

CAVA - SAFETY

Functional Overview

2023-04-20

CAVA – Vehicle Homologation

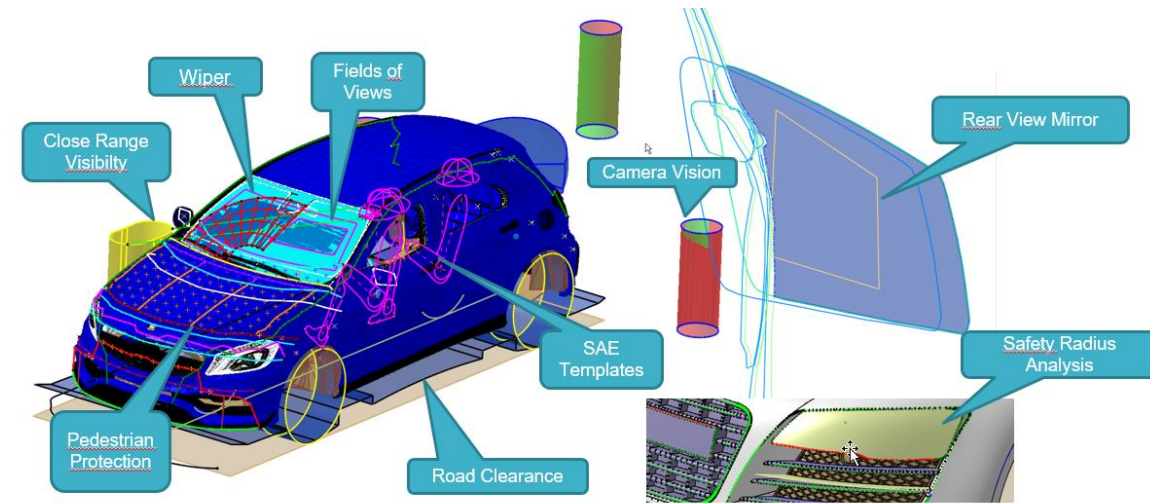


Vehicle Compliance is a compulsory part of Automotive design. CAVA (CATIA Automotive Extensions Vehicle Architecture) provides the solution to efficiently and confidently validate the compliance of your vehicle design and architecture against international standards and regulations.

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



Integration into CATIA

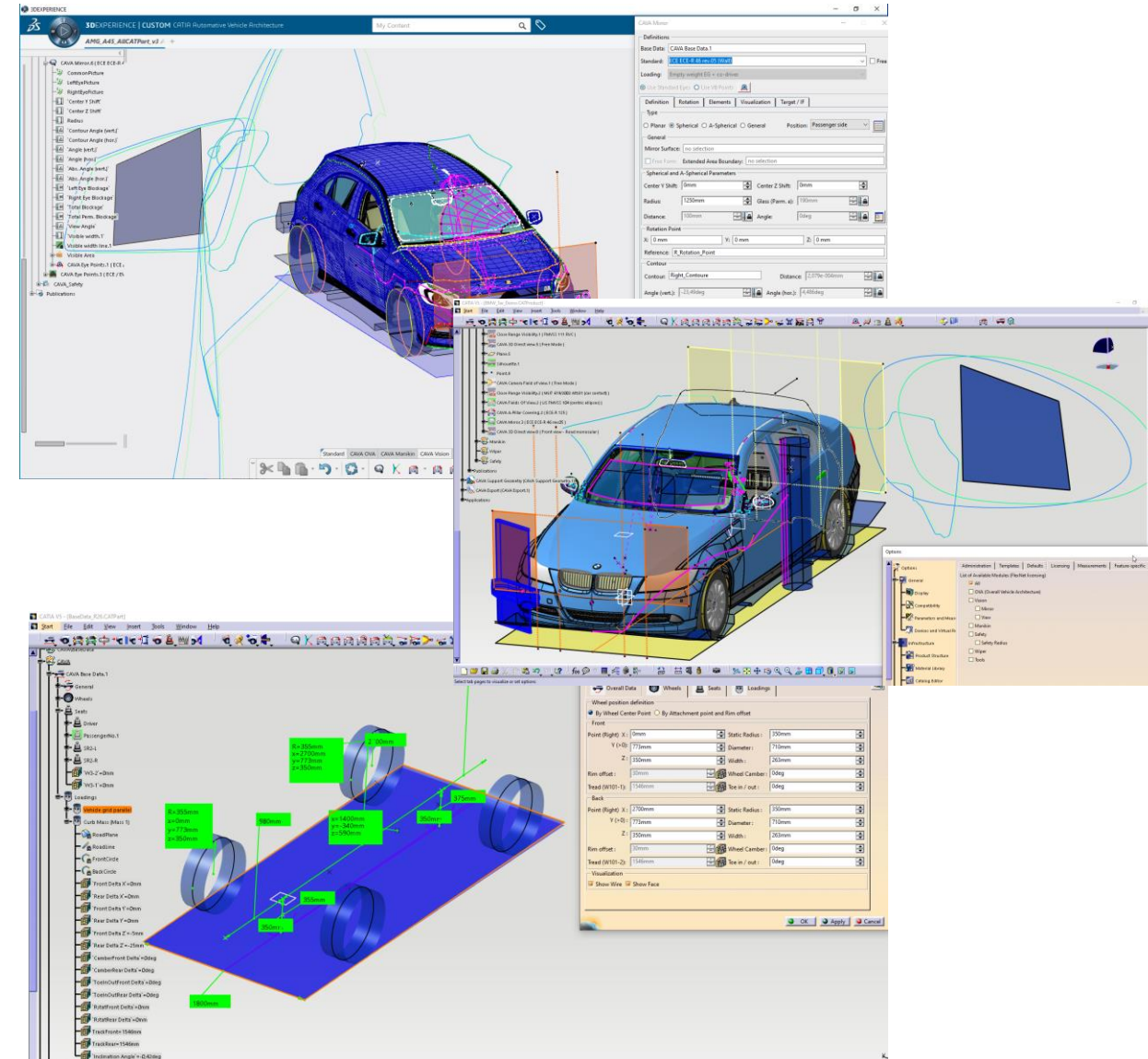
- CAVA is integrated into CATIA as a separate workbench or App.
- CAVA features are stored directly with the CAD data.
- Working in part and product context.
- Automatic feature update on change of any input parameters or changed geometry.

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 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

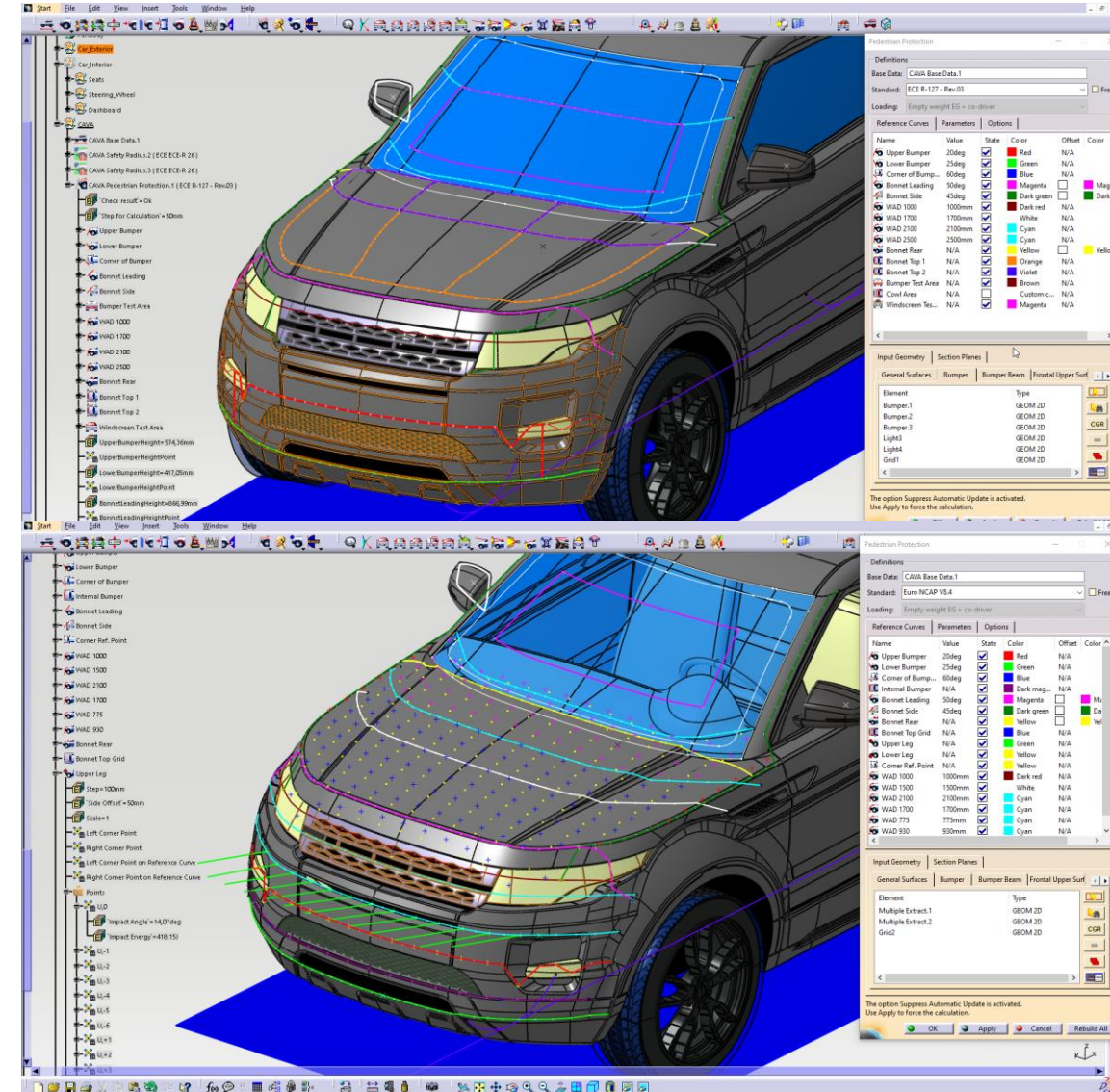
- ECE-R 127, Euro NCAP

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



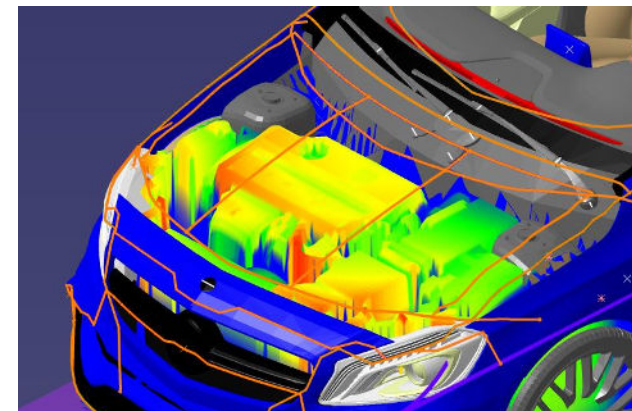
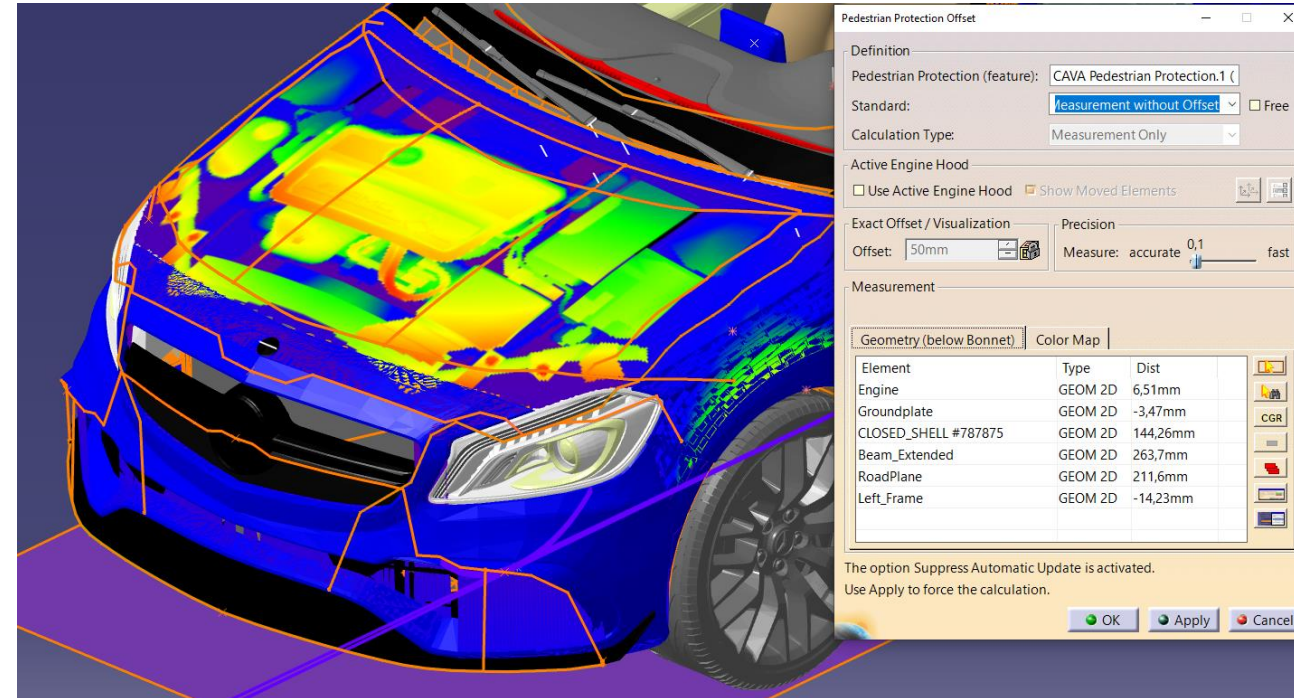
This visualization helps the designer to measure the distance from engine geometry to the pedestrian impact zone on the bonnet hood. The CAVA function creates an offset surface from the Pedestrian Protection reference curves to the inside of the engine room.

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

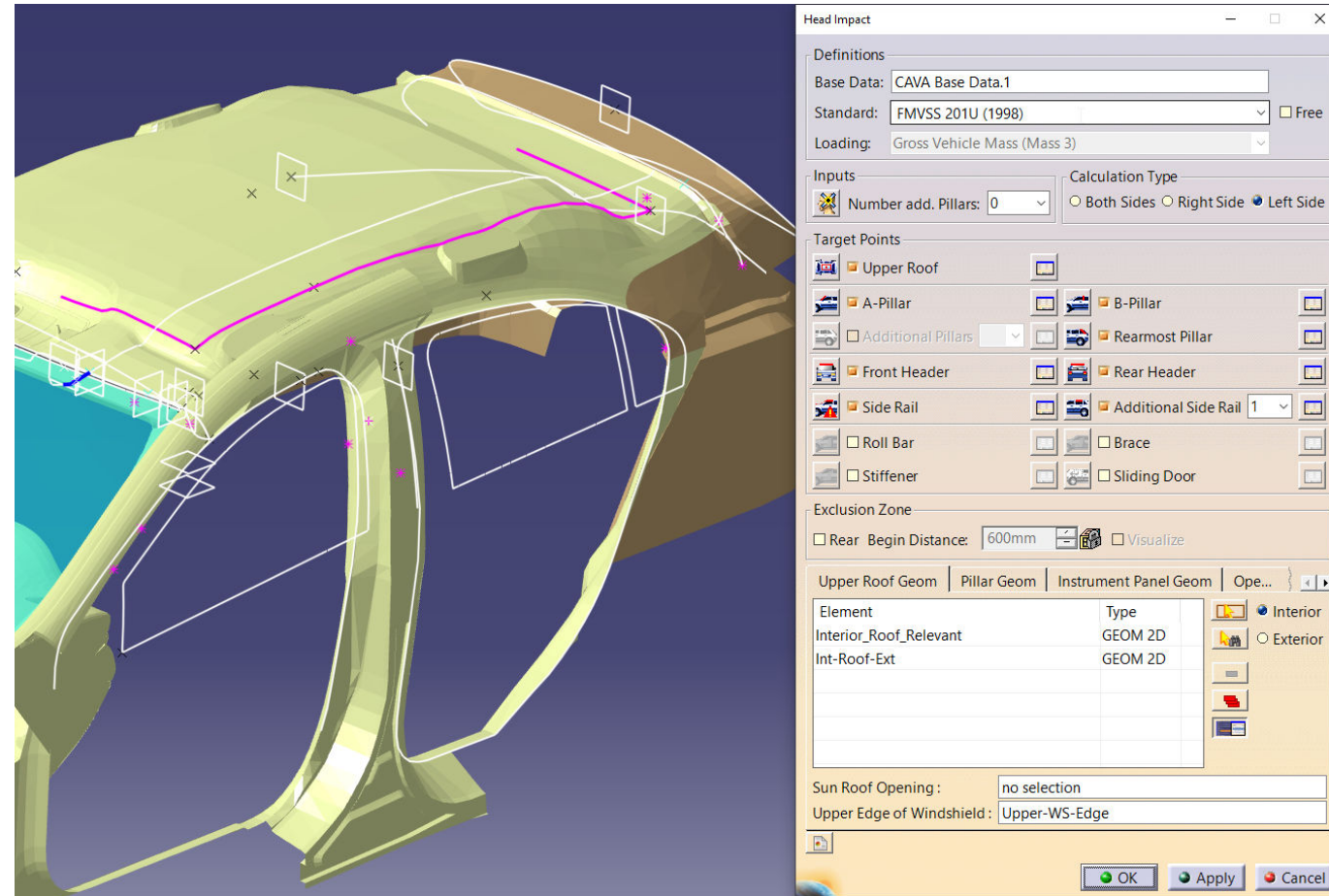
- FMVSS 201U

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:

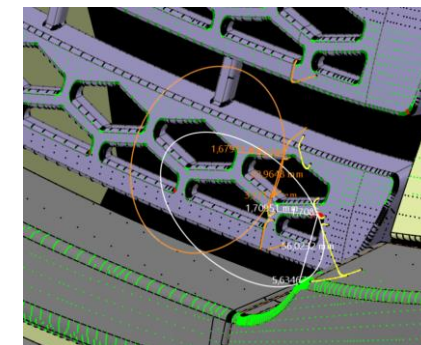
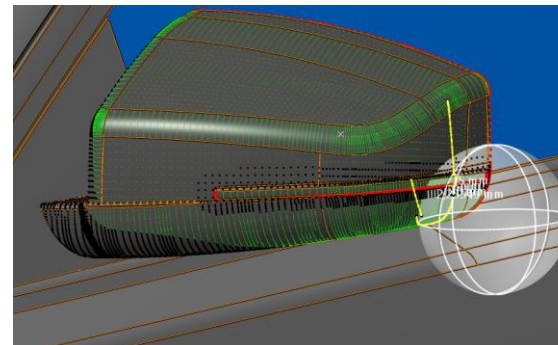
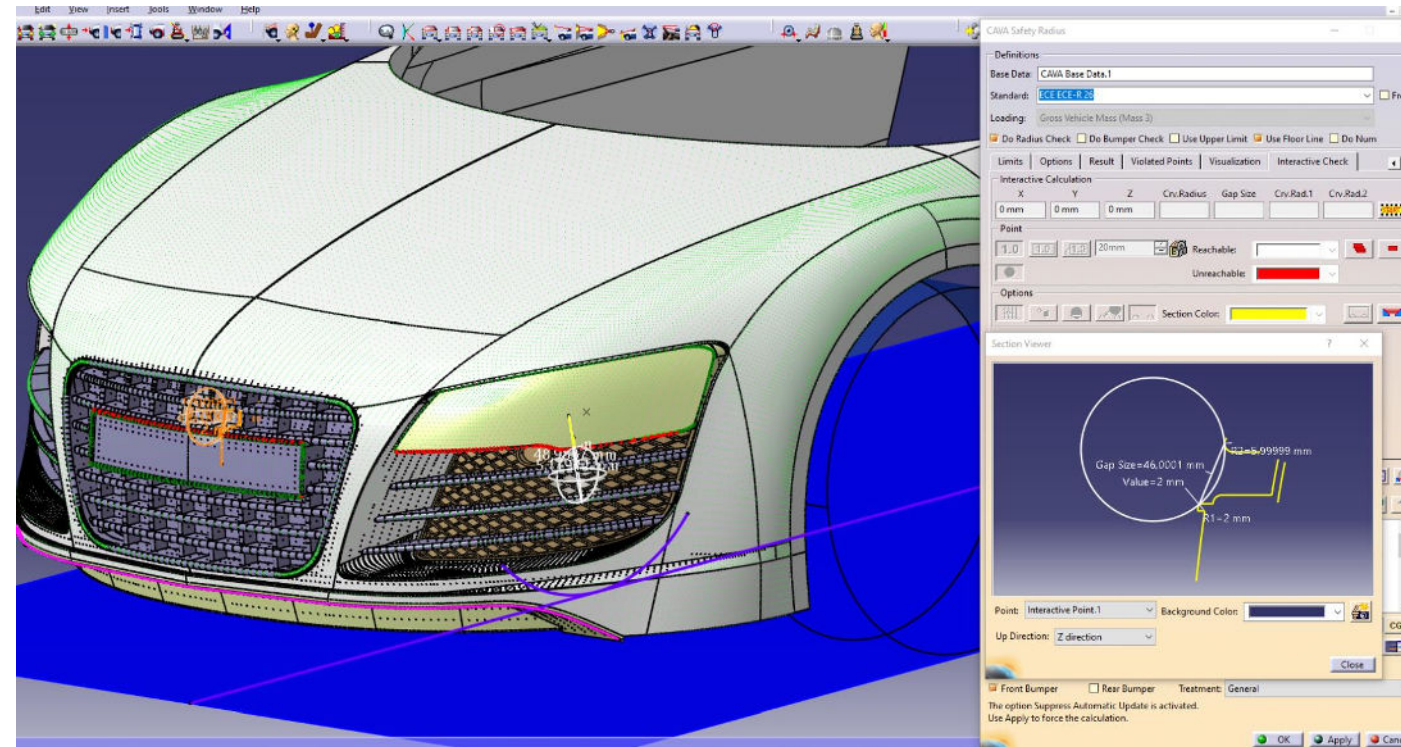
- ECE-R 26, EU1023/2010 (Number Plate)

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:

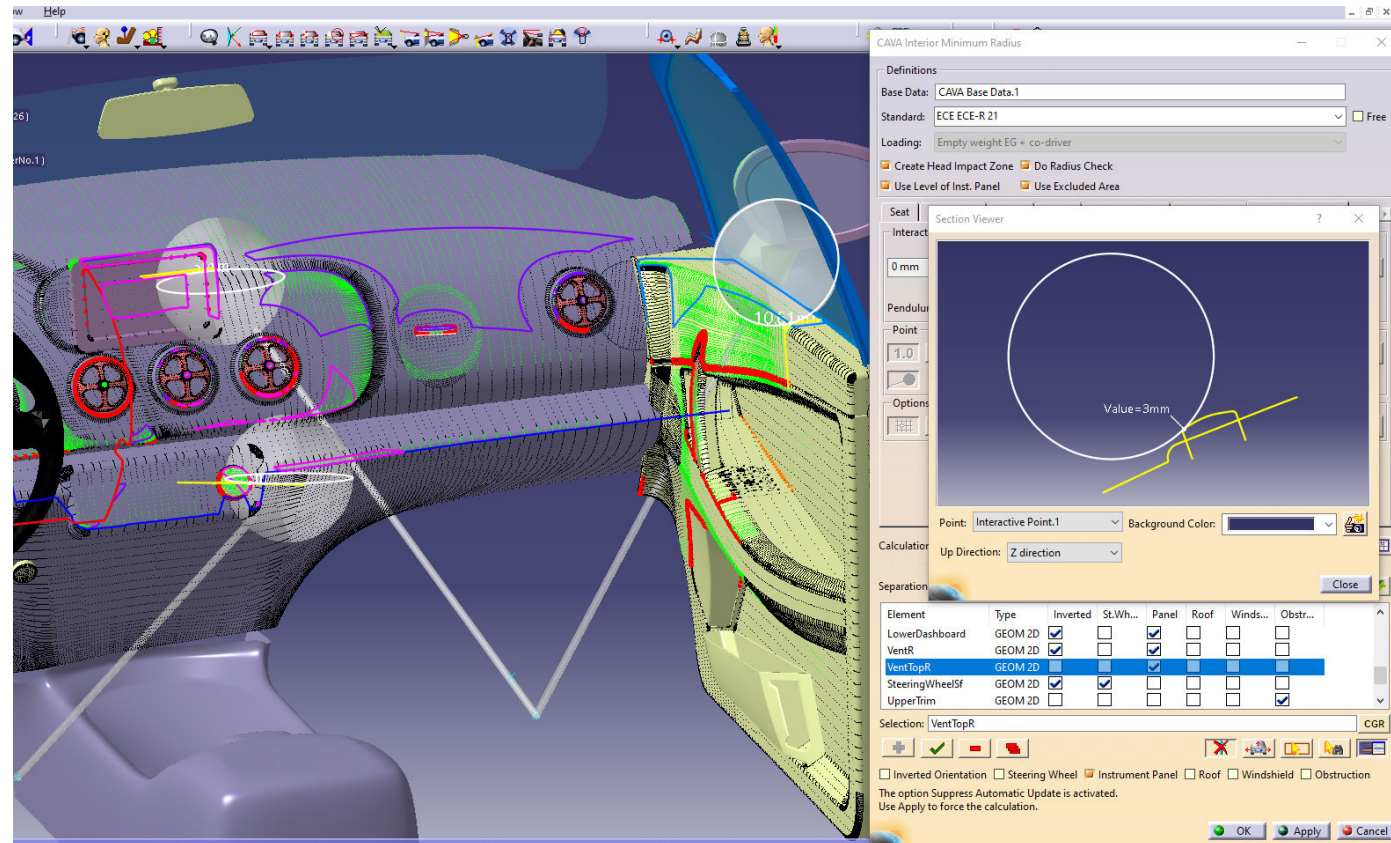
- ECE-R 21, FMVSS 201

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

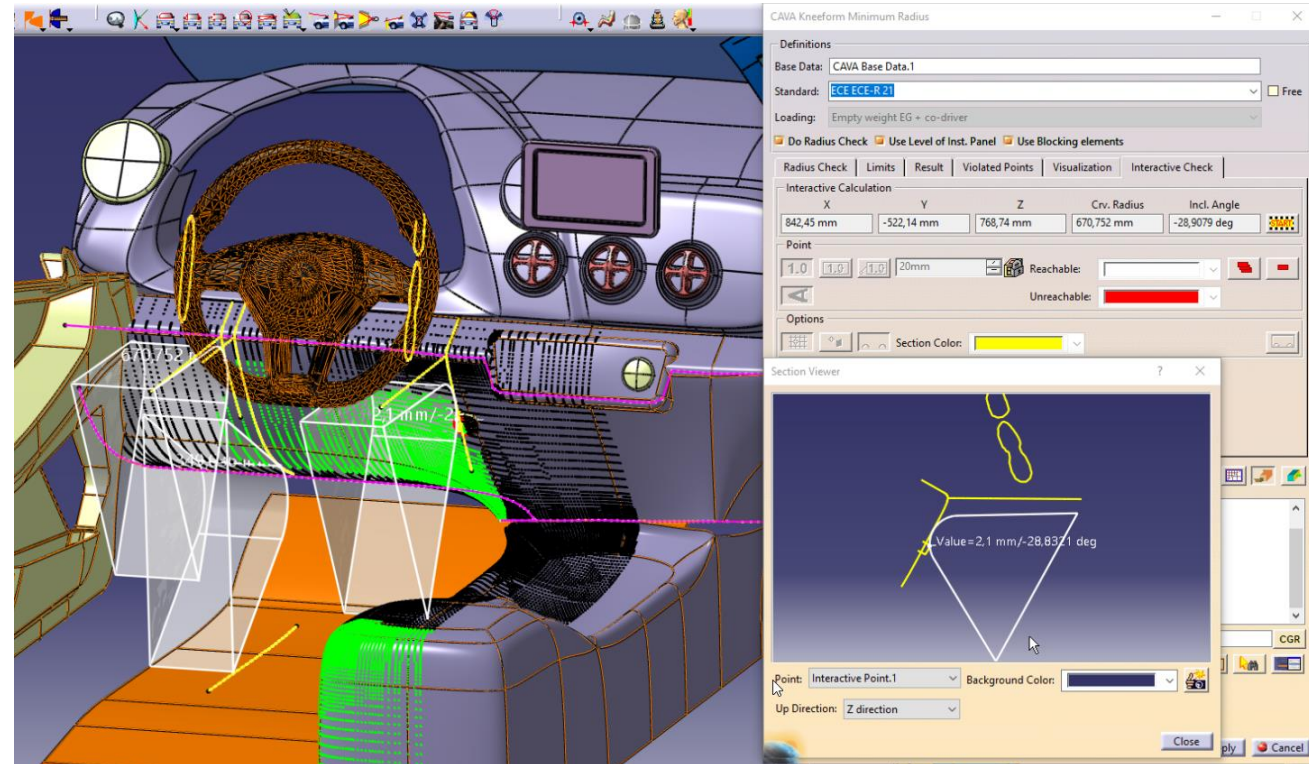
- ECE-R 21

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:

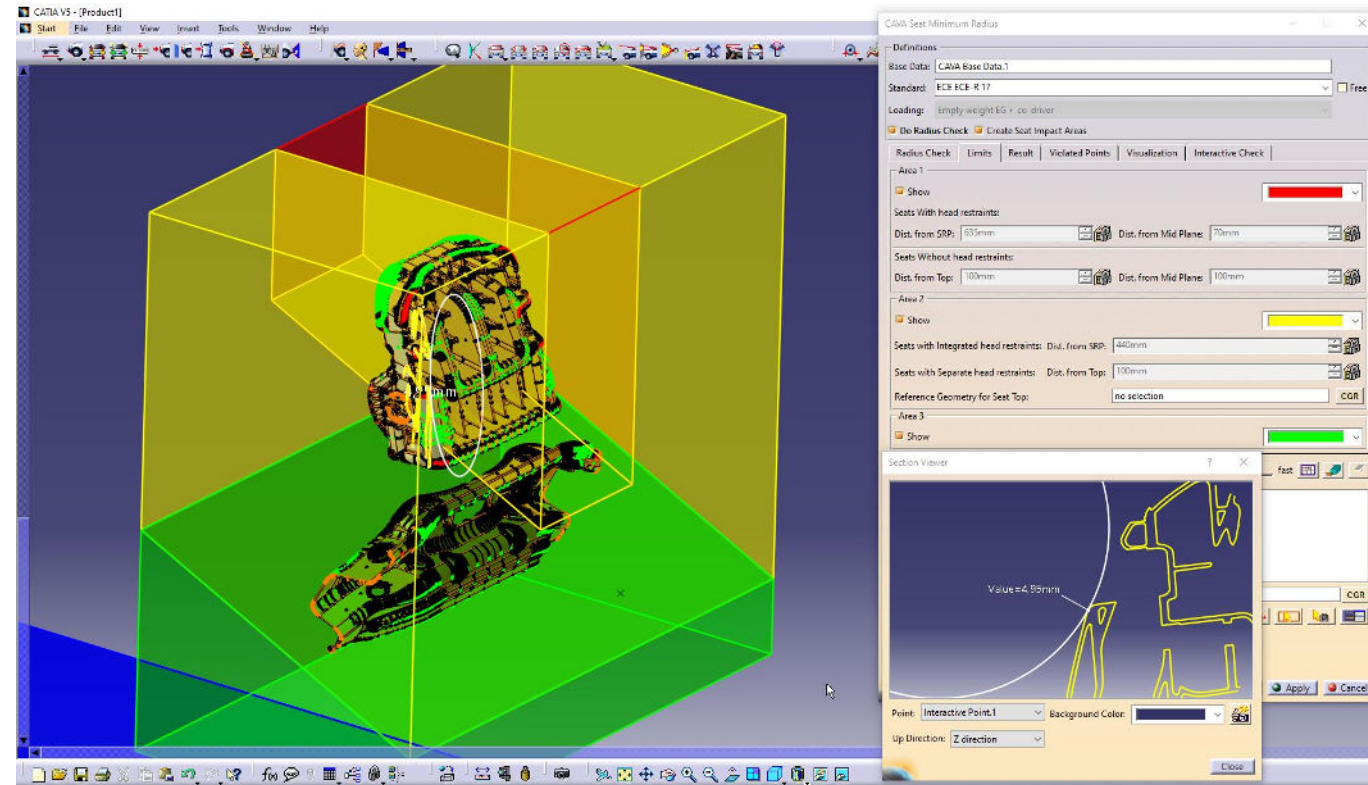
- ECE-R 17

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

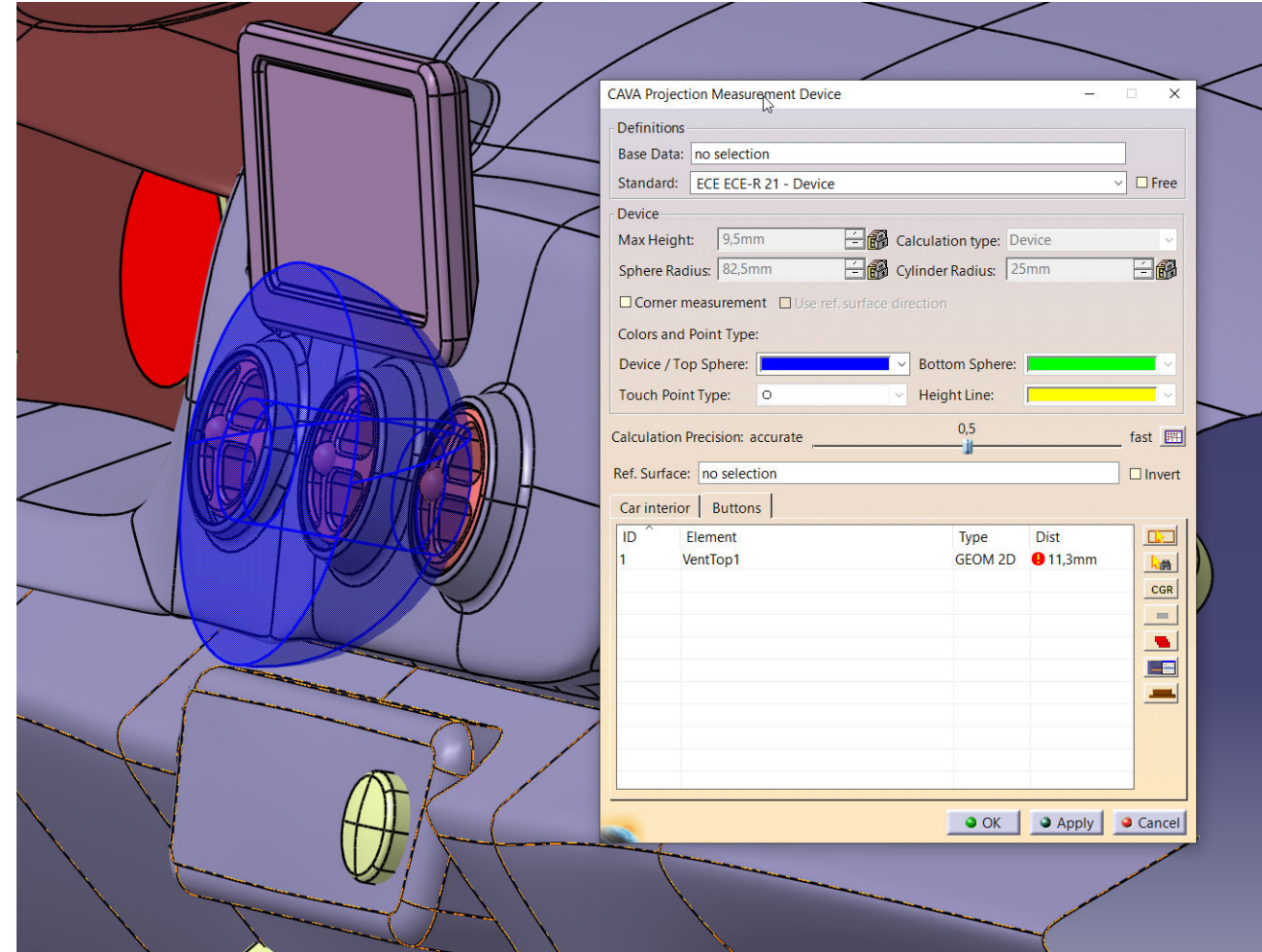
- ECE-R 21

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

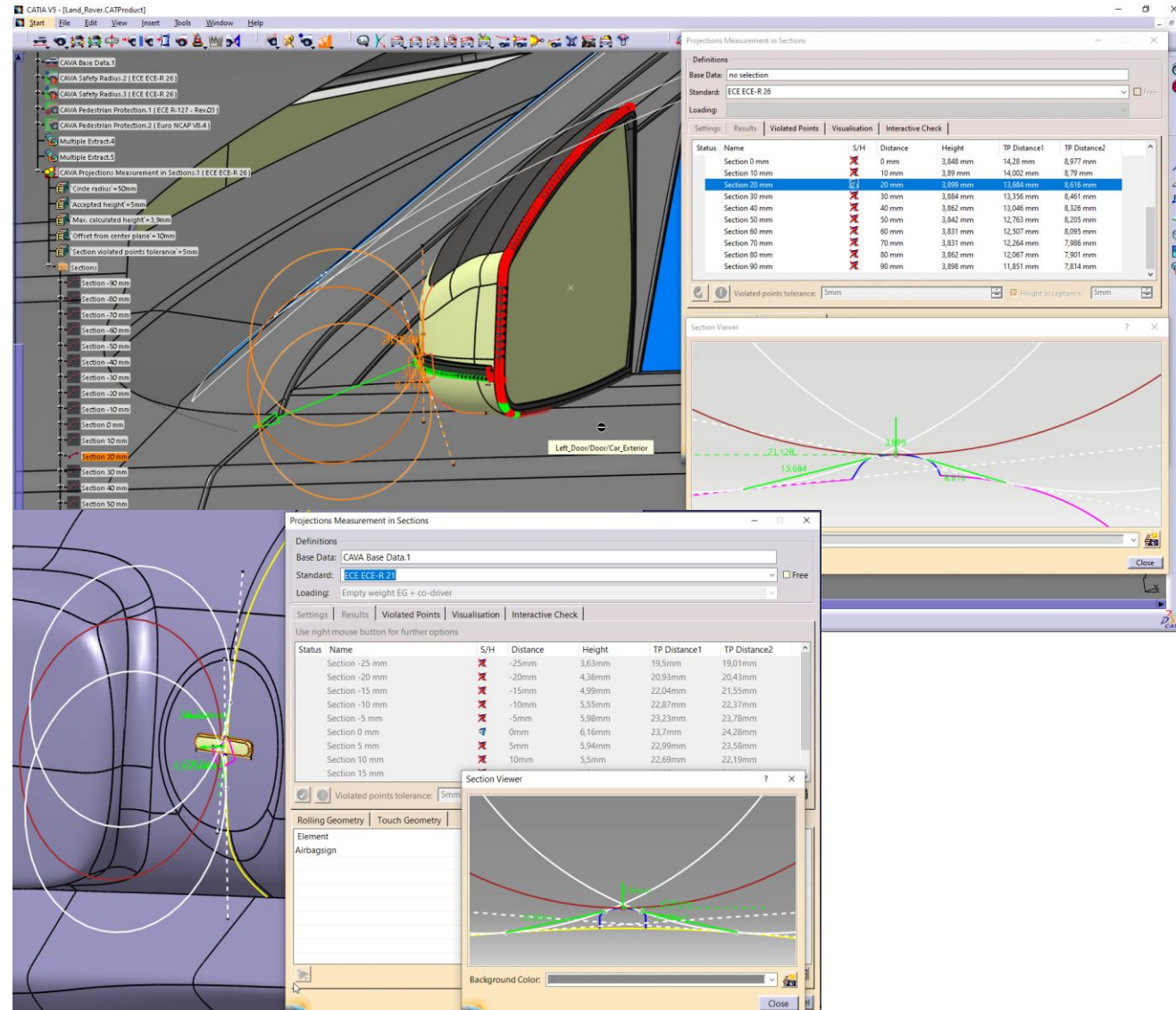
- ECE-R 21, ECE-R26

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

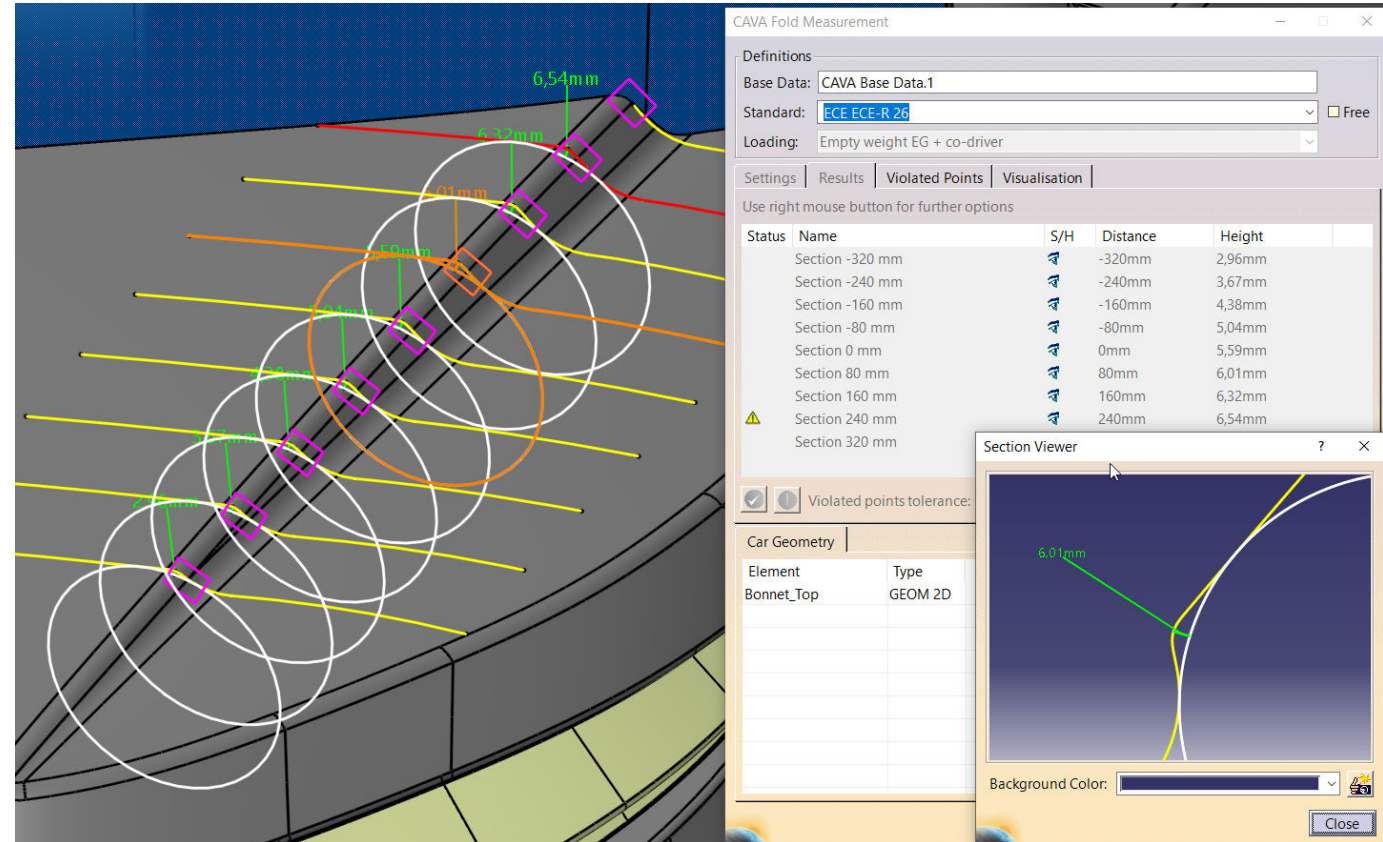
- ECE-R 26

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



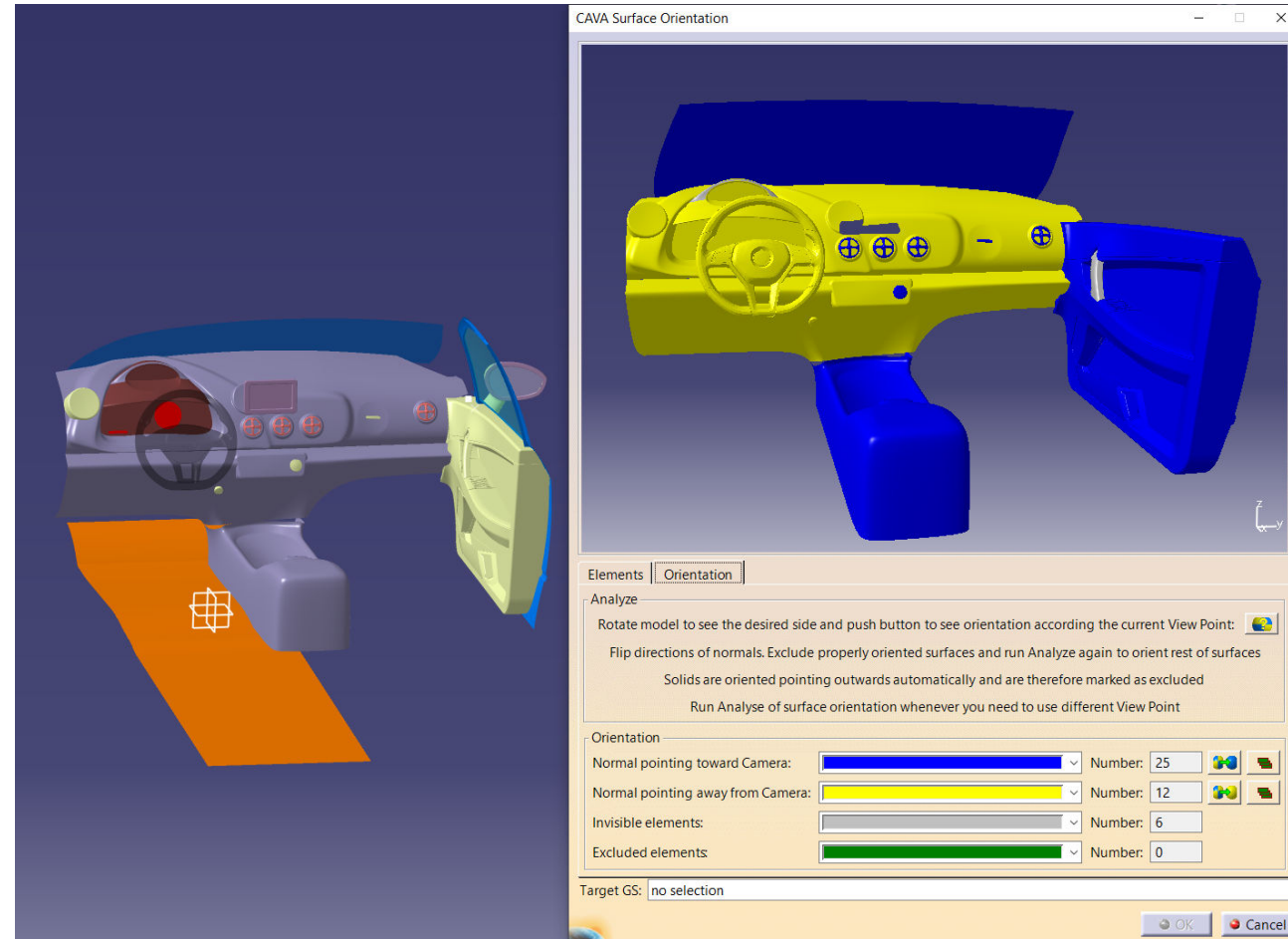
For CAVA Safety Radius checks it is important to have consistently oriented surfaces. This tool helps to facilitate consistent surface orientations for larger sets of individual surfaces.

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 – Product comparison: Safety and Safety Radius



CAVA Feature	Product Safety-Radius	Product Safety
Safety Radius Exterior	✓	✓
Interior Minimum Radius	✓	✓
Seat Minimum Radius	✓	✓
Kneeform Minimum Radius	✓	✓
Projection and Fold Measurement Tools	✓	✓
Surface Orientation Check	✓	✓
Pedestrian Protection		✓
Pedestrian Protection Offset		✓
Head Impact FMVSS 201U		✓