

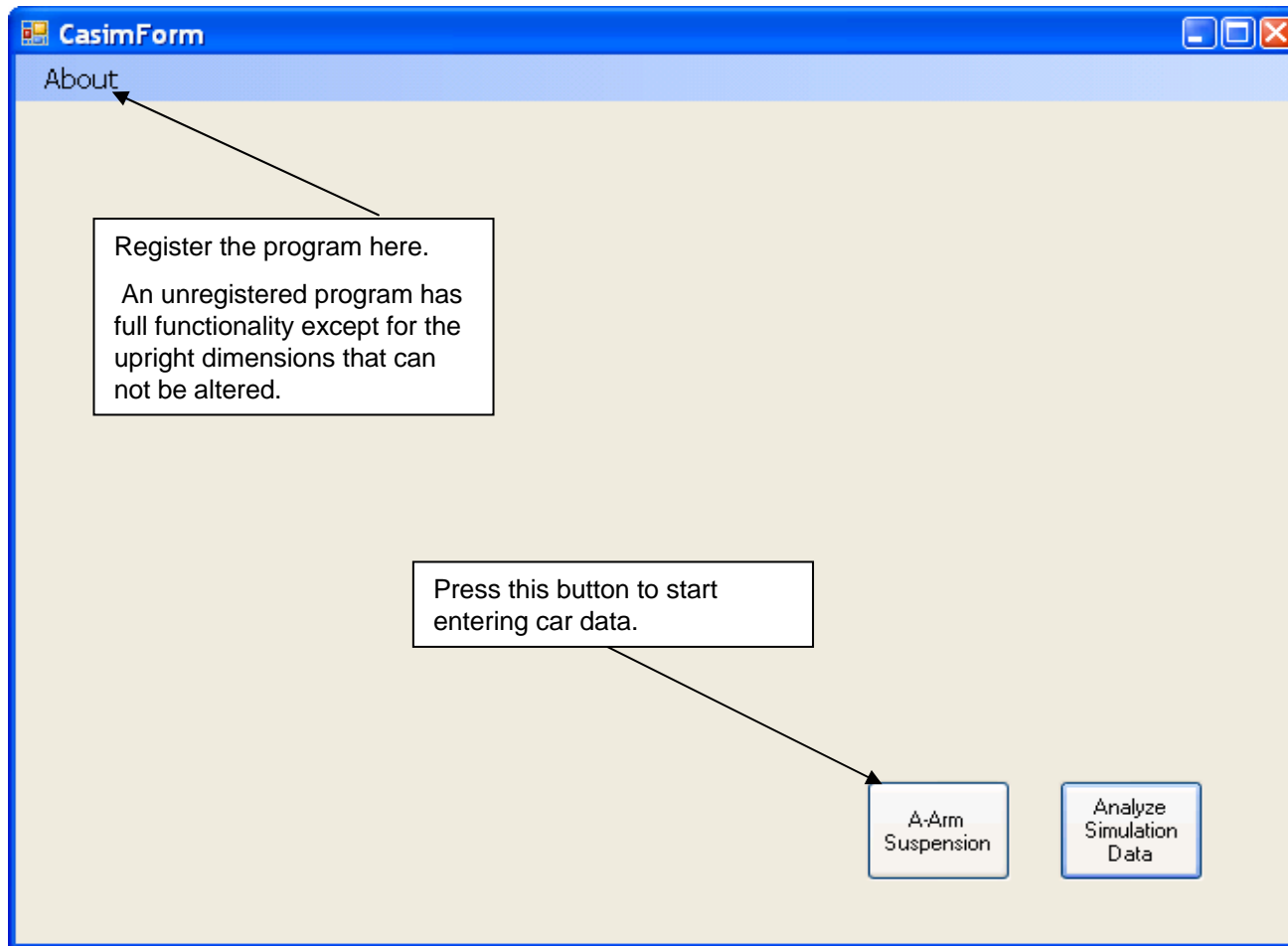
CASIM

KNOWN BUGS

- No real check if dimensions of the suspension is reasonable with regards to the movements.
I.E Program may hang if movements are not limited enough so that solid suspension details would have to "stretch".
- Program may crash or hang for unexpected input. Some checking is done. Use reasonable dimensions.
- Screen update is slow (it sucks, but on the other hand it is not an arcade game)
- No caster setting causes dimensions for upright to be slightly wrong during calculations.

BRIEF DESCRIPTION OF THE PROGRAM

STEP 1: REGISTRATION MAIN WINDOW



STEP 2.1: SETUP CAR DATA

"SETUP CAR" TAB

Car and Upright data is measured and entered here. See measurement instructions later in this document.

Data entered here limits the car movement.

The angle of the Car will not exceed the *Max Roll* angle.

The Lower A-Arm mounts will never go above or below the *Max Bump* or *Max Droop* distance

This setting has priority over any other movement limit setting in simulations or animations.

Parameter	Value
Car Name	DefaultCar
Upper A-Arm X	297
Upper A-Arm Y	350
Lower A-Arm X	209
Lower A-Arm Y	160
Camber @ Ride Height	-2.0
Wheel Diameter	520
Wheel Width	100
Wheel Offset	20
Track Width	1060

Parameter	Value
Upright Name	DefaultUpright
Upright Upper X Offset	100
Upright Upper Y Offset	100
Upright Lower X Offset	100
Upright Lower Y Offset	100

Parameter	Value
Max Bump	50
Max Droop	50
Max Roll	5.0

Parameter	Value
Roll Centre X	0
Roll Centre Y	31.46
Scrub Radius	80.05

STEP 2.2: ROLL CENTRE "SETUP CAR" TAB

The screenshot displays the 'Casim' software interface, specifically the 'Setup Car' tab. The left-hand panel contains several sections of adjustable parameters:

- Car**
 - Car Name: DefaultCar
 - Upper A-Arm X: 297
 - Upper A-Arm Y: 350
 - Lower A-Arm X: 209
 - Lower A-Arm Y: 160
 - Camber @ Ride Height: -2.0
 - Wheel Diameter: 520
 - Wheel Width: 100
 - Wheel Offset: 20
 - Track Width: 1060
- Upright**
 - Upright Name: DefaultUpright
 - Upright Upper X Offset: 100
 - Upright Upper Y Offset: 100
 - Upright Lower X Offset: 100
 - Upright Lower Y Offset: 100
- Car Movement Limits**
 - Max Bump: 50
 - Max Droop: 50
 - Max Roll: 5.0

The central diagram shows a top-down view of a car chassis with a roll centre point indicated by a vertical line and a horizontal line. A callout box points to the roll centre position with the text: "Roll Centre position is shown here as an X".

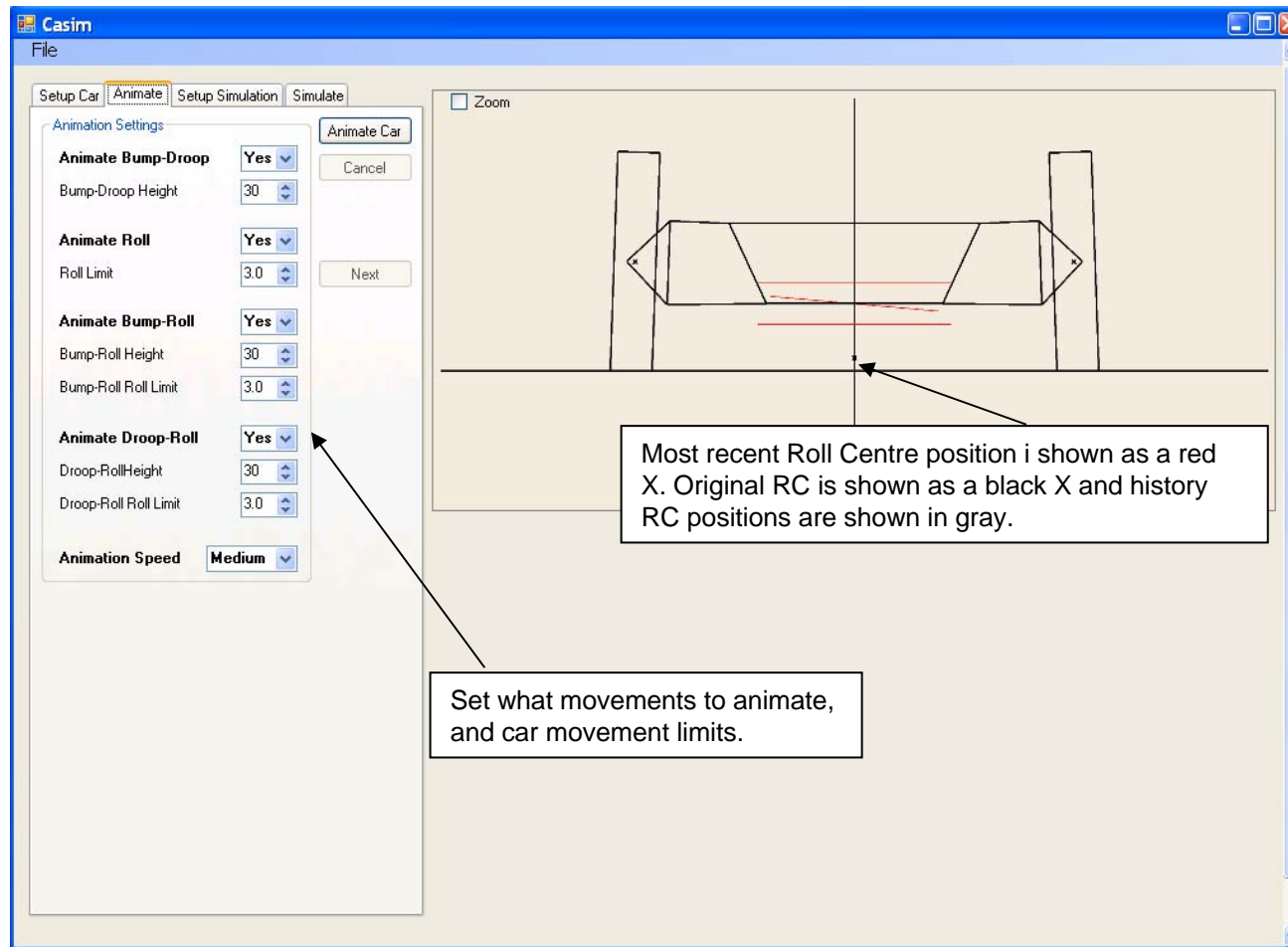
Below the diagram, the following parameters are listed:

- Roll Centre X : 0
- Roll Centre Y : 31.46
- Scrub Radius : 80.05

At the top of the diagram area, there are three checkboxes: Zoom, Show Roll Centre Help Lines, and Show Scrub Radius Help Lines.

STEP 3: ANIMATE CAR

"ANIMATE" TAB



STEP 4.1: SIMULATE CAR "SETUP SIMULATION" TAB

The program simulates car movements for different mounting positions of the A-Arms to the chassis.

For each position the max left and right Camber angles, max Vertical and Horizontal Roll Centre positions, and max Track Width change are recorded.

Upper A-Arm Chassis Mounting
 Max Y: 355
 Min X: 292 Max X: 302
 Min Y: 345

Lower A-Arm Chassis Mounting
 Max Y: 165
 Min X: 204 Max X: 214
 Min Y: 155

Simulation Settings

- Simulate Bump-Droop** Yes
- Bump-Droop Height: 30
- Simulate Roll** Yes
- Roll Limit: 3.0
- Simulate Bump-Roll** Yes
- Bump-Roll Height: 30
- Bump-Roll Roll Limit: 3.0
- Simulate Droop-Roll** Yes
- Droop-Roll Height: 30
- Droop-Roll Roll Limit: 3.0
- Simulation Precision** Medium

Enter restrictions to where mounting positions may be placed.
 Restrictions are indicated in yellow.

Set what movements to simulate, and car movement limits.

Set simulation precision.

High: Simulates A-Arm mounting positions every 1 mm. With a large amount of small movements around Roll Centre per position.

Medium: Simulates A-Arm mounting positions every 1 mm. With a medium amount of small movements around Roll Centre per position.

Low: Simulates A-Arm mounting positions every 5 mm. With a medium amount of small movements around Roll Centre per position.

Simulations are time consuming (often several hours on a 2Ghz P4). High is slowest and Low fastest. To use Low first and then Medium for a small area of interest would seem like a good approach.

STEP 4.2: SIMULATE CAR

"SIMULATE" TAB

When the simulation result is saved.
Close this window.

File

Setup Car Animate Setup Simulation **Simulate**

Simulation Result Limits

Limit Left Wheel Camber Yes

Max Pos Camber Change 5

Max Neg Camber Change 5

Limit Right Wheel Camber Yes

Max Pos Camber Change 5

Max Neg Camber Change 5

Limit Horizontal RC Yes

Max RC Change X 100

Limit Vertical RC Yes

Max RC Change Y 100

Limit TrackWidth Change Yes

Max Track Width Change 100

Zoom

Simulate

Cancel

This Button starts the simulation. After the simulation is finished you will be prompted to save the result to a file.

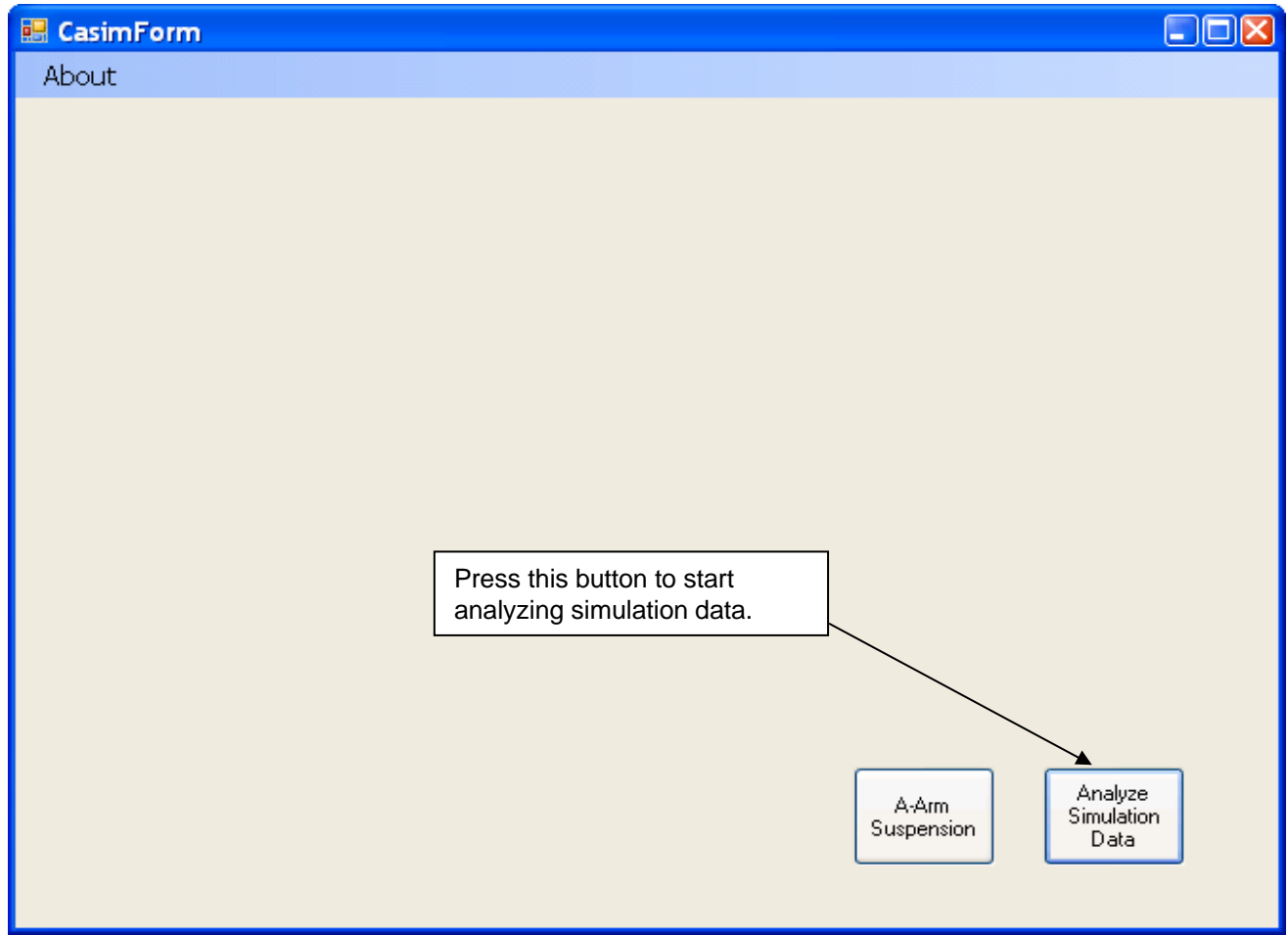
When the result is saved .

It is possible to restrict the amount of data that is saved from a simulation.

Data from a simulated A-Arm mounting position is not saved if it does not pass the filter criteria for Camber Roll Centre and Track Width.

It is higly recommended to use this function to limit the amount of simulation data. Large amounts of data requires a PC with a massive amount of memory.

STEP 5.1: ANALYZE SIMULATION DATA



STEP 5.2: OPEN A SIMULATION FILE

The screenshot shows the 'SimulationResultAnalyzeForm' application window. It features a menu bar with 'File' and 'View'. The main area contains seven bar charts: 'Positive Camber Change Left', 'Positive Camber Change Right', 'Roll Center Change Horizontal', 'Roll Center Change Vertical', and 'Track Width Change'. Each chart has a y-axis from 0 to 5 or 100. Below the charts are 'Set Limits' controls with spinners for values like 5.00 and 0.00. There are also 'Total Cars: 3053' and 'Filtered Cars: 3053' labels, a 'Select Movement' section with radio buttons for 'Bump Droop', 'Roll', 'Bump Roll', and 'Droop Roll', and an 'Update Screen' button. A status bar at the bottom left shows 'Idle'.

File View

Open a simulation file here.

Simulation result for each manouver is plotted for each simulated A-Arm mounting position.

Positive Camber Change Left

Positive Camber Change Right

Roll Center Change Horizontal

Roll Center Change Vertical

Track Width Change

Set Limits

5.00 5.00 5.00 5.00 100.0 100.0 100.0

0.00 0.00 0.00 0.00

Total Cars: 3053

Filtered Cars: 3053

Select Movement

Bump Droop Roll Bump Roll Droop Roll

Update Screen

Idle

Total number of simulated cars, and amount of cars left after filtering are shown here

STEP 5.3: FILTER OUT CARS

The screenshot displays the 'SimulationResultAnalyzeForm' window with a menu bar (File, View) and a status bar (Idle). The main area contains seven histograms: 'Positive Camber Change Left', 'Negative Camber Change Left', 'Ball Center Change Vertical', and 'Track Width Change'. Below the histograms are 'Set Limits' controls with spinners for values like 1.00, 0.50, 5.00, 0.00, 5.00, 0.00, 5.00, 0.00, 100.0, 100.0, and 100.0. A 'Select Movement' section has radio buttons for 'Bump Droop', 'Roll', 'Bump Roll', and 'Droop Roll', with 'Bump Droop' selected. An 'Update Screen' button is also present. Three callout boxes provide instructions: one points to the histograms, another to the 'Update Screen' button, and a third to the 'Select Movement' radio buttons.

A filter can be set for each manouver.
In this examble all simulated cars with A-Arm mounting positions that have a positive camber change, that is greater than 1.0 and less than 0.5, during A Bump-Roll are removed.

After one or several filters have been set press *update screen* to execute the filtering operation and to update the screen.

Sets which manouver to work with.

STEP 5.4: FILTER OUT CARS

The screenshot displays the 'SimulationResultAnalyzeForm' application window. It features a menu bar with 'File' and 'View'. The main area contains seven histograms representing different car metrics: Positive Camber Change Left, Negative Camber Change Left, Negative Camber Change Right, Positive Camber Change Right, Roll Center Change Horizontal, Roll Center Change Vertical, and Track Width Change. Each histogram has a vertical axis and a horizontal axis with red vertical lines indicating filter limits. Below the histograms is a 'Set Limits' section with seven spinners for adjusting the filter values. The first spinner is set to 1.00 and the second to 0.50. The other five spinners are set to 5.00, 5.00, 5.00, 100.0, and 100.0 respectively. To the right of the spinners is a 'Select Movement' section with four radio buttons: 'Bump Droop' (selected), 'Roll', 'Bump Roll', and 'Droop Roll'. An 'Update Screen' button is located to the right of the radio buttons. At the bottom left, the status bar shows 'Idle'. In the bottom right corner, a text box contains the text: 'After pressing update screen a number of simulated cars have been filtered out.' An arrow points from this text box to the 'Filtered Cars' count.

SimulationResultAnalyzeForm

File View

Positive Camber Change Left

Negative Camber Change Left

Negative Camber Change Right

Positive Camber Change Right

Roll Center Change Horizontal

Roll Center Change Vertical

Track Width Change

Set Limits

1.00

0.50

5.00

5.00

5.00

100.0

100.0

100.0

Select Movement

Bump Droop Roll Bump Roll Droop Roll

Update Screen

Total Cars: 3053

Filtered Cars: 1186

Idle

After pressing update screen a number of simulated cars have been filtered out.

STEP 5.5: FILTER OUT CARS

The screenshot shows the 'SimulationResultAnalyzeForm' window with a menu bar (File, View) and seven bar charts. Each chart has a y-axis and a set of red vertical bars representing data points. Below the charts are 'Set Limits' controls with spinners and a 'Drop Roll' checkbox. A status bar at the bottom left shows 'Total Cars: 3053' and 'Filtered Cars: 7'. A status bar at the bottom right shows 'Idle'. Two callout boxes provide instructions: one points to the 'Filtered Cars' count, and another points to the 'Update Screen' button.

Chart Title	Y-axis Range	Limit 1	Limit 2
Positive Camber Change Left	0 to 5	5.00	0.00
Negative Camber Change Left	0 to 5	5.00	0.00
Negative Camber Change Right	0 to 5	5.00	0.00
Positive Camber Change Right	0 to 5	5.00	0.00
Roll Center Change Horizontal	0 to 100	55.0	-
Roll Center Change Vertical	0 to 100	100.0	-
Track Width Change	0 to 100	100.0	-

Set Limits

Total Cars: 3053
Filtered Cars: 7

Idle

Cars left can be viewed and saved here.

After some more filtering a small number of simulated cars are left.

Update Screen

STEP 6: SAVE FILTERED CARS

Car number: 3
Cars Total: 7

Save This Car

R-arm Mountings

Upper Arm Mounting Position X:	292
Upper Arm Mounting Position Y:	350
Lower Arm Mounting Position X:	213
Lower Arm Mounting Position Y:	165

BumpDrop Manouever

Max Positive Camber Change Left:	0.94
Max Negative Camber Change Left:	0.414
Max Positive Camber Change Right:	0.94
Max Negative Camber Change Right:	0.414
Max Roll Center Change Horizontal:	0
Max Roll Center Change Vertical:	-57.791
Max Track Width Change:	8.282

Roll Manouever

Max Positive Camber Change Left:	0.024
Max Negative Camber Change Left:	2.6
Max Positive Camber Change Right:	2.084
Max Negative Camber Change Right:	0
Max Roll Center Change Horizontal:	54.803
Max Roll Center Change Vertical:	-19.423
Max Track Width Change:	0.409

BumpRoll Manouever

Max Positive Camber Change Left:	0
Max Negative Camber Change Left:	3.017
Max Positive Camber Change Right:	0.593
Max Negative Camber Change Right:	0.939
Max Roll Center Change Horizontal:	-8.603
Max Roll Center Change Vertical:	14.003
Max Track Width Change:	-3.345

DroopRoll Manouever

Max Positive Camber Change Left:	0.404
Max Negative Camber Change Left:	2.807
Max Positive Camber Change Right:	3.054
Max Negative Camber Change Right:	0
Max Roll Center Change Horizontal:	51.412
Max Roll Center Change Vertical:	-57.791
Max Track Width Change:	8.286

Save one or several cars and. Close this window and return to the first window where the car can be imported and suspension movements studied in detail.

STEP 7: VIEW FILTERED CAR IN DETAIL

The screenshot shows the Casim software interface. On the left, the 'File' menu is highlighted with an arrow. Below it, the 'Animation Settings' panel is visible, containing several sections with dropdown menus and input fields:

- Animate Bump-Droop:** Yes (dropdown), Bump-Droop Height: 30 (input field)
- Animate Roll:** Roll Limit: 3.0 (input field), Next (button)
- Animate Bump-Roll:** Yes (dropdown), Bump-Roll Height: 30 (input field), Bump-Roll Roll Limit: 3.0 (input field)
- Animate Droop-Roll:** Yes (dropdown), Droop-Roll Height: 30 (input field), Droop-Roll Roll Limit: 3.0 (input field)
- Animation Speed:** Medium (dropdown)

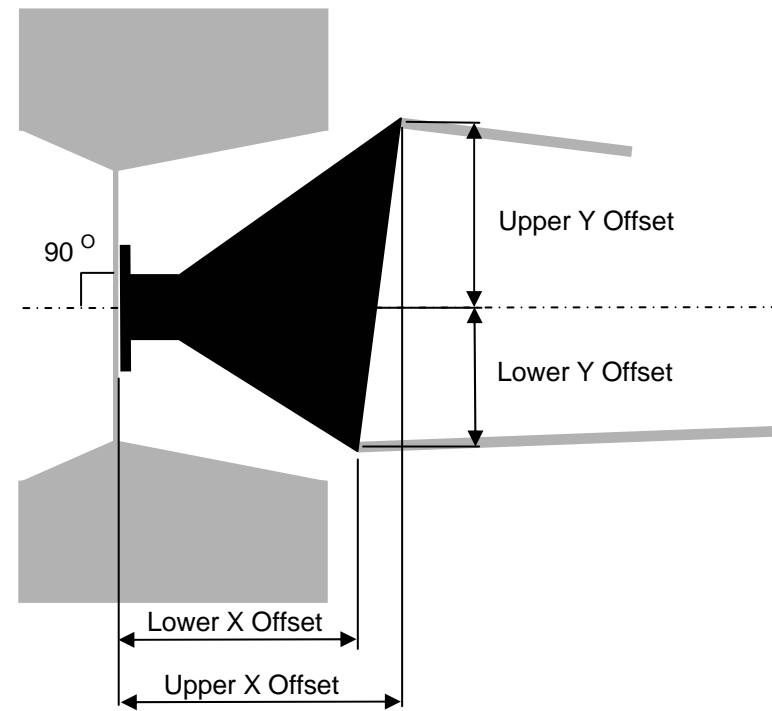
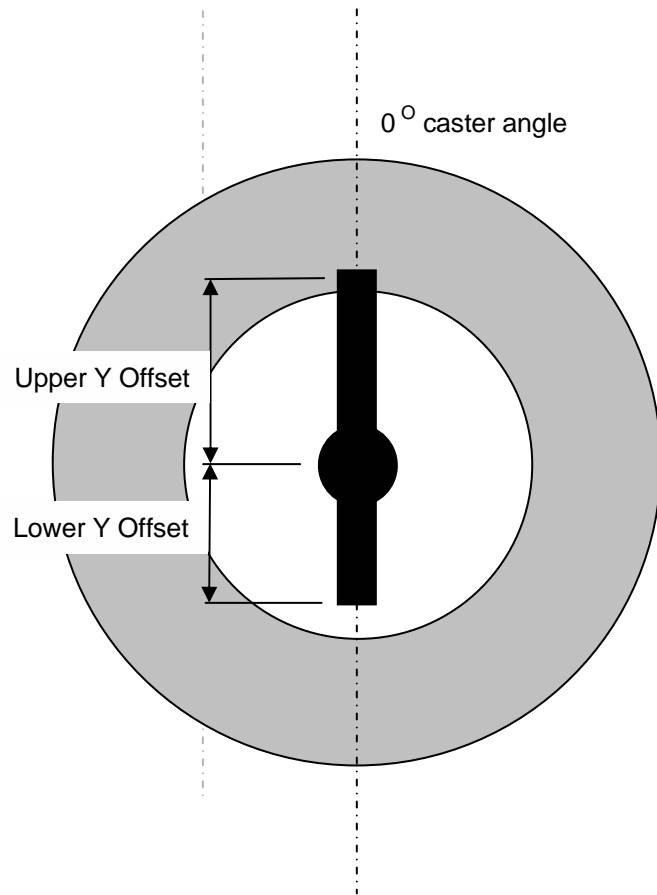
A callout box points to the 'File' menu with the text: "Open the saved car File->Import->Car".

On the right, a 3D wireframe model of a car chassis is shown in a perspective view. Below the model, a table of technical specifications is displayed:

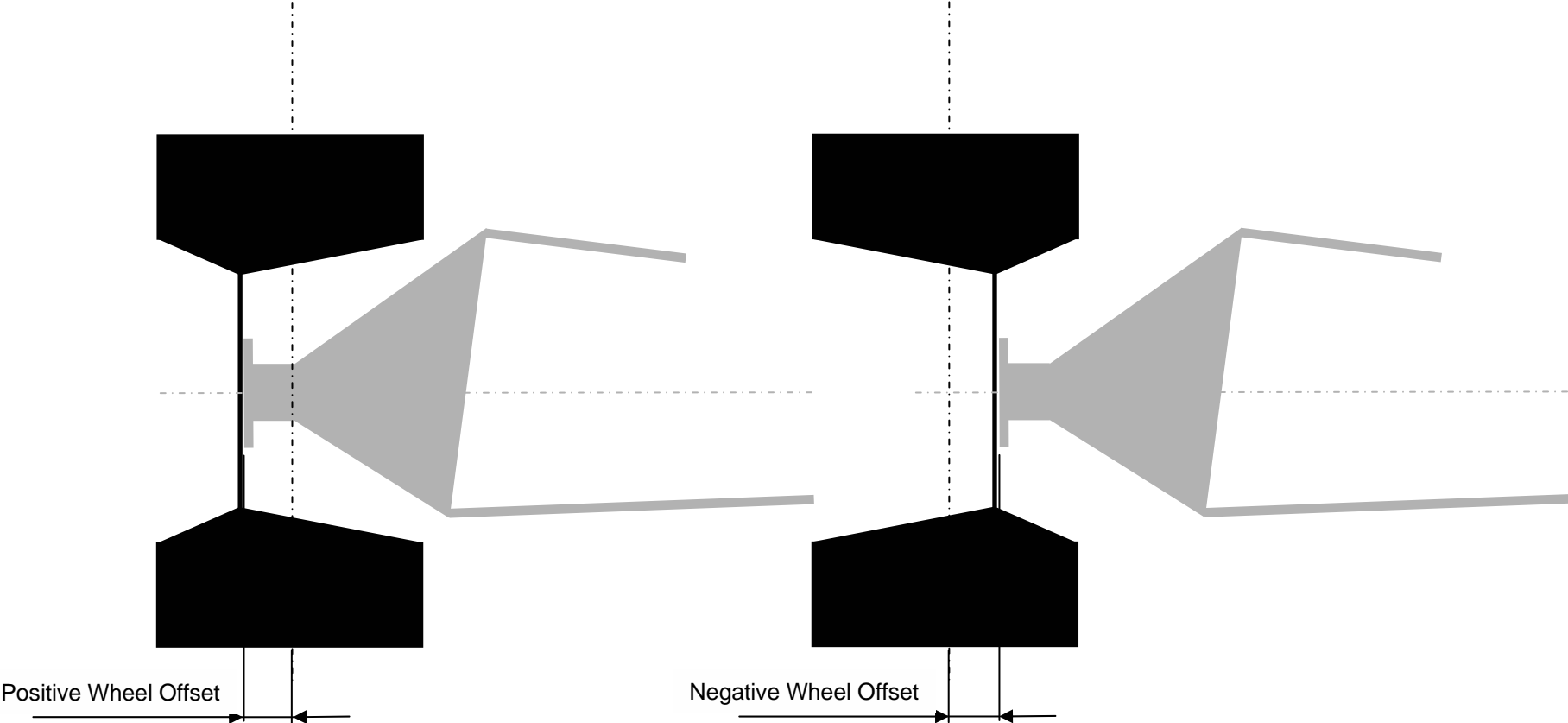
Camber Left:	-4.73	Camber Right:	-1.9
Camber Change Left:	-2.73	Camber Change Right:	0.1
Original Camber Left:	-2	Original Camber Right:	-2
Roll Centre X :	68.16	Track Width:	1064.53
Roll Centre Change X :	68.16	Track Width Change :	-4.53
Original Roll Centre X :	0	Original Track Width:	1060
Roll Centre Y :	29.71		
Roll Centre Change Y :	-25.17		
Original Roll Centre Y :	54.88		

**MEASUREMENTS
AND
OTHER MISCELLANEOUS INFORMATION**

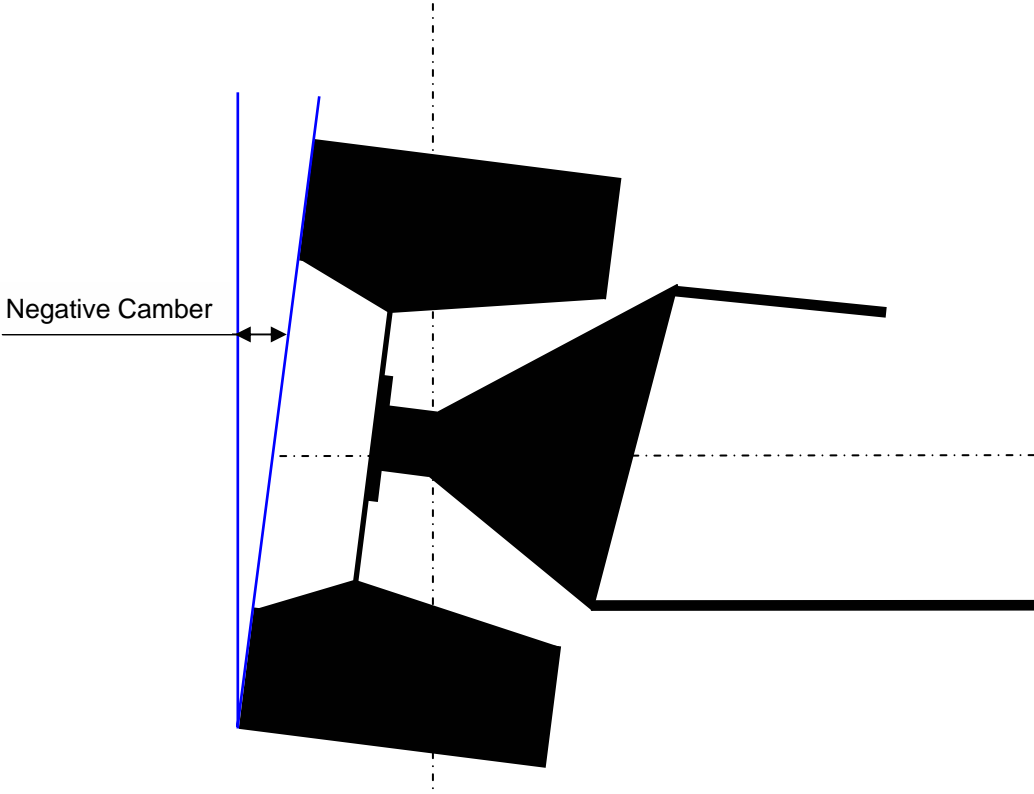
MEASURE THE UPRIGHT



MEASURE THE WHEEL OFFSET



CAMBER ANGLE



A-ARM MOUNTINGS

