
SIEMENS
Ingenuity for life
Version
2020.2
Siemens Digital Industries Software
Simcenter STAR-CCM+
Release Notes
www.siemens.com/mdx

Contents

Simcenter STAR-CCM+ Release Notes 2020.2

This document provides important information about Simcenter STAR-CCM+ 2020.2.

Contents:

New Features and Enhancements 2020.2

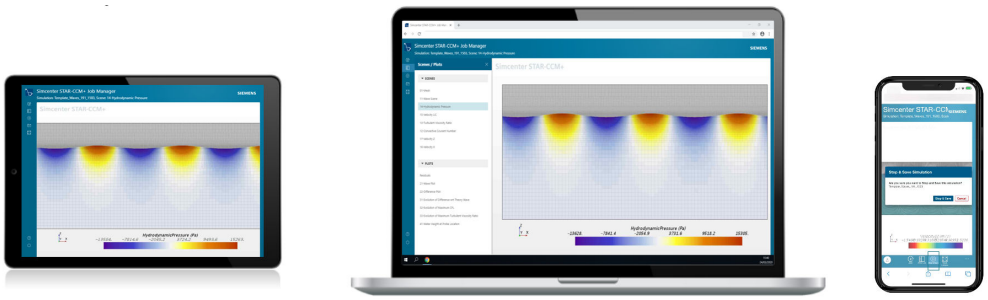
Enhancements to Simcenter STAR-CCM+ 2020.2 are presented by category:

Contents:

Platform

Deployment

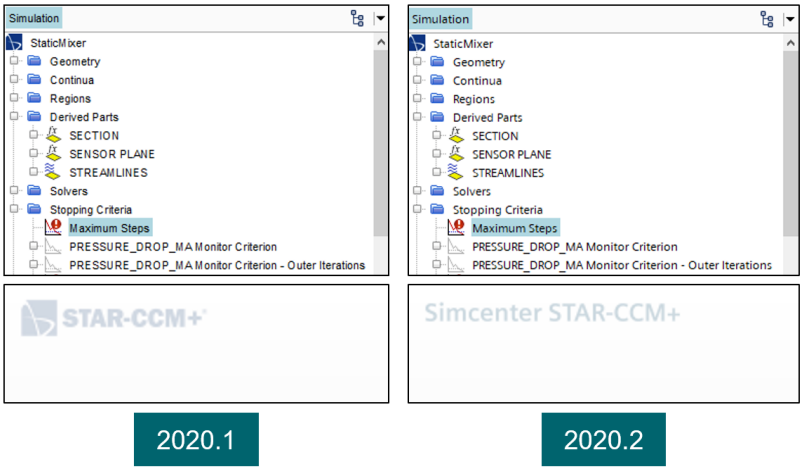
- **Web Monitor for simulations submitted with Job Manager**
  - Anytime, anywhere, any device access to your jobs through a web interface
    - Monitor progress of simulations submitted using Job Manager
    - No installation required on connecting devices
    - Web responsive and streamlined user interface
    - No convoluted cluster connection process
  - Immediate grasp of simulation status with interactive access to simulation progress indicators
    - View live updates to plots and scenes
    - Explore scenes to deepen understanding: zoom, pan, rotate
    - Consult output log for complete details or troubleshooting purposes
  - Take action on the go, save time by stopping the simulation if needed
    - Immediately free up hardware and license resources from a review of your simulation progress indicators
    - Either stop and save the simulation, or abort it instantly



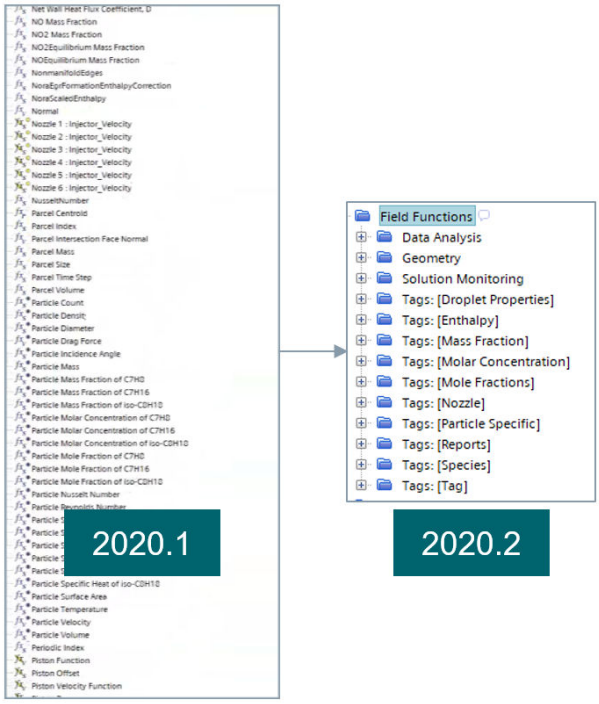
        - See Client-Server Setup > Job Manager > Web Monitor
    - Limitations:
        - No support for plot interaction
        - Uses server rendering with a single thread: the graphics capabilities of the machine where the master process is running are used. Activities depending on hardware graphics or multiple render threads for best performance may suffer: for instance, opening a scene with advanced rendering can result in long delays before the first frame displays.
- **Job Manager updates**
    - SLURM scheduler now compatible
    - LSF scheduler now compatible
    - See Client-Server Setup > Job Manager > Setting Up Job Manager (Admin) > Defining Resource Groups
    - Support of Job Manager instances for simulation submissions on HTTPS (SSL)
- **Newly certified operating systems (OS)**
    - CentOS 7.7
    - RedHat Linux Enterprise (RHEL) 7.7
- **Retiring operating systems (OS) in 2020.3 (15.06)**
    - CentOS 6.10
    - Red Hat Linux Enterprise (RHEL) 6.10
- **Newly certified Message Passing Interface (MPI) versions**
    - Intel MPI 2019.5
    - Open MPI 3.1.5 (planned as new default for 2020.3 (15.06))
    - MS MPI 10.1.1 (now included in release distribution)
- **Newly supported Message Passing Interface (MPI) versions**
    - Open MPI 4.0.2
- **Retired Message Passing Interface (MPI) versions**
    - Intel MPI 2018.1
    - Open MPI 3.1.3
    - MS MPI 8.1.1, 10.0

User Experience

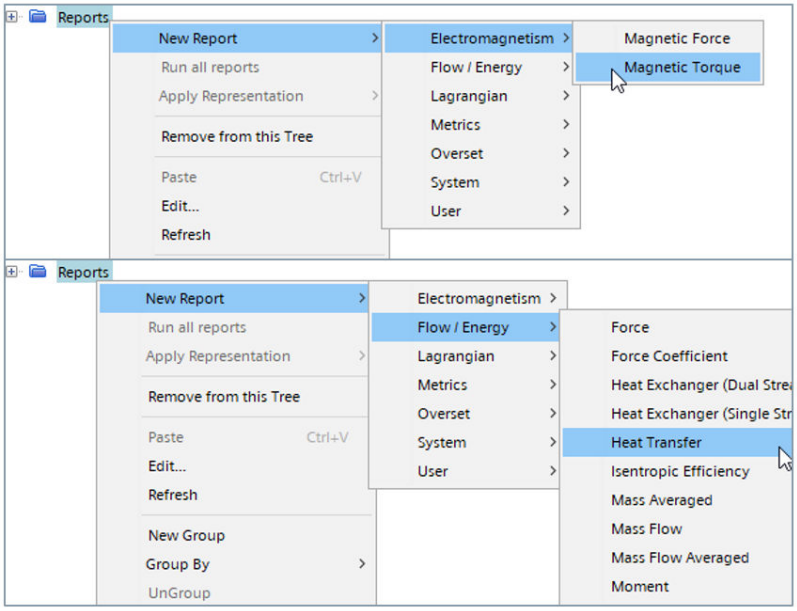
- **User interface updates to font and default scene logo**
    - Clear, common and coherent user experience across products in Siemens Digital Industries Software portfolio
    - Font of user interface updated to Siemens Sans Global on both Windows and Linux
    - Update of the default scene logo



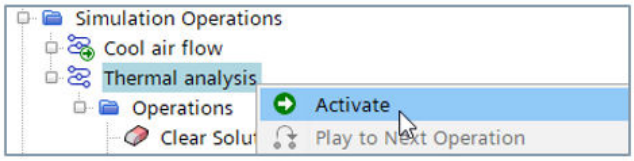
- **Grouping of Field Functions D976**
  - Improved ease of use through groups of field functions
    - Find field functions faster with less scrolling, less clicks
  - Reduced thinking time to process large amount of similar data sets with automatic and custom groups
    - Either create your own custom groups
    - Or choose the automatic grouping from attributes shared between field functions: dimensions, value type, tags
  - Limitation: groups for field functions are not yet available in the object selector, in the scenes pull-down menu, and in the expression editor



- **New ordering for creation of reports**
  - Faster access to the right report type with groups



- **Simulation Operations activate from context menu**
  - Activate in-situ, no need to resort to toolbar



CAD Integration

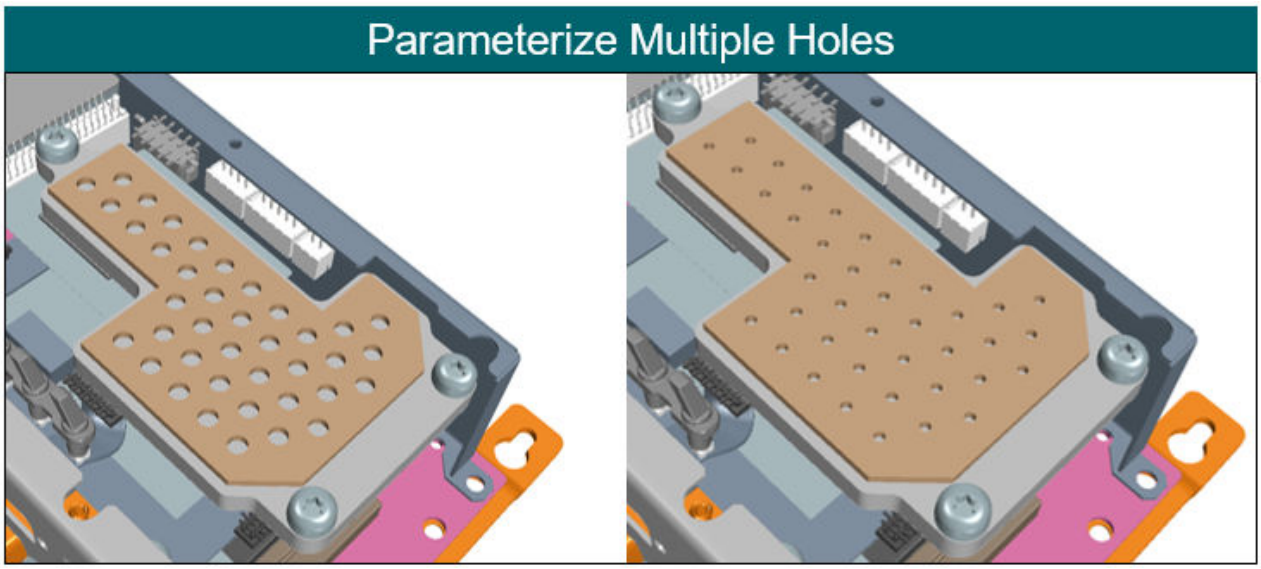
CAD-Clients

- **Client for NX version upgrade**
  - Support added for
    - NX 2019.2 (1872 series) and NX 2020.1 (1899 series)
    - Simcenter 3D 2019.2 and Simcenter 3D 2020.1
  - All functionality and user interface stay the same as previous versions
- **Important Note: Planned removal of CAE Mode for CAD Clients**
  - The capability to setup simulations (physics parameters, mesh settings etc) within the CAD environment is planned to be removed for all tools apart from CATIA V5 from Simcenter STAR-CCM+ 2021.1
  - CAD Clients will continue to focus on
    - Direct geometry import
    - Bi-directional parameter transfer
  - Please contact your Simcenter customer support representative for further information

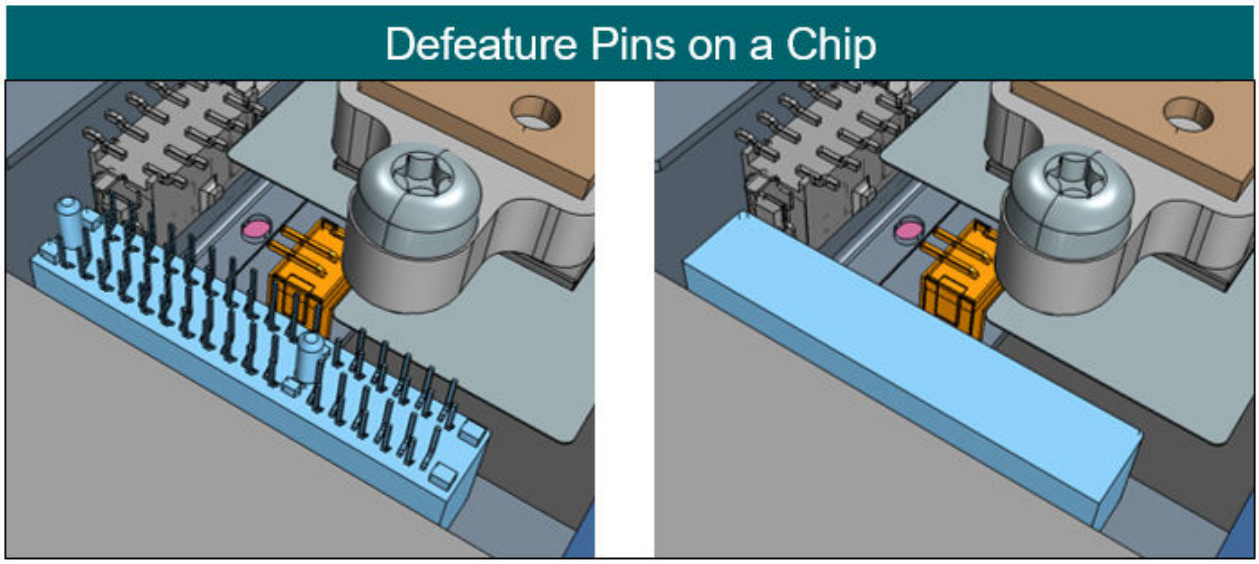
Geometry

3D-CAD

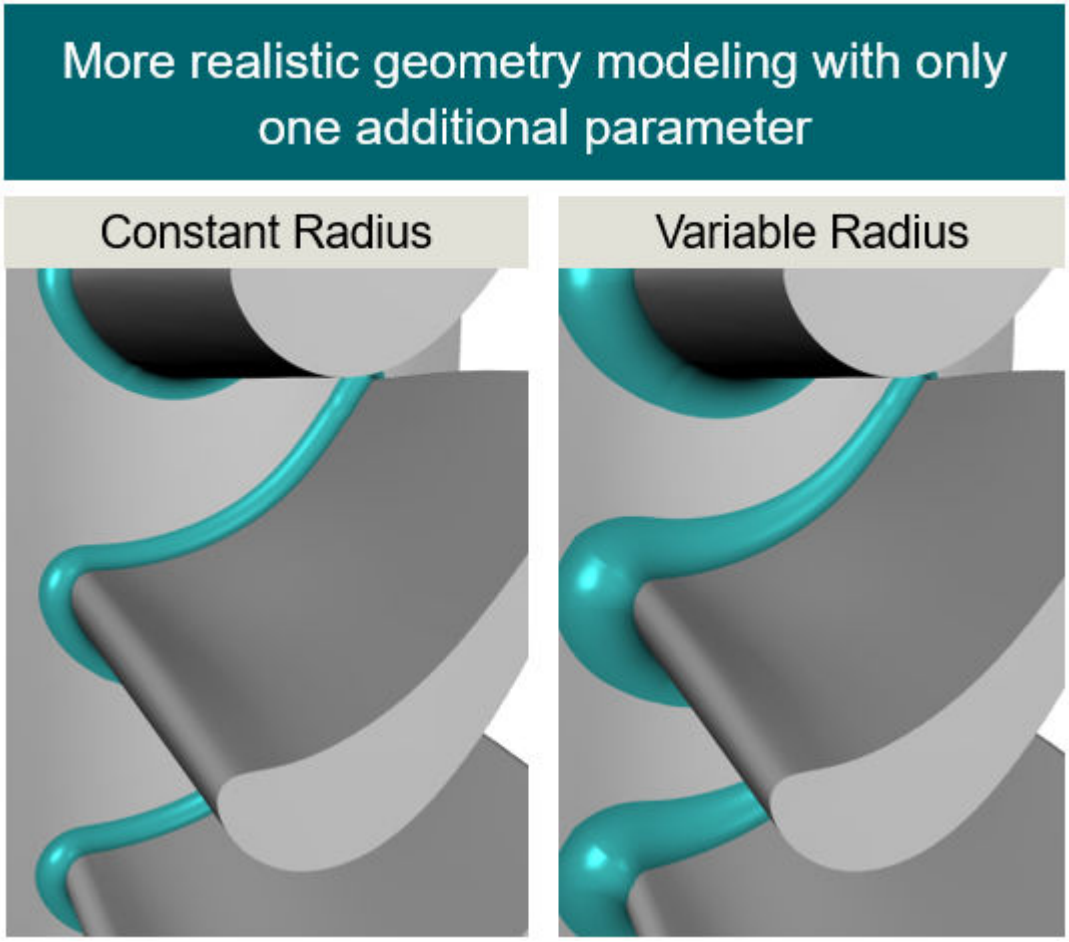
- **Extend Solid D5128**
  - Allows easier parameterization through the extension of existing faces of solid body
    - Parameterize dumb CAD with a few clicks
      - Example: Enlarge or reduce multiple holes
  - Extend one or more faces along the face normal, linear, or angular direction
    - New "Extend Solid" option is added to the right-click menu in the scene
    - See Pre-Processing > Modeling Geometry > Using 3D-CAD > Working with Faces, Edges, and Vertices > Extend Solid
  - No need to unite the new faces to the base body
  - Limited to solid faces
  - Supports multiple faces in a single feature



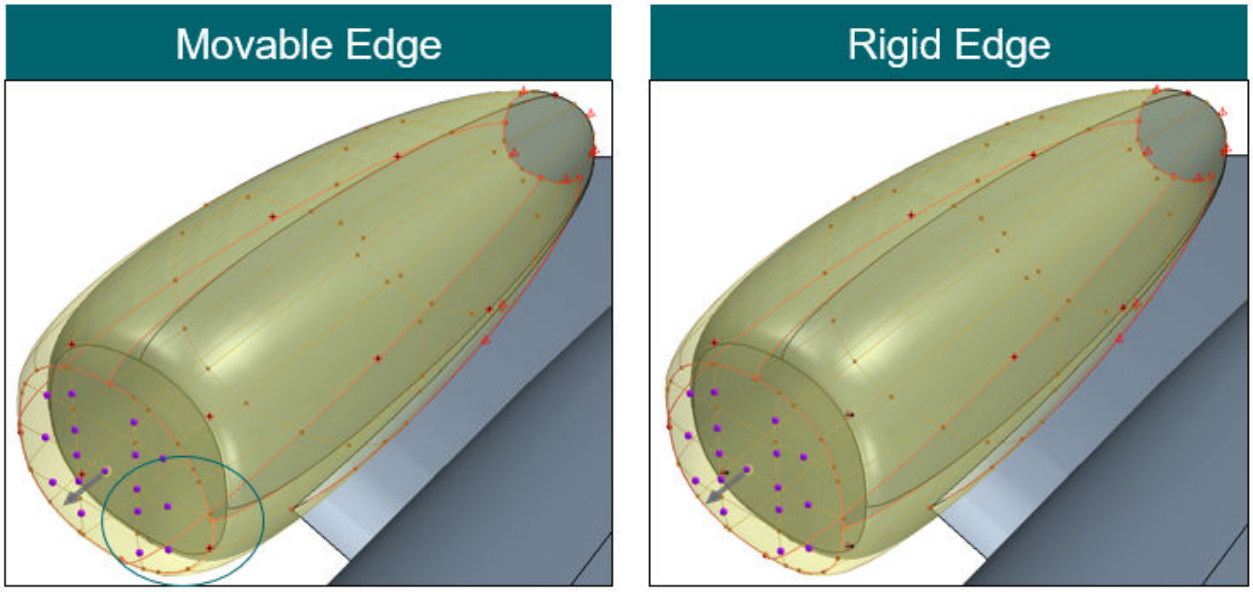
- **Defeature Faces - Delete Interior Faces**
  - Enables easy removal of unwanted internal faces that are not required for analysis
    - Delete embossed features from a body
    - Defeature circuit board and chips
    - Remove interior details of the engine block
  - See Pre-Processing > Modeling Geometry > Using 3D-CAD > Removing Unwanted Features
  - Defeature Faces operation is enhanced to support “Delete Interior Faces”
    - Supports both solid and sheet bodies
    - Off by default
  - *Limitation: Cannot handle interior faces spanning more than one face*



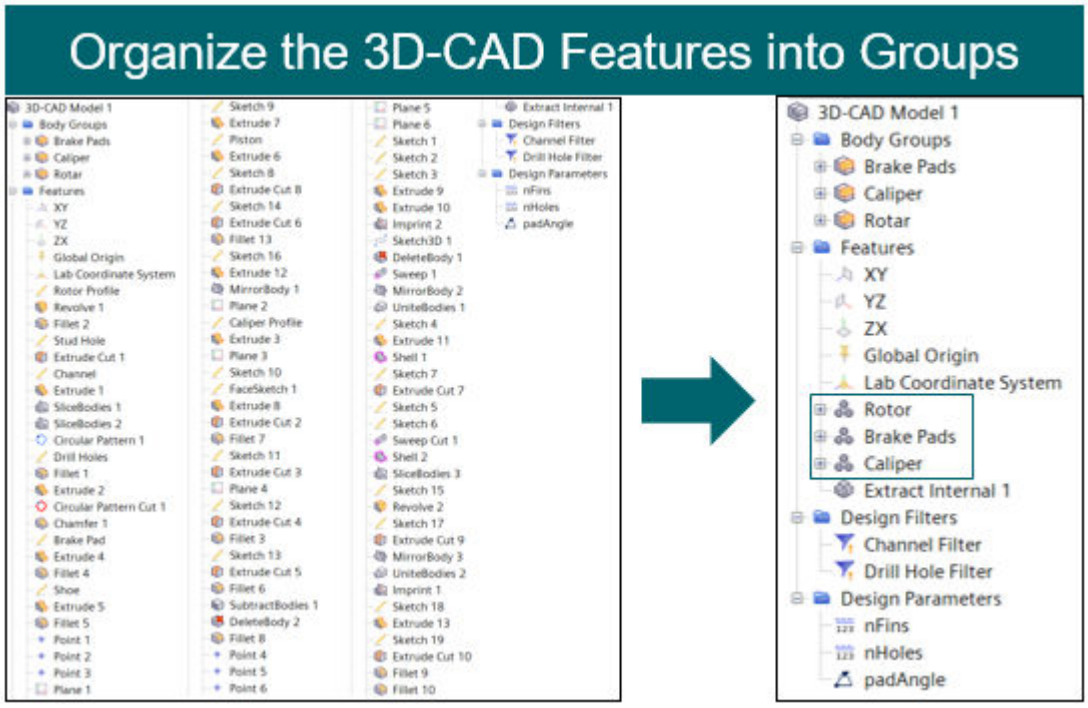
- **Variable Radius Fillet D5260**
  - Enables creation of more realistic models with variable fillet along the edges
    - Fillet operation now supports variable radius
    - Supports connected edges of a single body
    - Manually add extra points on the edges with “add points on edges” option
    - Add Points on edge with a slider control
    - The fillet shape can be either circular or conic
    - See Pre-Processing > Modeling Geometry > Using 3D-CAD > Working with Fillets and Chamfers > Creating Fillets > Using Variable Radius to Create a Fillet



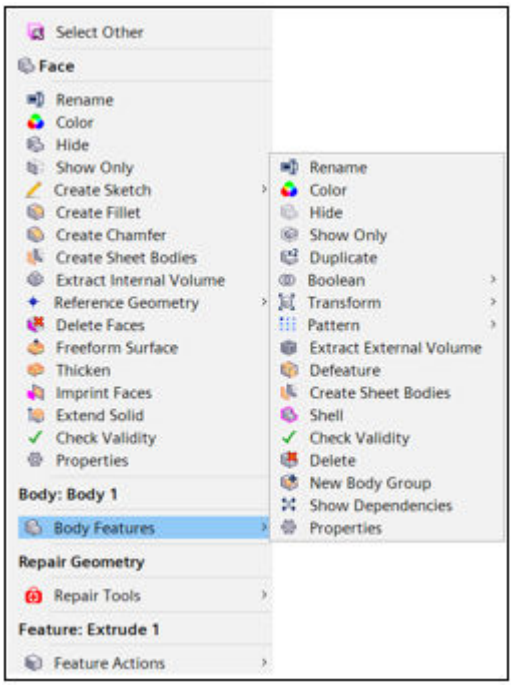
- **Freeform – Rigid Edge Constraints**
  - Provides better control over organic shape changes in design studies through defining constraints on edges
    - During freeform, user can retain the shape of the internal and laminar edges
    - Rigid constraint for free and internal edges
    - Fixed constraint for internal edges
    - New icon **Display Interior Edge Constraints** is added in display options
    - Off by default



- **Search tool enhancement**
  - Search Tags set to Body, Body Group, Face and Edges
    - Allows you to select entities assigned with Tags to feature via filters
  - Support Body Group in predicates
    - Search Body Group by Area, Volume, Name, and Tag
  - Filter support for sketch imprint, color and rename features
  - Repair features are added to the Design Filter feature pop-up menu
- **Easier navigation in feature tree through grouping D4222**
  - Right-click option “Group Feature”
  - Introduces a new folder name, “Group” in the feature tree
  - Supports drag-and-drop of features into the group folder



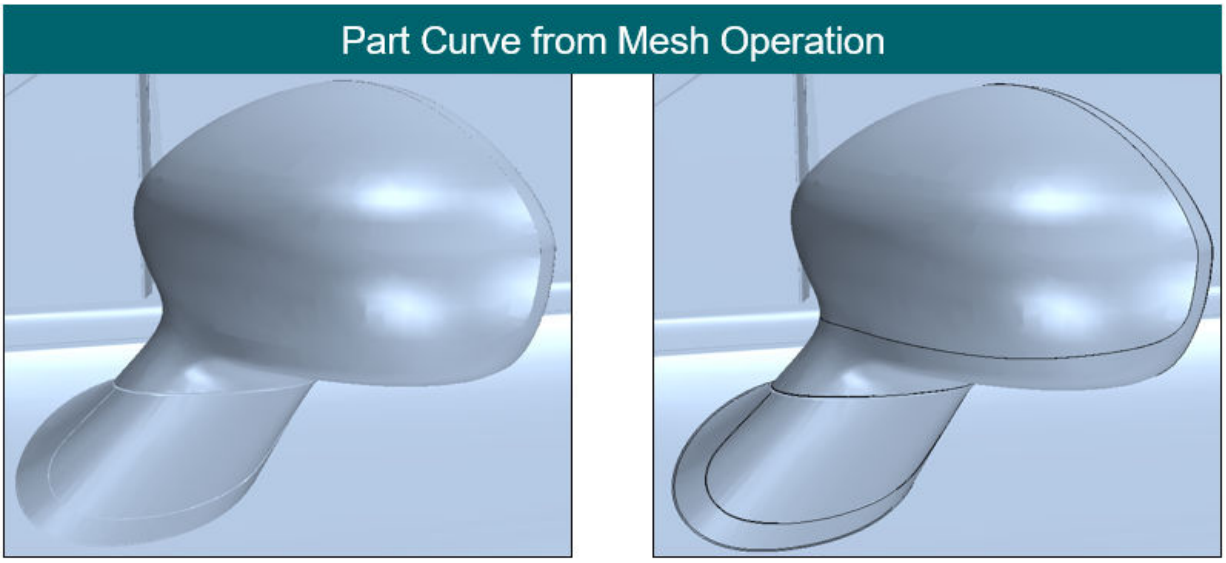
  - See Pre-Processing > Modeling Geometry > Using 3D-CAD > Introducing 3D-CAD Modeling > Working with Features and the Feature Tree > Grouping Features
- **3D-Sketch enhancements**
  - Accurate creation of point, line, and spline on geometry in 3D sketches through icon **Pick on Geometry**
    - ON by default
    - Display other 3D-Sketches in a different color
- **Context Menu**
  - The Body features in the 3D-CAD scene right-click menu are collapsed to a sub-folder



- **Feature Panel Changes**
  - Support drag-and-drop of bodies between the group boxes in a Feature Panel. For instance, in the Unite Operation Feature Panel, you can now drag and drop a body between the target and tool bodies group box.
  - When editing a feature, removed the focus on the top group box to avoid any mouse click in the scene that can remove the entity already selected in the group box.
  - The feature name now appears in the title of a feature edit panel.
  - **Enable-Feature Preview** option added to the **Tools** > **Options** > *3D-CAD* panel for switching off the preview in the feature panel.

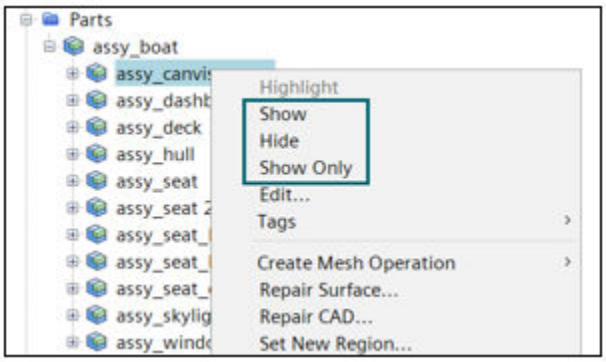
Parts

- **Part Curve Creator Operation D2582, D5292**
  - Java macros are no longer needed to mark feature curves thanks to new mesh pipeline operation
  - Part Curve Creator operation provides the ability to:
    - Mark Sharp Edges, Free Edges, Non-manifold Edges, Perimeters
    - Automatically Fix Errors
    - Maintain Existing
    - Delete Empty



- See Pre-Processing > Meshing > Mesh Operations > Part Curve Creator

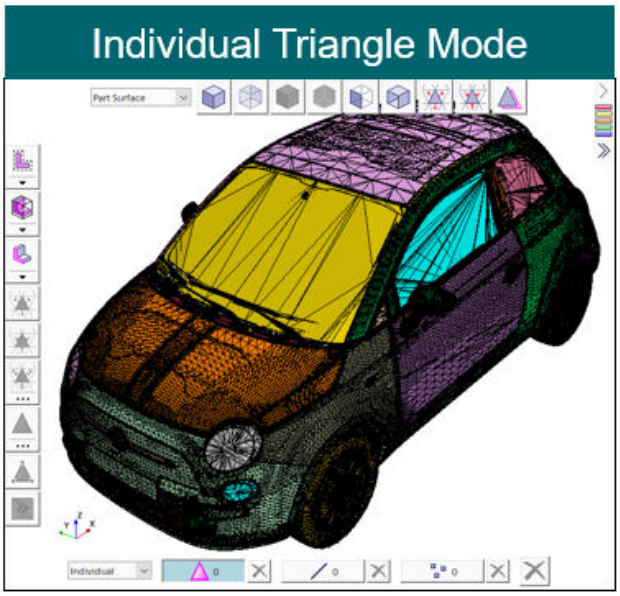
- **Show/Hide/Show Only through right-click menu in simulation tree**
  - Edit visibility of composites or parts in the active scene directly from simulation tree
    - No need to manually drag the composite or parts to the scene

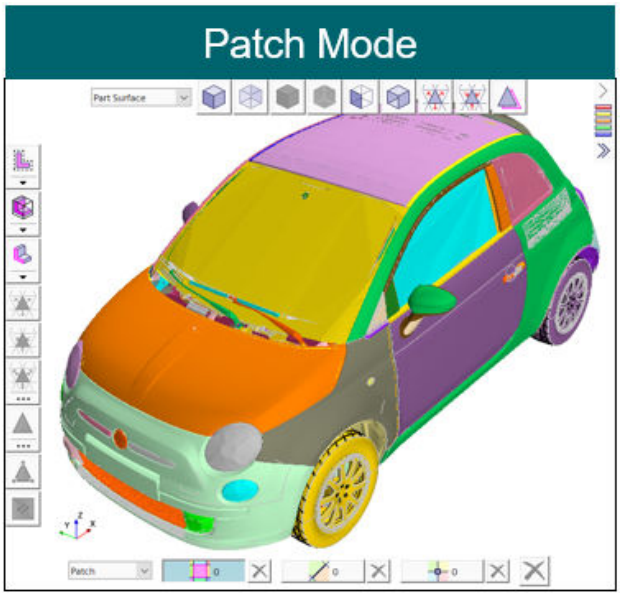


Mesh

Surface Repair

- **Surface Repair – Patch mode**
  - Improves turnaround time during model preparation by interacting with a patch instead of triangles
  - Geometry represented as patches instead of triangles.
    - A mouse click will select entire patch or patch bounding edge instead of individual triangles or edge
    - All repair operations accept patches
    - Toggle button to switch between patch and triangle mode
  - See Pre-Processing > Modeling Geometry > The Surface Repair Tool > Selecting Entities > Using Individual or Patch-Based Selection





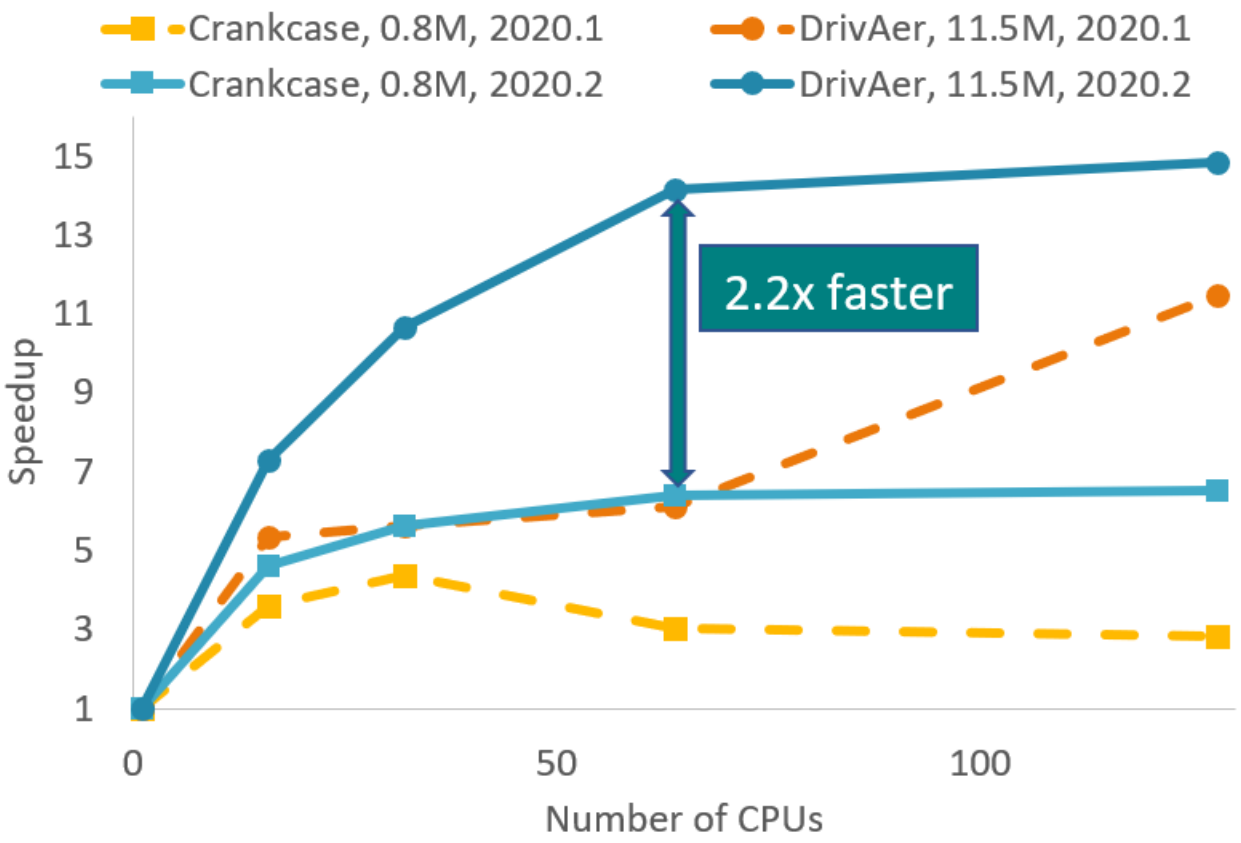
- **Repair input surface**
  - Easy access to repair Surface from mesh operation through right-click menu option **Repair Input Surface**
    - Opens Repair Surface with the input parts from the Mesh operation automatically selected
- **Remesh faces**
  - **Modify Free Edges** option allows you to maintain existing vertex placement and number on free edges when remeshing
    - To enable this behavior, deactivate the **Modify Free Edges** option

Surface Mesh

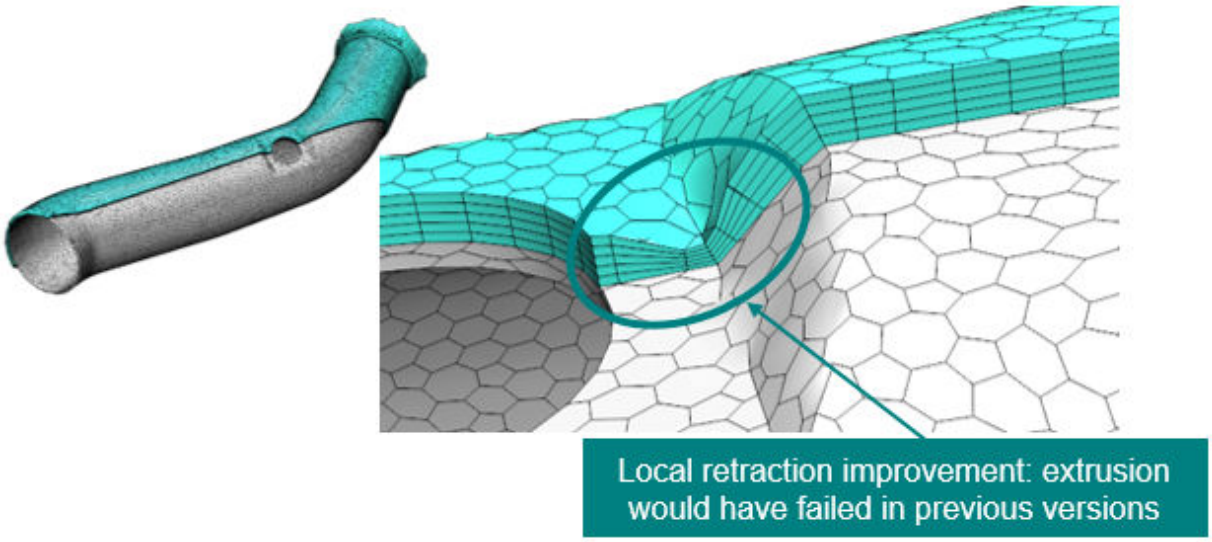
- **Surface Wrapper - Gap Closure**
  - Improved performance of surface wrapper on large cases that use gap closure
    - No change in the surface wrapper setup process
    - 1.2x speedup observed on full car wrap
- **Surface Remesher - Surface Growth Rate**
  - Now possible to specify surface growth rate as Fast, Default, Slow, or User Specified
    - Absolute value calculated based on mesh type and Surface Growth Rate
    - User Specified allows setting absolute value

Volume Mesh

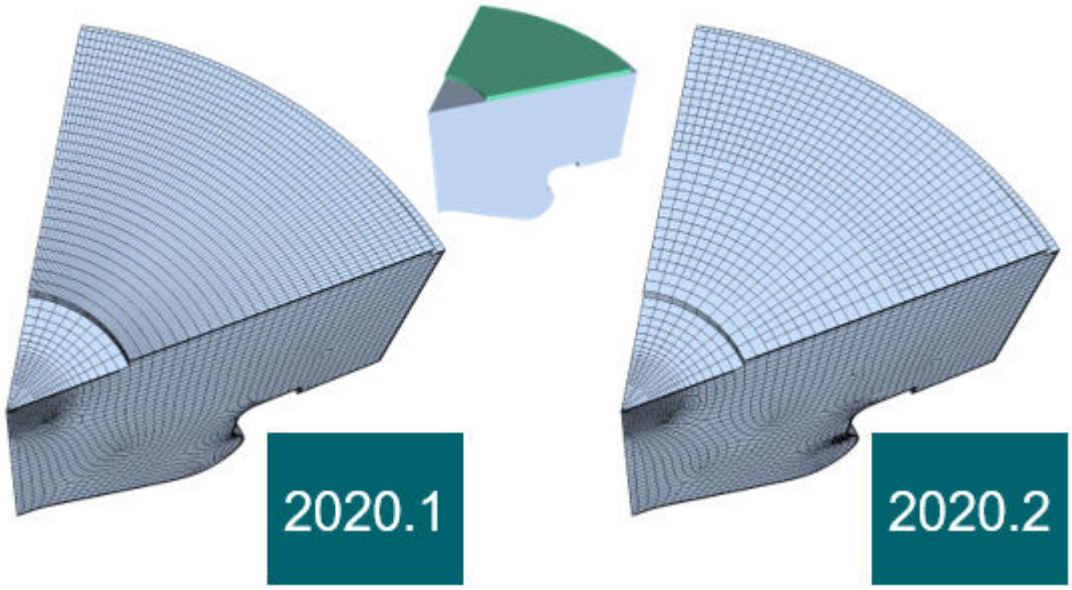
- **Improved performance for parallel polyhedral meshing**
  - Faster generation of tetrahedral and polyhedral meshes in parallel
    - 1.07-3.8x faster for 128 cores
    - Performance gain dependent on the deployed number of cores and is case dependent
      - Highest impact for high core counts & high surface area to volume ratios



- **Improved robustness for thin mesher**
  - Previously the mesher could fail in thin parts where a tiny zone of the part could not be thin meshed, because the zone was too small to mesh with polyhedral or tetrahedral cells
  - To avoid this, now the thin mesh surrounding the tiny zone is retracted, which gives enough space for the tetrahedral / polyhedral mesher
- **More robust meshing for abrupt prism layer transitions in convoluted geometries through improved layer transition algorithm**
  - Less meshing failures proven for geometries with transitions from many to few layers
    - For example vehicle underhoods which typically have transitions from 20 to 3 prism layers
- **More robust extrusion of non-planar part surfaces through local retraction D4688**
  - Previously parts-based volume extruder stopped if self-intersection in surface extrusion, and retracted globally in case of negative volume cells
    - Now extrusion is performed and retracts locally
    - Consistent with regions based meshing extrusion



- **Consistent rotational sweep coarsening across contacting parts**
  - Rotational sweep coarsening now also accounts for parts not connected to rotational axis



- **Improved parallel mesh equivalence for polyhedral and tetrahedral meshers**
  - Improved parallel mesh equivalence for a limited range of applications which contain thin gaps where the surface mesh size varies greatly between the two sides of the gap
- **Conformal tetrahedral meshes at interfaces between operations**
  - When using the "conformal between operations" option in tetrahedral meshing, conformality across interfaces is more aggressively enforced across contact interfaces.
    - May improve robustness in finite element simulations e.g. electric machines
- **Directed mesher robustness improvement**
  - Better resolution of curved geometries and less failures through improved handling of geometric features that do not need to be resolved by the mesh.

- **Important Note: Planned removal of Region-Based Meshing**
  - Region-based meshing has been deprecated in Simcenter STAR-CCM+ 2020.1 and is planned to be removed in version 2021.1
  - The recommended practice is to use parts-based meshing. See the section “Simcenter STAR-CCM+ > Pre-Processing > Meshing > Parts-Based Meshing” in the Simcenter STAR-CCM+ User Guide
  - Please contact your Simcenter customer support representative for further information

CAE Integration

- **Co-Simulation third party version support**
  - **Support added**
    - Simcenter Amesim 2019.2 (new recommended version)
  - **Support maintained**
    - Simcenter Amesim 17 and 2019.1
  - **Support ended**
    - Simcenter Amesim 16.1

Physics

Contents:

CFD

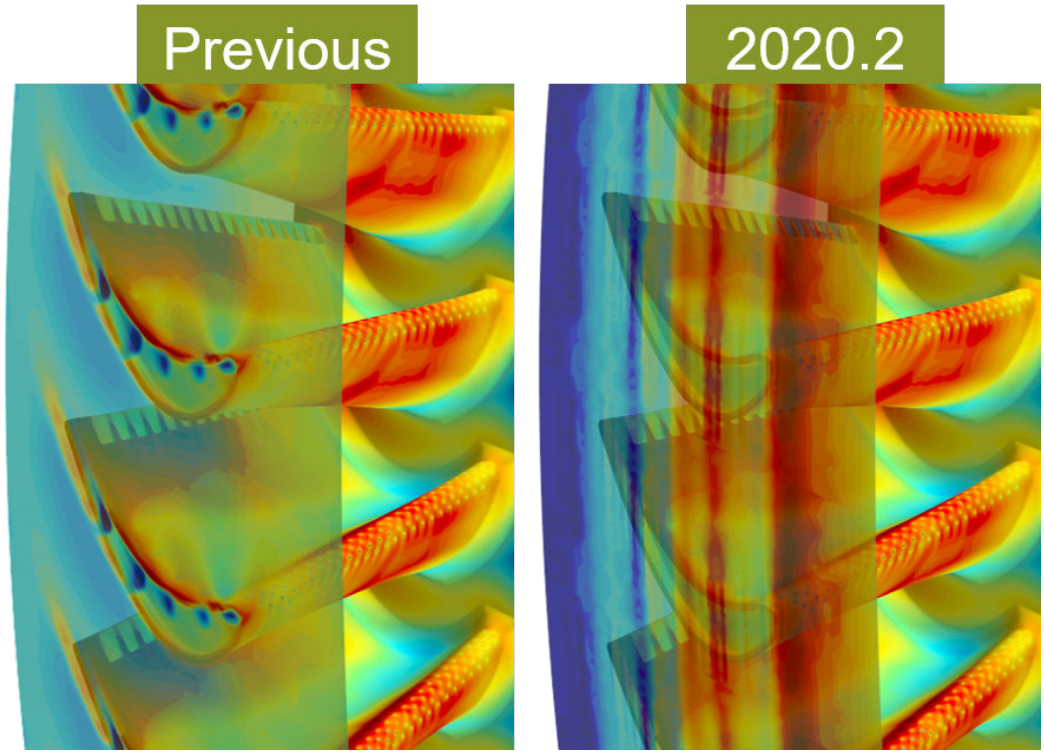
Flow

- **Treatment for species boundary conditions with reversed flow**
  - Improved robustness for reacting flow simulations with outlet recirculation where inflowing species mass fractions, combustion scalars, passive scalars, and temperatures are set at the boundary
    - These conditions may vary from interior values causing robustness issues
    - Using extrapolated values from the interior for the boundary values stabilizes the solution

Energy

- **Energy averaging for stationary surfaces in rotating media**
  - Improved physical realism of the shroud thermal profile

        - Improves physical realism of averaged results on the shroud for turbomachinery simulations with a moving reference frame
        - Boundary condition option for shroud wall allows separate reference frame to be specified
    - Easy to use workflow
        - Uses radial bins to average quantities in a similar manner to a mixing plane
        - Allows post processing using existing field functions
    - *Incompatible with EMP and non-equilibrium phasic porous media*

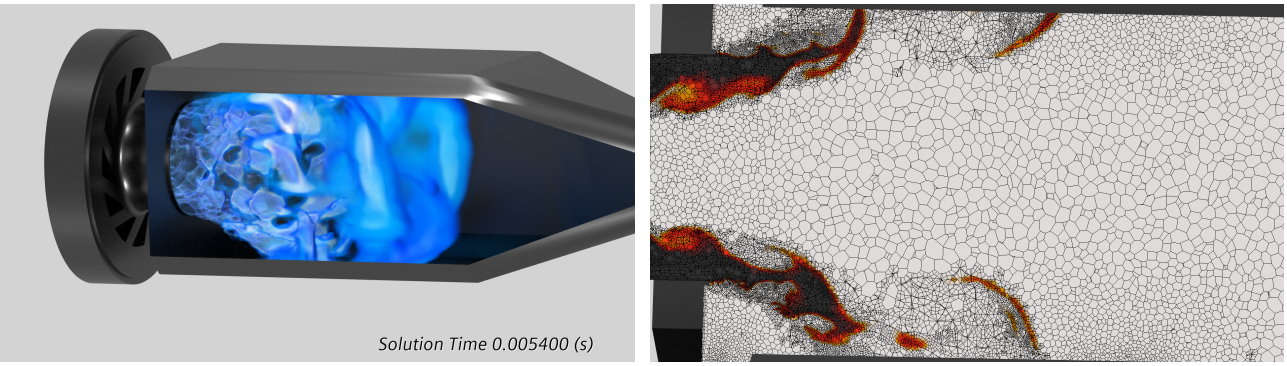


- **Improved ray tracing efficiency using packets and streams**
    - Up to 5x speed-up of the View Factor calculation
        - Streams consist of many rays being traced at once to try to maximize cache coherence
    - Particularly beneficial for large vehicle thermal management cases
        - Greatest speed-up shown for cases with large cell counts
    - *Shells are not yet supported by Advanced Ray Tracing*

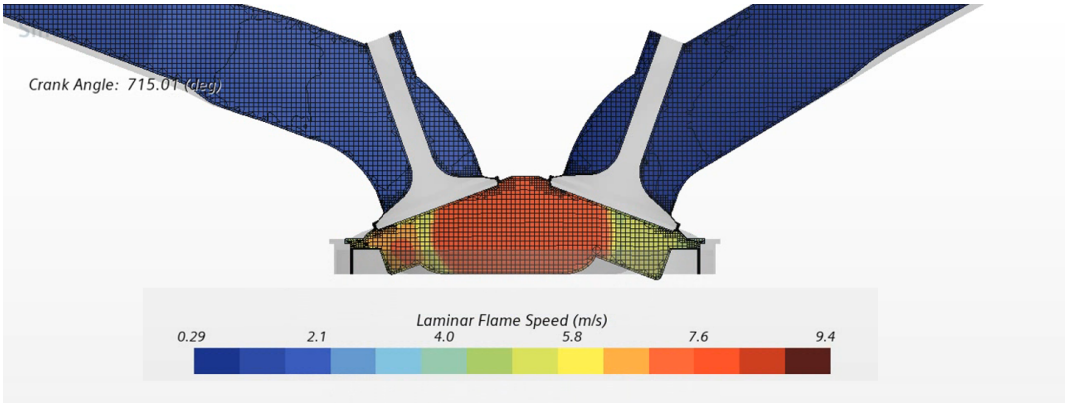
# cores	Adv RT (s) 2020.1	Adv RT (s) 2020.2	VF Speed up
	ViewFactor	ViewFactor	
40	1614.9	367.3	**4.40**
80	1097.0	228.9	**4.79**
160	636.1	139.0	**4.58**
320	598.3	136.2	**4.39**
400	545.1	135.2	**4.03**

Reacting Flows

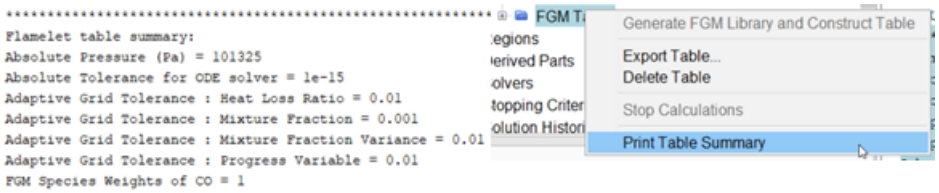
- **Model based refinement for Adaptive Mesh Refinement (AMR)**
  - Reacting flow flame front model based refinement
    - Provided in addition to standard field function driven refinement
    - Refines cells specifically around the flame front preventing the flame from becoming unresolved by a coarse mesh
    - Preserves the sharp interface of the flame front
  - Reduced computational expense
    - Fine mesh is only needed where it is required
    - Can be used alongside adaptive time-step, allowing refinement in space and time
  - Improved ease of use
    - Reduces the need for 'guesswork' of where the flame is going to be
    - Start with a coarse mesh for flame propagation studies and let the solver define where the mesh needs to be
  - Typical applications include dynamic flame propagation and steady flame positioning
  - See Simulating Physics > Combustion and Other Reacting Flows > Reacting Flow General Reference > Mesh Adaption for Reacting Flows Reference



- **Unburnt temperature for Laminar Flame Speed (LFS) correlations**
  - Accurately model complex fuel propagation with the CC-TFC model
    - The unburnt temperature is now available as a field function
    - LFS correlations can now be built using the field function editor
    - See Simulating Physics > Combustion and Other Reacting Flows > Flamelet > Flamelet Reference > Turbulent Flame Speed Closure Model Reference
  - Improved ease of use
    - Previously estimates of the unburnt temperature had to be used
    - Now the unburnt temperature used by the CC-TFC model is available.
  - Typical applications are for novel or complex fuels



- **Flamelet table generation summary**
  - Improved ease of use and reduced opportunity for error
    - Use the 'Print summary' option to quickly understand what parameters were used to build the table
    - See Simulating Physics > Combustion and Other Reacting Flows > Flamelet > Flamelet Workflow > Creating Flamelet Tables
  - Reduced complexity
    - Previously expert warning messages that were printed to the console caused concern during the table generation process
    - A verbosity flag has been added so that only expert users can see these warnings that have a very low impact on the simulation



- **Soot modeling using generalized precursor**
  - Accurately model soot formation with method of moments
    - Use multiple soot precursors as source of soot
    - New precursor soot species can be specified: A2, A2R5, A3, A3R5, A4, A4R5, FLTN, P2
    - See Simulating Physics > Combustion and Other Reacting Flows > Emissions > Emissions Reference > Soot Moments Model Reference
  - Improved Ease of Use
    - Wider variety of chemical mechanisms now useable for soot predictions
- **Liquids in Reacting Channel**
  - Accurately model liquids in the tubes of reacting channel approach
    - Constant density is now available for liquids in the 1-D channel

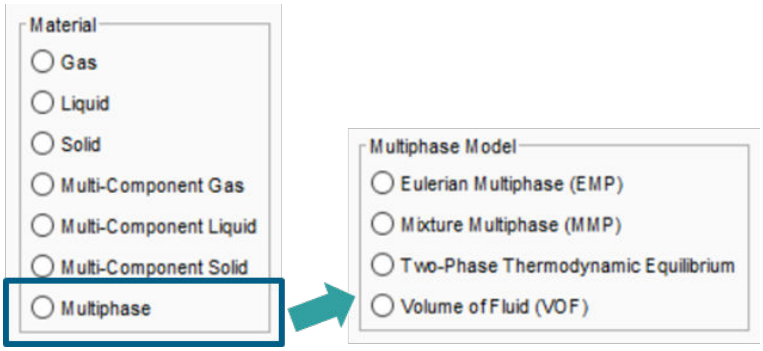
Turbulence

- **Important Note: Removal of the AKN k-epsilon turbulence model**
  - The previously deprecated AKN k-epsilon turbulence model has now been removed
  - The model has been superseded by models such as Lag Elliptic Blending and Standard k-epsilon Low-Re

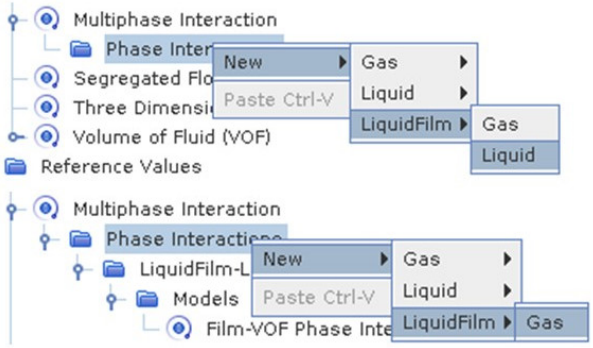
Multiphase Flow

General User Experience Improvements for Multiphase

- **Clearer labeling of multiphase models**
  - Reduced set-up time and user error
  - Consistent terminology used
  - Eulerian family of multiphase models are now accessed as *Multiphase* under material with the following multiphase model choice:
    - Eulerian Multiphase (EMP)
    - Mixture Multiphase (MMP)
    - Two-Phase Thermodynamic Equilibrium
    - Volume of Fluid (VOF)



  - See Simulating Physics > Multiphase Flow > Using the Multiphase Model
- **Easier to set-up phase interactions**
  - Reduced set-up time and user error
  - New workflow
    - Under new phase interaction, simply select the primary phase associated with any multiphase model
    - Possible partner phases across all multiphase models are listed for selection
    - Once a pair of phases is chosen, appropriate phase interaction set up automatically without the need to chose type



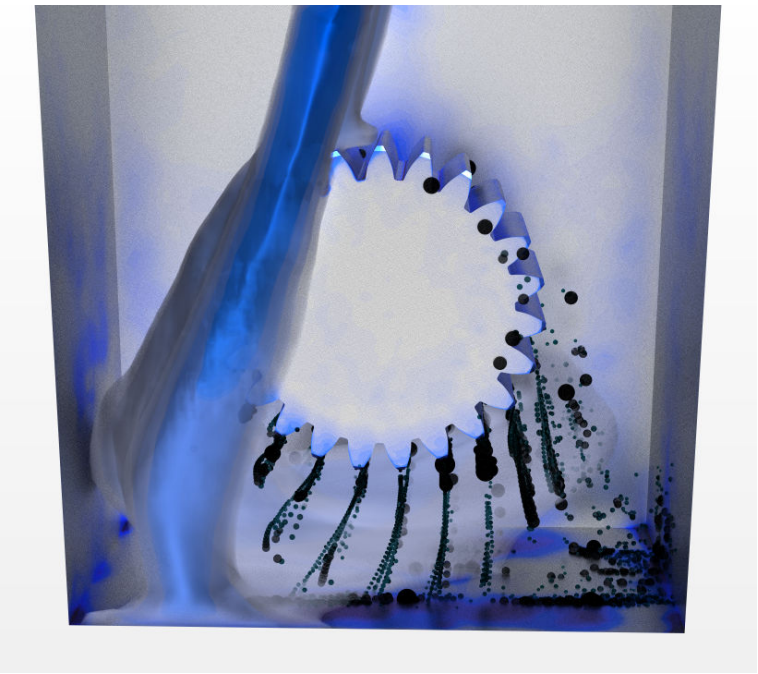
    - For subsequent phase interaction set-up this pair of phases is no longer shown simplifying selection
      - Allows simple set-up of all relevant phase interactions and ability to review any possible pairs not yet set-up
    - See Simulating Physics > Multiphase Flow > Introduction to Multiphase Flow > Defining Phase Interactions

Volume of Fluid (VOF)

- **Hybrid VOF-Film (resolved Film) transition**
  - Improved accuracy of hybrid VOF-Film simulations
    - Option to equalize velocity between Film and VOF phase at transition
    - Reduces disturbances to flowfield due to transition
  - Benefits cases where Film layer is thick compared to first cell at transition
    - Occurs when a zonal approach is taken alongside a low y+ mesh instead of using cell volume fraction
  - See Simulating Physics > Multiphase Flow > Modeling Fluid Film > Modeling a Fluid Film with Different Characteristic Length Scales > Resolved Fluid Film Model Reference

Mixture Multiphase (MMP)

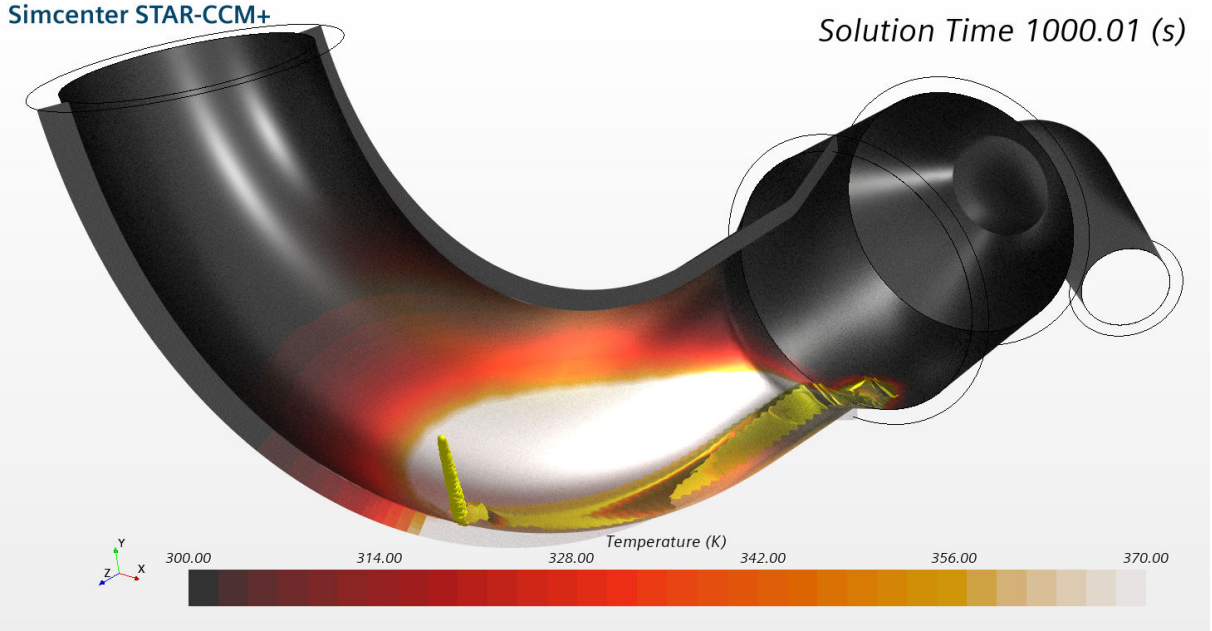
- **Mixture Multiphase impingement into Fluid Film**
  - Reduced computational expense for mixtures with film
    - Allows Mixture Multiphase (MMP) to be used with Fluid Film in place of Eulerian Multiphase (EMP)
  - Allows modeling of applications with fluid films on surfaces including annular flows
  - Brings MMP into the hybrid multiphase family
    - Allows mixtures to impinge into Fluid Film phases
    - Can also be used alongside Lagrangian (LMP) phases
    - Allows modeling strategy of MMP phases for fine sprays/mists and LMP phases for larger ballistic droplets



  - See Simulating Physics > Multiphase Flow > Modeling Fluid Film > Modeling Impingement > Setting Up Mixture Multiphase Impingement

Fluid Film

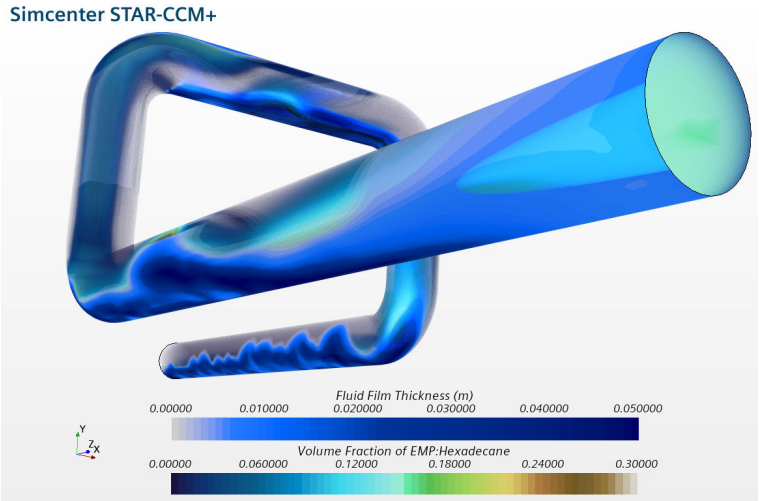
- **Compatibility of Fluid Film with Explicit Mapped Contact Interface**
  - Reduced run time for Conjugate Heat Transfer (CHT) problems with Fluid Film
    - Allows multi-timescale workflow for cases with a fluid film on the wall between fluid and solid
      - Small timescale for flow and film
      - Large timescale for solid
  - Allows simulations with Fluid Film to work with finite element solid energy



- **Solidification and melting with Liquid-Solid-Gas multi-component Fluid Film**
  - Improved ease of use when using Fluid Film Melting-Solidification model
    - Track solidified components in Fluid Film as a solid species in multi-component Liquid-Solid-Gas mixture
    - Previously used 'Relative Solid Volume Fraction' scalar (maintained for compatibility)
  - Consistent approach to other multiphase models' treatment of solid species
  - See Simulating Physics > Multiphase Flow > Modeling Fluid Film > Modeling Fluid Film Melting and Solidification > Melting-Solidification Model Reference

Eulerian Multiphase (EMP)

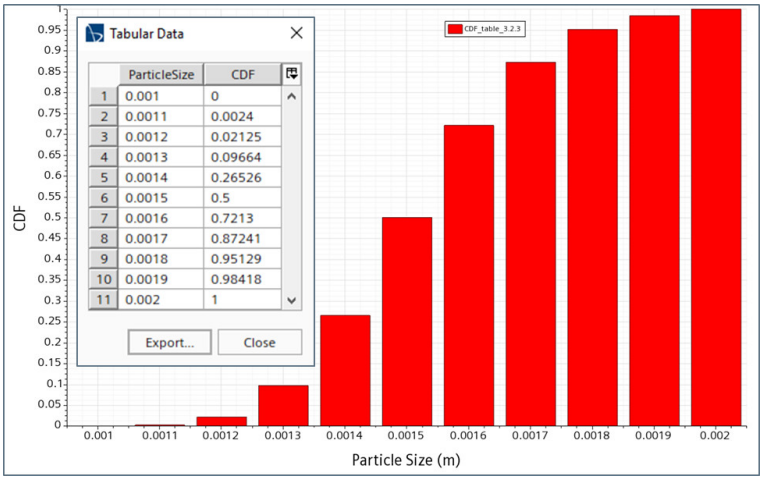
- **Fluid Film surface tension with EMP**
  - Improved fidelity of multiphase simulations
    - Model annular flows of thin Fluid Film with EMP
    - Surface tension can play a significant role
      - Particularly for hydrophilic fluid-wall interactions where otherwise wetting could be underestimated
    - Such flows are difficult to capture with resolved EMP
    - See Simulating Physics > Multiphase Flow > Modeling Fluid Film > Modeling Fluid Film Surface Tension > Surface Tension Model Reference



  - Reduced computational cost
    - No need to resolve film at wall with EMP

- Enables the use of coarser mesh

- **Fixed bins for A-MUSIG boundary conditions and initialization D4607**
  - Improved ease of use without loss of functionality
    - Allows size distribution specification in pre-defined bins for boundary conditions and initialization
      - A-MUSIG solver continues to solve on adaptive groups, new user defined bins are for the purpose of easier data input
    - Complements existing capability for post-processing



    - Allows easier set-up for comparison of results with other sources of data (experiments/other software)
    - Useful for working with populations of 'standard' sizes
    - See Simulating Physics > Multiphase Flow > Eulerian Multiphase (EMP) > Physics Models Reference > Size Distribution Models > Adaptive Multiple Size-Group Model Reference
  - Applications include bubble columns and evaporators in refrigeration/air conditioning

- **A-MUSIG surface and volume moment reports D4963, D5049**
  - Improved insight into distribution of dispersed phases
    - Report the mean moments of the A-MUSIG distribution that describe its shape
    - Moments represent the concentration of particles, the average particle diameter, surface area and volume fraction
    - Moment reports are available for boundary and part surfaces and regions
    - Moments can be reported based on
      - Number density weighting
      - Volume fraction weighting

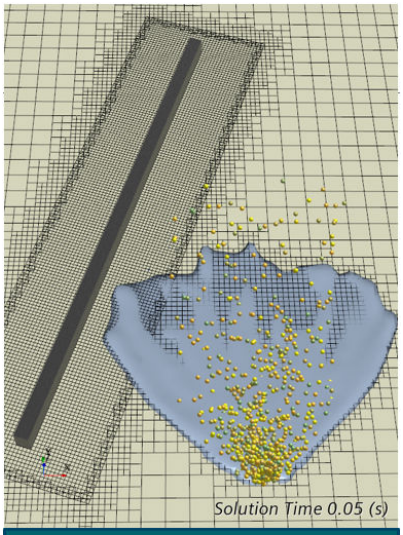
- **Multiple Regime Model - blending function**
  - Improved stability for multiple regime simulations
    - Blending function between regimes can now be controlled via a range of options
  - The following methods are now available:
    - Standard (Default)
      - The previous method plus additional parameter to control width of transition zone
    - Gradient corrected standard
      - Leads to smoother field of blending weight function
    - User specified
      - Blending weighting functions can be set by field function
    - See Simulating Physics > Multiphase Flow > Eulerian Multiphase (EMP) > Physics Models Reference > Multiple Flow Regime Models > Multiple Flow Regime Topology

- **Wall Lubrication Force Model**
  - Improved accuracy for bubbly flow applications

        - Allows more accurate prediction of wall lubrication layers, a critical phenomenon in bubbly flow where bubbles gather and slide along the wall to form a layer of vapor
    - New option added for Wall Lubrication Force
        - *Force* option (Lubchenko model) added as option alongside existing *Coefficient* based models (Antal, field function)
        - Shows improved accuracy over existing methods
    - See Simulating Physics > Multiphase Flow > Eulerian Multiphase (EMP) > Physics Models Reference > Phase Interaction Models > Wall Lubrication Force Model Reference
- **Available Volume Field Function for EMP**
    - *Available Volume* field function that accounts for presence of blockage due to the presence of Fluid Film phases made available for EMP
        - Previously available for single phase
        - Complements existing *Effective Volume* which is phasic

Lagrangian Multiphase (LMP)

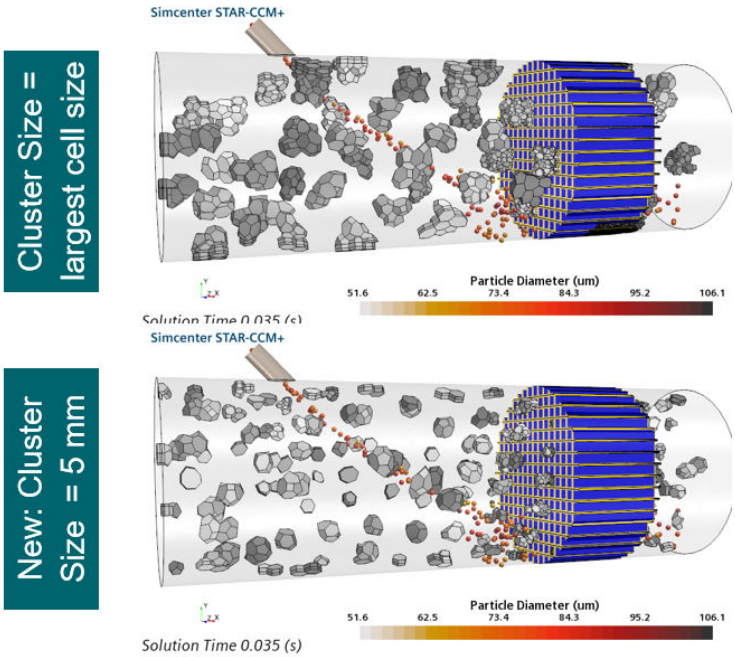
- **Compatibility of Lagrangian multiphase with Adaptive Mesh refinement (AMR)**
    - Reduced computational cost in simulations including Lagrangian phases (LMP)
        - Allows AMR to be used for continuous flow field when LMP present (e.g. VOF free surface refinement)
        - Provides cell count reduction for cases where LMP droplets coexist with:
            - Model based refinement for VOF, overset, and reacting flows; AND/OR
            - User defined refinement based on field functions
    - Possible to refine the mesh based on Lagrangian fields via parcel data mapper and field functions



Lagrangin droplets hitting windshield. AMR applied to VOF surface

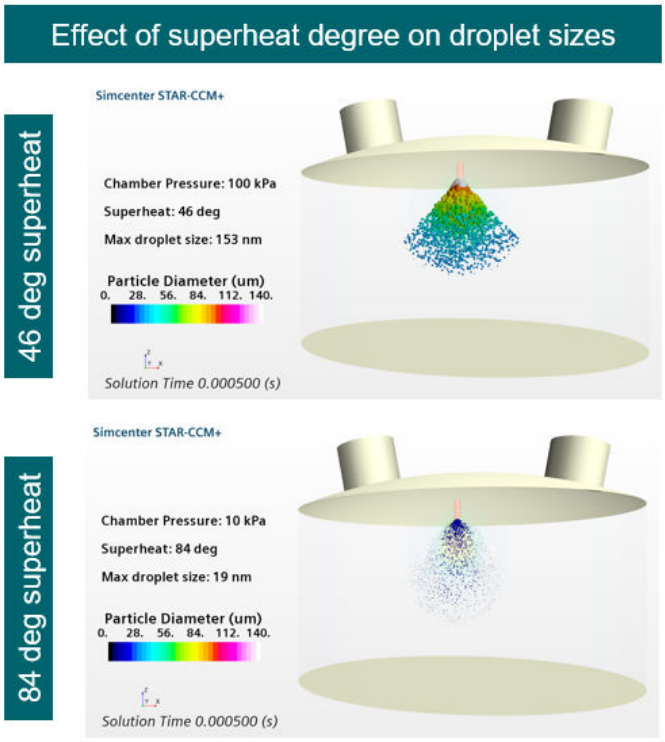
- **Improved control over the size of cell clusters D4354**
    - Improve convergence and accuracy for 2-way coupling model and reduce mesh dependency
    - Cell clustering is used to spread coupling effects of LMP on the flow solution over a cluster of cells
        - Previously minimum cluster size set by maximum cell size
    - New methods allow small clusters in near field when large cells exist elsewhere. Clusters defined by
        - Absolute size

- Relative to geometric mean
- Relative to largest cell (previous method)



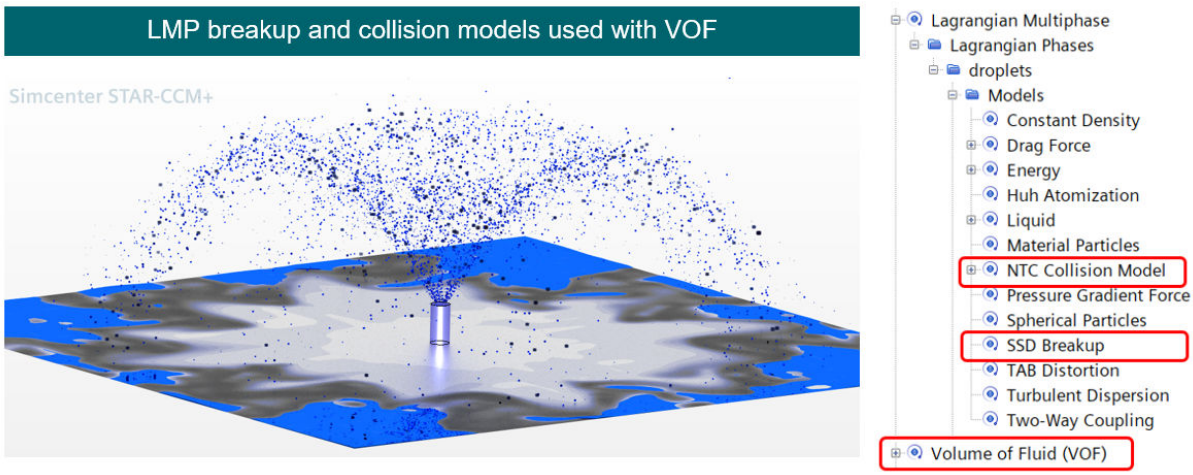
  - See Simulating Physics > Multiphase Flow > Using the Lagrangian Multiphase Model > Lagrangian Multiphase Model Reference > Lagrangian Multiphase Solver Reference

- **Flash boiling modeling D4035**
  - More accurate modeling of fuel sprays
  - Flash boiling causes a fast transition from liquid to vapor
    - Can occur in internal combustion engines
    - Highly non-equilibrium and complex physics
  - Includes effects within nozzle
    - Control via Nozzle Injector parameters
    - Uses zero-dimensional cavitation and nucleation models to provide nozzle exit conditions
      - Nozzle Injector injects both LMP droplets and continuous phase for vapor
  - In-chamber flash boiling effects
    - Droplet Flash-Boiling model set in physics continuum
    - Accounts for
      - Enhanced vaporization due to superheating
      - Thermal breakup due to bubble growth
    - See Simulating Physics > Multiphase Flow > Using the Lagrangian Multiphase Model > Lagrangian Phase Models > Droplet Flash-Boiling Model Reference



- **Every N Iterations option for Lagrangian Solver Update Frequency D4503**
  - Reduced time to solution
    - Avoids solving Lagrangian phase unnecessarily
    - Increased flexibility controlling update frequency
    - Allows solution every N flow iterations
      - N must be smaller than maximum number of iterations
    - Can improve the simulation time and maintain the stability for simulations with 2-way coupling
  - Lagrangian update frequency options
    - Recommended
    - Once per Time-Step
    - Every N Iterations (new)
  - See Simulating Physics > Multiphase Flow > Using the Lagrangian Multiphase Model > Lagrangian Multiphase Model Reference > Lagrangian Multiphase Solver Reference
- **Compatibility of collision and breakup models with VOF D4010, D5246**
  - Improved realism in hybrid multiphase simulations
    - Allow Lagrangian droplet collisions and break-up to be modeled in simulations also including
      - VOF or Hybrid VOF-film (resolved fluid film)
    - See Simulating Physics > Multiphase Flow > Using the Lagrangian Multiphase Model > VOF-Lagrangian Impingement and Stripping
  - Applications include
    - Vehicle water management
    - Spray dryers
    - Filtration units
    - Wet scrubbers

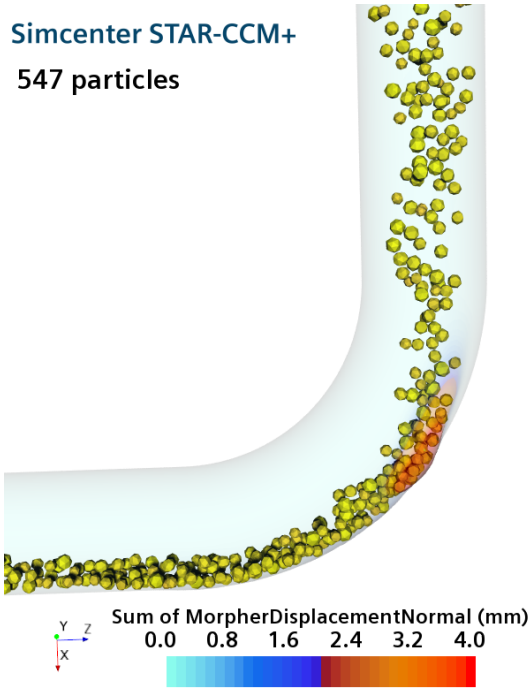
- Fuel and other sprays



- **Limit for surface vapor mass fraction in evaporation model**
  - Allow tuning of balance between accuracy and robustness when simulating evaporating droplets at high temperatures
  - New parameter *YsUpperLimit* limits the value of the surface vapor mass fraction
    - The default value is 0.99999
  - Facilitates users migrating from Simcenter STAR-CD to Simcenter STAR-CCM+Simcenter STAR-CCM+
    - Setting *YsUpperLimit* to 0.99 allows better reproduction of Simcenter STAR-CD results
- **Parcel Intersection Face Normal field function**
  - Improved computational cost and accuracy when particle-wall contact physics depends on local surface normal
  - Useful for setting complex dependencies for the coefficients of restitution and boundary stuck mode probability
- **Output spray cone angle for Huh atomization model**
  - Enables a workflow for tuning various model parameters to match experimental spray cone angle
  - Introduces new Output Level Control sub-node in Injector tree
    - Available only when Huh atomization model is selected
    - Provides Verbose option to output Half Cone Angle value in output window

Discrete Element Method (DEM)

- **DEM compatibility with mesh morphing D3217**
  - Increased realism for cases where particles causes boundary erosion or deformation
    - Improved accuracy for boundary erosion and wear
    - Ability to model deformable boundaries in FSI simulations with DEM
  - Applications include
    - Erosion in pipelines
    - Particles on chain, belt drive, incline conveyor
      - Structural analysis of silos for granular materials

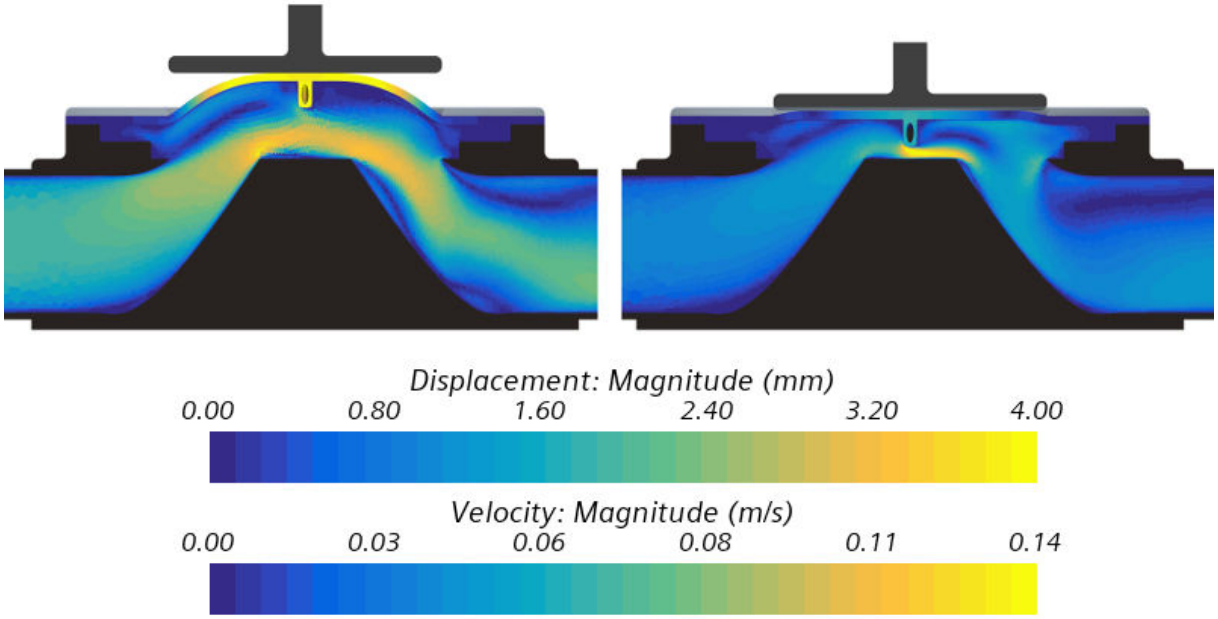


Computational Rheology

- **High Weissenberg number flow support D4919**
  - Allows modeling of more highly viscoelastic problems
    - Such problems traditionally unstable as elasticity dominates
  - Square root conformal option significantly increases critical Weissenberg number at which simulation becomes unstable
    - Enables Simcenter STAR-CCM+ to run problems and flow rates that other codes cannot
    - See Simulating Physics > Viscous Flow > Setting Up Viscous Fluid Flow
- **Multi-layer Film Casting D4912**
  - Allows wider range of film casting applications to be modeled
  - Film casting solver now allows multiple layers to be simulated
    - Each layer may have independent material properties/laws
    - See Simulating Physics > Viscous Flow > Setting Up a Film Casting Simulation
  - Applications include the production of food packaging, medical blister packs and electronic displays
- **Open boundary condition for traction at Freestream boundary**
  - Accurately predict extrudate geometry for viscoelastic materials
    - More physical boundary conditions for extrusion cases
  - Open boundary provided as new sub-option for traction at Freestream boundary
    - Neutral boundary
    - Calculates traction based on interior values such that open boundary leads to no change from domain values
  - Available when Free Surface and Viscoelastic models are both selected

Computational Solid Mechanics

- **Frictionless contact - rigid plane obstacle D3602**
  - Model frictionless contact with an infinite rigid plane
  - Solve Fluid-Structure Interaction (FSI) applications with opening and closing flow paths such as valves and seals
  - Use in combination with the hyperelastic material model to study rubber seals or gaskets being squeezed against flat surfaces
  - The rigid plane specification supports moving Cartesian coordinates systems
    - To model the squeezing of a structure simply specify the plane in a Cartesian coordinate system managed by a translation motion
  - The contact implementation is based on a penalty formulation
  - Refer to the user guide for help on how to chose the penalty parameter

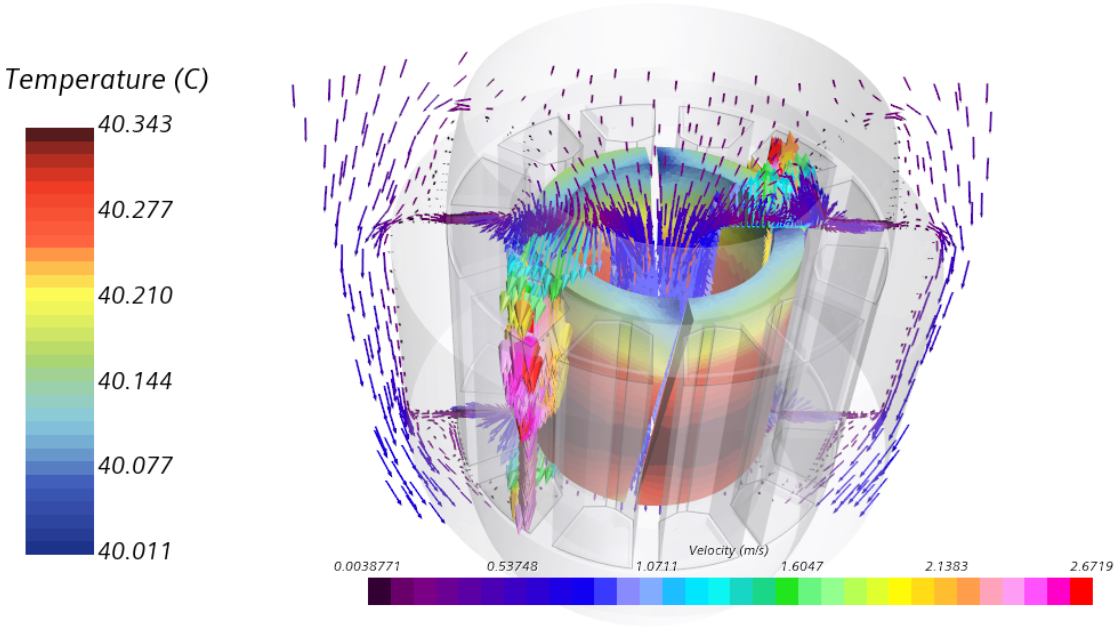


Electromagnetics and Electrochemistry

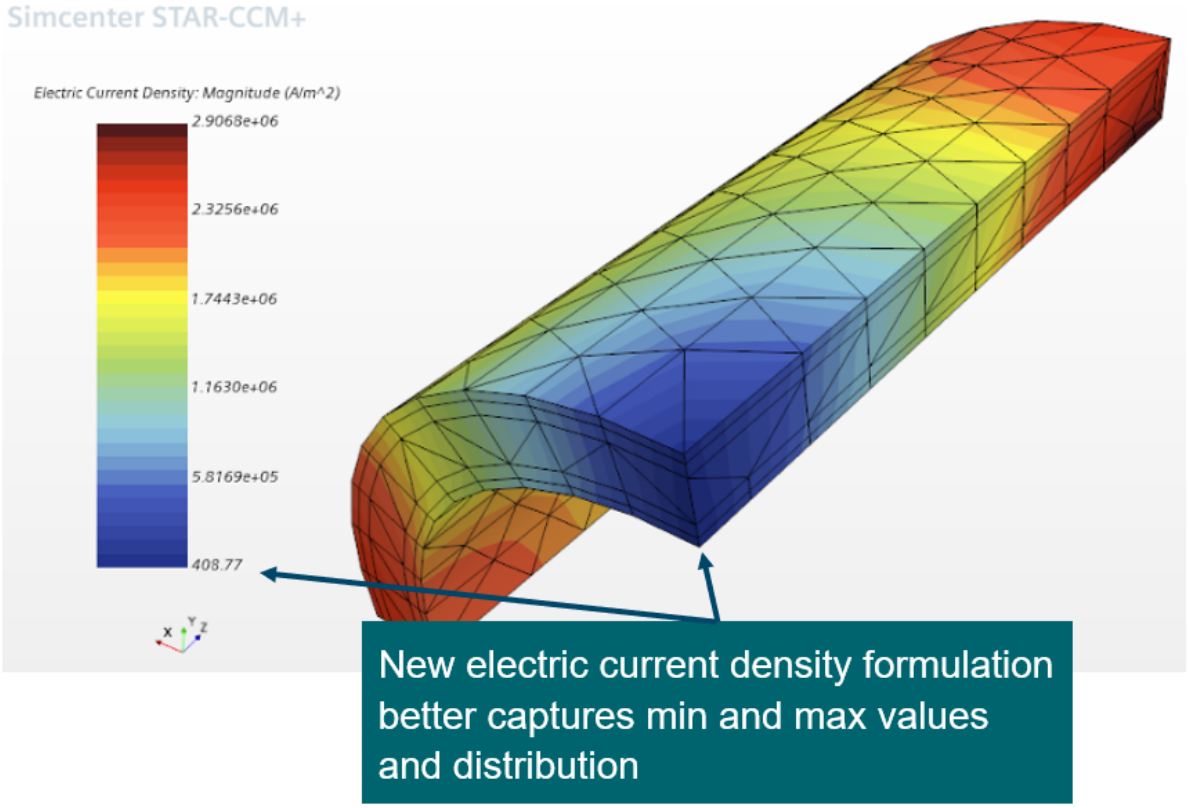
Electromagnetics

- **Temperature sensitivity of permanent magnets**
  - Simplifies setup of permanent magnets with temperature-dependent properties
    - Introduction of Table (T) option in Permanent Magnet model for the following two properties:
      - Remanence Flux Density (flux density at zero excitation, B(H=0))
      - Magnetic Permeability (slope of the B-H curve at zero excitation, μ(H=0))
    - New Table (T) option added also to Material Database for user-defined materials
    - See Simulating Physics > Electromagnetism > Modeling Magnetic Fields > Defining Electromagnetic Material Properties > Defining Temperature-Dependent Properties
  - New option available
    - In both 2D (Transverse Magnetic Potential) and 3D setups
    - When an energy model is selected (including Specified Temperature)

- Useful for simulation of electric machines
- Note that the Permanent Magnet model remains a linear model

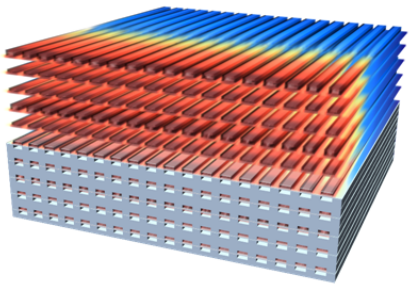


- **Local point variable Electric Current Density**
  - Improves accuracy of Electric Current Density distribution
    - When computed via the FE Magnetic Vector Potential model
    - When eddy currents are included
  - New field function is now
    - Natively defined on vertices and captures intra-cell variations
    - Lends itself to higher order visualization
  - Improves accuracy of Ohmic Heating distribution if this is constructed using the local point variable Electric Current Density field function
    - The new definition allows for a reduction of the mesh count for the same level of solution accuracy
- **Conformal interfaces for Finite Elements**
  - Enhanced robustness for Finite Element workflows through conformal face match at interface
  - See corresponding section in Mesh
- **Hypre LA solver for Finite Volume Electrodynamic Potential**
  - Reduction of turn-around time and more robust convergence for cases with electrical conductivity jumps
  - See corresponding section in Electrochemistry



Electrochemistry

- **Hypre LA Solver for Finite Volume Electrodynamic Potential**
  - Reduced Run-time of 2-3x for Fuel Cell Stack simulations
    - An alternative AMG solver (Hypre LA) is available for the electrodynamic potential solver
    - This solver gives significant speed up and scalability improvements
  - Improved ease of use and convergence
    - Only the number of cycles needs to be set
    - See Simulating Physics > Electromagnetism > Physics Models Reference > Electric Potential Solver Reference



# cores	Linear Solver		Speed up
	AMG **2020.1**	Hypre LA **2020.2**	
16	739.5	360	**2.05**
32	371.5	143	**2.60**
48	302.5	117.8	**2.57**
64	260	92	**2.83**
80	198.1	66.9	**2.96**
96	156.7	60.4	**2.59**

- **Highly Convective Flows with Electrochemical Species**

- Improved ease of use and run-time
  - Turbulent and highly convective flows can now be modeled
  - Gradient limiting is now enabled
- Typical applications include etching analysis where the flow is highly turbulent

- **Surface reactions with Electrochemical reactions**
  - Improved physics resolution
    - Surface reactions are now compatible with electrochemical reactions
    - A surface can have both an electrochemical mechanism and a surface mechanism associated with it
    - See Simulating Physics > Electrochemistry > Electrochemical Surface Reactions > Electrochemical Surface Reactions Reference > Electrochemical Reaction Model Reference
  - Typical applications include Solid Oxide Fuel Cells where in a two step process methane is reformed (surface reaction) and the resulting hydrogen is then hydrolysed in an electrochemical reaction.

Aeroacoustics

- **Important Note: Planned removal of Convective effects for FW-H**
  - Convective FW-H has been deprecated starting in Simcenter STAR-CCM+ 2020.2 and is planned to be removed in version 2021.2.
  - Please contact your Simcenter customer support representative for further information.

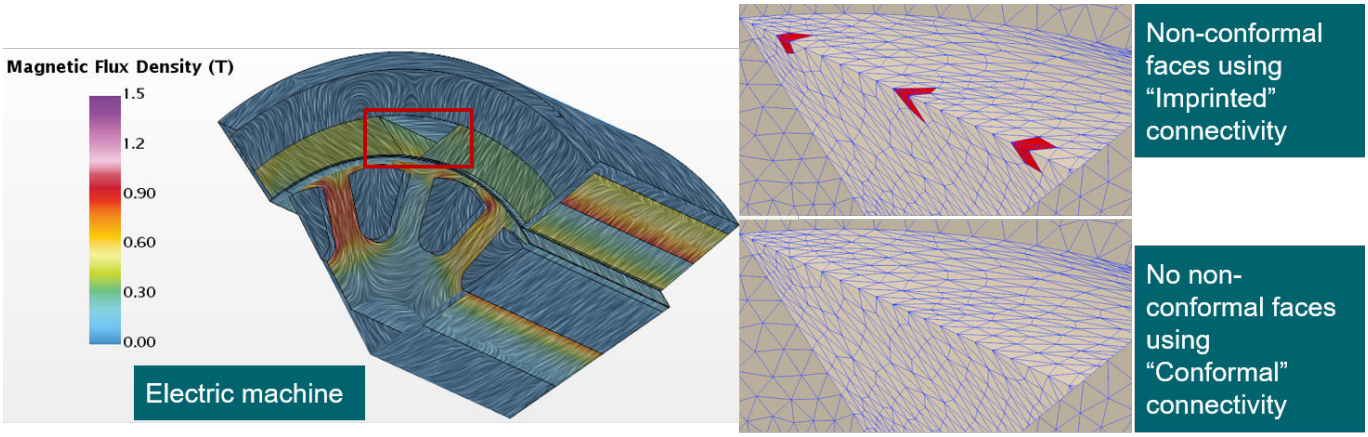
Harmonic Balance

- **Improved Harmonic Balance visualization workflow**
  - Simplified workflow when moving from steady simulation to unsteady simulation with Harmonic Balance
    - Most commonly used field functions will no longer require changes in the scene when moving from steady simulation to HB
    - Time-averaged solution automatically displays in existing scenes
    - Consistent naming of field functions between steady and harmonic balance simulation

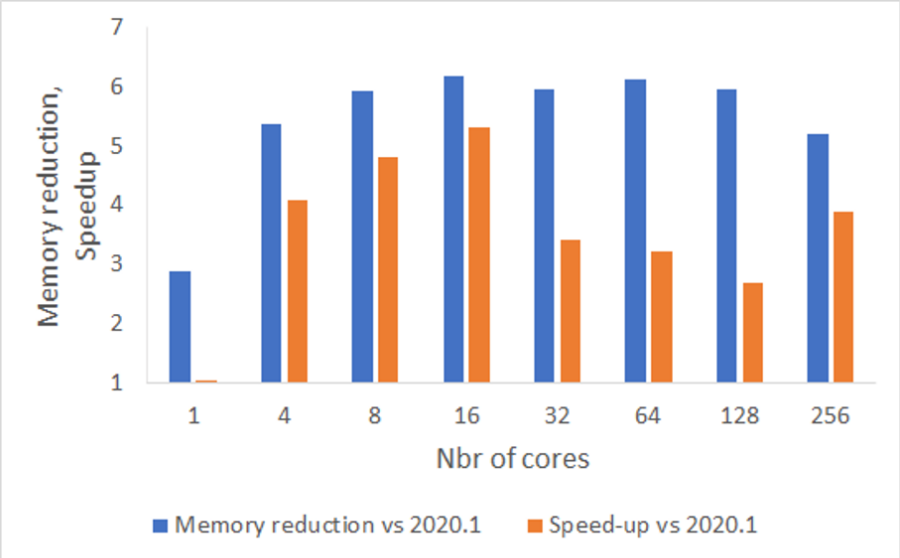
Motion, Mesh Adaption, and Mapping

- **Improved small gap handling for overset AMR D3459**
  - More easily refine small gaps through model-driven overset AMR
    - Easily model gear teeth pair intrusion
    - Uniform gap refinement is a pre-requisite for Prism layer shrinkage model
      - Previously user defined refinement criteria needed
      - New option "Uniform Gap Refinement" ensures refinement with no negative volume cells and no hanging nodes in prism mesh
        * Refinement based on "Gap zone width"
      - See Simulating Physics > Overset Meshes > Adaptive Mesh Refinement for Overset Meshes
- **Model based Adaptive Mesh Refinement for reacting flows**
  - Reacting flow flame front model based refinement
    - Refines cells specifically around the flame front preventing the flame from becoming unresolved by a coarse mesh

        - Preserves the sharp interface of the flame front
    - Typical applications include dynamic flame propagation and steady flame positioning
    - For more information refer to the section on CFD - Reacting Flows
- **Compatibility of Lagrangian multiphase with Adaptive Mesh Refinement**
    - Reduced computational cost in simulations including Lagrangian phases (LMP)
    - For more information refer to the section on Multiphase Flows - Lagrangian Multiphase
- **Conformal Interfaces for Finite Element solver**
    - Enhanced robustness for finite element workflows through conformal face match at interface
        - Previously “Imprinted” connectivity type could produce hanging nodes, non-conformal facets
        - Now conformality guaranteed through new "Conformal" connectivity
            - Automatically chosen for contact interface type and FE physics models
    - Improves ease of use by removing dependence on user specified tolerance



- **Automatic deactivation of rigid prism layers in small gaps**
    - Enhanced morpher robustness by controlling "rigid prism layer" behavior in small gaps
        - Beneficial in situations where prism layer structure is critical such as heat transfer in valves
        - Previously rigid prism layers could create negative volume cells when gap decreased
        - Now method dynamically detects small gap and toggles off rigid prism layer
            - Results in maintained prism layer thickness on all wall boundaries, except in narrow gaps
            - See Simulating Physics > Space, Time, and Motion > Modeling Motion > Working with Morphing > Morphing Workflow > Applying Rigid Prism Layer Morphing
- **Reduced memory and faster volume data mapping**
    - Reduced memory footprint of data mapper
        - Applies to all volume data mappers
        - Provides benefit in scenarios where data mapping is executed once or multiple times
            - Single instance volume data mapping such as solution interpolation
            - Repeated volume data mapping in remeshing scenarios, e.g. in-cylinder combustion, marine multi-mesh sequencing
        - Better data partitioning to localize the interpolation and reduce halo cells
        - Up to 6x reduction in memory on higher core counts for mapping solution from 20 M cells to 15 M cells.
    - Faster volume data mapping
        - Up to 5x speedup for mapping solution from 20 M cells to 15 M cells.



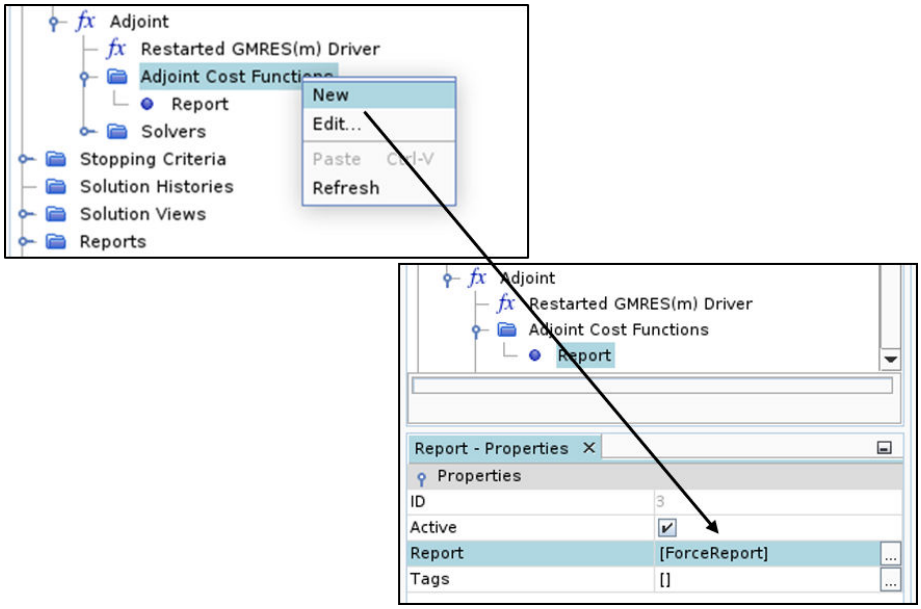
Mapping of a race car from 20M to 15M cells

- **Blade element method for high advance ratios**
  - Better net lift and torque prediction for rotors at high forward speeds
    - Inflow model now accounts for reverse flow region
    - Suitable for simulation of retreating side stalling behavior for aerospace propellers and helicopter rotors
    - Supports both steady and unsteady BEM methods
- **Closed-loops of DFBI bodies**
  - Previously, modeling closed loops of articulated multi-body systems in DFBI was not possible
    - This limitation has now been removed
  - Example: Subsea template hung by rope, excavator bucket
  - See Simulating Physics > Dynamic Fluid Body Interaction > Working with 6-DOF Bodies > Setting up Multi-Body Motion
- **Enhanced mass conservation across overset interfaces using coupled flow solver**
  - Mass conservation across overset interfaces now available for both coupled and segregated flow solvers
  - Can be used for both closed and open systems
  - See Simulating Physics > Overset Meshes > Overset Mesh Workflow > Setting up the Overset Method > Enforcing Overset Mass Conservation

Design Exploration

Adjoint

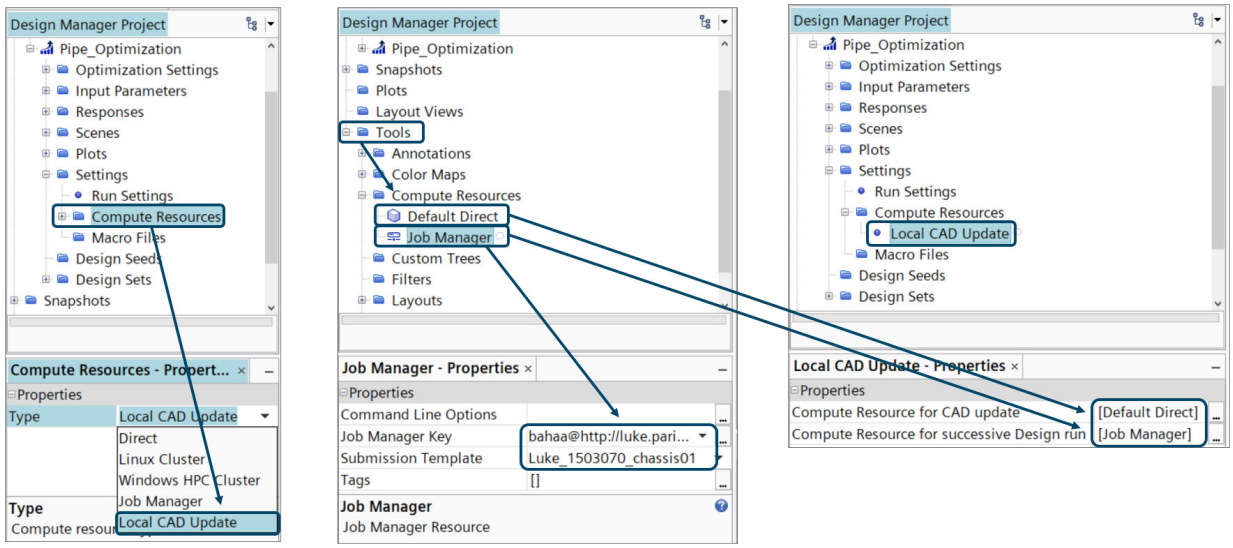
- **Reports for adjoint cost functions**
  - Simplifies optimization workflow by reducing the need for duplicate setup of cost functions
    - Ability to create a cost function directly from a report
      - Select cost function from already existing report
      - See Simulating Physics > Solving the Adjoint > Creating the Adjoint Cost Functions
  - Consistent workflow with Design Manager that uses report for cost functions
  - Only reports of differentiated functions can be selected as cost functions



- **Adjoint MRF compatibility for relative reference frame**
  - Expanding application coverage by including MRF definition based on another reference frame
  - Beneficial for vehicle cornering simulations

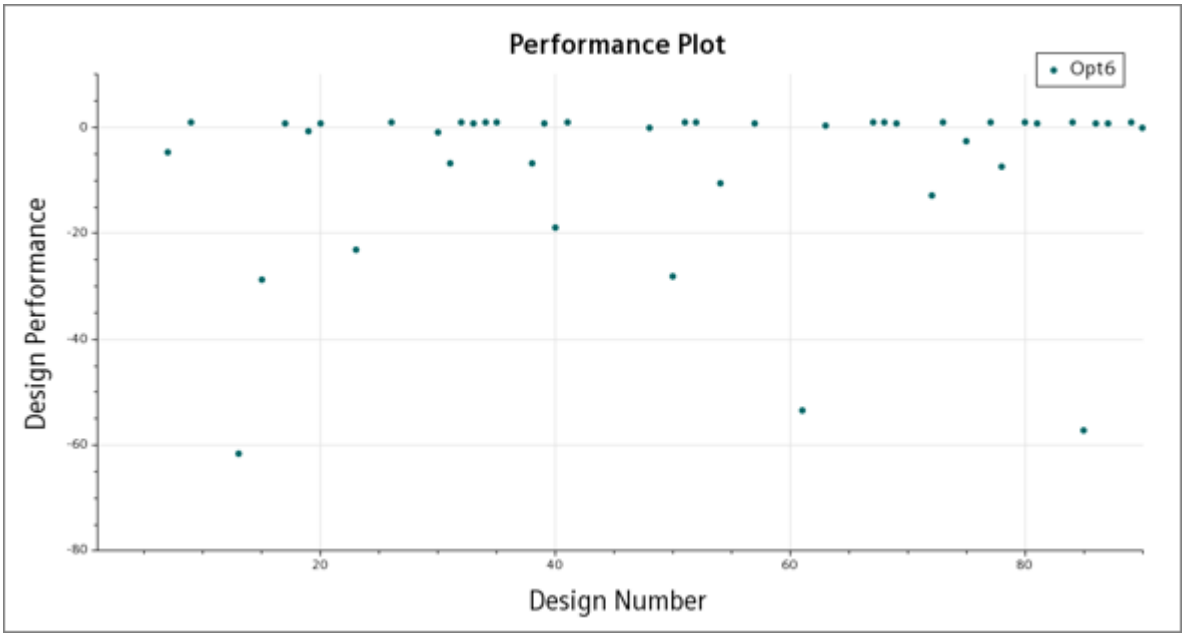
Design Manager

- **Local CAD update with CAD Clients**
  - Tighter integration of design exploration with your industrial native CAD process
    - Easily and robustly explore designs using native CAD tools
    - New cross platform communication process fully integrated in Simcenter STAR-CCM+
    - CAD update requested and performed locally on Windows using your preferred CAD tool
    - See Design Manager > Design Manager Workflow > Running a Design Study > Running a Design Study with Local CAD Update
  - Facilitate deployment with an automated workflow
    - Automated transfer of .sim files containing new CAD models to Linux systems for meshing and solving
    - Use Job Manager for operations orchestration and file transfers



- **Improved visibility of Design Details**
  - Identify runtime information for each design easily and intuitively
    - Quickly find additional runtime details such as
      - Execution type
      - Compute resource used
      - Start and end dates and times
    - Scope of support covers
      - Initial design runs
      - Design rerun, appending new information to previous run
      - Multiple resource usage (Local CAD update)

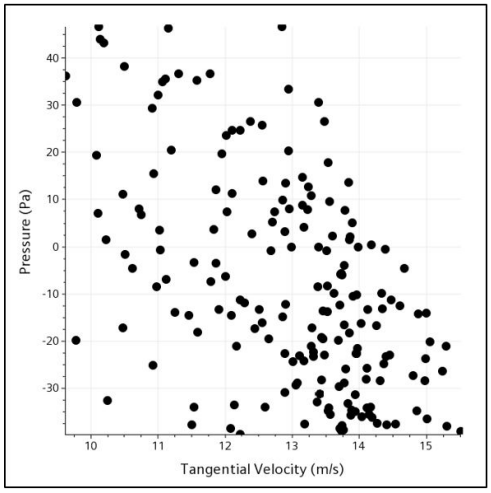
- **Performance Plot D5016**
  - Performance now accessible in any plot type



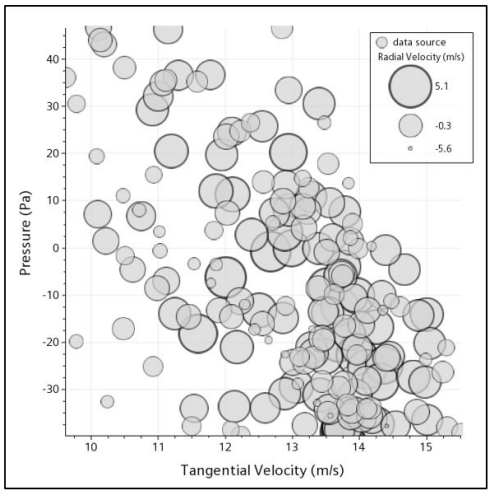
- **Automatic abort of study when baseline design fails**
  - Saves time for studies with objectives using the Baseline Normalization

Data Analysis

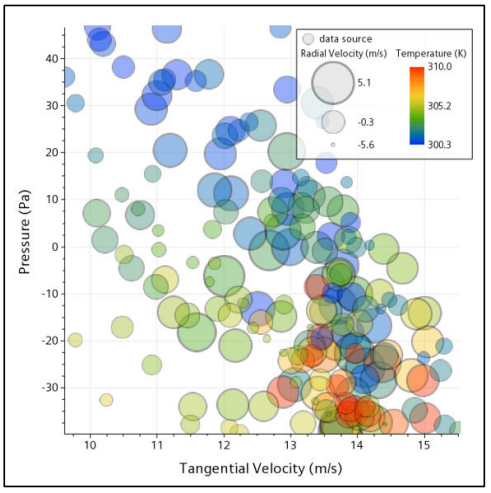
- **Bubble Plots D3442, D5054**
  - Use bubble plots to add layers of information to standard XY plots
    - Use bubble size and color to understand additional functional dependencies
    - See Post-Processing > Plots > Working with XY Plots > Setting and Viewing Bubble Plots



Relationship between Pressure versus Tangential Velocity

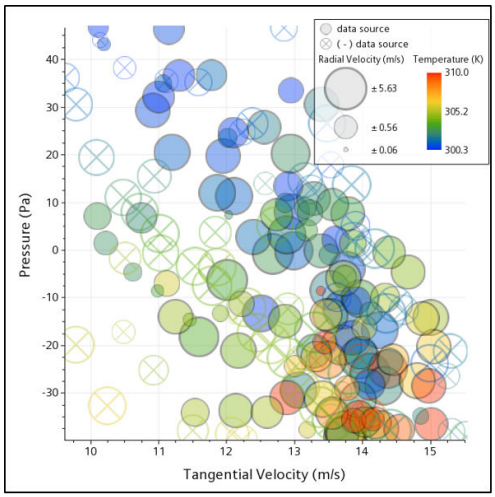


Bubble **size** adds an information layer (Radial Velocity)

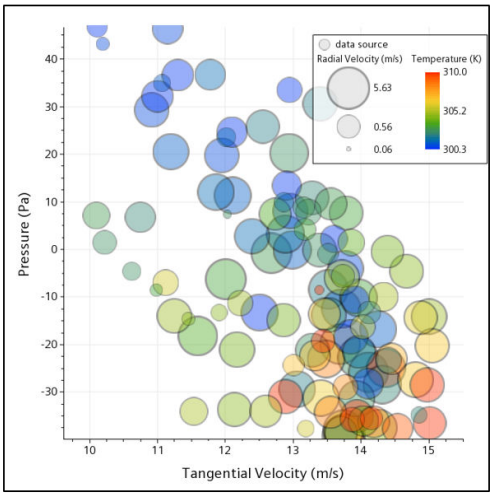


Bubble **color** adds another information layer (Temperature)

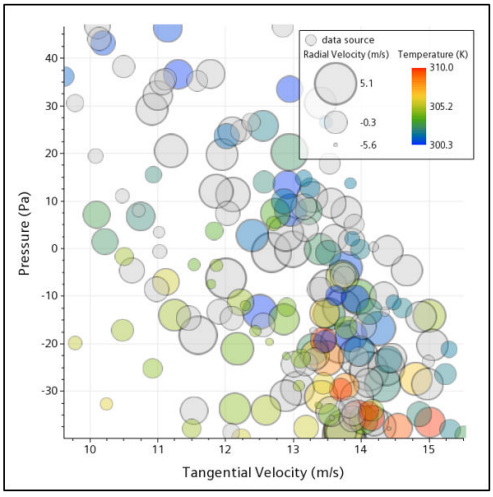
  - Customize XY plots with controls for
    - General bubble size and appearance
    - Size scaling based on any Field Function
    - Color scaling based on any Field Function
    - Legend display and placement
  - Special support permits display of negative values for log and square root scaling
  - Add additional layers of information with full support for Data Focus



Negative data values need special handling if log or square root size scaling is used

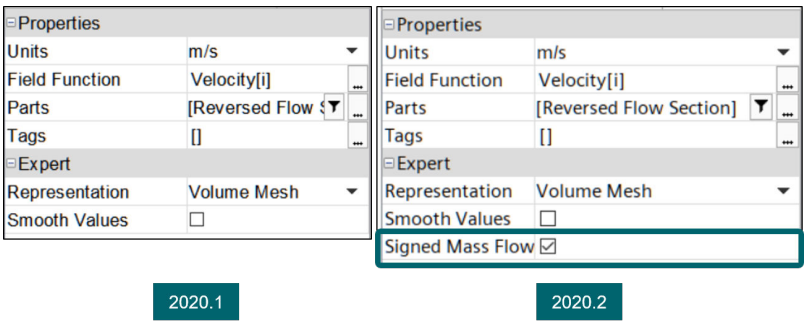


Data with negative symbol sizing can be hidden to improve plot appearance

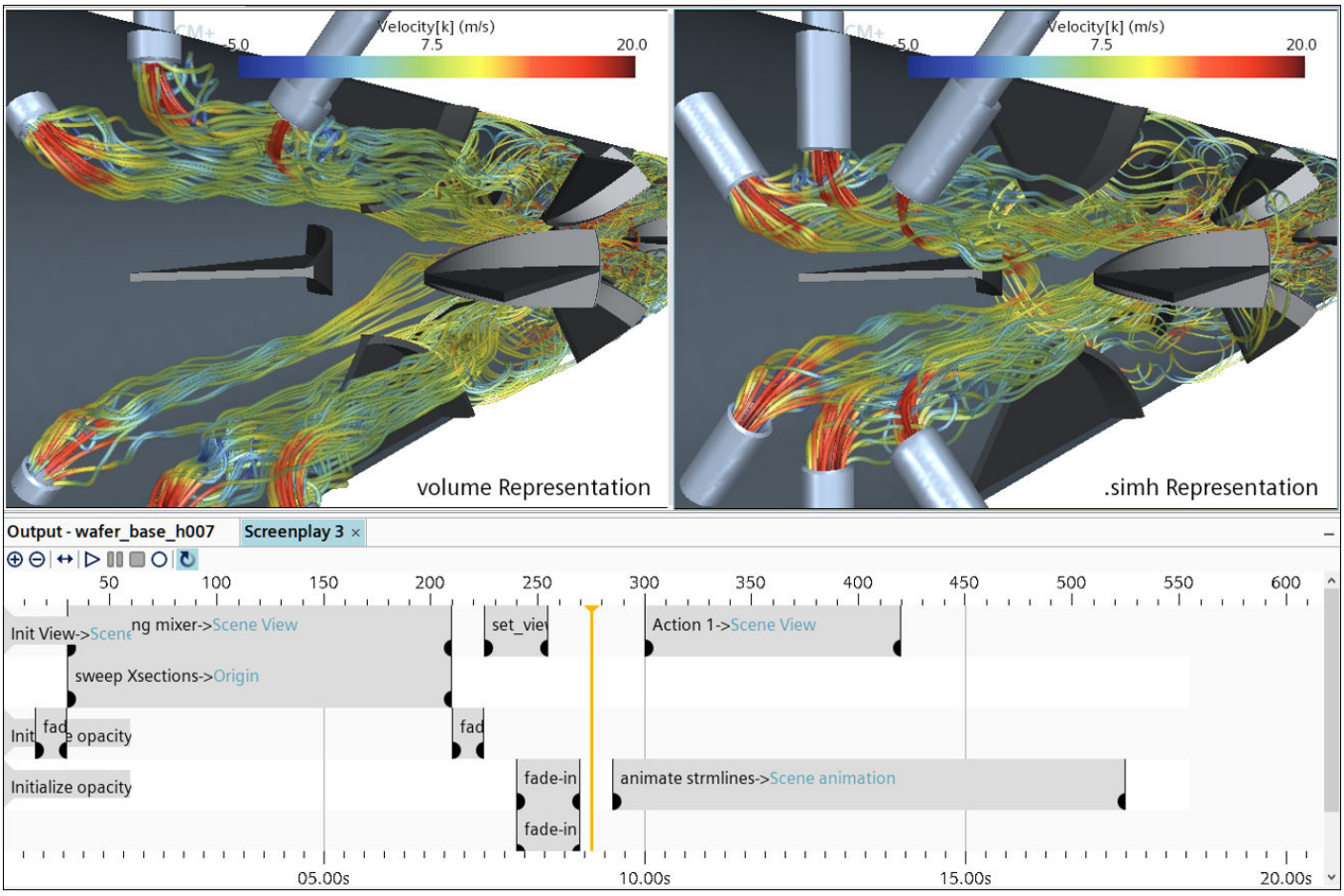


Data Focus is supported in Bubble Plots

- **Signed (+/-) Mass-Flow Average Reports D5100**
  - Quantify the extent of reversed flow within your flow domain
    - New option lets you return a signed mass flow rate
    - Default behavior returns the absolute mass flow rate



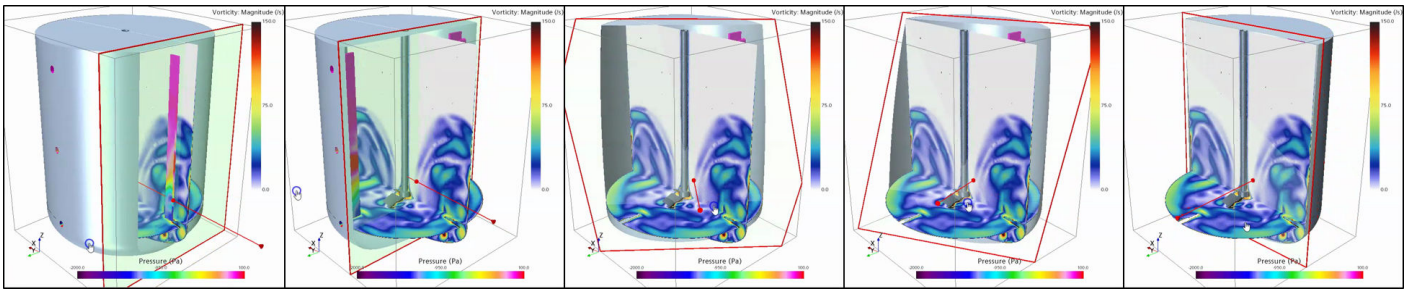
- **Layout View hardcopy support for Screenplay animations**
  - Create highly effective animations for a broad range of stakeholders, leveraging dashboard-style Layouts
  - Use your existing data analysis workflows, combining Layouts with Screenplay
    - Export of the full layout view is automatic
      - Resolution settings for writing an animation apply to the Layout width/height
  - Important note:
    - It is possible to populate Layout Views with content from different simulations but...
    - Screenplay can only be used to animate properties for the active .sim file



  - See Post-Processing > Visualizing the Solution > Screenplay Animation > Screenplay Workflow > Creating and Editing a Screenplay Animation

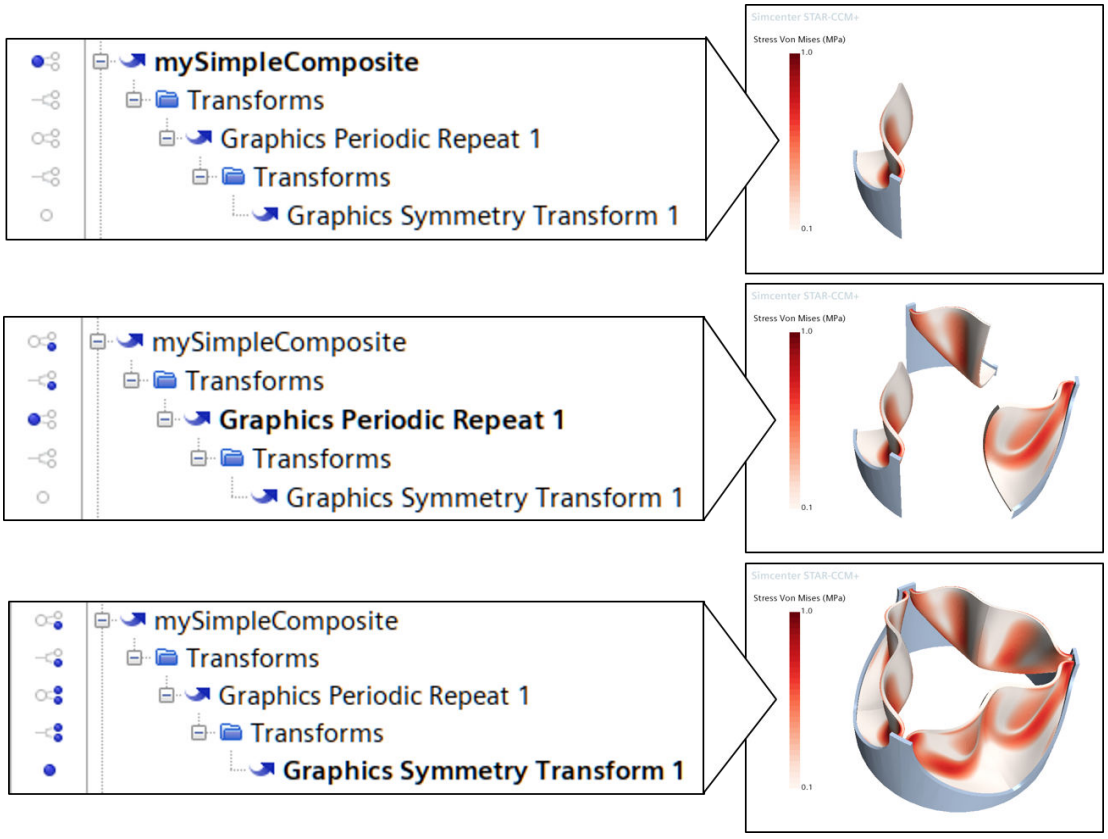
- **Interactive Clip Plane manipulation D2251, D4606, D5234**
  - Explore complex datasets quicker and more intuitively

- Modify the location and orientation of any clip plane on-the-fly



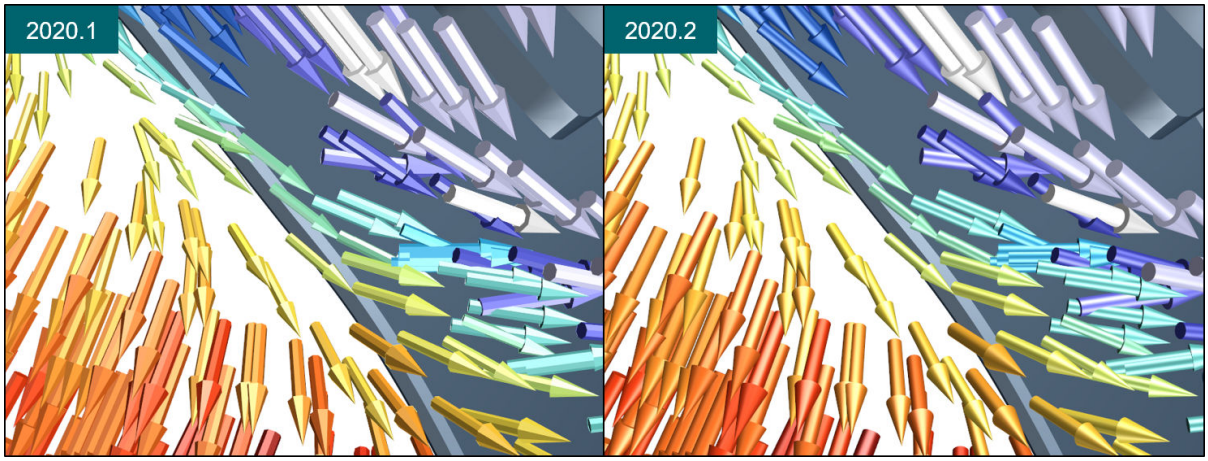
- See Post-Processing > Visualizing the Solution > Changing the Attributes of a Scene > Using Clip Planes

- **Composite Transform support D5344**
  - Streamline your workflow for presentation and animation of your results
    - Composite transforms overcome the previous limitation of having just one transform per displayer
    - A new Superposing transform lets you combine multiple transforms in a logical, hierarchical order

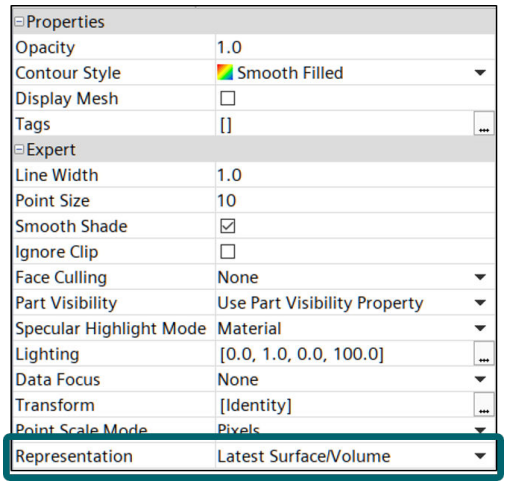


  - See Post-Processing > Visualizing the Solution > Using Transforms > Working with Transforms > Superposing Additional Transforms

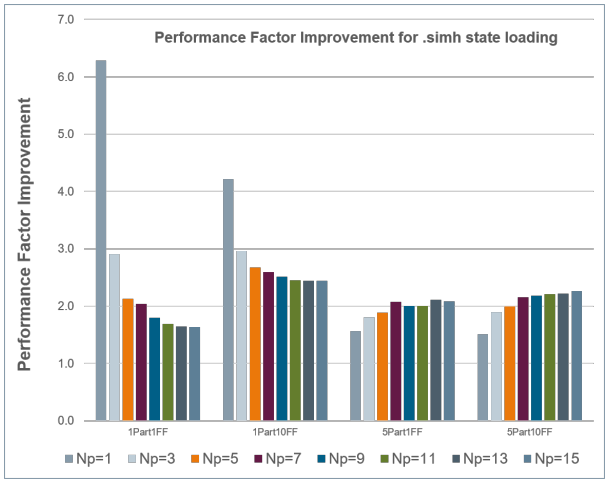
- **Improved appearance for vectors in scenes**
  - Vector appearance is improved for better visual comprehension of results
    - The "3D Head and Tail" glyph Vector Style is now the default
    - Vectors displayed this way will use less memory and animations will play more smoothly



- **Latest Surface/Volume is new default Representation for Scenes D5262**
  - Avoid the frustration of being unexpectedly confronted with empty scenes
    - The display of content in scenes depends on the choice of Representation
    - The new default makes it more likely that your scene will have relevant information displayed at any point in the meshing operation pipeline



- **Performance improvement of ~2X for Solution History loading**
  - Navigate between Solution History (.simh) states faster
  - Performance improvements realized through framework optimizations
  - The chart below shows factor improvements for different stored part and Field Function counts, for different processor counts



- **Hardware Headset updates for Simcenter STAR-CCM+ Virtual Reality**
  - **Certified** (fully tested in-house)
    - HP Windows Mixed Reality
    - HTC Vive
    - Oculus Rift S
  - **Supported** (known to work)
    - Oculus Rift
    - HTC Vive Pro
    - Varjo VR-2
  - **Unsupported** (and expected to work)
    - All Windows Mixed Reality Devices (using standard controllers)

Application Specific Tools

Contents:

Simcenter STAR-CCM+ In-cylinder Solution

- **RNG *k-ϵ* Turbulence Model**
  - Renormalization Group version of the *k-ϵ* model has been implemented for in-cylinder simulations
  - The model is available from the Simcenter STAR-CCM+ In-cylinder solution Model Selection panel as an alternative RANS (Reynolds-Averaged Navier-Stokes) turbulence model
  - See Theory > Internal Combustion Engines > RNG K-Epsilon Turbulence
- **LES for In-cylinder Simulations**
  - Through Large Eddy Simulations, detailed investigations of flow structure and flow fluctuations can be carried out in order to correlate cycle-to-cycle variations with variations in engine performance parameters
  - LES can now be selected as turbulence model from the Simcenter STAR-CCM+ In-cylinder solution Model Selection panel

- The LES turbulence model has been verified for cold flow simulations

- **Support for Tables with Data Outside 0-720 degCA**
  - Any engine cycle convention can now be used in tables describing valve lift profiles, boundary conditions and initial conditions
  - Manual shifting of tables with cyclic data to 0-720 degCA is no longer required
- **Huh Atomization Model Setup**
  - Huh atomization can be activated in combination with the Reitz-Diwakar and KHRT break-up models from within the Simcenter STAR-CCM+ In-cylinder solution for single-pulse injections
  - Mean injection velocity is automatically calculated, and nozzle data can be specified for the whole injector or individually per nozzle hole
  - Support for multi-pulse injection will be included in a future release
- **Auto-Ignition/Knock with TKI Model**
  - The Tabulated Kinetics for Ignition model is activated by selecting “Knock” in the Model Selection panel
  - The TKI model is compatible with the ECFM combustion models, and relies on TKI tables containing auto-ignition data
  - A set of basic tables is available through Support Center under Simcenter STAR-CCM+ > Downloads > Major Releases > 2020.2 > [platform] > Related Files and Documentation > In-Cylinder
  - See Add-ons > Simcenter STAR-CCM+ In-Cylinder > Combustion and Ignition
- **NOx and CO emissions post-processing**
  - NOx and CO emissions are grouped together in a separate folder allowing for a quick overview of emissions
  - Emissions data are retrieved at a specific reporting time (by default exhaust valve opening) and reports and plots are created for mole and mass fractions and specific emissions in g/kWh
  - See Add-ons > Simcenter STAR-CCM+ In-Cylinder > Solution Analysis
- **Basic Support for 2-stroke Cycle and More Engine Configurations**
  - Previous limits on number of intake and exhaust valves have been relaxed
  - The number of intake and exhaust valves is automatically calculated
  - Zero-valve geometries are supported
  - The number of strokes (2 or 4) is specified when creating engine parts
  - Manual setup in the Simcenter STAR-CCM+ Simulation Tree is required for a complete 2-stroke simulation setup
  - Full support for 2-stroke simulations from within Simcenter STAR-CCM+ In-cylinder solution will be provided in a future release
  - See Add-ons > Simcenter STAR-CCM+ In-Cylinder > Simcenter STAR-CCM+ In-Cylinder Workflow > Setting up the Engine

Electronics Cooling

- **PCB library QuickPart**
  - Improves setup time with storing/recalling PCB QuickParts into libraries
    - Supports both simple and detailed rectangular, circular, and custom PCB types

User Guide

- **New Tutorials**

- Foundation Tutorials

  A new section has been added for basic post-processing tutorials. These short tutorials are based on material that was previously contained within the Introductory tutorial.
  - Post-Processing: Examining Velocity Vectors
  - Post-Processing: Plotting Data on a Derived Part
  - Post-Processing: Creating Streamlines
- Geometry
  - 3D-CAD: Cyclone Separator
- Reacting Flow
  - Flamelet Generated Manifold: Perfectly Premixed Combustion with Adaptive Meshing
  - Eddy Break-Up: Coal Combustion
- Solid Stress
  - Contact with Rigid Plane: Diaphragm Valve
- Coupling with CAE Codes
  - FMU Co-Simulation: Temperature Controller
- Analysis Methods
  - Field Histories: Pressure Time Derivative

- **Modified Tutorials**
  - Introductory Tutorial – Revised to reduce the length; some post-processing sections removed and presented as foundation tutorials instead
  - All multiphase tutorials were updated to use the new method for creating phase interactions
  - Simcenter Amesim Co-Simulation: 1D Coupling – Updated to couple with Simcenter Amesim 2019.2
  - GT-SUITE Co-Simulation: 1D Coupling – Updated to couple with GT-SUITE 2019
  - Adaptive Mesh Refinement: Hypersonic Flow – Now uses a dome-shaped mesh for reduced cell count; also the *Range* parameter on the **Adaption Request** has been changed to [0.5, 1.0]
  - FSI and 6-DOF Motion: Stress Analysis on Boat Propeller – Modified in order to reduce the overall runtime
  - DEM Particles in a Conveyor – Now includes use of the plane widget when defining the location of the clip plane
  - Harmonic Balance: Single Stage Periodic Flow – Post-processing sections now use new HB field function names and the HB Solution View
  - Gasoline Engine: Motored – Removed any setup associated with the valve lash
  - Moving Reference Frames: Rotating Fan – New geometry and mesh settings
  - Rigid Body Motion: Rotating Fan – Updated due to new mesh from the MRF rotating fan tutorial
  - DES and FW-H On-The-Fly: Noise from a Cylinder (Unsteady Analysis) – *Maximum Physical Time* for the solution reduced to 0.0533 s (instead of 0.12 s previously)
- **Retired Tutorials**
  - Flamelet Generated Manifold: Perfectly Premixed Propane – Replaced with new version that utilizes Adaptive Mesh Refinement

Important Notes 2020.2

This section contains important notes that you must become familiar with before using this latest release of Simcenter STAR-CCM+.

Java Upgraded to OpenJDK Version 11.0.5

The Java SDK (Software Development Kit), which is required to compile the Java macros, has been upgraded to OpenJDK v11.0.5 in the current release.

Previous versions of the JDK will not work, but later versions of JDK 11 will be allowed (both OpenJDK-based distributions and Oracle's JDK).

Changes to Support for MPI and Operating System Versions in Current Release

Beginning with the current release, support has changed for the following MPI versions:

MPI Vendor	Added Versions	Discontinued Versions
Intel MPI	2019.5	2018.1
Microsoft MS MPI	10.1.1	10.0, 8.1.1
Open MPI	3.1.5, 4.0.2	3.1.3

Microsoft MS MPI 10.1.1 is now distributed with Simcenter STAR-CCM+.

Beginning with the current release, support has changed for the following operating system versions:

Operating System	Added Versions
CentOS	7.7
Red Hat Enterprise Linux (RHEL)	7.7

Planned End of Support for Operating System Versions (2020.3)

Beginning with **2020.3**, support will end for the following operating system versions:

Operating System	Discontinued Versions
CentOS	6.10
Red Hat Enterprise Linux (RHEL)	6.10

Planned End of Support for Intel Xeon Phi and AVX 512 Vectorization (2021.1)

Beginning with Simcenter STAR-CCM+ 2021.1 support will end for Intel Xeon Phi processors which have been discontinued by Intel. Additionally, Simcenter STAR-CCM+ will also cease to support AVX 512 vectorization which provides no benefit on non-Xeon Phi CPUs

Planned End of Region-Based Meshing (2021.1)

Region-based meshing has been deprecated starting in Simcenter STAR-CCM+ 2020.1 and is planned to be removed in version 2021.1. The recommended practice is to use parts-based meshing—see the section "Simcenter STAR-CCM+ > Pre-Processing > Meshing > Parts-Based Meshing" in the Simcenter STAR-CCM+ User Guide. Please contact your Simcenter customer support representative for further information.

Planned End of Co-Simulation with Abaqus Version 2016

The end of Simcenter STAR-CCM+ co-simulation with Abaqus Version 2016 has been rescheduled for **2021.1**, subject to further changes.

Planned End of HEEDS|post Access as Part of the Simcenter STAR-CCM+ Intelligent Design Exploration License (2021.1)

Access to HEEDS|Post using the Simcenter STAR-CCM+ Intelligent Design Exploration license has been deprecated starting in Simcenter STAR-CCM+ 2020.1 and is planned to be removed in version 2021.1. You are encouraged to utilize the native data analysis tools within Simcenter STAR-CCM+.

Starting 2021.1:

- HEEDS|post will no longer be packaged with the Simcenter STAR-CCM+ Intelligent Design Exploration license
- HEEDS|post will still be accessible from the Design Manager interface with:
  - a standalone HEEDS|post license (one license checked out per session)
  - a separate HEEDS|post installation

Please contact your Simcenter customer support representative for further information.

Planned End of CAE Mode for CAD Clients (2021.1)

The CAE mode for CAD Clients has been deprecated starting in Simcenter STAR-CCM+ 2020.1 and is planned to be removed in version 2021.1. Please contact your Simcenter customer support representative for further information.

Planned End of Convective Option in Ffowcs Williams-Hawkings (FW-H) Aeroacoustics Modeling (2021.2)

The Convective Acoustic Effects option in FW-H modeling has been deprecated starting in Simcenter STAR-CCM+ 2020.2 and is planned to be removed at earliest in version 2021.2.

Please contact your Simcenter customer support representative for further information.

Removal of Abe-Kondoh-Nagano (AKN) K-Epsilon Turbulence Model

The previously deprecated AKN K-Epsilon turbulence model has now been removed.

You are advised to contact your support engineer to update your simulation workflow.

3D-CAD: Change of Selection UI

When you are editing an existing feature in 3D-CAD, the selection box no longer has the focus by default. To add or remove any object in the selection box, you must first click inside the box and then proceed with the selection changes. This change prevents the accidental removal of all inputs, which could happen in previous releases when you clicked in a blank area in the scene while the selection box had the focus.

Adjoint: Changes to Cost Function Creation Workflow

In the current release, you now create one type of cost function within the **Adjoint** solver, which is the **Report** cost function. Thereafter, on the cost function node, you select a report within the *Report* property. You can select any report whose type supports adjoint differentiation.

Multiphase: Changes to Model Names

To improve the ease of model selection and to increase consistency of terminology, several multiphase models have been renamed in the current release. The model child nodes are unchanged in all cases.

UI Element	Old Name	New Name
Model selection dialog - model options and group boxes	**Eulerian Multiphase**	**Multiphase**
	Eulerian Multiphase Model group box	*Multiphase Model* group box
	Eulerian Multiphase Mixture	**Mixture Multiphase (MMP)**
	Multiphase Segregated Flow	**Eulerian Multiphase (EMP)**
Nodes under **[physics continuum]** > **Models**	**Eulerian Multiphase**	**Multiphase**
	Multiphase Segregated Flow	**Eulerian Multiphase (EMP)**
Nodes under Solvers	**Multiphase Segregated Flow Solver**	**Segregated EMP Flow Solver**

Additional changes to the model selection dialog:

- The *Eulerian Multiphase Mixture Model* group box no longer exists.
- The **N-Phase Mixture** option is the **Mixture Multiphase (MMP)** option above.
- The **Two-Phase Thermodynamic Equilibrium** has been added to the *Multiphase Model* group box.

VOF: Change to Resolved Fluid Film Phase Model Default Setting

The default constant value of the Resolved Fluid Film Volume Fraction has been changed from 0.5 to 0.8. The reason for making this change is that the transition of film mass to the VOF representation is only reasonable if it can be well represented as VOF film. In other words, the liquid mass should dominate the volume of the first cell next to the wall boundary, which is not really the case if it only fills half of it.

DFBI: Changes to Multi-Body Constraint Solver Default Settings

The default values of the Multi-Body Constraint Solver properties were changed as follows:

- *Maximum Number of Iterations*: from 10 to 30
- *Residual Tolerance*: from 10e-3 to 10e-4

Electrochemistry: Surface Reactions Now Allowed with Electrochemical Reactions

The incompatibility between the Surface Chemistry model and the Electrochemical Reactions model has been removed. In previous releases, these models were incompatible due to their need to use the same Surface Mechanism Option.

In the current release, the Electrochemical Reactions model now uses the Electrochemistry Mechanism Option. This option appears in the user interface, in the same places as the Surface Mechanism Option:

- **Interfaces** > **[Interface]** > **Physics Conditions** > **Electrochemistry Mechanism Option**
- **Regions** > **[region]** > **Boundaries** > **[boundary]** > **Physics Conditions** > **Electrochemistry Mechanism Option**

Plots: Change to Data Focus Default Setting

For the **Data Focus** node of a plot (**Plots** > **[plot]** > **Y Types** > **Y Type 1** > **Data Focus**), the default setting of the **Coloring Mode** property has been changed from **Highlight** to **Mask**, since the highlight can distort the interpretation of data if a color channel is used.

Visualization

Change to Default Vector Glyphs

For the **Glyph** sub-node of a vector scene displayer, the new default setting of the *Vector Style* property is **3D Head and Tail**.

These vector glyphs have been updated with a smoother look. This change might cause problems with older graphics hardware or when using Mesa graphics. You can revert to using the old glyphs by deactivating the option *Use Implicit Representation* in the **Visualization** node of the *Options* dialog (activated with the **Tools** > **Options** menu item).

Change to Default Displayer Representation

The default selection for the *Representation* property of a scene displayer is now **Latest Surface/Volume**. As you go through the steps for creating a surface or volume mesh, the displayer that contains this representation is updated as well.

This change only affects default representations of displayers—plots and reports are not affected.

Expanded Use of Upgraded OpenGL (version 3.3)

OpenGL 3.3 is now used more extensively than in previous releases. Therefore it is recommended that you update your graphics drivers in the unlikely event that you encounter graphics issues on machines where previous releases of Simcenter STAR-CCM+, Simcenter STAR-CCM+ Viewer, and/or Simcenter STAR-CCM+ Virtual Reality had no such issues.

Simcenter STAR-CCM+ Viewer and Simcenter STAR-CCM+ Virtual Reality: Changes to Default Folder

The default folder for **Open**, **Export**, and **Hardcopy** actions is now the most recent folder in which you executed that action. For example, suppose you do the following:

1. Open a scene file in the **Documents** folder.
2. Export a scene to the **Downloads** folder.
3. Generate a hardcopy of a scene to the **Pictures** folder.

Then the next **Open** action points to **Documents**, the next **Export** action points to **Downloads**, and the next **Hardcopy** action points to **Pictures**.

Simcenter STAR-CCM+ Viewer: Upgraded Graphics Library Requirements

In the current release, Simcenter STAR-CCM+ Viewer requires the libraries `xkbcommon` and `xkbcommon-x11` to be installed when using Linux. These are standard system libraries that are typically already installed.

Macro API Changes 2020.2

This section contains the changes to the macro API since the previous release of Simcenter STAR-CCM+.

Directed Meshing: Possible Need for Rerecording Directed Patch Source Mesh Code

Due to improvements in how directed meshing works with source surfaces, existing macros with the `DirectedPatchSourceMesh.autopopulateFeatureEdges` command might not work in some of the cases. In that case, you must record a new macro.

Material Properties: Change to Default Choice of Material Property Method

In material properties, the default choice of method is now determined by the most recent choice of physics model. As a result, simulation files that are generated with macros saved in previous versions of Simcenter STAR-CCM+ may have some different default material property methods in the current release.

When running old macros, check the method settings of the material properties.

Adjoint

Renaming of Field Function

Due to refactoring of the Adjoint Solver, the field function `CostFunction::CoordLagrangian_q` has been renamed to `CostFunction::CoordSensitivity`, where `CostFunction` is the name of any cost function defined in the `.sim` file. Update all instances of this field function in your macros.

Change to Cost Function Creation Workflow

In the current release, you now create one type of cost function within the **Adjoint** solver, the **Report** cost function, and then select a (differentiable) report for the *Report* property of the cost function node. This redesign has resulted in changes to the macro code:

- All specific cost functions must be replaced with report cost functions, that is, `<X>CostFunction` becomes `ReportCostFunction`.

Previous Release	Current Release

`ForceCostFunction costFunction_0 =`
 	
`simulation.get(AdjointCostFunctionMa`
`nager.class).createAdjointCostFuncti`
`on(ForceCostFunction.class);`
	`ReportCostFunction costFunction_0 =`
	
	`simulation.get(AdjointCostFunctionMa`
	`nager.class).createAdjointCostFuncti`
	`on(ReportCostFunction.class);`

- All specific `get` and `set` methods of cost functions need to be changed to `getReport` and `setReport`, that is, `get<X>Report` becomes `getReport` and `set<X>Report` becomes `setReport`.

Previous Release	Current Release

`ForceCostFunction costFunction_0 =`
`  ((ForceCostFunction)`
`simulation.get(AdjointCostFunctionMa`
	`ReportCostFunction costFunction_0 =`
	`  ((ReportCostFunction)`
	`simulation.get(AdjointCostFunctionMa`

Previous Release	Current Release
`nager.class).getAdjointCostFunction("Force"));`	`nager.class).getAdjointCostFunction("Force"));`
`ForceCostFunction.getForceReport()`	`ReportCostFunction.getReport()`
`costFunction_0.setForceReport(forceReport_0)`	`costFunction_0.setReport(forceReport_0)`

- The default presentation name of newly created cost functions is now **Report**, irrespective of the associated report type. If you want the presentation name to reflect the report type (for example **Force** for a cost function associated with a Force Report), set it explicitly by adding the following command:

```
costFunction_0.setPresentationName("Force");
```

Multiphase

End of Eulerian Activation Macro Code

Due to the renaming of some multiphase models, macro code for adding and subsequently removing a Eulerian Multiphase Mixture model by macro is no longer valid. To update your macros, remove instances of the following code:

```
EulerianMultiphaseMixtureModel eulerianMultiphaseMixtureModel_0 =
physicsContinuum_0.getModelManager().getModel(EulerianMultiphaseMixtureModel.class);
physicsContinuum_0.disableModel(eulerianMultiphaseMixtureModel_0);
```

Changes to Wall Lubrication and Lift

Due to the introduction of the Lubchenko Wall Lubrication model in the current release, macro code has changed.

Wall Lubrication

Previous Release	Current Release
`AntalWallLubricationCoefficientMethod antalWallLubricationCoefficientMethod_0 = wallLubricationForceModel_0.getWallLubricationCoefficient().getMethod(AntalWallLubricationCoefficientMethod.class);`	`DispersedFlowRegime dispersedFlowRegime_0 = ((DispersedFlowRegime) eulerianPhaseInteractionModel_0.getFlowRegime(0)); AntalWallLubricationCoefficientMethod antalWallLubricationCoefficientMethod_0 = ((WallLubricationCoefficientMethodManager) wallLubricationForceModel_0.getWallLubricationCoefficientMethodManager(dispersedFlowRegime_0)).getMethod(AntalWallLubricationCoefficientMethod.class);`

Lift

Remove the following code from your macros:

```
((LiftCoefficientMethodManager)
liftForceModel_0.getLiftCoefficientMethods()).getCoefficientCorrectionOption().
setSelected(LiftCoefficientCorrectionOption.ON);
```

Changes to Creation of Phase Interactions

In previous releases, the workflow related to Passive Scalar Interaction required you to create multiple interactions between the same Lagrangian phase and its physics continuum so that multiple passive scalars within those continua could interact with each other. Additionally, for each weighting model, that is, Area or Volume, a new interaction had to be created.

Since the new workflow for creating interactions in the current release is designed to avoid the need for creating duplicate interactions, that is, interactions connecting the same two phases (continua in general), the Passive Scalar Interaction objects have been refactored. The previous weighting models have been refactored into methods that can be created multiple times within the same interaction, each working on its own pair of passive scalars. This approach allows you to incorporate any combination of passive scalars and weighting methods in a single interaction for those two phases.

This refactoring has resulted in changes to the macro code.

Previous Release	Current Release

`// Area weighting`
`{`
`  PhaseInteraction phaseInteraction_0 = multiPhaseInteractionModel_0.createPhaseInteraction();`
 	
`phaseInteraction_0.enable(PassiveScalarPhaseInteractionModel.class);`
`  PassiveScalarPhaseInteractionModel passiveScalarPhaseInteractionModel_0 =`
 	
`phaseInteraction_0.getModelManager().getModel(PassiveScalarPhaseInteractionModel.class);`
 	
`passiveScalarPhaseInteractionModel_0.setPhase0(lagrangianPhase_0);`
 	
`passiveScalarPhaseInteractionModel_0.setPhase1(physicsContinuum_0);`
 	
`phaseInteraction_0.enable(PassiveScalarAreaWeightInteraction.class);`
 	
`  PassiveScalarAreaWeightInteraction passiveScalarAreaWeightInteraction_0 =`
 	
`phaseInteraction_0.getModelManager().`
	`// Area and Volume weighting in one interaction`
	`multiPhaseInteractionModel_0.createPhaseInteraction(`
	
	`PhaseInteractionTopology.LAGRANGIAN_PASSIVE_SCALAR, lagrangianPhase_0, physicsContinuum_0);`
	`// NB., accounts for enabling "PassiveScalarPhaseInteractionModel"`
	
	`phaseInteraction_0.enable(LagrangianPassiveScalarTransferModel.class); // NB., new model LagrangianPassiveScalarTransferModel`
	`lagrangianPassiveScalarTransferModel_0 =`
	
	`phaseInteraction_0.getModelManager().getModel(LagrangianPassiveScalarTransferModel.class);`
	
	`PassiveScalarAreaWeightInteraction passiveScalarAreaWeightInteraction_0 =`
	
	`lagrangianPassiveScalarTransferModel_0.getPassiveScalarInteractionMethodManager().createObject(PassiveScalarAreaWeightInteraction.class);`
	`PassiveScalarVolumeWeightInteraction passiveScalarVolumeWeightInteraction_0 =`

Previous Release	Current Release

`getModel(PassiveScalarAreaWeightInteraction.class);`
`  // work on passiveScalarAreaWeightInteraction_0`
`}`	

`// Volume weighting`
`{`
`  PhaseInteraction phaseInteraction_0 = multiPhaseInteractionModel_0.createPhaseInteraction();`
 	
`phaseInteraction_0.enable(PassiveScalarPhaseInteractionModel.class);`
`  PassiveScalarPhaseInteractionModel passiveScalarPhaseInteractionModel_0 =`
 	
`phaseInteraction_0.getModelManager().getModel(PassiveScalarPhaseInteractionModel.class);`
 	
`passiveScalarPhaseInteractionModel_0.setPhase0(lagrangianPhase_0);`
 	
`passiveScalarPhaseInteractionModel_0.setPhase1(physicsContinuum_0);`
 	
`phaseInteraction_0.enable(PassiveScalarVolumeWeightInteraction.class);`
 	
`PassiveScalarVolumeWeightInteraction passiveScalarVolumeWeightInteraction_0 =`
 	
`phaseInteraction_0.getModelManager().getModel(PassiveScalarVolumeWeightInteraction.class);`
`  // work on passiveScalarVolumeWeightInteraction_0`
`}`
	`lagrangianPassiveScalarTransferModel_0.getPassiveScalarInteractionMethodManager().createObject(PassiveScalarVolumeWeightInteraction.class);`
	
	`// work on either interaction`

The macro API within the `PassiveScalarAreaWeightInteraction` and `PassiveScalarVolumeWeightInteraction`, and dependent classes has not been changed.

Eulerian Multiphase (EMP): Transfer of Incident Mass Flux Impingement Phase Model

As a result of the implementation of incident mass flux impingement in the Mixture Multiphase (MMP) model, the registration of `ImpingementEfficiencyProfile` for the EMP `IncidentMassFluxImpingementModel` has been moved from the dispersed liquid phase to the phase interaction.

Previous Release	Current Release

`private static final String LIQ_PHASE_NAME = "Eulerian-Liquid";`
`// Set impingmenent efficiency InterfaceBoundary interfaceBoundary_0 = ((InterfaceBoundary) region_0.getBoundaryManager().getBoundary("Bottom [In-place 1]"));`
`PhaseConditions phaseConditions_0 = ((PhaseConditions) interfaceBoundary_0.get(PhaseConditionsManager.class).getPhaseConditions(LIQ_PHASE_NAME));`
`ImpingementEfficiencyProfile impingementEfficiencyProfile_0 =`
 	
`phaseConditions_0.getPhaseValueManager().get(ImpingementEfficiencyProfile.class);`
`impingementEfficiencyProfile_0.getMethod(ConstantScalarProfileMethod.class).getQuantity().setValue(0.8);`
	`private static final String PHASE_INTERACTION_NAME = "Film-EulerianLiquid";`
	`// Set impingmenent efficiency InterfaceBoundary interfaceBoundary_0 = ((InterfaceBoundary) region_0.getBoundaryManager().getBoundary("Bottom [In-place 1]"));`
	`PhaseConditions phaseConditions_0 = ((PhaseConditions) interfaceBoundary_0.get(PhaseConditionsManager.class).getPhaseConditions(PHASE_INTERACTION_NAME));`
	`ImpingementEfficiencyProfile impingementEfficiencyProfile_0 =`
	
	`phaseConditions_0.getPhaseValueManager().get(ImpingementEfficiencyProfile.class);`
	`impingementEfficiencyProfile_0.getMethod(ConstantScalarProfileMethod.class).getQuantity().setValue(0.8);`

Solid Stress: Specified Temperature Model No Longer Requires Initial Conditions

For the Specified Temperature Model, the use of initial conditions has been found to be an excessive specification of the temperature profile. In the current release, the temperature profile chosen for the continuum or region now dictates the initial conditions as well. Some workflows are affected by this change, specifically those that use `DataMapper` and rely on the specified (initial) values when the data mapper itself has not been initialized. In these instances, it is possible to use the `alternateValue()` field function to specify a fall-back value when the data mapper is not ready to be queried.

At the same time, the initial condition specification for this model has been removed. To update your macro code, remove the instances of initial conditions for this model, as shown in the following example of an option that no longer works:

```
SpecifiedTemperatureProfile specifiedTemperatureProfileInitial_0 =

physicsContinuum_0.getInitialConditions().get(SpecifiedTemperatureProfile.class);
```

Electrochemistry: Surface Reactions Now Allowed with Electrochemical Reactions

The incompatibility between the Surface Chemistry model and the Electrochemical Reactions model has been removed. In previous releases, these models were incompatible due to their need to use the same Surface Mechanism Option.

In the current release, the Electrochemical Reactions model now uses the Electrochemistry Mechanism Option, resulting in changes to the macro code:

- Provided you are not currently using surface chemistry in your simulation (in a different continuum since previously the models were incompatible), you must replace headers:

Previous Release	Current Release
`import star.reactions.SurfaceMechanismOption;`	`import star.reactions.ElectrochemistryMechanismOption;`

- Any macro code that referenced the `SurfaceMechanismOption` class must be updated to use the `ElectrochemistryMechanismOption` class:

Previous Release	Current Release
`SurfaceMechanismOption smo = iface.getConditions().get(SurfaceMechanismOption.class); SurfaceMechanismOption smo2 = boundary.getConditions().get(SurfaceMechanismOption.class);`	`ElectrochemistryMechanismOption smo = iface.getConditions().get(ElectrochemistryMechanismOption.class); ElectrochemistryMechanismOption smo2 = boundary.getConditions().get(ElectrochemistryMechanismOption.class);`

Visualization: Change to Default Displayer Representation

The default selection for the *Representation* property of a scene displayer is now **Latest Surface/Volume**. As you continue to create a surface or volume mesh, the displayer that contains this representation is updated as well. This change only affects default representations of displayers—plots and reports are not affected.

This modification has resulted in changes to the macro code. The `LatestMeshProxyRepresentation` has moved from `star.meshing package` to `star.common package`. If you have included the entire path in the import statement, update your macros.

Previous Release	Current Release
`import star.meshing.LatestMeshProxyRepresentation;`	`import star.common.LatestMeshProxyRepresentation;`

Simcenter STAR-CCM+ In-Cylinder: Change to PDF Table Import

Due to changes in table headers, the way in which Simcenter STAR-CCM+ In-Cylinder imports PDF tables has changed, resulting in changes to the macro code for this import.

Previous Release	Current Release
`starIcePhysicsManager_0.createProfileFileTable(resolveDataPath("case/injector_DropletDiameterPDF.csv"), quickPartInstance_0, "Droplet Diameter");`	`starIcePhysicsManager_0.createProfileFileTable(resolveDataPath("case/injector_DropletDiameterPDF.csv"), quickPartInstance_0, "Droplet Diameter", "PDF");`

CAD Packages Support

This section contains a list of supported CAD Clients, the CAD import versions, and the CAD export versions.

CAD Packages for CAD Clients

When installing CAD Clients, the target CAD package must be present on the installation machine. Without this, you can force the installation of a particular sub-component, but there is no guarantee that this will work correctly with your CAD package. The following CAD packages are required to run the CAD Clients:

CAD Client	CAD Package Version	Comments
Simcenter STAR-CCM+ Client for CATIA V5	CATIA V5-6R2015 (R25)	An additional `ME2` or `MD2 + GPS` configuration license is required from Dassault Systemes to run Simcenter STAR-CCM+ Client for CATIA V5.
	CATIA V5-6R2016 (R26)	
	CATIA V5-6R2017 (R27)	
	CATIA V5-6R2018 (R28)	
	CATIA V5-6R2019 (R29)	
Simcenter STAR-CCM+ Client for NX	NX 10.0	
	NX 11.0	
	NX 12.0	
	NX 1847	
	NX 1872	
	NX 1899	
	Simcenter 3D 2019.2-1872	
	Simcenter 3D 2020.1-1899	
Simcenter STAR-CCM+ Client for Creo	Creo Parametric 4.0	
	Creo Parametric 5.0	
	Creo Parametric 6.0	
Simcenter STAR-CCM+ Client for Inventor	Inventor 2017	
	Inventor 2018	
	Inventor 2019	

CAD Import Versions

CAD File Formats for HOOPS Exchange

CAD import is available on all platforms. The supported file formats and corresponding version numbers are given below. The table below shows the supported CAD file formats for HOOPS Exchange.

File Format	File Extensions	Versions Supported	Add-on Required	Type of Import
CATIA V4	.model, .exp, .session	Up to 4.2.5	CAD Exchange	Triangulated Data, B-rep
CATIA V5	.CATPart, .CATProduct, .cgr	Up to V5-6 R2019 (R29)	CAD Exchange	Triangulated Data, B-rep
CATIA V6 / 3DExperience	.3dxml	Up to V5-6 R2019 (R29)	CAD Exchange	Triangulated Data
SolidWorks	.sldprt, .sldasm	Up to 2019	CAD Exchange	Triangulated Data, B-rep
JT Open	.jt	Up to v10.2	JTOpen Reader & CAD Exchange	Triangulated Data, B-rep
NX	.prt	v11.0 to NX 12.0, and 1847	CAD Exchange	Triangulated Data, B-rep
Solid Edge	.par, .asm	v19 to v20, ST to ST10, 2019	CAD Exchange	Triangulated Data, B-rep
Parasolid	.x_t, .x_b,	Up to 31.1	None	B-rep
Pro/E - Creo	.asm, .prt	Pro/E 19.0 to Creo 6.0	CAD Exchange	Triangulated Data, B-rep
Inventor	.ipt, .iam	Up to 2020	CAD Exchange	Triangulated Data, B-rep
IGES	.igs, .iges	5.1, 5.2, 5.3	None	B-rep
STEP	.stp, .step	AP 203 E1/E2, AP 214, AP 242	None	B-rep
Stereo Lithography (STL)	.stl	All versions	None	Triangulated Data
VDA-FS	.vda	1.0, 2.0	CAD Exchange	B-rep
Rhino 3D	.3dm	4, 5, 6	CAD Exchange	Triangulated Data, B-rep
ACIS	.sat, .sab	Up to 2019	CAD Exchange	Triangulated Data, B-rep

CAD File Formats for Siemens Adapter

The table below shows the supported CAD file formats for Siemens Adapter.

File Format	File Extensions	Versions Supported	Add-on Required	Type of Import
CATIA V5	.CATPart, .CATProduct	Up to V5-6 R2018 SP2 (R28)	None	B-rep
JT	.jt	Up to v10.1	None	B-rep
Solid Edge	.par, .asm	Windows up to 2019 Linux — no support	None	B-rep
STEP	.stp, .step	AP 203, AP 214, AP 242	None	B-rep
NX	.prt	Windows - Up to NX1847 Linux - Up to NX 12.0	None	B-rep

CAD Export Versions

CAD export is available on all platforms. 3D-CAD supports exporting to the following file formats.

File Format	File Extensions	Versions Supported	Add-on Required	Type of Export
Parasolid	.x_t, .x_b	31.1	None	B-rep
IGES	.igs, .iges	5.3	CAD Exchange	B-rep
STEP	.stp, .step	AP 203 E1/E2, AP 214, AP 242	CAD Exchange	B-rep

External Packages Support

Simcenter STAR-CCM+ can interact with a range of third-party software tools, either by importing their meshes and data, exporting to their formats, or through co-simulation.

Third-Party Software

Simcenter STAR-CCM+ supports the following packages :

Package	Provider	Supported Versions	Import	Export	File-Based Coupling	Co-Simulation[1]
Abaqus	SIMULIA-Dassault Systemes	All	✓	✓[2]	✓	
		2017 (recommended) 2016				✓
Simcenter Amesim	Siemens PLM Software	**2019.2** (recommended) 2019.1 17	-	-	-	✓
ANSYS	ANSYS Inc.	All	✓[3]	✓[2]	✓	
Simcenter Battery Design Studio	Siemens PLM Software	**2020.2**	✓	-	-	-
Ensight	Computational Engineering International	**10.1** (recommended) 9 8	✓	✓[4]	-	-
FieldView	Intelligent Light	15	-	✓[4]	-	-
GT-SUITE	Gamma Technologies Inc.	**2019** (recommended) 2018 2017	-	-	-	✓
JMAG	JSOL Corporation	JSOL defines the JMAG versions that are supported				✓
Simcenter Nastran	Siemens PLM Software	All	✓[3]	✓[2]	✓	
		2019.2-1884				✓
MSC Nastran	MSC Software Solutions	All	✓[3]	✓[2]	✓	-
TAITherm (Formerly known as RadTherm)	ThermoAnalytics Inc.	All	✓	✓[2]	✓	-

Package	Provider	Supported Versions	Import	Export	File-Based Coupling	Co-Simulation[1]
RELAP5-3D	Idaho National Laboratory	**4.1.3**[5]		-	-	✓
Simcenter SPEED	Siemens PLM Software	**2020.2**	✓	-	-	-
Tecplot 360	Tecplot Inc.	**2015**		✓[4]	-	-
WAVE	Ricardo	**2017.1** (recommended) 2016.2 2016.1				✓

[1] Currently, co-simulation does not support host specification using the IPv6 communication protocol
[2] Exports solution data, but not the mesh
[3] There is no version restriction on the files to import
[4] Exports mesh and solution data
[5] Specially modified version; must be obtained from INL.

Known Issues

This section contains a list of known issues that may occur in special circumstances. None of the issues affect the validity of the results that you obtain with Simcenter STAR-CCM+.

In the following topics, the symbol New is used to identify issues that are new in this release. Only issues where resolution is related to a third-party product or system provider, and is outside of our control, are listed here.

Contents:

Issues Relevant to All Operating Systems

This section contains a list of known issues that affect Simcenter STAR-CCM+ on all operating systems.

Flexera Publisher 2019 R2 Recommended to Avoid Security Vulnerabilities New

Kaspersky labs have identified four possible vulnerabilities in versions of FlexNet Publisher version 2018 R3 (11.14) and earlier. While there are no known exploits of these vulnerabilities, it is possible they could result in a DoS (Denial of Service) attack if they were to be exploited. If the Simcenter STAR-CCM+ license server is running on a secure network, as is recommended, then there is no way of exploiting these vulnerabilities except from within the firewall.

To mitigate any possible concerns over this issue FlexNet Publisher 2019 R2 (11.16.4) is available for download from the support center. To patch your existing Simcenter STAR-CCM+ license server simply replace your existing `lmgrd` executable with the new one and restart your server.

AVX-512 Optimizations on Newer Intel CPUs Can Lead to Spurious Numerical Failures New

Simcenter STAR-CCM+ finite element solvers and some meshing modules depend on the Intel Math Kernel Library (MKL) for performance-critical linear algebra subroutines. The AVX-512 optimizations inside the MKL library can be too aggressive and cause the linear system solution process to fail even for a valid input.

If your system has an AVX-512 capable Intel CPU and the solver fails to produce a result due to a floating point exception, you can try setting the environment variable `MKL_ENABLE_INSTRUCTIONS` to a value of `AVX2`. This setting can help to stabilize the system. For example:

- Bash shell: `export MKL_ENABLE_INSTRUCTIONS=AVX2`
- C shell (csh or tcsh): `setenv MKL_ENABLE_INSTRUCTIONS AVX2`

This setting configures the MKL library to avoid optimizations that are only appropriate for architectures more recent than Intel AVX2. For more details, see https://software.intel.com/en-us/mkl-linux-developer-guide-instruction-set-specific-dispatching-on-intel-architectures.

Potential Sub-Optimal Performance on Advanced AMD CPU-Based Systems New

Simcenter STAR-CCM+ finite element solvers and some meshing modules depend on the Intel Math Kernel Library (MKL) for performance-critical linear algebra subroutines. The Intel MKL library CPU capability detection routines can misdiagnose the ability of a non-Intel CPU to execute AVX2 instructions. When this incorrect diagnosis occurs, the library uses subroutine versions with a lesser vectorization level which results in unnecessary performance degradation.

To ensure that AVX2 instructions are used optimally on AVX2 capable AMD CPUs, set the environment variable `MKL_DEBUG_CPU_TYPE` to a value of `5`. For example:

- Bash shell: `export MKL_DEBUG_CPU_TYPE=5`
- C shell (csh or tcsh): `setenv MKL_DEBUG_CPU_TYPE 5`

For more information, see https://en.wikipedia.org/wiki/Math_Kernel_Library#Performance.

Hyperthreading Should be Disabled on Systems Running Simcenter STAR-CCM+

Siemens Digital Industries Software currently recommends that you disable hyperthreading on systems that will be used to run Simcenter STAR-CCM+.

Simcenter STAR-CCM+ May Not Run in Conjunction with Synergy

There are reports of Simcenter STAR-CCM+ failing to launch on platforms that use Synergy to share a mouse and keyboard between platforms. This is due to an open bug in the Java JDK, as reported on the JDK Bug System: https://bugs.openjdk.java.net/browse/JDK-6322854.

XWindows Can Cause Problems

If you use XWindows software, especially on Windows, to "display" a Simcenter STAR-CCM+ client back to the local machine from a remote machine, various problems may occur, such as the remote client not starting correctly or at all. This method of working is not supported by Simcenter STAR-CCM+. You must run the client directly on your local machine and connect to a remote Simcenter STAR-CCM+ server.

Zero-Sized Files in Some NFS Systems

In some newer NFS systems, if the disk becomes full while you are saving a simulation file, a zero-sized simulation file is written to the disk. No error message appears.

Issues Relevant to Linux

This section contains a list of known issues that affect Simcenter STAR-CCM+ on Linux operating systems.

Latest Workspace Fonts May Require Anti-Aliasing New

On some Linux systems, the latest Simcenter STAR-CCM+ workspace fonts have had issues such as blurriness. The workaround is to activate font anti-aliasing in your operating system settings.

The following example is a workaround for activating anti-aliasing in KDE. It is offered only as an example for a particular operating system. For instructions on your operating system, refer to its user documentation.

1. Launch **KDE settings**.
2. Under **Look & Feel**, click **Appearance**.

3. Navigate to **Fonts**.
4. Next to **Use Anti-Aliasing**, choose **Enabled** from the drop-down box.

Memory Leak After Abnormal Termination with Open MPI 3 Can Cause Startup Failures New

When a simulation using Open MPI 3 terminates abnormally, shared memory files from Open MPI's Vader component might be left behind in the `/dev/shm` folder. When another user runs a subsequent simulation with Open MPI on the same node, and `/dev/shm` has not been cleaned up, intermittent startup failures due to file name conflicts can occur. As workarounds, consider the following options:

- Clean up the files in `/dev/shm` after job termination.
- Instead of Open MPI version 3, use Open MPI version 4 using the flag `-mpi openmpi4`. The files in `/dev/shm` may still require clean up from previous Open MPI 3 runs.

Intel MPI 2019.5 Can Fail in MPI_Finalize New

The new version of Intel MPI 2019.5 can fail in `MPI_Finalize` under certain circumstances. The issue manifests with an error message indicating a problem in `MPI_Finalize` being printed at the end of the simulation. The simulation results are not affected and there are no other known negative effects. Thus, the message can safely be ignored. To avoid the message, you can use a different MPI library if possible.

Omni-Path Compatibility with Intel MPI and Platform MPI

Extra steps are required for using Omni-Path with Intel MPI and Platform MPI:

- For Intel MPI, you can use the flag `-mppflags -TMI` to force the use of Omni-Path. Otherwise, it uses Infiniband or Ethernet if it is available, and ignores Omni-Path.
- For Platform MPI, install the PSM2-compatibility libraries.

Intel MPI Library Can Fail When ptrace Restricted

On some Linux distributions, the Intel MPI Library will fail for non-root users due to security limitations. This failure has been seen on Ubuntu 12.04, and could impact other distributions and versions as well. Two workarounds have been identified for this issue:

- Enable unrestricted ptrace for non-root users with:
  ```
  echo 0 | sudo tee /proc/sys/kernel/yama/ptrace_scope
  ```
- Alternatively, revert the Intel MPI Library to an earlier shared memory mechanism which is not impacted by setting:
  ```
  I_MPI_SHM_LMT=shm
  ```

Errors Running on SLES 12.2

When running on SUSE Linux Enterprise Server 12 SP2 Linux Distribution, Simcenter STAR-CCM+ may exceed default limits on the number of processes in the `cgroup controller`, resulting in errors such as `fork: retry: No child processes`. To avoid this issue the default limits should be increased as documented in the SLES documentation.

Line Integral Convolution Does Not Work Properly with Intel Graphics Chipsets on Linux

Vector scenes that are set to display Line Integral Convolution (LIC) do not render properly on Intel graphics chipsets. This is due to issues with the Intel graphics driver. As a result, LIC is disabled on Intel graphics chipsets on Linux.

lmutil: "command not found" Error

On Linux platforms not conforming to the minimum LSB 3.0 (Linux Standard Base) requirement, a *command not found* error may appear when attempting to launch lmutil for the FLEXlm licensing. If this occurs, you must upgrade to LSB 3.0 or higher.

Minimized Dialogs on OpenSUSE

There is a reported issue with OpenSUSE 11.2 where a Simcenter STAR-CCM+ child dialog that is minimized cannot be immediately reinstated. In this instance, you must first minimize the whole Simcenter STAR-CCM+ GUI, and then maximize it again using the tab in the task bar. The child dialog should reappear after this operation.

Shared Memory Limits Too Low

Linux workstations are often configured with low limits on the amount of allowable shared memory. This restricts how much memory can be pinned by the libraries that MPI uses. These libraries can print warning messages even when only using a single host and they usually indicate the limits are set too low-even if the library isn't being used. Some example error messages are displayed below:

- IBM Platform MPI:

```
libibverbs: Warning: RLIMIT_MEMLOCK is 32768 bytes
```

- Open MPI:

```
The OpenIB BTL failed to initialize while trying to allocate some locked
memory.
This typically can indicate that the memlock limits are set too low.
For most HPC installations, the memlock limits should be set to "unlimited".

The failure occurred here:

Host: compute_node.example.com
OMPI source: btl_opebib.c:114
Function: ibv_create_cq()
Device: Out of memory
Memlock limit: 32767
```

  The Open MPI Frequently Asked Questions describe how the limits are changed. See the answer to How can a system administrator (or user) change locked memory limits?.

To resolve these types of issues, set workstations to have high (or preferably unlimited) limits.

Simcenter STAR-CCM+ Fails on Clusters with OFED 1.5.3 Installed

OFED 1.5.3 changed the default number of memory regions that can be registered with the driver at any given time. On large clusters this can lead to two different error messages from IBM Platform MPI and Simcenter STAR-CCM+:

```
starccm+: Rank 0:17: MPI_Init: hpmp_rdmaregion_alloc() failed
starccm+: Rank 0:17: MPI_Send: ibv_reg_mr() failed: addr 0xf82a680, len 4194304
```

To resolve this issue, try increasing the amount of allowable registered memory in the driver parameters. Depending on the version of your operating system, add the following line to `/etc/modprobe.d/mlx4_en.conf` or `/etc/modprobe.conf`:

```
options mlx4_core log_num_mtt=24
```

Make this change on all hosts of the cluster. Restart the ib services or reboot the cluster after the change.

Simcenter STAR-CCM+ Viewer Fails to Run If Required Libraries Are Not Found

In the current release, Simcenter STAR-CCM+ Viewer requires the following libraries:

- `xkbcommon` and `xkbcommon-x11`—these are standard system libraries that are typically already installed.
- GNU C library version 2.12 or greater
- GIMP Toolkit (GTK+) version 2.20 or greater

If Simcenter STAR-CCM+ Viewer cannot detect these versions, it generates an error message.

If you have these versions installed on your machine and you still get this error, it may be that your `xkbcommon` and GTK+ libraries are installed in a location other than the global packages location. Simcenter STAR-CCM+ Viewer expects to find these libraries in the global packages location, typically `/usr`.

If you installed GTK+ version 2.20 or greater in a different location:

- Add the path to your `pkgconfig` directory to the `PKG_CONFIG_PATH` variable. An example bash shell command is shown below:

  ```
  % export PKG_CONFIG_PATH=[GTK+_INSTALL_DIR]/lib/pkgxonfig:$PKG_CONFIG_PATH
  ```

- Add the path to your `lib` directory to the `LD_LIBRARY_PATH` variable. An example bash shell command is shown below:

  ```
  % export LD_LIBRARY_PATH=[GTK+_INSTALL_DIR]/lib:$LD_LIBRARY_PATH
  ```

Similarly, if you installed the `xkbcommon` libraries in a different location, add the path to your `lib` directory to the `LD_LIBRARY_PATH` variable. An example bash shell command is shown below:

```
% export LD_LIBRARY_PATH=[XKBCOMMON_INSTALL_PATH]/lib:$LD_LIBRARY_PATH
```

Issues Relevant to Windows

This section contains a list of known issues that affect Simcenter STAR-CCM+ on Windows operating systems.

Font Rendering Issues Occur with OpenJDK 11

When Simcenter STAR-CCM+ runs with OpenJDK 11, the client workspace can have font rendering issues, such as extra spacing between characters or truncated object labels.

To remedy this issue when it occurs, add the following environment variable then relaunch Simcenter STAR-CCM+:

Name	Value
`FREETYPE_PROPERTIES`	`truetype:interpreter-version=35`

MPI Bind Failure

CPU binding is activated by default when running Simcenter STAR-CCM+. However, depending on your choice of MPI and number of processors, CPU binding may fail.

- On hardware with more than 64 processors per compute node, CPU binding must be deactivated (`-cpubind` off) when using IBM Platform MPI or Microsoft MPI. CPU binding can be used with Intel MPI.
- On hardware with less than or equal to 64 processors per compute node, CPU binding can be used with all supported MPIs, namely IBM Platform MPI, Intel MPI, and Microsoft MPI.

MS MPI Compatibility

Microsoft MPI Version 8.1 is not supported due to an issue of ignoring saved credentials. To avoid this issue, install Version 8.1.1.

Client Fonts May Appear Blurry When Sizes Are Changed in Windows 10 Display

In the Display control of Windows 10 Settings, changing the size of text and other elements in the display may cause Simcenter STAR-CCM+ fonts to appear blurry. To improve the appearance of the fonts:

1. Right-click the desktop shortcut icon of Simcenter STAR-CCM+ and select **Properties**.
2. Make the **Compatibility** tab active.
3. Activate the option **Disable display scaling on high DPI settings**.

   Note: This option may have a different label, depending on your version of Windows 10. For example, it may read **Override high DPI scaling behavior.**

4. After you make that change, if the font appears too small in Simcenter STAR-CCM+, increase it as follows:
   a. Make the **Shortcut** tab active.
   b. In the **Target** text box, append `-fontsize 18` at the end.
   c. If desired, change the value after `-fontsize` to a different number.

Exiting Some Screenshot Tools Causes Simcenter STAR-CCM+ Client Exception

When you take screenshots with software such as the Windows 7 Snipping Tool or SnagIt, the Simcenter STAR-CCM+ client may undergo a fatal error after you exit the screenshot tool. Such an error can also occur when you reactivate Simcenter STAR-CCM+ after exiting the screenshot tool.

To prevent this error, do one of the following:

- Manually activate an application other than Simcenter STAR-CCM+ before closing the screenshot tool. You can then switch to Simcenter STAR-CCM+ from the third application without causing the fatal error.

- Minimize the screenshot tool but leave it running.

Context-Sensitive Help Not Compatible with Microsoft Edge

When using Microsoft Edge as the default browser, help pages do not open at the correct location when you press `F1` for a selected node in the simulation tree. To avoid this issue, use an alternative browser such as Firefox or Google Chrome.

Black Picture Appears in PowerPoint When Playing Movie Files From Simcenter STAR-CCM+

On some systems, movie (.avi) files recorded using Simcenter STAR-CCM+ may not play back in Microsoft PowerPoint. This is potentially a problem with incompatible hardware acceleration, as discussed on the following Microsoft webpage: http://office.microsoft.com/en-us/powerpoint-help/my-movie-doesn-t-play-HA010077716.aspx

The recommended response is to turn down your hardware acceleration setting, which is found in the Control Panel.

Default Scene Lighting

If you have an older graphics card that supports an older version of OpenGL, the default lighting in a scene in Simcenter STAR-CCM+ can result in hardcopies that are too dark or poorly lit. To improve the output, use a different lighting setup, such as a headlight.

Internet Explorer May Block Access to the Help System

When using Internet Explorer to access the User Guide, you may see the following message:

```
To help protect your security, Internet Explorer has restricted this file from
showing active content that could access your computer.
```

You can then click for the option to **Allow Blocked Content**, which will then produce a Security Warning that says:

```
Allowing active content such as script and ActiveX controls can be useful, but
active content might also harm your computer.
Are you sure you want to let this file run active content?
```

To allow this content to run without getting blocked please follow these steps:

1. Open Internet Explorer.
2. Go to the **Tools** > **Internet Options** > **Advanced** tab.
3. Scroll down to the section labeled *Security*.
4. Activate the **Allow active content to run in files on My Computer** option.
5. Click **OK** and then close the *Internet Options* window.

Warnings About Network Access

If you have a personal firewall (for example, Norton Internet Services) that is set up to warn you about network access from your computer, you may get warnings about an IP address being accessed on port `47827`. This is caused by the session locator sending a multicast query looking for Simcenter STAR-CCM+ servers on your local network.

When the client is started without a specified simulation file (the default when Simcenter STAR-CCM+ is started via **Start** > **Program Files** > **CD-adapco** > **STAR-CCM+** menu on Windows), the session locator is started (in case you are attempting to connect to a running server). If you then open a simulation file or connect to a running server, the session locator stops. It restarts if you go to the *Servers* tab in the Simcenter STAR-CCM+ explorer window.

Open that port to prevent the warning, or if you are running from the command line, the `-loc` argument prevents the session locator starting.

Issues Relevant to the CAD Clients

This section contains known issues that affect the CAD Clients.

Simcenter STAR-CCM+ Installer Chooses to Install NX Components Even Though NX is not Installed

On a machine where NX has been installed and subsequently removed, the Simcenter STAR-CCM+ installer may choose to install the NX components even though the CAD software is no longer present. This is due to the NX uninstaller not removing all relevant information from the Windows registry.

Credits

Simcenter STAR-CCM+ makes use of several third party software components to provide certain features within its code.

For details about the licensing of these components, refer to the file `ReadMe_OSS.html` which is included in the root installation directory of Simcenter STAR-CCM+: 15.04.###/STAR-CCM+15.04.###.

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