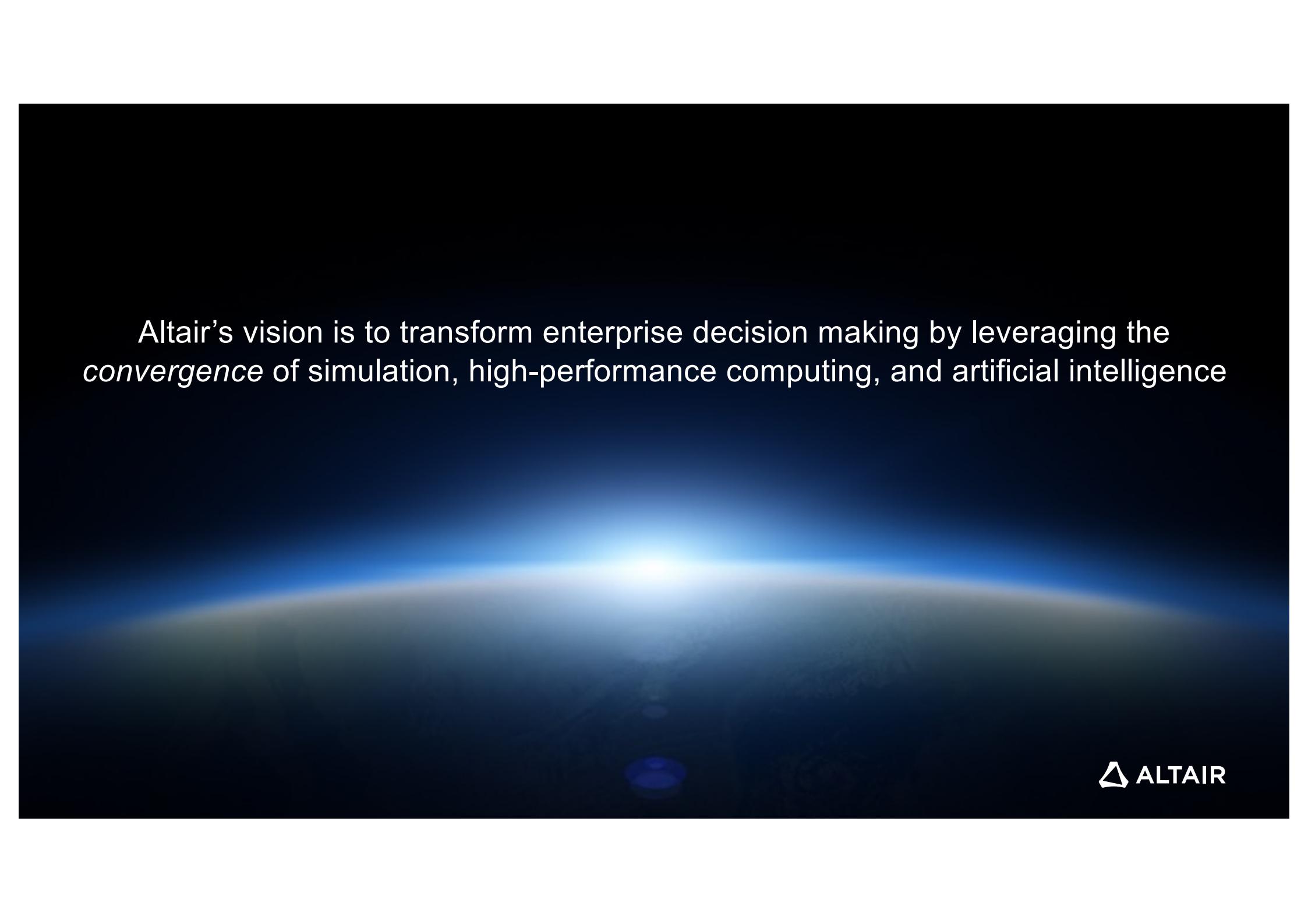


## Arm Servers in the Cloud Bringing Leading Performance for OpenRadioss

Eric Lequinio, VP Radioss Development & Altair Solver HPC

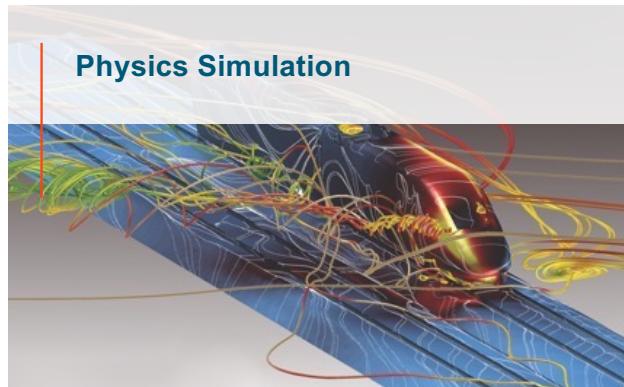
Arm HPC User Group 2022, November 14<sup>th</sup> 2022



Altair's vision is to transform enterprise decision making by leveraging the convergence of simulation, high-performance computing, and artificial intelligence



# Broad Solutions Portfolio

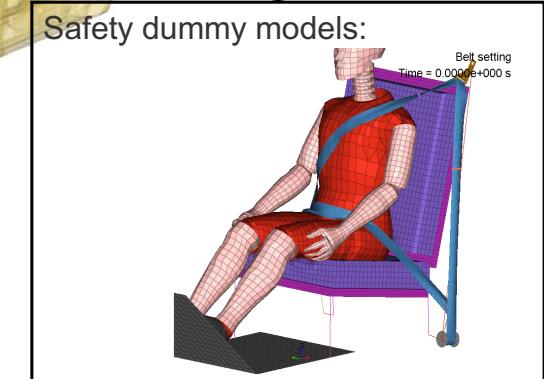
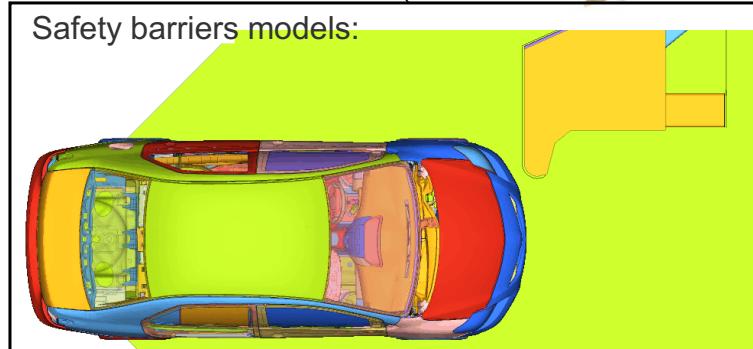
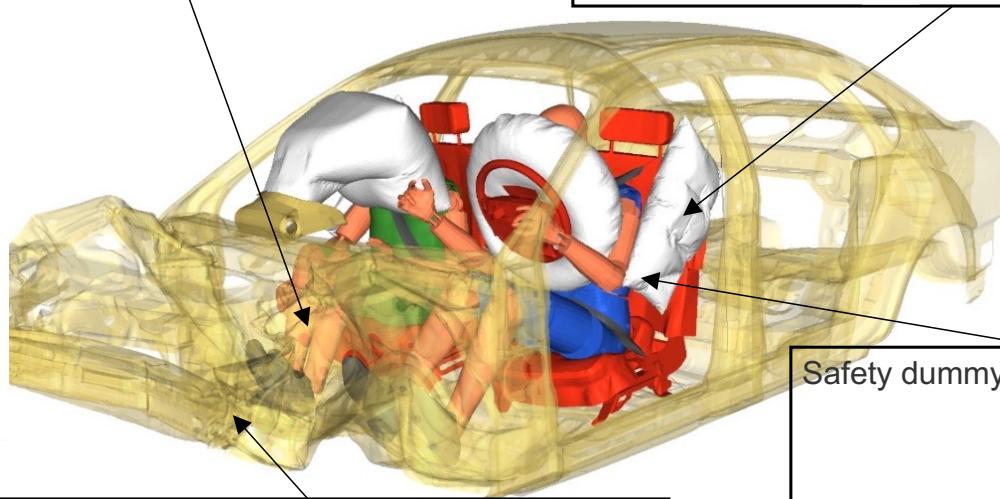
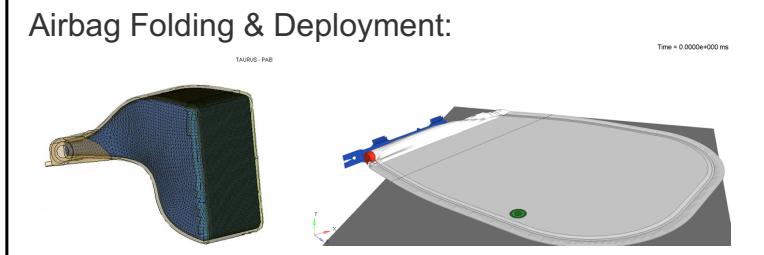


# What is Radioss ?

**Crash & Safety  
in  
Automotive**



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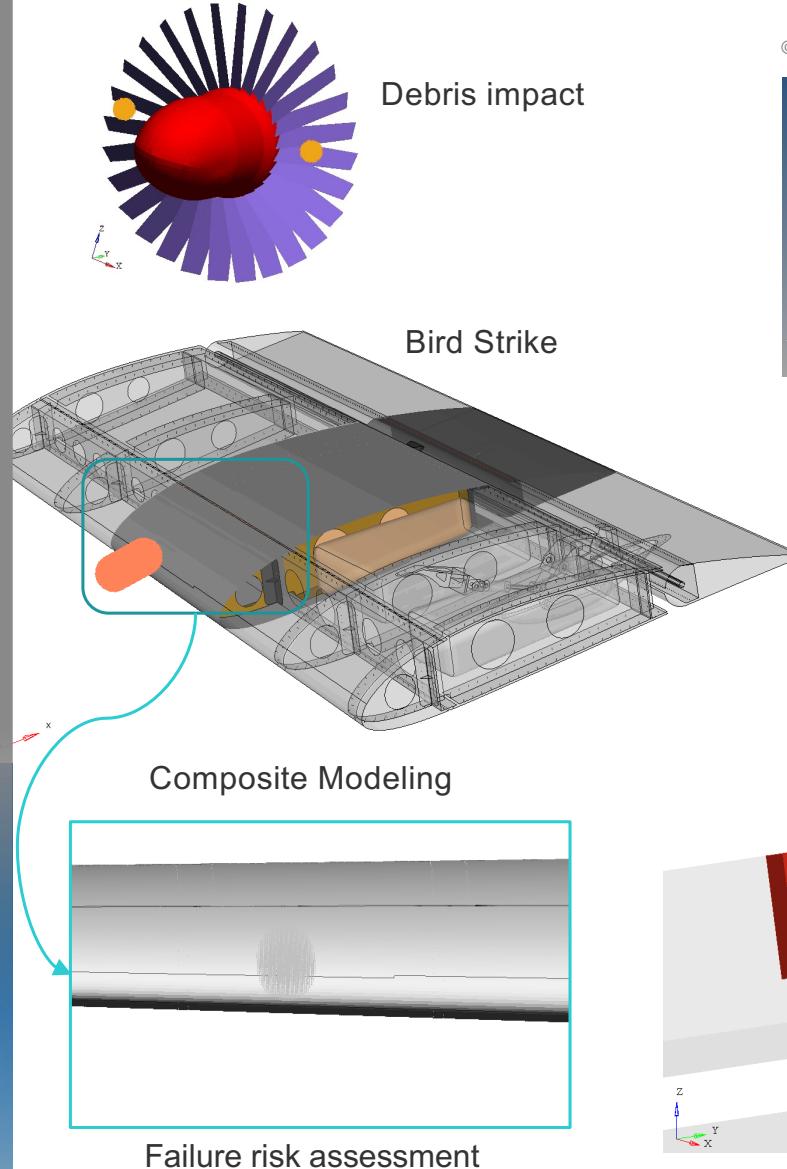
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# What is Radioss ?

## Crash & Safety in Aero



5



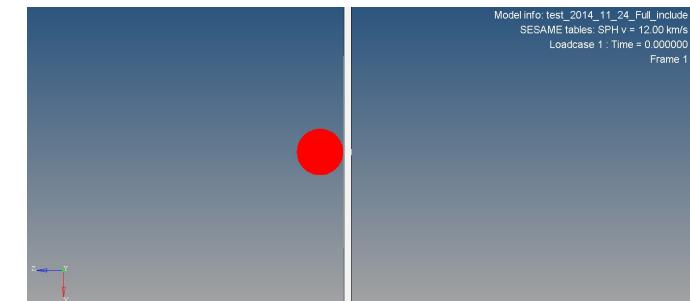
Composite Modeling

Failure risk assessment

Debris impact

Bird Strike

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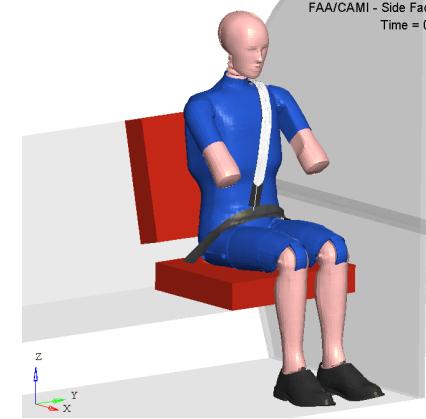


Model info: test\_2014\_11\_24\_Full\_include  
SESAME tables, SPH v = 12.00 km/s  
Loadcase 1, Time = 0.000000  
Frame 1

Space Application  
Ultra High velocity  
Impact



FAA/CAMI - Side Facing Seats Tests  
Time = 0.0000e+000 ms

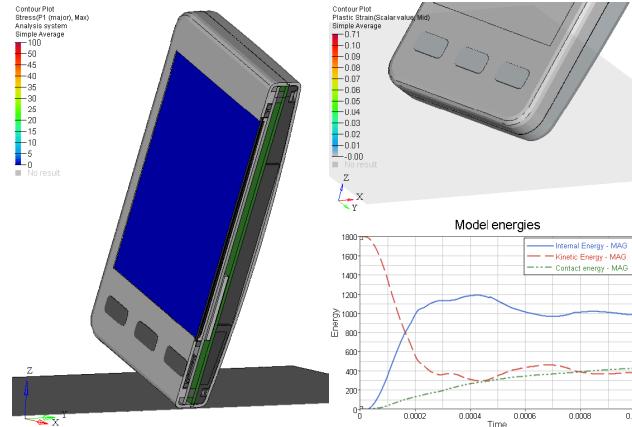


Seat & Safety

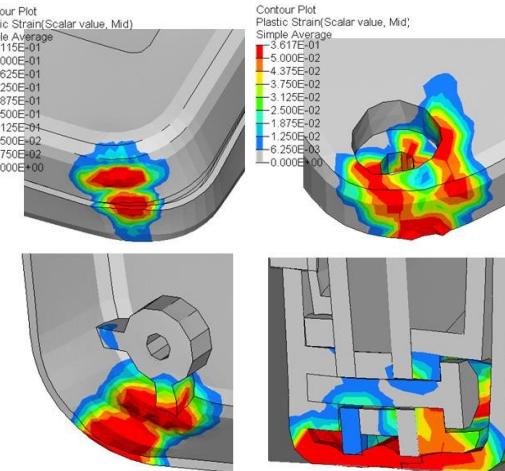


# What is Radioss ?

## Drop and Impact

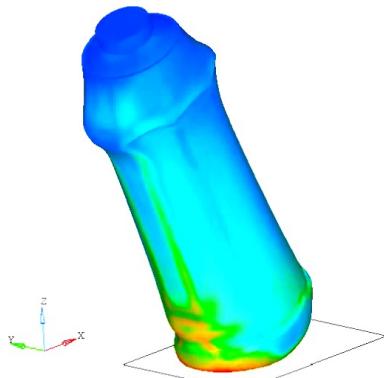


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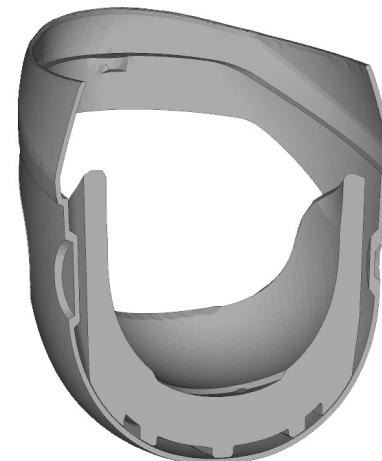


Cellphone

Time = 0.000e+000



Bottle

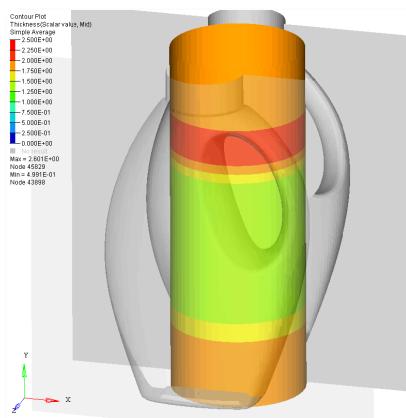
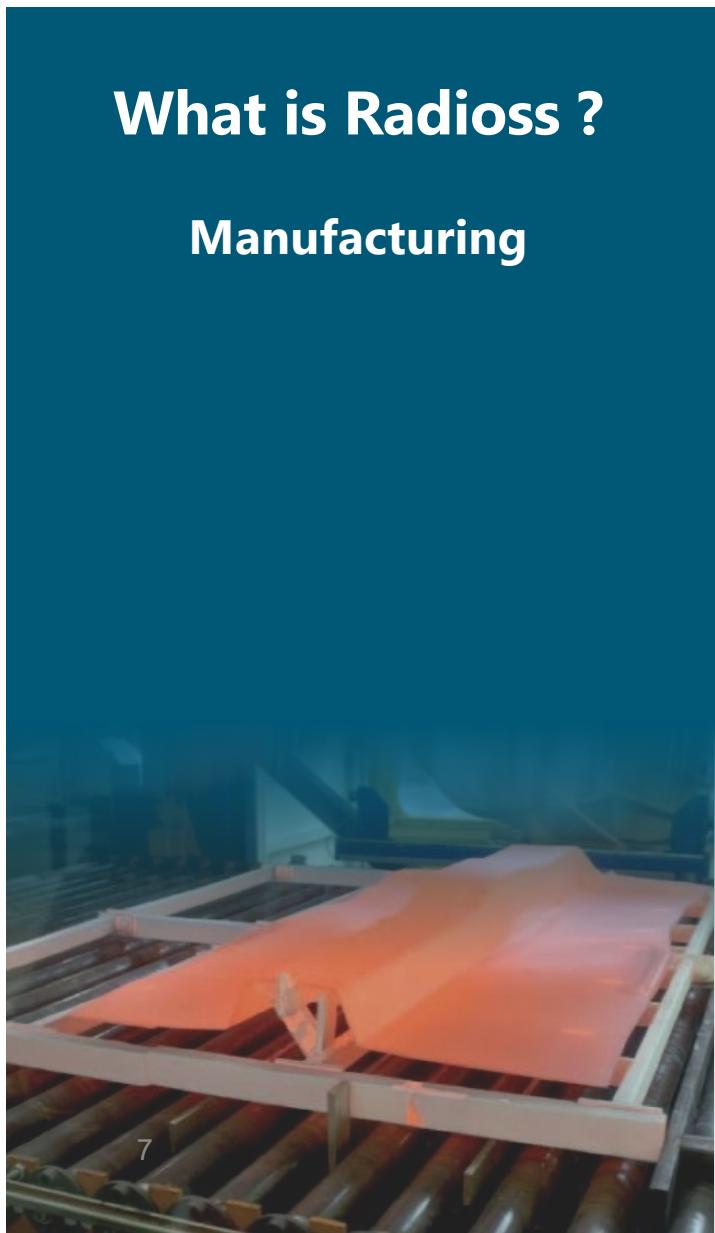


Moto helmet

 ALTAIR

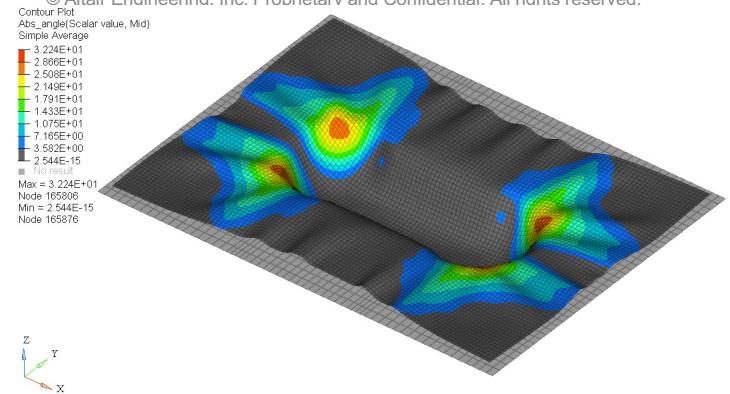
# What is Radioss ?

## Manufacturing

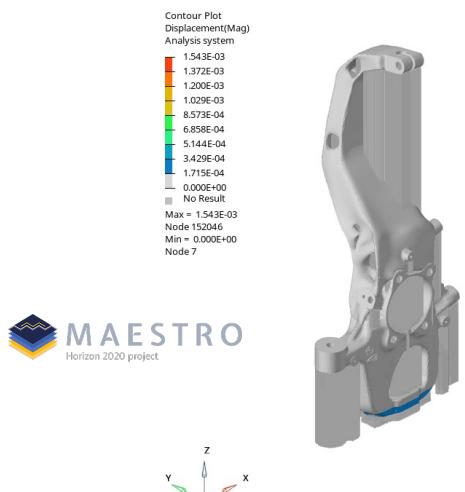


Blow molding

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Composite forming



MAESTRO  
Horizon 2020 project



Residual deformation



Stresses



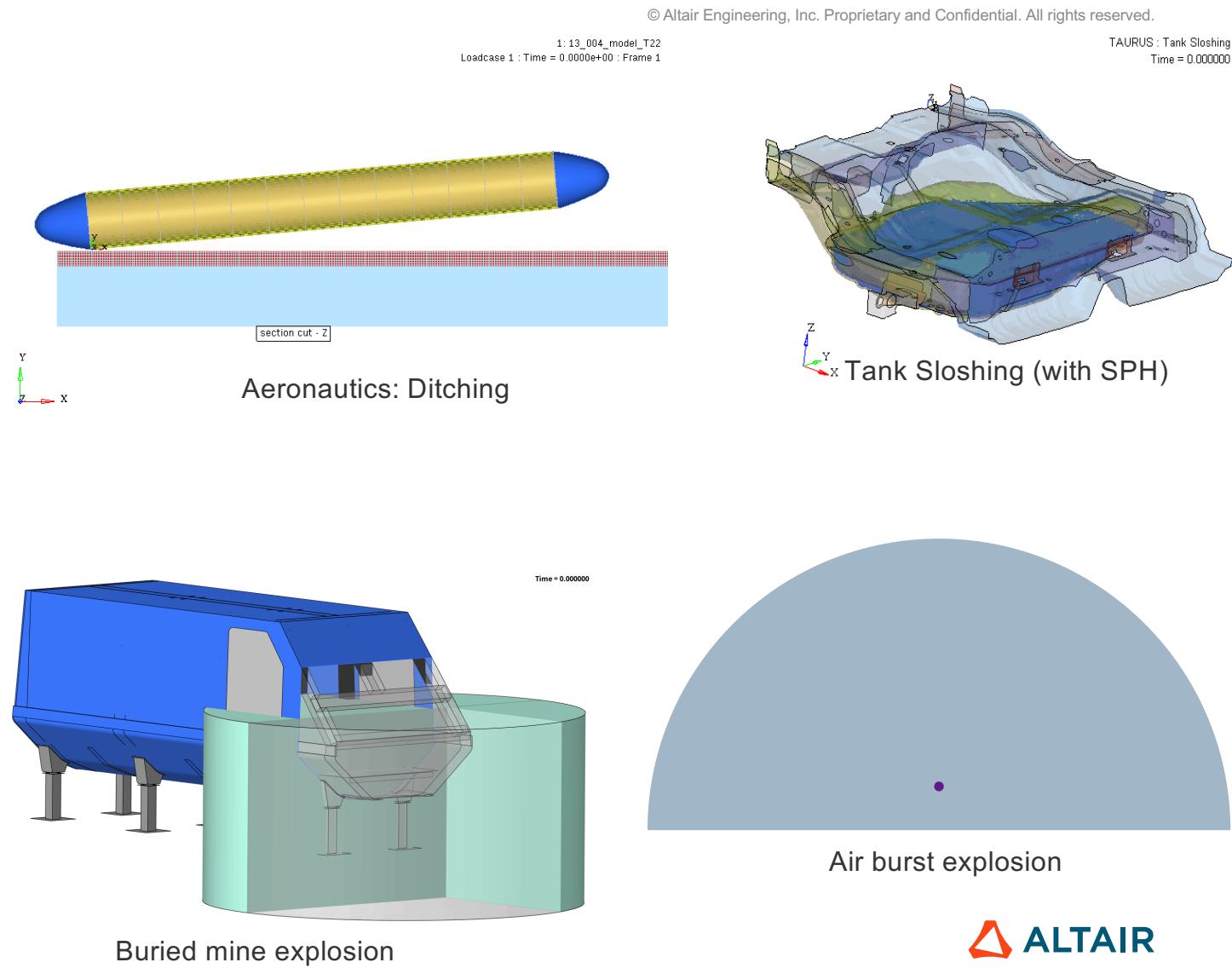
Temperature

Additive Manufacturing for knuckle part

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# What is Radioss ?

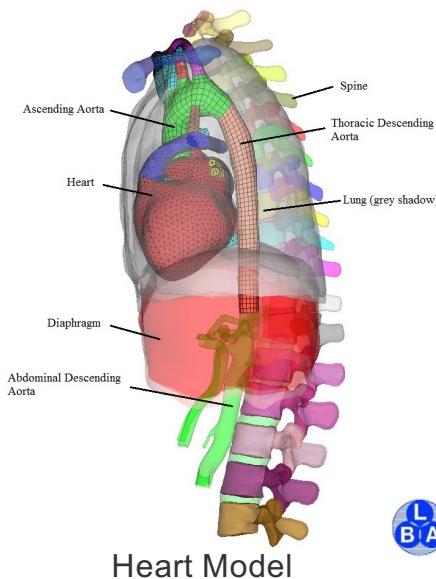
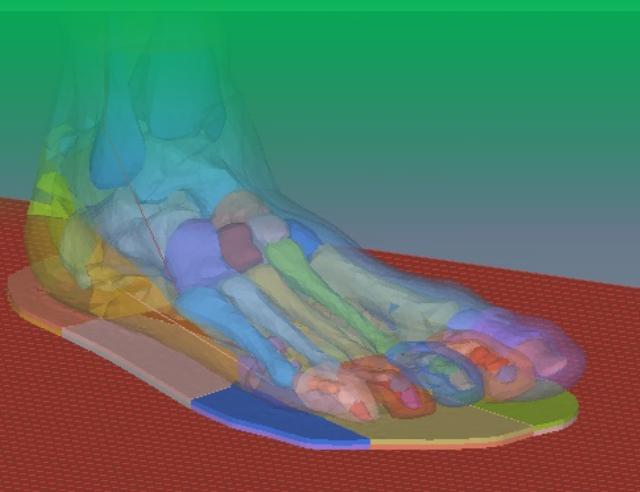
## Fluid-Structure Interaction



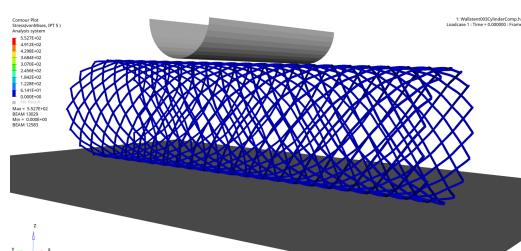
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# What is Radioss ?

## Biomechanics

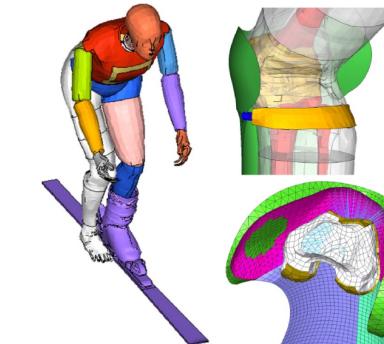


L  
B  
A Aix-Marseille université IFSTTAR

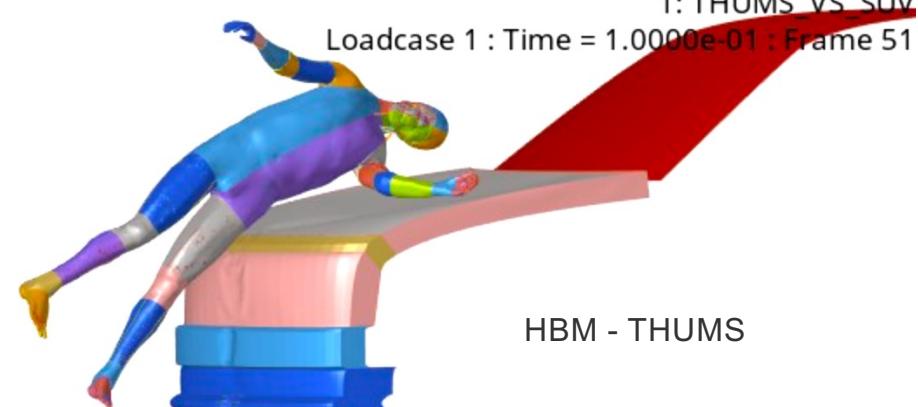


Stent with Shape Memory Alloy material (Nitinol)

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Lower Limb Model for Safety (LLMS)

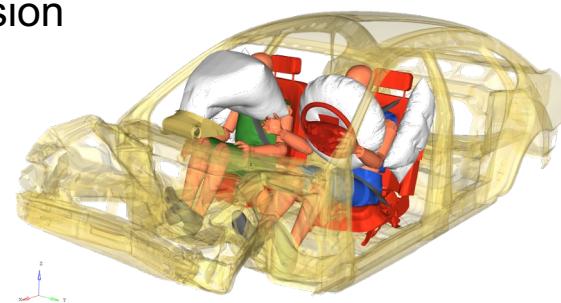


HBM - THUMS

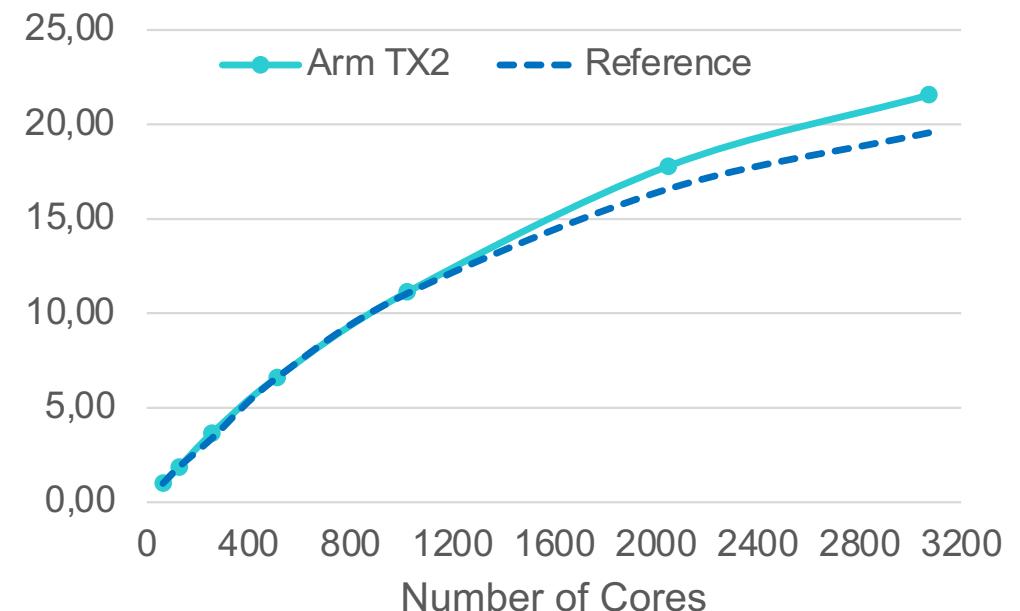
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# Radioss HPC Technologies

- Highly parallel code
  - MPI Domain decomposition
    - OpenMPI on Arm platform
  - OpenMP parallelization
  - Vectorization
- Robustness
  - Perfect repeatability in parallel
  - Double precision (default) + extended single precision



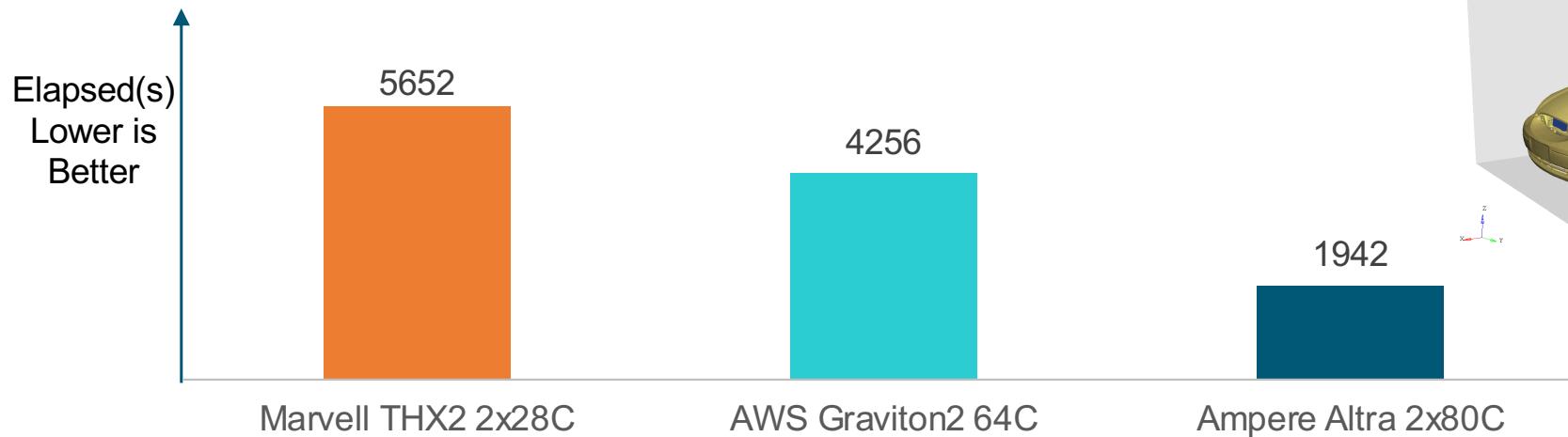
**Radioss Scalability - T10M**



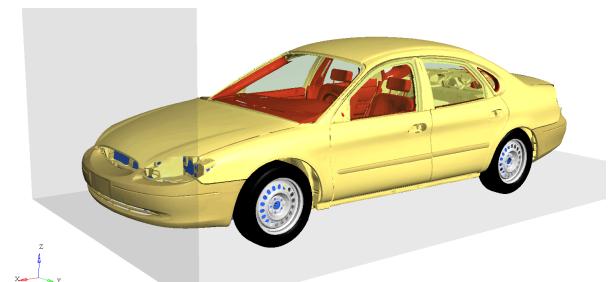
Source: SC19 AHUG

## Radioss Porting on Arm Platform

- Strong partnership with Arm
  - Arm Fortran compiler v20.1 including Arm Performance Library
  - Professional support & expertise throughout the project (parallel arithmetic, OpenMP, vectorization,...)
  - Radioss v2021 officially released on Arm
- Continuous Performance Improvement



**Single node performance results**  
T10M: front crash with 10 million of shells+solids



## Introducing OpenRadioss™

Altair Radioss now also available as open-source software under the name **OpenRadioss**

### Our Vision

**Accelerate innovation** in the research community

Maximize synergy between **leading edge research and industry**

Build a highly engaged and inclusive **open-source community**

Facilitate **knowledge and model exchange**

**Ensure the future**, advancing FEA technology and modernizing software



Altair is pleased to welcome Arm as an active member of the **OpenRadioss** community!

## OpenRadioss™ Concepts

- OpenRadioss source code publicly accessible from:  
<https://github.com/OpenRadioss>
- Stable but constantly evolving code based
- Precompiled Linux executables to run latest builds of OpenRadioss (no license check)
- Support from the community
- Steering committee for future roadmap



[www.openradioss.org](http://www.openradioss.org)



From EUROWNCAP website

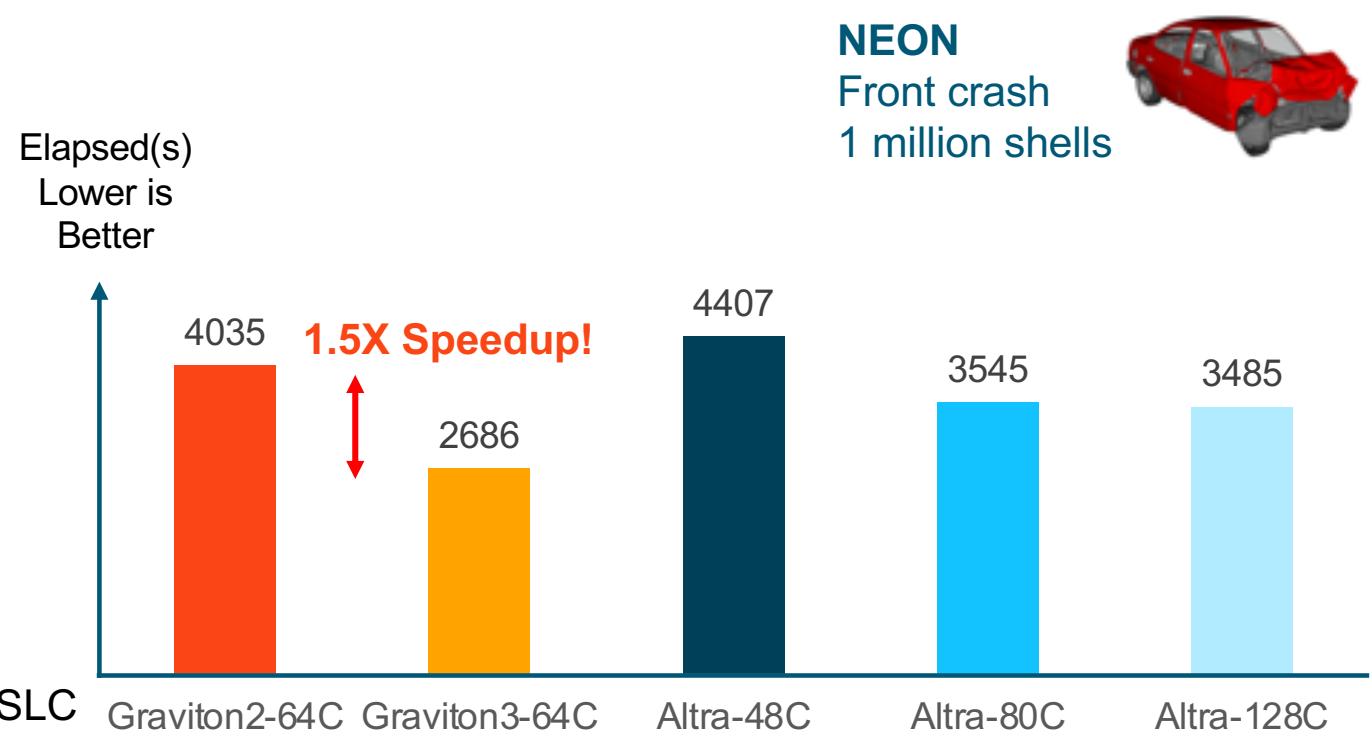
### Altair Radioss commercial version

- Commercial releases with extensive QA on industrial models
- Commercial support, documentation and maintenance priority
- Required for encrypted models: dummies & barriers
- Channel valuable community contributions into release, with full QA and support

 ALTAIR

## First results\* with OpenRadioss on the Cloud – Single Socket

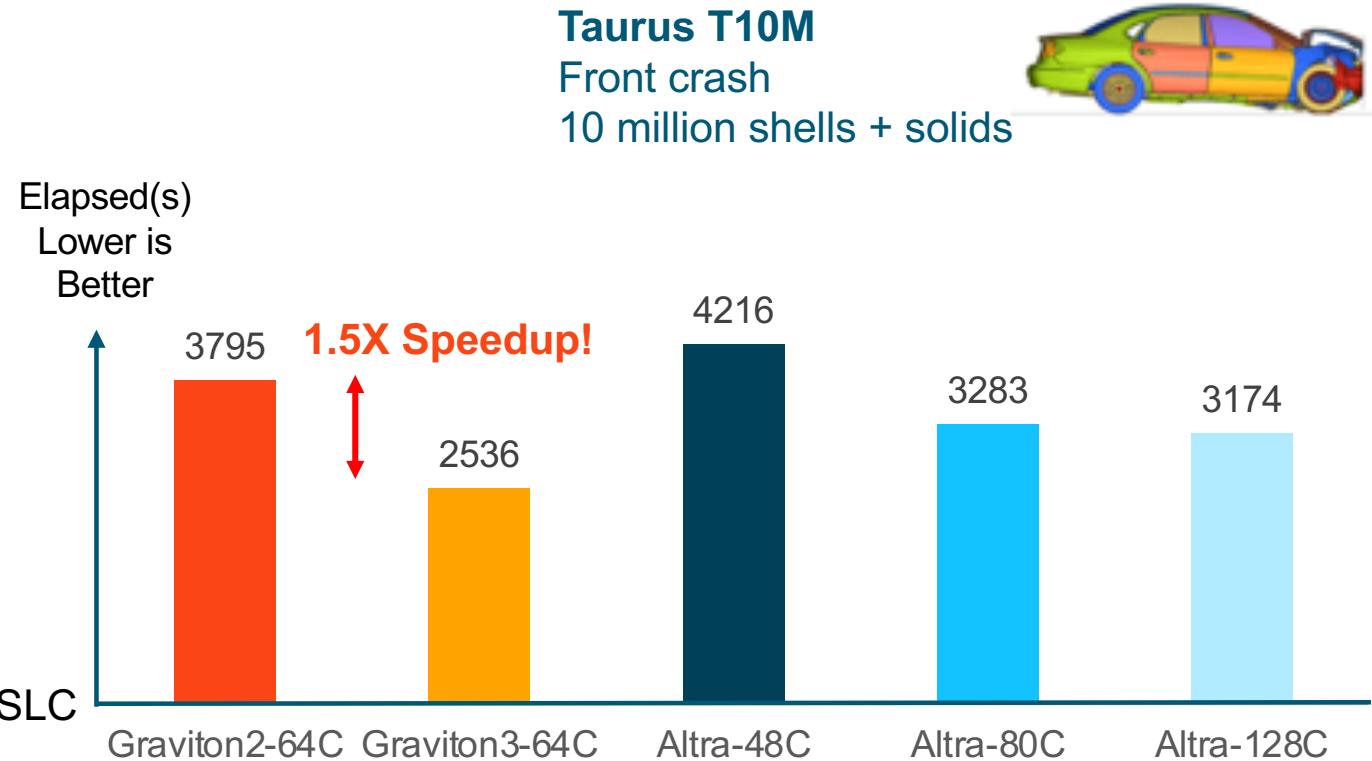
- **AWS Graviton2 (C6g)**
  - Arm Neoverse N1
  - 64C @ 2.5GHz; 32MB L3
  - 8 channels DDR-3200
- **AWS Graviton3 (C7g)**
  - Arm Neoverse V1
  - 64C @2.6 GHz; 32MB L3
  - 8 channels DDR5-4800
  - **2x256-bit SVE**
- **Ampere Altra**
  - Arm Neoverse N1
  - Up to 128 cores @ 3GHz; 32MB SLC
  - 8 channels DDR4-3200



\*Arm Fortran updated to version 22.1 for OpenRadioss

## First results with OpenRadioss on the Cloud – Single Socket

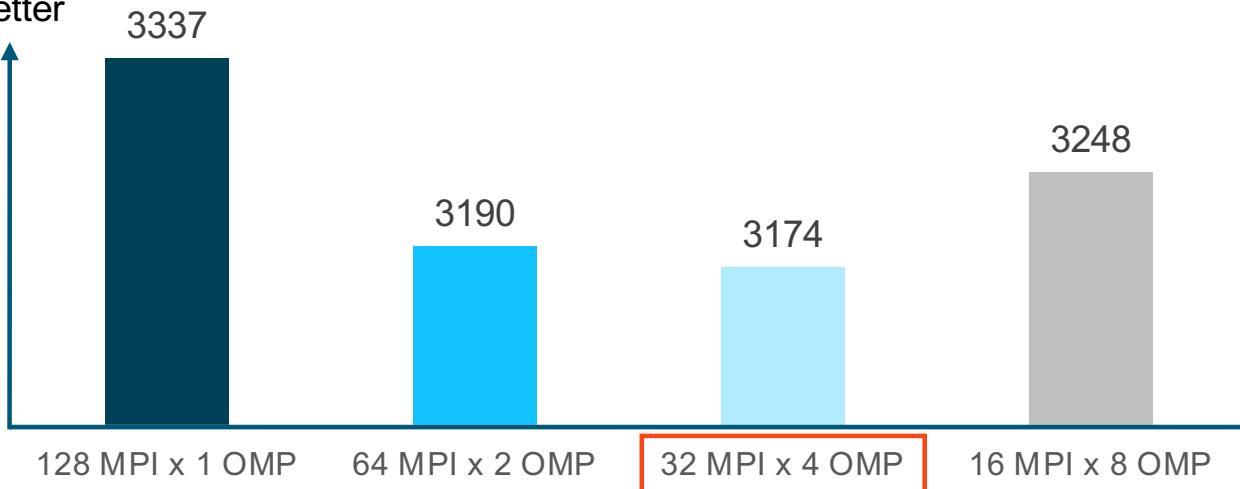
- **AWS Graviton2 (C6g)**
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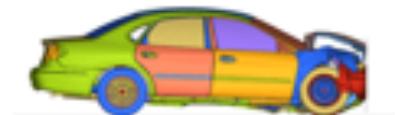
## First results with OpenRadioss on the Cloud – Single Socket

- **Ampere Altra**
  - Arm Neoverse N1
  - 128 cores @ 3GHz; 32MB SLC
  - 8 channels DDR4-3200

Elapsed(s)  
Lower is  
Better



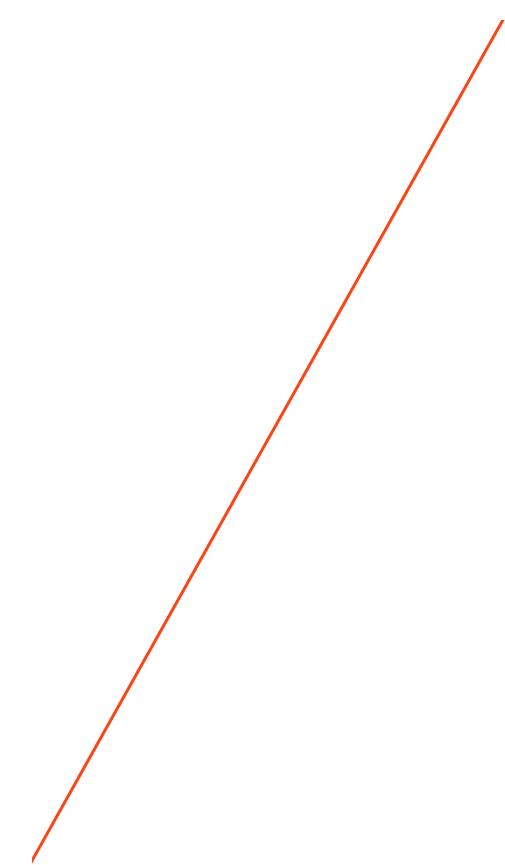
**Taurus T10M**  
Front crash  
10 million shells + solids



- **Influence of MPI x OMP setup**
  - Best with Hybrid 32 MPI x 4 OMP (5% gain)
  - Important for multi nodes performance

## Takeaways & Outlook

- Altair Radioss commercially available on Arm processors since Altair Simulation 2021
- Continuous performance improvement achieved on Arm based processors
- Significant performance improvement observed in the cloud with Graviton3 based on Arm Neoverse V1 architecture, up to **1.5X** faster than previous generation!
- Broader availability in the cloud ☞ agile, scalable and cost optimized solutions based on Arm to run Radioss simulations
- **OpenRadioss** the open-source version of Radioss now available for all at no cost to increase innovation pace through collaboration!



Visit Altair at booth #3033  
Contact: [elequiniou@altair.com](mailto:elequiniou@altair.com)

**THANK YOU**

altair.com



#ONLYFORWARD

