EXPLORE DESIGN PERFECTION

modeFRONTIER

The Integration Platform for Multiobjective and Multidisciplinary Optimization

Danilo Di Stefano

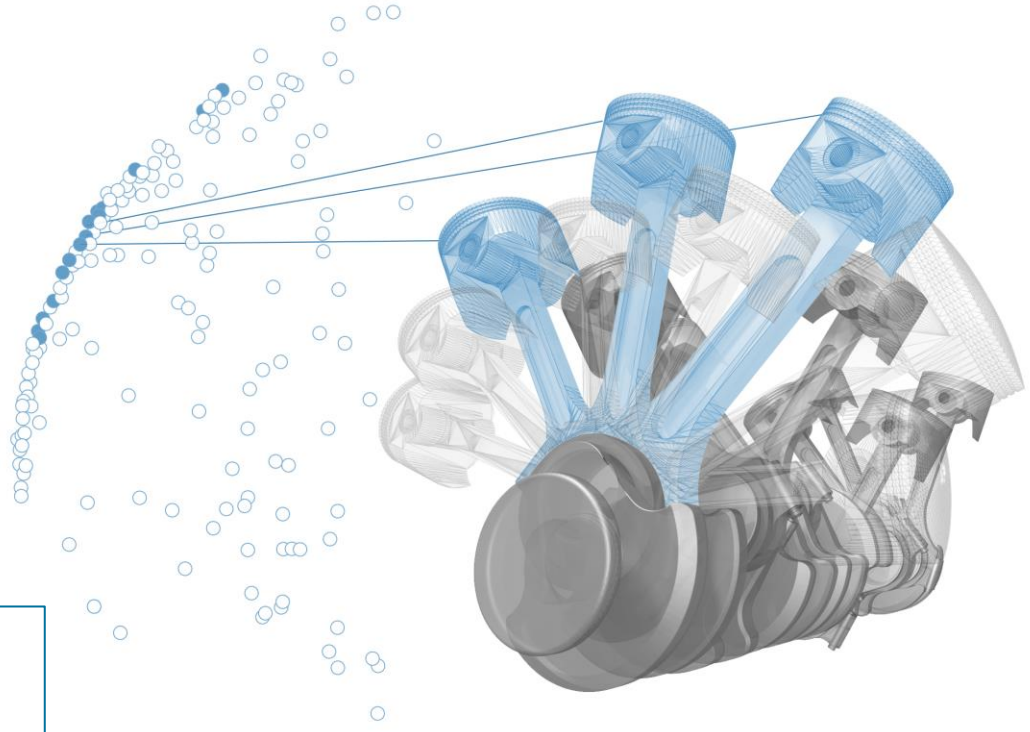
Product manager modeFRONTIER

Multiobjective Optimization with modeFRONTIER

Multi-objective problems are solved using **sophisticated optimization algorithms**, which identify a set of **Pareto designs** whose objective functions are non-dominated by any other design among those tested.

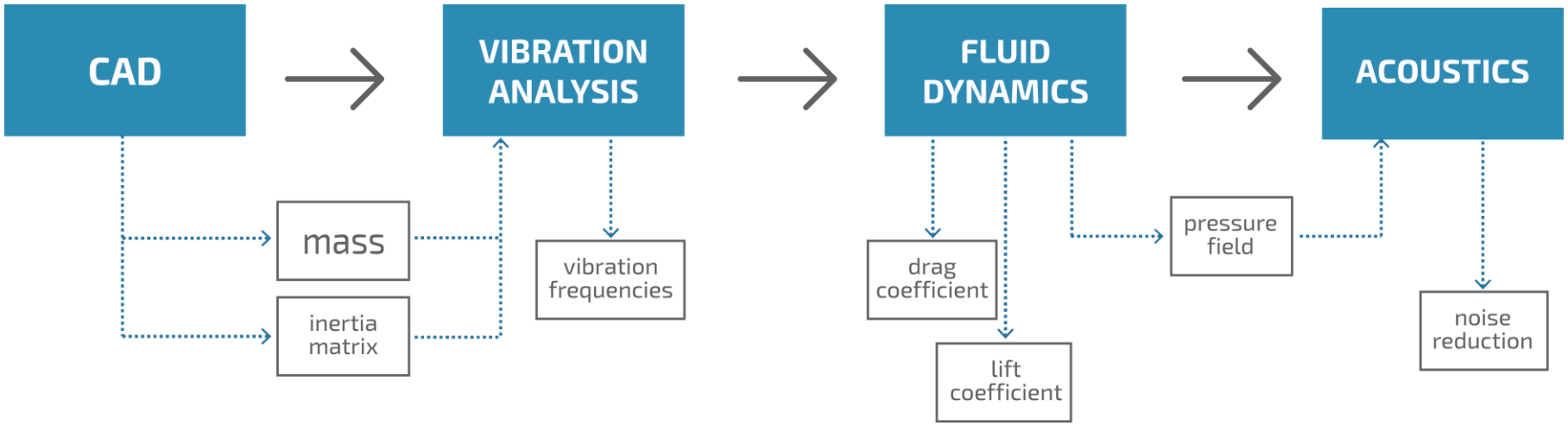
With ***modeFRONTIER*** you can define **the most suitable optimization strategy** according to:

- number, type and range of variables, objectives and constraints
- reliability and robustness required
- attainable computational resources



Multidisciplinary Optimization with modeFRONTIER

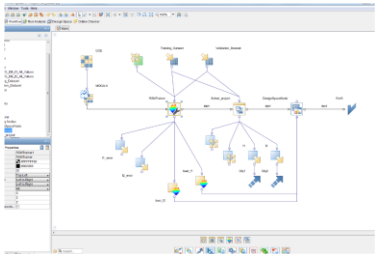
modeFRONTIER integrates with **any parametric software** (CAD, CAE, FEM, generic, etc.) **automating** the entire optimization process in which data is transferred from one simulation to the next and the relevant values of outputs and objectives are extracted.



This **multidisciplinary approach** allows to exploit the **interaction** between the disciplines and determine the **global optimum solution**, instead of optimizing each discipline sequentially.

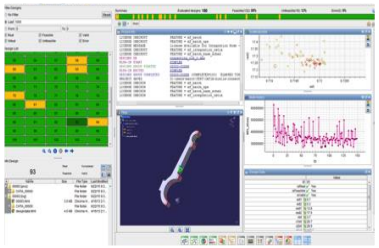
modeFRONTIER Technology

modeFRONTIER offers a **modular environment** giving access to different sets of functionalities



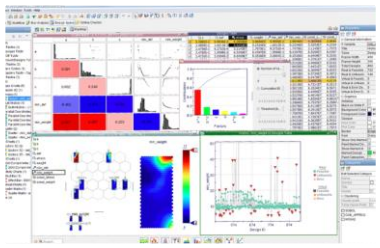
ACCESS THROUGH mF mP

WORKFLOW BUILDING



ACCESS THROUGH mF

PROCESS MONITORING

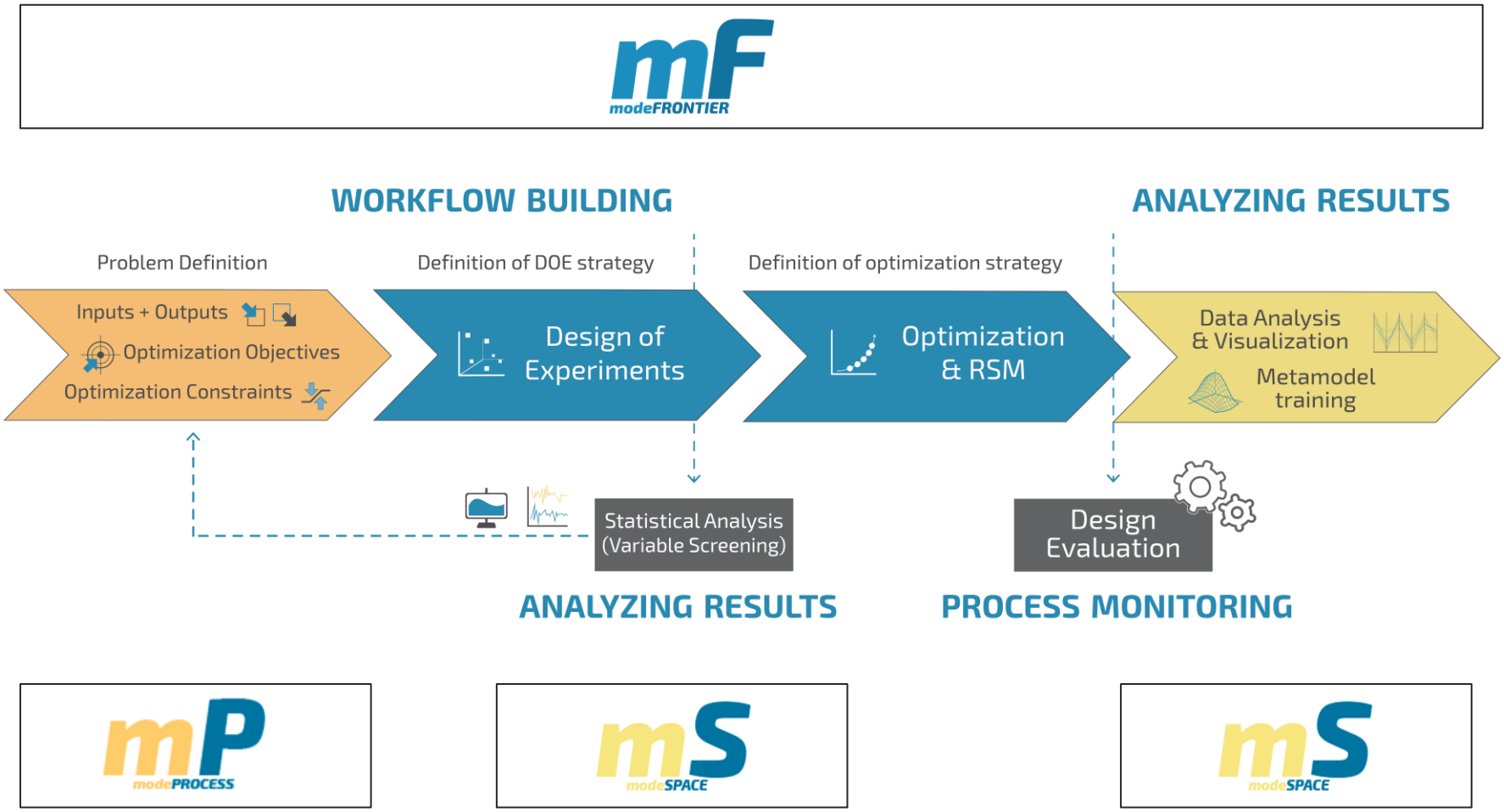


ACCESS THROUGH mF mS

ANALYZING RESULTS

Each of these groups of capabilities is tailored to achieve the ultimate goal
» **DESIGN OPTIMIZATION**

modeFRONTIER Process Flow



EXPLORE DESIGN PERFECTION

modeFRONTIER 2016

Concept

esteco.com

modeFRONTIER2016 Viewpoint

Consolidate specialized expertise *and* streamline teamwork

Improving efficiency

✓ Tailored access to functions

✓ Flexible team-focused licensing

Reducing complexity

✓ Worflow management

✓ Customized views

Cutting development time

✓ Programmatic access to Design Space functions

✓ Enhanced wizards for key functions

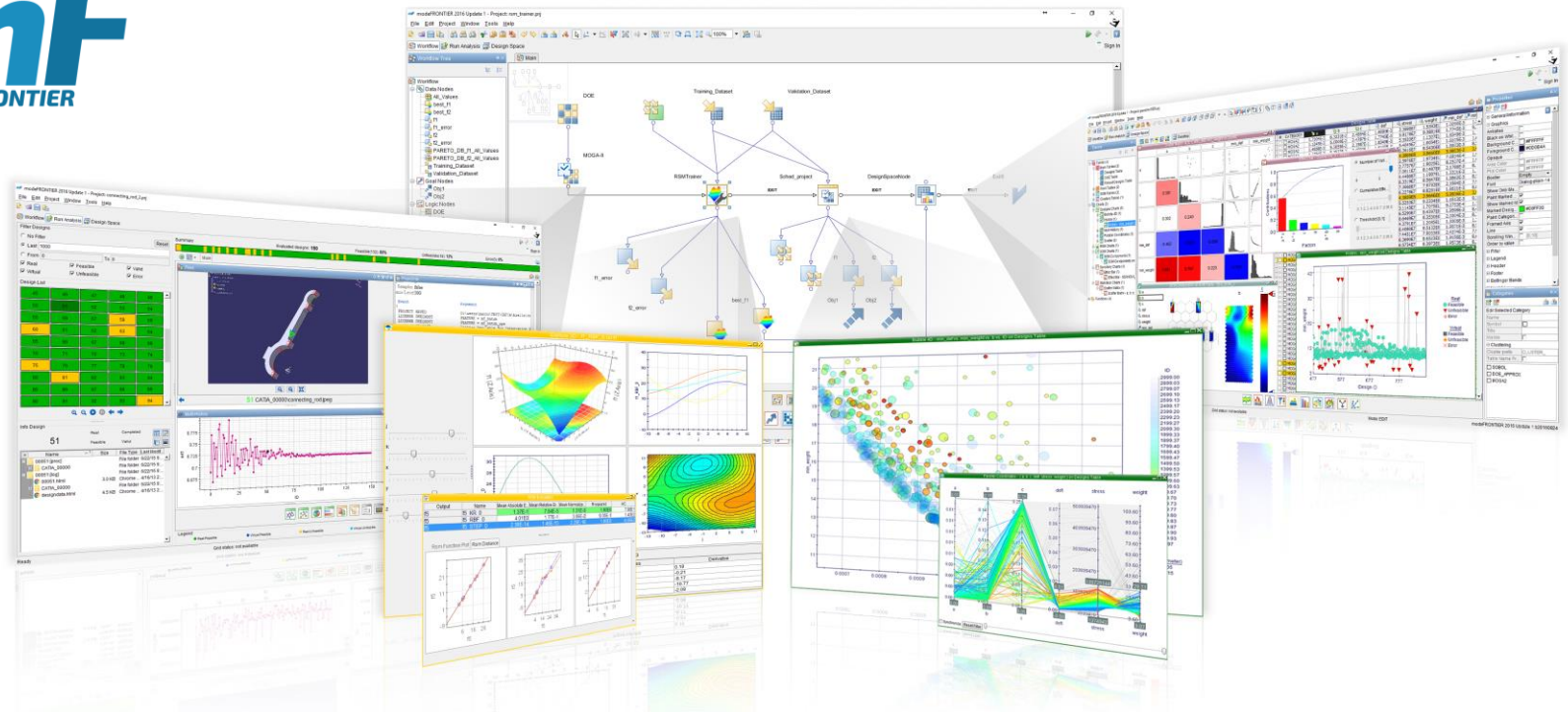
modeFRONTIER2016 Modular Environment

EXPLORE DESIGN PERFECTION

modeFRONTIER 2016

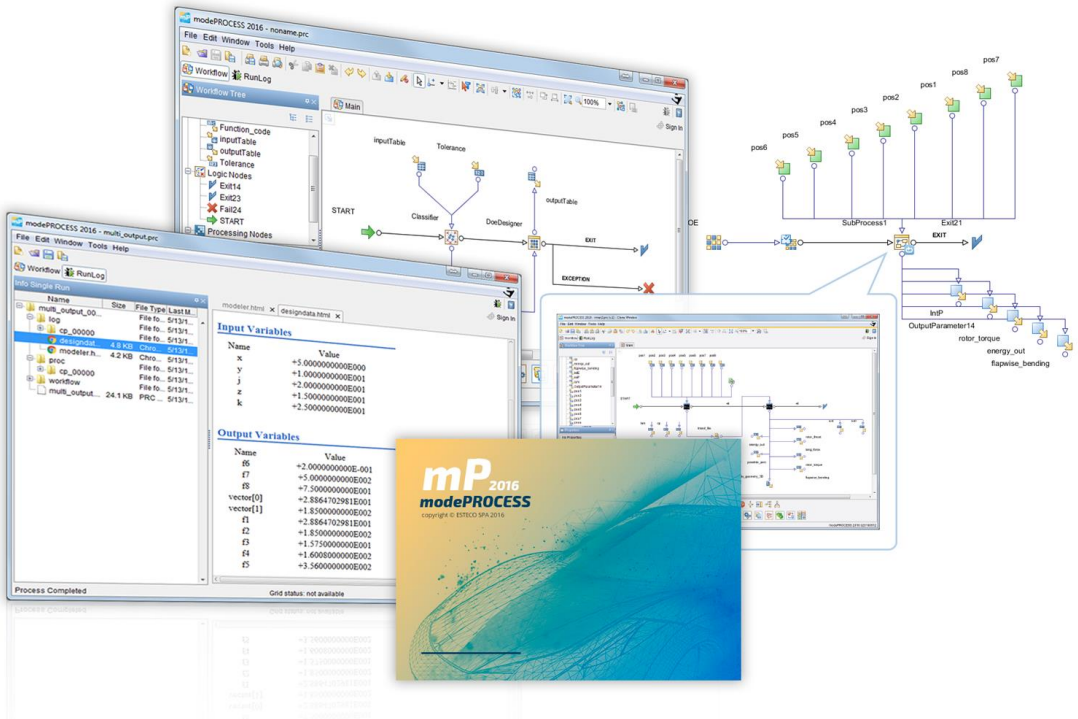
Modules

esteco.com



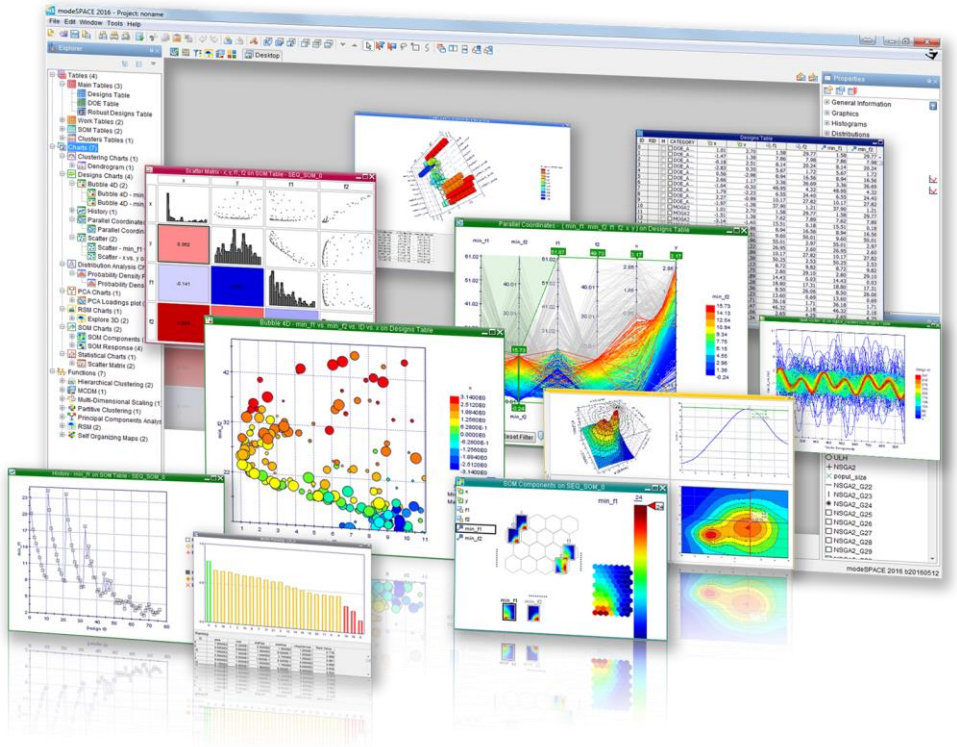
modeFRONTIER

Streamlines the design process with powerful workflows, innovative algorithms and sophisticated post-processing tools. Its advanced capabilities for multidisciplinary design, keeps it at forefront of engineering technology.



modePROCESS

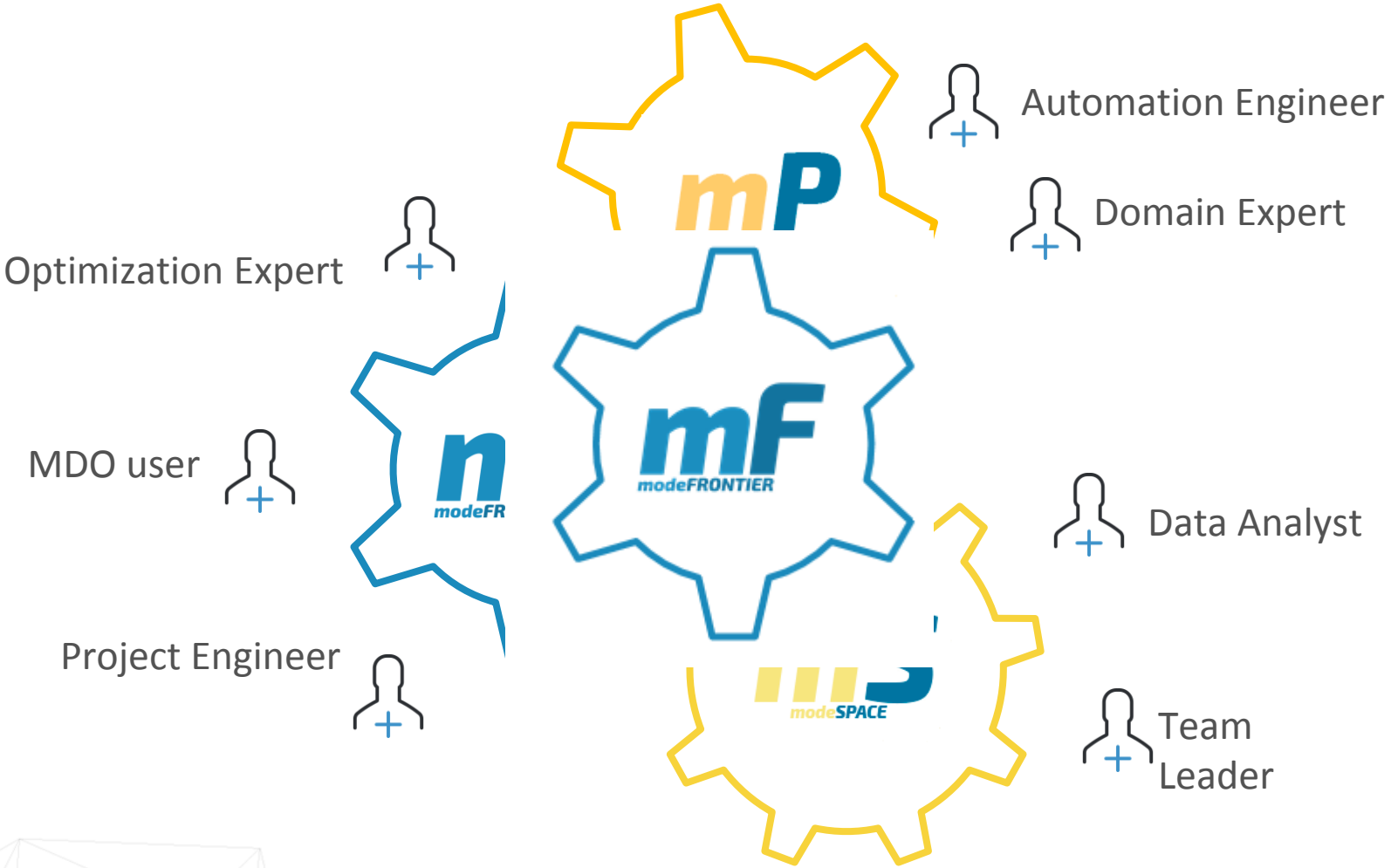
Independent desktop application useful to describe processes in the form of graphical workflows, by specifying which parameters and calculations are required to solve a design problem.



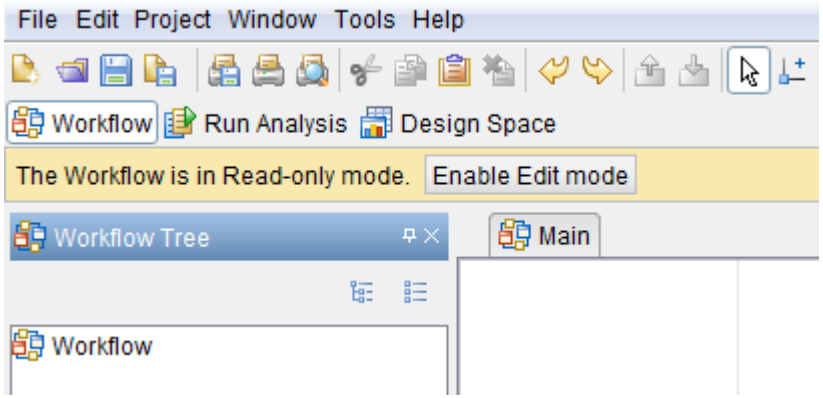
modeSPACE

Includes the sophisticated set of modeFRONTIER tools for data analysis and problem investigation and support to decision making, both in the pre-optimization and in the post-processing phase.

License and role management streamlined



Efficient license handling for workflow and design space



mF2016 news:

mF license contains two separated Workflow and DesignSpace keys, which can be enabled/disabled

Advantage:

Two users can simultaneously access same mF license, working on the two environments (keys) separately

EXPLORE DESIGN PERFECTION

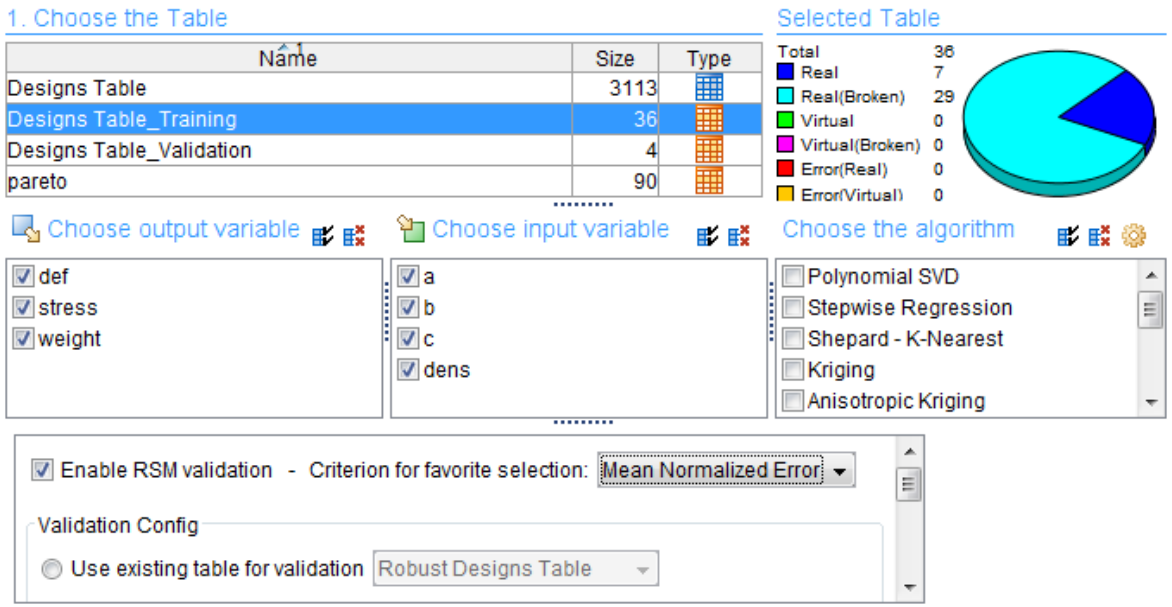
modeFRONTIER 2016

Data Space

esteco.com

Automatic RSM Training mode

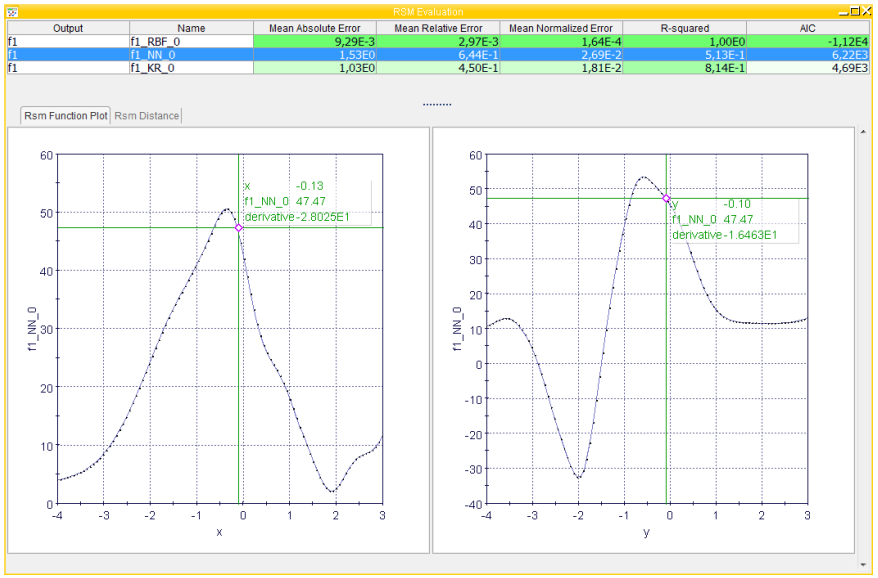
Going straight from data to RSM with **less clicks** and **less parameter settings**



guided training process

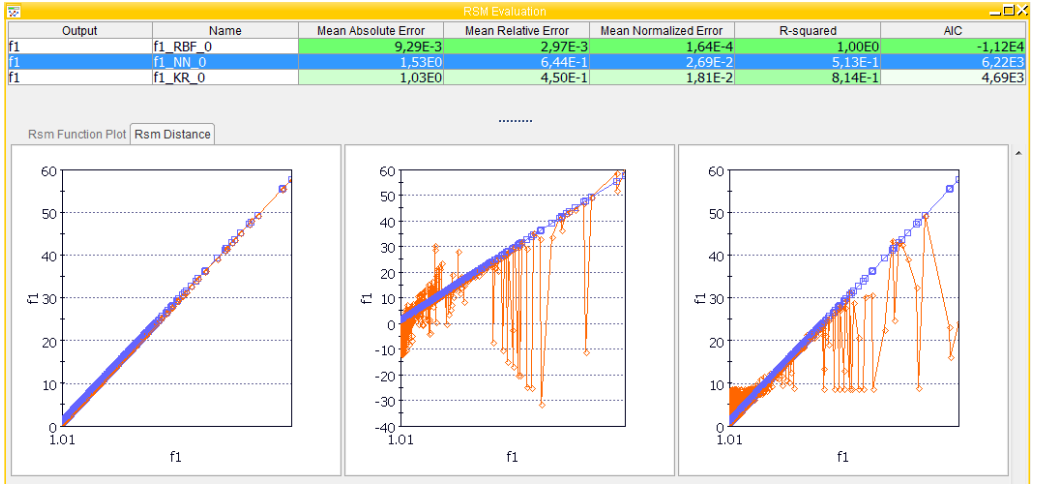
- ✓ Saving time
- ✓ Easier and faster editing
- ✓ Manual RSM training wizard still available

RSM Evaluation chart

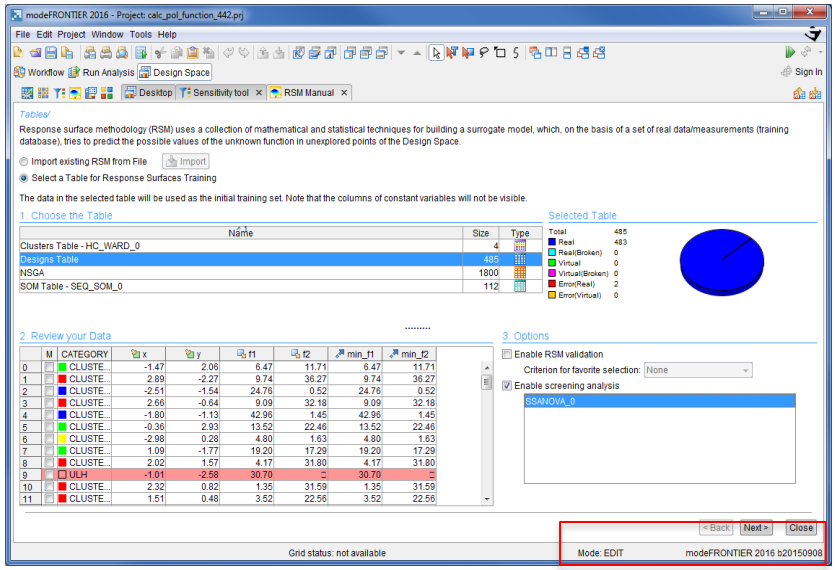


All-in-one chart showing relevant information for the quality evaluation of many RSMs

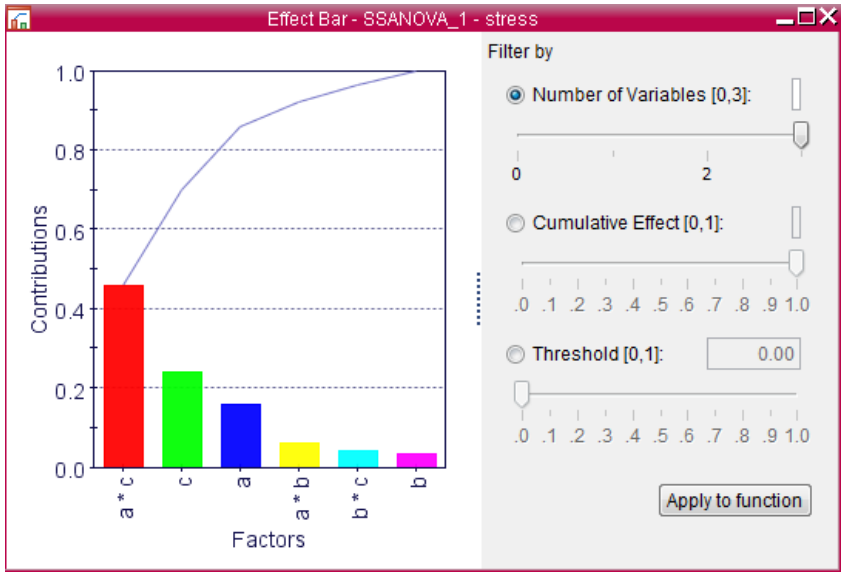
Useful to compare multiple RSMs, selecting the best model



Sensitivity Analysis tool



Variable screening based on **SS-ANOVA** >> detects the most important input variables in a process



- ✓ Efficient with **scarce** and **not factorial** database
- ✓ Detect **non-linear** and **interaction** effects

EXPLORE DESIGN PERFECTION

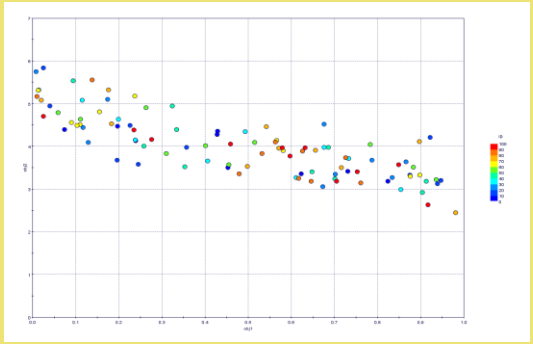
modeFRONTIER 2016

Process & Optimization

esteco.com

pilOPT: self-adapting one-click optimizer

pilOPT



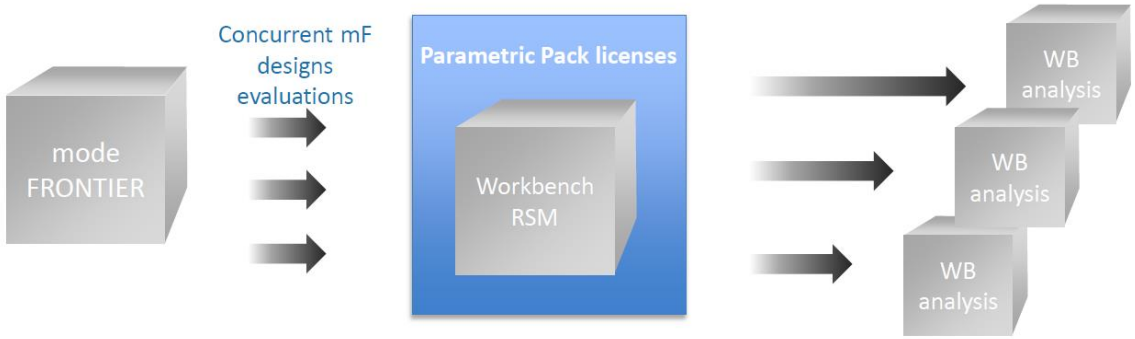
The new self-adapting one-click optimization algorithm

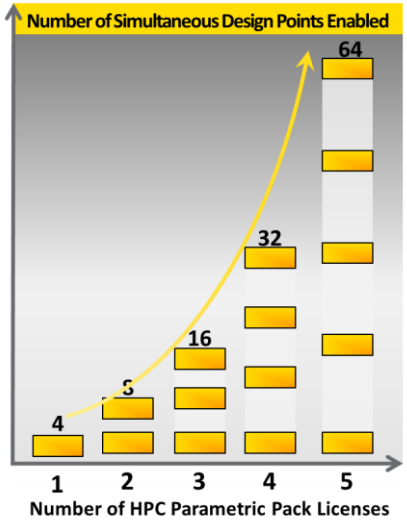
Improved pilOPT release:

- ✓ responding to a **wider variety** of engineering designs problems
- ✓ increased performance with **single-objective** problems
- ✓ better **exploitation of computational** resources
- ✓ effective handling of problems with **discrete** variables.

Integration node – Ansys WB Parametric Pack

modeFRONTIER 2016 supports the HPC license consumption scheme from Ansys Workbench

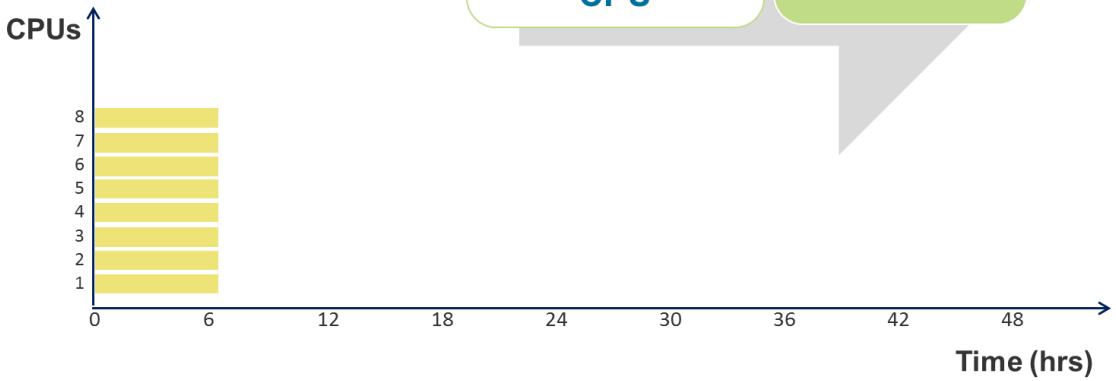




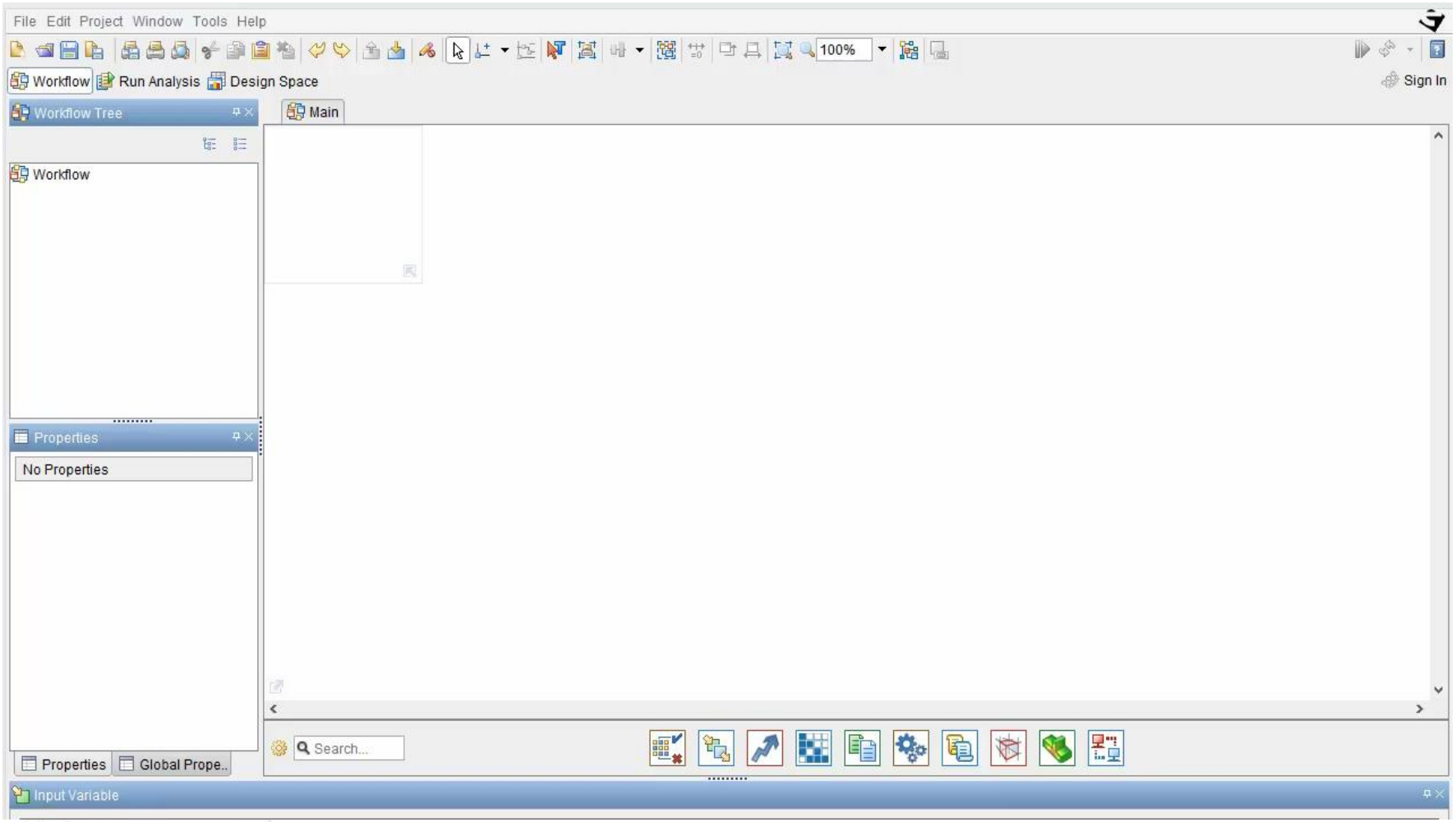
modeFRONTIER submitting designs through **2 ANSYS HPC parametric packs**

concurrent execution of 8 designs on 1 CPU

6:15hr total time



ANSYS direct interface in modeFRONTIER



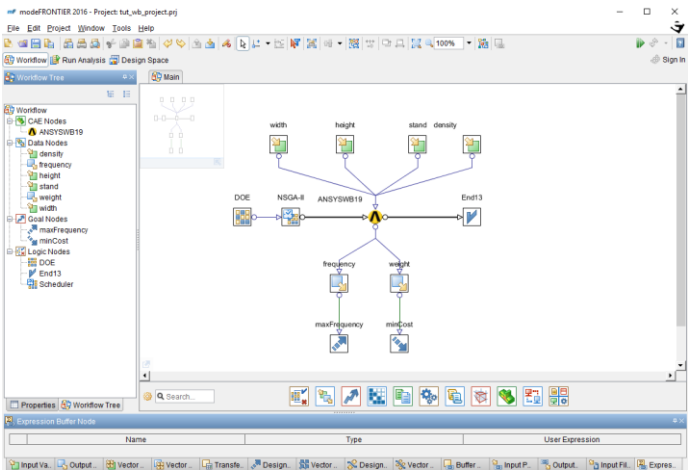
Ansys Integration node - advantages

>> fully exploit the **process automation** capabilities of modeFRONTIER in combination with the accuracy of the ANSYS multiphysics solvers

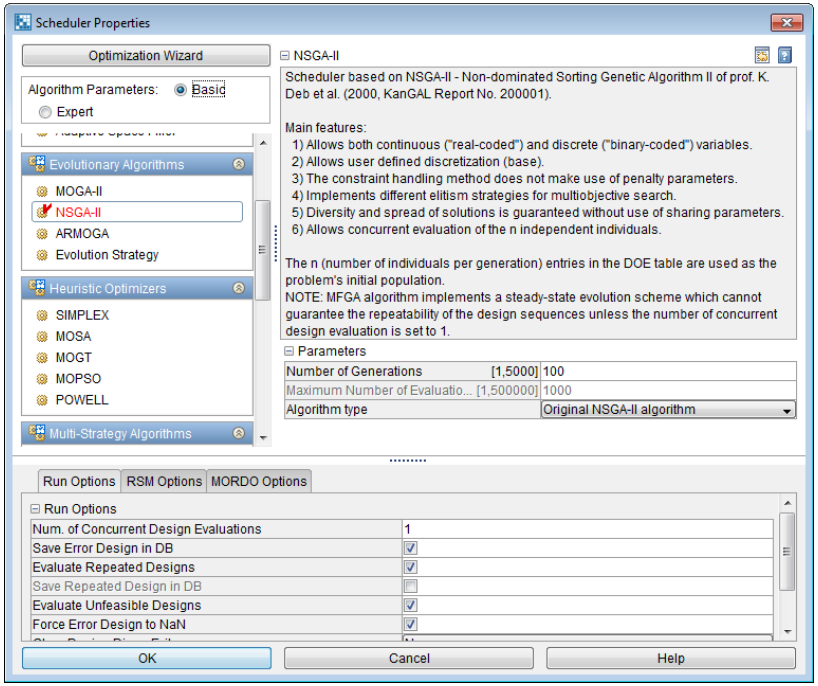
>> get **optimization results before** and dedicate more time to post processing and data analysis

>> Multiple concurrent design evaluations without checking out additional Workbench licenses

>> **save on HPC setup costs**

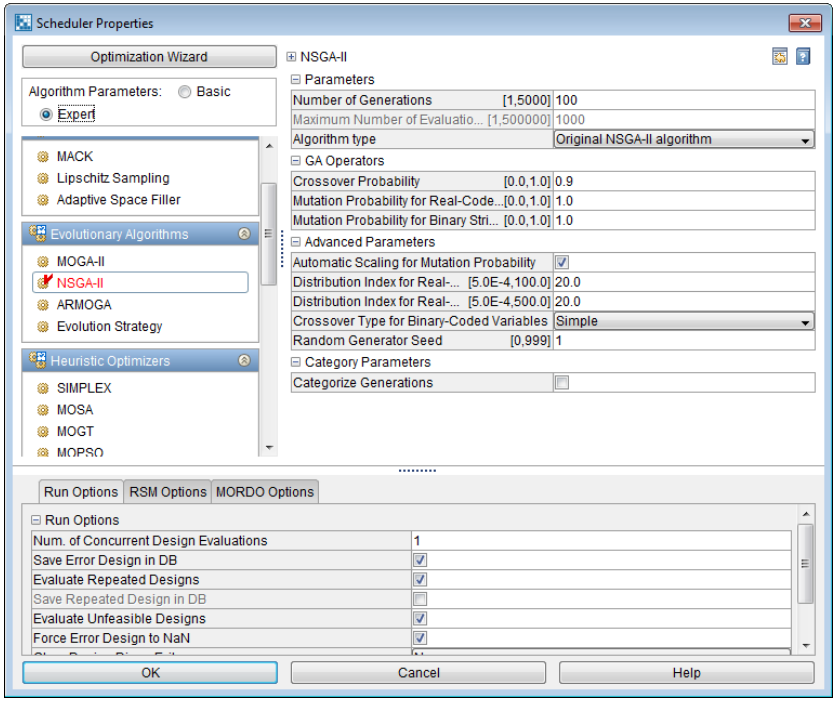


Basic and Expert mode



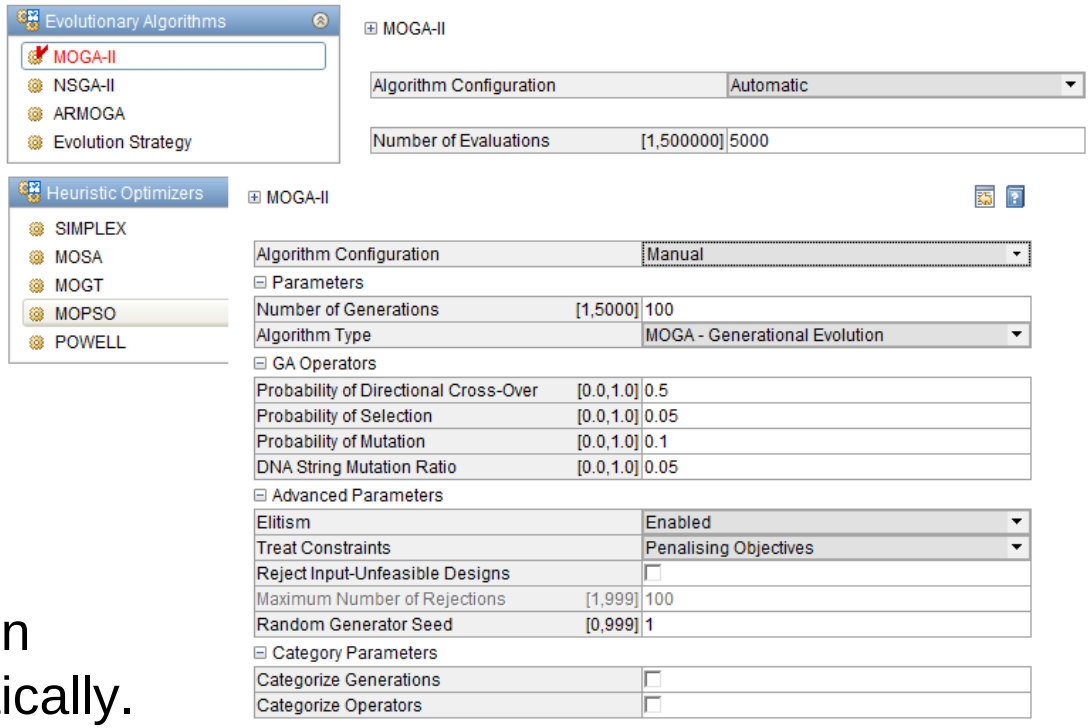
Basic mode: easy set-up of only essential algorithm parameters

Expert mode: edit advanced algorithm parameters



Automatic Setup Algorithms

We have expanded our selection of One-Click Optimizers from the adaptive multi-strategy pilOPT to also include **automatic single-parameter setup** versions of our classic algorithms MOGA-II and MOPSO.



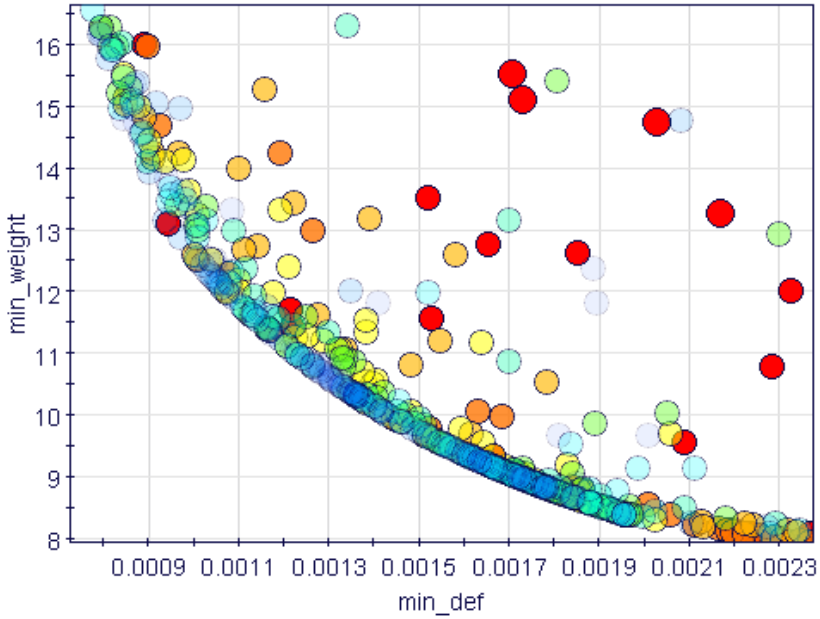
No DOE required – the chosen algorithm generates it automatically.

Only one parameter is required – **Number of Design Evaluations**. Population size and number of iterations/generations computed according to the problem characteristics.

MOGA-II and MOPSO are also available in the classic Manual setup mode in which all parameters are exposed.

New MOPSO Algorithm

Good alternative to Genetic Algorithms because it has a **higher convergence rate** if the evaluations require greater computational effort.
All parameters are exposed so the user can tune them to adapt the MOPSO performance to their problems.



Main features:

- ✓ Uses **elitisim** – the best solutions are stored in the elite set and updated at each iteration
- ✓ **Steady-state evolution** - enables the saturation of all evaluation threads
- ✓ At each iteration particles change their position following **three types of guides**: the *personal best* position of the whole run, the position of the best particle in the *neighborhood* and the closest particle in the *elite* set.

The new MOPSO has shown **better results** than the previous version in all cases it was tested on.

Available in the Automatic and Manual mode.

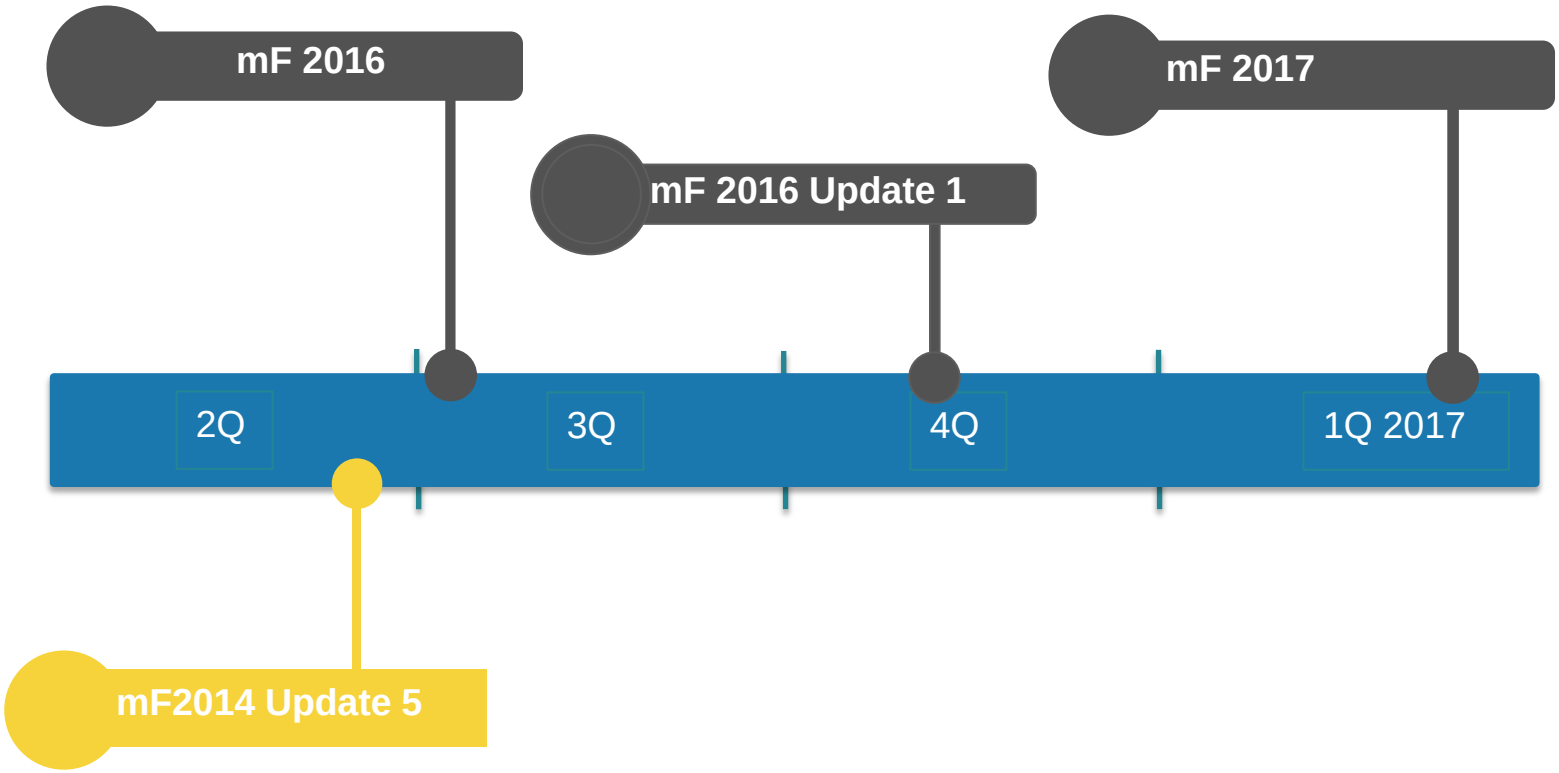
PLORE DESIGN PERFECTION

mF 2016
modeFRONTIER

Product roadmap

esteco.com

modeFRONTIER product roadmap



modeFRONTIER 2014-2016 transition

mF2014 → mF2016

- ✓ mF2014 product line will be supported until end of 2017
- ✓ mF2014 compatible with mF2016 license files
- ✓ It will be possible to install mF2016 and mF2014 together on the same machine
- ✓ mF2016 will open mF4.5 (and mF2014) projects

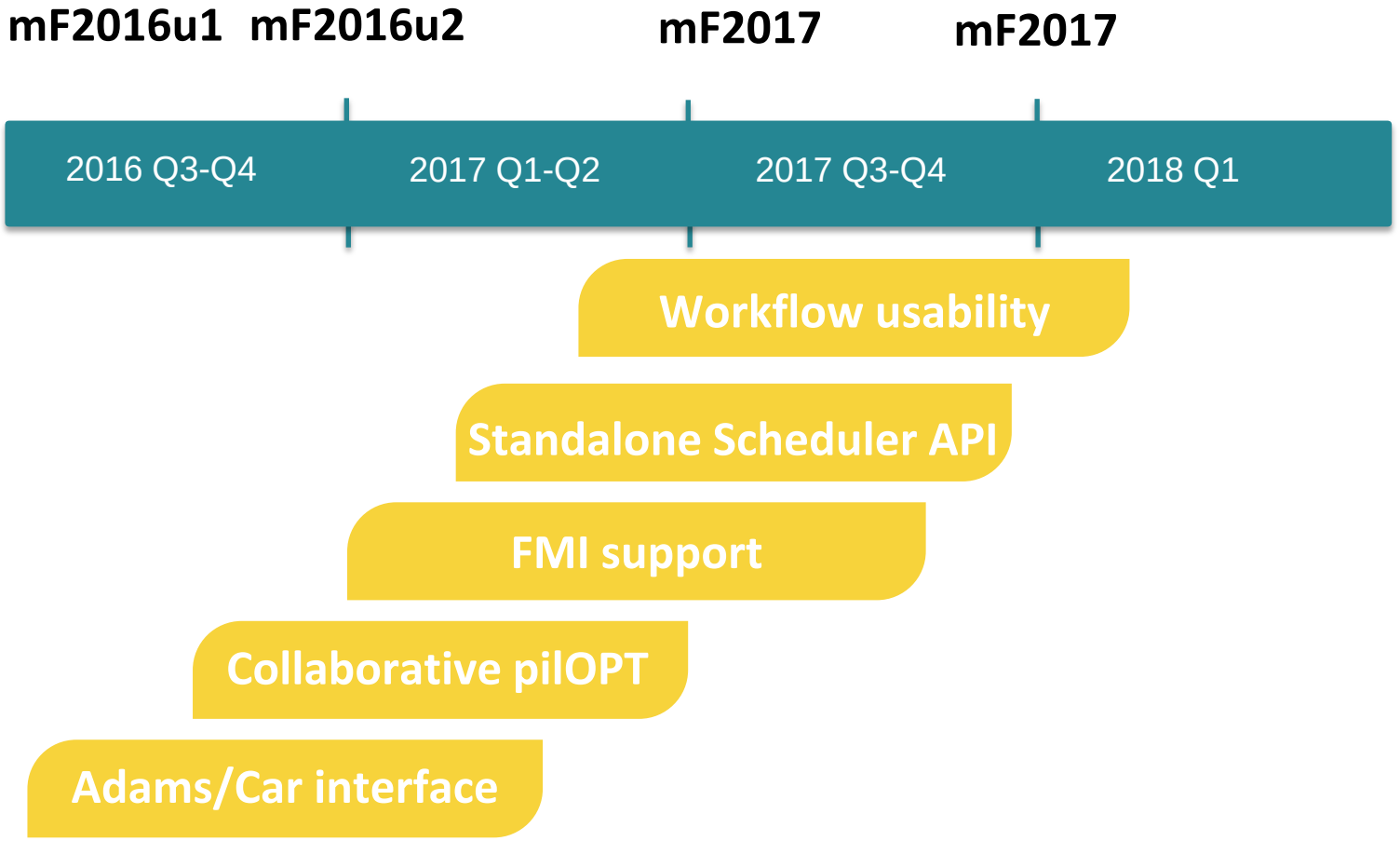
EXPLORE DESIGN PERFECTION

mF 2016
modeFRONTIER

Product line

esteco.com

modeFRONTIER 2016 development plan



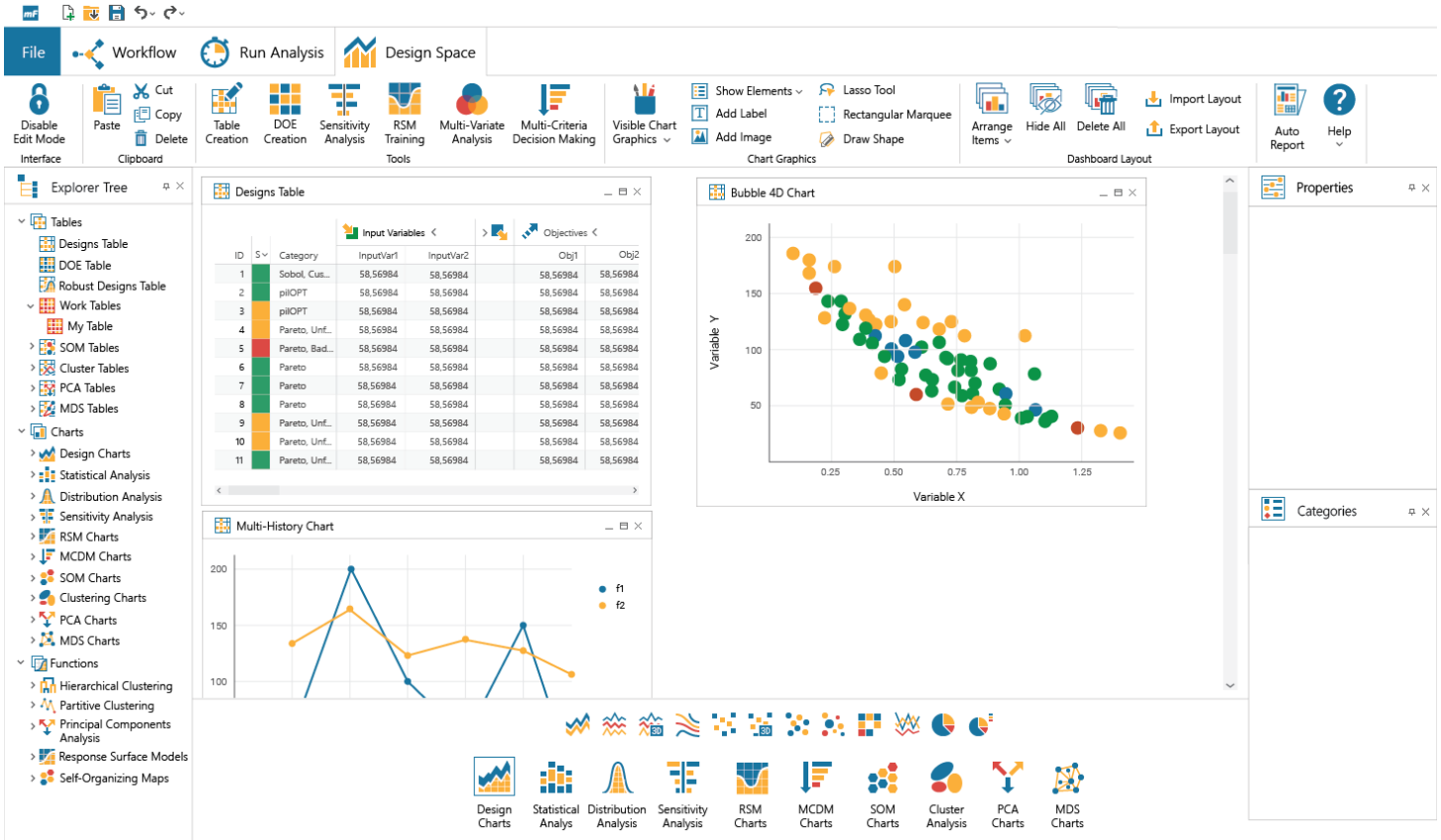
EXPLORE DESIGN PERFECTION

modeFRONTIER

Looking forward

esteco.com

New Interface Design

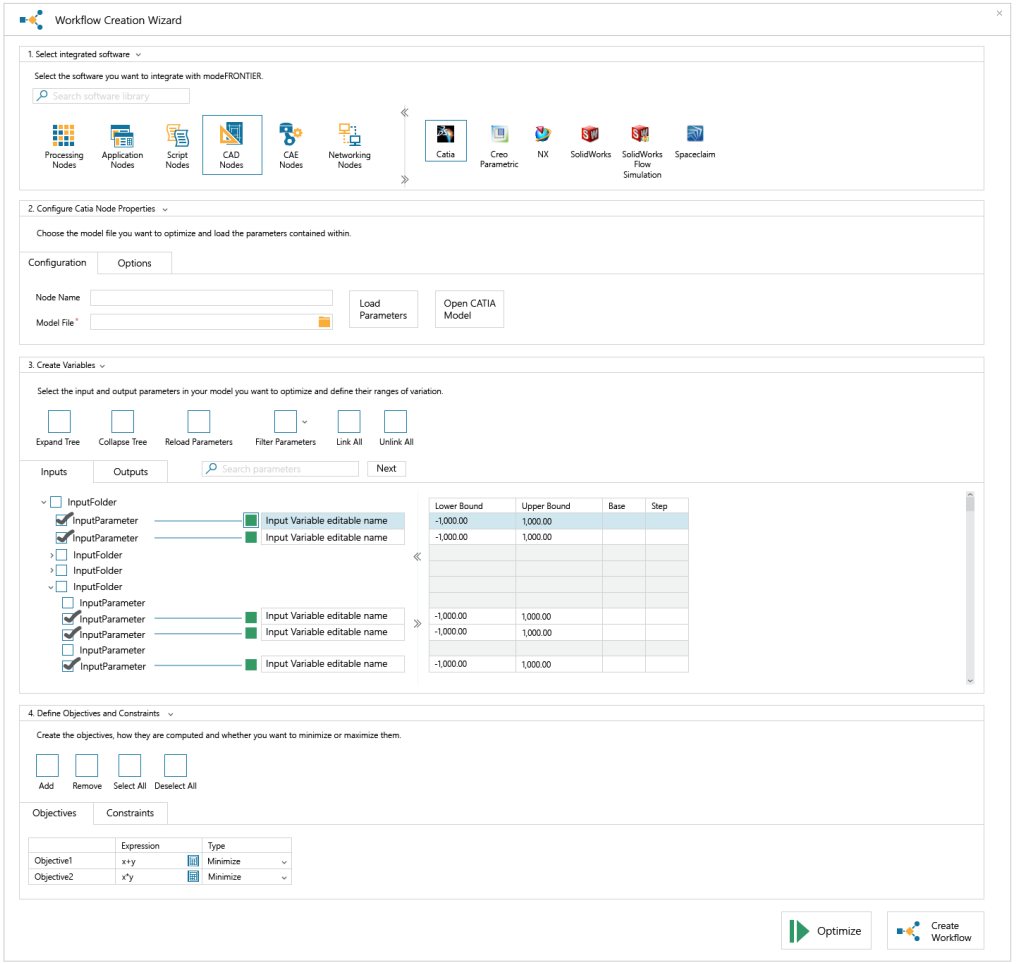


- ✓ Contemporary Look & Feel and Color Uniformity
- ✓ Icons with clearer meanings
- ✓ Consideration for usability issues
- ✓ Replacement of the old toolbar with a new one with larger icons and descriptions

Workflow Wizard

Quick workflow building in one dialog:

1. Select the software you want to integrate (Search function available).
2. Choose a model file and Load the Parameters contained in it.
3. Use checkboxes to select the input and output parameters in the model you want to optimize with modeFRONTIER. You can also define the range of variation of inputs.
4. (Optional) Define the Objectives and Constraints
5. You can then close the wizard and go to the workflow or click Optimize and at once start the project execution.



登陆www.idaj.cn申请试用和资料

EXPLORE DESIGN PERFECTION

esteco.com