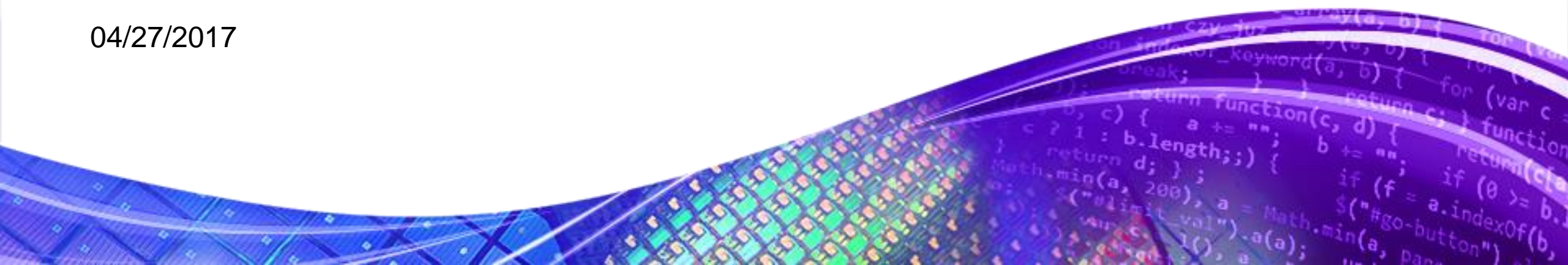


Simpleware: 3D Image Data to Simulation

NAFEMS

Kerim Genc PhD – Simpleware Technical Sales

04/27/2017



Synopsys / Simpleware Intro

Introduction to Simpleware

Image-based modelling and workflow

Software overview

New features for 2016.09

Simpleware Case studies

Summary

Why Did Synopsys Acquire Simpleware?

*The acquisition of Simpleware represents Synopsys' **entry into new markets** where the **simulation of complex 3D** structures addresses product design and data analysis applications in the life sciences, consumer products, aerospace, automotive, defense, oil and gas industries.*

Synopsys Completes Acquisition of Simpleware

MOUNTAIN VIEW, Calif., May 17, 2016 /PRNewswire/ -- Synopsys, Inc. (Nasdaq:SNPS) today announced it has completed its acquisition of Simpleware Ltd., a privately held, leading provider of software products for the conversion of 3D scan data into high-quality computer models used for engineering design and simulation. The Simpleware products address a wide range of product design and data analysis applications in the life sciences, consumer products, aerospace, automotive, defense, oil and gas industries. The terms of the deal, which are not material to Synopsys financials, are not being disclosed.

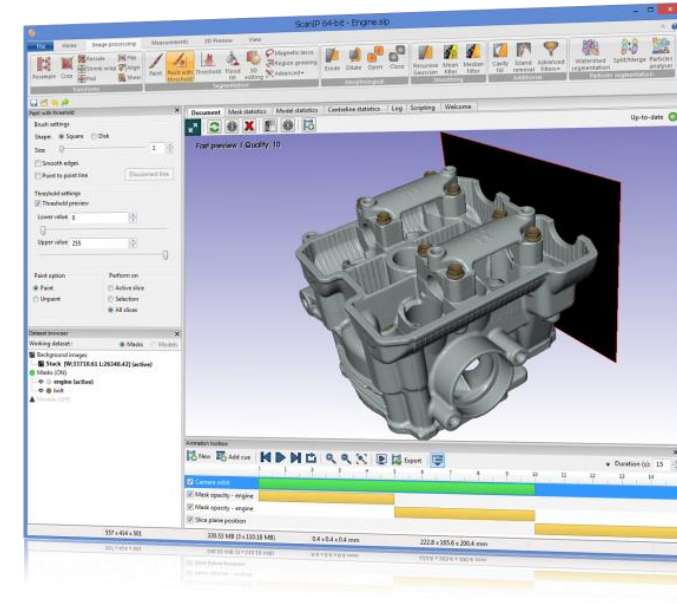
<http://news.synopsys.com/2016-05-17-Synopsys-Completes-Acquisition-of-Simpleware>

- Synopsys has preserved Simpleware's current product development focus, technical support and sales infrastructure
- Synopsys is adding resources to accelerate product innovation
- Dr Philippe Young continues to lead R&D and technical support

Simpleware Product Group

Developers of industry-leading software solutions for the visualisation and analysis of 3D image data

- Pioneers in image-to-mesh techniques to generate simulation-ready models of highly complex structures
- Over **130 customers** worldwide, supported by global sales channel
- Award winning software solutions and services
- Expertise in Life Sciences, Materials / Industrial Engineering, and applications to Oil and Gas, Automotive / Aerospace and Consumer Product design
- Skilled services team for development of customized models
- Dedicated training on-site or in our offices
- Excellent support & guidance via web, email and phone



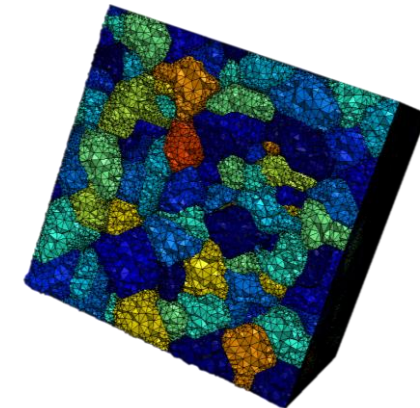
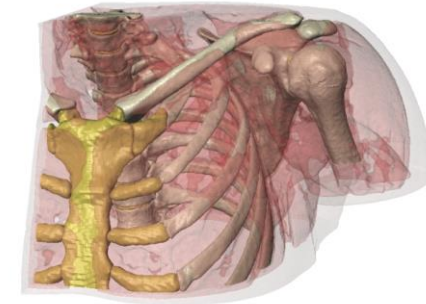
THE QUEEN'S AWARDS
FOR ENTERPRISE:
INNOVATION



THE QUEEN'S AWARDS
FOR ENTERPRISE:
INTERNATIONAL TRADE

Need for Image-based Modeling and Simulation is Rising

- Fast adoption of 3D imaging technology
 - Captures external and internal features,
 - Industrial and medical settings
- Driven by the demand for more realistic simulation
 - Expanding capability of FEA/CFD codes,
 - Ever increasing access to high specification hardware,
 - Allow the study of true topology, structures and materials
- Leading to a growth in image based inspection and simulation



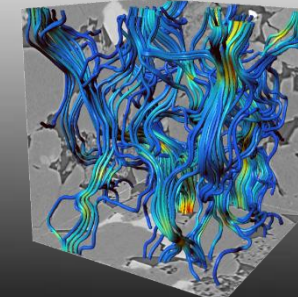
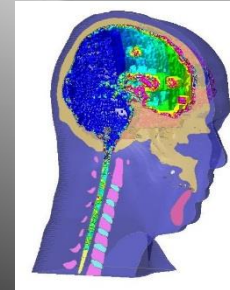
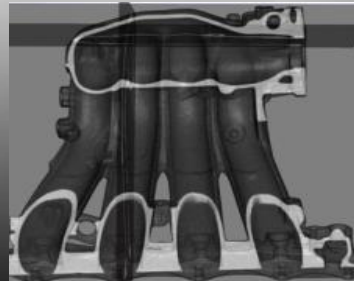
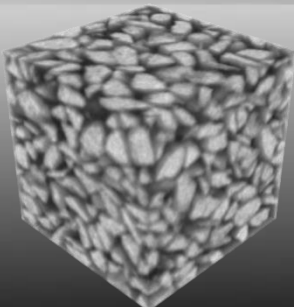
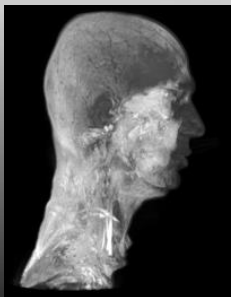
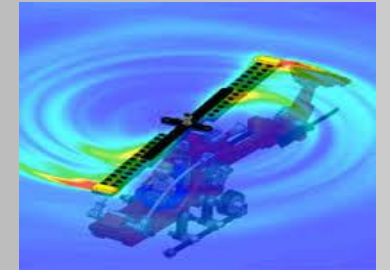
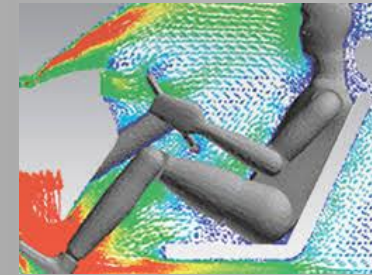
Simpleware Products Bridge 3D Imaging and Simulation of Complex Objects and Shapes

3D Imaging



Simpleware
Products

Simulation



BIG Disconnect: Trying to use CAD-Based Meshing on Something that is NOT CAD

Lost Opportunity for Simulation Use and Workflow Adoption

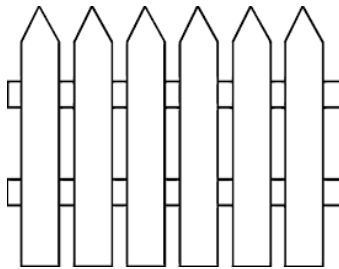
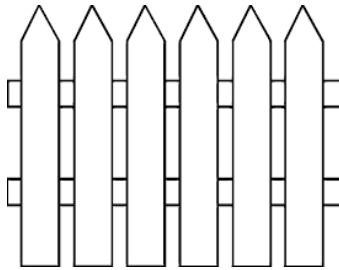
CAE Group



Original Part to Model



Not able to create FE mesh



Original Part



CT Scan



3D Image Data



STL Meant for Basic Visualization

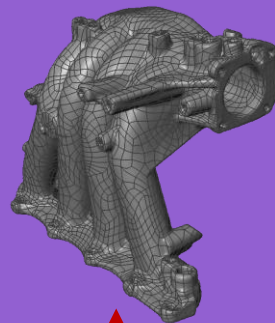
Imaging Group

With Simpleware You Go Directly from Segmented 3D Image Data to High Quality and Robust FE Mesh

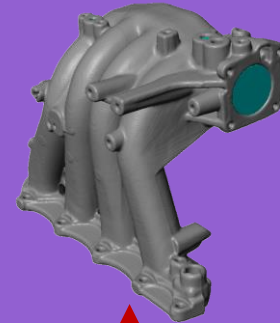
CAE
Group



Original
Part to
Model



NURBS (IGES)



STL

Original
Part



CT Scan



3D Image
Data

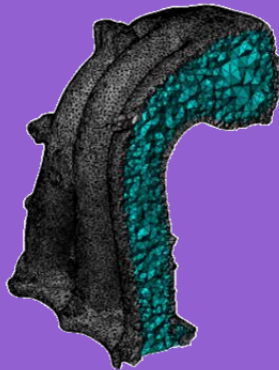
Imaging
Group

With Simpleware You Go Directly from Segmented 3D Image Data to High Quality and Robust FE Mesh

CAE
Group



Original
Part to
Model



FE Mesh



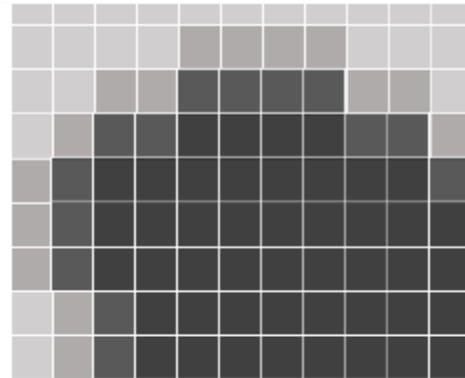
CT Scan



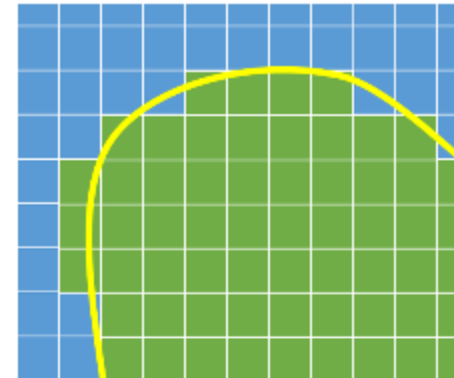
3D Image
Data

Imaging
Group

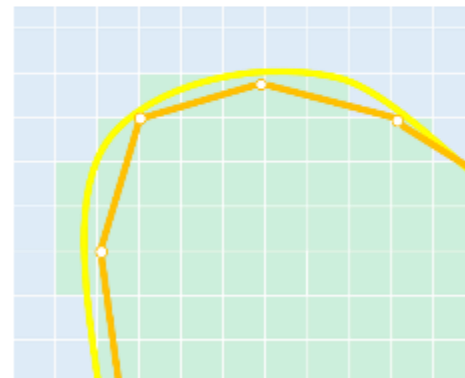
Enhanced Volumetric Marching Cubes



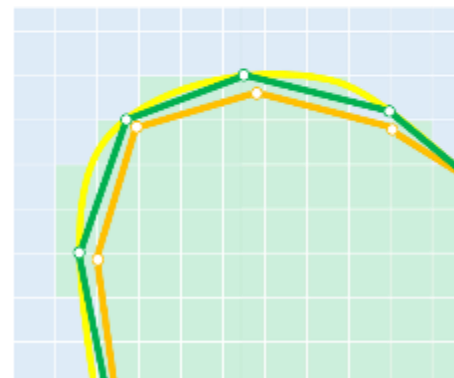
1. Original greyscale image



2. Mask segmentation and EVoMaC surface (yellow)

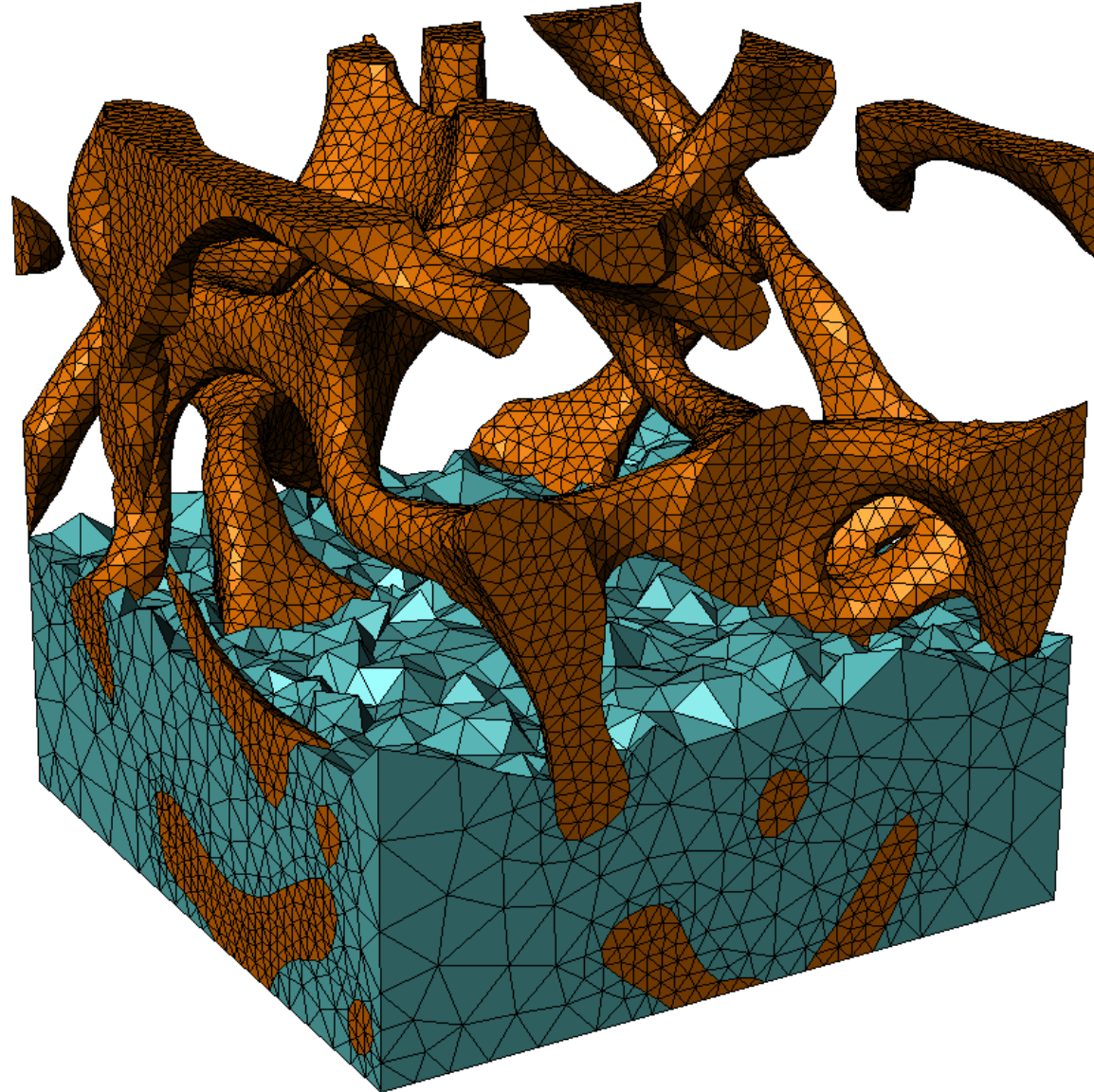


3. Remeshed surface with larger edge lengths (orange)
Note – differences not to scale

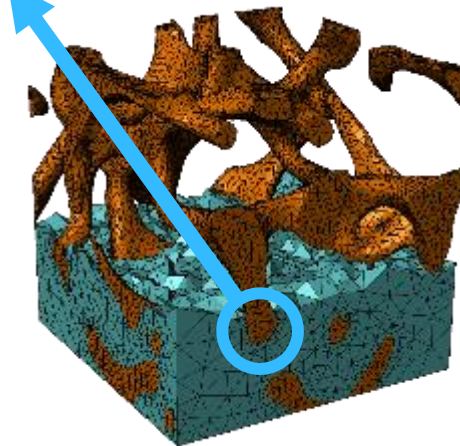
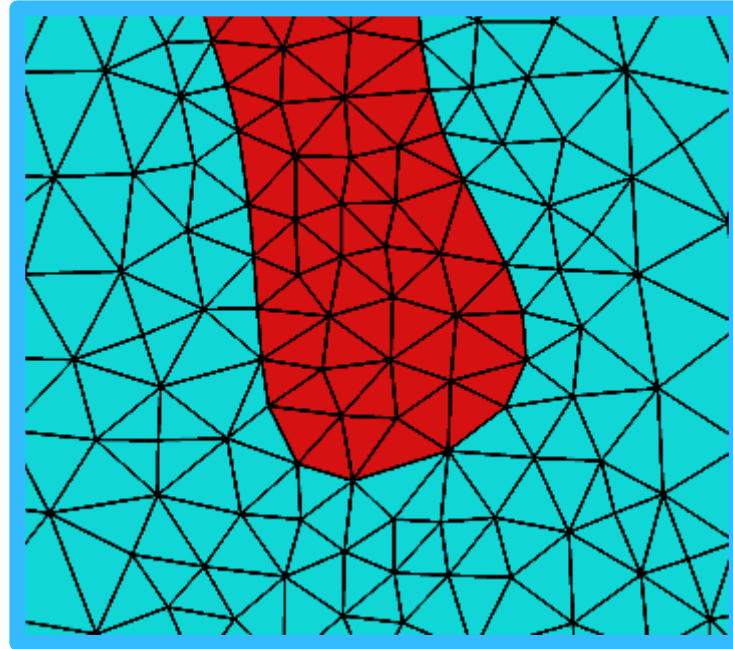


4. Snap to parent applied to move coarser mesh back to EVoMaC position (green)

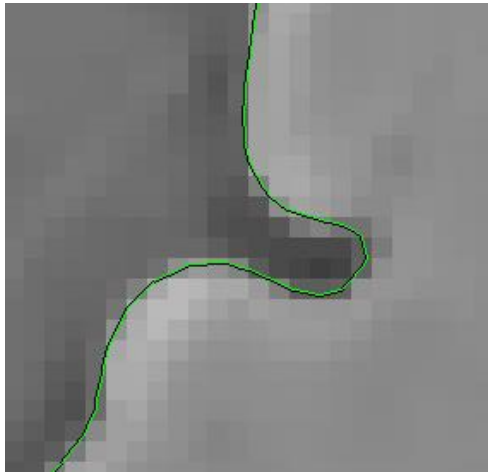
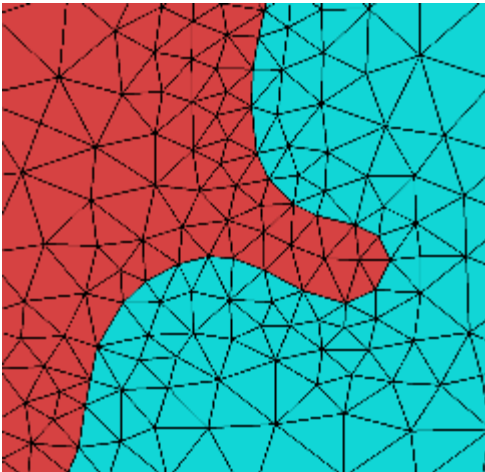
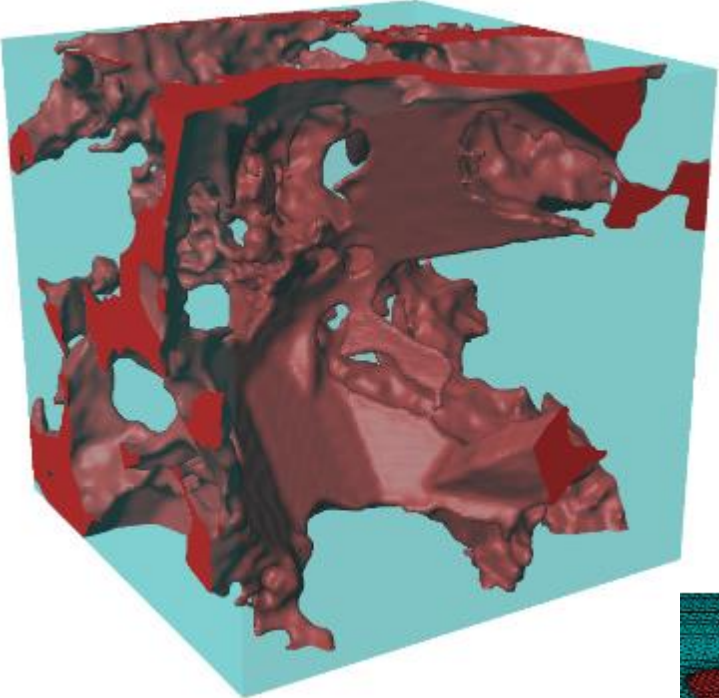
Simpleware meshing workflow



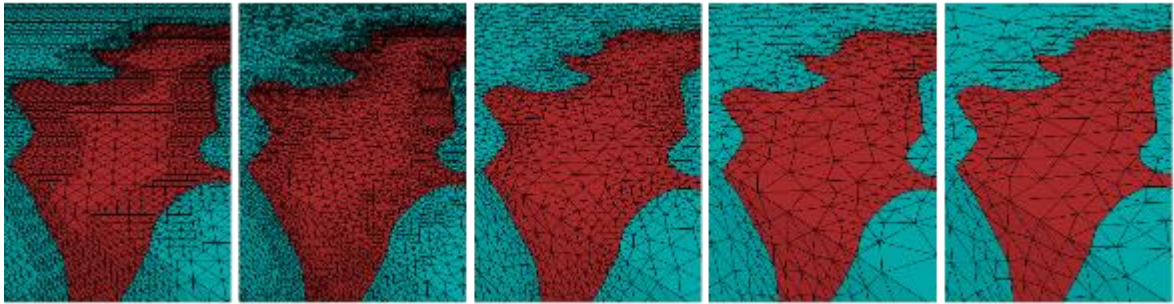
Simpleware meshing workflow



Mesh Control



Shared nodes → Matching interfaces → Accurate meshing



Mesh setting	+FE Grid	+FE Free -10	+FE Free -25	+FE Free -50	+FE Free custom
No. of Elements	11.636M	2.844M	1.093M	816k	503k
Porosity [%]	16.83	16.82	16.82	16.82	16.81

Automotive Applications

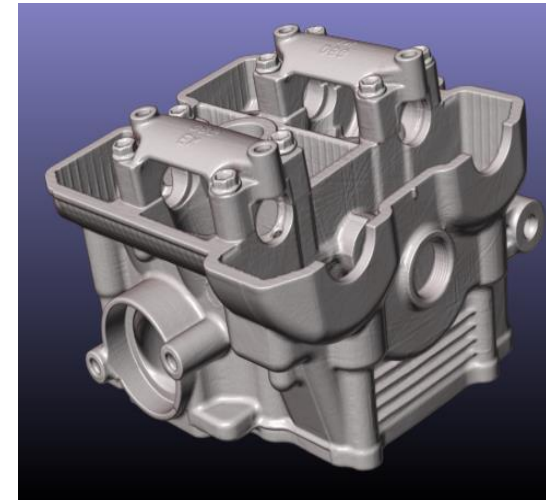
- **Reverse Engineering**

- Rapidly and accurately reverse engineer legacy parts
- Scans of parts can be visualized, segmented, quantified and exported for Additive Manufacturing (AM) or exported as multi-part FE/CFD meshes.



Original Part

simpleware 



Visualization, CAD/FE/CFD
Model Generation,
Measurements etc.

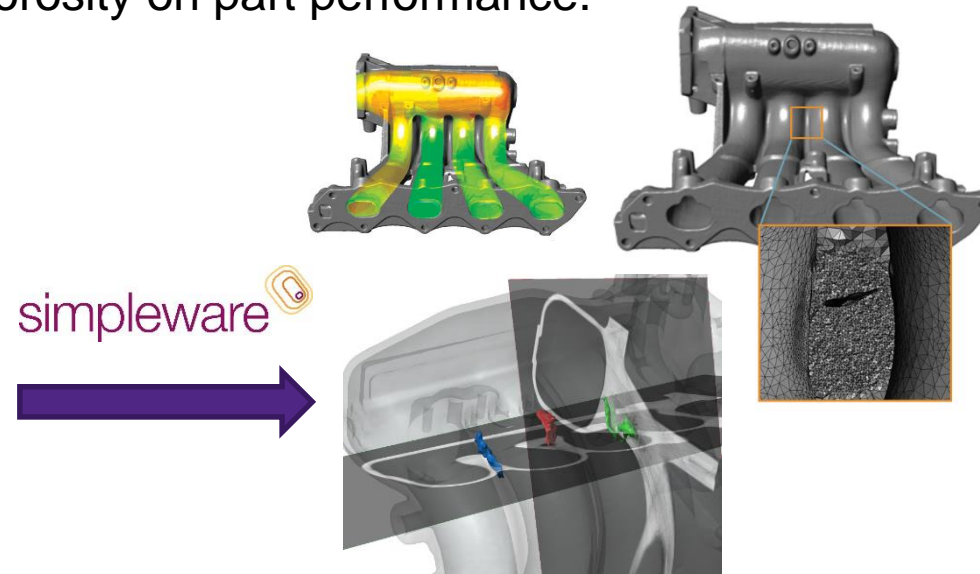
Automotive Applications

- **Non-Destructive Evaluation/Analysis**

- Inspect defects and changes in density
- Crack size/length and distribution
- Surface Characteristics
- Exported model as NURBS for CAD, or as FE and CFD models for analysis of the effects of cracks or porosity on part performance.



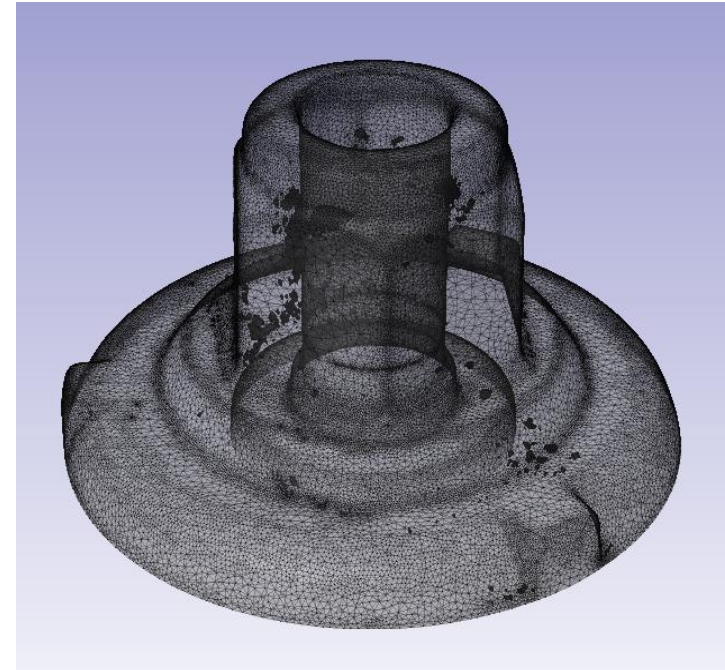
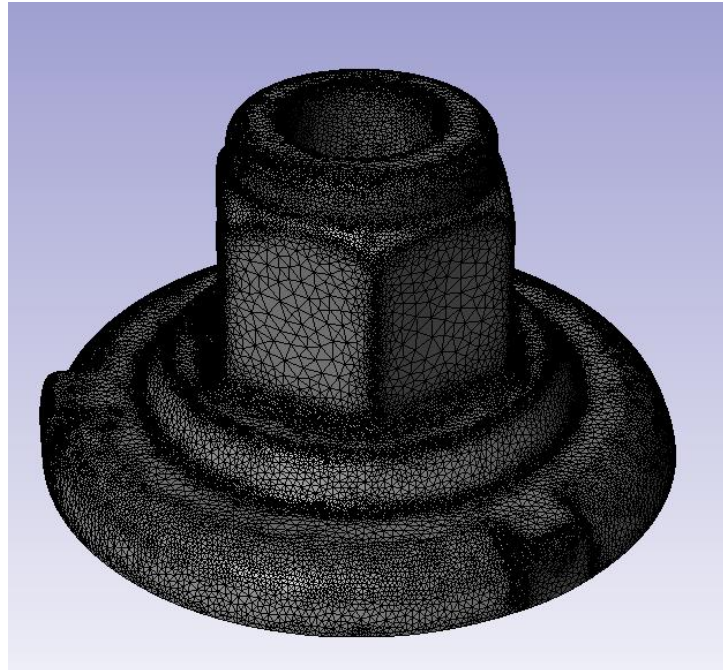
Original Part



Visualization, Defect Quantification,
CAD/FE/CFD Model Generation

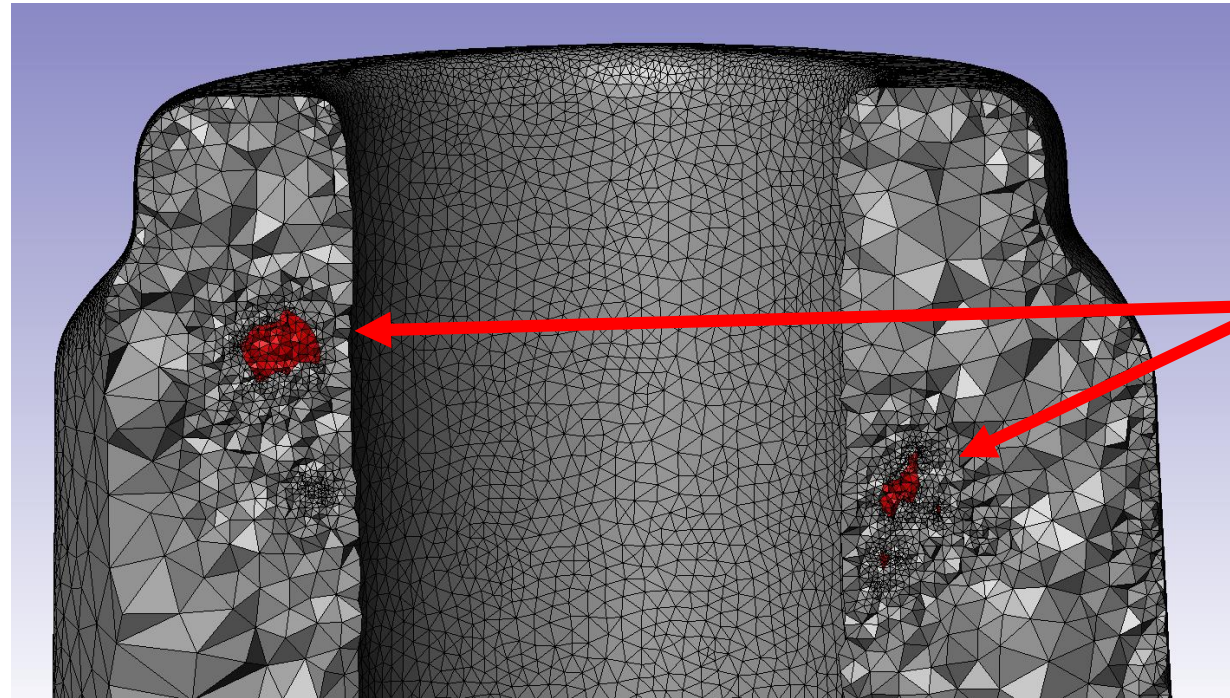
- **Composite Fasteners**

- Fasteners scanned by Microphotonics using a SkyScan CT Scanner
- Non-Destructive Evaluation of potential Porosity, Microcracks, & Defects



- **Composite Fasteners**

- Fasteners scanned by Microphotonics using a SkyScan CT Scanner
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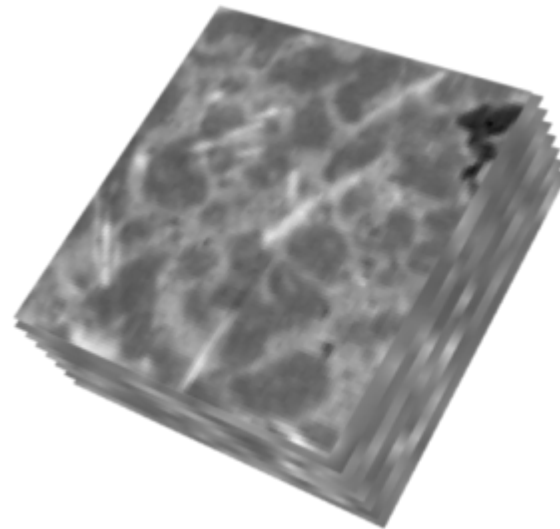


Defects and Pores not only visualized and quantified, but also **incorporated into FE Mesh**

Automotive Applications

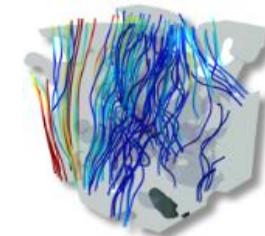
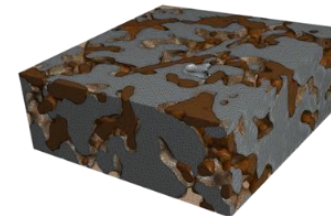
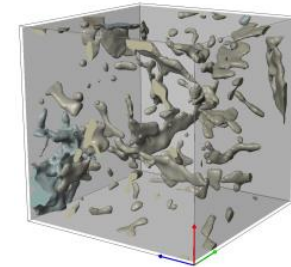
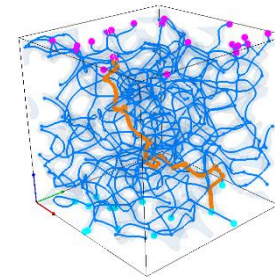
- **Materials Characterization**

–Pore-Scale Flow, Composite Analysis, Quantify porosity/defects/tortuosity and homogenization to calculate effective material properties



CT, MicroCT or nanoCT scan of Material

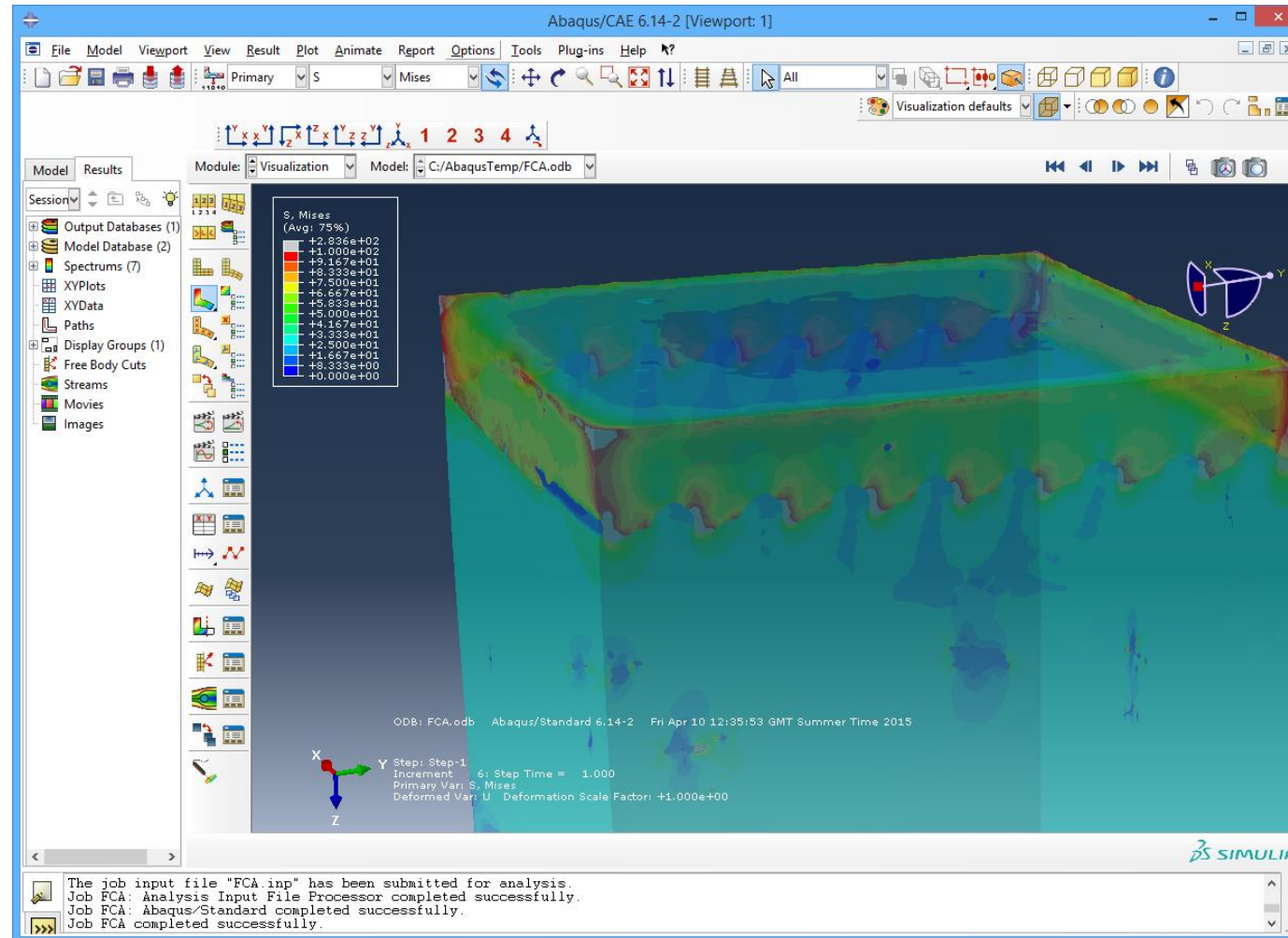
simpleware



Visualization, Tortuosity, Pore/Crack Size and Distribution Statistics, FE/CFD Simulation, Homogenization etc.

+FE module

- Range of dedicated export formats to major solvers



Summary



Simpleware provides complete 3D image-based software solution to



- ...generate high quality and adaptable **3D image based models** easily and rapidly (STL, NURBS and FE Meshes).



- ...have a software platform to aid with

- Reverse Engineering
- Material Characterization
- Porosity/Defect/Crack Quantification (NDA)
- Visualization & Measurement
- FE/CFD Volumetric Meshing
- Many more applications...



- ... enable the full use of imaging hardware to extract the most value out of the 3D image data it generates



- ... enable synergy between analysts and imaging expert groups to build fast and efficient workflows



Thank You

