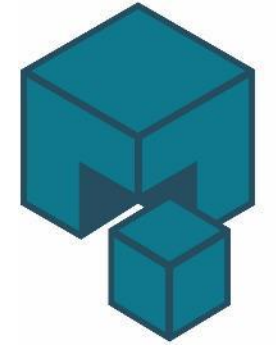


DYNAmore ECO SYSTEM – News on DYNAmore's LS-DYNA-Tools



Steffen Mattern, DYNAmore GmbH
Kurt Schweizerhof, DYNAmore GmbH

- LS-DYNA-Tools
 - status quo before 2022
 - what's new?
- New license model
- DYNAmore ECO SYSTEM
 - DYNAmore.pre
 - DYNAmore.post
 - DYNAmore.quality
 - DYNAmore.mapping
 - DYNAmore.testing
- what's next?

what are they for?

- support your daily work with LS-DYNA
- slim, command-line based tools
- handle different LS-DYNA related files to
 - prepare input files e.g., for subsequent simulations or sub-models
 - collect model information e.g., regarding mass scaling, contact messages, failed elements, etc.
 - reduce the size of output files for efficient data storage
 - ...

where do they come from?

- developed and maintained by DYNAmore
- originally mainly funded by German automotive OEMs
- free of charge for DYNAmore customers for over 20 years until July 2022

what's new?

- increasing popularity over the last years goes along with increasing demand for
 - technical and application support
 - maintenance and functional enhancements
 - licensing
- development/ integration of new tools
 - DM.inspect
 - Envyo
 - DM.binout2isomme
- DYNAmore ECO SYSTEM: relaunch under new licensing model in July 2022
 - grouped in five separately bookable packages → greatest possible flexibility
 - original tools stay free of charge for major contributors.



New license model

started in July 2022

what's different?

- tools are organized in five packages
 - DYNAmore.pre
 - DYNAmore.post
 - DYNAmore.quality
 - DYNAmore.mapping
 - DYNAmore.testing
- each can be licensed individually

how can I join?

- find details under <https://www.dynamore.de/en/products/pre-and-postprocessors/tools>
- interested? Please contact us!

Contact



Kathleen Fritz
@ Kathleen Fritz
t +49 711 459600273
f +49 711 45960029



Kathrin Faas
@ Kathrin Faas
t +49 711 459600274
f +49 711 45960029

■ **DM.plot2bc**

- generate `*BOUNDARY_PRESCRIBED_MOTION` for set of nodes from d3plot
- generate `*INTERFACE_LINKING_NODE_SET` for set of nodes from d3plot

■ **DM.check-hsp**

- extract model information from d3hsp file
- add data from other output files (d3plot, binout, mesXXXX)
- report in ASCII text or XML-Format

■ **DM.check-c**

- scan mes-files for all kinds of contact messages
- generate output for easier post-processing (e.g., Animator session file)

■ **DM.seghandle**

- list, visualize and manipulate binary INFMAK-files from `*INTERFACE_COMPONENT`

■ **DM.plot2coor**

- extract nodal coordinates of deformed geometry from arbitrary plot state
- directly replace `*NODE` in given keyword file

DYNAmore.pre: **DM.check-hsp**

- Example: typical command line for DM.check-hsp

```
DM.check-hsp <d3hsp> -cf -ps -ms -xwarn -mes <mes> -bin <bin> -g <d3plot>
```

- required input files
 - **<d3hsp>** ... the d3hsp file
 - **<mes>** ... all messag files (e.g., mes*)
 - **<bin>** ... all binout files (e.g., binout*)
 - **<d3plot>** ... the d3plot geometry state
- ASCII-output may be redirected to a file (> **check-hsp.txt**)
- an XML-output is available (**DM.check-hsp [...] -xml > check-hsp.xml**)

DYNAmore.post

- **DM.plotcpvs**
 - manipulate or select d3plot file result data
 - remove data from d3plot to reduce size
- **DM.check-failed**
 - collect info about failed elements and NaN forces/ velocities from messag-files
 - write session files for post processing
- **DM.check-binout**
 - list contents and integrity of binout file (and other LSDA-files)
 - repair corrupt LSDA-file
- **DM.d3plot-head**
 - manipulate d3plot header (title)
- **DM.plotintrusion**
 - calculate maximum intrusion of a subset of nodes
- **DM.plot2nodout**
 - extract nodout data from d3plot for a given node set
 - write nodout (ASCII) or binout
- **DM.hsp-tailor**
 - eliminate redundant information from d3hsp or messag files in order to keep the files small

DYNAmore.post: DM.plotcprs

- Example: typical command line for DM.plotcprs

```
DM.plotcprs -plast -thick -box <boxfile> <d3plot>
```

- will only keep displacements (default), plastic strain (shells) and thickness (shells)
- will only keep elements inside a rectangular box defined in **<boxfile>**
e.g., `xmin=0.0, xmax=100.0, ymin=-10.0, ymax=10.0, zmin=0.0, zmax=10.0`
- may substantially reduce the size of the resulting d3plot (depending on the applied options)
→ data is removed from file, i.e., compression is irreversible

■ **DM.inspect**

- perform quality checks on LS-DYNA input files
- ensure compliance with modeling guidelines on sub-model level
- define different quality criteria for different types of models

→ some of the checks are performed on the XML-output generated by DM.check-hsp

■ **DM.check-hsp**

- extract model information from d3hsp file
- add information from other output files (d3plot, binout, mesXXXX)
- report in ASCII text or XML-Format

DYNAmore.quality: **DM.inspect**

- batch program to perform quality checks on LS-DYNA input files
→ intention: ensure compliance with modeling guidelines on sub-model level
- does not bring own checks → to be individually defined for the respective application
- stand-alone executable for Windows or Linux programmed in Python
- typically executed via command-line, can be integrated in any environment

```
DM.inspect -i <MAIN_INPUT> -k <CHECKED_INPUT> -c <CHECK_CONFIG>
```

- expected input
 - **<MAIN_INPUT>** ... runnable LS-DYNA main input file
 - **<CHECKED_INPUT>** ... LS-DYNA input file to be checked (typically included in main input)
 - **<CHECK_CONFIG>** ... configuration file with defined check criteria

DYNAmore ECO SYSTEM

DYNAmore.quality: **DM.inspect**

- configuration file in YAML-format
- structured in different check categories
 - primer
 - dyna
 - additional
 - ...
- checks specified via unique identifier
- classification as 'error' or 'warning'
- optional parameter 'description' for documentation

DM.inspect_config.yaml

```
checks:
  primer:
    TABL_012:
      description: "non-monotonic values in table"
      mestype: warning
  XSEC_060:
    description: "cross section cuts no elements"
    mestype: warning
  dyna:
    '20446':
      description: "x-axis reverses direction"
      mestype: error
    '20006':
      description: "no output interval for D3PLOT"
      mestype: warning
  additional:
    added_part_mass:
      description: "added mass of part exceeds 'ratio'"
      mestype: warning
      ratio: 0.10
```

■ pre-phase

- utilizing check capabilities of PRIMER
→ 7000 LS-DYNA specific checks
- may be skipped via command line option
- any PRIMER check can be defined in DM.inspect's configuration file

■ simulation-phase

- LS-DYNA initialization run is performed
- `mcheck=y` for explicit (10 cycles)
- `ncycle=1` for implicit
- model information collected in XML-file by DYNAmore's LS-DYNA-Tool 'check-hsp'

■ post-phase

- individual checks using data from XML-file
 - limit amount of mass-scaling
 - name, type and value of parameters
 - part attributes
 - time history definitions
 - ...
- individual checks by parsing keyword
 - identify crypted content
 - expected or forbidden keywords
- check numbering range
 - evaluated by LS-PrePost

DYNAmore.quality: **DM.inspect**

- results are reported to an ASCII-text file
 - the filename is `<CHECKED_INPUT>.report`
 - errors and warnings are reported for the different check categories
 - passed checks can be reported optionally

DM.inspect_config.yaml

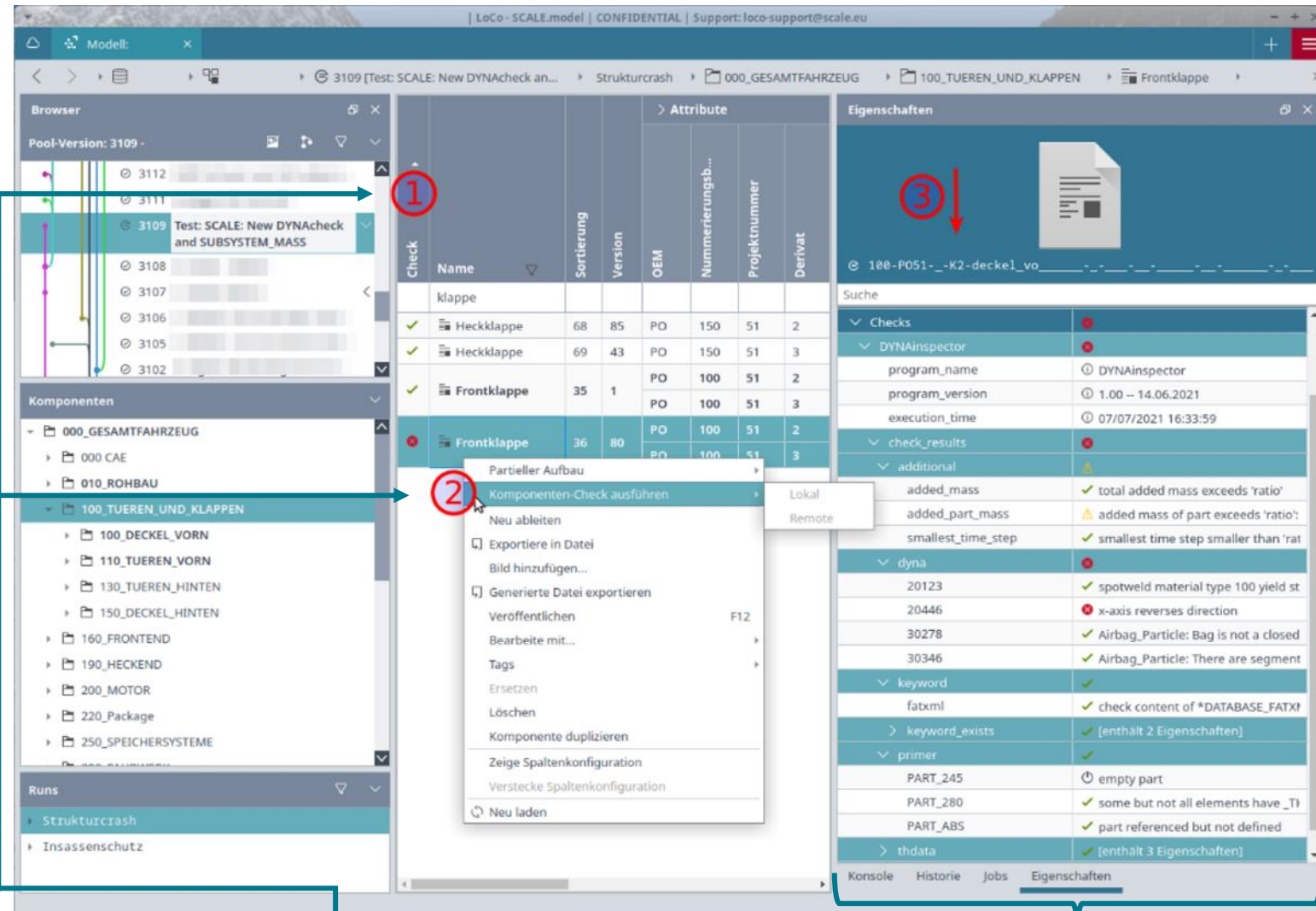
```
report:
  full:
    description: "write report including passed checks"
```

- Furthermore, results can be reported to a JSON file to be processed by other software
→ e.g., integration into SDM-software SCALE.model at Porsche
- command line option `--json` → `DM.inspect_report.json`
- further file formats possible

DYNAmore ECO SYSTEM

DYNAmore.quality: **DM.inspect**

- simulation data management system SCALE.model (formerly known as LoCo) is used at Porsche for
 - model assembly
 - version control
 - access control
 - exchange with suppliers
 - management of CAE components
 - ...
- model check can be initiated on component level
- check results are accessible in SCALE.model GUI



DYNAmore ECO SYSTEM

DYNAmore.quality: **DM.inspect**



- Integration into Simulation Data Management at Porsche
 - check result for the component are aggregated from the results of the single checks
 - component mass and mass center are also reported by DM.inspect
 - used for mass trim during assembly by SCALE.model

Suche	
> Basisinformation	[enthält 8 Eigenschaften]
> Änderungen	[enthält 1 Eigenschaften]
> Abhängigkeiten	[enthält 5 Eigenschaften]
> Snippets	[enthält 5 Eigenschaften]
▼ Checks	⊗
▼ DYNAmore	⊗
program_name	Ⓜ DYNAmore
program_version	Ⓜ 1.00 -- 14.06.2021
execution_time	Ⓜ 07/07/2021 16:33:59
> check_results	⊗ [enthält 5 Eigenschaften]
▼ extracted metadata	✓
COMPONENT_ADDED_MASS	Ⓜ 0.1513
COMPONENT_MASS	Ⓜ 23.2342
COMPONENT_MASS_CENTER	Ⓜ [112.112, 0.2422, 452.62324]
COMPONENT_STRUCTURAL_MASS	Ⓜ 23.0829

Suche	
▼ Checks	⊗
▼ DYNAmore	⊗
program_name	Ⓜ DYNAmore
program_version	Ⓜ 1.00 -- 14.06.2021
execution_time	Ⓜ 07/07/2021 16:33:59
▼ check_results	⊗
▼ additional	⚠
added_mass	✓ total added mass exceeds 'ratio'
added_part_mass	⚠ added mass of part exceeds 'ratio': addec
smallest_time_step	✓ smallest time step smaller than 'ratio'*so
▼ dyna	⊗
20123	✓ spotweld material
20446	⊗ x-axis reverses direction
30278	✓ Airbag_Particle: Bag is not a closed volurr
30346	✓ Airbag_Particle: There are segments four
▼ keyword	✓
fatxml	✓ check content of *DATABASE_FATXML to l
> keyword_exists	✓ [enthält 2 Eigenschaften]
▼ primer	✓
PART_245	Ⓜ empty part
PART_280	✓ some but not all elements have _THICKNI
PART_ABS	✓ part referenced but not defined
> thdata	✓ [enthält 3 Eigenschaften]

DYNAmore ECO SYSTEM

DYNAmore.quality: **DM.inspect**



■ **DM.inspect**

- batch-mode checking of LS-DYNA input
- configurable check criteria
 - no integrated checks!
- including LS-DYNA initialization run
- integration in SDM software possible

■ **What do you have to do?**

- configure DM.inspect for your environment
- provide your components 'ready-to-run'
- define check criteria
 - this is actually the difficult part!

■ **future plans**

- implementation of further checks and functionalities
- integration of further pre-processors
- extent report functionalities
- manual/ documentation of available checks

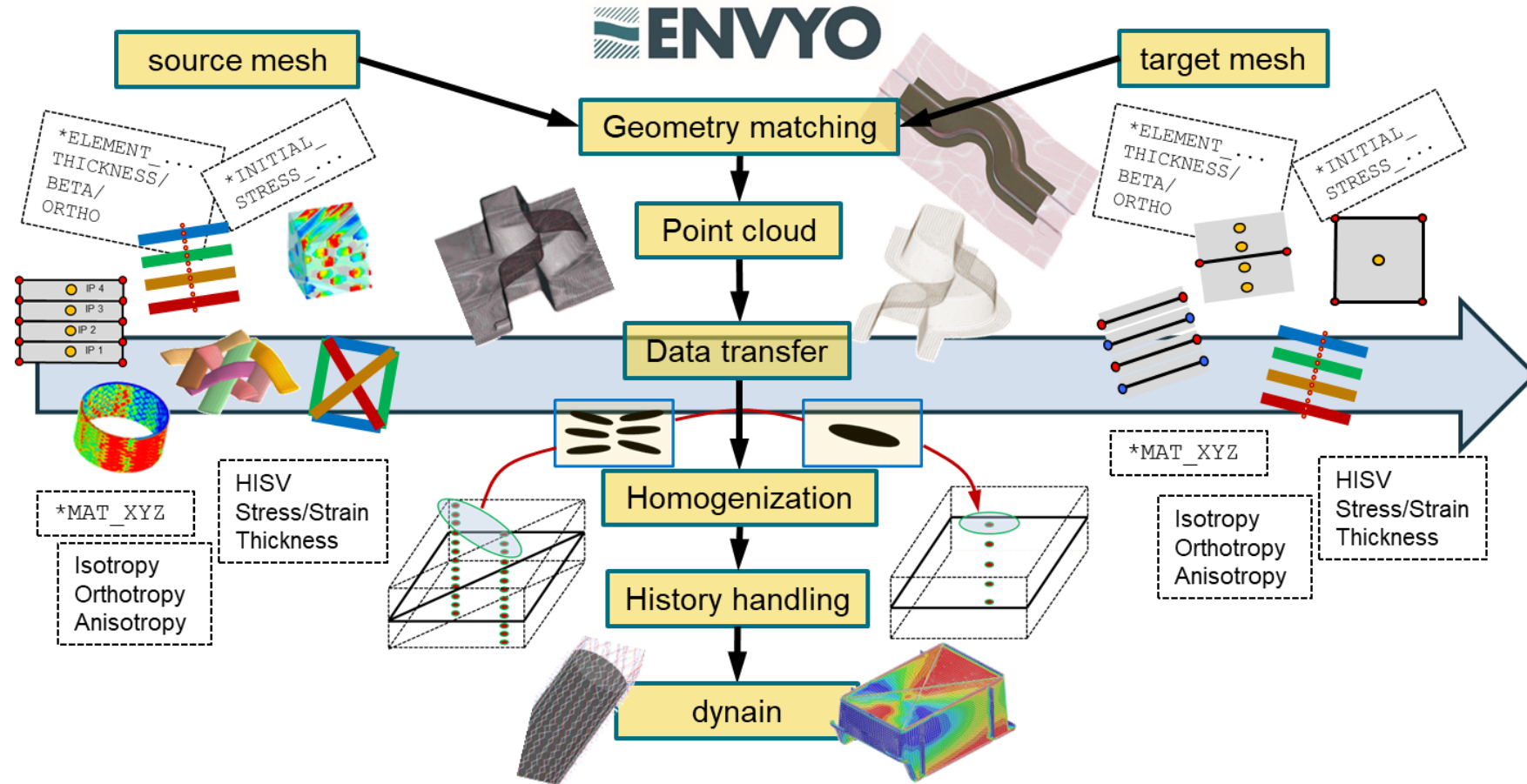
■ **interested?**

→ please contact DYNAmore

DYNAmore ECO SYSTEM

DYNAmore.mapping: ENVYO

- multi-purpose mapping tool dedicated to LS-DYNA
- transfer and manipulation of simulation result data
 - between differently discretized meshes
 - from different solvers
- to an LS-DYNA specific input format



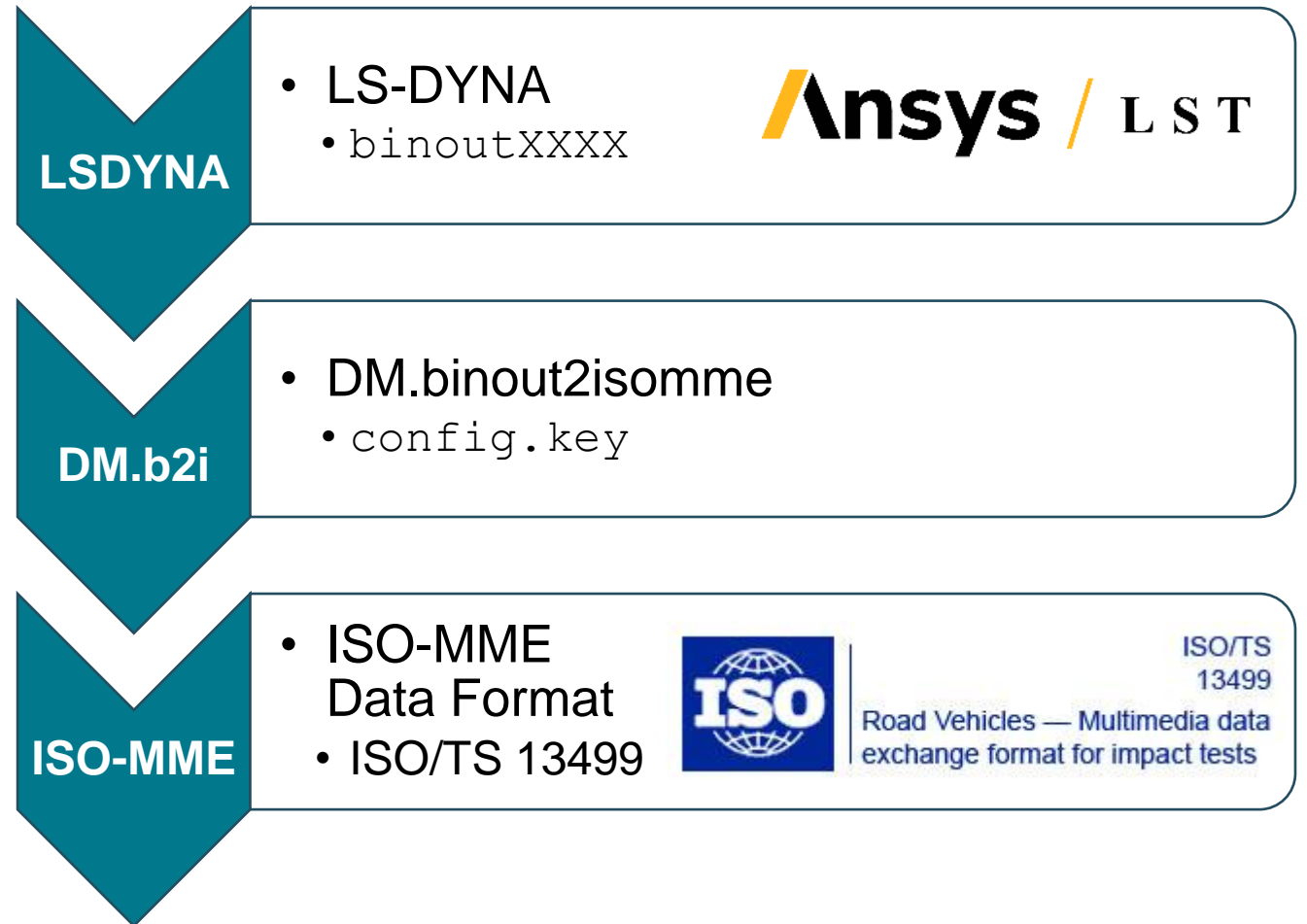
- DYNAmore Express: Envyo - Mapping capabilities and recent developments:

<https://www.youtube.com/watch?v=DvOchqNhaZA>

DYNAmore ECO SYSTEM

DYNAmore.testing: **DM.binout2isomme (DM.b2i)**

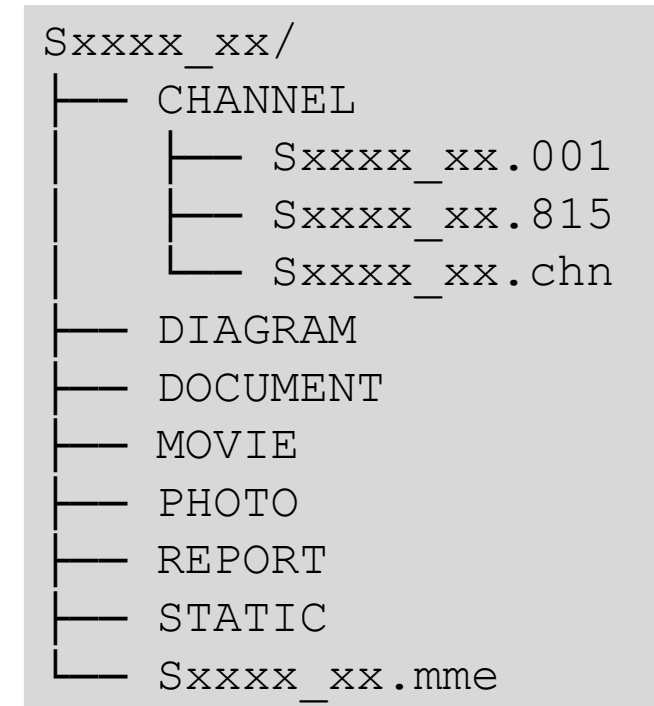
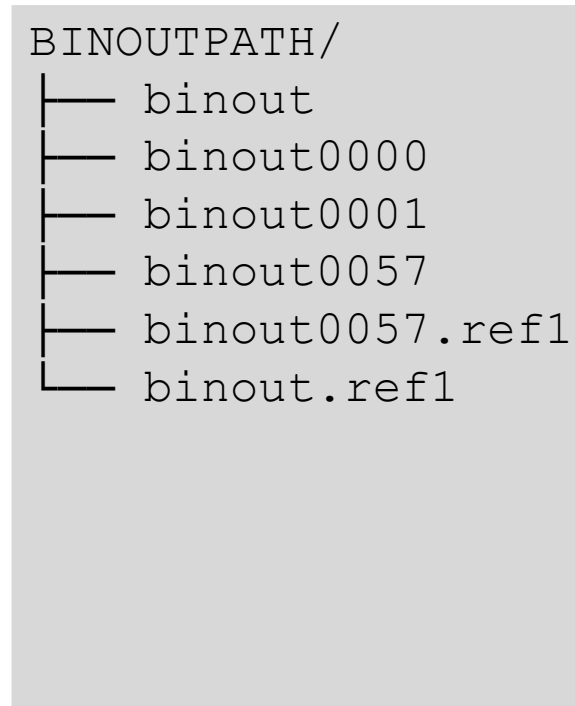
- DM.binout2isomme is a Linux command line tool (rhel6, rhel7, ...)
- DM.b2i converts selected LS-DYNA BINOUT results in an ISO-MME structure
- Execution in batch mode
 - Cluster support → no GUI



DYNAmore ECO SYSTEM

DYNAmore.testing: **DM.binout2isomme (DM.b2i)**

- Channel modification
 - differentiation, integration of channel data
 - time-offset and time scale
 - y-offset and y-scale
 - filtering (filter class A, B, C ,D)
- Channel aggregation
 - sum, mean
- Appending of channels to an existing ISO-MME data structure
- Support of additional customer dependent export formats
 - isomme.zip
 - xy.dat



what's next?



- keeping existing tools up-to-date, i.e., supporting new LS-DYNA Features
- implementation of new features in existing tools
 - development of new check capabilities for DM.inspect
 - adding information to XML-file generated by DM.check-hsp
 - ...
- development of new tools
 - soon to be released: DM.keyword-crypt
 - support creating and handling encrypted LS-DYNA input files
- harmonized licensing concept over all tools
 - one single license file supported by every tool
 - license server decoupled from the individual tools

Thank You

- technical requests: support@dynamore.de

- license requests:



Kathleen Fritz
@ Kathleen Fritz
t +49 711 459600273
f +49 711 45960029



Kathrin Faas
@ Kathrin Faas
t +49 711 459600274
f +49 711 45960029

DYNAmore GmbH
Industriestr. 2
70565 Stuttgart-Vaihingen
Germany

Tel.: +49 - (0)711 - 459 600 0
Fax: +49 - (0)711 - 459 600 29
info@dynamore.de

www.dynamore.de
www.dynaexamples.com
www.dynasupport.com
www.dynalook.com

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