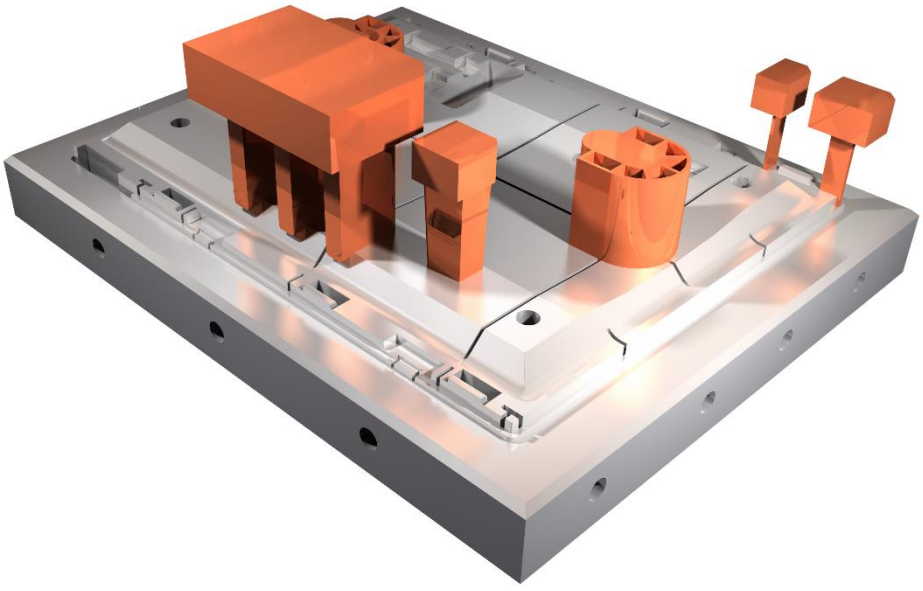
TopSolid Electrode

Training Guide

Electrodes



MASTER YOUR MANUFACTURING PROCESS

7, Rue du Bois Sauvage
F-91055 Évry, France
Web: www.topsolid.com
Email: contact@topsolid.com

Version 7.14 Rev.01

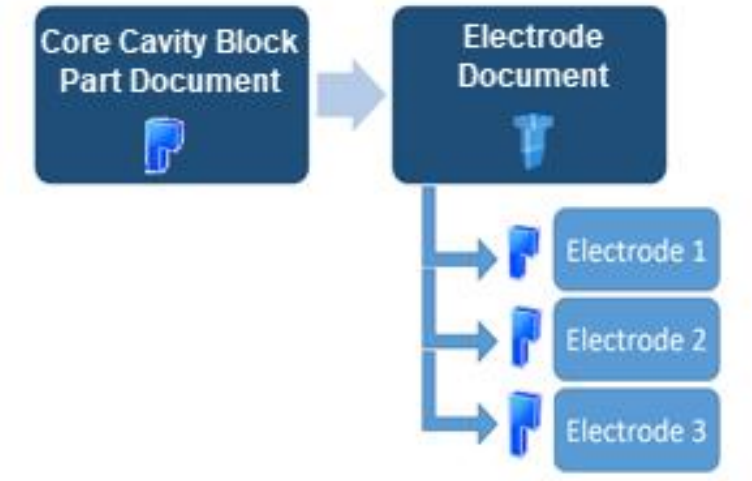
Note: If you are experiencing problems using this training guide, please feel free to send your feedback and comments to edition@topsolid.com.

Contents

Document Structure and General Principle

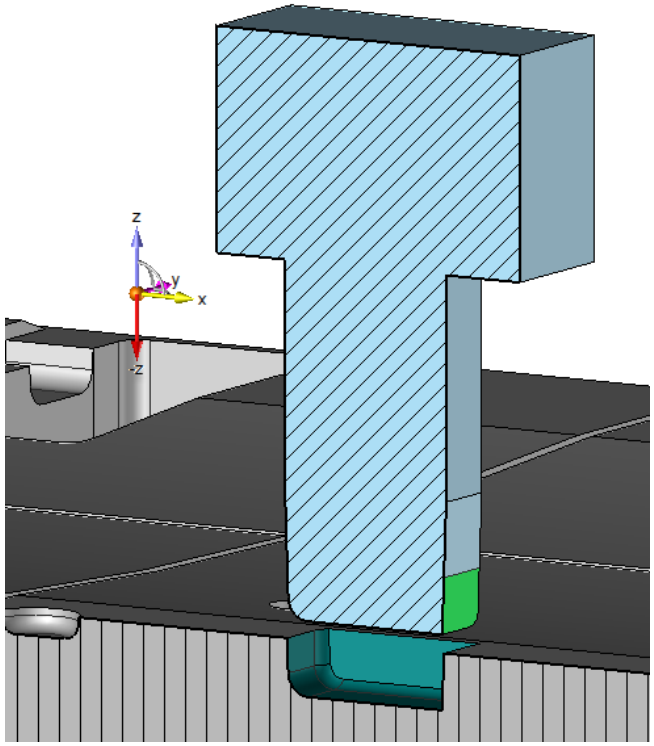
Synoptic

The principle is to generate an electrodes document using the core/cavity block's part document in which you can model the shape of the electrodes based on the faces of the shape to be burnt. Each resulting electrode will be a part document.



Reference system of electrodes

By convention, we will use the **Z-** axis of the electrodes document's absolute frame as the plunge direction of electrodes.



Exercise 1: Creating an Electrode Using the Wizard

Importing the package

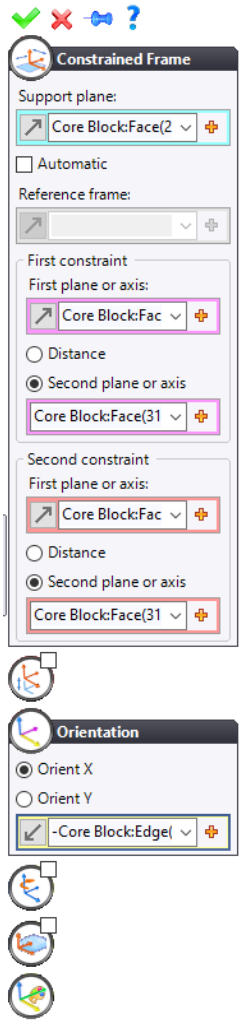
- From the **Home** tab, **import the project** named *TopSolid-Electrode Training.TopPkg.*

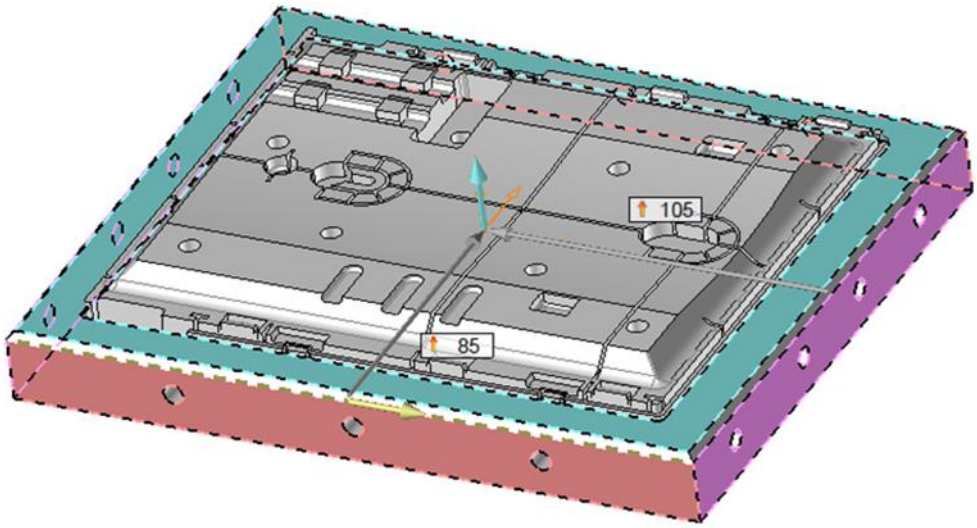
Preparing the core block

- Open the part document named *Core Block*.

Creating the frame origin for electrode positioning

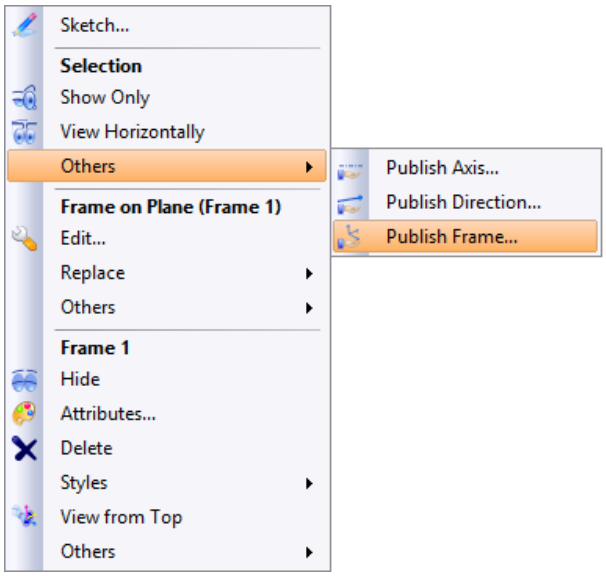
- From the **Construction** tab, create a **constrained frame**. Select the part's parting surface as the **support plane**.
- Select the right face as the **first plane** and the left face as the **second plane** for the **first constraint** as shown below.
- Select the front face as the **first plane** and the back face as the **second plane** for the **second constraint** as shown below.
- For the **orientation**, select a block edge as shown below.

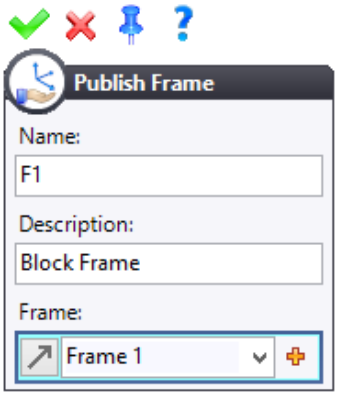




- Click on to **confirm** the frame.
- Right-click on the frame that you have just created and select the **Others** > **Publish Frame** command.

- Rename the publishing as shown below.





- **Save** the document.

Including the core block in a new electrodes document

Note: There are many ways to include a part in an electrodes document:

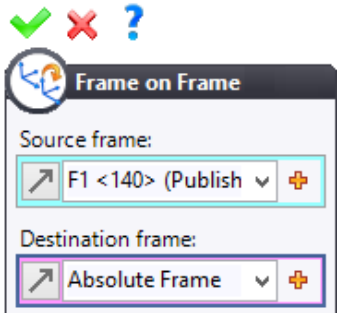
- Right-click on the part document's tab and select the **Electrodes** command.
- Right-click on the part document in the Project tree and select the **Electrodes** command.
- Create a **new document** by selecting an **electrodes** document, and then drag and drop the part document into the electrodes document from the Project tree.

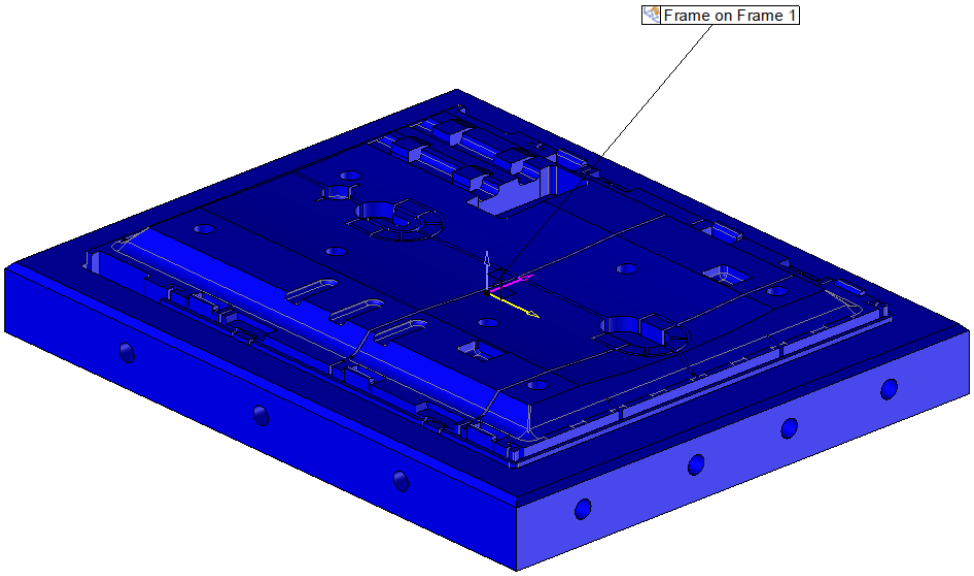
- From the Project tree, right-click on the *Core Block* part document and select the **Electrodes** command.
- Select **Blank Template** and click on to **confirm** the operation.

Positioning

- Right-click on the part in the graphics area and select the **Edit Positioning** command.

A **Frame on Frame** constraint has been created. **TopSolid** automatically positions the published frame on the absolute frame, which often saves you time when it relates to positioning.





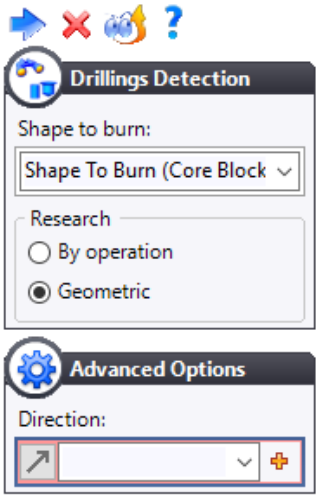
- **Confirm** the positioning by clicking on the Positioning 1 button.

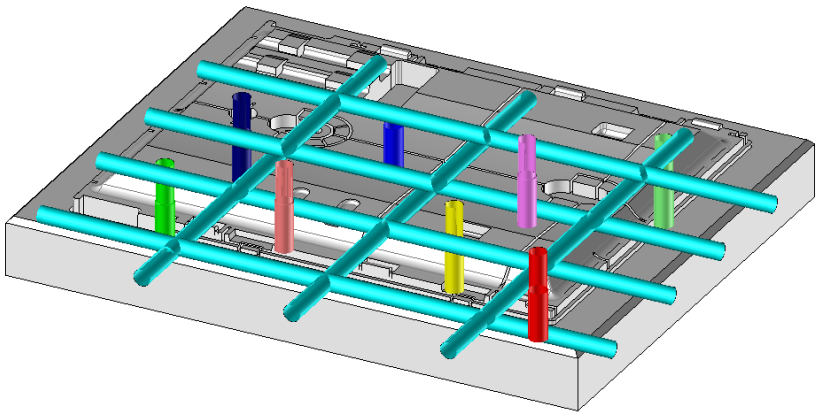
Warning: If more than one frame has been published, the **Frame on Frame** positioning constraint is not created and is replaced by a fixed constraint.

Removing the drillings

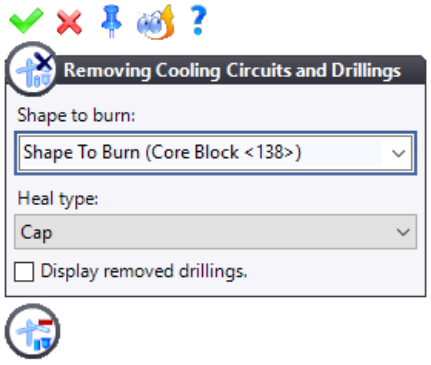
Removing the drillings makes it easier to create electrodes when there is, for example, an ejector in the area to be eroded.

- From the **Electrode** tab, select the **Drillings Detection** command.





- Click on the **Next** icon. The **Removing Cooling Circuits and Drillings** command launches automatically.
- Select **Cap** as the heal type.



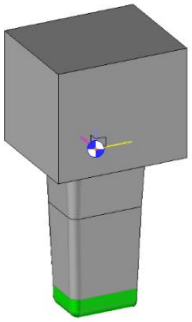
- Click on to **confirm** the operation.

Warning: This command is only available in the **preparation** stage.

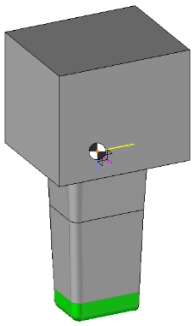
Selecting the origins

We are going to define the different frames of the electrode:

- Machining frame
- Machining positioning frame
- EDM frame

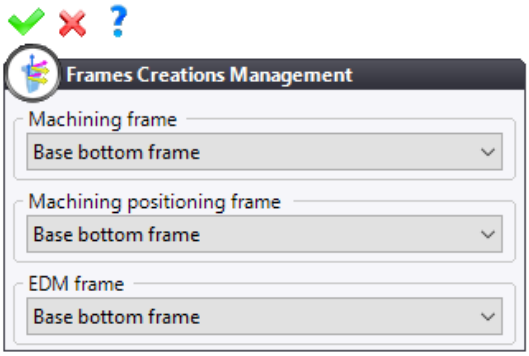


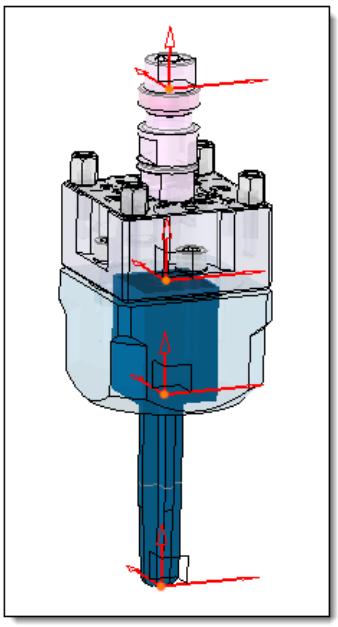
EDM frame



Machining frame

- From the **Electrode** tab's drop-down menu, select the **Electrodes Frames** command.
- Select **Base bottom frame** as the **machining frame**, **machining positioning frame** and **EDM frame**.





- Click on to **confirm** the operation.

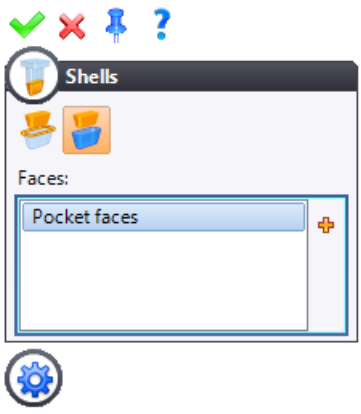
Note: The EDM frame corresponds to the electrode's frame and will later be used to dimension the positions of the electrodes in the drafting document. It can also be used as a reference for the coordinates of control points.

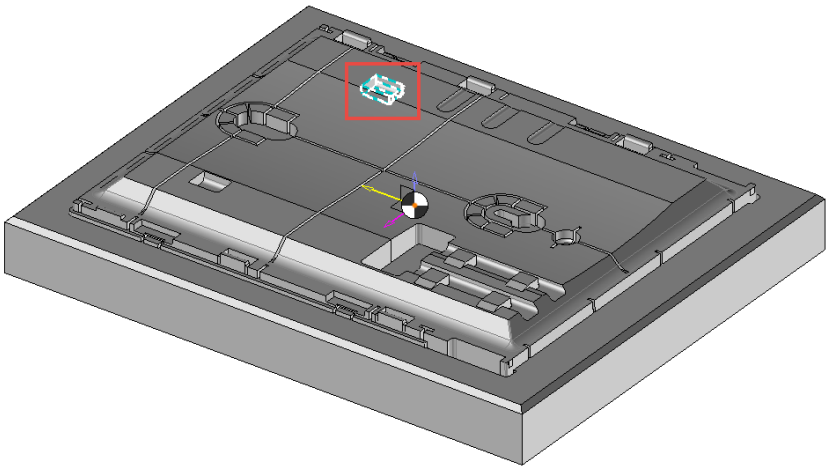
Creating an electrode using the wizard

The creation of an electrode is done in three steps:

- Creating the **shells** (area to be eroded)
- Creating the **eroding shape**
- Creating the **electrode**

- Select the **Electrode Wizard** command. The **Shells** command launches automatically.
- Select the **Faces** mode, and then use the rotary picking technique to select all the pocket's faces as shown below.

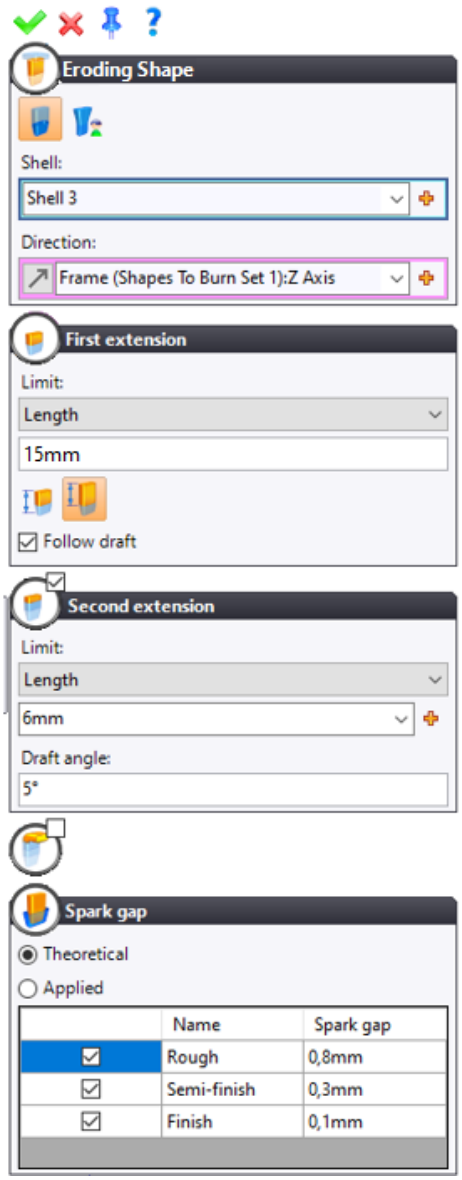


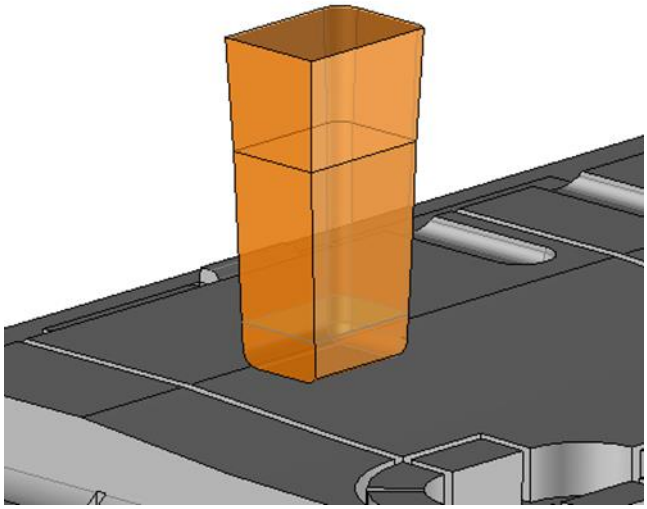


- Click on to **confirm** the operation.

The **Eroding Shape** command launches automatically.

- Adjust the following settings.



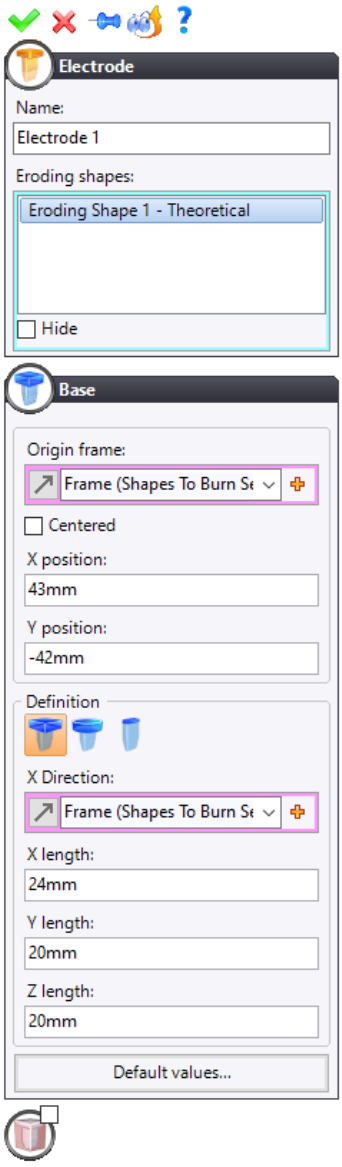


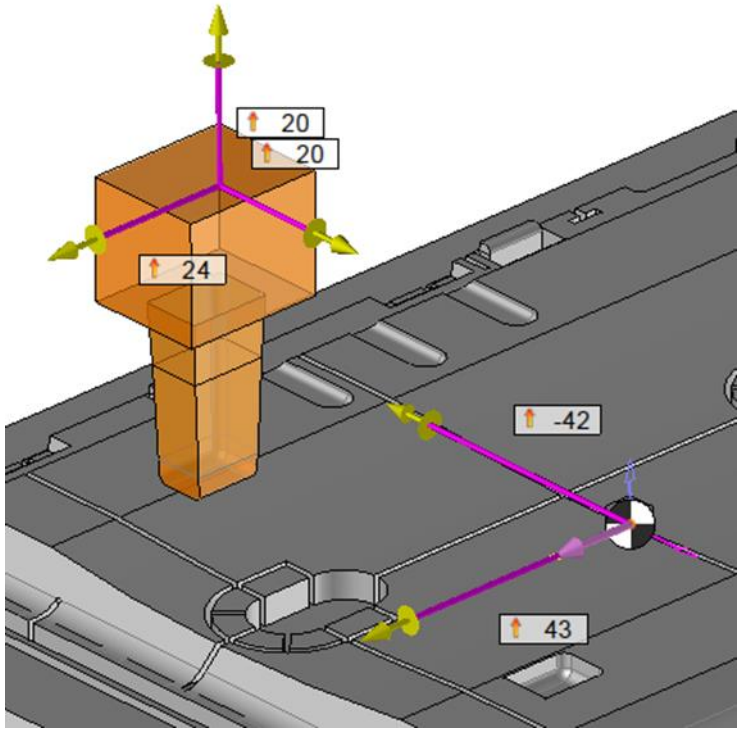
Note: If the spark gap is applied, the faces of the eroding shape are offset by the spark gap value. However, if the spark gap is theoretical, the faces are not offset, but the information is retrieved in the machining.

- Click on to **confirm** the operation.

The **Electrode** command starts automatically.

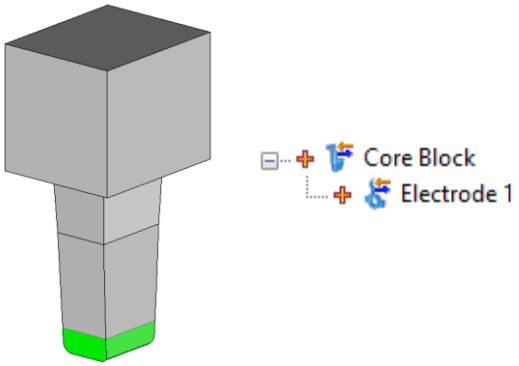
- Adjust the following settings.



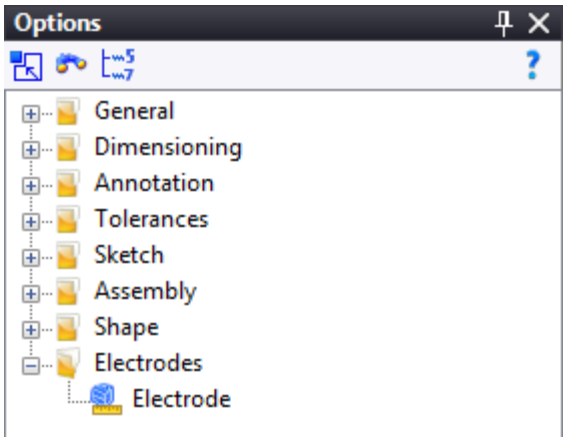


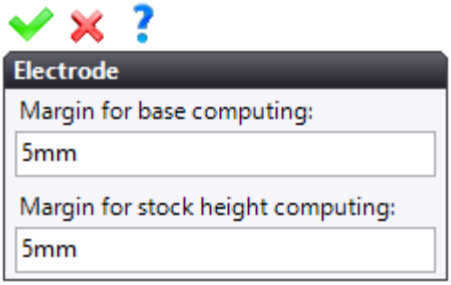
- Click on to **confirm** the operation.

A part document for the electrode is then created in the Project tree, within the electrodes document.

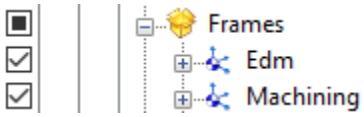


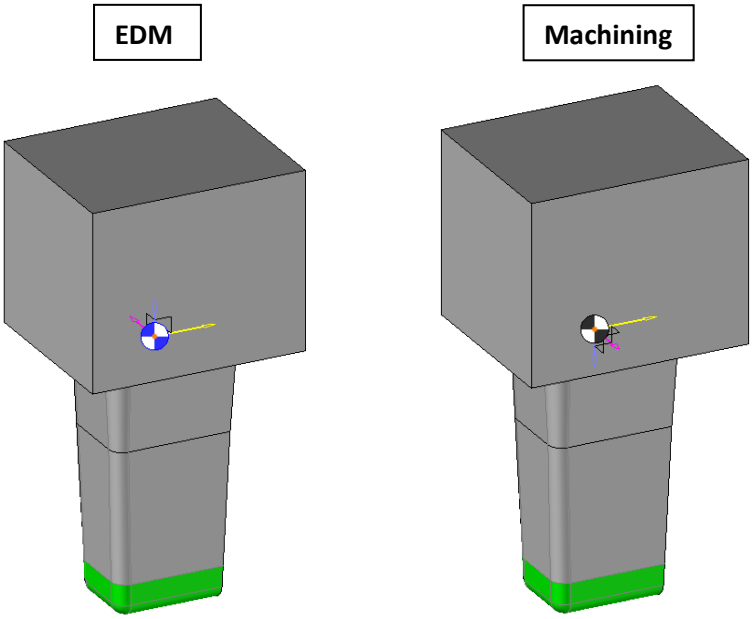
Note 1: The base dimensions are calculated automatically based on the margin defined in the **Electrodes** section of the Electrodes document's Options tree.





Note 2: If you open the part document of the electrode and you switch to **Analysis Stage**, you can find the machining and EDM frames.





Note 3: The icon bar at the bottom right of the graphics area lets you easily hide or show the main elements of the document.

: **Hide/Show Shapes to Erode**

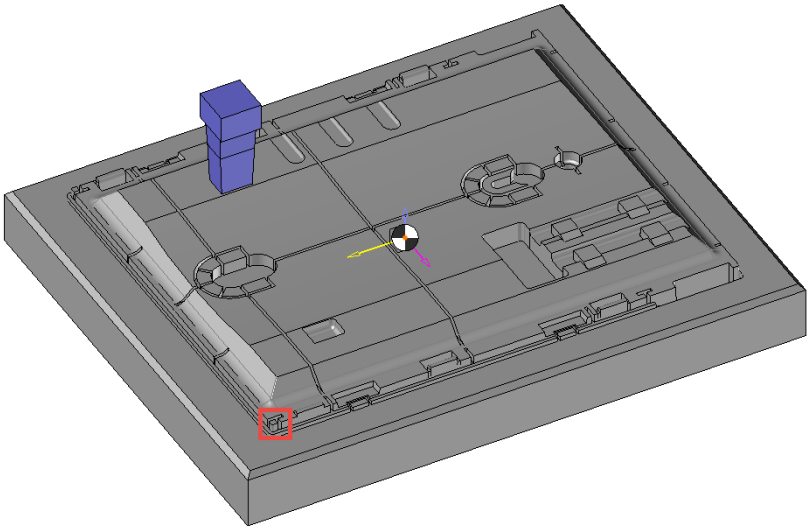
: **Hide/Show Shells**

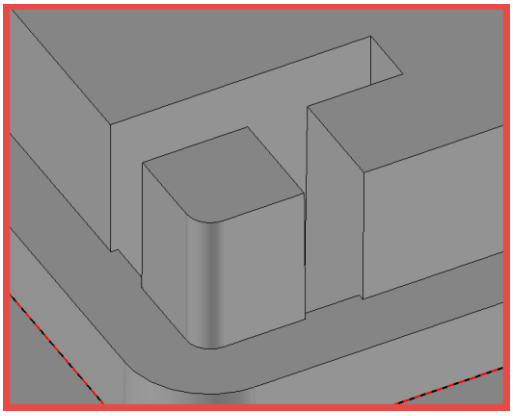
: **Hide/Show Eroding Shapes**

: **Hide/Show Electrodes**

- **Save** the document.

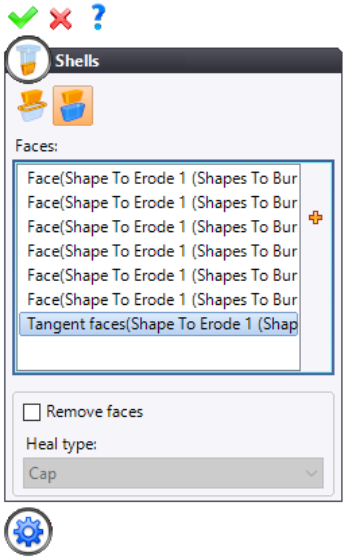
Exercise 2: Electrode and Shell by Face Selection

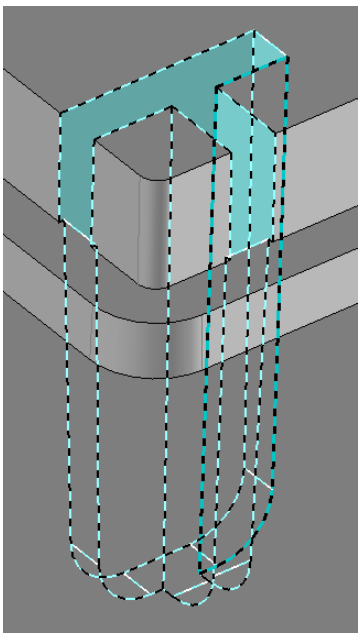




Creating the shell

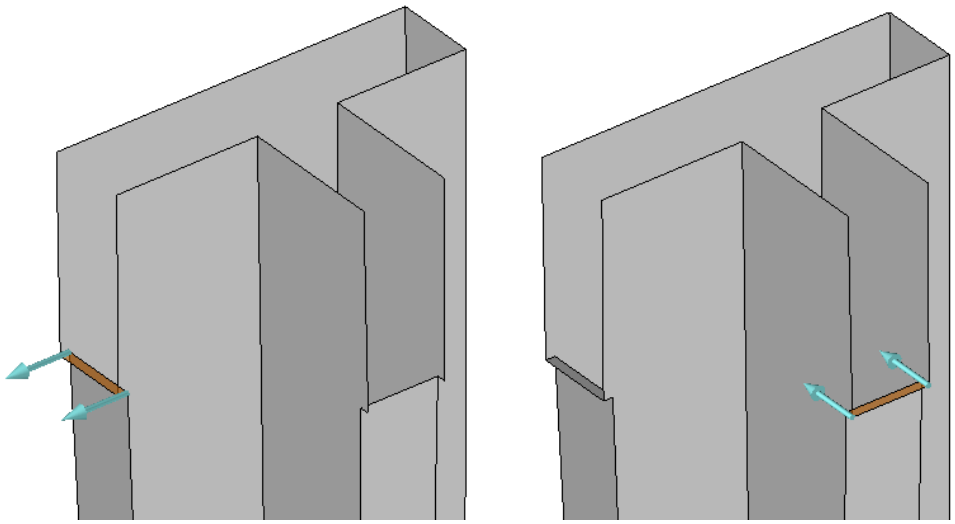
- Select the  **Shells** command.
- Select the following inner faces of the pocket framed in red in the above image as shown below by using the rotary picking technique if necessary.



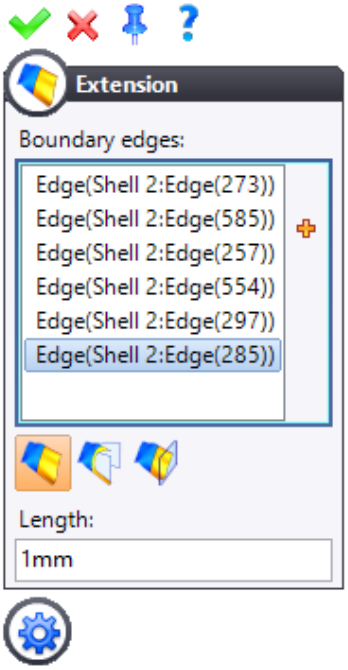


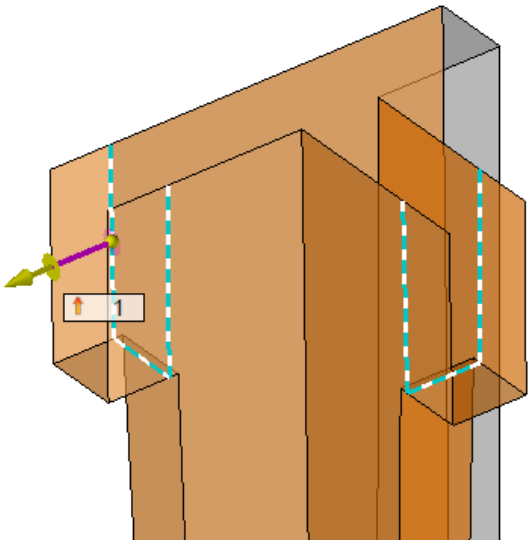
- Click on  to **confirm** the operation.
- Click on the  **Hide/Show Shapes to Erode** icon to hide the block.

- From the **Surface** tab, create two **lofted** surfaces based on the shell edges.



- **Sew** these two surfaces to the shell.
- **Extend** the surface to *1mm* as shown below.

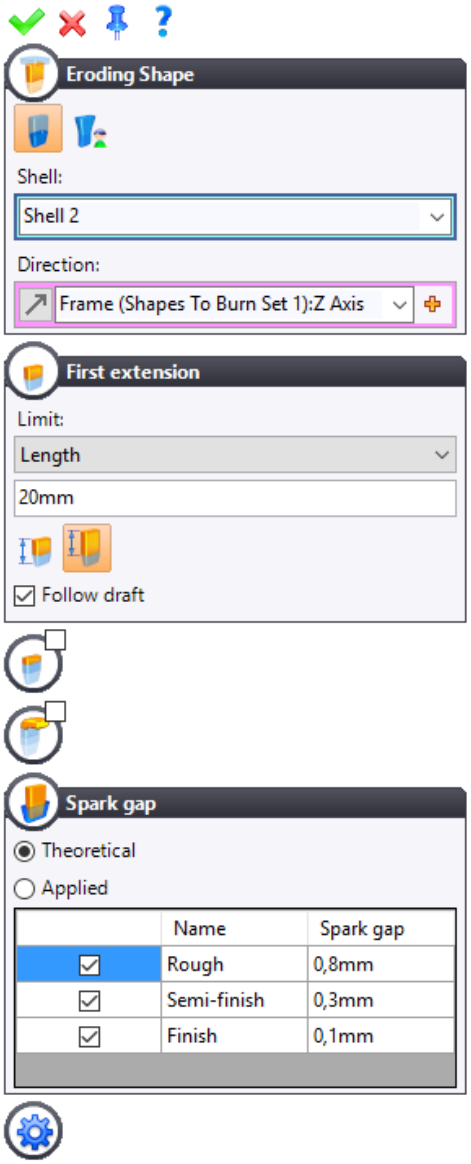


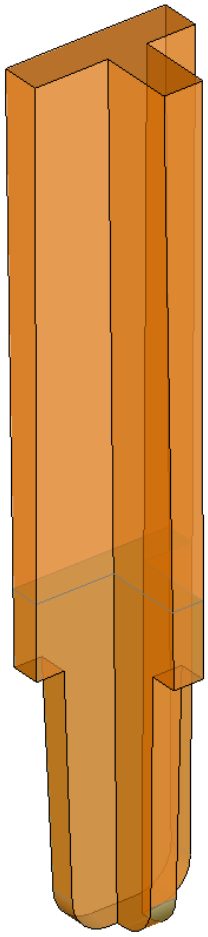


- Click on to **confirm** the operation.

Creating the eroding shape

- Select the **Eroding Shape** command and adjust the following settings.



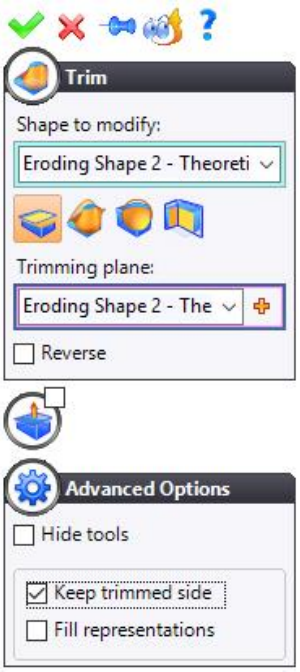


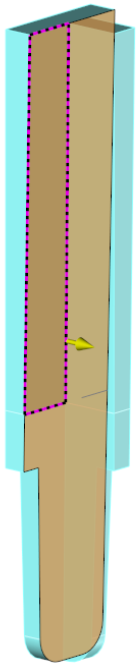
- Click on to **confirm** the operation.

In order to guarantee the sharp angles on the eroded shape and to facilitate the realization of the electrode, we are going to break down this electrode into two parts.

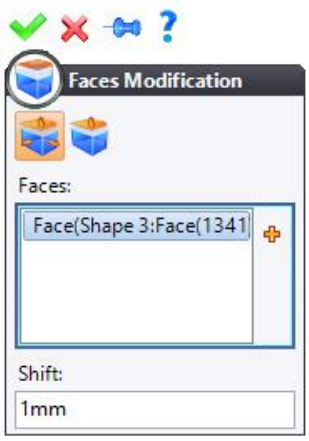
Creating a second eroding shape using the Shape mode

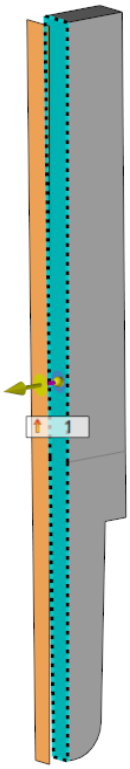
- From the **Shape** tab, **trim** the eroding shape with a plane.
- Check the **Keep trimmed side** box in the **Advanced Options** dialog box.



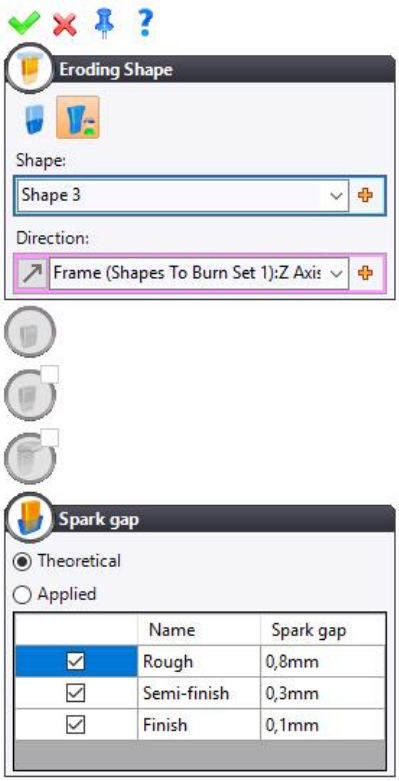


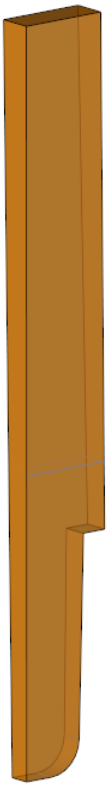
- Click on to **confirm** the operation.
- From the **Shapes** folder in the Entities tree, hide the **eroding shape 2**.
- On the trimmed side, perform a **face modification** operation in order to offset the following face by *1mm*.





- Select the **Eroding Shape** command, select the **Shape** mode, and then adjust the following settings.

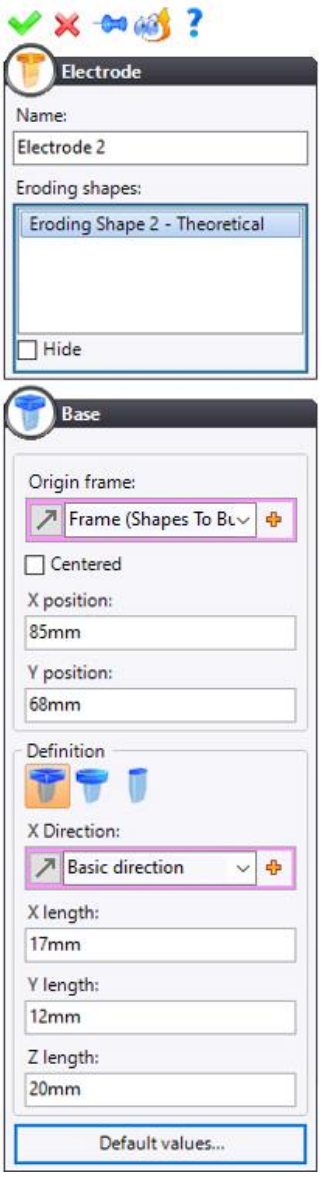


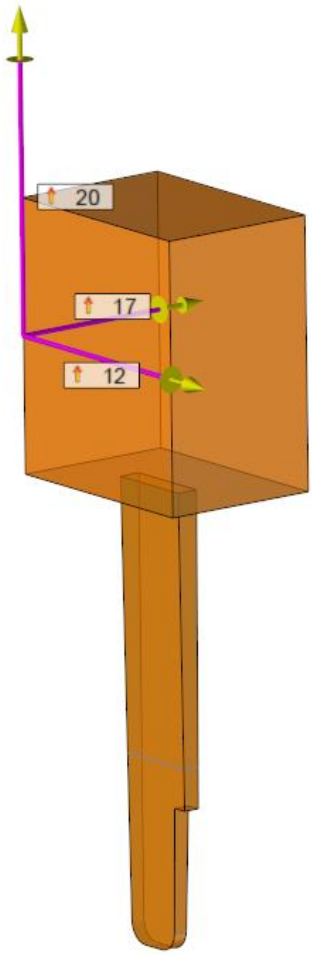


- Click on to **confirm** the operation.

Creating the electrode

- Select the **Electrode** command and select **eroding shape 2**.

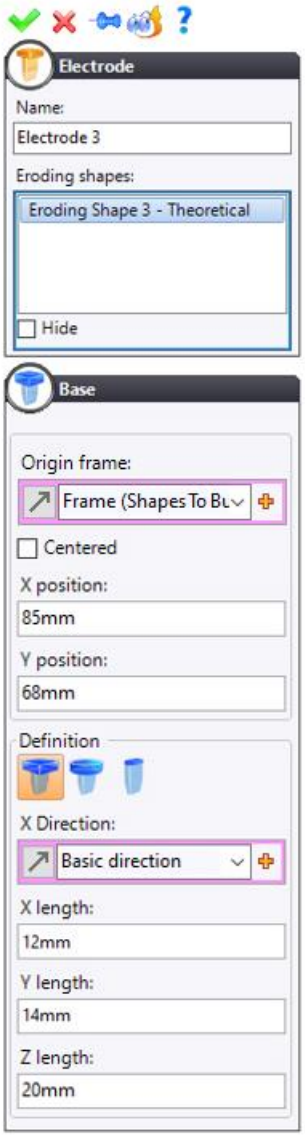


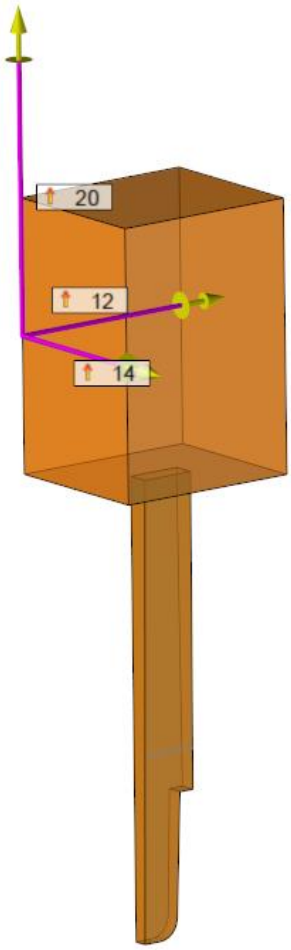


- Click on to **confirm** the operation.

Note: Once the electrode has been created, it appears in the **Parts** folder in the Entities tree.

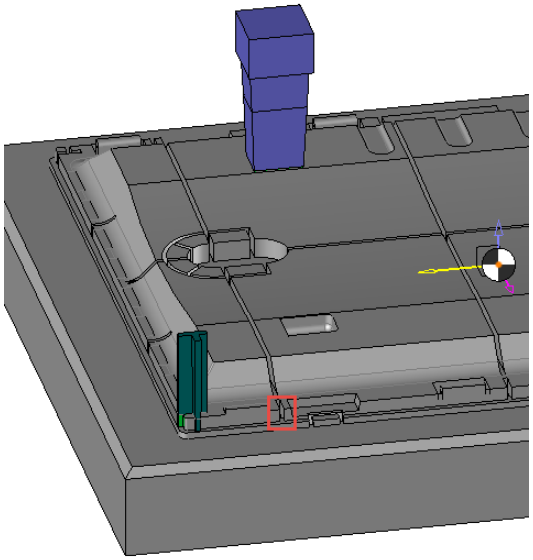
- Repeat the procedure for **eroding shape 3**.

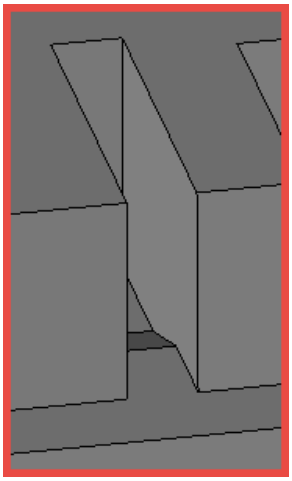




- Click on ✔ to **confirm** the operation.
- **Save** the document.

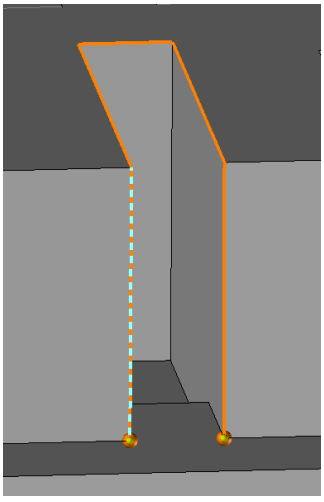
Exercise 3: Multiple Electrodes and Shell by Edge Selection





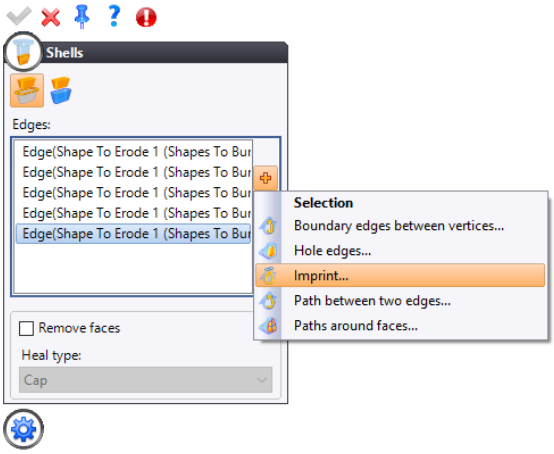
Creating the shell

- Select the **Shells** command using the **Edges** mode. Select the following edges.

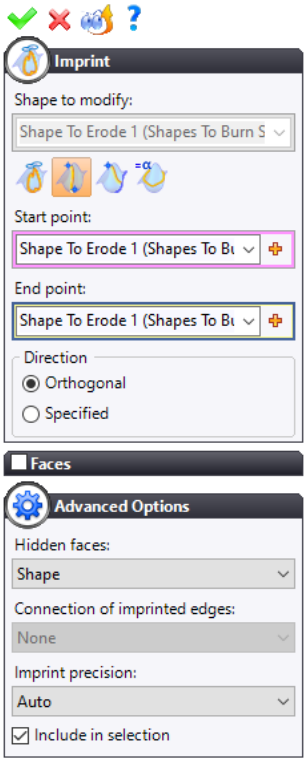


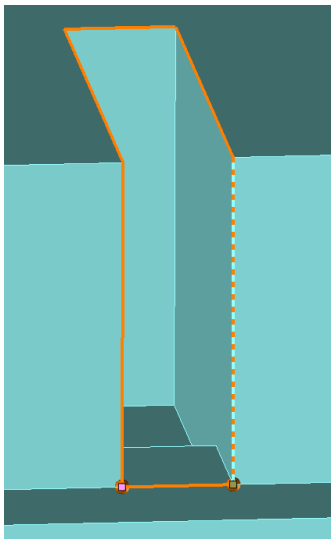
To complete the loop, we will create the last segment.

- Click on the icon and select the **Imprint** command.



- Select the **By two points** mode.

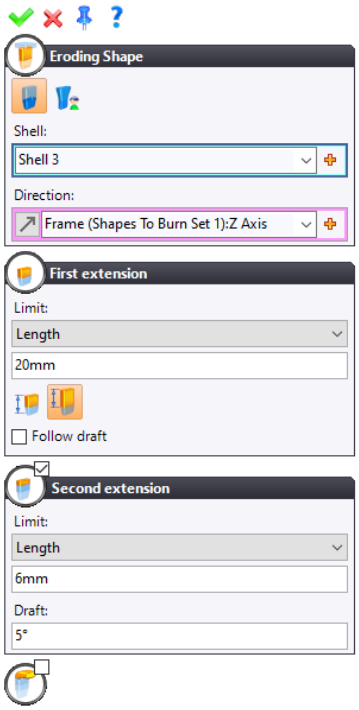


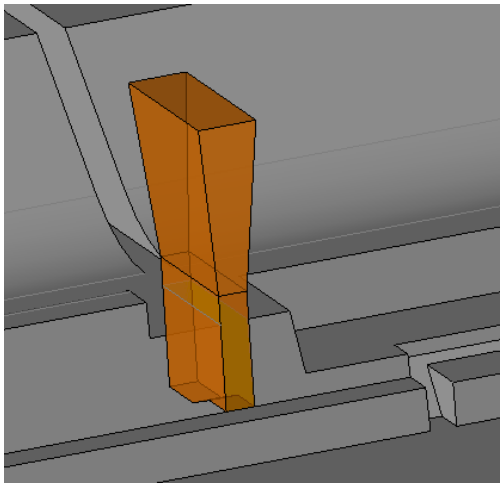


- Click on to **confirm** the imprint and the shell.

Creating the eroding shape

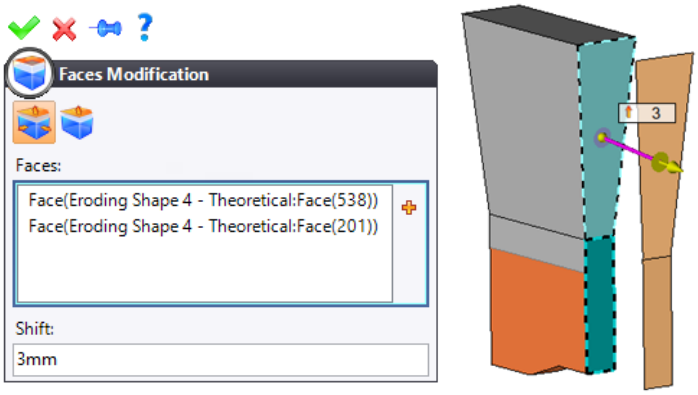
- Select the **Eroding Shape** command and select the previously created shell.





- Click on to **confirm** the operation.

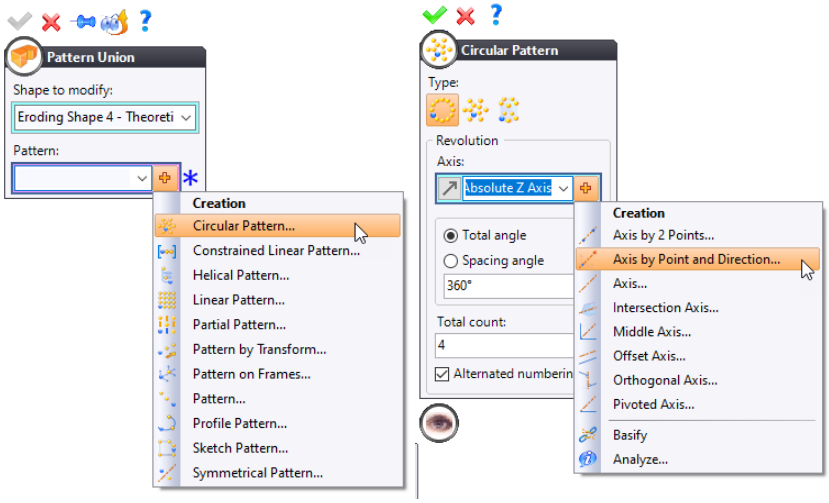
- From the **Shape** tab, perform a **face modification** operation to offset the electrode from the part by *3mm.*



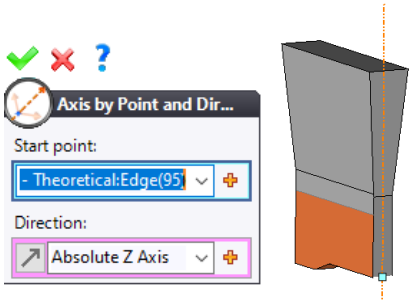
- Click on to **confirm** the operation.

Creating electrodes

- Select the **Pattern Union** command and adjust the following settings.



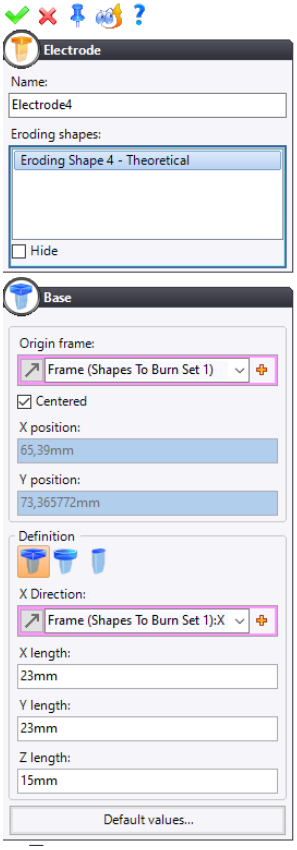
- To define the axis of rotation, select the **midpoint** of the electrode as the **start point** and the **Absolute Z Axis** as the **direction**.

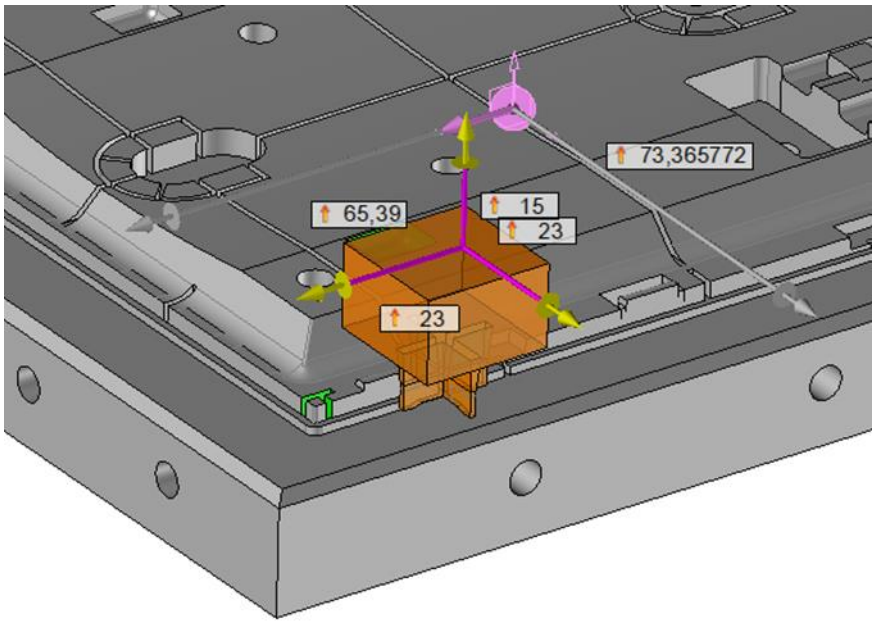


- Click on to **confirm** the pattern and the pattern union.

Creating the electrode

- Select the **Electrode** command and adjust the following settings.



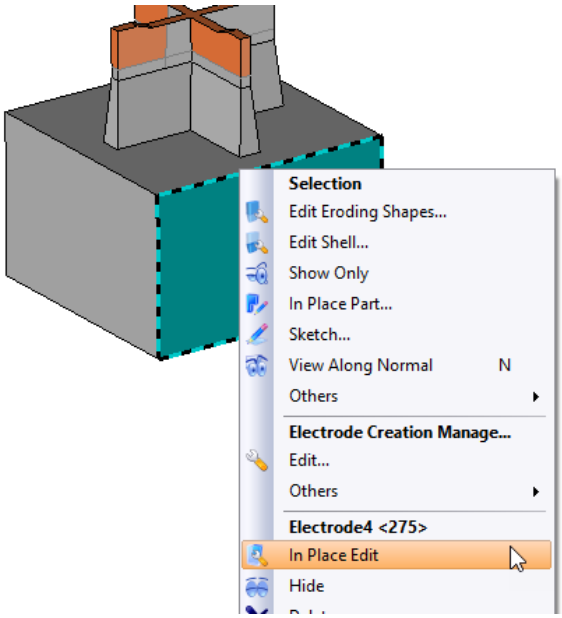


- Click on to **confirm** the operation.

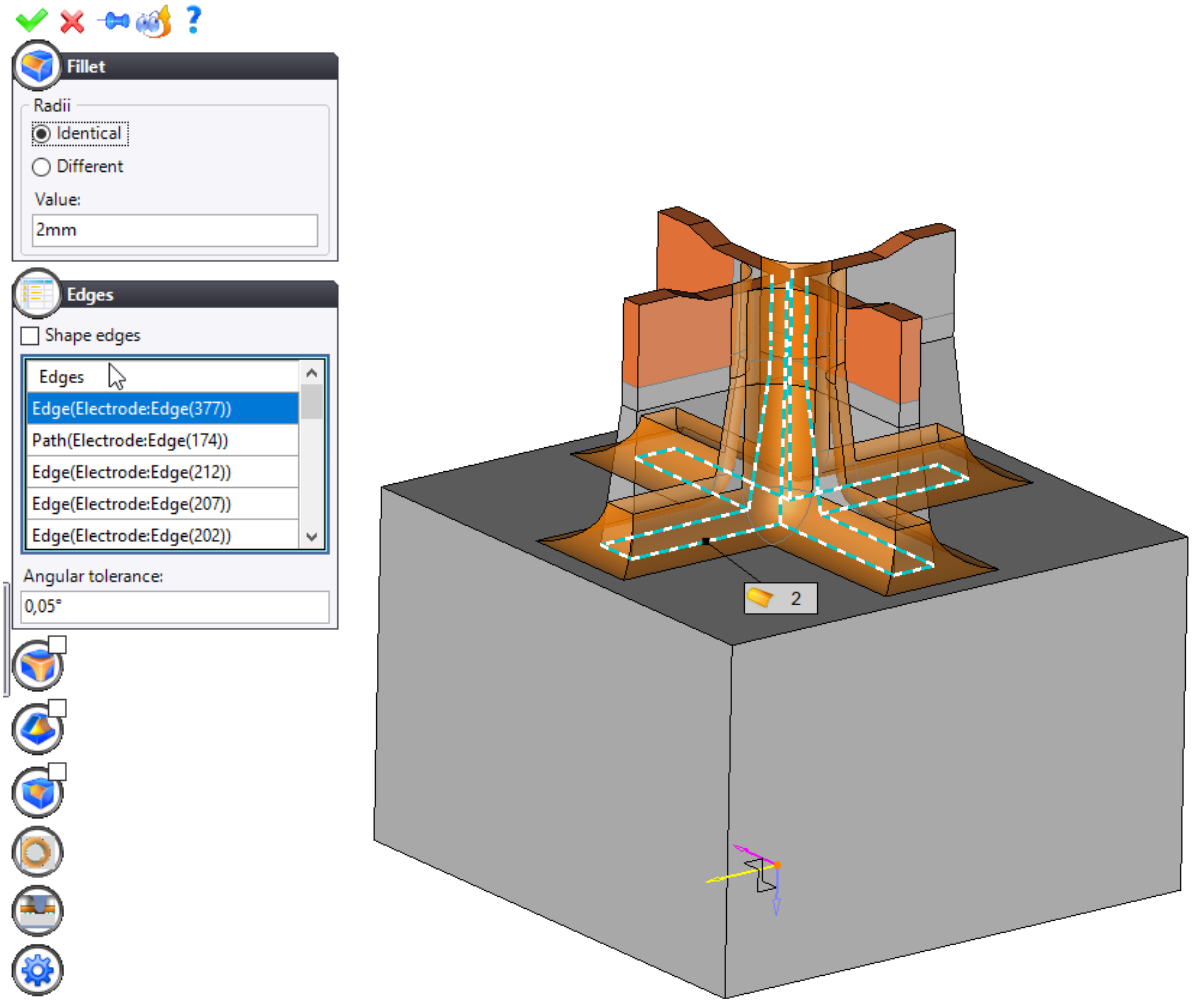
Warning: The base must be centered on the axis of rotation selected during the **Pattern union** operation.

Adding fillets on the base

- Right-click on **electrode 4** and select the **In Place Edit** command as shown below.



- Right-click on one of the vertical edge of the electrode and select the **Fillet** command.

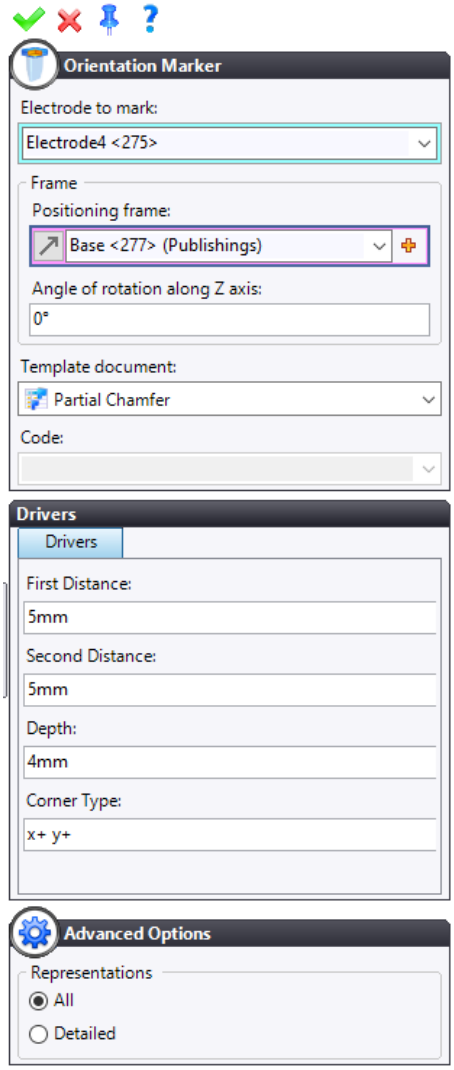


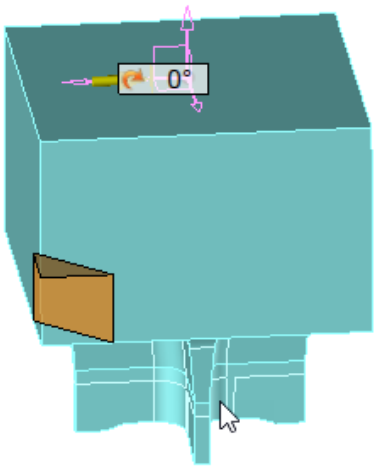
- Click on to **confirm** the operation.
- **Confirm** the in-place editing by clicking on the In Place Editing button.
- **Save** the document.

Exercise 4: Markers, Control Points and Properties

Orientation markers

- Select the **Orientation Marker** command. Select **electrode 4** and adjust the following settings.





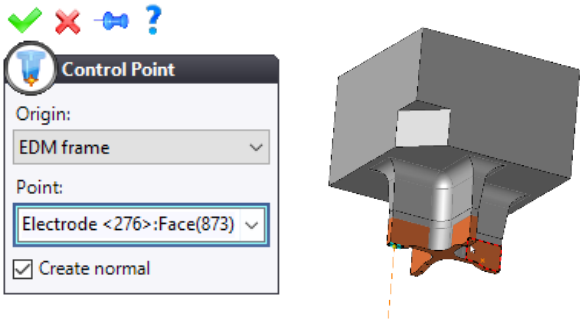
- Click on to **confirm** the operation.
- Repeat the operation for the other electrodes.
- **Save** the document.

Control points

The **Control Point** command allows you to create a significant point on the electrode. This point will be projected in the electrode drafting document and can be dimensioned according to the gap applied to the electrode via the **Control Point** command in the drafting document.

Note: The control point is added to the detailed representation of the electrode part. Therefore, by default it will be visible in the detailed drawing of the electrode part. However, in the global drawing of the electrodes document, it will not be visible. However, it is possible to add these points manually in the detailed representation of the electrodes document.

- Select the **Control Points** command. Select the bottom face of the first electrode.

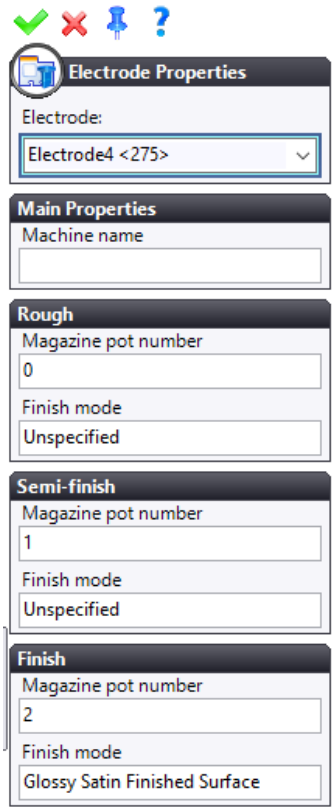


- Click on to **confirm** the operation.
- Position the control points on the other electrodes.

Note: In the **Origin** field, if the **EDM frame** is selected, the reference for the coordinates of the control point is the absolute frame of the electrodes document.

Electrode properties

- Select the **Electrode Properties** command. Select the first electrode and enter the following properties.



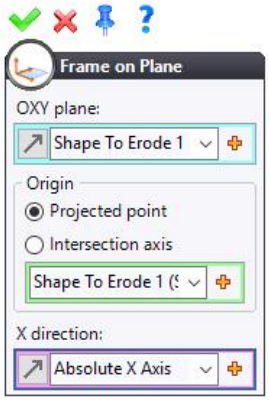
Note: The electrode properties can be retrieved in a bill of material and a drafting document. As with standard properties, you can create user properties. These properties come from the **TopSolid Electrode** library which must be referenced.

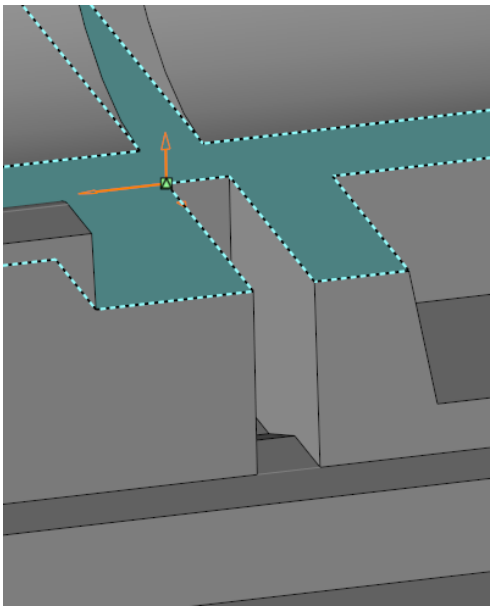
- Repeat the same operation on the other electrodes if necessary.
- Click on to **confirm** the operation.
- **Save** the document.

Exercise 5: Theoretical Positions

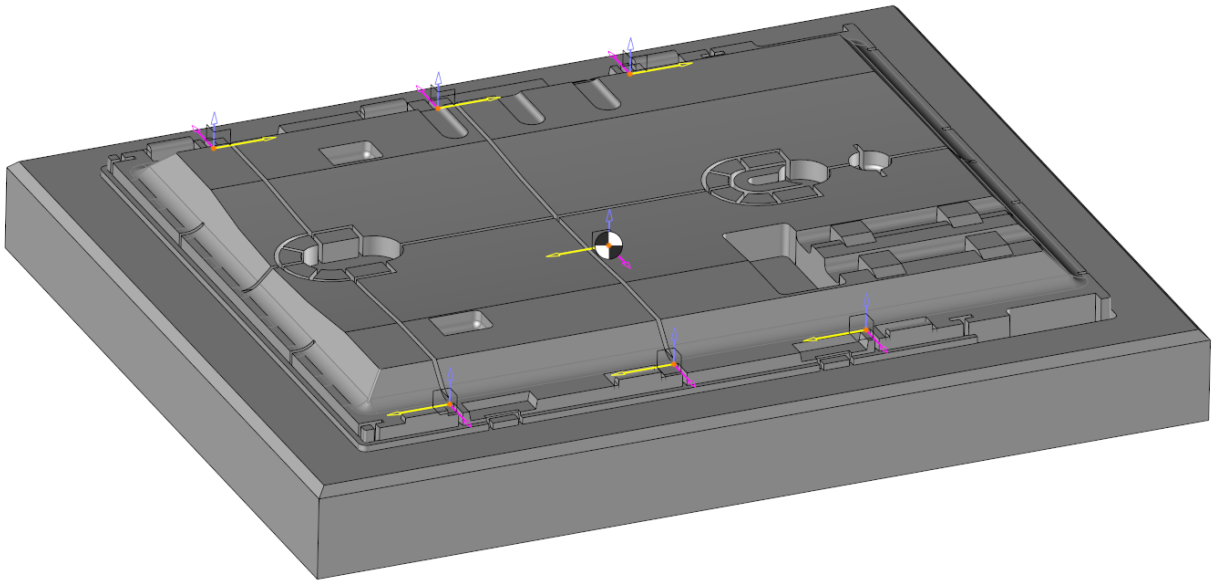
Repeating an electrode

- Create the following **frame on plane**.

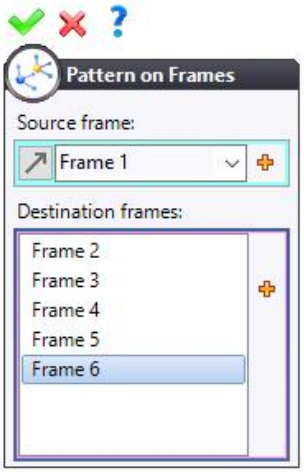


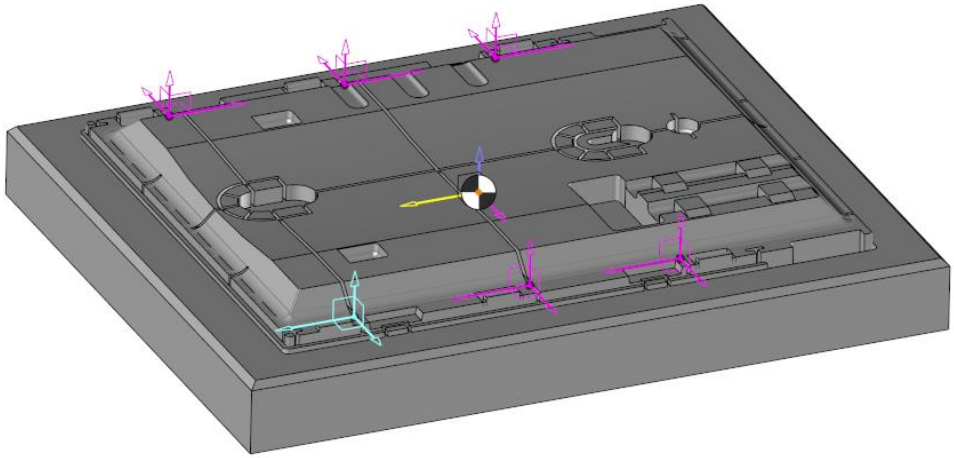


- Create similar frames on the other grooves. Make sure you invert the X axis on the opposite grooves.

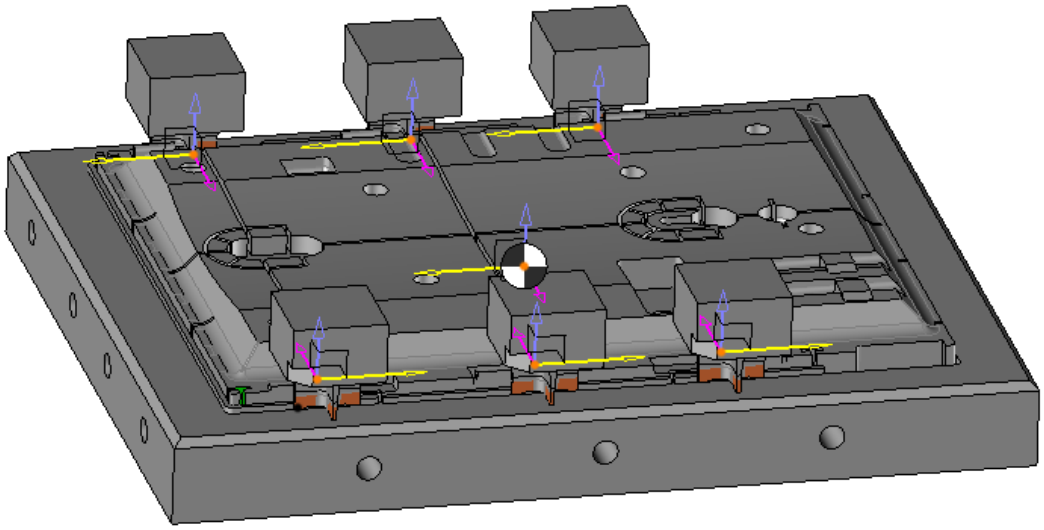


- **Repeat** electrode 4 using a **pattern on frames**. The reference frame is the frame corresponding to the position of the first electrode.





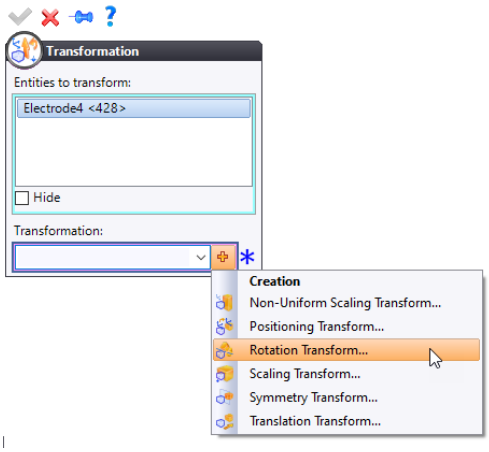
- Click on to **confirm** the pattern and the repetition.

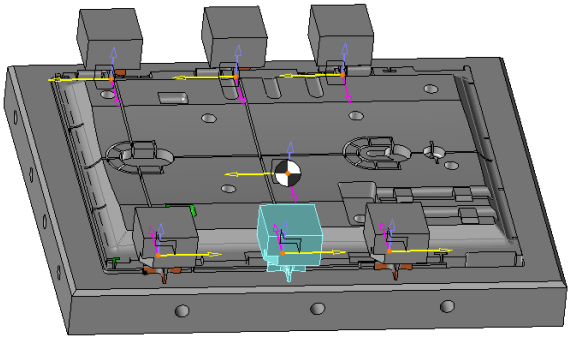


- **Save** the document.

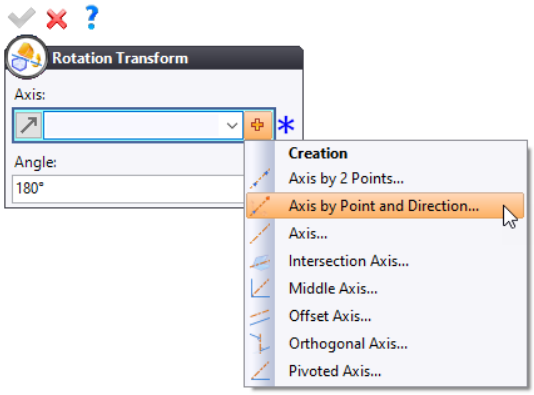
All the electrodes were machined in the same area. We will therefore impose rotations on them.

- In the **Construction** tab, select the **Transformation** command.

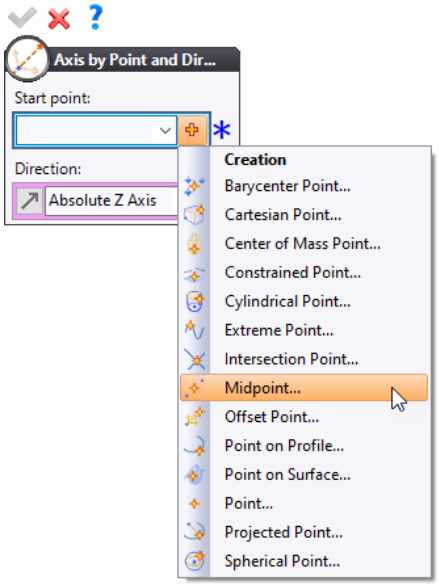


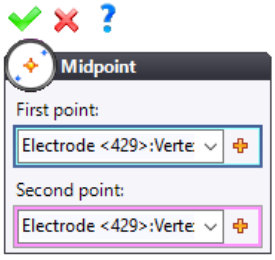


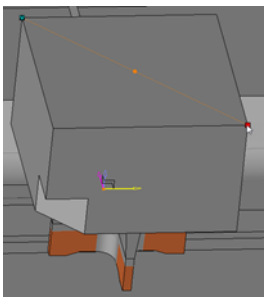
- For the rotation **axis**, select **Axis by Point and Direction**.



- For the **start point**, select the **midpoint** as shown below and the **Absolute Z** direction.





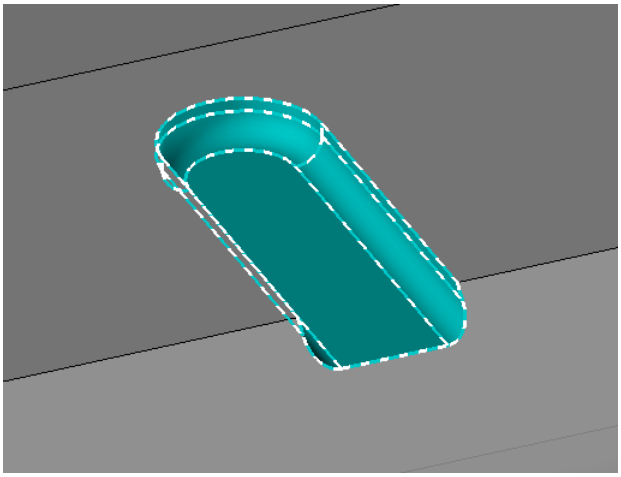


- Click on  to **confirm** the transformation.
- Repeat the same operation on the other electrodes if necessary.

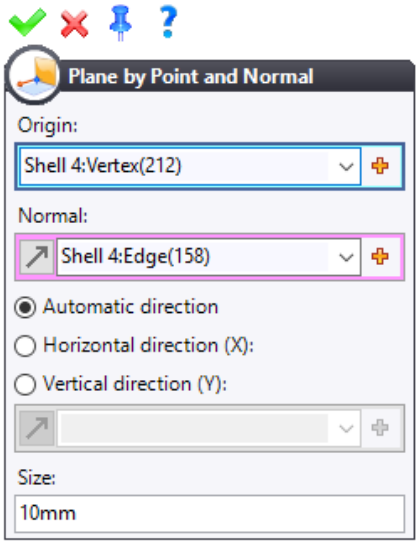
Exercise 6: Electrode Bridge

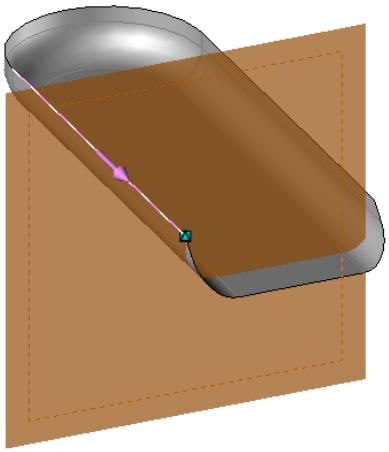
Creating the shell

- Select the **Shells** command using the **Faces** mode. Select the faces of the first pocket using the rotary picking technique.



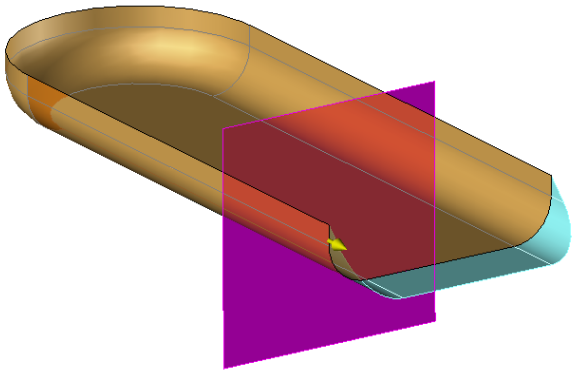
- Click on to **confirm** the operation.
- Create a **plane by point and normal**.





- Click on to **confirm** the operation.

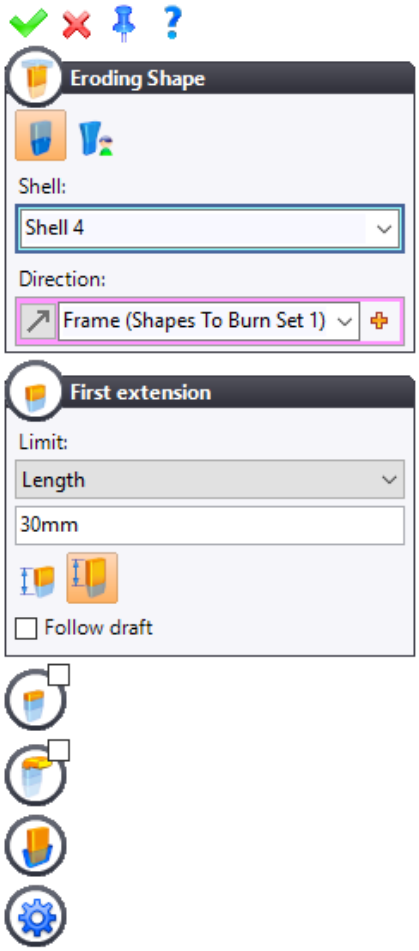
- **Trim** the shell using the plane you have just created.

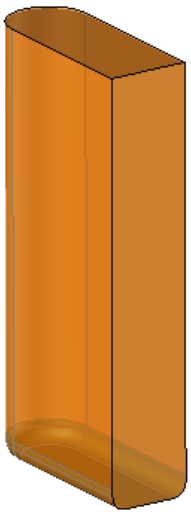


- Click on to **confirm** the operation.

Creating the eroding shape

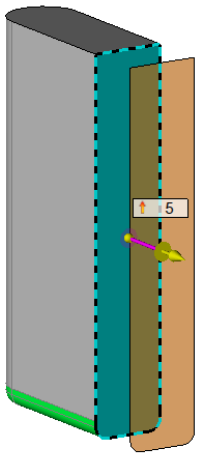
- Select the **Eroding shape** command.





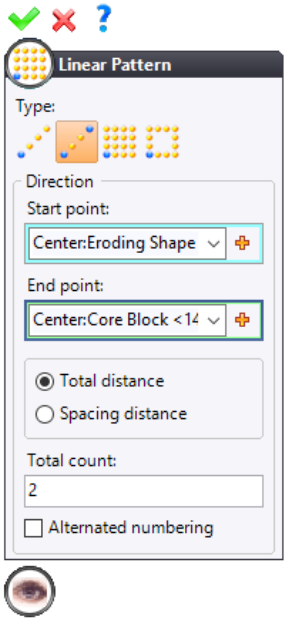
- Click on to **confirm** the operation.

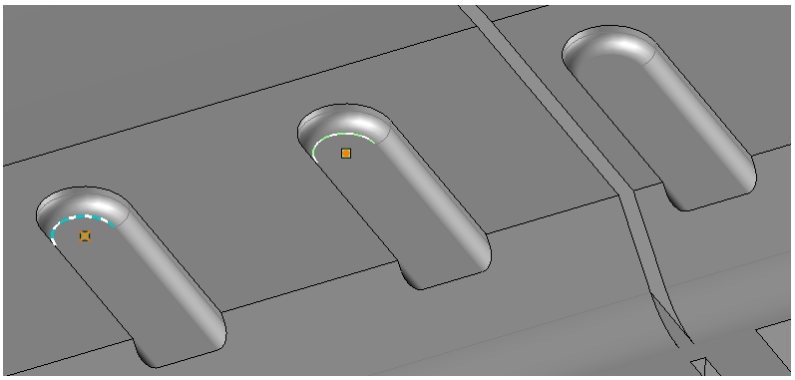
- Shift the following face by *5mm* using the **Faces Modification** command.



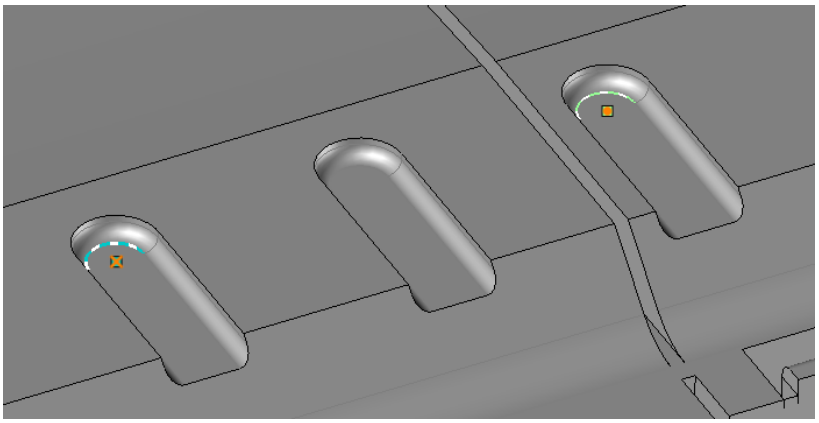
Repeating the eroding shape

- **Repeat** the eroding shape using a **linear pattern** in **Line by two points** mode.



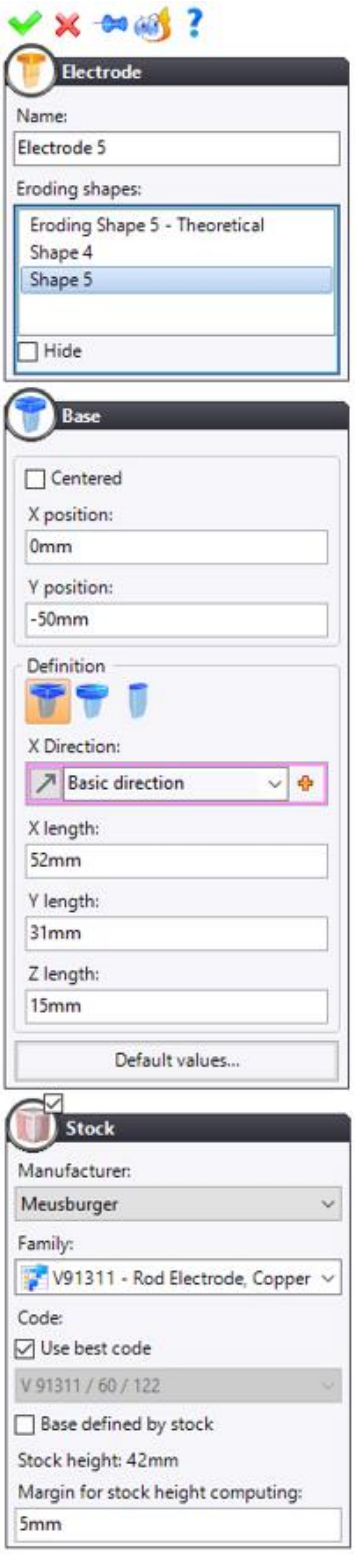


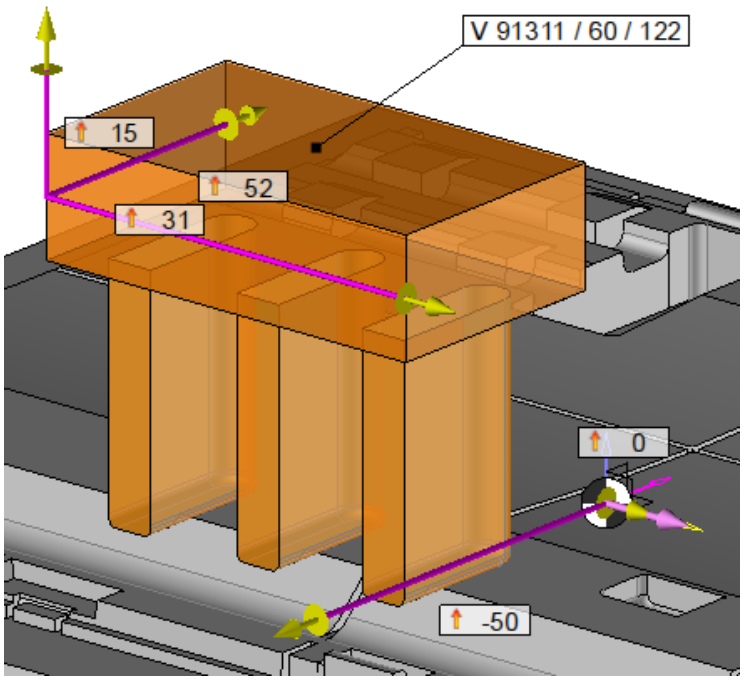
- Click on to **confirm** the pattern, and then the repetition.
- Repeat the operation using a **linear pattern** and by selecting the following points as **start** and **end** points.



Creating the electrode

- Select the **Electrode** command and create the following electrode by selecting the three eroding shapes.





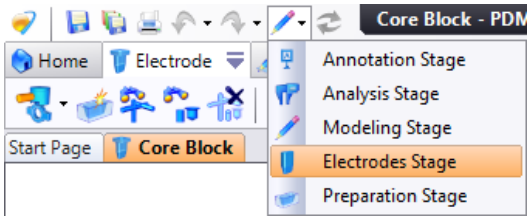
Note: If a predefined manufacturer's stock is used and the **Base defined by stock** box is checked, the dimensions of the selected stock are taken into account for the base.

- Click on to **confirm** the operation.
- **Save** the document.

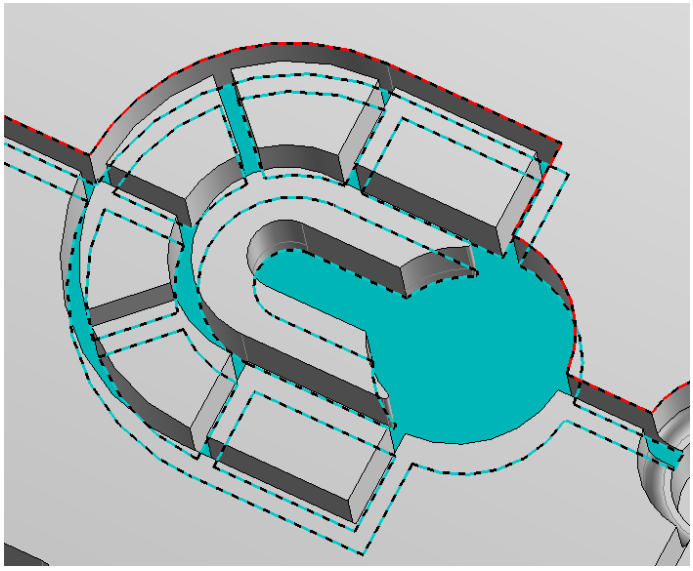
Exercise 7: Wire Electrode

Creating the shell

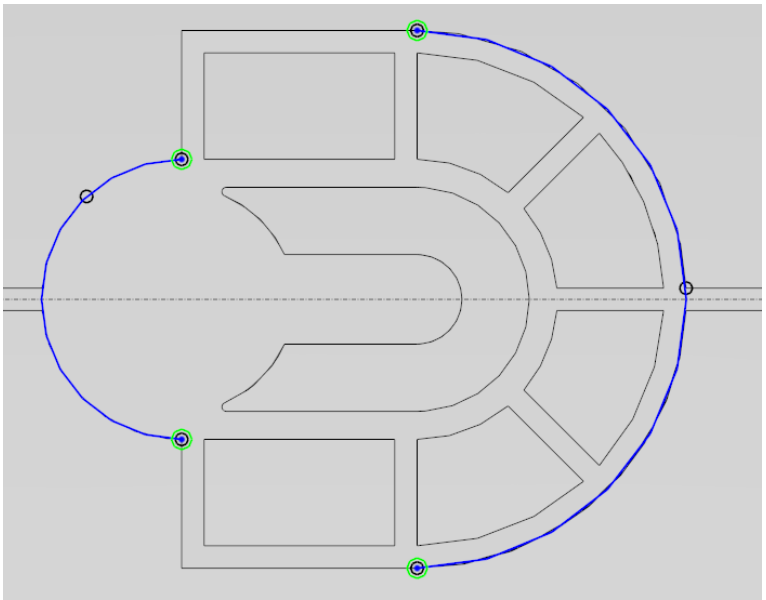
- Switch to **Electrodes Stage**.



- Create a **sketch** on the highlighted plane as shown below.

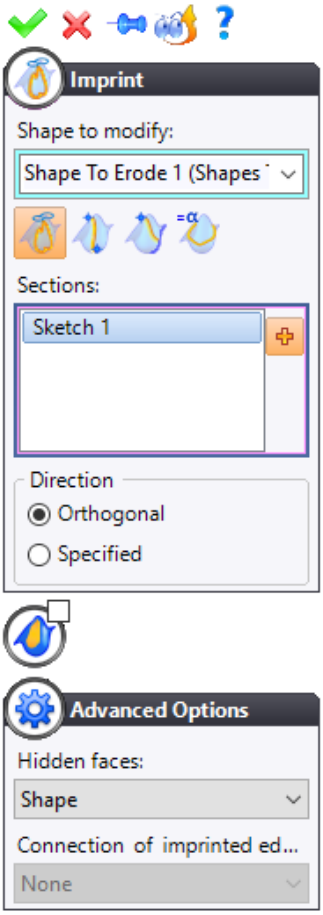


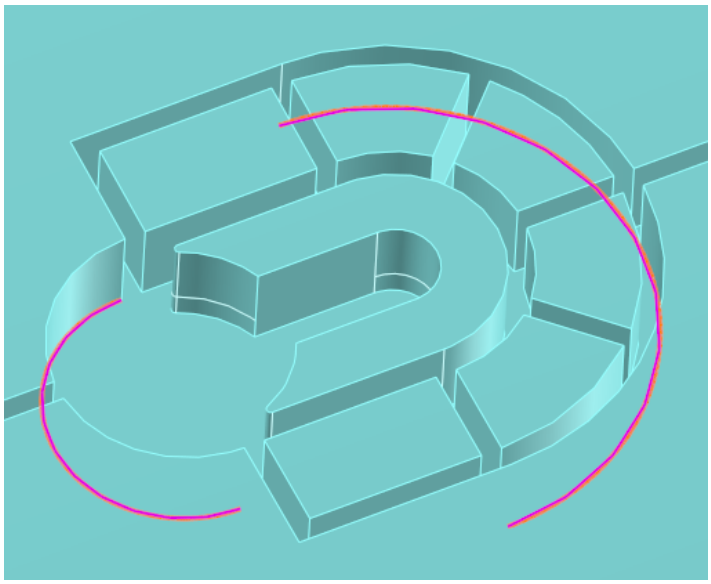
- Create the following two **arcs** as shown below.



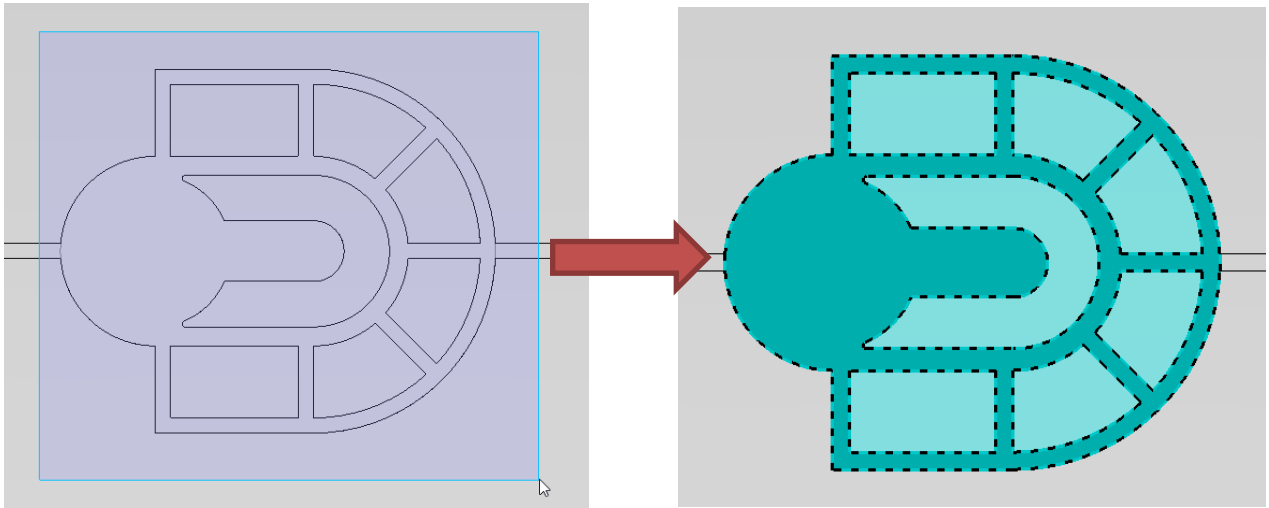
- **Confirm** the sketch by clicking on the Sketch 1 button.

- **Imprint** the previously created sketch on the shape to erode.



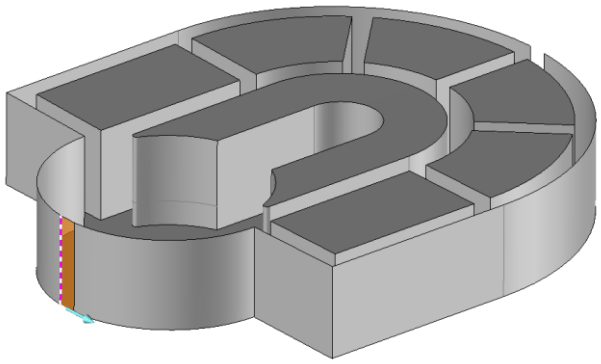


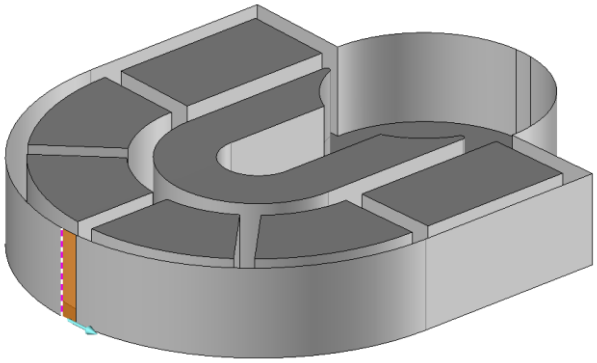
- Create the following **shell** using the **Faces** mode. Draw a selection box from left to right as shown below.



- Click on to **confirm** the operation.
- **Hide the shape to erode** and **hide the eroding shapes**.

- Select the **Pipe** command and create the following two surfaces in order to fill the holes.

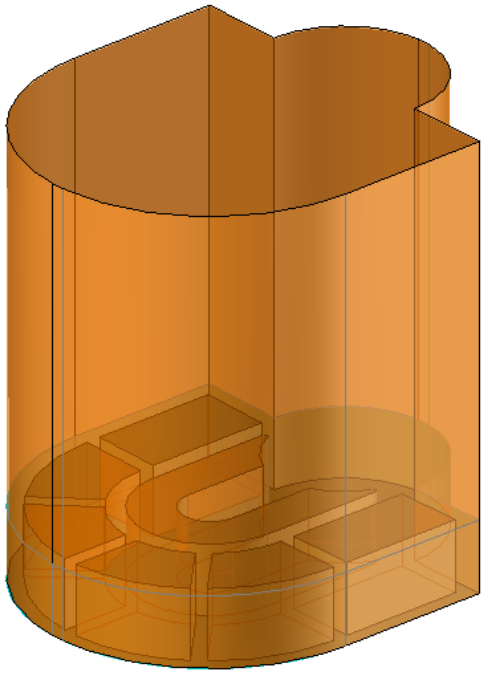




- **Sew** the two new surfaces to the shell.
- Click on to **confirm** the operation.

Creating the eroding shape

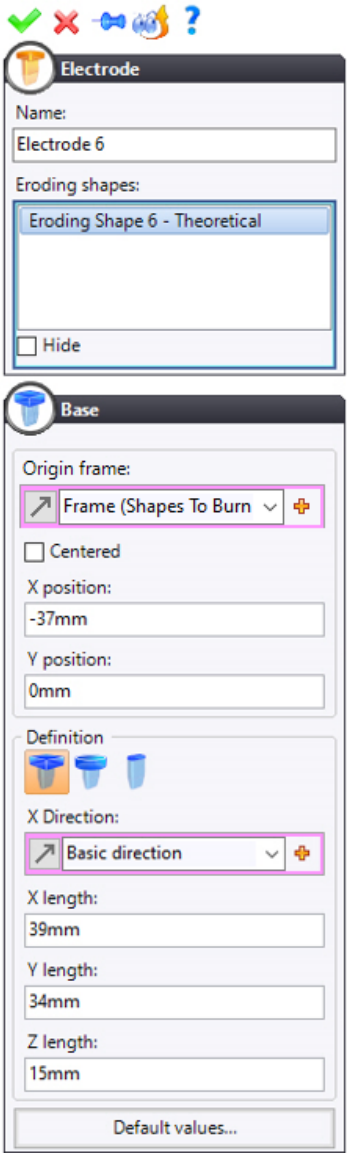
- Create the following **eroding shape** using the **Shell** mode.

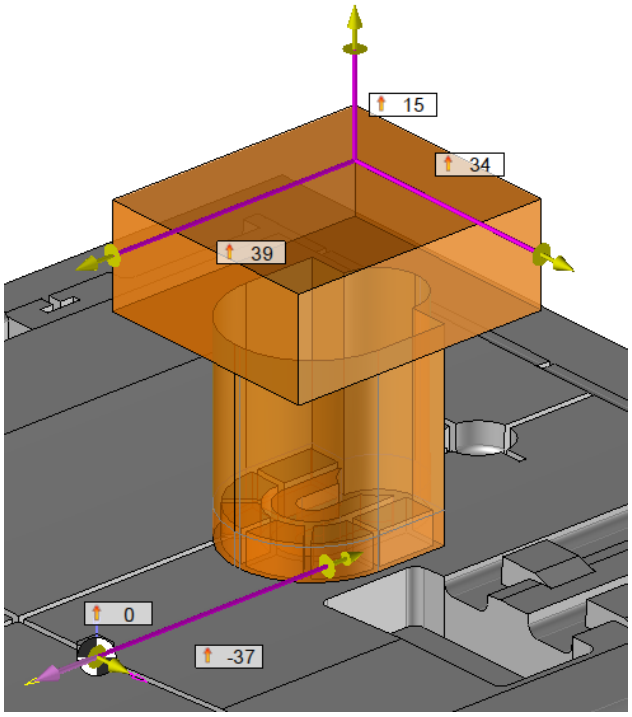


- Click on to **confirm** the operation.

Finishing the electrode

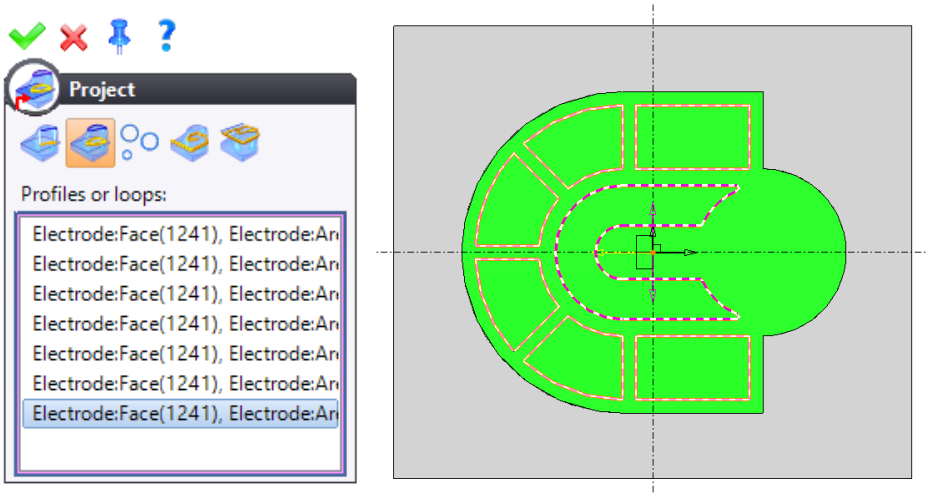
- Select the **Electrode** command and adjust the following settings.



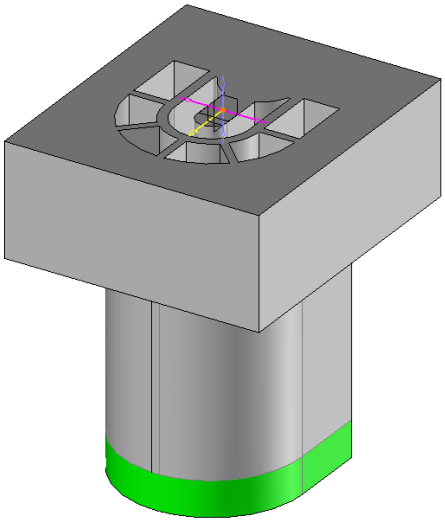


- Click on to **confirm** the operation.
- **Edit the in-place part** and create a **sketch** on the top plane of the base.

- From the **2D Sketch** tab's drop-down menu, select the **Operations** > **Project** command and project the following edges.



- Click on to **confirm** the operation.
- Right-click in the graphics area and select the **Trim by Profile** command. Create the following trimming operation.

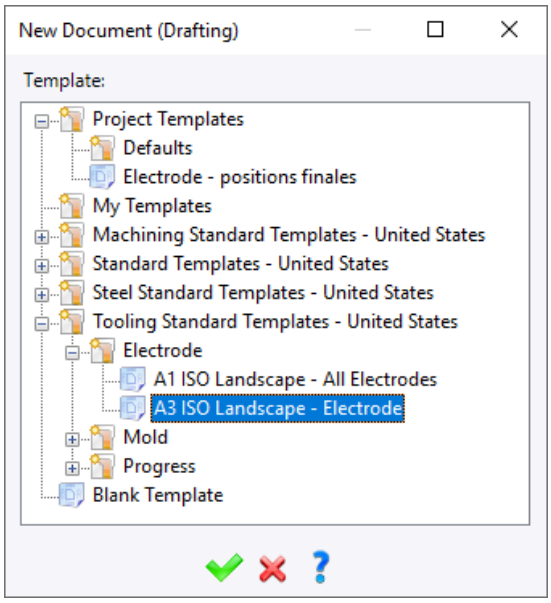


- **Confirm** the in-place editing by clicking on the In Place Editing button.
- **Save** the document.

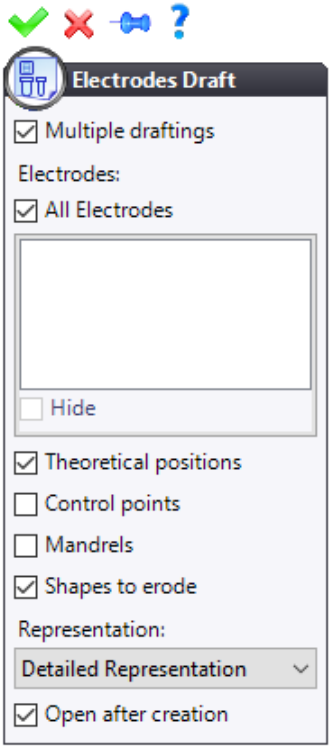
Exercise 8: Electrode Drafting

Electrode, core block and theoretical positions

- Select the **Electrodes Draft** command.
- From the **Project Templates** folder, select the **A3 ISO Landscape - Electrode** template.

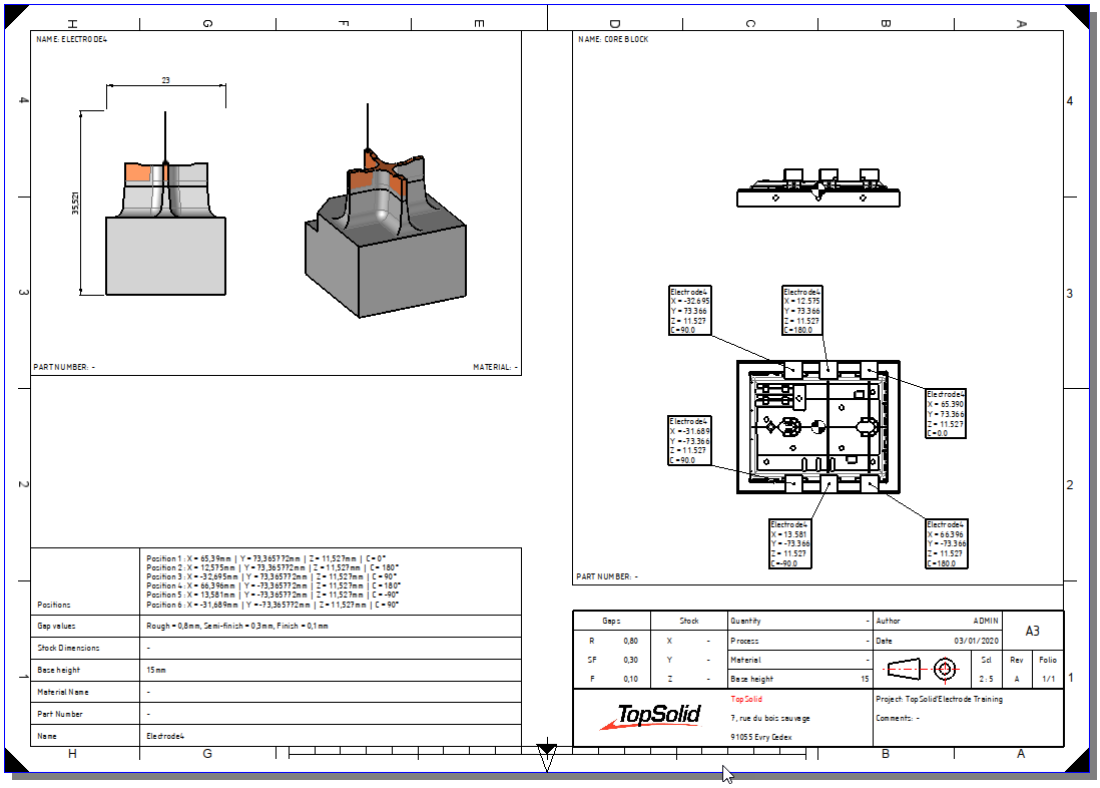


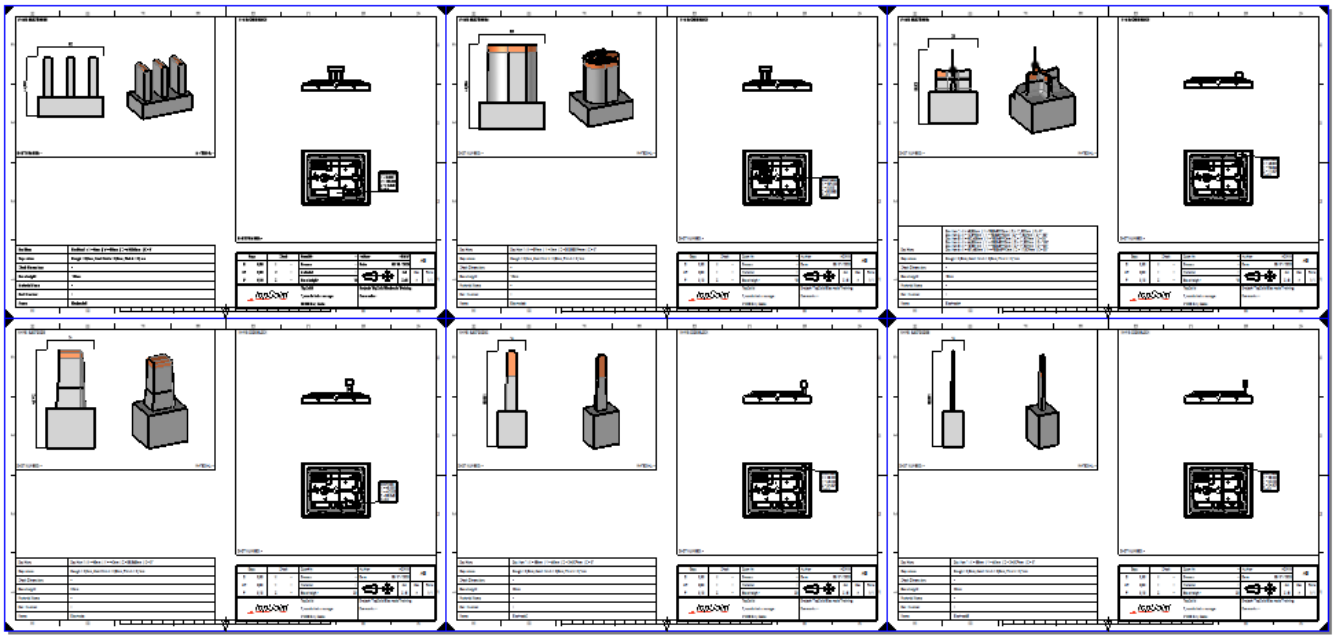
- Click on to **confirm** the operation.
- Select the following options.



- Click on to **confirm** the operation.

A drawing is created for each electrode.

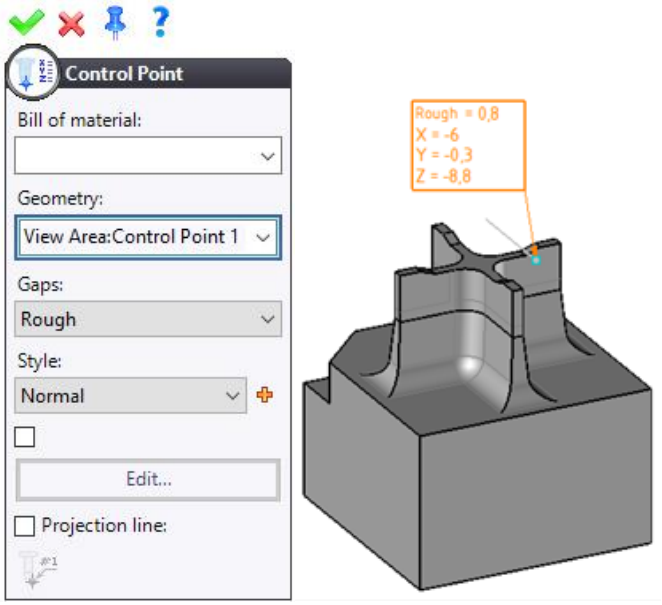




Note: A drafting template must be created beforehand. The method used for creating the template is detailed at a later stage.

Control point notes

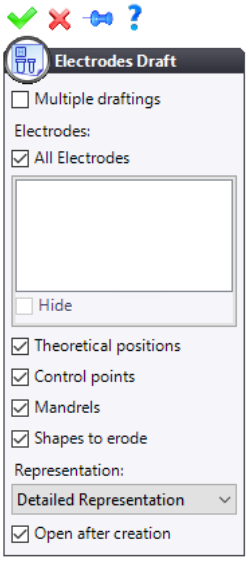
- Open the drawing of electrode 4.
- From the **Electrode** tab, select the **Control Points** command.
- Select the control point, select the **Rough** gap and place the note.

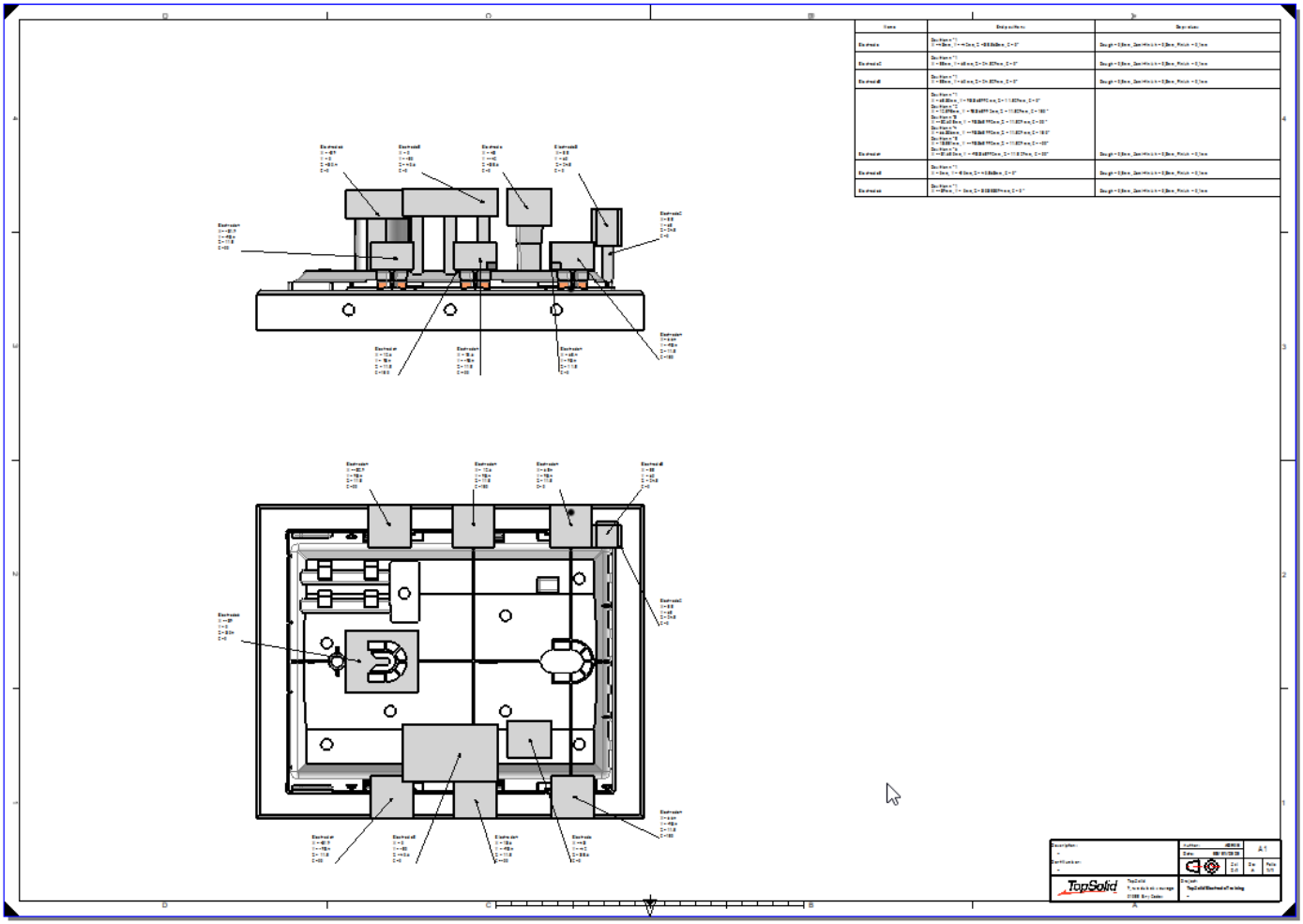


- Click on to **confirm** the operation.
- Repeat the operation for the semi-finish and finish gaps.

Additional Exercise: Drafting all the electrodes

- Select the  **Electrodes Draft** command.
- In the **Project Templates** folder, select the **A3 ISO Landscape – All Electrodes** template.
- Check the **All Electrodes** box and uncheck the **Multiple draftings** box.



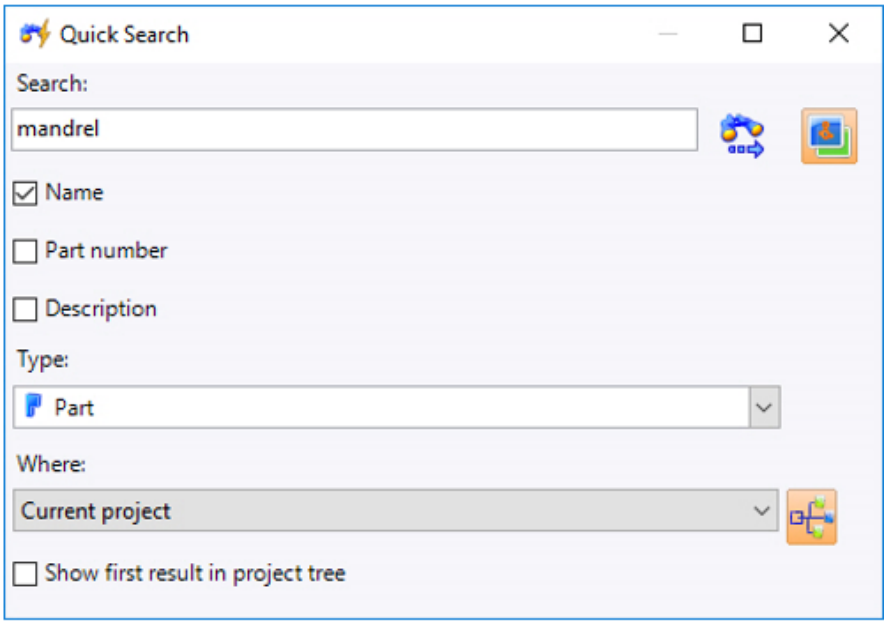


Note: If more than one electrode is selected in the command, the **Multiple draftings** option is used to create one drafting document per electrode. If the option is unchecked, only one drawing will be created, with a global view of all the electrodes.

Exercise 9: Including Mandrels

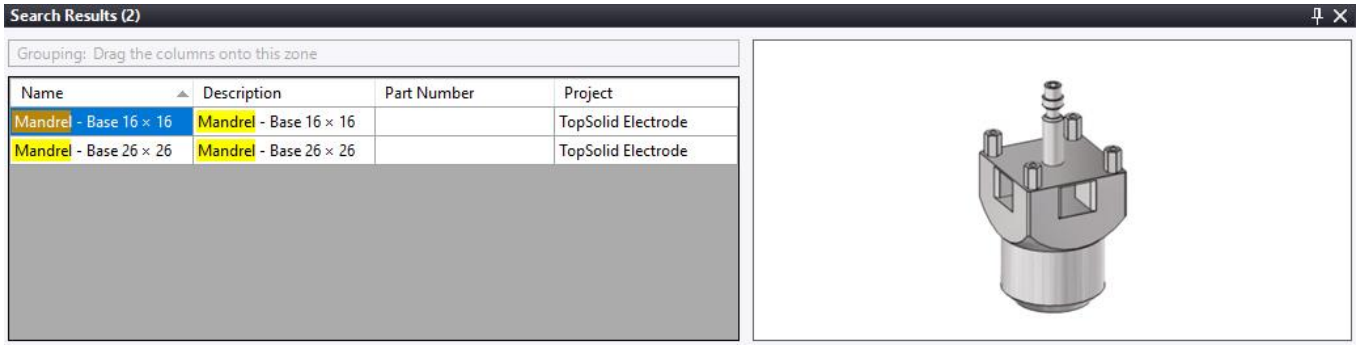
Component search

- Open the electrodes document named *Core Block*.
- Click on the **Quick Search** icon at the top right of the screen.
- Adjust the following settings.



- Click on the icon to run the search.

The following search results are displayed.

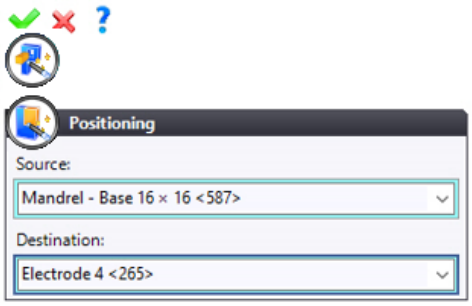


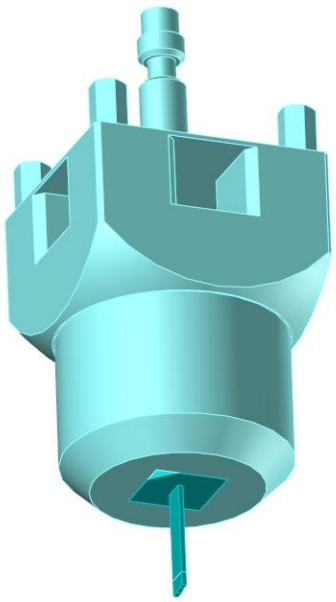
- **Close** the quick search dialog box.

Including the mandrel

- Drag the **Mandrel - Base 16 x 16** part to the graphics area.
- Select the electrode 4 as the **destination**.

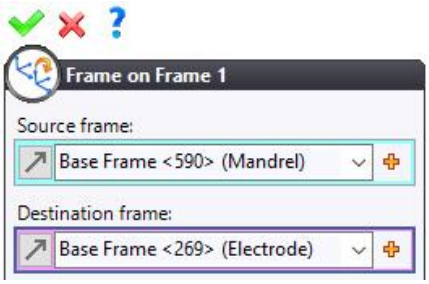
The mandrel is automatically positioned on the electrode.





- Click on to **confirm** the operation.

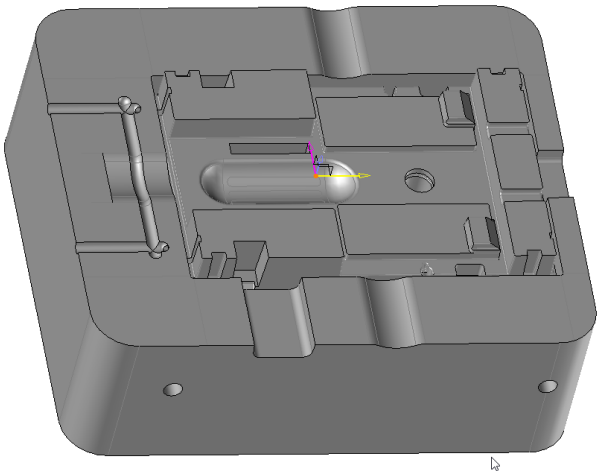
Note: To position the mandrel, a **Frame on Frame** constraint is automatically created between the **base frame** of the mandrel (position to be defined when the mandrel function is provided) and the **base frame** of the electrode (above the base).



Exercise 10: Creating electrodes on several parts

Preparing the cavity block

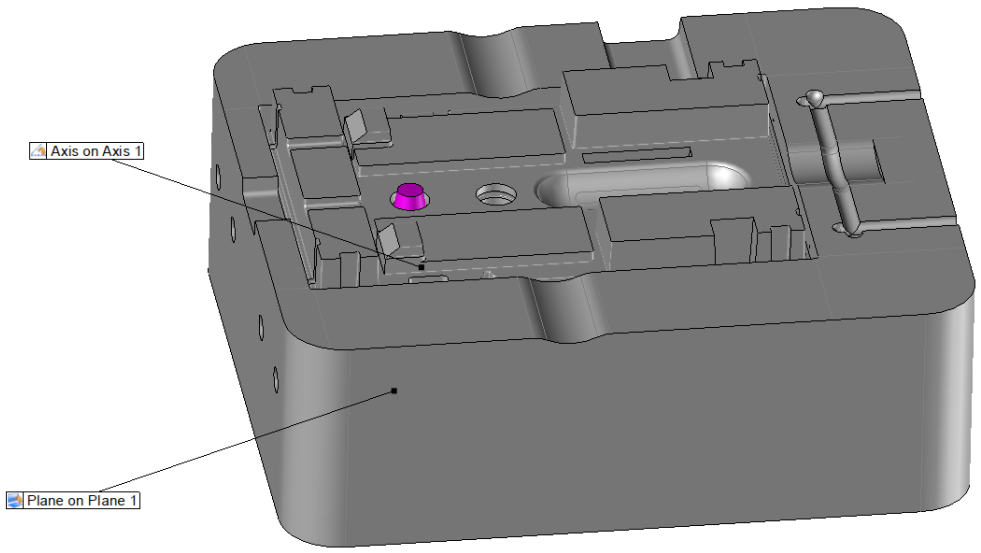
- Open the part document named *P1.Cavity block*.
- Create the origin frame for electrode positioning as shown below.
- Publish the frame.



- **Save** and **close** the document.
- Create an electrodes document using a **blank template** and name it *P1.Cavity block – Electrodes*.
- Drag the *P1.Cavity block* part document into the graphics area. This automatically creates a fixity constraint for the first inclusion.
- From the Entities tree, remove the fixity constraint.
- Edit **positioning 1** and create a **frame on frame** constraint with the published frame.

We are now going to include the *Spindle* part document.

- Drag the *Spindle* part document into the graphics area and **constrain** the spindle in its housing as shown below.



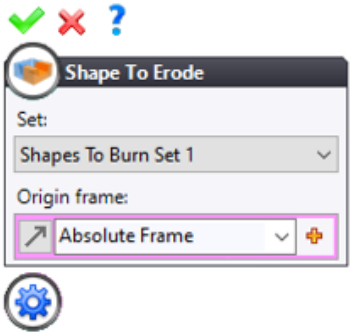
- **Confirm** the positioning.

Note: Only part documents can be included in an electrodes document.

- In the **Preparation** step, select the **Shapes to burn** command from the **Electrode** tab.

The **Shapes to burn** command allows you to create a set of shapes to be burnt from the part or parts included in the electrodes document.

- Select the spindle and the block as the **parts to burn**.
- Switch to **Electrodes stage**.
- In the **Electrode** tab, select the **Shape To Erode** command and keep the default values as shown below.

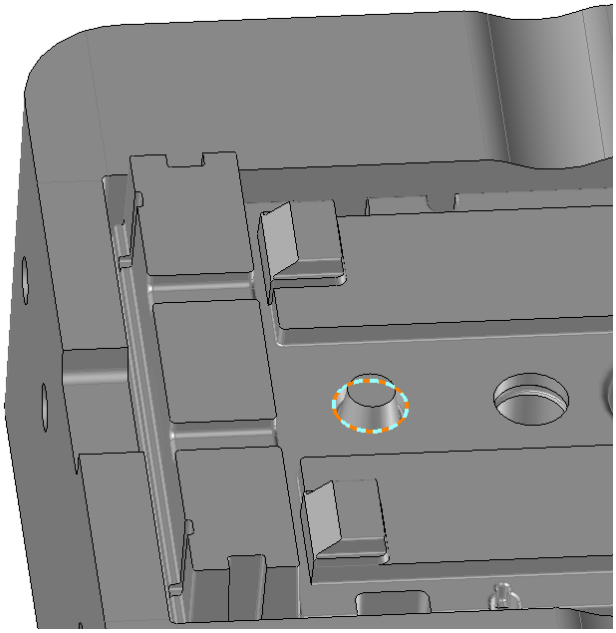


The **Shape To Erode** command allows you to create a set of shapes to be eroded from the set of shapes to be burnt that were previously created in the document. The electrodes will be defined from these shapes.

- Remove the drillings if necessary.
- Select the frames using the **Electrodes Frames** (machining, machining positioning and EDM) command.

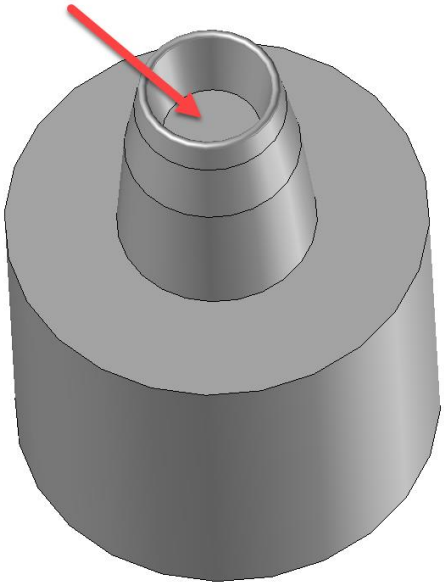
Creating the electrode on two parts

- Launch the **Electrode Wizard** command in **Edges** mode.
- Select the outer edge of the shape as shown below.

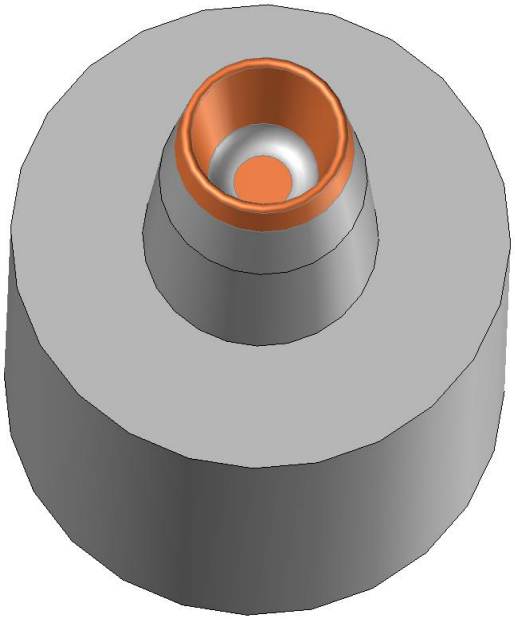


- Create the electrode using a cylindrical base.

We will clear the bottom face of the cone.



- **Edit the part in-place** and offset the face of the shape by *1,5mm* using the **Faces Modification** command.
- Add a *1mm* connection radius to the bottom to obtain the result as shown below.



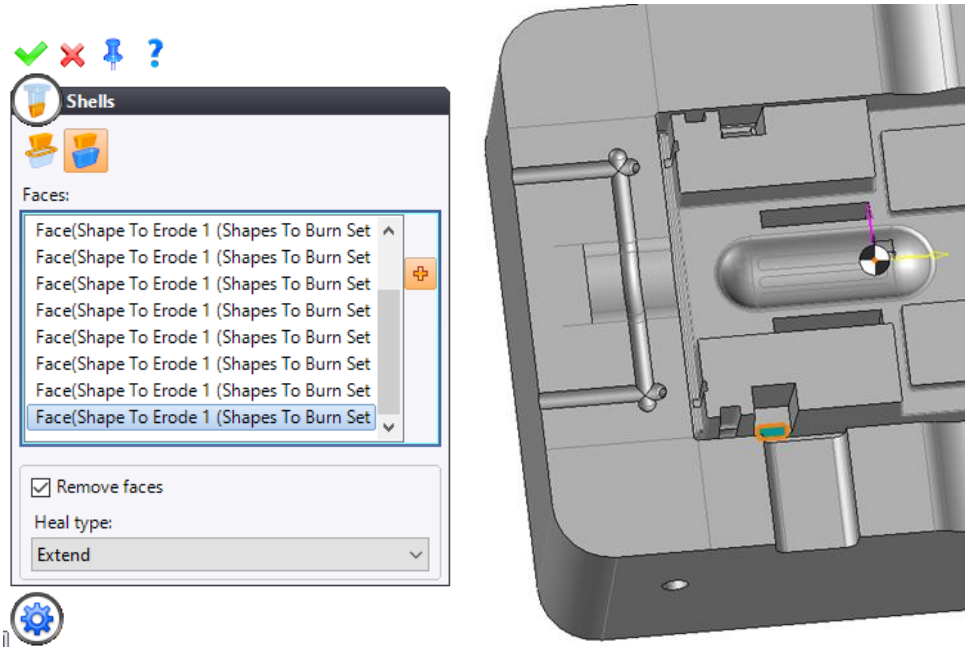
- **Confirm** the in-place editing.

Creating an electrode with face removal

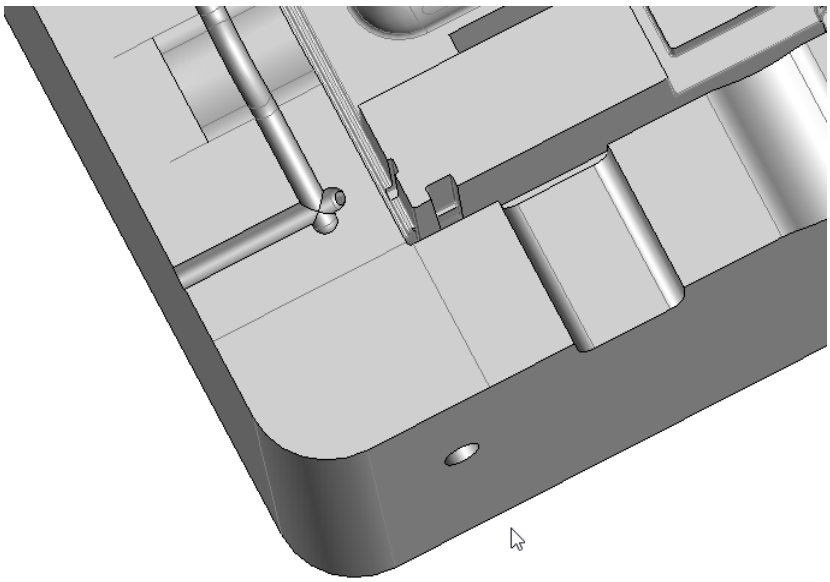
In the **Shells** dialog box, the **Remove faces** option allows you to remove the faces on the shape to be eroded selected to create the shell. Several types of healing are available and are identical to those of the **Delete** command.

In addition, the **Parts to erode** command allows you to create part(s) from the final state of the shapes to be eroded (i.e. possibly without drillings and cavities eroded by the electrodes).

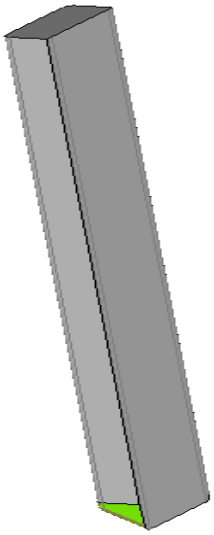
- Select the **Shells** command using the **Edges** mode and then select the following edges.
- Check the **Remove faces** box and select **Extend** as the **heal type** as shown below.



- Create a second shell by removing the faces to obtain the result as shown below.

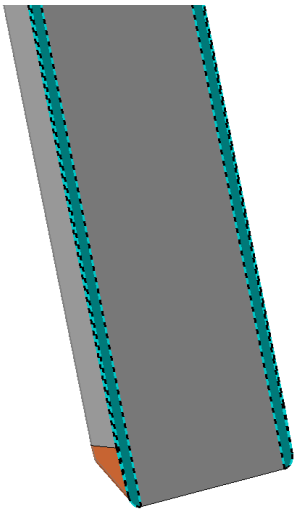


- Create the eroding shape using the first shell.

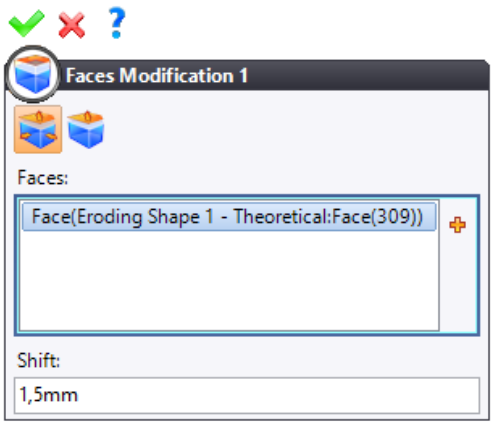


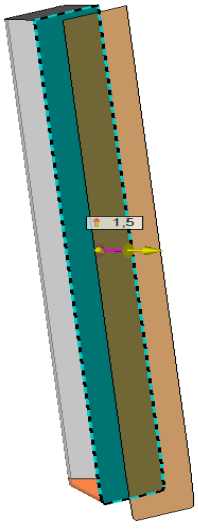
Shell no.1 **Eroding shape no.1**

- Using the  **Removing** command, delete the superfluous faces and select **Extend** as the **heal type**.

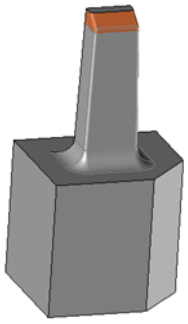


-  **Extend** the face using the  **Faces Modification** command.

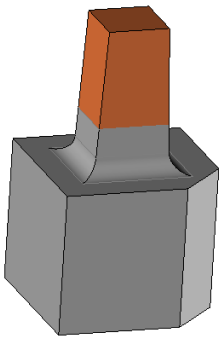




- Limit the bottom of the electrode in relation to the face of the part and select the **Electrode** command to obtain the result as shown below.

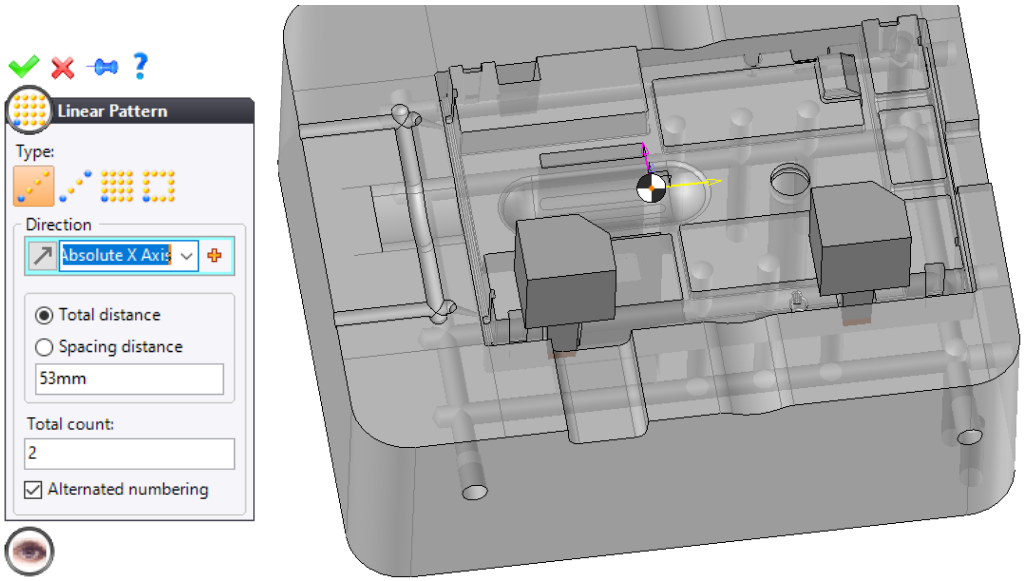


- Repeat the same procedure for the second shell to obtain the result as shown below.



On the part, you can plunge the first electrode in several places.

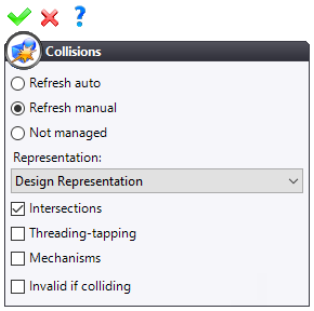
- Repeat the first electrode using a **linear pattern** with a value of *53mm*.



Collision check

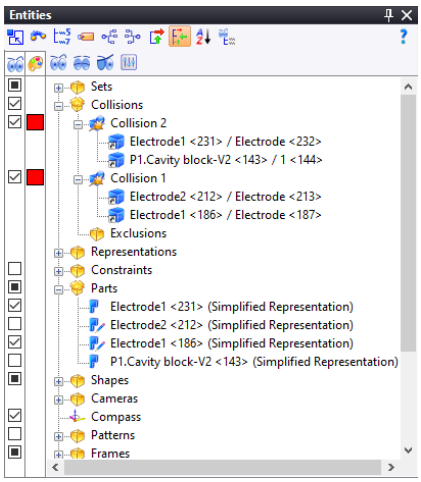
To check the position of the repetitions, we will use the **Collisions** command.

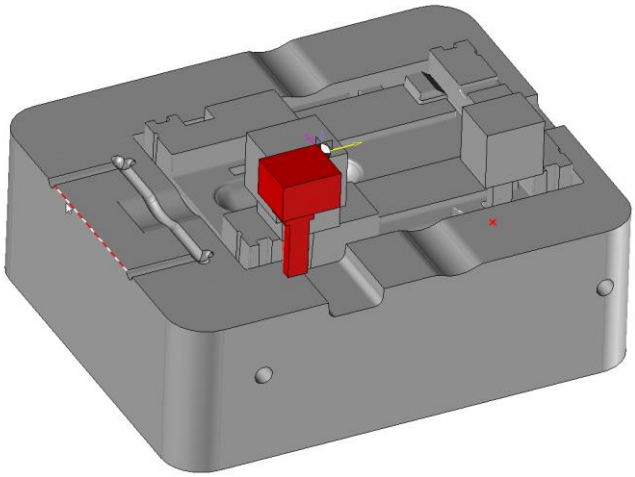
- Select the **Collisions** command and adjust the following settings.



We automatically switch to **Analysis** mode and a **Collisions** folder is created in the Entities tree.
Since we have chosen to update the collision check manually, we have to restart the calculation using the icon to update it.

Collisions are detected.





Collisions between electrode bases are normal. To prevent them from reappearing as collisions, you can exclude them.
There is still a collision between the repetition of the first electrode and the part.

- Check the distance between the two areas to be burnt.
- Modify the pattern of the repetition.
- Relaunch the collision check.

Note: When the electrodes are repeated, the burnt areas are not deleted.

- Delete the burnt areas using the **Removing** command.

Creating the part to be eroded

We are going to create a part without the areas to be eroded which can be based on to perform the machining operations. There are therefore no filled-hole surfaces to be created for the tool paths.

- Create a folder named *Part to be eroded* in the Project tree.
- Select the **Parts to erode** command.
- Click on to **confirm** the operation.
- Select the destination folder.

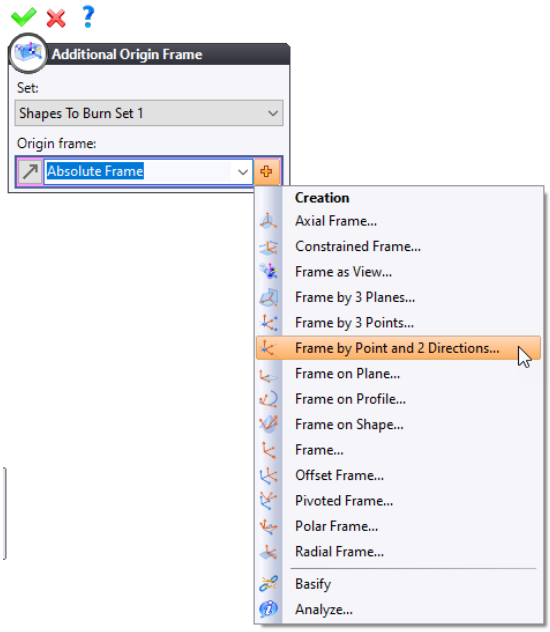
Exercise 11: Multi-directional Electrode

In this chapter, we will make injection electrodes.

Creating an additional origin frame

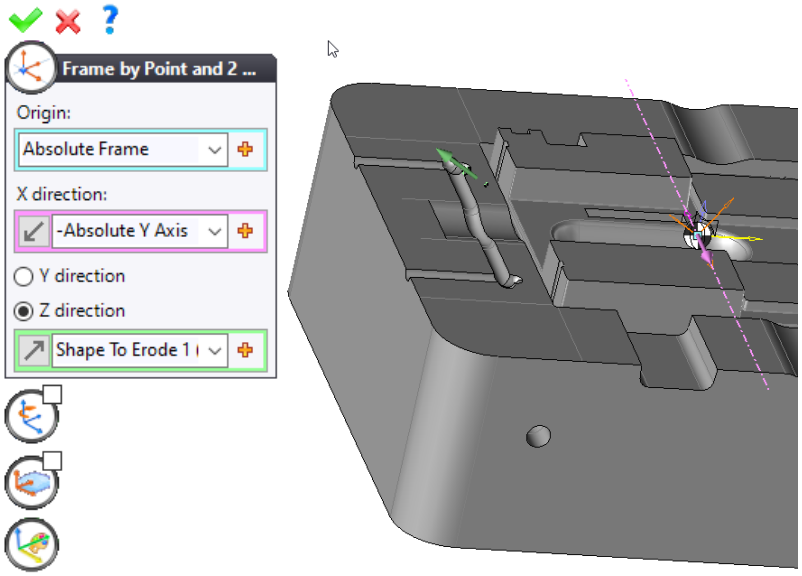
The **Additional Origin Frame** command allows you to assign several origin frames to the shape to be eroded and to have different orientations. When the electrode is created, you can select the newly created frame as the **origin**.

- In the **Electrode** tab, select the **Additional Origin Frame** command.
- Adjust the settings as shown below.



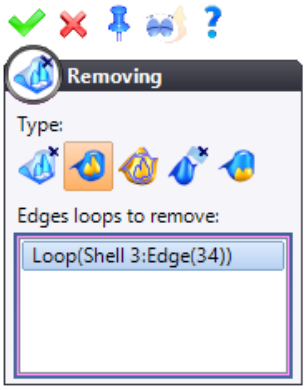
To create the **frame by point and 2 directions** constrain, you simply have to orient it along the injection point.

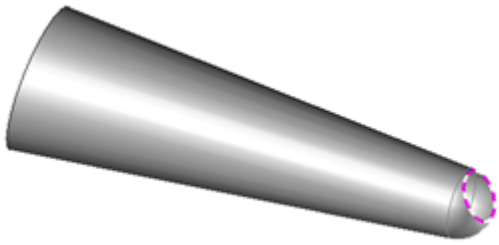
- Select the injection cone as the **Z direction** to orient the frame along the injection axis.



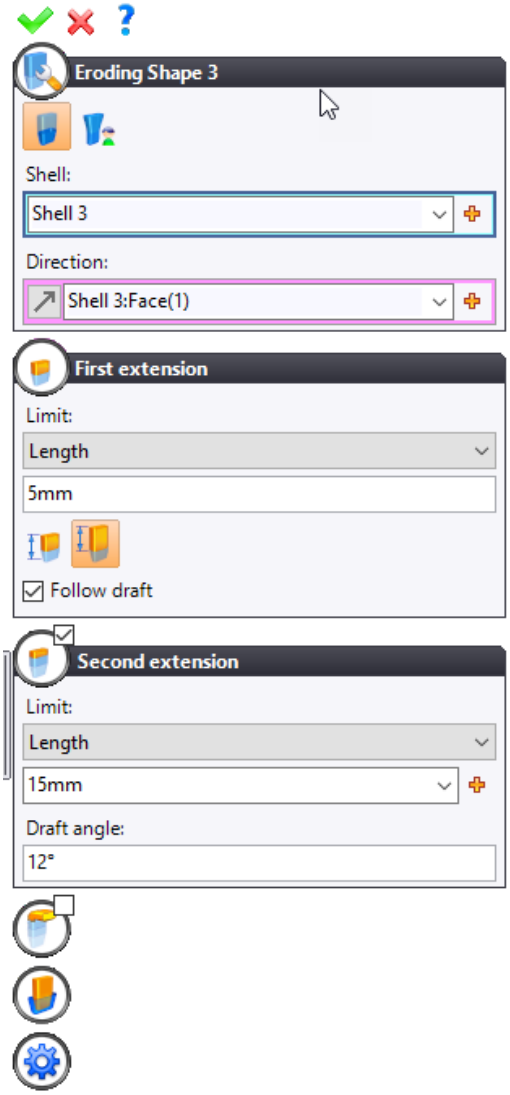
Creating the electrode

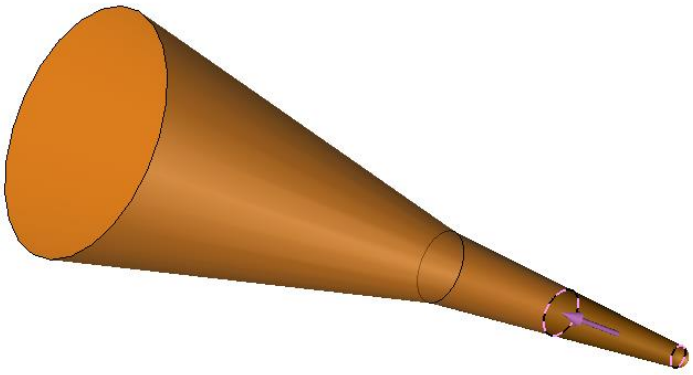
- Create the shell corresponding to the two injection points.
- Fill the hole of the shell using the **Removing** command.



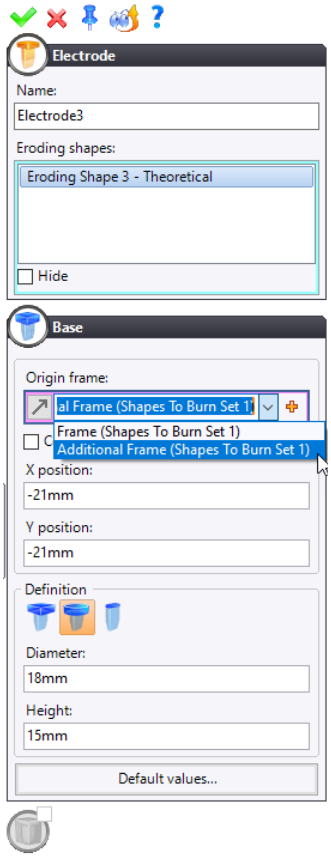


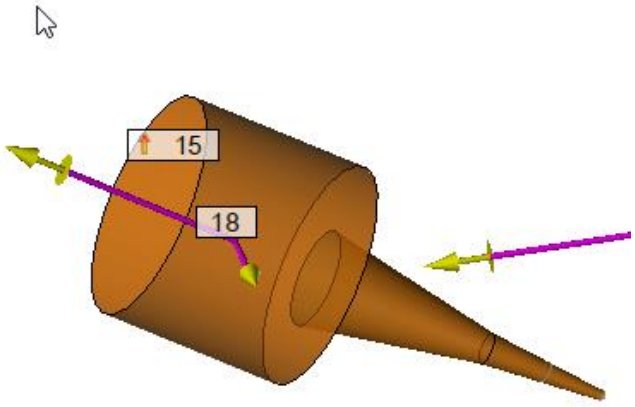
- Create an **eroding shape** by selecting the injection cone as the **direction**.





- Create an **electrode** with the **additional origin frame** previously created as **direction**.

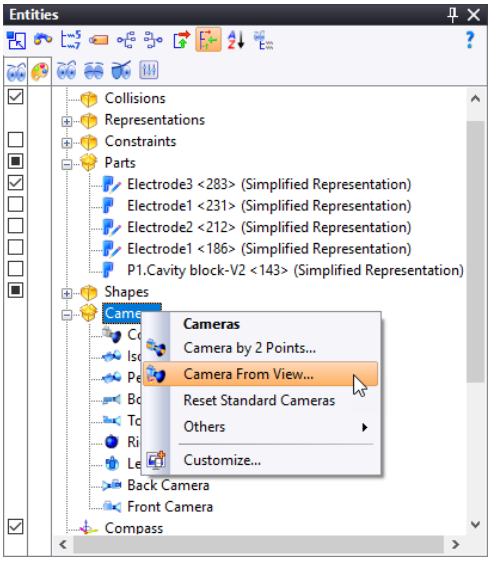




Drafting the injection electrode

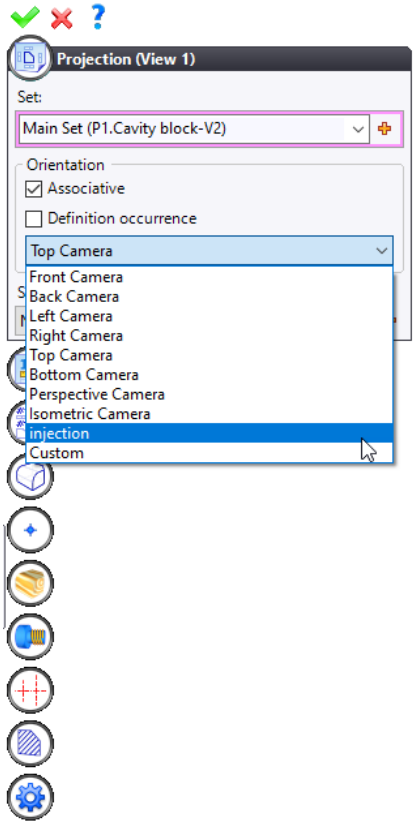
To be able to orientate the drawing with the electrode along the Z axis of the erosion machine, we need to create a camera.

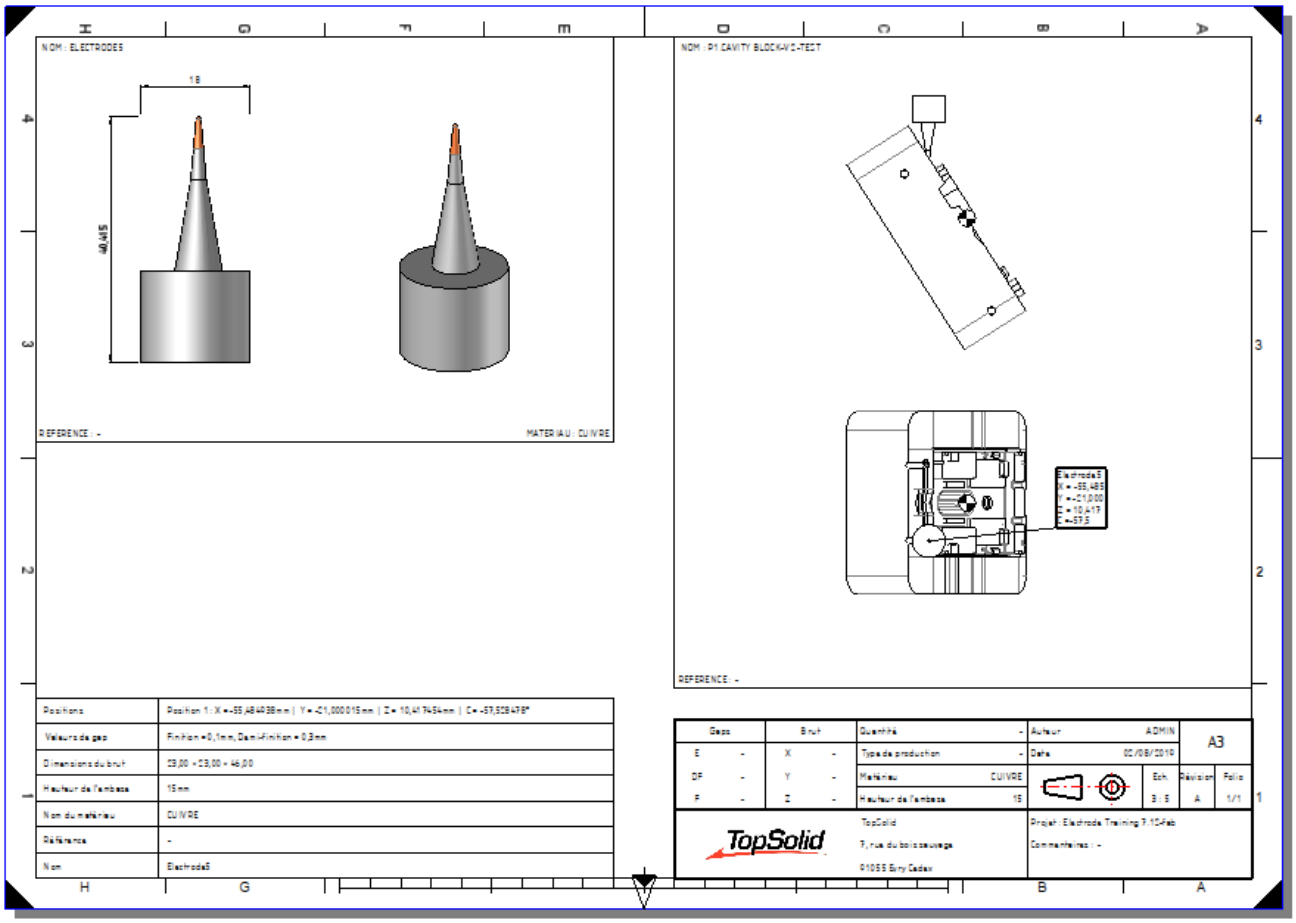
- To orientate the view, select the back face of the electrode base and create a normal view to this face.
- From the Entities tree, right-click on the **Cameras** folder and select the **Camera From View** command in order to create a new camera.



- Name the camera *Injection*.

- In the **Orientation** section, select the **injection** camera for the main view of the injection drafting.





Note: An exercise on the plunge injection electrode along a vector is available in the annex.

Exercise 12: Creating an Electrode Part Template

Introduction

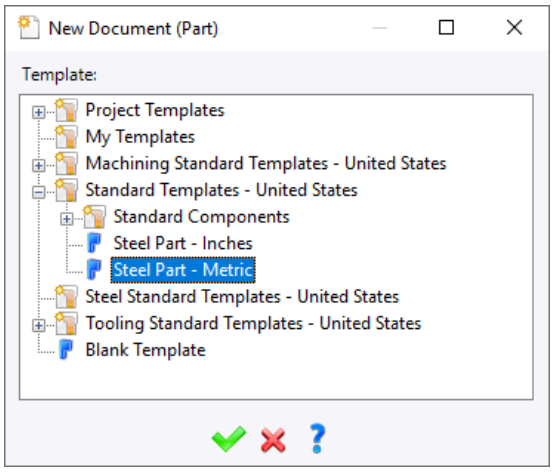
When an electrode is generated, the template selected to create the part document is blank.

Accordingly, the part has no material and the physical properties are not calculated, which forces you to apply the material and ask for the properties to be calculated manually on each electrode.

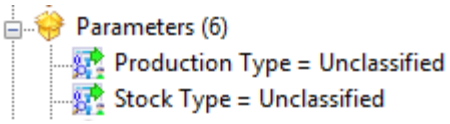
To avoid this, you need to create a specific part template for the electrode.

Creating the template with calculated stock dimensions

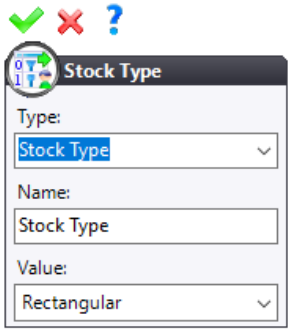
- Click on the **TopSolid 7** icon and select the **File** > **Document Templates** > **Open My Templates** command.
- Create an **Electrode** folder.
- Create a part document using the **Steel Part - Metric** template.



- Rename the part document *Electrode Template*.
- From the Entities tree, open the **Parameters** folder and double-click on the **Stock Type** parameter.

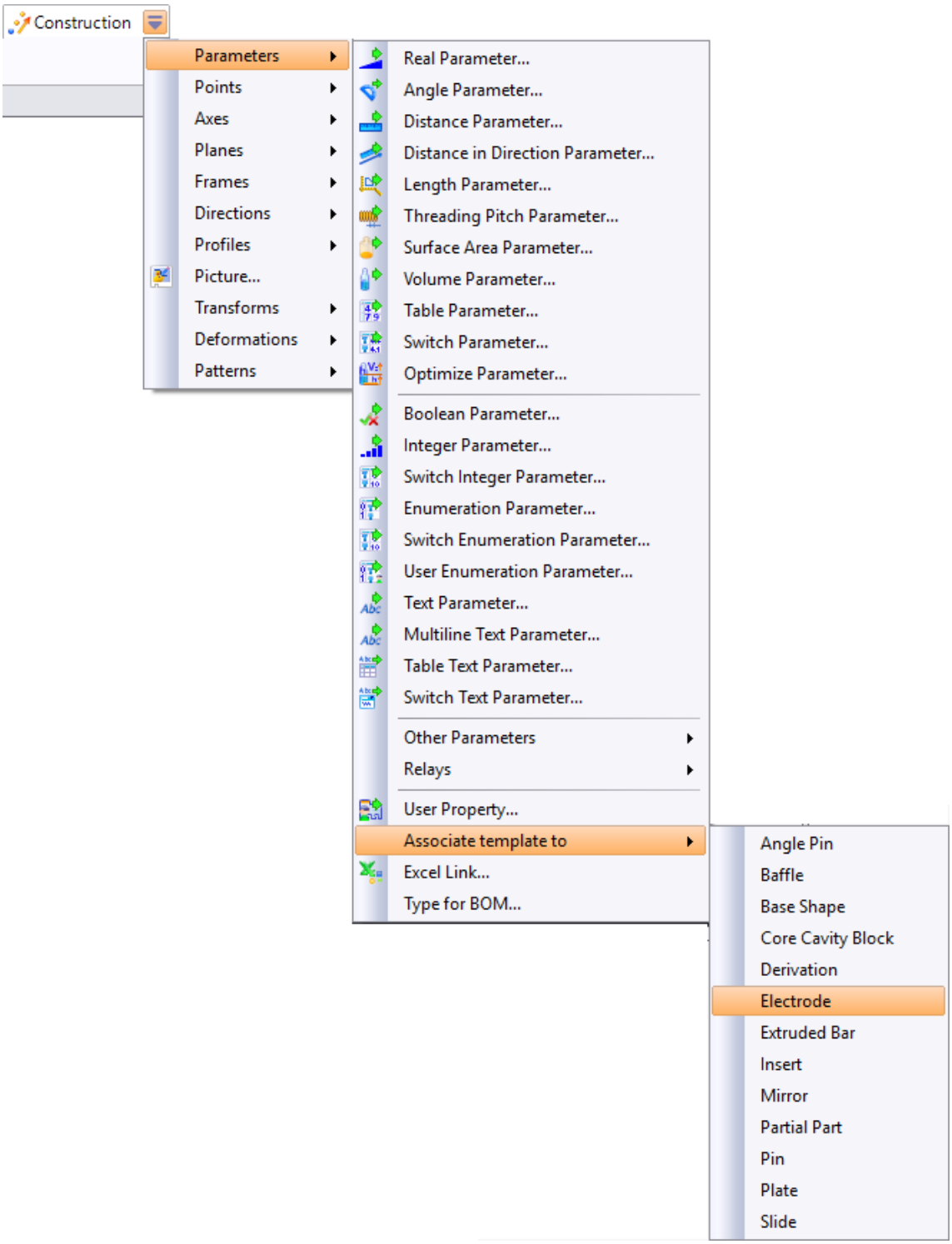


- Select **Rectangular** from the drop-down list.

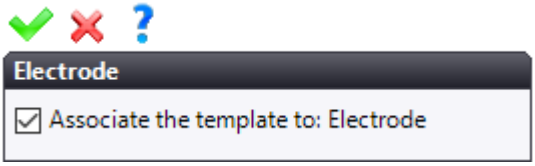


- Click on to **confirm** the operation.
- From the Entities tree, open the **Parameters** > **Stock Calculation** > **Rectangular** folders, double-click on the **BoxXSizeMargin**, **BoxYSizeMargin** and **BoxZSizeMargin** parameters and enter margin values for the stock calculation.
- Click on to **confirm** the operation.

- From the **Construction** tab, select the **Parameters** > **Associate template to** > **Electrode** command.



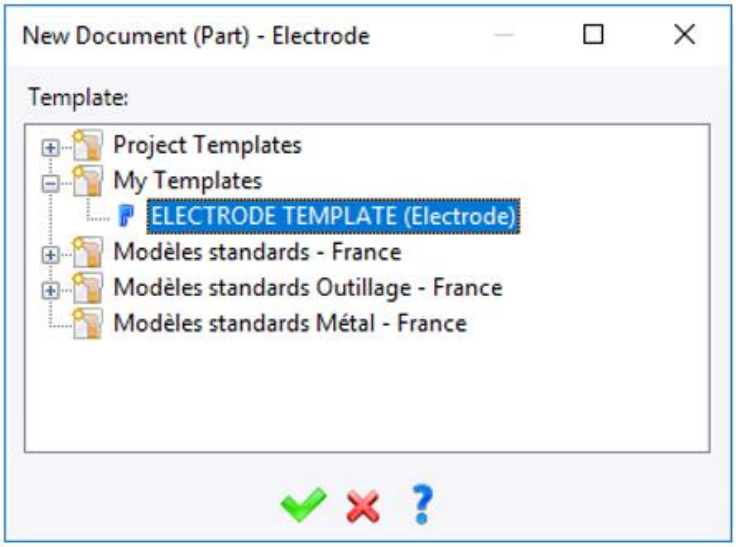
- Check the **Associate the template to: Electrode** box and click on to **confirm** the operation.



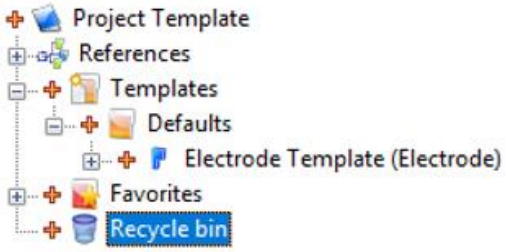
Material

- From the **Tools** tab, select the **Material and Coating** command, uncheck the **No material** box and select the **Copper** material.
- **Save** the document.

Note: When creating the electrode, **TopSolid** will offer to select a document template.



You can also store the electrode template in the **Templates** > **Defaults** folder of the project template. In this way, the template will be selected by default and **TopSolid** will not offer again.



Exercise 13: Creating Customized Properties

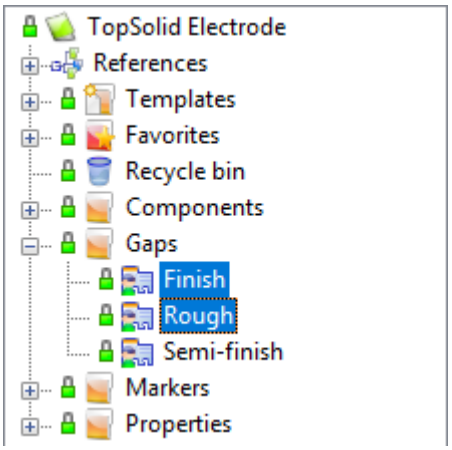
Introduction

The gap properties or electrode properties are documents that come from the **TopSolid Electrode** library by default.

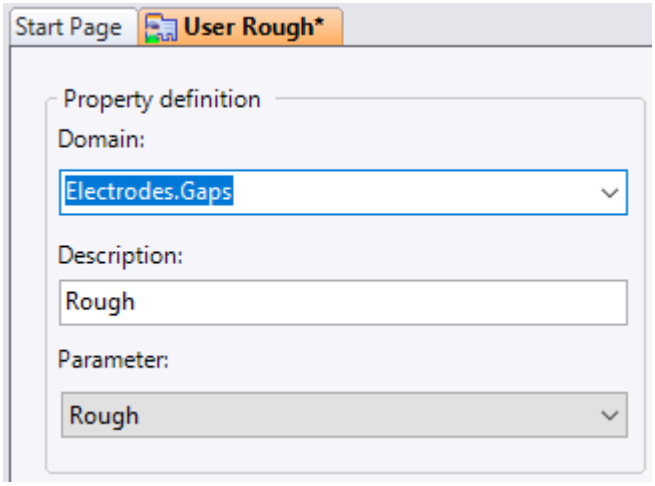
Other properties can be created in a user library. The simplest way to do this is to copy a property from the **TopSolid** library, paste it into your own library, and then make the necessary changes.

Copying the gap properties

- Open the **TopSolid Electrode** library.
- From the **Gaps** folder, **copy** the **Rough** and **Finish** properties.



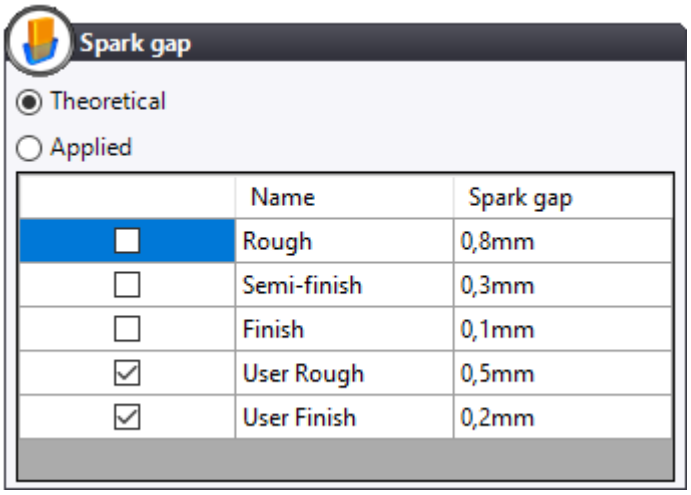
- Click on the **TopSolid 7** icon and select the **File** > **New Library** command.
- Select **Blank Template** and rename the library *User Electrode*.
- Right-click on the library name and create a new **folder** named *Gaps*.
- Right-click on the folder and **paste** the previously copied properties.
- Rename the new properties *User Rough* and *User Finish*.
- Open the *User Rough* document.



Note: Do not modify the domain name since this field is used as a link to an electrode's gap.

- From the Entities tree, open the **Parameters** folder, double-click on the **Rough** parameter and adjust the value to *0.6mm*.
- Click on to **confirm** the operation.
- **Save** the document.
- Repeat the procedure with the *User Finish* document by adjusting the value of the **Finish** parameter to *0.2mm*.

In this way, when creating the next electrode, the customized gap properties will be available, provided that the library in which they are contained is referenced.



Creating an electrode property

To create a new finishing mode, e.g. CH 21, you simply have to follow the procedure below.

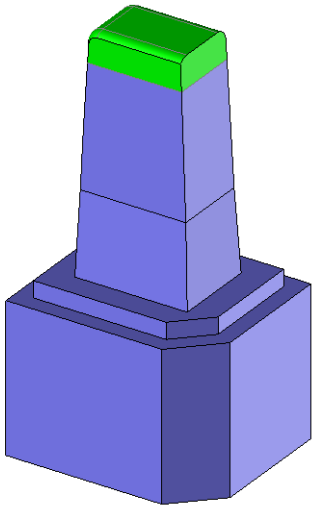
- Copy the **Properties** folder from the **TopSolid Electrode** library and paste it into your *User Electrode*.
- Open the **Properties** folder and then open the **Type of finishing mode** enumeration document.
- Add line **CH 21**.
- **Save** and **close** the document.

Note: It is recommended to reference the **TopSolid Electrode** library to avoid duplicates in the dialog boxes.

Annex 1: Customized Marker Component

Introduction

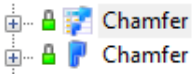
This exercise will show you how to create a marker model that calibrates the base, in addition to the chamfer.



The existing models are stored in the **TopSolid Electrode** library. The simplest thing is to copy one of the models, paste it into a user library, rename it, and then make the changes.

Copying the model

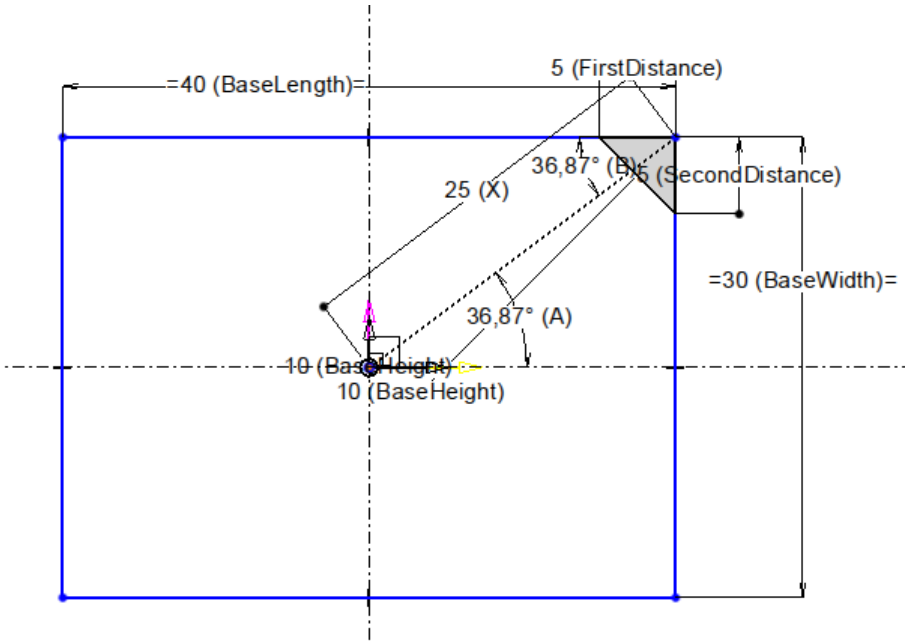
- Open the **TopSolid Electrode** library.
- From the **Markers** folder, select the **Chamfer** family document and generic document.



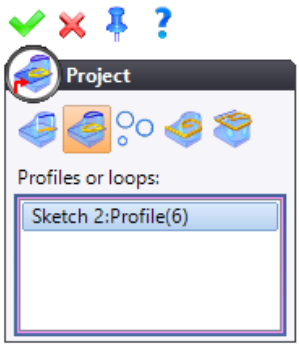
- **Copy** the two documents.
- Open the **User Electrode** library (created in a previous exercise).
- Create a new **folder** and rename it *Markers*.
- **Paste** the previously copied documents into the new folder.
- Rename the documents *Chamfer + Calibration*.

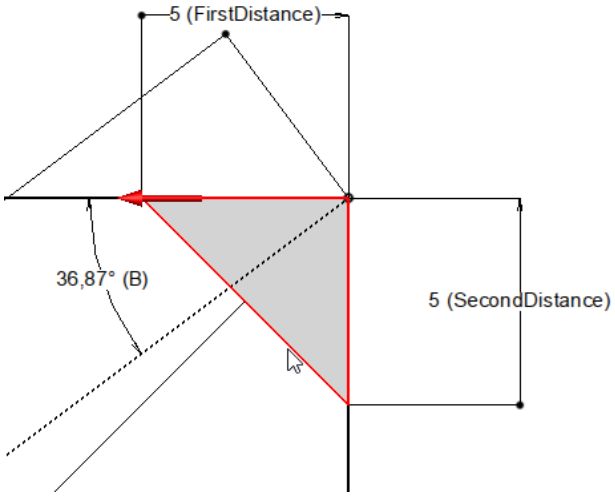
Modification

- Open the part document *Chamfer*.
- Right-click on the chamfer sketch and create a new **sketch**.
- Create a **rectangle** using the **BaseLength** and **BaseWidth** parameters as shown below.



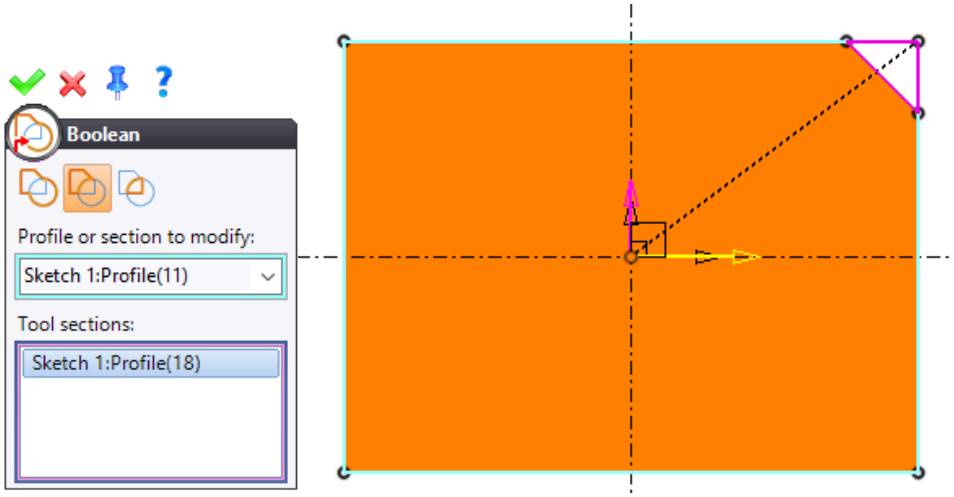
- From the **2D Sketch** tab's drop-down menu, select the **Operations** > **Project** command in **Profiles or loops** mode and project the chamfer shape.



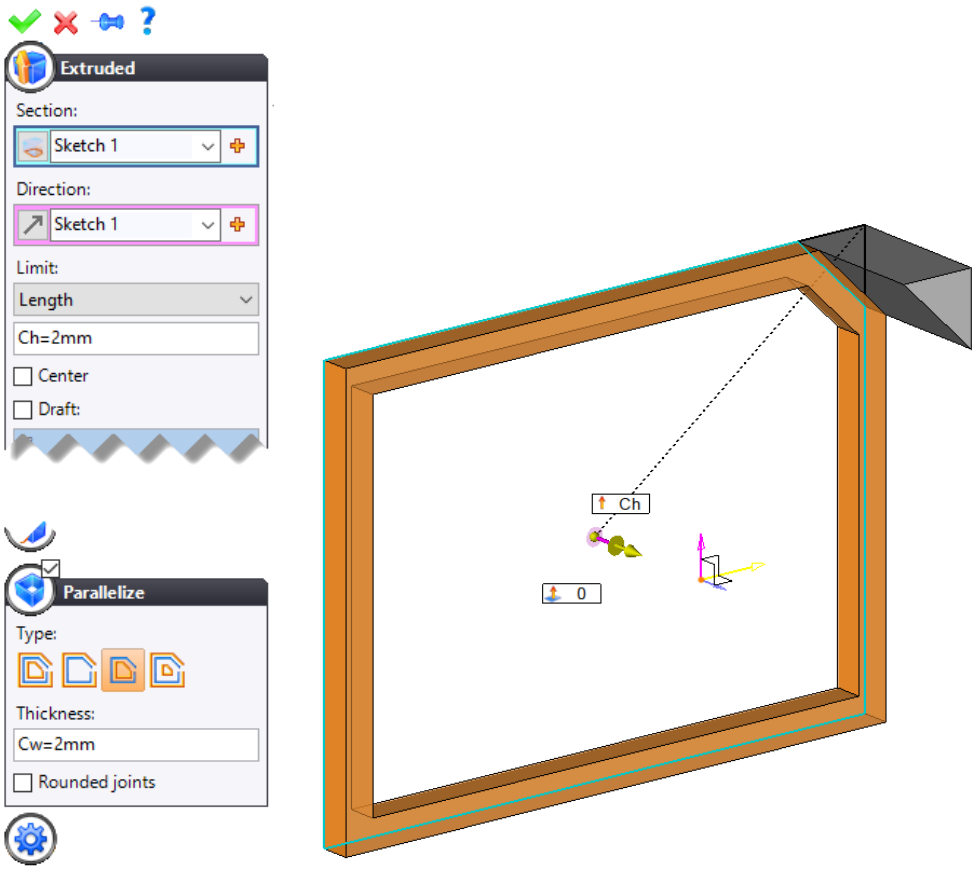


- Click on to **confirm** the operation.

- From the **2D Sketch** tab's drop-down menu, select the **Operations** > **Boolean** command in **Subtraction** mode and create a Boolean operation based on the two previously created profiles by selecting the rectangle as the profile to be modified and the triangle as the **tool section**.

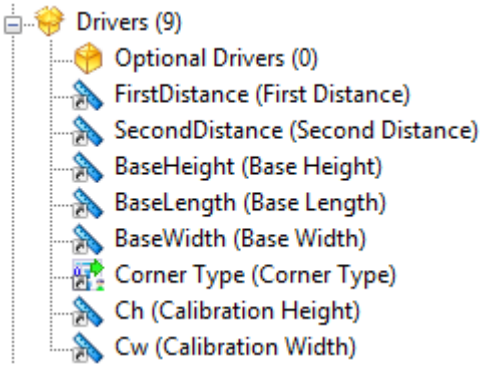


- Click on to **confirm** the operation.
- **Extrude** the contour by checking the **Parallelize** box and creating two **Ch** and **Cw** parameters on the fly for the calibration height and width.



- Click on to **confirm** the operation.
- **Unite** the new shape with the chamfer shape. Make sure you select the chamfer shape as the **shape to modify**.
- **Save** the document.

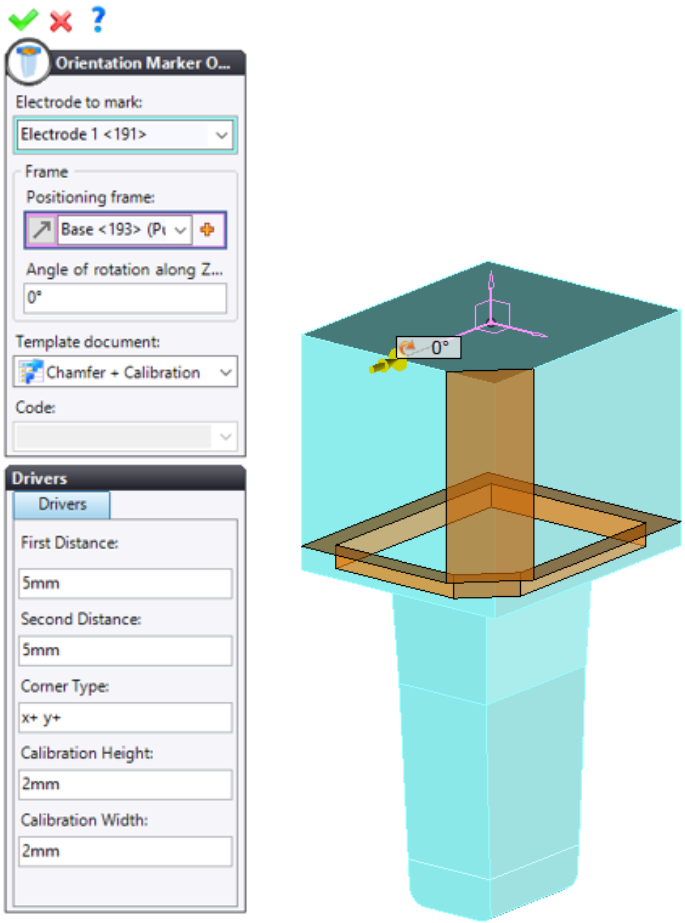
- Open the family document.
- From the Entities tree, open the **Generics** folder and drag the **Ch** and **Cw** parameters to the **Drivers** folder.
- Modify the descriptions as shown below.



- **Save** the document.
- **Check** the documents into the vault.

Testing the component

- Open the electrodes document named *Core Block*.
- **Edit** the orientation marker of the first electrode.
- Select the **Chamfer + Calibration** template and adjust the following settings.

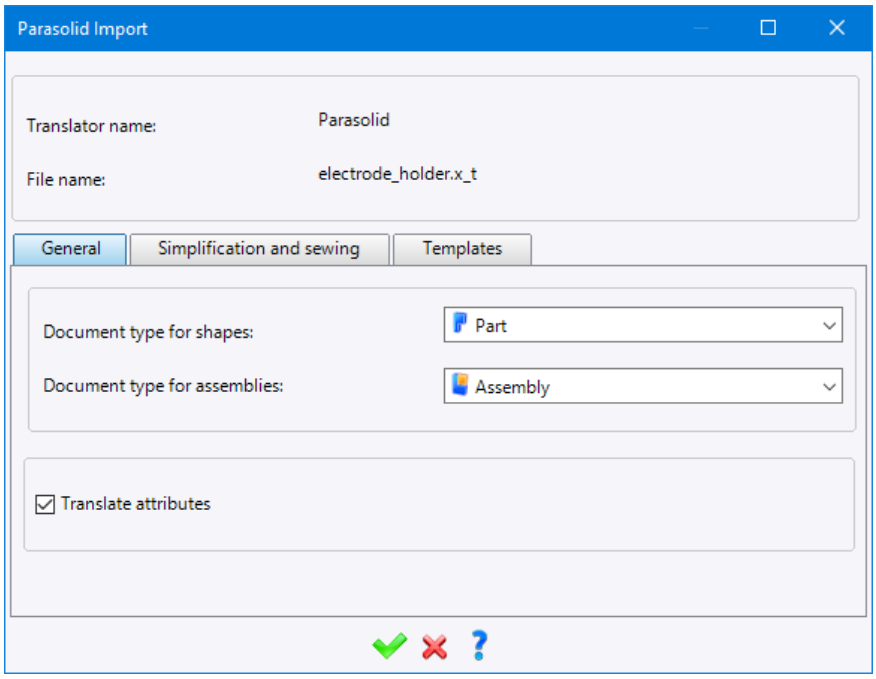


- Click on to **confirm** the operation.

Annex 2: Creating a Customized Mandrel

Parasolid import

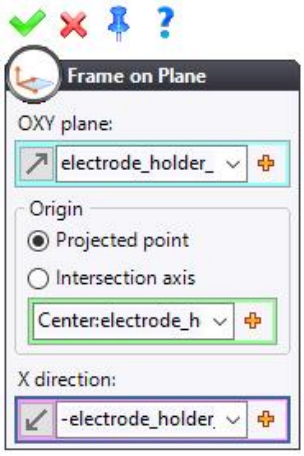
- From the *TopSolid'Electrode Training* Project tree, right-click on the file named *electrode_holder* and select the **Convert Document** command.

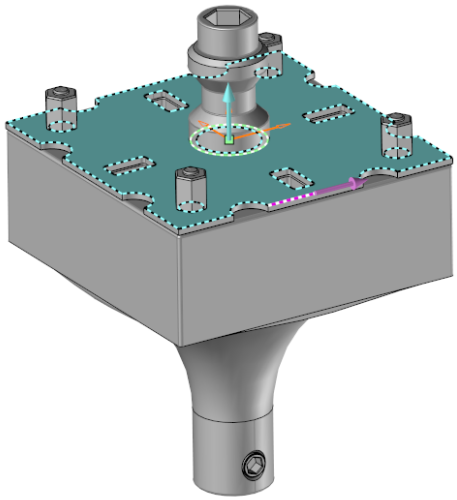


- Click on to **confirm** the operation.

Providing the Mandrel function

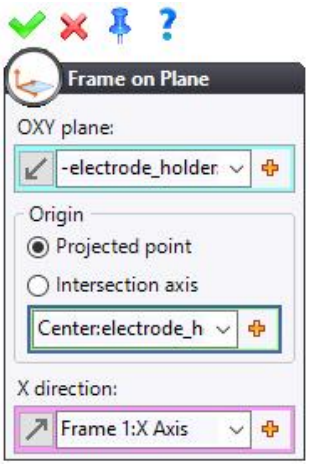
- From the **Tools** tab, select the **Functions** > **Provide Function** command.
- Select the **Mandrel** function.
- Click on to **confirm** the operation.
- For the mandrel frame, click on the icon and create the **frame on plane** constrain as shown below.

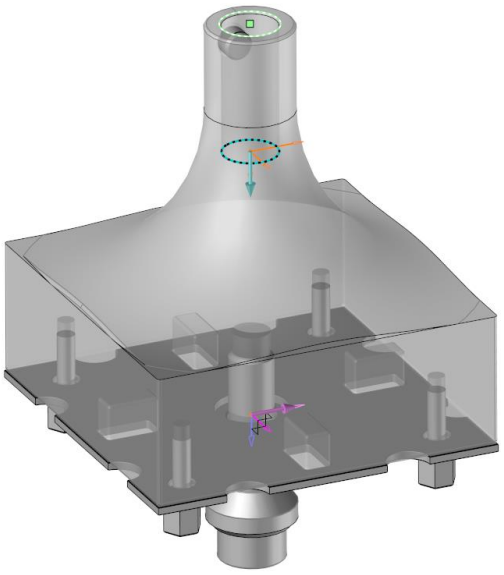




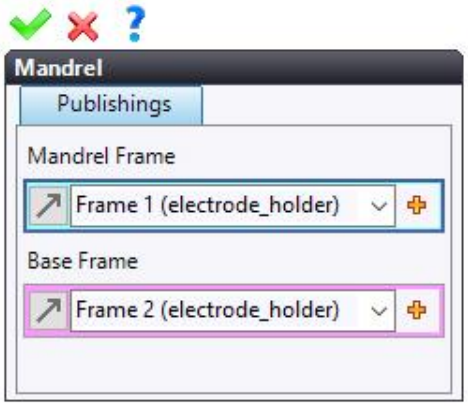
- Click on to **confirm** the operation.

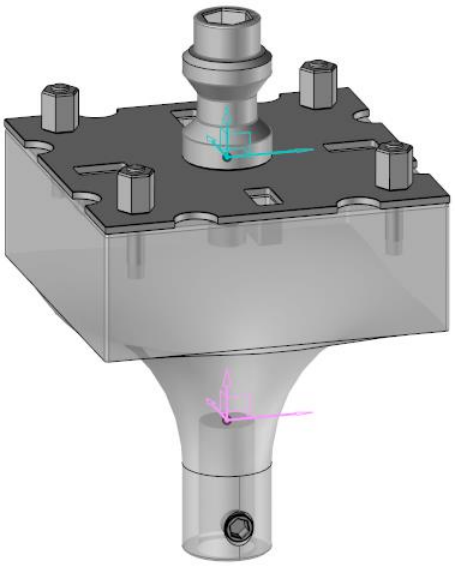
- For the base frame, click on the icon and create the **frame on plane** constrain as shown below.





You should obtain the following result.





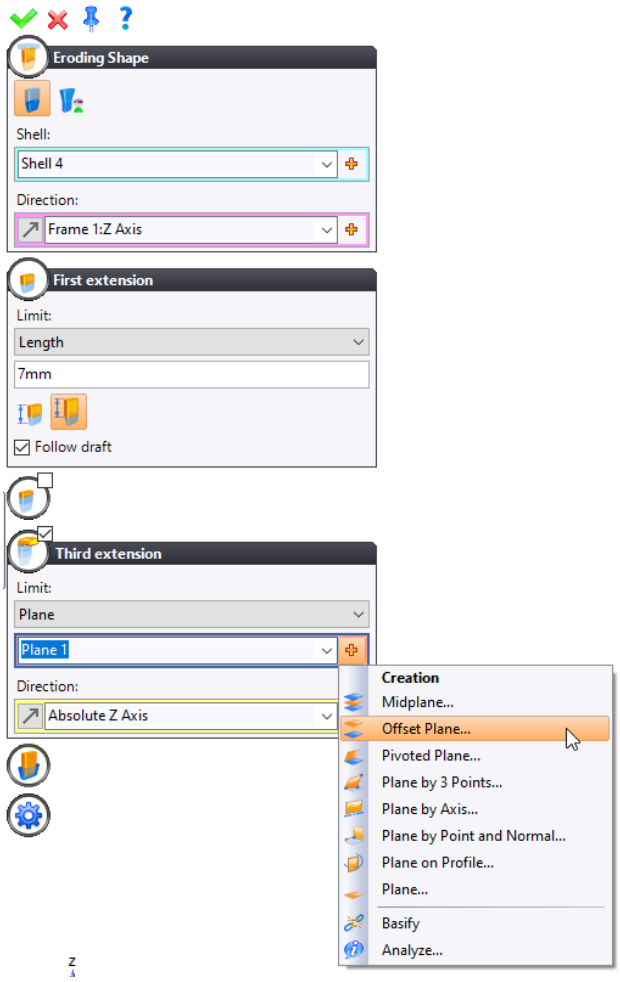
- Click on to **confirm** the operation.
- **Save** the document.

Annex 3: Creating a vector plunge electrode

- Open the electrodes document named *P1.Cavity block*.

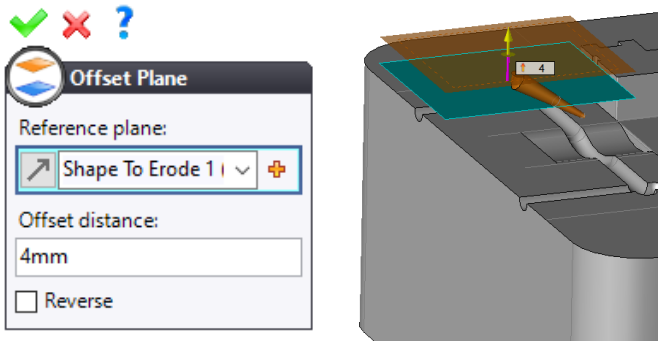
Creating the electrode

- Create the shell for the injection electrode.
- Create the eroding shape as shown below by making sure that the **Z axis** of **frame 1** is selected as the **direction**. Check the **Third extension** option and select a plane as the **limit**.

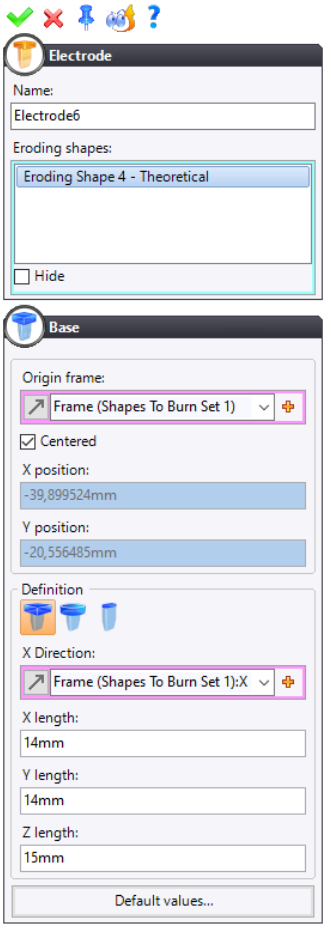


Note: To select the direction, you can click directly on the shell in the graphics area.

The third extension allows you to create the base along the Z axis of the block.



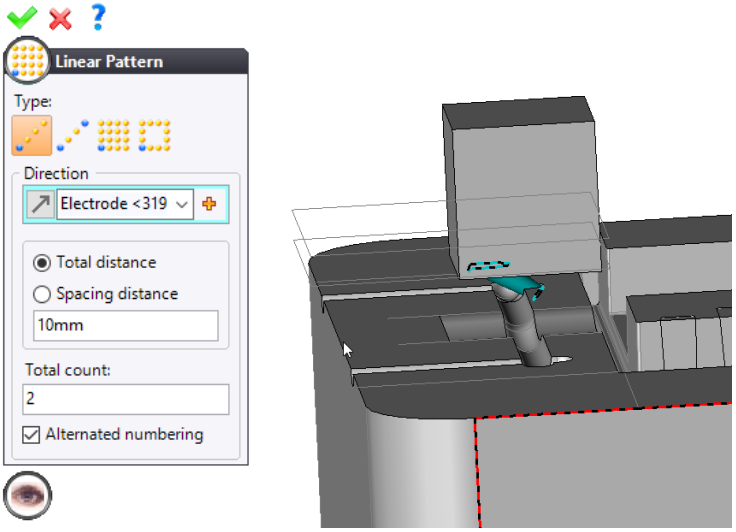
- Create the electrode as shown below.



Note: To create a connection radius, you simply have to **edit the part in-place**, **delete** the unnecessary faces and select the **Fillet** command.

Creating the start position

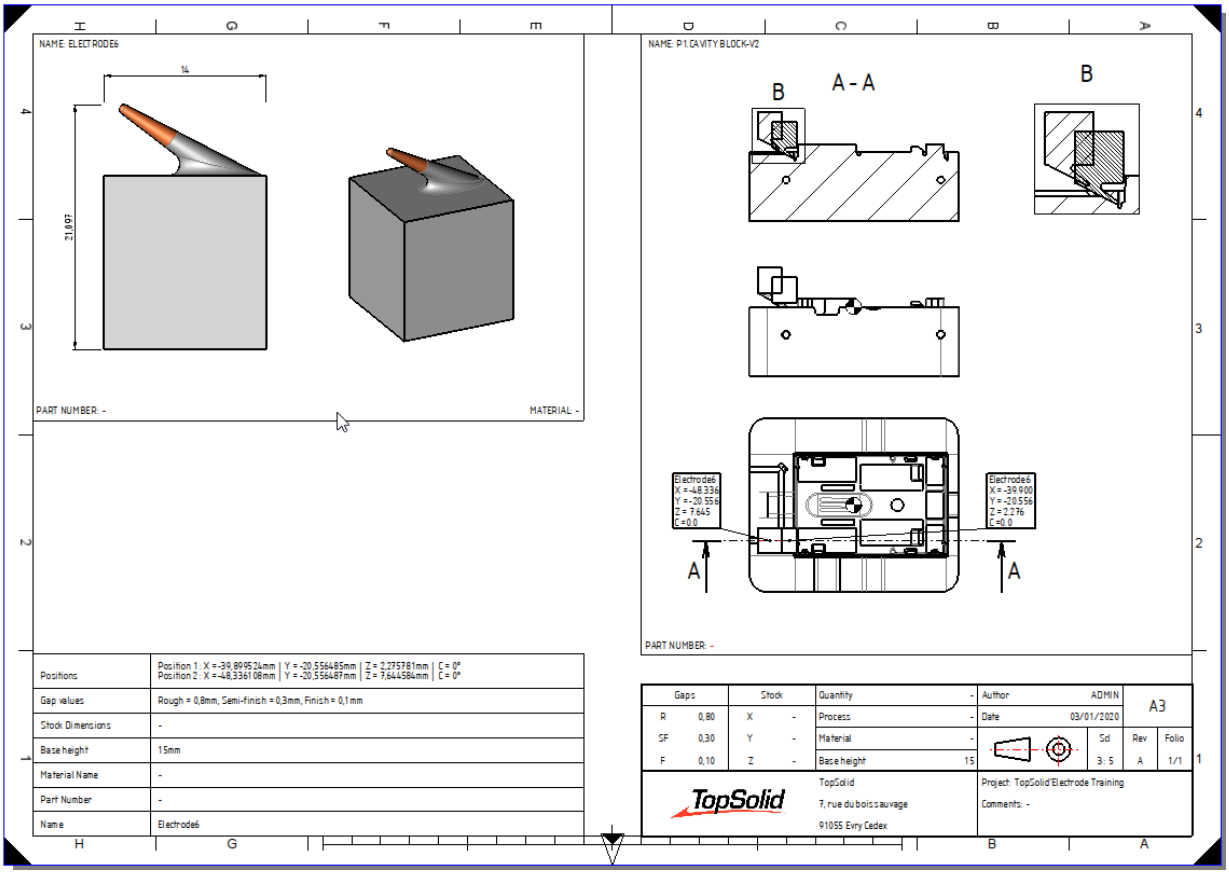
- Select the **Repetition** command and create a **linear pattern** by selecting the injection cone as the **direction**.



- Click on to **confirm** the pattern and the repetition.
- **Save** the document.

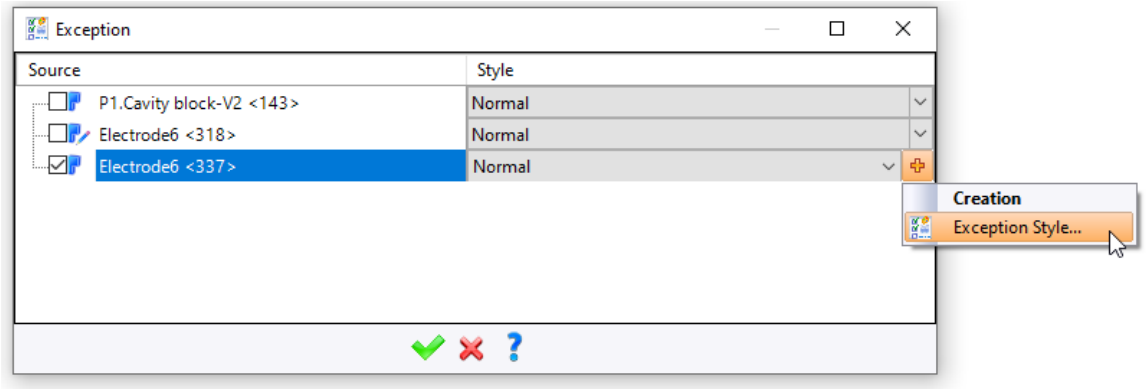
Creating the drafting document

- Select the **Electrodes Draft** command.

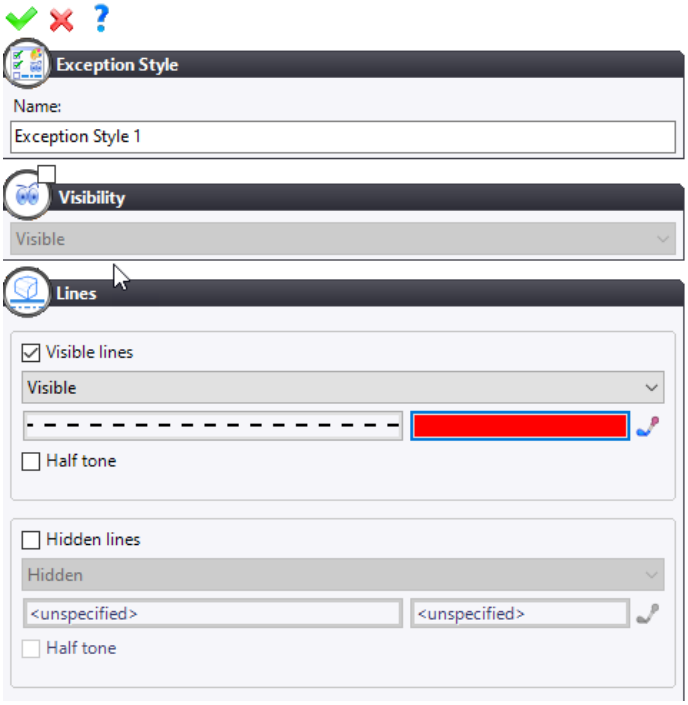


To avoid overloading the view, you can create exceptions on the views and apply them to certain parts. You can change the color of the lines, to make a part unbreakable, etc.

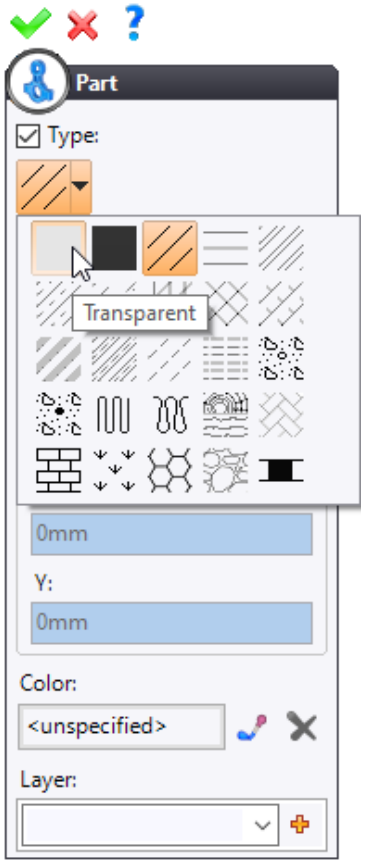
- Right-click on the sectional view and select the **Exception** command.
- Create a new style.



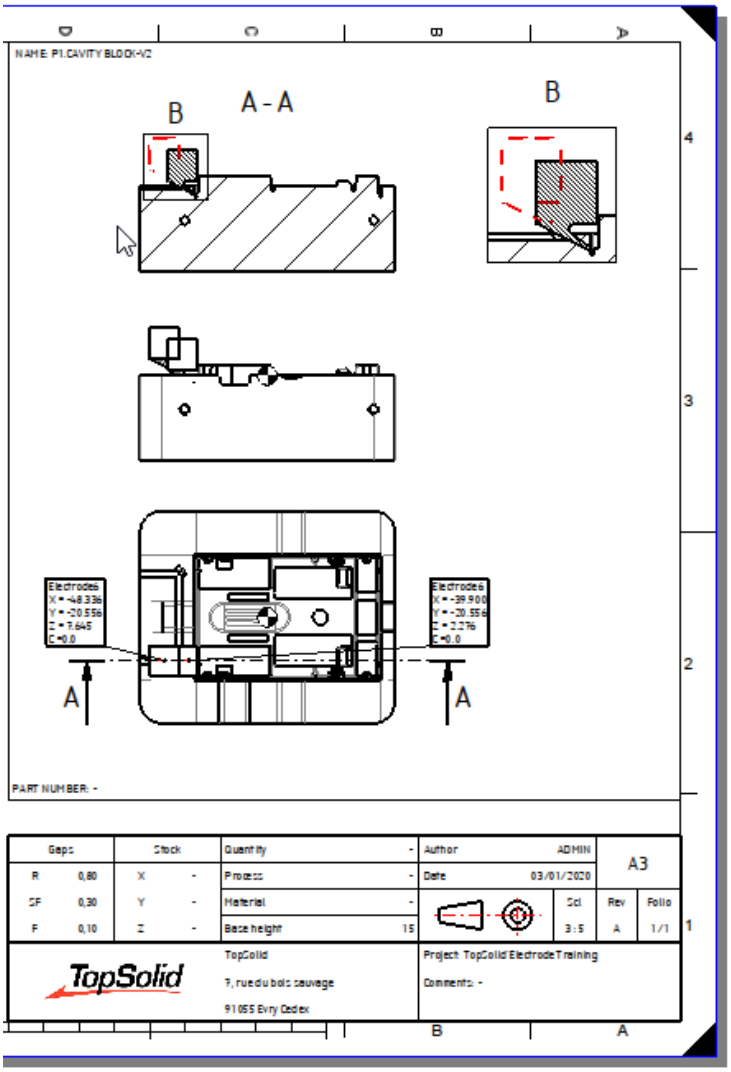
- Check the **Visible lines** box.
- Select the type of line and the color as shown below.



- Click on to **confirm** the operation.
- To remove the hatchings on the starting electrode, right-click on the starting electrode and **edit** the hatchings.
- For the **type**, select **Transparent** as shown below.



You should obtain the following result.

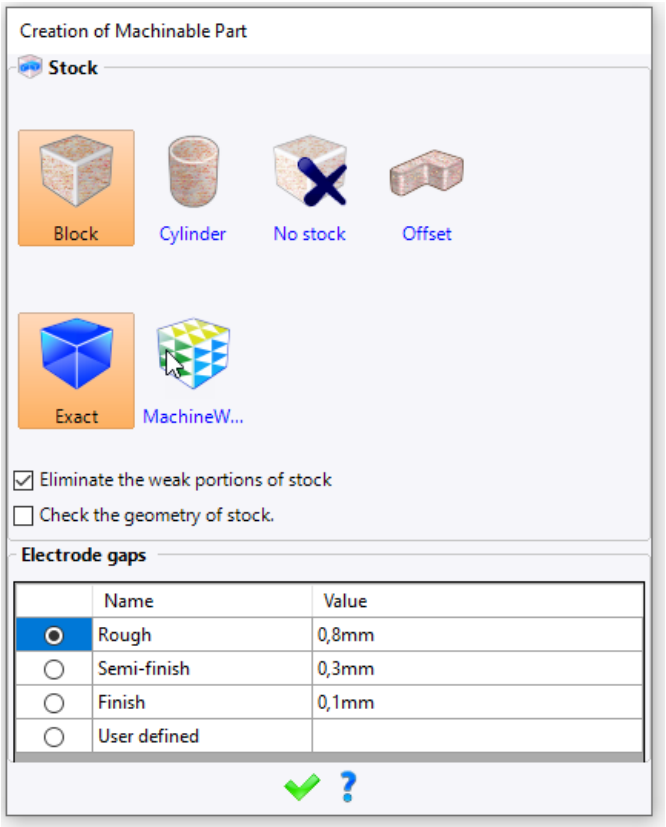


Annex 4: Machining an electrode

Machining an electrode

- Right-click on the electrodes document to be machined and select the **Machining** command.
- Select the desired machine model.
- Select the gap to be applied to the electrode.

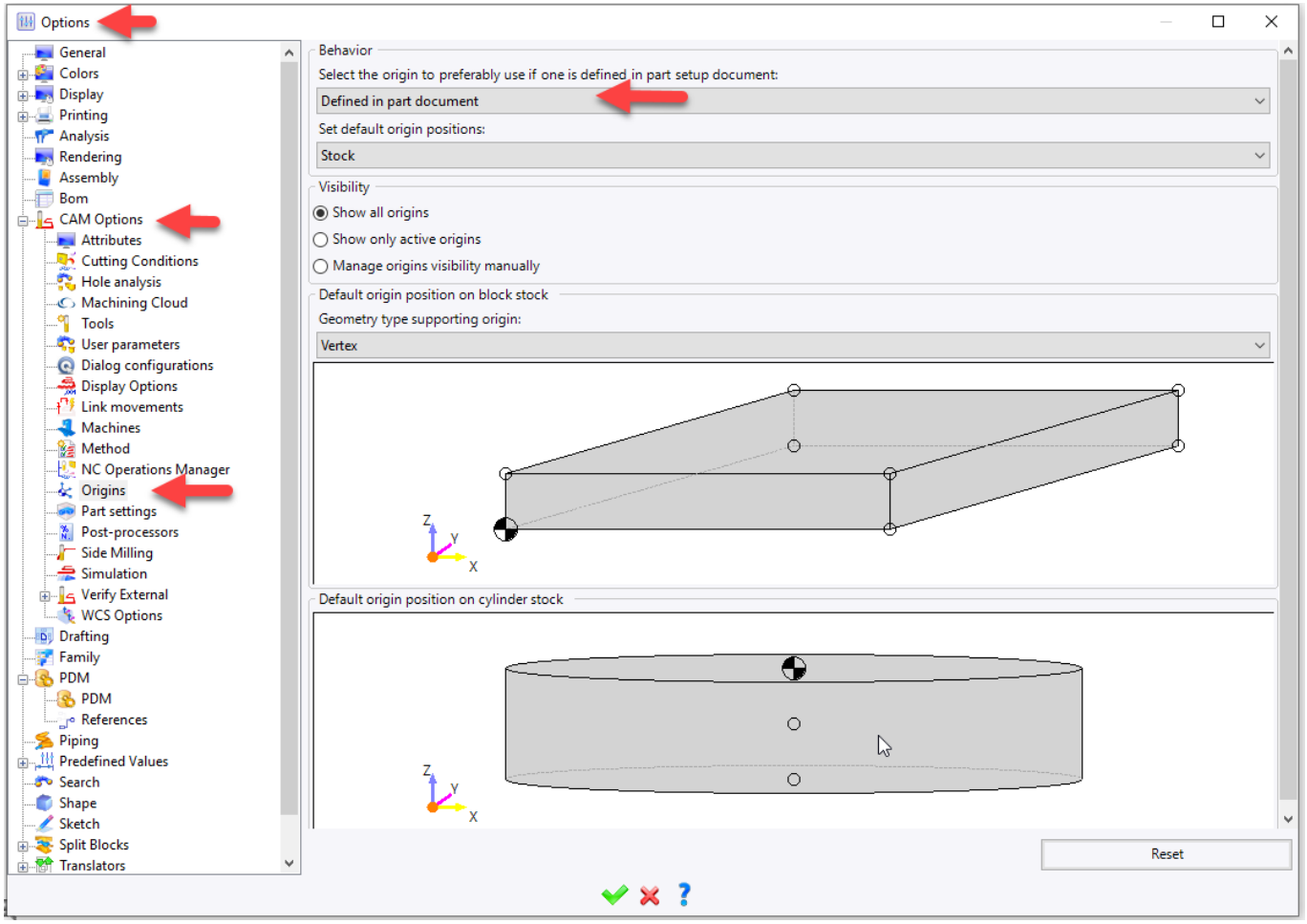
Note: These gaps correspond to the theoretical gaps that were selected when designing the electrode.



Note: The electrode gap is applied directly to the tool path.

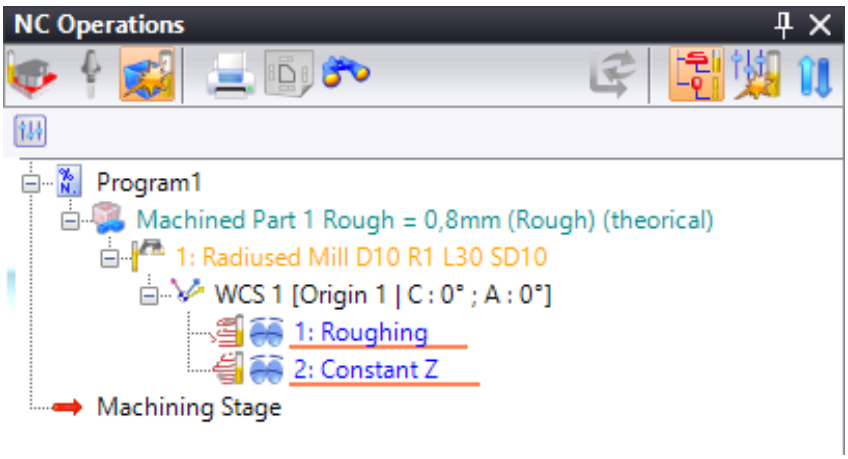
Machining and positioning origins

Note: If you want the **machining positioning frame** and the **machining frame** defined in the electrodes document to be taken into account, in the machining document, you simply have to adjust the options as shown below.



- Select a machining method to create the electrode or to machine the electrode in the traditional way.

Warning: When finishing, you must keep the value of the offset at 0. The gap is automatically applied. The gap appears in the NC Operations tree: **Rough=0.8 (Rough) (theoretical)**.

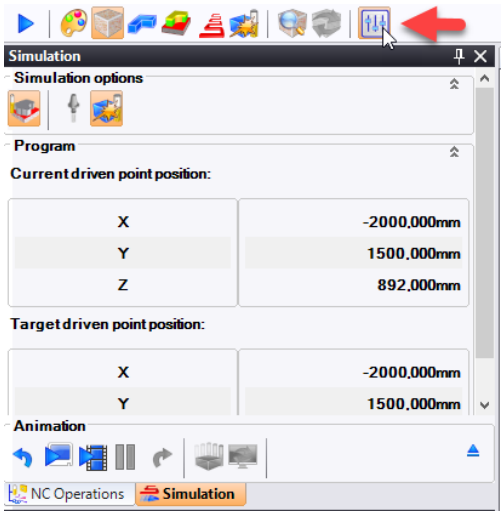


Machining verification

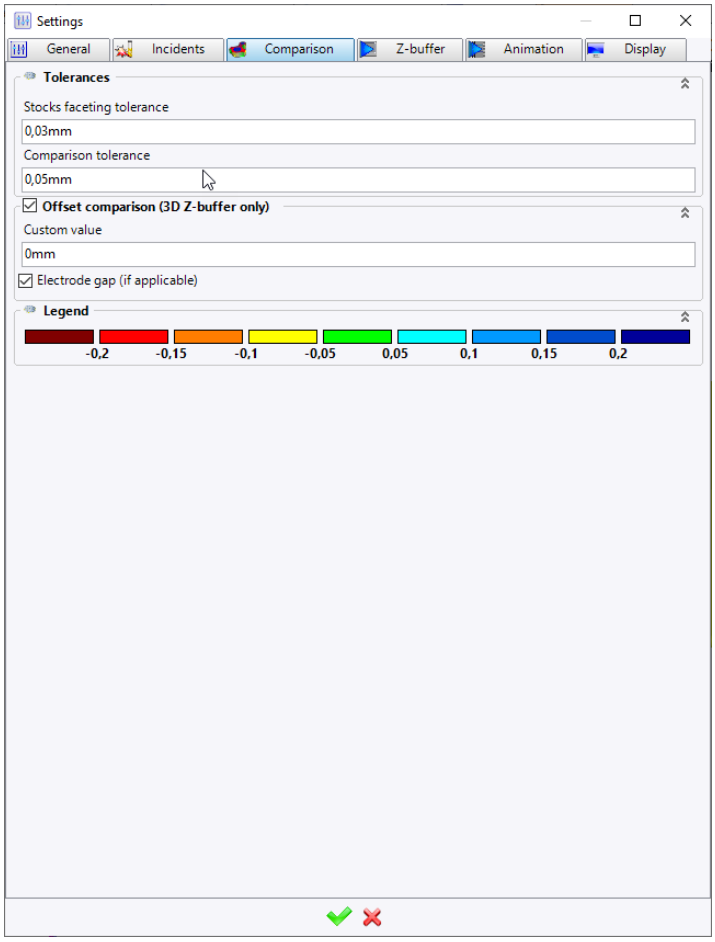
- Check the machining using the **Start in turbo mode** command.

Before launching the comparison command, we will configure this mode.

- From the Entities tree, select the **Settings** command.

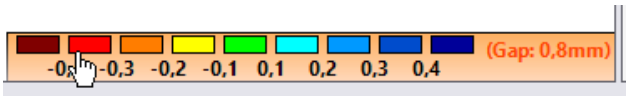


- Check the **Offset comparison (3D Z-buffer only)** box.
- Check the **Electrode gap (if applicable)** box.



- Select the **Display comparison** command.

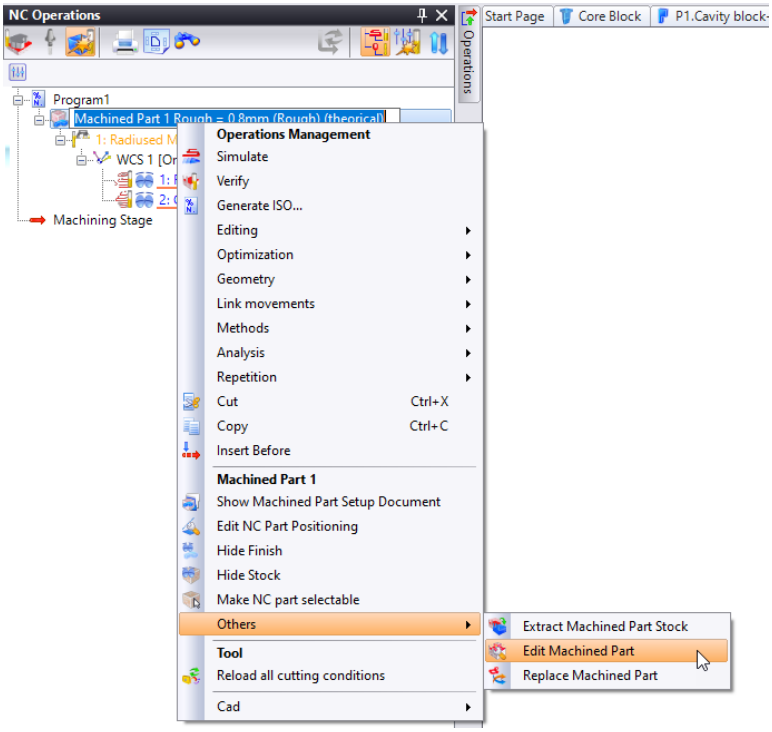
The part should appear in green if it is finished. The comparison takes into account the gap, as indicated in the color legends below.



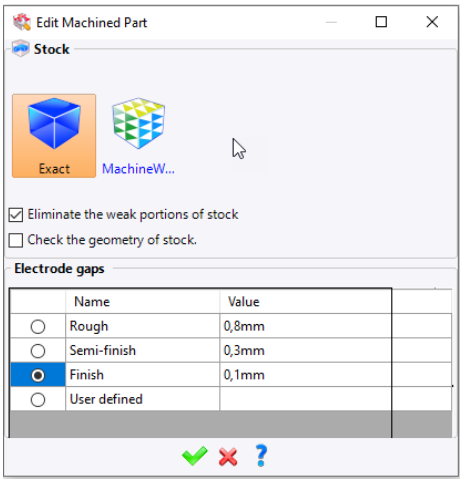
We performed a roughing electrode operation. To perform a finishing electrode, you simply have to follow the procedure below.

Machining the finishing electrode

- **Copy** and **paste** the rough electrode machining document and rename it *Finishing*.
- Open the electrode finishing document.
- From the NC Operations tree, right-click on **Machined Part 1** and select the **Others** > **Edit Machined Part** command.



- Select the finishing gap.

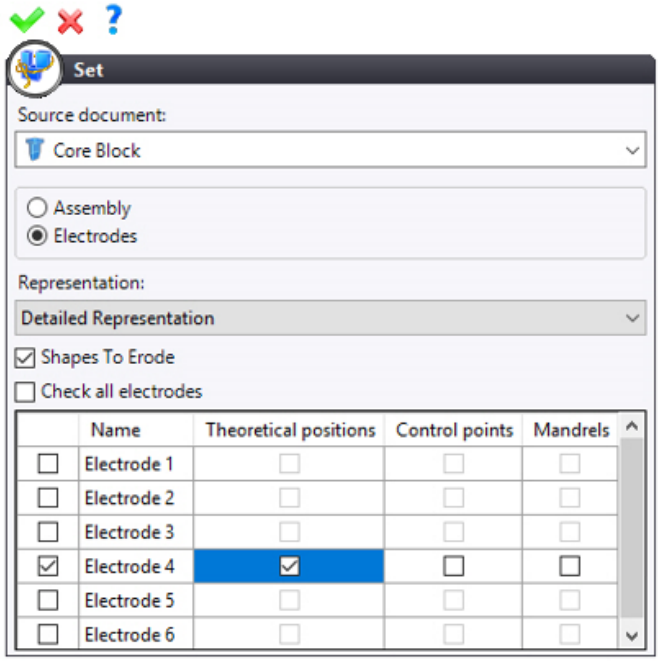


- Restart the machining sequence using the **Refresh** command.
- **Save** the document.

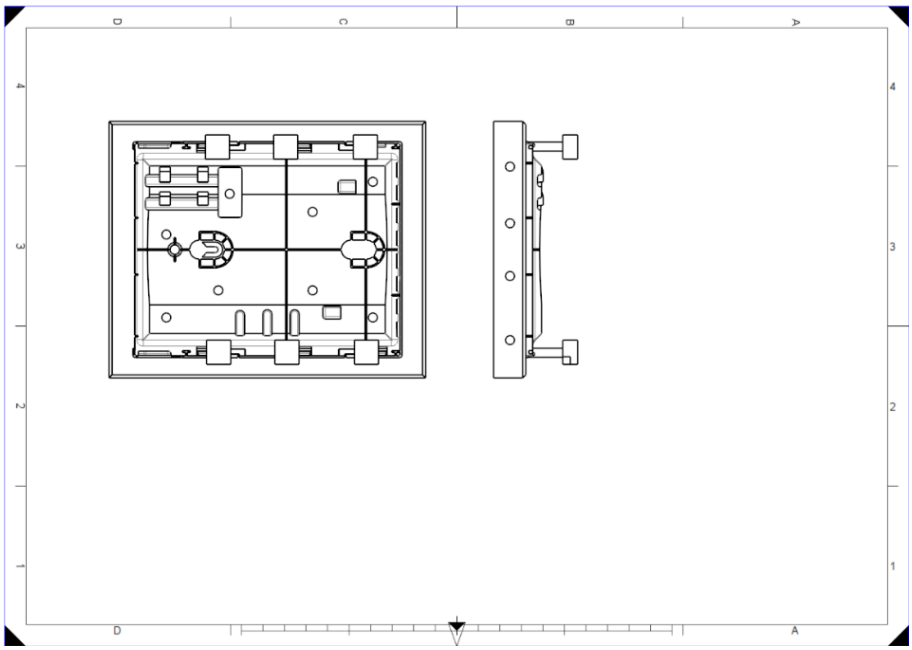
Annex 5: Electrode Drafting Template

Creating the drafting document

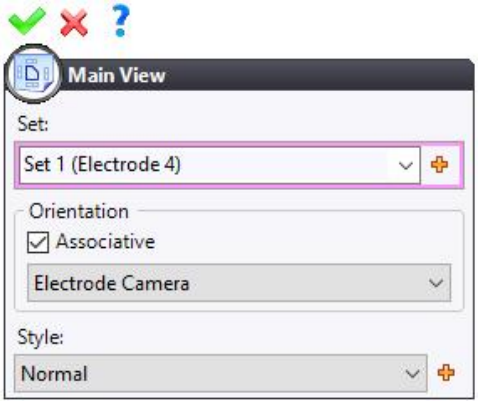
- Right-click on the *TopSolid'Electrode Training* project name and create a **drafting**.
- Select **Blank Template** and click on to **confirm** the operation.
- Rename the drafting document *Electrode - End positions*.
- Right-click in the drawing, select the **Format** command and select the **A3 ISO Landscape** format.
- Drag the *Core Block* electrodes document into the graphics area.
- Adjust the following settings.

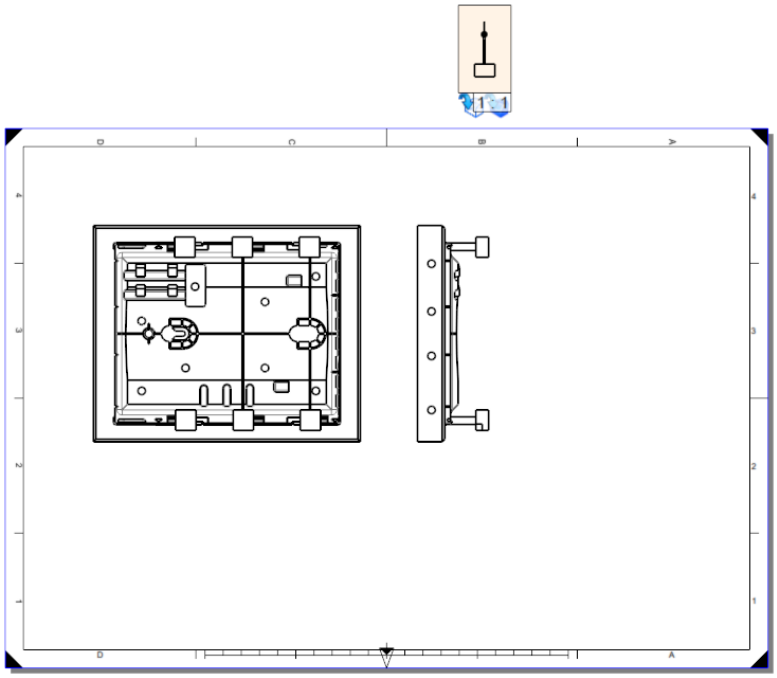


- Click on to **confirm** the operation.
- Position the views as shown below.

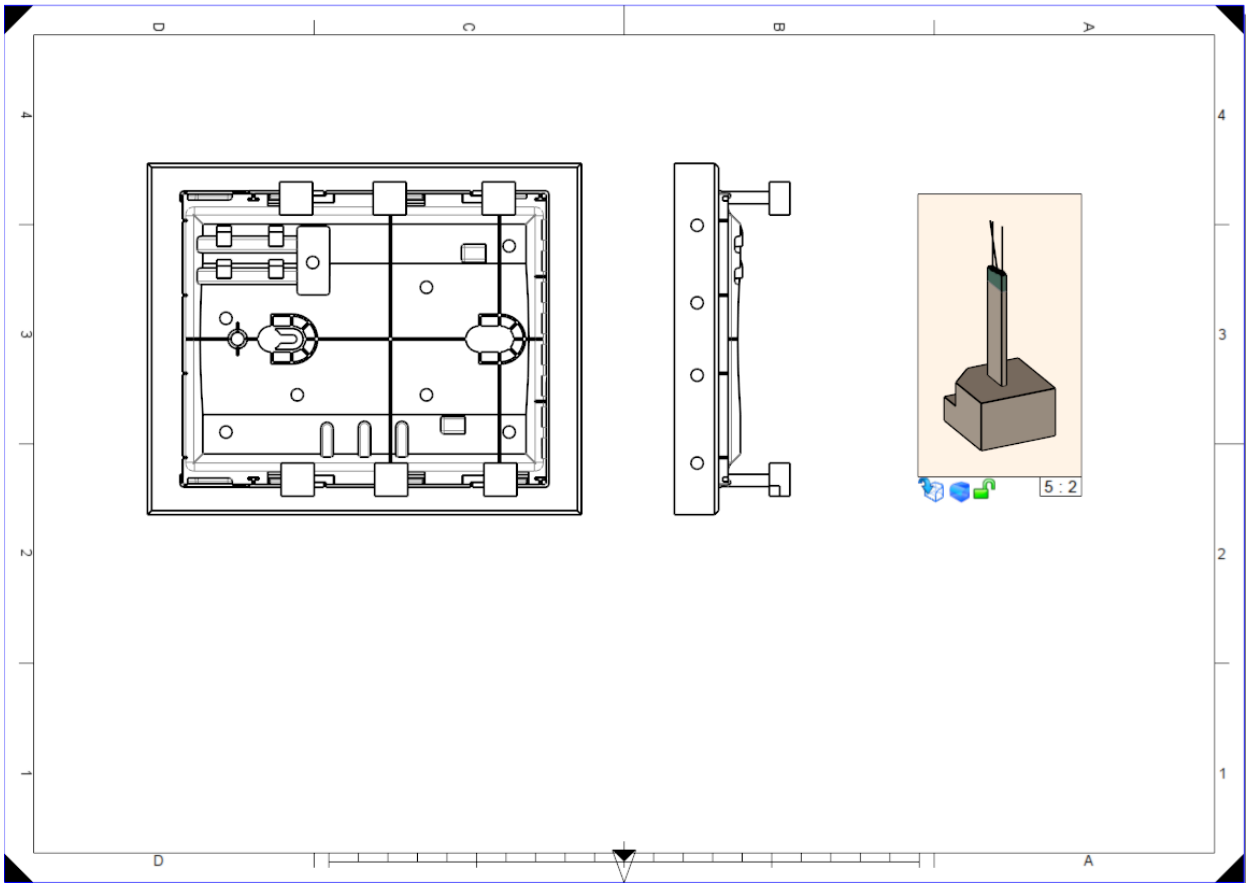


- From the Project tree, drag the **electrode 4** into the graphics area, select **Electrode Camera**, check the **Associative** box and place the view outside of the drawing.





- Click on ✔ to **confirm** the operation.
- Place the auxiliary view as shown below in order to produce a perspective view.

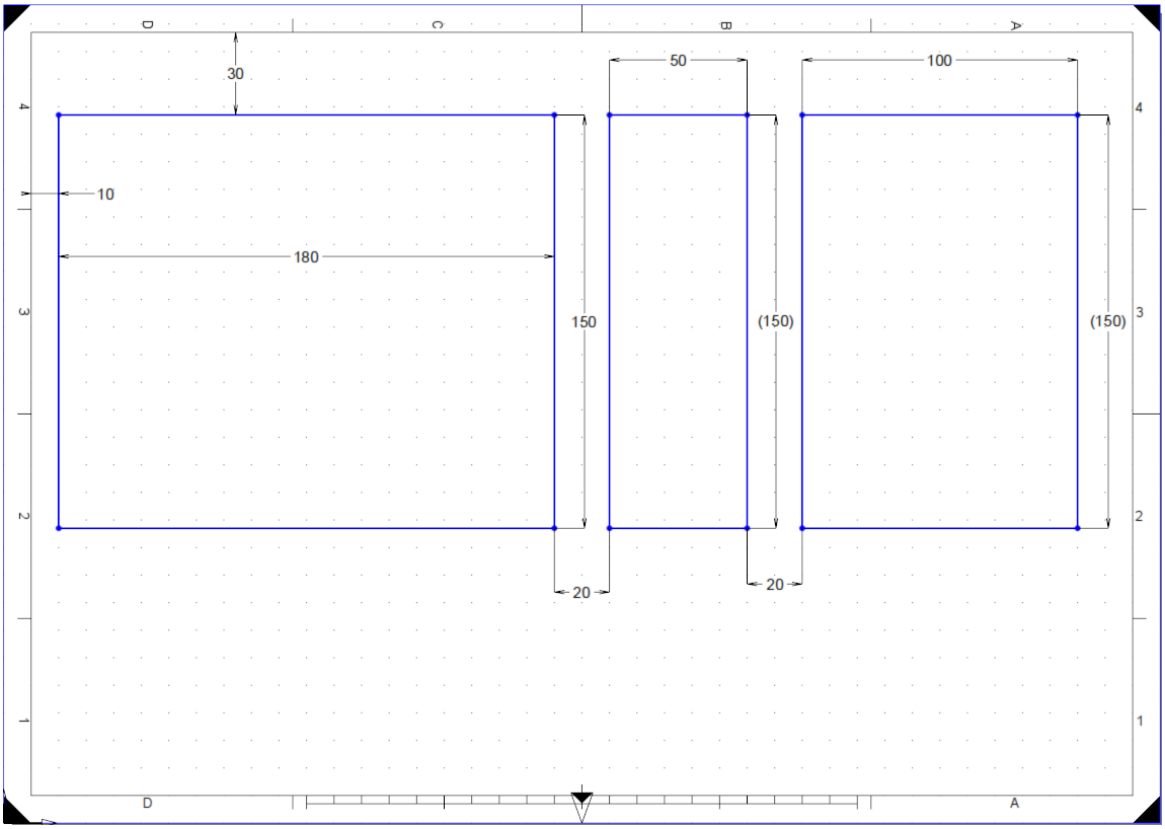


- Click on ✔ to **confirm** the operation.

Layout sketch

Note: The **Layout sketch** command allows you to create different rectangles which will be used to position the views which will be attached to them. Each view will be placed in a rectangle when using the **Optimize View Layout** command.

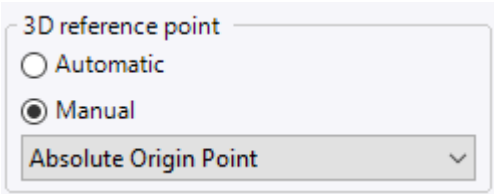
- From the **View** tab, select the **Layout Sketch** command.
- Set the dimensions for the profiles as shown below.



- **Confirm** the layout sketch by clicking on the View Layout Sketch button.
- Select the **Optimize View Layout** command.

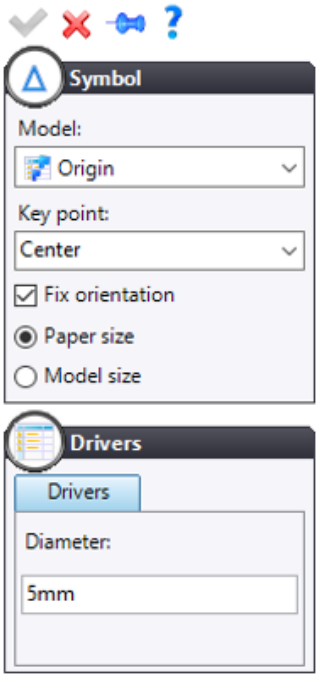
View origins

- Right-click on the main view and **edit** the projection.
- Click on the **Advanced Options** icon. In the **3D reference point** field, select the **Manual** option and select **Absolute Origin Point** from the drop-down list.

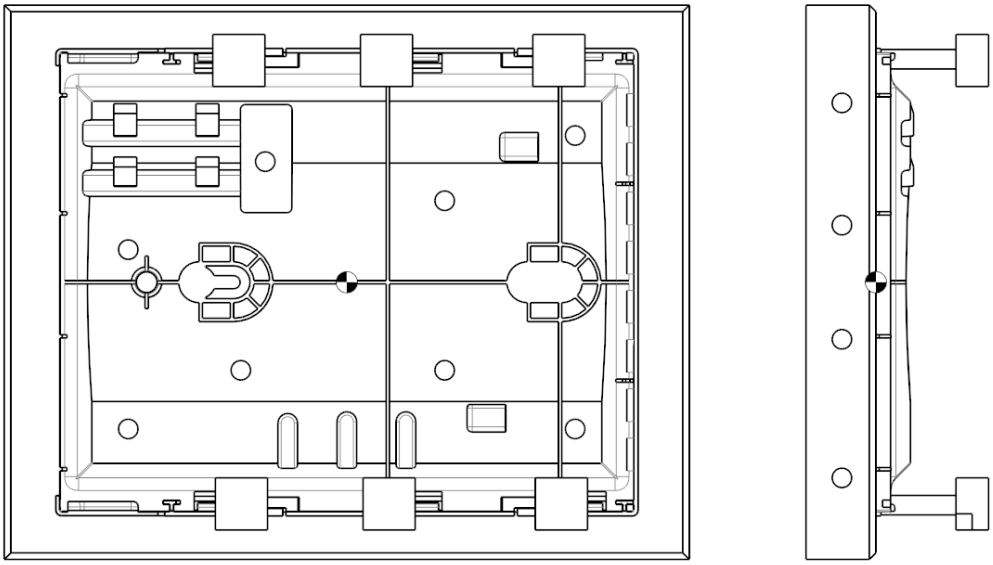


- Click on to **confirm** the operation.
- Right-click on the main view and select the **Edit Detailing** command.

- Select the **Symbol** command, select the **Origin** model and place the view's absolute frame.

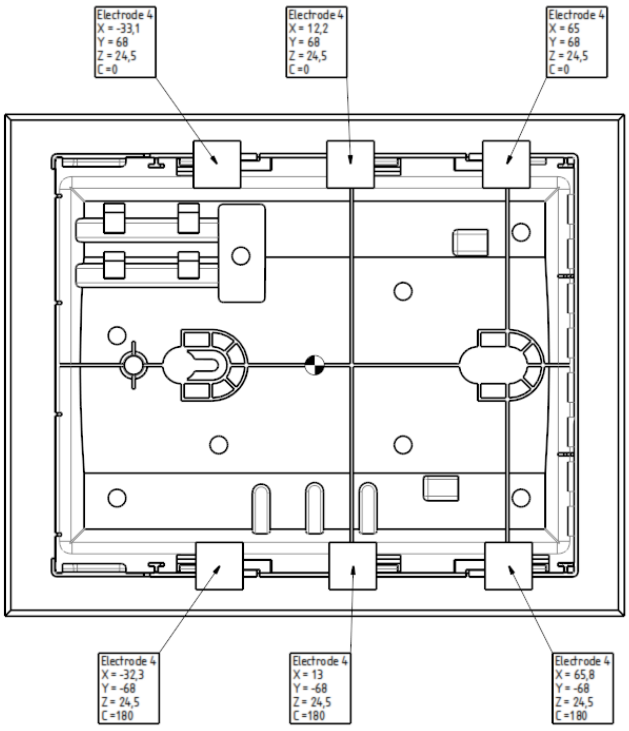


- **Confirm** the view detailing by clicking on the Detailing button.
- Repeat the procedure on the left view.

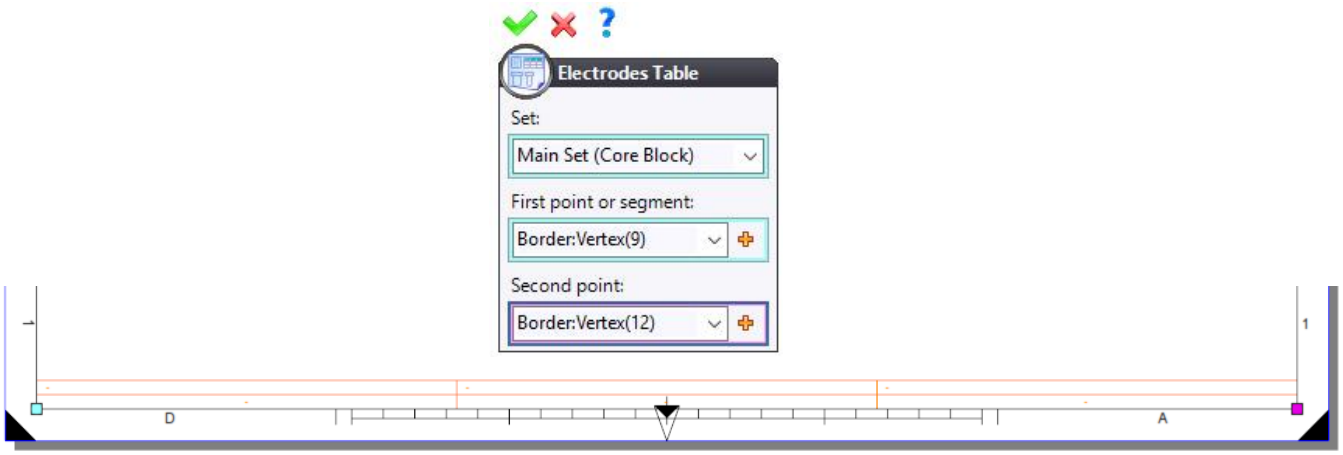


Electrode note and table

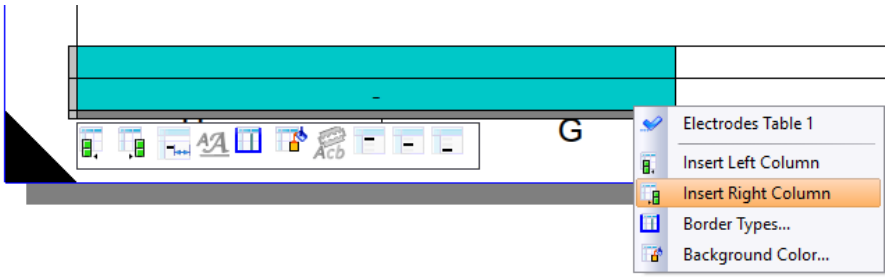
- From the **Electrode** tab, select the **Automatic Electrode Note** command.
- Select the main view and click on to **confirm** the operation.



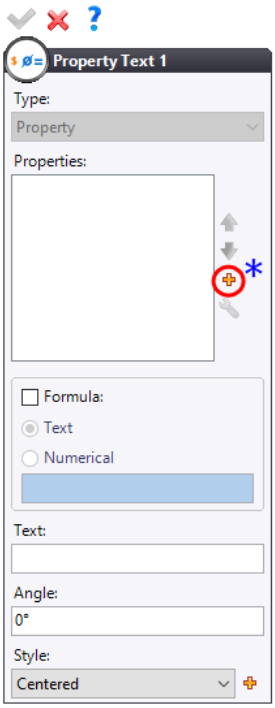
- Select the **Electrodes Table** command. Click on a first point, and then click on a second point to position the table.



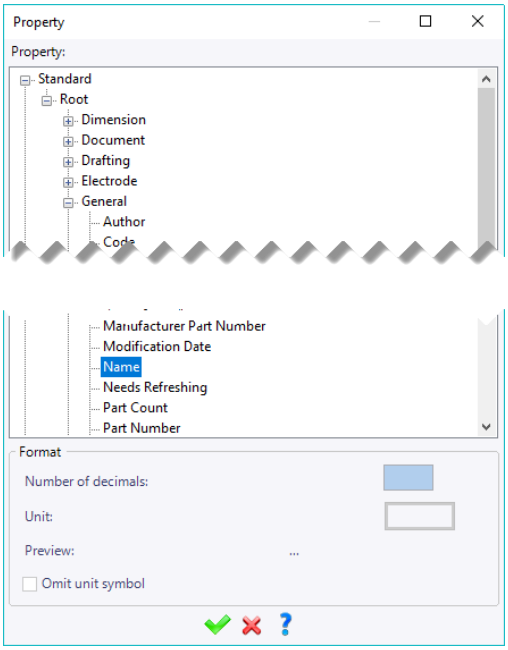
- Click on to **confirm** the operation.
- Right-click on the first column and select the **Insert Right Column** command.



- Double-click on the bottom left cell.
- Click on the  icon to access the properties.

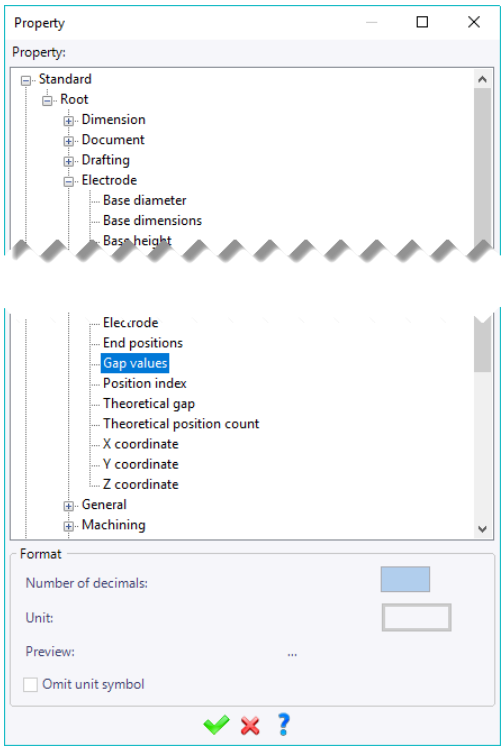


- Open the **Standard** > **Root** > **General** categories and select the **Name** property.

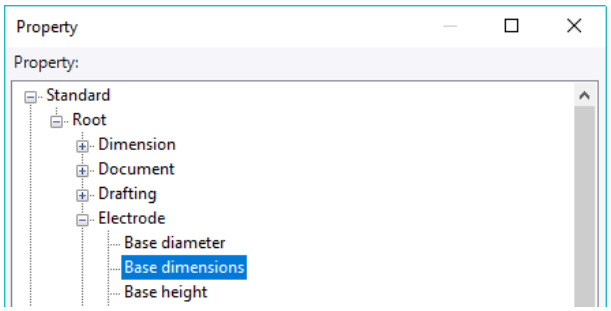


- Click on  to **confirm** the operation.

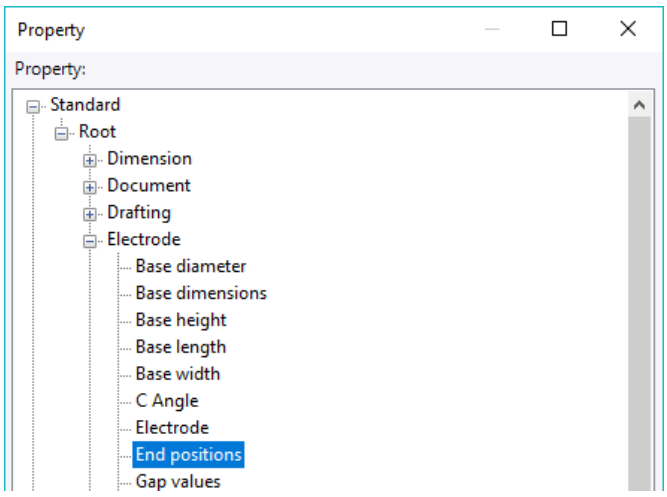
- From the **Electrode** category, insert the **Gap values** property in the second column.



- Click on  to **confirm** the operation.
- Insert the **Base dimensions** property in the third column.



- Insert the **End positions** property in the last column.

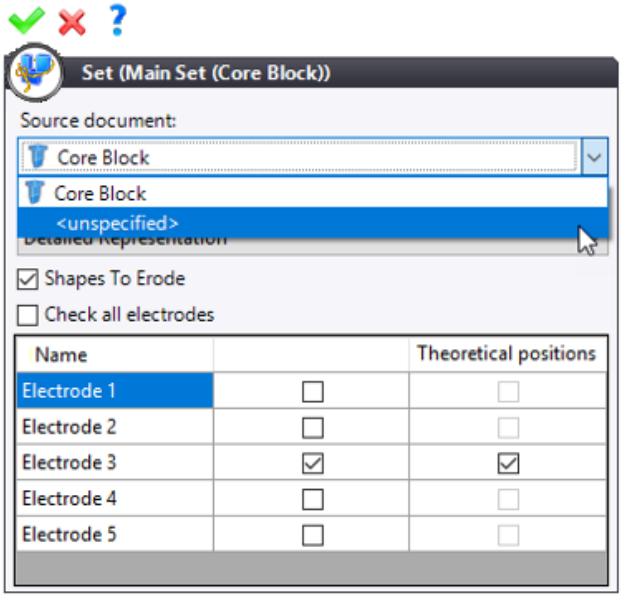


- Adjust the size of the columns for better readability.
- **Confirm** the electrode table by clicking on the 

button.

Breaking the link

- To break the link with the Electrodes document, right-click on the first view and select the **Edit Set** command.
- In the **Source Document** field, select **Unspecified**.
- Repeat the procedure for the view with the single electrode.



- Click on to **confirm** the operation.
- **Save** the document.
- **Copy** and **paste** the drafting document into **My Templates** or **Company Templates**.

Note: The drafting template must be used with the **Electrodes Draft** command.

Notes

Individual Course Evaluation Form

(To be completed and returned to the training instructor at the end of the course)

TopSolid'Electrode 7

Name : .....

Company : .....

Date(s) from ..... to .....

By completing this individual evaluation form, you are helping to improve the quality and usefulness of the training provided in the future. Please complete it carefully.

Number of people during the course: Onsite at your company? YES ☐ NO ☐

GENERAL ASSESSMENT	Poor	Average	Good	Excellent
Overall, this course has been:	☐	☐	☐	☐

What grade would you assign?

0	1	2	3	4	5	6	7	8	9	10

LOGISTIC	Poor	Average	Good	Excellent
Orientation (quality, organization, user-friendliness, etc.)	☐	☐	☐	☐
Physical setup (room, materials, etc.)	☐	☐	☐	☐

TRAINING	Poor	Average	Good	Excellent
Instructor's teaching method	☐	☐	☐	☐
Group relationship (participation, sharing of experiences)	☐	☐	☐	☐
Quality and clarity of educational materials (documentation)	☐	☐	☐	☐
Balance between Theory and Practice	☐	☐	☐	☐
Consistent presentations with what has been announced	☐	☐	☐	☐
Training Content	☐	☐	☐	☐

DURATION	No	Somewhat no	Somewhat yes	Yes
Does the overall duration of the course seem appropriate?	☐	☐	☐	☐
If no, was it?	Too short ☐			Too long ☐

PACE	No	Somewhat no	Somewhat yes	Yes
Does the overall pace of the course seem appropriate?	☐	☐	☐	☐
If no, was it?	Too slow ☐			Too fast ☐

USE OF ACQUIRED KNOWLEDGE IN THIS TRAINING	No	Somewhat no	Somewhat yes	Yes
Have you found this training to be useful in your work?	☐	☐	☐	☐
Do you think you can put the acquired knowledge into use quickly?	☐	☐	☐	☐
Do you believe that you have achieved your objectives upon completion of this course?	☐	☐	☐	☐

Comments and suggestions: .....