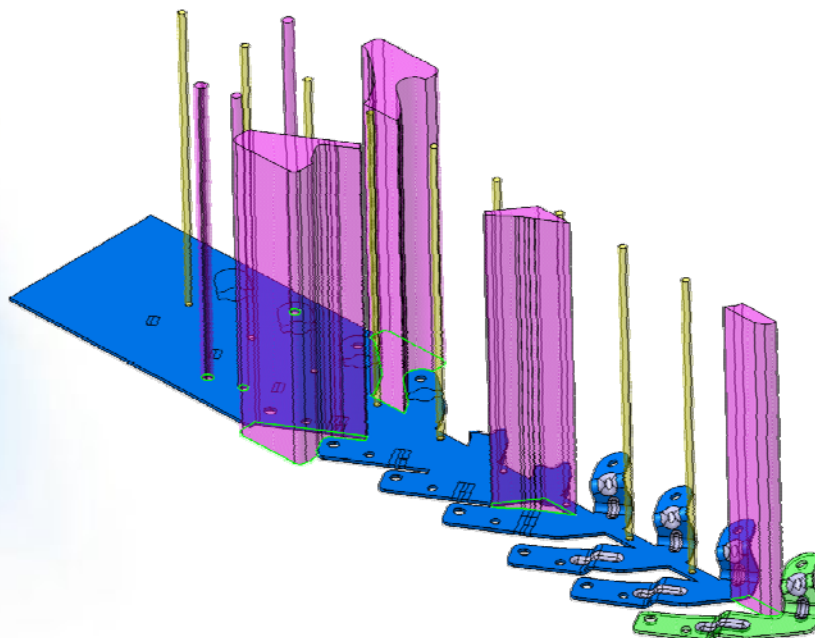


Progressive Die Strip Layout Design (SL9) BPA

Delivery 6 for V5R19 (V5.6)

User Guide



Version 3.00

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Introduction

- This document is part of a set of documents that will develop a CATIA V5 BPA to define a Strip Layout for Progressive Dies business.
- This document will describe
 - 👤 All the specific functions developed for the Strip Layout BPA.
- The user needs to know how to use the basic functions of CATIA if he wants to understand this entire guide.

Strip Layout: Assembly Design functions




Those four functions are available in the Assembly Design workbench.

Icon	Function	Description
	Strip Layout Construction	Instantiate the product template witch generate the working environment.
	Strip Update	Copy the final part to the Strip_Construction CATPart and publish and/or update the punch contours.
	Final Part	Compute the final strip
	Automatic Drawing	Generate the drawing of the strip according to the user's options.

Strip Layout Construction










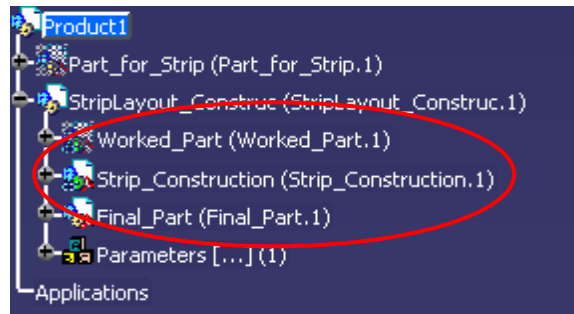
Overview :

-  In the case when the part does not contain stamps, this function is the first one to be used in the Strip Layout BPA.
It generates the strip layout working files and assemblies.

Activities :

This function has three main activities:







-  It is used to position the finished part in the orientation chosen by the user.
 -  *As the strip layout follows the X direction, the user may want to orientate the part perpendicularly to the X direction or not.*
-  It is used also to structure the BPA by instantiating the “Worked_Part”, the “Strip_Construction” and the “FinalPart” parts.
 -  *In “Worked_Part”, the strip layout will be prepared by creating the contours of the punch and by optimizing the nesting.*
 -  *In “Strip_Construction”, the strip layout will be designed step by step from the finished part which has been previously positioned until the starting metal plate.*
 -  *In “Final_Part”, the final strip will be computed at the end of the design.*
-  It is used finally to initialize the basic parameters (Step_Length, Strip_Width, Number_Of_Steps) that are mandatory to clearly define the strip layout in an associative way

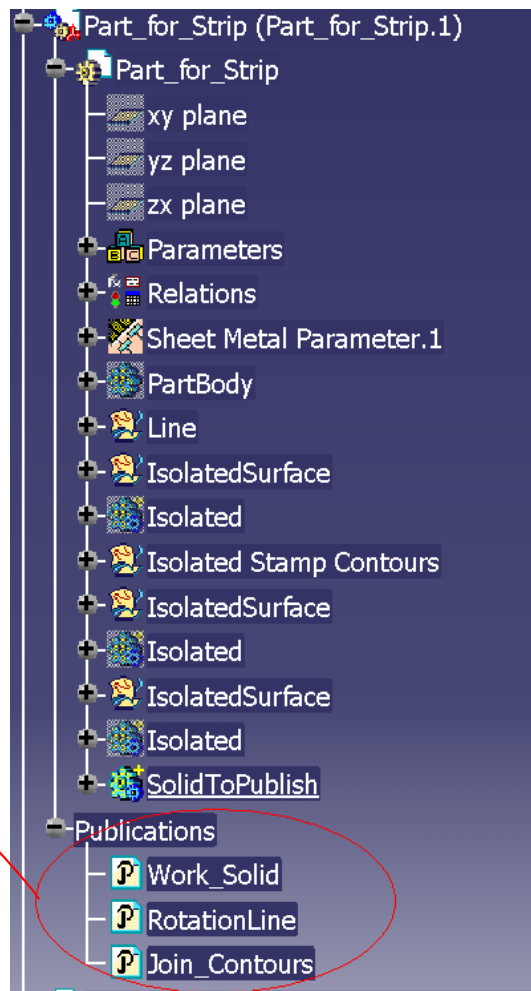
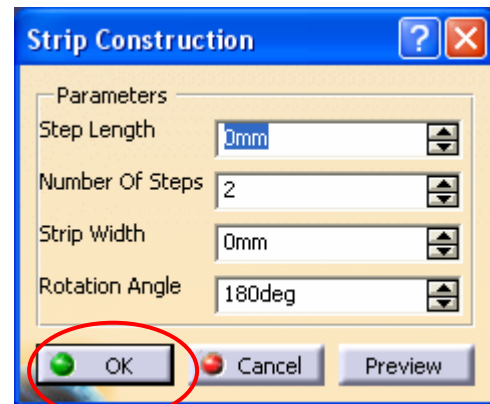
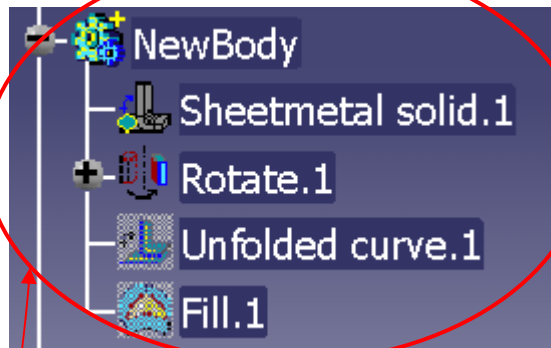


Limitations :

-  To use this function, verify that you are in Assembly Design Workbench and you have a product containing the folded starting part

Inputs and outputs

-  This tool is a Product Template
 -  *It requires the solid as input in order to copy and past it as result in Worked_Part.*
 -  *It requires also the RotationLine as input in order to position the Worked_Part in the needed orientation*
 -  *It requires a Part Thickness parameter in order to set the strip thickness.*
-  The Step_Length, Strip_Width, Number_Of_Steps and Rotation_Part parameters have to be defined while the tool is executed in order to be instantiated in Worked_Part
- 



The published body is copy/pasted.

Strip Update



Overview :

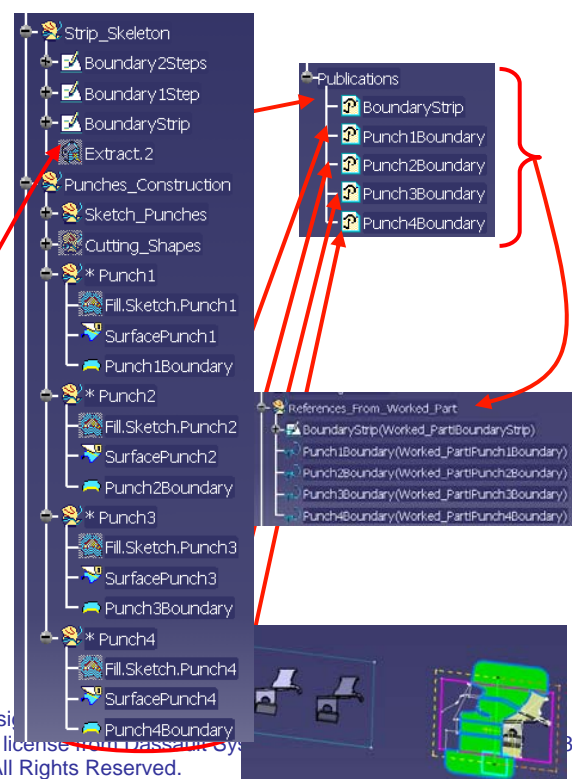
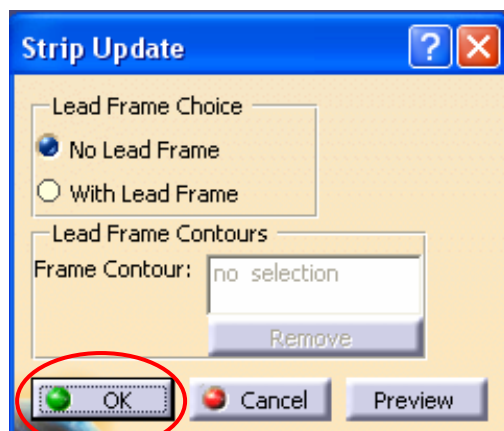
- This function transfers the components needed for the strip layout design from the Working Part to the Strip Construction part.

Activities :

- As the strip layout has been clearly defined before (definition of parameters, creation of the punches' contours...), all this parameterization has to be transferred to the "Strip Construction" part.
- Also if User wants to have a lead frame for the strip User can select the option of strip with lead frame and give the lead frame inputs.
- This tool has three main functions:
 - Publish the punches' contours and the sketch representing the strip boundary under new names.
 - Copy those publications and paste them as result under the "References_From_Worked_Part" geometrical set of the "Strip_Construction" Part.
 - Prepare the last step of the strip layout in the strip by copying two consecutive steps.

Limitations :

User cannot give multi profile sketches as inputs for Creation of Lead Frame. For that purpose User has been given an option of selecting multiple sketches for Lead Frame.



Final Part



Overview :

- ⤴ This function computes the final strip.

Activities :

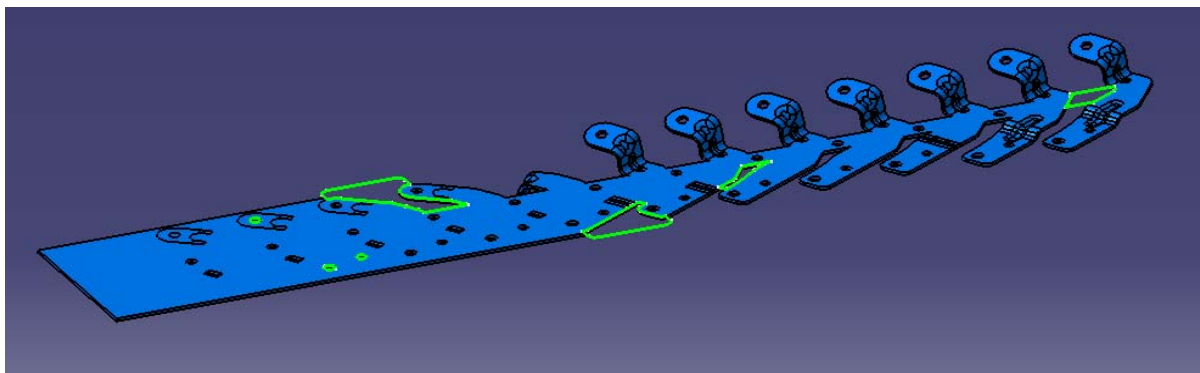
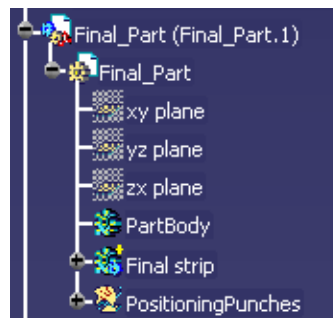
- ⤴ This function does a copy/paste without link of the strip and the punch contours.
- ⤴ The resulting CATPart can be use out of the construction product structure.

Inputs and outputs :

- ⤴ The user does not have inputs to choose.
- ⤴ The result is the final strip computed in the Final_Part part.
- ⤴ Each "Removed" body has been assembled to the main body.
- ⤴ A geometrical set contains the punch contours.

Limitations :

- ⤴ **Mandatory:** To launch this function, the upper Product must be edited (highlighted in blue)



Automatic drawing



Overview :

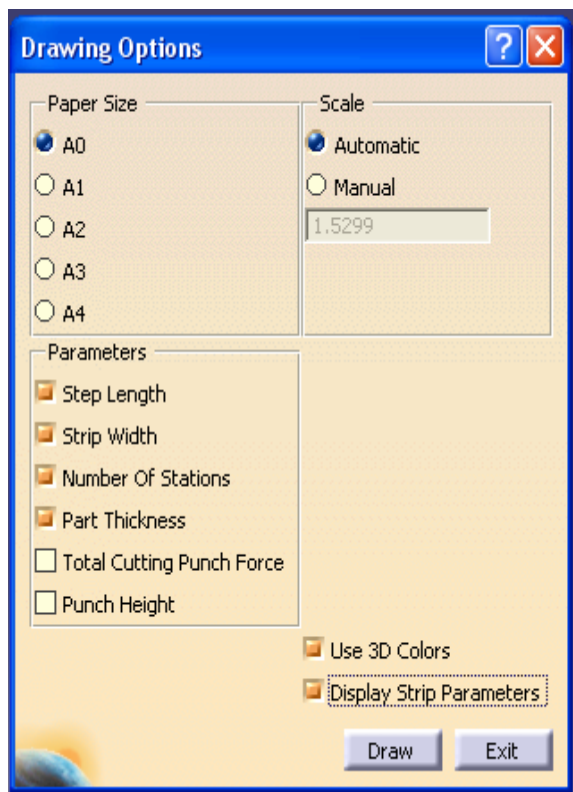
- This function computes the drawing of the top view of the strip.

Activities :

- A window allows the user to choose some parameters, then the drawing is computed and the drawing window is activated.

Inputs and outputs :

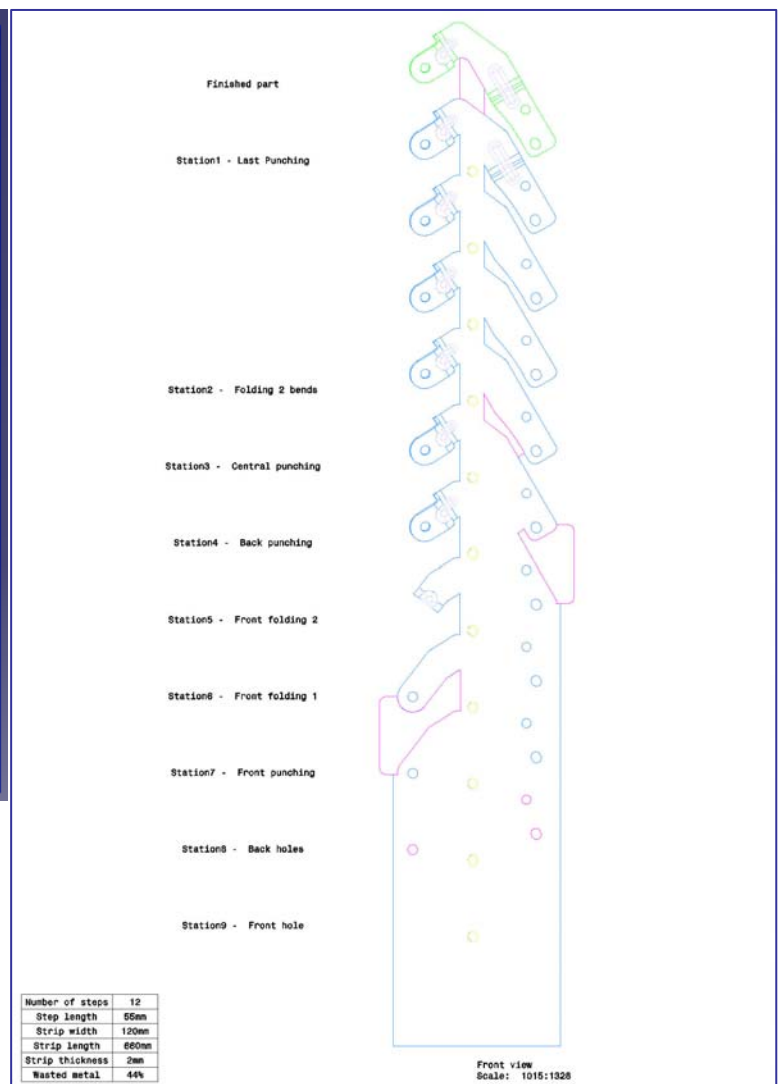
- The user need to choose:
 - The paper size.
 - The scale computation (automatic of manual, if manual, he needs the enter the scale)
 - Black & white or colour drawing.
 - Parameters table display or not



- The result is the drawing with the wanted options and the station's name in front of them.

Limitations :


















- Mandatory:** To launch this function, the upper Product must be edited (highlighted in blue)



Strip Layout: Generative Sheetmetal Design functions



Seventeen functions are available in the Generative Sheetmetal Design workbench.

Icon	Function	Description
	Isolate Specific Geometries	Isolate a 2D or 3D stamp.
	Prepare For Strip	Publish the element needed for the strip construction.
	Strip Definition	Instantiate the punch contour definition working area.
	Punch Contour	Compute external/internal punch contours.
	Add Step	Add a step to the strip
	Cutting Punch	Add a punching operation to the strip.
	Move Punch	Move Punch
	Trim Strip	Compute the end of the strip.
	Pilots Automatic	Instantiate pilots automatically.
	Pilots Manual	Instantiate pilots manually.
	Punch Simulation	Add a punch tool.
	Generate Flat View	Generate flat view of sheet metal solid.
	Delete Station	Delete Station.
	Sketch Contour	Sketch Contour.
	Show Isolated Area	Show Isolated Area.
	Automatic_Recovery	Move the removed geometries to the final part and the first station.
	Manual_Recovery	Move a specified geometry to a specified station and help the user to put the geometry in the right position.

Isolate Specific Geometries



Overview :

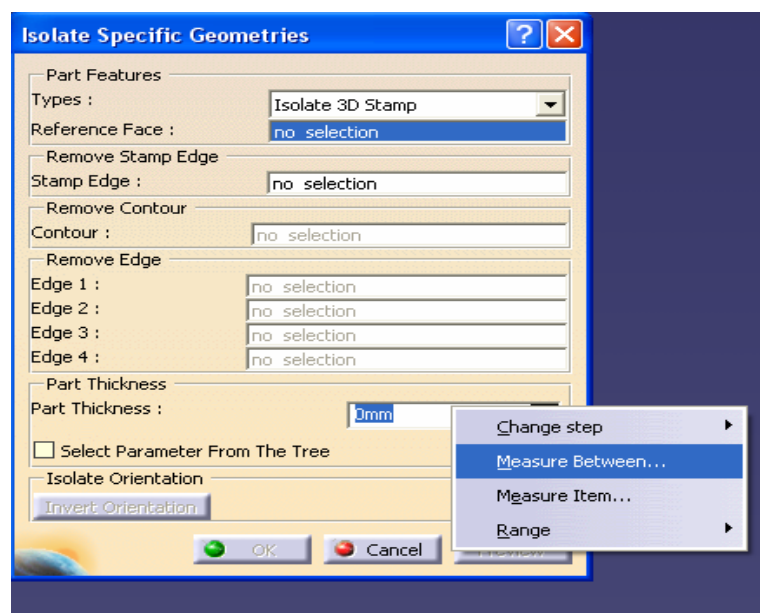
- This function isolates any complex geometry in a sheet metal part.

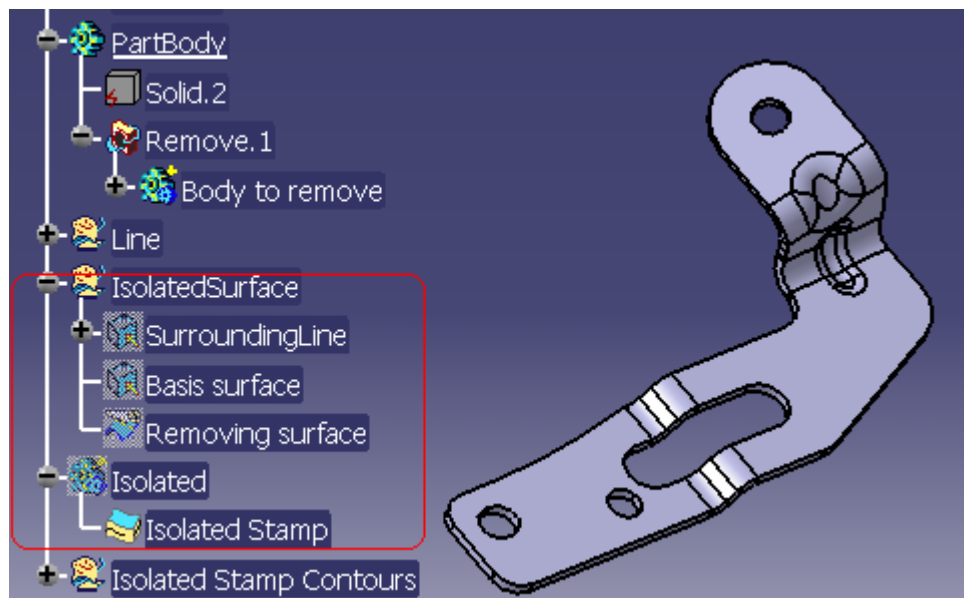
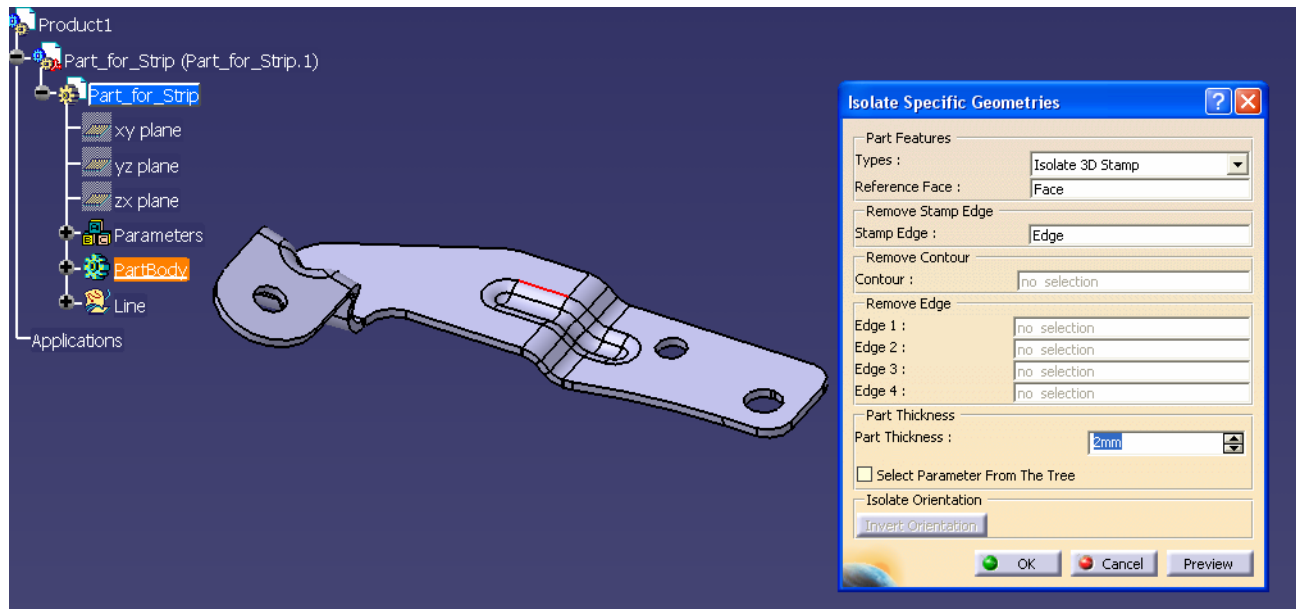
How does it work?

- A “Surfaces” geometrical set is created. It contains all the elements needed for the isolation of the stamp.
- A “Removed” body is created. It contains a thick surface representing this isolated geometry. This body is hidden.
- A remove as bee added to the work body. It is used to delete the geometry to isolate from the work body.
- An Additional functionality of inverting the orientation of Isolation has been provided. This button gets activated only on preview. On click this button the orientation of isolation changes.

Inputs and outputs :

- The function takes the following inputs :
 - The type of geometry.
 - The reference face.
 - The “Part Thickness”. The Part thickness can be :
 - Entered manually in the “Part Thickness field.
 - Measured on the fly (by using “Measure Between” option from the contextual menu).
 - An existing parameter can be selected from the tree, whose value will be the part thickness.
 - For Isolate Stamp, select the Stamp Edge.
 - For remove contour select a previously created contour (or) create a contour on the fly using the “Join” command from the contextual menu.
 - For Isolate Rib, select the rib edges.
- For each isolated geometry, the function gives:
 - A “Surfaces” geometrical set.
 - The “Isolated” body.
 - The remove feature in the work body.





Prepare for strip



Overview :

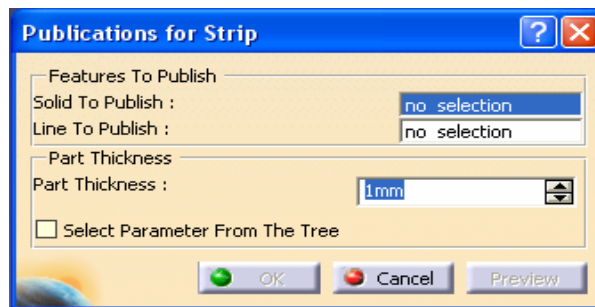
- ✎ This function publishes the needed elements for the StripLayoutConstruction function.

How does it work?

- ✎ This function gets the work body and the rotation line you pick and publishes them.

Inputs and outputs :

- ✎ Pick the work body for “Solid To publish” and the reference line for rotation as the “Line to Publish”.
- ✎ The function does as Copy / Paste as result of the work body, named “solid to publish”
- ✎ The solid to publish and the rotation line are published.
- ✎ Also if the Part does not contains any stamps In that case isolate command will not be run. Hence during this command user has an option to give part thickness for his part.



Strip Definition

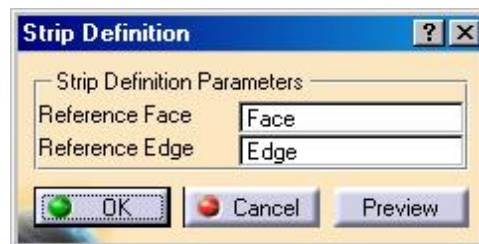
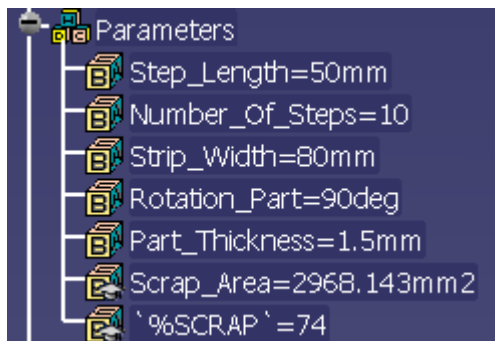


Overview :

- This function is necessary to prepare the strip layout. The function will instantiate all the features necessary to create the punches contours and to optimize the nesting of two consecutive steps

Inputs and outputs

- This functions needs the following inputs:
 - A Reference Face used to define the plane of the Strip Layout
 - A Reference Edge (outer edge) used to define the boundary of the unfolded Part
- Created parameters
 - Scrap_Area = wasted area regarding the nesting according the parameterization
 - %SCRAP = the percentage of wasted sheet metal

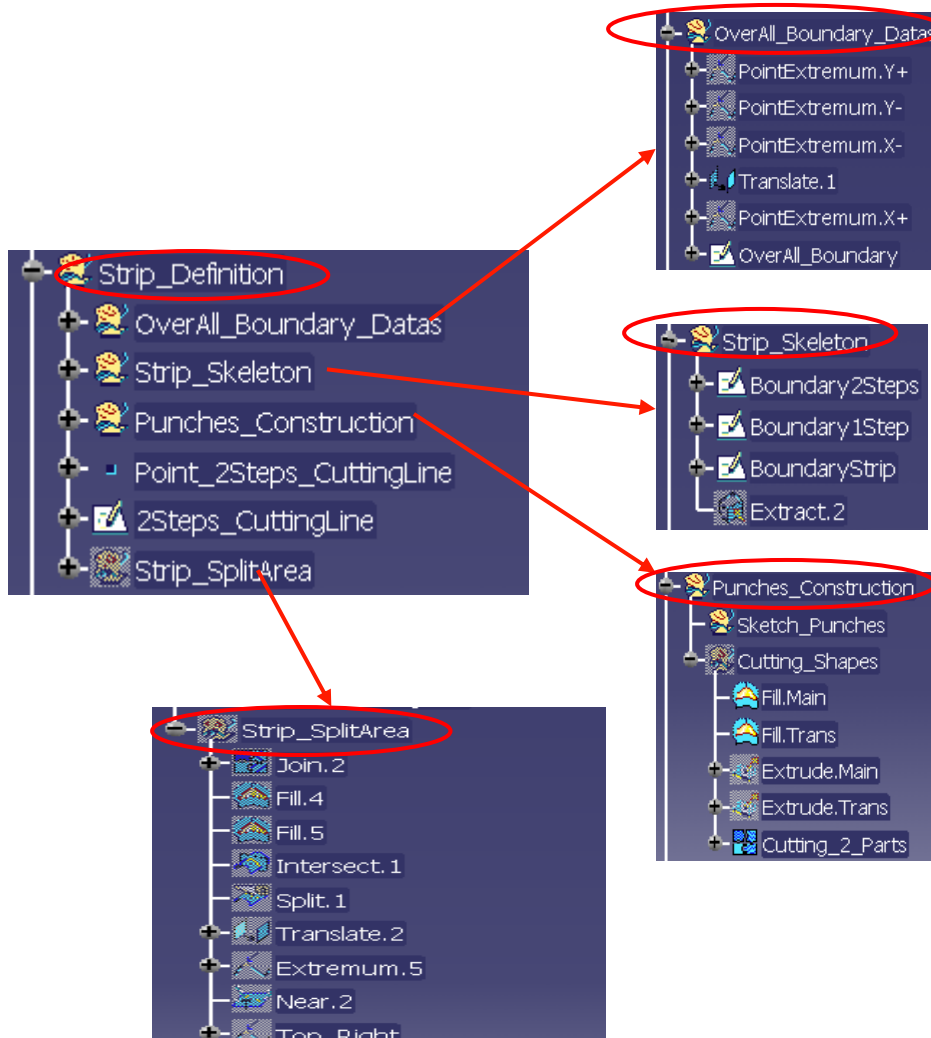


How to get the correct features in output:

- To obtain the correct output, the Worked_Part need to be recognized and unfolded with the "Recognize" and "Fold/Unfold" functions of Sheetmetal Design.
- The instantiated features are:
 - The Data_For_Strip geometrical set, composed of the features necessary to define the outer boundary of the unfolded part and the plane of the strip



 The *Strip_Definition* geometrical set composed of geometrical sets.





 A set of relations managing the size of the strip or the disposition of two consecutive steps.


```

Formula.2: Strip_Definition(OverAll_Boundary_Datas)Translate.1\Length=Step_Length
Formula.3: Strip_Definition(Strip_Skeleton)Boundary2Steps\Length.13\Length=Strip_Width
Formula.4: Strip_Definition(Strip_Skeleton)Boundary2Steps\Length.14\Length=2*Step_Length
Formula.5: Strip_Definition(Strip_Skeleton)Boundary1Step\Length.25\Length=Strip_Width
Formula.6: Strip_Definition(Strip_Skeleton)Boundary1Step\Length.24\Length=Step_Length
Formula.7: Strip_Definition(Strip_Skeleton)BoundaryStrip\Length.32\Length=Strip_Width
Formula.8: Strip_Definition(Strip_Skeleton)BoundaryStrip\Length.31\Length=Step_Length * (Number_Of_Steps + 1)

```

Limitations :

-  To use this function, verify that you are in Generative Sheetmetal Design, and that the part Worked_Part is the current part.
-  **Mandatory:** Before executing the StripDefinition function the part must be recognized.

-  **Mandatory:** Be sure to have PartBody name on the PartBody, this name is mandatory in any language, if needed, rename it.



Punch Contour

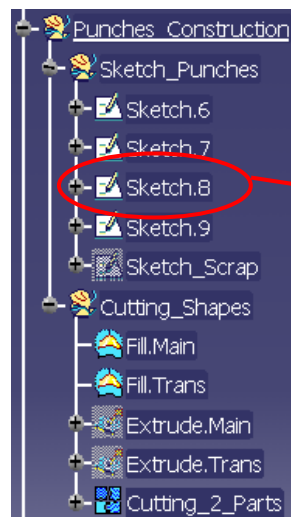


Overview :



-  This function generates quickly the punch contours according to the user's geometry (Sketch).

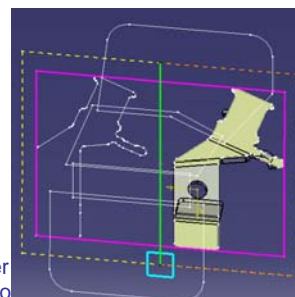
Activities :






-  This function splits a punch sketch with the boundaries of two consecutive steps for an external contour and splits a punch sketch with the internal boundary of the part for internal contours.
-  As input, this tool requires the type of contour (Internal or External) and the sketch representing the punch tool.



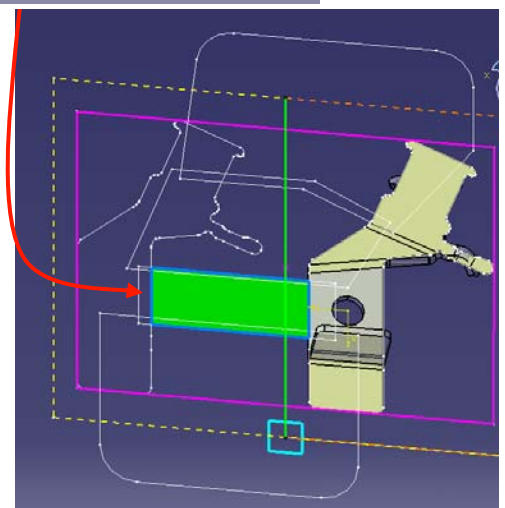
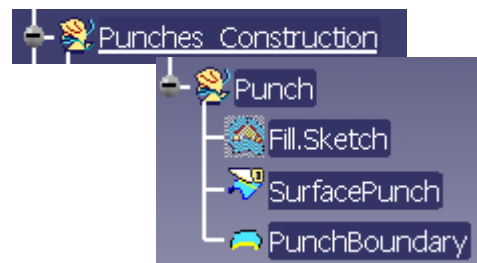
Inputs and outputs :

-  The sketches defining the punches are firstly created in a roughly way. This tool is used to define the exact contour of the punch that is a contour that follows exactly the boundaries of the Part.
-  The rough sketches are defined, in the Sketch_Punches geometrical set, in a way that their contours stay inside the boundary of the part and do not exceed the boundary's other side. This sketch is not a correct one.

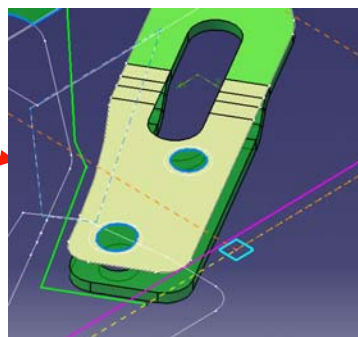
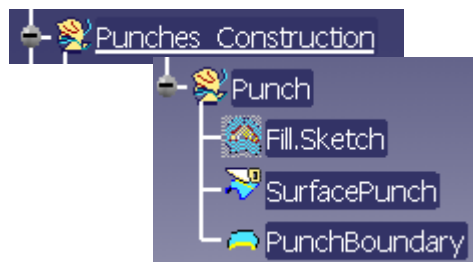


-  The output features need to be instantiated in the “Punches_Construction” geometrical set because the reaction launched after, requires the exact path of the instantiated features.
-  The instantiated feature is a geometrical set named “Punch”. It is composed of:
 -  A fill named “Fill.Sketch” used to fill the surface contained in the created sketch.
 -  A split name “SurfacePunch” used to retrieve only the surface out of the boundaries of the Part.
 -  A boundary named “Punch Boundary” used to retrieve the boundary of “SurfacePunch”. It is displayed in blue.

External Punch



Internal Punch



Limitations :

-  **Mandatory:** The user has to identify and select the right type value for the punch type (internal or External).

Add Step (Insert Station)

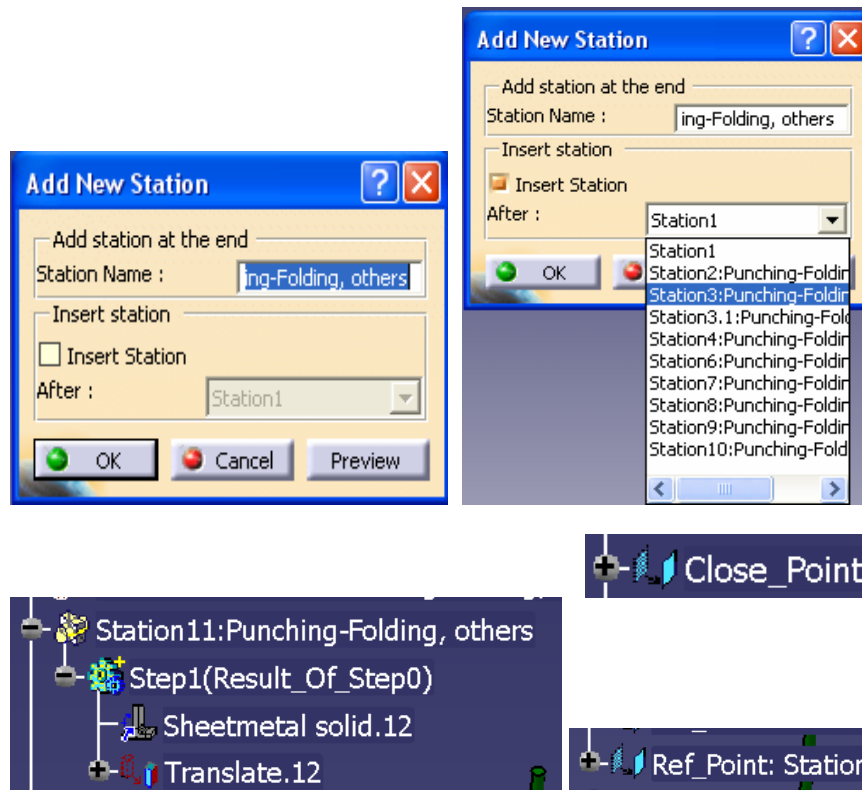


Overview :

- This function is used to create a new step. It represents the previous step in the industrial process. This function is also used to insert a station between two existing stations.

Activities :

- The copy will be done in order to propagate the (As result with link) all along the strip layout.



How does it work?

- All the Sheet Metal features i.e. the whole of the previous station's body is copied and Pasted as a result in order to create a new station with a link to the previous station.
- Then this copied body is assembled to the strip [Part Body].
- Also a Ref_point will be created in the surfaces shadow GS for the added station depending on the Step and the Close_Point will be modified as each station is added.
- If we select Insert Station option and then insert a new station then its name will be dependent on the previous station. E.g. If the Previous station is 3 then inserted station's Name is 3.1.

Inputs and outputs :

- When the function is launched, you will be invited to give a name for your station.

As output, the function gives you a new station.

Limitations :

Mandatory: This function can only be launched if the Strip Update function has been previously launched.

Cutting Punch



Overview :

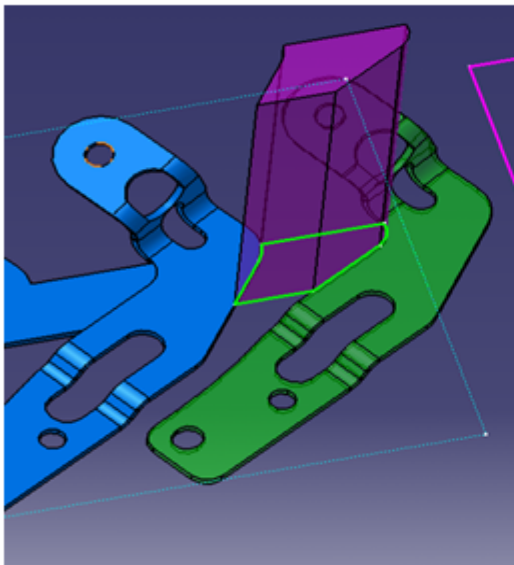
This function is used to create at a specific position a display of a cutting punch and its contour.

Inputs and outputs :

This function needs two inputs: The station to receive the punch operation and the punch boundary.

This function has three main results:

- Create the punch tool that removes material on its passage (1)
- Instantiate the material of the previous step that has been punched by the tool (2)
- Display the punch (3)



How does it work?

- 👤 Select on the tree the station on which the punch has to be instantiated and on the screen the contour of this punch (blue)
- 👤 This function creates three sets of features
 - 👤 A set of features [like a wall and cut-out] in a Boolean assembly used to define the material that has been removed by the punch tool.
 - 👤 A translate feature in the "Positioning Punches" geometrical set used to define the position of the punch and later used to calculate the force of the punch.
 - 👤 A set of features in a geometrical set like a Fill and an Extrude used to display the punch tool in purple.
 - 👤 If the user does not want to see the associated material he just needs to check the No Associated Material Box in the Dialog.

Limitations :

As of Now User cannot create Punches from Sketches which have Multiple Profiles .In order to create punches for those sketches user will have to create different sketches for different profiles and he can create the 2 punches in the similar station.

Move Punch

Overview :


 This function is used to Move the existing Punch from its station to a different station.

Activities :



 This function will move all the features related to the punch [i.e. wall and cut-out] from its original station to the destination station given by you.



How does it work?

-  All the Sheet Metal features i.e. the whole of the punch features in station's body are reordered into the destination station's body.

Inputs and outputs :

-  When the function is launched, you will be told to select the punch you want to move and then the destination of the punch you wish to move.
-  As output, the function will move the punch from its original station to the destination station given by the user.



Limitations :

-  **Mandatory:** This function can only be launched if the Strip Update function has been previously launched.

Trim Strip



Overview :

-  This function automates the creation of the beginning of the plate and it displays the exact contours generated by the punches.
-  As the strip layout is designed according to the reverse way of the time, the covering areas of the punch tools are not well treated. This function computes the entire strip and verifies these details.

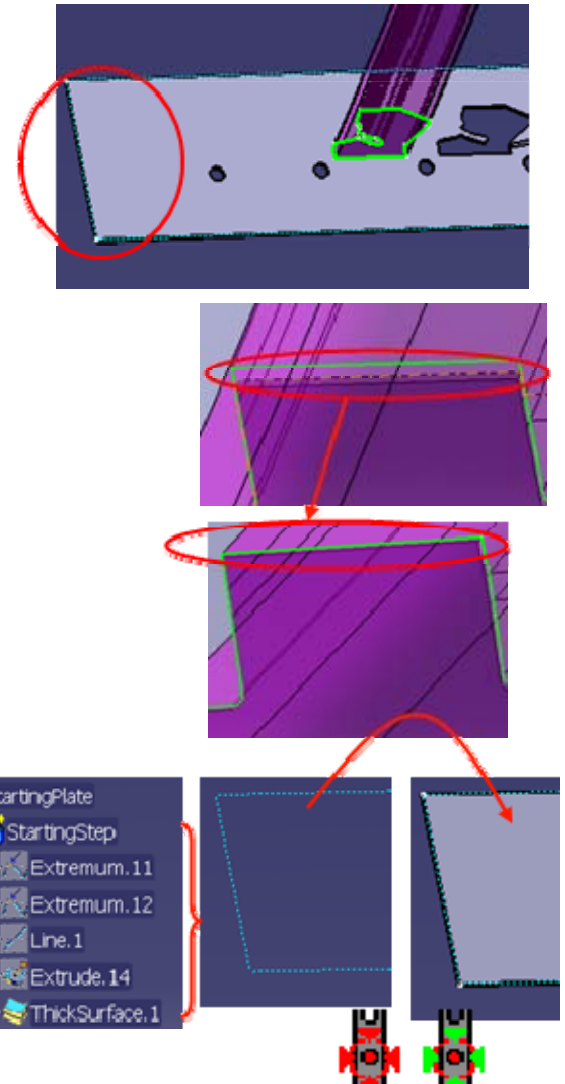
- ✎ This function is included in the AddStep function, used automatically only when we are at the end of the Strip. The user will have the choice to launch it immediately (within AddStep function) or after using *Trim Strip* function.

Activities :

- ✎ As this function has two applications clearly different, there are two different features created.
 - ✎ An assemble called "StartingPlate" is added to the strip layout. It is in fact the ThickSurface of an extrusion going from the farthest line of the strip boundary to the last created step
 - ✎ A Remove feature that removes all the material that has not been removed while PunchTrimOperation was running.
 - ✎ *A Join of all the punches' contours positioned in the strip is done in "PositioningPunches"*
 - ✎ *This Join is extruded and repeated on all the strip layout*

How to launch it :

- ✎ This function can be used directly or through the Add Step macro. AddStep automatically detects the start of the strip and proposes to run the StartingPlate_ExactContours.



PILOTS Auto & PILOTS Manual

Overview :

- ✎ These functions enable the instantiation and position of the strip layout centering tools.

Activities :

- ✎ The CenteringTools_Auto calculates automatically the number of steps of the strip layout to instantiate the corresponding number of tools whereas CenteringTools_Manu enables the user to choose the number of centering tools he wants to create.
- ✎ Those functions have two main results:
 - ✎ Remove the material of the strip layout impacted by the centering tools.
 - ✎ Create and Display the centering tools.

🔥 Inputs and Outputs :

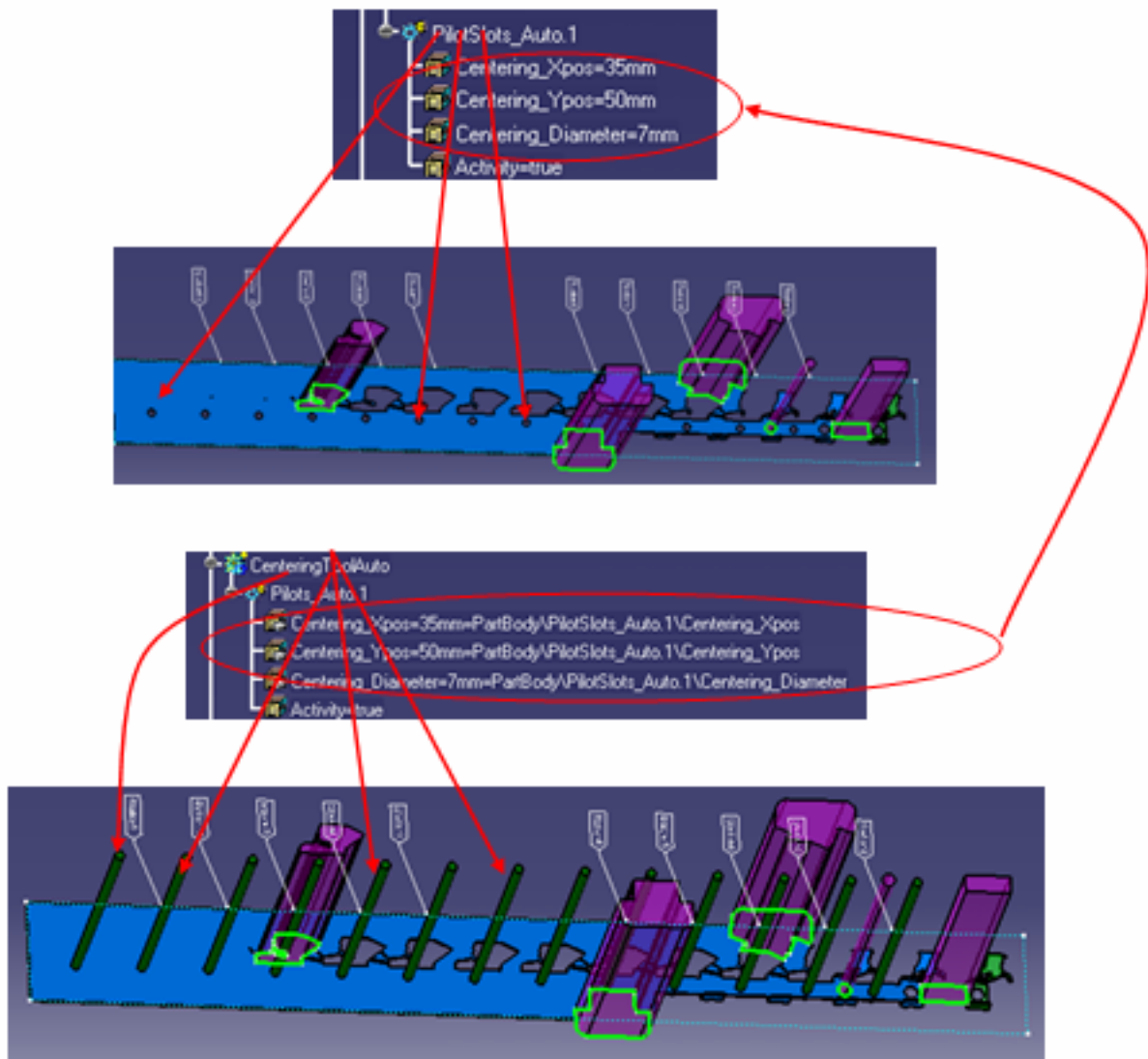
- ✎ The user inputs are:
 - ✎ The parameters positioning the tool in X and Y
 - ✎ The diameter of the tool
 - ✎ The number of instances (For CenteringTools_Manual).
- ✎ The created features are:

For PILOTS Auto

- ✎ The PilotSlots_Auto feature is created in the PartBody that symbolizes the removal of the material impacted by the pilots on the strip. The parameters of this feature can be varied even after the execution of the functions to vary the position of the pilots.
- ✎ The CenteringToolAuto body is created, that contains the Pilots_Auto feature that creates and displays the Pilots. The parameters of this feature are related to the corresponding parameters of the PilotSlots_Auto using formulae.

For PILOTS Manual

- ✎ The PilotSlots_Manual feature is created in the PartBody that symbolizes the removal of the material impacted by the pilots on the strip. The parameters of this feature can be varied even after the execution of the functions to vary the position of the pilots.
- ✎ The CenteringToolManu body is created, that contains the Pilots_Manual feature that creates and displays the Pilots. The parameters of this feature are related to the corresponding parameters of the PilotSlots_Manual using formulae.
- ✎ The launch of either of the functions indicates the origin point in green, which is the reference point for calculating the position of the pilots.



Punch simulation



Overview :

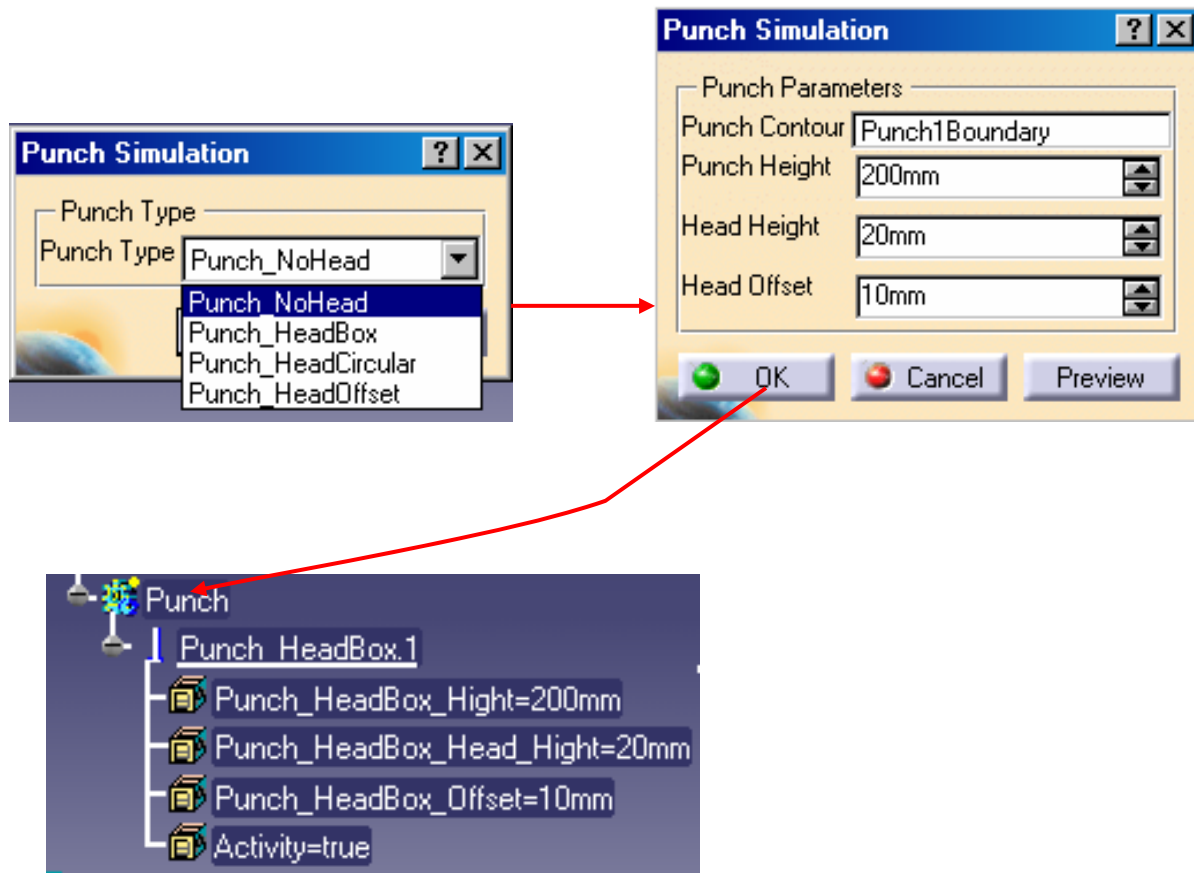
- ✎ This function is used to display a punch, with a desired head configuration

Activities :

- ✎ It will be used in complement of the instantiation of a Punch in order to check a collision or to display punches for internal cut of the part.

Inputs and Outputs :

- ✎ This function requires two inputs:
 - ✎ The function first offers to choose the head type in the first panel.
 - ✎ The second panel allows to select the punch boundary input and the parameters of the punch based on the head type.
- ✎ The output of this tool is a body containing one User Features and the parameters managing the punch head.



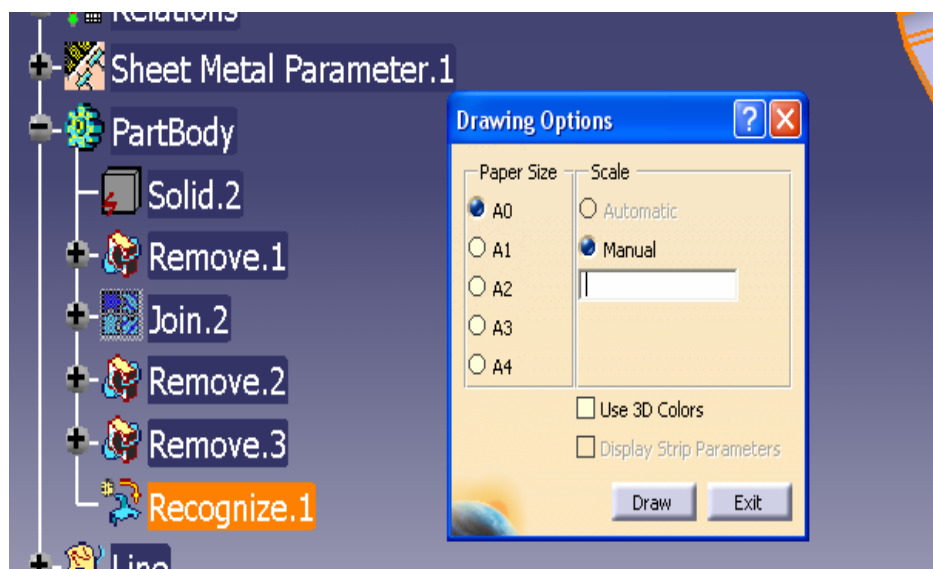
Generate Flat View

Overview :

- This function will generate a Drawing Sheet with the isometric view of the part and the bend table.

How does it work?

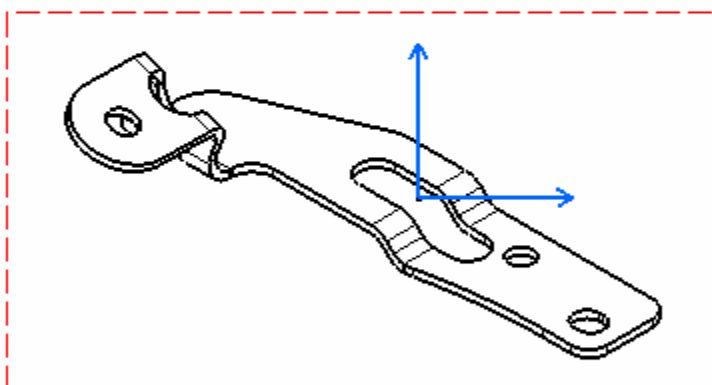
- When you click on the command In the CATIA status bar you will be asked to select a Sheet Metal solid.
- After selection of the Sheet Metal solid this function will create a Drawing sheet which will contain an isometric view of the Solid and a bend table which will have all the bend parameters of the solid.



Bend Table:

B.No	B.Angle	B.Radius	K-Factor
1	92.840000	4.000000	0.400515
2	45.000000	4.000000	0.400515
3	90.000000	4.000000	0.400515
4	45.000000	4.000000	0.400515

Isometric View of the Solid:



B.No	B.Angle	B.Radius	K-Factor
1	92.840000	4.000000	0.400515
2	45.000000	4.000000	0.400515
3	90.000000	4.000000	0.400515
4	45.000000	4.000000	0.400515

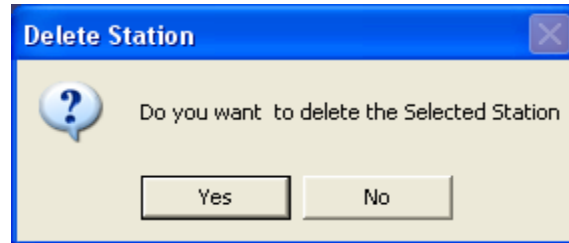
Delete Station

Overview :

 This function is will delete all the features in the station and the station itself.

Activities :

- ✎ This function deletes the station and all the features in it .If the station contains a punch in it the this command tells the user to delete the punch first and then re-launch the command



How does it work?

- ✎ After clicking on the icon this command just asks for the Station to delete This is Displayed in the CATIA Status Bar .Once you click on any station this command will ask you "Do you want to delete the Selected Station?"When you say yes the station will be deleted.
- ✎ Also all the features associated with the station as Ref_Point will be deleted.

Inputs and outputs :

- ✎ When the function is launched, you will be told to select the station which you want to delete.

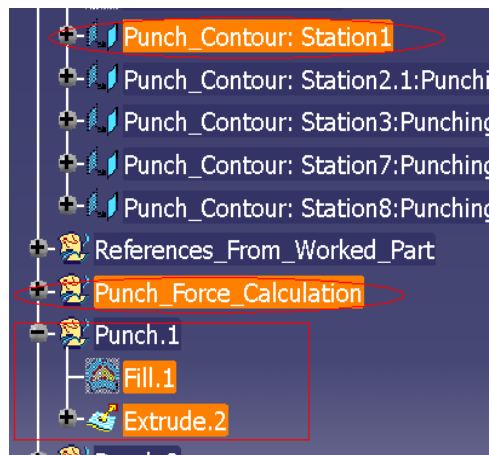
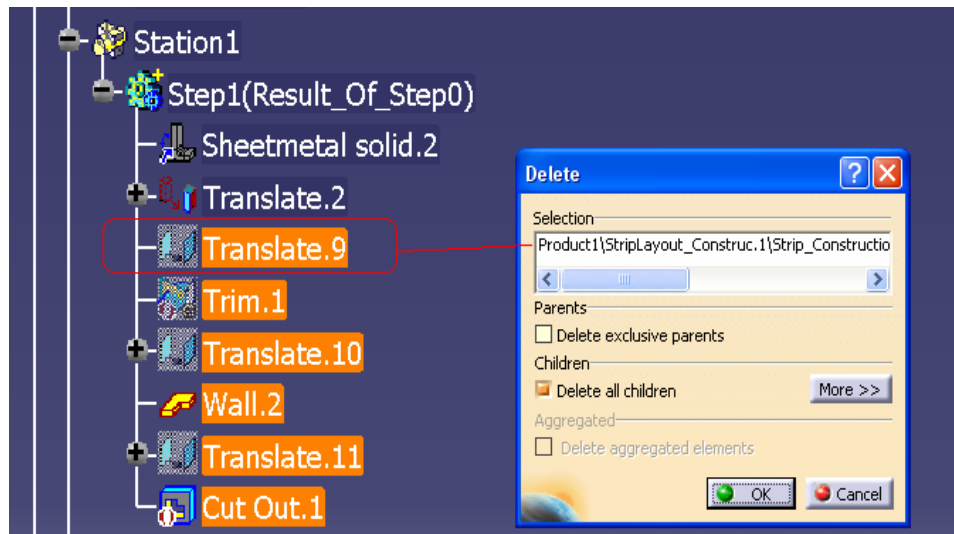
Limitations :

- ✎ **Mandatory:** This function can only be launched if the Strip Update function has been previously launched.
- ✎ Also if the station contains a Punch the user is told to delete the punch in that station first and then re-launch the command.



Procedure to Delete a Punch:

- ✎ Go to the selected station in the spec tree and select the first GSD Translate Feature.[Not the sheet metal Translate Feature].
- ✎ Go to the Punch Force Calculation GS and There From the "Punch Contour " Join Remove the Translate which was in your selected station First.
- ✎ Right Click on it and say delete.
- ✎ You can see from the snap shots below when we say delete what all features are highlighted. Then ensure that Delete all Children Check Box is Checked and Then say OK.



-  All the Highlighted features will get deleted.
-  Then Re-launch the Delete Station Command.

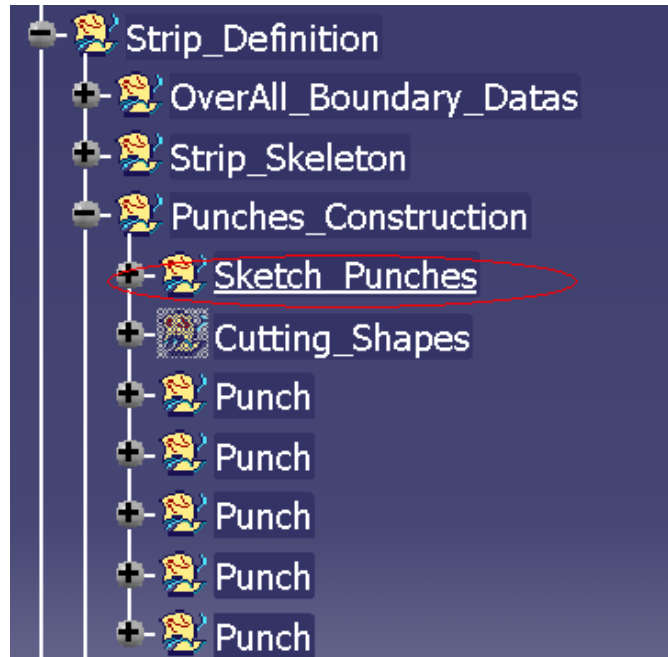
Sketch Contour

Overview :

- 👤 This function will take the blue plane created during Strip Definition and launch the sketcher.

How does it work?

- 👤 When you click on the command this function will launch the sketcher using the blue plane and it also defines the Sketch Punches GS in Work Object.




Limitations :

- 👤 **Mandatory:** The user has to run the Strip Definition Command before launching this command.

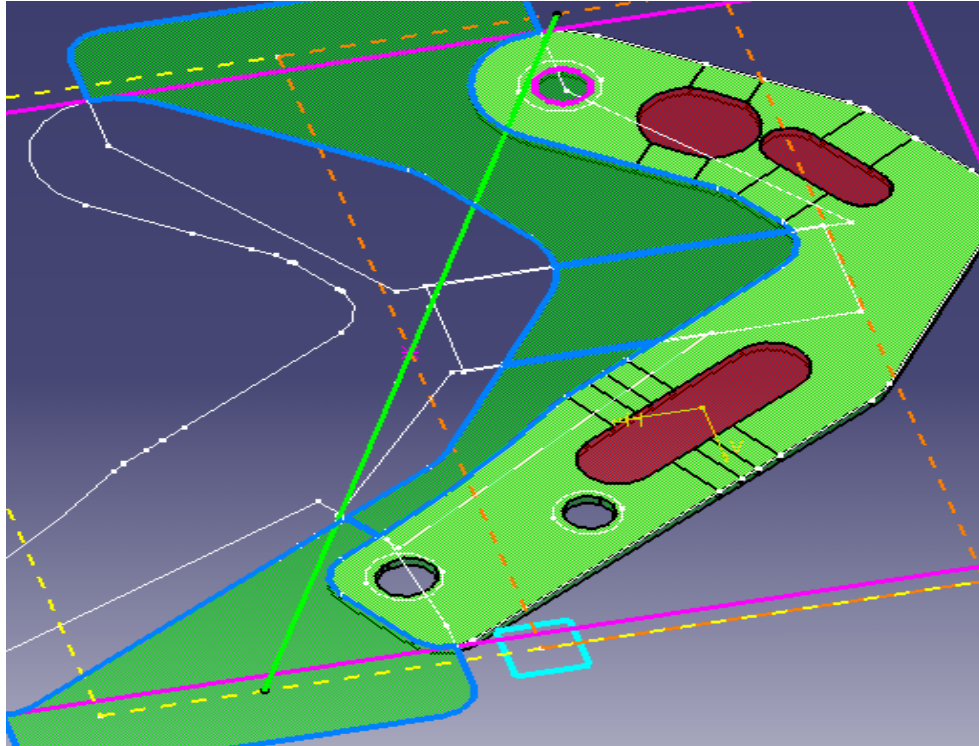
Show Isolated Areas

Overview :



-  This function publishes shows the stamp areas which are created during the Isolate command. This command will help the user to distinguish whether the area is punched or isolated.

How does it work?

-  When you click on the command this function shows the isolated areas in Red Colour.



Limitations :

-  **Mandatory:** The user has to be in the Worked Part to view Isolated Areas.
-  Make sure that At least one stamp is isolated and the stamp contour is mapped in the New Body.

Automatic Recovery



Overview :

- ✎ This function does a copy/paste with link of the isolated geometries.
- ✎ It ensures a full automatic recovery for the two first steps (None_Station & Last punching).

Activities :

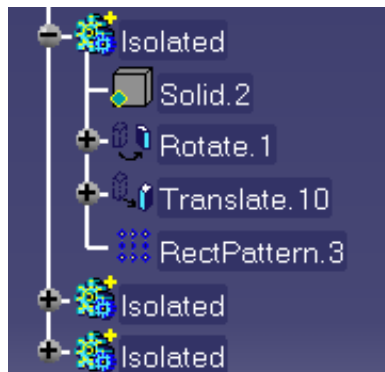
- ✎ These functions recover the “Isolated” bodies in the starting part, and copy/paste them in the Strip_Construction part. A rotation and a translation are applied according to the strip layout parameters.

How does it work?

- ✎ Some bodies (one per isolated geometry) are added to the Strip_Construction part.
- ✎ Each body contains:
 - ✎ A solid representing the geometry to recover.
 - ✎ A rotate using the RotationLine as axis and the Rotation_part parameter as value.
 - ✎ A translate linked with the step length parameter.
 - ✎ A rectangular pattern to duplicate the geometry from the None_station to the “Last punching” one.

Limitations :

- ✎ **Mandatory:** To launch this function, the Make Sure that you are in the Strip Construction Part.





Manual Recovery








Overview :

-  This function does a copy/paste with link of the isolated geometries.
-  It ensures an aided manual positioning of the geometries that were isolated.










Activities :

-  The function recovers one “Isolated” body in the starting part, and copy/paste it in the Strip_Construction part. A rotation and a translation are applied according to the strip layout parameters in order to put the geometry close from its destination position.
-  Two other modifications are proposed to the user (“point to point translation” and an “axis two elements” rotation). They can be skipped by pressing the “Escape” key.

How does it work?

-  The user is firstly invited to pick a solid recovered by the previous function. This solid represent the geometry which will be recovered
-  The user will, then, choose a station to receive the geometry.
-  One body is added to the Strip_Construction part.
-  The user can do a semi-automatic translation and rotation.
-  If the receiving station has some free steps, the geometry will be automatically patterned at the end of the process.

Inputs and outputs :

-  The user need to choose:
 -  A solid recovered with the previous function.
 -  A receiving station.
 -  Two points to translate the geometry (if wanted).
 -  An edge and two points to rotate the geometry (if wanted).
-  Each body contains:
 -  A solid representing the geometry to recover.
 -  A rotate using the Rotation Line as axis and the Rotation_part parameter as value.
 -  A translate linked with the step length parameter.

Limitations :

-  **Mandatory:** To launch this function, the Make Sure that you are in the Strip Construction Part.

