



# COMPOSING SYSTEM MODELS

Lecture 1.1

*Modelon*

# OVERVIEW

✓ How to launch/access Modelon Impact

✓ UI features of Modelon Impact

✓ Composing a system model

✓ Setting parameters

✓ Getting results

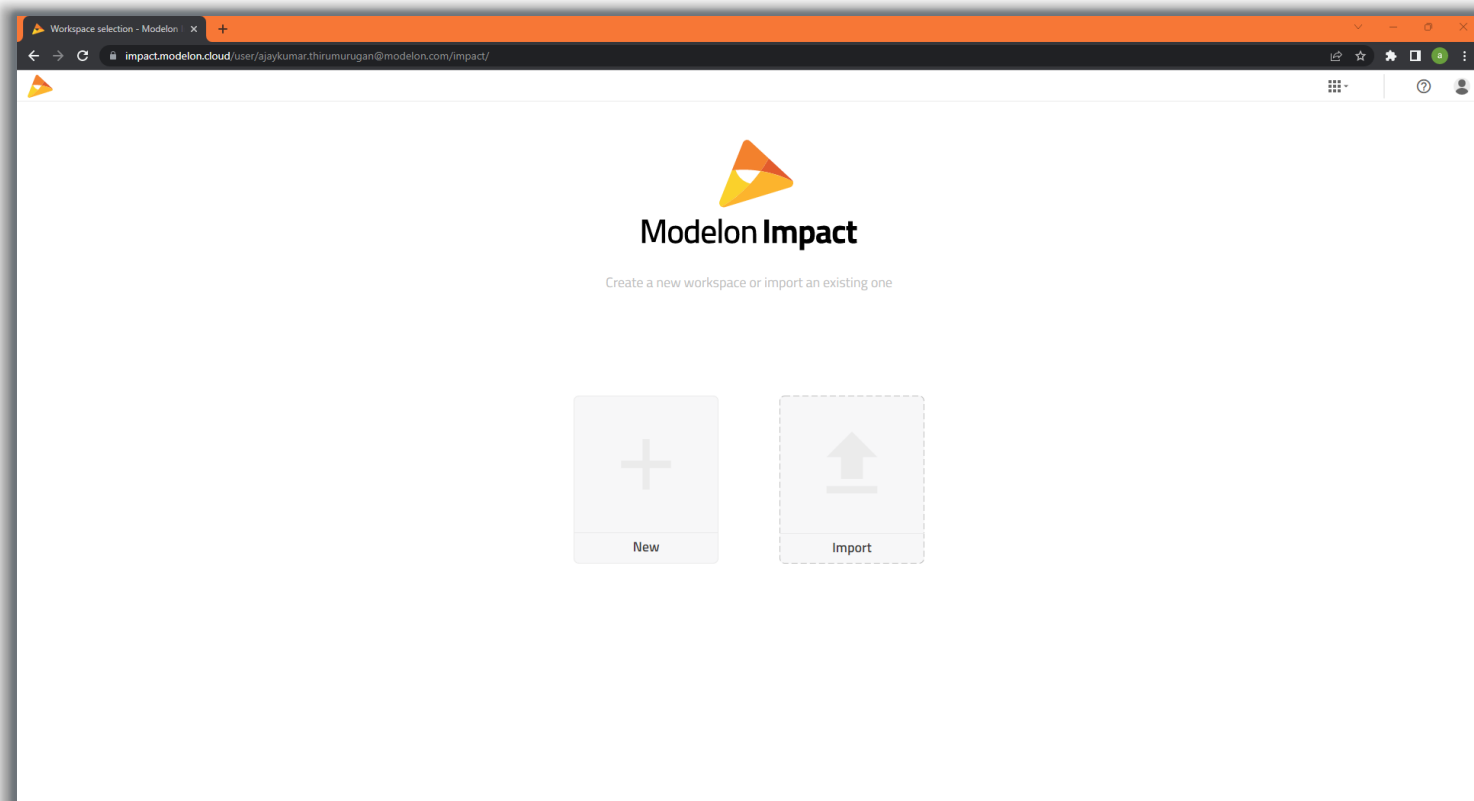
✓ Help and documentation



# STARTING MODELON IMPACT

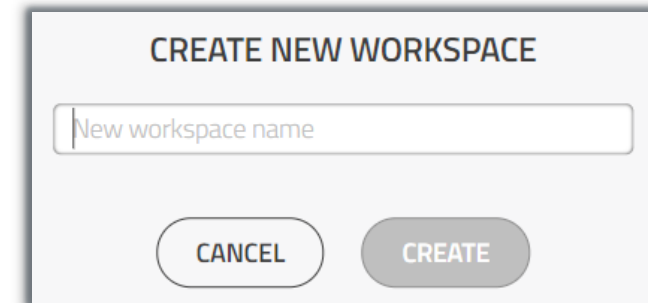
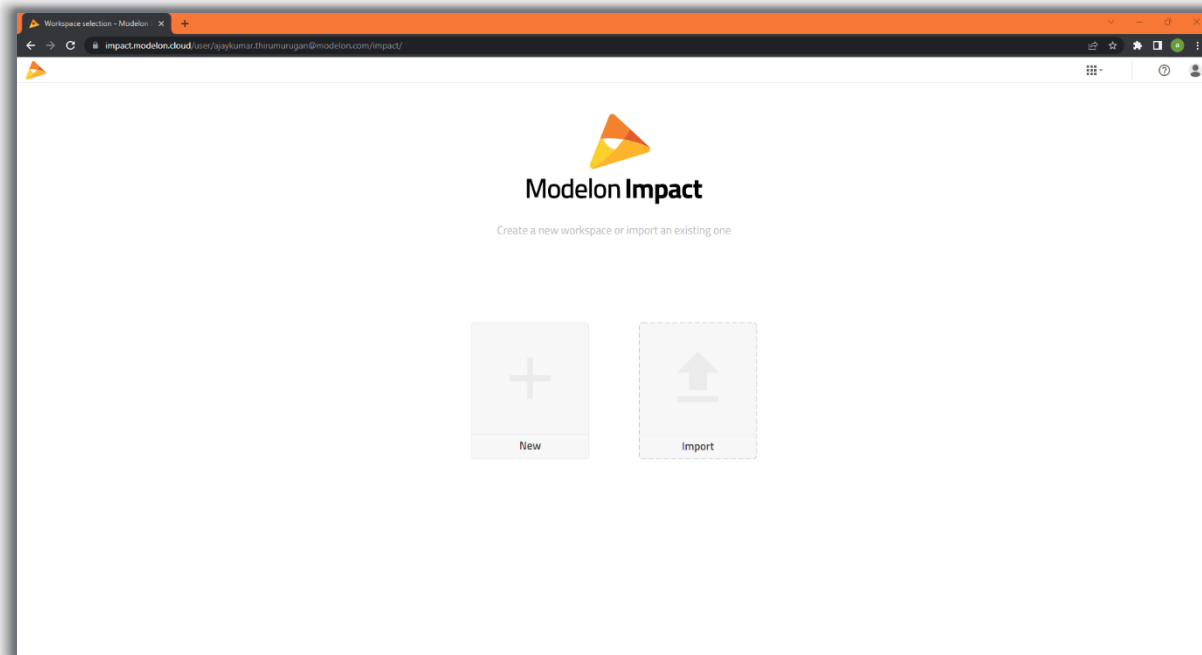
# STARTING IMPACT

- Cloud version:
  - Open Chrome and browse to the URL shared with you
  - Example: <https://impactdemo.modelon.com>



# LANDING PAGE

- To create a new workspace, select **New** on the landing page, then give a suitable name to the workspace
- You can also Import an existing workspace by clicking **Import**

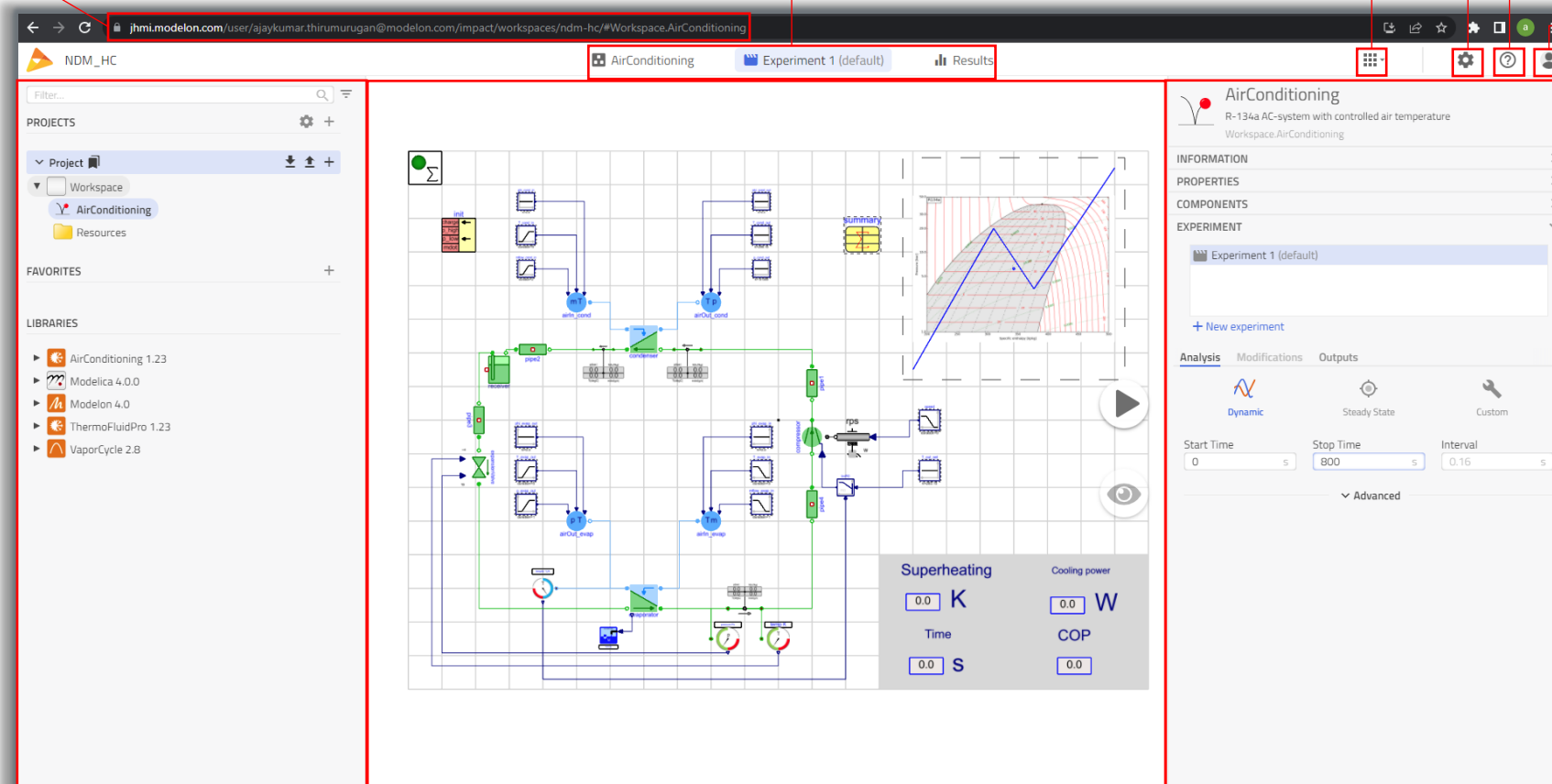




# MODELON IMPACT GUI

# GUI OVERVIEW

Impact URL



Modes

Apps

Settings

User support

Log out\*\*

Details Panel\*

Workspace Panel\*

Model Canvas

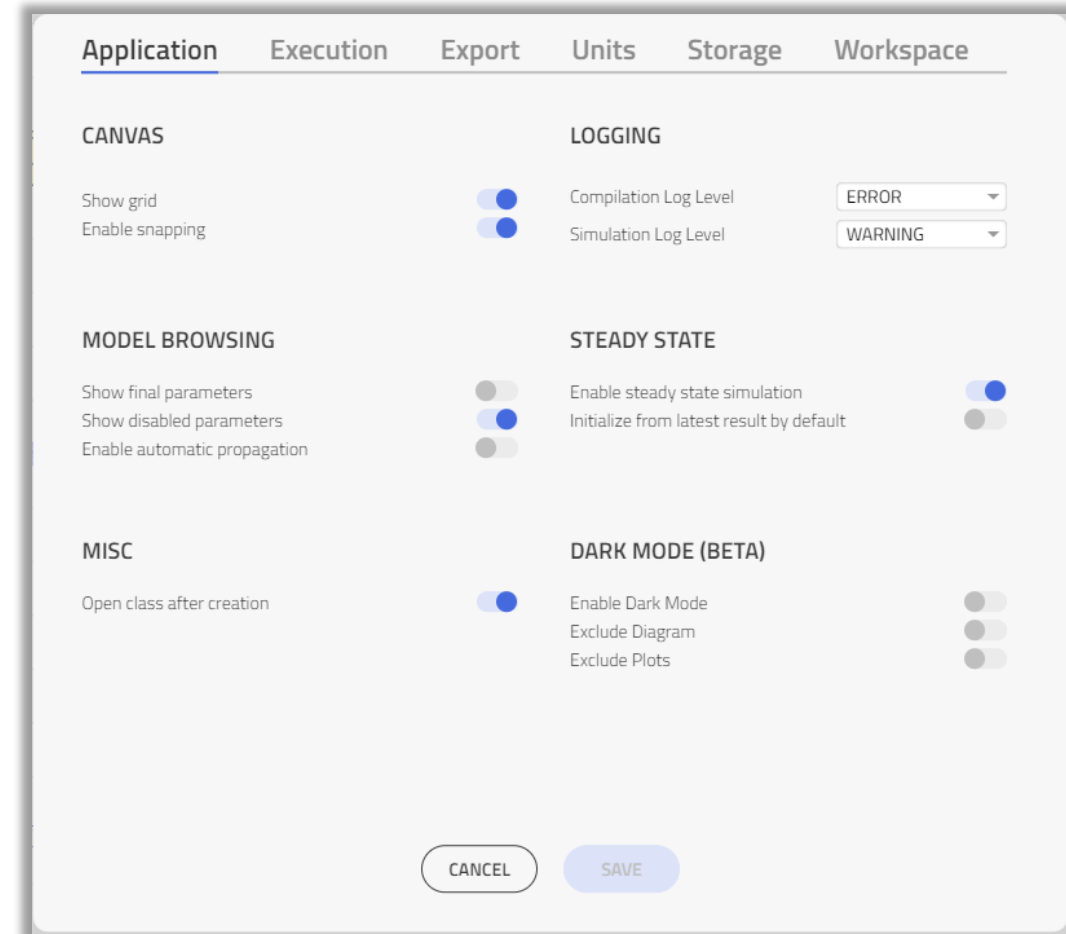
\*Can be hidden.



# SETTINGS

Tool settings available from the UI include:

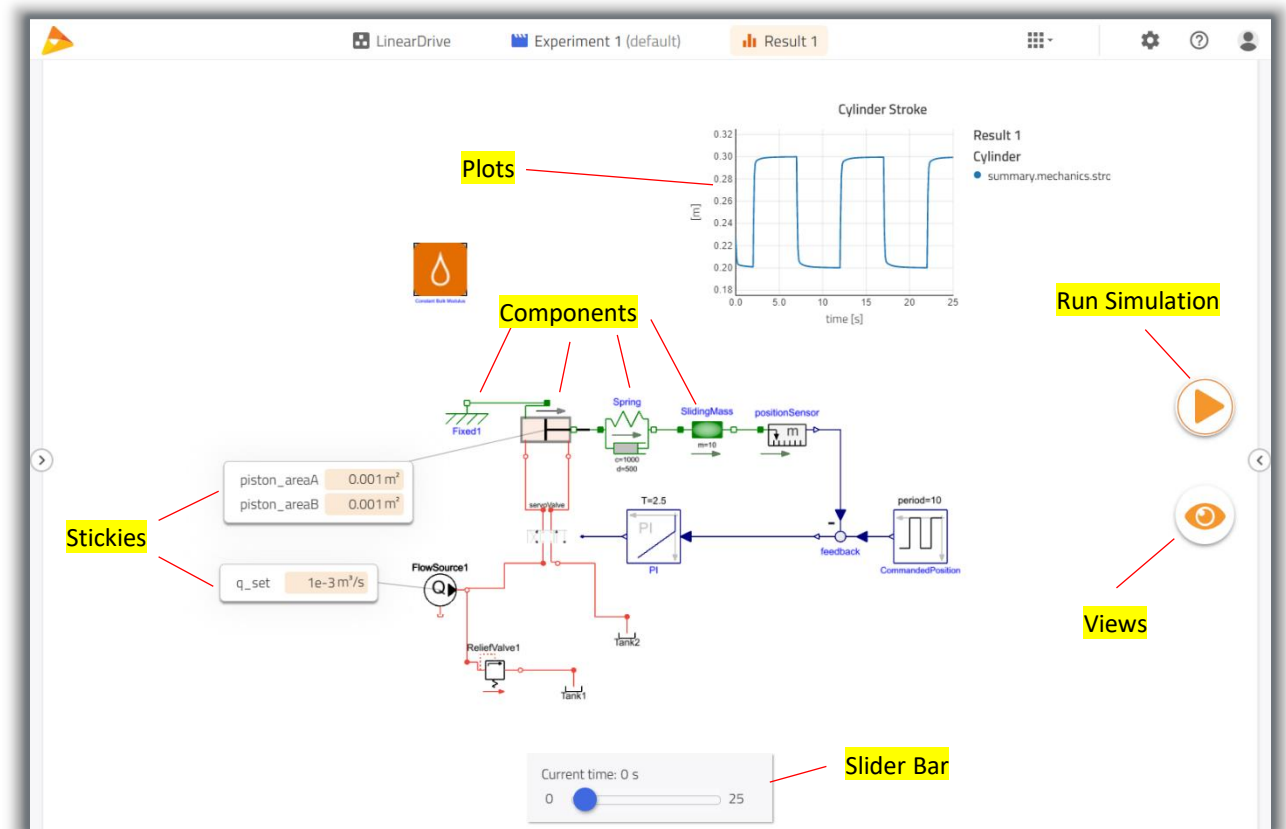
- Application Settings:
  - Controls Impact behavior
  - Set log levels, enable experimental UI features etc.
- Execution Settings
  - Set compiler, simulation, solver and runtime settings
- Export Settings
  - Control FMU export settings
- Units
  - Toggle between SI/Imperial display units
  - Control rounding of results
- Storage
  - Free up more space by deleting experiment results
- Workspace
  - Deleting all contents of workspace





# MODEL CANVAS

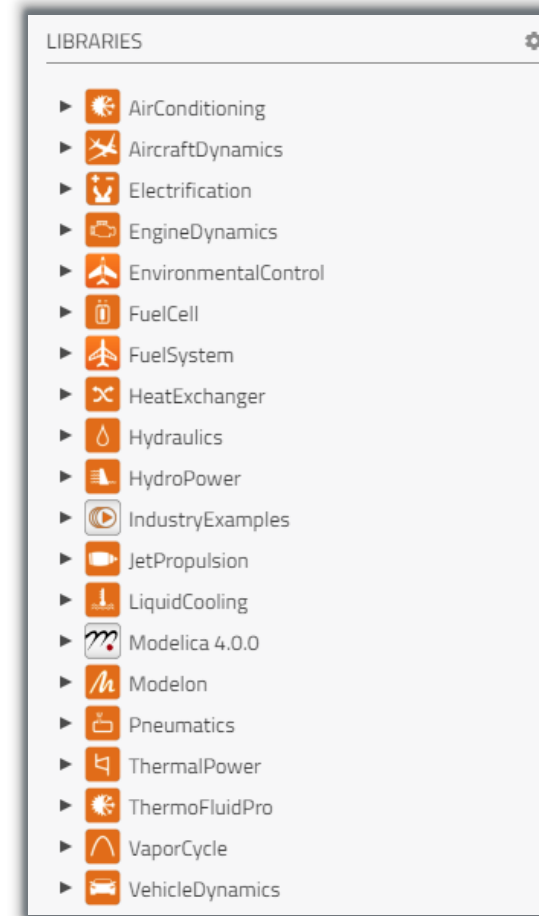
- Drag & Drop modeling
- Common editing and viewing operations:
  - Copy/Paste
  - Undo/Redo
  - Resize
  - Pan/Zoom
- Serves as backdrop both during Modeling phase and Analysis phase
  - Model diagram
  - Plots and stickies



# LIBRARY BROWSER

## GLOBAL LIBRARIES

- Libraries available to all Projects
- Not editable
- Classes from global libraries can be duplicated/copied into workspace for experimenting (or a local library)



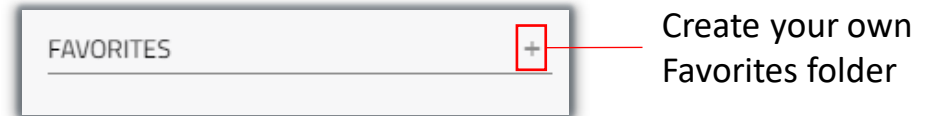
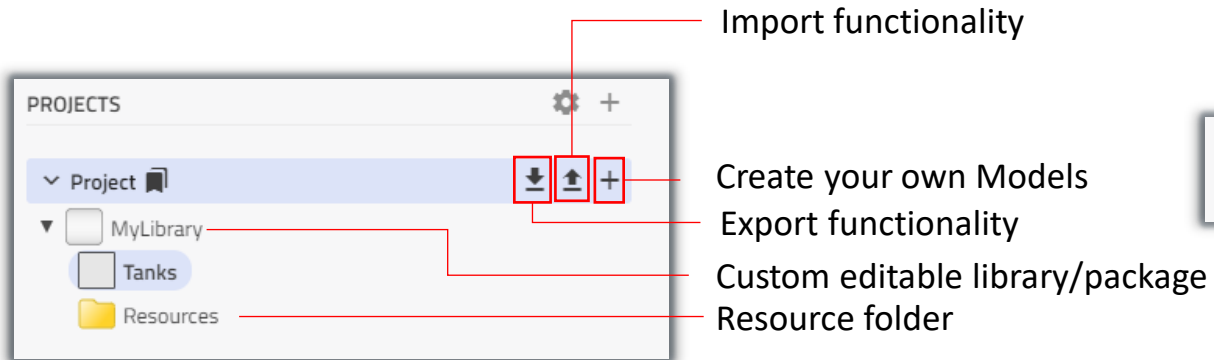
# LIBRARY BROWSER

## WORKSPACE

- Create a project/use default project
- Where you create your own packages

## FAVORITES

- Shortcuts to frequently used models

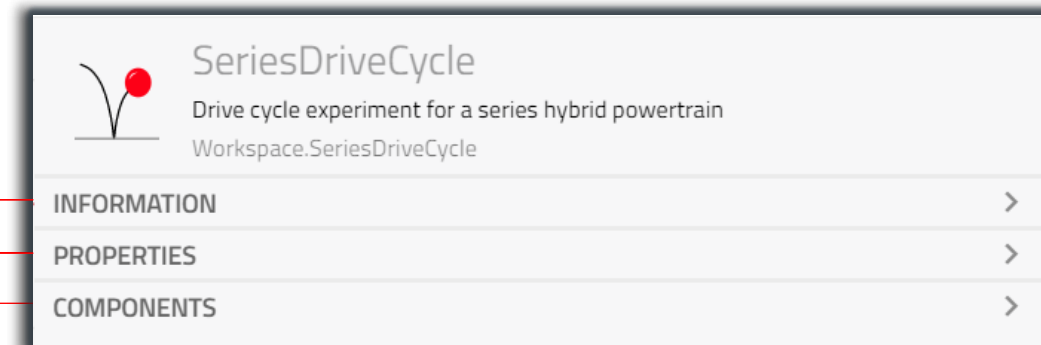


# MODES IN IMPACT

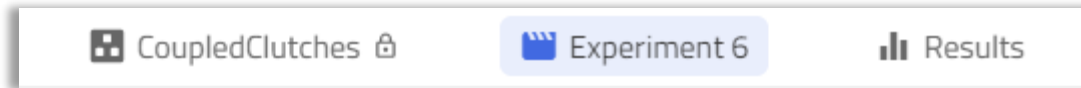


## Modeling Mode

- This mode is used to Create, Edit and Parametrize a model
- Any model edit is automatically saved
- It enables a user to:
  - View the documentation
  - Parameterize components
  - Inspect components in canvas

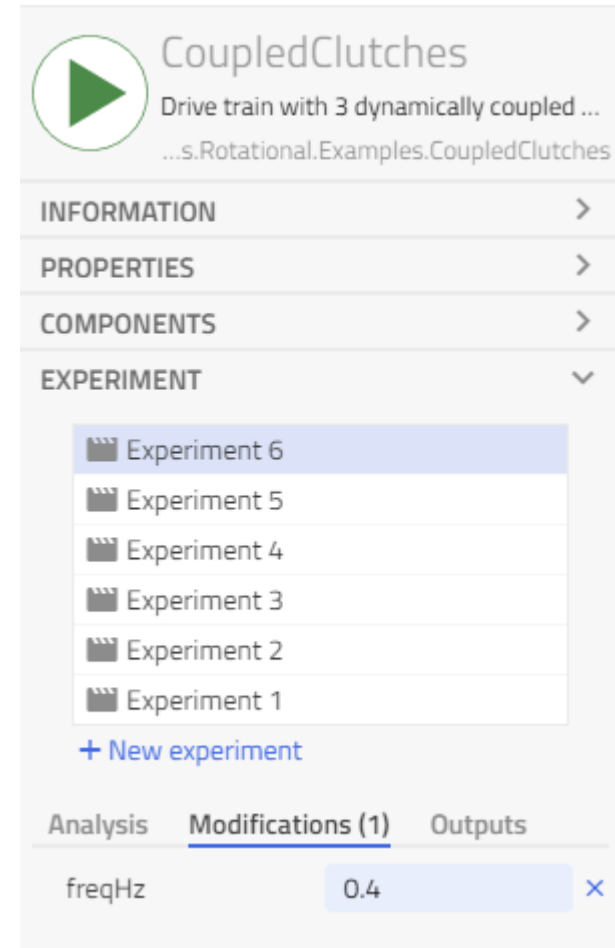


# MODES IN IMPACT



## Experimentation Mode

- This mode is used for experimentation and gives the additional option:
  - **Experiment** – To manage multiple experiment setups for a model. Contains further options like:
    - **Analysis** – To customize the simulation *Start Time*, *Stop Time* and some Advanced simulation settings like solver and tolerance
    - **Modifications** – To configure experimental modifiers for parameters
    - **Outputs** – To apply filters to simulation output

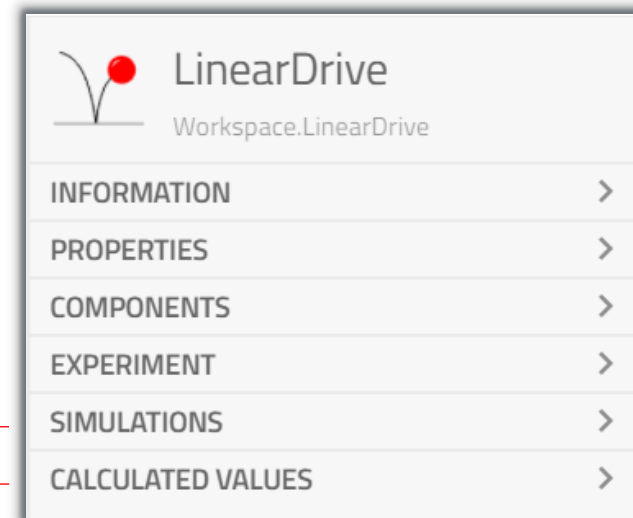


# MODES IN IMPACT



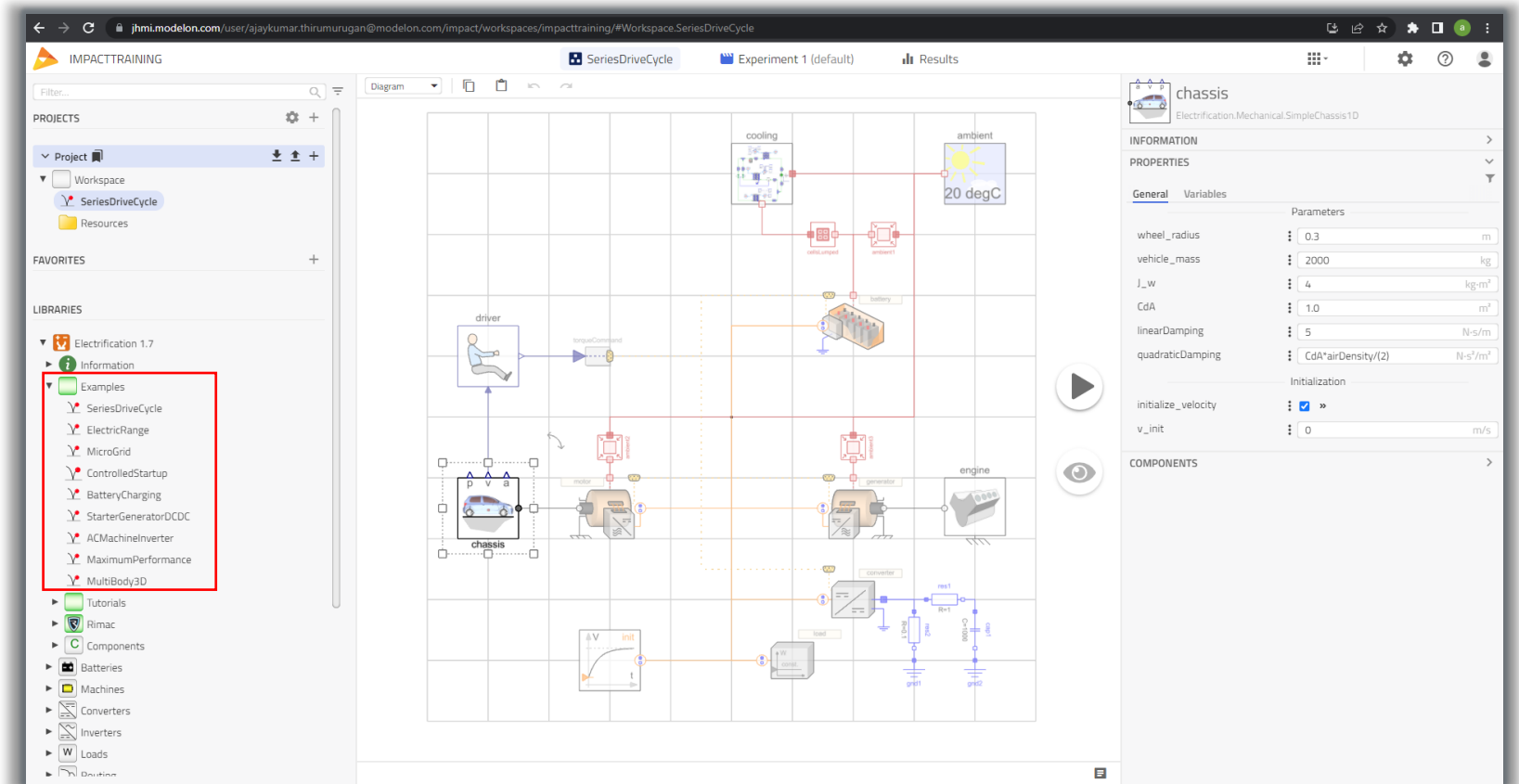
## Result Mode

- This mode is used for visualization of results and gives additional options like:
  - **Simulations** – To manage results from multiple experiments
  - **Calculated Values** – To plot/view the results obtained



# OPEN A MODEL

- Models are generally opened from the Library Browser
  - Double-click on a model to open it in the model canvas
- Also, possible to open a models with a link (URL)
- Executable experiments are often marked with this icon:





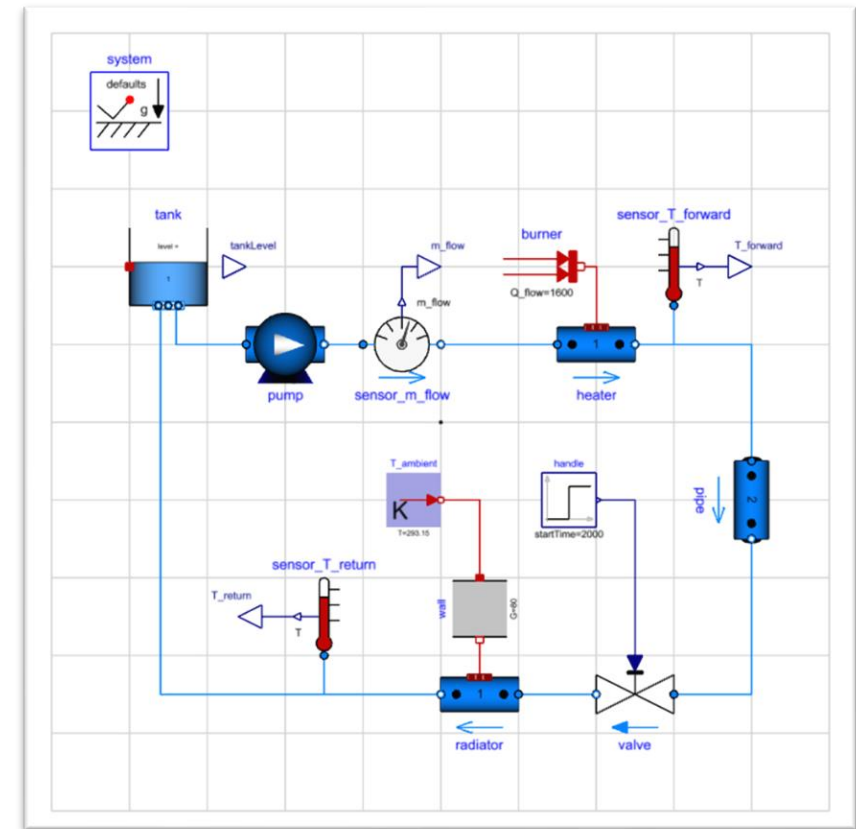
# COMPOSING A SYSTEM MODEL



# COMPOSE A NEW SYSTEM MODEL

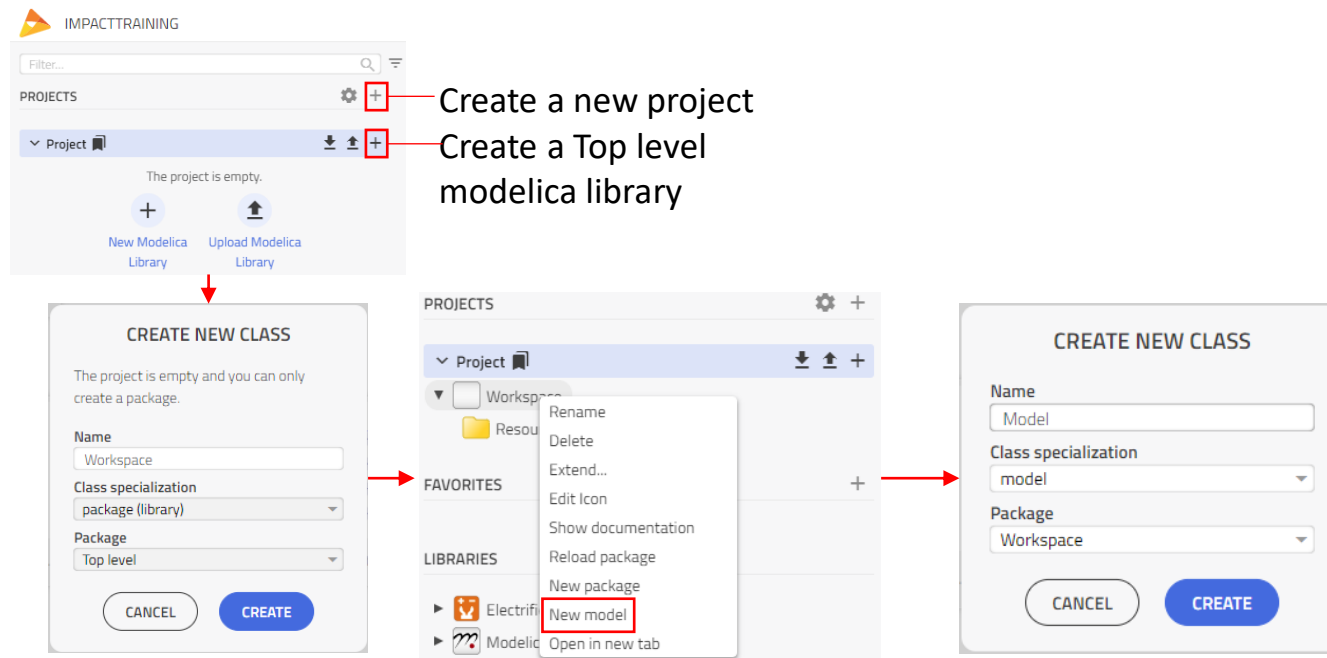
The following steps are typical basic steps to get started with a system model:

- Create a new empty model
- Drag and drop all components needed
- Connect them
- Set parameter values
- Simulate and analyse results



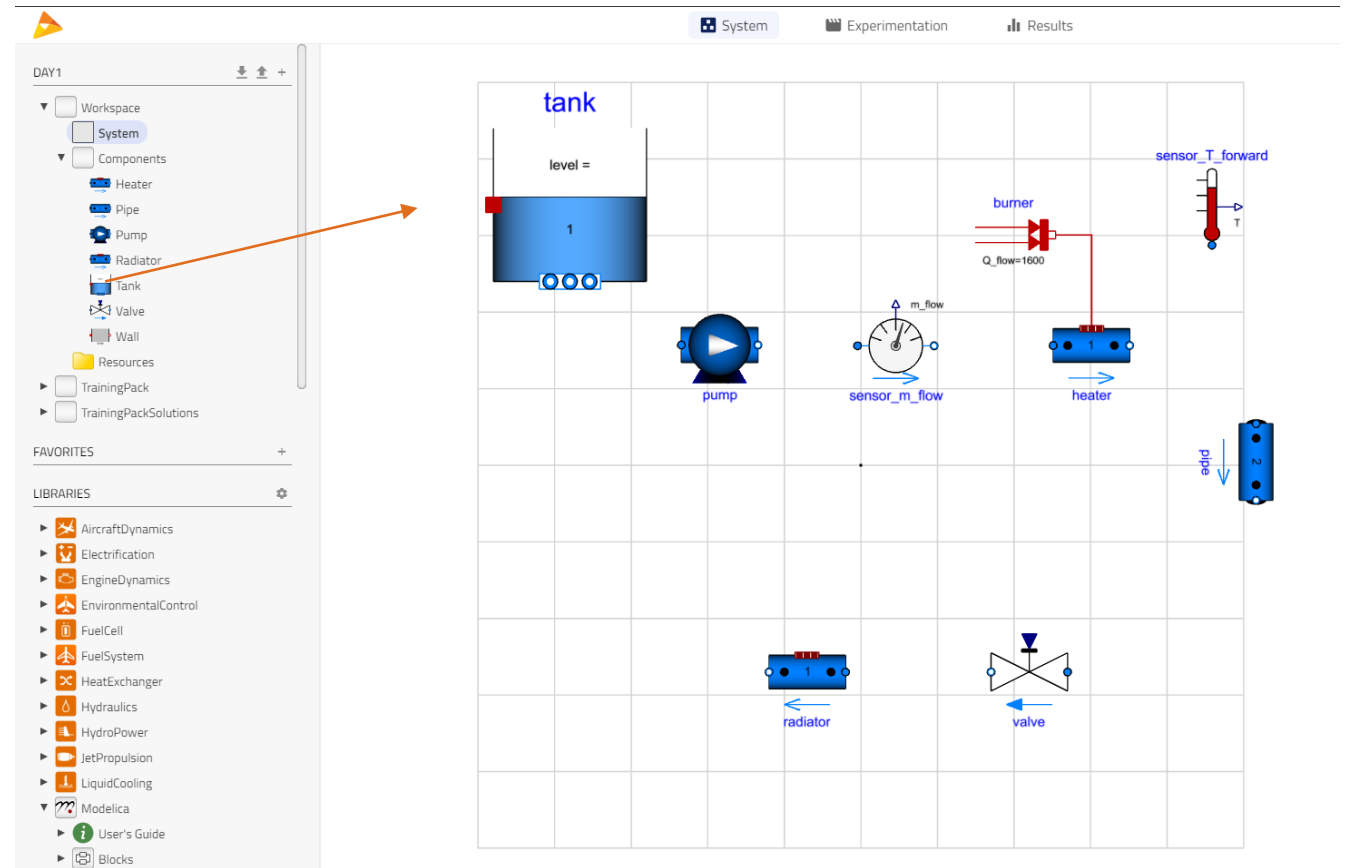
# CREATE A NEW MODEL

- Use default project/create a new project
- New top level “Modelica Library” can be created from create new class icon
- A new model can be created from the library browser or from create new class icon



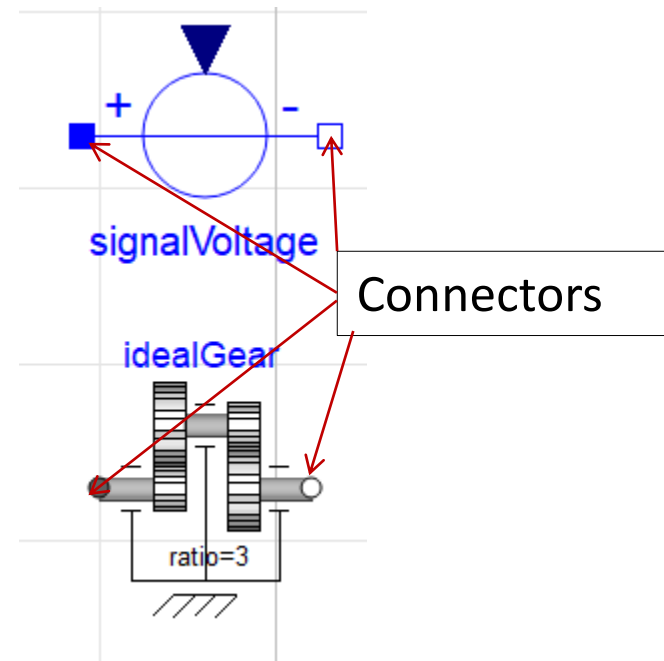
# COMPOSE

- Drag library components into the canvas
- Use components from any library
- The instantiated component will have
  - Default name
  - Default parameter values



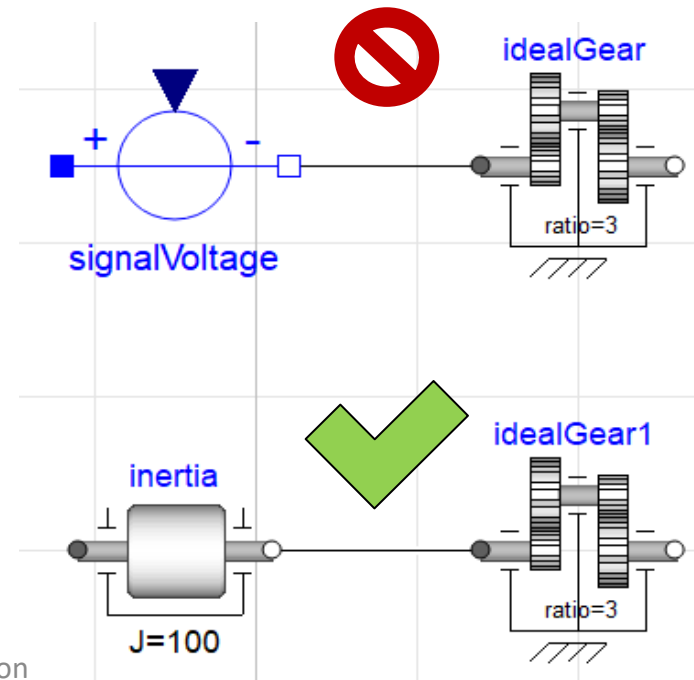
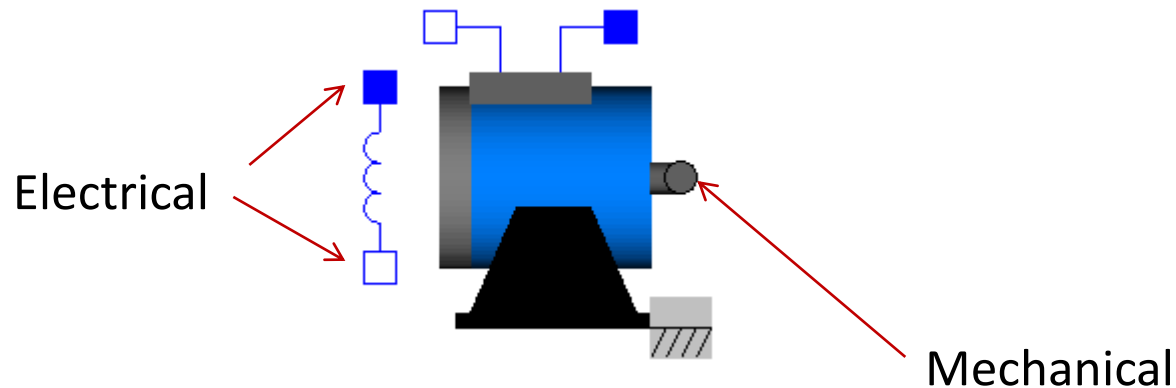
# CONNECTING COMPONENTS, CONNECTORS

- Connector defines an interface to a model
  - The interface defines physical properties at the boundaries of the model
    - **Electrical:** current, voltage
    - **Mechanical:** torque, angle
    - **Fluid dynamics:** flow rate, pressure
- Connections are actual physical connections, i.e.: electrical line, mechanical connection, heat flow between two components.



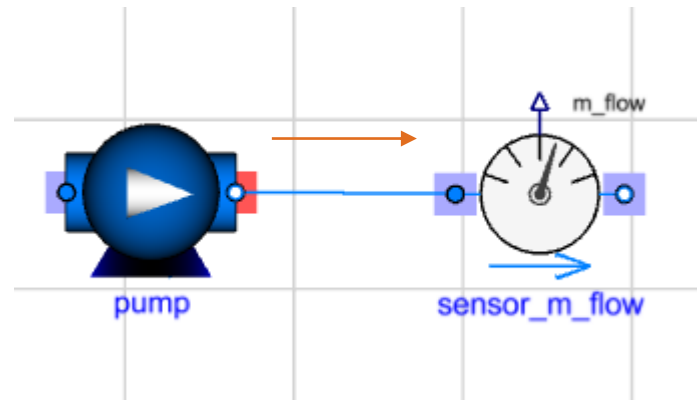
# CONNECTING COMPONENTS, CONNECTORS

- Components with the same type of connector can be connected
  - Part of the same domain
- Some components cross between domains.
  - Used to go from one domain to another
  - The DC motor goes from the electrical to the mechanical domain.



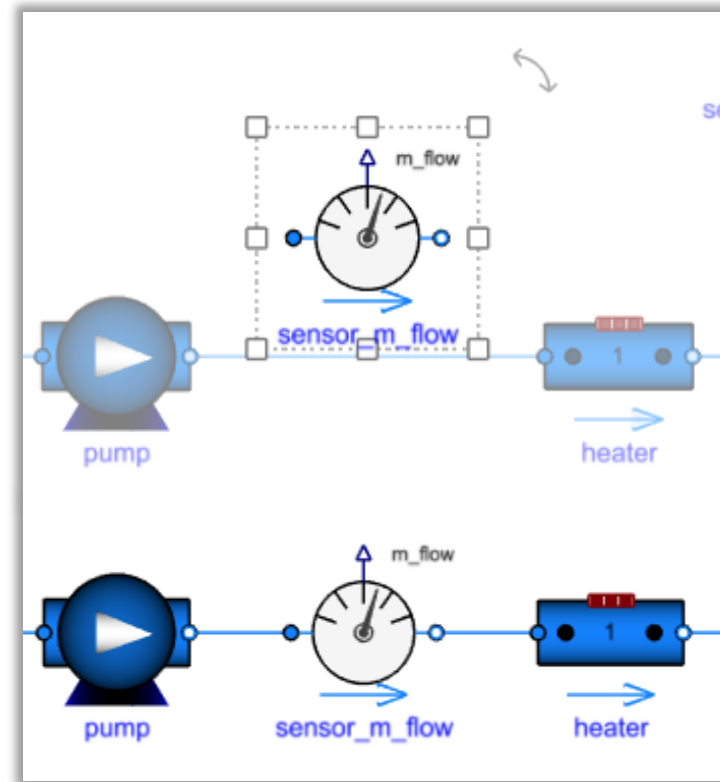
# CONNECT

- Click and drag mouse to create connection line
- Available connectors will be highlighted



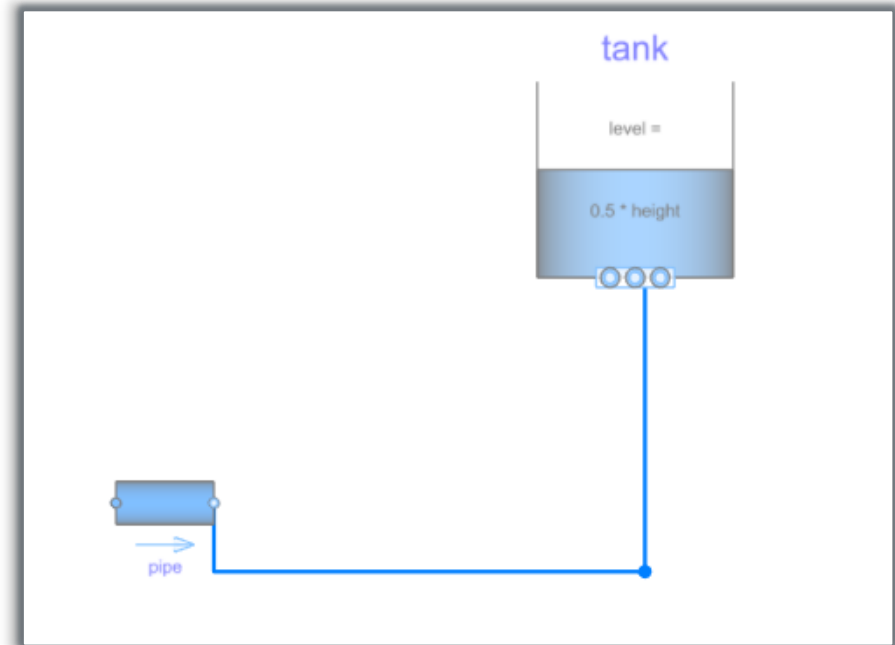
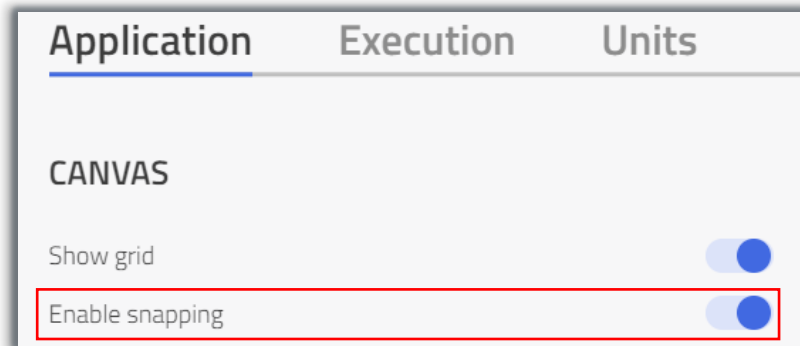
# CONNECTING COMPONENTS

- Possible to insert a component between two other components by dropping it on top of the connection line



# CONNECTING COMPONENTS

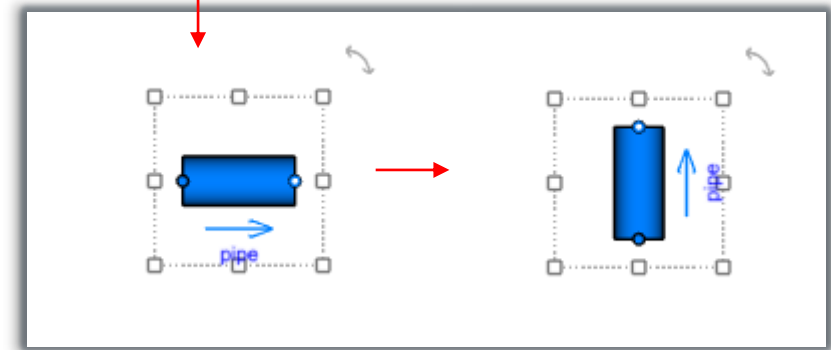
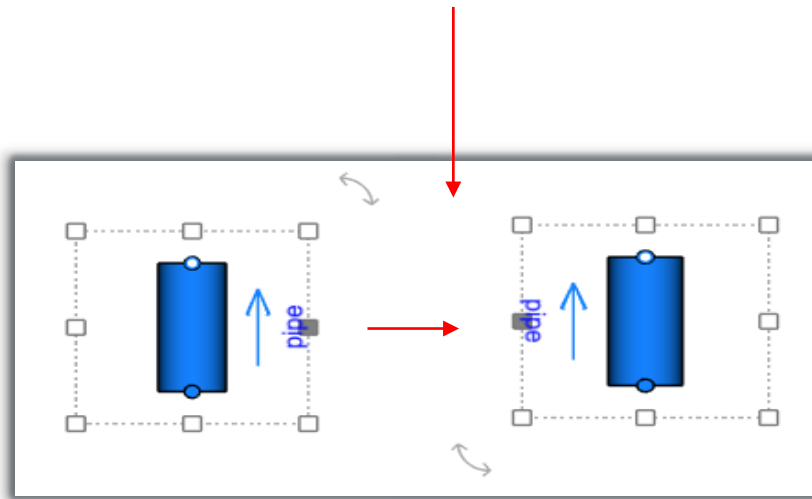
- Edit connection line shapes by dragging at either the line or the corner point.
- Possible to snap connections to grid lines with toggle snapping option
  - Enable toggle snapping from settings
  - If snapping are enabled, the component can be aligned to the grid





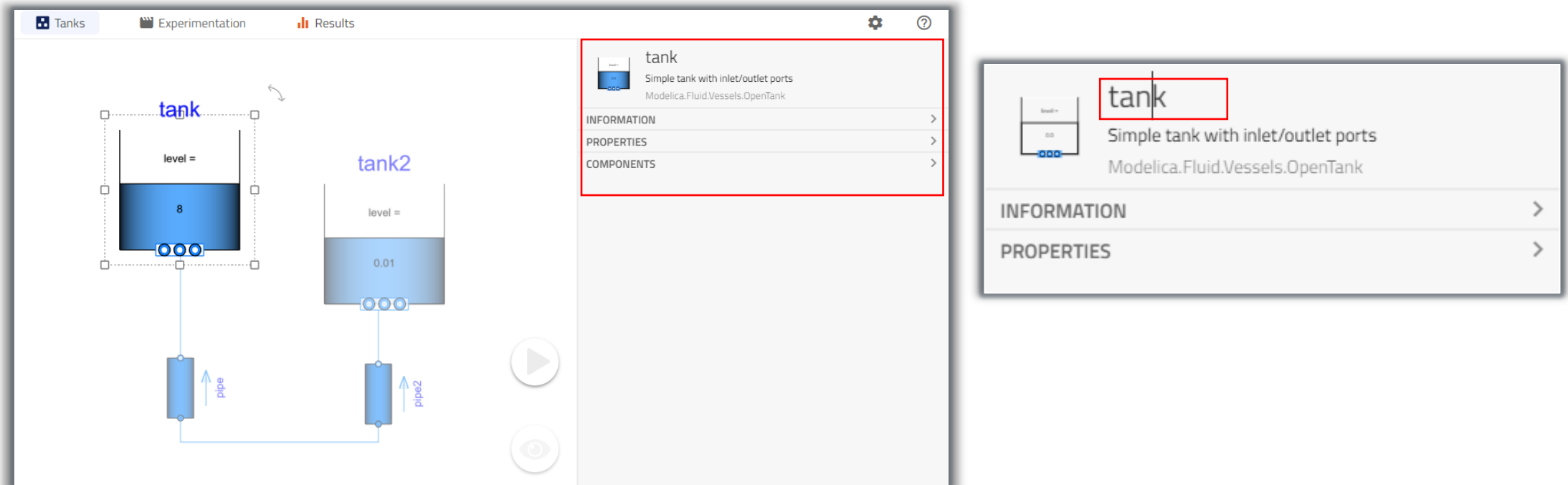
# CONFIGURING LAYOUT

- Select a component
- A dotted square box with a *handle* will be shown around the component.
- Use the *handle* to scale or rotate the components.
- You can also flip the components sideways and upside down



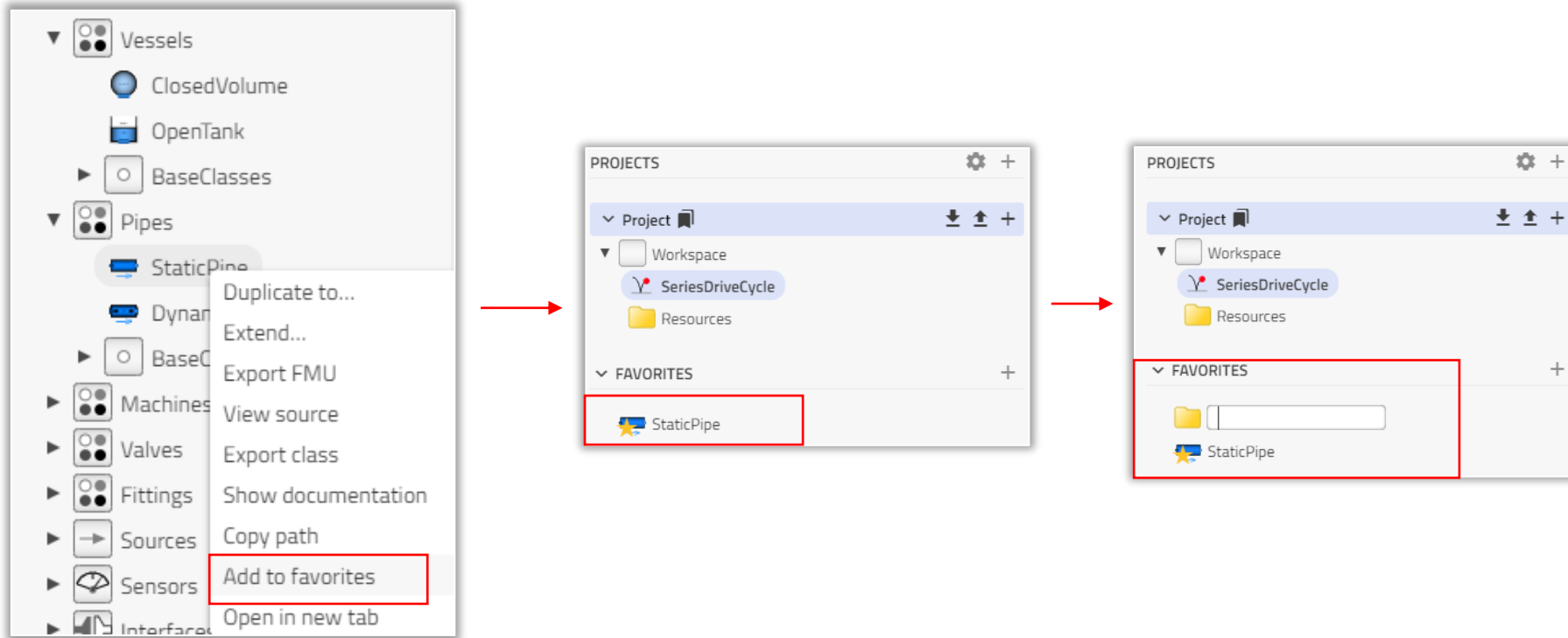
# RENAMING COMPONENTS

- To rename a component click on that component and edit on the control panel by simply clicking on name



# ADD COMPONENTS

- Frequently used components can be stored as favorites
- Organize your favorites in folders
- Favorites are workspace-specific

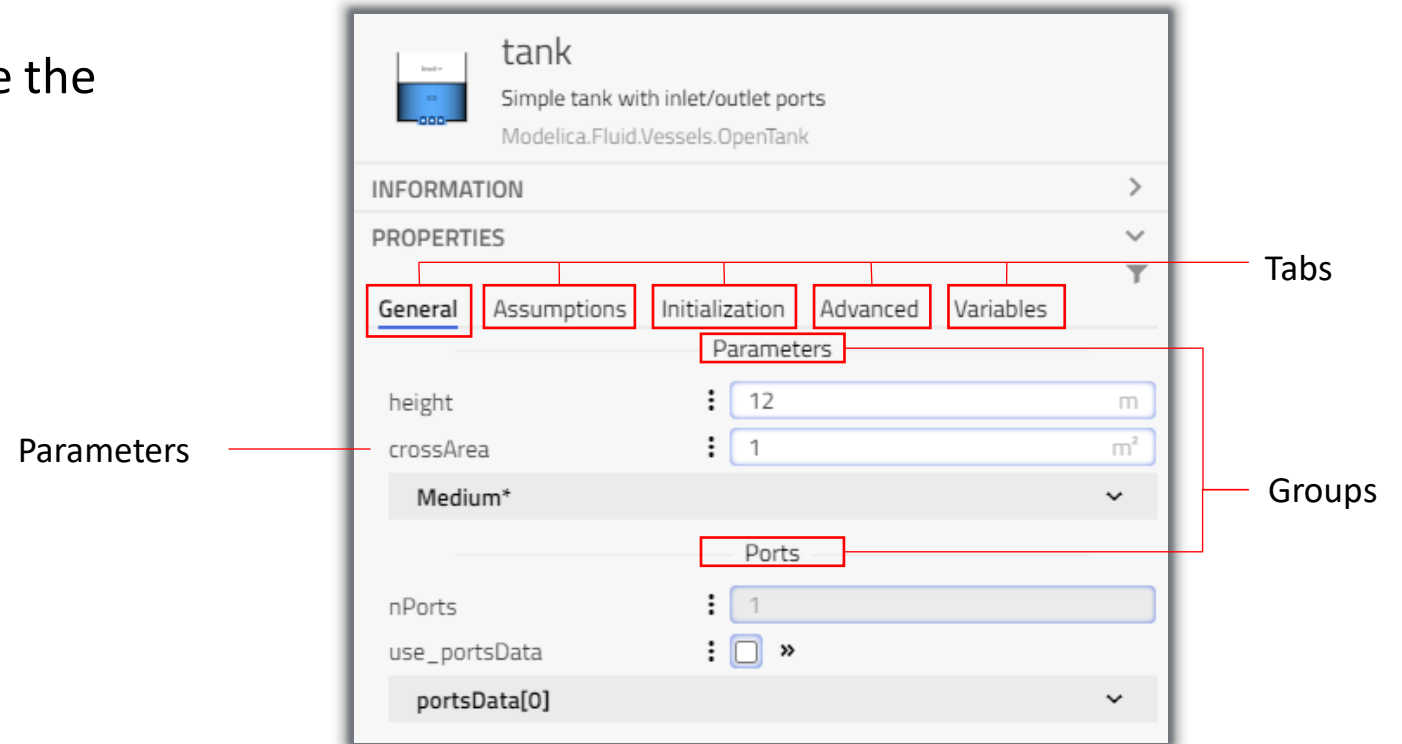




# SET PARAMETERS

# SET PARAMETERS

- Double-click on a component in an editable model to open the Control Panel
- Edit parameters from the Properties tab in the Control Panel
- Tabs and groups are utilized to organize the parameter interface



# SET PARAMETERS

- One tab is always reserved for all variables
  - To view time dependent variables
  - To be able to set attributes to them

tank  
Simple tank with inlet/outlet ports  
Modelica.Fluid.Vessels.OpenTank

INFORMATION >

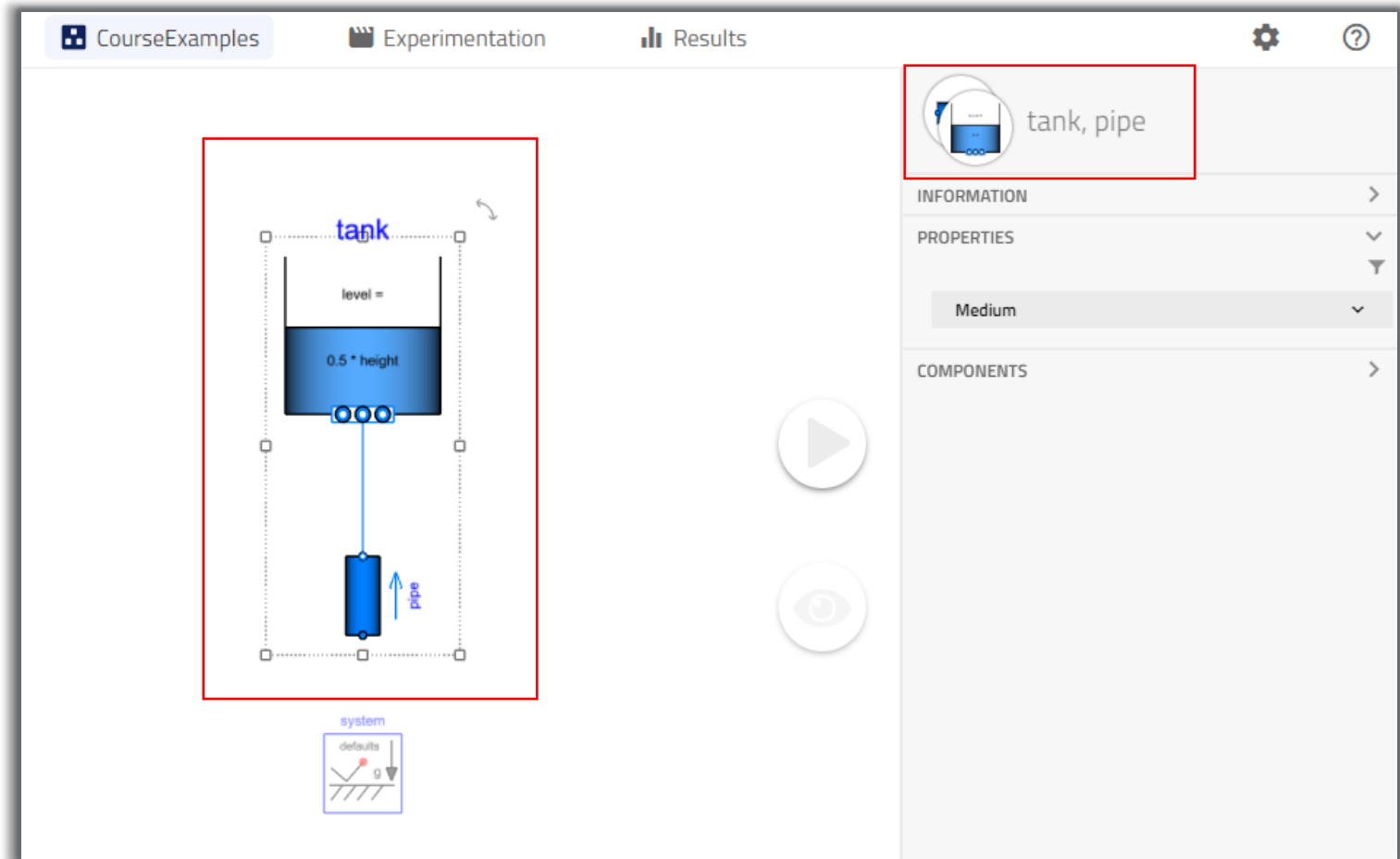
PROPERTIES

General Assumptions Initialization Advanced **Variables**

level	:		m
V	:		m <sup>3</sup>
ports_H_flow	:		W
ports_mXi_flow	:		kg/s
sum_ports_mXi_flow	:		kg/s
ports_mC_flow	:		kg/s
sum_ports_mC_flow	:		kg/s
portInDensities	:		kg/m <sup>3</sup>
portVelocities	:		m/s
ports_E_flow	:		W
s	:		

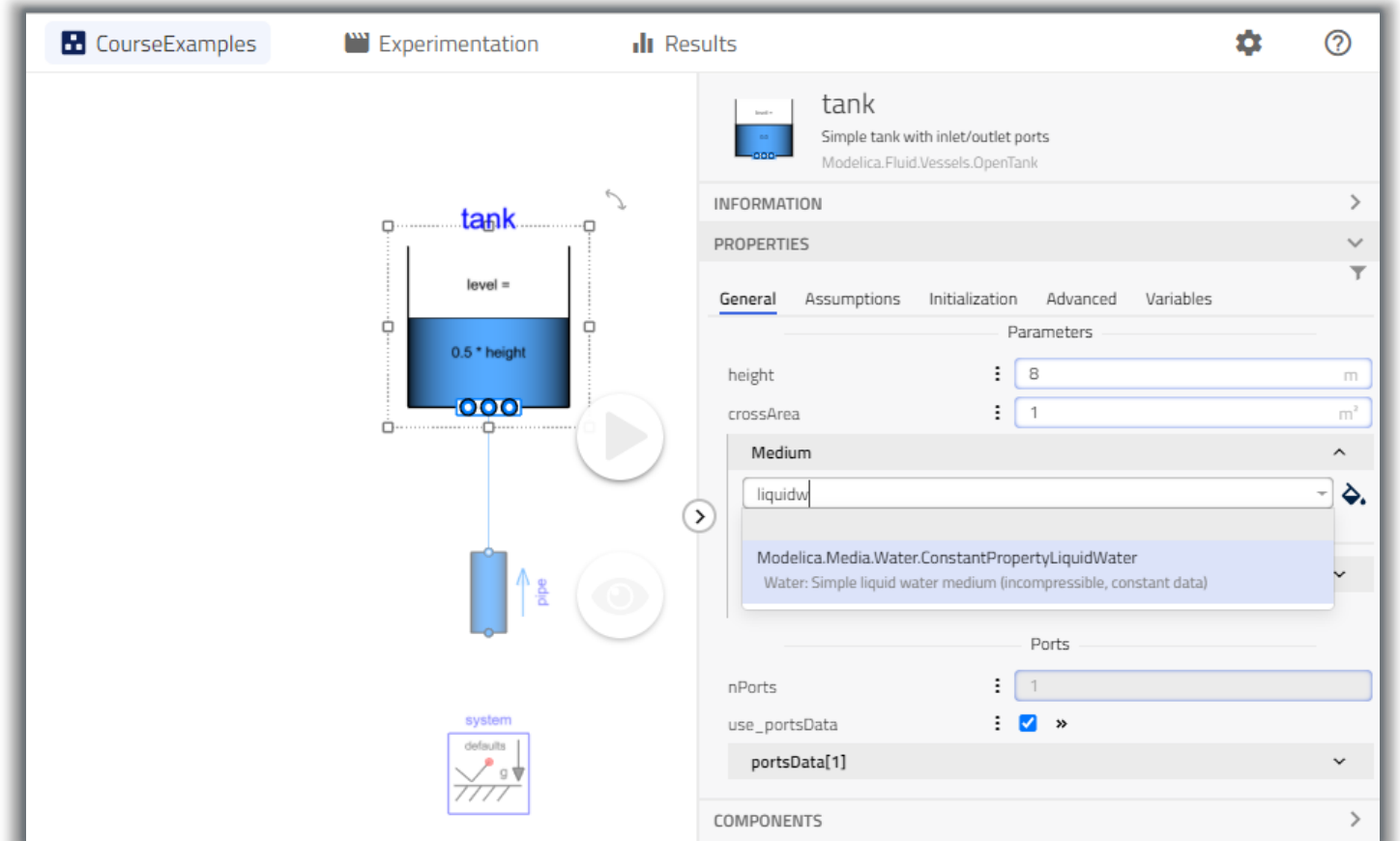
# PARAMETERIZATION

- Component selection on canvas determines what parameters are displayed
- Common parameters can be configured simultaneously if multiple components are selected
- It can be done by **Selecting first component + Ctrl** then **Selecting the next component**



# PARAMETERIZATION


- Replaceable classes inside a model are modified via a drop-down list of all valid choices
- Write on that drop-down list to find desired class faster

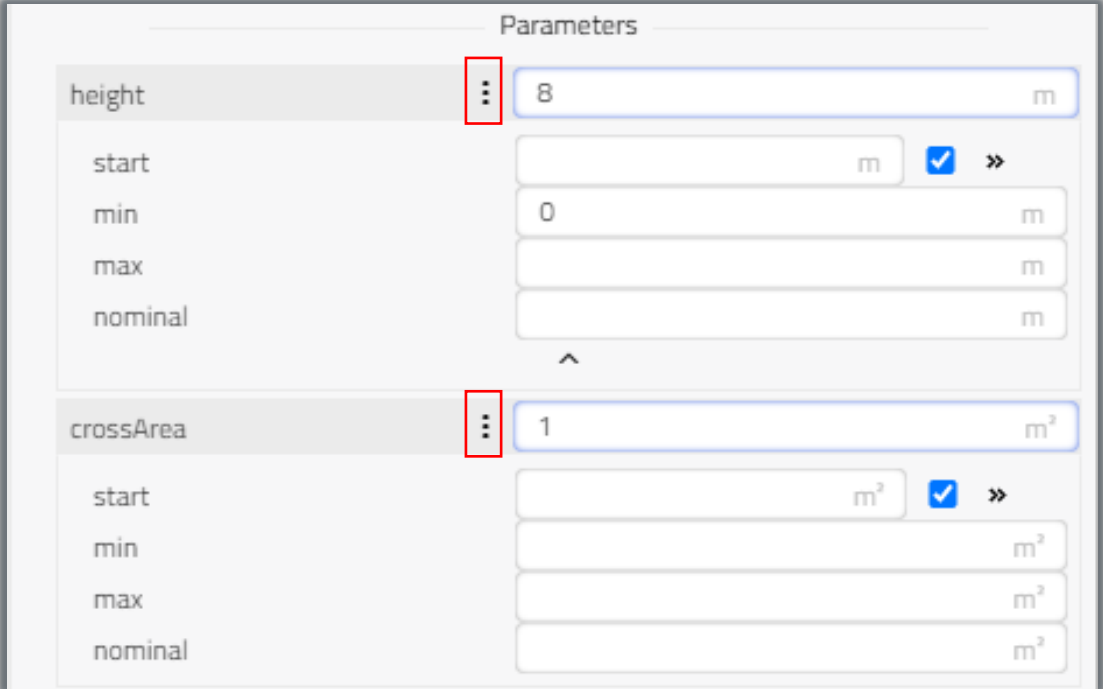


The screenshot displays the Modelon software interface. The main workspace shows a diagram of a tank component labeled 'tank' with a 'level =' indicator and a '0.5 \* height' value. Below the tank is a 'pipe' component. The right-hand panel shows the 'tank' component's configuration. The 'General' tab is active, displaying parameters: 'height' (8 m) and 'crossArea' (1 m²). A dropdown menu for the 'Medium' property is open, showing 'liquidw' selected and a search result for 'Modelica.Media.Water.ConstantPropertyLiquidWater' (Water: Simple liquid water medium (incompressible, constant data)). The 'Ports' section shows 'nPorts' (1) and 'use\_portsData' (checked). The 'COMPONENTS' section is visible at the bottom.



# PARAMETERIZATION: ATTRIBUTES

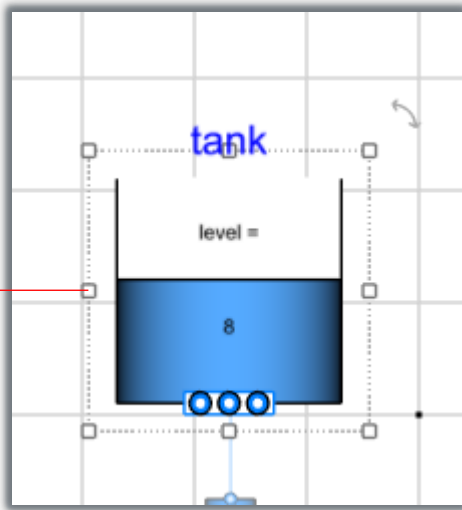
- The attributes for a particular parameter or variable are accessed using the  button, which gives various options like
  - Start
  - Min/max
  - State-select, etc.
- Variables are accessed from the Variables-tab
  - Can set start values for variables here



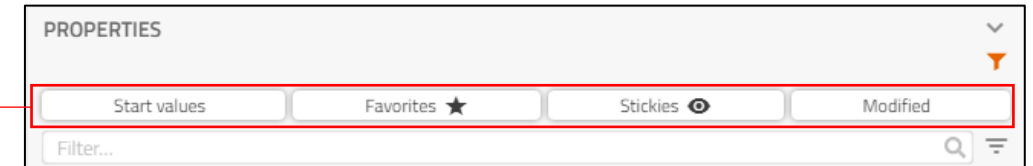
The screenshot shows a 'Parameters' dialog box with two main sections. The first section is for the parameter 'height', which is currently set to 8 m. Below the value field, there are four attributes: 'start', 'min', 'max', and 'nominal', each with an input field. The 'start' attribute has a checked checkbox and a right-pointing arrow. The second section is for the parameter 'crossArea', which is currently set to 1 m<sup>2</sup>. It also has four attributes: 'start', 'min', 'max', and 'nominal', each with an input field. The 'start' attribute has a checked checkbox and a right-pointing arrow. Red boxes highlight the three-dot menu icons for both parameters.

# PARAMETERIZATION: FILTERING

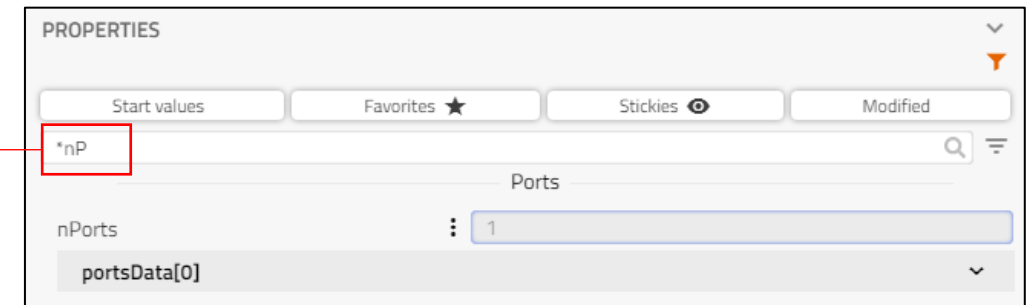
- The content of the model browser can be filtered by **Toggle filters** button.
- It is available in the **Control Panel -> Properties**
- Filtering criteria are additive



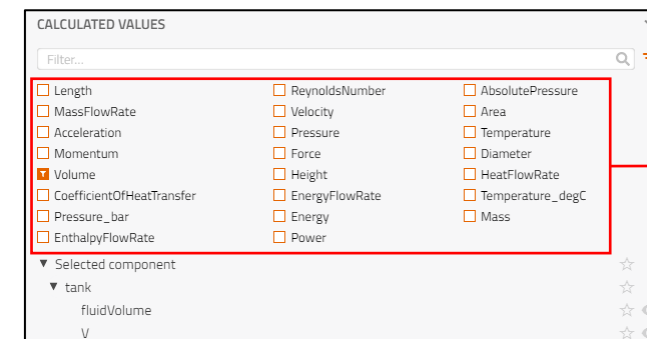
Selection of component on canvas



Filtering by categories



Filtering by text with "\*" as wildcard



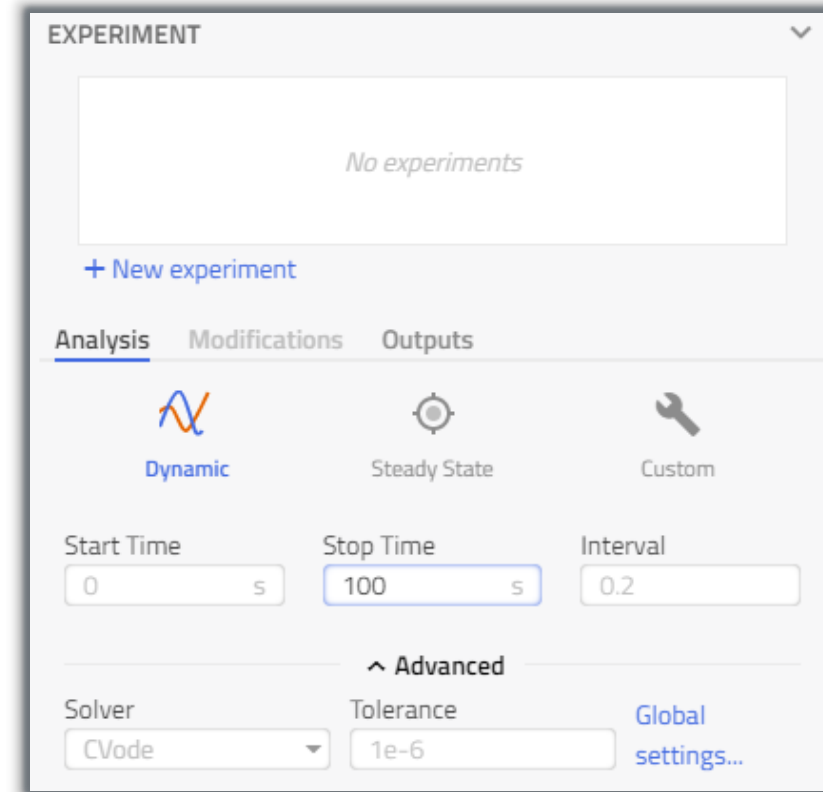
Filtering by Types




# GETTING RESULTS

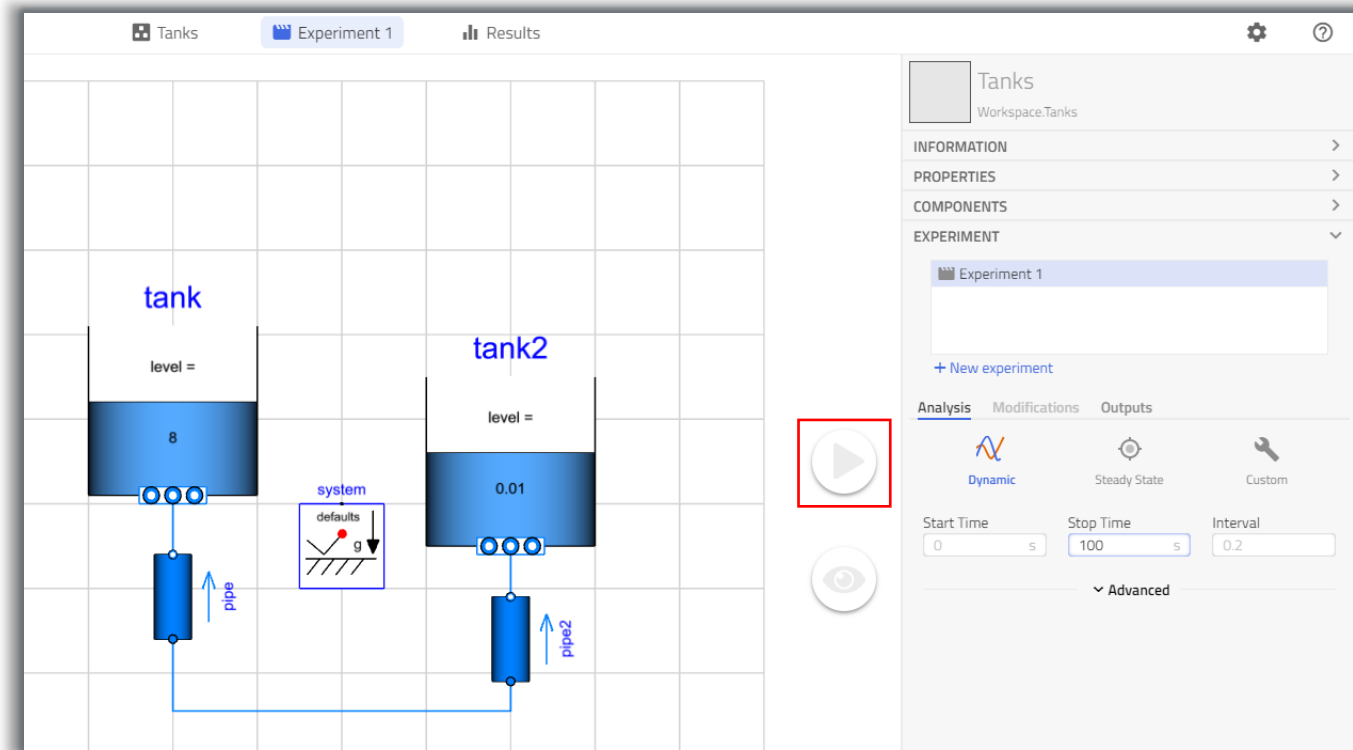
# SIMULATION

- Simulation setup can be done using **Analysis** sub-tab in **Experiment** tab of **Control Panel**
- Three types of simulation
  - Dynamic (Default)
  - Steady State
  - Custom
- **Analysis** tab can be used to customize
  - Start time
  - Stop time
  - Interval
- **Advanced** tab allows a user to change the solver and tolerance value



# SIMULATION

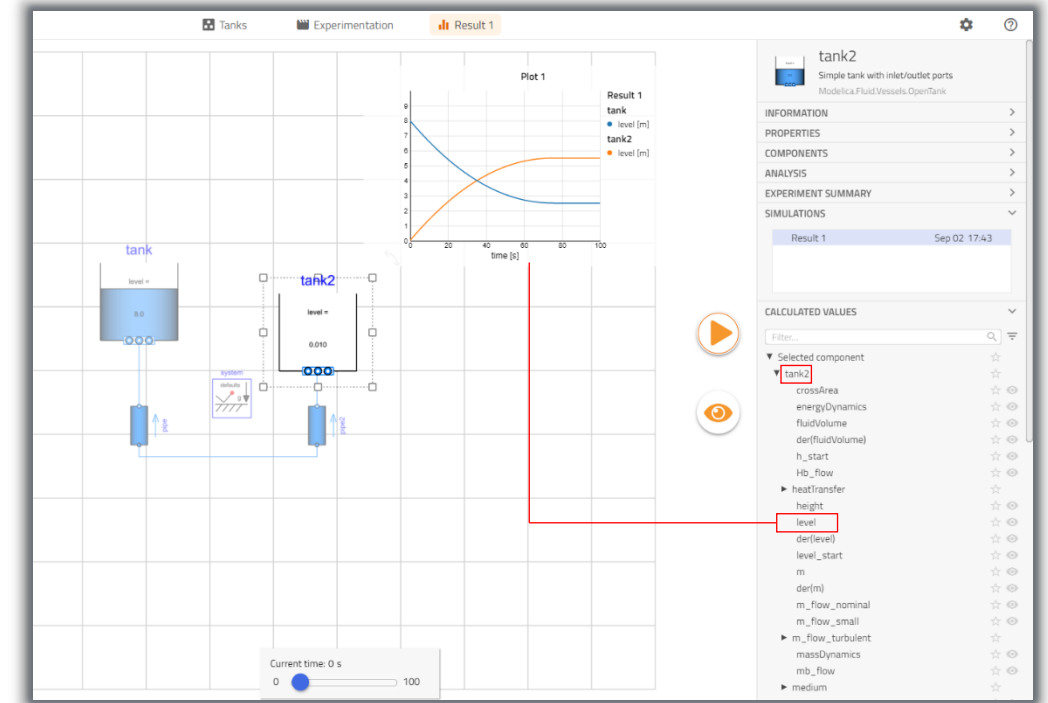
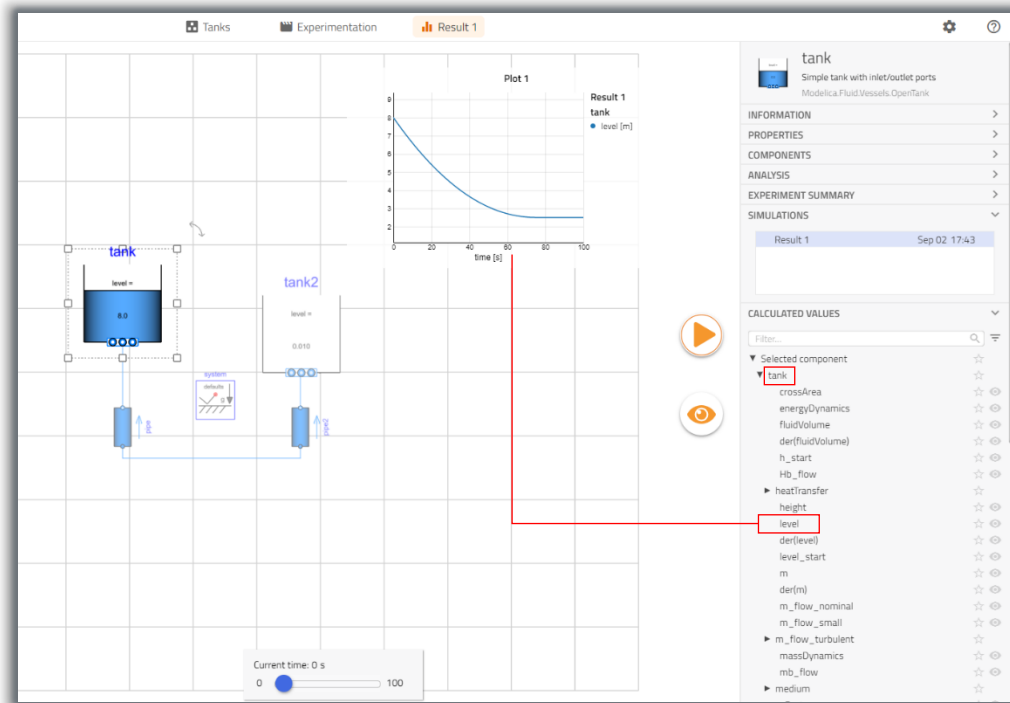
- Execute the  button to start the simulation
  - Compiles first if needed
- The button gives feedback on compilation/simulation progress



# INSPECTING RESULTS: PLOTS

- To plot a variable, simply drag a variable on to the canvas from the variable list

- Multiple variables can be dropped on the same plot for comparison

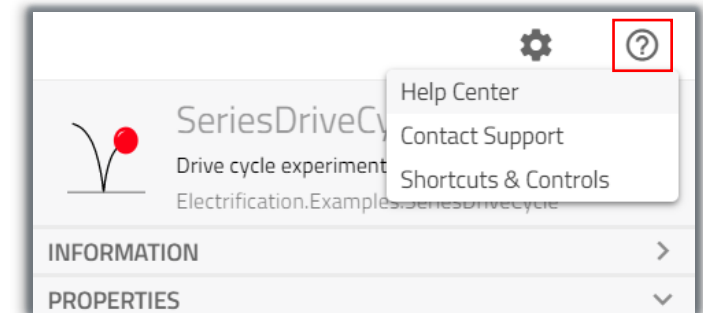
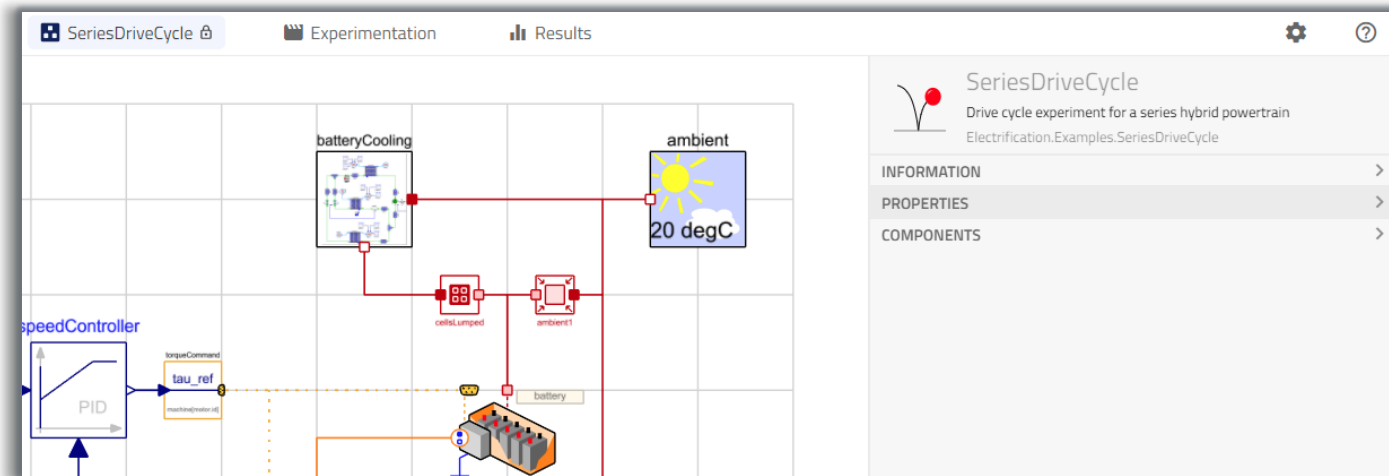




# HELP AND DOCUMENTATION

# USER SUPPORT

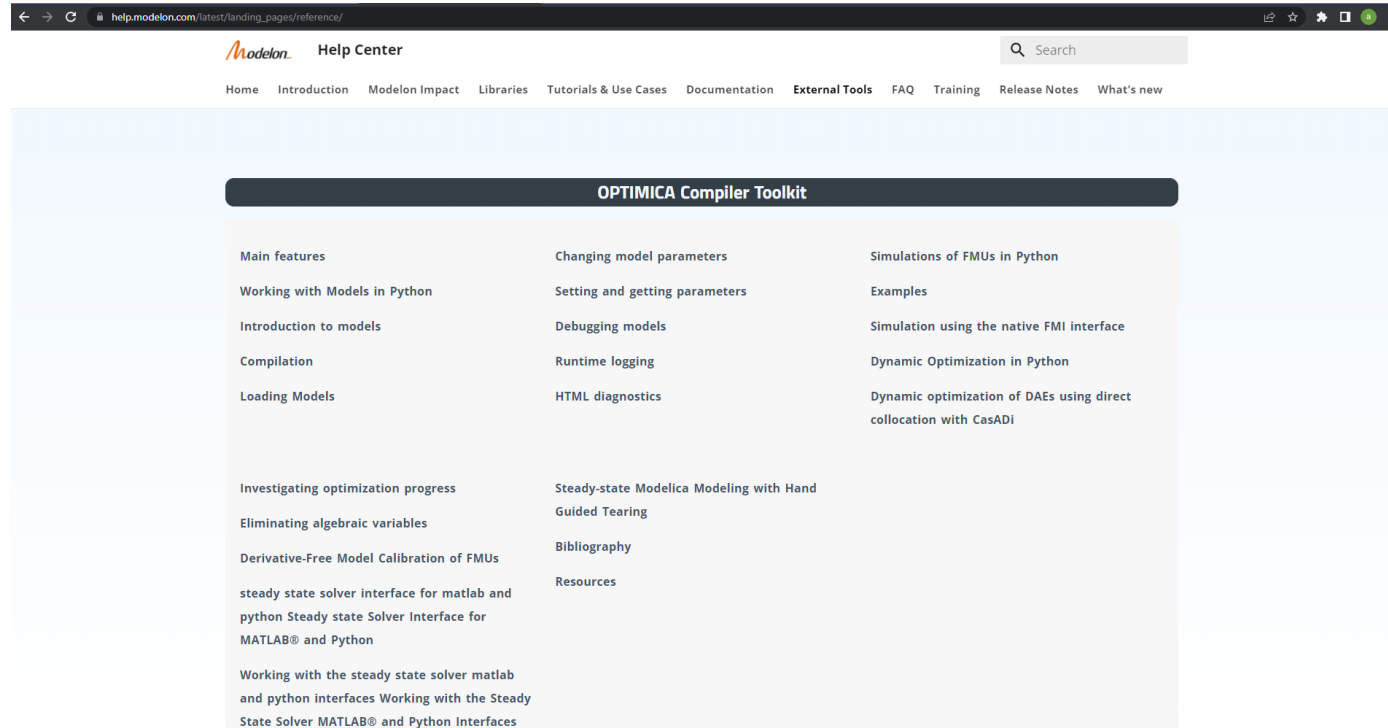
- User support options are available on the right-hand side of the App toolbar





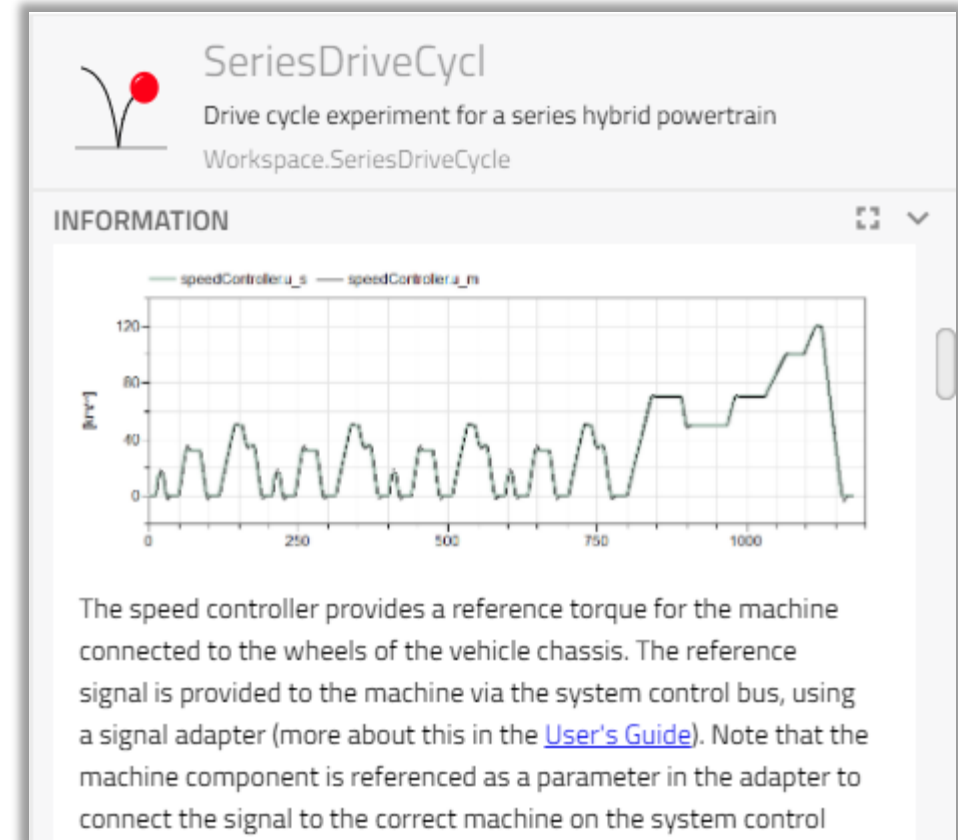
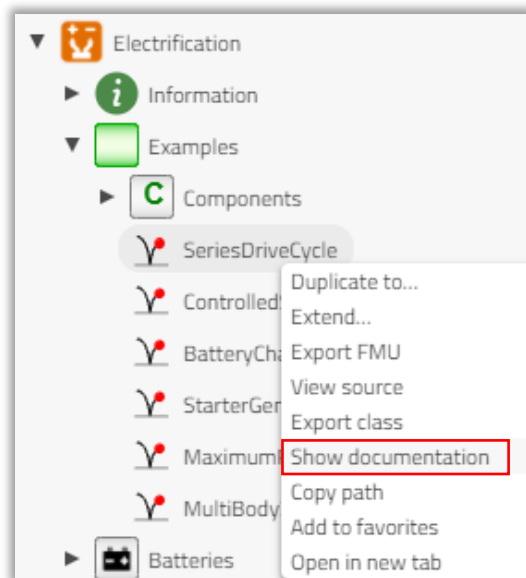
# USER SUPPORT: HELP CENTER

- Impact comes with a Help Center for convenient access to documentation
  - The help center is a modern take on documentation with videos, gifs and images that quickly communicate key ideas
  - Help center has information that will help you get started with Modelon Impact and Modelica
- You can also use the URL directly <https://help.modelon.com/latest/> to access the help center



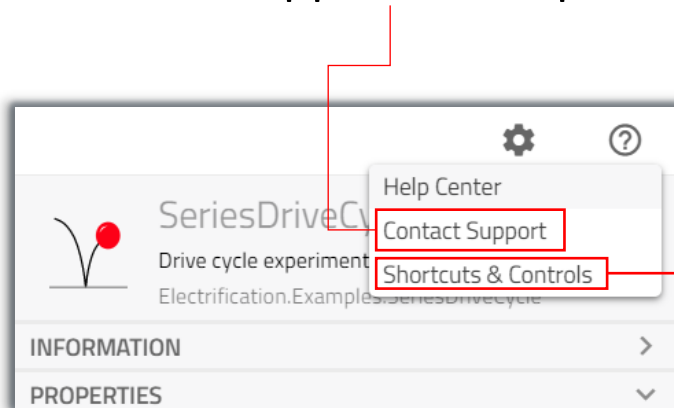
# USER SUPPORT: MODEL DOCUMENTATION

- Model specific documentation is available in the **Information** tab in the Control Panel
- Or from the Library Browser: **right click -> Show documentation**
- Specific **Information** classes are available in libraries

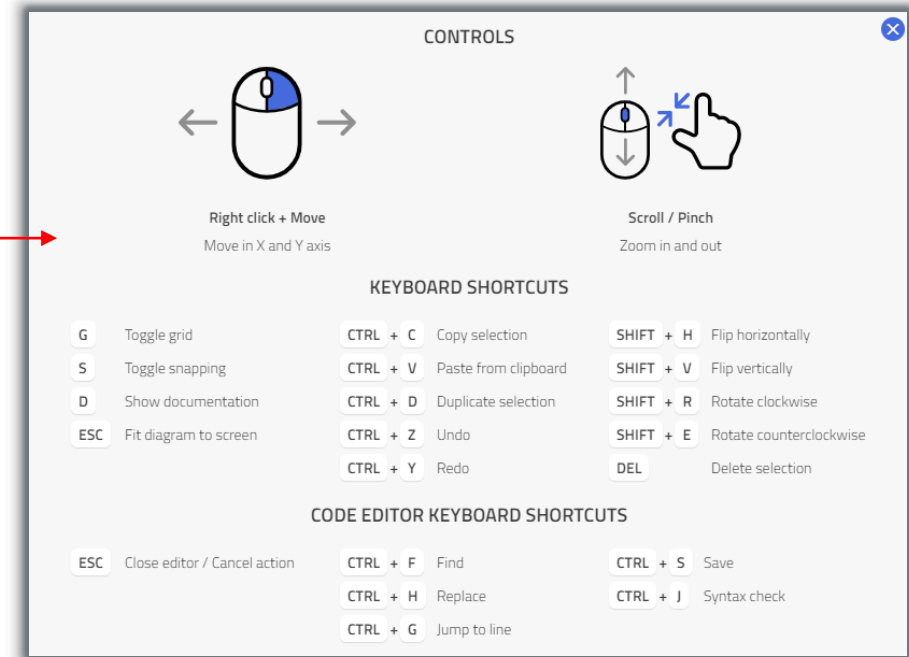


# USER SUPPORT

- Contact Support will direct you to the mail [support@modelon.com](mailto:support@modelon.com) where you can directly contact Modelon Support for help



- Shortcuts & Controls will help you to find keyboard/mouse shortcuts that might save you some time



# WORKSHOP 1.1

In this workshop you will:

- Create a personal workspace
- Get to know the Impact GUI
- Simulate an existing model
- Plot results