PRIMER 22.0



PRIMER 22.0 – Contents

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Complete Ansys LS-DYNA

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Keyword support including ***AIRBAG_CPG**



Ansys LS-DYNA Keyword Support

- PRIMER 22.0 keywords:
 - Ansys LS-DYNA keywords up to and including R15.0 fully supported (excluding *ISPG).
 - Some Ansys LS-DYNA R16.0 additions and modifications to commonly used keywords supported.
 - Default output version remains R11.0 (later versions including R16.0 can be selected).





Support for *AIRBAG_CPG

A New Airbag Gas Solver





Support for Continuum-based Particle Gas (CPG)

- CPG is a new continuum-based particle approach for airbag simulations, available from Ansys LS-DYNA 2025R1 (R16).
- As a fully functional fluid solver, CPG is more effective at simulating gas flow than the corpuscular particle method (CPM), and more capable at internal fluid-structure interaction than ALE.
- Key features:

Uasvs 🧩 LS-DYNA Environment

- Compressible Navier-Stokes solver coupled with an ideal gas equation of state.
- Meshless by design, based on a generalized finite-difference scheme.
- Particle cloud fills airbag volume, gas passes from particle to particle (Eulerian approach).
- Particles added or removed only when necessary.
- Excellent accuracy, robustness & scalability to hundreds of cores.
- Designed for airbag simulation, validated by airbag CAE engineers:
 - Simple *AIRBAG_CPG keyword format that copies other *AIRBAG_ types. Same input data for inflators, fabric, etc.
 - First release supports internal structures, simple venting, fabric porosity, multiple gases/orifices/inflators, moving environment, local particle refinement, and more.
 - Inviscid with free-slip boundary by default, although viscosity and wall friction available.
- CPG is destined to take airbag simulation to the next level required for virtual testing, however accurate input data and well folded models are also vital to achieve useful results.



Support for CPG Keyword Input in PRIMER

We work closely with Ansys to ensure that the Oasys LS-DYNA Environment is the leading choice for CPG workflows

- PRIMER 22.0 supports all CPG-related R16.0 keywords:
 - *AIRBAG_CPG
 - *DEFINE_CPG_GAS_PROPERTIES
 - *CONTROL CPG
 - *DEFINE_CPG_REGION
 - *INITIAL CPG
 - *MESH SIZE SHAPE





MODIFY DEFINE CPG REGION 1 (for INITIAL)

K ? - X

NPDATA

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NVENT₁

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NID3

CAIR =

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0.0

C(2) F

INFG(1)

0

0

0

MODIFY AIRBAG M1/ABAG1

A Text Edit

🕂 Update 🏷 Reset All 🖌 Check 🧪 Sketch 👬 Only 🔻

- X-Refs

X Cancel



Images courtesy of JSOL Corporation

Improvements to Include File Handling





***INCLUDE** files skipped during input are now remembered

- When an *INCLUDE file cannot be found during keyword input PRIMER has always allowed you to skip it and continue the input process. However, that keyword file was 'forgotten': it would not appear in PRIMER's include tree and no *INCLUDE statement would be written in its parent file during keyword output.
- PRIMER 22.0 now remembers these files by default:
 - They will appear in the include tree, and in the part tree in 'include' mode.
 - An *INCLUDE statement will appear in the parent keyword output file, but no child include file will be output.
- It is possible to control this behaviour using the preference:

primer*missing_include_file_action: remember | forget



Shift+click is now supported for selecting ***INCLUDE** files





All include files between clicks are (de)selected. Supported for reading and writing include files



Ability to select formats per include file

 Added a File format option to map the file format panel in SELECT INCLUDE FILES TO WRITE window. This can be used to select different formats (ASCII/Binary/Compression) per include file while writing out.





***TITLE** and Includes

- Previous versions of PRIMER only supported writing of *TITLE cards to master models
- If multiple *TITLE cards were read in (irrespective of whether they were from the input master or input includes), the last one would take precedence and would then become the master model's title

- PRIMER 22.0 adds per-include support for *TITLE
- Each include (as well as the master model) can now have its own ***TITLE** card

Previous versions

PRIMER 22.0



Keyword Output to Excel





Writing Keyword Definitions in Excel format

- PRIMER 22.0 includes a new option to write keyword definitions to XIsx format. This can be accessed in the following way:
 - From the Keyword editor, select the keyword row(s);
 - Right-click and choose the **Export File** option;
 - Select **XIsx** using the radio button.
- This export to XIsx functionality is available for all keywords.
- Some keywords come with additional options that allow users to capture images, similar to the existing Contact > Write options feature.
- Settings for capturing images for selected database keywords can be accessed via the Excel output options button.

| _ | | Export to file | - 🗆 × |
|-----------|-----------|----------------|----------------------|
| Save | | Can | icel |
| Filename: | file.xlsx | | ▼ 🖴 |
| O csv | | Keyword layout | Excel output options |
| ○ Keyw | ord file | | |
| 🔘 Xlsx | | | |

Excel output options for Images

- Images can currently be captured for the following keywords:
 - *DATABASE_HISTORY_NODE
 - *DATABASE_HISTORY_BEAM
 - *DATABASE_CROSS_SECTION
- Excel output options panel allows users to set:
 - Orientation view
 - Drawing mode
 - Image column position in the Excel file
 - Image width and height
- Find Volume is input for *DATABASE_HISTORY_NODE.
- Recursive loops for find attached is input for *DATABASE_HISTORY_BEAM.

| Excel output options | ? - 🗆 X |
|------------------------------------------|----------------|
| Save to oa_pref Reset all | Help |
| Find Volume: | 200.0 |
| Orientation View: | +ISO ► |
| Drawing Mode: | SH 🕨 |
| Recursive loops for find attached: | 3.0 |
| Image Width(in pixels): | 257.0 |
| Image Height(in pixels) : | 166.0 |
| Image column: | LAST 🕨 |



Writing Keyword Definitions and Images in Excel Format

• *DATABASE_HISTORY_NODE:

- Image based on items found within a cube volume centred on the node.
- The input value (Find Volume) defines the cube volume for the search.





Writing Keyword Definitions and Images in Excel Format

• *DATABASE_HISTORY_BEAM:

 Based on number of recursions applied to attached items around the beam.





Writing Keyword Definitions and Images in Excel Format

• *DATABASE_CROSS_SECTION:

- 'Display' and 'Annotate' images are output.
- Annotate: Output zoomed-in view of the crosssection with the cross-section plane parallel to the screen.





User Defined Error Categories





Filtering of errors and warnings by category

- In the error tree viewer a new drop down allows filtering of errors and warnings by category.
- Categories are defined in the preference: primer*check_tree_category_list
- This functionality can help make model setup more efficient:
 - Errors or warnings you are not interested in can be hidden.
 - Display only those belonging to certain categories, e.g. those deemed important for the current study.

| _ | | | | | Error tr | ee viewer | | | | | | | |
|---------|-----------------------------------------------------|-----------------------------------|--------------|-----------------------------------|------------------------------------|--------------|-----------------------------------|---------------------------------------------------------------------------|--------------|----------------------|----------|------------------------|--------------|
| Recheck | Clear | ->error mode | ->item mode | list | show tags | warnings | include | Filter applied | ▼ ? | | | | |
| Autofix | Delete | Sketch B | lank Unblank | Only | Autosca | Write xml | Rechec | Apply filter | | | | | |
| | ROR [17]]CONNECTIO]CONSTRAIN]NODAL_RK | DN [4] NED [1] GID_BODY [1] | | | | | | Select all (No filterin Select none Messages with no cates FATAL | g) Jory | | | | |
| | CONTACT []DEFINE_CU]MATERIAL]NODE [1] | 3] RVE [1] [3] | _ | | | | | ✓ HIGH MEDIUM LOW | | | | | |
| |]PART [3] | | — File | Edit | Search | n: check_tre | e_cate ? | Preferences | for Primer | | | | ? Dismiss |
| | ARNING [15]]NODAL_RK]CONTACT [| GID_BODY [1] 1] | | }binary }bom_read }checking | _ | | Name: Type: | primer*check_tree_categ <string></string> | ory_list | | | | |
| Ċ | CONTROL [| 1] | | error_co | onfiguration_file ree_category_ | e list | Description: Active: Value: | FATAL:HIGH;MEDIUM;LO | be displayed | on check tree e.g. L | OW_PRIOR | TY:HIGH_PRIORITY:FATAL | |
| | | nont | | _recheck _default_ | ing_level table_create | | | | | | | | |

Filtering of errors and warnings by category

- Any message can be given a category in an error configuration file.
- By default this file is found in the home area, but can be changed with preference: primer*error_configuration_file
- Can be edited manually, or from tree viewer by right-clicking on any message.



Battery Setup Tool Enhancements



Saving battery definition attributes at file level

The attributes of a battery definition can now be saved in the model keywords file after the *END card. This allows the creation of multiple battery definitions within a model, as well as the ability to modify, delete, copy, orient and sketch an existing definition.



Initial orientation of the battery cell

 The orientation of the battery cell created through the 'Battery Setup' tool has been changed to something more sensible. The battery cell can then be oriented freely using the PRIMER 'Orient' tool and selecting the battery definition from the object menu.





Creation of ***EM_MAT**

- Added the option to turn off the auto-creation of ***EM_MAT** cards in the '2. Layers structure' panel.
- This applies to both layers and tabs parts.

| Layers material and | ICRO and MES | SO scales] | ? | Unit cell material and thickness [MACRO and MESHLESS scales] ? | | | | |
|-------------------------|--------------|---------------|------------|----------------------------------------------------------------|-------------------------|--------|-----------------------------|--|
| PCC Cathode | Separator | Anode | NCC | | Structural Material id: | 1 • | Auto-create *EM_MAT cards 🖌 | |
| Structural Material id: | 1 🔻 | Auto-create * | *EM_MAT ca | ards 🖌 | Thermal Material id: | 1 • | • | |
| Thermal Material id: | 1 🔻 | | | | Thickness: | 3.2E-2 |] | |
| Thickness: | 1.0E-2 | | | | Positive conductivity: | 0.0 |] | |
| Initial conductivity: | 0.0 | | | | Negative conductivity: | 0.0 |] | |



Read CSV

- Improved the file selection for importing CSV data in the startup panel.
- The file can be selected by either entering the path in the textbox or using the file selector. Then clicking on 'Read CSV' imports the data.





*EM_ISOPOTENTIAL and *EM_ISOPOTENTIAL_CONNECT

 Added drawing and picking functionalities for *EM_ISOPOTENTIAL and modified sketching to connect composite nodes by lines.



• Added drawing, sketching and picking functionalities for ***EM_ISOPOTENTIAL_CONNECT**.





*EM_ISOPOTENTIAL and *EM_ISOPOTENTIAL_CONNECT

 Added a new entry in the ENTITIES panel that controls the drawing and labelling of *EM_ISOPOTENTIAL and *EM_ISOPOTENTIAL_CONNECT.

| _ | • | | | ENTITIES | 3 | | ? | |
|---|-----------------|------|--------------|---------------------|---------------|------|-------|----------------------------------|
| | Dismiss | | | Upc | late | | Hel | p |
| I | Туре | Name | Label | Drawn | Туре | Name | Label | Drawn |
| ı | ALL TYPES | ✓ × | ✓ × | ✓ | ALL NODES | | | |
| ı | ELEMENTS | | | \checkmark | ATTACHED | | | |
| ı | AIRBAG | | | | UNATT'D s | | | |
| ı | ALE | | | | PARTS | | | |
| ı | BOUNDARY | | | | 174(10 | | | |
| ı | CONNECTION | | | | | | | |
| ı | CONSTRAINED. | | | | All elements | | | |
| ı | CONTACT | | | | BEAM | | H | |
| ı | DAMPING | | | | BEAM PULLEY | | H | |
| ı | DATABASE | | | | BEAM SOURCE | | H | |
| ı | DEFINE | | | | DISCRETE | | H | |
| ı | DEF_TO_RIG | | | | DISCRETE SPH | | H | |
| ı | IGA | | | | INERTIA | | | |
| ı | INITIAL | | | | MASS | | H | |
| ı | INTERFACE | | | | MASS MATRIX | | | |
| ı | LOAD | | | | MASS PART | | H | |
| ı | RIGIDWALL | | | | SBELT | | | |
| ı | SET | | | | ACCEL | | H | |
| ı | TARGET | | | | PRETENS | | | |
| ı | | | _ | | RETRACT | | H | |
| ı | MESH | | | \checkmark | SENSOR | | | |
| ı | | _ | _ | _ | SLIP | | H | |
| ı | GEOMETRY | | | \checkmark | SHELL | | | |
| | | _ | | _ | SHL NURBS P | | H | ✓ ✓ |
| ١ | TARGET MARKER | | | | SOL NURBS P | | | |
| | | | | _ | SHL SRC SNK | | H | |
| | MORPH | | | | SOLID | | H | V |
| | | | | | SPH TSHELL | | H | ▼ ▼ |
| | GEN_GRAPHICS | | | | ISHELL | | | Ŀ |
| | EM_ISOPOTENTIAL | | \checkmark | \checkmark | | | | |



*EM_ISOPOTENTIAL and *EM_ISOPOTENTIAL_CONNECT

• Added *EM_ISOPOTENTIAL to the list of 'find attached through' types within the Attached tool.



- Added the option to move between different steps using either the newly added Previous and Next buttons or the tabs at the top.
- The tool will no longer automatically jump to the next step when clicking on Create as before but it will remain at the current panel to give the chance to check the settings and make any modifications if needed before proceeding to the next step.





 Added the option to undo creation of 'Layers structure', 'Tabs structure' and 'Randles parameters' using the **Edit** button.

| - | CREATE | Battery Defn in model 1 | | ? - 🗆 🗙 |
|--------------------------------|--------------------------------|-------------------------|-----------------------|----------------|
| 1. Geometry & Scale | 2. Layers Structure | 3. Tabs Structure | 4. Randles Parameters | 5. Analysis |
| Previous | | Setup tabs structure | | Next |
| Tabs dimension and p | position ? | | Reset | Edit Create |
| Position: Same side | e A 🛛 🔻 | | | |
| Y length: 2.01E-2 | | Pos | sitive tab Separation | Y length |
| Z length: 2.0E-3 | | | | Z length |
| Separation: 8.2E-2 | | | | |
| Alternate tab polarities in: | X dir Y dir | | | Negative tab |
| Tabs meshing ? | | | | |
| Type: Number of el | lements Element Size | | | |
| No. of elements (X): | 4 | | | |
| No. of elements (Y): | 2 | | | |
| No. of elements (Z): | 8 | | | 2 1 |
| Create *CONSTRAINED_NOD | DAL_RIGID_BODY | | | × |
| Tabs material ? | | | | |
| Positive tab Negative tab | b | | | |
| Structural Material id: | 2 ▼ | | | |
| Thermal Material id: | 1 | | | |
| Initial conductivity: | 0.0 | | | |
| Isopotentials ? | | | | |
| Create isopotentials between | n tabs and current collector 🧹 | | | |
| Create isopotentials at free s | surfaces of tabs | | | |
| Create isopotential connection | ons between unit cells | | | |
| Inter-cell connection type | e X-parallel 🔺 | | | |
| Wire resistance: | 0.0 | | | |



- Added the option to make modifications in the '5. Analysis' panel after clicking on Apply.
- The Apply button will get reactivated if any of the parameters in the panel get updated.

| CREATE Battery Defn in model 1 | | | | | | | | |
|-------------------------------------|---------------------------------------------------------------|---------------------------|----------------------------|-----------------------------|--|--|--|--|
| 1. Geometry & Scale 2. Layers 5 | Structure | 3. Tabs Structure | s 5. Analysis | | | | | |
| Previous Define analysis parameters | | | | | | | | |
| Structural analysis | | | | Write CSV Apply | | | | |
| *CONTROL_SOLUTION | Anal | ysis type: Combined ▼ | Edit | Reset Done | | | | |
| *CONTROL_TERMINATION | Termin | ation time: 3600.0 | Edit | Create Battery | | | | |
| *CONTROL_TIMESTEP | | time step: 5.0 | Edit | | | | | |
| Thermal analysis | | | | | | | | |
| *CONTROL_THERMAL_TIMESTEP | ✓ | Time step: 10.0 | Edit | | | | | |
| *CONTROL_THERMAL_SOLVER | Analysis type: Transient V Problem type: Non-Linear (gauss) V | | | | | | | |
| EM analysis | | | | | | | | |
| *EM_CONTROL | \checkmark | EM cycles for FEM: | 10 EM cycles | for BEM: 5000 Edit | | | | |
| *EM_CONTROL_TIMESTEP | \checkmark | Time step: | 5.0 | Edit | | | | |
| *EM_OUTPUT | Level of | f matrix assembly output: | No output V Level of solve | er output: No output ▼ Edit | | | | |
| *EM_RANDLES_EXOTHERMIC_REACTION | | Heat source area type: | Per unit area 🔻 🖡 | Function: The Edit | | | | |
| *EM_RANDLES_SHORT | | Resistance area type: | Per unit area 🔻 🛛 | Function: T Edit | | | | |



• Added the option to reset all the parameters to their defaults at any stage.

| CREATE Battery Defn in model 1 | | | | | | | |
|---------------------------------|--------------------------------|-------------------------|-----------------------------|-----------------|-----------|--|--|
| 1. Geometry & Scale 2. Layers | Structure | 3. Tabs Structure | 5. A | nalysis | | | |
| Previous | | Next | | | | | |
| Structural analysis | | | | Write CSV | Apply | | |
| *CONTROL_SOLUTION | Analys | sis type: Combined ▼ | Edit | Reset | Done | | |
| *CONTROL_TERMINATION | ✓ Terminat | ion time: 3600.0 | Edit | Create E | Battery | | |
| *CONTROL_TIMESTEP | ✓ Initial tir | me step: 5.0 | Edit | | | | |
| Thermal analysis | | | | | | | |
| *CONTROL_THERMAL_TIMESTEP | Tir | ne step: 10.0 | Edit | | | | |
| *CONTROL_THERMAL_SOLVER | Analys | sis type: Transient V | Problem type: Non-Line | ar (gauss) 🔻 | Edit | | |
| EM analysis | | | | | | | |
| *EM_CONTROL | \checkmark | EM cycles for FEM: | 10 EM cycles fo | r BEM: 5000 | Edit | | |
| *EM_CONTROL_TIMESTEP | \checkmark | Time step: | 5.0 | | Edit | | |
| *EM_OUTPUT | Level of n | natrix assembly output: | No output V Level of solver | output: No outp | ut 🔻 Edit | | |
| *EM_RANDLES_EXOTHERMIC_REACTION | | Heat source area type: | Per unit area 🔻 Fu | nction: | ▼ Edit | | |
| *EM_RANDLES_SHORT | | Resistance area type: | Per unit area 🔻 Fu | nction: | ▼ Edit | | |

Creating an array of unit cells

 Added the option to create an array of unit cells under the same battery definition by setting any number of unit cell repetitions in both x and y directions.



Alternating tab polarities

Added the option to alternate the tab polarities every other cell in x and/or y directions. This is
reflected in the titles provided to the tabs parts, the position of tabs if in 'micro scale' mode, and the
isopotential connections configuration between unit cells.


Isopotential connections between unit cells

 Added the option to auto-create *EM_ISOPOTENTIAL_CONNECTs that model the electrical connections between unit cells. This can be done based on a range of possible configurations. The options offered depend on the selected tabs positions and relative polarities.



на индер 1996 и более на Абрик. Ра Милар Тар Бирику нари Милар Санки, нар (<u>Бангула), крански за Аргики</u>, рок (1995) и парти — и и и и и и и и растако в съконо. ХАРОСТ:

Maxalo

0.500 0.000 0.700 0.800

Max S10103877 : 1.262904E+00, Min S10595151 : 1.823150E-12

Efficient End-to-End Workflows

Virtual Testing

- <u>C-NCAP Management Regulation</u>
- Working with Test Data
- <u>Automotive Assessments Improvements</u>
- <u>SimVT Graph Options</u>
- <u>VTC Quality Criteria Workflows</u>
- VTC Videos File Size



C-NCAP Management Regulation





C-NCAP Management Regulation (2024 Edition)

Since Oasys 21.1, there has been support for the various requirements of the C-NCAP Far Side Occupant Protection Protocol, including:

- For each of the eight Working Conditions:
 - Occupant injury assessment
 - ISO Correlation Fitting indices
 - Correction Factor A
- Dual-Occupant Penalty calculation
- ISO correlation fitting indices for the Virtual Assessment Certificate (prerequisite for the symmetry of far side occupant protection airbags)
- Overall score calculation

Oasvs 🔅 LS-DYNA Environment

Read the documentation to learn more



C-NCAP VTC Quality Criteria

- The C-NCAP VTC Quality Criteria Workflow tool follows the same principals as the Euro NCAP version but assesses the quality criteria specified in section H.1.1(f) of the C-NCAP Far Side Simulation & Assessment Protocol.
- The tool can be automated using the REPORTER template provided.





Oasys 🔅 LS-DYNA Environment

C-NCAP VTC Videos

 The C-NCAP VTC Videos Workflow tool follows the same principles as the Euro NCAP version but helps you calculate the views and export the videos specified in section H.2.8 of the C-NCAP Far Side Occupant Protection Protocol (2024 Edition).

 Use the standard Workflow method in
 PRIMER and D3PLOT or the whole process can be automated using the
 REPORTER template provided.

Oasys 🔅 LS-DYNA Environment



Chinese Language Reports

Oasys 🔅 LS-DYNA Environment

 You now have access to all the C-NCAP REPORTER templates in both English and Chinese, for ease of communication with your teams, partners, suppliers, and C-NCAP.



中文版报告模板

• 所有 C-NCAP REPORTER 模板都同时提供英 文和中文版供您使用, 方便您与团队、合作伙 伴、供应商, 和 C-NCAP 沟通。

Chinese Language Reports

 Example reports generated by C-NCAP REPORTER templates, in English (left) and Chinese (right):



中文版报告模板

• 下方展示了由 C-NCAP REPORTER 模板自动 生成的英文版(左侧)和中文版(右侧)报告 示例。



Working with Test Data





Improved unit handling and configuration for imported data

- Previously, imported ISO-MME data was assumed to be in SI units. This assumption was not always valid and data with non-standard units (e.g. accelerations in 'g' or rotations in 'degrees') needed to be manually scaled.
- Additionally, the vehicle drive side was inferred from the position code of the first occupant channel, which was assumed to be the driver.
- Now, when importing ISO-MME channel data, T/HIS attempts to automatically determine the units from the unit header in each channel file and the drive side from the "Driver position object 1" header in the MME file. However, it is not always possible to correctly infer this information.
- The new Import Configuration window (and Import Config. file) gives you the option to correct any issues with the channel units, polarity, scale and naming before importing ISO-MME or CSV data.

| #DRIVE_SIDE #PROTOCOL | LHD | | | | C | onfigure impo | ort | | | | |
|--------------------------|-----------------------|-----------------------|------------|---------------------|-------------|----------------------|----------------------------------|---------|---------------------|----------|-------------|
| #UNITS | | • | - | | | Import Configuration | | | 3 | | |
| TIME | ms | Import | Apply | Configuration file | : Load Save | Channel | New Name | Y Scale | Unit Type | | |
| FORCE | g kN | Config | | - | | 11HEAD0000WSDCX0 | <optional></optional> | 1 | LENGTH | | |
| ENGTH | mm | Conng. | Protocol | None | | | contional> | 1 | | | |
| IOMENT | kN*m | File | Drive side | : LHD | | ▼ IIHEAD0000w3DCT0 | optional> | 1 | LENGTH | | |
| DTATIONAL_VELOCITY | deg/s | 1 110 | Lipite | TIME | | 11HEAD0000WSDCZ0 | <optional></optional> | 1 | LENGTH | • | |
| ELUCITY | IU'S | | Onits | . IIME | 5 | 11HEAD0000WSAVX0 | <optional></optional> | 1 | ROTATIONAL_VELOCITY | | |
| CHANNEL_DATA | | | | ACCELERATION | g | 11HEAD0000WSAVY0 | <optional></optional> | 1 | ROTATIONAL VELOCITY | v | |
| nannel | New Name | Y Scale Unit Type | | FORCE | kN | 11HEAD0000WSAVZ0 | <optional></optional> | 1 | ROTATIONAL VELOCITY | v | |
| HEAD0000WSDCX0 | <optional></optional> | 1 LENGTH | | LENGTH | mm | | contional> | 1 | | - | |
| HEAD0000WSDCZ0 | <optional></optional> | 1 LENGTH | | MOMENT | kN*m | TINEAD0000W3ACX0 | optional> | 1 | ACCELERATION | - | |
| HEAD0000WSAVX0 | <optional></optional> | 1 ROTATIONAL_VELOCITY | | | dog/o | 11HEAD0000WSACY0 | <optional></optional> | 1 | ACCELERATION | • | |
| HEAD0000WSAVY0 | <optional></optional> | 1 ROTATIONAL_VELOCITY | | KOTATIONAL_VELOCITT | deg/s | 11HEAD0000WSACZ0 | <optional></optional> | 1 | ACCELERATION | • | |
| 1HEAD0000WSAV20 | <optional></optional> | 1 ROTATIONAL_VELOCITY | | VELOCITY | ft/s | 11HEAD0000WSVEX0 | <optional></optional> | 1 | VELOCITY | v | |
| | -optionat- | THOULLINHIGH | | | | 11HEAD0000WSVEY0 | <optional></optional> | 1 | VELOCITY | • | |
| | | | | | | 11HEAD0000WSVEZ0 | <optional></optional> | 1 | VELOCITY | • | |
| Import ISO | -MME/CS | V | | | | 11NECKUP00WSF0X0 | <optional></optional> | 1 | FORCE | • | |
| | | | | | | 11NECKUP00WSF0Y0 | <optional></optional> | 1 | FORCE | • | |
| nnort IS | | E or CSV data in | | | | 11NECKUP00WSF0Z0 | <optional></optional> | 1 | FORCE | • | |
| iipoit io | | | | | | 11NECKUP00WSM0X0 | <optional></optional> | 1 | MOMENT | • | |
| utomotiv | /e Ass | essments | | | | 11NECKUP00WSM0Y0 | <optional></optional> | 1 | MOMENT | • | Dete lasses |
| | / T | | | | | 11NECKUP00WSM0Z0 | <optional></optional> | 1 | MOMENT | • | Data Import |
| | 1.00 | | | | | 11NECKL000WSF0X0 | <optional></optional> | 1 | FORCE | • | |
| | | | | | | 11NECKL000WSE0Y0 | <ontional></ontional> | 1 | FORCE | | |

Time of first sample

To accommodate the pre-crash (settling) phase in a simulation, a new "Time of first sample" input has been added to the Automotive Assessments workflow set-up in PRIMER.

Automotive Assessments and SimVT

- In accordance with ISO-MME convention a <u>negative</u> time value is used to shift the start time of the output curves when post-processing using the Automotive Assessments or SimVT workflows in T/HIS.
- For example, if your analysis begins with 200 milliseconds of set-up (e.g. seat squash etc.) before the crash test load case commences then you would enter -0.2 in the "Time of first sample" input to shift the curves so that the crash test will effectively start at t=0.
- Any data before t=0 is automatically discarded.

LSDYNA to ISO-MME

- The "Time of first sample" value is also used by the LS-DYNA to ISO-MME workflow.
- If it is defined, then the "Time of first sample" header value will automatically be set in the channel files.
- Note that in this instance the samples which are shifted to time < 0 will not be discarded as this only happens when the ISO-MME data is processed.



| Test object number | :1 |
|-------------------------|---------------------------------------------------------|
| Name of the channel | :Accel x - Node 10001 : (HEAD0000WSAC) (Reg 0.100E-03) |
| Laboratory channel code | :NOVALUE |
| Customer channel code | :NOVALUE |
| Channel code | :11HEAD0000WSACX0 |
| Unit | :m/(s*s) |
| Reference system | :NOVALUE |
| Pre-filter type | :NOVALUE |
| Cut off frequency | :NOVALUE |
| Channel amplitude class | :NOVALUE |
| Sampling interval | :0.0001 |
| Bit resolution | : NOVALUE |
| Time of first sample | :-0.02 |
| Number of samples | : 2000 |
| 0 | |
| -2.86178e-08 | |
| -5.19904e-09 | |



Automotive Assessments Improvements





Automotive Assessments Improvements

 Entity IDs that are defined but don't have corresponding *DATABASE_HISTORY_XXXX keyword defined are now shown with a latent cyan-coloured textbox background:



A window is now mapped when such entity IDs are selected or typed into the text box, giving you the option to create the corresponding *DATABASE_HISTORY_XXXX keyword for them. It also provides an option to select the include file to which the keyword will be added. Note: you have to save the include and re(run) the analysis to obtain results for the corresponding entity.

| - | Create *DATABASE_HISTORY_NODE? | |
|--------------------|-----------------------------------------------------------|------------------------------------------------|
| *DATABASE_HISTO | DRY_NODE not present for 32198. Do you wish to create it? | |
| Create in Include: | 08_FS_AEMDB_75_x-ref_z-ref_50M_Sim_1.key | Dropdown to select the include file |
| | ✓ Update Current Layer Include | If ticked, then the current layer include will |
| | Title: | be updated to the one selected in the |
| | | dropdown above |
| | Create Cancel | |
| | | Option to provide optional Title |



Automotive Assessments Improvements

- The ISO channel codes have been updated for several channels in the Far Side VTC v1.1 draft protocol. The necessary changes have been incorporated in Automotive Assessments workflows tool, and backward compatibility support has been added for the older ISO codes. The channels whose ISO codes have changed are:
 - LAP Belt (SEBE00**03**B6FO00 to SEBE00**00**B6FO00)
 - Shoulder Belt (SEBE0003B3FO00 to SEBE0000B3FO00)
 - Contact Dummy-Airbag (ARBG0000WSFOX/Y/Z to AIRB0000WSFOX/Y/Z)
 - Thoracic Spine 04 and 12 Displacements (THSP04/120000DCX/Y/Z0 to THSP04/1200WSDCX/Y/Z0).
- The 'Far Side + VTC' and 'Far Side' crash tests have been renamed to 'Far Side Sled' for consistency across the tools. The
 version for the former 'Far Side + VTC' is now 2024, while the version for the former 'Far Side' crash test is 2022. Support for
 backward compatibility has also been added.
- The term Physiology has been renamed to Anthropometry and support for backward compatibility has also been added.
- Users can now select multiple contacts for contact structures (Contact Dummy Airbag, Contact Dummy Centre Console, Contact Dummy – Seat and Contact Dummy - Seatbelt) via SELECT option.



SimVT Graph Options





SimVT Graph Options – Show Corridors

- A new graph option "Show corridors" has been added to SimVT plotting controls. This determines whether the inner and outer corridors are plotted along with the reference and simulation curves.
- Deselecting show corridors can help reduce clutter on the graphs.







Corridors turned on

Corridors turned off



VTC Quality Criteria Workflows





Quality Criteria – Euro NCAP Frontal

 The Euro NCAP VTC Quality Criteria Workflows tool and associated REPORTER Template are now capable of assessing the Euro NCAP Virtual Frontal Simulation & Assessment Protocol (draft) as well as the existing Far Side protocol.



| Euro NCAP VTC | Quality Criteria ? = 🗌 🗙 |
|----------------------------|--------------------------|
| Test Type | Frontal (Draft) |
| Model Unit System | U2 (mm, t, s) ▼ |
| Display Time Unit | Seconds [s] |
| Display Energy Unit | Millijoules [mJ] ▼ |
| Display Displacement Unit | Millimetres [mm] |
| Display Mass Unit | Kilograms [kg] |
| Dummy Parts | 1030 PARTs selected |
| Head History Node (Global) | 01HEAD0000T3ACX |
| H-point History Node | 01PELV0000T3ACZ |
| B-pillar History Node | 45011535 |
| Seat Parts | 109 PARTs selected |
| Save To File | Save To Model |

Quality Criteria – Euro NCAP HBM

 The Euro NCAP HBM Quality Criteria Workflows tool and associated REPORTER Template allow you to perform the quality checks outlined in Section 7.1 of the Euro NCAP VTC HBM Frontal Protocol (draft) relating to energy, added mass and displacements.





VTC Videos File Size





VTC Videos Settings Improvements

- The displayed End time is now determined by model simulation end time rounded down to three decimal places rather than model simulation end time minus 1 interval step (which had caused issues with video capture previously).
- For the Euro NCAP version, the Video Quality slider has been replaced with a target file size option to allow users to satisfy the 1-10 MB video requirement.





Workflows

Oasys 🔅 LS-DYNA Environment

Pulse Index Workflow (PI)

Uasvs 🔅 LS-DYNA Environment

- The Pulse Index workflow allows you to estimate the acceleration that would be experienced by a vehicle occupant in a crash test scenario. The following improvements have been made:
 - The occupant mass input has been removed with stiffness now being taken per unit mass.
 - Based on the stiffness input, time period of the system is now displayed to serve as a sense check.
 - The acceleration curve filter can now be chosen from three options: C60, C180, and C600.
 - A differentiated velocity curve can now be used in place of the acceleration curve.



Pulse Index

Connections Enhancements





New spotweld line connection: ARC-WELD (contact)

- This new connection type creates contact connection on free edges or feature lines.
 - Defined directly by 2 node picks.



- Or by selection of 1 or more IGES curves.
- The IGES curves may exist in another model.

| — | NS | ? - 🗆 🗙 | | | | | | | | | |
|-------------------------------------------------|-------------|----------------|---------|--|--|--|--|--|--|--|--|
| Dismiss Crea | ate Un | do Last | Help | | | | | | | | |
| Create connection - Select free edge start node | | | | | | | | | | | |
| ATTRIBUTES | | | | | | | | | | | |
| Connection ele | ement type: | MIG (I | beam) 🔻 | | | | | | | | |
| Part id for | spotwelds: | Elem t | уре 🔻 | | | | | | | | |
| Spotwel | d diameter: | Bear | m | | | | | | | | |
| | | Hex | a | | | | | | | | |
| PID rule: | | 2 Hex | as 🔍 | | | | | | | | |
| | | 3 Hex | as | | | | | | | | |
| | | 4 Hex | as | | | | | | | | |
| | | 8 Hex | as | | | | | | | | |
| Creation method | Free e | 12 He | xas des | | | | | | | | |
| | | 16 He | xas | | | | | | | | |
| | Min | MIG (be | eam) | | | | | | | | |
| free edge / feat ling | ne | ARC-W | ELD — | | | | | | | | |
| O geometry line | Edg | ge inset | 10.0 | | | | | | | | |
| | ak angle | 30.0 | | | | | | | | | |
| | I | Pitch | 5.0 | | | | | | | | |
| Modify existing path | h | | | | | | | | | | |



New spotweld line connection: ARC-WELD (contact)

- Each ARC-WELD connection "owns" a TIED_SHELL_EDGE_TO_SURFACE_CONTACT
- Contact thickness SAST, SBST set to maximum calculated from nodal projection
- PARMAX increased to user limit (if necessary to tie nodes)





New spotweld line connection: ARC-WELD (contact)

• The connection status is REALIZED if all nodes tie.

- The connection status is INVALID if any nodes fail to tie.
- Easy to identify weld failures on connection table.



| — | | | | | CONNECTI | ON TABLE | | | | | - 🗆 × |
|--------|----------|----------|----------|-----------------------|----------------|----------------|---------------------------|------------------|-------------------|-----------------------|-------|
| Dismi | ss View | Options | Refresh | Action: update & rema | ake 🕨 🕨 | Show all | Spotwelds Adhesi | ve Rivet | Write | Sketch conx on select |) ? |
| Apply: | Undo All | Selected | Changed | Autoscale Clear | Sel all Select | Show sel | Bolts/Joints Spot lin | es | Set columns | Save columns to pref | |
| ŧD | Туре | | Subtype | Status | Error | | | Details | | Contact | id |
| CNX | 1 LINE | | ARC-WELD | Invalid | ARCWELD CONTAC | T FAIL - faile | d to tie all tracked node | 9/21 nodes untie | ed. sfst=2.00 sfr | nt=2.00 C1 | |
| CNX | 2 LINE | | ARC-WELD | Realized | | | | | | C2 | |
| | | | | | | | | | | | |

New spotweld line connection: ARC-WELD (NRB)

- ARC-WELDs can be easily converted from tied contacts to multiple NRBs.
- The default for newly created Arc-Welds can be set using the connection option: "Use NRBs for Arc-Weld".
- Alternatively existing welds can be remade using the saved setting on the connection table "NRB for Arc-Weld" to switch between contact and NRB.



New spotweld line connection: ARC-WELD vs MIG (beam)

• ARC-WELDs can be converted to MIG (beam) via the connection table.





| — | | | | CONNECTI | ON TABLE | | | | −□× |
|-------------|--------------|----------------|--------------------|----------------|----------|--------------------------|-----------------|--------------------|-----|
| Dismiss | View Options | Refresh Actio | n: update & remake | ► | Show all | Spotwelds Adhesive Rivet | Write Ske | tch conx on select | ? |
| Apply: Undo | All Selected | Changed Autoso | ale Clear S | Sel all Select | Show sel | Bolts/Joints Spot lines | Set columns Sav | ve columns to pref | |
| ŧD | Туре | Subtype | Status | Error | | Details | Contact id | Part ID | |
| CNX1 | LINE | MIG (beam) | Realized | | | | C1 | 100 | |
| CNX2 | LINE | ARC-WELD | Realized | | | | C2 | <n a=""></n> | |
| | | | | | | | | | |



Connections – bolt hole drilling

- The Connections creation panel can now, optionally, also drill bolt holes as a part of bolt creation.
- This new option is currently only supported for single point, cylindrical nodal rigid body type bolts.



Oasys 🔅 LS-DYNA Environment

Connections – modular bolt part

• The default is to use same part for deformable elements when making multiple bolts, e.g. all bolt heads in same part.



 There is now a new option to use unique parts for deformable elements of modular bolts (same as treatment of rigid elements), e.g. unique part for each bolt head.





Connections – modular bolt contact

- The new feature described here applies when working with connection bolt modules containing *SET_SEGMENT_GENERAL which typically will use *DEFINE_CONTACT_VOLUME.
- The following new bolt connection option will automatically create



- On bolt creation *CONTACT is created with *SET_SEGMENT_ADD containing multiple *SET_SEGMENT_GENERAL.
- All bolts of same module will have the ***CONTACT**.
- The ***SET_SEGMENT_ADD** title references the module name.





HAZ – options for increased number of elements per ring

- Beam welds previously supported either 6 or 8 elements/ring in the heat-affected zone.
- Options have now been added for 10, 12, 14 and 16 elements per ring giving more flexibility when creating connections.





Solid spotwelds – new nugget types

• New solid spotweld types 2-hexa and 3-hexa have been added.





Connections – spotweld_remake_auto_remove_layer

• There is now a new preference:

spotweld_remake_auto_remove_layer

When it is TRUE, PRIMER will automatically remove layers that failed to connect when remaking spotwelds.

- This option is also available on the panels as shown.
- For example, when doing part replace PRIMER now automatically converts 3-layer spotwelds to a 2-layer ones where appropriate instead of having to convert manually afterwards via the connection table.

| Connection creation options | 3 | 수 Part K | | | | | |
|------------------------------------------|---------------|----------|---------------|-------------------|-------------------|------------------|--|
| Dismiss 🎝 Reset All | Hel | р | Create | Replace | Sketch | Renumber | |
| Spotwelds Bolts Rivets A | dhesive Label | ling | Сору | Delete | Table | Compare | |
| | | _ | Modify | Keyword | Check | Pen Check | |
| Common options | | ? | Next > | SELECT THE | GET PARTs (| nothing selecte | |
| Search distance | 10.0 | ? | | ingle target part | | iotining bolooto | |
| Min dist between connections | 10.0 | _ | | ultiple parts m | tchod by ID | | |
| ✓ Length of spotweld | | ? | | at accombly | atched by ID | | |
| Minimum | 0.5 | | O replace pa | art assembly | | | |
| Maximum | 10.0 | | O renumber | option | | | |
| Complete maximum | 20.0 | | O connectio | n option | | | |
| Edge distance | 3.0 | ? | 🔘 assign ma | ass option | | | |
| Angle tolerance | 30.0 | ? | O re-attach | options | | | |
| Max number of panels joined | 5 | | O set contro | ol options | - PAR | | |
| Max warp for solid spotwelds | 20.0 | | O transfer o | ptions | All None | Sont | |
| Use _PID for beam spotwelds | | | Re-at | tach? | Filter Vis | Key In Sk | |
| Spotweld/glue part A <-> part A | | | | | | Key_m ok | |
| Spotweld/glue multi-part clinch | | | Remake cor | nnections | M1 M2 | | |
| Automatically remove missing layer(s) of | on remake | | Rem mis | ssing layer(s) | (M/L) PART | s) (all models) | |
| | | | Process HA | Z welds | M1/P4 (Plane | e_4) | |
| Align solid weld to free edge | | | non-structur | al items | M1/P10 (Spo | tweld) | |
| Consider feature lines for alignment | 20.0 | | | me | M1/P11 (Plan | ie_11) | |
| Always align flat edge | | | | 51110 | M1/P12 (Plane_12) | | |
| Ignore inner layers for alignment | | | ✓ masses | | M1/P31 (Plan | ie_31) | |
| Alignment search distance | 50.0 | | import shells | s on solid part | M1/P32 (Plan | ie_32) | |
| | | | | | M2/P12 (Plar | ie_12) | |
Connections Compare – Filter options

- The connection compare feature allows users to compare connections across models or with connection files.
- In previous versions, we can filter the connections by visible domain by toggling the "<u>Set domain from visible elements</u>" option on.
- For PRIMER 22.0, we have added the functionality to <u>filter connection by PARTs</u>





Connections – UI improvements

• The Connections creation panel and the Connections Table both see some user-interface improvements including the renaming of controls and the rearrangement of menu layouts to make them more intuitive.

| ー 中 MAKE CONNECTIONS ? - □× | - | | | | | | CONNECTION | TABLE | |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|--------------|---------|---------------|---------------|---------|------------|--------------|------------|
| Dismiss Create Undo Last Help | Dismiss V | iew Options | Refresh | Autoscale | Clear Sel all | Select | Show sel | Spotwelds | Adhesive |
| Create spotwelds/Rivets | Apply: Undo | All Selected | Changed | Action: updat | te & remake | ► | Show all | Bolts/Joints | Spot lines |
| ATTRIBUTES | ŧD | Туре | | Status | Error | Details | Part | ID | Contact id |
| Connection element type: Beam V | M2/CNX2 | SPOTWELD | 2 hexas | Realized | | | 4 | | C1 |
| Part id for spotwelds: 3 | M2/CNX3 | SPOTWELD | 3 hexas | Realized | | | 4 | (| C1 |
| Spotweld diameter: 5.0 Remesh: Remesh Options PID rule: n/a Creation method Pick screen point O X, Y, Z coords Image: Pick screen point Pick screen point Image: Pick screen point Pick screen point | | | | | | | | | |
| all nodes in set line of welds/rivets pick connection auto weld pick geom point | | | | | | | | | |

Load Path Tool Enhancements





• Added the option to automatically create multiple cross sections through a desired structure.



| — | CREATE LOAD_PATH in model 1 |
|-----------------------------------------------------------|-----------------------------------------------------|
| + Create | Reset All 🗸 Check 🖋 Sketch 👶 Only 🔻 |
| X Cancel | Copy In 🔐 X-Refs 🖌 Text Edit |
| Include: M1 < | Master file> |
| | reate LOAD_PATH (model 1) |
| Label: | 1 |
| Title: <no< th=""><th>Load Path name given></th></no<> | Load Path name given> |
| Return | Help Save to oa_pref |
| 1. Structure sele | ction & PSID definition : |
| Select | Select All Select Visible 0 elements selected |
| Elements to exclude | Je from selection: solids beams shells thick shells |
| Sketch | Show only |
| Xsec PSID: | Auto-create part set Label: 1001434 |
| 0 | Manually select or create part set |
| 2. Pitch, position | and dimension of XSECs : |
| Orientation: | Normal to path |
| Pitch | Number of XSECs Snap to grid |
| Pitch: | 0.0 |
| Start offset : | 0.0 Auto (Offset by half of the pitch) |
| Auto size | Fixed size |
| % increase: | 10.0 Only visible |
| Max size: | 0.0 |
| 3 Path construct | ion : |
| Pick nodes | Undo last Reset path |
| Modify path | Sketch path |
| XSEC start label: | 1 Automatically add locations to titles |
| Preview XSECe | Create XSECs |
| HEVIEW ABEUS | ordite Added |



- The process involves the following steps:
- 1. Select the desired structure and the PSID to be referenced by the *DATABASE_CROSS_SECTIONs.



2. Define the pitch, position and dimensions of the cross sections.

| | CREATE LOAD_PATH in model 1 ? |
|--------------------------------------------------------------|----------------------------------------------------|
| + Create | Reset All 🗸 Check 🧪 Sketch 👶 Only 🔻 |
| 🗙 Cancel 📑 | Copy In 🔥 X-Refs 🖌 Text Edit |
| Include: M1 <n< th=""><th>laster file></th></n<> | laster file> |
| Ci | reate LOAD_PATH (model 1) |
| Label: | 1 |
| Title: <no l<="" th=""><th>oad Path name given></th></no> | oad Path name given> |
| Return | Help Save to oa_pref |
| 1. Structure selec | tion & PSID definition : |
| Select | Select All Select Visible 1082 elements selected |
| Elements to exclude | e from selection: solids beams shells thick shells |
| Sketch | Show only |
| Xsec PSID: | Auto-create part set Label: 1001434 |
| 0 | Manually select or create part set |
| 2. Pitch, position a | ind dimension of XSECs : |
| Orientation: | Normal to path |
| Pitch | Number of XSECs Snap to grid |
| Number of XSEC: | 8 |
| Start offset : | 0.0 Auto (Offset by half of the pitch) |
| Auto size | Fixed size |
| % increase: | 10.0 Only visible |
| Max size: | 0.0 |
| 3. Path constructi | on : |
| Pick nodes | Undo last Reset path |
| Modify path | Sketch path |
| XSEC start label: | 1 Automatically add locations to titles |
| Preview XSECs | Create XSECs |
| | |



3. Define a path at the desired structure by picking at least 2 nodes.



 The *DATABASE_CROSS_SECTIONs can then be created by PRIMER and the load path list in the main panel is automatically populated.



Saving 'auto-create' settings as preferences

All configuration settings (excluding entity selection and labelling) from the auto-create panel can be saved as preferences.
 Clicking on 'Save to oa_pref' will save the values in the current session as defaults for future sessions of the load path auto-create panel.

| — & | (| REATE LOA | D_PATH in mod | el 1 | ? > |
|----------------|----------------------------------------------------------------------------|-----------------|-------------------|---------------------|--------------|
| + Create | ື Reset All | ✓ Check | A* Sketch | i 🍀 Only | Y |
| X Cancel | 🗋 Copy In | 🚓 X-Refs | A Text E | dit | |
| Include: M | 1 <master file<="" td=""><td>></td><td></td><td></td><td></td></master> | > | | | |
| | Create LOAI | D_PATH (mo | del 1) | | |
| Label: | 1 | ► | | | |
| Title: < | No Load Path | name given> | | |] |
| Return | Help | Save to oa | a_pref | | |
| 1. Structure | election & PSI | D definition : | | | |
| Select | Sele | ect All | Select Visible | 4669 elements s | selected |
| Elements to ex | clude from sel | ection: se | olids 📄 beam | s shells | thick shells |
| Sketch | Show | v only | | | |
| Xsec PSID: | Auto-create | part set | | PSID: 21003 | • |
| | Manually se | elect or create | e part set | | |
| 2. Pitch, posi | tion and dimen | sion of XSEC | s: | | |
| Orientation | : Norm | al to path | • | | |
| Pitch | Number | of XSECs | Snap to grid | | |
| Number of XS | EC: 5 | | | | |
| Start offset | : 0.0 | A | uto (Offset by ha | If of the pitch) | |
| Auto size | Fixed | size | | | |
| % increase | : 10.0 | 0 | nly visible | | |
| Max size: | 0.0 | | | | |
| 3. Path const | ruction : | | | | |
| Pick nodes | Undo | last | Reset path | | |
| Modify path | n Sketch | n path | | | |
| XSEC start lat | el: 1 | ▼ ~ A | utomatically add | locations to titles | |
| Preview XSE | Cs Create | XSECs | | | |
| | | | | | |



Exporting properties to CSV

 The option to export the cut section properties of all *DATABASE_CROSS_SECTIONs referenced by a load path to a csv file has also been added.

| CREATE LOAD_PATH in model 1 ? - X | | | | | | | | | | | | |
|-----------------------------------|----------------------------|---------------------------------------------------------------------------------|---------------------------|----------|-------------------|-------------------------|--|--|--|--|--|--|
| + Cre | eate | | ່ງ Reset All | ✓ Ch | eck 🧨 Sketch | 👶 Only 🛛 🔻 | | | | | | |
| × Ca | incel | | D Copy In | # X-F | Refs A Text Edit | | | | | | | |
| Inclu | de: | M1 | <master file=""></master> | | | | | | | | | |
| | Create LOAD_PATH (model 1) | | | | | | | | | | | |
| Lat | bel: | | 1 | - | | | | | | | | |
| Tit | le: | <n< th=""><th>o Load Path na</th><th>ime give</th><th>en></th><th></th></n<> | o Load Path na | ime give | en> | | | | | | | |
| | | | Cross Sectio | ns | Multi Select | | | | | | | |
| | 1 | ► | 1 | ▼ | Auto-Create | Keep old xsecs in model | | | | | | |
| | 2 | ► | 2 | T | Delete All | | | | | | | |
| | 3 | Þ | 3 | • | Export Properties | | | | | | | |
| | 4 | ► | 4 | T | | - | | | | | | |
| | 5 | ► | 5 | ▼ | | | | | | | | |
| | 6 | ► | | W | | | | | | | | |
| | 7 | ► | | W | | | | | | | | |
| | 8 | ► | | | | | | | | | | |
| | 9 | ► | | | | | | | | | | |
| | 10 | ► | | | | | | | | | | |
| | | | | | | | | | | | | |

| | A B | С | D | E | F | G | H | 1 | J | K | L | M | N | 0 | Р | Q | R | S |
|-----|-------------------|------------------|--------------|------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| 1 C | Cut section prope | rties for load p | ath 1 in mod | el 1 | | | | | | | | | | | | | | |
| 2 C | Cross secti title | psid | xct | yct | zct | xch | ych | zch | xhev | yhev | zhev | lenl | lenm | Area | Хс | Yc | Xc_g | Yc_g |
| 3 | 1 X=31 | 62 100143 | 4 3.16E+03 | 3 7.01E+02 | 9.32E+02 | 3.09E+03 | 6.78E+02 | 9.95E+02 | 3.16E+03 | 7.01E+02 | 2.93E+03 | 8.29E+01 | 4.75E+01 | 8.39E+01 | 3.94E+01 | 2.44E+01 | 3.18E+03 | 7.32E+02 |
| 4 | 2 X=29 | 7 100143 | 4 3.00E+03 | 6.62E+02 | 1.06E+03 | 2.92E+03 | 6.39E+02 | 1.13E+03 | 3.00E+03 | 6.62E+02 | 3.06E+03 | 7.92E+01 | 4.85E+01 | 8.25E+01 | 3.98E+01 | 2.44E+01 | 3.01E+03 | 6.92E+02 |
| 5 | 3 X=28 | 32 100143 | 4 2.83E+03 | 6.15E+02 | 1.18E+03 | 2.75E+03 | 5.85E+02 | 1.23E+03 | 2.83E+03 | 6.15E+02 | 3.18E+03 | 7.73E+01 | 4.94E+01 | 8.19E+01 | 4.00E+01 | 2.53E+01 | 2.84E+03 | 6.46E+02 |
| 6 | 4 X=26 | i9 100143 | 4 2.66E+03 | 3 5.51E+02 | 1.27E+03 | 2.56E+03 | 5.43E+02 | 1.30E+03 | 2.66E+03 | 5.51E+02 | 3.27E+03 | 7.73E+01 | 6.77E+01 | 9.95E+01 | 4.39E+01 | 4.04E+01 | 2.67E+03 | 5.92E+02 |
| 7 | 5 X=24 | 6 100143 | 4 2.47E+03 | 4.87E+02 | 1.33E+03 | 2.37E+03 | 4.76E+02 | 1.35E+03 | 2.47E+03 | 4.87E+02 | 3.33E+03 | 7.66E+01 | 9.87E+01 | 1.31E+02 | 4.91E+01 | 5.74E+01 | 2.47E+03 | 5.45E+02 |

es the mark the Part (and - Dary of PEN-Max \$10103877 : 1.262904E+00. Min \$10595151 : 1.823150E-12

- Hothes D

- I in gins

d Utilisation Factor (Max all ob

0.300 0.400 0.500 0.000 0.700 0.800

0.900

8.6317

Human-Safe Design

M R R M N N M

Loadcases



- This tool enables you to quickly create seat mechanisms and position the seat at various predefined points along the seat track, in accordance with different testing protocols. Specify part sets, node sets, and connection nodes, which are used to build mechanisms such as seat slider, height adjustment, base tilt, and headrest movement.
- The seating positions are determined based on track curve points provided via file input (.iges or text file) or model selection.
 Once configured, you can easily visualise and position the seat according to different regulatory or design requirements.
- A tutorial is available via Help \rightarrow Tutorials.



Oasys 🔅 LS-DYNA Environment

• The following testing protocols are supported for Frontal and Side Impact:

| Frontal Impact | Side Impact |
|-------------------------------------------------------|--------------------------------------|
| ASEAN NCAP | ASEAN NCAP |
| C-IASI | C-IASI |
| C-NCAP Full Width Rigid Barrier (2024-Hybrid III 50M) | C-NCAP (2024-WorldSID 50M) |
| C-NCAP 50% Overlapping MPDB (2024-THOR 50M) | EuroNCAP MDB (2023-WorldSID 50M) |
| EuroNCAP Full Width (2021) | EuroNCAP POLE (2023-WorldSID 50M) |
| EuroNCAP MPDB (2024) | ISO (WorldSID 50M) |
| EuroNCAP ODB (2018) | JNCAP (WorldSID 50M) |
| JNCAP (2023) | KNCAP (WorldSID 50M) |
| KNCAP Full (2022-Female dummy III) | UN R95 (2014-50M ES-2re Dummy) |
| KNCAP Offset (2022-Hybrid III 50M) | UN R135 (2016-WorldSID 50M) |
| US NCAP FMVSS 208 (50th Percentile Male Dummy) | US NCAP FMVSS 214 (50M ES-2re Dummy) |
| US NCAP FMVSS 208 (5th Percentile Female Dummy) | US NCAP FMVSS 214 (50M SID Dummy) |
| UN R94 (2022-Hybrid III 50M) | |

Oasys 🔅 LS-DYNA Environment

- In the "Seat Model Input" panel, you will need to select a seat model. You will also need to specify "Seat Type," "SGRP-Point (R-point)," and the default seating positions.
- The tool assumes that the seat will be positioned at the default SGRP-point when it is read.
- Select the manufacturer's design position for the various assemblies required by the regulation.

| - | Seat Position | ning Tool | - 🗆 × | | | | | | | | | |
|------------------------|------------------------------------------------------------------------------------------------|------------------------|------------------------------------------|--|--|--|--|--|--|--|--|--|
| Settings F | ile: Documents\SEAT_POSITIONING\ | DCC_POSN_SCRIPT\OCC_PO | DSN_SCRIPT\seat_pos_inp1.st 😭 🥐 | | | | | | | | | |
| | Read S | ave | | | | | | | | | | |
| | | | | | | | | | | | | |
| Select Regulations | Select 'Seat Part Set Input >>' to configure the part set inputs for the mechanism definitions | | | | | | | | | | | |
| Seat Model Input | Seat Model Input: | GIOCC_POSN_SCRIPTIO | CC_POSN_SCRIPT\demo_seat_model2.ke 🛛 😭 🥐 | | | | | | | | | |
| Seat Part Set Input | | Read Model | _ | | | | | | | | | |
| Mechanism and H-Points | Seat Type: | FRONT_RIGHT | ? | | | | | | | | | |
| Final Seat and Output | Vehicle Direction: | +X 🔻 | ? | | | | | | | | | |
| | Height Adjustable | YES 🔻 | ? | | | | | | | | | |
| | R-Point: | -373.12079, 510.49701 | Select Sketch | | | | | | | | | |
| Quit | Manufacturer's Seat Fore/Aft: | Full Forward 🔻 | ? | | | | | | | | | |
| | Manufacturer's Seat Fore/Aft Offset: | 0 | ? | | | | | | | | | |
| | Manufacturer's Seat Height: | Mid Point 🔹 | ? | | | | | | | | | |
| | Manufacturer's Seat Back Angle: | Default 🔻 | ? | | | | | | | | | |
| | Manufacturer's Head Restraint Height: | Mid Point 🔻 | ? | | | | | | | | | |
| | Manufacturer's Head Restraint Fore/Aft: | Default 🔻 | ? | | | | | | | | | |
| | Manufacturer's Base Tilt: | Default 🔻 | ? | | | | | | | | | |
| | Default Seat Back Angle: | 23 | ? | | | | | | | | | |
| | Default Seat Base Tilt Angle: | 0 | ? | | | | | | | | | |
| | Default Head Restraint Angle: | 0 | ? | | | | | | | | | |
| | Default Head Restraint Height: | 0 | 2 | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | << Select Regulations | Seat Part Set Input >> | | | | | | | | | | |



- You will need to select part sets (and node sets if any) to specify different assemblies as shown in the images.
- Click the "?" help button to learn more about the inputs that need to be selected. Specify all the inputs and press "Create Mechanism" to define the mechanisms in the seat.

| Select Regulations | Select 'Create Mecha | nism' after specifying th | e relevant s | eat part set ID |)(s) for creating mechanisms that a | llows for seat and hea | adrest adjustm | ient. | Seat Back |
|----------------------|--------------------------------|---------------------------|--------------|-----------------|-------------------------------------|------------------------|----------------|----------|-------------------------------------|
| Seat Model Input | Seat Slide & Height | Seat Bas | e Tilt | Не | ad Restraint Height & Tilt | | | | |
| Seat Part Set Input |] | Seat Back | & Bottom | | 2 | | | | |
| chanism and H-Points | Seat Back Part Set: | 12005 | Select C | Visualise ? | Seat Back Node Set: | | Select C | Sketch ? | |
| inal Seat and Output | Seat Cushion Part Set: | 12004 | Select C | Visualise ? | Seat Cushion Part Set: | | Select C | Sketch ? | |
| | Hinge Conx Node N1: | 1244819 | Select | Sketch ? | Hinge Conx Node N2: | 1252065 | Select | Sketch ? | |
| | | Seat Mount | & Slider | | | | | | |
| Quit | Lower Fixed Rails Part Set: | 12000 | Select C | Visualise ? | Lower Fixed Rails Node Set: | | Select C | Sketch ? | |
| | Upper Moveable Rails Part Set: | 12001 | Select C | Visualise ? | Upper Moveable Rails Node Set: | | Select C | Sketch ? | |
| | Line Conx Node N1: | 1254649 | Select | Sketch ? | Line Conx Node N2: | 1254508 | Select | Sketch ? | |
| | | Seat Height A | diustment | | - | | | | Seat Cushion |
| | Front Bar Linkages Part Set: | 12002 | Select C | Visualise ? | Front Bar Linkages Node Set: | | | Sketch ? | |
| | Rear Bar Linkages Part Set: | 12003 | Select C | Visualise ? | Rear Bar Linkages Node Set: | | | Sketch ? | |
| | Upper Linkages Cen Node Set: | 1200020 | Select C | Sketch ? | Lower Linkages Cen Node Set: | 1200021 | Select | Sketch ? | |
| | | | | | - | | _ | | VI PI 2005 TEAT CUCHYON NALL SPELLS |
| | << Seat Model Input | Create Mechanism | Mechan | ism and H-Point | S >> | | | | |
| Linne | or Moyoblo Po | il 🖌 | | | | | | | |
| Oppe | | | | | | | | | |
| | | | - | | MI.P12379 SEAT RALLAR | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

 In the Mechanism and H-Points panel, you can visualise assemblies and sketch connections. Select the relevant assemblies/connections from the drop-down to Sketch/Visualise.

Se

Sea

Mecha

- Select Seat Track Points: You can define the seat track curve points using an .iges file, a CSV file (name, x, y, z), or by selecting nodes directly in the model. After selecting the points, click "Process Points" to extract the seating positions—this will activate the "Position Seat" button.
- You can also select a different regulation to position the seat at multiple locations.

| | | Seat Position | ning Tool – 🗆 🗙 |
|------------------|-----------------------------|----------------------------------------------------|---------------------------------------------------------------------------------------------------------------|
| Settings | s File: C:\SOURCE\scripts_d | ir\PRIMER\SEAT_POSITIONING\test_inp_h_pt1.stg | 2 |
| | Read | Save | |
| ct Regulations | Select an .csv file o | containtaing seat points (point_name, x, y, z) and | click 'Process Points' to load the seat points. Then select 'Position Seat' to begin the positioning process. |
| at Model Input | Select Regul | lation | |
| Part Set Input | Impact Type: | Frontal Impact | |
| ism and H-Points | Regulation: | ASEAN NCAP | |
| Seat and Output | Seat Fore/Aft: | Mid Point | |
| | Seat Fore/Aft Offset: | 0 | а |
| | Seat Height: | Lowest | d g |
| Quit | Seat Back Angle: | Manufacturer's Design | R h |
| | Base Tilt: | Manufacturer's Design | · · · · · · · · · · · · · · · · · · · |
| | Head Restraint Height: | Highest | • |
| | Head Restraint Fore/Aft: | Manufacturer's Design | a Foremost, Top of Default, Top og Rearmost, Top |
| | Seat Fore/Af | t — | ♦ Foremost, Middle |
| | Sketch Assembly: | 1 fixed_floor Visu | alise C Foremost, Bottom f Default, Bottom i Rearmost, Bottom L |
| | Sketch Connection: | 1 slider_rail_line_connection V Ske | tch Middle, Bottom (Frontal Impact : ASEAN NCAP) |
| | Seat Base Ti | ilt | Write H Deint (any) |
| | Sketch Assembly: | 1 seat_base Visu | aliseSelect Seat Track Points ? |
| | Sketch Connection: | 1 seat_base_cushion_line_conn∈▼ Ske | tch Seat Track File (.igs): |
| | Head Restrai | int | H-Points File (.csv): SEAT_POSITIONING\h_point.csv |
| | Sketch Assembly: | 1 head_rest Visu | alise Seat Track Nodes: Select Nodes on Seat Track Cu |
| | Sketch Connection: | 1 head_rest_slide_rail_line_conn/V Ske | tch Move Seat: 2-Step: 🖌 1-Step: 🤇 ? |
| | Head Restrai | int Tilt | Process Points |
| | Sketch Assembly: | 1 head_rest Visu | alise |
| | Sketch Connection: | 1 head_rest_seat_back_pin_coniv Ske | tch |
| | er Capit Bard Ca | At Input | and and Guland by |
| | << Seat Part Se | Position Seat Final S | eat and Output >> |



• After running the tool, you should be able to move the seat from the "Default Position" to a user defined position (e.g., Foremost, Top).



Default Position (R-point)

Oasys 🔅 LS-DYNA Environment



- Model Write Out: There are two methods available for saving the seat model:
 - Method 1: Store all seat positions within a single model. To visualize these positions later, use the "Read a Model with Stored Positions" option on the main input panel.
 - **Method 2**: Save separate models for each individual seat position.

HPM/HRMD Tools

- The H-Point Machine (HPM) and Head Restraint Measurement Device (HRMD) Tools are now available in the Tools menu.
- A separate licence is needed to run the tool in PRIMER and gain access to the required HPM/HRMD models (no extra licence is necessary to then run in Ansys LS-DYNA).
- The HPM tool enables users to quickly and easily set-up an analysis to find the H-point of your particular seat/seating package model within the Ansys LS-DYNA suite.
- The HRMD tool allows users to perform assessments of your seat and head restraint geometries.









HPM/HRMD Tools

- Euro NCAP protocols have been updated to the latest regulations:
 - Whiplash Test Protocol 4.2 (2023);
 - Rear Whiplash Test Protocol 1.1 (2018);
 - Euro NCAP Assessment Protocol 9.3 (2023).
- Improved occupant and seat positioning angle feedback. •
- Master file can now be written out to retain original input • model as an include file.

| _ | | Model Write Out | | | |
|---|------------------------|-----------------------|------|---|-------|
| ľ | | | | | |
| | Select directory: | C://Whiplash/ | | | |
| I | Filename: | Master_File.key | | |] |
| L | Model title: | H-Point Machine Setup | | | |
| | Write Out Master File: | ? | | | |
| | Save session data | | Exit | V | Vrite |

| | | | | | RESULT | rs (Eurol | NCAP) | | | | | |
|--------------------------------|----------------|------------|------|-----------|-------------------|------------------------|--------------------|-----------|---------------------|---------------------|-----------------|------------|
| | | | | | | | | Backse | t (mm) | | | |
| | | | | | 0 860 - | 20 | 40 | 60 | 80 | 100 | 120 | 140 |
| | | | | | | Positiv | • | | | | | |
| | | | | | 840 | Scorin | | | | | | |
| | | | | | 820 | | _ | | | | | |
| | | | | | | | | | | | | |
| | | | | | 800 | (| | | | | | |
| | | | | Height | 780 | | | | | | | |
| Positioning Res | sults | | | (mm) | 100 | | | | | | | |
| H-POINT AND HPM A | NGLE RESUL | TS | | | 760 | | $ \downarrow$ | | | | | |
| | | | | | 740 | | | | | | | |
| H-Poi | nt | | | | | | | | | | | |
| | | | | | 720 | Negativ | . | | | | | |
| The HPM H-Point | is located at: | _ | | | 700 | Scorin | | | | | | |
| X Y 2269.0 291.1 | 1 9 | Z 987.5 | | | 700 | Hea | d Restr | aint Geor | metry (H | R) | | |
| | | | | | | | | | | | | Score |
| Left H-Point button coords: 2 | 630.7, 396.0, | 632.5 | | Backset: | 32 | 2.6 | mm | | < | 4 | 5mm limit | 1.000 |
| Right H-Point button coords: 2 | 568.7, 505.1, | 575.3 | | Height: | 80 | 0.5 | mm | | | | | 0.301 |
| Delta X: -62.0 | Delta Z: -57.2 | 2 | | HR | neight sc | ore determ at 755mm | ined on and a s | a sliding | scale fi 1.000 a | rom a se t 825mm | core of -1 n | .000 |
| | | | | | | Head Rest | raint Sc | ore: | 0.301 | | | |
| HPM Ar | ngle | | | HR score | is equal f | to the wors | se perfo | orming of | the HR | Height a | ind Backs | et scores. |
| The HPM torso angle is: | 42.4 | degrees | | | | Wo | rst Cas | e Geome | etry (WC | :) | | |
| The HPM hip angle is: | 96.4 | degrees | | | | | | | | | | Score |
| The HPM left knee angle is: | 133.4 | degrees | | Backset: | 32 | 2.6 | mm | | < | 7 | 0mm limit | 1.000 |
| The HPM right knee angle is: | 132.7 | degrees | | Height: | 80 | 0.5 | mm | _ | > | 79 | 0mm limit | 1.000 |
| The HPM left foot angle is: | 139.6 | degrees | | WC ees | ra is agu | Worst (| ase So | front eas | 1.000 | naeeee | both limit | oritoria |
| The HPM right foot angle is: | 142.2 | degrees | | where | n is the | number of | seats. | Only 1 se | eat is co | nsidere | d for this | script. |
| The HPM thich angle is: | 10.2 | degrees | | Note that | these a | re raw, un | factored | discores | and tha | t award | of the w | orst case |
| | 10.2 | 309,000 | | geon | etry sco | re is condi | tional up | oon achie | eving a r | aw sco | re greate | r than |
| | | | | 3.0 | 0 in dyna | imic asses | sment a | after cap | ping and | I modifie | er applicat | ion. |
| | | Fin | lisn | | | | | | | H-I | Point | Finis |
| | | | | | | | | | | | | |

Results

IP Pendulum – Enhancements

- The IP Pendulum tool is used to set up multiple Instrument Panel Pendulum impact models.
- In PRIMER 22.0 the default ECE R21 option automatically applies
 *DEFINE_TRANSFORMATION to rotate the line of flight onto the trim normal if
 the impact angle is more than 5 degrees.
 The ECE R21 (Deprecated) option does not apply any rotation.







IP Pendulum – Enhancements

- Default settings for FMVSS201 have been added.
- When the regulation is switched between FMVSS201 and ECER21 you are now asked to confirm whether the settings should be updated to the new regulation. Any settings can be further modified if required.
- A default pendulum can be found in \$OA_INSTALL/primer_library/Arup_Pendulum. However, you can also use your own pendulum model.

| — | IPP SETTINGS | ? - 🗆 🗙 |
|----------|-----------------------------|----------------|
| APPLY | RESET ALL | |
| 165.0 | Diameter of head | |
| 757.5 | Max extent of rod | |
| 653.5 | Min extent of rod | |
| 25.4 | Min distance above H-point | |
| 6604 444 | Initial valacity standard | |
| 0034.444 | | |
| 5361.111 | Initial velocity reduced | |
| 1.0E20 | Max target-contact distance | |

Default settings for ECE R21

| — | IPP SETTINGS | ? - 🗆 🗙 |
|----------|-----------------------------|----------------|
| APPLY | RESET ALL | |
| 165.1 | Diameter of head | |
| 755.65 | Max extent of rod | |
| 654.05 | Min extent of rod | |
| 25.4 | Min distance above H-point | |
| 6694.444 | Initial velocity standard | |
| 6694.444 | Initial velocity reduced | |
| 1.0E20 | Max target-contact distance | |

Default settings for FMVSS201



Other Safety Tool Updates

- In the Seat Belt Anchorage tool:
 - There is an additional option available to constrain the inertia loading device using rigid bodies.
- In the Luggage Retention tool:
 - The sliding planes have been constrained to the bottom rigid plate so that they will move together.
- In both Seat Belt Anchorage and Luggage Retention tools:
 - A check has now been added for constrained extra nodes. The tool will issue a warning if any node in the set belongs to an NRB, a rigid body, or references a rigid part.
- The help manual can be accessed directly from the input panels of the Seat Belt Anchorage, Luggage Retention, and Sled Test tools.



| - | | SBA test se | t-up | | | -🗆 × |
|-----------------------------|----------------|---------------|---------------------------|--------|---------------------|--------------------|
| | | Seat bel | t inputs | | | |
| Setti | ings file: | | | Select | ? | Manual |
| | | | SAVE | | | |
| Seat selection: | Right seat 🖌 ? | Middle seat ? | Left Seat ? | | Seat settings and b | elt fitting inputs |
| Middle seatbelt type: | 2 7 | | | | | |
| Seatbelt connection method: | Bolt holes ? | Rigid patch ? | Constrained extra nodes ? | | | |



HBM Tools



Positioning cable elements for HBMs

- Simulation-based positioning of Dummies/HBMs uses cables (shown in RED in the image) to pull assemblies into the desired position using an Ansys LS-DYNA simulation.
- There are two types of cable available: force-based and displacement-based.
- Displacement-based cables are highly recommended because they ensure the target is reached by the end of the analysis. However, with just three per assembly, it was reported that sometimes high cable loads caused excessive deformation and oscillations in HBMs.
- To improve this, from PRIMER 22.0 onwards:
 - *ASSEMBLY definitions for HBMs can now have more than three cable nodes.
 - Cable attachment locations can be selected by the user.
 - Load curves controlling the cable length reduction ("displacement") have been improved to reduce peak load and oscillations.



Updates to *ASSEMBLY keyword for Dummies/HBMs

- From PRIMER 22.0 onwards, users can select more than three positioning cable nodes on a HBM assembly.
- The ***ASSEMBLY** definition for HBMs has been updated in the following ways:
 - 1. The bitwise encoded dyna_pos field gives the details of the positioning cable nodes for the assembly;
 - The nodes selected for each HBM assembly are now added into a *SET_NODE and the reference for this set is mentioned in the *ASSEMBLY card.





Select positioning cable nodes for HBM assemblies

- For Dummies: You can select up to three positioning cable nodes for an assembly, as before.
- For HBMs: Pressing the "HBM Adv." toggle button maps a new "advanced" panel for updating the positioning cable nodes.
- The positioning cable nodes for each assembly can be defined via a new selection panel. This new selection panel shows
 only the "rigid" entities in the graphics window to allow easy picking of the positioning cable nodes.
- You can select any number of nodes on a HBM assembly, and all these nodes get added in to a *SET_NODE entity.

| | D | um | my/HBM | | ? > | | |
|-----------------------|-----|------|---------------|----------|----------------------------------------|--|--|
| Select not | les | an | d rigidify as | semblies | | | |
| HBM Adv. | Ca | anc | el Pre | vious | Next | | |
| Automatically determi | ne | noo | des Vis | Table | Help | | |
| ✓ Ignore parts belo | w | ma | ss: 1.0 | E-2 (| • FREE | | |
| Consider encrypted | i m | nate | rials | ? | Inode2nodes | | |
| Assembly actions | ' | 2 | Node 1 • | Node 2 • | Node 3 • | | |
| 1: PELVIS | 1 | R | 6108816* | 6129180* | 6111604 | | |
| 2: Thorax | 1 | R | 4146912* | 4278474* | 4273660* | | |
| 3: Head | 1 | R | 1000091* | 1000563* | 1000360* | | |
| 4: Upper Leg Right | 1 | R | 7622072* | 7688280* | 7627096 | | |
| 5: Lower Leg Right | 1 | R | 7611675* | 7615087* | 7615406 | | |
| 6: Foot Right | 1 | R | 7602819* | 7717923* | 7600989 | | |
| 7: Upper Leg Left | 1 | R | 7122072* | 7188280* | 7127096 | | |
| 8: Lower Leg Left | 1 | R | 7111675* | 7115087 | 7115406 | | |
| 9: Foot Left | 1 | R | 7102819* | 7217923* | 7100989* | | |
| 10: Upper Arm Righ | 1 | R | 3607733* | 3629901* | 3624344 | | |
| 11: Lower Arm Righ | 1 | R | 3617144* | 3626214* | 3606798 | | |
| 12: Hand Right | 1 | R | 3641957* | 3600120* | 3607566* | | |
| 13: Upper Arm Left | 1 | R | 3107733* | 3129901* | 3124344 | | |
| 14: Lower Arm Left | 1 | R | 3117144* | 3126214 | 3106798 | | |
| 15: Hand Left | 1 | R | 3141957* | 3108459* | 3107566* | | |

For Dummies/ATDs/HBMs

Oasvs 🔅 LS-DYNA Environment

| Select nod | es | and | l rigidi | fy as | semblies | | | |
|---------------------|---------|------|---------------|--------|----------------|-------------------------------------------------------------|--|--|
| HBM Adv. | Ca | ance | el | Re | evious | Next | | |
| | | | | Vis | . Table | Help | | |
| ✓ Ignore parts belo | w mass: | | | 1.0E-2 | | ● FREE | | |
| Consider encrypted | m | ater | rials Remo | ve • | ? Default N | Inode 2nodes Auto Nod | | |
| 1: PELVIS | 1 | R | Sele | ect | Default | Auto | | |
| 2: Thorax | 1 | R | Select | | Default | Auto | | |
| 3: Head | I | R | Sele | ct | Default | Auto | | |
| 4: Upper Leg Right | 1 | R | Sele | ect | Default | Auto | | |
| 5: Lower Leg Right | 1 | R | Sele | ct | Default | Auto | | |
| 6: Foot Right | 1 | R | Sele | ct | Default | Auto | | |
| 7: Upper Leg Left | 1 | R | Sele | ect | Default | Auto | | |
| 8: Lower Leg Left | 1 | R | Sele | ct | Default | Auto | | |
| 9: Foot Left | 1 | R | Sele | ect | Default | Auto | | |
| 10: Upper Arm Righ | 1 | R | Sele | ect | Default | Auto | | |
| 11: Lower Arm Righ | 1 | R | Sele | ct | Default | Auto | | |
| 12: Hand Right | 1 | R | Sele | ct | Default | Auto | | |
| 13: Upper Arm Left | 1 | R | Sele | ect | Default | Auto | | |
| 14: Lower Arm Left | 1 | R | Sele | ect | Default | Auto | | |

Only for HBMs





Selection panel and graphics view in PRIMER

New panel to process positioning cable nodes

- 1. The **HBM Adv.** button maps the new "advanced panel" for updating positioning cable nodes.
 - A new preference controls whether the updated HBM panel is mapped by default: primer*hbm_use_new_cable_node_panel
- 2. Even though some HBMs come with "encrypted" materials, PRIMER can still identify the "rigid" entities for the HBM by ticking this checkbox as ON.
 - A new preference controls the value of this button by default: primer*hbm_use_encrypted_mats_for_cables
- 3. The **Select** button launches a new panel to select the positioning cable nodes for that assembly.
- 4. The **Default** button reverts the positioning cable nodes to the defaults defined in the original positioning tree.
- 5. The **Auto** button automatically re-calculates up to three positioning cable nodes to attach cables on that assembly.
- 6. Pressing the "I" button ignores that assembly for positioning cable nodes.
- 7. Pressing the "**R**" button rigidifies that whole assembly.
- 8. Using the check buttons on the left and the menus on the top of the assembly list, you can process positioning cable nodes on multiple assemblies simultaneously.
 Oasys Start Environment



Updates to load curves for Dummy/HBM positioning

- PRIMER creates new keywords for each of the cable elements during the positioning simulation.
- The displacement of the cable elements uses the load curves included in these new keyword definitions.
- From PRIMER 22.0 the load curve definitions have been refined to make the displacements smoother.
- You can choose to use:
 - The new definition of the load curve (default). This is specific to each of the positioning cables created for each assembly and aims to reduce peak load and oscillations.
 - A load curve definition equivalent to the previous load curve method.
 - A new preference controls this behaviour: primer*dummy_hbm_use_new_cable_equation



Writing positioned HBM without the encrypted HBM tree file

- The PRIMER positioning tools for HBMs always need to load the PRIMER positioning tree files. These positioning tree files are unique for a HBM type.
- Since these positioning tree files are "encrypted", these files cannot be read outside PRIMER.
- Therefore, the reference to this file must be removed from the master model deck before submitting the positioned model files for Ansys LS-DYNA positioning simulations.
- From PRIMER 22.0 onwards, a new check button is added to the "Create Model" panel of the "Combined Dummy and Seatsquash" tool.
- By enabling this check button, you can create a model ready for a positioning analysis "without" the encrypted HBM tree include.





HBM Trees



Positioning trees for HBMs

- PRIMER positioning tree files help position and prepare HBMs for Ansys LS-DYNA analysis.
- Tree files are free to PRIMER users and available from your local distributor.
- Positioning tree files are available for the following HBMs:
 - **GHBMC** (Elemance)
 - Detailed HBMs occupant and pedestrian models;
 - Simplified HBMs occupant and pedestrian models;
 - **THUMS** occupant, pedestrian and TB-024 models;
 - SAFER;
 - VIVA(+) seated and standing;
 - AC-HUM (CAERI) occupant and pedestrian;
 - **HBM-Connect** (Humanetics);
 - HANS (Ansys-Dynamore);
- PRIMER also supports visualisation of all the above HBMs via the "Visualisation Table" tool.



| — | Visualisation entities table of DUM | | | | | | | /IM1 in Model1 | | | | | 2 | |
|------------------------------------------------------------------------------------------------------------|-------------------------------------|---------------------------------------------------|------|----------------------|-----------------------------------------------------------------------------------------------------------------|------|--------|-----------------------------|--------------|-------------|------|-------|-----------|---------|
| Dismiss Save View Properties | | | | 5 | | | | | Create D | 3PLOT group | ? | | | |
| Dummy/HBM typ THUMS HBM | | | | Create Entities for: | | | | Assembl | y entities |] | | | | |
| Enable parts view Enable assemblies view Enable anatomy view Visualisation entities of DI IMM1 | | THUMS HBM GHBMC HBM SAFER HBM AC-HUM HBM | | | Anatomy entities Anatomy and Assembly entitie group001.vis Apply | | | | | | | | | |
| | All Title Cold | | Colo | HBM-Connect | | | | e ► Stippled ► Actions ► Or | | | Only | All | Blank All | |
| | | Outer Skin Shells | | V | VA(+) HBM | | | • | Solid (def)► | Actions • | Only | Blank | | Unblank |
| | ✓ | Solid Skeleton | | 0 | ther HBMs | | | • | Solid (def)► | Actions + | Only | Blank | | Unblank |
| | ✓ | Position Beams | | St | tandard Dumn | m١ | , | • | Solid (def)► | Actions + | Only | Blank | | Unblank |
| | \checkmark | Inner Skin Shells | | Þ | Trans 70% | • | Shaded | • | Solid (def)► | Actions + | Only | Blank | | Unblank |
| | \checkmark | Shell Skeleton | | Þ | Opaque 🕨 | • | Shaded | • | Solid (def)► | Actions • | Only | Blank | | Unblank |
| | \checkmark | Outer Solid Flesh | | Þ | Trans 70% 🕨 | • (| Shaded | • | Solid (def)► | Actions • | Only | Blank | | Unblank |
| | \checkmark | Inner Solid Flesh | | Þ | Trans 70% | • \$ | Shaded | • | Solid (def)► | Actions < | Only | Blank | | Unblank |
| | \checkmark | Muscle Beams | | Þ | Opaque 🕨 | • (| Shaded | • | Solid (def)► | Actions + | Only | Blank | | Unblank |
| | ✓ | Seat-Belt and Sliprings | 6 | Þ | Opaque 🕨 | • (| Shaded | • | Solid (def)► | Actions + | Only | Blank | | Unblank |
| | \checkmark | Foam | | Þ | Trans 70% | • | Shaded | • | Solid (def)► | Actions • | Only | Blank | | Unblank |



Supported GHBMC models – detailed

- PRIMER supports the positioning for all the available versions of the GHBMC "Detailed" HBMs.
- PRIMER also supports the positioning for all the previously released versions of these HBMs.
- Tree files are free to PRIMER users and available from your local distributor.
- Detailed occupants
 - F50-O v6.03
 - F05-O v6.0
 - M50-O v6.2
 - M95-O v6.0
- Detailed pedestrians
 - F05-P v1.2/v5.3.4
 - M50-P v1.6/v5.3.1/v5.3.4
 - M95-P v1.2/v5.3.4





Detailed Occupants

Detailed Pedestrians



Supported GHBMC models – simplified

- PRIMER supports the positioning for all the available versions of the GHBMC "Simplified" HBMs.
- PRIMER also supports the positioning for all the previously released versions of these HBMs.
- Tree files are free to PRIMER users and available from your local distributor.
- Simplified occupants
 - F50-OS v2.3.2
 - F05-OS v2.3
 - M50-OS v2.3
 - M95-OS v2.3
- Simplified pedestrians
 - F05-PS v1.8/v5.3.5
 - M50-PS v1.8/v5.3.5
 - M95-PS v1.8/v5.3.5
 - 3YO-PS v1.8
 - 6YO-PS v1.8/2.8.2
 - 10YO-PS v1.8



Simplified Occupants

Simplified Pedestrians



M-95

Supported THUMS models

• PRIMER supports the positioning for all the available versions of the THUMS "Pedestrian" and "Occupant" HBMs.

M95

- PRIMER also supports the positioning for all the **EuroNCAP TB-024** HBMs.
- Tree files are free to PRIMER users and available from your local distributor.



- Version 4 Pedestrians:
 - AF05-P v4.02
 - AM50-P v4.02
 - AM95-P v4.02
 - 3YO/6YO/10YO v4.0

- Version 4 TB-024:
 - AF05-P v4.02
 - AM50-P v4.02
 - AM95-P v4.02
 - 6YO v4.0



- Version 4/5/6/7/7.1 Occupants:
 - AF05-O v4.1/v5.0.3/v6.1/v7/v7.1
 - AM50-O v4.1/v5.0.3/v6.1/ v7/v7.1
 - AM95-O v4.1/v5.0.3/v6.1/ v7/v7.1
 - 3YO/6YO/10YO v4.0

Supported THUMS models – reclined and others

- PRIMER supports the positioning for all the available versions of the THUMS "Reclined" HBMs.
- PRIMER also supports the positioning for all the Other category HBMs, including the **Pregnant** HBM.
- Tree files are free to PRIMER users and available from your local distributor.


Supported AC-HUM HBMs (CAERI)

- PRIMER supports the positioning for all the available versions of the AC-HUM HBMs from CAERI:
 - AM50 Occupant V1.3 (S2/S3)
 - AM50 Pedestrian V1.3 (S2/S3)
 - AM95 Occupant V1.3 (S2/S3)
 - AM95 Pedestrian V1.3 (S2/S3)
- PRIMER also supports the positioning for all the previously released versions of these HBMs.
- Tree files are free to PRIMER users and available from your local distributor.





Supported SAFER/VIVA+ HBMs

- PRIMER supports the positioning for the **SAFER** Occupant HBM V11.1.0.
- PRIMER also supports positioning for the VIVA+ 2.x HBMs both seated and standing postures.
- Tree files are free to PRIMER users and available from your local distributor.





Automotive Protocols





New Protocols and Regulations

 Automotive Assessments and REPORTER now support the following new protocols and regulations:

| Regulation | Loadcase |
|-------------|------------------------------|
| C-NCAP | Far Side Occupant Protection |
| Global NCAP | MDB, ODB, Side Pole |
| JNCAP | FFB, MDB, ODB |
| KNCAP | FFB, MDB, Side Pole |
| UN ECE | R94, R95, R135, R137 |



| | | | | | | aluation Result | Total Score |
|--------------------------------------------------------------|--------|------------|-------------------------------------------|-------|--------|--------------------------------|-------------------------------------|
| KNCAP Side Pole | | | | | | Level 5 | >= 10.5 |
| | _ | _ | | _ | | Level 4 | >= 9.0 and < 10.5 |
| | | Body Regio | on Assessments | | | Level 3 | >= 7.5 and < 9.0 |
| Head | Value | Points | Abdomen | Value | Points | Level 2 | >= 6.0 and < 7.5 |
| Direct head contact with pole | NO | 4.000 | Top Compression [mm] | 30.6 | 4.000 | | |
| Peak resultant acceleration [g] | 591.5 | 0.000* | Bottom Compression [mm] | 23.2 | 4.000 | Level 1 | < 6.0 |
| HIC15 | 5247.5 | 0.000* | Incorrect airbag deployment (-1) | | 0.000 | | |
| Incorrect airbag deployment (-1) | | 0.000 | Top Abdomen Viscous criterion [m/s] | 0.28 | Pass | uation result is the value cor | responding to the occupant score in |
| Head Score *Capping limit exceeded | | 0.000* | Bottom Abdomen Viscous criterion [m/s] | 0.20 | Pass | above | |
| Chest | Value | Points | Abdomen viscous criterion | | Pass | | |
| Top Compression (mm) | 60.4 | 0.000* | Lowerspine 3ms acceleration criterion [g] | 58.03 | Pass | Drivor | Front Baccondor |
| Middle Compression [mm] | 54.9 | 0.000 | Abdomen Score | | 4.000 | Driver | FIOIIL Fassenger |
| Bottom Compression [mm] | 40.6 | 1.715 | | | | | |
| Incorrect airbag deployment (-1) | | 0.000 | Pelvis | Value | Points | 1/5 | 1/5 |
| Top Chest Viscous criterion [m/s] | 1.19 | Fail | Pubic Symphysis force [kN] | 0.916 | 4.000 | 115 | 1/5 |
| Middle Chest Viscous criterion [m/s] | 0.96 | Pass | Incorrect airbag deployment (-1) | | 0.000 | | |
| Bottom Chest Viscous criterion [m/s] | 0.54 | Pass | Pelvis Score | | 4.000 | | |
| Chest viscous criterion | | Fail | Shoulder | Value | Points | | |
| Shoulder lateral force criterion | | Pass | Right Shoulder lateral force [kN] | 0.80 | Pass | | |
| Chest Score | | 0.000* | Left Shoulder lateral force [kN] | 2.19 | Pass | | |
| Passing light accorded. Chart circle is adhered field accord | and a | | Shoulder lateral force criterion | | Pass | | |

Upgraded Protocols

• The following protocols have been updated:

| Regulation | Loadcase | Update |
|------------|--------------------------|------------------------------------------------------------------------------------------------------------|
| Euro NCAP | MPDB Occupant Assessment | 2024 (Follows Adult Occupant Protocol v9.3) Includes DAMAGE assessment |
| IIHS | Front SOB | 2024 (Version VII)New fuel modifier |
| IIHS | Side MDB | 2024 (Version IV) New fuel modifier and updated head protection rating system |



Automotive Assessments Workflow • New in version 21.1

| Regulation | Year | Loadcase/Workflow | PRIMER | T/HIS | D3PLOT | REPORTER (migrated to workflows) | REPORTER (standard template) |
|------------|------|----------------------|--------|-------|--------|----------------------------------------|------------------------------------|
| | 2018 | ODB | • | • | | | • |
| | 2021 | Head Impact | | | | | • |
| | | Leg Impact | | | | | • |
| | 2022 | MPDB Occupant | • | • | | • | |
| | 2023 | MPDB Compatibility | | | | | • |
| | | Side Pole | • | • | | • | |
| C-INCAP | | Far Side Pole | • | • | | • | |
| | | Far Side Sled | • | • | | • | |
| | 2024 | VTC Quality Criteria | • | • | | • | |
| | | VTC Videos | • | | • | • | |
| | | LS-DYNA to ISO-MME | • | • | | • | |
| | | SimVT | | • | | • | |

Automotive Assessments Workflow • New in version 21.1

| Regulation | Year | Loadcase/Workflow | PRIMER | T/HIS | D3PLOT | REPORTER (migrated to workflows) | REPORTER (standard template) | | | | |
|------------|-----------|--------------------|--------|-------|---------------|----------------------------------------|------------------------------------|--|--|--|--|
| | 2017 | FFB | • | • | | • | | | | | |
| | 2017 | ODB | • | • | | • | | | | | |
| | 2020 | MPDB Occupant | • | • | | • | | | | | |
| | | Side Pole | • | • | | | | | | | |
| | | MDB | • | • | • | | | | | | |
| | 2022 | Far Side | • | • | • | | | | | | |
| EURO NCAP | | MDB | • | • | • | • | | | | | |
| | | Side Pole | • | • | | • | | | | | |
| | | MPDB Compatibility | | | | | • | | | | |
| | 2023 | Head Impact | | | | | • | | | | |
| | | Leg Impact | | | | | • | | | | |
| | Continued | | | | | | | | | | |



Automotive Assessments Workflow • New in version 21.1

| Regulation | Year | Loadcase/Workflow | PRIMER | T/HIS | D3PLOT | REPORTER (migrated to workflows) | REPORTER (standard template) |
|------------|-----------------|--------------------------|-------------------------------------|-------------|------------|----------------------------------------|------------------------------------|
| | 2024 | Far Side Sled | • | • | | • | |
| | | MPDB Occupant | • | • | | • | |
| | | VTC Quality Criteria | • | • | | • | |
| | | VTC Videos | • | | • | • | |
| | | LS-DYNA to ISO-MME | • | • | | • | |
| Euro NCAP | | SimVT | | • | | • | |
| | | Front Sled | E | arly access | on roquest | | |
| | | FWDB Full Vehicle | Early access – available on request | | | onrequest | |
| | 2026 (Draft) | VTC Quality Criteria | • | • | | • | |
| | (Dran) | VTC HBM Quality Criteria | • | • | | • | |
| | | SimVT | Ea | arly access | on request | | |



• Available for some time

Automotive Assessments Workflow • New in version 21.1

| Regulation | Year | Loadcase/Workflow | PRIMER | T/HIS | D3PLOT | REPORTER (migrated to workflows) | REPORTER (standard template) |
|-------------|------|-------------------|--------|-----------|--------|----------------------------------------|------------------------------------|
| | 2022 | MDB | • | • | | • | |
| Global NCAP | 2023 | ODB | • | • | | • | |
| | 2024 | Side Pole | • | • | | • | |
| OTD | 2019 | Leg Impact | | | | | • |
| GIK | 2020 | Head Impact | | | | | • |
| | 2017 | MDB | • | • | • | | |
| IIHS | | ODB | • | • | | | |
| | | SOB | • | • | | | |
| | | | | Continued | | | |



• Available for some time

Automotive Assessments Workflow • New in version 21.1

| Regulation | Year | Loadcase/Workflow | PRIMER | T/HIS | D3PLOT | REPORTER (migrated to workflows) | REPORTER (standard template) |
|------------|------|--------------------|--------|-------|--------|----------------------------------------|------------------------------------|
| | | MDB | • | • | • | • | |
| | | MDB Structure Only | | | | • | |
| | 2021 | ODB | • | • | | • | |
| | | ODB Structure Only | | | | • | |
| шце | | SOB | • | • | | • | |
| шпэ | | SOB Structure Only | | | | • | |
| | | MDB | • | • | | • | |
| | 2024 | MDB Structure Only | | | | • | |
| | | SOB | • | • | | • | |
| | | SOB Structure Only | | | | • | |

Automotive Assessments Workflow • New in version 21.1

| Regulation | Year | Loadcase/Workflow | PRIMER | T/HIS | D3PLOT | REPORTER (migrated to workflows) | REPORTER (standard template) |
|------------|------|-------------------|--------|-------|--------|----------------------------------------|------------------------------------|
| | 2018 | Leg Impact | | | | | • |
| | 2023 | FFB | • | • | | • | |
| UNCA | | MDB | • | • | | • | |
| | | ODB | • | • | | • | |
| | 2019 | Leg Impact | | | | | • |
| | 2024 | FFB | • | • | | • | |
| KNCAF | | MDB | • | • | | • | |
| | | Side Pole | • | • | | • | |
| | 2015 | R135 (Side Pole) | • | • | | • | |
| | 2022 | R94 (ODB) | • | • | | • | |
| | 2022 | R95 (Side MDB) | • | • | | • | |
| | 2023 | R137 (FFB) | • | • | | • | |

Crash Test Setup Enhancements





Crash Test Setup – Various

- In past versions, barriers had to be a stored in a single master file. The tool now supports barriers that have a *INCLUDE file structure.
- The Batch Crash Test Setup tool will now write all the newly created keywords to the Master file.
- When using the Rigidwall option for rigid frontal impact load cases, the sign of the rotation angle in the ROTATE row of the *DEFINE_TRANSFORMATION card that rotates the Rigidwall by the impact angle, now always reflects the sign of the impact angle provided in the test settings. In past versions, the ROTATE angle was getting multiplied by -1.





Га Макал Тай Бару наро менар Сани на <u>Пакала (Пакала) (</u>лика реб.) а из — на пакала на и на реста се а съруда (<u>Пакала)</u> (на еле бара) ЗАРИСТ. Им сболована

- Hottes -

Utilisation Factor

0.400 0.500 0.000 0.700 0.800

A DESCRIPTION OF

(Max all ob

The State

Max \$10103877 : 1.262904E+00, Min \$10595151 : 1.823150E-12

Speed and Performance

User Interface Updates





Visualising Node Sets for seatbelt keywords

- To visualise node sets on seatbelt related keywords, the sketching of the following entities has been added: *ELEMENT_SEATBELT_SLIPRING SBRNID, *ELEMENT_SEATBELT_RETRACTOR SBRNID and *SECTION_SHELL EDGSET.
- When these keywords are sketched, a vector is drawn from the first to the last node in the set to help visualise the direction of the node sets.







Custom colours for contact surfaces

- Added popup buttons 'surf A' and 'surf B' under Contacts in 'Display \rightarrow Colour'.
- Custom colours can be set to contact surfaces using the colour palette popup for each surface.
- This helps to enhance the visual distinction between different contact regions in the model.





Custom sketching colours for contact surfaces

 In addition to setting custom colours for surf A and surf B, the same popup buttons under 'Contacts' in 'Display → Colour' are used for contact sketching.







New search to filter drop down options

 A search text box has been added to the 'Select bolt module' drop down when creating bolt connections from a library.



- In previous versions if the bolt library was large, finding the required bolt could be difficult.
- In PRIMER 22.0, pattern matching filters the drop down list based on what has been typed in the new text box making finding required bolts easy.

| - BOLT FE METHOD - | |
|-----------------------------------------|---|
| Select bolt module | ¥ |
| Reload primer_library modules X | |
| Q <search></search> | |
| EXAMPLE_M6BOLT_ELASTIC_NO_STRETCH.key | |
| EXAMPLE_M6BOLT_ELASTIC_WITH_STRETCH.key | |
| EXAMPLE_M6BOLT_RIGID_NO_STRETCH.key | |
| EXAMPLE_M6BOLT_RIGID_WITH_STRETCH.key | |
| EXAMPLE_M6FDSBOLT_ELAS.key | |
| EXAMPLE_M6FDSBOLT_ELASTIC.key | |
| EXAMPLE_M6FDSBOLT_RIGID.key | |
| EXAMPLE_M7CAPSCREW_RIGID.key | |



Automatically resize Part Table columns to fit content

- Columns in the Part Table and Part Compare Table can be resized by clicking on the edge of a column header and dragging the mouse.
- To make it easier to view content in a column, it is now possible to automatically resize a column to fit its widest content by double-clicking on the right-hand edge of the column header.
- Additionally, similar to the Keyword Editor, there are now two buttons, one to automatically resize all
 visible columns to best fit their content and one to reset the size of all columns back to be equal.

| — | PART TABLE | | | | | | | | | | | | P ? - X |
|---|------------|--------|---------------|-----------|-------|---------|----------|----|-------------------------|----------|-----|---------------|------------|
| | Dismiss | View | Refresh | Write | Clear | Sel all | Show all | То | tal Parts: 27 (0 s | elected) | 7 🗖 | Auto fit cols | Reset cols |
| | Table Cha | anges: | Undo | Apply | | Select | Show sel | | | | | | |
| | ∳Part ID | Part | title | | Part | type | Sect ID | | Sect Gauge | Mat ID | | Numel | Colour |
| | P20200 | GRIL | LE | | SHEL | L | 20200 | | 1.000000 | 20201 | | 11543 | |
| | P20201 | OB - | bumper - FT | | SHEL | L | 20201 | | 2.850000 | 20400 | | 9414 | |
| | P20202 | OB - | fender - L | | SHEL | L | 20202 | | 0.900000 | 20577 | | 3219 | |
| | P20203 | LOG | 0 | | SHEL | L | 20203 | | 1.000000 | 20201 | | 3228 | |
| | P20204 | OB - | fender - R | | SHEL | L | 20204 | | 0.900000 | 20577 | | 3219 | |
| | P20205 | LEN | Z (RH) | | SHEL | L | 20205 | | 3.500000 | 20200 | | 1845 | |
| | P20206 | HEA | DLAMP | | SHEL | L | 20206 | | 2.000000 | 20201 | | 1916 | |
| | P20207 | HOU | SING HEAD L | LAMP (RH) | SHEL | L | 20207 | | 2.000000 | 20201 | | 3883 | |
| | P20208 | LEN | Z (LH) | | SHEL | L | 20208 | | 3.500000 | 20200 | | 1845 | |
| | P20209 | HEA | DLAMP | | SHEL | L | 20209 | | 2.000000 | 20201 | | 1916 | |
| | P20210 | HOU | SING HEAD L | LAMP (LH) | SHEL | L | 20210 | | 2.000000 | 20201 | | 3883 | |
| | P20211 | HOO | D LOCK BOX | (| SHEL | L | 20211 | | 2.850000 | 20202 | | 6738 | |
| | P20212 | BIW | - tie bar mod | ule | SHEL | L | 20212 | | 4.300000 | 20203 | | 5328 | |
| | P20215 | ноо | D LOCK 1 | | SOL | D | 20215 | | <undefined></undefined> | 20206 | | 600 | |
| | P20300 | OB - | hood | | SHEL | L | 20300 | | 0.700000 | 20578 | | 10373 | |
| | P20301 | OB - | hood hinge 1 | 1-L | SHEL | L | 20301 | | 3.500000 | 21010 | | 197 | |
| | P20302 | OB - | hood hinge 2 | 2 - L | SHEL | L | 20302 | | 3.000000 | 21010 | | 54 | |
| | P20303 | OB - | hood - I | | SHEL | L | 20303 | | 0.800000 | 20578 | | 10853 | |

| - | PART TABLE | | | | | | | | | | |
|----------------|----------------------|-----------|--------------|-------------------------|-----------------|--------------|------------|--|--|--|--|
| Dismiss View | Refresh Write | Clear | Sel all Show | all Total Parts | 27 (0 selected) | Auto fit col | Reset cols | | | | |
| Table Changes: | Undo App | y _ | Select Show | sel | | | | | | | |
| Part ID | Part title | Part type | SectID | Sect Gauge | MatiD | Numel | Colour | | | | |
| P20200 | GRILLE | SHELL | 20200 | 1.000000 | 20201 | 11543 | | | | | |
| P20201 | OB - bumper - FT | SHELL | 20201 | 2.850000 | 20400 | 9414 | | | | | |
| P20202 | OB - fender - L | SHELL | 20202 | 0.900000 | 20577 | 3219 | | | | | |
| P20203 | LOGO | SHELL | 20203 | 1.000000 | 20201 | 3228 | | | | | |
| P20204 | OB - fender - R | SHELL | 20204 | 0.900000 | 20577 | 3219 | | | | | |
| P20205 | LENZ (RH) | SHELL | 20205 | 3.500000 | 20200 | 1845 | | | | | |
| P20206 | HEADLAMP | SHELL | 20206 | 2.000000 | 20201 | 1916 | | | | | |
| P20207 | HOUSING HEAD LA | SHELL | 20207 | 2.000000 | 20201 | 3883 | | | | | |
| P20208 | LENZ (LH) | SHELL | 20208 | 3.500000 | 20200 | 1845 | | | | | |
| P20209 | HEADLAMP | SHELL | 20209 | 2.000000 | 20201 | 1916 | | | | | |
| P20210 | HOUSING HEAD LA | SHELL | 20210 | 2.000000 | 20201 | 3883 | | | | | |
| P20211 | HOOD LOCK BOX | SHELL | 20211 | 2.850000 | 20202 | 6738 | | | | | |
| P20212 | BIW - tie bar module | SHELL | 20212 | 4.300000 | 20203 | 5328 | | | | | |
| P20215 | HOOD LOCK 1 | SOLID | 20215 | <undefined></undefined> | 20206 | 600 | | | | | |
| P20300 | OB - hood | SHELL | 20300 | 0.700000 | 20578 | 10373 | | | | | |
| P20301 | OB - hood hinge 1 - | SHELL | 20301 | 3.500000 | 21010 | 197 | | | | | |
| P20302 | OB - hood hinge 2 - | SHELL | 20302 | 3.000000 | 21010 | 54 | | | | | |
| P20303 | OB - hood - I | SHELL | 20303 | 0.800000 | 20578 | 10853 | | | | | |



Contact Penetration





Contact Penetration

- A cap is drawn with a radius equal to one-half the contact thickness to display automatic contact wrapping around the shell edge when "Use Part_Contact values" is used in cutsections.
- The capping is always drawn assuming an orthogonal cut. Also, currently the capping visualisation is applied to all contacts. However, in Ansys LS-DYNA this only applies to AUTOMATIC type contacts. Furthermore, at present *SHLEDG* is not considered.





Contact Penetration

- This can also be visualised through CONTACT \rightarrow Penetration Check \rightarrow WR.
- Set the penetration elements to be drawn "As thick" under contour setting. Plot a wireframe contour plot.



| - PEN CHECK M2/CONT10 ? X | M2/CONT10 Contact Che | ck Plot Settings ? |
|---------------------------------------------|-------------------------------------------|------------------------|
| Dismiss Check all Options | Dismiss Upda | ate plot |
| List Info Check visible Only | M2/CONT10 Contac | t Check Error Plotting |
| All segments of contact checked | Contact Surface Error Plot | settings |
| 0 AUTOMATIC_SINGLE_SURFACE | Min value: | Max value: |
| No title defined> | 0.2048844 Auto | 0.5604558 |
| select parts sel none sel all sel xedge ? | Values < min | Values > max |
| List crossed: List penetrating: | Not Drawn | Not Drawn |
| P11:P12 x=0 p=2 (0.226) | O Drawn Wireframe | O Drawn Wirefram |
| P12:P13 x=48 p=12 (0.560) | O Drawn Hidden | O Drawn Hidden |
| | O Drawn Normally | O Drawn Normally |
| | Penetration vectors | DRAWN |
| | Pen elems: Drawn | Labels As |
| | Pen nodes: Drawn | Labels Va |
| | Crossed edges | DRAWN |
| penetration magnitude >=▼ 0.0 | X'd elems: Drawn | Labels As |
| sketch unblank recursive | Contact surfA side | Contact surfB sid |
| <- Only Pen elements Only X'd elements | O Not Drawn | O Not Drawn |
| Contour Pen: 14 vis 14 total | Orawn Wireframe | Orawn Wirefram |
| CT SI WR Sh X'ed: 48 vis 48 total | O Drawn Hidden | O Drawn Hidden |
| Settings Min: 2.0488e-01 Max: 5.6046e-01 | O Drawn Normally | O Drawn Normally |
| Levels Sum: 7.7914e+00 | Rest of model: | Blanking |
| ->warnings.k Elem details Beams on xedge | Not Drawn | O Ignored |
| >pencheck.cs | O Drawn Wireframe | Considered |
| Move x-edge elems to exempt part ter 1 | O Drawn Hidden | |
| Sketch parts protected from swap | O Drawn Normally | |
| | | |

Speed and Precision Improvements



Faster create of NRBs/JOINTS in large model with S_NO general

 Models with complex set definitions (such as Set Node General defined with box) build set caches to store set contents on a short term basis.

*SET_NODE_GENERAL

Very complex definitions involving Boxes, Parts, etc. Slow to use in raw form.



Internal set cache

Very fast to use once created.



- These caches are used to speed up internal operations, but they must be rebuilt when the model "data_changed" status indicates they are out of date. Rebuilding them can be slow.
- Create of NRB/JOINT performs operations which mark the model as "changed" which, in turn, mark the set cache as being out of date. This used to cause of lot of churning, slowing down creation in large models.
- In PRIMER 22.0 bypassing the update of set caches in this special case makes the creation process much faster without compromising data.



Speeded up connections tool

- Repeated use of the connections tool could be very slow for a model in which welds are connected by Nodal Rigid Bodies.
 - The main connection tool resolves existing MAT100 welds without connections.
 - This runs a contact check operation to get the layers correct, which is an expensive operation.
 - If all welds resolve, subsequent actions using the connection tool are fast because no further checking is done.
 - However, welds attached by Nodal Rigid Bodies do not resolve meaning that any further use of the Connections tool reran a contact check, which was slow and pointless because the results would not change.
- In PRIMER 22.0 this special case is detected and the "attached" welds no longer trigger 2nd and subsequent contact checks.
- This makes the Connections tool much faster to use in this situation.

| - * | Tools | Mesh tools 🔻 | D ₃ T _H Post |
|-----------|-------------|--------------|------------------------------------|
| Assign ms | Composite | JavaScript | Other 🔹 🔻 |
| Attached | Connection | Load Path | Remove |
| Batteries | Cut Section | Macro | Rigidify |
| Blanking | Find | Mass Prop | Safety 🔹 |
| BOM | Groups | Measure | Text Edit |
| Check | ICFD Setup | Mechanism | Units |
| Clipboard | Implicit | Node Import | Workflows |
| Coat | Include | Orient | Xrefs |



Improvements for very large models

- We have had the opportunity to work on a "Gigacasting" project during this development cycle, a model with 330 million elements and 70 million nodes. PRIMER handled this but it demonstrated some areas where performance was slow, so the following improvements have been made:
 - The graphics cache, used to redraw models, now uses longer data vectors in GPU memory by default, although this is configurable. This makes better use of high-performance graphics cards, no longer throttling their performance.
 - Screen-picking has been speeded up somewhat for elements and considerably for nodes.
- We will continue to make further incremental improvements in performance of very large models.



ORIENT panel now uses double precision for input

- In PRIMER 21.0 internal nodal coordinate storage and all transformations for operations such as
 ***INCLUDE_TRANSFORM** was switched from single to double precision. However, the ORIENT panel
 continued to use single precision for most interactive input. This limited the resolution of interactively defined
 transformations to approximately 7 significant figures.
- In PRIMER 22.0 all input in the ORIENT panel is now double precision and all the underlying transformations are now also performed in double precision, giving approximately 15 significant figures of resolution.
- The default output resolution for double precision numbers in interactive GUI buttons is 10 sig figs, this can be controlled under **Program options, Precision**.

| Orient ? 🗙 | | | | |
|--------------------------------|--------------------------|---------------|---------|--|
| Project | Rotate | Translate | Help | |
| Reflect | Scale | Trans-Rot | Sketch | |
| Apply | Copy off | 1 | Options | |
| Node drag | Offset | Consider INCL | TRANS | |
| TRANSLATE: (no object defined) | | | | |
| [X,Y,Z] dist: | t: 1.23456789E12 0.0 0.0 | | | |
| 10 sig figs by default | | | | |



Email Minidump Files





Windows Minidump files can now be emailed

- Following a crash on Windows a "minidump" file is created which, if sent, can sometimes enable us
 to diagnose the cause of the crash, suggest workarounds and fix the bug. Historically this file has
 been written to an obscure temporary directory making it laborious to extract and send it.
- PRIMER can now:
 - Compose an email automatically, attaching the minidump file.
 - Include further information about the crash (stack trace) in that email.
 - Launch the default email handler on the system so that you can add further information if you wish.
- This email is *not* sent automatically, you can choose to send it or not.
- Composition of these emails is optional; they can be turned off.



Windows Minidump files can now be emailed (continued)

 Minidump files and crash handling generally can be configured by preferences, but to make this easier there is now an interactive GUI which can be used to control this behaviour:

| Help Blank | | |
|-----------------|---|--|
| User Manual | | |
| Support | | |
| What's New | • | |
| Tutorials | • | |
| Keyword manuals | • | |
| Online/HTML | • | |
| Crash handler | | |
| About | | |

 Crash dump behaviour can also be configured at the "admin" or "installation" levels during software installation, configuring it for all users.





Initial Window Placement





Master PRIMER window can start on a selected monitor

 On a multi-monitor desktop the "placement" preference can be used to select which of multiple monitors on a desktop the master PRIMER window starts in. Previously this was always the main display window. The bounding box (red) around the monitors (black) that make up the desktop in pixel space which is divided into 1/3rds. For example:





 The preference value may be a combination of LEFT | CENTRE | RIGHT

and / or **TOP | MIDDLE | BOTTOM** The monitor nearest to the centre of that 1/3rd sub-area is used.



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Flexible Automation and Integration

Oasys 🔅 LS-DYNA Environment

Updates to both JavaScript and Python APIs



Updates to both JavaScript and Python

- It is no longer necessary to specify the memory required when running a script. The memory is now automatically increased as required.
- The GetAll and GetFlagged methods available for keyword classes can now take an optional argument, which is a property from the object to return in the array, instead of the object itself.
- A new AllItems method has been added to the Set class that returns all of the items in a set (after decomposing any special set definitions) as an array. This matches the method in D3PLOT and is an alternative to spooling the set.


Updates to both JavaScript and Python

- Static GetTargetEye and SetTargetEye methods have been added to the View class to enable getting/setting the target and eye position.
- Added SetAssemblyPart, SetAssemblyPartSet and SetAssemblyNodeSet to the Dummy class.



JavaScript and Python API: Attached.SetEntity

 In the Attached class, the Attached.SetEntity method now allows users to toggle entities on or off for the find attached function. Previously, users had to manually switch each entity on or off. With the PRIMER v22.0 release, it is possible to select all entities or all constrained entities using "ALL" or "CONSTRAINEDALL" as the type argument.





JavaScript specific updates





JavaScript API

• The function assigned to the Window onClose event can now return false to prevent the window closing if required.



Python specific updates





Python API

- The GetAll and GetFlagged methods available for keyword classes now work for very large lists. In PRIMER 21.0 there was a limit of ~300,000 items.
- Scripts which garbage collect and reuse lots of objects should now be significantly faster.



Isogeometric Analysis (IGA)



***IGA** – Visualisation

- ***IGA_SOLID**s are now rendered, allowing for visualisation and graphical picking.
- Parametric trim faces (*IGA_FACE_UVWs) and parametric trim edges (*IGA_EDGE_UVWs), for parent *IGA_SOLIDs and *IGA_SHELLs can also be visualised.
 - Drawing of these entities need to be turned on via the entities panel.
- Following a change to an *IGA entity that could affect the geometry of the parent *IGA_SHELL or *IGA_SOLID the graphics of the affected entities will be automatically rerendered.



K×,







***IGA** – Visualisation

 *IGA_SHELL keywords with the BASIS_TRANSFORM option (formerly called BEXT) can now be rendered, allowing for visualisation and graphical picking.



| - | | MODIFY | GA_SHELL M1/ | IGSH1 | | | K ? — 🗆 : | × |
|----------------------------|---------------------------------------------------------------------------------------------------------|---------------|---------------|------------|-----------|----|-----------|-----------|
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***IGA** – API

- *IGA keywords can now be created/edited through the JavaScript API and Python API.
- Most of the *IGA keywords valid from version R15 can be edited through the APIs.
- The image shows the list of the new API classes added for the *IGA keywords.
- Following edits made to an *IGA entity, via a script, the parent *IGA_SHELL(s) and *IGA_SOLID(s) can be rerendered via IGAShell.RedrawAll() and IGASolid.RedrawAll()

🗄 <mark>IGA</mark> IGA1DBrep class IGA1DNurbsUVW class IGA1DNurbsXYZ class IGA2DBasisTransformXYZ class IGA2DBrep class IGA2DNurbsUVW class IGA2DNurbsXYZ class IGA3DBasisTransformXYZ class IGA3DNurbsXYZ class ■ IGAEdgeUVW class IGAEdgeXYZ class ∃ IGAFaceUVW class IGAFaceXYZ class IGAIntegrationShellReduce class IGAIntegrationSolidReduce class IGAMass class GAPointUVW class GAShell class IGASolid class IGAVolumeXYZ class



D3PLOT Link Changes





Linked D3PLOT Session Blanking Lock Behaviour

 PRIMER now preserves the blanking Lock status when an Unblank action is carried out in linked D3PLOT sessions (and vice versa).



| СТ | LC ► | SI 🕨 | CL ► | lso | Draw | Li 🗗 li | 비스기 | Sh д | Save P | Lock |
|--------|--------|-------|------|-----|------|---------|------|------|--------|------|
| PR 🕨 | DP | Vel ► | Vec | | REC | AC [| Zoom | CN | | All |
| Manual | Tidy 🕨 | +XY | +YZ | +XZ | +ISO | | AIN | R | Views | Rev |
| Stop | ? | -XY | -YZ | -XZ | -ISO | | ٧D | > ls | æð | Ent |



> Other Developments and Perferences

The Mass

Oasys 🔅 LS-DYNA Environment

Control Calc DT2MS tool

| | Control | K ? > | | |
|--------|---------------------|-------|--|--|
| Modify | Calc DT2MS | Help | | |
| Check | Convert to Implicit | | | |

| - | CALC DT2MS AND %ADDED MASS | | | | | |
|------------------------|----------------------------|----------------------------------------------------|--|--|--|--|
| Dismiss Set DT2MS | Set DT2MSF | | | | | |
| Model Mass: | 1300.058 | | | | | |
| Current DT2MS | 0.0 | on *CONTROL_TIMESTEP | | | | |
| Model Timestep: | 1.33E-3 | Input required model timestep | | | | |
| %age added mass: | 5.00% | Input required %age added mass | | | | |
| Target Mass: | 1365.061 | Input required target i.e. model mass + added mass | | | | |
| MAT100 <dt> mass:</dt> | 0.0 | ? | | | | |

| — | - CALC DT2MS AND %ADDED MASS | | | | | |
|------------------------|------------------------------|----------------------------------------------------|--|--|--|--|
| Dismiss Set DT2MS | Set DT2MSF | | | | | |
| Model Mass: | 1300.058 | | | | | |
| Current DT2MS | 0.0 | on *CONTROL_TIMESTEP | | | | |
| Model Timestep: | 1.33E-3 | Input required model timestep | | | | |
| %age added mass: | 5.00% | Input required %age added mass | | | | |
| Target Mass: | 1365.0 | Input required target i.e. model mass + added mass | | | | |
| MAT100 <dt> mass:</dt> | 0.0 | ? | | | | |

In previous versions the model timestep can be set by specifying %age added mass.

In PRIMER 22.0 the model timestep can also be set by specifying target mass which is sum of structural mass and added mass.

***DEFINE_TABLE** conversion to _2D

- *DEFINE_TABLE_2D references *DEFINE_CURVEs by label.
- Therefore *DEFINE_TABLE_2D is usually preferable and easier to work with than *DEFINE_TABLE which must be followed by an ordered list of *DEFINE_CURVEs.
- A new model check warns of existing ***DEFINE_TABLE**s and offers an autofix.

```
WARNING [2]
CONTROL [1]
DEFINE_CURVE [1]
F TABLE_<NONE> should be converted to preferred _2D : Convert *TABLE_<NONE> to _2D (1)
```

• The drop-down on the ***DEFINE_TABLE** edit panel now permits conversion to _2D format.



Mesh – extrude solids

- The Mesh extrude panel can now also extrude solid elements to create new solid elements. For tetrahedrons the tool will extrude exactly along the selected face normal and does not consider local faces.
- The single face option will extrude the chosen face only. Propagate will select the entire surface defined by the break angle.



Mesh – extrude solids

• This new option is supported for up to 8 noded solids. Extrusion of higher order solids is not currently possible.





Mesh – Ruled Discrete/Continuous selection

- The Ruled Mesh panel now allows for discrete and continuous selection options when using Pick Edge Nodes or Pick using shortest path:
 - Discrete selection allows you to pick nodes in discrete lines between two nodes and automatically starts a new line to select nodes after each second click.
 - Continuous selection allows you to pick nodes in a continuous line without separation.





Continuous



Parameter Expressions

• PRIMER 22.0 now supports pow (x, y) as well as the previously supported format: x**y.

| Undata | Denet All | 1 04 | a a k | A Cha | tab | Usesse | | | | | | |
|--------------------|-------------|------------|----------|----------|---------|------------|----------|-------|-------|--------|-------|-----------------|
| Update | - Reset All | V UN | еск | 🖌 эке | ton | Usage a | 11 | | | | | |
| Cancel | 🖹 Copy In | # X-F | Refs | A Tex | t Edit | | | | | | | |
| | Modify PAR | AMETER | (model | 1) | | | | | | | | |
| reate new | Include f | ile policy | on Cre | ate: | Use cur | rent layer | ▼ | | | | | |
| Find | Filter: | | | Clear so | orting | | | | | | | |
| Name | Тур | Value | EXPR | LOC МИТ | TYP N | ECO | Inc file | Usage | Xrefs | Sketch | Reset | Reorder votions |
| | R V | 3.0 | | | | Edit | Master | Usage | Xrefs | Sketch | Reset | Move 🛟 |
| myparam | | | | | | Edit | Master | Usage | Xrefs | Sketch | Reset | Move 1 |
| myparam MyPower | R 🔻 | 9.0 | ∠ | | | | | | | | | ¥ |

| - Edit parameter M1 MyPower K ? - X | Edit parameter M1 MyPower2 K ? - X |
|-------------------------------------------------------------------|-------------------------------------------------------------------|
| 🕂 Update 🏷 Reset All 🗸 Check 🧪 Sketch 👬 Only 🔻 | 🕂 Update 🏷 Reset All 🗸 Check 📝 Sketch 👬 Only 🔻 |
| 🗙 Cancel 📄 Copy In 🚠 X-Refs 🛛 🗛 Text Edit | Cancel Copy In A Text Edit |
| Include: M1 <master file=""></master> | Include: M1 <master file=""></master> |
| Include file policy when creating parameters: Use current layer V | Include file policy when creating parameters: Use current layer V |
| Edit parameter expression MyPower | Edit parameter expression MyPower2 |
| Name: MyPower Value: 9.0 Recalculate | Name: MyPower2 Value: 27.0 Recalculate |
| Type: R V_EXPRESSIONLOCALMUTABLE | Type: R V_EXPRESSION _LOCAL _MUTABLE |
| _TYPENOECHO | _TYPENOECHO |
| Row 1 pow(myparam,2) | Row 1 myparam**3 |
| Row 2 | Row 2 |

Forming tool – Interpolate shell thickness

- The forming tool maps analysis results onto another model, transferring initial thicknesses and plastic strains from a source to a target model.
- The Interpolate thickness option has been introduced to interpolate the shell thicknesses at the nodes from the matched shells in the source model, allowing for an improved shell thickness mapping.
- This feature is active by default and can be controlled using the preference: primer*forming_shell_thickness_interpolation or the Interpolate thickness checkbox on the panel.
- If interpolation is disabled, the tool will revert to the previous method of using the average thickness of the matched source model shells.

| | For | ming | ? X | | |
|------------|---------------|----------|--------------|--|--|
| Apply | | | Help | | |
| | | | | | |
| Target: | | Source: | | | |
| 1 () | | 2 () | | | |
| Parts o | on Target | Parts | on Source | | |
| Pick Tar | get nodes | Pick S | ource nodes | | |
| Node 1: | 0 | Node 1: | 0 | | |
| Node 2: | 0 | Node 2: | 0 | | |
| Node 3: | 0 | Node 3: | 0 | | |
| Map ini | tial stresses | Search d | istance ? | | |
| ✓ Map pla | astic strains | Side | en x | | |
| Map ini | tial strains | O Fixed | O Fixed dist | | |
| Map th | icknesses | 2.0 | 25.0 | | |
| Reflect | in Y = 0 | | | | |
| ✓ Interpol | ate thickness |] | | | |

Forming tool – Interpolate shell thickness



Preferences



| Preference | Description |
|-----------------------------------------------------|-------------------------------------------------------------------------|
| oasys*javascript_maximum_memory_size | Maximum memory allocated for garbage collection (MB) |
| oasys*cd_compose_email primer*cd_compose_email | Whether or not to offer to compose an email for sending minidump files. |
| oasys*cd_email_address primer*cd_email_address | Email address in To: field of crash dump emails. |
| oasys*cd_cc_addresses primer*cd_cc_addresses | Email address(es) in Cc: field of crash dump emails. |
| oasys*cd_custom_email primer*cd_custom_email | Custom method of sending emails. |
| oasys*cd_dump_directory primer*cd_dump_directory | Directory in which to save crash dump files |
| oasys*cd_email_method primer*cd_email_method | Method used to create crash dump emails. |
| oasys*cd_minidump_file primer*cd_minidump_file | Whether or not to create minidump files, and what to do with them. |



| Preference | Description |
|-------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| primer*battery_undo_warn | Warn before deleting entities from following steps |
| primer*battery_overwrite_analysis_warn | Warn before overwriting control keywords in 'Analysis' panel |
| <pre>primer*check_tree_category_list</pre> | List of user categories to be displayed on check tree e.g. LOW_PRIORITY:HIGH_PRIORITY:FATAL |
| primer*default_table_create | Default option for table create edit panel. |
| primer*database_des_check | Check for absence of database history des |
| primer*max_contact_parmax_for_arcweld | Max parmax used when creating arc-weld contact (1.01,1.02) |
| <pre>primer*modular_bolts_get_unique_deformable_parts</pre> | Multiple modular bolts will share same deformable part unless this is set |
| <pre>primer*modular_bolts_form_set_gen_add_contact</pre> | Multiple modular bolts containing SET_GENERAL will form SET_ADD and *CONTACT |
| <pre>primer*spotweld_remake_auto_remove_layer</pre> | TRUE to automatically remove layer(s) that failed to connect when remaking spotwelds |



| Preference | Description |
|-------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| <pre>primer*contact_post_redist_perc</pre> | Percentage of unused memory to distribute to free pool after contact checking |
| <pre>primer*contact_post_redist_type</pre> | Which memory types to redistribute after contact checking |
| <pre>primer*contact_treat_attached_node_as_tied</pre> | Include attached nodes in tied contact in the tied count |
| primer*cut_section_neg_action | Negative action for cut sections |
| primer*cut_section_pos_action | Positive action for cut sections |
| primer*hbm_use_new_cable_node_panel | The new cable nodes attachment panel will be activated by default while working with human body models |
| primer*hbm_treat_bones_as_rigid | PRIMER rigidifies all Bone related parts in a human body model for Ansys LS-DYNA positioning analysis |
| primer*dummy_hbm_use_new_cable_equation | Use the new equation to create the *DEFINE_CURVE used while pulling positioning cables for Dummies/HBMs during Ansys LS-DYNA analysis |



| Preference | Description |
|--------------------------------------------------|--------------------------------------------------------------------------------|
| primer*hbm_use_encrypted_mats_for_cables | PRIMER will use the encrypted materials for finding cable attachment nodes |
| primer*forming_shell_tickness_interpolation | Forming to interpolate shell thickness rather than averaging it |
| primer*missing_include_file_action | Whether or not to remember missing (skipped on input) include file definitions |
| primer*threaded_elem_node_lookup_spin | Number of spin iterations in threaded element topology lookup before sleep |
| <pre>primer*load_path_intersection_warning</pre> | Warn about unexpected intersections when auto- creating a load path |
| primer*load_path_exclude_solids | Exclude solid elements by default when auto-creating a load path |
| primer*load_path_exclude_beams | Exclude beam elements by default when auto-creating a load path |



| Preference | Description |
|-----------------------------------------------------|----------------------------------------------------------------------------|
| primer*load_path_exclude_shells | Exclude shell elements by default when auto-creating a load path |
| <pre>primer*load_path_exclude_tshells</pre> | Exclude thick shell elements by default when auto- creating a load path |
| primer*load_path_psid_mode | Default mode for Xsec PSID definition |
| primer*load_path_orientation_mode | Default xsec orientation mode |
| primer*load_path_position_mode | Default xsec position mode |
| primer*load_path_pitch | Default pitch value |
| primer*load_path_xsec_count | Default number of xsecs |
| primer*load_path_snap_axis | Default 'snap to grid' global axis |
| primer*load_path_snap_grid | Default 'snap to grid' grid size |
| primer*load_path_offset | Default start offset |
| primer*load_path_size_mode | Default xsec size mode |
| <pre>primer*load_path_auto_size_perc_increase</pre> | Default percentage increase for the auto-size mode |



| Preference | Description |
|----------------------------------------------------|---------------------------------------------------------------------------|
| primer*load_path_auto_size_only_vis | Default 'only visible' status for the auto-size mode |
| primer*load_path_auto_size_max | Default max size for the auto-size mode |
| primer*load_path_l_length | Default L length for the fixed-size mode |
| primer*load_path_m_length | Default M length for the fixed-size mode |
| primer*load_path_add_loc_to_title | Default status of the 'Automatically add location to title' |
| <pre>primer*orient_child_include_with_parent</pre> | Orient child include(s) when parent is oriented |
| primer*excel_drawing_mode | Type of Images in excel output for keywords |
| primer*excel_find_volume | Find volume for database history node images in excel output for keywords |
| primer*excel_image_column | Column in which images are written in excel |
| primer*excel_image_height | Height of Images(pixels) in excel output for keywords |
| primer*excel_image_orientation | View of Images in excel output for keywords |
| primer*excel_image_width | Width of Images(pixels) in excel output for keywords |



| Preference | Description |
|-----------------------------------------------------------|-----------------------------------------------------------------------------------------|
| primer*excel_recursive_loops | No of recursive loops in find attached for database history beam images in excel output |
| <pre>primer*define_transformation_transl2nd_a3_zero</pre> | Behaviour for *DEFINE_TRANSFORMATION TRANSL2ND option with a3 zero |
| <pre>primer*output_control_solid_tet13v_r11</pre> | Output field TET13V on *CONTROL_SOLID in R11 |
| <pre>primer*belt_ignore_pelvis_rotation_check</pre> | Show the pelvis buckle rotation warning about lap belt point type. |
| primer*gtune_vbo_mult | The number of GDSIZE cache blocks in a VBO |
| primer*gtune_gdsize | Size of graphics data cache storage in KWords |



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