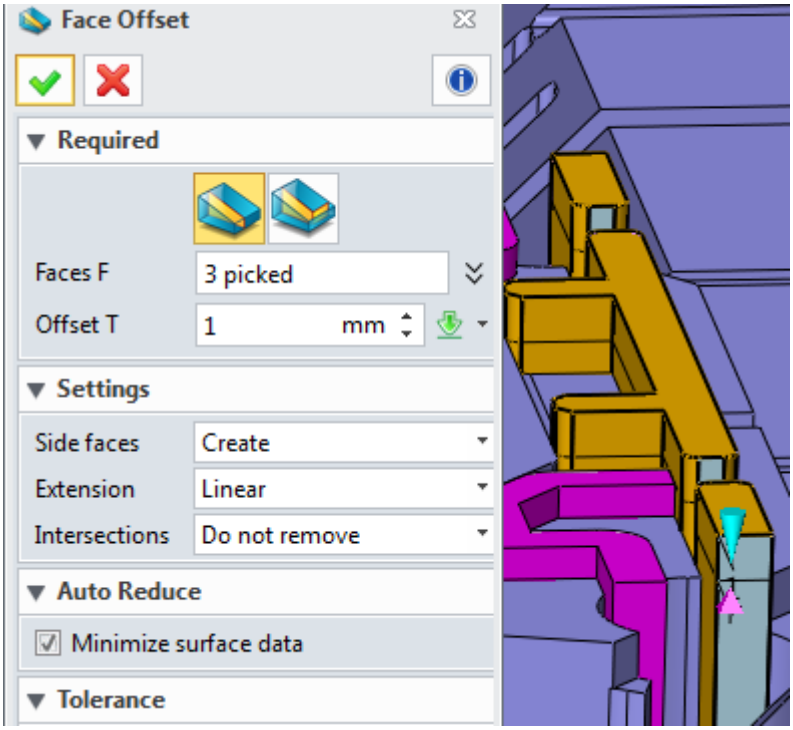


Figure69 Offset the top face of eletrode group 1

ii. Create stock as follows:

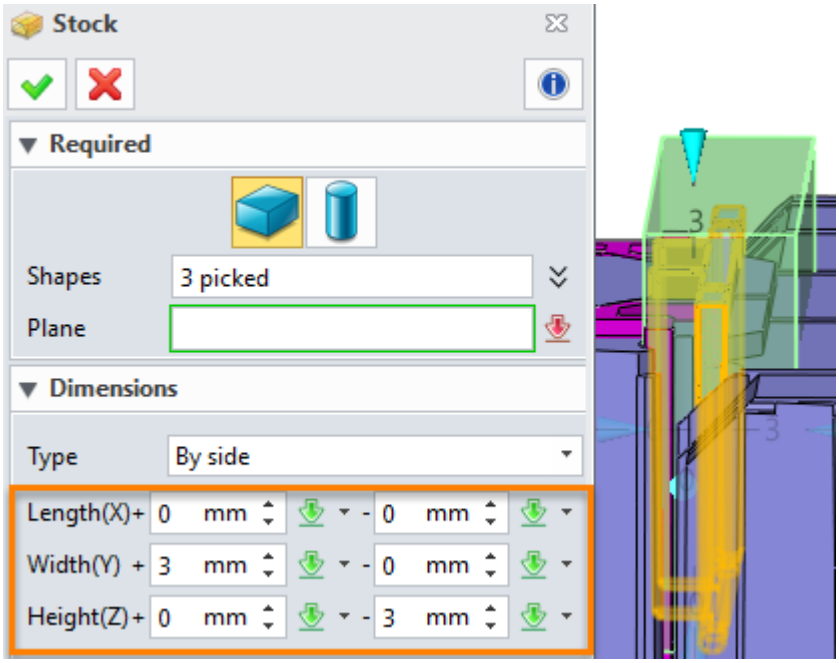


Figure70 Create stock for electrode group 1

iii. Trim it by face as follows:

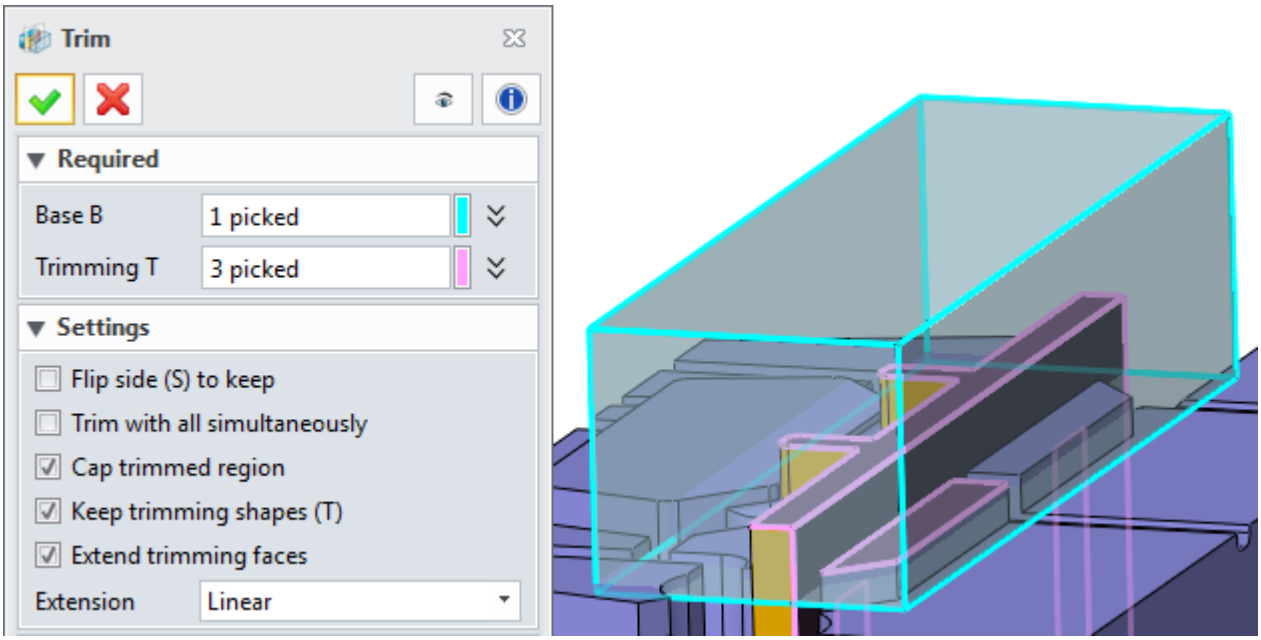


Figure71 Trim the stock by face

iv. Combine the trimmed shape with group 1 shape as follows:

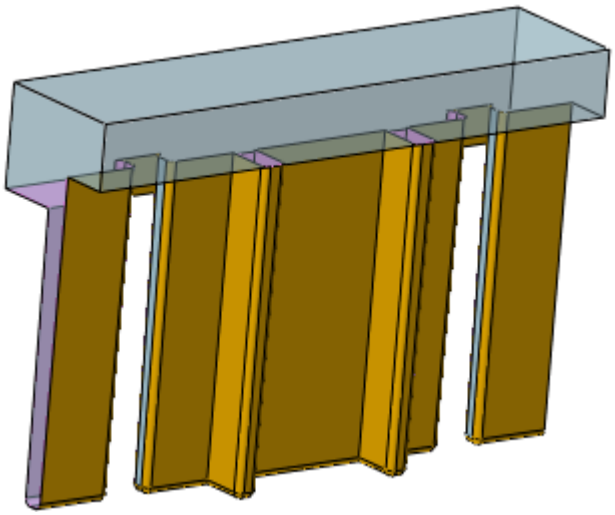


Figure72 Combined the trimmed shape with group 1

v. Just only show this shape and then divide it by face as follows:

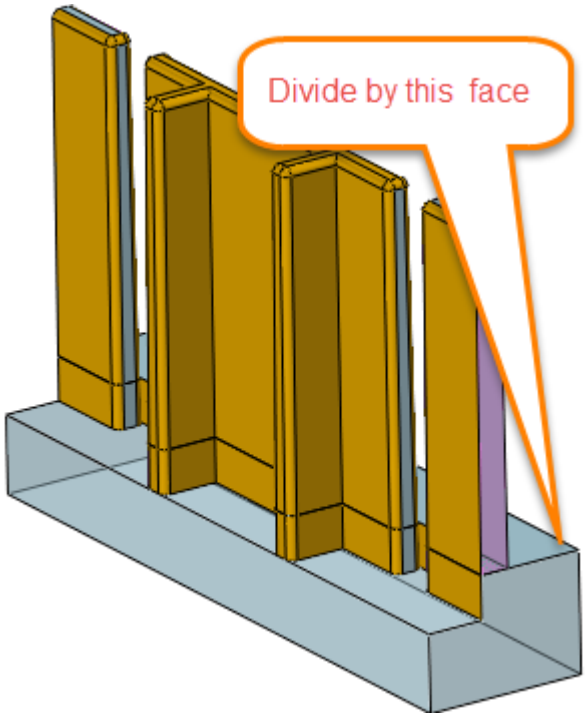


Figure73 Divide the combined shape

vi. Simplify as follows:

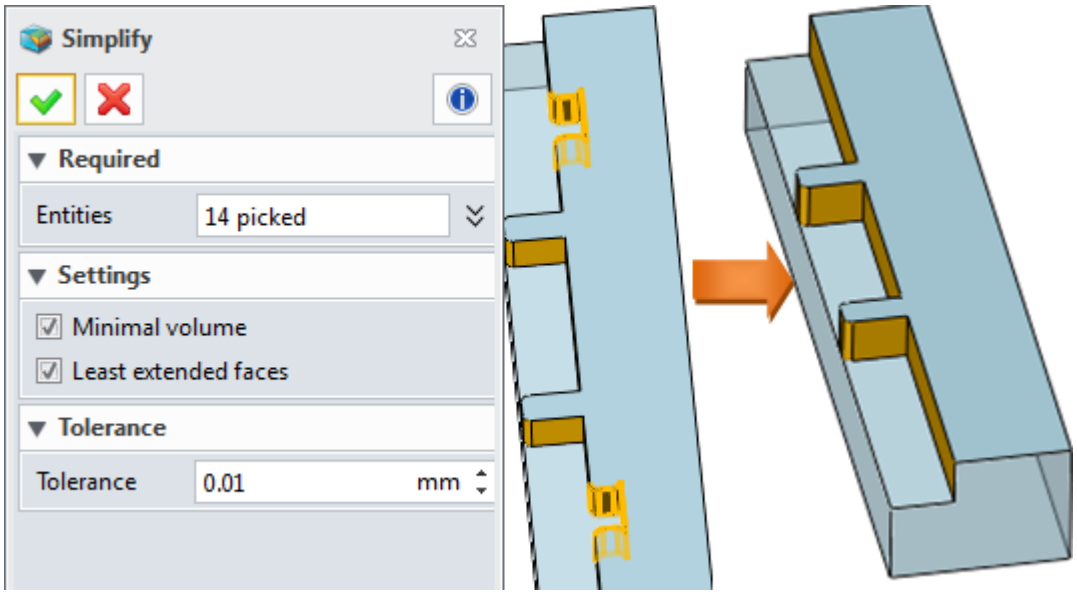


Figure74 Simplify the half bottom of the divided shape

vii. Combine the divided shapes again as follows

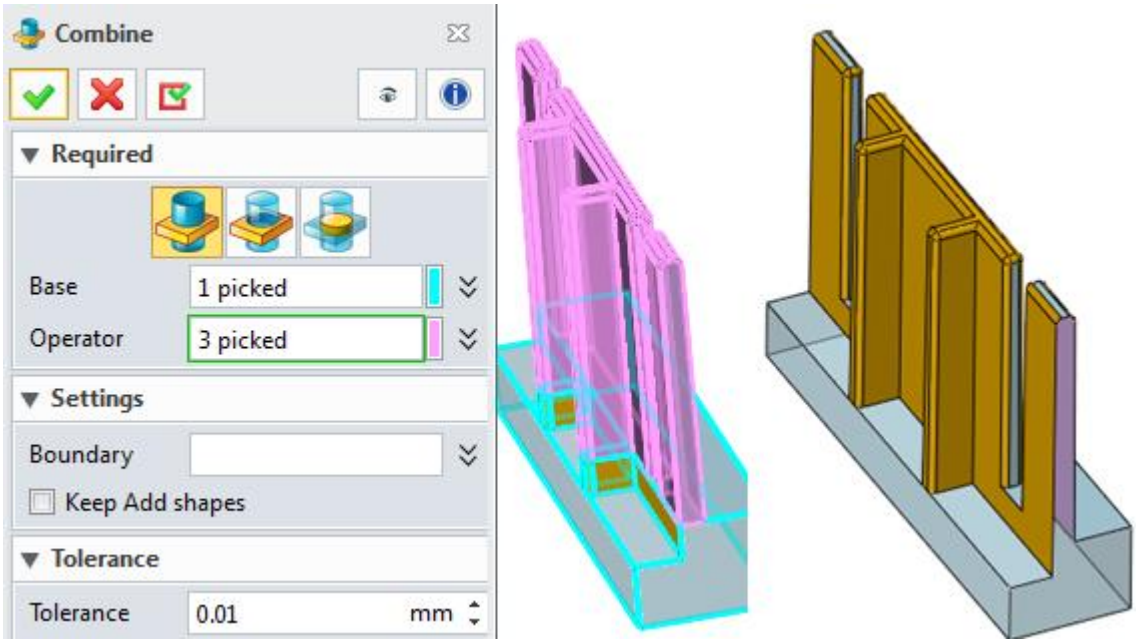


Figure75 Combine the divided shapes again

STEP 08 Add stiffer to electrode group 2

i. Offset the top face of the eletrode shapes as follows:

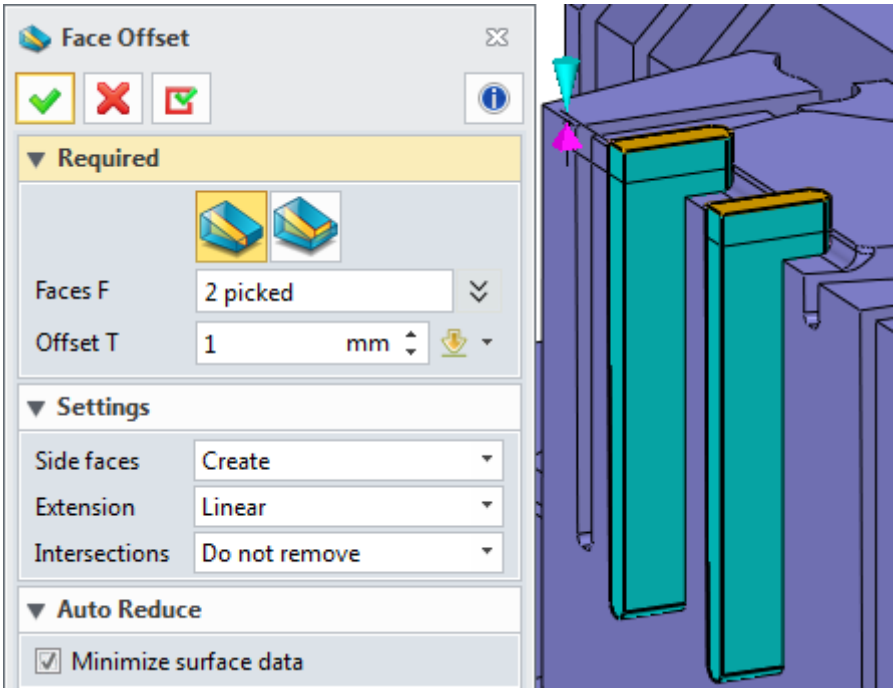
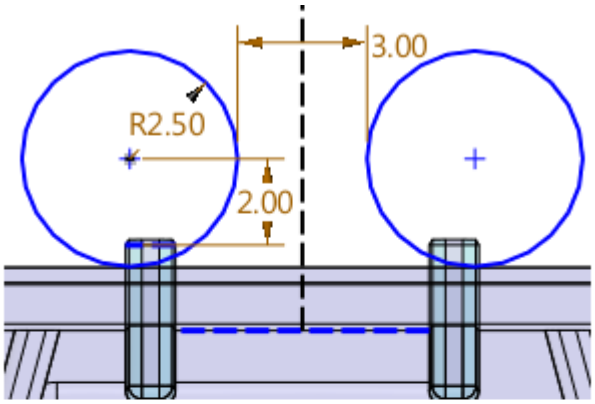


Figure76 Offset top face of electrode shapes

ii. Create sketch based on the top face of electrode as follows:



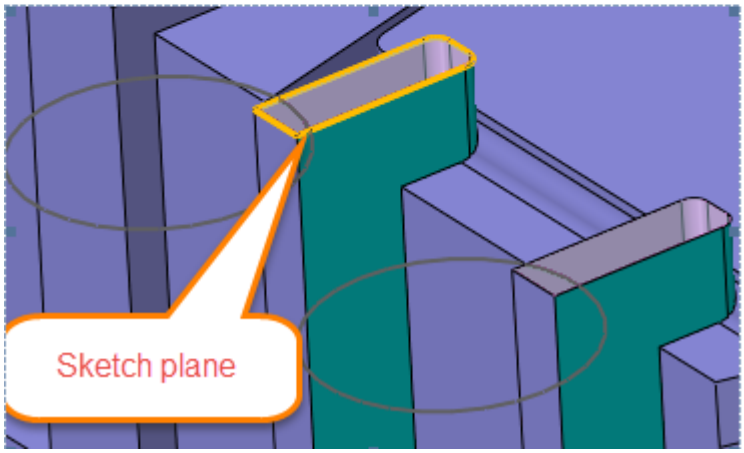


Figure77 Create sketch

iii. Extrude the sketch as follows:

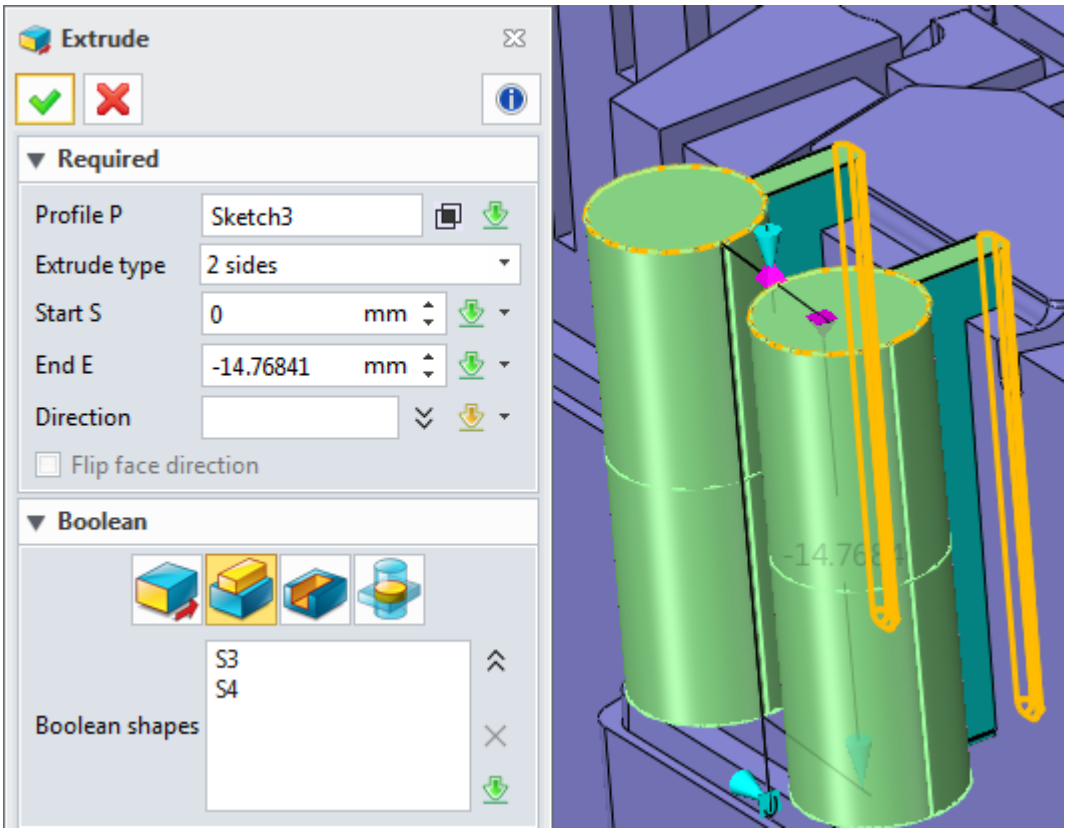


Figure78 Extrude the sketch

iv. Add fillet at the corners as follows:

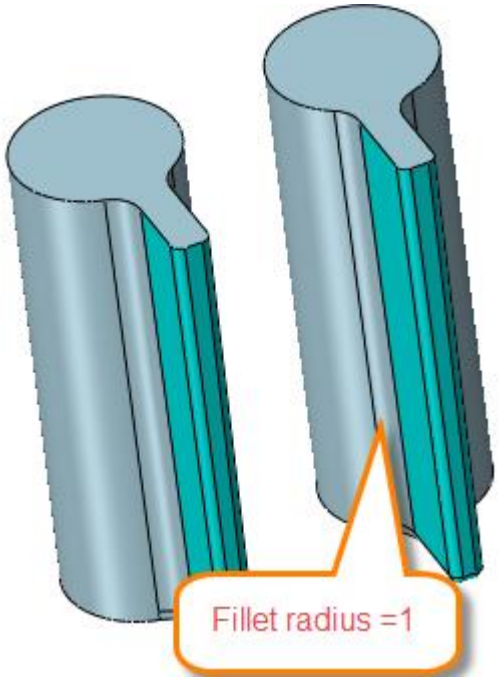


Figure79 Add fillet at the corners

STEP 09 Add stiffer for group 3

Offset the top face and side face of shapes of group 3 by 1 mm again as follows:

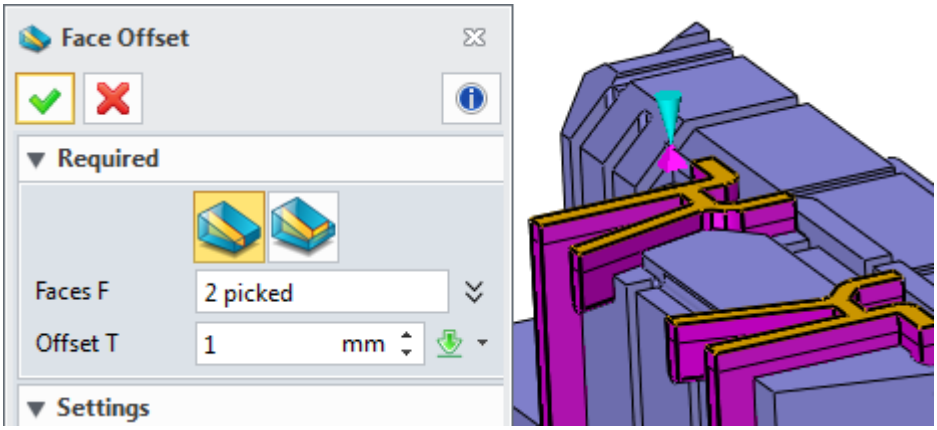


Figure80 Offset the top face of electrode group 3

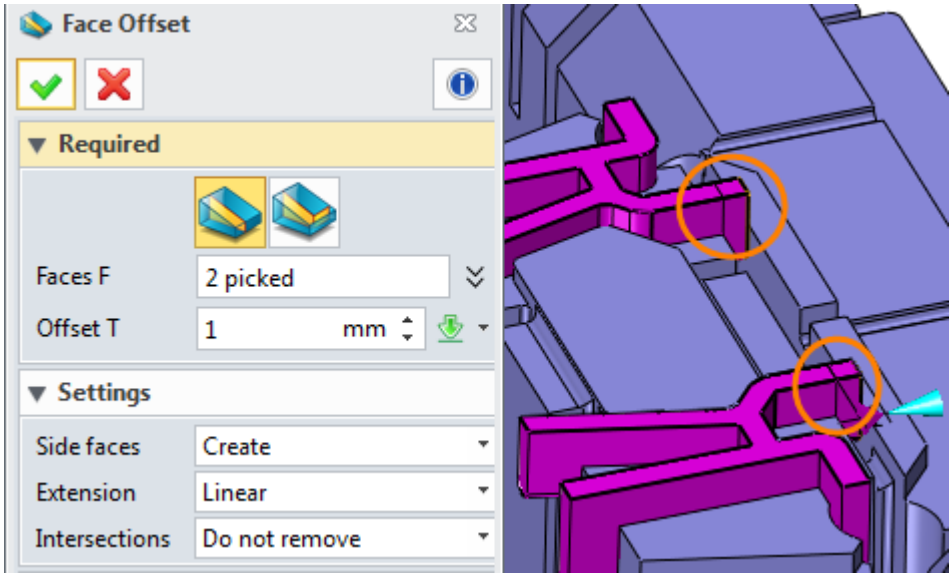


Figure81 Offset the side faces

Next let's go to add stiffer for them:

i. Create stock for the electrode shape by shaping on the left side as follows:

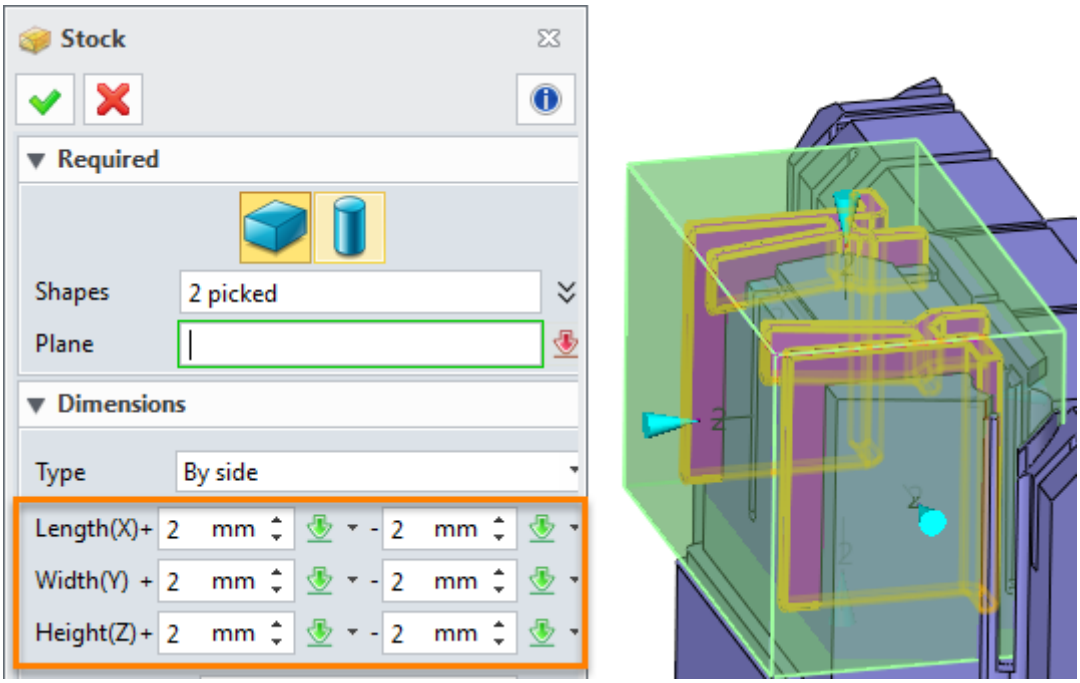


Figure82 Create stock for electrode group 3

ii. Trim it as follows:

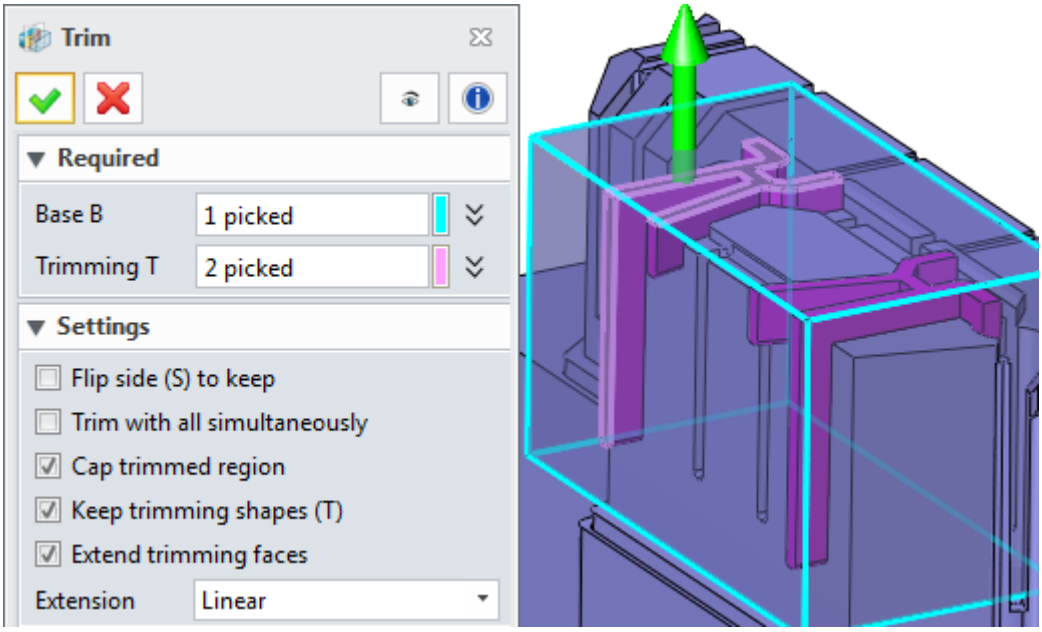


Figure83 Trim the stock by faces

iii. Combine the trimmed stock shape with the electrode shape as follows:

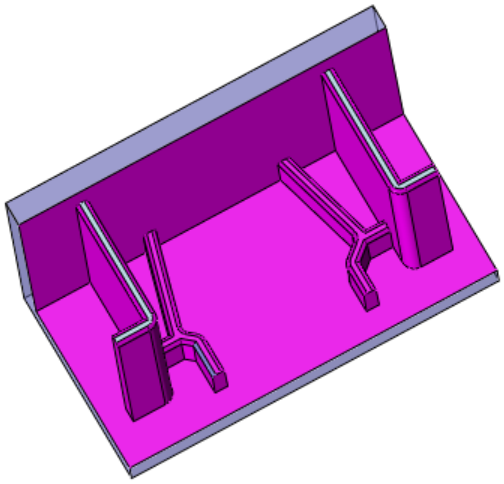


Figure84 Combined the trimmed shape with electrode shapes

iv. Fillet the out side edges by radius of 0.5 mm as follows:

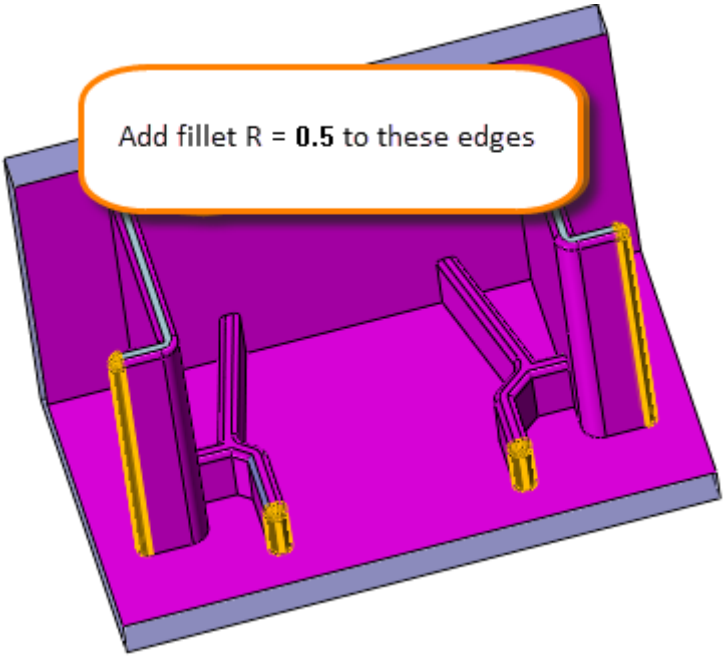


Figure85 Fillet the outside edges

v. Fillet other edges by raidus of 1 mm as follows:

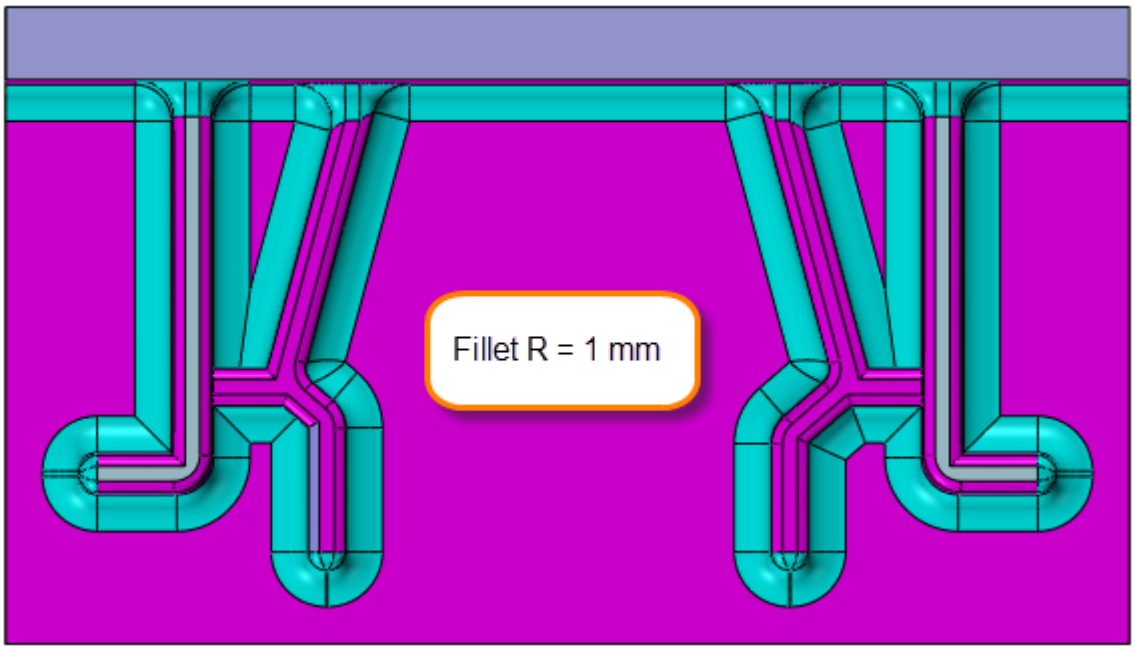


Figure86 Fillet other edges by raidus of 1 mm

STEP 10 Add blank for each group as follows:

i. Add blank for group 1 as follows:

1) Basic dimension for blank:

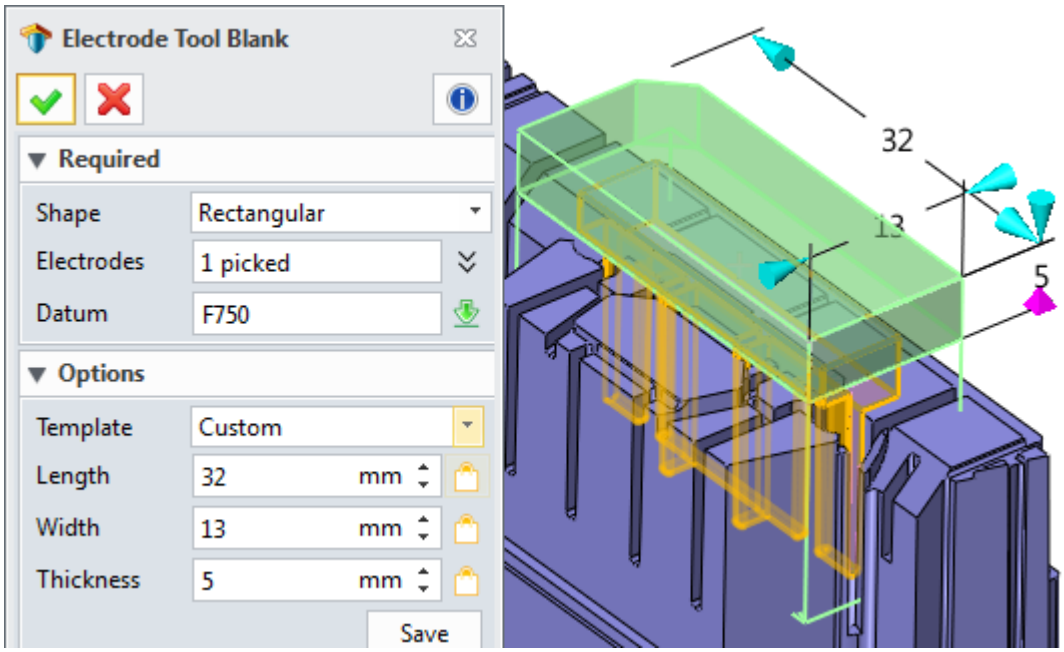


Figure87 Basic dimension for blank of electrode group 1

2) Origin and Mark setting :

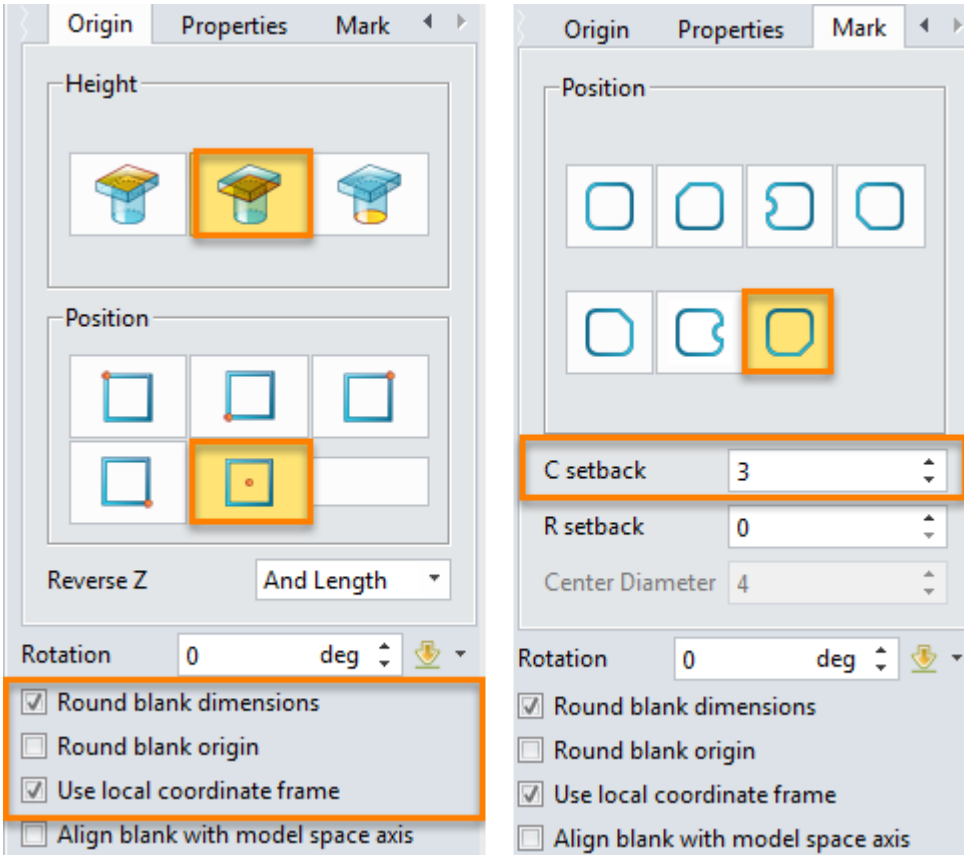


Figure88 Origin and mark for blank of electrode group 1

Change the face color of blank to “brown” and confirm the command. We can get the result as follows:

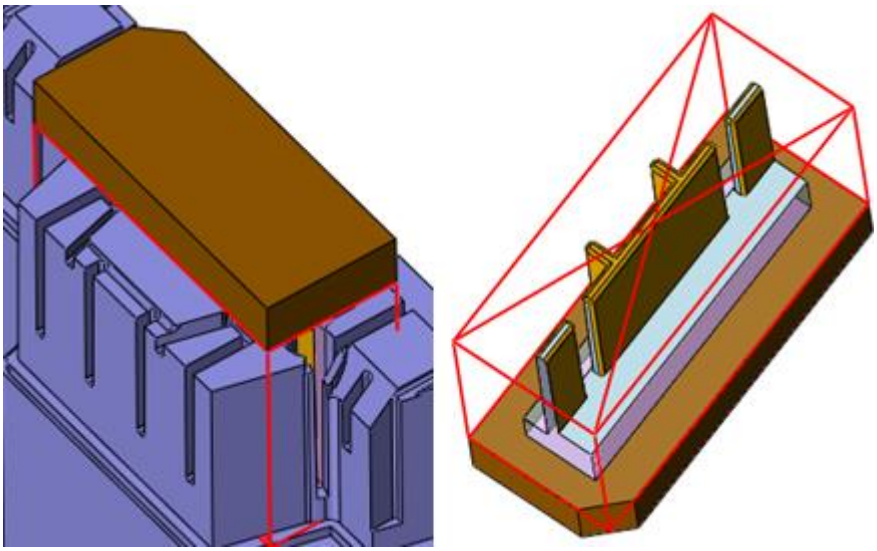


Figure89 Added blank for electrode group 1

ii. Add blank for electrode group 2 as follows:

1) Basic dimension for blank:

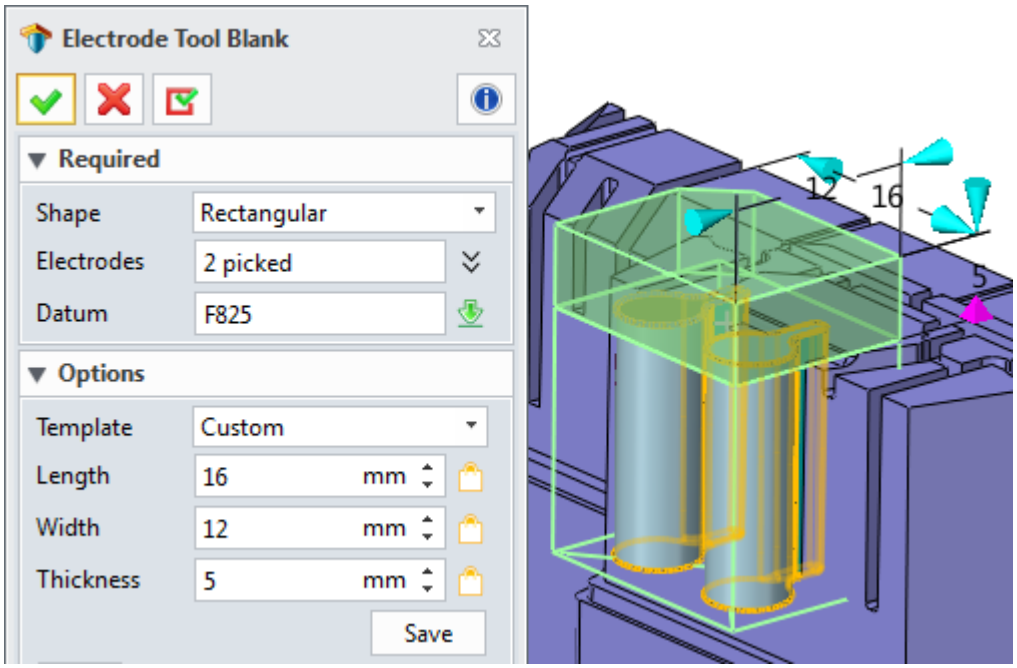


Figure90 Basic dimension for blank of electrode group 2

2) The orgin and mark use the same setting as electrode group 1. Confirm it then we can get the following result:

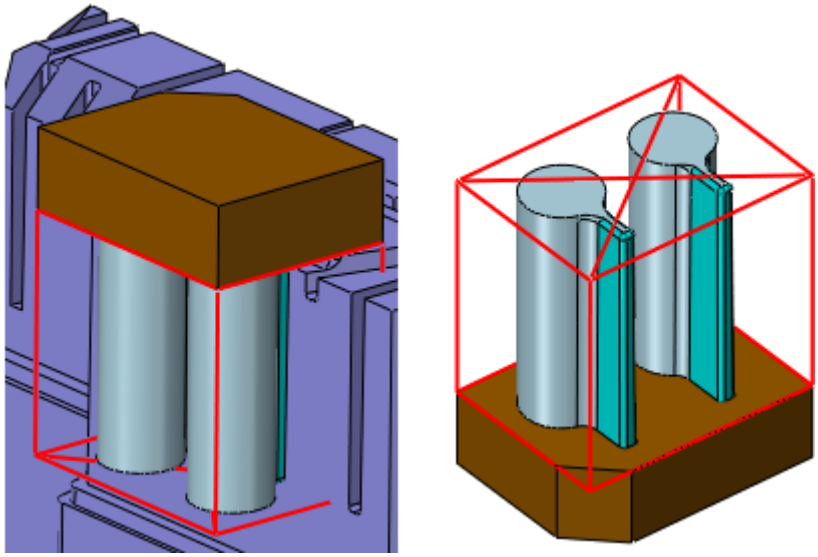


Figure91 Added blank for electrode group 2

iii. Add blank for group 3

1) Basic dimension:

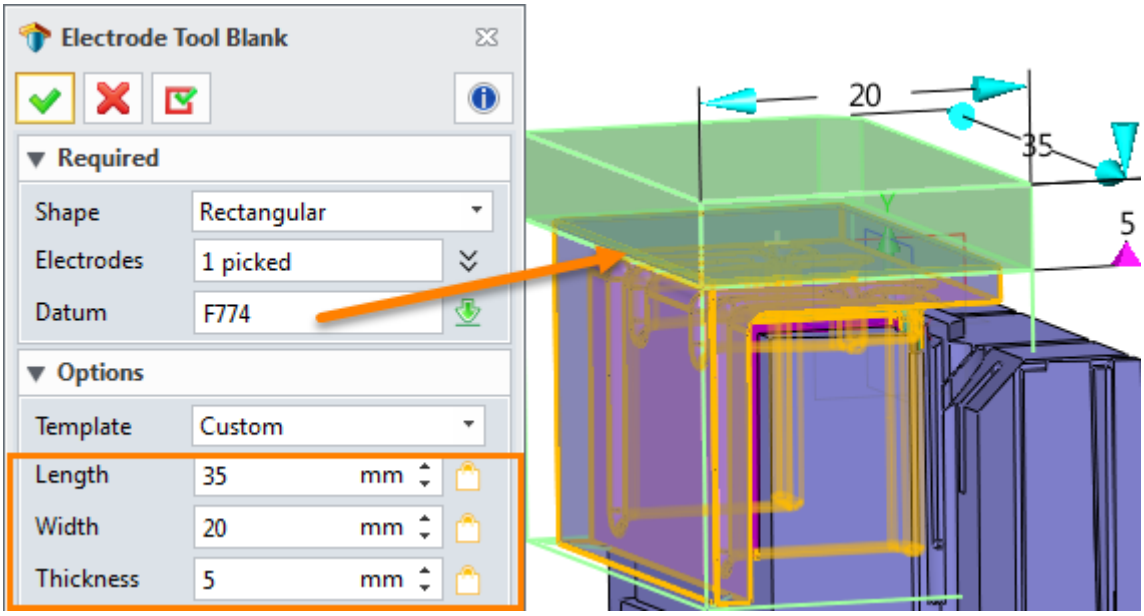


Figure92 Basic dimension for blank of electrode group 3

2) Also apply the same origin and mark setting and we can get the following result :

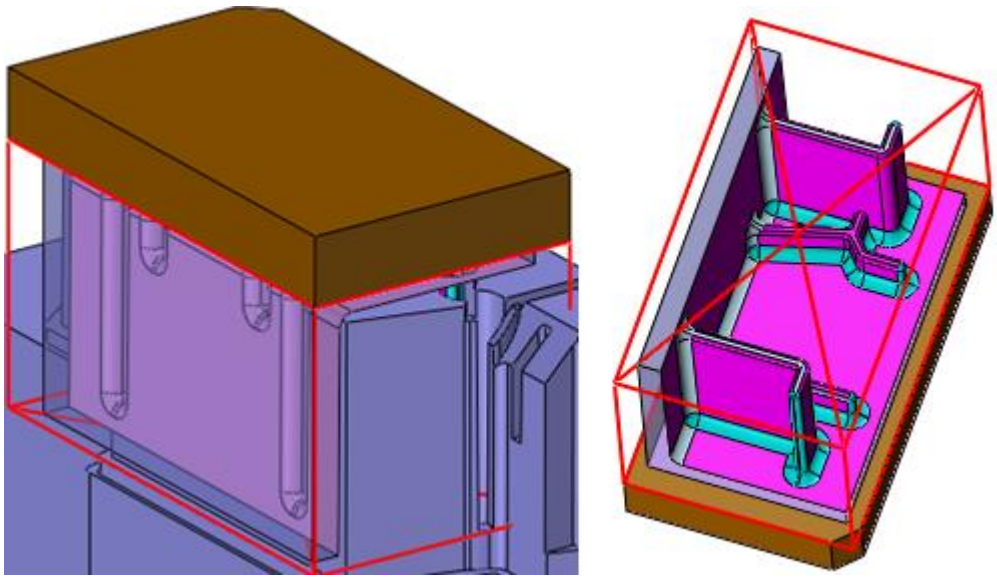


Figure93 Added blank for eletrode group 3

1.3.2 Create Electrodes for Feature Group2

In order to have a clear idea about the creating sequence we can also number the electrode in different area as follows:

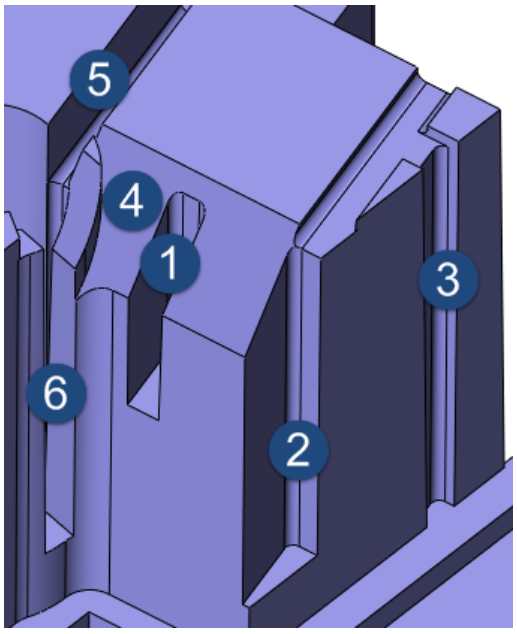


Figure94 Number the electrode by position

STEP 01 Create electrode 1

i. Create stock for the electrode 1 as follows:

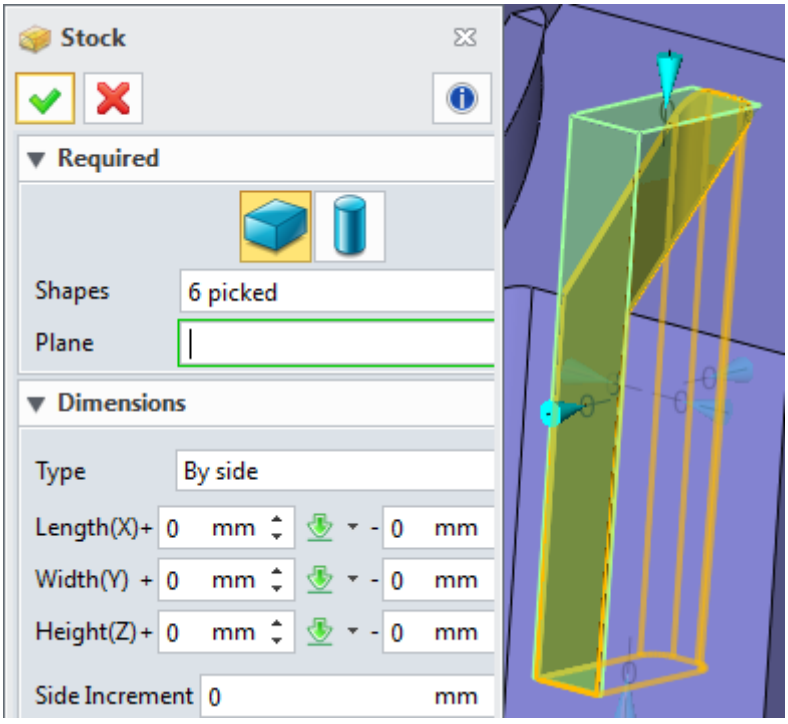


Figure95 Create stock for the open pocket area

ii. Trim it

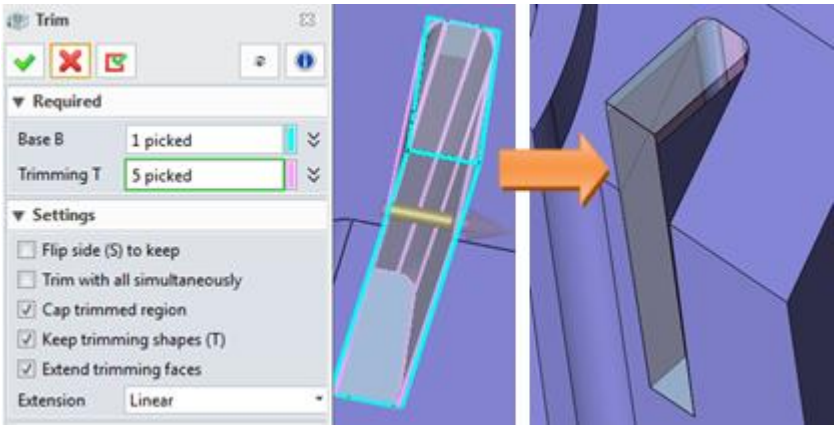


Figure96 Trim the stock

STEP 02 Create electrode2

i. Since the position for electrode 2 is in open area and the area is so small, in order to make the shape have enough strength, we can create a bigger stock as follows:

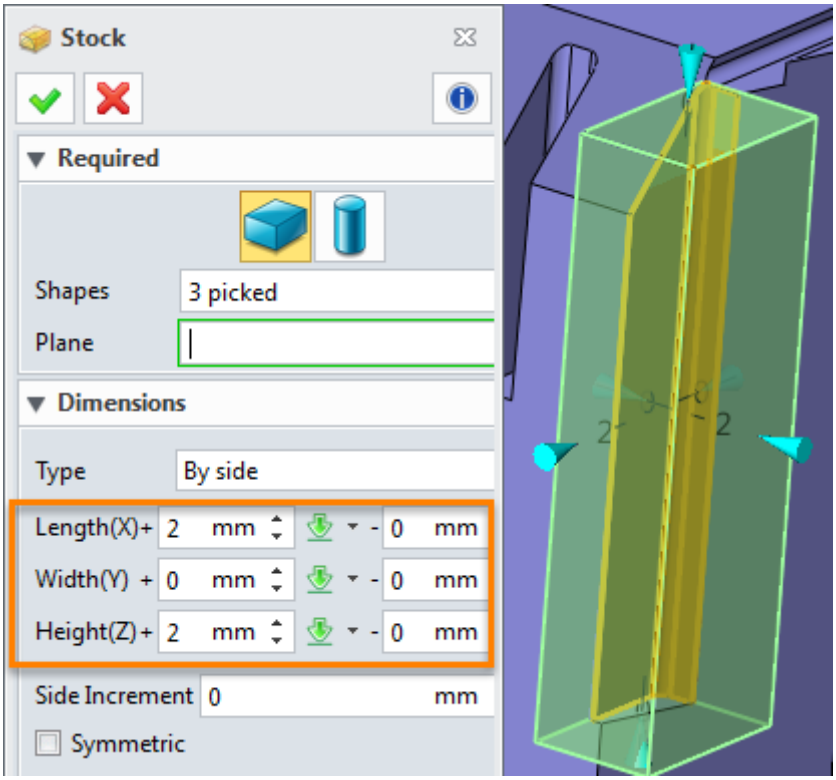


Figure97 Create stock for electrode 2

ii. Trim the stock to get the electrode shape as follows:

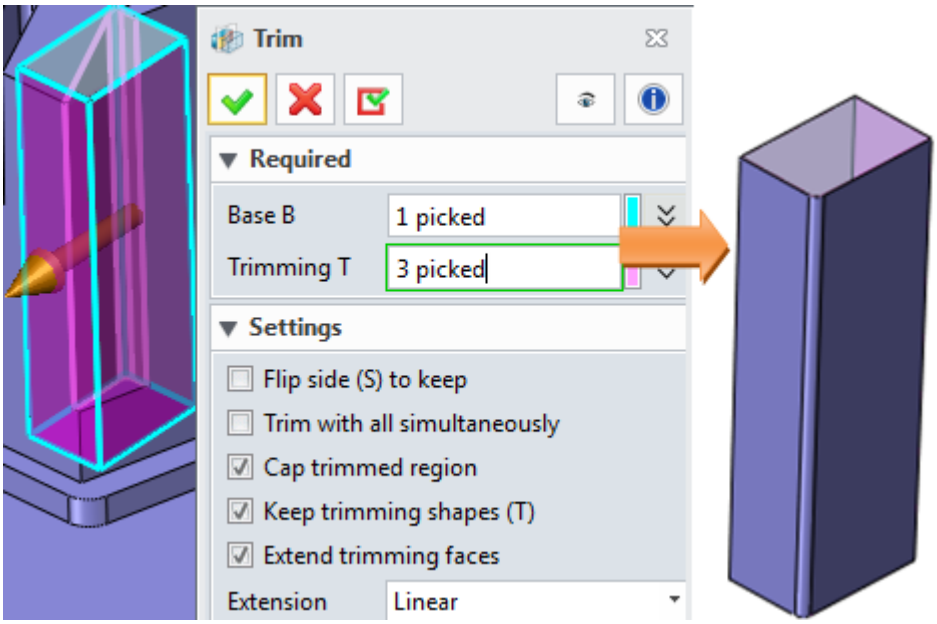


Figure98 Trim the stock to get the electrode 2

iii. Fillet the electrode 2 shape as follows:

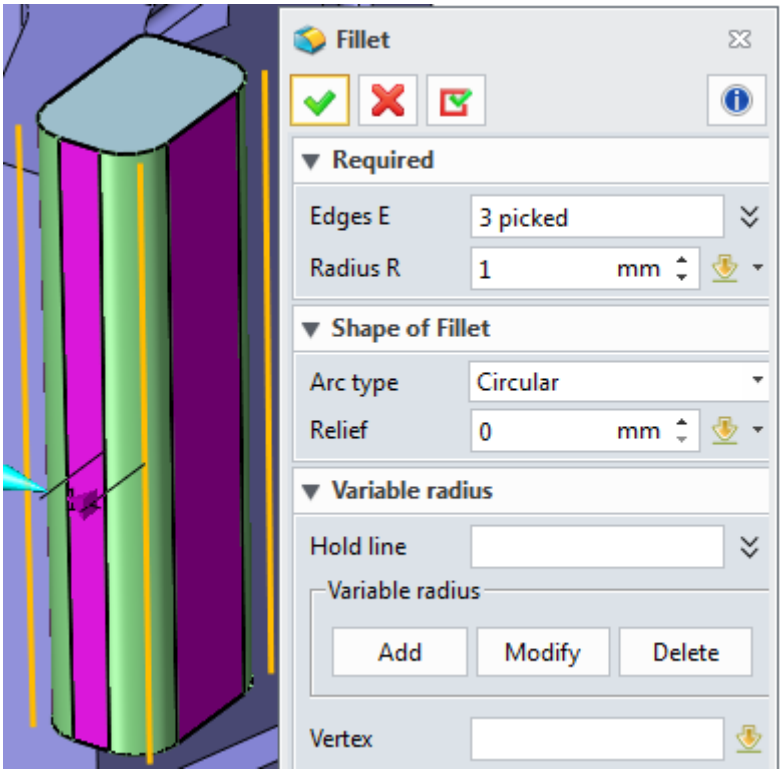


Figure99 Fillet the edges of the electrode 2

STEP 03 Create electrode 3

i. It is the same that we can stiffen the electrode by creating a bigger stock as follows:

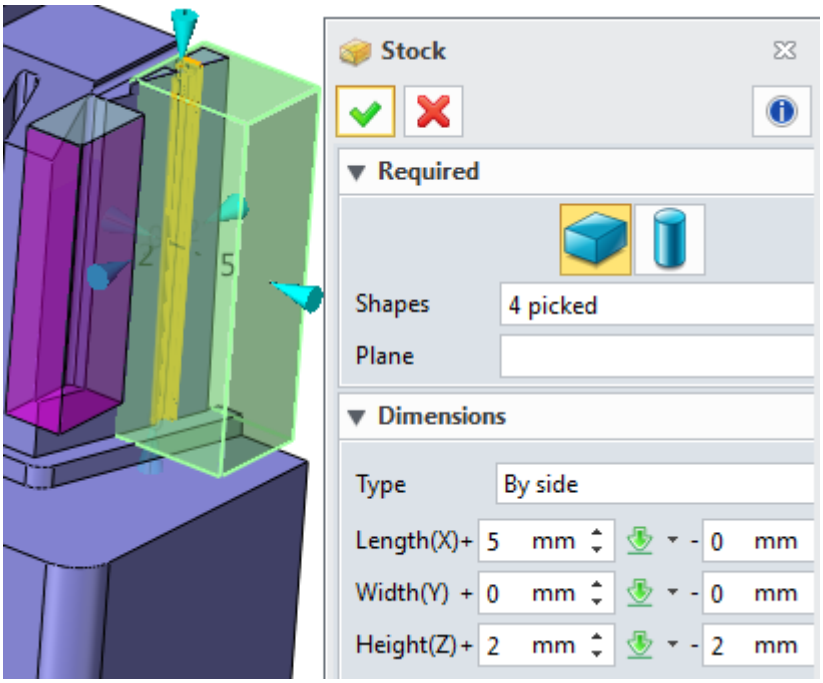


Figure100 Create stock for electrode 3

ii. Trim the stock as follows

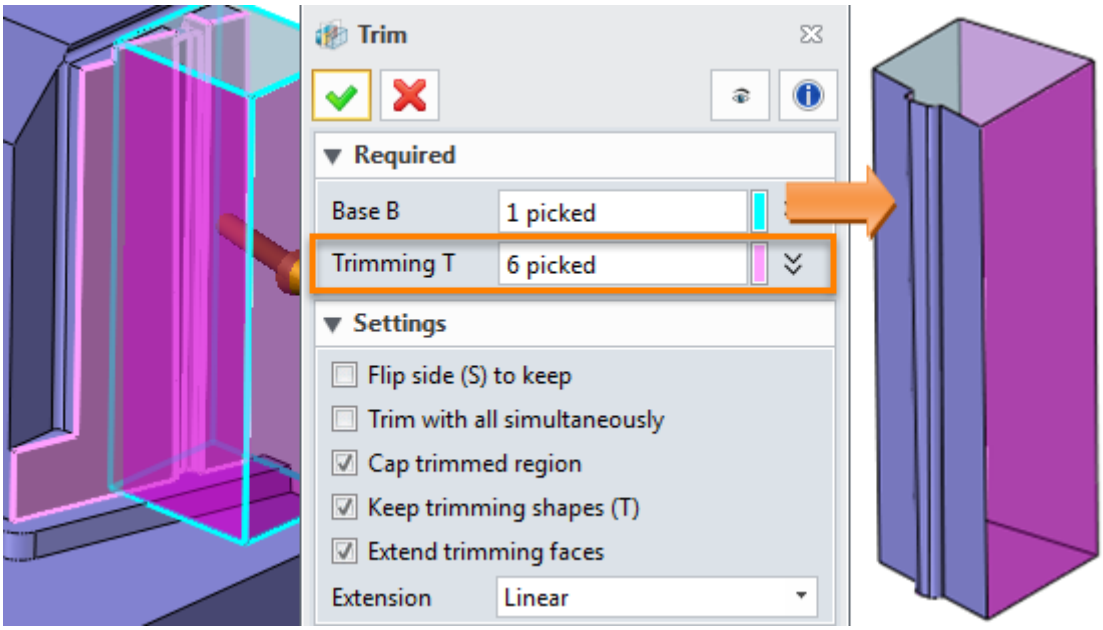


Figure101 Trim the stock

iii. Then offset the face to get clearance as follows:

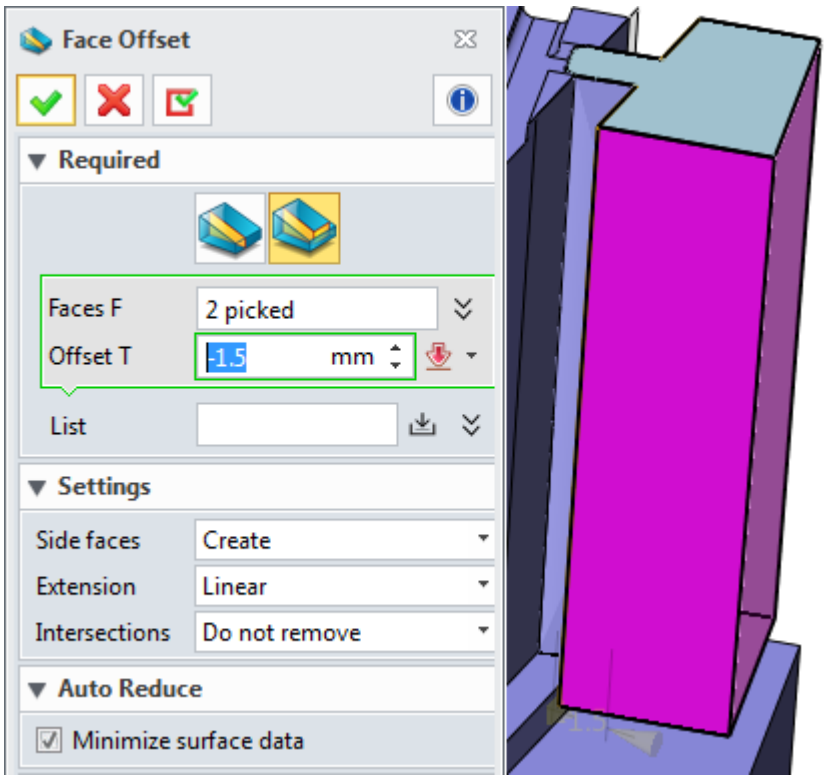


Figure102 Offset face

iv. Fillet the corner edges as follows:

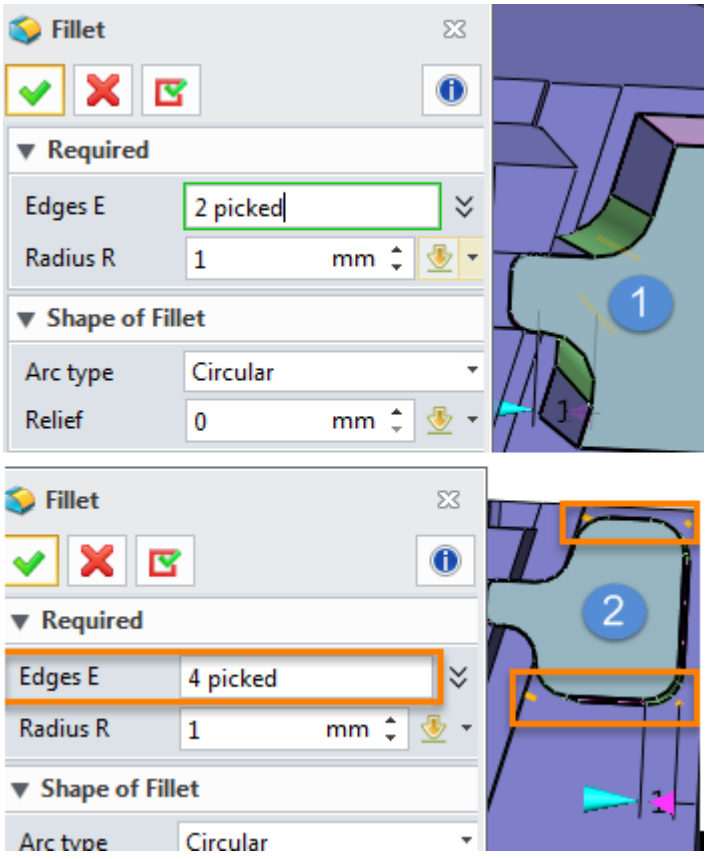


Figure103 Fillet the corner edges

STEP 04 Create electrode 4

i. Create stock as follows

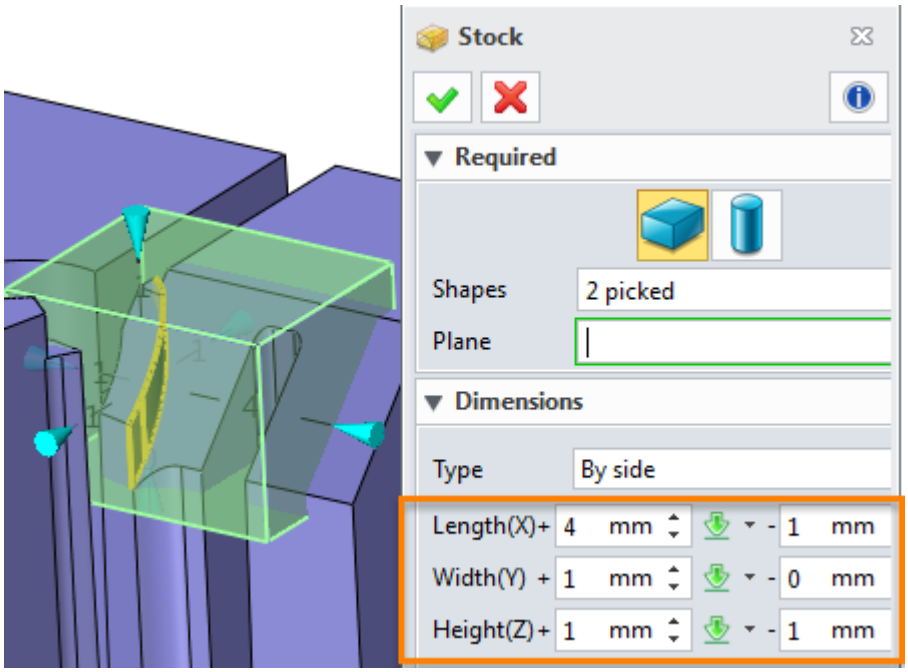


Figure104 Create stock for electrode 4

ii. Trim by bottom face:

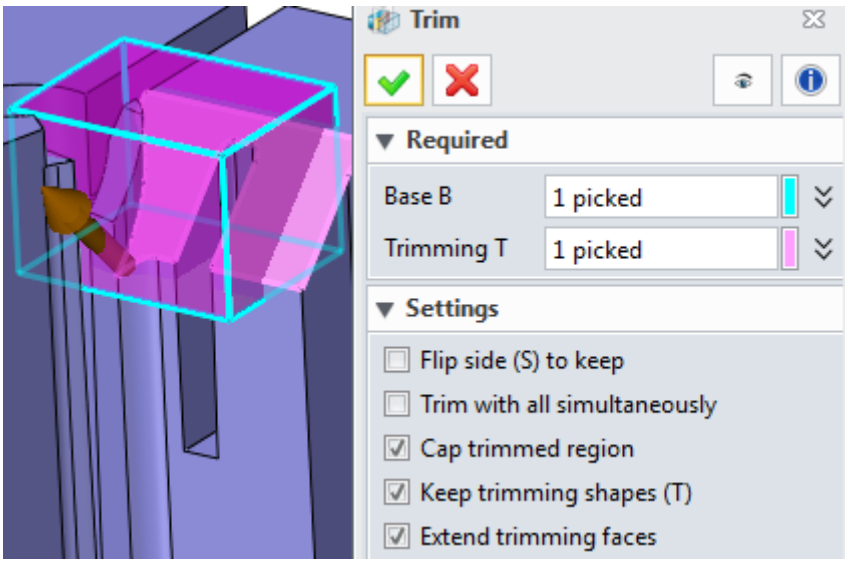


Figure105 Trim by bottom face

iii. Trim by side faces

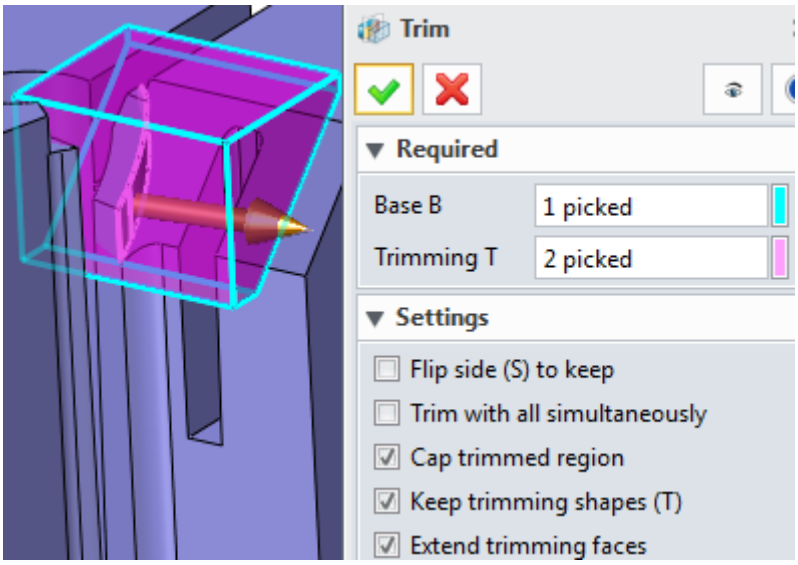


Figure106 Trim by side faces

iv. Set up color for final electrode shape as follows:

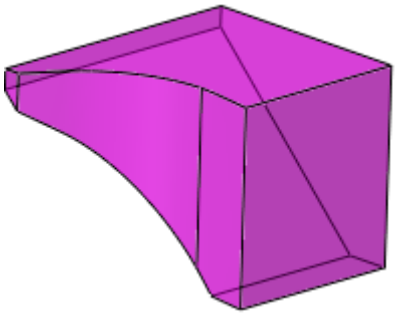


Figure107 Electrode 4

STEP 05 Use the same way we can create the electrode5 as follows:

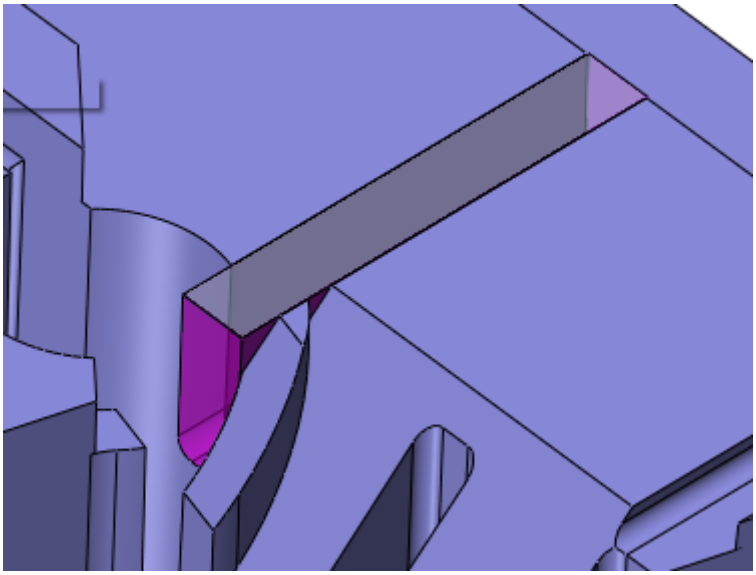


Figure108 Electrode 5

STEP 06 Create electrode 6

To create a good shape for the electrode 6 we can use a sketch to create it as follows:

i. Create sketch on the bottom face as follows:

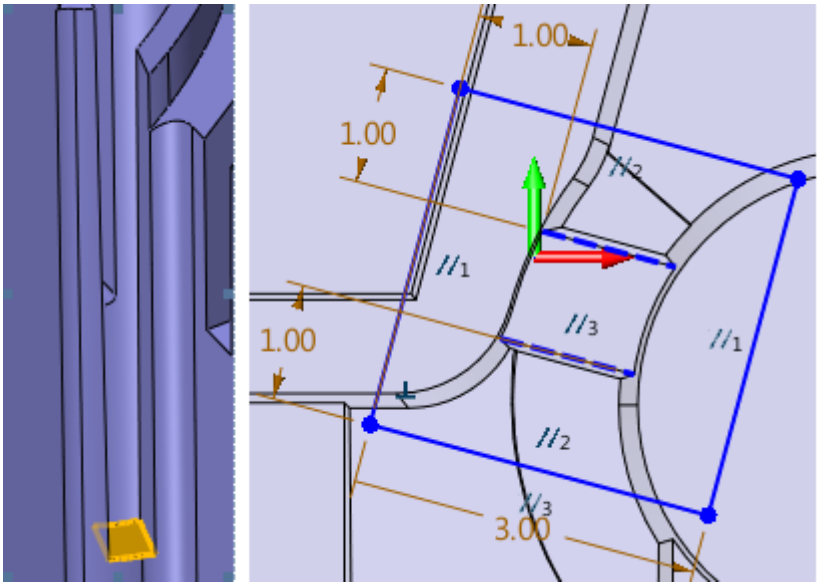


Figure109 Create sketch on bottom face

ii. Extrude it to the top face as follows:

Figure110 Extrude sketch until to the top face

iii. Replace the side face to get the electrode 6 as follows:

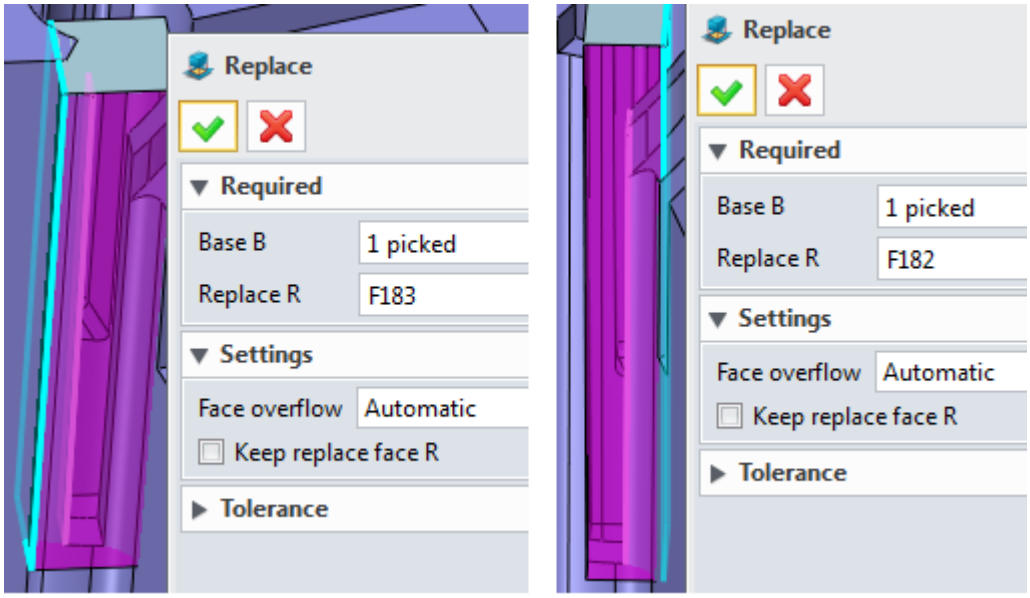


Figure111 Replace the side faces of stock

Result is as follows:

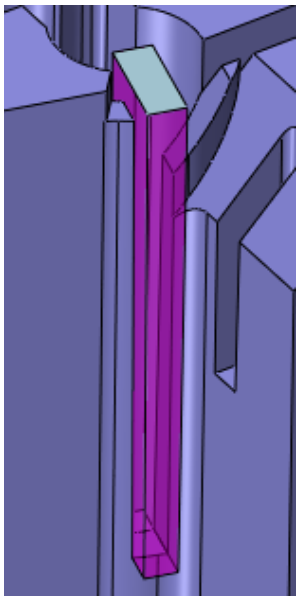


Figure112 Electrode 6

So far, we have finished all of the electrode shapes in the position 2. except some electrode shape like 3, 4, and 5. It is the same that we need to add stiffer for the others 1, 5, 6. Next we will add stiffer as follows:

STEP 07 Create the first stiffer for electrode 6 as follows:

i. Offset the outside face by 1 mm as follows:

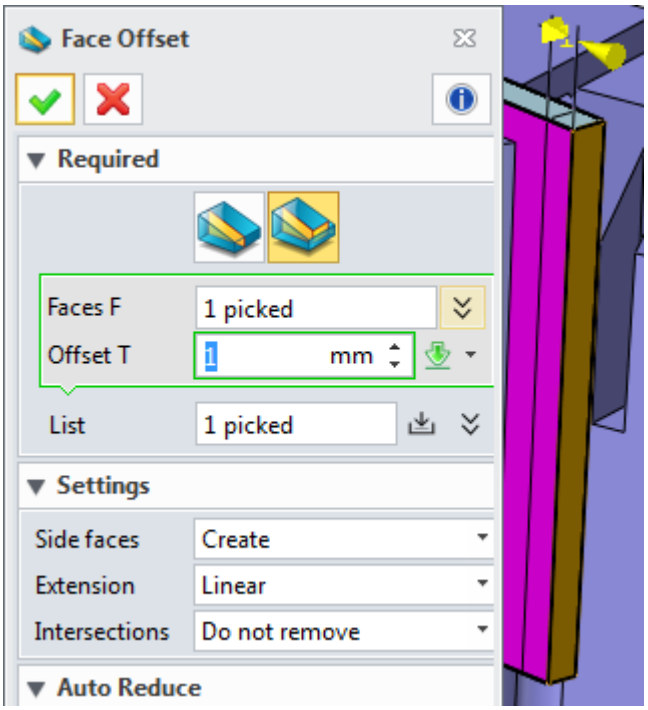


Figure113 Offset the outside face by 1 mm

ii. Create sketch on the top face as follows:

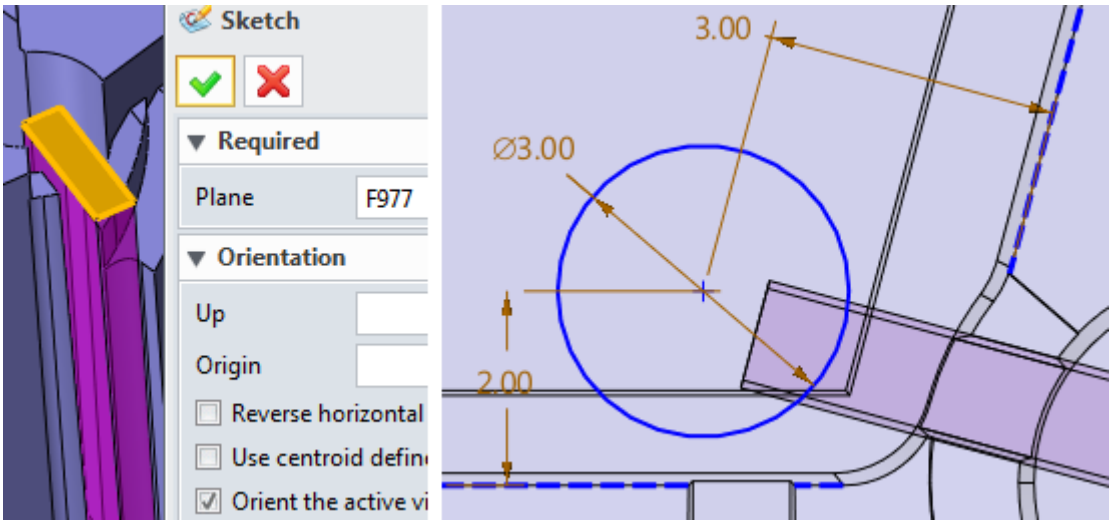


Figure114 Add sketch on top face

iii. Extrude it and combine with electrode 6 as follows:

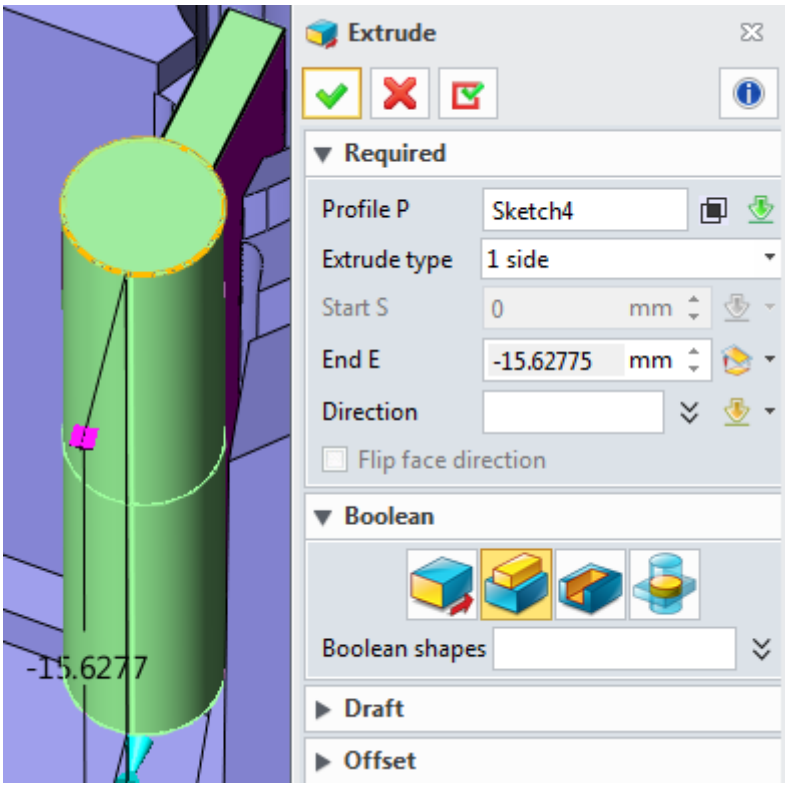


Figure115 Extrude sketch and combine it with electrode 6

iv. Fillet the edges as follows:

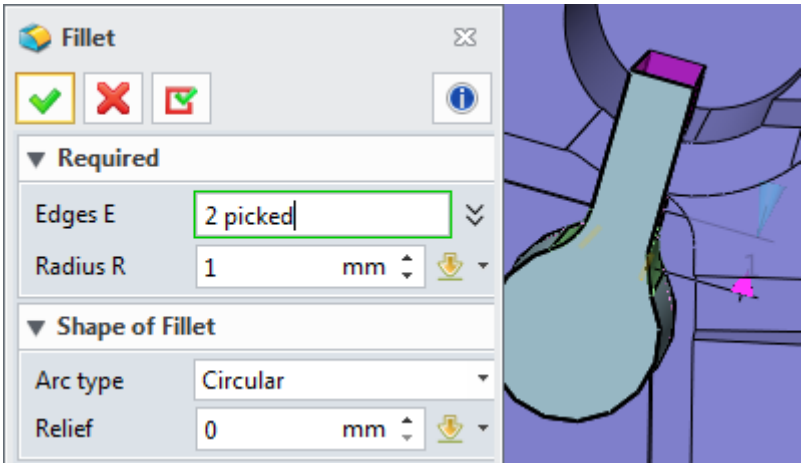


Figure116 Fillet the edges

STEP 08 Create stiffer for electrode 5 as follows:

i. Offset electrode face as follows:

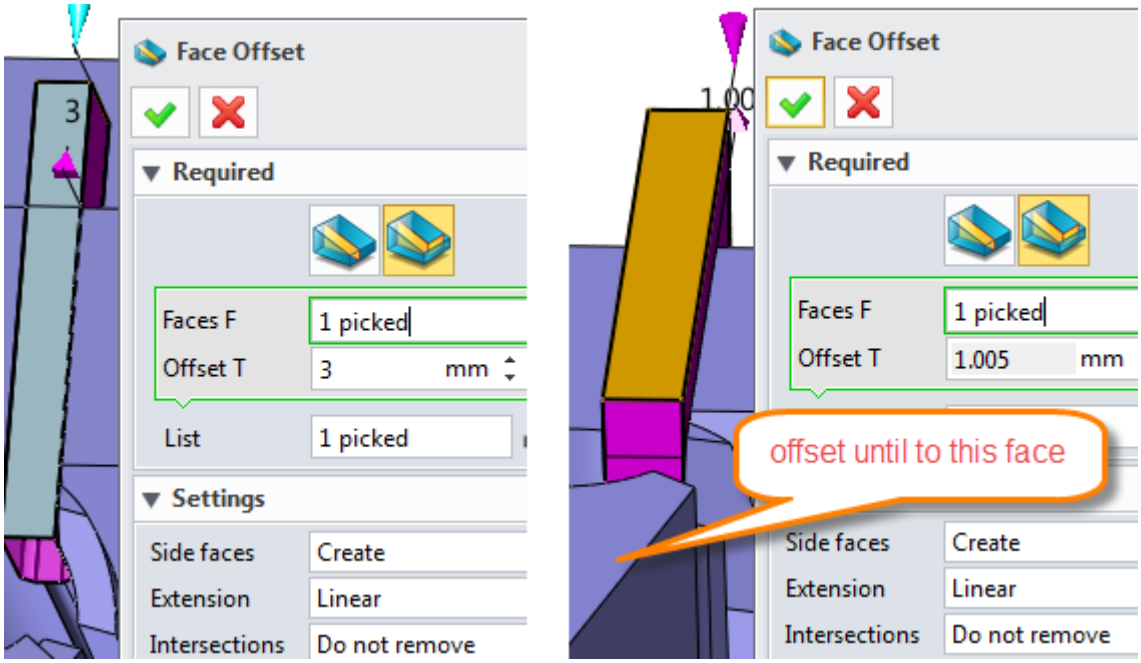


Figure117 Offset side face and top face of electrode 5

ii. Create sketch on top face as follows:

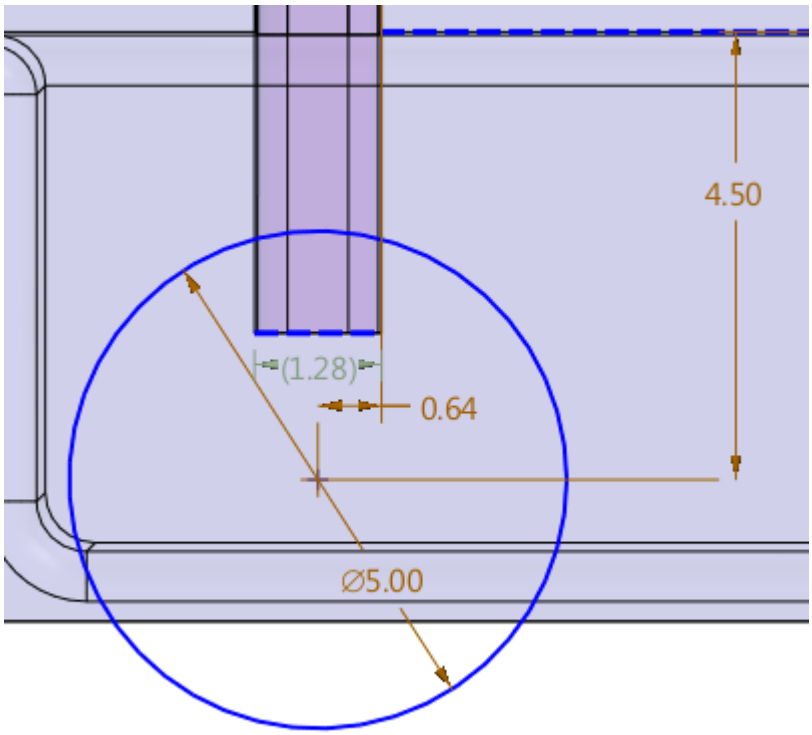


Figure118 Create sketch for electrode 5 on top face

iii. Extrude sketch and combine it with electrode 5 as follows:

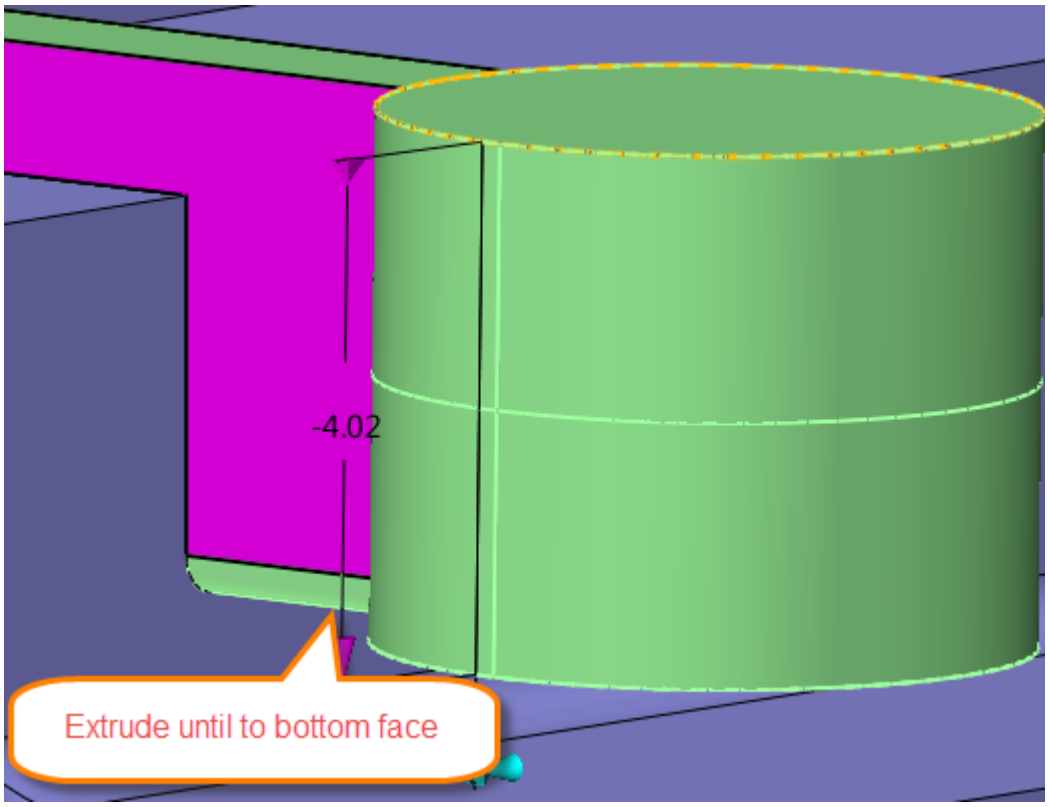


Figure119 Extrude sketch and combine with the electrode 5

iv. Fillet the corner as follows:

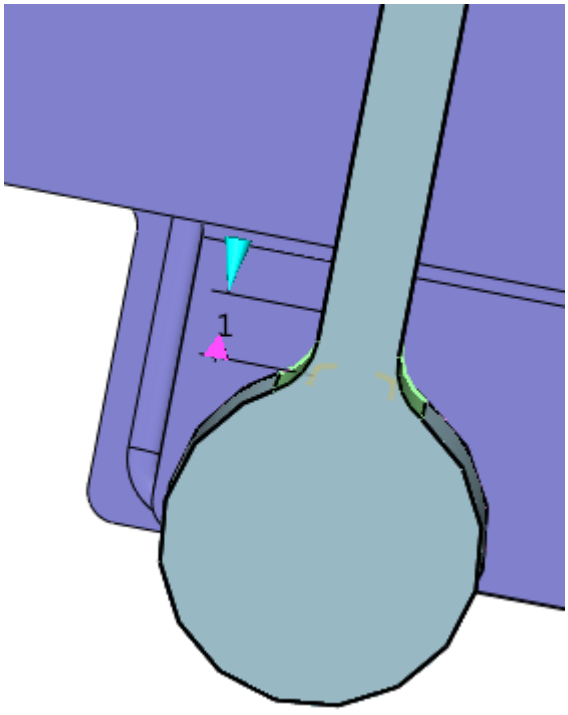


Figure120 Fillet corner edges

STEP 09 Create stiffer for electrode 1

i. Offset side face and top face as follows:

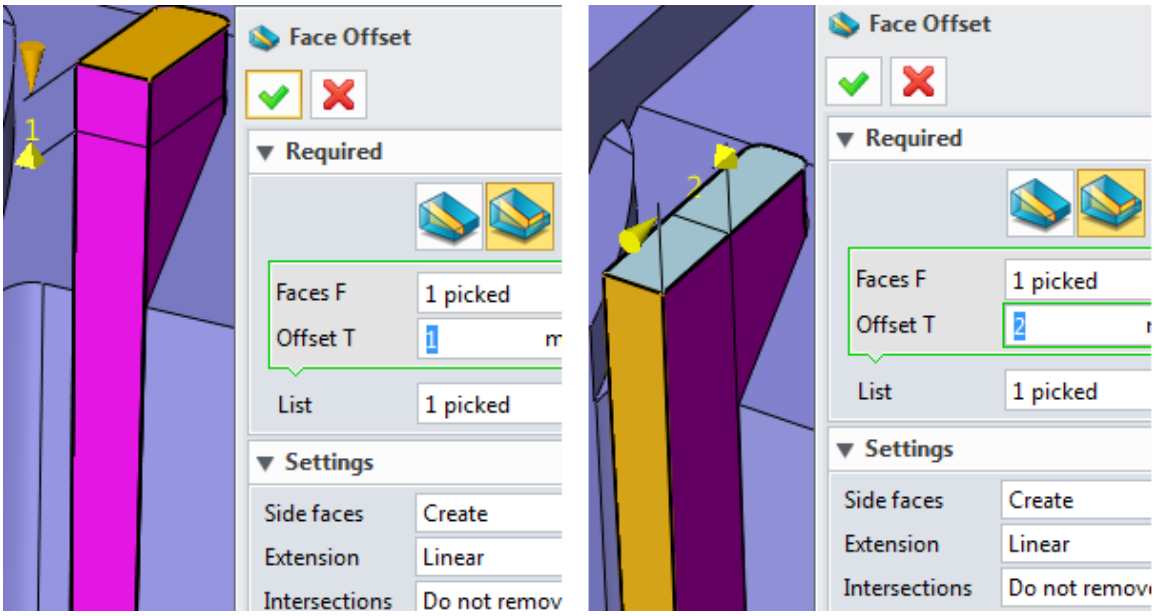


Figure121 Offset the side face and top face

ii. Create sketch on the top face as follows:

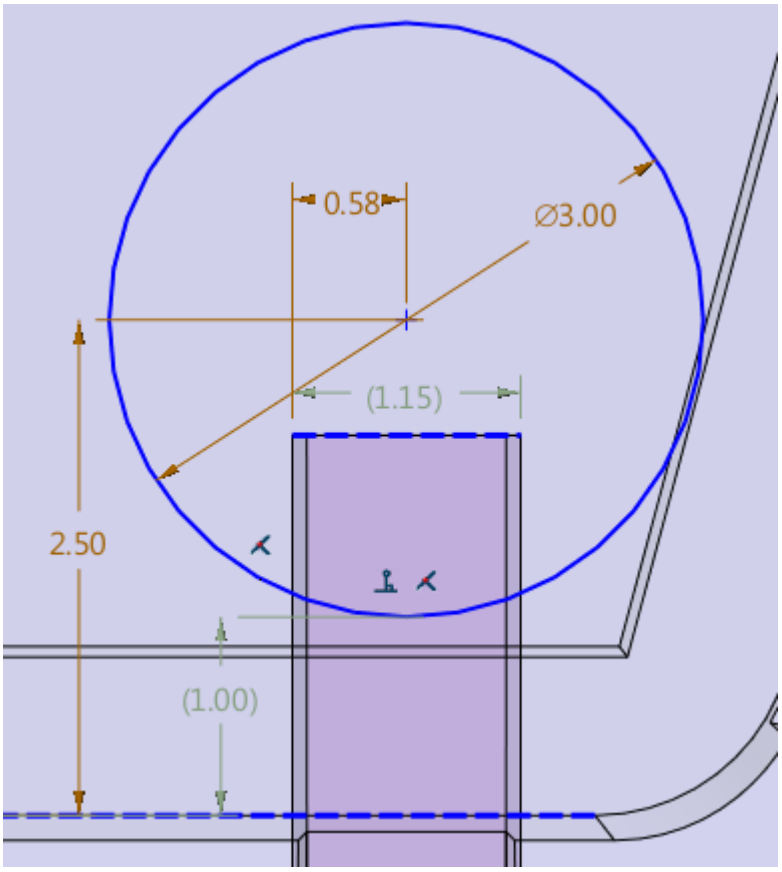


Figure122 Sketch on the top face of electrode 1

iii. Extrude the sketch until to bottom face of electrode 5 as follows:

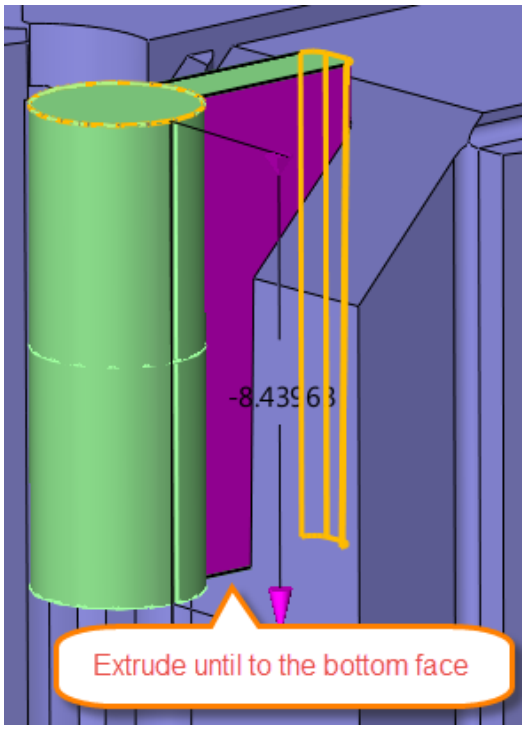


Figure123 Extrude sketch until bottom face of electrode 5

iv. Fillet the corner edges as follows

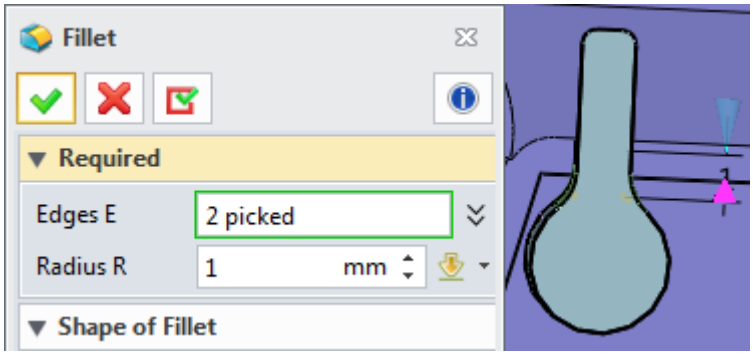


Figure124 Fillet the corner edges

STEP 10 Align all the electrode shapes' top face to same level by replacing face as follows:

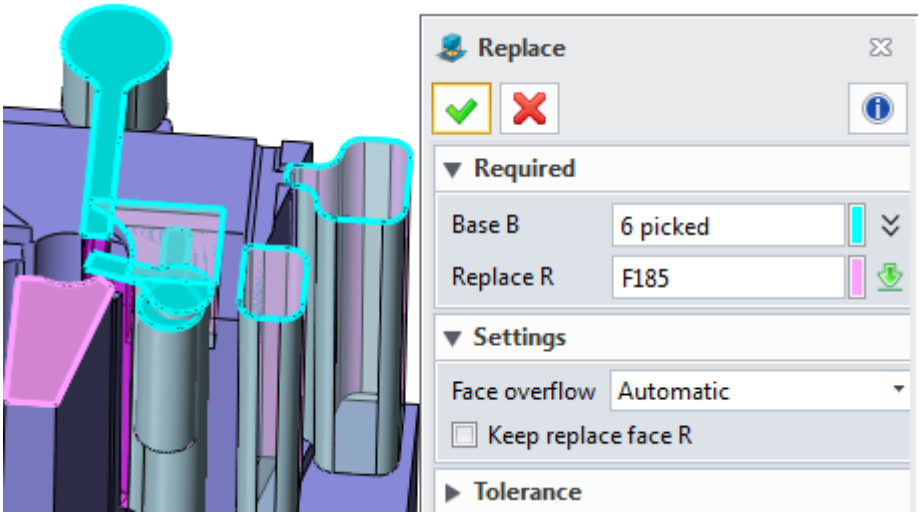


Figure125 Align all of the electrodes' top face to same level

STEP 10 Add blank for the electrodes

i. Firstly, we can observe the electrode and actually we can group the electrode 1, 2, 3 and 5 into one group and share the same blank as follows:

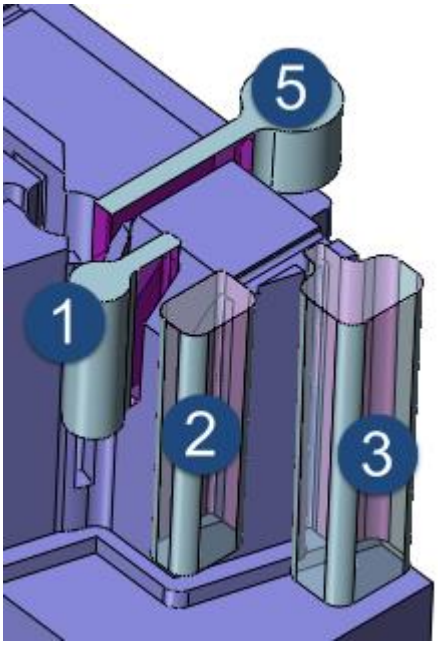


Figure126 Group electrodes into one group

ii. Next let's Add blank for the group :

1) Basic dimension for the blank:

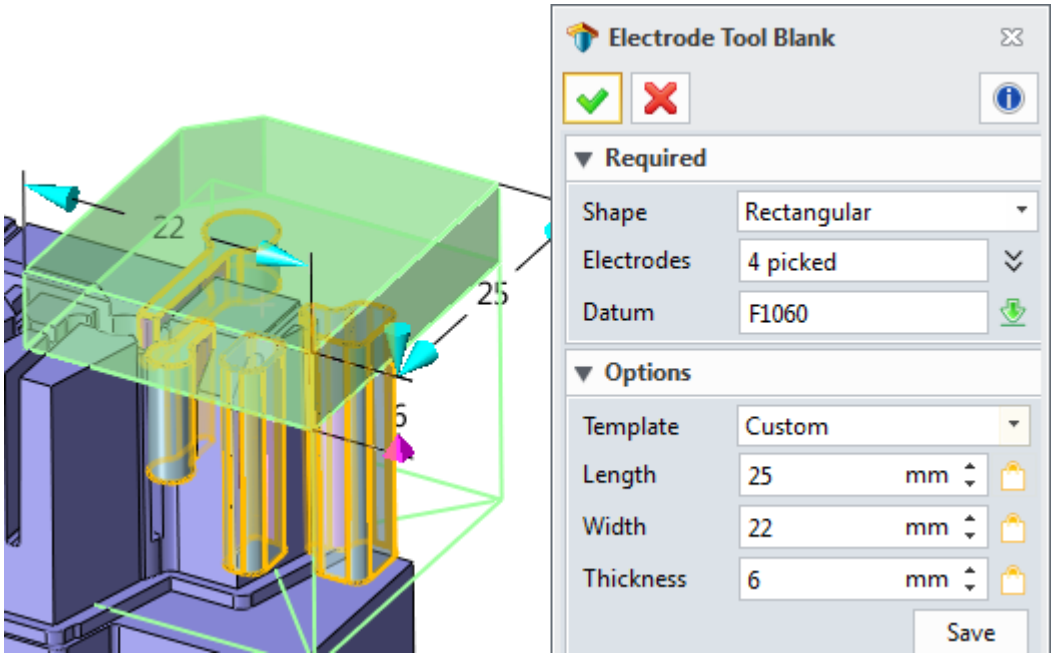


Figure127 Basic dimension for blank of electrode group

2) Orign and Mark setting as follows:

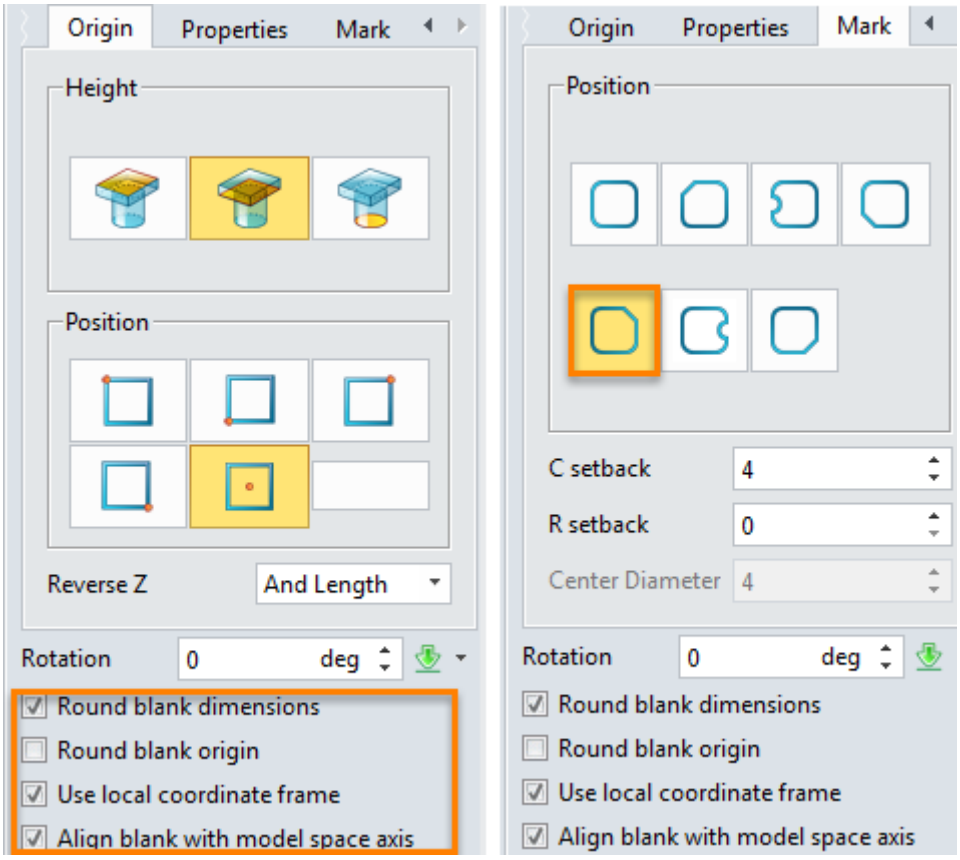


Figure128 Origin and Mark setting for blank of electrode group

3) Result is as follows:

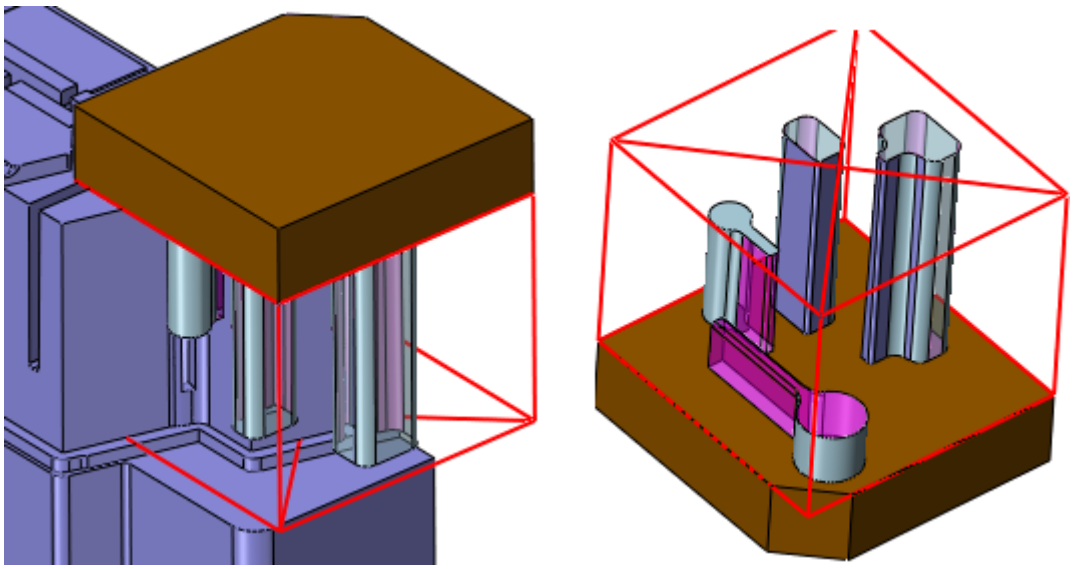


Figure129 Added blank for electrode group

iii. Add blank for electrode 4

1) Basic dimension for blank of electrode 4

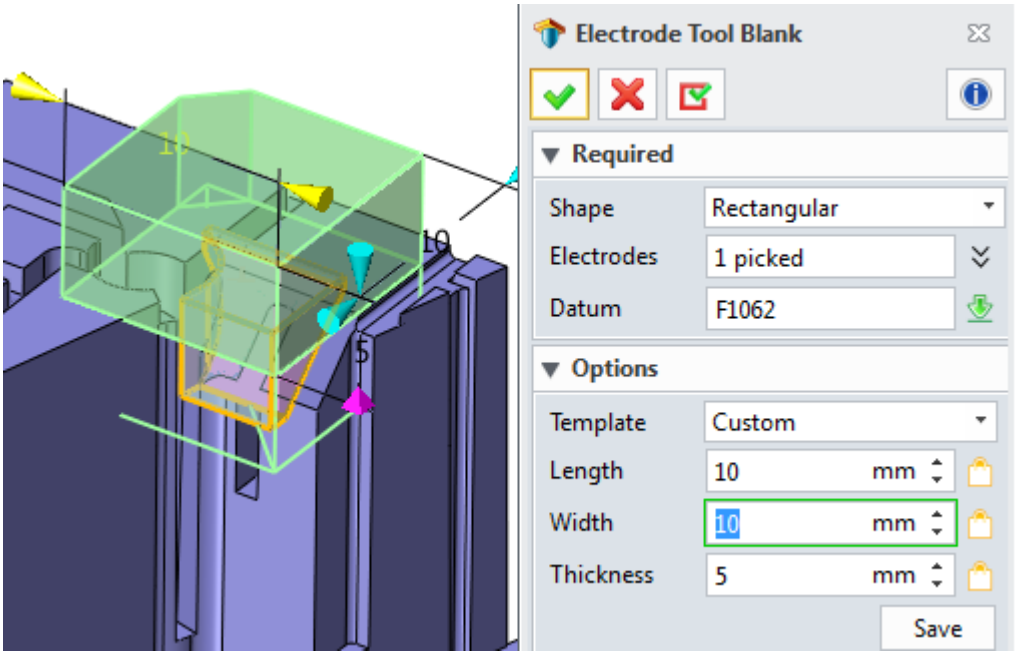


Figure130 Basic dimesnion for blank of electrode 4

2) Origin and Mark setting as follows:

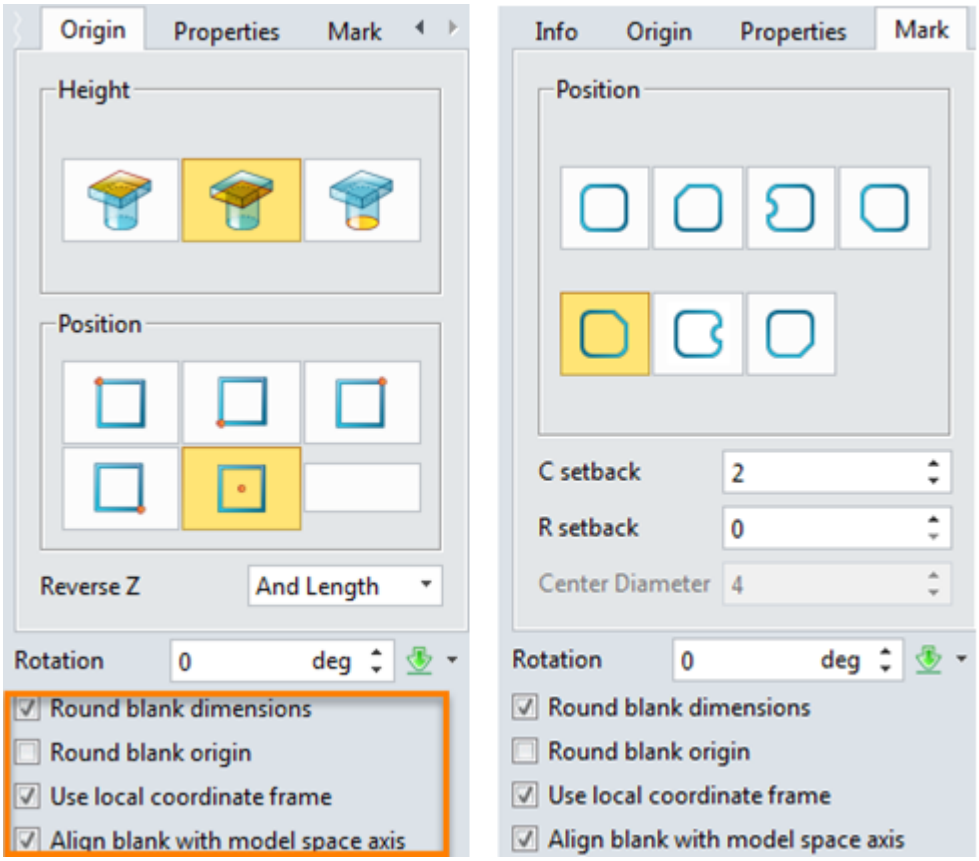


Figure131 Origin and Mark setting for blank of electrode 4

3) Result is as follows:

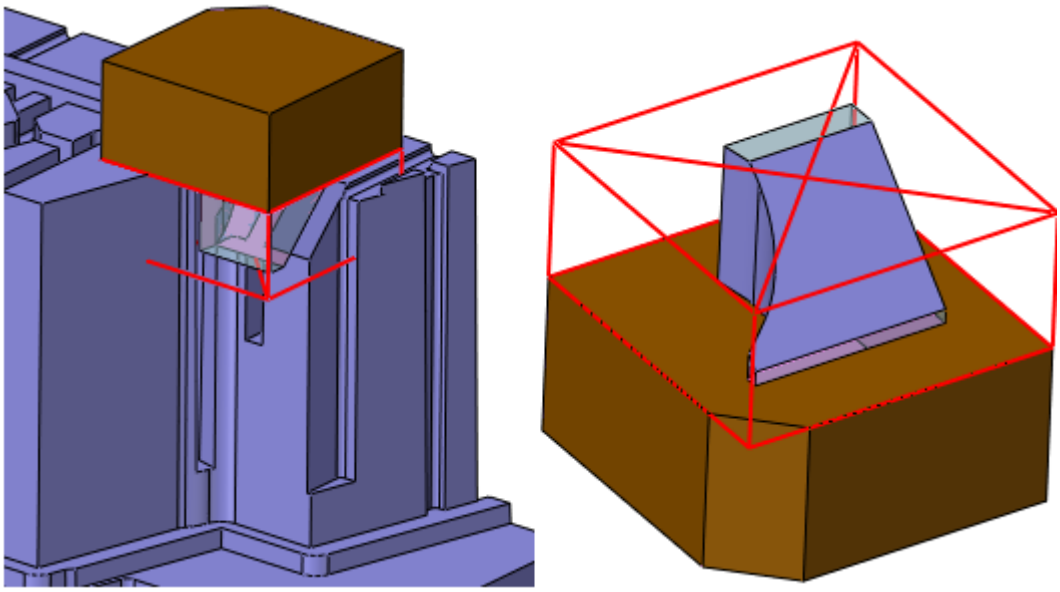


Figure132 Added blank for electrode 4

iv. Add blank for eletrode 6

1) Basic dimension for blank of electrode 6

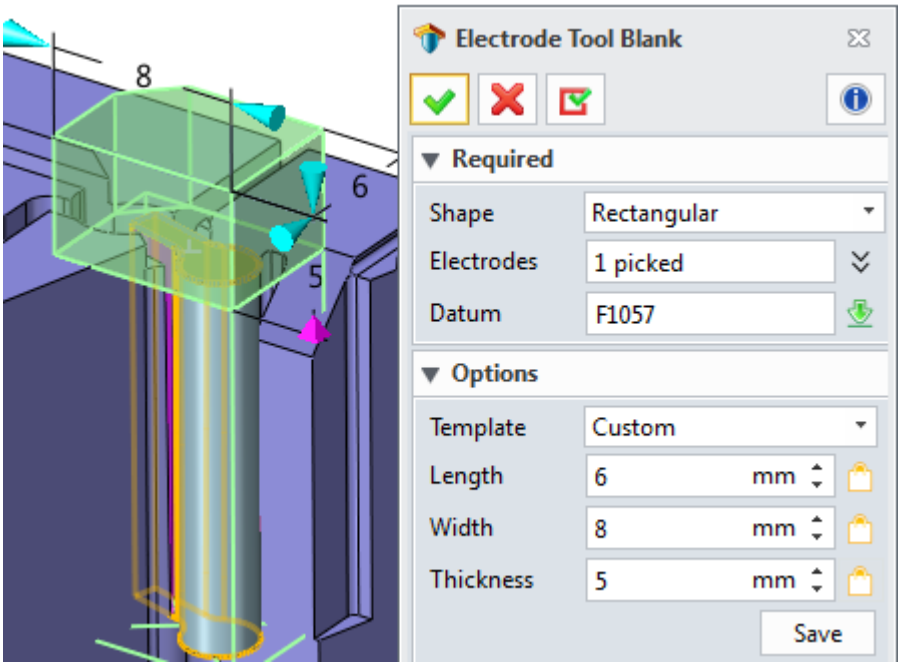


Figure133 Basic dimension for blank of electrode 6

2) Origin and Mark setting as follows:

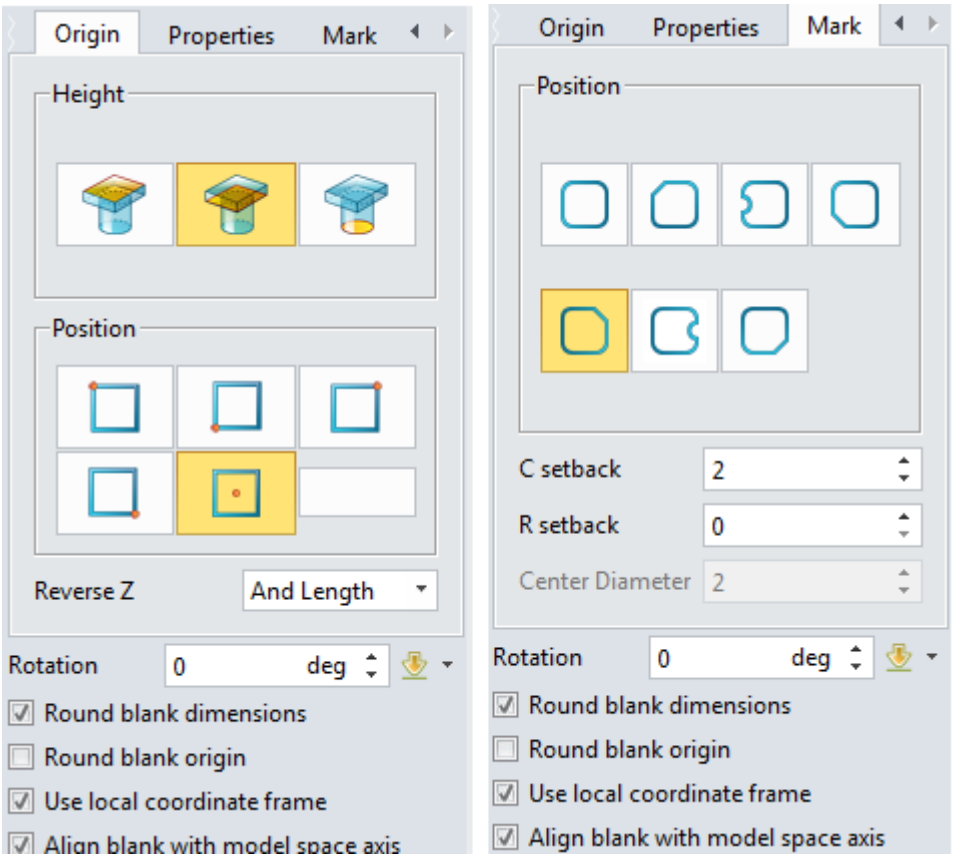


Figure134 Origin and Mark setting for blank of electrode 6

3) Result is as follows:

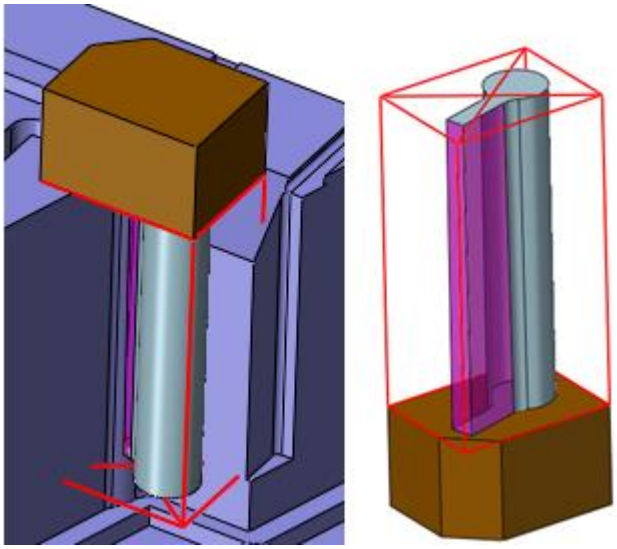


Figure135 Added blank for electrode 6

1.3.3 Sparking Drawings for All Created Electrodes

Here let's use the customized base point to create the sparking drawing. As follows:

STEP 1 Specify base point

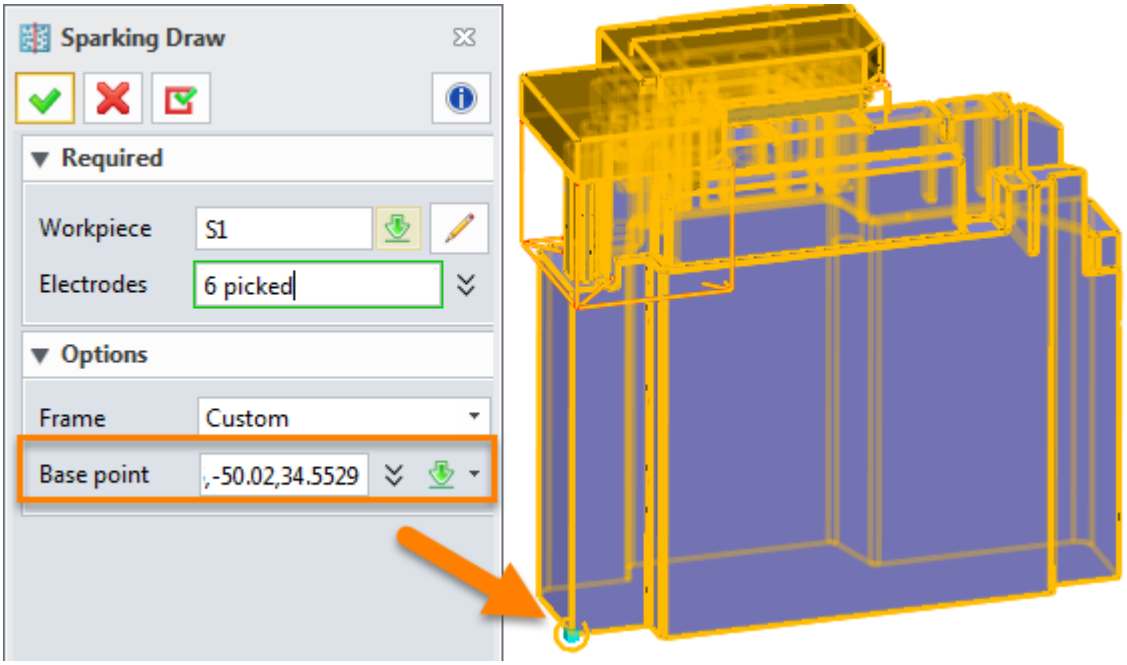


Figure136 Create sparking drawing based on customized base point

STEP 2 Create general drawing and individual sparking drawing for each electrode as follows:

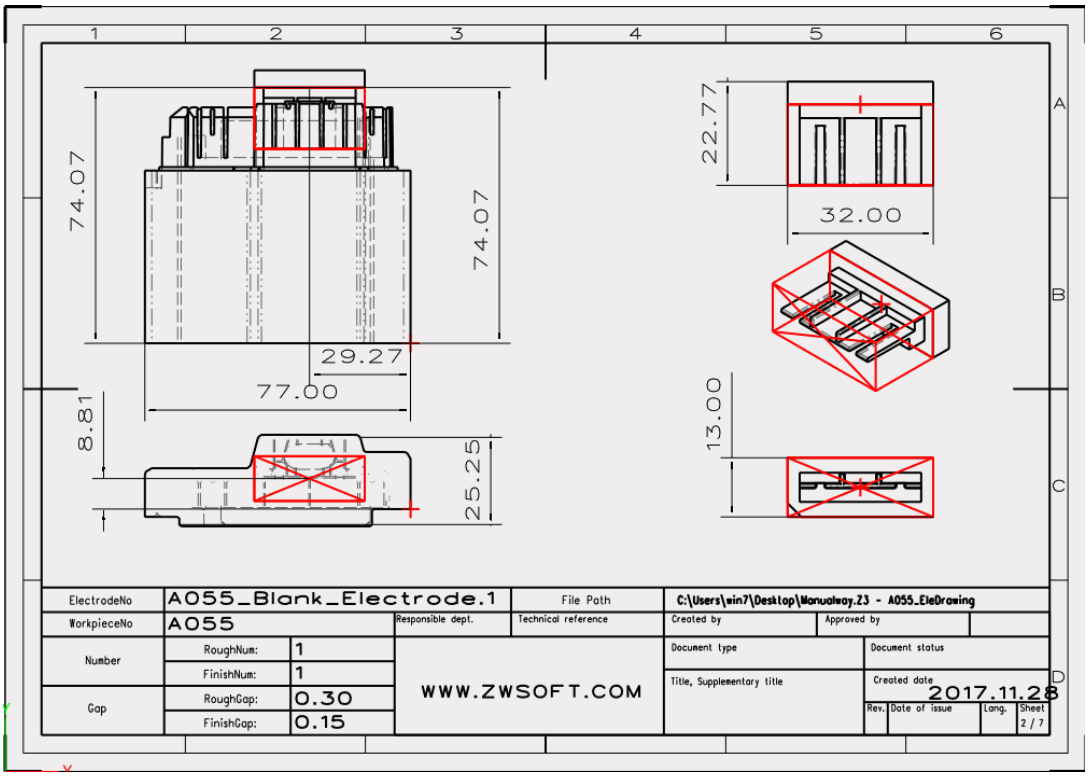
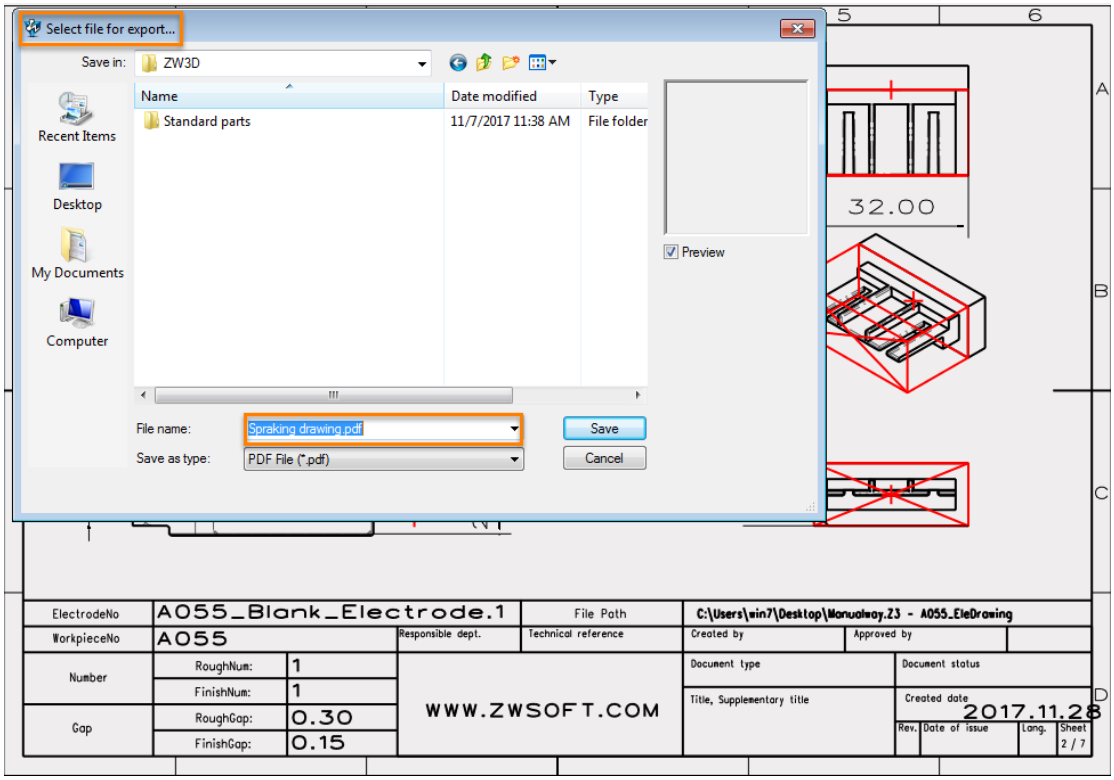


Figure137 One of created sparking drawing for individual electrode

STEP 3 If necessary , we can export the drawing as PDF file for workshop as follows:



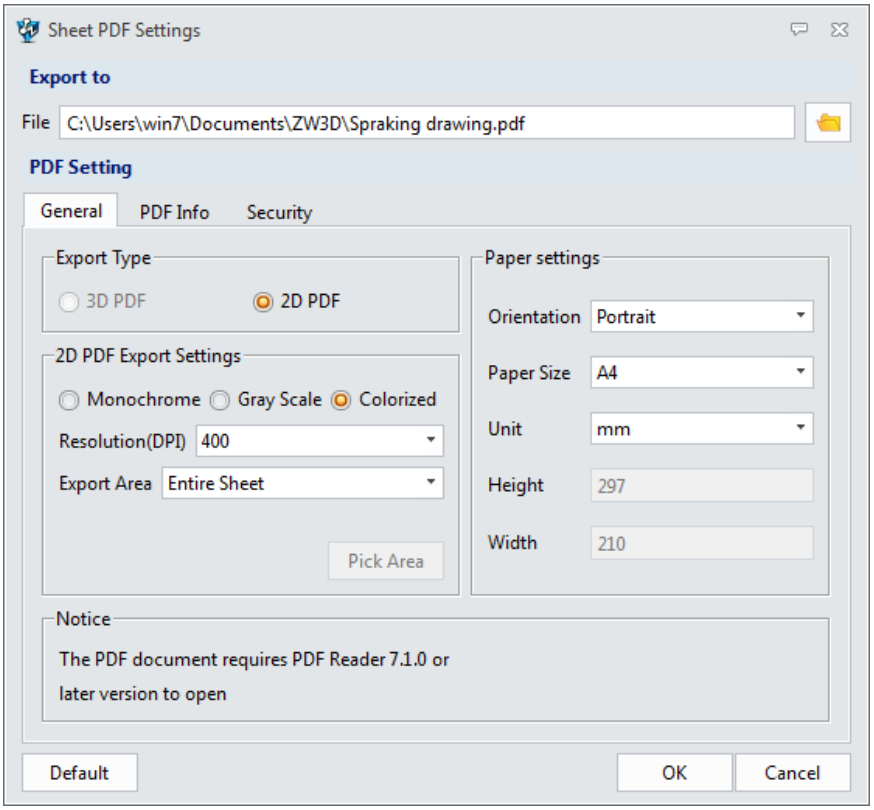


Figure138 Export the sparking drawing as PDF

1.4 Summary

So far, we have finished the electrode design for these samples by both automatic way and manual way.

From the whole process you will get the idea about how to use ZW3D's electrode modules and learn how to use the typical manual tools for the complicated electrode design. Besides it also introduced how to add the stiffer for thin and narrow electrode.

Finally, it introduced how to create the blank for electrodes and create the sparking drawing for EDM.