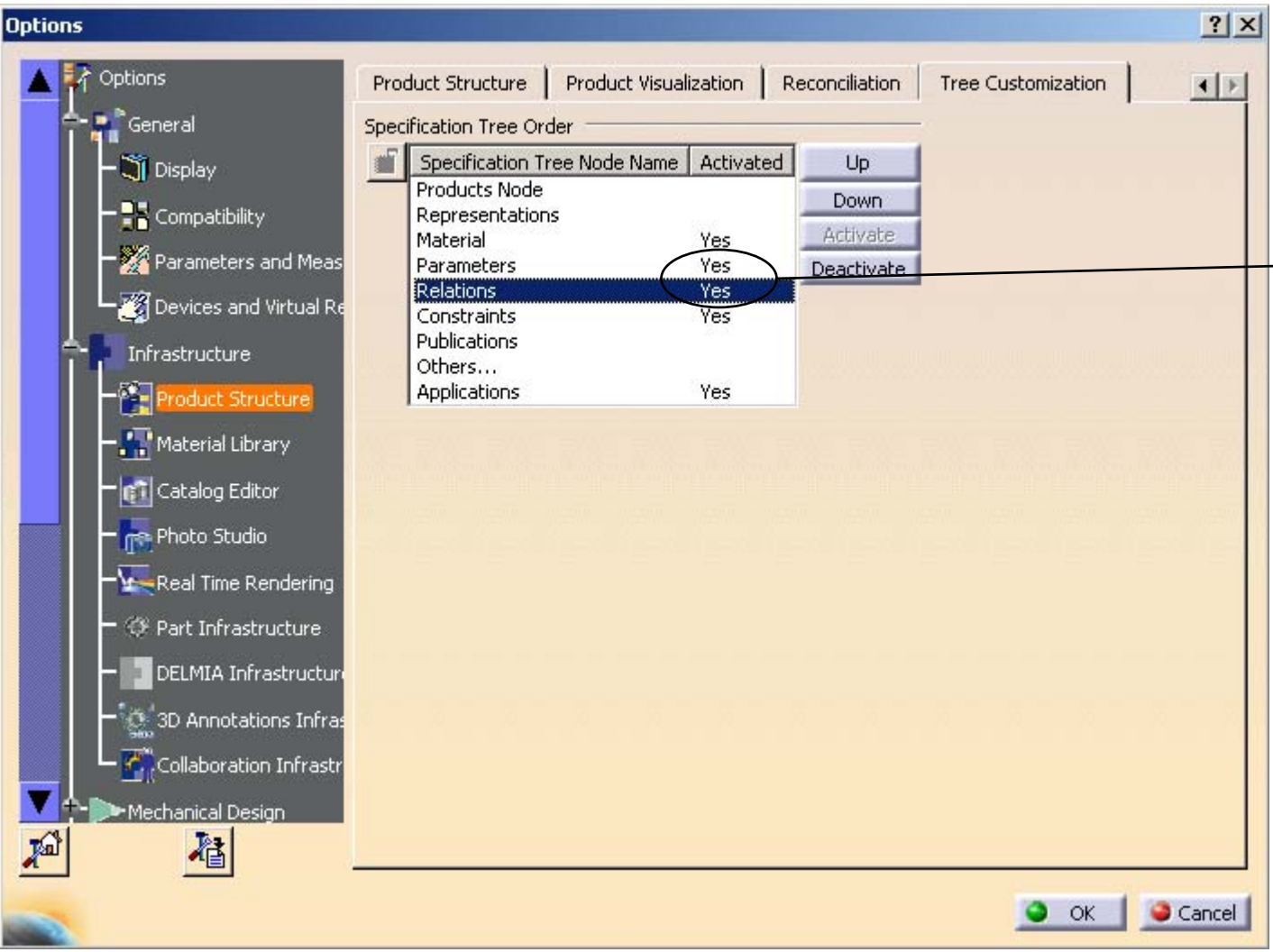
CATIA:

Definition of trajectories

Inverse and direct kinematics

D. CHABLAT / S. CARO
Damien.Chablat@irccyn.ec-nantes.fr

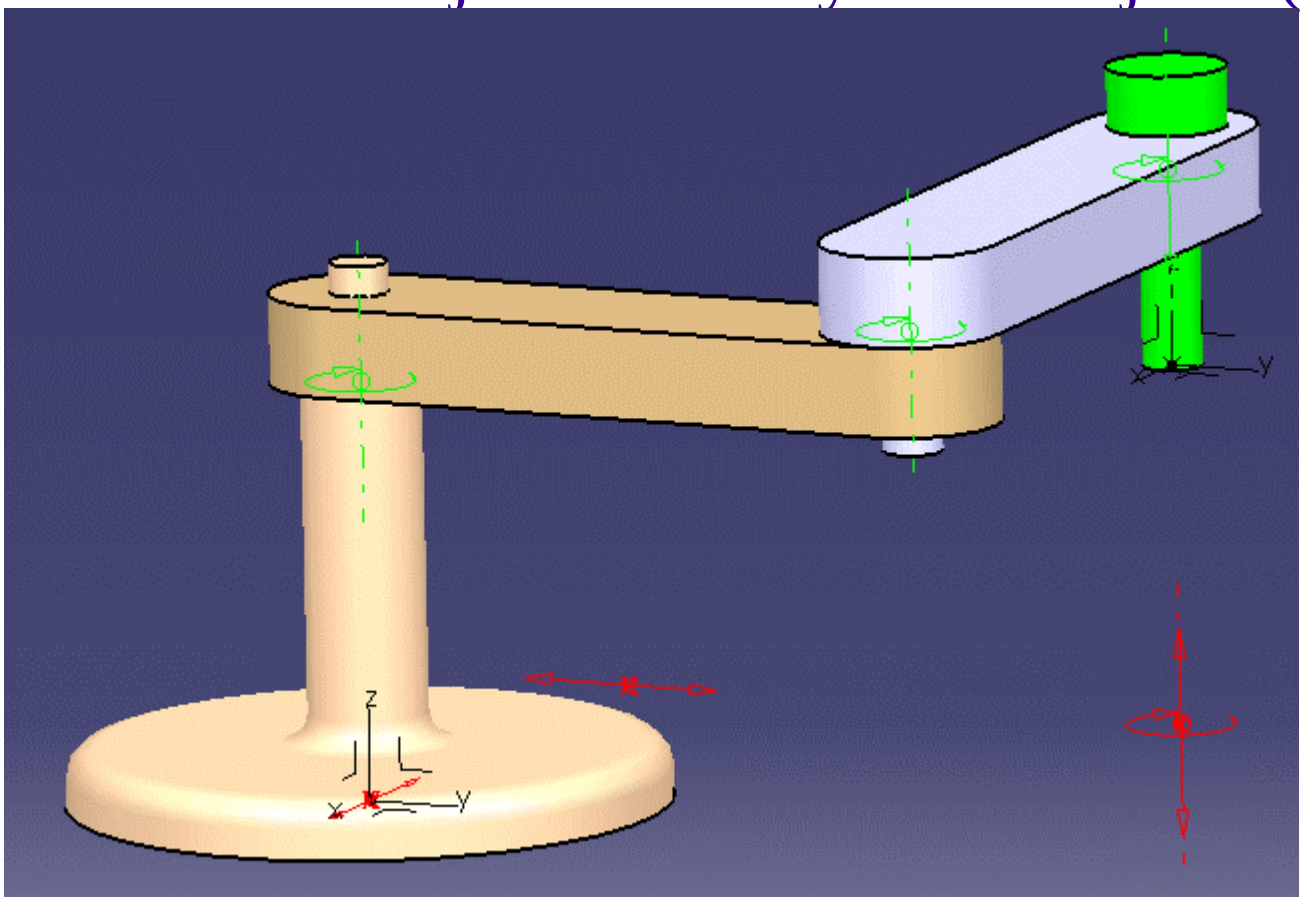
Show the relations and parameters in the product



Switch to YES

Create a Scara robot

- Two revolute joint and a cylindrical joint (4 dof, x, y, z, θ)



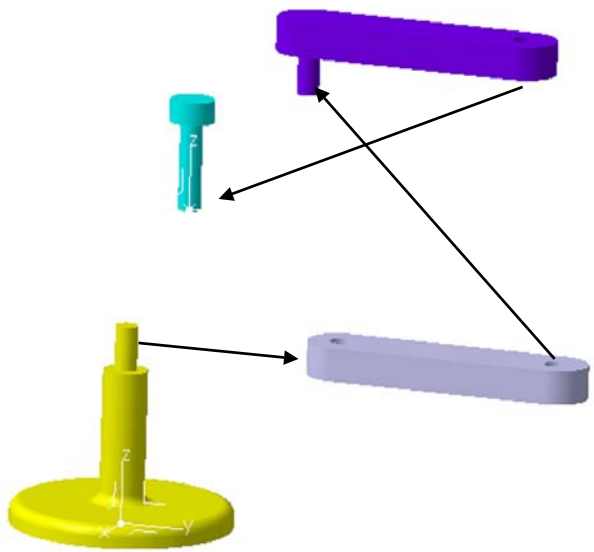
Attention, not to create the robot in a singular configuration!

Create a new product in assembly design 

- Create a « New Product »
- Insert the pieces
  - "Insert " ⇒ "existing component"
    - «Robot_Link_0.CatPart»
    - «Robot_Link_1.CatPart»
    - «Robot_Link_2.CatPart»
    - «Robot_Link_3.CatPart»
- Separate the parts with explode  or manipulation 

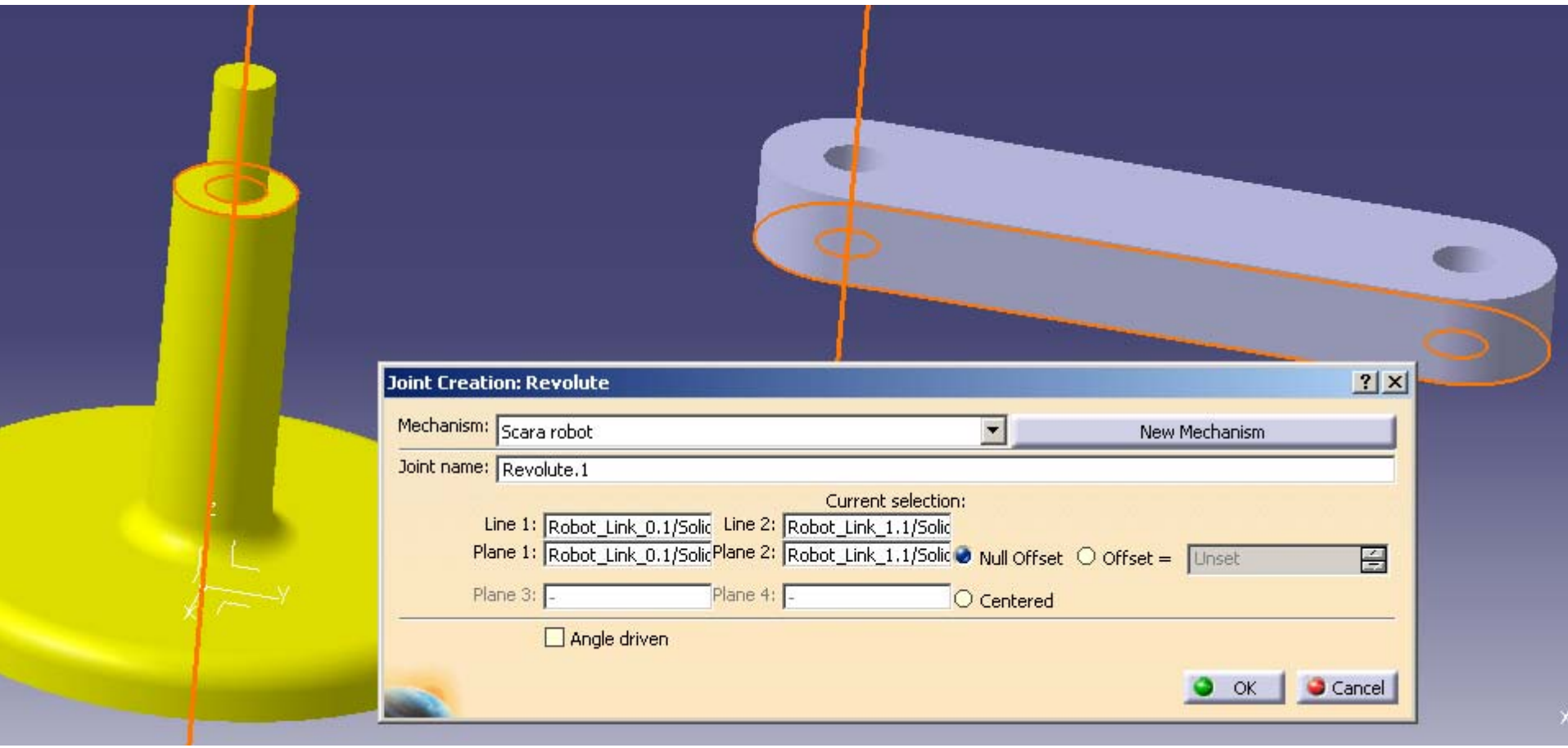
Create a mechanism in DMU kinematics

- Insert a piece fixed "Robot_Link_0.CatPart "
- Create a new mechanism called "Scara"
- Create two pivots with angle driven
- Create a cylindrical between «Robot_Link_2.CatPart» and «Robot_Link_3.CatPart» with angle and length driven



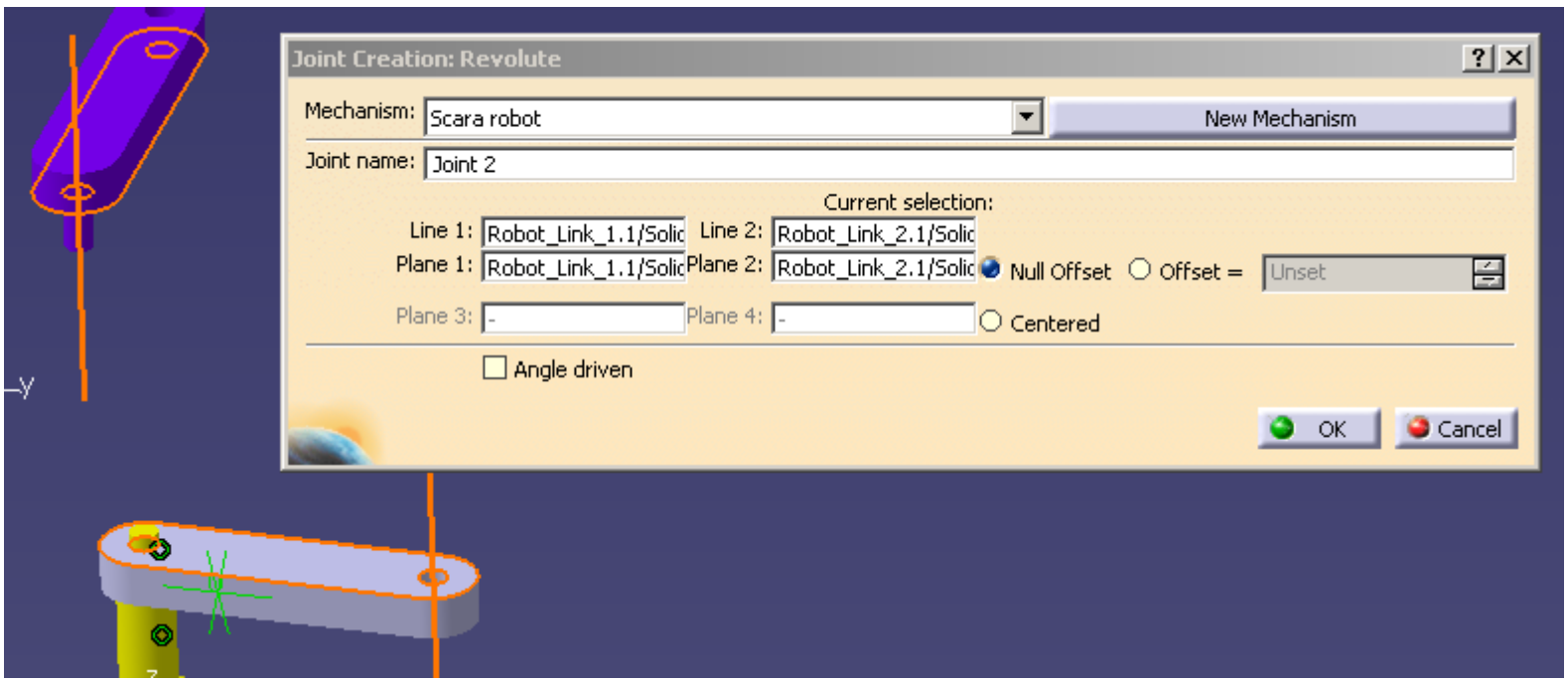
Create a mechanism in DMU kinematics

- First revolute joint 



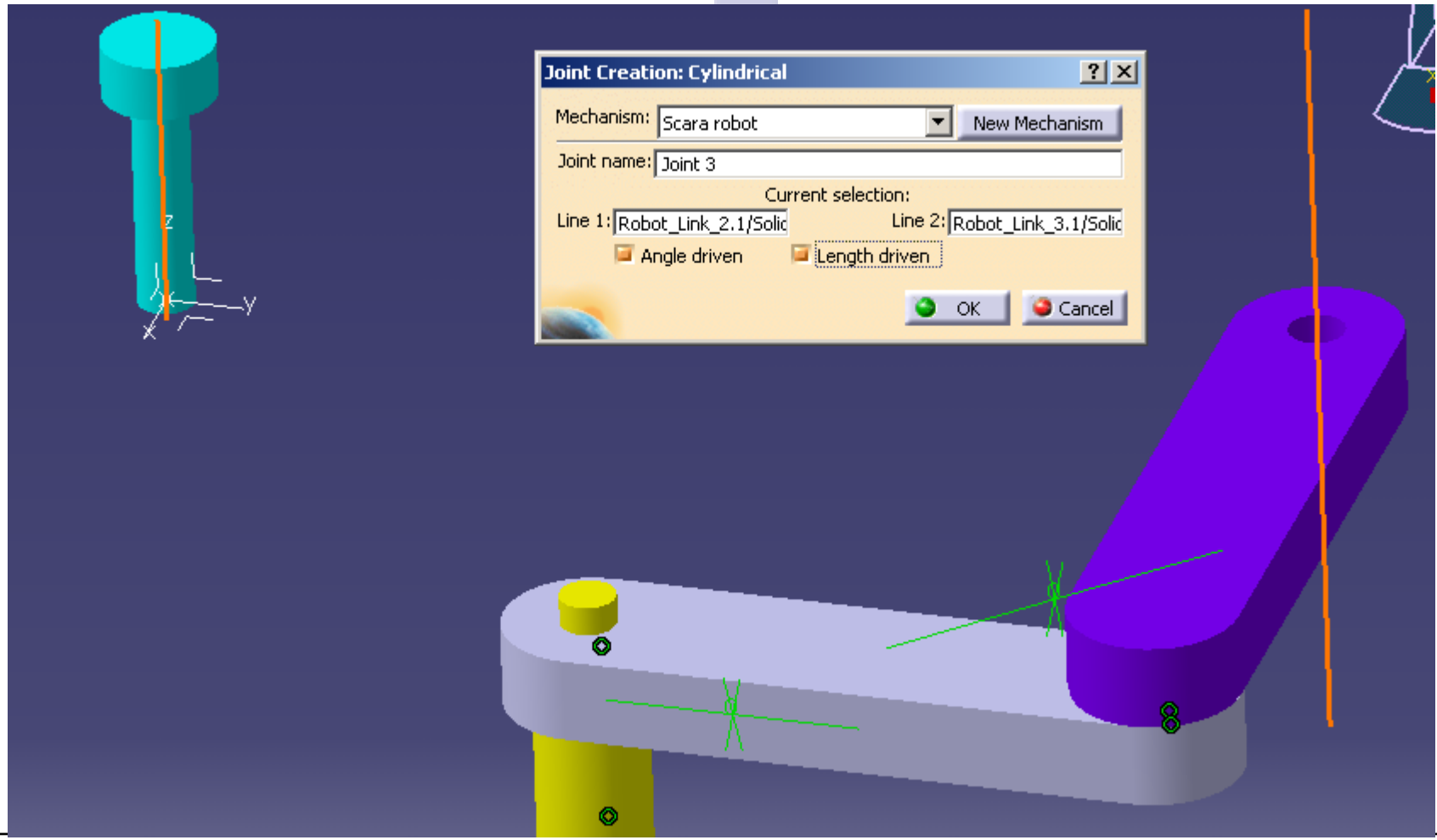
Create a mechanism in DMU kinematics

- Second revolute joint 



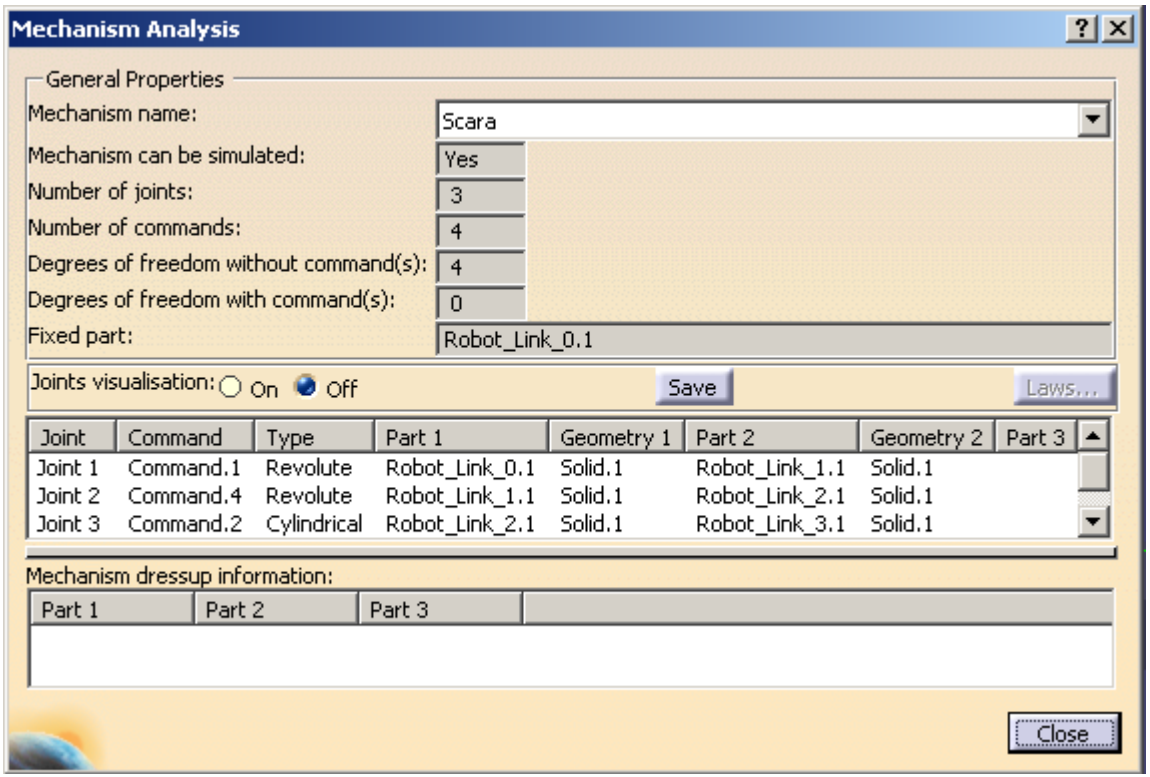
Create a mechanism in DMU kinematics

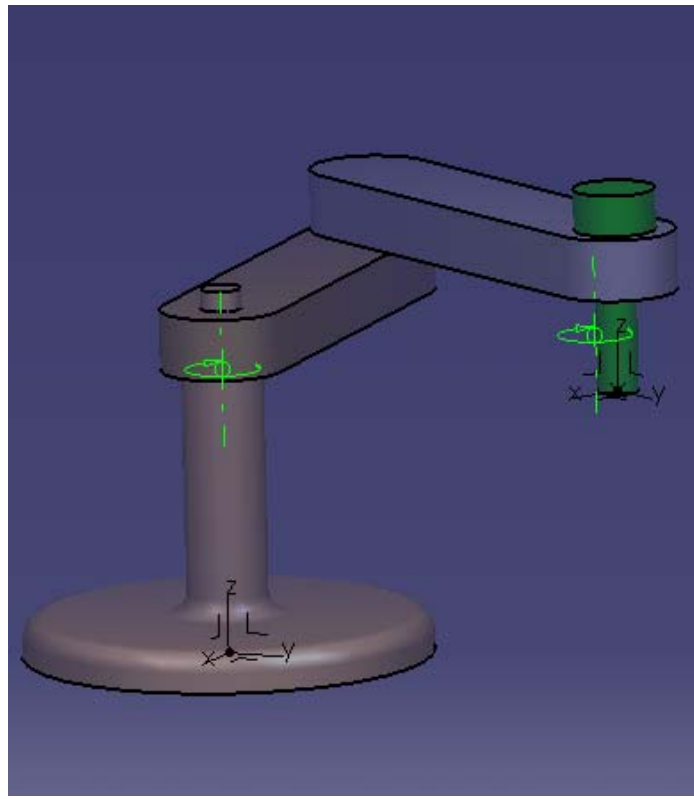
- Create the cylindrical joint 



Display properties of the mechanism

- Enable the display of the joints

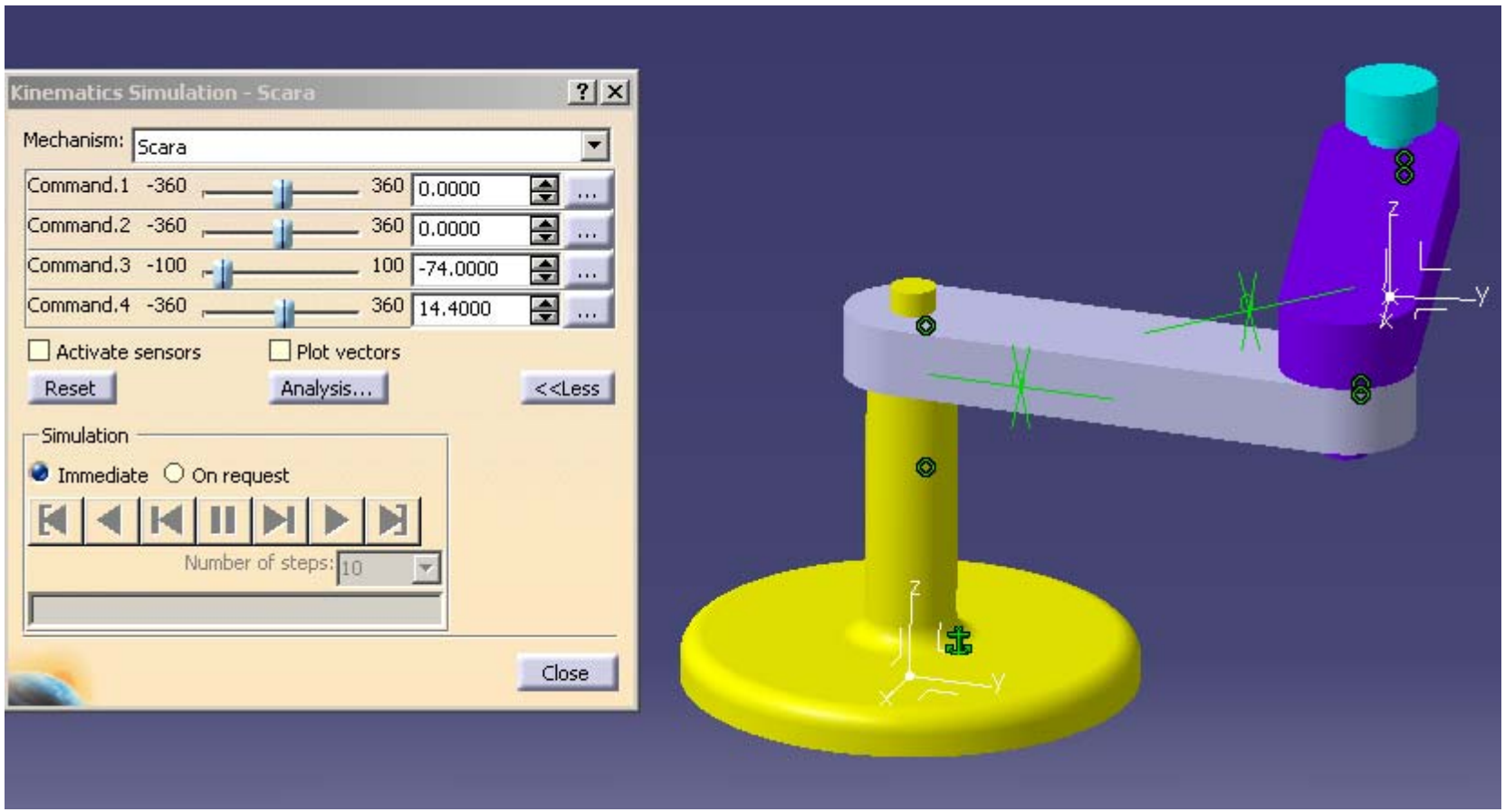




Note: It is possible to save the definition of the joints in Excel format

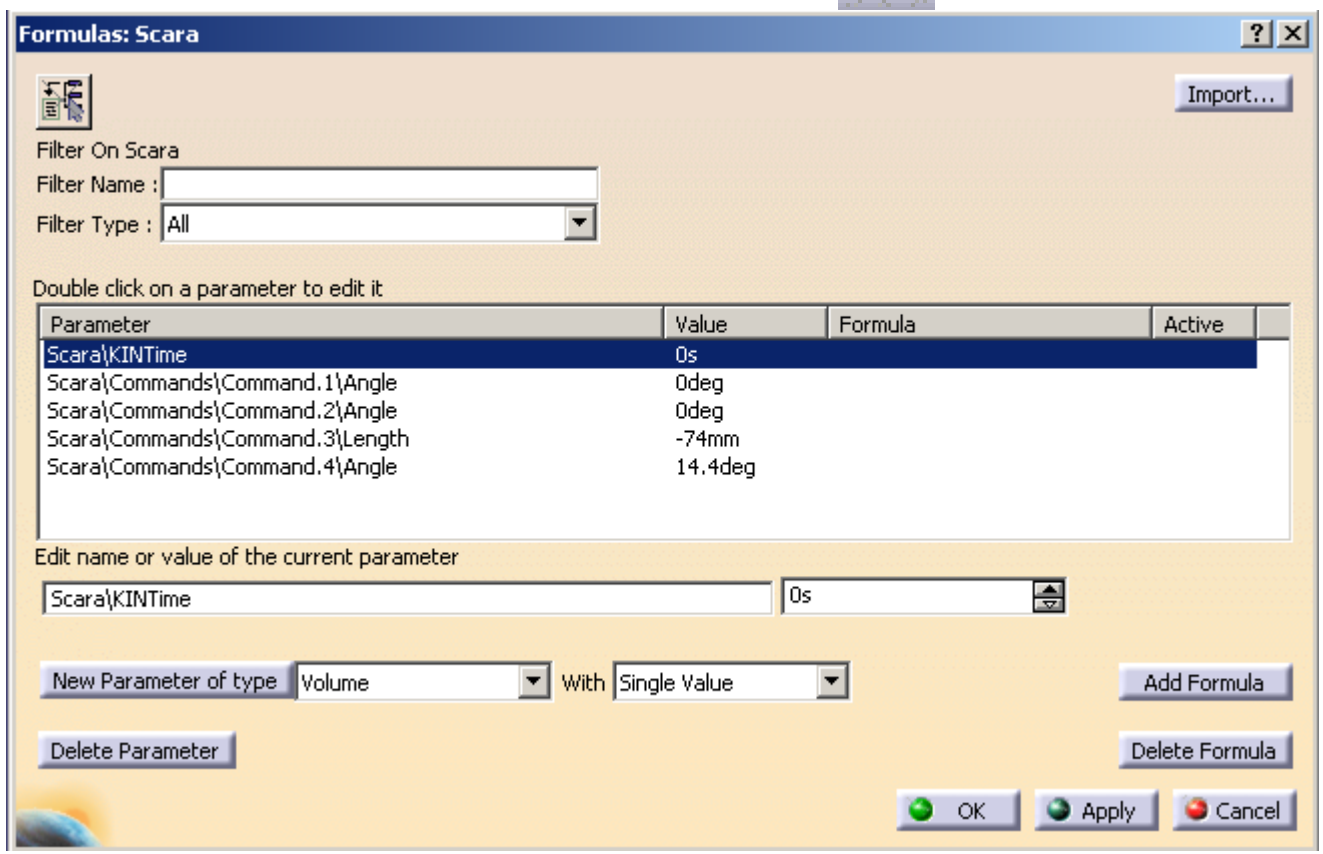
Simulation with commands

- Either « immediate » or « on request »



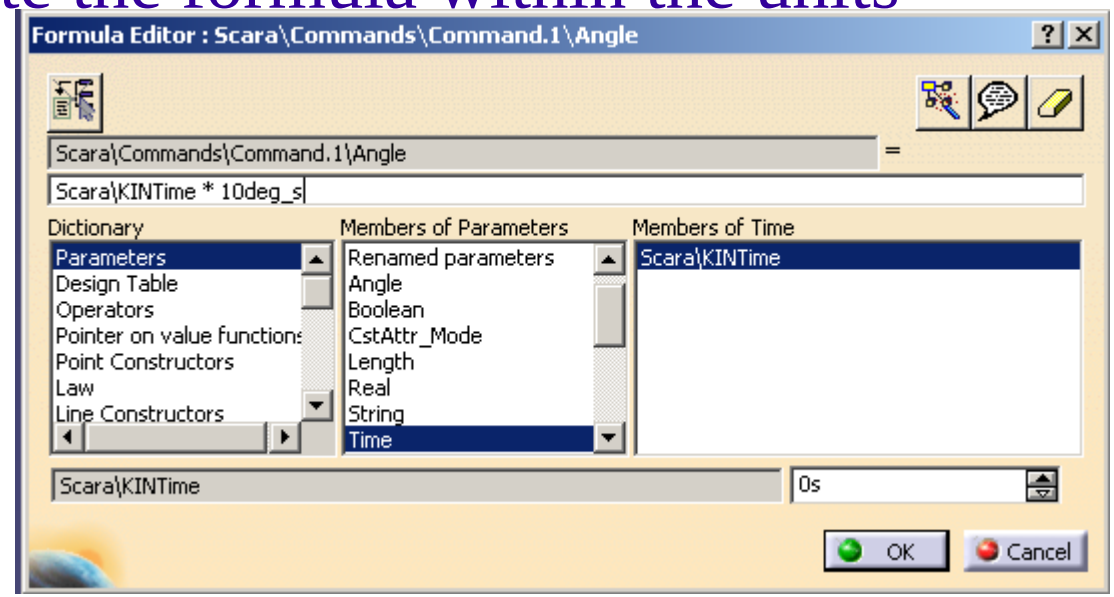
Simulation with laws

- Add formulas associated joints
  - Select the mechanism "Scara" in the specification tree



Create a formula

- Using the timer associated with the "Scara" robot (0 to 10s)
- Write the formula within the units



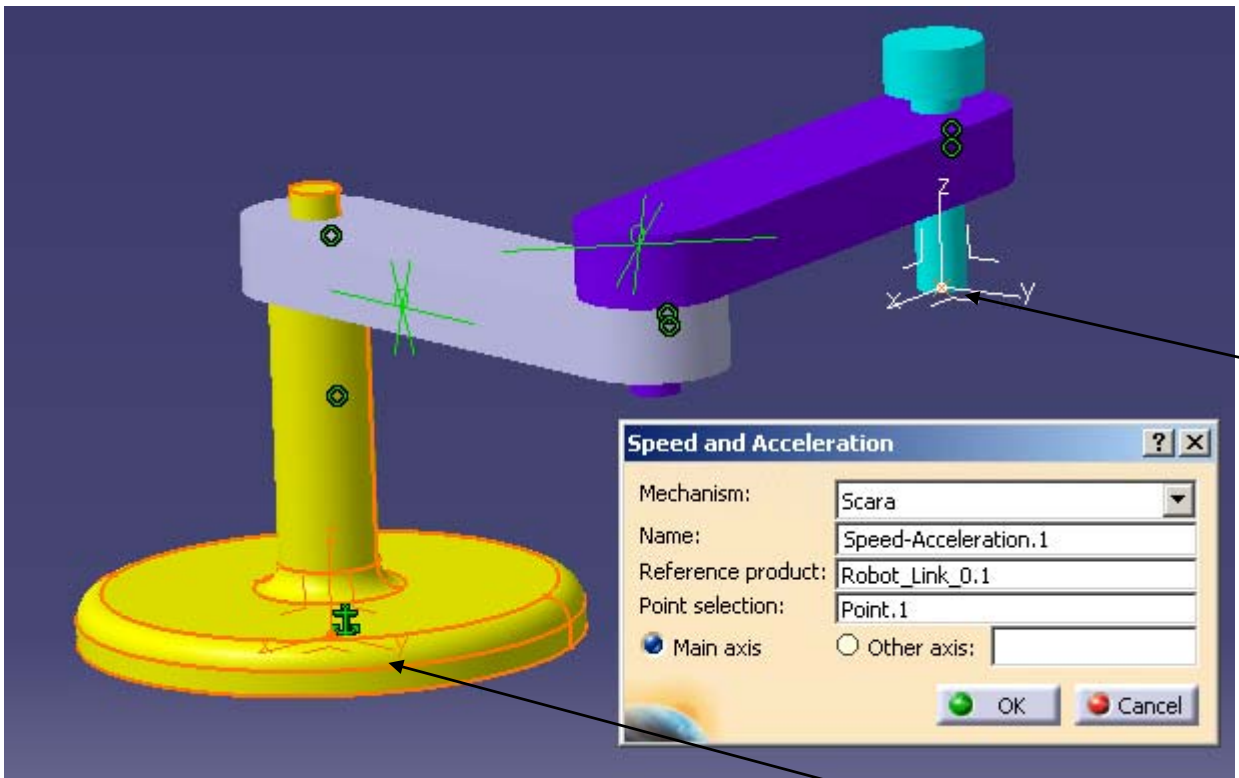
Parameter	Value	Formula	Active
Scara\KINTime	0s		
Scara\Commands\Command.1\Angle	0deg	= Scara\KINTime *10 deg_s	yes
Scara\Commands\Command.2\Angle	0deg	= Scara\KINTime * 2 deg_s	yes
Scara\Commands\Command.3\Length	0mm	= Scara\KINTime *3mm_s	yes
Scara\Commands\Command.4\Angle	0deg	= Scara\KINTime * 5 deg_s	yes

Simulation with laws

- The timer is between 0 and 10s
- The number of steps can to be changed
- If we active sensor, we can plot curves on the active and passive joints
- Other laws of motion

Scara\Commands\Command.1\Angle	0deg	= sin(Scara\KINTime *36 de...	yes
Scara\Commands\Command.2\Angle	0deg	= sin(Scara\KINTime *36 de...	yes
Scara\Commands\Command.3\Length	0mm	= Scara\KINTime *3 mm_s	yes
Scara\Commands\Command.4\Angle	0deg	= sin(Scara\KINTime *36 de...	yes

Speed and acceleration

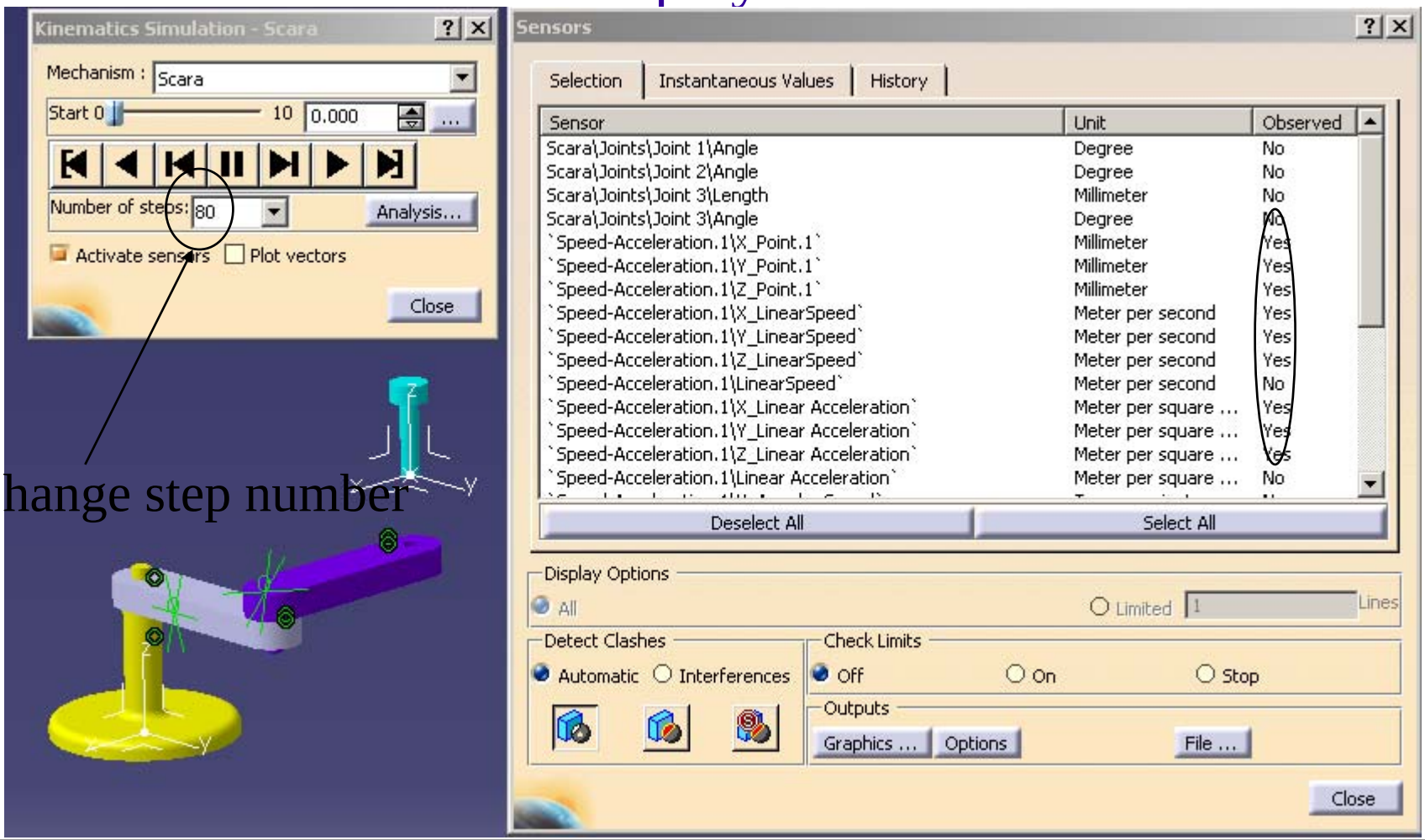


Point selection

Reference product

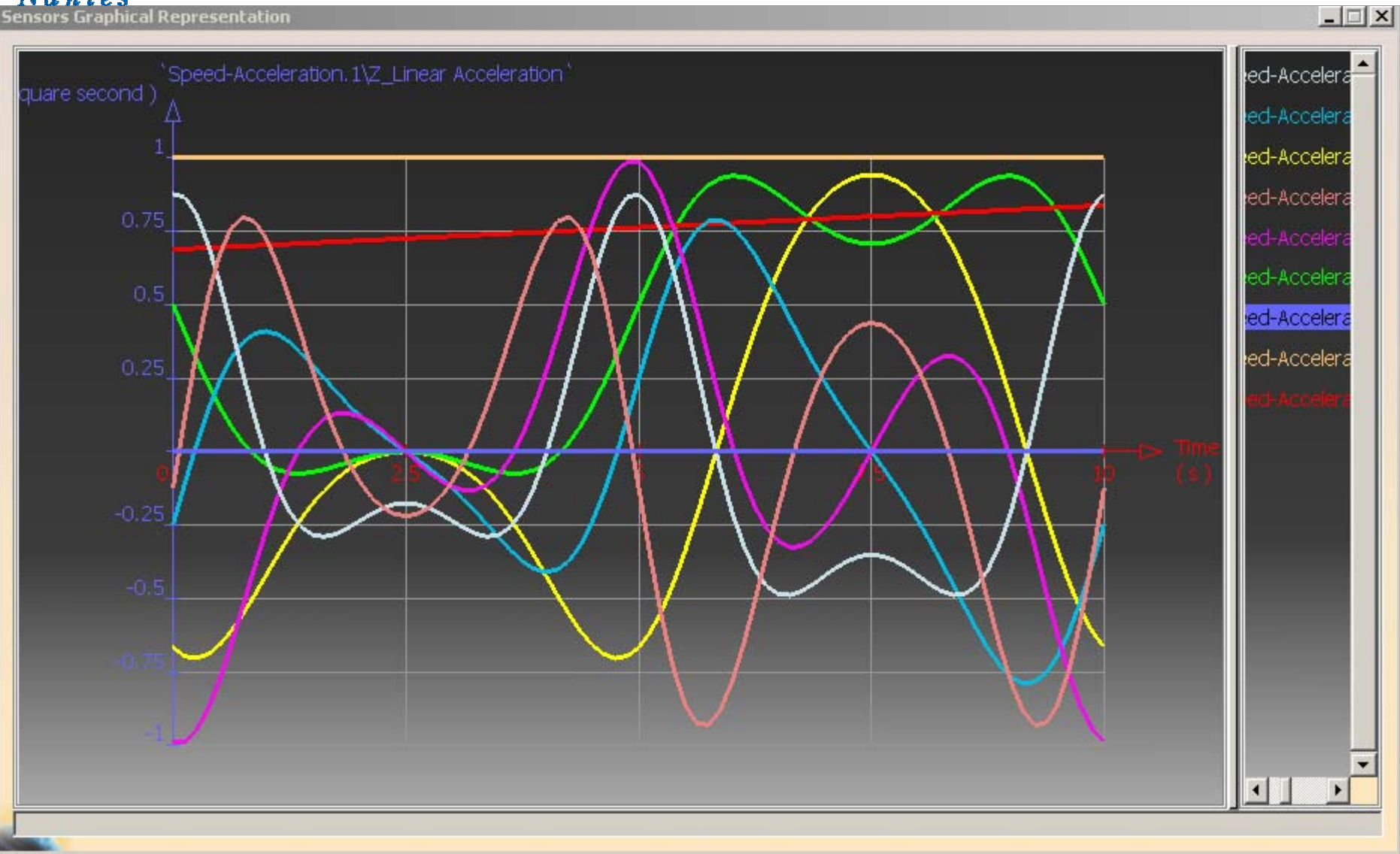
Simulation with laws

- Activate the sensors and play forward



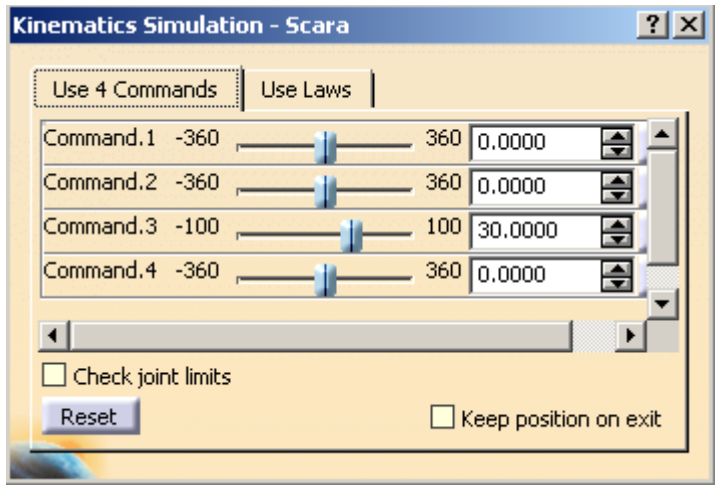
Change step number

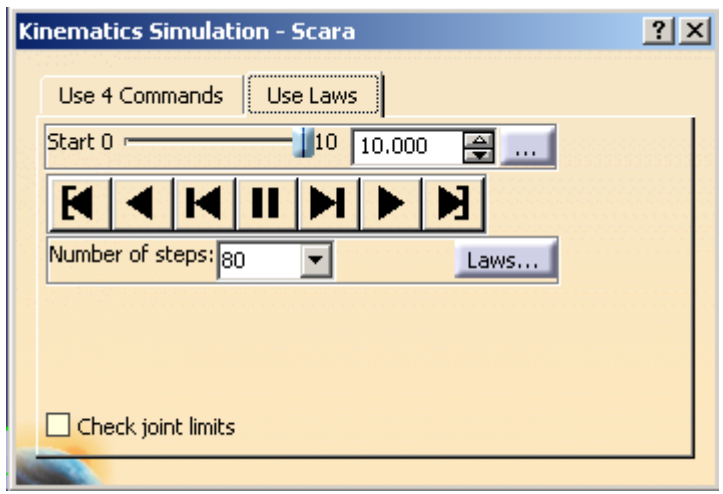
Simulation with laws

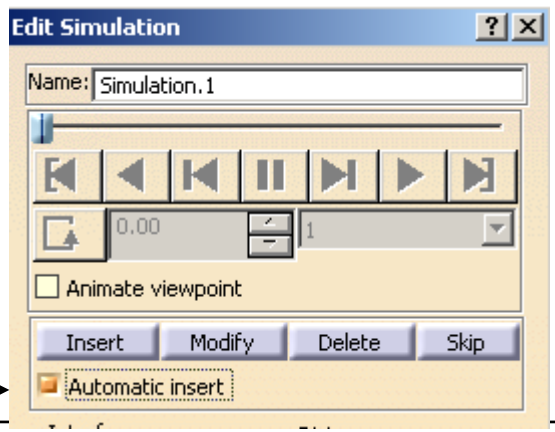


Create a simulation

- Simulation
  - Uses commands
  - Uses laws
- Edit simulation
  - Add the option « automatic insert »

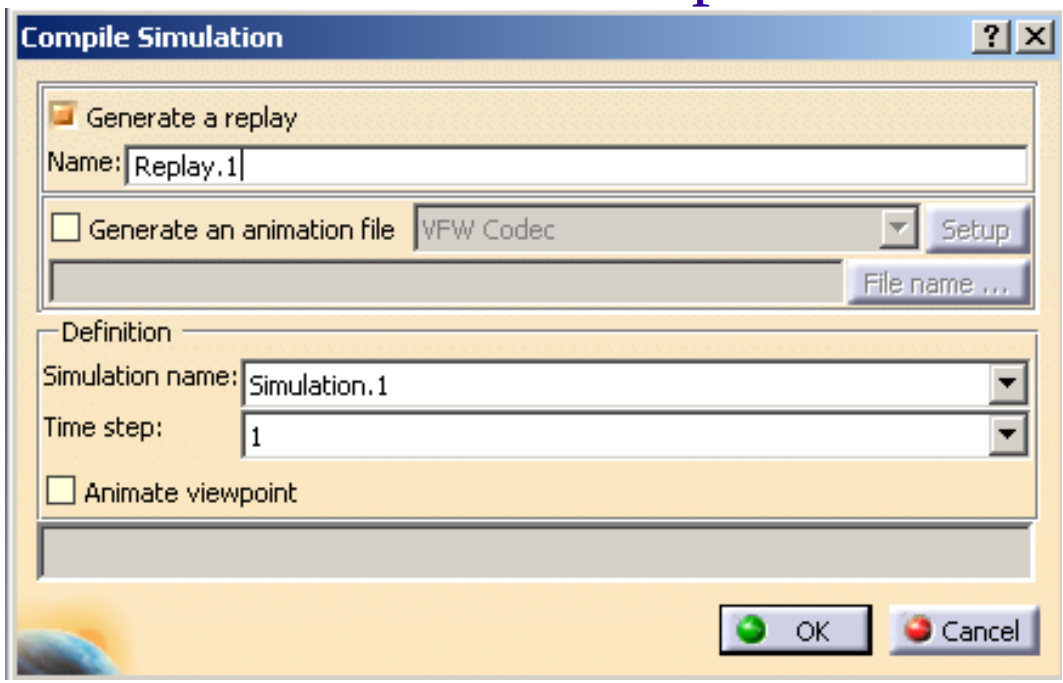






Compile simulation

- Generate a replay (internal movie) or a animation file
- Please define the codec for the movie in Setup



- Change the frame rate in VirtualDub (http://www.virtualdub.org)

Simple animation (25 images/seconds)