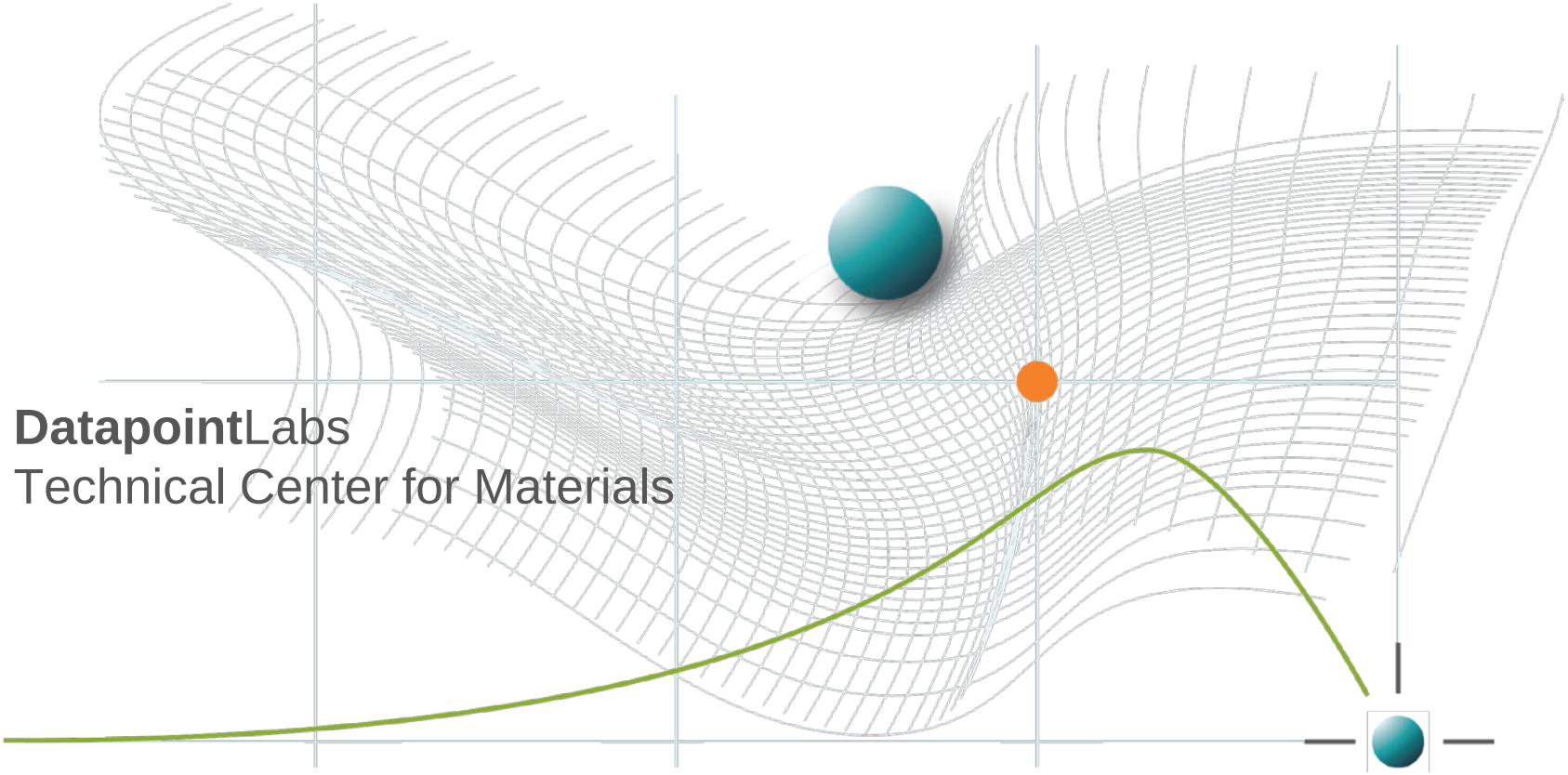
Validation of Simulation



DatapointLabs
Technical Center for Materials

DatapointLabs | TestPaks | matereality | knowmats | picsci

expert material testing | CAE material parameters | CAE Validation | software & infrastructure for materials | materials knowledge | electronic lab notebooks

Outline

- Why validate
- Validation – how it works
- Using validation through the simulation cycle
- Best practice

What is *Verification*?

- Simulations use mathematical models to replicate physical reality
- Verification is confirmation of mathematical model
- Unit element test checks that finite element behaves realistically

What is *Validation*?

- Confirmation of everything else
  - Choice of element type
  - Mesh size effect
  - Simulation settings
  - Material data & model
  - Material parameter conversion

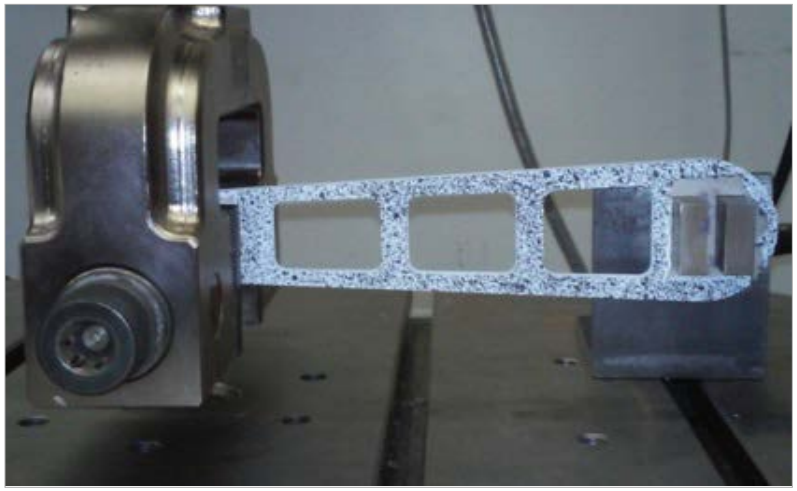
Requirement for high-fidelity simulation

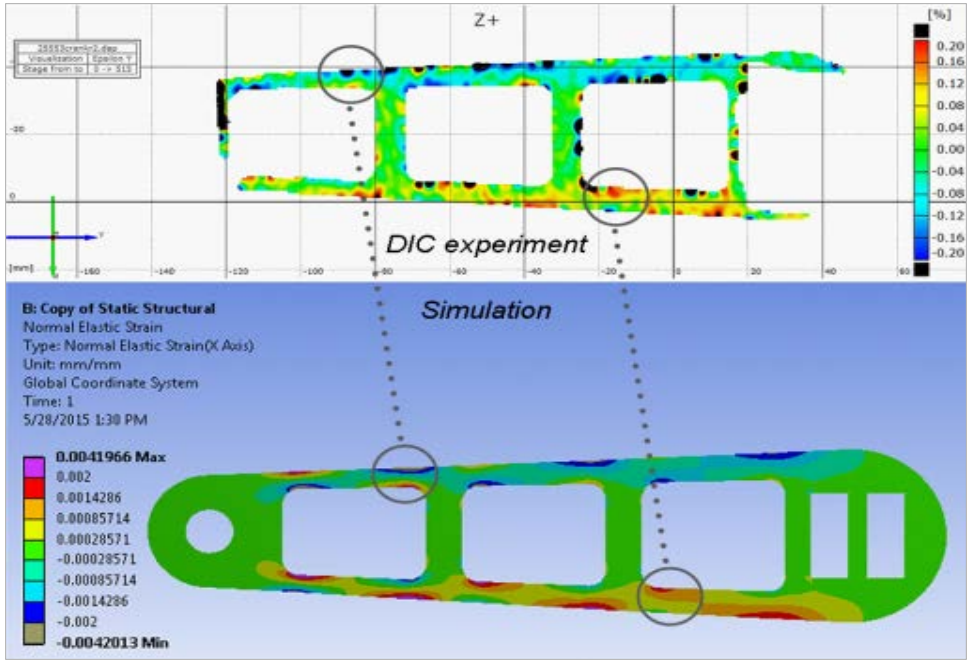
- Correctly represent the real-life scenario
- Application of hi-fi simulation
  - Late-stage prototyping
  - Additive manufacturing
  - Digital twinning

When to validate?

- Before starting work on real product
- Whenever you change/modify a simulation parameter
  - Finite element
  - Mesh size
  - Material model

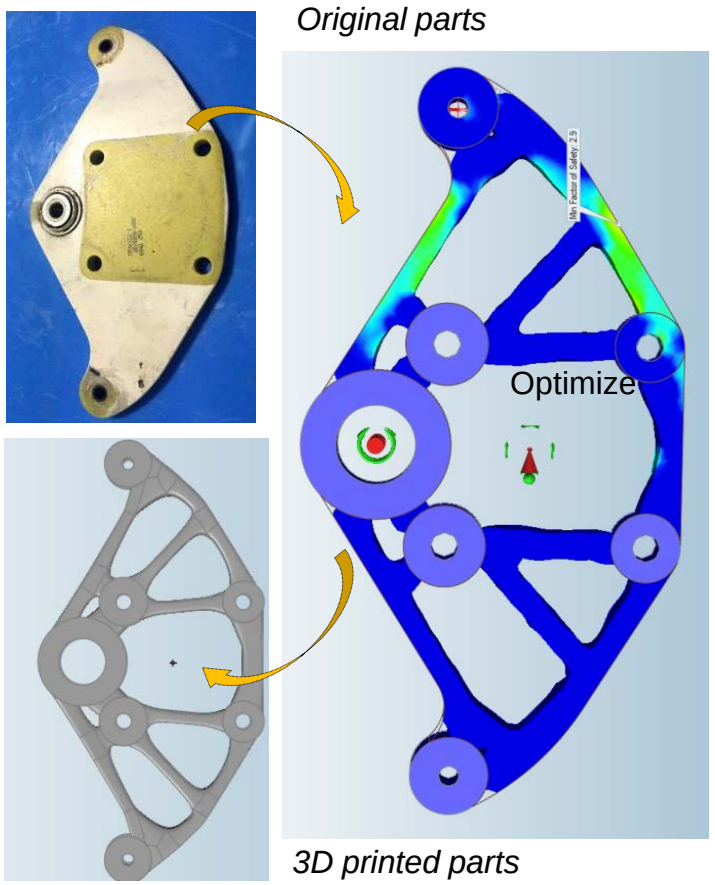
Step 1 – Validate your simulation



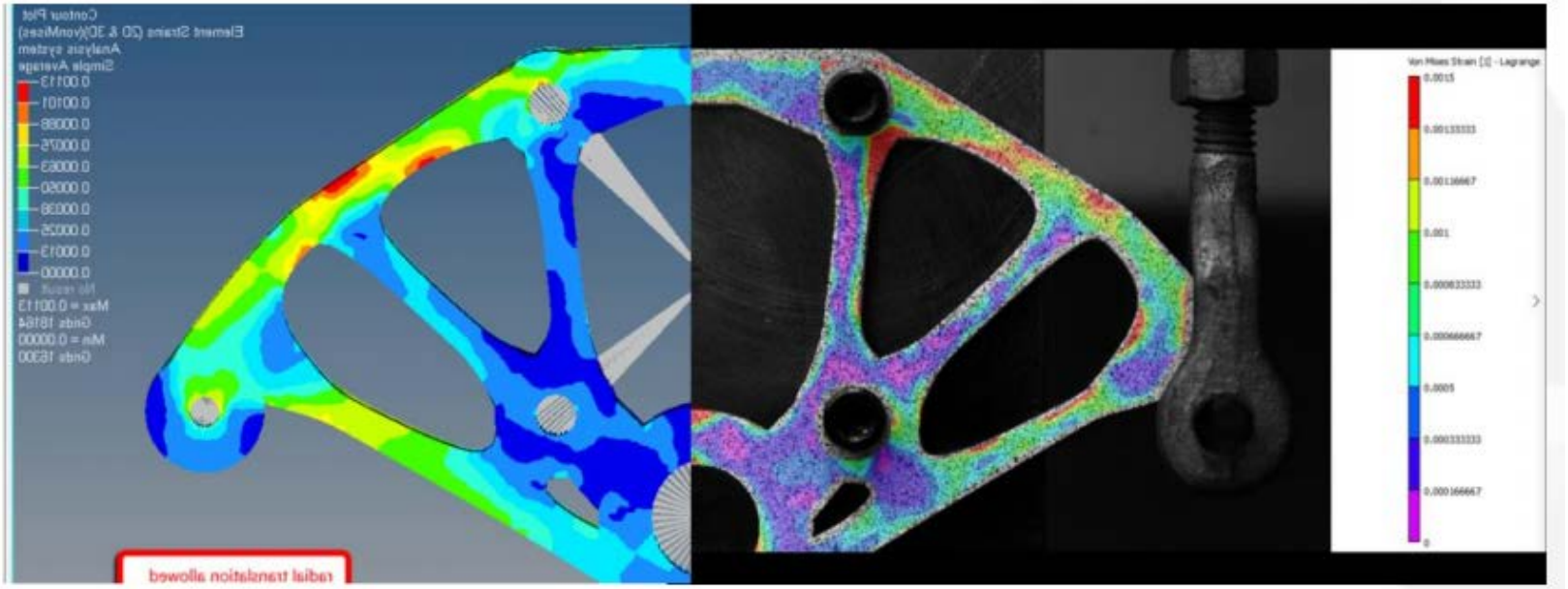


Step 2 – Start making parts

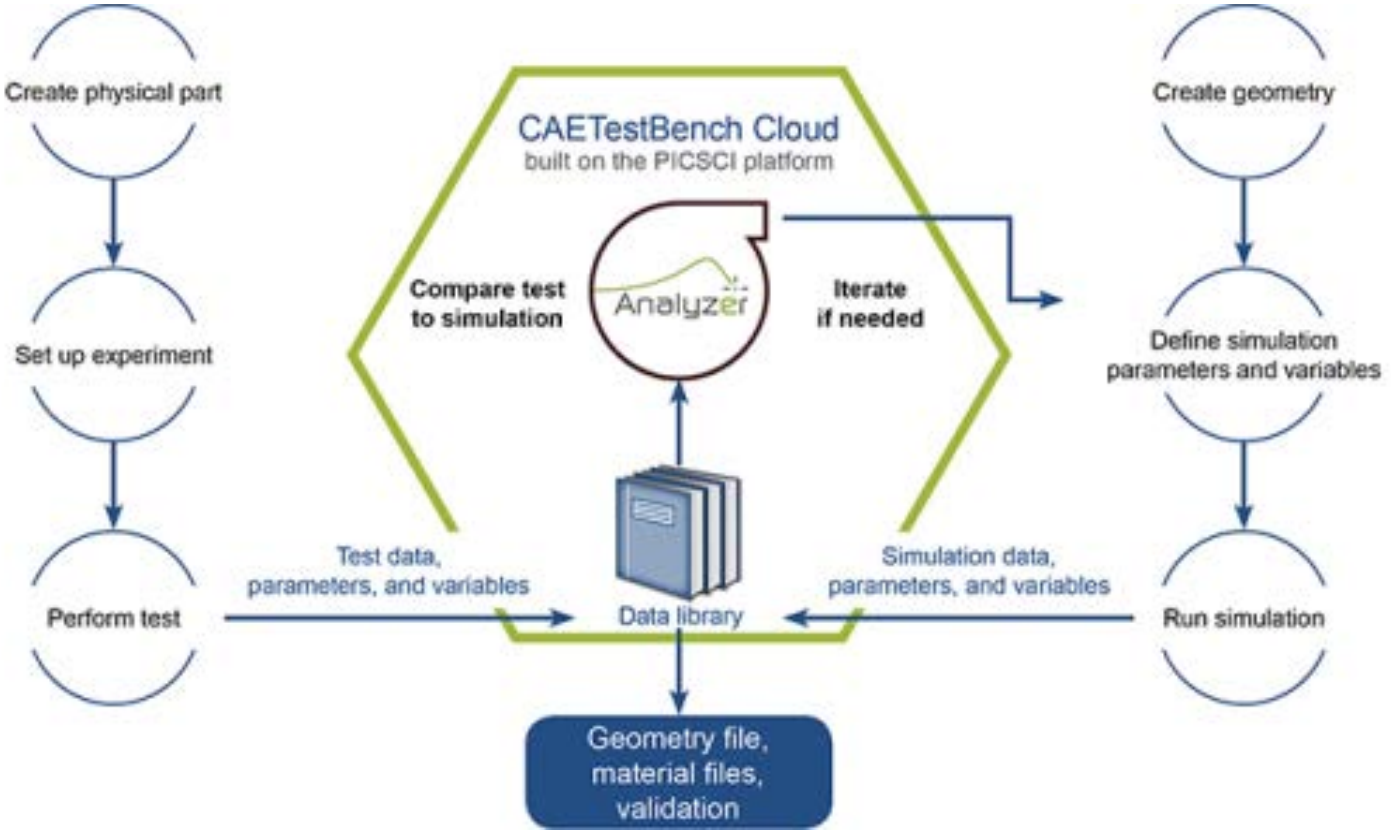
- Take original design
- Load case
- Perform topology optimization
- Print



Printed part performs as simulated!



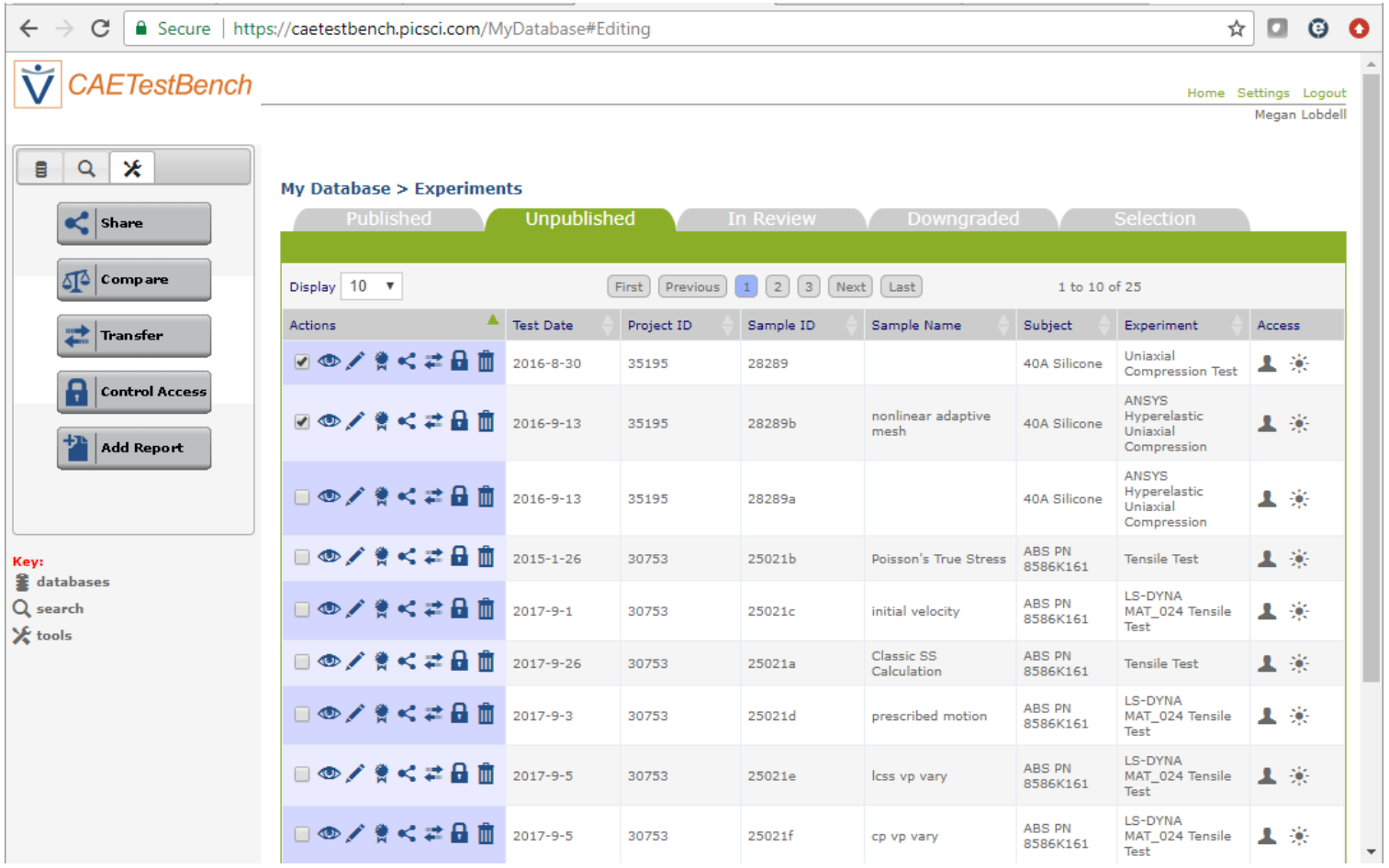
The initial validation process



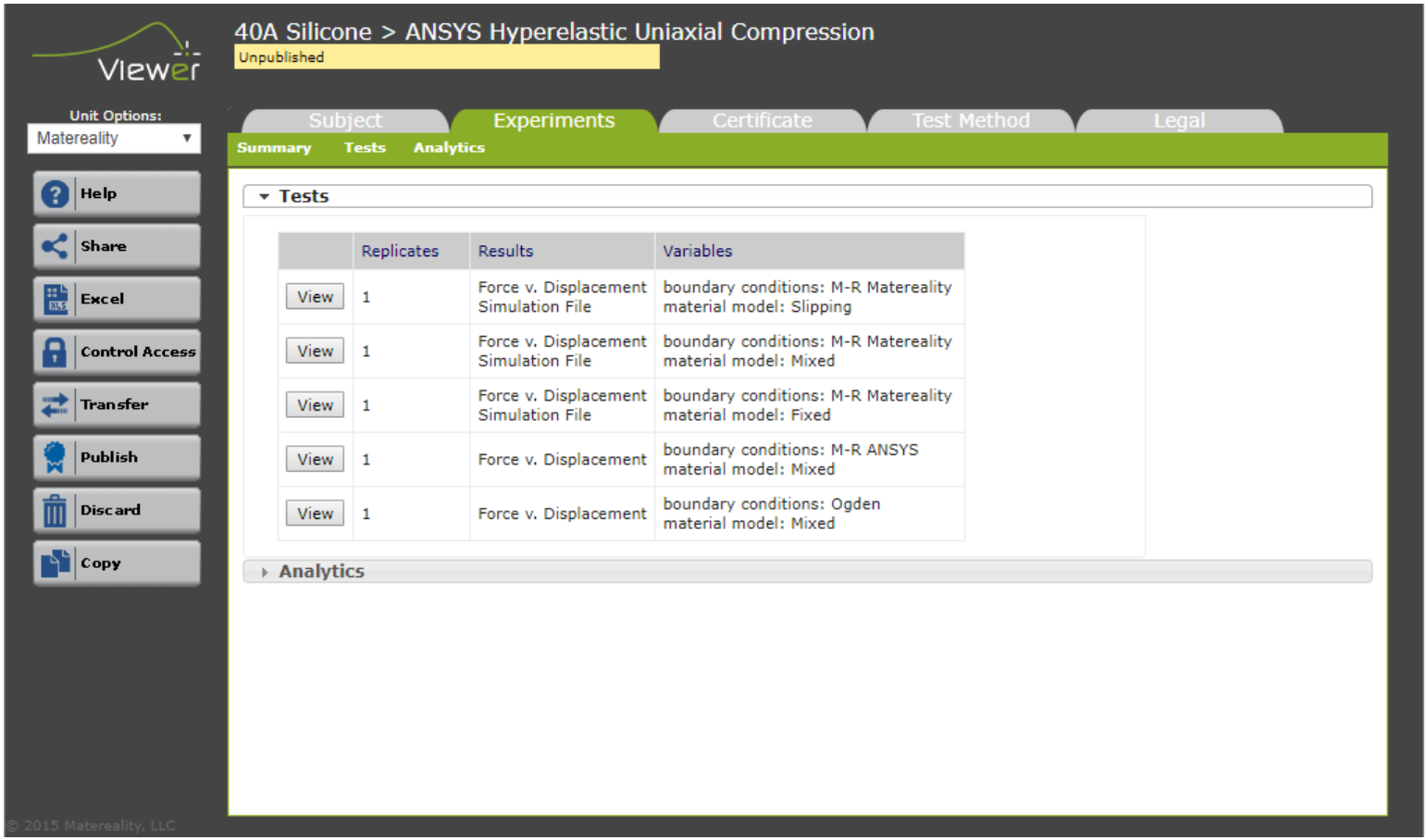
How it works

- Set up experiments and simulations in PICSCI
- Perform test > drop data into PICSCI
- Stage simulation
  - Record simulation parameters and variables in PICSCI
  - Perform simulation > drop data into PICSCI
- Use Analyzer module to measure simulation accuracy
- Iterate as needed to explore best material models and parameters
- Deliver to client
  - Validation Report
  - Simulation file
  - CAE Material file(s)

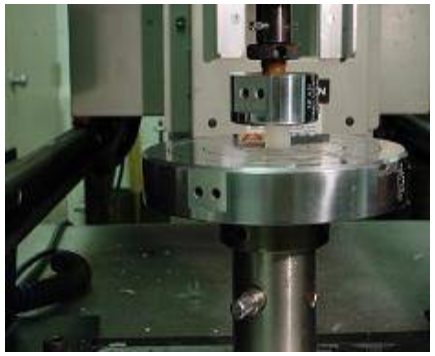
Stored simulation and physical test data

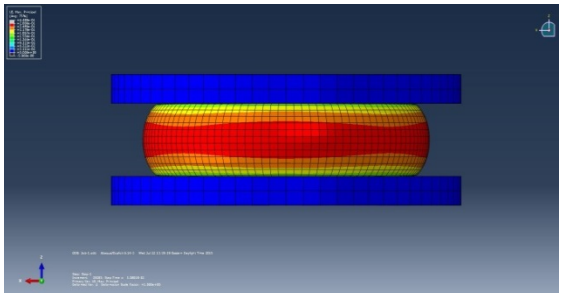


Iterations of simulations

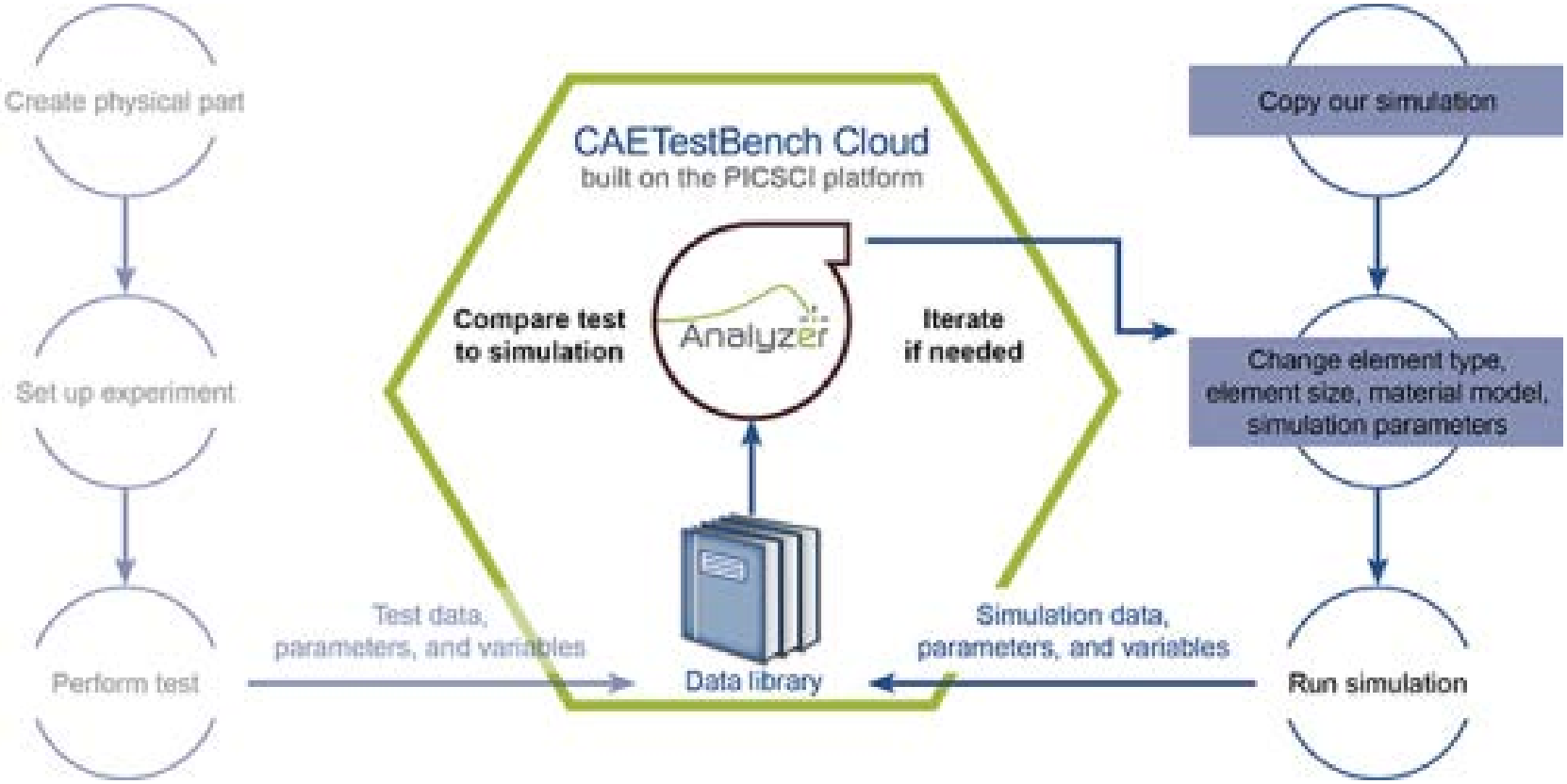


Curve Analytics - Automated Viewer Analytics





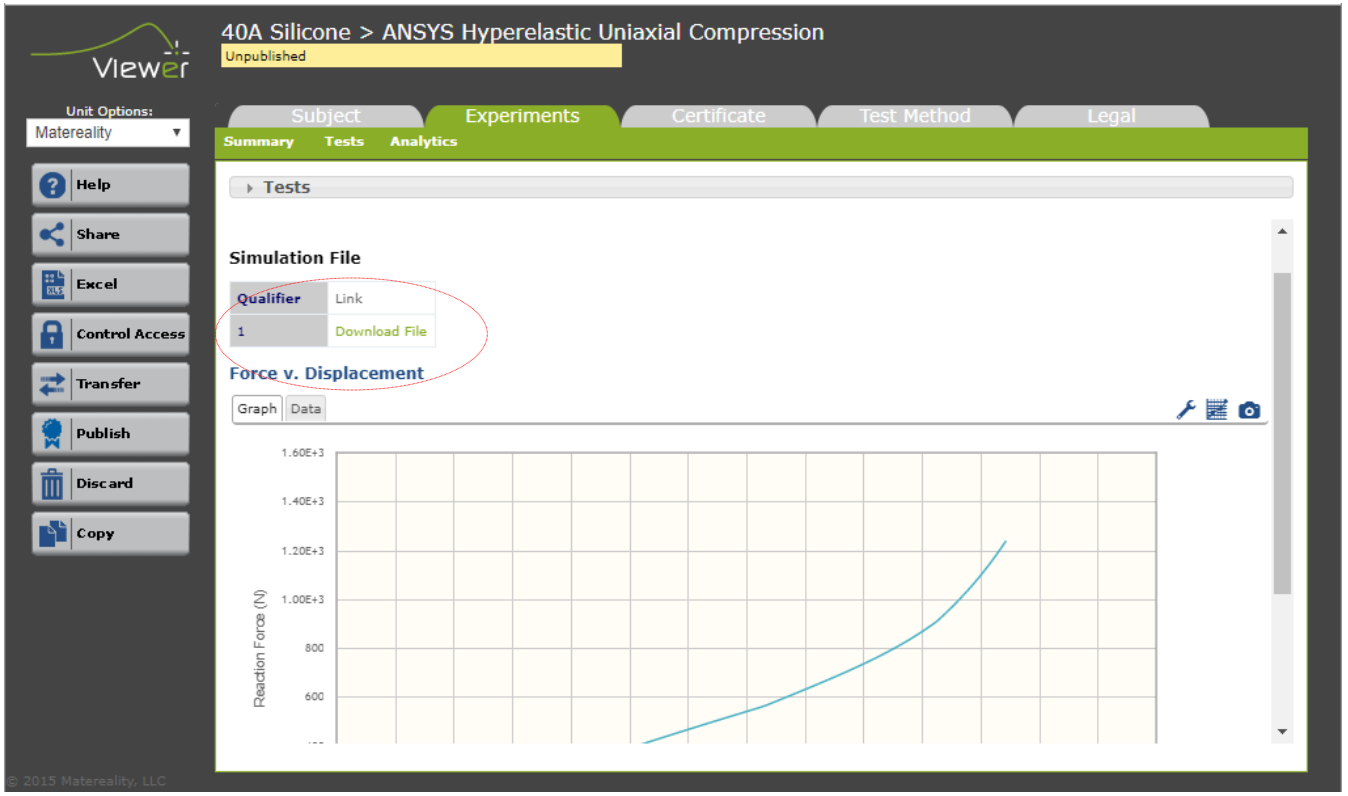
Continuing Validation



How to do it

- If you change your simulation parameters, element configuration, or material model, you can re-validate to assess the impact on your simulation
- Go to *CAETestBench.PICSCI*
- Make a copy of the simulation
- Download our simulation file and material card
- Modify inputs as needed
- Run simulation
- Upload new simulation data, parameters and variables
- Use Analyzer module to compare simulation to experiment
- Iterate as needed to explore best material models and parameters

Downloading the simulation file



Thank you

- Read about Materials in Simulation at our free site www.knowmats.com
- Links to technical papers
- Contributions from industry experts