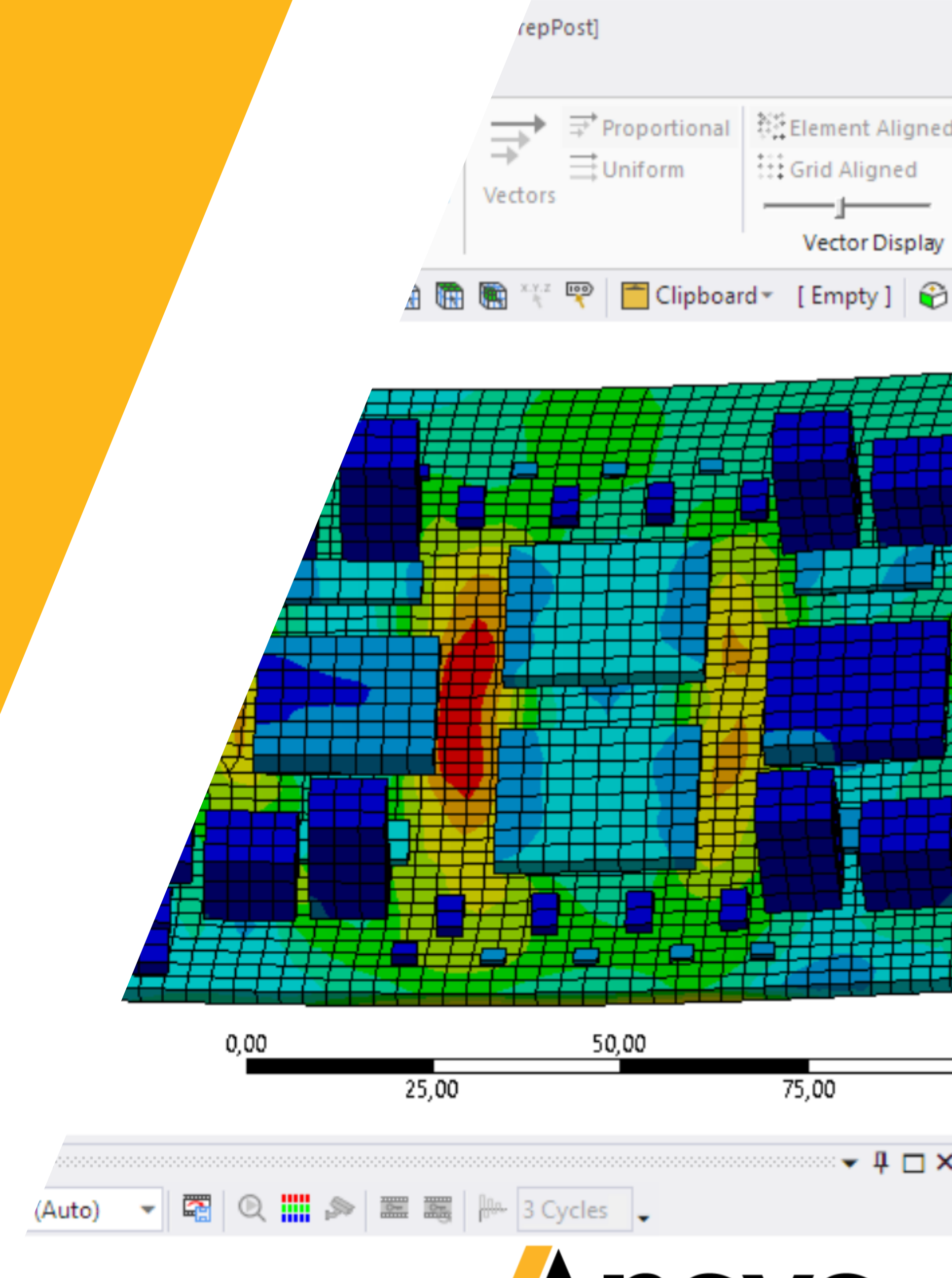
Workbench LS-DYNA Update

Siddharth Shah

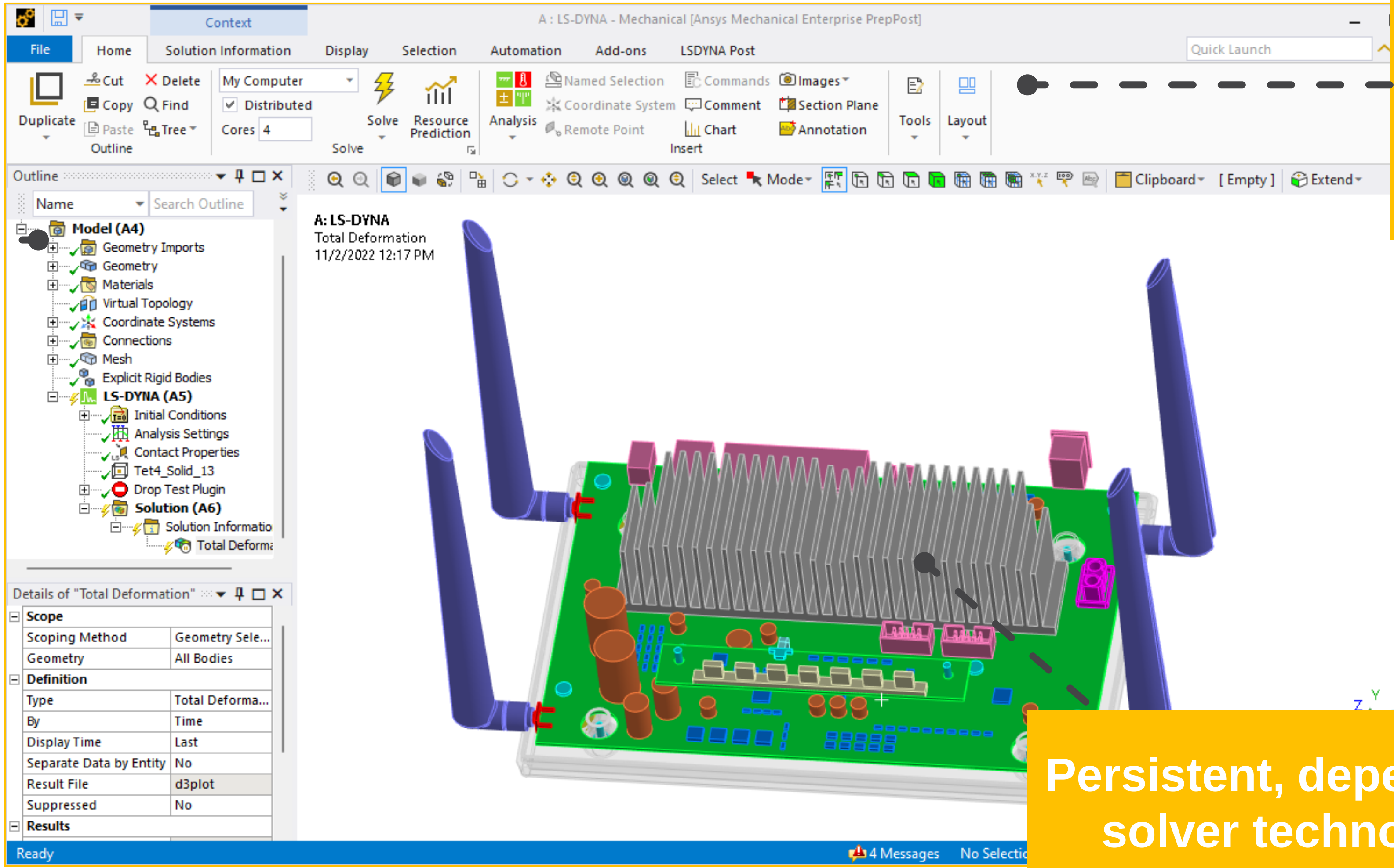


Ansys

LS-Dyna Solver exists within Mechanical Interface

Dynamic, integrated platform

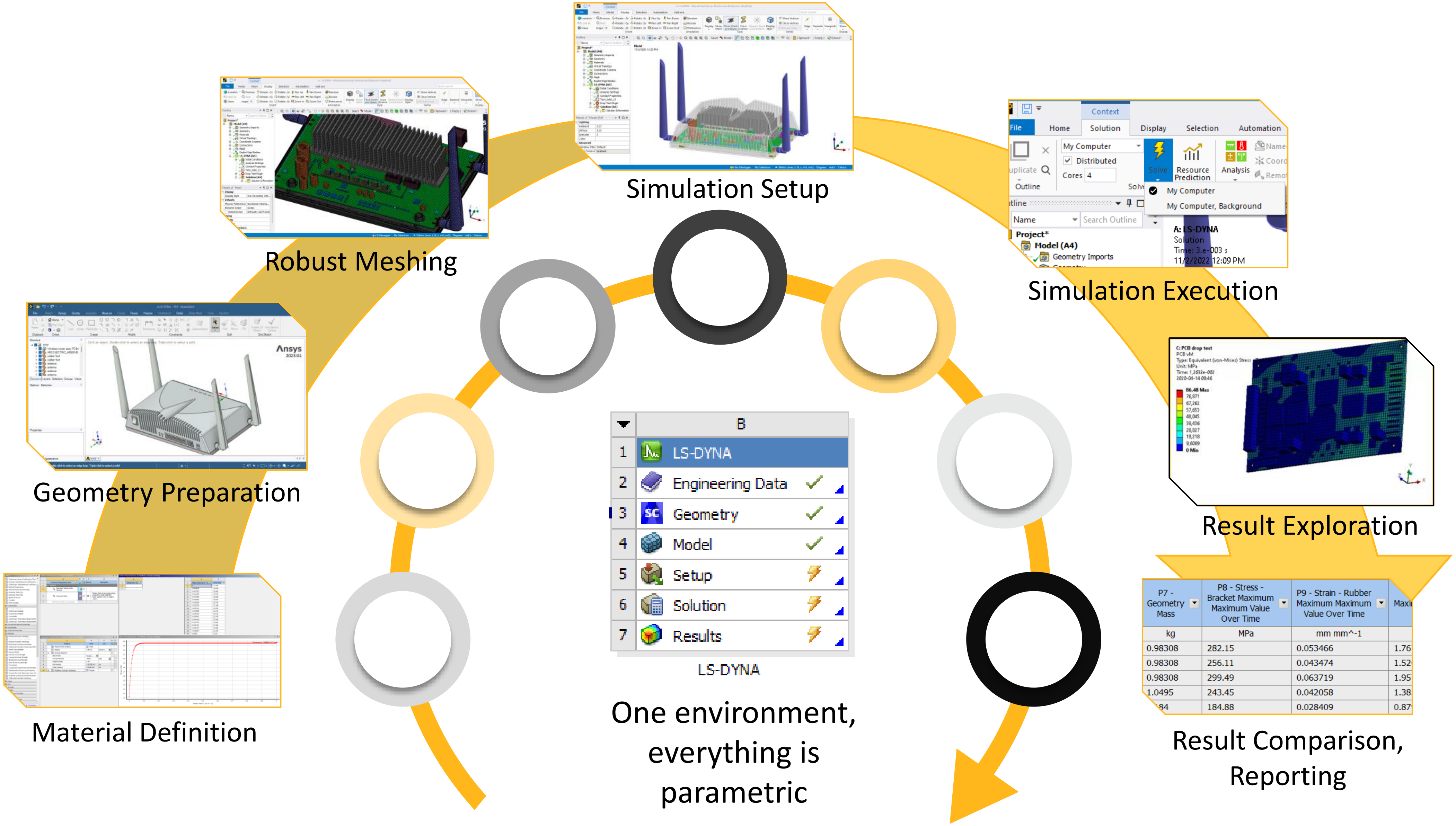
Easy to use, multi-purpose tool



Cad connected, Parametric, Easy to learn

Persistent, dependable solver technology

Integrated Workflow

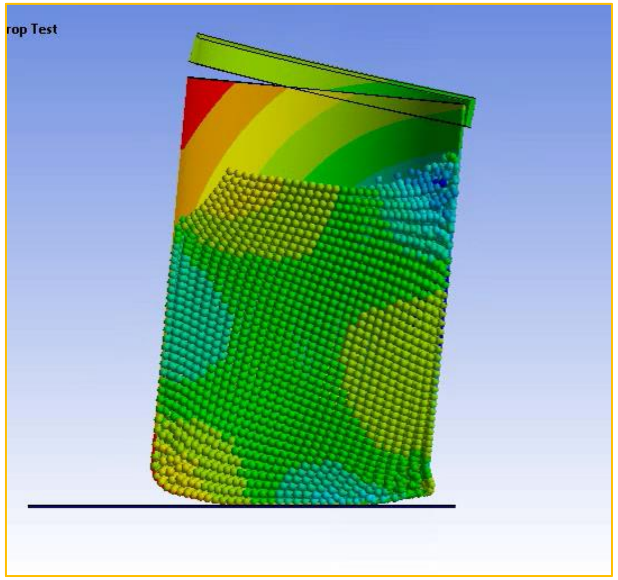


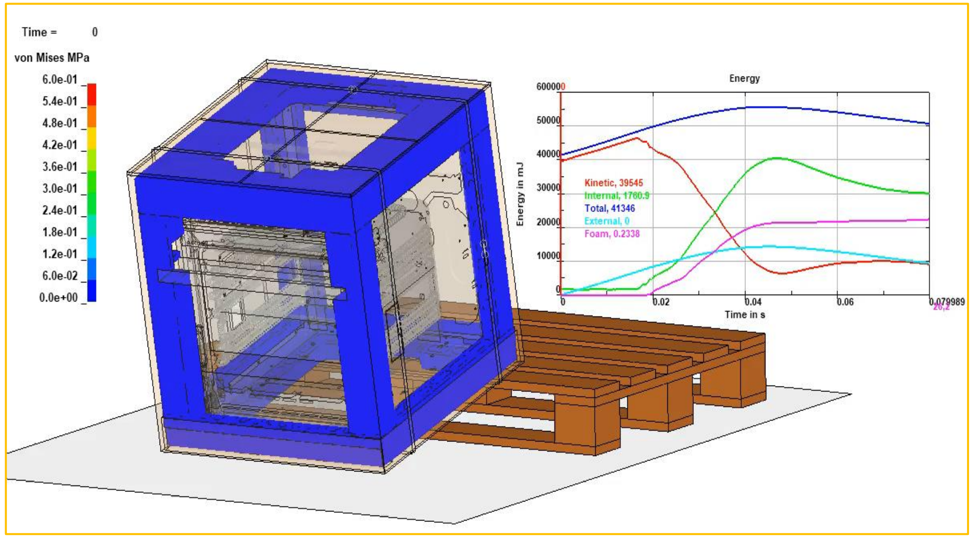
P7 - Geometry Mass	P8 - Stress - Bracket Maximum Maximum Value Over Time	P9 - Strain - Rubber Maximum Maximum Value Over Time	Maxi
kg	MPa	mm mm^-1	
0.98308	282.15	0.053466	1.76
0.98308	256.11	0.043474	1.52
0.98308	299.49	0.063719	1.95
1.0495	243.45	0.042058	1.38
84	184.88	0.028409	0.87

One environment, everything is parametric

Application Focus Areas

- Integration with Ansys Tools e.g. Sherlock
- Drop and Impact test
- Product Misuse/ Failure
- Containment and Safety
- Machining / Cutting / Drawing





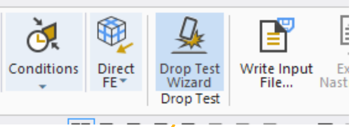
PCB Drop Test Workflow

sherlock AUTOMATED DESIGN ANALYSIS™ → Discovery SpaceClaim → Ansys

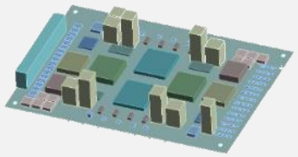
PCB geometry

Geometry clean-up

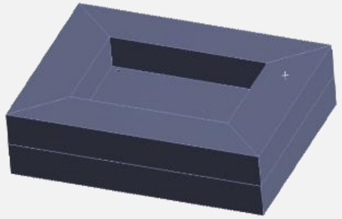
Model setup in Workbench LS-Dyna



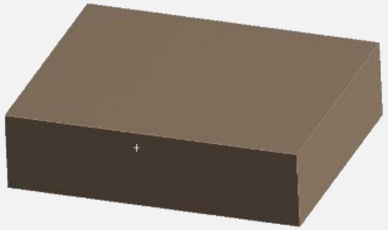
PCB
Various linear elastic material models



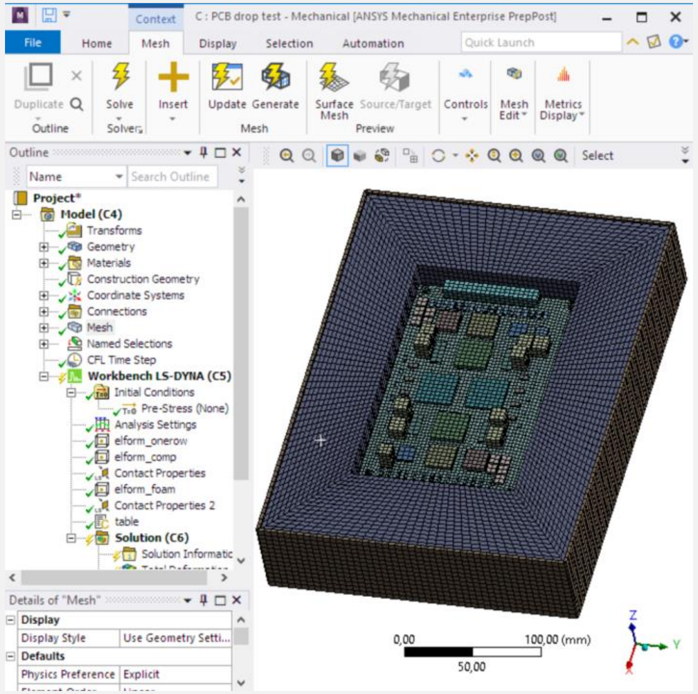
Foam,
Fu Chang EPP material model



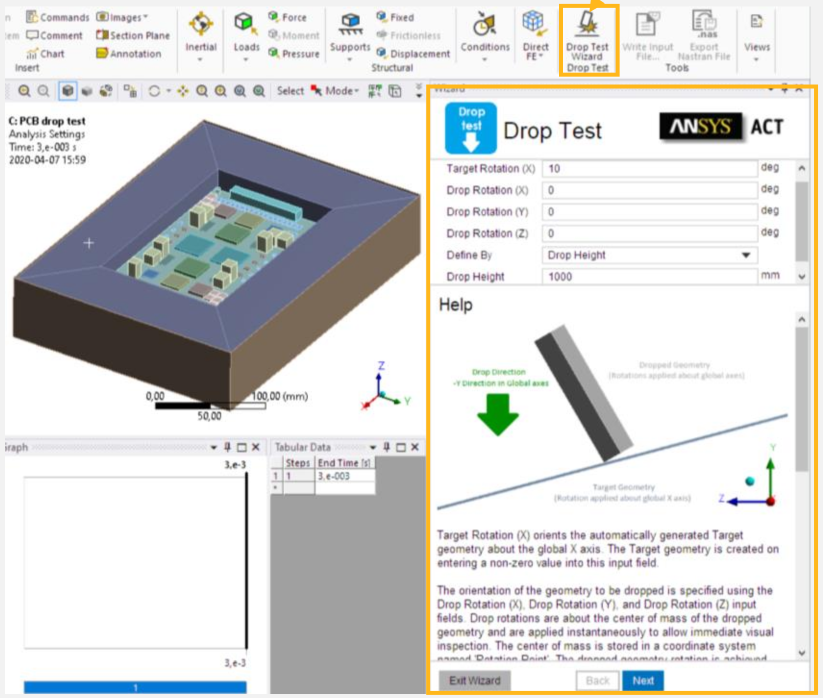
Casing
Polycarbonate bilinear isotropic hardening



Assigning materials



Meshing components



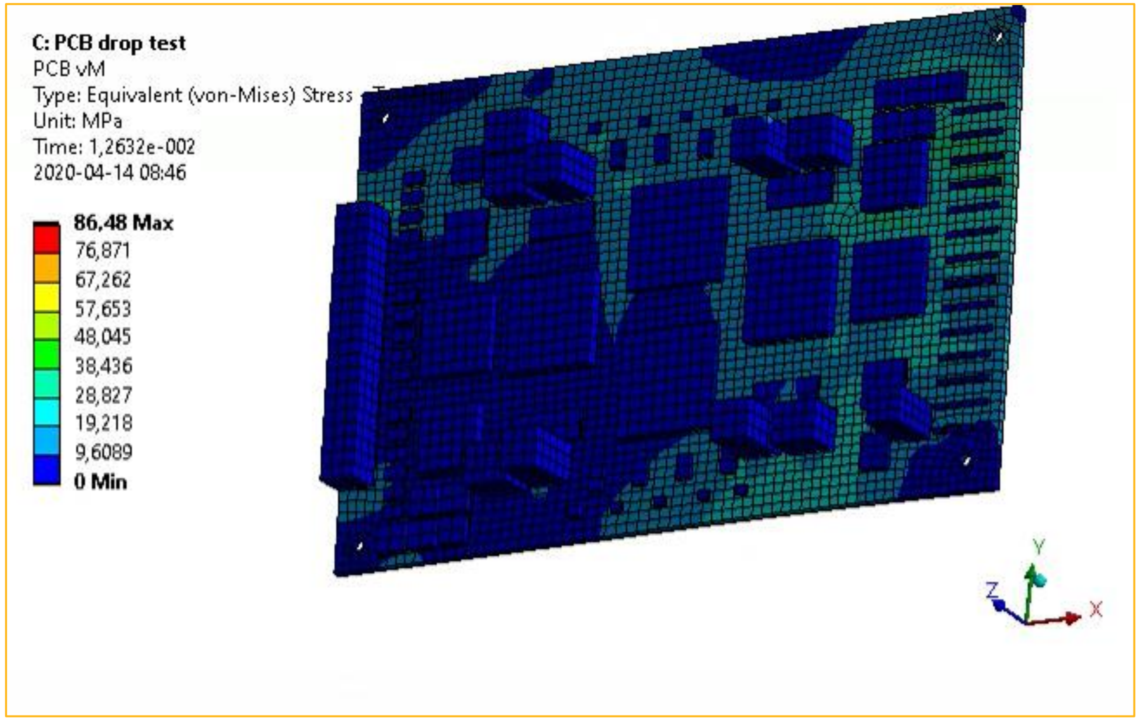
Setting up Drop-Test with DropTestWizard

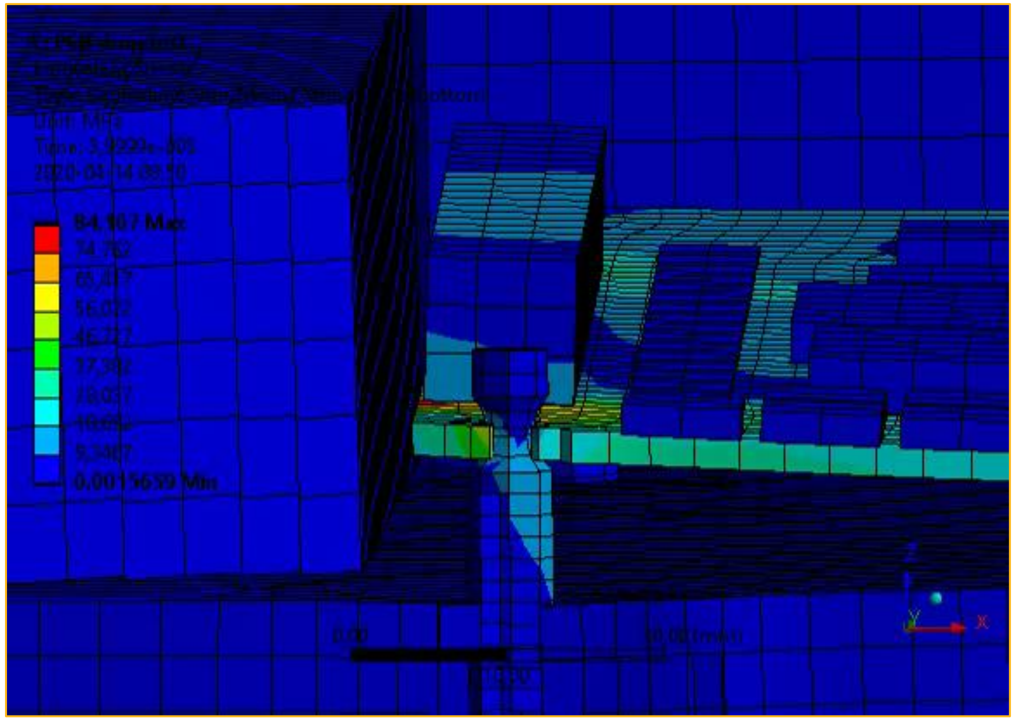
PCB Drop Test Workflow

sherlock
AUTOMATED DESIGN ANALYSIS™
PCB geometry

Discovery SpaceClaim
Geometry clean-up

Ansys
Solve model in
Workbench LS-Dyna





Material Models Support

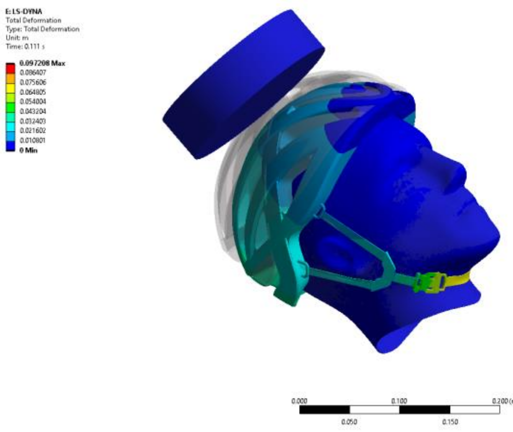
- Additional material models have been introduced for applications using Fabric\Foam
- Can be imported to Engineering Data from .k file using External Model
- These definitions generally follow the input card with the variable names added as a suffix

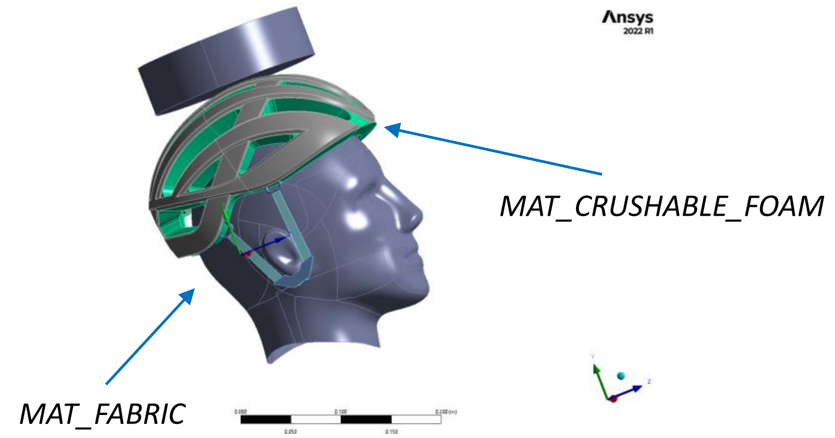
LSDYNA External Model - MAT

- *MAT_ELASTIC
- *MAT_ORTHOTROPIC_ELASTIC
- *MAT_ANISOTROPIC_ELASTIC
- *MAT_PLASTIC_KINEMATIC
- *MAT_BLATZ-KO_RUBBER
- *MAT_HIGH_EXPLOSIVE_BURN
- *MAT_NULL
- *MAT_JOHNSON_COOK
- *MAT_POWER_LAW_PLASTICITY
- *MAT_PIECEWISE_LINEAR_PLASTICITY
- *MAT_CRUSHABLE_FOAM
- *MAT_SIMPLIFIED_JOHNSON_COOK
- *MAT_MODIFIED_PIECEWISE_LINEAR_PLASTICITY
- *MAT_SIMPLIFIED_RUBBER/FOAM
- *MAT_BILKHU/DUBOIS_FOAM
- *MAT_FABRIC

Properties of Outline Row 8: MAT_CRUSHABLE_FOAM

	A	B	C	D	E
1	Property	Value	Unit		
2	Material Field Variables	Table			
3	Density	70	kg m^-3		
4	Isotropic Elasticity				
5	Derive from	Young's Mod...			
6	Young's Modulus	2.5E+07	Pa		
7	Poisson's Ratio	0.2			
8	Bulk Modulus	1.3889E+07	Pa		
9	Shear Modulus	1.0417E+07	Pa		
10	*MAT_CRUSHABLE_FOAM				
11	Definition				
12	Tensile Stress cutoff, tsc	3.9E+05	Pa		
13	Rate Sensitivity via damping coefficient, damp	0			
14	Yield Stress versus Volumetric Strain, lcid	Tabular			
15	Scale	1			
16	Offset	0	Pa		

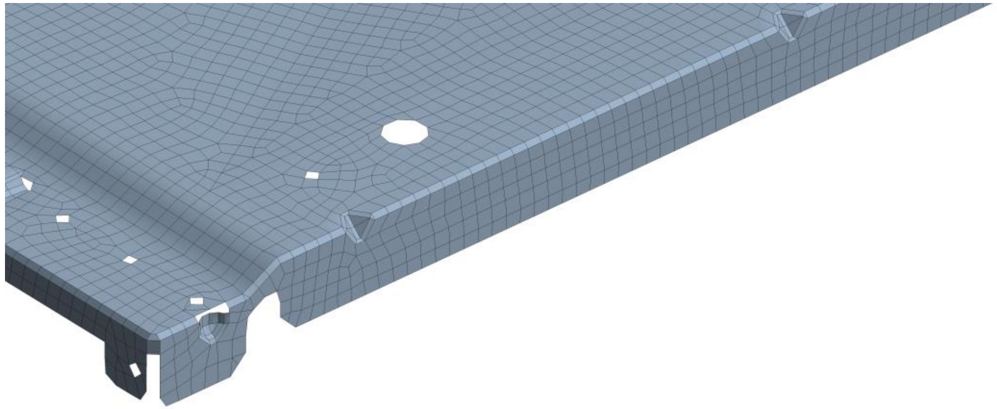




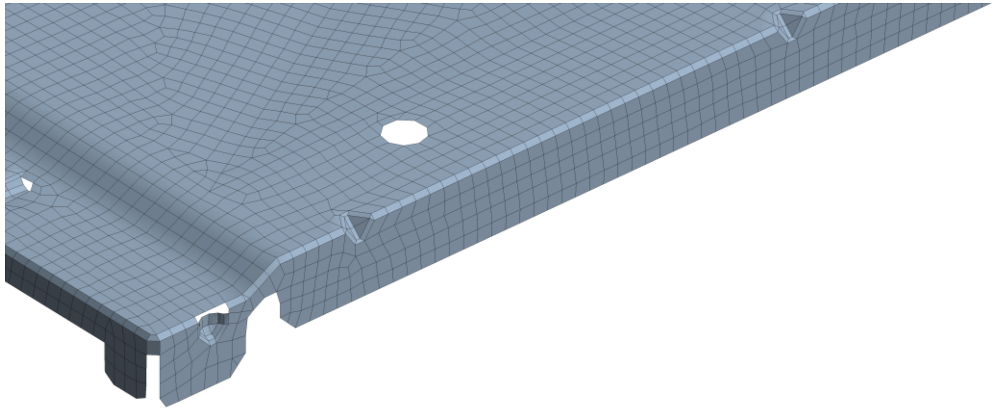
Shell Meshing

Multiple Mesh Metrics for Explicit

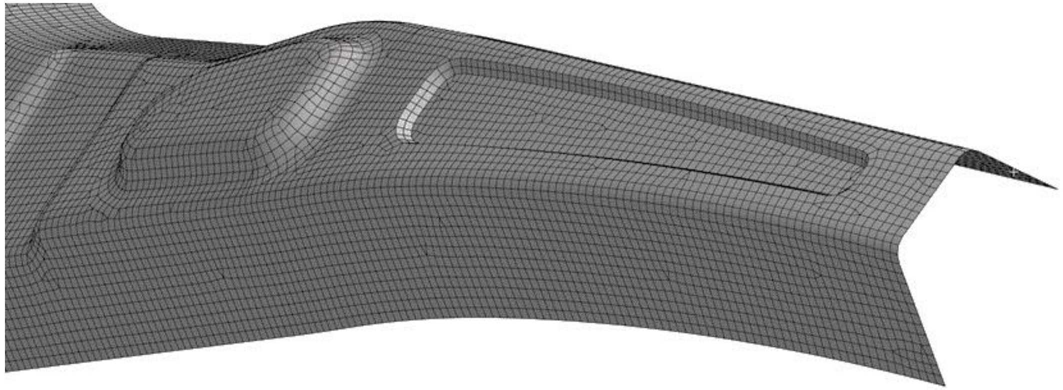
Without Fill Holes



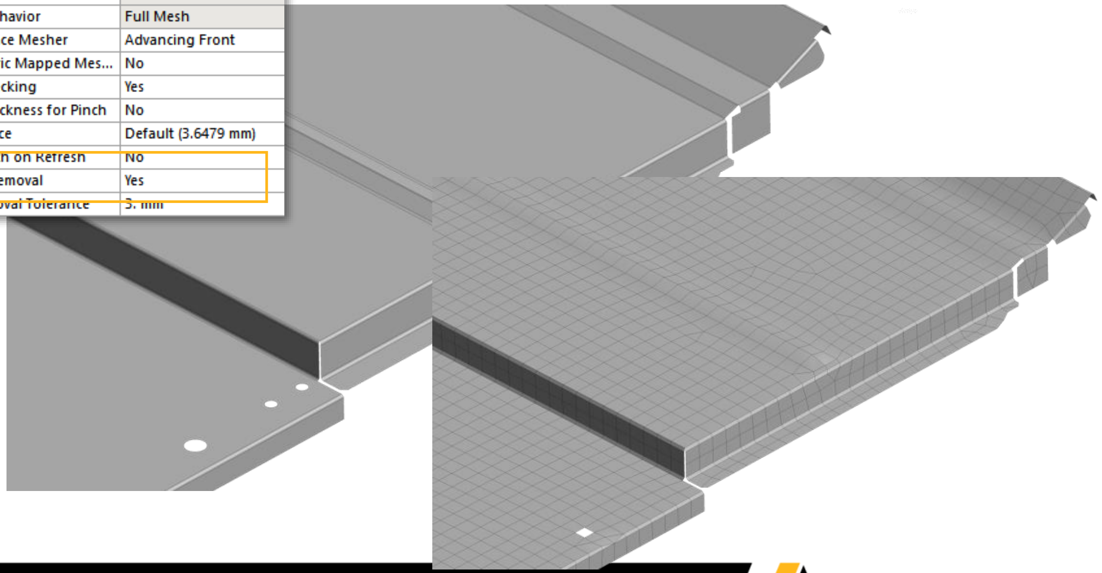
With Fill Holes



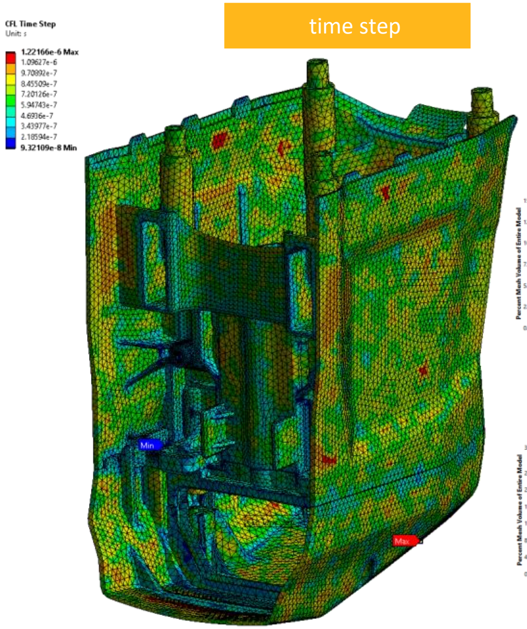
Optimized Shell Mesher available

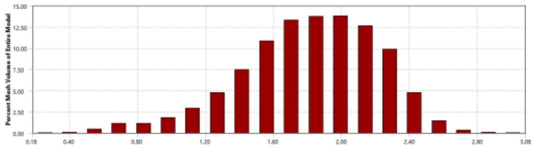


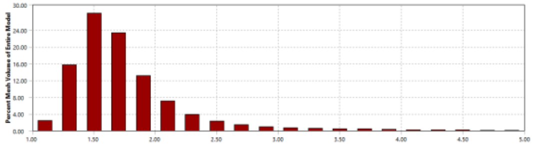
Advanced	
Number of CPUs for Parallel P...	Program Controlled
Straight Sided Elements	
Rigid Body Behavior	Full Mesh
Triangle Surface Mesher	Advancing Front
Use Asymmetric Mapped Mes...	No
Topology Checking	Yes
Use Sheet Thickness for Pinch	No
Pinch Tolerance	Default (3.6479 mm)
Generate Pinch on Refresh	No
Sheet Loop Removal	Yes
Loop Removal Tolerance	3. mm



Volume Meshing

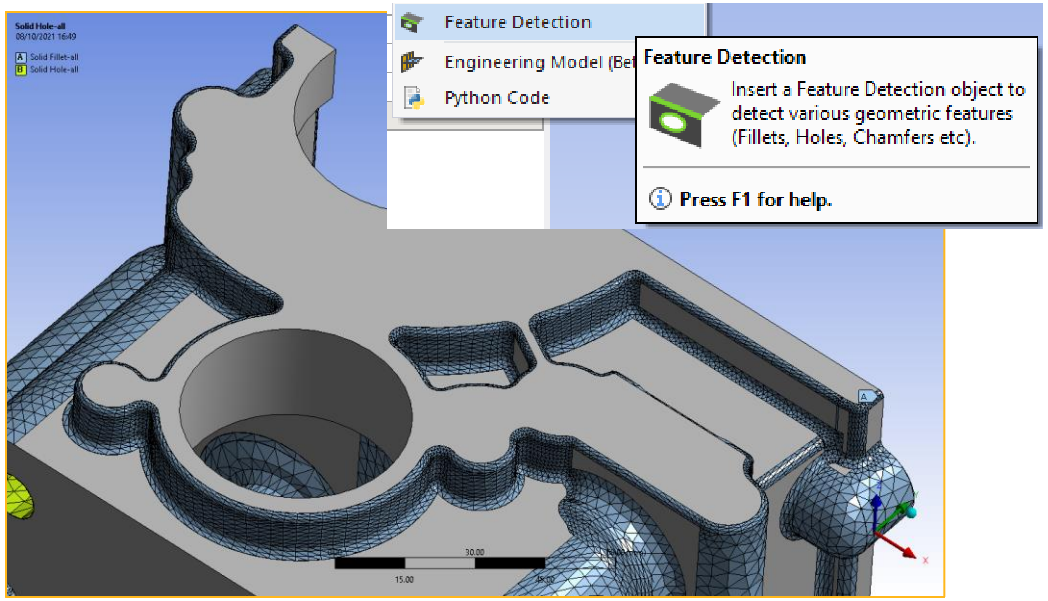


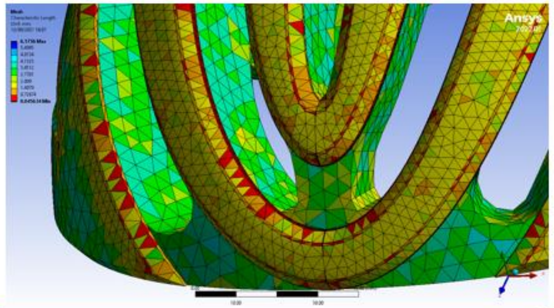




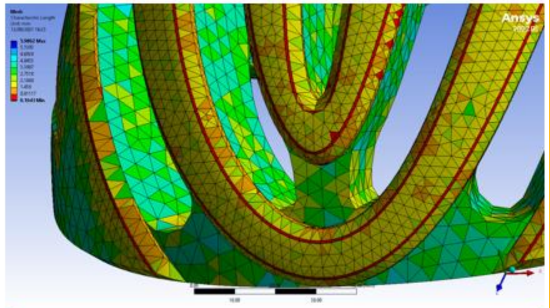
Final mesh:

- ~215.000 elements
- Δt_{min}=9.30E-08s
- Mass scaling (Δt_{min}=2.6E-07s):
  - ~1.5E-04% part scaling
  - 315 % element scaling (max)





2021R2 – Max AR*=53, Min CL=0.05mm



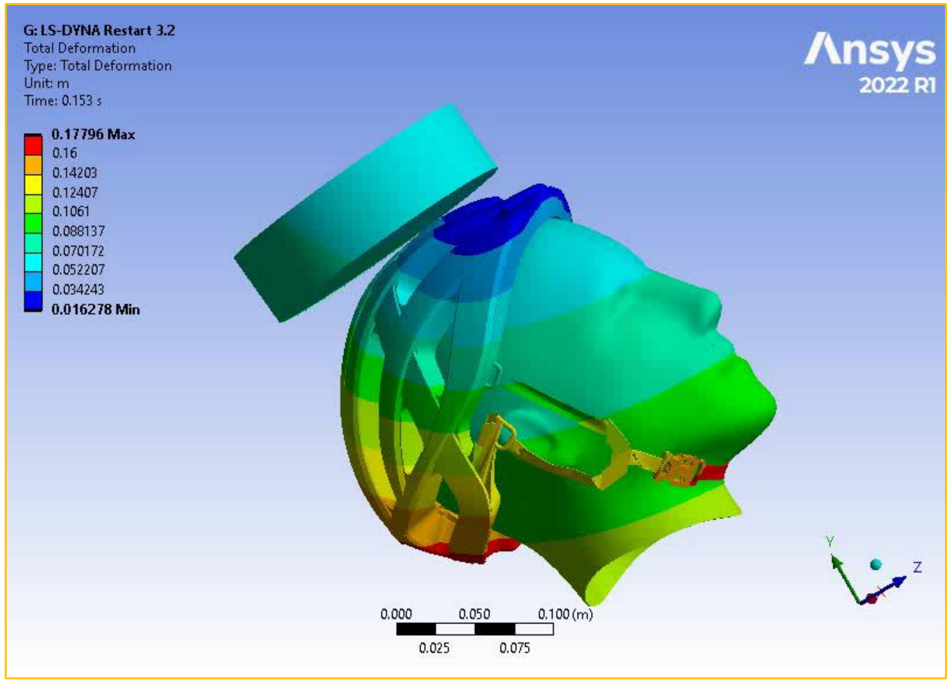
2022R1 – Max AR*=7.6, Min CL=0.16mm

Tet Meshing - Aspect Ratio & Characteristic Length targeting

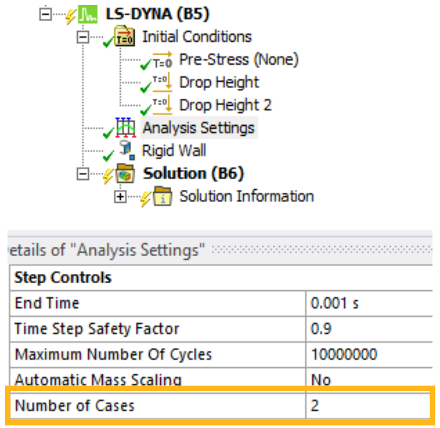
Ansys

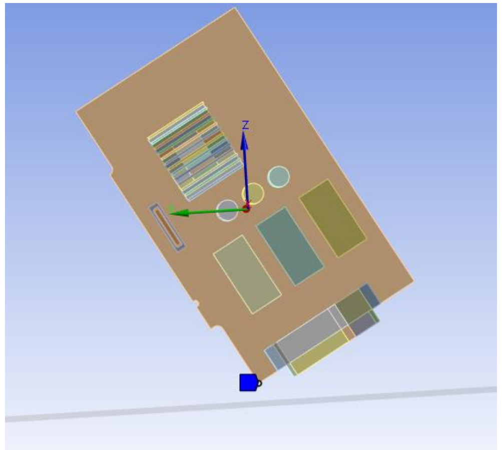
Multi-Step, Multi-Case Supported

- Multi-step impact analysis using a series of small restarts is supported

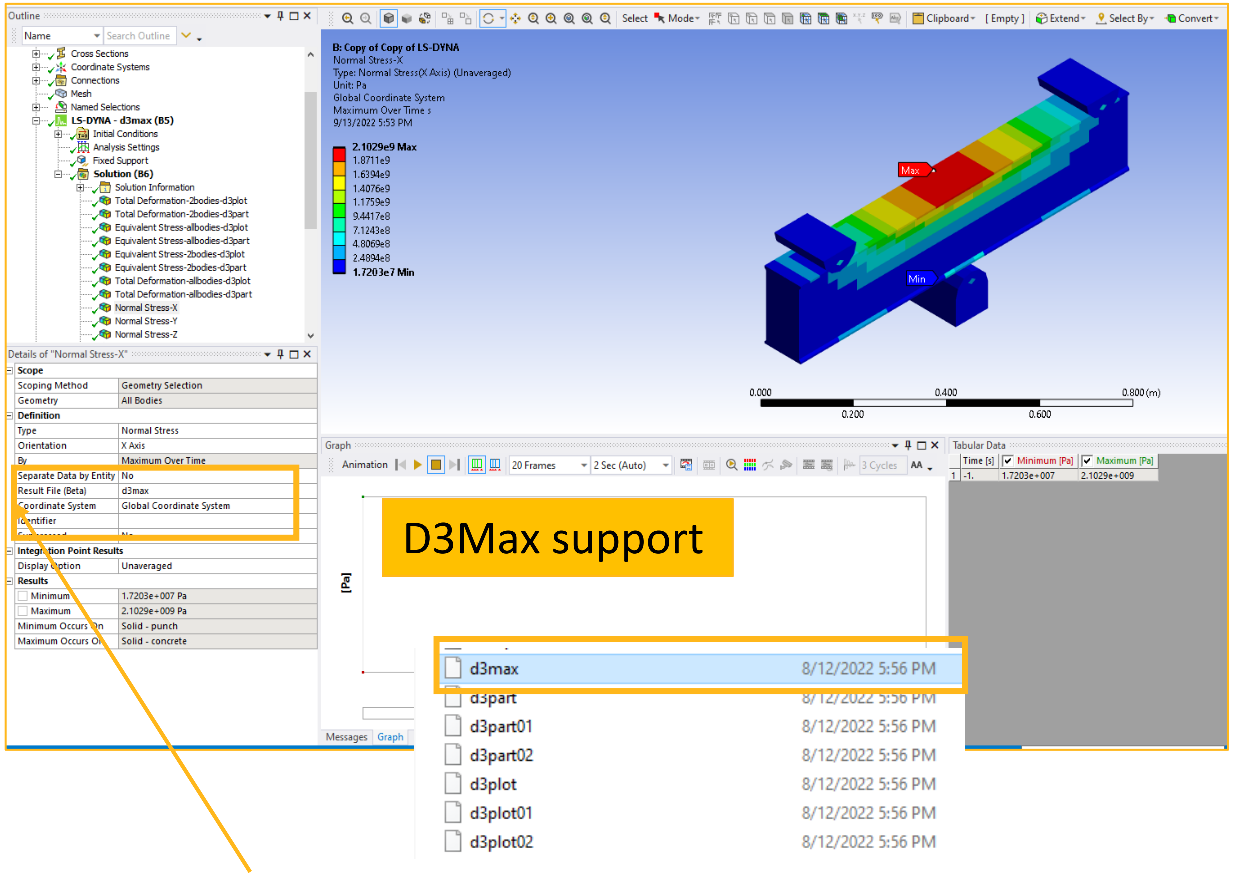


- Multiple cases defined in a single system
  - Initial conditions: Velocity & Drop Height
  - Rigid Wall (including orientation)
- All cases evaluated in one solve
- Postprocess on a per case basis

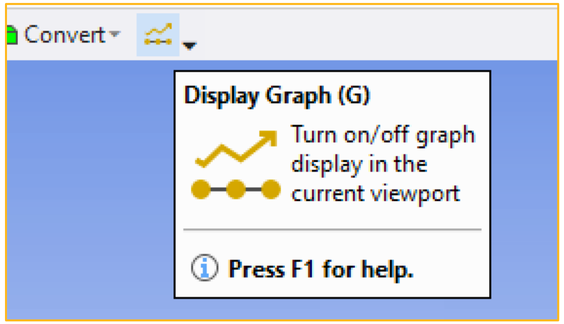


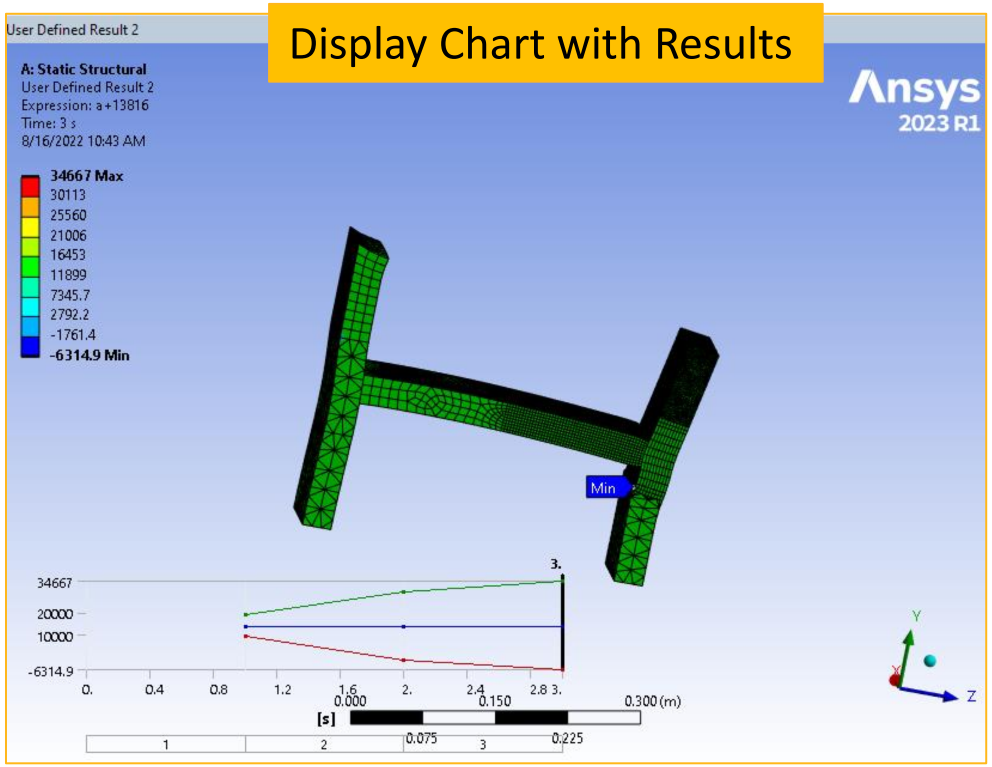


Integrated Postprocessing



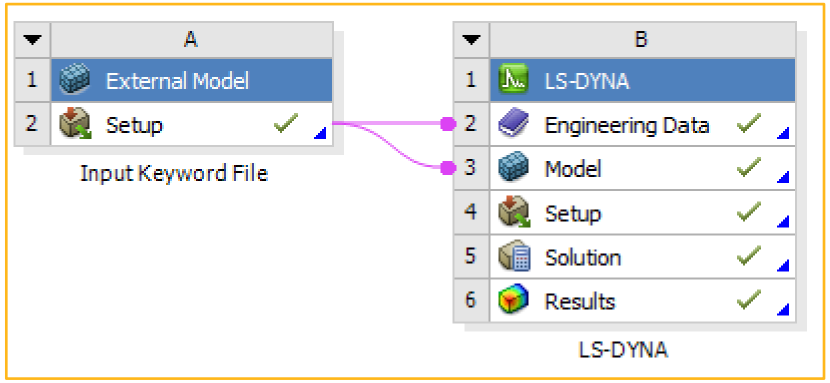
Maximum Over Time will become read-only when the d3max file is selected





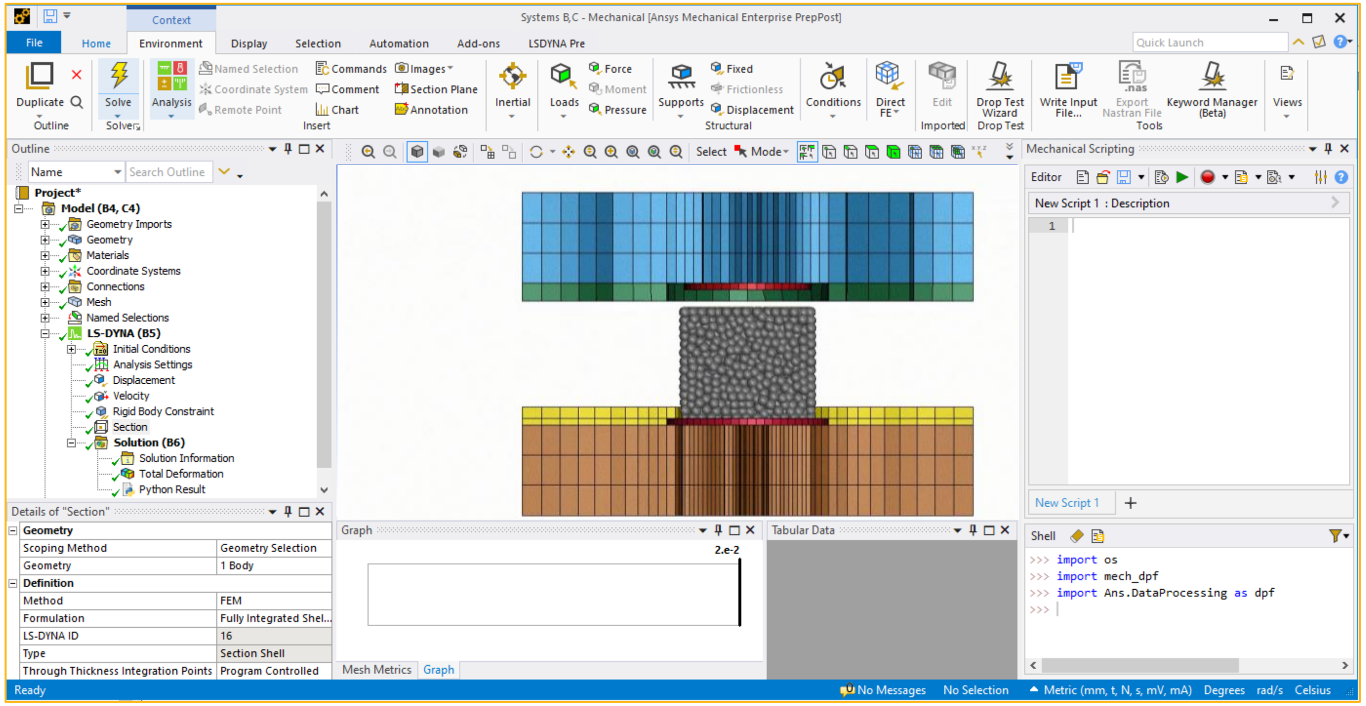
Summary

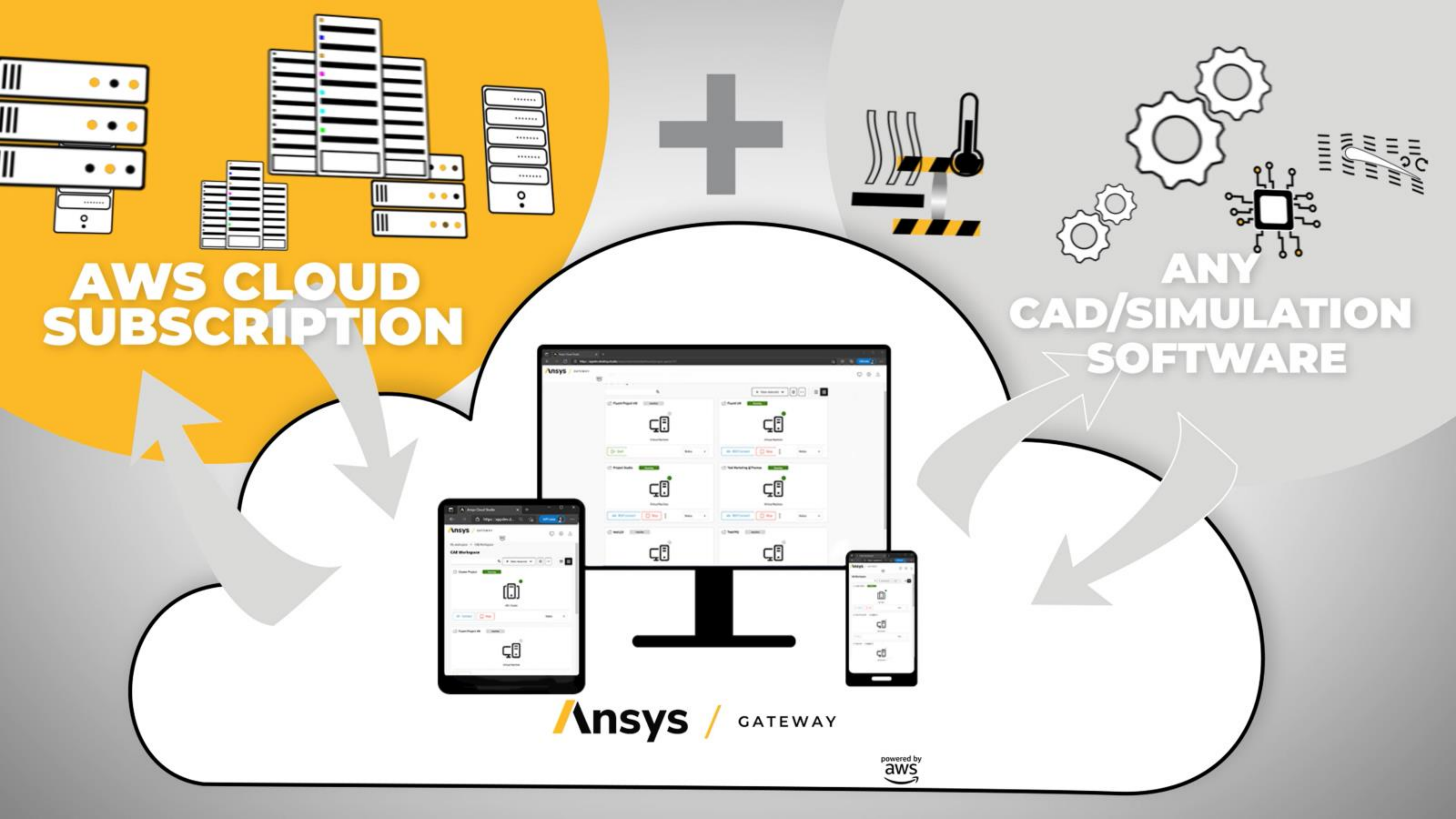
- Multiple Cases - Drop test workflows
- Trace Mapping support for Printed Circuit Boards
- Material Properties Support
- Meshing Support for Explicit
- Import Keyword Files (ongoing)
- Post processing Performance



Solver Support

- SPH, (S)ALE
- (Beta) : BEM- Acoustics, ISPH, ISPG
- Packaged LS-DYNA Solver 13.1

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What is the use of the plugin

Submodeling in Random,

Unable to open 'Video Options'

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