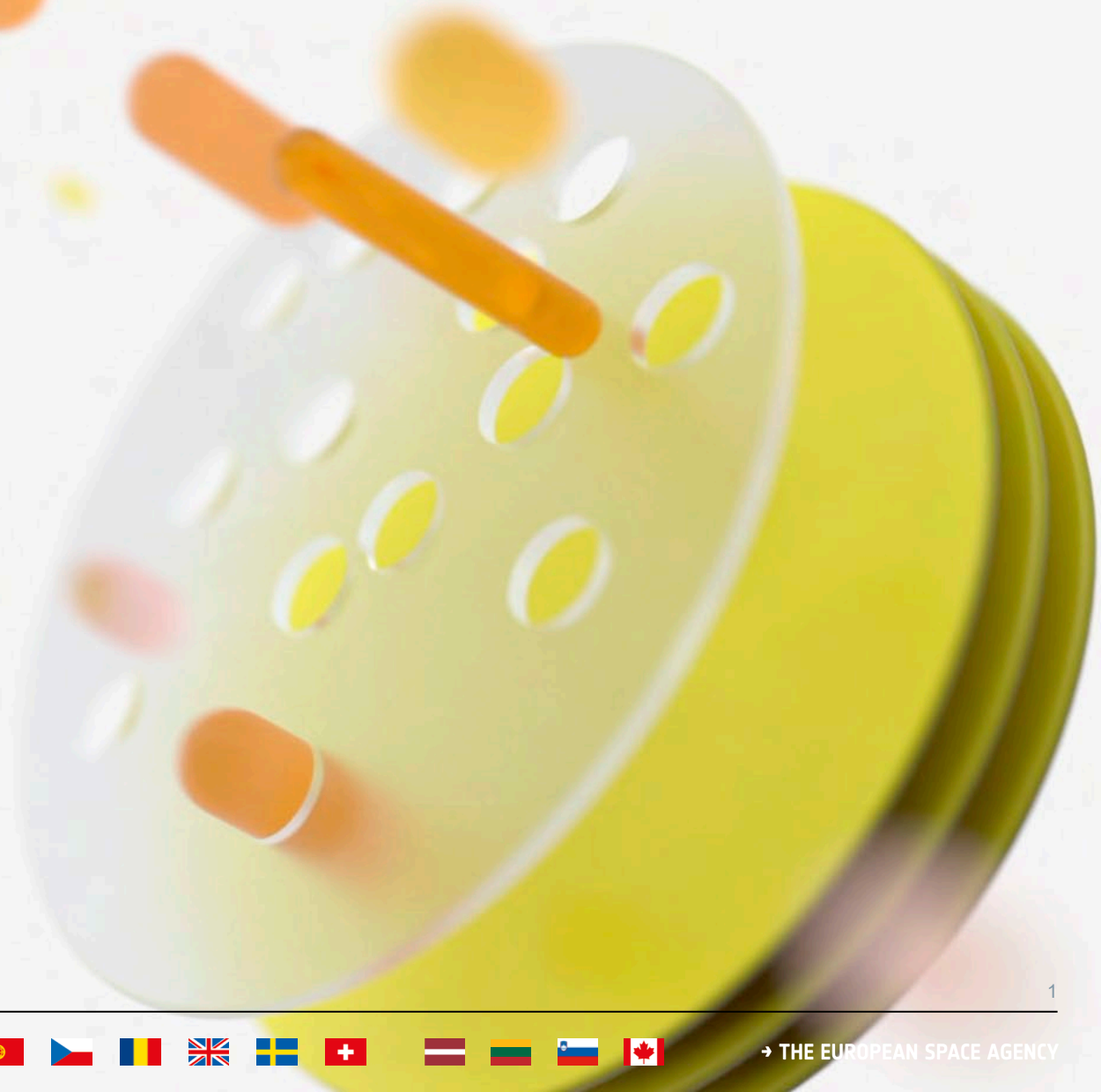
DEFINE

Remi Lanza

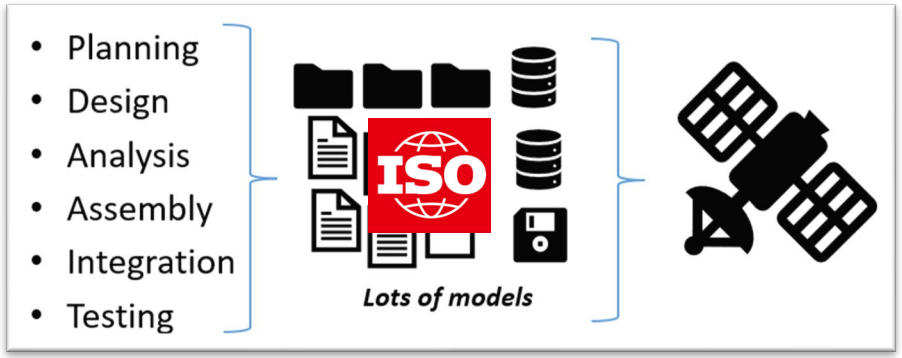
22/06/2022

ESA AO/1-9874/19/NL/BJ



INTRODUCTION

→ The main objective of this activity is to increase the integration of 3D digital models in order to improve the efficiency and effectiveness of the assembly, integration and test procedures and documentation, fully integrated into the overall space system lifecycle."

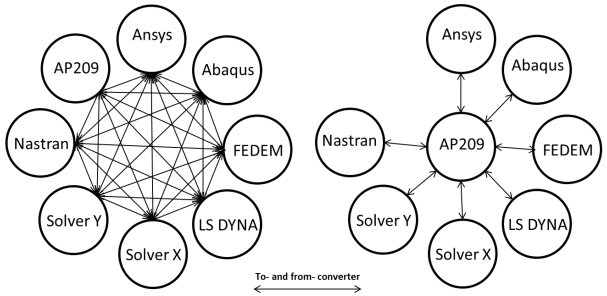


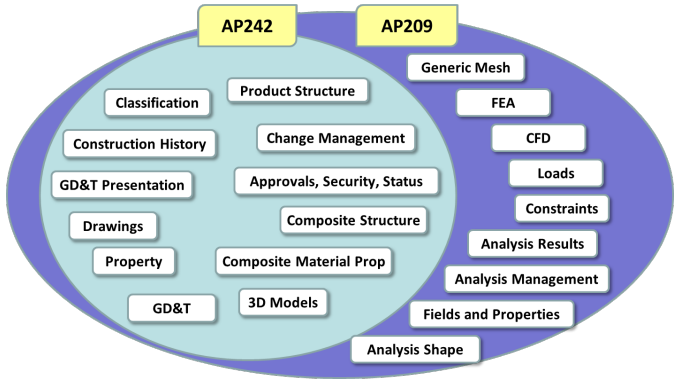
→ This can be potentially achieved with the use of existing, standard formats like STEP AP242, AP209, STEP-TAS or alike, and with the development of specific software routines to achieve the integration of digital models and to increase the TRL from the currently estimated 3 to 6."

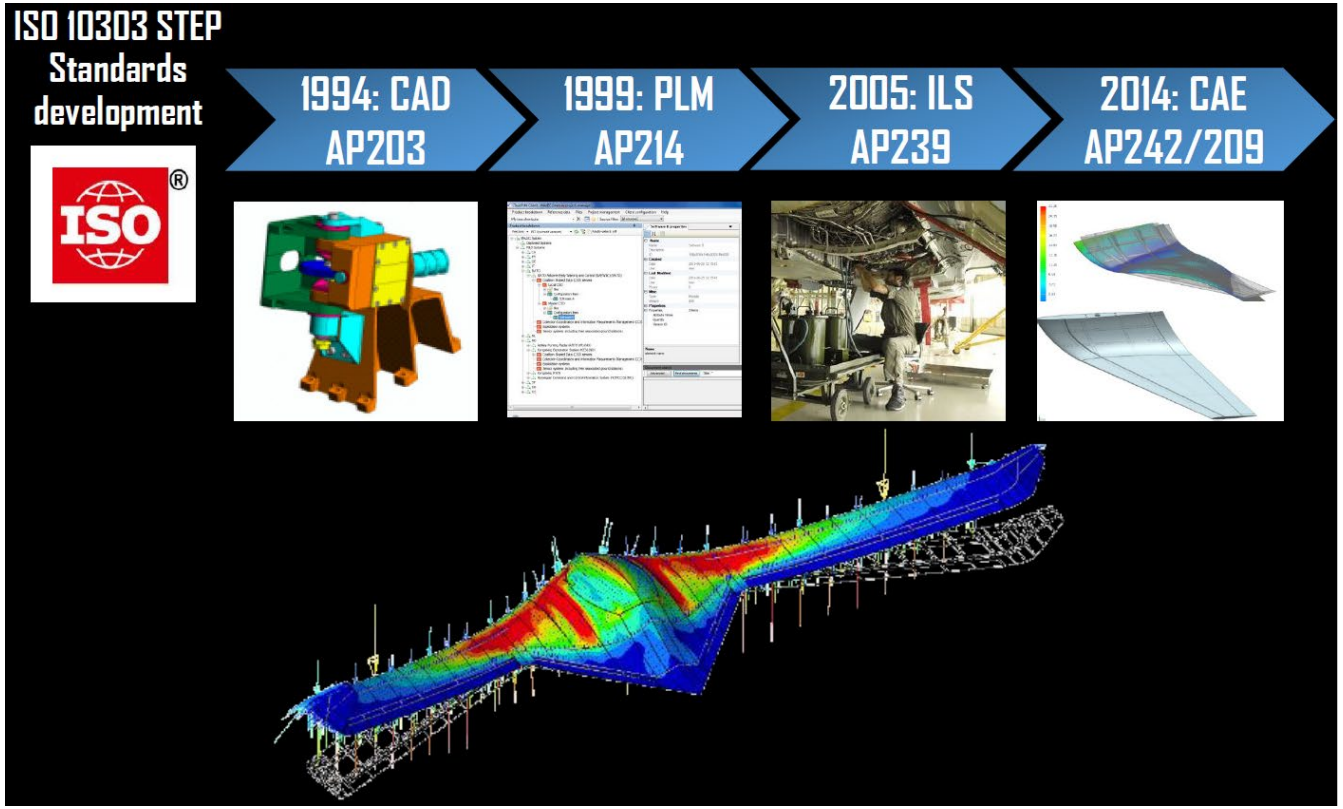
INTRODUCTION: ISO 10303

→ **STEP (ISO 10303)**
- Not only CAD models

→ **ISO 10303-209**
- Standard data model covering
  - Product Data Management
  - CAD
  - FEM
  - CFD
  - Composites
  - Physical test data

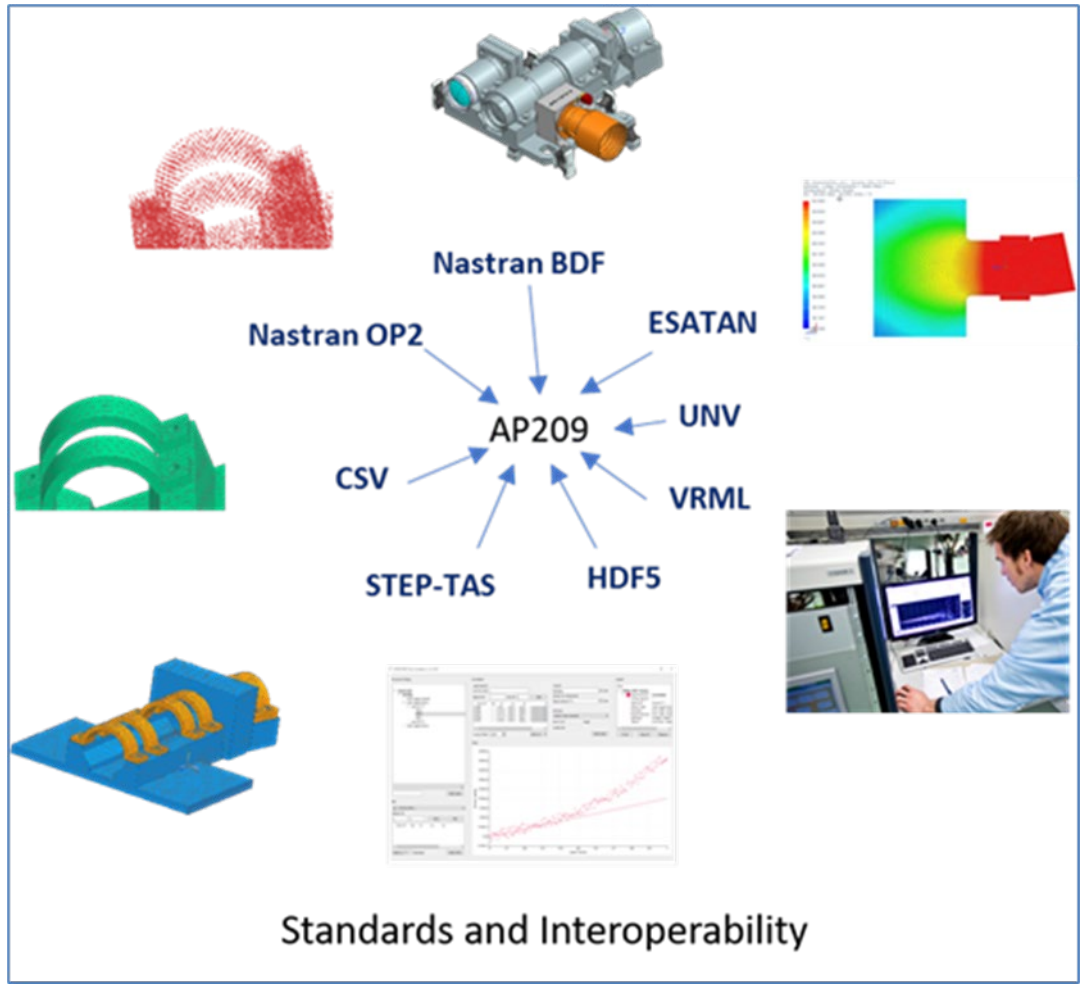






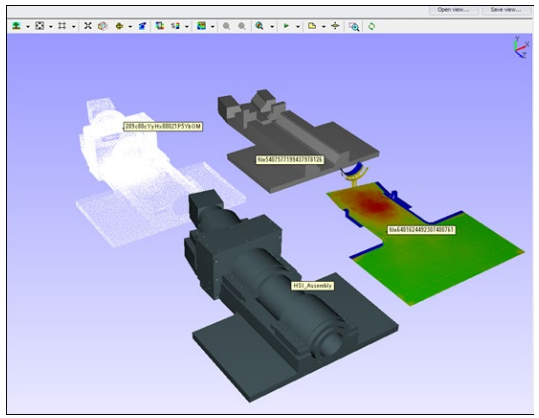
INTRODUCTION: PROJECT SUMMARY

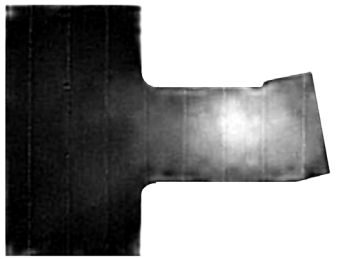
- → Contract:
  - ESA AO/1-9874/19/NL/BJ
- → Performed by ESA and Jotne
- → Budget 700,000 EURO
- → Timeframe: Dec 2019 to Apr 2022
- → The project was given a set of **ESA use cases** with data interoperability challenges.

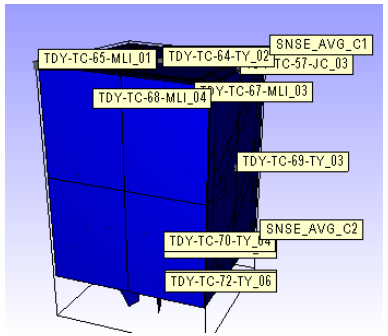


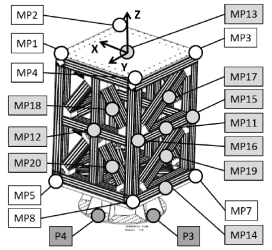
USE CASES

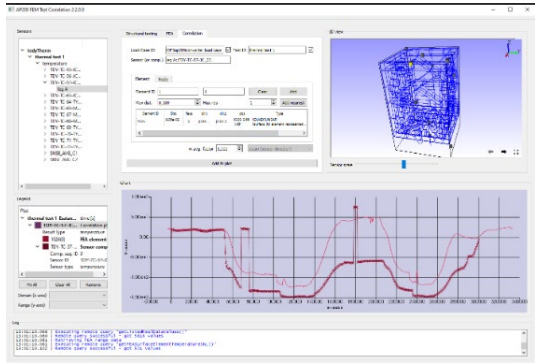
- → Compare various models (shapes) from different domains and sources
- → Superimpose/project raster images on 3D models
- → Map raster image data to nodes on meshes
- → Compare predicted (analysis) and measured (sensor) results
  - Locate nearest nodes and elements to sensors
- → Visualize and compare sensor locations on different models
- → Manage data from different sources

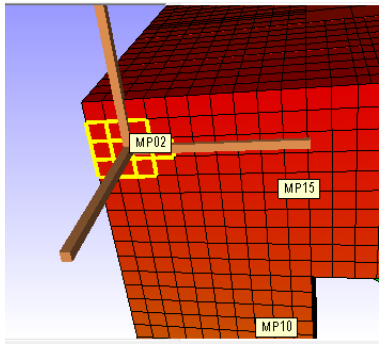




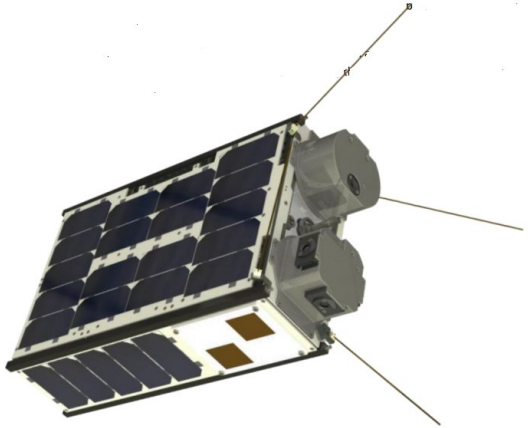


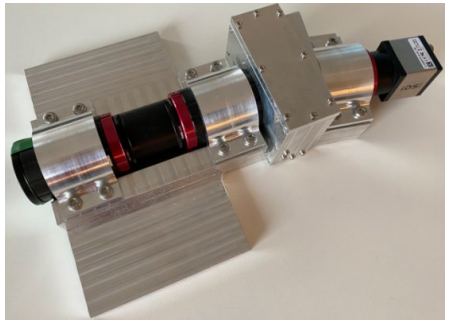


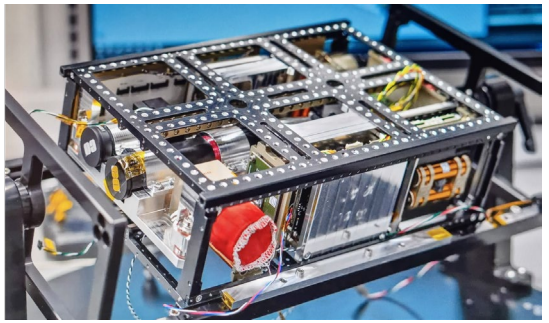




TEST MODELS

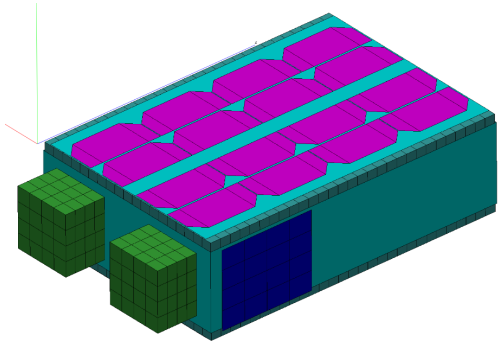


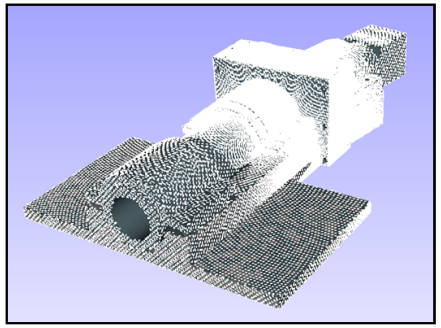


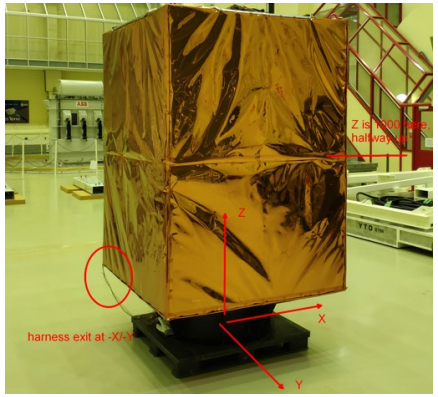


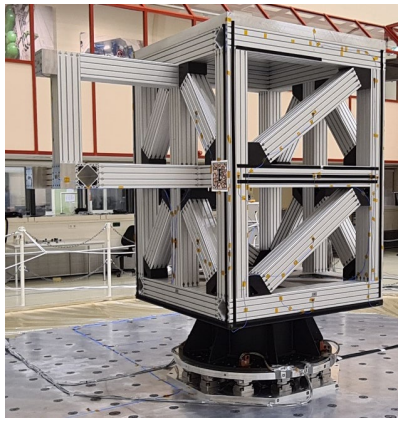
→ HYPSO-1
- was successfully launched January 13th, 2022, and is in operation

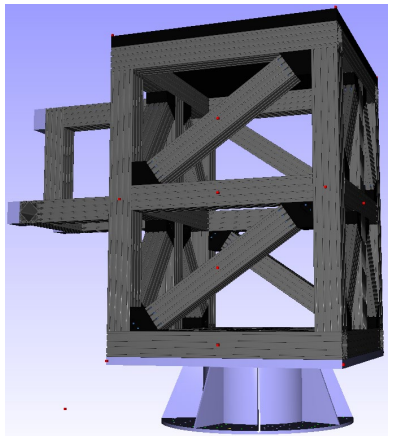
→ TEDY
- Calibration model for the ESTEC vibration and thermal tests

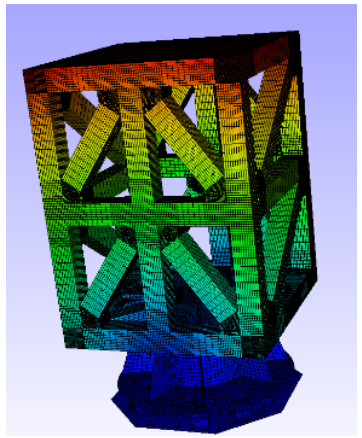


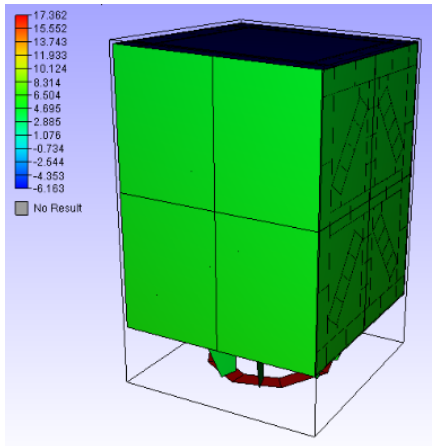




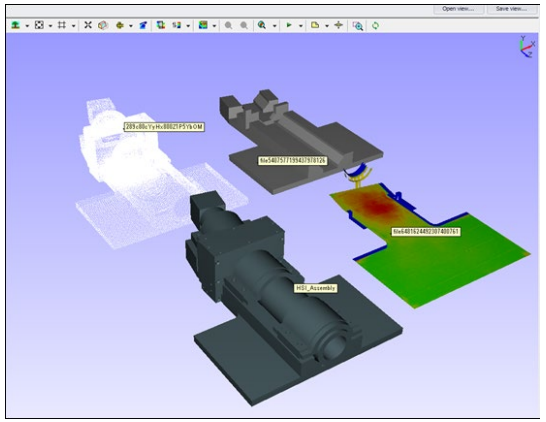




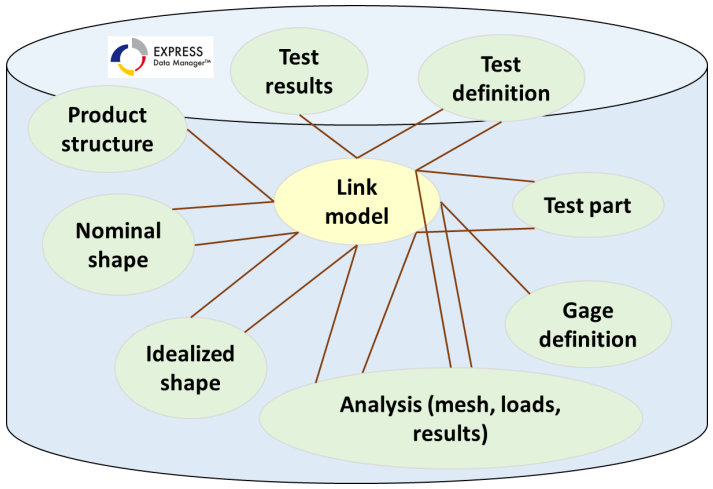


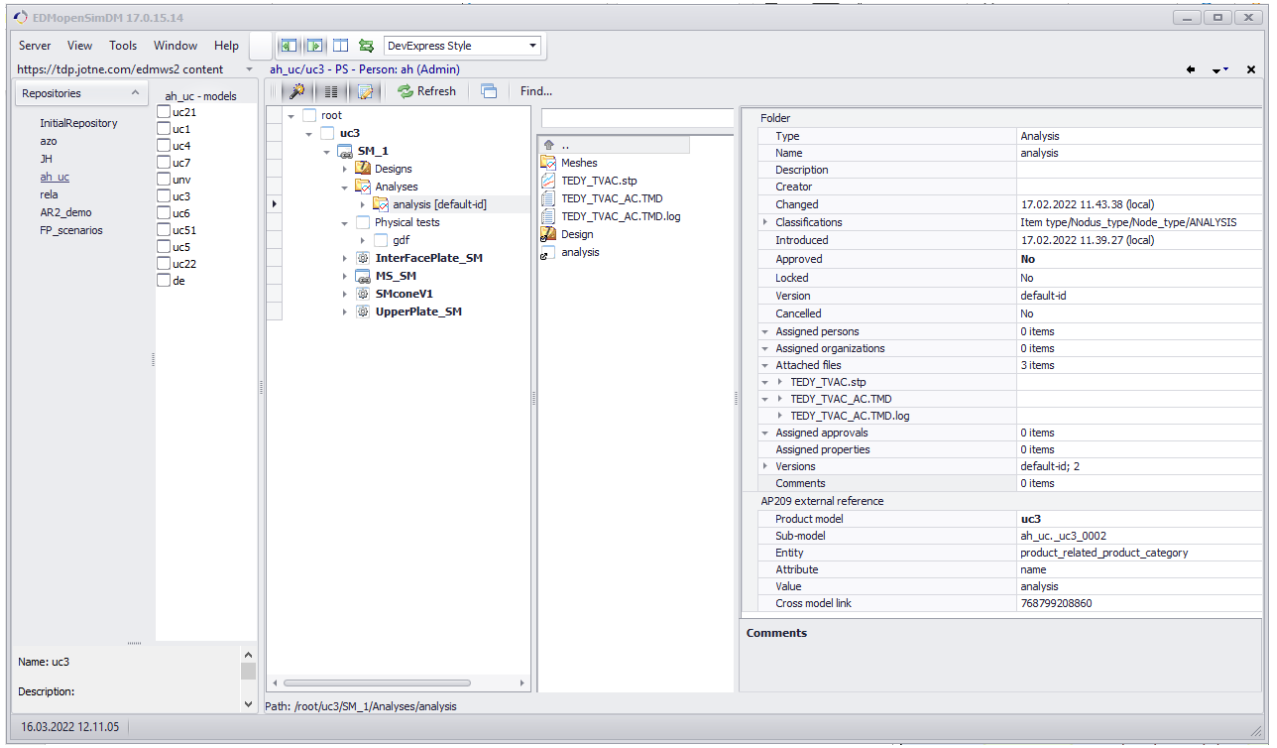


SOLUTION: EDMOPENSIMDM



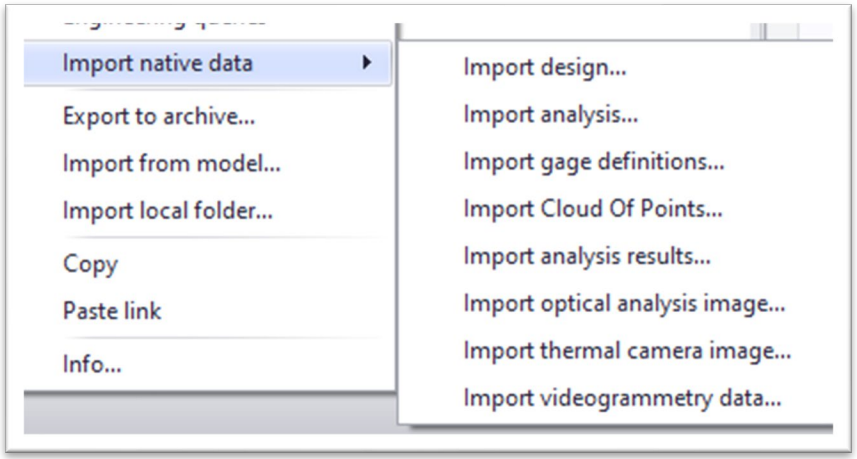
- → An SDM collaboration tool - not a replacement of existing engineering tools
- → Managing AP209 data and any documents incl. native engineering files
- → Server / client application

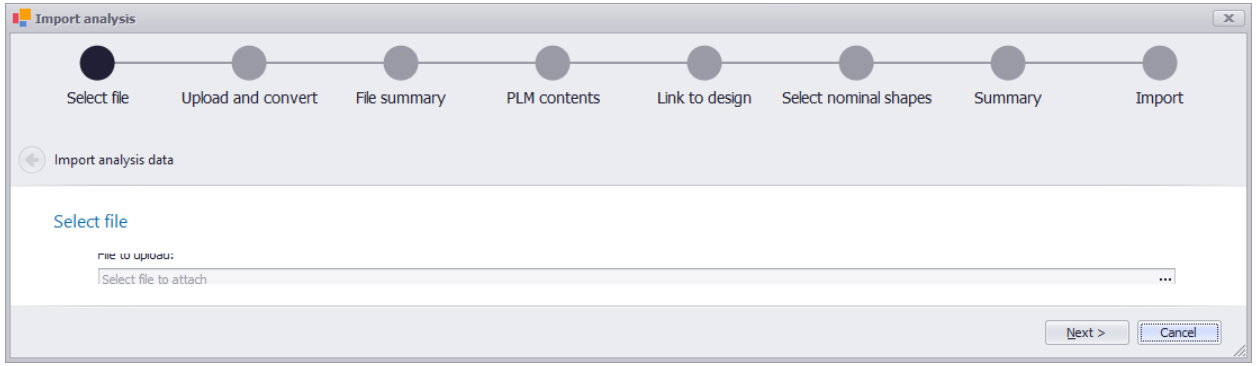




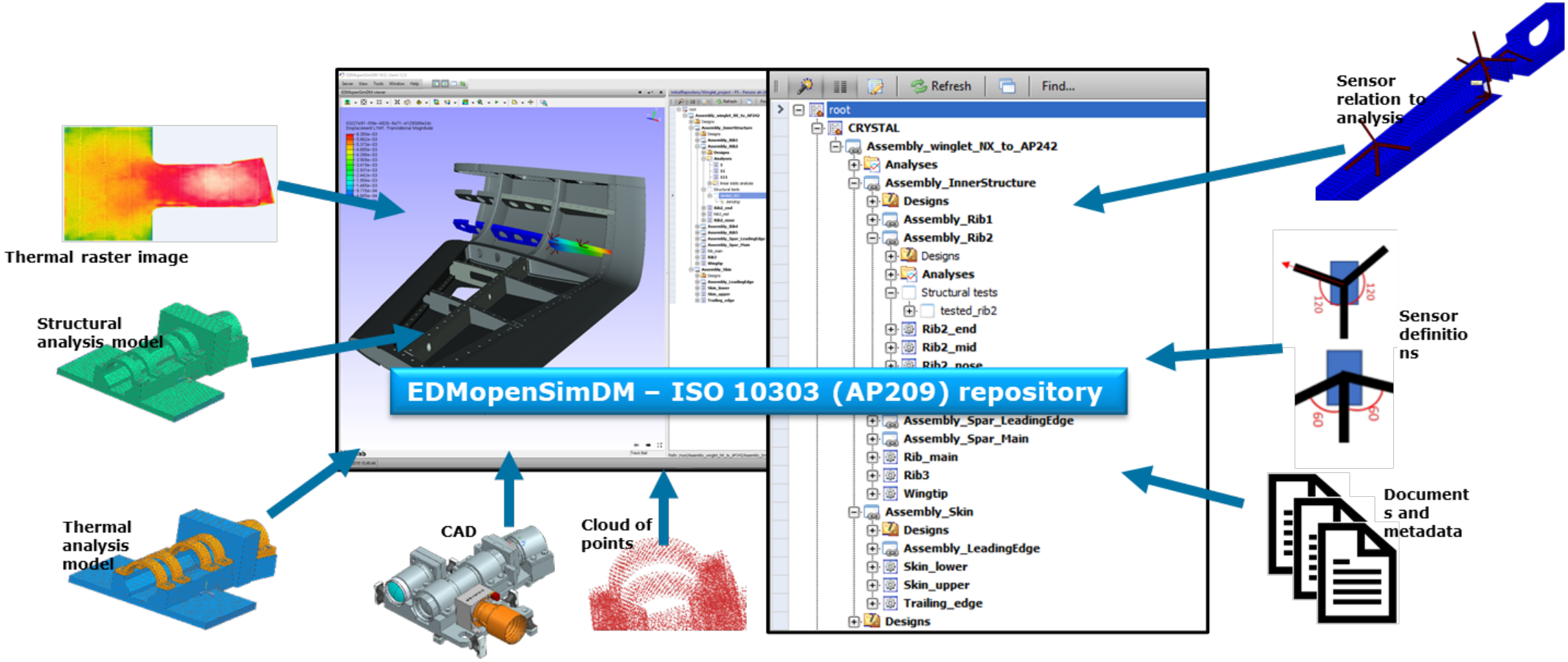
SOLUTION: IMPORT WIZARDS

→ Implemented converters for
- Nastran (bdf, pch and op2)
- Structural test data (csv and unv formats)
- Thermal raster image (jpg, png, tiff)
- ESATAN-TMS results (HDF5)
- STEP-TAS (.stp)
- 3D cloud of points (VRML-format)
- Videogrammetry data (.csv)





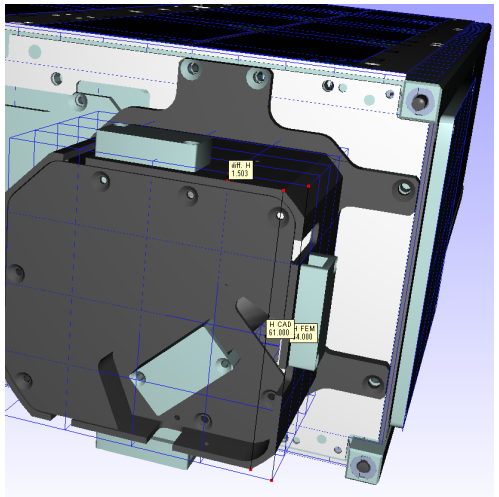
SOLUTION: IMPORT OF MODELS

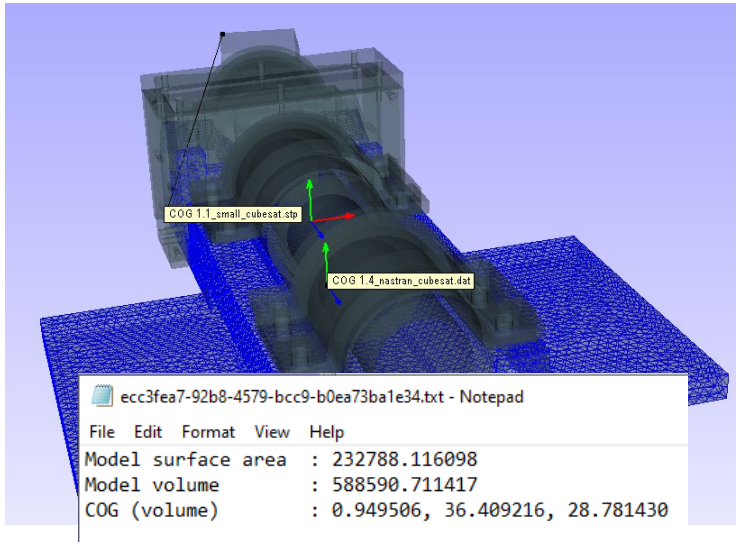


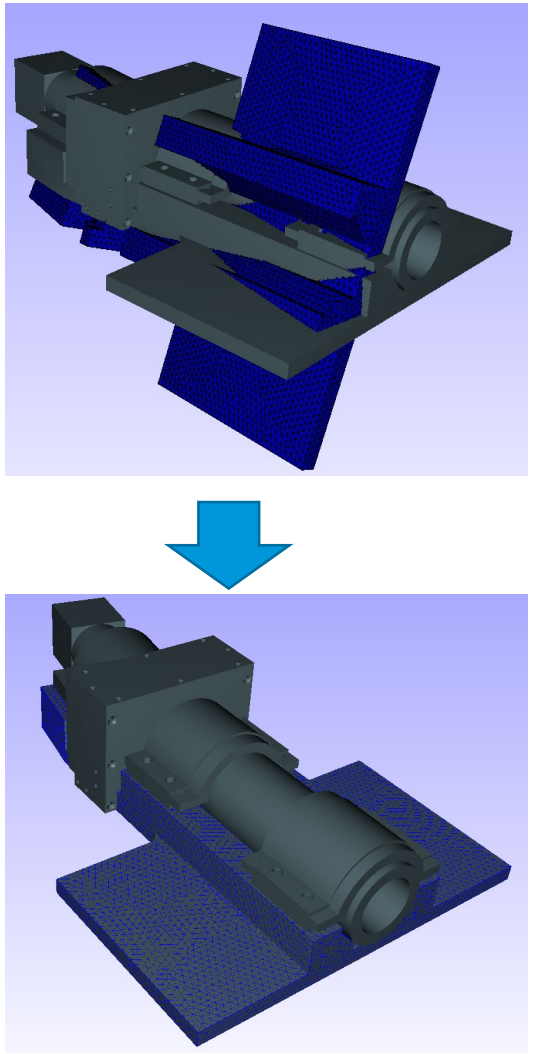
SOLUTION: MODEL COMPARISON

→ Implemented model comparison functionality

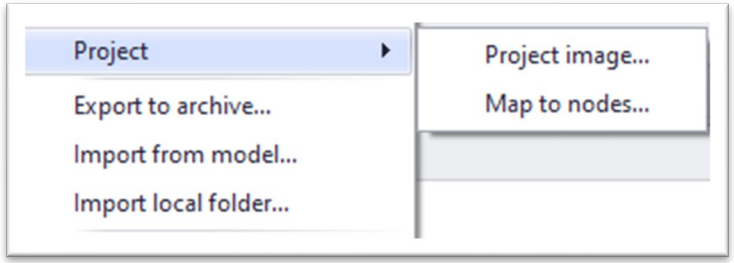
- Model alignment
- Model measurement (cross models)
- Model properties calculations





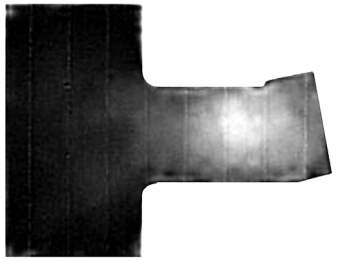


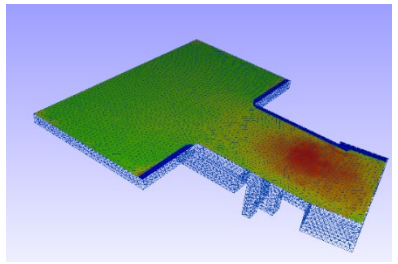
SOLUTION: PROJECTION / MAPPING

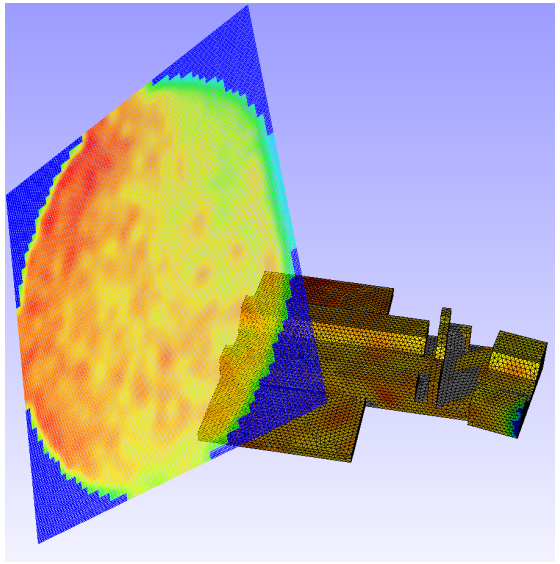


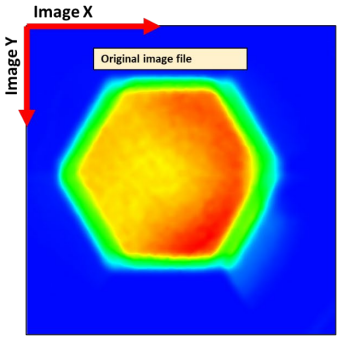
→ Implemented projection and mapping functionality (for raster images)

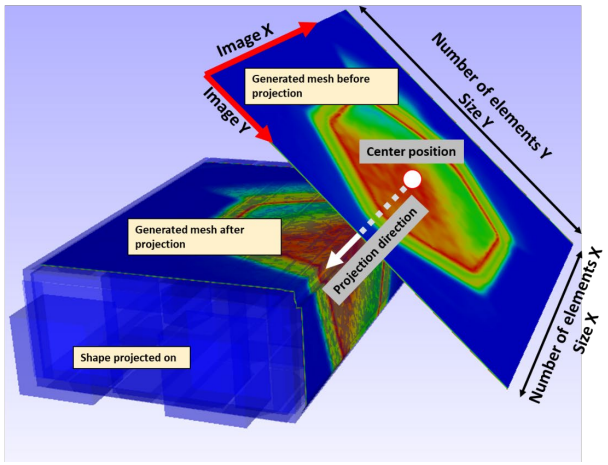
- For thermal camera images
- For optical simulation results

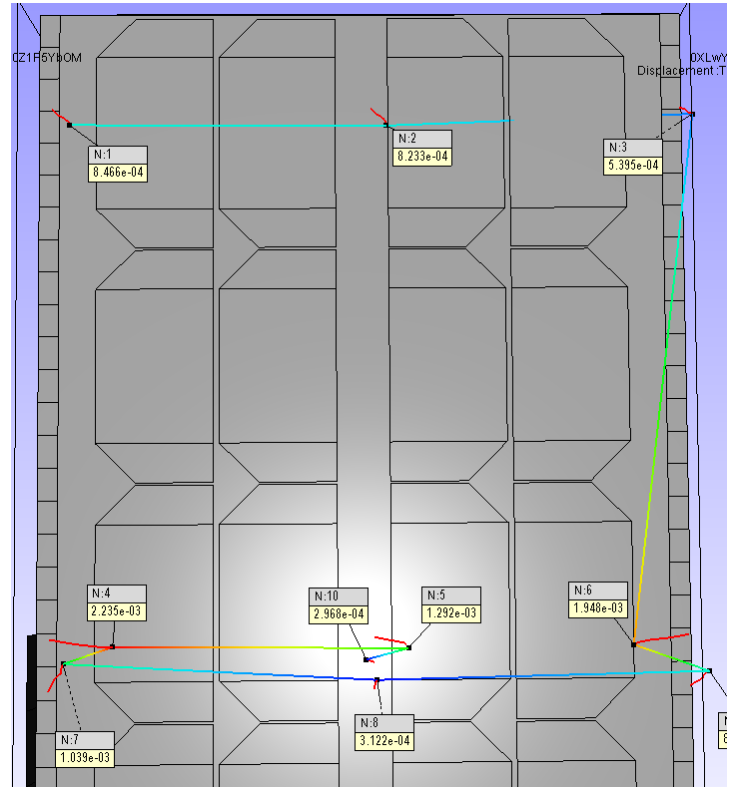








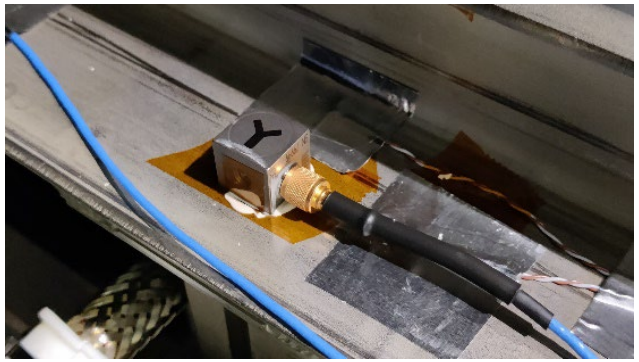


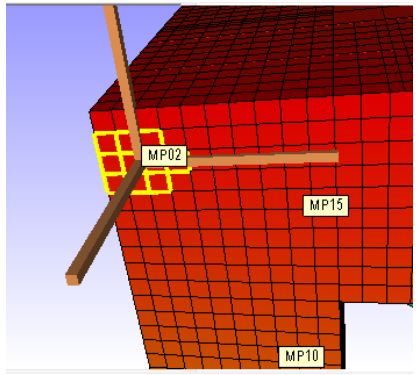


SOLUTION: ANALYSIS AND SENSOR DATA COMPARISON

→ Developed “Correlation tool”

- Reads related AP209 models containing analysis and sensor data
- Plotting of sensor and analysis results
- Locates nearest nodes and elements to sensors
- Visualizes analysis model with sensors





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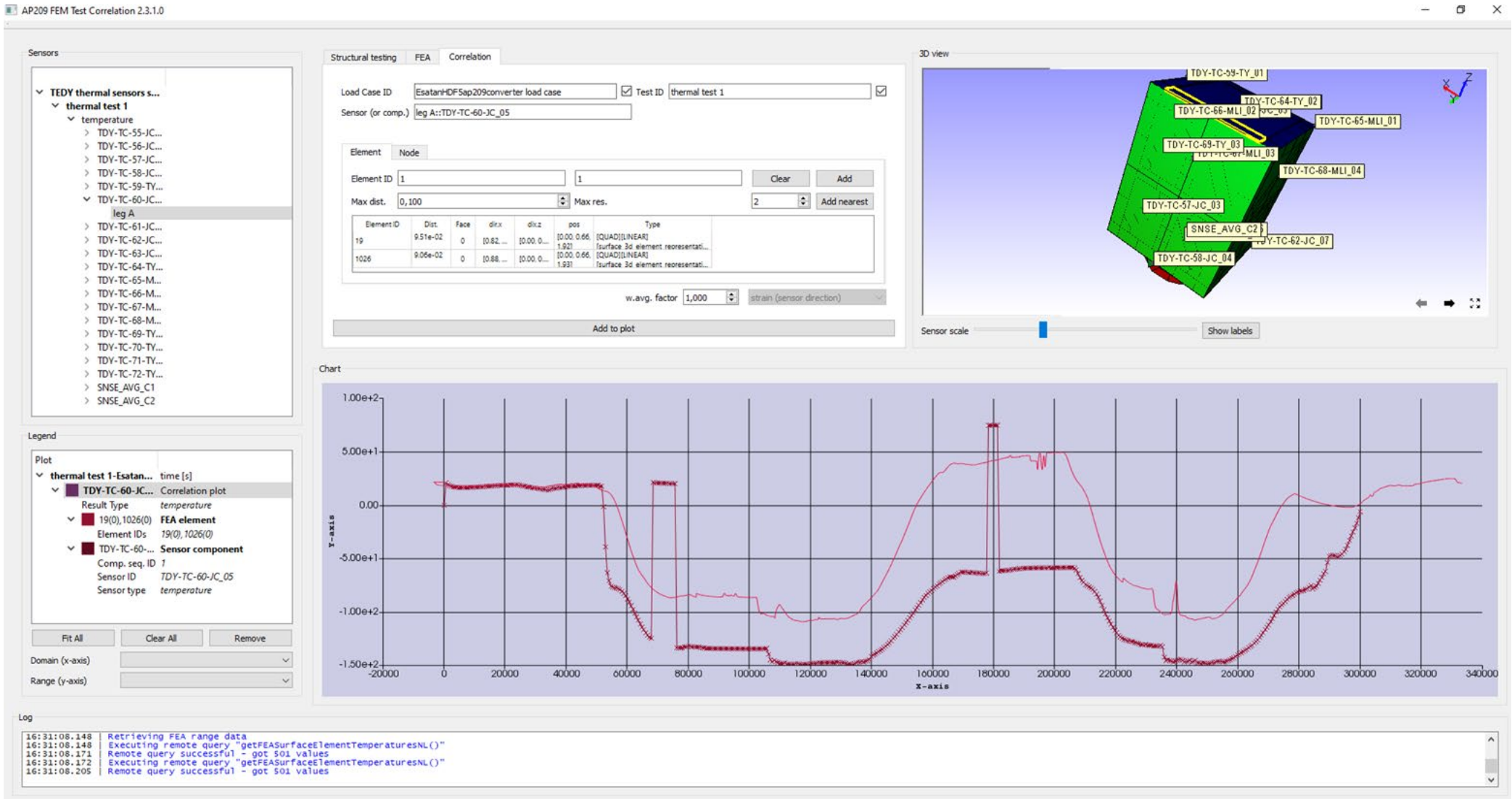

NEXT STEPS

- → Software validation by ESA in operational environment
- → New GSTP project “Digital Twin in the Supply Chain and over the Life Cycle” will start in 2022
- → Continuous development of the end user application by Jotne in among others EU R&D programs.
- → IOT integration with EDMopenSimDM

QUESTIONS?