



creo®



22. Bayreuther 3D-Konstrukteurstag
15. September 2021

PTC CREO NEUIGKEITEN PRODUKTAUSBLICK PRÄSENTATION



Klaus Raab
&
Christoph
von Andrian-Werburg



22. Bayreuther 3D-Konstrukteurstag

15. September 2021

Programm

Ab 9:00				
Vortragsrunde				
9:00 bis 9:10	Begrüßung und Einführung in die Konferenz Prof. Dr.-Ing. Stephan Tremmel, LS Konstruktionslehre und CAD, Universität Bayreuth			
9:10 bis 10:10	Neuigkeiten / Produktausblick PTC, Live-Präsentationen PTC Themen INNEO. Christoph von Andrian-Werburg, PTC, München Klaus Raab, INNEO Solutions, Ellwangen			
10:10 bis 10:30	Session 1	Session 2	Session 3	Session 4
10:30 bis 11:00	3D in der technischen Dokumentation – Welche neuen Möglichkeiten bietet die Kombination HTML und 3D Andreas Vogel, theorie3.De	Live-Simulation mit Ansys Discovery Joel Grognez, CADFEM GmbH	Nachhaltige additive Innovationen durch interdisziplinäres Mindset Christian Bay, Campus Additive.Innovationen, UBT	Elevator Pitch verschiedener Forschungsprojekte
11:00 bis 11:30	Model Based Definition – Möglichkeiten zur digitalen Produktdefinition im 3D-Modell mit Creo Parametric Klaus Raab, INNEO	Livesimulation im Konstruktionsalltag: Erfahrungen aus der Praxis Marc Vidal, CADFEM GmbH	Generative Design: Hocheffiziente Erzeugung optimierter Leichtbaustrukturen Gereon Deppe, Thomas Reiher, Hexagon / MSC Software	
11:30 bis 12:00	NX Mold Wizard - Spritzgußwerkzeuge intelligent & effektiv konstruieren Uwe Müller, PBU CAD-Systeme	Finite-Elemente-Analyse mit der OpenSource Software Code-Aster Johannes Ackva, Ingenieurbüro für Mechanik	Machine Learning im CAE Cornelia Thieme, Hexagon / MSC Software	Diskussion
12:00 bis 13:00	Mittagspause			
13:00 bis 13:30	Semantisches Datenmanagement für Softwaretools in der digitalen Produktentwicklung Tobias Siegel, Andreas Kormann LS Konstruktionslehre und CAD, UBT	Model-led NVH Process for EV-drive applications, - the next chapter of CAE-led design Annabel Shahaj, Romax Technology GmbH	Topologieoptimierung (Generatives Design) und 3D-Druck mit Creo Klaus Raab, INNEO	
13:30 bis 14:00	Ansatz zur Bereitstellung von Modelldaten für Strömungssimulationen auf Basis von CT-Daten Dirk Hofmann, IAVT	CAD-unabhängige Topologie-Optimierung für Entwickler mit ProTop Urs Simmler, GIA Informatik AG	Tribologische Kontakte verstehen und optimieren – Ein numerischer Ansatz zur Berechnung hochbelasteter TEHD-Kontakte. Christian Orgeldinger, LS Konstruktionslehre und CAD, UBT	
14:00 bis 14:30	Die Zukunft der Produktentwicklung: CAD, Datenmanagement und Echtzeit-Zusammenarbeit in einer Lösung Ludwig Haas, INNEO	Automatisierte Simulation von Sandwichbauteilen mit Z88Aurora Johannes Glamsch, Florian Hüter LS Konstruktionslehre und CAD, UBT	OpAL – mit Optimierung, Additiver Fertigung und Leichtbau gegen die Folgen der Pandemie Thomas Schütt, LS Konstruktionslehre und CAD, UBT	
14:30 bis 14:40	Abschlussdiskussion der Vortragsrunde Prof. Dr.-Ing. Stephan Tremmel, LS Konstruktionslehre und CAD, Universität Bayreuth			
Ab 15:00				
Fachausstellung				
15:00 bis 16:00	Elevator Pitch der Aussteller			
16:00 bis 17:00	Fachausstellung in verschiedenen Räumen			
17:00 bis 17:15	Abschlussdiskussion und Verabschiedung Prof. Dr.-Ing. Stephan Tremmel, LS Konstruktionslehre und CAD, Universität Bayreuth			



creo®

Klaus Raab

Anwendungsberater

INNEO Solutions GmbH
kraab@inneo.com

+49 7961 890 146

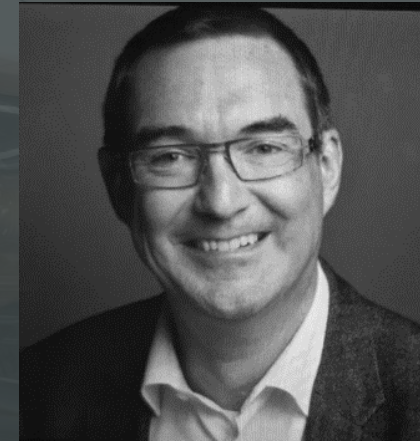


**Christoph von
Andrian-Werburg**

Director CAD Sales

PTC Parametric Technology GmbH
candrian@ptc.com

+49 151 19548852



AGENDA

Usability & Productivity

New Creo Methods

Innovation & Roadmap



creo®

USABILITY AND PRODUCTIVITY

Enhancements to the everyday core functions

- Streamlines workflows
- Improves ease of use
- Helps automate manual processes

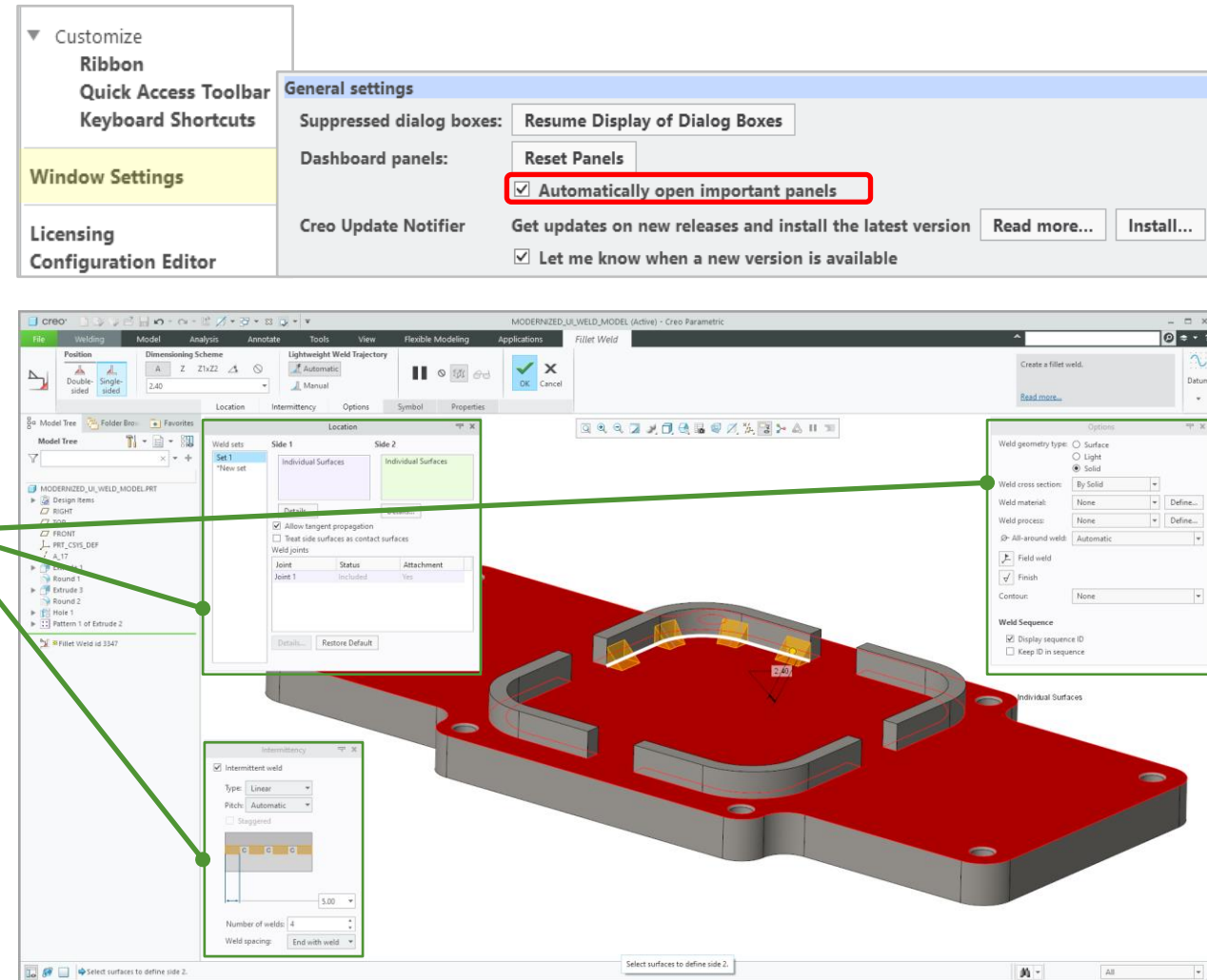


USABILITY AND PRODUCTIVITY

Creo User Interface

Modernized UI – Dashboards and Skins

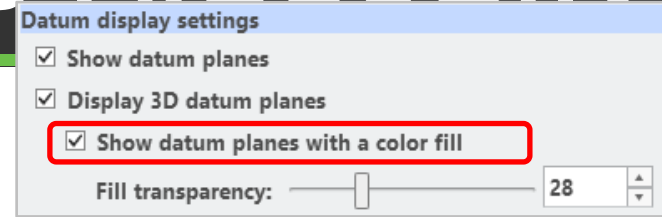
- Improved dashboard layout
 - Command ribbon organization improves workflow, usability and user experience
- Optimized UI
 - New option to **Automatically open important panels**
 - Auto expand panels when entering feature definition workflow
 - Detach multiple panels from the dashboard and display them simultaneously
 - Drag to panels to preferred position on screen
 - Panel positions are remembered and restored
 - Easy access and visibility to feature creation options and defining references
 - Detachable panels simplify interaction and streamline workflows when defining features with a rich set of options



Creo User Interface

Shaded 3D Datum Plane Display

- Modernized display of datums using semi-transparent 3D object
 - Datum config options: **3D_datum_display_fill**, **3D_datum_planes_transparency**
 - Easier to visualize datums and intersections with geometry
- Transparent fill is switched off programmatically
 - Sketcher, HDR display (hidden, no hidden, wireframe)
- Toggle Plane Fill Display from graphics toolbar



Modernized display of coordinate systems and datum points

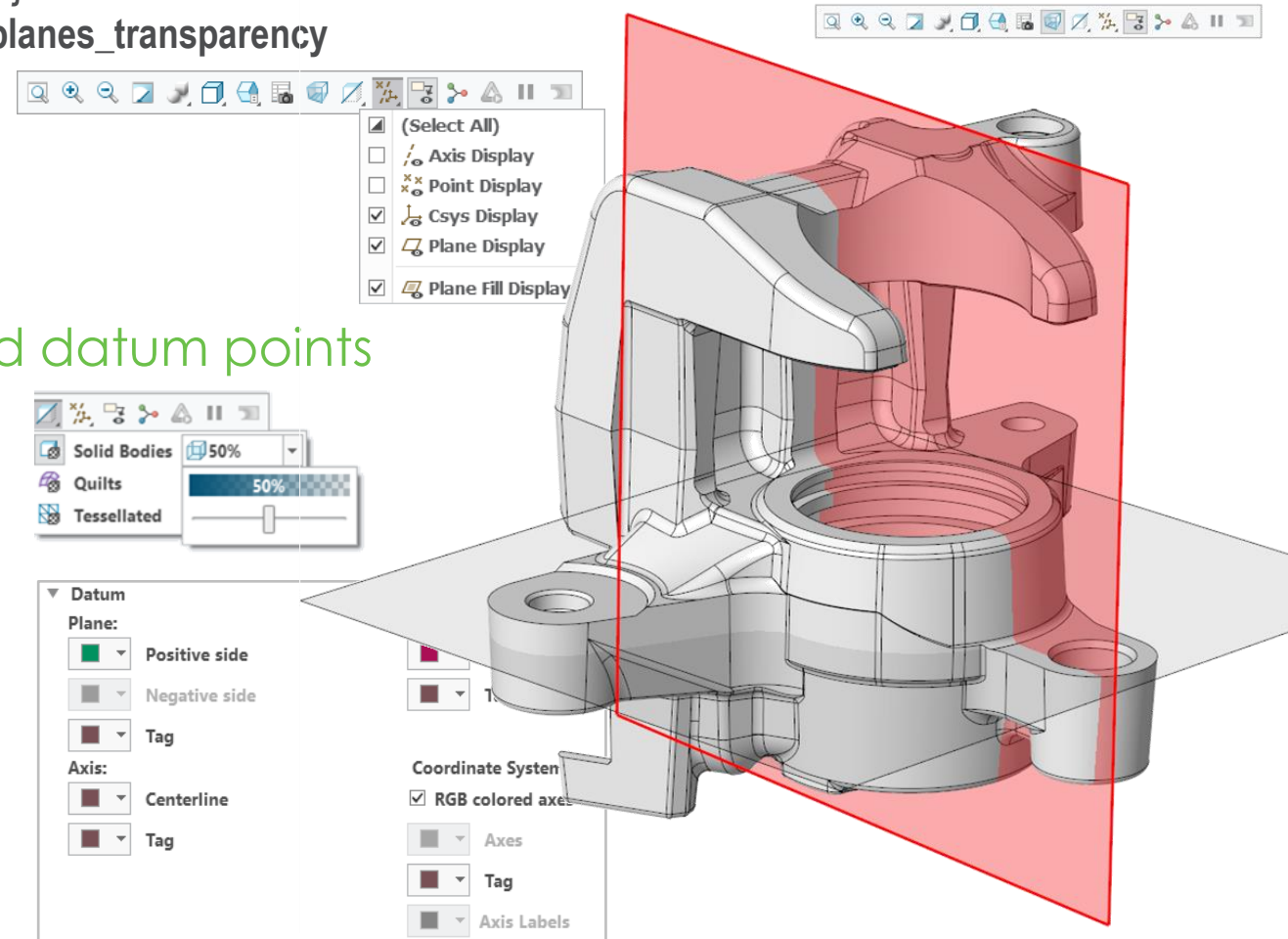
- CSYS config option: **csys_color_rgb**

Customize display settings (i.e., colors)

- File > Options > Systems Appearance > Entity Display
- File > Options > Entity Display > Datum display settings

Legacy 2D datum planes can improve performance in some areas

- Config option: **enable_legacy_datum_planes** (Yes)

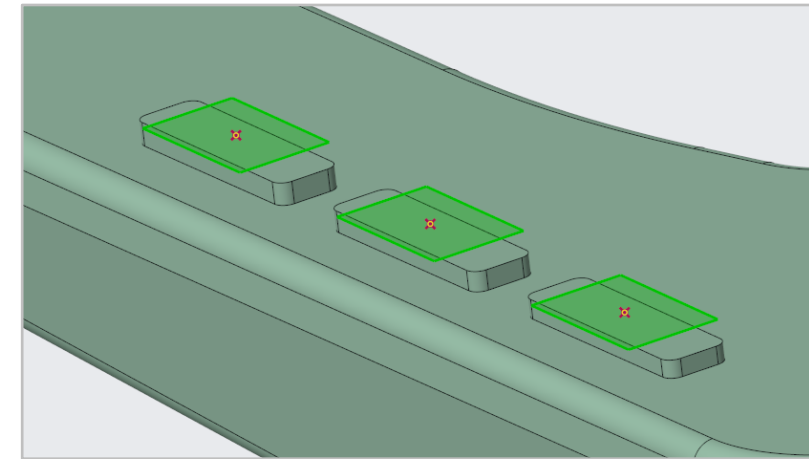


USABILITY AND PRODUCTIVITY

Creo User Interface

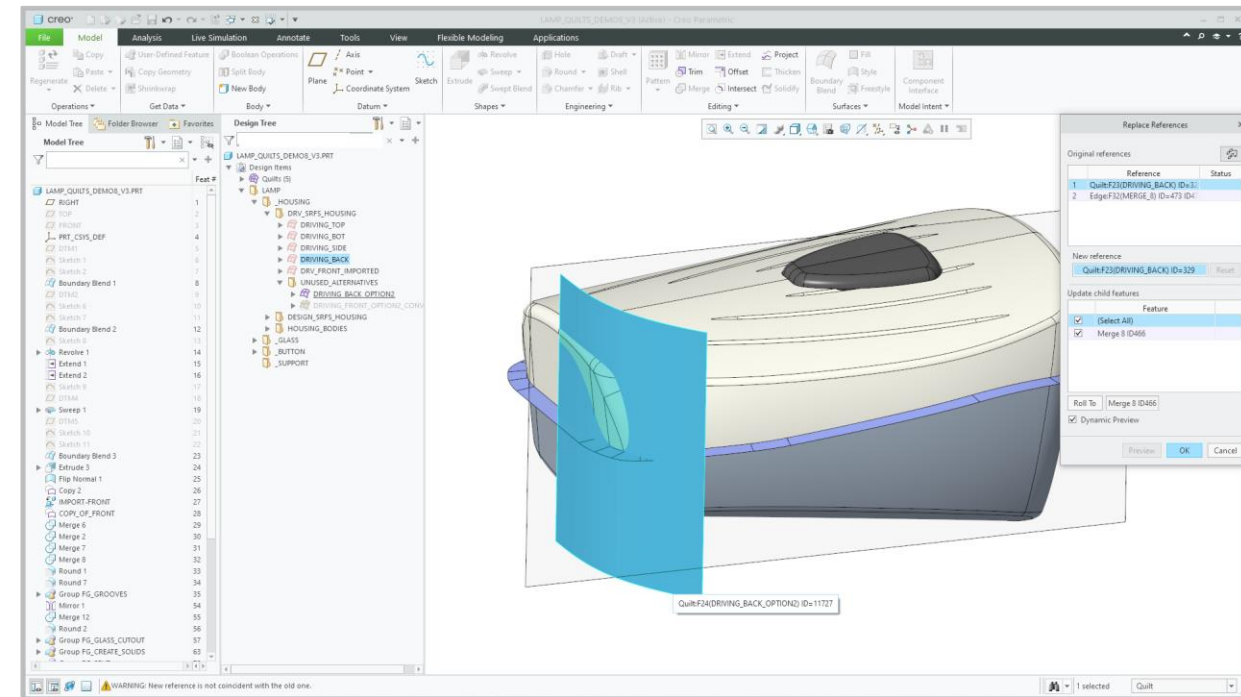
Options to Control Default Datum Plane Size

- Additional Options To Control Datum Plane Default Size
 - Default size is automatically calculated to fit the model outline (as previously)
 - Default size is automatically calculated to fit the size of the display reference
 - Default size is set to pre-configured
- Additional logic for point and vertex placement references
- Configuration options:
 - datum_display_default
 - datum_outline_default_height
 - datum_outline_default_width



Enhanced “Replace References”

- Simplified reference replacement workflow when replacing quilt geometry
- New option “Recursive References”
 - For Quilt reference replacements
 - Recursively list potentially impacted references in the Replace References dialog and replace them
- New option “Dynamic Preview”
 - Automatically trigger regeneration and move to next missing reference

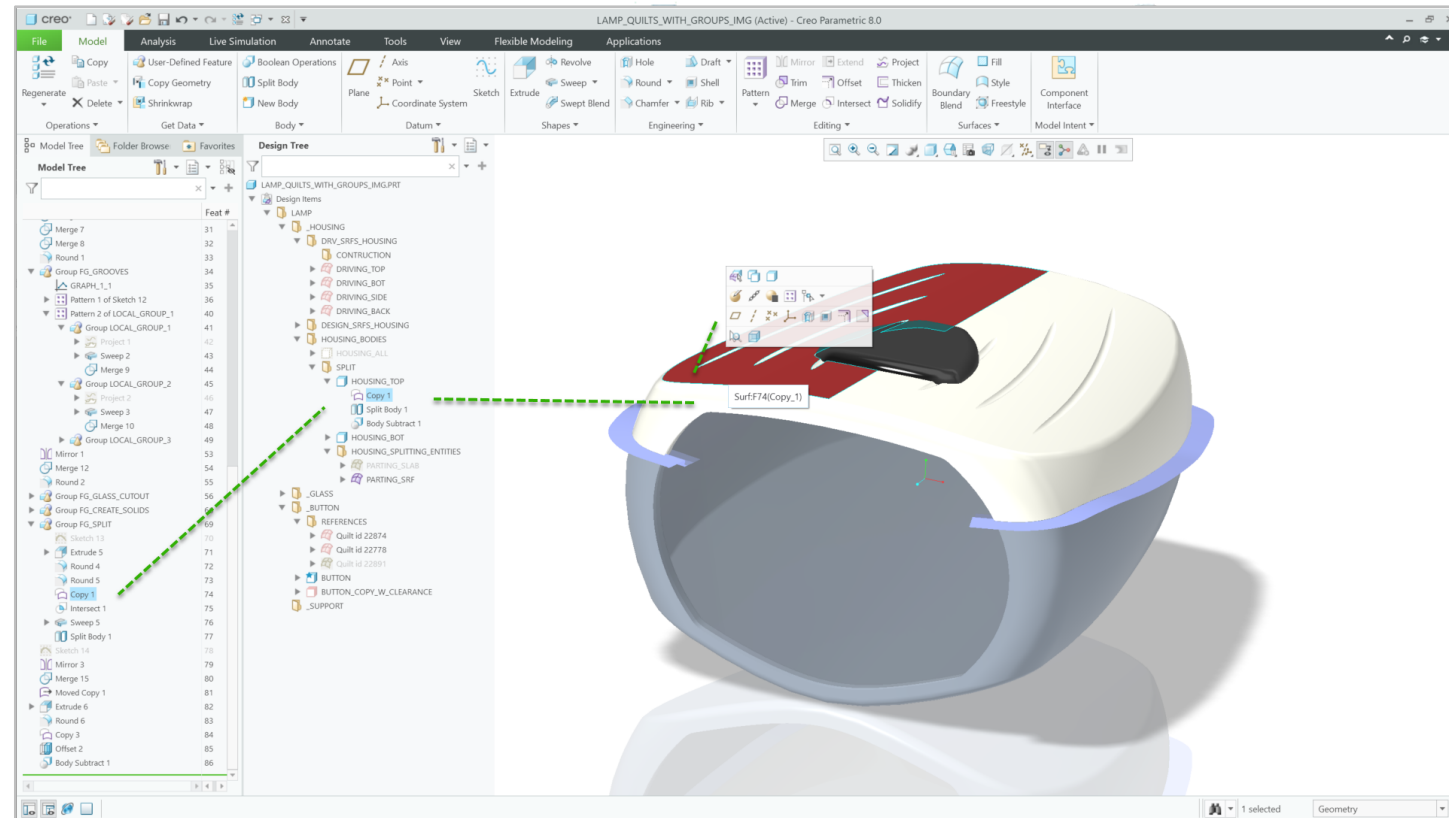
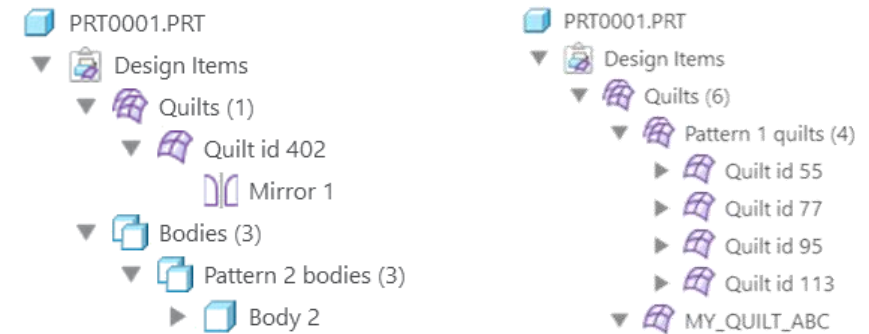
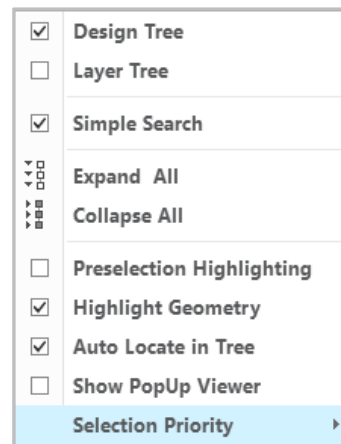


USABILITY AND PRODUCTIVITY

Creo Model and Design Tree

Side-by-side positioning of Model and Design Tree

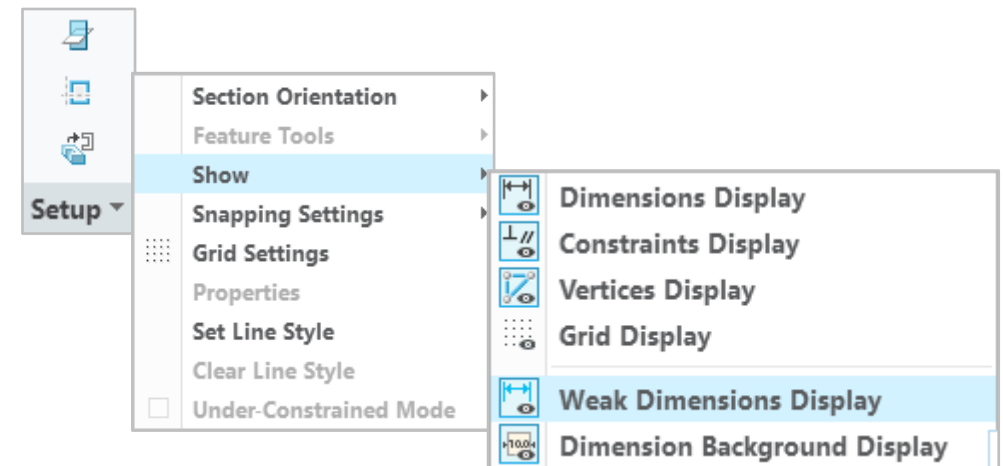
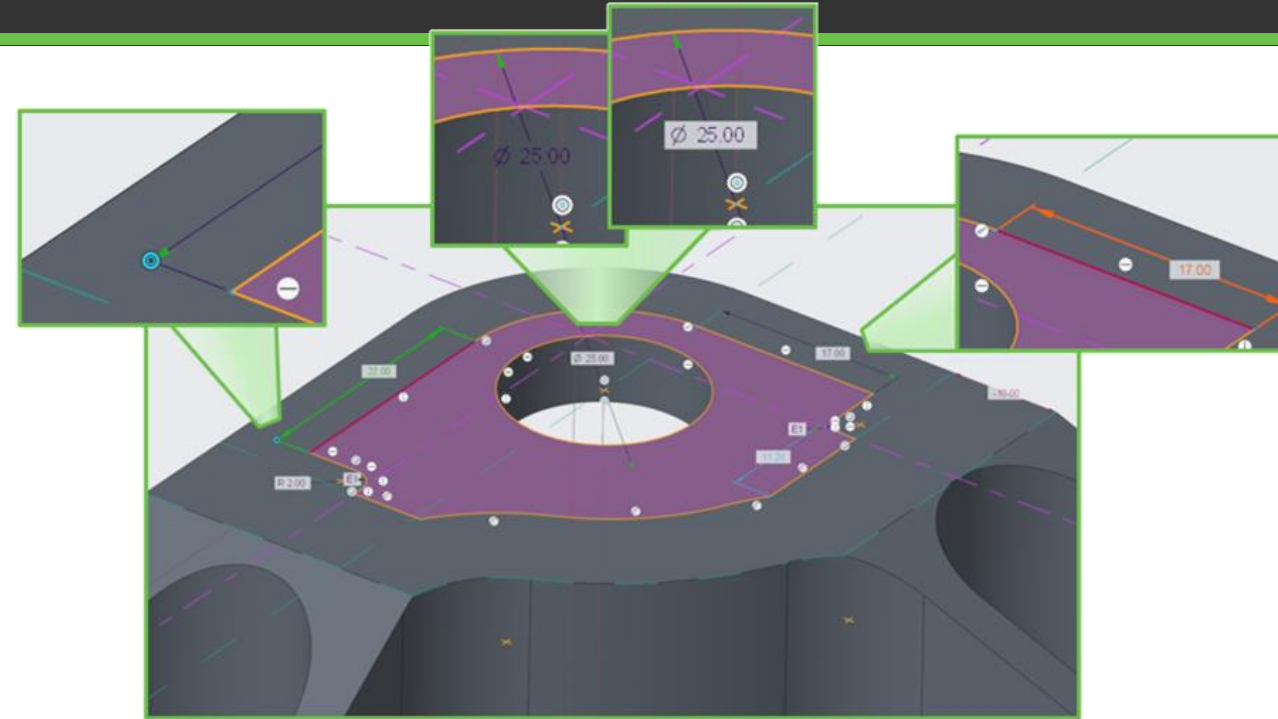
- Easy visualization of design features and design intent
- Secondary trees (i.e., layer tree, design tree) can be docked to various screen locations
 - Within or outside navigation bar
- Separate configuration settings and “Simple Search”
- Auto Locate in Tree
 - Design items in Design Tree
 - And
 - Features in Model Tree



Creo Sketcher

Improved Visibility Controls in Sketcher

- Control of dimension background appearance
 - Color and transparency
- More pronounced dimension display during selection and pre-selection
 - Sketch_thick_dim_line_highlight (yes)
 - Dimension and sketch entity are highlighted when cursor is placed over dimension
- Modernized dimension dragger
 - Dragger icon is easier to see, select and drag
- Easy access to sketch display options
 - Toggle display of Weak Dimensions and Dimension Background

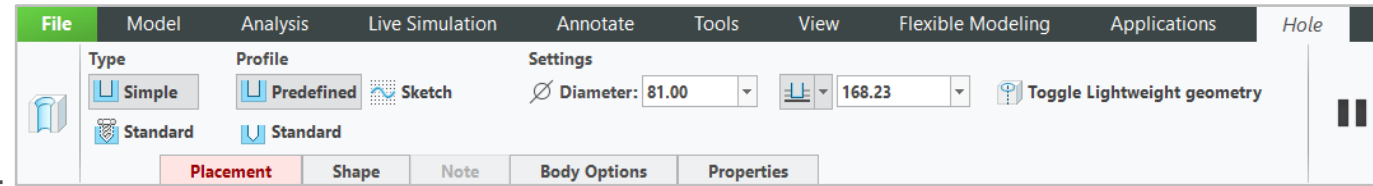


USABILITY AND PRODUCTIVITY

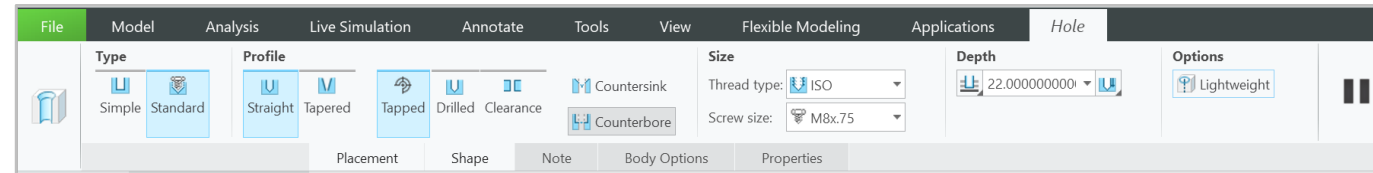
Creo Modeling

Enhanced Hole Feature UI and Usability

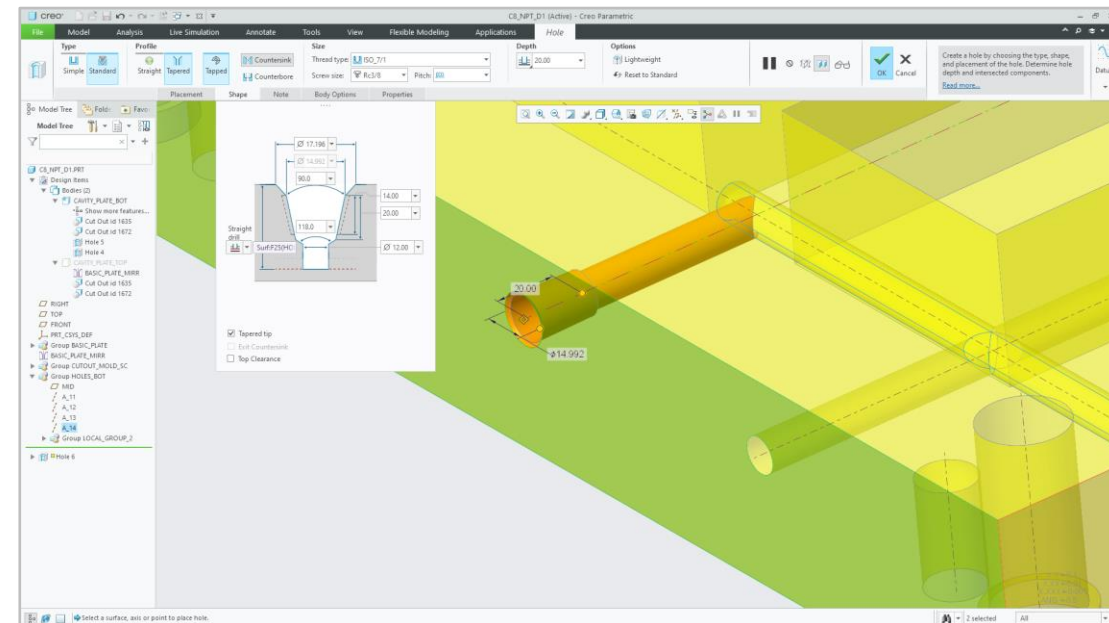
- Improved Command Ribbon organization and UI layout
 - Simplified workflow with improved clarity and access to hole feature creation tools
- Easy to understand icons and labels
- New Tokens for hole note call-outs
 - HOLE_INSTANCE_COUNT (number of instances as in PATTERN_NO)
 - HOLE_INSTANCE_LEFT_BRACKET (evaluates to “(“)
 - HOLE_INSTANCE_RIGHT_BRACKET (evaluates to “)”)
 - HOLE_INSTANCE_HYPHEN_SYMBOL (evaluates to “-“)
 - HOLE_INSTANCE_X_SYMBOL (evaluates to “x”)
 - HOLE_INSTANCE_SPACE (evaluates to “ “)
 - Improved call-out control to differentiate single hole and multiple holes
 - Enhanced compliance to MBD and drawing standards
- Medium-fit options for metric clearance holes
- Standard compliance (selected hole chart corrections)



Creo 7.0



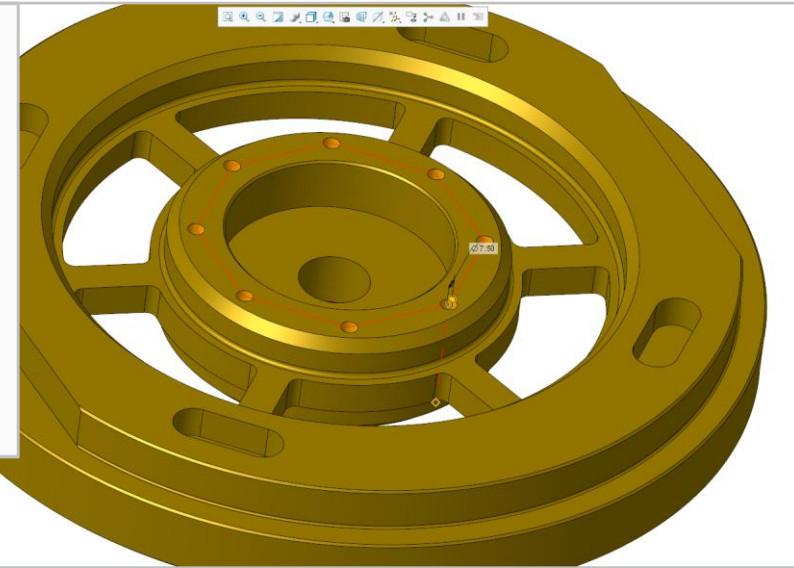
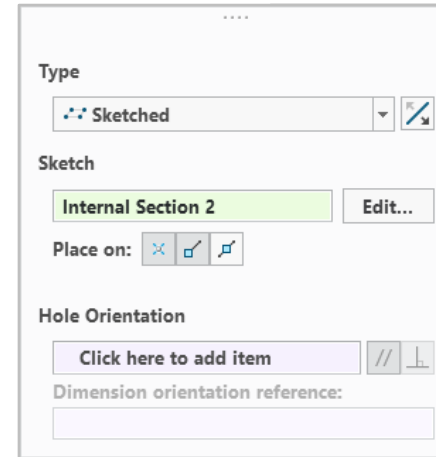
Creo 8.0



Creo 8.0 Modeling

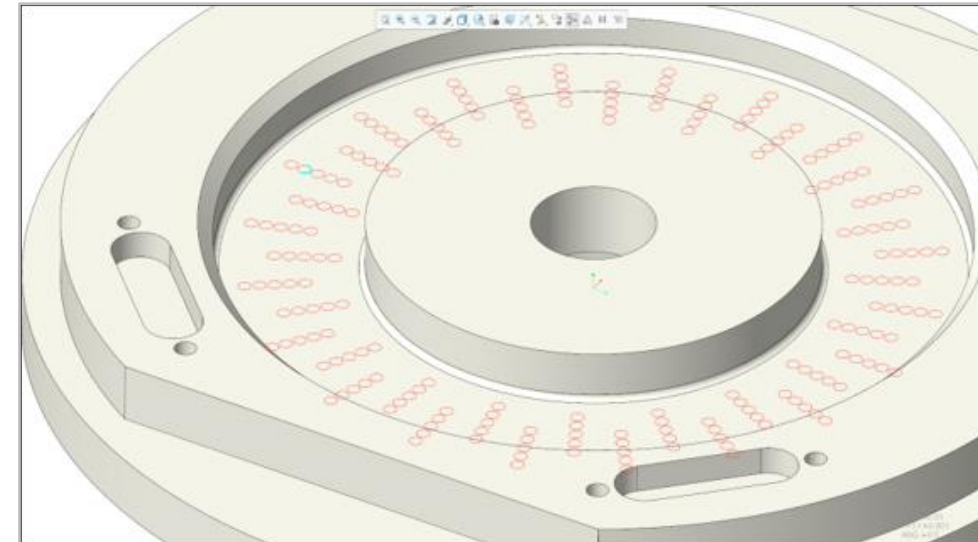
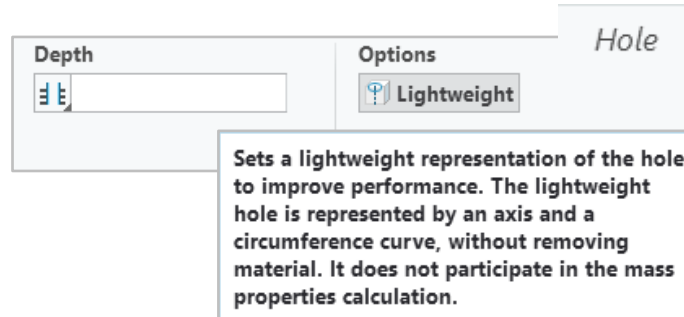
Multi-hole Feature

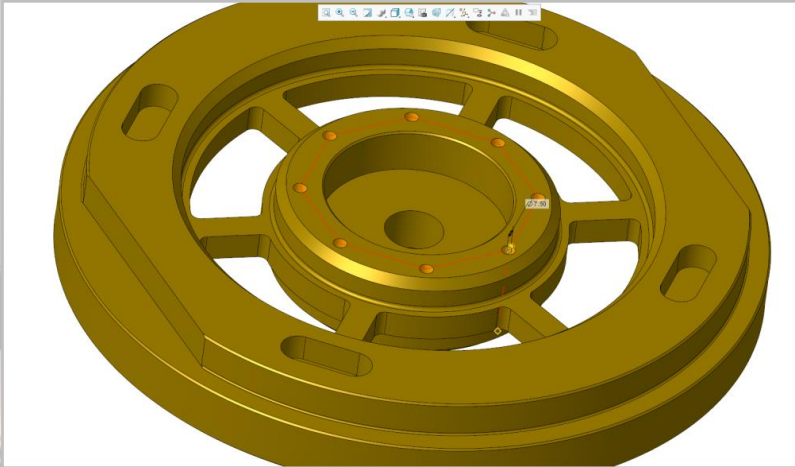
- New sketch-based placement workflow option in hole feature
 - Option to place holes on sketched points and endpoint and midpoints of sketched lines
- Supporting sketched holes with drawing hole tables
- Reference pattern support
 - Multi-hole feature can be used as a Ref Pattern for subsequent geometry
- Hole note pattern number summation



Lightweight Representation Support for All Hole Types

- Option to set lightweight representation of hole to improve performance
 - Lightweight representation propagates to all pattern members
 - Previous functionality limited lightweight representation to simple hole types with rectangular profile





AGENDA

Usability & Productivity

New Creo Methods

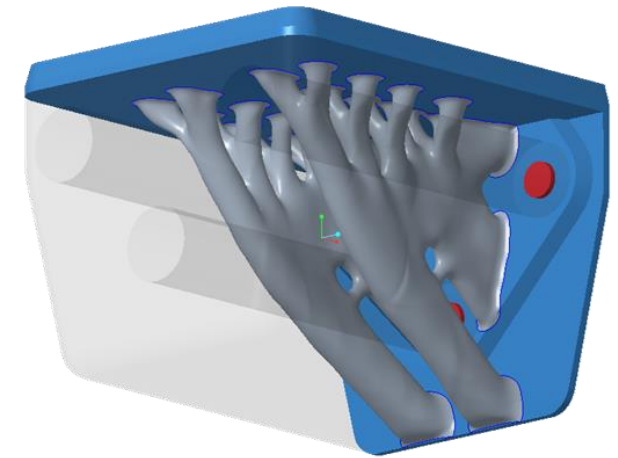
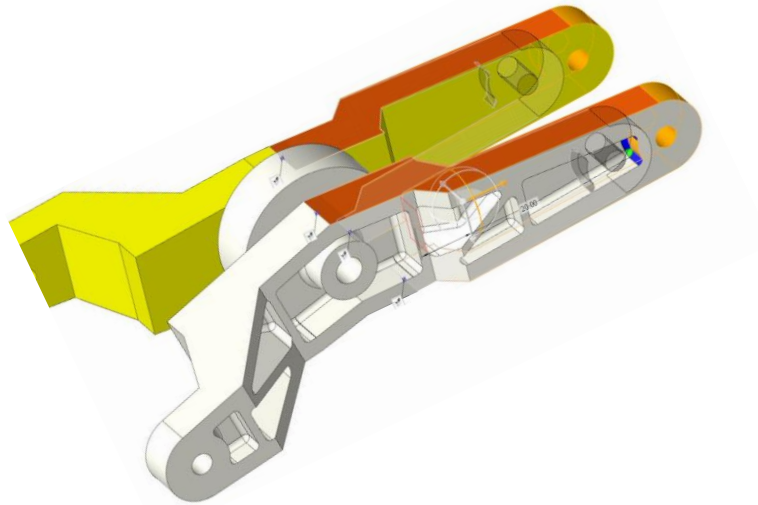
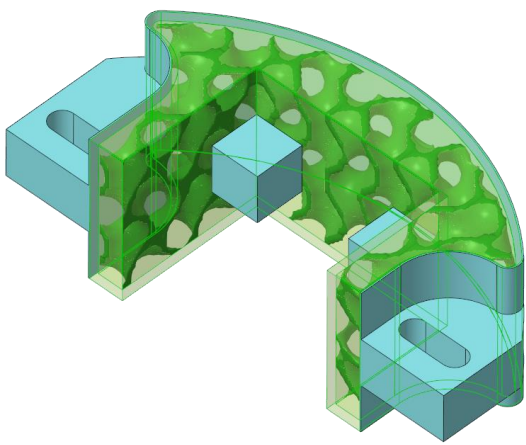
Innovation & Roadmap



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MULTIBODY DESIGN

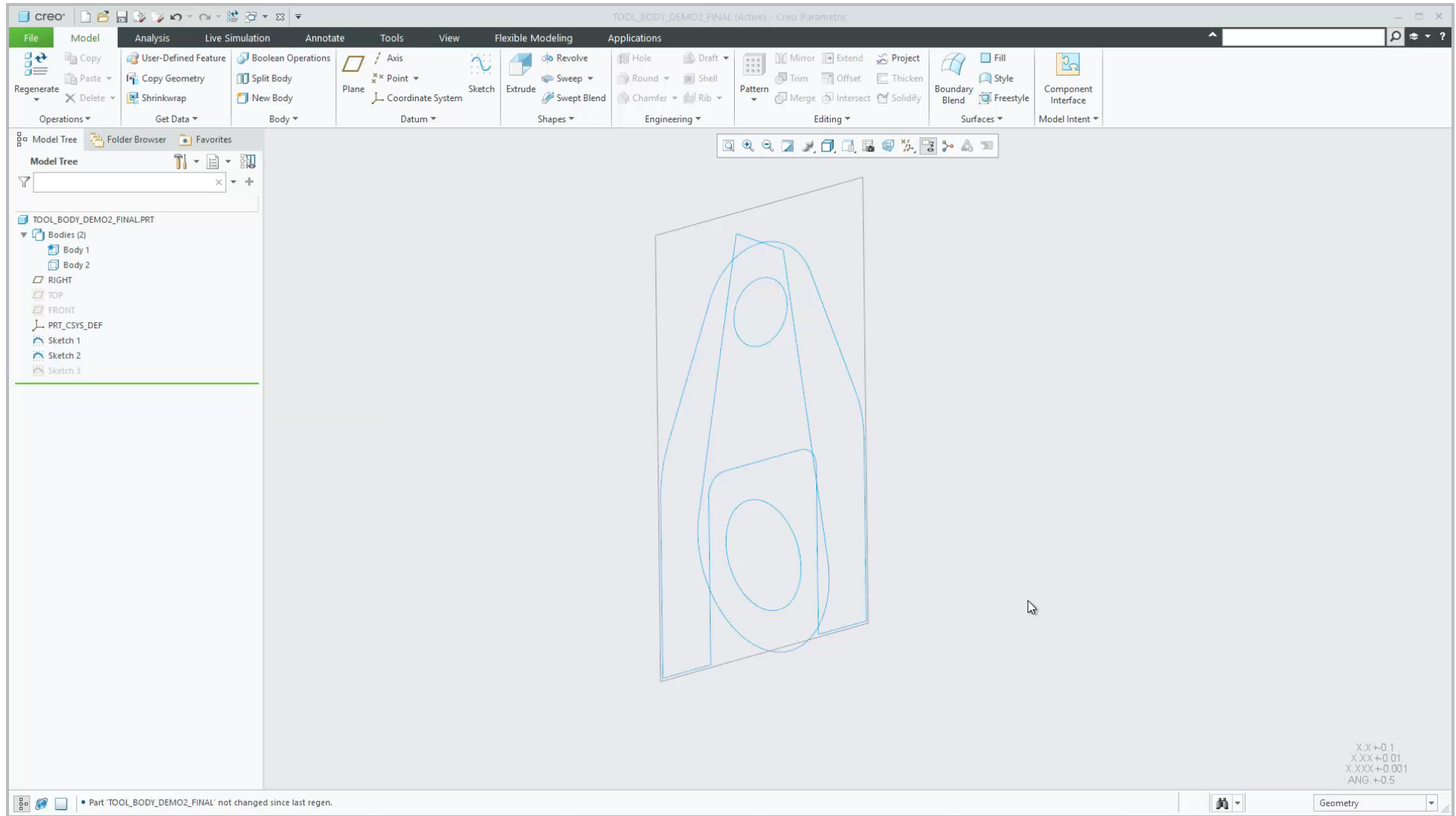
Creo 7.0 introduces multibody design, a new set of design tools that will enable you to complete many design tasks more efficiently while making your part design easier to manage, understand and modify.



What does Multibody Design Do?

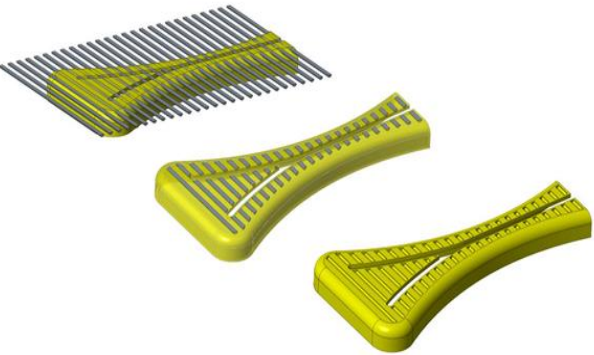
Enables designers to manage, visualize, and design multiple geometric volumes as individual objects within a single part.

MULTIBODY DESIGN



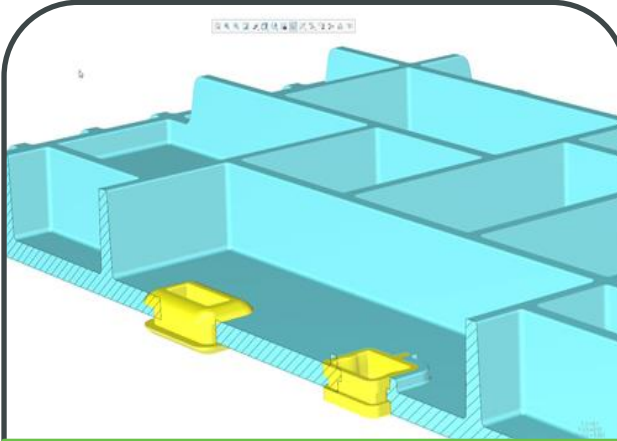
MULTIBODY DESIGN

Enabling faster, easier, more flexible modeling



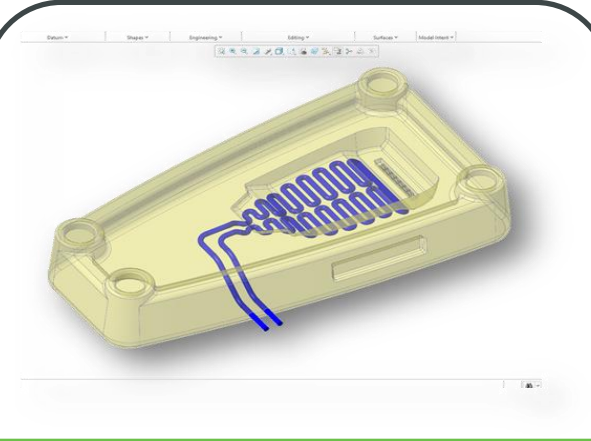
SPEED

Simply certain complex modeling task while making the design more easily to understand, maintain and modify.



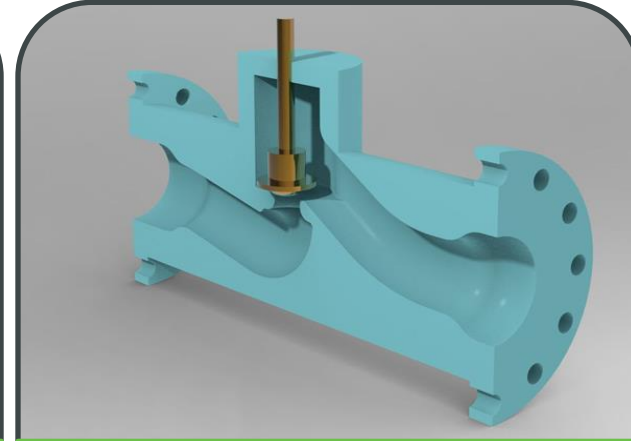
CLARITY

Easily design multi-material injection molding, managing each material as a separate body within a single part.



FLEXIBILITY

Separately manage and model different pieces of a single part that require very different design approaches, such a cooling channel within a block.

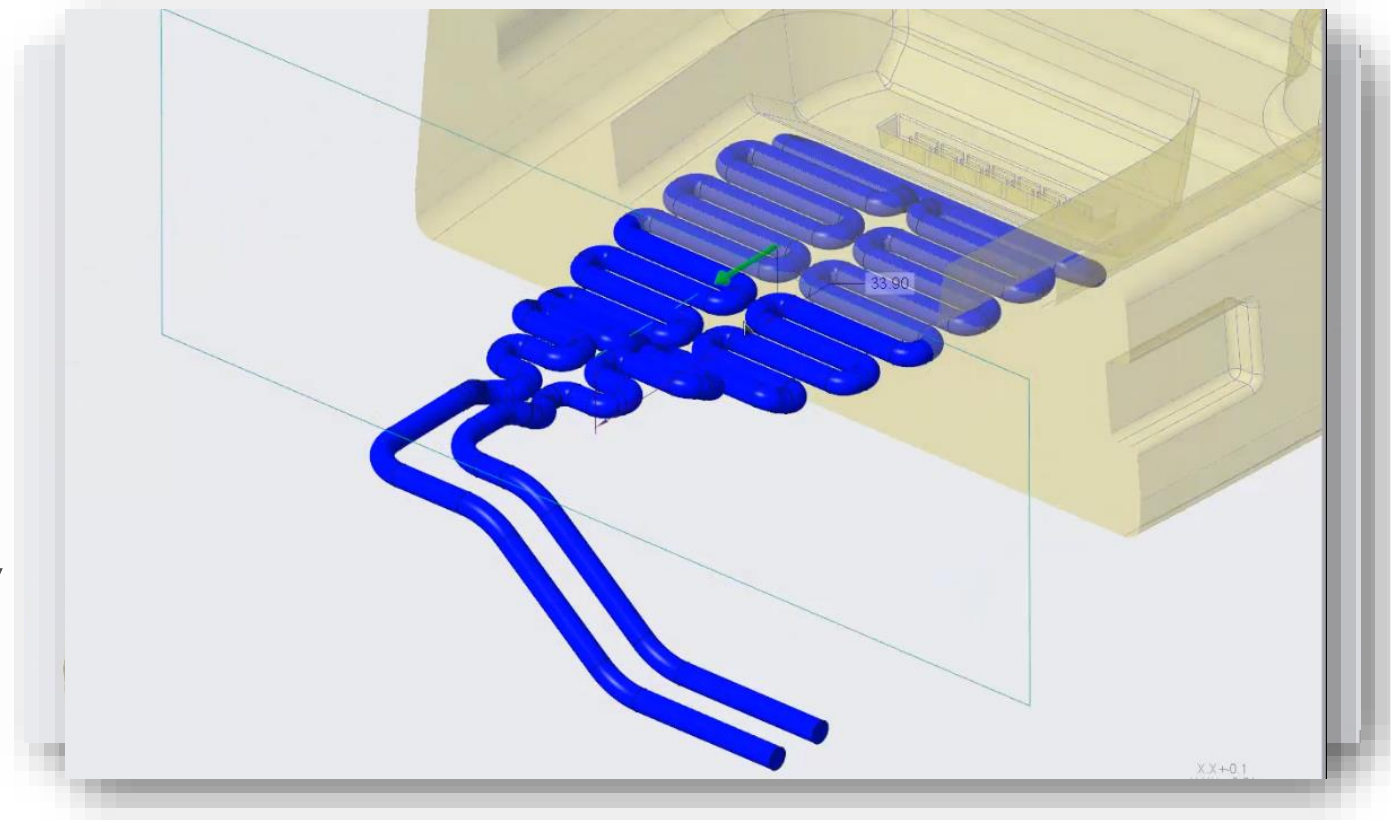


FLEXIBILITY

More easily design parts where the exterior and the interior follow very different design philosophies such as the exterior of a pipe and the internal cavity.

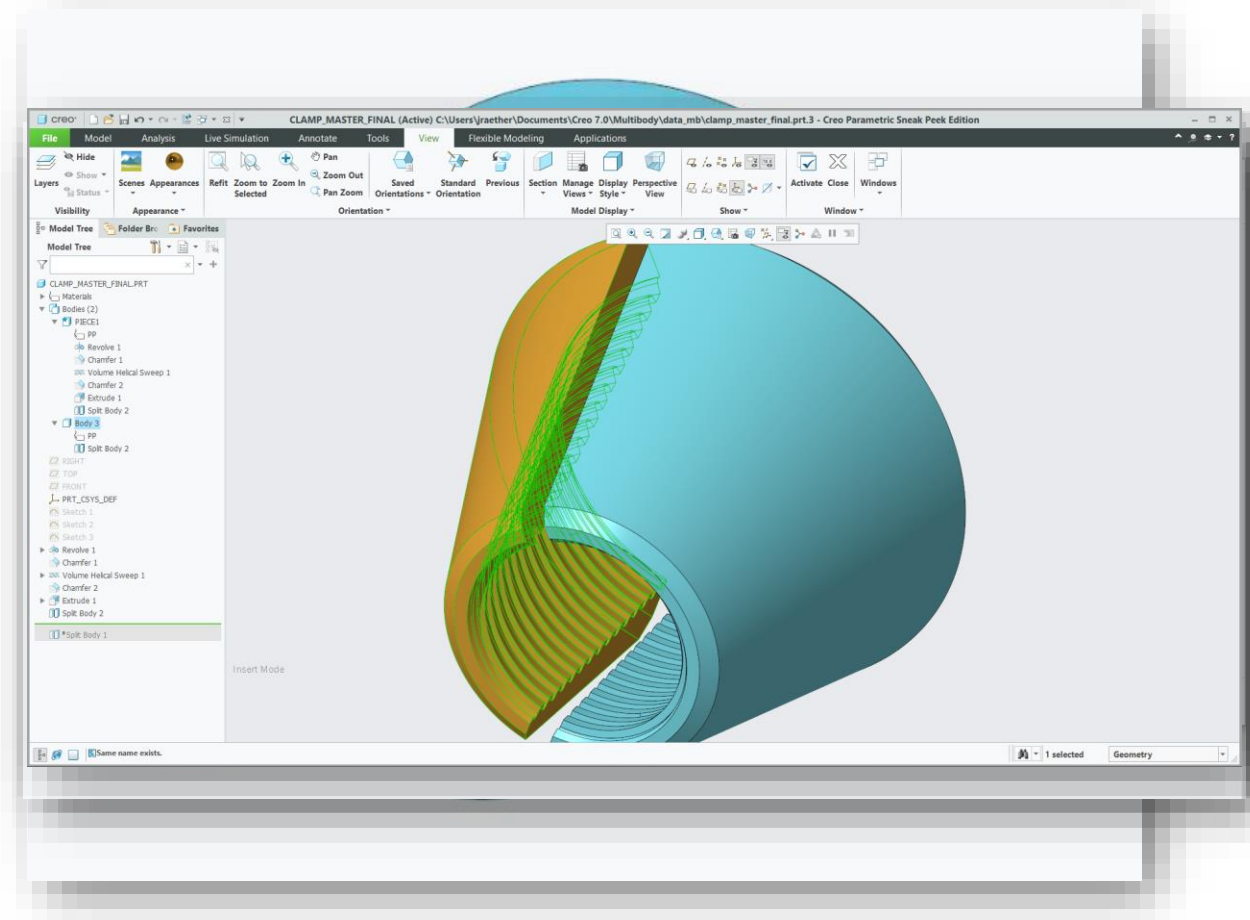
Bodies as Subtractive Geometry

- Multi-body design methodologies improve efficiency and flexibility using bodies to define subtractive geometry
- Create solid bodies representing cavities or subtractive geometry
- Multi-body design improves flexibility and visual clarity



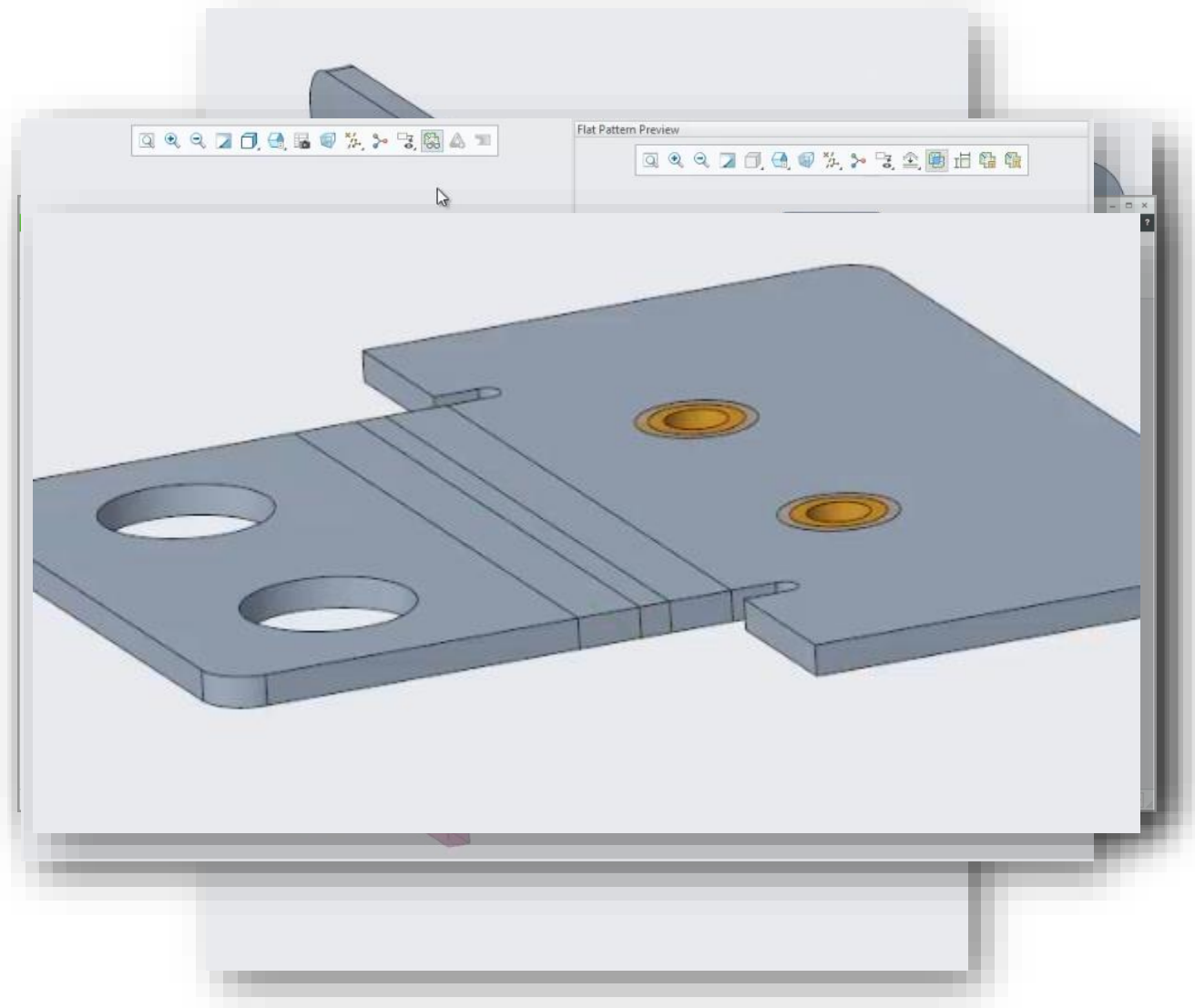
Master Model Methodology

- Leverage body operations for faster in-context design of body geometry and body interface geometry
- Create construction bodies to indicate space claim for final part
- Extraction of bodies to parts
- Support of out-of-date notifications and update control upon body changes in master model



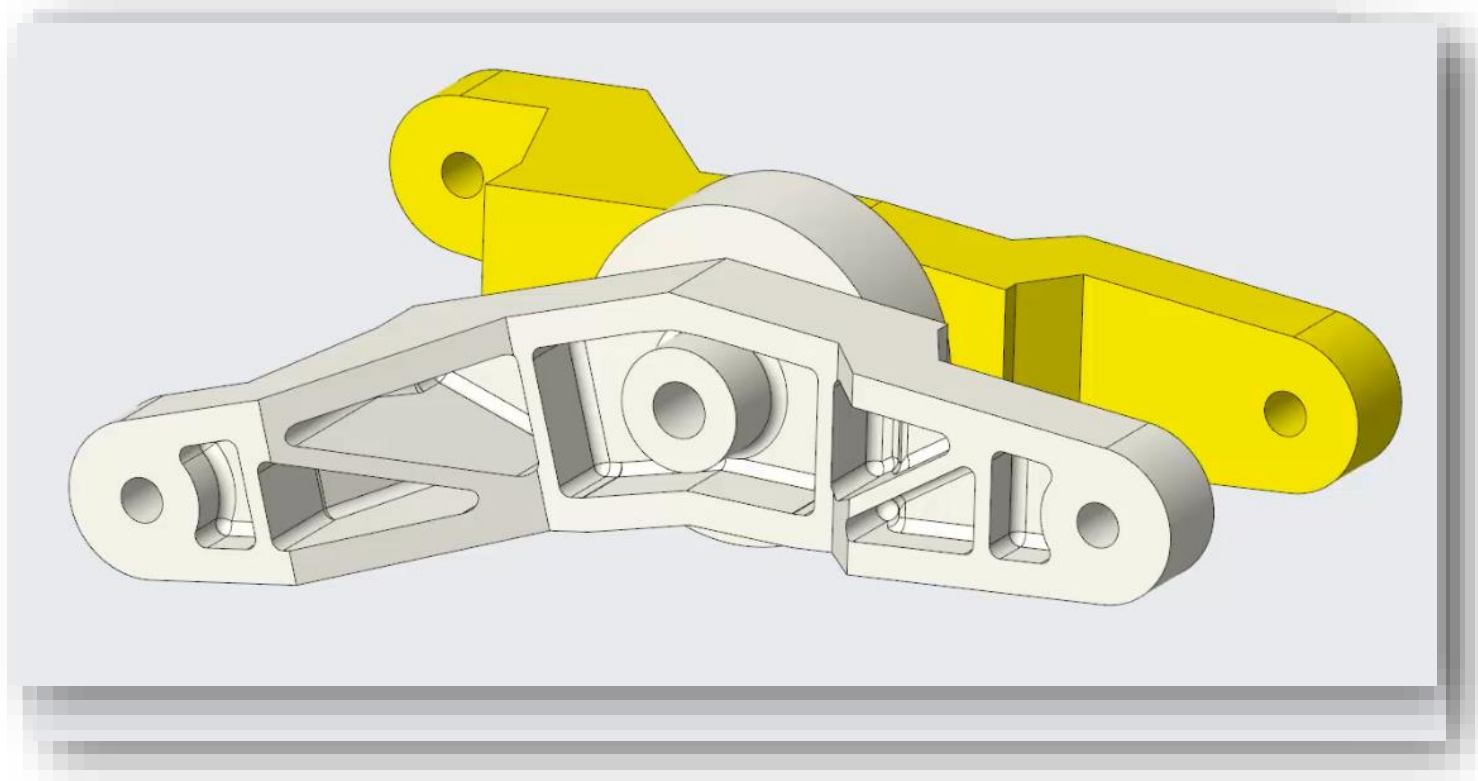
Sheetmetal Design

- Work with Sheetmetal (SMT) body in context of other body/bodies
- Convert single body to SMT
- New UI tab for SMT body vs other bodies
- External “copy geometry” to insert regular geometry bodies
- Boolean Subtract from the SMT body
- Unfold/Flatten “SMT-body”



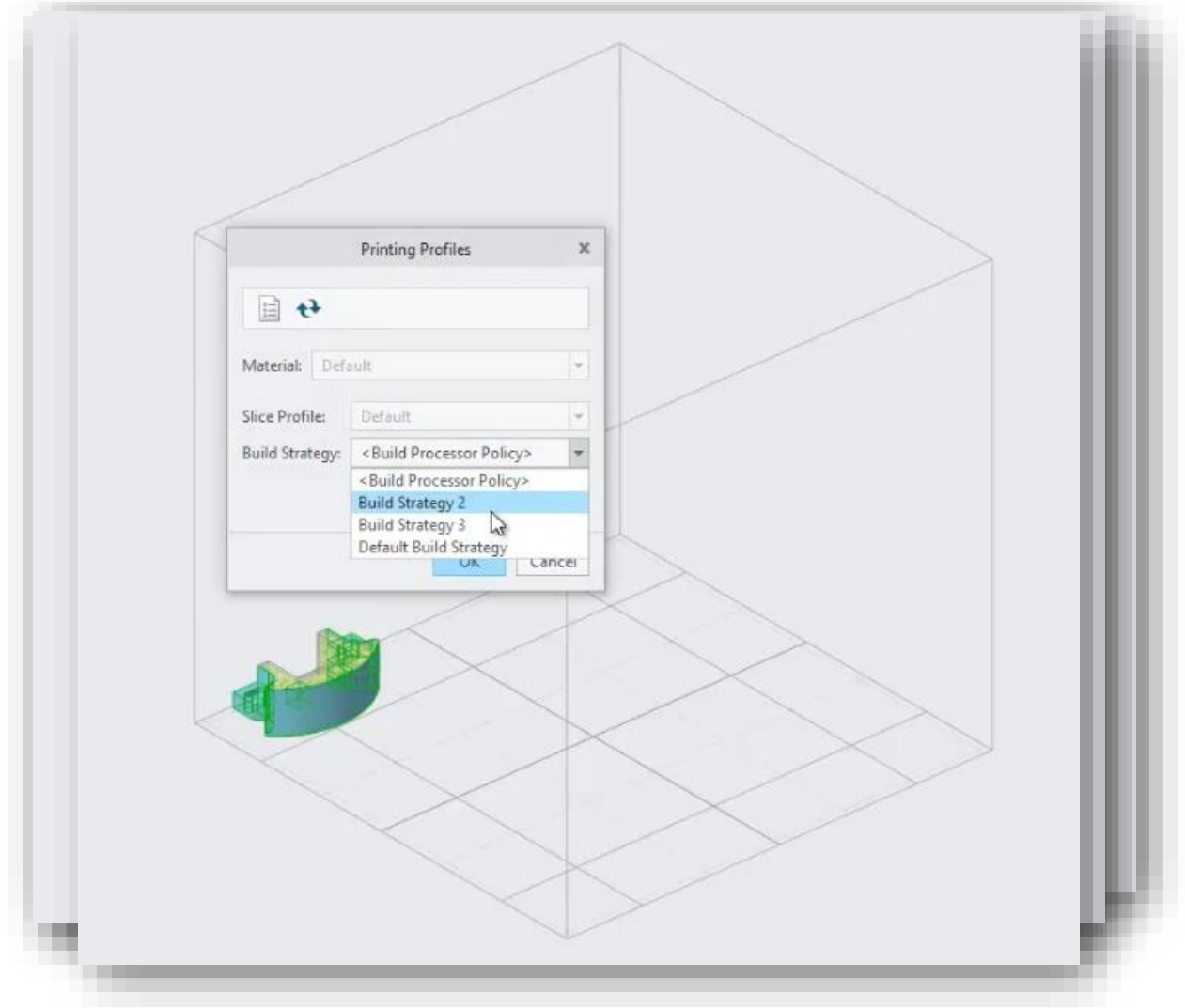
Flexible Modeling

- Use bodies as design tools
- Apply Boolean Operations: Merge, Subtract
- Use Flexible Modeling capabilities on bodies



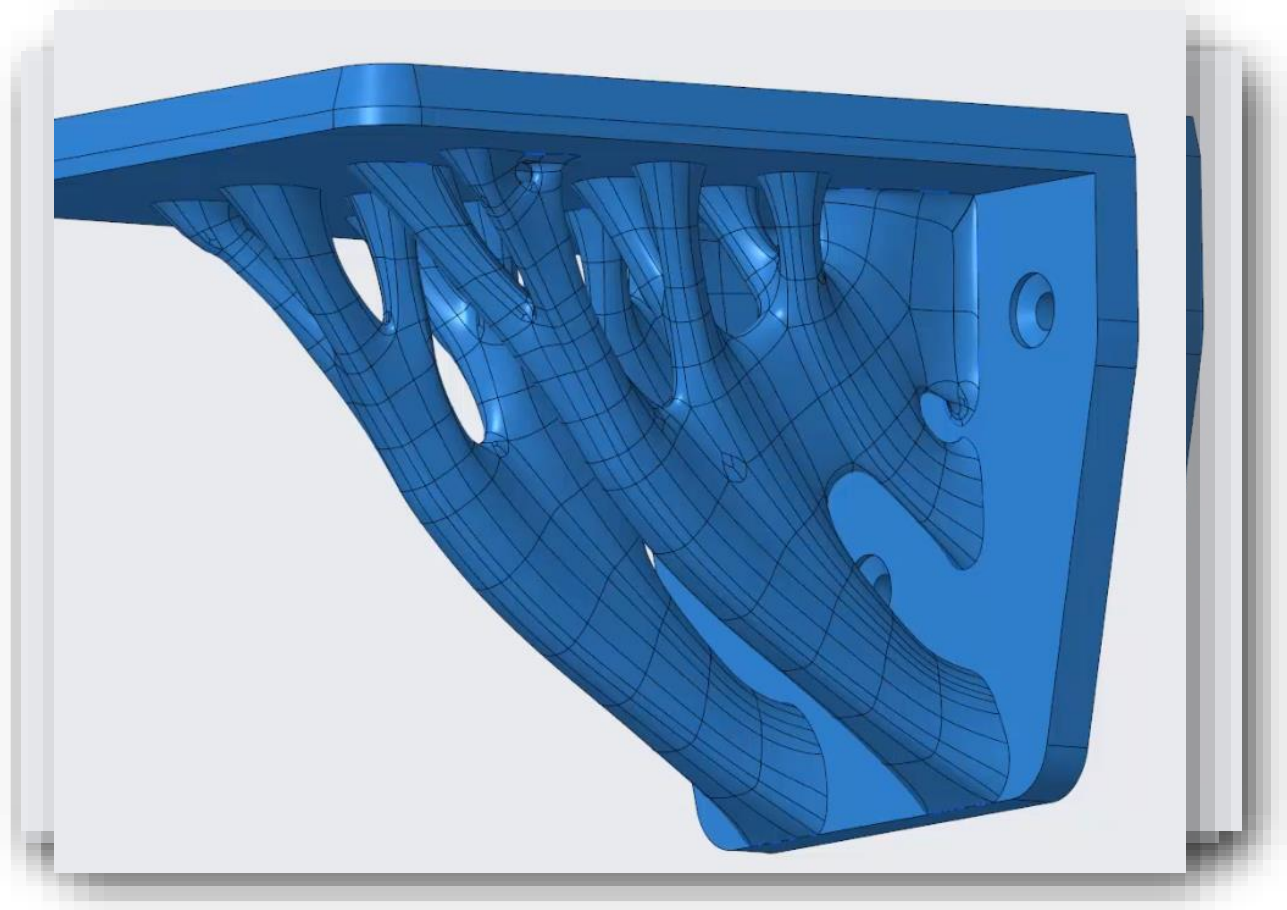
Additive Manufacturing

- Use multi-body to create, manage and visualize lattice structures
- Bodies for 3D printed parts
- Define printing strategies by assigning different printing and build profiles to individual bodies
- Work with bodies independently



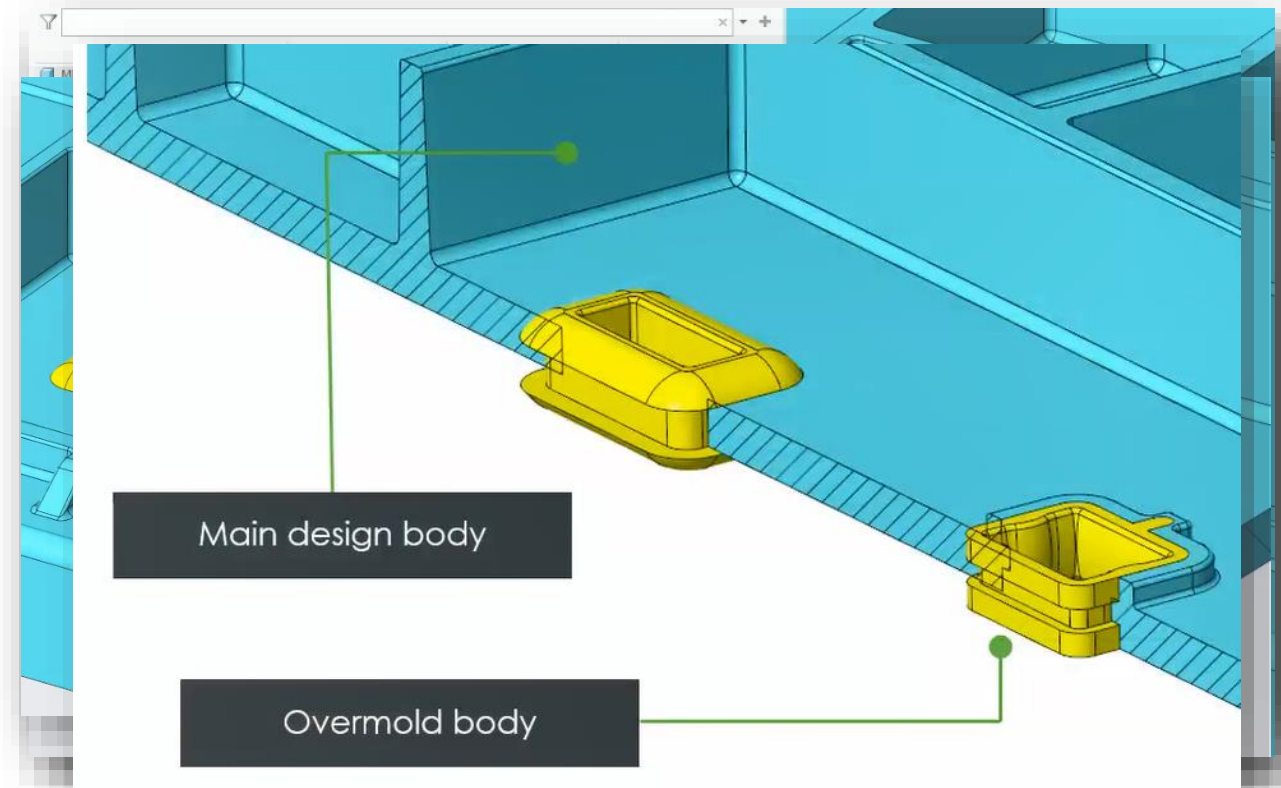
Generative Design

- Use multi-body design to create, manage and visualize generative design “input” geometry
- Use multi-body design to manage and visualize “results”
- Use multi-body design to create final design
- Use “construction” body concept to reflect correct mass



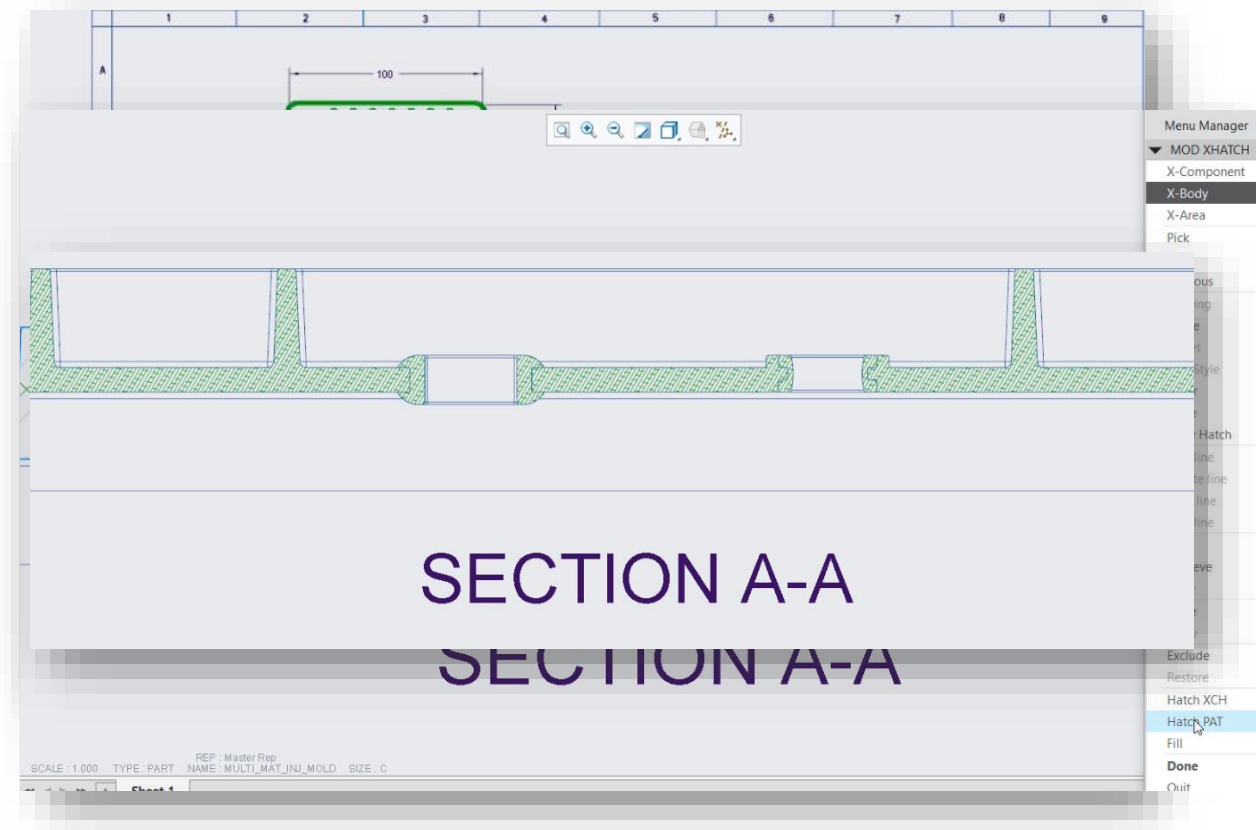
Multi-material Parts

- Simplify the design of over-molded and multi-material parts
- Improve design visualization and clarity
- Encourage and facilitate re-use
- Support of body concept for parameters, relations and mass property analysis feature
- Support for mold design using reference parts



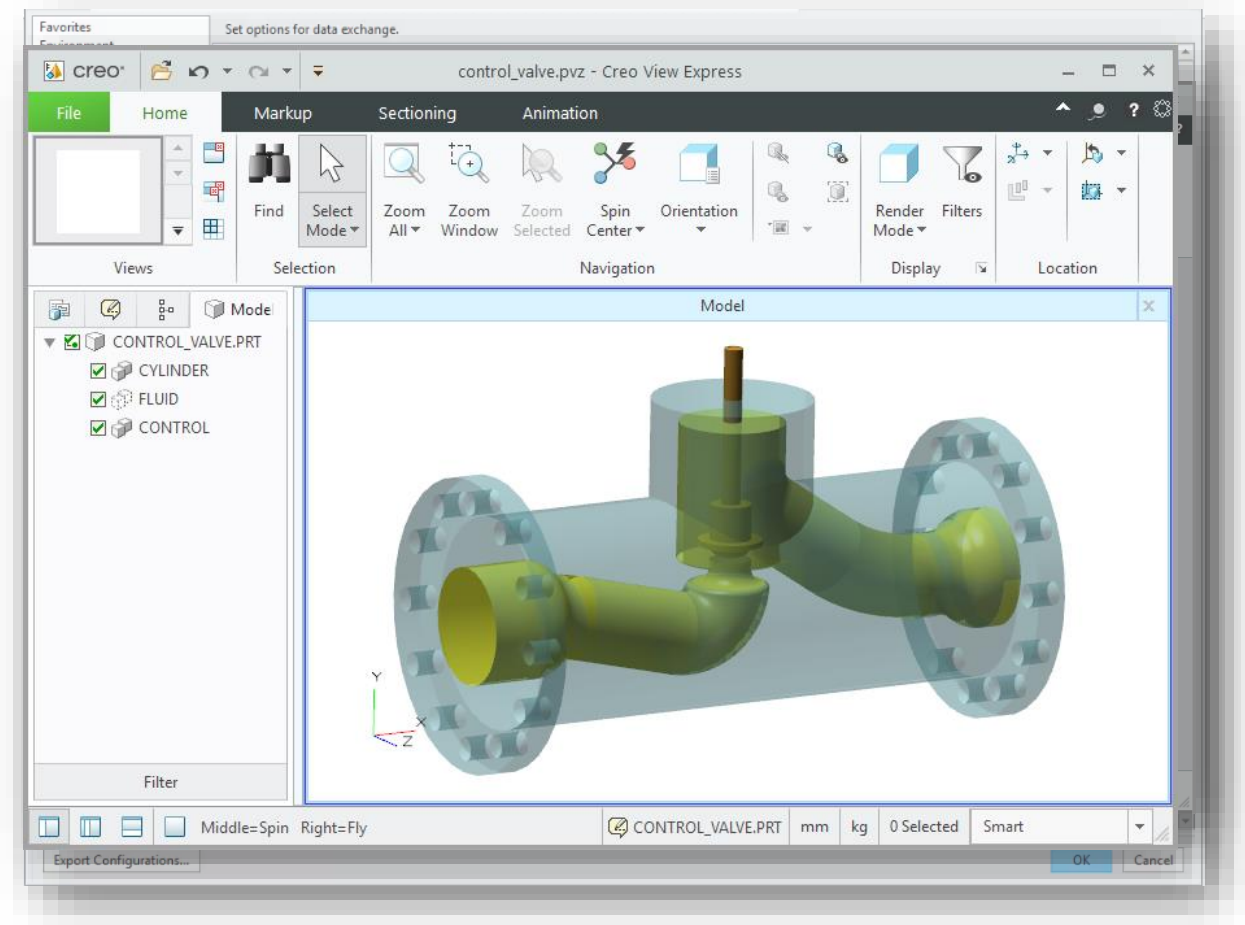
Drawings

- Drawings support listing of body information in repeat regions tables
- New drawing table templates added for the use of multi bodies design
- Modify cross section and hatching per body
- “Copy hatch” to allow copying of hatching properties from one section to another (component/body)



Unite Technology

- Support for Multibody parts in Data Exchange
- Maintain multibody definition for export and imported geometry
- Creo Parametric preserves the multibody definition during export



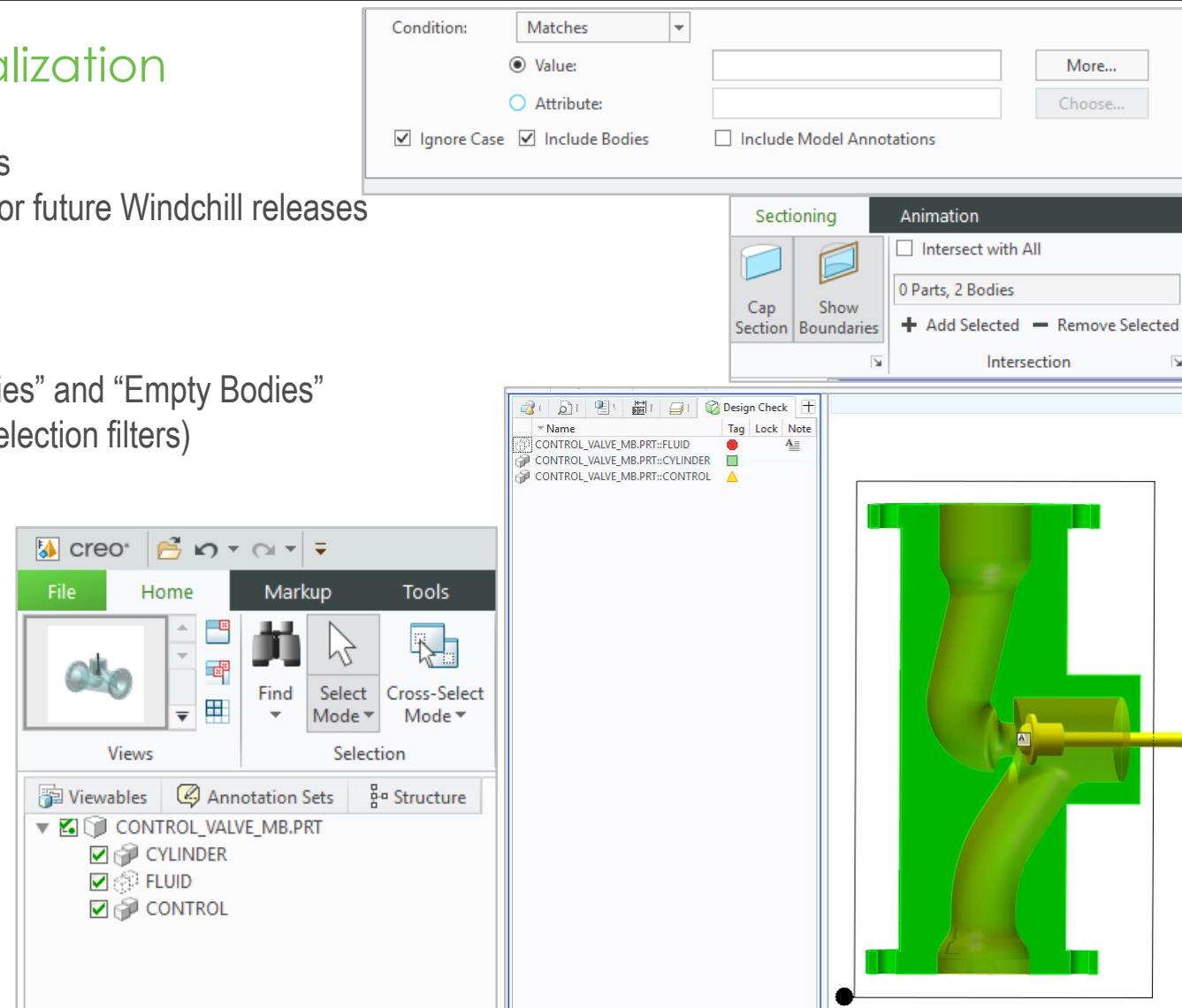
MULTIBODY DESIGN

Multi-body Part Design – Windchill and Visualization

- Windchill
 - Multibody parts are managed similarly to single body parts
 - Windchill support for bodies designated in Creo planned for future Windchill releases
- Creo View 6.1 or higher
 - Bodies represented as entity below part (w. own Geometry, Material and Attributes)
 - Differentiation between “Solid Bodies”, “Construction Bodies” and “Empty Bodies”
 - Control options (body display, body section interaction, selection filters)
 - Body support in color-coded search

Multi-Body Design Benefits:

- Compatibility and essential Windchill management of Creo multibody parts
- Creo View based visualization support for Creo multibody parts



INSEPARABLE ASSEMBLY

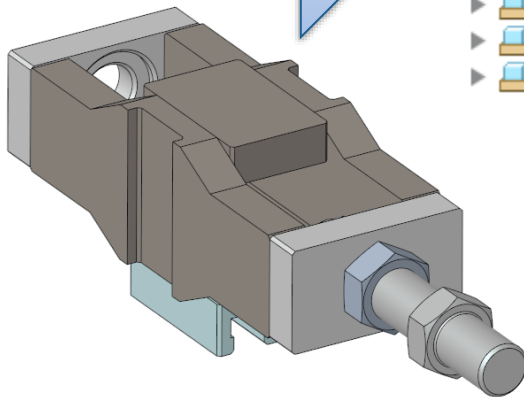
New Inseparable Assembly

- Convert existing assembly into inseparable assembly (partial or full)

CARRAIGE_ASSY.ASM

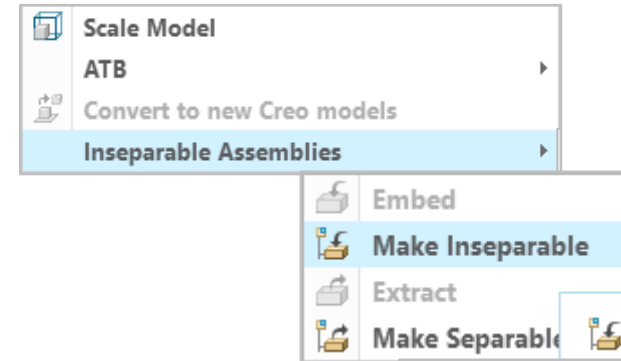
- ASSY_SIDE
- ASSY_TOP
- ASSY_FRONT
- CSYS_ASM_DEF
- C_SIDE_PLT.PRT
- C_SIDE_PLT.PRT
- C_TOP_PLT.PRT
- C_TOP_PLT.PRT
- C_END_PLT.PRT
- C_END_PLT.PRT
- C_BRNG_PLT.PRT
- CPLNG_CARRAIGE.PRT
- NUT_3_1.PRT
- NUT_3_1.PRT

Convert to
inseparable assembly

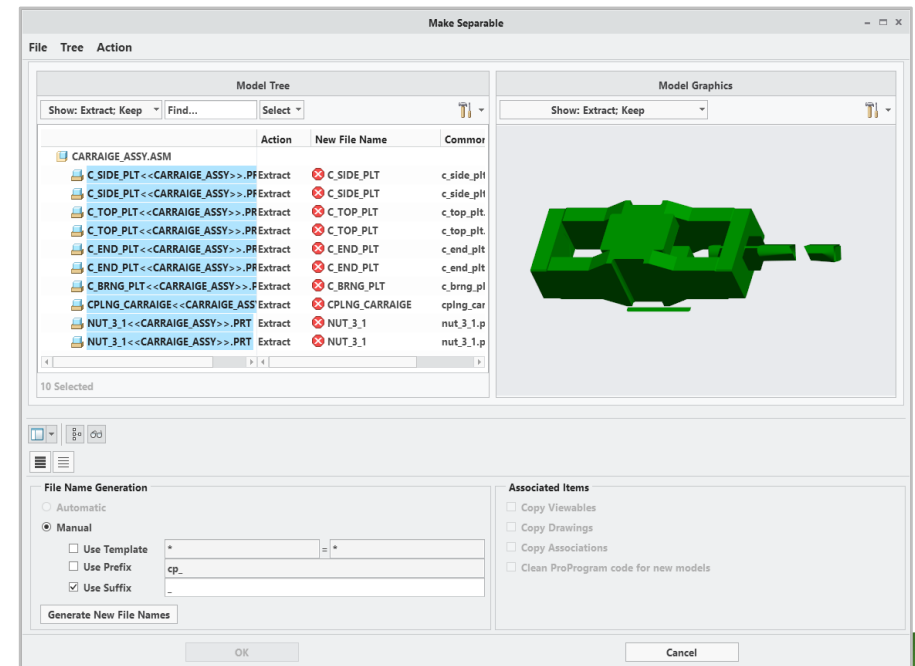


CARRAIGE_ASSY.ASM

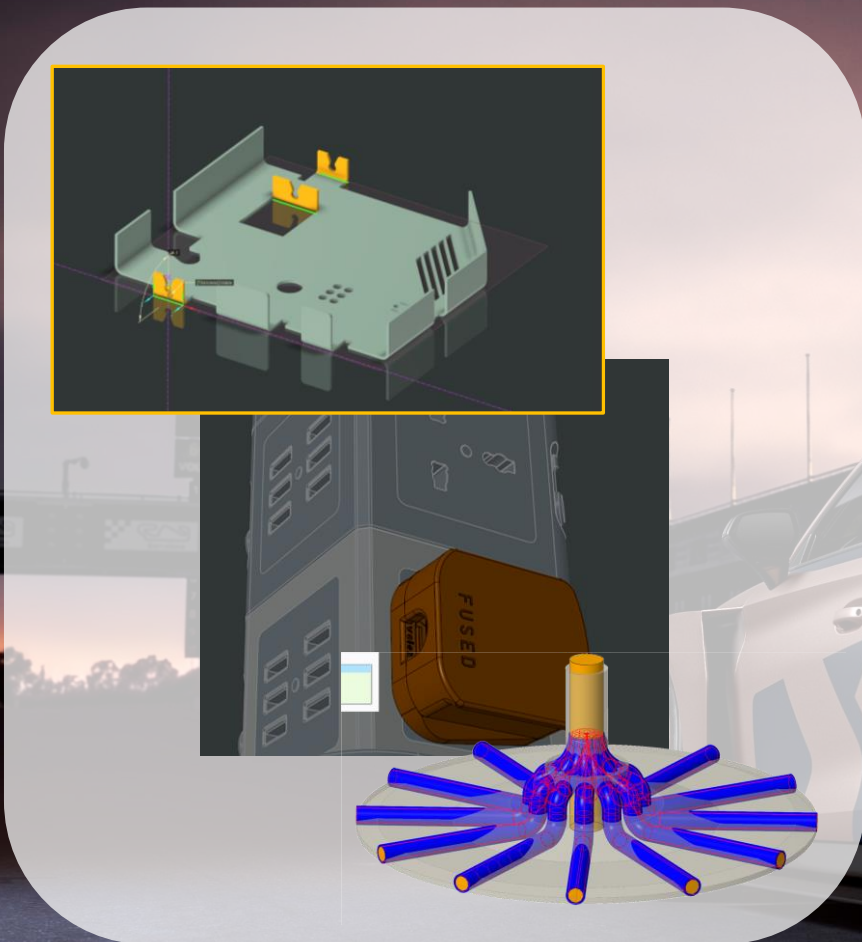
- ASSY_SIDE
- ASSY_TOP
- ASSY_FRONT
- CSYS_ASM_DEF
- C_SIDE_PLT<<CARRAIGE_ASSY>>.PRT
- C_SIDE_PLT<<CARRAIGE_ASSY>>.PRT
- C_TOP_PLT<<CARRAIGE_ASSY>>.PRT
- C_TOP_PLT<<CARRAIGE_ASSY>>.PRT
- C_END_PLT<<CARRAIGE_ASSY>>.PRT
- C_END_PLT<<CARRAIGE_ASSY>>.PRT
- C_BRNG_PLT<<CARRAIGE_ASSY>>.PRT
- CPLNG_CARRAIGE<<CARRAIGE_ASSY>>.PRT
- NUT_3_1<<CARRAIGE_ASSY>>.PRT
- NUT_3_1<<CARRAIGE_ASSY>>.PRT



Make Inseparable
Embed the lower level components into
the selected assembly.



CREO – DEMO

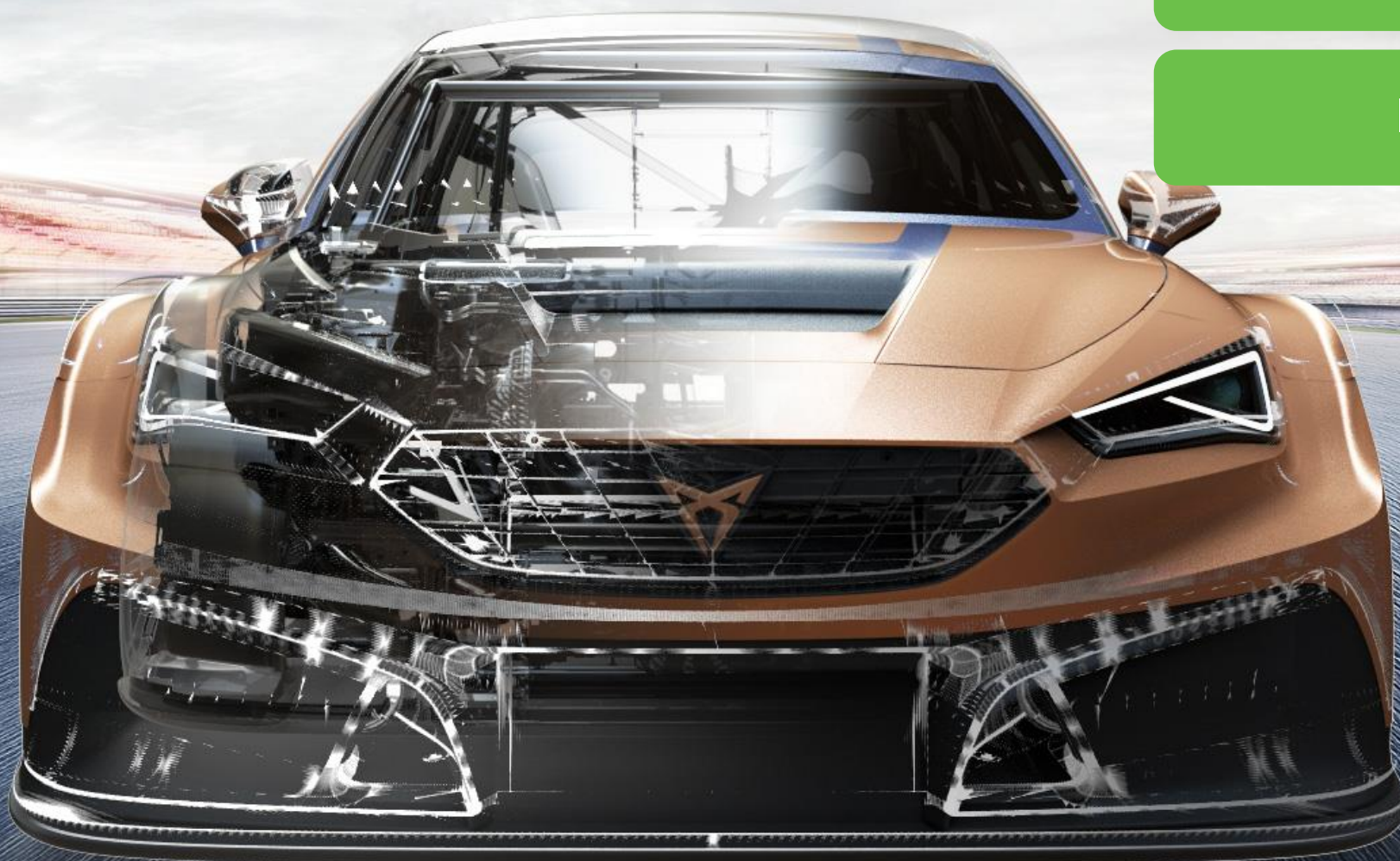


AGENDA

Usability & Productivity

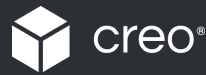
New Creo Methods

Innovation & Roadmap



creo®

EMERGING TECHNOLOGIES ARE CHANGING DESIGN AND MANUFACTURING



Only Creo delivers these technologies deeply integrating into the design environment...

...while delivering integral design, manufacturing & simulation capabilities supporting the entire digital and physical product lifecycle.



Real-Time Simulation



AI-Driven Generative Design



IoT-Driven Design



AR Collaboration



Design for Additive Manufacturing



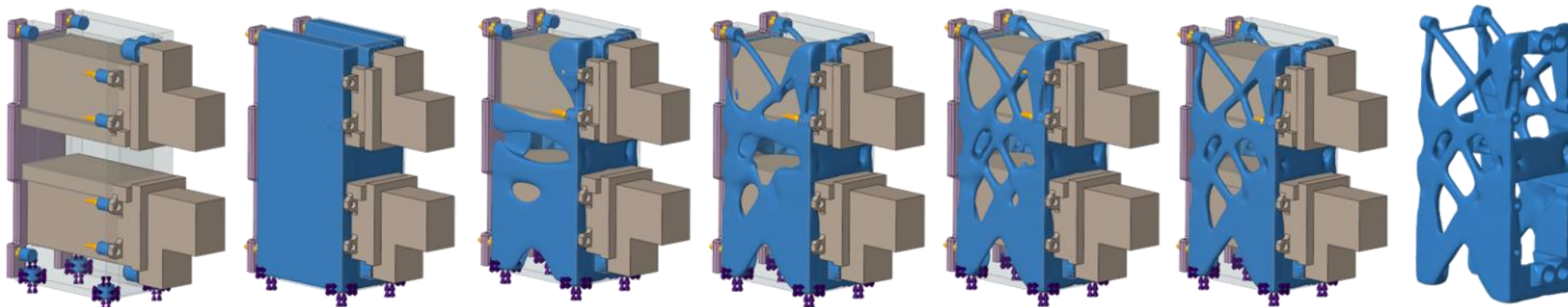
What is Generative Design?

A means of **autonomously creating optimal designs** from a set of system design requirements, such as **loads, constraints, preferred materials** and **manufacturing processes**.

Reduces **Time-to-Market**

Delivers **Innovative**, Differentiated Products

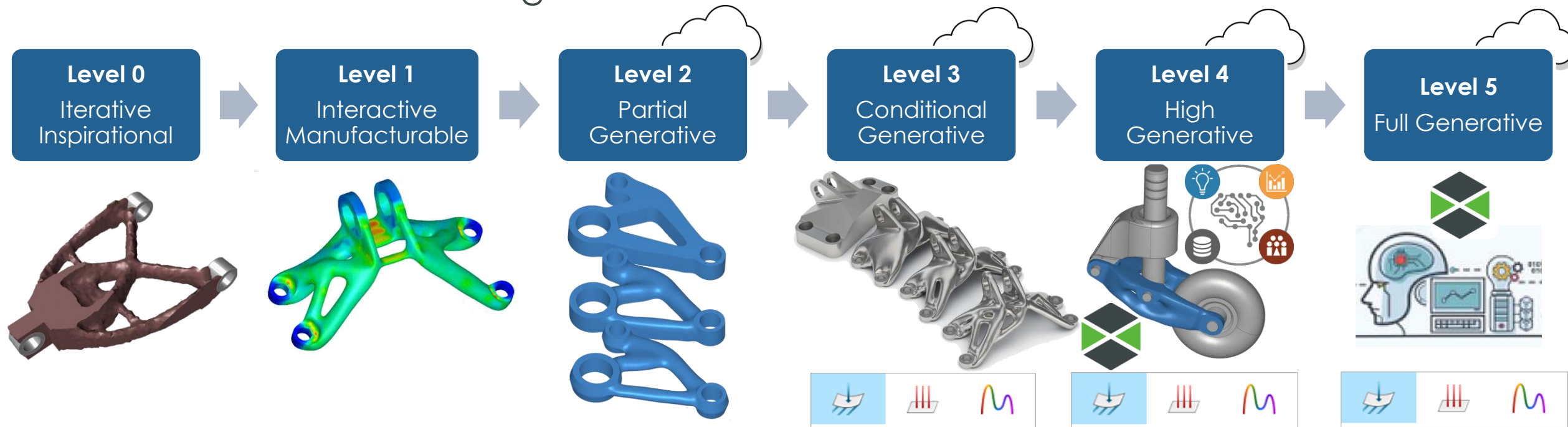
Reduces **Product Costs**



GENERATIVE TOPOLOGY OPTIMIZATION

Generative design autonomously generates optimal designs from a set of system design requirements.

5 levels to Generative Design



CREO – DEMO



VOLVO

Volvo Group is working on making long-haul freight haulers hyper-efficient by utilizing PTC's Generative Design solution

“Generative design has the potential to absolutely transform the transportation industry as it seeks to improve fuel economy through aggressive weight reduction.”

**Kevin McClintock
Senior Consultant
Volvo Group N.A.**

VOLVO GROUP – SUPER TRUCK

Part Description: Forward engine mount

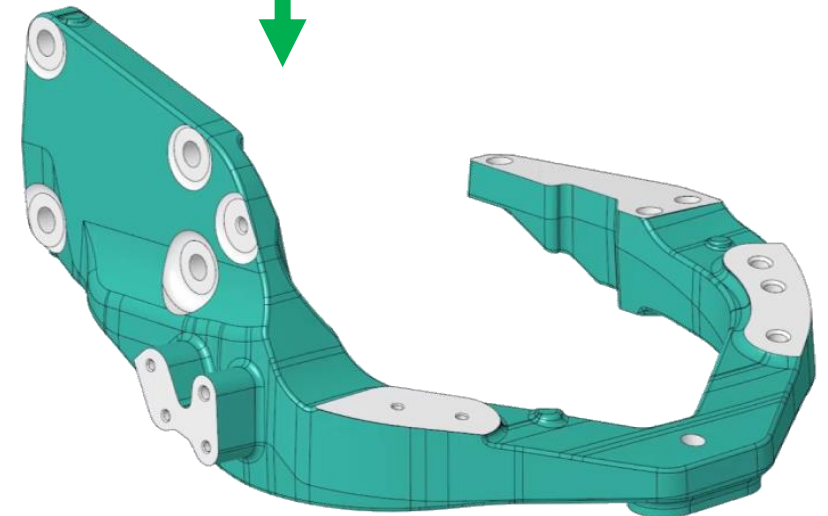
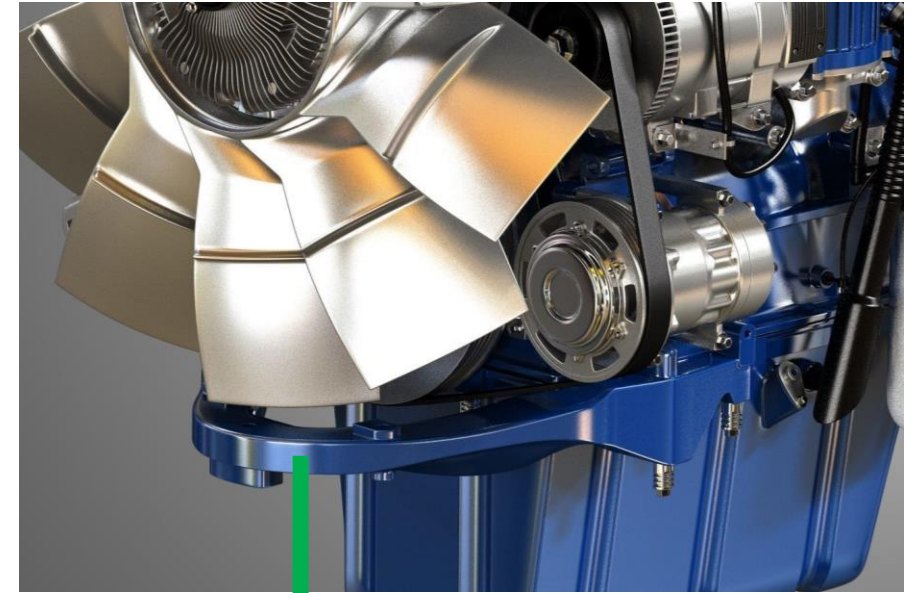
Stated Customer Objective(s): Since the part is forward of the front axle, weight savings is more valuable than in other parts of the vehicle; original cast iron part designed 17 years ago and still in production

Primary Business Case Driver: Decrease weight of original design, while achieving equal or better strength; also wanted to improve upon a second version that was designed by Penn State University during a year-long paid collaborative project

Secondary Business Case Driver: Increased design productivity amongst structural designers; frequent changes in the engine mean rapid design iterations necessary

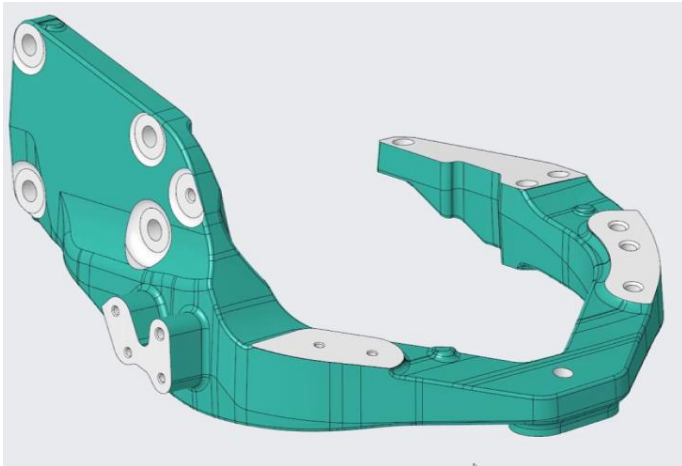
Load Case(s): Provided by Volvo

Preferred Material: Cast aluminum

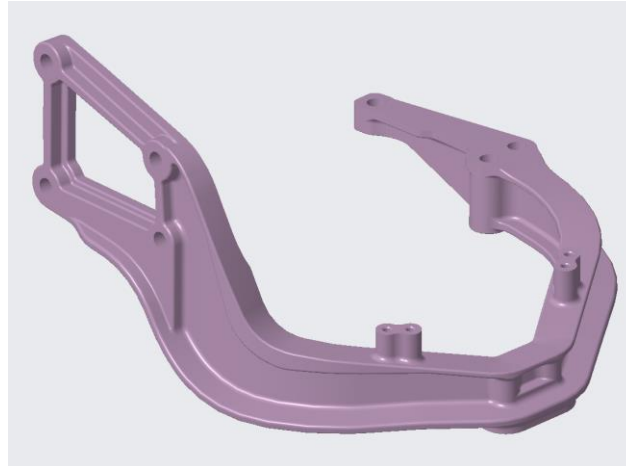


VOLVO GROUP – SUPER TRUCK

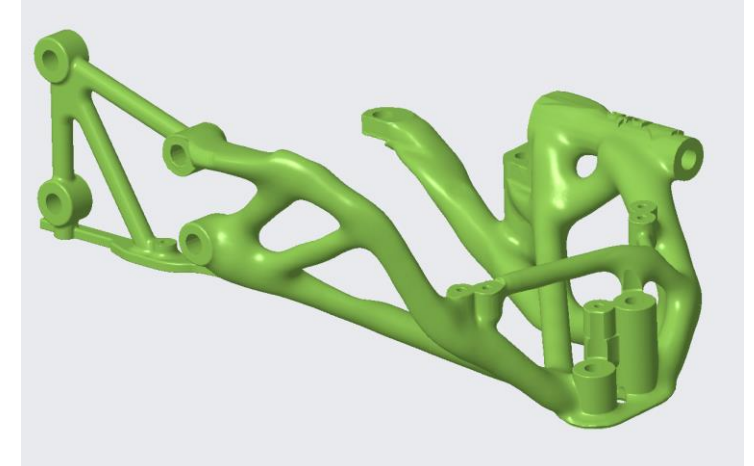
Variant	Material	Weight (kg)	Max Disp (mm)	Max Stress (MPa)	Comments
Original Design	Iron (cast)	20.36	3.5	1393	Stress is 4.3x yield
PSU Design	Iron (cast)	11.86	2.6	1255	Stress is 3.9x yield
Generative Design	Al 356 (cast)	5.00	0.85	250	Stress is 1.5x yield



Original Design



Penn State Design



Final Generative Design

Weight Reduction: 75% **Peak Stress Reduction: 82%**

VOLVO GROUP – SUPER TRUCK

Part Description: Fan motor mount

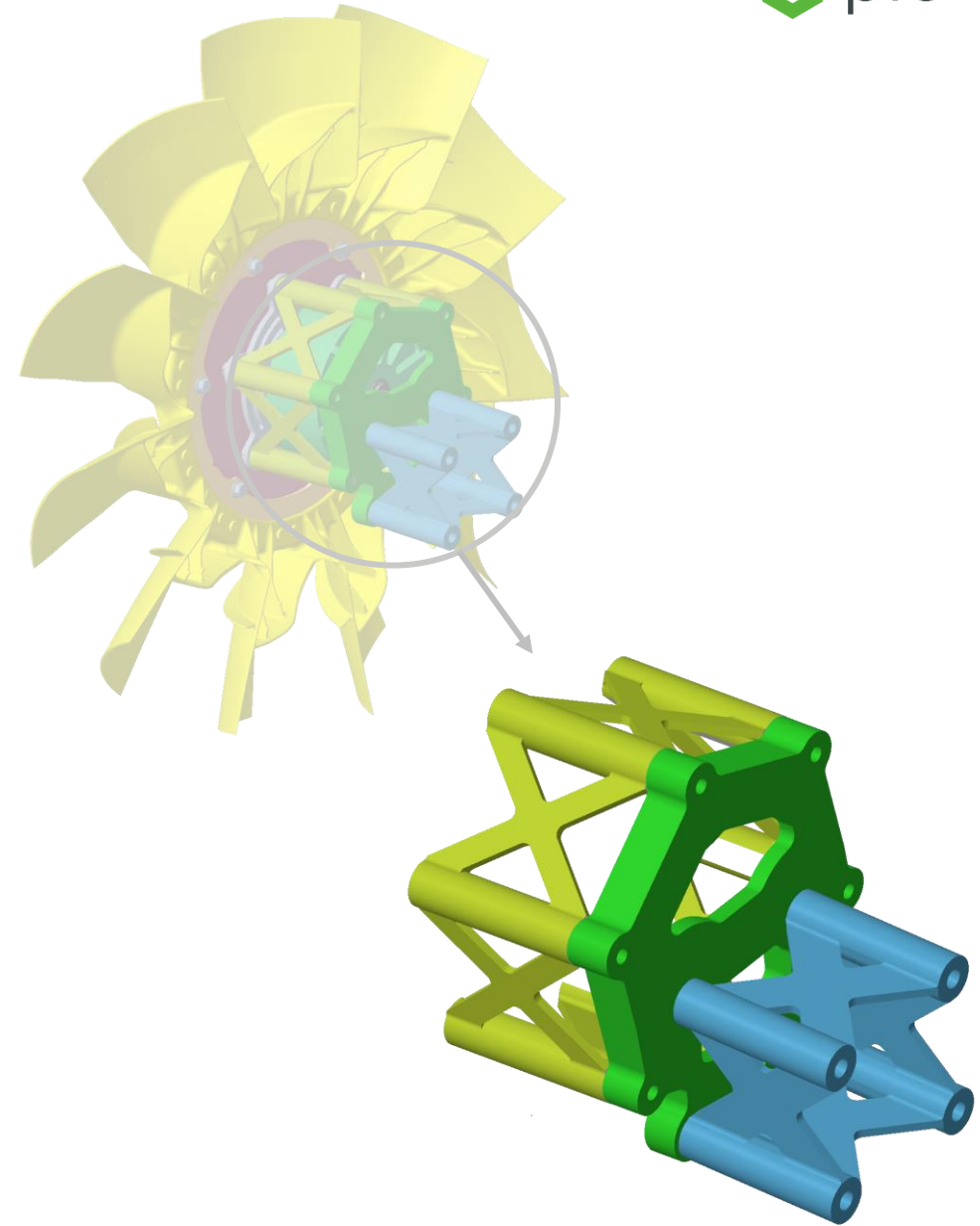
Stated Customer Objective(s): Current belt-driven fan clutch was being replaced with new fully variable electric motor, requiring a new mount; preliminary design was a three-piece sub-assembly; goal was to simplify to a single part

Primary Business Case Driver: Design brand new part, improving upon weight and stiffness of preliminary sub-assembly, with reduced complexity and fastener count

Secondary Business Case Driver: Increased design productivity amongst structural designers; frequent changes in the engine mean rapid design iterations necessary

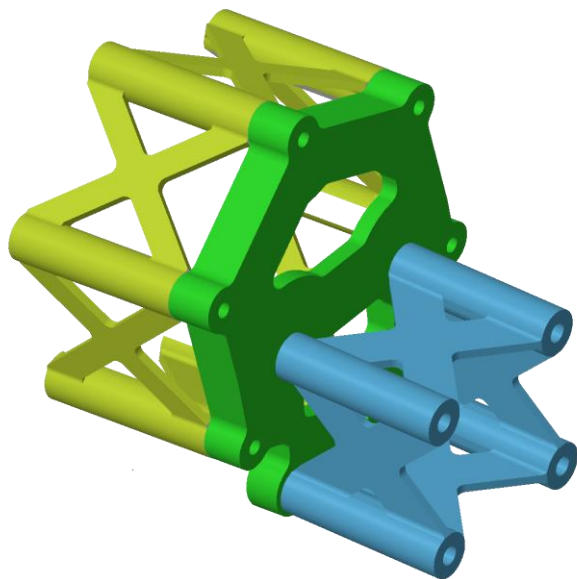
Load Case(s): Provided by Volvo

Preferred Material: Machined aluminum



VOLVO GROUP – SUPER TRUCK

Variant	Material	Weight (kg)	Max Stress (MPa)	Comments
Original Design	AL6061	2.45	153 MPa	Stress is 0.55x yield
Generative Design	AL6061	1.06	101 MPa	Stress is 0.38x yield



Original Multi-Part Design

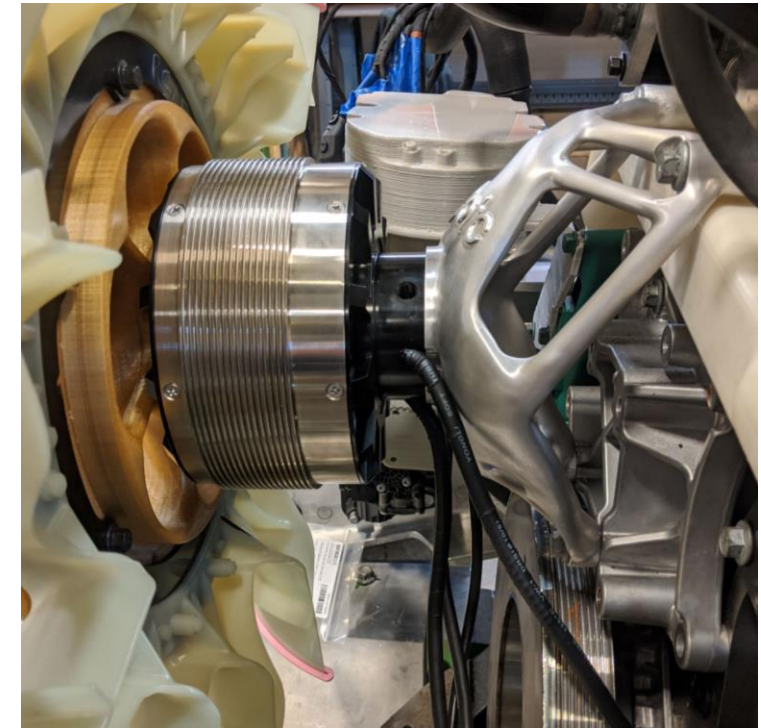
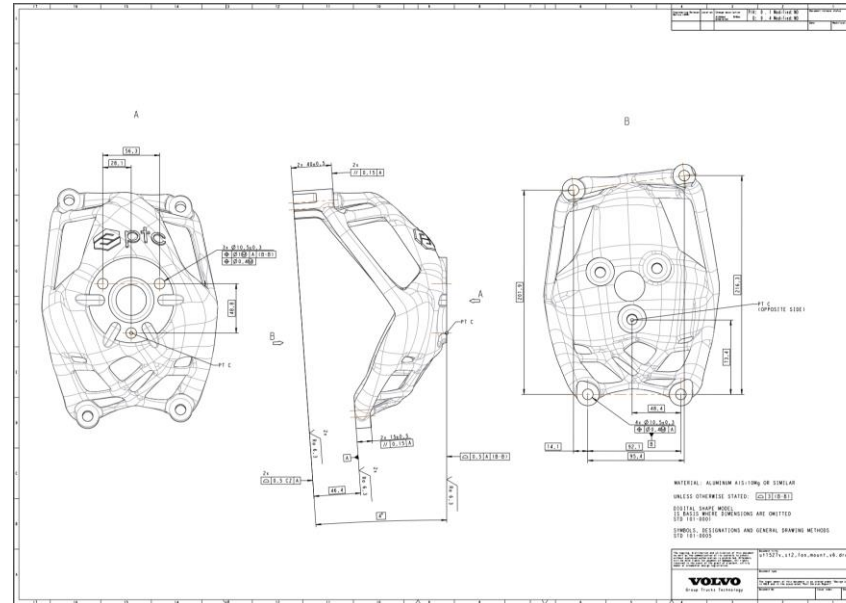


Final Generative Design

Weight Reduction: 56% **Peak Stress Reduction: 33%**

VOLVO GROUP – SUPER TRUCK

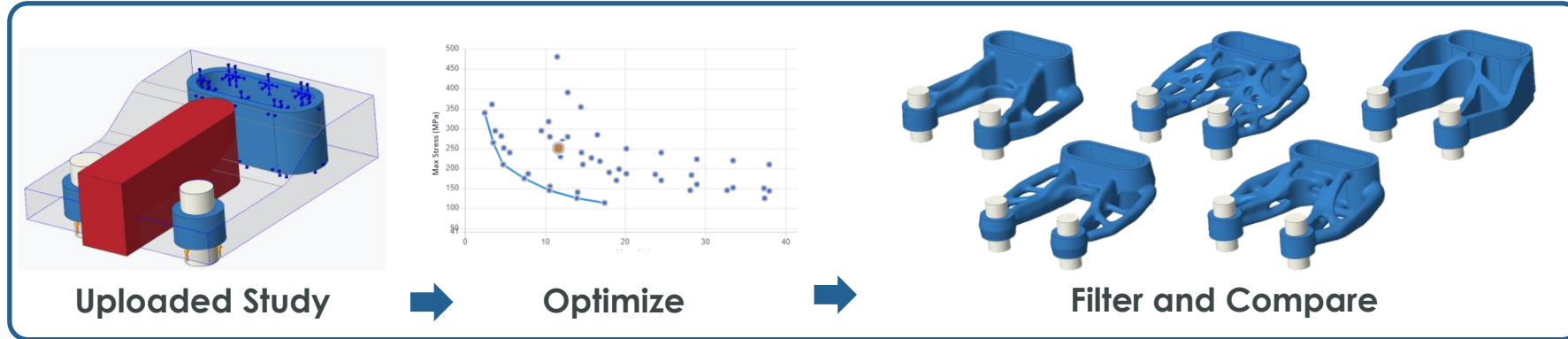
Final Result: Optimized for machining; exceeds target safety factor; lighter weight than three-piece original design



GENERATIVE DESIGN STRATEGY

Deliver your best designs in less time

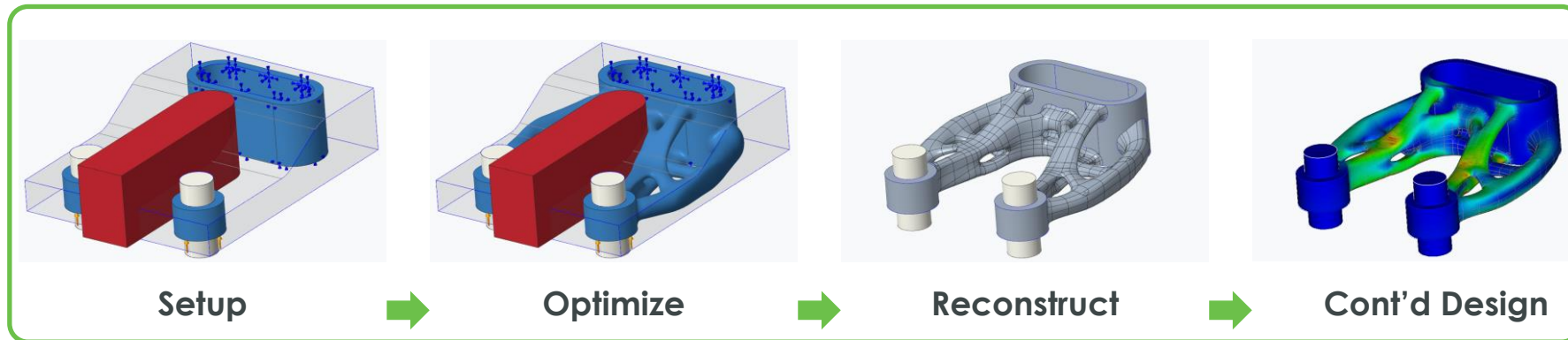

Creo Generative Design Extension
(Creo 7.0.2.0)



- Full-study optimization
- Leverages high-performance computing
- Simultaneously generates multiple viable designs




Creo Generative Topology Optimization
(Creo 7.0.0.0)



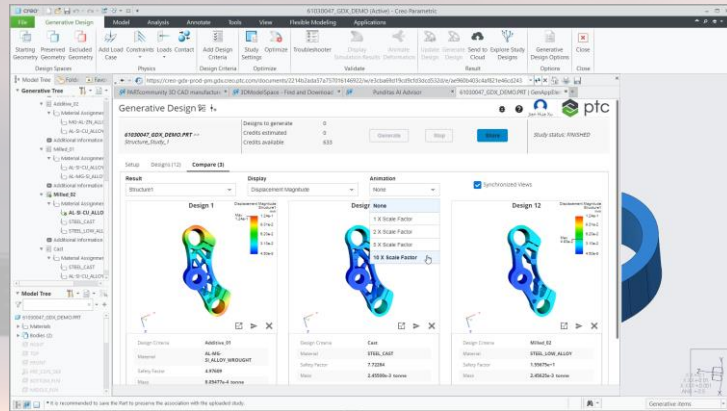
- New Application fully-integrated in Creo
- Familiar workflow and UI
- Replaces legacy Topology Optimization

Accelerate new product introduction

Democratize knowledge of manufacturing processes

Deliver innovative, differentiated products

CREO – DEMO



REAL-TIME SIMULATION

Revolutionize product design by removing the barriers between CAD and CAE

Partnership provides
best and broadest
portfolio of
engineering simulation
software

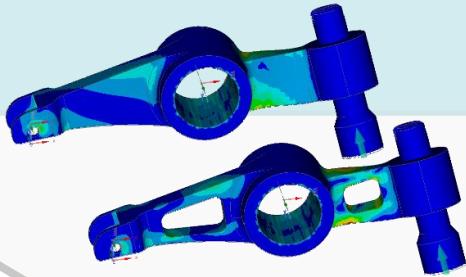


PTC and ANSYS will put
best in class design and
simulation capabilities
integrated into one
product at the fingertips
of every Design Engineer

REAL-TIME SIMULATION

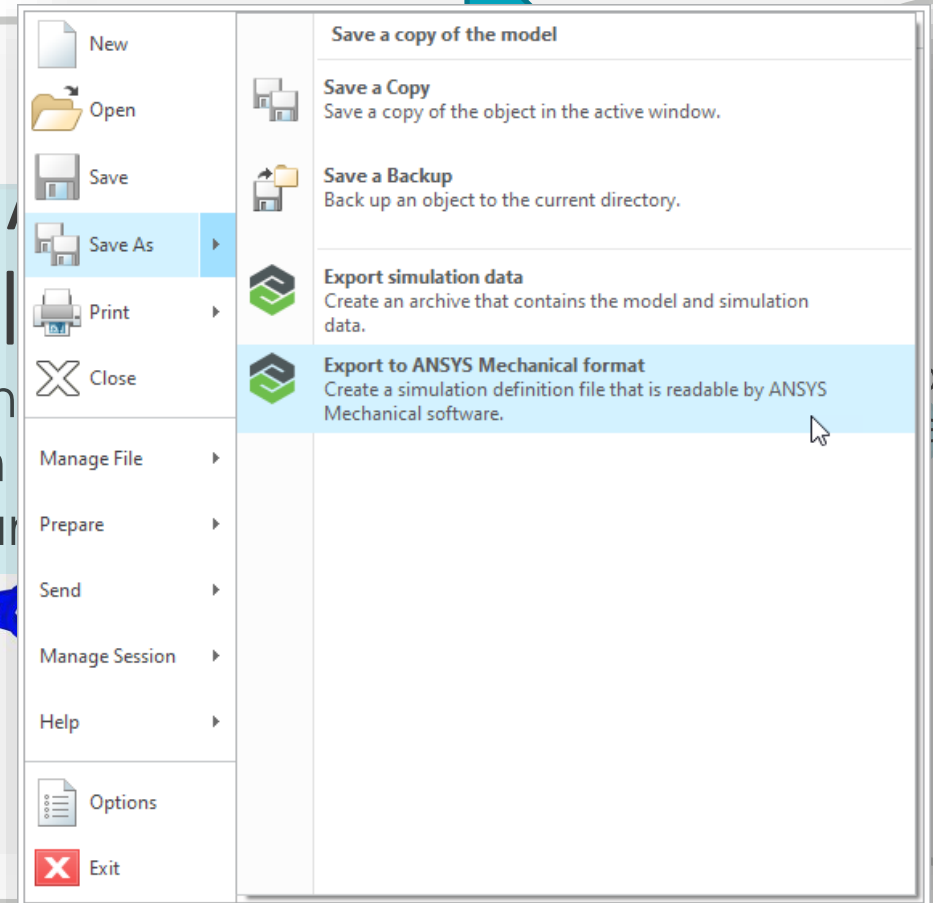
Creo Simulation Live

Instantaneous & interactive simulation for guidance in early design phases



Creo Simulation

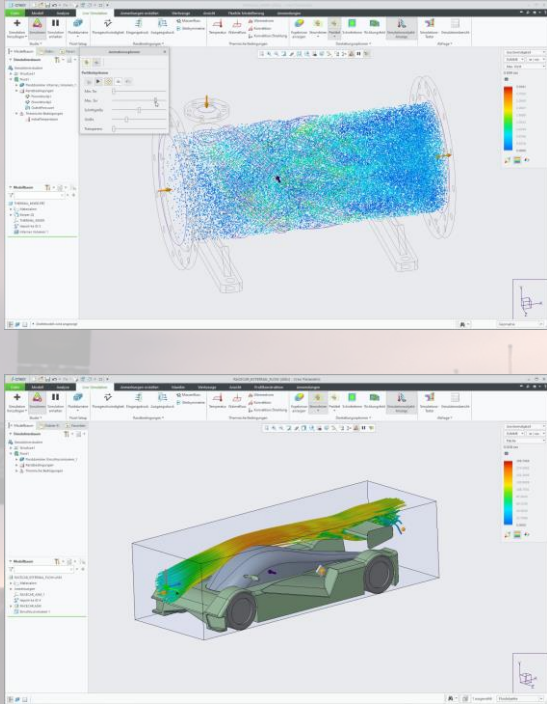
High-fidelity, high-precision simulation refinement and analysis



Speed & Interactivity

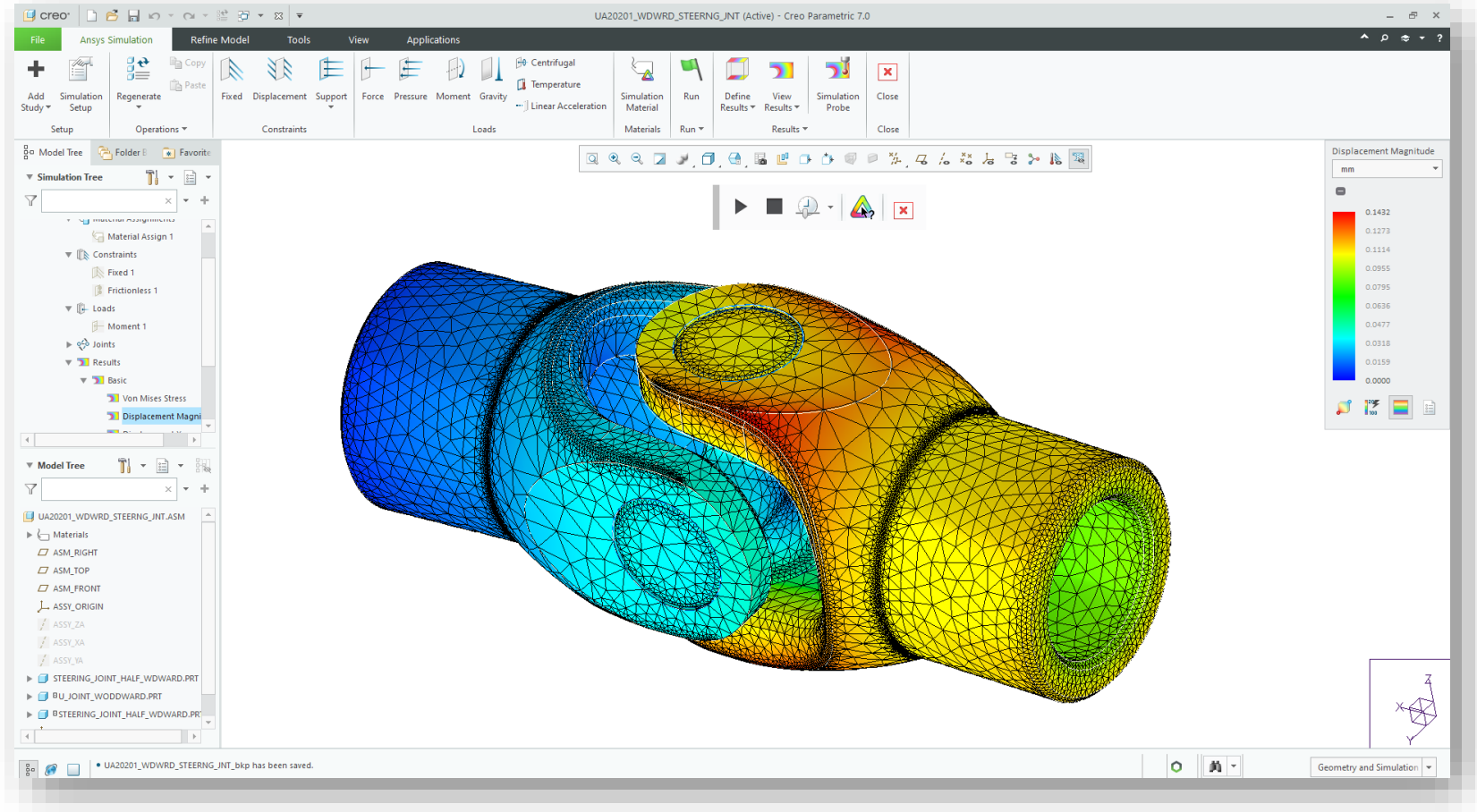
Fidelity & Accuracy

CREO – DEMO



Creo ANSYS Simulation

- Introducing Creo ANSYS Simulate (Creo 7.0.2.0)
- Powered by Ansys
- Support Structure, Thermal, Modal
- Automatic mesh and contacts (advanced options for manual control)
- Preserves all Creo Simulation Live setup
- Support for masses, springs, shells and beams
- Includes powerful Ansys solver and mesh creation
- Export to Ansys Mechanical

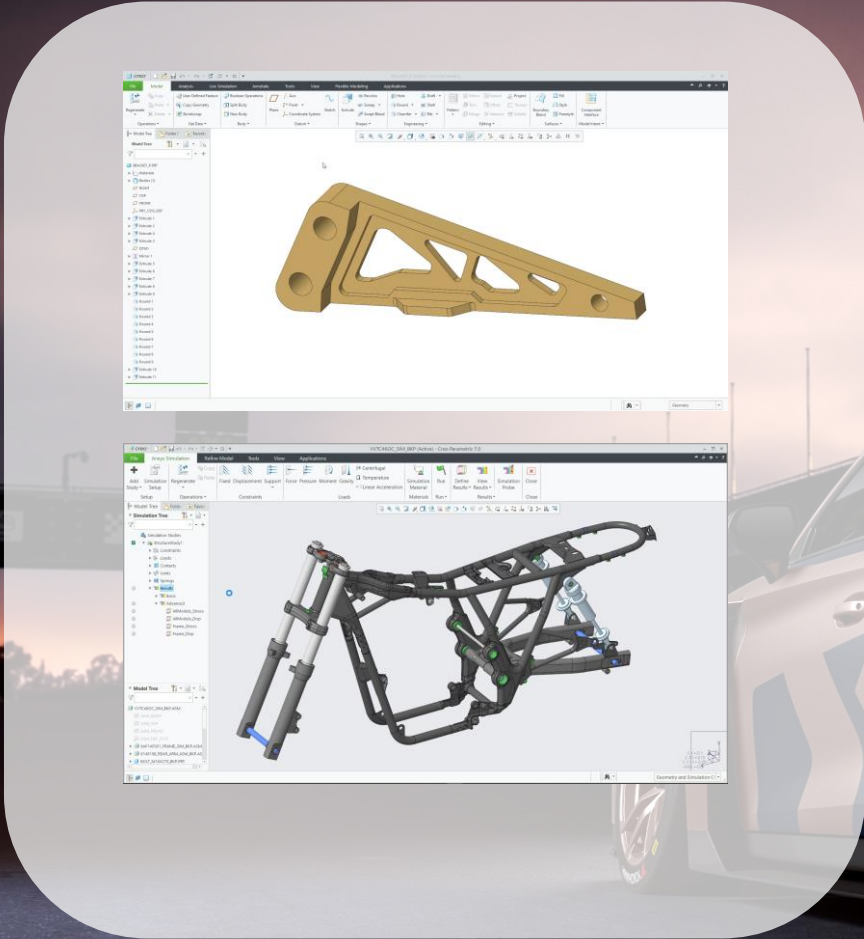


True Ansys Integration

Easy to setup and run
high fidelity simulations

Multiple result types

CREO - DEMO



Creo Simulation Live and Creo Ansys Simulation Roadmap*



2019

2020

2021

Dec '18 – Trial
Creo 5.0.3.0

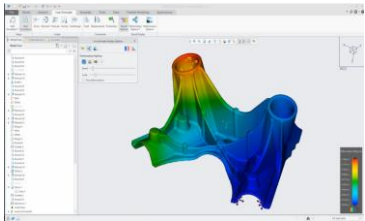
Q1/Q2 - Release
Creo 4.0 M090
Creo 5.0.4.0
Creo 6.0.1.0

Q2 - Release
Creo 7.0

Q2 - Release
Creo 8.0 & Beyond

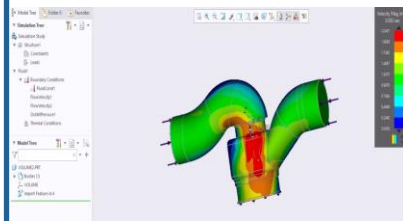
Creo Simulation Live

- Creo Simulation Live
 - Static Structural
 - Thermal
 - Modal



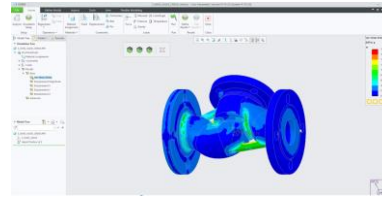
Creo Simulation Live

- Phase 2 Improvements
 - Performance
 - Transient Thermal
 - Fluids



Creo Ansys Simulation

- Creo Ansys Simulation–
Creo 7.0.2.0
 - Initial Implementation



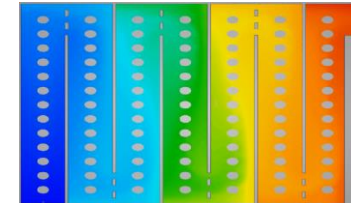
Creo Ansys Simulation

- Phase 2 implementation
 - Shell elements
 - Non-Linear materials



Creo Simulation LIVE

- Planned Enhancements
 - Steady State CFD
 - Improved Probes
 - Linear contact*



*subject to change

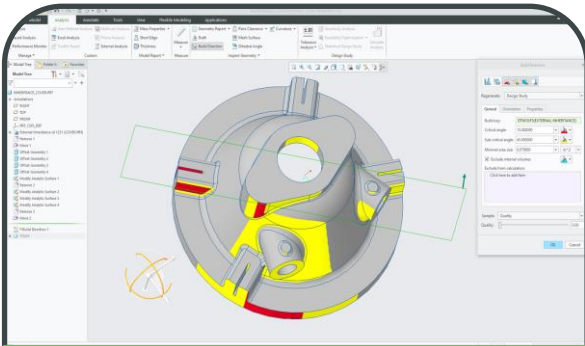


Creo Additive Manufacturing



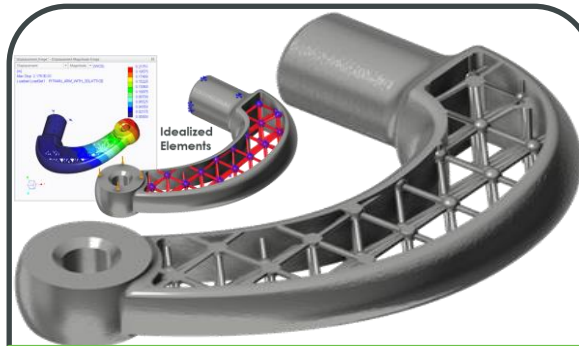
Design for Additive Manufacturing with Creo

Go from design to manufacturing, all in one environment



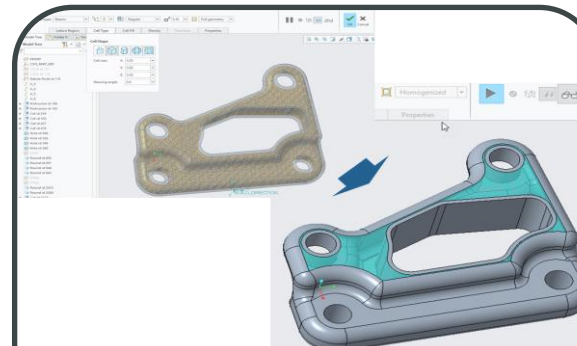
BUILD DIRECTION OPTIMIZATION

Predict supported areas
Manual selection
Optimization



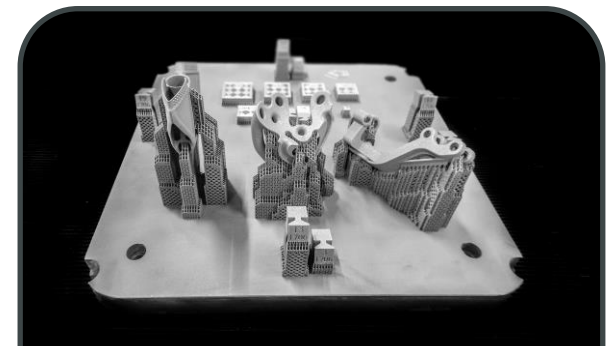
LATTICE MODELLING

2 ½ D extrusion based
3D Beam lattices
Stochastic, Formula-based, custom
Multiple Representations



MATERIAL HOMOGENIZATION

2nd level of simplification
for the simulation of very-
large lattice structures

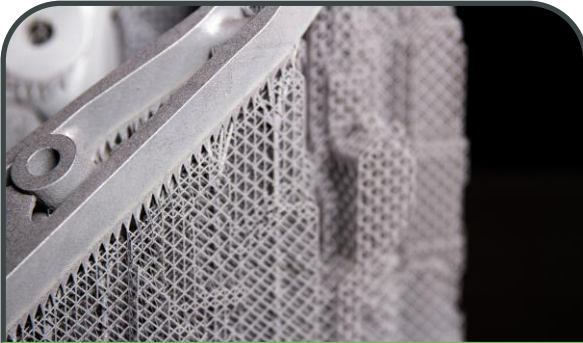


TRAY ASSEMBLY

Full Associativity with Creo
Data managed object in WC
3D Nesting

Design for Additive Manufacturing with Creo

Go from design to manufacturing, all in one environment



SUPPORT STRUCTURES FOR METAL PRINTING

Materialise technology for
Support Generation



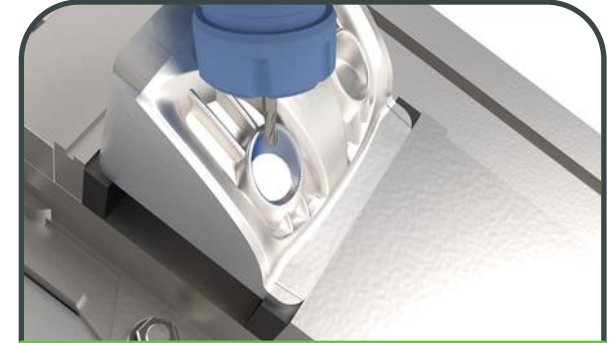
SIMULATION

3rd Party technology for:
Metal Printing Simulation and
Distortion compensation
-Amphyon Powered-



INTEROPERABILITY

STL, AMF, 3MF, CLI, Windows
10 Driver, Materialise Build
Processors ...



MACHINING AS A POST- PROCESSING OPERATION

Machining capabilities for
support removal and multi-
task machines programming

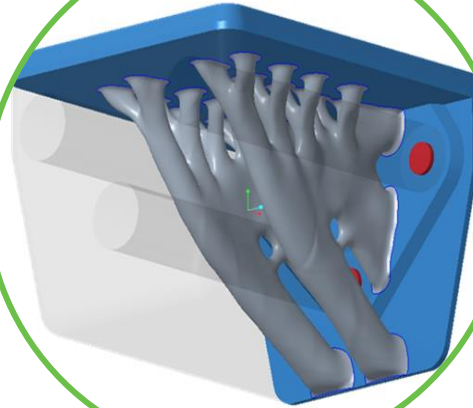
Creo Additive Manufacturing

- Tray assembly specific to printer
- Pattern and nest components
- Support structure generation

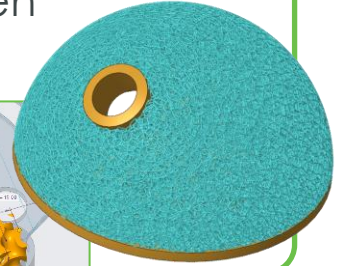
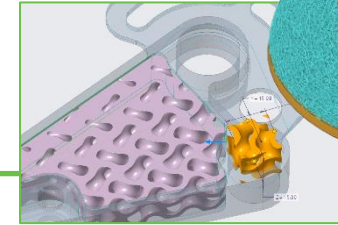
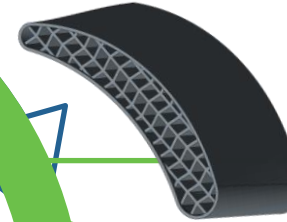


3DP CHECK

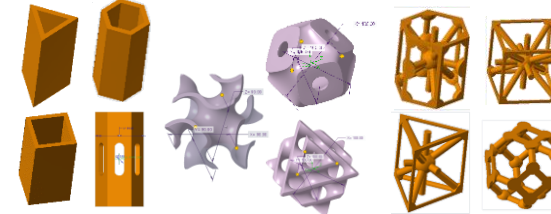
DESIGN



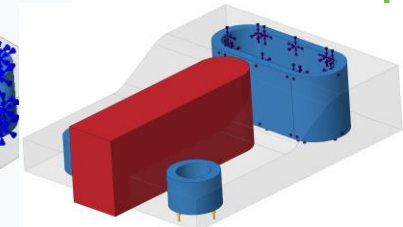
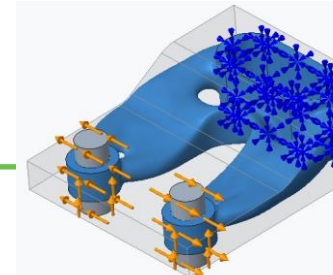
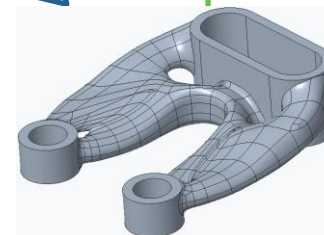
- Lattice Creation & Optimization
 - 2.5D, bean based, stochastic and Formula driven
- Build Direction analysis



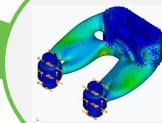
OPTIMIZE



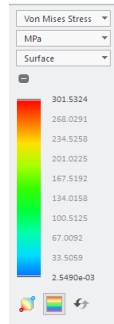
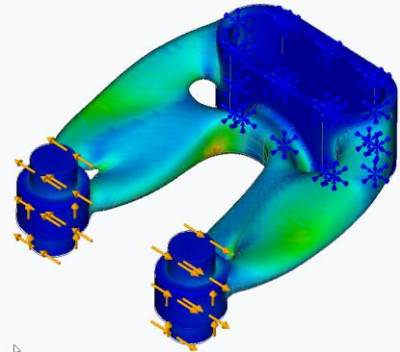
- Generative Topology Optimization
- Generates optimal designs from a set of system design requirements.
- Geometry reconstruction



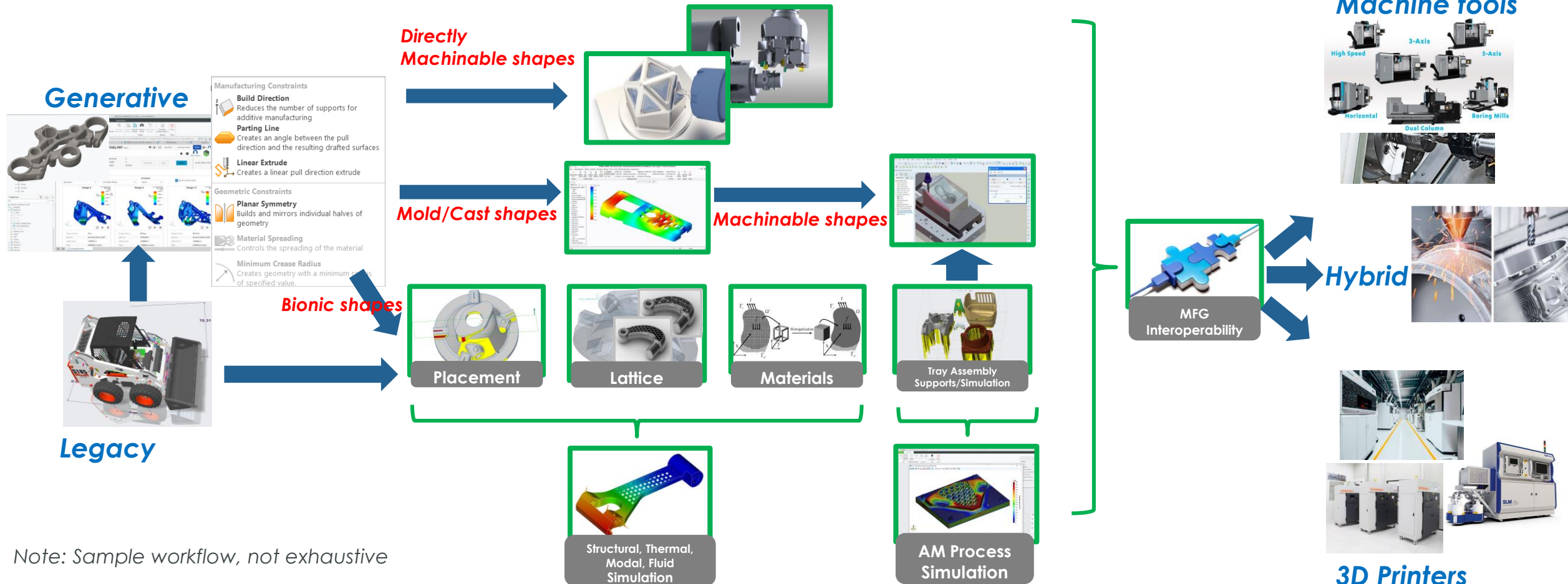
VALIDATE



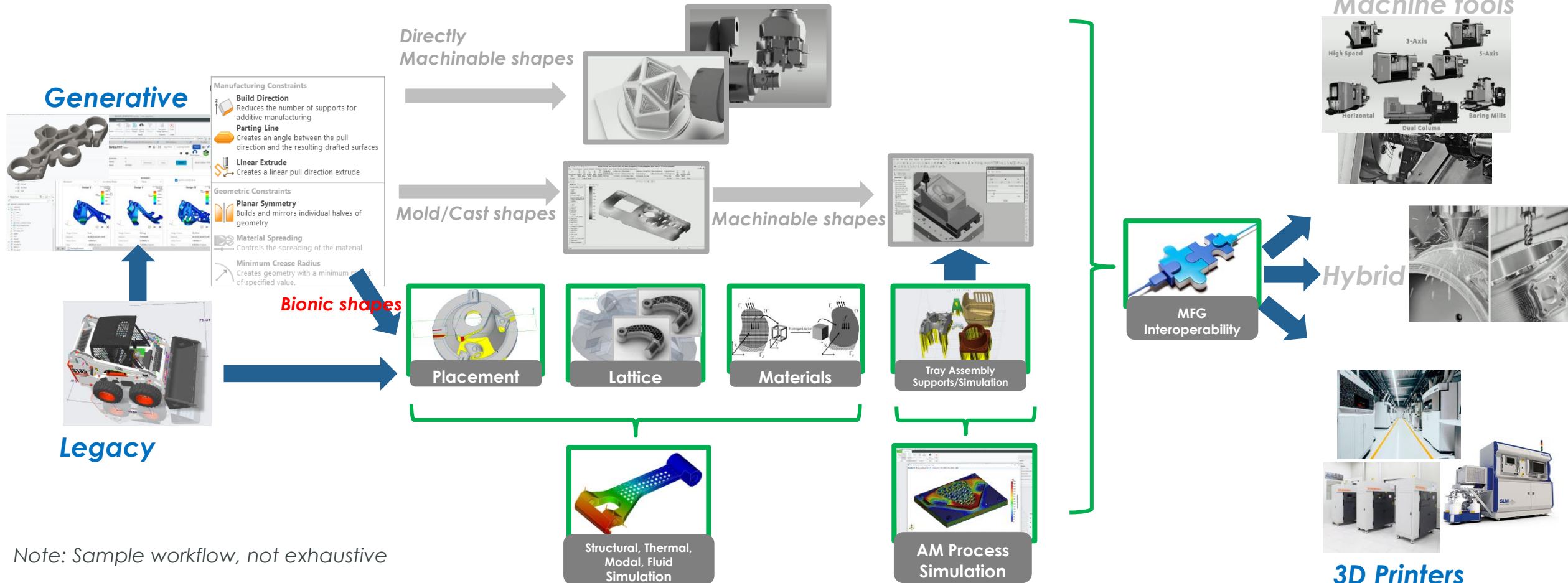
- Validate Geometry in real time using Creo Simulation Live



Faster exploration of innovative design alternatives and selection of the most efficient manufacturing processes

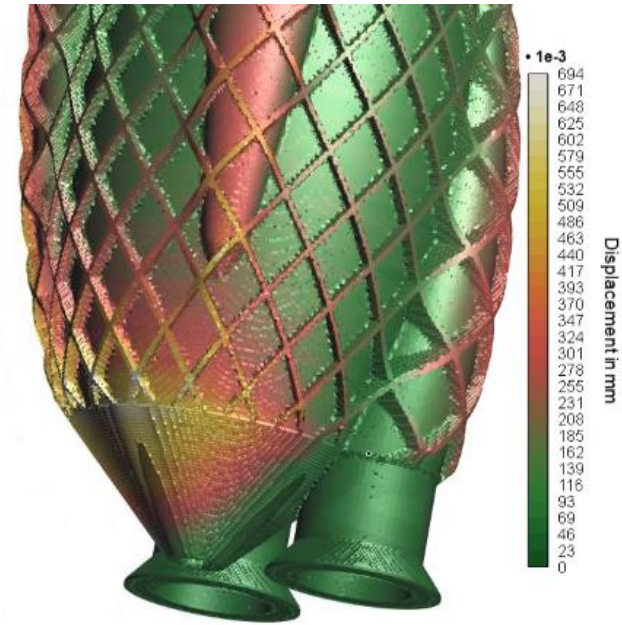


Faster exploration of innovative design alternatives and selection of the most efficient manufacturing processes





COMPACT HEAT EXCHANGER EXCHANGER EXAMPLE

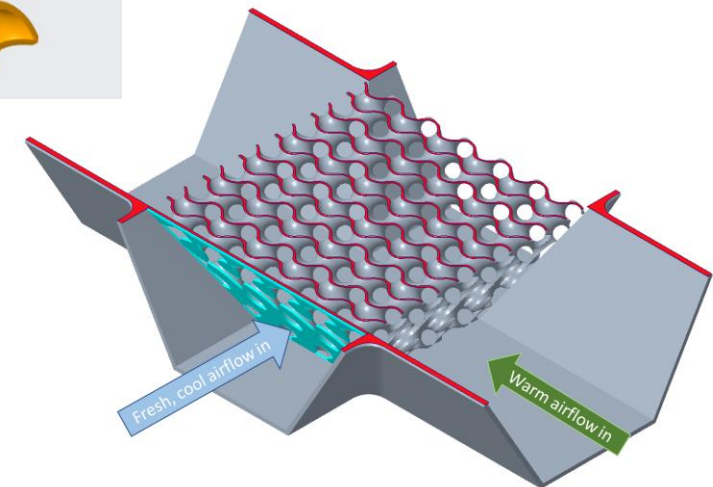
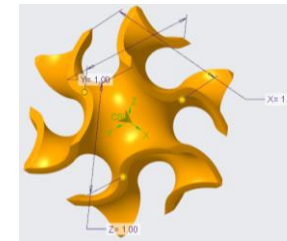
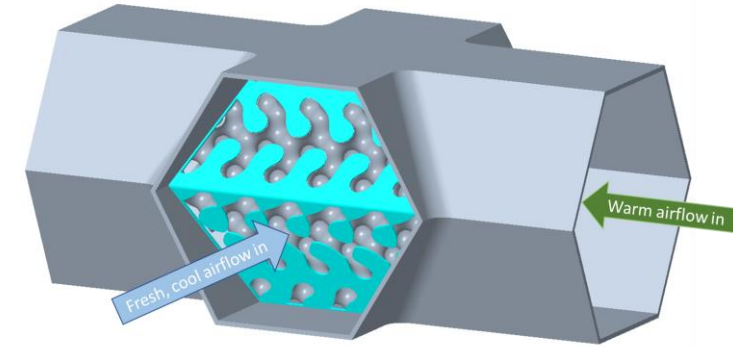


TPMS CELLS AND HEAT EXCHANGERS BACKGROUND INFORMATION

- Modern heat exchangers are made of thin wall thickness components.
 - Manufacturing capabilities needed span from laser cutting, welding, hydroforming, brazing and the like...



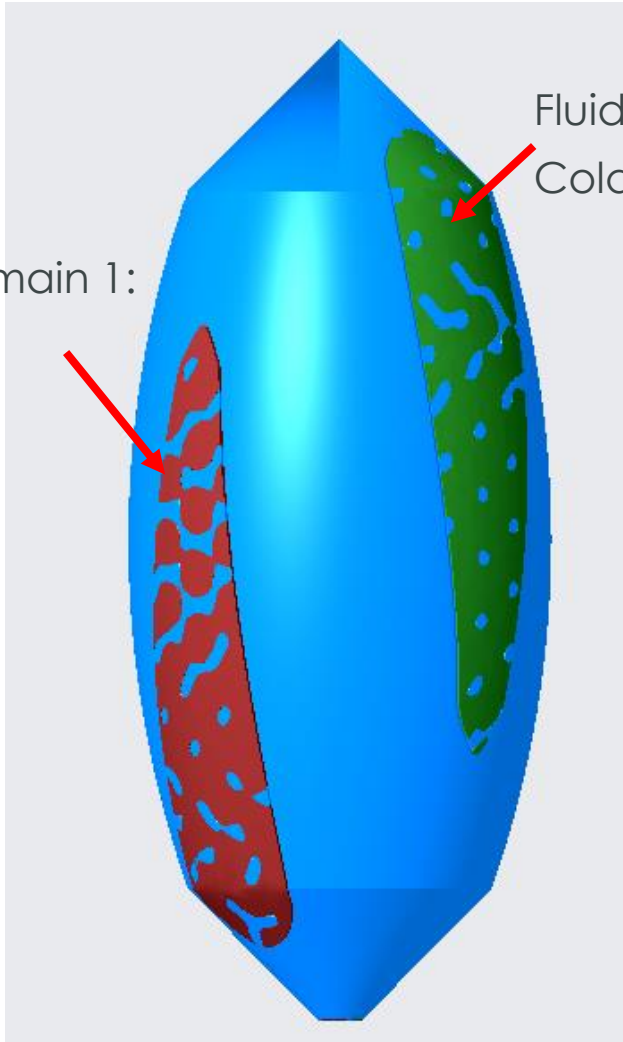
- TPMS structures split the infill volume in two separate continuous fluid domains, there are very strong structures, and they don't require supports during Powder-Bed Fusion printing process.
- Lately, specially in R&D departments and Universities, several research projects have been presented about the efficiency of TPMS-based heat exchangers.



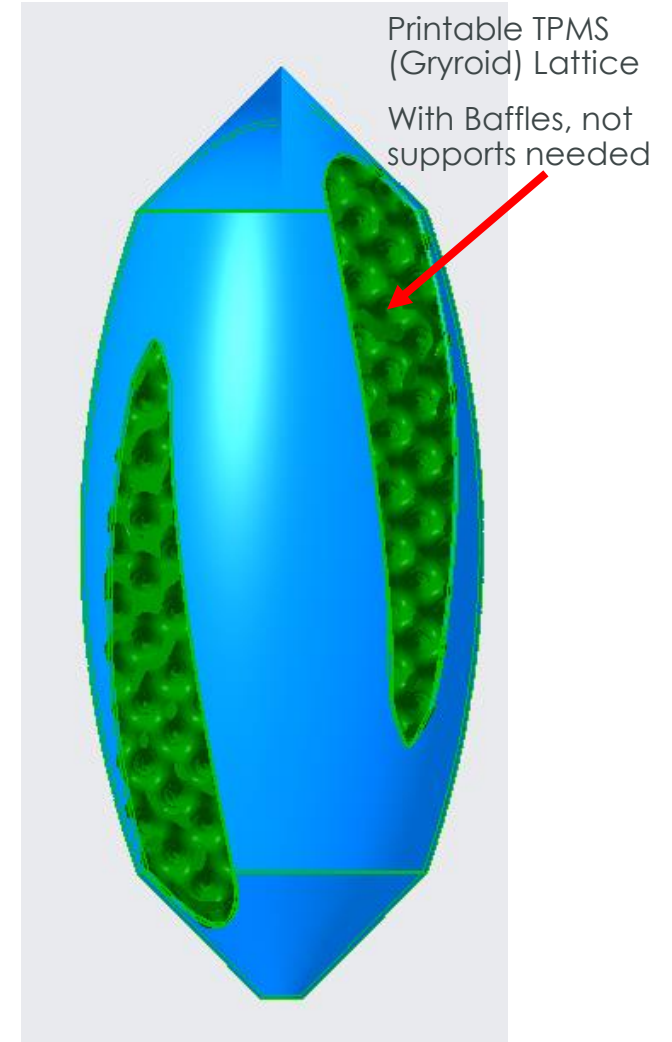
A DEMONSTRATOR FOR A COMPACT HEAT EXCHANGER. WITH NO SUPPORT STRUCTURES NEEDED



Fluid Domain 1:
Hot

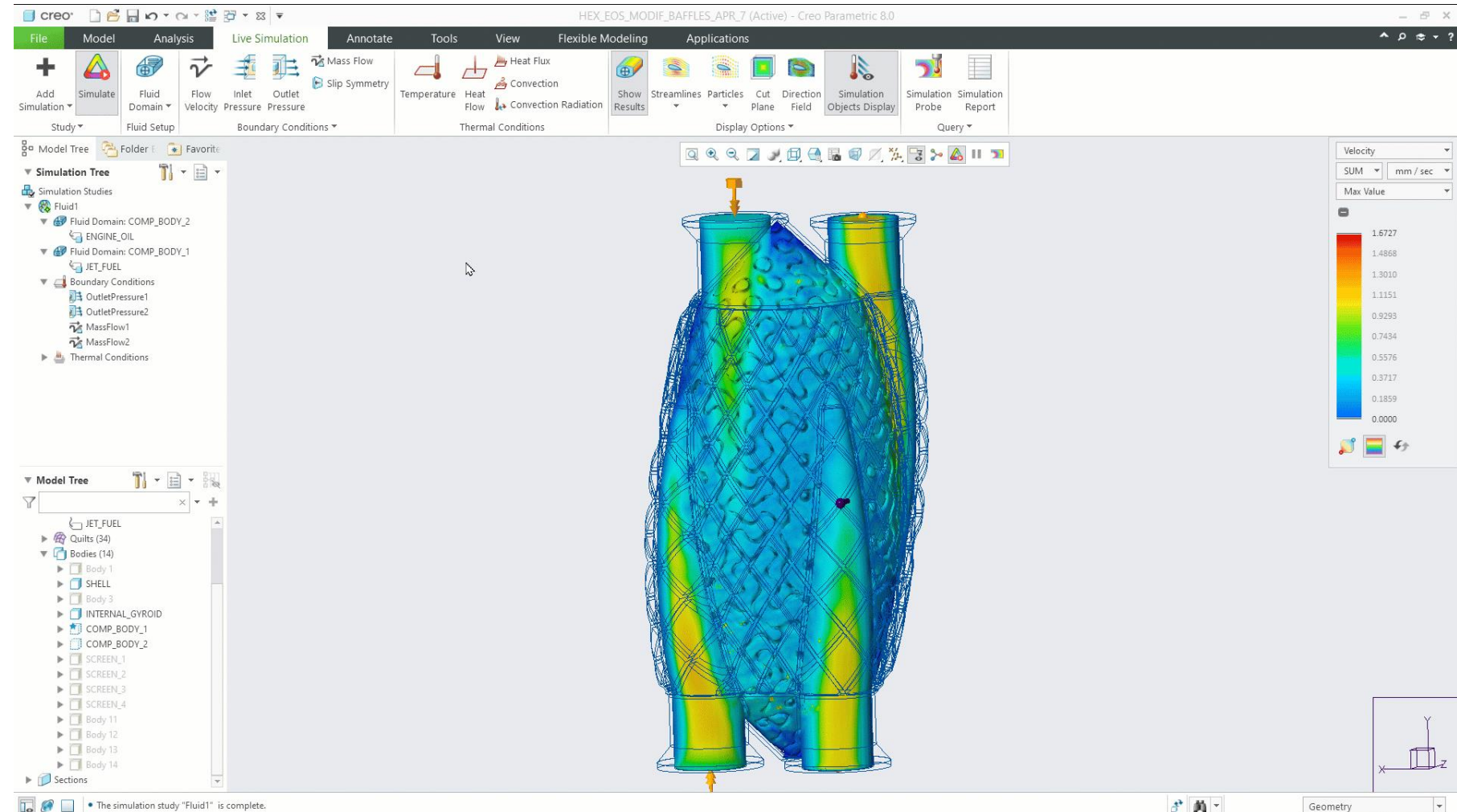


Fluid Domain 2:
Cold



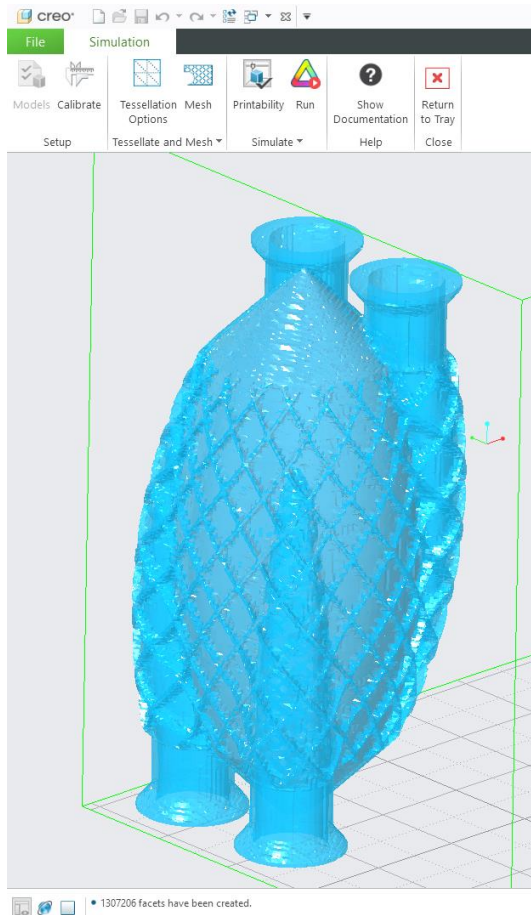
CFD USING CREO LIVE SIMULATION

- We used Creo Live Simulation to avoid recirculation regions and get quick feedback on the flow streamlines, velocity distribution and pressure drop.



PROCESS SIMULATION PROVIDE FEEDBACK TO THE DESIGN PROCESS

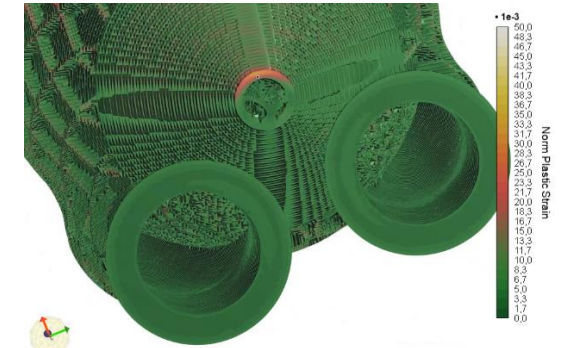
- Amphyon for Creo simulate the printing process.



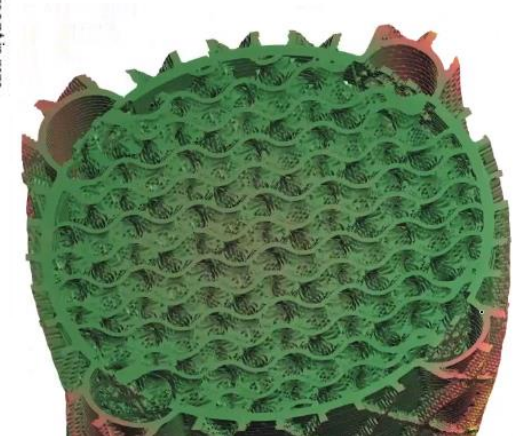
- The simulation detected displacement and plastic strain problems which allow improve the design before the final print



Displacement in mm
• 1e-3
694
671
648
625
602
579
555
532
509
486
463
440
417
393
370
347
324
301
278
255
231
208
185
162
139
116
93
69
46
23
0



Nom Plastic Strain
• 1e-3
50.0
48.3
46.7
45.0
43.3
41.7
40.0
38.3
36.7
35.0
33.3
31.7
30.0
28.3
26.7
25.0
23.3
21.7
20.0
18.3
16.7
15.0
13.3
11.7
10.0
8.3
6.7
5.0
3.3
1.7
0.0

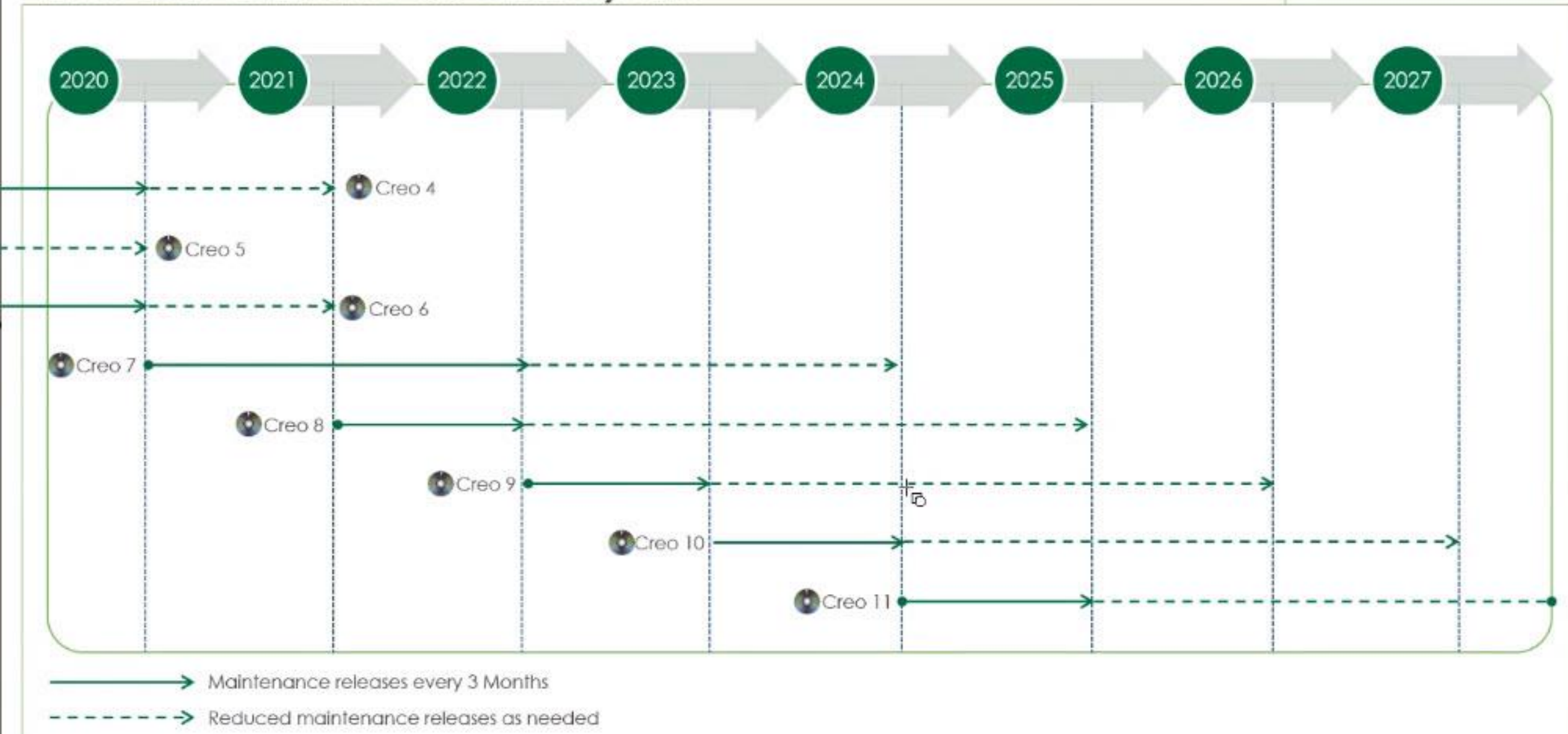


Displacement in mm
• 1e-3
694
671
648
625
602
579
555
532
509
486
463
440
417
393
370
347
324
301
278
255
231
208
185
162
139
116
93
69
46
23
0



CREO ANNUAL RELEASE CADENCE •

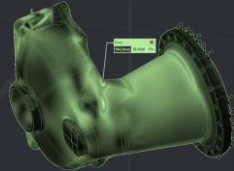
New Plan from Creo 8.0 and Beyond



CREO STRATEGY LOOKING FORWARD



Model Based
Definition



Simulation
Driven Design



User
Productivity



Generative
Design



Design for
Additive



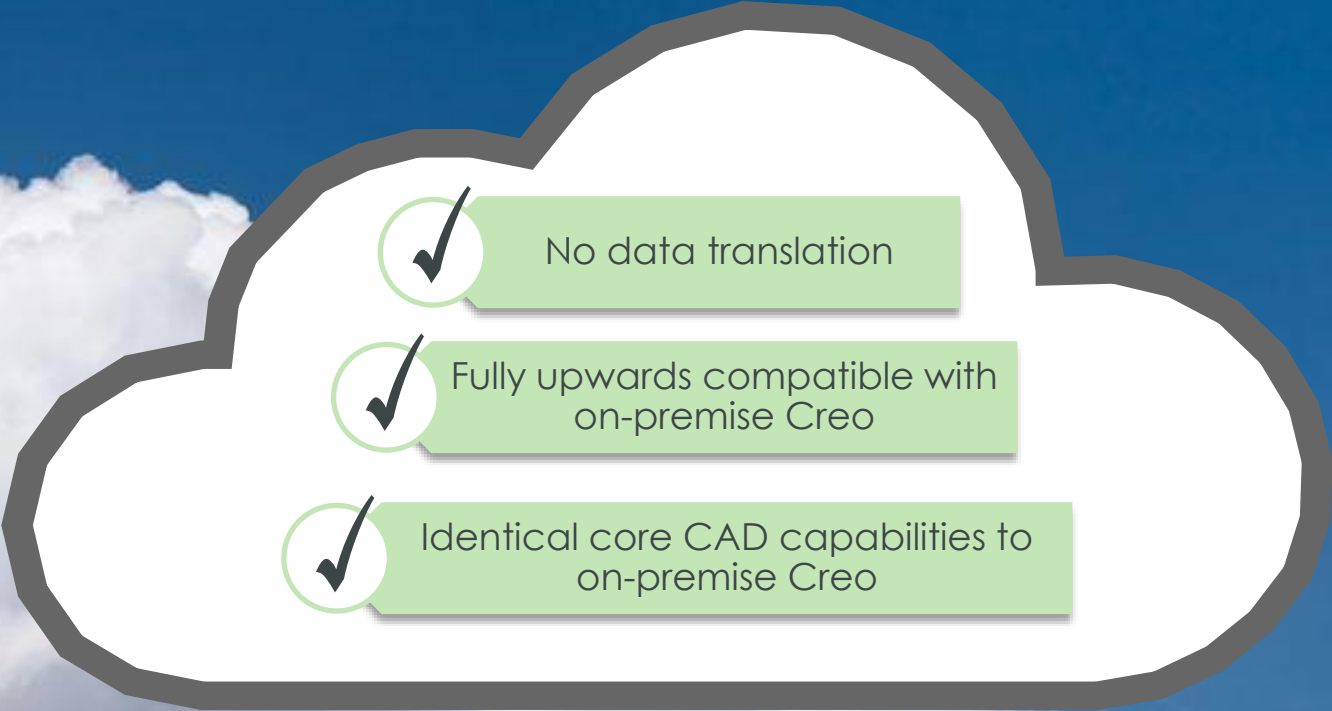
Design with
Composites



creo® SaaS

WHAT IS CREO SAAS?

The power and proven functionality of Creo with new tools to enhance collaboration, create greater accessibility for designers and easier administration for IT, tightly integrated with Windchill SaaS or with PDM on PTC Atlas.

- 
- ✓ No data translation
 - ✓ Fully upwards compatible with on-premise Creo
 - ✓ Identical core CAD capabilities to on-premise Creo

• **easy** to use • **easy** to configure • **easy** to deploy • **always** up to date •

THE CREO SAAS ROADMAP ON PTC ATLAS



Available Today:

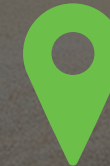


Augmented Reality

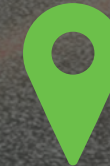


Generative Design

What's Coming:



Deployment & Licensing



Collaboration



Creo SaaS



22. Bayreuther 3D-Konstrukteurstag

15. September 2021

Programm

Ab 9:00				
Vortragsrunde				
9:00 bis 9:10	Begrüßung und Einführung in die Konferenz Prof. Dr.-Ing. Stephan Tremmel, LS Konstruktionslehre und CAD, Universität Bayreuth			
9:10 bis 10:10	Neuigkeiten / Produktausblick PTC, Live-Präsentationen PTC Themen INNEO. Christoph von Andrian-Werburg, PTC, München Klaus Raab, INNEO Solutions, Ellwangen			
10:10 bis 10:30	Session 1	Session 2	Session 3	Session 4
10:30 bis 11:00	3D in der technischen Dokumentation – Welche neuen Möglichkeiten bietet die Kombination HTML und 3D Andreas Vogel, theorie3.De	Live-Simulation mit Ansys Discovery Joel Grognez, CADFEM GmbH	Nachhaltige additive Innovationen durch interdisziplinäres Mindset Christian Bay, Campus Additive.Innovationen, UBT	Elevator Pitch verschiedener Forschungsprojekte
11:00 bis 11:30	Model Based Definition – Möglichkeiten zur digitalen Produktdefinition im 3D-Modell mit Creo Parametric Klaus Raab, INNEO	Livesimulation im Konstruktionsalltag: Erfahrungen aus der Praxis Marc Vidal, CADFEM GmbH	Generative Design: Hocheffiziente Erzeugung optimierter Leichtbaustrukturen Gereon Deppe, Thomas Reiher, Hexagon / MSC Software	
11:30 bis 12:00	NX Mold Wizard - Spritzgußwerkzeuge intelligent & effektiv konstruieren Uwe Müller, PBU CAD-Systeme	Finite-Elemente-Analyse mit der OpenSource Software Code-Aster Johannes Ackva, Ingenieurbüro für Mechanik	Machine Learning im CAE Cornelia Thieme, Hexagon / MSC Software	Diskussion
12:00 bis 13:00	Mittagspause			
13:00 bis 13:30	Semantisches Datenmanagement für Softwaretools in der digitalen Produktentwicklung Tobias Siegel, Andreas Kormann LS Konstruktionslehre und CAD, UBT	Model-led NVH Process for EV-drive applications, - the next chapter of CAE-led design Annabel Shahaj, Romax Technology GmbH	Topologieoptimierung (Generatives Design) und 3D-Druck mit Creo Klaus Raab, INNEO	
13:30 bis 14:00	Ansatz zur Bereitstellung von Modelldaten für Strömungssimulationen auf Basis von CT-Daten Dirk Hofmann, IAVT	CAD-unabhängige Topologie-Optimierung für Entwickler mit ProTop Urs Simmler, GIA Informatik AG	Tribologische Kontakte verstehen und optimieren – Ein numerischer Ansatz zur Berechnung hochbelasteter TEHD-Kontakte. Christian Orgeldinger, LS Konstruktionslehre und CAD, UBT	
14:00 bis 14:30	Die Zukunft der Produktentwicklung: CAD, Datenmanagement und Echtzeit-Zusammenarbeit in einer Lösung Ludwig Haas, INNEO	Automatisierte Simulation von Sandwichbauteilen mit Z88Aurora Johannes Glamsch, Florian Hüter LS Konstruktionslehre und CAD, UBT	OpAL – mit Optimierung, Additiver Fertigung und Leichtbau gegen die Folgen der Pandemie Thomas Schütt, LS Konstruktionslehre und CAD, UBT	
14:30 bis 14:40	Abschlussdiskussion der Vortragsrunde Prof. Dr.-Ing. Stephan Tremmel, LS Konstruktionslehre und CAD, Universität Bayreuth			
Ab 15:00				
Fachausstellung				
15:00 bis 16:00	Elevator Pitch der Aussteller			
16:00 bis 17:00	Fachausstellung in verschiedenen Räumen			
17:00 bis 17:15	Abschlussdiskussion und Verabschiedung Prof. Dr.-Ing. Stephan Tremmel, LS Konstruktionslehre und CAD, Universität Bayreuth			