Release 2022 R1 Highlights
Ansys optiSLang

Why Ansys optiSLang?

Innovate with Automation

Accelerate innovation by **minimizing non-value add, repetitive tasks** by fully automating and orchestrating the simulation workflows between heterogenous CAX tools across the entire enterprise.

Product Improvement

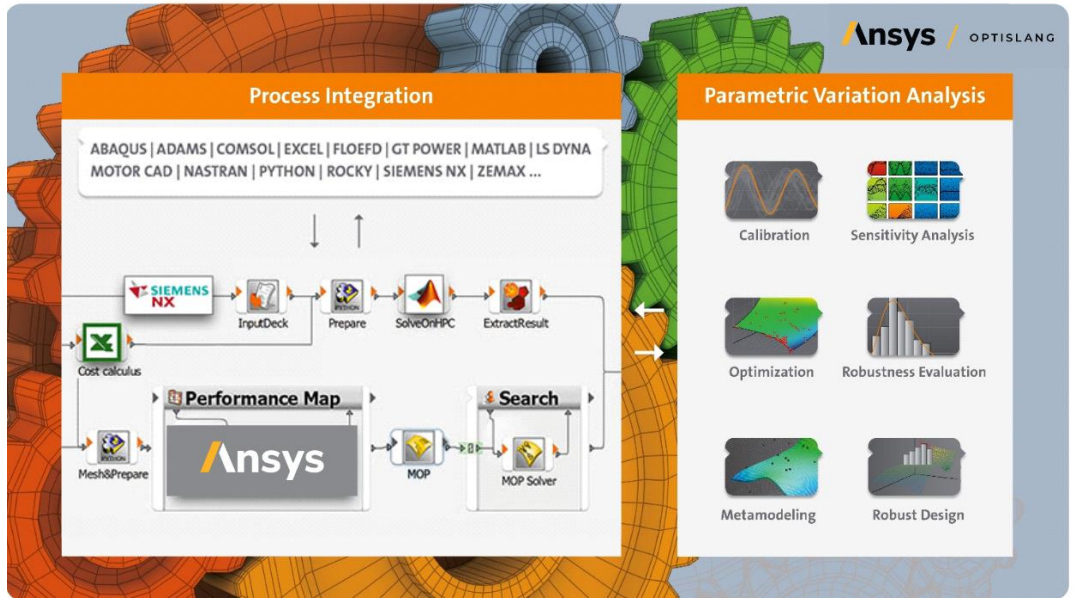
Equip your engineers with tools that help **improve product designs beyond what human brain can perceive**. This could mean tweaking several hundred design parameters, figuring out the parameter subset that make a huge impact on product performance and optimizing the design.

Product Reliability

Quantify and minimize the uncertainty of risk going from simulation to real-world production when it comes to unexpected manufacturing tolerances and other real-world environmental factors.

Ansys

OPTISLANG



Enables Pervasive Simulation

Ansys optiSLang - Optimize and orchestrate your virtual product development

Orchestrate and Automate

Increase productivity

- Tools Agnostic Process Integration
- Standardized workflows
- Tool Chaining
- Openness for Plugins and Extension

Understand and Optimize

Reduce complexity and make better product decisions

- Model Calibration
- Variation Analysis
- Metamodeling including AI/ML
- Efficient optimization algorithms and execution
- Robust Design Optimization

Evaluate Robustness

Manufacture with confidence

- Proprietary algorithms for robustness evaluation
- Design for Six Sigma
- Uncertainty Quantification
- Manufacturing tolerance evaluation

AND MORE….

Ansys optiSLang 2022 R1 Release Summary

Ansys / OPTISLANG

New connectors to LS-Dyna and SpaceClaim/Discovery

New algorithms from extended partnership with Probaligence

Orchestrate and Automate

- **More NEW nodes: ModelCenter, Nastran**
- AEDT node improvements
- Export ModelCenter wrapper
- Desktop App & Test-run

Innovate with Automation

Understand and Optimize

- **One Click Optimizer (beta)**
- GLAD for HFSS (beta)
- Unigene (beta)
- DX algorithms: Linux support

Product Improvement

Evaluate Robustness

- **Reliability Importance: Monte Carlo, FORM**
- Poisson distribution
- Postprocessing discrete distributions

Product Reliability

Ansys

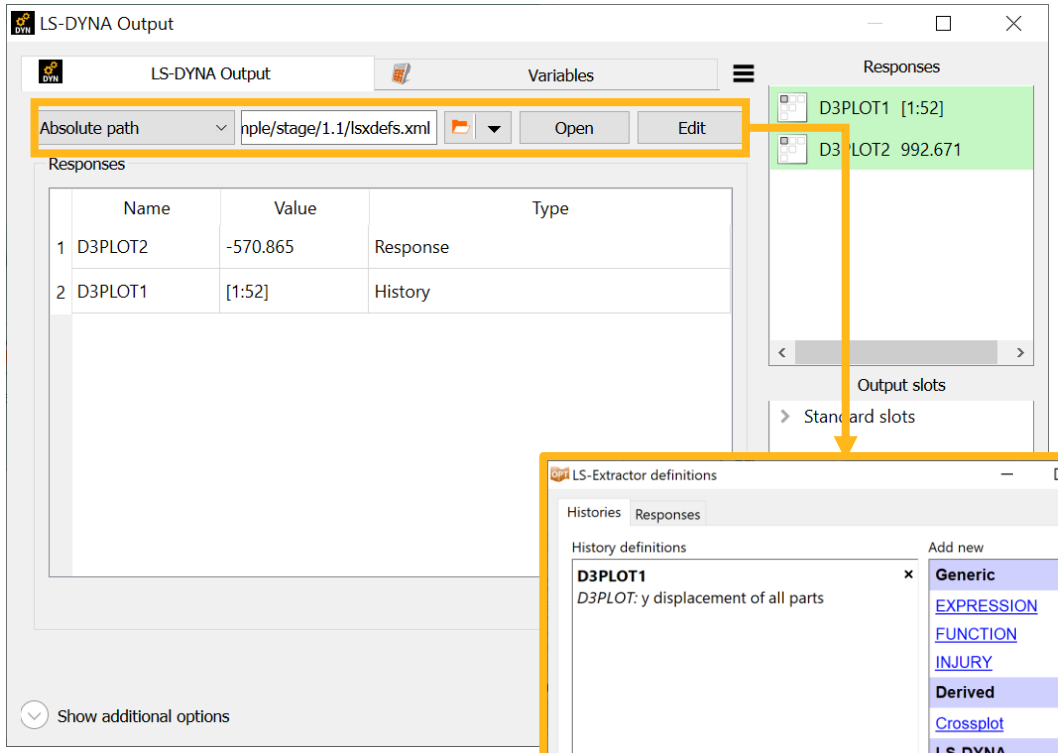
Orchestrate and Automate

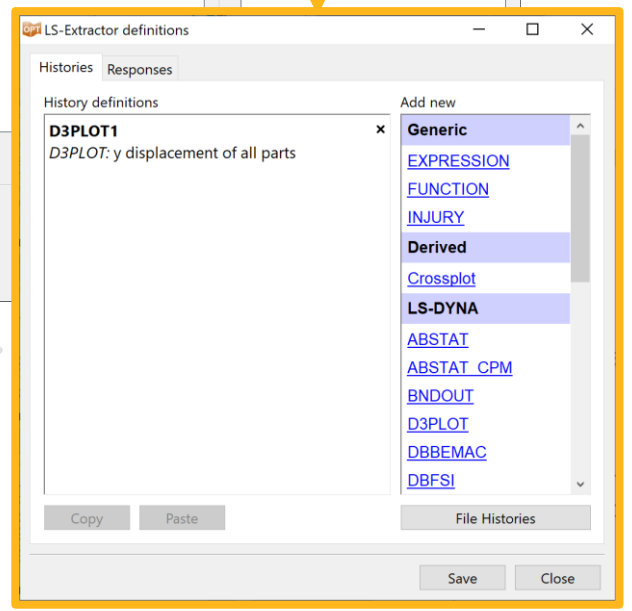
Accelerate innovation by **minimizing non-value add, repetitive tasks** by fully automating and orchestrating the simulation workflows between heterogenous CAX tools across the entire enterprise.

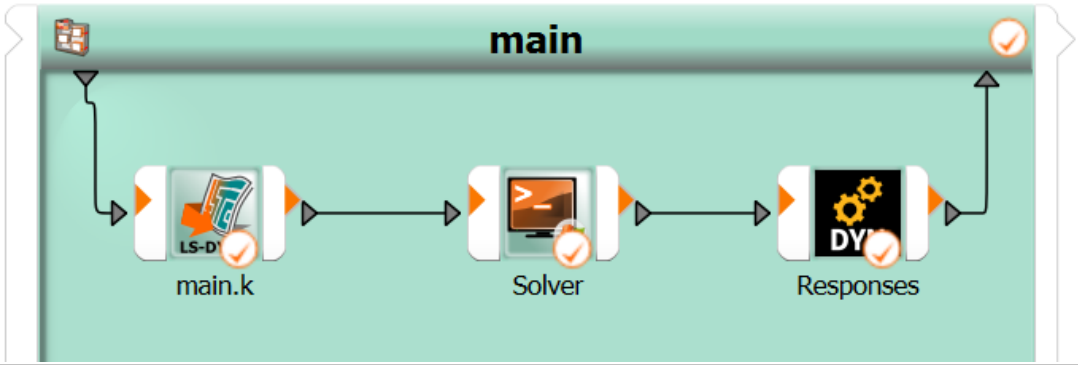
Better LS-DYNA Connector

Much easier workflow building with LS-Dyna

- Easier extraction of LS-DYNA results
  - Provided by LS-DYNA Team
  - Works similar to LS-OPT
- Use like in any other integration node
  - Instant visualization, read mode, variables …
- Solver wizard with better Batch/Bash scripts



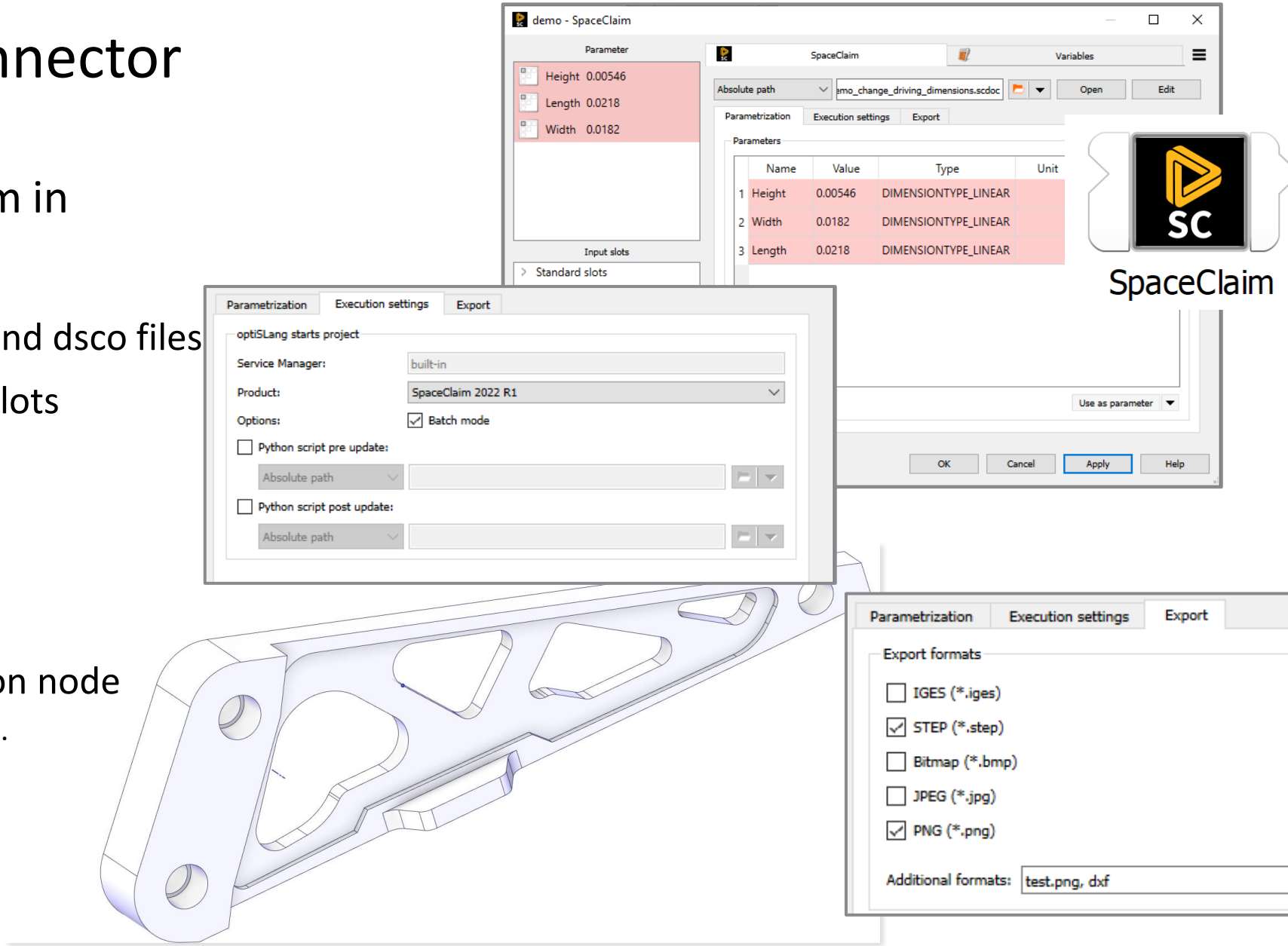




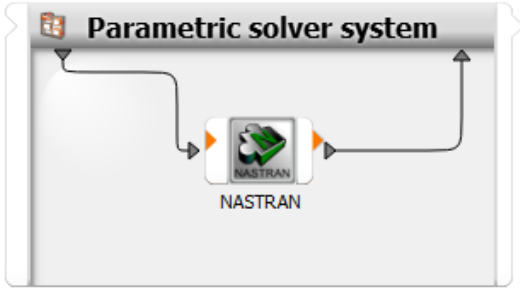
New SpaceClaim connector

Directly connect SpaceClaim in optiSLang workflows

- Directly integrate with scdoc and dsco files
- Register Parameters or Input slots
- Execute
  - Batch or GUI mode
  - Pre- or Post- Update Journals
- Export several output formats
- Use like in any other integration node
  - Parallel execution, Max. Runtime, …
- Limitation: Windows only

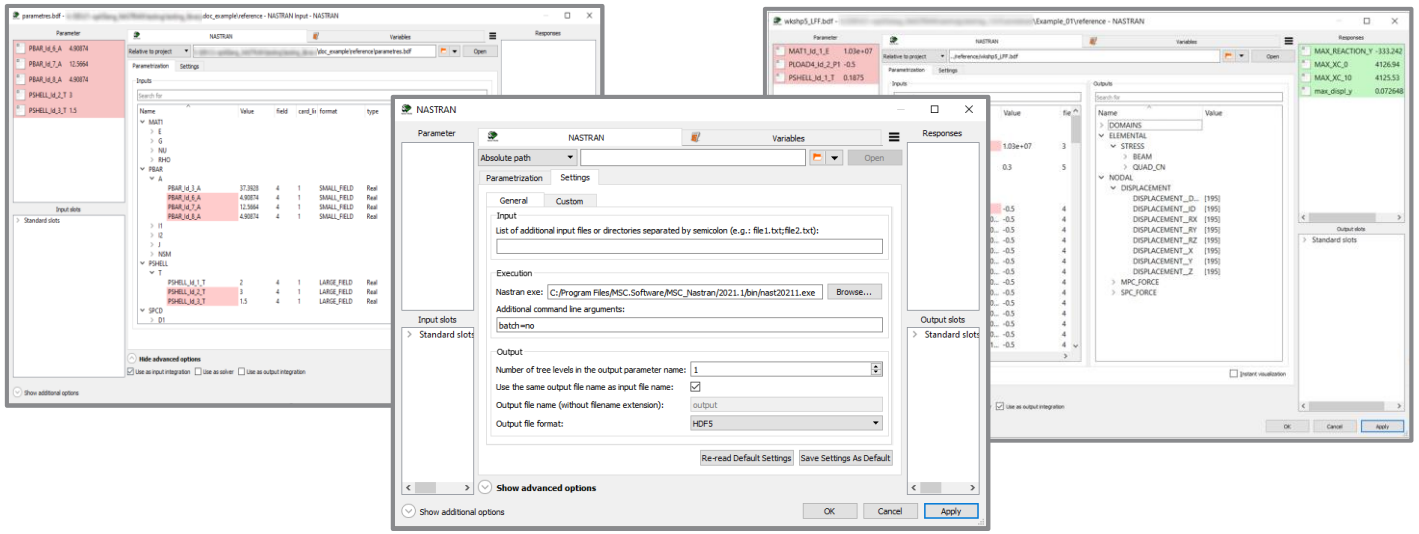


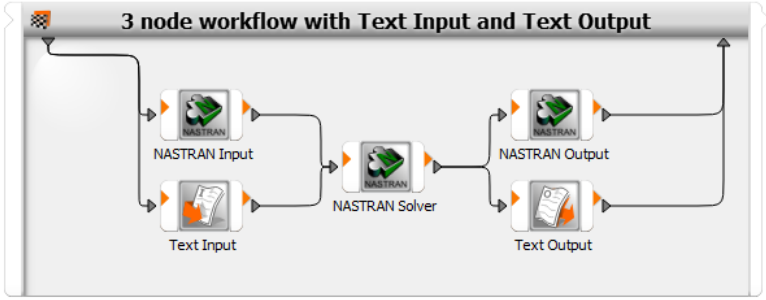
New Nastran connector



Guided and easier set up of workflows

- Input parametrization:
  - Fileformats: bdf, nas, inp, dat
- Output parametrization:
  - Fileformats: hdf5, h5, op2
- MSC Nastran & Simcenter Nastran
  - 2021 versions
- Windows & Linux

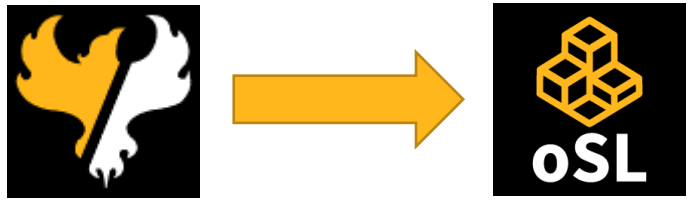


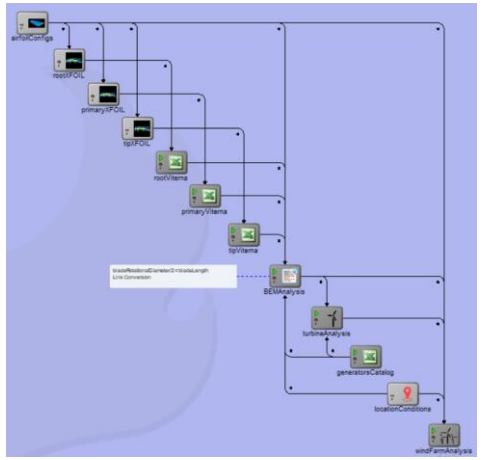


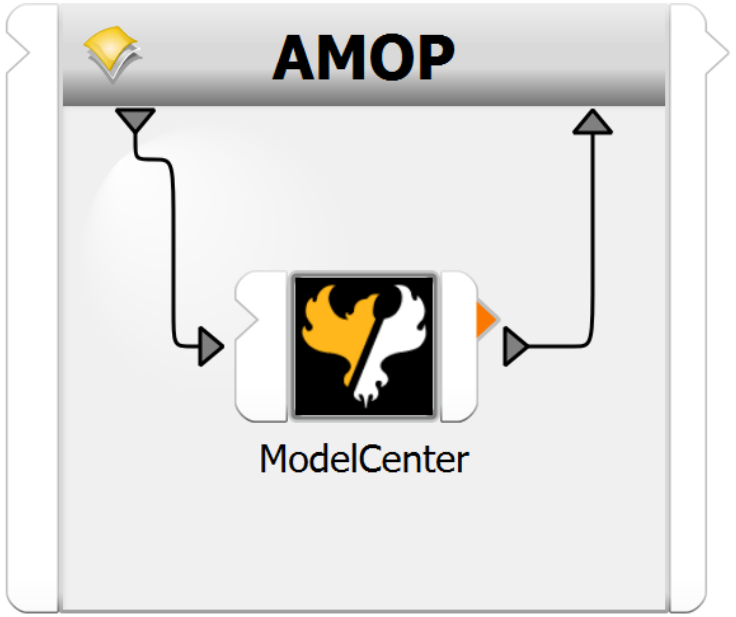
New ModelCenter MBSE node in optiSLang

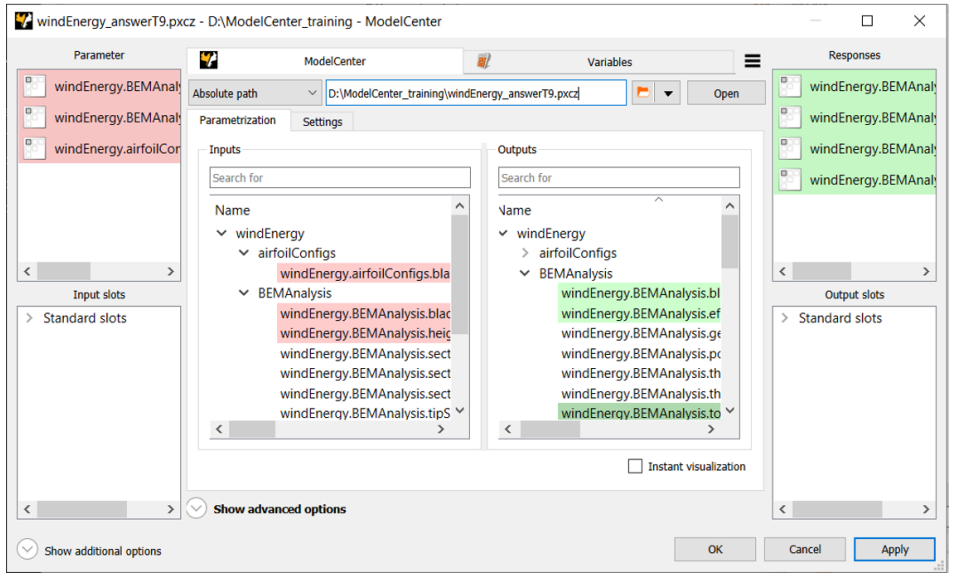
ModelCenter MBSE users can use optiSLang algorithms and extend workflows

- Directly connect inputs and outputs of ModelCenter project
- Limitation: Windows only



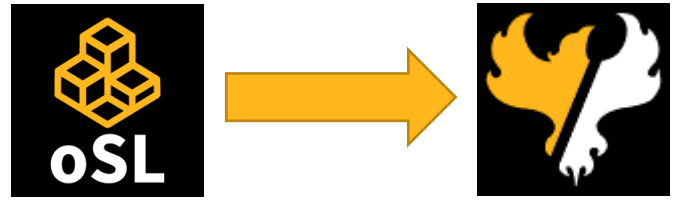


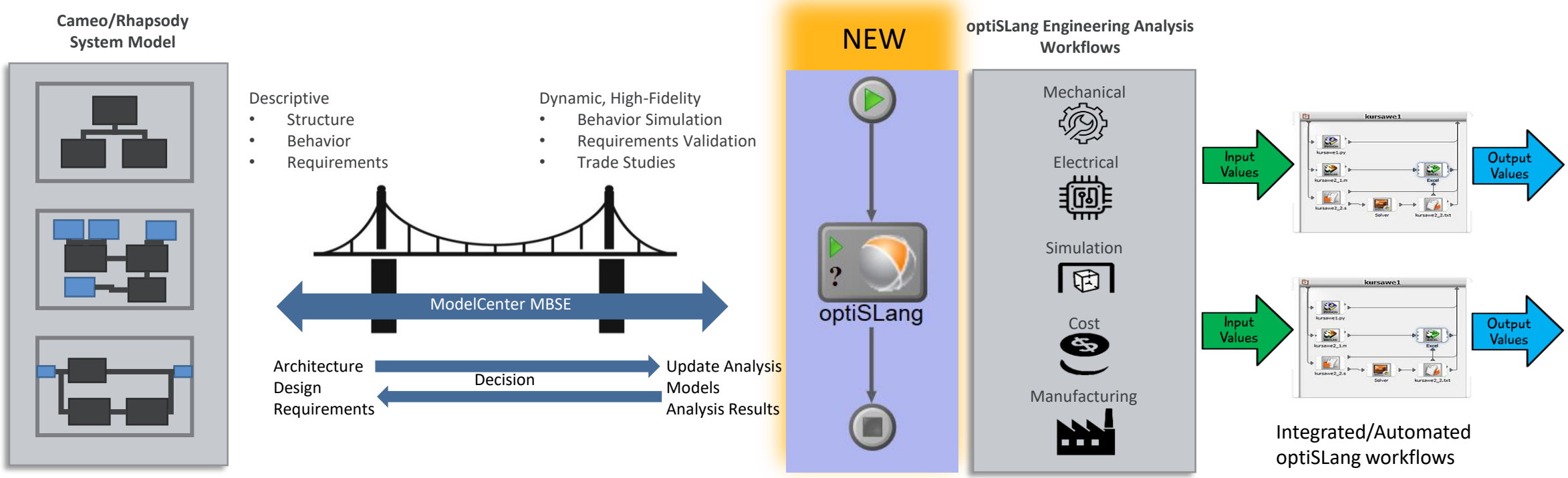




optiSLang Wrapper in ModelCenter MBSE

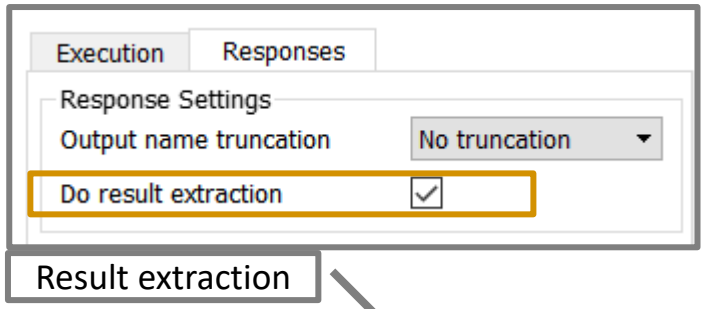
- Export Wrapper from optiSLang → Project parameters and responses are available in MC
- ModelCenter users can include optiSLang workflows
- MBSE can be coupled to optiSLang workflows



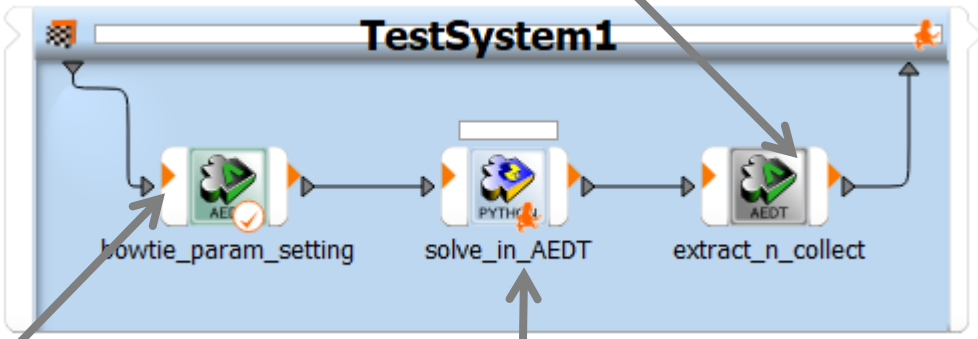


Ansys Electronics Desktop Node improvements

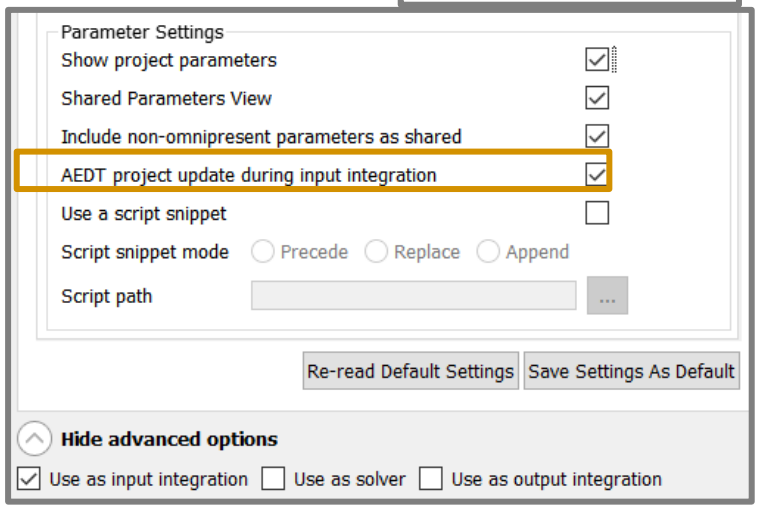
- Enable splitting workflow in 3 nodes
- Performance drag reduction
  - Store only active projects of active designs
- Run mode “regular DSO”:
  - default: only relevant Optimetrics variation tables are solved
  - default: copying of reference .aedtresults is switched off
  - efficiency improvement of the nested loops for exporting CSV files



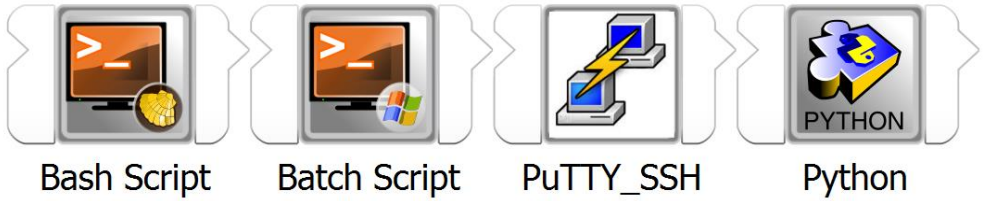
Result extraction



parameter setting



Allow user-defined command line
e.g. ansysedt.exe -BatchSolve



HPC licensing for parametric variations

→ Use any queueing system

2022R1 API Changes

Write less and cleaner customization and automation script code

- Custom integration API Version 3 (Beta)
  - Use JSON instead of DesignPoint in settings
  - Old (V1, V2) integrations still work as expected
  - Can be used in QML backend of customized settings widget and are interpreted as JSON there
- SoS script API
  - Single DataObjectContainer for all DataObjects
  - Remove DataObjectFilter (filter methods at container instead)
  - Documentation improvements
- OWS API end point
  - API end point paths are prepended with /api
  - API can be configured distinct from static files (in the reverse proxy)
  - Legacy paths are preserved for compatibility
- OWS API end point versioning
  - API end points are (optionally) versioned
  - All API end points can have an additional version in the path
  - Allows proper support for different API versions

UNDERSTAND:
All SoS actions in every component, is executed by running SoS script code (Python or Lua).
This includes **all** actions in the GUI.

/get_projects *(legacy)*

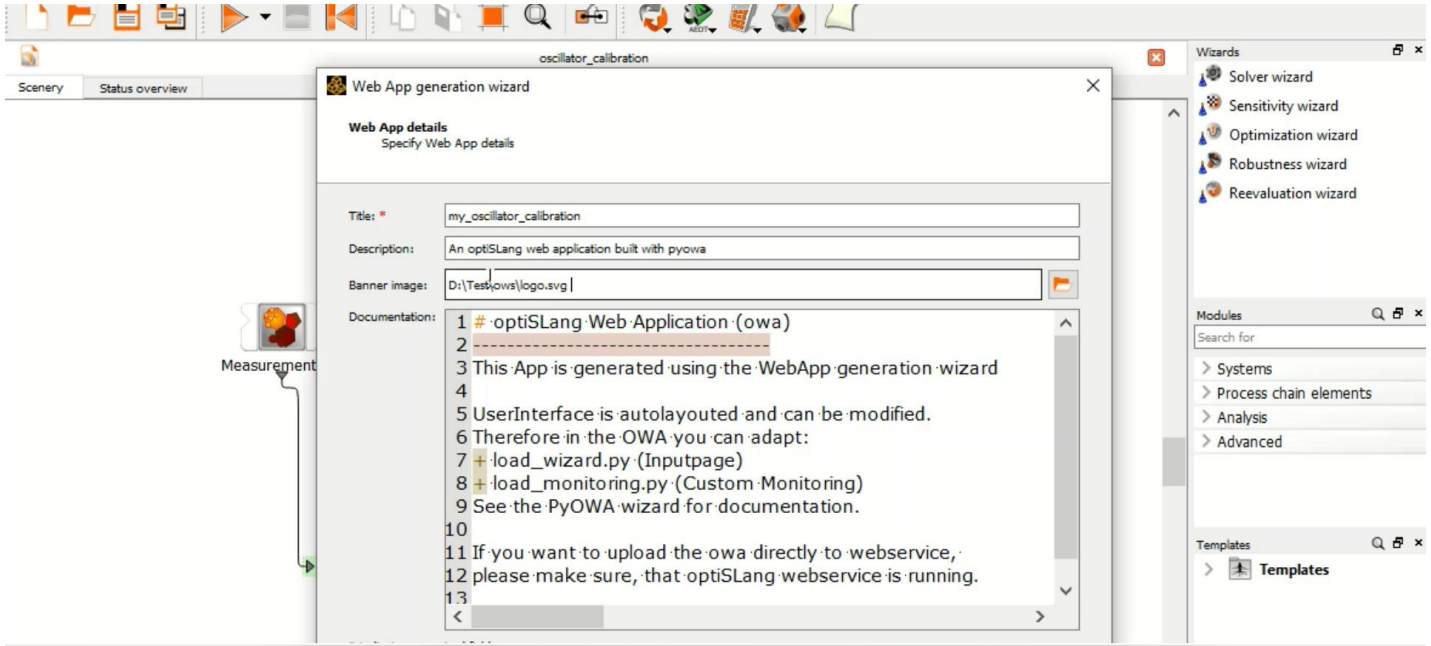
/api/get_projects *(current version)*

/api/0/get_projects *(latest version)*

App Generation Wizard

Easily generate and publish optiSLang workflows as Apps

- Part of optiSLang Enterprise license
- Use wizard-based step-by-step guidance for
  - Web app building
  - Project clean up
  - Registered files
  - Project placeholder
  - OWA Packaging
- Generate optiSLang Apps (.owa extension) along with
  - Placeholder optiSLang Project
  - Autolayout Web Dialogs
  - Publish to Ansys Minerva (improved in 22R1)

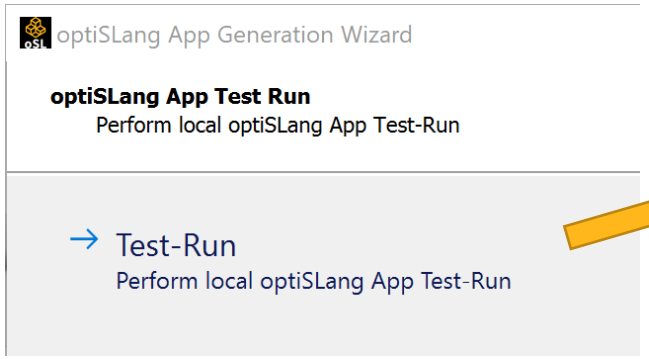


Specify Title, Description, Icon, Documentation

Test-Run & Desktop App

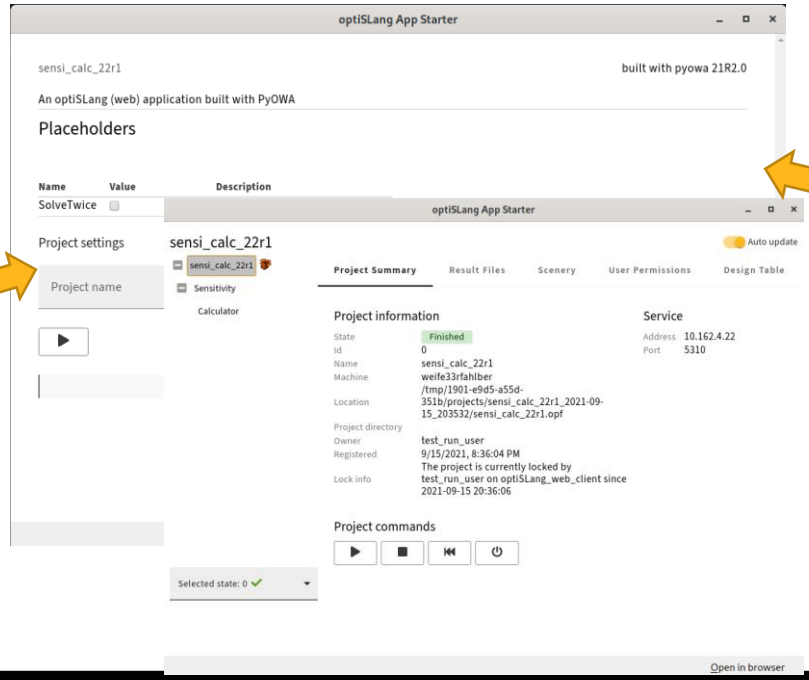
Smart testing before upload to central Web App hosting service such as Ansys Minerva

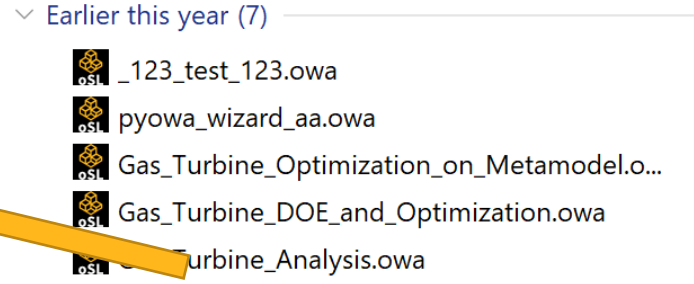
- Temporary run with Local (Test-Run) user
- Monitoring and all Web-App capabilities available
- Includes pyowa etc.



Test-Run

- New part of App Generation wizard





Desktop App

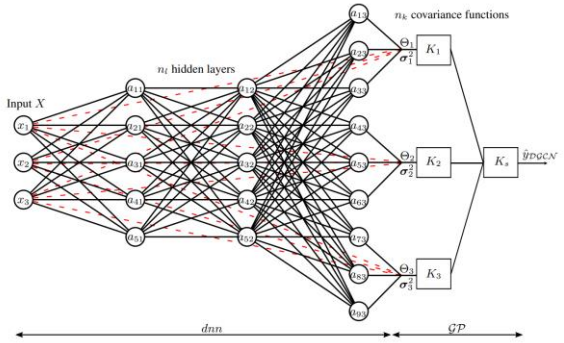
- Start an optiSLang App from Desktop
- Double Click on *.owa file

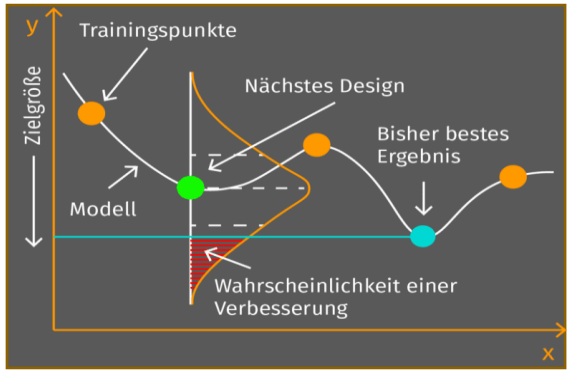
Understand and Optimize

Equip your engineers with tools that help **improve product designs beyond what human brain can perceive**. This could mean tweaking several hundred design parameters, figuring out the parameter subset that make a huge impact on product performance and optimizing the design.

Extended partnership with Probaligence

- Probaligence algorithms are now integrated part of optiSLang Enterprise





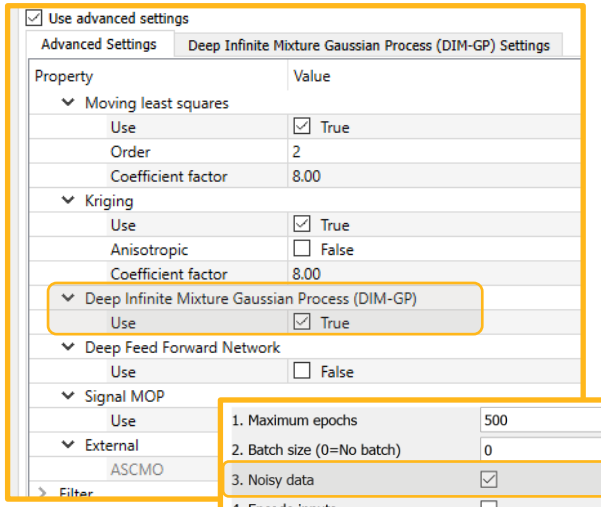
"I am very happy that we have succeeded in bringing together the best solution for design studies- Ansys optiSLang, the most user-friendly and flexible environment and the most efficient methods of stochastics and optimization for big data analysis from Probaligence into one tool and now combining our strengths."

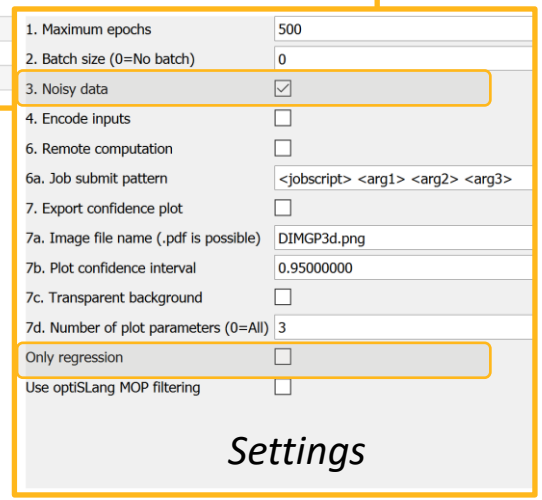
Prof. Dr. Dirk Roos

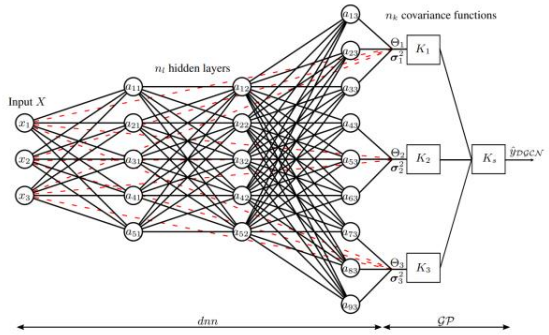
Probaligence Algorithms

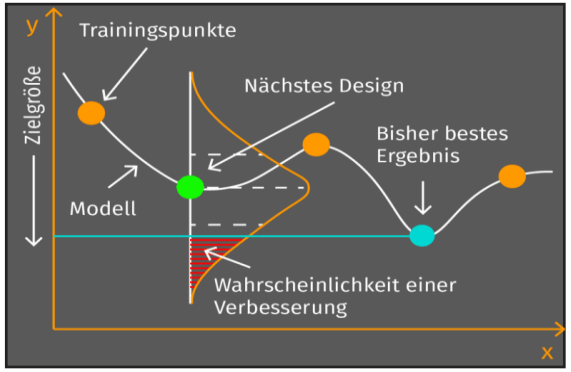
- NEW Metamodel as part of MOP and AMOP competition (**Enterprise**)
  - Deep Infinite Mixture of Gaussian Processes (DIM-GP)
    - Hybrid approach combining neural networks with Gaussian processes
    - DIM-GP interpolation option
      (not default / not yet linked to MOP approximation type)
    - Regression and classification supported
    - Activation via advanced mop settings

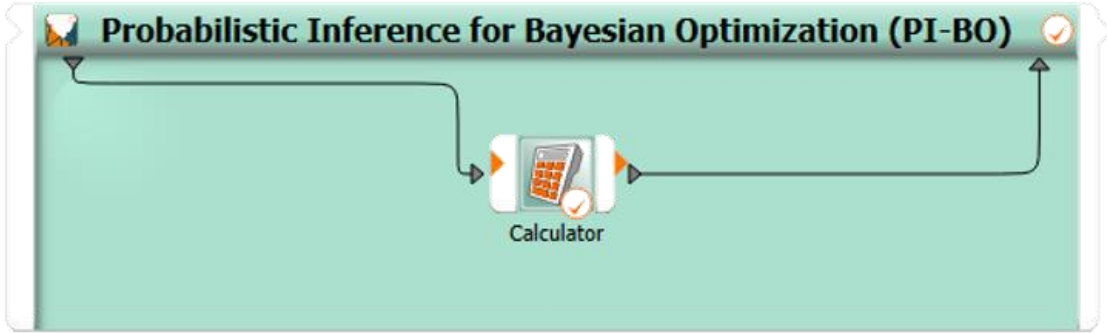
- NEW Bayesian Optimizers (**Enterprise**)
  - Probabilistic Inference for Bayesian Optimization (PI-BO)
  - Bayesian Adaptive Sequential Sampling (BASS) (Beta)











DesignXplorer Algorithms: Linux support

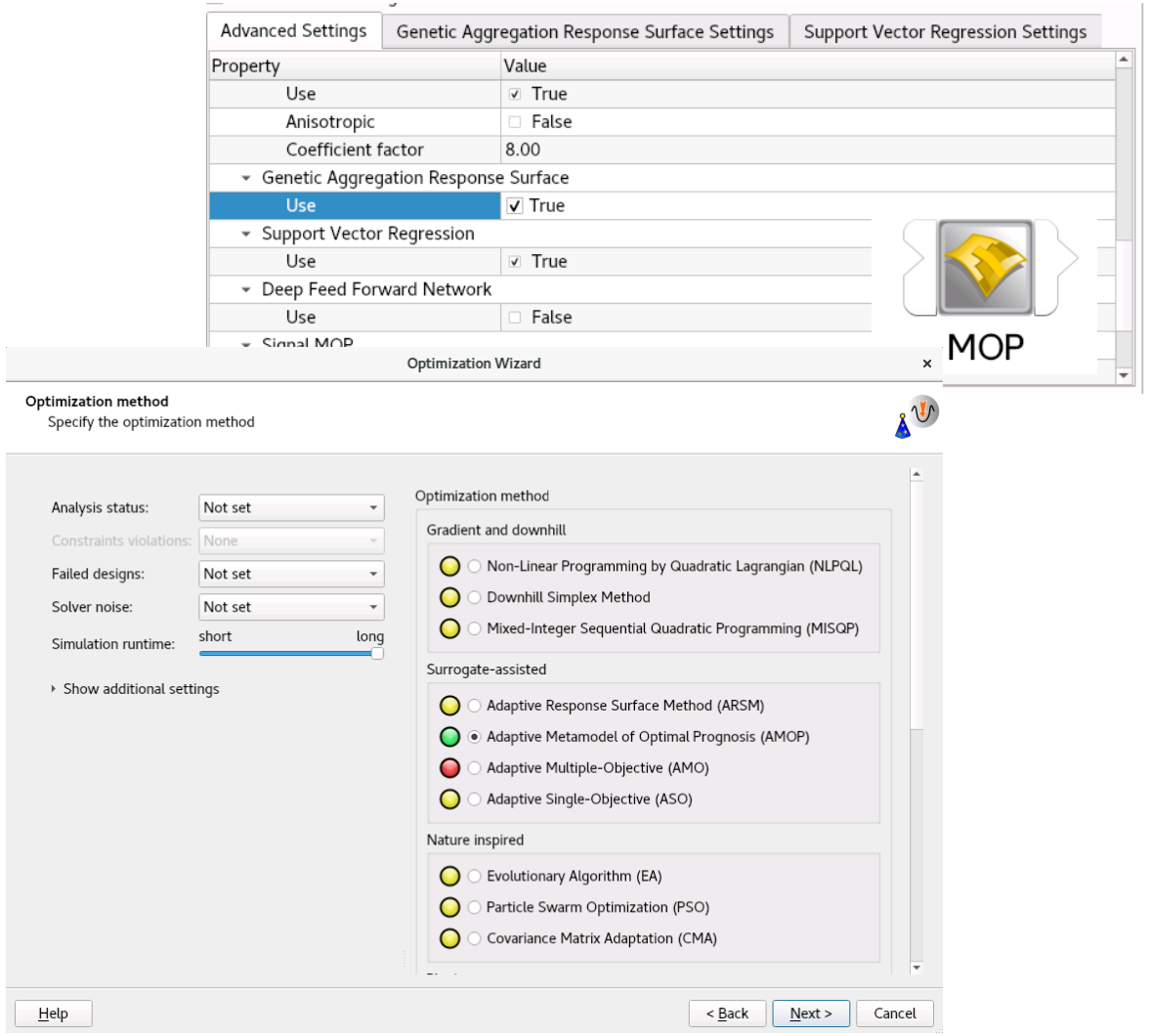
DX Algorithms are now available for Linux, too

Meta-models:

- *GARS*: Genetic Aggregation Response Surface
- *SVR*: Support Vector Regression

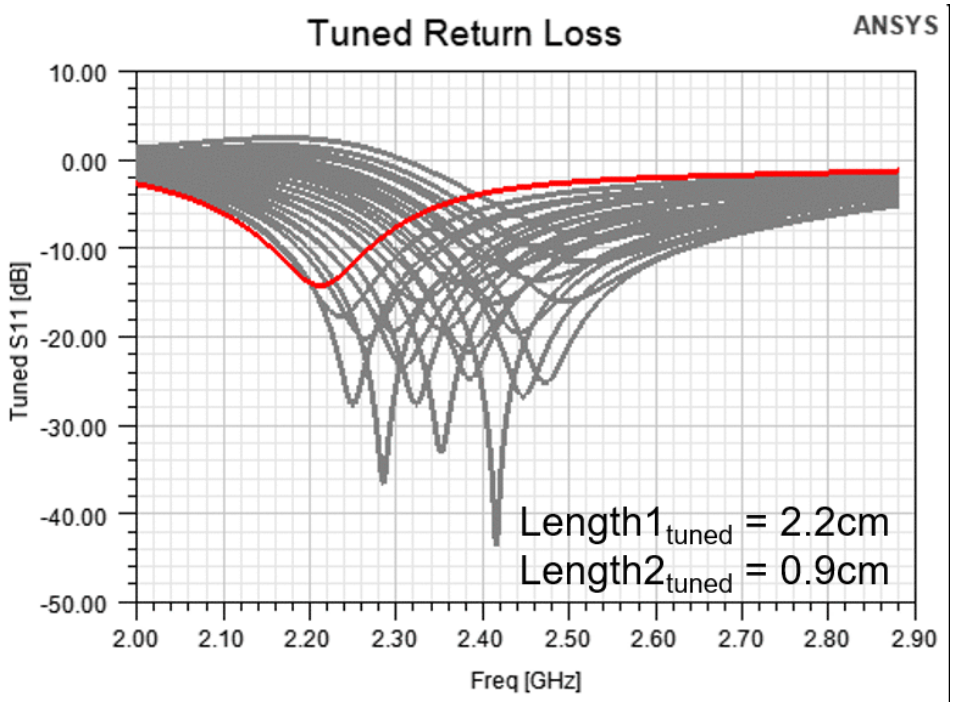
Optimization algorithms:

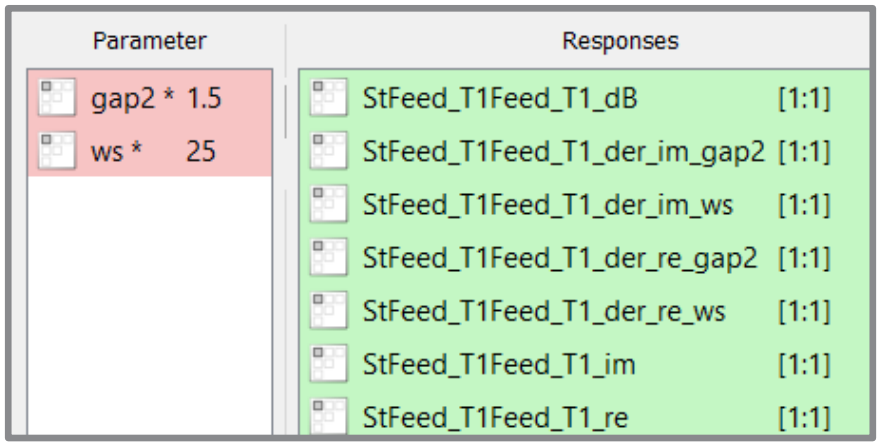
- *MISQP*: Mixed-Integer Sequential Quadratic Programming
- *ASO*: Adaptive Single-Objective
- *AMO*: Adaptive Multi-Objective
- *UP-EGO*: UP Efficient Global Optimization (Beta)

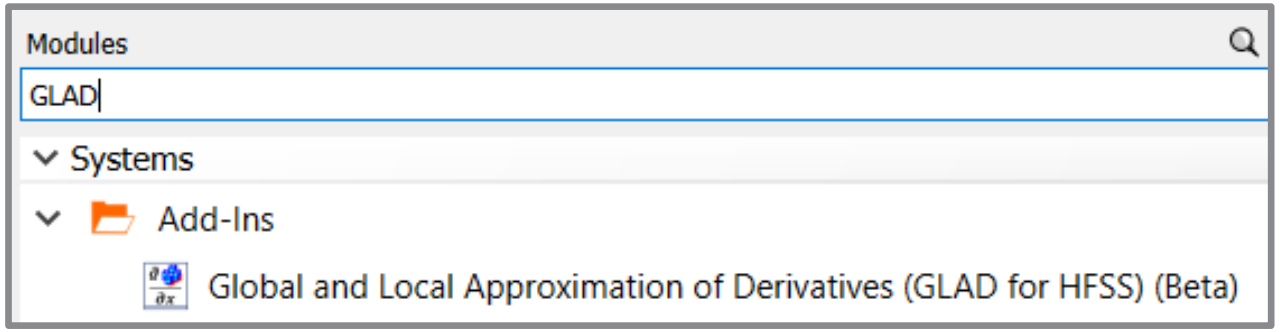


Global and Local Approximation of Derivatives (GLAD) for HFSS (BETA)

- Introduced at WOST 2021
- Considers the HFSS derivatives of signal responses for more efficient optimization
- Setup of integration is supported by an AEDT wizard

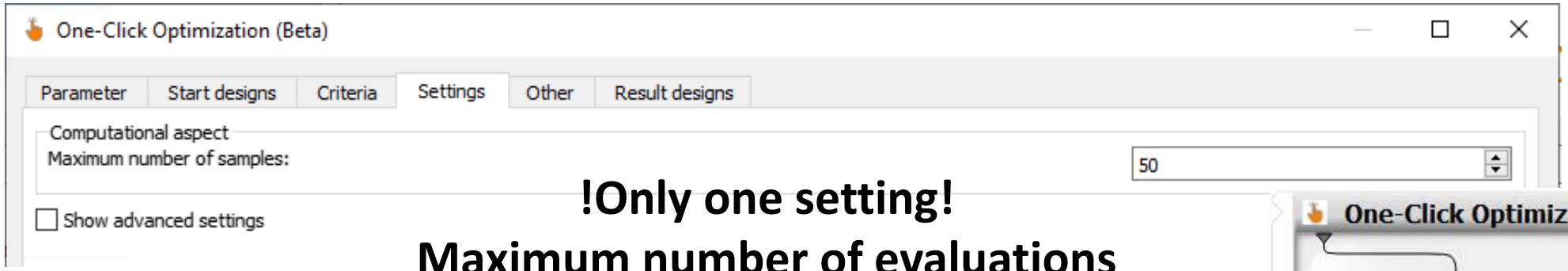




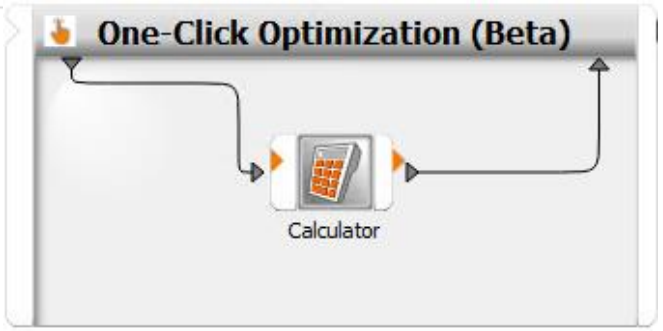


One-Click-Optimization (OCO) (BETA)

- Internal AI runs multiple optimization approaches simultaneously
  - Selects automatically & dynamically the most suitable optimization algorithms
  - For single-objective optimization applications
  - Supports continuous and integer parameters (discrete by value or ordered by index)



!Only one setting!
Maximum number of evaluations



Example: One-Click-Optimization (OCO)

Cantilevered beam example with mixed variables

objective function to be minimized is:

$$f(H,h_1,b_1,b_2) = V = [2*h_1*b_1 + (H - 2*h_1)*b_2]*L$$

The constraint functions are defined as:

$$g_1(H,h_1,b_1,b_2) = P*L*H/(2*I) = \sigma_{max} \leq \sigma_{all} = 5000$$

$$g_2(H,h_1,b_1,b_2) = P*L^3/(3*E*I) = \delta_{max} \leq \delta_{all} = 0.10$$

where:

$$I = 1/12*b_2*(H-2*h_1)^3 + 2*[1/12*b_1*h_1^3 + b_1*h_1*(H-h_1)^2/4]$$

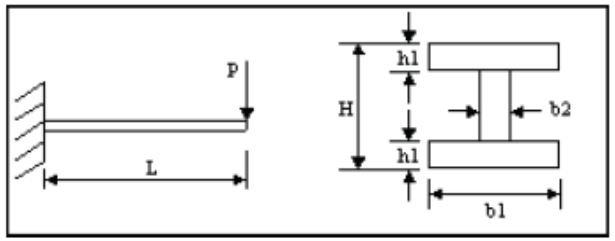


Figure 12. Cross-sectional shape variables in the cantilevered I-beam with a tip load.

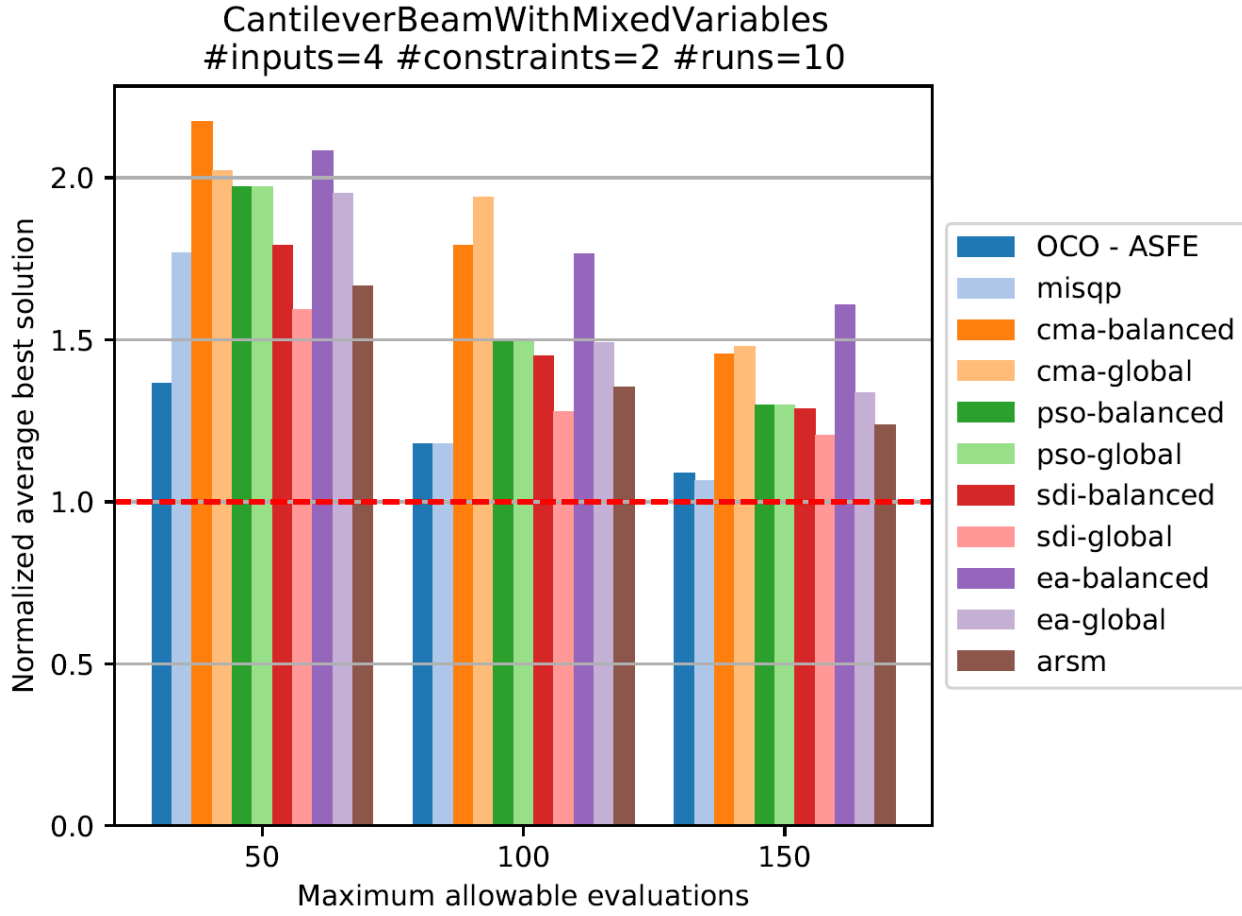
$3.0 \leq H \leq 7.0$

h1 in {0.1, 0.25, 0.35, 0.5, 0.65, 0.75, 0.9, 1.0}

$2.0 \leq b1 \leq 12.0$

$0.1 \leq b2 \leq 2.0$

The global minimum has a value f = 92.77 at the location H = 7.0, h_1 = 0.1, b_1 = 9.48482, b_2 =0.1.

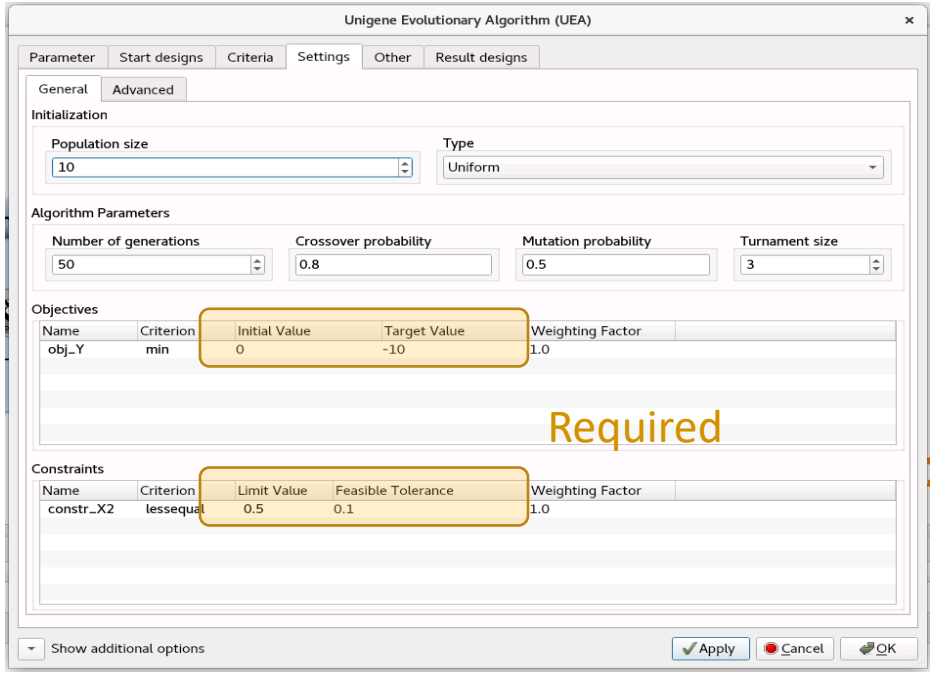


Unigene Evolutionary Algorithm (UEA) (BETA)

Collect Ansys‘ RDO algorithms in optiSLang as central hub

Integration of specific Evolutionary Algorithm into optiSLang

- Algorithm from Ansys Zurich developers
- For single objective optimization applications
- **Additional objective and constraint settings – synchronized with „Criteria“ tab**
- **Initialization type** – gauss only if start designs are defined
- **Number of generations** – algo iterations
- **Crossover probabilty** – likelihood of applying crossover to a design
- **Mutation probability** – likelihood for mutating a design
- **Tournament size** – pool of randomly selected designs from offpsring – best becomes parent

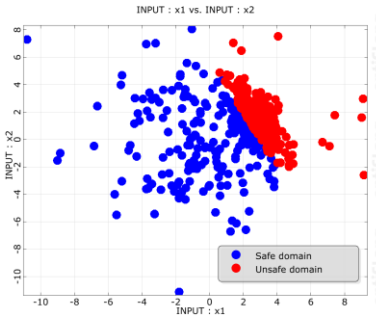


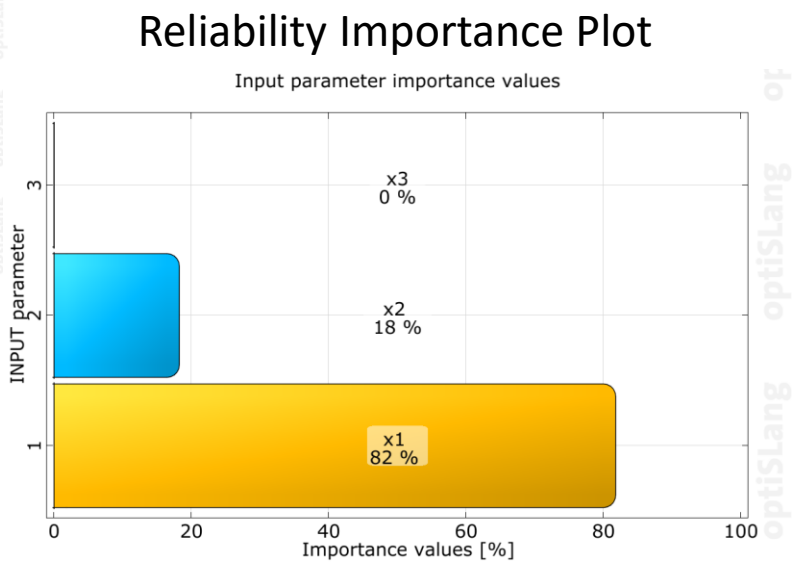
Evaluate Robustness

Quantify and minimize the uncertainty of risk going from simulation to real-world production when it comes to unexpected manufacturing tolerances and other real-world environmental factors.

Reliability Importance

- Calculation of reliability importance for Monte Carlo
- Calculation of reliability importance for FORM
- Show the reliability importance for FORM
- Provide reliability importance values as output slot





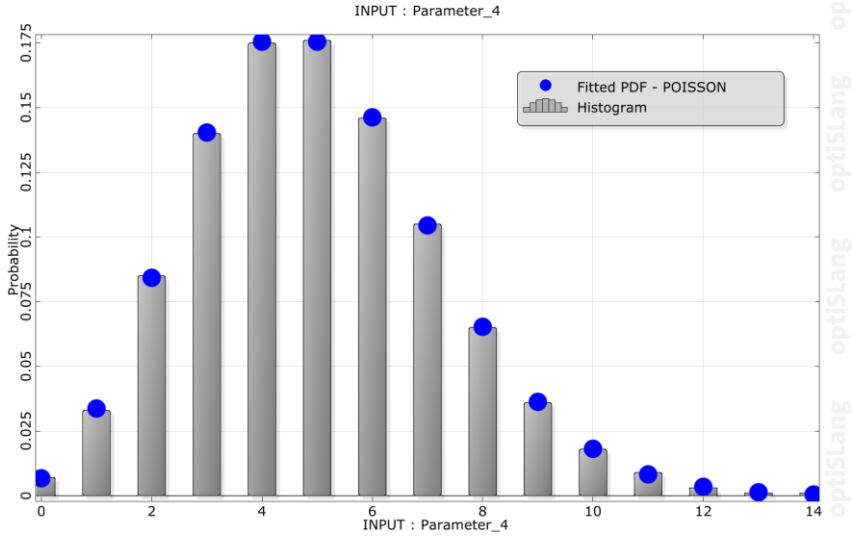
Algorithm	Available	Continuous RVs	Discrete RVs	Correlated RVs	Comment
Monte Carlo	**2022 R1**	V	V	V	
Adaptive Sampling	2021 R1	V	V	X	
FORM	**2022 R1**	V	X	X	Supports multiple design points
ISPUD	2021 R2	V	V	X	Supports multiple design points
Directional Sampling	-				
ARSM-DS	-				Requires Directional Sampling

Poisson distribution for stochastic parameters

Discrete distribution to model the number of occurrences of specific events

- Define in parameter manager
- Use in Monte Carlo, Directional, Adaptive Sampling, (FORM), (ISPUD)
- Postprocessing (Bernoulli, Discrete, Poisson distribution)
  - Show point wise PMF in Histogramm
  - Fit distribution

PDF	Type	Distribution parameter
	BERNOULLI	0.8
	DISCRETE	-1; 0.15; 1; 0.6; 1.8; 0.25
	DISCRETE	1; 0.3; 2; 0.5; 4; 0.05; 7; 0.05; 8; 0.1
	POISSON	0.1
	POISSON	1
	POISSON	2
	POISSON	4
	POISSON	10
	TRUNCATEDNORMAL	0; 1.60678; -10; 10



Distribution parameter

- Expected number of events $\lambda > 0$

Mean value & standard deviation

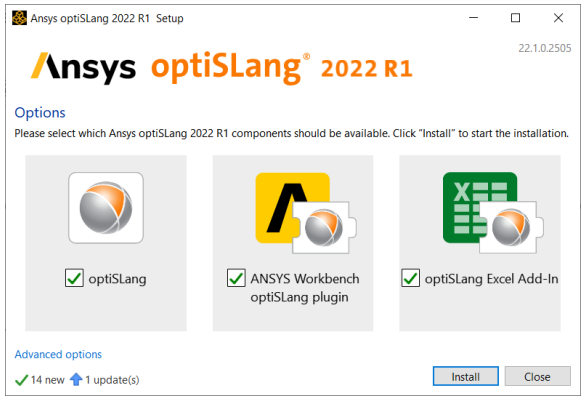
- $\bar{X} = \lambda$
- $\sigma_X = \sqrt{\lambda}$

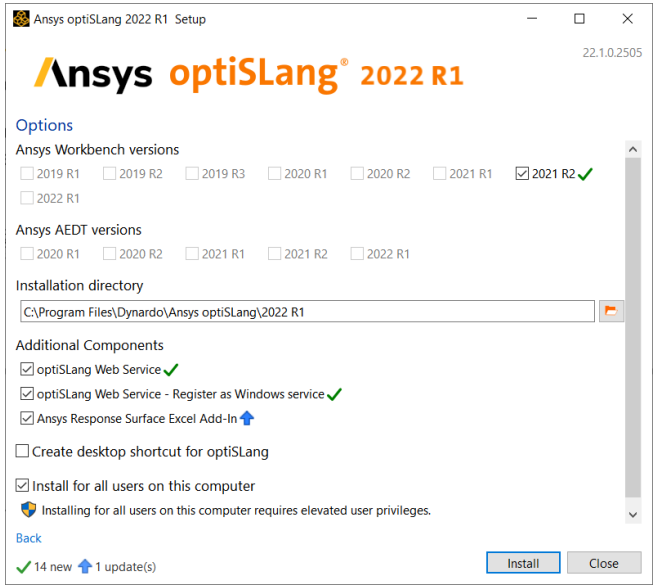
Probability mass function

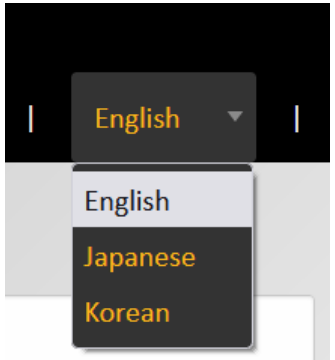
- $p_X(x) = \begin{cases} \frac{\lambda^x \cdot e^{-\lambda}}{x!} & \text{if } x \in \{0, 1, 2, 3, ...\} \\ 0 & \text{otherwise} \end{cases}$

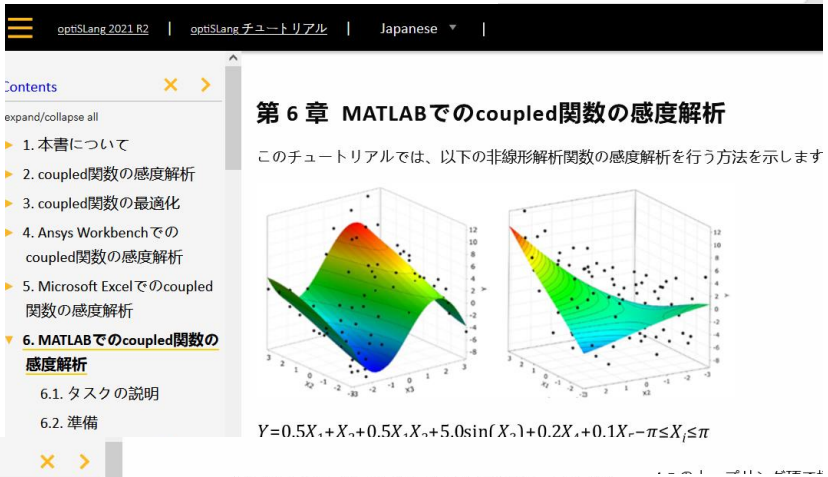
Ansys optiSLang 22R1

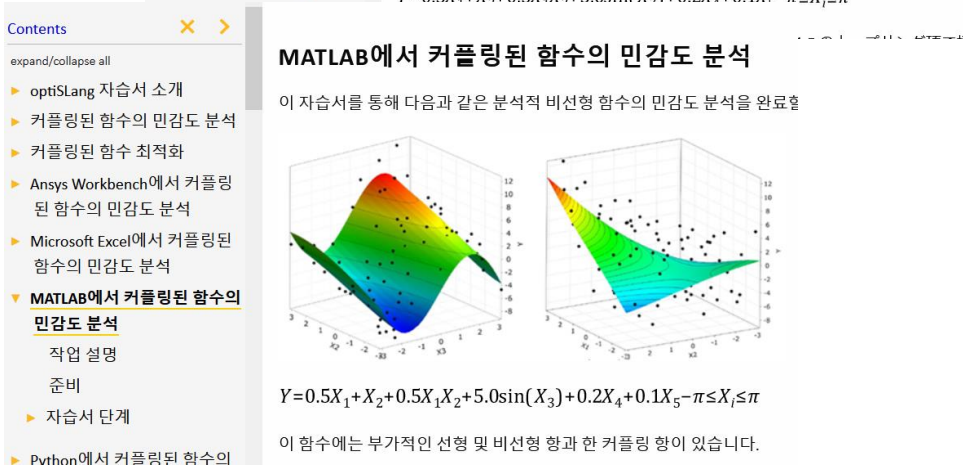
- Documentation (partly) available in Japanese and Korean
  - Started with tutorials, more to come in next months







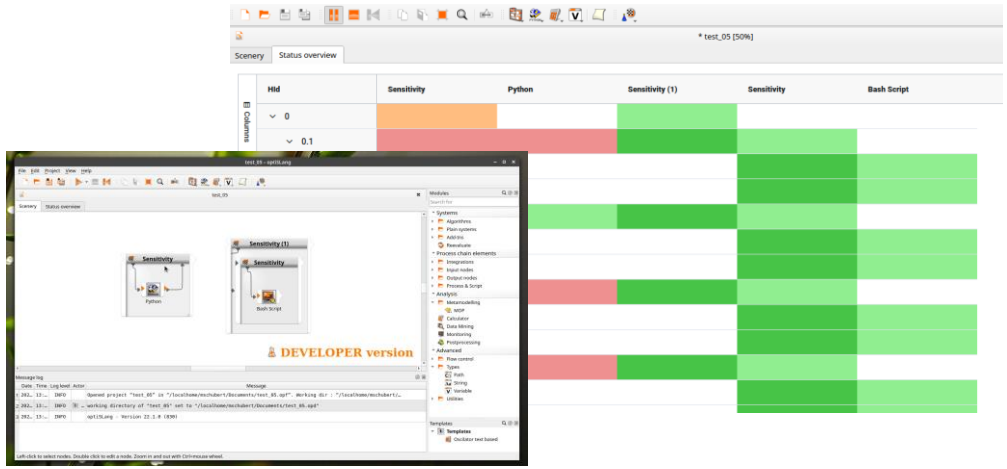




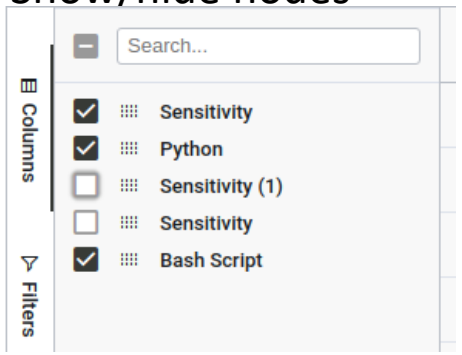
- New Option: register oSL Web Service as Windows service
  - Service is uninstalled with optiSLang deinstallation
- No extra odbwrapper installer needed anymore
  - now ETK uses Abaqus libraries directly

Node Status Overview Improvements

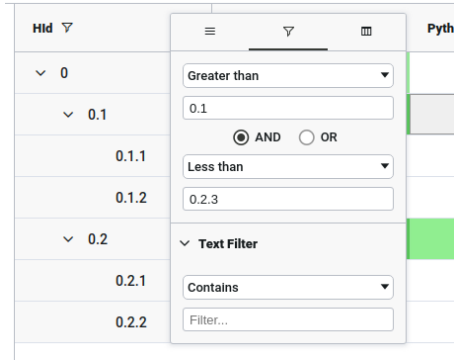
- Improved performance for thousands of designs
- Additional features
  - Keyboard navigation and selection
  - Range selection, multiple ranges
  - Context menu providing actions on selected nodes
  - Node IDs are displayed as a tree (collapsible)
  - New filter rules
  - Show/hide individual node columns
  - Flyout panel with node statistics



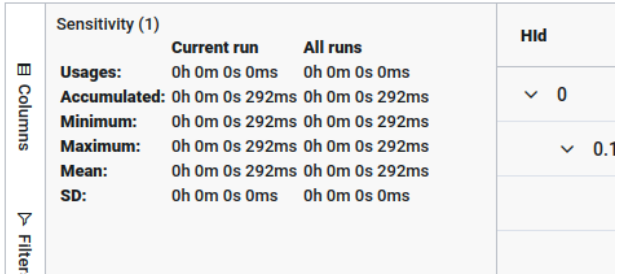
Show/hide nodes



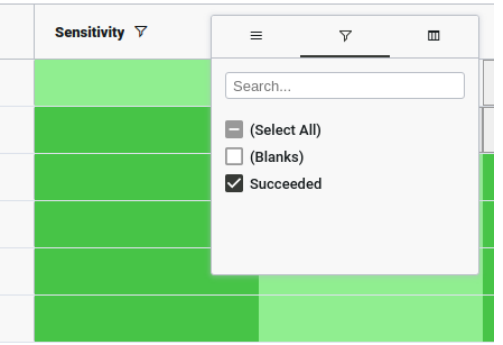
Filter by state Id



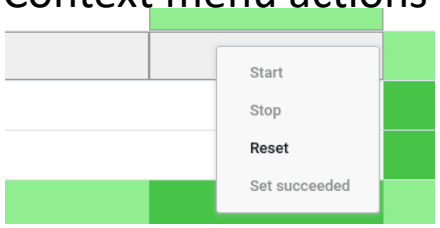
Node statistics



Filter by node state

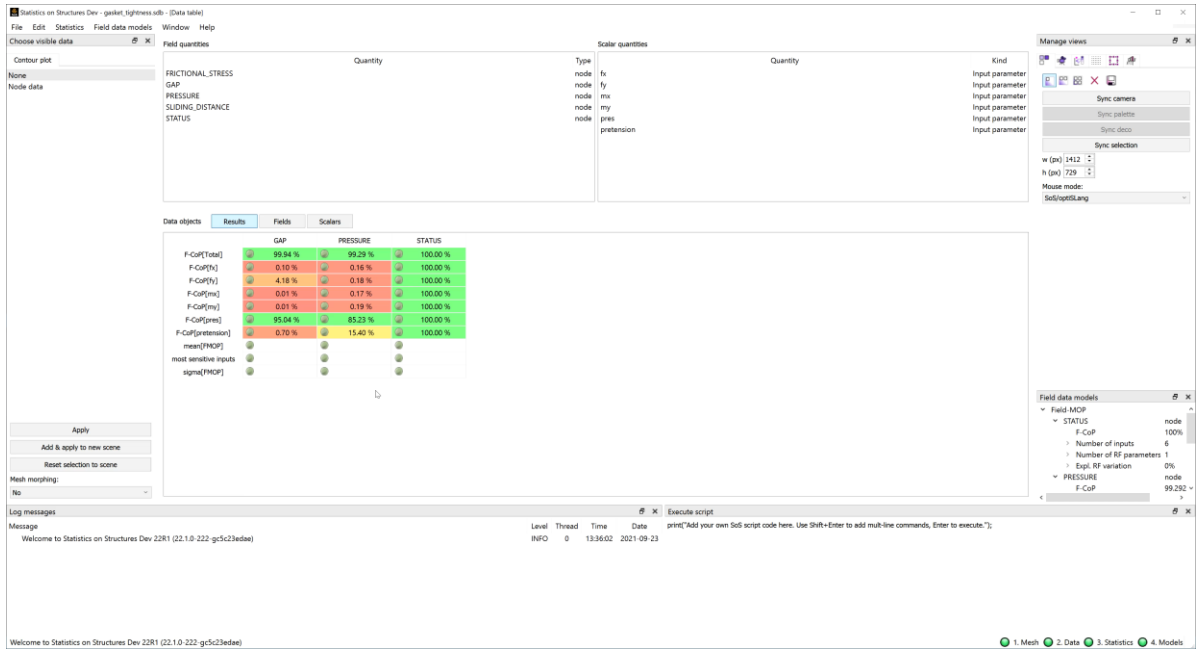


Context menu actions



SoS GUI Improvements: Datatable

- Improved performance for large data sets [s] -> [ms]
- Fewer clicks necessary



➔ Enjoy Statistics on Structures with much better User Experience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