New Features In the Latest LS-PrePost 4.11 (2024R1) and the Solution/Post Explorer

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Ansys

Outlines

- LS-PrePost Versions Overview
- Recent new features
- PyDyna-PyPre
- PDF plugin for LS-DYNA data
- Solution Explorer
- Post Explorer
- Conclusions

LS-PrePost Version Overview

- LS-PrePost is delivered *free* with LS-DYNA. As of today, still ***NO*** license key needed to run LS-PrePost
- LSPP 4.10 has been officially released October 2022
- LSPP 4.11 (2024R1) is the current development version, will be released Jan. 2024
- One can download LS-PrePost from:
  https://ftp.lstc.com/anonymous/outgoing/lsprepost/dev/ (2024R1)
  https://ftp.lstc.com/anonymous/outgoing/lsprepost/4.10/
- LS-PrePost is developed on Windows and ported to Linux…
  - Windows - LS-PrePost-4.10.8-x64-26Oct2023_setup.exe
  - Linux - lsprepost-4.10.8-common-26Oct2023.tgz
  - Apple Mac - We will not continue to support Apple Mac in future releases

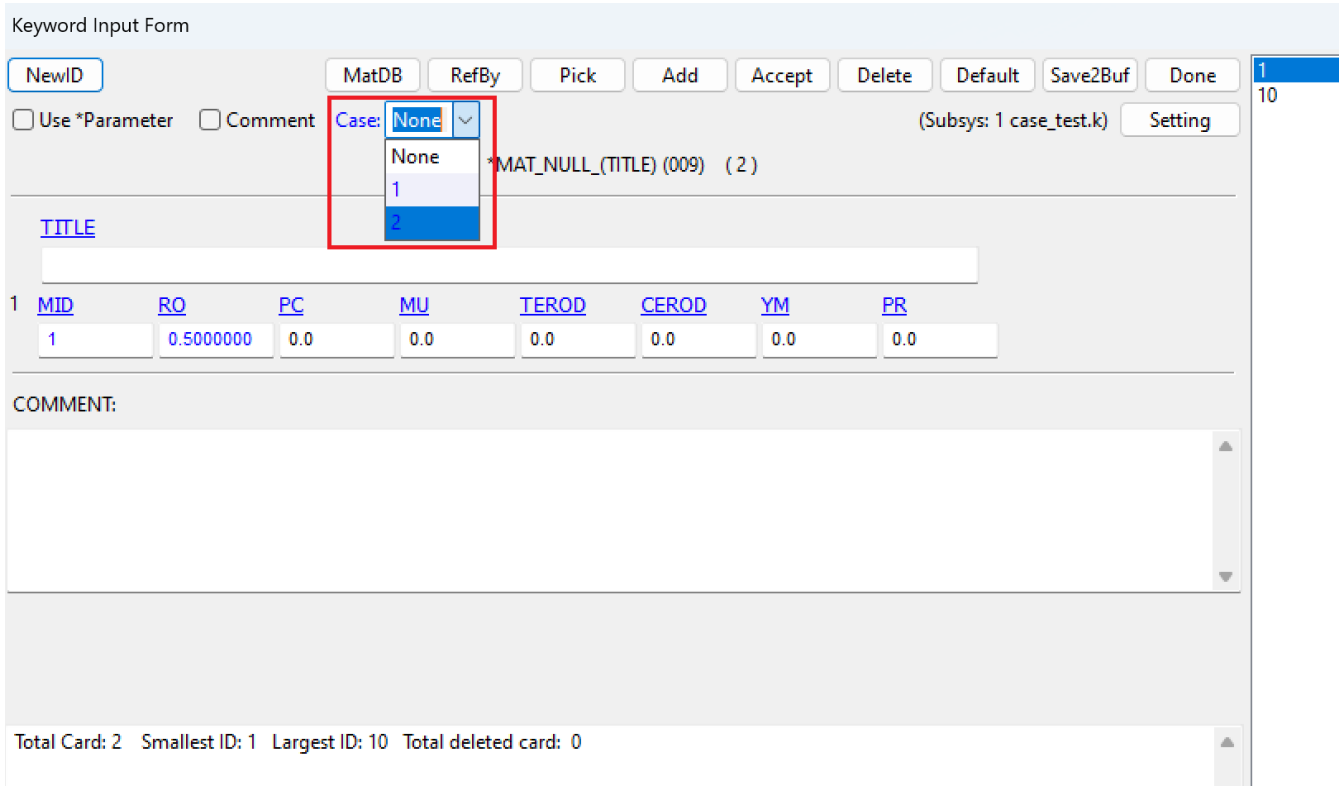
LS-PrePost Special DP (Double Precision) Version

- LS-DYNA allows Part IDs, Material IDs, and Property IDs to be longer than 10 Digits when using the double precision version of LS-DYNA
- A special DP version of LS-PrePost 4.10 (and later) is available for users to handle such input data or d3plot files
- User can download this version from:
  - https://ftp.lstc.com/anonymous/outgoing/lsprepost/4.10/win64/lsprepost4.10.8_dp.exe
  - Put this file in the installation directory of the regular version
  - One will need to build a separate link to this version
  - Check the README file https://ftp.lstc.com/anonymous/outgoing/lsprepost/4.10/win64/README_lsprepost4.10_dp.txt

Keyword data - Process *CASE

process of multiple keywords with the same IDs declared by *CASE

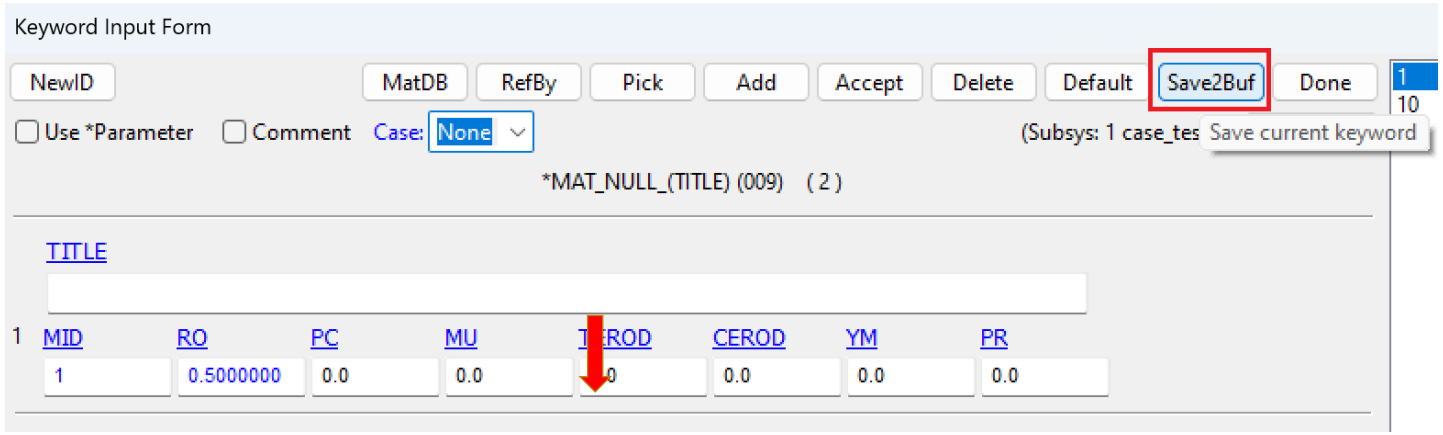
- Color of the index will be blue if the keyword exist with the *case;
- Select different index to update keyword data of it.

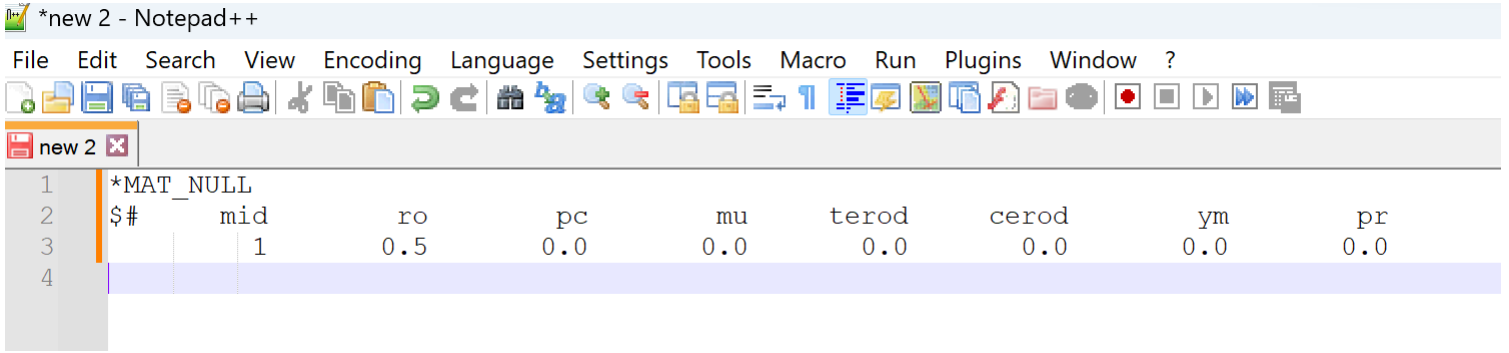


Keyword Data - Save2Buf

Save current keyword data to clipboard from keyword form, then user can paste the keyword data to another keyword file, this operation will save user from opening the original keyword file and do a copy, it also copy whatever keyword data in the keyword input form only.

- Click “Save2Buf” to copy keyword data to clipboard;
- Paste keyword data from clipboard.



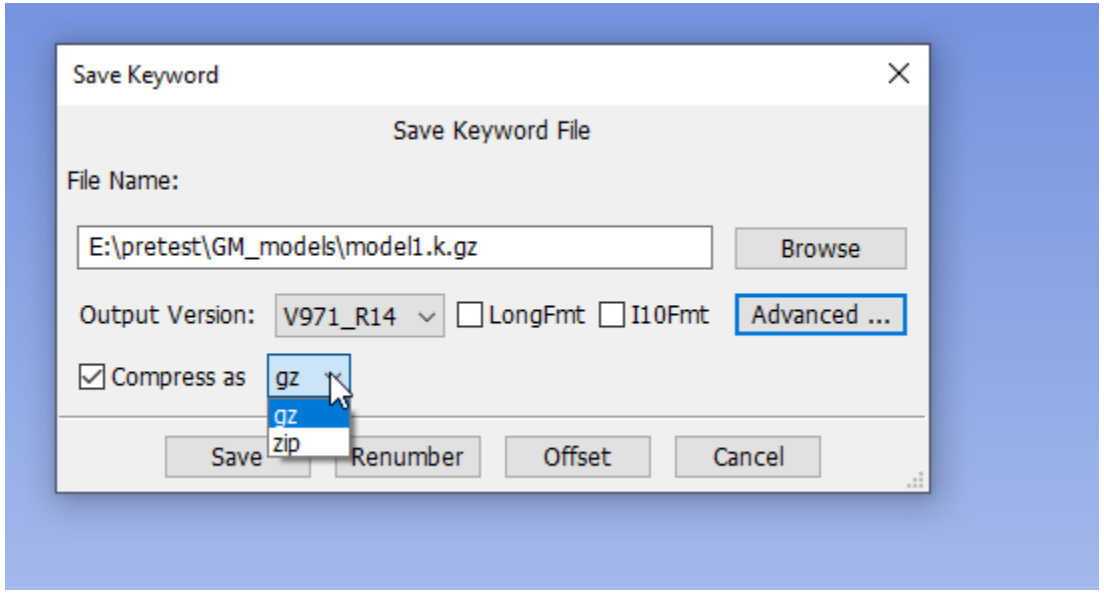


Keyword data – Reading/Writing Compressed (gzip/zip) input files

- LS-PrePost can read gz/zip compressed keyword files, this will allow user to compress their keyword files and not to worry about de-compressing them before reading into LS-PrePost
- Special treatment of include files, if there are many include files being included by the main input file, there is no need to change the include file name to *.gz/*.zip, LSPP will automatically look for the *.gz/*.zip file even the filename on the include statement is not *.gz/*.zip
- When writing gzipped files from LSPP, all one needs to do is to specify the file name with *.gz

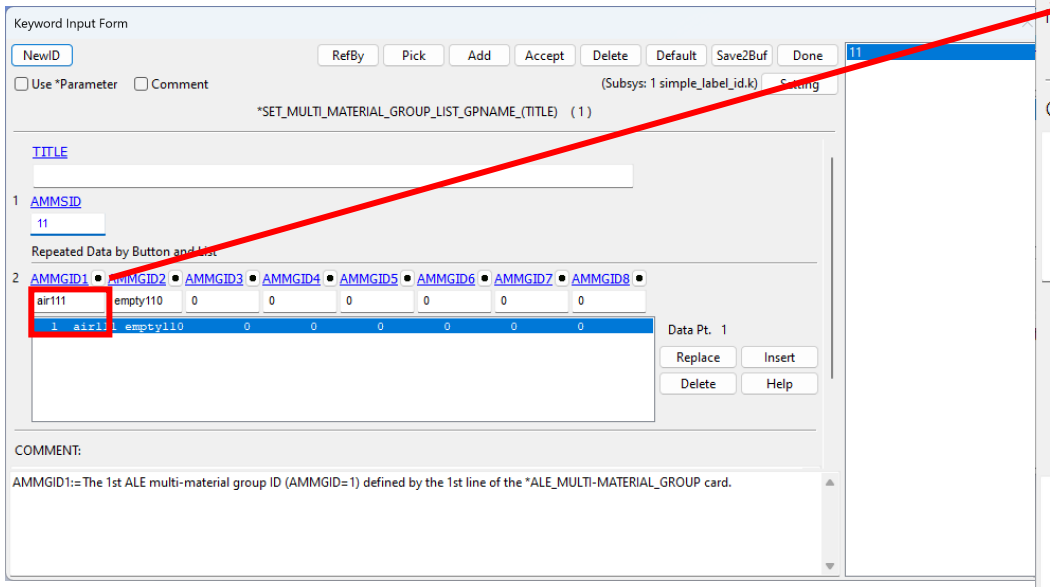
Keyword data – Reading/Writing Compressed (gzip/zip) input files

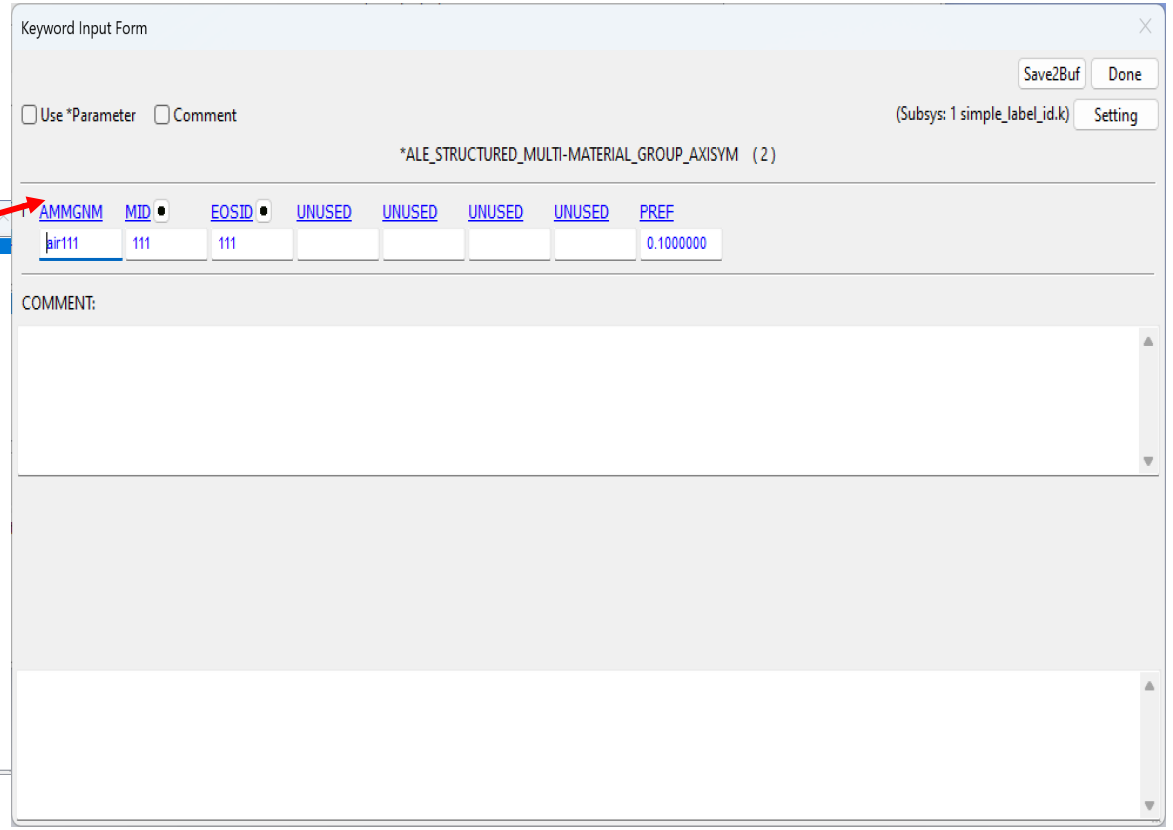
- When writing compressed files from LSPP, all one needs to do is to turn on the “Compress” option and specify the file type either gz or zip



Keyword Data - Process of label ID

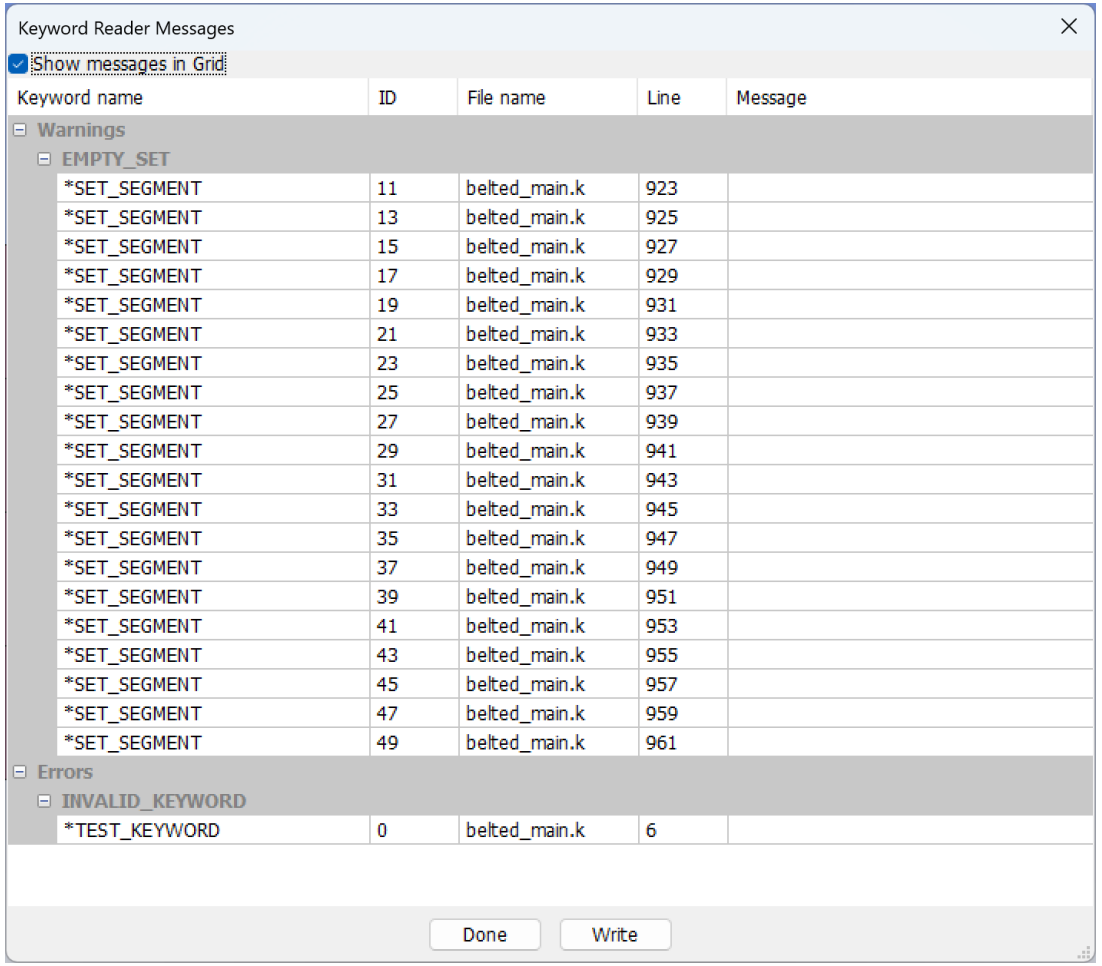
```
*ALE_STRUCTURED_MULTI-MATERIAL_GROUP_AXISYM
$#   ammgnm       mid      eosid    unused    unused    unused    unused      pref
empty110          111        111                                             0.1
$#   ammgnm       mid      eosid    unused    unused    unused    unused      pref
air111            111        111                                             0.1
*SET_MULTI_MATERIAL_GROUP_LIST_GPNAME
$#   ammsid
         11
$# ammgid1    ammgid2    ammgid3    ammgid4    ammgid5    ammgid6    ammgid7    ammgid8
air111     empty110
*END
```





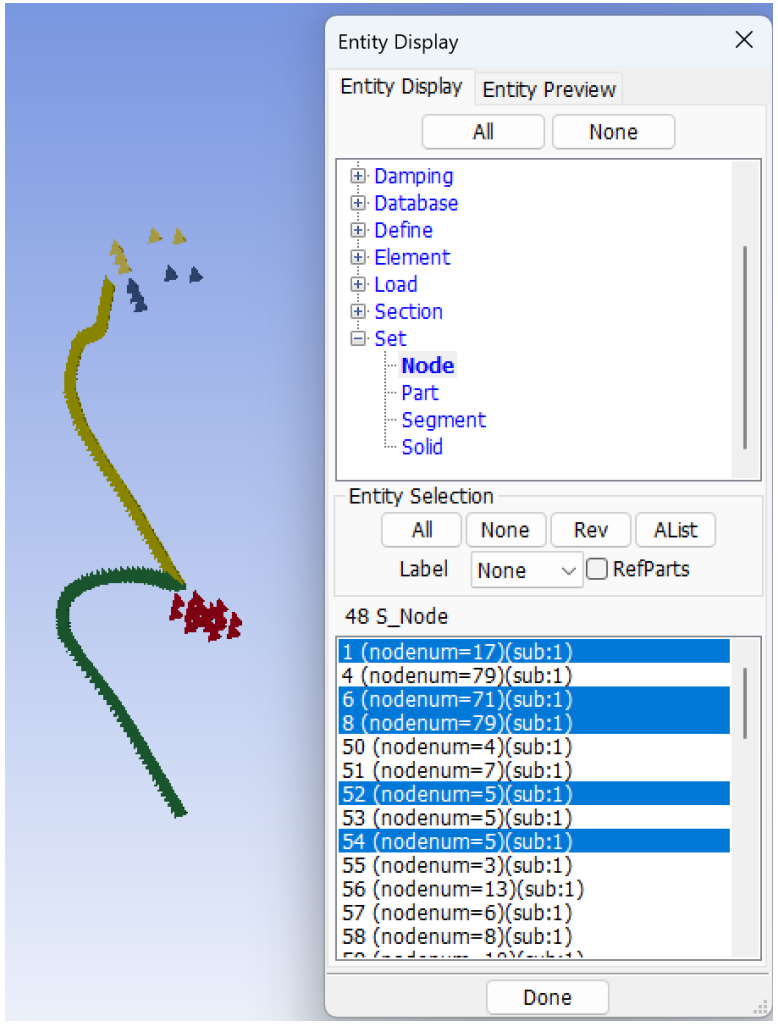
Keyword Data - Table view of "Keyword Reader Messages" dialog

- List messages of read keyword file in a property grid, user can sort the messages by clicking the labels on the grid header
- Option "Write" is used to output the messages to an XML file



Keyword Data - Display *SET_entities with different colors

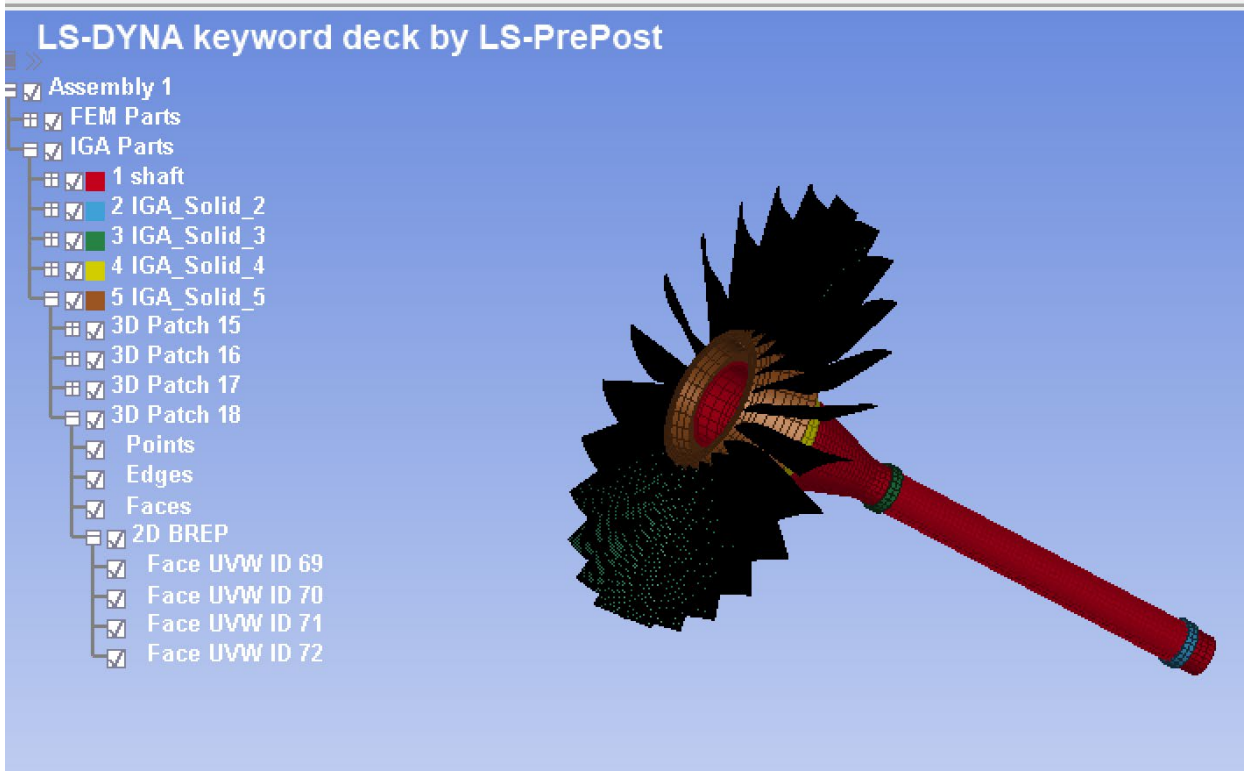
- Draw *SET_entities with different color, much easier for user to identify different entities



IGA feature tree

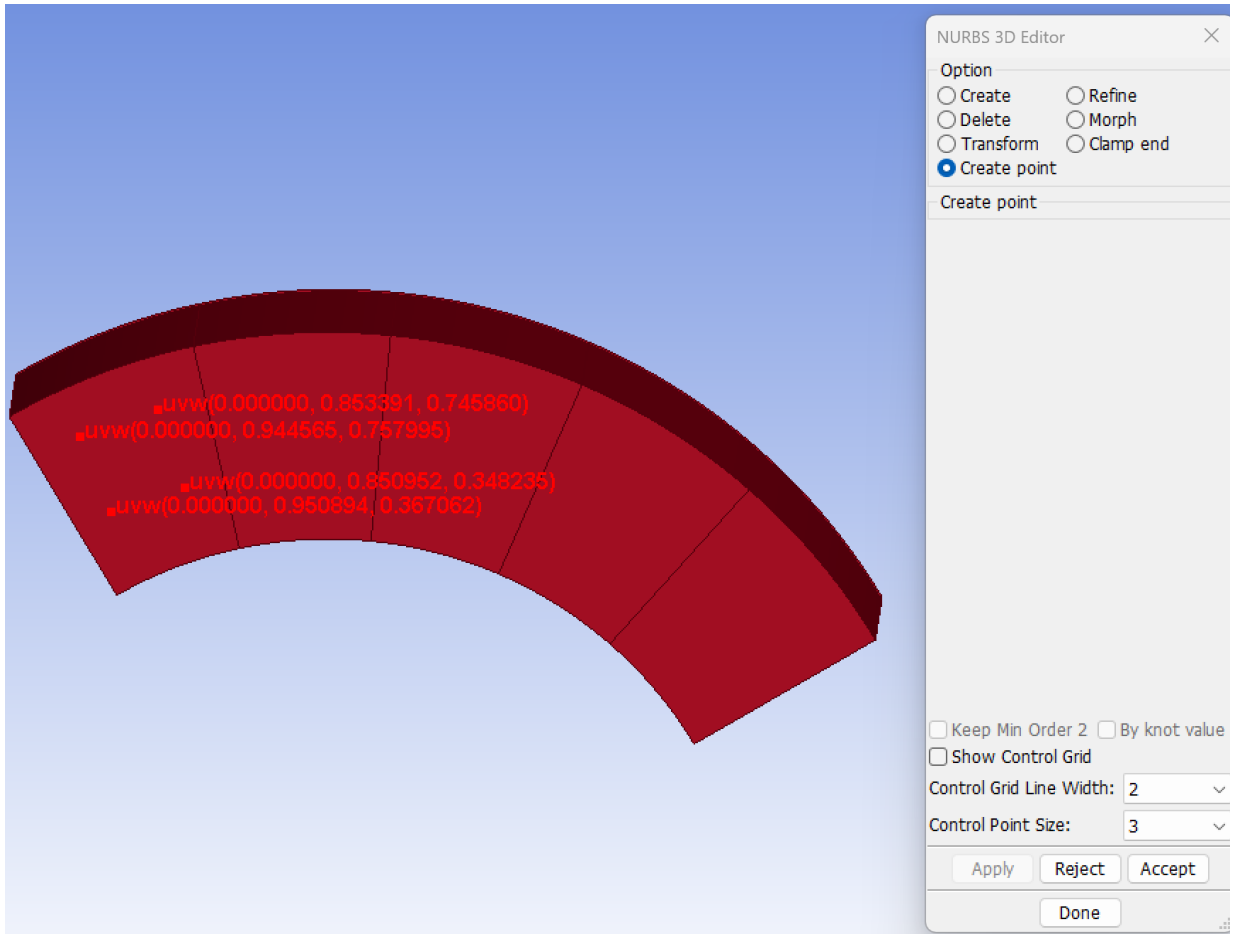
Update feature tree for IGA model

- 1. Show/hide IGA parts when click the corresponding checkbox in feature tree.
- 2. Show/hide IGA patches when click the corresponding checkbox in feature tree.
- 3. Show/hide faces when click the corresponding checkbox in feature tree



IGA Preprocessing

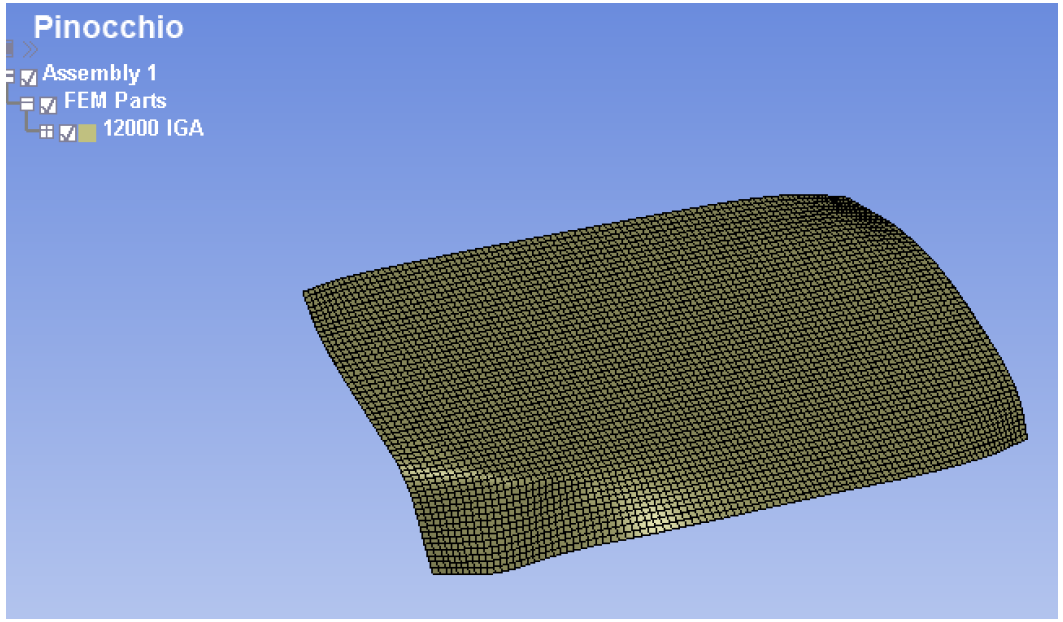
Create point_uvw by picking on the IGA solid patch



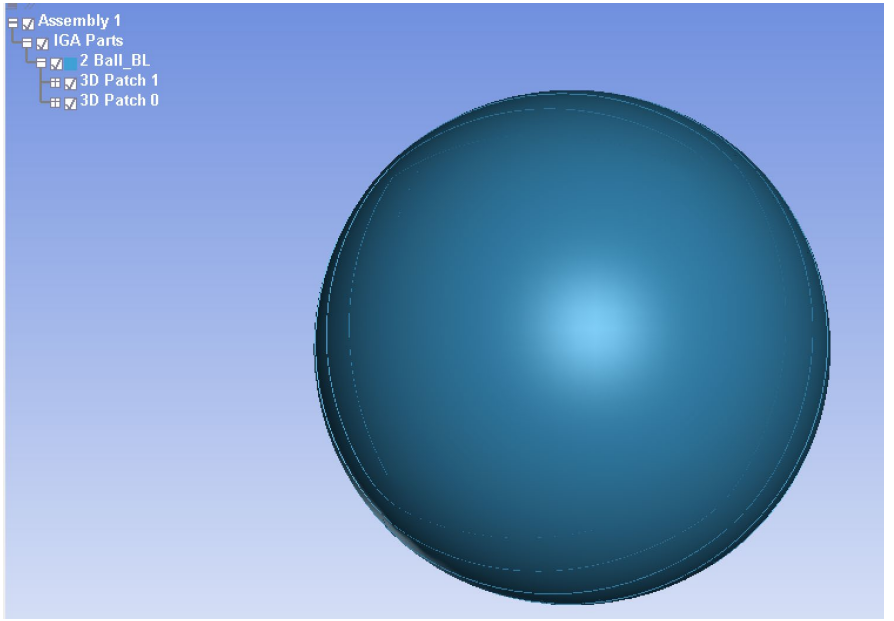
IGA Pre-Processing

Support IGA binary input in LSPP

LSPP supports the traditional ASCII keyword input as well as their hybrid counterparts where all *IGA keywords are included using the binary input format.



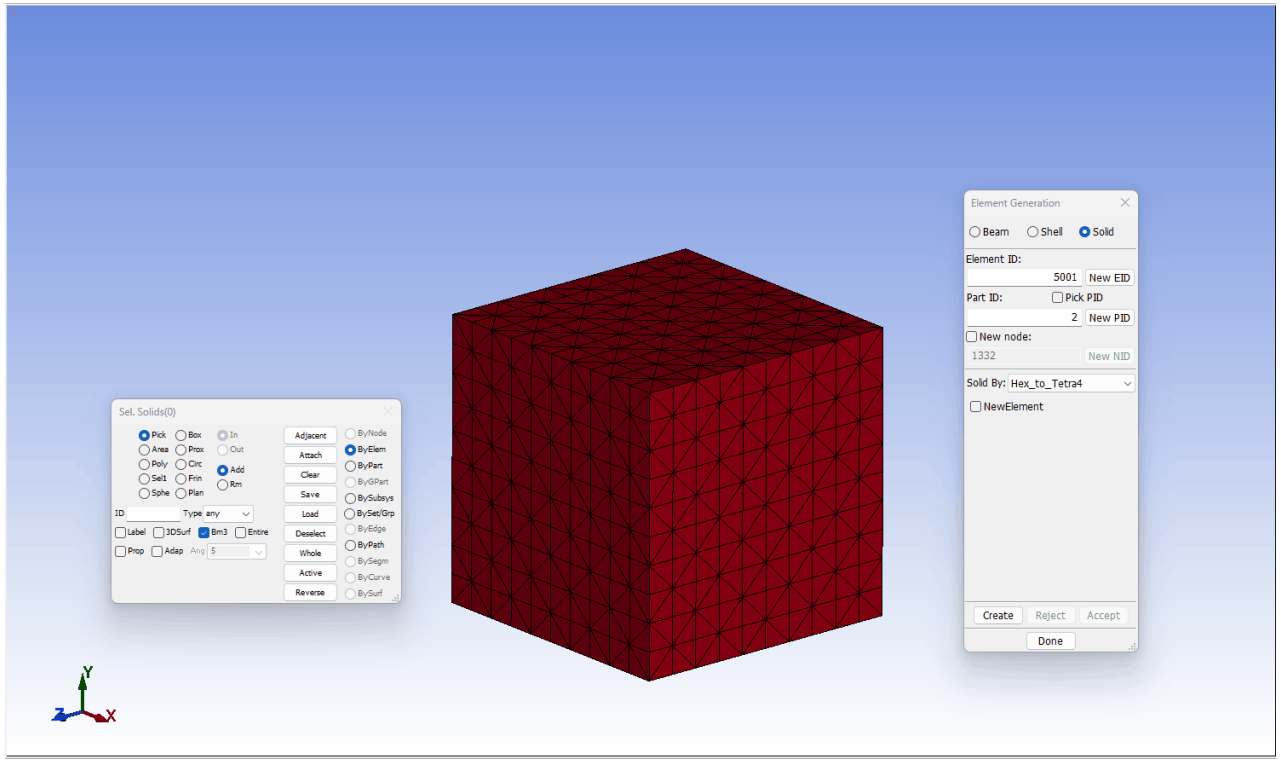
IGA shell



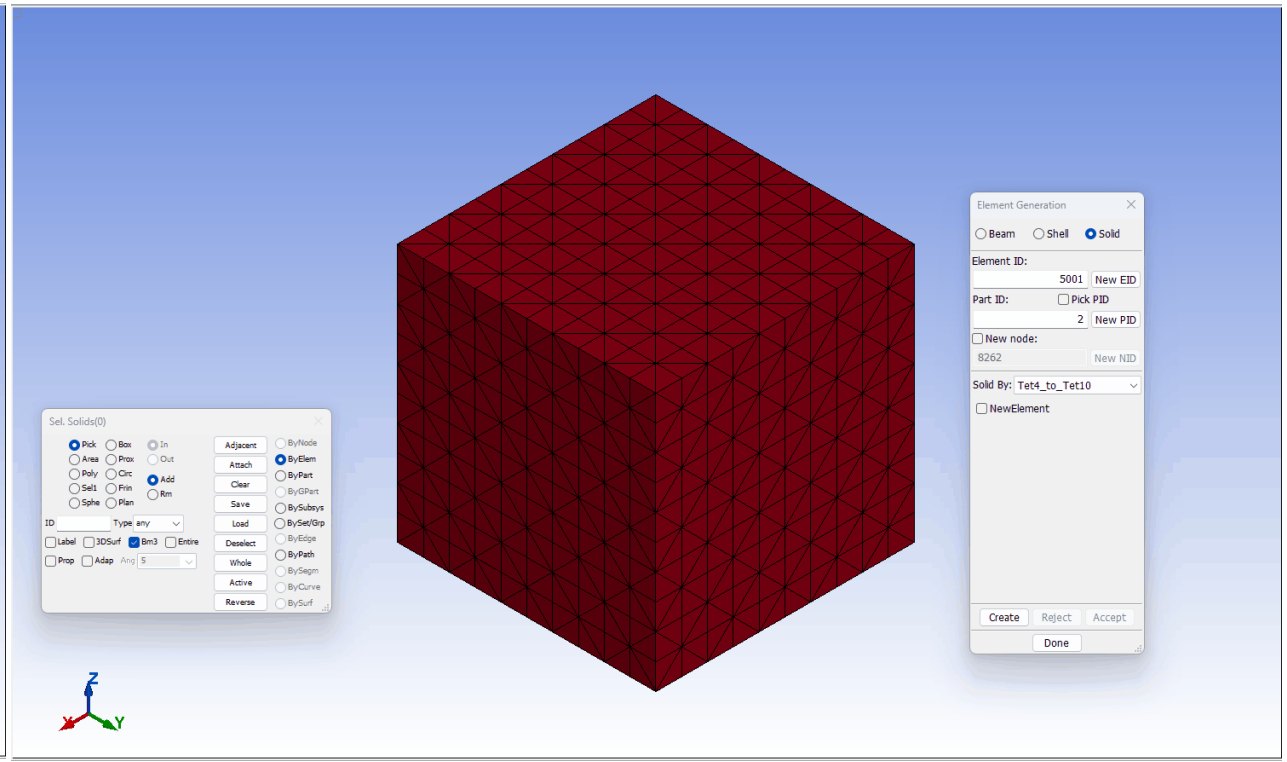
IGA solid

Mesh Editing

- Supports splitting tetrahedron element (tet4, tet10) to hexahedron element (hex8) in “Element Generation”



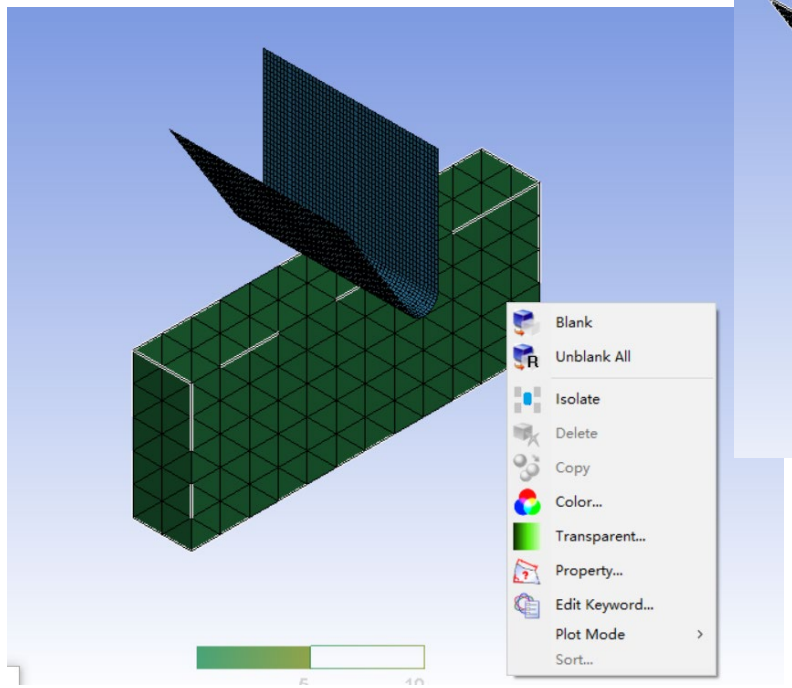
Tet4 to Hex8



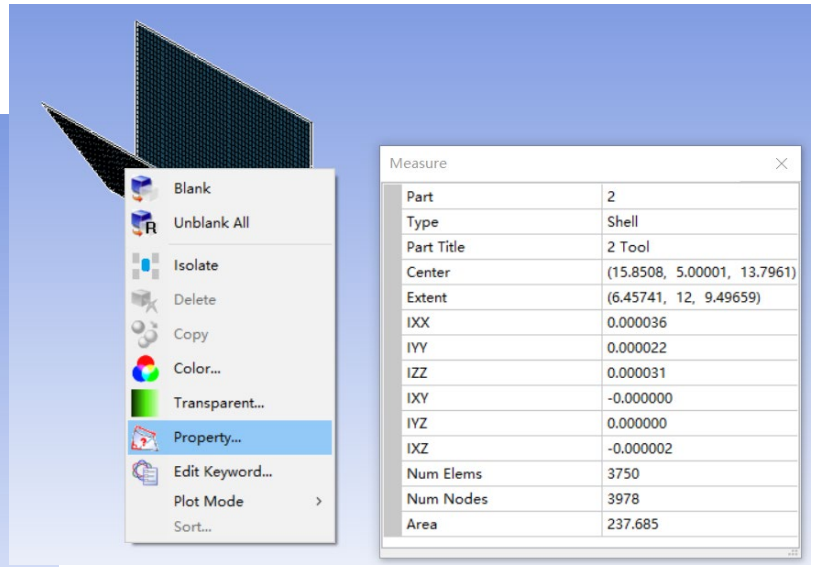
Tet10 to Hex8

Right click to Popup different Options

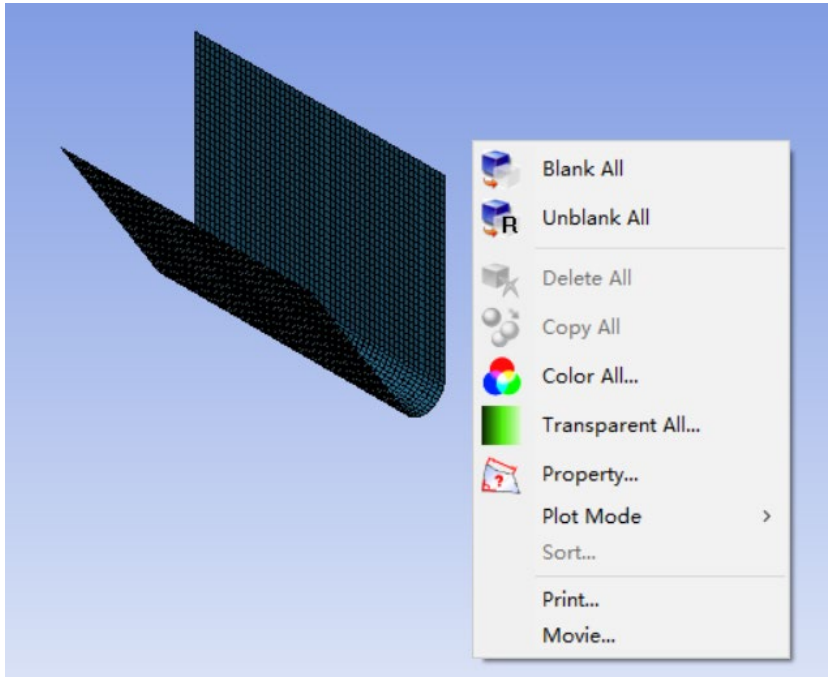
- Supports splitting tetrahedron element (tet4, tet10) to hexahedron element (hex8) in “Element Generation”



Right click part to popup part manager options.



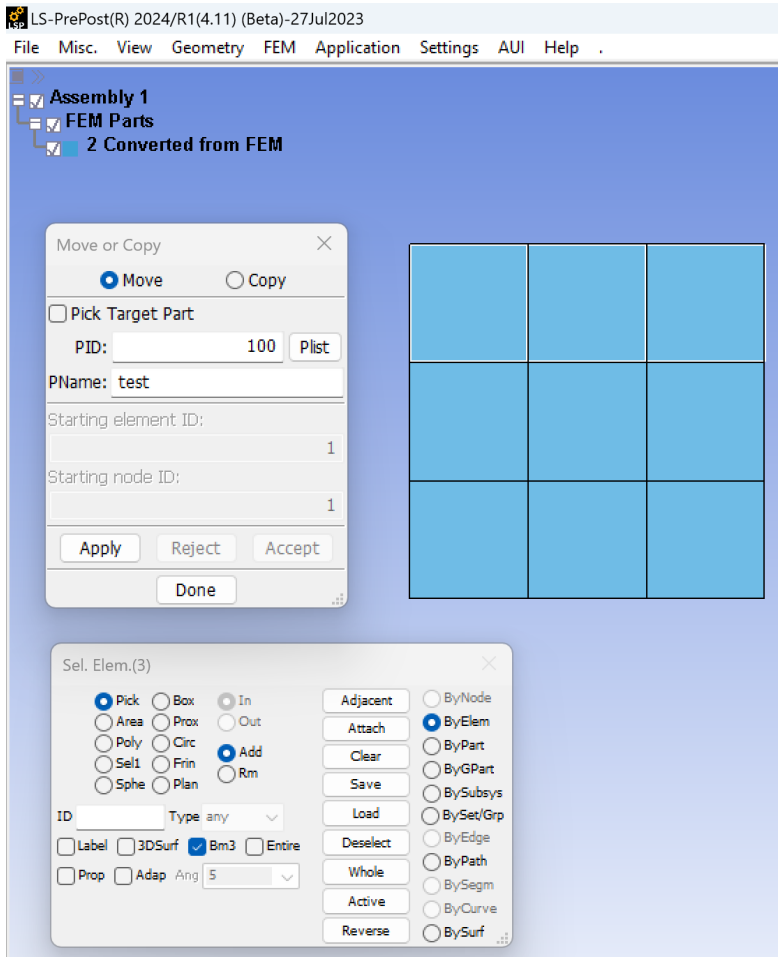
Part property list by “Property…” in pop-up menu.

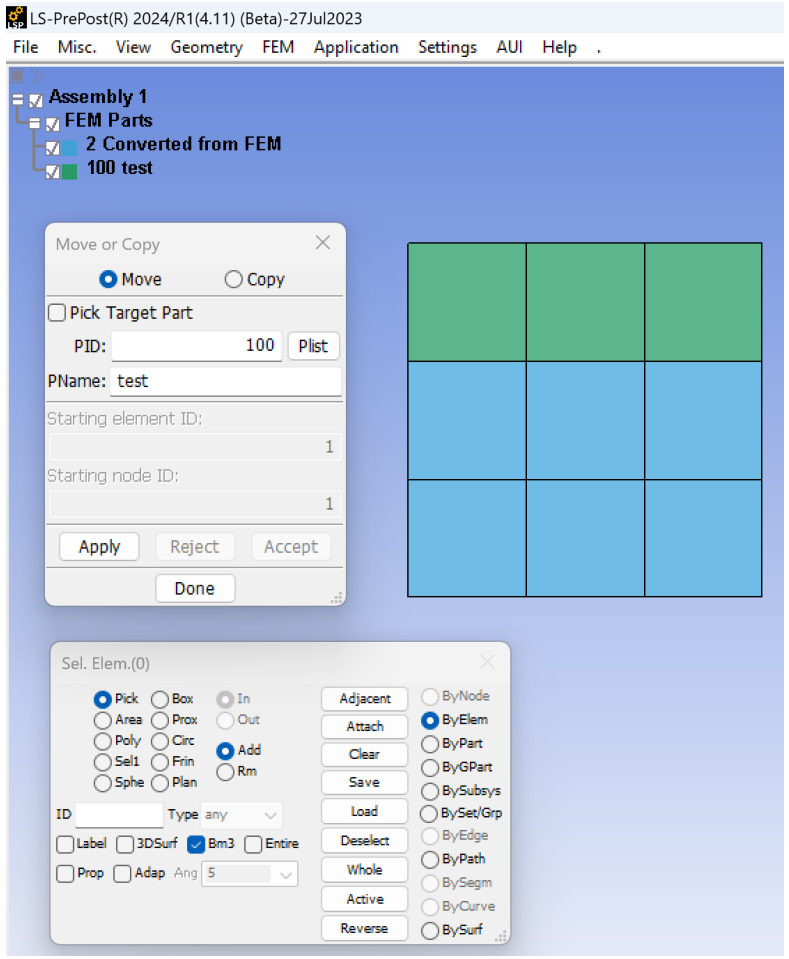


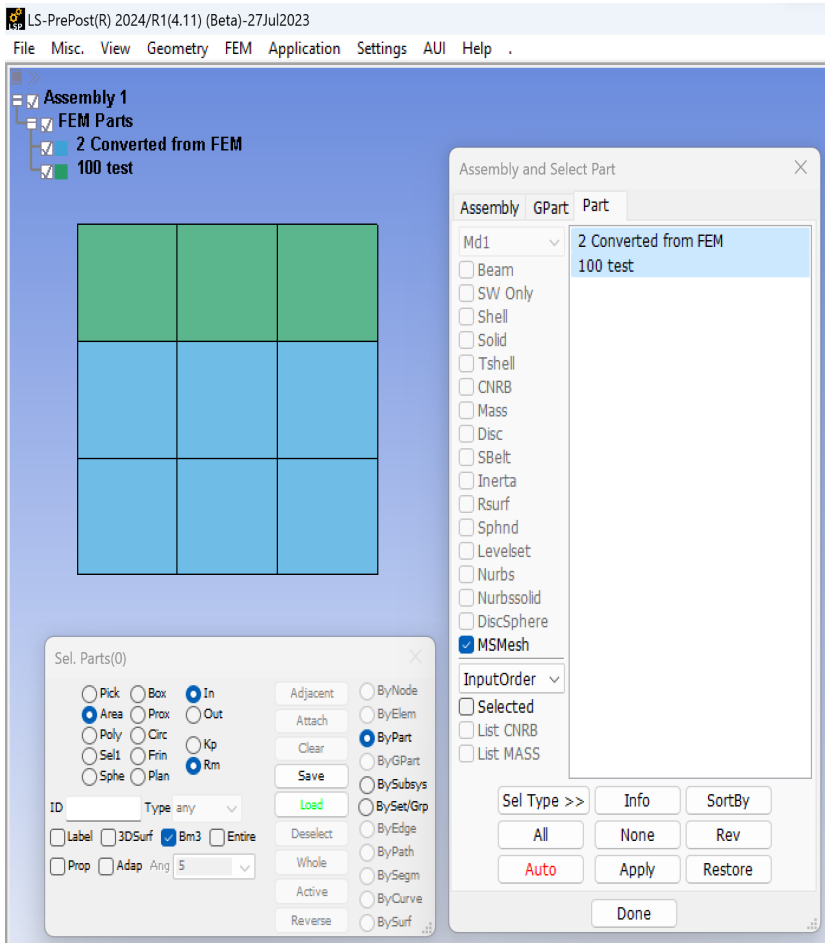
Right click empty region to popup model manager options.

Copy/Move MS(DualCESE) elements

Support move or copy MS(DualCESE) elements from one part to another part

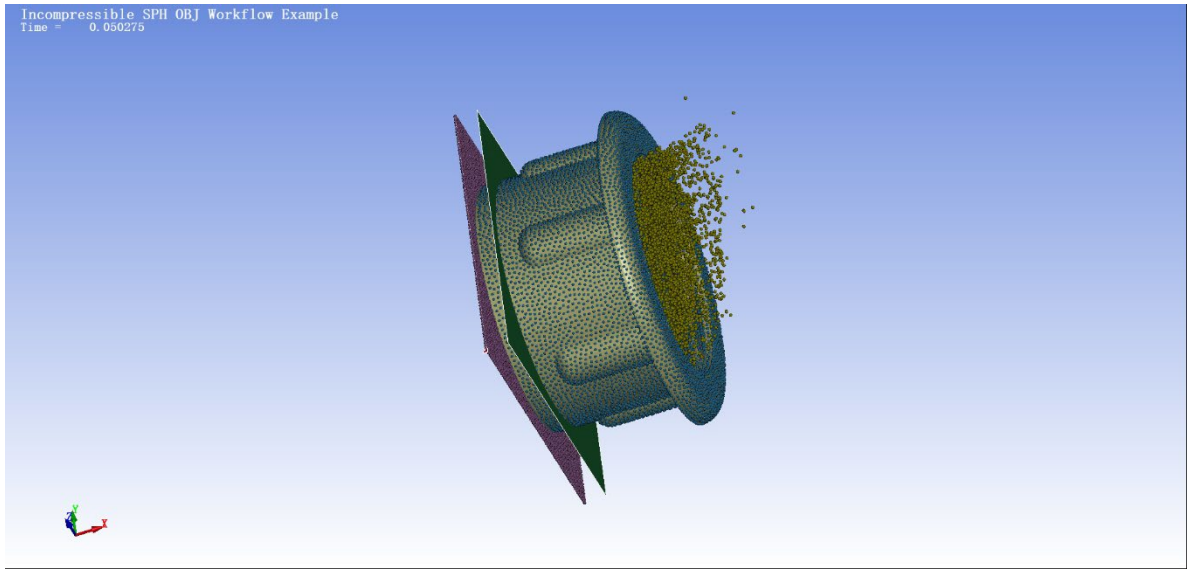


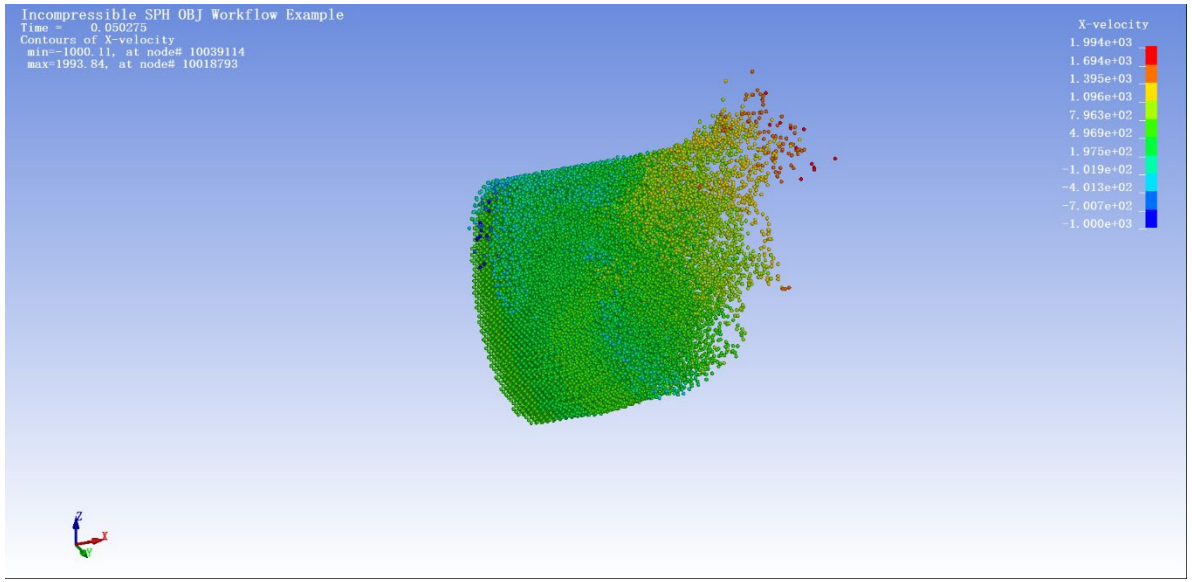




ISPH Post-Processing

- Supports ISPH model for post-processing
- The d3plot files contain the regular structural model while a separated d3dat file contains the ISPH data
- D3dat file is in LSDA format
- LSPP automatically recognizes and open the d3dat file





VENT_LSDAOUTPUT_V5-npp1.d3dat

VENT_LSDAOUTPUT_V5-npp1.d3plot

VENT_LSDAOUTPUT_V5-npp1.d3plot01

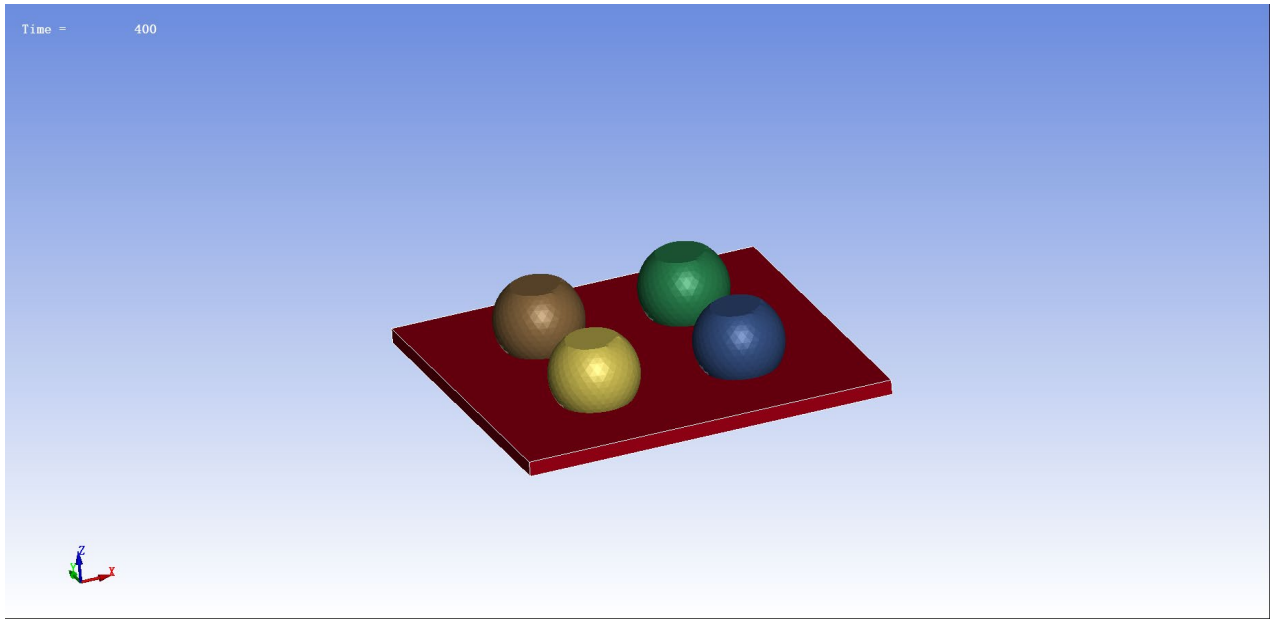
ISPG Post-Processing

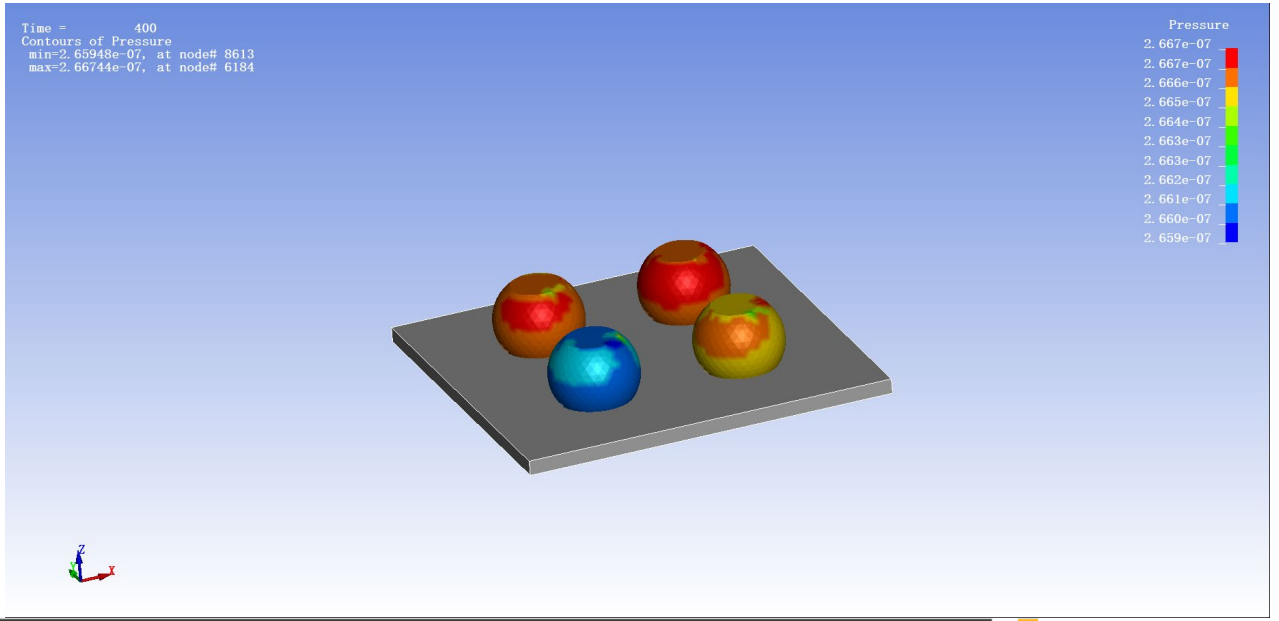
- Supports ISPG model for post-processing
- The d3plot files contains regular structural model while a separated d3ispg file(s) contains the ISPG part data
- D3ispg is in LSDA format
- LSPP automatically recognizes and open the d3ispg file

d3ispg

d3plot

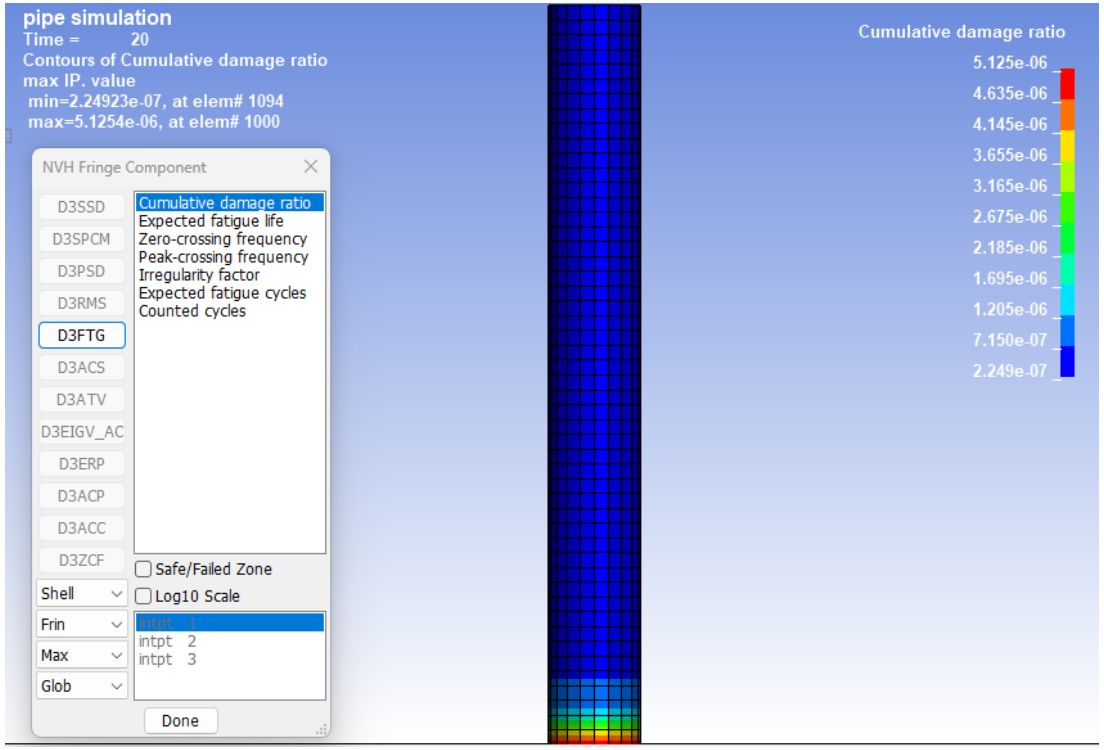
d3plot01



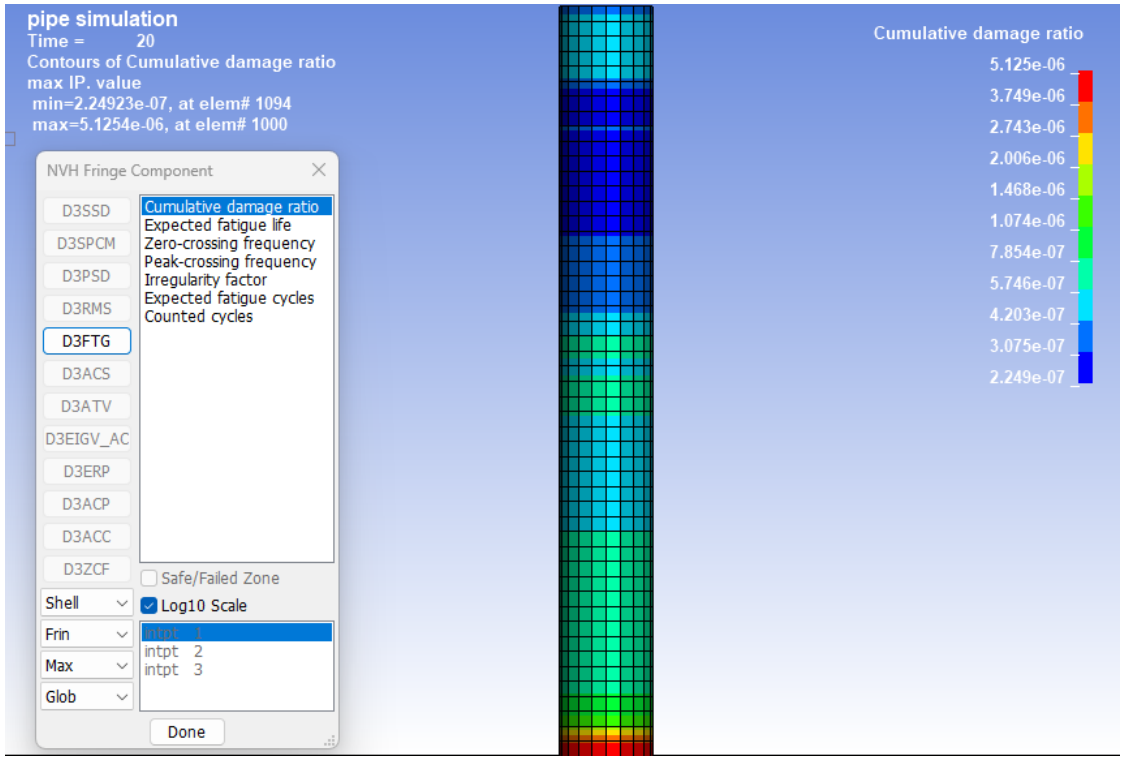


Legend Bar for NVH D3FTG Analysis

- Use a new method to compute the fringe level values for showing Log10 scale fringing



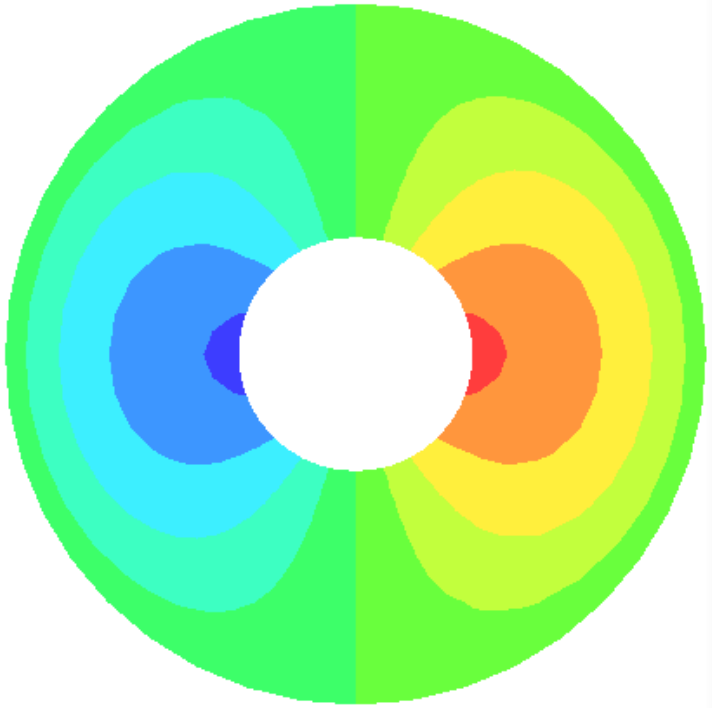
Without using the Log10 Scale

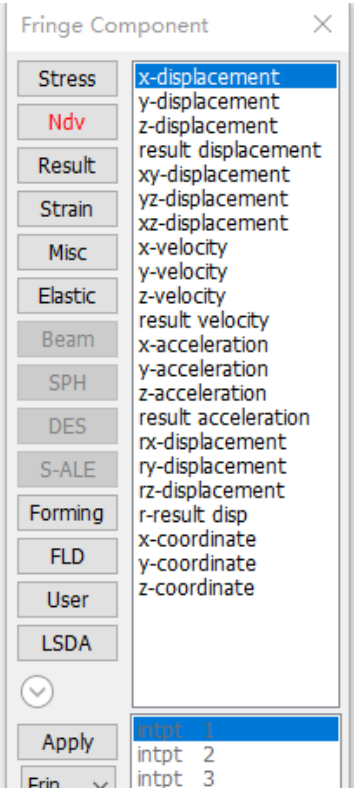


det = (log10(max) - log10(min)) / level
value1 = min
value2 = value1 + pow(10, det);
value3 = value2 + pow(10, det);
...
valuen = max;

LS-DYNA stores Displacement in d3plot files

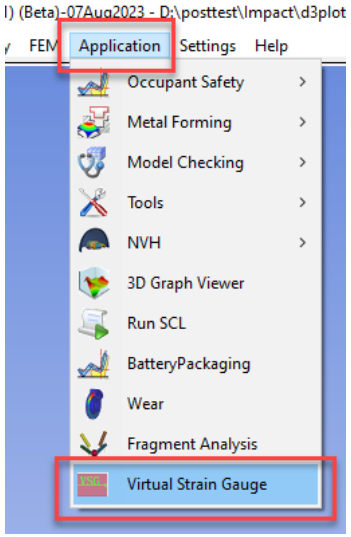
- LS-DYNA now can output nodal displacement to d3plot file instead of nodal coordinates. LSPP will automatically recognize the data and handle it accordingly
- For problem (especially implicit analysis) with very small displacement, this is very important to see the displacement fringe plot

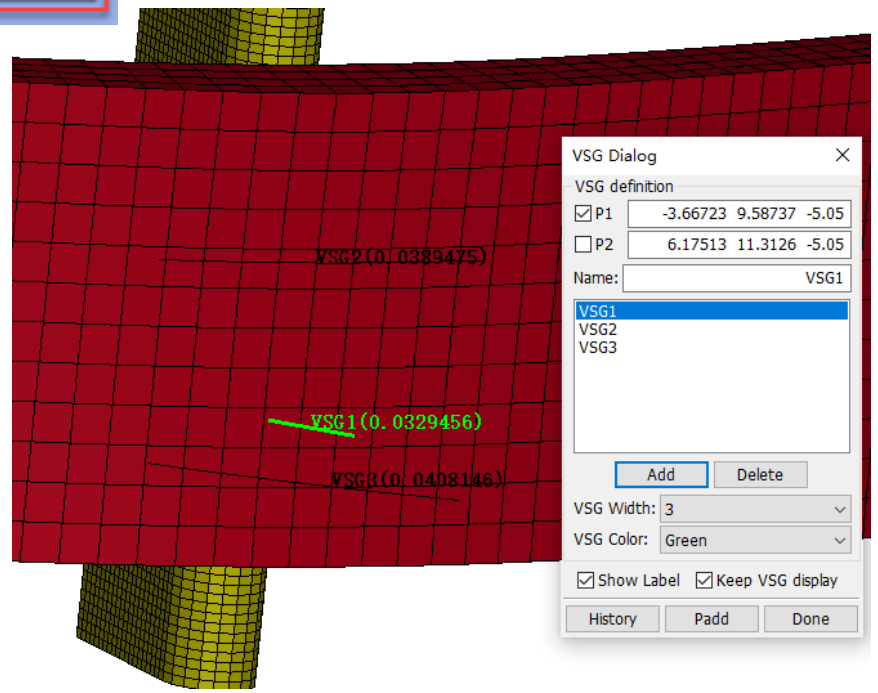




VSG: Virtual Strain Gauge

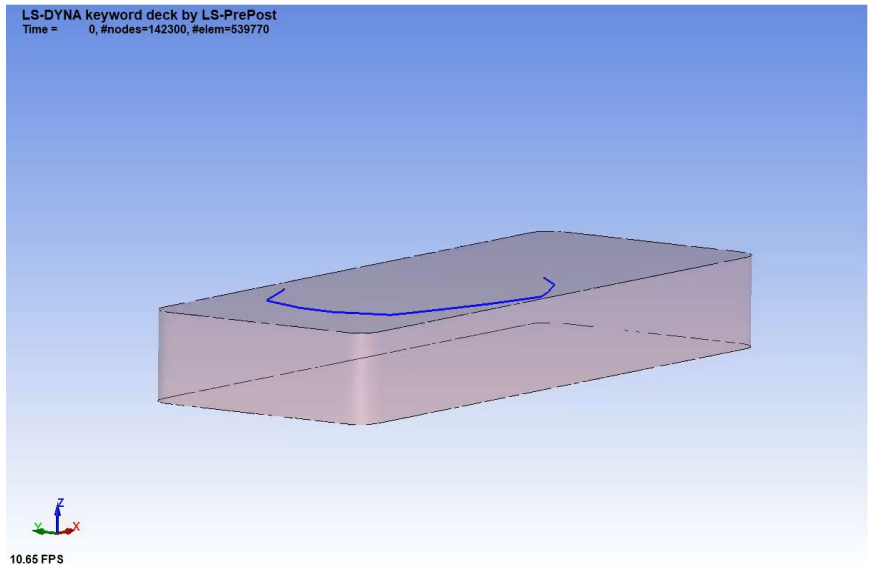
- Virtual Strain Gauge provides a new way to measure the total strain on the surface of the deformed structure.
- It is a post-processing operation, user does not need to know the location ahead of time, nor need to build surface NULL elements in order to get the strain values

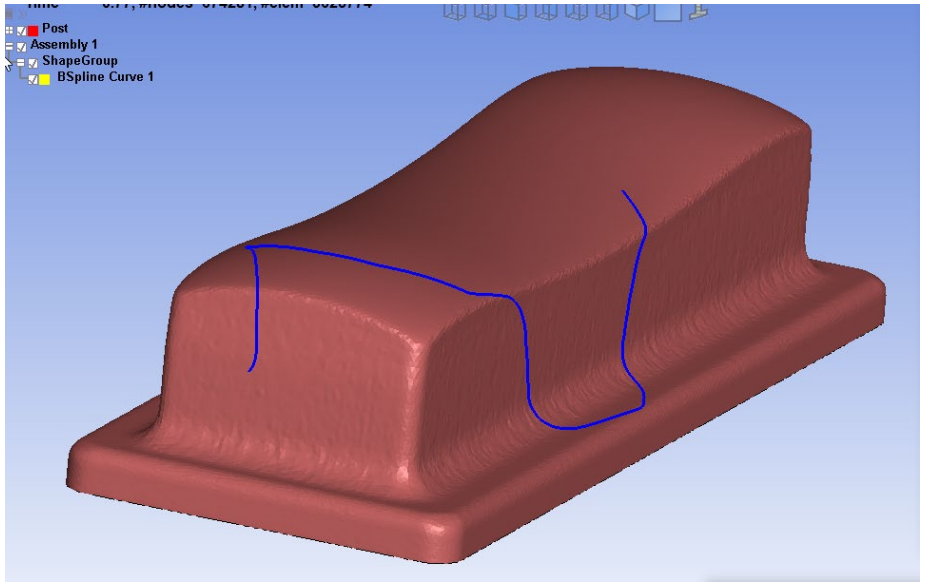


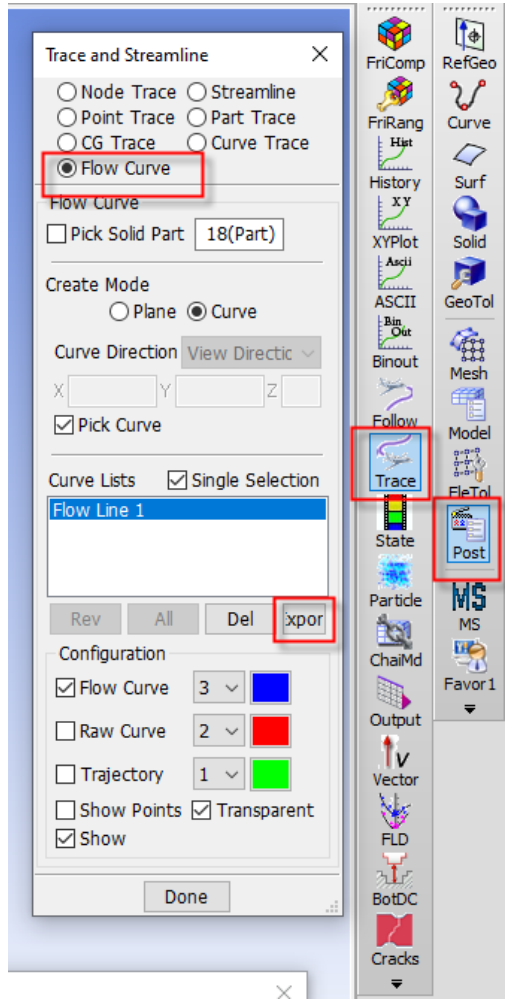


Flow Curve on R-Adaptive Remeshing for Forging

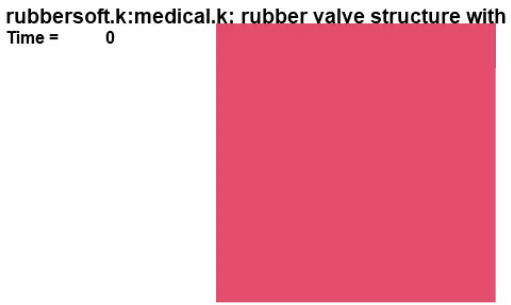
- In Forging Analysis, the part usually goes through very large deformation and remeshing is necessary
- With the Flow-Curve option LSPP can trace a curve from it original shape to its final shape on the deformed part
- The trace curve can be output as an line in Iges format



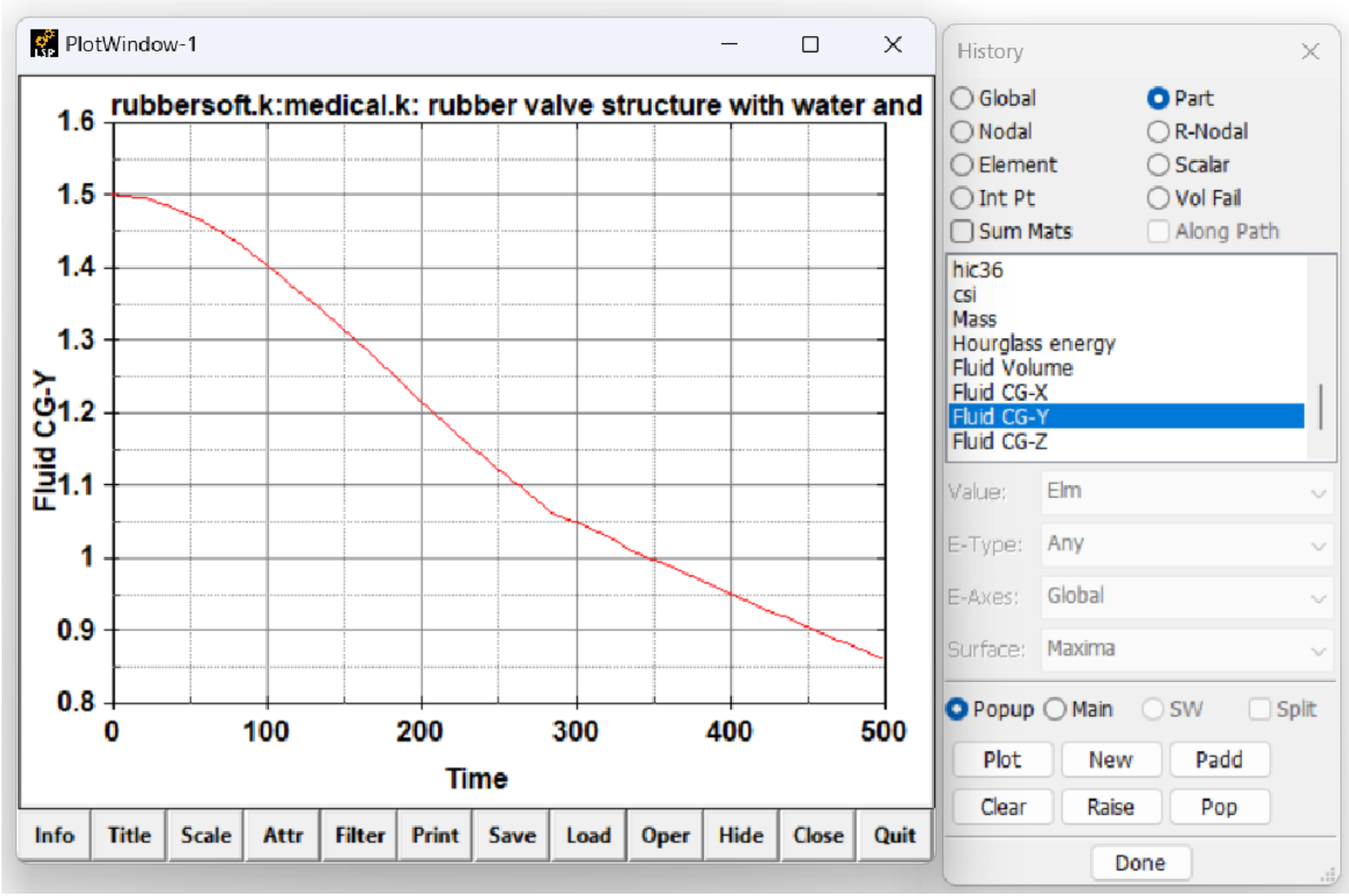




History>Part: Plot the CG location of an ALE domain

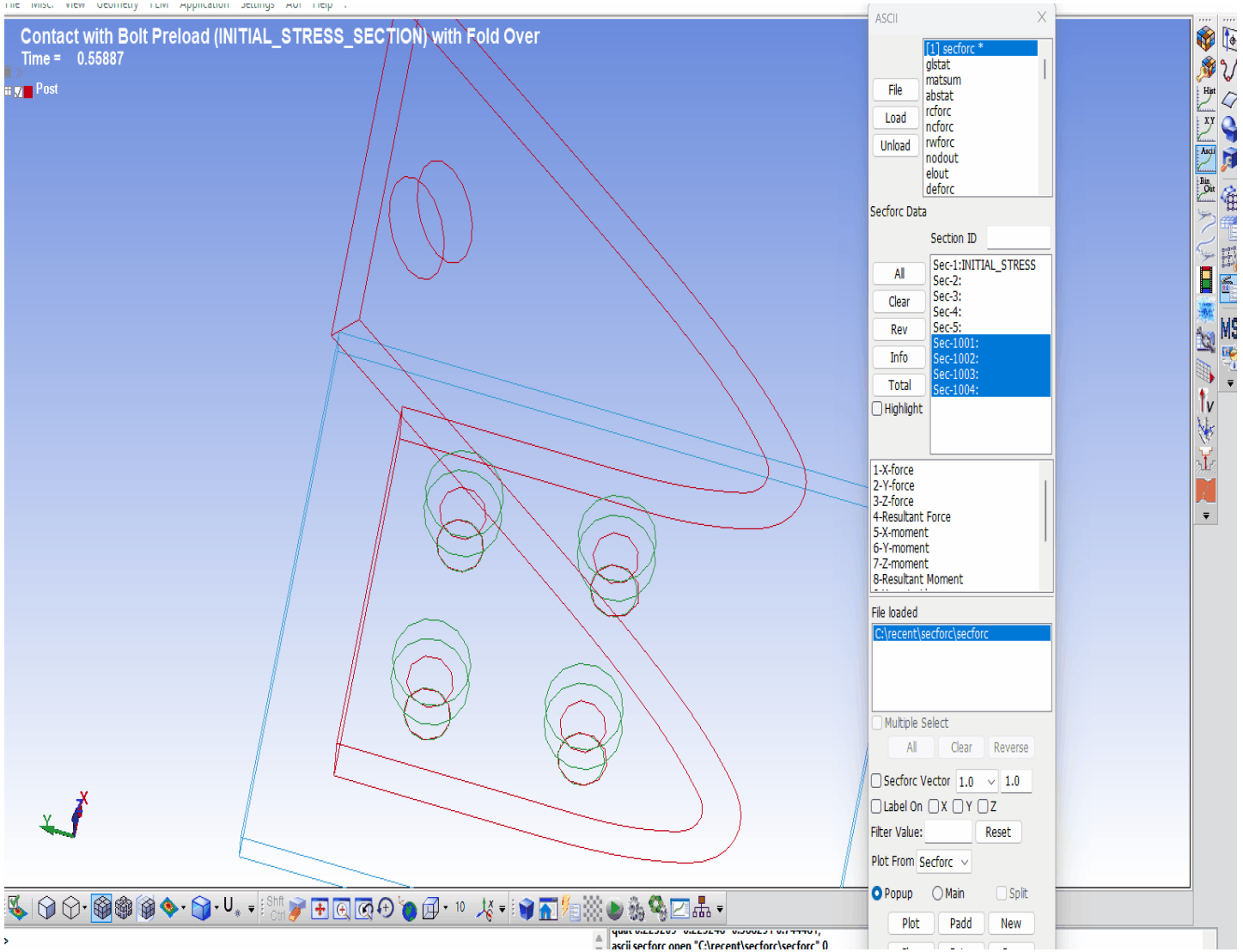


The CG location change with Time when the fluid deform



Secforc Ascii Files improvement

- Implement vector plot for Secforc ascii file
- Choice of X,Y,Z components independently
- Apply Filter value (Threshold for plotting)
- Support for change of vector plot size and label size in configuration display general "title font size".
- GUI operations have commands associate with them and can be re-run in batch mode



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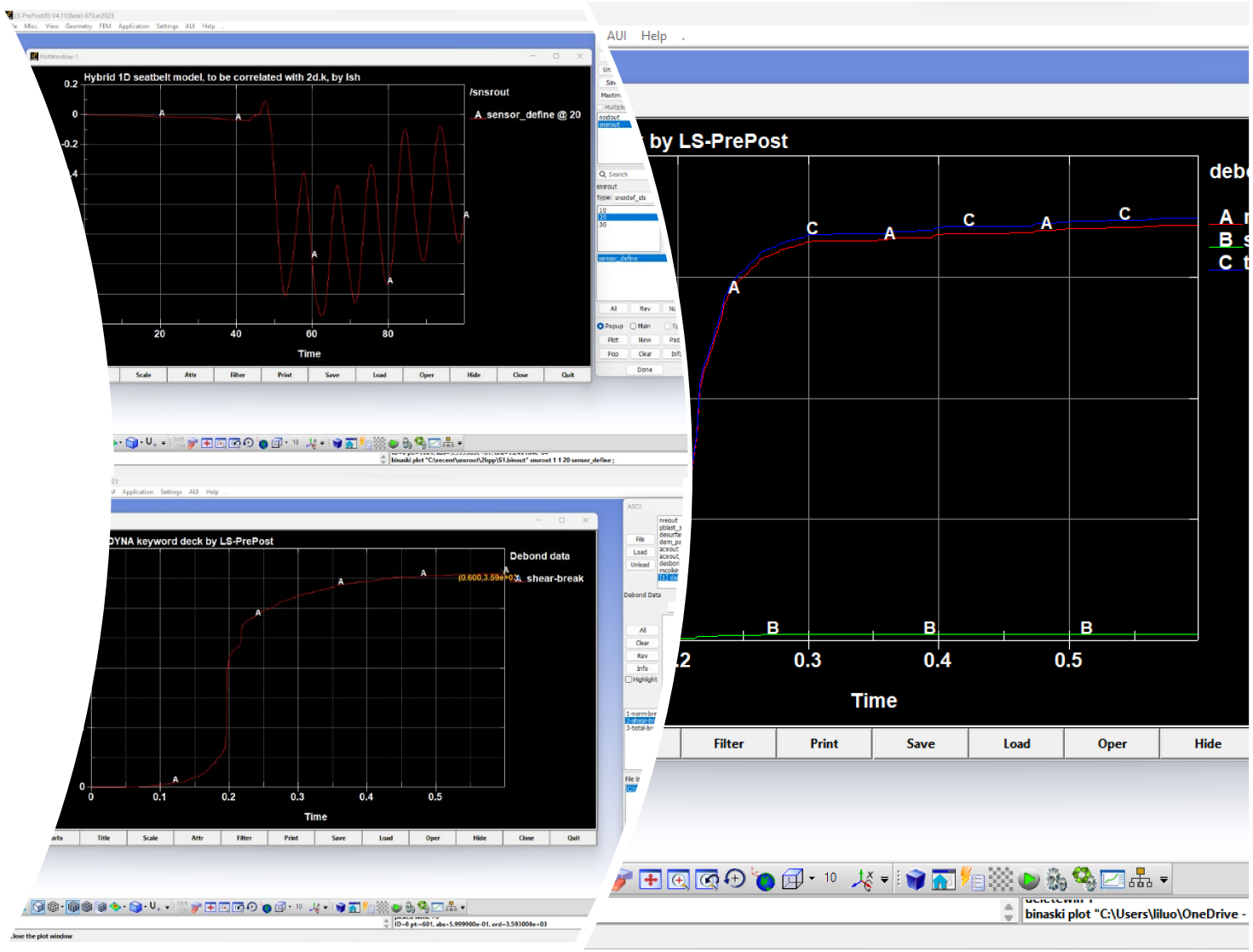
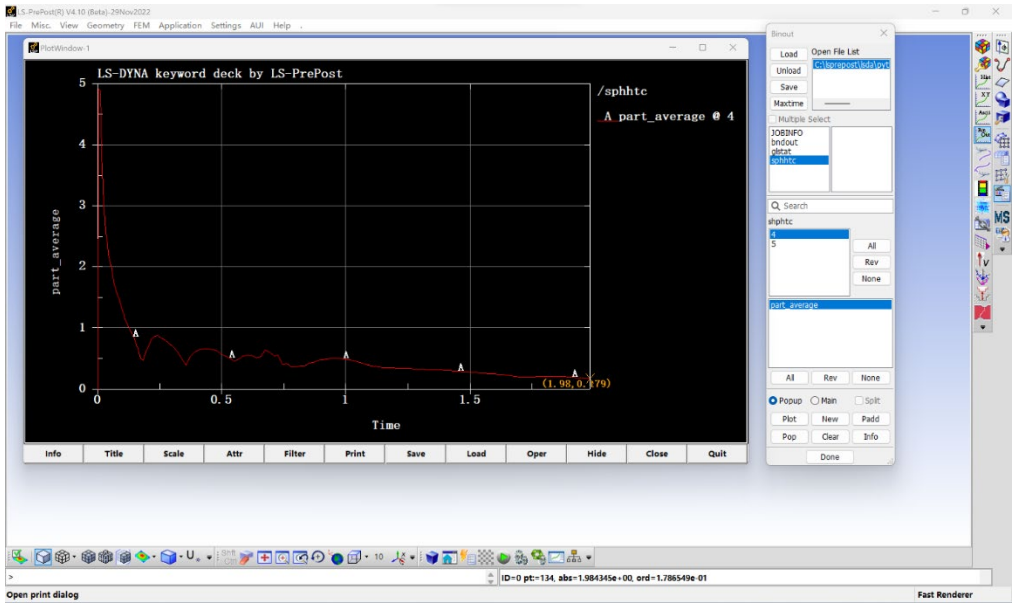
Binout/Ascii

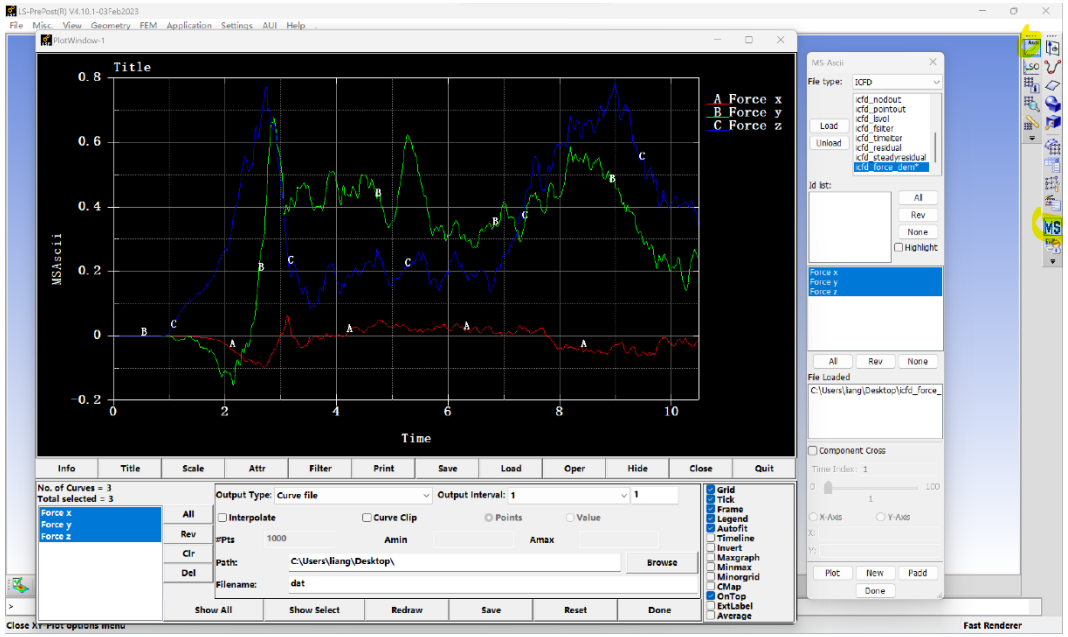
- Support for DEBOND branch both in Binout and Ascii
- Support for SNSROUT branch in Binout.
- Support for ISPG_Cpl branch in Ascii
- Support for ISPG_Sumforc branch in Ascii



Binout

- Support for sphhtc branch.
- Unify the traleh UI component names for Binout and Ascii.
- Unify the trhist UI component names for Binout and Ascii
- Improve sphvicinity branch total_mass calculation
- Support icfd_force_dem branch in the MS-Ascii





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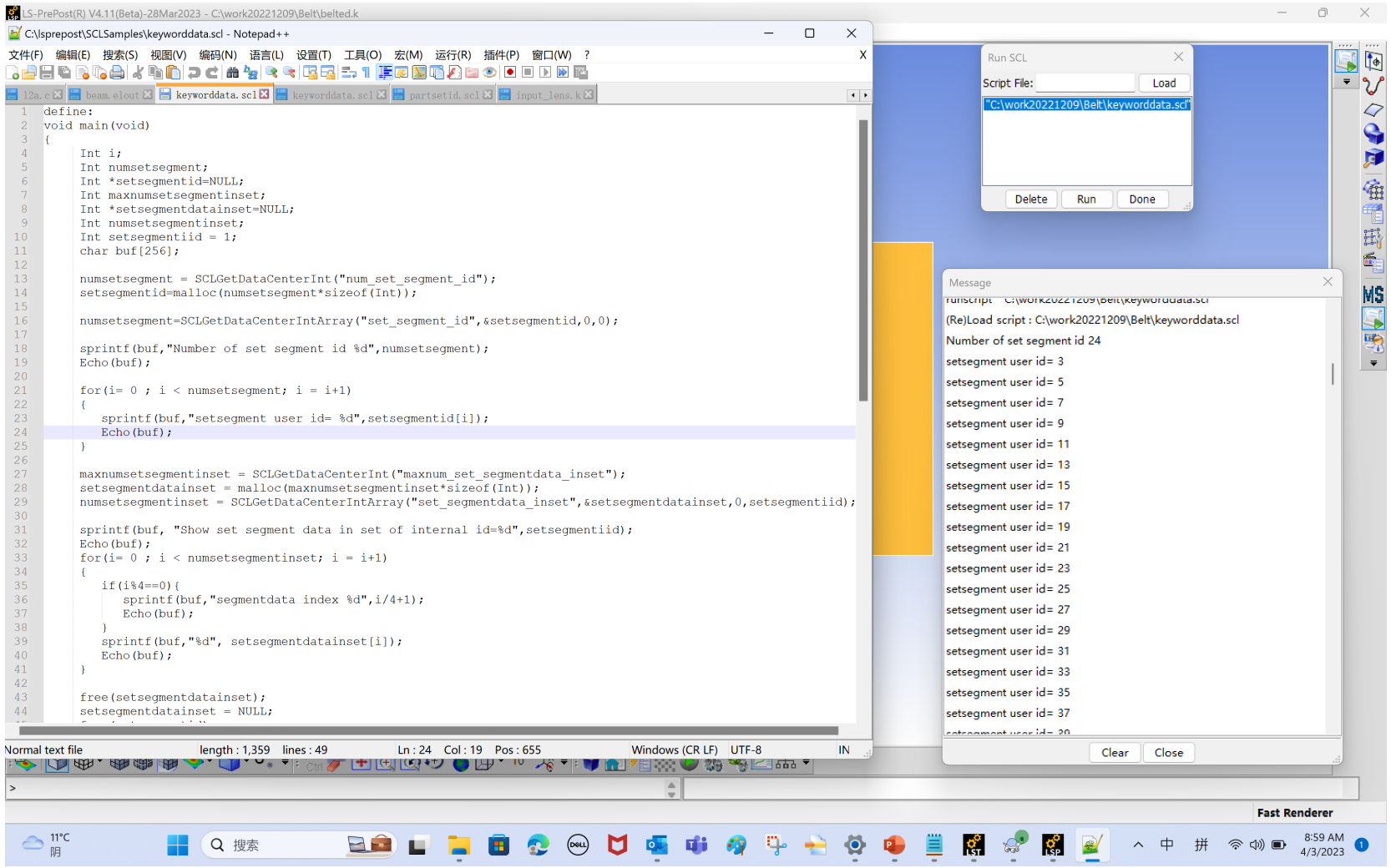
SCL

- SCL: document update and support for user's script example.
- SCL: support for getting *DEFINE_COORD_system keyword data from input file.
- Command: support for #fold #dir when doing parameter command.
- SCL: support for getting the *SET_SEGMENT keyword data.
- SCL: change the GUI name to "Run SCL".
- SCL: fix dropping icon disappear problem after changing the "Application->Run SCL" name.



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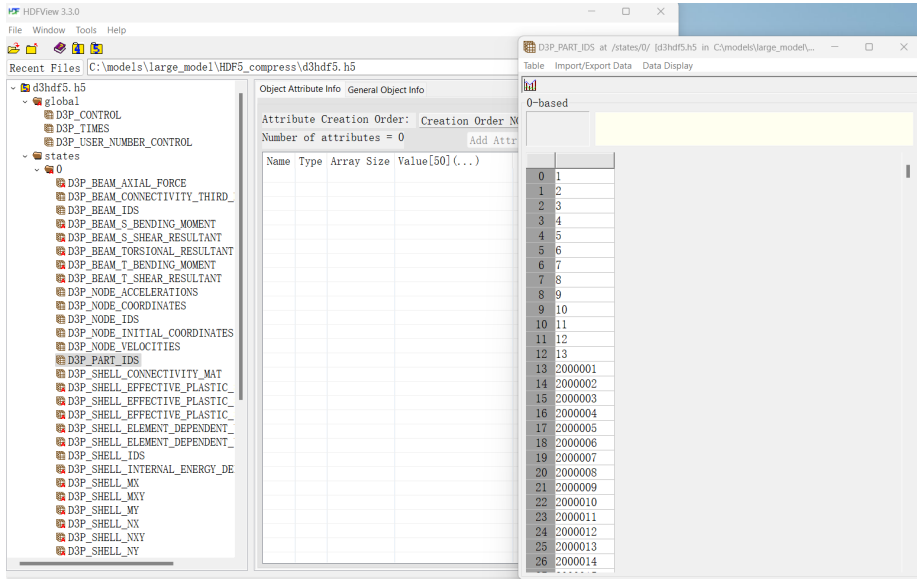
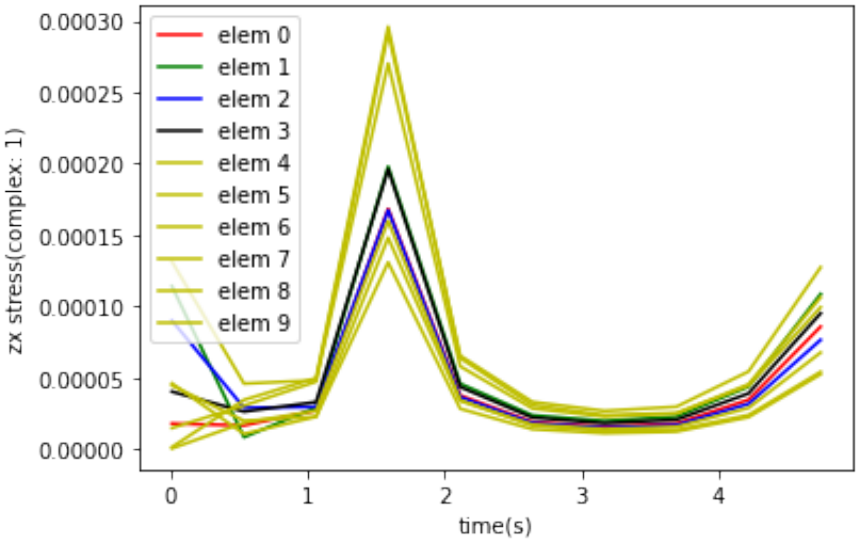
Future LS-DYNA data format

- Support to write the file of HDF5 format by using d3plot.
- Support to read the HDF5 file.
- Support compression and reduction of HDF5.
- Improve the speed of extracting data by part.
- Update the extracting of solid20 and solid 27.
- Fix the bug about part variables.
- Add D3P_BEAM_INTERNAL_ENERGY_DENSITY and D3P_NODE_KINETIC_ENERGY_DENSITY.
- Update the APIs for the Interface Force File.
- Embedded LS-Reader API into DPF



Write and read hdf5 file



Use LS-Reader in DPF

pyDyna

PyDYNA is a Pythonic package for providing a more convenient and complete way to build an Ansys DYNA input deck, submit it to the Ansys LS-DYNA solver, and finally postprocess the results

https://github.com/ansys/pydyna
https://dyna.docs.pyansys.com

PyDyna

```
git clone https://github.com/pyansys/pyDyna
cd pyDyna
pip install -e .
```

```
unzip ansys-dyna-core-v0.3.5-wheelhouse-Linux-3.8.zip -d wheelhouse
pip install ansys-dyna-core -f wheelhouse --no-index --upgrade --ignore-installed
```

PyDPF

https://github.com/ansys/pydpf-post

Pre

```
from ansys.dyna.core.pre.dynasolution import DynaSolution
solution = DynaSolution(hostname)
solution.open_files(fns)
solution.set_termination(termination_time=10)
ballplate = DynaMech(AnalysisType.NONE)
solution.add(ballplate)
solution.download(serveroutfile,downloadfile)
```

Solver

```
import ansys.dyna.core.solver as solver
dyna=solver.DynaSolver(hostname,port
dyna.push("./output/ball_plate.k")
dyna.start(4)
dyna.run("i=ball_plate.k memory=10m ncycle=20000")
```

Post

```
from ansys.dpf import core as dpf
ds = dpf.DataSources()
ds.set_result_file_path(r'./d3plot', 'd3plot')
resultOp = dpf.Operator("lsdyna::d3plot::stress_von_mises")
result = resultOp.outputs.stress_von_mises()
```

Docker Service

Pre-Service

docker compose up -d

gRPC Architecture

Solver-Service

docker compose up -d

DynaSolution

DynaMech
DynaIGA
DynaICFD
DynaSALE
DynaEM
DynaAirbag

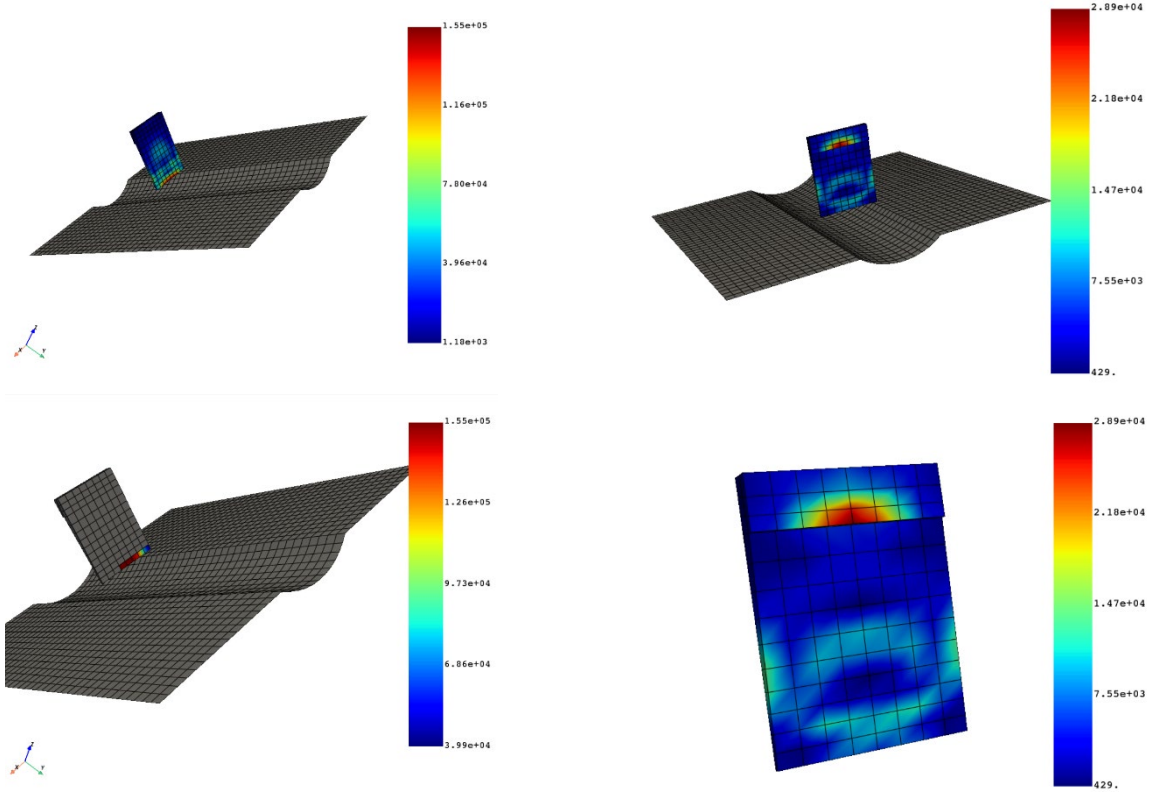
DPF (Data Processing Framework) LS-DYNA PlugIn

- Used to extract LS-DYNA results from d3plot files and binout files
- Advantage of DPF-LSDYNA
  - Easy to get the model information
  - Easy to get the variables using operators
  - Easy to fringe variables
  - Easy to deal with the xy-ploting data for binout file
  - Support scoping(mesh, time, location, name_selection, shape)
  - Field is a self-describing piece of data
  - Powerful workflow
  - Easy to use

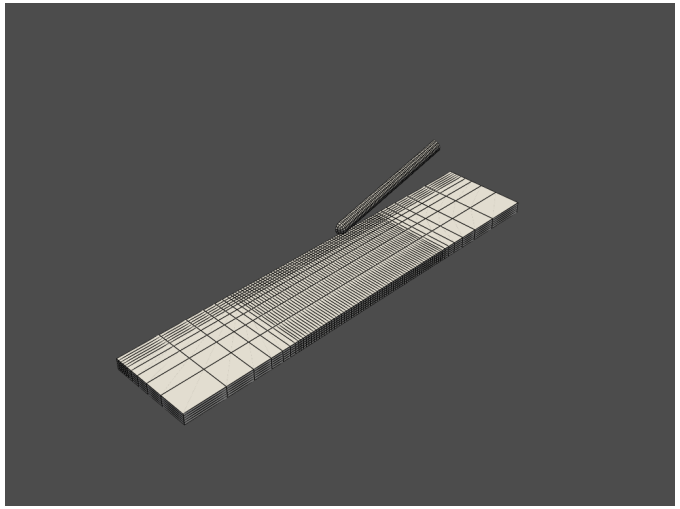
```
ds = dpf.DataSources()
ds.set_result_file_path(r'C:\ansys-dpf\lsdyna\Ans.Dpf.LSDYNAHGP\Ans.Dpf.LSDYNA.test\test_models\case18\test.d3plot')
model = dpf.Model(ds)
print(model)
model.plot()

em_current_op = model.results.em_cur()
em_current = em_current_op.eval()
em_current[20].plot()
```

DPF (Data Processing Framework) LS-DYNA PlugIn

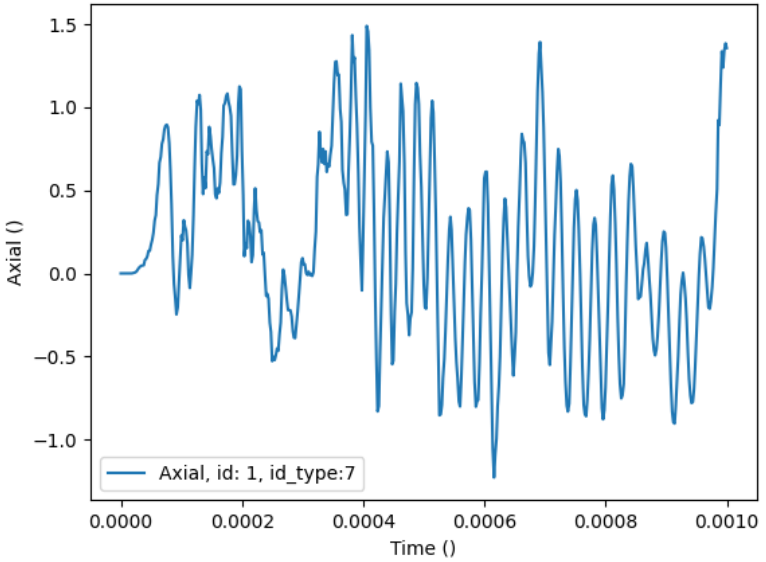
- **Fringe Results (scoping, by part)**



- **Adaptive Model**



- **Binout**



Solution Explorer

Multiphysics

- Structure
- ICFD
- Structured-ALE
- Thermal
- EM
- Drop Test
- ……

Translation Tools

- LS-DYNA input data
- Tree structure & Properties
- Material databases

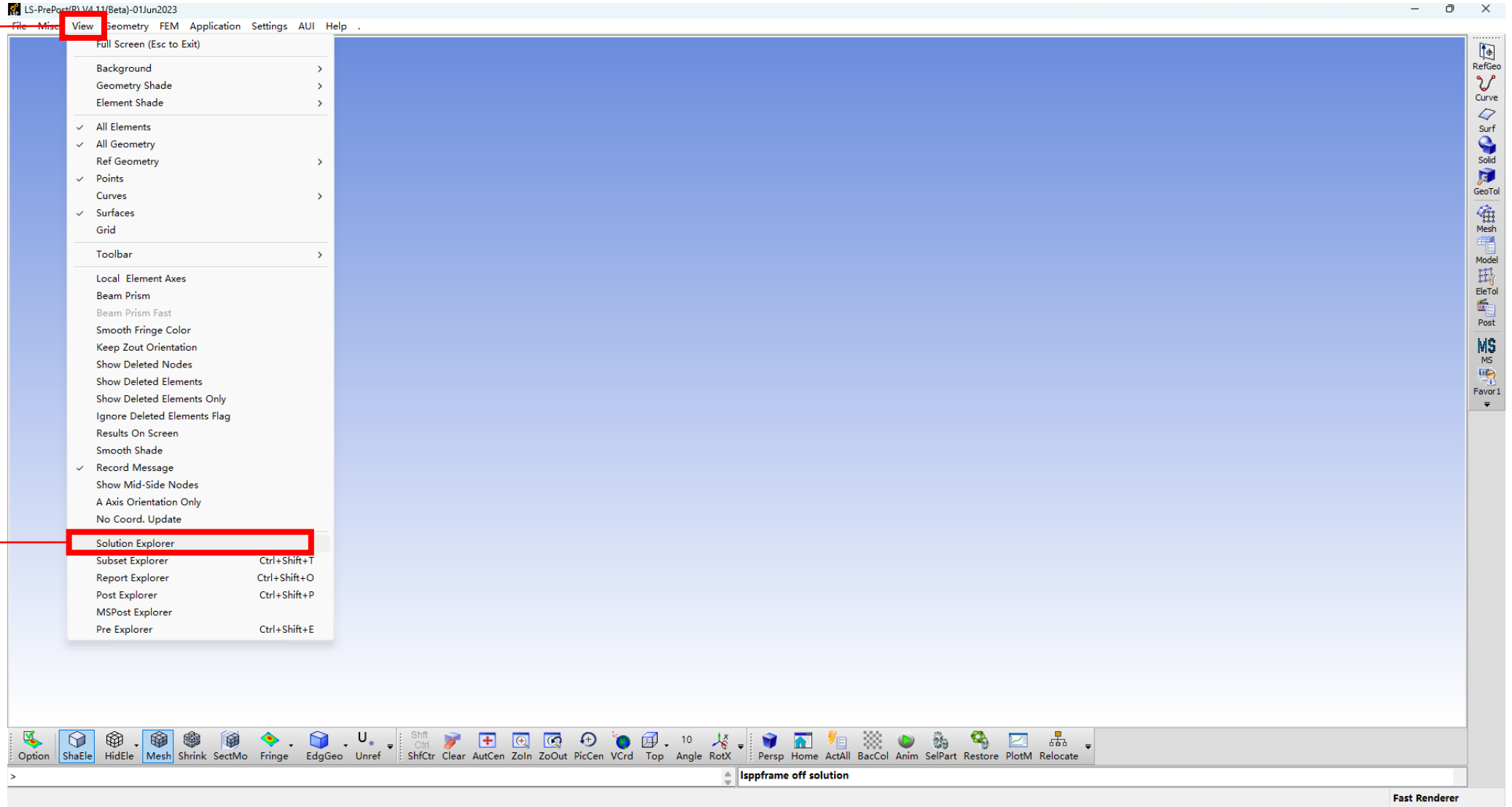
One Flow Line

- No LS-DYNA input data file editing
- Whole flow line based on tree structure and friendly to engineers

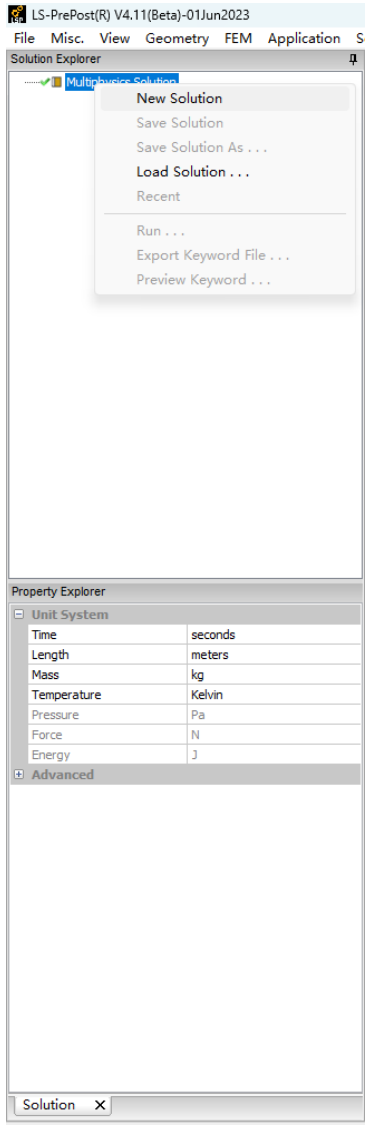
Solution Explorer Entrance

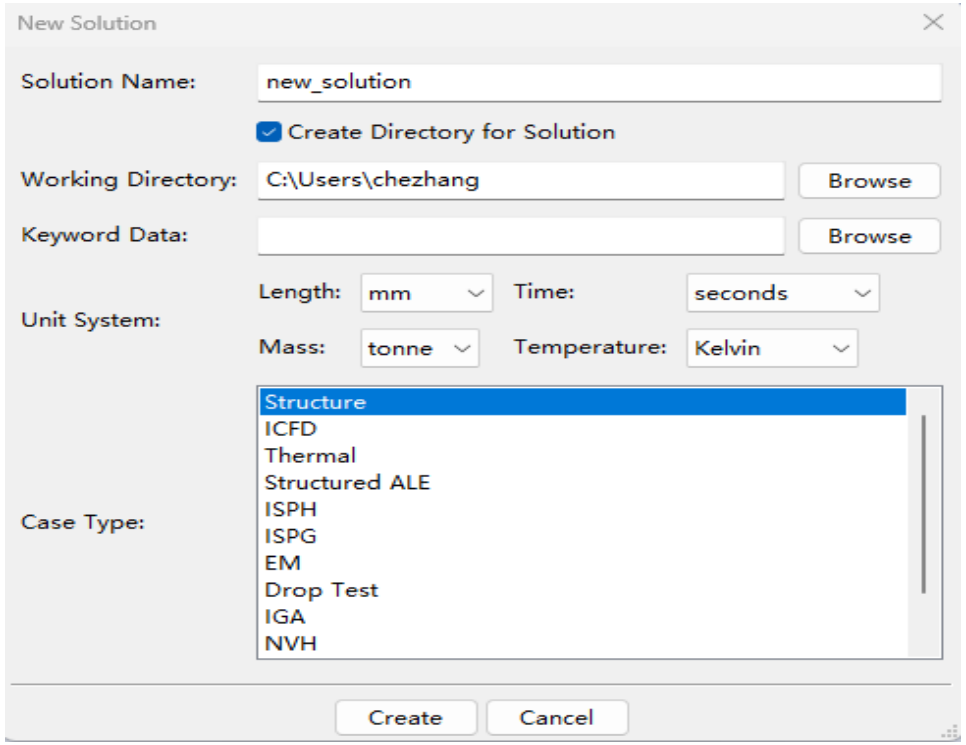
Step 1.
View
Menu

Step 2.
Check on
“Solution
Explorer”



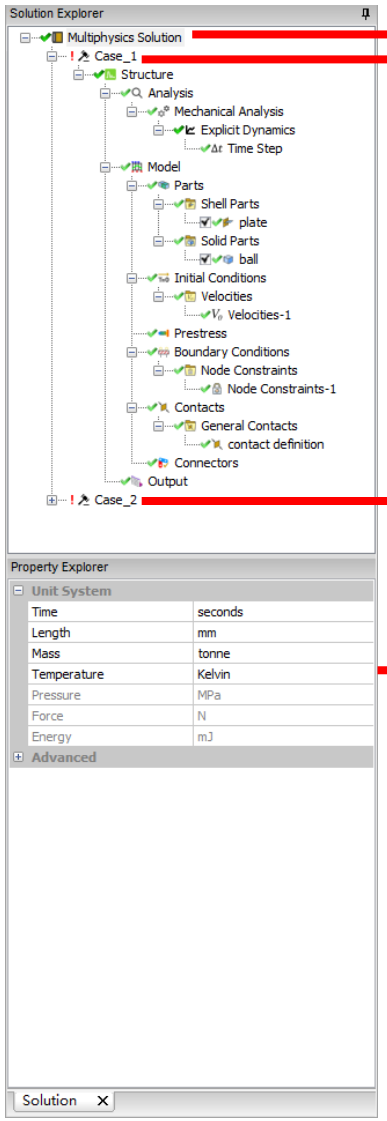
Create New Solution





Folder	LS-DYNA Input	Case
• Solution Name • Working Directory	• Mesh data (Part , Element data, Node data, Material…) • Unit System	• Structure • ICFD • … • EM • Drop Test

Structural Structure



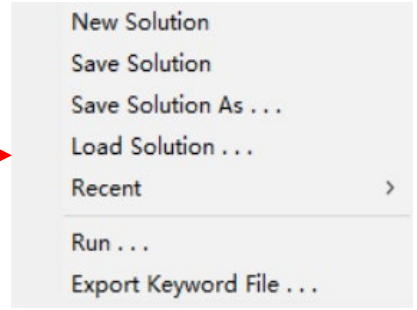
Top Level

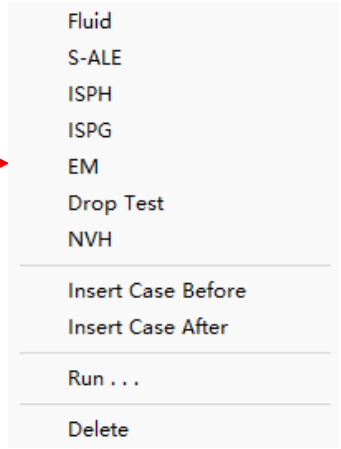
Case Level

Structural Tree Structure

Case Level

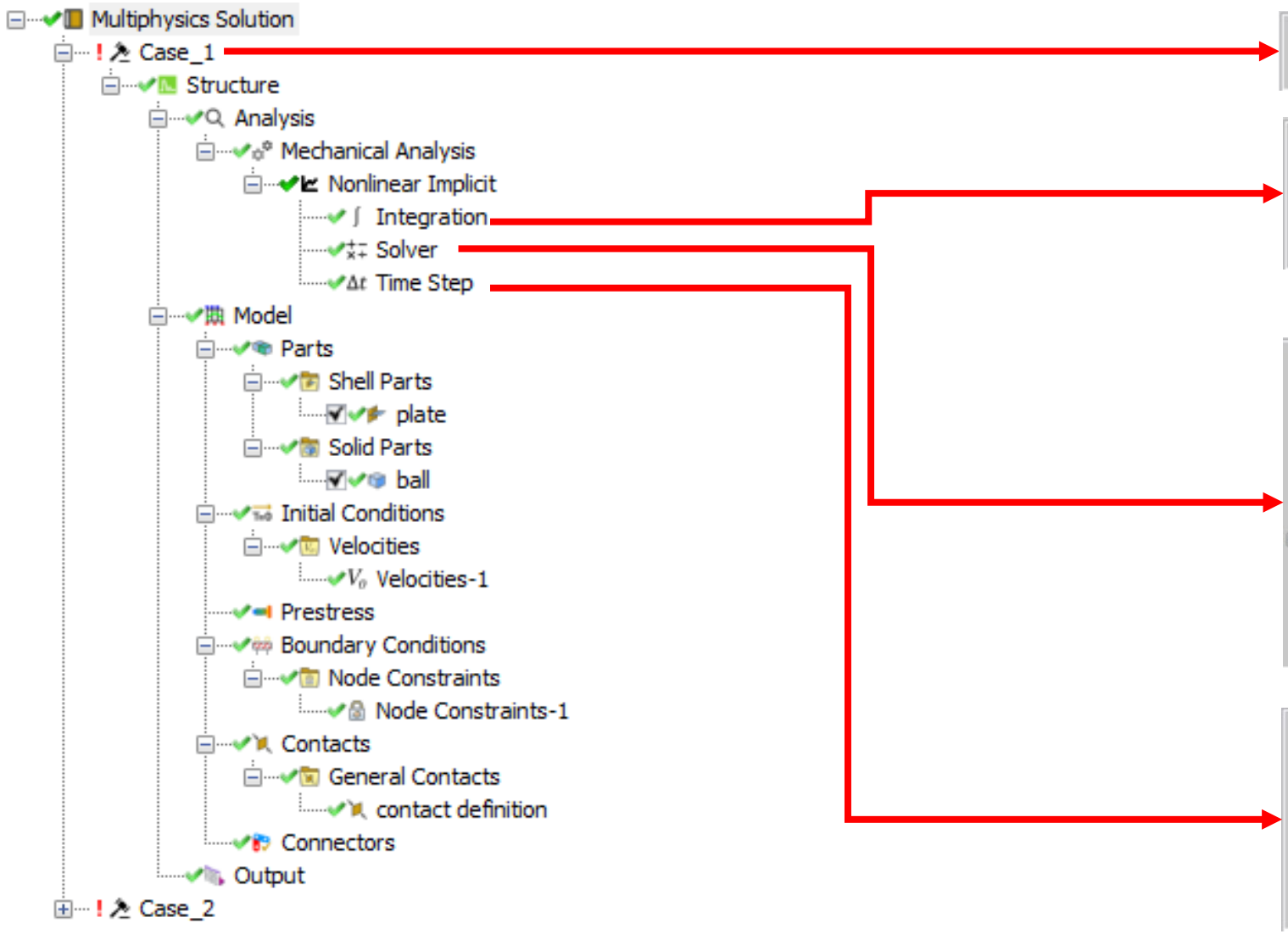
Property Explorer





1. Different tree item has different properties.
2. Edit the properties to change analysis data.
3. Many tools can be designed to the properties.
4. The descriptions of the properties are friendly to engineers.

Structural Structure



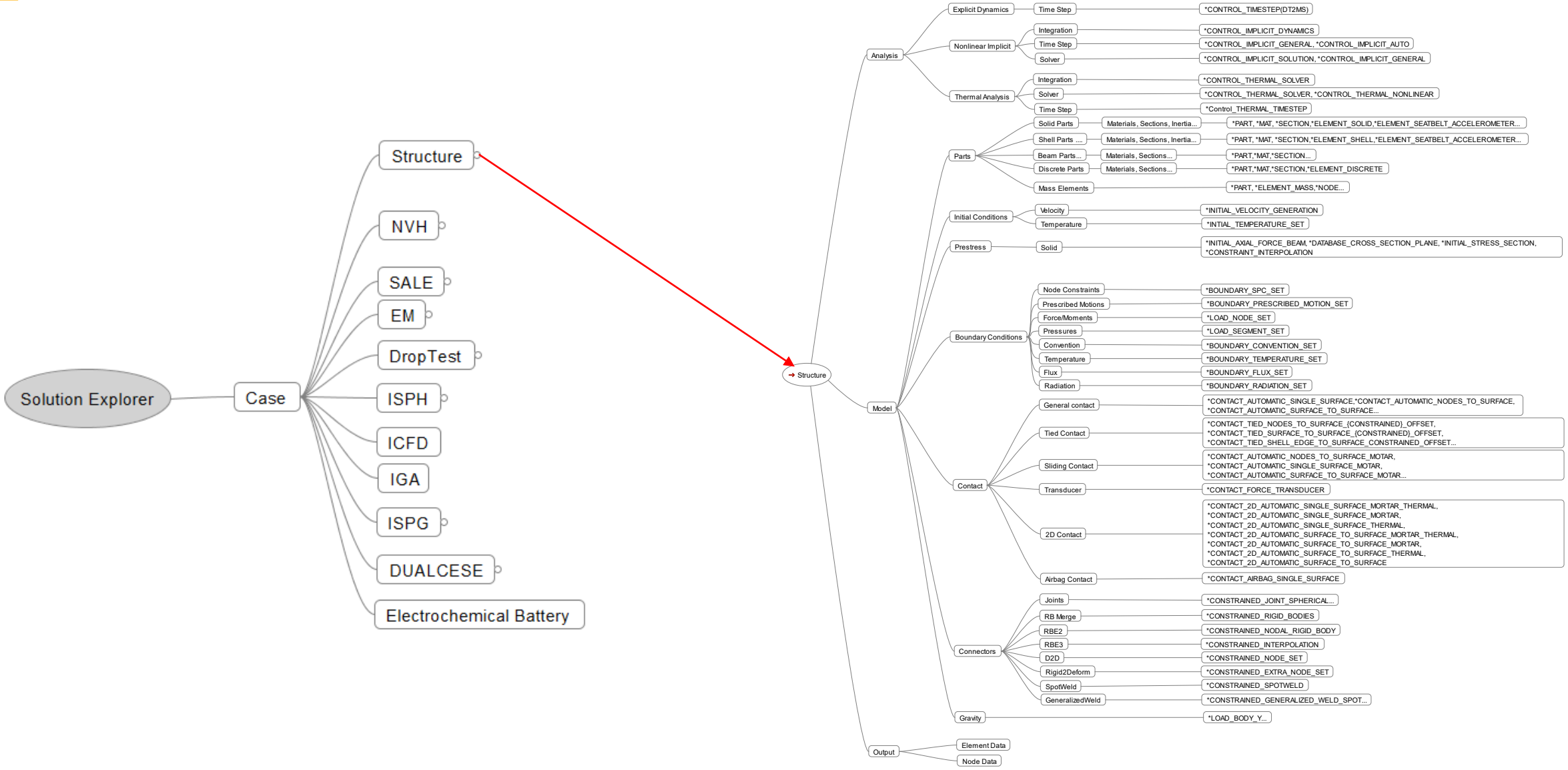
End Time	1 s
Database Plot Interval	0.01 s

Types	Dynamics
Methods	Newmark Damped
Gamma	0.6
Beta	0.38

Solution Method	BFGS Slightly Nonlinear
Reformations Before Retry	15
BFGS Iterations Before Reform	11
Tolerance Type	Recommended
Relative Displacement	0.001
Advanced	
Geometric Stiffness Matrix	☐
Linear Solver	Symmetric
Use residual tolerances	☐

Initial Size	0.01 s
Step Size Option	Maximum Time Step Size
Maximum Time Step Size	0.05 s
Change Strategy	Aggressive
Increase T.S. if iter <	100
Decrease T.S. if iter >	110

Maps of LS-DYNA input data from tree objects



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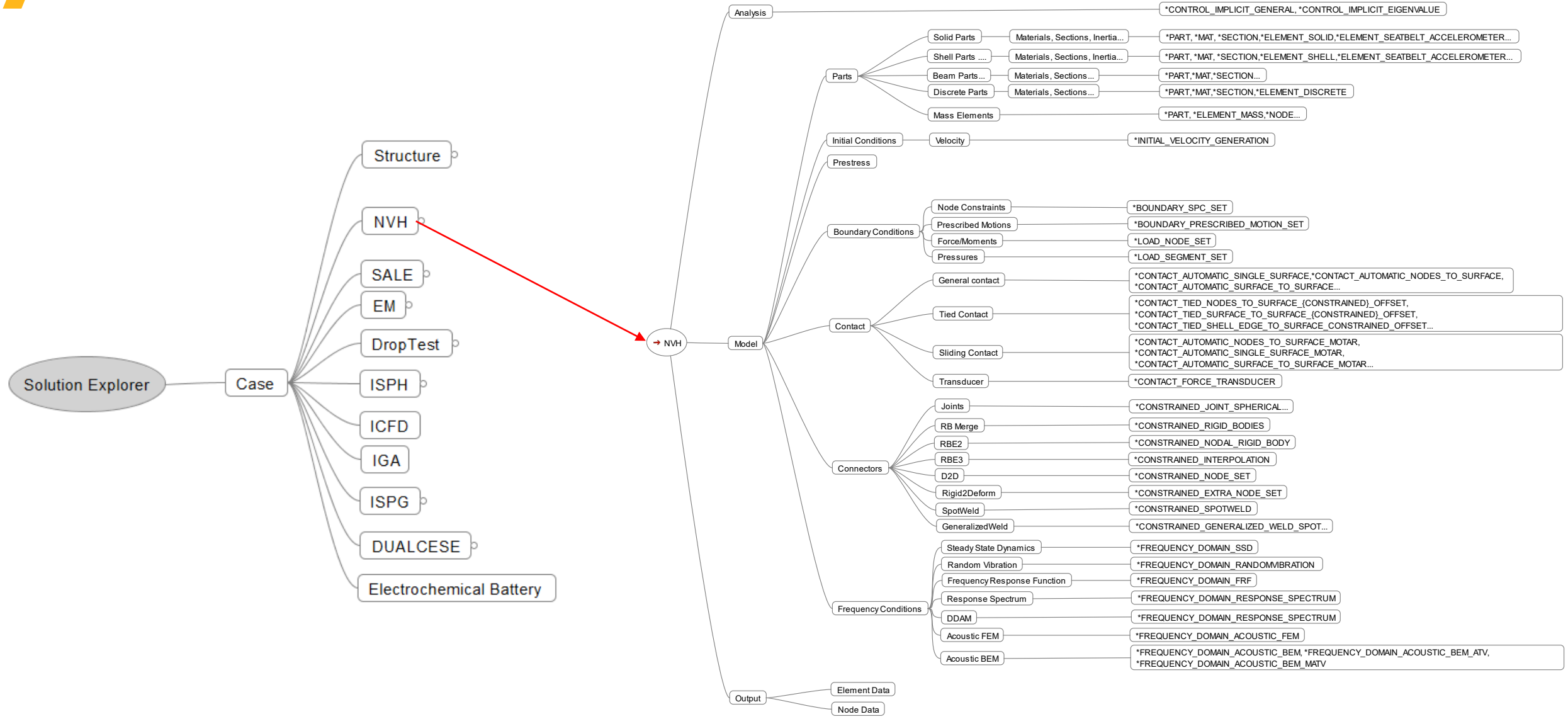

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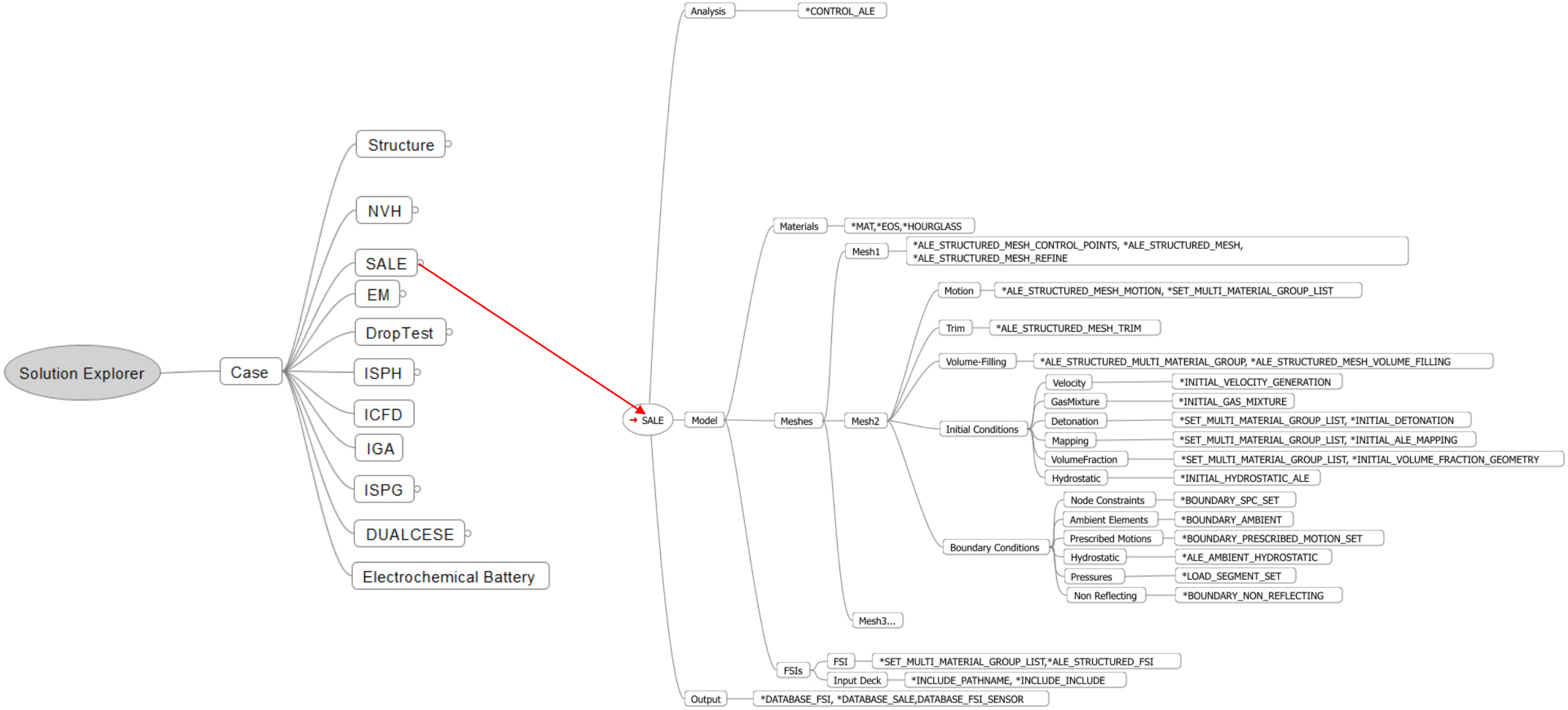

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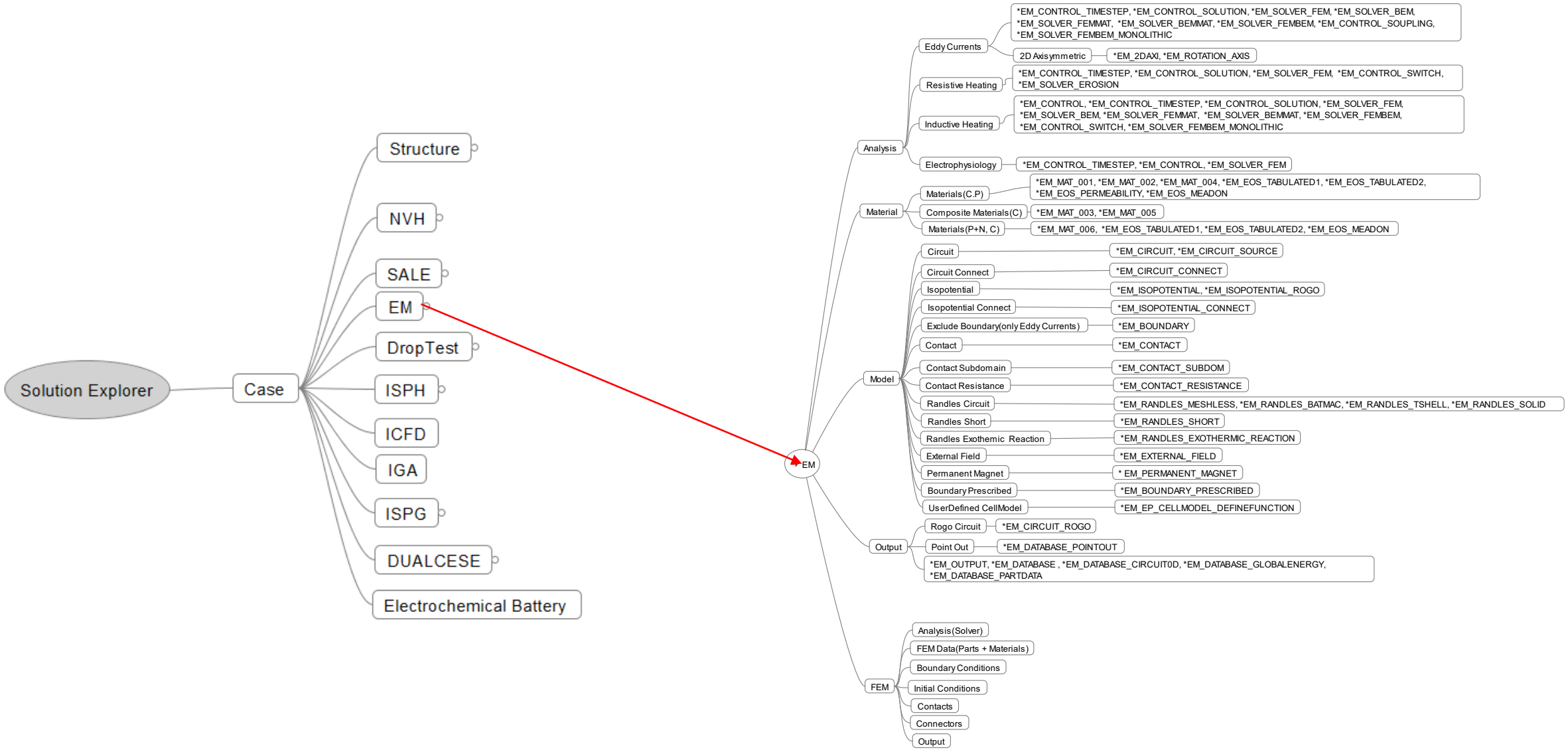
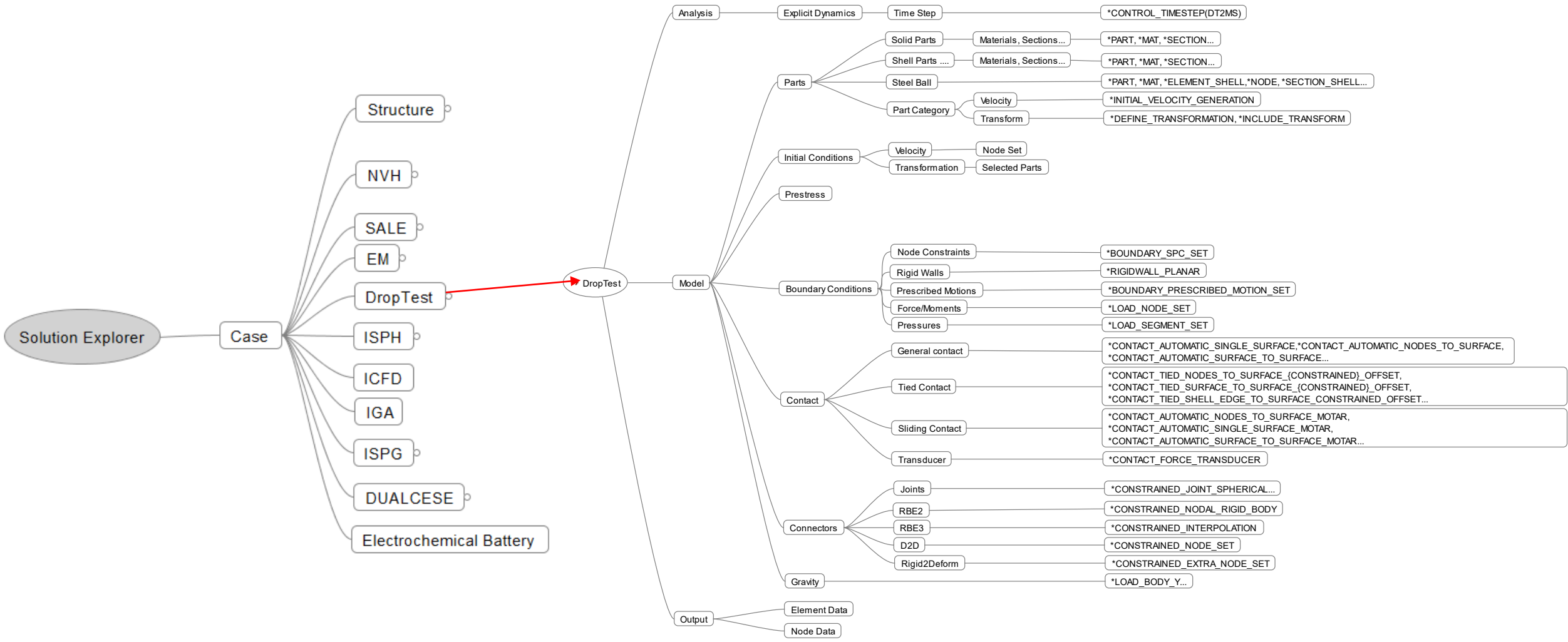
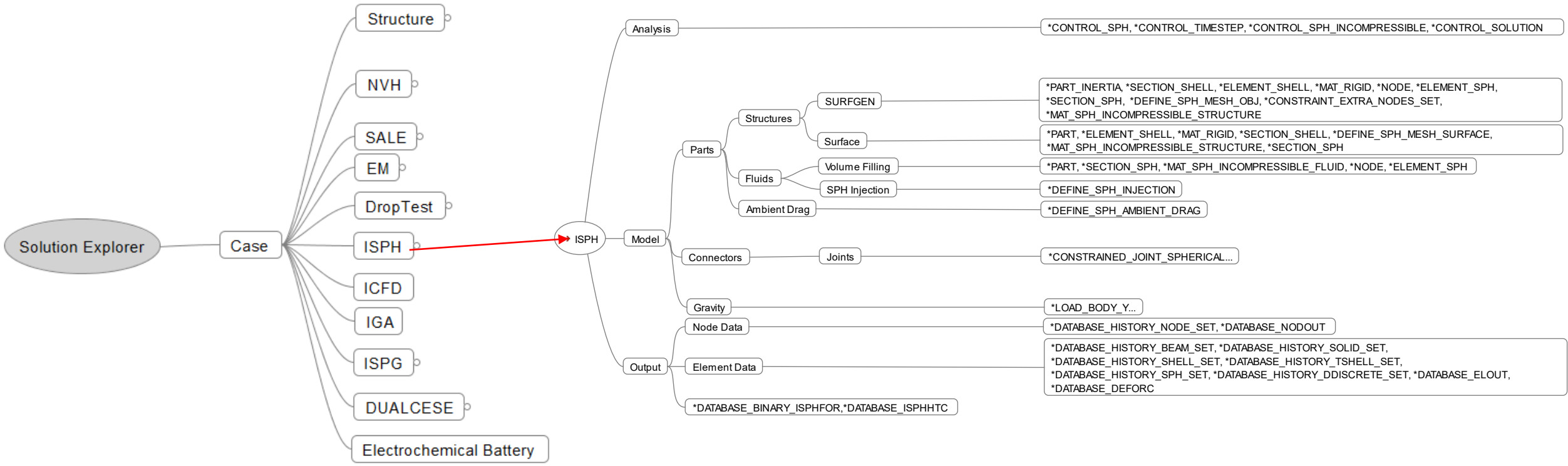


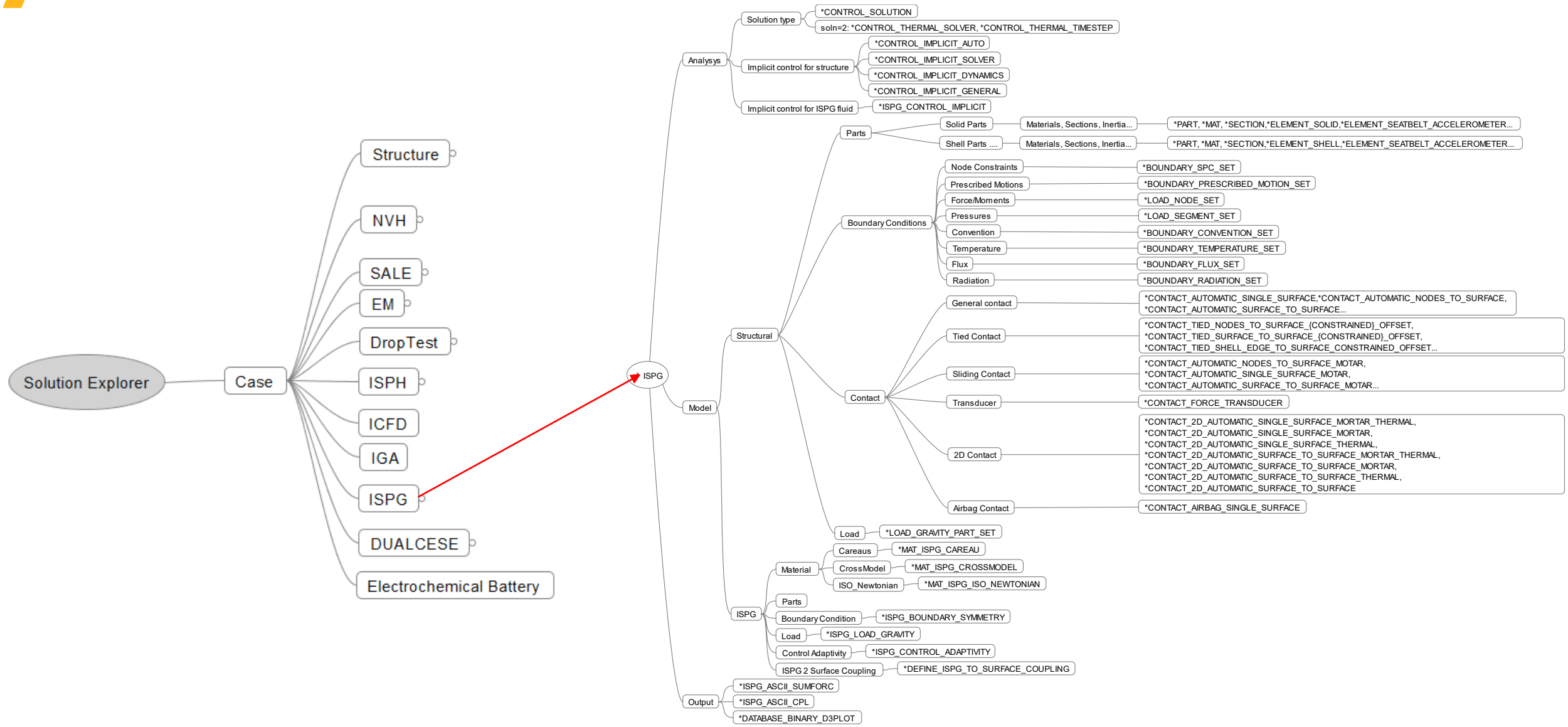
Maps of LS-DYNA input data from tree objects



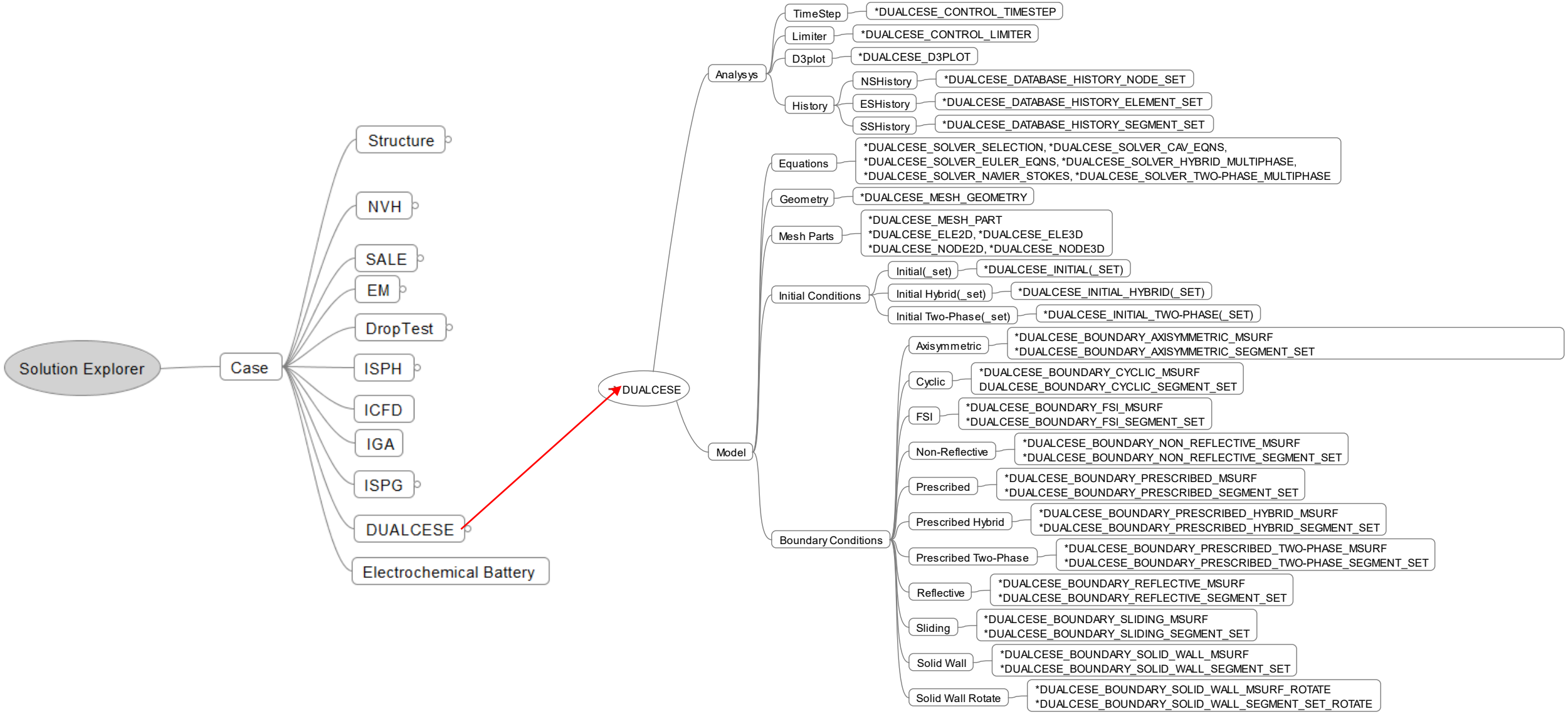
Maps of LS-DYNA input data from tree objects



Maps of LS-DYNA input data from tree objects

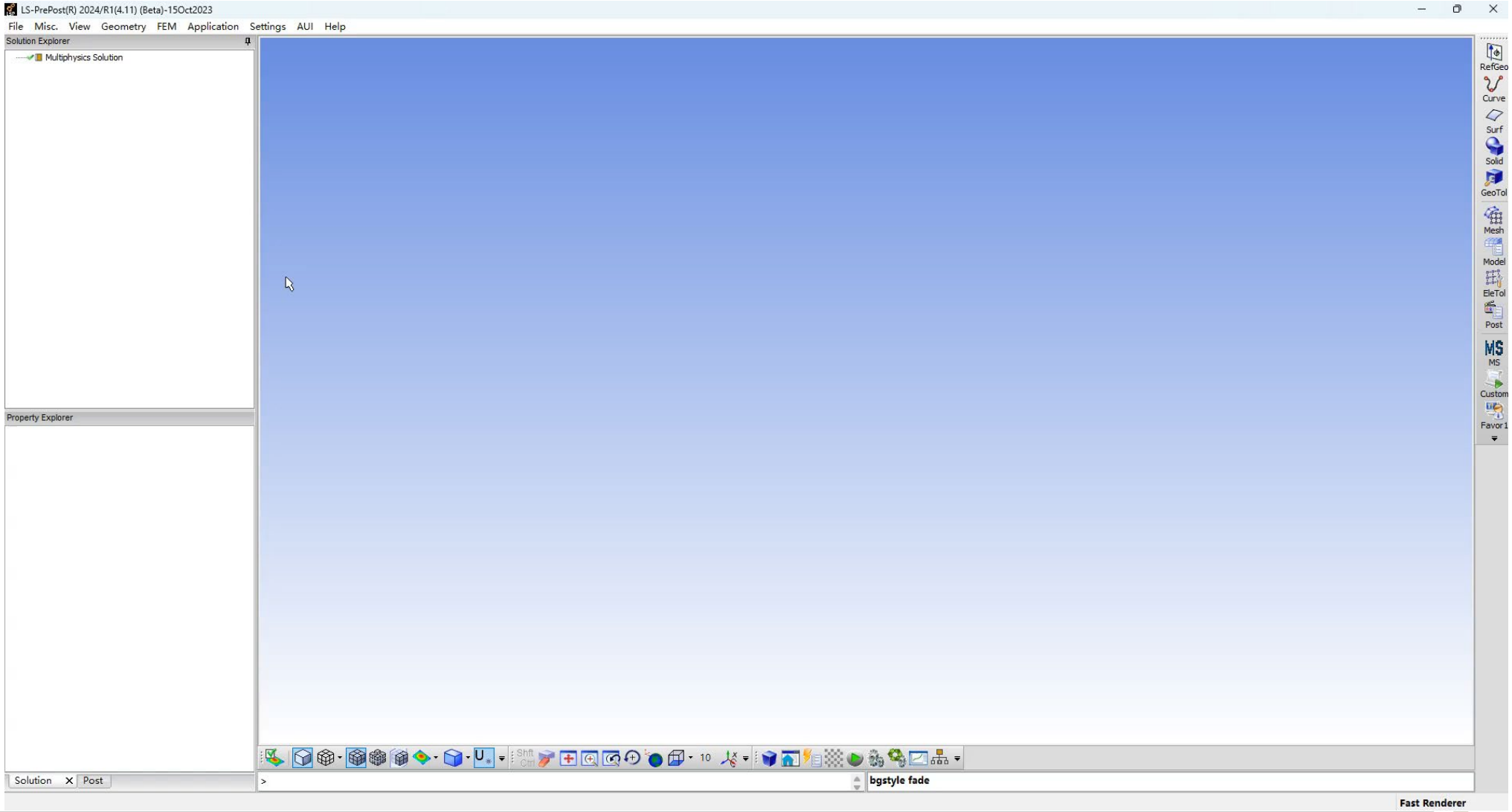


Maps of LS-DYNA input data from tree objects



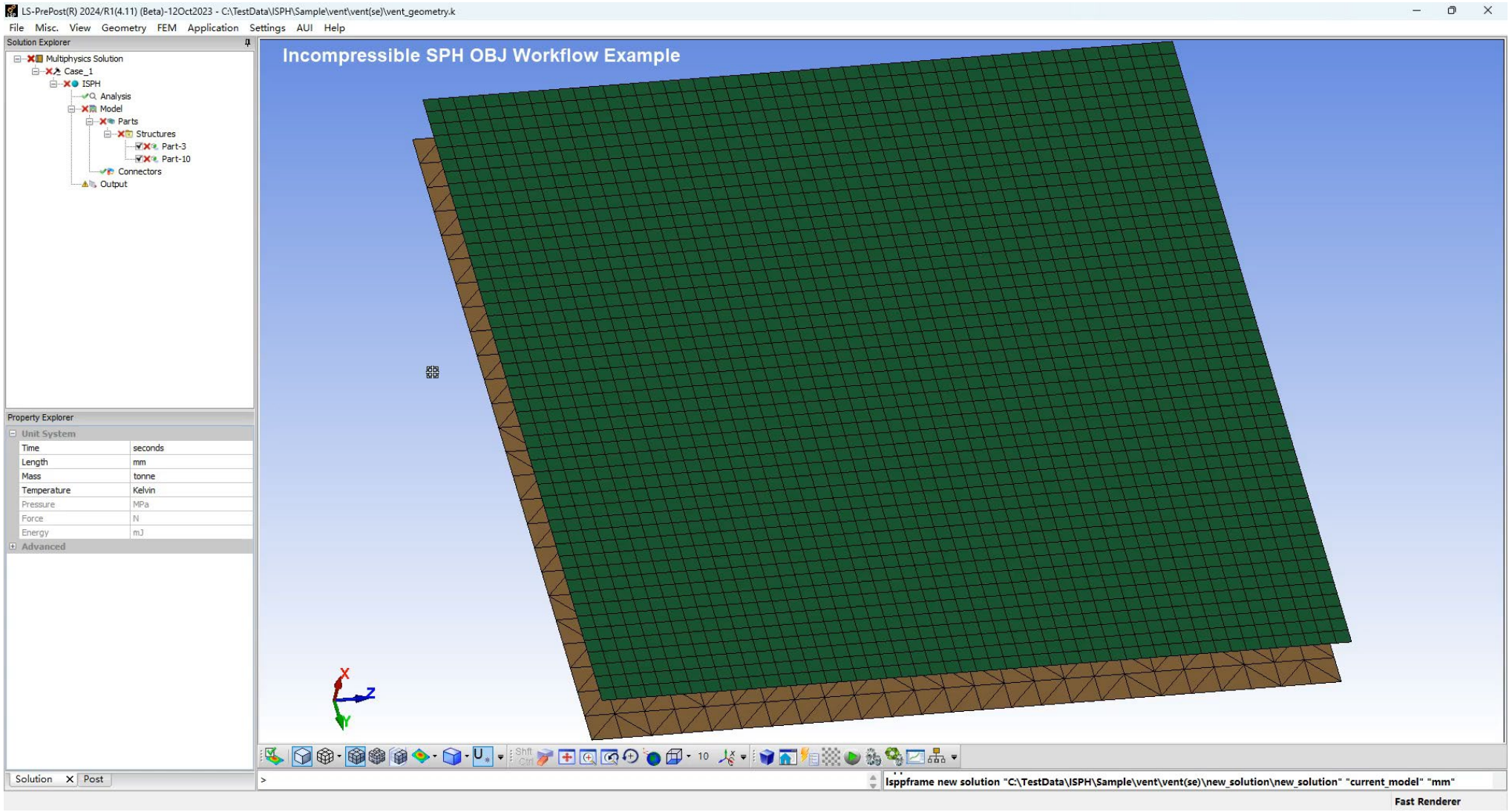
Highlights(structured-ALE)

Fast visualization of Structured-ALE mesh based on LS-DYNA input data.

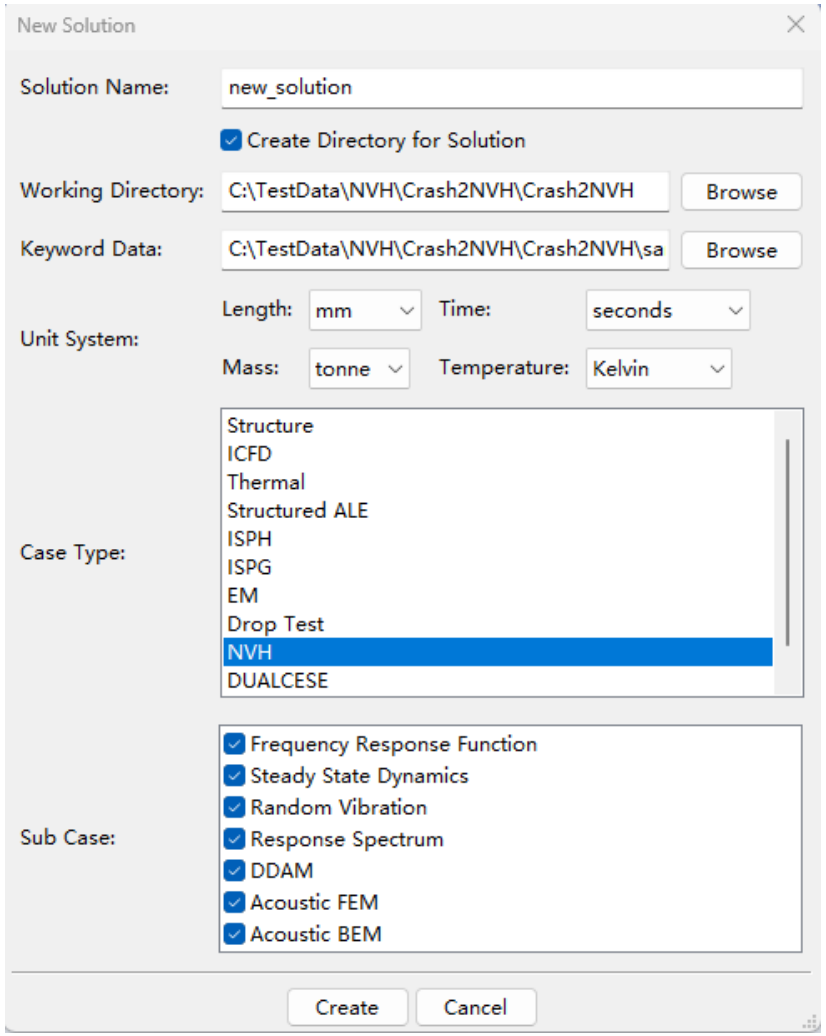


Highlights(ISPH)

Call “SurfGen” program to compute the particles with imported object files.

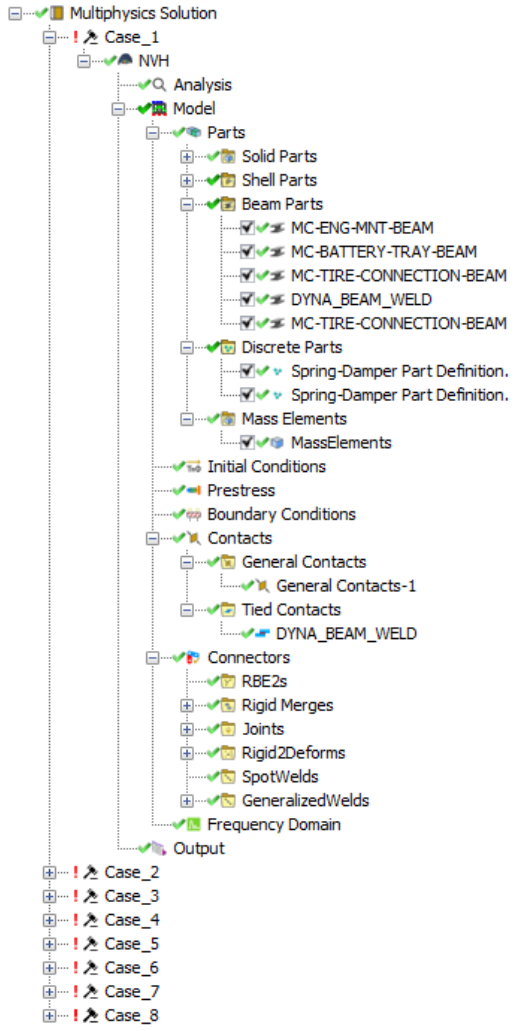


Highlights (NVH)

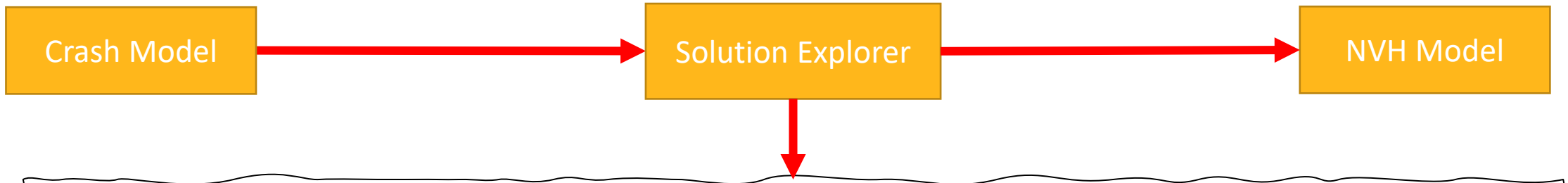


Click “One Button” to create multiple solution trees at one time:

Case_1: Eigen Value
Case_2: Frequency Response Function
Case_3: Steady State Dynamics
Case_4: Random Vibration
Case_5: Response Spectrum
Case_6: DDAM
Case_7: Acoustic FEM
Case_8: Acoustic BEM



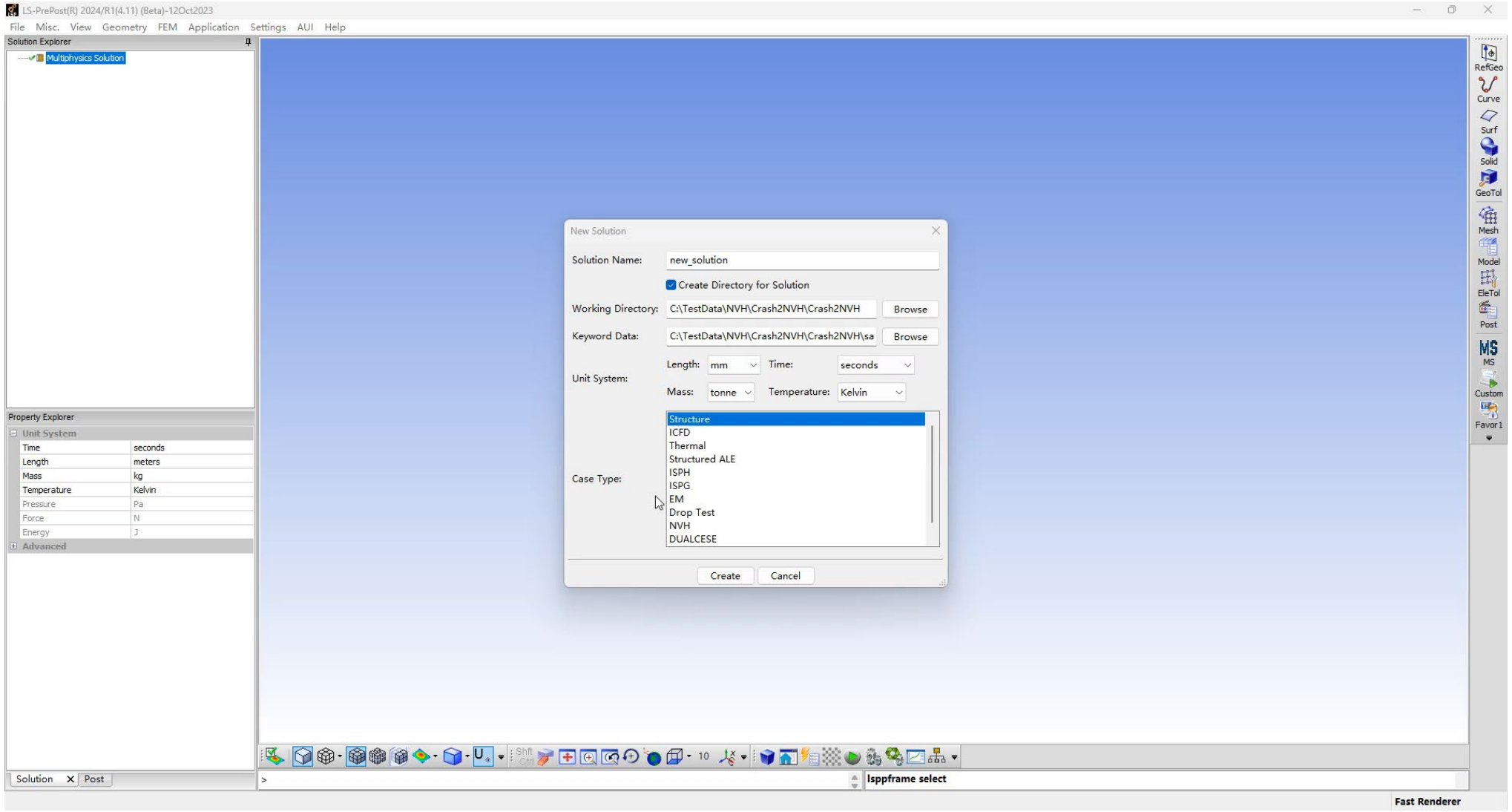
Highlights (NVH: conversion rules)



1. **Disable**: Airbag, Gravity...
2. **Contact**: tied contact
   a) TIED_NODES_TO_SURFACE_CONSTRAINED_OFFSET
      TIED_SURFACE_TO_SURFACE_CONSTRAINED_OFFSET
   b) TIED_NODES_TO_SURFACE_OFFSET TIED_SURFACE_TO_SURFACE_OFFSET
   c) TIED_SHELL_EDGE_TO_SURFACE_CONSTRAINED_OFFSET
   d) TIED_SHELL_EDGE_TO_SURFACE_BEAM_OFFSET
3. **Materials:** changing to linear material
   Keep : *MAT_ELASTIC, *MAT_BLATZ-KO_RUBBER, *MAT_NULL, *MAT_RIGID, *MAT_HONEYCOMB,
   *MAT_CRUSHABLE_FOAM,*MAT_SPOTWELD,*MAT_SPRING_ELASTIC,*MAT_DAMPER_VISCOUS...
   Change:*MAT_PIECEWISE_LINEAR_PLASTICITY to MAT_ELASTIC
4. **Section:** changing to linear elements
   Linear element tyepe: **Shell** 18,20, and 21; **solid** 18.
5. **Keep:** ”Boundary Conditions” and ”Connectors” like joints, spotwelds, rbe2s, rbe3s and so on.

Highlights (NVH)

Click “One Button” to convert crash model to nvh model.

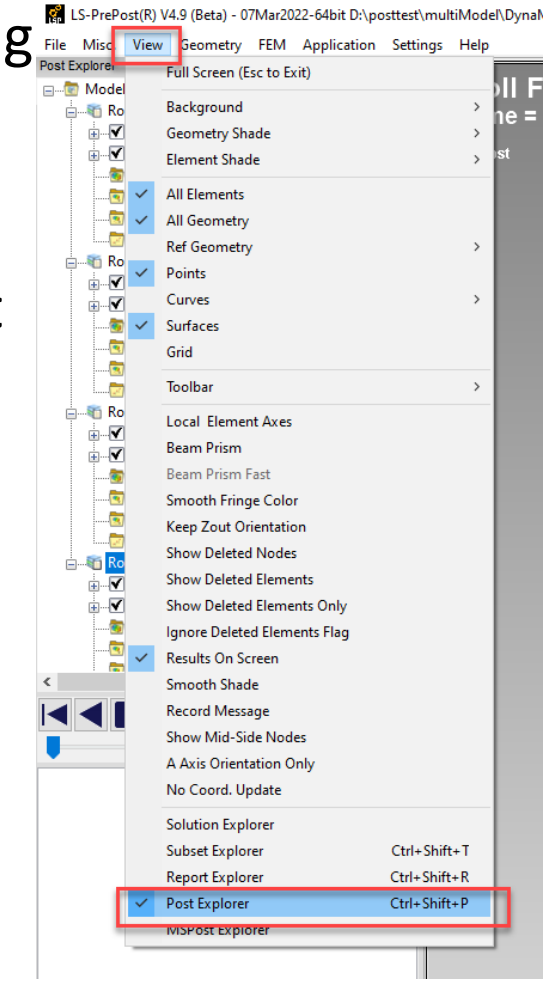


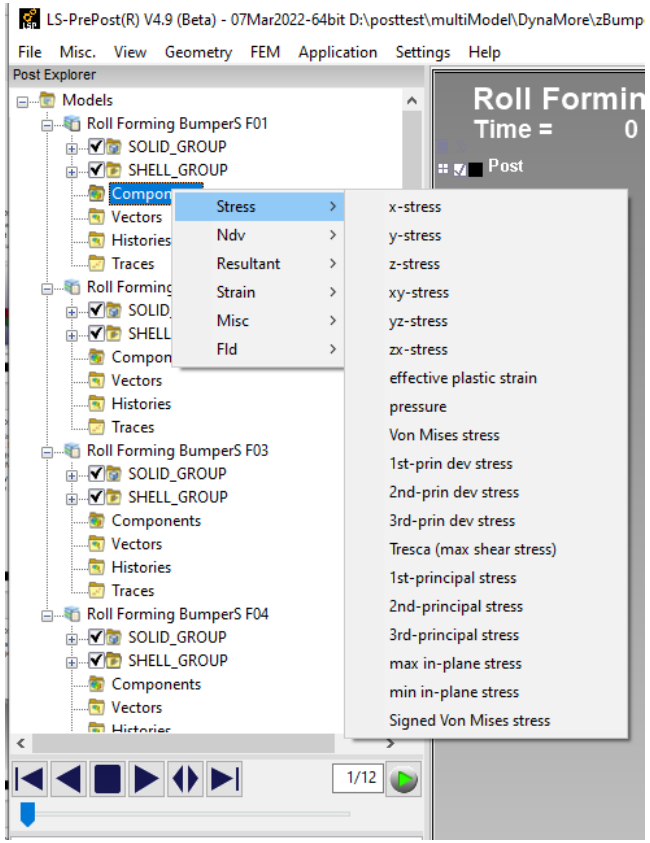
Solution Explorer

- Solution Explorer can support different case types: “Structure”, “ICFD”, ”Thermal”, “Structured-ALE” ,“Drop Test” ,”EM”, ”NVH”…. And LS-Prepost can add more analysis types into the Solution Explorer.
- The flow line is based on the tree structure and items’ properties, including the whole pre-processing.
- Users don’t need to edit the LS-DYNA input file by hand. The tree structure and properties are both designed to be friendly to engineers.
- Many tools in LS-PrePost can be integrated to the property explorer. And this can reduce the number of the popup windows

Post-Processing – Introduction of Post Explorer

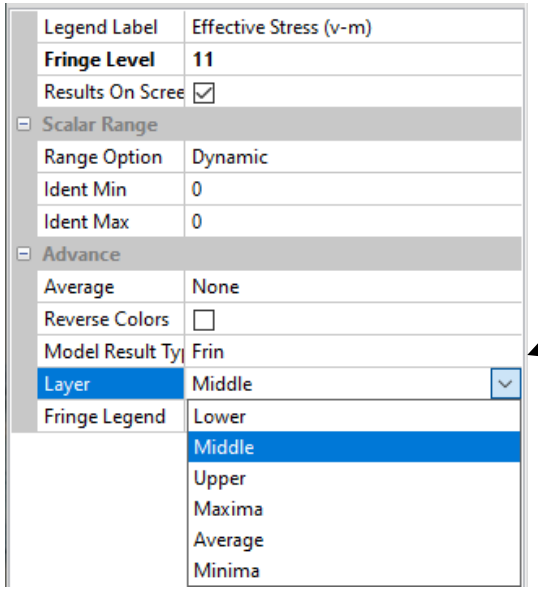
- A new paradigm of LS-DYNA post-processing in LS-PrePost
- It is feature tree based operations
- To activate: pull down menu “View”->”Post Explorer”
- Multiple models will be listed
- Each model has its own Components, Vectors, Histories, and Traces main objects
- Right click on these objects to select sub-object

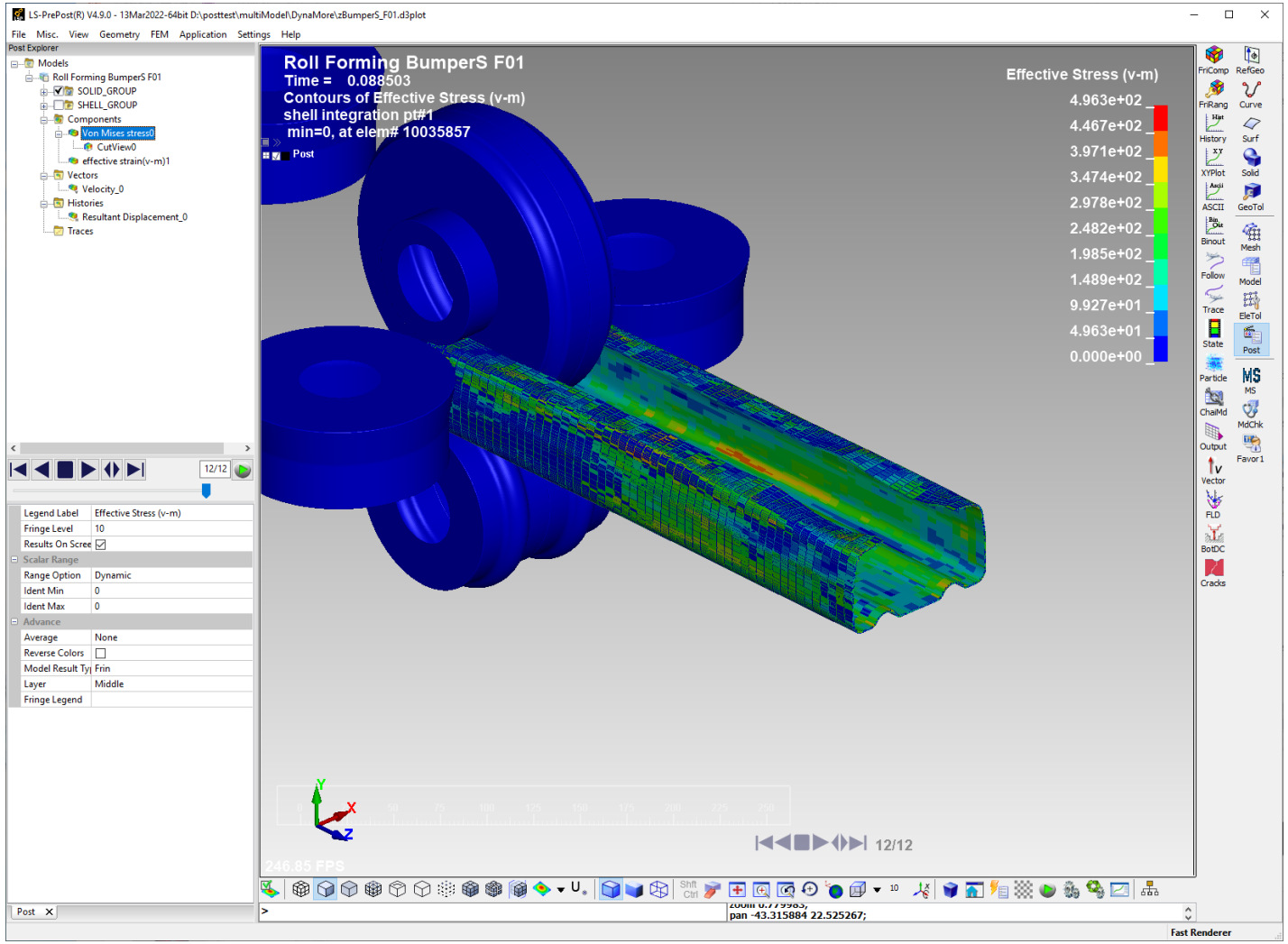




Post-Processing – Introduction of Post Explorer

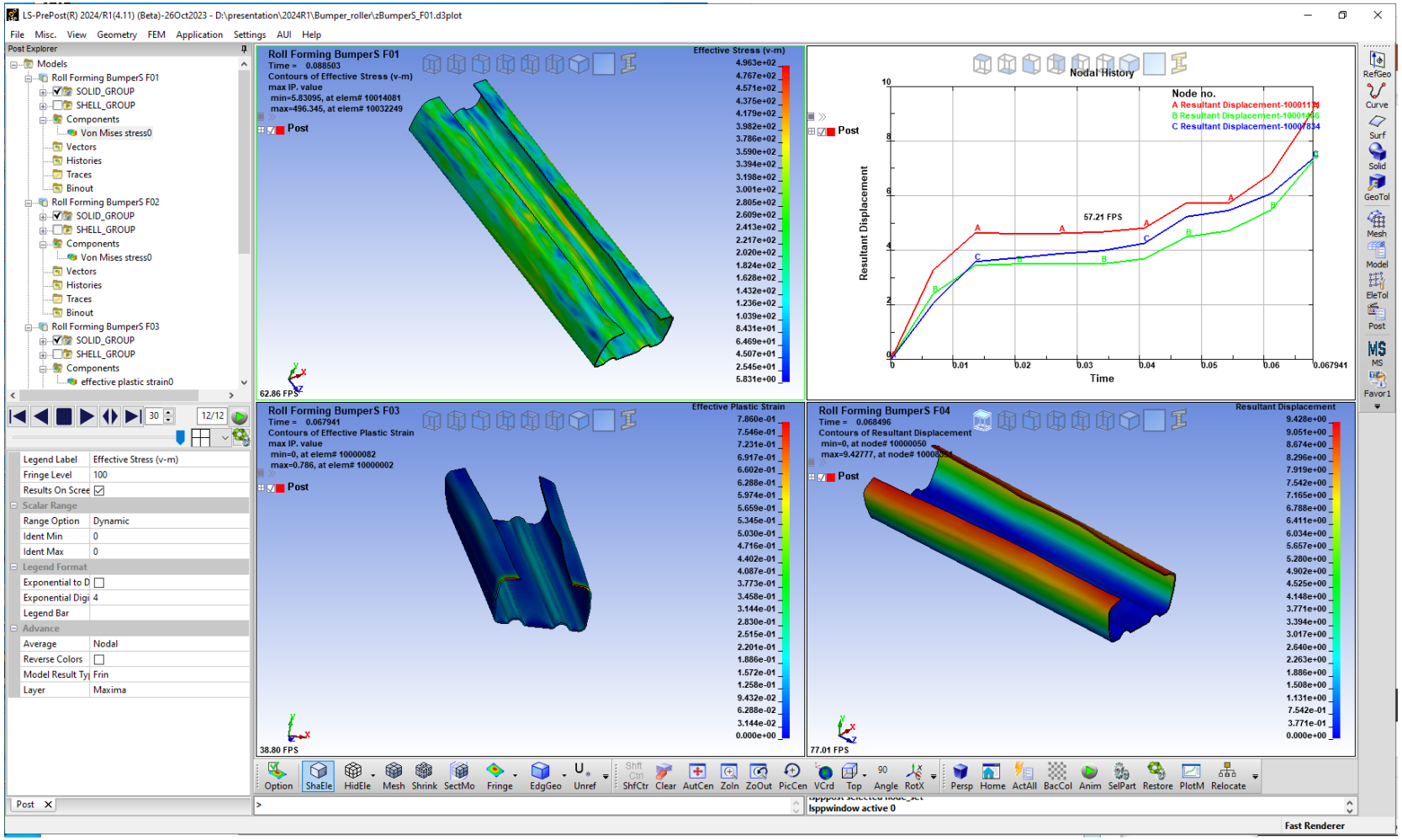
- Each selected object has its own property tree
- Many quantities associated with this object can be changed on the property tree





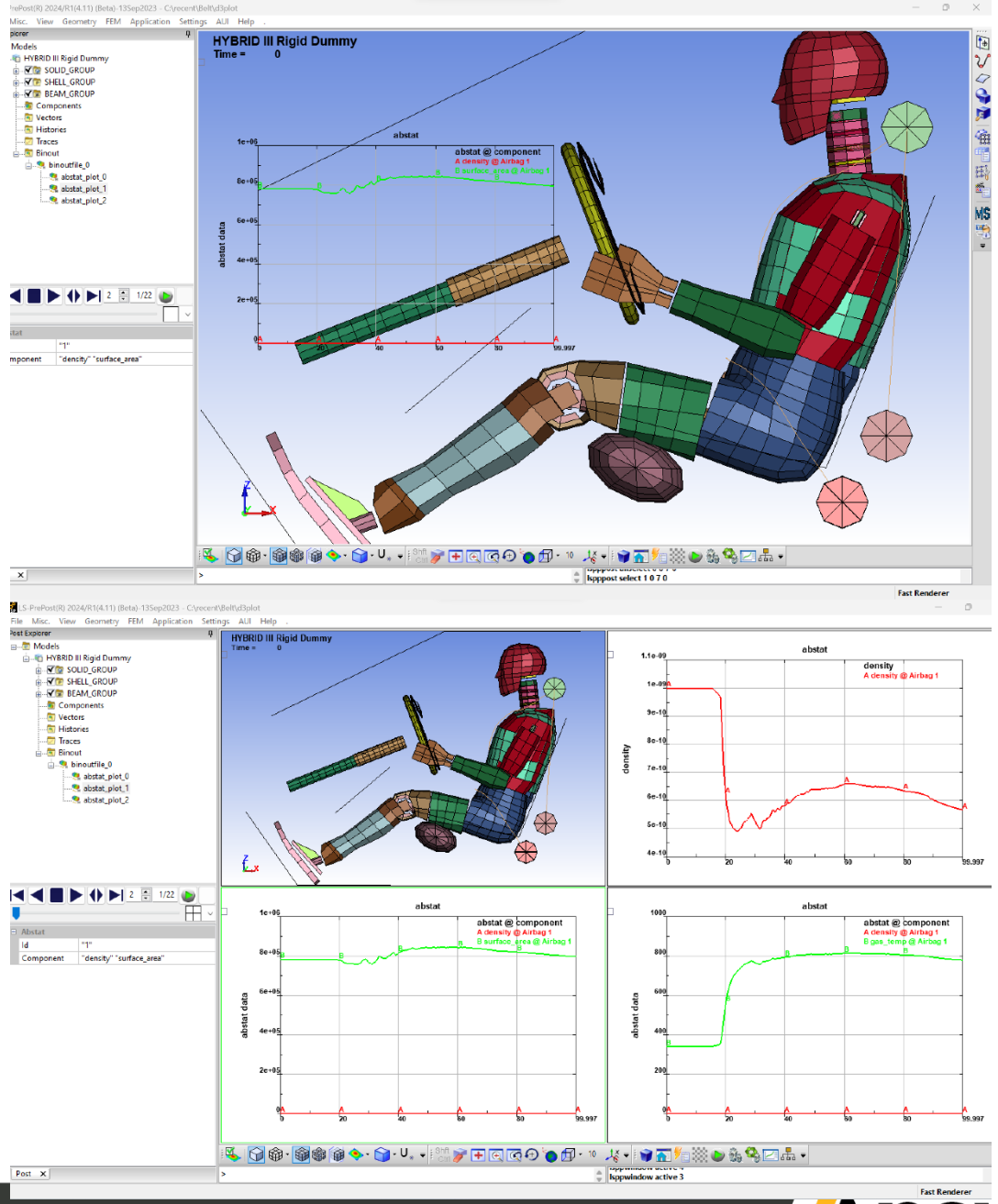
Post-Processing – Introduction of Post Explorer

- Multiple models can be shown on Split windows
- History data (XY plot) can also be drawn on one of the windows



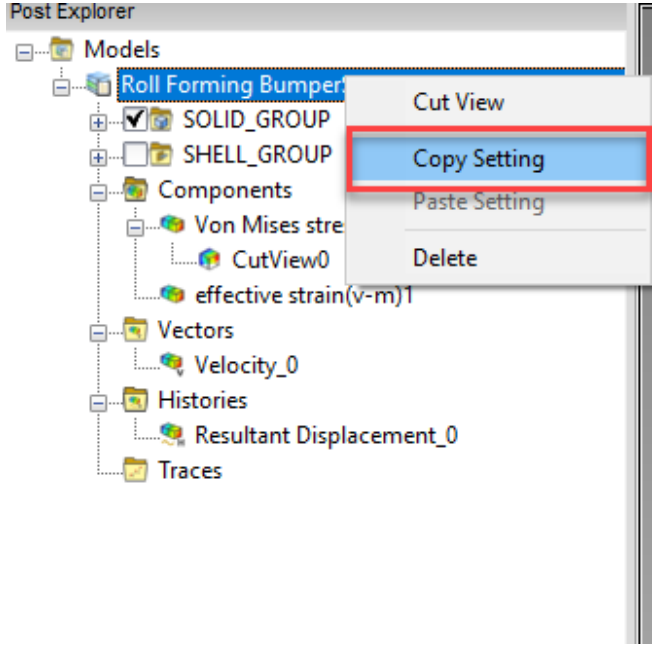
Post-Processing – Post Explorer

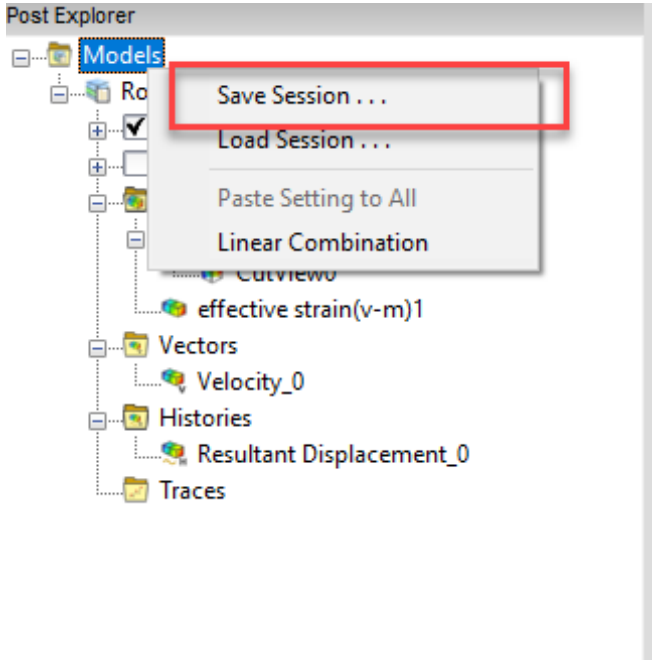
- Binout Support
- Binout data is one of the object on the Feature tree
- Not all Binout branches are supported for now
- ASCII data interface will come in the future



Post-Processing – Introduction of Post Explorer

- Many objects with their properties can be setup in the feature tree
- The Settings for one model can be copied and pasted to other model (if multiple modes have been loaded)
- All settings for the session can be saved to file and be loaded back in the future





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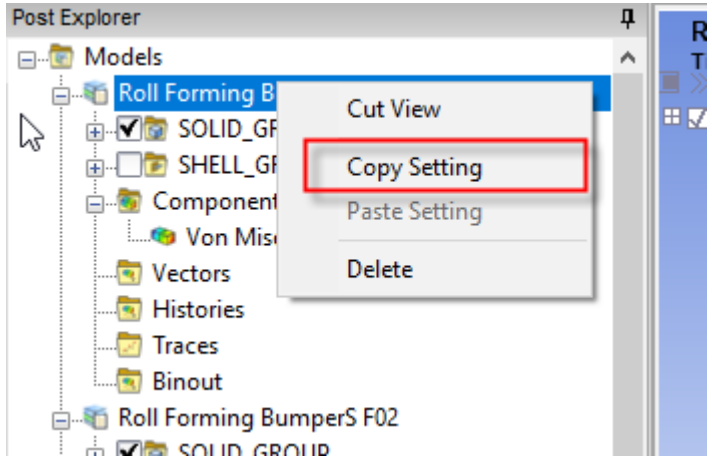

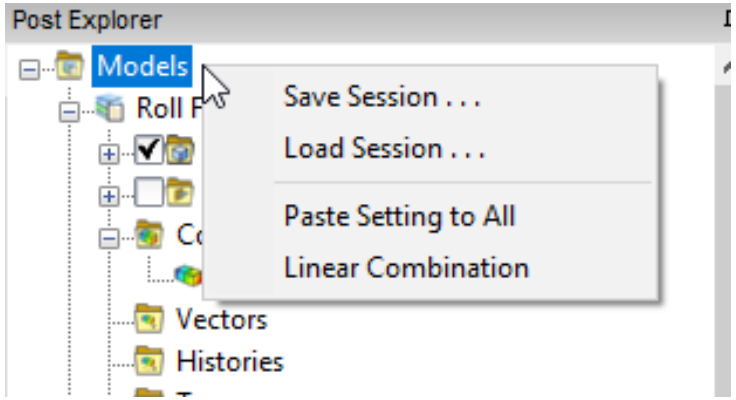

Conclusions

- The development version LSPP4.11 will be formally released early 2024 (to match Ansys R2024R1)
- LSPP4.9 and 4.10 will only have updates for bug fixes
- Continue to focus in Solution Explorer and Post-Explorer developments
- Continue to keep up with the LS-DYNA's demand in pre- and post-processing requirements
- User's suggestions and requests make LSPP better and more robust

Thanks

Ansys