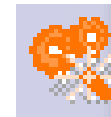
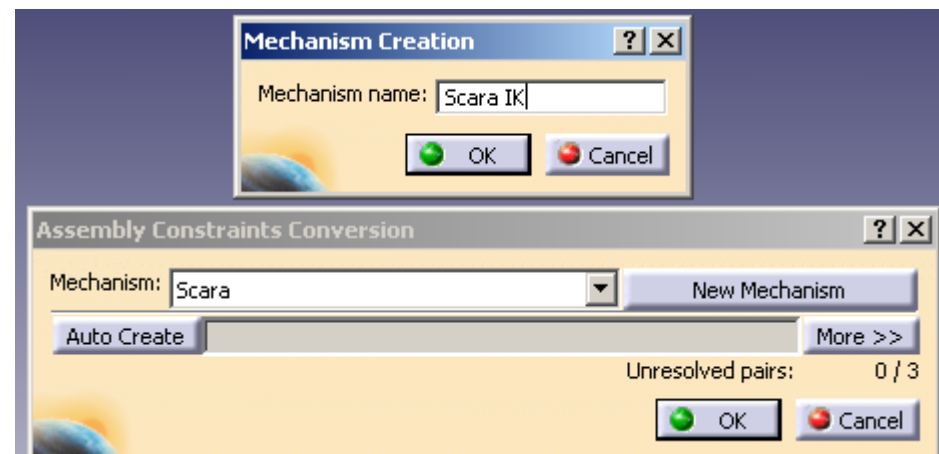
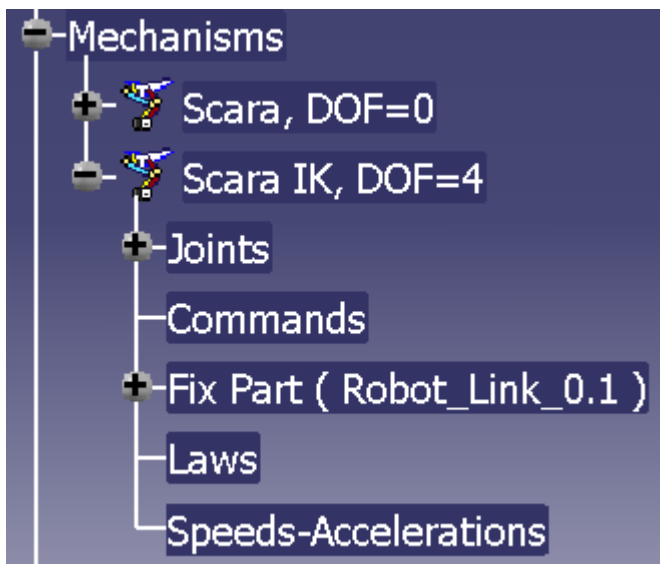


Move the end-effector

- Creating a virtual mechanism
 - Three orthogonal prismatic joints (X, Y, Z)
 - One revolute joint around Z axis
- Insert parts
 - X.CatPart,
 - XY.CatPart,
 - YZ.CatPart,
 - Z.CatPart
 - Rot_ZY.CatPart



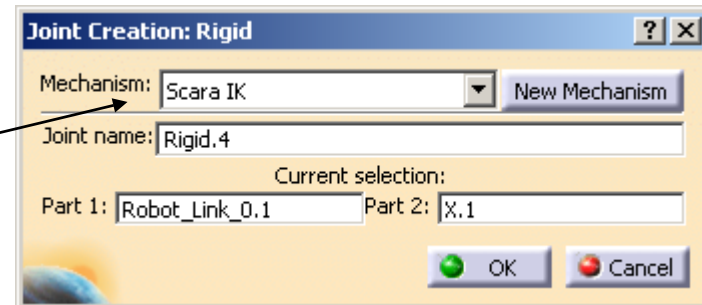
- New mechanism: «Assembly constraints conversion»
 - Create a new mechanism from previous one
 - Change the name «Scara IK»
 - Use «Auto create» to use the previous joint definition





Move the end-effector

- Create a rigid joint between «Robot_link0» and «X» 

Change the mechanism!



- Create three prismatic joint between 
 - «X» and «XY»
 - «XY» and «YZ»
 - «YZ» and «Z»
- Create a revolution joint between «Z» and «Rot_ZY»
- Create a rigid joint between «Rot_ZY» and «Robot_link3» 

Move the end-effector

Joint Creation: Prismatic ? X

Mechanism: Scara IK

Joint name: Prismatic.5

Current selection:

Line 1: X.1/x Line 2: XY.1/x

Plane 1: X.1/xy plane Plane 2: XY.1/xy plane

☐ Length driven

Joint Creation: Prismatic ? X

Mechanism: Scara IK

Joint name: Prismatic.7

Current selection:

Line 1: YZ.1/z Line 2: Z.1/z

Plane 1: YZ.1/zx plane Plane 2: Z.1/zx plane

☐ Length driven

Joint Creation: Rigid ? X

Mechanism: Scara IK

Joint name: Rigid.9

Current selection:

Part 1: Rot_ZY.1 Part 2: Robot_Link_3.1

Joint Creation: Prismatic ? X

Mechanism: Scara IK

Joint name: Prismatic.6

Current selection:

Line 1: XY.1/y Line 2: YZ.1/y

Plane 1: XY.1/xy plane Plane 2: YZ.1/xy plane

☐ Length driven

Joint Creation: Revolute ? X

Mechanism: Scara IK

Joint name: Revolute.8

Current selection:

Line 1: Z.1/z Line 2: Rot_ZY.1/Z

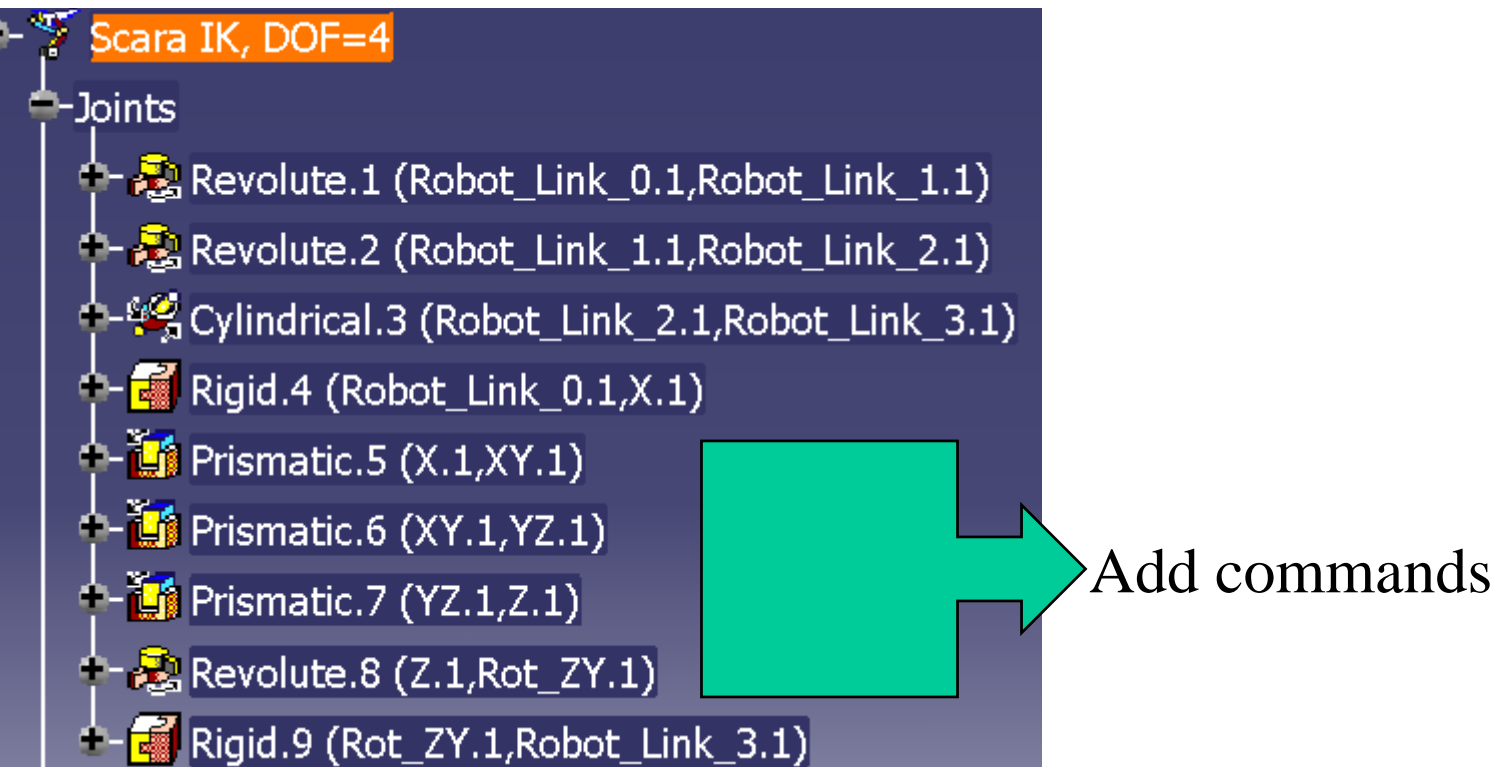
Plane 1: Z.1/xy plane Plane 2: Rot_ZY.1/xy plane ☒ Null Offset ☐ Offset =

Plane 3: - Plane 4: - ☐ Centered

☐ Angle driven

Move the end-effector

- Only 4 dof for the mechanism at the end



Scara IK, DOF=4

Joints

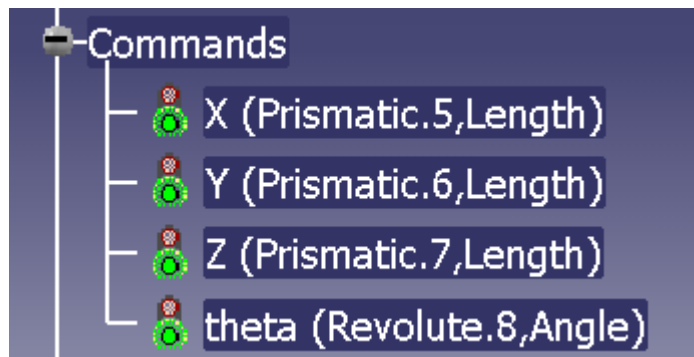
- Revolute.1 (Robot_Link_0.1, Robot_Link_1.1)
- Revolute.2 (Robot_Link_1.1, Robot_Link_2.1)
- Cylindrical.3 (Robot_Link_2.1, Robot_Link_3.1)
- Rigid.4 (Robot_Link_0.1, X.1)
- Prismatic.5 (X.1, XY.1)
- Prismatic.6 (XY.1, YZ.1)
- Prismatic.7 (YZ.1, Z.1)
- Revolute.8 (Z.1, Rot_ZY.1)
- Rigid.9 (Rot_ZY.1, Robot_Link_3.1)

Add commands

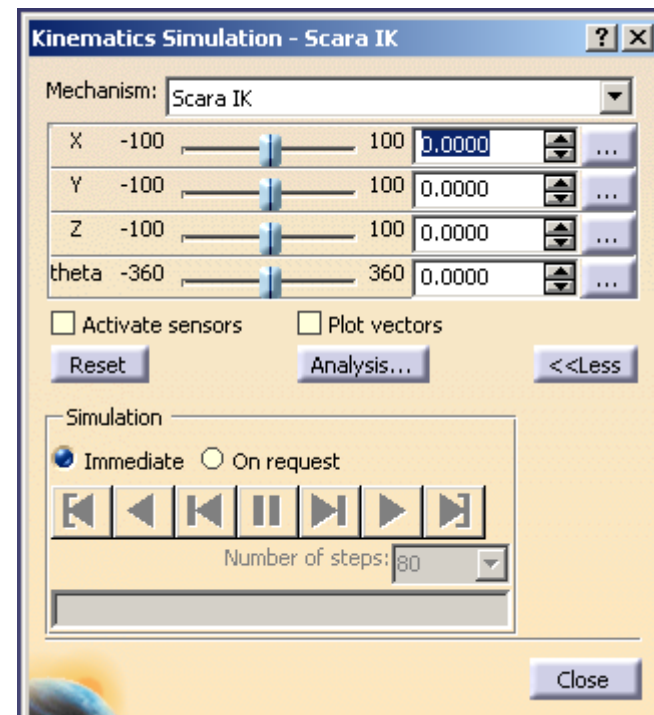
- The mechanism can be simulated

Move the end-effector

- Rename the commands



- Kinematics simulation
- Caution: the rotation axis is not well defined!



Mechanism analysis

- 9 joints, 4 commands and 4 degrees of freedom

Mechanism Analysis [?] [X]

General Properties

Mechanism name: Scara IK

Mechanism can be simulated: Yes

Number of joints: 9

Number of commands: 4

Degrees of freedom without command(s): 4

Degrees of freedom with command(s): 0

Fixed part: Robot_Link_0.1

Joints visualisation: ☒ On ☐ Off [Save] [Laws...]

Joint	Command	Type	Part 1	Geometry 1	Part 2	Geometry 2	Part 3
Revo...		Revolute	Robot_Link_0.1	Solid.1	Robot_Link_1.1	Solid.1	
Revo...		Revolute	Robot_Link_1.1	Solid.1	Robot_Link_2.1	Solid.1	
Cylin...		Cylindrical	Robot_Link_2.1	Solid.1	Robot_Link_3.1	Solid.1	
Rigid.4		Rigid	Robot_Link_0.1		X.1		
Prism... X		Prismatic	X.1	x	XY.1	x	
Prism... Y		Prismatic	YV.1	y	YV.1	y	

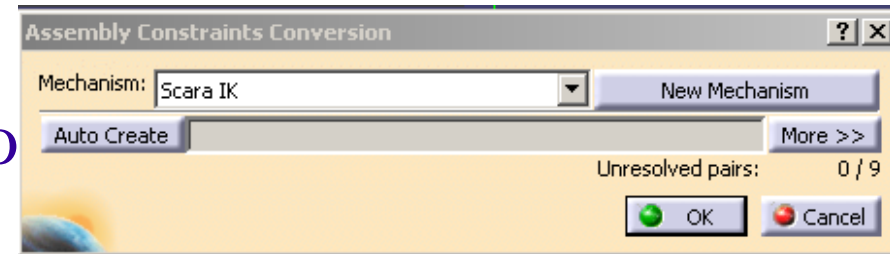
Mechanism dressup information:

Part 1	Part 2	Part 3

[Close]

Update direct kinematics

- Delete the first mechanism
- Assembly constraints conversion
- Create a new mechanism



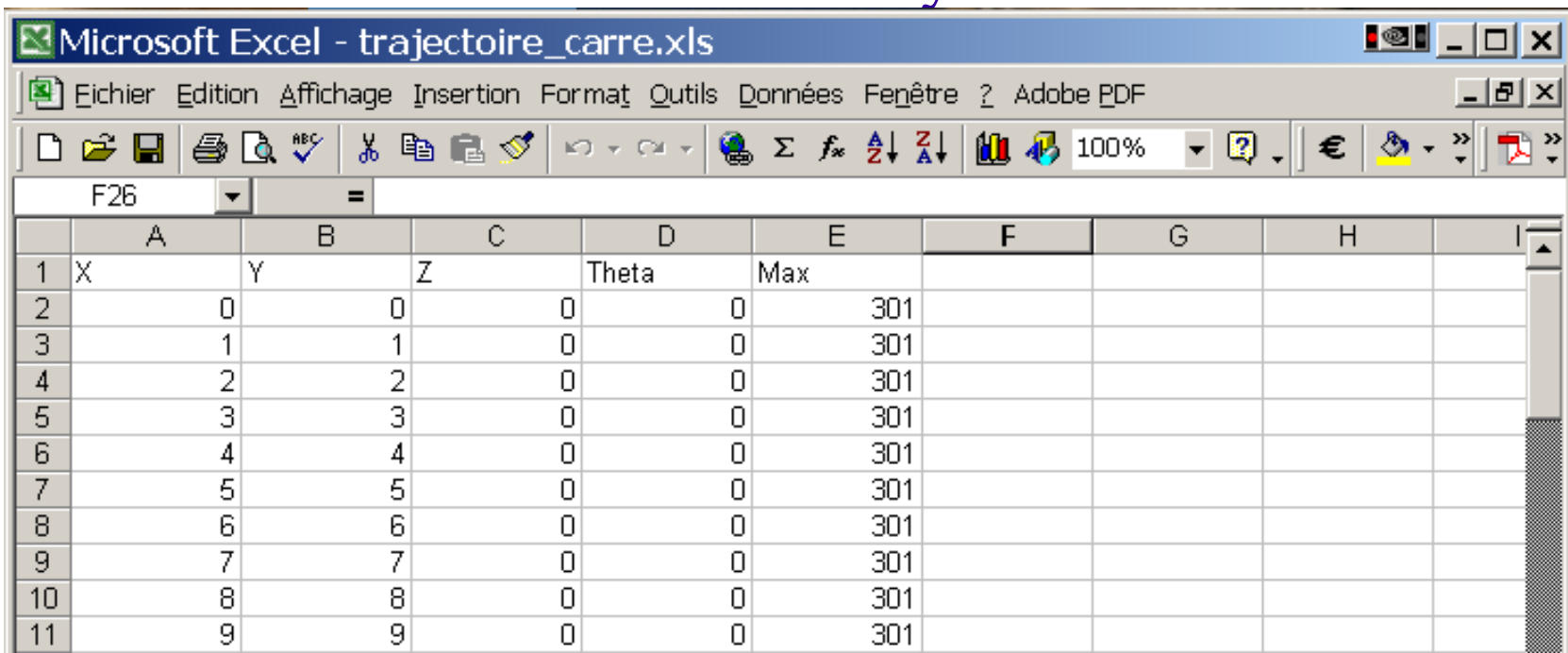
Add commands

- Rename commands
 - theta1, theta2, theta3
 - Z



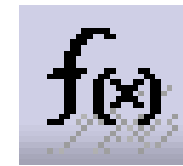
Link to an Excel spreadsheet

- Defining a spreadsheet that describes a square in the XY plane
- 5 columns, X, Y, Z, Theta, and the number of lines (Max)
- No unit ... because Catia real only real numbers

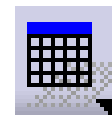


The screenshot shows a Microsoft Excel window titled "Microsoft Excel - trajectoire_carre.xls". The spreadsheet contains a table with 5 columns: X, Y, Z, Theta, and Max. The data represents a square path in the XY plane with 11 lines (Max = 301 for all lines). The Z and Theta values are constant at 0 for all lines.

	A	B	C	D	E	F	G	H	I
	X	Y	Z	Theta	Max				
2	0	0	0	0	301				
3	1	1	0	0	301				
4	2	2	0	0	301				
5	3	3	0	0	301				
6	4	4	0	0	301				
7	5	5	0	0	301				
8	6	6	0	0	301				
9	7	7	0	0	301				
10	8	8	0	0	301				
11	9	9	0	0	301				



- Creating parameters
- Why?
 - Allow association with the Excel file (X, Y, Z, Theta)
 - See the variations of the position of the tool (XX, YY, ZZ, THETA)
 - Number of rows in the Excel file (Max)
- Caution
 - Create the parameters with the proper type (length and angle).



- Create a design table

Name of the table

Creation of a Design Table

Name:

Comment:

☒ Create a design table from a pre-existing file
☐ Create a design table with current parameter values

Orientation : ☒ Vertical ☐ Horizontal

For Excel or Lotus 1-2-3 sheets, sheet index :

You should create a design table:
either from a text file, an Excel sheet or a Lotus 1-2-3 sheet (on NT).
Here is an example of a design table:

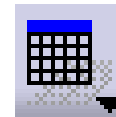
PadHeight (mm)	PadWidth (mm)	Material
15	12	Steel
17	1,3 cm	Aluminium

In a text file, columns should be separated by tabulations.

Destination :

OK Cancel

- Select the Excel file
- Combine the columns of the table with the parameters of the product automatically



- Creation of a formula to read Excel spreadsheet
- Warning:
 - No function to known the number of lines
 - The timer is between 1 and 10 seconds by default
 - Create new laws for the « Scara IK »

Relations

- Trajectoire
 - Configuration=1
 - Sheet.1

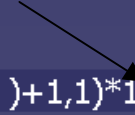
Formula.1: ` Scara IK\Commands\X\Length` =CellAsReal("Trajectoire",int(` Scara IK\KINTime` * Max/10)+1,1)*1mm

Formula.2: ` Scara IK\Commands\Y\Length` =CellAsReal("Trajectoire",int(` Scara IK\KINTime` * Max/10)+1,2)*1mm

Formula.3: ` Scara IK\Commands\Z\Length` =CellAsReal("Trajectoire",int(` Scara IK\KINTime` * Max /10)+1,3)*1mm

Formula.4: ` Scara IK\Commands\theta\Angle` =CellAsReal("Trajectoire",int(` Scara IK\KINTime` * Max/10)+1,4)*1deg

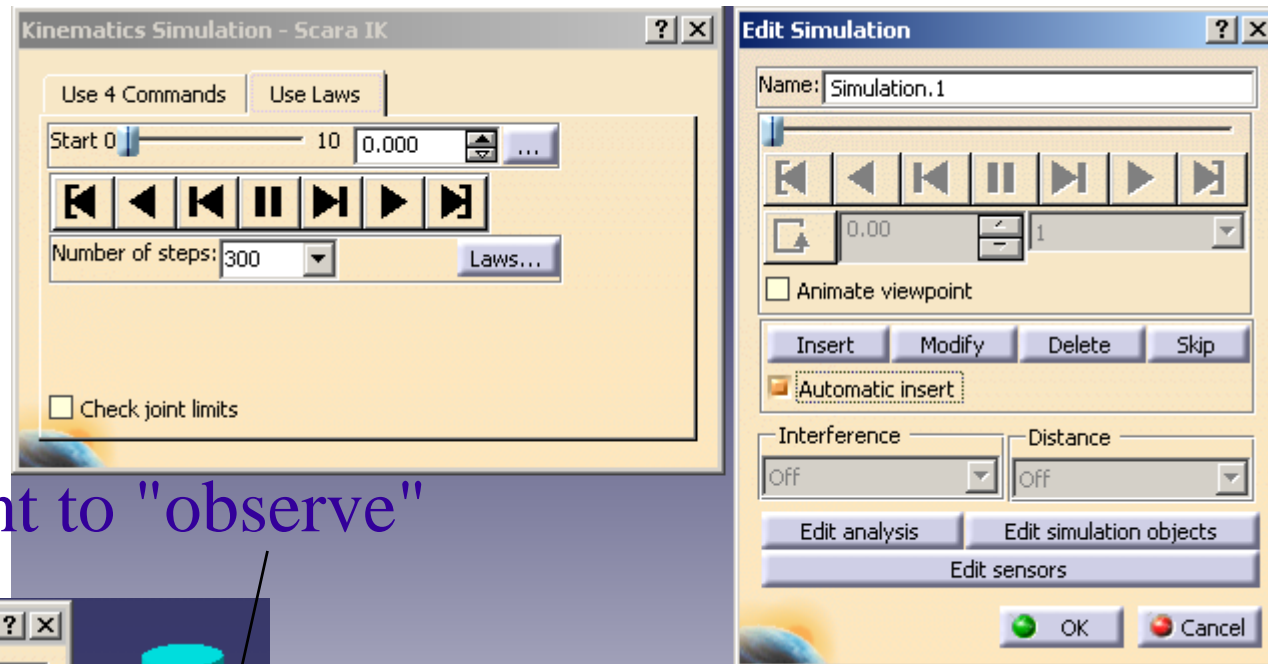
**Define the
units!**



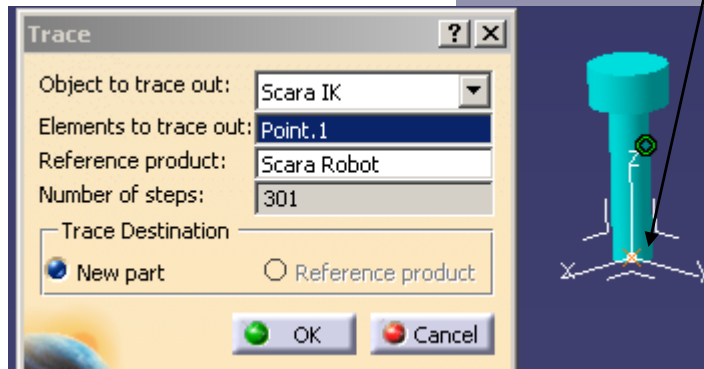
Trace the trajectory made by the end-effector



- Make a simulation with «Scara IK»



- Definition of point to "observe"

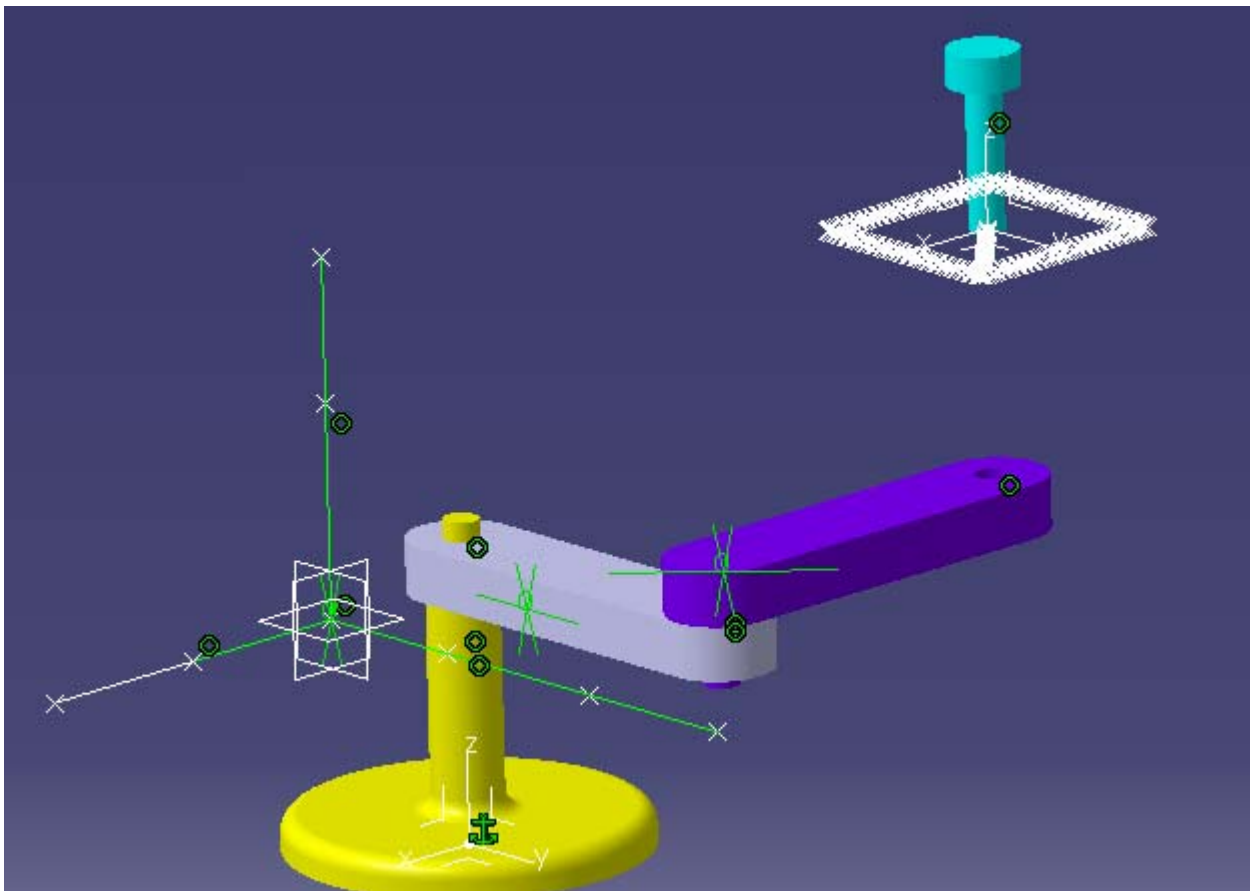


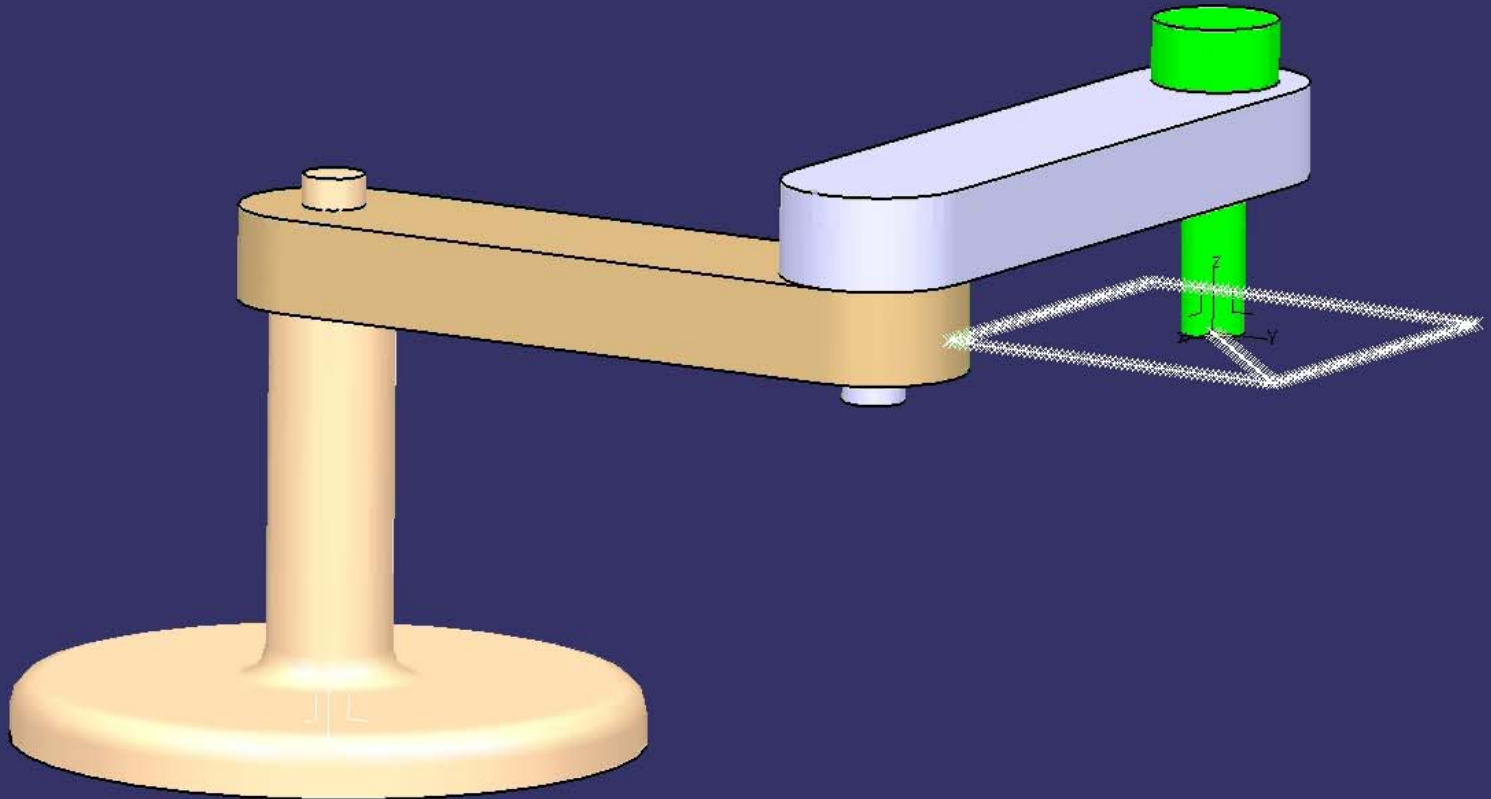
Save as « Trace_EMARO.CATPart »

Trace the trajectory made by the end-effector





- Insert the part «Trace_EMARO» in the product





Display the coordinates of the trajectory

- Problem:
 - No change in the configuration parameter table
 - How to display the position of the tool?
- Defining a rule  in the Knowledge module 
 - Same formula but parameters associated with XX, YY, ZZ, THETA

YY= CellAsReal("Trajectoire",int(` Scara IK\KINTime` * Max/10)+1,2)*1mm
ZZ= CellAsReal("Trajectoire",int(` Scara IK\KINTime` * Max/10)+1,3)*1mm
THETA= CellAsReal("Trajectoire",int(` Scara IK\KINTime` * Max/10)+1,4)*1 deg"/>

```
/*Rule created by damien 03/05/2009*/  
XX= CellAsReal("Trajectoire",int(` Scara IK\KINTime` * Max/10 )+1,1)*1mm  
YY= CellAsReal("Trajectoire",int(` Scara IK\KINTime` * Max/10 )+1,2)*1mm  
ZZ= CellAsReal("Trajectoire",int(` Scara IK\KINTime` * Max/10 )+1,3)*1mm  
THETA= CellAsReal("Trajectoire",int(` Scara IK\KINTime` * Max/10 )+1,4)*1 deg
```