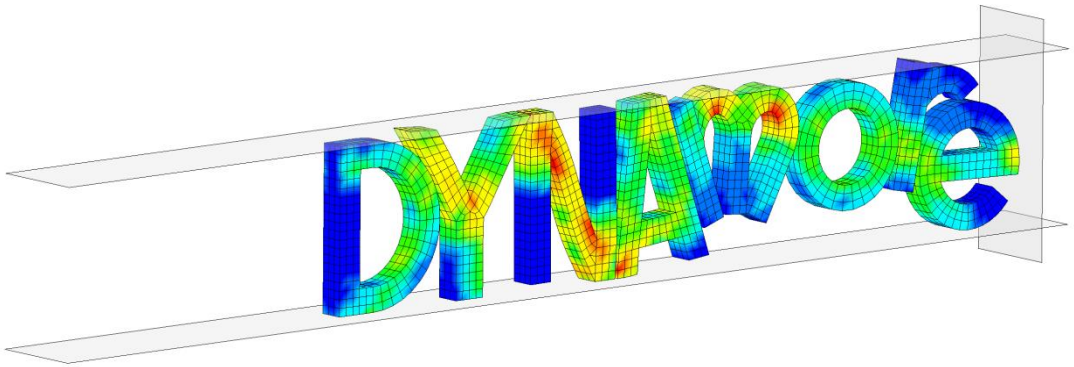
DYNAmore GmbH
LS-DYNA

- Current status of LS-PrePost
- New Features for Preprocessing
- New Features for Postprocessing
- Ongoing Developments



Current Status of LS-PrePost

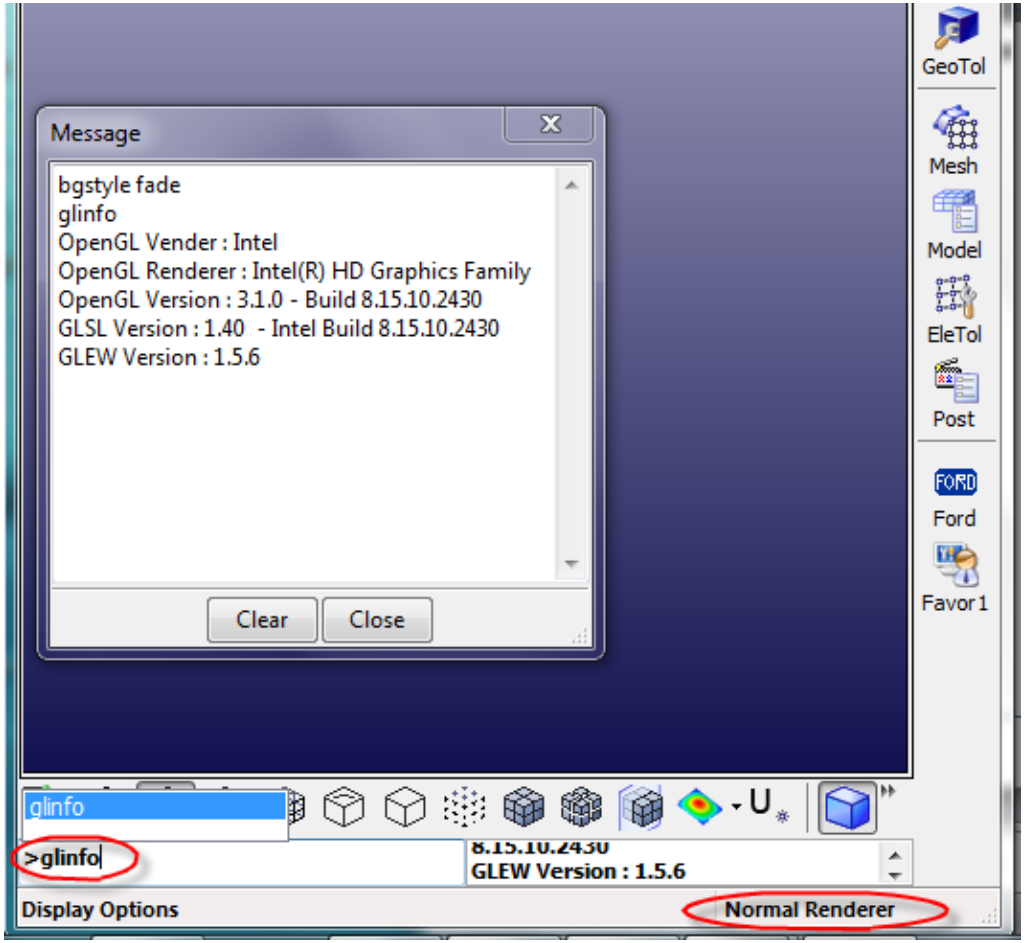
- Support has been done from United States, Europe and China, which yields better turn around time
- Version Status
  - 4.0 is the currently released version
  - 4.1 has been frozen and will be released end of April 2014
  - 4.2 will soon be started and will be available with new features in April 2014
- OS Support
  - Linux 64-bit systems, Windows 32bit and 64bits (XP, Vista, Win7), Apple Mac OS 10.6 and 10.9
- Both version 4.0 and 4.1 still support the old-style interface but
  - New features will not be implemented in the old style interface
  - Some features like reading IGES/VDA data format and meshing are no longer supported in the old-style interface

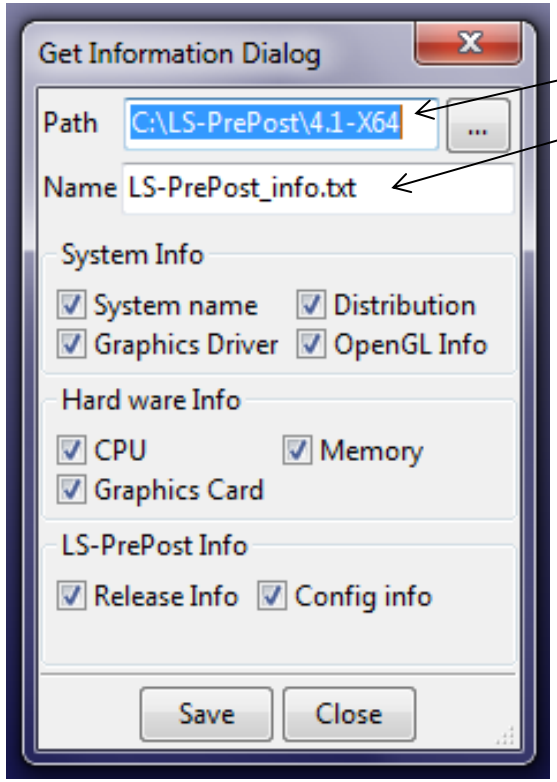
http://ftp.lstc.com/anonymous/outgoing/lsprepost/4.0
http://ftp.lstc.com/anonymous/outgoing/lsprepost/4.1

Fast Rendering & System Information in V4.0/4.1

- Fast rendering is the default rendering mode for versions 4.0/4.1
- If graphics hardware is not capable, “normal rendering” will be used automatically
- If “fast rendering” still causes problems, please switch to “normal rendering”
- To switch between “fast rendering” and “normal rendering” mode, press “ctrl+L twice” before loading the data
- Rendering mode will be memorized and recorded in the configuration file
- For certain hardware and model size, the “fast rendering” mode can result in 10x to 15x speed up

- Type “glinfo” in the command area to show graphics hardware and software version while “crtl+O” will save system information to file





Path and file name

Batch Mode Operations

- Use -nographics on the command line:
  - LsPrePost c=cmd.cfile -nographics
- The -nographics option
  - Disables the graphics window but still requires graphics hardware and software to perform operations
  - Works well on local desktop machine
  - On remote machine, it requires compatible graphics hardware between the local machine and the remote machine
- Use “runc” command for truly no graphics operations (same as LS-PrePost 2.4 or older):
  - LsPrePost runc=cmd.cfile

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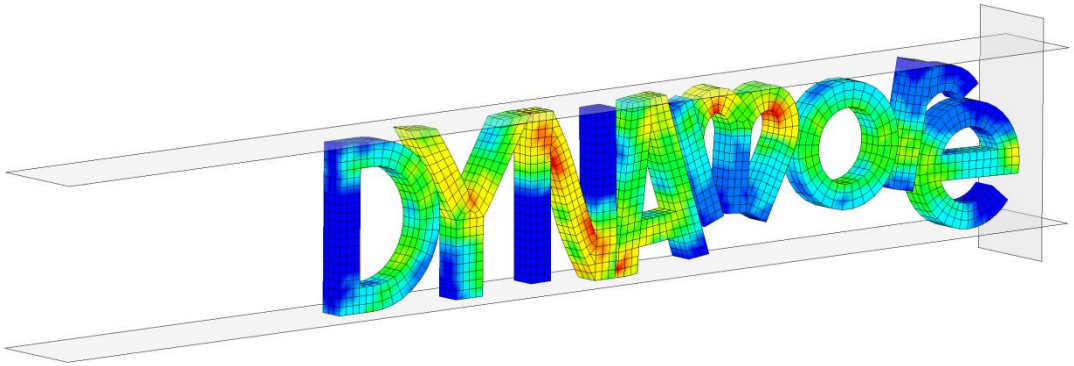
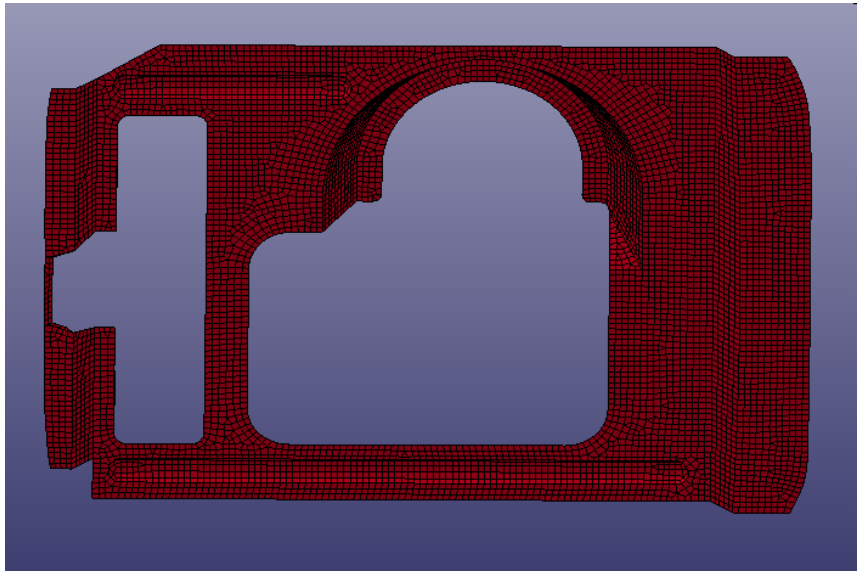


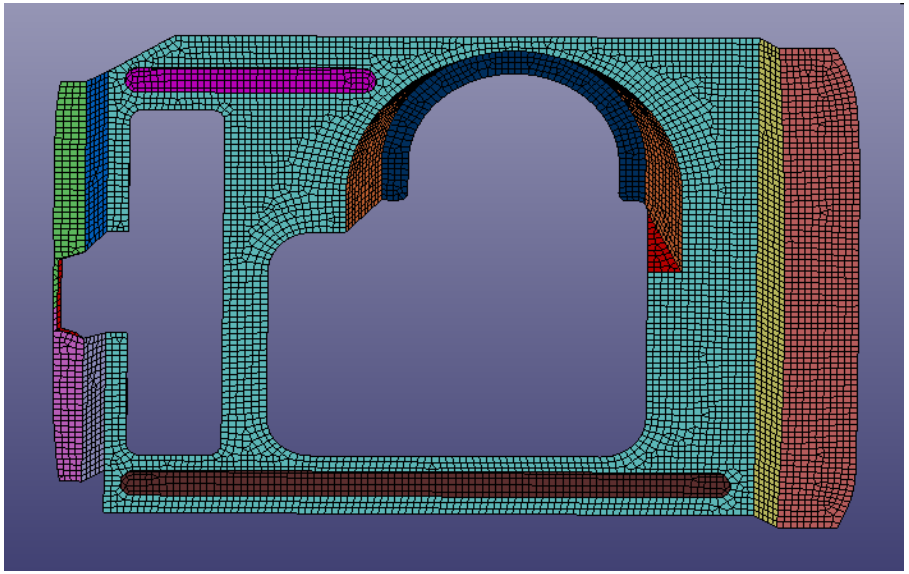
New Features for Preprocessing

- Support all latest LS-DYNA input keywords
  - **`*CESE_*`**
  - **`*MAT_261, _262, _266, _270, _271`**
  - **`*MAT_ALE_INCOMPRESSIBLE`**
  - **`*LSO_*`**
  - **`*DEFINE_DE_*`**
  - **`*CONTROL_FORMING_*`**
- Support merging of CNRB (constrained Nodal Rigid Body) data
- Create **`*ELEMENT_PLOTEL`** from CNRB data for visualization in post-processing
- Create Beam element end release data
- In “SelPart” interface, right click on part to show part properties
- Allow offsetting nodes/elements/parts IDs with negative number

New Features in Geometry Module

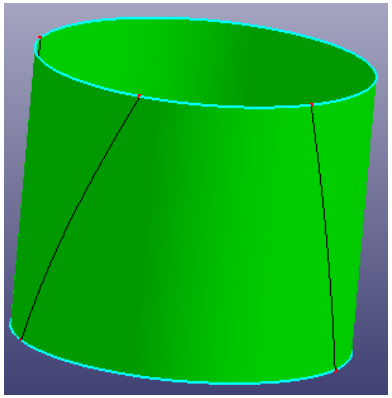
- Upgrade OCC (Open Cascade) kernel from 6.3 to 6.5.3
  - Many bug fixed and memory leaks fixed
  - Better geometry tessellation algorithm
- New middle surface creation algorithm
- 3D interactive tools
- Mesh regionalization – separate mesh into regions based on curvature

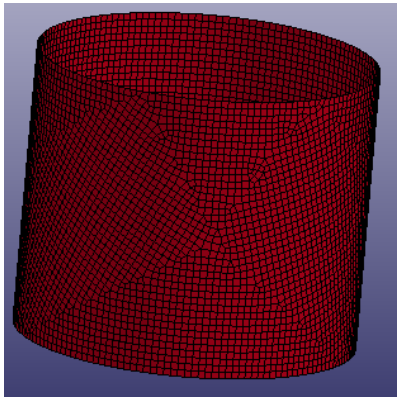




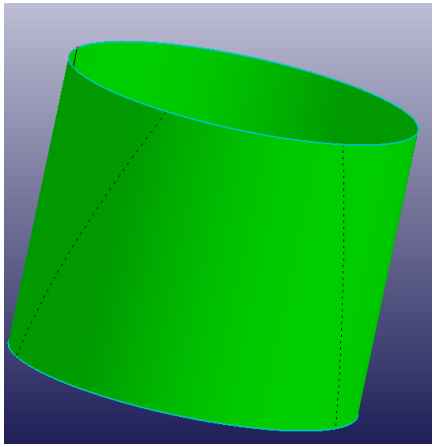
Suppress Boundary Lines for Surface Meshing

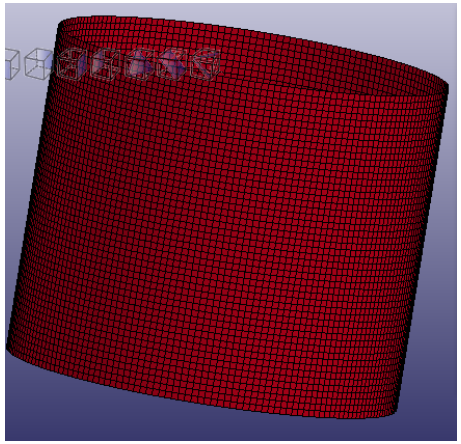
- Common boundaries between surfaces can be suppressed to form a joint surface, this will allow mesh across boundary lines to give a better mesh.





Boundary lines not suppressed

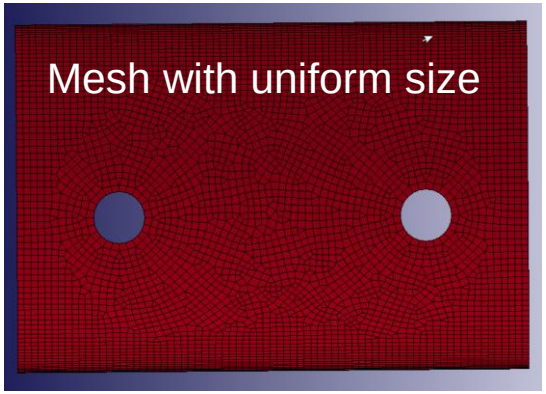


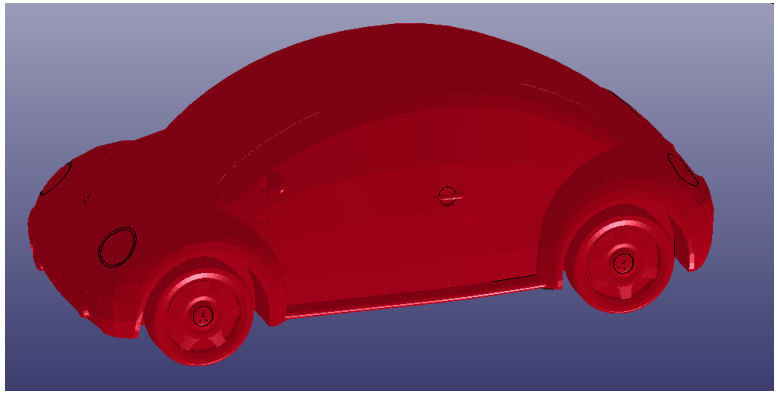


Boundary lines suppressed

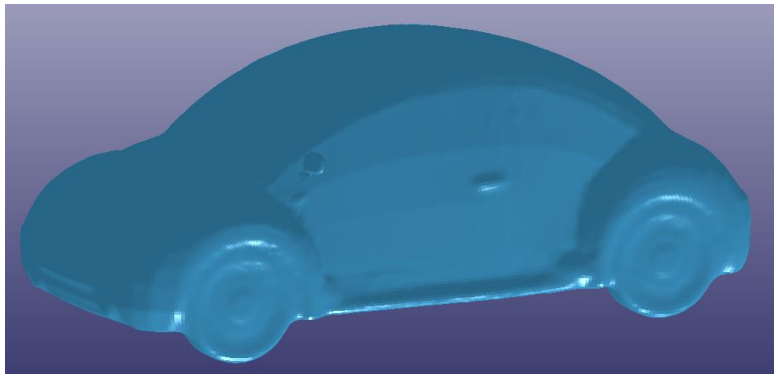
New Features in Meshing

- Shell surface re-mesh to give better mesh quality at the same time maintain boundary compatibility
- Variable size mesh for automatic surface meshing
- Shrink wrap model for CFD application (Mesh -> EleGen -> Shell By: Wrap)



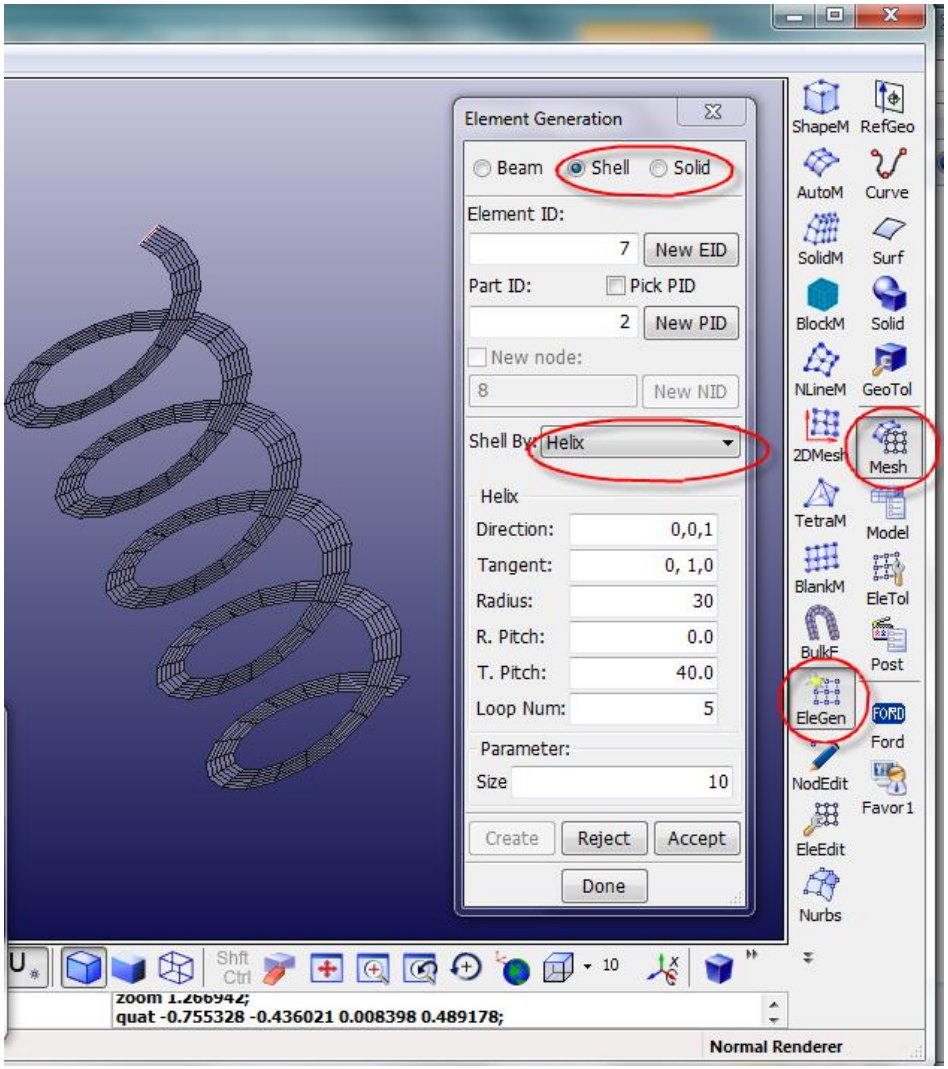


Original car model



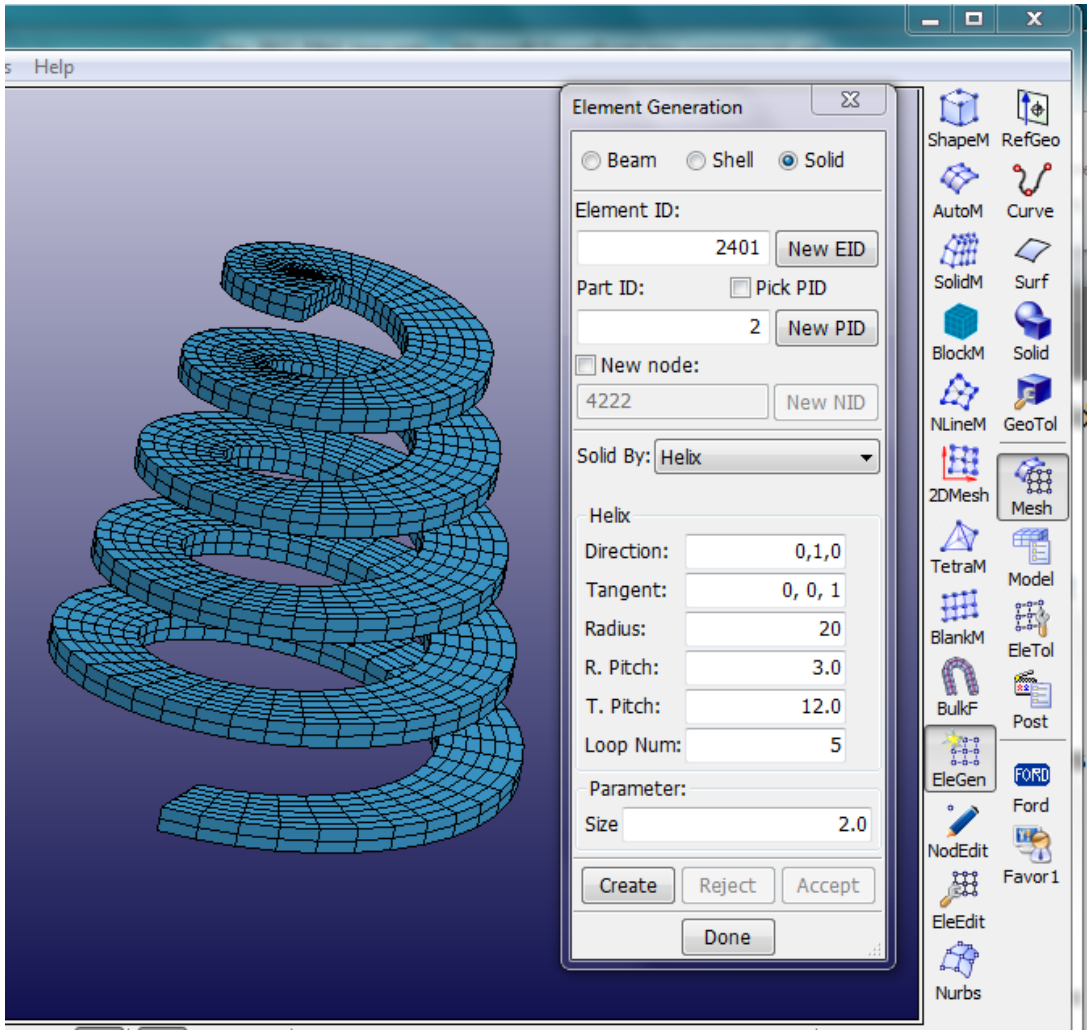
Outer skin of the car model (shrink wrap)

Helix Finite-Element Model Creation



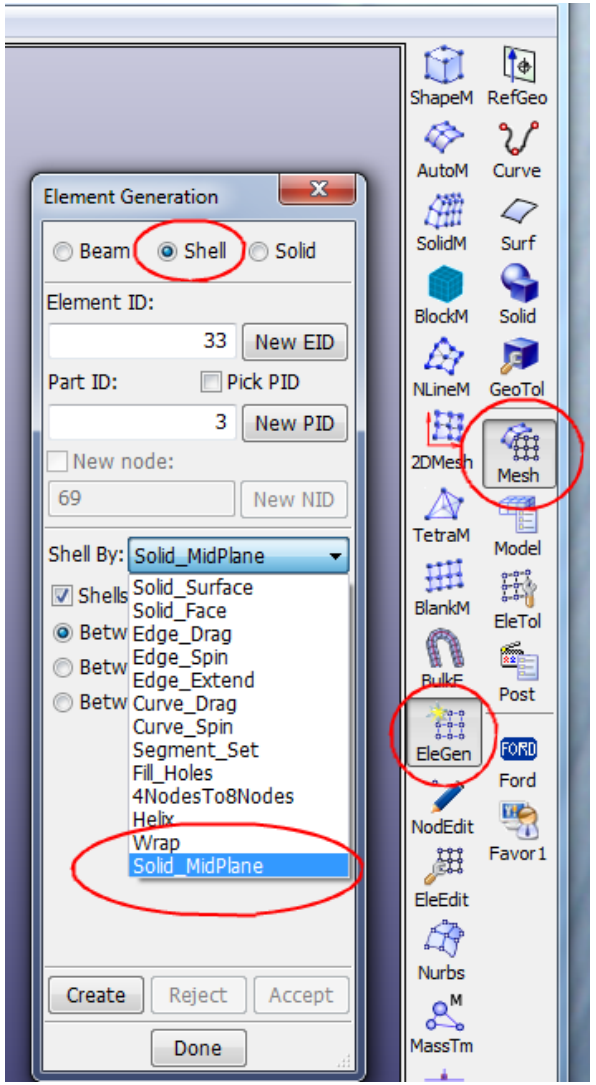
- Model can be generated with
  - Shell elements
  - Solid elements
- Workflow
  - Go to Mesh->EleGen->Shell or Solid
  - Select Helix
  - Choose paramters
- Warning message will be given if it is not possible to create the helix model

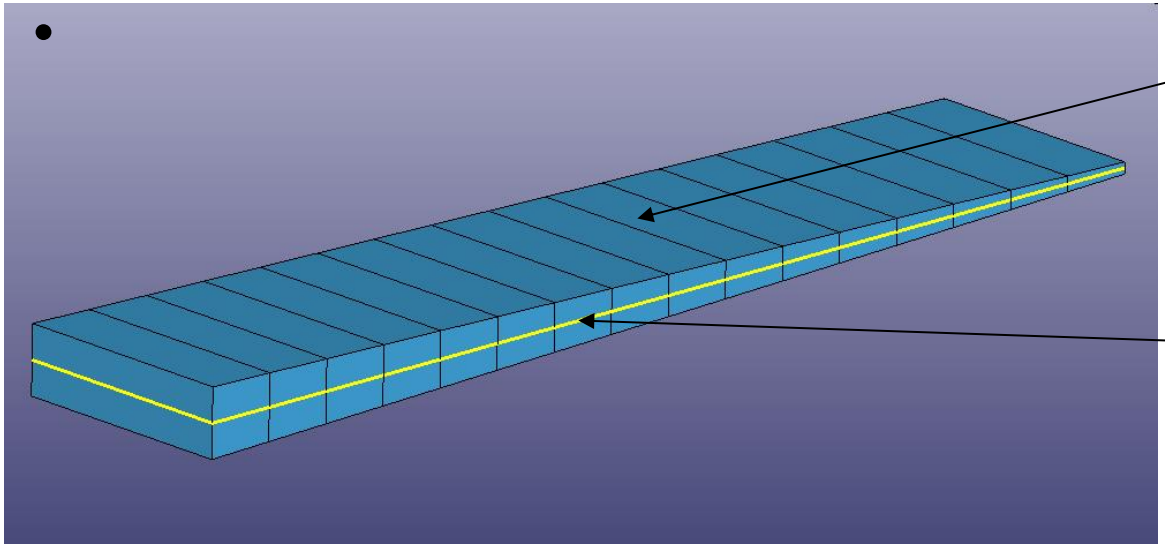
- Pitches can be entered in
  - T direction
  - R direction
- Size is the element size in the spiral direction
- Number of loops has to be an integer number

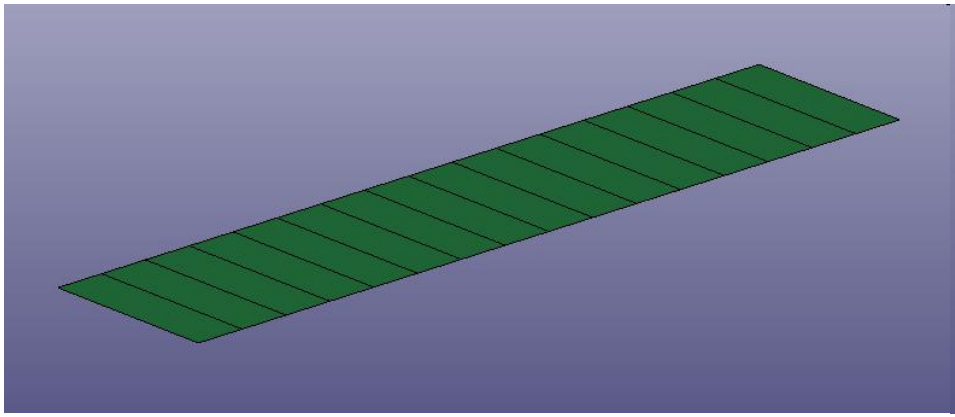


Solid Mid-Plane Element Creation

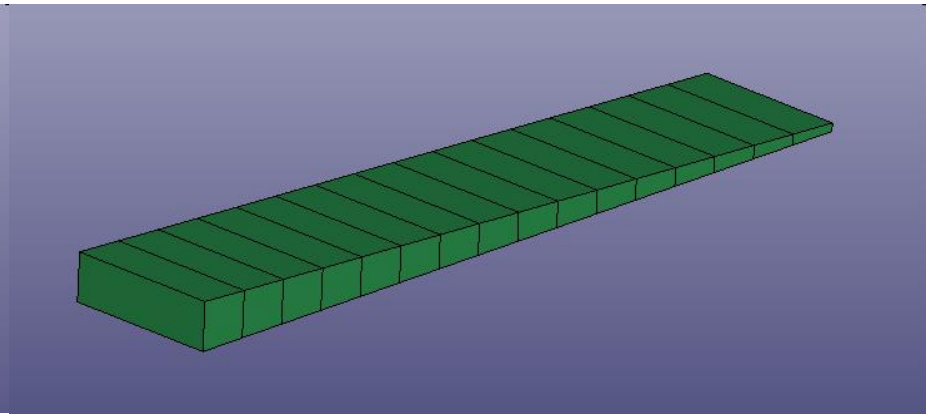
- To create shell elements at the mid-plane of solid elements
  - Captures the thickness of the solid element
  - Includes the thickness in the **`*ELEMENT_SHELL_THICKNESS`** card for each node of the shell
  - User can choose the mid-plane between the solid element faces pair as 1-2, 3-5 or 4-6
- Workflow
  - Go to Mesh->EleGen->Shell
  - Select Shell by: Solid_MidPlane
  - Choose between faces







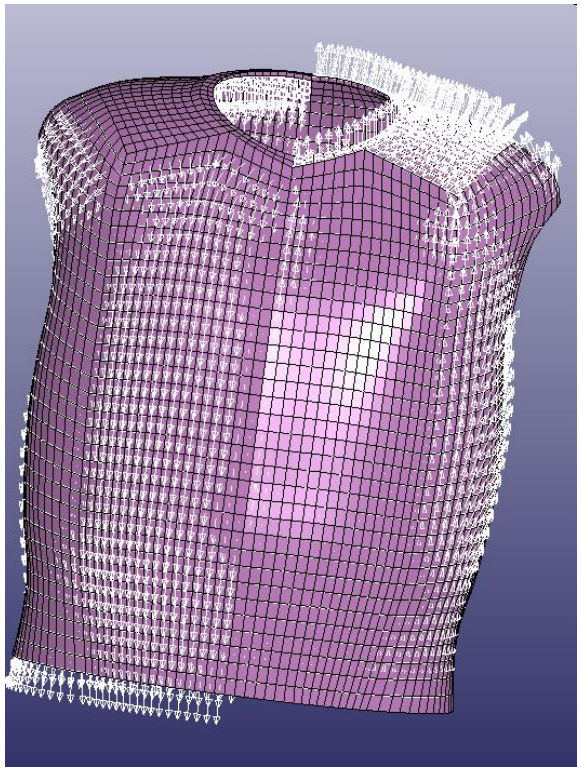
The new shell part



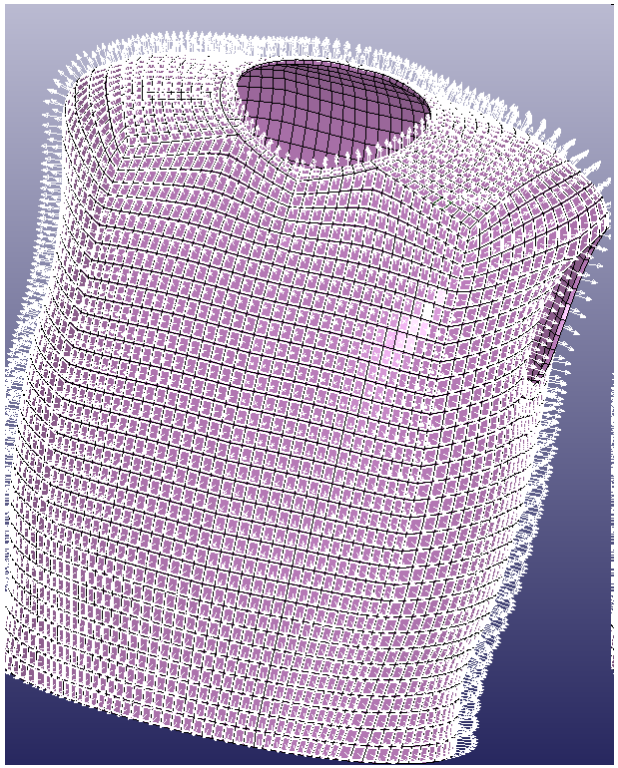
Shell display with thickness

SOLID/TSHELL Alignment

- Tshell normal re-orientation
  - Re-orient the connectivity of the Tshell elements such that the normal of all elements are aligned

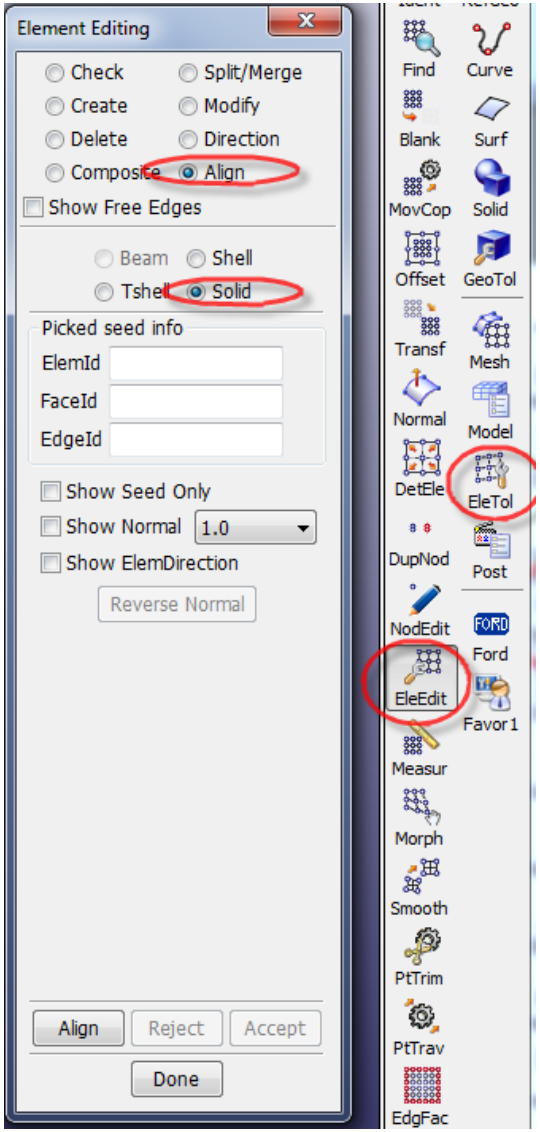


Normals before alignment

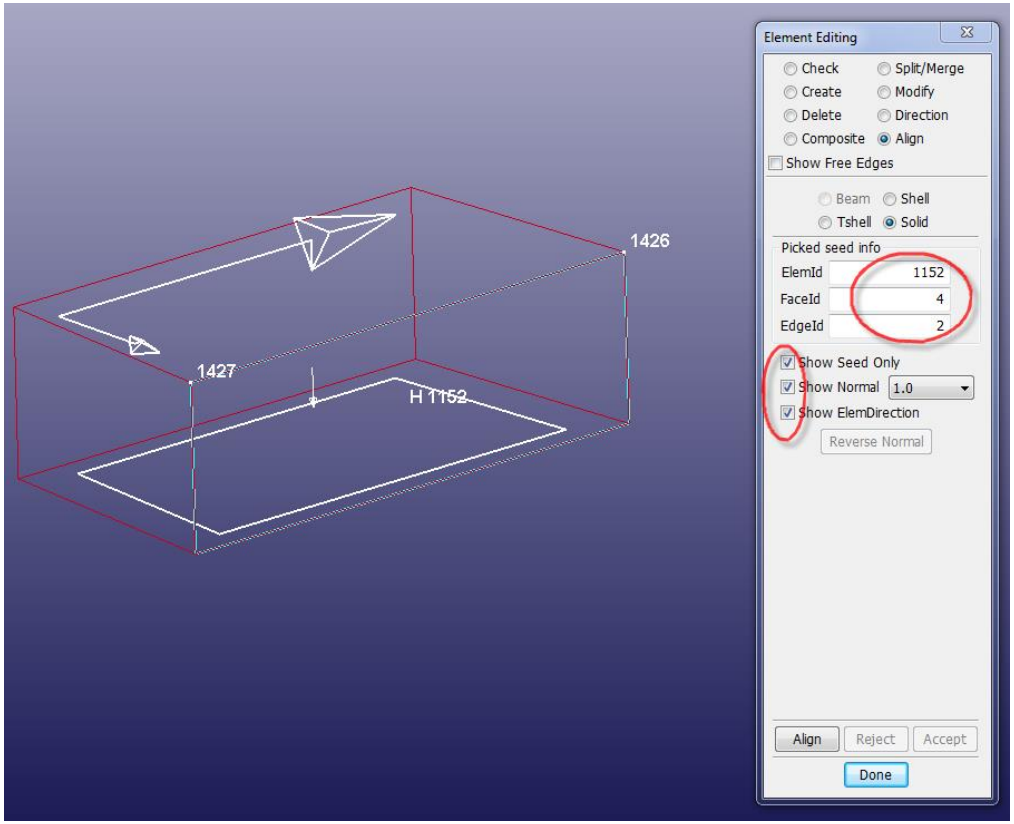


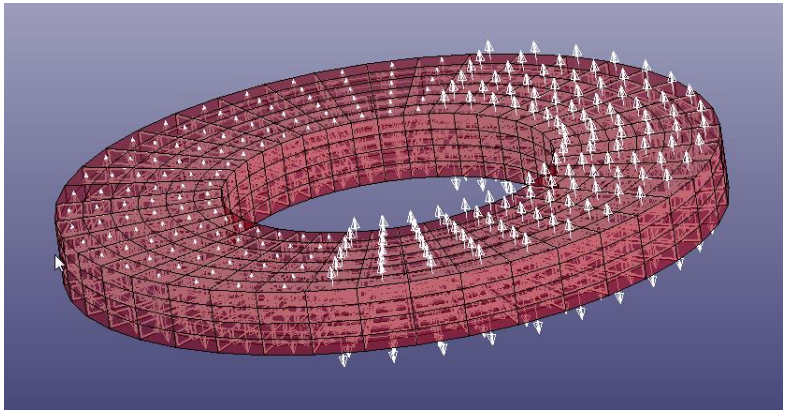
Normals after alignment

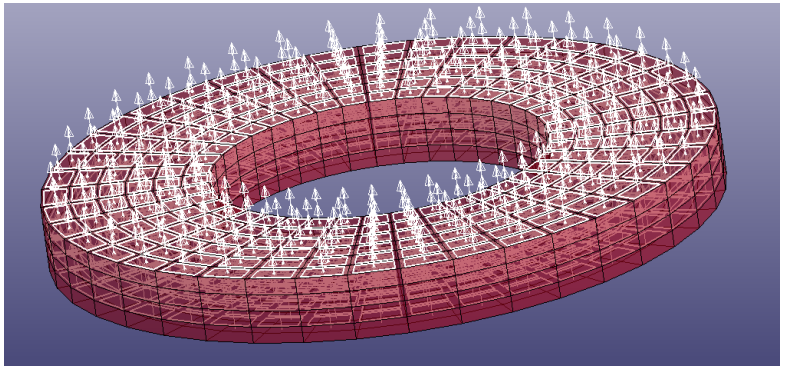
- Solid/Tshell connectivity re-alignment
  - Re-align the connectivity of a group of solid/Tshell elements such that the orientation of the elements will be consistent
- Workflow
  - Pick the face and edge of a seed element,
    - the picked face will be used as face one
    - the picked edge will be used as n1->n2 (first edge)
  - “Show Seed only” will show only the picked element and allows the user to select different face/edge
  - Show normal, show direction will show element orientation



- Solid/Tshell connectivity re-alignment
  - Re-align the connectivity of a group of solid/tshell elements such that the orientation of the elements will be consistent



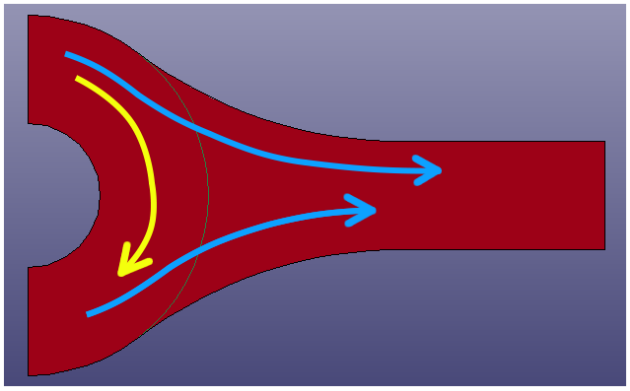


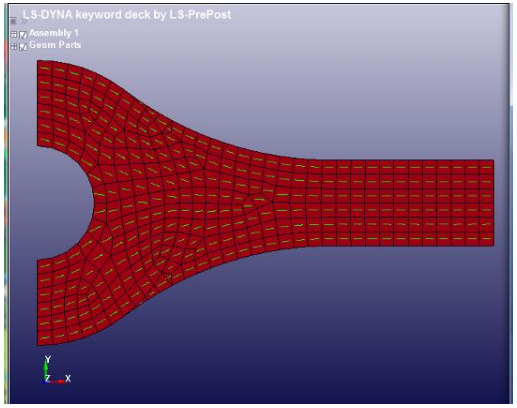


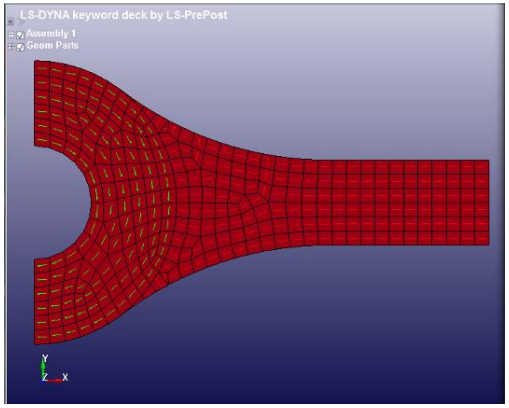
Composite Lamination Modeling Setup

- Each layer (ply) can have its own physical properties
  - thickness
  - material data
  - material direction
- A part can have different number of layers

- Layer material orientation can be defined by
  - Vector, Rotation, Smoothing by averaging all elements direction, and Mapping (mapping from a set of defined curves)

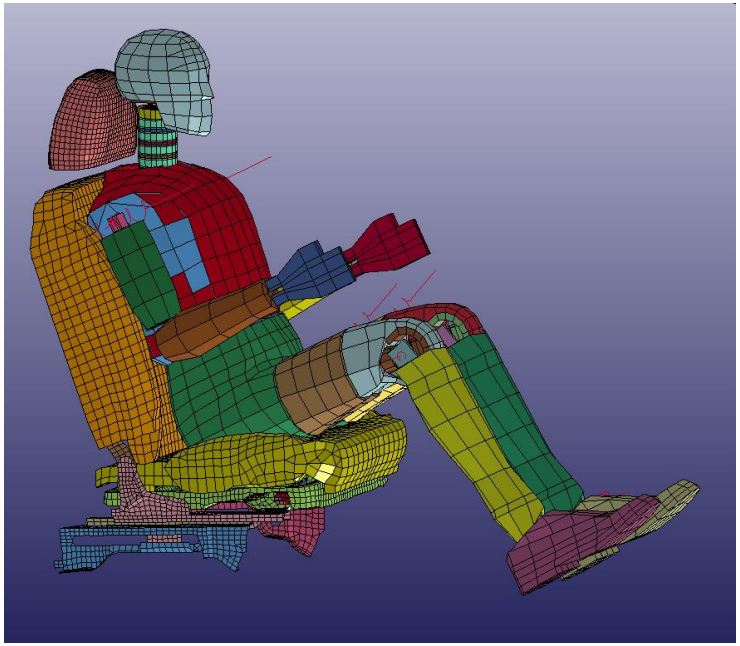




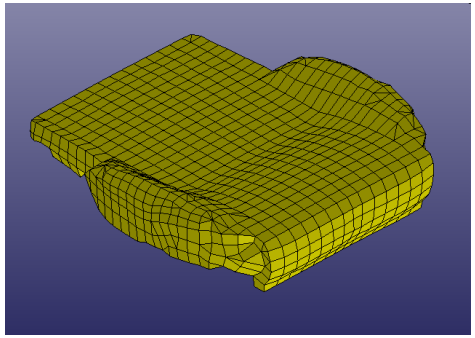


Seat Deformer

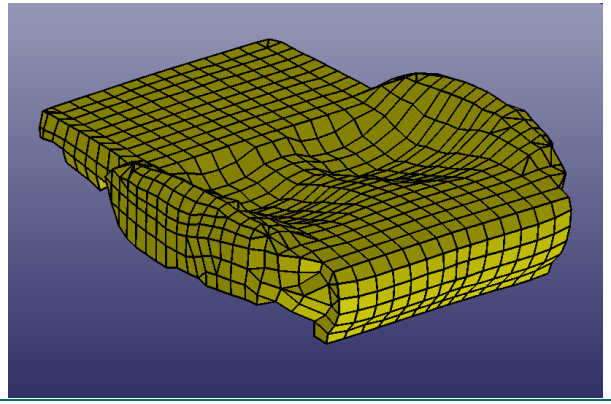
- To deform the seat after a dummy has been positioned in its correct location
- Interior nodes of the seat are moved such that interior elements are smoothly deformed
- **`*INITIAL_FOAM_REFERENCE_GEOMETRY`** is created (initial deform. grad.)



Dummy position on the seat

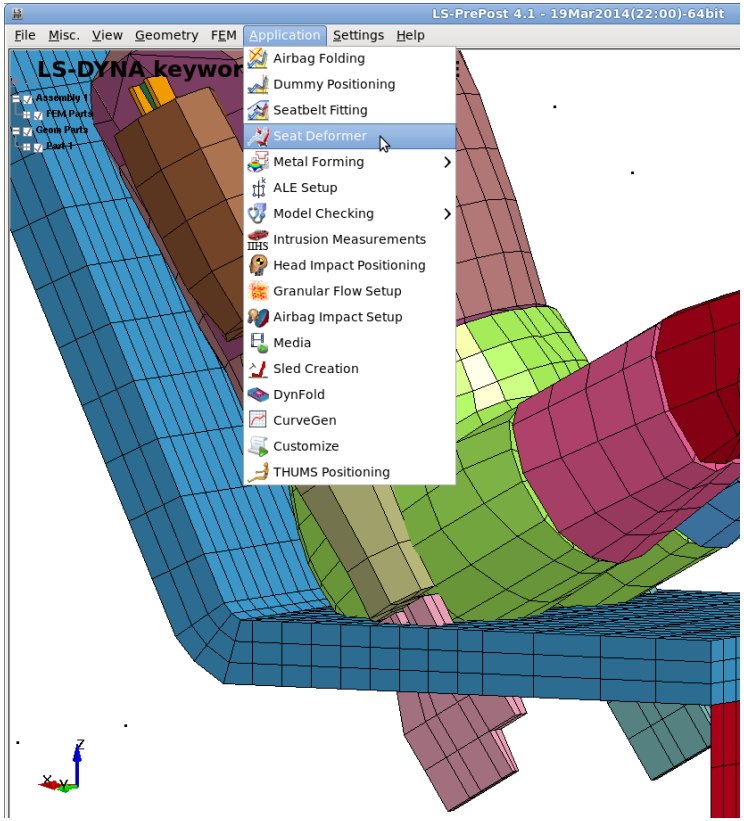


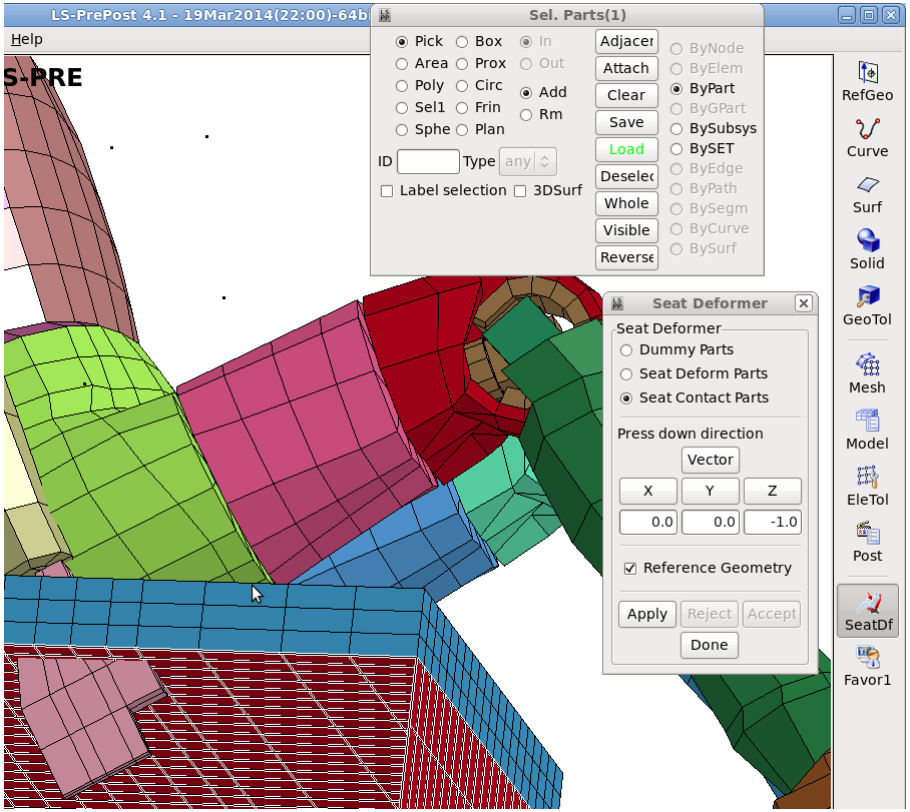
Before the “Seat Deformer” operation



After the “Seat Deformer” operation

- Workflow
  - Generate a situation with overlap
  - Open: Application -> Seat Deformer
    - Click on respective parts Dummy, Seat and Support of the Seat
    - Define press down direction

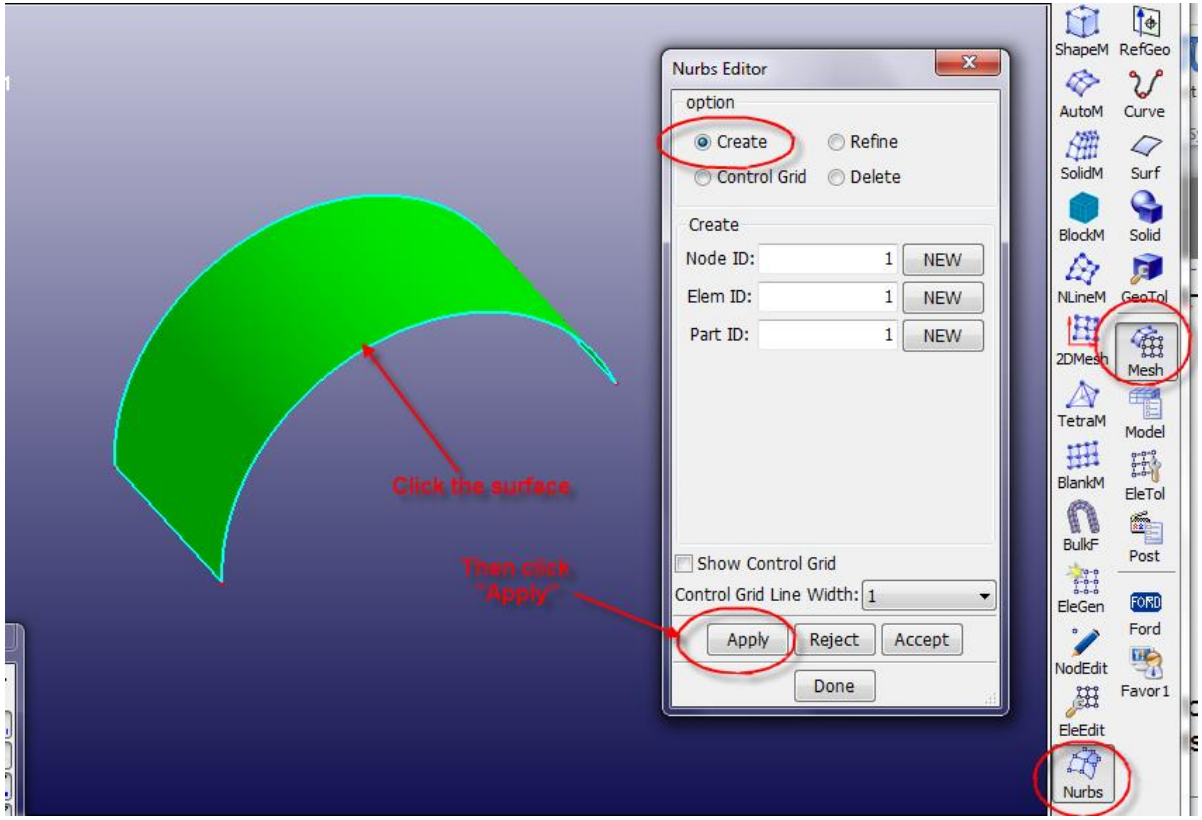




Iso-Geometric Elements

- Create **`*ELEMENT_NURB`** data from IGES or STEP geometry data
- Read iso-geometric elements (**`*ELEMENT_NURB`**) data
- Read igaplot file for post-processing
  - An igaplot is created by LS-DYNA when iso-geometric elements are present in the keyword data
- Current version of LS-DYNA
  - Create igaplot file along with interpolated mesh for the NURBS element
  - The interpolated mesh is stored in the regular d3plot file
  - Fringe data can only be processed with the interpolated mesh for now
- Future versions of LS-DYNA
  - d3plot will not contain the interpolated mesh
  - LS-PrePost will directly fringe stress/strain data on iso-geometric elements

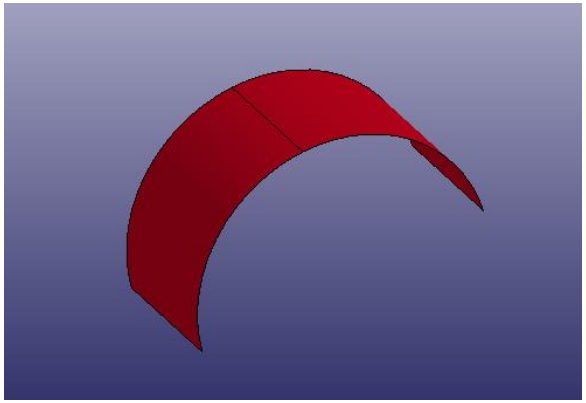
- To create iso-geometric elements, go to Mesh->Nurbs->Create,



- Current development
  - Provide capability to modify the iso-gemetric elements in LS-PrePost
  - Allow the user to refine the number of patches and modify the control points

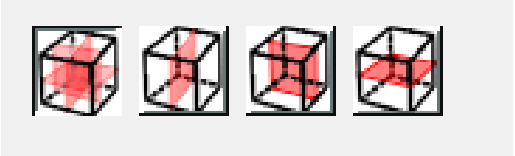
- The keyword data for iso-geometric elements

```
$# LS-DYNA Keyword file created by LS-PrePost 4.1 (Beta) - 12Apr2013(23:00)
$# Created on Apr-21-2013 (00:35:25)
*KEYWORD
*ELEMENT_SHELL_NURBS_PATCH
$#   npeid       pid       npr        pr       nps        ps
         1         1         5         2         2         1
$#     wfl      form       int      nisr      niss     imass
         1         0         0         0         0         0
$#     rk1       rk2       rk3       rk4       rk5       rk6       rk7       rk8
   0.000     0.000     0.000  1.552261  1.552261  3.104522  3.104522  3.104522
$#     sk1       sk2       sk3       sk4       sk5       sk6       sk7       sk8
   0.000     0.000  1.000000  1.000000     0.000     0.000     0.000     0.000
$#      n1        n2        n3        n4        n5        n6        n7        n8
         1         2         3         4         5         0         0         0
         6         7         8         9        10         0         0         0
$#      w1        w2        w3        w4        w5        w6        w7        w8
  1.000000  0.713630  1.000000  0.713630  1.000000     0.000     0.000     0.000
  1.000000  0.713630  1.000000  0.713630  1.000000     0.000     0.000     0.000
*NODE
$#   nid               x               y               z      tc      rc
       1       -0.999313       -0.037062           0.000       0       0
       2       -0.962931       -1.018022           0.000       0       0
       3        0.018534       -0.999828           0.000       0       0
       4        1.000000       -0.981634           0.000       0       0
```

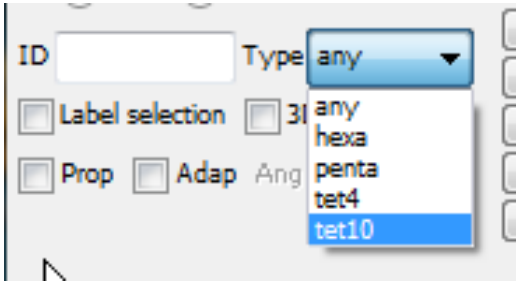


Other Miscellaneous Features

- Solid element splitting
  - Options with all 3 directions (2x2x2)
  - Or only one direction



- General selection for element can choose sub types



- Support of
  - 3D Connexion device
  - LS-DYNA Random Vibration Analysis
  - LS-DYNA Shock Spectrum Analysis

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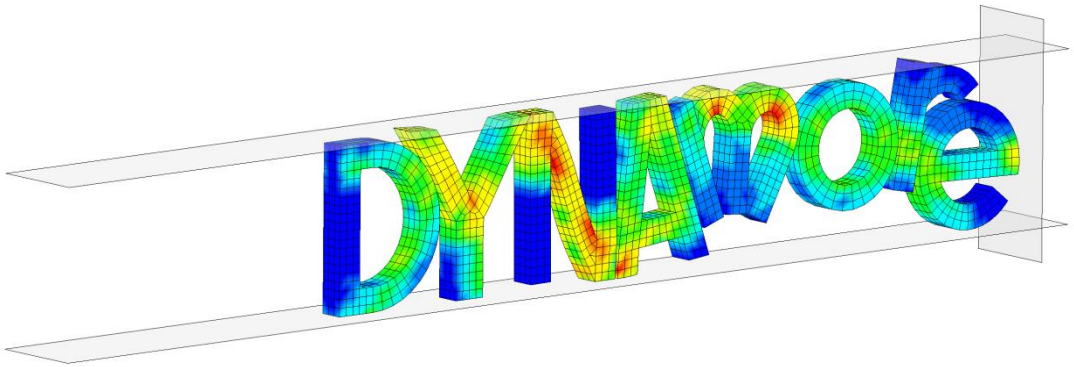
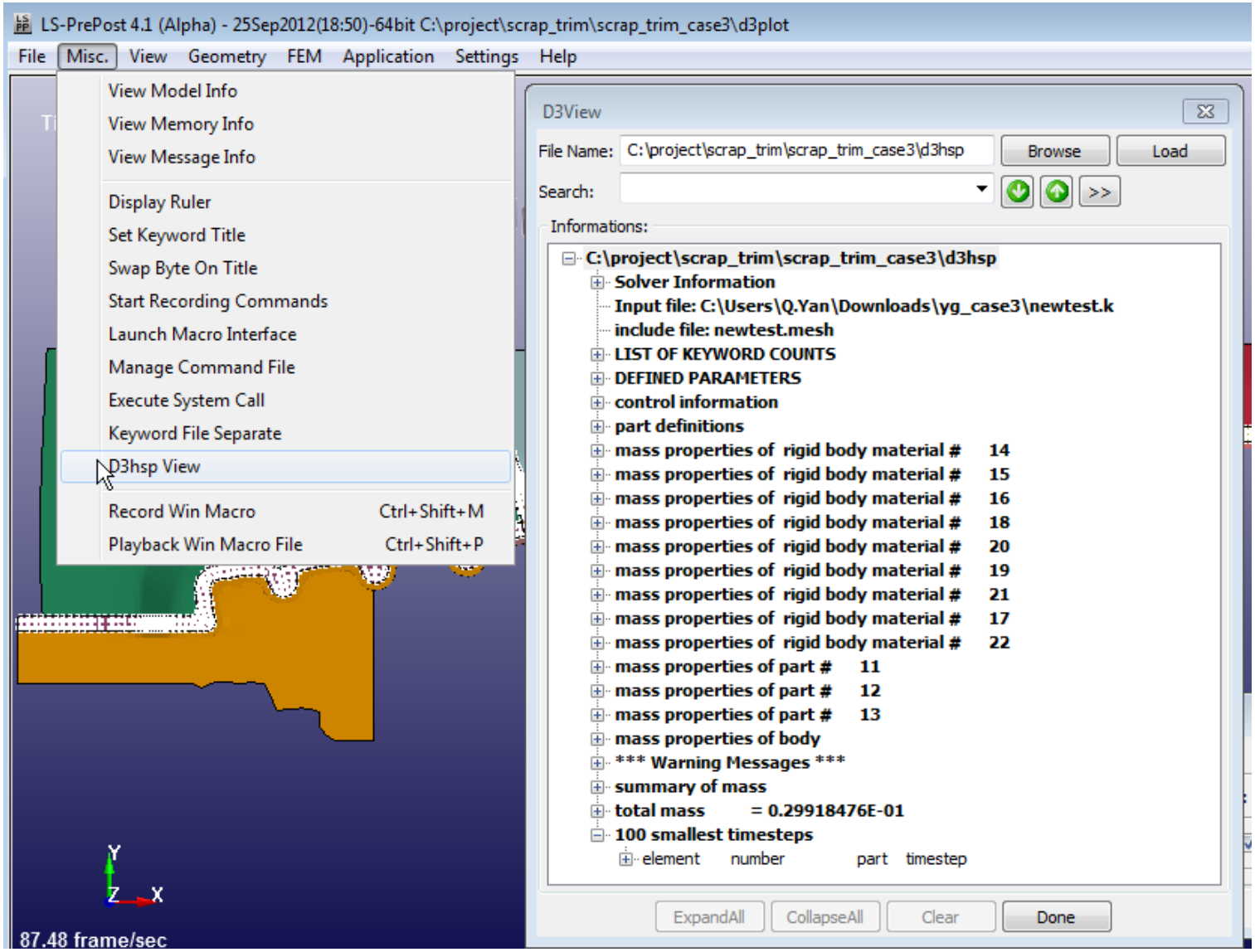
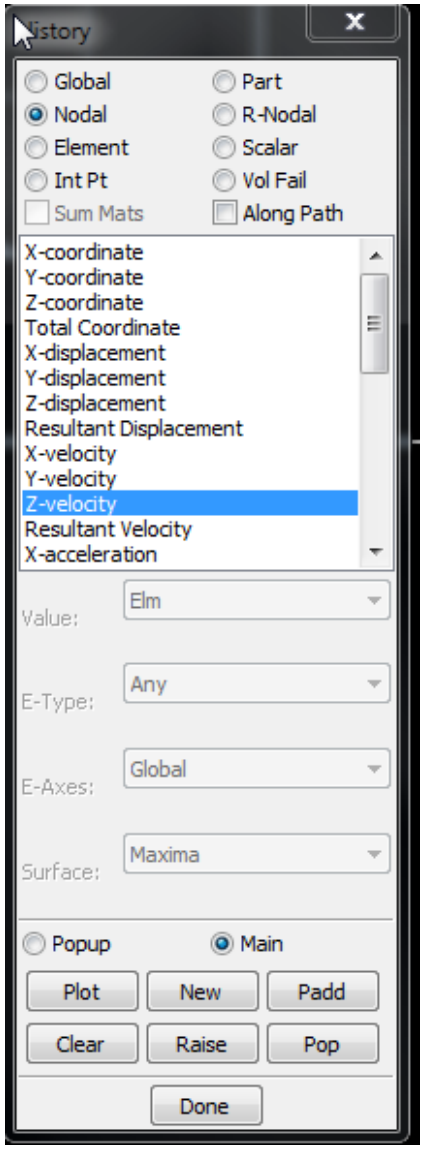


D3HSP File Viewing

- Purpose: To look at the content of the d3hsp file in an organized way
  - The d3hsp file contains a lot of information for the LS-DYNA run
  - LS-PrePost reads the information from the d3hsp file and organizes it into a tree/list structure for easy reading
  - Key phrase search is possible
  - Launch d3hsp view in the “misc” pull-down menu
  - Only available in version 4.0 and later

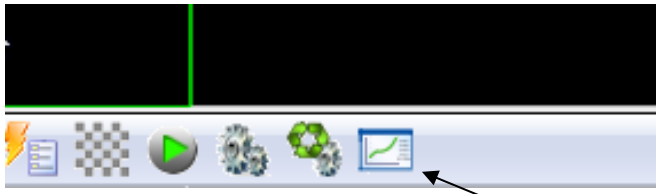

LS-PrePost 4.1 (Alpha) - 25Sep2012(18:50)-64bit C:\project\scrap_trim\scrap_trim_case3\d3plot
File
Misc.
View
Geometry
FEM
Application
Settings
Help
View Model Info
View Memory Info
View Message Info
Display Ruler
Set Keyword Title
Swap Byte On Title
Start Recording Commands
Launch Macro Interface
Manage Command File
Execute System Call
Keyword File Separate
D3hsp View
Record Win Macro Ctrl+Shift+M
Playback Win Macro File Ctrl+Shift+P
D3View
File Name: C:\project\scrap_trim\scrap_trim_case3\d3hsp
Browse
Load
Search:
>>
Informations:
C:\project\scrap_trim\scrap_trim_case3\d3hsp
Solver Information
Input file: C:\Users\Q.Yan\Downloads\yg_case3\newtest.k
include file: newtest.mesh
LIST OF KEYWORD COUNTS
DEFINED PARAMETERS
control information
part definitions
mass properties of rigid body material # 14
mass properties of rigid body material # 15
mass properties of rigid body material # 16
mass properties of rigid body material # 18
mass properties of rigid body material # 20
mass properties of rigid body material # 19
mass properties of rigid body material # 21
mass properties of rigid body material # 17
mass properties of rigid body material # 22
mass properties of part # 11
mass properties of part # 12
mass properties of part # 13
mass properties of body
*** Warning Messages ***
summary of mass
total mass = 0.29918476E-01
100 smallest timesteps
element number part timestep
ExpandAll
CollapseAll
Clear
Done
Y
Z
X
87.48 frame/sec

New XY Plot Layout

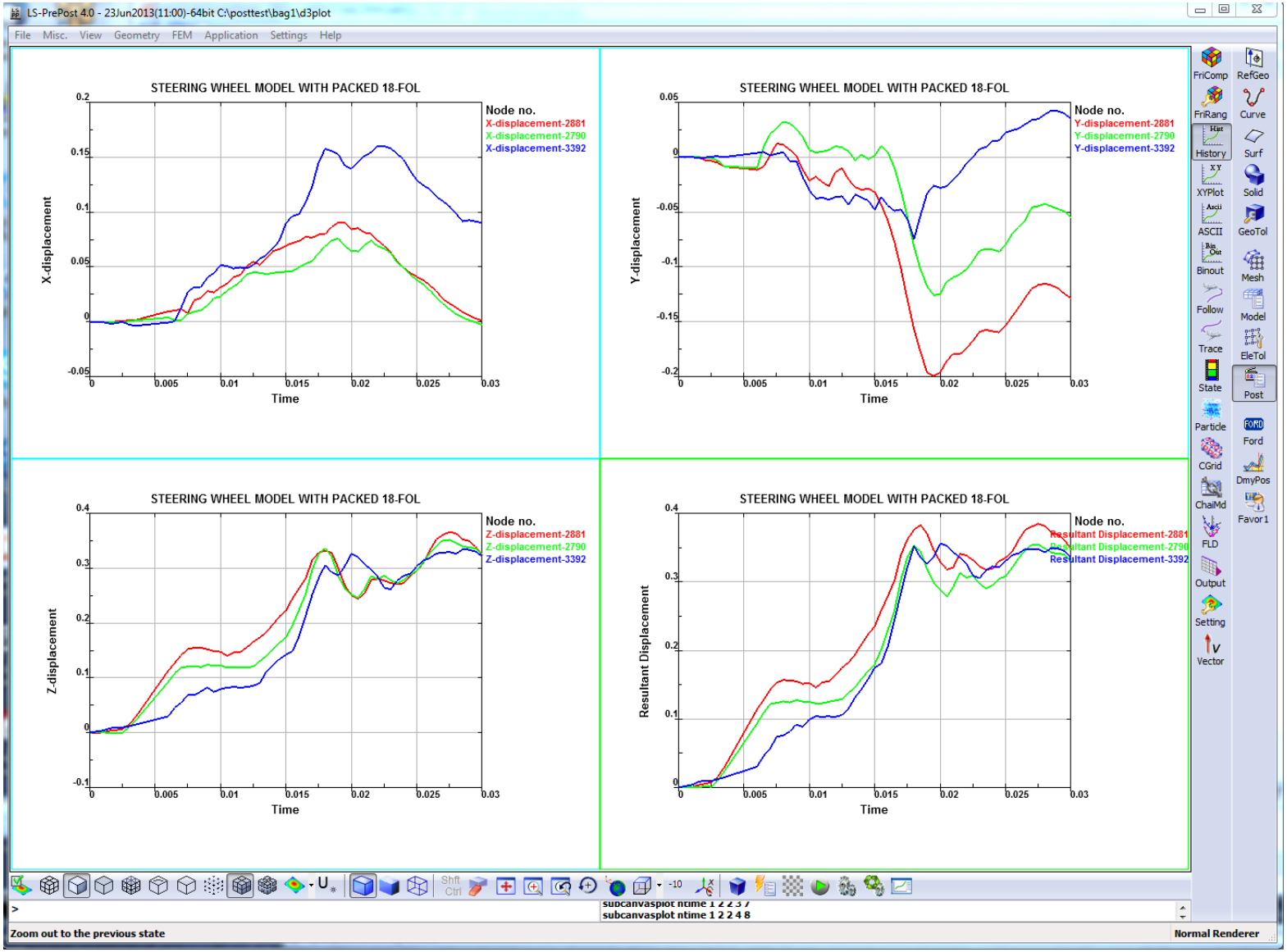


- New XY plot interface allows xy plots to be drawn in
  - The main graphics windows
  - A separate page with multiple plots per page

- Select "Popup" for the old XY plot interface
- Select "Main" to activate new XY plot interface
- Select "New" to plot the xy data in the new port
  - If the page is full, then a new page will be created automatically



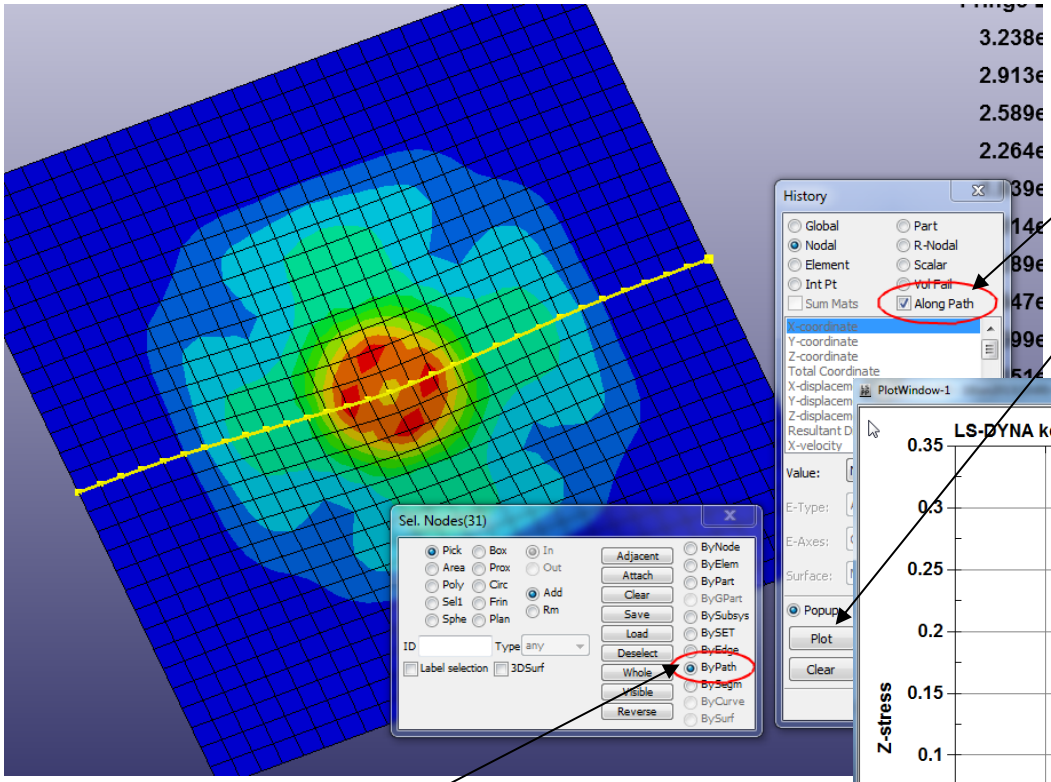
Use this icon (located on the bottom toolbar) to activate page control



New XY Plot Layout

Plot Fringe Values Along a Path

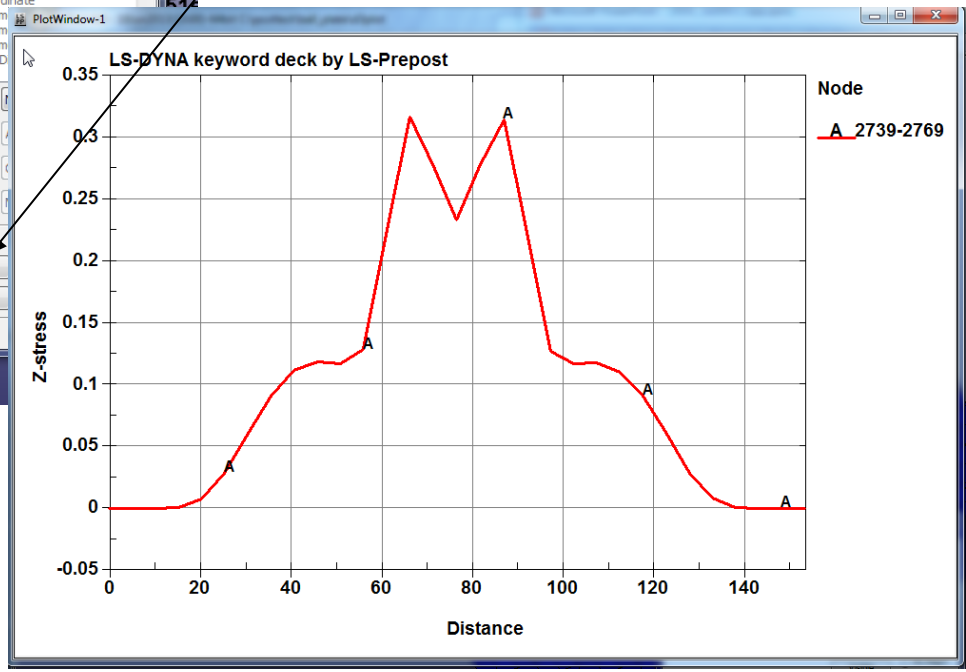
- Purpose: To produce a XY plot of the fringe values along a defined path
  - After fringing the model, go to History interface and select nodes or elements
  - Check the “Along Path” button
  - Define the path by selecting a well-defined sequence nodes or elements
  - Use the “ByPath” option in the general selection for easy selection
    - This option can be performed on shell or solid elements



"Along Path" button

Click "plot" to plot graph

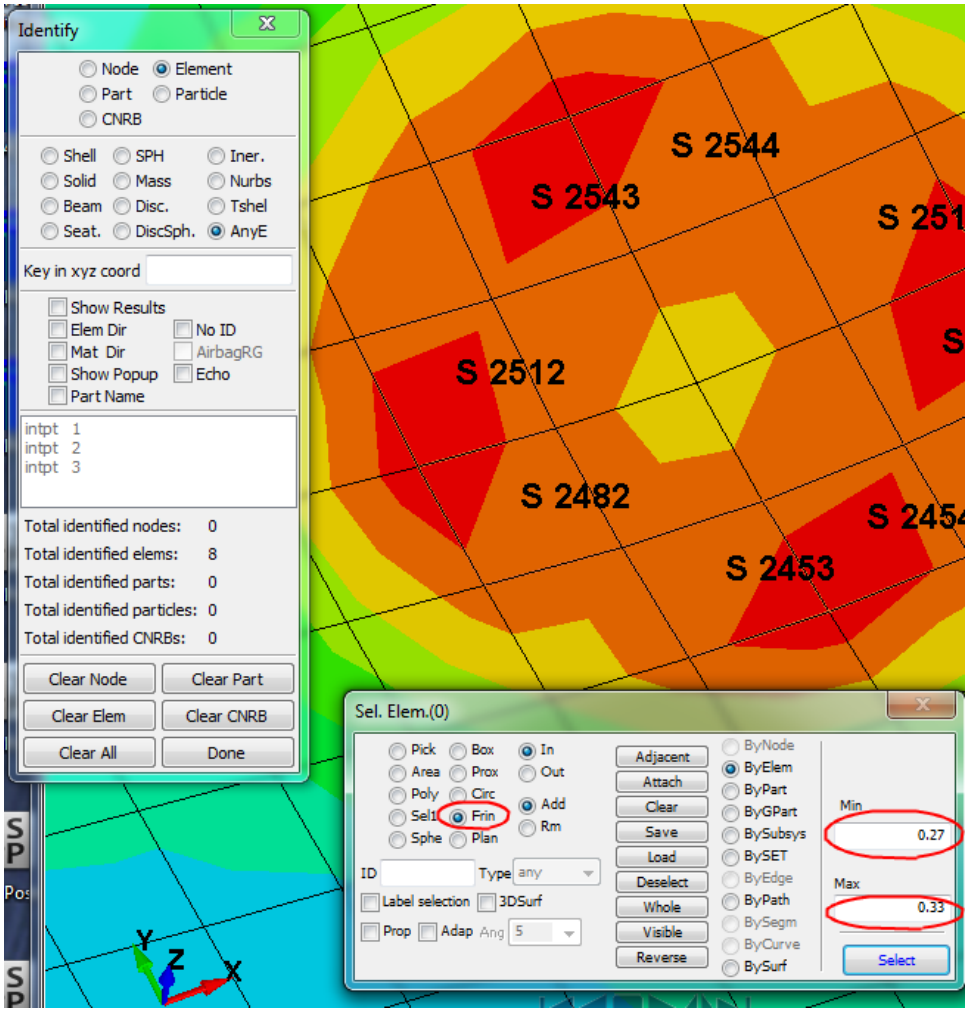
Turn on "ByPath" (will need only 2 clicks)



Graph will show distance vs. fringe value

Selection Based on Fringe Value

- After fringing the model, the selection of elements or nodes can be filtered by the fringe value
- Workflow
  - Select “Frin” in the general selection
  - Enter minimum and maximum values
  - Click “Select”

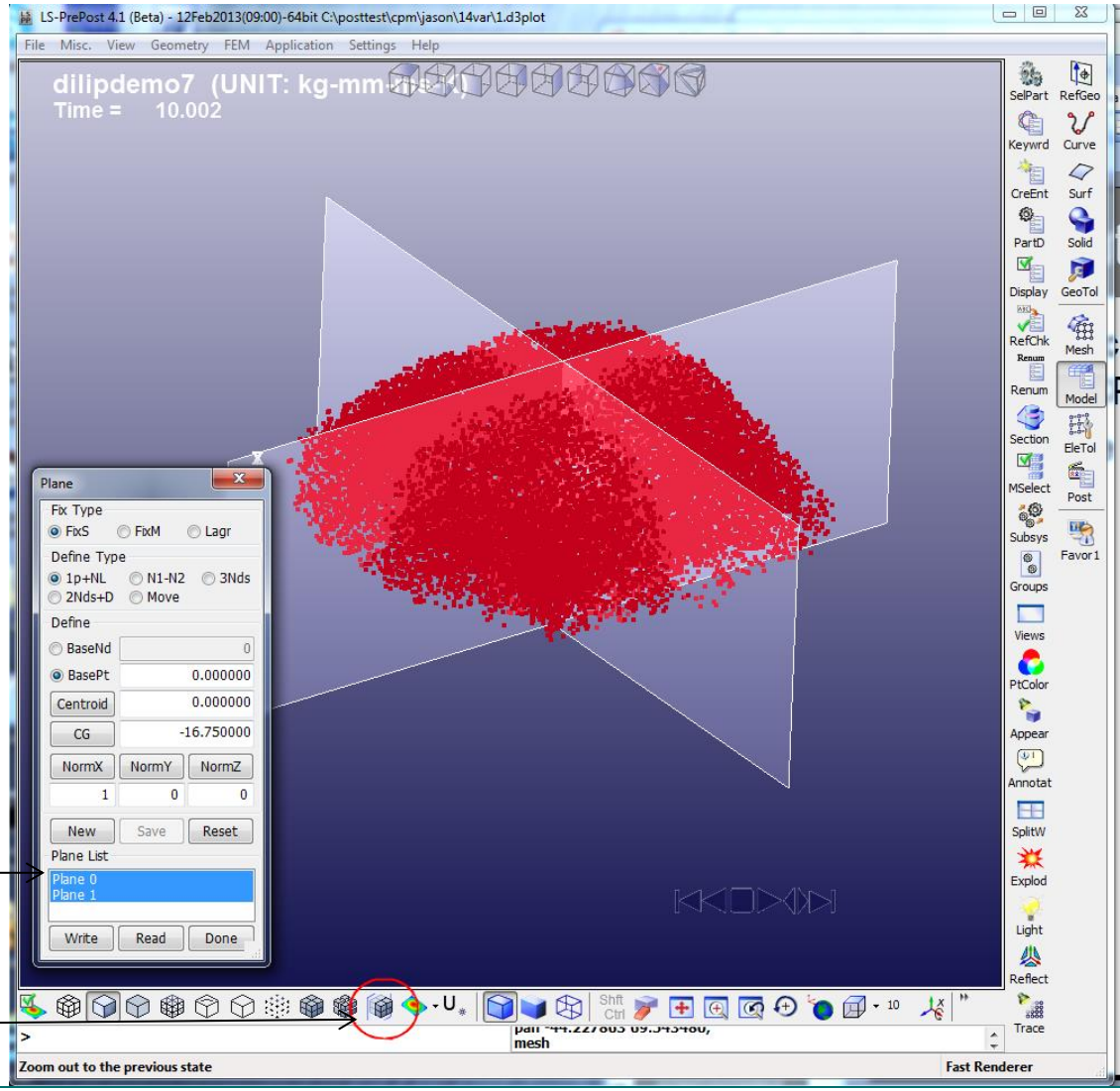


New Cutting Plane Interface

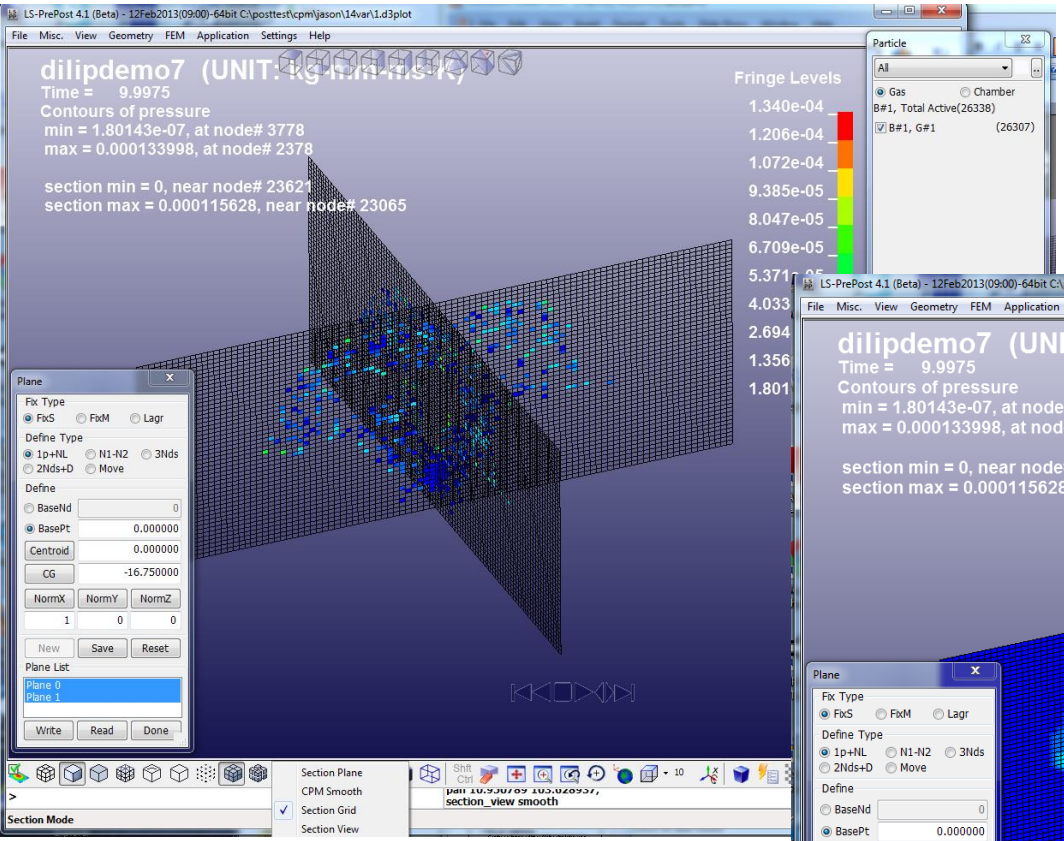
- A new cutting plane interfaces has been developed for
  - SPH
  - CPM (particle)
  - DES
  - CFD analyses.
- Multiple planes can be defined and visualized
- Must set environment variable lspp_developemode to yes or no

Multiple planes definitions

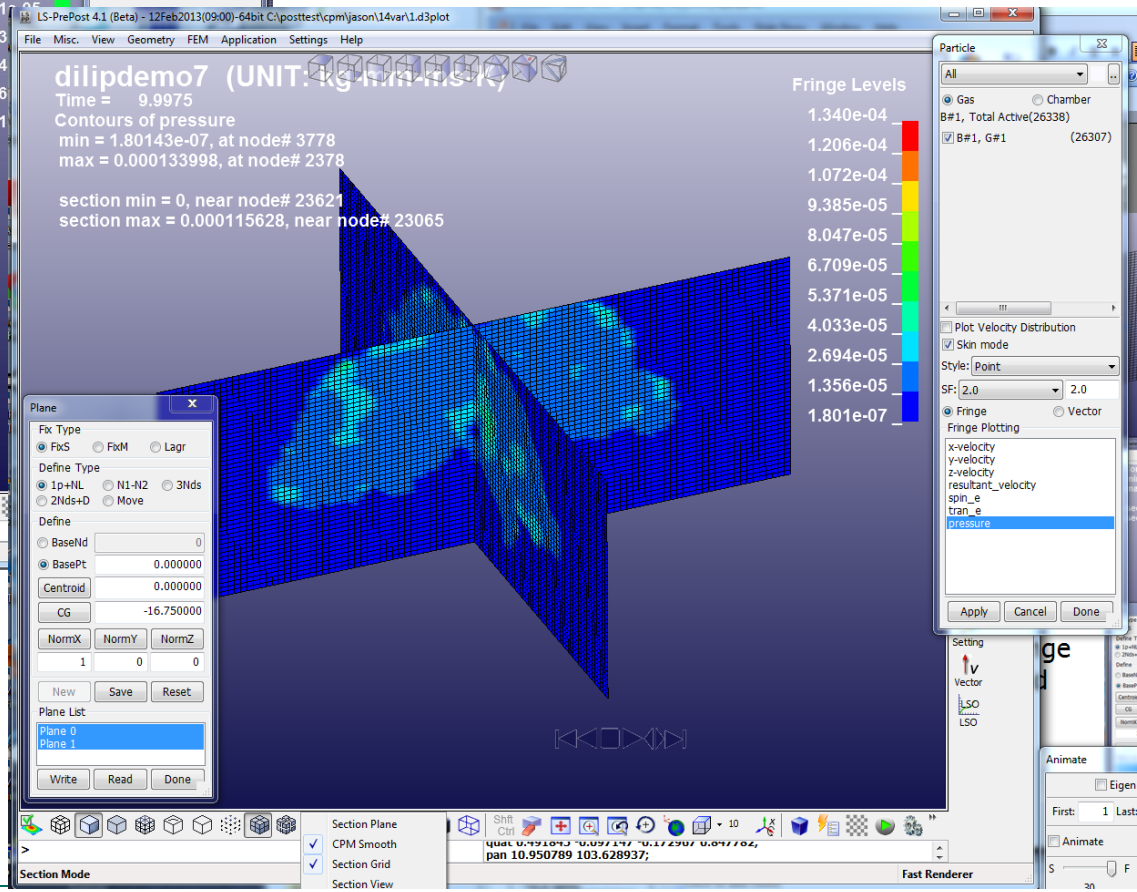
Click this icon to activate the plane interface



Fringe particle data on cutting planes with grid

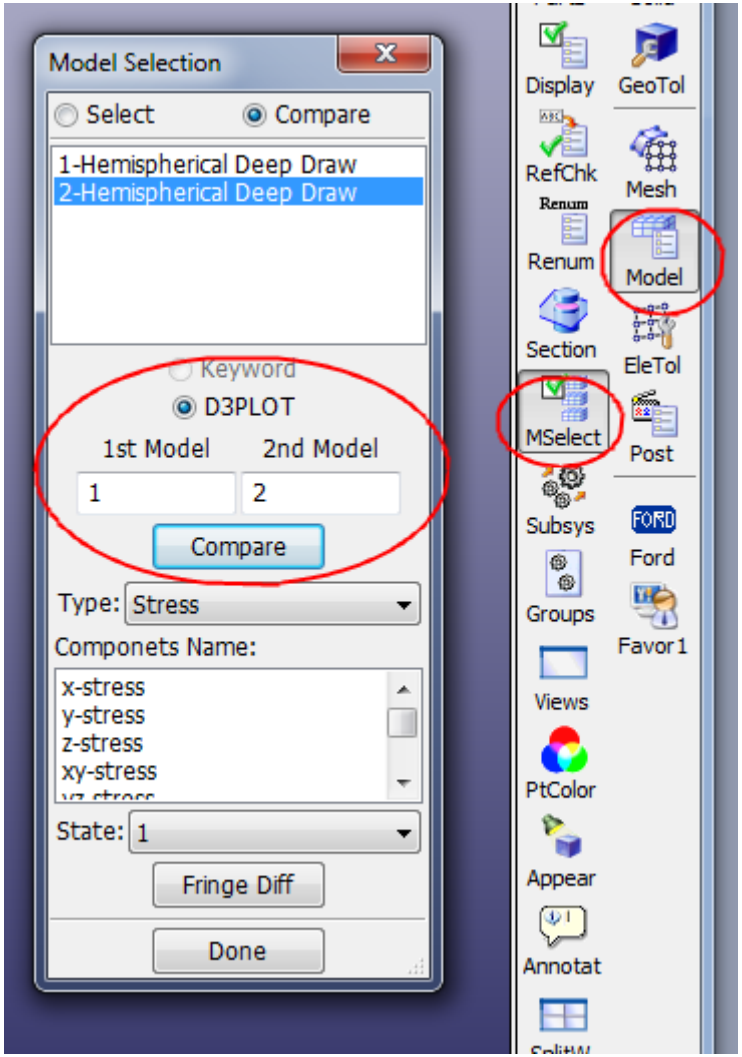


Smoothed fringe particle data on multiple planes with grid

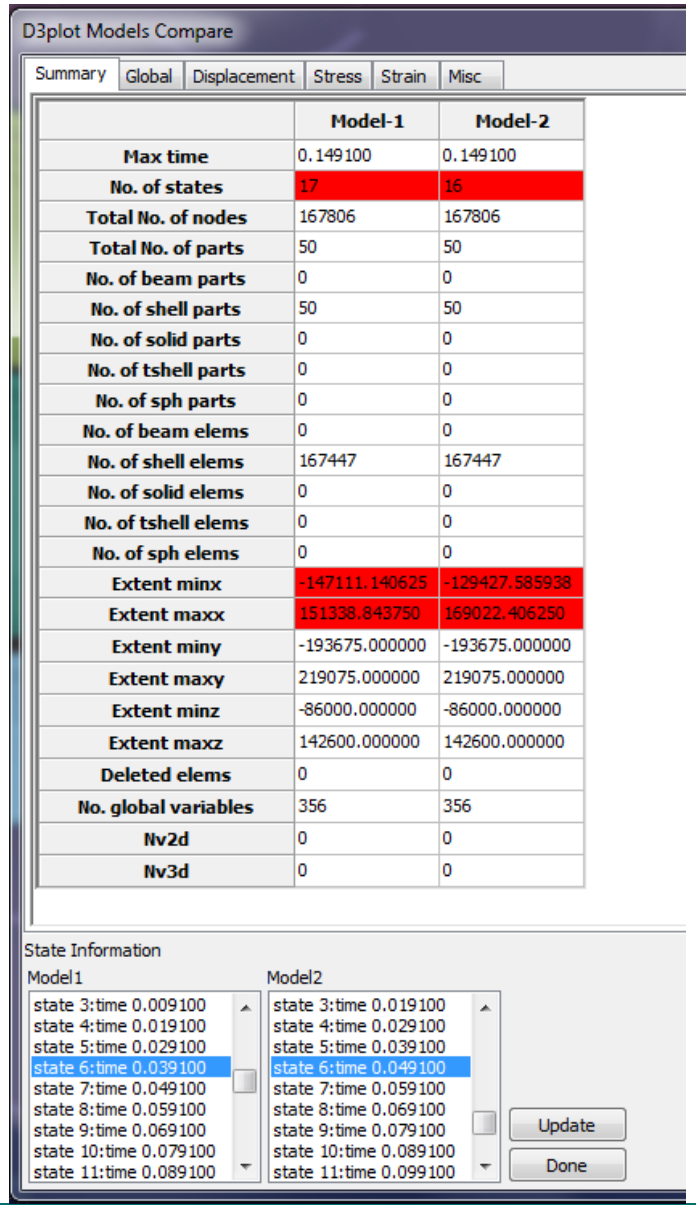


Model Compare for Post-Processing

- Read 2 sets of d3plot files
- Models should be similar
- Workflow
  - Go to Post->Mselect
  - Select 1st and 2nd model for comparison
  - Click “Compare” and wait for the data processing (will take some time depending on model size)
  - Select State (time) for both models
  - Click “Update”
- Compare will show different data in the following categories
  - Summary
  - Global
  - Displacement
  - Stress
  - Strain



- Possible values to compare
  - Summary
    - Basic model information
  - Global
    - Global energy results
  - Displacement
    - The 3 global min/max values of displacement with node IDs
  - Stress
    - The six global min/max stress values with element IDs
  - Strain
    - The six global min/max strain values with element IDs



	Model-1	Model-2
Max time	0.149100	0.149100
No. of states	17	16
Total No. of nodes	167806	167806
Total No. of parts	50	50
No. of beam parts	0	0
No. of shell parts	50	50
No. of solid parts	0	0
No. of tshell parts	0	0
No. of sph parts	0	0
No. of beam elems	0	0
No. of shell elems	167447	167447
No. of solid elems	0	0
No. of tshell elems	0	0
No. of sph elems	0	0
Extent minx	-147111.140625	-129427.585938
Extent maxx	151338.843750	169022.406250
Extent miny	-193675.000000	-193675.000000
Extent maxy	219075.000000	219075.000000
Extent minz	-86000.000000	-86000.000000
Extent maxz	142600.000000	142600.000000
Deleted elems	0	0
No. global variables	356	356
Nv2d	0	0
Nv3d	0	0

Displacement values comparison table

D3plot Models Compare

Summary | Global | Displacement | Stress | Strain | Misc

	Model-1(Value)	Model-1(Part)	Model-1(Item)	Model-2(Value)	Model-2(Part)	Model-2(Item)
x-displacement min	2002.7	1	N66162	19696.3	1	N157713
x-displacement max	2519.2	1	N72301	24408.1	1	N72301
y-displacement min	-298.821	1	N98280	-868.625	1	N39071
y-displacement max	115.359	1	N72296	989.434	1	N11957
z-displacement min	-349.383	1	N63693	-872.531	1	N70856
z-displacement max	327	1	N95485	1925.96	1	N32235

Stress values comparison table

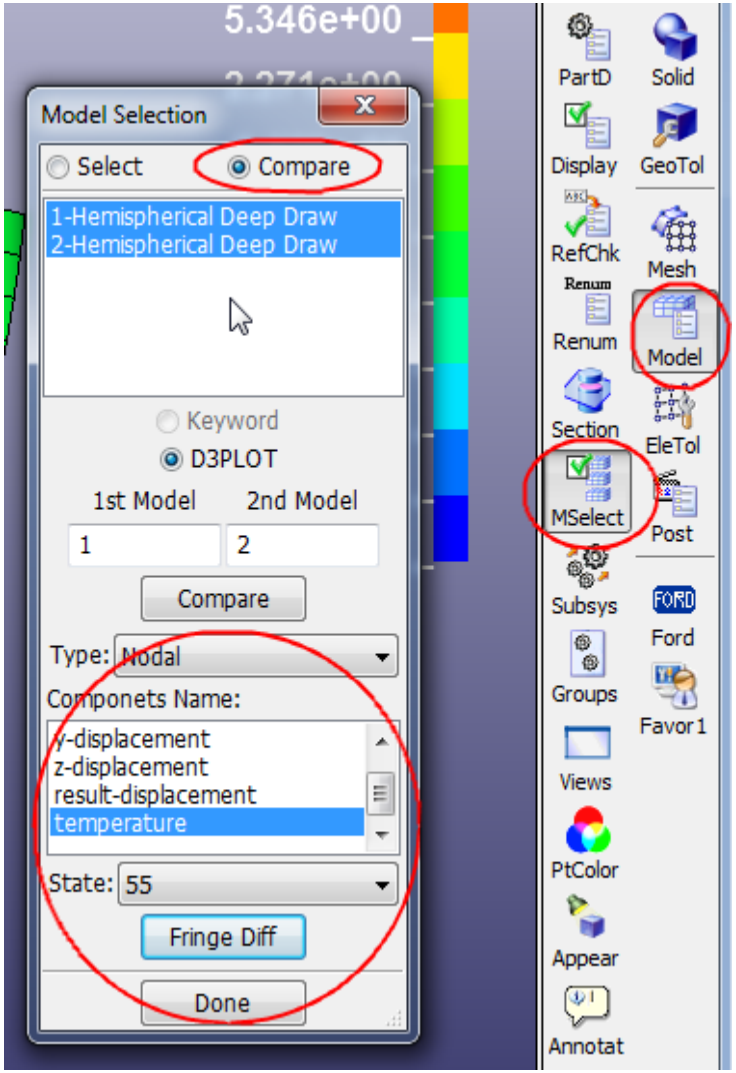
D3plot Models Compare

Summary | Global | Displacement | Stress | Strain | Misc

	Model-1(Value)	Model-1(Part)	Model-1(Item)	Model-2(Value)	Model-2(Part)	Model-2(Item)
x-stress min	-4.88605e+011	44	S97584	-5.07636e+011	32	S70473
x-stress max	5.26891e+011	32	S70359	4.61351e+011	8	S16143
y-stress min	-3.85562e+011	29	S70844	-6.62668e+011	13	S36069
y-stress max	6.37134e+011	32	S70353	6.657e+011	9	S25514
z-stress min	-5.14827e+011	29	S70906	-6.65736e+011	9	S27028
z-stress max	5.20831e+011	29	S70937	6.87303e+011	13	S36064
xy-stress min	-3.35629e+011	32	S70352	-2.26296e+011	32	S70358
xy-stress max	3.2788e+011	32	S70359	2.87103e+011	12	S25308
yz-stress min	-2.497e+011	41	S97952	-3.21899e+011	9	S25547
yz-stress max	2.93272e+011	29	S72085	3.1249e+011	13	S36066
zx-stress min	-3.22076e+011	29	S71899	-2.27891e+011	41	S99099
zx-stress max	3.01729e+011	41	S98076	2.63092e+011	5	S16722
von mises stress min	0	51	S108433	0	51	S108433
von mises stress max	6e+011	32	S70353	6e+011	13	S34548

Model Compare with Fringe Difference

- Read 2 sets of d3plot files
- Models should be similar
- Workflow
  - Go to Post->Mselect
  - Select 1st and 2nd model for comparison
  - Select nodal/stress/strain
  - Select component in the components list
  - Select the state where the difference between the 2 models will be computed
  - Click “Fringe Diff” button to show the difference in fringe



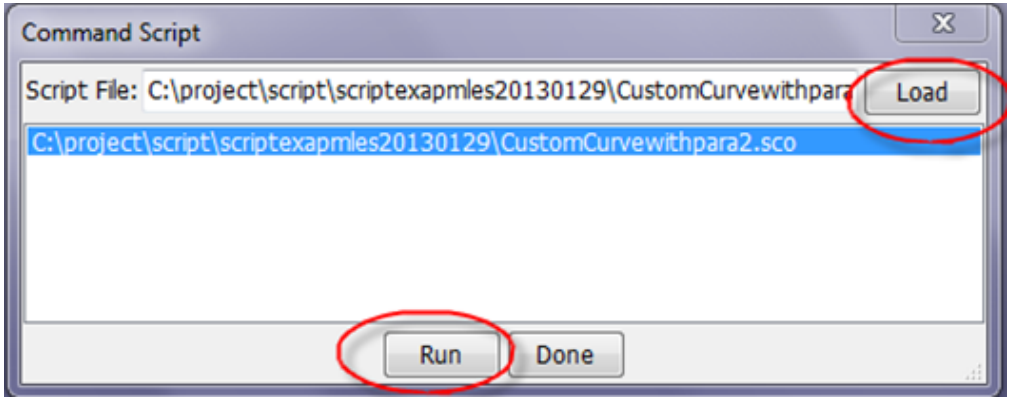
Scripting Command Language

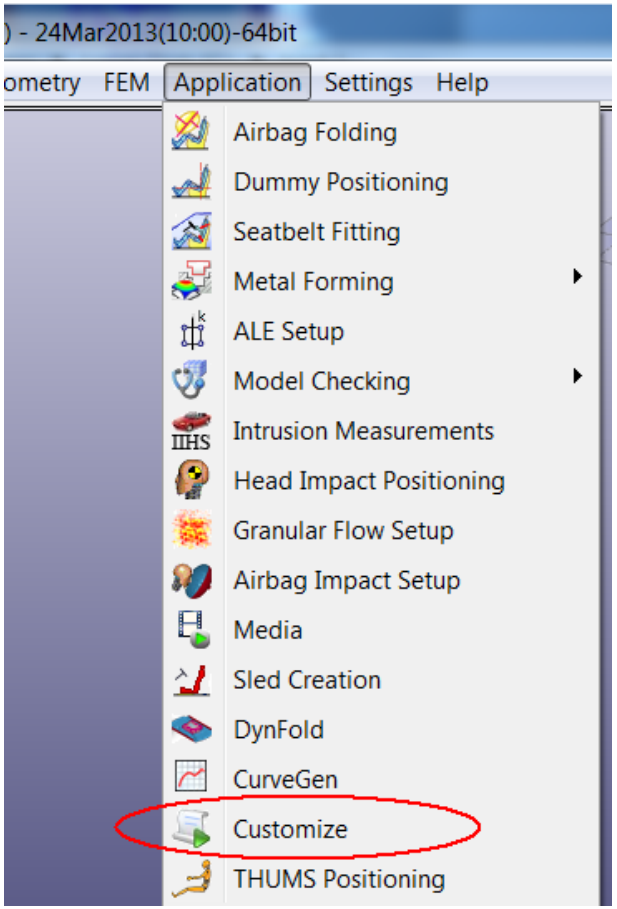
- Scripting Command Language (SCL)
  - Is a C-like programming language to be executed within LS-PrePost
  - Executes LS-PrePost commands
  - Allows "`if then else`", `for`, and `while` loop operations
  - Provides API (Application Programming Interface) to extract model and result data from the LS-PrePost data base
- Operations can be done on extracted data to form new data
- New data can be output to file or fringed on screen
- Most suitable to perform same operations over different parts of the model
- Documentation and tutorial for the Scripting Command Language
  - Download the document on Scripting Command Language
    - ftp://ftp.lstc.com/outgoing/lsprepost/SCLexamples
  - Lsppscripting.doc – describes usage of the Scripting Command Language
  - SCL_Examples.zip –contains example scripts which demonstrate different operations

- LS-PrePost SCL specifications and limitations
- LSPP-SCL is like the 'C' programming language with the following exceptions
  - For integer data declaration, use "`Int`" not "`int`"
  - For floating point declaration, use "`Float`" not "`float`"
  - Frequently used combined assignments
    - Not supported are `i++`, `i--`, `--i`, `++i`, `i+=`, `i*=`
    - Must use `i=i+1`; `i=i-1`; `i=i+n`; `i=i*x`; `i=i/n`
  - Do not typecast data conversion, e.g. `Int i`; `Float x`
    - correct: `i = x`
    - wrong: `i = (Int)x`
  - Not supported operations
    - `Switch case`
    - `do....while` loop
    - Conditional operation: (`boolean`) ?

- There are 2 ways to execute the SCL file
  - 1. Command line:
    - Run it within the regular LS-PrePost command file
    - Use the “Runscript” command to execute SCL file
    - Parameters can also be passed to the script
      - Runscript “SCL_filename” [optional parameters]
      - Example: runscript myscript.scl 100, 0.5, 1.2
    - When passing the parameters to the SCL, there are API functions to retrieve the parameters within the script

- The second way to execute the SCL file
  - 2. User interface:
    - Go to the Application pull down menu
    - Select “Customize”
    - In the pop up dialog, click “Load” to load the SCL file
    - Click “Run” to execute
    - Running the script this way cannot pass parameters to the script file



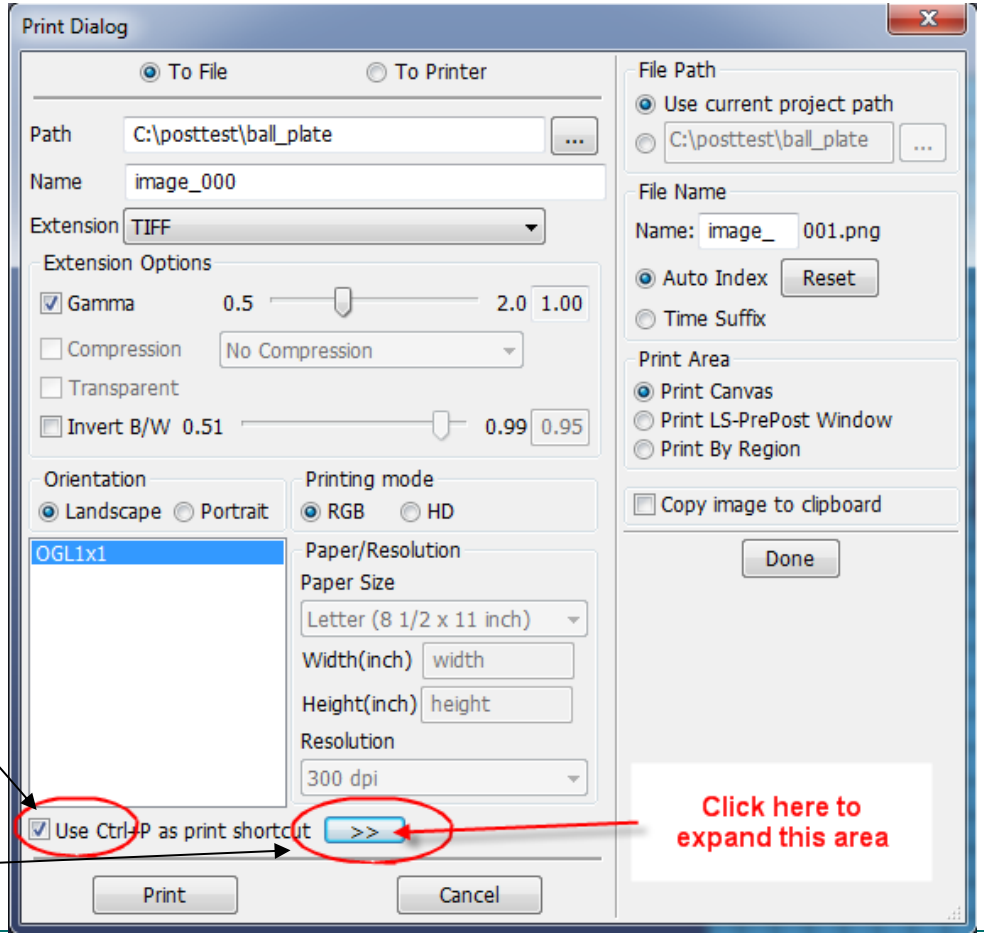


Ctrl+P Printing Short Cut

- A new short cut to print LSPP windows
- Once it is activated, press Ctrl+P key to print LSPP screen to a file or clipboard.

Check this box to activate usage of Ctrl+P for printing

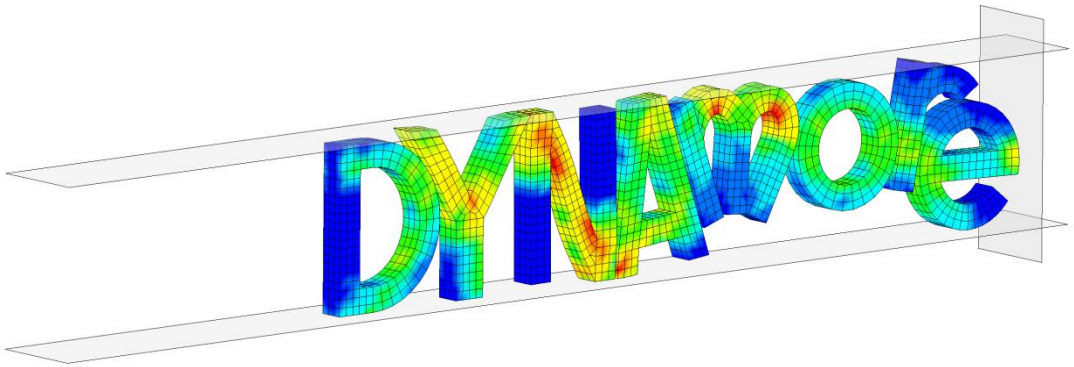
Click this button to expand the new interface



- Ctrl+P printing allows user to print
  - The canvas (just the graphics window)
  - LSPP windows (canvas plus GUI interfaces)
  - By region (use mouse to define a print area, this will always include GUI interfaces)
  - The printed image can be copied to clipboard for faster transfer to other applications
  - Currently, only png, jpeg and bmp formats are allowed to be used in Ctrl+P printing
  - Printed file can go to the current project directory or a permanently defined directory
  - Printed file name can use time stamp or auto indexing
    - The index counter will be memorized until user reset it back to 0
  - All parameters will be kept in the LSPP configuration file

DYNAmore GmbH
LS-DYNA

- Current status of LS-PrePost
- New Features for Preprocessing
- New Features for Postprocessing
- Ongoing Developments



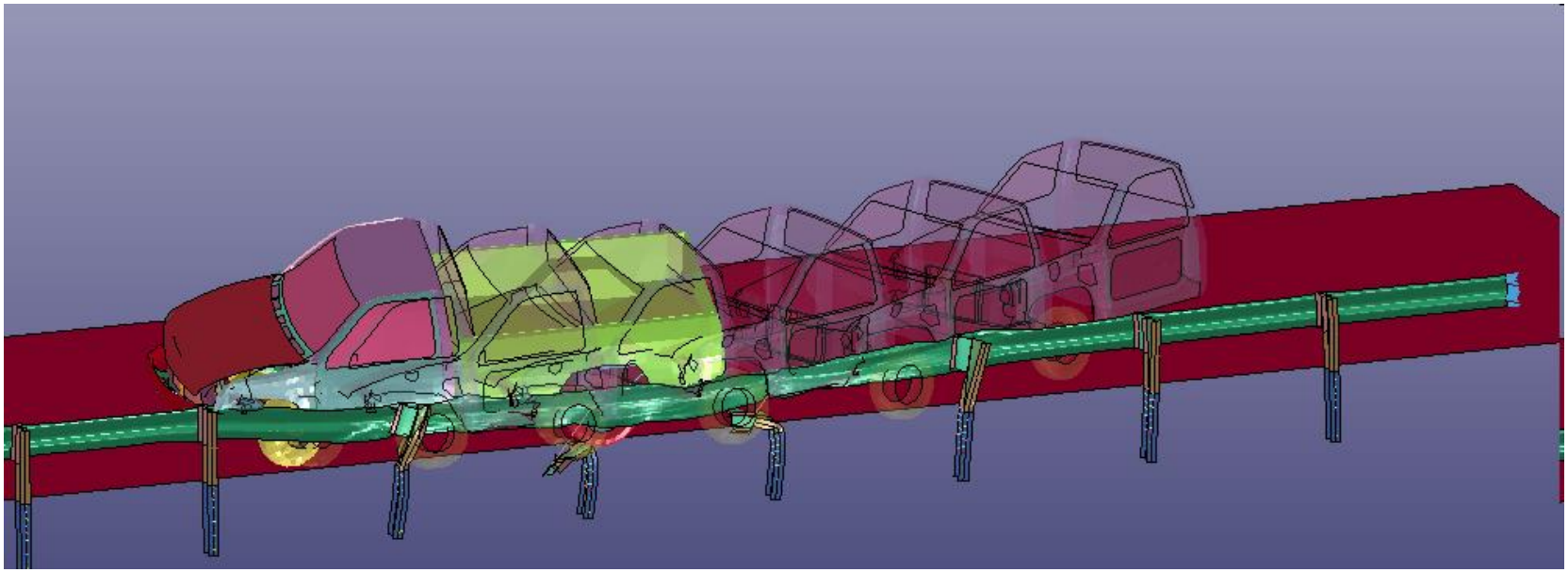
On Going Developments

- Continue to improve the surface auto meshing to give better quality
- Also provide various mesh densities
- Continue to improve Geometry functions to create, heal, and simplify geometry entities
- Improve the graphics rendering speed for iso-geometric elements both in pre-process and post-processing.
- Fringe plot for stress/strain components for iso-geometric elements within LS-PrePost.
- Not to depend on LS-DYNA to create the interpolated mesh with the post-processing data interpolated on the mesh
- More post-processing function for CFD results
- Better section cut operations and post-processing for Particles/SPH/CPM/DES types of elements
- Support macro on transparent toolbar with users defined icons
- Support printing in PDF and Post-Script format

- A special double precision version of LS-PrePost to support LS-DYNA long format (20 columns field length)
  - Long format uses 64 bits for all floating point and integer data
  - Long format allows user ID to be as large as 15 digits
  - Floating point number will be saved in 15 digits
  - This special double precision version will double the memory requirement
  - This version will process regular keyword file as well as 32bit d3plot files
  - Not recommended for normal use and post-processing due to the large memory requirement

On Going Developments

- Support FEMZIP version 6.86 with SPH data
- Support all Frequency Domain post-processing data file
- Support stress extrapolation for shell/solid element with multiple in-plane integration points
- Support stroboscopic display of selected parts



Thank you for your attention!

DYNA MORE

Your LS-DYNA distributor and more