Altair® FluxMotor® 2024.1

Motor Factory – Design, Test, Export

Introduction

General user information

Altairhyperworks.com

Contents

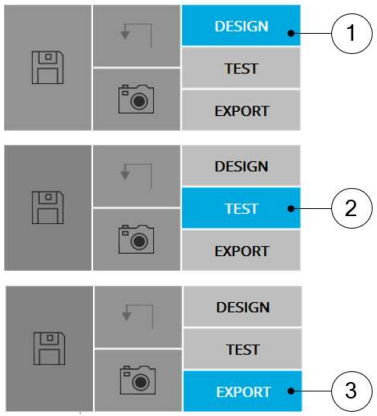
1 MOTOR FACTORY OVERVIEW

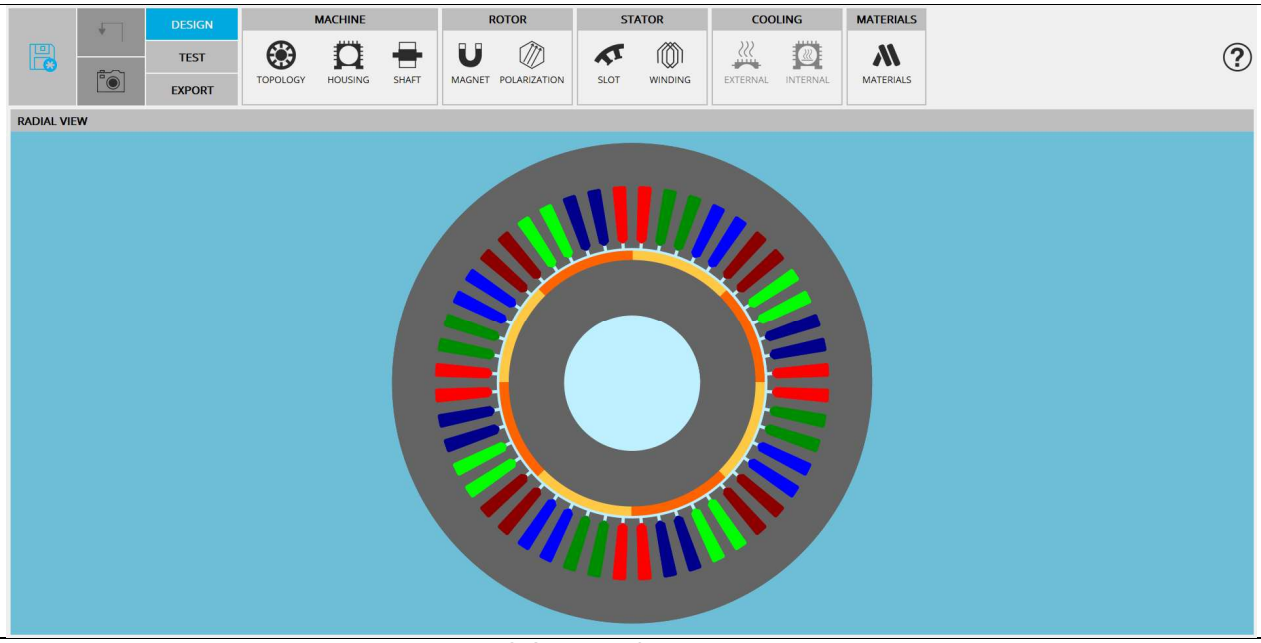
1.1 Main areas of Motor Factory

Motor Factory is a dedicated application to design and test motors.
Motor Factory consists of three main areas:

- The DESIGN area to design the motor (topology, winding, materials etc.…).
- The TEST area to perform tests and performance analysis of motors.
- The EXPORT area to export documents or models to perform advanced studies.

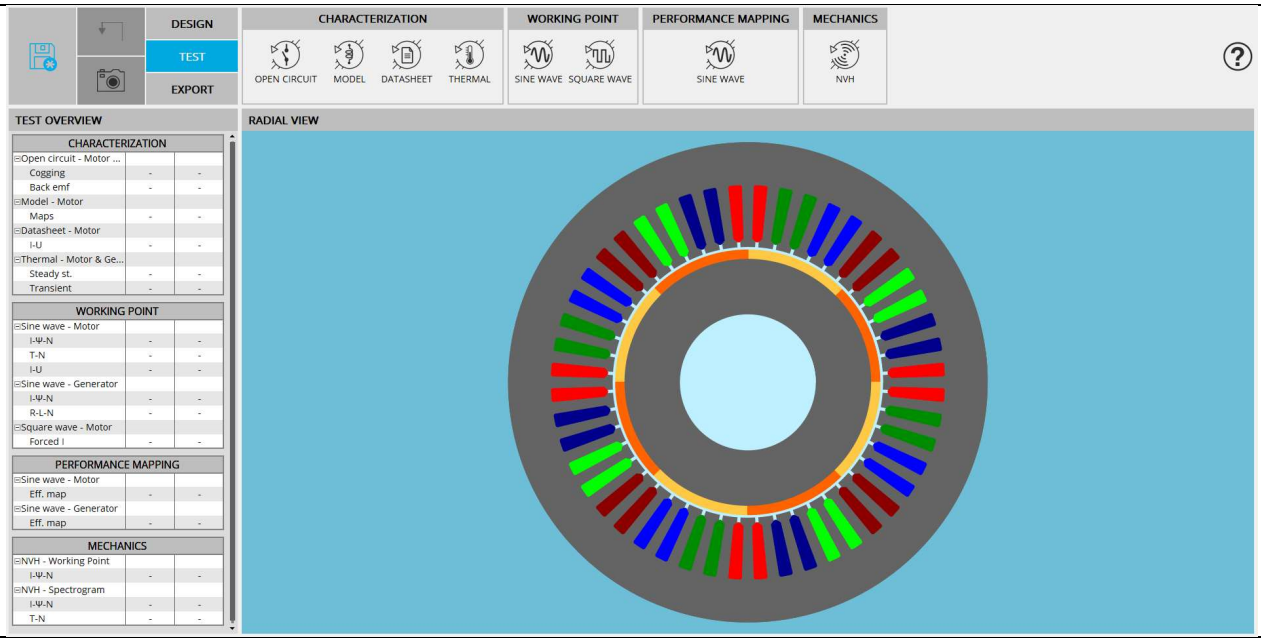
To reach one of these areas just click on the corresponding button.

	1	Get into DESIGN area.
	2	Get into TEST area.
	3	Get into EXPORT area.

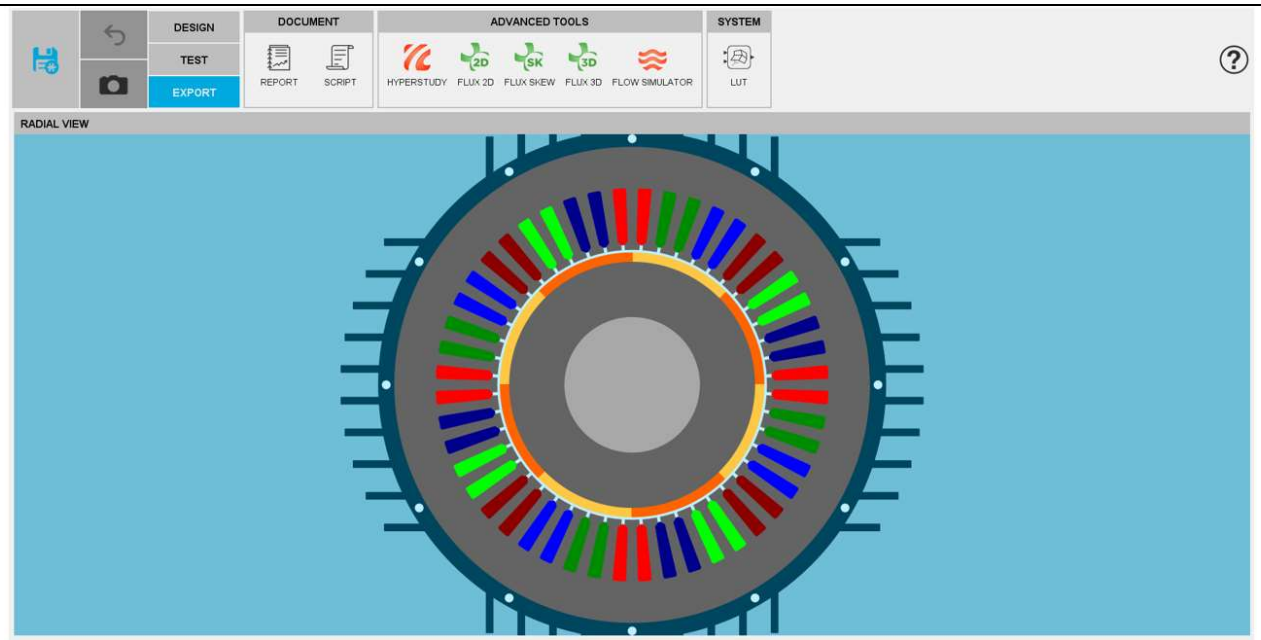


DESIGN area of Motor Factory
Example for a Synchronous Machine with Permanent Magnets and Inner Rotor

Note: By default, accesses to External cooling and Internal cooling environments are locked. See how to consider thermal cooling properties in the section below.



TEST area of Motor Factory
Example for a Synchronous Machine with Permanent Magnets and Inner Rotor



EXPORT area of Motor Factory
Example for a Synchronous Machine with Permanent Magnets and Inner Rotor

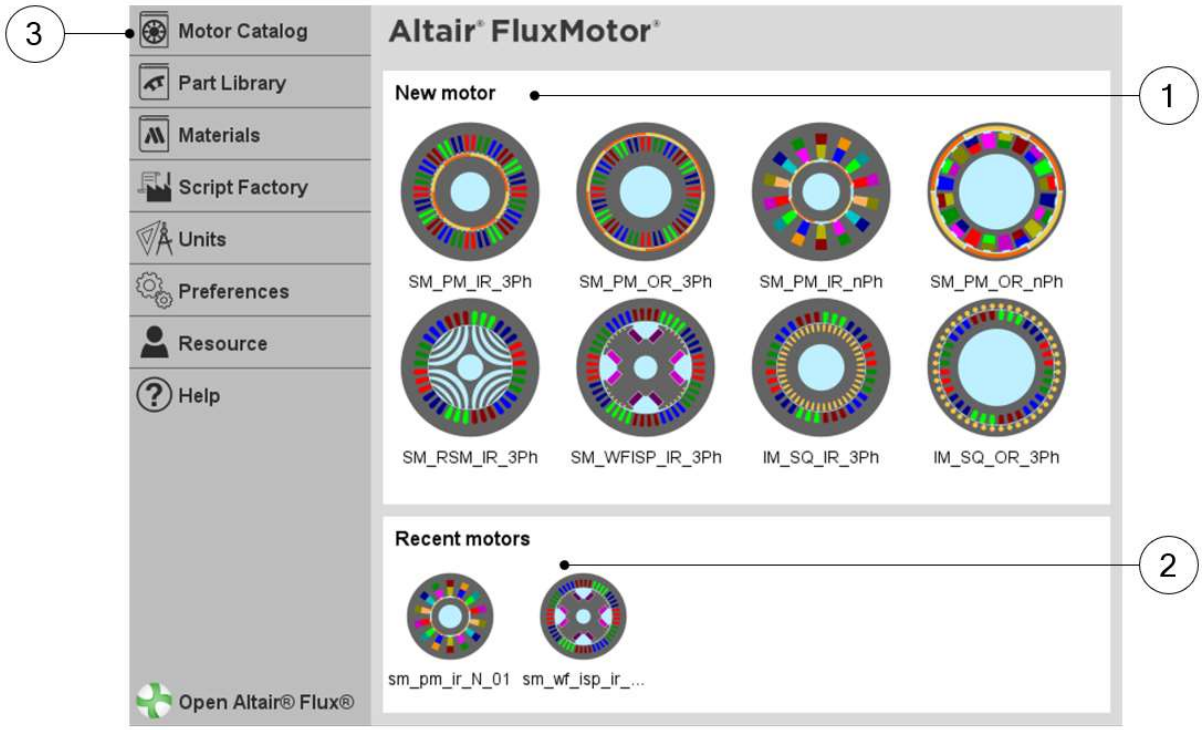
1.2 How to get into Motor Factory

1.2.1 Introduction

Two ways are possible to get into Motor Factory:

1) From the supervisor, select the type of motor you want to design

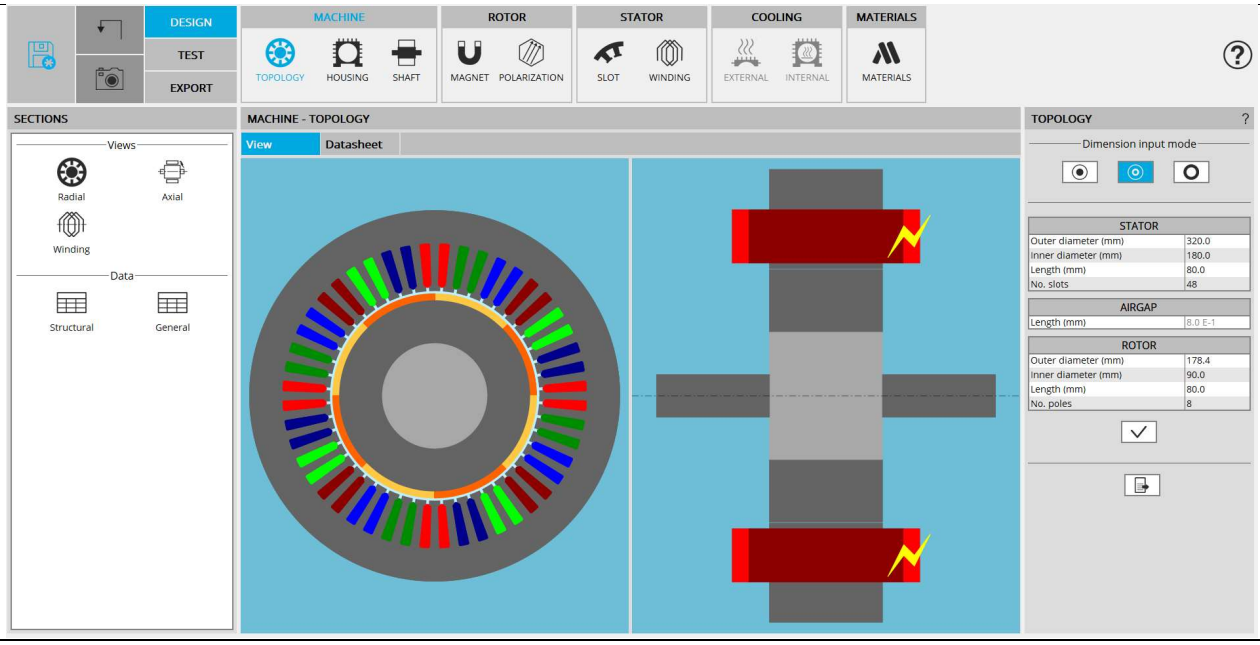
2) From the “Motor Catalog”, by editing a selected motor in a catalog



Create a new motor or open one of the most recently used motors	
1	Get into Motor Factory for designing and testing a new motor. Create a new motor in Motor Factory by selecting a type of motor you need to design. 8 types of motor are currently available: • SM_PM_IR_3PH: 3-Phase Synchronous Machine with Permanent Magnets - Inner Rotor • SM_PM_OR_3PH: 3-Phase Synchronous Machine with Permanent Magnets - Outer Rotor • SM_PM_IR_nPH: Polyphase Synchronous Machine with Permanent Magnets - Inner Rotor • SM_PM_OR_nPH: Polyphase Synchronous Machine with Permanent Magnets - Outer Rotor • SM_RSM_IR_3PH: 3-Phase Reluctance Synchronous Machine - Inner Rotor • SM_WF_ISP_IR_3PH: 3-Phase Wound Field Synchronous Machine Inner Salient Pole – Inner Rotor • IM_SQ_IR_3PH: 3-Phase Induction Machine with SQuirrel cage - Inner Rotor • IM_SQ_OR_3PH: 3-Phase Induction Machine with SQuirrel cage - Outer Rotor
2	Choose a motor among a list of most recently used motors and get into Motor Factory. The number of most recently used motors available are defined with the user preferences. See section “User preferences” in the supervisor user guide.
3	Refer to catalogs, compare and choose a motor already designed.

1.2.2 Get into Motor Factory for designing and testing a new motor

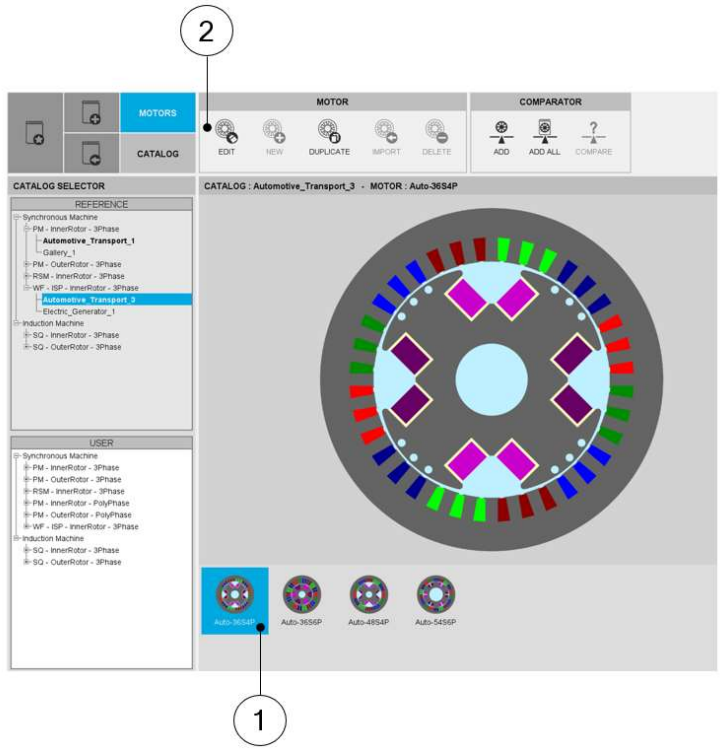
From supervisor, clicking on a motor from the “New motor” section or from the “Recent motors” section opens directly Motor Factory environment.
Structural data (outer and inner diameters, number of poles, number of slots, etc. must be defined from the sub area “Topology” when designing a new machine.



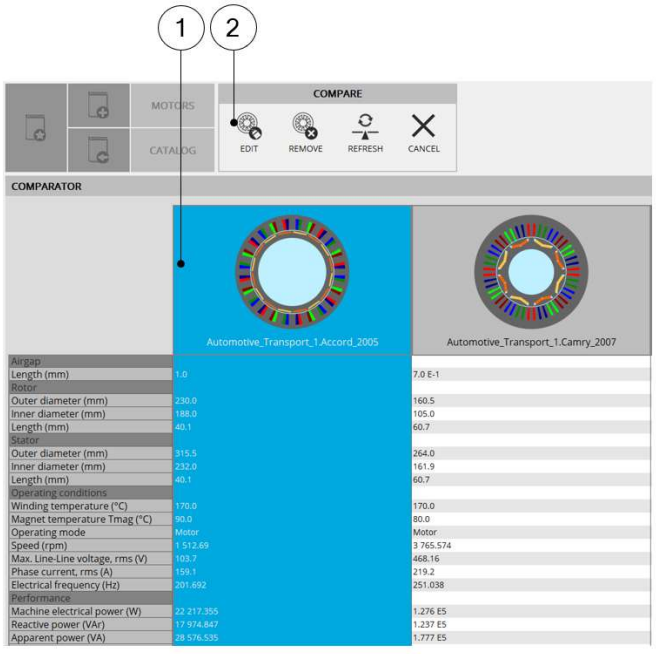
Definition of the machine structural data in Topology area

1.2.3 Edit a motor from Motor Catalog

For additional information, please see “Motor Catalog” application.



1	Select a motor from the main area of Motor Catalog.
2	 “Edit” the selected motor in Motor Factory.

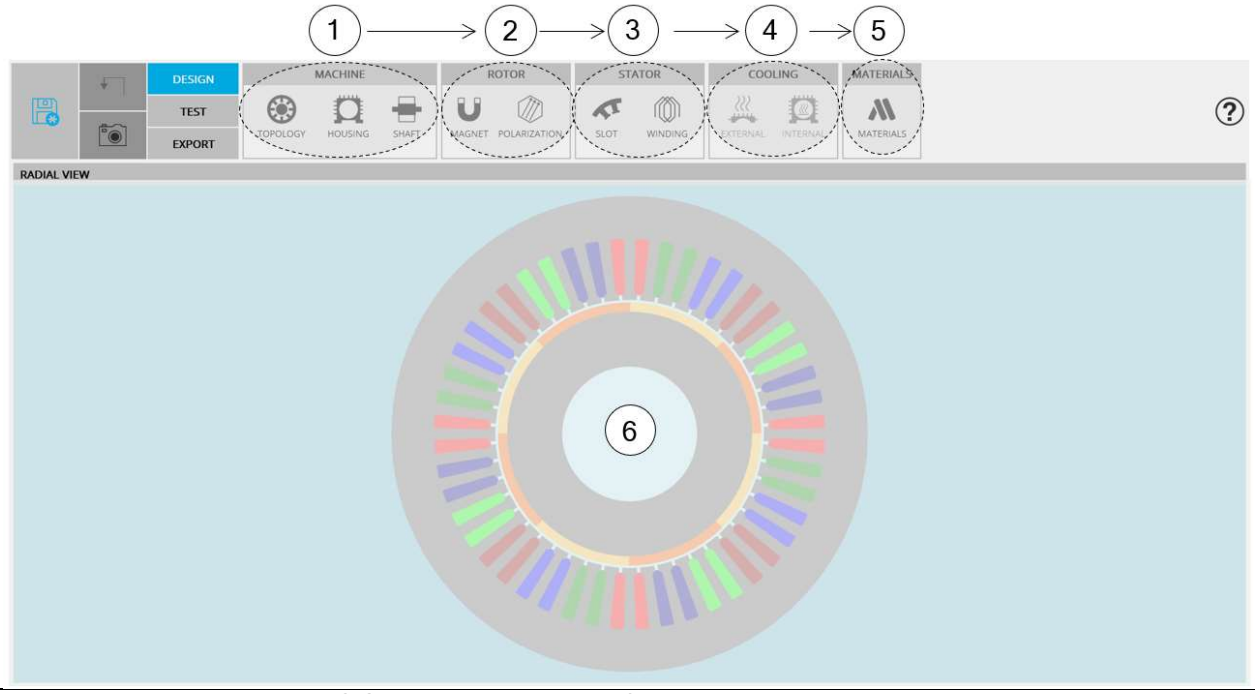


1	From the comparator area Add the motors to be compared and select the motor.
2	 “Edit” the selected motor in Motor Factory.

2 OVERVIEW MOTOR FACTORY – DESIGN AREA

2.1 Home page view

The Motor Factory – DESIGN area is the first environment of Motor Factory.
It is composed of five main zones. This is the guided line to design your machine.



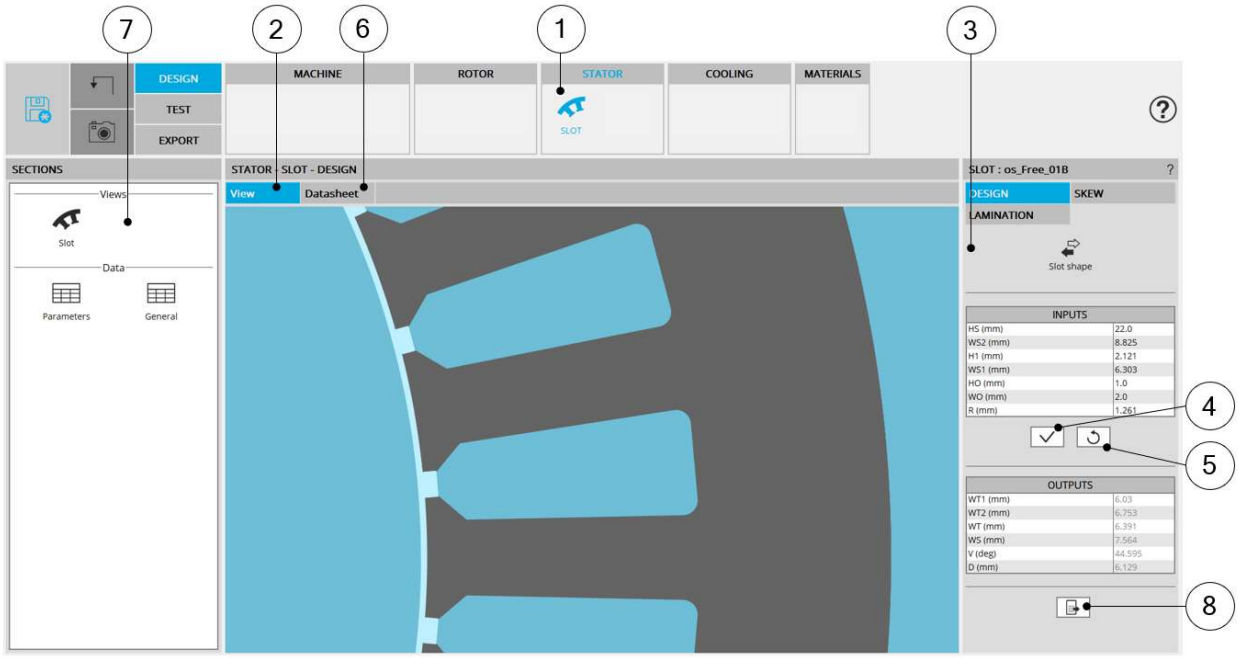
Motor Factory – DESIGN area view – Example for synchronous machine – Permanent magnets

Zone 1 **MACHINE**	Definition of general data of the machine depending on the considered type of machine • Topology with overall dimensions, No. slots, No. poles, • Housing, Frame, Fins and cooling circuit topologies and dimensions • Shaft, type, Bearings and dimensions
Zone 2 **ROTOR**	Access to the main functions to design the ROTOR and its corresponding subsets: • Magnet, Polarization
Zone 3 **STATOR**	Access to the main functions to design the STATOR and its corresponding subsets: • Slot, Winding
Zone 4 **COOLING**	Define external and internal cooling parameters Convection, radiation, conductivity parameters and X-factors Note: By default, accesses to External cooling and Internal cooling environments are locked. **External cooling** is unlocked when a frame is defined (Housing / Frame environment) **Internal cooling** is unlocked when a frame is defined (Machine / Housing / Frame environment) and a shaft with bearings are defined (Machine / Shaft / Bearing environment).
Zone 5 **MATERIALS**	Area to select all the materials needed to build the machine, rotor, stator and the cooling
Zone 6 VIEW	Visualization of the motor radial view. The winding (automatically defined) is shown. Note: Graphic functions like export picture and zoom are available on this view by right clicking on mouse (right part of the panel). See system functions, graphic management to get more information.

2.2 Description of Sub areas

In each of three main areas (Machine, Rotor and Stator), there are sub areas, which allows defining a sub section of the machine such as shaft, housing, slots, winding, magnets, polarization, materials.

2.2.1 Sub area design view

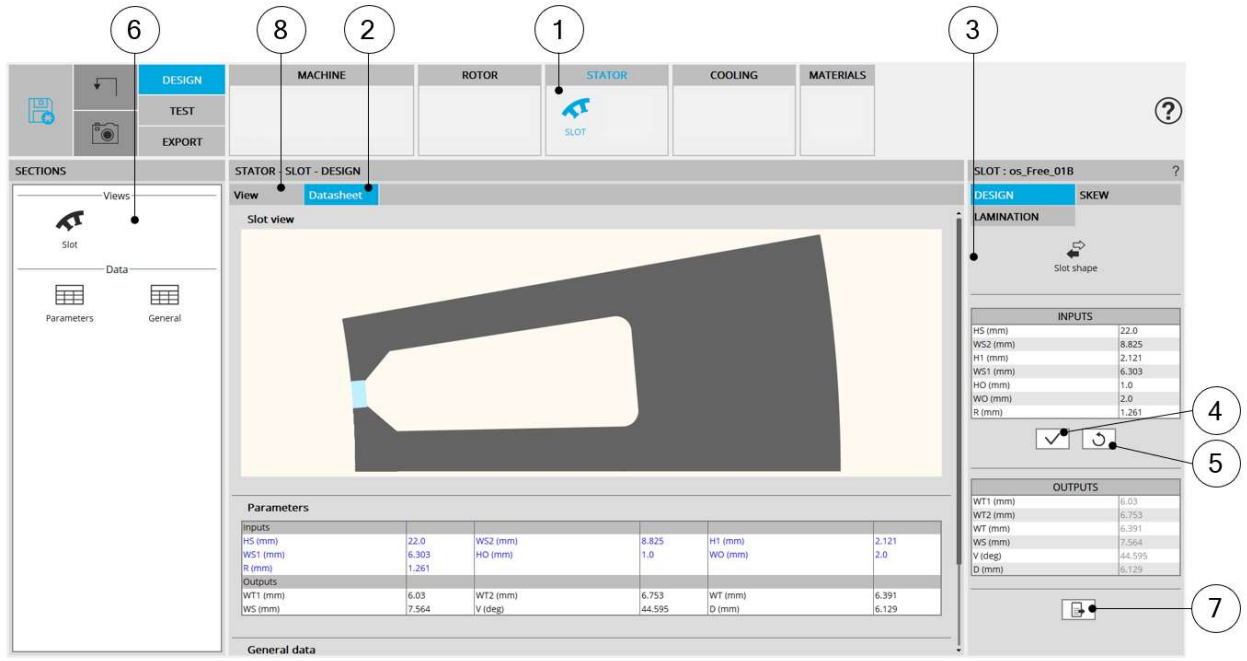


Motor Factory – Design sub area
Example - Sub area of Stator dedicated to the design of slot topology – Main view

1	Icon to access the sub area (Slot area in this example)
2	The default screen allows displaying the main view which illustrates the purpose of the study
3	Inputs are always displayed on the right part of the screen
4	Button to apply inputs
5	Button to restore default values
6	Each sub area has its own design report. It is visible under the tab “Datasheet”
7	Shortcuts allow reaching main section of the current design report
8	Icon to export data into *.txt or *.xlsx files.

The next table described the tab “Datasheet”

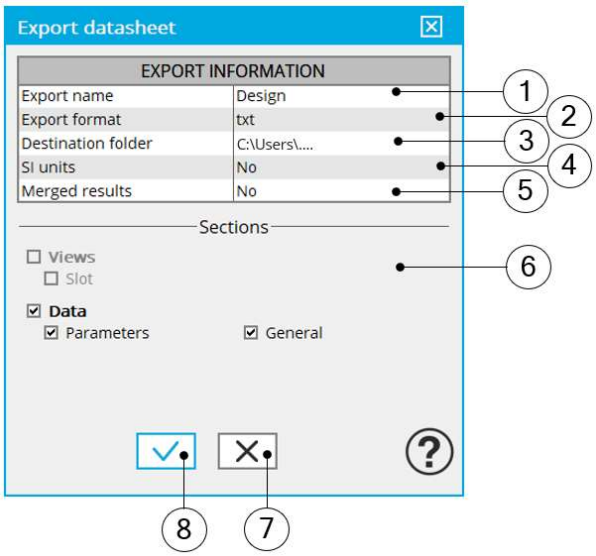
2.2.2 Sub area Datasheet



Motor Factory – Design sub area
Example - Sub area dedicated to the design of slot topology – Datasheet view

1	Icon to access the sub area (Slot area in this example)
2	Each sub area has its own design report. It is visible under the tab “Datasheet” Note: Input data are written in blue, Output data are written in black
3	Inputs are always displayed on the right part of the screen
4	Button to apply inputs
5	Button to restore default values
6	Shortcuts allow reaching main section of the current design report
7	Icon to export data in text files - Please see below illustration
8	The default screen which illustrates the purpose of the study

2.2.3 Export of data

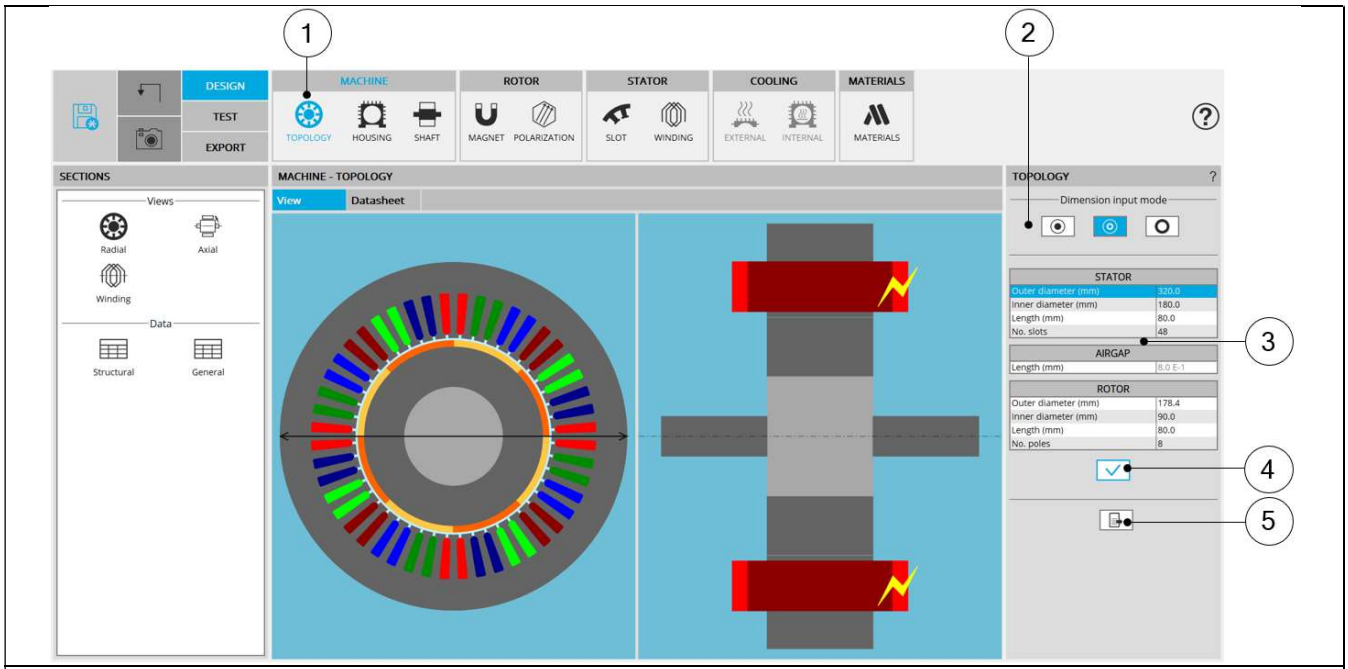


Motor Factory – Design sub area
Example of dialog box to export data into *.txt or *.xlsx files

1	Name of the exported text file
2	Choice for exporting data into *.txt or *.xlsx files
3	Folder in which the provided file will be stored
4	System of units for numerical data can be given using SI Units (Units based on International System of Units) When the answer is “No”, the default units used in FluxMotor® will be considered
5	Merged results mean the results are written in one text file. When the answer is no, a text file is provided for each category of result (Parameters and General in our example.
6	Visualization of all categories of results. Categories must be checked for adding them to the text files
7	Button to cancel action and close the panel
8	Button to apply inputs, close the panel and open the folder in which the generated text files are stored

2.3 Structural data

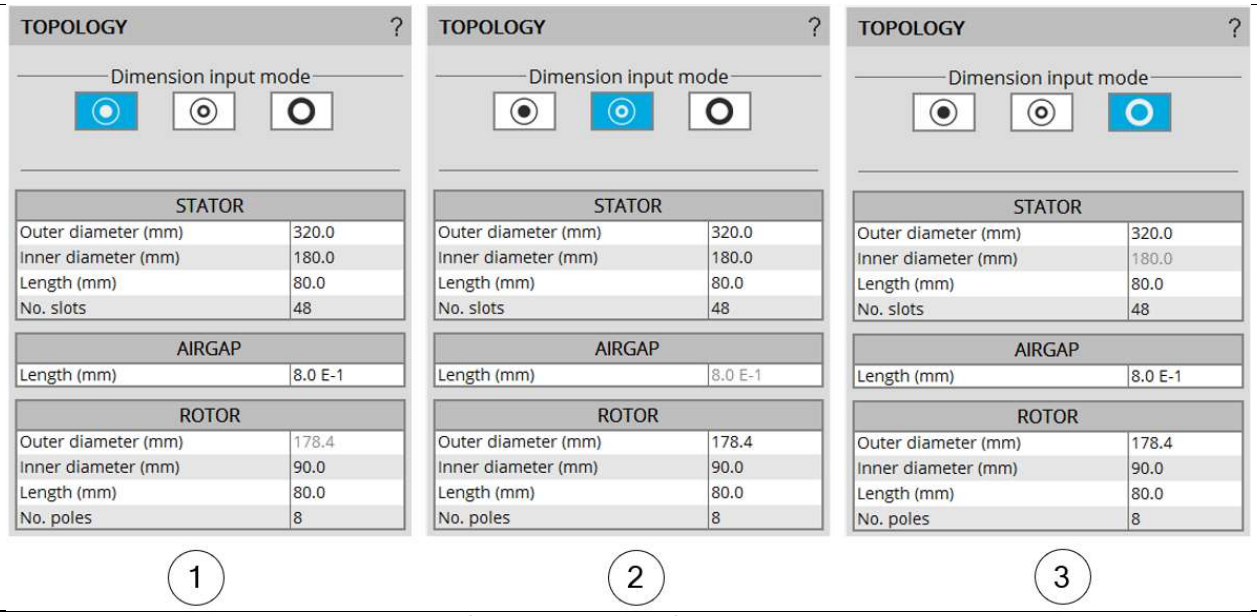
The first step of the design consists of defining structural data of the machine.
However, at any time, it is possible to reach and modify the structural data from the Motor Factory design environment.
Here is the process to modify the structural data from the general data panel.



Process to modify the structural data	
1	Open the TOPOLOGY panel (Click on the icon TOPOLOGY)
2	Choose a way to define the diameters of the machine and the airgap See below illustration
3	Modify the values of structural data – When relevant the corresponding arrow is displayed on the view
4	Button to apply inputs
5	Icon to export data into text files - Please see above illustration

2.4 Method to define the airgap

In the topology sub area, three ways are possible to define the structural data of the machine based upon the diameters and the airgap. They are illustrated below.

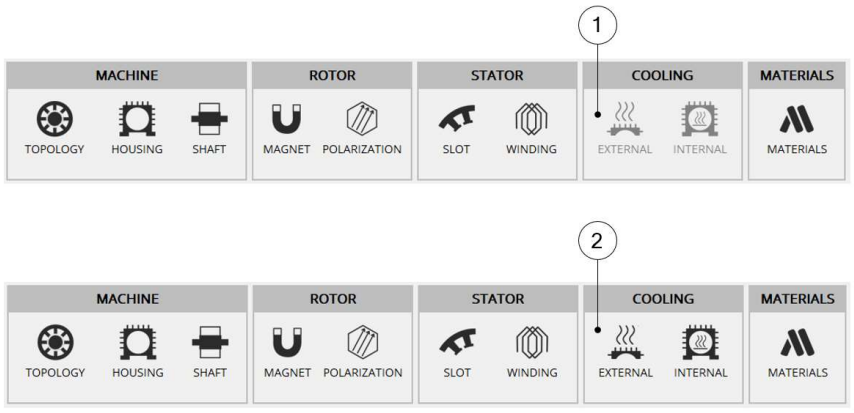


Method to define the diameters of machine and the airgap Example for a Synchronous Machine with Permanent Magnets and Inner Rotor	
1	User defines the inner diameter of the stator and the airgap. The outer diameter of the rotor is automatically deduced (automatically computed value is displayed in grey color).
2	User defines the inner diameter of the stator and the outer diameter of the rotor. The airgap is automatically deduced (automatically computed value is displayed in grey color).
3	User defines the outer diameter of the rotor and the airgap. The inner diameter of the stator is automatically deduced (automatically computed value is displayed in grey color).

2.5 Consideration of thermal properties

By default, accesses to External cooling and Internal cooling environments are locked.

External cooling is unlocked when a frame is defined (Housing / Frame environment)
Internal cooling is unlocked when on the one hand a frame is defined (Machine / Housing / Frame environment) and on the other hand a shaft with bearings are defined (Machine / Shaft / Bearing environment). See below illustrations.



How to unlock cooling environments	
1	External and internal cooling environments are locked
2	External and internal cooling environments are unlocked

2.6 Advice for use

The choice of diameters is possible over the range [1, 20000] mm.
The number of slots is possible over the range [3, 2400].
The number of poles is possible over the range [2, 400].
The number of bars (induction machines) is possible over the range [5, 500].

For more information, see the list of allowed combinations between the number of slots and the number of poles, synthesized in the section dedicated to winding.

Note: Our process for building and computations have been qualified over the following data ranges:

For Synchronous Machines with Permanent Magnets – Inner or Outer Rotor
Or for Reluctance Synchronous Machines – Inner Rotor
Range for diameters [1, 1000] mm.
Range for number of slots [3, 90].
Range for number of poles [2, 80].

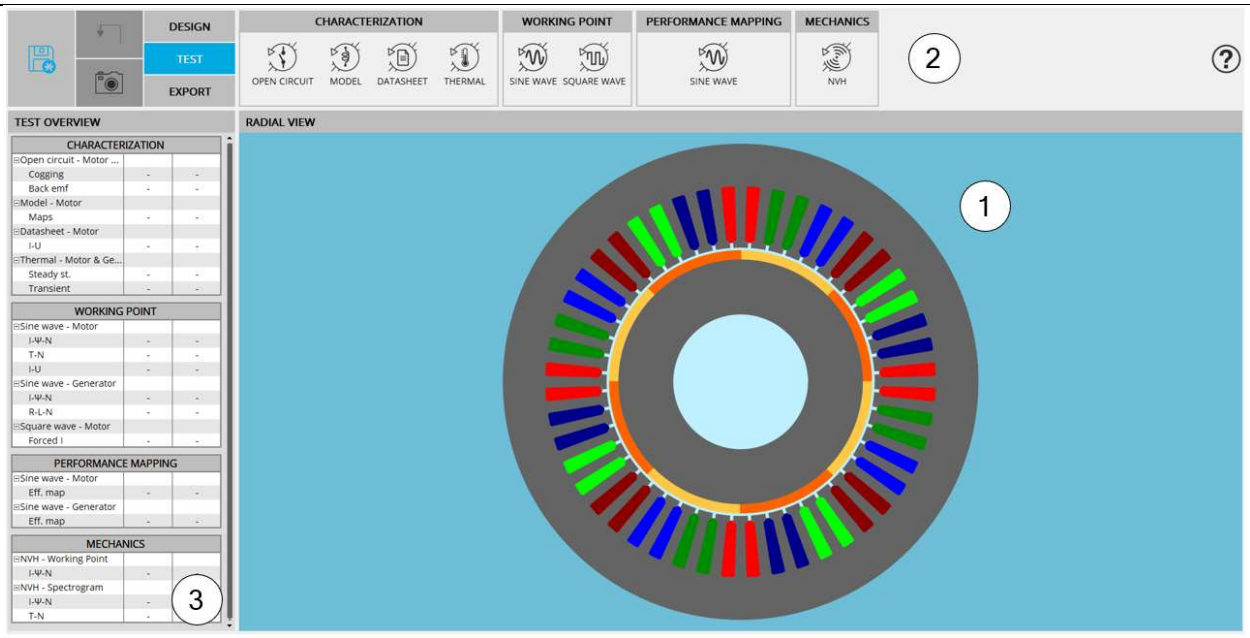
For Induction Machines with Squirrel Cage – Inner or Outer Rotor
Range for diameters [1, 1000] mm.
Range for number of slots [3, 144].
Range for number of poles [2, 20].
Range for number of bars (induction machines) [5, 180].

Working beyond these limits is possible but accurate results are the responsibility of the user.

3 OVERVIEW MOTOR FACTORY – TEST AREA

3.1 Home page view

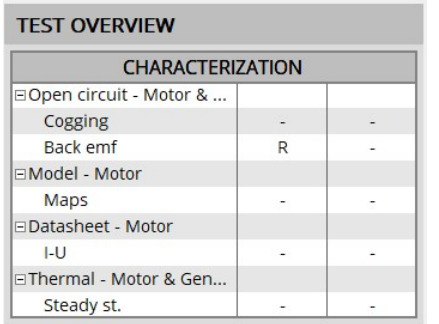
The test area home page includes three main zones



Home page view of the test area
Example for a Synchronous Machine with Permanent Magnets and Inner Rotor

Zone 1	Visualization of topology of the machine being studied.
Zone 2	Visualization and access to the different test packages classified into families. One clicks on a package's icon opens it and gives access to the tests stored in it.
Zone 3	All the test names are displayed in this zone and classified under test families and test packages.

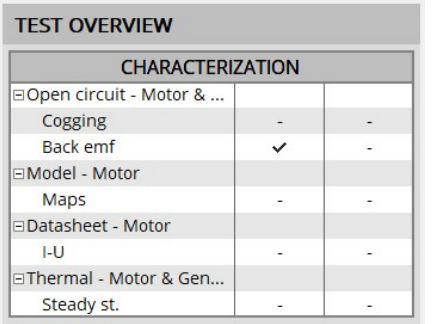
When no test package is selected, an overview ("TEST OVERVIEW") appears, giving more details about the status of each test.
Here is an illustration for Synchronous Machine with Permanent Magnets



TEST OVERVIEW

CHARACTERIZATION		
Open circuit - Motor & ...		
Cogging	-	-
Back emf	R	-
Model - Motor		
Maps	-	-
Datasheet - Motor		
I-U	-	-
Thermal - Motor & Gen...		
Steady st.	-	-

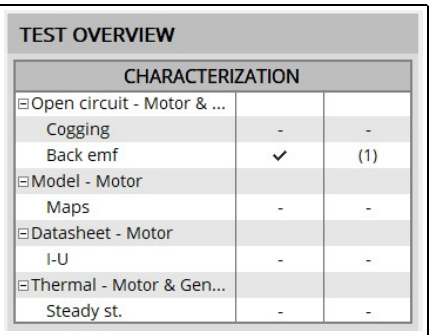
« R »: Test is running



TEST OVERVIEW

CHARACTERIZATION		
Open circuit - Motor & ...		
Cogging	-	-
Back emf	✓	-
Model - Motor		
Maps	-	-
Datasheet - Motor		
I-U	-	-
Thermal - Motor & Gen...		
Steady st.	-	-

« ν »: Test is already performed



TEST OVERVIEW

CHARACTERIZATION		
Open circuit - Motor & ...		
Cogging	-	-
Back emf	✓	(1)
Model - Motor		
Maps	-	-
Datasheet - Motor		
I-U	-	-
Thermal - Motor & Gen...		
Steady st.	-	-

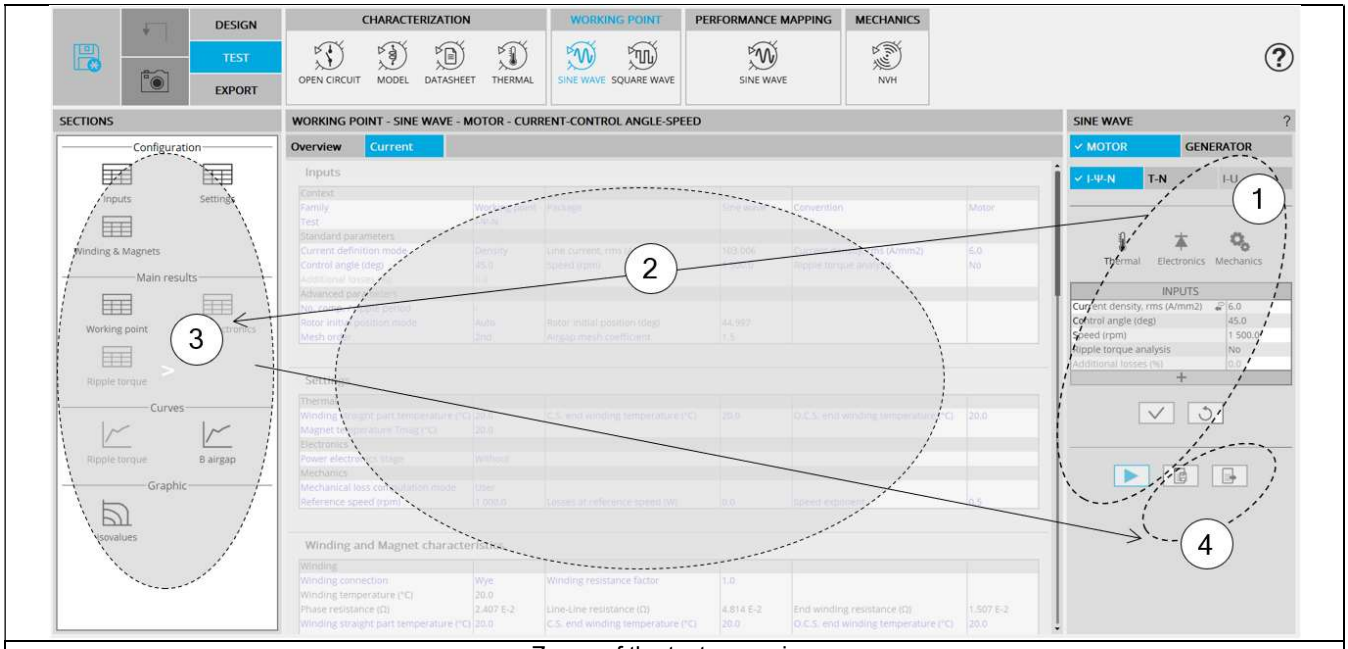
« (1) » One test is saved

Clicking on a test row shows the operational area dedicated to the corresponding test.

3.2 Test page view

3.2.1 Overview

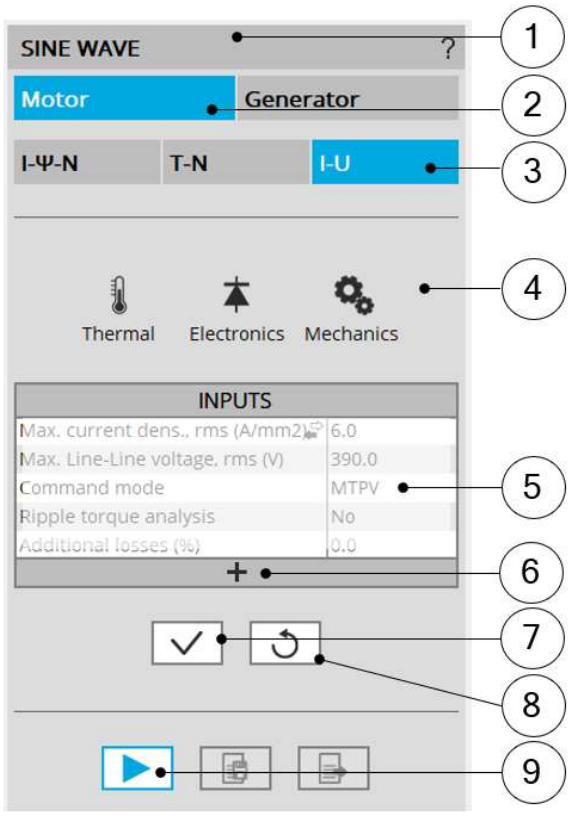
The test page view is composed of four main zones.



Zones of the test page view
Example for a Synchronous Machine with Permanent Magnets

Zone 1	Management of inputs and test execution • Defining test settings • Defining test parameters • Buttons apply parameter values, restore default parameter values and to start running the test
Zone 2	Once a test is finished, corresponding results are automatically displayed in this zone. Visualization of the test reports (inputs, data, curves etc…) are possible. Scrollbars allow browsing the whole document rapidly and having an overview of all the results. Using scrollbars, complete data can be accessed and visualized.
Zone 3	Shortcuts for displaying quickly the corresponding chapter of the test report.
Zone 4	Buttons to save and export test results.

3.2.2 Management of inputs – Overview



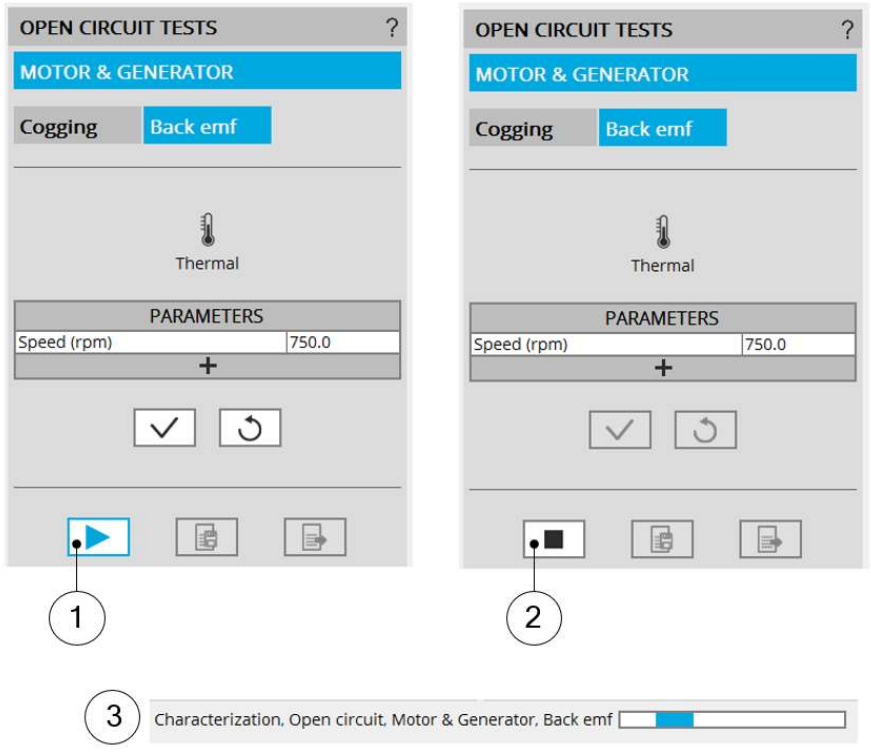
1	Name of the test package
2	Selection of the operating mode: Motor or Generator.
3	Button to select the test to perform, when several tests are available in the test package. The check mark ν indicates that the results are available.
4	Defining test settings: General conditions relative to the machine: • Active component temperatures (winding, magnet) • Electronics • User Mechanical loss model parameters For more information, please see “Test settings” section
5	User input parameters to be defined.
6	Click on (+) to displayed advanced parameters when needed
7	Button to apply input parameter values.
8	Button to restore default parameter values.
9	Button to start running the test (Input parameters are validated after clicking this button). For more details see the section dedicated to test functions.

3.2.3 Start and stop

To start the test, click on the **Start test** button (1).
Note that before running the test, even if the dedicated button to validate input parameters has not been used, FluxMotor® automatically validates and records all the input parameters.

When the solving begins, the **Start test** button (1) turns into **Stop** button (2).

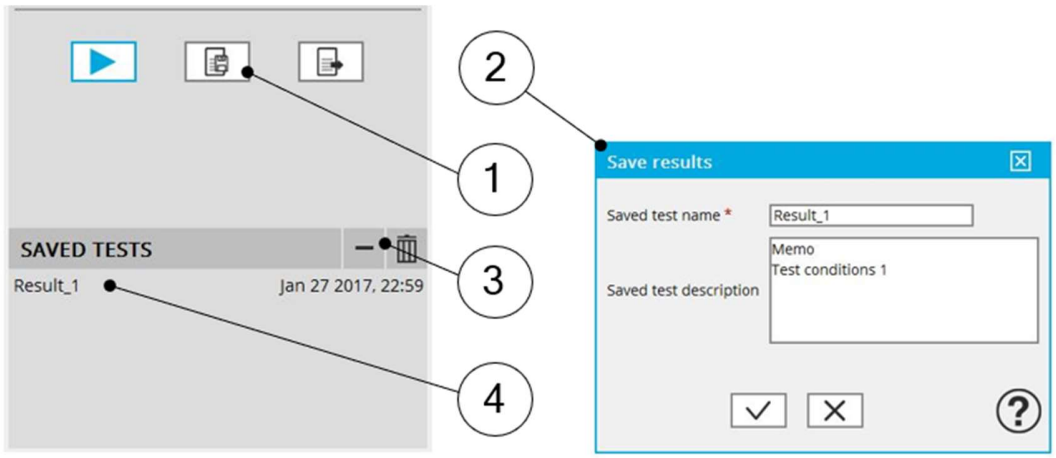
During the computation a progress bar appears (3). At any moment, the computation can be stopped by clicking on the **Stop** button (2).



Running the test

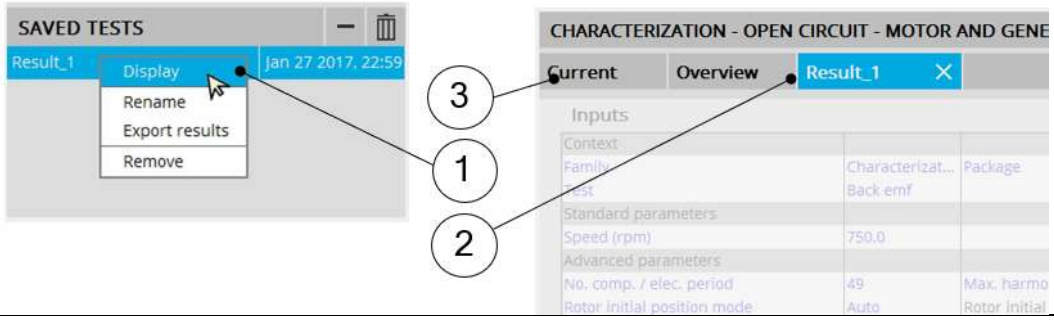
3.2.4 Save the results

Once a test is completed, the corresponding results can be saved by using the **Save test results** button (1).



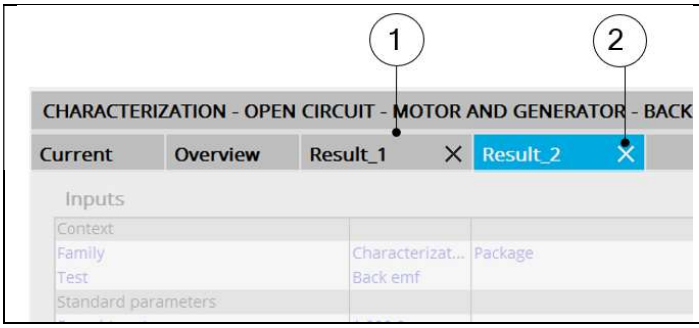
Save test results	
1	Button to save the test result
2	Dialog box to save test results. Give a name and write a description.
3	By clicking on the **Remove selected test** (-) button, the selected saved test result is removed By clicking on the Remove all tests (bin) button all the saved test results are removed.
4	List of the saved tests. The list of saved test results is limited to five elements.

Saved results can be displayed in the test area for analysis. See below to know how to do that.

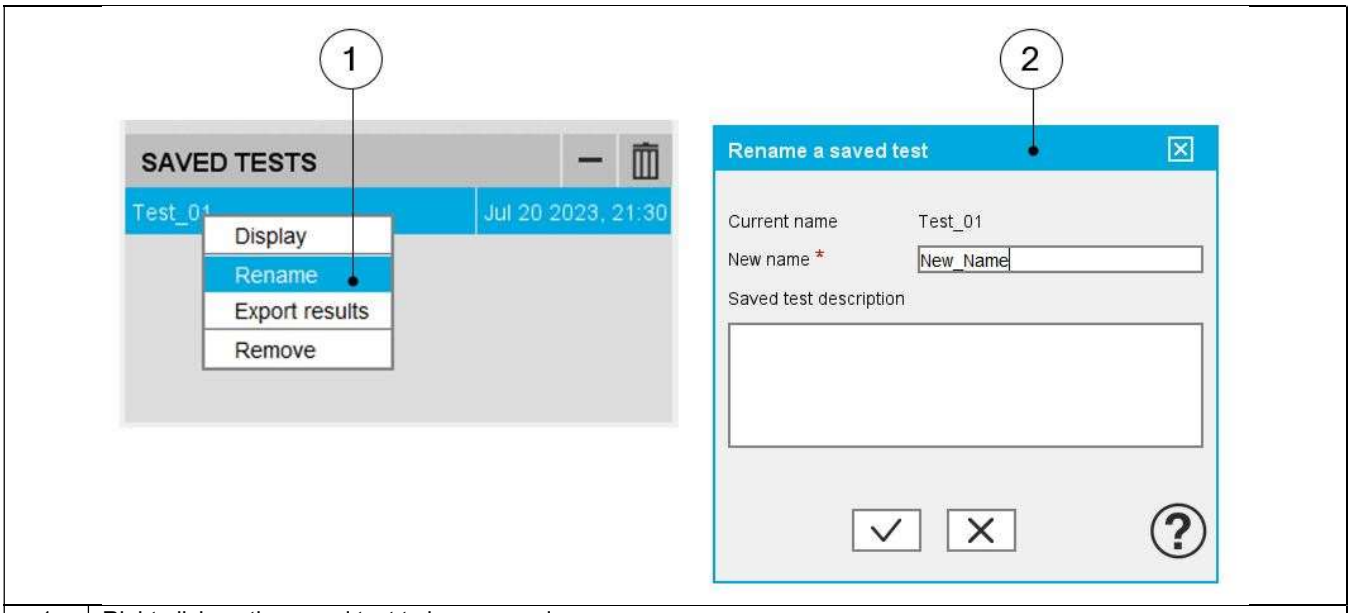


Saved test	
1	Click on a saved test to select it. Once the test is selected, right-click on it to open a list box which allows displaying results with the command “**Display**”. A double-click on the saved test result name (**for example Result_1**) gives the same result.
2	The test result is displayed in a new tab inside the test results zone (Zone 2)
3	Displaying of edited results (saved and current results) is possible by clicking on the corresponding tabs. Several saved tests can be displayed. See below.
*	Note: Other functions available in this list box are: The selected test result can be renamed, exported (see next section) and removed.

Additional information about the saved test results

	1	Several saved test results (maximum five) can be displayed inside the test area for comparison with each other.
	2	**X** allows removing the selected test result from the test area A test result removed from test area can be re-displayed at any moment.

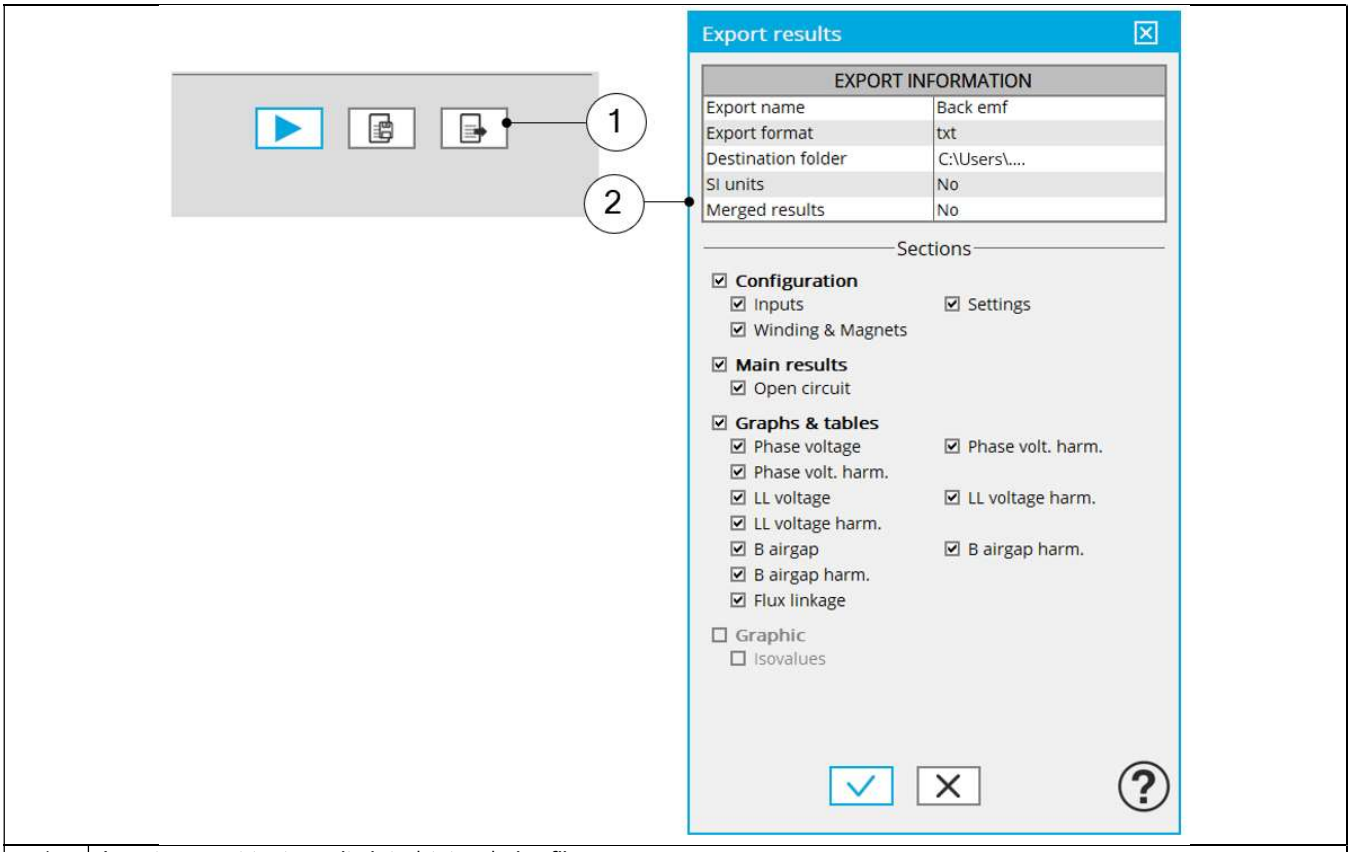
3.2.5 Rename a saved test



1	Right-click on the saved test to be renamed.
2	Dialog box to define the new saved test name with a description.

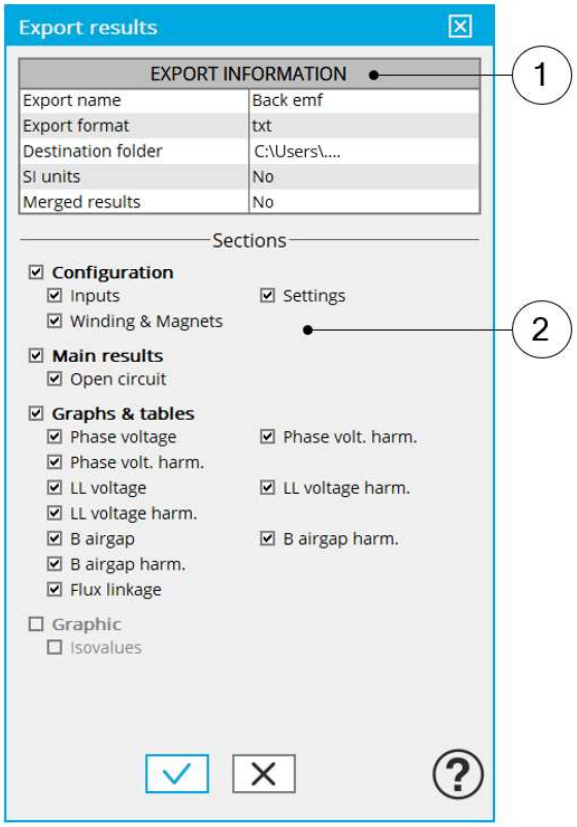
3.2.6 Export test results

When a test is completed, the corresponding results can be exported in a text file format by using the **Export test results** button (1)



1	Icon to export test results into *.txt or *.xlsx files.
2	Dialog box to export test results. See the next chapter for details about the fields in this dialog box.

The process of exporting results into a text file is managed inside the following dedicated dialog box.



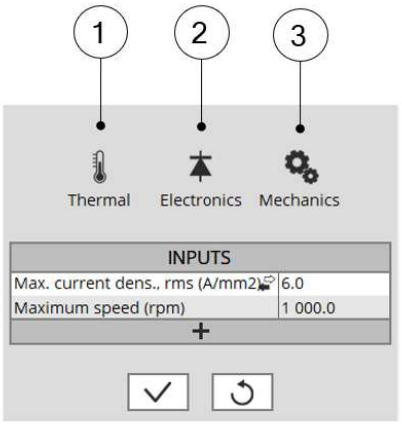
1	Field to give information about the exported file: • Name of the file (*.txt or *.xlsx file) • Folder where the file must be stored • Check if you want to export data in SI unit system. If not, data are exported in the current unit system that was used to solve the test (defined in “Units” application). • Merged results are to be chosen if you want to export all results in one file or one file per result
2	Select the results you want to export. All the results available for exporting are grouped in section as it is in the result panel of the considered test.
*	Resulting file can be imported in other software packages like MS Excel, Compose, Octave etc.

3.3 Test settings

The settings allow defining the context in which the tests are going to be performed.
Their definition is specific to each test.

Settings are defined into three main domains:

- Thermal: To define active components temperature (magnets and winding)
- Electronics: To define the power electronics stage feeding the machine
- Mechanics: To define the mechanical loss model parameters



1	Button to define winding and magnet temperatures to be considered in the test.
2	Button to define the user inputs of the power electronics stage
3	Button to define the parameters of the mechanical loss model

For more details refer to the dedicated section “Test settings” in the user help document to each type of machine and test.

4 MOTOR FACTORY – EXPORT AREA

4.1 Home page view

The area “EXPORT” of Motor Factory groups two main families of functions:

1) “DOCUMENT”

   In “DOCUMENT” area the function “REPORT” allows building reports automatically to describe all the work achieved in the design as well as for the tests.

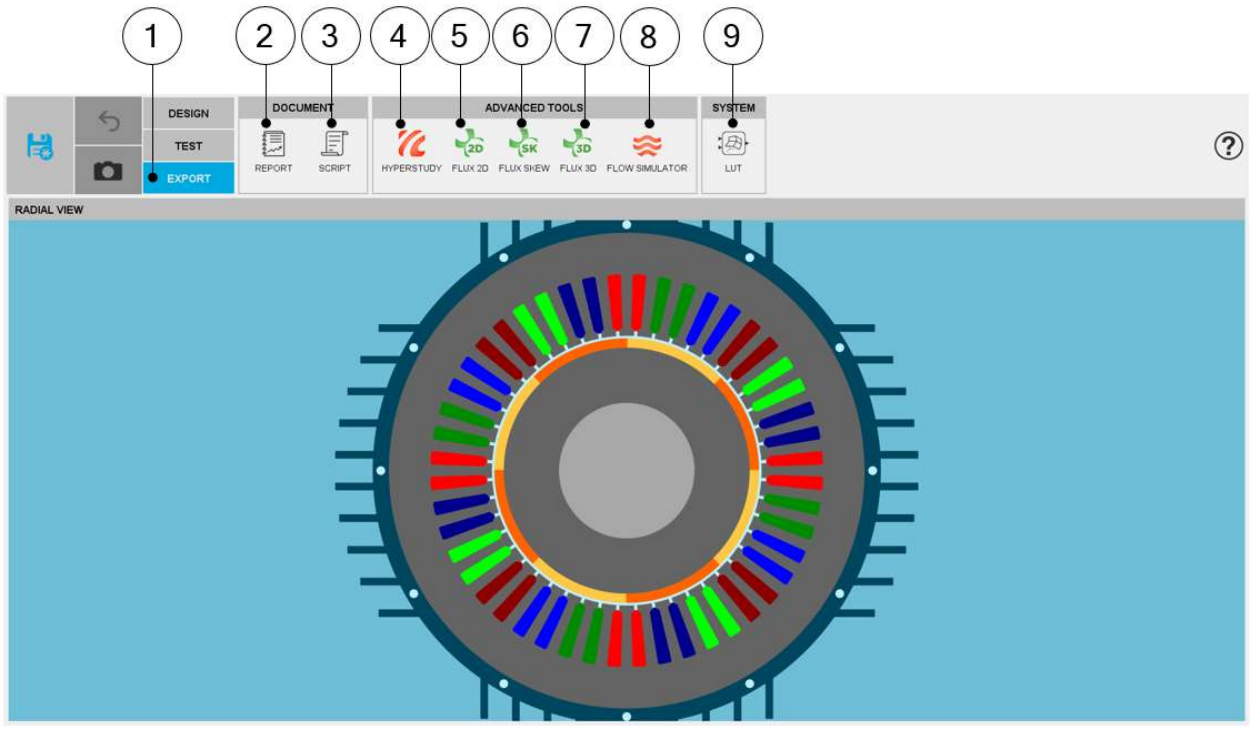
   Then, the function “SCRIPT” allows to build and export a python script of a current motor in the application Script Factory or in a targeted folder. “ADVANCED TOOLS “

2) In “ADVANCED TOOLS” area the function “HYPERSTUDY” allows to build and to export a connector in Altair® HyperStudy® for performing studies like optimization or Design Of Experiment (DOE).

   Then, the functions “FLUX2D”, Flux Skew, Flux 3D allow to build and export a model in Altair® Flux® environment (2D, Skew or 3D) for performing advanced studies either with magneto static or transient applications.

3) “SYSTEM”

   Last, the function “SYSTEM” allows exporting files in FMU (Functional Mock-up Unit) format file or in MAT format file from FluxMotor® for PSIM or Activate.



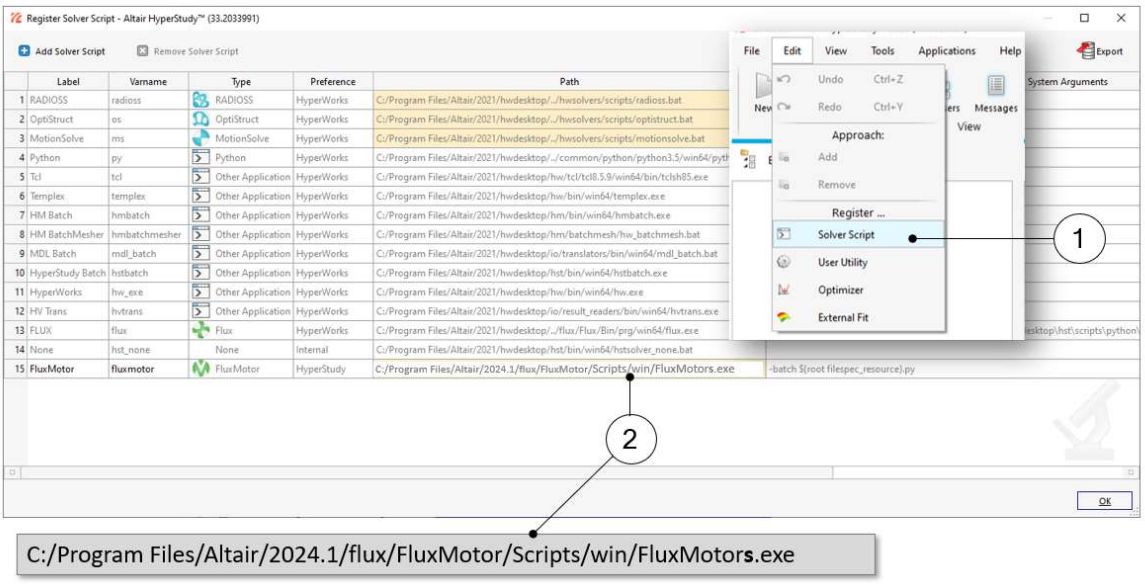
Motor Factory - EXPORT area	
1	Selection of EXPORT area of Motor Factory opens Export window
2	Access the area “REPORT” through which a report can be made
3	Access the area “SCRIPT” through which a python file in which all the needed command lines are written to rebuild the motor
4	Access the area “HYPERSTUDY “in which a connector can be made and be sent to Altair® HyperStudy®
5	Access the area “FLUX 2D” through which a model can be made and be sent to Flux® 2D
6	Access the area “FLUX SKEW” through which a model can be made and be sent to Flux® Skew
7	Access the area “FLUX 3D” through which a model can be made and be sent to Flux® 3D
8	Access the area “FLOW SIMULATOR” through which the thermal model of the machine can be analyzed in Flow Simulator™
9	Access the area “SYSTEM” in which a Lookup tables can be exported in FMU or MAT format files for PSIM or Activate

For more information, please, refer to the user guide dedicated to Motor Factory – Export environment.

4.2 Export environment – HyperStudy®

4.2.1 New solver script to be registered

Before starting new studies in Altair® HyperStudy® by using connectors exported from Altair® FluxMotor®, FluxMotor® must be registered as a new solver script in HyperStudy®. This must be defined only while using the coupling for the first time.



Connection between Altair® FluxMotor® and Altair® HyperStudy®	
1	Open the area in HyperStudy® to register FluxMotor® 2024.1 script
2	Path where FluxMotor**s**.exe must be selected to be registered as a new solver in HyperStudy®. **Note**: FluxMotor**s**.exe with an “s” at the end of FluxMotor**s.** This must be defined only when using the coupling for the first time.

Note: In the version 2022.1 of HyperStudy, the FluxMotor solver script is automatically registered, when the default path installation is selected while installing Flux and FluxMotor.

Note: The new auto generation of the HyperStudy study in HyperStudy Application (described above) allows to automatically register FluxMotor® as a new solver script in HyperStudy®. If HyperStudy is not installed in the same folder (by default : C:\Program Files\Altair\2024.1\hwdesktop\hst), the path must be defined in the user preferences via the supervisor of FluxMotor (Path to HyperStudy – Needed for HyperStudy export).

Warning: Mandatory synchronization between connector and FluxMotor versions
The connectors used in HyperStudy must be synchronized with the FluxMotor solver version. An error message (inside the log files) is generated while performing HyperStudy studies with a connector provided with a former version of FluxMotor solver.

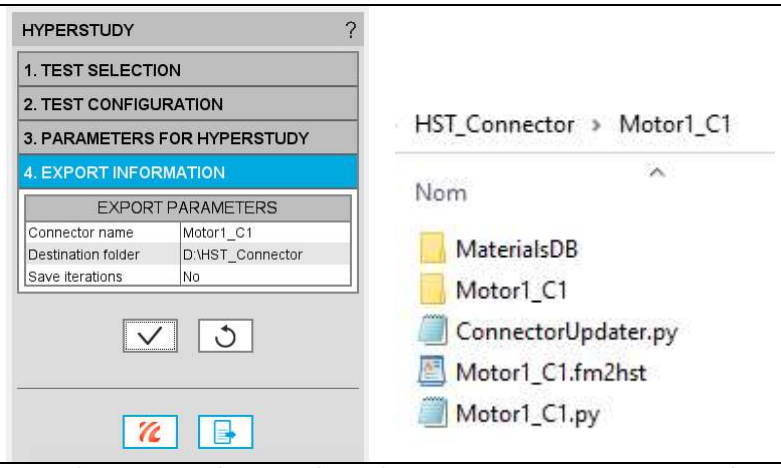
4.2.2 Export a connector for HyperStudy studies – Process.

4.2.2.1 What happens while using a compatible HyperStudy connector?

Illustration of the problem when one uses a non-compatible HyperStudy connector with the selected solver in HyperStudy application (Refer to the Register Solver Script).

Open the FluxMotor project (example Motor1) with the version FluxMotor 2022.3
Get into the EXPORT area and select HyperStudy workspace

- Select the test to be performed.
- Select the test configuration.
- Select the parameters for HyperStudy
- Define the Export information: Connector name: Motor1_C1, for example, and the destination folder
- Then, export the connector.



Generation of a connector for HyperStudy from Motor Factory Export- HyperStudy area.

In the HyperStudy software, create a new study:
- Give a name to this study.
- Locate the connector to be considered.
- Select the Solver Execution Script.

In a first step, let's select the FluxMotor 2022.3 solver
- Import variables
- Define inputs (and constraints if needed)
- Run the definition of the model

In such a case, the Test Models execution (Write / Execute / Extract) must pass (all the indicators are green) since the Connector exported from FluxMotor 2022.3 is compatible with the FluxMotor Solver used in HyperStudy.

4.2.2.2 What happens while using a non-compatible HyperStudy connector?

Now, what happens if one selects the FluxMotor 2023 solver instead of the FluxMotor 2022.3 solver i.e., if one uses a FluxMotor solver newer than the version with which the connector has been generated?

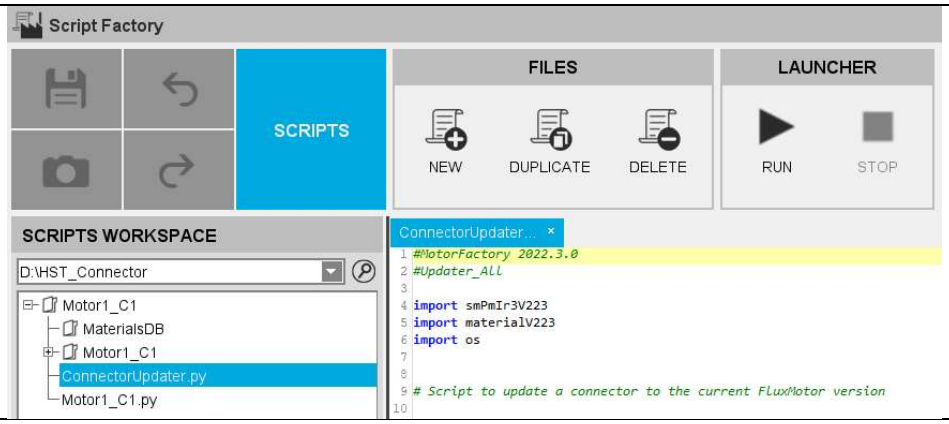
So, let's modify the Solver Execution Script by targeting the FluxMotor 2023 solver.
And operate all the same previous steps:
- Import variables.
- Define inputs (and constraints if needed).
- Run the definition of the model.

In that case, the Test Models execution do not pass (the indicator write is green but the two other ones - Execute and Extract are red).
If you get into the folder where the runs are stored, in the log.out file you'll see the following error message:

The Hyperstudy connector version 2022.3.0 is incompatible with the FluxMotor solver version 2023.0.0#100.6.268 (FluxMotorLogger.java:212)

4.2.2.3 How can a non-compatible HyperStudy connector be made compatible?

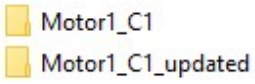
Since FluxMotor 2023 version, a solution exists to update the connector and make it compatible with a more recent FluxMotor Solver Script. This consists of running the ConnectorUpdater.py file which is provided and located in the same folder as the connector. This allows us to update the connector and make it usable with a newer version of the FluxMotor solver.
.
To apply this new process, one must open FluxMotor 2023 and get into Script Factory. Then, in the Script Workspace, one must select the folder in which the previous connector is stored.
Then, open the ConnectorUpdater.py file located in this folder and run it.



Edit and run the ConnectorUpdater.py file from the Script Factory application

Warning: It is mandatory to run the ConnectorUpdater.py file in the folder where the Connector to be updated is located (the default location) otherwise the updating process will fail.
The ConnectorUpdater.py file must remain in the same folder as the connector to be updated.

A new folder containing the previous connector is then built at the same level as the former folder.
Its name is the same with the additional following extension: "_updated".
For example, if the former connector was "Motor1_C1", the new one is "Motor1_C1_updated".



Resulting updated folder while running the ConnectorUpdater.py file

Now, in HyperStudy, you can build a new Study, by selecting this new resource and then run the Study with the new FluxMotor Solver Script, i.e., FluxMotor 2023.

Thanks to the updated connector the test Models (Write / Execute / Extract) pass (all the indicators are green).

4.2.3 General rules

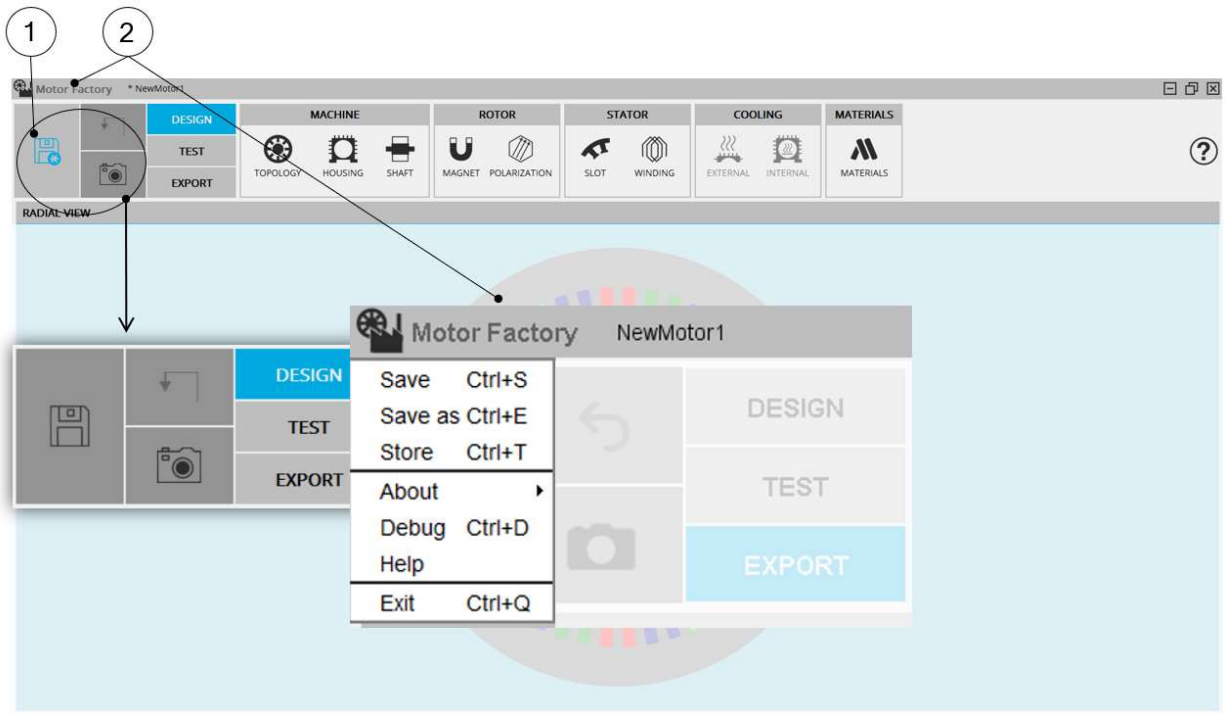
- A connector provided with FluxMotor version N-1 (or older) cannot be used in HyperStudy where the FluxMotor Solver Version N (or newest) is selected.
- However, since the FluxMotor 2022.3 version, each time you generate a connector, a ConnectorUpdater.py file is provided and located in the same folder as the connector.
- Thanks to this script, the user can update an older HyperStudy connector generated with a former version of FluxMotor.
- This process is fully operational with FluxMotor 2023.
- Indeed, FluxMotor 2022.3 was the very first version where a ConnectorUpdater.py file was automatically generated each time a HyperStudy connector is provided from the Export/HyperStudy workspace of Motor Factory.
- Hence, when using the FluxMotor 2023 solver in HyperStudy, one can update the connector provided with FluxMotor 2022.3 by using the ConnectorUpdater.py file generated with the previous version, i.e., FluxMotor 2022.3.
- Note: as indicated, for FluxMotor versions older than 2022.3, the ConnectorUpdater.py is not available and consequently, the generated HyperStudy connectors with such versions cannot be updated.

5 SYSTEM FUNCTIONS

5.1 Overview

The main system functions are accessible from the top menu of Motor Factory.
Expanding the menu in the left top part of Motor Factory – for any area: DESIGN, TEST or EXPORT allows to visualize and select these functions.
Note: Some of these functions are directly available from the Motor Factory area.

The main ways to access to the functions like SAVE, SAVE AS or STORE are illustrated below.



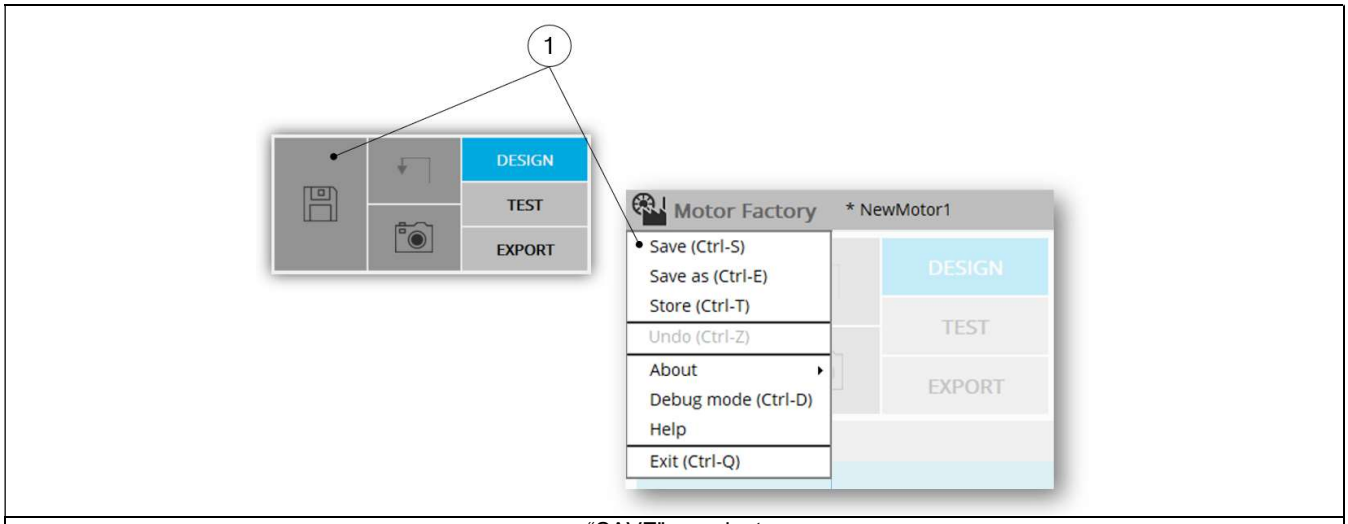
1	SAVE function (disk), STORE function (Camera) or UNDO (Back arrow) are accessible directly from the main area of Motor Factory.
2	When expanding the menu in the left top part of Motor Factory – for any area: DESIGN, TEST or EXPORT gives access to the main system functions. All these functions are explained and illustrated below.

5.2 File management

5.2.1 Save, Save as

5.2.1.1 SAVE a project

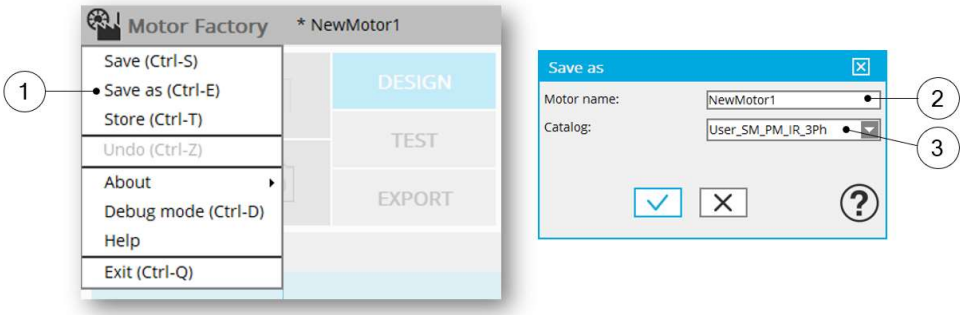
“SAVE” a project is possible, directly from the top part of the Motor Factory or via the top expanded menu. Saving a project keeps the same name of the project and the same catalog.



“SAVE” a project

5.2.1.2 SAVE AS a project

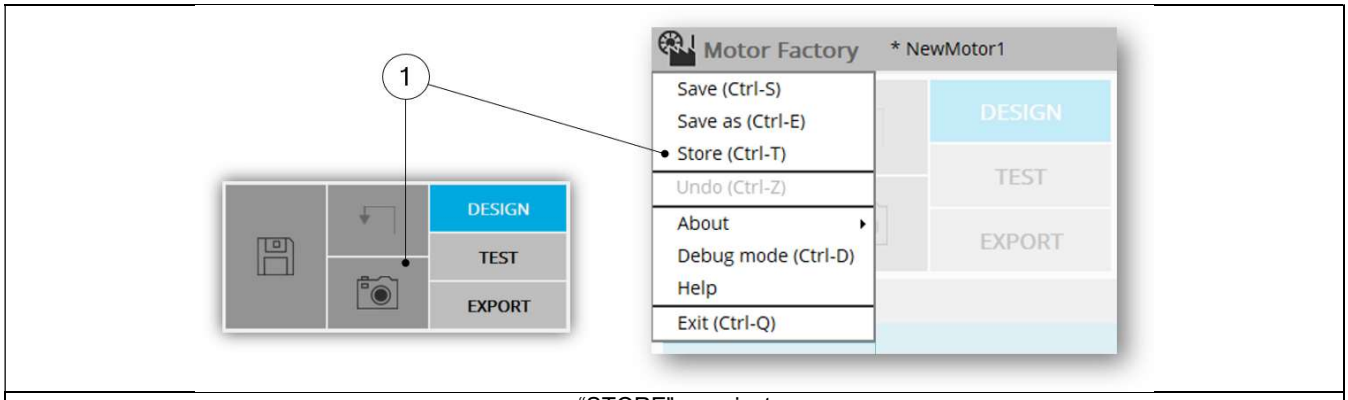
SAVE AS” a project is possible only via the top expanded menu.
“SAVE AS” a project allows to choose a new name for the project and save it in another catalog.
User must give a new name to the motor and select an existing catalog in which the motor will be stored.



1	Access to the top menu of Motor Factory to access the “SAVE AS” function.
2	Give a new name to the project.
3	Select an existing catalog in which the motor will be stored.

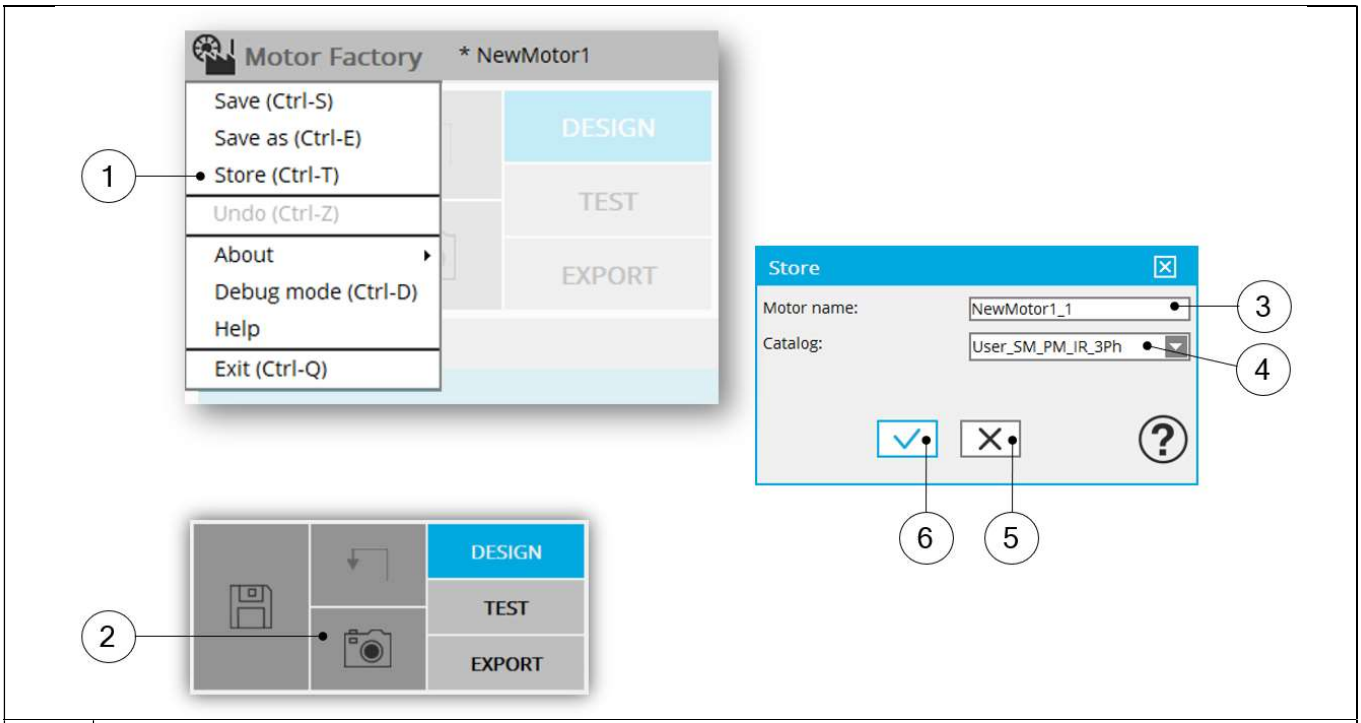
5.2.2 Store

“STORE” a project is possible directly from the top part of the Motor Factory (by using the camera) or via the top expanded menu.



“STORE” a project

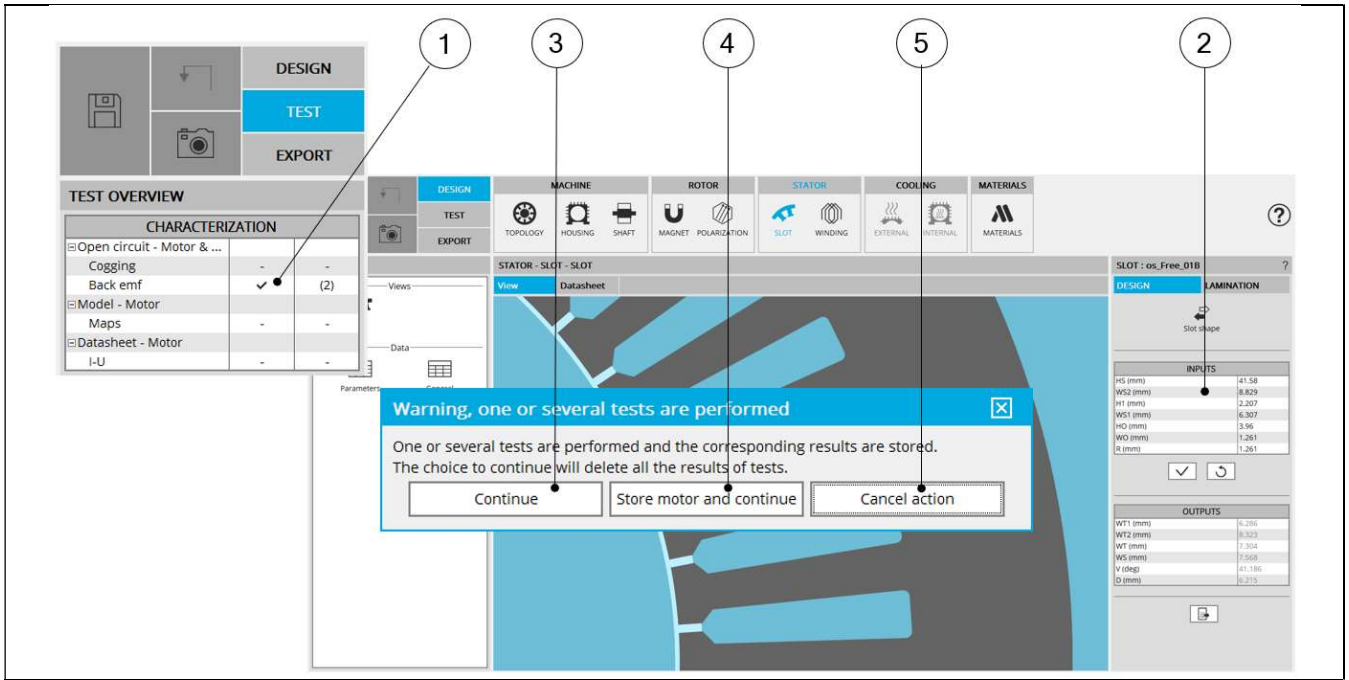
In any case, user must give a new name of the motor and select an existing catalog in which the motor will be stored.



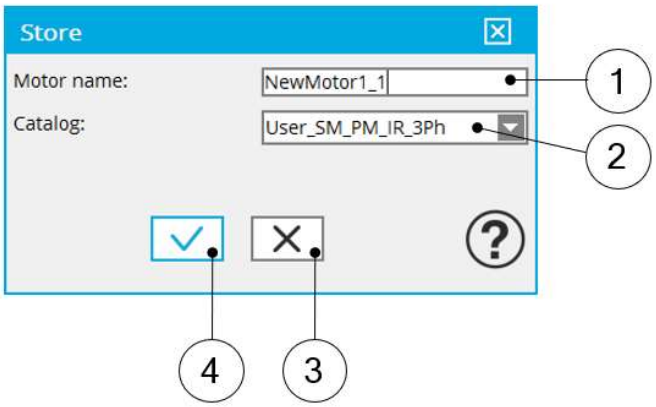
1	Access the top menu of Motor Factory to access the “STORE” function.
2	“STORE” the project by using the Camera located at top part of the Motor Factory.
3	Give a new name to the project.
4	Select an existing catalog in which the motor will be stored.
5	Button to cancel action and close the panel.
6	Button to apply inputs and close the panel.

5.2.3 Store and continue

The conditions to use this function are described below.



1	One or several tests are performed.
2	Modification in DESIGN dealing with dimensions topology etc
3	“**Continue**” removes test results and considers the new modification and keeps the current name of the project.
4	“**Store motor and continue**” allows the user to first store the current motor and then continue the design on the current motor. • The stored motor keeps the test results • The current motor loses the test results thus allowing the modification of the design parameters See the dialog box which allows the storage of the motor below.
5	“**Cancel action**” closes the dialog box. Previous modifications are cancelled.



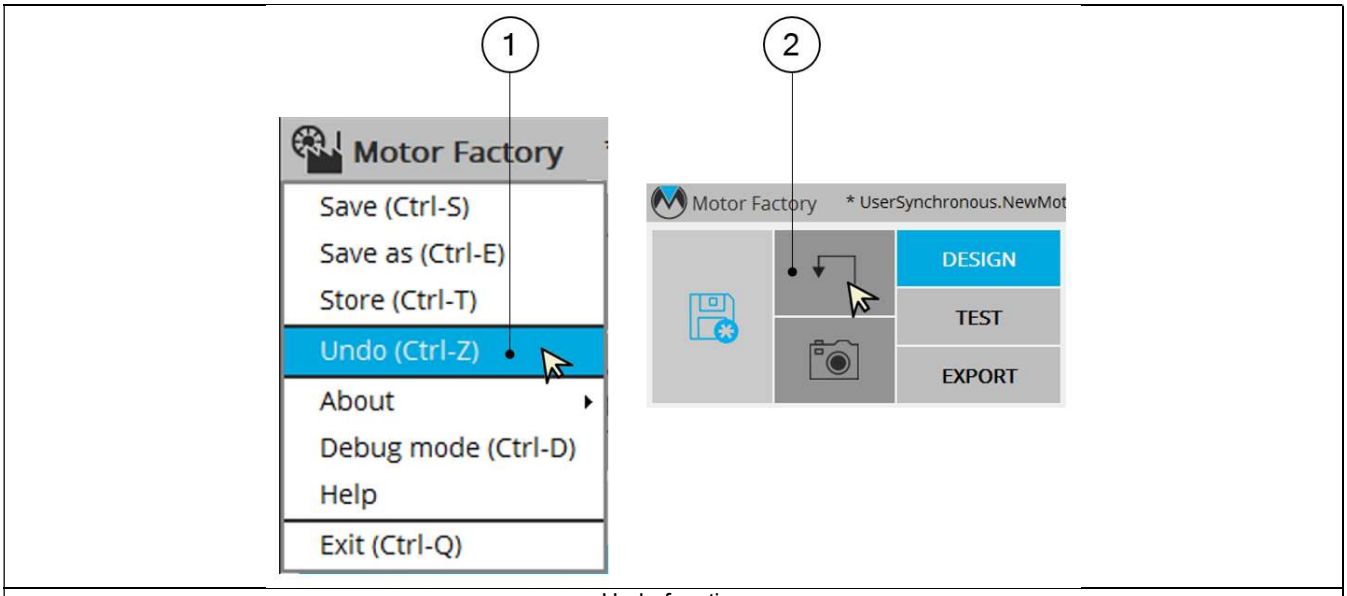
Dialog box allowing to store a motor

1	Give a new name to the project.
2	Select an existing catalog in which the motor will be stored.
3	Button to cancel action and close the panel.
4	Button to apply inputs and close the panel.

5.3 User actions

5.3.1 Undo

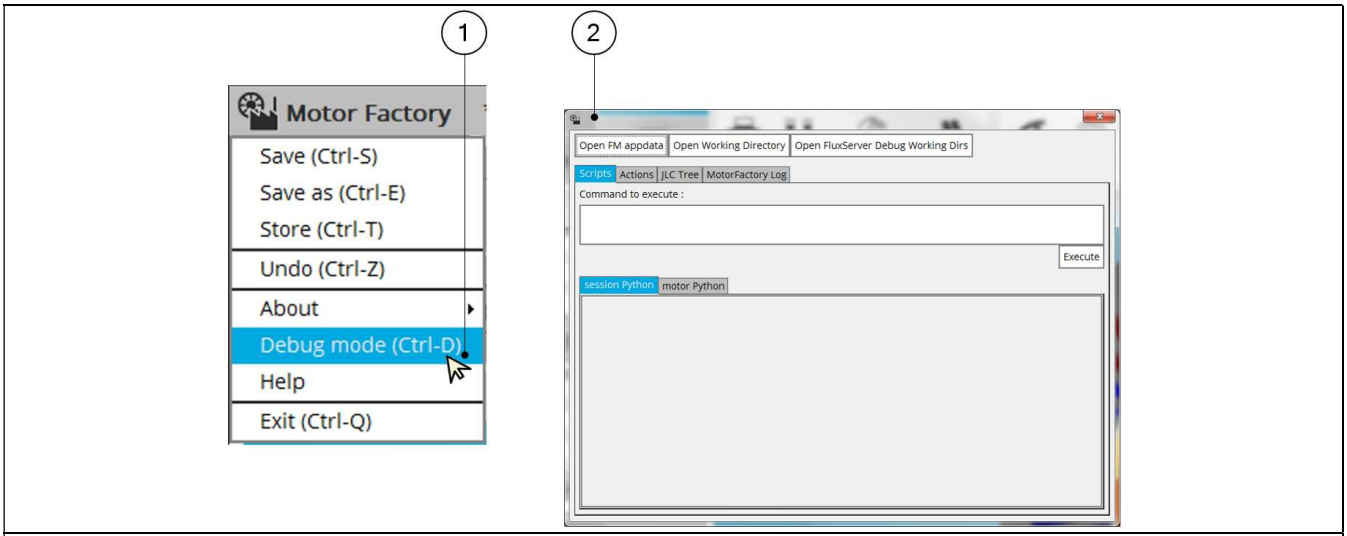
Undo function cancels the last action.
The three ways allowing to access the undo function are illustrated below.



Undo function	
1	Access from the top menu of Motor Factory.
2	Access by clicking on one of the three main buttons on the top left part of Motor Factory • Back arrow = Undo the last action
*	Access by using the shortcut CTRL-Z defined in the user preferences. For more information, refer to the chapter “user’s preferences”.

5.3.2 Debug mode function

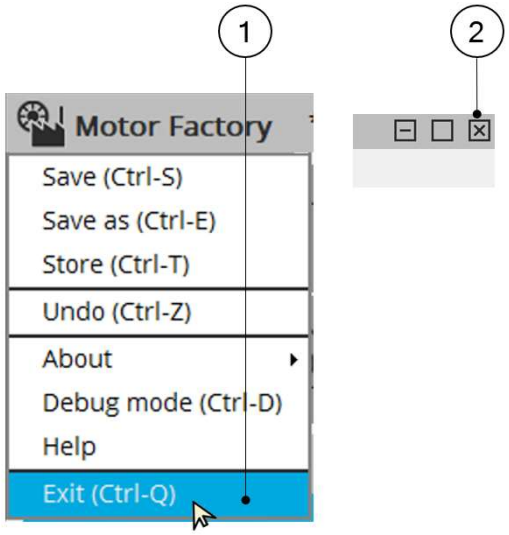
The Debug mode function is dedicated to solving of problem in the use of Motor Factory.
In case of trouble, instructions will be given by our support team to use this function.



Debug mode function	
1	Access to the “Debug mode” from the top menu of Motor Factory.
2	Dialog box corresponding to the “Debug mode” function.

5.3.3 Exit

Closing Motor Factory is possible

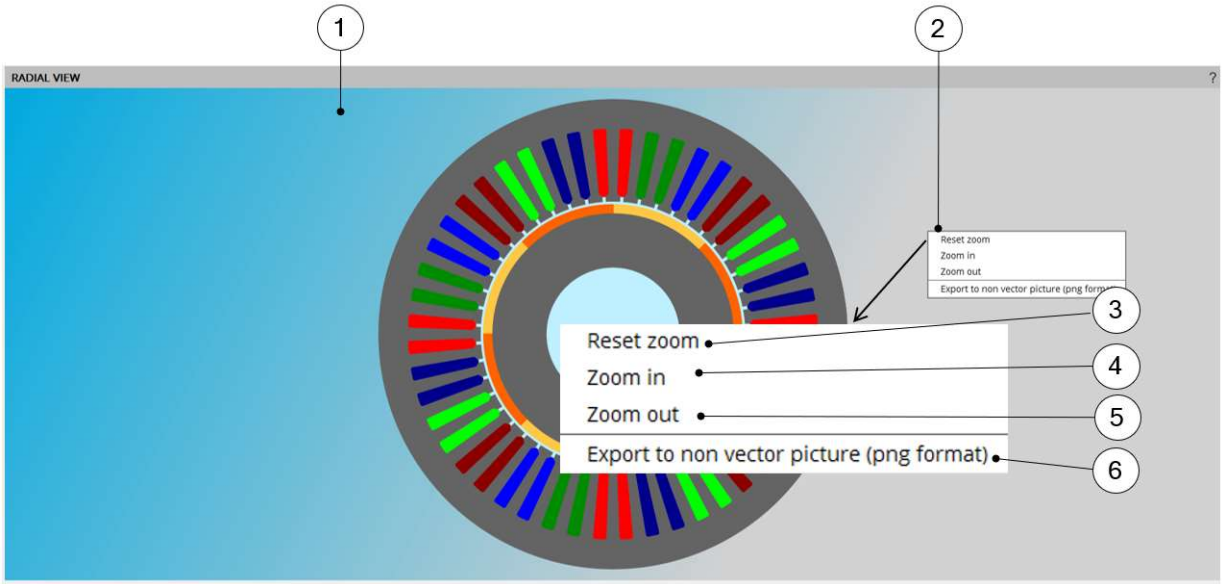


Exit – Close Motor Factory	
1	Close Motor Factory from the top menu of Motor Factory.
☒	Close Motor Factory by using the following icon on the right top part of the Motor Factory panel.
*	Close Motor Factory by using the shortcut CTRL-Q defined in the user preferences. For more information, refer to the chapter “user’s preferences”.

5.4 Graphic management

5.4.1 Overview

The graphic functions are available on every graphic area of the Motor Factory application.

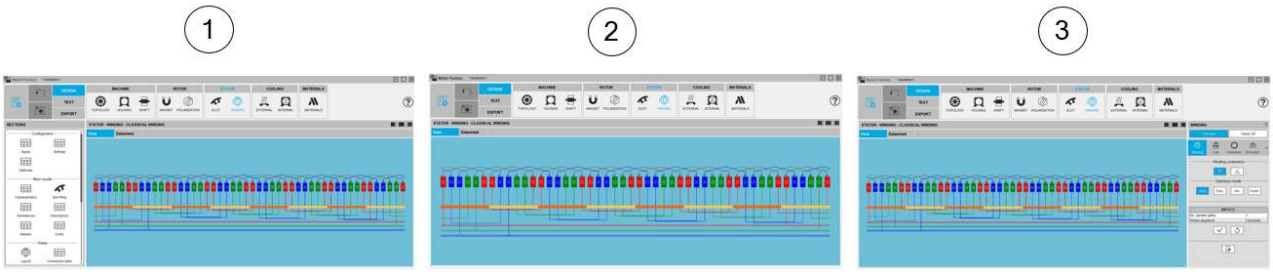


1	From the any graphic window it is possible to access the graphic functions by using the right mouse button.
2	A dialog box allows to choose among four functions: • Reset zoom • Zoom in • Zoom out • Export to non-vector picture
3	Reset zoom allows getting back the original size of the picture (i.e. without zooming). Reset zoom allows making the picture recover its original size.
4-5	Zoom in and zoom out are used for adjusting the size of the picture, step by step. Zoom in and zoom out can also be applied by using the scroll wheel on the mouse.
6	Export function to get a picture with .png format. The picture is captured by considering its original size (i.e. without zooming).

5.4.2 Management of panels in Motor Factory

When the computer screen is too small or when the resolution of the screen is too low, three buttons appear on the top part of Motor Factory panels.
They allow to remove or to display the right and/or left panels of the screen. See illustrations below.

Dedicated buttons allow the management of panels in Motor Factory	
1	Three buttons are available to manage the displaying of panels in Motor Factory.
2	Button to hide right side and/or left side or both sides.
3	Button to display right side and/or left side or both sides.

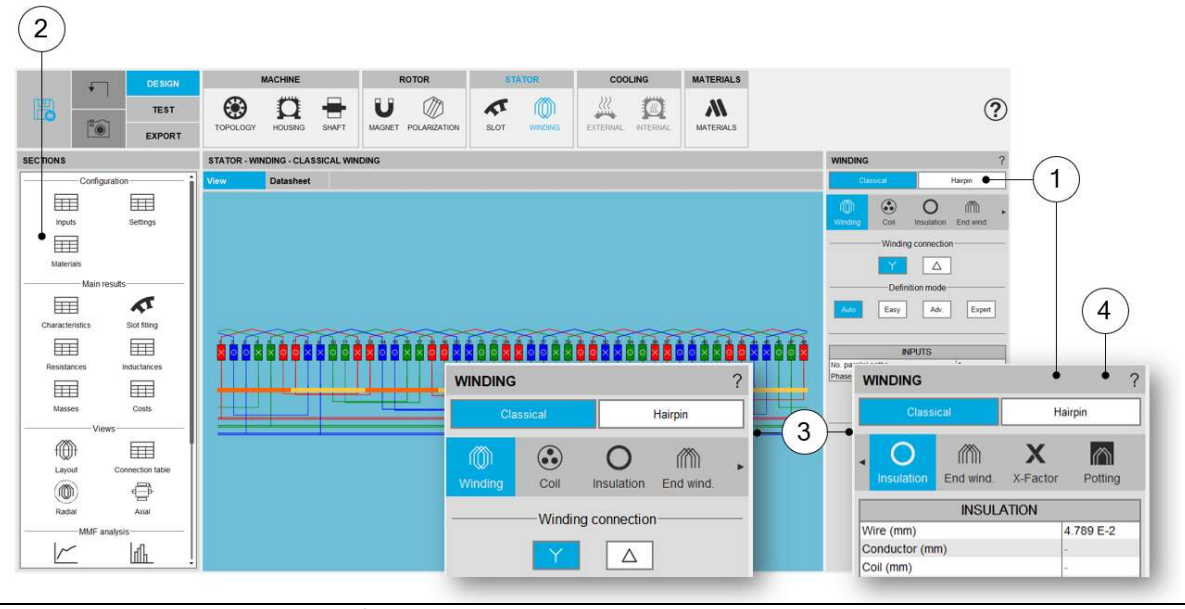


Different ways to display (or remove) the panels in Motor Factory	
1	Right side removed and left side displayed.
2	Both sides (right and left) removed.
3	Right side displayed and left side removed.

5.5 Selection modes in GUI

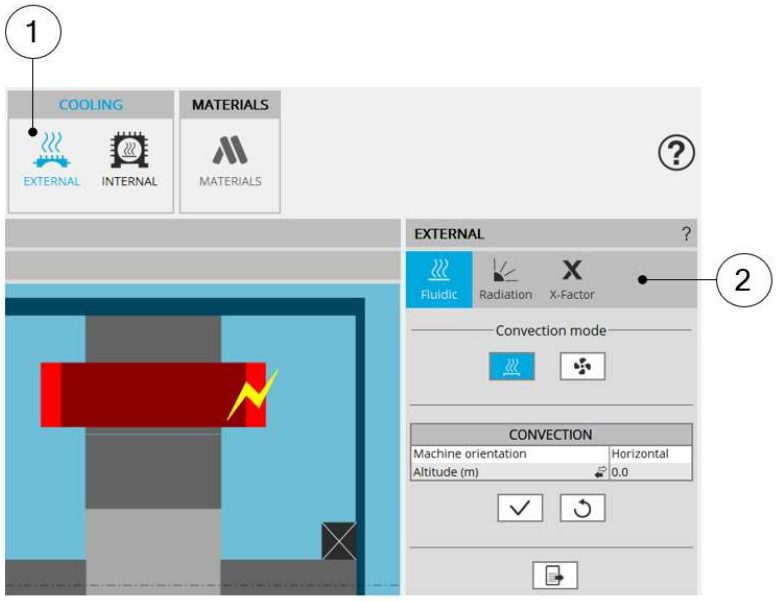
5.5.1 Section selection mode

The process for choosing the section in which user inputs are defined is implemented in the winding area as illustrated below

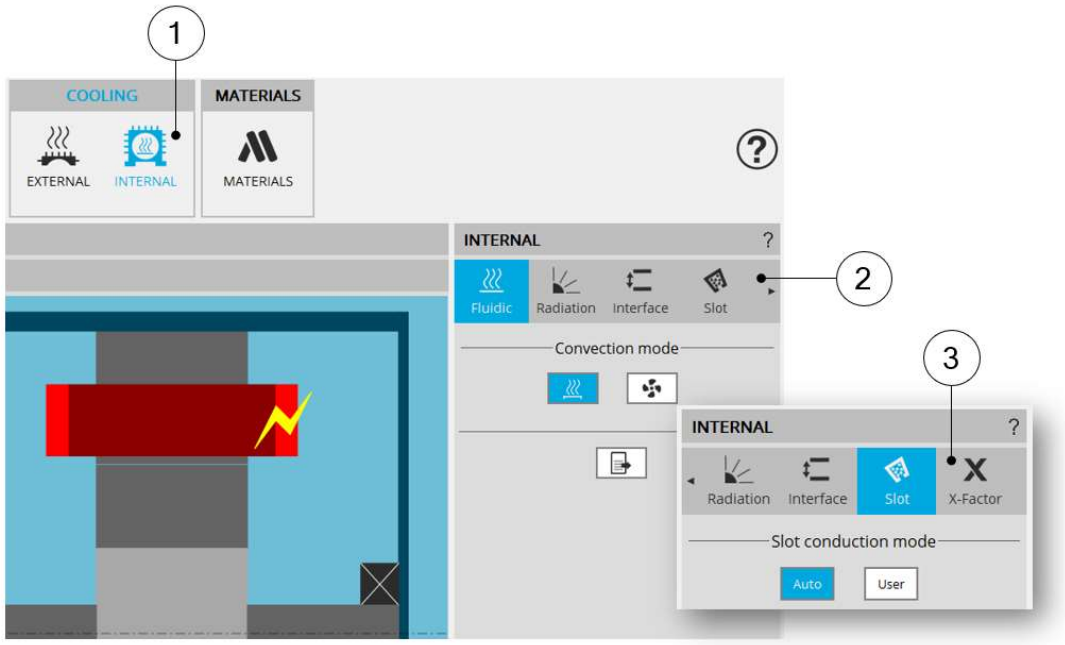


Scrolling selection bar – Winding environment	
1	Scrolling selection bar where Winding, Coil, End-winding, X-Factor and Potting sections can be selected.
2	Section data can be reached thanks to shortcuts.
3	Arrow allows to scroll the bar to reach other sections (on the right or the left) when needed.
4	The bar slides on the right to allow reaching Potting section.

Note: This new way of selection has been implemented in the design environment of Motor Factory for external and internal cooling as illustrated bellow.



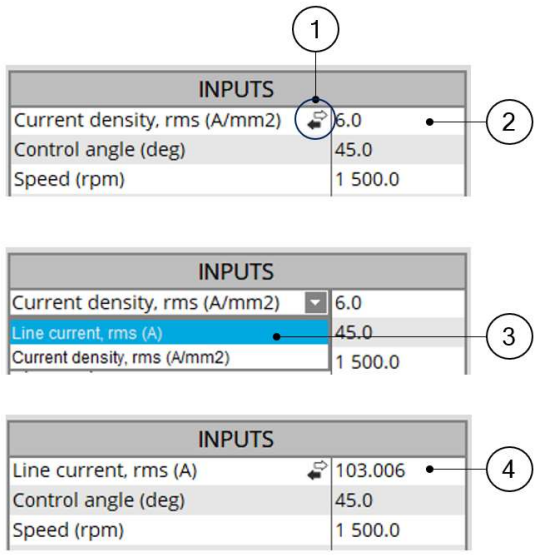
Scrolling selection bar – External cooling area	
1	External cooling area of Motor Factory design environment.
2	Scrolling selection bar where Fluidic, Radiation, X-Factor sections can be selected. In that case, all the sections can be reached without sliding the bar.



Scrolling selection bar – Internal cooling area	
1	Internal cooling area of Motor Factory design environment.
2	Scrolling selection bar where Fluidic, Radiation, Interface, Slot sections can be selected.
3	The bar slides on the right to allow reaching X-Factor section.

5.5.2 Multiple choices for inputs

A process allowing Multiple choices for selecting the type of user's inputs has been implemented. This allows giving users several choices within only one input line. Please see the below example showing the different ways to define the electrical current in conductors.

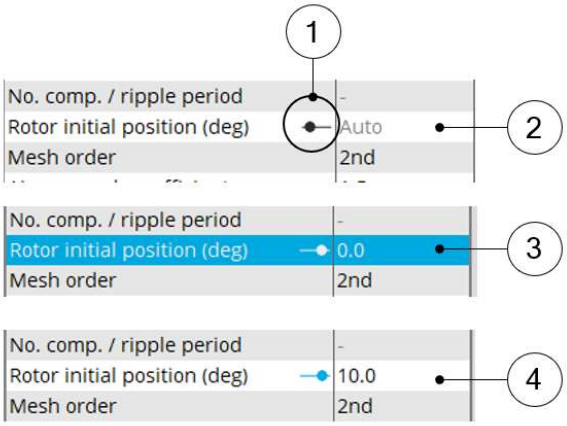


Scrolling selection bar – External cooling area	
1	Icon allowing to give multiple choices to the users.
2	First choice = Current density (A/mm²).
3	In that case two choices are possible: either the current density or the line current. Whatever is the choice the units and the corresponding data are updated.
4	Second choice = Line current, rms (A).

5.5.3 Auto/User mode switch

A process allowing to switch between two types of answer (Auto or user for example) has been implemented.

For example, when the “Rotor initial position mode” is set to “Auto”, the initial position of the rotor is automatically defined by an internal process of FluxMotor®.
When the “Rotor initial position” is set to “User input” (i.e. toggle button on the right), the initial position of the rotor to be considered for computation must be set by the user in the field « Rotor initial position ».

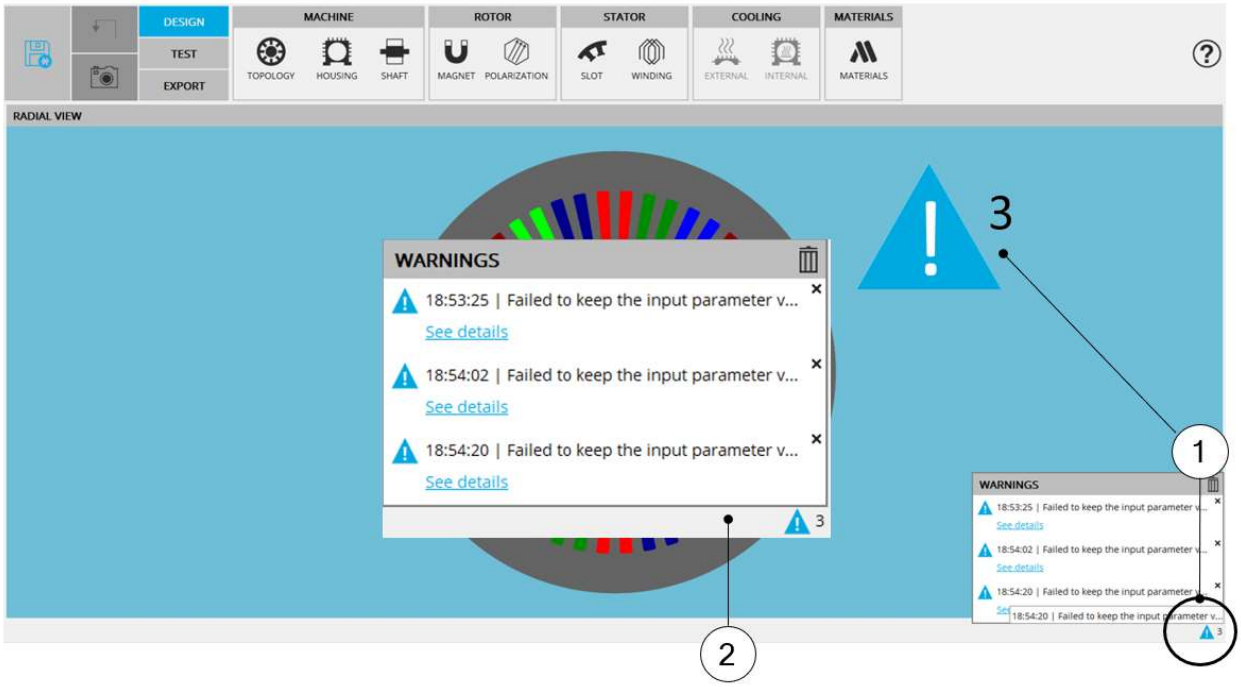


Auto/User mode switch – Example of application	
1	Icon allowing to switch between two types of answer.
2	First position: automatic mode
3	Second position - toggle button on the right – One can write a data in the field
4	The toggle button is blue, the data is taken into account.

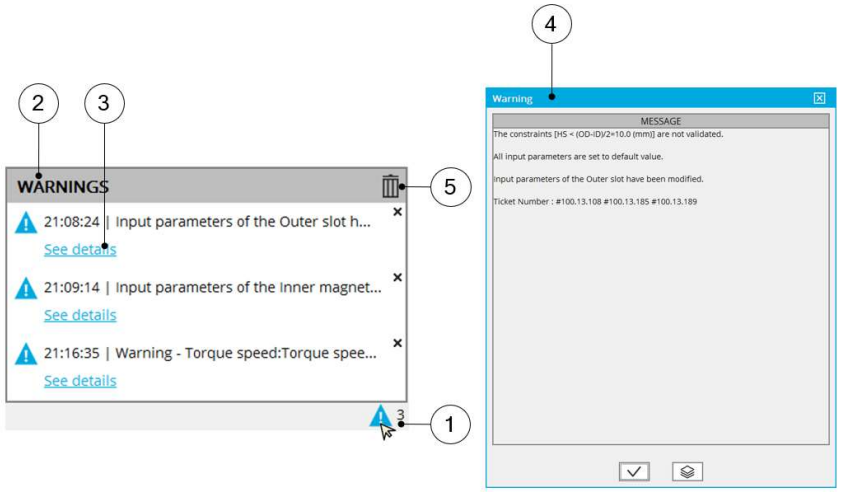
5.6 Warning messages

5.6.1 Standard warnings

In the DESIGN, TEST or EXPORT area of Motor Factory, warning messages can be issued.
They are stored on the right bottom part of the screen.



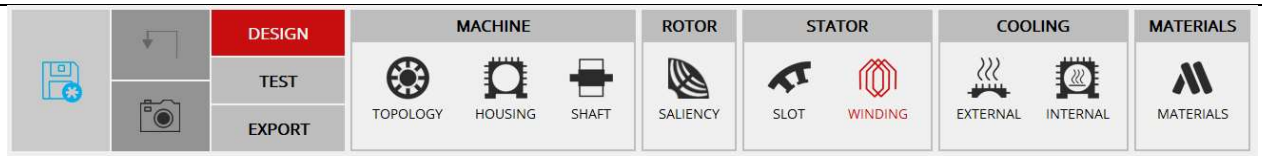
1	Location of the warning messages. The number (3 in the example) indicates the number of warning messages to read.
2	When the test is running or when designing a machine, messages can appear on the screen to notify user about some warnings to check.



1	Click on the warning message icon to open the corresponding dialog box.
2	Dialog box dedicated to display warning messages.
3	Each warning message can be visualized by clicking on: “see details”.
4	Clicking on “See details” allows to read the warning message.
5	All the warning messages can be removed from the list by clicking on the bin icon.

5.6.2 Case of a design fault

Motor Factory Design environment button and winding icon in the Stator section can be colored in red. This meaning that a design fault must be corrected in the winding section of the design environment.



Motor Factory Design environment button and the winding icon in the Stator section are colored in red.
= a design fault must be corrected

Therefore, the tests cannot be performed; the tooltip message indicates that the slot filling is not valid, and the user must modify the slot filling parameters to unlock the test.

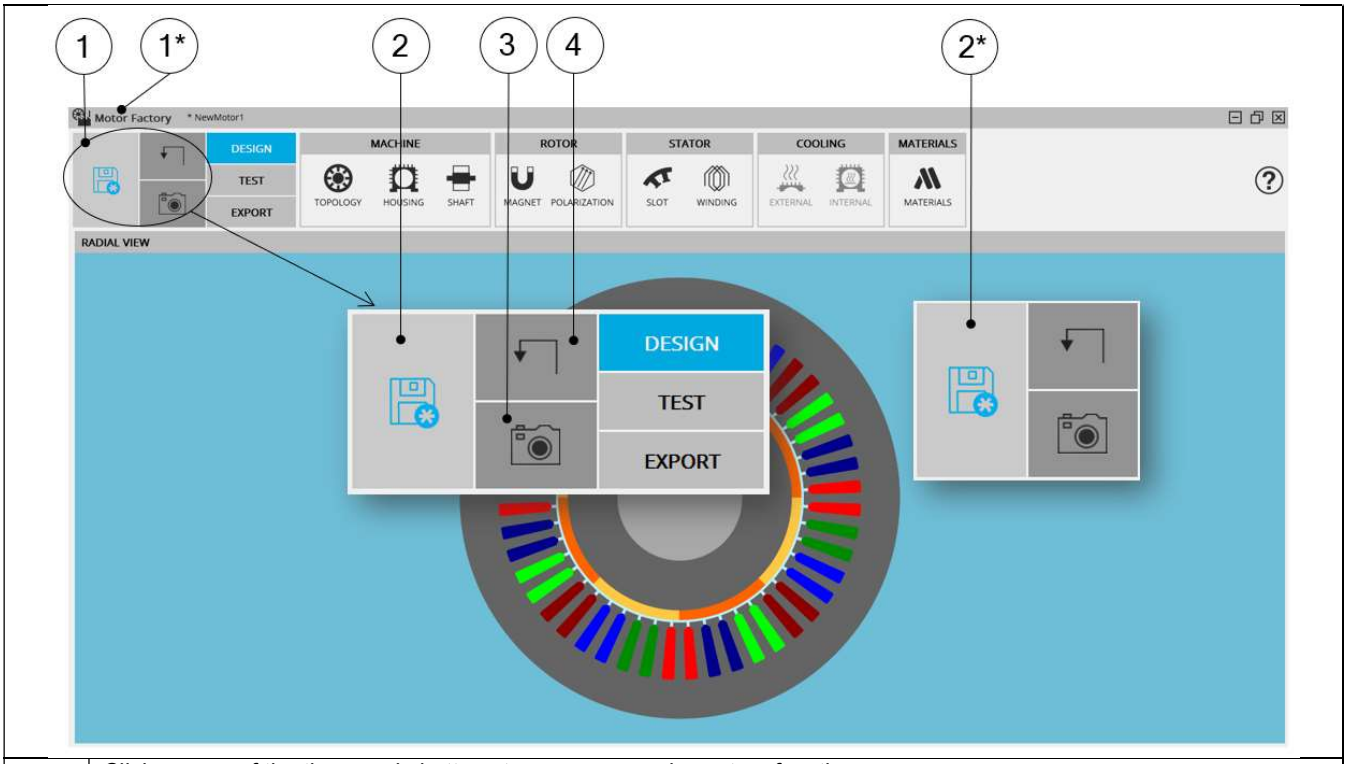
At the same time, a warning message indicates that there is not enough space for the specified number of wires. The allowed number of wires is mentioned in comparison with the targeted ones.

The tests cannot be performed

5.7 System functions

5.7.1 Direct access to some system functions

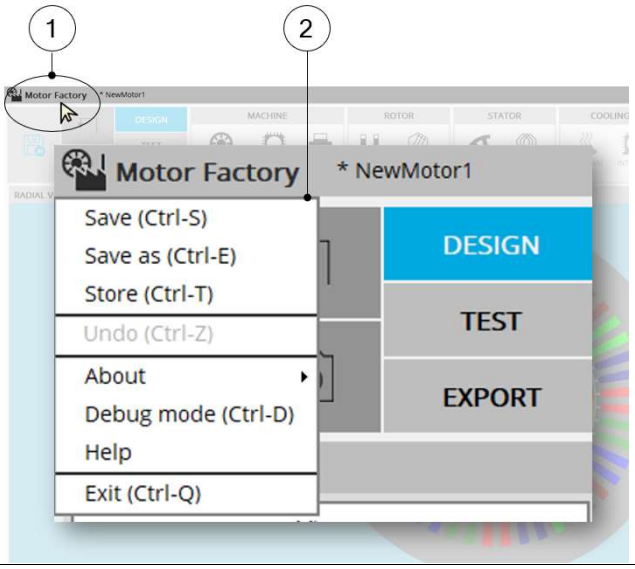
All the functions listed below are described in the section dedicated to system functions.



1	Click on one of the three main buttons to use some main system functions. • Disk = Save motor changes • Camera = Store motor • Back arrow = Undo action Note: These three functions are available in the DESIGN and TEST area. In the EXPORT area, Undo action is not available (See “expanding the menu in Motor Factory”).
1*	Clicking on this zone allows access to the main menu.
2	Save motor changes: to save the current project, by keeping the same name of the motor which remains in the catalog.
2*	A new button to save motor changes appears when any modifications are done in the description of the motor inside Motor Factory.
3	Store motor by using the camera button. Store a motor means that a copy of the current motor is stored in a catalog using a new name. User must give a new name of the motor and select an existing catalog in which the motor will be stored. Note: This command allows user to continue working on the current motor. “Store” can also be selected from the main menu (ref. 1* - See “expanding the menu in Motor Factory”).
4	Undo action, to cancel the previous actions.

5.7.2 Expanding the menu in Motor Factory

This menu gives access to some system functions.
All the functions listed below are described in the section dedicated to system functions.

<table>
<tr><td colspan="2"> 
</td></tr>
<tr><td>1</td><td>Expand the menu in the left top part of Motor Factory – can be used from all the DESIGN, TEST and EXPORT area.</td></tr>
<tr><td>2</td><td>List of actions available:
• Save
• Save as
• Store
• Undo

• About
• Debug mode
• Help

• Exit

All these functions are described in the dedicated section: System functions</td></tr>
</table>