International ADAMS Users Conference 1999

Integrated generation of full vehicle models

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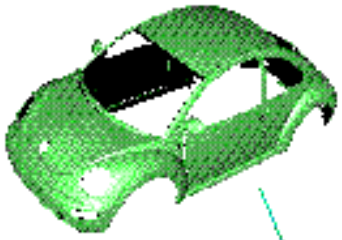
VOLKSWAGEN

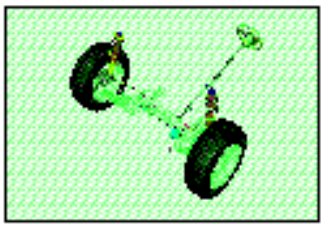
Integrated generation of full vehicle models
Overview

Chassis (Rigid body)



Driveline ADAMS/ATS

Suspension Design Mogessa/Pro



Tire (Delft, Durability, Boehm)
Road (2D, 3D)
Driver (ADAMS, VW)
Brakes (Std., ABS)

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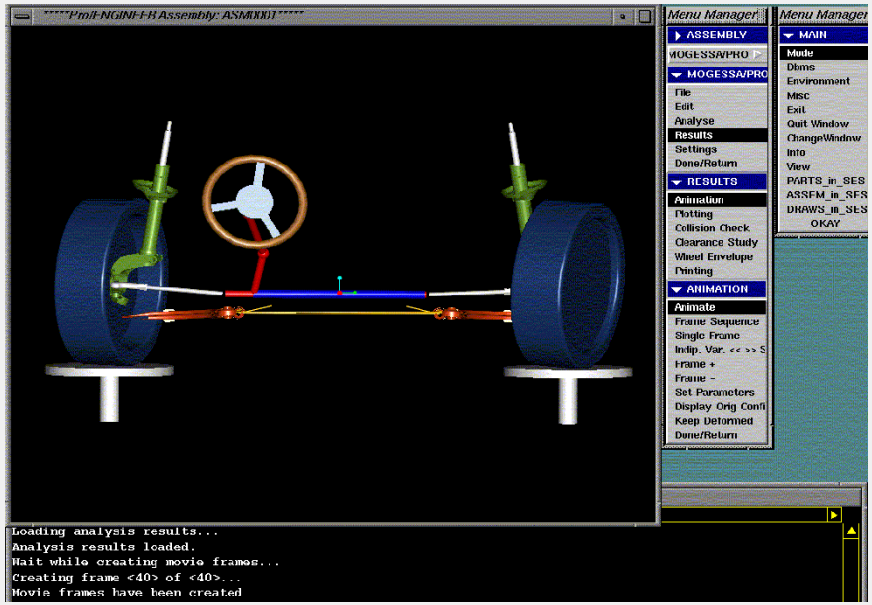
Suspension design with Mogessa/Pro

- Create Control Part
- Create Pro/E Assemblies using real or dummy Pro/E Parts
- Define mechanism
- Create Subsystem and perform suspension analysis within Pro/E
- Export Car-Template/Subsystem
- Rework Templates slightly (add communicators and mount parts)



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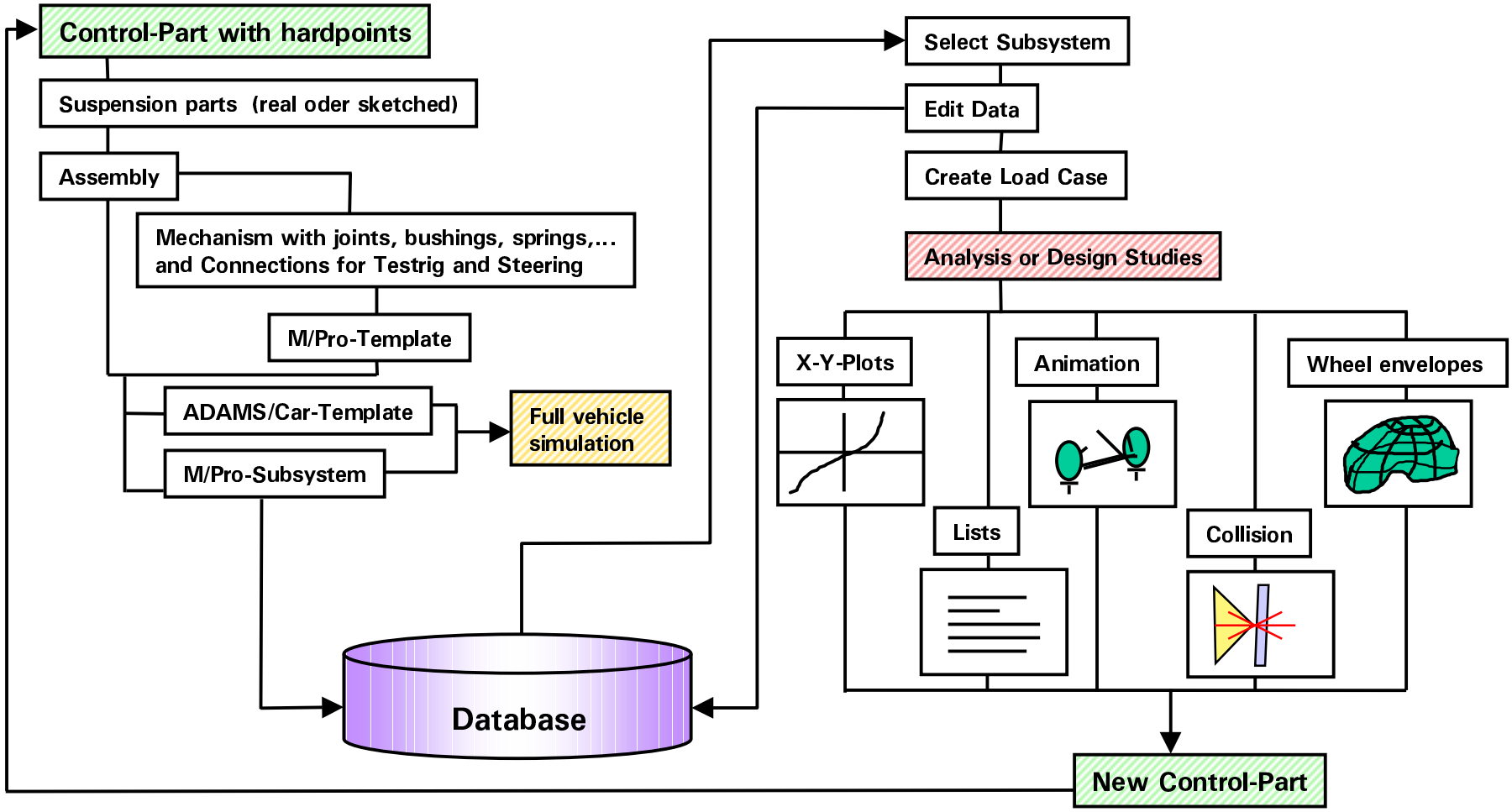
Suspension design with Mogessa/Pro



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Driveline design with ADAMS/ATS

- MDI Marburg consulting project for VW
- Based on ADAMS Car 4.x (ADAMS View 8.2)
- “Create” - macros for engine, gearbox, clutch, engine mounts, driveline, ...
- Perform analysis on “Engine-Testrig” in ATS
- Save to database: Car Template / Subsystem
- Convert the Template to Car 9.2
- Rework Templates slightly (add communicators and mount parts)

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Other necessary Subsystems

- **Modified steering Subsystem**
  Uses hooke joints instead of convel joints
  Rigid connection to suspension subframe
- **Modified chassis Subsystem**
  Additional communicators
- **Tires**
  Delft tire model (Property files from measurements on VW testground in Ehra-Lessien)
  Pacejka tire model
  Durability option for handling tire models
  User tire models (tirsub)
  Boehm tire model (gfosub)

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Other necessary Subsystems

- **Standard Brake Subsystem**
  Uses variables to calculate brake torque for standard brake system according to existing brake calculation Software
  Uses information supplied from other Subsystems such as Marker positions to determine regulator switch pressure

- **ABS Brake Subsystem**
  Includes usersub to simulate a simple ABS

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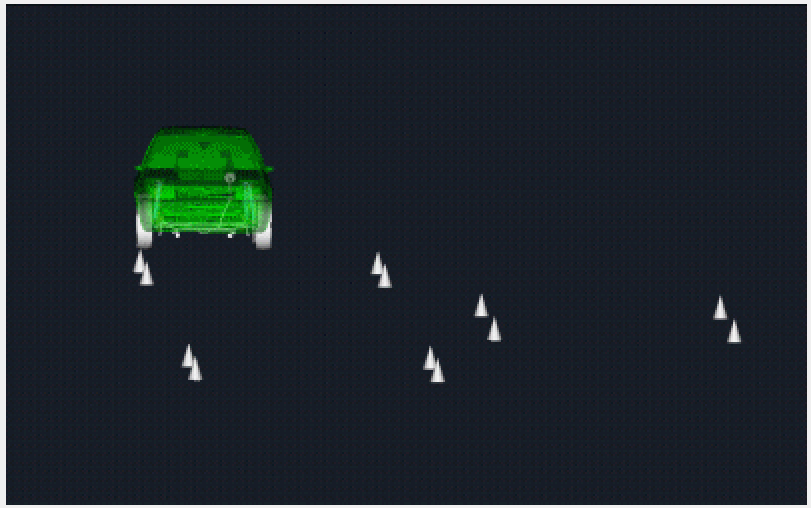
Examples: “Elchtest”

- **Objective**: Check critical handling manoeuvre for concept vehicle with higher centre of mass
- **No controller used**: Changed steering-demand to step function and manually optimised steering angles to follow the given track layout



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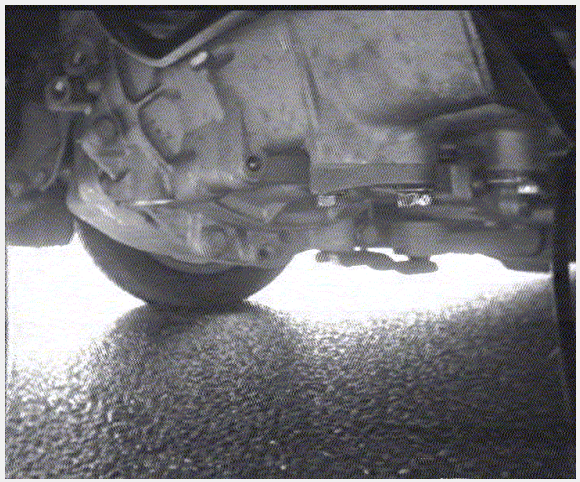
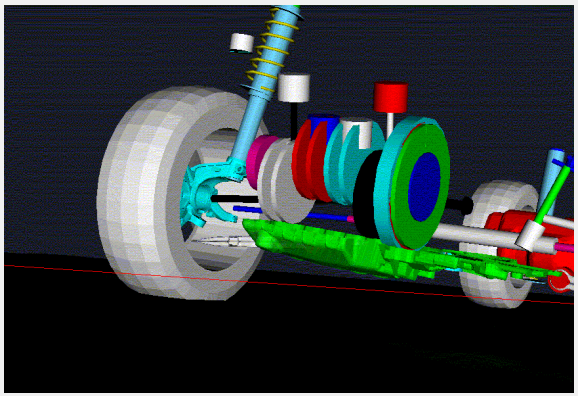
Examples: Ground clearance

- Objective: Check ground clearance on uneven surface on VW testground for different vehicle speeds and tracks
- Full vehicle model including engine/driveline
- Model modified to use simple path controller to maintain staying in defined track
- Collision check with ADAMS/Animation, CAD (Pro/E, Tecoplan) or subroutine





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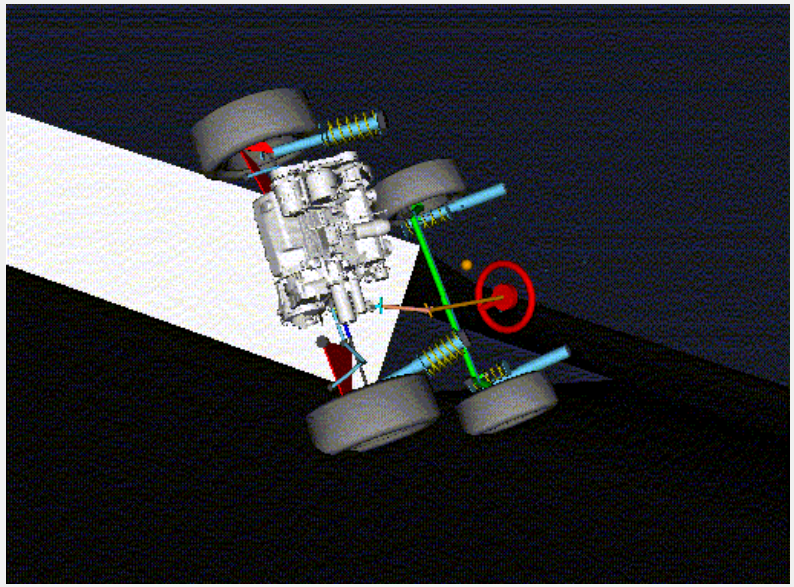
Examples: Rollover 1

- Objective: Controller development to follow a given track for rollover manoeuvre
- Full vehicle model (engine mass attached with bushings to chassis)
- Using durability tire option
- Ramp: 3-D roadfile



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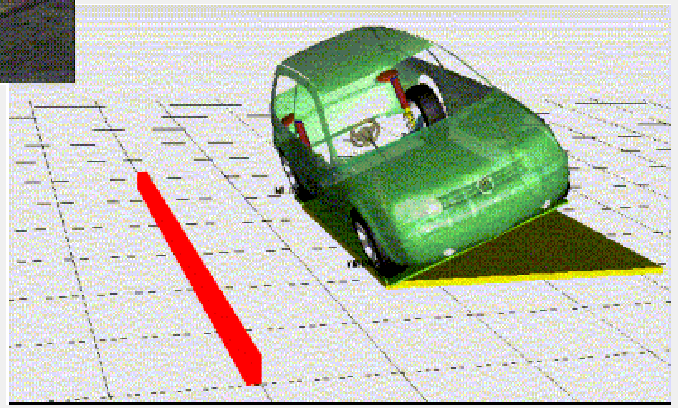
Examples: Rollover 2



- Objective 1: Determine the first contact (location, forces) of chassis to road for crash simulation
- Objective 2: Determine influences on objective 1 such as slider speed or tire to road friction

- Full vehicle model from ADAMS Car with manually modelled slider-testrig
- Using durability tire option
- Using sphere to plane contact for chassis/road interaction

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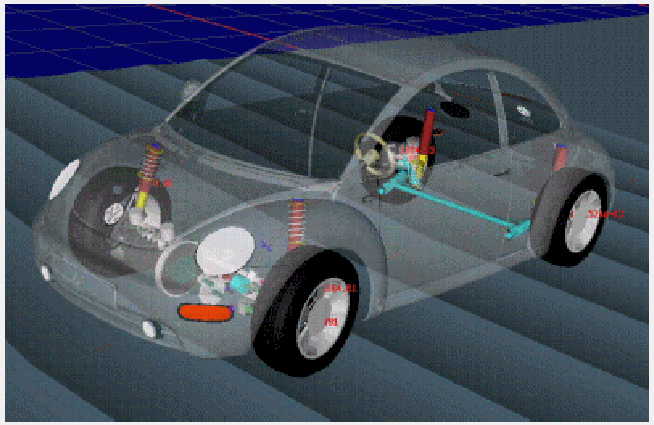
Examples: Manoeuvres for critical engine displacements

- Objective: Check given list of different manoeuvres for most critical engine displacement



- Full vehicle model including engine/driveline
- Using durability tire option with measured uneven roads
- Using handling tire option on flat tracks
- Export VDA transformation matrix for engine part to FREIA to check displacements of specific hardpoints or comparison with measurements

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Examples: Measurement of engine displacements

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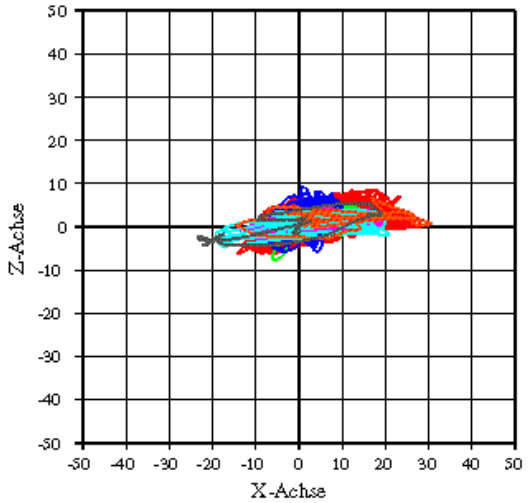
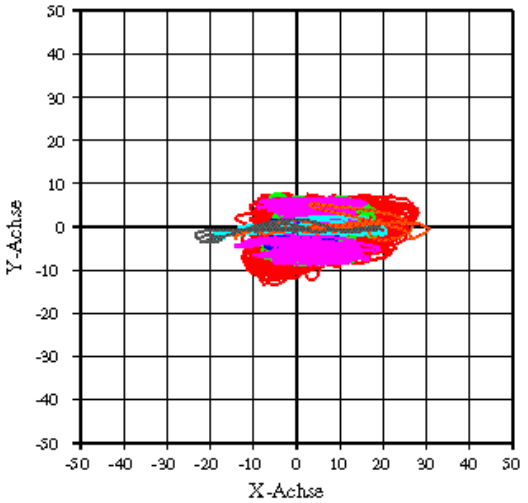
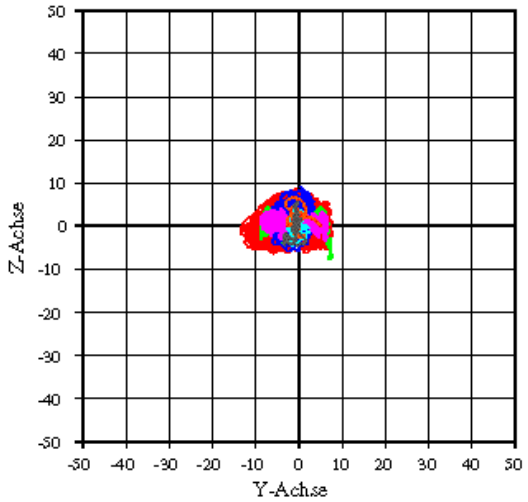
Examples: Postprocessing with FREIA







Relativbewegung eines Punktes im Fahrzeugnetz

Fahrzeug:	VW[illegible]
Motor:	Otto [illegible]
Getriebe:	[illegible] Syncro
Punktlage in KL:	-300.00 / 0.00 / 500.00
	Messpunkt 1

Fahrmanöver:

MESS_VW[illegible]_Otto_[illegible]_Syncro_WASCHBRETT_3

MESS_VW[illegible]_Otto_[illegible]_Syncro_WEDELN_1

MESS_VW[illegible]_Otto_[illegible]_Syncro_FLADEN_1

MESS_VW[illegible]_Otto_[illegible]_Syncro_KREIS_1

MESS_VW[illegible]_Otto_[illegible]_Syncro_RUCKELN_1

MESS_VW[illegible]_Otto_[illegible]_Syncro_KUPPLUNG_VORW_1

MESS_VW[illegible]_Otto_[illegible]_Syncro_KUPPLUNG_RUECK_1

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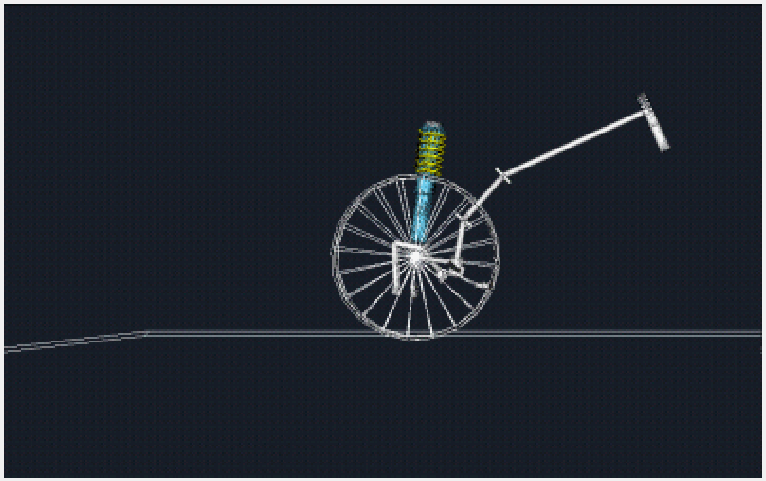
Examples: Synthetic obstacles

- Objective: Design synthetic obstacle which gives similar force ranges to measured road section in Brazil (Working title: “Brasilien Schlagloch”)
- Simple full vehicle model
- Using durability tire option
- Manually change roadfile until loads equal measured values
- Specific Problem: Rim to road contact has to be considered (Usersub)



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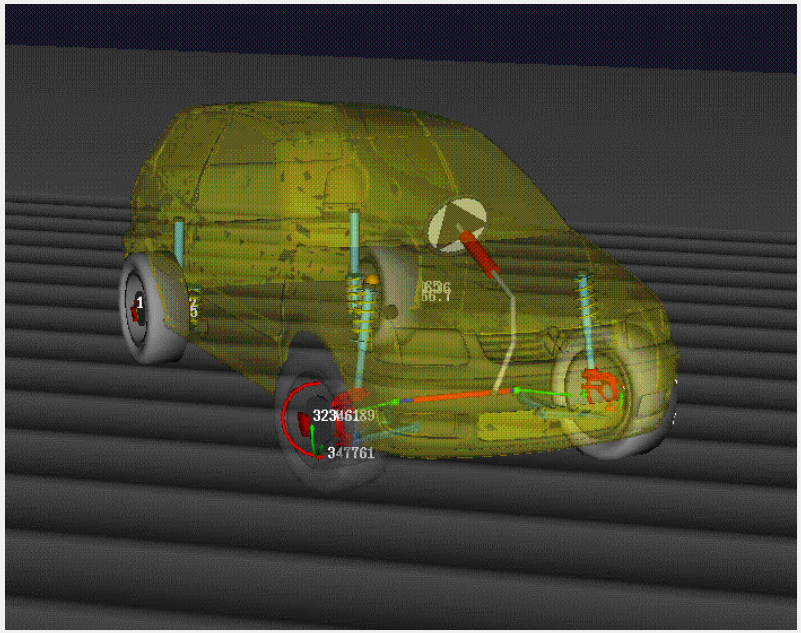
Examples: Wheel envelope manoeuvres

- Objective: Determine critical manoeuvres for maximum size of wheel space requirement
- Simple full vehicle model
- Depending on track using handling or durability tire option



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Examples: Resulting wheel envelope