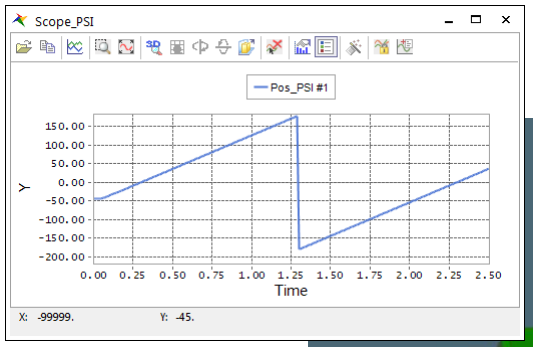
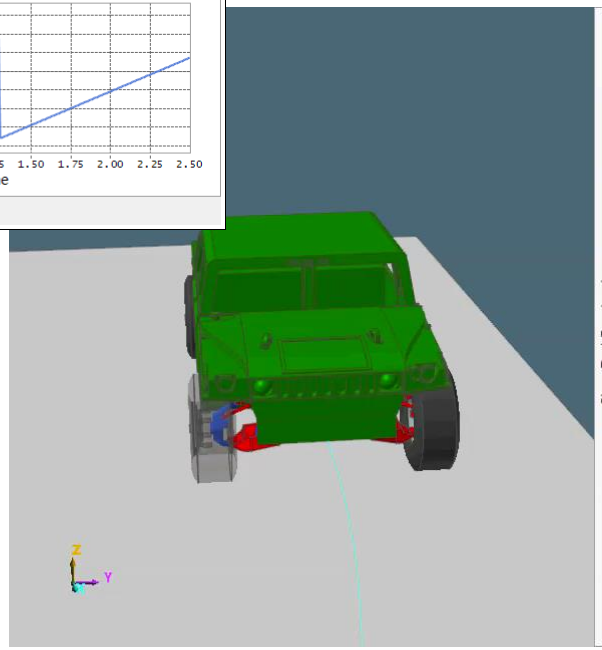
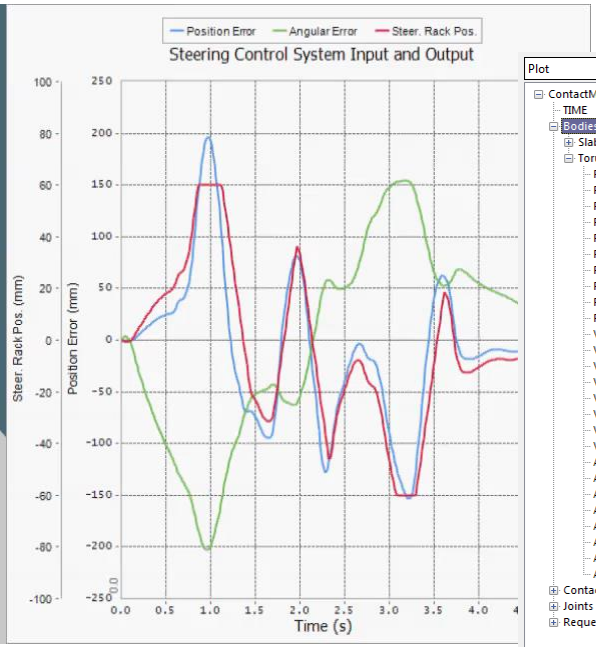
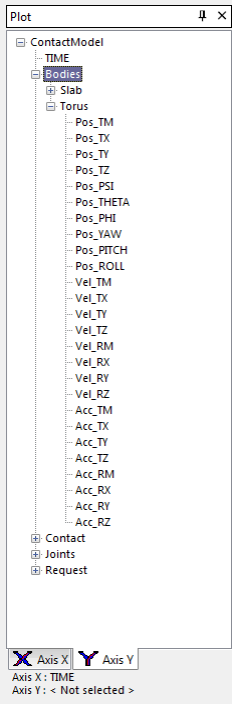
Postprocessing in RecurDyn

10/25/2017









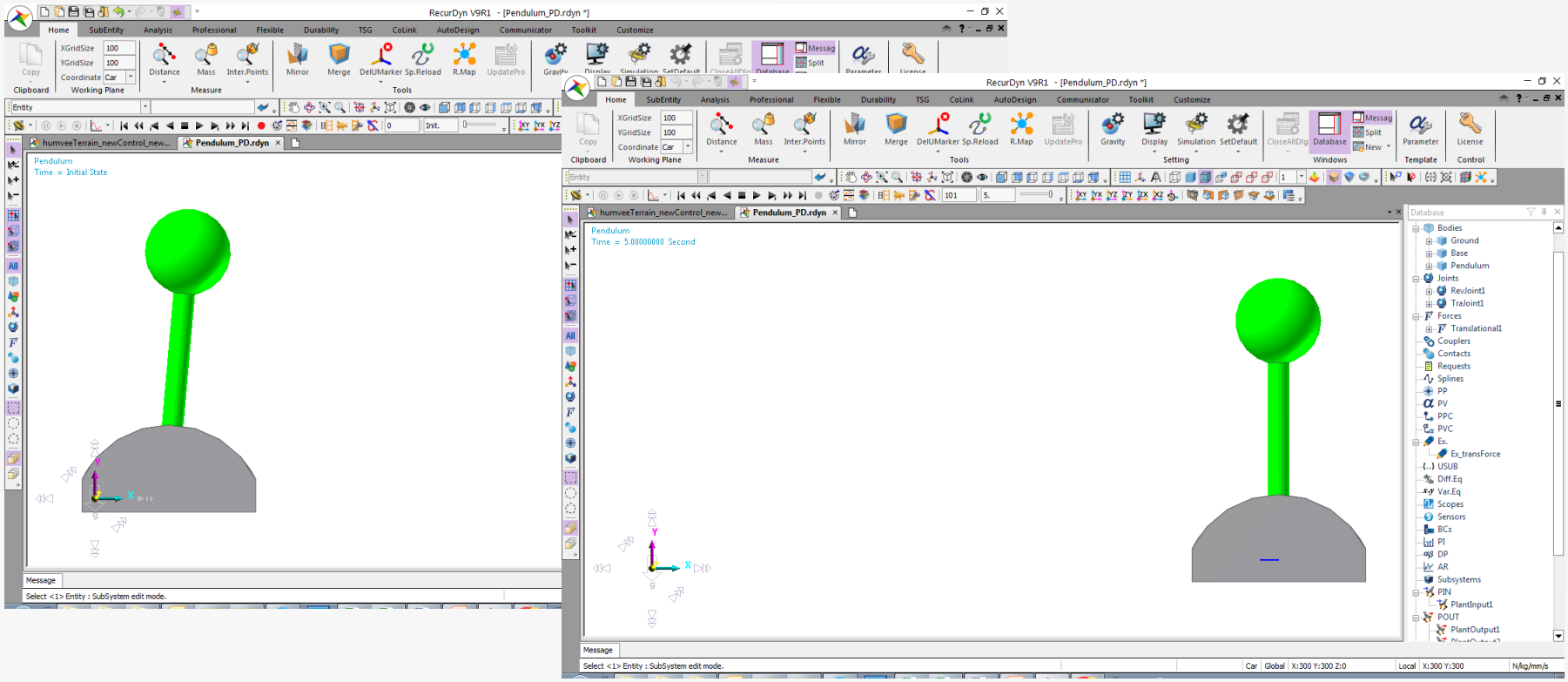
Nelson Woo

MotionPort

Topics Covered

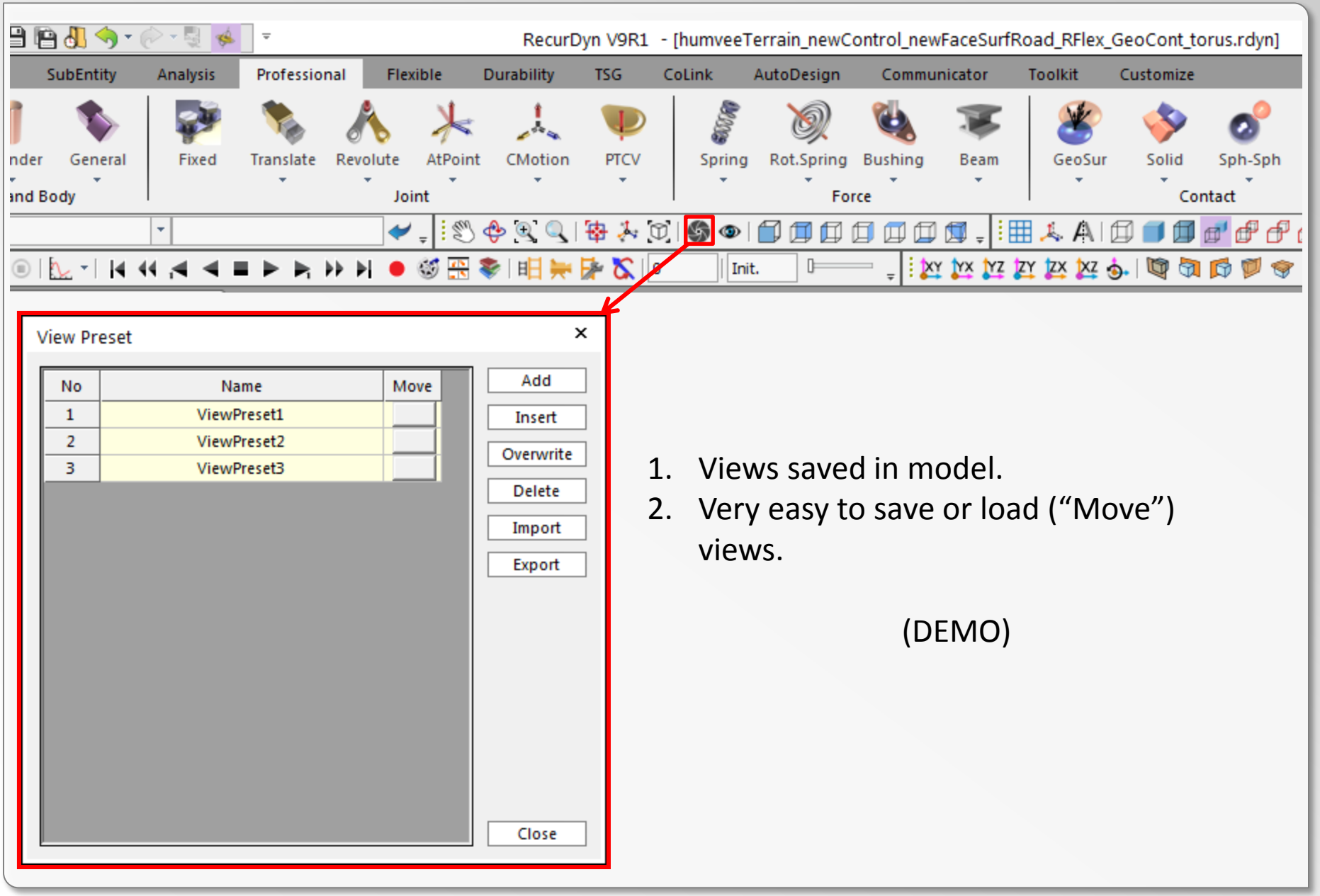
- Working with Views
  - View Presets
  - Custom View
- Cameras
  - Camera control panel
  - Following camera
- Multi-Animation
- Scopes
  - Orientation
    - Euler Angles
    - Angle Expressions (Projected Angle)
  - Gap/Interference
- Marker Trace
- Plot Output
  - Bodies
  - Geo Surface Contacts
  - Multi-Axis Control
  - Plot with Animation
  - Plot Templates

Working with Views



- View: Position / Orientation / Zoom
- Ability to save, load, export and import views.
- Views saved in model or XML files.
- Purpose: allows the user to view results in a consistent manner from one result set to another.
- Two methods: View Presets and Custom Views

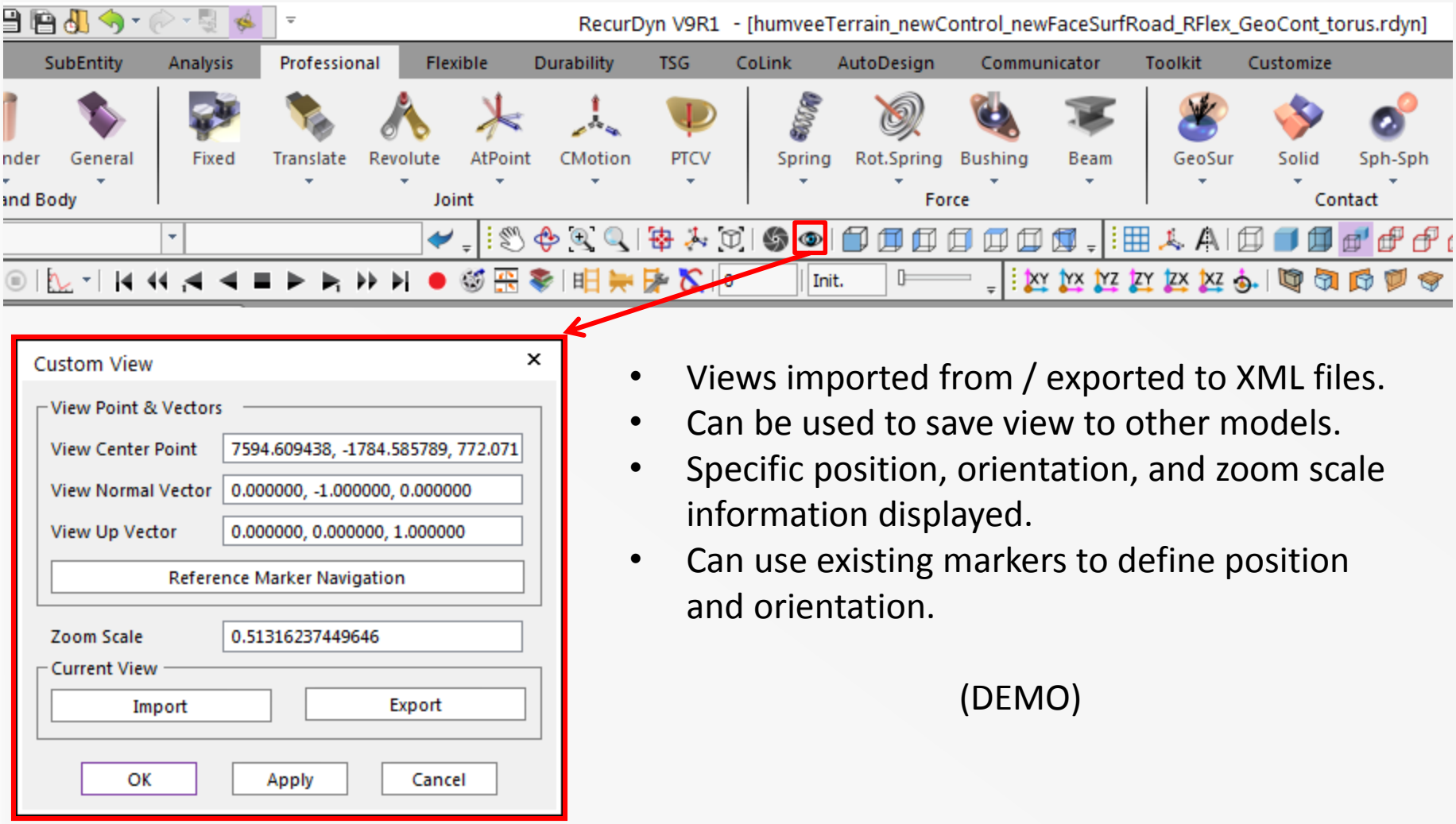
Working with Views: View Presets



1. Views saved in model.
2. Very easy to save or load (“Move”) views.

(DEMO)

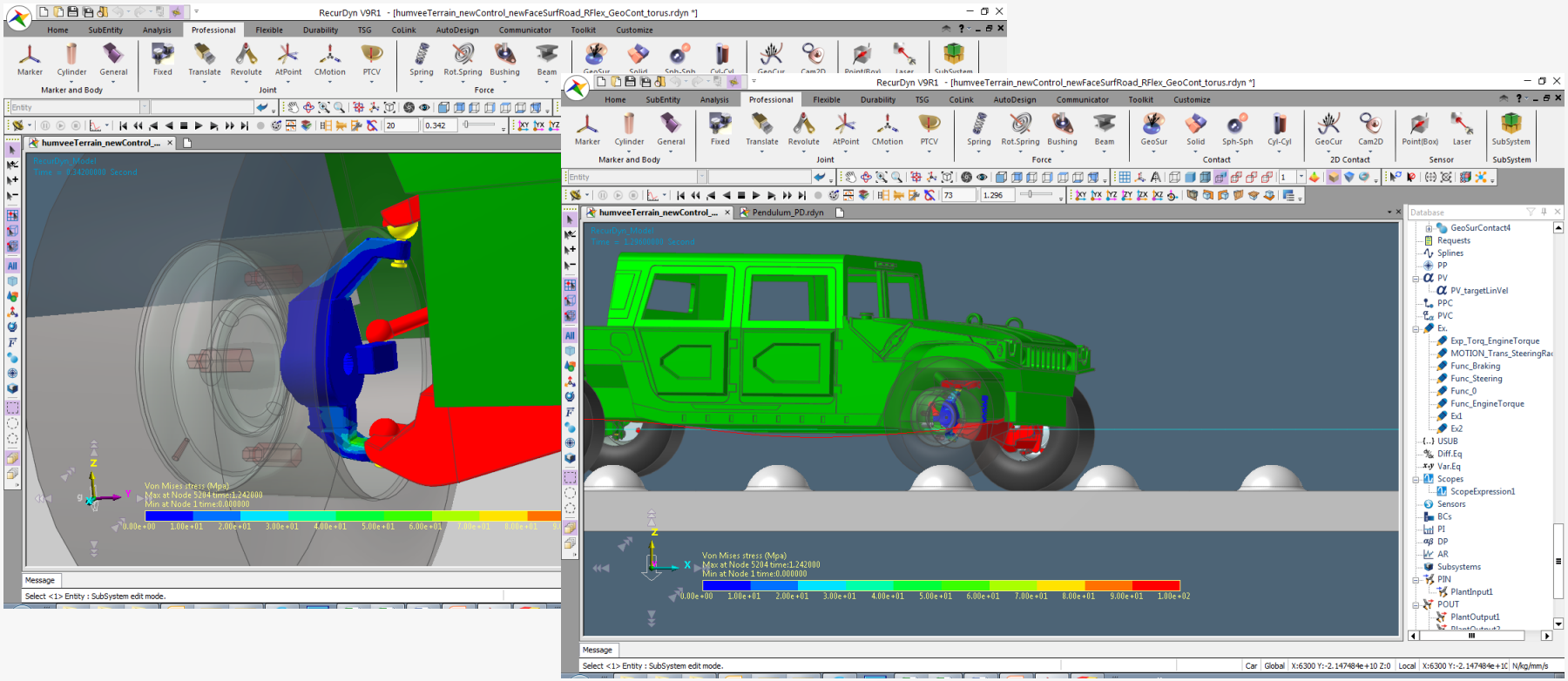
Working with Views: Custom View



- Views imported from / exported to XML files.
- Can be used to save view to other models.
- Specific position, orientation, and zoom scale information displayed.
- Can use existing markers to define position and orientation.

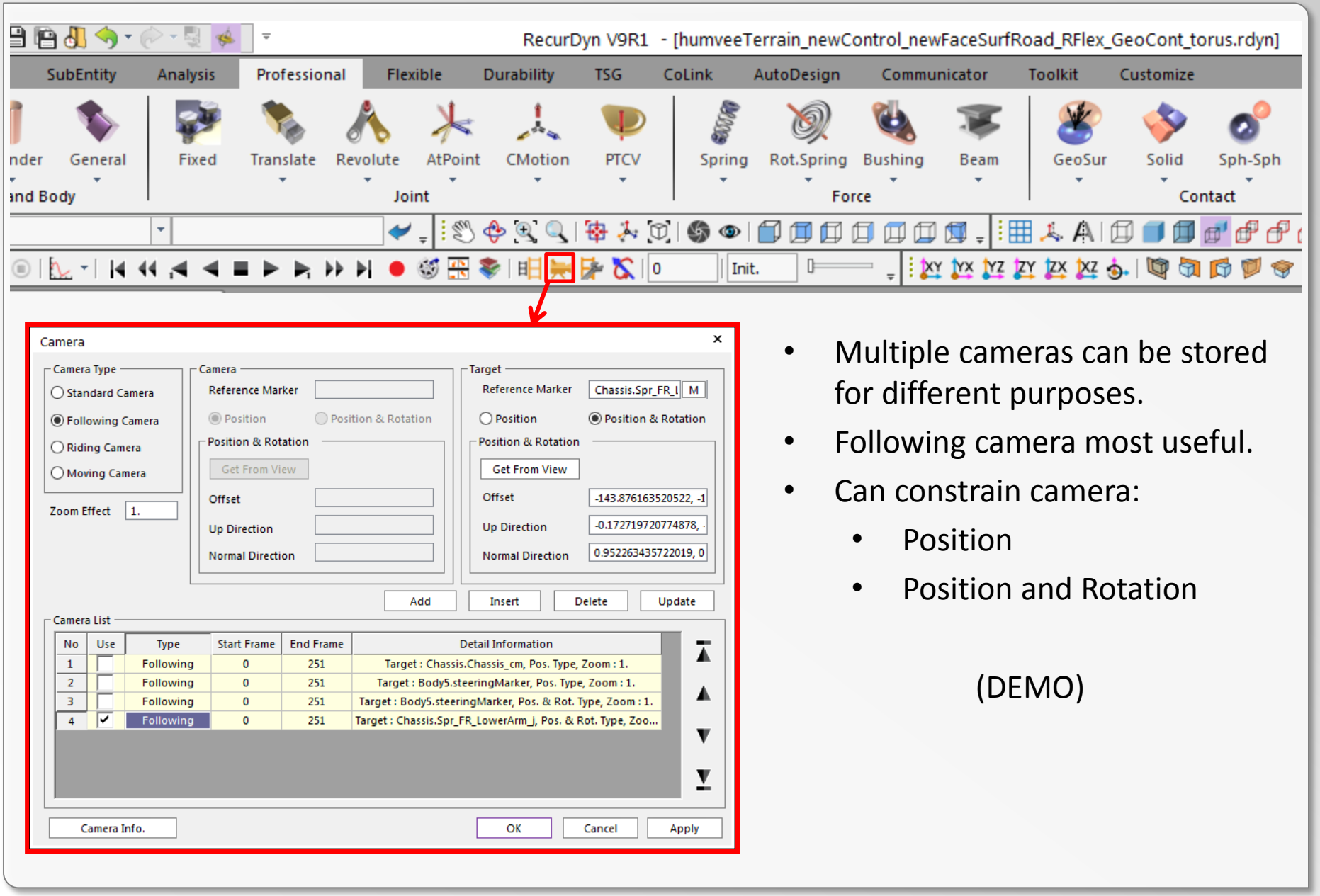
(DEMO)

Cameras



- During animation, different camera types can be used to view or emphasize different aspects of the results.
- The standard camera remains stationary.
- A following camera can be very useful to focus on moving parts of the model that could be difficult to focus on otherwise.

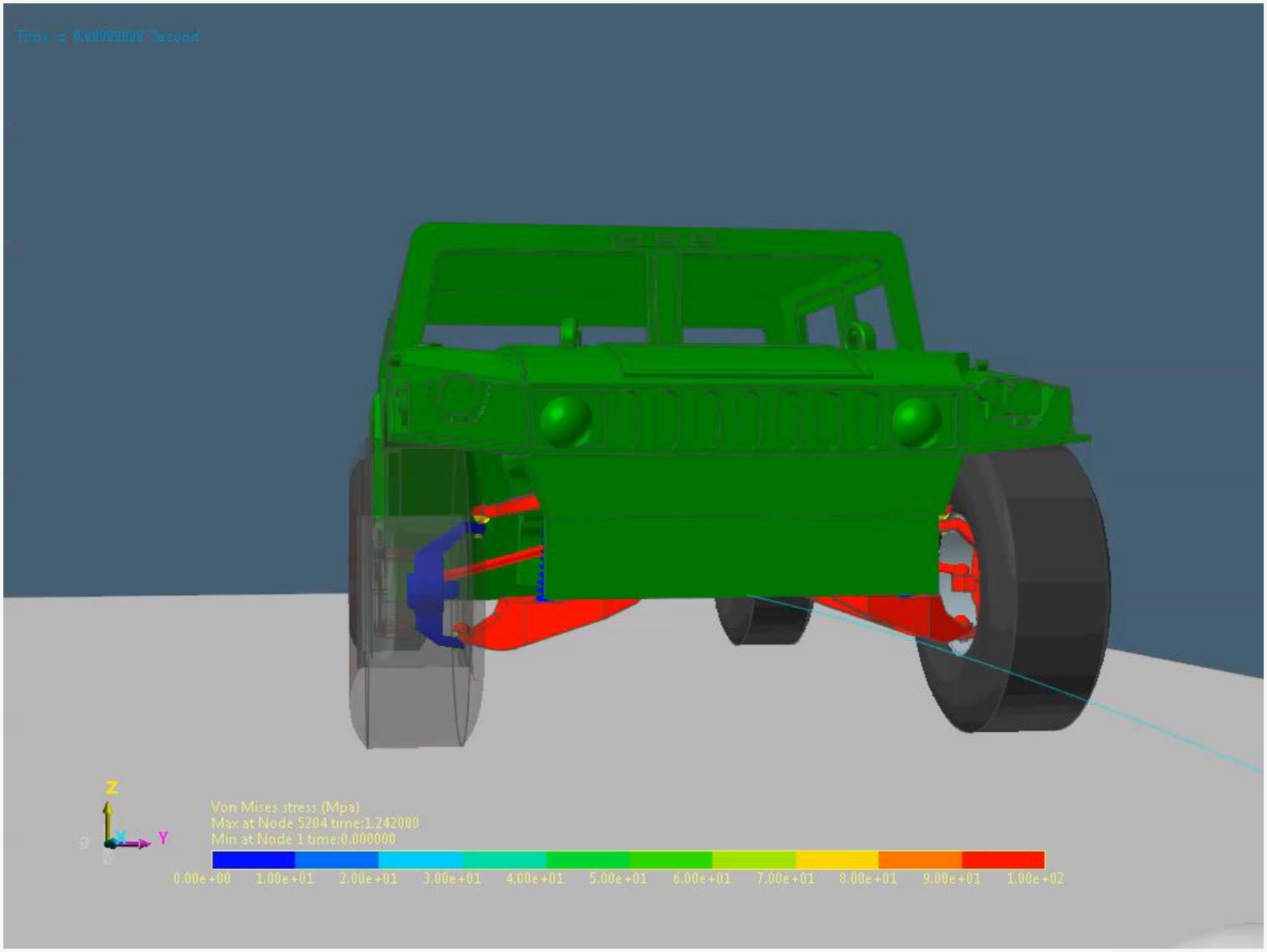
Cameras



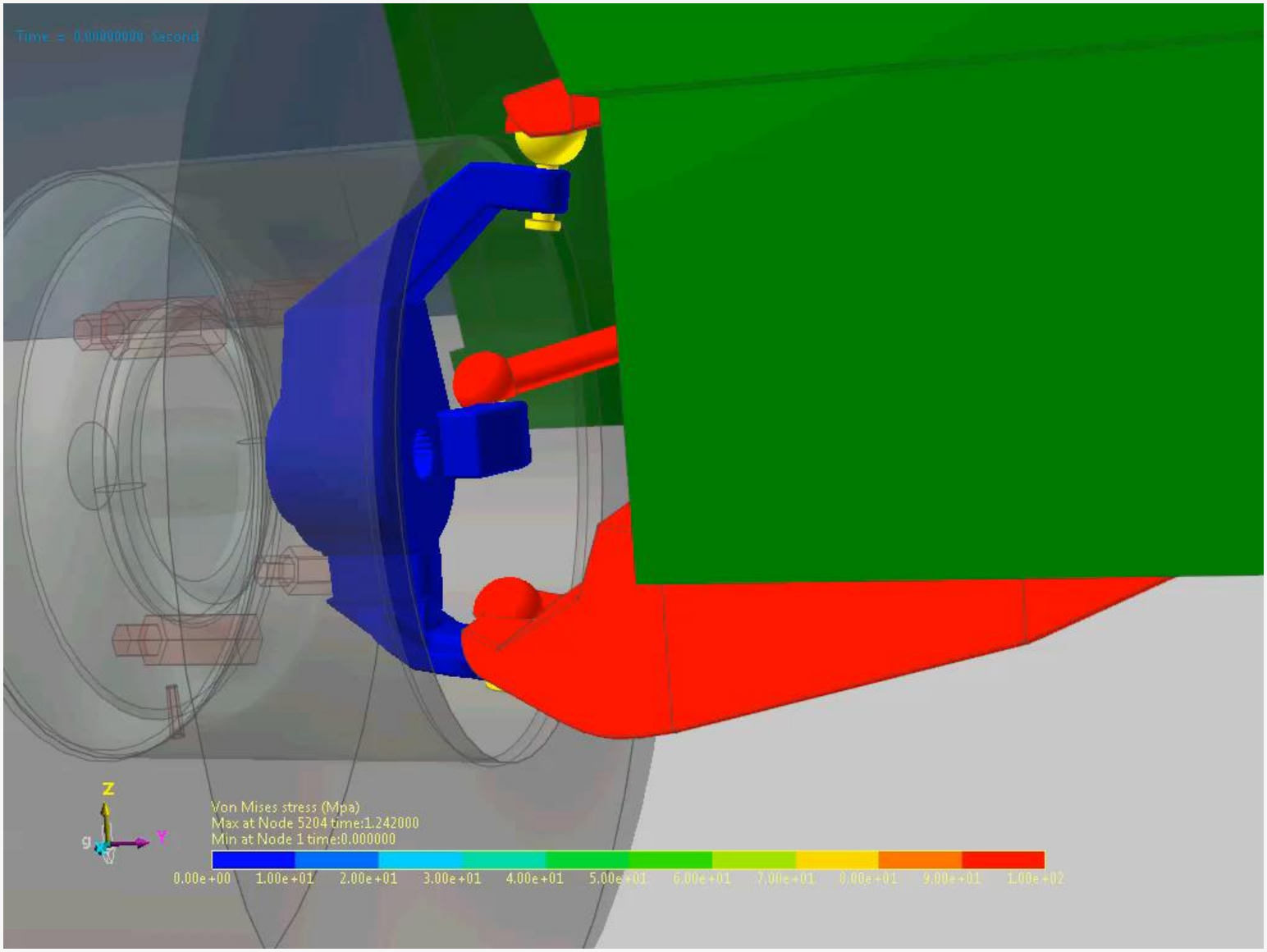
- Multiple cameras can be stored for different purposes.
- Following camera most useful.
- Can constrain camera:
  - Position
  - Position and Rotation

(DEMO)

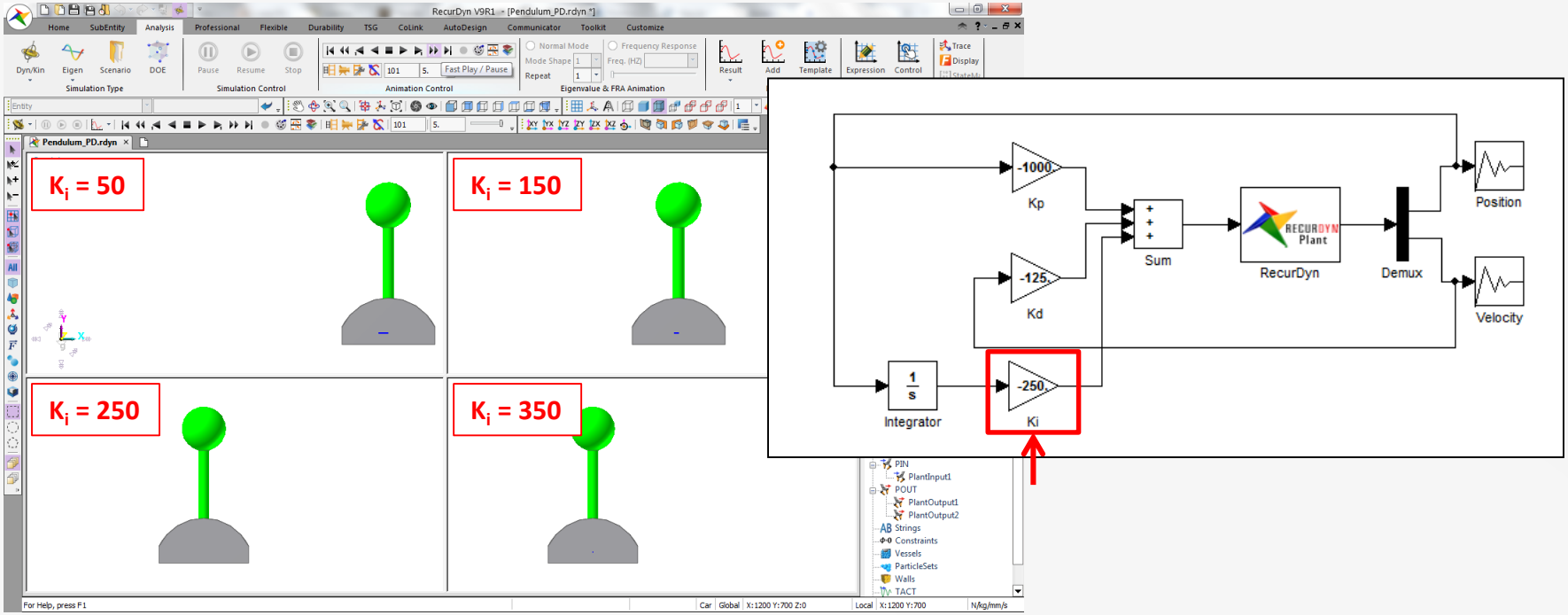
Following Camera: Position



Following Camera: Position & Rotation

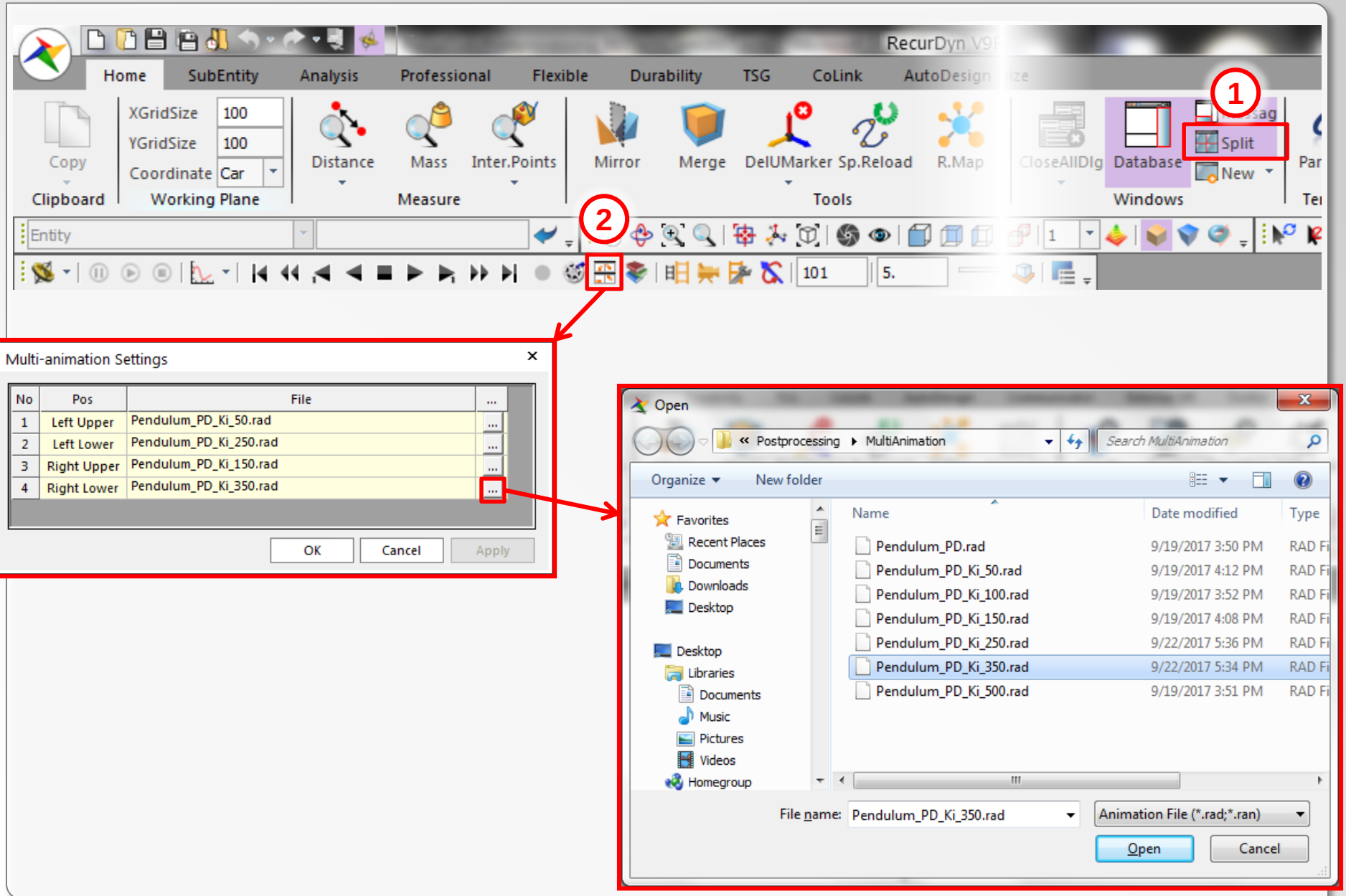


Multi-Animation

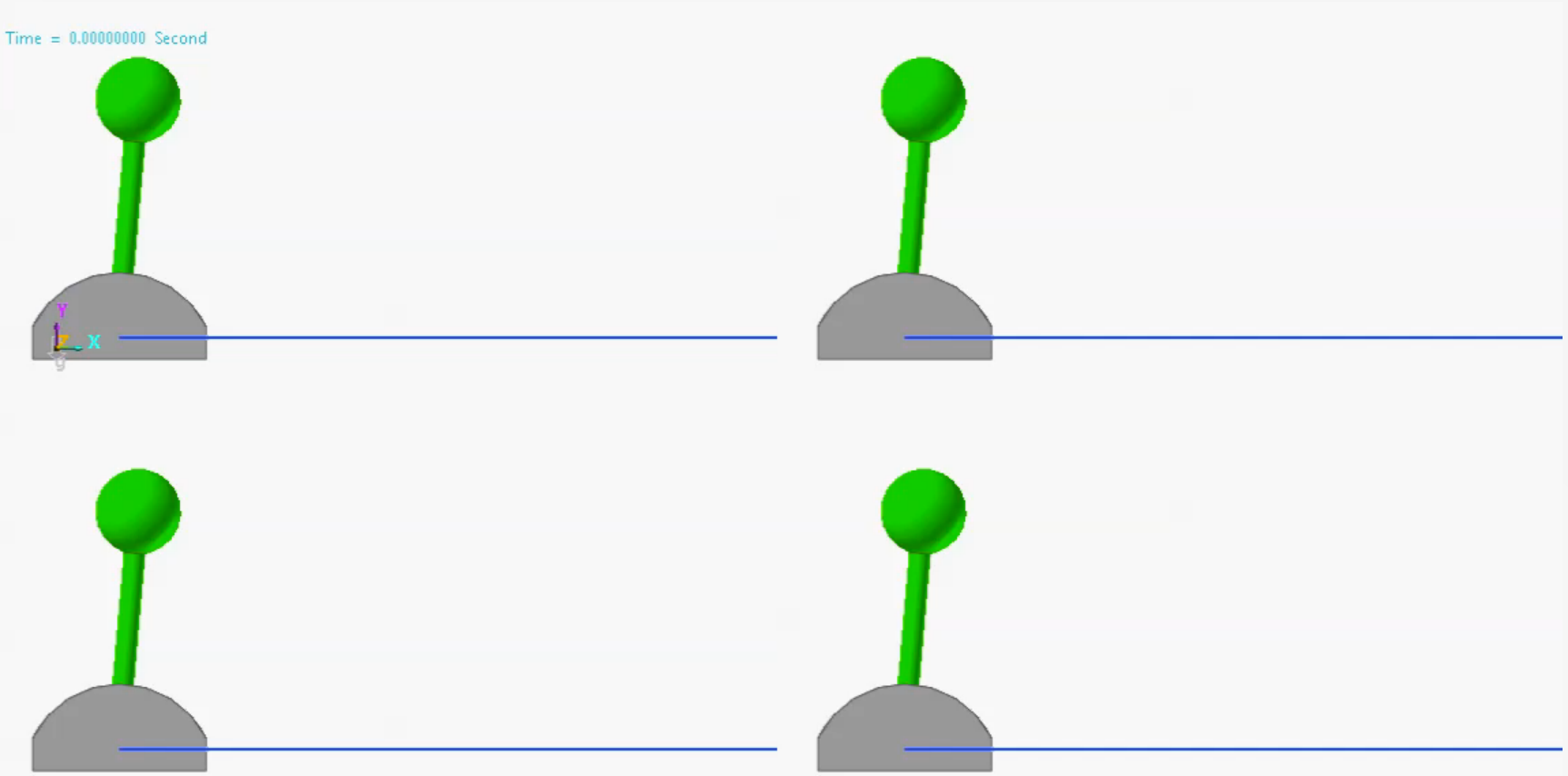


Enables user to view different animation results simultaneously in different windows.

Multi-Animation

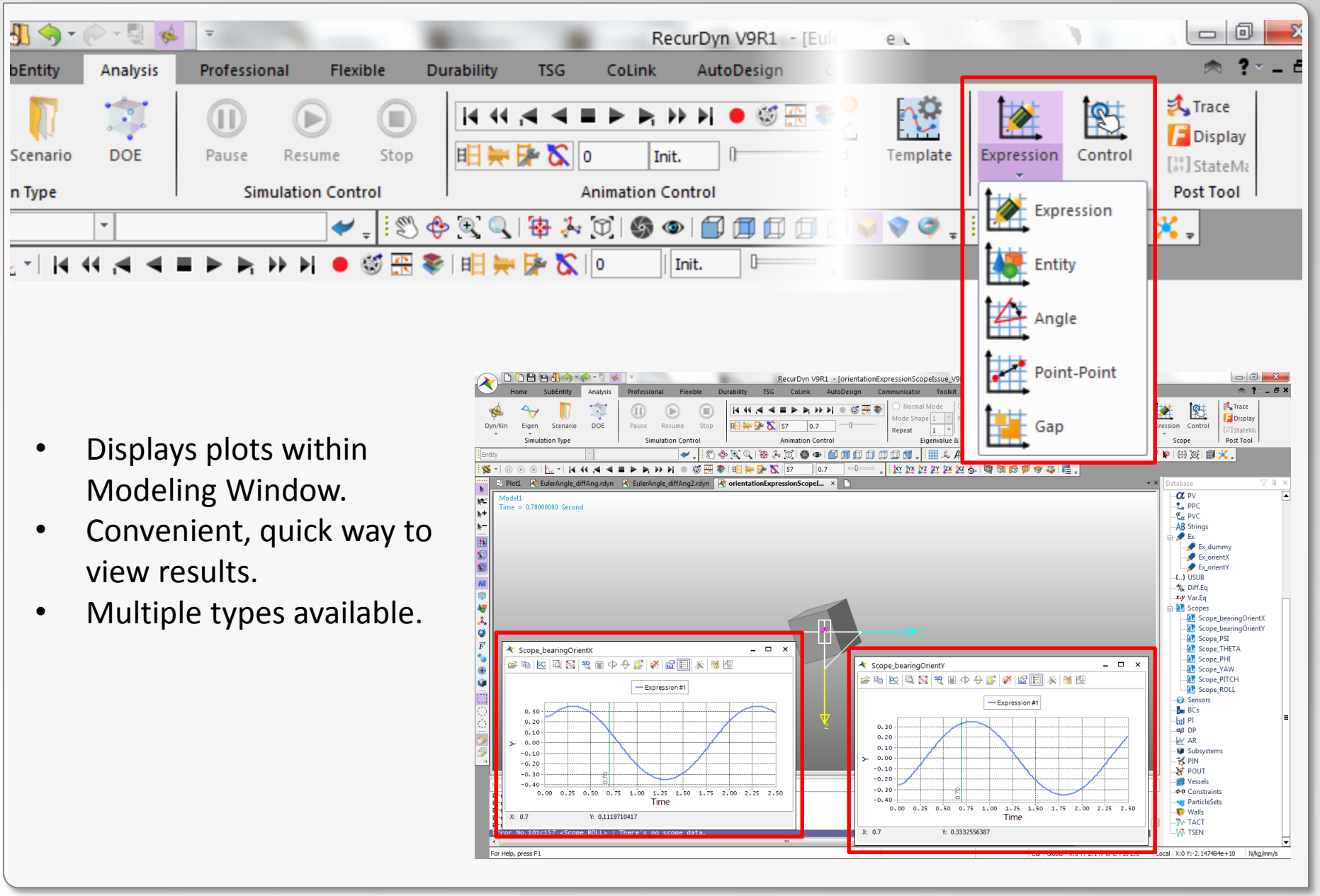


Multi-Animation



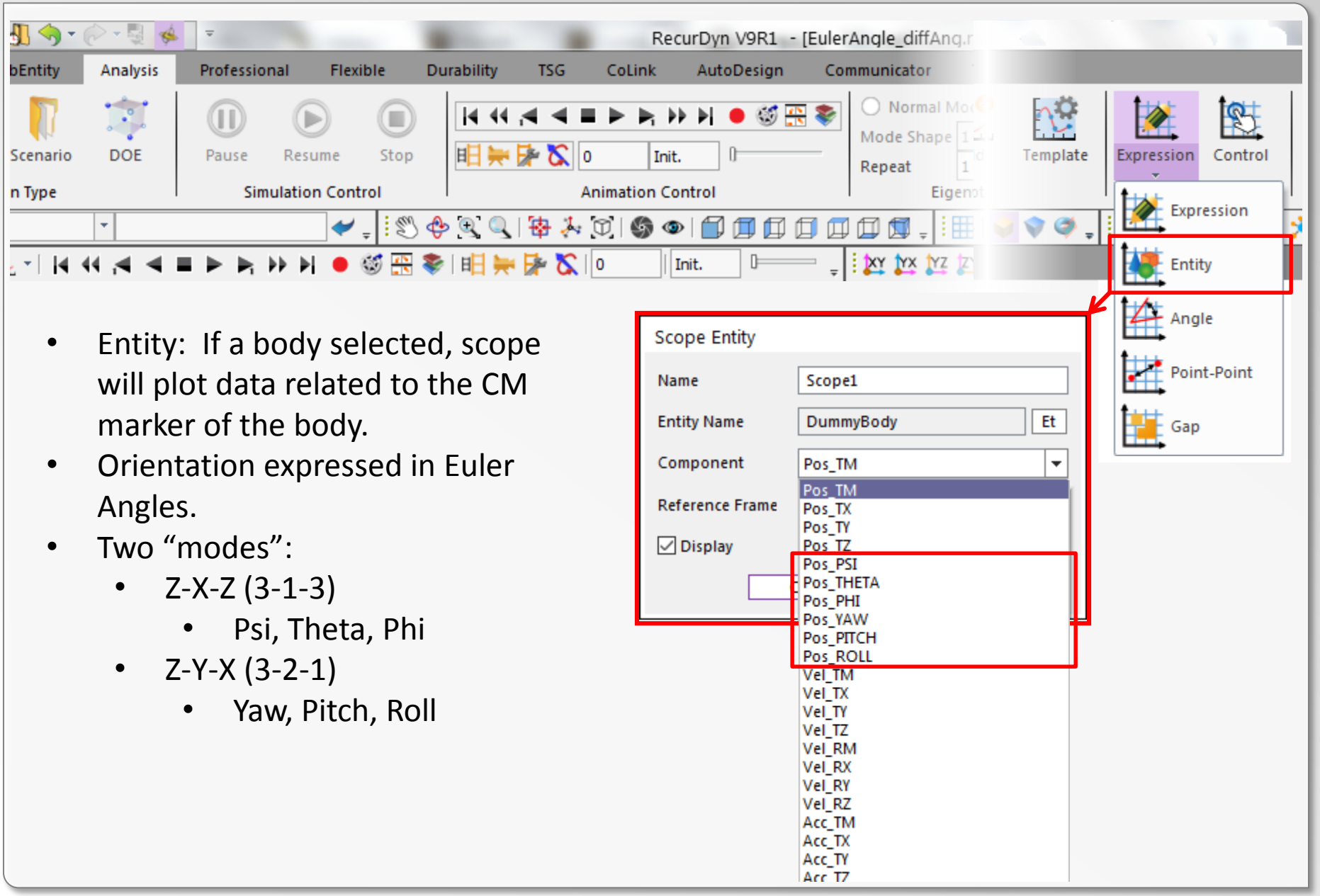
Scopes

- Displays plots within Modeling Window.
- Convenient, quick way to view results.
- Multiple types available.

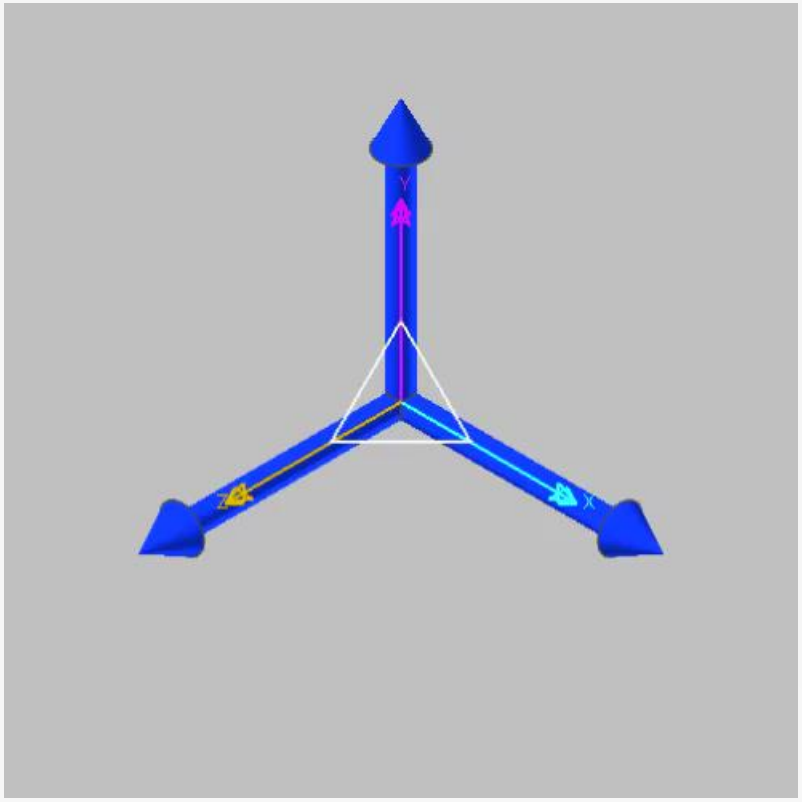


Entity Scope: Orientation

- Entity: If a body selected, scope will plot data related to the CM marker of the body.
- Orientation expressed in Euler Angles.
- Two “modes”:
  - Z-X-Z (3-1-3)
    - Psi, Theta, Phi
  - Z-Y-X (3-2-1)
    - Yaw, Pitch, Roll



Orientation: Euler Angles

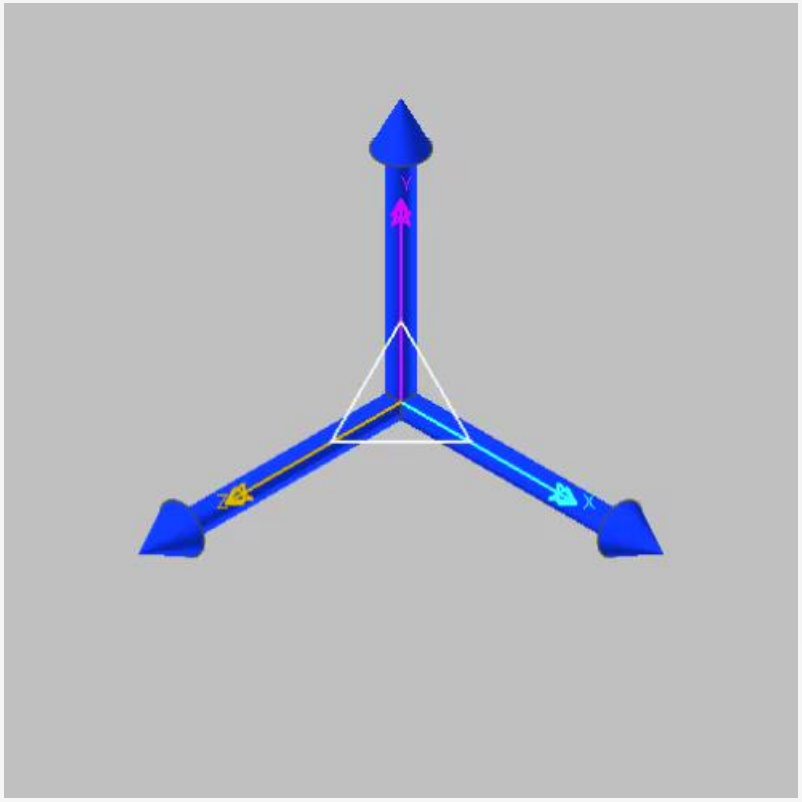


Z-X-Z (3-1-3)

Psi = 20°

Theta = -45°

Phi = -45°



Z-Y-X (3-2-1)

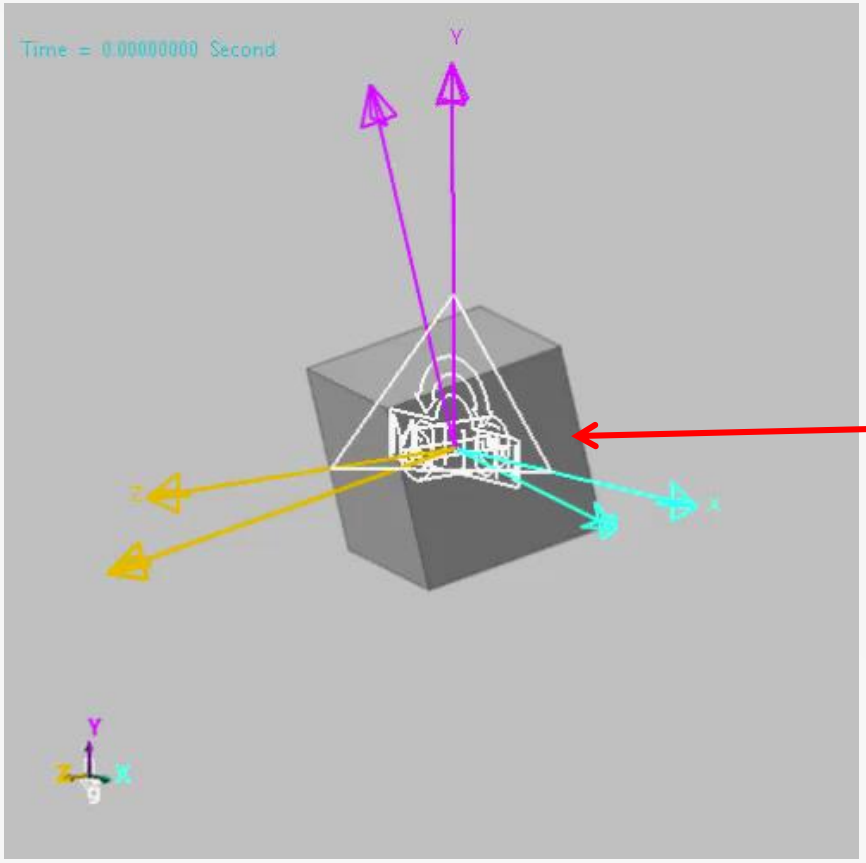
Yaw = -15.26°

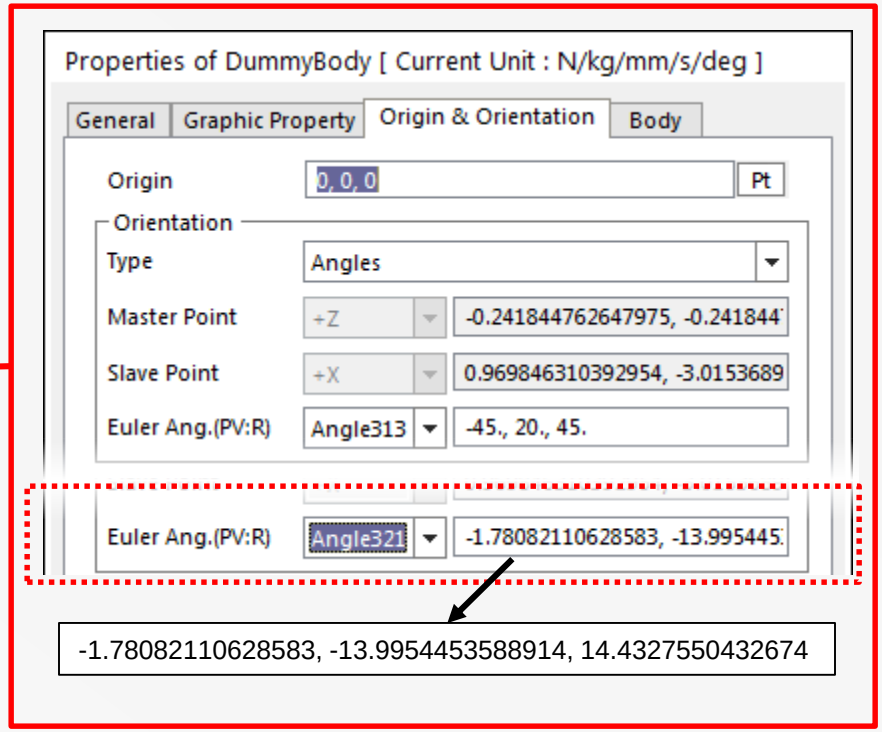
Pitch = -30°

Roll = -35.26°

- Intrinsic rotation: axes of rotation attached to moving body.
- In examples above, different Euler Angle types (Z-X-Z and Z-Y-X) can be used to reach the same orientation, but different angle values must be used.

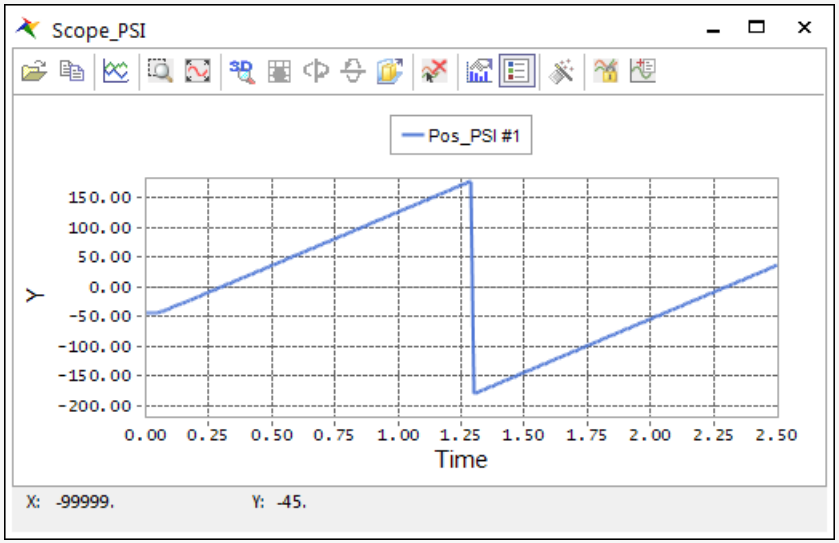
Orientation Example Model

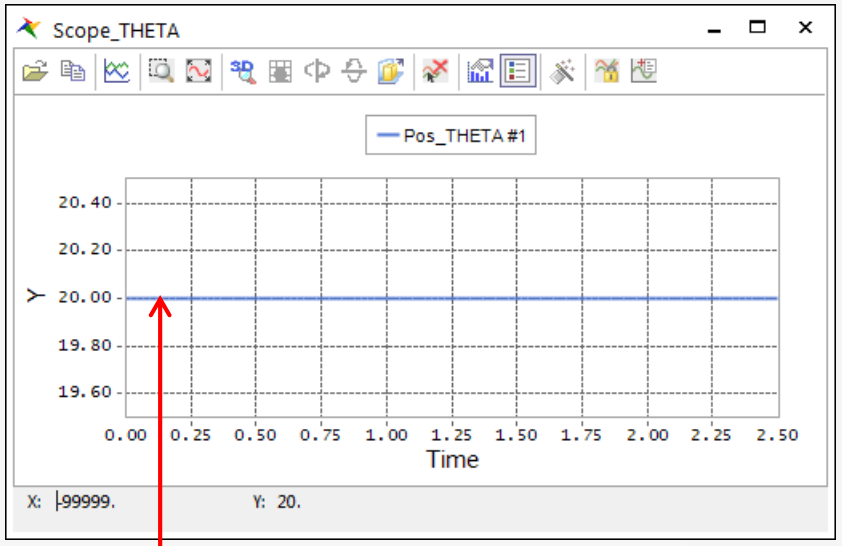


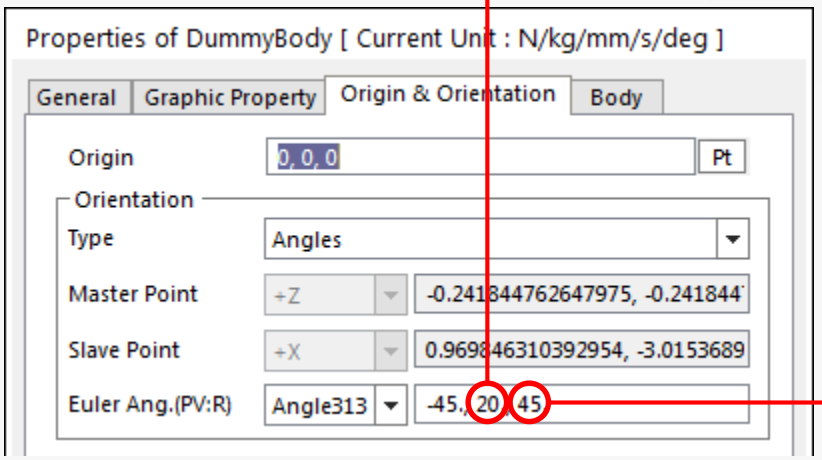


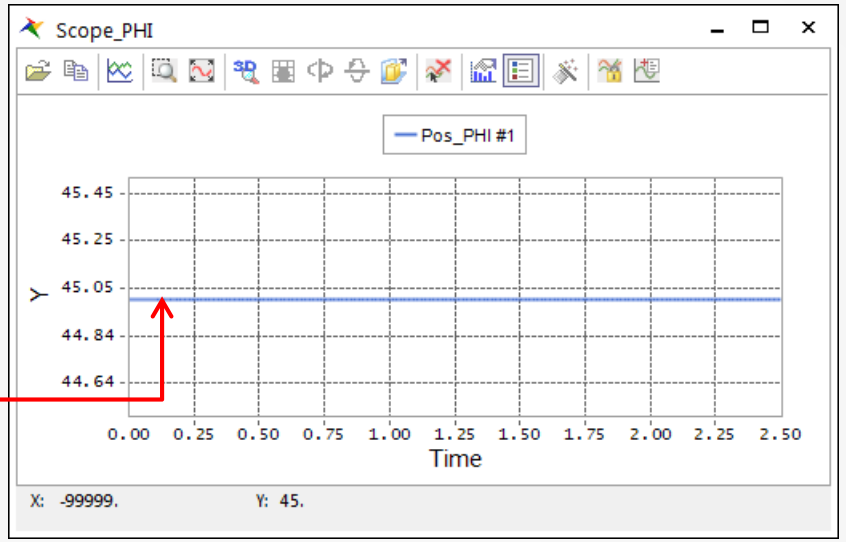
Body with offset orientation rotates about global Z-axis.

Psi, Theta, Phi (3-1-3 Angles)

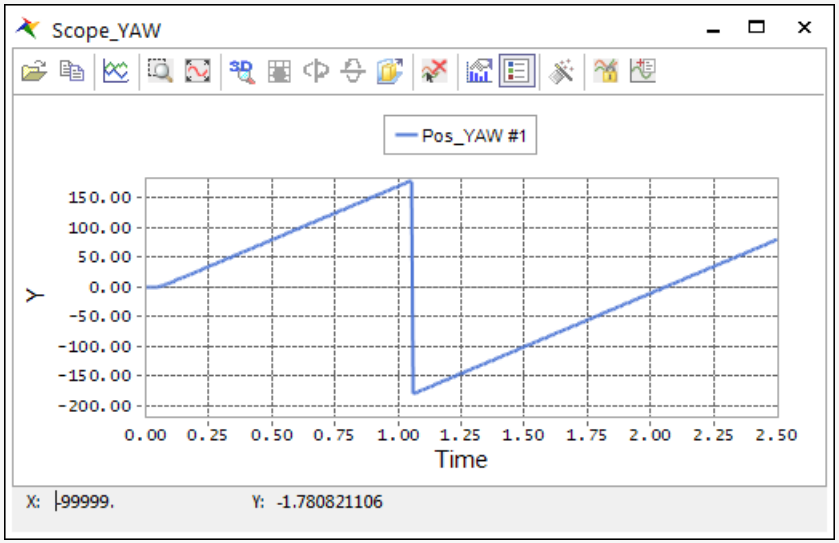


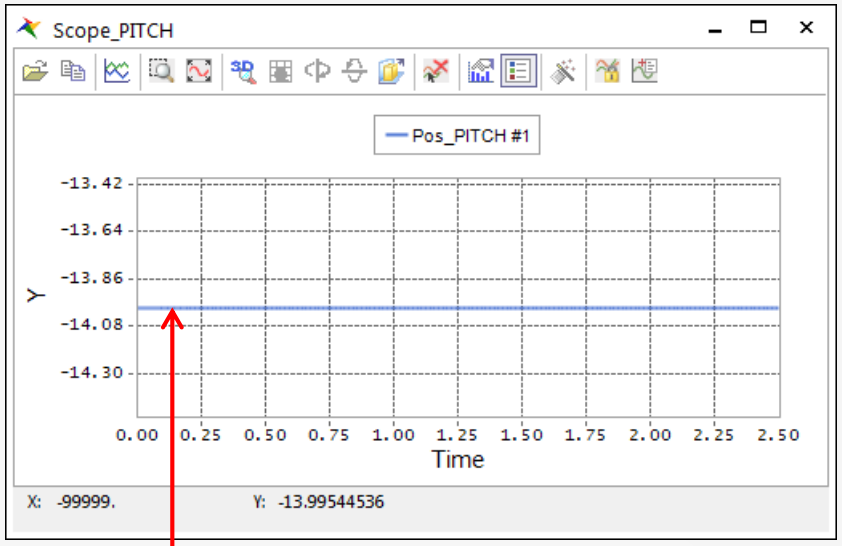


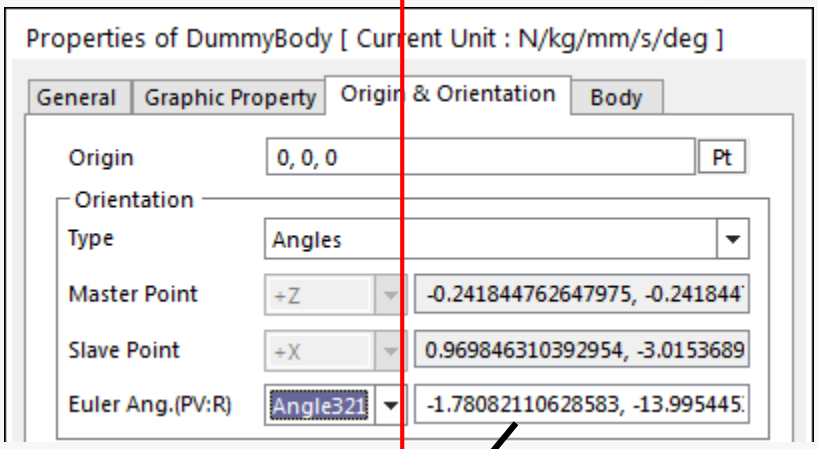


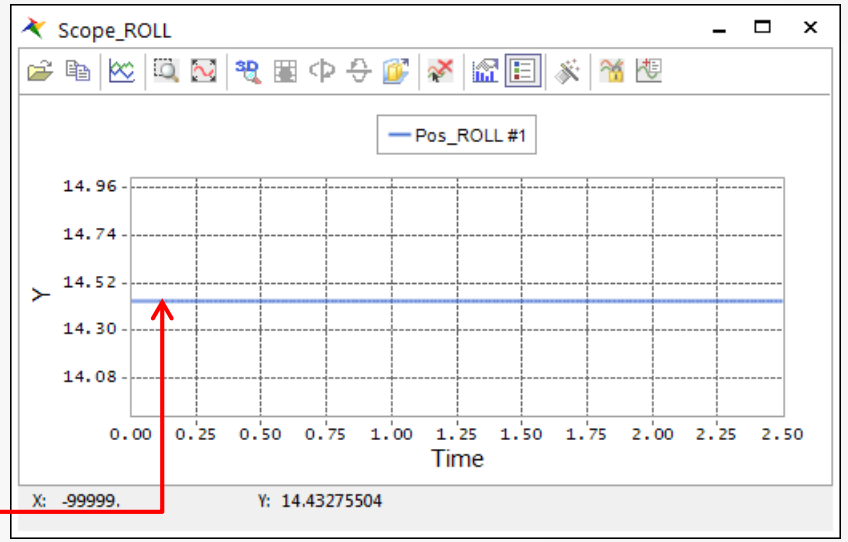


Yaw, Pitch, Roll (3-2-1 Angles)



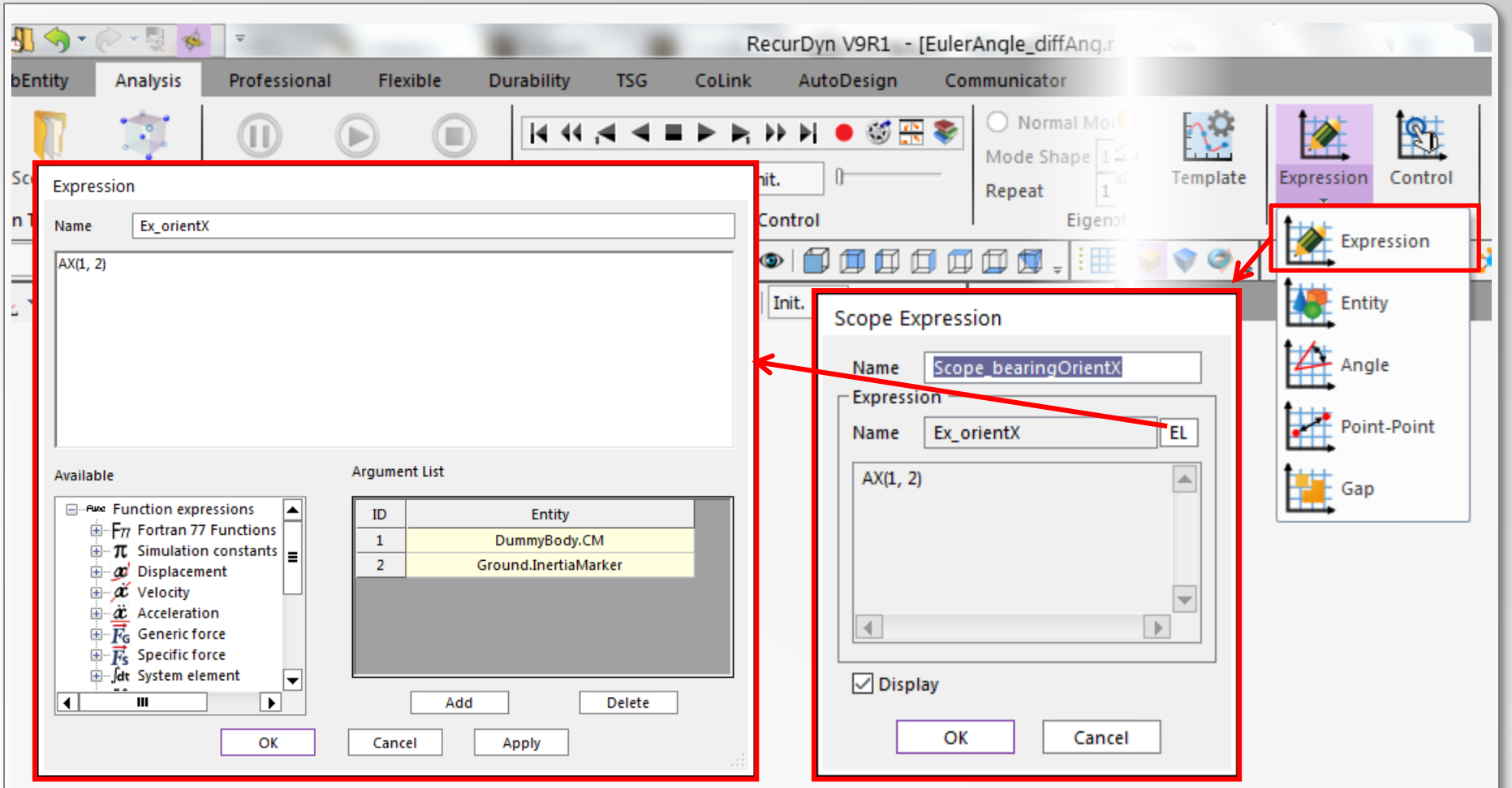






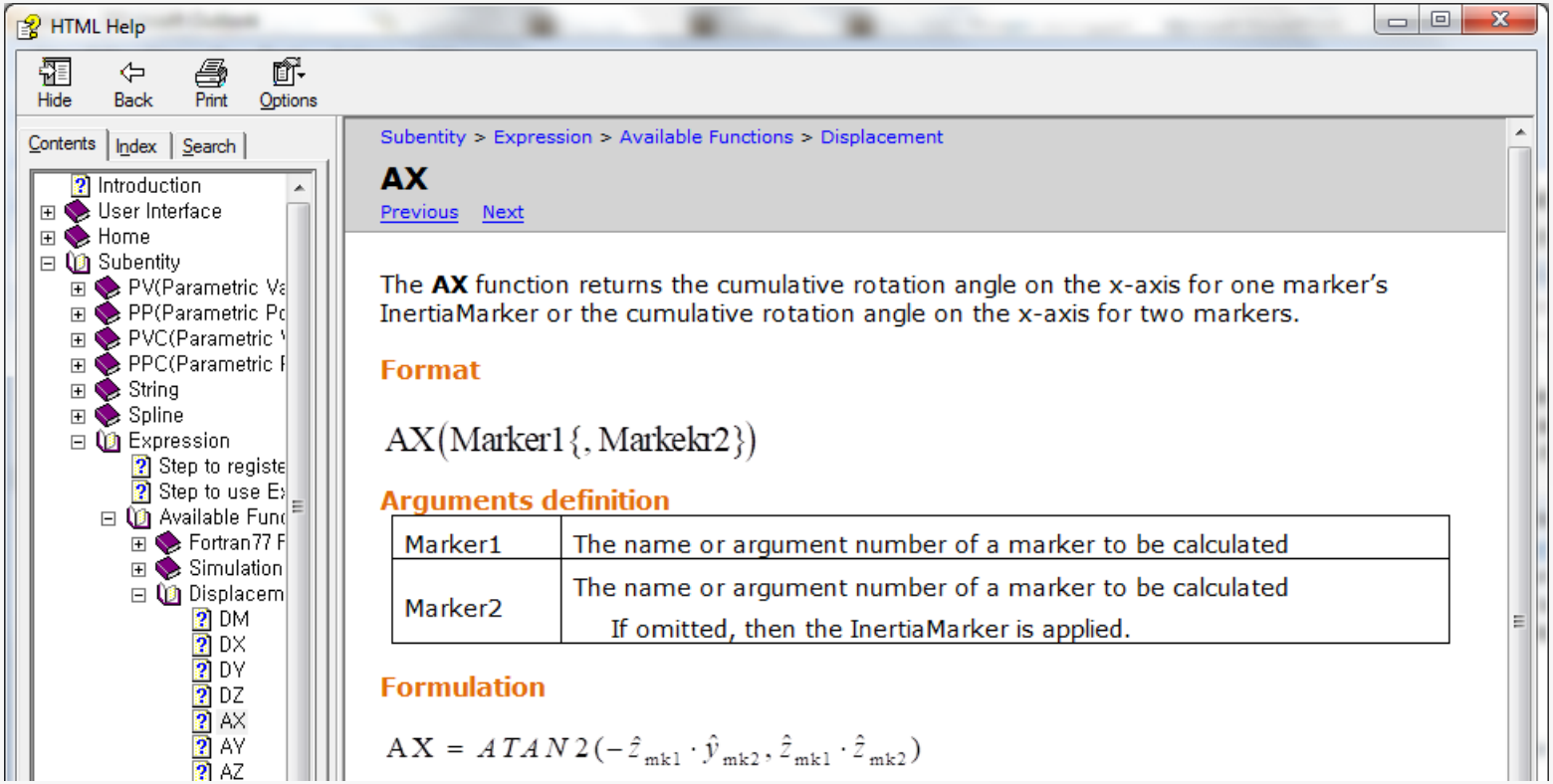
-1.78082110628583, -13.9954453588914 14.4327550432674

Projected Angle of Rotation



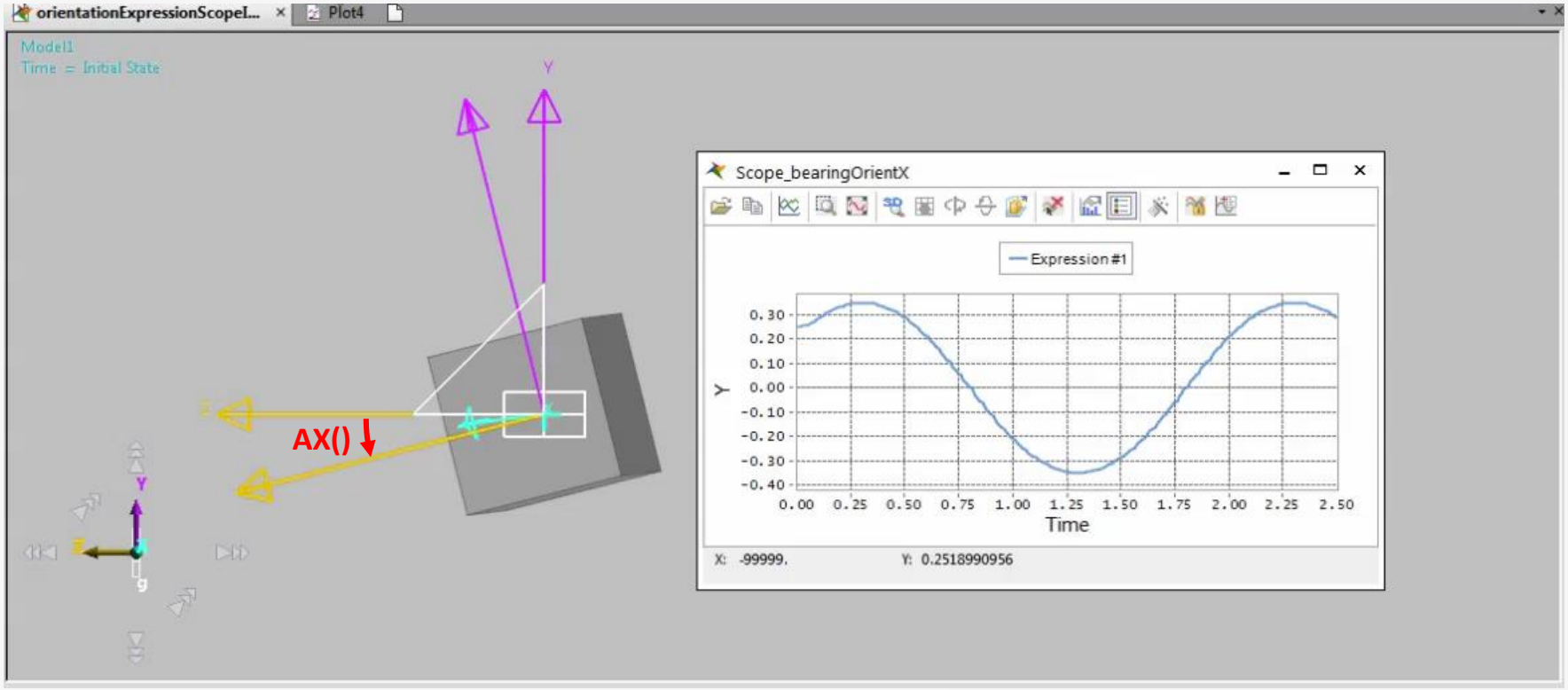
- An alternative to the Euler Angles is to get the projected angle of rotation.
- Use expression functions AX(), AY(), and AZ().
- Can then create Expression Scope (or Expression Request for plot output).

Projected Angle of Rotation



Formulation from Help documentation

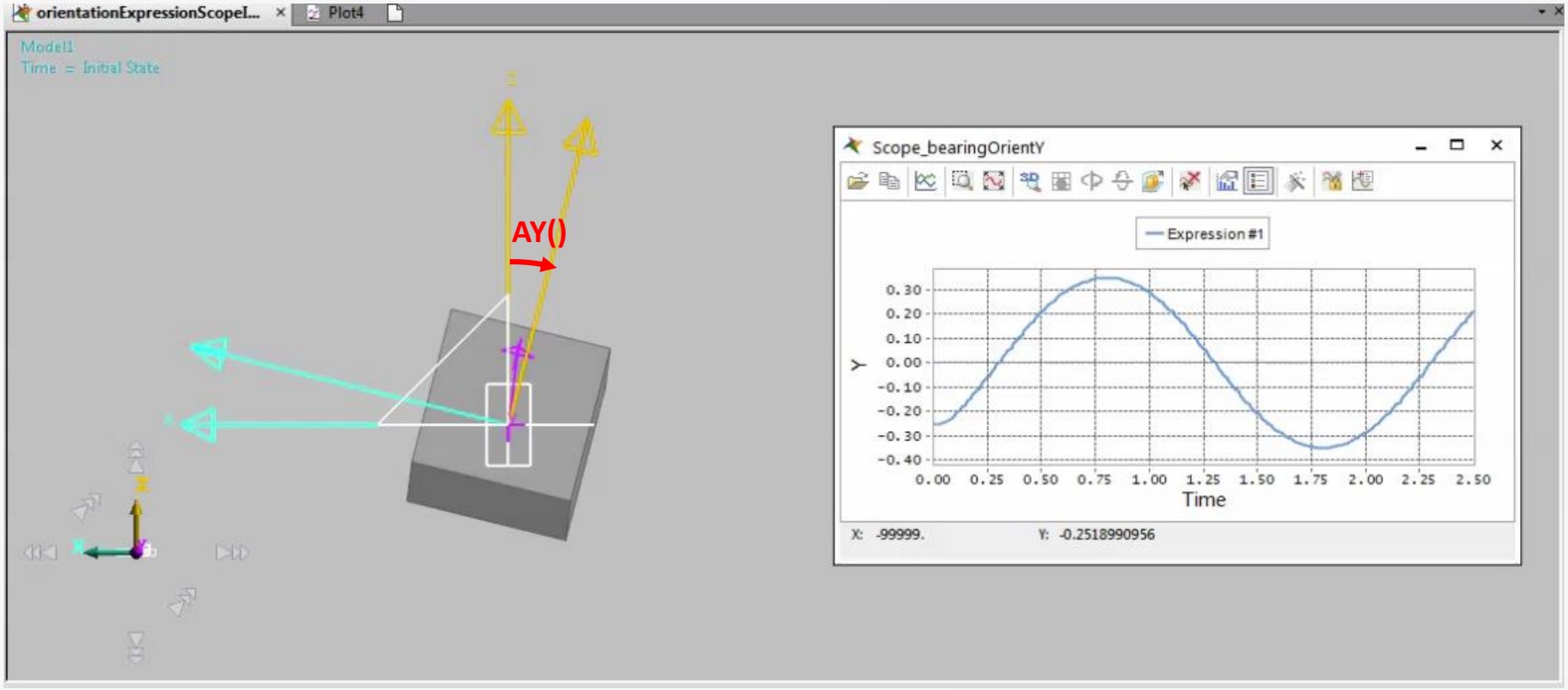
AX() Function



$$AX(\ ) = \tan^{-1}(-\hat{z}_1 \cdot \hat{y}_2, \hat{z}_1 \cdot \hat{z}_2)$$

→ AX() measures rotational deviation of Z-axis about X-axis.

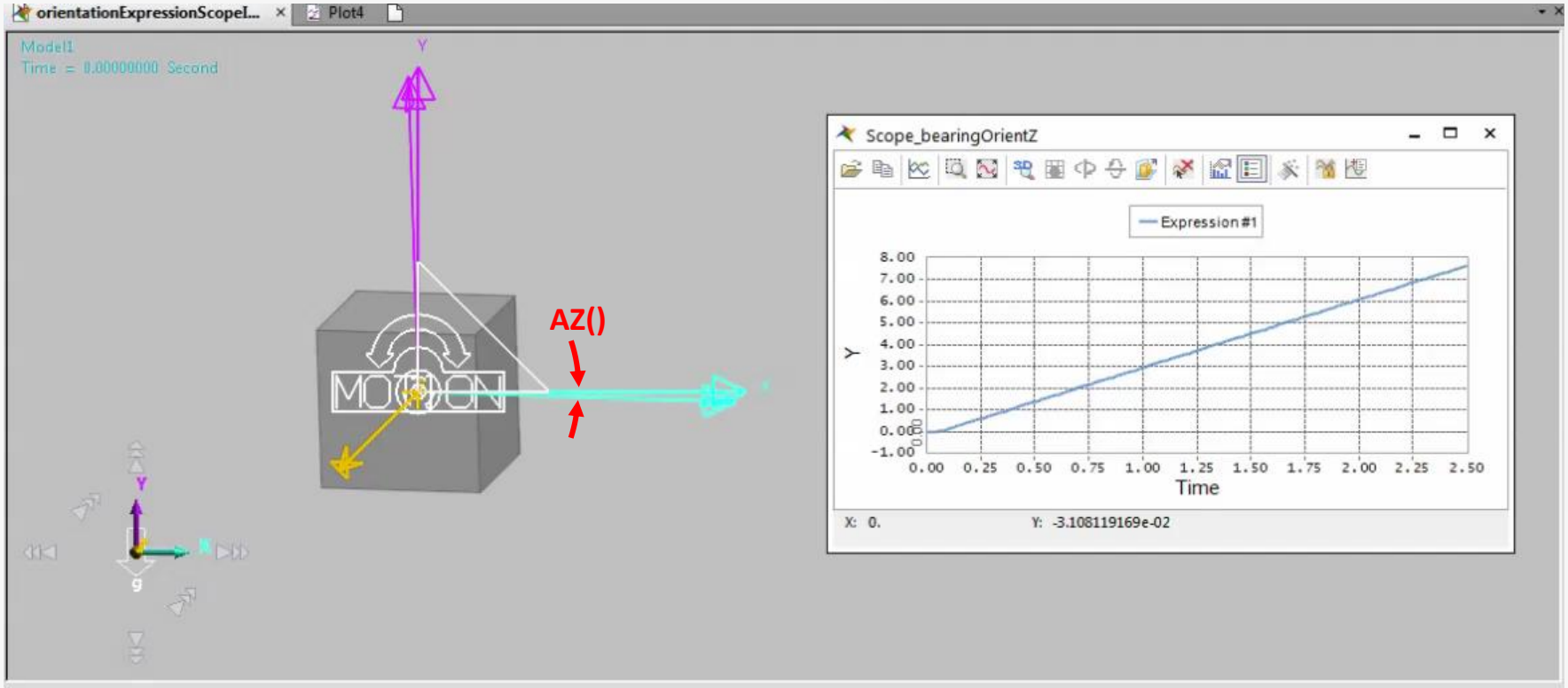
AY() Function



$$AY(\ ) = \tan^{-1}\left(\hat{z}_1 \cdot \hat{x}_2, \hat{z}_1 \cdot \hat{z}_2\right)$$

→ AY() measures rotational deviation of Z-axis about Y-axis.

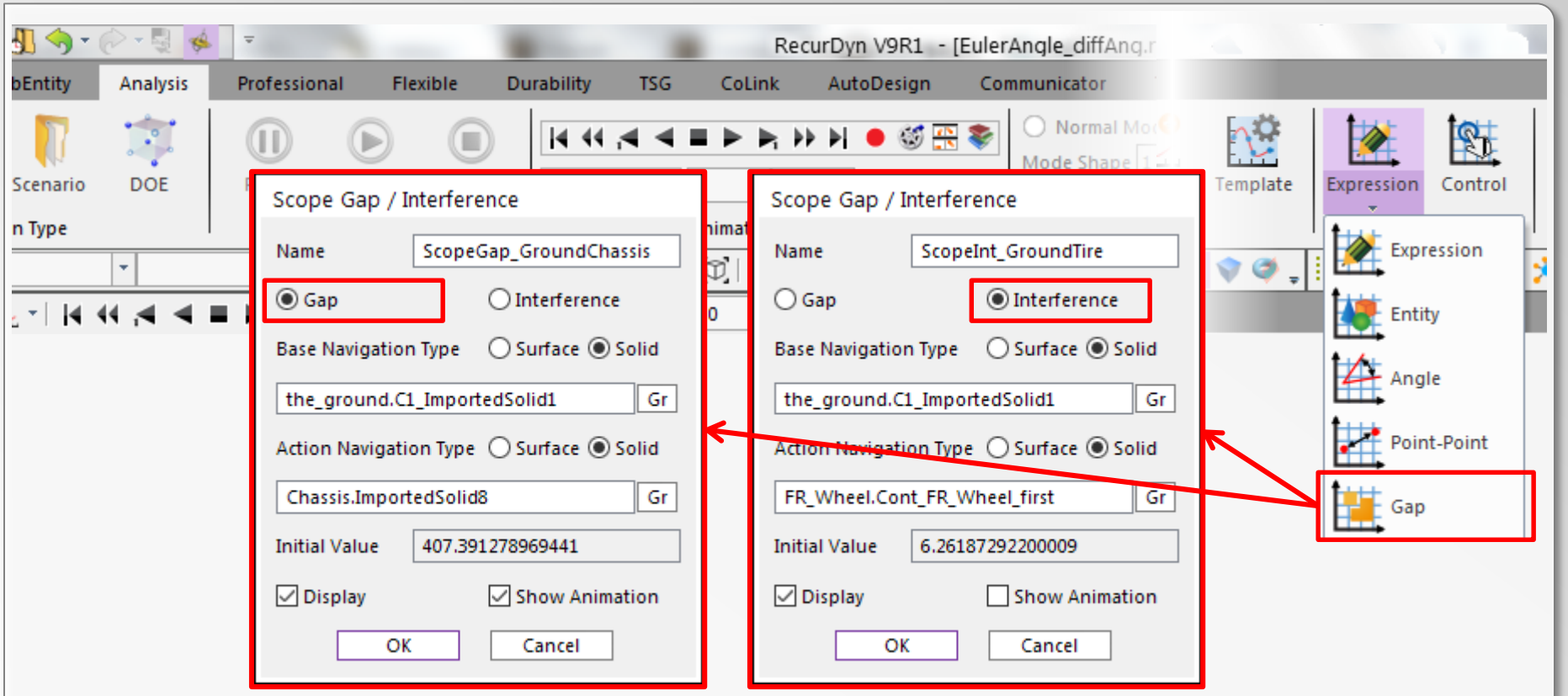
AZ() Function



$$AZ(\ ) = \tan^{-1}(\hat{x}_1 \cdot \hat{y}_2, \hat{x}_1 \cdot \hat{x}_2)$$

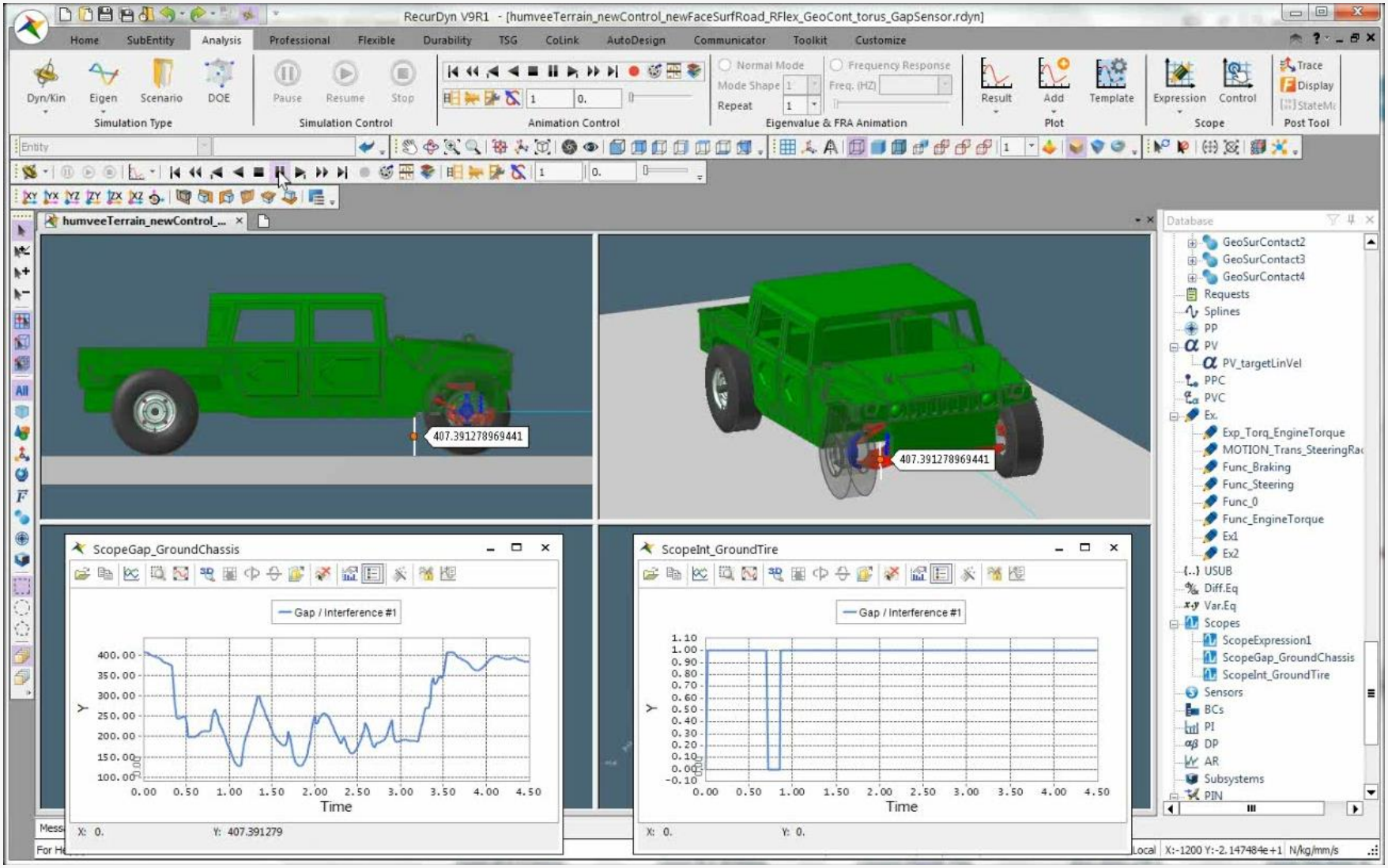
→ AZ() measures rotational deviation of X-axis about Z-axis.

Gap/Interference Scope

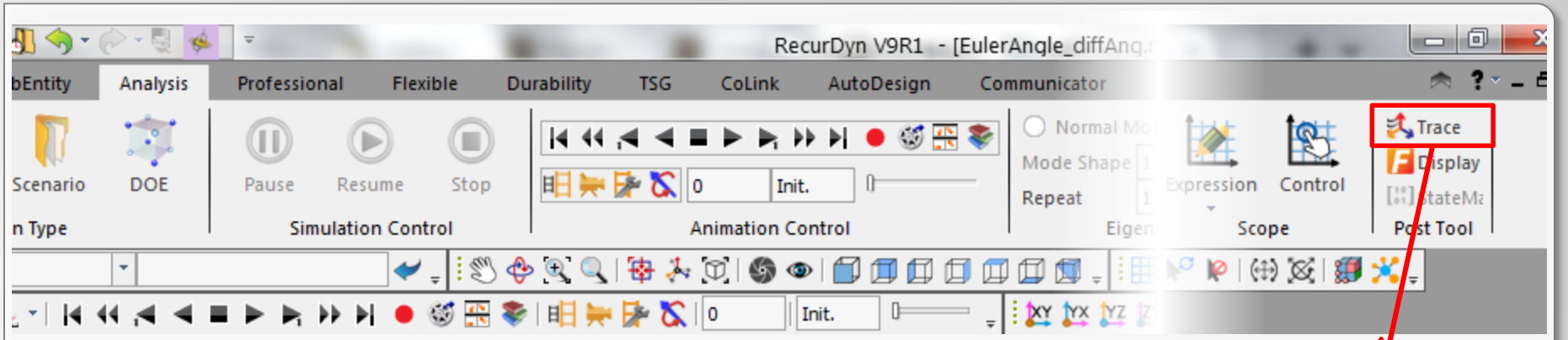


- **Gap Scope** measures minimum 3D distance between two geometries.
- **Interference Scope** displays whether two geometries are intersecting each other or not.

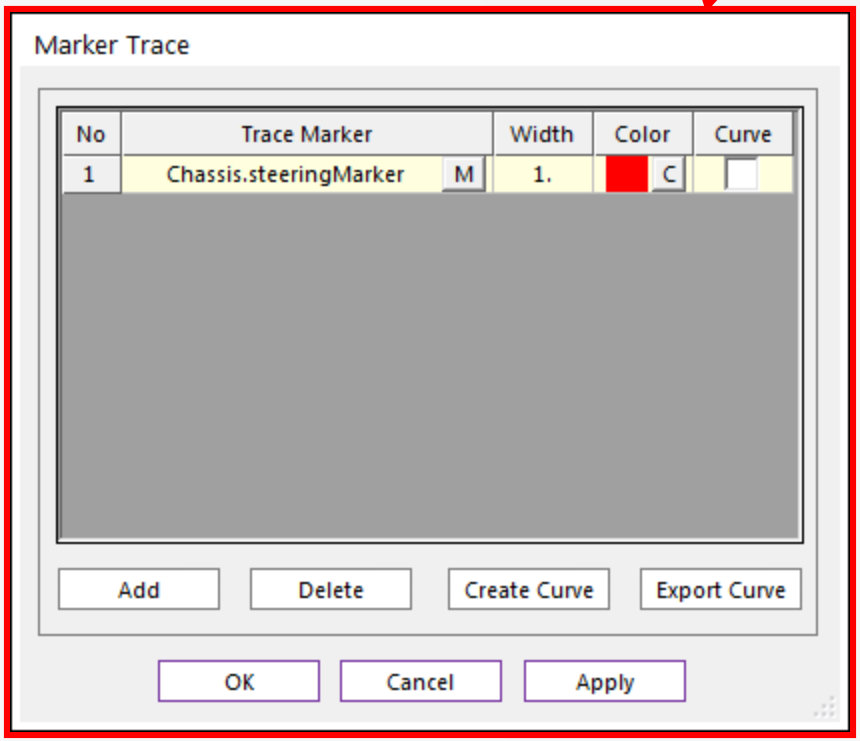
Gap/Interference Scope



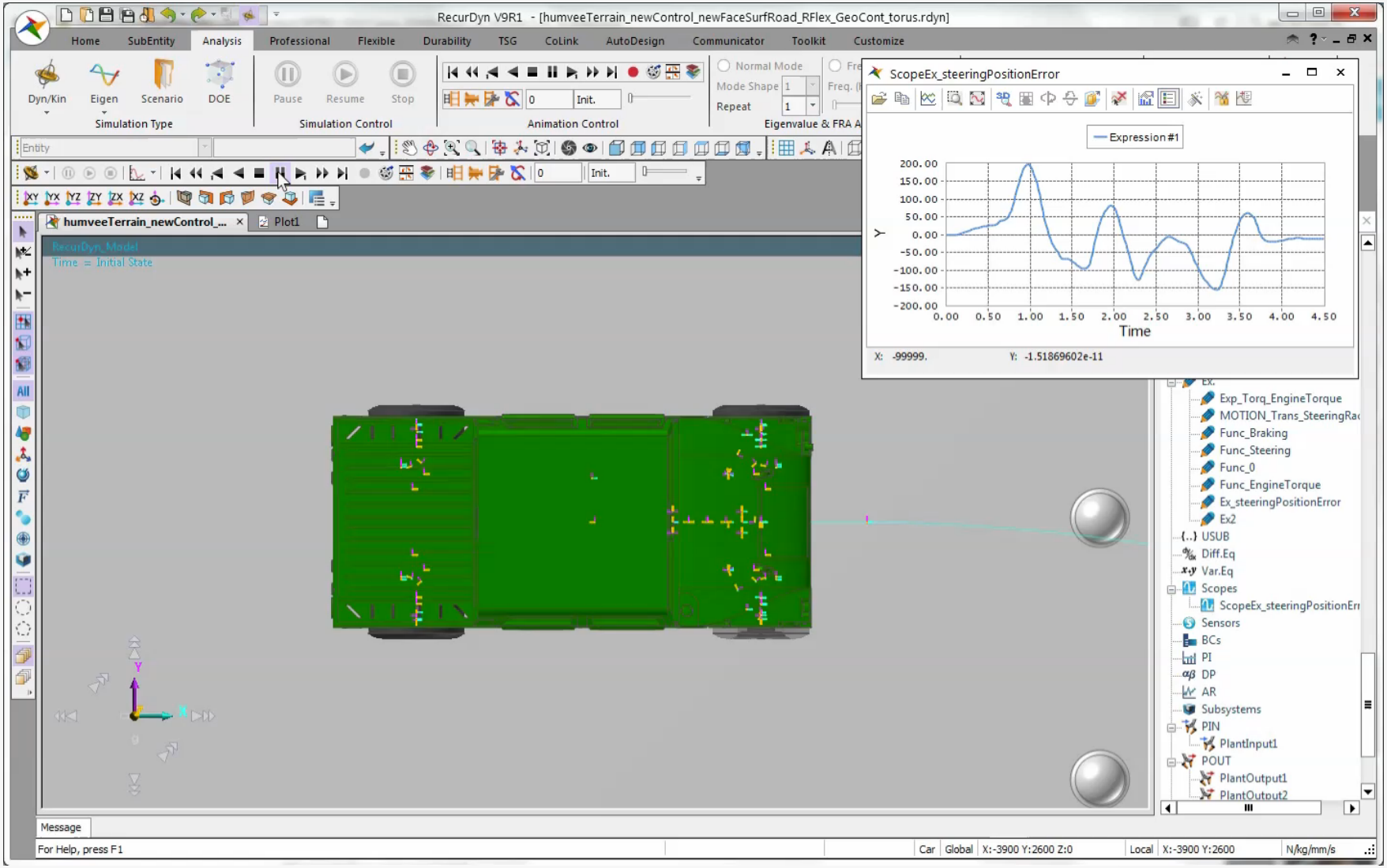
Marker Trace



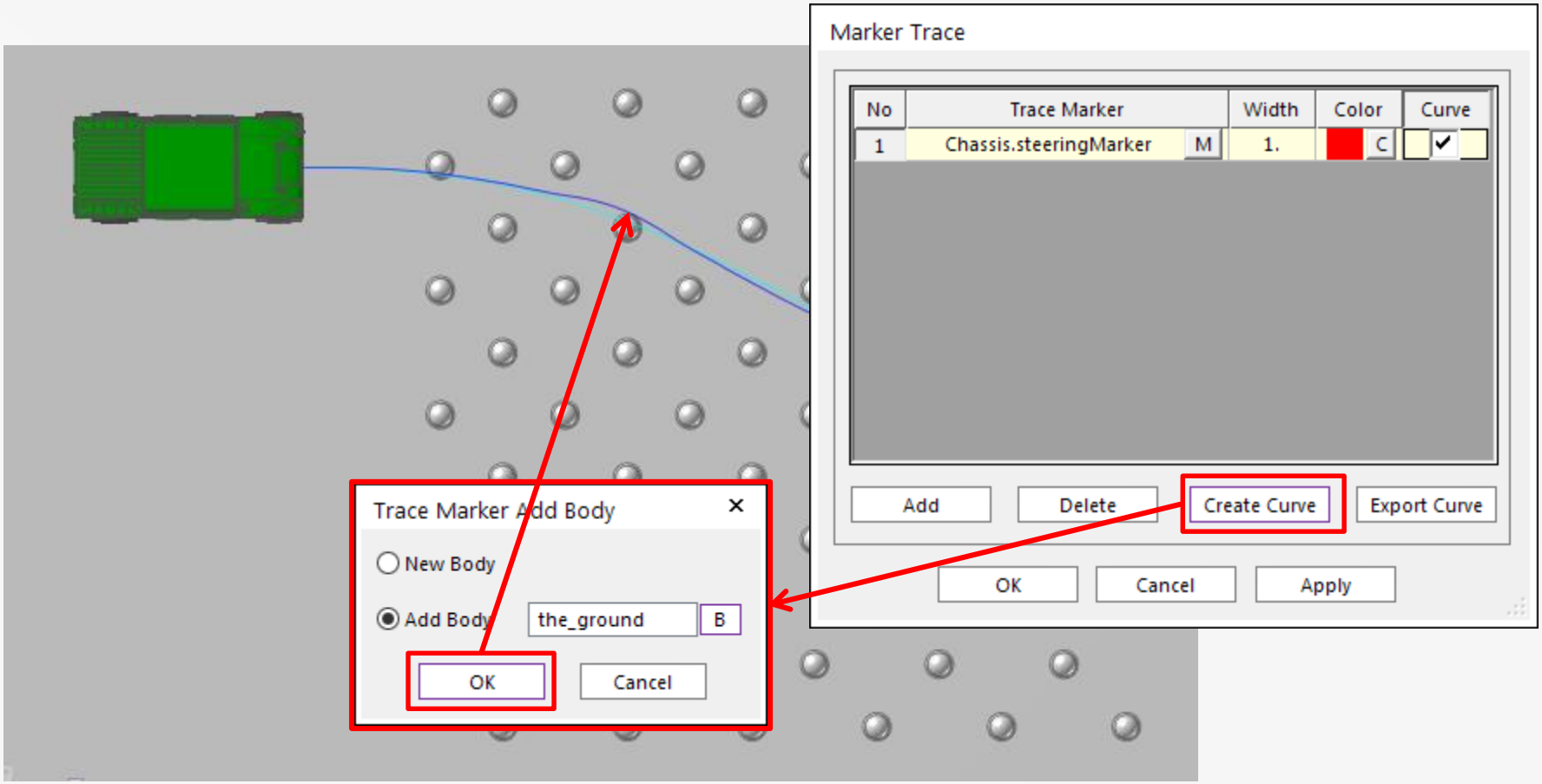
- Displays path that a marker goes through during the simulation.
- Helps to visualize path that bodies take.
- New for V9R1:
  - Create Curve
  - Export Curve



Marker Trace

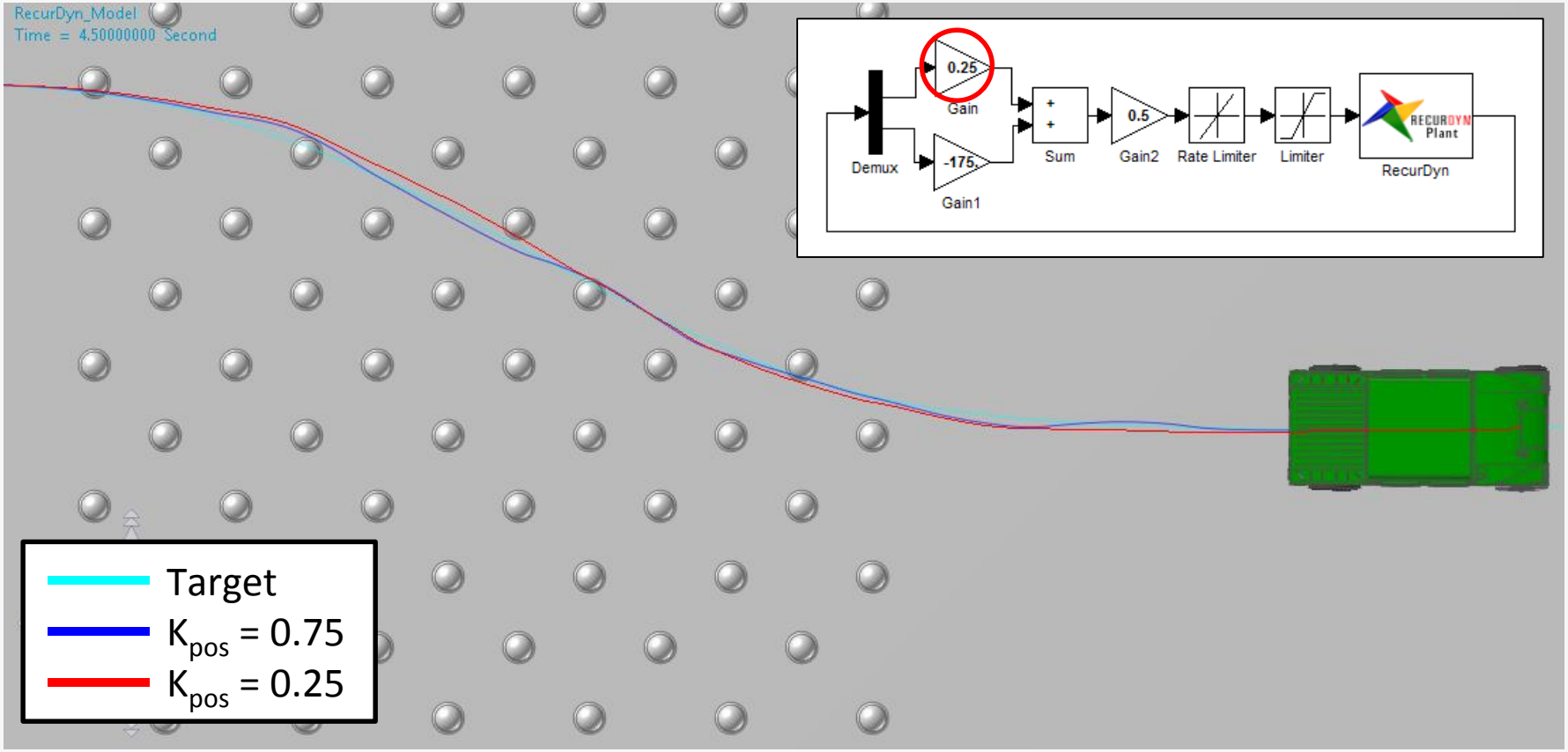


Marker Trace – Create Curve



- Can create curve on new or existing body.
- Can be used to compare results.

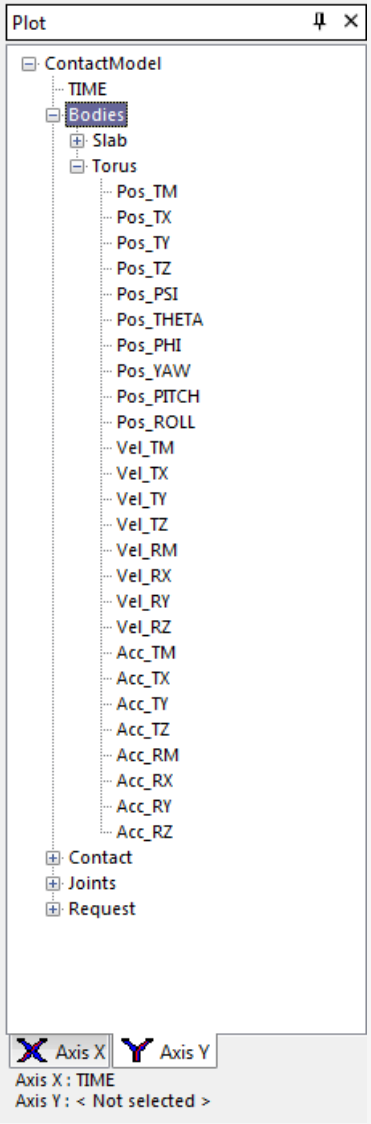
Marker Trace – Create Curve



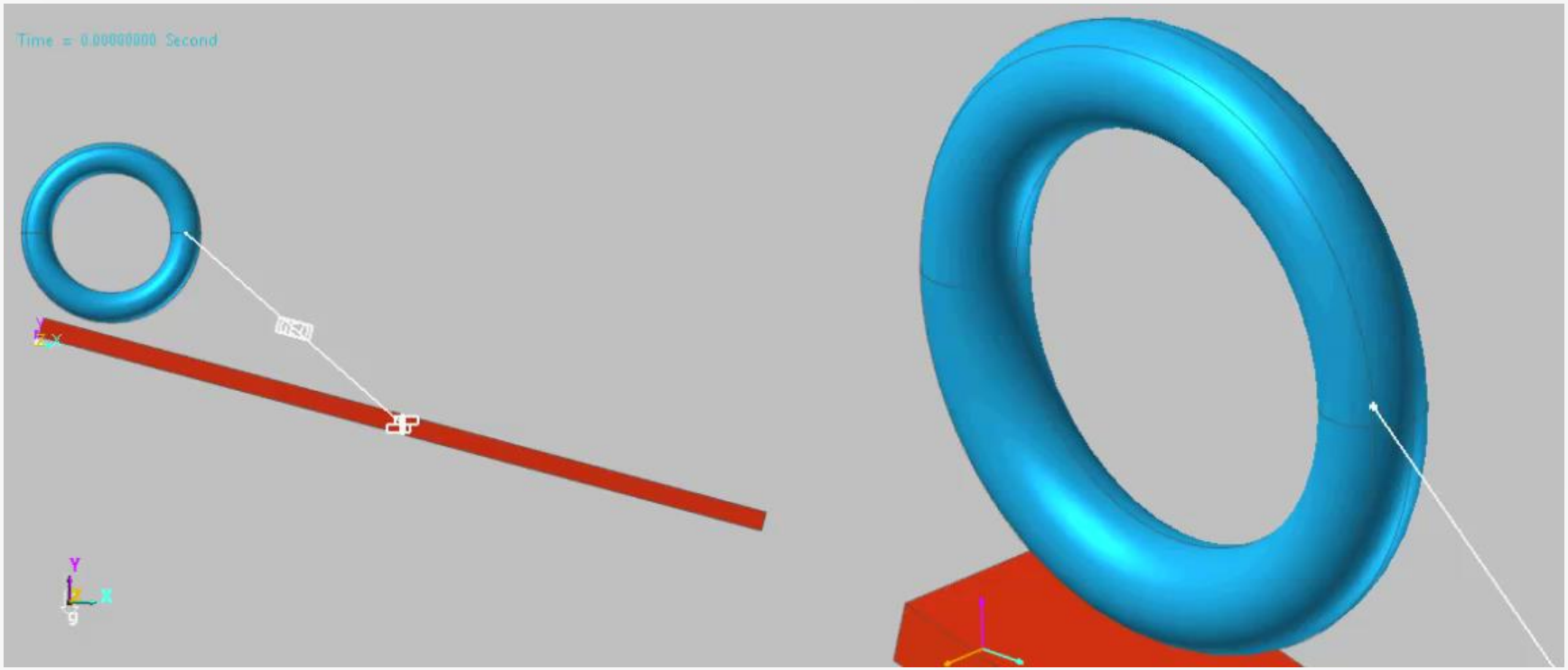
- Change made to model and model simulated again.
- In steering control system, reduced k_{pos} from 0.75 to 0.25.

Plot Output - Bodies

- Results in global reference frame.
- Rotational position results defined as described earlier (Pos_THETA, Pos_THETA, Pos_PHI, Pos_YAW, Pos_PITCH, Pos_ROLL).



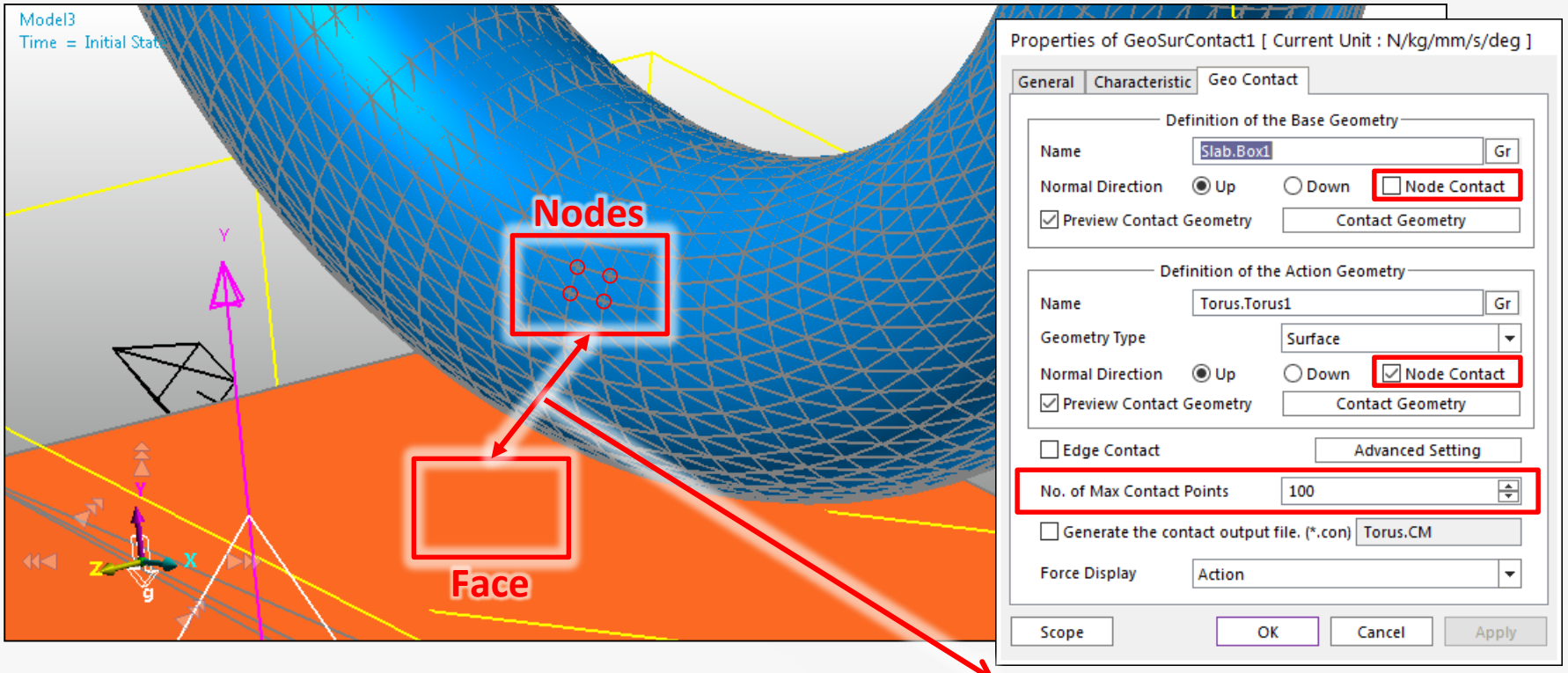
Plot Output - Geo Surface Contacts



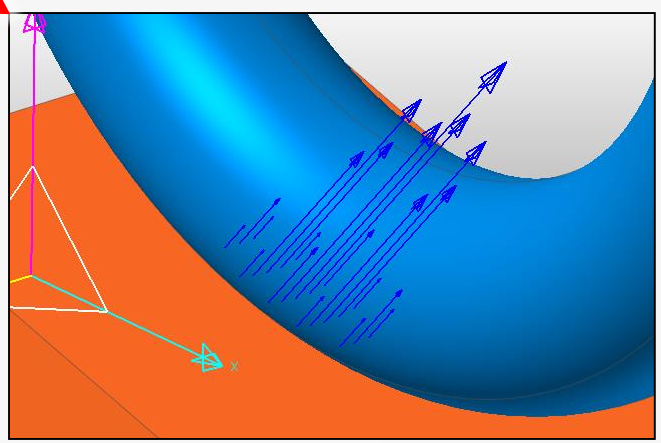
Sample model:

- Simple torus rolling down inclined slab.
- Geo Surface Contact used.

Plot Output - Geo Surface Contacts

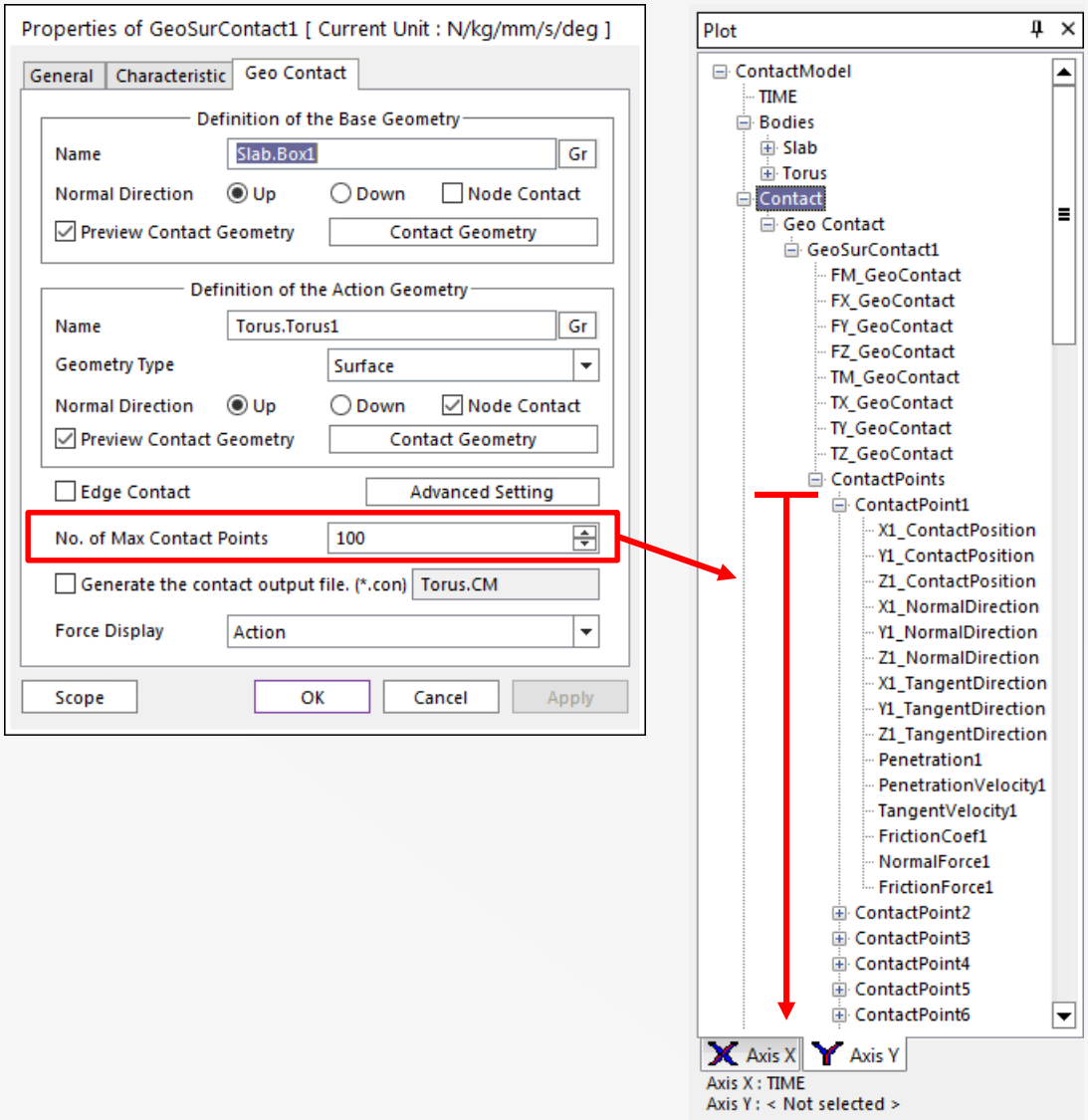


- Geo Surface Contacts based on Node-to-Face algorithm.
- Contact surfaces tessellated using triangular or rectangular patches.
- Nodes defined at corners of patches.
- Faces are the faces of patches.
- **Node Contact** option should only be selected for one body, whichever has more closely-spaced nodes.

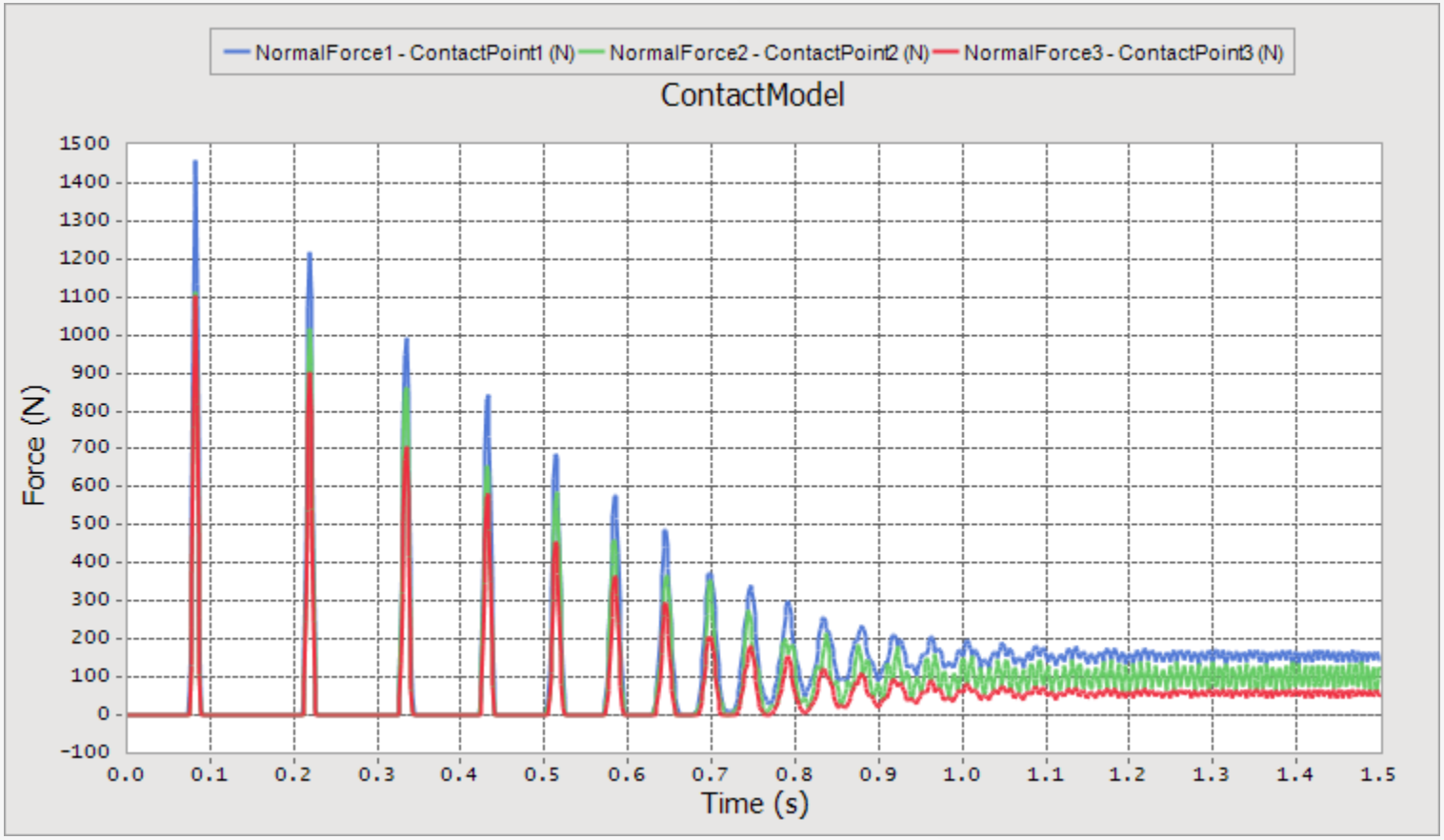


Plot Output - Geo Surface Contacts

- In Properties of Geo Surface Contact, **No. of Max Contact Points**:
  - Sets number of points output is generated for.
  - Does not affect contact behavior.
- Results are in global reference frame.
- Contact points ordered by normal force magnitude at any given time during the simulation.

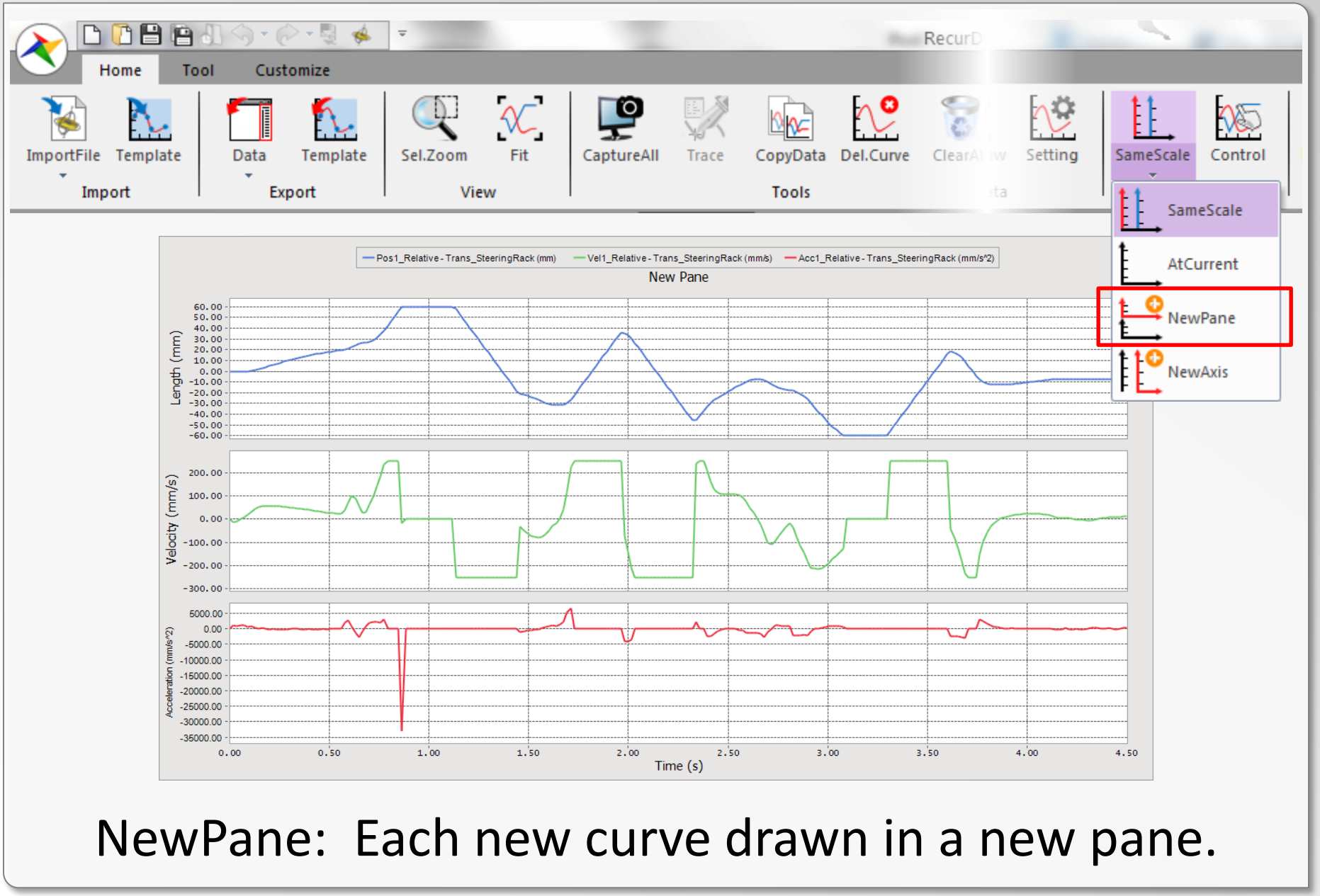


Plot Output - Geo Surface Contacts



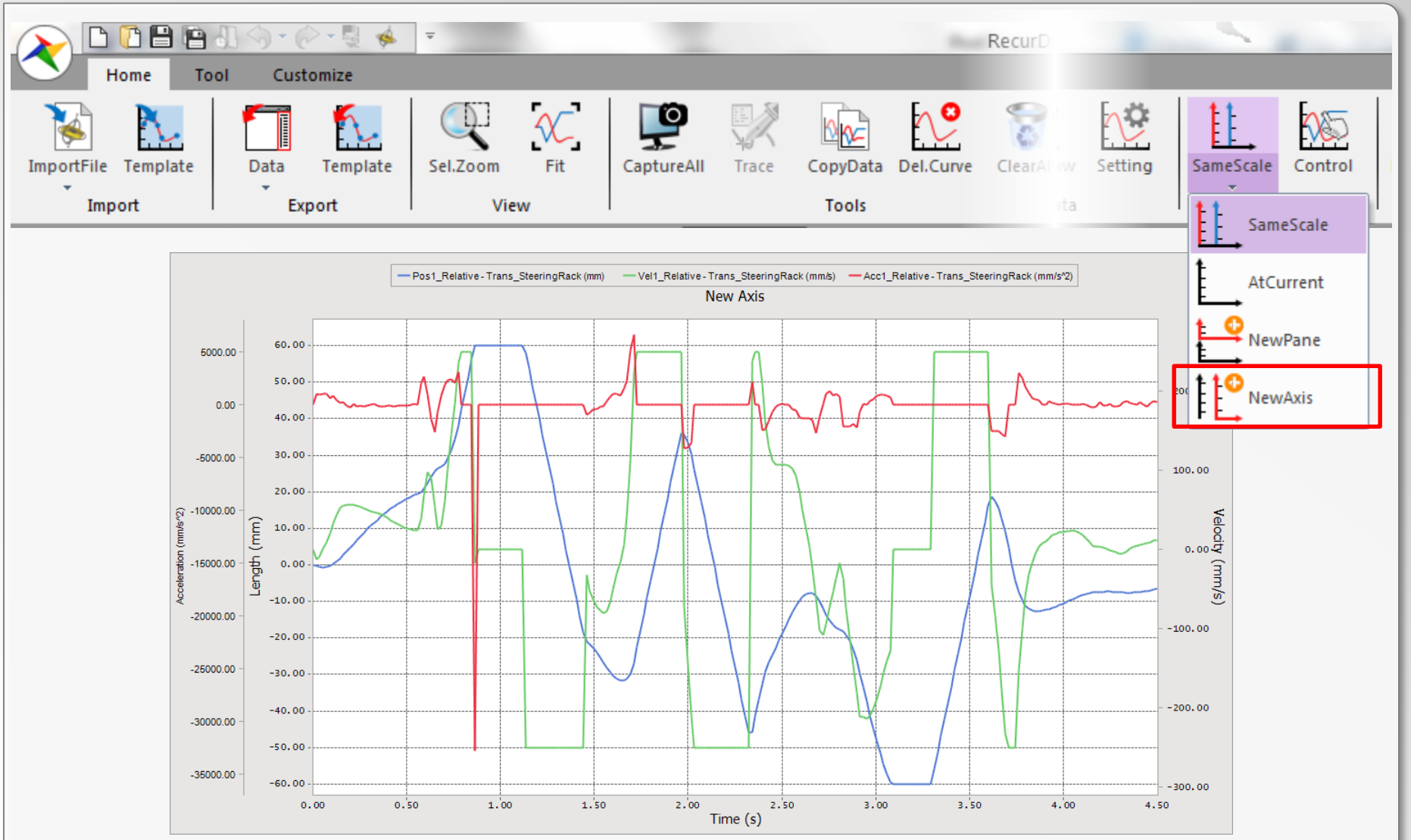
New for V9R1: Contact points ordered by normal force magnitude at any given time during the simulation.

Plot Output - Multi-Axis Control



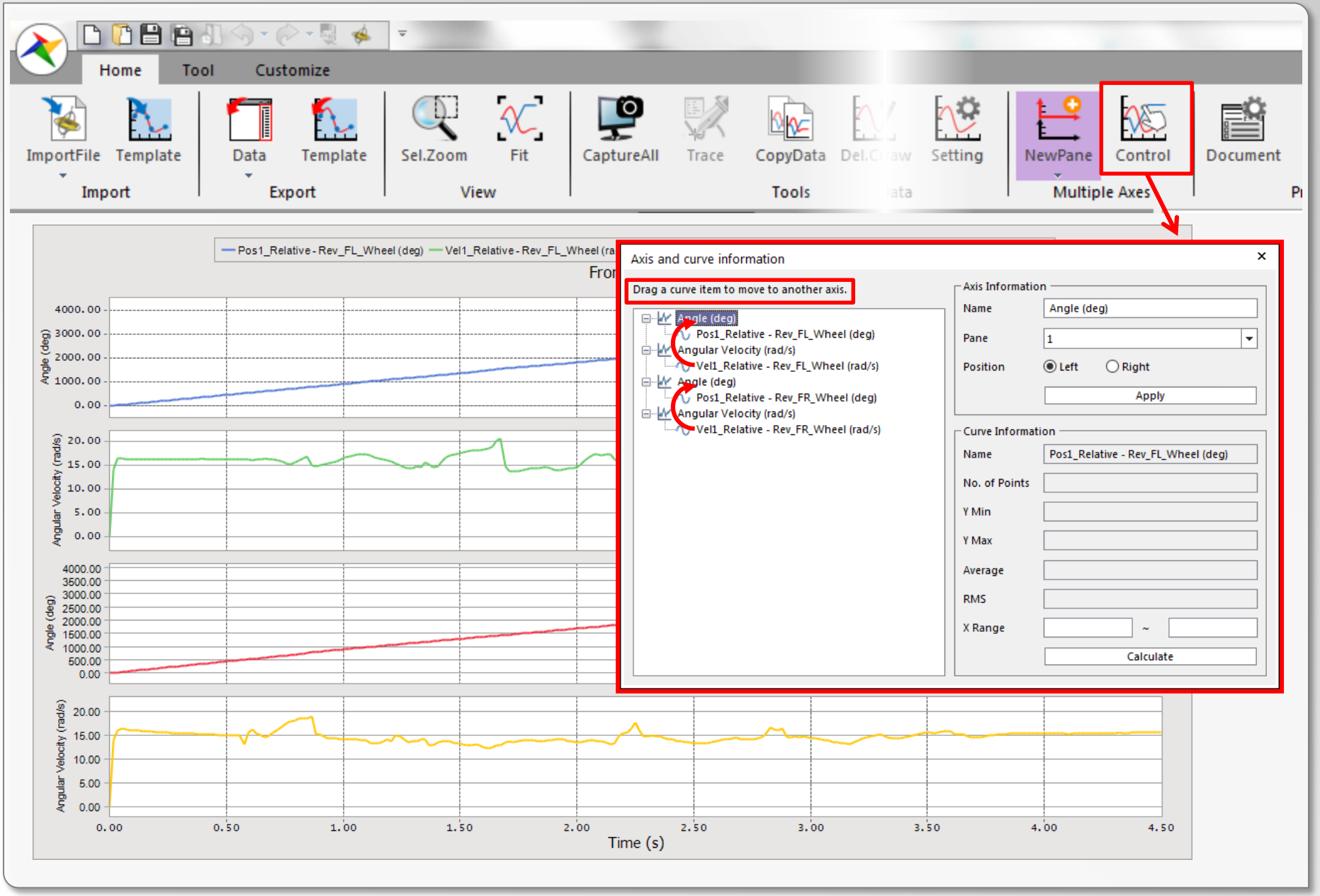
NewPane: Each new curve drawn in a new pane.

Plot Output - Multi-Axis Control

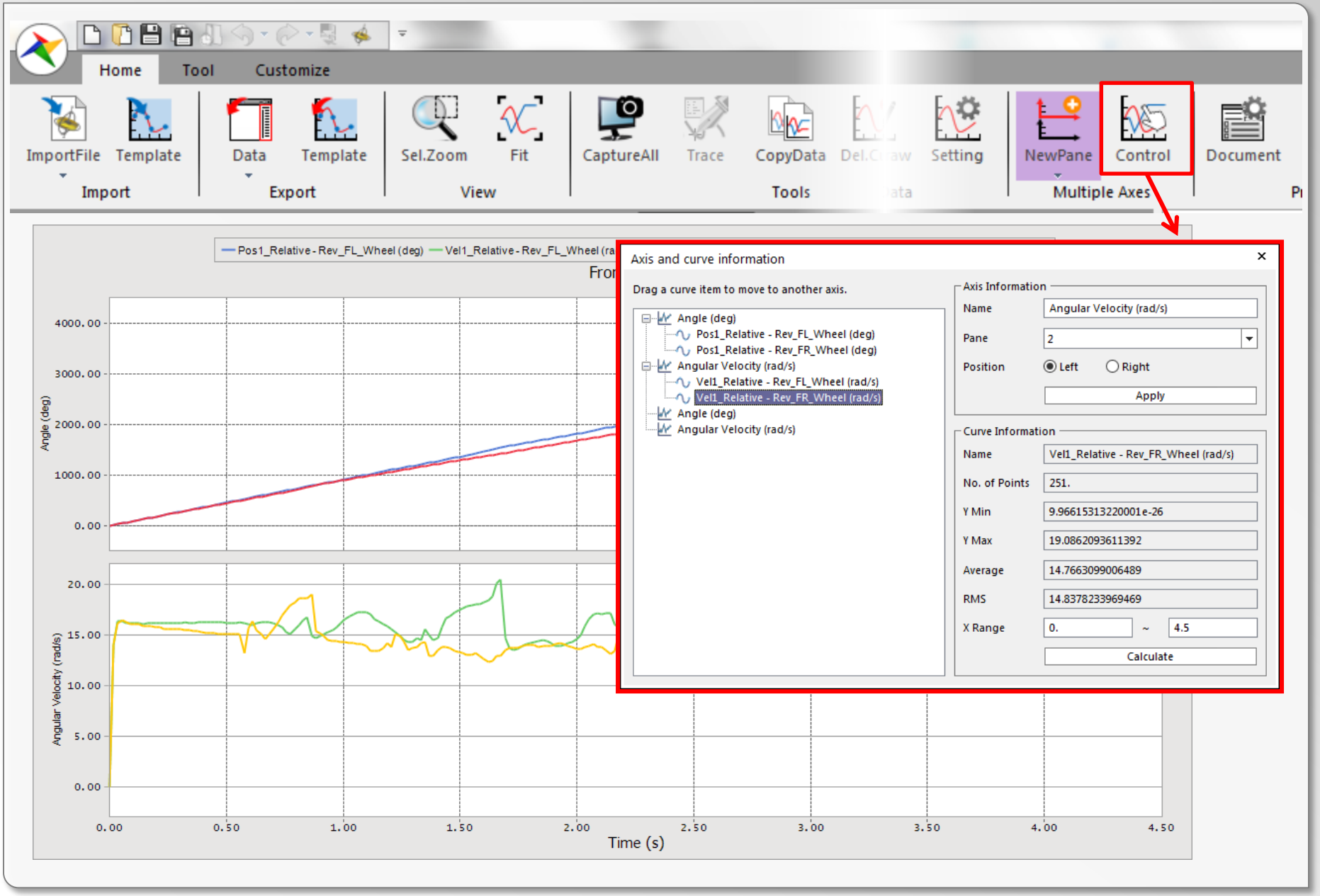


NewAxis: Each new curve drawn with a new axis.

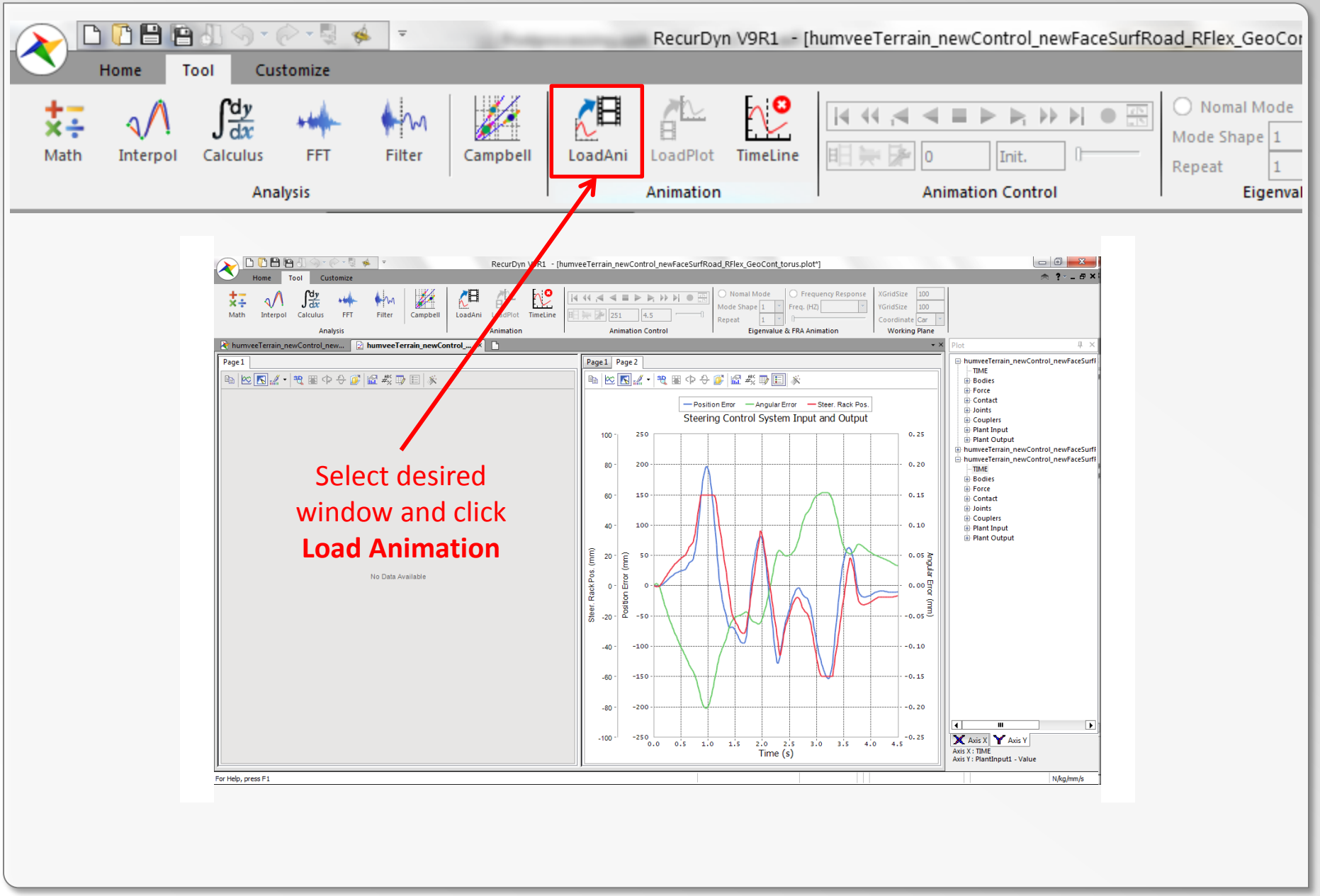
Plot: Multiple Axis Control



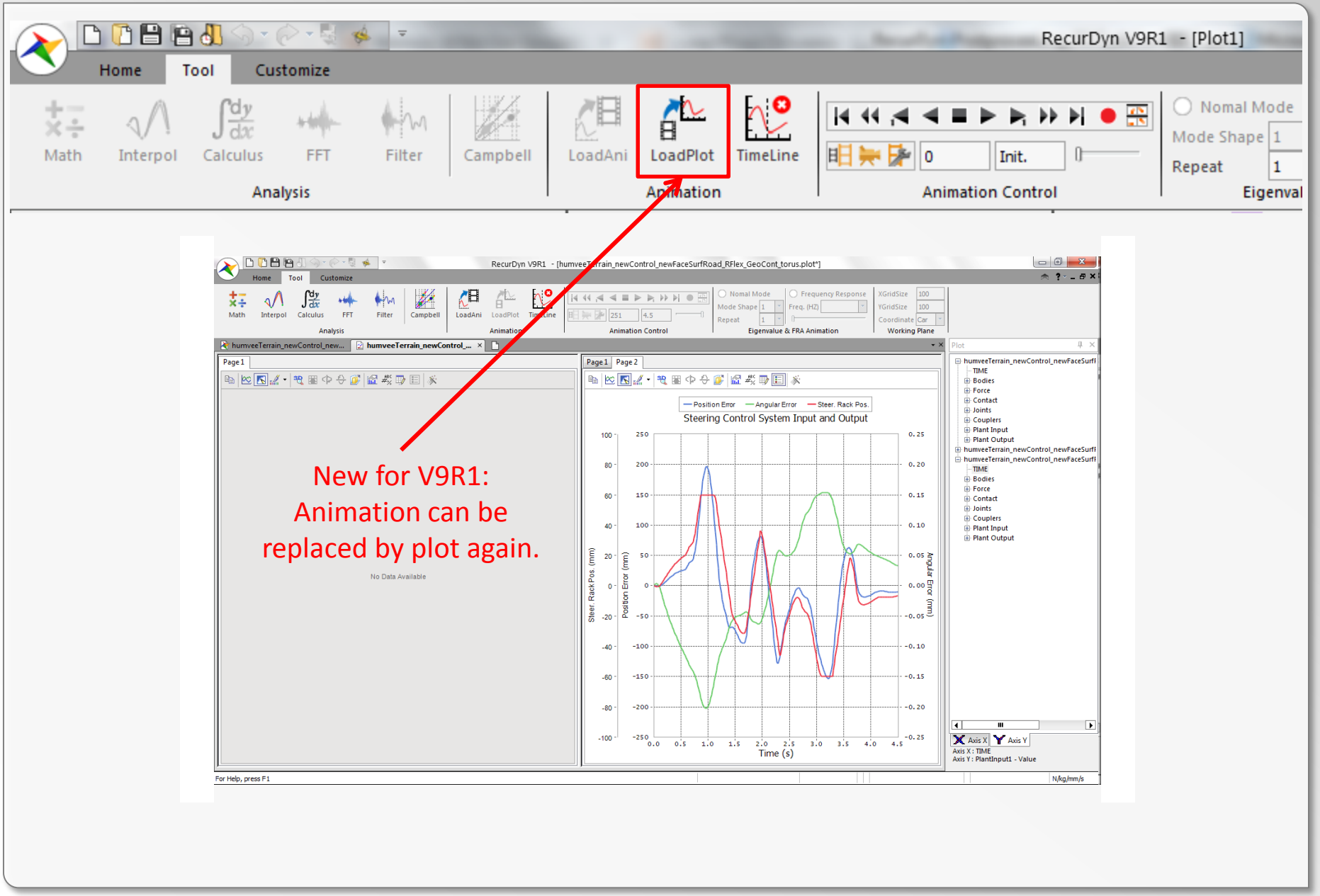
Plot: Multiple Axis Control



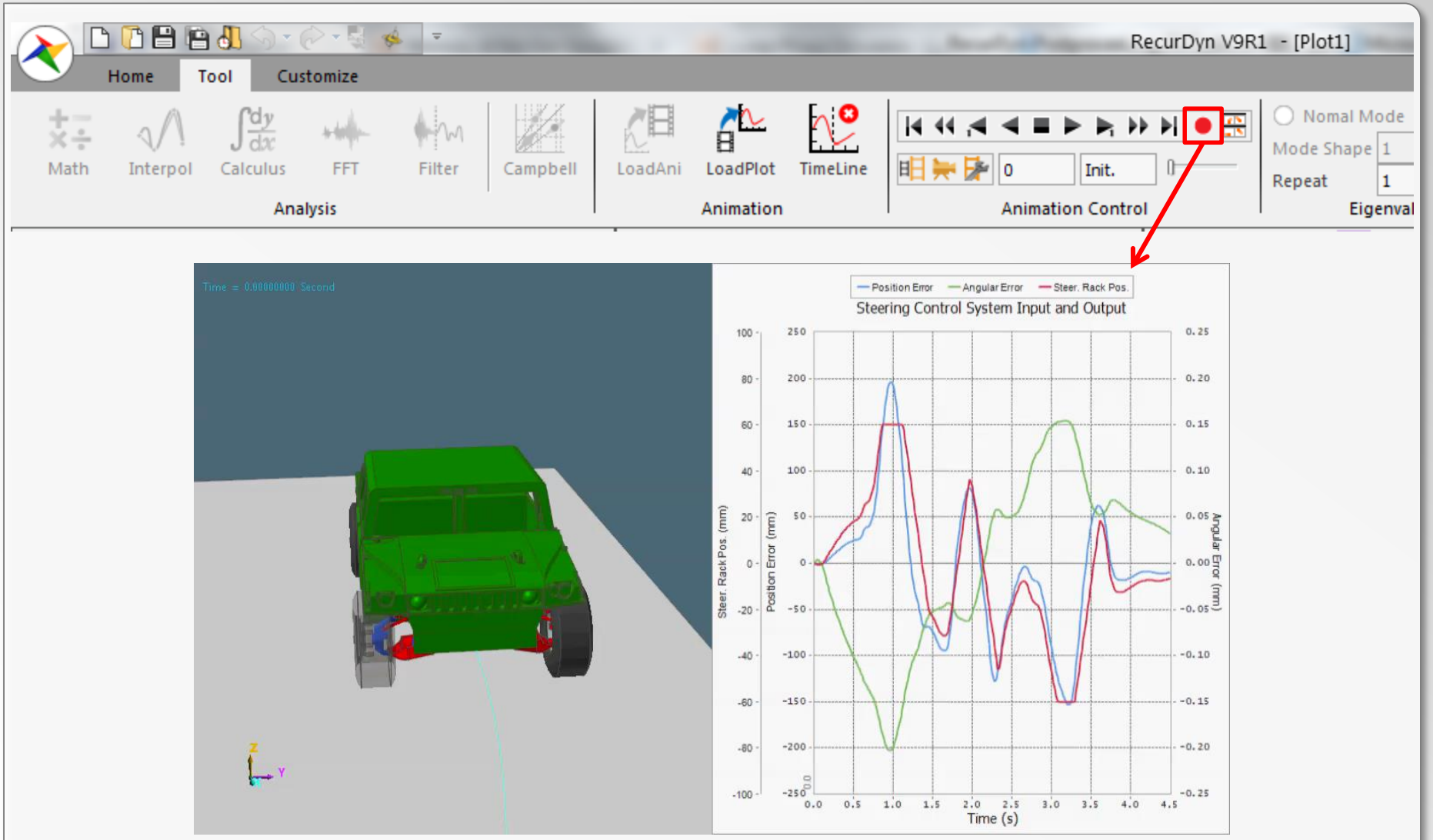
Plot with Animation



Plot with Animation



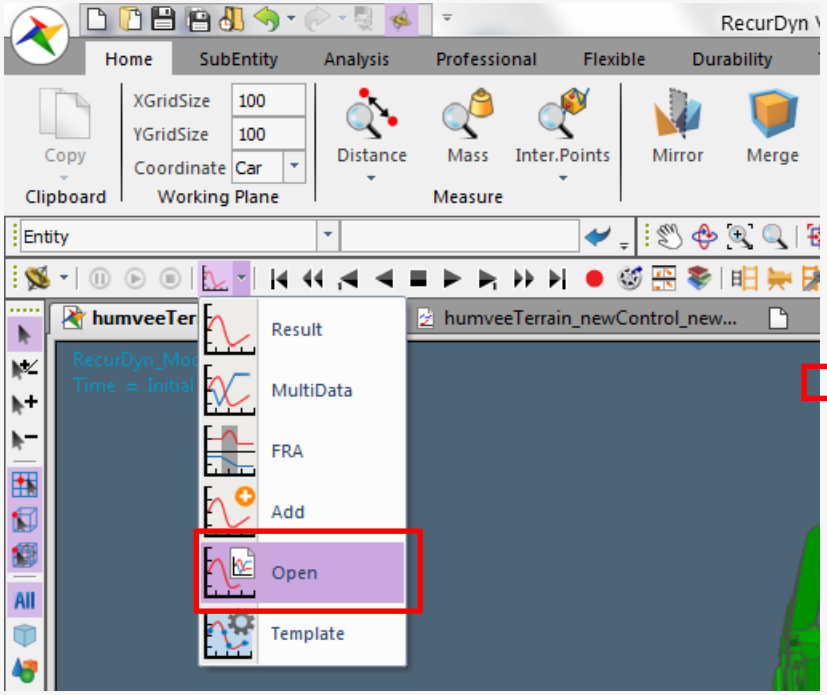
Plot with Animation: AVI Creation



Quality of AVIs higher than earlier versions of RecurDyn.

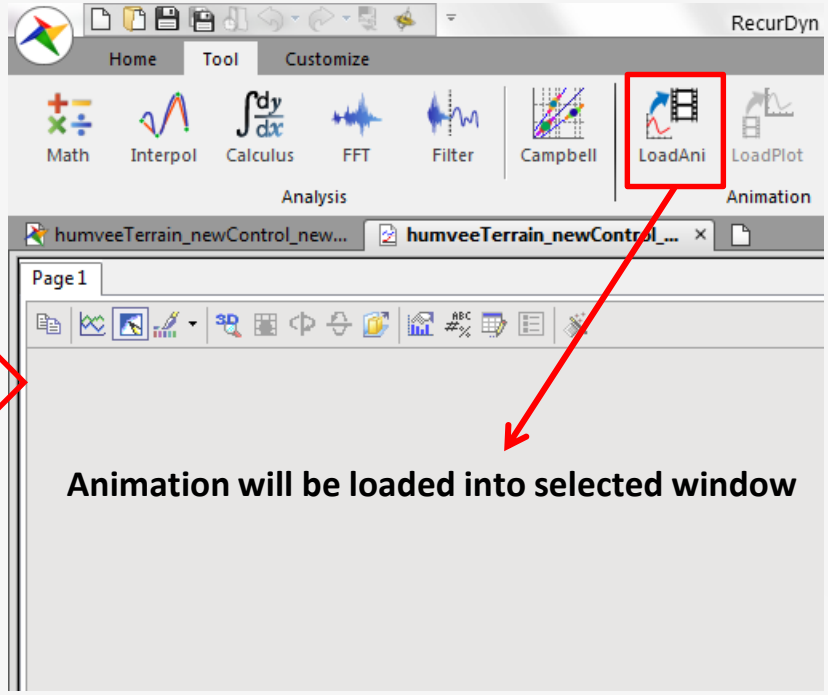
Reloading Animation into Existing Plot

Modeling Window with animation results loaded



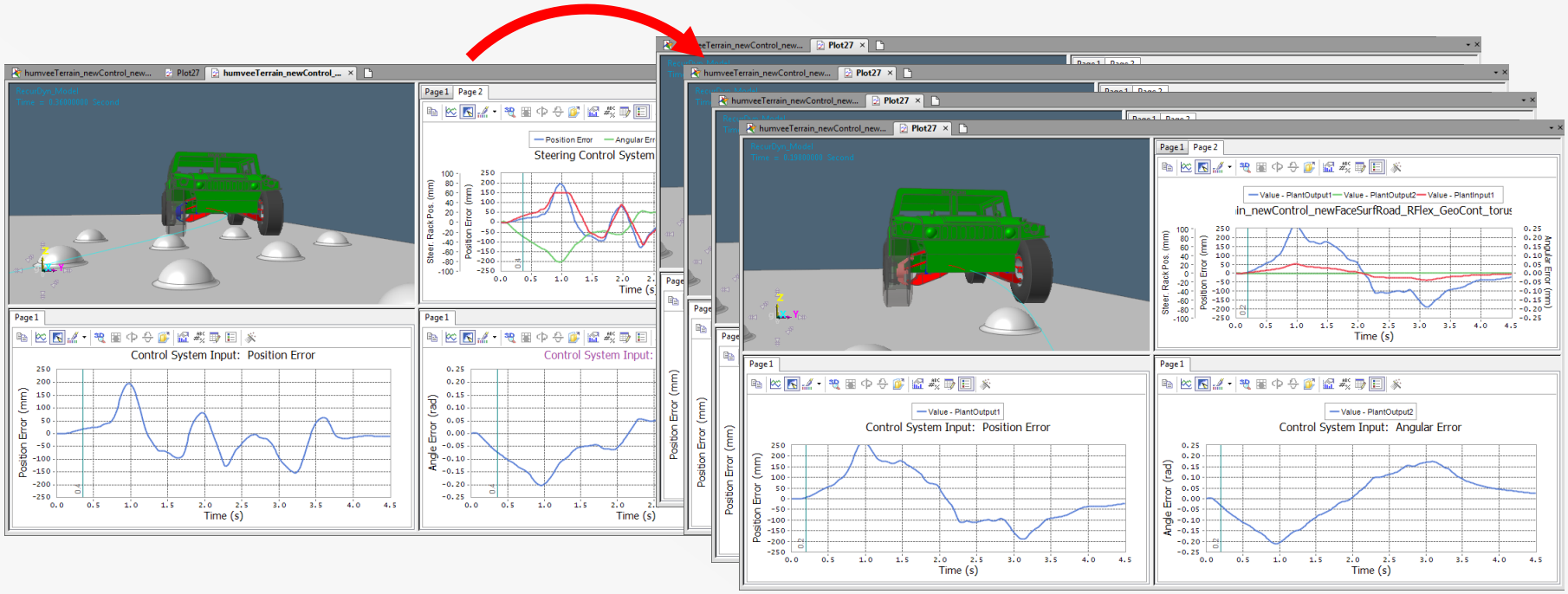
Select existing plot

In Plotting Window, click Load Animation.



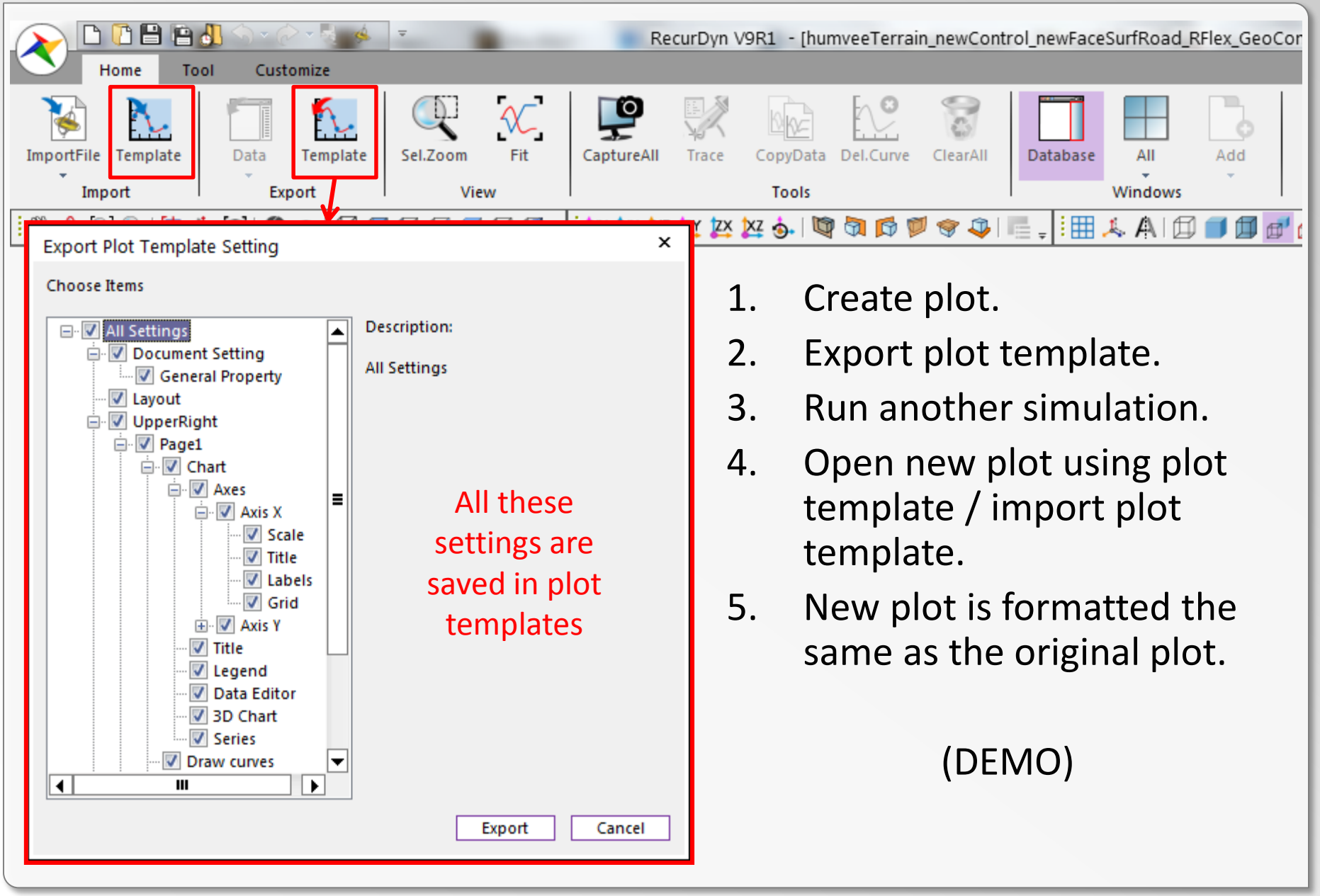
- In previous versions, after a plot with animation results is closed, the animation could no longer be associated with the animation file.
- In RecurDyn V9R1, the new Open Plot button now allows this.

Plot Templates



- Quick way to automate plot creation.
- Transfers many plot settings such as plot title, axis scale and title, window and page layout, imported animation, curve appearance, etc.
- Plot Template files are in XML format.

Plot Templates



1. Create plot.
2. Export plot template.
3. Run another simulation.
4. Open new plot using plot template / import plot template.
5. New plot is formatted the same as the original plot.

(DEMO)

Conclusion

Thank You!
Questions?