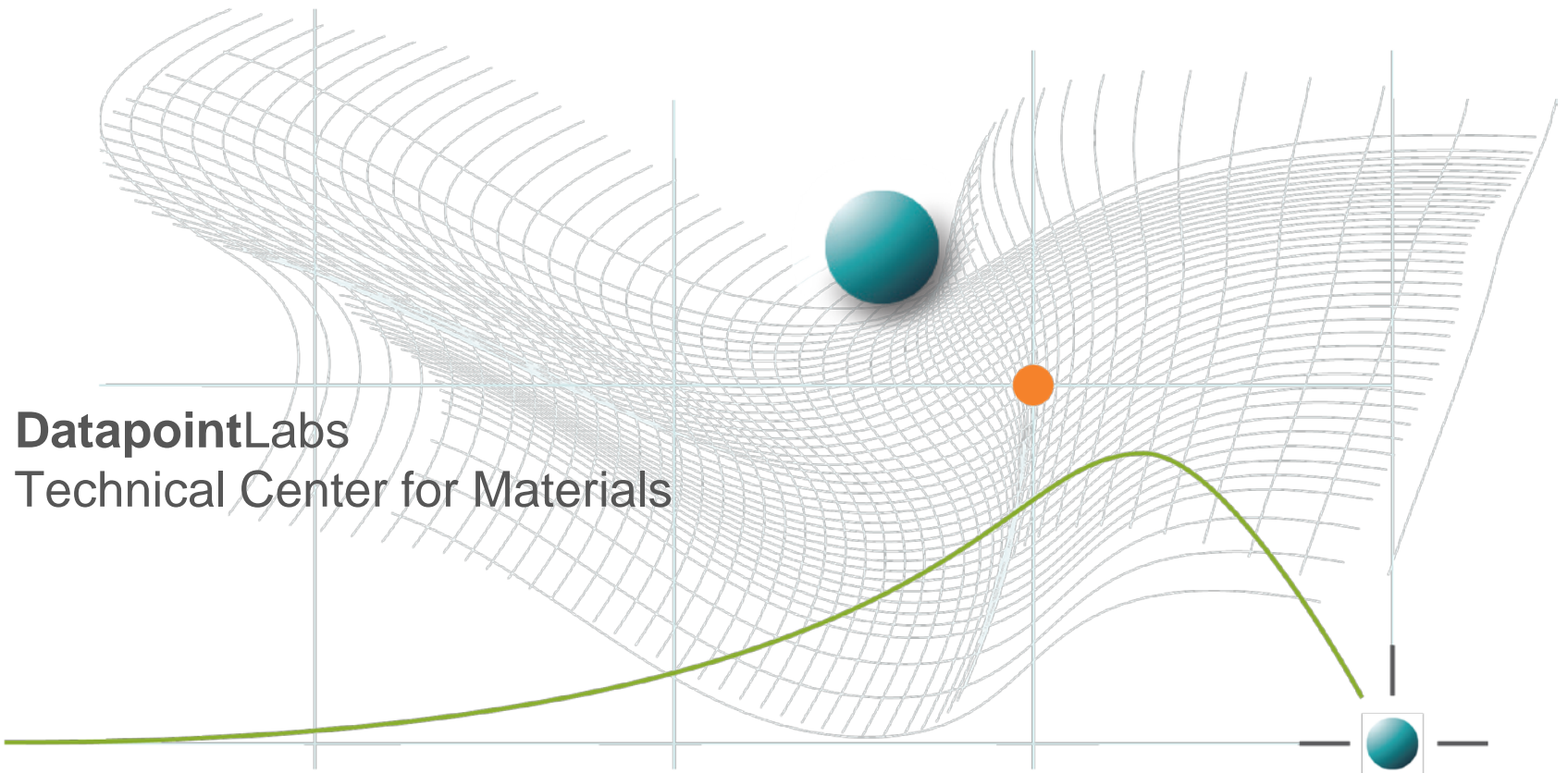


Validation of Simulation



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

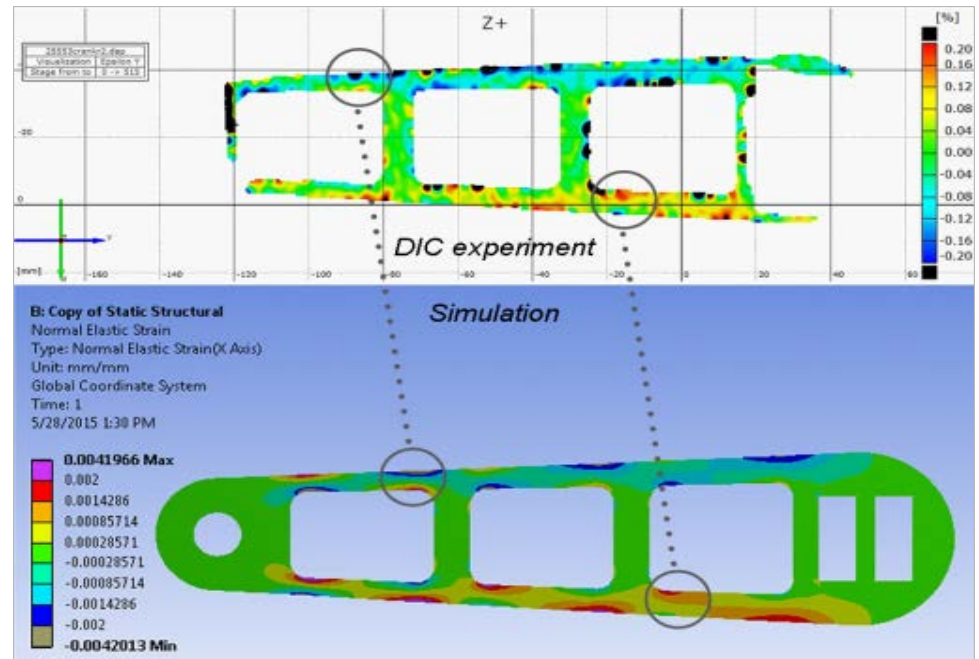
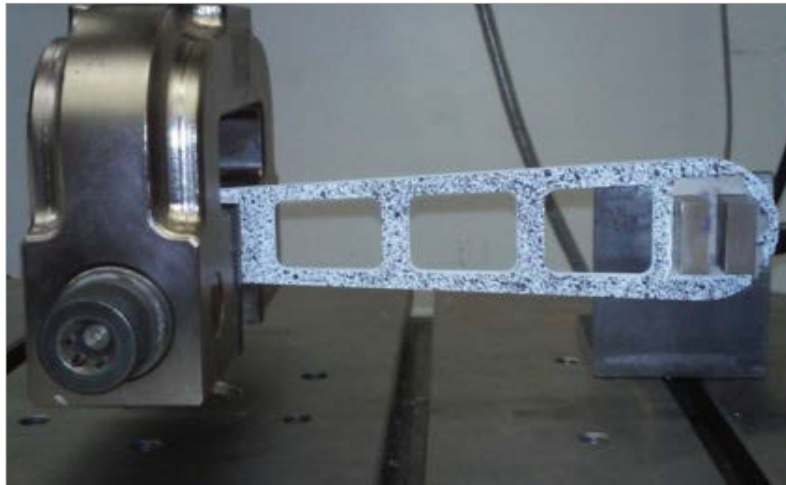
Requirement for high-fidelity simulation

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

When to validate?

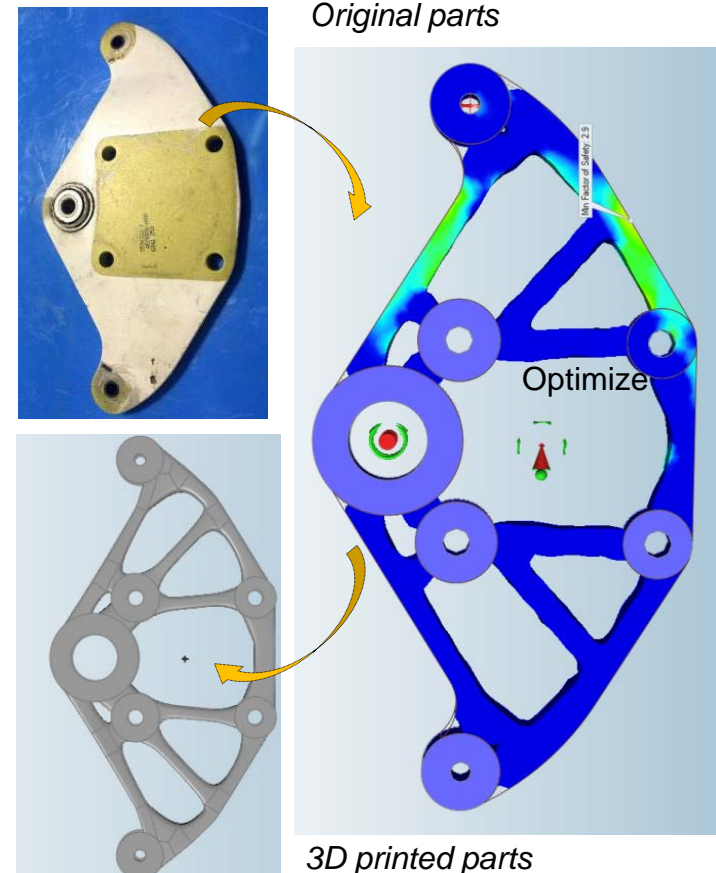
- Before starting work on real product
- Whenever you change/modify a simulation parameter
 - Finite element
 - Mesh size
 - Material model

Step 1 – Validate your simulation

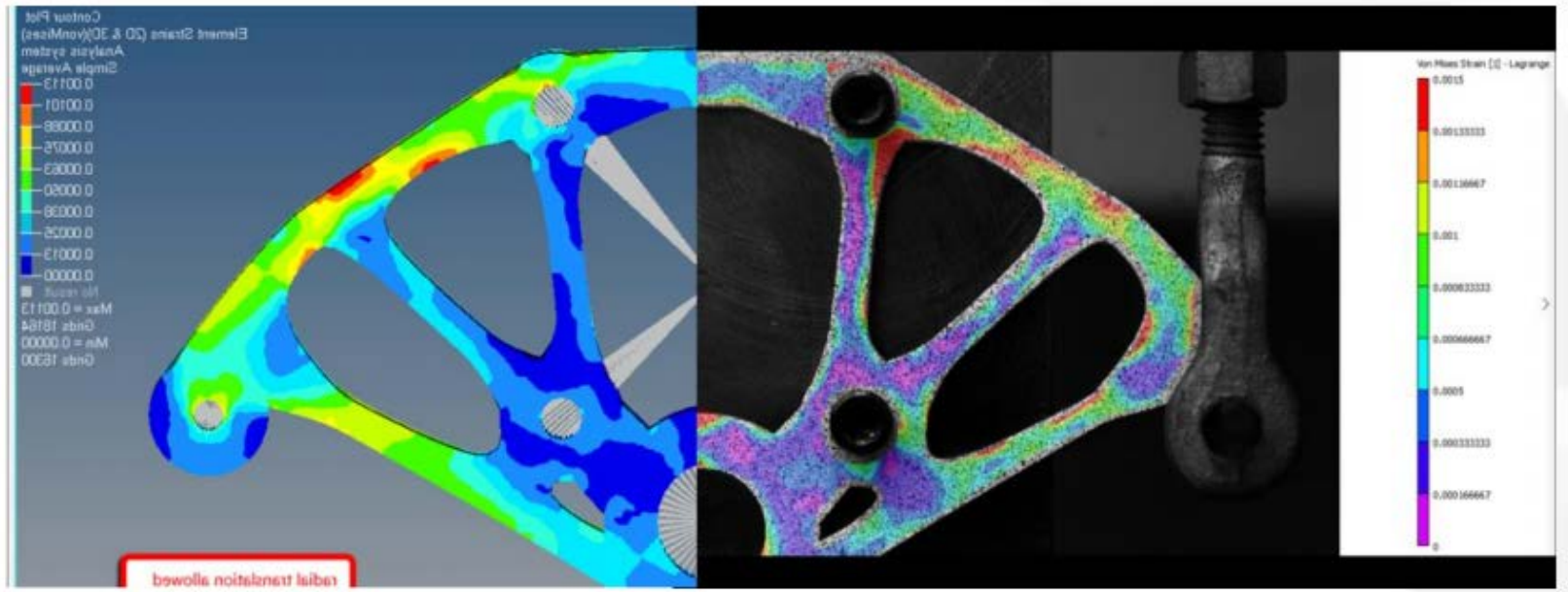


Step 2 – Start making parts

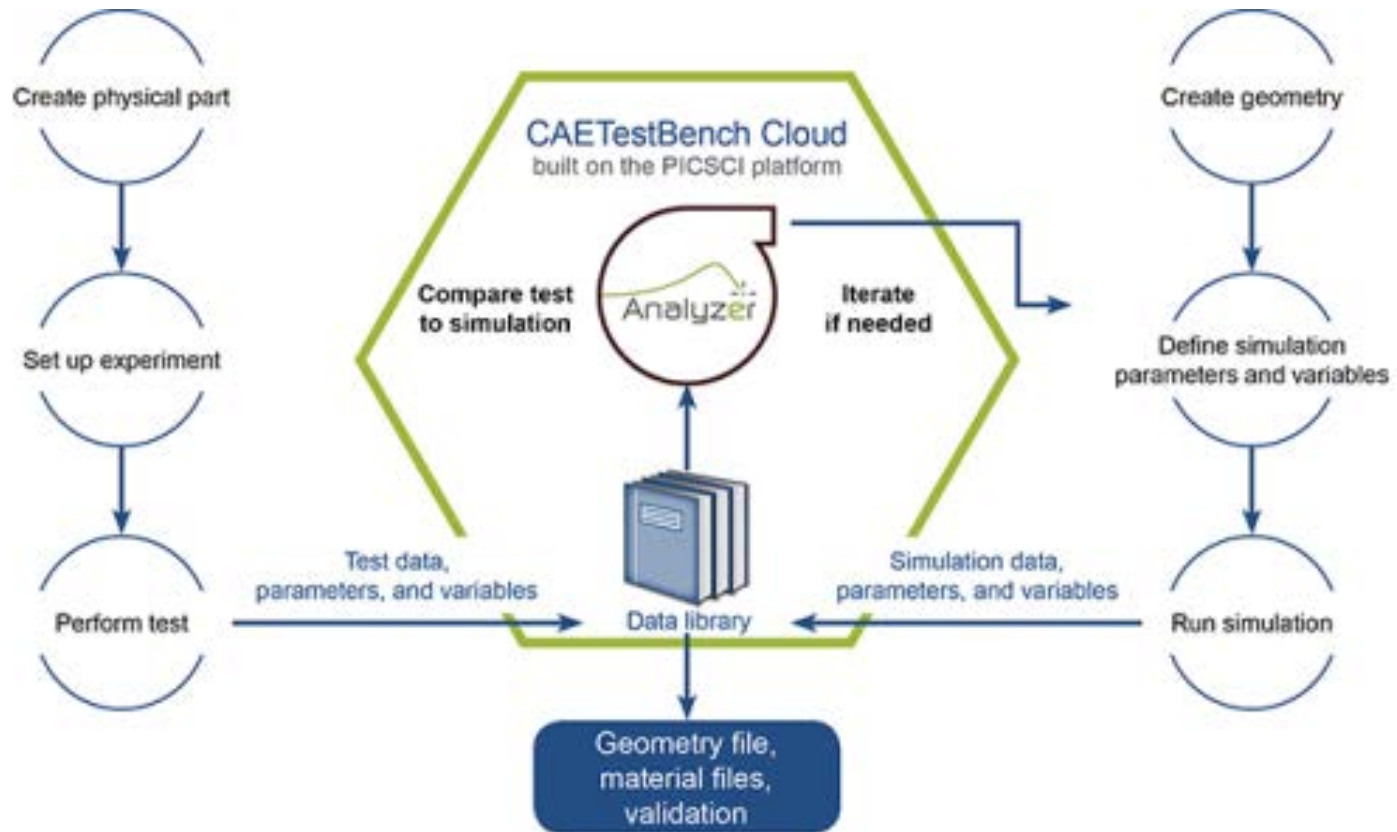
- Take original design
- Load case
- Perform topology optimization
- Print



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

CAE TestBench

Home Settings Logout
Megan Lobdell

My Database > Experiments

Published Unpublished In Review Downgraded Selection

Display 10 First Previous 1 2 3 Next Last 1 to 10 of 25

Actions	Test Date	Project ID	Sample ID	Sample Name	Subject	Experiment	Access
<input checked="" type="checkbox"/>	2016-8-30	35195	28289		40A Silicone	Uniaxial Compression Test	
<input checked="" type="checkbox"/>	2016-9-13	35195	28289b	nonlinear adaptive mesh	40A Silicone	ANSYS Hyperelastic Uniaxial Compression	
<input type="checkbox"/>	2016-9-13	35195	28289a		40A Silicone	ANSYS Hyperelastic Uniaxial Compression	
<input type="checkbox"/>	2015-1-26	30753	25021b	Poisson's True Stress	ABS PN 8586K161	Tensile Test	
<input type="checkbox"/>	2017-9-1	30753	25021c	initial velocity	ABS PN 8586K161	LS-DYNA MAT_024 Tensile Test	
<input type="checkbox"/>	2017-9-26	30753	25021a	Classic SS Calculation	ABS PN 8586K161	Tensile Test	
<input type="checkbox"/>	2017-9-3	30753	25021d	prescribed motion	ABS PN 8586K161	LS-DYNA MAT_024 Tensile Test	
<input type="checkbox"/>	2017-9-5	30753	25021e	lcss vp vary	ABS PN 8586K161	LS-DYNA MAT_024 Tensile Test	
<input type="checkbox"/>	2017-9-5	30753	25021f	cp vp vary	ABS PN 8586K161	LS-DYNA MAT_024 Tensile Test	

Key:
 databases
 search
 tools

Iterations of simulations

The screenshot displays the Viewr software interface for a simulation titled "40A Silicone > ANSYS Hyperelastic Uniaxial Compression". The status is "Unpublished". The interface includes a sidebar with navigation options like Help, Share, Excel, Control Access, Transfer, Publish, Discard, and Copy. The main content area shows a table of simulation results under the "Tests" tab.

Unit Options: Matereality

40A Silicone > ANSYS Hyperelastic Uniaxial Compression
Unpublished

Subject Experiments Certificate Test Method Legal

Summary Tests Analytics

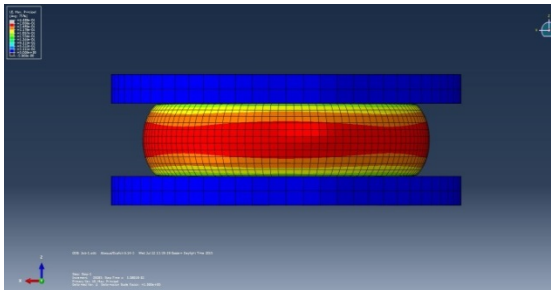
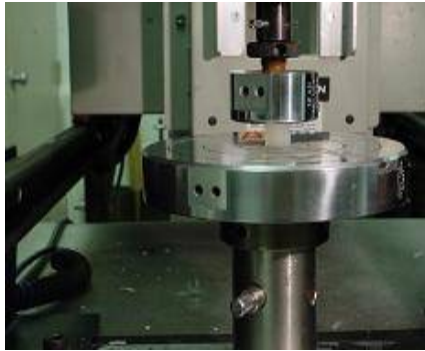
▼ Tests

	Replicates	Results	Variables
View	1	Force v. Displacement Simulation File	boundary conditions: M-R Matereality material model: Slipping
View	1	Force v. Displacement Simulation File	boundary conditions: M-R Matereality material model: Mixed
View	1	Force v. Displacement Simulation File	boundary conditions: M-R Matereality material model: Fixed
View	1	Force v. Displacement	boundary conditions: M-R ANSYS material model: Mixed
View	1	Force v. Displacement	boundary conditions: Ogden material model: Mixed

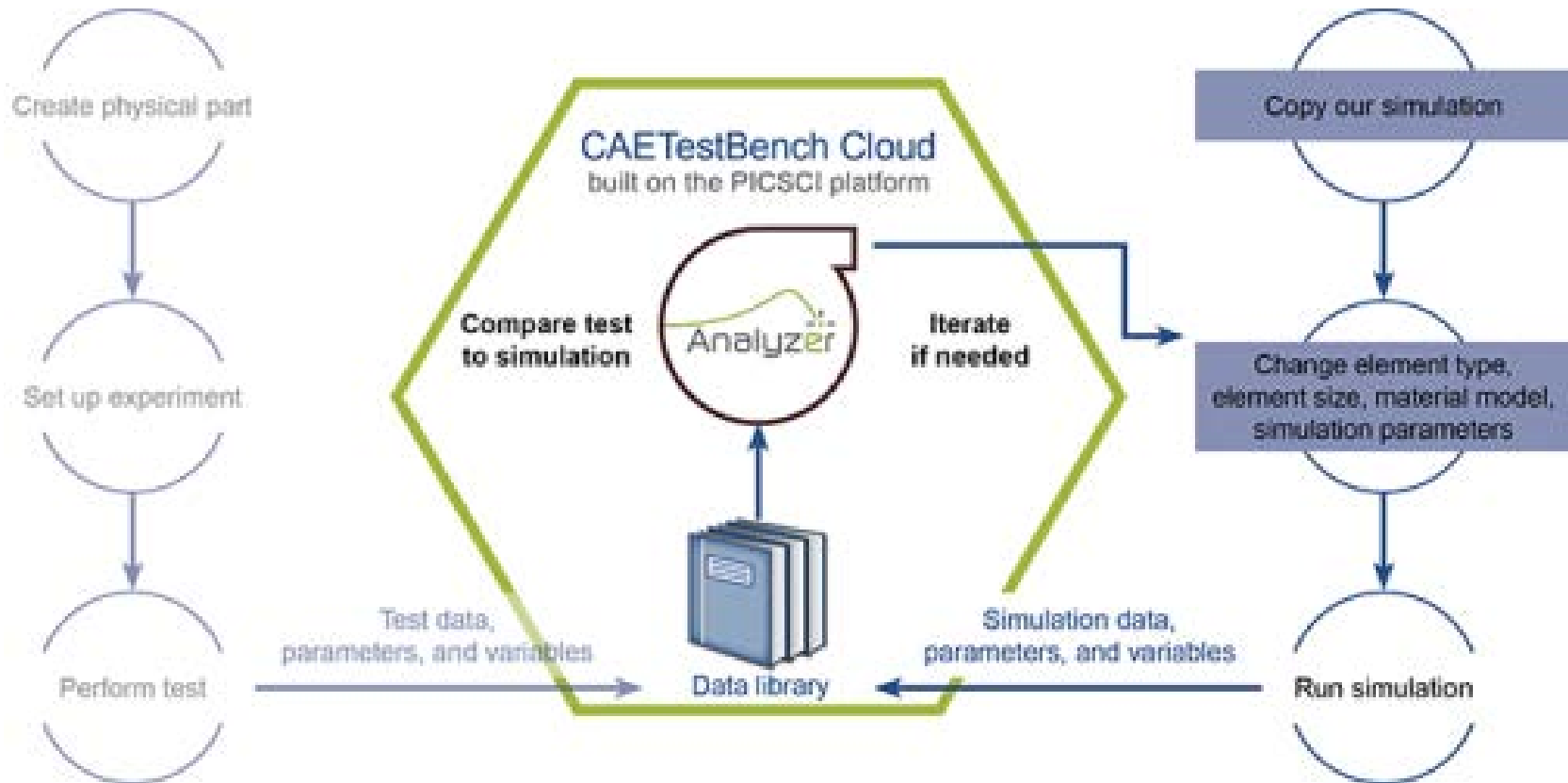
► Analytics

© 2015 Matereality, LLC

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

Viewer

40A Silicone > ANSYS Hyperelastic Uniaxial Compression
Unpublished

Unit Options:
Materiality

Help
Share
Excel
Control Access
Transfer
Publish
Discard
Copy

Subject Experiments Certificate Test Method Legal

Summary Tests Analytics

Tests

Simulation File

Qualifier	Link
1	Download File

Force v. Displacement

Graph Data

Reaction Force (N)

1.60E+3
1.40E+3
1.20E+3
1.00E+3
800
600
...

Thank you

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

