III - SMOOTHING FUNCTION

We are going to make a part with complex shapes with 2 smoothing functions, 2 extrusions and a revolution (fig. 1):

The smoothing function is often called in other software "Blend sections" because it allows you to create shapes from well-defined and well-spaced sections. The software fills the space between these sections in a way that we cannot always control. Only the shapes at the right of the sections are faithful.

This 3D function being derived from surface modeling, Catia offers volume creation options that allow you to control the shapes created by the smoothing function between the straight sections.

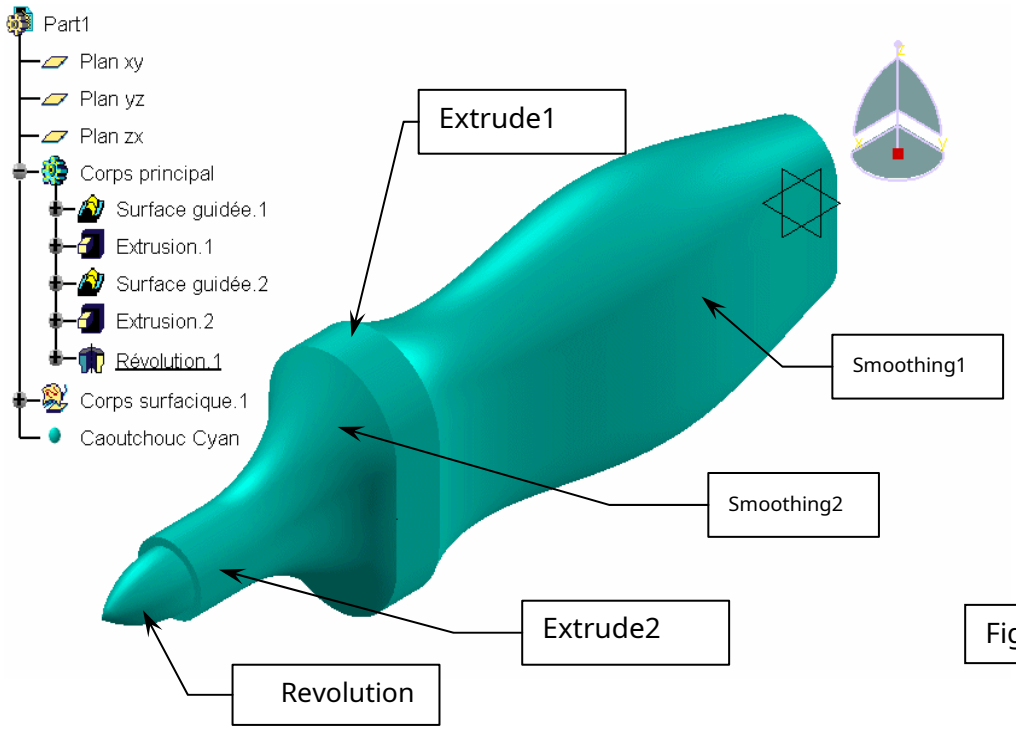


Fig. 1

On the following page, you will find the drawing of the highlighter pen (fig. 2):

MARQUEUR

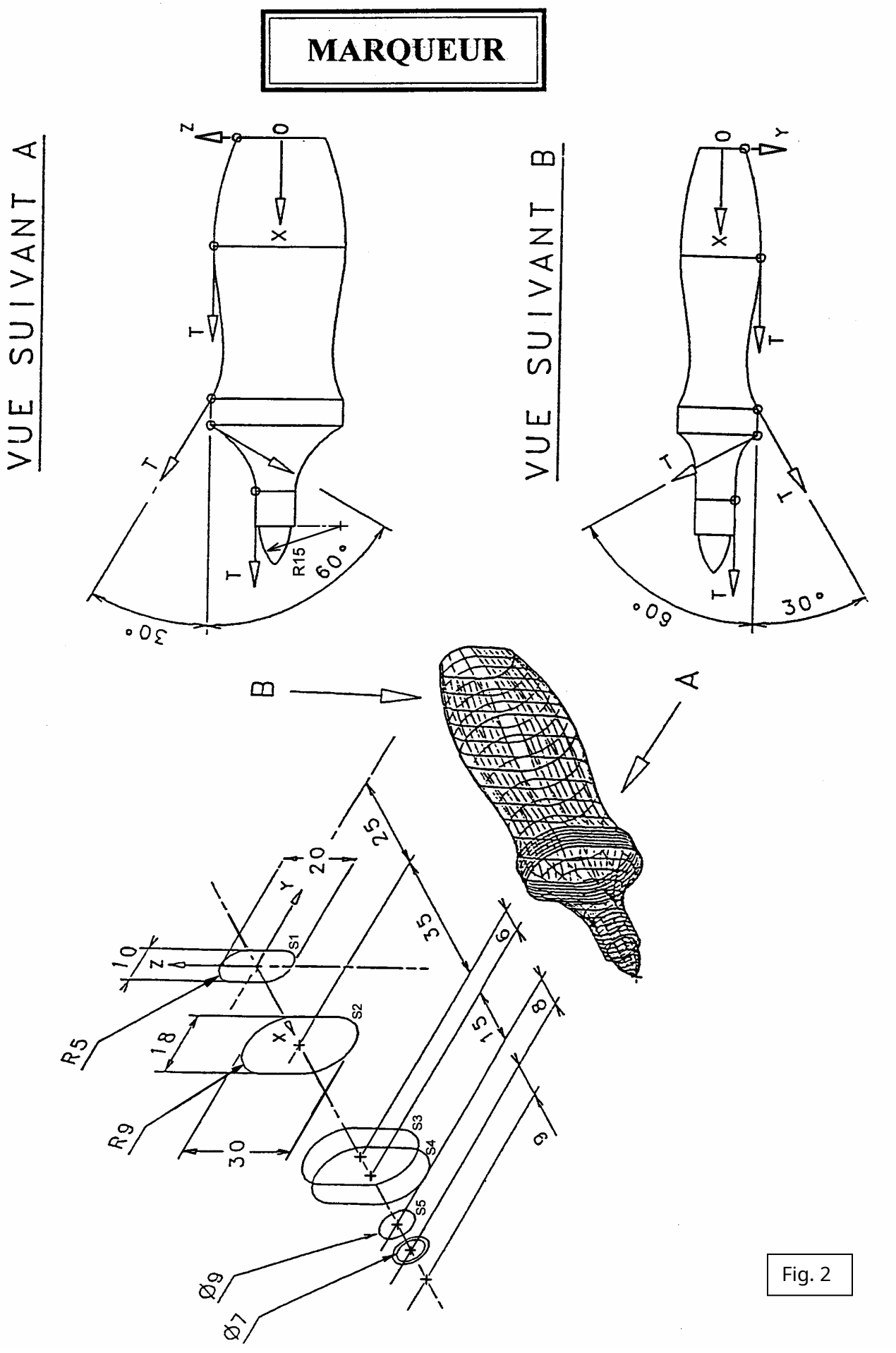
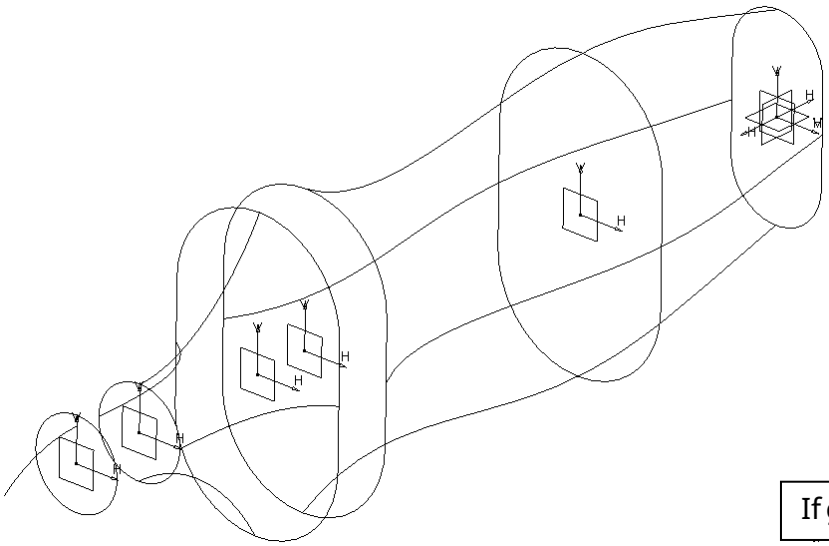


Fig. 2

On the views along A and along B, vectors T are drawn: they indicate the tangents of the curves of apparent contours. As for the isometric view, it gives you the dimensions of the different sections of the pen. Sections S2, S3 and S4 are identical. In the following figure (fig. 3) are gathered all the sketches and the plans that we are going to have to create.



If g. 4

1° Creation of cross sections S1 S2 S3 S4 S5

We will build all of these sketches before creating the part. Start by creating a new "CATPart" type document and create 5 plans that will allow you to create the cross sections (fig. 5):

Double click on the plan icon (Reference elements)
Plane 1 is 25mm from the central (YZ) plane.
The other planes will also be positioned relative to this plane (YZ):
plane 2 is 60mm,
plane 3 is 66mm,
plane 4 is 81mm,
plane 5 is 89mm.

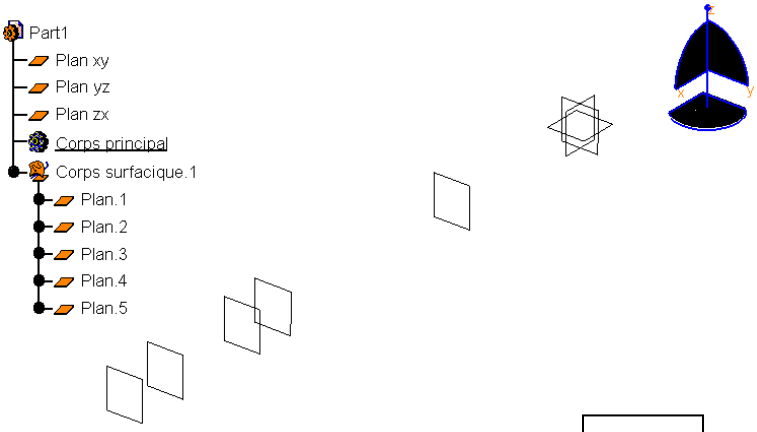
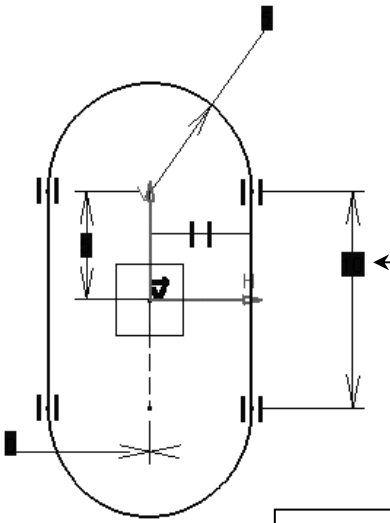


Fig. 5

Section S1



Select the plane (YZ) and create the sketch of the section S1 (fig. 6):

Fig. 6

Section S2

Select plane 1 and create the sketch of section S2 (fig. 7): With the sketch selected, press Ctrl C (copied)

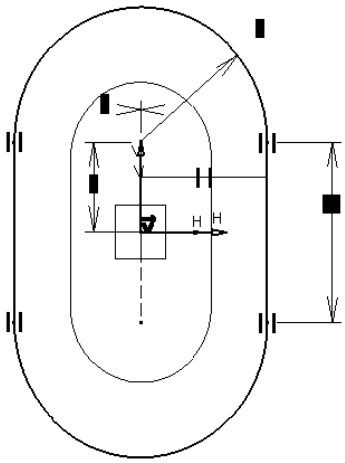
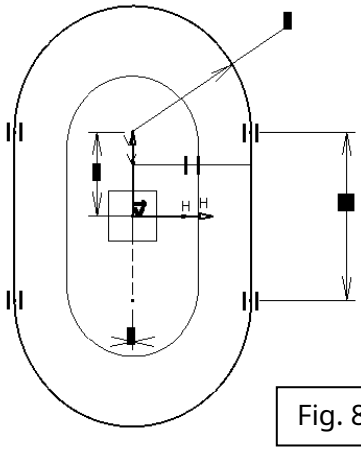


Fig. 7

Section S3



<--- Select plane 2 and paste the sketch (Ctrl V). Section S3 is identical to S2 (fig. 8):
Another possibility: use the icon projection of 3D elements

Fig. 8

Section S4

Select plane 3 and use the other possibility to obtain the sketch of section S4 identical to S2 (fig. 9):

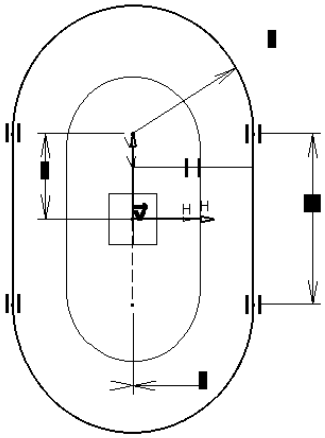


Fig. 9

Section S5

Select plane 4 and create the sketch of section S5 (fig. 10):

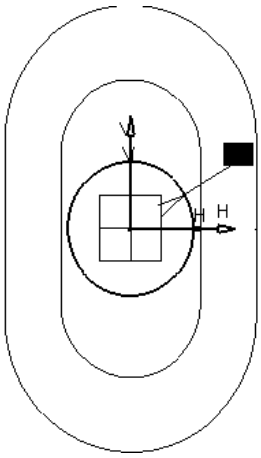


Fig. 10

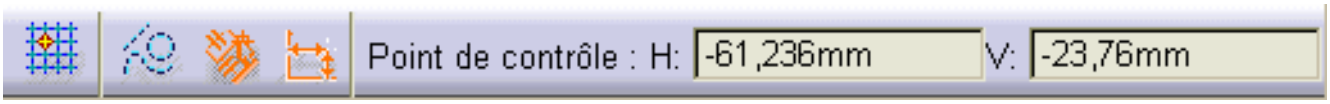
2° Creation of the 4 guide curves for the 1 er smoothing:

1 er smoothing will be built from sections S1, S2 and S3. Auto-smoothing will not give the desired shape with these sections alone, we need to create guide curves to impose the desired shape between the sections.

How many guide curves are needed? If you want a symmetrical evolution of the shape to be smoothed, you need 2 in the vertical plane (ZX) and 2 in the horizontal plane (XY).
Select the vertical center plane parallel to the plane (ZX) and create a new sketch. Click the icon **Curve** :

We are going to create a curve of which we know 3 crossing points.

Bar **Sketch tools** displays the boxes indicating the coordinates of the cursor in absolute coordinates in the local coordinate system:



These boxes can be filled in to obtain the absolute coordinates of these points in the coordinate system (H,V). Click in the "**H**: »and type on the keyboard "**0**» (zero) then press the key **Tab** to move to the "**V**: » and type "**10**»then tap ↵ (**Hall**).

1 er point is created and dimensioned.

For the 2 n/a point, renew the operation with coordinates H:- 25; V:15.

The 3 th point a for coordinates H:-60; V:15. After pressing ↵ you must stop drawing this curve by clicking again on the “Curve” icon:

You should obtain the following figure (fig.11):

REMARK : the curve obtained currently has the natural shape that the smoothing function would use in the absence of a guide curve.

The advantage of this curve is that you can show the tangent to the control points and impose a preferred direction on them.

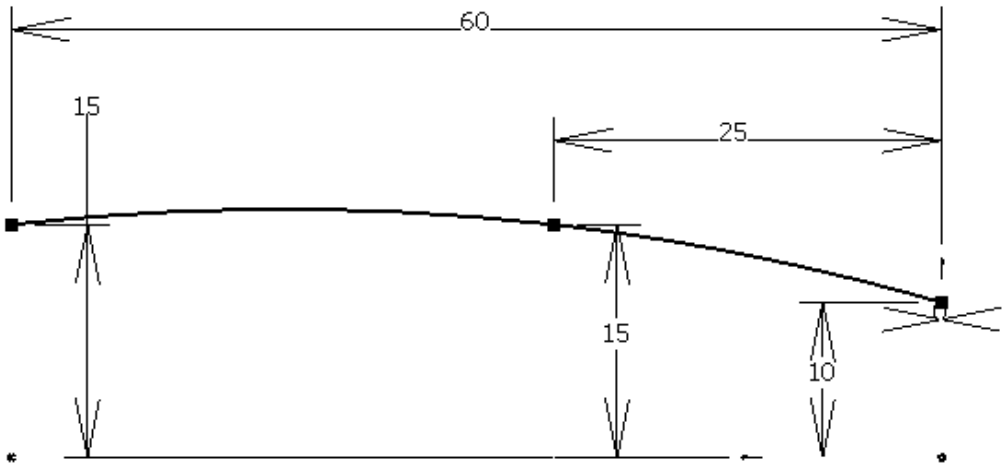


Fig. 10

Double click on the 2n/acheckpoint, a dialog box **Checkpoint**appears, check the box**Tangent**» then press “OK” (fig. 11):-->

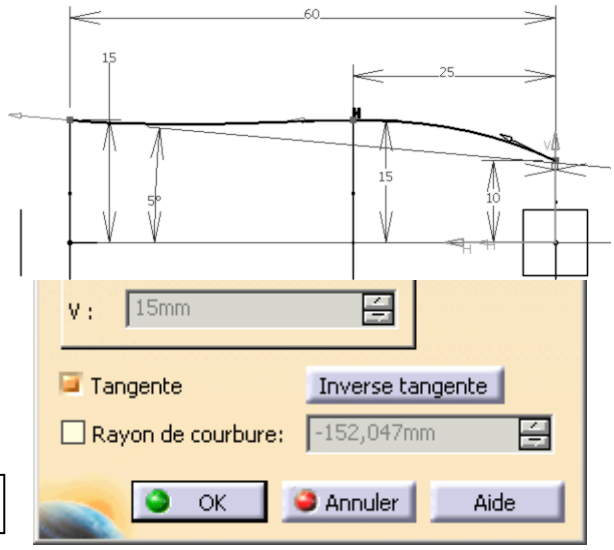


Fig. 11

Select**that**the tangent vector which has just appeared then apply a horizontality constraint to it (fig. 12): ----->

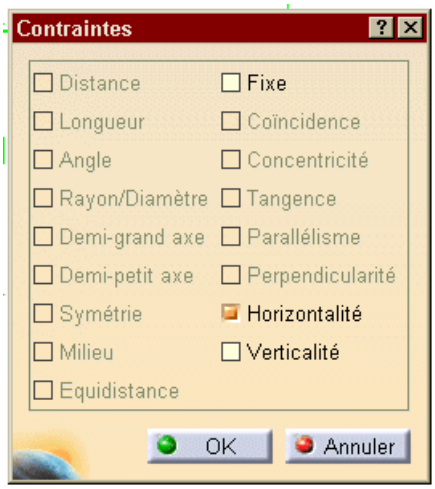


Fig. 12

Do the same with 3thpoint of the curve: show its tangent (fig. 13):-->

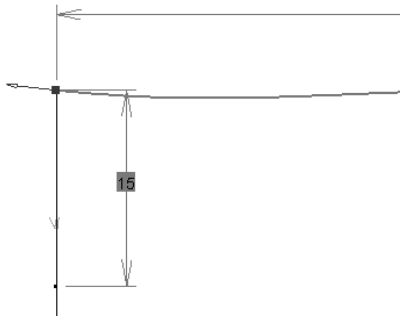


Fig. 13

This time we are not going to force it to be horizontal but inclined at 30° from the horizontal.

Select the tangent of 3th point, click on the icon " **Constraints**»then select the vector**H**of the landmark.

Place the angular dimension anywhere (fig. 14):-->

This is another way to put a rating.

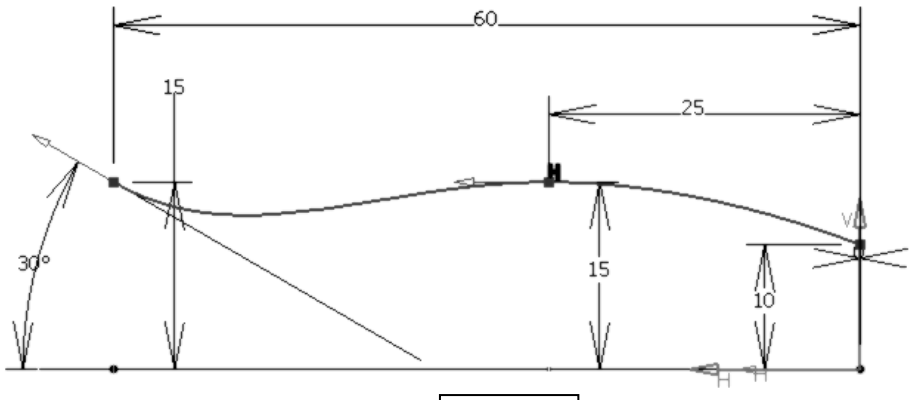


Fig. 14

Modify the value to 30, double click on the angular dimension and enter the value 30. The tangent changes from direction and the curve tilts (fig. 15)

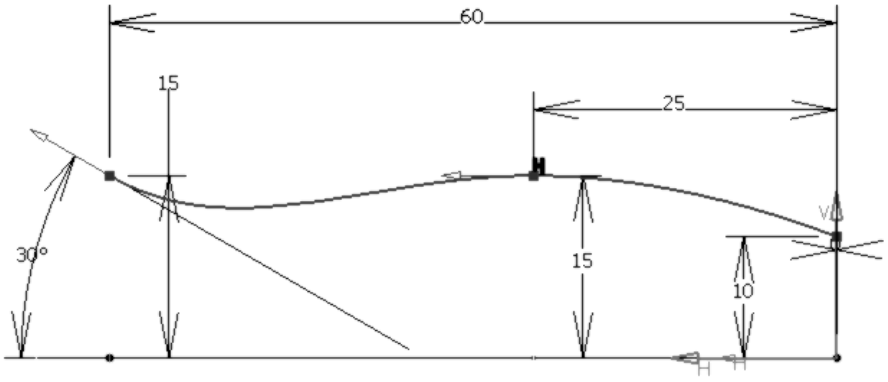


Fig. 15

Close the Sketch Workbench, this first curve-guide is finished.
Rename this one: **Guide A1**.

In the same plane, you will create another sketch representing the curve symmetrical to the previous curve. To do this, use the icon:**Projection of 3D elements**then**Symmetric elements**and finally transform the projection into a construction element to keep only the symmetrical curve of “Guide A1” active. Rename this sketch "**Guide A2**".Here is its layout (fig.16):

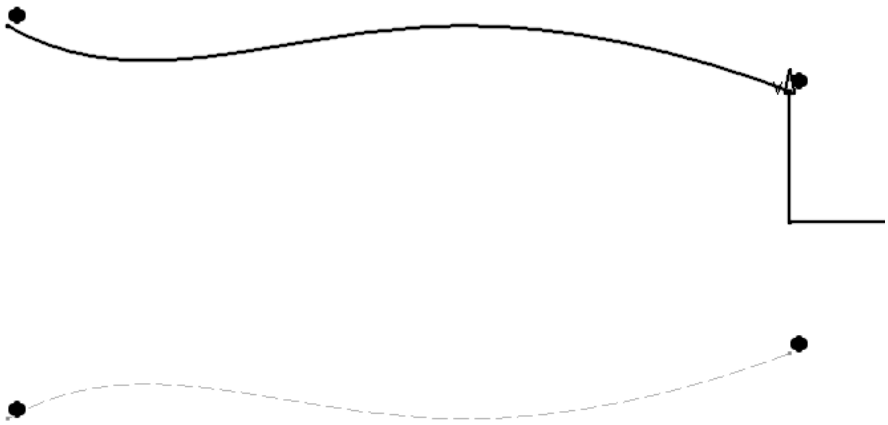


Fig. 16

For the 3thguide curve, select the horizontal center plane parallel to the plane (XY) and create the following sketch: tangent at 30°. You will name this sketch “**Guide A3**» (fig. 17):

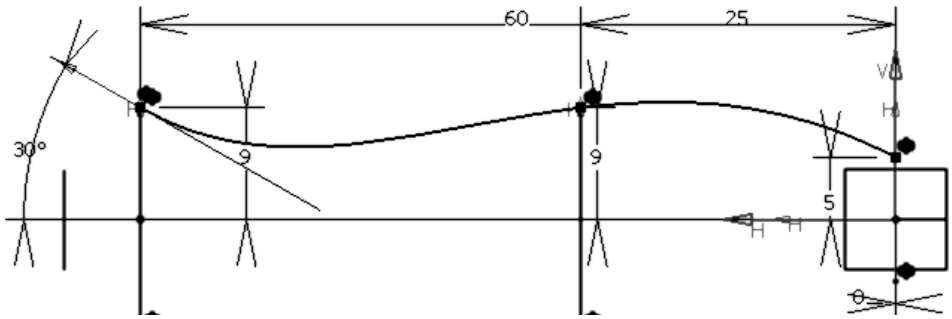


Fig. 17

For the 4thguide curve, select the horizontal center plane parallel to the (XY) plane and create the following sketch. You will name this sketch "**A4 guide**» (fig. 18):

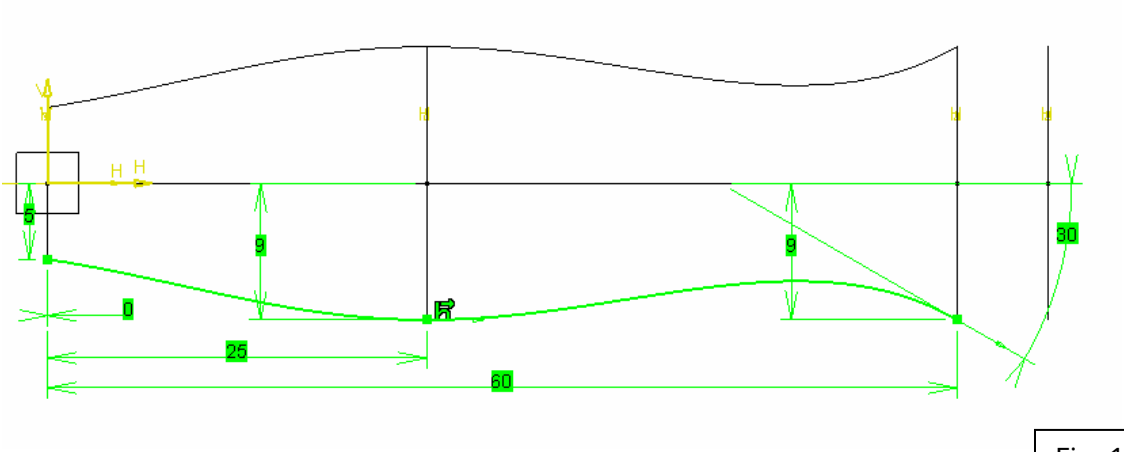


Fig. 18

3° Creation of the 4 guide curves for the 2n/asmoothing:

For the 2thsmoothing function we will only need 2 cross sections S4 and S5. On the other hand, we will need 4 guide curves made up of 2 control points whose tangents have a privileged direction.

Select the vertical plane (ZX) and create the following sketch. You will rename it "Guide B1" (fig. 19):

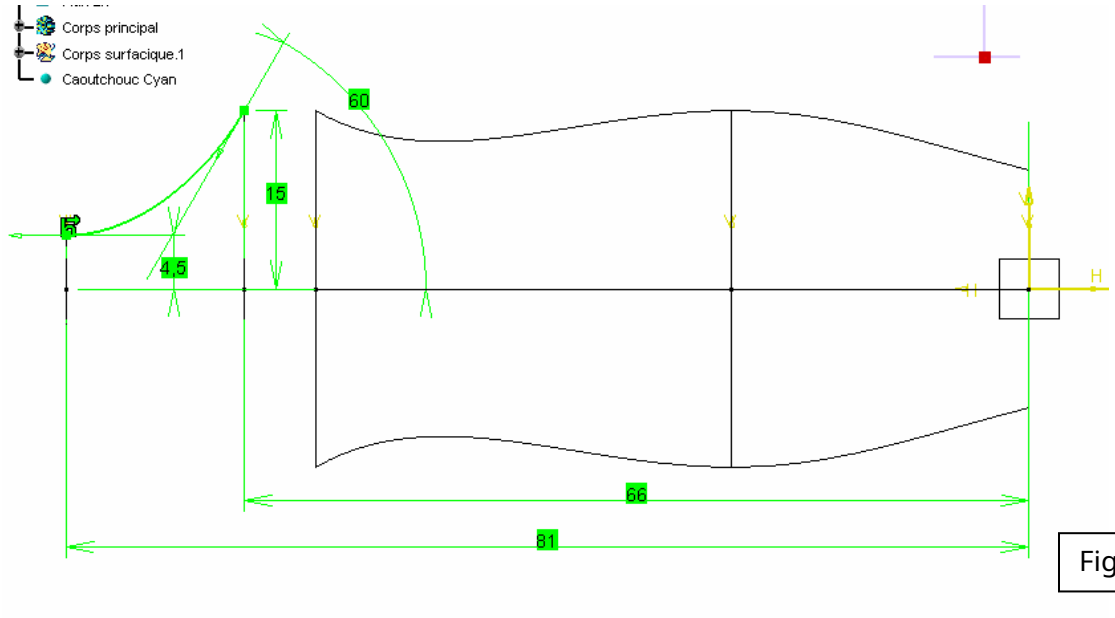


Fig. 19

Select the vertical plane (ZX) again and create the next sketch (think symmetry). You will rename it " **Guide B2**» (fig. 20):

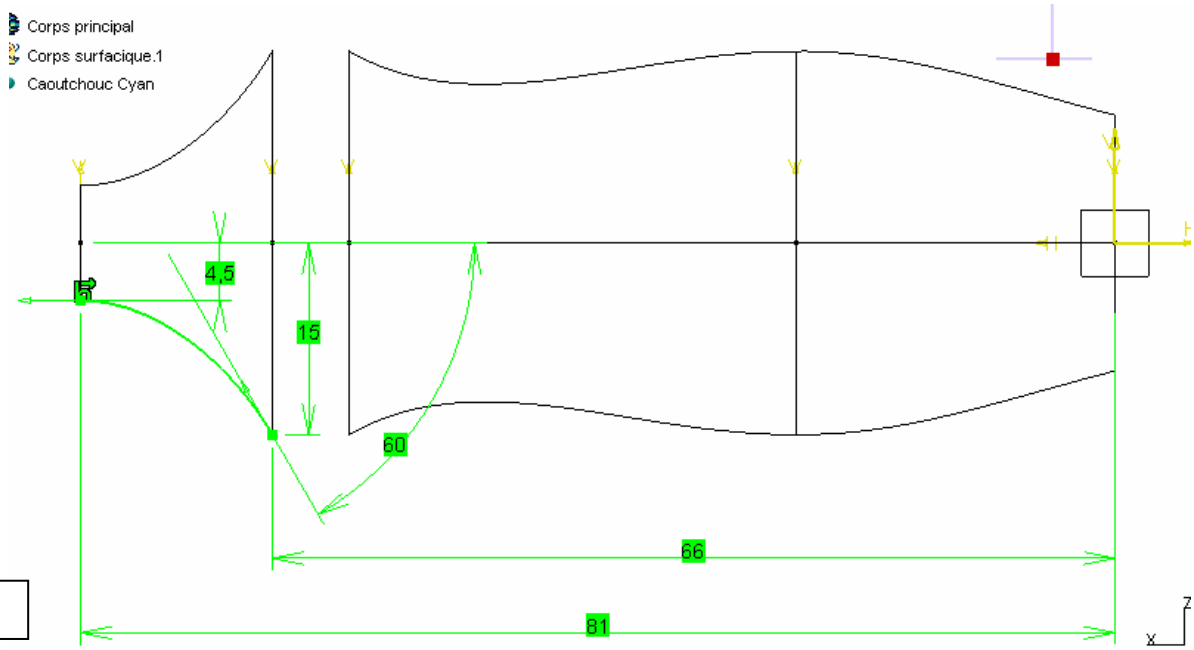


Fig. 20

Select the**XY plane**and create the following sketch. You will rename it "**Guide B3**» (fig. 21):

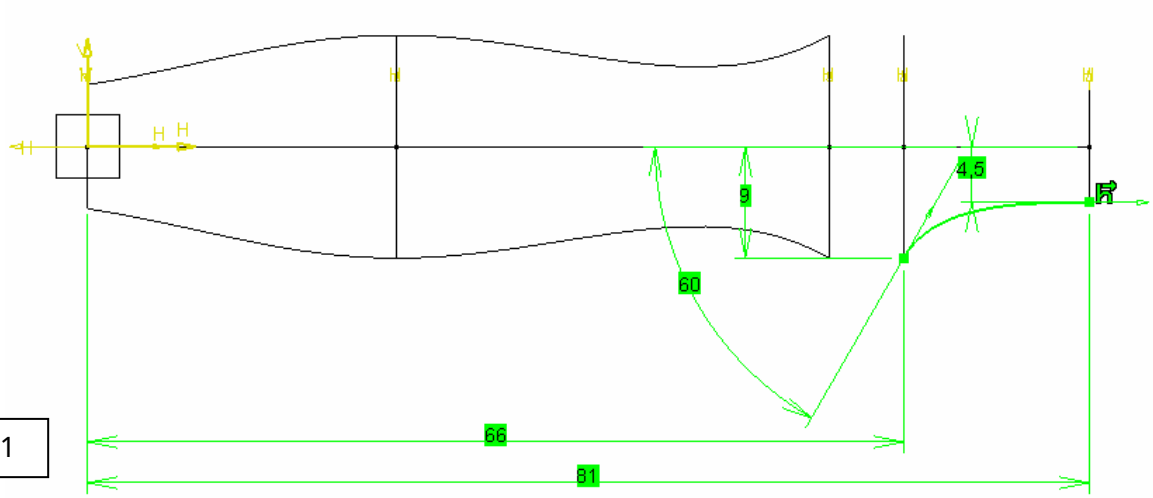


Fig. 21

Select the horizontal (XY) plane again and create the next sketch. You will rename it "**Guide B4**» (fig. 22):

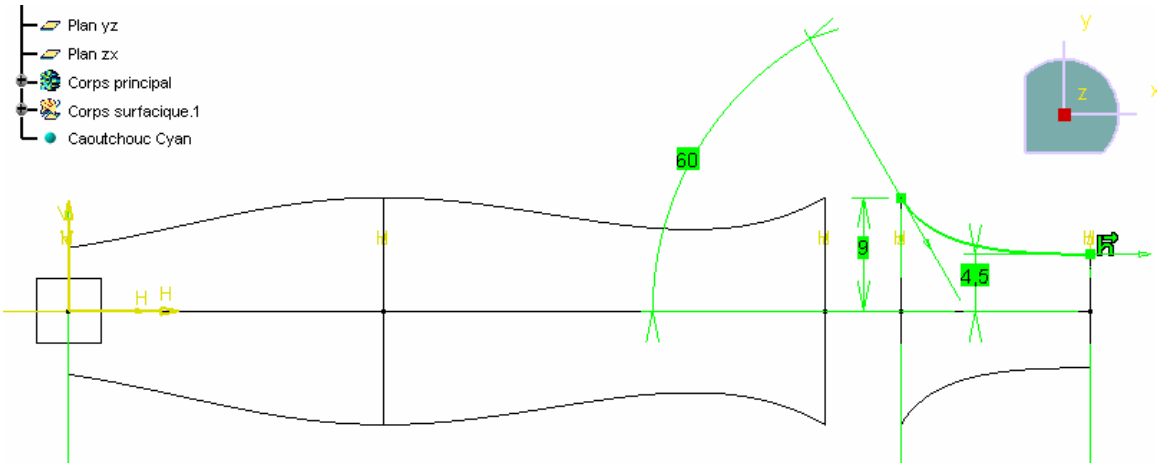


Fig. 22

4° Sketch copy for 1st extrude:

To do the 1st extrusion we will need a sketch identical to the sketch in section S3. However the S3 sketch will be used by the 1st smoothing function, so let's just make a copy of it: Select the sketch of the S3 section in the tree view, press the right mouse button and click on "**To copy**".Select the main body then press the right mouse button then click "**To stick on**".Catia superimposes the 2 sketches but in the tree structure, the name of a new sketch has appeared (Sketch.24 in this tutorial).

Another possibility: Make a projection of 3D elements as before.

5° Sketch for 2nde extrude:

Select plane 5 and create a new sketch (fig.23):

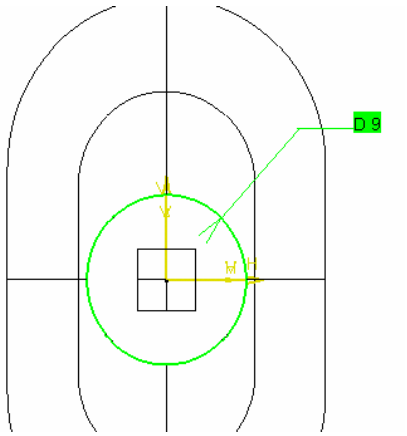


Fig. 23

6° Sketch for the revolution function:

Select the vertical plane (ZX) and create the following sketch. This is an arc of a circle and a horizontal axis line (fig. 24):

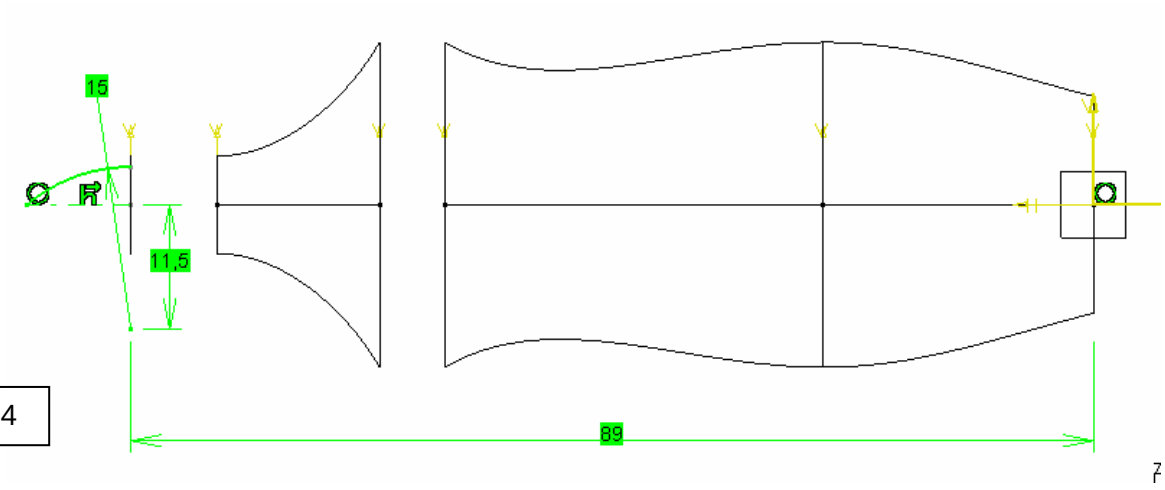


Fig. 24

7° Construction of the room: 1 ersmoothing:

Click on the "**Smoothing**»  and select the 3 sketches of sections S1, S2 and S3 (click on the 3 top points in the dialog box if necessary) then click on the "**Insight**», click on 1timeline in the area "**Guide**»of the box and select the 2 guides A1, A2, click on the button**Insight**»observe the evolution of the form. Add the other 2 guides A3 and A4 click on the button «**Insight**» (fig. 25):

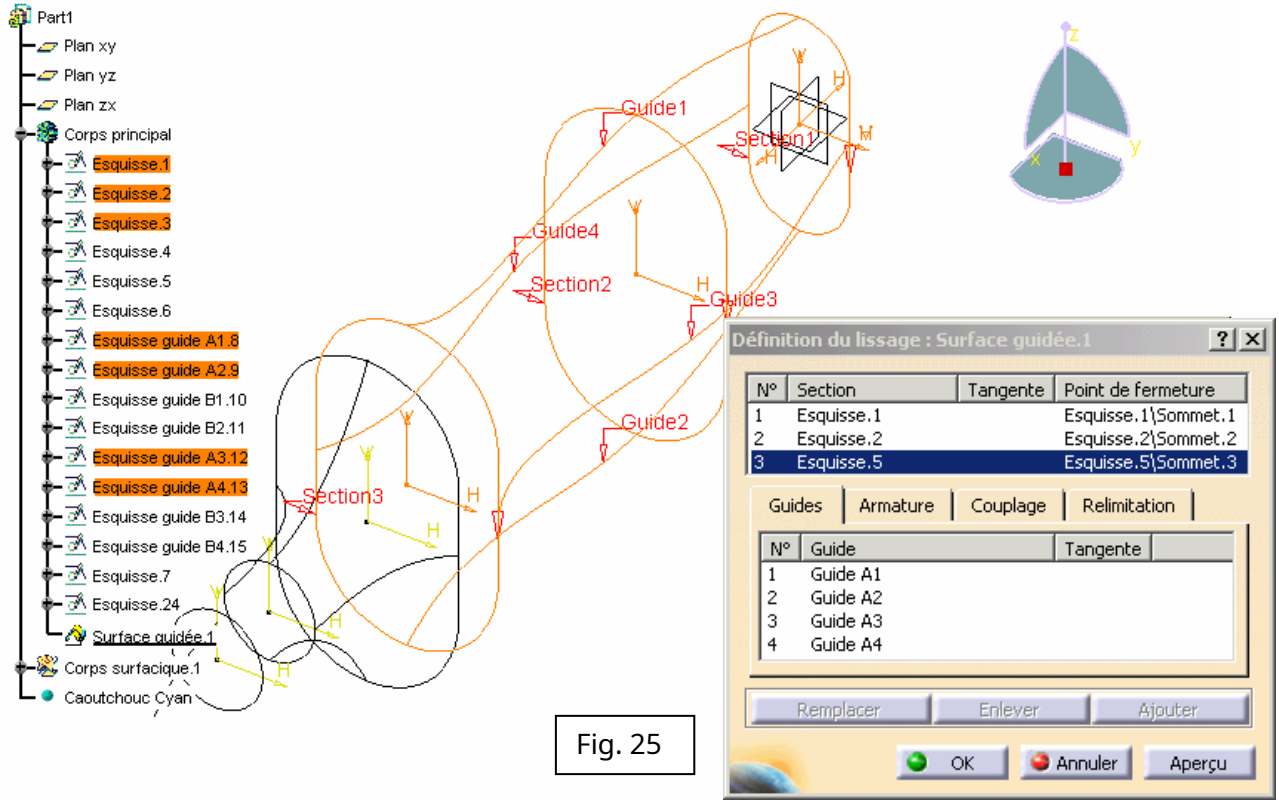


Fig. 25

Click on the tab**Coupling**and make sure that the coupling of the sections is of the type "**Tangency then curvature**» (fig. 26):

Click on "**okay**".

Fig. 26

8° Extrusion:

Select the duplicated sketch (Sketch.24 from the lab) and make a 6mm extrusion (fig. 25):

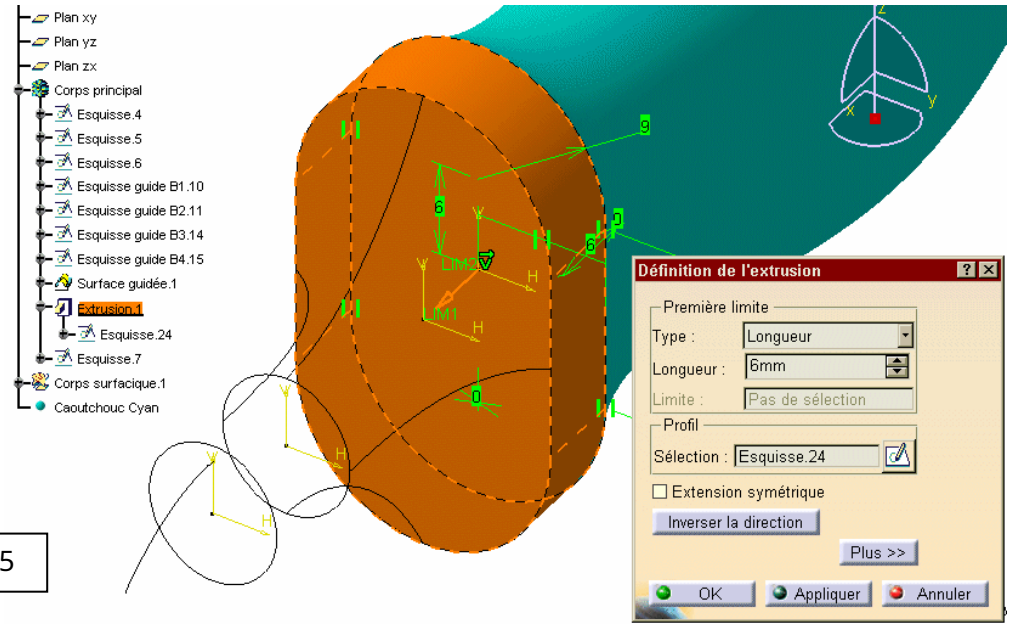


Fig. 25

9° Smoothing n°2:

Click the icon**Smoothing**  and select the sketch of the S4 section
Attention, the 2 sections do not have the same number of entities (lines, arcs) which imposes the choice of a closing point for each of the 2 sections. Click on the end of guide B1. this point becomes the new closing point Click on the sketch of the S5 section (the circle) then right click on the 2n/a line in the dialog box then click on**Remove the closing point,**start again right click then**Create a closing point**and finally click on the other end of guide B1.

Check that the arrow indicating the direction of the sections are identical, otherwise click on one of them.

Click on the**...**of the area**Guide**in the dialog box then select the 4 Guide curves B1, B2, B3 and B4 (fig.26):

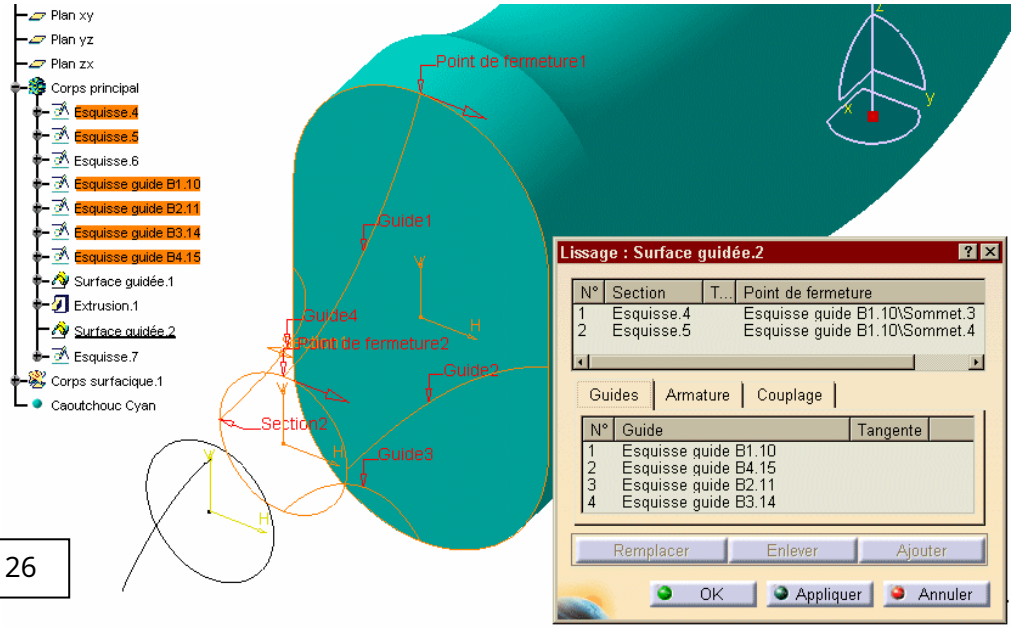


Fig. 26

Make sure that the coupling is of the "**Tangency**» (fig. 27):

Click on "**okay**".

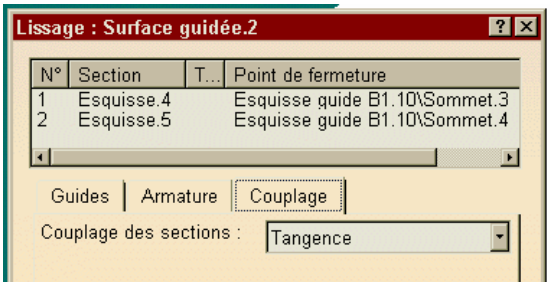


Fig. 27

10° Extrusion:

Select the sketch (Sketch.6 in the lab) and make an 8mm extrusion (fig.28):

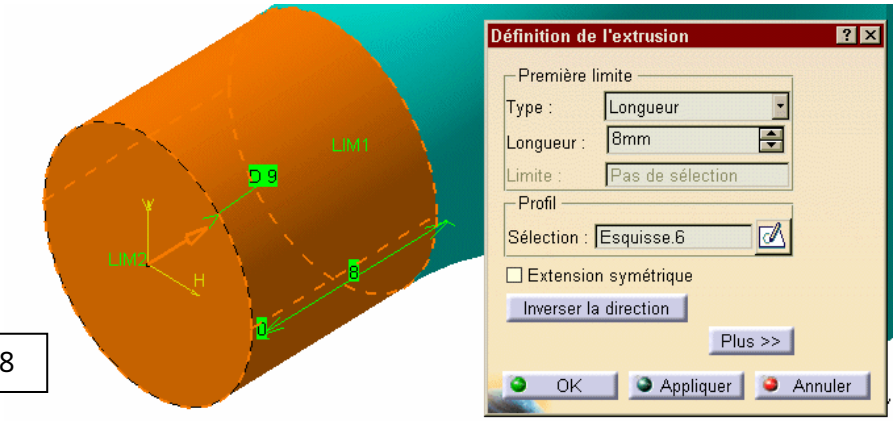


Fig. 28

11° Revolution:

Select the sketch (Sketch.7 in the lab) and revolve 360° around the axis**H** (fig.29):

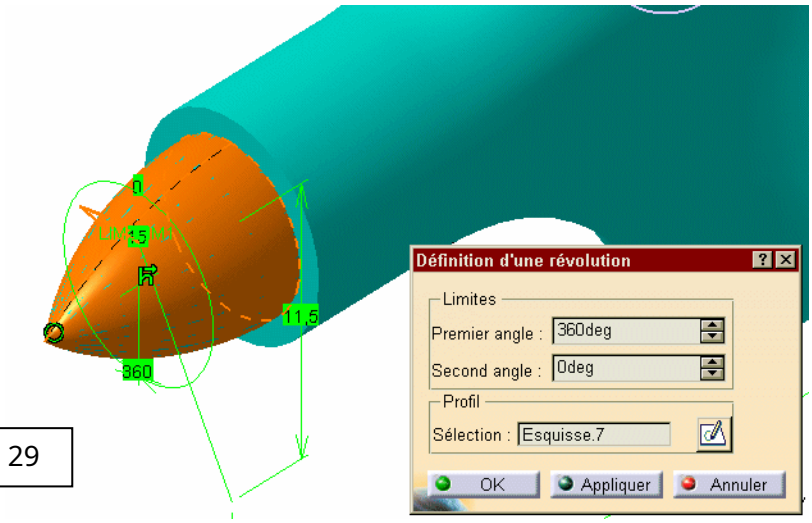
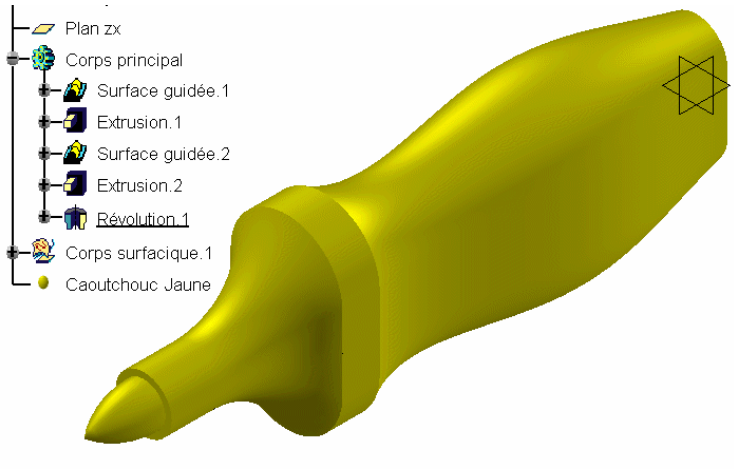


Fig. 29

12° The play is over



END OF THE WORKSHOP