ŠKODA AUTO University

Computer Simulation of Logistics Processes

Plant Simulation Parameters

Jan Fábry

15/03/2023

Plant Simulation Parameters

ŠKODA AUTO University

Aim of the lecture

- Introduce the parameters of the simulation software Plant Simulation 16.

Plant Simulation Parameters

ŠKODA AUTO University

Structure of the lecture

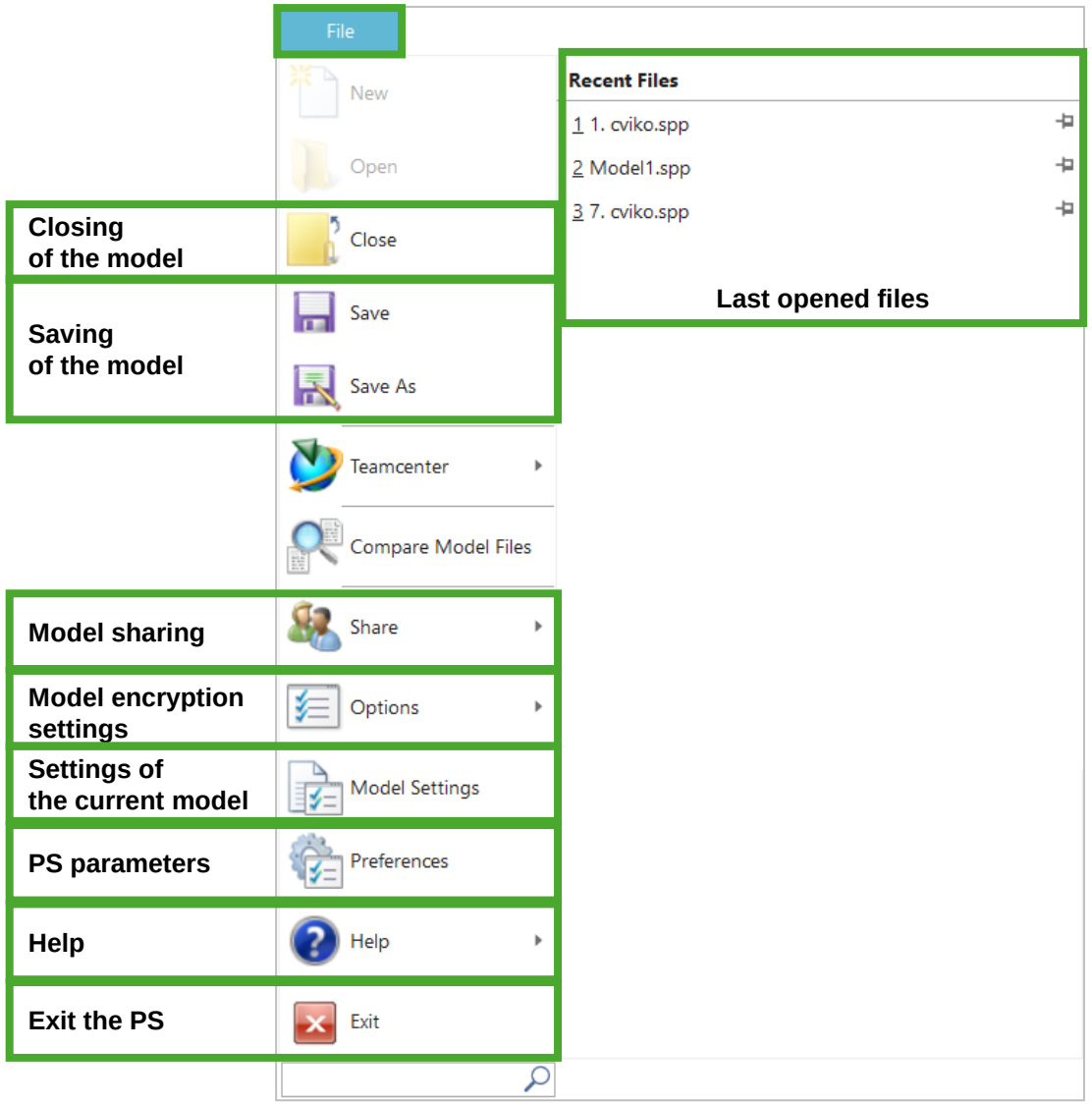
- Basic menu of PS.
- File types, automatic saving.
- Default settings of PS:
  - Units, modelling, icons.
- Graphics of PS:
  - Icon editor, icon animation, creating of the conveyors.
- Attributes.

Plant Simulation Parameters

ŠKODA AUTO University

Menu File

- Menu “File“ is used for basic operations with the model file:
  - Opening.
  - Closing.
  - Saving.
- We can continue with:
  - Manage the settings of the current model and the parameters of the entire PS.
  - Create files that can be initiated without PS license (presentation purposes).

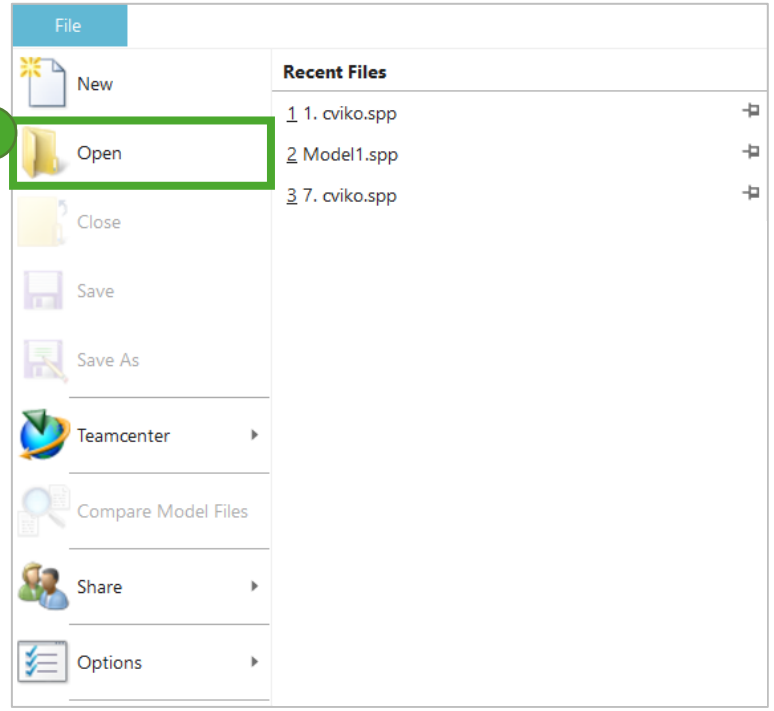


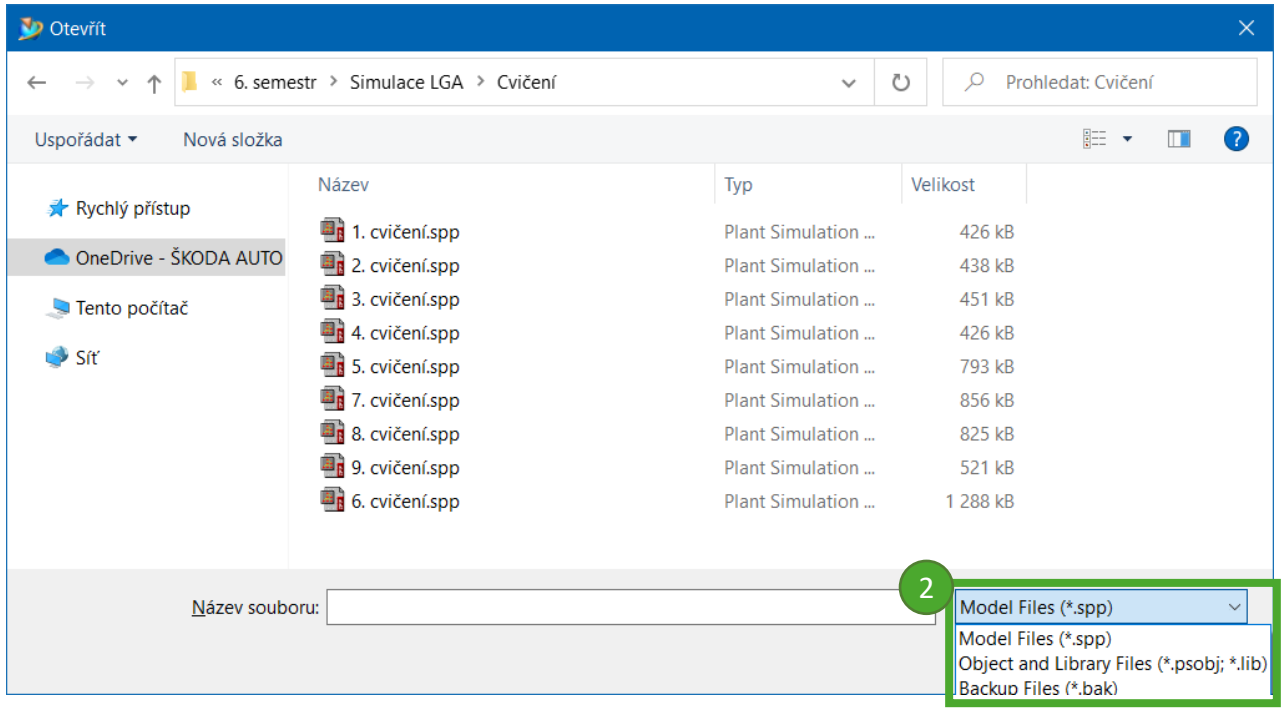
Plant Simulation Parameters

ŠKODA AUTO University

Types of files – opening of the models

- Opening of existing file through the option “Open” in the “File” menu (1).
- Plant Simulation usually works with *.spp (2) files.
- It can also work with *.bak (2) files.



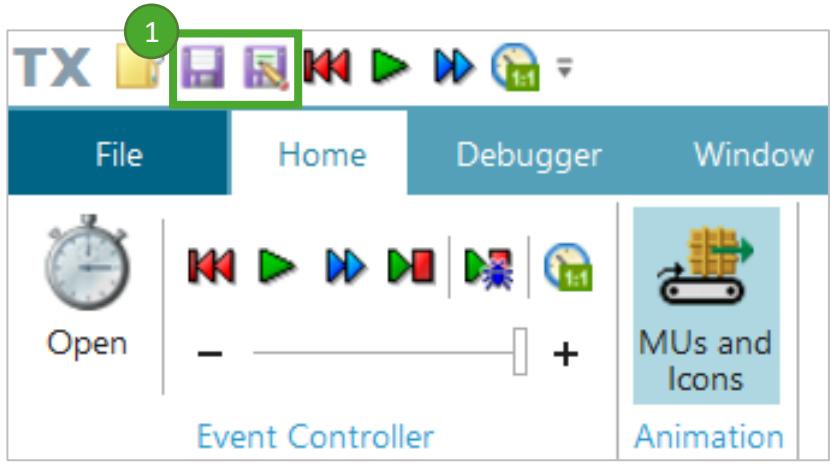


Plant Simulation Parameters

ŠKODA AUTO University

Types of files – models saving

- Model can be saved by buttons (1) or in the standard menu:
  - File – Save Model.
  - File – Save Model As.
- Plant Simulation creates file with suffix *.spp for the first model saving.
- After that, Plant Simulation saves all the upcoming changes into this file (*.spp). At the same time, PS renames the previous version of this file and stores it in the backup file with suffix *.spp.bak.

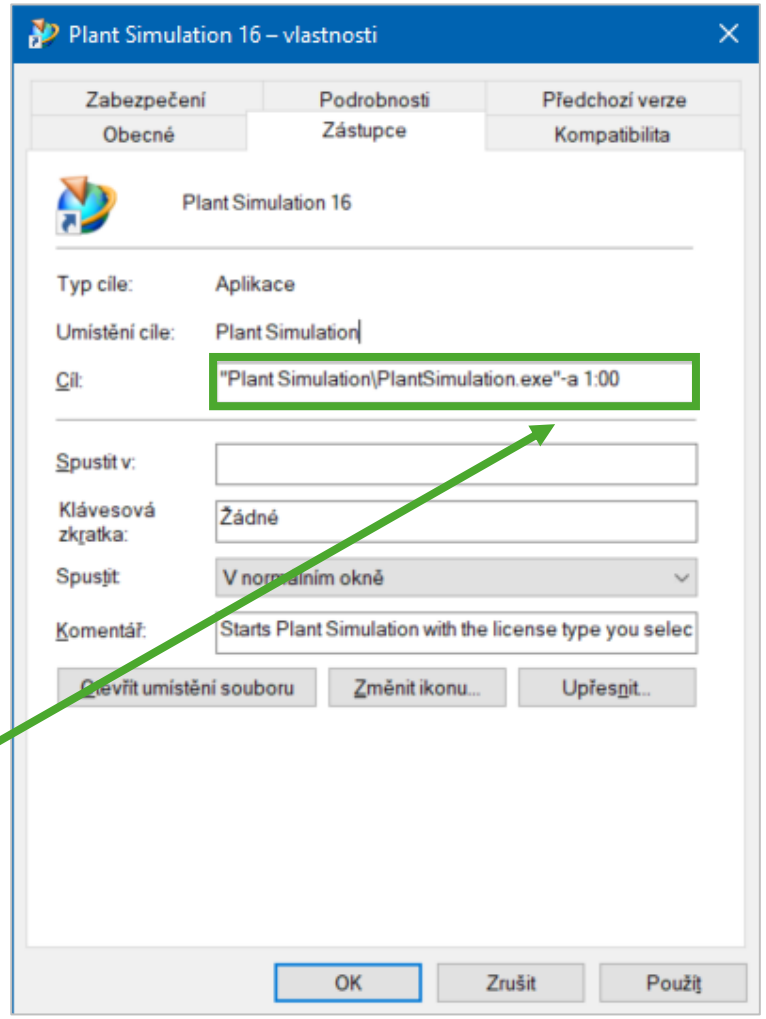


Plant Simulation Parameters

ŠKODA AUTO University

Automatic file saving

- In the PS direct option of automatic file saving after some pre-set time (not in the running PS) does not exist.
- Saving has to be done manually during the work – do not forget about it!!!
- This indirect option might help:
  - In the attributes of the shortcut, where the Plant Simulation is launched, it is possible to set the automatic saving in user's predefined time interval.
  - It is necessary to write the path to *.exe file:
    - -a (syntax for auto-save)
    - 1:00 (syntax for defined period between the saving – in this case it is 1 minute).



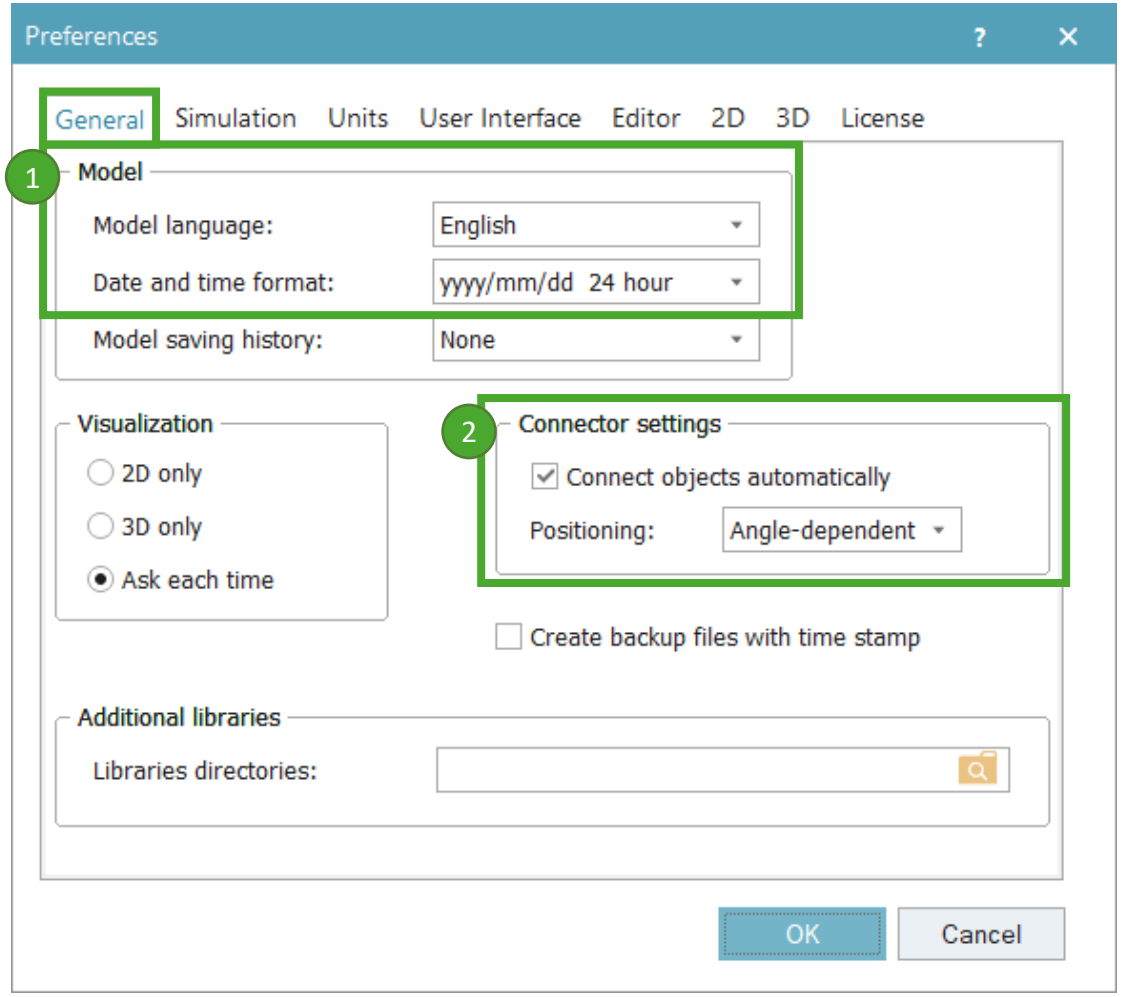
-a 1:00

Plant Simulation Parameters

ŠKODA AUTO University

Default settings – General

- In the “File“ menu under “Preferences“ can be made various settings for the entire PS program.
- Model language can be modified in the tab “General“ (i.e., German, Japanese,…) as well as the time format (12 or 24 hours) (1).
- In addition, the setting allows user to enable or disable the automatic connection of objects with connectors (2).

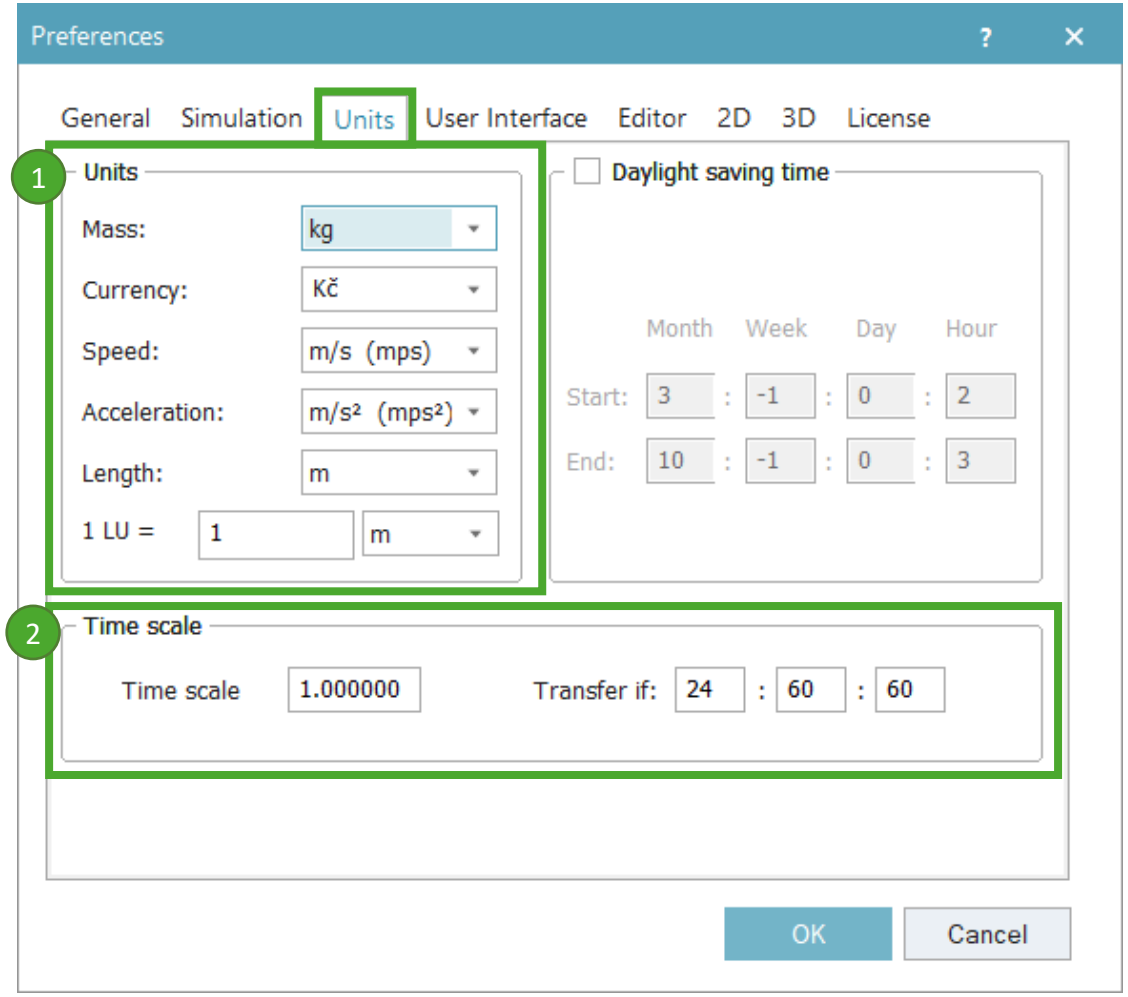


Plant Simulation Parameters

ŠKODA AUTO University

Default settings – Units

- We can set the units of mass (weight), currency, speed, acceleration or length in tab “Units“ (1).
- Timeline scale can be also changed individually (2).

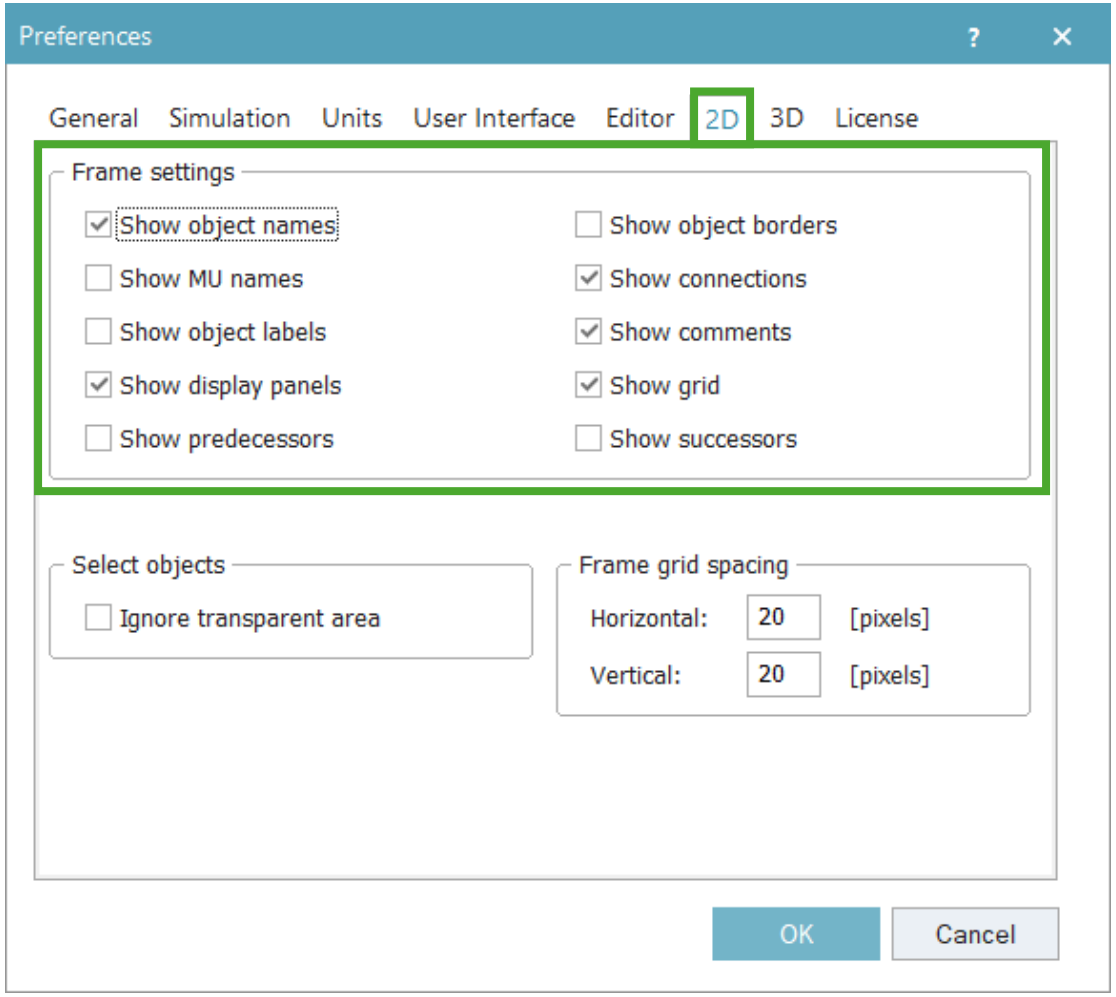


Plant Simulation Parameters

ŠKODA AUTO University

Default settings – 2D

- Various display of the frame can be set in tab “2D“.
- This particular setting can be also changed individually in the frame itself.

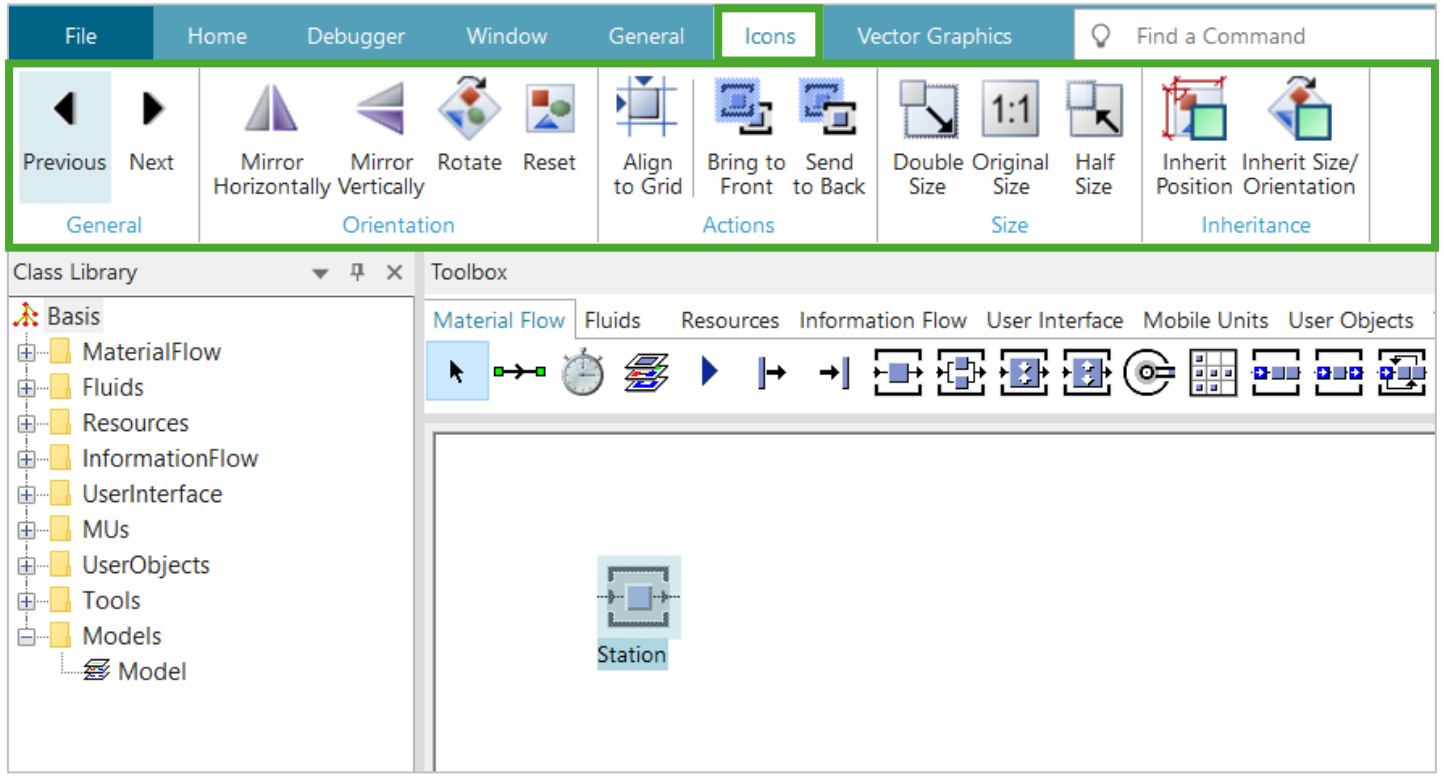


Plant Simulation Parameters

ŠKODA AUTO University

Symbols and icons

- It is possible to change location, orientation and size of objects and their icons in menu Icons.
- However, for proper operation of the object in the frame, it must be activated (selected).

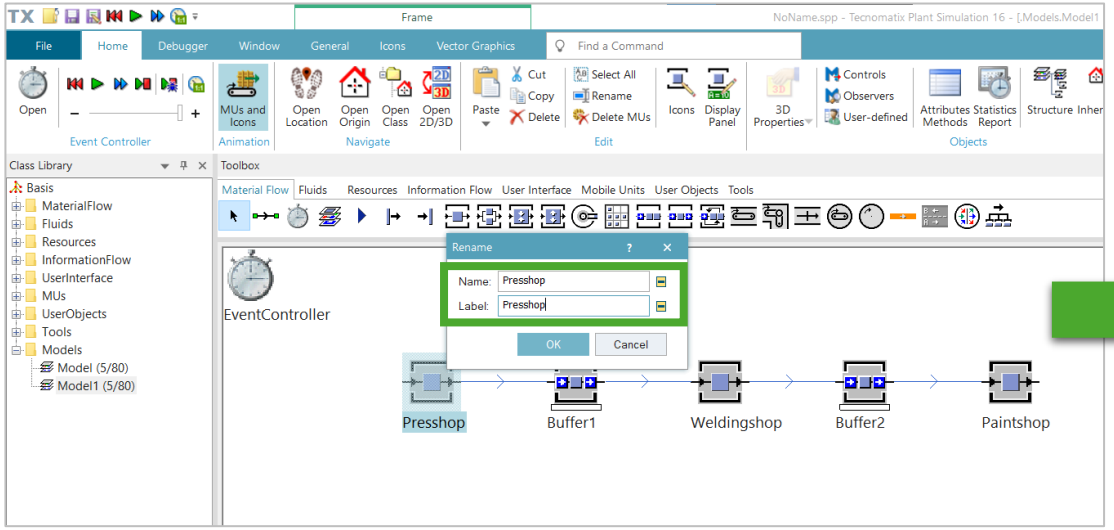


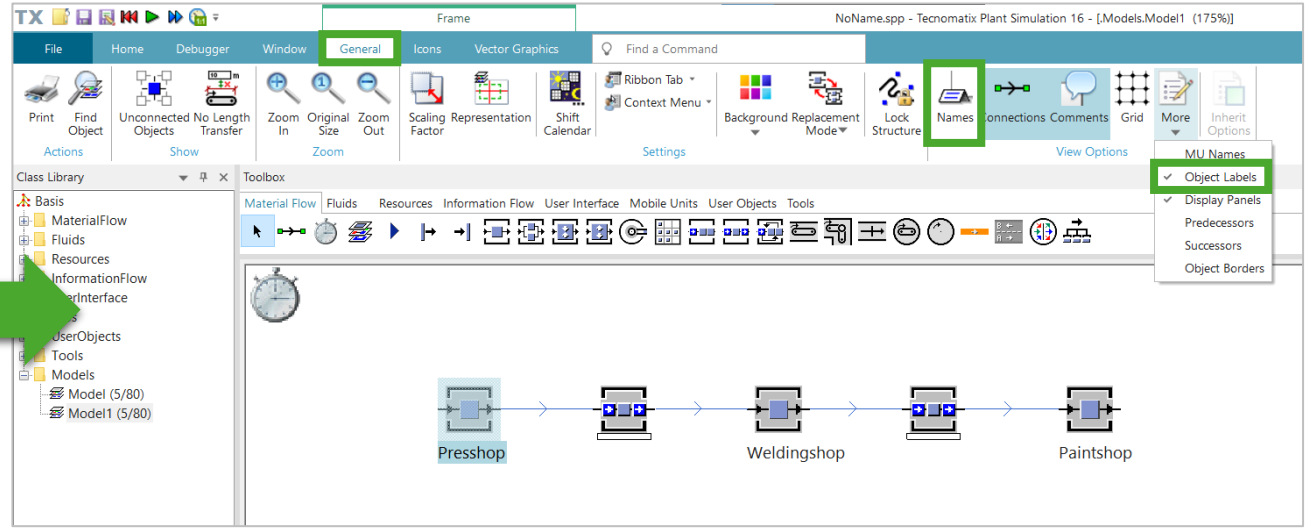
Plant Simulation Parameters

ŠKODA AUTO University

Names and labels of objects

- Each object must have the Name and can have the Label.
- By displaying the labels and hiding the names, you can show the descriptions for some objects and hide them for others, which helps the model's clarity.





Plant Simulation Parameters

ŠKODA AUTO University

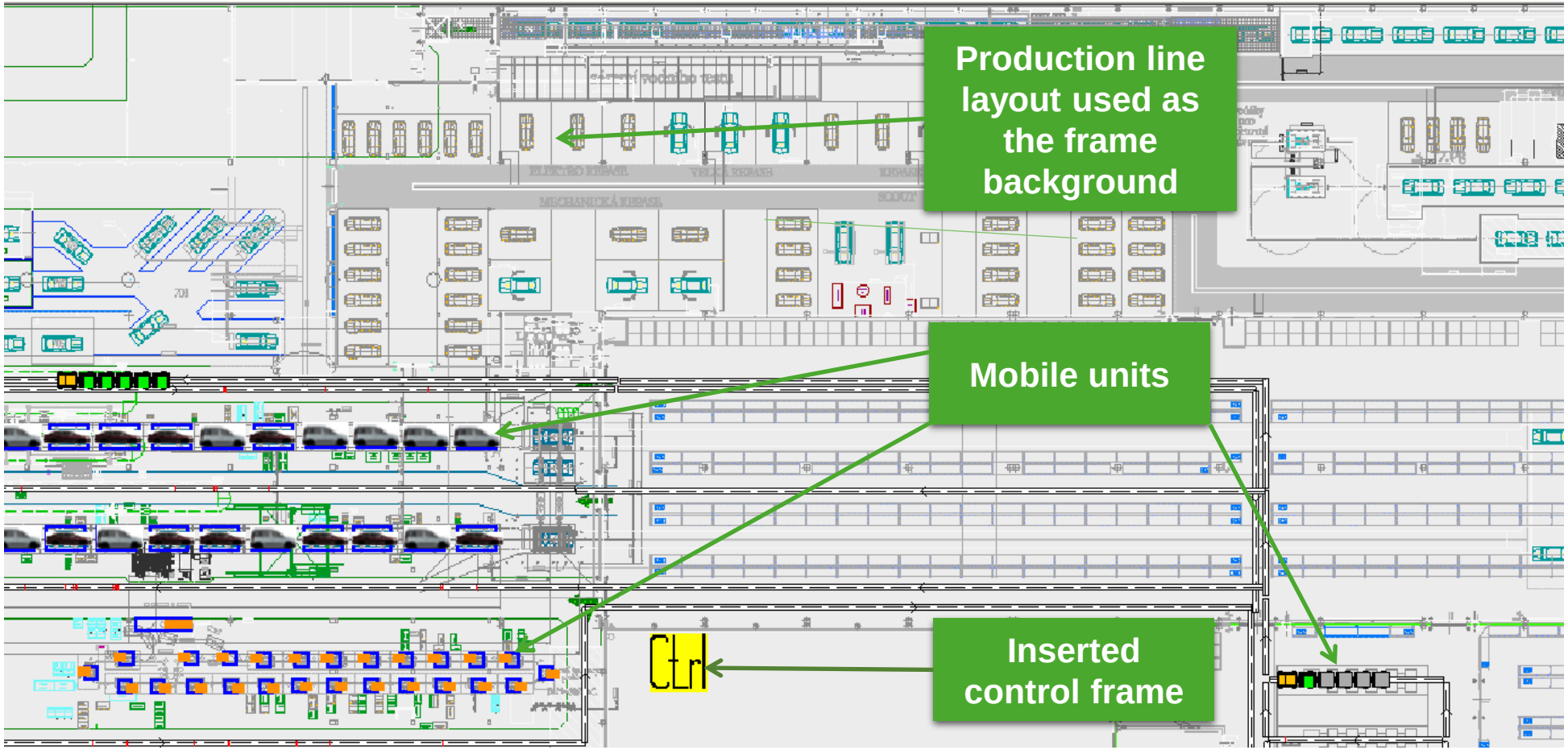
Icons editor - usage

- Icon editor allows graphical visualization of objects via selected pictures and their animation.
- We can use own icons (not only the predefined) for displaying most of all objects in models. For objects of material flow, MUs and frames is also possible to define animation points or lines for MUs visualization on specific objects.
- It is also possible to use pictures in the background. We can use, for example, the layout of plant or production line, which will be later transferred into compatible format with the Plant Simulation and paste it as the frame background. The individual objects of the model are then placed on the exact locations as they are, or will be, oriented in reality. This is useful for modeling of length-specified objects.

Plant Simulation Parameters

ŠKODA AUTO University

Appearance of the model using the icon editor

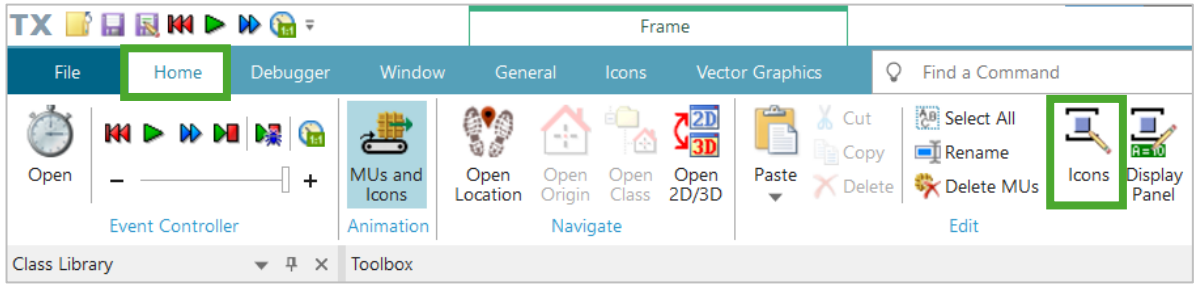


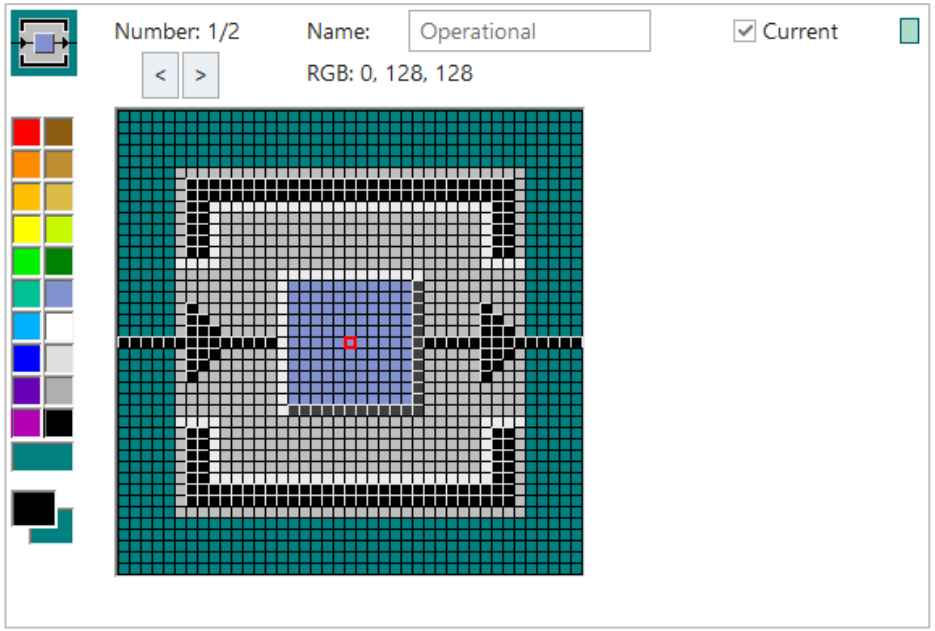
Plant Simulation Parameters

ŠKODA AUTO University

Icons editor

- The icons editor is opened in the “Home“ tab with the icon named “Icons“.
- It is possible to keep the existing icons and assign a number of additional icons where the size can be changed, etc.
- We can create an icon picture or insert file with a picture: File – Open (to choose required compatible file - *.gif, *.bmp, *.ppm, *.dxf, *.dwg, *.ico) or use the function Drag&Drop to ”move” a picture to the drawing area.

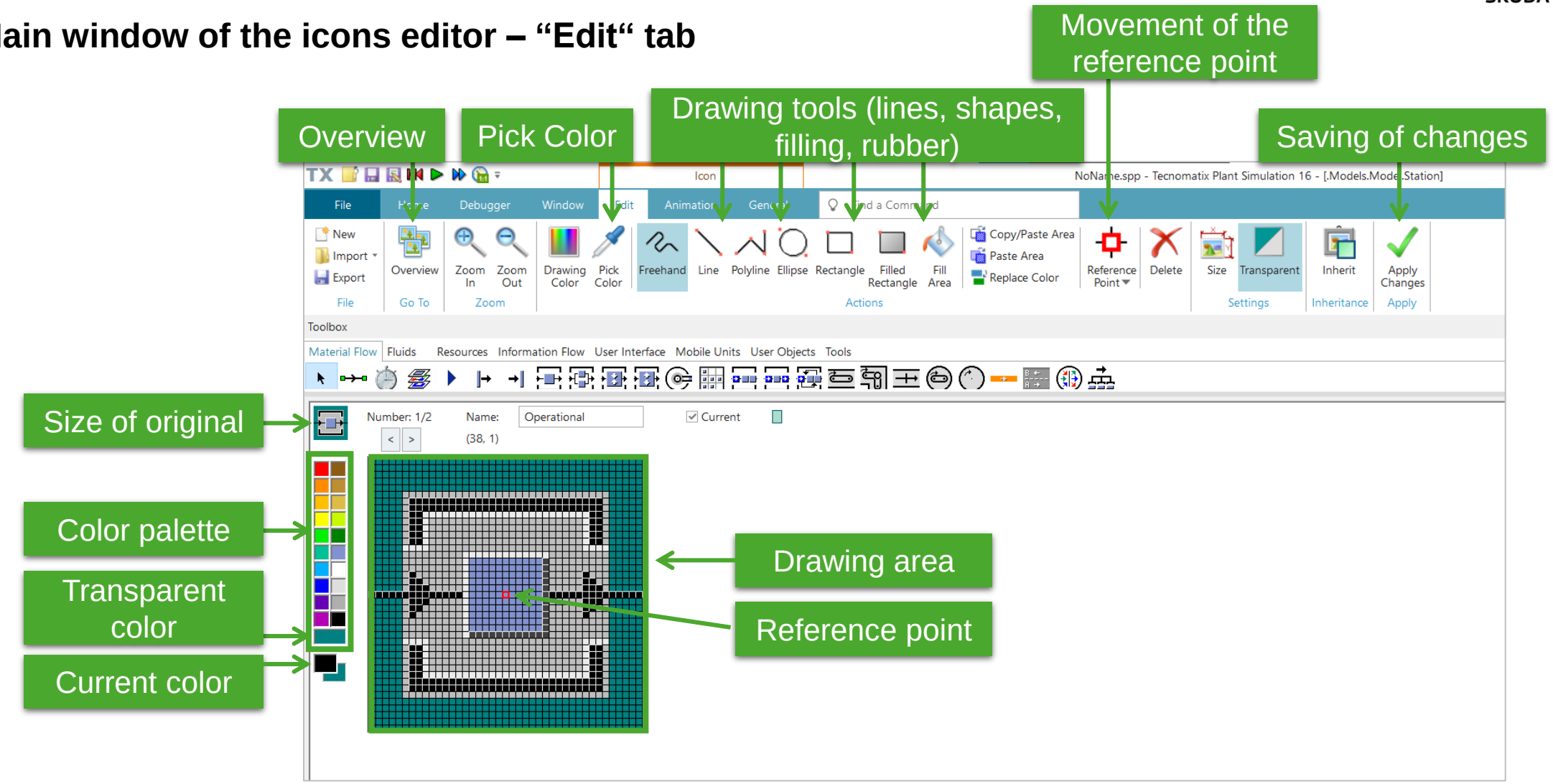




Plant Simulation Parameters

ŠKODA AUTO University

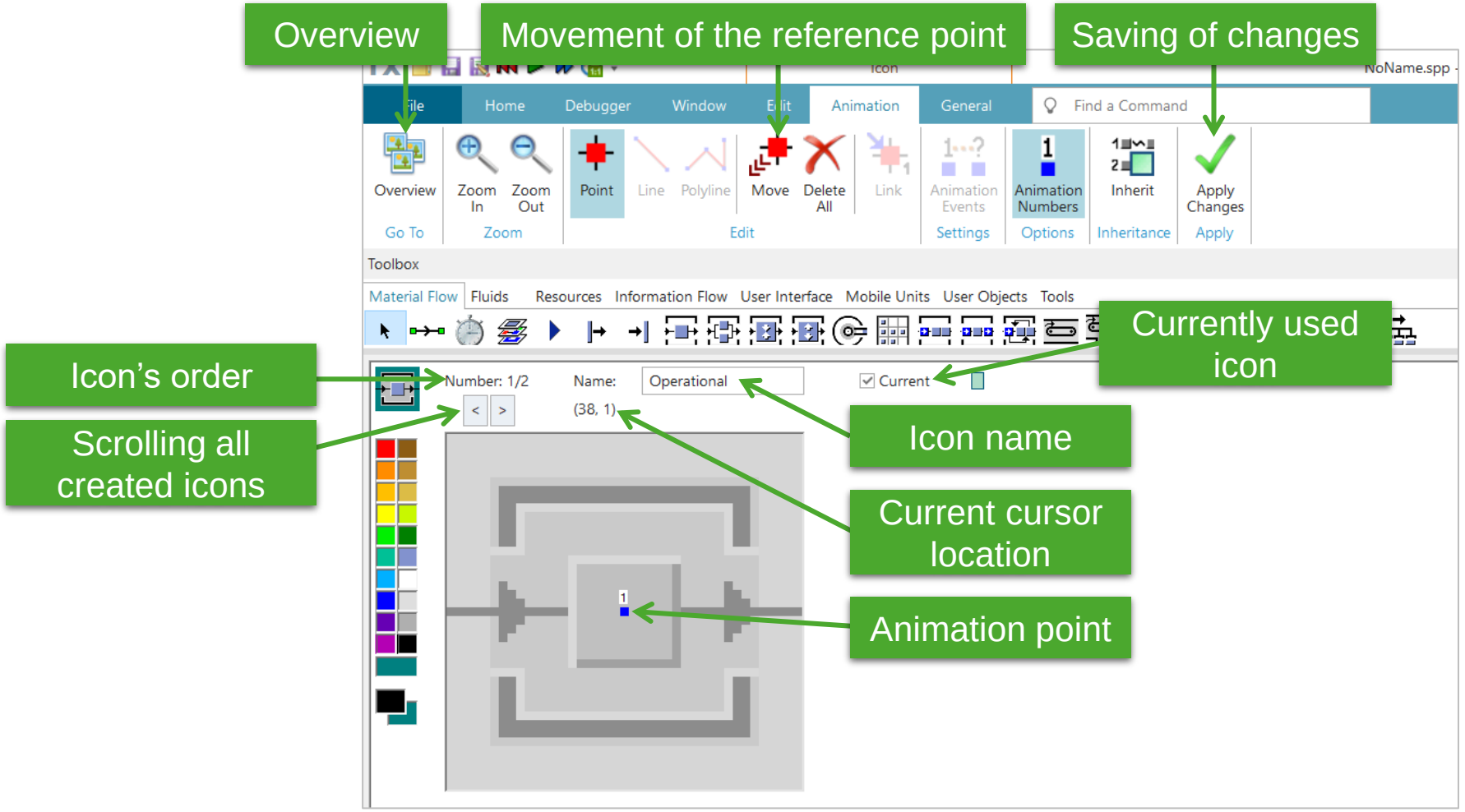
Main window of the icons editor – “Edit“ tab



Plant Simulation Parameters

ŠKODA AUTO University

Main window of the icons editor – “Animation“ tab

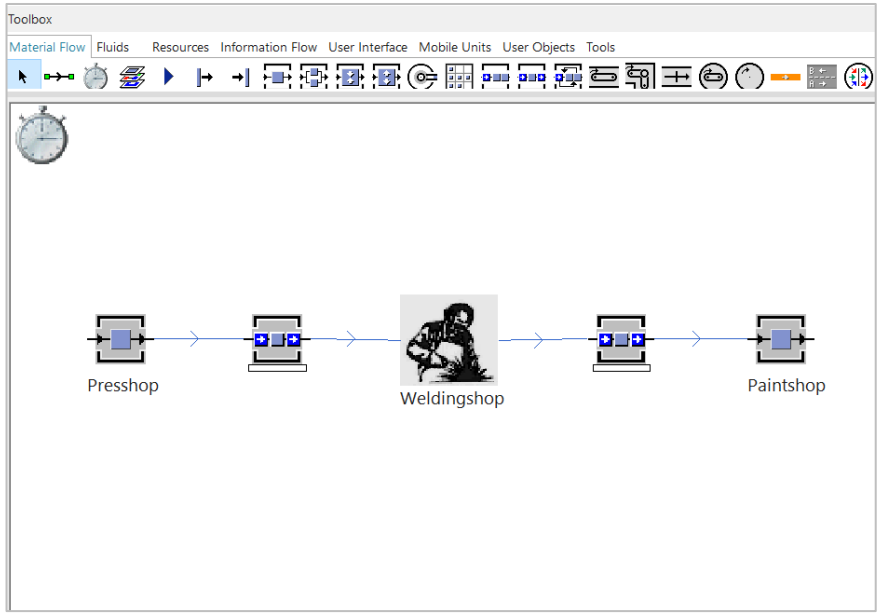


Plant Simulation Parameters

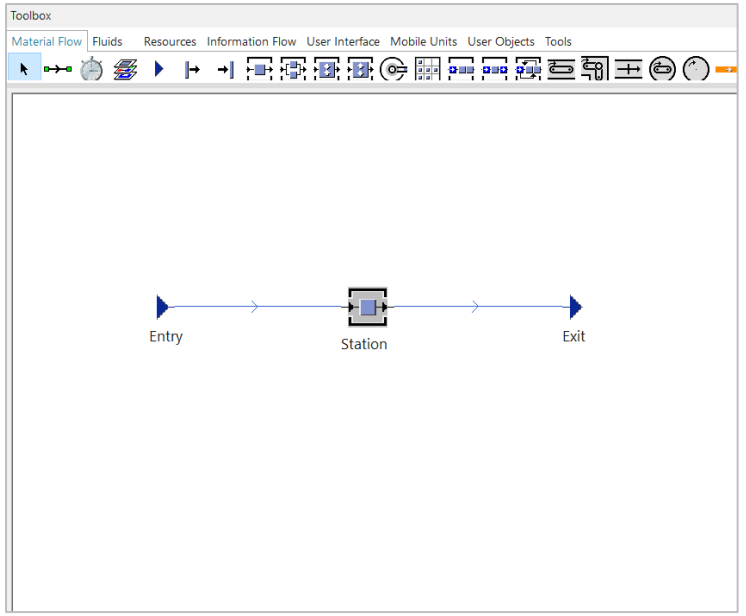
ŠKODA AUTO University

Frame animation

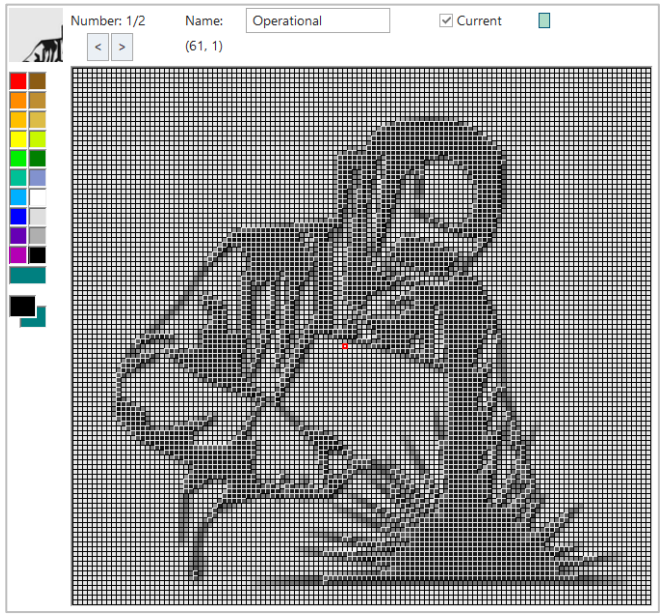
- We can also assign custom icon to a frame. In the example below, in the model, Station object is replaced by a separate frame. In the frame, the image is assigned to the icon with the name operational.



Main model



Nested frame



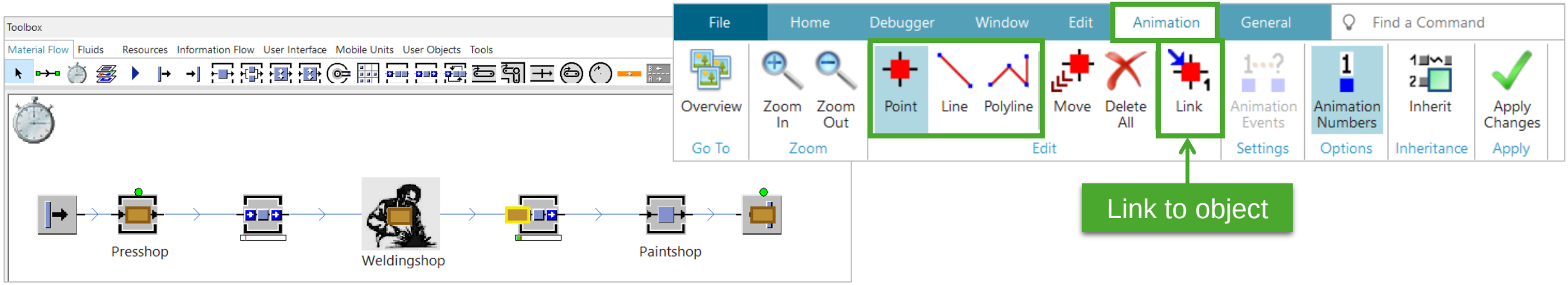
Icon editor

Plant Simulation Parameters

ŠKODA AUTO University

Icon animations

- MU movement can be visualized by animation points, even in the hierarchical structure of frames (for frames inserted into other frames).
- These points represent the connection of the icon and the object that lies in the frame. MUs that are currently on the object during the simulation run will appear on the corresponding animation point of the icon.
- Depending on the object type, animation lines can be also assigned.
- Setting of the animation points/lines is made in the "Animation" tab in the icons editor.
- The animation points can only be assigned to class objects.

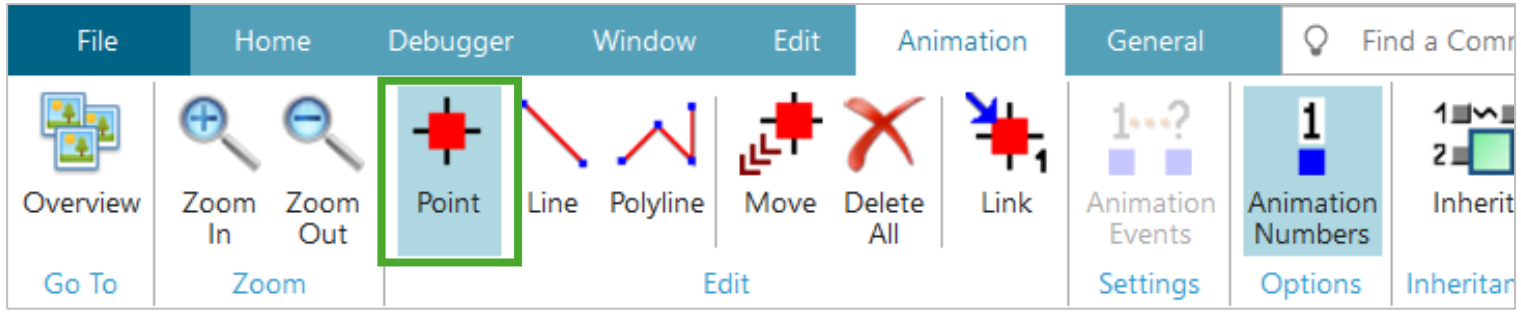


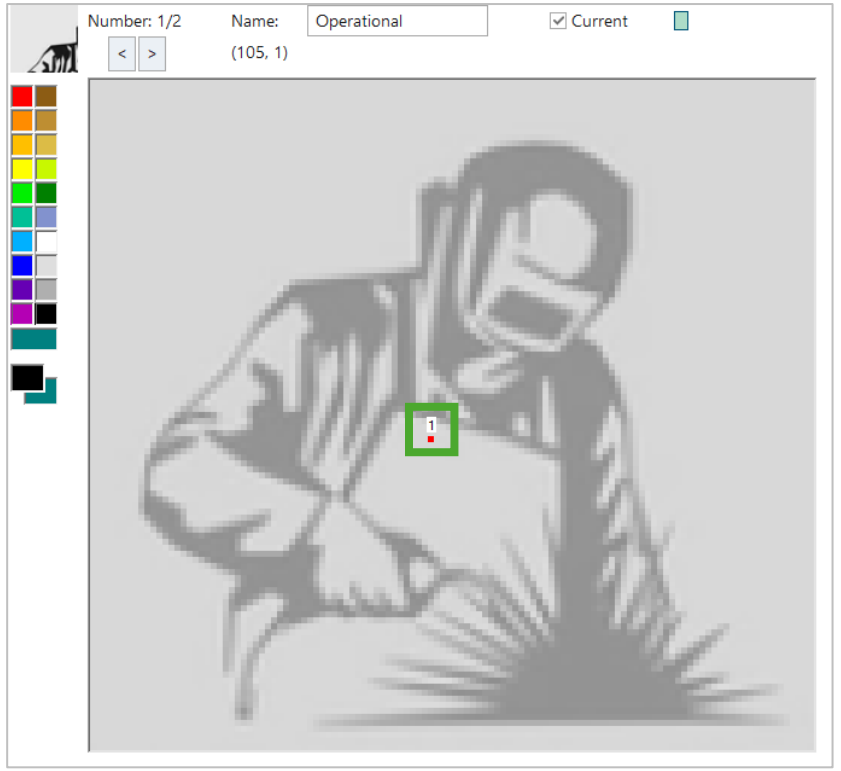
Plant Simulation Parameters

ŠKODA AUTO University

The process how to create a simple icon

- First of all, we need to activate some of the animation tools, for example adding of the animation point.
- Then click on the desired insertion point on the icon, where you want the animation to be visible.



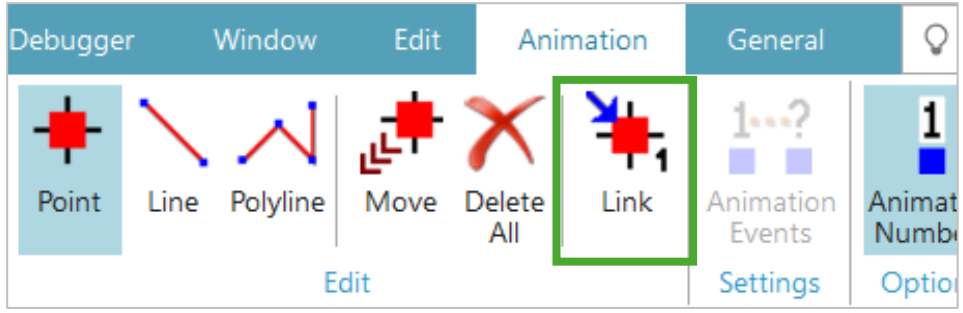


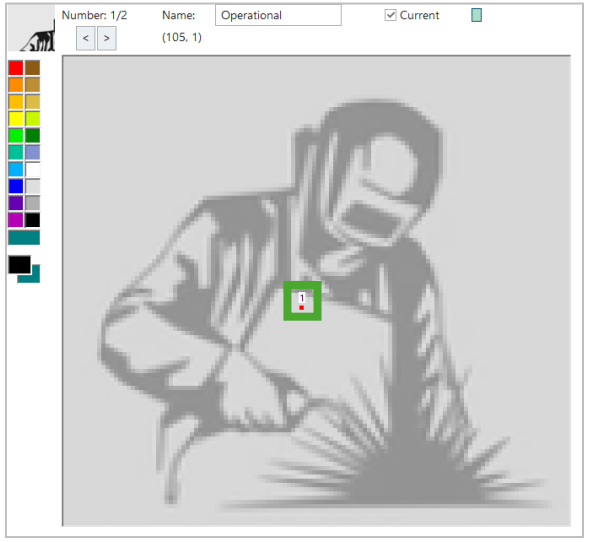
Plant Simulation Parameters

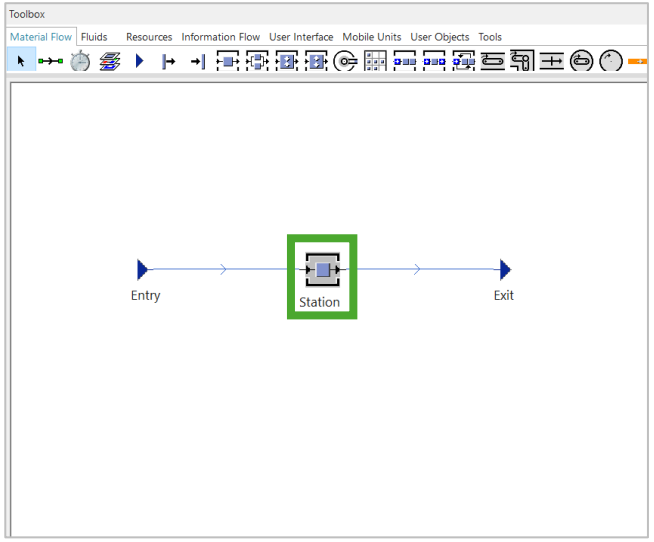
ŠKODA AUTO University

The process how to create a simple icon

- Activate the animation point link tool. Click on the animation point, this will automatically open the frame for which you are editing the icon.
- Click on the animated station (Station). If we have more stations in the frame, we can repeat this process for them.
- We will ensure that the button Current is active (it means that this icon will be used). It is even possible to change the icon's name.
- All the changes must be saved by "Apply Changes".







Plant Simulation Parameters

ŠKODA AUTO University

Icons editor – additional information

- In case that we are creating custom icons (not inserting pictures), we use drawing tool from the toolbar in the editor menu. We can draw freehand, straight lines, polylines, ellipses, rectangles, filled rectangles, we can fill areas with color, or we can copy areas and paste copies of them.
- Pick Color - this tool is used for color selection from a drawing area. The picked color will be then selected as the active color on the drawing area.
- The reference point is used to determine the position of the used object icon in the frame and to represent MUs on this object (example - during the animation, the Station reference point coincides with the reference point of the mobile unit that is currently inside the object). By default, the reference point is located 20x20 pixels from the top left corner of the icon.

Plant Simulation Parameters

ŠKODA AUTO University

Icons editor – additional information

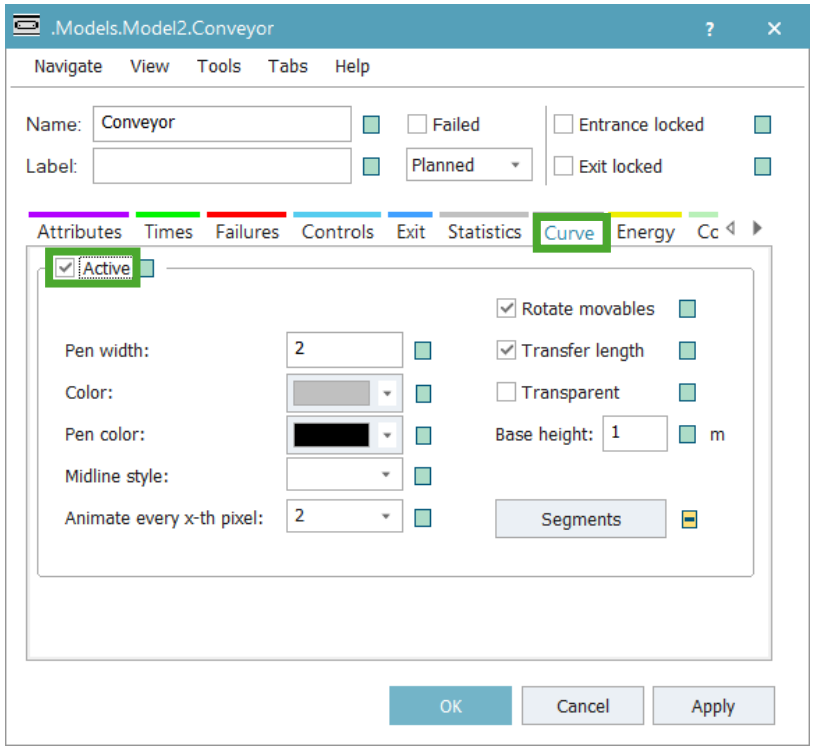
- Transparent color – if we use the transparent color in the icon's desktop, it means that on that particular spot the icon will be "transparent" and the frame background will be visible.
- The currently used icon has the Current check box enabled.
- Maximal size of an icon is 4000x4000 pixels.
- If we name an icon as background, picture will be used on the frame background.
- Use of the user-defined icons and their animation slow down the simulation run.
- It is possible to switch automatically icons in case they have special names (working, setUp, no Entry, failed, pause, waiting).
- If you don't want the object icons to change, you must rename these icons (they must not have any of the special names) or delete them.

Plant Simulation Parameters

ŠKODA AUTO University

Conveyor creation

- Conveyors can be modelled very realistically by inserting a sequence of curves and straight segments into the model. The length is set according to the layout (according to the distance between two grid points - by default it is 1 m).
- This depends on the setting of tab Curve of the Conveyor class in class library - the Active checkbox must be checked here.
- In general, the length dimensions are given by the frame scale: “General“ tab - Scaling Factor.
- Scaling Factor determines what the length of 1 pixel is. The default setting is 0.05 m. The distance between grid lines is 20 pixels. Then the distance between two grid points is 1 m. If we set the Scaling Factor to 0.5 m, for example, then the distance between two grid points is 10 m.
- On tab Curve, it is possible to set the conveyor’s width and color, width and color of the ending line, to choose whether the MUs will rotate according to the direction of the conveyor during animation (Rotate MUs).
- If you do not want to adjust the length according to the layout, deactivate the Transfer length option.

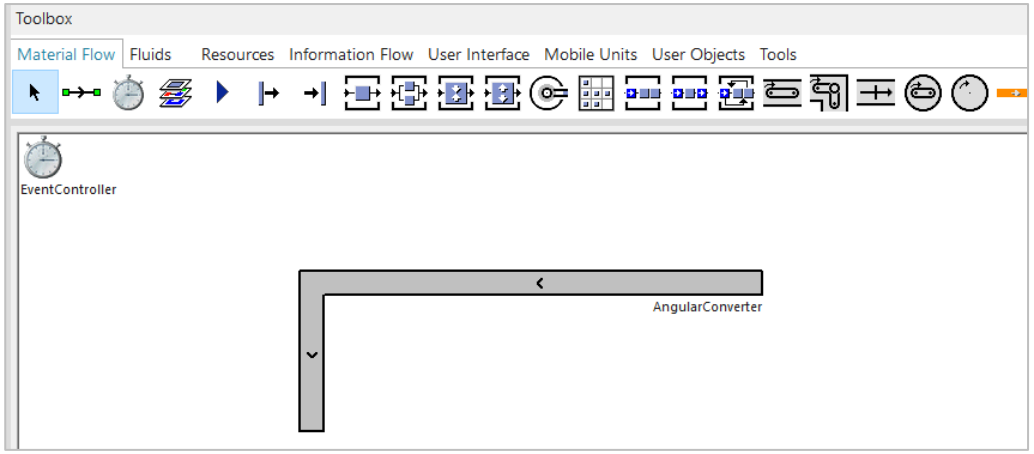


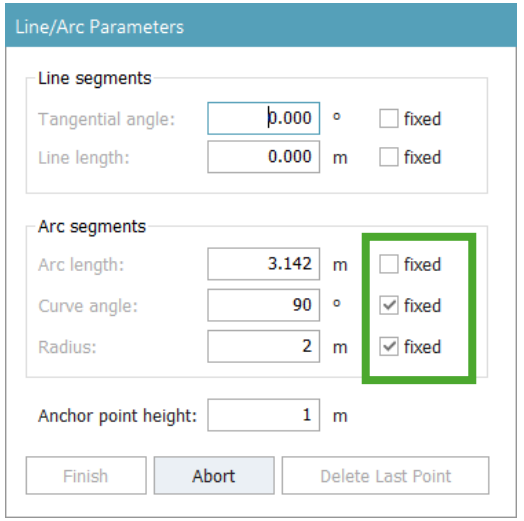
Plant Simulation Parameters

ŠKODA AUTO University

Conveyor creation

- Straight segments
  - Activate the conveyor in the Toolbox (then release the left mouse button again).
  - Click in the frame on the starting point of the conveyor.
  - Each new segment is created by another click in the frame.
  - If we right-click in the frame, we complete the conveyor creation.
  - The window Edit Parameters of Curve is automatically opened when dragging the conveyor segment, here we can fix the tangent angle (e.g., 90° for convenient creation of rectangular segments) or the length of each segment (e.g., 10 m - each new click will extend the conveyor length by just 10 m) to the fixed value.



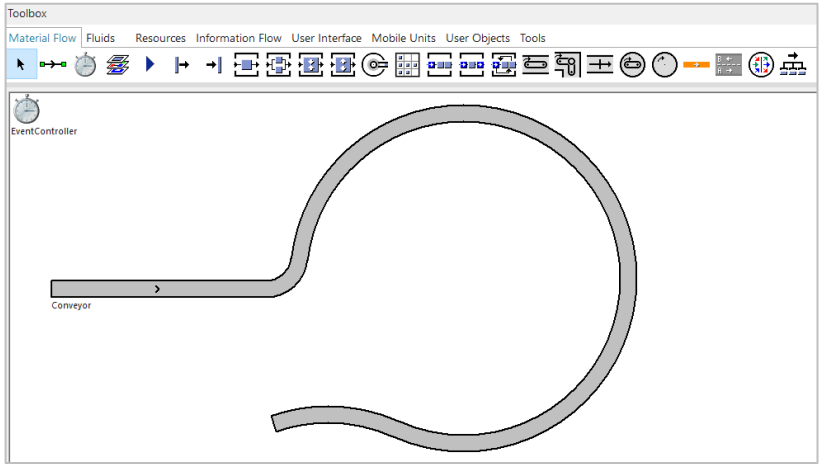


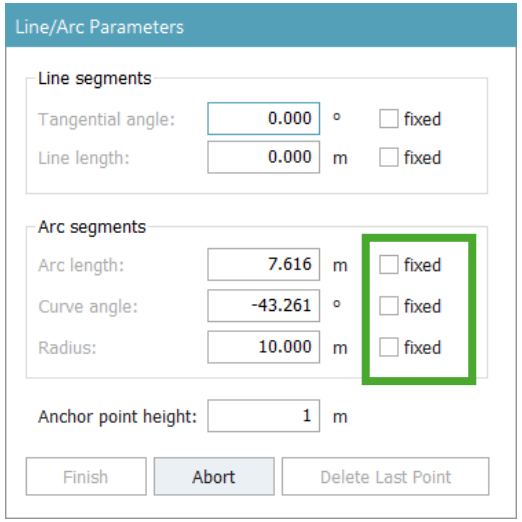
Plant Simulation Parameters

ŠKODA AUTO University

Conveyor creation

- Arcs
  - Arcs are inserted by pressing and holding the CTRL key.
  - In window Edit Parameters of Curve, the lower part of Arc segments is now active:
    - The tangent angle can be set.
    - Determine the radius of curvature.
    - Set the arc length - the calculated central angle is displayed.
  - If the object is active ("selected"), a right-click will open the context menu, we can add another point, delete the last segment, etc.



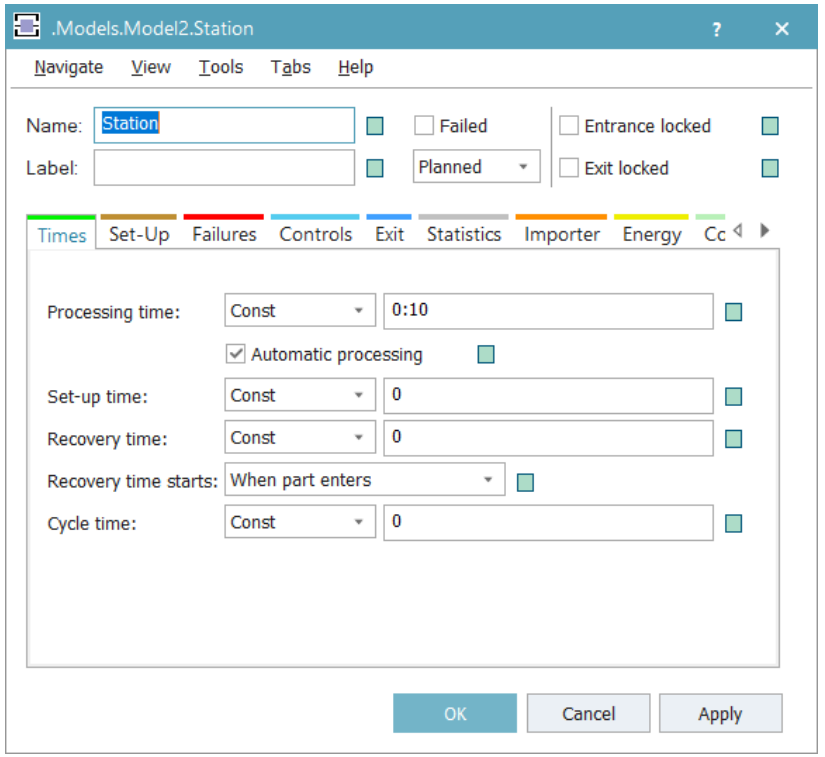


Plant Simulation Parameters

ŠKODA AUTO University

Attributes

- Each object has a lot of standard attributes such as length, speed, time, capacity, icon's name, icon's number, etc.
- The list of standard attributes and methods can be displayed via the object context menu in the class library using the command Show Attributes and Methods or by activating the object and pressing the F8 key.
- In addition, for most of objects there can be assigned any number of additional, user-defined attributes. Handling them is the same as handling standard attributes.

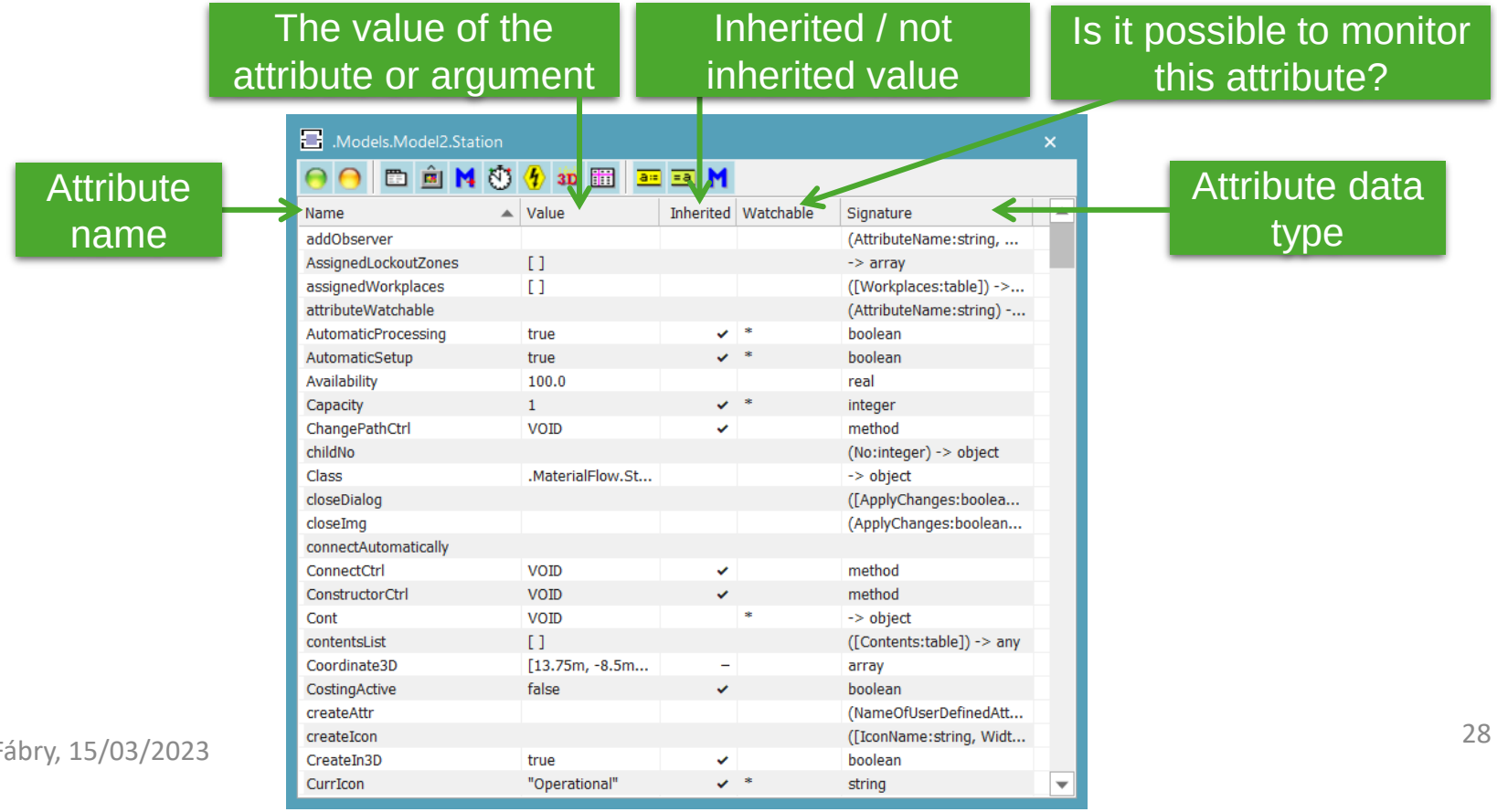


Plant Simulation Parameters

ŠKODA AUTO University

Table of attributes

- Names of object attributes start with a capital letter in the list and take on a value while the simulation run, unlike the methods.
- Double-click on an attribute line opens a dialog where the value can be changed or assigned. This functionality is not active for all attributes.



Name	Value	Inherited	Watchable	Signature
addObserver				(AttributeName:string, ...
AssignedLockoutZones	[ ]			-> array
assignedWorkplaces	[ ]			([Workplaces:table]) ->...
attributeWatchable				(AttributeName:string) -...
AutomaticProcessing	true	✔	*	boolean
AutomaticSetup	true	✔	*	boolean
Availability	100.0			real
Capacity	1	✔	*	integer
ChangePathCtrl	VOID	✔		method
childNo				(No:integer) -> object
Class	.MaterialFlow.St...			-> object
closeDialog				([ApplyChanges:boolea...
closeImg				(ApplyChanges:boolean...
connectAutomatically				
ConnectCtrl	VOID	✔		method
ConstructorCtrl	VOID	✔		method
Cont	VOID		*	-> object
contentsList	[ ]			([Contents:table]) -> any
Coordinate3D	[13.75m, -8.5m...	–		array
CostingActive	false	✔		boolean
createAttr				(NameOfUserDefinedAtt...
createIcon				([IconName:string, Widt...
CreateIn3D	true	✔		boolean
CurrIcon	"Operational"	✔	*	string

Thank you for attention

Jan Fábry

Department of Production, Logistics and Quality Management

fabry@savs.cz www.janfabry.cz

www.savs.cz