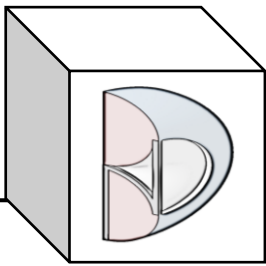


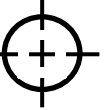
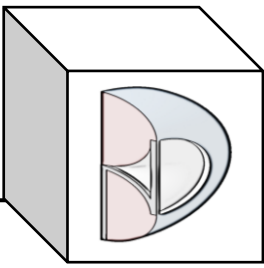
BND TechSource

A detailed 3D CAD rendering of a vehicle's front suspension system. The image shows the lower control arms, steering knuckle, coil spring, and shock absorber assembly. The entire assembly is rendered in a blue, semi-transparent style, allowing the internal components to be visible. The text is overlaid on the central part of the suspension.

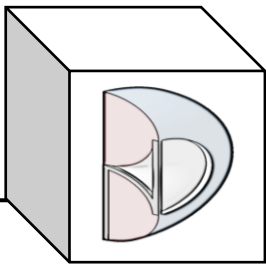
Front Suspension Baseline Optimization of Bump/Roll Steer



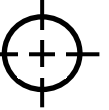
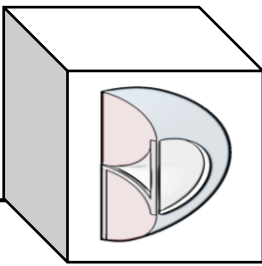
- The following licenses are required to create perform this simulation:
 - Digital Mockup Kinematics
 - Mechanical Part Design
 - Assembly Design



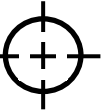
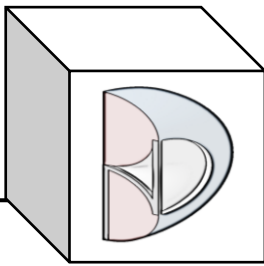
- The Steering Knuckle in an SLA (Short/Long Arm) Independent Front Suspension has three pivot point attachments. These are at the Upper Control Arm, the Lower Control Arm, and the Tie Rod end.
- Bump/Roll Steer (change in toe) occurs due to the Tie Rod pivot at the Knuckle swinging through a different arc than the Control Arms.
- The baseline for this arc can be optimized using CATIA DMU Kinematics.



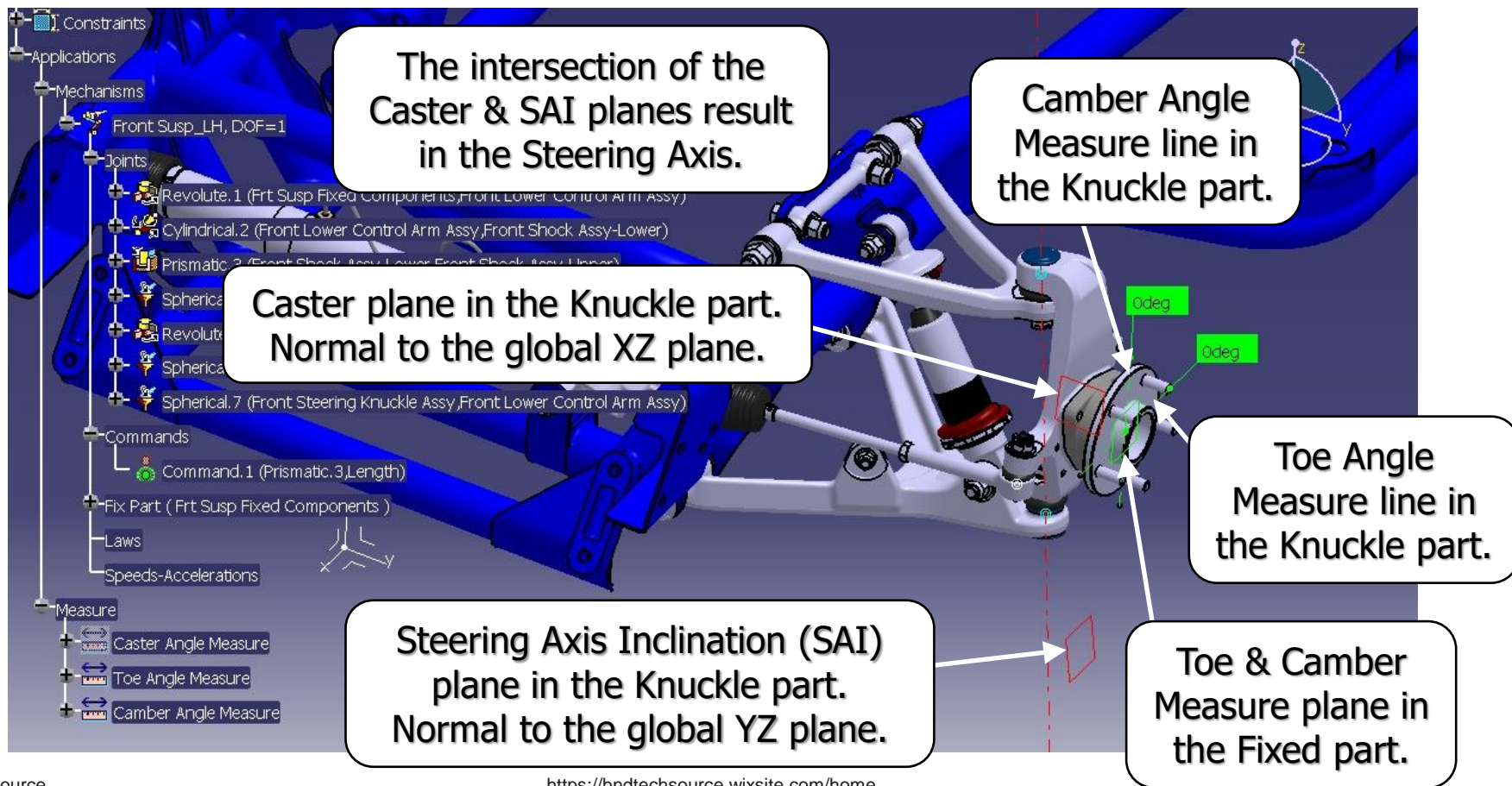
- Certain parameters were set in this particular design.
 - Track: Front/Rear = 1490/1510mm
 - Wheelbase = 2489.2mm
 - Tire Size:
 - Front = P245/45ZR-17
(Static Rolling Radius = 302mm)
 - Rear = P275/40ZR-18
(Static Rolling Radius = 314mm)
 - Wheel Size:
 - Front = 17 x 8.5 in, Offset = 56mm
 - Rear = 18 x 9.5 in, Offset = 63mm

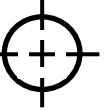
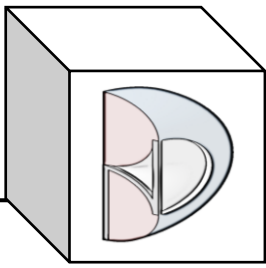


- Parameters (cont'd).
 - Scrub Radius = +10mm
 - Steering Axis Inclination = 8.8°
 - Caster Angle = 6.5°
 - SLA Ratio = 1.43:1
 - Brake Rotor Offset (Hub face to Rear Rotor face) = 38mm
 - Ackermann Steering = 82.5%
 - Shock Extension/Compression = 48.7/36.1mm
- All of these parameters affect the three pivot points on the Steering Knuckle.



- In design position, the Toe and Camber Angles measure zero degrees.

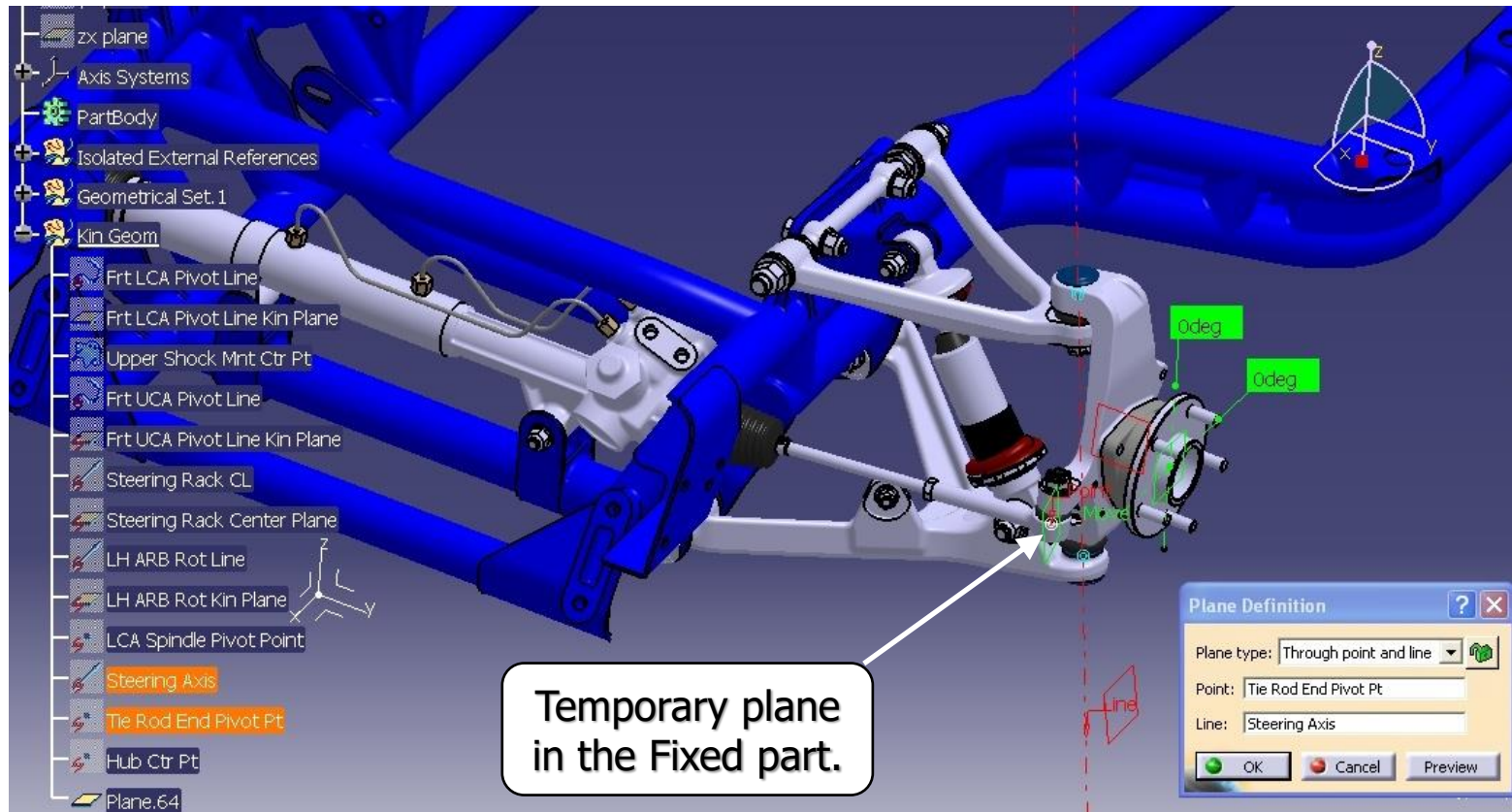


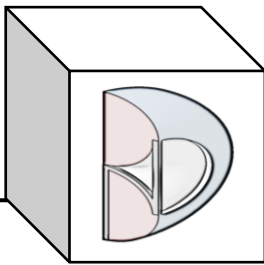


- To optimize the Toe Angle delta as the suspension moves through jounce and rebound, the Tie Rod pivot arc must first be determined.
- The method shown in this example is an expedient way to get the optimized plane to swing the Tie Rod pivot arc.

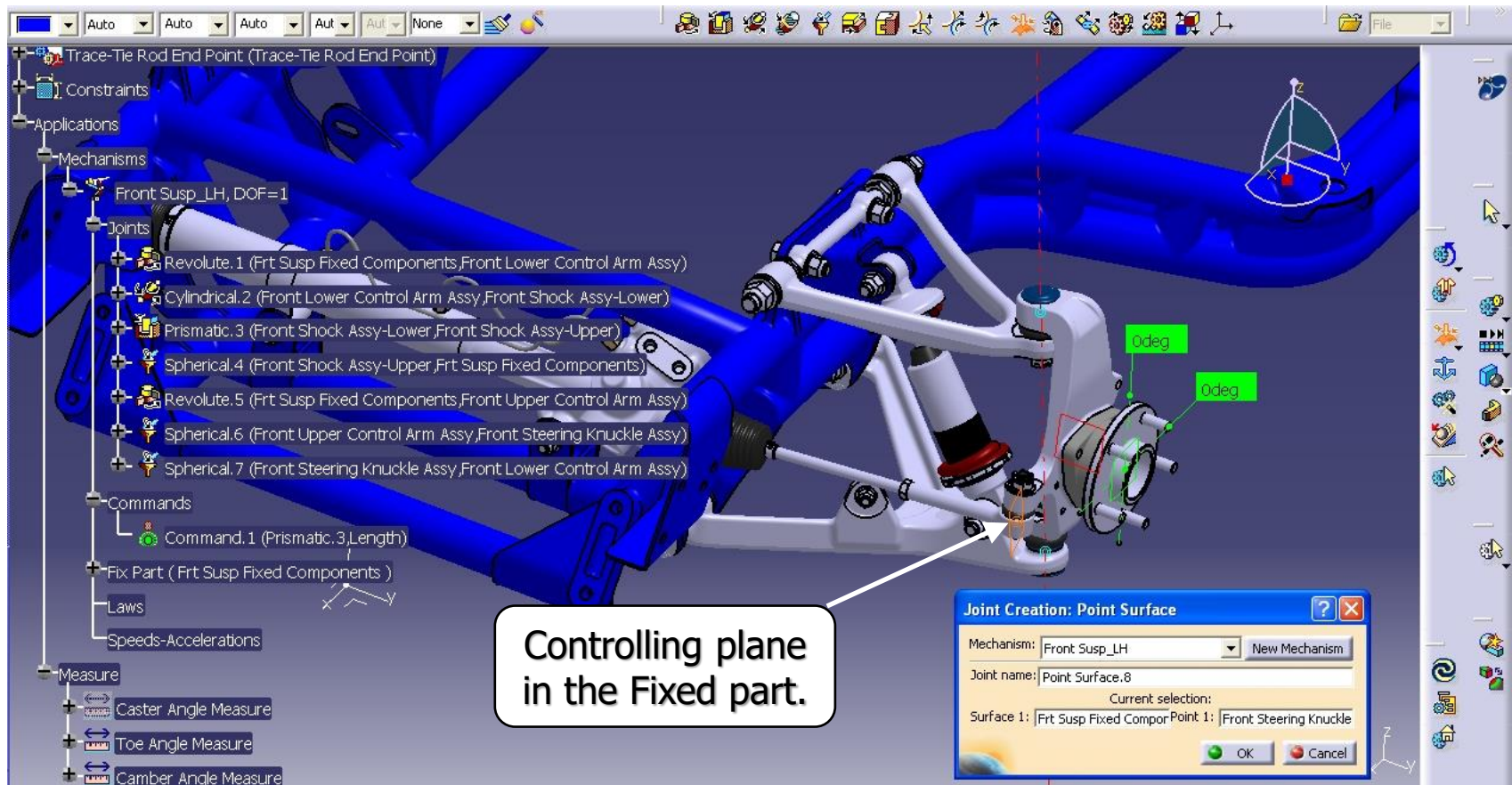


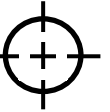
- Step 1: In the Fixed Part, create a temporary plane through the Steering Axis and the Tie Rod pivot point.



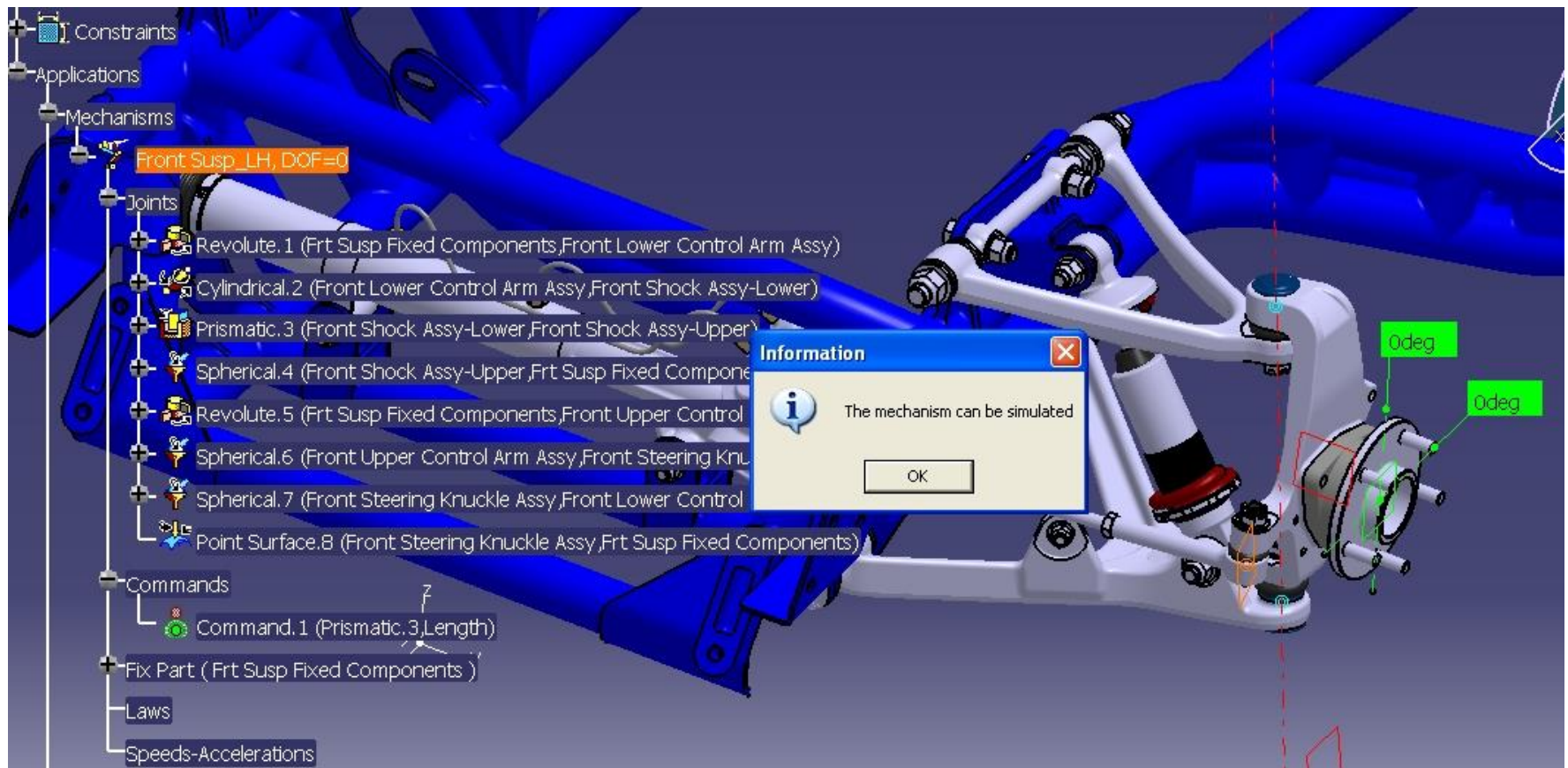


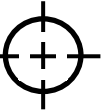
- Step 2: Use the temporary plane as the controlling surface in a Point-Surface joint to complete the suspension Kinematic.





■ Step 2: The completed Kinematic.





- Step 3: Run the Kinematic to full jounce position.

Sensors

Sensor	Value	Unit
*Front Suspension Assy (Chassis Axis)\Toe Angle Measure\A...	0.192023	Degree
*Front Suspension Assy (Chassis Axis)\Camber Angle Measur...	0.0131141	Degree

Kinematics Simulation - Front Susp_LH

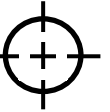
Mechanism: Front Susp_LH
Command.1: -36.1 | 48.7 | 48.7000

☒ Activate sensors ☐ Plot vectors
Reset Analysis... <<Less

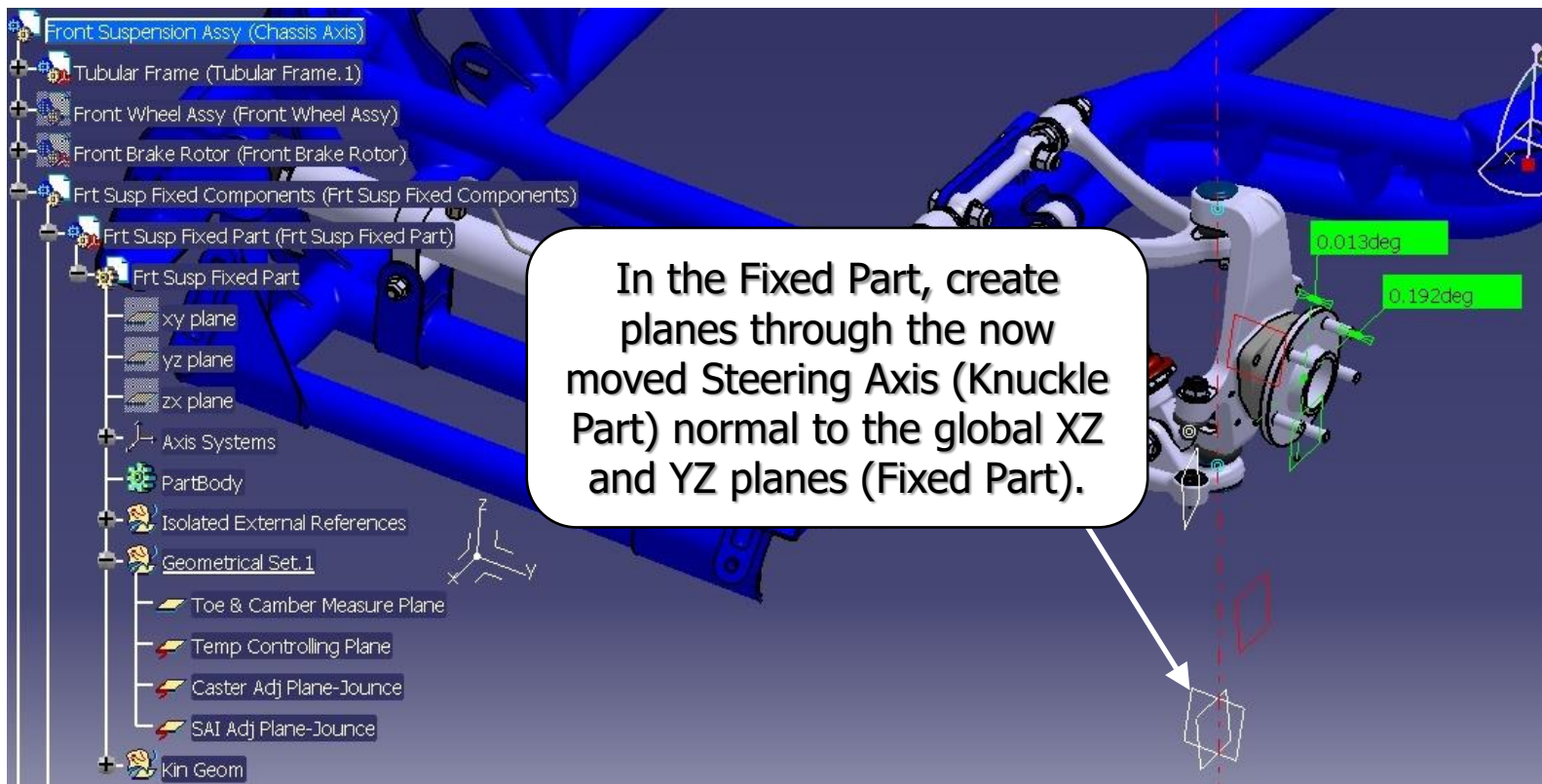
Simulation
☒ Immediate ☐ On request
Number of steps: 40

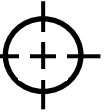
To view the values, the measures must first be chosen in the Selection tab.

Pick Activate Sensors.



- Step 4a: Adjust the Knuckle to Optimized position.





- Step 4b: Adjust the Camber to Optimized position using Snap.

In Assembly, Snap the SAI Plane (Knuckle Part) to the SAI Adjustment Plane (Fixed Part).

0.011deg

0.011deg

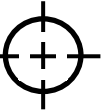
Snap

After Snap, apply Force Measure Update on the Toe & Camber Angular Measures

Definition...

Force Measure Update

Notice the Camber reduction, and the Toe increase.



- Step 4c: Adjust the Toe to Optimized position using Snap.

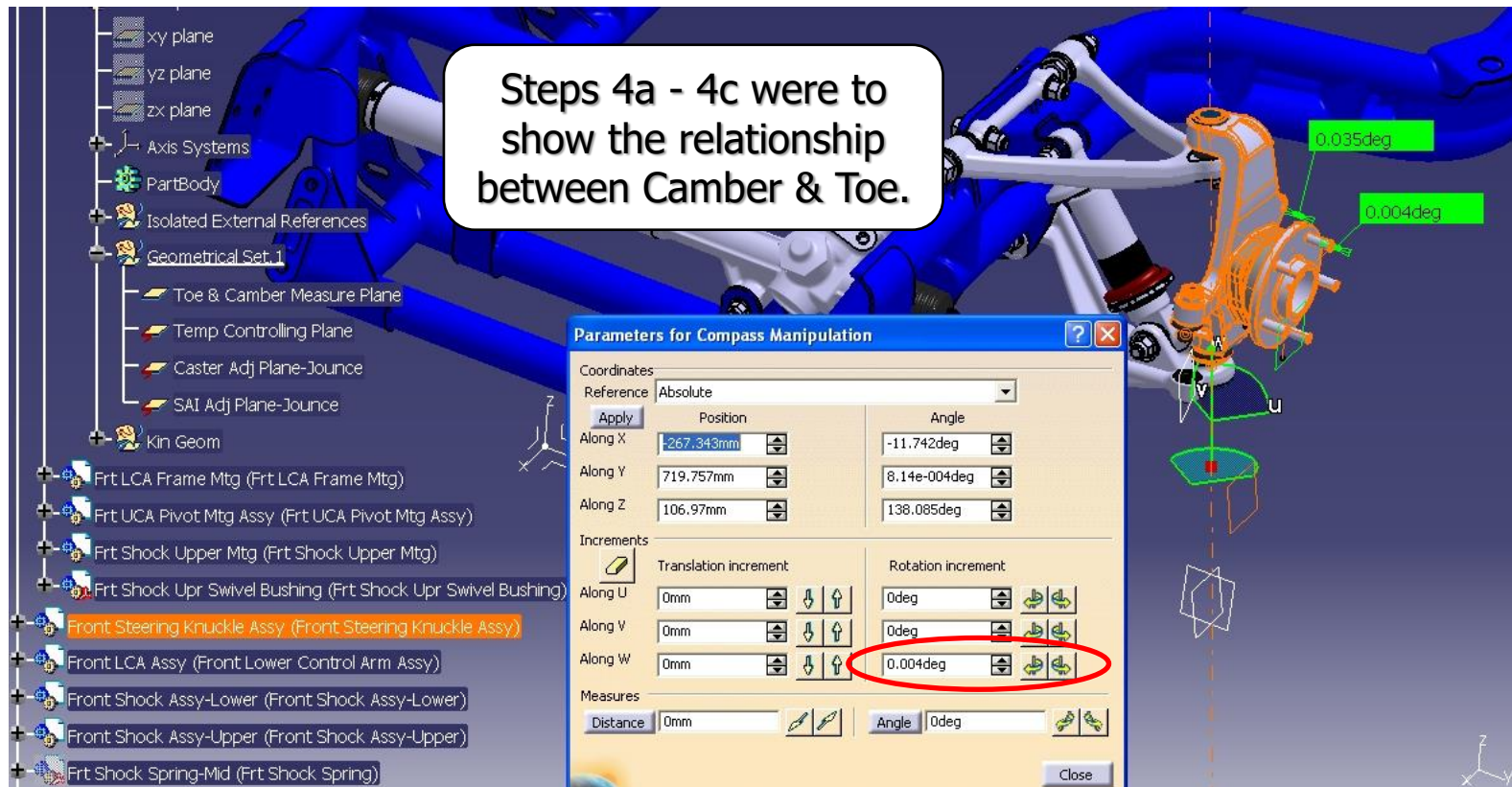
Next, Snap the Caster Plane (Knuckle Part) to the Caster Adjustment Plane (Fixed Part).

After Snap, apply Force Measure Update on the Toe & Camber Angular Measures

Notice the Camber increase, and the Toe reduction.

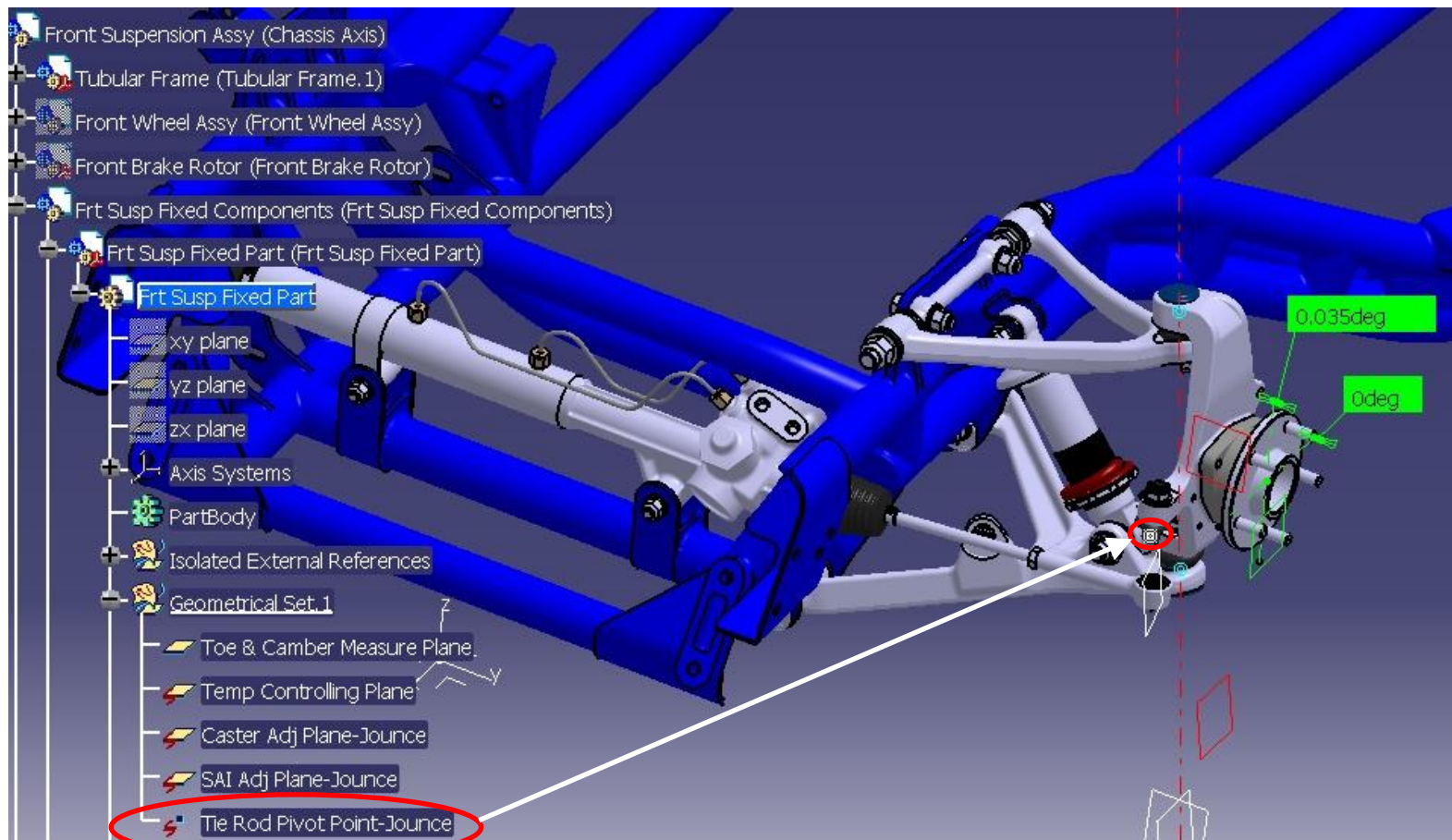


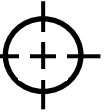
- Step 4d: Adjust the Toe to Optimized position using Compass on the Steering Axis. This method could be used in lieu of steps 4a – 4c.



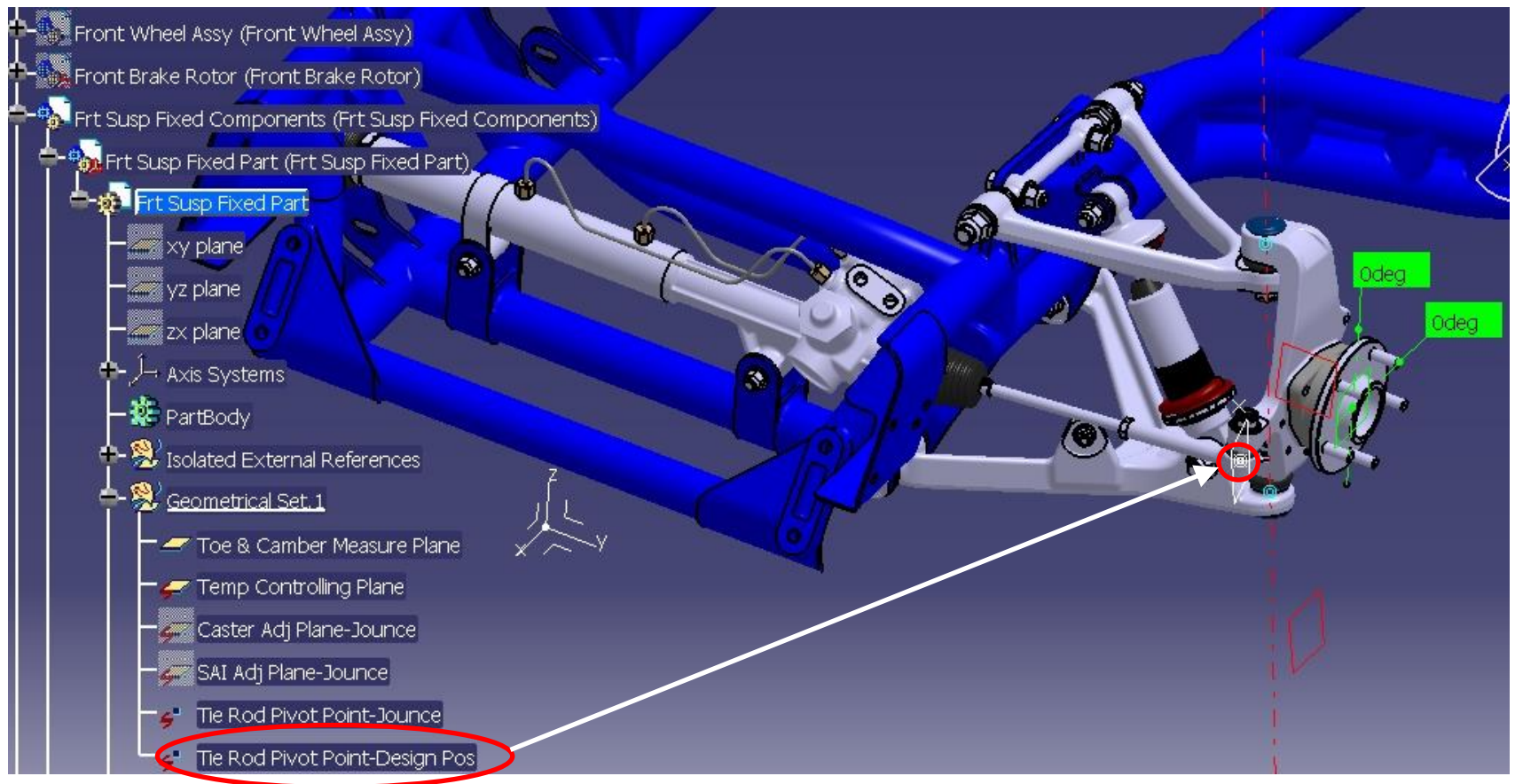


- Step 4e: In the Fixed Part, create a point at the now moved Tie Rod pivot.





- Step 5: Return the Kinematic to design position. In the Fixed Part, create a point at the now moved Tie Rod pivot.





- Step 6: Run the Kinematic to full rebound position.

The screenshot displays a 3D CAD model of a front suspension assembly. Two dialog boxes are open:

- Sensors**: This dialog box has three tabs: 'Selection', 'Instantaneous Values', and 'History'. The 'Selection' tab is active, showing a table of sensors.
- Kinematics Simulation - Front Susp_LH**: This dialog box shows simulation settings. The 'Activate sensors' checkbox is checked, and an arrow points to it from a text box.

Sensors Table:

Sensor	Value	Unit
`Front Suspension Assy (Chassis Axis)\Toe Angle Measure(A...	4.15265	Degree
`Front Suspension Assy (Chassis Axis)\Camber Angle Measur...	0.237913	Degree

Kinematics Simulation - Front Susp_LH

Mechanism: Front Susp_LH

Command.1: -36.1 to 48.7 (slider)

☒ Activate sensors ☐ Plot vectors

Reset Analysis... <<Less

Simulation: ☒ Immediate ☐ On request

Number of steps: 40

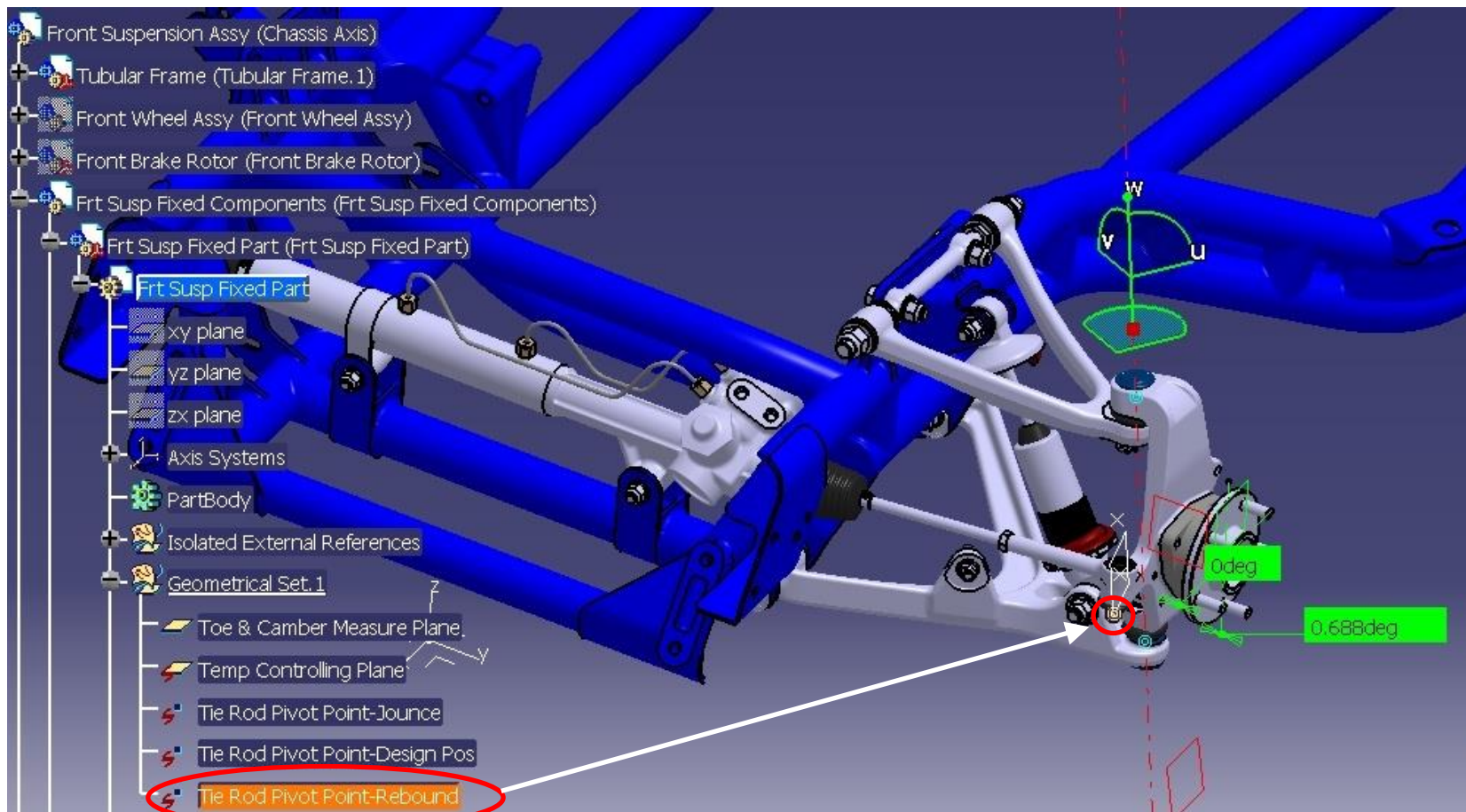
Close

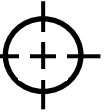
Text Boxes:

- To view the values, the measures must first be chosen in the Selection tab.
- Pick Activate Sensors.

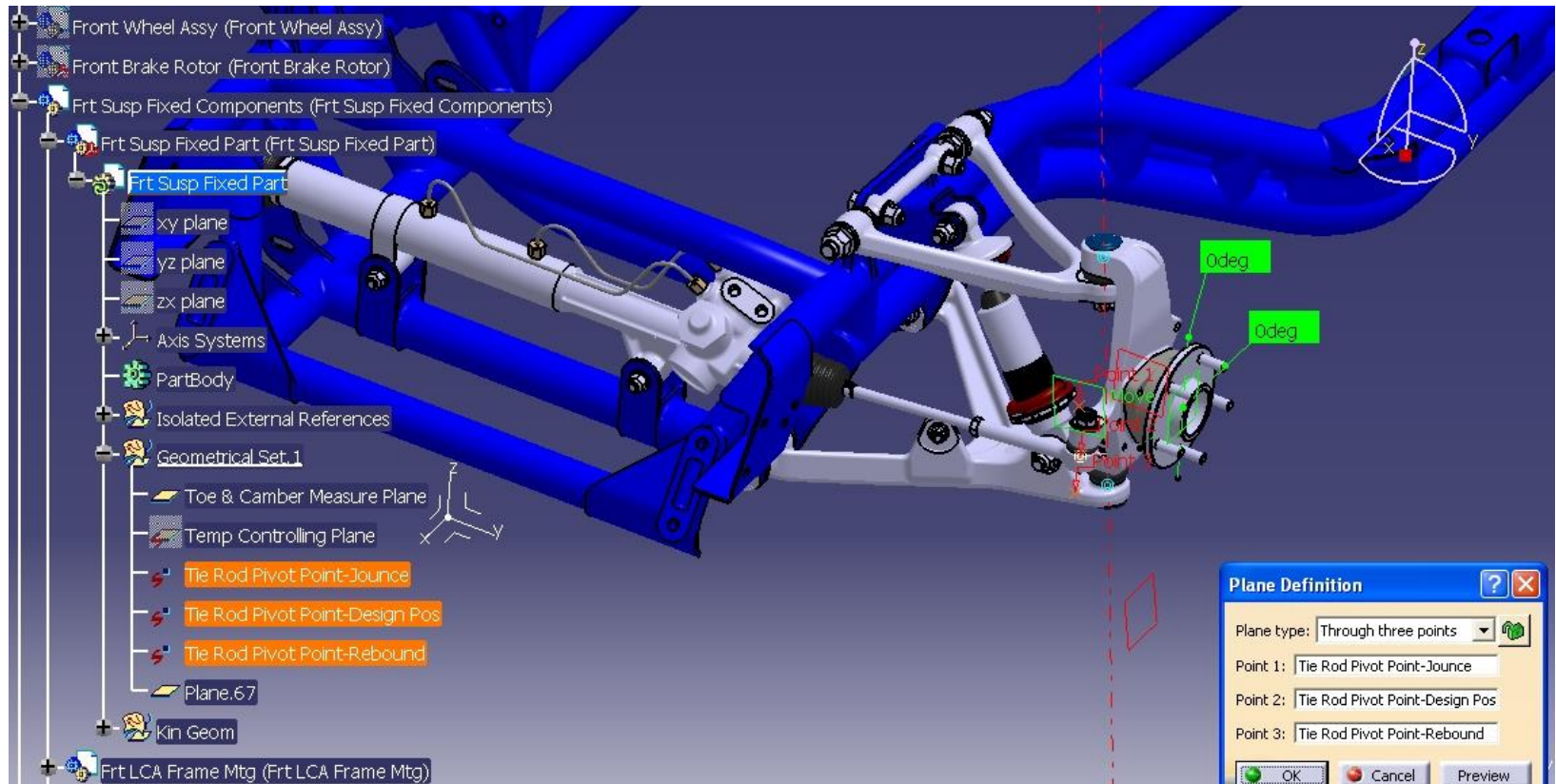


- Step 7: Repeat Steps 4d & 4e in rebound position.



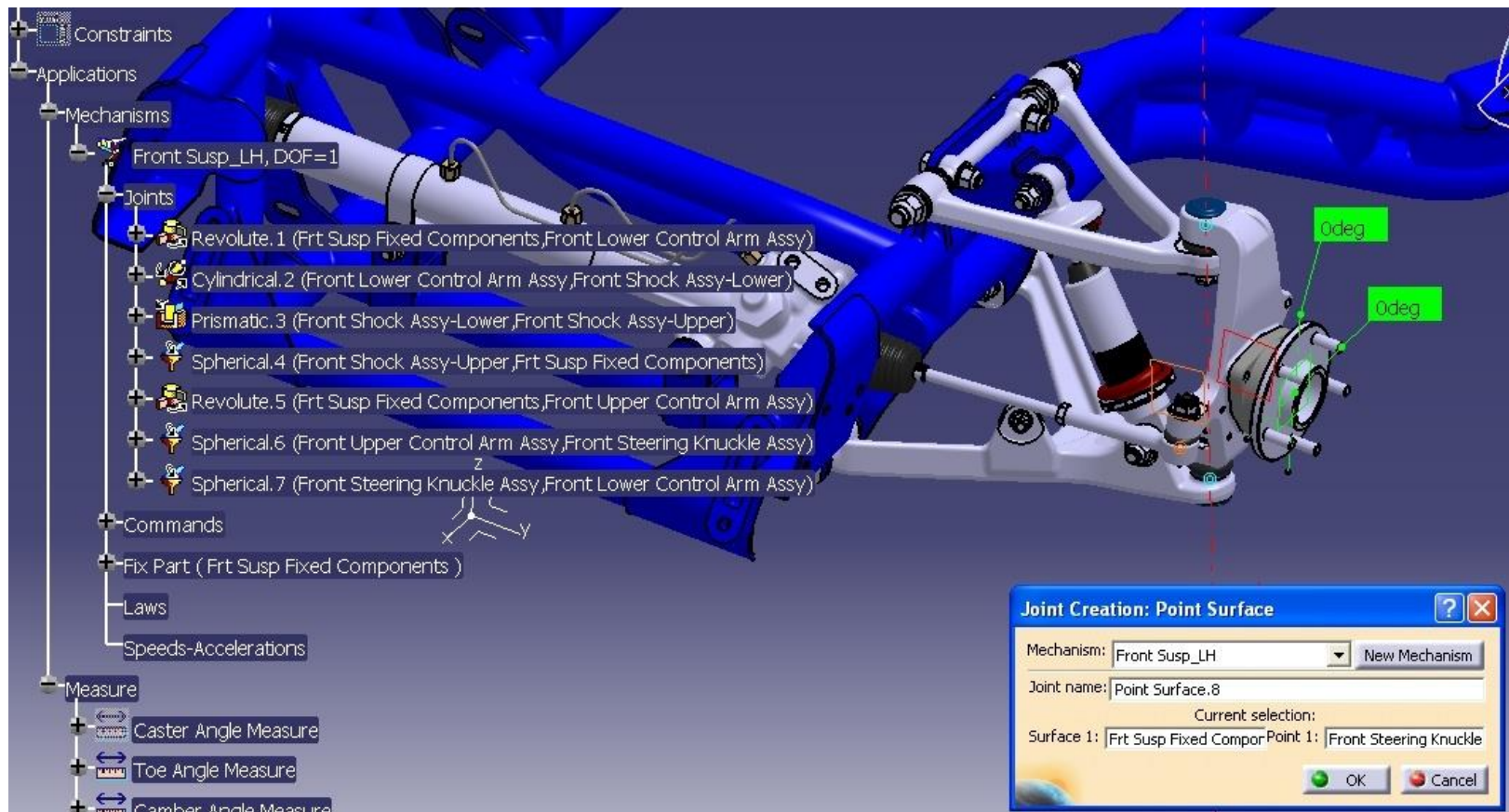


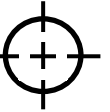
- Step 8: Return the Kinematic to design position. In the Fixed Part, create a plane through the three Tie Rod Pivot points.



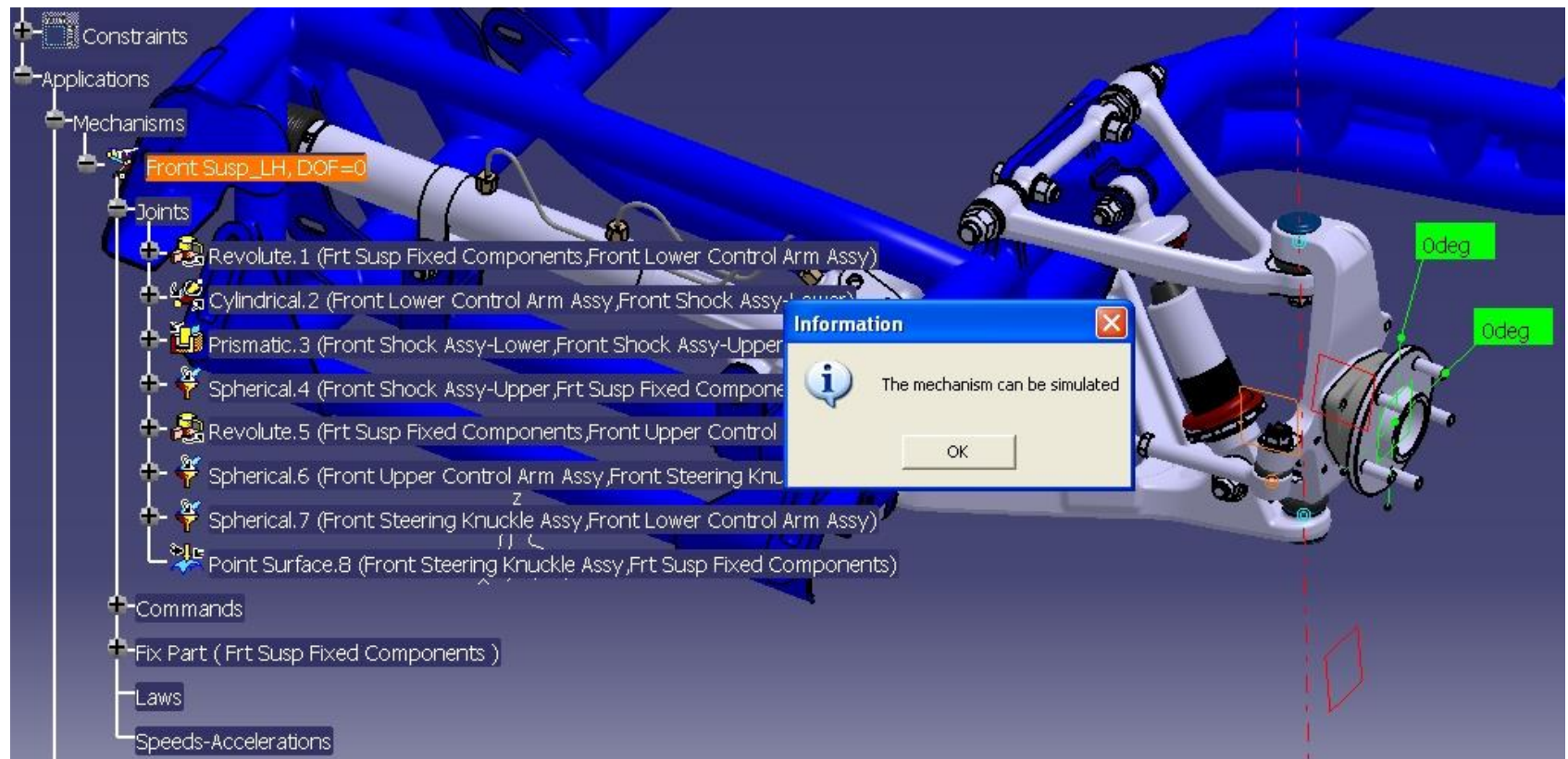


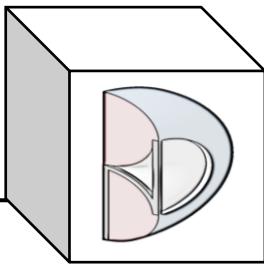
- Step 9: Replace the Temporary Controlling Plane in the Kinematic with the Optimized Controlling plane.



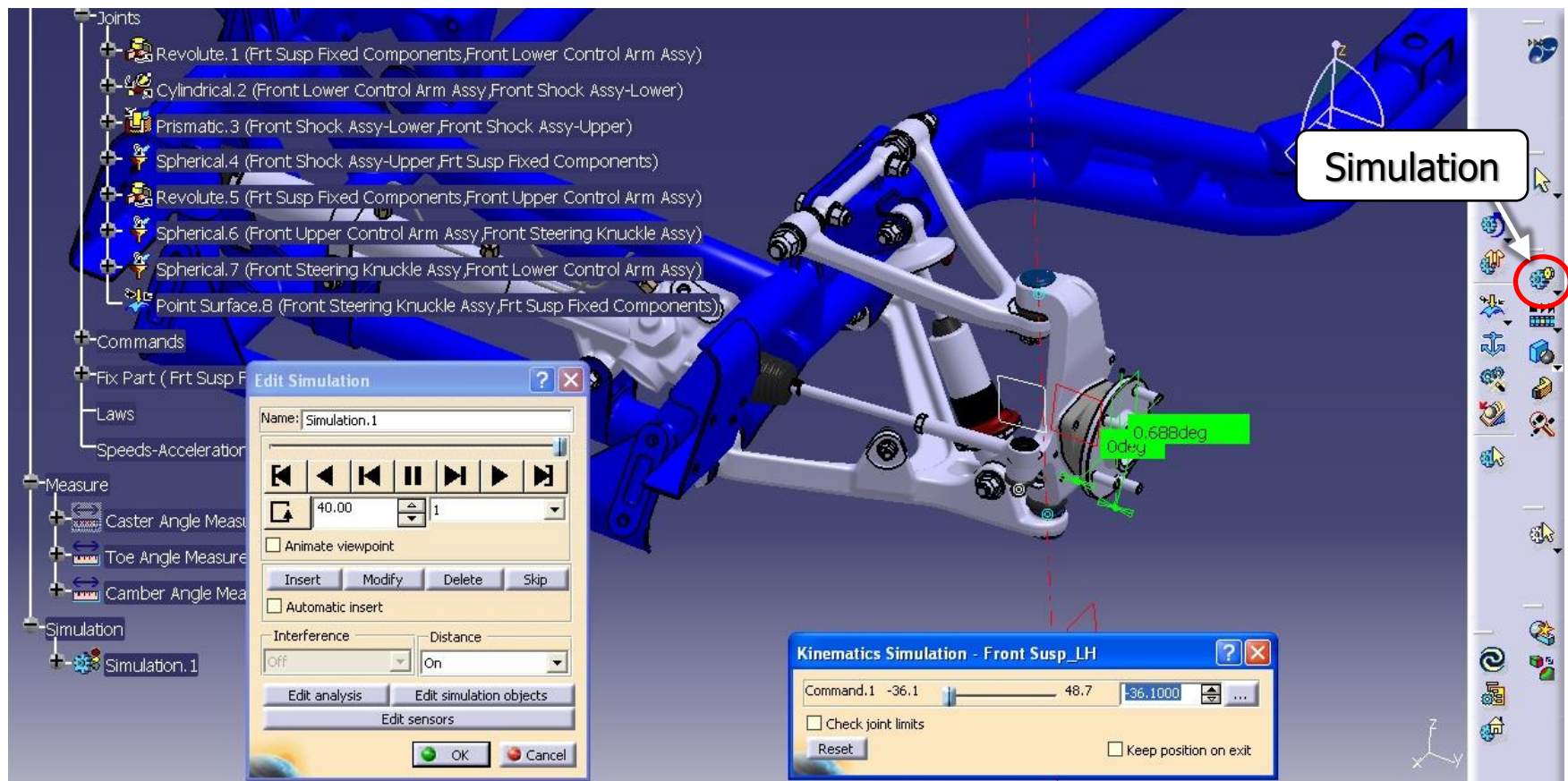


- Step 9: The completed Kinematic.



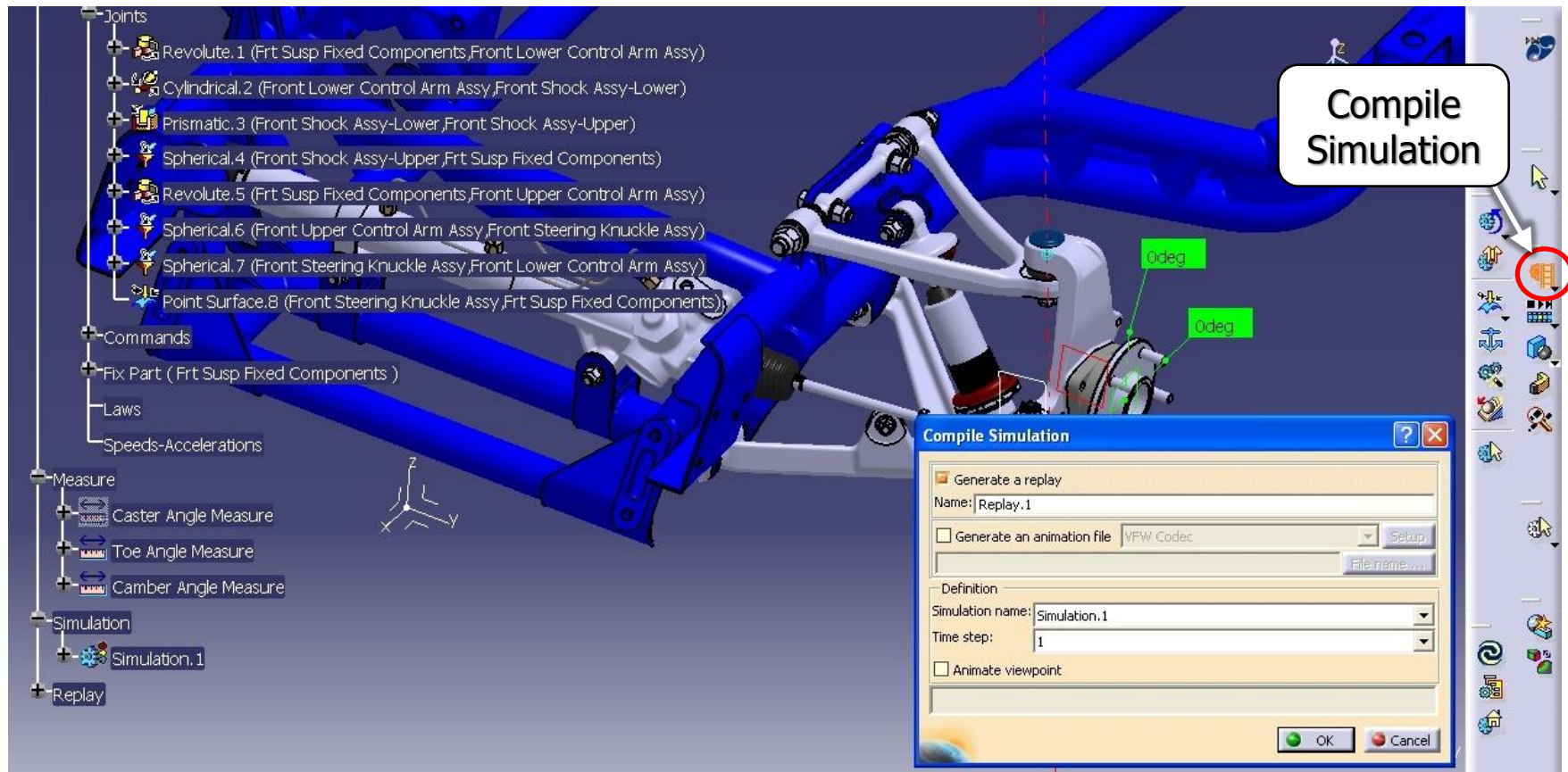


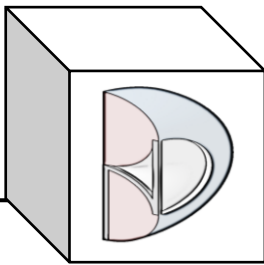
- Step 10a: Create a Kinematic Simulation (for the Trace).



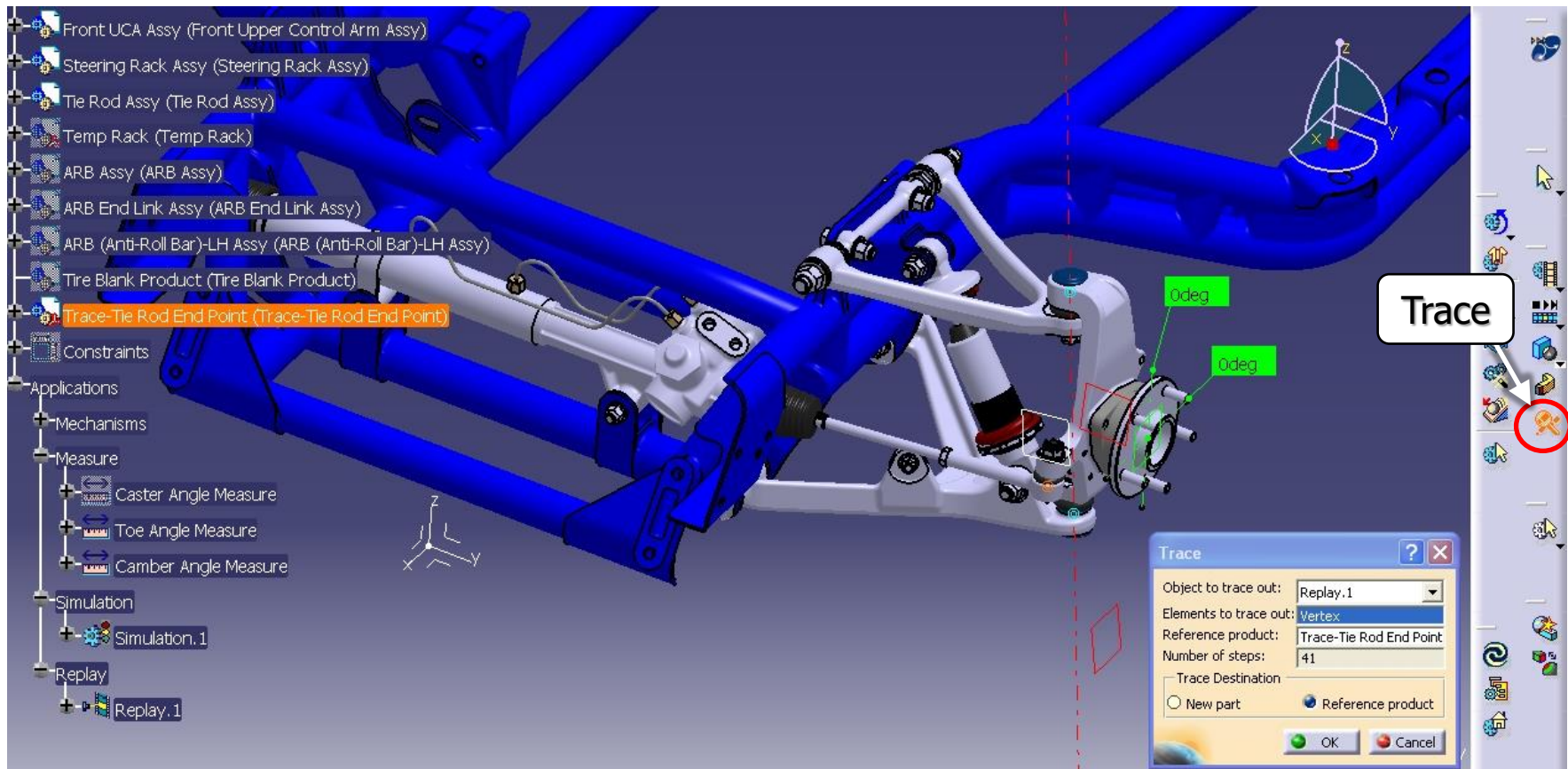


■ Step 10b: Compile the Kinematic Simulation (for the Trace).



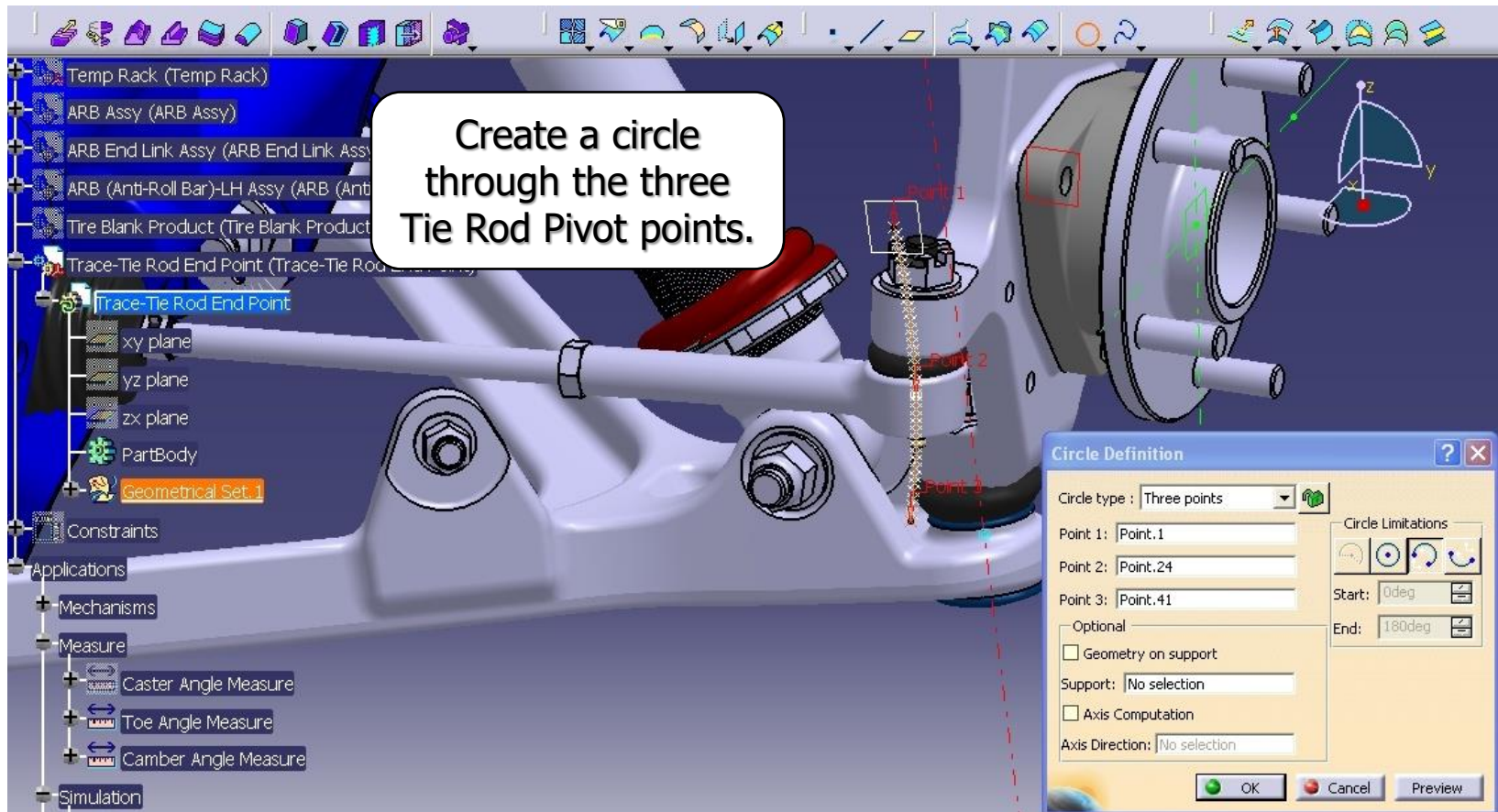


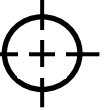
- Step 10c: Create a Kinematic Trace of the Optimized Arc for the Tie Rod Pivot Points.



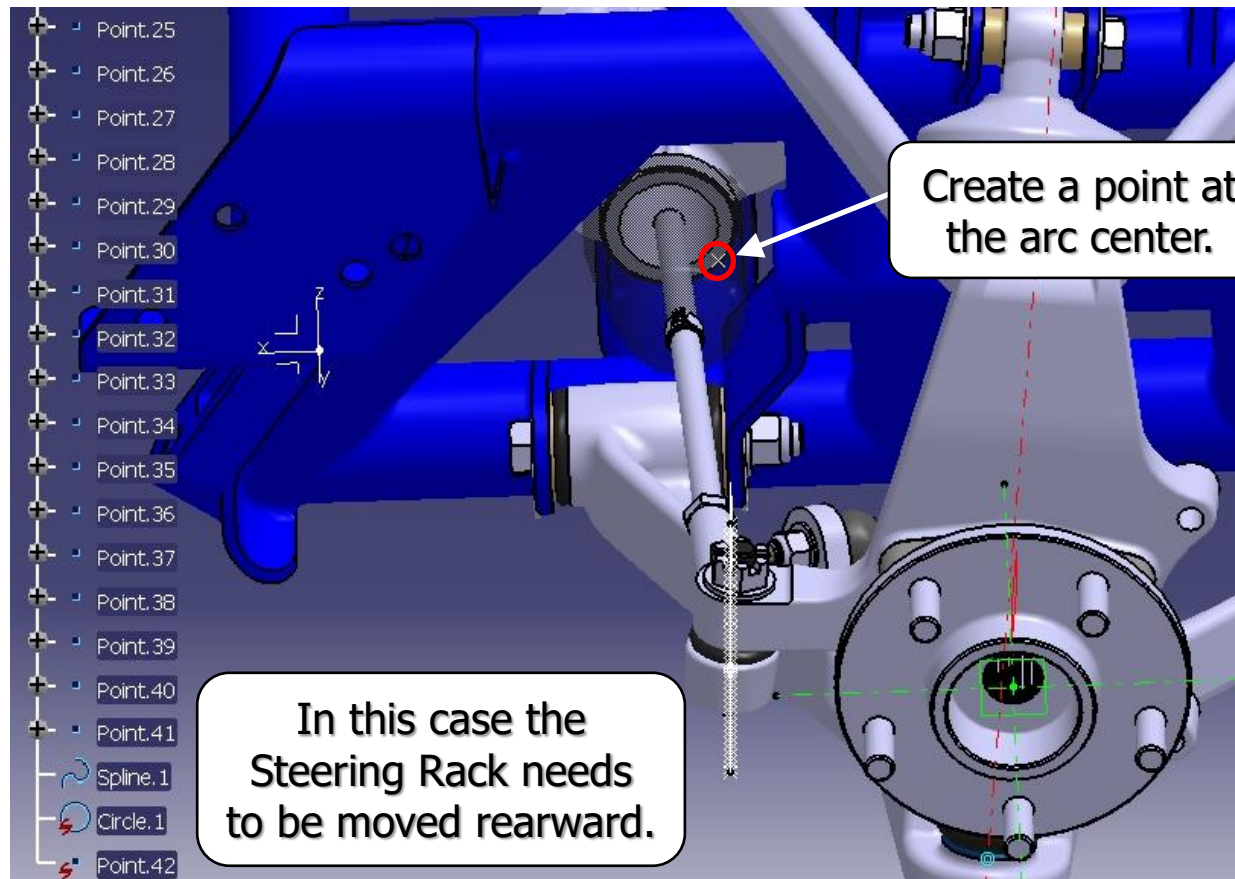


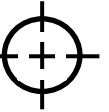
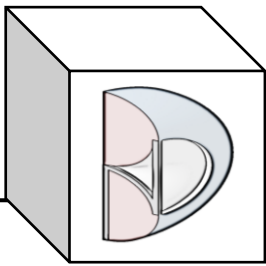
- Step 11a: Use the Kinematic Trace of the Optimized Arc to determine the optimized Steering Rack attachment point.



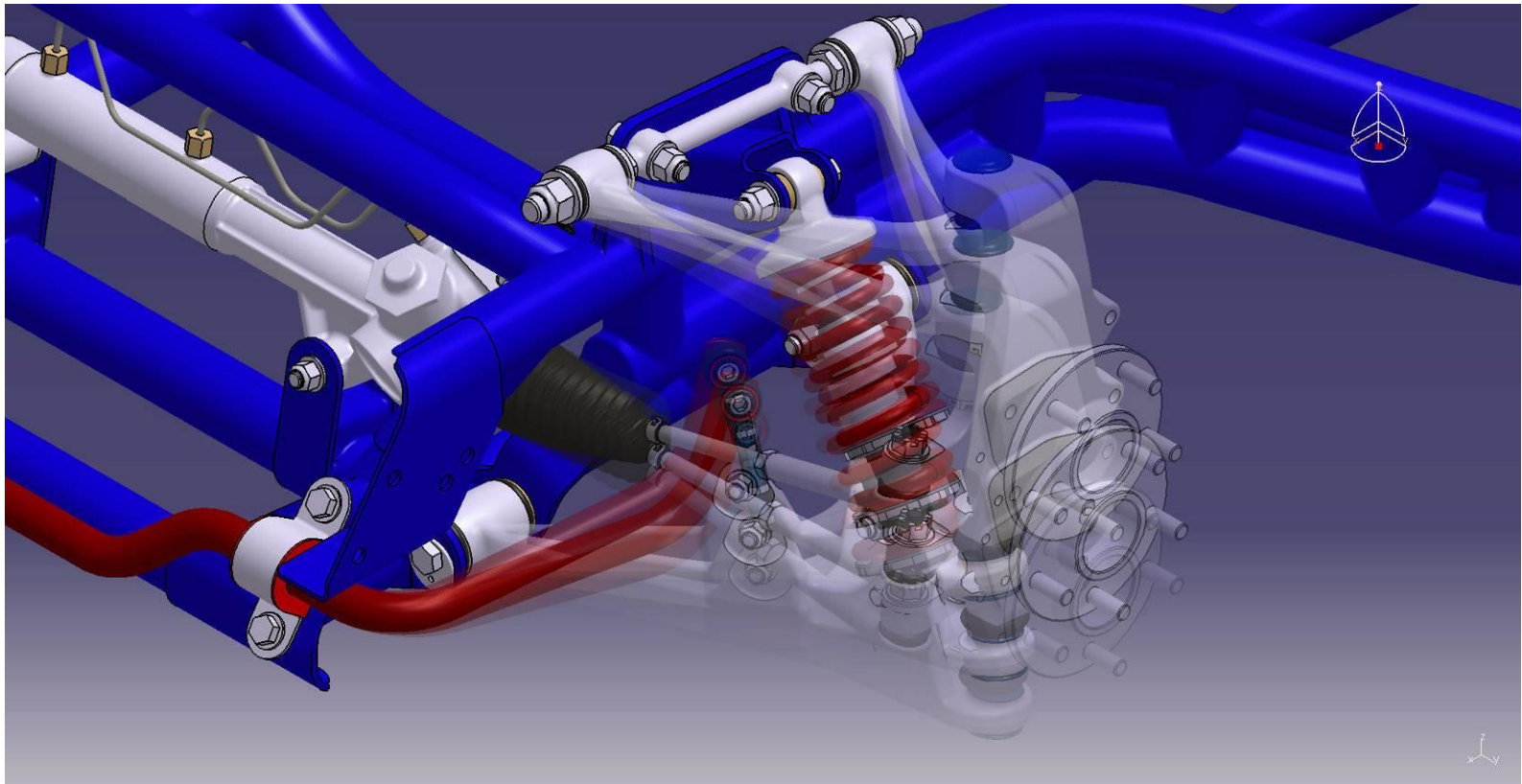


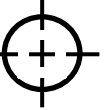
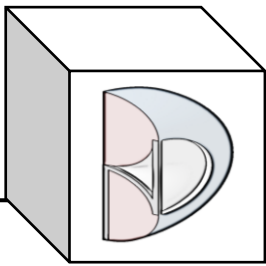
- Step 11b: Use the Optimized Arc to determine the optimized Steering Rack attachment point.



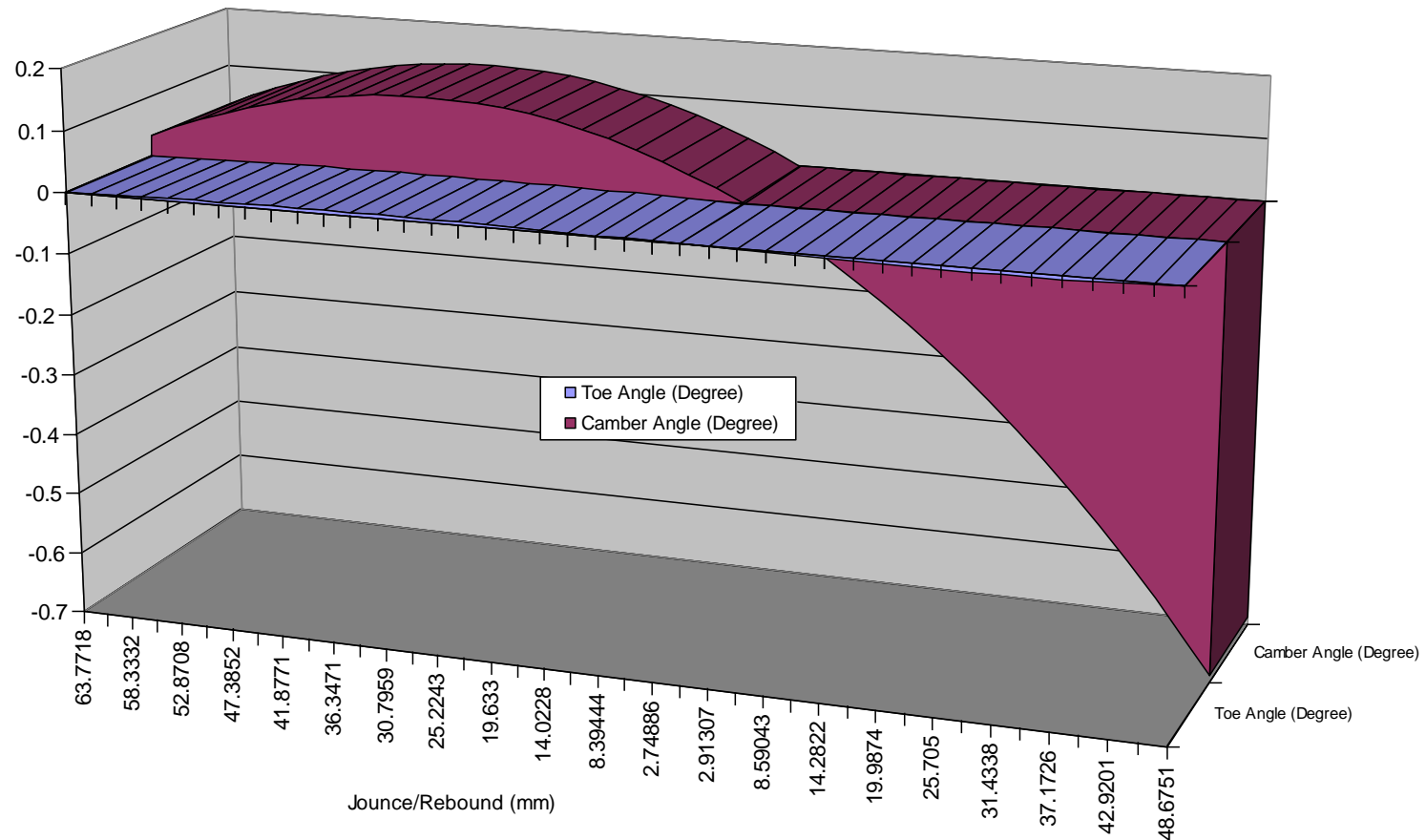


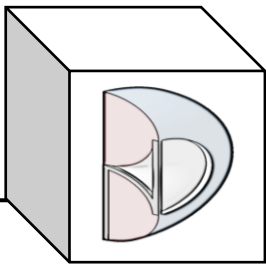
- Step 12: Reposition the Steering Rack to the Optimized Arc Center Point and complete the Kinematic with the proper Tie Rod joints in place of the Point-Surface joint.





- Step 12: Run the Kinematic with Sensors Activated and Output the data into an Excel Spreadsheet.





- Conclusion:

This is an example of how to use CATIA DMU Kinematics to create Front Suspension Baseline Optimization of Bump/Roll Steer.

We hope this will help those who need this type of simulation.

As always, we are open to any discussions this may bring.

Please ***subscribe*** to our YouTube channel!

