

VirtuSurv Revit Tutorial: Creating a new Window Family

Software used: Revit Architecture 2015, VirtuSurv with Revit Link 15.0

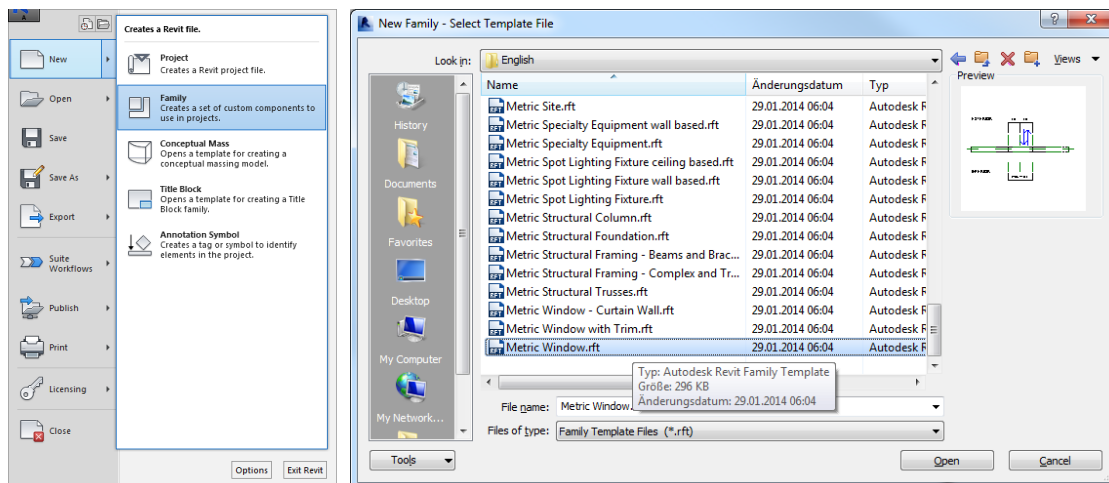
Let's start

Please load the sample project from the VirtuSurv web site and open it, if you have not done so already. You can find it under following web link: <http://download.kubit.de/VirtuSurv/Examples/>.

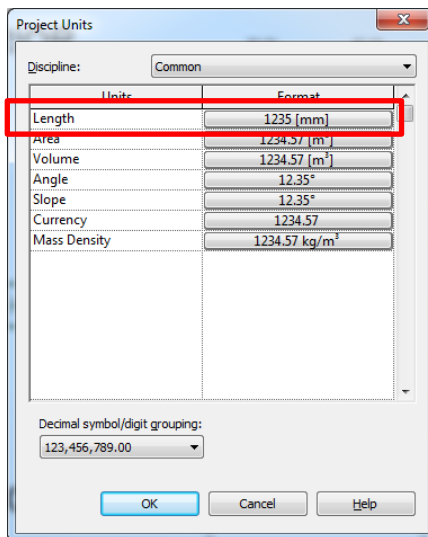
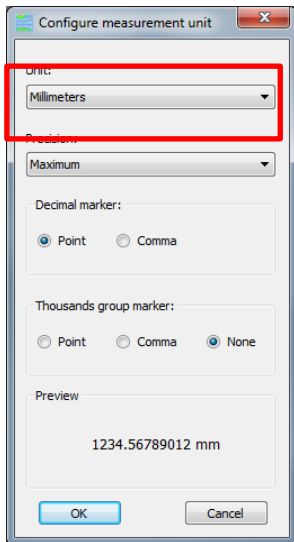
You may also start VirtuSurv and hit the icon  in the Welcome screen to access this website.

Download the EXAMPLE02_KUBIT_HOUSE_FIVESCANS.ZIP file. Save it to your computer and then decompress it.

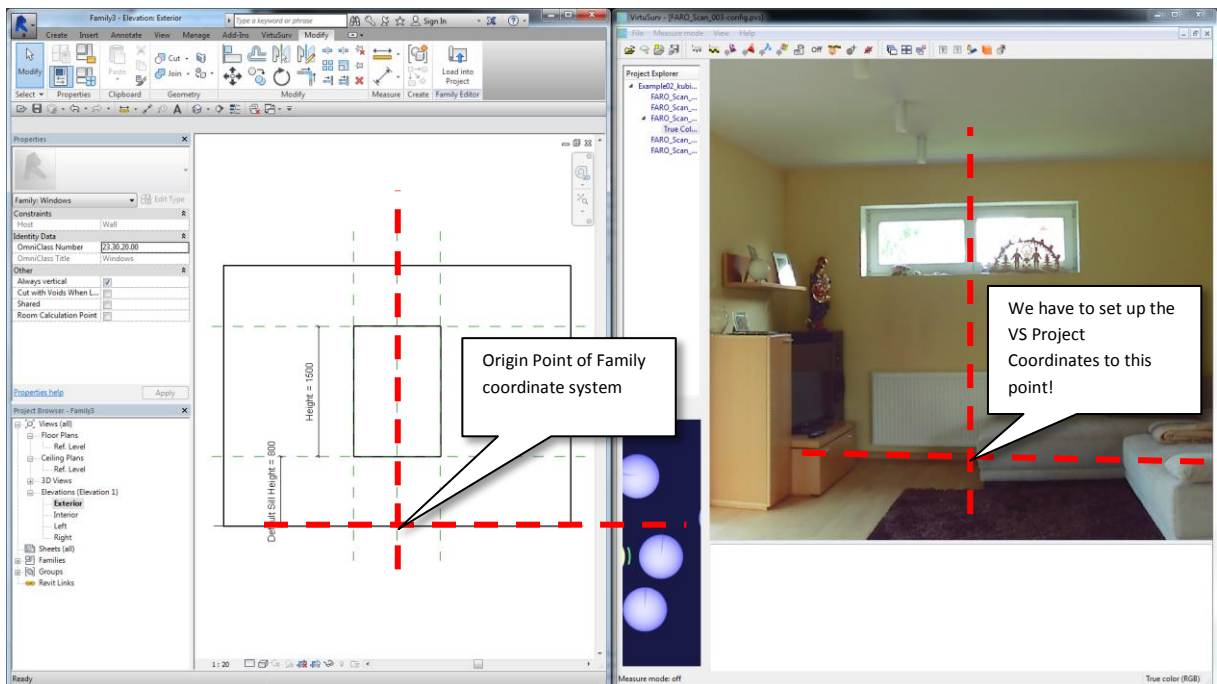
Start Revit and create a new Family choosing a Window template (e.g. "C:\ProgramData\Autodesk\RAC 2015\Family Templates\English\Metric Window.rft").




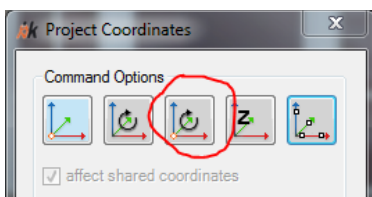
Change the measure unit in VirtuSurv to the same unit as the family file (in Revit: Ribbon: Manage → Group: Settings → Project Units).



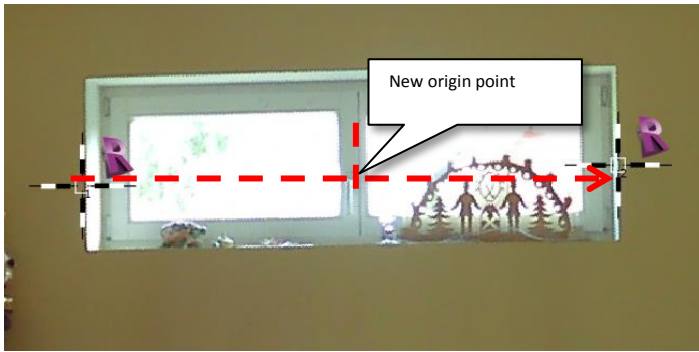
Before we can start modelling, you have to set up the VirtuSurv project coordinates! That means, we have to define the origin point and the orientation for the Family inside VirtuSurv:



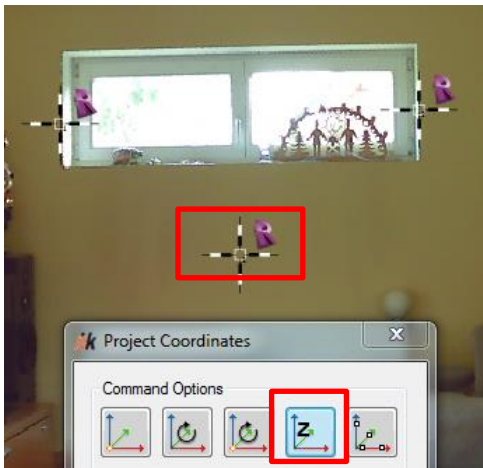
In VirtuSurv start the “project coordinates” command  and choose the option „origin and orientation”:



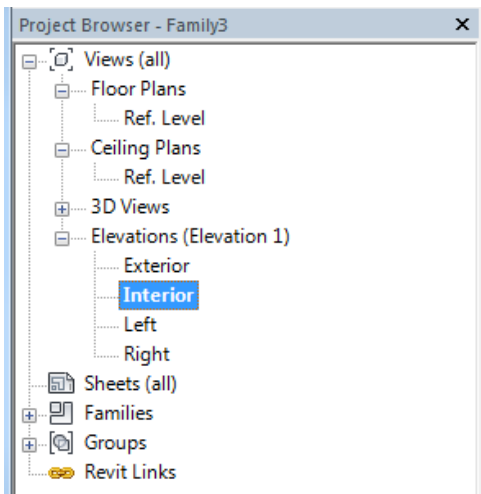
Click two points at the edges of the window in Scan_003 (left to right). This will set up the orientation of the x-axis and also the origin point exactly in the middle of the two clicked points:




Now choose the “z height” option and click a point a few centimeters below the window. It need not be exact because the sill height will be parameterized later:




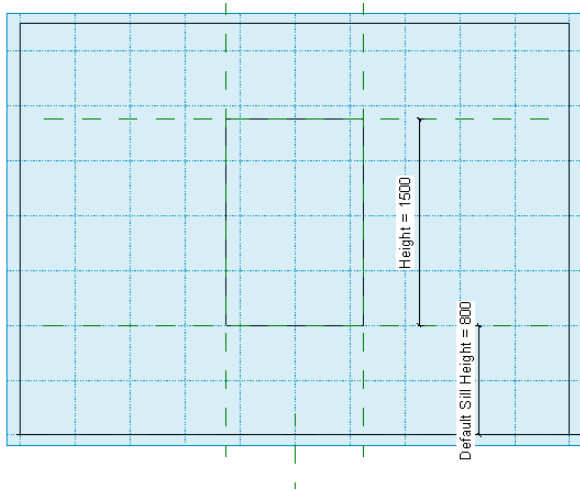
In Revit switch to the “Interior” elevation view (double click on the Project Browser entry):





Now we want to start modelling some 3d lines as construction guides for later detailing. To ensure that all lines are on the same work plane, we should set the active Revit work plane to the wall face.

In Revit use the “Set work plane” tool (Ribbon: Create → Group: Work Plane → Set ). Choose “Pick a plane” in the dialog and click [OK].

Move the mouse cursor over the wall bounding, so that it is highlighted and click left mouse button. Now the interior wall face is set as active work plane. You can check this by choosing “Show Work Plane”  (Ribbon: Create → Group: Work Plane → Show Work Plane):

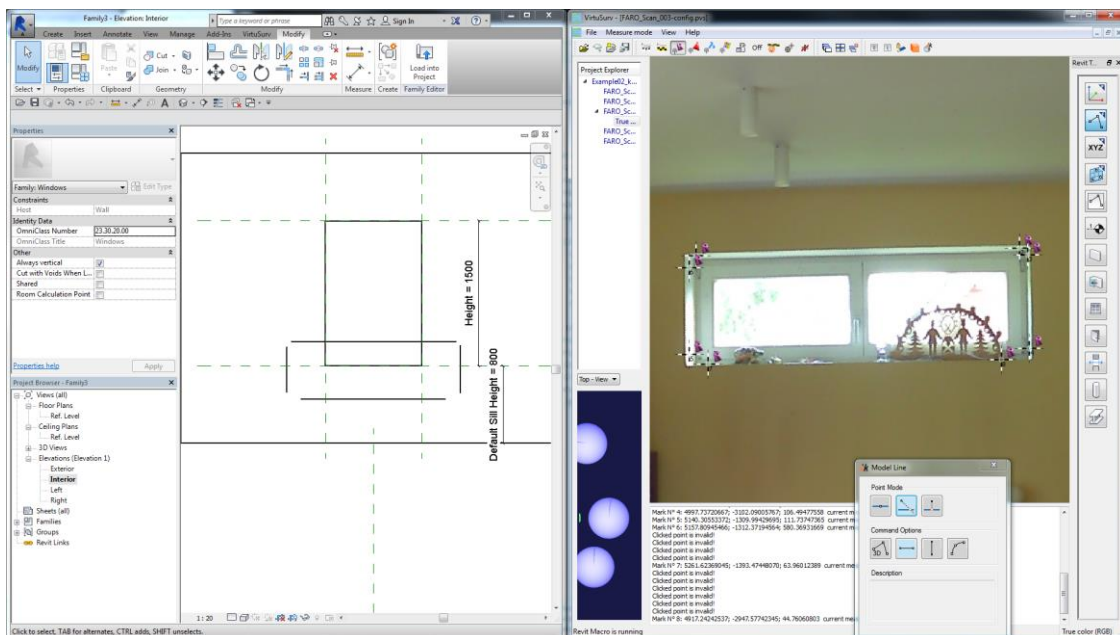


Hint: When Revit expects a selection from the user, you can move the mouse over the element. The first element will be highlighted. Now you can switch through all elements “under” the mouse cursor with [tab]. If the right object is highlighted you can confirm the selection by clicking the left mouse button.


In VirtuSurv start the “3d model line”  command and choose the “Plumb point mode” .




Now you can start drawing model lines in the reveals and lintel. The “Point Mode” ensures that the lines arise on active work plane in Revit. It is recommended to use “horizontal” and “vertical” model lines to get a more “clearer” result. But for more as-built accuracy you can also use the “3d” option.

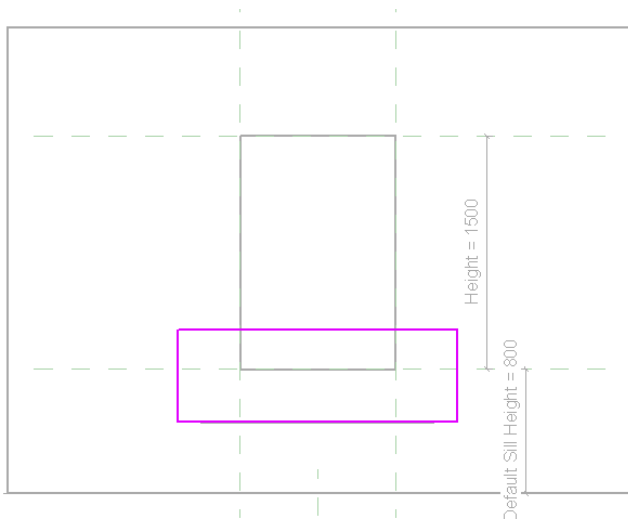
For the line at the sill you can use the “Intersection point mode”  to click point at the edge.




Now we have the “skeleton” for the new window opening. Select the opening rectangle in Revit (use the [tab] key to select the right object!). The green context Ribbon “Modify | Opening cut” appears. Select “Edit Sketch” in the Group: Opening.

Revit turns over to the “Sketch editing mode”. That means now you can only edit the previously selected element (the opening cut). Choose the “Pick Lines”  tool (Ribbon: Modify|Opening → Edit Boundary → Group: Draw) and click on all four model lines coming from VirtuSurv.

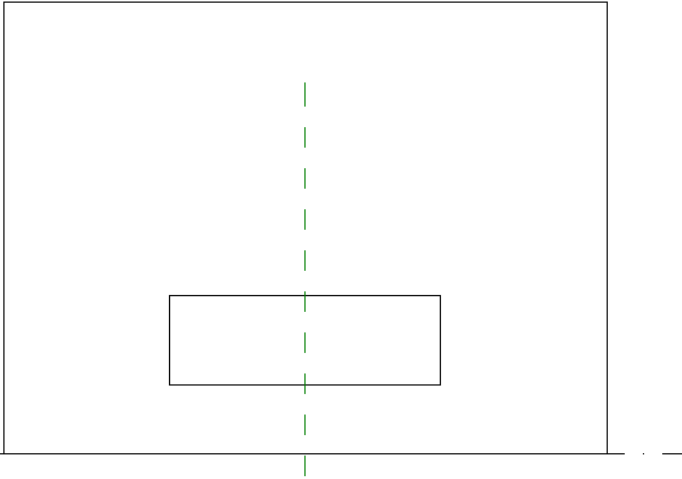
Choose the “Trim/Extend to Corner”  tool (Ribbon: Modify|Opening > Edit Boundary → Group: Modify) and click the lines one after the other to trim. Cancel the current command with [Esc] (or choose the selection arrow ) and select the “old” opening cut rectangle (if you press the [tab] key while the cursor is over one line, you can select all connected lines at once) and press the [del] key (or the “Delete”  tool under Ribbon: Modify|Opening → Edit Boundary → Group: Modify). Your sketch should look like this:





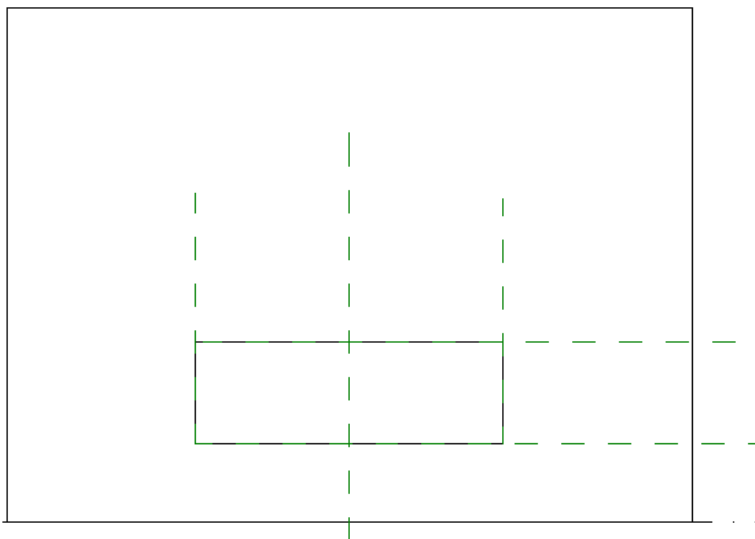
Finish the sketch by confirming the green checkmark  . The new opening is finished.


Now we want to adapt the family parameters (height, width and sill height) to our new opening. One idea would be to move the reference planes (the green dashed lines) to the new opening. But if we do this, Revit moves our new opening also! Revit tries to set a dependency between reference planes and geometry! Therefore we delete the reference planes first and create new once at the right place afterwards.

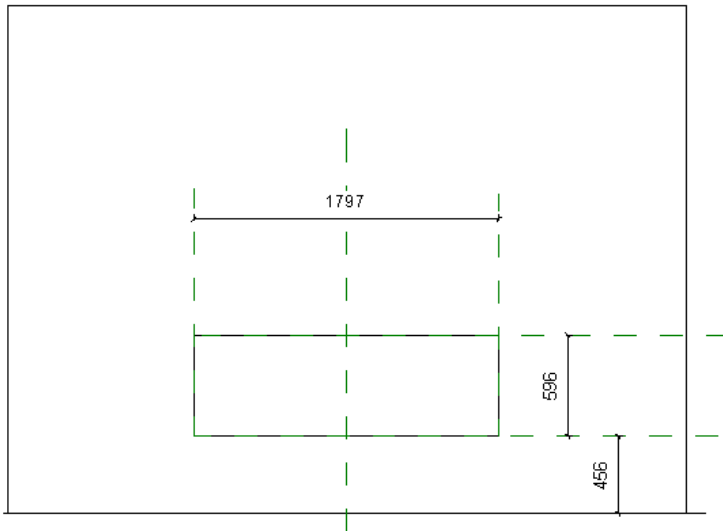
Delete the “left”, “right”, “sill” and “head” plane:




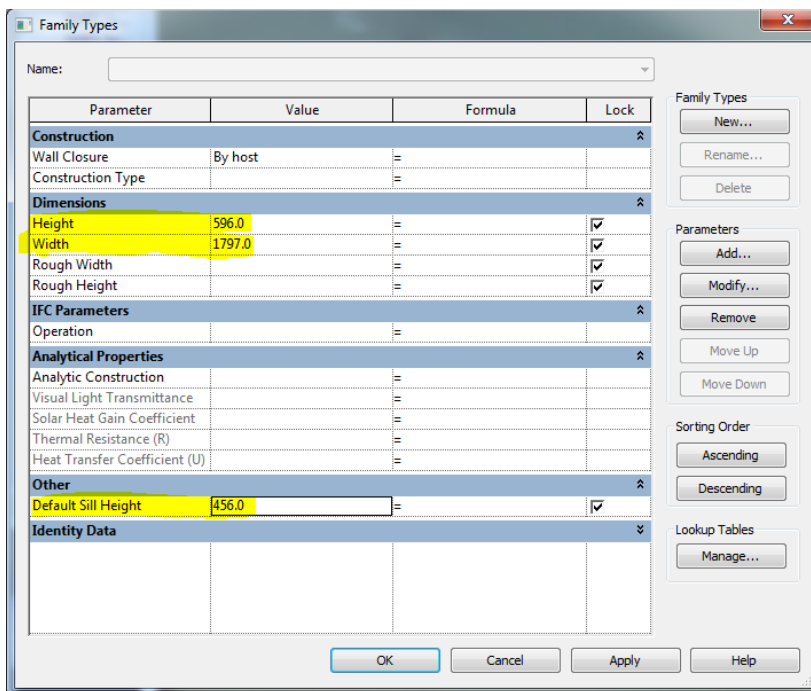
Create new reference planes exactly at the edges of the opening cut (Ribbon: Create → Group: Datum → Reference Plane ). Use the “Line”  option (Ribbon: Modify | Place Reference Plane → Group: Draw) and use the corners of the opening cut for the first points of the new reference planes:



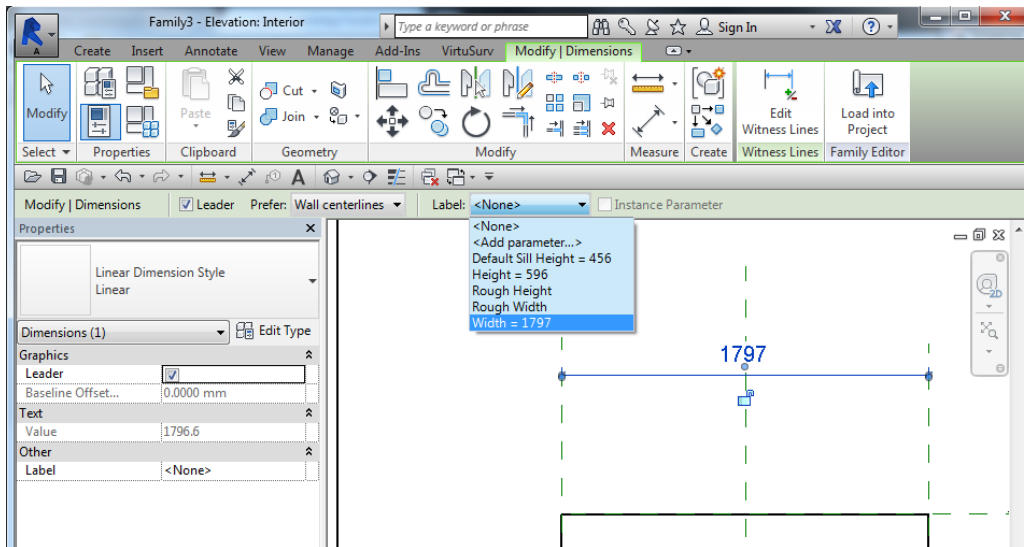
Next step is adding new dimension for the family parameters between the reference planes. Choose the “Aligned” dimension  tool (Ribbon: Annotate → Group: Dimension). Click on the first plane then on the second one and after that finish the command by clicking next to the second plane. Create three dimensions for “height”, “width” and “sill height”:



Next we want to adapt the already existing family parameters to the exact dimensions. In Revit open the “Family Types” Dialog  (Ribbon: Modify → Group: Properties) and change the values for “height”, “width” and “sill height” according to the exact sizes:




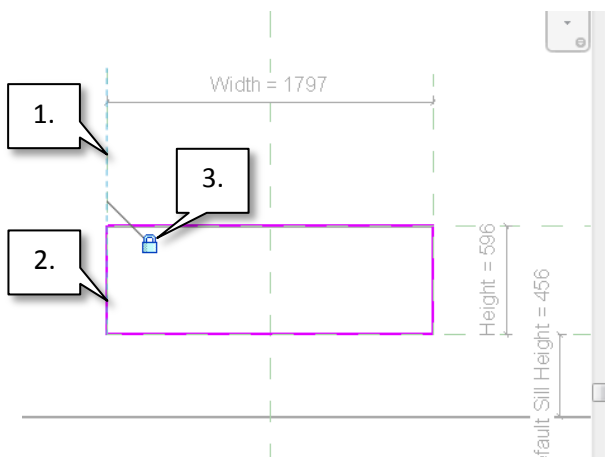
Now we can connect the dimension symbols to the parameters. Select a dimension in the view and choose the corresponding parameter from the “Label” drop-down list:



Repeat with the other two dimensions. Now the three main elements of our family are finished: the muscles (reference planes), bones (dimensions) and skin (geometry). But our “skin” is not yet connected with the muscles and bones! Try to “flex” (that means changing the parameter values!) the family and you will see it! Hence we will connect the geometry with the reference planes.

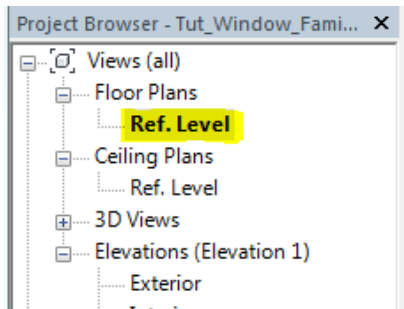
Select the opening cut (don’t forget to use the [tab] key!) and start editing the sketch (Ribbon: Modify | Opening cut → Group: Opening → Edit Sketch). Now we are back in the sketch mode


Align the edges of the opening to the reference planes (Ribbon: Modify | Opening cut → Group: Modify → Align ). First click on the reference plane and afterwards on the edge. Click on the small lock to close the connection:

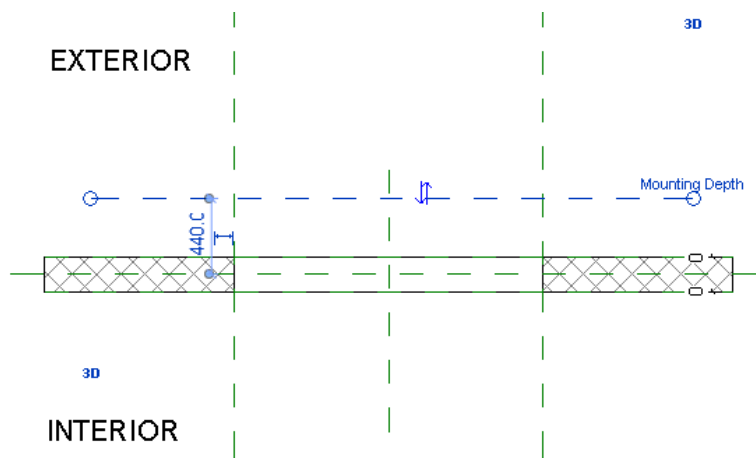


Repeat the process with the other three edges and finish the sketch mode. Now we can “flex” the parameters for “height” and “sill height” and the opening will adjust correctly (don’t forget to go back to the previous values after flexing, otherwise our project coordinates are no longer correct).

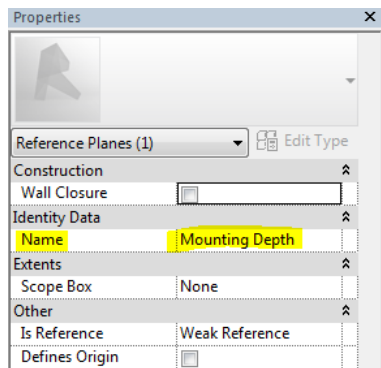
Now we can (finally) start modelling the frame and sash. Open the “Ref. Level” view in Revit (double click in the Project Browser).




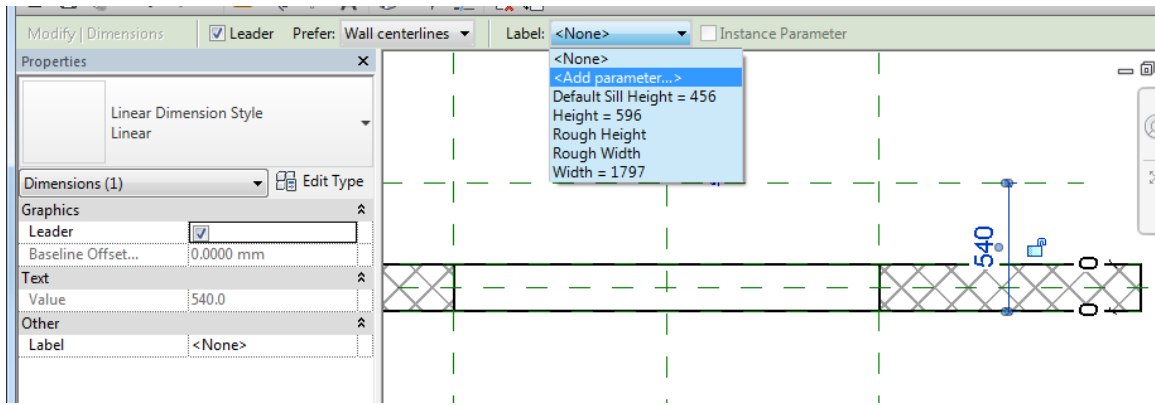
Create a new reference plane parallel to the interior wall face (Ribbon: Create → Group: Datum → Reference Plane ). The exact position is not important for the moment! We will control this with a parameter later:



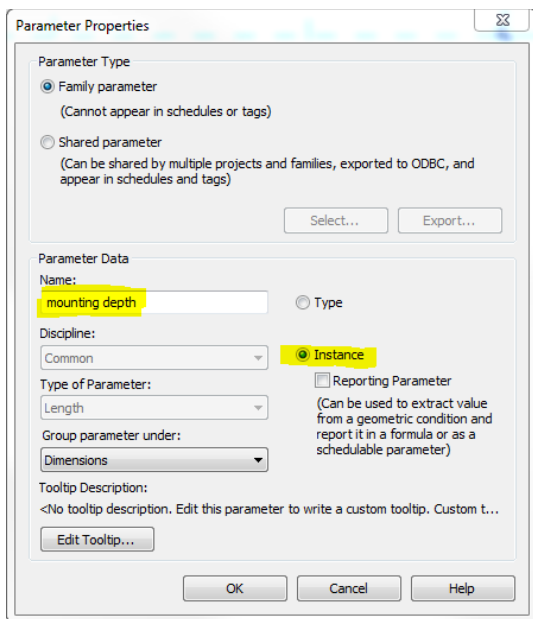
Select the reference plane and name it “Mounting Depth” in the properties palette:




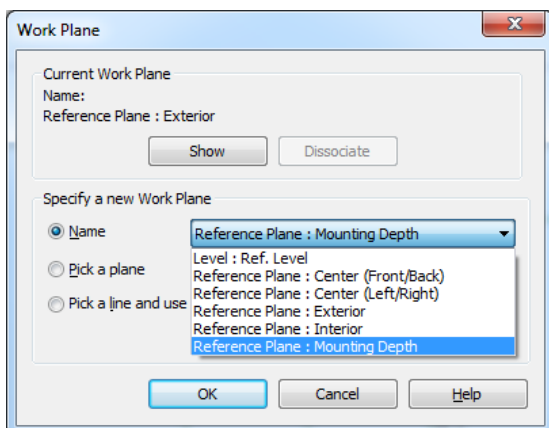
Now add an “Aligned” dimension (Ribbon: Annotate → Group: Dimension → Aligned ) between the new reference plane and the exterior wall face (don't forget to use the [tab] key to find the right selection). Select the dimension and choose <Add parameter> in the label drop-down list:





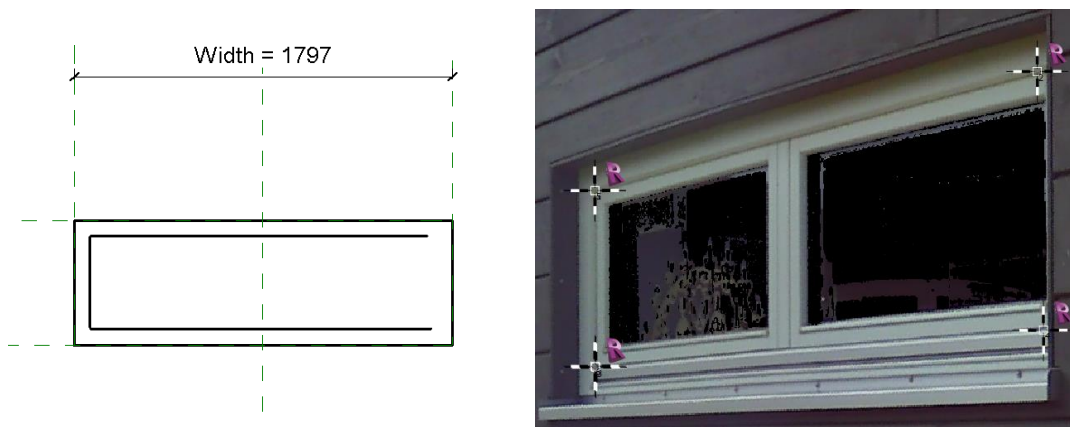
Name the new parameter also with “Mounting depth” and select “Instance” as parameter type:





Switch back to the “Exterior” view and set the “Mounting depth” reference plane as active work plane (Ribbon: Create → Group: Work Plane → Set ). You will find it in the drop-down list of the work plane dialog:

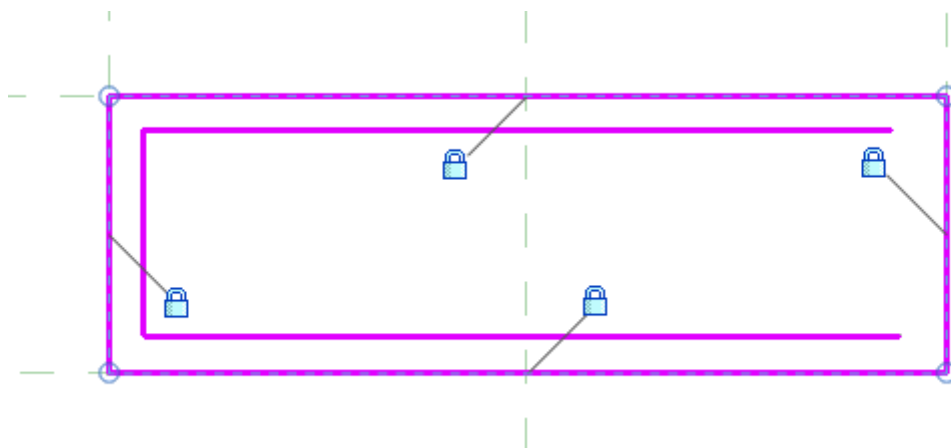



Now we can start modelling the window frame. In VirtuSurv open the Scan_002 and start the command “3d model lines” . Choose the “plumb point mode”  and draw three lines at the inner edges of the frame with the “vertical and “horizontal” options:





The right edge of the frame is not visible in the scan view, so we will create this later by mirroring the left edge.

In Revit start a new extrusion (Ribbon: Create → Group: Forms → Extrusion ). Revit turns over to the “Sketch editing mode”. Choose the “Pick Lines”  tool (Ribbon: Modify|Opening → Edit Boundary → Group: Draw) and click on all three model lines coming from VirtuSurv and on the four edges of the opening cut (you can use the [Tab] key to select all four edges at once). Close all locks at the opening cut to connect the extrusion to the opening.

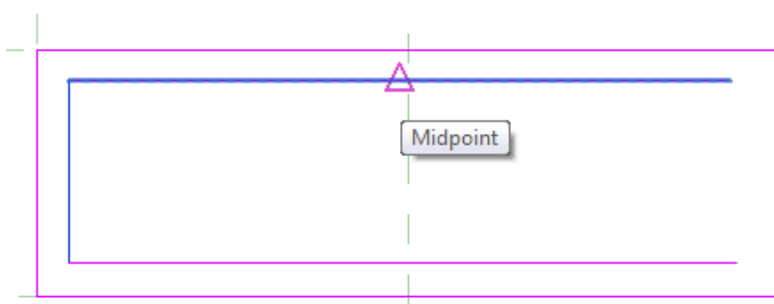


Choose the “Trim/Extend to Corner”  tool (Ribbon: Modify|Opening → Create Extrusion → Group: Modify) and click the inner three lines one after the other to trim the corners.

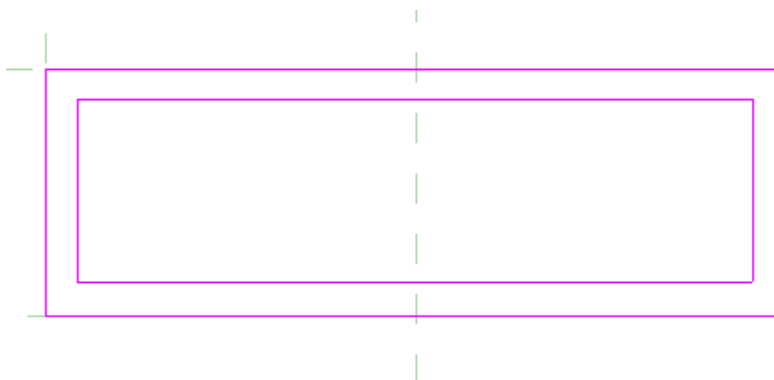
Hint: For a clearer view to the model you can choose the „Thin lines“  Tool in the „Quick Access Toolbar“.

Choose the “Mirror – Draw Axis”  tool (Ribbon: Ribbon: Modify|Opening → Create Extrusion → Group: Modify). Select the left edge of the inner frame boundary and press [Enter]. Now we need to

draw the mirror axis. Move your mouse to the midpoint of the upper line at the opening cut. If the midpoint snap symbol appears press left mouse button.

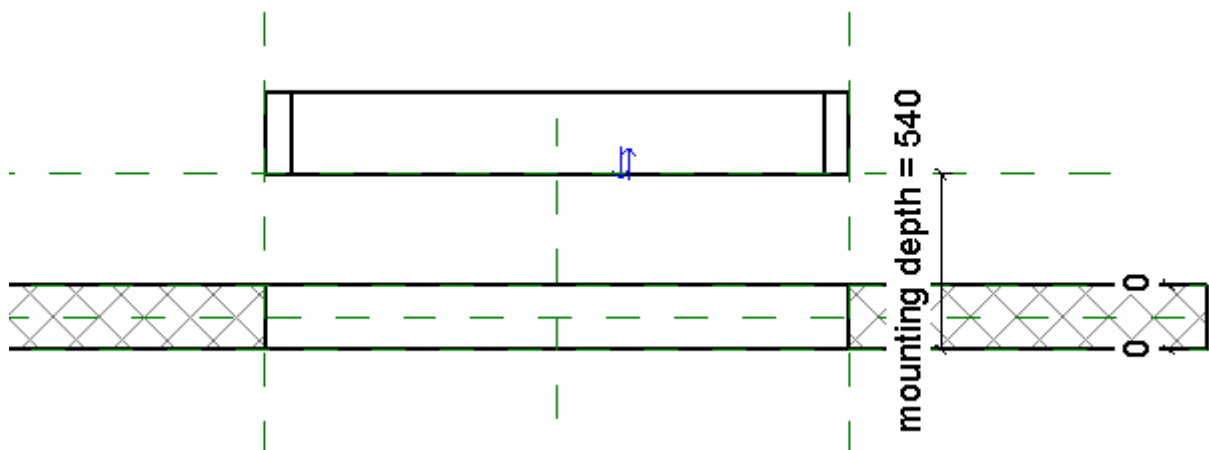



Now you can move straight down the mouse cursor to the lower edge. Press left mouse button again to finish the mirror command. Trim the new edge with the lower and upper line.



Finish the extrusion by confirming the green checkmark ✓.

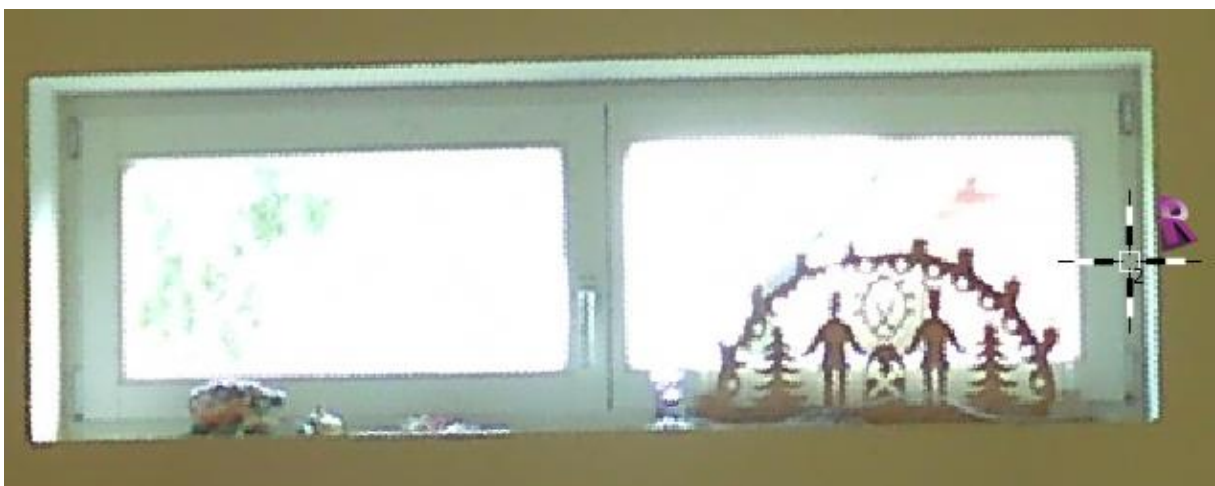
After switching to the "Re. Level" view you can see the new extrusion object connected to our "Mounting depth" reference plane.




In VirtuSurv choose the "Construction Point"  command and click a point on the frame in Scan_002.

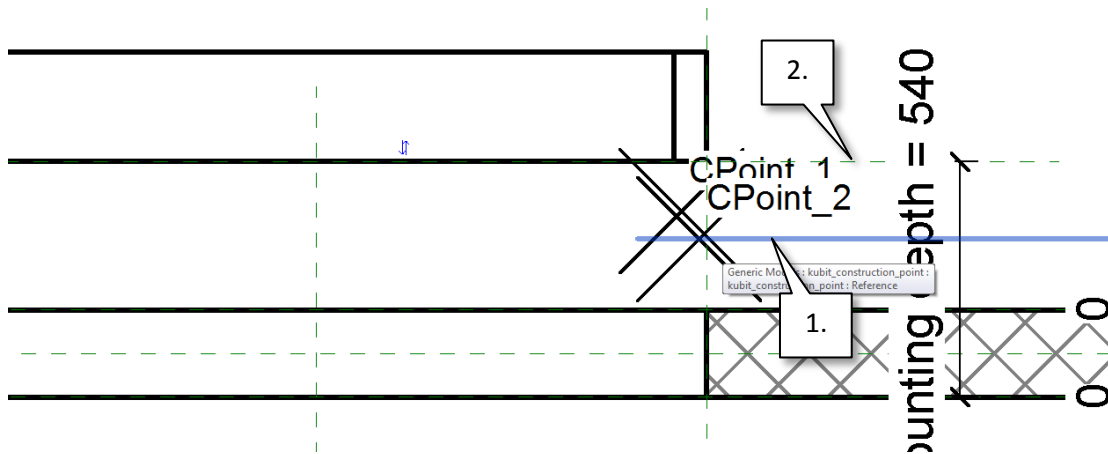


Switch to Scan_003 and do the same at the interior side of the frame.

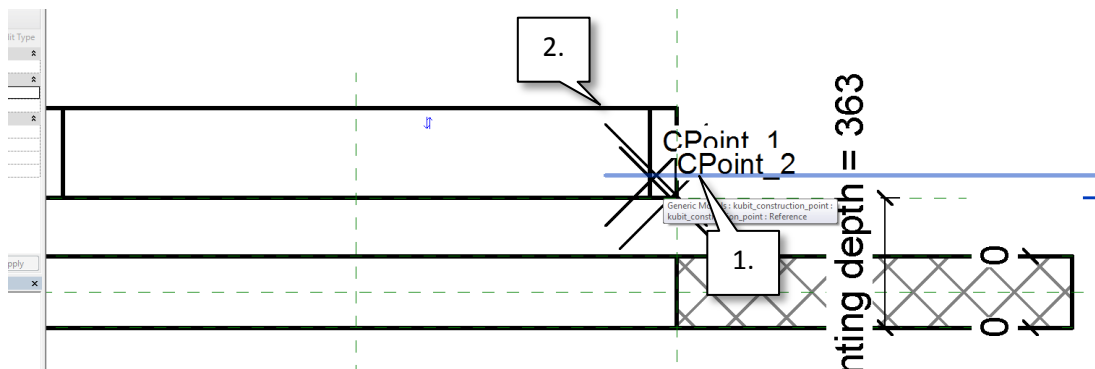


Now we have two construction points in our family that help us to adjust the extrusion for the window frame.

In Revit choose the “Align” command (Ribbon: Modify → Group: Modify → Align ). Click on the reference at the inner construction point (CPoint_2) and afterwards on the Mounting depth reference plane.

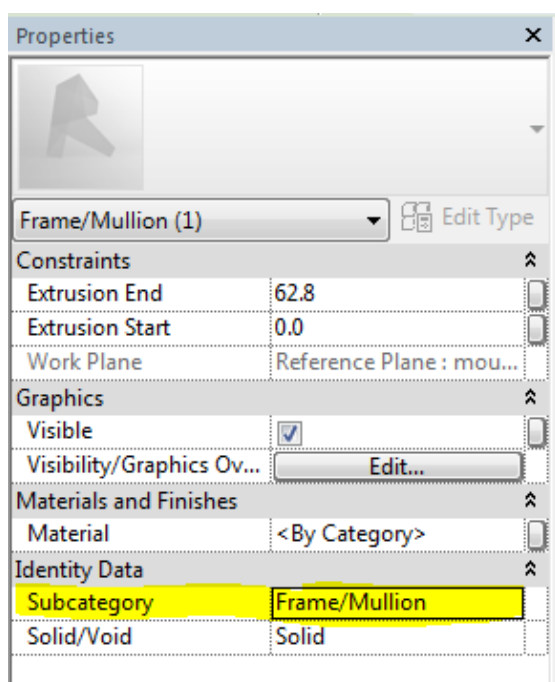


With the align command still active click on the reference at the second construction point (CPoint_1) and afterwards on the upper edge of the extrusion form (use the [Tab] key to select the right face).





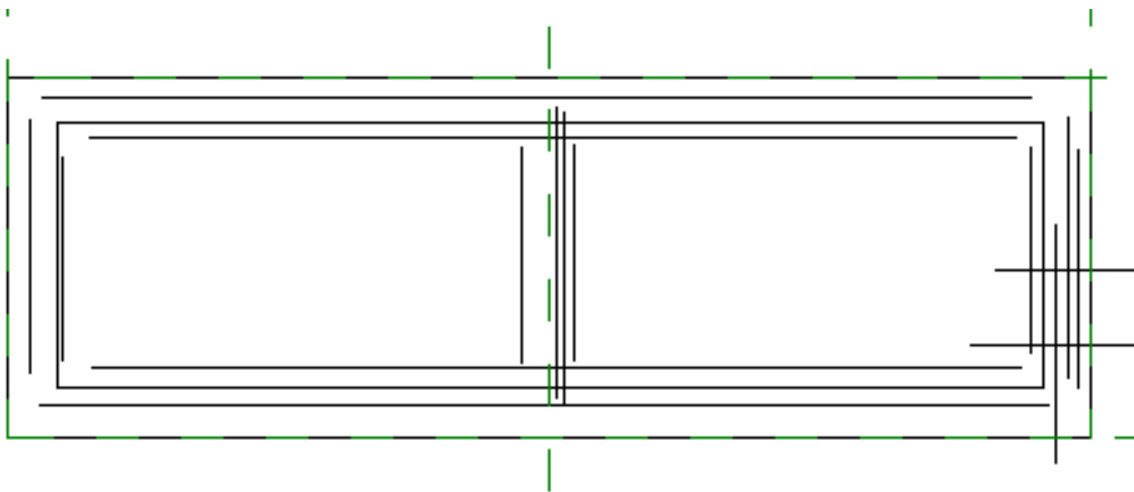
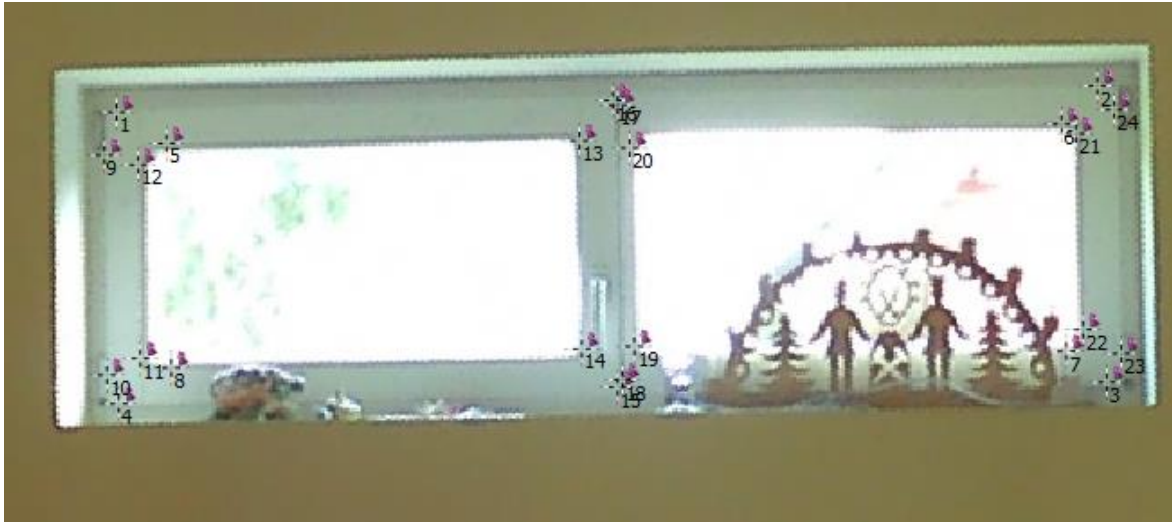
Now the window frame has the right thickness.


Select the extrusion and choose under “Subcategory” the entry “Frame/Mullion” in the properties palette. This will bring a bit more “intelligence” to our window:




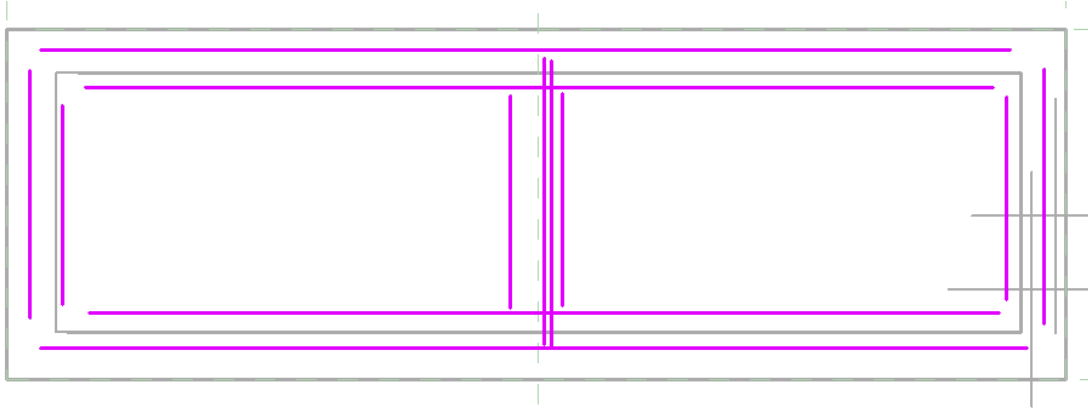
Now we can start modelling the window sash.



Open the “Interior” view in Revit and choose the “Mounting depth” reference plane as active work plane (Ribbon: Create → Group: Work Plane → Set ). In VirtuSurv choose the “3d Model line” command  and the “plumb point mode”. Draw the lines at the edges with the “vertical” and “horizontal” options in Scan_003:

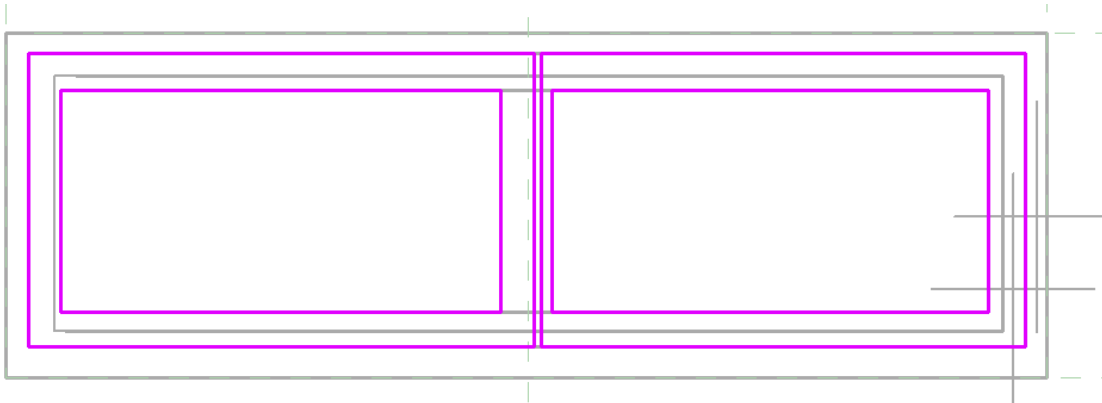


In Revit start creating an extrusion (Ribbon: Create → Group: Forms → Extrusion ). Revit switches to the sketch editing mode.

Choose the “Pick Lines”  tool and select all model lines for the window sash.




With the “Split Element”  tool (Ribbon: Modify|Create Extrusion → Group: Modify → Split Element) you can cut the four horizontal lines near the midpoint. Now it is possible to complete the sketch with the “Trim/Extend to Corner”  tool (Ribbon: Modify|Opening → Create Extrusion → Group: Modify).

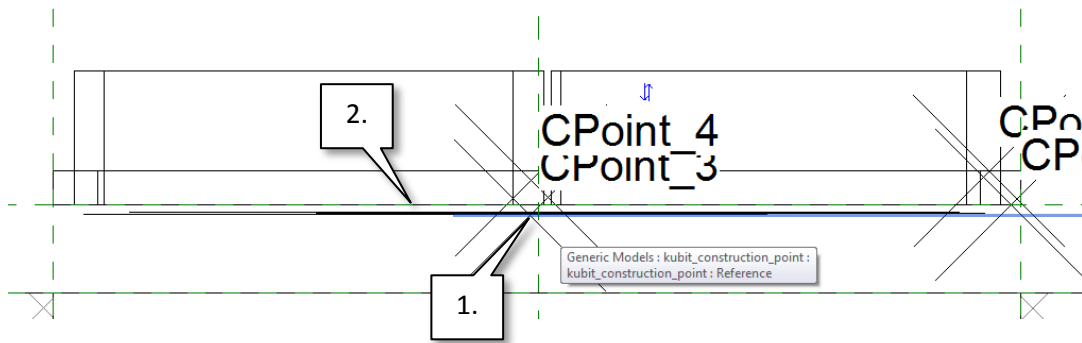


Finish the extrusion by confirming the green checkmark .

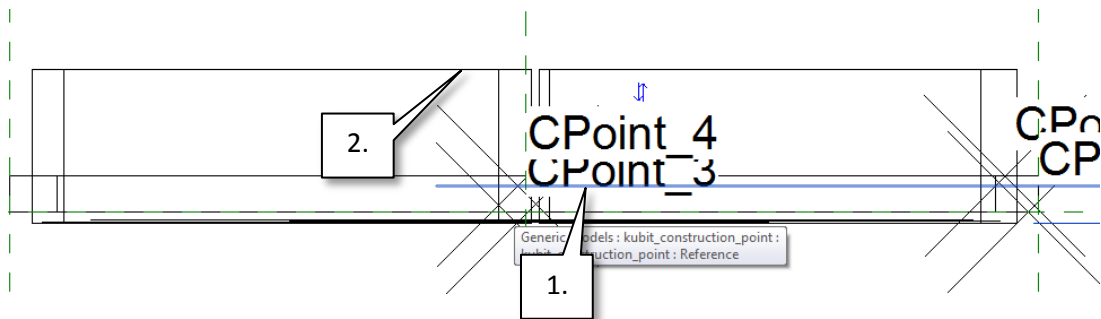
After switching to the “Re. Level” view you can see the new extrusion object connected to our “Mounting depth” reference plane. In VirtuSurv choose the “Construction Point” command and click one point on the sash in Scan_003 and the second point in Scan_002:




Under “Subcategory” choose “Frame/Mullion”. In Revit choose the “Align” command (Ribbon: Modify → Group: Modify → Align ). Click on the reference at the inner construction point (CPoint_3) and afterwards on the lower edge of the extrusion form for the sash (use the [Tab] key to select the right face).

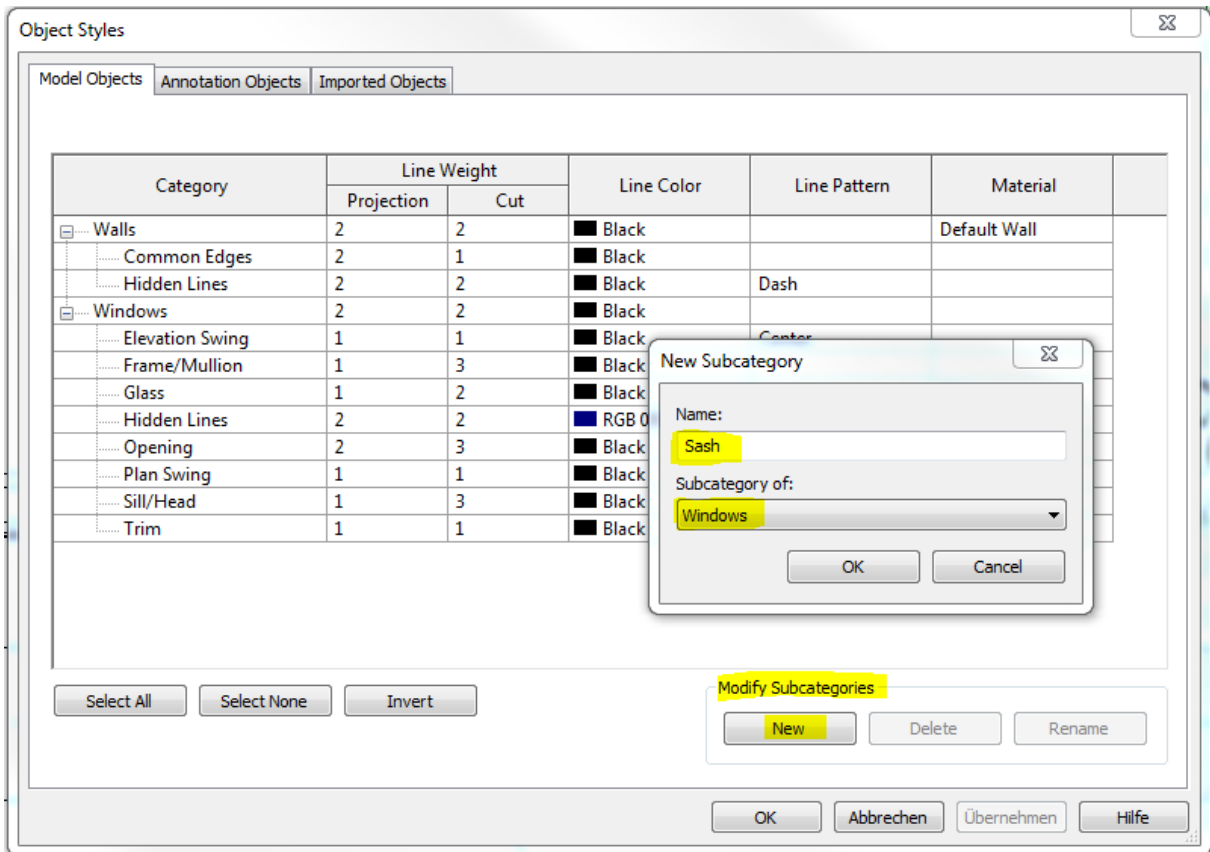


With the align command still active click on the reference at the second construction point (CPoint_4) and afterwards on the upper edge of the extrusion form (use the [Tab] key to select the right face).

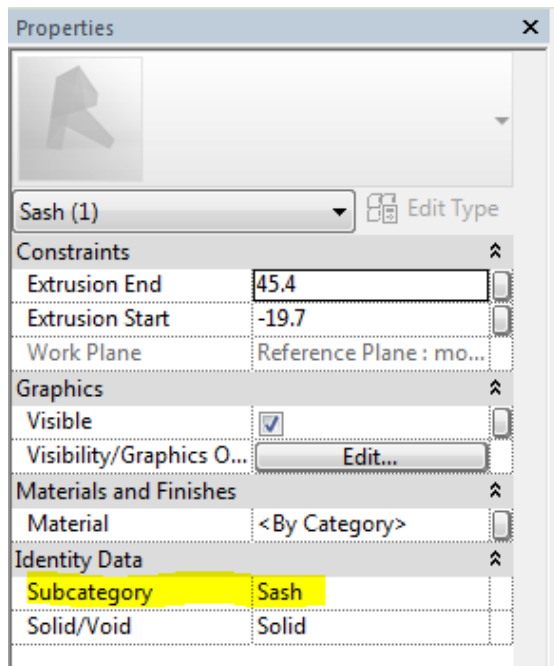


Now the window sash has the right thickness.

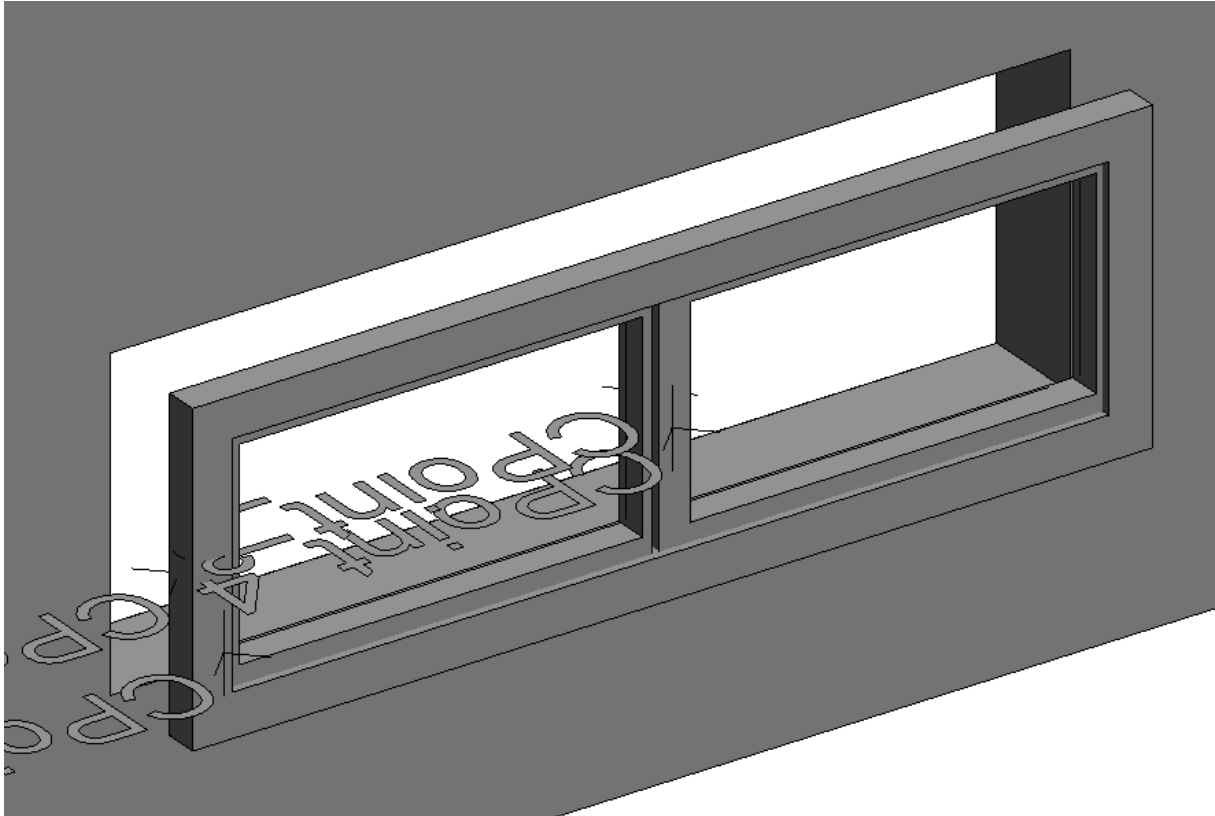
For our window sash we want to create a new subcategory. Go to the “Manage” Ribbon and choose “Object Styles” . In the appearing dialog create a new entry with the name “Sash” as subcategory of “Windows”:



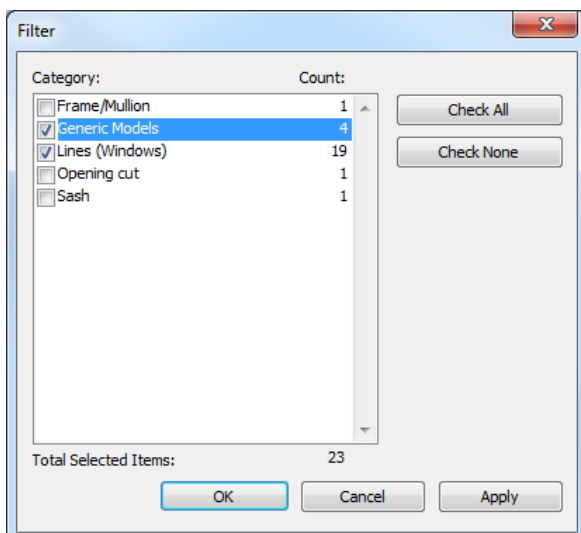
Change the “Line weight” for “Cut” to 3 (the same as for “Frame/Mullion”) and close the dialog with [OK]. Select the extrusion and choose under “Subcategory” the new entry “Sash” in the properties palette.





In the 3d view our window should look like this:

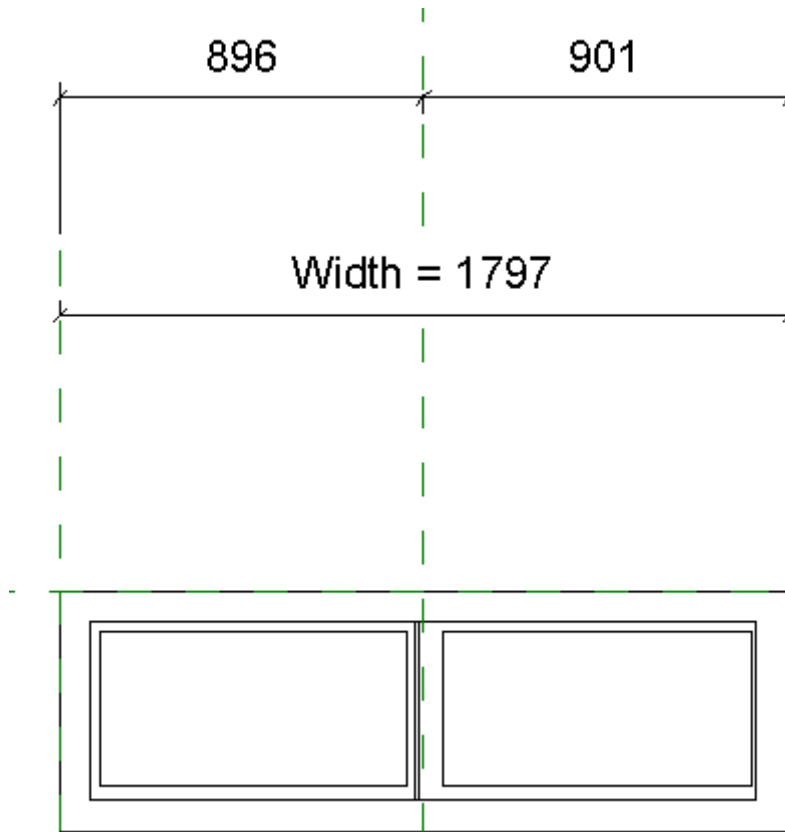


Now it is time to clean up the family. Switch to the 3d view and zoom out to see all elements. Choose the “Modify” tool and draw a window selection box to select all elements. The green “Modify | Multi-Select” Ribbon appears. Choose “Filter” (Ribbon: Modify | Multi-Select → Group: Selection) and un-check all categories except “Generic Models” and “Lines” and confirm with [OK].



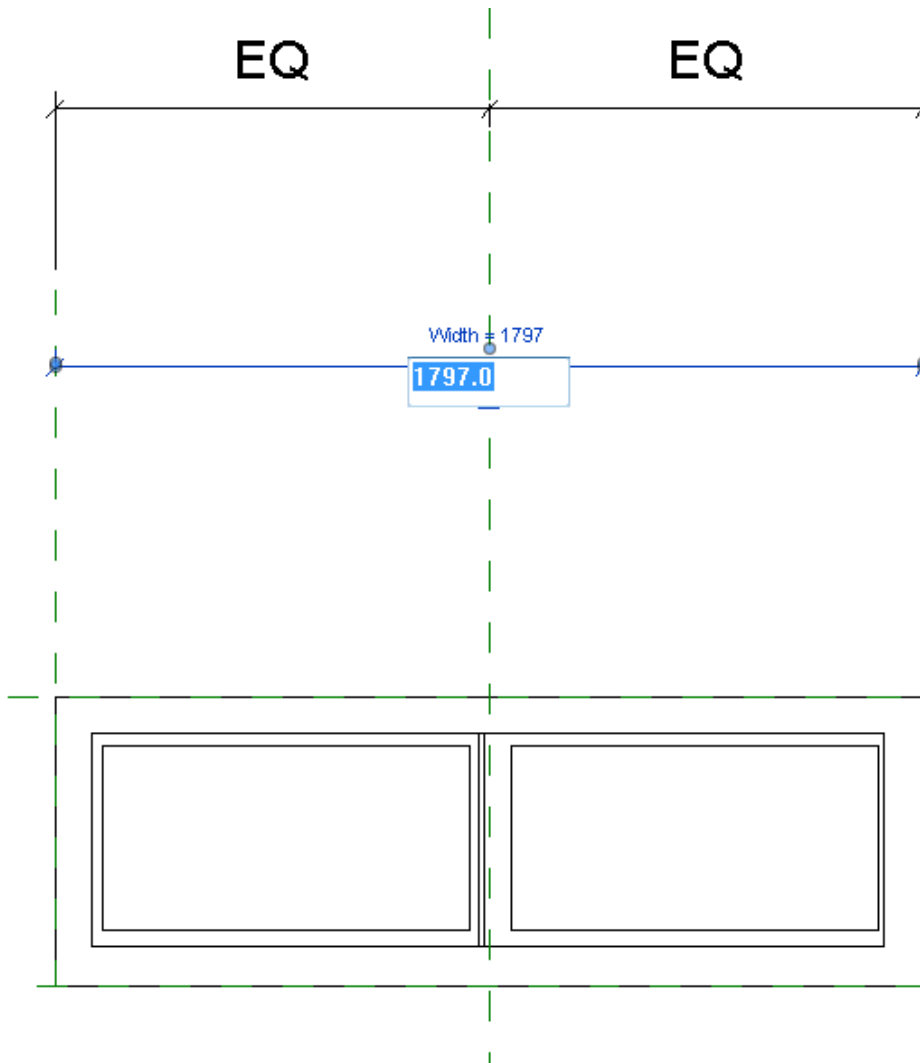
Now only elements that belong to these categories are selected. If you are working with Revit 2015, you need to unpin the “construction points” before deleting (Ribbon: Modify|Multi-Select → Group: Modify: Unpin ). Now you can press the [Del] key to delete all selected elements.


Now we also want to improve the parameterization of our family. Open the “Exterior” view. You can see a vertical reference plane that represents the middle of our family. Create new a dimension between the three vertical reference planes (Ribbon: Annotate → Group: Dimension → Aligned ). Make sure that you create only one dimension with two values and not two separate dimensions!





At the values can be seen that our window is not sitting quite in the middle. This should be corrected.

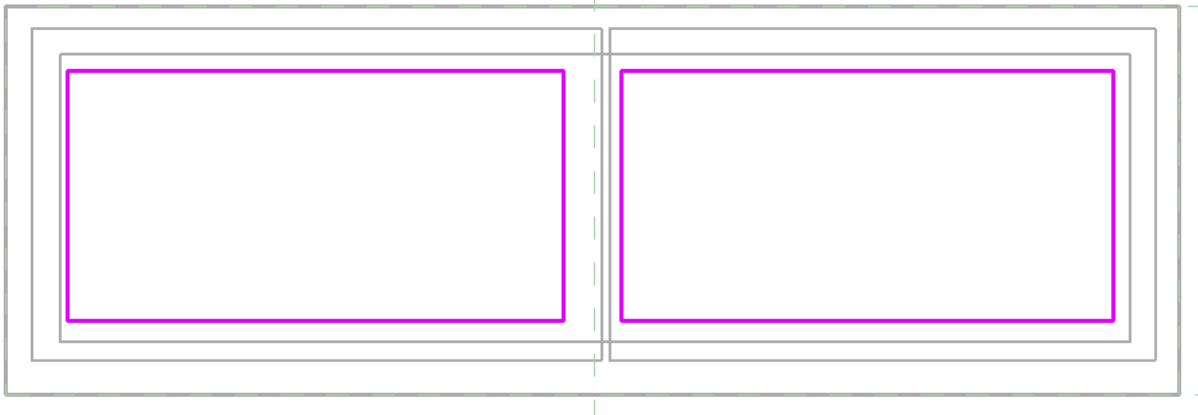
Select the “Width” dimension and open the blue lock. This will remove the length constraint between the left and right reference plane. Now select the upper dimension and click on the “EQ” symbol. This will apply an equality constraint between the three reference planes. Unfortunately Revit changes the width of our window, so we have to set this value back to the previous value. You can do this easily while double clicking on the “Width” text. Change the value and close the blue lock again.




Let's complete the family with an object for the glass pane. Open the "Interior" view in Revit and start a new extrusion (Ribbon: Create → Group: Forms → Extrusion ). Revit turns over to the "Sketch editing mode".

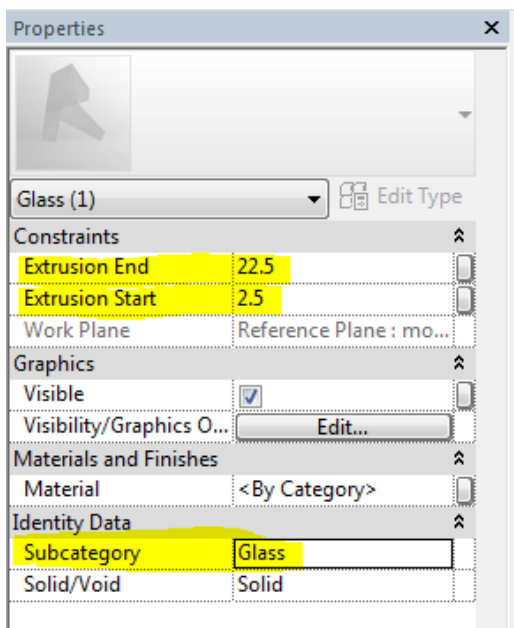
Set the "Mounting depth" reference plane as active work plane (Ribbon: Create → Group: Work Plane → Set ) and choose the "Pick Lines"  tool (Ribbon: Modify | Opening → Edit Boundary → Group: Draw).

Move the mouse cursor to the inner edge of the window sash. When toggling with the [tab] key you can pick all four edges at once. Confirm the selection with the left mouse button and close all four locks. Repeat on the other part of the window sash.



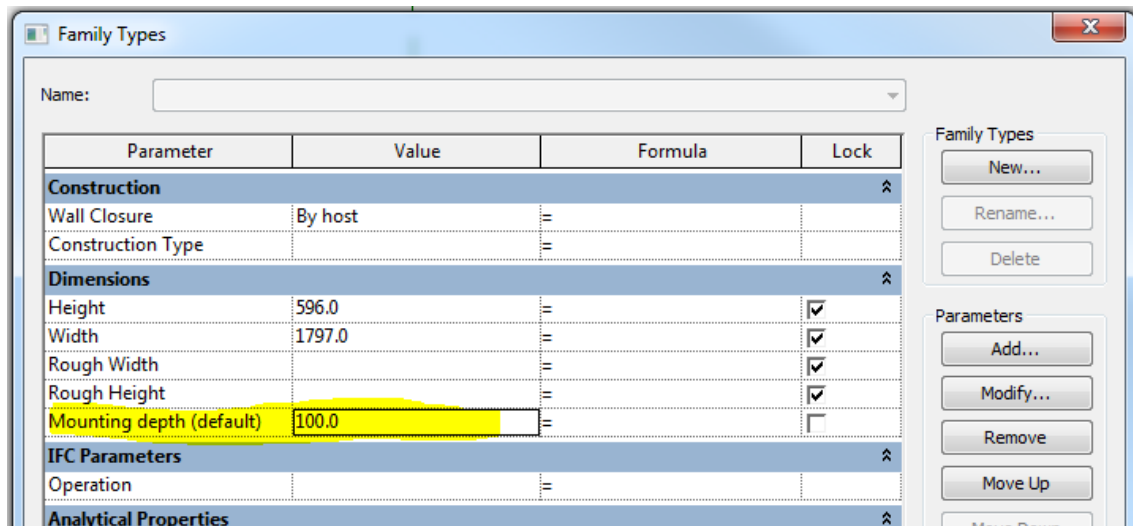
Finish the sketch by confirming the green checkmark  and switch to the “Re. Level” view. You can see the new extrusion object connected to our “Mounting depth” reference plane. Now we can adjust the extrusion depth as well as the extrusion direction.

Select the extrusion object and change the “Extrusion Start” parameter to 2.5 mm and the “Extrusion End” parameter to 22.5 mm. The subcategory is set to “Glass”:



Before we load the family into a project, we should adjust the “Mounting depth” parameter so that the frame and sash sit inside the wall opening.

Open the “Family Types” dialog and change the value of the “Mounting Depth” parameter to 100 mm.



Before we leave the dialog let's create also a new type for our family. Click on the [New ...] Button in the "Family Types" grouping box and insert a name for the family type (e.g. "180 x 60 cm" for the width and height of that family type). Now we can close the dialog and save the family. The name of the family file will also be the name of the family when loaded into a project.



Our Window family is finished!

Using the family in a project


If you already done the "Modelling a room with VirtuSurv and Revit" tutorial from the manual, you can use the resulting Revit project and delete the window we have now modelled as new family.

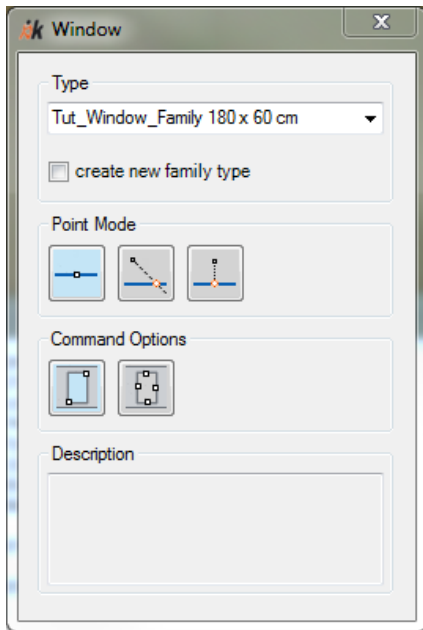
You can also create a new project and model at least the one wall with the window in VirtuSurv (don't forget to switch back to the right measurement unit in VirtuSurv!).

To load the new family into the project we can use two ways:

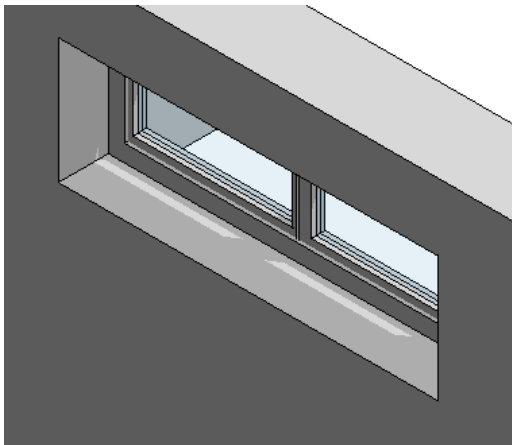
1. In the "Insert" Ribbon choose "Load Family"  and search for the family file.
2. If the family file is already open, you can also switch back to this file and choose "Load into Project"  from any Ribbon.

Now you can insert the loaded family manually, but we want do this with VirtuSurv. Hence cancel the process with the [Esc] key and switch to VirtuSurv.


Open the Scan_003 and start the "Window"  command, the "Option Dialog" appears. Select our new window family in the "Type" drop-down list and choose the "Diagonal Points" option with the "Standard" point mode:

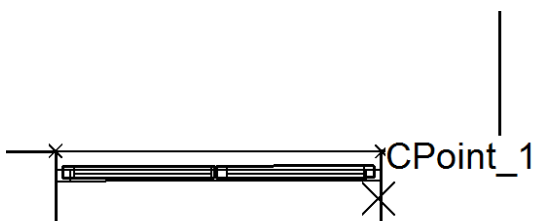



Now you can insert the window by clicking one point in the lower left corner and one point in the upper right corner. The window appears in your Revit model (if not, you should check out the Revit project units and the VirtuSurv measurement unit! They have to be the same!).

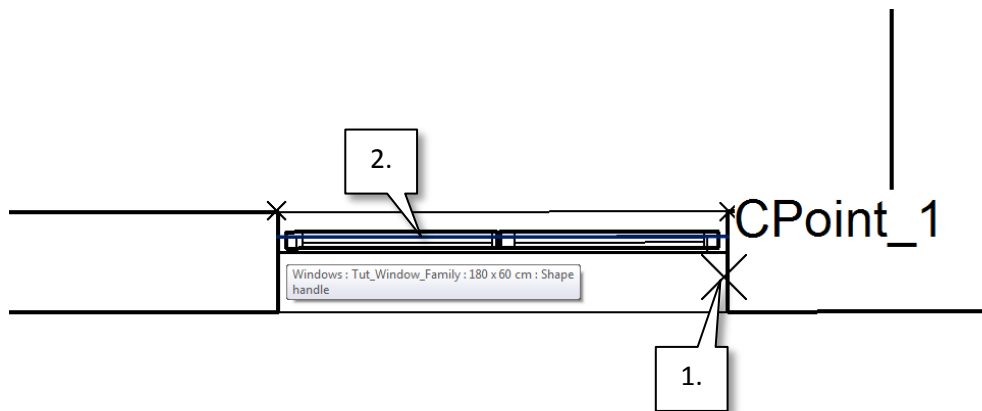


If the orientation of the window is in the wrong direction (interior and exterior side), you can flip the instance in the “Level 1” view by selecting the window and clicking the symbol with the two blue arrows.

At the end we want to adjust the mounting depth of the window frame. In VirtuSurv choose the “Construction Point”  command and click a point at the window frame in Scan_003.




In the “Level 1” view you can now use the “Align”  command (Ribbon: Modify → Group: Modify → Align) to adjust the frame. Click the reference at the construction point first and afterwards the “Shape handle” reference at the window frame.

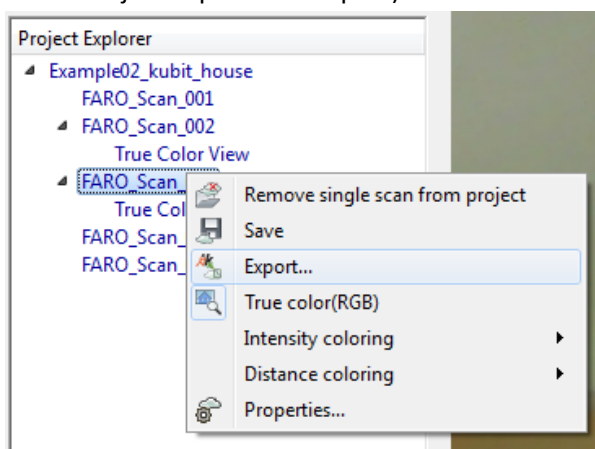


Congratulation! You created you first own window family from scan data and placed and instance into your project!


Another way to use point cloud data in the family editor

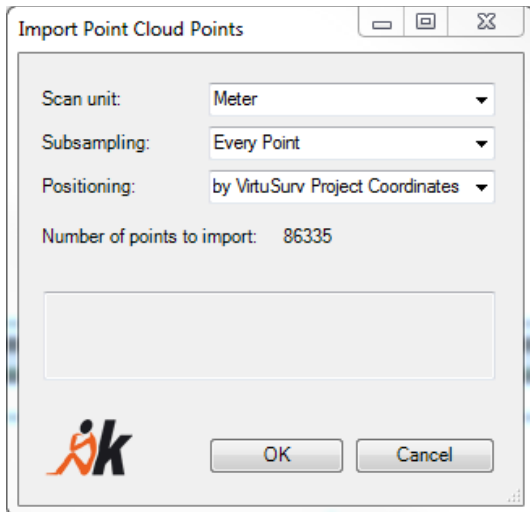
Unlike Revit themselves, with VirtuSurv it is possible to insert point cloud regions into the family editor. First you have to create a PTS file from the needed part of the point cloud. This can be done in different ways:

1. You create a region in ReCap and safe this as PTS
2. If you have an imported point cloud in Revit, you can define a region with the section box in the 3d view and export this with the VirtuSurv addin command “Export PC Section”  (Ribbon: VirtuSurv → Group: Point Cloud Link)
3. You can also export parts of the scan view in VirtuSurv. (Right mouse click on the scan name in the Project Explorer → Export)

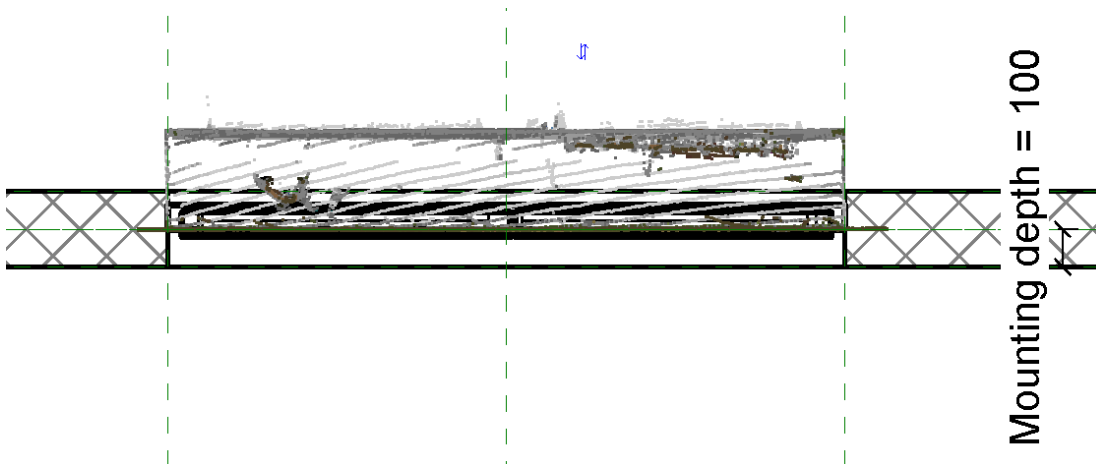



In the “Export” dialog choose “Via box” or “Via polygon” to define the region and export this as PTS.

In the Family editor you can insert the point cloud region with the VirtuSurv addin command “Insert PC”  (Ribbon: VirtuSurv → Group: Point Cloud Link). In the “Import” dialog you can select the scan unit (it must be the same while creating the PTS file!), the subsampling (if you don’t want import all points) and the position of the point cloud region. If you already defined VirtuSurv project coordinates (remember, you have done this at the beginning of this tutorial), you should always use “by VirtuSurv Project Coordinates”.



After confirming with [OK] the point cloud will insert into the family file.



Depending on your project coordinates, the point cloud may be not at the best position. But this is not a problem. You can easy move the point cloud region to the right place. Now choose the “Linking PC”  command (Ribbon: VirtuSurv → Group: Point Cloud Link) and click on the point cloud. Now the transformation of the point cloud region is linked to the VirtuSurv project. That means, if you create new elements with VirtuSurv (model lines, construction points or work planes) they are created at the correct position in the point cloud.