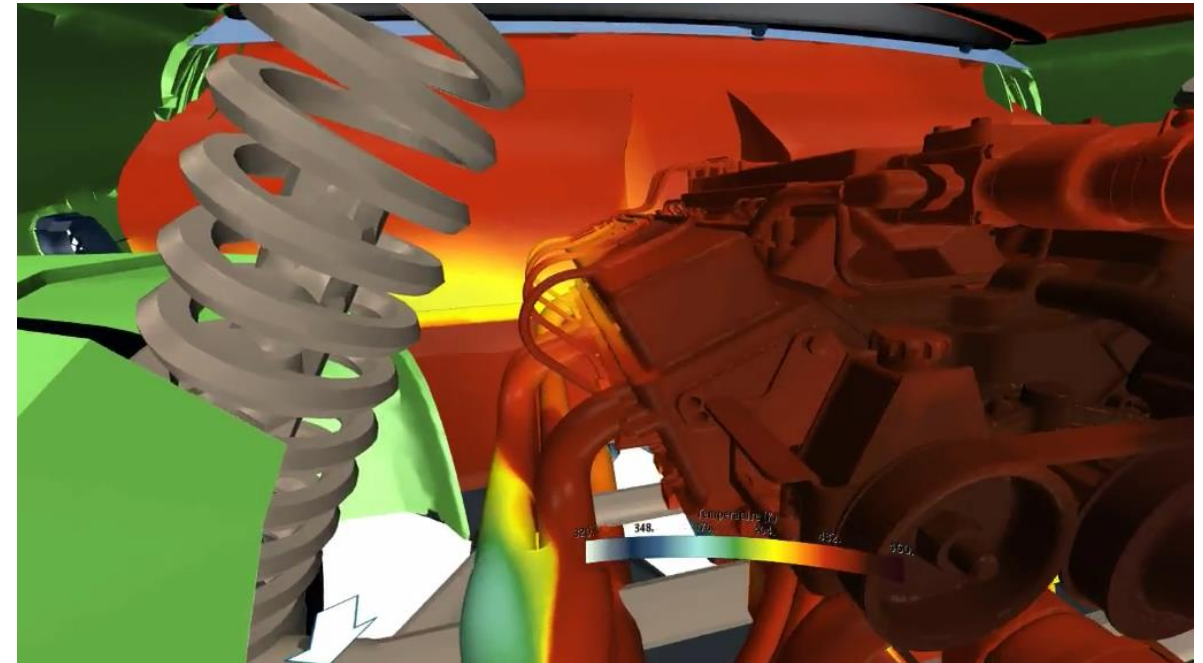


# Data Analysis in Simcenter STAR-CCM+

## Simcenter STAR-CCM+ Virtual Reality

State of the art technology permitting immersive interaction with your simulation results in a human way

- Explore your simulation results using hand gestures and movements
- Appreciate the size and scale of your simulation domain
- Find key insights with your existing designs rapidly
- Locate recirculation zones that can adversely affect performance using interactive massless particles
- Collaborate in virtual reality with stakeholders
- Take snapshots directly in Virtual Reality to extract gained insight for later communication

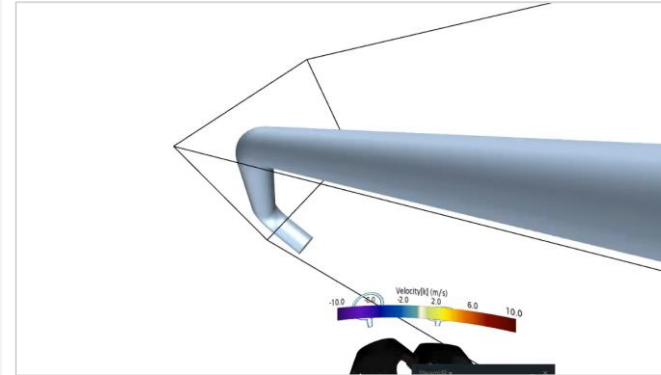


Investigate temperature distribution in motor compartment

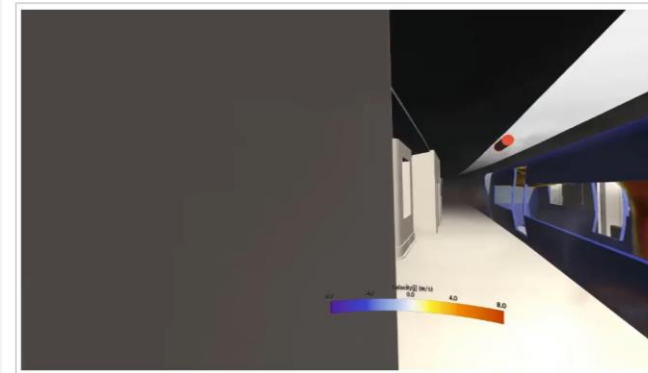
# Simcenter STAR-CCM+ Virtual Reality

## Key Information

- **Simcenter STAR-CCM+ Virtual Reality** offers a unique way of interacting with a simulation and its results
- In an immersive environment users can discover simulation behaviour that they were previously unaware of
- These behaviours can be complex flow environments or obscured geometry details
- Virtual reality capabilities are license free and run only under windows
- Collaborative working
  - Meet in VR sessions with up to 10 participants
  - Shared gesturing and viewing allows for more personal interaction among participants
- Quantitative data analysis in VR
  - Dynamically create, manipulate and move probes in VR for quantitative data analysis during and after simulation



VR used case: Flow in catalytic converter



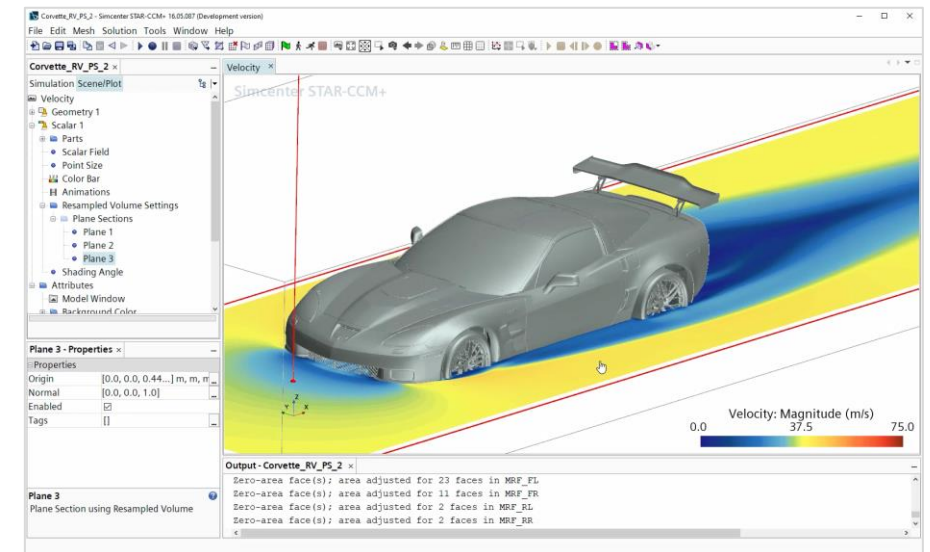
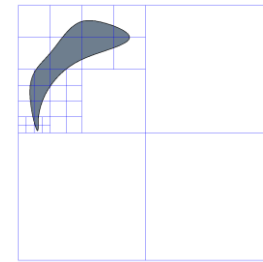
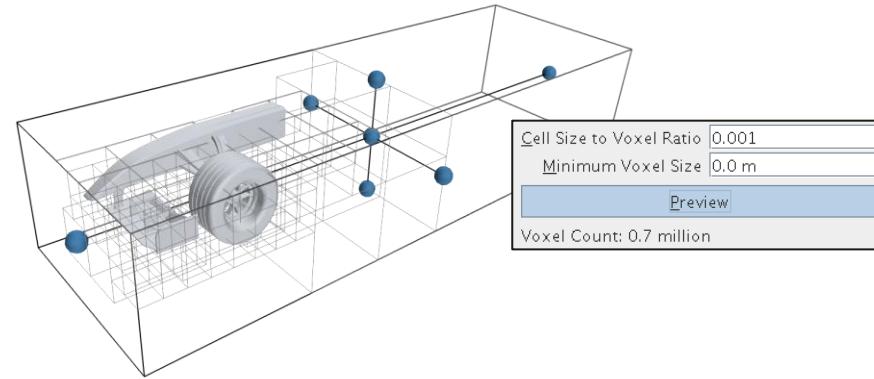
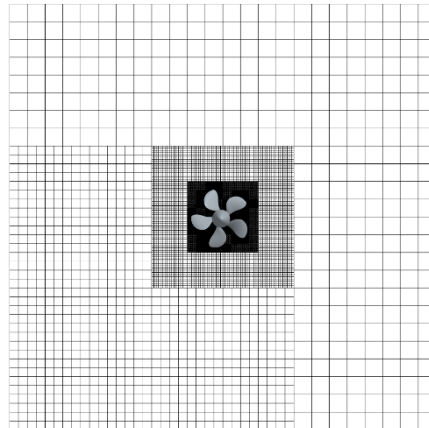
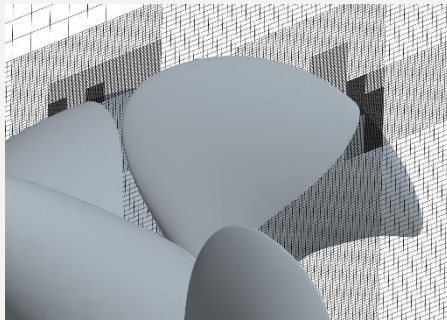
VR used case (HBI Haerter): Smoke in an underground train station. Flow pattern can be assessed in an immersive first-person fashion allowing for impactful design decisions based on simulation results.



# Resampled Volume for Virtual Reality

## Key Information

- Resampled Volumes can be used for rapid and interactive qualitative data analysis on volumetric data within virtual reality
- The data stored in the volume mesh is down-sampled using a structured octree mesh, made from cubic cells or **voxels** (volume elements analogous to pixels)
- The resampling algorithm is adaptative and mimics the cell sizes of the underlying volume mesh



## Extracting information from Simcenter STAR-CCM+ Virtual Reality

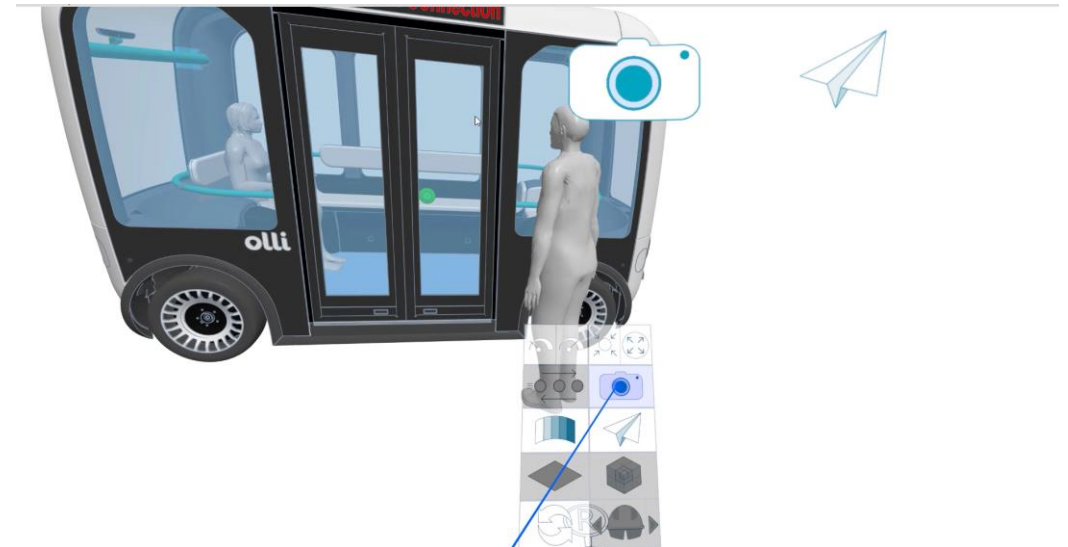
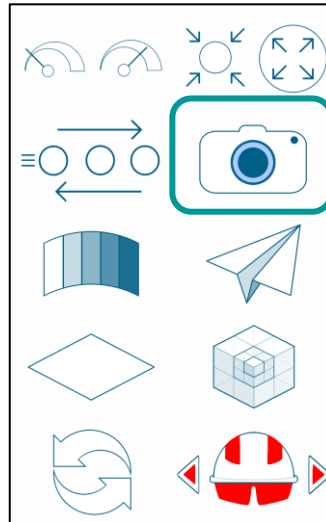
Extract insight discovered in Virtual Reality

- Capture images on the fly without removing headset and using controller palette
- Create individual or a sequence of hardcopies

Allows effective sharing of discovered information across the organization

Leverage insights from virtual reality

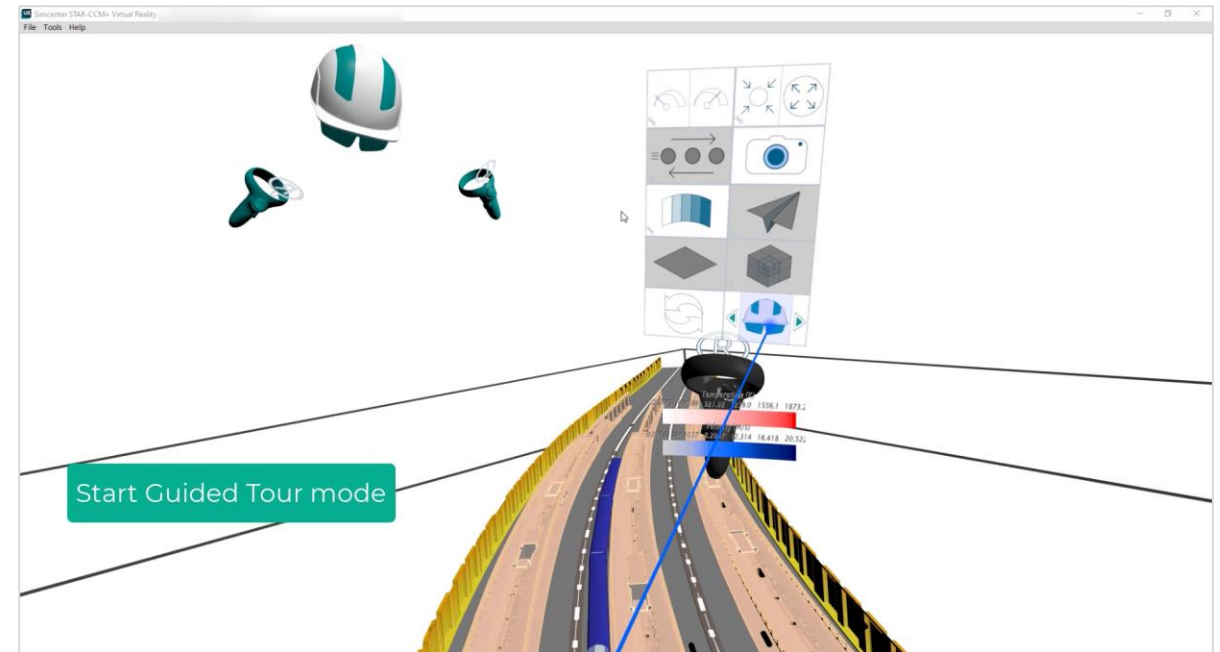
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# Data Analysis in Simcenter STAR-CCM+

## Simcenter STAR-CCM+ Virtual Reality Collaboration

- Multiple user interaction by connecting Virtual Reality client to running Simcenter STAR-CCM+ server
- Save time when performing:
  - Reviews of complex geometries or simulation results
  - Participate in Virtual Reality session with zero familiarization time, when using Guided Tour Mode
  - Avatars show location of other users
  - Gestures and pointing improves conversation effectiveness
  - Particles emitters, plane sections, iso-values can be created, modified, deleted in collaborative way or on an individual basis





# Simcenter STAR-CCM+ Virtual Reality operating modes

## Model Description

- Simcenter STAR-CCM+ Virtual Reality can be used in two different modes:
  - Scene file-based
  - Connected to a running STAR-CCM+ Server:
    - “Live” server changes will be immediately visible in VR

## When to use it?

- Scene file-based: Single user viewing in immersive environment
- Connected to live server: Collaborate with up to 10 (remote) participants in a shared immersive environment

## Typical Applications

- Send Scene file to another (external) VR user
- Collaborate in more efficient way, since gestures (pointing) and motions (viewing) of every participant visible to each other

### Scene file-based VR



↓ load .sce



Virtual Reality client

### Connect to live server



Virtual Reality client 1



Virtual Reality client 2



“PC client”

“Live” connection

“Live” connection

Makes changes

Simcenter STAR-CCM+ Server

