CAVA – ALL PRODUCTS

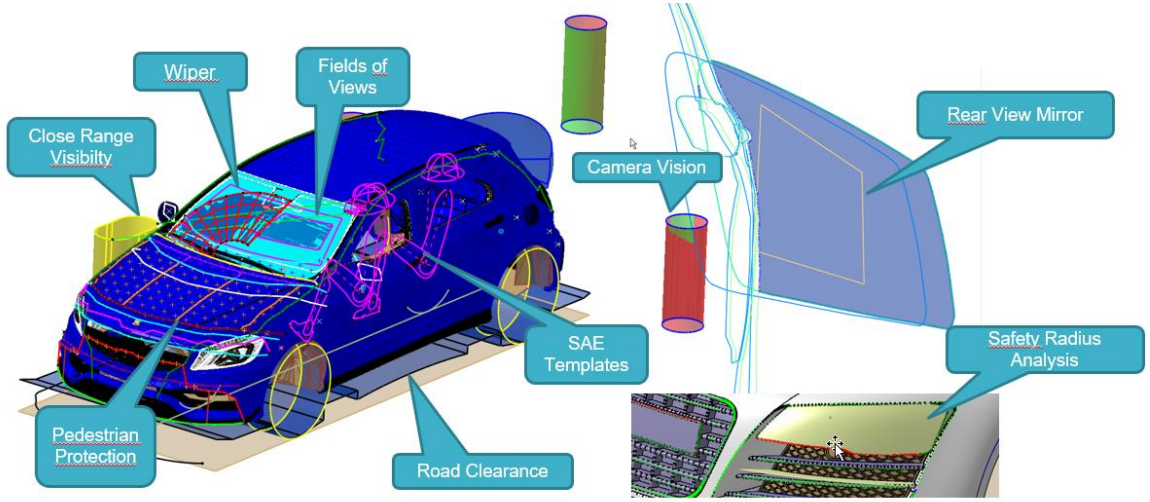
Functional Overview

2023-04-20

CAVA – Vehicle Homologation

Vehicle Compliance is a compulsory part of Automotive design. CAVA (CATIA Automotive Extensions Vehicle Architecture) provides the solution to efficiently and confidently validate the compliance of your vehicle design and architecture against international standards and regulations.

Available as a CATIA V5 or 3DEXPERIENCE enhancement, CAVA is successfully used by OEMs and suppliers world-wide and can be installed as a complete solution or as individual sub products for specific application areas.



CAVA Product Portfolio

- **CAVA OVA:** Verify the overall vehicle packaging
- **CAVA Manikin:** Verify seating positions, pedals and headroom
- **CAVA Vision:** Analyze the direct and indirect vision of the driver
- **CAVA Safety:** Analyze safety of occupants and pedestrians
- **CAVA Wiper:** Analyze wiper kinematic and wiping quality
- **CAVA Tools:** Project the silhouette outlines of a complete vehicle with one click using Silhouette Tools

CAVA – General Features

Integration into CATIA

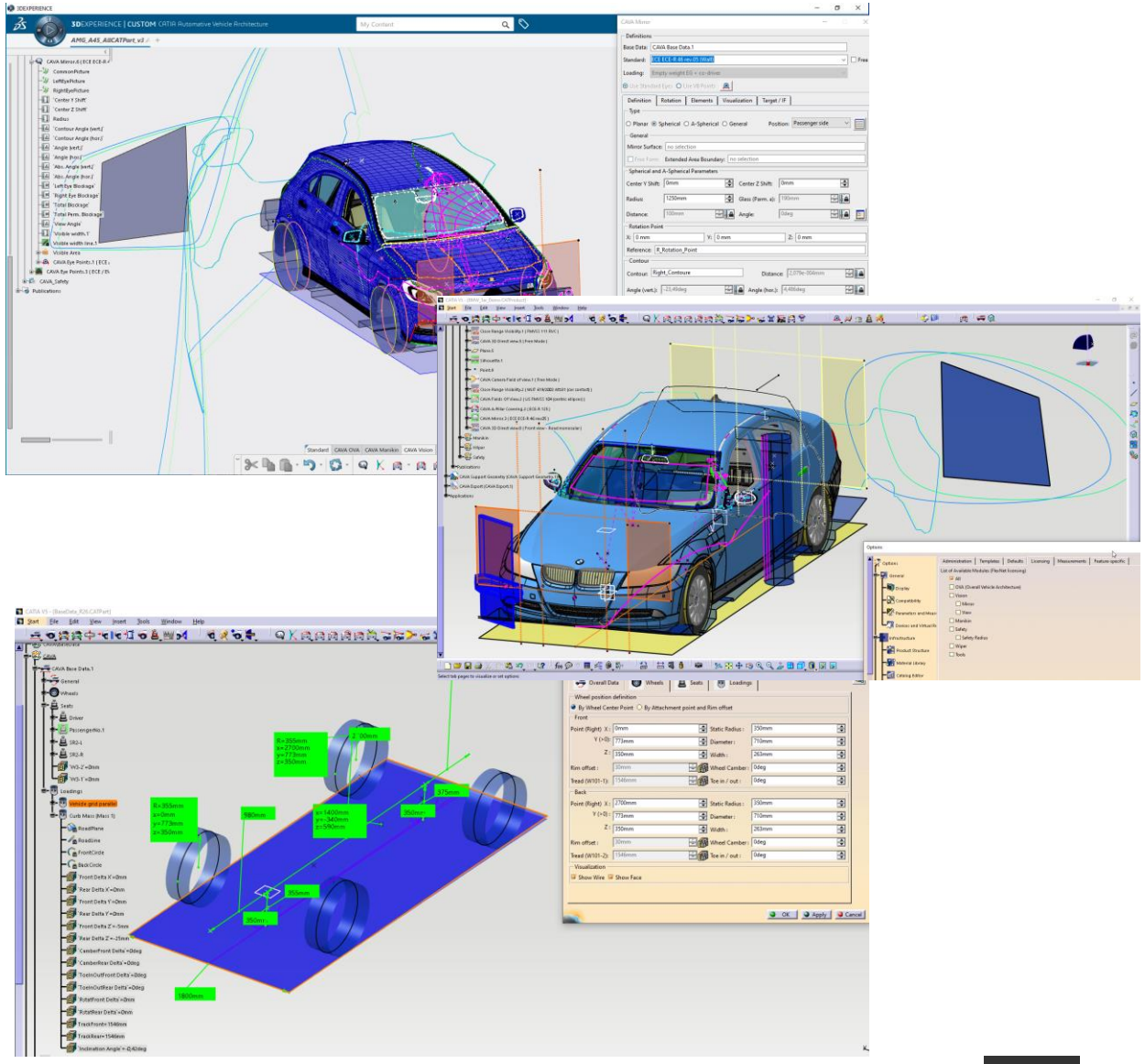
- CAVA is integrated into CATIA as a separate workbench or App.
- CAVA features are stored directly with the CAD data.
- Working in part and product context.
- Automatic feature update on change of any input parameters or changed geometry.

Configurable and Open

- Supported standards are available as readable xml file.
- You can create your own adapted company-specific standards easily.
- Export your results as regular CATIA geometry for downstream applications, readable without CAVA.
- Create textual, excel and drawing reports using customizable report templates.

Base Data Concept

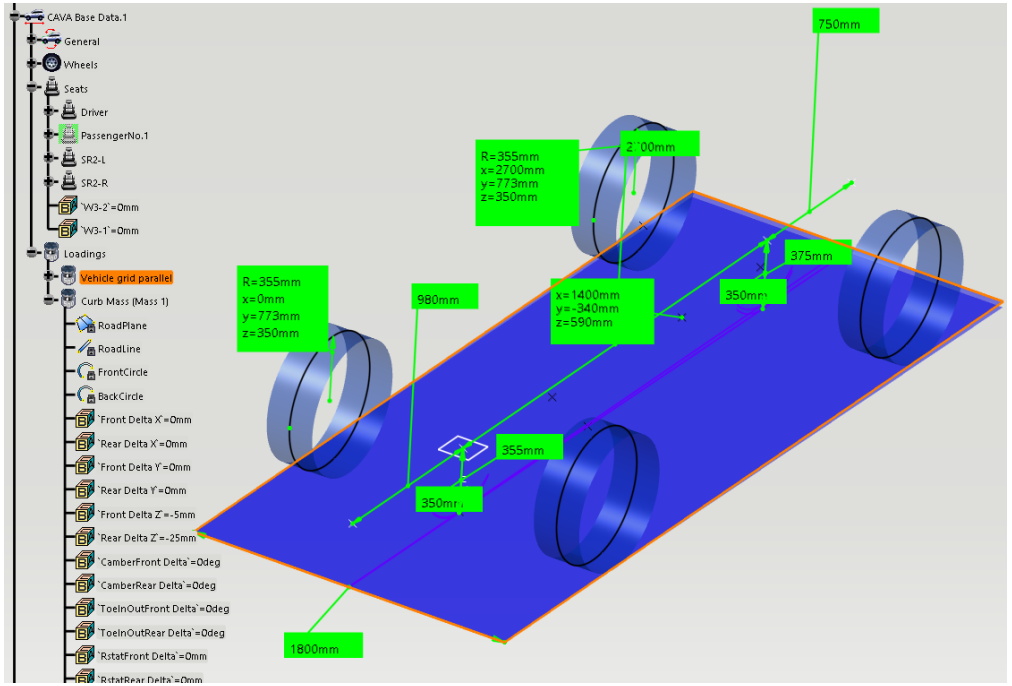
- Organize relevant parameters in a central location.
- Define vehicle size, wheel size, driver and occupant placement.
- Define different ground reference planes to accommodate loading configurations.

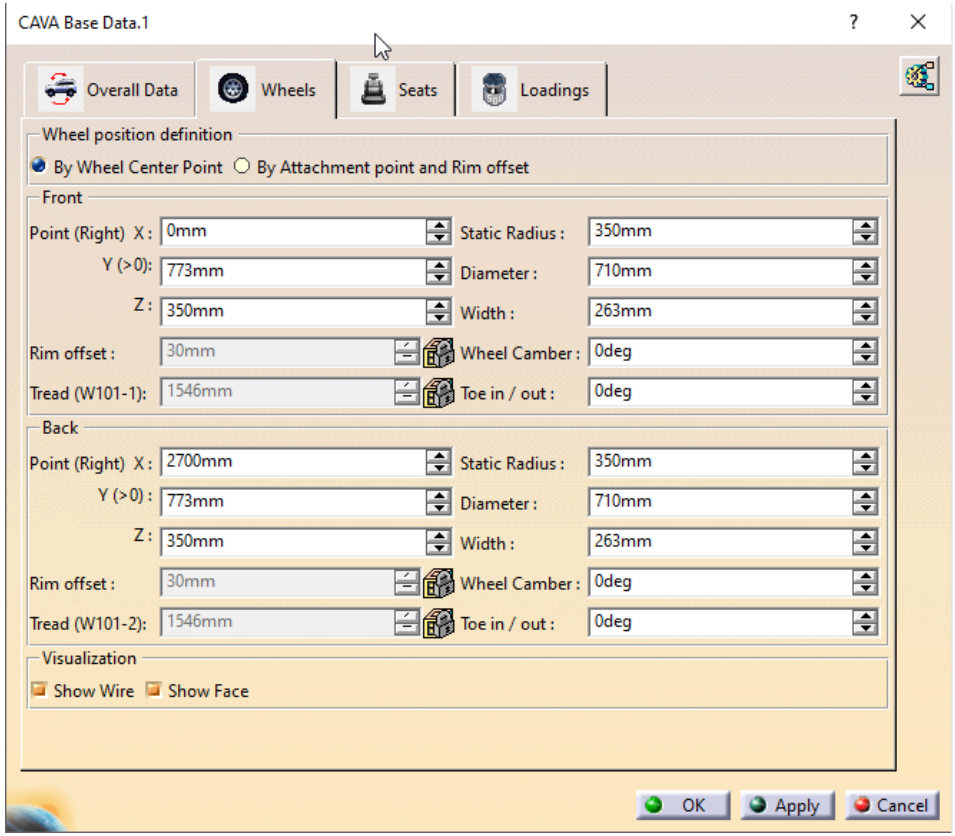


CAVA OVA - Base Data

Manage basic input data to be used for CAVA calculations

- Organize relevant parameters for a project in a central location
- Define vehicle size, wheel size, seating of driver and occupants
- Define different ground reference planes to accommodate required loading configurations



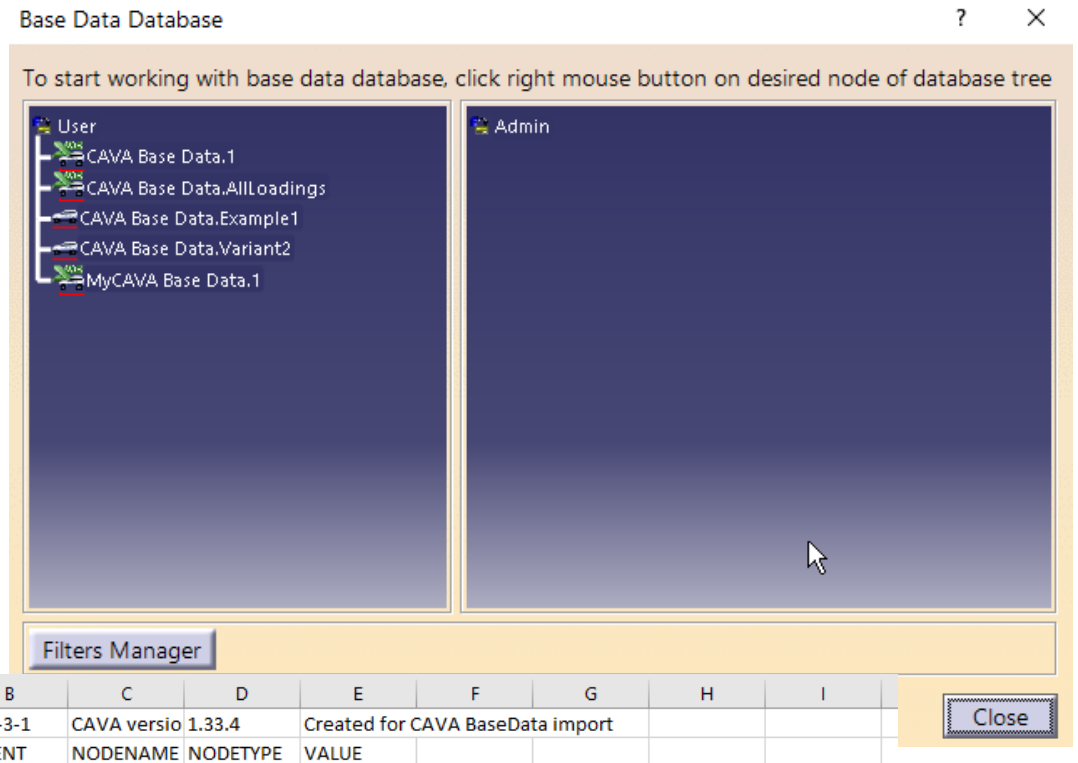


CAVA OVA - Base Data Database

Function to manage Base Data for different projects and vehicle variants

Features

- Copy, Edit and Rename
- Export data to xml or xlsx
- Import data from xml or xlsx
- Interface to customer's own database



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6	4	2	BodyWidth	attribute	0mm				
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8	6	2	CarDescripti	attribute	Limousine				
9	7	2	ForwardDist	attribute	1000mm				
10	8	2	BackwardDis	attribute	1000mm				
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13	11	9	ShowWheel'	attribute	true				
14	12	9	ShowCenter	attribute	false				
15	13	9	WheelDistar	attribute	2760.01mm				

CAVA OVA - Underfloor Clearance

This feature verifies the underfloor clearance of the vehicle and measures slope angles, static and dynamic curb clearance, inner angle, oil tub, water wading and wheel fixing clearance.

Supported standards

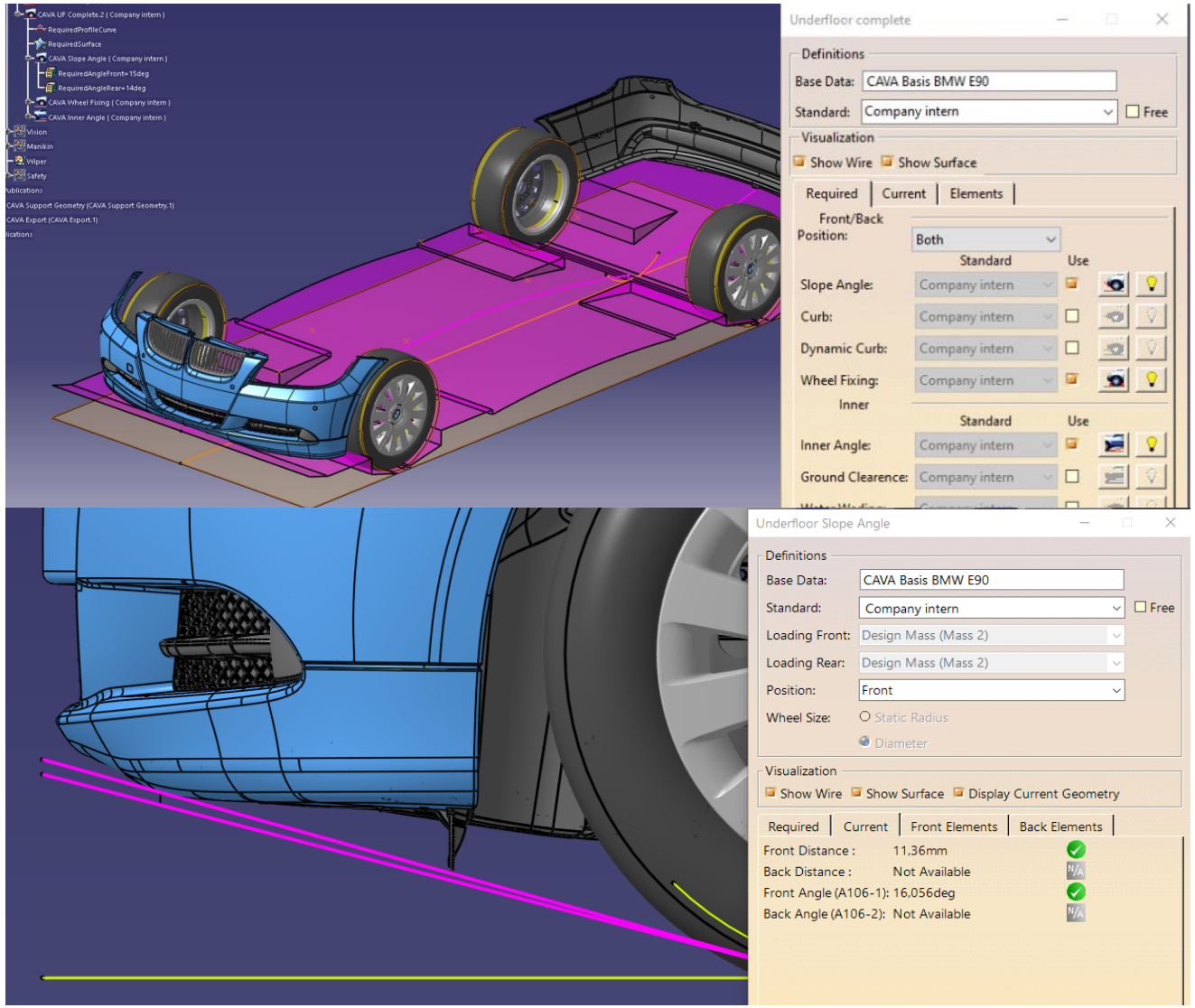
- Company specific example
- Offroad EU, US, AUS
- KMVSS Art. 5

Features

- Calculates combined overall ground clearance surface
- Measures and shows clearance values to selected vehicle geometry
- Optionally uses wheel diameter or static radius

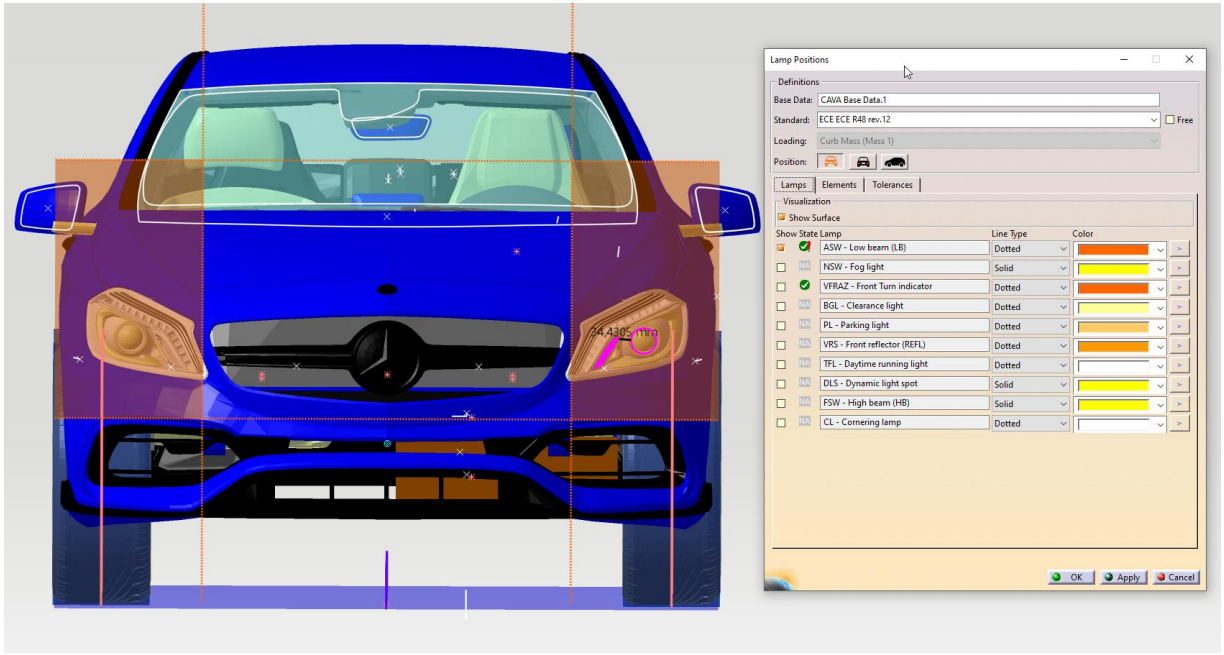
Result

- Visualization of target and achieved values and surfaces
- Measured values



CAVA OVA - Lighting Position

This feature gives guidance and verification about lamp types and their required absolute and relative positions.



Supported standards include

- ECE-R 48, US FMVSS 108
- Japan Safety Regulations Nr. 67, Korea KMVSS
- Australia ADR 13, India AIS-008//2001
- Taiwan MOTC 2004, China GB 4785-1998

Features

- Shows a grid of limiting borders for each lamp type
- Measures if lamp geometry is within allowed limits
- Creates additional lamp-lamp distance measurements
- Checks the visibility of specific lamp types

Result

- Visualization of allowed limits
- Report of performed checks
- Measured values

CAVA OVA - Lamp Visibility

Check the visibility of red lamps from a defined zone in front of the car and white lamps from a zone back of the car as required by the ECE regulation.

Supported standard

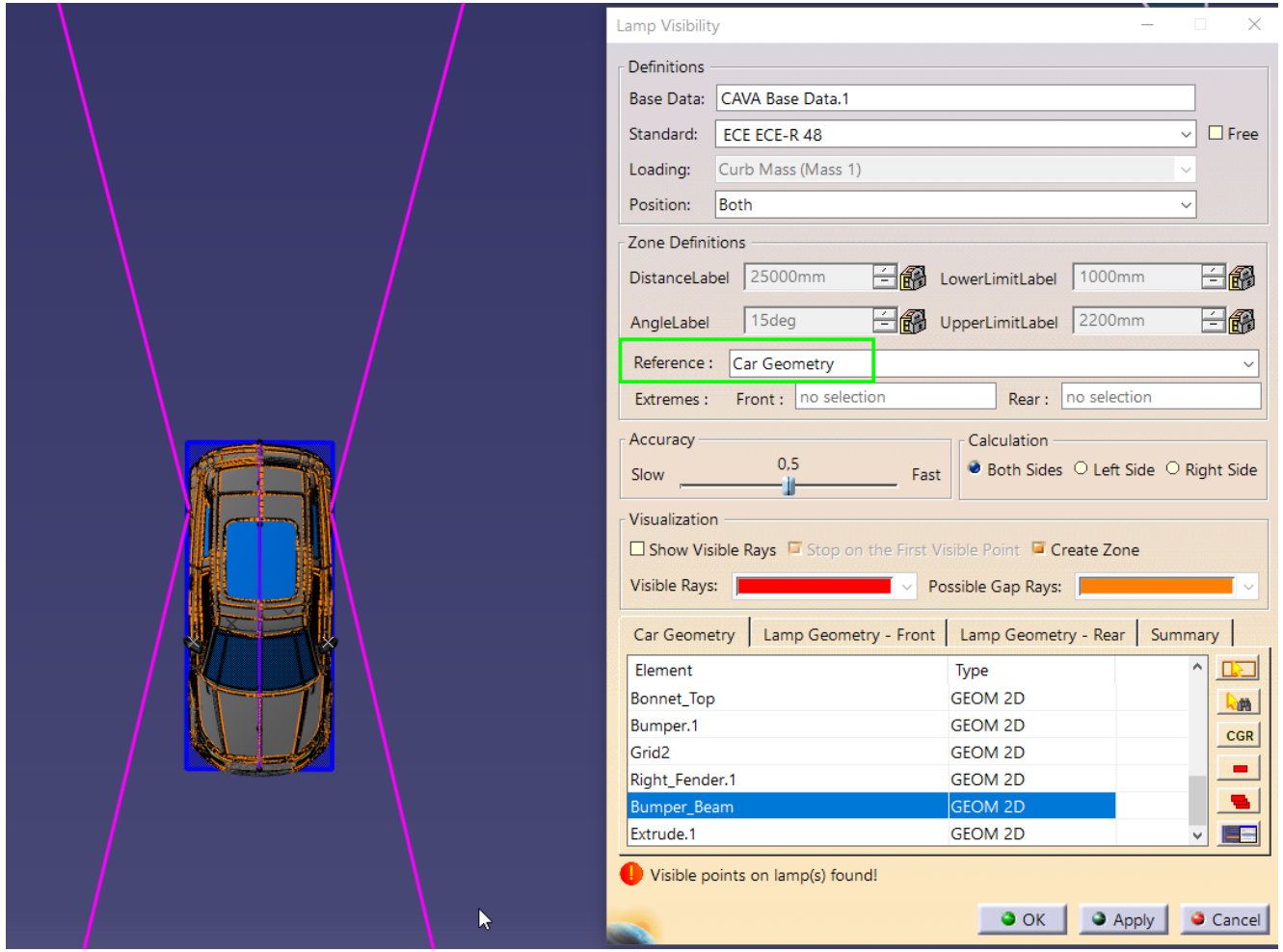
- ECE-R 48

Features

- Creates and shows the visibility check zone in the front and back of the vehicle
- Finds and shows the sight rays to incorrectly visible lamps
- Options to use width of base data or width of selected geometry

Result

- Visualization of the vision check zones
- Visualization of sight rays to lamps with incorrect visibility



CAVA OVA - Number Plates

This feature is a tool for the verification of the size, position, visibility and illumination of number plates as required in a variety of regional regulations.

Supported standards include

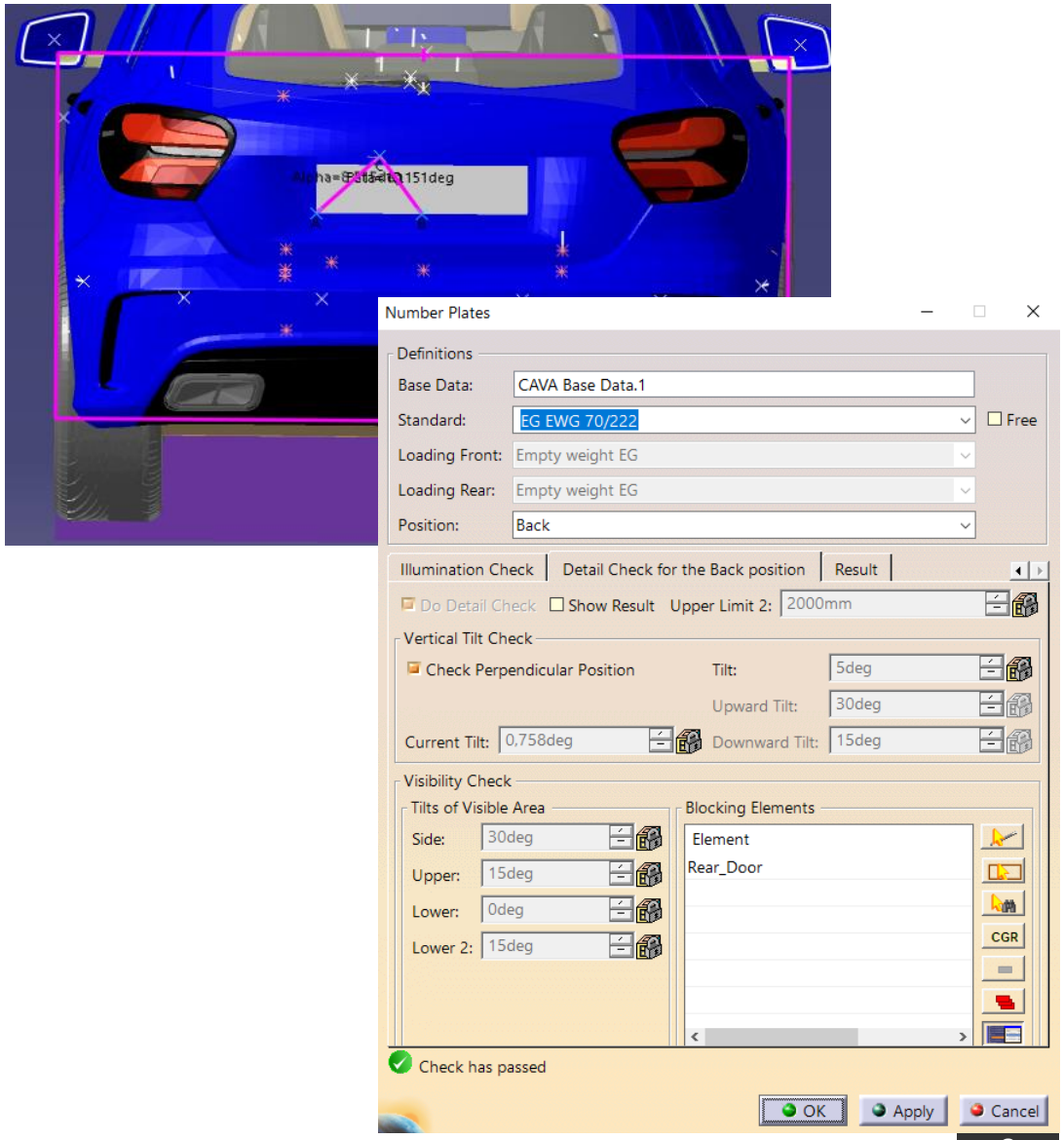
- EG EWG 70/222, EU 1003-2010
- AUS ADR 61/02
- USA, CDN Traffic Act 1964 22 ff.
- China GB 15741-1995

Features

- Checks the size and position of the selected number plate
- Including specific checks for the rear plate like tilt, visibility and position of the illumination
- Options to help finding an appropriate position on the vehicle

Result

- Measured values for size and other properties
- Visualization of positioning area and measurements



CAVA OVA – Bumper Pendulum

This feature provides the bumper shape and correct bumper contact position according to the applicable regulations.

Supported standards include

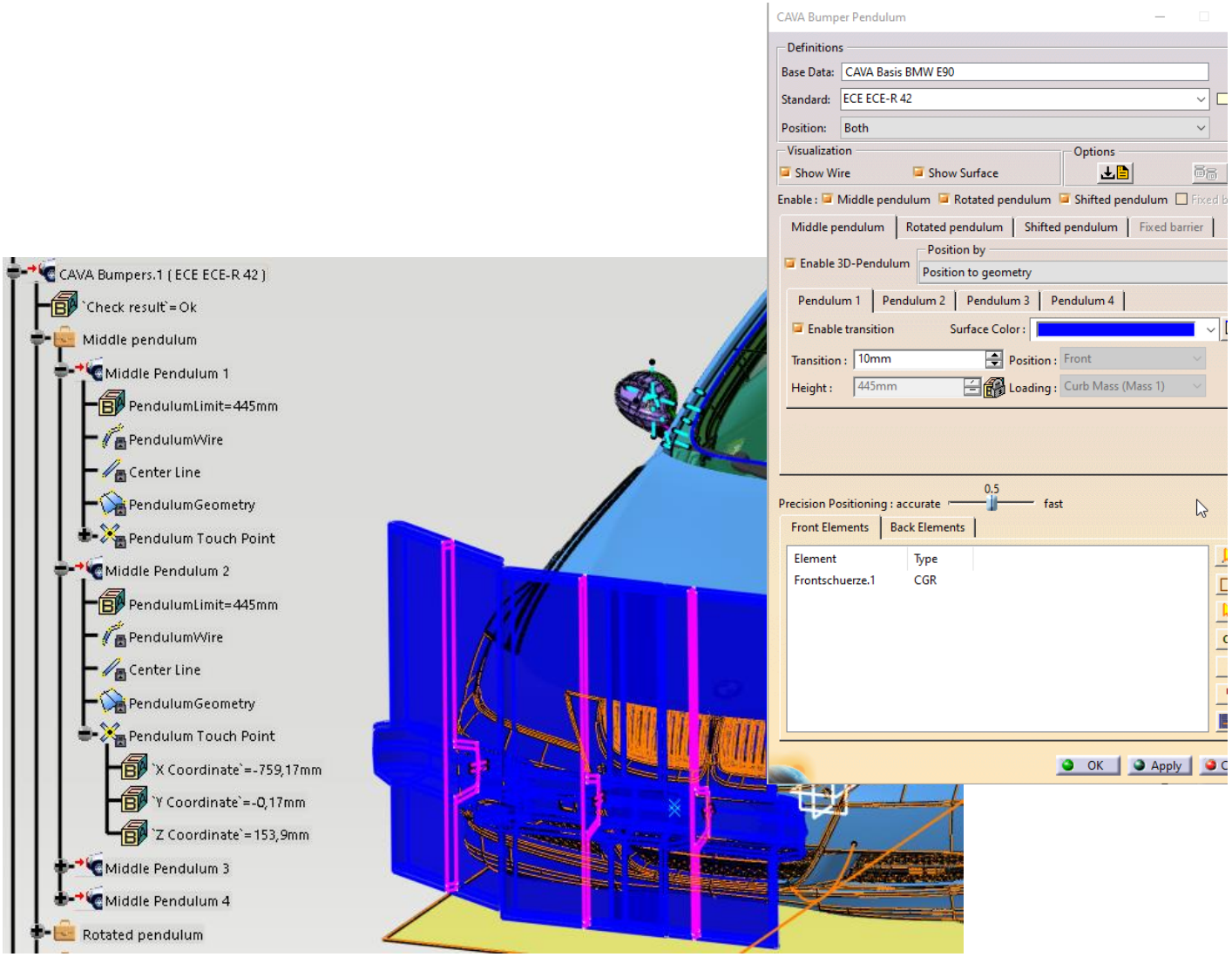
- ECE-R 42
- US 49 CFR 581
- CDN (CVMSS 215)

Features

- Positioning of middle, rotated and shifted pendulums
- Positioning on front and rear
- Calculates contact point with the vehicle
- User defined pendulum profiles

Result

- Visualization of bumper pendulum geometry and contact points for two different loadings



CAVA OVA - Crash Barriers

This feature facilitates the positioning of crash barriers on the front and back of the vehicle.

Supported standards include

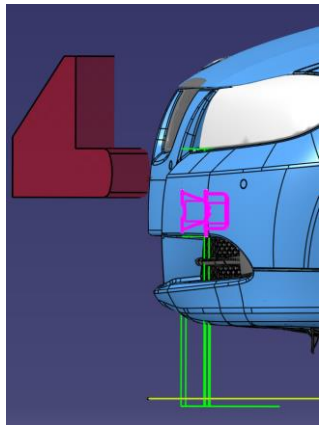
- RCAR (2004, 2006)
- IIHS (2009, 2016 small overlap)
- MPDB (2020) overlap

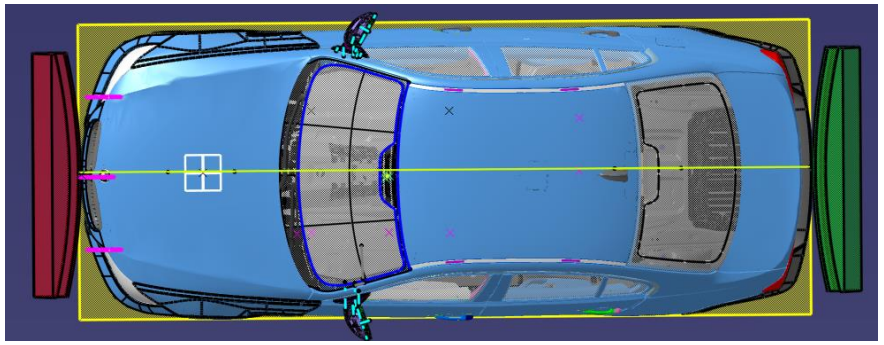
Features

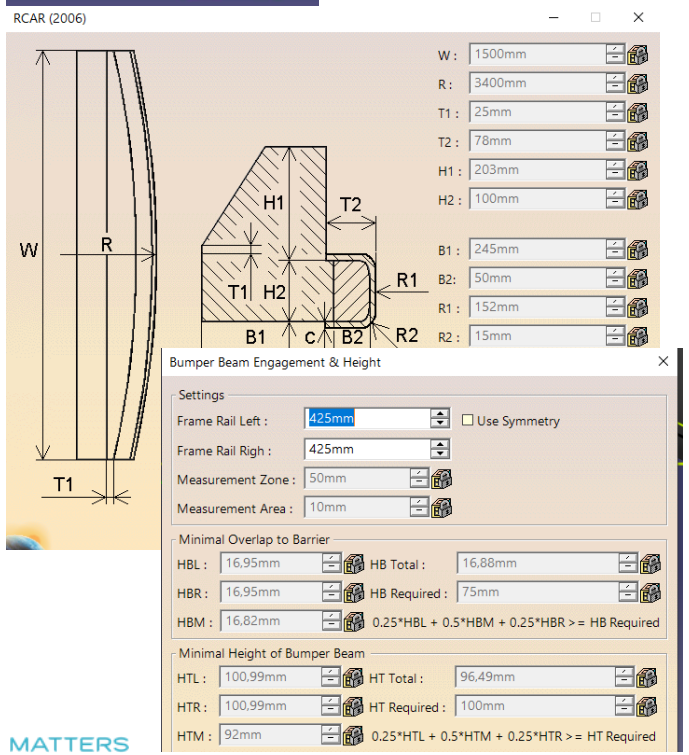
- Positioning of crash barriers
- Entry Card: This option calculates the qualifying bumper beam height and relevant bumper engagement according to the RCAR procedure
- Calculates contact point with the vehicle.
- User defined barrier profiles

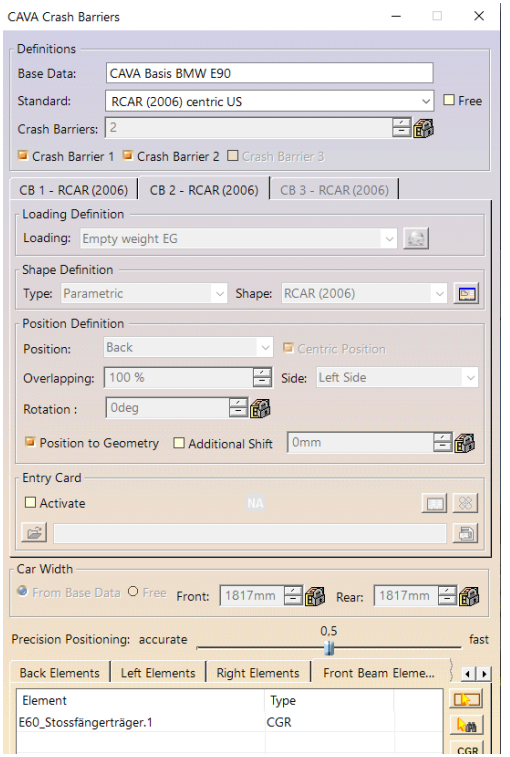
Result

- Visualization of crash barriers geometry and contact points
- Entry Card values and Drawing









CAVA OVA - Side Impact

This feature facilitates positioning of barriers for side impact crash tests on the vehicle.

Supported standards include

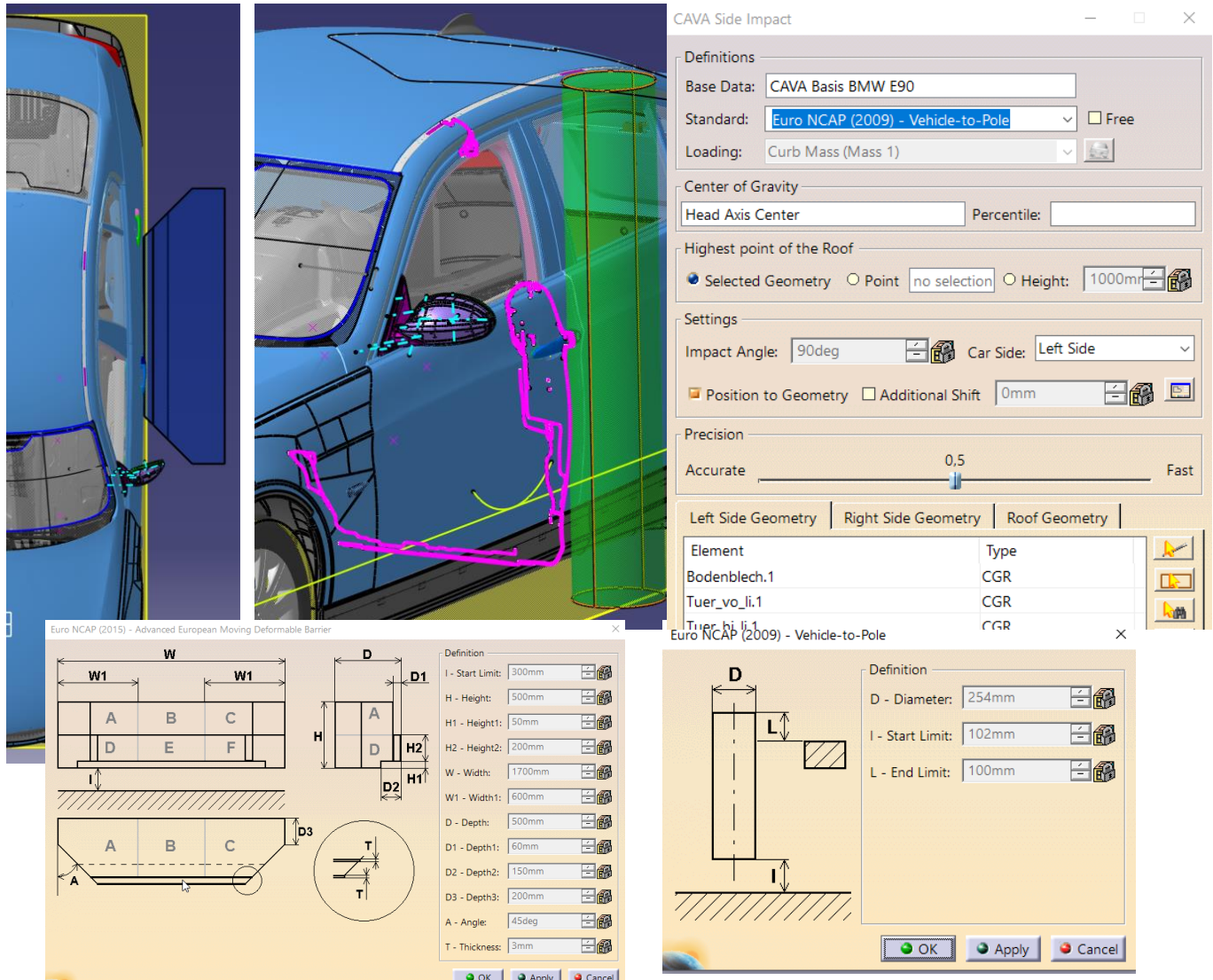
- MDB: Euro NCAP (2009), Euro NCAP MPDB (2015), FMVSS 214, IIHS
- Vehicle to Pole: FMVSS 214, Euro NCAP
- Door Crush Resistance: FMVSS 214, IIHS

Features

- Positioning of the crash barrier
- Visualize contact area
- User defined barrier shapes

Result

- Visualization of barrier geometry and contact area



CAVA OVA – Wheel Covering

Regulations require that the wheel is sufficiently covered by the fender to avoid damage by flying objects. This feature measures and visualizes the coverage values.

Supported standards include

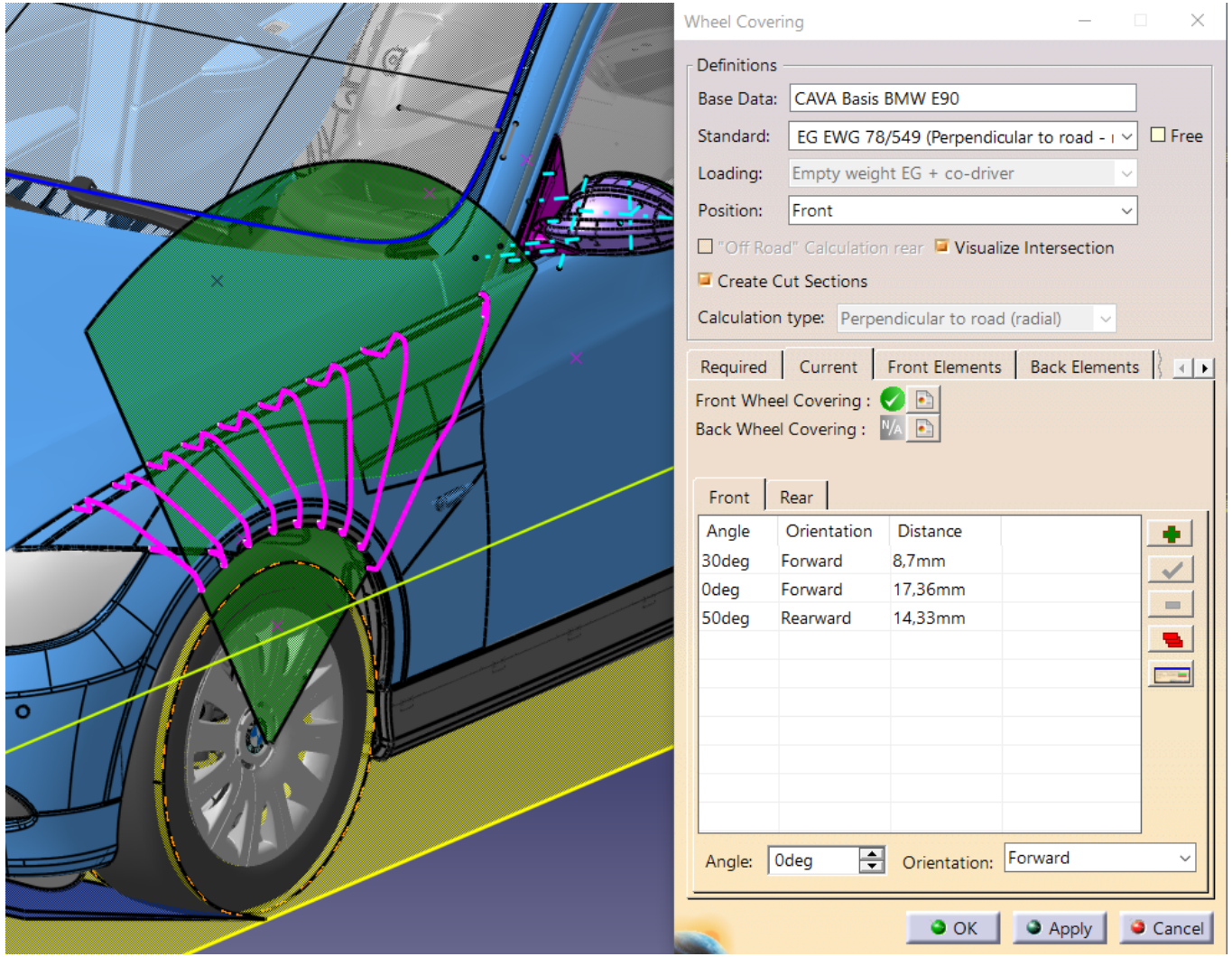
- EG EWG 78/549
- EG EWG 78/549 (Perpendicular to road - radial)
- AUS ADR 42/03
- Japan (TRIAS 1-1996)

Features

- Creates and visualizes the outer boundary surface of required coverage
- Different methods to calculate the boundary surface according to supported standards
- Measures distance values

Result

- Measured coverage values and visualization
- Check result if coverage is sufficient



CAVA OVA - Seat-belt mounting points

This feature provides visualization of the fields containing the allowed positions of the guide and/or end fitting and/or buckle

Supported standards include

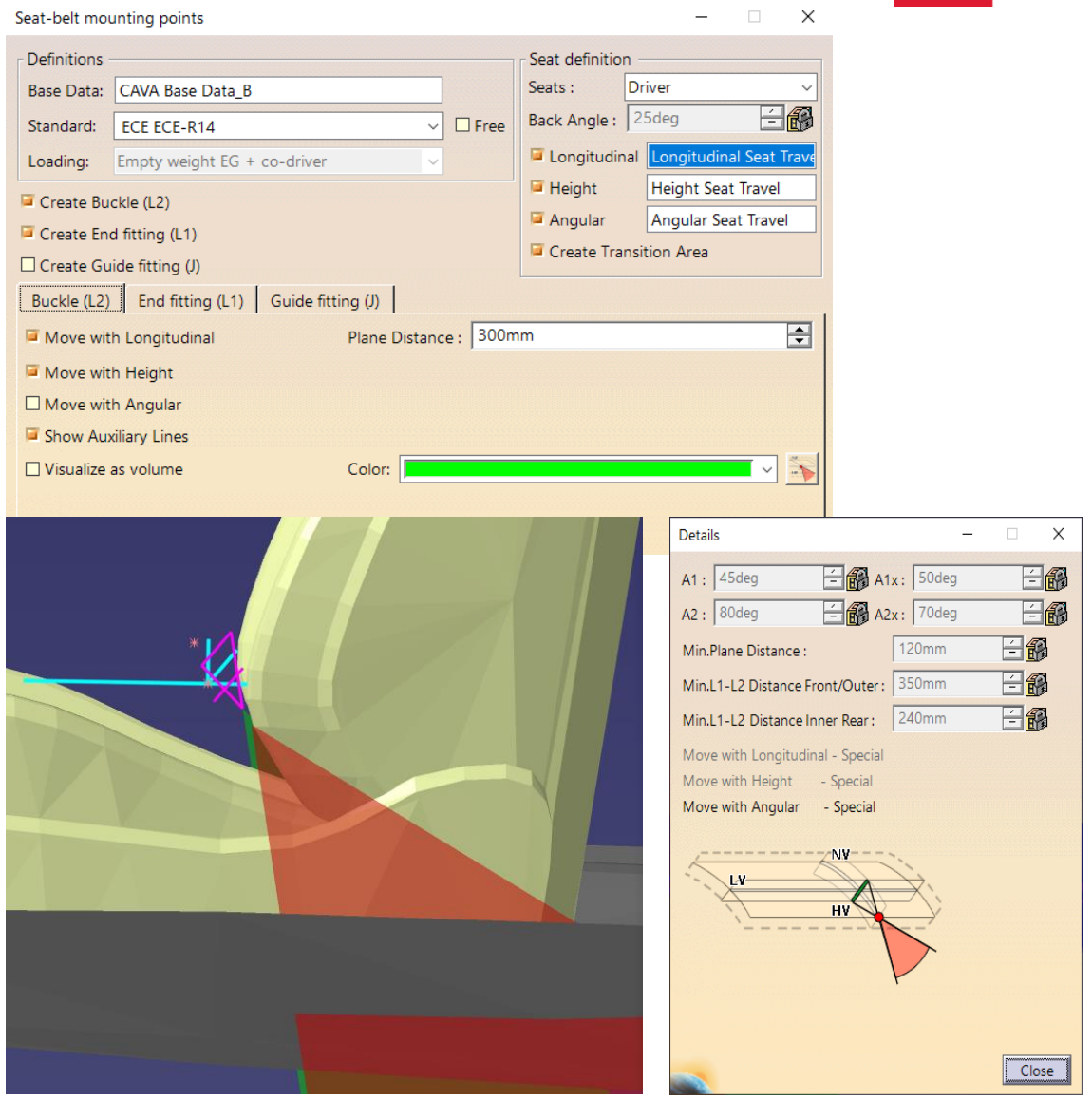
- ECE-R 14
- FMVSS 210

Features

- Creates allowed position fields for buckle, guide fitting and end fitting, considering the limits of position and distance to each other
- Considers the movement of the seat
- Support buckle and fittings attached to the seat or fixed to the frame

Result

- Visualization of allowed position fields for buckle and fittings



CAVA OVA - Child Protection & Free Space Top Tether

This feature creates a visualization of the allowed positions for fixing the top tether of a child seat, as well as a visualization of the required free space to fix the top tether at a given point.

Supported standards include

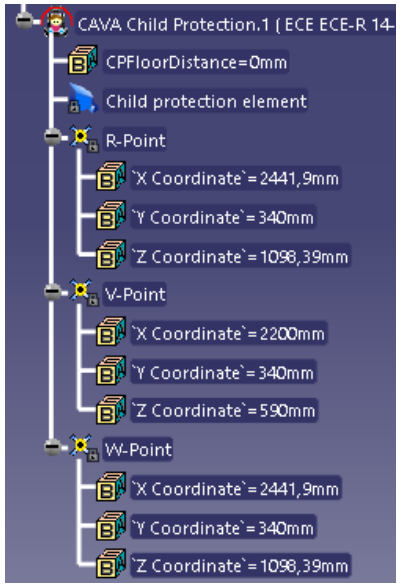
- ECE-R 14
- FMVSS 225
- AUS ADR 34

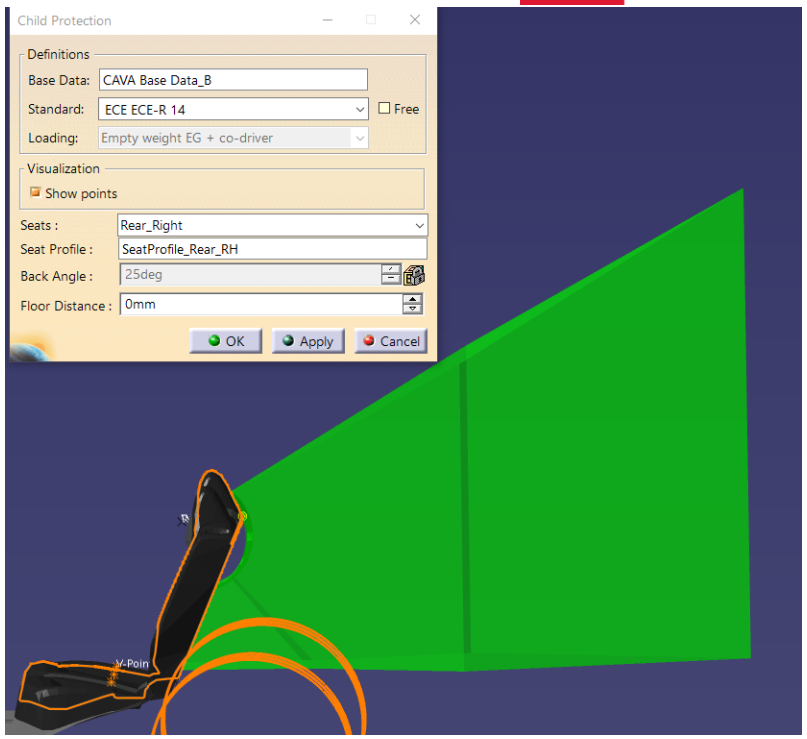
Features

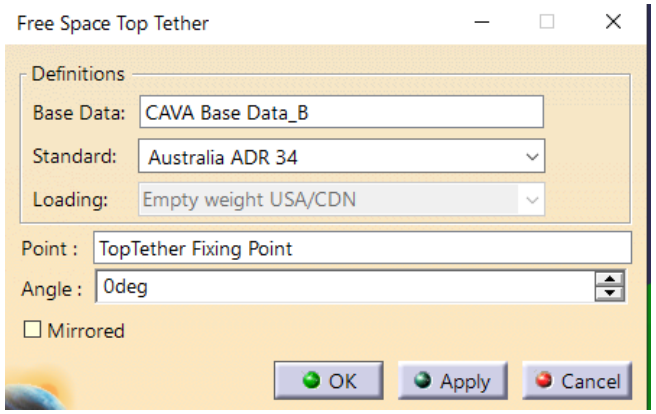
- Visualization of the top tether fixing space including the cutout area based on the seat profile
- Calculation of the R-Point, V-Point and W-Point

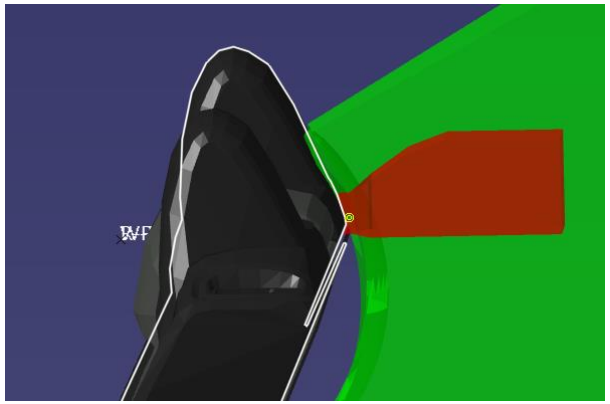
Result

- Visualization of the top tether fixing space
- Visualization of the free space around a selected fixing point









CAVA OVA - Pedal Clearance

This feature measures the clearance between the accelerator, brake, clutch pedals and the floor.

Supported standard

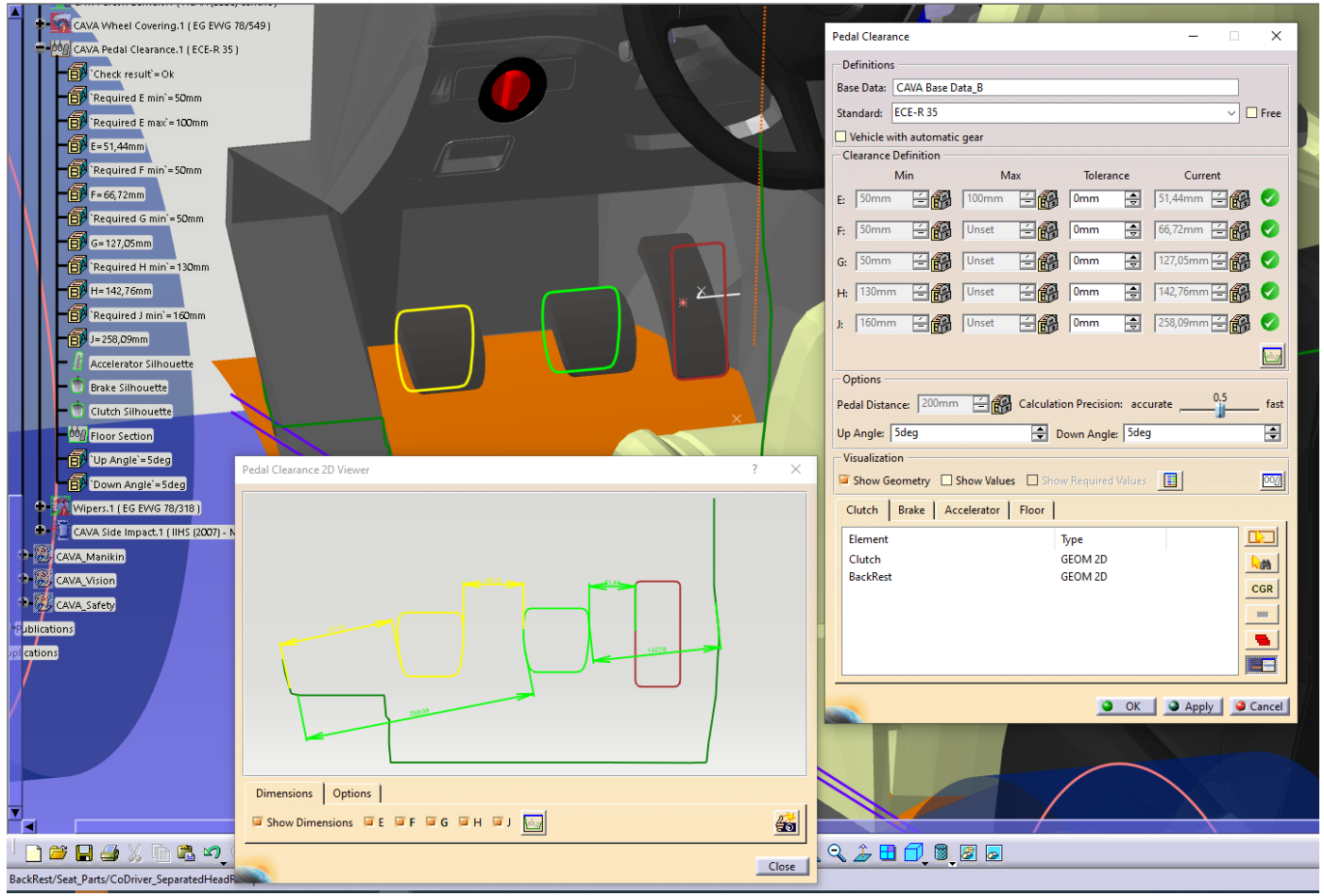
- ECE-R 35

Features

- Calculates actual clearance values
- Supports vehicles with manual and automatic gear
- Creates the projection to the measure plane
- Configurable visualization in a 2D Viewer for easy capturing and documentation of the result

Result

- Measured clearance values
- Visualization of measurement in 3D and 2D viewer
- Check result if values are within limits



CAVA OVA - TCD Clearance

This feature visualizes and checks the required clearance from the TCD (trailer coupling device) to the vehicle geometry.

Supported standards include

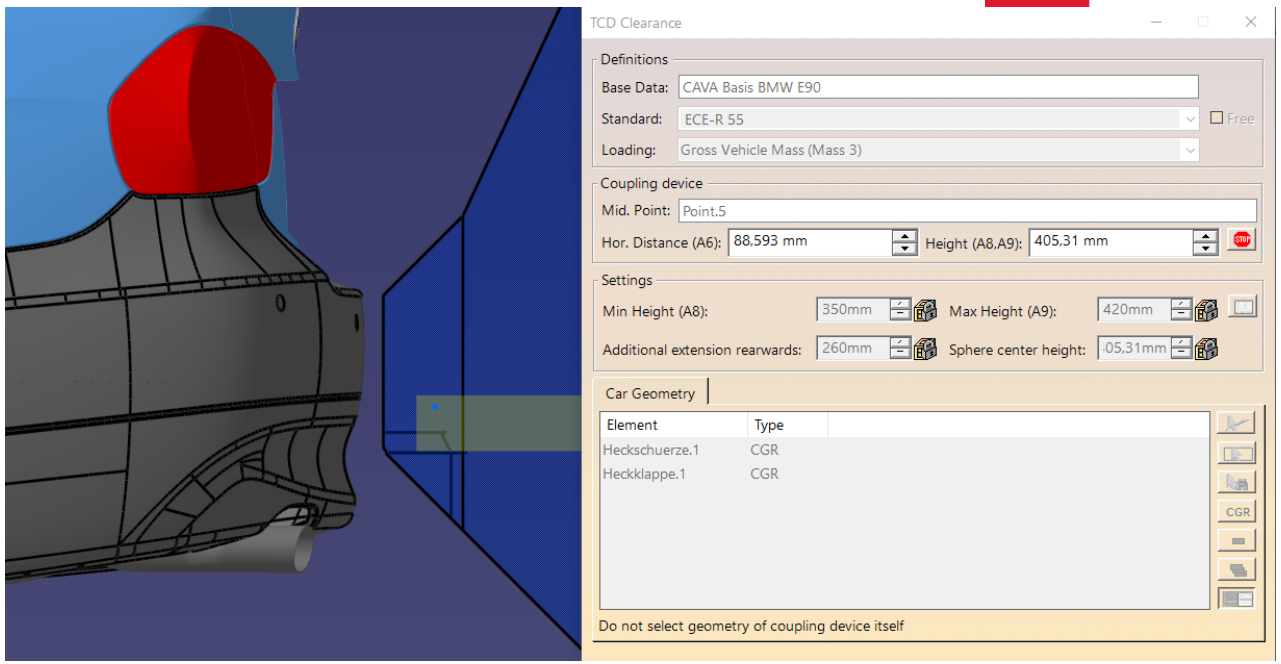
- ECE-R 55
- 94/20/EG

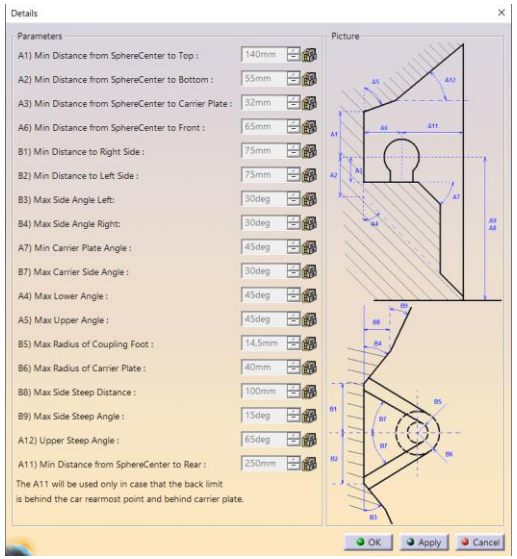
Features

- Visualize the required free space around the TCD
- Checks violation of the free space by the vehicle geometry
- Positioning tool to define the TCD center point in the allowed area

Result

- Visualization of the free space around the TCD
- Check result for free space violations





CAVA Manikin – Eye Points and Eye Ellipses

These CAVA functions simplify the tasks to create Eye Points and Eye Ellipses as required by international vision analysis standards.

Supported standards

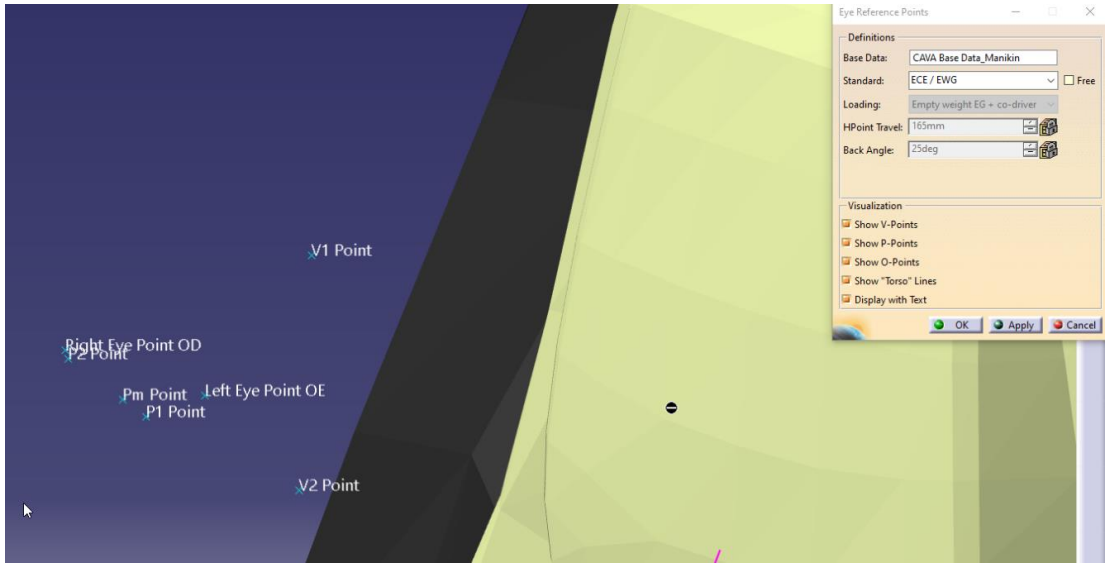
- Eye Points: ECE / EWG, ADR
- Eye Ellipses: FMVSS / SAE J941 (1965, 1997, 2002)

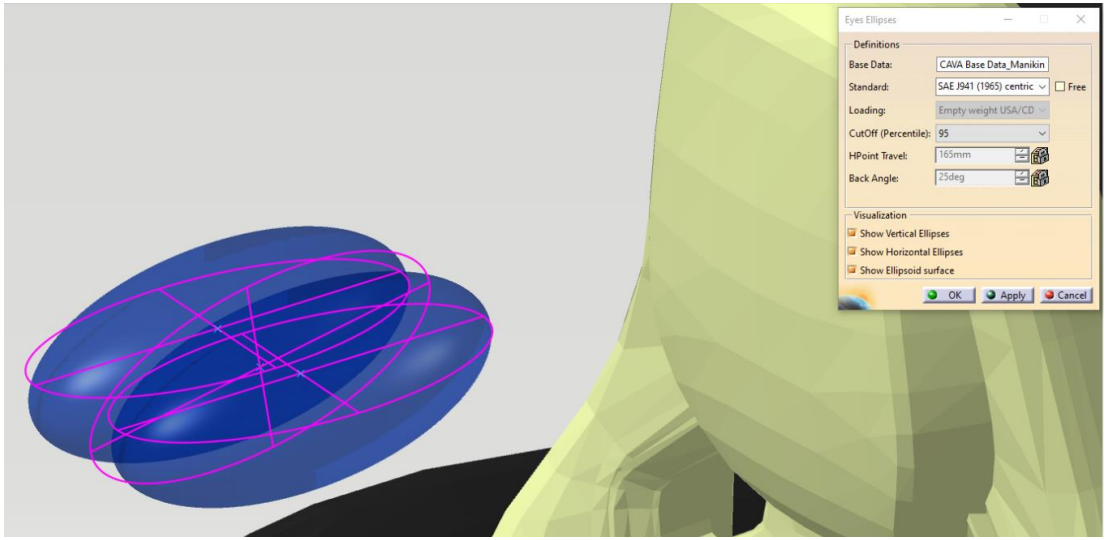
Features

- ECE Eye Points (V-Points, O-Points, P-Points) according to UNECE-R 125 for different purposes in vision and mirror analysis.
- SAE 941 Eye Ellipses as required by FMVSS vision standards
- Considers SRP point, seat back angle, seat travel, percentile and other seating parameters

Result

- Eye Points and Eye Ellipses positioned based on the selected standard and on seating parameters from CAVA Base Data





CAVA Manikin – 2D-Manikin Template

This function creates the 2D SAE Manikin template in different percentiles. Practical positioning options are available to help to define a good seating position as well as floor and pedal position and shape.

Supported standards include:

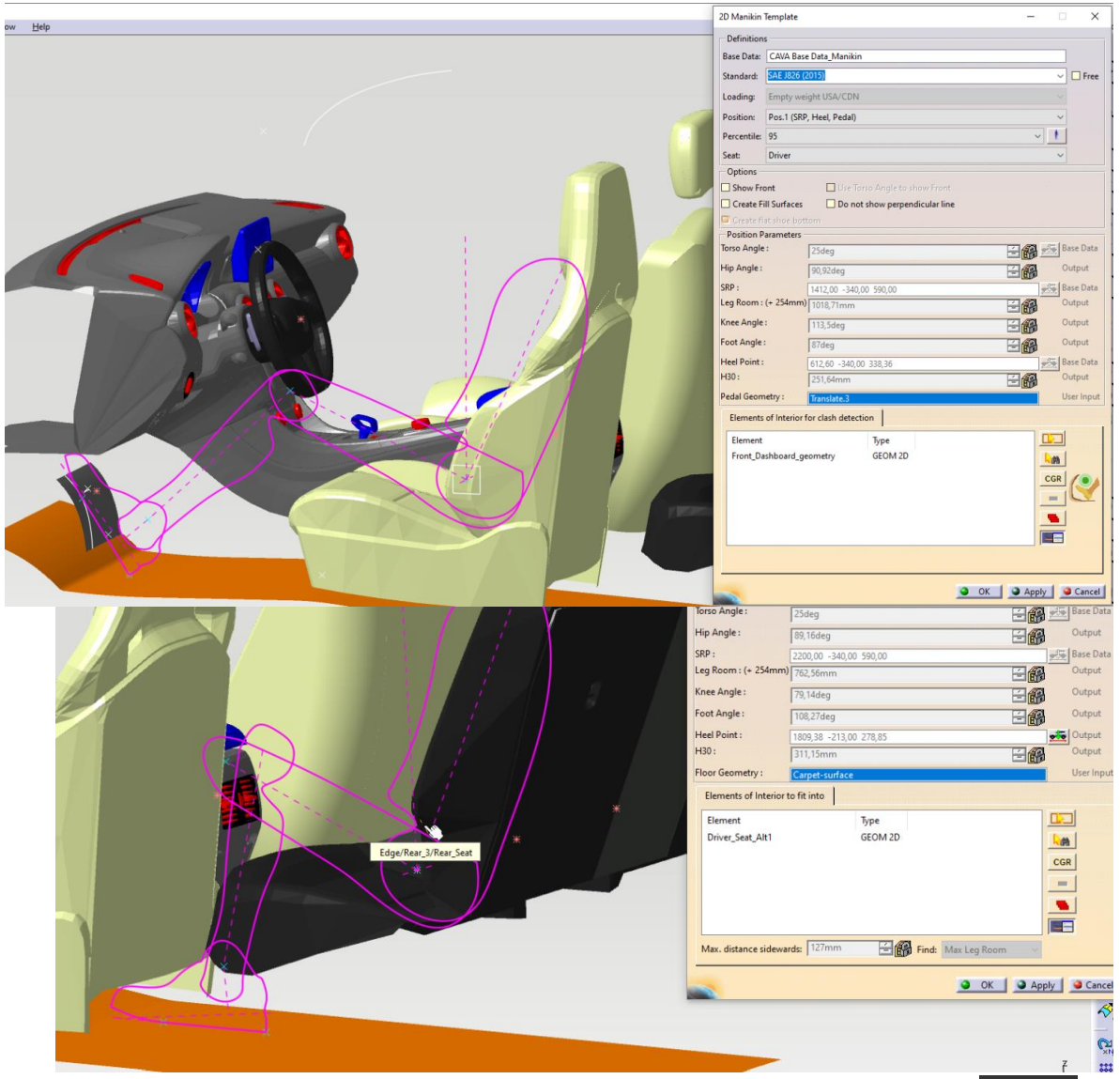
- SAE J941 (2015, 2016) – flat shoe and classic shoe

Features

- Manikin template of 95th, 50th and 10th percentile and user defined values
- Positioning methods based on seating reference point (SRP and input parameters to determine heel point and pedal position
- Positioning methods to determine SRP based on heel, floor and pedal
- Measurement of legroom for rear passengers

Result

- Manikin template positioned as per method and constraints
- Output of reference points and measurements for the joint angles, seating height and leg room
- Clash feedback



CAVA Manikin – SRP Location Curves

SAE SRP location curves are designed to provide a good and ergonomic SRP point for a given percentile, pedal point, seating height and legroom.

Supported standards

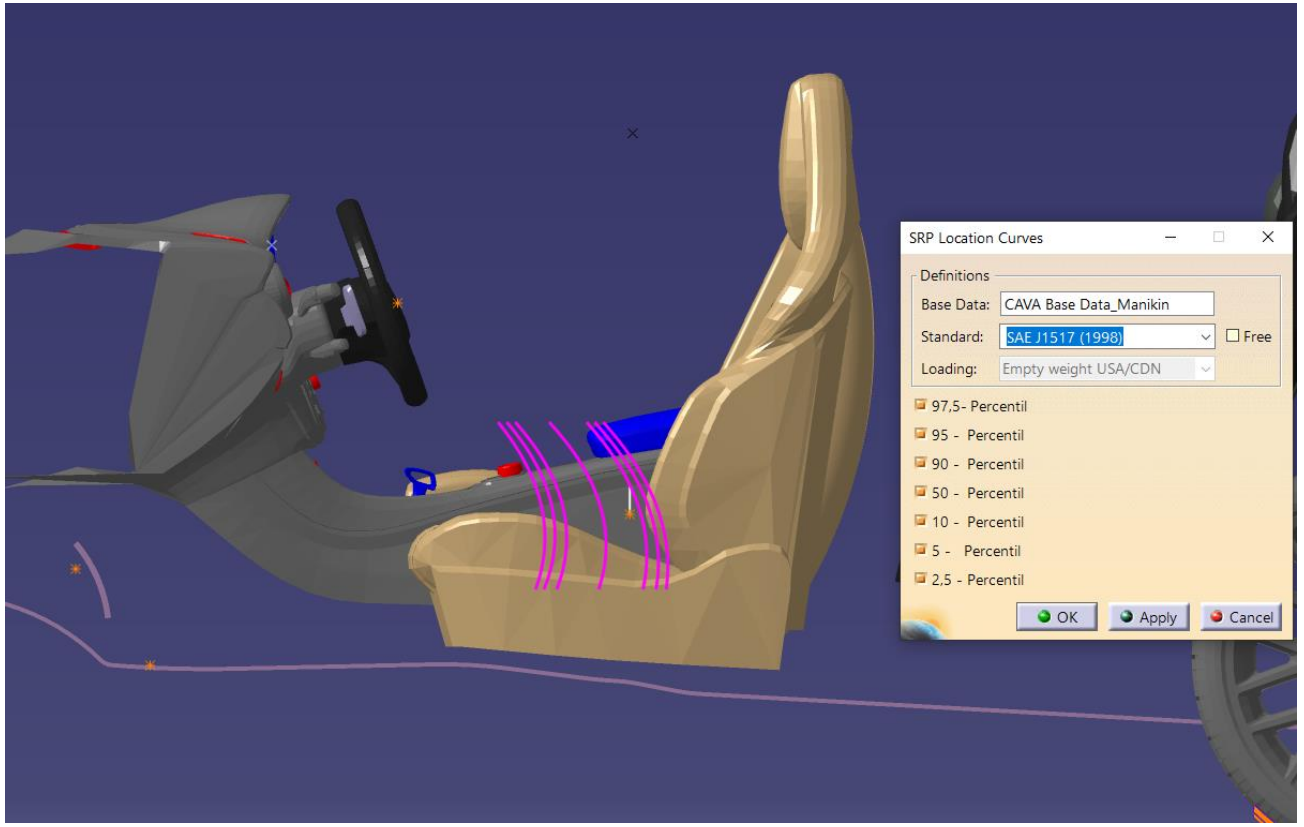
- SAE J1517, SAE J4004

Features

- Required input parameters are taken from CAVA Base Data
- Selectable percentiles
- Included in specific Manikin positioning methods

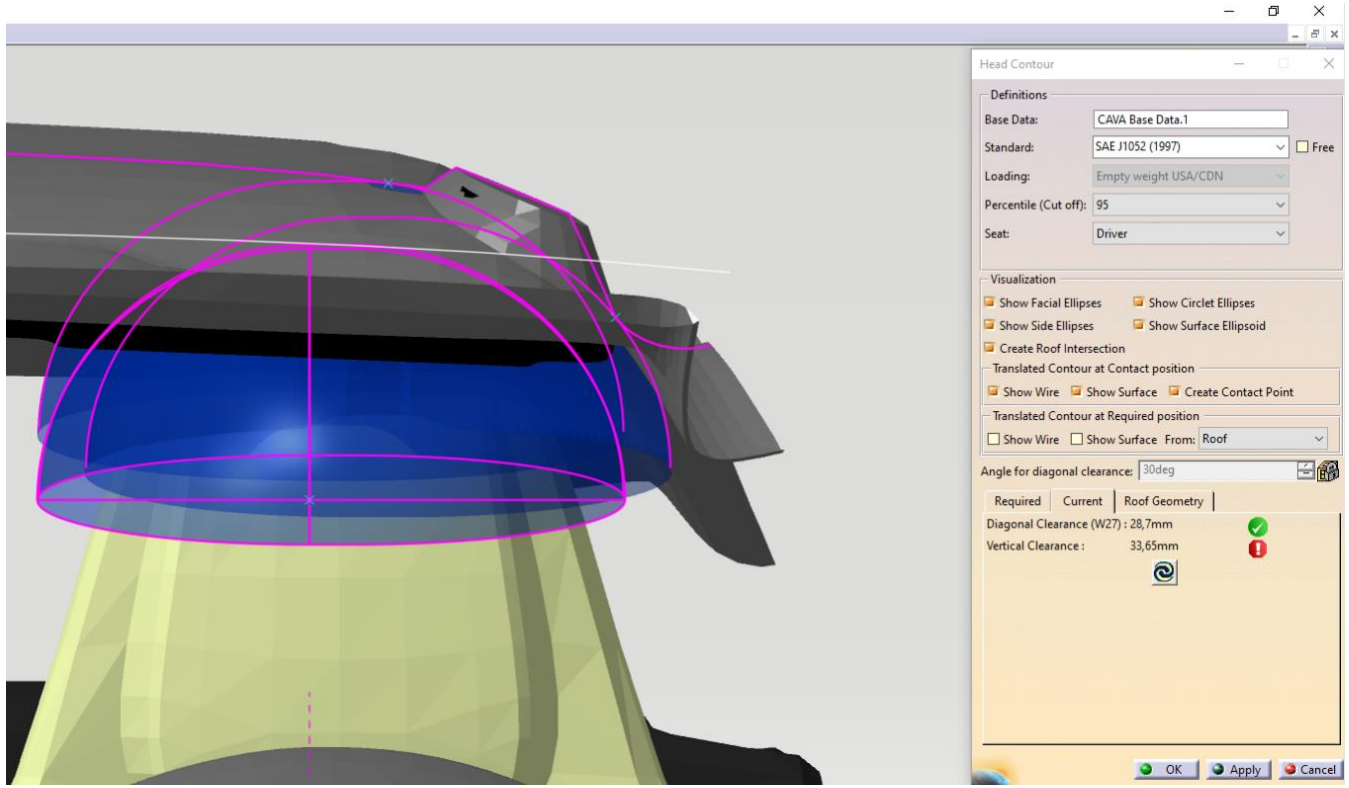
Result

- SRP location curves positioned based on percentile and on seating parameters from CAVA Base Data



CAVA Manikin – Head Position Contour

The SAE Head Position Contour describes an area of the position of an occupant's head for given percentiles. This CAVA function facilitates the required headroom measurements.



Supported standards

- SAE J 1052 (1997, 2002, 2010)

Features

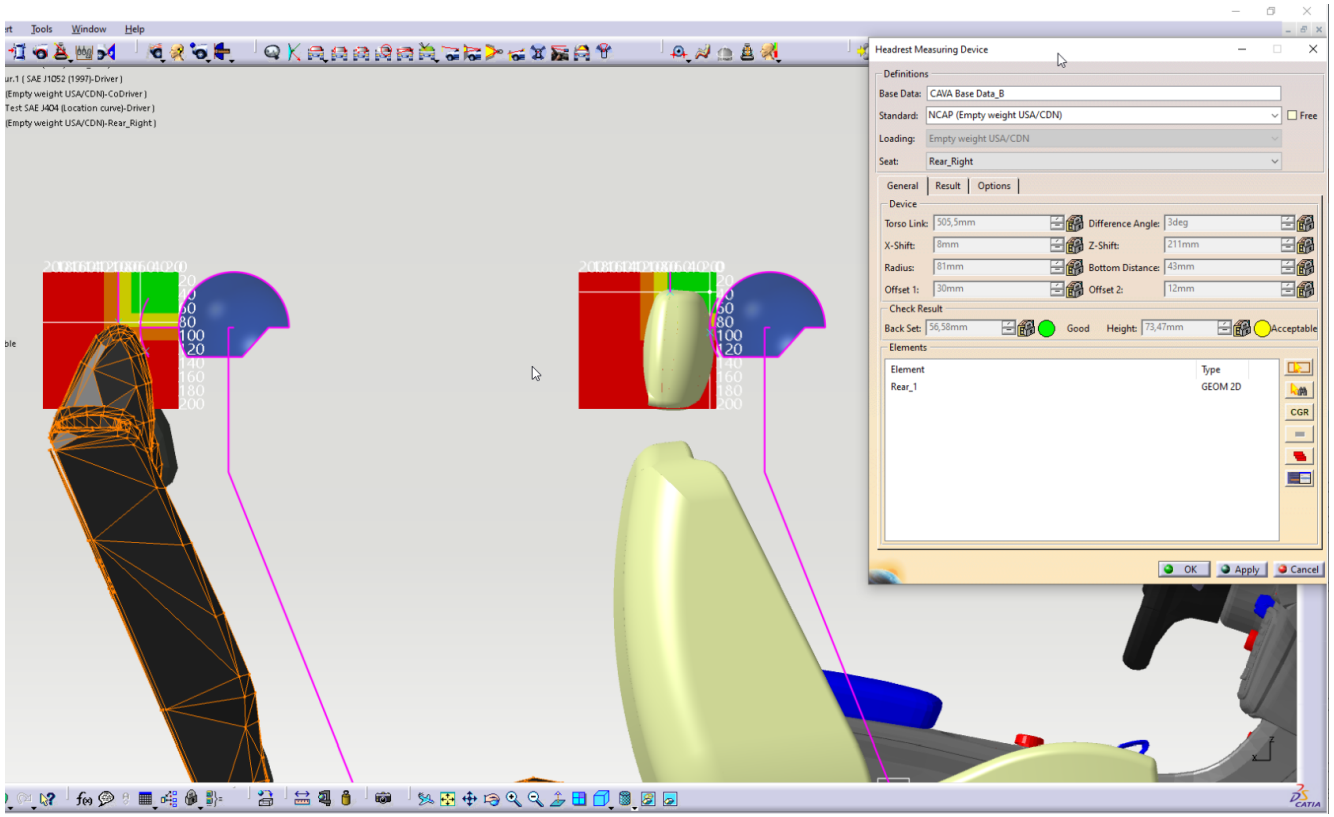
- Creates the shape of the ellipsoid according to SAE for a selected seating position
- Measurement of the values H35 („vertical head clearance“) and W27 („head clearance diagonal“)
- Display contact point and displaced position at contact point
- Transition of the ellipses in vertical and diagonal direction in relation to roof or origin position

Result

- Check result if required clearance is achieved
- Visualization elements for HPC and displaced shapes for contact measurements

CAVA Manikin – Headrest Measurement Device

This feature facilitates the determination of the backset and height as measured with the headrest measurement device (HMD) according to FMVSS and NCAP.



Supported standards include

- FMVSS 202a
- NCAP

Features

- Measurement with a head form placed according seating parameters
- Graphical display of backset and height measurement
- 2D-View display of the standards evaluation schema
- Optional visualization of the view pyramid planes

Result

- Check result classified according to limits in the standard

CAVA Manikin – Head Rest Validation

This function checks the width and height of the headrest in respect to roof clearance distance.

Supported standard

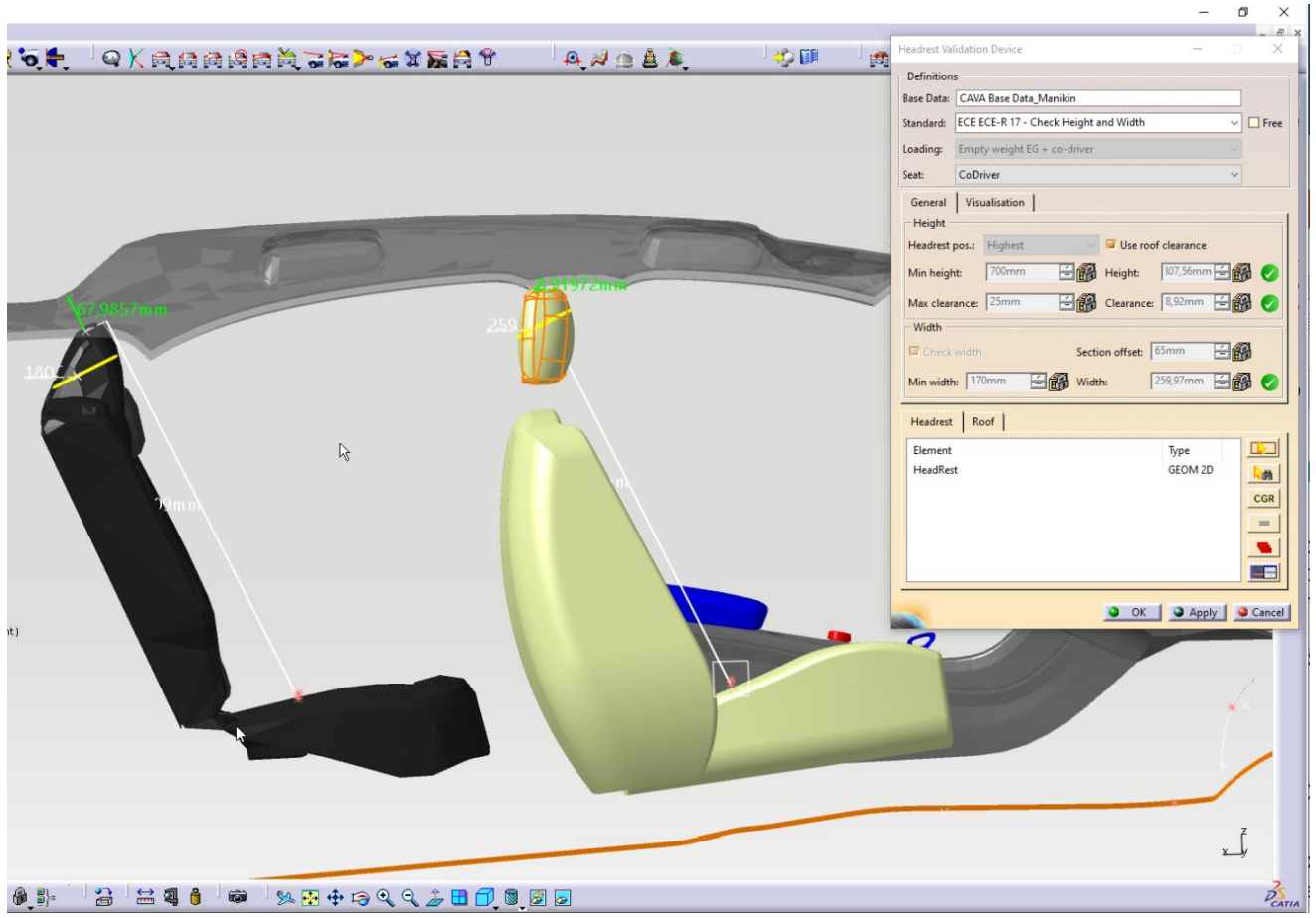
- ECE-R 17 (Height and Width)

Features

- Measures and displays maximum width of the headrest in the required plane
- Measures the height of the headrest for lowest and highest position at each seating position
- Measures and considers clearance to the roof

Result

- Check result if head rest width is within limits
- Check result if head rest height is within height limits



CAVA Manikin – Hand Reach Zones

This function helps to determine the Drivers Hand Reach Zone as defined in SAE J827.

Supported standard

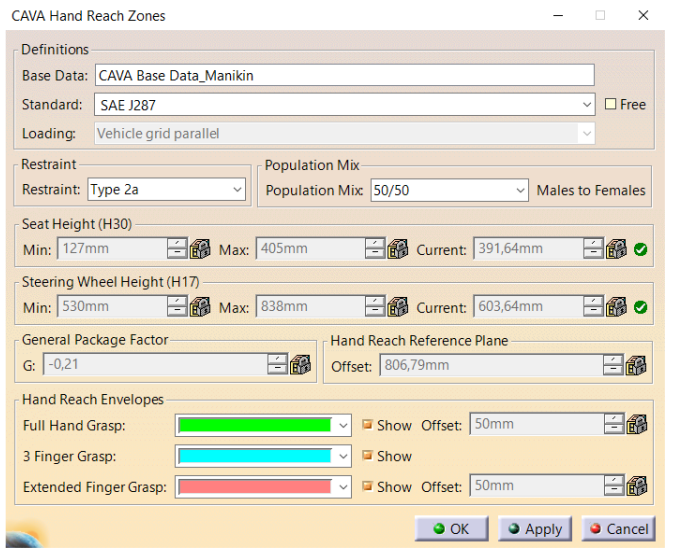
- SAE J827

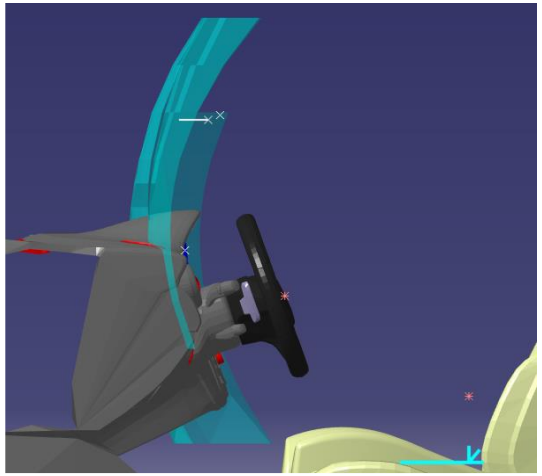
Features

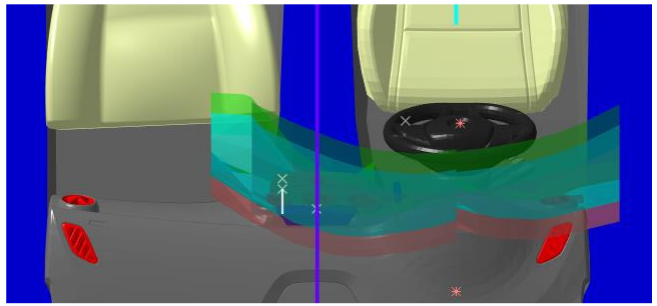
- Calculates General Package Factor from the Base Data Seat parameters
- Considers seat belt restraint type and population mix
- Hand envelope calculated for
  - Full hand grasp
  - 3 Finger grasp
  - Extended finger grasp

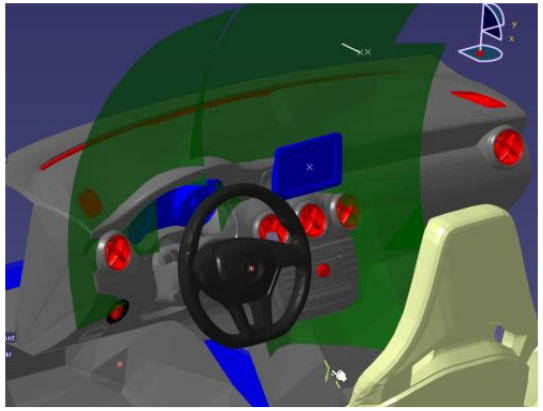
Result

- Calculated General Package Factor
- Graphical feedback of the Hand Envelope









CAVA Vision - Fields of View on the Windshield

The fields of view on the windshield describe areas on the windshield, which are relevant for certain studies. These A-, B- and C-Fields are required to check the regulations for the wiped area, defrosting or optical properties of the windshield.

Supported standards include

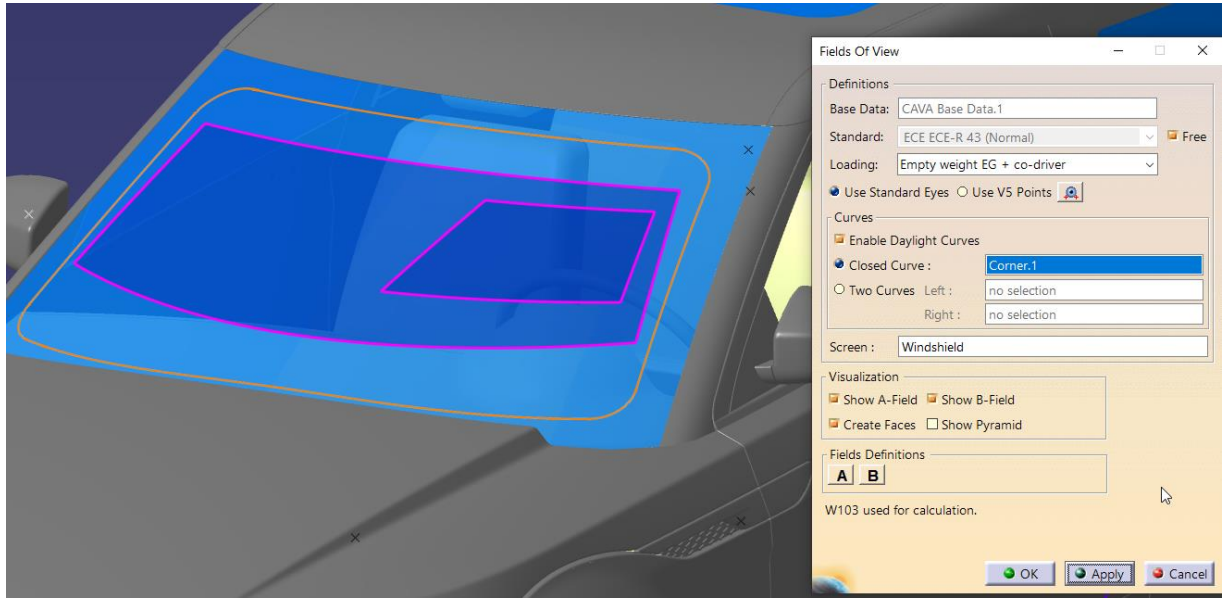
- ECE-R 43, EG EWG (Wiper, Defrosting)
- FMVSS 104, CMVSS 104
- ADR 16, ADR 8, China GB 11555-2009 Defrosting

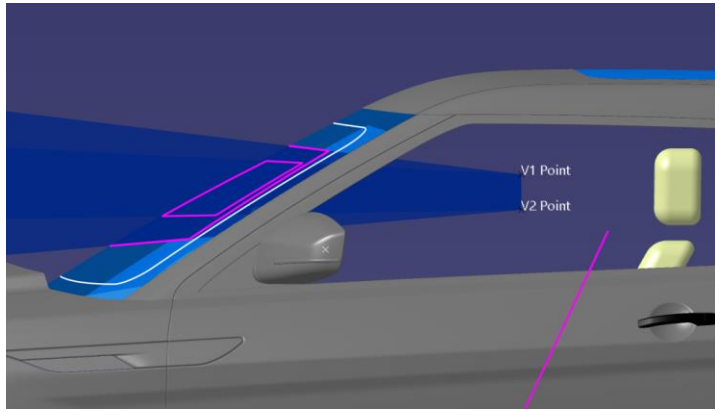
Features

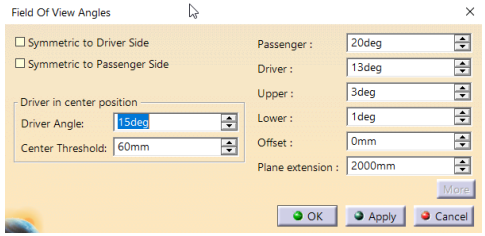
- Calculates the boundaries and surfaces for the A,B,C fields
- Automatically uses Eye Points or Eye Ellipses acc. to selected standards
- Option to consider daylight opening curves
- Optional visualization of the view pyramid planes

Result

- Visualization of field boundaries and surface
- Feature ready to be use for CAVA wiper and CAVA optical properties analysis







CAVA Vision – Extended/ Reduced Fields of View on the Windshield

The standard ECE-R 43 defines an extended A-Field and a reduced B-Field. Considering that vision reference points on the windshield always need to be in the visible area, several options are available how to define the reduced B-Field in practice.

Supported standard

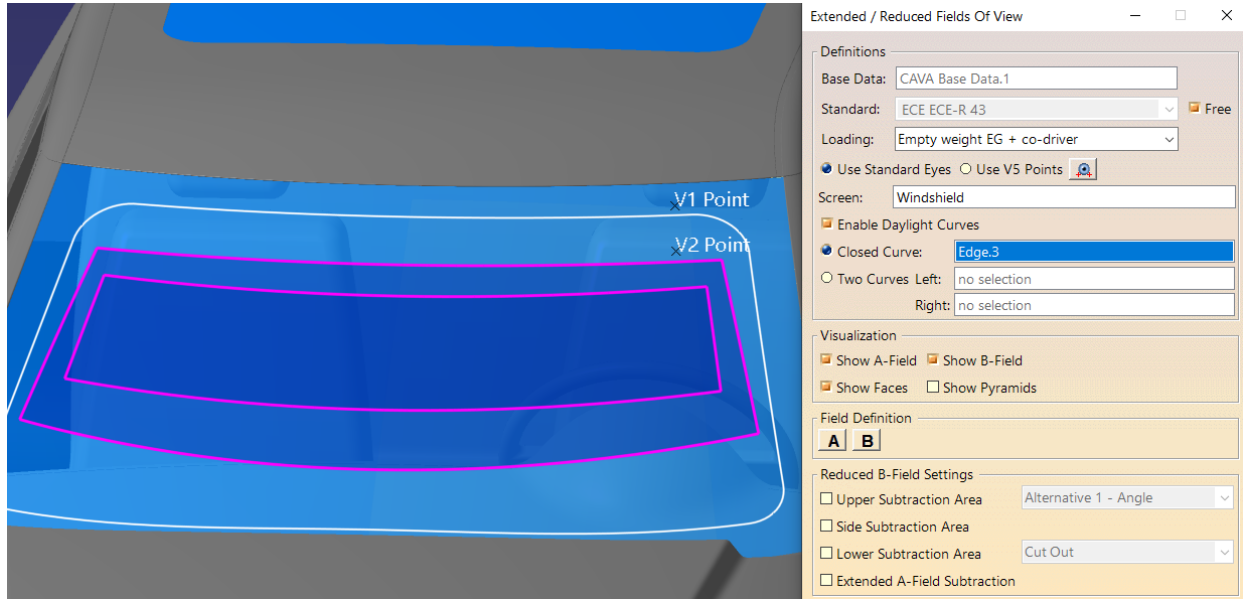
- ECE-R 43

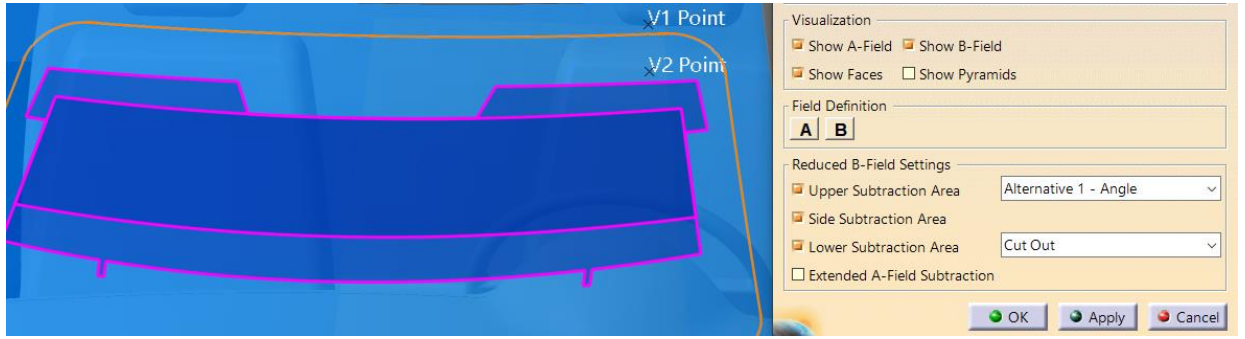
Features

- Different options to create the lower, upper and side subtraction areas (cutouts)
- Automatically uses Eye Points for ECE (V-Points)
- Optional visualization of the view pyramid planes including the subtraction areas

Result

- Field boundaries and Field surfaces for extended A-Field and reduced B-Field





CAVA Vision – A-Pillar Obstruction

This feature calculates where the field of view is obstructed by the A-pillars according to the UNECE-R 125 regulation.

Supported standard

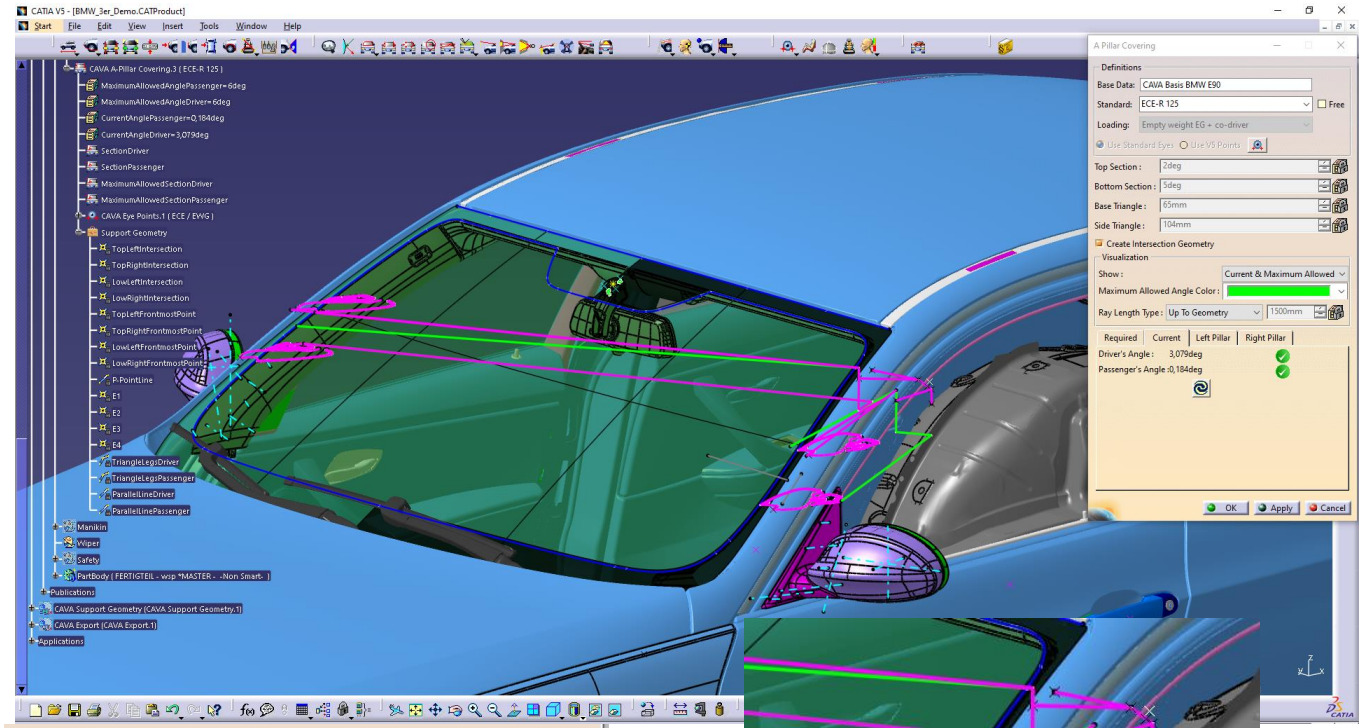
- ECE-R 125

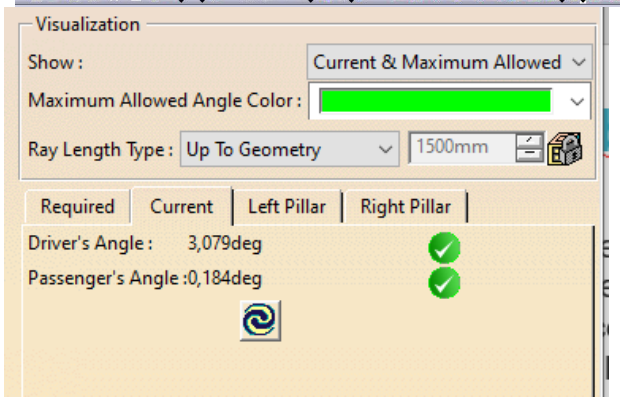
Features

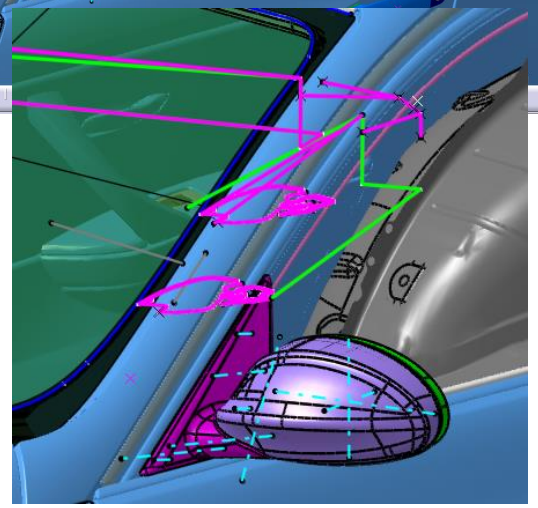
- Calculate the ambinocular obscuration angle of the A-Pillar geometry for left and right side
- Uses the automatically created P-Points acc. to ECE
- Visualization of the measured angle and maximum possible angle
- Visualizes the construction geometry

Result

- Visualization geometry and measured angles
- Check result for obstruction values for left and right side







CAVA Vision – Vision Points

The standard UNECE-R125 defines six points which must be positioned in the transparent area of the windshield. Therefore, it is important for the designer to determine the position of these points already when designing the windshield.

Supported standard

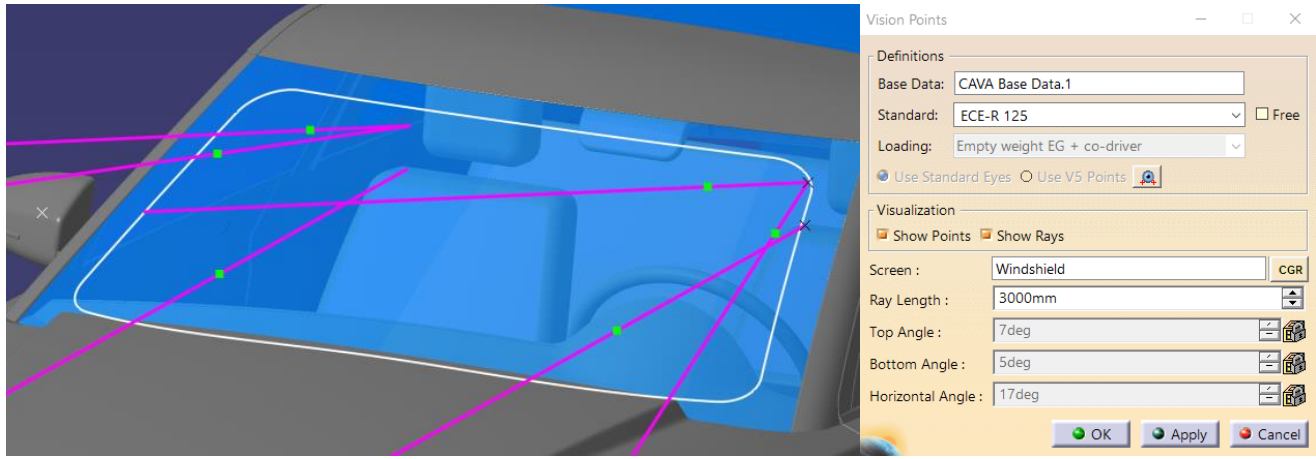
- ECE-R 125

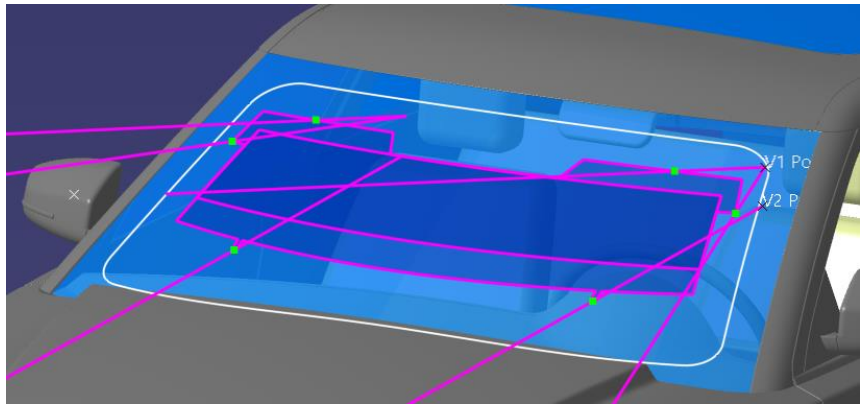
Features

- Determines the reference points on the windshield based on the V-Points
- Display of the sight rays based on angles from the standard

Result

- Reference points on the windshield
- Sight rays from V points through the reference points





CAVA Vision – Vision Planes

In the Standard UNECE-R 125 planes are defined starting from the V-points. Between the planes there must be no view obstructions. There are exceptions for steering wheel, and some obstruction is allowed in the defined “Area S”.

Supported standard

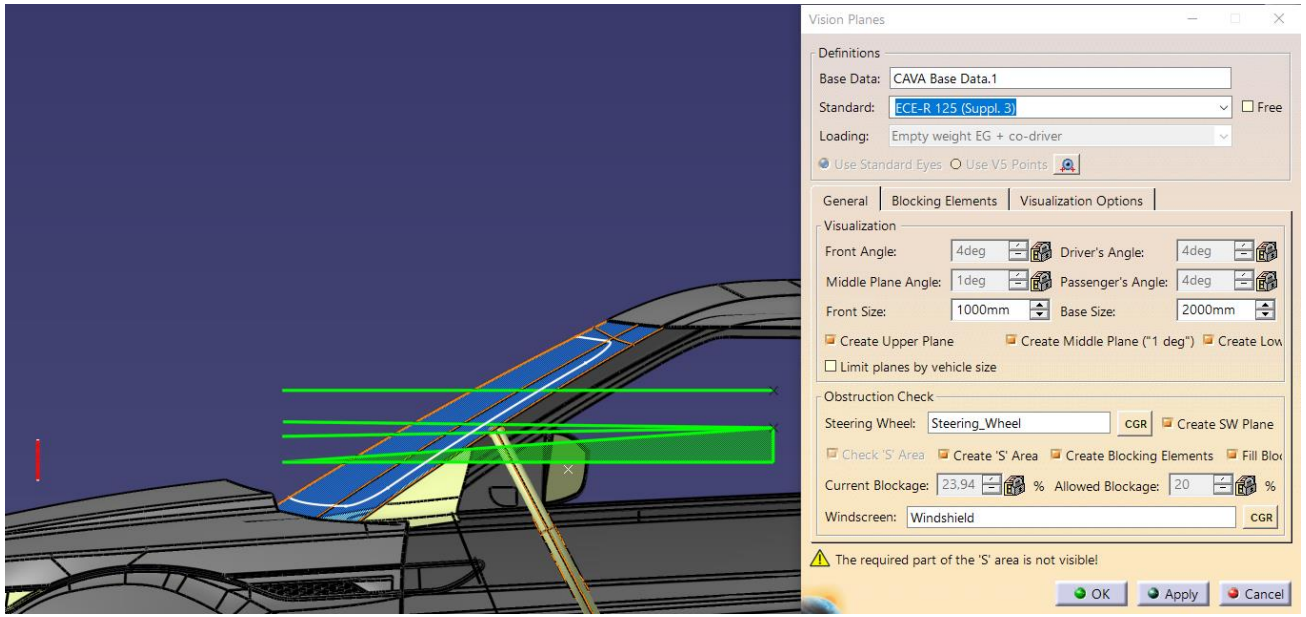
- ECE-R 125

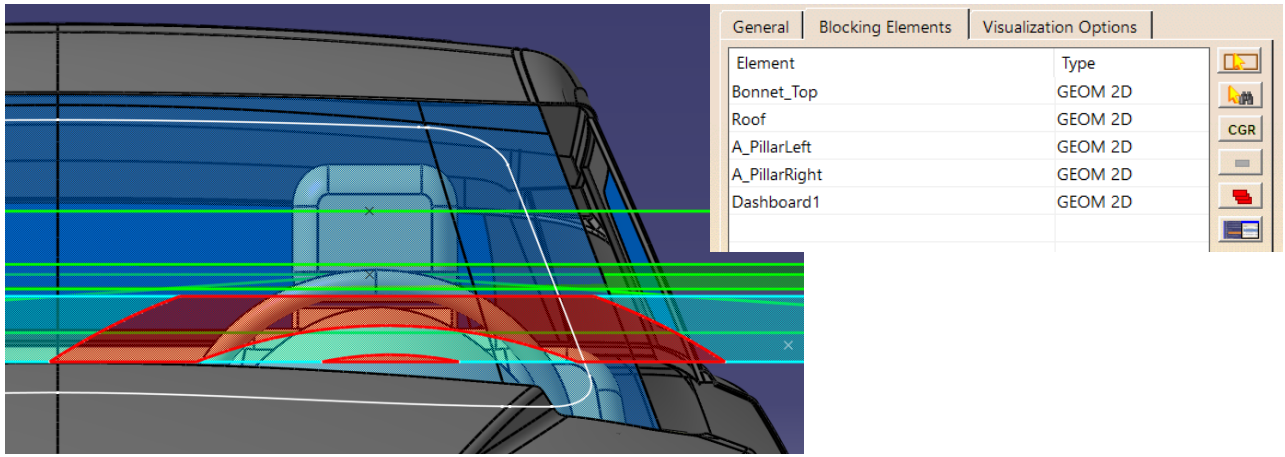
Features

- Creates the plane limits of the obstruction free zone
- Checks if obstructions occur in the forbidden zone
- Checks the steering wheel height specifically
- Visualizes obstructed areas in “Area S” and calculates the obstruction percentage

Result

- Visualization of reference planes and Area S
- Check result for obstruction in the forbidden zone
- Check result if the allowed obstruction value in Area S is violated





CAVA Vision – Optical Properties of the Windshield

A windshield needs to comply with regulations with respect to optical quality in the A-Field and B-Field. With CAVA you can measure and visualize the **optical distortion** and the **double image angle** and check if the actual values are within the given limits.

Supported standard

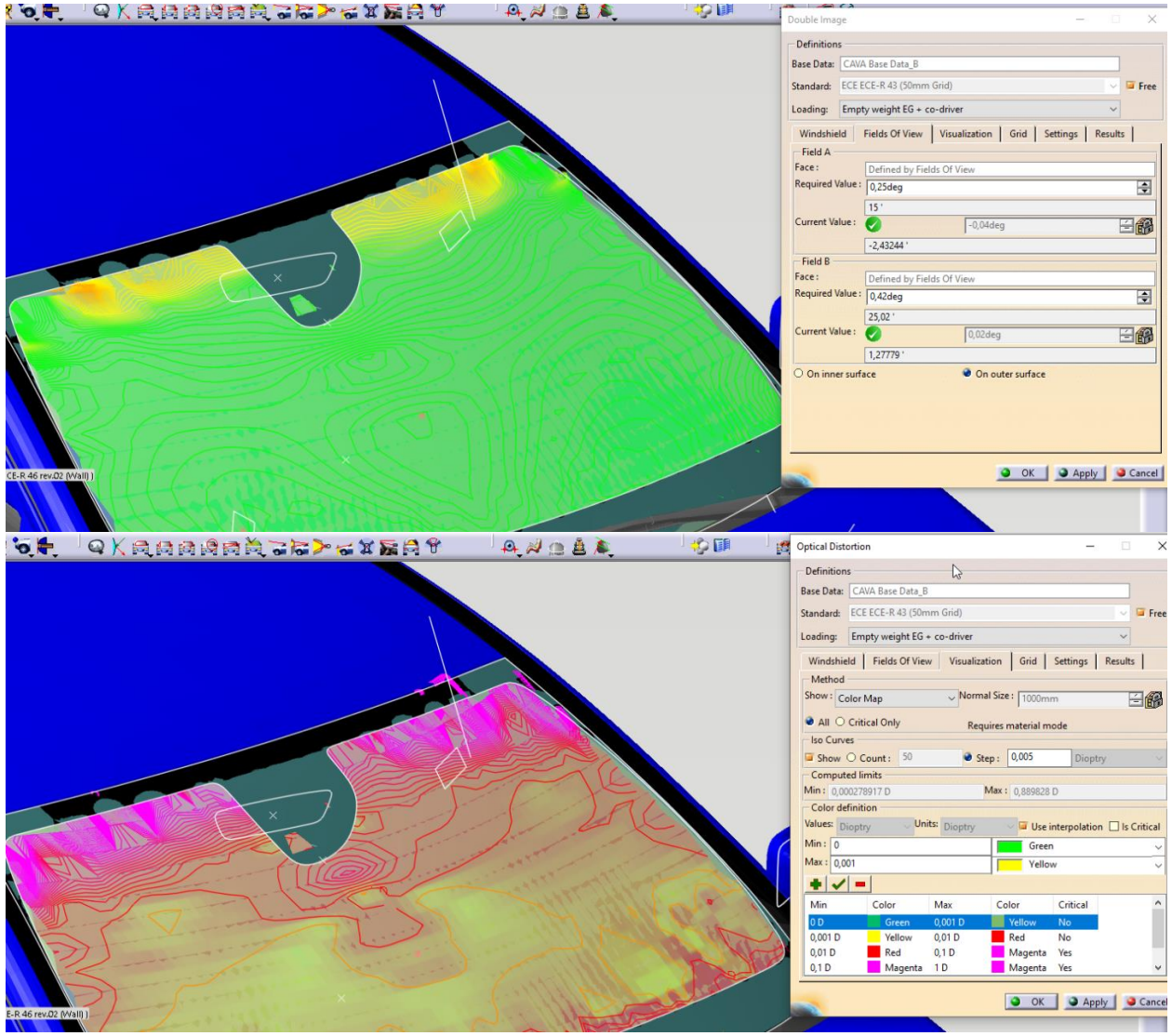
- ECE-R 43

Features

- Visualizes the measured values as color coded feedback
- Shows isoline on the windshield
- Automatically creates a windshield for the given thickness
- Double angle calculation can consider the correction by non–uniform glass thickness with a given wedge angle
- Interactive measurement of user selected points

Result

- Check result if optical distortion and double image angle is within the limits of the regulation



CAVA Vision – Rear View Mirror

The CAVA Mirror function shows the fields of vision through the rearview mirror, including measuring possible obstructions. In addition to checks of the homologation requirements, you can easily check how changes to individual mirror parameters affect the field of vision.

Supported standard

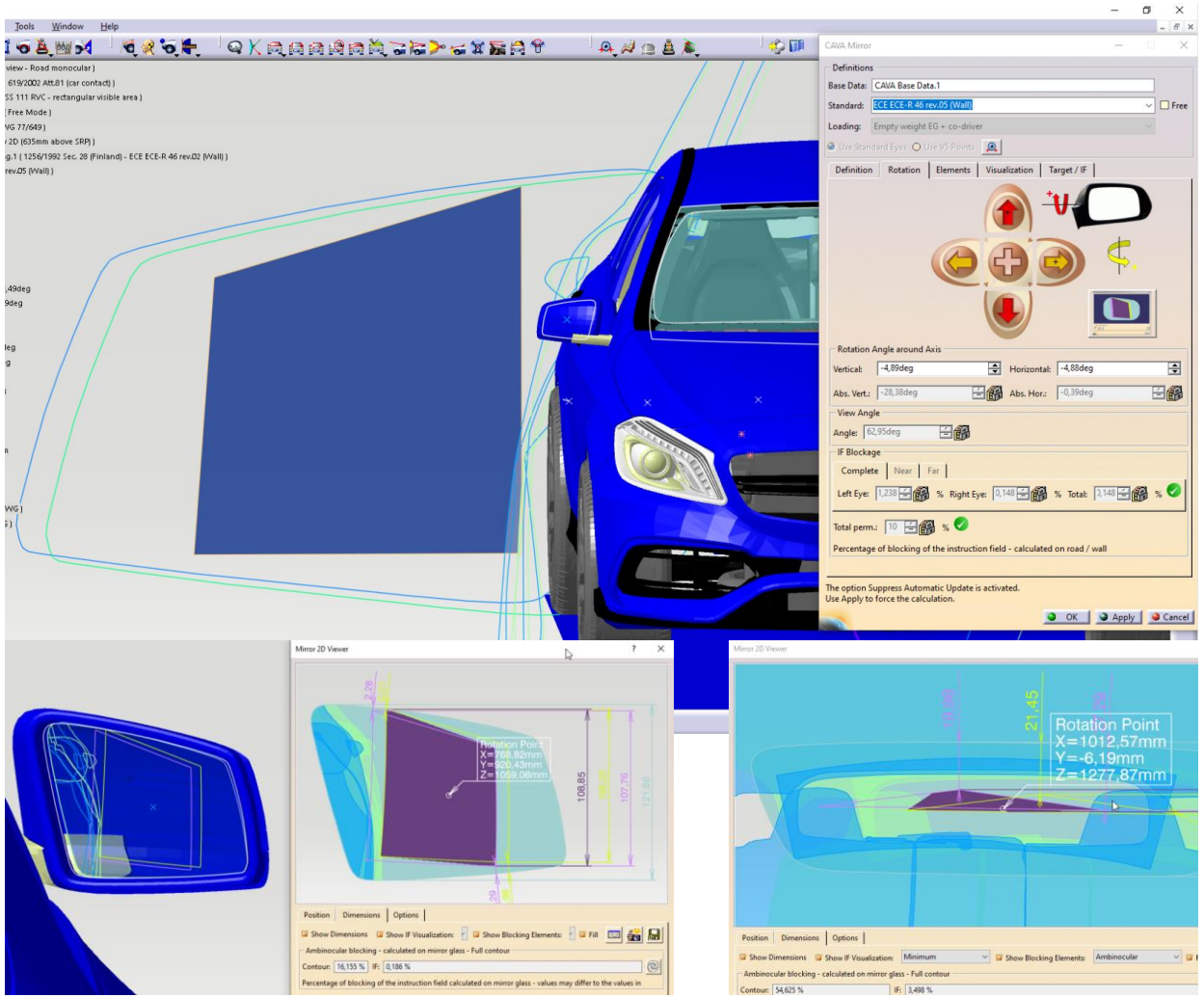
- ECE-R 46, FMVSS 111, GSO
  - Standards with instruction fields on road and on wall

Features

- Shows the ambinocular field of vision of the mirror
- Parametrical mirror definition (planar, spherical, toroid and aspherical) or definition by selected surface. Available for exterior and interior mirrors.
- Visualizes and measures obstructions by the car geometry
- Visualizes the resulting vision cone

Result

- Check result if complete instruction field is in field of vision
- Check result for % of allowed obstructions
- Check result for mirror parameters



CAVA Vision – General Mirror

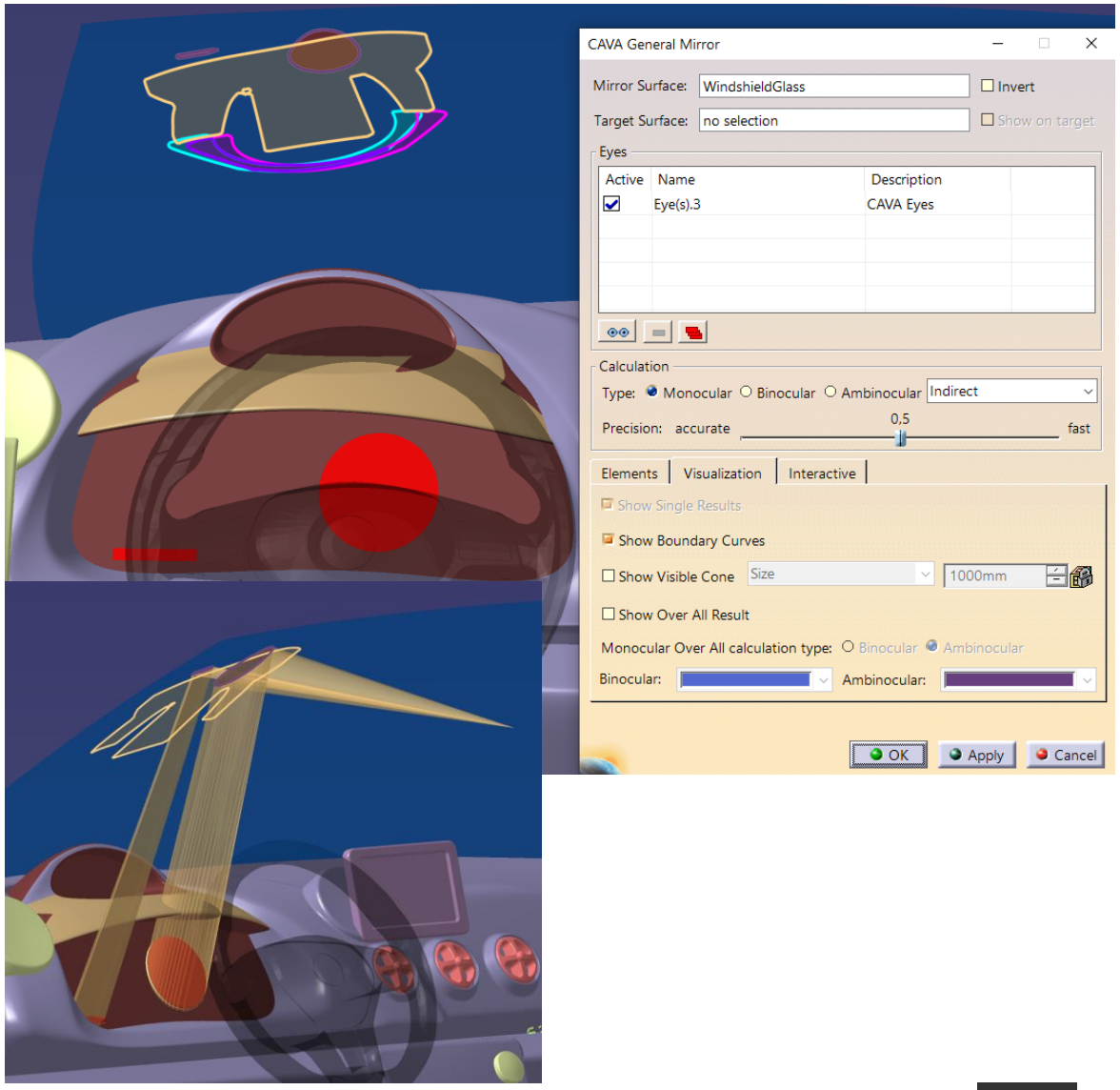
This function enables the user to detect mirroring reflections of specular or illuminated interior elements in the glass surfaces like windshield or the side windows.

Features

- Shows the reflection of selected elements in the screen
- Use multiple eye-positions for drivers of different sizes
- Monocular, binocular and ambinocular result
- Shows the vision cone to the reflecting elements
- Detect if the reflecting or illuminated element is covered by a glare shield
- Interactive vision ray check of selected point on screen

Result

- Visualization of reflection on the windshield
- Visualization of the vision cone



CAVA Vision – Direct View

This CAVA function checks the view in a defined direction, e.g. to the front, rear or to the side.
The aperture angle between the possible top and bottom vision rays is determined by the window opening. The limiting geometry of the vehicle can be taken into consideration.

Standards

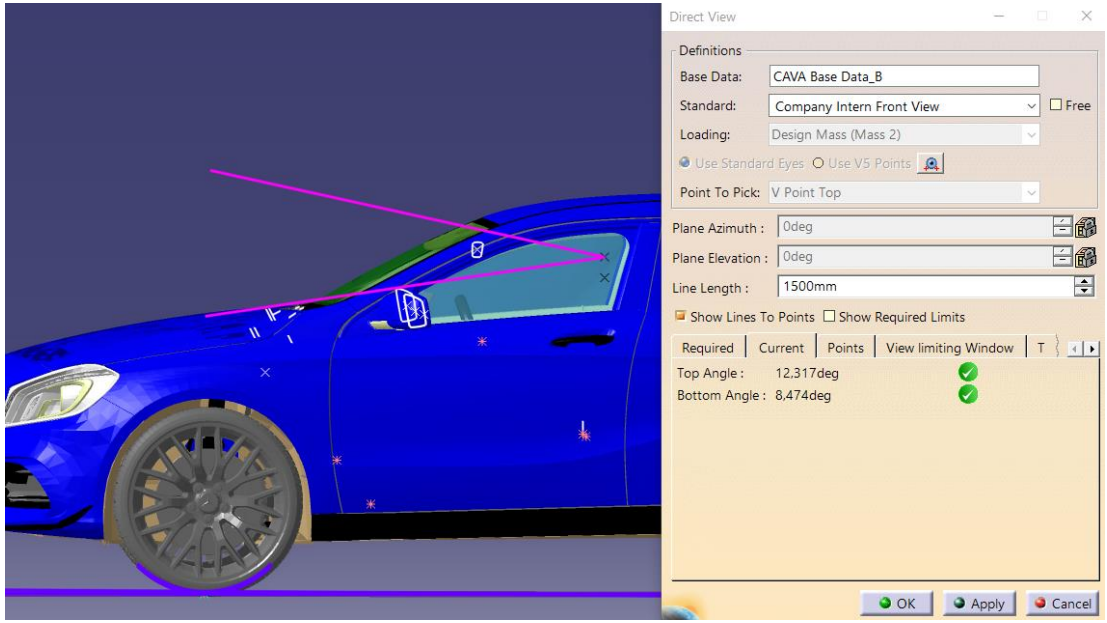
- GCIE A124-1-U
- GCIE A123-1-U & GCIE A123-1-L (Front)
- GCIE A123-2-U & GCIE A123-2-L (Rear)

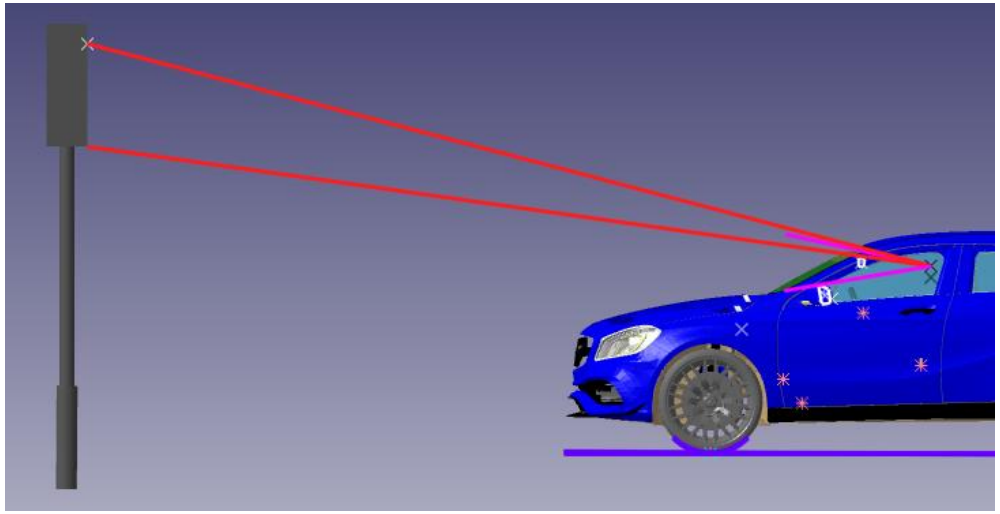
Features

- Calculates upper and lower view angle
- Visualizes the maximum angle sight rays
- Checks visibility of user selected point for requirements like the visibility of a traffic light

Result

- Check result if required angles are achieved





CAVA Vision – Direct View 3D

Create the obstructed areas on the road or on a wall around a car from the driver's viewpoints. Analyze and detect obstructions from the steering wheel on the dashboard.

Practical Application Standards:

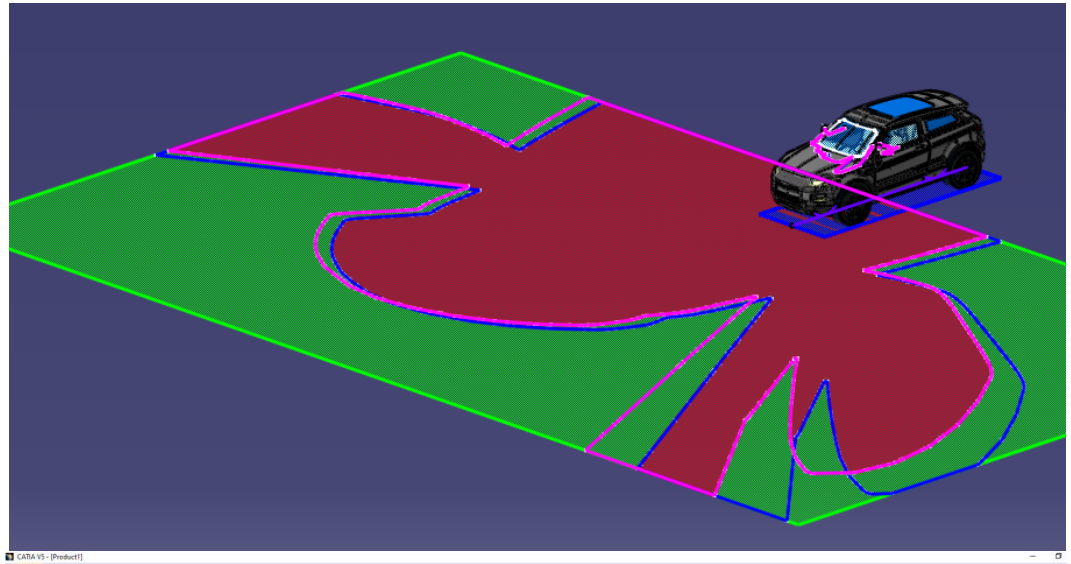
- All-round Vision
- Vision on the road to the Front

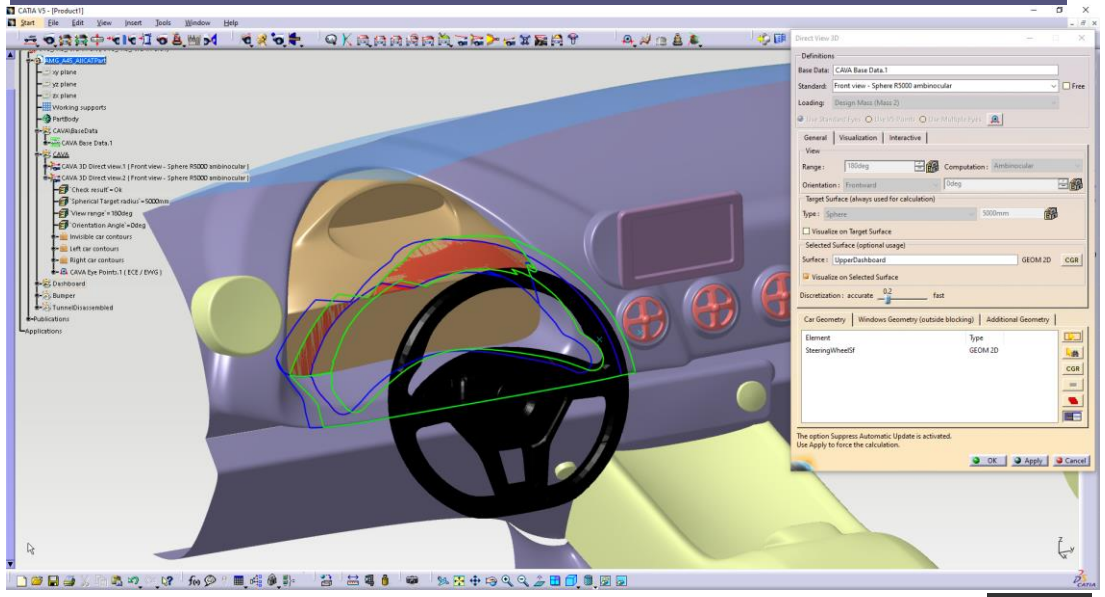
Features

- Calculate the vision boundaries ("shadow lines")
- Calculate obstructed and visible area on a target surface
- Create monocular or ambinocular vision
- Visualize the resulting vision cone
- Create the "hood line"

Result

- Calculation of all vision boundaries
- Create an overall result for multiple eye positions





CAVA Vision – Camera Field of View

Calculates the vision cone for a camera and visualizes the visible areas on the road, wall or other objects.
Calculates the combined view of a set of cameras (like for artificial “surround view”).
Applicable for optical cameras but also for similar sensors like ultrasound and thermal imaging and radar.

Supported standard

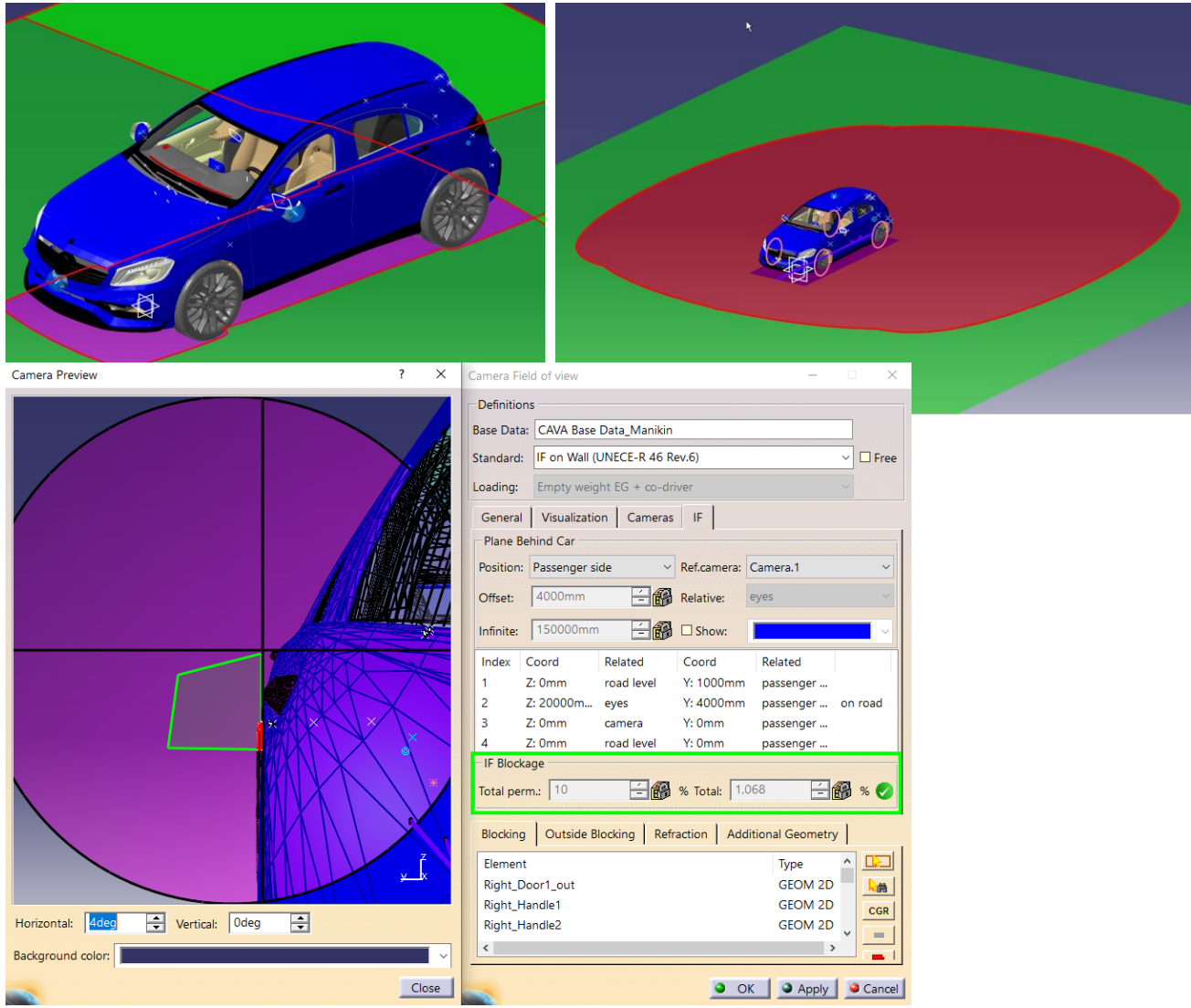
- ECE-R 46 (IF visibility and obstruction value)

Features

- Calculate the vision boundaries (“shadow lines”)
- Calculate obstructed and visible area on a target surface
- Create combined vision of multiple cameras
- Visualize the resulting vision cone
- Supports user defined vision cones: conical, pyramidal, custom by section or surface, LIDAR
- Camera Preview Window

Result

- Resulting Field of View boundaries and areas
- CMS Rear View: Check result for % of allowed obstructions



CAVA Vision – Close Range Visibility

The Japanese visibility law requires the visibility of an „obstacle“ for the driver by direct view or by using a mirror or other optical systems. The obstacle, which is defined as a cylinder with a height of 1 m and a diameter of 0,3 m, must be visible (even partly) in a defined range in front of and beside the driver.

Supported standards

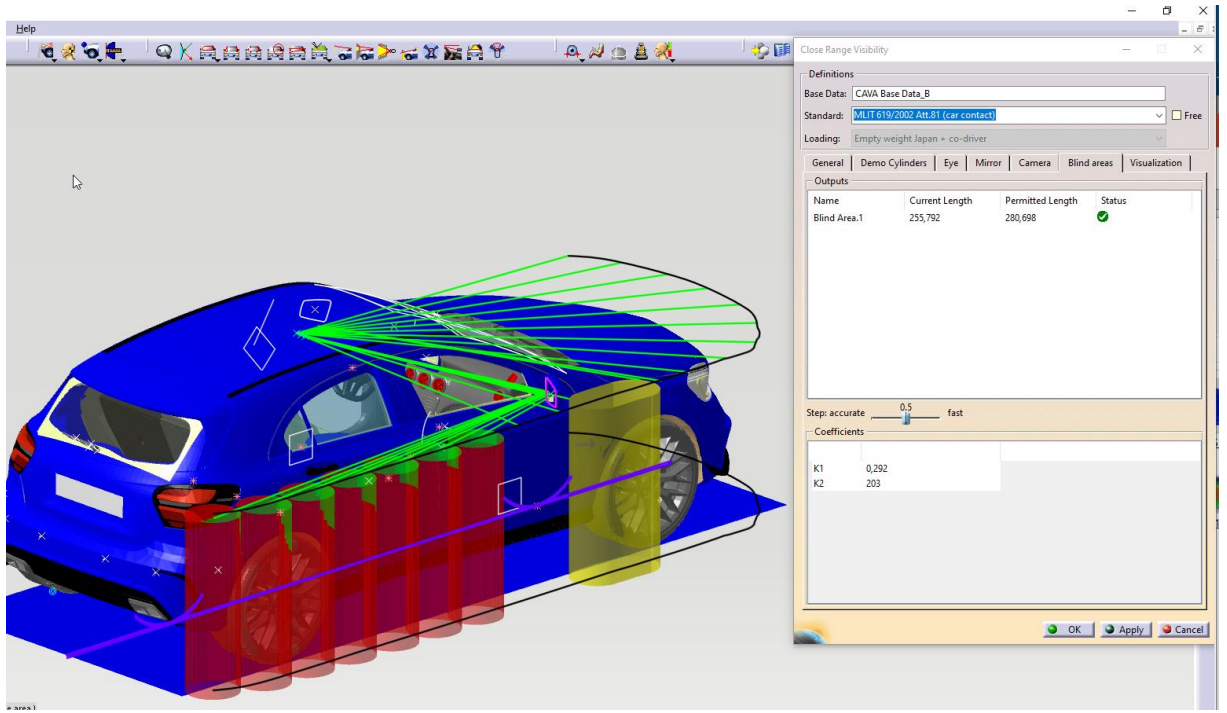
- MLIT 619/2002 Att.81
- ECE-R 125 Frontal Field
- FMVSS 111 and ECE (Rear View Camera)

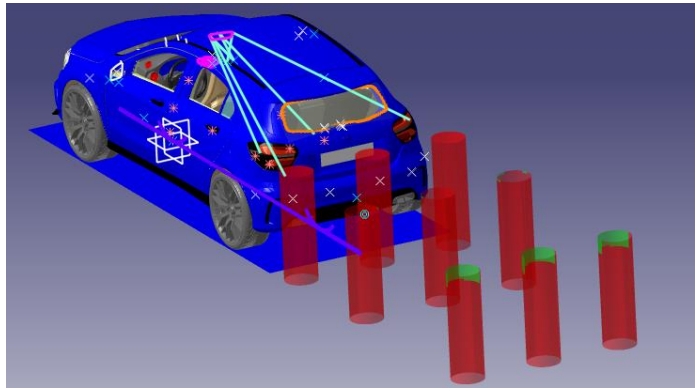
Features

- Detects and measures the Blind Area according to MLIT
- Support specific eye point definition for MLIT regulation
- Shows the visible and non-visible areas on the test cylinders
- Combines direct vision, mirror vision and camera vision
- Camera definition like in Camera Field of View
- Import Mirror definition from CAVA mirror analysis

Result

- Check result for MLIT Blind Area and FMVSS111 requirements
- Detailed visibility feedback on the test cylinders





CAVA Vision – Plan View

Visualization of all around view according to GCIE requirements. Automatic calculation of GCIE pillar obstructions and DLO angles as parameter values.

Supported standard

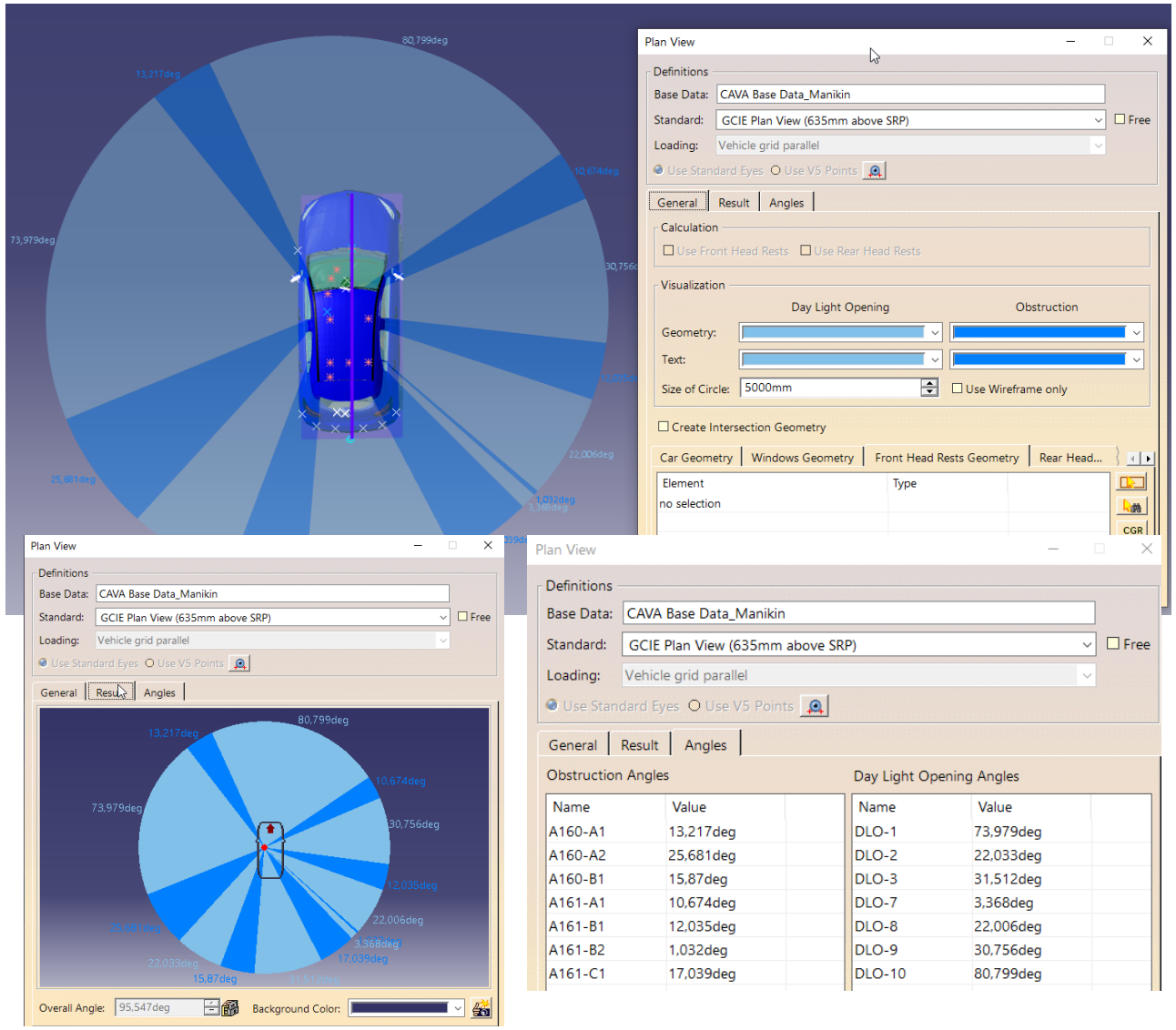
- GCIE Plan View

Features

- Selection of vehicle, window geometry and headrests
- Customizable display in 2D-View window with capture option
- Obstruction angles and DLO angles calculated as parameters named according to GCIE guidelines

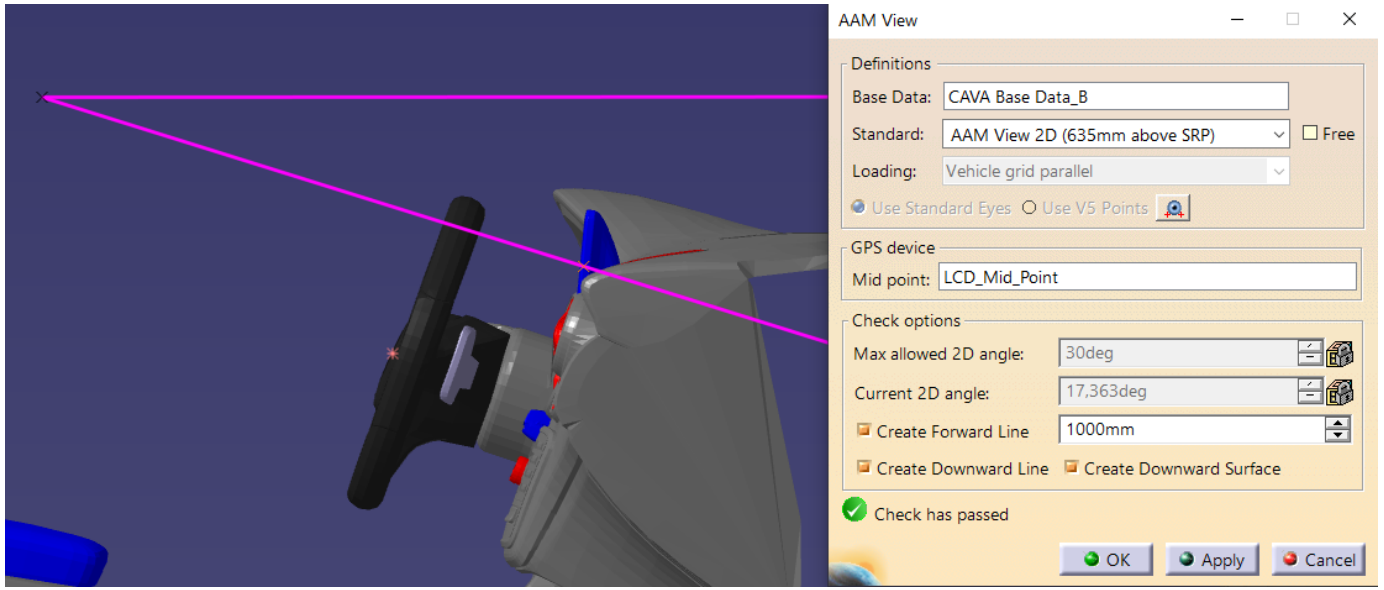
Result

- Visualization of obstructions and DLO
- Parameters for obstructions and DLO angles
- Calculates overall obstruction angle



CAVA Vision – AAM View

This feature checks the view to a GPS Device and visualize the required 2D View range.



Supported standard

- AAM

Features

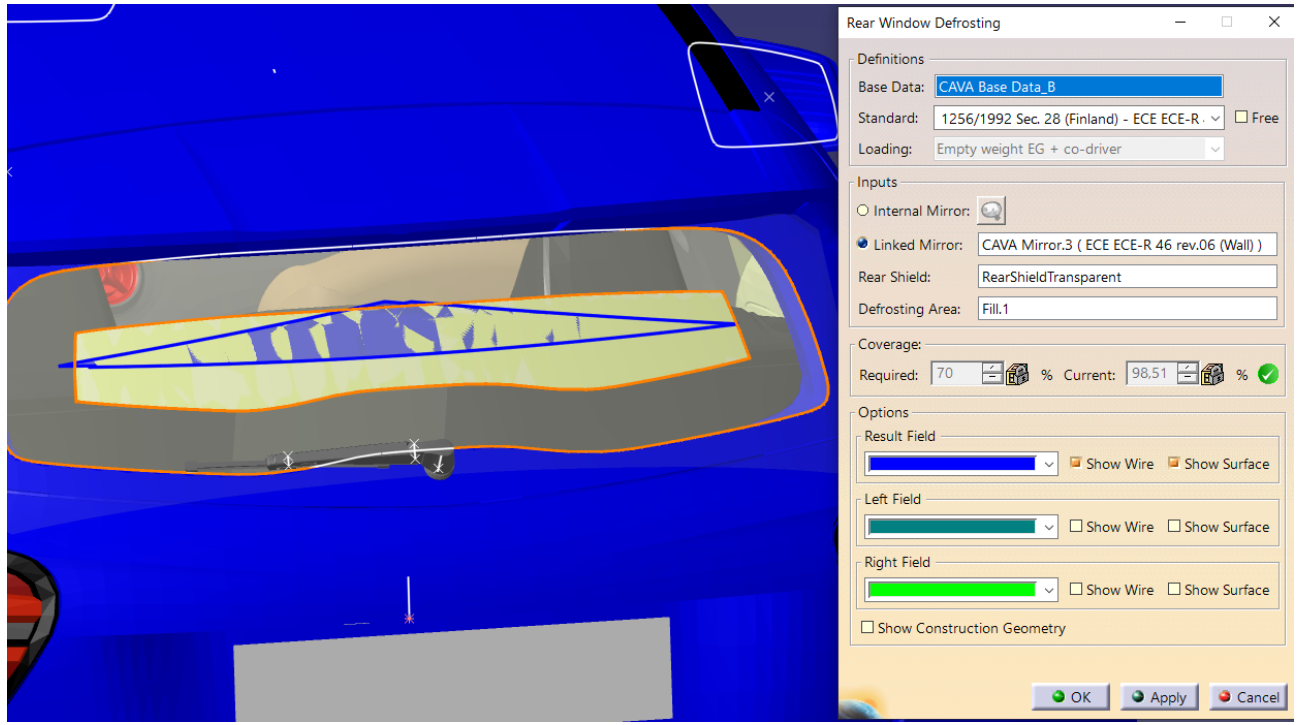
- Shows the sight ray to the navigation device screen
- Visualizes the downward surface
- Measures the vertical view angle

Result

- Check result if vertical view angle is within given limit

CAVA Vision – Rear Window Defrosting

The rear window needs to be defrosted so that the area corresponding to the required mirror instruction field, is sufficiently visible. CAVA displays this area and can calculate the coverage value based on the input of the actual defrosted zone.



Supported standard

- 1256/1992 Sec. 28 (Finland)/UNECE-R 46 rev.06 (Wall)

Features

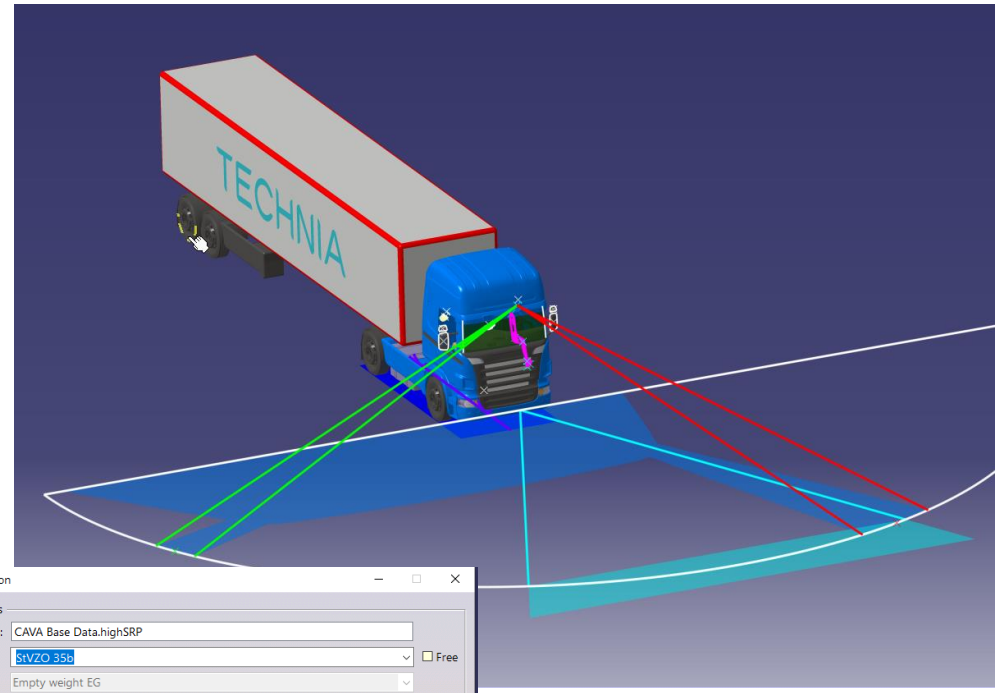
- Shows and creates the area of the instruction on the rear window to be defrosted
- Based on given defrosted area calculates the coverage value

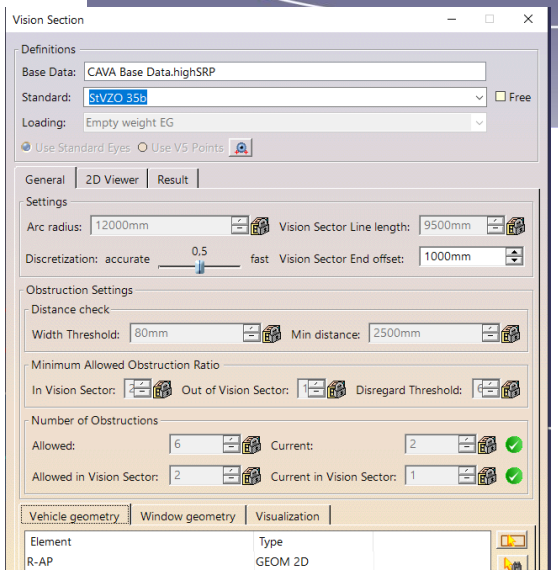
Result

- Check result if required coverage is achieved

CAVA Vision – Vision Section

A trucks driver’s direct vision on the road is important for safety of pedestrians.
This feature analyzes the view obstructions on a 12m circle (around a single eye point) on the road.





Supported standard

- StVZO 35b

Features

- Calculates number of obstruction on the required circle
- Calculates obstruction ratios in vision sector

Result

- Check result if obstruction is within limits of the regulation
- Check result for % of allowed obstructions

CAVA Vision – Large Vehicle Close Range Direct Vision

The CAVA Mirror function measures the visible ground volume around a truck cabin acc. to directive ECE-003155-1 - Large Vehicle Direct Vision

Supported standard

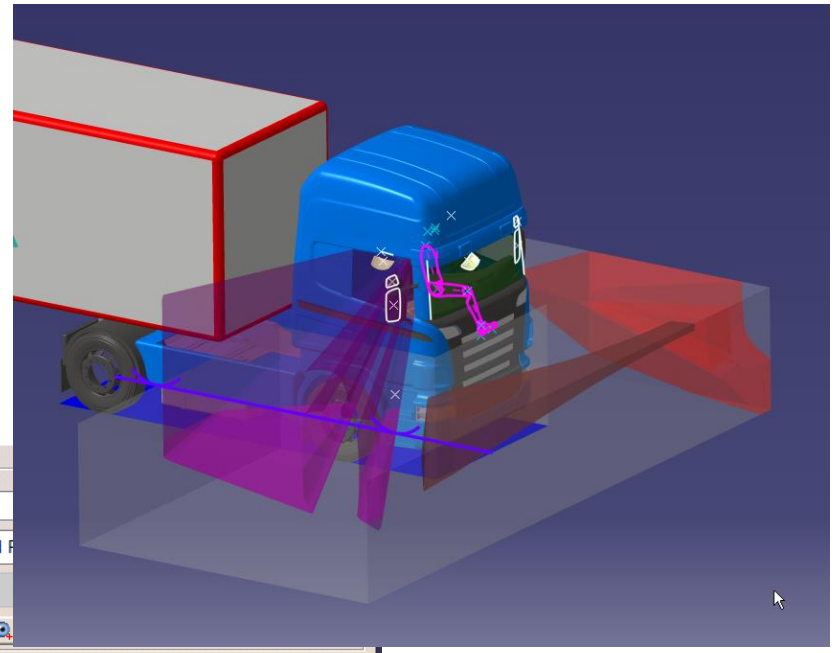
- ECE-003155-1 - Large Vehicle Direct Vision

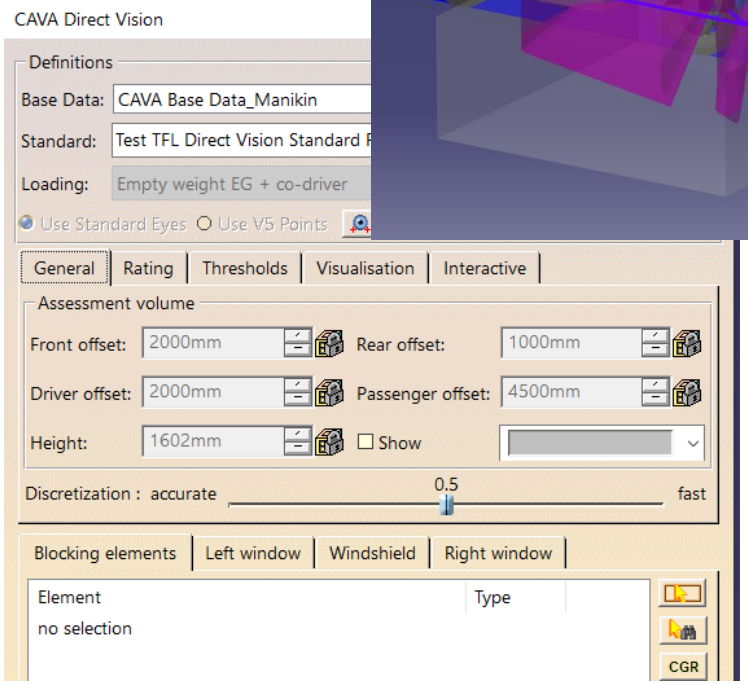
Features

- Shows the required vision volume around the cabin
- Calculates the visible volume for the front, left and right view direction from the automatically calculated eye points
- Considers obstructions and windows of the vehicle
- Visualizes the resulting vision cone

Result

- Check result if vision volumes are within the required limits
- Creates the star ratings according to the standard





CAVA Safety – Pedestrian Protection

Prepare the crash simulation on the digital model according to legal requirements and consumer protection guidelines. The feature calculates the reference curves, impact points, and areas for head and leg impactors on the vehicle front.

Supported standards include

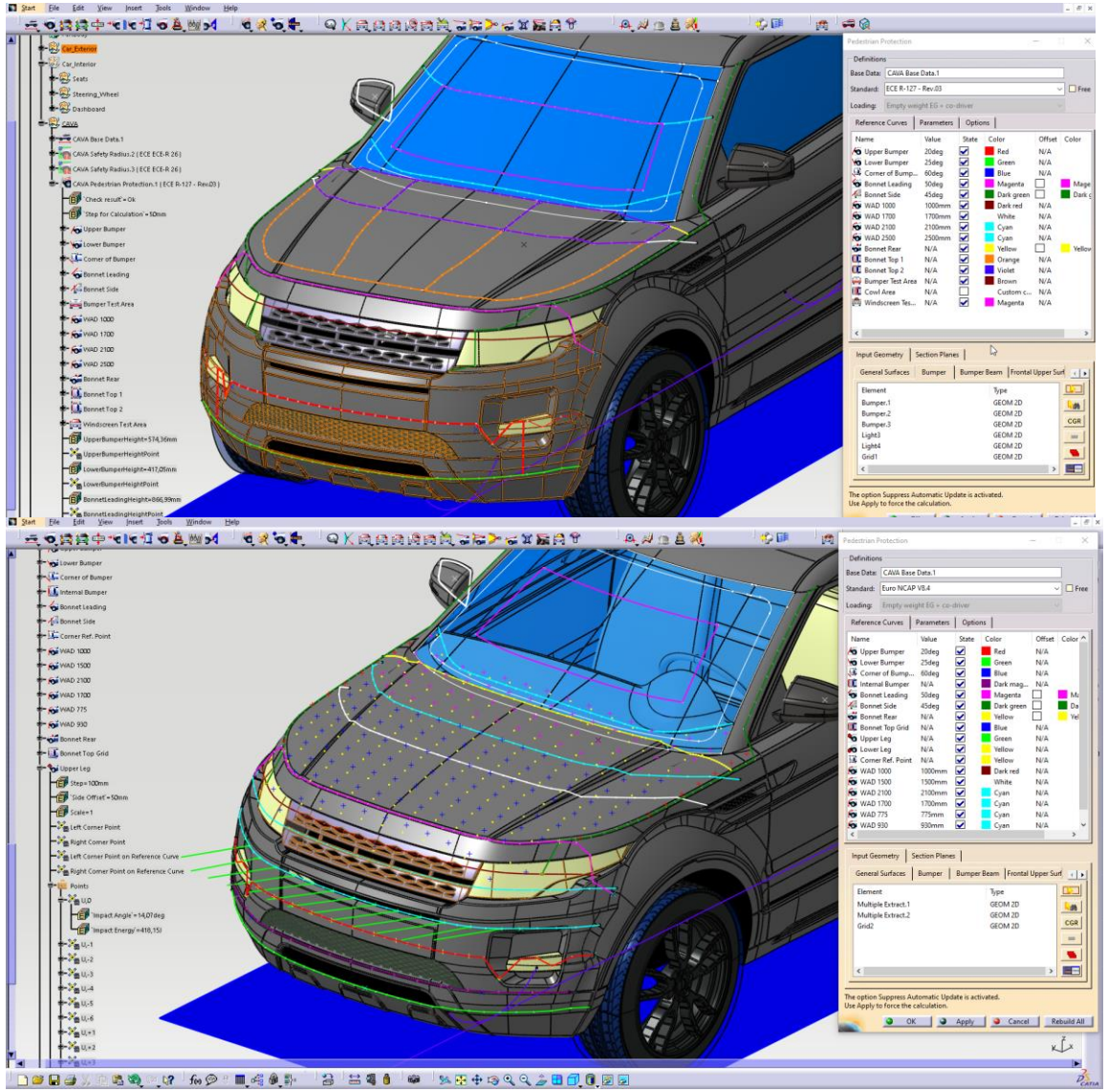
- ECE-R 127, Euro NCAP

Features

- Calculates the BLE, BSL, BRL and WAD reference and offset curves on the bonnet and windshield area
- Calculates the impact area for child and adult headform and bumper test zone for ECE
- Calculates the bonnet top grid and upper and lower leg grid of target points for NCAP
- Configurable accuracy and construction geometry

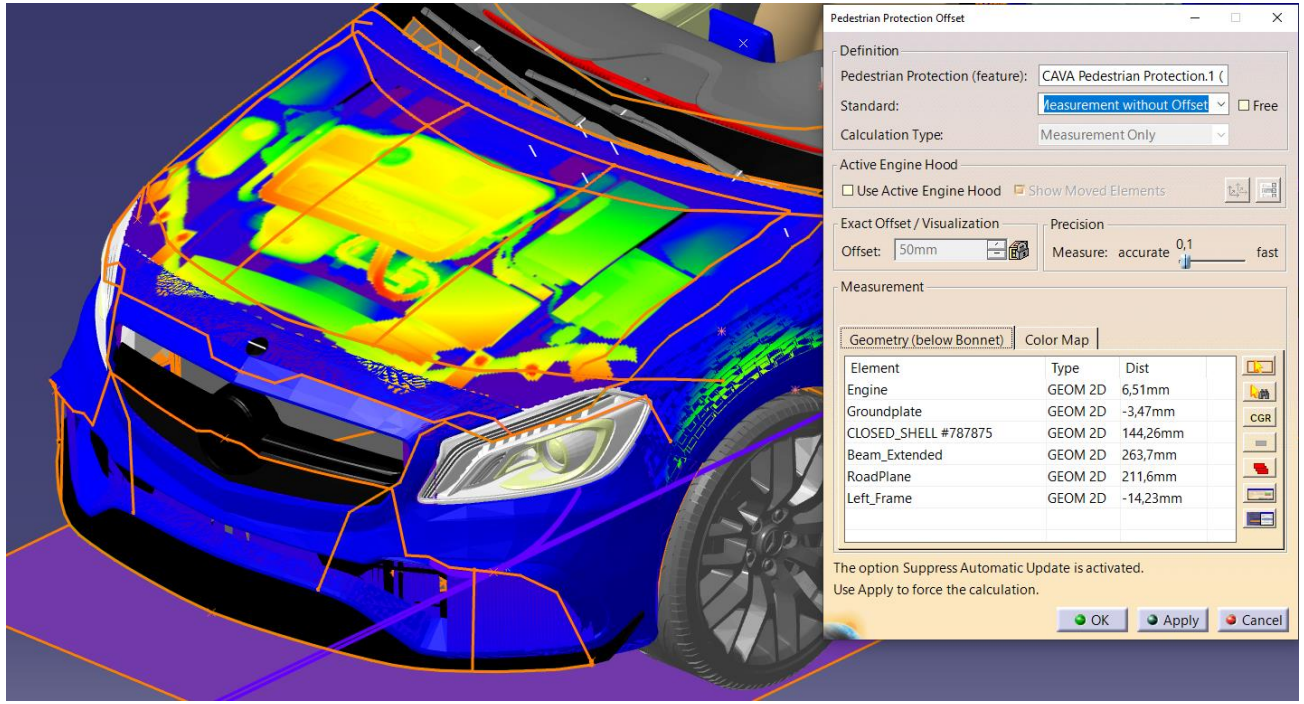
Result

- Visualization of impact area and target impact points for head and leg impactors
- Calculated impact points and target angles



CAVA Safety – Pedestrian Protection Offset

This visualization helps the designer to measure the distance from engine geometry to the pedestrian impact zone on the bonnet hood. The CAVA function creates an offset surface from the Pedestrian Protection reference curves to the inside of the engine room.

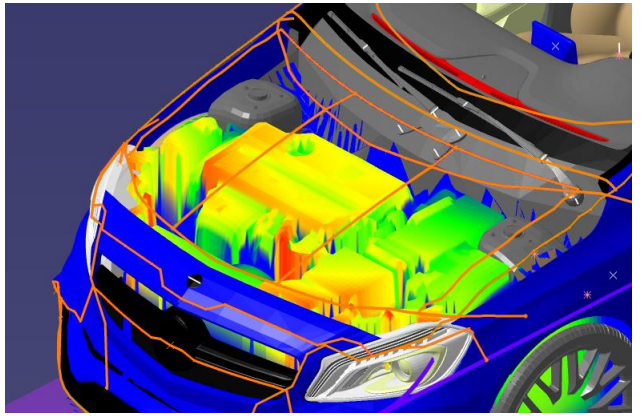


Features

- Visualization of distances as heatmap on the bonnet or on the engine components
- Creates offset surface in the bonnet top area
- Option to define an active engine hood
- Customizable accuracy

Result

- Visualization of distance on the hood
- Bonnet offset surface
- Measured minimum distance values for each selected engine component



CAVA Safety – Head Impact

The FMVSS 201 standard describes a series of reference points (target points) within the interior of the vehicle to be used for head impact tests. The CAVA Head Impact feature generates these points based on the selected geometry.

Supported standard

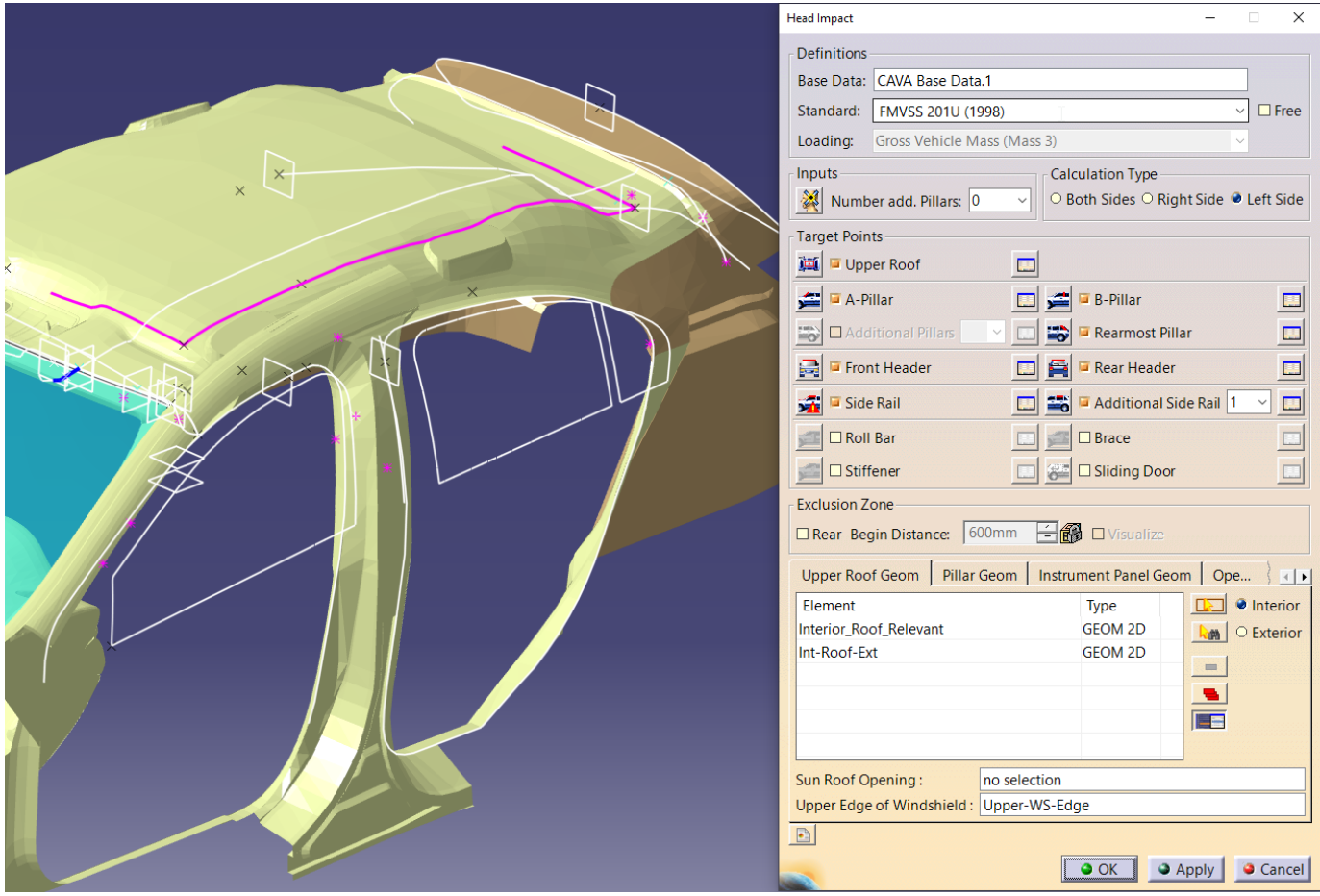
- FMVSS 201U

Features

- Selection Wizard to guide the user during the selection of the required vehicle components
- Creation of A-, B-, and rearmost pillar target points
- Creation of upper roof area
- Creation of side rail and front/rear header target points
- Creation of the construction geometry

Result

- Visualization of target points
- Report of all created target points



CAVA Safety – Safety Radius

The safety radius feature checks the exterior vehicle geometry if the minimum required radius is violated. It considers the reachability with the test sphere and the specific radii for bumper zone, lamp and grill elements.

Supported standards include:

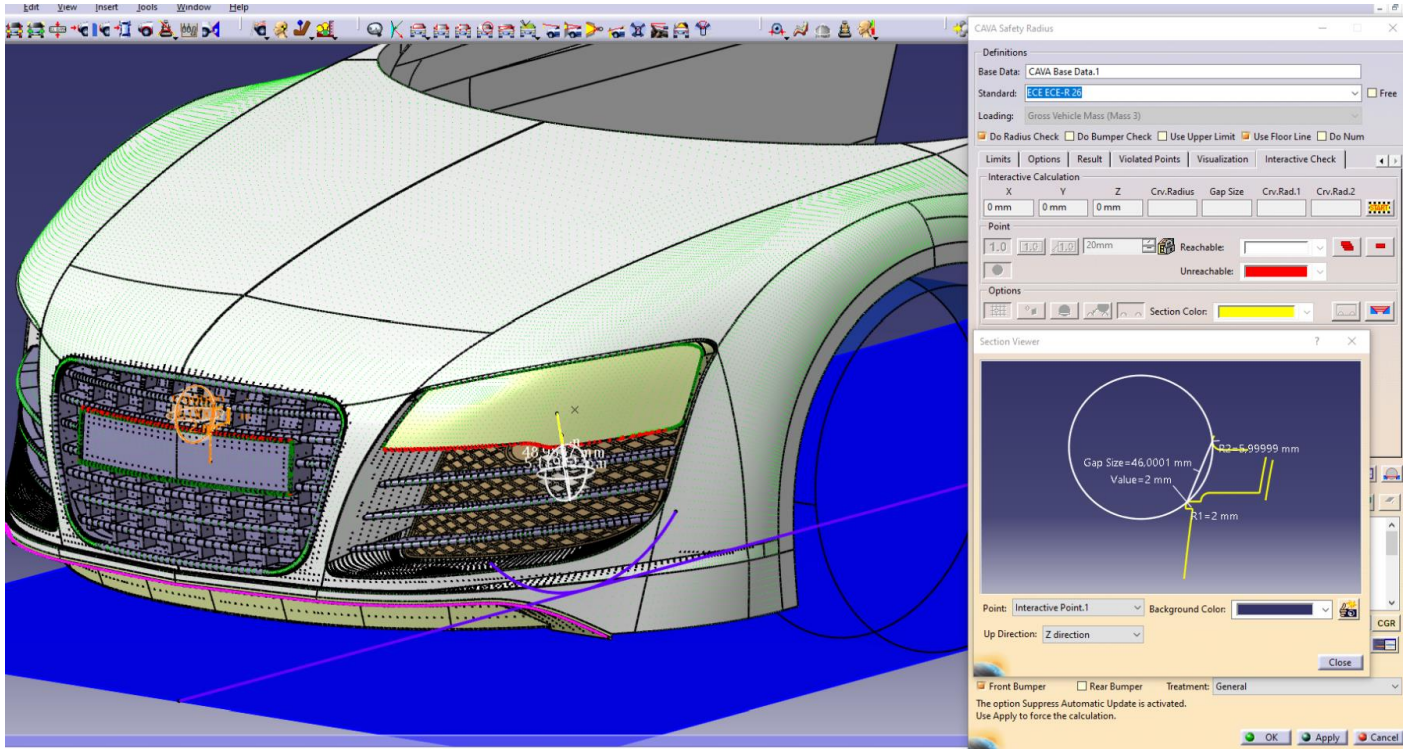
- ECE-R 26, EU1023/2010 (Number Plate)

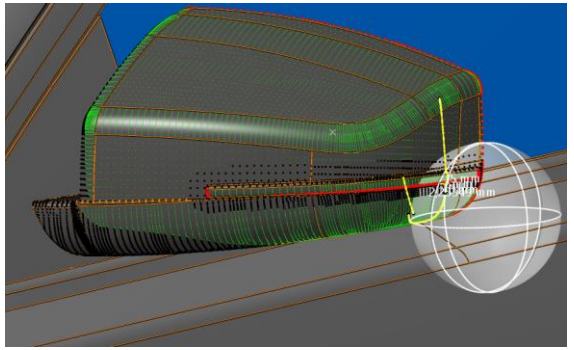
Features

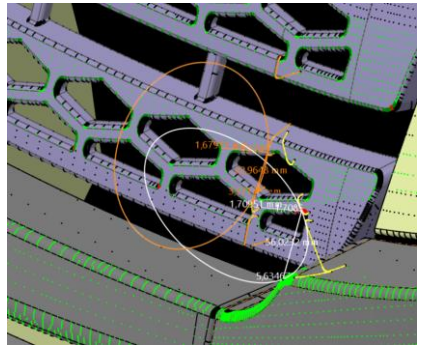
- Calculates the floor line
- Checks the reachability with a 50mm test sphere
- Considers specific radii for measured gap size on grille and lamp elements
- Option to create the bumper zone and considers its specific radius requirement
- Interactive check allows markup of selected points

Result

- Visualization of points violating the allowed minimum radius
- Markup and section views of user defined points







CAVA Safety – Interior Minimum Radius

The minimum radius feature checks the interior vehicle geometry to see if the minimum required radius is violated. It calculates the head impact and exclusion zones, considers the reachability with the test pendulum and the specific radius requirements for each zone.

Supported standards include:

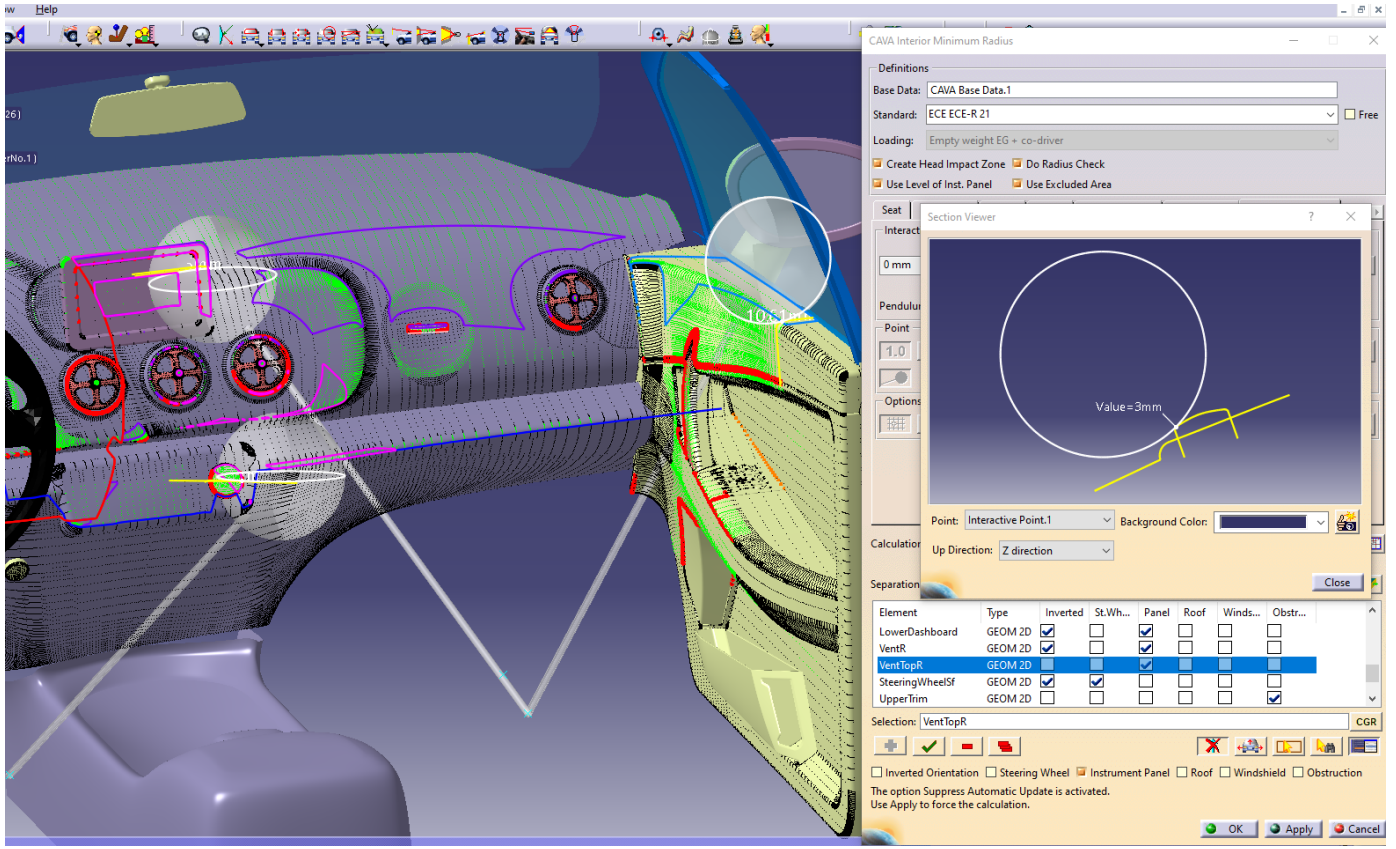
- ECE-R 21, FMVSS 201

Features

- Calculates the head impact zone, level of instrument panel and exclusion zone around the steering wheel
- Checks the reachability with the 82.5 mm test sphere pendulum fixed to the occupant's seat
- Considers specific radii for the "reference zone"
- Interactive check allows markup of selected points

Result

- Visualization of points violating the allowed minimum radius
- Visualization of the head impact zone
- Markup and section views of user defined points



CAVA Safety – Kneeform Minimum Radius

Feature to check for minimum radius on interior vehicle surface below the level of instrument panel. Reachability of the tested points is calculated using the kneeform shape template.

Supported standard

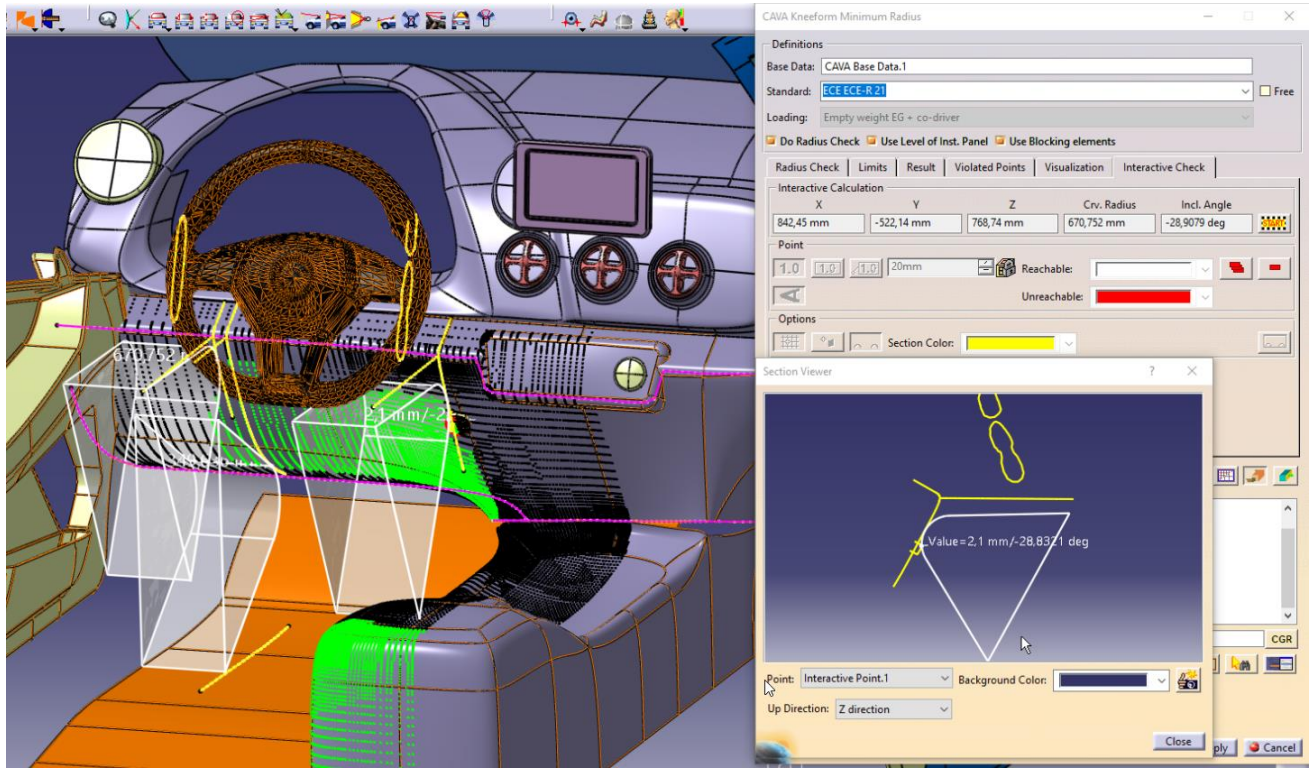
- ECE-R 21

Features

- Calculates the level of instrument panel lines
- Checks the reachability with the kneeform shaped element as defined in ECE-R 21 under consideration of movement and rotation angle.
- Considers obstructing elements like floor and steering wheel
- Interactive check allows markup of selected points

Result

- Visualization of points violating the allowed minimum radius
- Markup and section views of user defined points



CAVA Safety – Seat Minimum Radius

Feature to check for the minimum radius on seat geometry according to ECE R-17. The feature visualizes areas 1, 2 and 3 and checks the radii for these areas. Supports seats with and without headrests.

Supported standard:

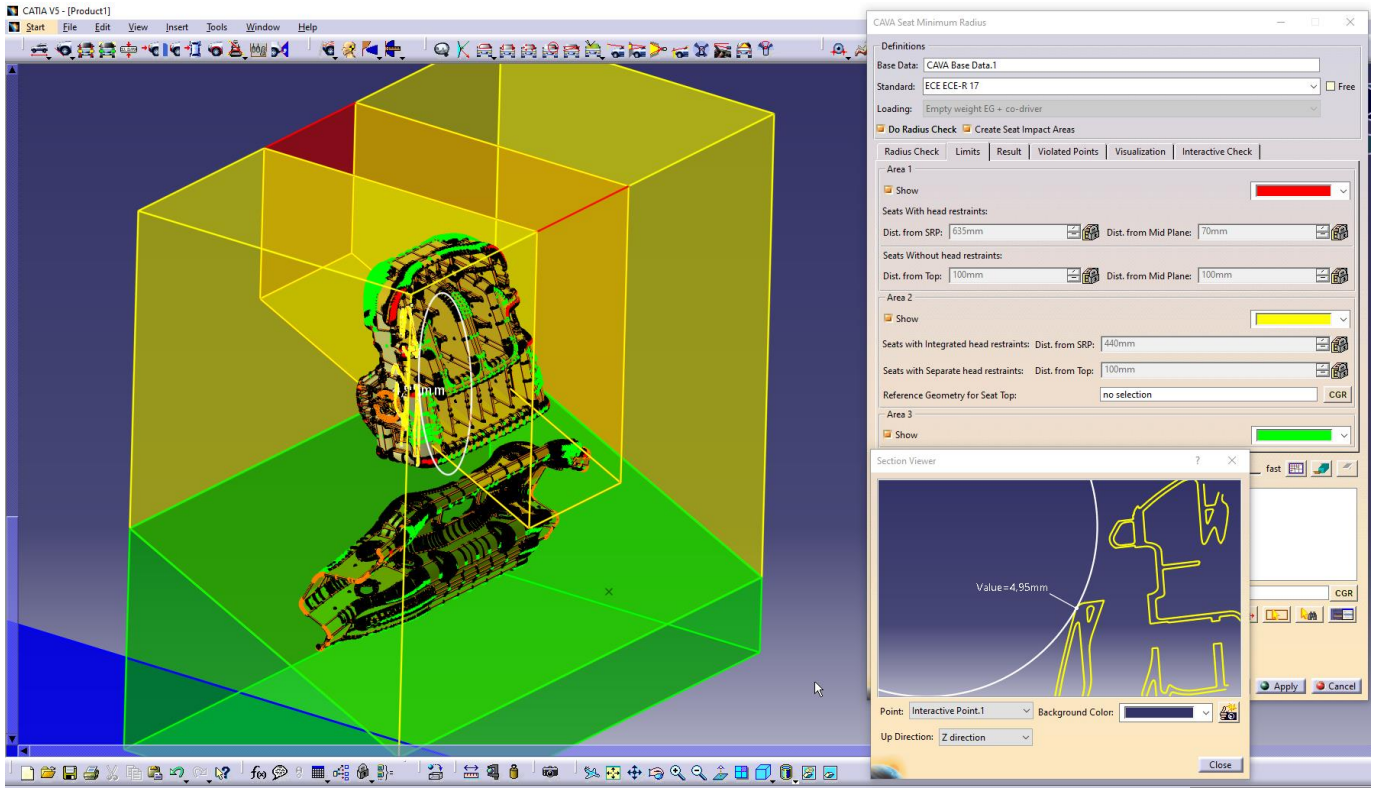
- ECE-R 17

Features

- Calculates the areas 1, 2 and 3 for seats with separate headrests, integrated headrests and without headrests
- Checks the reachability with the 82.5 mm test sphere
- Considers specific minimum radii for area 1, 2 and 3
- Interactive check allows markup of selected points

Result

- Visualization of points violating the allowed minimum radius in the given areas
- Markup and section views of user defined points



CAVA Safety – Projection Measurement Device

Feature to determine the projection height of knobs and switches with respect to the mounting panel, according to ECE-R 21 Annex 6 top 2 (Apparatus). The measurement device is created at the position of the maximum measured height.

Supported standards

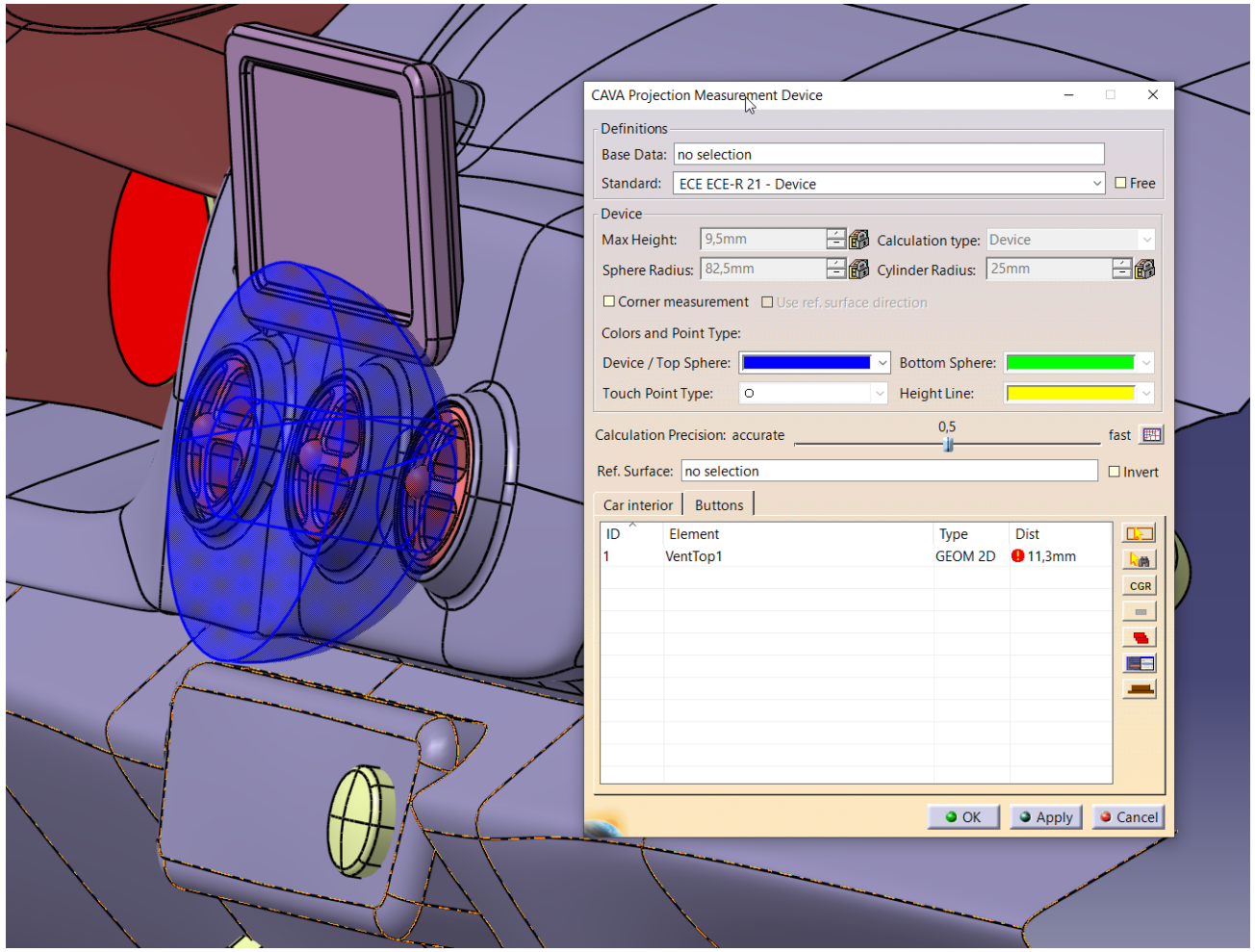
- ECE-R 21

Features

- Positions the device on the mounting panel with the selected knob in the cylindrical hole
- Measures the height of the knob in maximum position
- Several knobs can be measured in parallel

Result

- Device positioned at maximum height
- Measured projecting height
- Check result if the height is below the limit



CAVA Safety – Projection Measurement in Sections

ECE regulations allow exceptions for the minimum required radii for elements with a small projecting height. This feature will help to determine the height of projections of exterior or interior vehicle components measured in section planes normal to a selected curve.

Supported standards

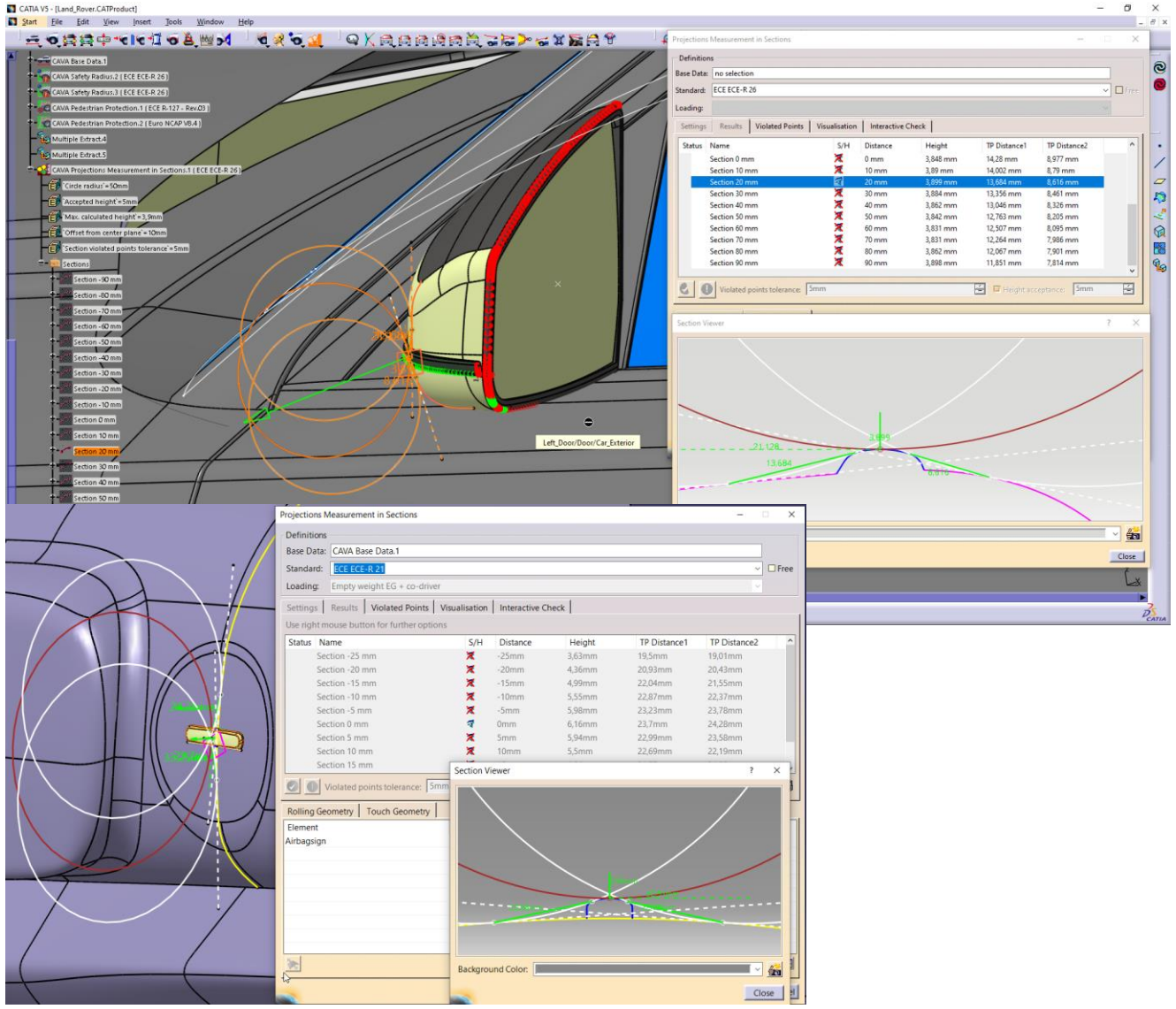
- ECE-R 21, ECE-R26

Features

- Supports measurements of the height of general projecting elements or of gaps in body panels in 2D sections
- Section planes are created normal to a user selected curve
- User defined offset between section planes
- Detail 2D-View of the sections
- Graphical feedback of the measured values

Result

- Sections geometry with touch points of positioned circles
- Measured values for height at each section



CAVA Safety – Fold Measurement

ECE regulations allow exceptions for the minimum required radii for folds in body panels. Use this feature to determine the height of such folds according ECE-R 26 6.9.

Supported standards

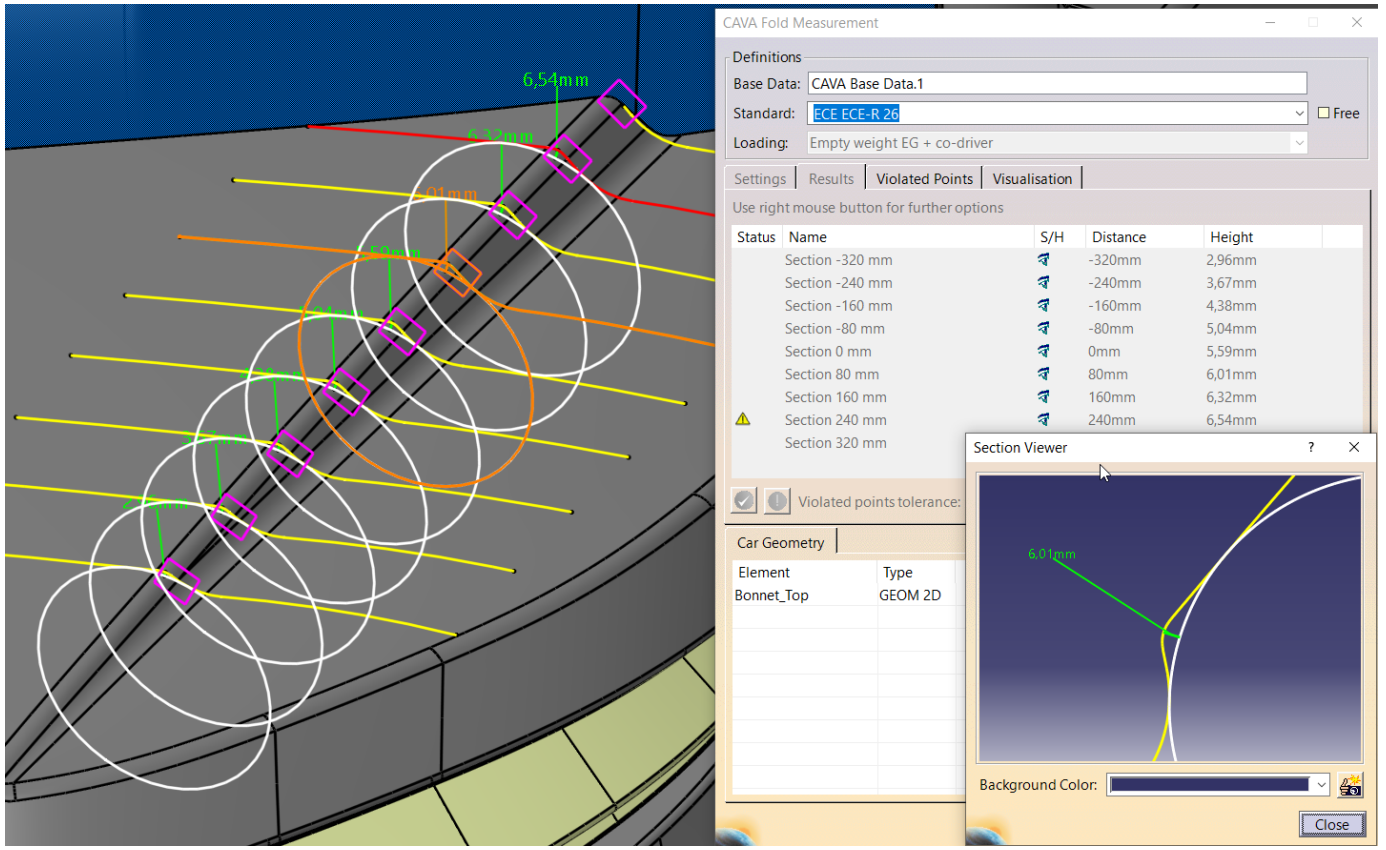
- ECE-R 26

Features

- Supports measurements of the height of folds in body panels
- Section planes created along a user defined curve
- User defined offset between section planes
- Detail 2D-View of the sections

Result

- Sections geometry with touch points of positioned circles
- Measured values for height of fold at each section



CAVA Safety – Surface Orientation Check

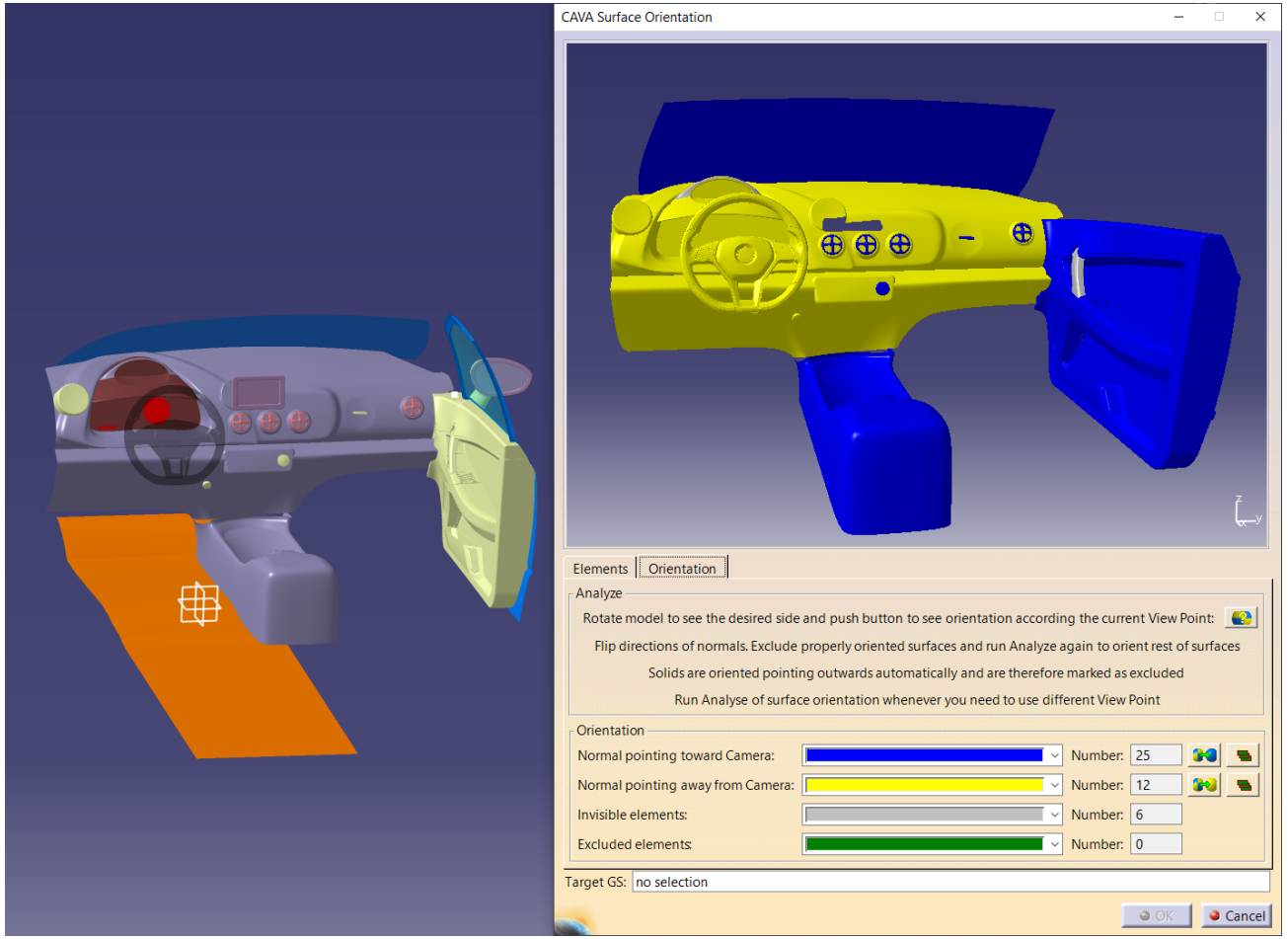
For CAVA Safety Radius checks it is important to have consistently oriented surfaces. This tool helps to facilitate consistent surface orientations for larger sets of individual surfaces.

Features

- Analyzes the surface orientation from a user selected viewpoint
- Provides a graphical colored feedback of surface orientation
- Invert all surfaces with reversed orientation with one click
- Exclude already corrected surfaces from further checks with changed viewpoints if needed
- Disassembles multi-domain surfaces for the check

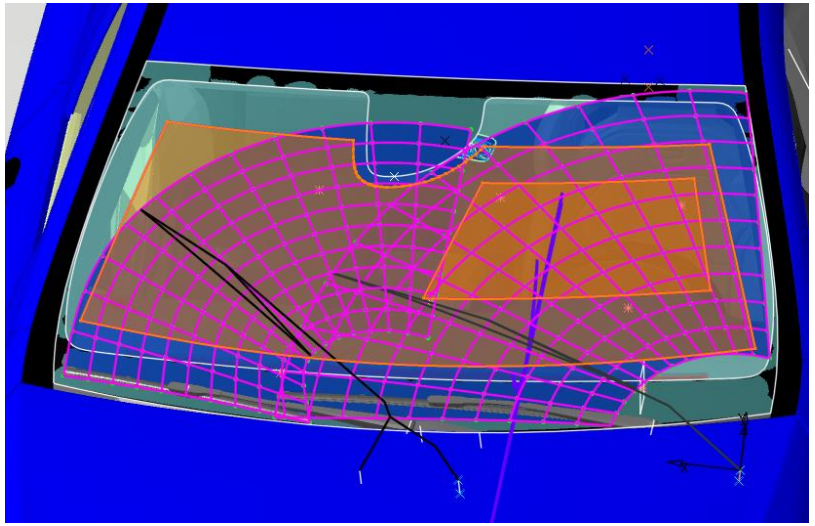
Result

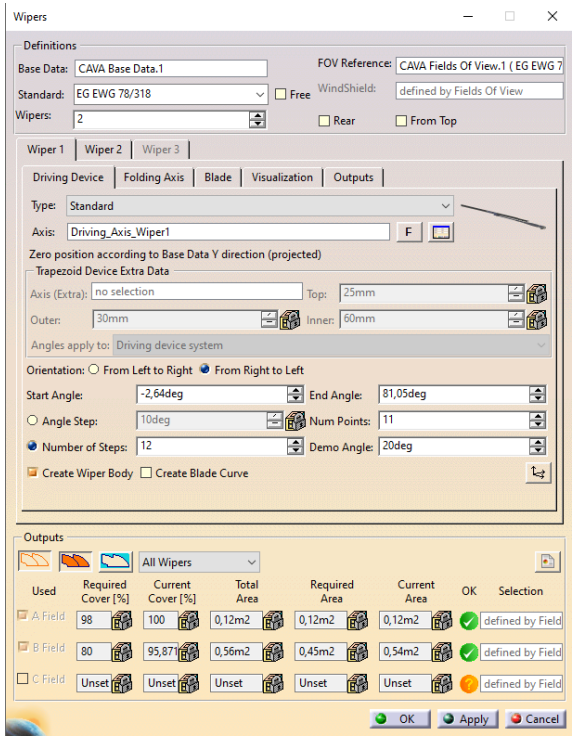
- The oriented surfaces are copied into a selected geo set
- Multi domain surfaces can optionally be disassembled

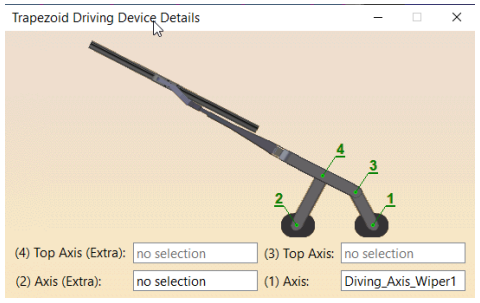


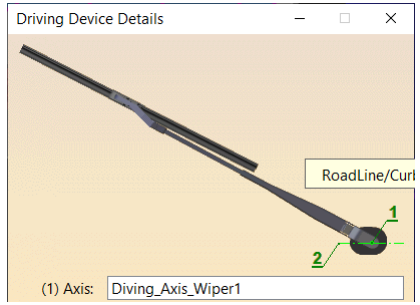
CAVA Wiper

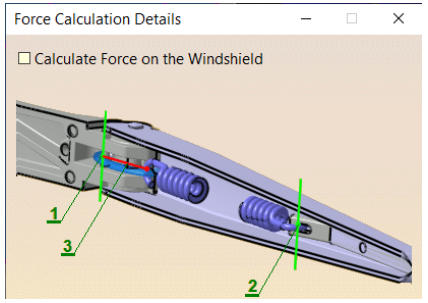
With CAVA Wiper, the user can simulate the geometry of a wiper system to determine the wiped area on the windshield. Used together with the Field of View feature in CAVA Vision, it is possible to check the percentage of wiped area within the field of view according to standards (ECE, FMVSS).











Features

- Calculate the wiped area on the windshield based on defining axis of the kinematic system
- Flexibly define a wiper system with up to 3 wipers for front and rear
- Supports the commonly used types of wiper kinematics: standard, trapezoid, parallel arm
- Calculates the covered percentage of wiping for the A- and B-Fields according to standards
- Measures and visualizes key quality parameters

Result

- Check result for coverage of required fields.
- Can optionally create filled surface

CAVA Wiper

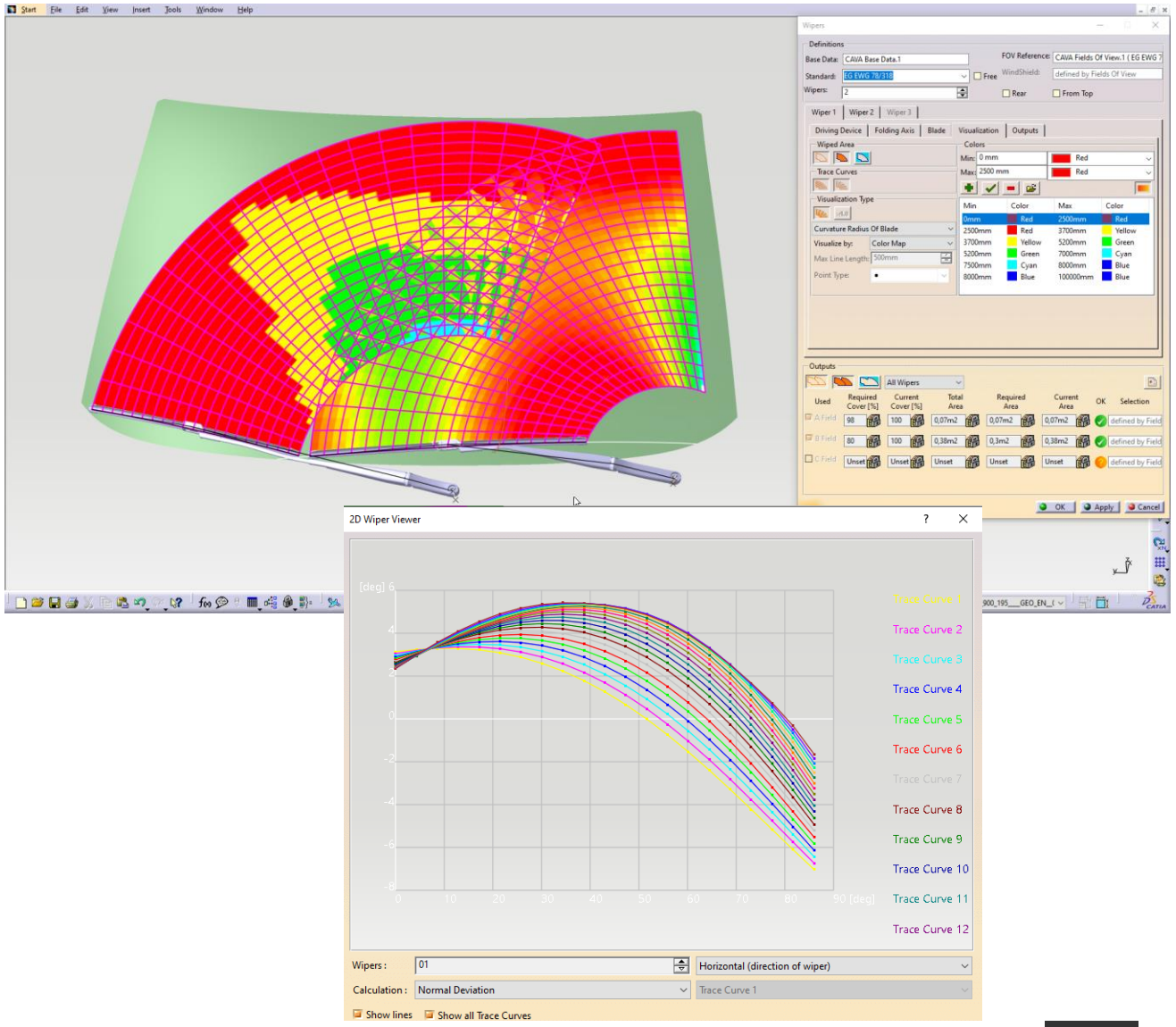
The Wiper tool can calculate and visualize the key parameters important for the quality of the wiping operation.

Features

- Measures key quality criteria like
  - Curvature radius of the blade
  - Sag of the blade
  - Normal deviation (attack angle)
  - Folding angle and height (rise & fall)
  - Folding pressure force (at blade axis)
- Visualize values as a color map on the windshield or as a 2D graph of curves
- Quickly observe the effects of design optimization
- Flexible reporting mechanism to create Excel or text reports of calculated parameters

Result

- Visualization of calculated parameters



CAVA Tools – Silhouette

The Silhouette function offers the possibility to project the silhouette outlines of a complete vehicle with one click. This helps to create homologation drawings including measurements of key parameters like length, width and height.

Features

- Can be used anywhere you need a silhouette, it's not limited to special automotive scenarios
- Works in product context and with visualization geometry – no limitation to single parts
- Enables you to select projection direction and projection plane independently
- User defined accuracy

Result

- Calculates exterior outlines and outlines of openings
- Can optionally create filled surface
- Calculates size of projection area