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Simcenter STAR-CCM+ Product Update

Patrick Niven, Senior Product Manager, Industry Solutions

Simcenter STAR-CCM+ Strategic Development Themes

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Leverage Complexity

From 1 to 100s

Hours not weeks


CFD Dominance


Design Exploration


Multiphysics


Siemens Integration


Productivity & Deployment


Cloud / SaaS


Application Enablement

Simcenter STAR-CCM+ 2019

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Over 350 new features

Over 100 features from IdeaStorm

Simcenter STAR-CCM+ 2019.1	Simcenter STAR-CCM+ 2019.2	Simcenter STAR-CCM+ 2019.3
February	June	October

Next-Generation Polyhedral Mesher

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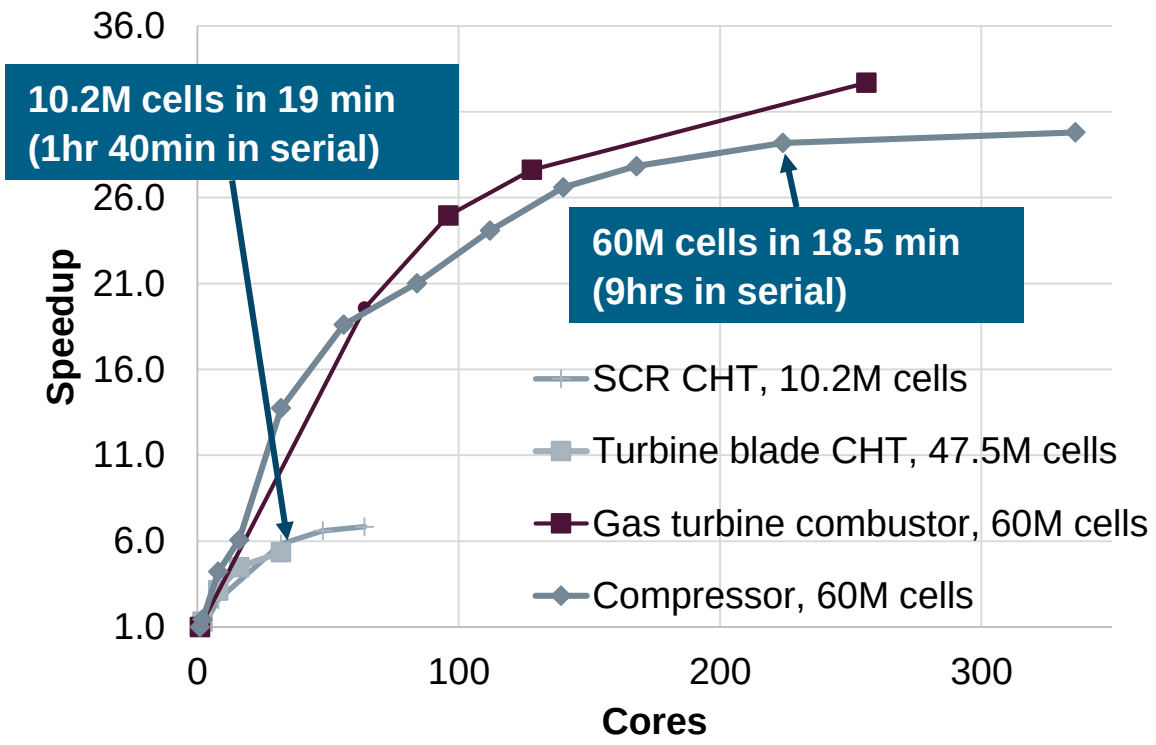
Hours not weeks

- Focus on parallel performance to address demand for high core-count meshing
- Simplified settings and consistent behavior with trimmed cell mesher
- Improved mesh quality metrics

- Easier-to-use: spend less time setting up
- Faster turnaround time: leverage same HPC resources as the solver
- More simulations with existing hardware and license resources means better design decisions

>30x Faster!



Adaptive Mesh Refinement

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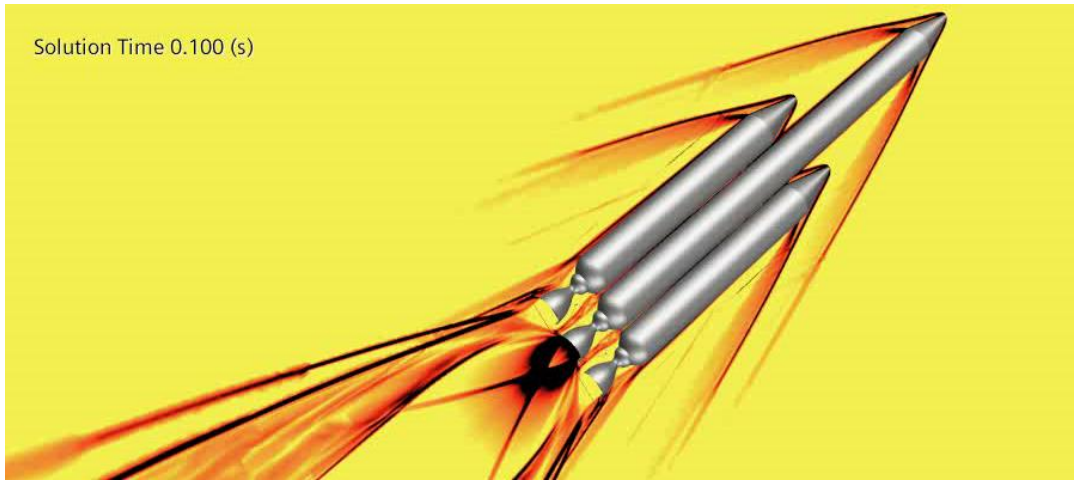
Hours not weeks

- Automatically adapt the mesh resolution during a simulation to refine where needed
  - User-defined solution-adaption
  - Novel model-based adaption (VOF, Overset, more coming…)

6x faster with AMR

- Consistency of results across users; simplifies mesh creation
- Improved accuracy through resolving physics
- Faster turnaround time through efficient cell distribution



Multiple Timescales in a Single Simulation

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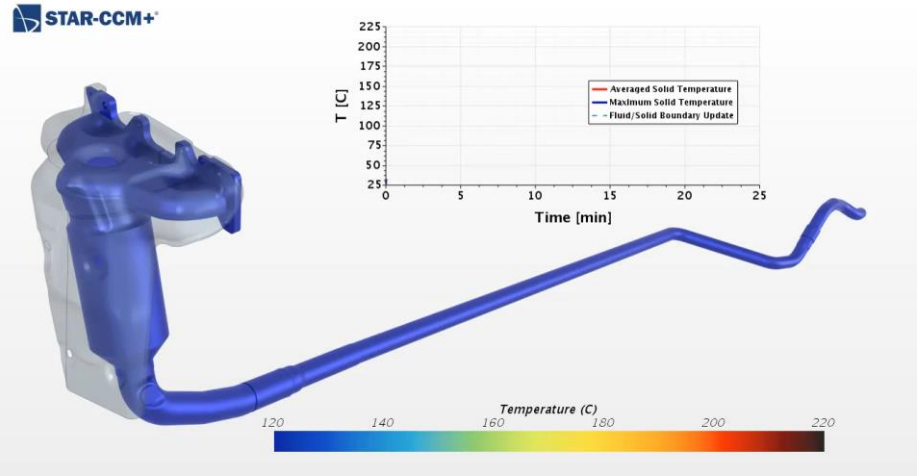
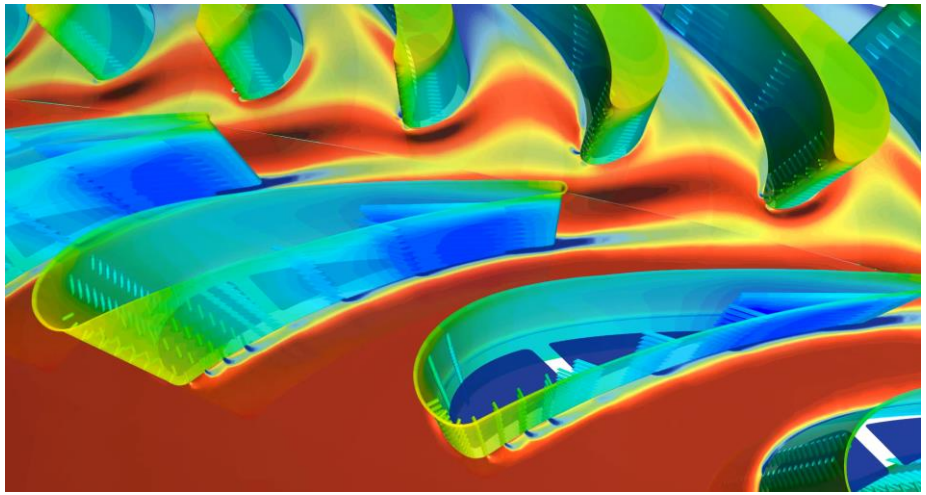
Hours not weeks

- Faster CHT simulations by avoiding the cost of running solid at fluid timescales
- More accurate solid temperatures by accounting for flow unsteadiness
- Improved robustness and user experience

- Transient solids with pseudo-steady fluids for long-duration CHT
- Transient fluids with steady-state solids for rotating machinery (harmonic balance)
- Transient fluids and solids with different time scales





VOF improvements

D4203

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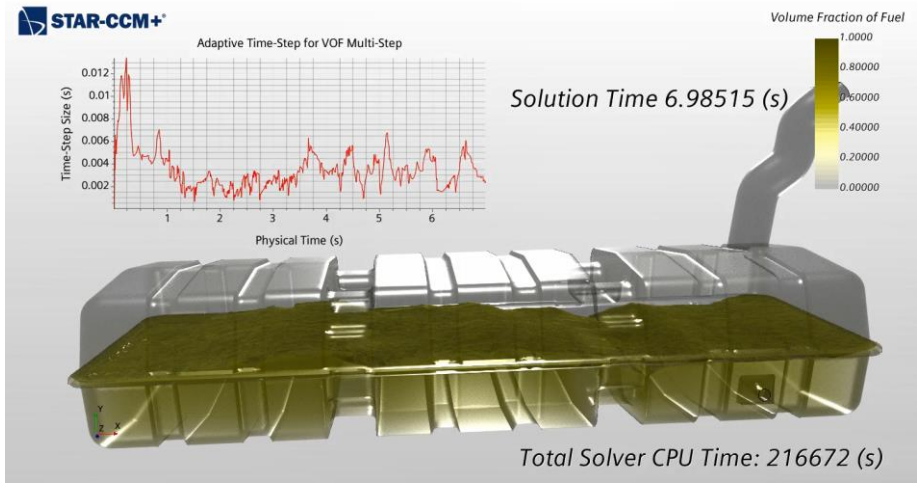
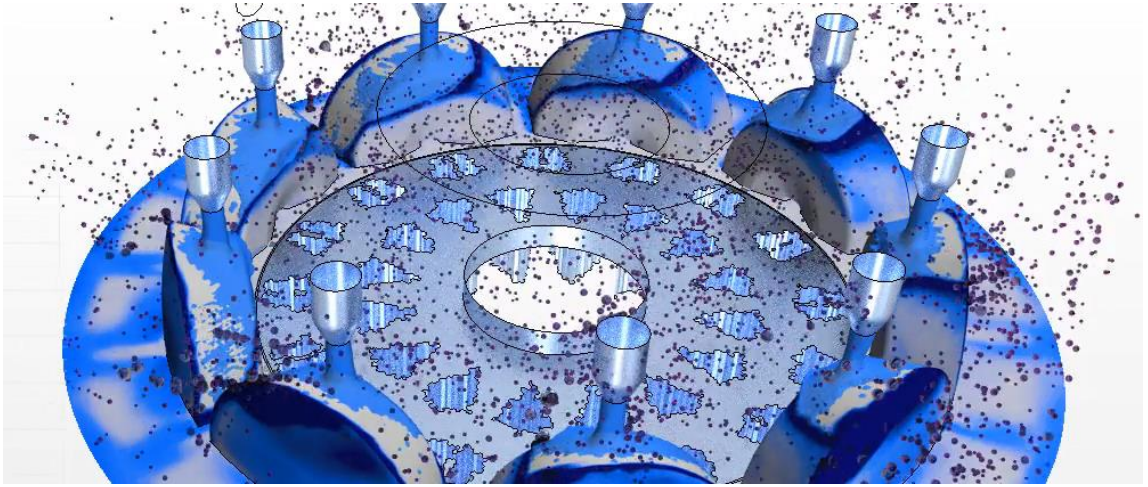
Hours not weeks

- VOF multi-step adaptive time-stepping
  - Filling, gearbox and tank sloshing simulations…
- Improved mass balance for under-resolved VOF time-steps
  - Liquid cooling of electric motors…



- Improved ease of use
- Up to 2.5x faster for similar accuracy
- 30x reduction in mass imbalance for gear-box increases confidence in the results



Screenplay

D401, D2264, D3502, D3558, D3838, D3952

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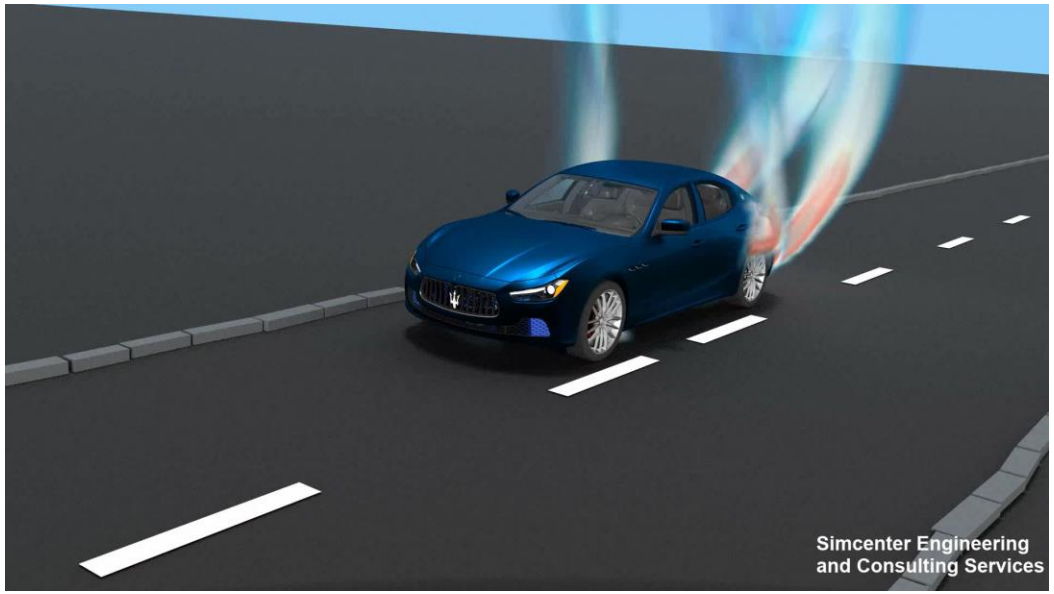
Hours not weeks

- Create animations of simulations using a keyframe approach
- Animate properties from multiple objects to create advanced animations

- Simple and straightforward drag-and-drop animation creation
- Create high-impact animations for effective communication



Advanced Rendering Performance

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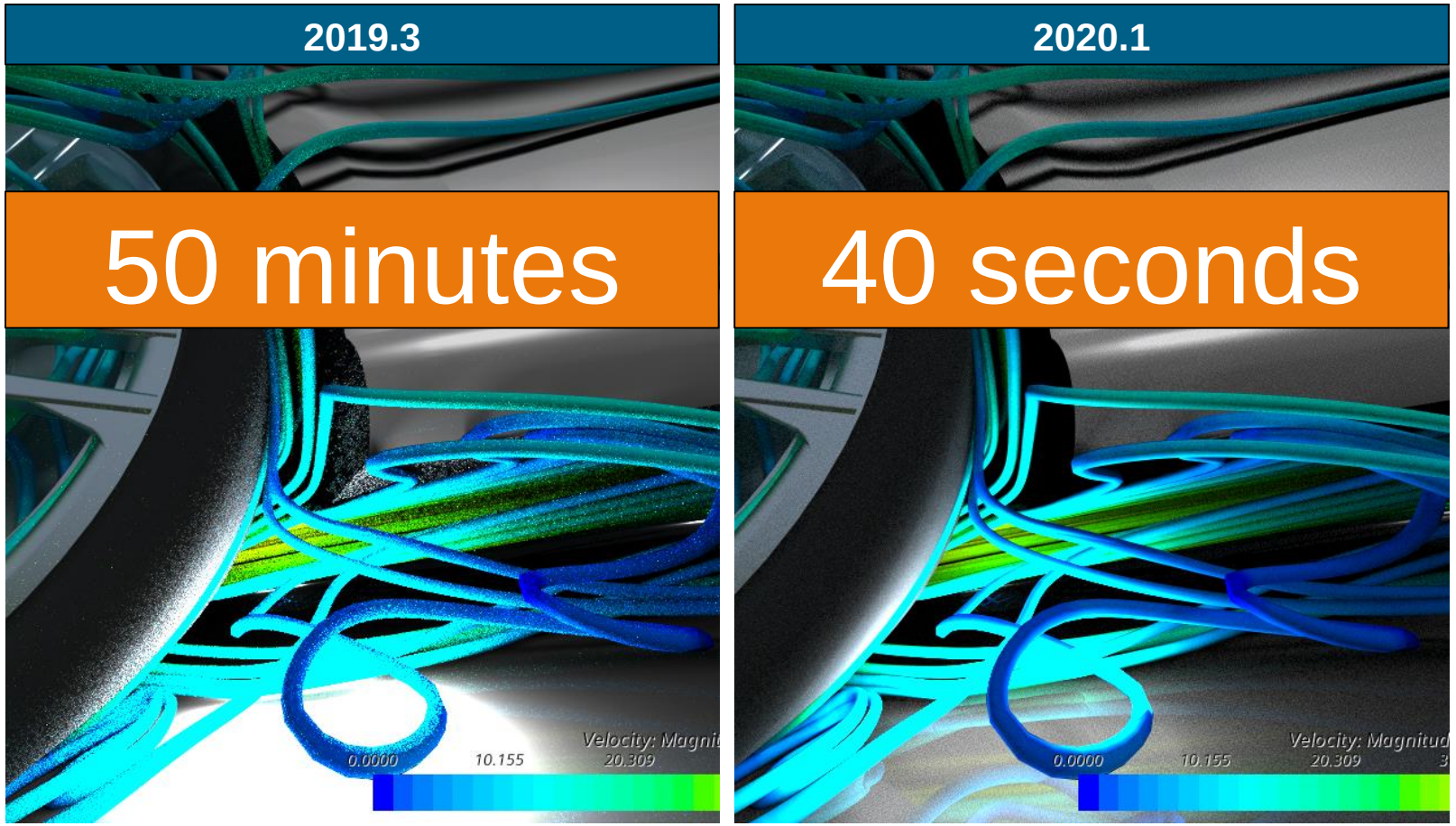
- Improved quality and rendering time for photo-realistic visualization

- Better communicate simulation results with decision-makers



Collaborative Virtual Reality

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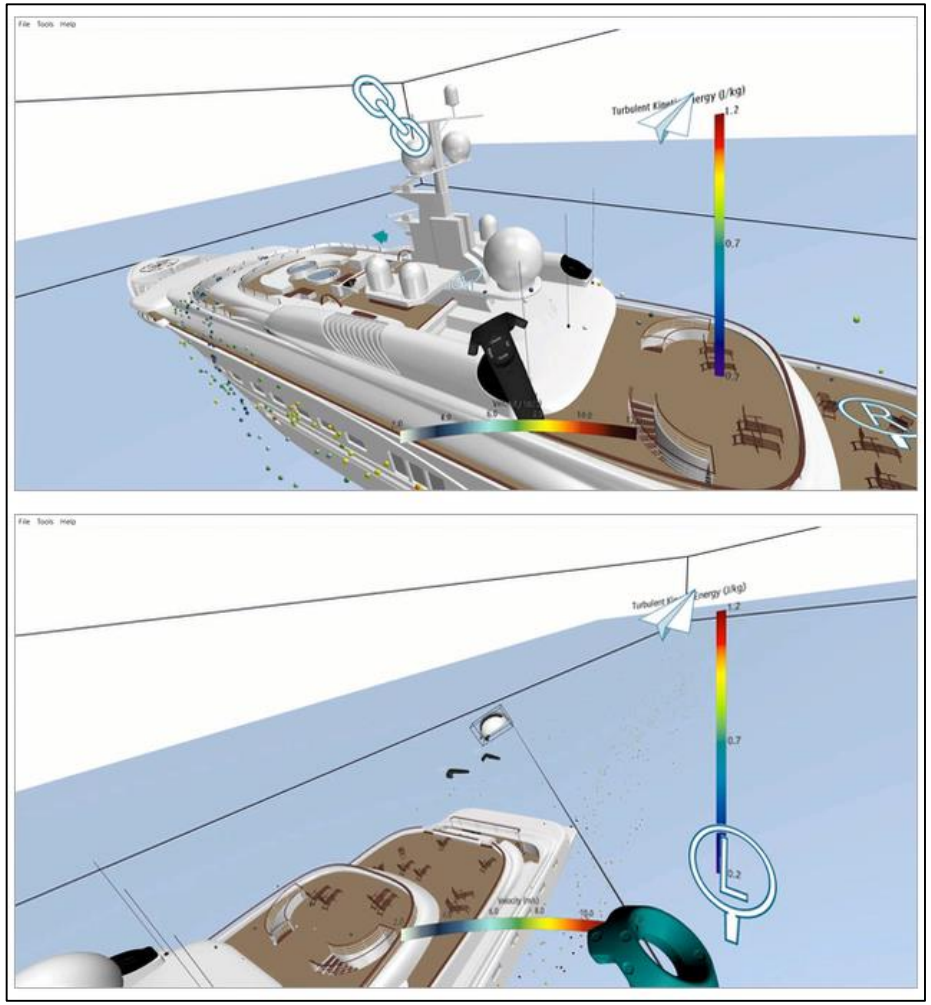
Hours not weeks

- Multiple users can connect to the same Simcenter STAR-CCM+ Virtual Reality model.
- Concurrently interrogate the model and view the solution

- Make better decisions faster by communicating with multiple stakeholders in the immersive environment



In Development: Local volume meshing

D1248, D320

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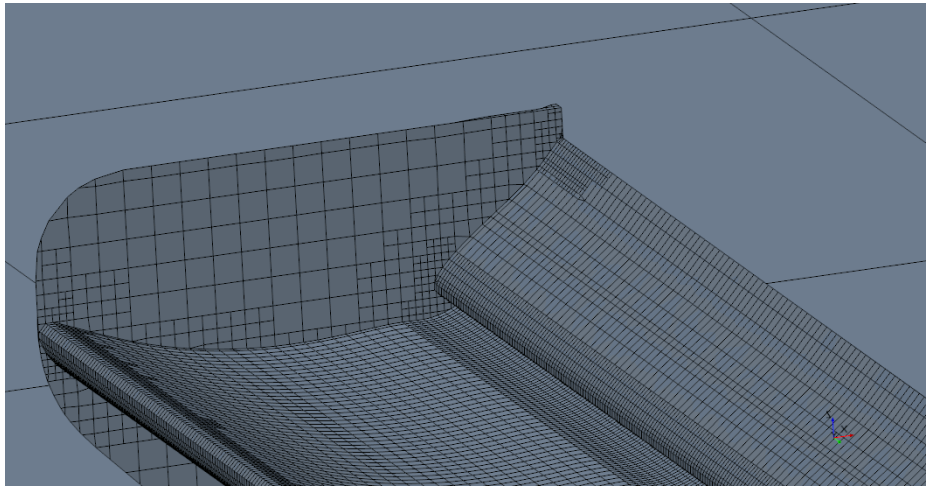
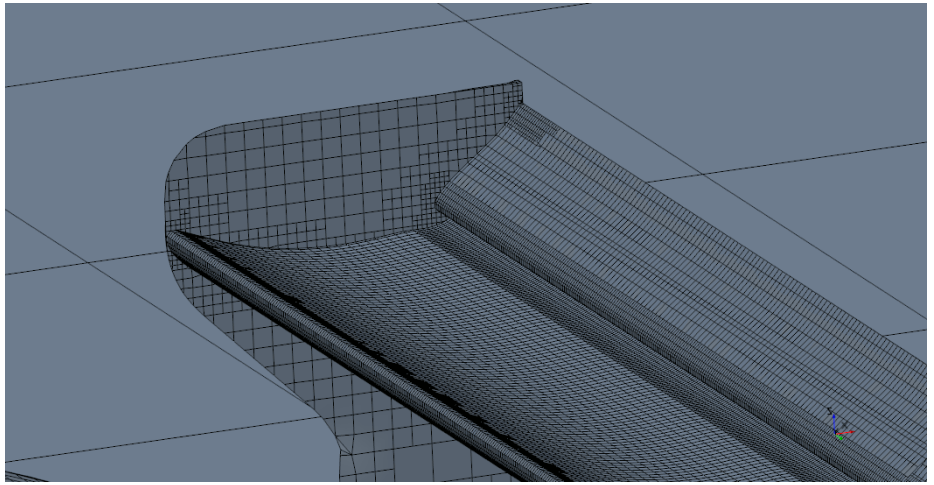
Hours not weeks

- Re-execute a volume mesh operation locally
  - With different mesh controls
  - With updated geometry
- Mesh outside the local operation remains unchanged

- Faster local mesh improvements for accuracy / convergence
- Faster evaluation of design changes
- Better isolate performance changes due to small geometry modifications





In Development: Predictive VOF-LMP Transition

D1541

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Hours not weeks

Hybrid approach using LMP for droplets and VOF for larger bodies of liquid

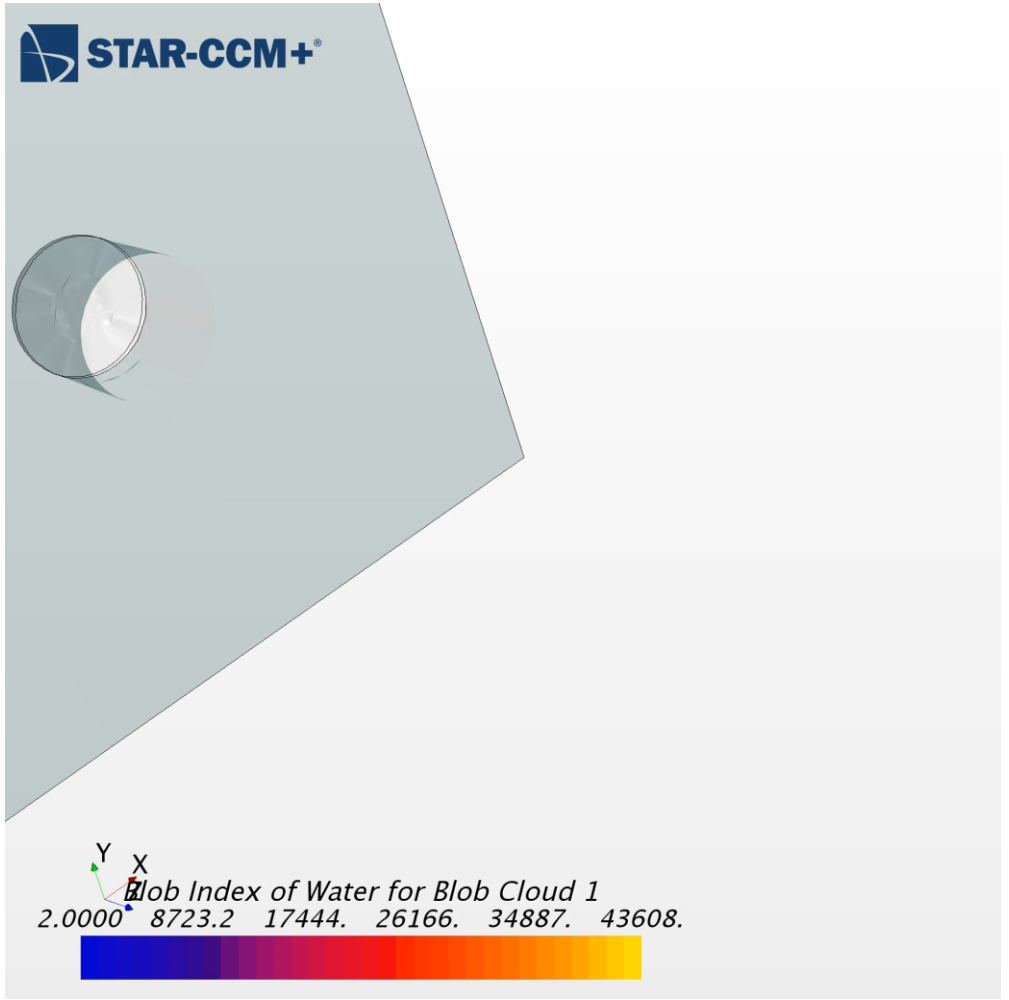
- Formation of droplets is resolved with VOF
- Subsequent tracking done with LMP

Typical use cases include:

- Vehicle water management
- Fuel spray breakup

Automatic transition of VOF droplets to LMP

- Transition criteria including local cell size
- Use with AMR to bridge scale gap



In Development: Fluid / Thermal Topology Optimization

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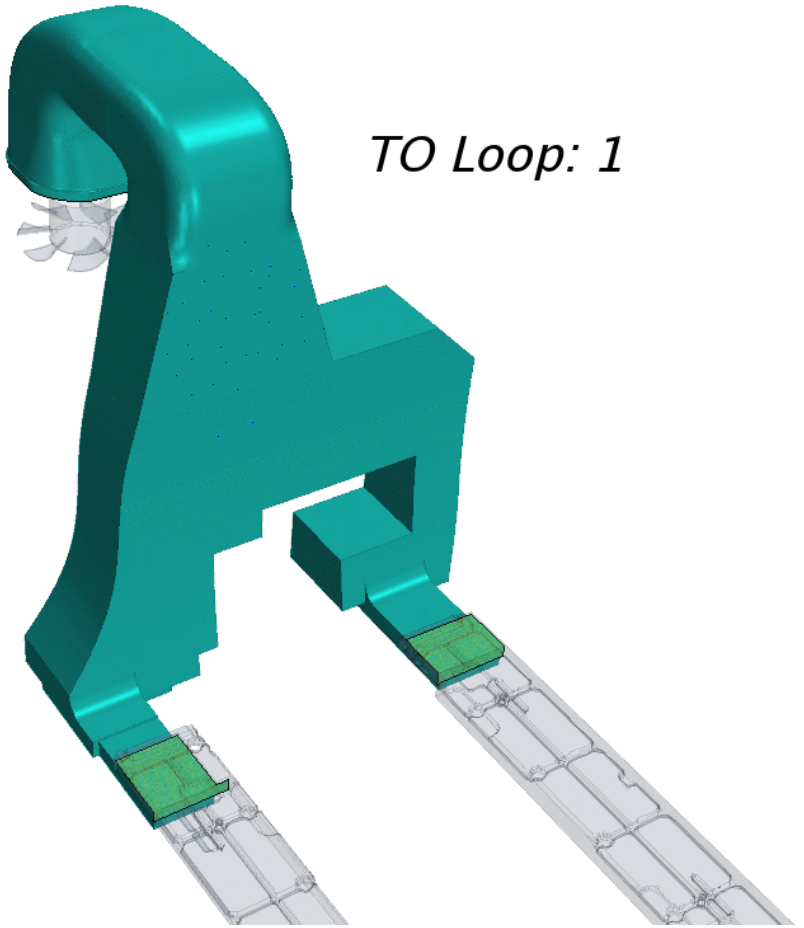
From 1 to 100s

- Robust and accurate adjoint-based level-set methodology
- Flexible to imposing geometric constraints
- Creates “manufacturable” geometries with fewer kinks and folds

- Easy workflow with minimal dependence on user input
- Discover performance-improving (sometimes non-intuitive) designs



In Development: Teamcenter Active Workspace inside Simcenter STAR-CCM+

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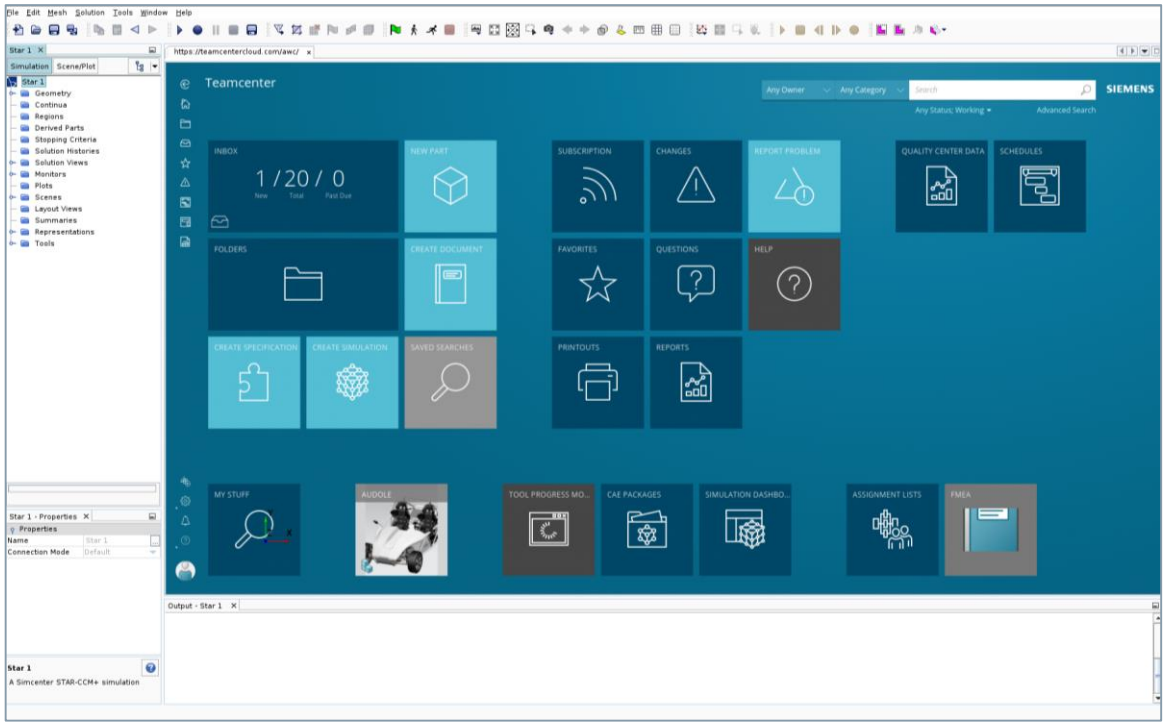
- The right data – at the right time
  - Access the right revisions directly and faster
  - Confidence in traceability of parts to simulation

- Seamless connection to Teamcenter
  - Analysts collaborating with the enterprise in one system
  - Direct access instead of unmanaged exports and exchange



e-Powertrain: Electric Machines

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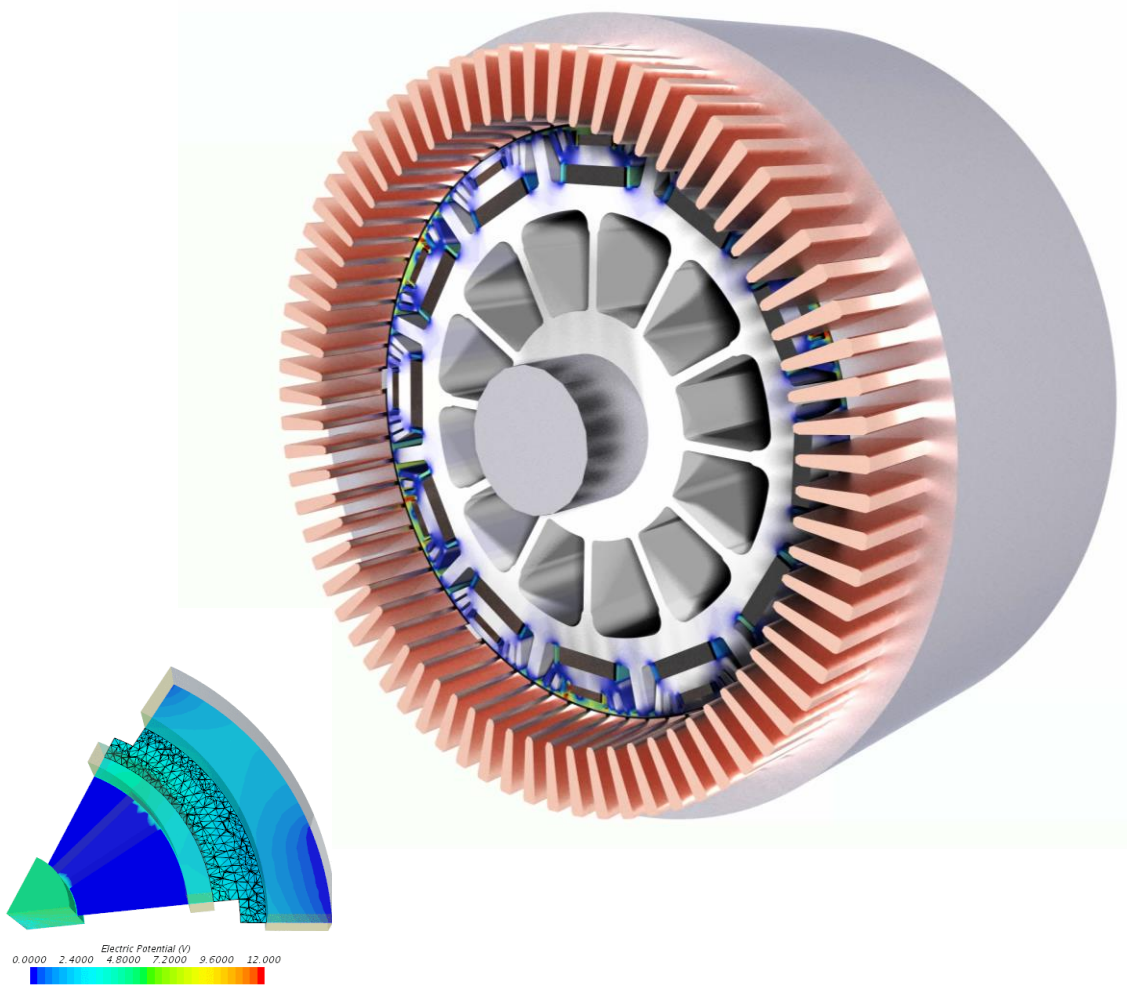
Leverage Complexity

- Simulation of 3D electromagnetics of e-machine with thermal (fluid and structural) interactions
  - High fidelity Magnet losses capturing their 3D nature and their true behavior in motion

- Key enablers for this application:
  - Airgap remeshing to allow for 3D rotor motion
  - Highly-scalable FE iterative solver to handle large, detailed geometries
  - Temperature sensitivity of magnetic materials (coming 2020.2)



e-Powertrain: Batteries

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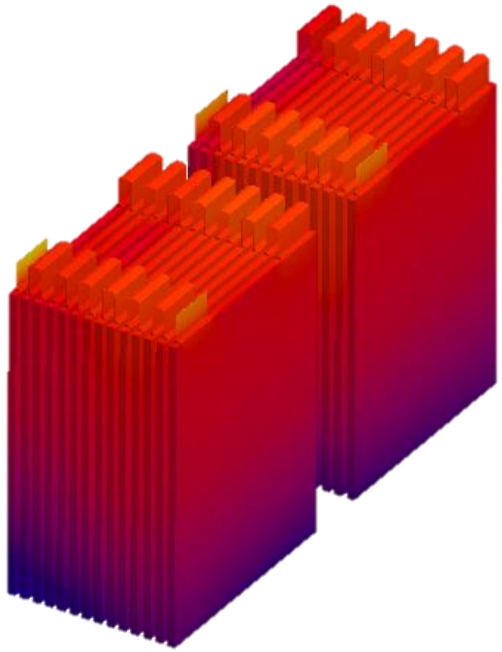
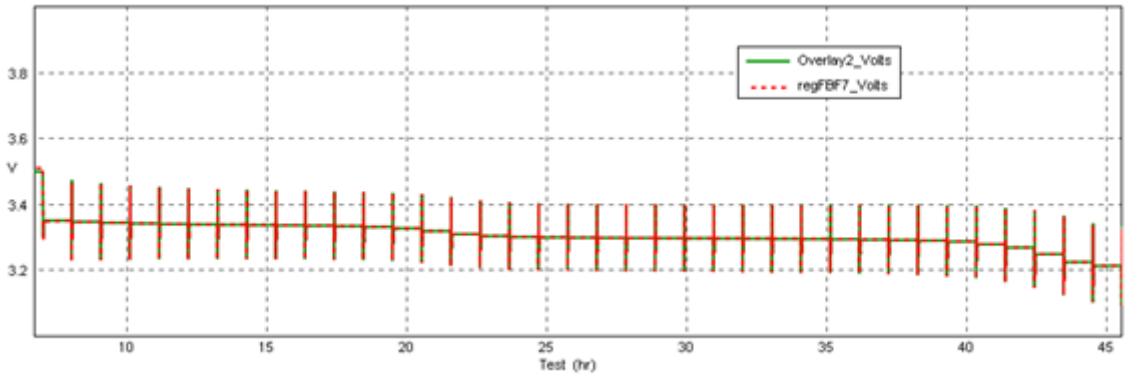
Leverage Complexity

- Characterize both performance and thermal behavior of battery in operation using equivalent circuit model
- Enable quick setup of battery model for further studies and decisions on cooling strategies

- Automatic fitting of RCR model parameters to imported experimental data
  - Fits multiple pulses in seconds
  - Flexible to user-specified level of resolution (0D to 3D RCR models)
  - Eliminates many tedious manual steps, prone to user error





In Development: Electric Machines

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Leverage Complexity

- Near Term
  - Higher resolution machine geometries with complex coil windings automated setup
  - Improved understanding of equivalent circuit models with better access to model editing via interactive circuit diagram graphical editor

- Mid Term
  - Improved resolution and performance with high-order EMAG FE solver
  - Integrated electric motor design offering combining SPEED/MotorSolve

In Development: Batteries

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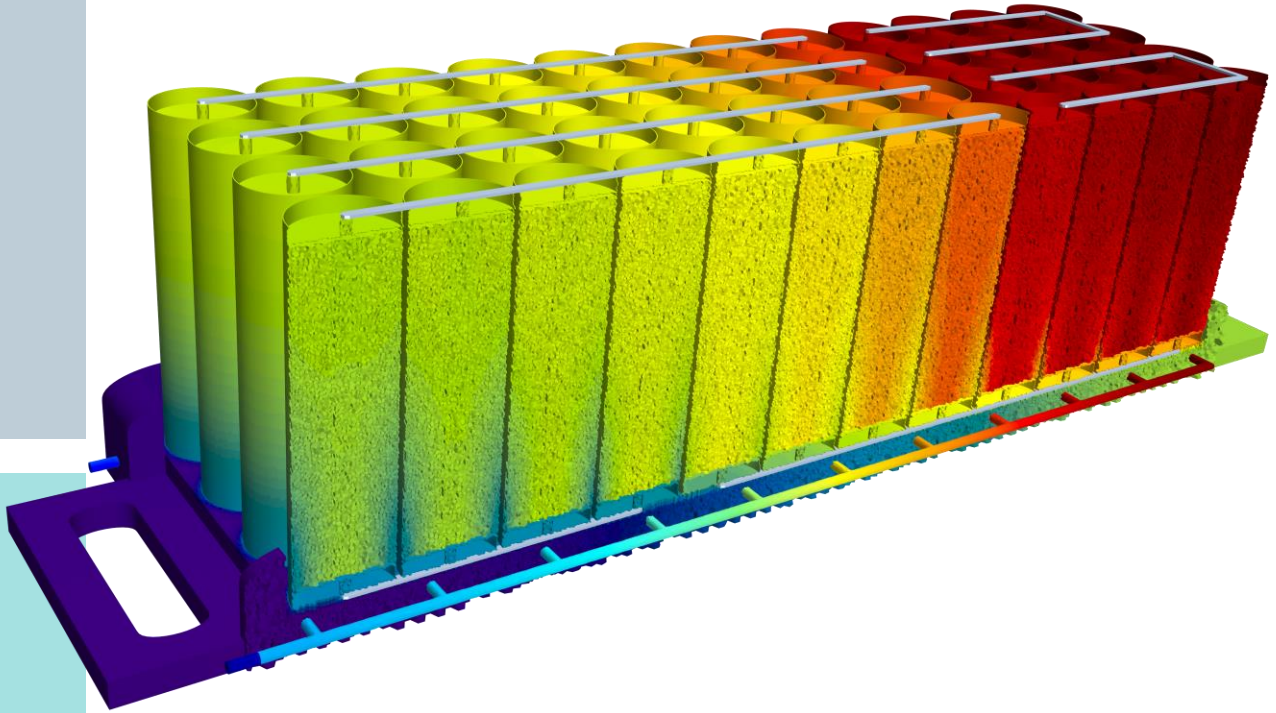
Leverage Complexity

- Near Term
  - Predicting battery cell ageing/degradation
  - Improved workflow for Thermal Analyst
    - Remove need for BDS
    - Support general CAD for cell geometry

- Mid Term
  - Accounting for expansion/contraction
  - Abuse
    - Predicting effect of crush, penetration, internal shorting
    - Thermal runaway propagation



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Thank you!

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