

---

PowerSHAPE 2015 R2

# Reference Help



## **PowerSHAPE**

Copyright © 1982-2015 Delcam Ltd. All rights reserved.

Delcam Ltd has no control over the use made of the software described in this manual and cannot accept responsibility for any loss or damage howsoever caused as a result of using the software. Users are advised that all the results from the software should be checked by a competent person, in accordance with good quality control procedures.

The functionality and user interface in this manual is subject to change without notice in future revisions of the software.

The software described in this manual is furnished under licence agreement and may be used or copied solely in accordance with the terms of such licence.

Delcam Ltd grants permission for licensed users to print copies of this manual or portions of this manual for personal use only. Schools, colleges and universities that are licensed to use the software may make copies of this manual or portions of this manual for students currently registered for classes where the software is used.

### **Acknowledgements**

This documentation references a number of registered trademarks and these are the property of their respective owners. For example, Microsoft and Windows are either registered trademarks or trademarks of Microsoft Corporation in the United States.

### **Patent Information**

Emboss functionality is subject to patent number GB 2389764 and patent applications US 10/174524 and GB 2410351.

Morphing functionality is subject to patent application GB 2401213.

# Contents

<b>Direct modelling</b>	<b>2</b>
Smart Feature Recognition .....	3
Detecting all features in a solid.....	6
Detecting all instances of a single type of feature .....	9
Detecting features in a solid with specified dimensions.....	10
Setting search criteria by selecting a feature.....	13
Smart Feature Selector.....	14
Smart Feature Selector - Example .....	16
Applying a draft angle to a face of a solid .....	19
Using multiple draft faces .....	23
Effect of selecting different reference entities.....	25
Draft Faces dialog .....	28
Draft Faces Options dialog.....	29
Healing a gap.....	30
Replace Faces.....	31
Replacing a face - an example.....	32
Feature recognition and editing .....	34
Hole recognition & editing.....	34
Pocket recognition & editing .....	36
Cut recognition & editing .....	38
Boss recognition & editing.....	40
Fillet recognition & editing .....	42
Using General Editing on faces .....	46
Move - editing faces .....	46
Rotate - editing faces .....	53
Mirror - an example .....	59
Offset - an example .....	62
Scale - an example.....	64

# Direct modelling

Direct Modelling provides tools to:

- make rapid edits to history-free solids.
- recognise key solid features for simple editing. For example, you can edit geometry that forms a hole region and register it as a hole feature whilst maintaining the integrity of existing features and creating new hole features.
- edit the radius of fillet geometry by recognising it as a fillet feature. Click on any fillet face and the entire track is automatically found. Enter a larger or smaller radius or remove the fillet entirely as part of a larger modification. Modified fillets are recognised as fillet features.
- add draft to faces and automatically extend and intersect all surrounding geometry to keep a closed solid. This saves you time compared to using traditional surface modelling methods.
- remove and heal to simplify geometry for downstream manufacturing operations or to accommodate design changes.
- edit faces, automatically extending and intersecting surrounding faces to maintain a closed solid. This lets you do operations like copying a strengthening rib or offsetting the side faces of a pocket.

Direct Modelling is particularly efficient for operations that are typically performed using surface modelling and would require you to extend and intersect each surrounding faces manually to create a closed solid.

As part of the **Direct Modelling**, the following functionality is included in PowerSHAPE:

- Applying a draft angle to a face of a solid (see page 19).
- Healing a gap by modifying the surrounding faces (see page 30).
- Feature recognition and editing (see page 34).

- Using General Edits operations on faces of solids (see page 46). Additional **Direct Modelling** functionality will be added in future PowerSHAPE releases.

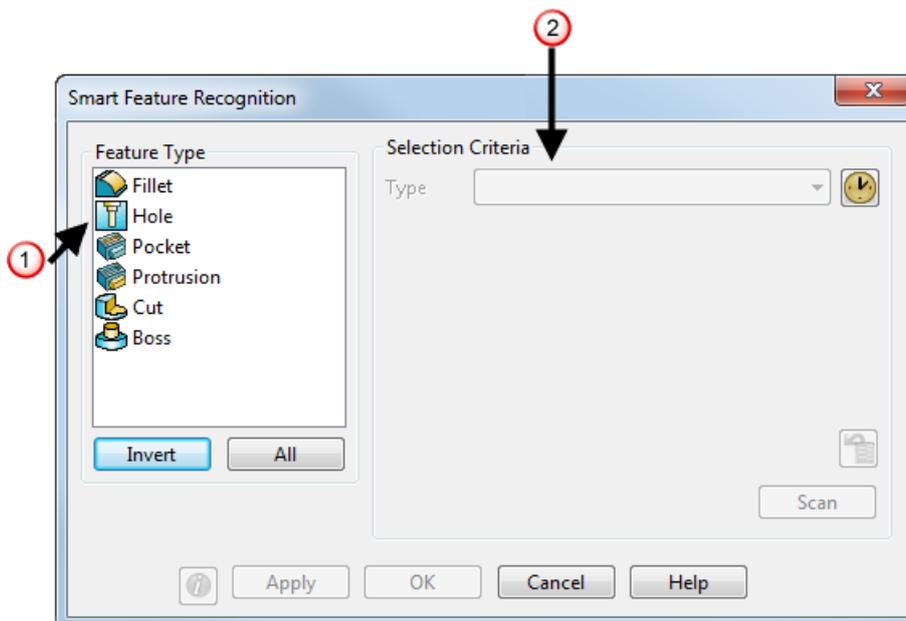
## Smart Feature Recognition

Use the **Smart Feature Recognition** dialog to recognise features in a solid that has no history. Use the dialog to:

- detect all features in a solid (see page 6).
- detect all features in a solid with specified dimensions (see page 10).
- detect all instances of a particular type of feature (see page 9).

The dialog enables you to complete the following steps:

- 1 Select the feature type.
- 2 Set the selection criteria for the selected feature types.
- 3 Detect the features in the solid that satisfy the type and selection criteria.
- 4 Add the features to the solid feature tree.

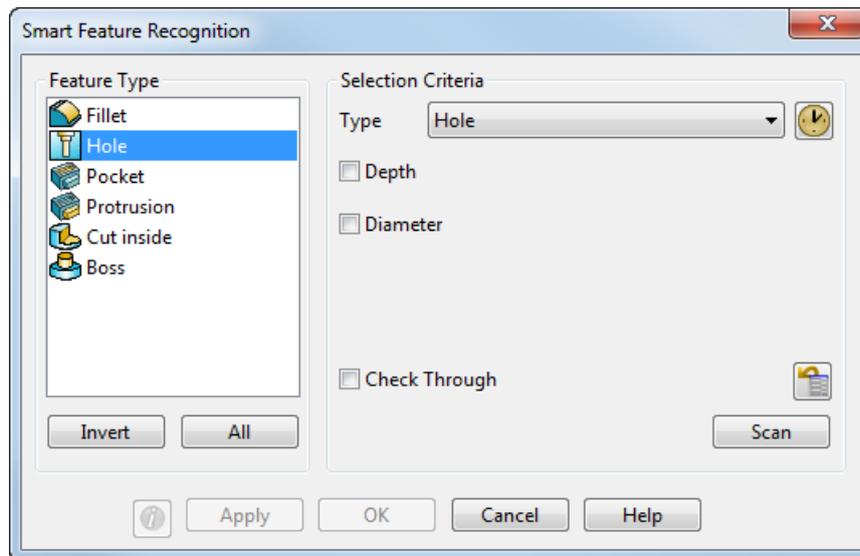


### Feature type

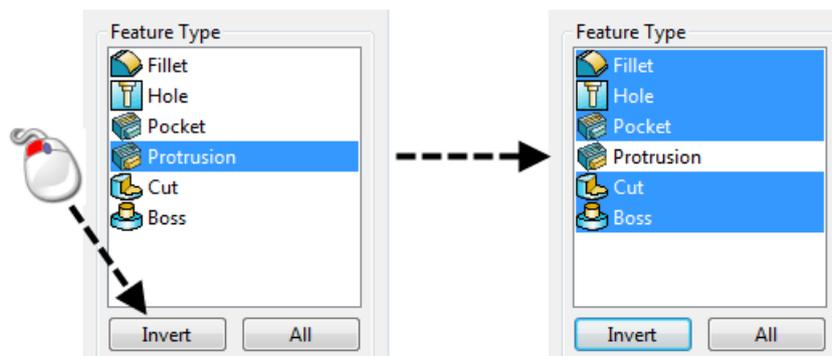
Use this section of the dialog to select the feature types to be detected.

- Select one or more types from the **Feature Type** panel **1**. Appropriate options are displayed in the **Selection Criteria** panel **2**. For **Hole**, the following **Selection Criteria** that are available:

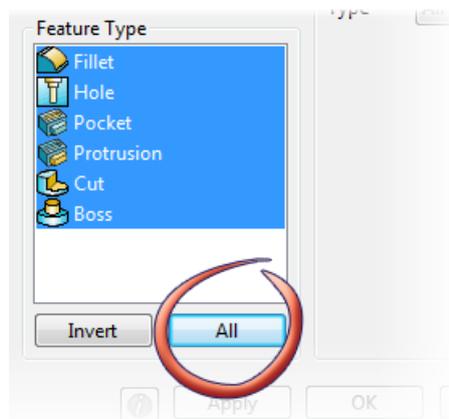
- **Depth**
- **Diameter**
- **Check though**



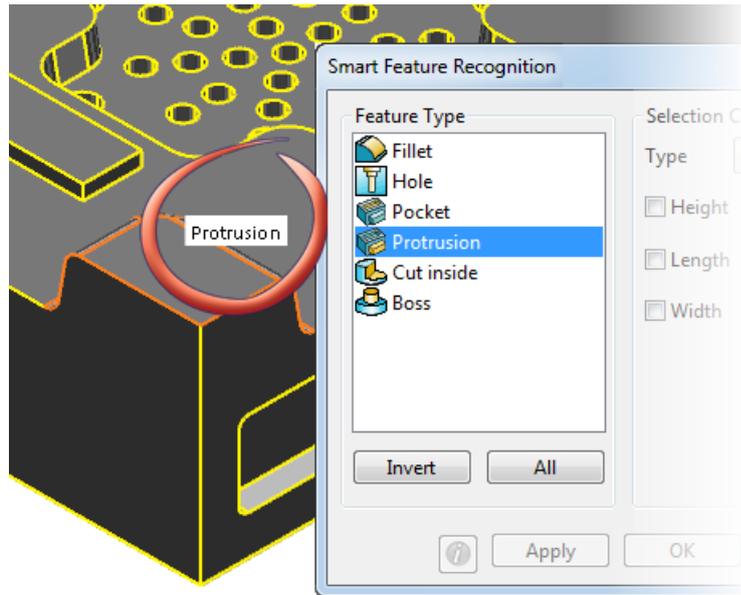
- Click **Invert** to select all the currently selected types and deselect all the types that are currently selected.



- Click **All** to select all feature types in the list.



- Move the cursor over the solid. As the cursor moves over an instance of the selected feature type, a label is displayed.



### Selection Criteria

- If you select a single type of feature from the **Feature Type** list, the corresponding **Type** is selected automatically from the drop-down list.
- If you have selected multiple features from the **Feature Type** list, **All selected** is displayed as the **Type** and no dimension selection options are displayed.
- When you have multiple feature types selected, you can set the dimension selection criteria for each type as follows:
  - Select the required feature type from the **Type** drop-down list.
  - Select additional selection criteria for the selected feature type.
  - Select another feature type and enter the dimensions.
- Click  to reset all selection criteria that you have entered.

### Detecting features

When you have selected the required feature types and entered the dimensions for each:

- Click **Scan** to detect the features on the model that match the criteria.
- Click  to display the **Scan and Apply Results** dialog. This gives details of the features that have been recognised.

## Adding features to the feature tree

Add the detected features to the feature tree by clicking one of the following buttons:

**Apply** — Adds the features to the feature tree and continues to display the **Smart Feature Recognition** dialog. This lets you continue to specify criteria and detect other features for addition to the feature tree.

**Cancel** — Closes the dialog without saving unapplied changes.

**OK** — Adds the features to the feature tree and closes the dialog.

You can select a new solid to recognise features on whilst the Smart Feature Recognition dialog is open. If you have any deferred features on the original solid, those features are updated in the feature tree when you select the new solid

## Detecting all features in a solid

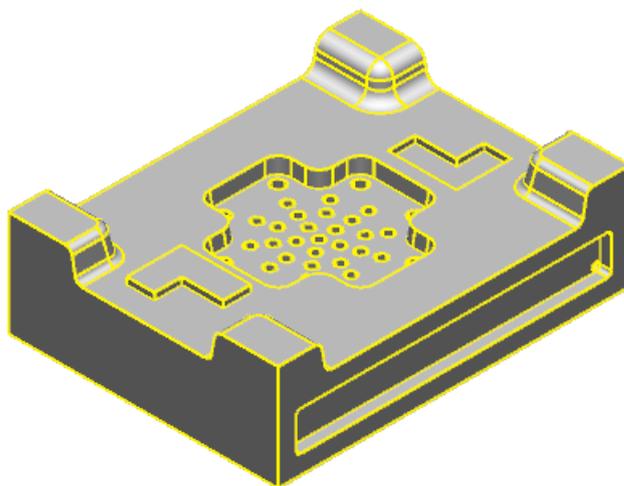
Use **Smart Feature Recognition** to detect:

- all features in a solid, without specifying any additional selection criteria.
- all features in a solid, where dimensions are specified for each feature type.

### Detecting all features in a solid

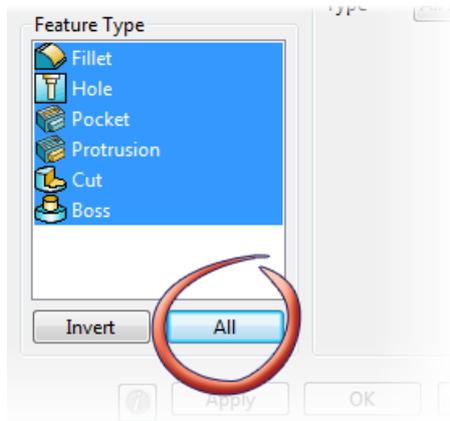
Use the following steps to detect all types and sizes of feature in a solid:

- 1 Select the solid you want to scan.

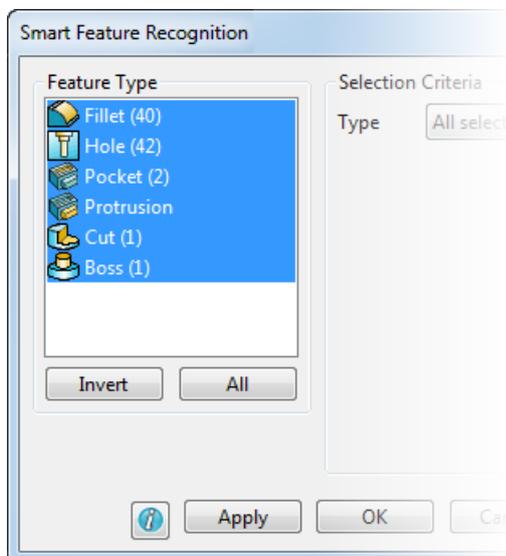


*If no solid is selected, then the active solid is used by default.*

- 2 Click  (Feature toolbar) to display the **Smart Feature Recognition** dialog.
- 3 Click **All** to select all the feature types.

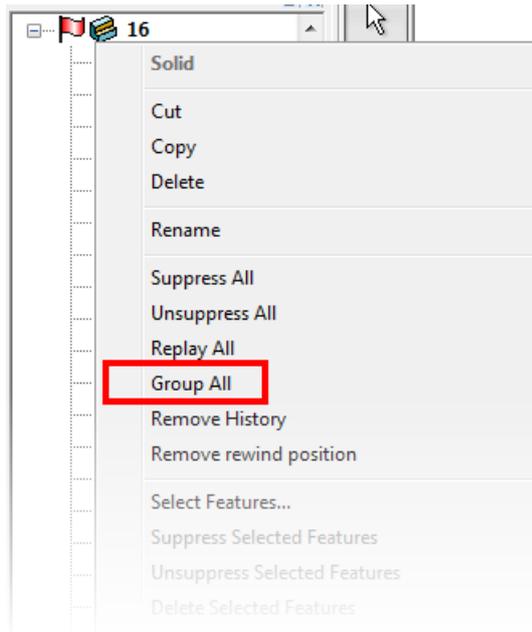


- 4 Click **Scan**. The number of each type of feature is displayed in the dialog.

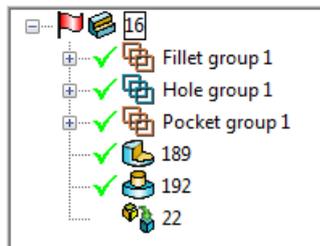


- 5 Click **OK** to add the features to the feature tree and close the dialog.

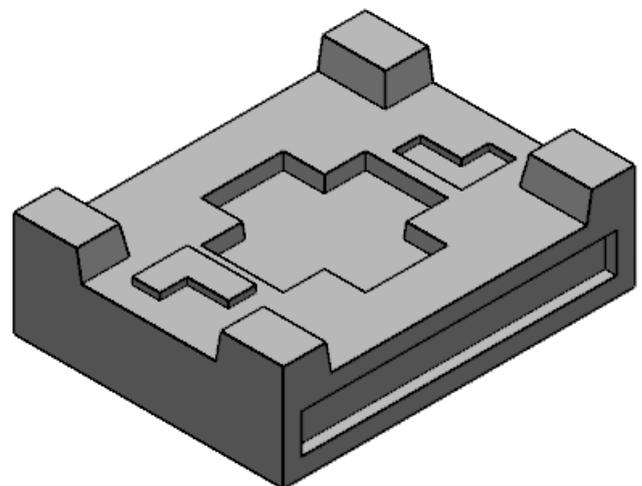
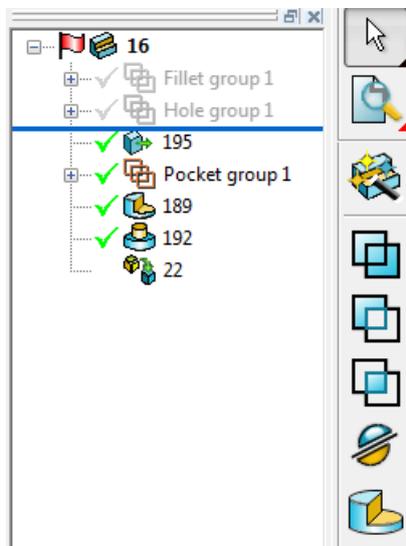
6 Select **Group All** from the **Solid** context menu.



The tree is updated to show the grouped features:



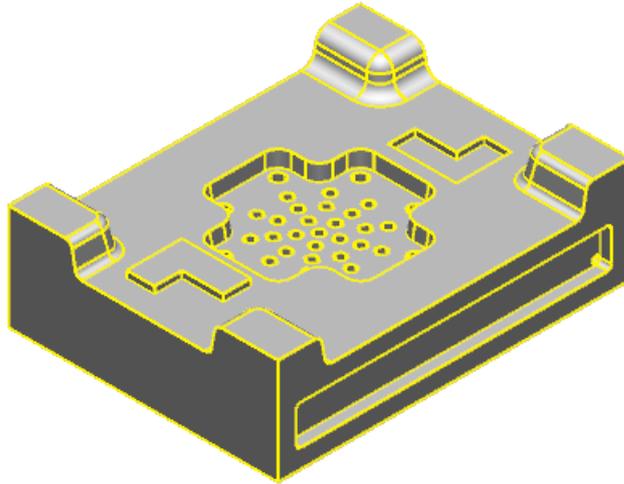
*You can use Rewind (Feature context menu) to rewind the history to any point*



## Detecting all instances of a single type of feature

You can use the **Smart Feature Recognition** to detect all instances of a single type of feature, The following example detects all instances of fillets.

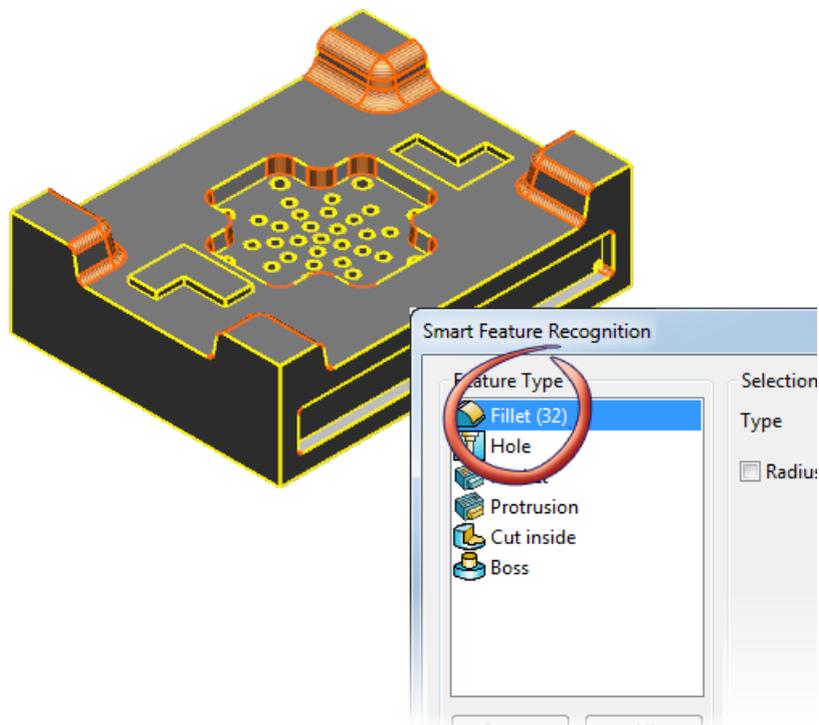
- 1 Select the solid you want to scan.



*If no solid is selected, the active solid is used by default.*

- 2 Click  (Feature toolbar) to display the **Smart Feature Recognition** dialog.
- 3 Select **Fillet** as the **Feature Type**.
- 4 Click **Scan**.
  - The number of fillets is displayed in the dialog.

- The fillets are highlighted on the model.



- 5 Click **OK** to add the fillets to the feature tree and close the dialog.

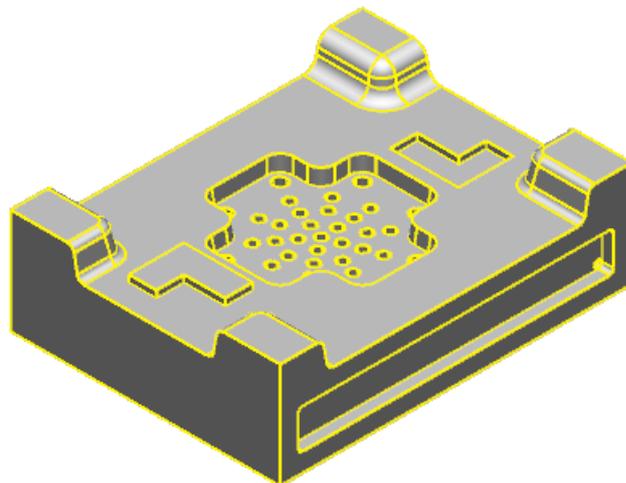
## Detecting features in a solid with specified dimensions

You can use the **Smart Feature Recognition** to detect all features, with dimensions specified for each feature type. The following example detects all plain holes that have a depth  $> 20$  and all protrusions that have a height  $> 10$ .



*You can also set search criteria by selecting a feature (see page 13).*

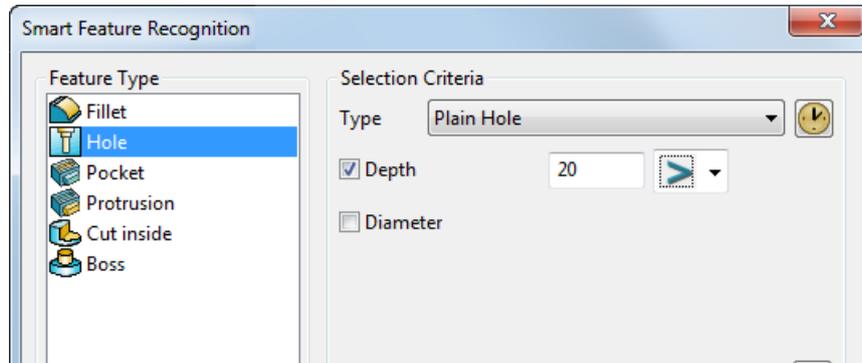
- 1 Select the solid that you want to scan.



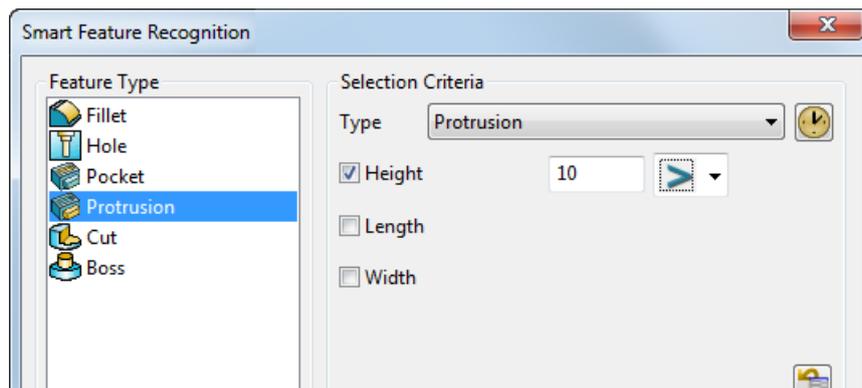


If no solid is selected, the active solid is used by default.

- Click  (Feature toolbar) to display the **Smart Feature Recognition** dialog.
- Select **Hole** as the **Feature Type** and then select **Plain Hole** from the **Type** drop-down list.
- Select the **Depth** option, enter a value of *20* and select  from the drop-down list.

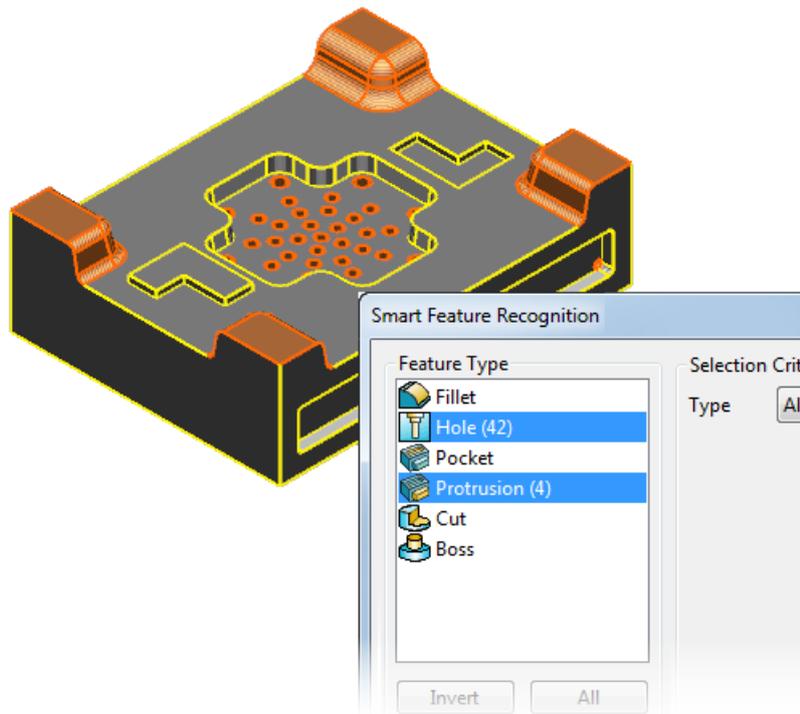


- Select **Protrusion** as the **Feature Type** and then select **Protrusion** from the **Type** drop-down list.
- Select the **Height** option, enter a value of *10* and select  from the drop-down list.



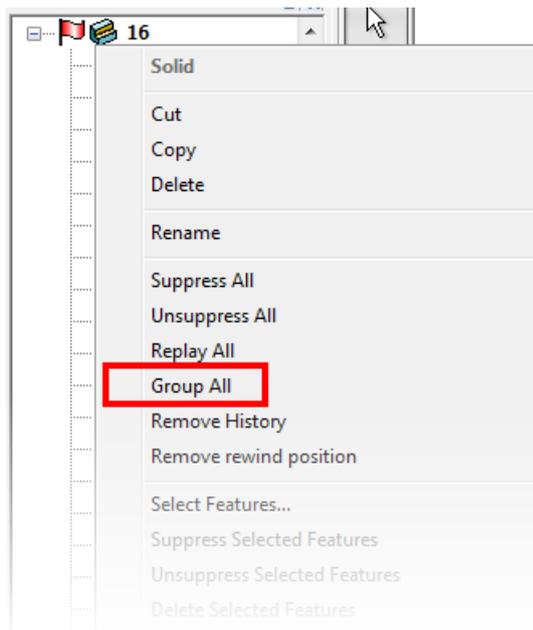
- Select **All selected** from the **Type** drop-down list.
- Click **Scan**.
  - The number of each type of feature that satisfy the criteria is displayed in the dialog.

- The features are highlighted on the model.



9 Click **OK** to add the features to the feature tree and close the dialog.

10 Select **Group All** from the **Solid** context menu.



The tree is updated to show the grouped features:



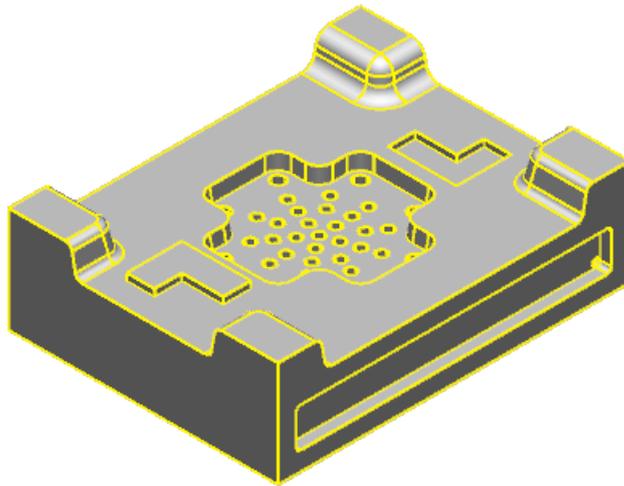


*It is important to remember that although you can specify the criteria for more than one type of feature, you must choose **All Selected** from the **Type** list before you click **Scan**.*

## Setting search criteria by selecting a feature

You can set search criteria by selecting a feature on the model. This lets you search for all similar features even if you don't know their size.

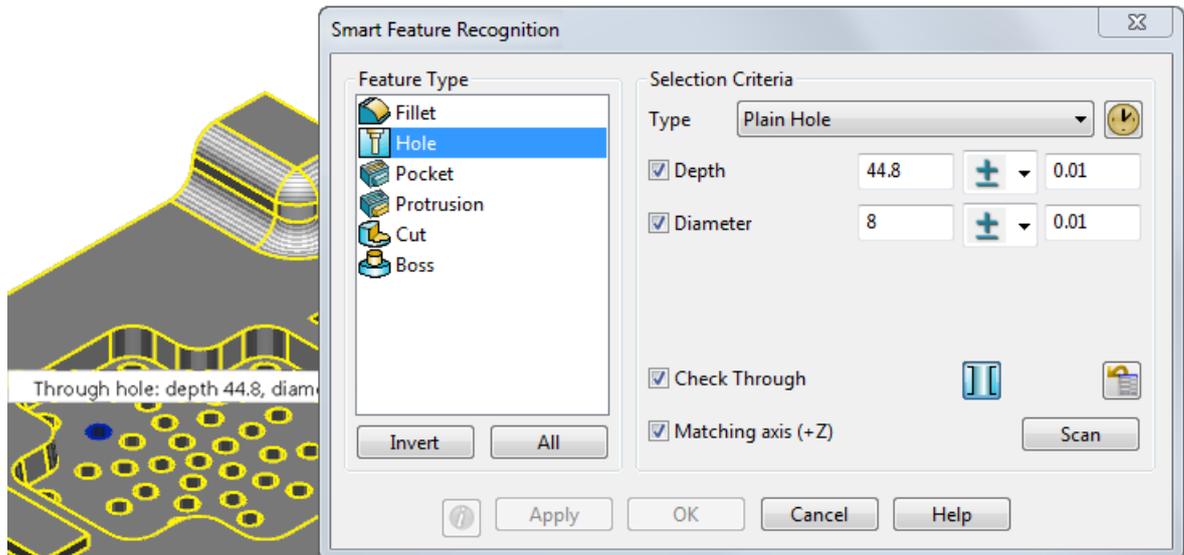
- 1 Select the solid that you want to scan.



*If no solid is selected, the active solid is used by default.*

- 2 Click  (Feature toolbar) to display the **Smart Feature Recognition** dialog;
- 3 Select the **Feature Type** you want to detect.

- 4 Hover the mouse over an instance of the selected feature type, so that its label and dimension information is displayed.



- 5 Click on the feature. The feature turns blue and the search criteria is set to match the selected feature.



*You can use this method to select multiple types of feature, but ensure that you select **All selected** from the **Type** list..*

---

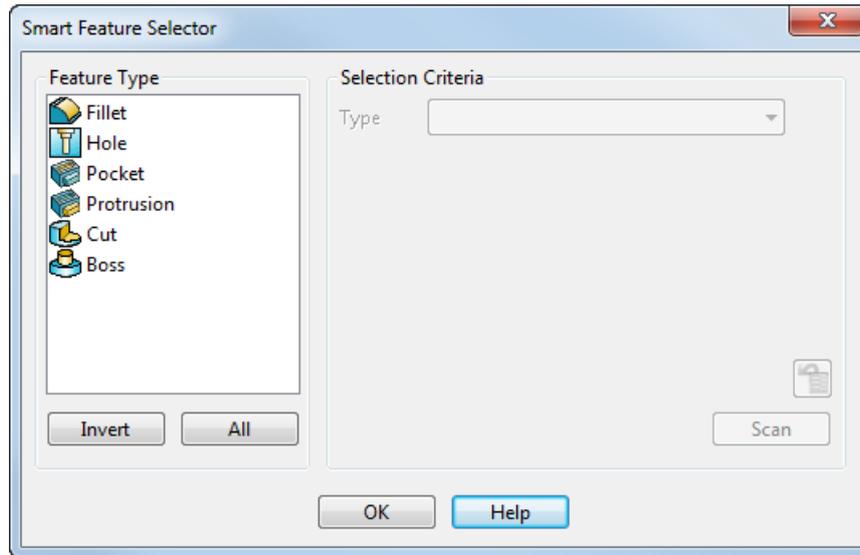
## Smart Feature Selector

Use the **Smart Feature Selector** dialog to recognise and select features in a solid that have a history (see page 16).

The dialog lets you complete the following steps:

- 1 Select the feature type.
- 2 Set the selection criteria for the selected feature types.

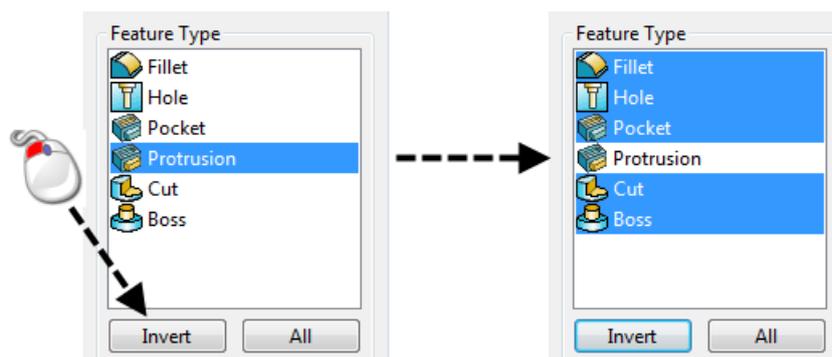
- 3 Detect the features in the solid that satisfy the type and selection criteria.



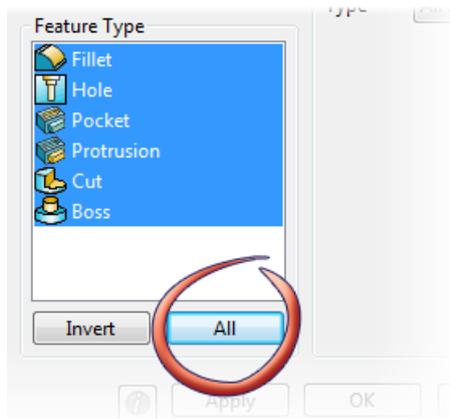
### Feature type

Use this section of the dialog to select the feature types to be detected.

- Select one or more types from the **Feature Type** panel. Appropriate options are displayed in the **Selection Criteria** panel.
- Click **Invert** to select all the currently selected types and deselect all the types that are currently selected.



- Click **All** to select all feature types in the list.



### Selection Criteria

- If you select a single type of feature from the **Feature Type** list, the corresponding **Type** is selected automatically from the drop-down list.
- If you have selected multiple features from the **Feature Type** list, **All selected** is displayed as the **Type** and no dimension selection options are displayed.
- When you have multiple feature types selected, you can set the dimension selection criteria for each type as follows:
  - 1 Select the required feature type from the **Type** drop-down list.
  - 2 Select additional selection criteria for the selected feature type.
  - 3 Select another feature type and enter the dimensions.
- Click  to reset all selection criteria that you have entered.

### Detecting features

When you have selected the required feature types and entered the dimensions for each. Click **Scan** to detect the features on the model that match the criteria.

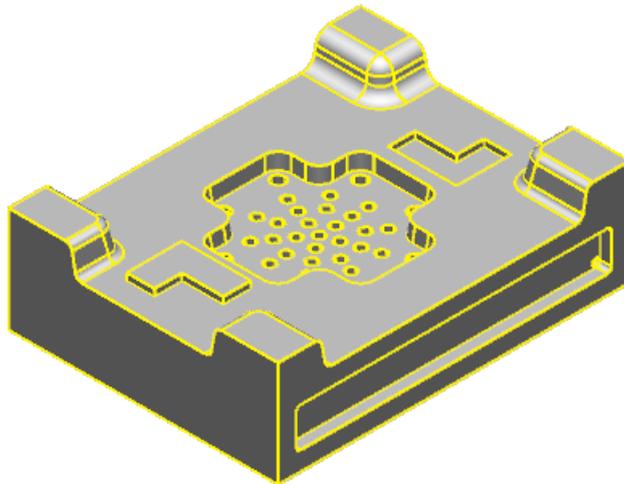
### Selecting features on the feature tree

Click **OK** to select the detected features on the feature tree and close the dialog.

## Smart Feature Selector - Example

Use the following example to select existing features in a solid with specified dimensions:

- 1 Select a solid.

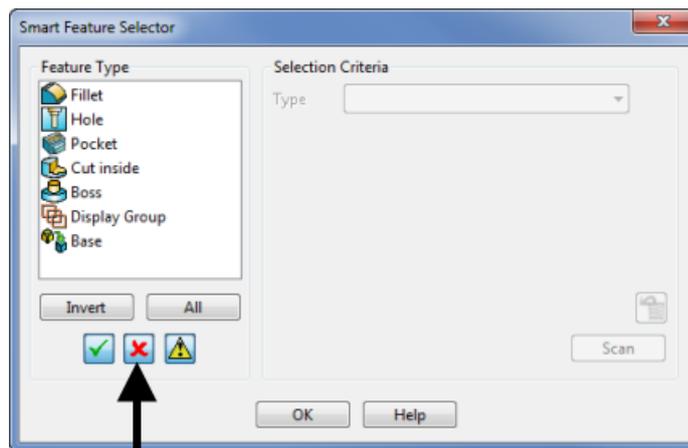


If no solid is selected, then the active solid is used by default.

- 2 Click  on the **Feature** toolbar to display the **Smart Feature Selector** dialog.



The following buttons **1** are displayed on the dialog only if the solid includes features that are suppressed or error suppressed.

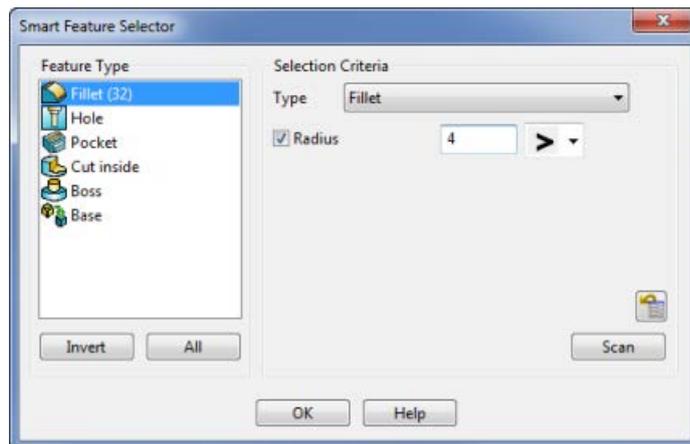


Toggle the following in order to:

-  include or exclude *unsuppressed* features in the selection.
-  include or exclude *suppressed* features in the selection.
-  include or exclude *error suppressed* features in the selection.

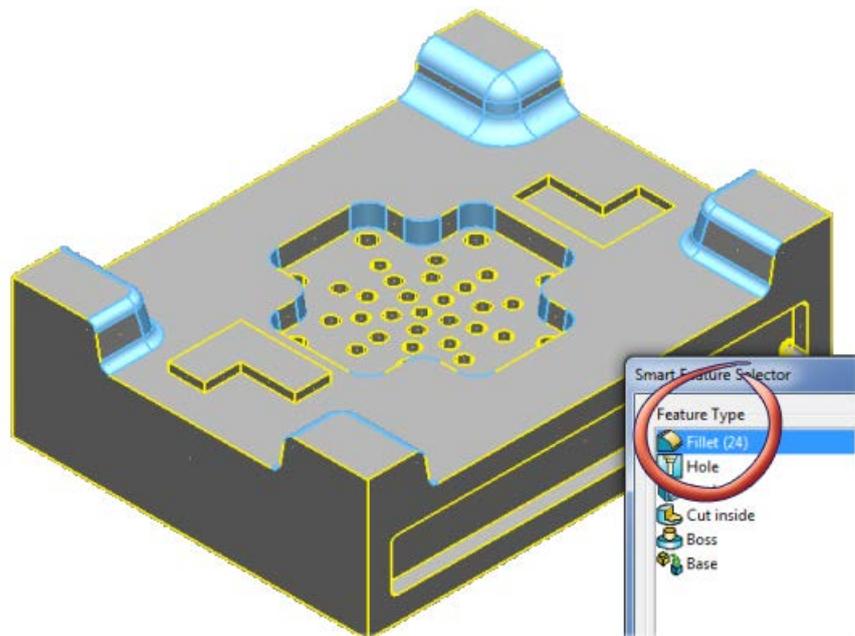
- 3 Select **Fillet** as the **Feature Type**.

- 4 Select the **Radius** option, enter a value of **4** and select **>** from the drop-down list.

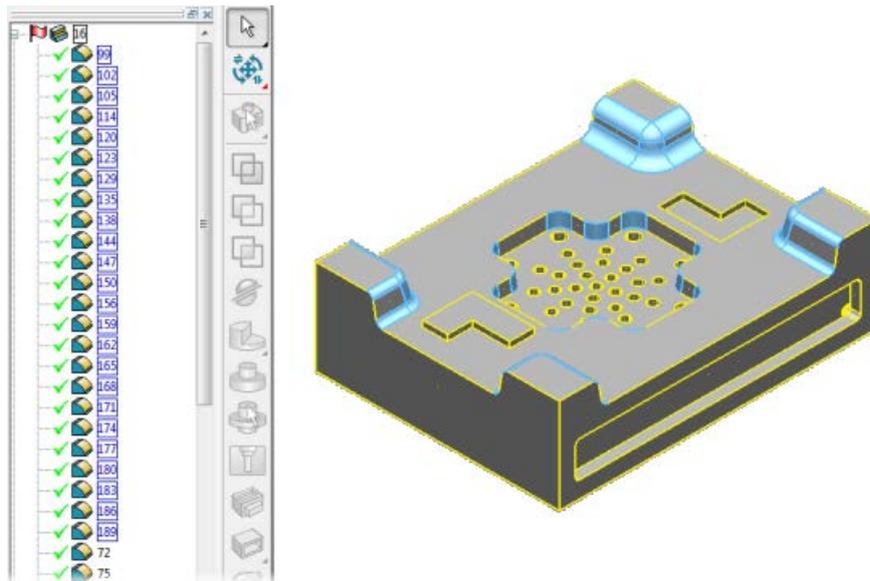


- 5 Click **Scan**.

- The number of each type of feature that satisfy the criteria, is displayed in the dialog.
- The features are highlighted on the model.



- 6 Click **OK** to select the features and close the dialog.

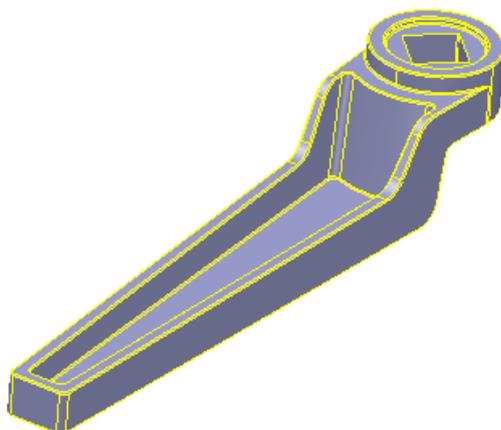


## Applying a draft angle to a face of a solid

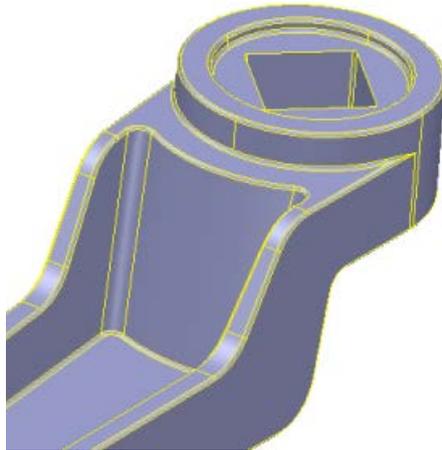
Use the **Draft Faces**  button (*Solid Edit toolbar*) to change the draft angle of a face of a solid.

Using the handle of the valve as an example, **Direct Modelling** will:

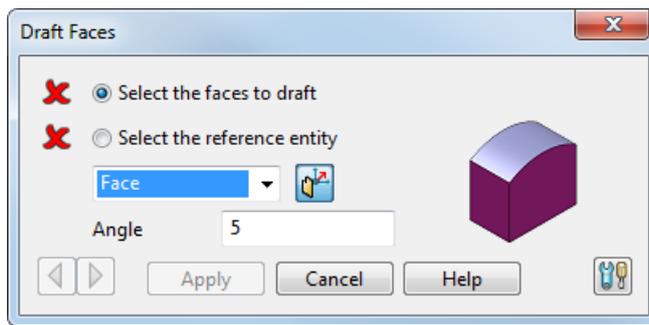
- change the draft angle of the selected face.
- extend the faces as required.
- reapply the fillets.



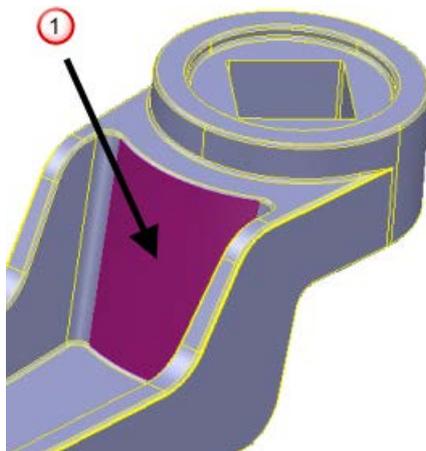
- 1 Zoom in so that the details of the handle are clearly visible.



- 2 Click  (Solid Edit toolbar) to display the **Draft Faces** dialog.

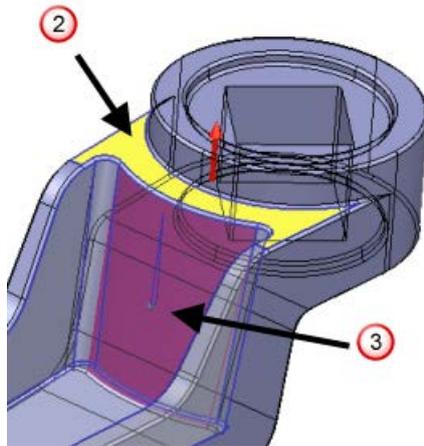


- 3 Select the face to draft **1**.



*If you select the face to draft before opening the **Draft faces** dialog, the dialog reflects the selection and is ready for you to select the reference entity.*

- 4 With **Face** selected in the drop-down box, select the reference face **2**.

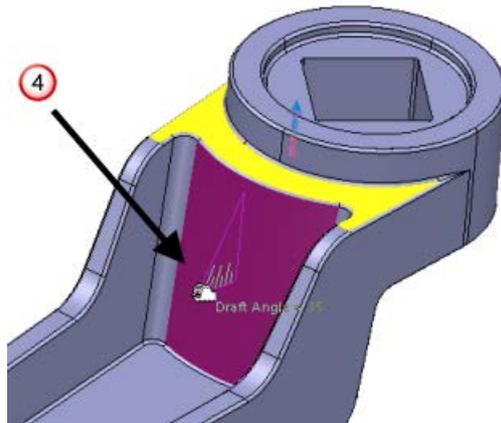


- 5 Change the angle of the face in one of the following ways:

- In the dialog, enter an **Angle** of **35**.

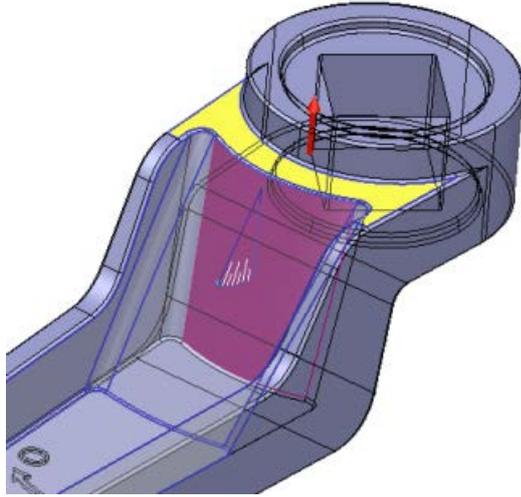
*If you enter an angle that will make the draft face conflict with other geometry, the cursor changes to  when it is moved over the model. To use a larger angle, additional draft faces need to be selected (see page 23).*

- Click the instrumentation handle **3** and drag the mouse to increase the angle to 35.



As you move the mouse, the instrumentation information shows the updated angle **4**. The **Angle** value in the dialog is updated when you release the mouse button.

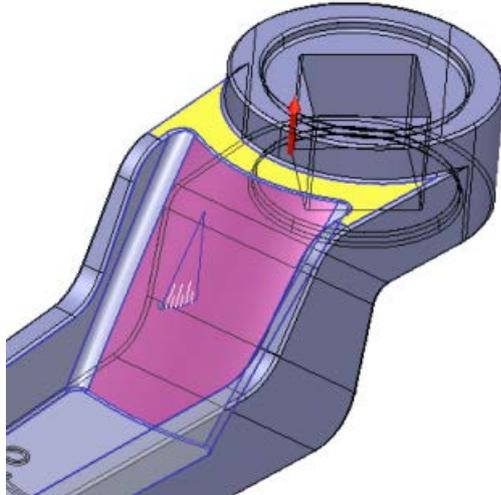
The preview shows the changes that will be made when you apply the chosen angle.



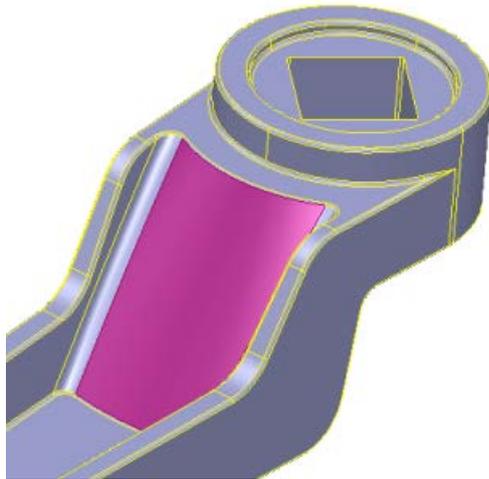
*If you create an angle that will make the draft face conflict with other geometry, the cursor changes to  when it is moved over the model and the preview is not created. To use a larger angle, additional draft faces need to be selected (see page 23).*

- 6 Click **Apply** to make the changes to the model. The angle of the face is updated and the fillets are re-applied.

The dialog and the instrumentation are still displayed to let you adjust the angle of the face if necessary.

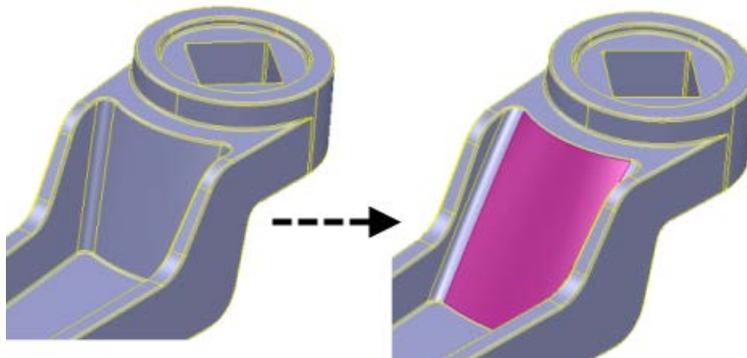


- 7 Click **Dismiss** to close the dialog and remove the instrumentation.



The comparison below shows:

- the change to the face of the handle.
- the updated fillets.



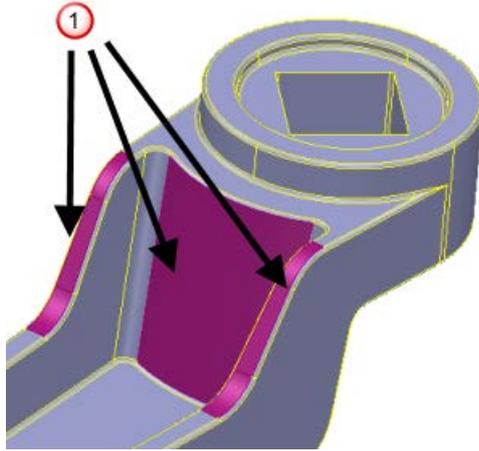
## Using multiple draft faces

Using multiple faces with **Direct Modelling** will:

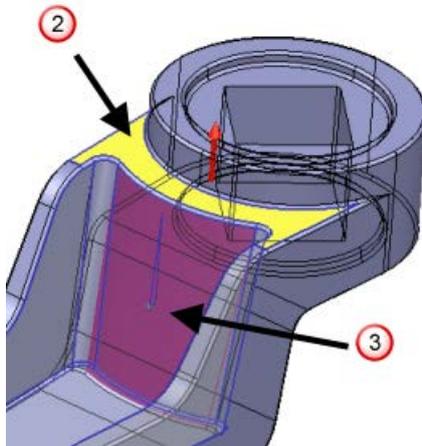
- change the draft angle of the selected faces.
- extend the selected and surrounding faces as required.
- reapply the surrounding fillets.

- 1 Click  (*Solid Edit toolbar*) to display the **Draft Faces** dialog.

- 2 Select the faces to draft **1**. Use the **Shift** and **Ctrl** selection modifiers to add and remove surfaces from the selection.



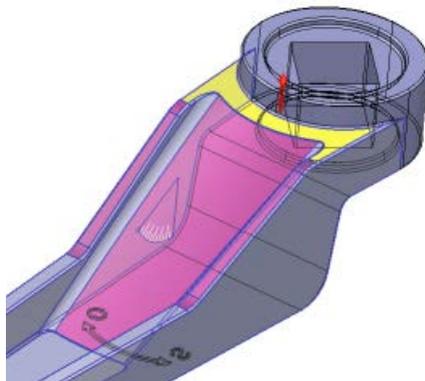
- 3 Select the reference face **2**.



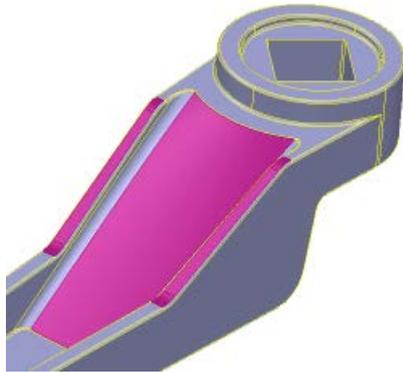
- 4 Use the instrumentation **3** to change the draft angle to **60** or enter an Angle of **60**.

- 5 Click **Apply** to make the changes to the model. The angle of the faces are updated and the surrounding fillets are re-applied.

The dialog and the instrumentation are still displayed to let you adjust the angle of the face if necessary.

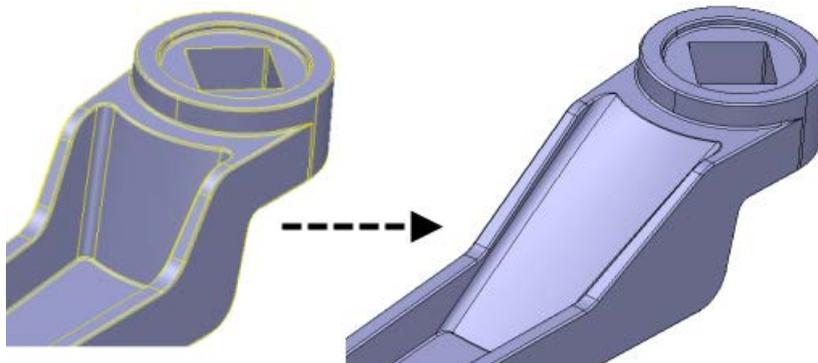


- Click **Dismiss** to close the dialog and remove the instrumentation.

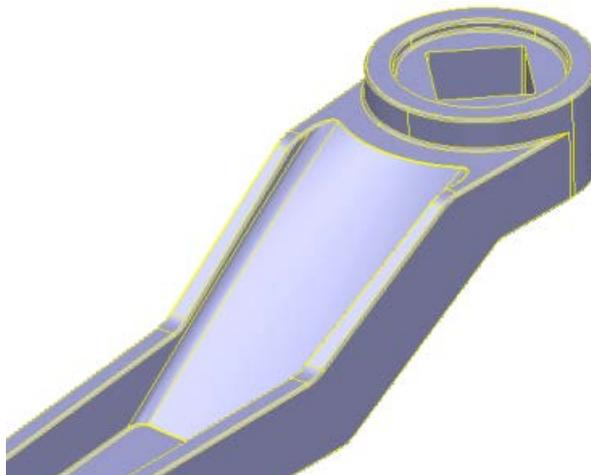


The comparison below shows:

- the change to the face of the handle.
- the updated fillets.



- Repeat steps 1 - 6 on the reverse side of the handle. The completed handle looks like this:



## Effect of selecting different reference entities

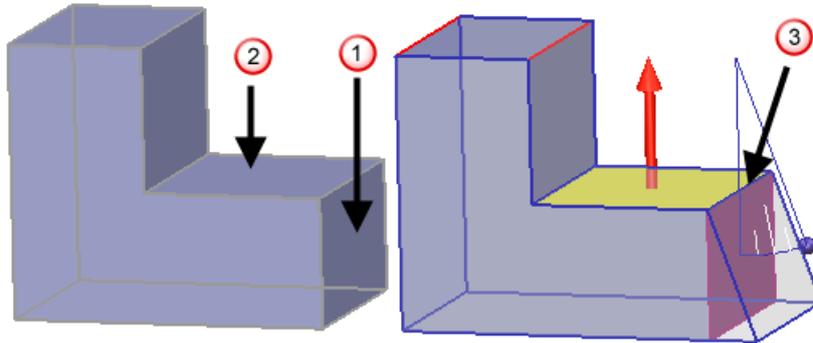
The examples below show:

- the effect of selecting different reference entities - *Examples 1 & 2*.

- the effect of selecting a curved reference entity- *Example 3.*

### Example 1

- 1 Select the face to draft ①.

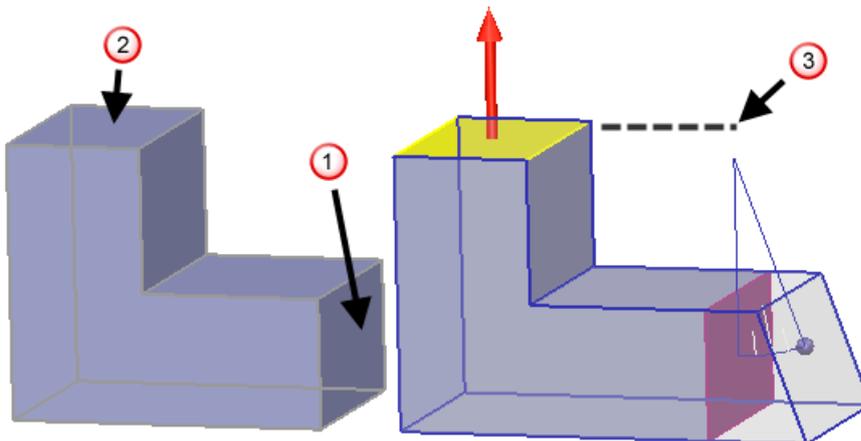


- 2 Select the reference entity ②.
- 3 Enter an **Angle** of 25.
- 4 Click **Apply**.

The pivot point for the draft face reflects the reference entity that was selected. The angle is measured at the pivot point.

### Example 2

- 1 Select the face to draft ①.

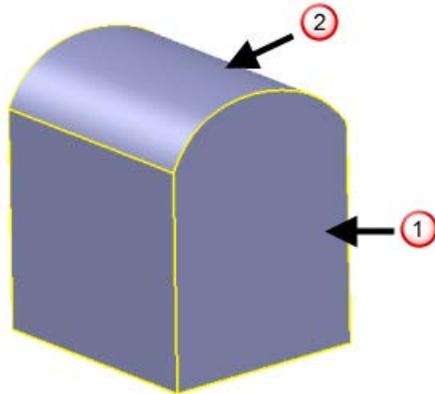


- 2 Select the reference entity ②.
- 3 Enter an **Angle** of 25.
- 4 Click **Apply**.

The pivot point for the draft face ③ reflects the reference entity that was selected. The angle is measured at the pivot point.

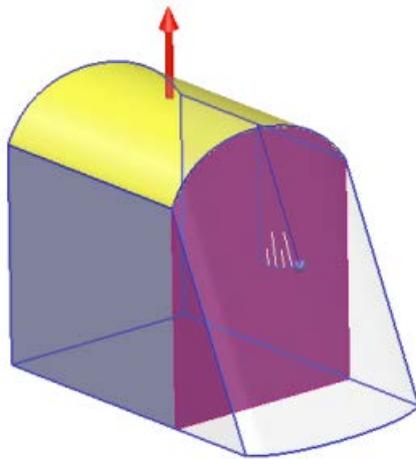
### Example 3 - Selecting a curved reference entity

- 1 Select the face to draft **1**.

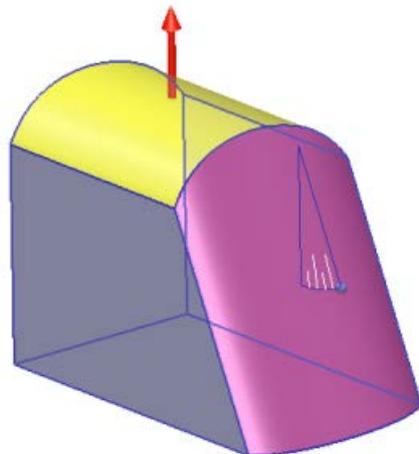


- 2 Select the reference entity **2**.

- 3 Enter an **Angle** of **25**.



- 4 Click **Apply**.

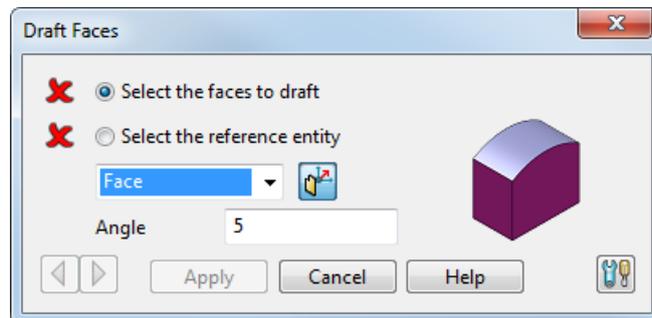


The draft face has a curved edge to reflect the curvature on the reference entity.

## Draft Faces dialog

Use the **Draft Faces** dialog to change the draft angle of faces of a solid (see page 19).

- 1 Click  (*Solid Edit toolbar*) to display the **Draft Faces** dialog.

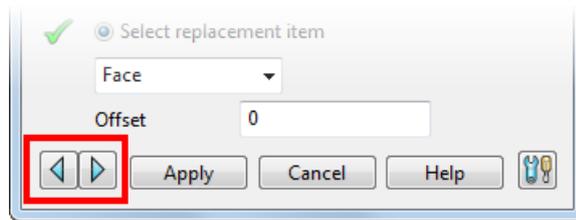


- 2 Ensure that the **Select the faces to draft** option is selected.
- 3 Select the faces to draft. The cross  icon changes to a tick .
- 4 Select one of the following types of reference entity from the drop-down list:
  - **Face** - a face of the solid.
  - **Surface** - a surface of the model.
  - **Workplane** - a workplane in the model.
- 5 Ensure that the **Select the reference entity** option is selected.
- 6 Select the reference entity. The cross  icon changes to a tick .
- 7 Use  to define the draw direction.
  - If this button is selected and the reference entity is a planar face or surface, the draw direction is defined as the normal of that face or surface. If the reference entity is a workplane, then the draw direction is defined as the Z-axis of that workplane.
  - If this button is not selected (or the reference entity face or surface is not planar), the draw direction is defined as the current principal plane axis.
- 8 Enter an **Angle** or use the drag handle to create the required draft angle.



If you enter an angle that will make the draft face conflict with other geometry, the cursor changes to  when it is moved over the model.

- Click  to display the **Draft Faces Options** dialog (see page 29). Use this dialog to specify the way the graphics are previewed.
- When more than solution is possible, use the **Previous** and **Next Solution** buttons to select the required solution.



These buttons work on the current operation; once you have selected **Apply**, you are not able to change the solution for the applied operation.

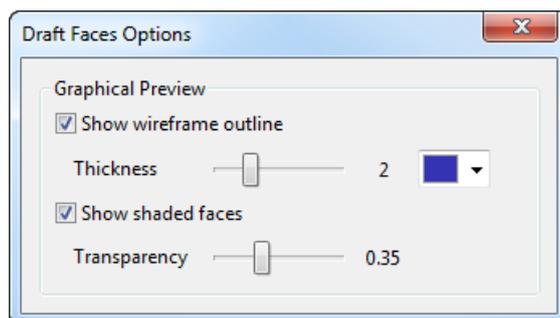
- Click **Apply** to make the changes to the model.



When the **Draft Faces** dialog is displayed, you can use **Restore Selection** (Views toolbar) to restore the previous set of selected faces to draft.

## Draft Faces Options dialog

Use the options on this dialog to define how the graphical preview is displayed.



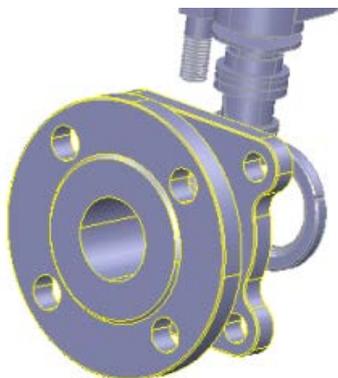
- Use **Show wireframe outline** to specify whether or not a wireframe outline of the draft faces are displayed.
- Use the **Thickness** slider to specify the thickness of the wireframe graphics.
- Use the drop-down list to specify the colour of the wireframe.
- Use **Show shaded faces** to specify how the draft faces are displayed.
- Use the **Transparency** slider to specify the transparency of the shaded faces.

---

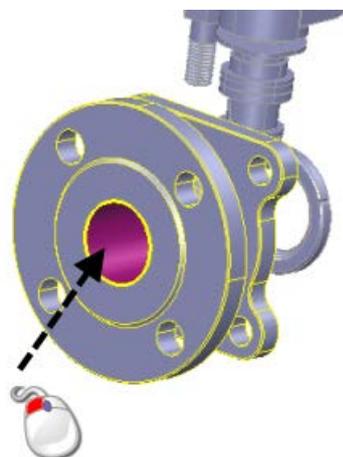
## Healing a gap

Use the **Remove and heal**  button (*Solid Edit toolbar*) to remove the selected faces and close the resulting gap by modifying the surrounding faces.

- 1 Select the solid to display the **Solid Edit** toolbar.



- 2 Select the face.

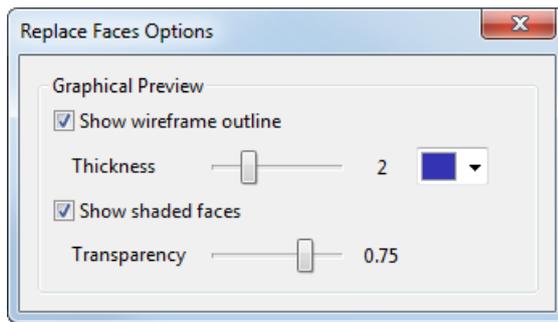


- 3 Click  to remove the face and heal the hole.





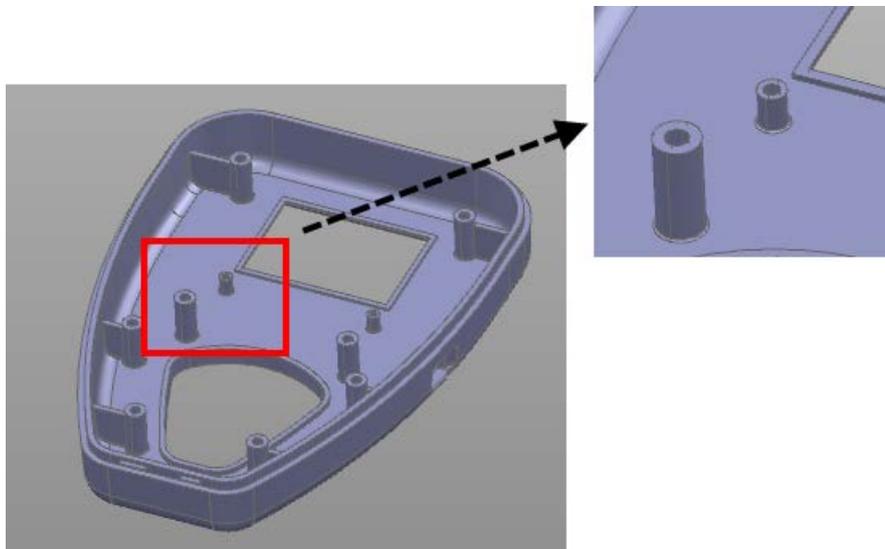
- 7 If required, click  to display the **Replace Faces Options** dialog.



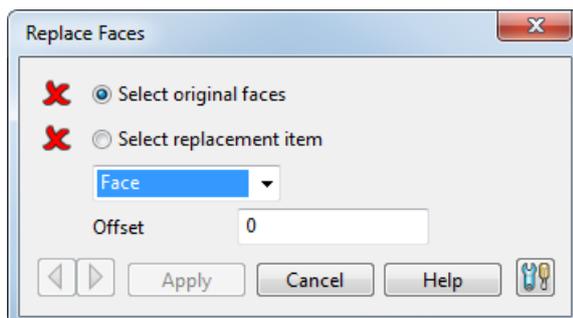
Use the options on this dialog to adjust the appearance of the graphical preview that is displayed before you click **Apply** on the **Replace Faces** dialog.

## Replacing a face - an example

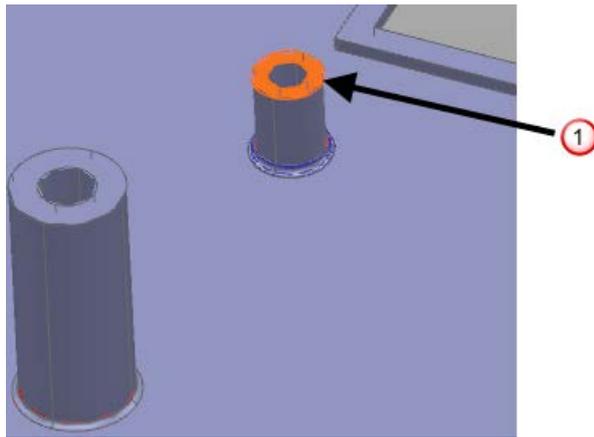
This example shows you how to replace one or more selected faces with another existing face.



- 1 Click the solid to display the **Solid Edit** toolbar.
- 2 Click  to display the **Replace Faces** dialog.

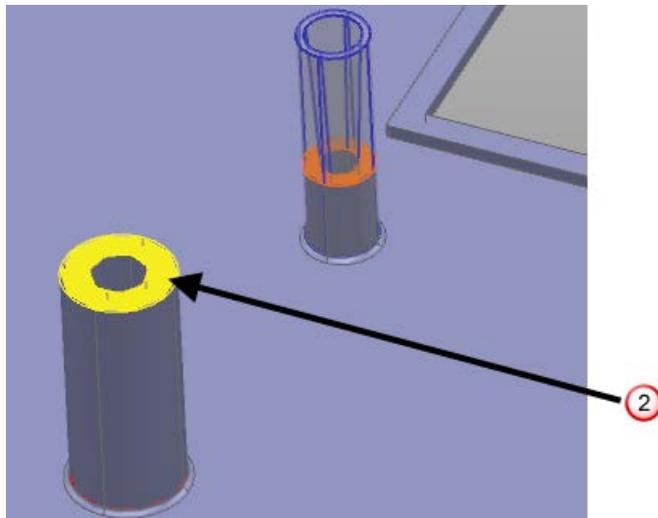


- 3 Select the original face ①. This is the face that will be replaced.

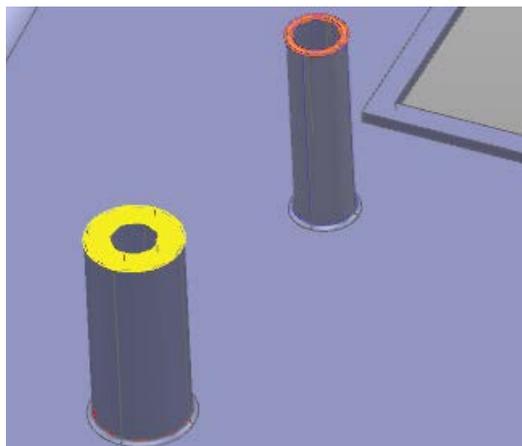


You can select the original faces before clicking  on the **Solid Edit** toolbar. In this case, there will be a ✓ next to **Select original faces**.

- 4 Select the replacement face ②. The preview of the updated face is displayed.



- 5 Click **Apply** to display the updated model.



---

# Feature recognition and editing

Use **Edit mode**  on the feature dialogs to recognise feature-like geometry in a solid.

Direct modelling will recognise geometry for the following and create appropriate solid features:

- Holes (see page 34)
- Pocket/Protrusion (see page 36)
- Cut (see page 38)
- Boss (see page 40)
- Fillet (see page 42)

## Hole recognition & editing

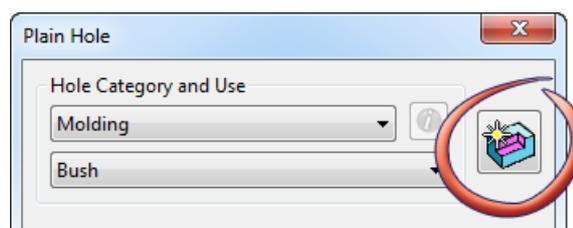
Use the **Edit mode**  button on the **Hole** dialog to identify holes on a dumb solid or a solid created from surfaces

- 1 Select solid to display the **Solid Edit** toolbar.

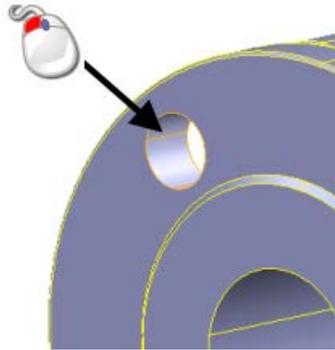


- 2 Select  (*Solid feature toolbar*) to display the **Hole** dialog.

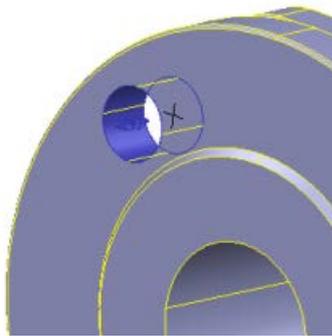
- 3 Click the **Edit mode**  button on the **Hole** dialog.



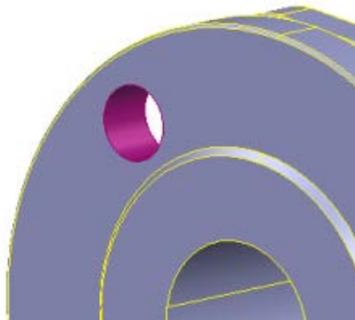
- 4 Move the cursor over the solid. When a hole is recognised it is highlighted.



- 5 Click to select the hole.

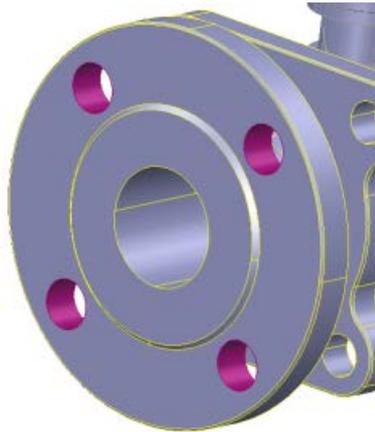


- 6 Use the **Hole** dialog to edit the hole as required.
- 7 Click **Apply** to make the changes and create a hole feature.

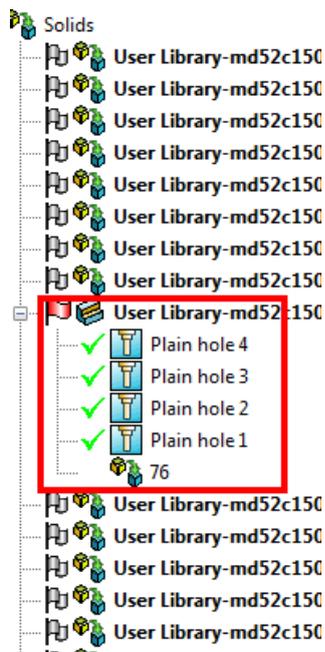


**Edit mode** remains active.

- 8 Create the remaining three holes on the plate.



- 9 Click **Cancel** to close the dialog. The new hole features are added to the solid tree.



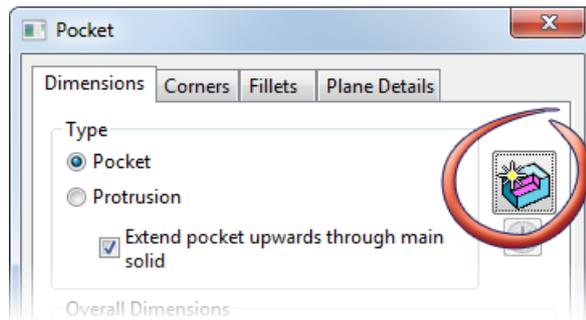
*Recognised holes can be exported to PowerMILL for drilling.*

## Pocket recognition & editing

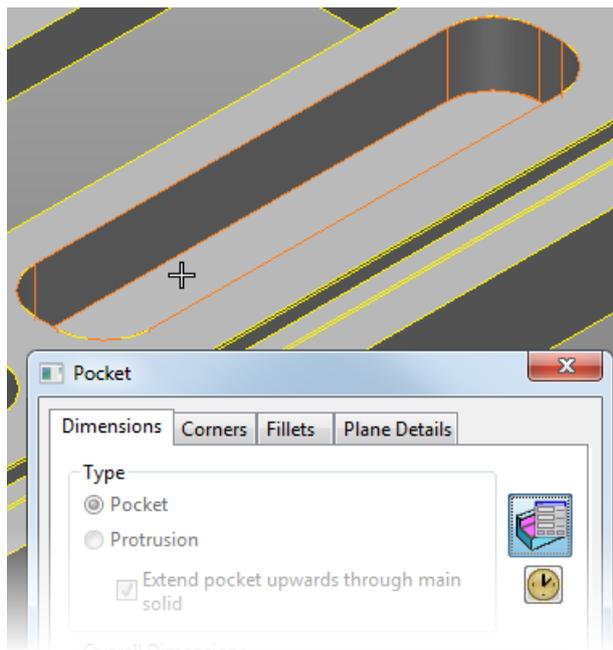
Use the **Edit mode**  button on the **Pocket** dialog to identify pocket-like geometry in a solid.

- 1 Click  (*Solid feature toolbar*) to display the **Pocket** dialog.

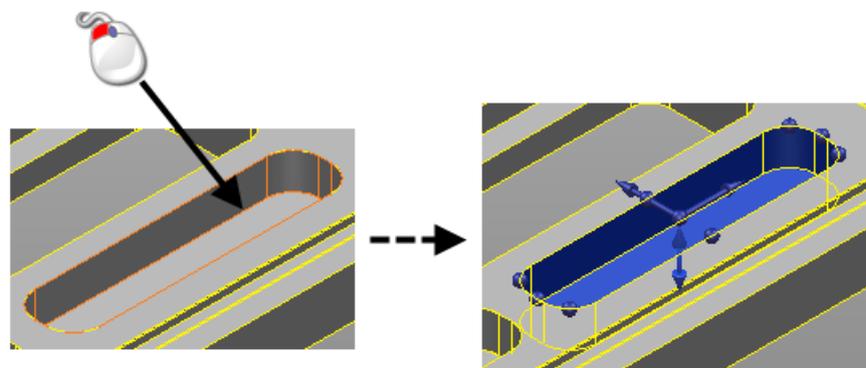
- 2 Click **Edit mode**  on the **Pocket** dialog.



- 3 Move the cursor over the model. Pocket-like geometry on the active solid is highlighted as you move the cursor over the solid.

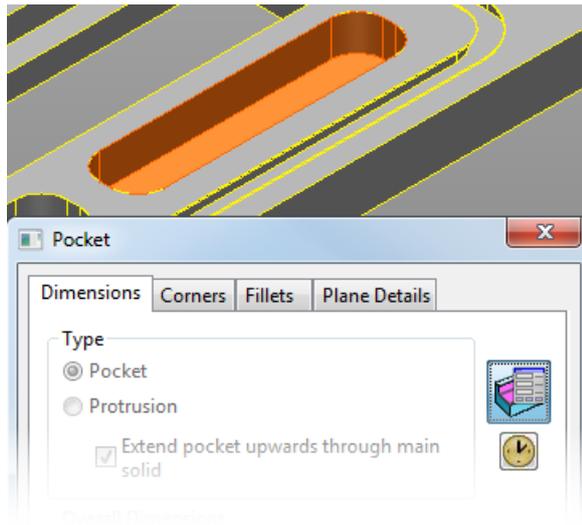


- 4 Click the required geometry to display the instrumentation.



- 5 Use the **Pocket** dialog to edit the pocket as required.

- 6 Click **Apply** to make the changes and create the pocket feature.



**Edit mode** remains active.

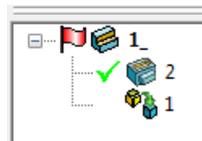
- 7 Identify more pockets or edit existing pocket features as required.



*If you want to identify multiple pockets or make changes to existing pockets without updating the geometry immediately, click  to turn on **Defer update**. The button changes to  to indicate that **Defer** is ON. Using **Defer** on multiple pockets is quicker because the tree is only updated when you click **OK**.*

- 8 Click one of the following:
- **Cancel** to close the dialog and cancel any unapplied changes.
  - **OK** to close the dialog and apply any unapplied changes.

The new pocket feature is added to the solid tree.



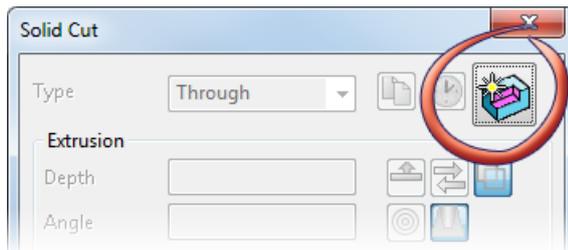
*Protrusion recognition and editing works in a similar way.*

## Cut recognition & editing

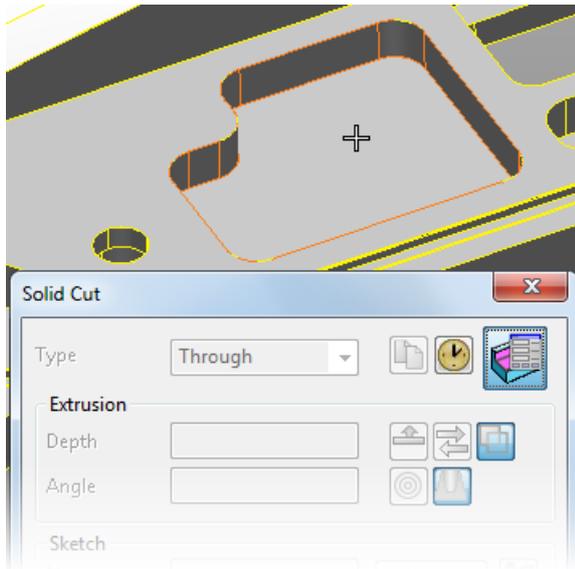
Use the **Edit mode**  button on the **Cut** dialog to identify cut-like geometry in a solid.

- 1 Click  (*Solid feature toolbar*) to display the **Cut** dialog.

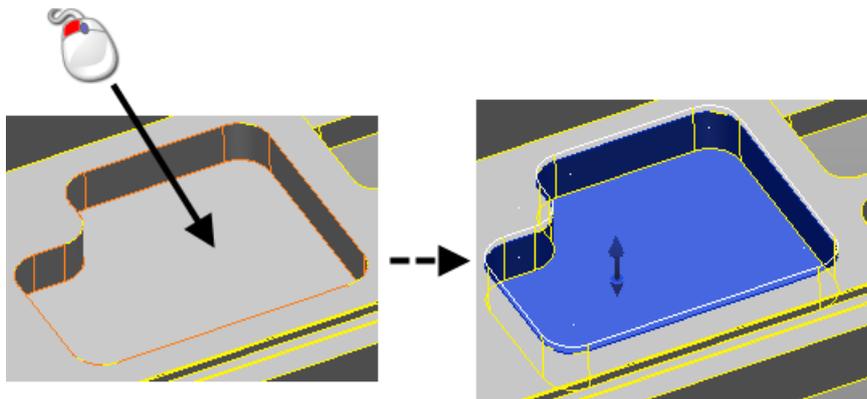
- 2 Click **Edit mode**  on the **Cut** dialog.



- 3 Move the cursor over the model. Cut-like geometry on the active solid is highlighted as you move the cursor over the solid.

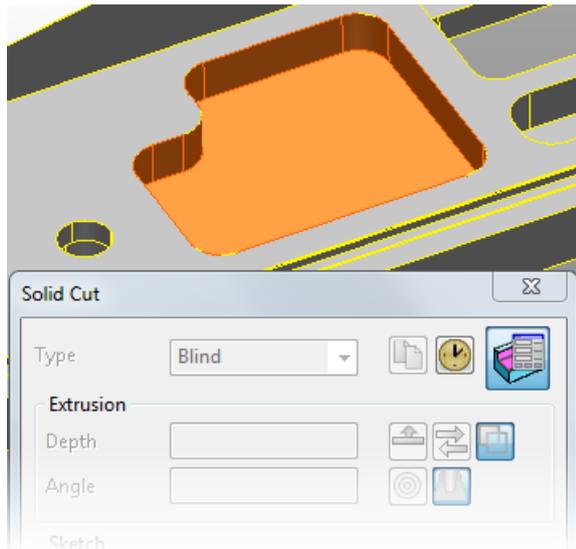


- 4 Click to select the required cut.



- 5 Use the **Cut** dialog to edit the cut as required.

- 6 Click **Apply** to make the changes and create the cut feature.



**Edit mode** remains active.

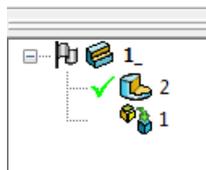
- 7 Identify more cuts or edit existing cut features as required.



*If you want to identify multiple cuts or make changes to existing cuts without updating the geometry immediately, click  to turn on **Defer update**. The button changes to  to indicate that **Defer** is ON. Using **Defer** on multiple cuts is quicker because the tree is only updated when you click **OK**.*

- 8 Click one of the following:
  - **Cancel** to close the dialog cancel any unapplied changes.
  - **OK** to close the dialog and apply any unapplied changes.

The new cut feature is added to the solid tree.

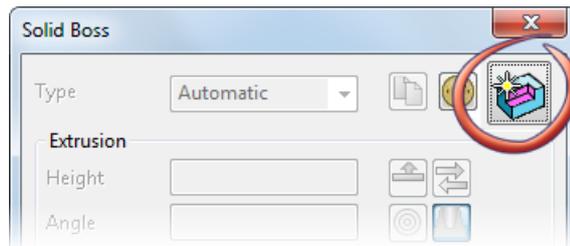


## Boss recognition & editing

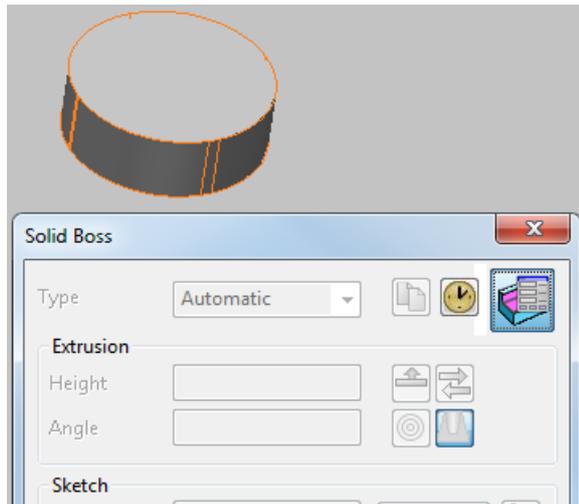
Use the **Edit mode**  button on the **Boss** dialog to identify boss-like geometry in a solid.

- 1 Click  (*Solid feature toolbar*) to display the **Boss** dialog.

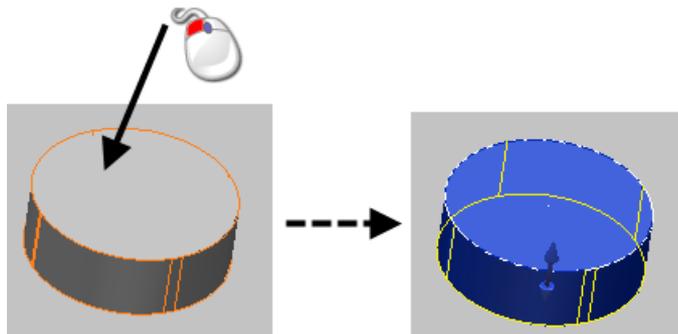
- 2 Click **Edit mode**  on the **Boss** dialog.



- 3 Move the cursor over the model. Boss-like geometry on the active solid is highlighted as you move the cursor over the solid.

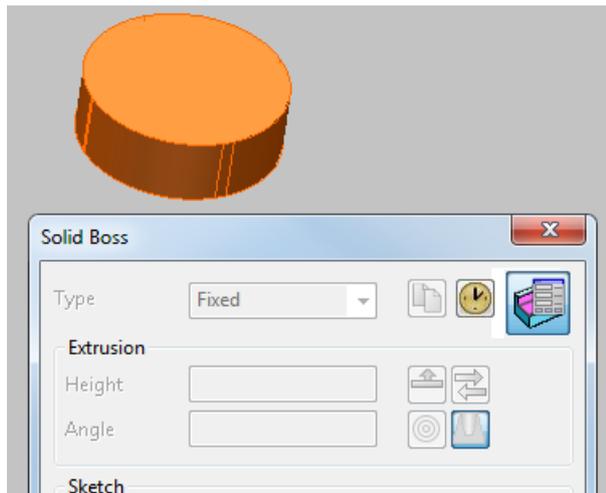


- 4 Click to select the required boss.



- 5 Use the **Boss** dialog to edit the boss as required.

- 6 Click **Apply** to make the changes and create the boss feature.



**Edit mode** remains active.

- 7 Identify more bosses or edit existing boss features as required.

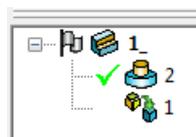


*If you want to identify multiple bosses or make changes to existing boss without updating the geometry immediately, click  to turn on **Defer update**. The button changes to  to indicate that **Defer** is ON. Using **Defer** on multiple bosses is quicker because the tree is only updated when you click **OK**.*

- 8 Click one of the following:

- **Cancel** to close the dialog cancel any unapplied changes.
- **OK** to close the dialog and apply any unapplied changes.

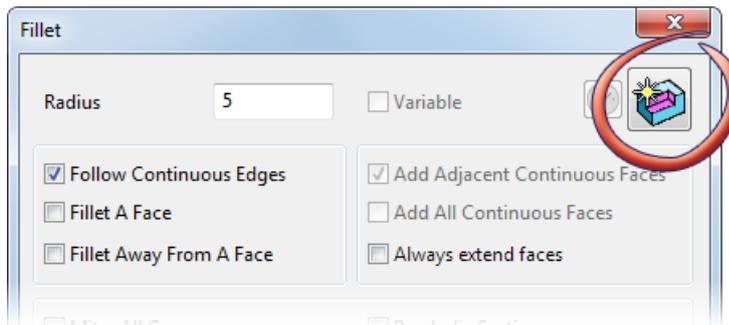
The new boss feature is added to the solid tree.



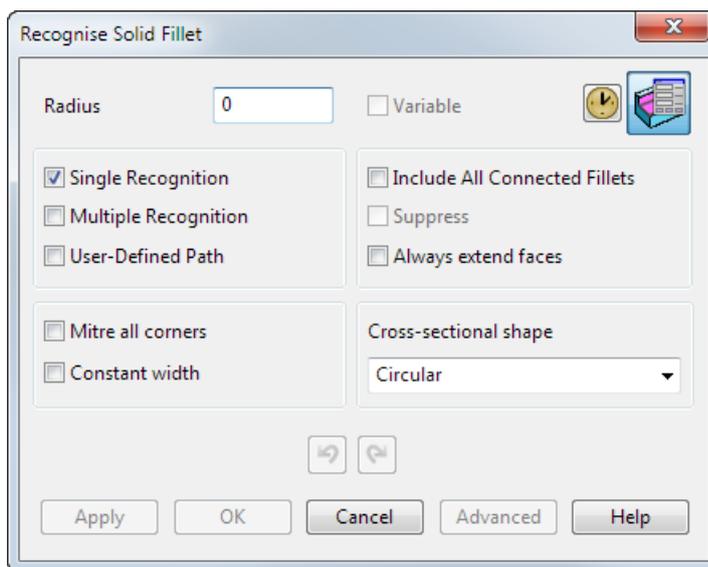
## Fillet recognition & editing

Use the **Edit mode**  button on the **Fillet** dialog to identify fillet-like geometry in a solid.

- 1 Click  (*Solid feature toolbar*) to display the **Fillet** dialog.



- 2 Click **Edit mode**  on the **Fillet** dialog to display the **Recognise Solid Fillet** dialog.



- 3 Select the appropriate editing options on the **Recognise Solid Fillet** dialog.

**Single Recognition** to use the cursor to recognise the fillets (default).

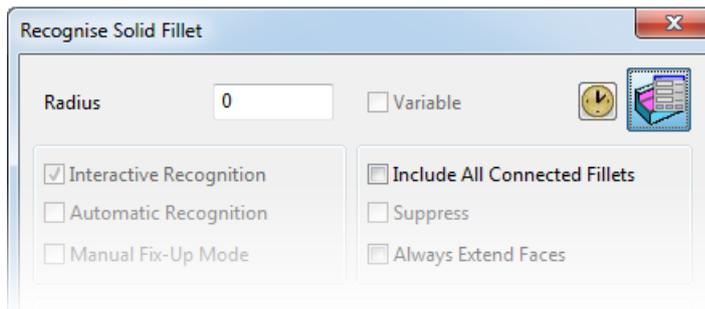
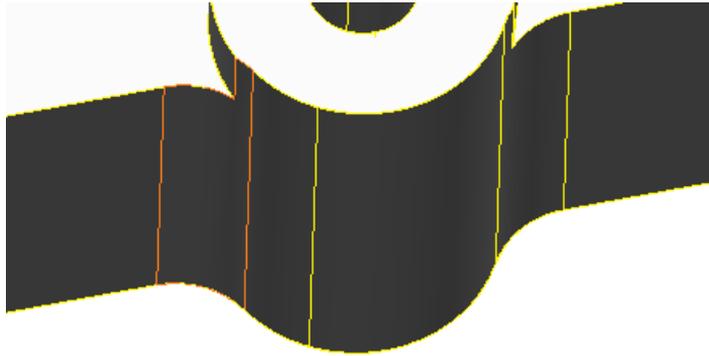
**Multiple Recognition** to automatically recognise all fillets

**User-Defined Path** to edit the fillet recognition selection.

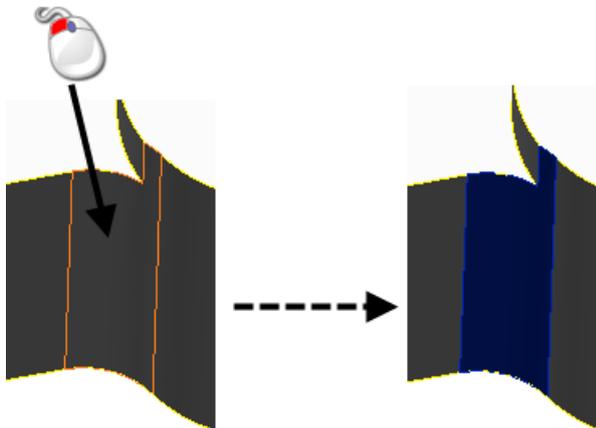
**Include All Connected Fillets** to include all fillet faces that are directly or indirectly connected.

**Suppress** to create a suppressed feature, effectively removing the fillet faces and healing the solids.

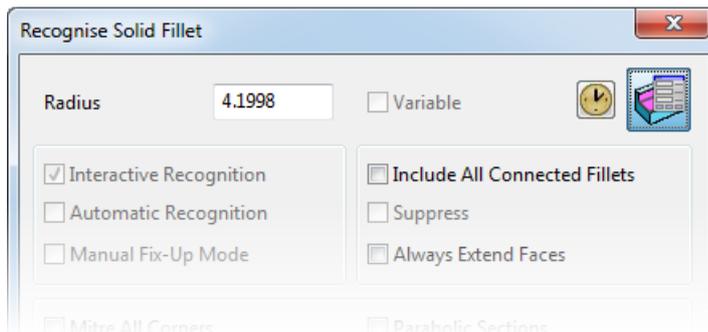
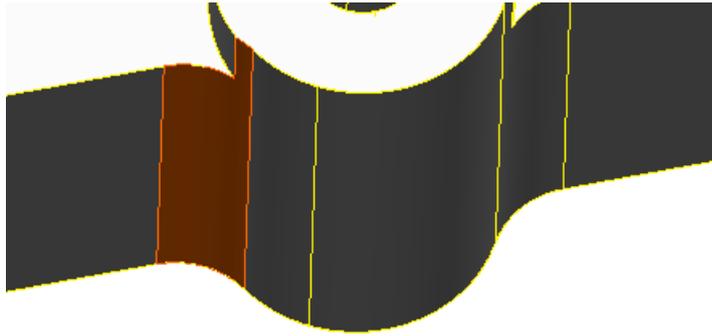
- 4 Move the cursor over the model. Fillets on the active solid are highlighted as you move the cursor over them.



- 5 Click to select the required fillet.



- 6 Click **Apply** to make the changes and create the fillet feature.



**Edit mode** remains active.

- 7 Identify more fillets or edit existing fillet features as required.

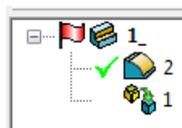


*If you want to identify multiple fillets or make changes to existing fillets without updating the geometry immediately, click  to turn on **Defer update**. The button changes to  to indicate that **Defer** is ON. Using **Defer** on multiple fillets is quicker because the tree is only updated when you click **OK**.*

- 8 Click one of the following:

- **Cancel** to close the dialog cancel any unapplied changes.
- **OK** to close the dialog and apply any unapplied changes.

The new fillet feature is added to the solid tree.



## Using General Editing on faces

The following **General Edit** operations can be used on faces of a solid as part of the **Direct Modelling** functionality:

**Move** (see page 46)

**Rotate** (see page 53)

**Mirror** (see page 59)

**Offset** (see page 62)

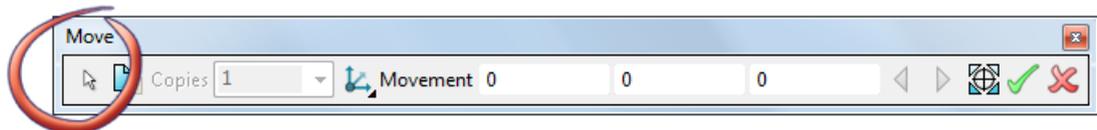
**Scale** (see page 64)



Use **Divide Face** (Solid Edit toolbar) to divide the faces of the selected solid using wireframe. This lets you to limit the effect of general editing operations.

### Move - editing faces

When used to edit faces, there is an additional button on the toolbar. This lets you change the face you have selected while the toolbar is displayed.

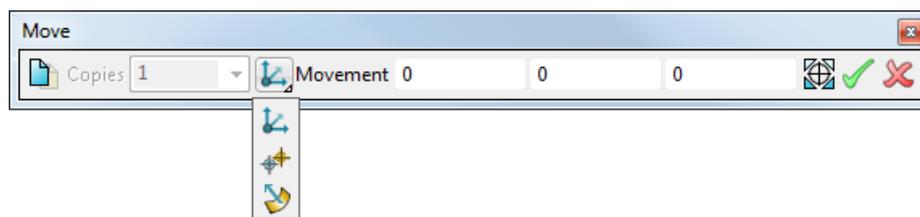


- 1 Click .
- 2 Change the face selection as required.
- 3 Click  to continue editing.



When you are in Select mode, the other buttons on the toolbar are unavailable.

In addition to entering the coordinates to define the movement direction, there are three additional ways to define the direction of movement:



Use the following buttons on the **Move** toolbar to define the movement method:

 Use a workplane axis (see page 47) .

 Use two points (see page 48).

 Use a normal (see page 51).

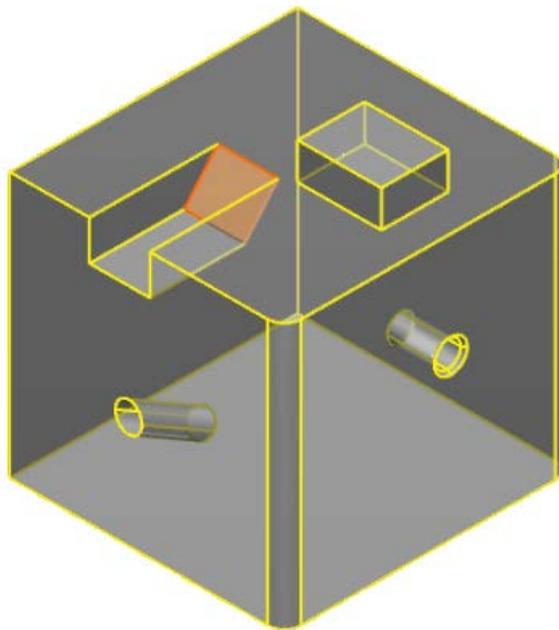


*You can enter the exact distance value in the box that is displayed when you have dragged instrumentation. If you don't to enter a value, you can ignore the box; it will disappear when you continue with your work.*

## Move - using the workplane axis

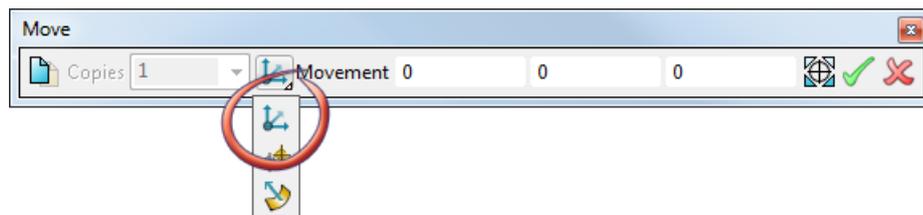
Use the flyout on the **Move** toolbar to define the movement direction using the axes of the workplane. This is the default mode.

- 1 Select the face to be moved.

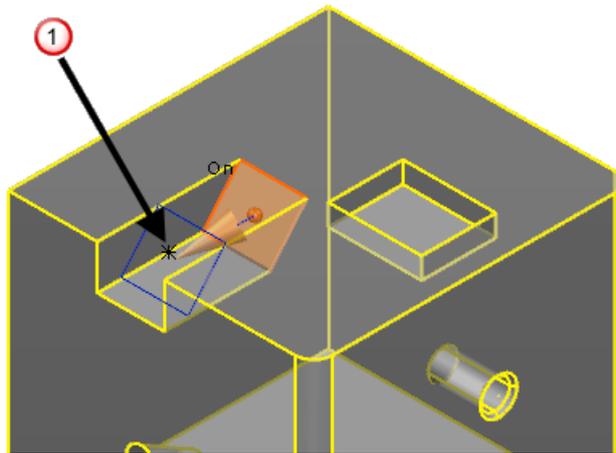


- 2 Click  (General Edits toolbar) to display the **Move** toolbar.

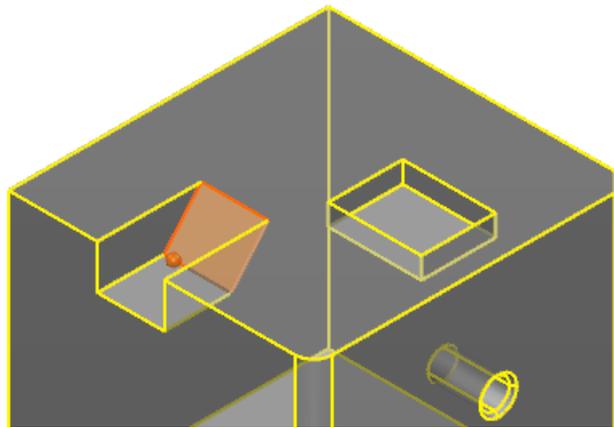
- 3 Click  (Move toolbar).



- 4 Either enter **Movement** values, or click a point **1**. The preview is displayed. Drag the instrumentation as required.



- 5 Click  to move the face and update all associated geometry.

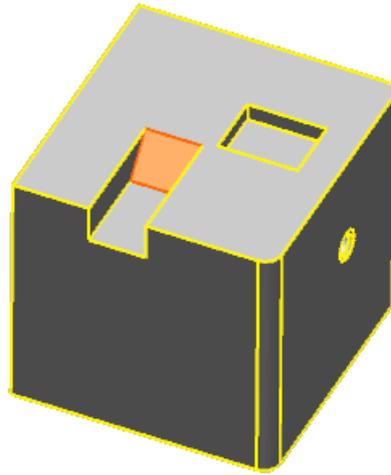


- 6 Click  to close the toolbar. The updated model is displayed.

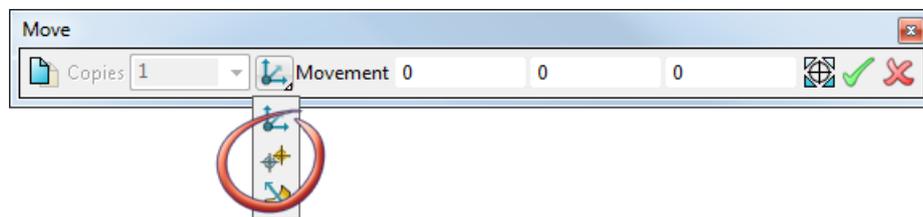
## Move - using two points to define the movement direction

Use the flyout on the **Move** toolbar to define the movement direction using two points.

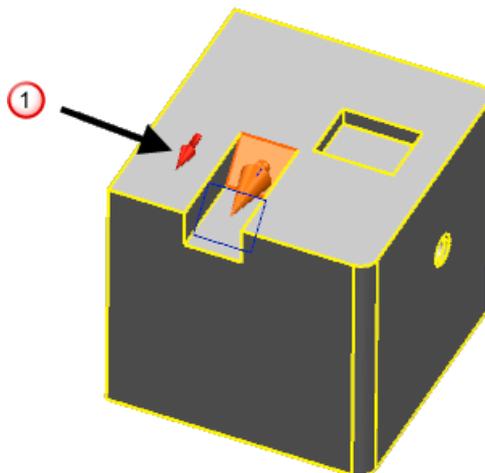
- 1 Select the face to be moved.



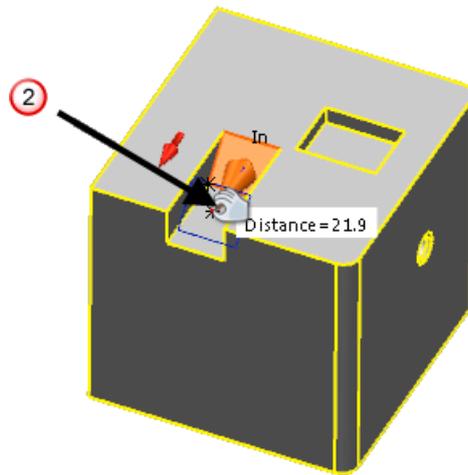
- 2 Click  (General Edits toolbar) to display the **Move** toolbar.
- 3 Click  (Move toolbar).



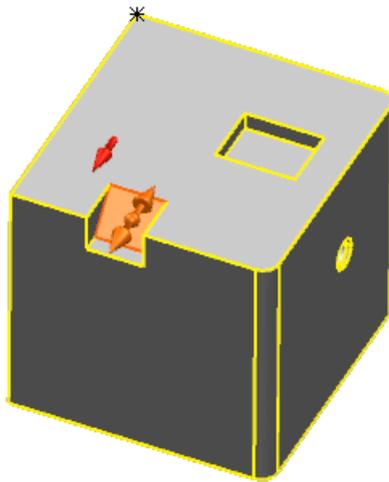
- 4 Click two points to define the move direction The instrumentation indicates the movement direction ①.



- 5 Drag the instrumentation. ②. The instrumentation can only be moved along the direction of movement. The **Distance** updates as you drag the instrumentation.

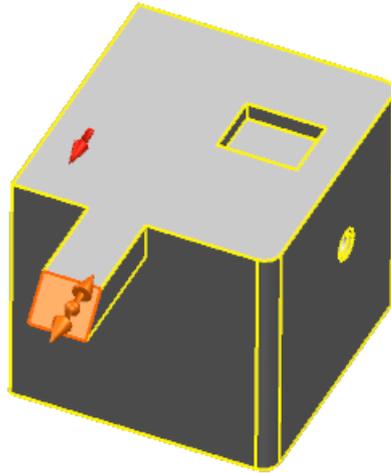


- 6 Click  to move the face and update all associated geometry.





If you move the face outside the model, the geometry will still be updated to reflect the move.

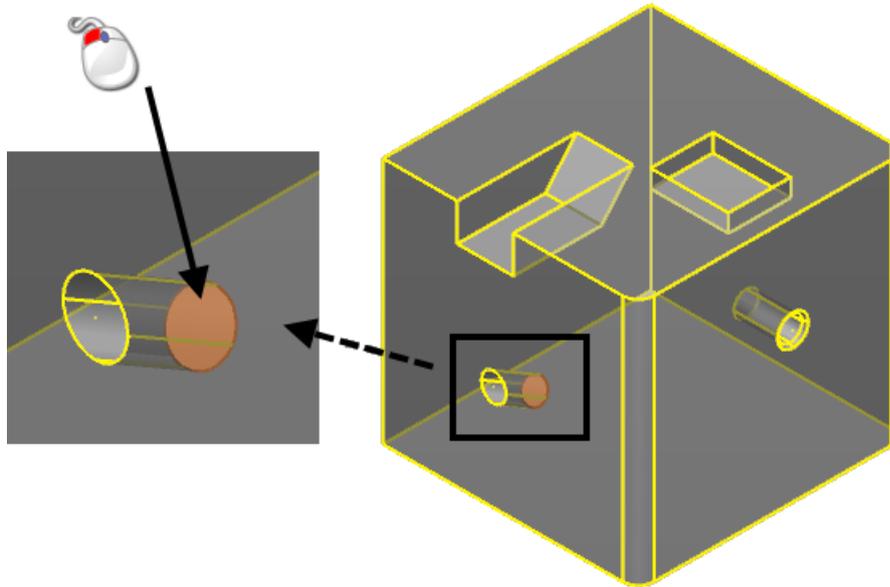


- 7 Click  to close the toolbar. The updated model is displayed.

## Move - using the normal of an item to define the movement

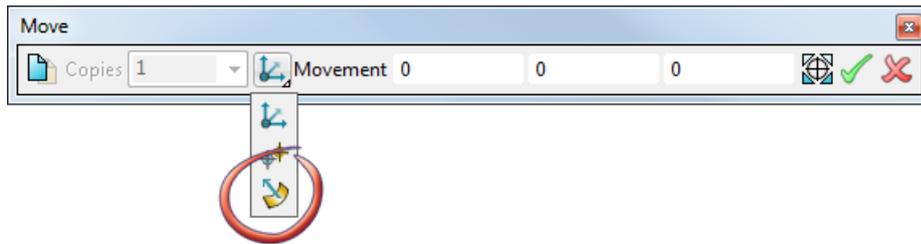
Use the flyout on the **Move** toolbar to define the movement direction using an item.

- 1 Select the face to be moved.



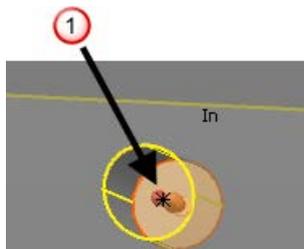
- 2 Click  (*General Edits toolbar*) to display the **Move** toolbar.

- 3 Click  (*Move toolbar*).

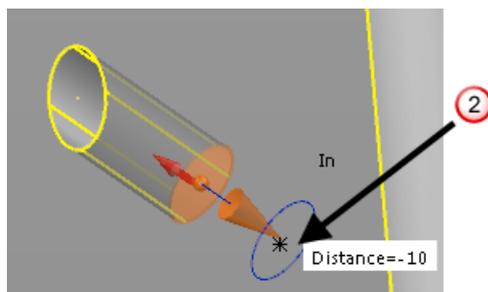


The toolbar is updated to reflect your selection.

- 4 Select an item ; it may be necessary to rotate the model manually before you can make the selection. The move direction will be the normal to the geometry at that point. The instrumentation indicates the movement direction.

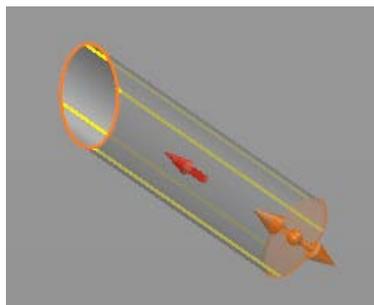


- 5 Enter a **Distance** or drag the instrumentation and click to fix the location .

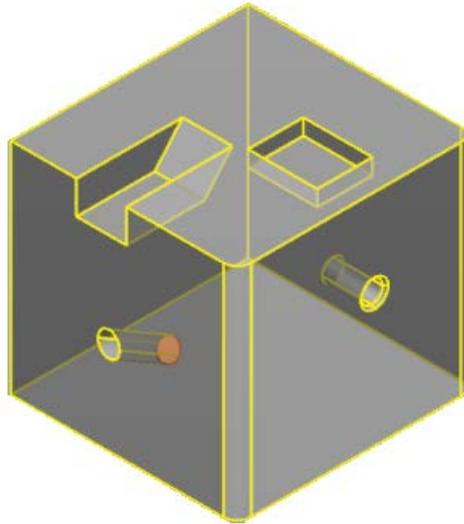


*If you drag the instrumentation, you can only be move along the direction of movement. The **Distance** tip updates as you drag the instrumentation.*

- 6 Click  to move the face and update all associated geometry.

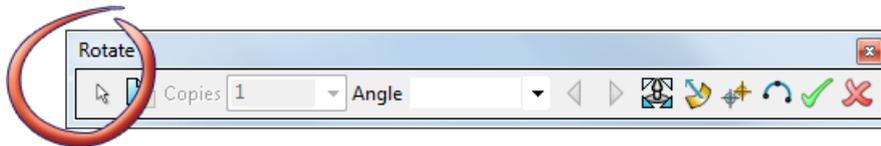


- 7 Click  to close the toolbar. The updated model is displayed.



## Rotate - editing faces

When used to edit faces, there is an additional button on the toolbar. This lets you change the face you have selected while the toolbar is displayed.



- 1 Click .
- 2 Change the face selection as required.
- 3 Click  to continue editing.



*When you are in Select mode, the other buttons on the toolbar are unavailable.*

In addition to entering the angle to define the rotation, there are three additional ways to define the direction of movement:

Using a normal as the rotation axis (see page 54)

Using two points to define the rotation axis (see page 56)

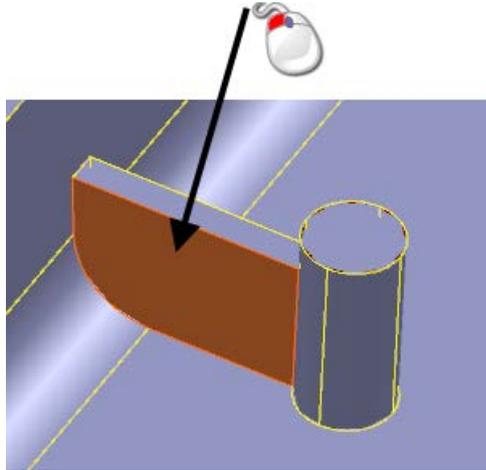
Using three points to define an arc as the rotation axis (see page 58)



*You can enter the exact angle value in the box that is displayed when you have dragged instrumentation. If you don't to enter a value, you can ignore the box; it will disappear when you continue with your work.*

## Rotate - using the normal of an item as the rotation axis

- 1 Select the face to be rotated.

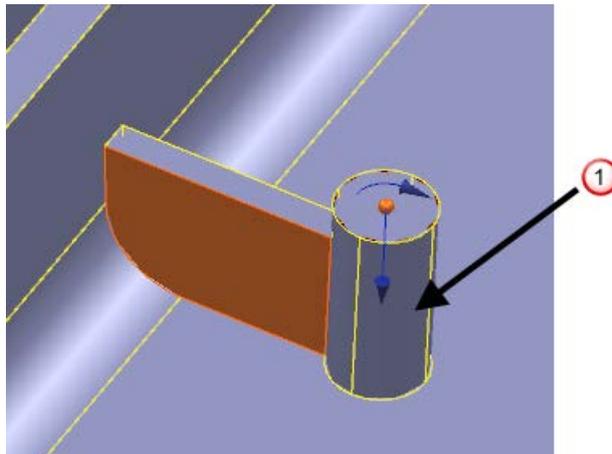


- 2 Click  (General Edits toolbar) to display the **Rotate** toolbar.

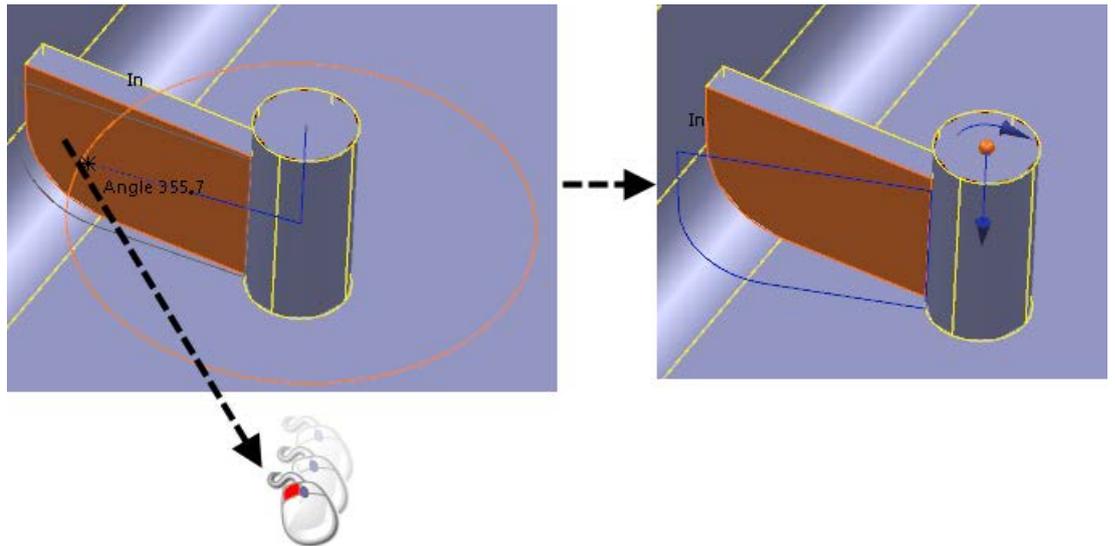
- 3 Click  to select the option to define the rotation axis using a normal. The toolbar is updated to indicate the next selection to be made.



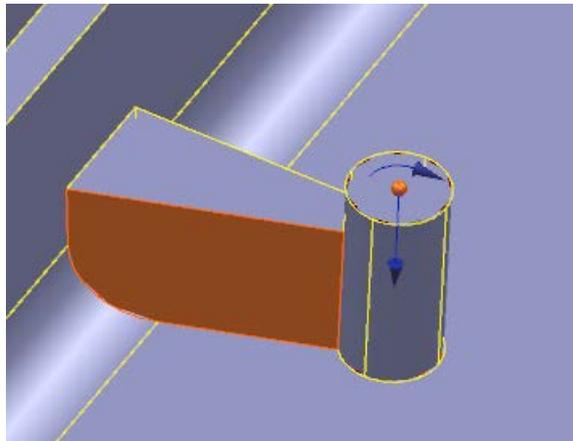
- 4 Click on geometry . The rotation axis is aligned to the selected normal.



- 5 Specify the **Angle** by entering a value in the toolbar.  
Alternatively, click and drag the face as shown below:



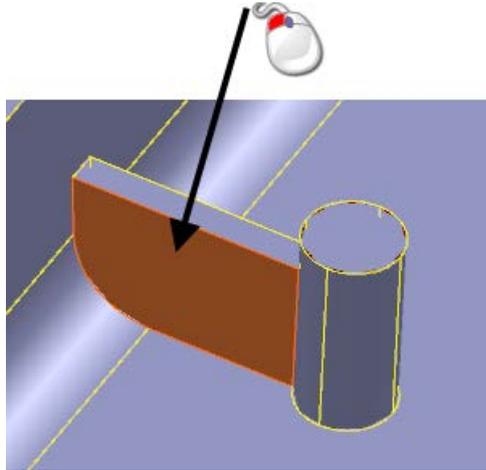
- 6 Release the mouse button when the face is in the required position.
- 7 Click . The face is displayed in the new location; all associated geometry has been automatically updated.



- 8 Click  to close the toolbar.

## Rotate - using two points to define the rotation axis

- 1 Select the face to be rotated.

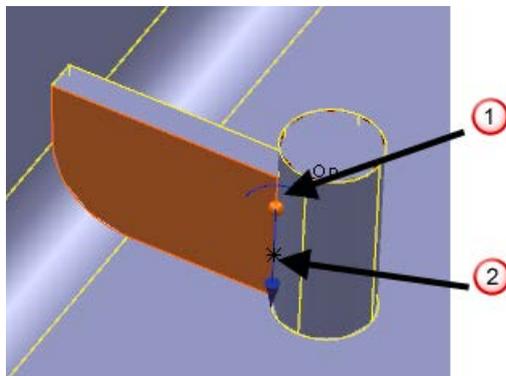


- 2 Click  (General Edits toolbar) to display the **Rotate** toolbar.

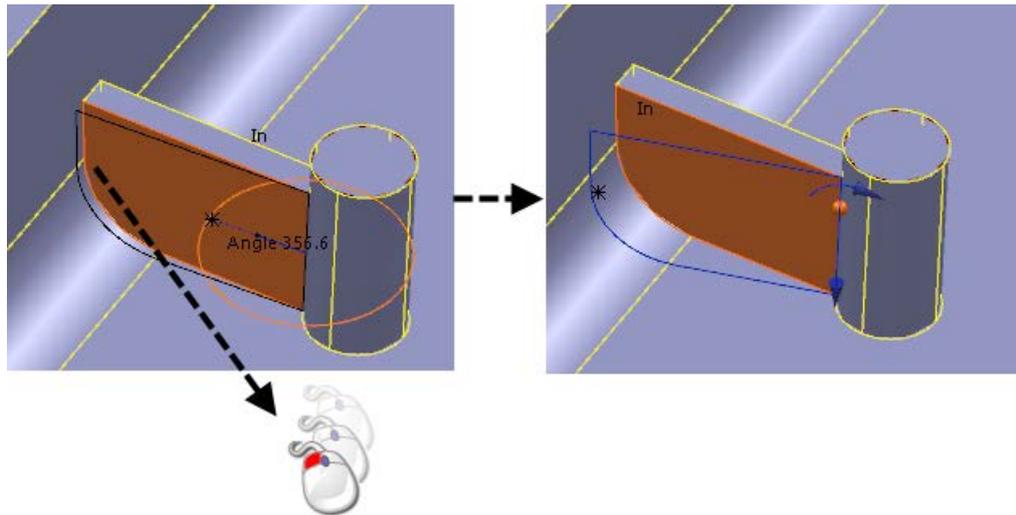
- 3 Click  to select the option to define the rotation axis using two points. The toolbar is updated to indicate the next selection to be made.



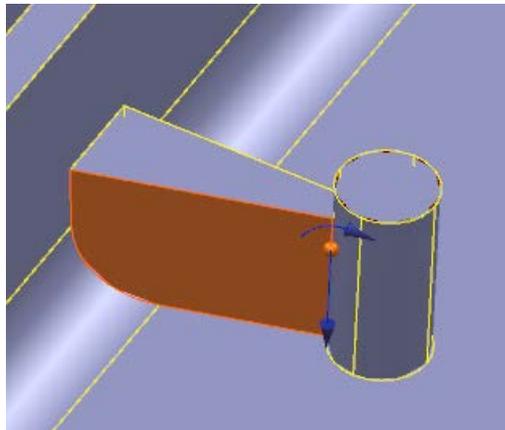
- 4 Select first point **1**. The toolbar is updated to indicate the next selection to be made.
- 5 Select second point **2**.



- 6 Specify the **Angle** by entering a value in the toolbar.  
Alternatively, click and drag the face as shown below:



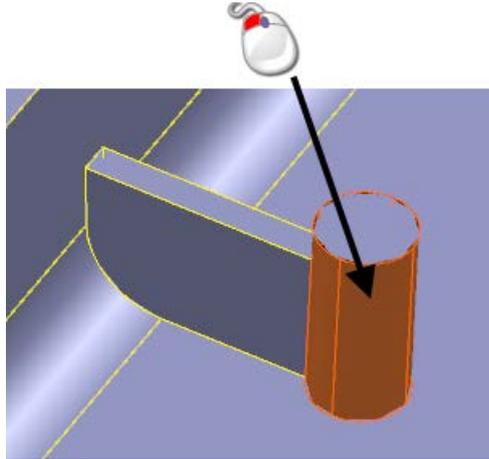
- 7 Release the mouse button when the face is in the required position.
- 8 Click . The face is displayed in the new location; all associated geometry has been automatically updated.



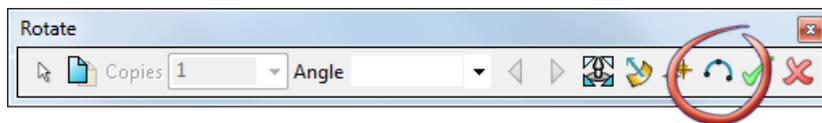
- 9 Click  to close the toolbar.

## Rotate - using three points to define an arc

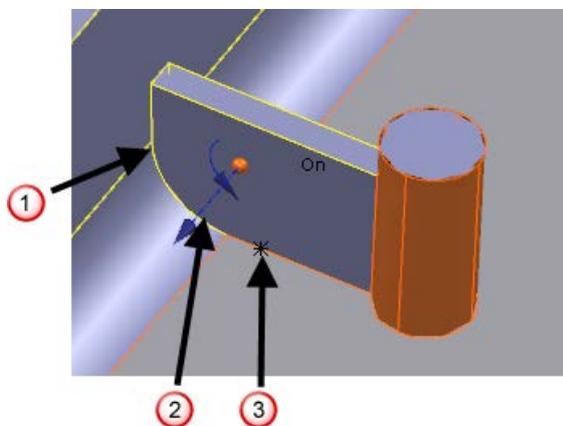
- 1 Select the face to be rotated.



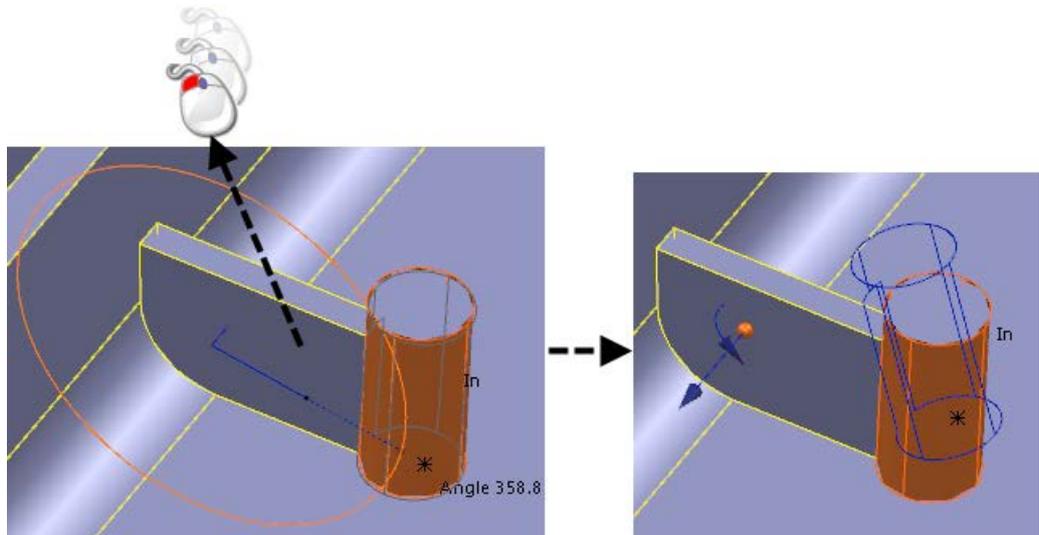
- 2 Click  (*General Edits toolbar*) to display the **Rotate** toolbar.
- 3 Click  to select the option to define an arc using three points.



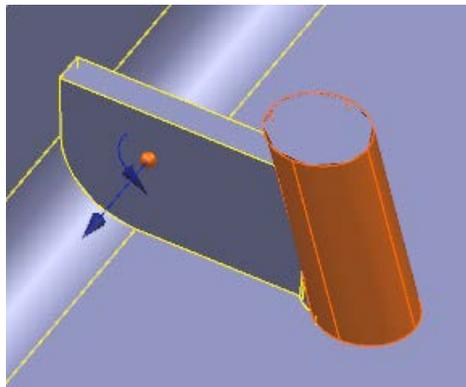
- 4 Select the first point . The toolbar is updated to indicate the next selection to be made.
- 5 Select the second point . The toolbar is updated to indicate the next selection to be made.
- 6 Select the third point of the arc . The rotation axis is created at the centre of the arc.



- 7 Specify the **Angle** by entering a value in the toolbar. Alternatively, click and drag the face as shown below:



- 8 Release the mouse button when the face is in the required position.
- 9 Click . The face is displayed in the new location; all associated geometry has been automatically updated.

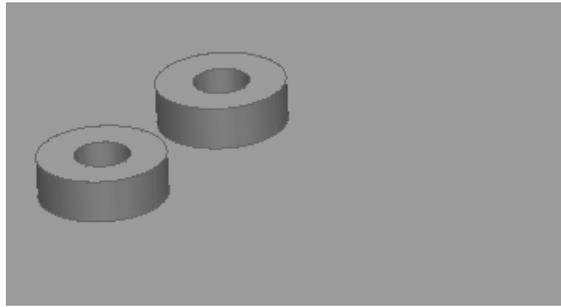


- 10 Click  to close the toolbar.

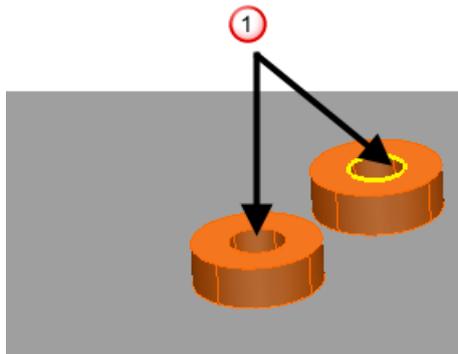
## Mirror - an example

Use **Mirror**  to mirror selected faces.

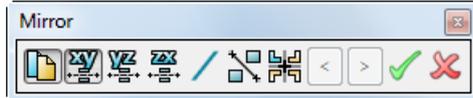
- 1 Zoom in and rotate the model so that the details are clearly visible.



- 2 Select the faces to mirror **1**.

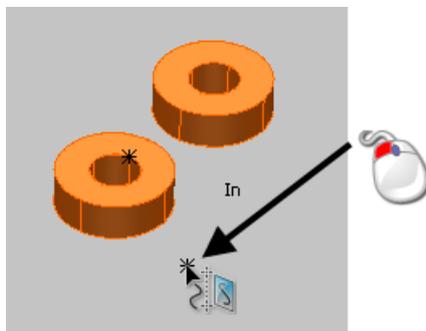


- 3 Click  (*General Edit toolbar*) to display the **Mirror** toolbar.

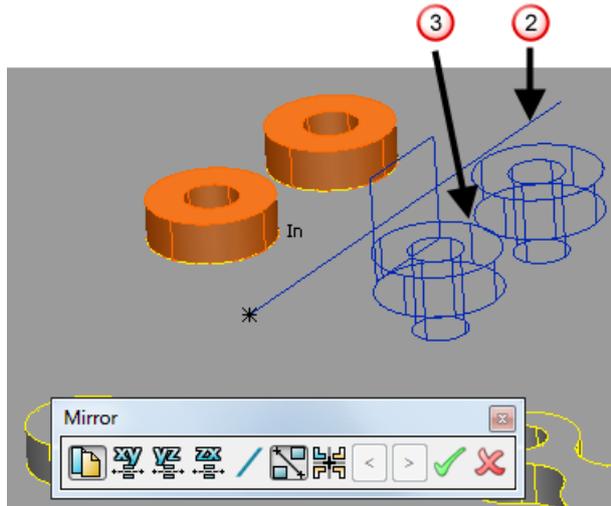


- 4 Click . The cursor changes to .

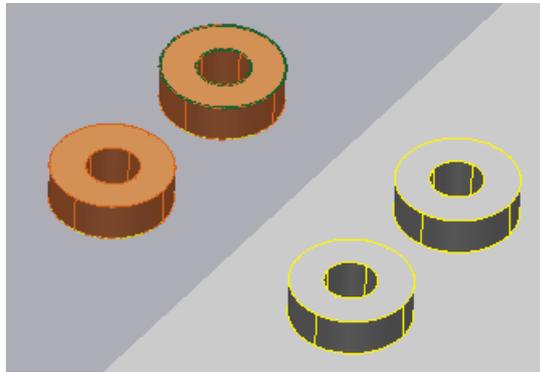
- 5 Click to define the start point of the mirror plane. As you move the mouse, the line and the mirrored objects are displayed.



- 6 Click to define the end point of the mirror plane. The mirror plane is displayed (2) with a preview of the mirrored object (3).



- 7 Click ✓ to update the model.

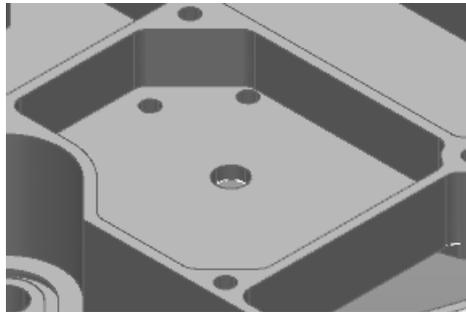


- 8 Click ✗ to close the toolbar.

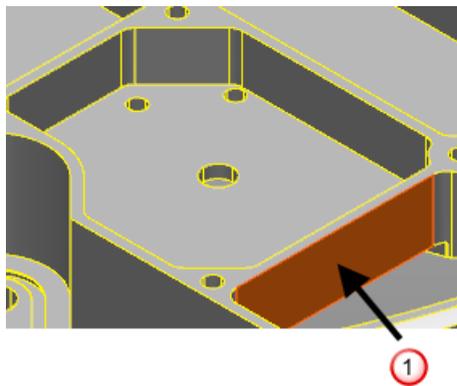
## Offset - an example

Use **Offset**  to offset the selected faces by a specified distance.

- 1 Zoom in and rotate the model to make the details clearly visible.



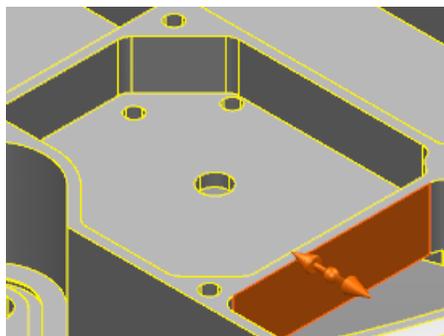
- 2 Select a face to be offset .



- 3 Click  (*General Edit toolbar*) to display the **Offset** toolbar.

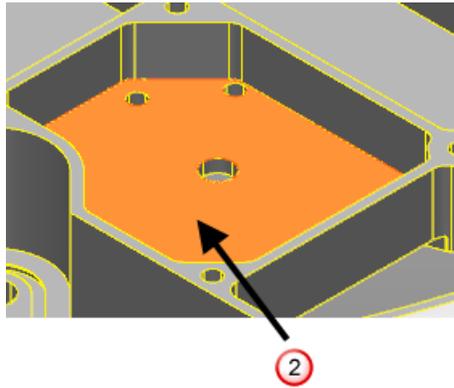


A drag handle is displayed:

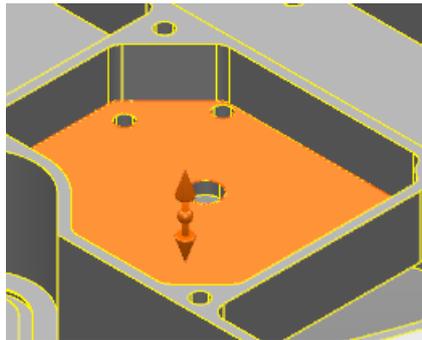


- 4 Click  to start selection mode.

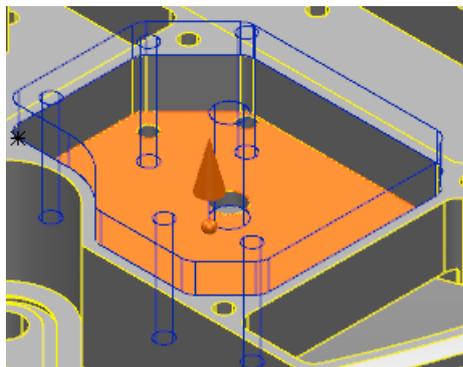
- 5 Click a different face **2**.



- 6 Click  to leave selection mode. The drag handle is displayed on the face you have just selected.

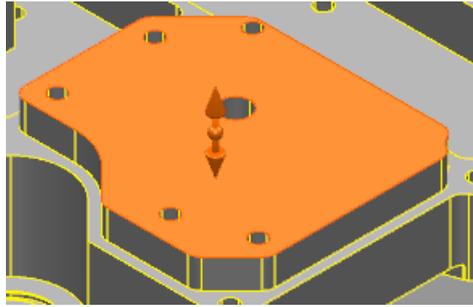


- 7 Use the drag handle to create the offset from the selected face by **24**. The **Distance** value on the toolbar is updated when you release the mouse button after dragging the handle. The offset to the face is previewed.



*Alternatively, if you want to specify the the offset as a value, enter the offset **Distance** of **24**.*

- 8 Click ✓ accept the offset.

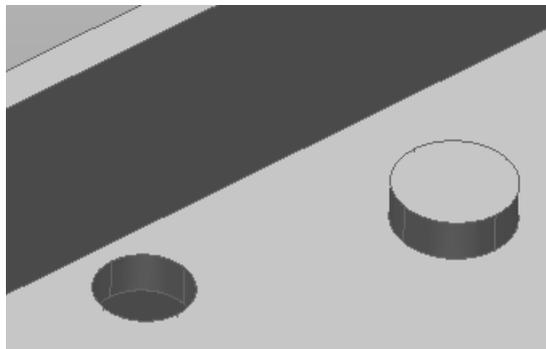


- 9 Click ✕ to close the toolbar.

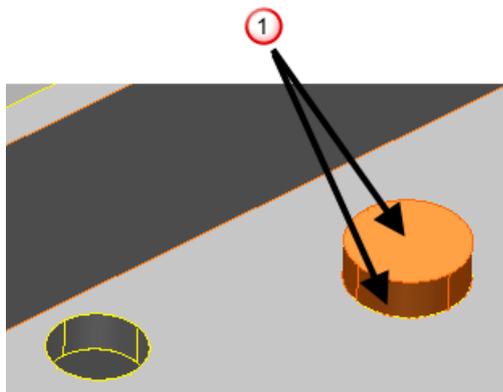
## Scale - an example

Use **Scale**  to move a selected face.

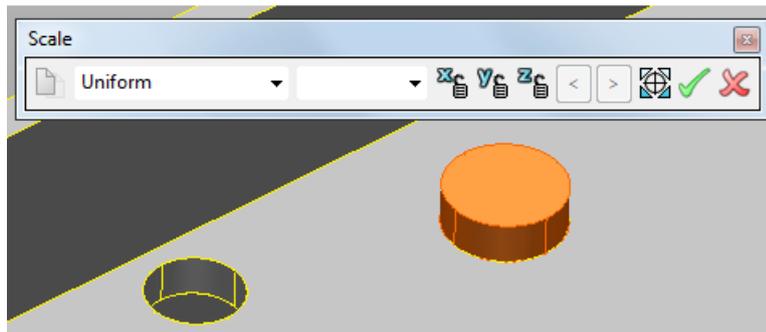
- 1 Zoom in and rotate the model so that the details are clearly visible.



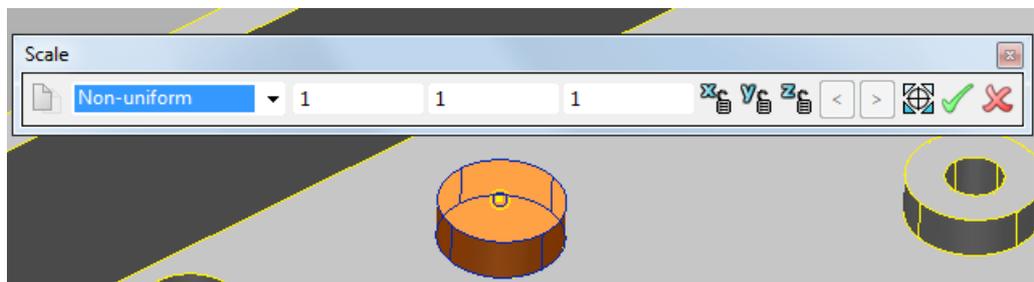
- 2 Select the faces to scale ①.



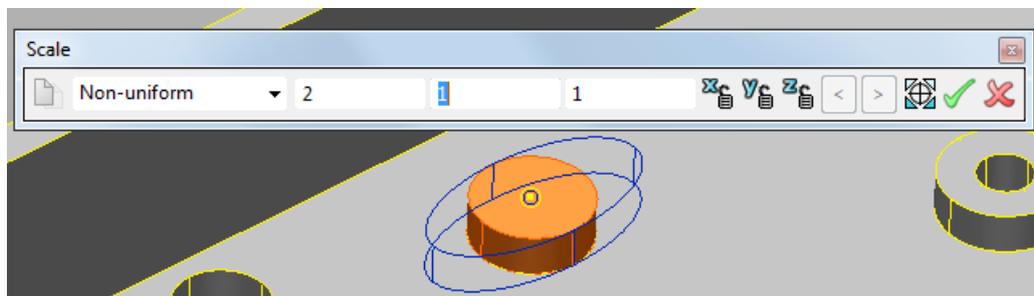
- 3 Click **Scale**  (General Edit toolbar) to display the **Scale** toolbar.



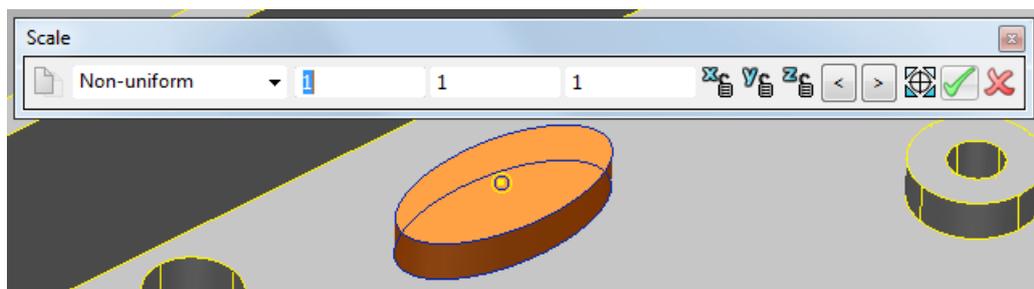
- 4 Select **Non-uniform** from the drop-down list.
- 5 Click  and click the centre of the selection to create a scale origin. The **Scale** toolbar is updated.



- 6 Enter an X value of **2** as the scaling factor.. After entering the value, press the **Tab** key.  
The preview displays the changes that will be made when the scaling factor is applied.



- 7 Click  to apply the scaling factor and update the model.



- 8 Click  to close the toolbar.

