

Creating Resizable Boxes by Using Components and Parameters

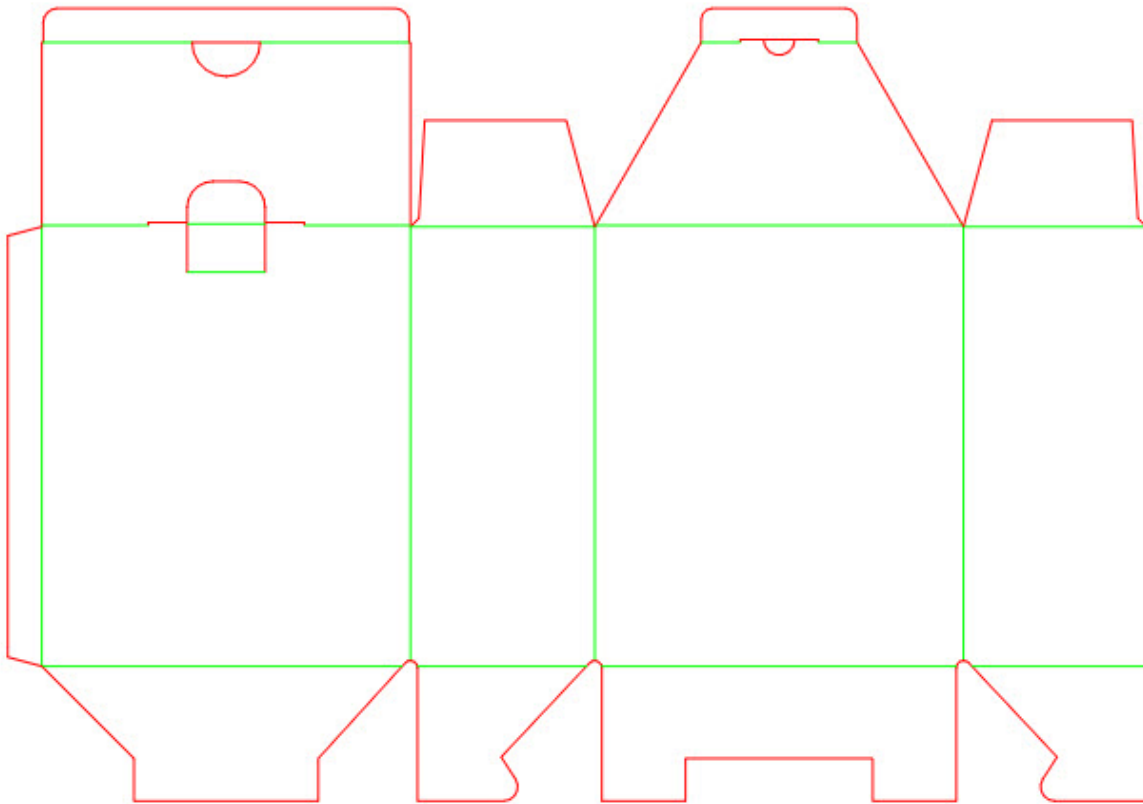
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Task

In this exercise you will learn how to make a new resizable design from components. We will load these components from the Synergy Components library. We will use the advanced parameter matching functionality, which moves the parameters of a component – compound or individual – to those of the entire project after the component has been attached to become part of the project.

Complete folding box




Exercise description

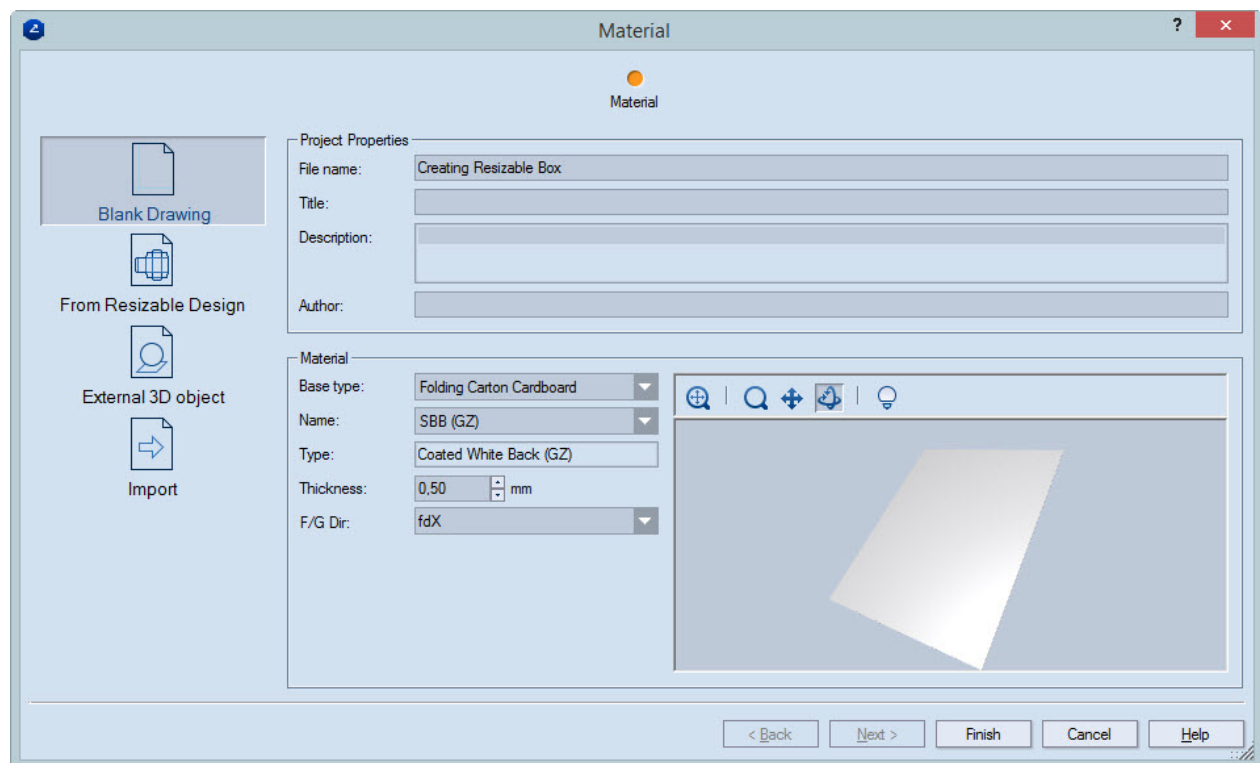
Prerequisites

To turn on the Advanced Parameter Matching functionality, on the **Tools** menu, click **Options**, then click the **Synergy** tab; in the Show group, select the **Advanced parameters matching** check box.


Preparation

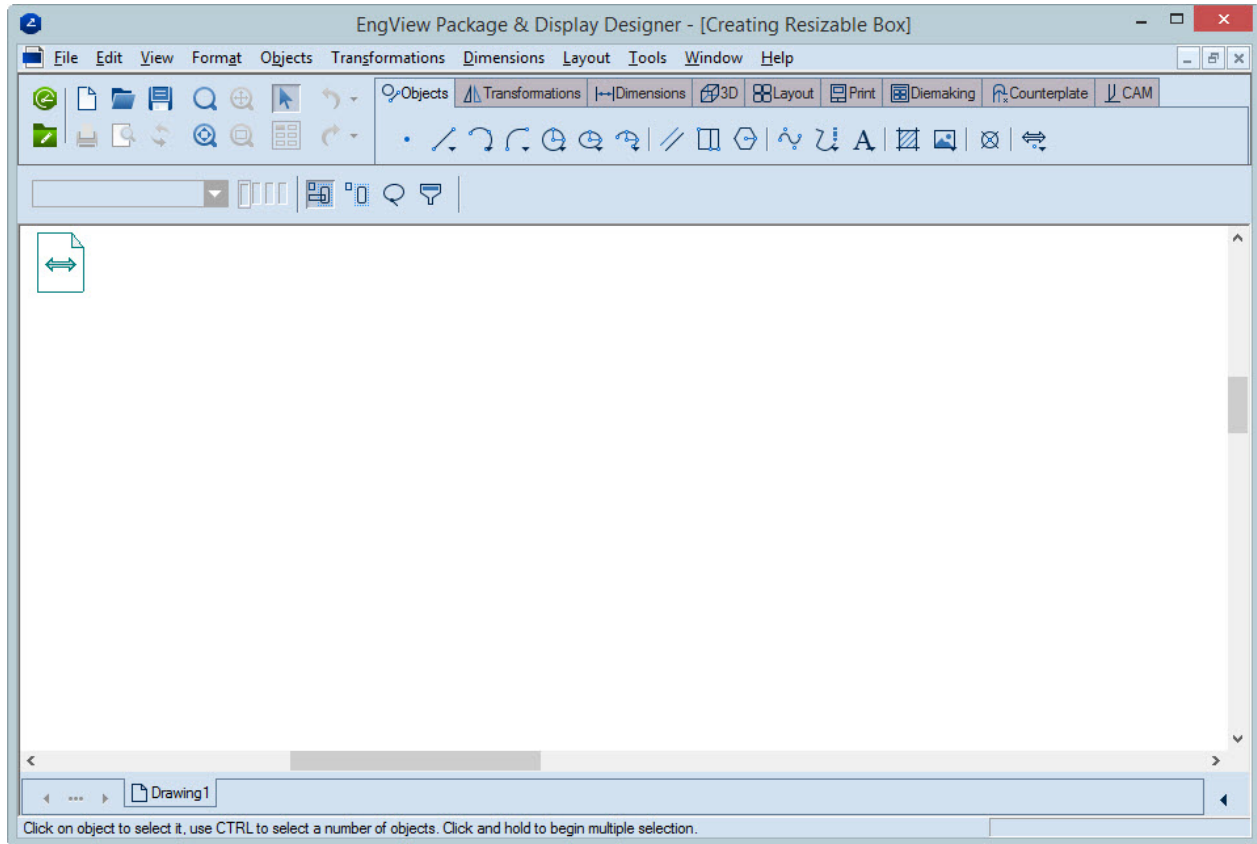
1. To begin creating a new project, do any of the following:
 - On the **File** menu, click **New**.
 - In the toolbar, click the **New Project** .

The **Material** dialog box appears.

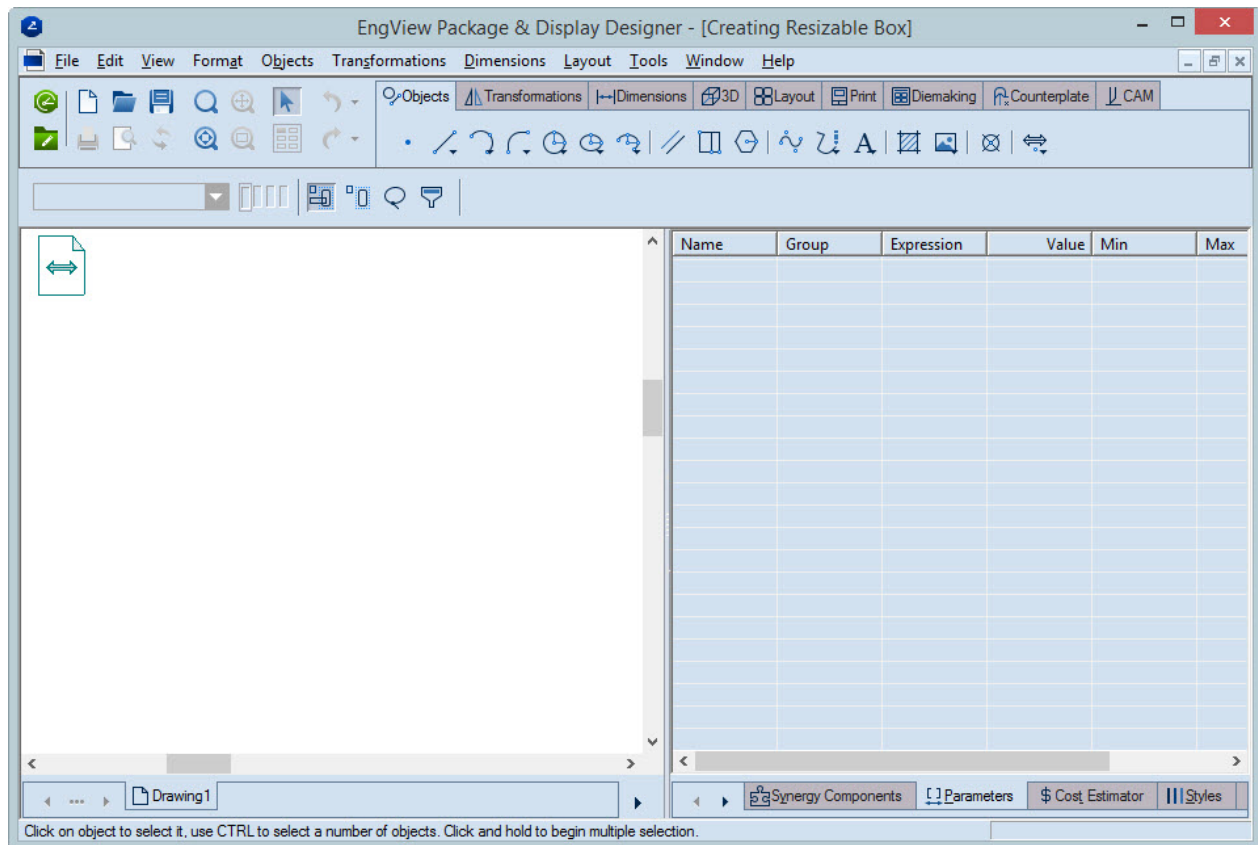


2. To begin creating a project from scratch, click **Blank Drawing**.
3. In **Base type**, select Folding Carton Cardboard, and then, in **Name**, select the material that you want to work with.
4. To begin working on the project, click **Finish**.
5. To show the tabular area, do any of the following:
 - On the **View** menu, click **Tables** in the menu bar.

- On the lower right corner, click the Show/Hide button .



6. Click the **Parameters** tab.

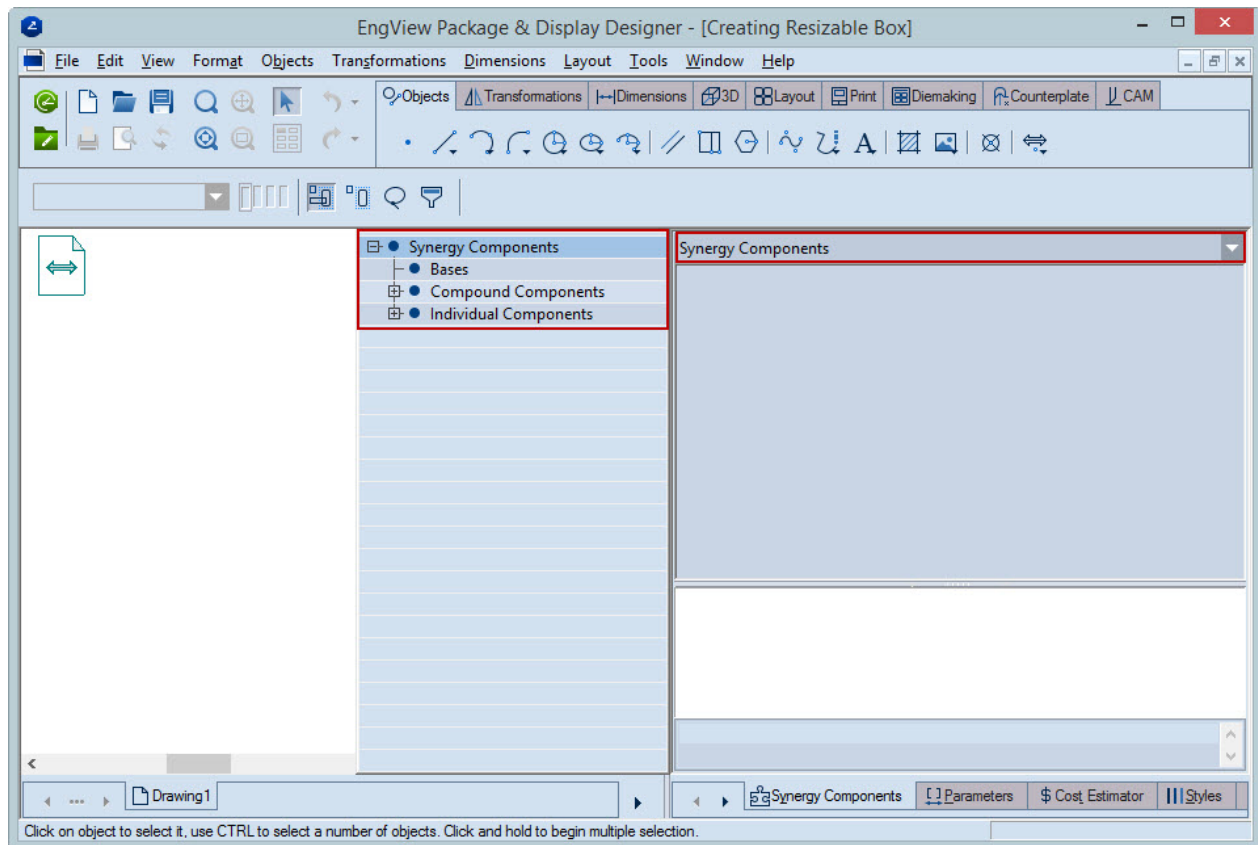


As we have no drawing to work with, when the blank drawing opens, the **Parameters** tab is empty.

NOTE: The **Parameters** tab is the tabular area that lists all the parameters in the project. This is the area in which parameters are edited, which changes a resizable structure's size.

7. Click the **Synergy Components** tab, and then click the **Synergy Components** dropdown menu; then click the **Synergy Components** folder.

The library's subfolder structure appears.



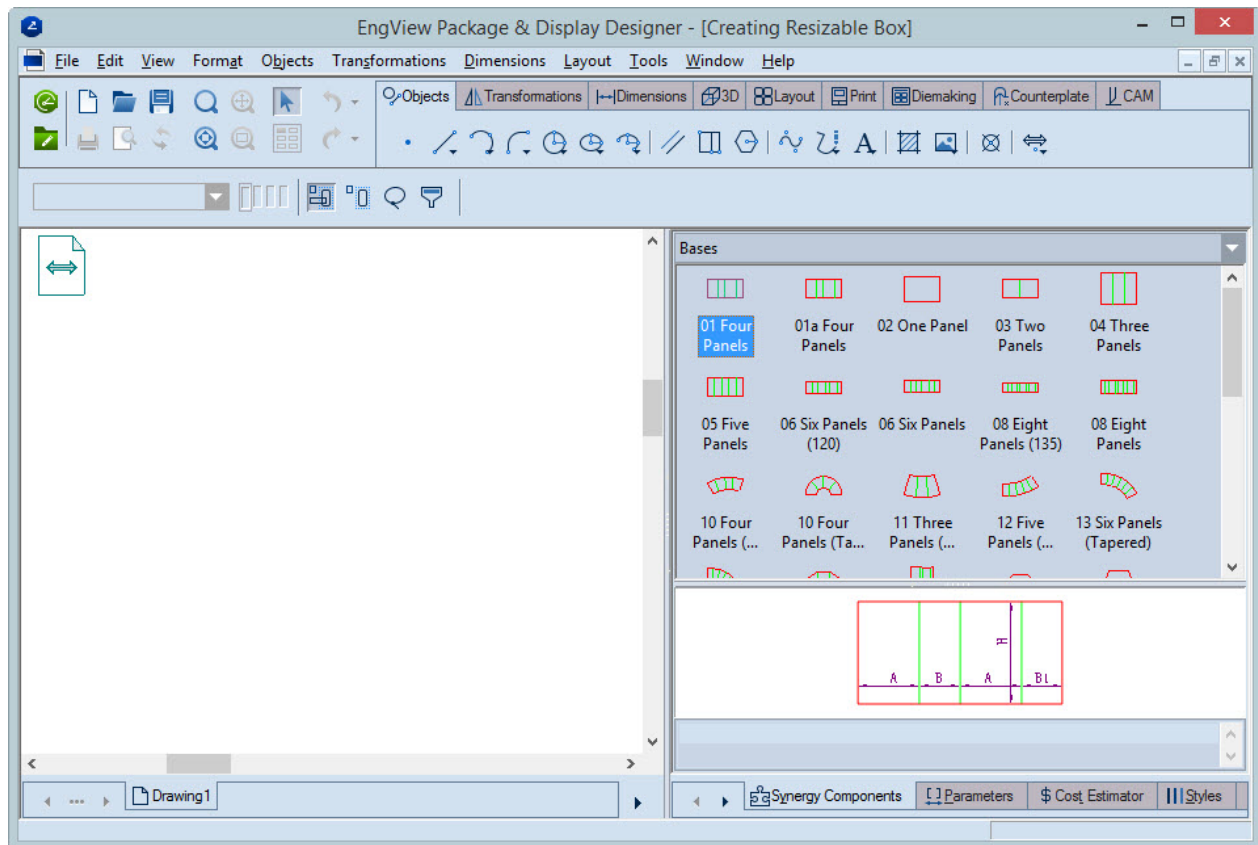
Positioning the base

1. We begin by creating the base component: click the **Bases** folder.

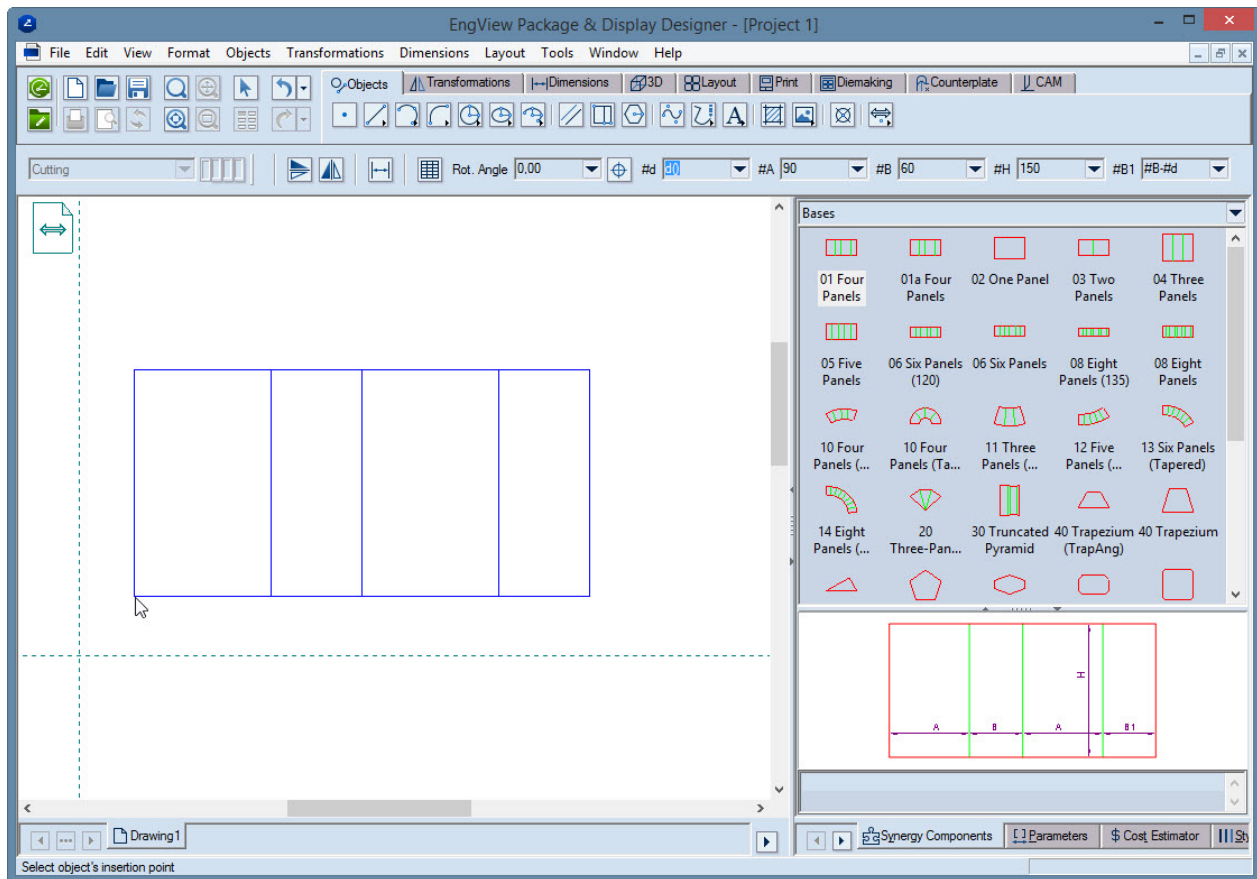
A list preview of the available bases appears in the right-hand area.

2. Select the component 01 Four Panels.

A preview of the selected component appears in the area below the component list.

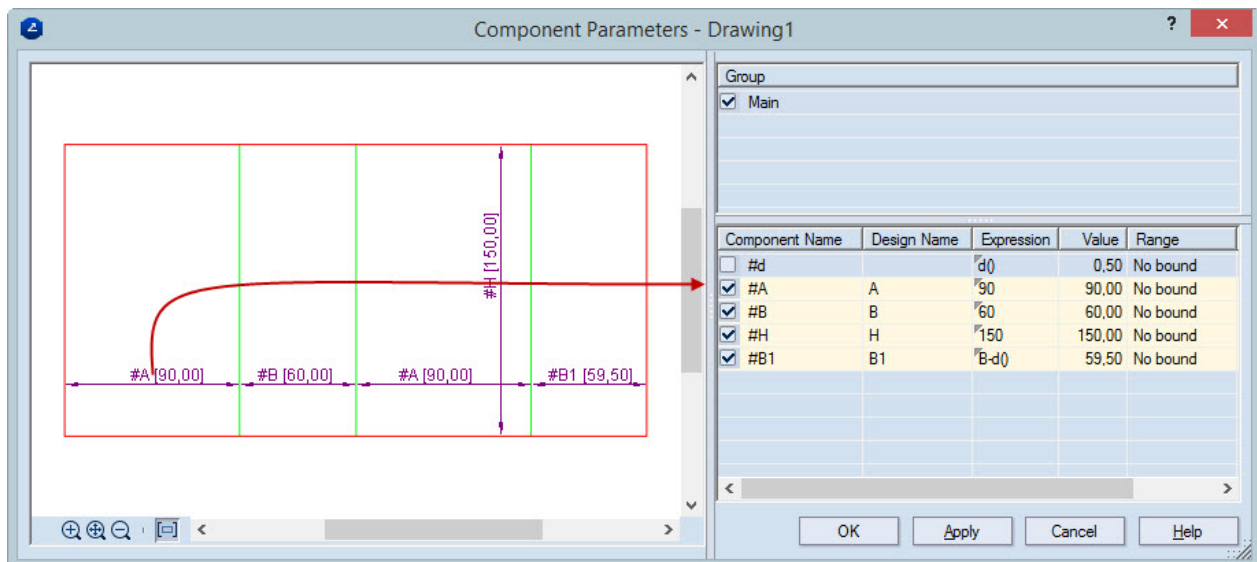


3. Holding down the mouse button, begin dragging the component into the graphical area.



4. When you decide where to place the component, click.

The **Component Parameters** dialog box opens.



What do these check boxes in front of parameters mean?

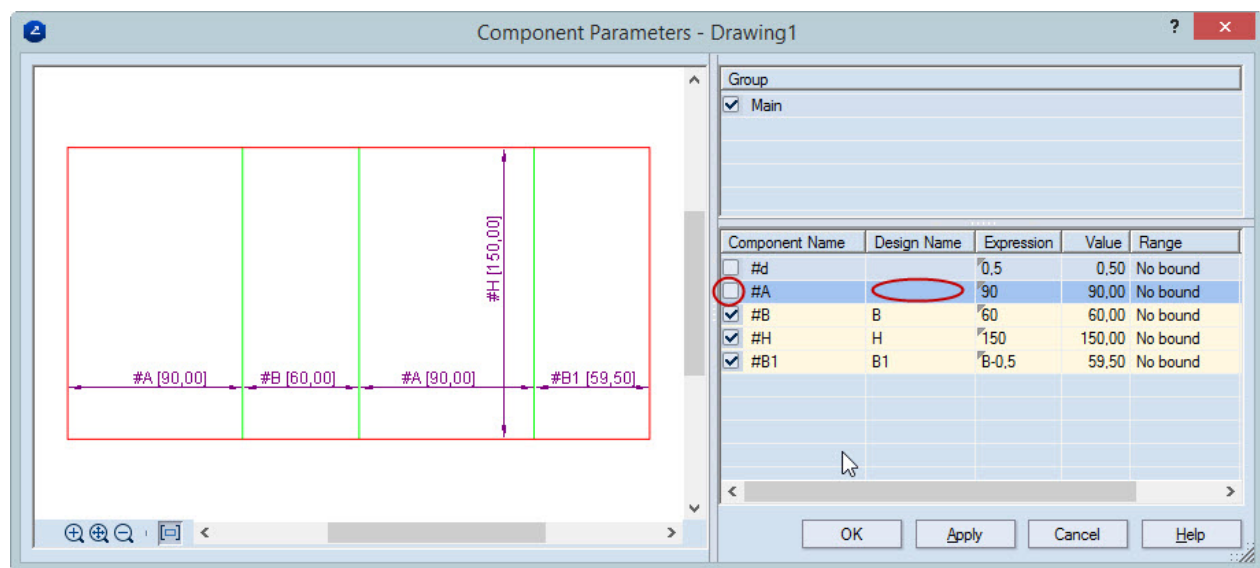
As we are working in the Advanced Parameter Matching mode, selected check boxes appear in front of the rows in the table. What does this mean?

Let us take a look at the second row, where the #A parameter is. We can see that the distance indicated with #A will be linked to the parameter A (seen in the **Design Name** column) and this parameter will appear in the parameters list with an expression 90. This distance will later be editable through the expression of the parameter A.

Why are the rows with selected check boxes highlighted in yellow?

These rows are highlighted in yellow, because the parameters (in **the Design Name** column), which will be linked to the component's dimension lines, are new for the drawing; they are not listed in the **Parameters** tab list. Highlighting the parameters means that the parameters named A, B, H and B1 will be added to the **Parameters** tab list. In this way, the corresponding distances will be editable through these parameters.

NOTE: If we choose to clear a check box, no parameter will be associated with the distance and this distance will not be editable later in the **Parameters** tab list:



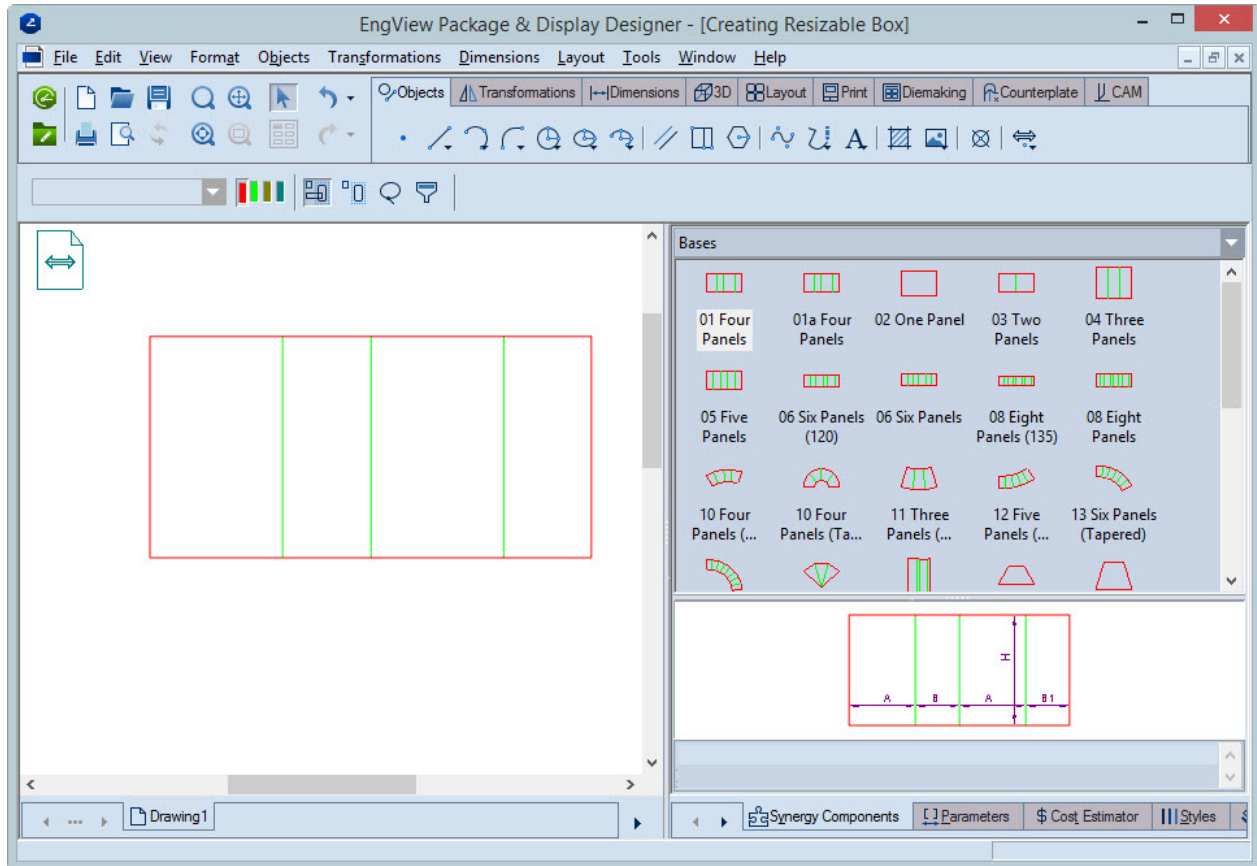
What about the #d?

The material thickness can be used during the creation of components that will be used for assembling the resizable design. For example, creating the component 01 Four Panels is based on the idea that the rightmost panel needs to be shortened by one material thickness. For this purpose, the parameter **d** has been created, which is used in the expression of the parameter B1 ($B1=B-d$).

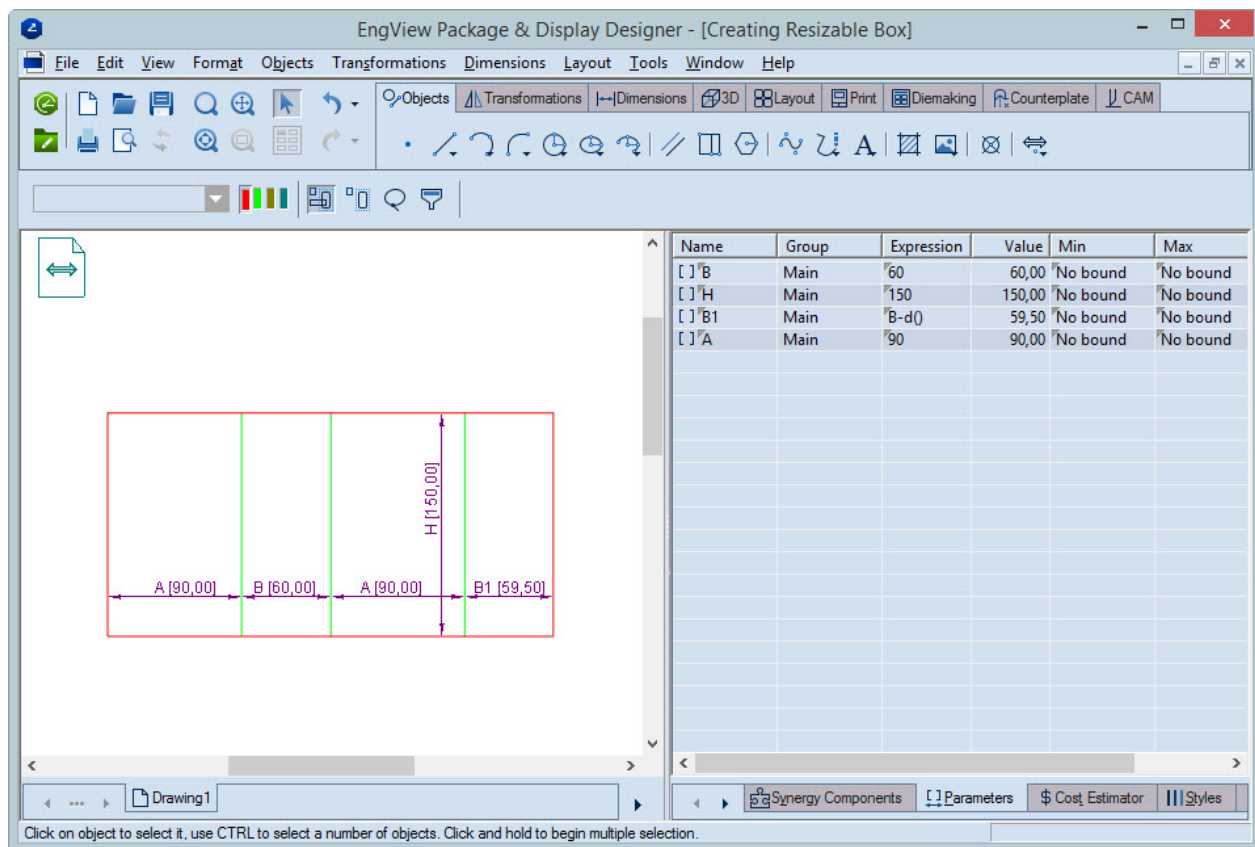
When this component is used during assembly of a resizable design, the parameter d is automatically substituted with d(). This is a function that extracts the material thickness from the drawing's properties. This means that we need no special parameter to indicate the thickness. That is why the check box in front of #d is unselected and its **Design Name** column field is empty.

5. To position the base, click **OK**.
6. To exit the component-placement mode, click **ESC**.

The base is now in the graphical area.



7. In the tabular area, click the **Parameters** tab. Note that we now have four new parameters.
8. In the graphical area, right-click the base and enable the appearance of the dimension lines. Note that in the base the indicated distances are linked to parameters in the tabular area.



This means that we are now able to use the parameters in the tabular area to edit the size of the base.

9. In the **Expression** column, make A=130.

Note that two of the panels in the base have been resized. This is because the parameter A is linked to two distances in the component.

10. Make B=55.

Note that two more panels have been resized too. The first resizing took place because the panel's dimension line is directly linked to the parameter B. The second panel was resized because its dimension line is linked to the parameter B1, which is indirectly linked to B: Its expression is B-d().

11. Make H=155.

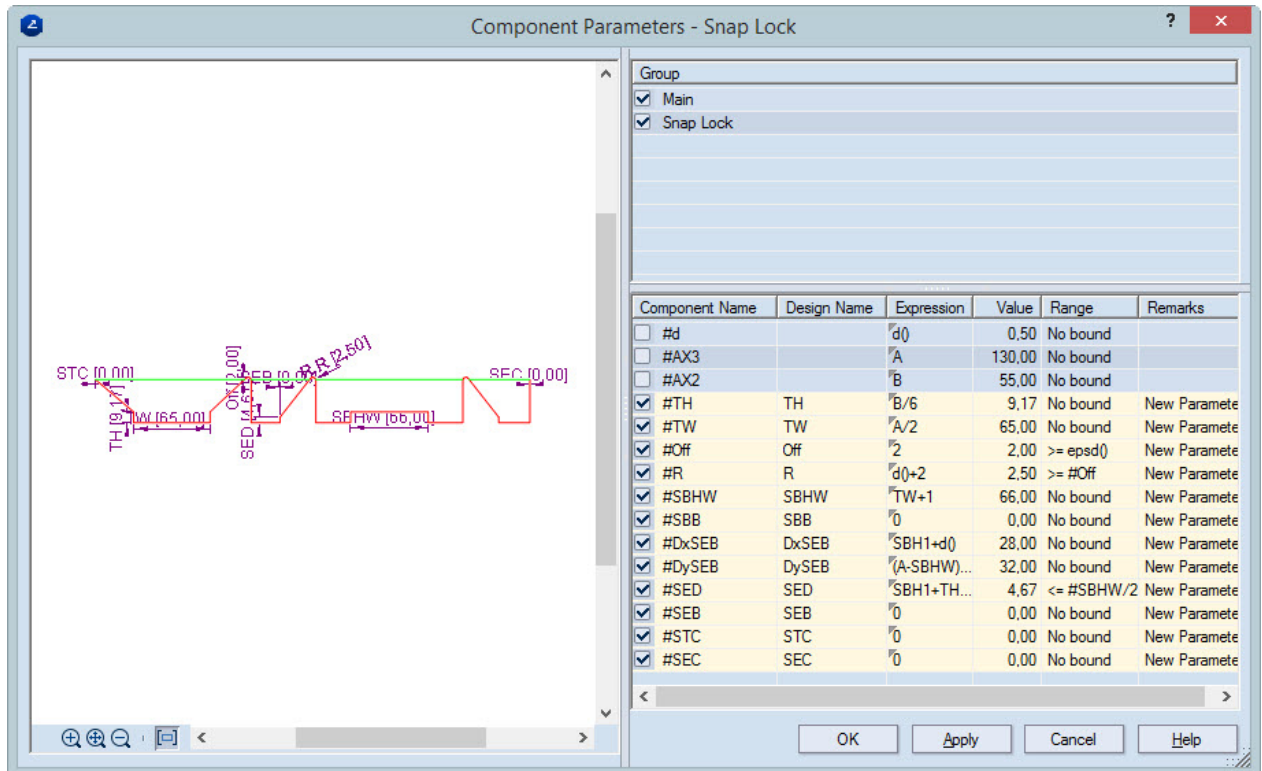
Attaching the bottom

1. To add the bottom, in the tabular area, click the **Synergy Components** tab, and then click the **Synergy Components** dropdown list.
2. Browse the sequence Compound Components | 01 Tops and Bottoms | 03 Snap Lock.
3. Select the component 01a Snap Lock (Rounding.STC.SEC).
4. Drag the component to the base and attach it to the lower part of the base.

After you have attached the last point of the component, the **Component Parameters** dialog box opens.

How to read the table

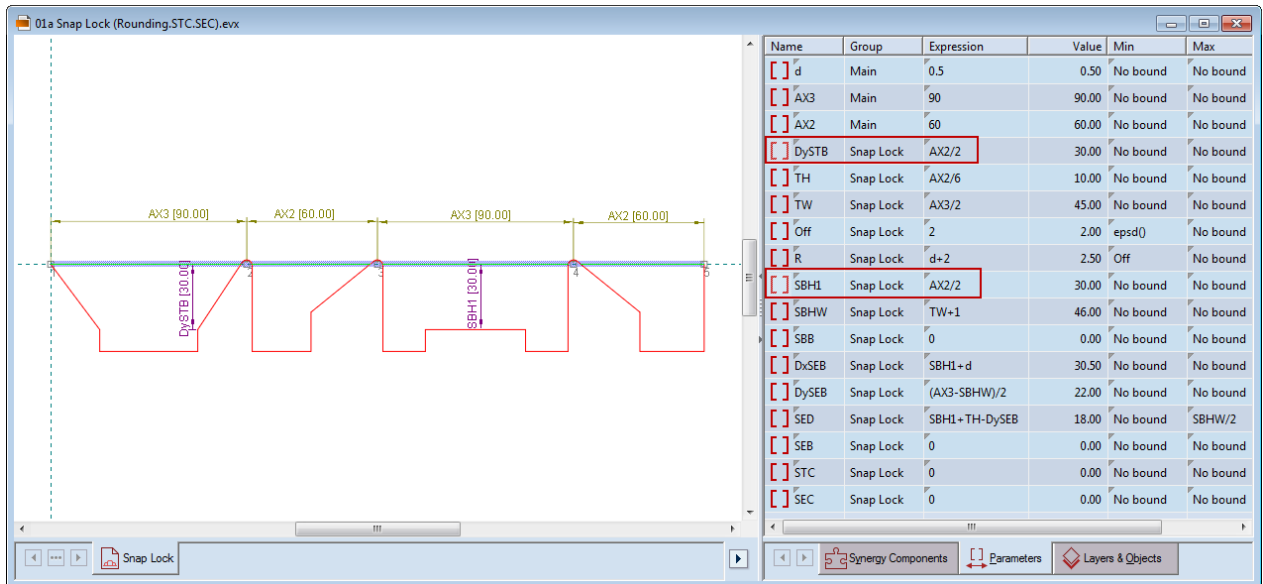
- On one hand after the attachment, the bottom component has been recalculated to fit the base because the component-level parameters #AX2 and #AX3 link the structure that we are attaching to the base. This took place because the values for #AX2 and #AX3 were automatically extracted from the respective values in the base. What's more, as in the **Parameters** tab list there are already parameters that have the same values (in this case A and B), the program links #AX2 and #AX3 to the parameters B and A, respectively:



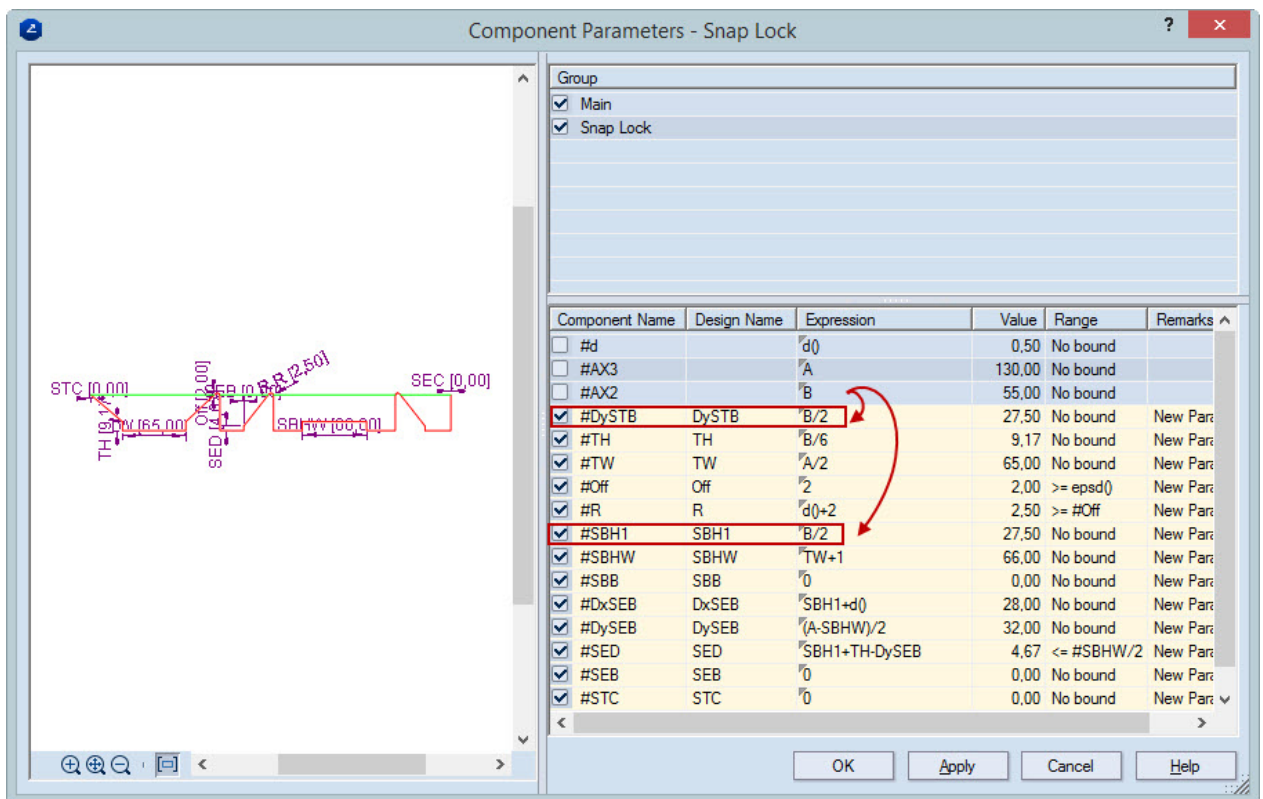
IMPORTANT: It is critical that the expressions of parameters #AX2 and #AX3 contain the parameters that control the design's main sizes – in this case the parameters A and B. Thus the attached bottom will recalculate each time the values of A and B change.

NOTE: By default, the two parameters are unselected, because they have been substituted by the parameters A and B

- On the other hand, when the compound component was created dependencies were set in the parameters' expressions between the distances AX2 and AX3 and the distances that form the compound component. In this way, when the compound component is used in the assembly of a resizable design, its parts are recalculated thanks to the information that comes from AX2 and AX3:



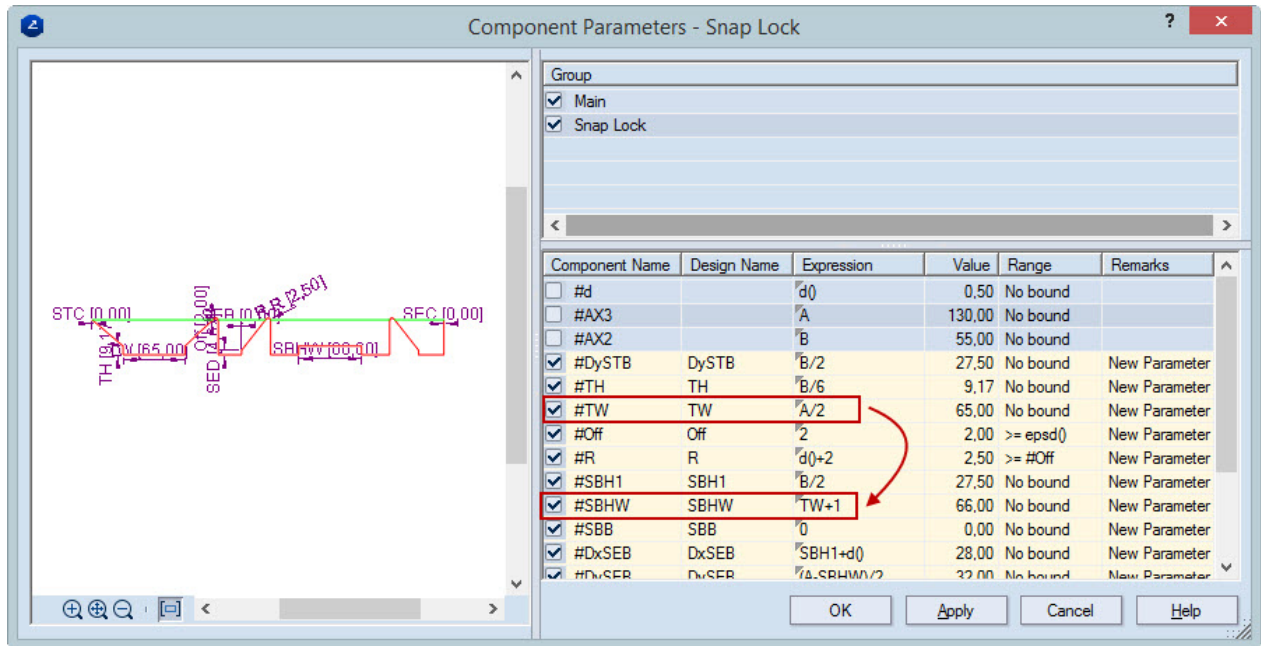
NOTE: This picture is from the Synergy software. It is shown here to offer an idea of how a compound component is created.



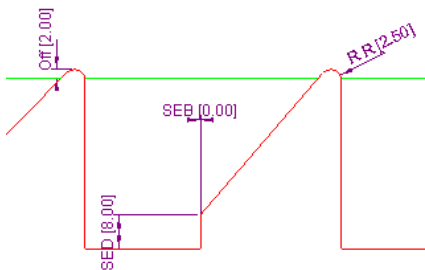
NOTE: To see the parameters DySTB and SBH1, in the tabular area, right-click, and then click **Show Hidden**.

- The rest of the parameters in the compound component – the ones highlighted in yellow --- will be transferred to the project and will appear in the parameter list. Some of them have their own

preset expressions, which are necessary for the calculation of the attached structure. Some of these preset expressions ensure the correct recalculation of the bottom when the design's main parameters (A and B) are changed – for example SBH1. Other preset expressions set dependencies between the parts of the bottom – for example, TTW and SBHW:

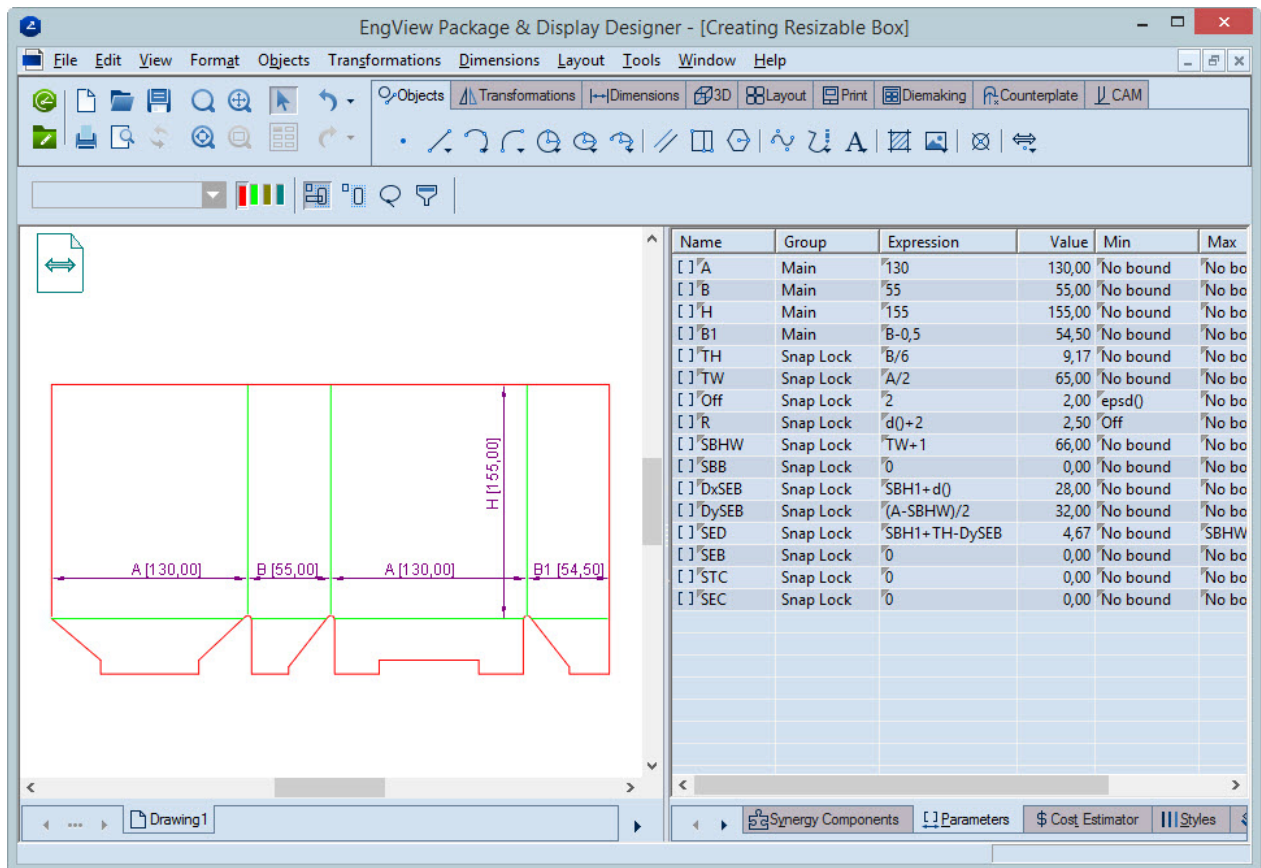


At this stage, using parameters has the advantage that we can trust their default values and not go into any detail. We can always control the bottom later when we edit the expressions of the parameters in the **Parameters** tab list. Consider the following example: During attachment, we have a much larger radius of rounding at the bottom's base (pictured). We can change this later.



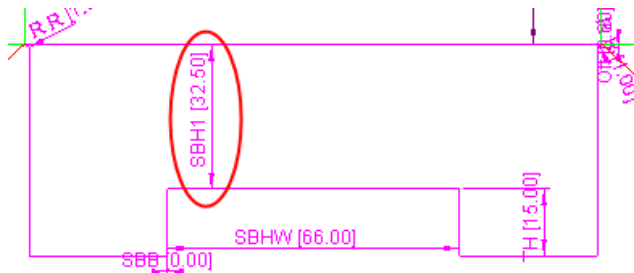
- To close the dialog box, click **OK**.

The snap lock is now part of the design and thanks to the use of parameters and their expressions it will be recalculated automatically each time the basic parameters of the design are change.



6. Make the parameter B=65.

Note that also the bottom changed. One critical dimension is, for example:

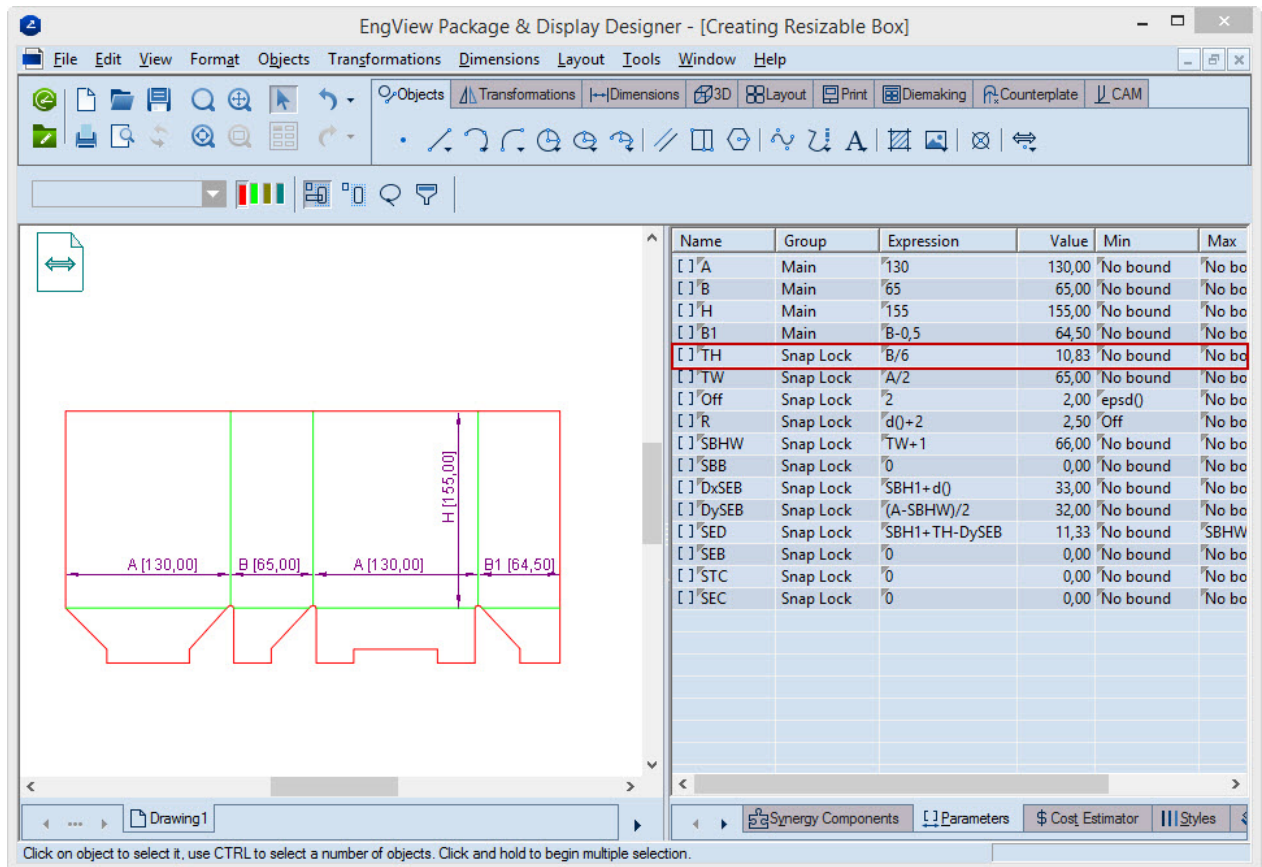
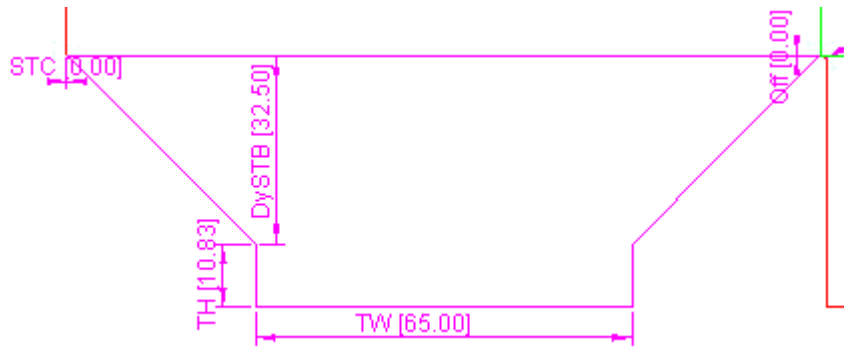


NOTE: To see the dimension lines in a component, select the component.

This distance will always be correct when the parameter B is given a new value, because in compound component the formula $AX2/2$ is preset. During the attachment of the component it becomes $B/2$.

By analogy, this applies also to the parameters DySTB, DxSEB and DySEB.

Note that not all expressions in the component are obligatory or critical. For example, the expression of the parameter $TH=B/6$ is freestanding – that is, it can be edited or even substituted with a concrete numerical value.



7. Make the parameter TH=15.

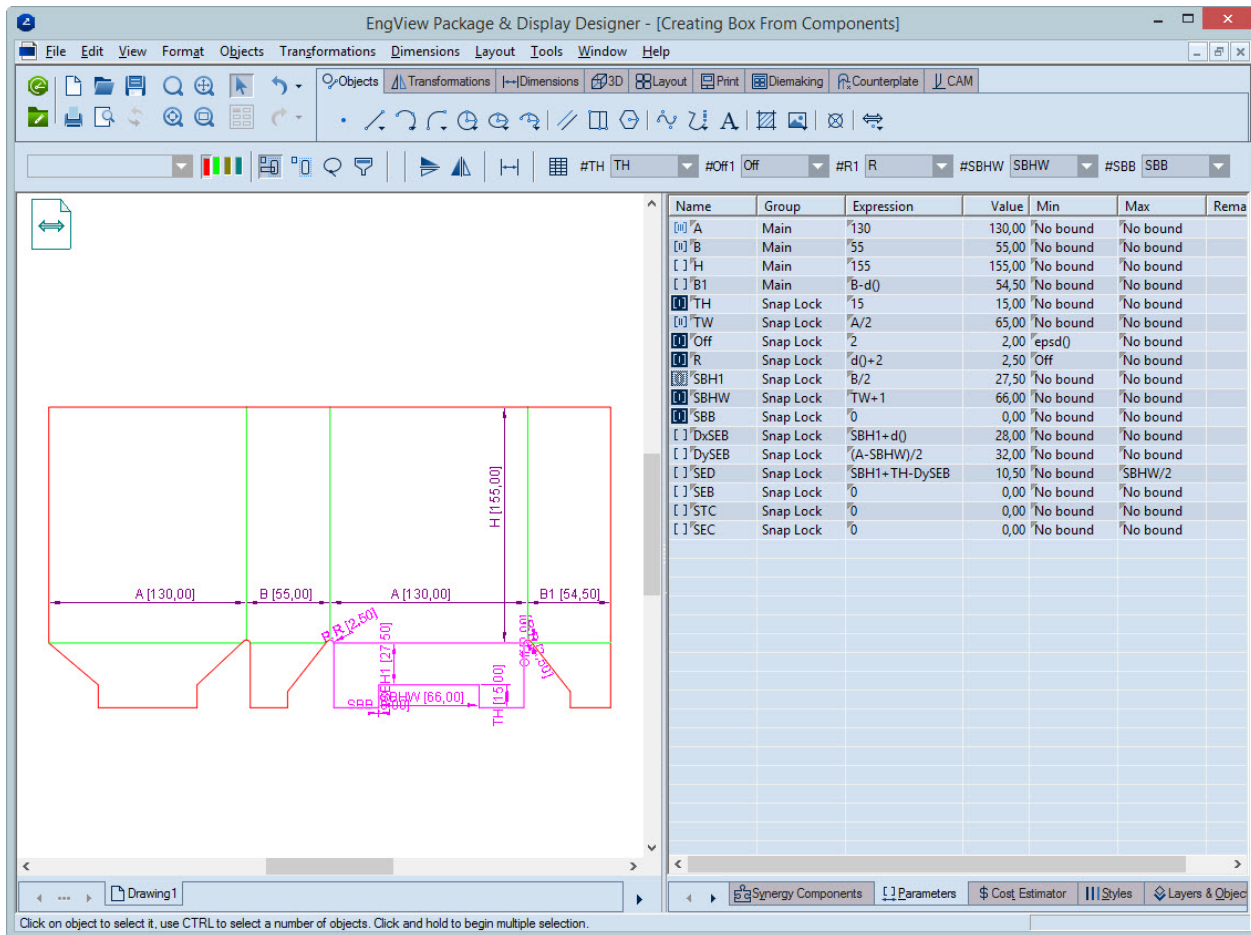
Note that also the height of the tongues of the middle panel is changed.

This took place thanks to the use of parameters and the fact that one and the same parameter controls the respective distances in the two components.

Editing the roundings

Now let us focus on the roundings and find out which parameter controls them. We will use the Trace Object Selection functionality, which highlights the parameters linked to a distance or a component that we point to in the graphical area.

8. To turn on the functionality, in the tabular area, right-click and then check **Trace object selection**.
9. As there are roundings in all parts of the bottom, select any one of them.



In the graphical area we can see the component's dimension lines and the parameters linked to them. In the tabular area, the parameters linked to these distances are indicated with red and blue dots. This is how we can quickly find the parameter R and edit its value to 1. Note that in this case a minimal-value threshold exists: The value of the parameter cannot be smaller than the value of the parameter Off (located right above the parameter R in the parameter list). If we want R to adopt the value 1, we need to reduce the value of the parameter Off.

10. Make the parameter Off=0.

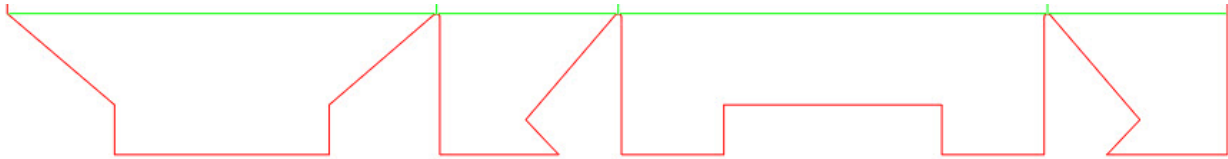
Now the parameter R can adopt the value 1.

Note that all the roundings have become smaller, not only those in the selected component. This is due to the role of parameters. In this case, the parameter R controls all the roundings in the bottom's individual components.

Editing the shape of the small flaps

11. Make the parameter SEB=10.

The shapes of the two flaps changed because a parameter exists that controls them.

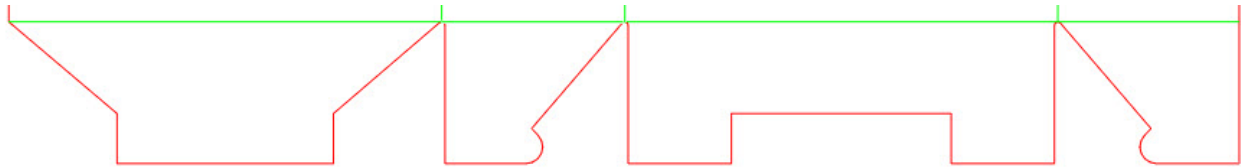


Now we will round the edges that have appeared.

12. On the **Objects**, click **Fillet**, and then, in **Radius**, type 5 and then press ENTER.

13. Ensure that the **Smart Fillet** button  is pressed in.

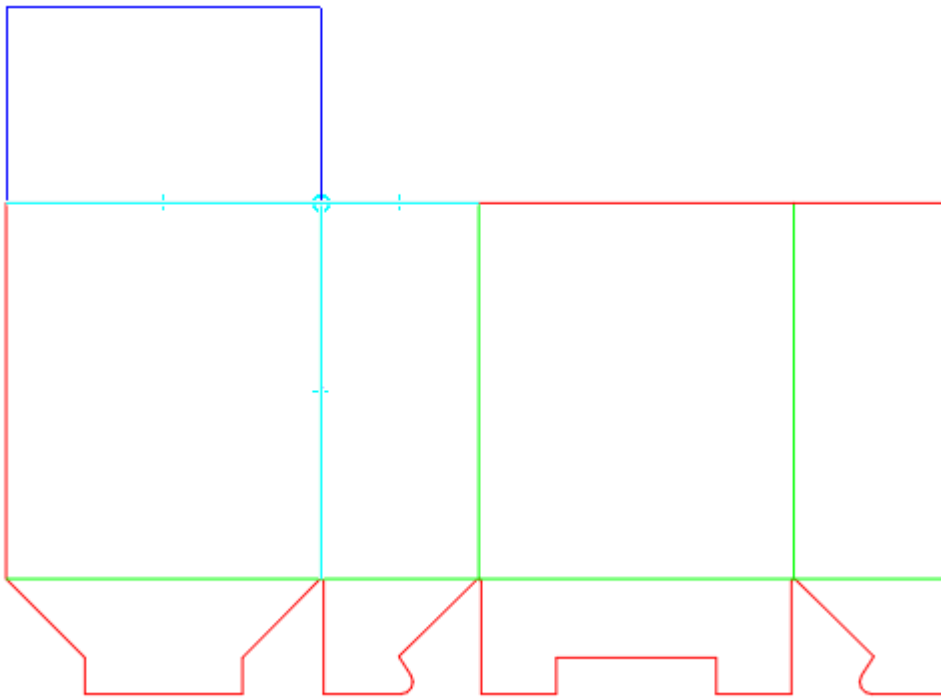
14. In the graphical area, make the two roundings. See the following example.



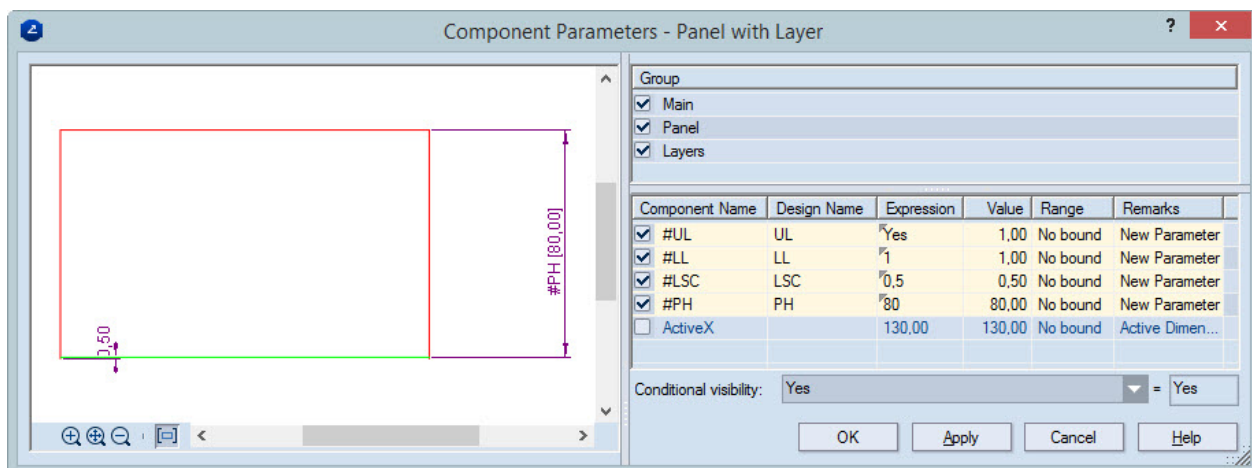
Assembling the top of the box

Attaching a panel

1. In the **Synergy** tab in the tabular area, browse the sequence Individual Components | 01 Geometrical Shapes | 01 Rectangles | 01 Rectangle (Layer).
2. Drag the component into the graphical area and attach it.



The component's table of parameters appears.

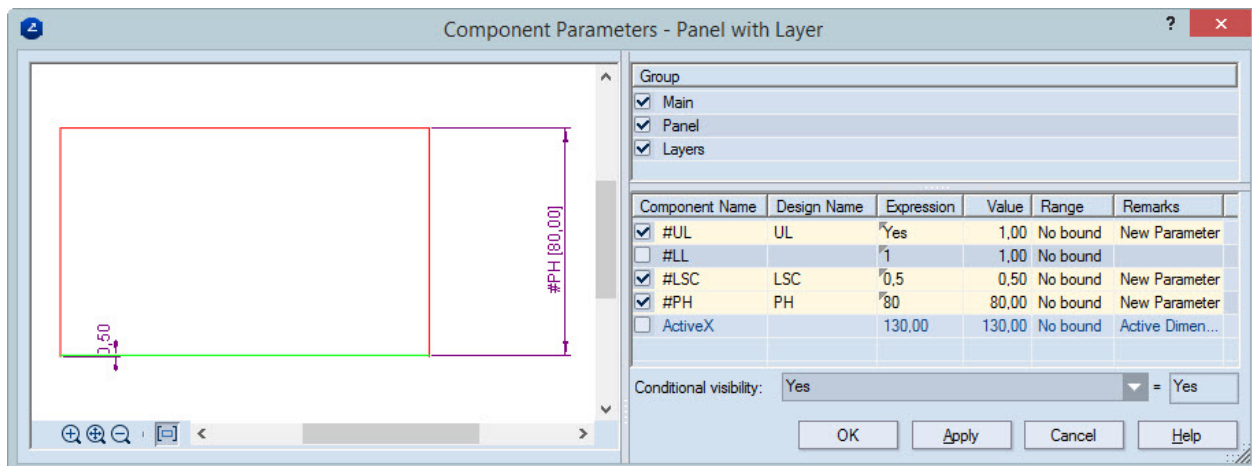


Four new parameters (highlighted in yellow) will go into the list of parameters:

- UL: When it has the value **Yes**, moves up the crease. When it has the value **No**, it makes the crease level with points of attachment.
- LSC sets the step of moving the crease. Normally it equals the material thickness.
- LL sets the number of steps needed for moving the crease.
- PH sets the panel height.

In our case the crease needs to be moved by one material thickness [d()]. We take it that the value of LSC will equal that of d(). So the number of steps necessary for moving (controlled by the parameter LL) must be 1 – this must not change.

Let us now take stock of the situation. In the table, the LL row is selected and we have LL in the **Design Name** column. This means that LL will go to the project's parameter list. But we do not need this because we need the parameter always to have the value 1. That is why we clear the check box (pictured). Note that the **Design Name** column is now empty.



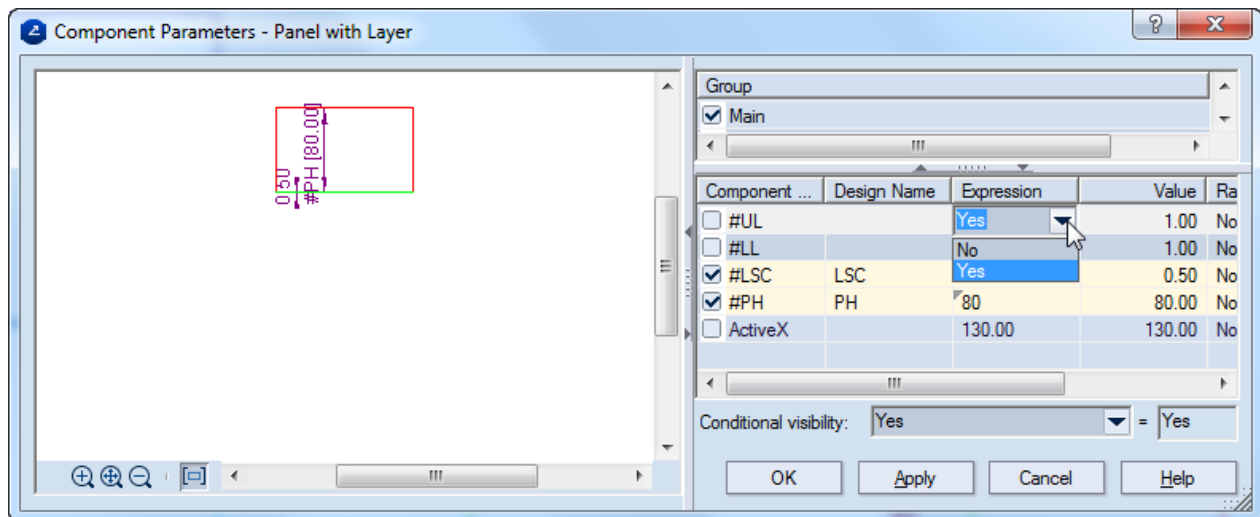
In this way we avoid sending LL to the parameter list and leave it to have the value 1 always.

About the use of layers (the parameter UL)

If we leave the UL row selected, UL will go to the parameter list, and this will add flexibility to the structure: If we make UL=No, creases will become collinear (it will not be offset).

But if we do not need this flexibility: We need to clear the check box in front of UL and in **Expression** choose either Yes or No. In this case we will discard the flexibility option:

3. Clear the check box and select Yes.



4. Click **OK**.

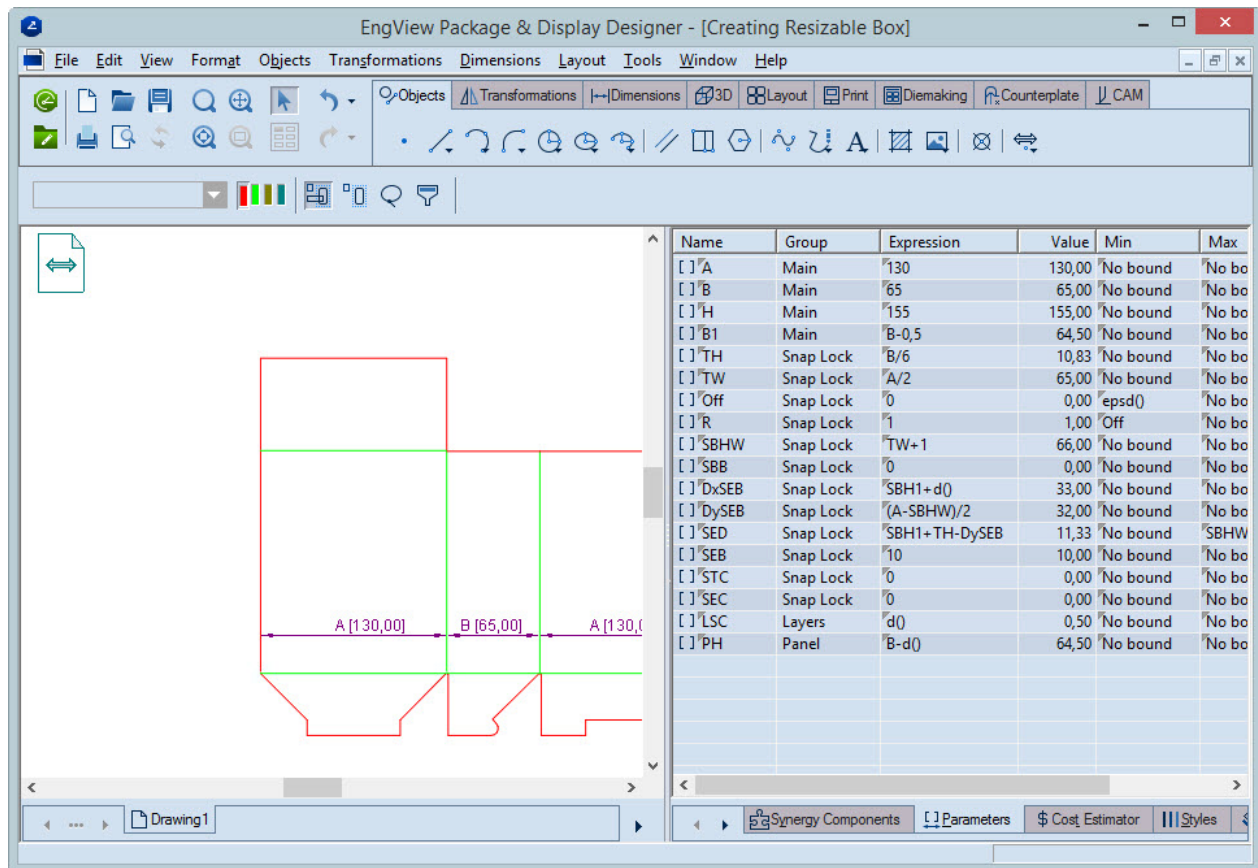
5. To exit the component-placement mode, press ESC.

Two new parameters appeared in the parameter list: LSC and PH.


6. Let us link the crease movement to the material thickness: Make the expression of LSC: d().

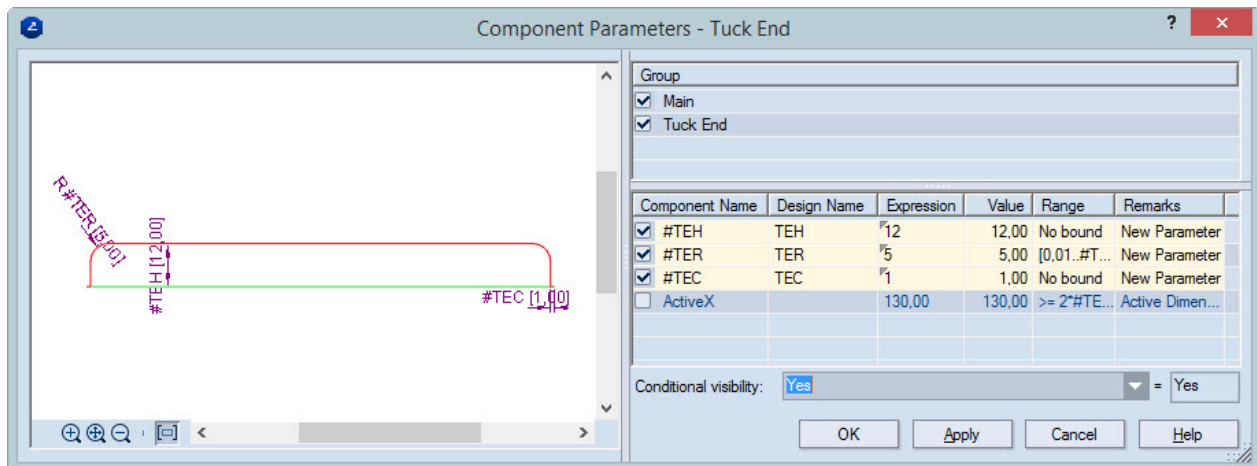
7. The height of the attached panel cannot be free: In the expression of PH, put a formula: B-d().

[]	LSC	Layers	d()
[]	PH	Panel	B-d()



Attaching a tuck end

8. Browse the sequence Individual Components | 12 Tongues | 06 Tuck Ends | 02 Tuck End.
9. Begin dragging the component into the graphical area. Then, before attaching it to the rectangle, on the contextual edit bar above the graphical area, click **Show component dimensions**  to make visible its dimension lines.



10. Click **OK**.
 11. Press **ESC**.
- Three new parameters have gone into the parameters list: THE, TER and TEC.
12. Normally TEC equals the material thickness: Make $TEC=d()$.

The screenshot shows a CAD software interface with a technical drawing of a box on the left and a parameter table on the right. The drawing includes dimensions for width (A [130.00], B [65.00], B1 [64.50]), height (TEH [12.00]), and tuck end (TER [5.00], TEC [0.50]). The parameter table on the right lists various components and their values.

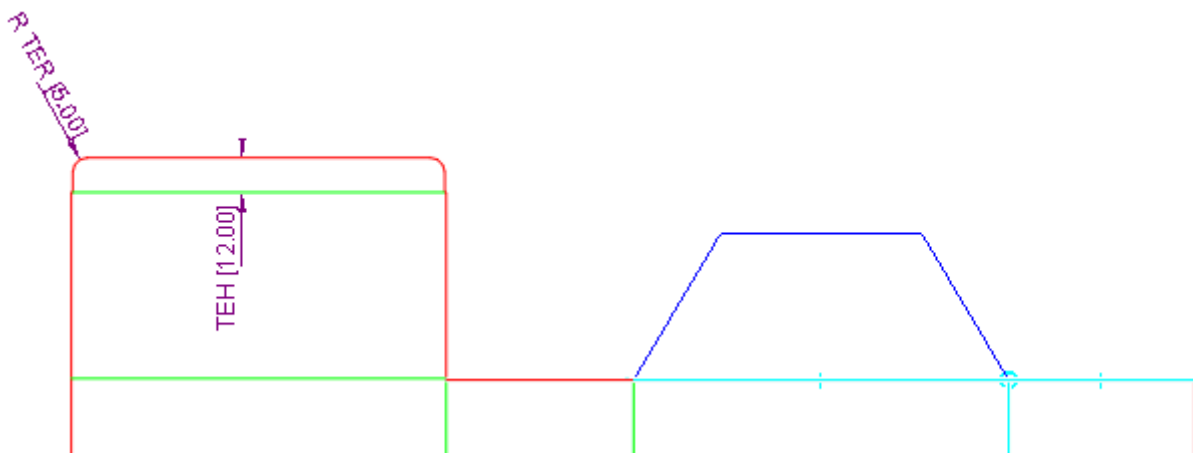
Name	Group	Expression	Value
[] TW	Snap Lock	A/2	65.00
[] Off	Snap Lock	0	0.00
[] R	Snap Lock	1	1.00
[] SBH1	Snap Lock	B/2	32.50
[] SBHW	Snap Lock	TW+1	66.00
[] SBB	Snap Lock	0	0.00
[] DxSEB	Snap Lock	SBH1+d()	33.00
[] DySEB	Snap Lock	(A-SBHW)/2	32.00
[] SED	Snap Lock	SBH1+TH-...	15.50
[] SEB	Snap Lock	10	10.00
[] STC	Snap Lock	0	0.00
[] SEC	Snap Lock	0	0.00
[] LSC	Layers	d()	0.50
[] PH	Panel	B-d()	64.50
[] TEH	Tuck End	12	12.00
[] TER	Tuck End	5	5.00
[] TEC	Tuck End	d()	0.50

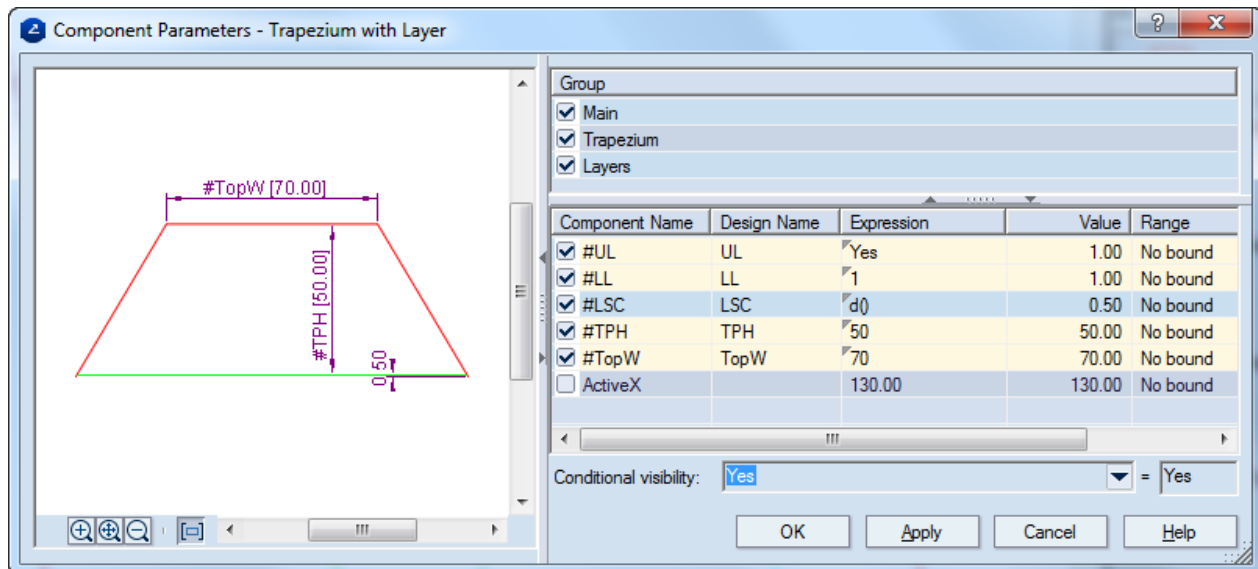
Let us hide the dimension line showing the TEC value: We have already a rule for that and we need not see something that we know works correctly.

13. Point to the dimension line, and when it is highlighted, right-click, and then click **Hide**.

Attaching a trapezium

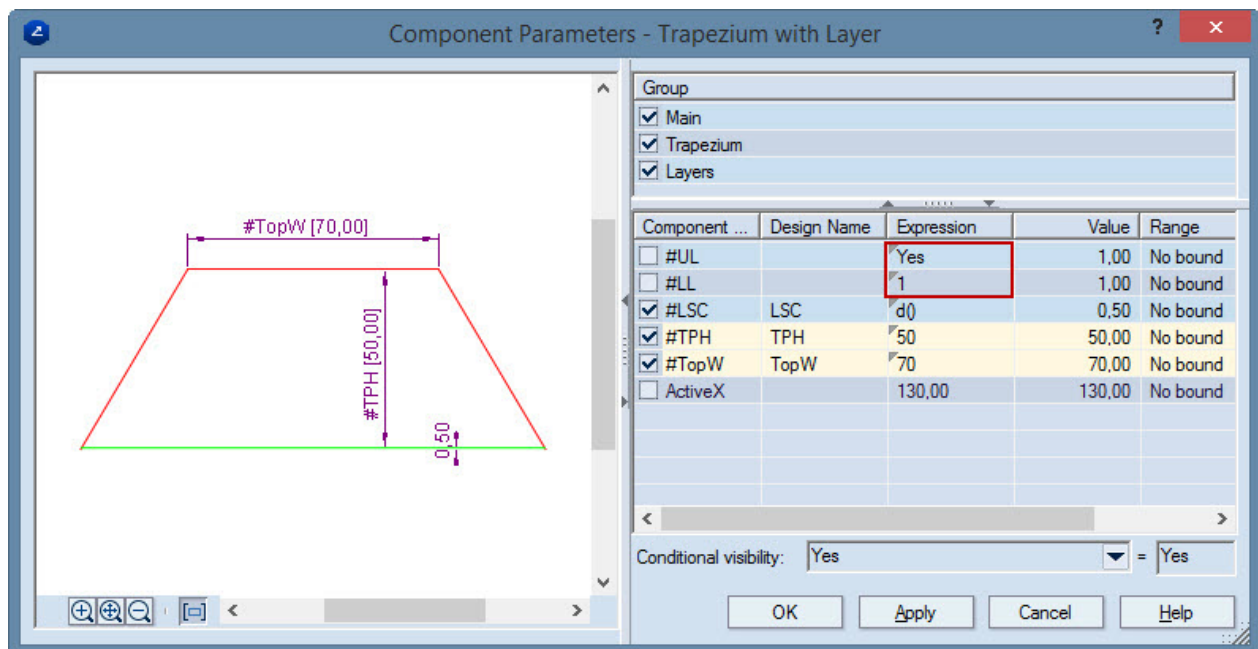
14. Browse the sequence: Individual Components | 01 Geometrical Shapes | 02 Trapeziums | 01b Trapezium (TopW.Layer). Drag the component, and attach it to the third panel of the base.





Note that LSC is selected but not highlighted. This means that a parameter LSC will be used for the movement of the crease. But we already have such a parameter in the parameter list. That is, no new parameter will be created with this name because such a parameter exists already; that's why the row is not highlighted in yellow. This means that the program will link the crease movement in the newly attached component to the parameter used for moving the crease in the earlier component (the rectangle). In the current case we need the two crease movements to be identical, and that is why we will leave things as they are.

Also the new component has parameters UL and LL, and the program offers to take them to the parameter list. But we do not need this, which is why we'll clear their check boxes and will use the values we have already chosen (pictured).

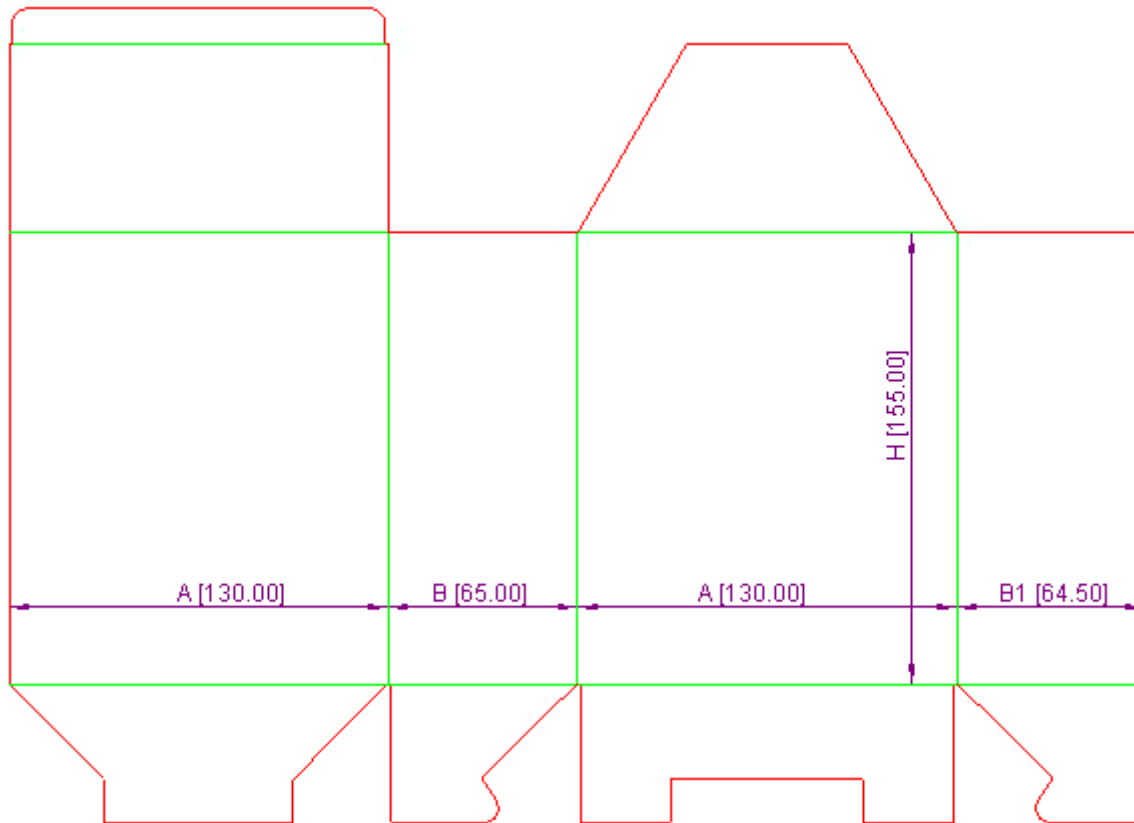


15. Click **OK**.

16. Press ESC.

Two new parameters – TPH and TopW – were added to the parameter list.

17. Make $TPH=B-d()$; make $TopW=55$.



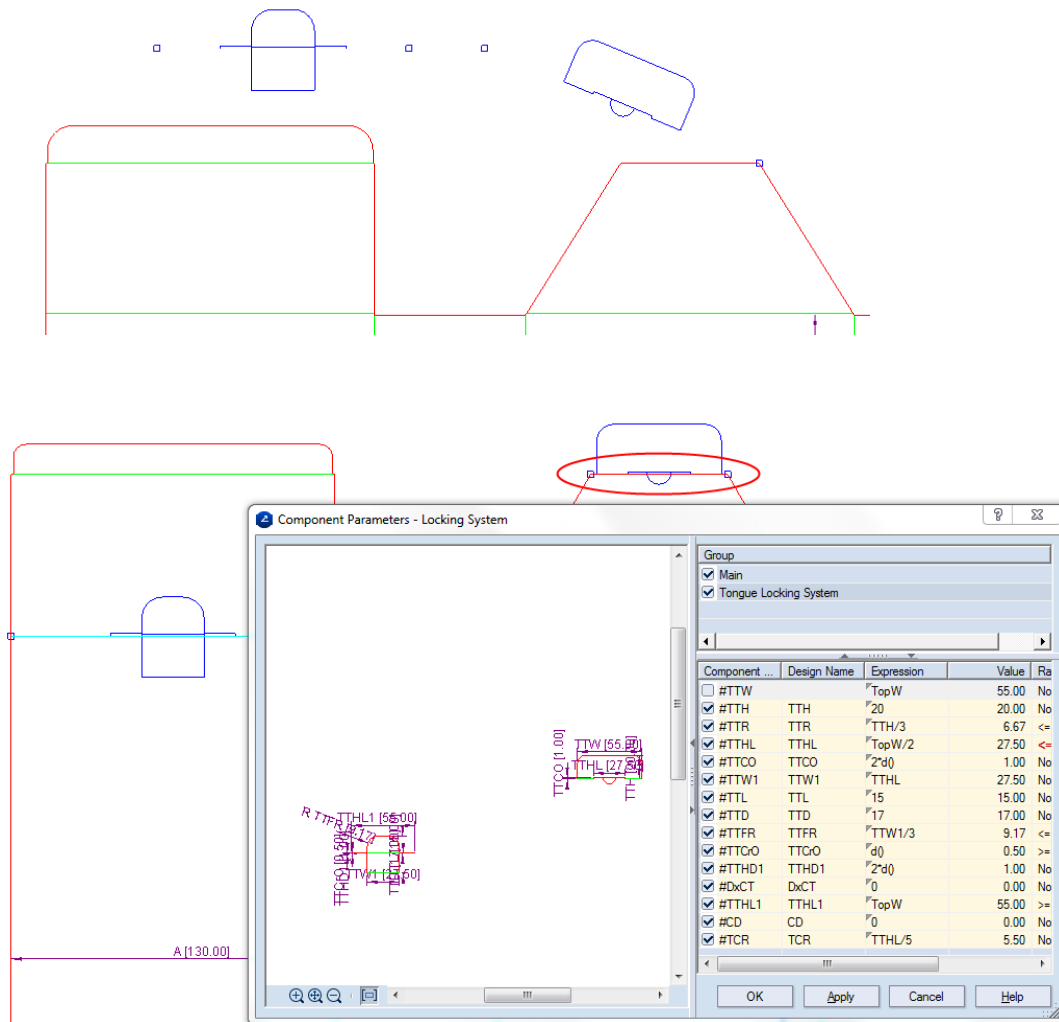
Attaching a tongue locking system

18. Browse the sequence: Compound Components | 02 Parts | 01 Tongue Locking Systems | 51 Tongue Locking System (TTCO.Centered)

19. Drag the component into graphical area, and before attaching its parts, click **Apply Vertical Mirror**



20. Attach the Tongue Locking System.



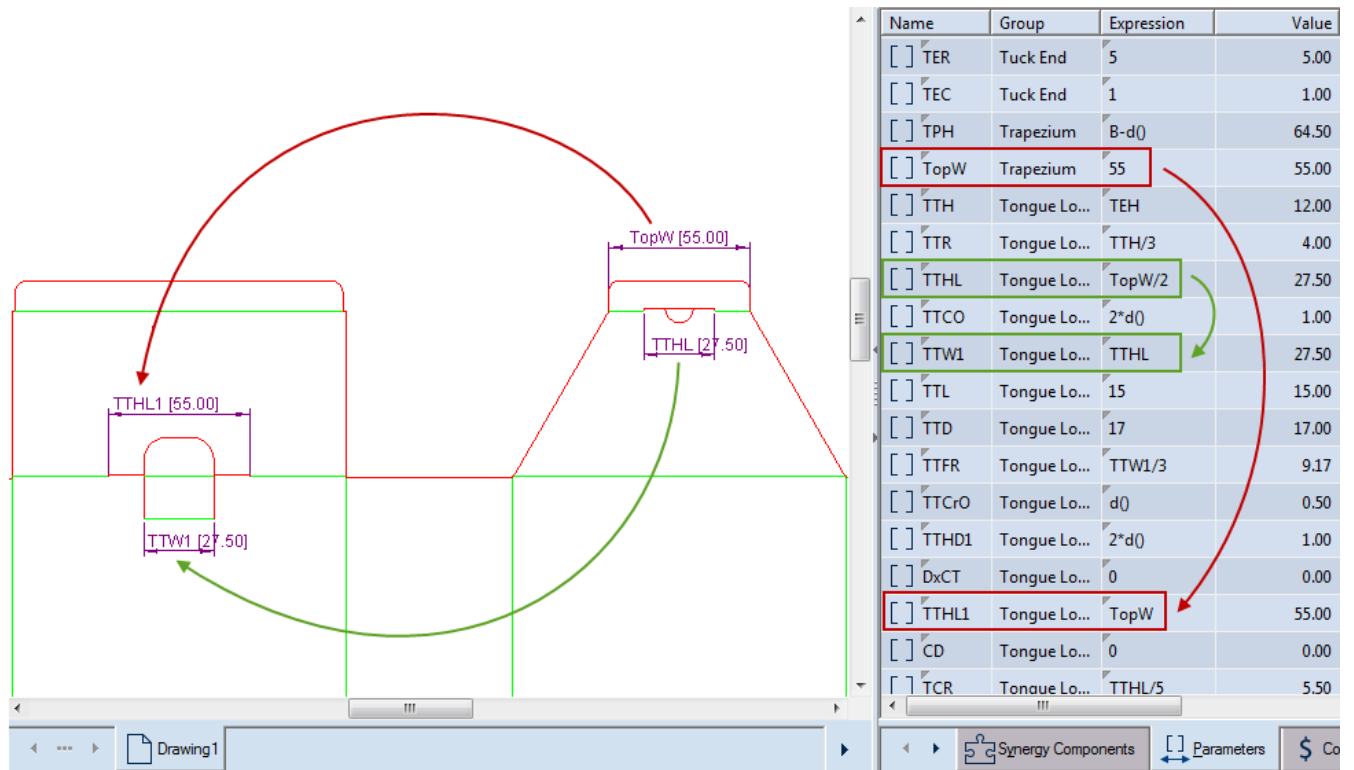
21. We need to link the tongue's width with the width of the trapezoid's upper base. That is why, clear the TTW check box and in its expression type TopW.

22. To see the changes, click **Apply**.

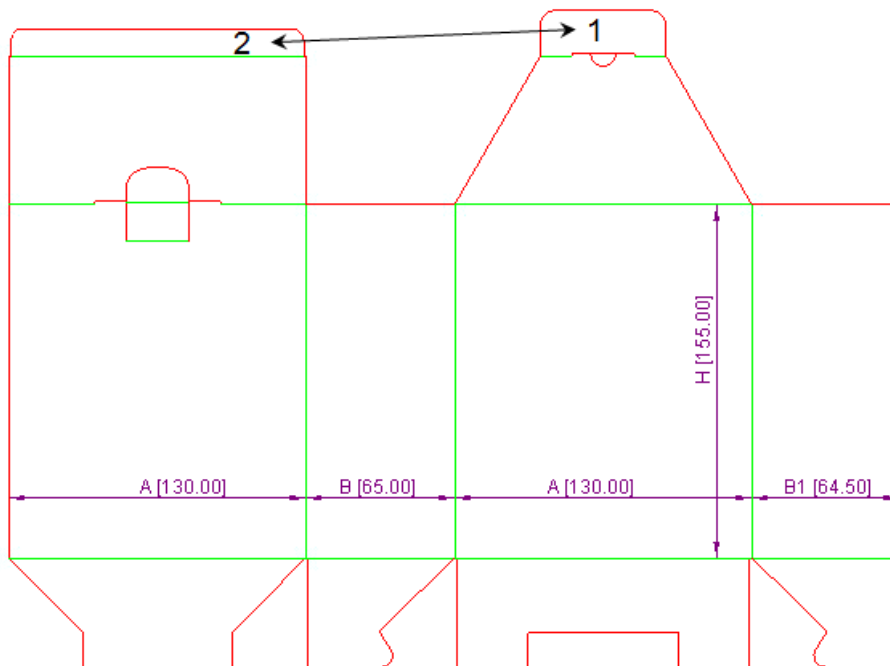
After we click OK, all the parameters highlighted in yellow will be added to the project's parameter list. No parameter TTW will be created (the **Design Name** field is empty), because we linked the width of the tongue to the existing parameter TopW.

23. Click **OK**.

Due to the preset link in compound components between the individual components, here the tongues' widths have been linked to the widths of the slits. After the compound component has been attached, this logic was transferred to the project (pictured):

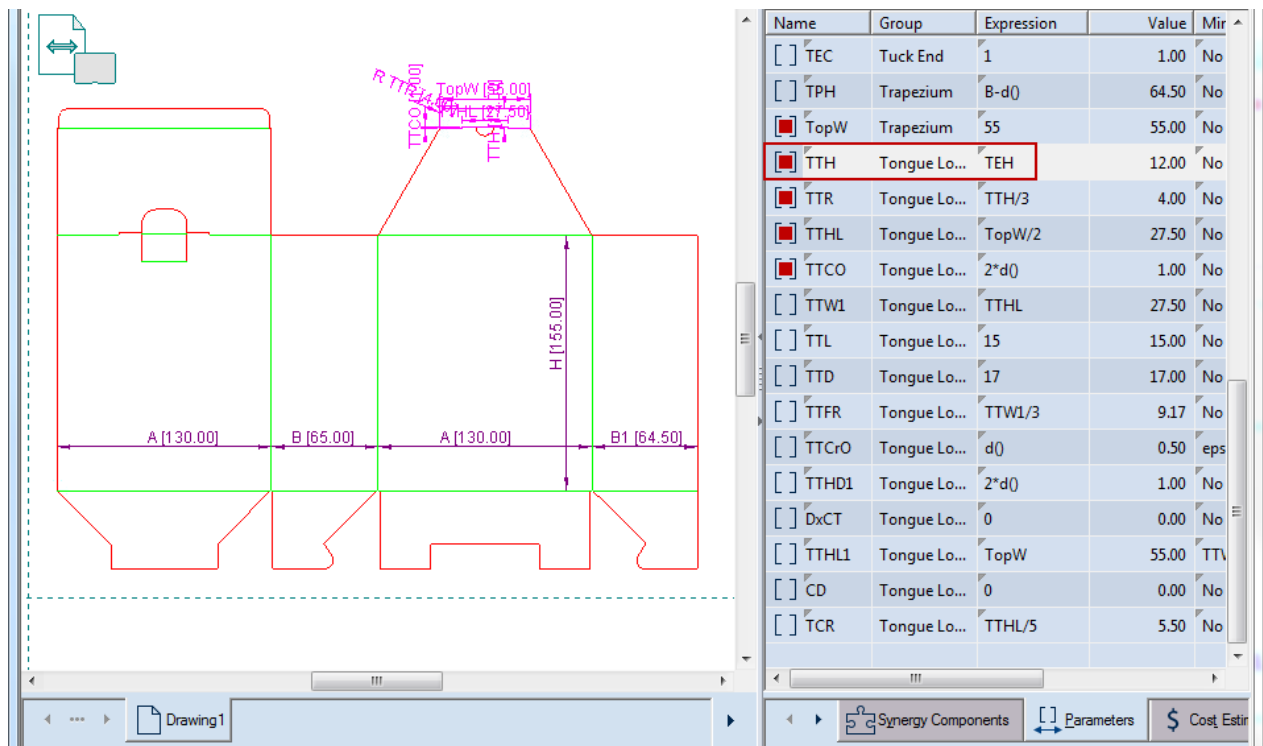


It is good practice to level the two tongues.



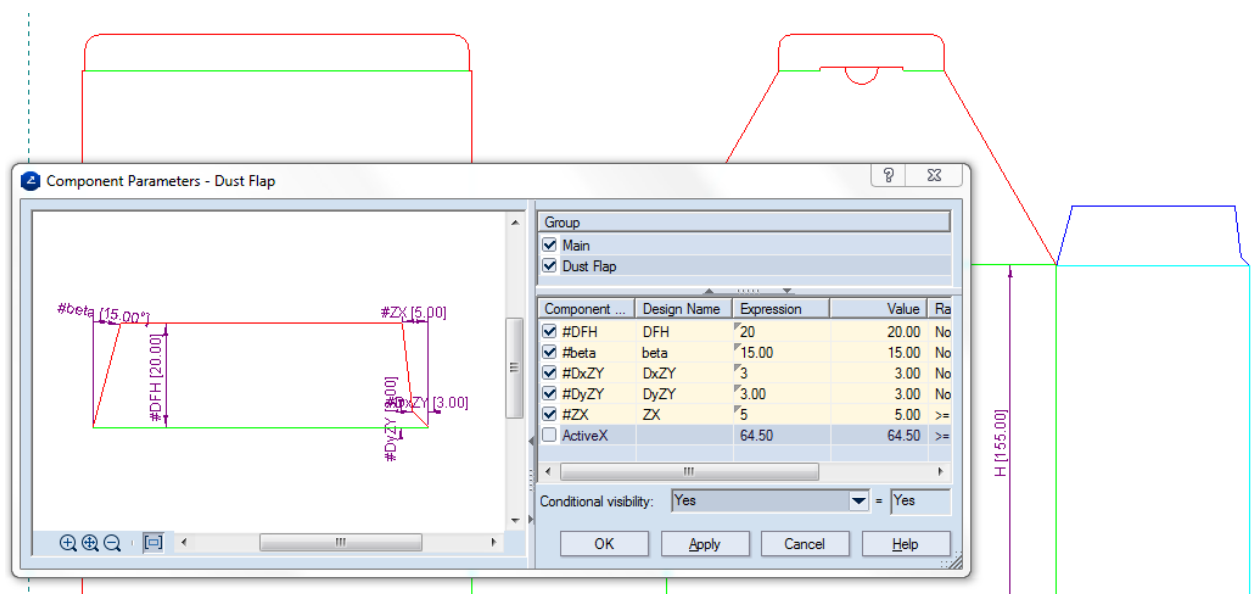
24. To easily locate the parameter that controls the component's height select the component 1. You can see that the parameter that controls the tongue's height is TTH.

25. In the expression of TTH, type TEH.



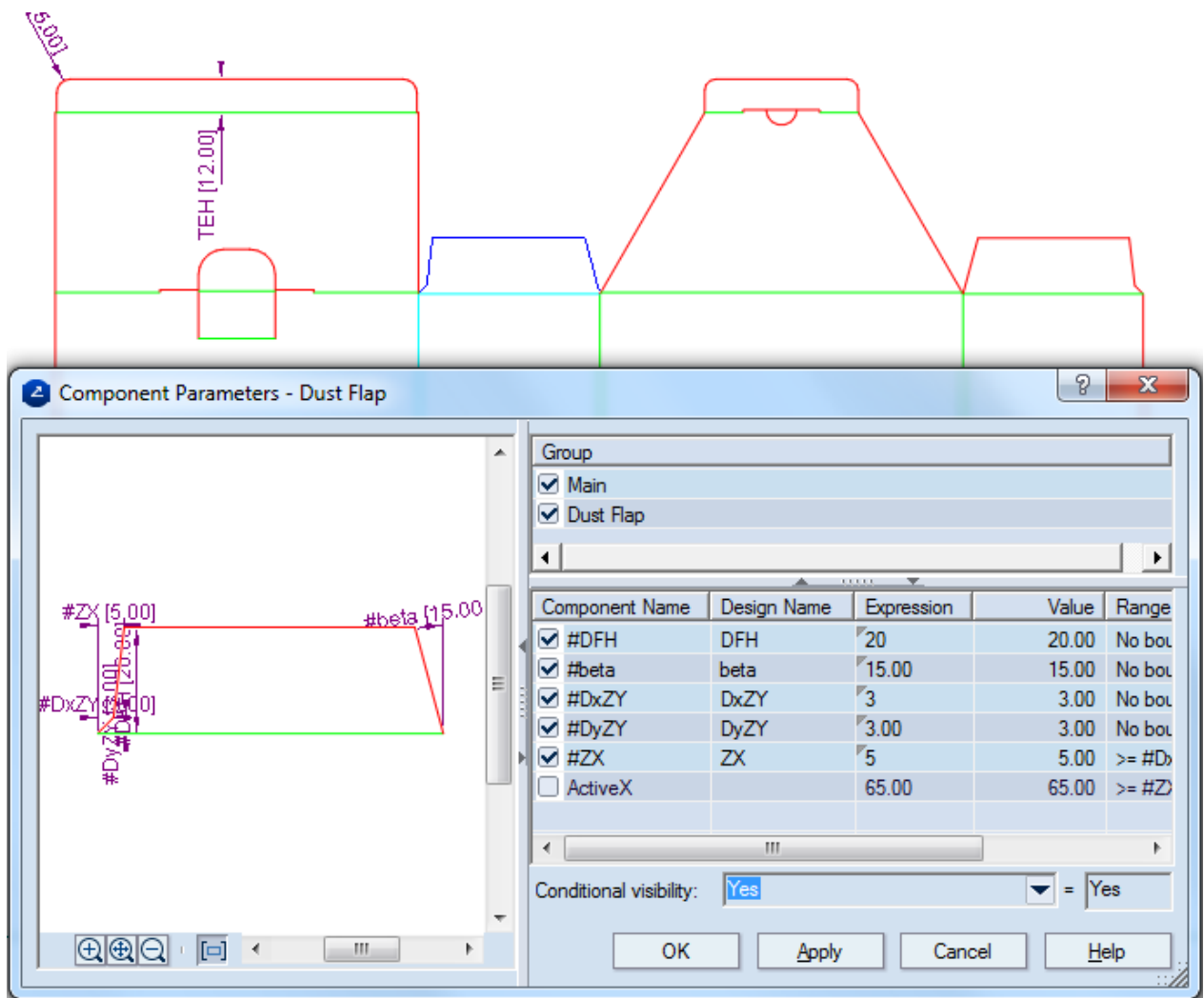
Attaching flaps

26. Browse the sequence: Individual Components | 02 Flaps | 02 Flaps | 30 Flap.
27. Drag the component into the graphical area, and attach it to the last panel of the base.



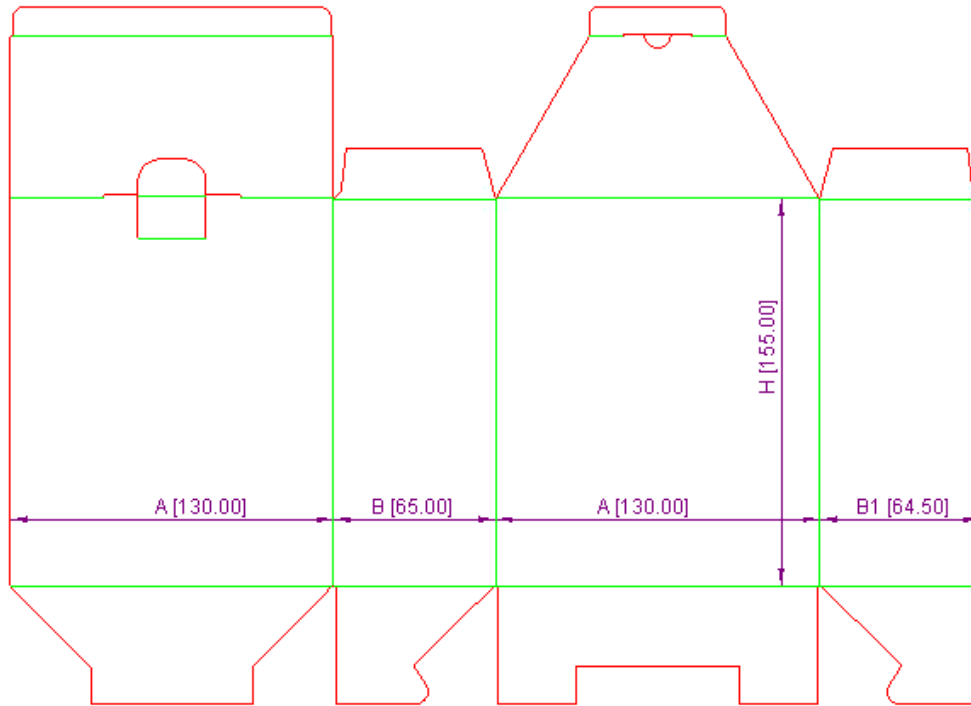
The parameters that arrive from the component are new for the parameters list (highlighted in yellow).

28. Repeat Step 56 using the Vertical Mirror functionality .



NOTE: No rows will be highlighted in yellow as these components already exist in **Parameters** tab list (they were added when the component was first attached). As the two flaps need to have the same shape, we will use the same parameters each time we need to edit their sizes.

29. To exit the component-placement mode, press ESC.



We need to ensure that the flaps' height does not get in the way of the locking system.

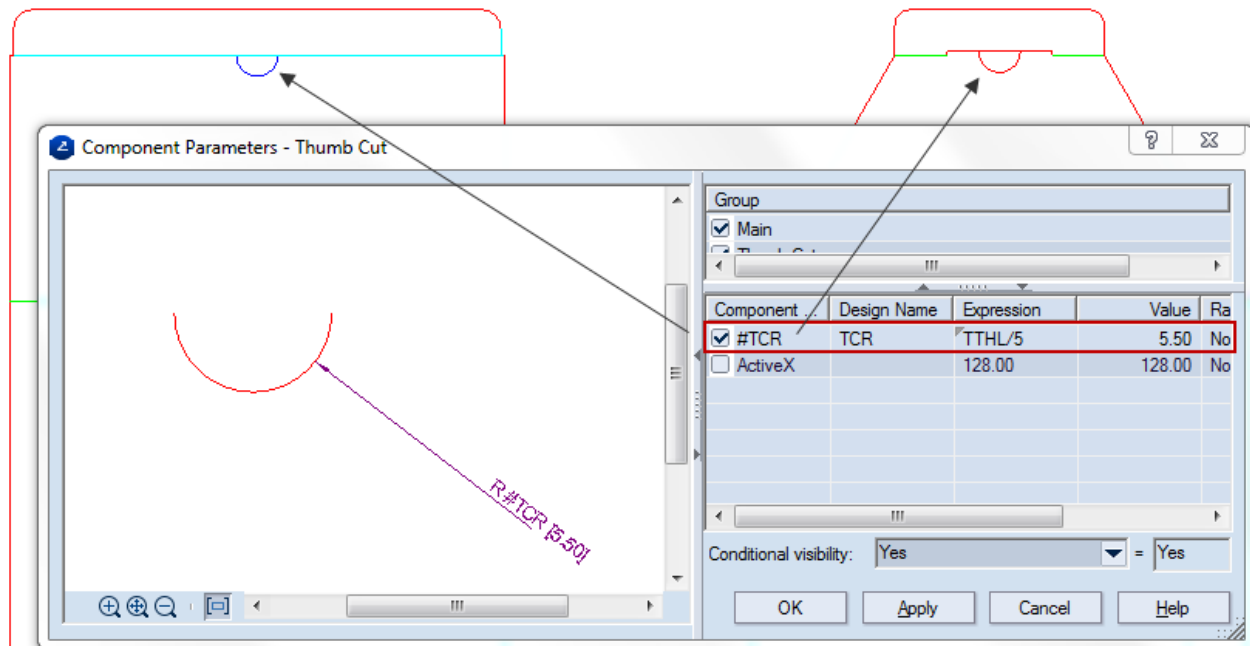
30. In the **Max** column, for the parameter DFH, type $(A - \text{TopW})/2$, and then change the value to 50.

The parameter's maximum value guarantees that if a bigger value is entered as an expression, the concept of the structure will not be violated.

Name	Group	Expression	Value	Min	Max
TTHL	Tongue Lo...	TopW/2	27.50	No bound	TopW
TTCO	Tongue Lo...	2*d()	1.00	No bound	No bound
TTW1	Tongue Lo...	TTHL	27.50	No bound	No bound
TTL	Tongue Lo...	15	15.00	No bound	No bound
TTD	Tongue Lo...	17	17.00	No bound	No bound
TTFR	Tongue Lo...	TTW1/3	9.17	No bound	min(TTW1...
TTCrO	Tongue Lo...	d()	0.50	epsd()	No bound
TTHD1	Tongue Lo...	2*d()	1.00	No bound	No bound
DxCT	Tongue Lo...	0	0.00	No bound	No bound
TTHL1	Tongue Lo...	TopW	55.00	TTW1+2*D...	No bound
CD	Tongue Lo...	0	0.00	No bound	No bound
TCR	Tongue Lo...	TTHL/5	5.50	No bound	No bound
DFH	Dust Flap	50	37.50	No bound	(A-TopW)/2
beta	Dust Flap	15.00	15.00	No bound	No bound
DxZY	Dust Flap	3	3.00	No bound	No bound
DyZY	Dust Flap	3.00	3.00	No bound	No bound
ZX	Dust Flap	5	5.00	DxZY	No bound

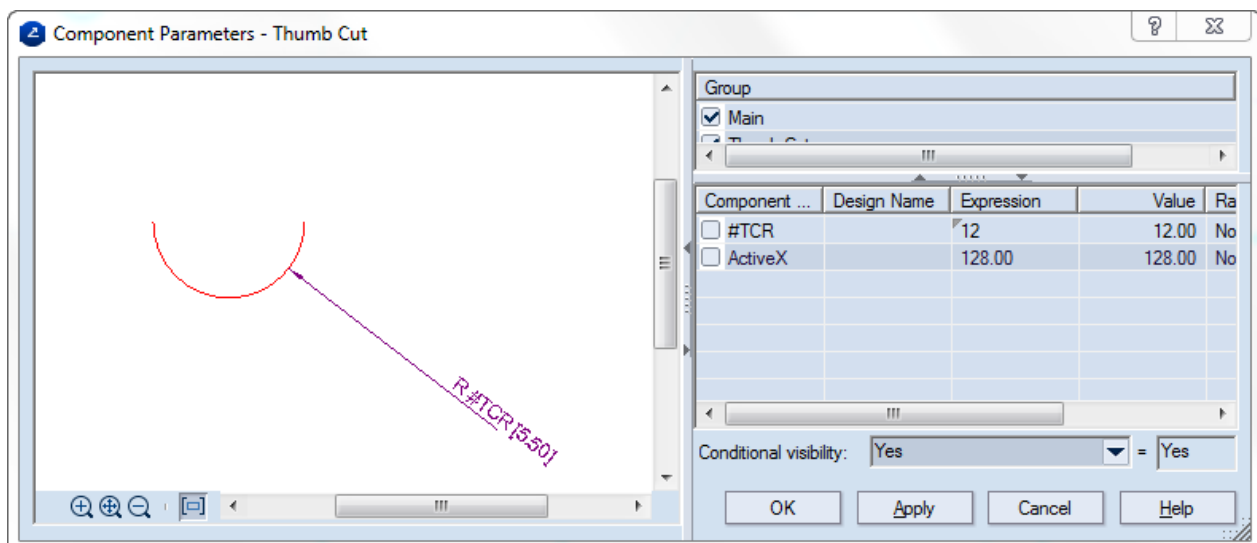
Attaching a thumb cut

31. Browse the sequence: Individual Components | 10 Cuts | 02 Thumbs and Arcs | 01 Thumb Cut (Centered). Drag it and attach it at the place as shown in the next picture.



Note that the TCR row is not highlighted. This means that a parameter exists in the project's parameter list and that this parameter will control the component that's being added. We proceed by allowing entry of different values for the two thumb cuts.

32. Clear the check box in front of the #TCR distance.

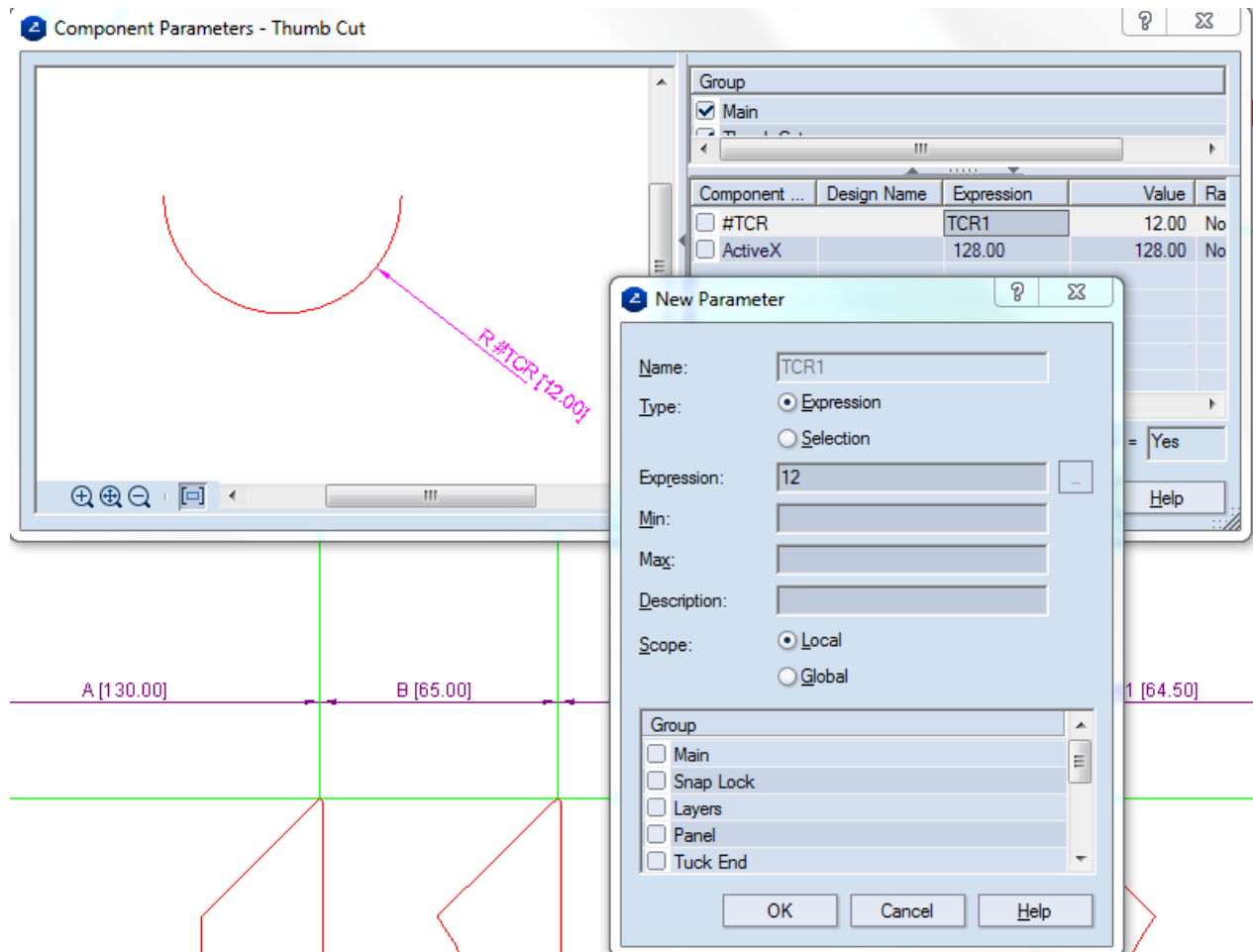


Note that the **Design Name** field is now empty and that a number appeared in the **Expression** field. If now we click **OK**, the thumb cut's radius will be 12 and there will be no parameter to control it.

We will now create a parameter to control this radius.

33. In the **Expression** field, type a name for the new parameter, for example, TCR1, and then press ENTER.

A dialog box appears in which we will create a new parameter.



34. In **Expression**, type the value for the new parameter, for example 12, and then click **OK**.

35. In the **Component Parameters** dialog box, click **OK**.

There is a new parameter, TCR1, in the **Parameters** tab list.

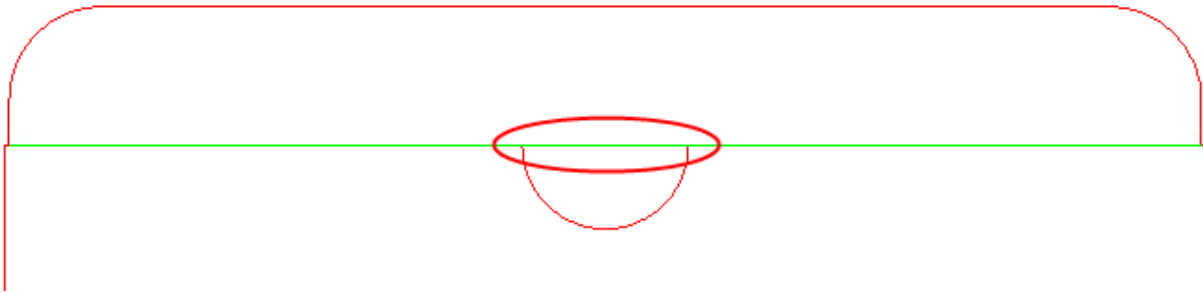
The screenshot displays the ENVIEW software interface. On the left, a technical drawing of a box net is shown with dimensions: A [130.00], B [65.00], A [130.00], and B1 [64.50]. The height is H [155.00] and the top width is TopW [55.00]. The drawing is outlined in red and green. On the right, a table lists parameters for the box design.

Name	Group	Expression	Value	Min	Max
[] TTCO	Tongue Lo...	2*d()	1.00	No bound	No bound
[] TTW1	Tongue Lo...	TTHL	27.50	No bound	No bound
[] TTL	Tongue Lo...	15	15.00	No bound	No bound
[] TTD	Tongue Lo...	17	17.00	No bound	No bound
[] TTFR	Tongue Lo...	TTW1/3	9.17	No bound	min(TTW1...
[] TTCrO	Tongue Lo...	d()	0.50	epsd()	No bound
[] TTHD1	Tongue Lo...	2*d()	1.00	No bound	No bound
[] DxCT	Tongue Lo...	0	0.00	No bound	No bound
[] TTHL1	Tongue Lo...	TopW	55.00	TTW1+2*D...	No bound
[] CD	Tongue Lo...	0	0.00	No bound	No bound
[] TCR	Tongue Lo...	TTHL/5	5.50	No bound	No bound
[] DFH	Dust Flap	50	37.50	No bound	(A-TopW)/2
[] beta	Dust Flap	15.00	15.00	No bound	No bound
[] DxZY	Dust Flap	3	3.00	No bound	No bound
[] DyZY	Dust Flap	3.00	3.00	No bound	No bound
[] ZX	Dust Flap	5	5.00	DxZY	No bound
[] TCR1	Thumb Cut	12	12.00	No bound	No bound

The bottom of the interface shows a toolbar with buttons for 'Synergy Components', 'Parameters', 'Cost Estimator', and 'St'.

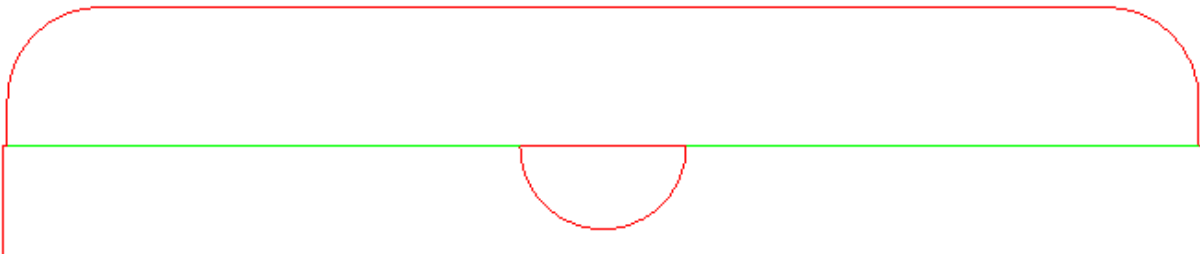
Making a creasing knife cutting

We now need to make a section of the creasing knife cutting (pictured).



36. On the **Transformations** menu, click **Break** .

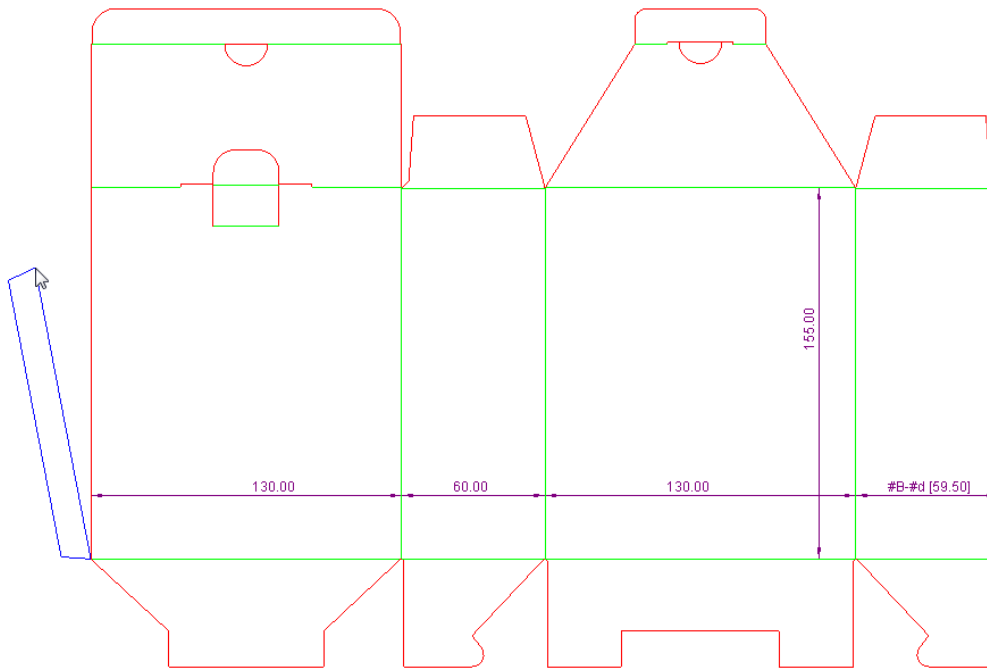
37. Select the Cutting style, and then click this section of the crease line.



Attaching the glue panel

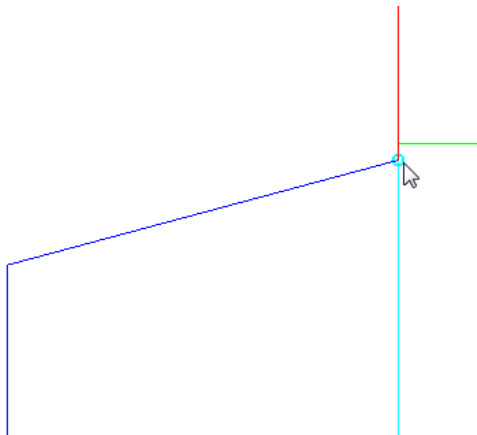
Now we are going to add the glue flap to the left side of the design.

1. In **Synergy Components**, browse the sequence Individual Components | 02 Flaps | 01 Glue Flaps.
2. Select the component 01 Glue Flap (GLA), and then drag it into the graphical area and attach its first active point to the bottom left control point of the base.

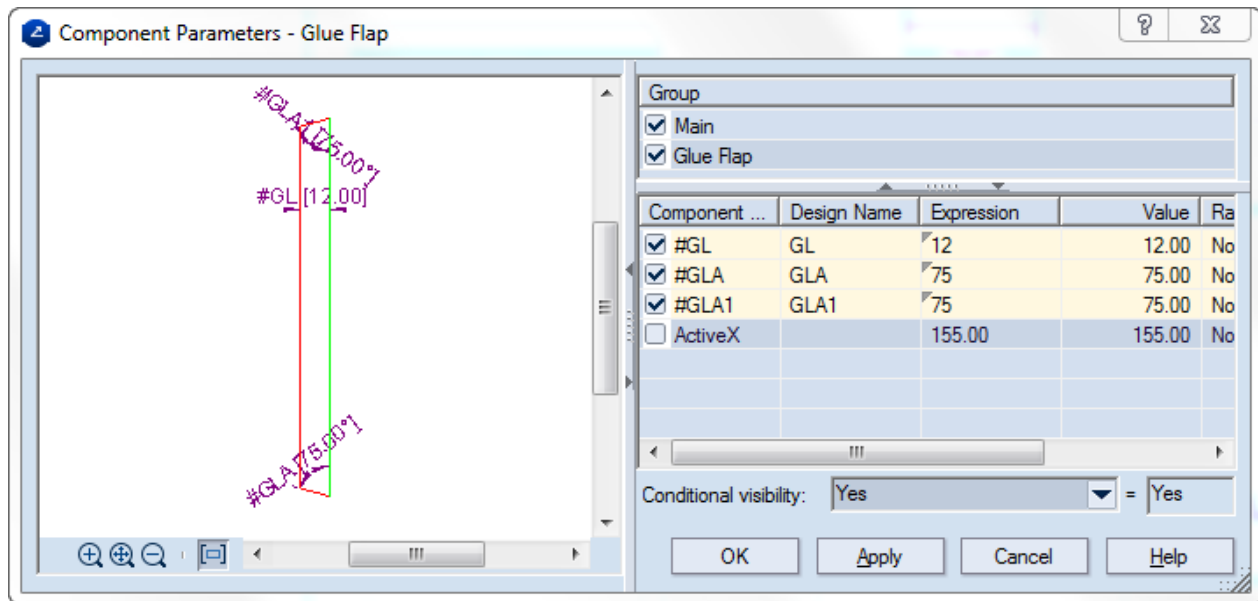


3. Attach the second active point of the glue flap.

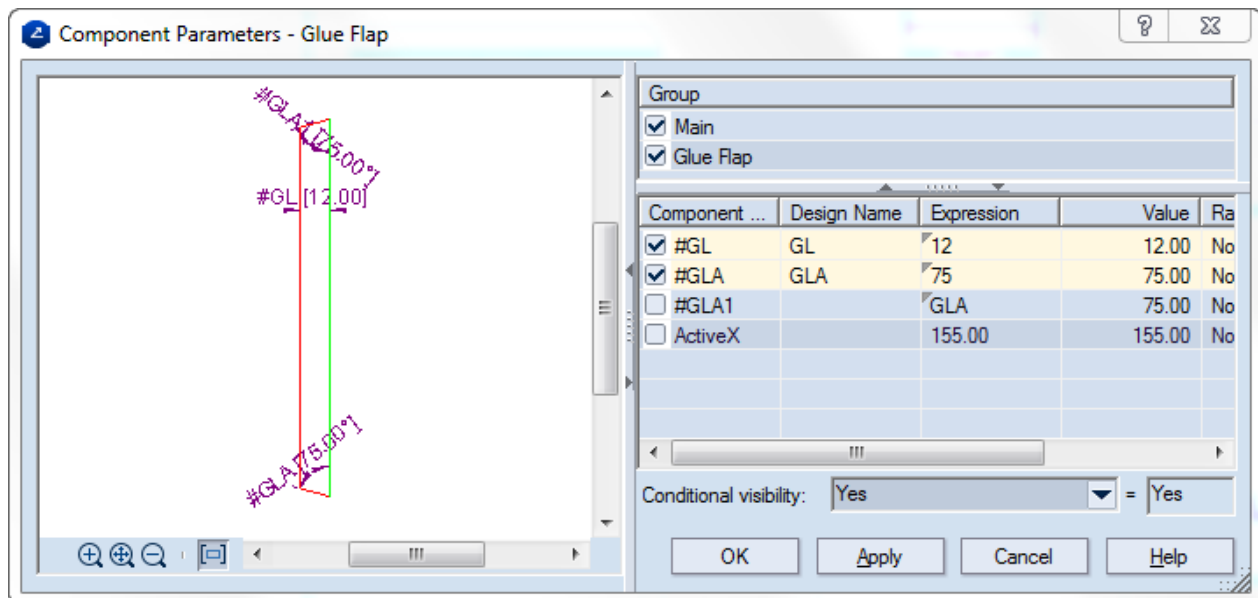
NOTE: Pay attention to the point of attachment.



The **Component Parameters** dialog box opens.



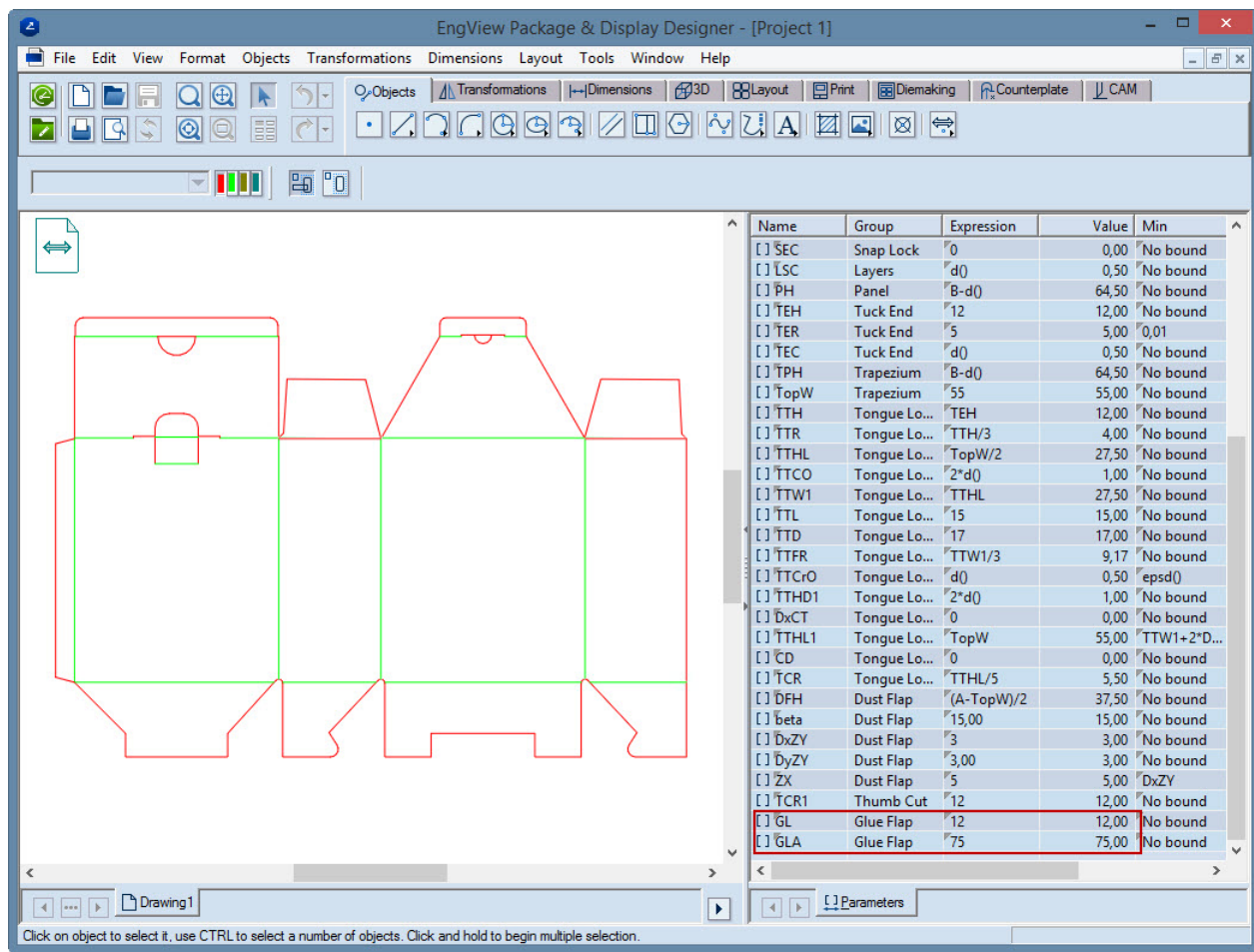
Two different parameters are set in the component for controlling the glue flap's left and right sides. In our case these angles can be equal – that is, we do not need two parameters. That is why, clear the check box of the #GLA1 row and in its expression type the name of the parameter that will control #GLA – GLA.



4. To close the dialog box, click **OK**.
5. To exit the mode, press ESC.

The glue flap is now part of the design.

There are now two – not three – parameters in the parameter list: GL, which controls the glue flap's width, and GLA, which controls the left and right sides.



6. Save the design.

IMPORTANT: We've just drawn a box by using components and their parameters. This drafting technique has the advantage that links are built between certain distances in the structure. This guarantees that the structure will be well-computed each time when any of its sizes are changed, and no additional editing will be necessary.