
SIMOGGA LD Qt Documentation

Release 4.6

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SIMOGGA, is an innovative graphical material handling system that optimizes factory layout design based on a global flow analysis.

SIMOGGA relies on an optimization core resulting from 10 years of intensive research and on an intelligent interface. It is user friendly and requires a small amount of data to deliver results. SIMOGGA guides the users through the process of improvement, but does not replace them. It feeds on the knowledge and experience collected from plant managers and operators and any other key players in the improvement process.

SIMOGGA key concepts

- The visualization of the results gives you concret elements to discuss
- The quantification of the results allows to justify your proposition
- The interactivity of the tool gives you the opportunity to test any scenarios and use it during the meetings
- The simplicity of use permits to include all actors concerned by the change
- The intelligence of the tool guides you in your approach

For the trial version, follow the process from the section : [Creating of the As-IS situation in the real view](#)

Good work

Note: Don't forget that you can contact us at anytime via this page: <http://www.amia-systems.com/contact>

Contents:

CHAPTER 1

Prerequisites

The screenshot displays the SIMOGGA LD software interface. The top toolbar includes icons for Interaction Mode, Select, Delete, Machines, Graph, Superposition, Lock up, I/O, Lock, Cell, and Report. The status bar shows "Transactions: 1162 | Intracellular Distance: 0.0" and "Evaluation of the solution".

The left sidebar contains several sections:

- Scenarios:** Scenario1, Graph view, S1GV1: GraphAlternative1, Real View, S1RV1: RealAlternative1. Includes the text "Navigation in the scenarios and alternatives".
- Optimized Scenarios:** Scenarios, Optimized Scenarios.
- Structure:** Company. Includes the text "Navigation in the factory design".
- Infos:** Selected Item Info: Incomplete connection for machines. Includes the text "View the information about the machines, flows...".
- Dashboard:** A table with columns: Alt, Cost, %, Nb kms, Time. Includes the text "Dashboard to compare the real alternatives".

The central visualization area shows a network of machines represented by colored boxes (M1, M2, M3, M4, M5, M6, M7, M8, M9, M10, M11, M12, M13, M14, M15, M16, M17, M18, M19, M20, M21, M22, M23, M24, M25, M26, M27, M28, M29, M30, M31, M32, M33, M34, M35, M36, M37, M38, M39, M40, M41, M42, M43, M44, M45, M46, M47, M48, M49, M50, M51, M52, M53, M54, M55, M56, M57, M58, M59, M60, M61, M62, M63, M64, M65, M66, M67, M68, M69, M70, M71, M72, M73, M74, M75, M76, M77, M78, M79, M80, M81, M82, M83, M84, M85, M86, M87, M88, M89, M90, M91, M92, M93, M94, M95, M96, M97, M98, M99, M100). The flow paths are represented by arrows of varying thickness, indicating the amount of transfers. The text "Thickness of the flow proportional to the amount of transfers" is placed near the flow paths.

The bottom dashboard includes a "Visualization Filter" section with a "Filter (%)" dropdown set to "0%", a "100%" button, and a "Magnify" button. It also features a "Thickness of the flows" section with "Thickness Min" and "Thickness Max" sliders.

Annotations on the right side of the visualization area:

- "Machines representing the raw materials and the finished parts" (pointing to M1 and M2).
- "Flow represented by the number of transactions or the amount of moved parts" (pointing to a flow path).
- "Machine characterized by a machine type (color) and a fill rate (load)" (pointing to a machine node).
- "Visualization screen - Real view : Traffic analysis in the factory - Graph view : Traffic analysis without constraint" (pointing to the visualization area).

At the bottom left, a message states "Current Language changed to English".

1.1 Flow

- *Flow* = number of movements or quantity of goods transferred between two machines (From - To). The *graphical view* represents the directional flow (From - To). The *real view* represents the flow on each segment without added indication of direction.
- Flow expressed in terms of **movement** (movement= transfer of a batch of parts from a position A to a position B): the value of the flux is the number of trips made to move all parts of a position A to a position B.
- Flow expressed in terms of **quantity** : The flow value is the sum of all parts moved from a position A to a position B.

1.2 Machine

- SIMOGGA considers a machine, all machines, workstations, and storage locations where the product is stopped, (it can be transformed by an operation of the process or just stored for some time).
- The machines have a **color** which characterizes the type of machine.
- The level of **filling** of the colored part is the percentage of the load with respect to the capacity.

1.3 Views

- SIMOGGA is organized into different views: *graphical view*,*term:design view*,*term:interaction view*,*term:scheduler view*.
- **Graphical** view : Visualization of directional flow without constraint (cultural, technical, historical).
- **Design** view: View that permit the plant layout definition.
- **Interaction** view : View with the plant layout to account for technical constraints of the plant (plant areas, entry-exit, immovable machinery).
- **Scheduler** view: View used to make different scheduling manipulations.

1.4 Scenario

- SIMOGGA is built based on a set of customer data = the Excel file where each transaction is assigned to a machine. This corresponds to a particular Operation-Machine solution. The assignment of operations on machines is used to define the matrix of From-To stream where all flows of a machine A to a B machines are represented.
- Each *scenario* presented in SIMOGGA corresponds to a solution **Machine-Operation** particular. This solution involves the flow between different machines and a specific use machine (with respect to the load capacity defined).
- Each *scenario* is also defined by a factory **design**.



2.1 Excel File

To collect the data from the customer and to simplify the completion of the xml, an excel file is used: [AMIA-SIMOGGA-SampleCase.xlsx](#)

The excel file with the data for the Trial Version can be download [here](#)

Per the instructions provided in the excel file, only the columns highlighted in yellow are required to be completed. All of the other columns are for information to enable a more in-depth analysis (such as machine load and capacity).

A macro converts the Excel file into xml file readable by SIMOGGA.

A file « SIMOGGA-output.xml » is created in the repository beginning by XLS2XML (at the same level as the excel file).

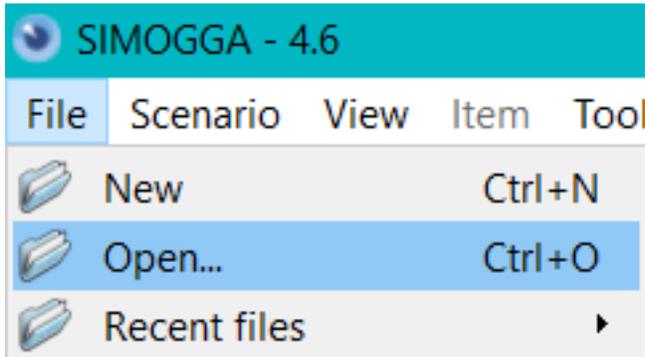
2.2 Creating of the As-IS situation in the interaction view

2.2.1 Opening a file

To start working with SIMOGGA, two options are possible: - Create a new case in the “File > New” menu. It create a new case whithout any data, you can fill all the data on the data panel. - Open an existing file and there you have also two choices.

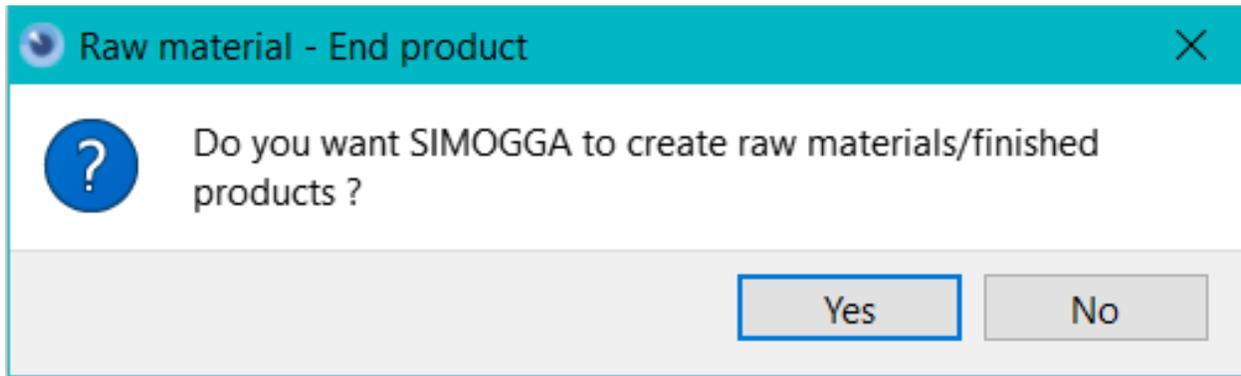
- Open a file generated from Excel. It is a .xml file.

- Open an already worked on case in SIMOGGA. It is a .db file that you can open in the “File > Open” menu or in the “File > Recent files” menu.



When opening a file, a dialog box appears asking whether SIMOGGA must create locations for Raw Material (MP) and Finished Part (FP). If the data already includes these inputs and outputs of the system, click on “No”.

For the TrialCase, click on “Yes”. The representation of the flow is more complete if we take into account the inputs and outputs of the system.



Opening a file starts in the ‘design’ view. You must first draw your factory, and define the working(yellow cell). Once it is done you can go to the ‘interaction’ view. By default, the machines are placed in a tray.

2.2.2 Saving a case

Two types of save options can be found in the “File” menu:

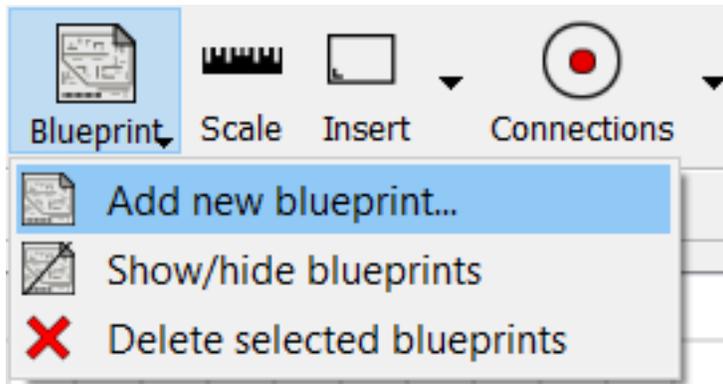
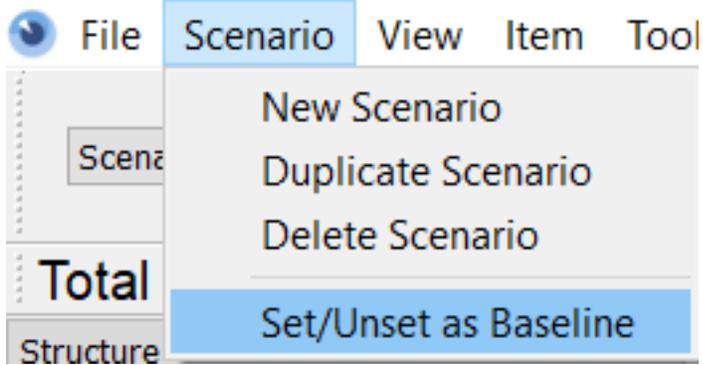
- Save: The backup will be done on the open file. The changes will be saved in a db file.
- Save As . . . : The user can choose the backup location and name of the saved file.

Hint: Don’t forget to save your work regularly to avoid any lost.

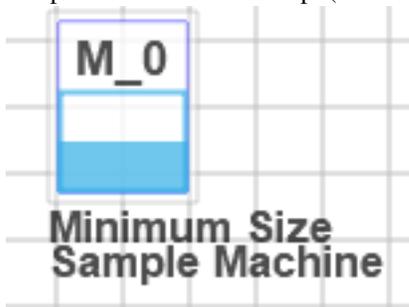
2.2.3 Create the factory - Design view

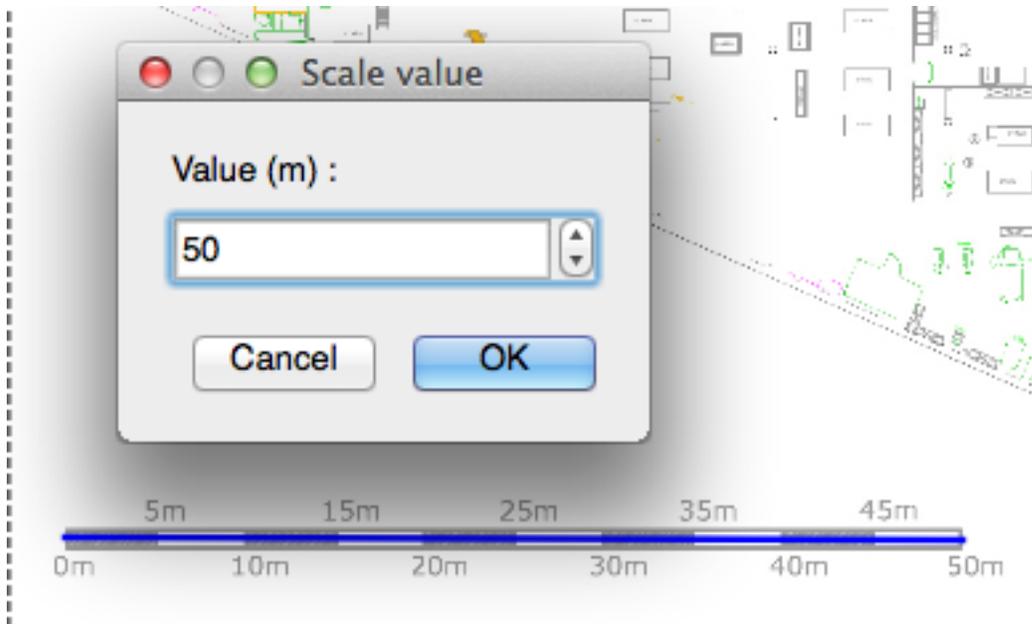
For a scenario it is possible to obtain a two-dimensional representation of the work area corresponding to the reality.

- Save this scenario as the reference: Click on ‘Scenario’ on the and select “Set / Unset as Baseline” option. This will serve as a benchmark to compare all scenarios.



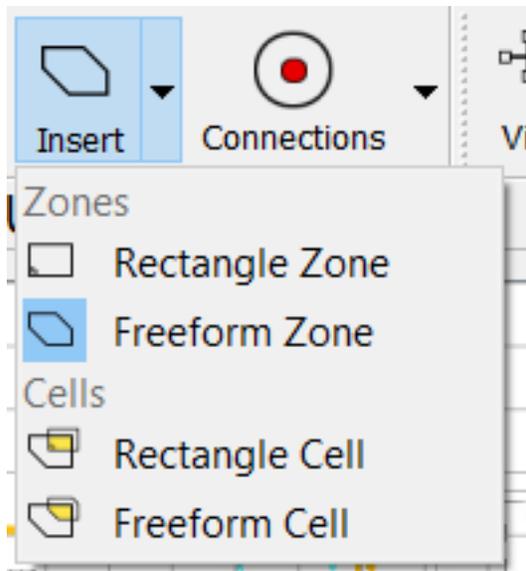
-  Insert a factory blueprint as a background image
- Adapt the size of the map (via the zoom with the mouse wheel) in function of the sample machine.



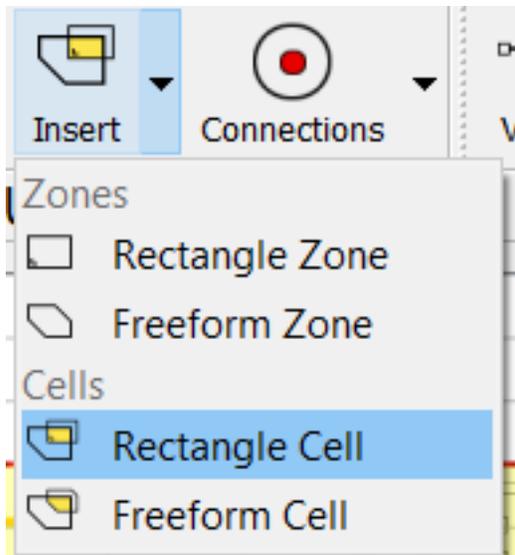


- of the factory plan.

Set the scale

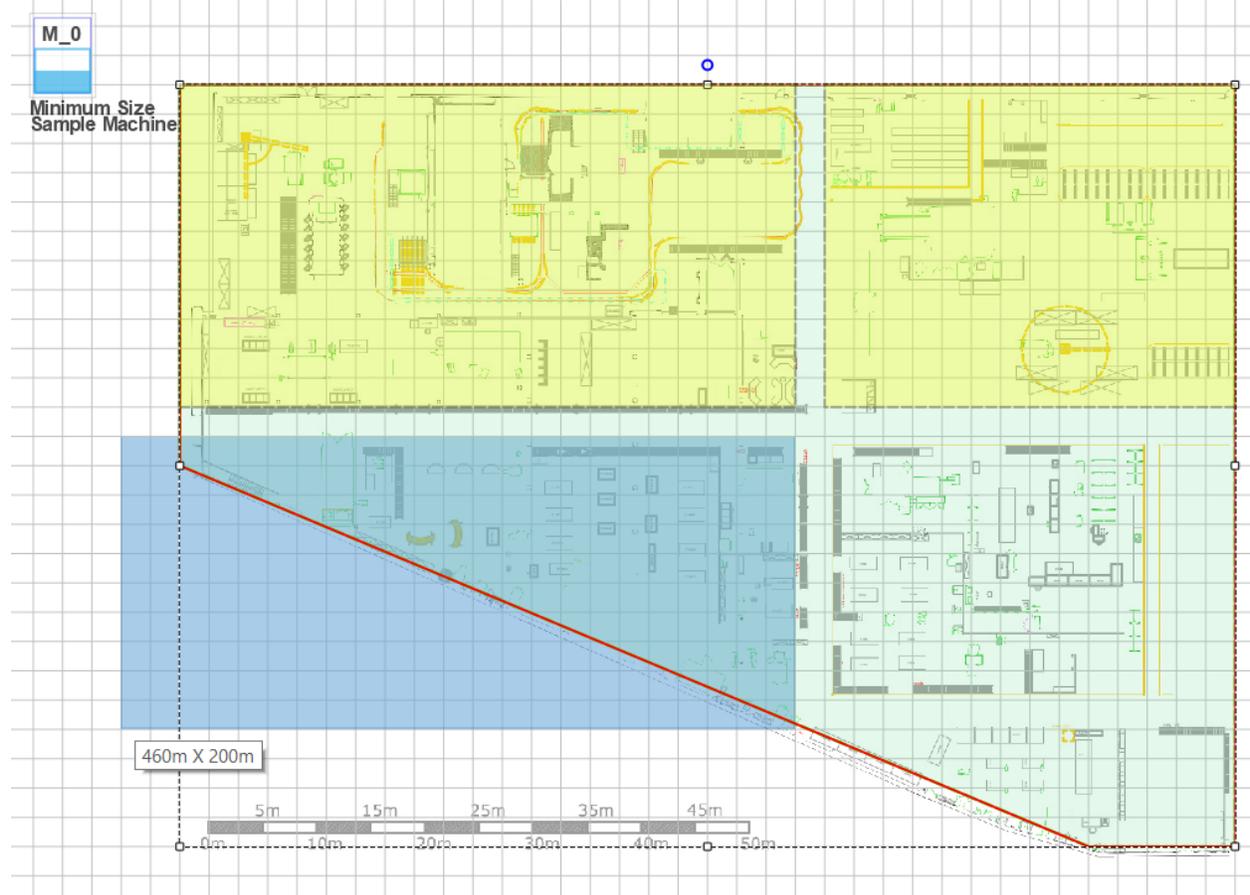


- Draw the outline of the factory on the plan. * With the freeform mode, click to draw the factory borders and double click to close it. * With the rectangle zone, click to fix a border of the rectangle, drag and drop to draw the zone.



- Draw the working areas (cells). To draw a cell, click first on its parent zone and then click on the insert cell menu.

When a cell is drawn out its parent zone, the borders will be cropped.



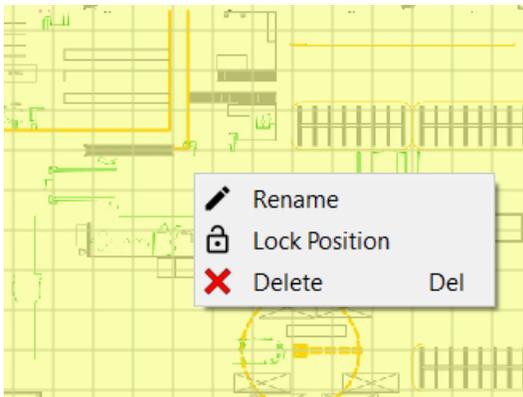
- To move a zone, just drag and drop it.



- To resize a zone, click on the zone and a little square will appear. Drag and drop the square and the zone will be resized.



- To turn a cell, click on the zone and a little circle will appear. Drag and drop the circle and the zone will turn 90°.



- By a right click on a zone, a context menu shows more actions on this zone.

2.2.4 Creation of the aisles

The skeleton of the aisles is a graphical representation of paths by points and lines.



- Insert the skeleton points by double clicking on the intersection of the aisles. These points represent the connection points of the aisles.
- Automatic interconnection points in order to create the aisle lines



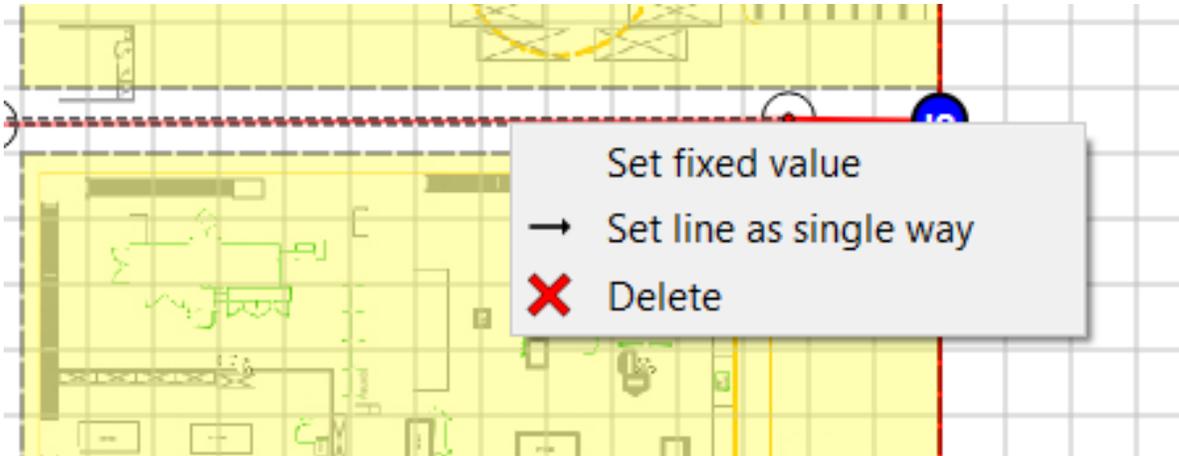
- Create connections between two unconnected points automatically by double-clicking on both points to connect



- Insert the In/Out (IO point) on the zone border with double clicking



- Define the aisles in the working area by successive double-clicking



- With a right click on a line, set it's distance or set this line as single or double way.

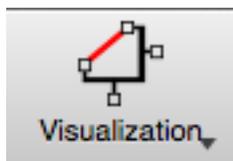
2.2.5 Positioning of the machines – Interaction Mode



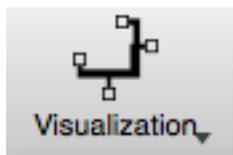
- Select the “Interaction Mode” in the menu.

- Move the machines from the tray to the working cells in the current location of the factory (by clicking CTRL / CMD you can select multiple machines). They will be automatically connected to the aisles. If there is a flow between two machines positioned on the plan, it will appear automatically.

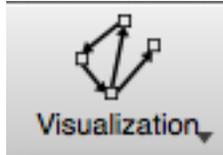
- Choose the visualization



- Standard : Machines are connected directly if they belong to the same area, if not traffic is through the aisles.

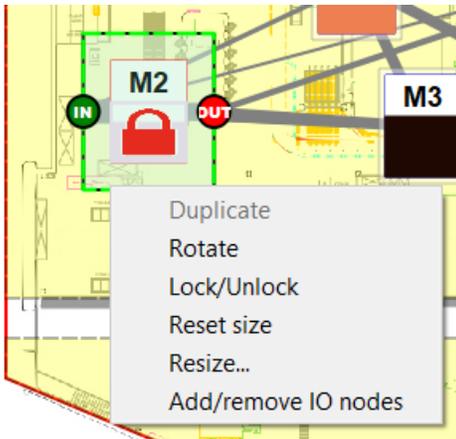


- By the aisles only: All traffic via the aisles.



- As the bird flies: The aisle backbone is not used. The machines are connected via directional flow.

Hint: In the first two displays, the concept of direction disappears. It is all the traffic that is shown on each segment. This type of view mode is only possible if an aisle skeleton was built in design mode. Otherwise, the representation is as the crow flies.



- The machines can be modified by:
 - The position with “drag & drop”
 - Their size to represent more accurately the real place that takes the machine within the factory
 - Their orientation
 - Their immobilisation. A locked machine cannot be moved.
 - Their in/out. You can choose where the flow enter to the machine and from where the flow go out the machine.

2.2.6 Dashboard

Dashboard					
	Scenario	Cost (€)	%	Distance (km)	Time (h)
1	Scenario1	3.269,0	0	196,1	65,4
2	Scenario2_Sc1	2.829,7	13,4	169,8	56,6

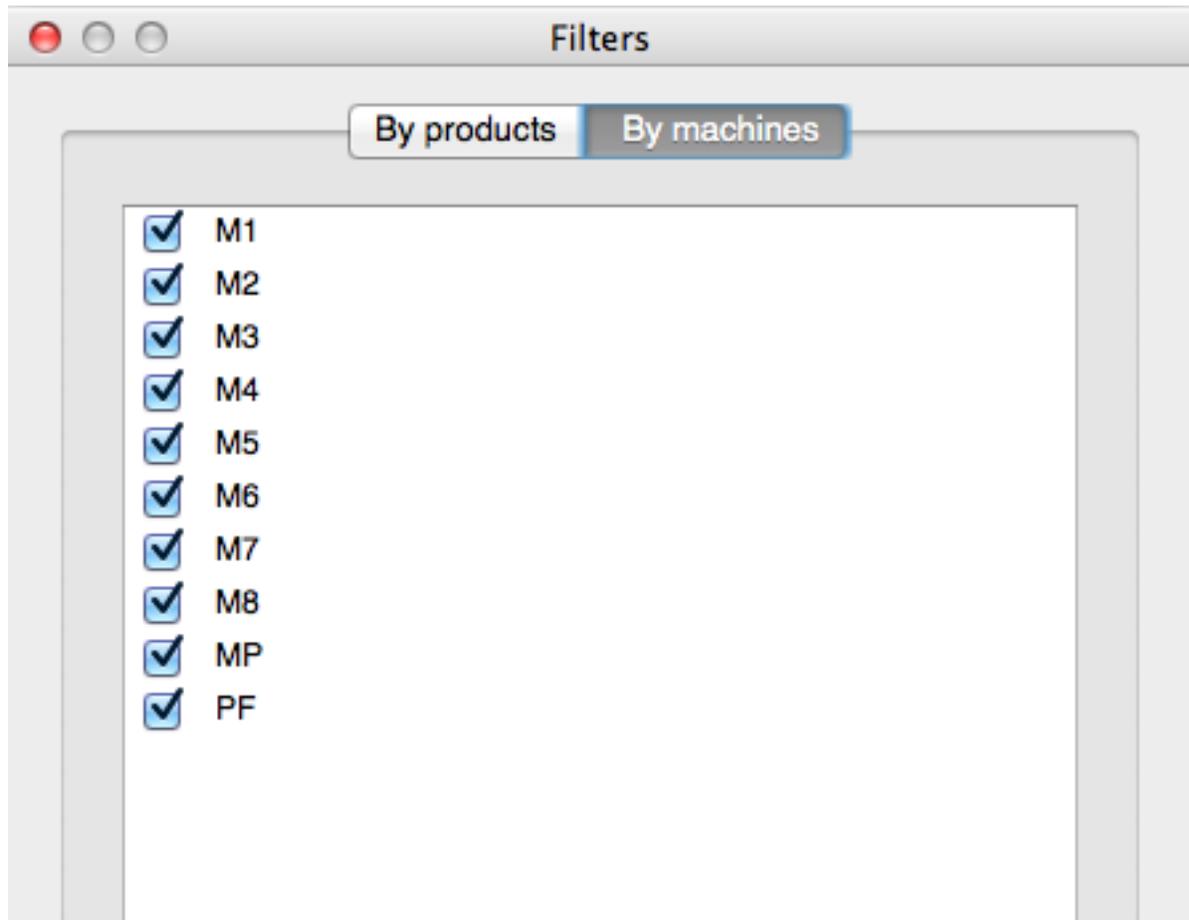
- When all machines are in position, the performance indicators assess the situation quickly
 - Number of kilometers traveled
 - Travel time

- Cost of transport

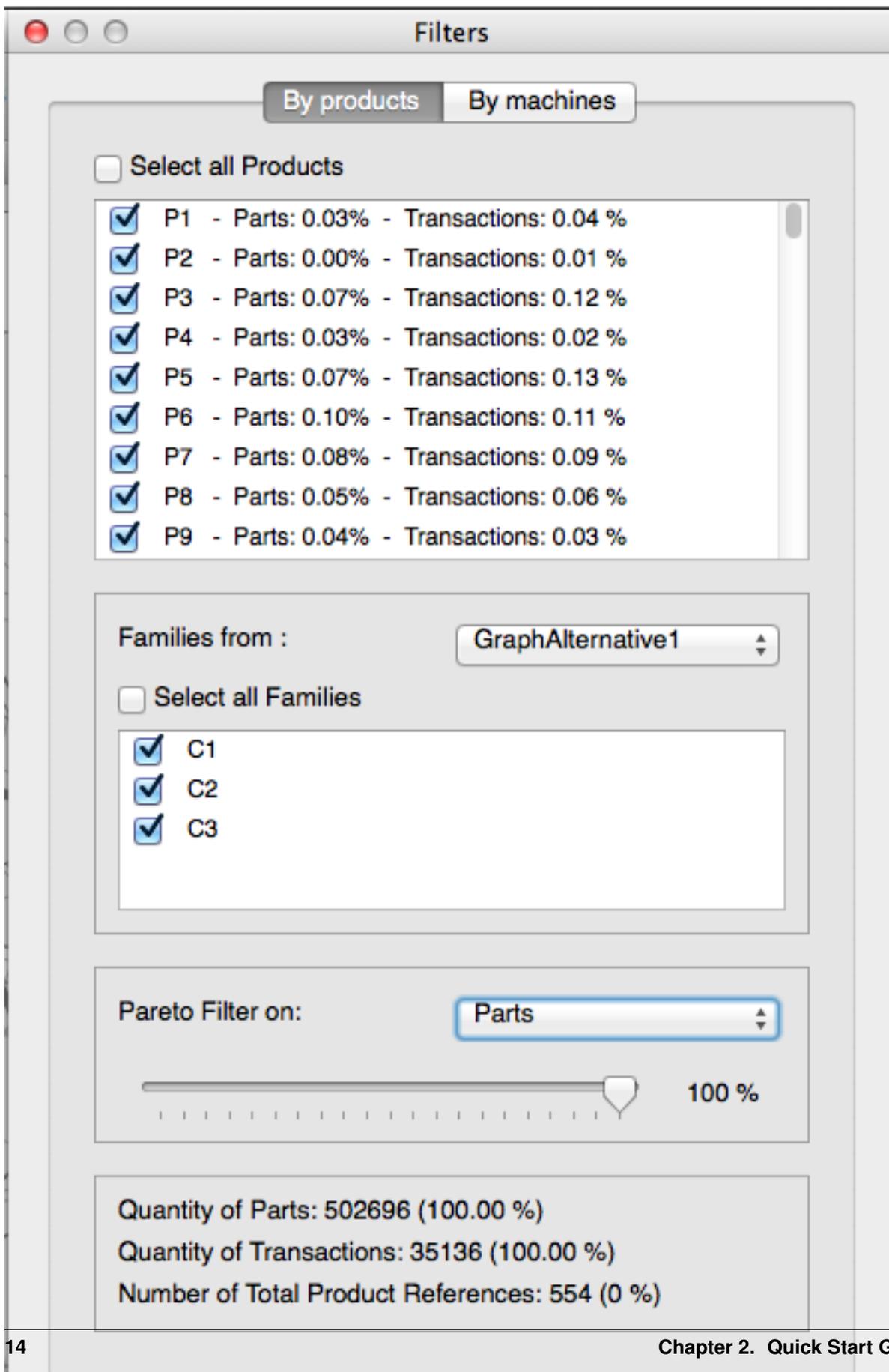
2.2.7 Reorganisation

Tools available:

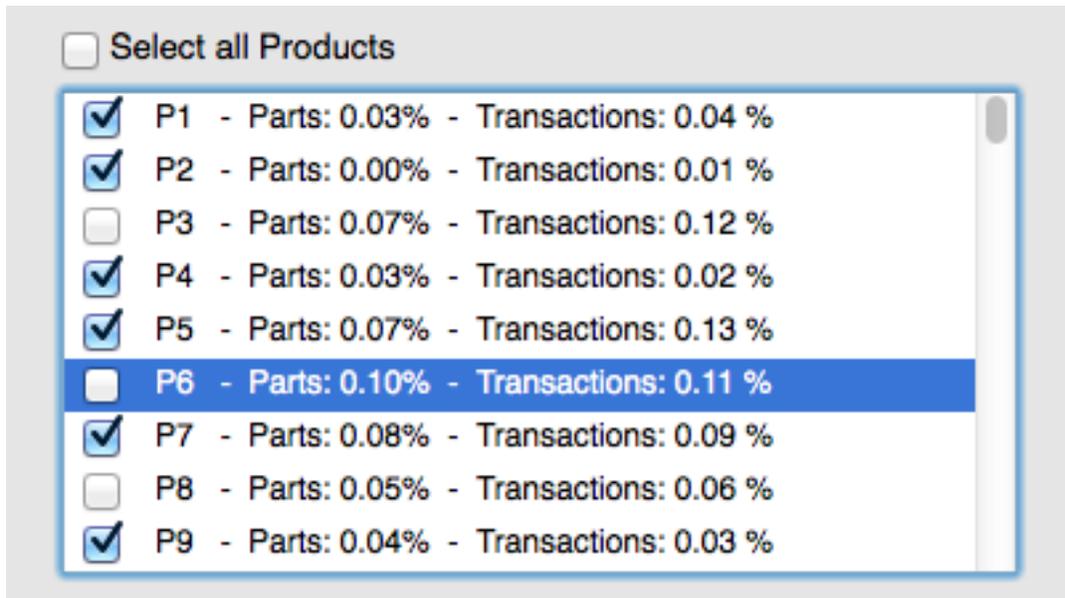
- The filters by machine allow the analysis of those flows connected to one or more machines.



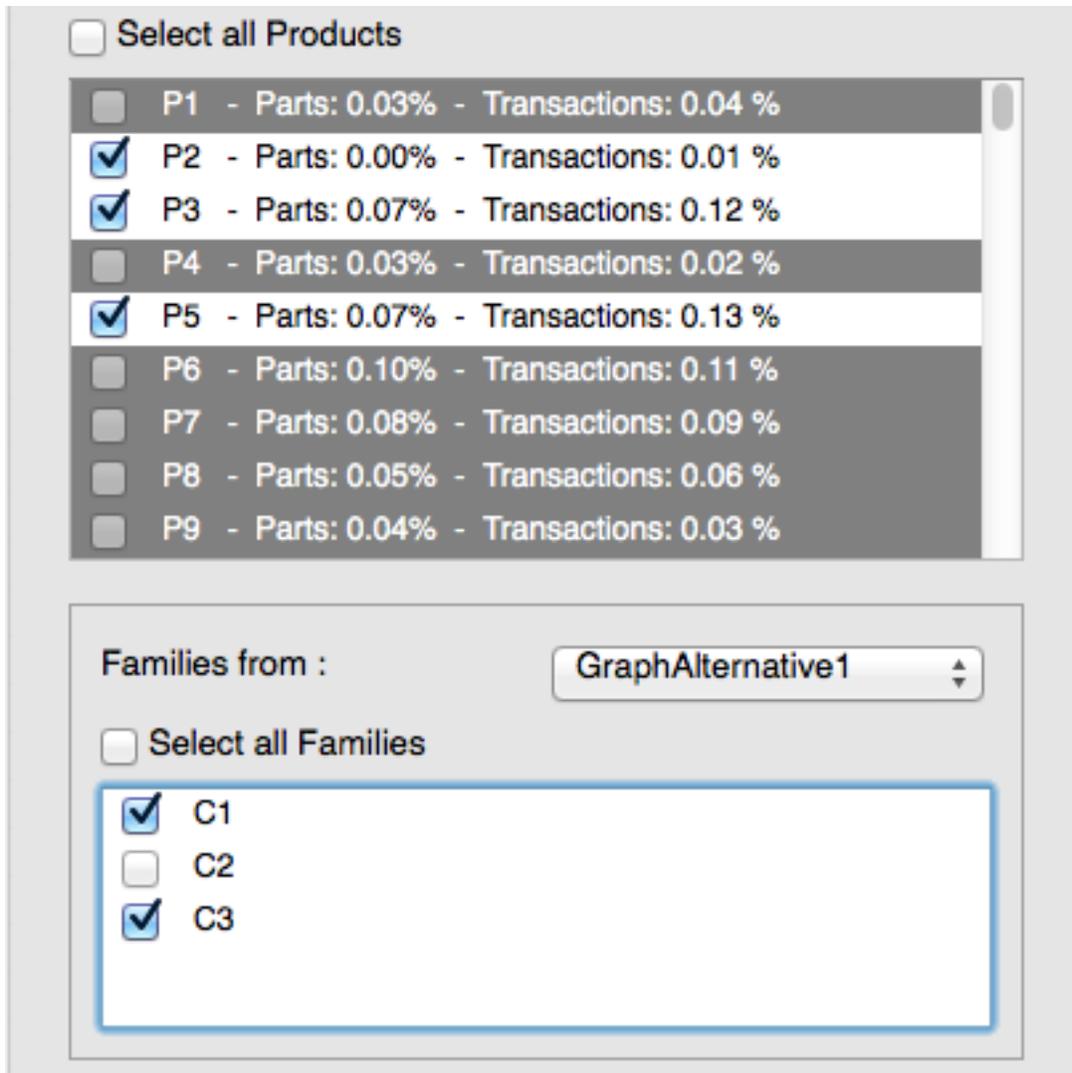
- Product filters visualize the flows of one or more products.



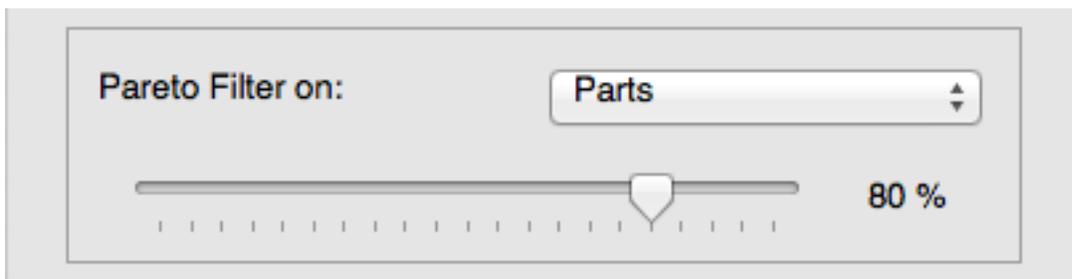
In the selection screen, each product is represented by its flow rate (in terms of quantity or transactions).



- Filters by product family visualize flows for one or more product categories when selecting a prior alternative



- A Pareto filter can be used on the quantities of goods transferred or the number of transfers made (transactions).



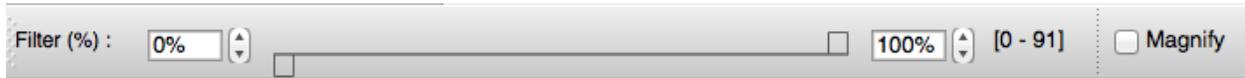
These filters will focus the analysis on some of the products

All information about the filtered products are available in the below of the windows (Number of parts, number of transactions)

Quantity of Parts: 402174 (80.00 %)
 Quantity of Transactions: 25880 (73.66 %)
 Number of Total Product References: 173 (31 %)

Making a flow analysis on a Pareto of products could bias the study. The tools available in SIMOGGA allow for the analysis of all the products.

- A visual filter takes into account all the products, but displays only the flows between a minimum value (bottom filter) and a maximum value (upper filter).

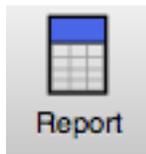


- Focus the analysis on a segment of value with a minimum and maximum value and look with a magnifying glass by checking “Magnify”. Flows will differentiate from each other.

2.2.8 Evaluation

The creation of the cells will allow SIMOGGA to create product families assigned to these cells. The products are allocated to a cell by the number of transactions inside a cell. They are displayed in different colors (from green to red) based on the relevance of membership to the cell.

This step is useful to know the directional flow between cells that we would like to create in the real view. The intracellular flux (inside the cells) are measured and represented as a percentage of total flows.



2.3 Scenario Generation

Based on the situation AS-IS and analysis of previous flows, it is possible to create all possible scenarios.

A scenario is used to test a new design (new working area, new aisles...), solutions with new investments in term of machines or new routings for the parts. It's also used to test the location of machines.

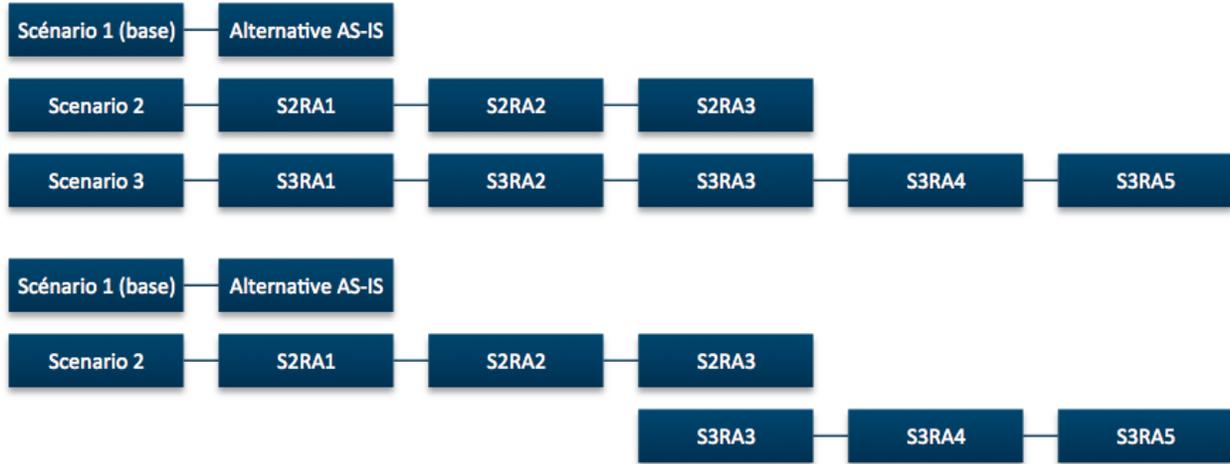
To change the positions of the machinery from the As-Is situation

- Duplicate « Scenario1»
- Changing the positions of the machines has a direct impact on the mileage (in green if a gain is observed)

Total Distance: 597.2 (-20%) km | Intracellular Distance: 444.8 (+44%) km (74.5 %)

Distance totale : **715.0** (+19%) km | Distance intracellulaire: **308.4** (-46%) km (43.1 %)

- Analyze the Dashboard



To create solutions based on the rerouting of flows performed in the graphical view of the “Scenario 2”:

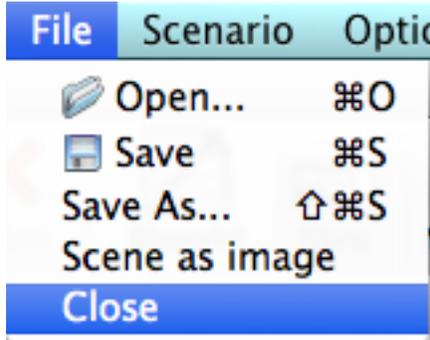
- Work in Scenario 2 alternative “S2RA1”
- Determine incremental changes (in terms of positioning of machines):**
 - Modify « S2RA1 »
 - Duplicate« S2RA1 » en « S2RA2 »
 - Modify « S2RA2 »
 - Duplicate « S2RA2 » en « S2RA3 »
 - Modify « S2RA3 »

..hint each stage to be saved must be duplicated in order to keep the changes.

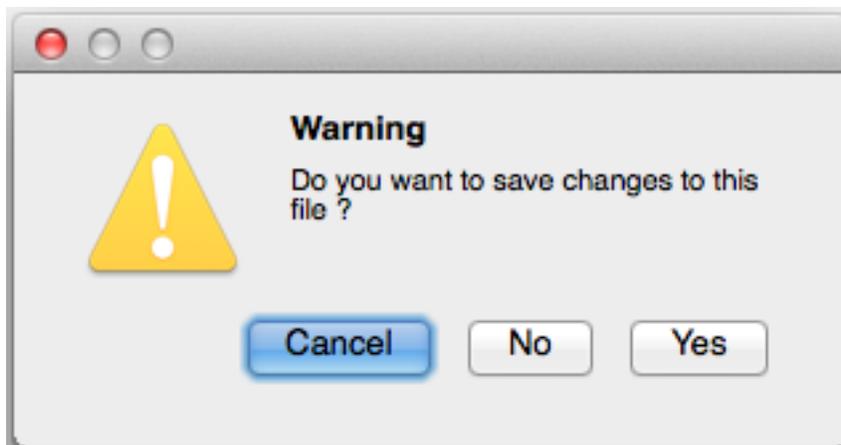
- Modify the design of the factory**
 - Duplicate Scenario 2 (Scenario 3 =)
 - Modify the design (delete cells, create new cells ...)
 - Delete the non-useful alternatives from the previous Scenario 2 (“S2RA1” and “S2RA2”)
 - Start to change the alternative “S3RA3” (new design with machines positioned as the last alternative scenario 2)
 - Proceed with incremental changes to create a different alternative “S3RA3”, “S3RA4” to “S3RA5”

Incremental changes (via alternatives) can result in freeing up of an area so as to facilitate redesign. (via a new scenario).

2.3.1 Close



When closing the opened case with the command “Close” in the menu “File”, it will first ask if a backup of any changes made to the current case is necessary.



If the response is “Yes”, the modification will be saved in the original file xml. On the contrary, the modification will be lost.

CHAPTER 3

Excel file



To collect the data from the customer and to simplify the completion of the xml, an excel file is used: [AMIA-SIMOGGA-SampleCase.xlsx](#)

The excel file with the data for the Trial Version can be download [here](#)

This excel file is composed by 5 sheets. The three firsts explain how to use the file. The sheet “Sample_Data” contains three tables to fill with the data from your ERP. The last sheet give you the visual process represented by the data.

Per the instructions provided in the excel file, only the columns highlighted in yellow are required to be completed. All of the other columns are for information to enable a more in-depth analysis (such as machine load and capacity).

3.1 Table of Products

Data manipulation

Product	Code	Quantity	Transfer Size	Batch Size	Transport Factor	Dimension
Brand1Red	B1R	10	1	10	2	L=450 x W=250 x H=170 cm
Brand1RedDoors	B1RD	40	1	40	1	L=90 x W=10 x H=120 cm
Brand1Yel	B1Y	6	1	6	2	L=450 x W=250 x H=170 cm
Brand1YelDoors	B1YD	12	1	12	1	L=90 x W=10 x H=120 cm
Brand2Red	B2R	12	1	12	2	L=460 x W=250 x H=170 cm
Brand2Yel	B2Y	4	1	4	2	L=460 x W=250 x H=170 cm

Operation	Precedences	Type	Machine	Transport Factor	Transfer Size	Batch Size	Setup Time	Load Time	Operating Time	Unload Time	Quality Check
Stamping		Stamping (Stem)	StampingBrand...	2	1	40			120		
Welding	Stamping	Welding (Weld)	WeldingBrand1 ...	2	1	40			180		
Painting	Welding	Painting (Paint)	PaintingRed (Pa...	2	1	40			160		
TFinalAssembly	Painting, TDoor...	TFinalAssembly ...	FinalAssembly (...)	2	1	40			240		

Allow to add operation via layout

■ Selected product group
■ Selected product
■ Selected operation
■ Current precedences
■ Not editable connections

In the table of products, each row corresponds to a stage of the process required to make the finished part. The sequence the stages are inserted on the file for each product corresponds to the actual production sequence. The required information for each stage of the production process for a part is:

- Product code
- Quantity to be produced
- The code of the machine to perform the stage of the process.
- The size of the transfer load between each stage of the process. (This is usually depends on the mode of transport and the type of packaging).

3.2 Table of Machines

Machines (e.g. capacity, machine type...)						
Id machine - (Computed)	Machine Code - (Mandatory)	Id of the machine type - (Mandatory)	Code Type - (Computed)	Amount of machines - (Desirable)	Capacity - (Desirable)	Comments - (Desirable)

The table of machines contains all of the information regarding machines, workstations and storage areas. The required inputs are:

- The machine codes used by each product
- The type of the machine: each machine belongs to one or more type of machine depending on the function and operation it can perform.

3.3 Table of Machine Type

Machine types (e.g. Operations type performed by the				
Id Machine Type - (Computed)	Code of type machine - (Desirable)	Number of machines by type - (Computed)	Capacity - (Desirable)	Comments - (Desirable)

The table of Machine Type lists the different types included in the machine table

3.4 Conversion

A macro converts the Excel file into xml file readable by SIMOGGA.

Via the main menu of Excel : Tools/Macro/Macros, Run the macro “ConvertToXMLFile”.

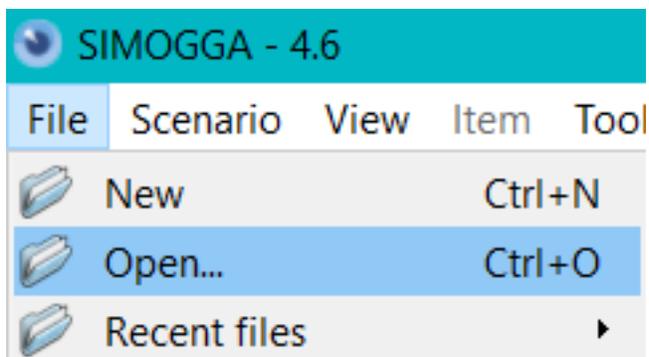
A file « SIMOGGA-output.xml » is created in the repository beginning by XLS2XML (at the same level as the excel file).

Creating of the As-IS situation in the **real view**



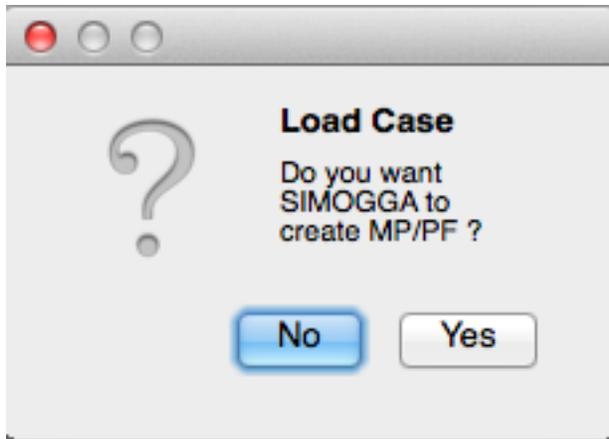
4.1 Opening a file

Opening the xml file starts in the ‘real’ view. The machines are placed in a tray. They may be placed on the factory drawing only once the working areas (yellow cell) are defined.



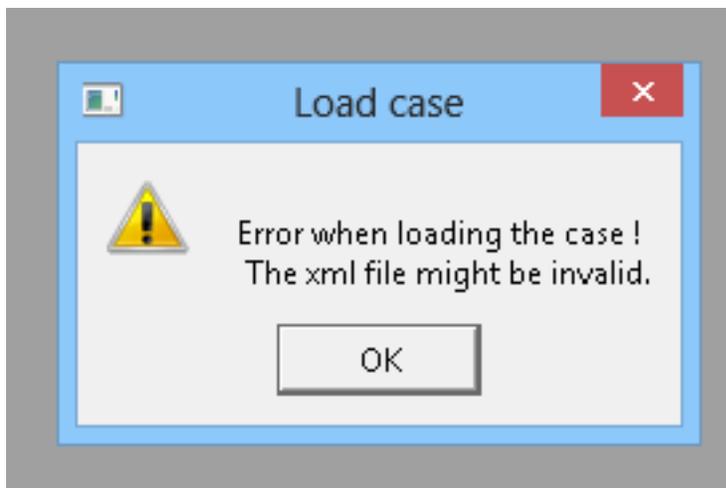
When opening a file, a dialog box appears asking whether SIMOGGA must create locations for Raw Material (MP) and Finished Part (FP). If the data already includes these inputs and outputs of the system, click on “No”.

For the TrialCase, click on “Yes”. The representation of the flow is more complete if we take into account the inputs and outputs of the system.



Hint: If the user loads a case that has already been saved with raw materials MP / PF finished parts, they will appear even if the user chooses not to create them. As it has already been created previously, they are now part of machines covered by this case.

If SIMOGGA fails to load the selected XML file, an error window will appear to inform to the user. For SIMOGGA to be able to load an xml file, the structure of it should be the structure set up by SIMOGGA.



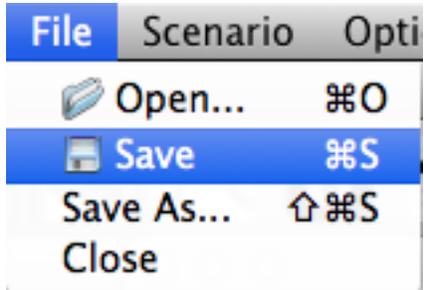
Check that the xml file does not contain special characters such as:

- #DIV/0!
- #N/A
- #VALEUR!
- /
- *
- ‘
- (or)
- &

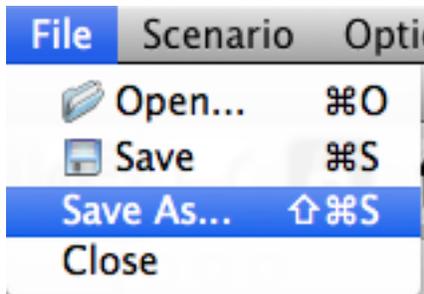
4.2 Saving a case

Two types of save options can be found in the “File” menu:

- Save: The backup will be done on the open file. The changes will be saved in the same xml file.



- Save As ...: The user can choose the backup location and name of the saved file.

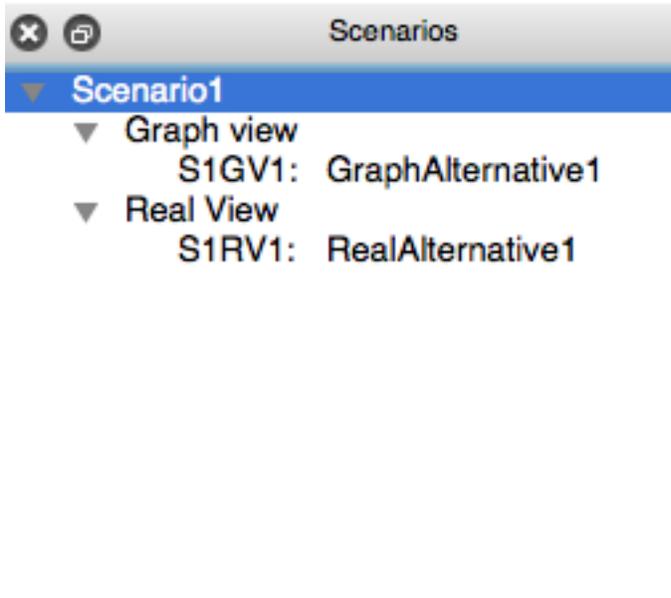


Hint: Don't forget to save your work regularly to avoid any lost.

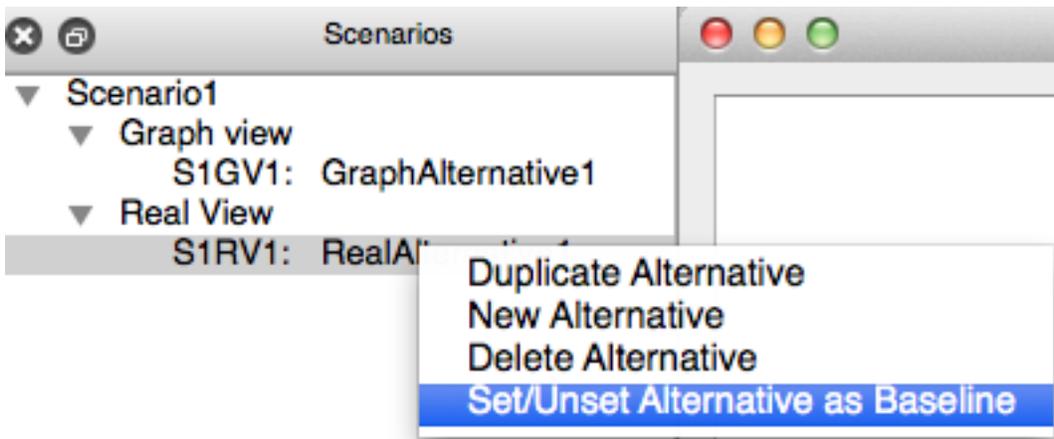
4.3 Create the factory - Design mode

In the real view, it is possible to obtain a two-dimensional representation of the work area corresponding to the reality.

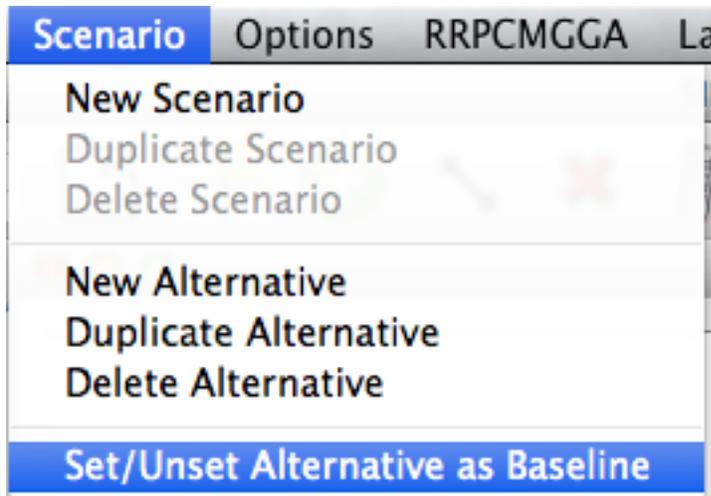
- Click on Scenario 1 (base)



- In "Real View", click on S1RV1 - RealAlternative1
- Save this alternative as the reference: Right click on the alternative, select "Set / Unset as Baseline Alternative" option. This will serve as a benchmark to compare all scenarios.



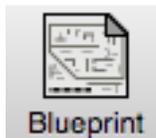
Or via the scenario menu:



- Select the “Design Mode” from the drop-down list



- The machine box is not visible. A reference machine appears in the left top. This machine represents the minimum size of all the machines.



4.3.1 Insert a factory plan as a background image

- Insert the plan



- Click on the button
- A windows open
- Sélectionner un plan d’usine au format png ou jpg
- Cliquer sur Ok
- Adapt the plan
 - Move the plan if need with the mouse
 - Click on the image to activate it
 - Adapt the size of the map (via the zoom with the mouse wheel)
 - The size of the reference machine must be the same than the machine on the plan

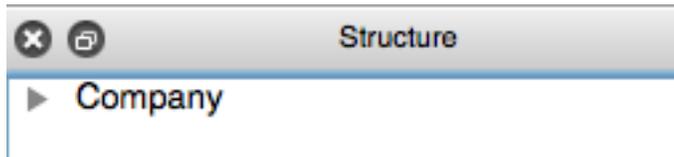


- To exit of this adaptation, click on “esc” on the keyboard or on the button



4.3.2 Draw the outline of the factory on the plan

- Info : Sidebar navigation

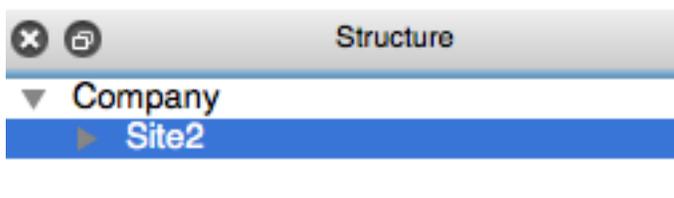


- Click on the icon
- Create the outline by simple successive clicks on the corners of the map. Every click is a point on the polygon representing the outline.
- End with a double-click (on the penultimate point) to indicate that the polygon is complete and it will close automatically.
- Choose the type of desired zone (site, building, floor, area)
- Rename the area



4.3.3 Identify sub-areas, if necessary

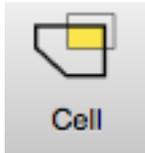
- Select the parent zone via a click on the area at the scene or at the navigation menu in the structure.



- Click on the icon
- Create the outline by simple successive clicks on the corners of the map. Every click is a point on the polygon representing the outline.
- End with a double-click (on the penultimate point) to indicate that the polygon is complete and it

will close automatically.

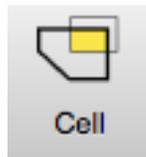
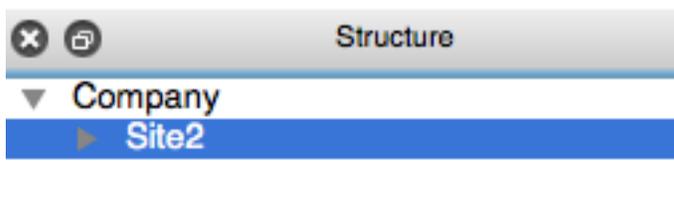
- Choose the type of desired zone (site, building, floor, area)
- Rename the area
- Automatic truncation of the new area relative to the parent zone. It is therefore not necessary to be precise in the drawing at the boundaries of the parent zone.



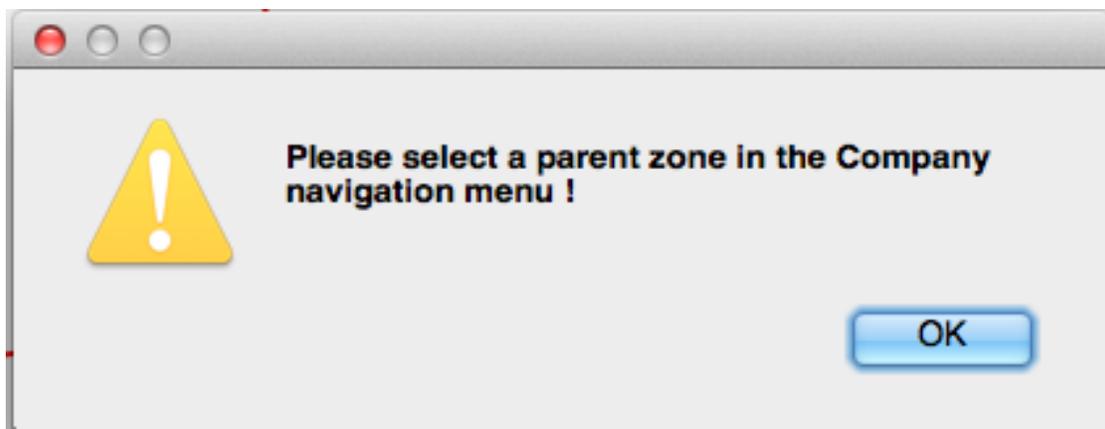
4.3.4 Identify work areas where machines may be placed (cell)

Les machines ne pourront être placées que dans ces zones pour être connectées.

- Select the parent zone via a click on the area at the scene or at the navigation menu in the structure.
An active zone is green.



- Click on the icon
- – If the parent zone is not selected, a warning message appears.



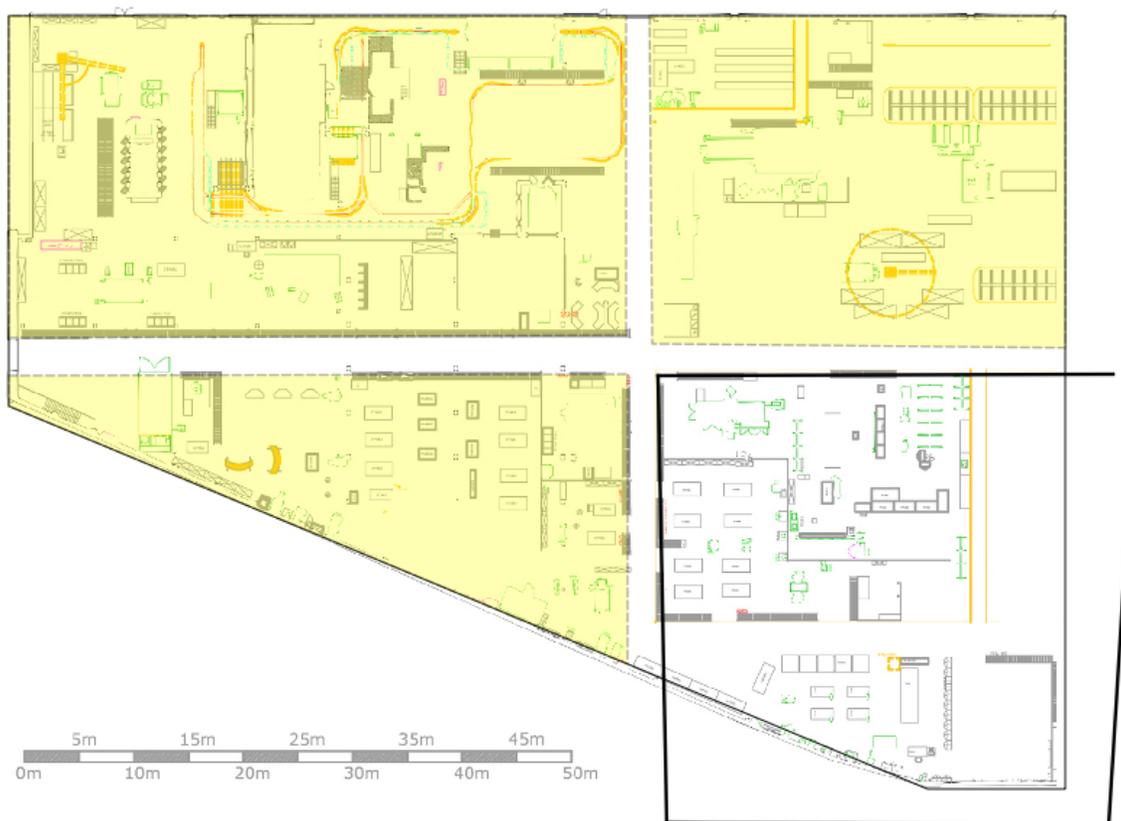
Hint: We must then select the parent in the side navigation menu. The scene is not accessible until the



button is pressed.

Hint: Pour désactiver n'importe quelle fonctionnalité, appuyer sur « esc ».

- Create a polygon using a series of mouse clicks
- Finish with a double click to mark the automatic closing of the polygon
- If the polygon created exceeds the area in which it is located, it will be truncated to fit the contour.

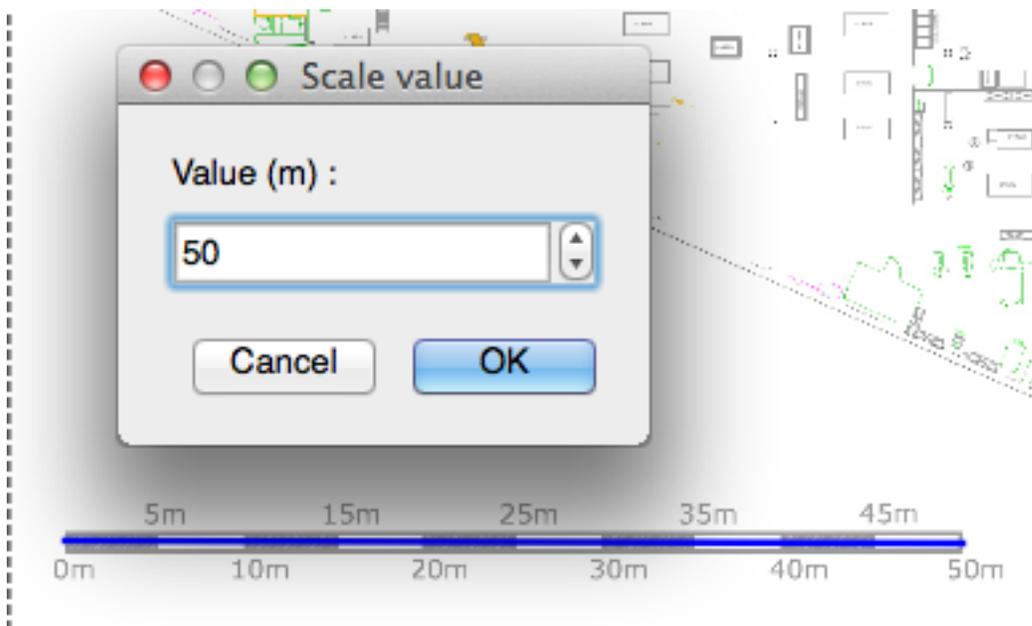


Hint: Les machines ne pourront être placées que sur ces zones cellules (jaune).

4.3.5 To scale



- Click on the button
- Use a distance that is defined on the plan.
- Click (single click) on the two points defining the distance.



- Set the distance in meters
- Click OK

4.4 Create the skeleton of aisles

The skeleton is the graphical of view the aisles of the factory through which will pass the traffic between the work areas (intercellular traffic). This tool is available in “design mode” of the real alternative.

- Select the area where you want to put aisles using the scene or the navigation menu



- Click the icon
- Insert the junction of aisles with double clicks.
- SIMOGGA automatically connects the points if:

- The line does not cross working areas
- line does not go too near the corners of working areas.
- The lines are not too close.



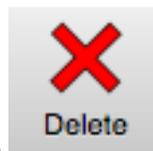
- Add lines manually



- Activate the button
- Double click on two points to connect

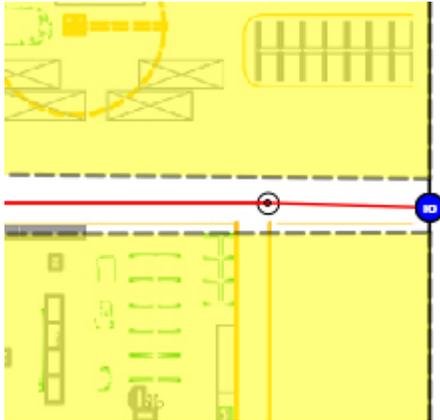
- Remove unwanted lines

- Select the element to be deleted
- Choose several elements holding down the Ctrl / Cmd keys



- Click on the button
- Click OK

- Add inputs and outputs (IO points) on the edge of an area.



- Activate the button
- Double click the edge of the area.
- **Right-click the item added to change its type**
 - * IN :Only inflows can pass
 - * OUT : Only outflows can pass
 - * I/O : All the flows can pass.

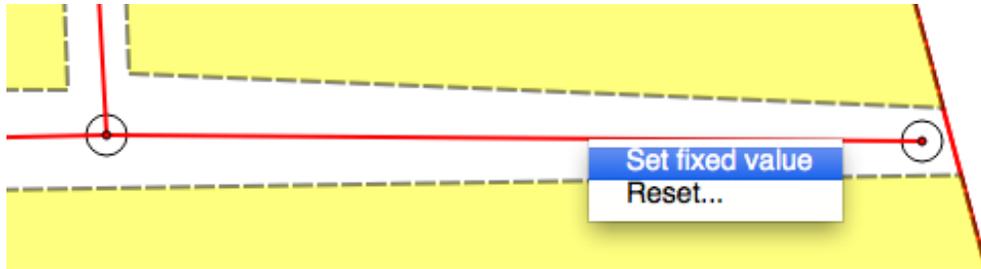
Hint: Les points IO seront utiles dans le cas où on se trouve face à une usine comportant plusieurs étages et/ou bâtiments, ou si l'on souhaite travailler sur plusieurs sites simultanément.

- Add aisles in the cells



- Click on button
 - Double-click in the IO in the cell, and double-click on the next point.
 - * If a point exists, it will be connected to the previous point
 - * Otherwise, a new point is created
 - Do it again until the aisle is completed in the cell
- Set a distance on a skeleton line.

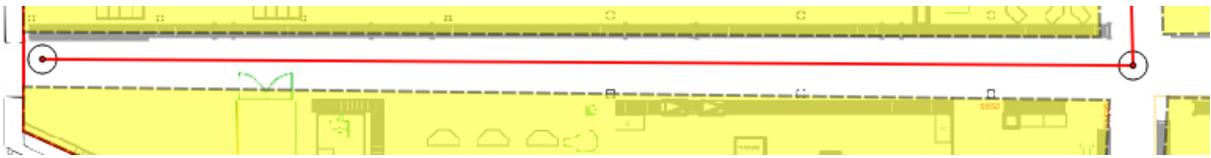
Hint: This will be particularly useful when you want to work with multiple sites simultaneously, a single skeleton line maybe set in meters or kilometers.



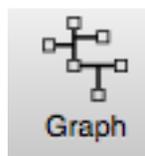
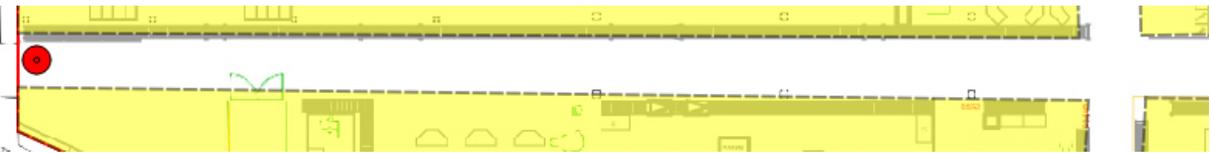
- Right click on the line to set
- Select “Set the distance”
- Enter a value in meters or kilometers
- Right-click the line to display the entered value
- Delete the value via the “Reset” option

4.5 Validation du design

Each crosspoint of the skeleton must be with a border red.



If the circle is completely red, the crosspoint is alone and not connected to the graph.



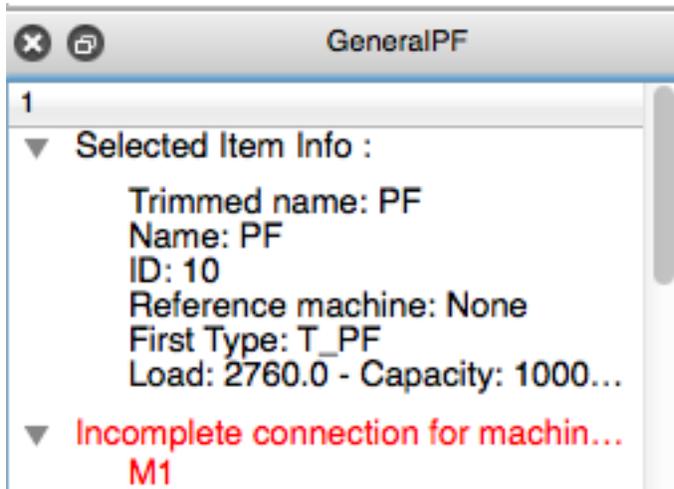
To check the connections, click on the button

Each skeleton point is represented with a red point and small blue lines. These blue lines show the connection to the graph.



When switching in the “Interaction mode”, a message appear if the graph presents some connection default as an isolated point.

In the lateral panel “Info”, the liste of used machines is red represent all the machines not connected to the graph.



4.6 Positioning the machines – Interaction Mode

When work areas (yellow) were created in design mode, machines can be placed. To do this, a simply “drag & drop” the machines. We can therefore represent the initial situation in which the plant is located.

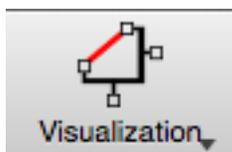
4.6.1 Positioning

- Select the “Interaction Mode” in the drop-down list



- Déplacer les machines du BAC vers les zones cellules dans la position actuelle de l’usine
 - En cliquant sur CTRL/CMD on peut sélectionner plusieurs machines
 - Les machines seront automatiquement connectées au graphe d’allées.
 - Si il existe un flux entre deux machines positionnées sur le plan, il apparaîtra automatiquement.

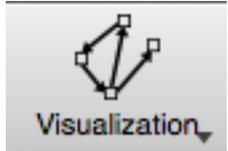
4.6.2 Different type of views are available



- standard : Machines are connected directly if they belong to the same area, if not traffic is through the aisles



- Visualization By the aisles only : All traffic via the aisles.



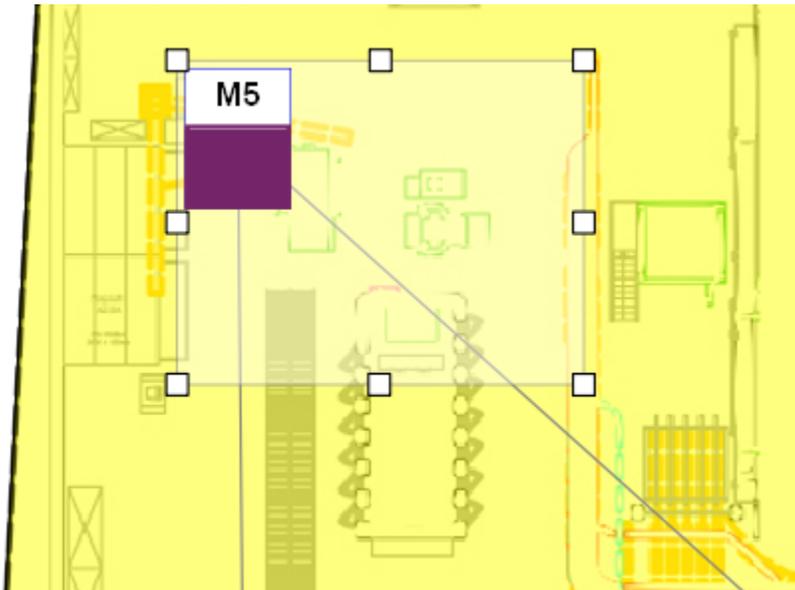
- Visualization As the bird flies :the aisle backbone is not used. The machines are connected via directional flow.

Hint: In the first two displays, the concept of direction disappears. It is all the traffic that is shown on each segment. This type of view mode is only possible if an aisle skeleton was built in design mode. Otherwise, the representation is as the crow flies.

4.6.3 Machine interaction

The machines can be modified by:

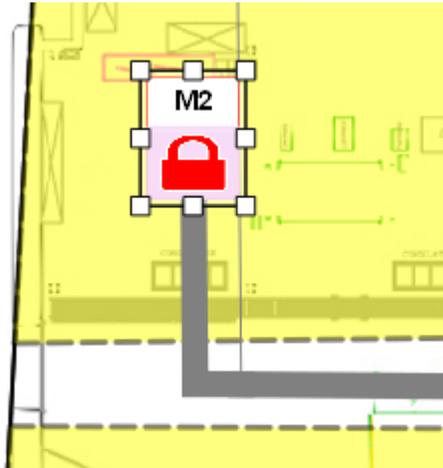
- The position with “drag & drop”.
- Their size to represent more accurately the real place that takes the machine within the factory:



- Select the machine
- Display of the squares on the contour
- Move the squares of a contour
- leur orientation :



- Click on the “Rotation” button
- Double click on the machine.
- Immobilisation. A locked machine cannot be moved:



- Click on the button
- Double click on the machine.
- The lock is displayed on the machine.

4.6.4 KPIs

- When all machines are in position, the performance indicators assess the situation quickly
 - Number of kilometers traveled;
 - Travel time
 - Cost of transport

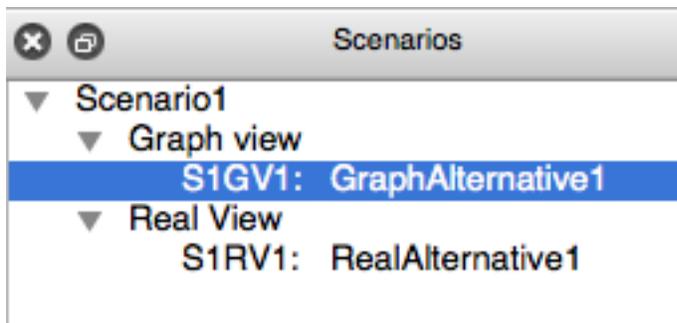
Dashboard 🔍 ×					
	Scenario	Cost (€)	%	Distance (km)	Time (h)
1	Scenario1	3.269,0	0	196,1	65,4
2	Scenario2_Sc1	2.829,7	13,4	169,8	56,6

Graphic flow analysis

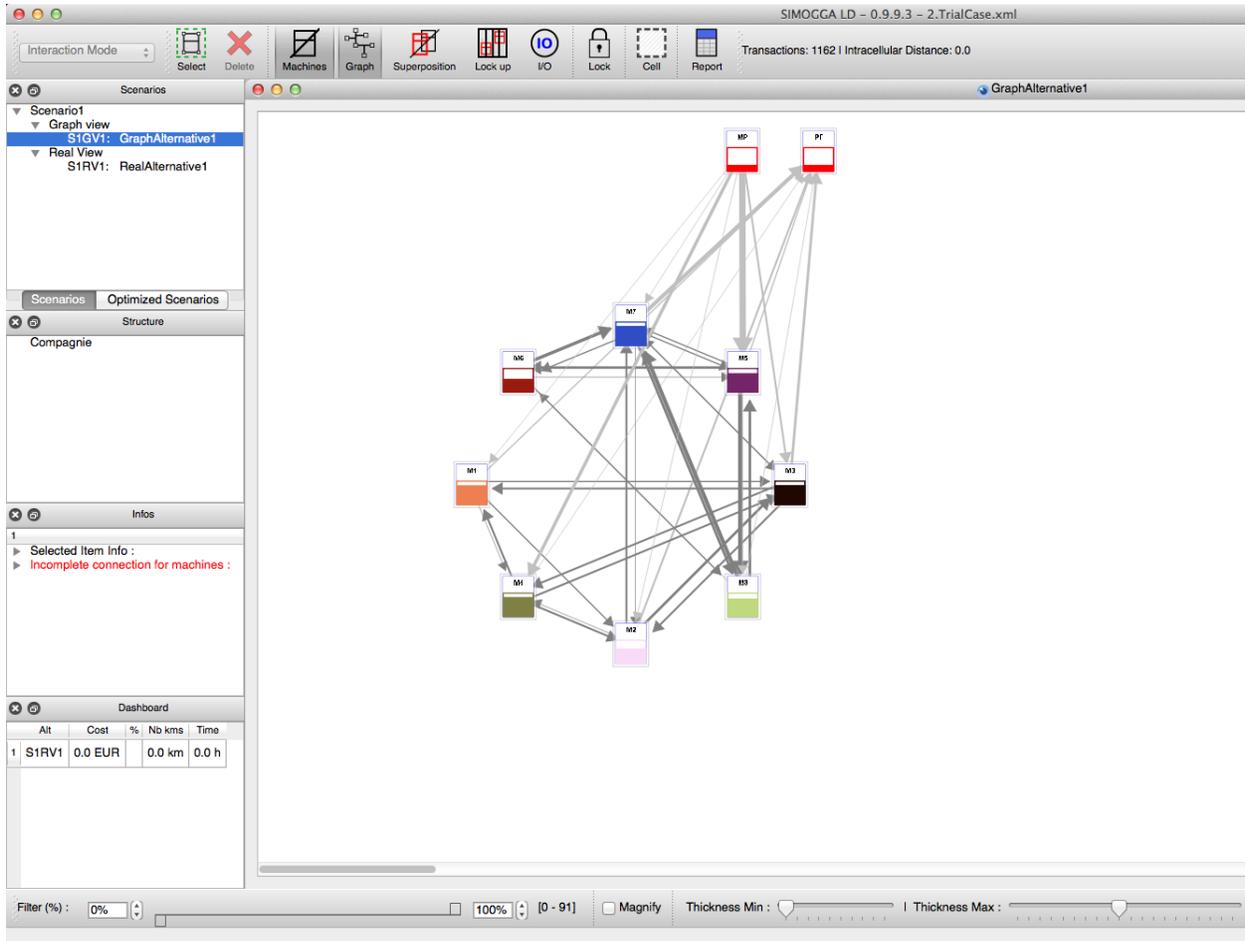


5.1 Graphical view

Select the alternative of the graphical view in the navigation panel.

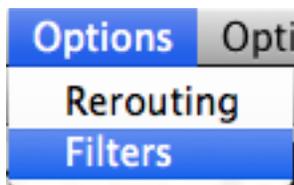


The machines are arranged in a circle so that all streams are visible. This view has many uses as described below.

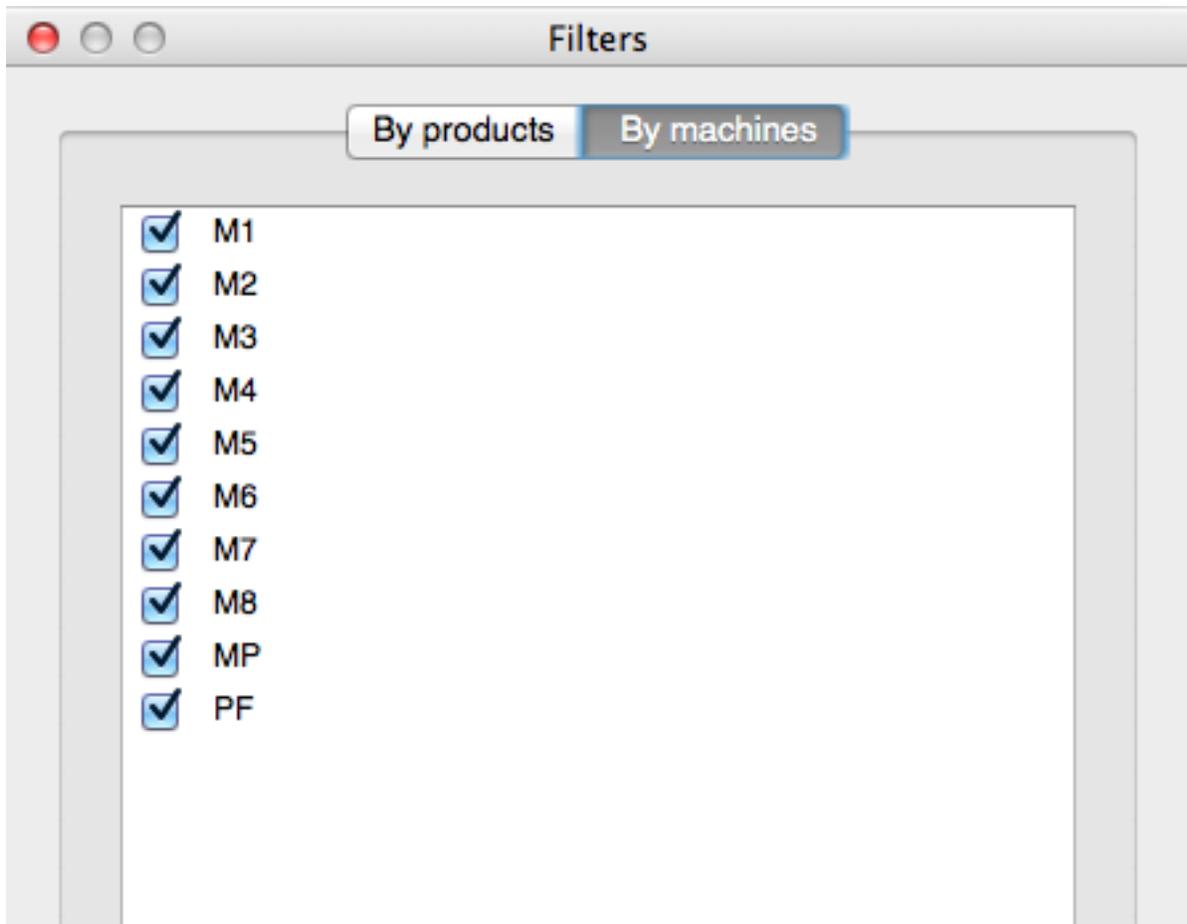


5.2 Available tools

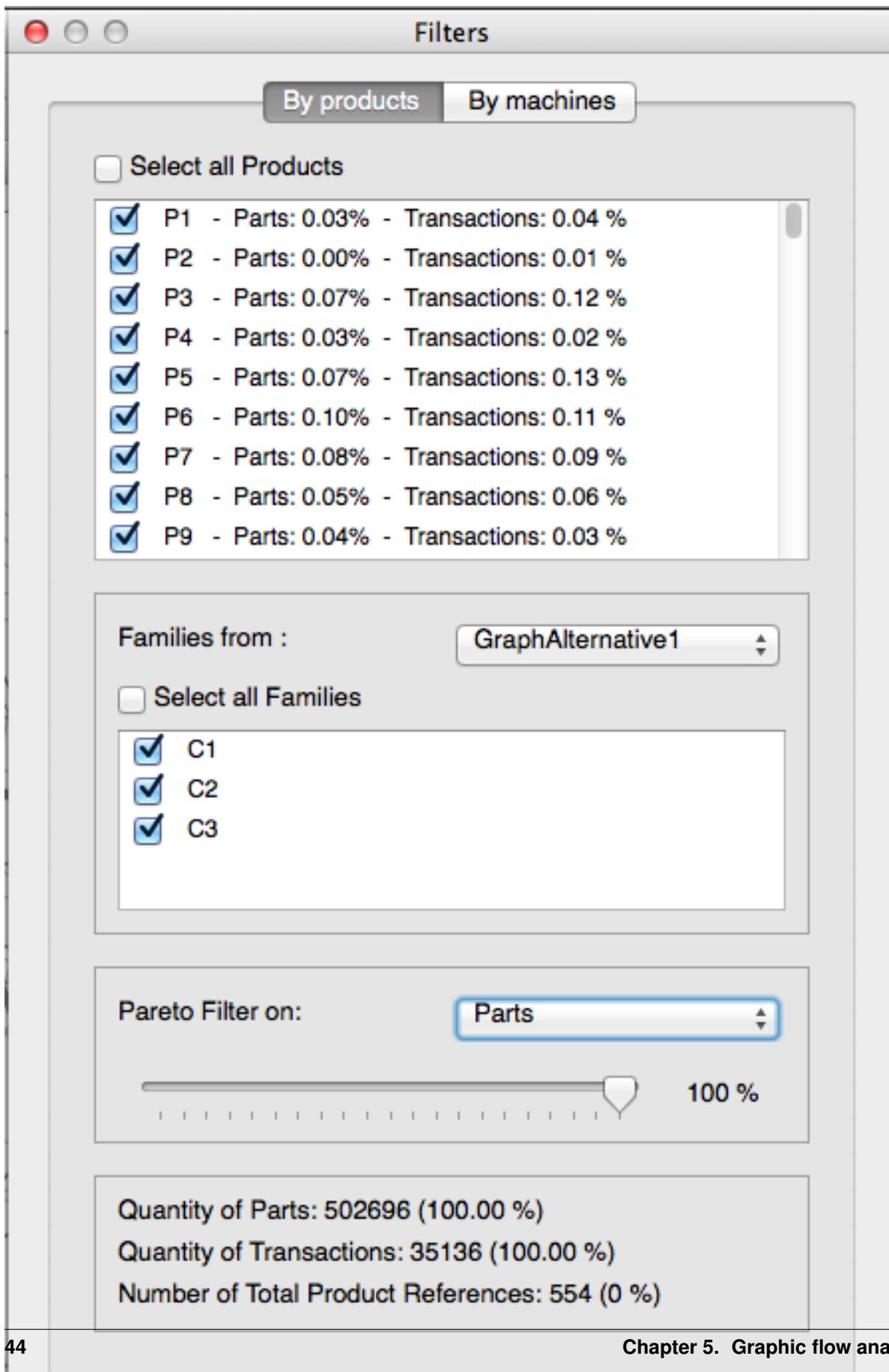
5.2.1 Via the main menu Option/Filter



- Filters by machine: allow the analysis of those flows connected to one or more machines.



- Product filters: allow to visualize the flows of one or more products.

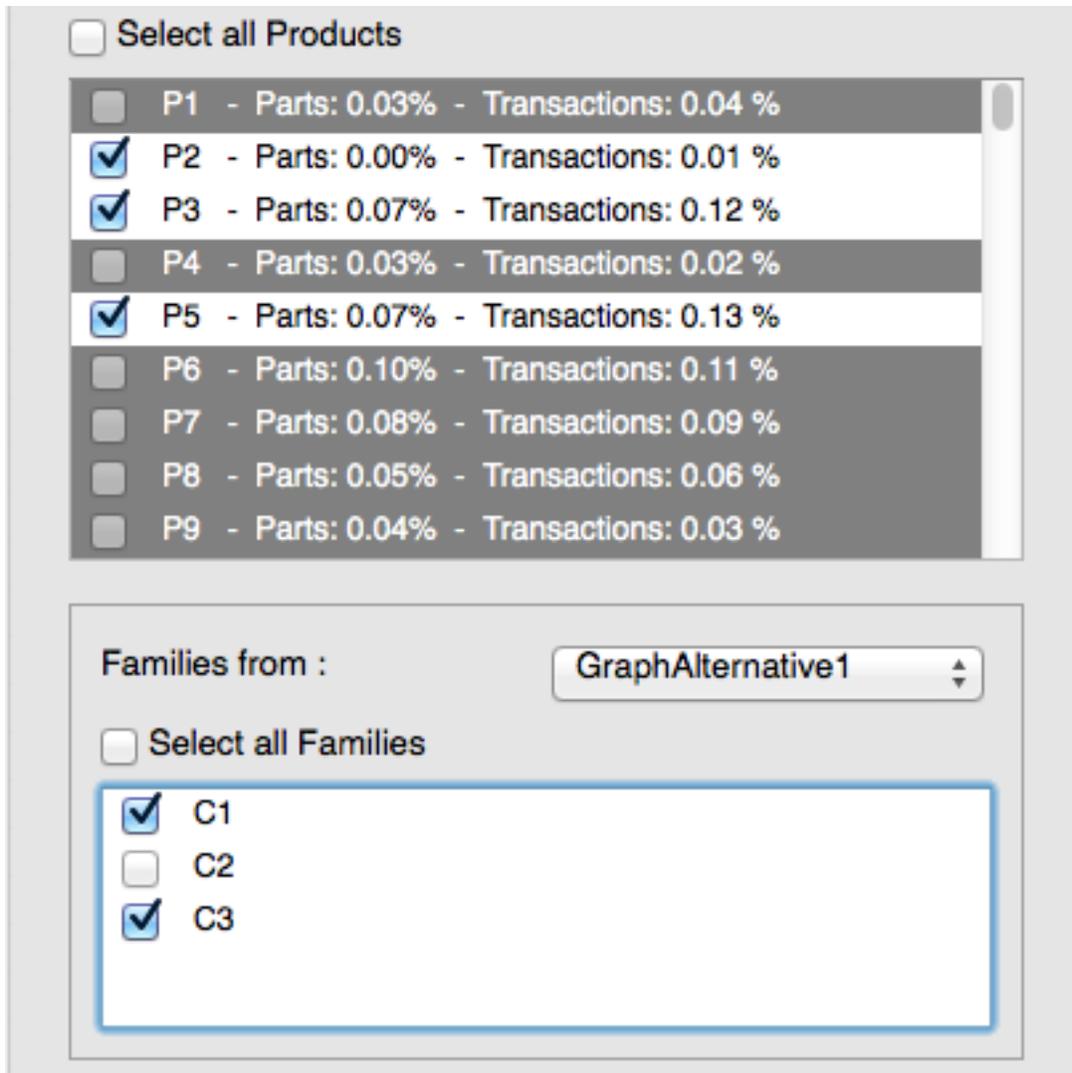


In the selection screen, each product is represented by its flow rate (in terms of quantity or transactions).

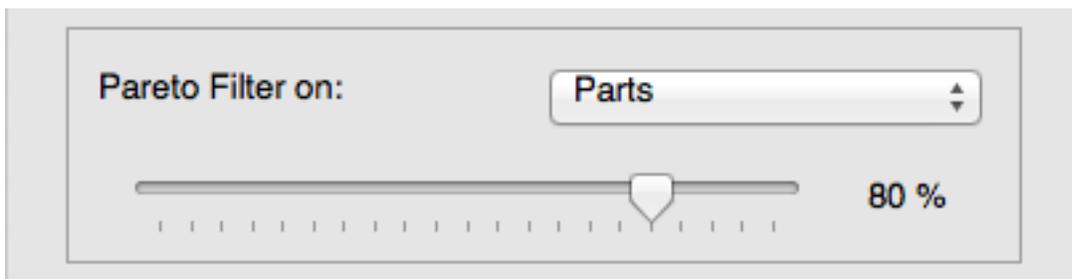
Select all Products

<input checked="" type="checkbox"/>	P1	-	Parts: 0.03%	-	Transactions: 0.04 %
<input checked="" type="checkbox"/>	P2	-	Parts: 0.00%	-	Transactions: 0.01 %
<input type="checkbox"/>	P3	-	Parts: 0.07%	-	Transactions: 0.12 %
<input checked="" type="checkbox"/>	P4	-	Parts: 0.03%	-	Transactions: 0.02 %
<input checked="" type="checkbox"/>	P5	-	Parts: 0.07%	-	Transactions: 0.13 %
<input type="checkbox"/>	P6	-	Parts: 0.10%	-	Transactions: 0.11 %
<input checked="" type="checkbox"/>	P7	-	Parts: 0.08%	-	Transactions: 0.09 %
<input type="checkbox"/>	P8	-	Parts: 0.05%	-	Transactions: 0.06 %
<input checked="" type="checkbox"/>	P9	-	Parts: 0.04%	-	Transactions: 0.03 %

- Filters by product family: permits to visualize flows for one or more product categories when selecting a prior alternative



- Pareto filter: can be used on the quantities of goods transferred or the number of transfers made (transactions).



These filters will focus the analysis on some of the products All information about the filtered products are available in the below of the windows (Number of parts, number of transactions)

Quantity of Parts: 402174 (80.00 %)
 Quantity of Transactions: 25880 (73.66 %)
 Number of Total Product References: 173 (31 %)

Making a flow analysis on a Pareto of products could bias the study. The tools available in SIMOGGA allow for the analysis of all the products.

5.2.2 Via the panel below

- A visual filter: allows to take into account all the products, but displays only the flows between a minimum value (bottom filter) and a maximum value (upper filter).



- Thickness Slider: allows to modify the thickness of the arrows representing the traffic thanks to min and max cursors.



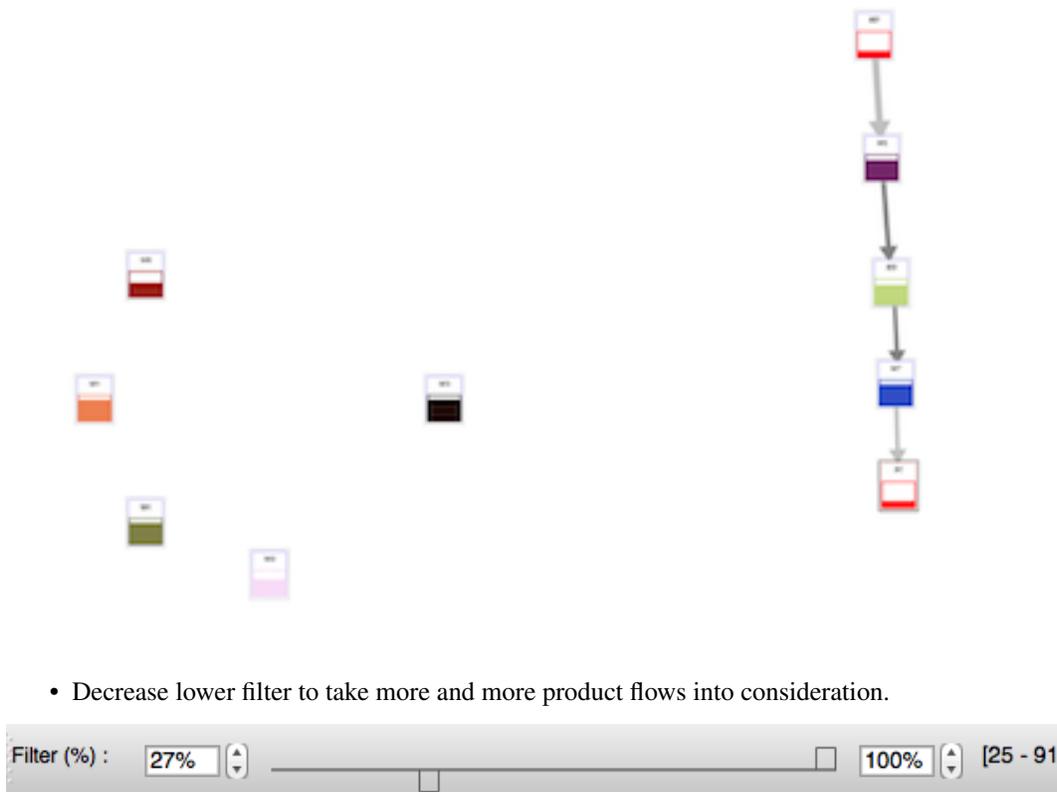
5.3 Machines Reorganization

- Begin by placing upper filter to 100% and bottom filter to 90%. This filter allows the reorganization of the machines with the largest flows by moving them to the right of the screen.

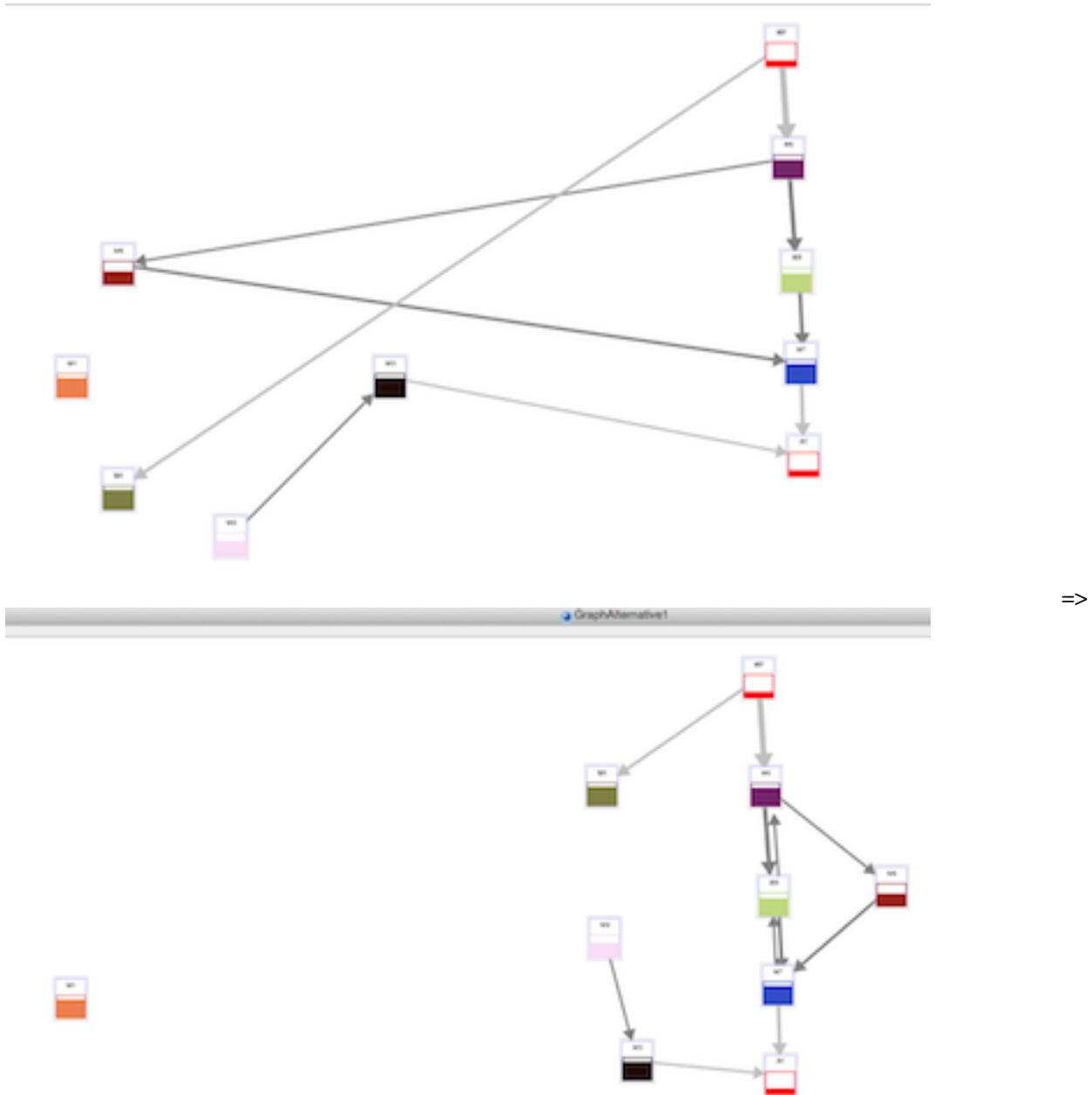




=>



- Decrease lower filter to take more and more product flows into consideration.



- Focus the analysis on a segment of value with a minimum and maximum value and look with a magnifying glass by checking “Magnify”. Flows will differentiate from each other.

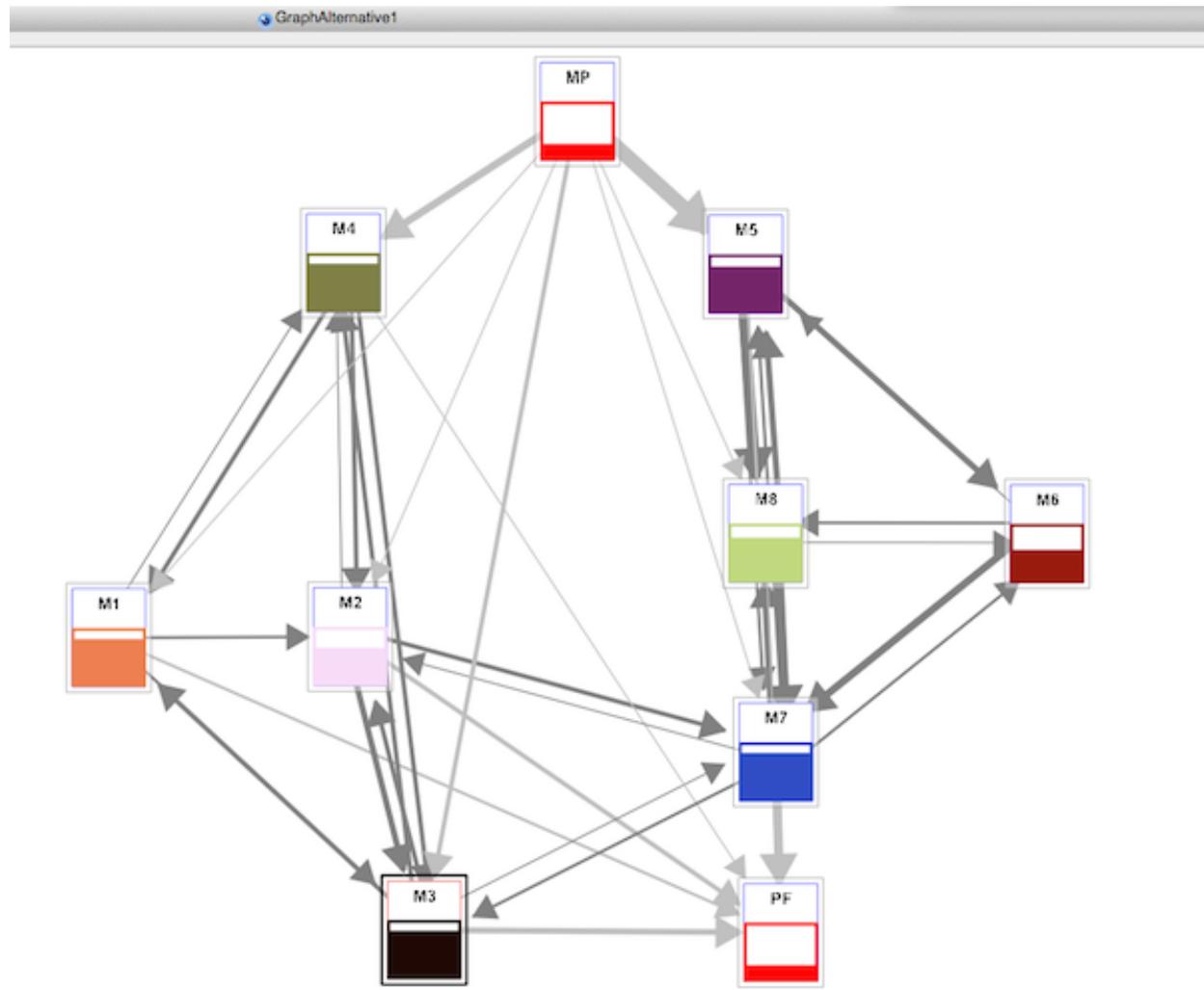
Extend the scale

Hint: This function is very appreciated when there are a lot of traffic in a concentrated range of values. For example, if there is some flows representing between 1 and 5000 transfers but the major part is concentrated between 1000 and 15000. The low filter is set to 1000 and the high filter to 1500. The parameter “Magnify” permit to focus the analysis

to this range of values.

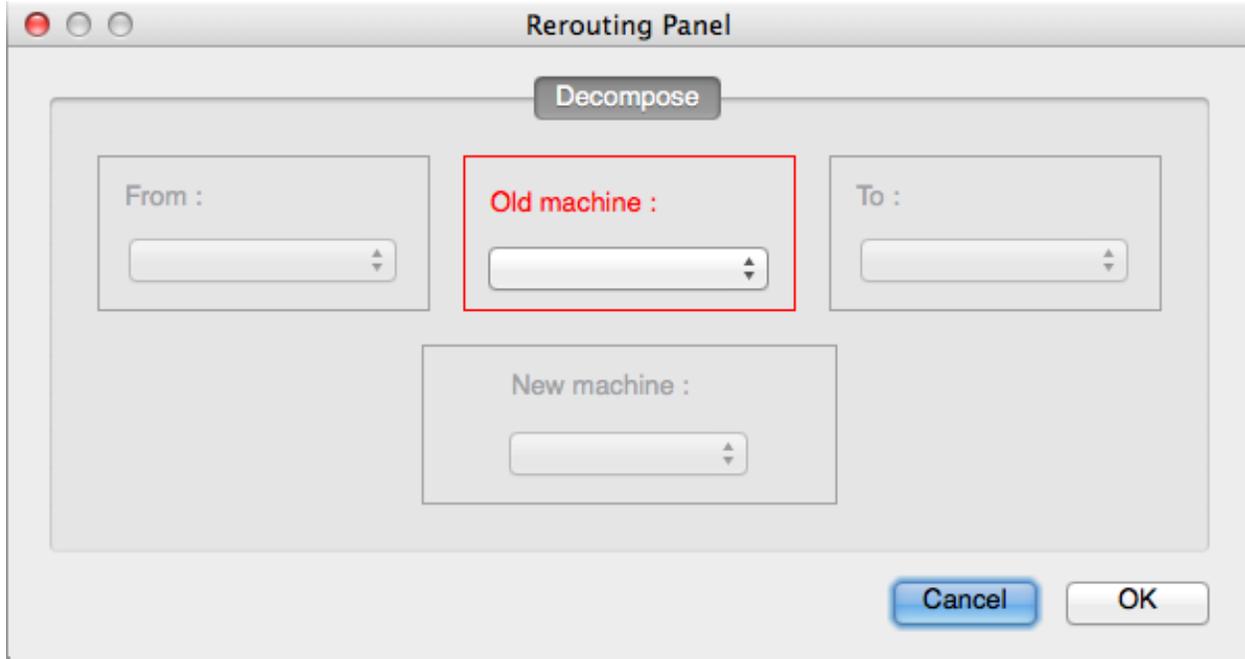
5.4 Rerouting

The representation of the flows gives a clear idea on machines linked together. This view doesn't give any information about the origin of the traffic.



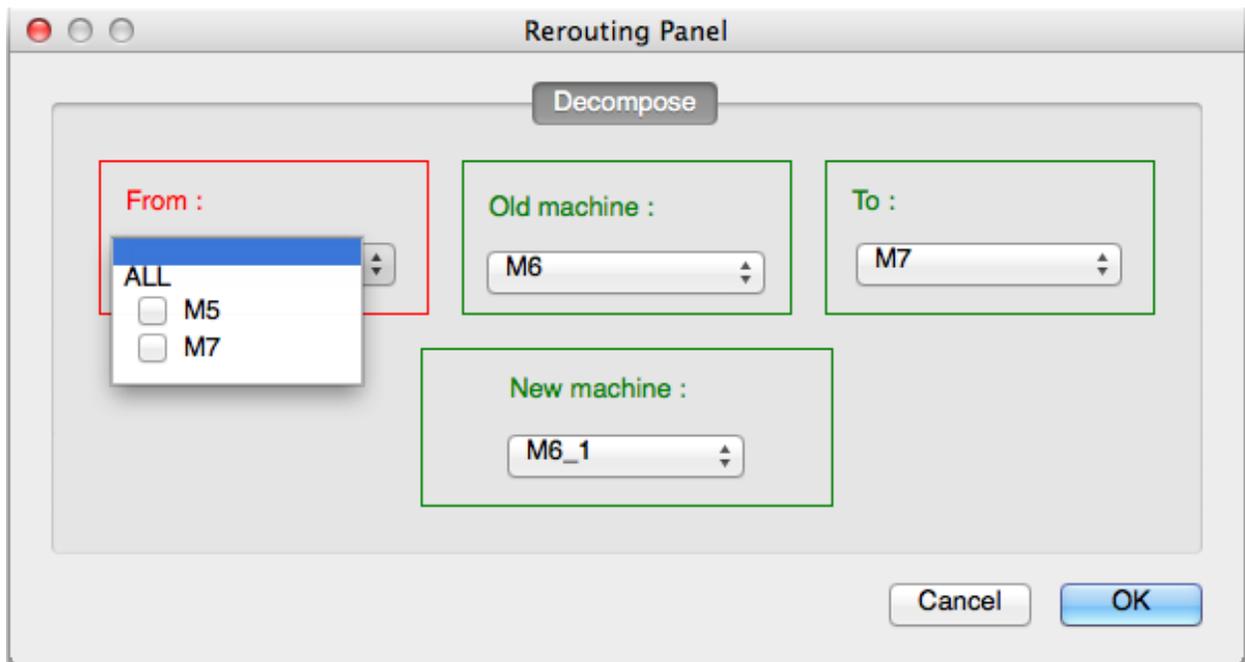
There is some traffic from machine M6 to machine M7, but we don't know where coming from (level N-1) and where going to (level N+1).

5.4.1 Tool



- Analysis: The rerouting tool allows us to analyse the flow in depth. A flow coming from N-1 and going to N+1 by N will be represented by N-1 -> N -> N+1. In the picture, we see the flow M6 -> M7 but we don't know anything about the origin and the destination.

The rerouting tool will help differentiate these flows. The screen shows that the parts going from M6 to M7 come from machine M5 or machine M7: M5 -> M6 -> M7 et M7 -> M6 -> M7



- Rerouting: This tool change the operations assigned to machine M6 to a new machine M6_1 for all the flows coming from M7 and go back to M7.

5.4.2 Creation of independent cells

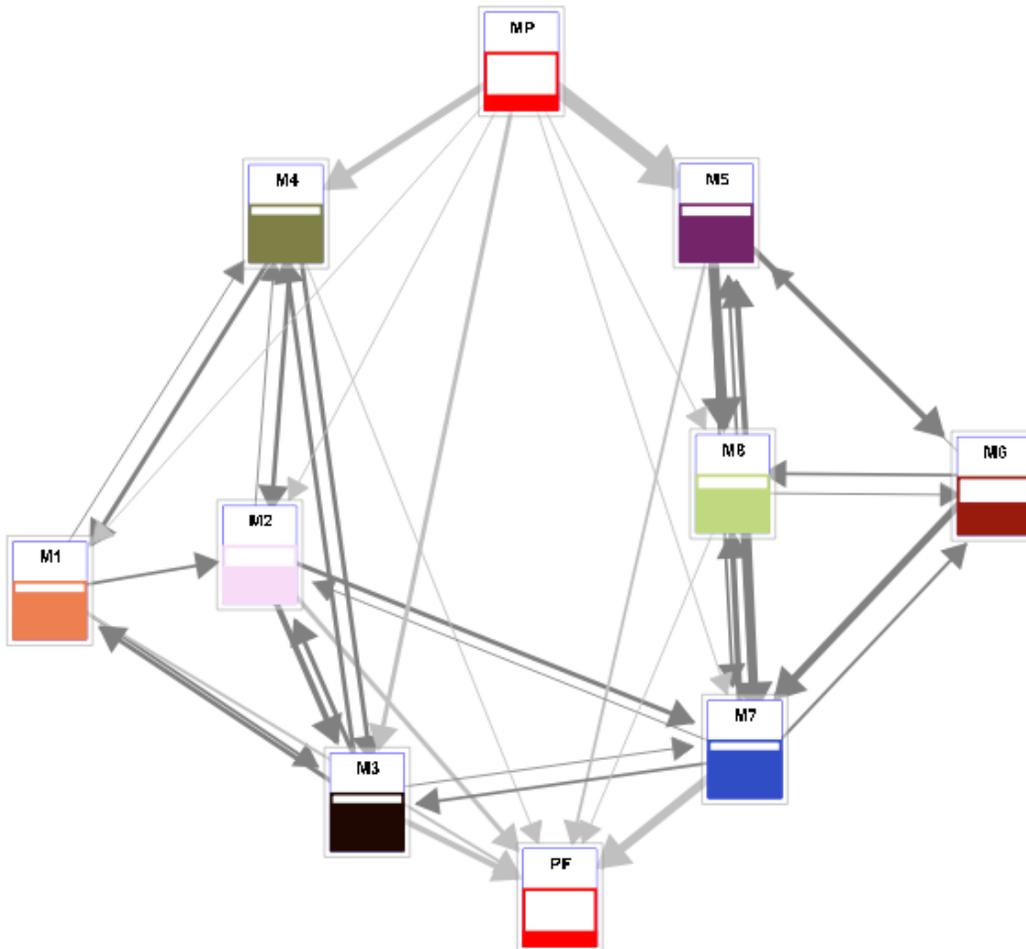
The basis of the analysis is to manually find groups of independent machines. The objective is to break the links/the flow between the machines clusters (called cells).

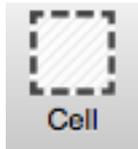
Because any addition / deletion of machines or reassignment of operations to a new machine involves creating a new scenario (see prerequisites), you must first create a new scenario or duplicate an existing one. To manually create these independent groups must duplicate certain machine and reallocate certain operations on this new machine. To do this, use the “rerouting” tool.

This analysis can be lengthy depending on the number of flows and number of connected flows being analyzed. One trick is to break down the flows in a systematic manner:

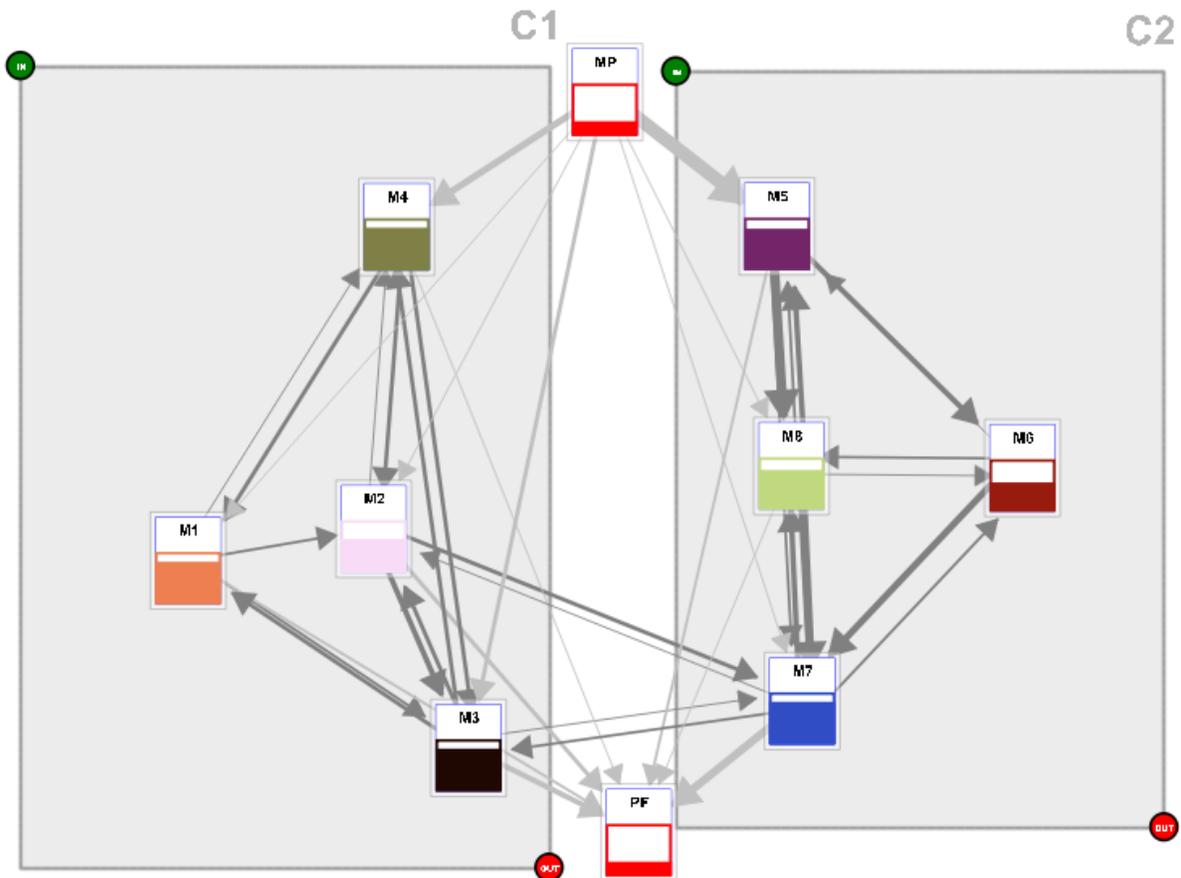
Hint: In the list of proposed machine in the rerouting tool, the cell are written (M5IC2). Use this information to facilitate the machine selection for the “Origin” and the “Destination”.

- Identify a main flow we want to isolate



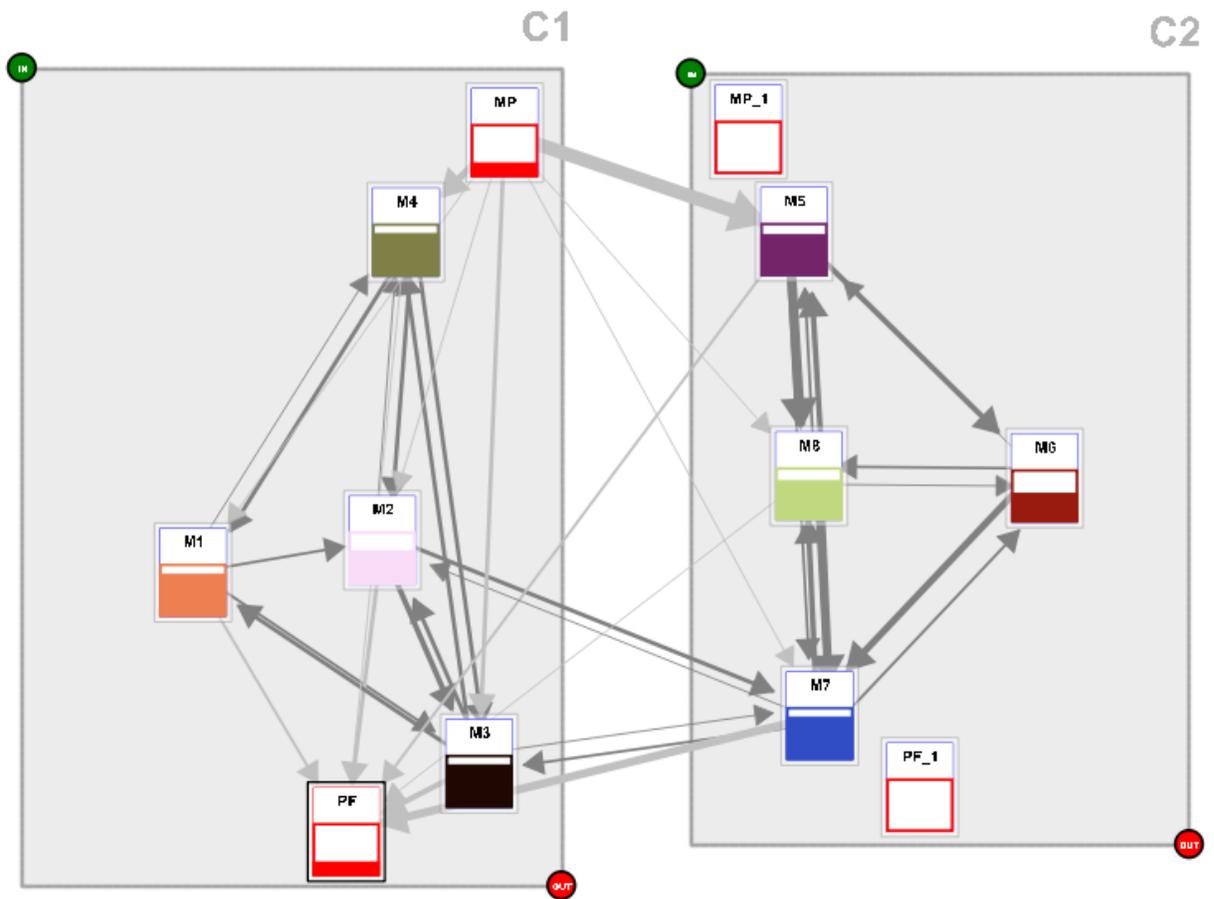


- Define a virtual cell around machines that we want to isolate

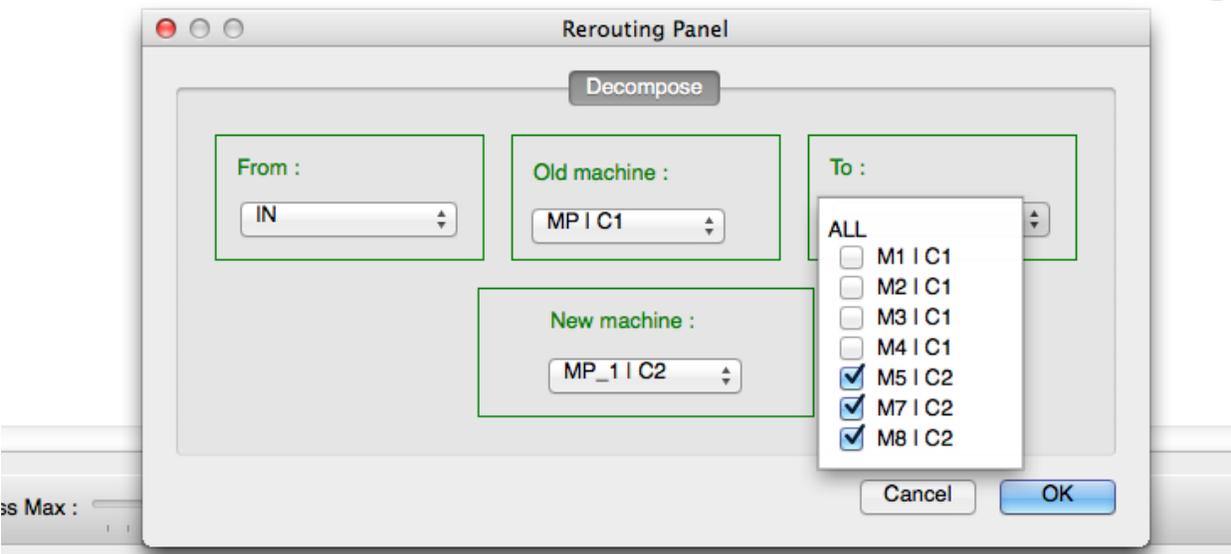
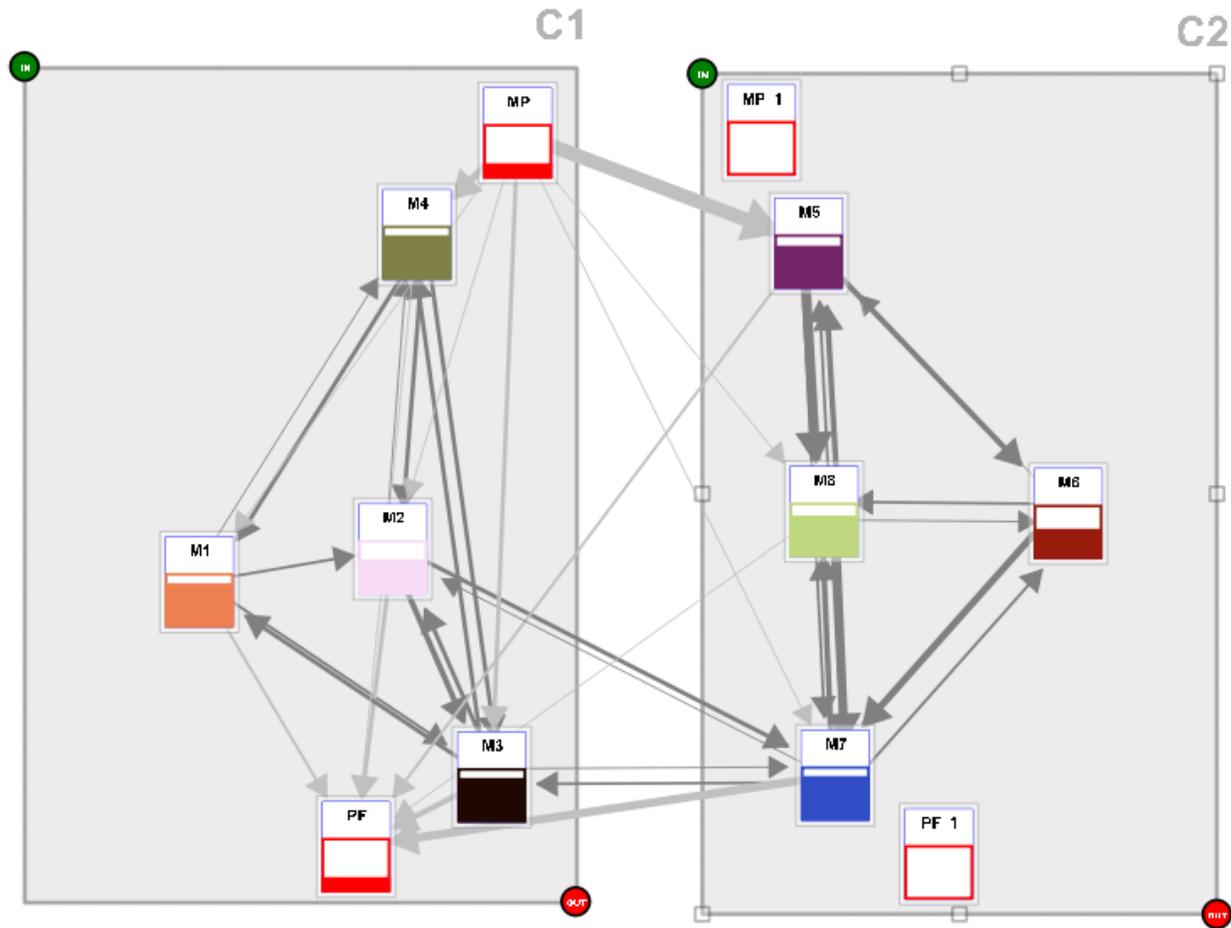


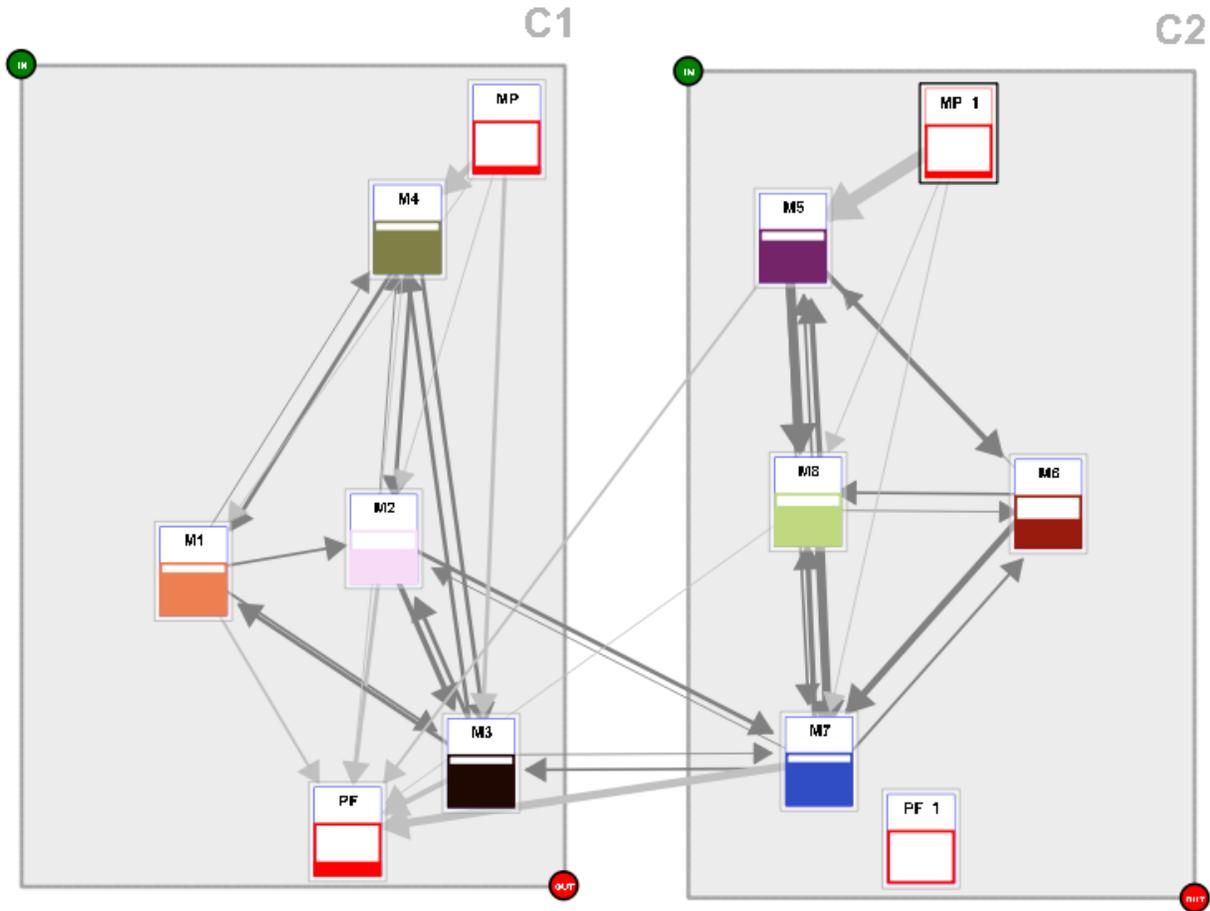
Hint: Use the button  to unlock the machine inside the cells.

- Start by duplicating the MP (raw material). In this way, we must look at two levels of flow and not three.

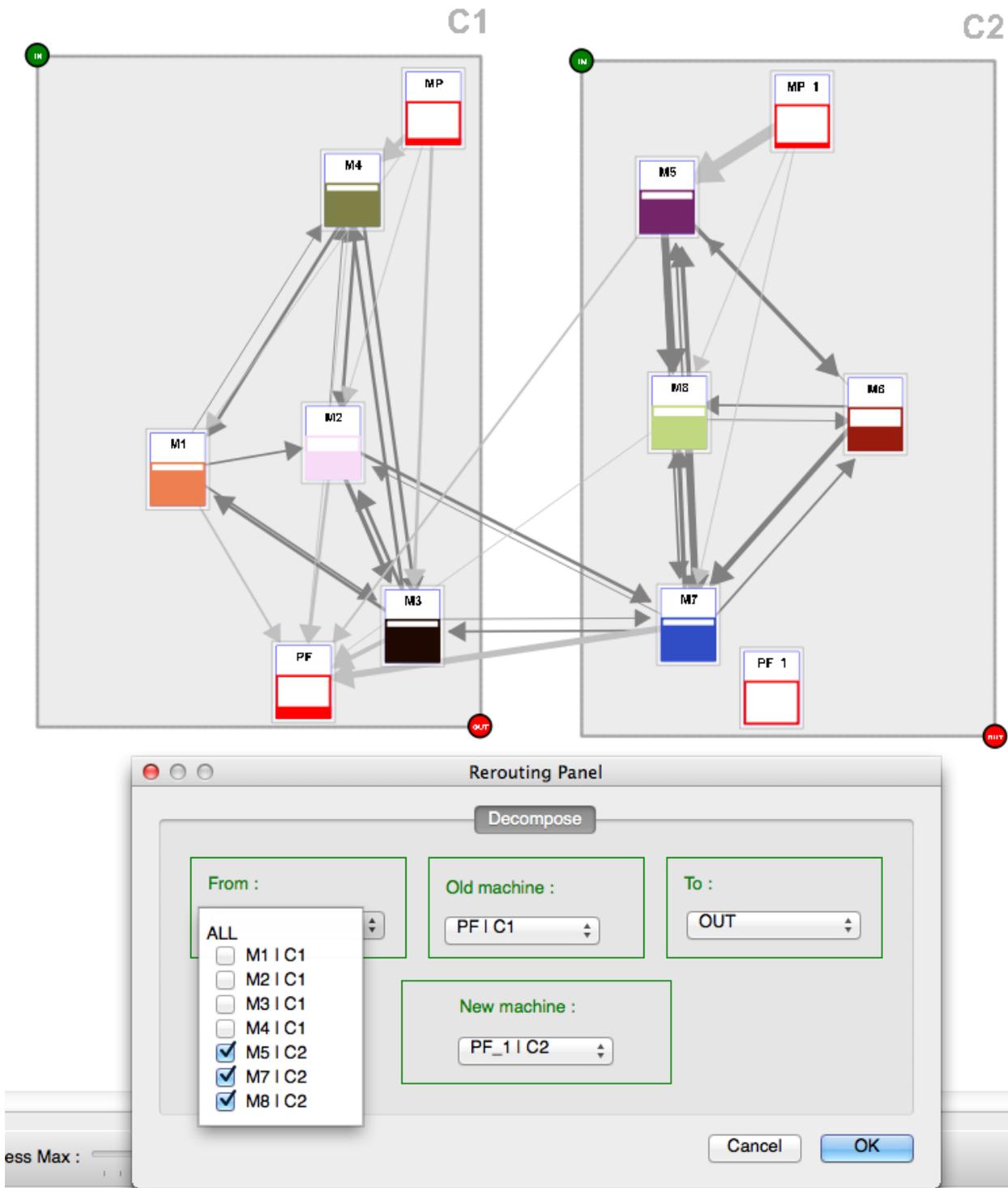


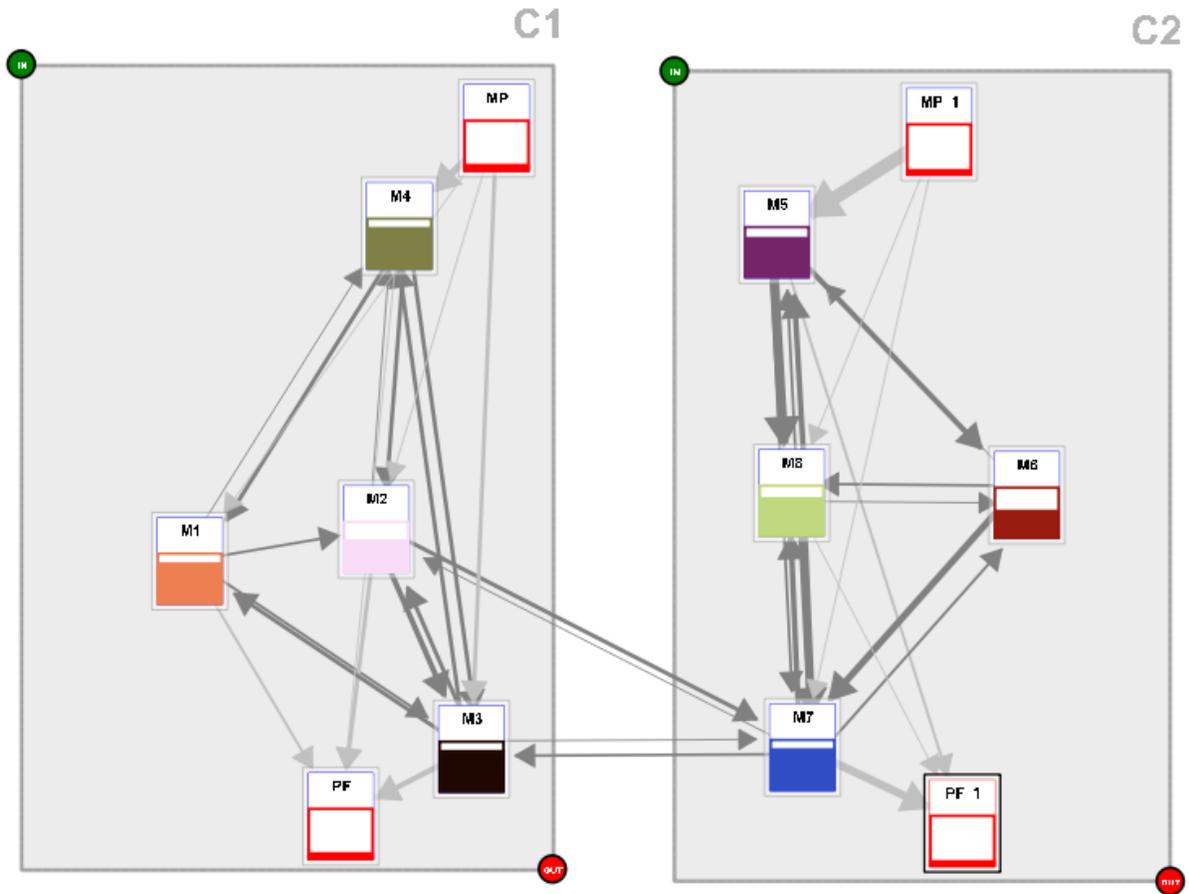
- Reassign all flows from MP that do not go to the main branch identified



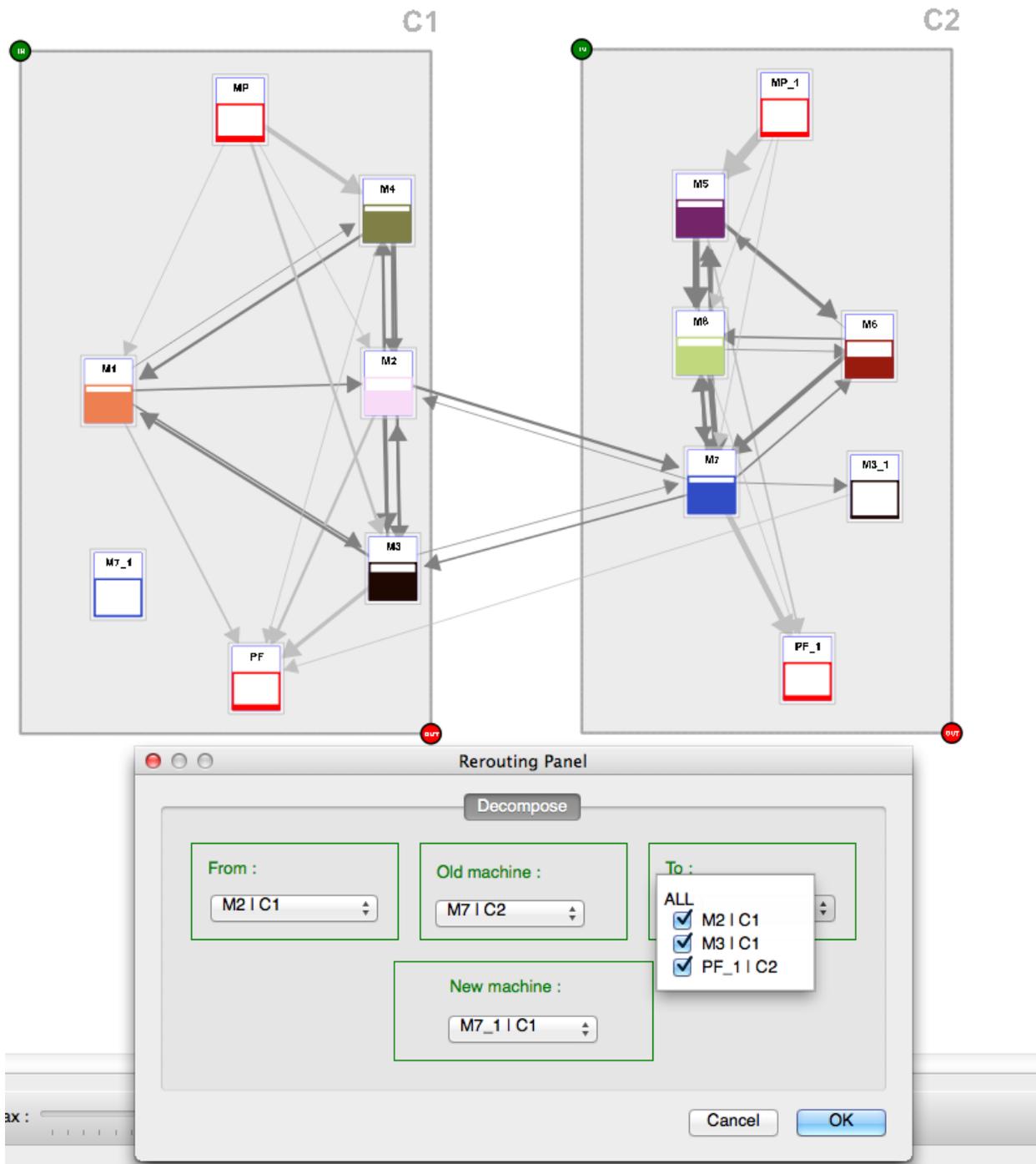


- The same process for PF (finished product)

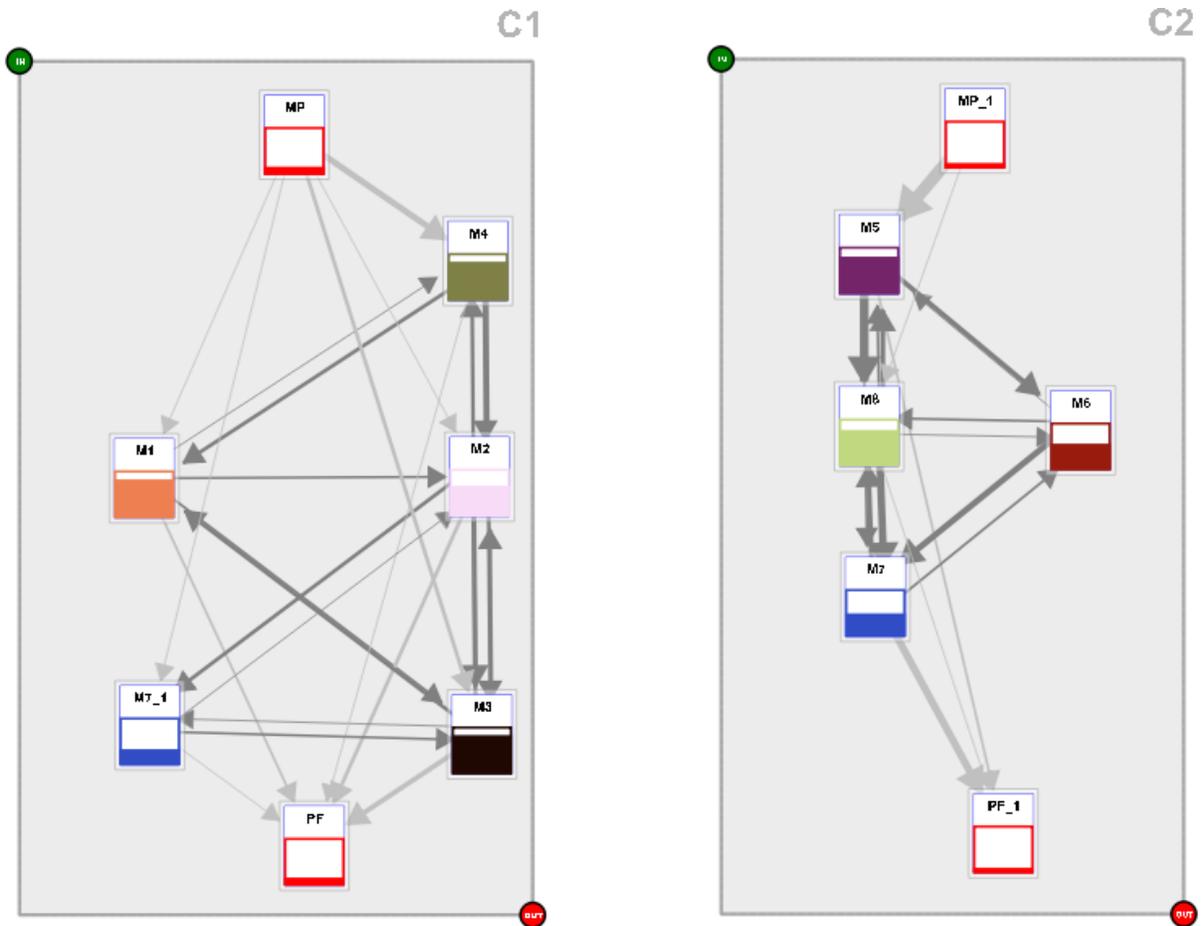




- Identify the machines that you want in the main flow, gradually isolate these machines by duplicating and reassigning all flows that do not come or do not go to the main branch identified.



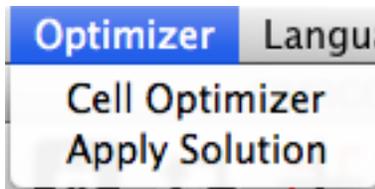
- Repeat for the other branches



5.5 Creating cells automatically

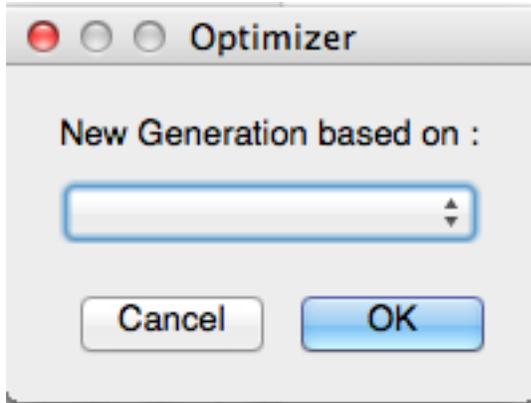
5.5.1 Cell optimizer

An optimization algorithm is available in SIMOGGA (main menu).

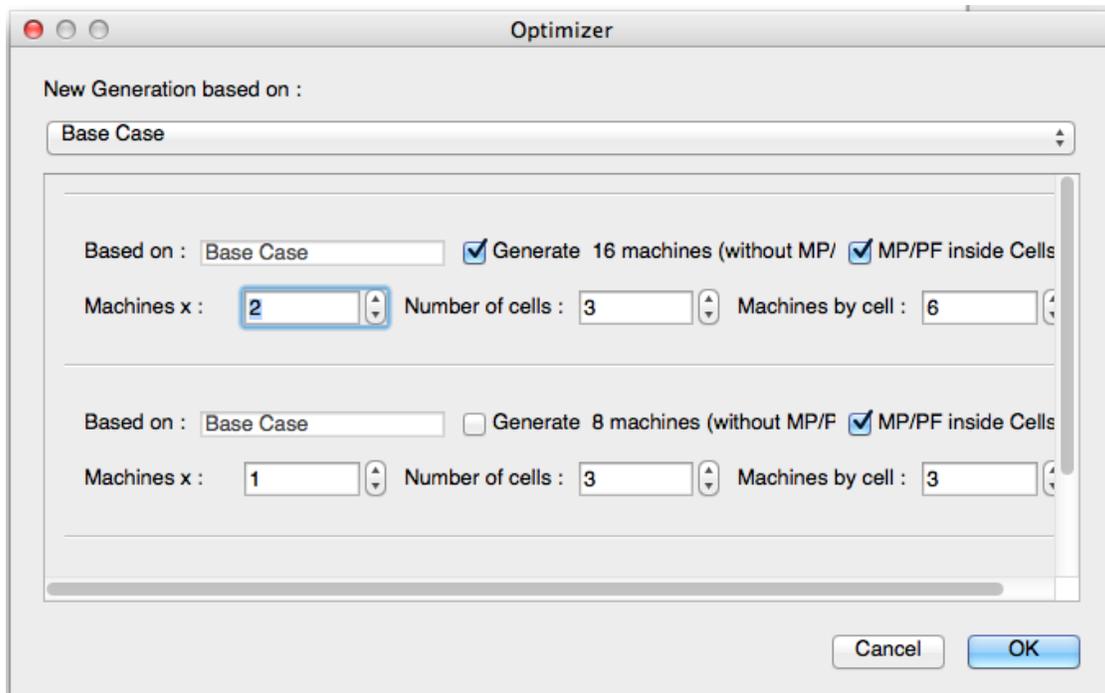


This algorithm looks for the optimal machine groupings in the scenario by assigning operations on the most suitable machines to minimize flow between cells.

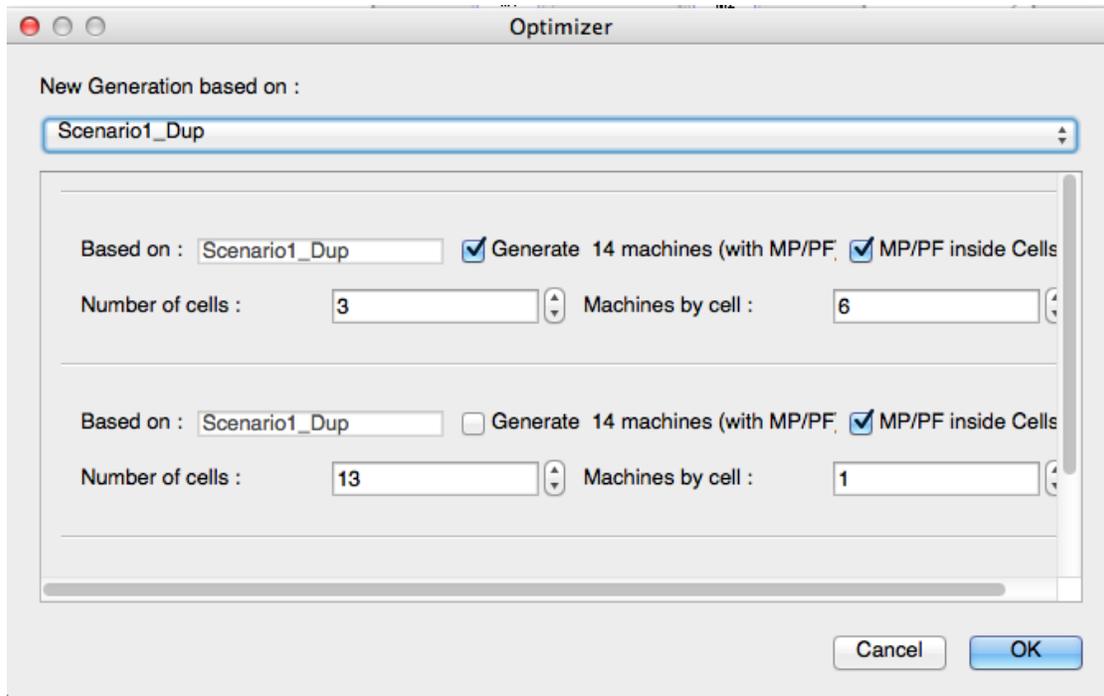
- Select the baseline: machines group are those defined in the selected scenario.



- Working with the “Baseline scenario”, the algorithm can find the best solution by duplicating (1x, 2x) all machines. Only useful machines to create independent cells will be used.



- Working with another scenario, SIMOGGA look for the optimal solution with the machine defined in this scenario



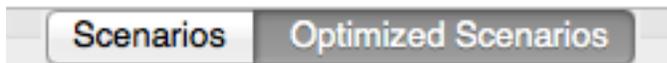
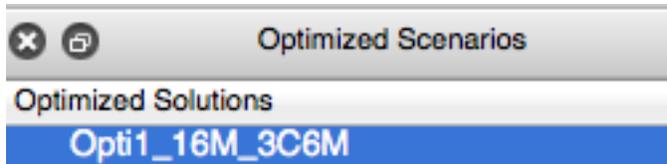
- Specify the parameters
 - The number of duplication of the machines (Machines x nbOccurrences)
 - The desired number of cells
 - The cell size by a maximum number of machines
 - Define if the raw material (PM) and finished products (FP) must be duplicated and inserted into cells (for a better view of the independence of cells)
- Select the cases to optimize from the suggestions (“Generate”)
- Insert new cases to optimize by selecting a new scenario
- The solution is presented to the screen

The screenshot shows the SIMOGGA LD Qt software interface. The main window displays two network diagrams, C1 and C2, with various nodes and connections. The left sidebar contains several panels:

- Optimized Solutions:** Lists 'Opti1_16M_3C6M' and 'Opti2_16M_3C6M'.
- Scenarios:** Shows 'Optimized Scenarios'.
- Structure:** Shows 'Company'.
- M3_1:** Displays 'Selected Item Info' for machine M3_1, including details like 'Trimmed name: M3_1', 'Name: M3_1', 'ID: 13', 'Reference machine: M3', 'First Type: TM3', and 'Load: 525.0 - Capacity: 3800 (13...'. A red warning message indicates 'Incomplete connection for machines'.
- Dashboard:** A table showing alternative solutions.

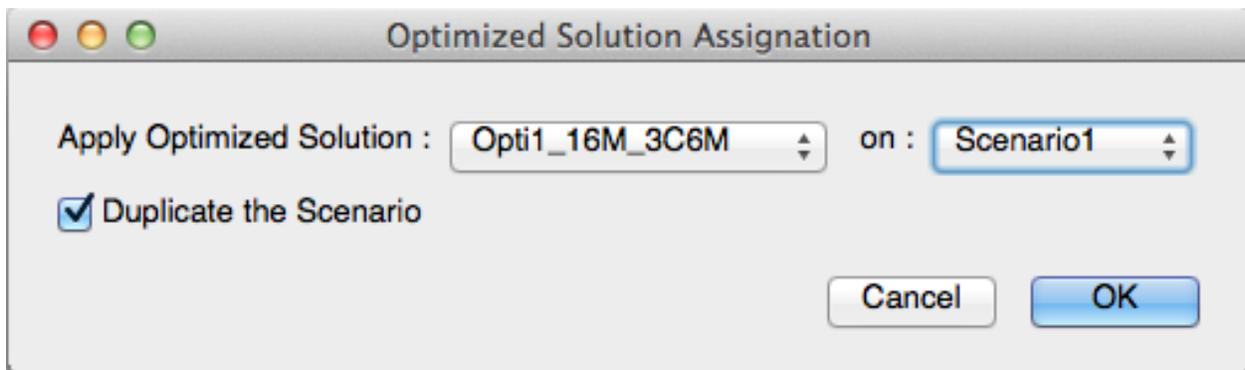
	Alt	Cost	%	Nb kms	Time
1	S1RV1	0.0 EUR		0.0 km	0.0 h
2	S2RV1	0.0 EUR		0.0 km	0.0 h
3	S3RV1	0.0 EUR		0.0 km	0.0 h

- The navigation in the optimized scenario is made by the navigation panel for the scenario



5.5.2 Apply the optimized scenario

- When the solutions are created, they can be applied on a scenario



- Select the optimized solution to apply
- Select the scenario on which the solution will be applied
- Specify if the scenario must be duplicated

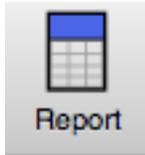
Hint: The cell solution is applied on the graphical view. The routing solution (operation assigned on machines) is applied to all the views of the scenario. The machines location on the real view will not be changed.

5.6 Evaluation

The creation of the cells will allow SIMOGGA to create product families assigned to these cells. The products are allocated to a cell by the number of transactions inside a cell. They are displayed in different colors (from green to

red) based on the relevance of membership to the cell.

This step is useful to know the directional flow between cells that we would like to create in the real view. The intracellular flux (inside the cells) are measured and represented as a percentage of total flows.



 Generate scenarios



6.1 How to use the scenarios and alternatives?

Based on the situation AS-IS and analysis of previous flows, it is possible to create all possible scenarios.

A alternative is used to test the location of teh machines.

A scenario is used to test a new design (new working area, new aisles...), solutions with new investments in term of machines or new routings for the parts.

6.1.1 Modify the location of the machines in the As-Is situation

- Duplicate « Alternative AS-IS »
- Changing the positions of the machines has a direct impact on the mileage (in green if a gain is observed if not red)

Total Distance: **597.2** (-20%) km | Intracellular Distance: **444.8** (+44%) km (74.5 %)

Distance totale : **715.0** (+19%) km | Distance intracellulaire: **308.4** (-46%) km (43.1 %)

6.1.2 New scenario based on the rerouting of flows

To create solutions based on the rerouting of flows performed in the graphical view of the “Scenario 2”:

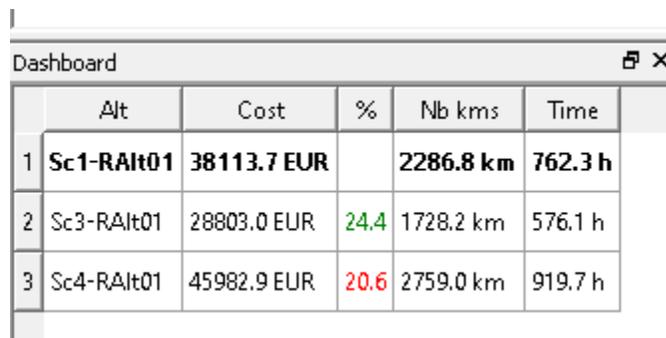
- Work in Scenario 2 alternative “S2RA1”
- **Determine incremental changes (in terms of positioning of machines):**
 - Modify « S2RA1 »
 - Duplicate« S2RA1 » en « S2RA2 »
 - Modify « S2RA2 »
 - Duplicate « S2RA2 » en « S2RA3 »
 - Modify « S2RA3 »

..hint each stage to be saved must be duplicated in order to keep the changes.

- **Modify the design of the factory**
 - Duplicate Scenario 2 (Scenario 3 =)
 - Modify the design (delete cells, create new cells ...)
 - Delete the non-useful alternatives from the previous Scenario 2 (“S2RA1” and “S2RA2”)
 - Start to change the alternative “S3RA3” (new design with machines positioned as the last alternative scenario 2)
 - Proceed with incremental changes to create a different alternative “S3RA3”, “S3RA4” to “S3RA5”

Incremental changes (via alternatives) can result in freeing up of an area so as to facilitate redesign. (via a new scenario).

6.2 Using the Dashboard



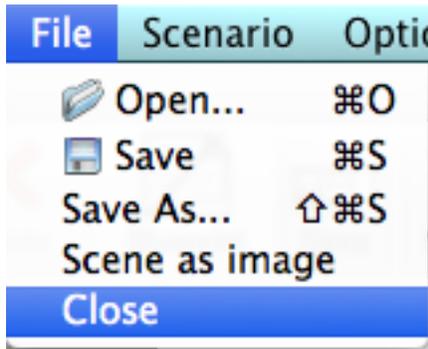
	Alt	Cost	%	Nb kms	Time	
1	Sc1-RAIt01	38113.7 EUR		2286.8 km	762.3 h	
2	Sc3-RAIt01	28803.0 EUR	24.4	1728.2 km	576.1 h	
3	Sc4-RAIt01	45982.9 EUR	20.6	2759.0 km	919.7 h	

The dashboard allows you to compare different real alternatives to quickly and easily visualize which is the best of them. It contains several data:

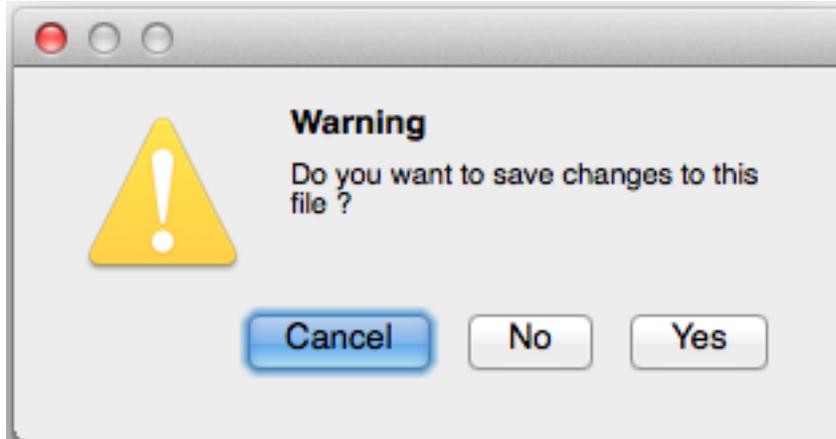
- The name of the alternative and it’s scenario .
- Total cost that represents the situation
- The percentage gain this situation than that indicated as the reference
- The total number of kilometers traveled by products
- The total time

To determine what is the alternative reference, you either go through the Scenario menu, or right-click on the selected alternative and choose “set as baseline” option. Computing the winning percentage of alternatives will be based on this alternative reference.

6.3 Fermeture



When closing the opened case with the command “Close” in the menue “File”, it will first ask it a backup of any changes made to the current case is necessary.



If the response is “Yes”, the modification will be saved in the original file xml. On the contrary, the modification will be lost.

Data and Data Panel

In order to simulate you will need data. In order to input, modify and visualize the data of your vase, click on the



following button: **Data**. The button is located on the ribbon where data manipulation makes sense. By clicking on the button, you will open the data manipulation windows. Different usages are possible with this Data Panel:

- Modelization of a new analysis case.
- Visualization of Excel imported data to validate them through visual and synthetic views
- Interaction with the data through the interface to adapt different scenarios, make different simulations with slightly different datasets or change input data

The creation and edition process of data is similar in all the different tabs of the data manipulation window:

- Adding a new data can be done by right-clicking on the tables or by clicking on “new” in the menu
- Editing the data is achieved by double clicking on the cell to modify

Data are either global or scenario specific. Data that are specific to a certain scenario are indicated in the title bar. The scenario that is being parametrized is always the present scenario.

Scenario1

Total Distance

Structure

- Company
 - CarFactory
 - PaintingZ
 - Stemplin
 - Assembly
 - DoorsZo

Selected Item

Data manipulation

Types and machines

Calendar by machine (Scenario1)

Machine Type	Code
Stemping	Stem
Welding	Weld
Painting	Paint
TFinalAssembly	TFAssemb
TDoors	TDoors
THood	TM6

Machine

- DoorsBrand1
- DoorsBrand2
- FinalAssembly
- HoodBran1
- PaintingRed
- PaintingYellow
- StempingBrand
- StempingBrand
- WeldingBrand1
- WeldingBrand2

Calendar

Machines

Products

Equipments (Scenario1)

Consumables (Scenario1)

Operators (Scenario1)

7.1 Calendar

The first tab of the data manipulation panel concerns the calendar and time parameters. Here will be defined everything that is related to time management: time period, shifts, time availability, operators availability, machines opening hours(etc.)

The screenshot shows the 'Data manipulation' window. In the 'Global' section, the 'Data start date' is 06.12.2017 and the 'Period' is 30 days. The 'Week templates' list includes 1Template, 1Template_SD, 2Template, 2Template_S, 3Template, 3Template_S, and 3Template_SD. The grid below shows machine availability from 0h to 23h for each day of the week. The 'Global calendar' table shows the following data:

Template	Week	Mon	Tue	Wed	Thu	Fri	Sat	Sun
3Template	48					1	2	3
3Template	49	4	5	6	7	8	9	10
3Template	50	11	12	13	14	15	16	17
2Template	51	18	19	20	21 (Ma.)	22	23	24
3Template	52	25 (Ho.)	26	27	28	29	30	31

7.1.1 Global

Before input of the parameters into the calendar, a span date and time period have to be defined. In the following example, the extraction data of the data is the 10th January 2018 and has a time period of 3 days. All the planning simulations will take these into account. The time period is used to compute the total capacity of machines. The machine capacity is the total time where the machine is available for production. The load (minutes) of the machine represents the real time needed to execute the operations on the machine. Consequently, the load (%) depicts the ratio between available time and time need for production. Input a large period of time will increase capacity but decrease machine usage (example: 62.5%)

The screenshot shows the 'Calendar' window with 'Global' settings. The 'Data start date' is 10.01.2018 and the 'Period' is 1 day. An arrow points from the 'Period' field to a table showing machine capacity and load.

Machine	Code	Type	Buffer	Capacity (mins)	Load (mins)	Load (%)
M1	M1	T_M1 (...)	20	480	900	187.5
M2	M2	T_M2 (...)	20	480	900	187.5
M3	M3	T_M3 (...)	20	480	900	187.5

On the contrary, for a shorter period of time might endangering the ability to produce the batch and result in machine overburden (example 2:187.5%)

Global
 Calendar Data start date: 10.01.2018 Period: 3 days

Machine	Code	Type	Buffer	Capacity (mins)	Load (mins)	Load (%)
M1	M1	T_M1 (...)	20	1440	900	62.5
M2	M2	T_M2 (...)	20	1440	900	62.5
M3	M3	T_M3 (...)	20	1440	900	62.5

7.1.2 Typical Week (Shifts)

The righten part of the window defines the “typical weeks” or shifts. A typical week is a definition of the production shifts during a week. From Monday to Sunday, a shift schedule can be added/modified/deleted throughout the entire day (24h). On the left, default typical weeks are offered, they are industry standards. On the right, the schedule and shifts of the selected week is depicted with colours.

Week templates

- 1Template
- 1Template_S
- 1Template_SD
- 2Template
- 2Template_S
- 2Template_SD
- 3Template
- 3Template_S
- 3Template_SD

Start: / End: /

	0h	1h	2h	3h	4h	5h	6h	7h	8h	9h	10h	11h	12h	13h	14h	15h	16h	17h	18h	19h	20h	21h	22h	23h
Mon																								
Tue																								
Wed																								
Thu																								
Fri																								
Sat																								
Sun																								

By right clicking, the user has the possibility to add new typical weeks or duplicate an existing one.

Week templates

- 1Template
- 1Template_S
- 1Template_SD
- 2Template
- 2Template_S
- 2Template_SD
- 3Template
- 3Template_S
- 3Template_SD

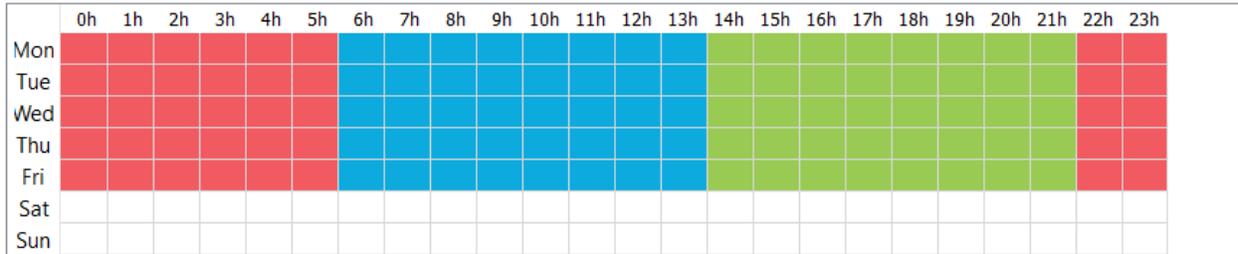
New template...
 Duplicate

The different shifts are depicted by colors and numbers:

- the first shift in blue, has the number 1,
- the second shift in green, has the number 2,
- the third shift in red, has the number 3,



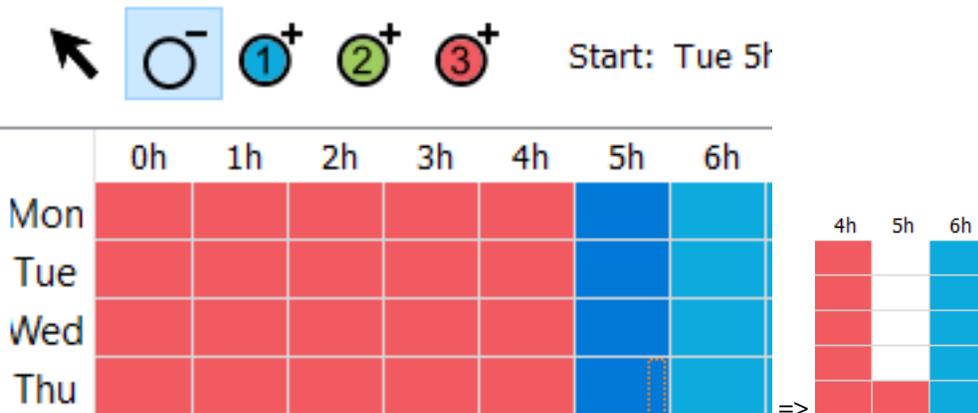
The maximum amount of shifts is 3 (without custom development). For a machine, a shift decomposition has no impact. The machine will be available (open) during the whole time defined through the different shifts. On the contrary, an operator will be assigned to a defined shift. In the example above, we can see that the template machine has 3 shifts from Monday to Friday.



There are 4 ways to modify a typical week:

- delete the working period, all shifts included
- add working period for the first shift
- add working period for the second shift
- add working period for the third shift

In order to apply them, the user should select the action to apply and select the working period that will be modified by the action.



7.1.3 Calendar

The last part of the Calendar depicts the global calendar of the factory. The calendar is arranged in the following way:

- Left-Top corner: events related actions
- Right-Top: Time related actions
- Bottom: Calendar

Global calendar

Template	Week	Mon	Tue	Wed	Thu	Fri	Sat	Sun
3Template	48					1	2	3
3Template	49	4	5	6	7	8	9	10
3Template	50	11	12	13	14	15	16	17
2Template	51	18	19	20	21 (Ma.)	22	23	24
3Template	52	25 (Ho.)	26	27	28	29	30	31

Typical Weeks (Shifts)

Typical shifts can be assigned by two methods:

*global, the modification is done for the whole calendar *Specifically, for a specific week

Global calendar

Template	Week	Mon	Tue	Wed	Thu	Fri	Sat	Sun
3Template	48					1	2	3
3Template	49	4				7	8	10
3Template	50	11				14	15	17
2Template	51	18	19	20	21 (Ma.)	22	23	24
3Template	52	25 (Ho.)	26	27	28	29	30	31

Events

We define events as exceptions that are : - time limited to specific days or period or time - hindering the production ability of the factory As of today, events have to be defined by day.

There are two ways to add an event: *Manually: Clicking on the event in the upper left and selection of the calendar cells to apply the modification *Generated: clicking on the event in the upper left and clicking on “generate event” To generate an event, there are 2 options:

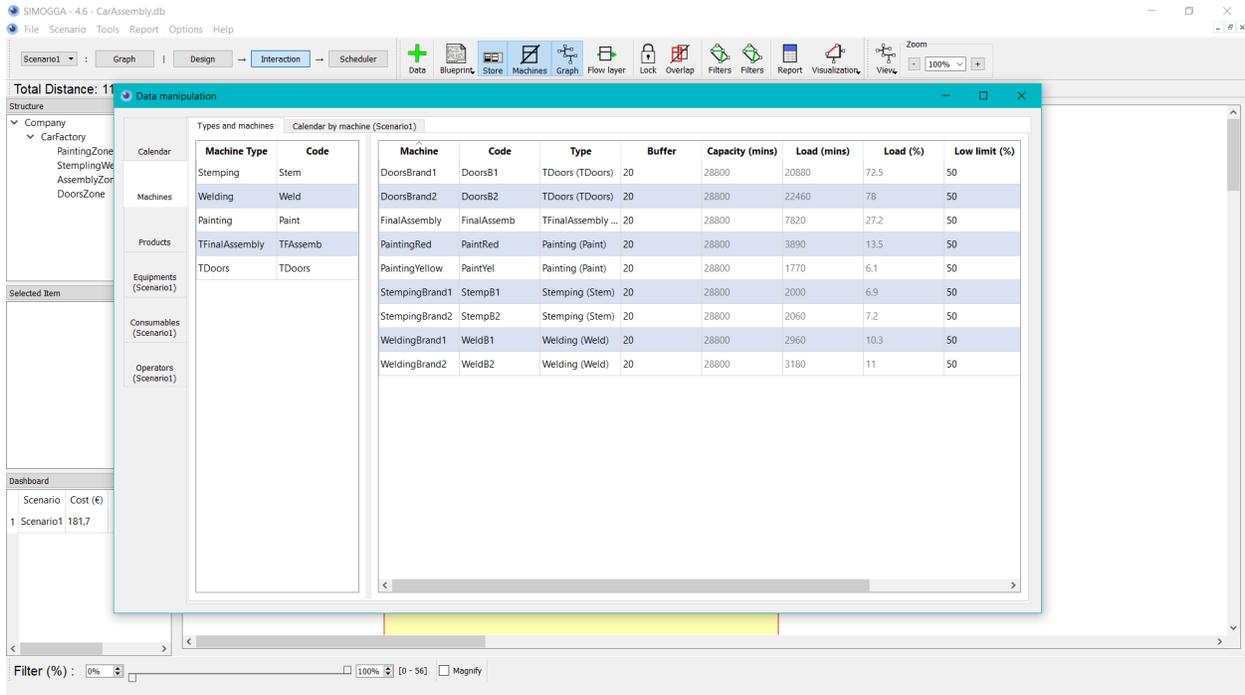
- occurrence :
- Variable, it is the percentage of occurrence of such events during the period
- Fixed, the event happens at one certain moment. For instance, once every 8 days.
- The options :
 - The event created in the past will be replaced by the event being defined
 - The generated event add up to the formerly created events.

Global calendar

Template	Week	Mon	Tue	Fri	Sat	Sun
3Template	48			1	2	3
3Template	49	4	5	8	9	10
3Template	50	11	12	15	16	17
2Template	51	18	19	22	23	24
3Template	52	25 (Ho.)	26	29	30	31

7.2 Machines

Machines are defined as a physical object where operations can be achieved. All the parameters related to the machines are located in the second vertical tab in the data manipulation pannel. This tab is divided in two sub-tabs: ” type and machines ” and ” calendar per machine “.



The screenshot shows the SIMOGGA LD Qt software interface. The main window is titled 'SIMOGGA - 4.6 - CarAssembly.dbt'. The 'Data manipulation' window is open, showing a table of machine types and their parameters. The table has the following columns: Machine, Code, Type, Buffer, Capacity (mins), Load (mins), Load (%), and Low limit (%). The table contains 12 rows of data.

Machine	Code	Type	Buffer	Capacity (mins)	Load (mins)	Load (%)	Low limit (%)
DoorsBrand1	DoorsB1	TDoors (TDoors)	20	28800	20880	72.5	50
DoorsBrand2	DoorsB2	TDoors (TDoors)	20	28800	22460	78	50
FinalAssembly	FinalAssemb	TFinalAssembly ...	20	28800	7820	27.2	50
PaintingRed	PaintRed	Painting (Paint)	20	28800	3890	13.5	50
PaintingYellow	PaintYel	Painting (Paint)	20	28800	1770	6.1	50
StempingBrand1	StempB1	Stemping (Stem)	20	28800	2000	6.9	50
StempingBrand2	StempB2	Stemping (Stem)	20	28800	2060	7.2	50
WeldingBrand1	WeldB1	Welding (Weld)	20	28800	2960	10.3	50
WeldingBrand2	WeldB2	Welding (Weld)	20	28800	3180	11	50

7.2.1 Machines and Types

In this tab, the user can create the different types of machines.

Types

The machine, allow to categorize the machines that are making similar operations. For instance: 2 painting workshops are two different physical machines. But, the painting operation can be achieved on any of the two machines. The user will then create two machines of the same type to indicate that the operation can be achieved on both.

In a nutshell: - Machines are physical location where operations are done - Machines type specific the type of operations that is being done(Category)

The tab in the left sums up the different types that can be specified for the machines.

Machine	Code	Type	Buffer	Capacity (mins)	Load (mins)	Load (%)
DoorsBrand1	DoorsB1	TDoors (TDoors)	20	10560	20880	197.7
DoorsBrand2	DoorsB2	TDoors (TDoors)	20	10560	22460	212.7
FinalAssembly	FinalAssemb	TFinalAssembly ...	20	10560	7820	74.1
PaintingRed	PaintRed	Painting (Paint)	20	10560	3890	36.8
PaintingYellow	PaintYel	Painting (Paint)	20	10560	1770	16.8
StempingBrand1	StempB1	Stemping (Stem)	20	10560	2000	18.9
StempingBrand2	StempB2	Stemping (Stem)	20	10560	2060	19.5
WeldingBrand1	WeldB1	Welding (Weld)	20	10560	2960	28
WeldingBrand2	WeldB2	Welding (Weld)	20	10560	3180	30.1

Machine Type

The name of the type (Category)

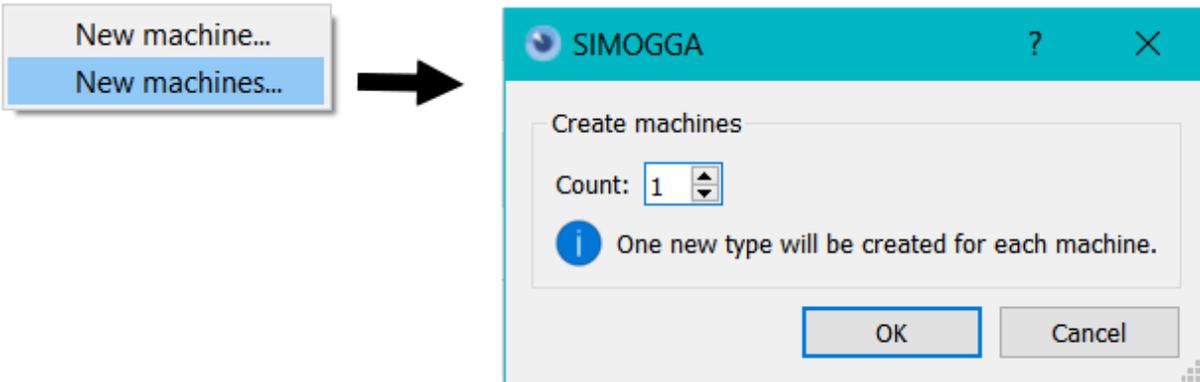
Code

Code of type of machine, is used as an abbreviation of machine type.

Machines The machines and their characteristics are depicted in the right table.

Machine	Code	Type	Buffer	Capacity (mins)	Load (mins)	Load (%)
DoorsBrand1	DoorsB1	TDoors (TDoors)	20	10560	20880	197.7
DoorsBrand2	DoorsB2	TDoors (TDoors)	20	10560	22460	212.7
FinalAssembly	FinalAssemb	TFinalAssembly ...	20	10560	7820	74.1
PaintingRed	PaintRed	Painting (Paint)	20	10560	3890	36.8
PaintingYellow	PaintYel	Painting (Paint)	20	10560	1770	16.8
StempingBrand1	StempB1	Stemping (Stem)	20	10560	2000	18.9
StempingBrand2	StempB2	Stemping (Stem)	20	10560	2060	19.5
WeldingBrand1	WeldB1	Welding (Weld)	20	10560	2960	28
WeldingBrand2	WeldB2	Welding (Weld)	20	10560	3180	30.1

In addition to the standard add elements in SIMOGGA, you will have the choice to add multiple machines in one single operation. A new machine type will be created for each new machine.

*Machine*

Machine name.

Code

Machine code. Technical abbreviation of the machine name.

Type

Name and code of the machine type.

Buffer

The maximum quantity of goods in production that can be stored in front of the machine. This value is not blocking in terms of simulation but allows to make visual representation of the production when simulating.

Capacity

Maximum timing in minutes, that products can spend on the machine during a determined time period (see calendar-> global -> Period) The capacity is computed based on the working and availability schedule defined in the calendar of the machine

Load (minutes)

The load in minutes is the total time cumulated of spend by products on machines.

Load (%)

The load, in percent, is the ratio between the capacity time and the load time. A big ratio depicts a machine that is highly used. On the contrary, if the ratio is little, it depicts a low usage level.

Hint: It is possible to sort the load (%) in ascending and not ascending order to check the loads. It is recommended to always let some free capacity to manage variations.

Hint: This load is theoretical and high-level. It doesn't take into consideration a full scale simulation. It is therefore even more important to ensure an optimal load ratio. machines surchargées (> 100%). La période devrait être réduite, s'il n'y a pas de machines surchargées et s'il y a des produits sous-chargés (<100%-marge%). La vraie indication des charges sera effectuée lors de la planification et sera visible lors de la visualisation des résultats de celle-ci.

7.2.2 Calendar per machine

The calendar per machine tab allows to manage the specification of the timing for each machine. The tab is divided in 3 different sections : “list of machines”, “calendar of the machine”, “global overview”.

The screenshot shows the 'Calendar by machine (Scenario1)' interface. On the left, a list of machines is displayed under the 'Types and machines' tab. The main area is divided into two parts: a specific machine calendar and an overview of capacity percentage by day.

List of machines:

- StempingBrand1 (selected)
- StempingBrand2
- WeldingBrand1
- WeldingBrand2
- PaintingRed
- PaintingYellow
- FinalAssembly
- DoorsBrand1
- DoorsBrand2

Machine Calendar (Scenario1):

Buttons: Select, Erase, Breakdown, Maintenance, Generate Event. Default template: 1Template. Start date: December 2017.

Template	Week	Mon	Tue	Wed	Thu	Fri	Sat	Sun
1Template	48					1	2	3
1Template	49	4	5	6	7	8	9	10
1Template	50	11	12 (Ho.)	13	14 (Br.)	15	16	17
1Template	51	18	19	20	21	22	23	24
1Template	52	25	26	27	28	29	30	31

Overview of machine's capacity percentage by day:

Start date: Days (2017)

Machines	6/12	7/12	8/12	9/12	10/12	11/12	12/12	13/12	14/12	15/12	16/12	17/12	18/12	19/12	20/12	21/12	22/12	23/12	24/12	25/12	26/12	
StempingBra...	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
StempingBra...	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
WeldingBran...	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
WeldingBran...	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
PaintingRed	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█

List of machines

At the top, left, are listed all the machines of the scenario that is being modified. To visualize the calendar of one machine, the user has to select it by left-clicking. The first machine is selected by default.

Machine Calendar

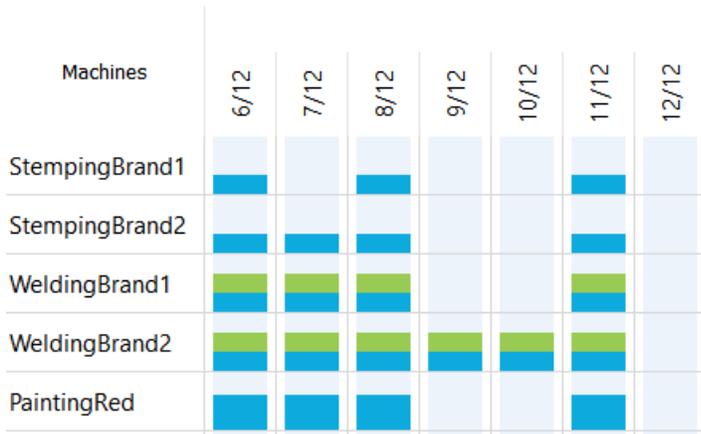
At the top, right, is displayed the specific calendar of the selected machine. This calendar sums up the information about the machine. The global calendar (including vents in light orange) as well as the information specific to the machine (including event in dark orange)

Mon	Tue	Wed	Thu	Fri	Sat	Sun
				1	2	3
4	5	6	7	8	9	10
11	12 (Ho.)	13	14 (Br.)	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

Any change on this calendar will only impact the selected machine. This calendar functions as the global calendar, with events related to specific machines: maintenance and breakdown.

Global overview

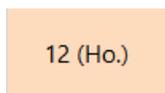
At the bottom, a recapitulating table is displayed with a global overview of the all the machines, their shifts, their breaks on a period of time. How to understand this overview? Let’s discover it with an example?



Observations on the machine StempingBrand1 :

- Only the blue color is present : the machine is only open during the first shift.
- 7/12 (Thursday) no color : seeing that the other machine are available the 07/12, something specific must happen to the machine.

If we look into the specific calendar, we will indeed see that there is breakdown on this day. *12/12 no color: no other machine is open the same day, there must be a global off day for the whole factory. This hypothesis is verified by verifying the global calendar or a machine calendar. By looking the calendar of “StempingBrand1”, an off-day is visible:



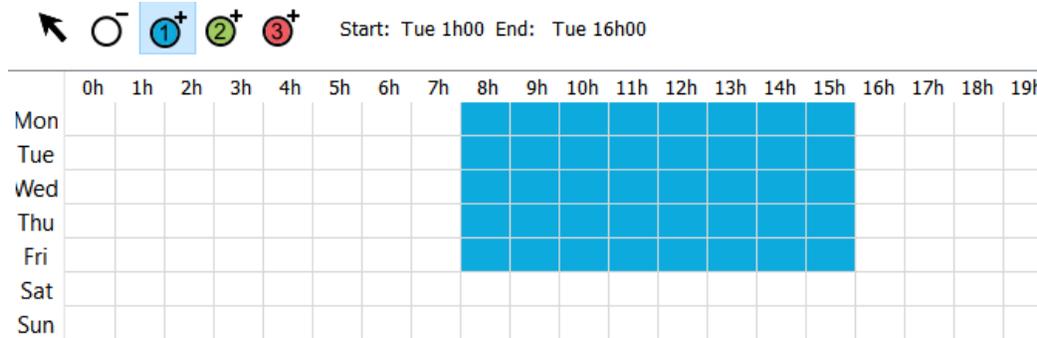
Observations on machine WeldingBrand1 :

- Blue and green colors are depicted: the first and second shift are used.

- In comparison with WeldingBrand2, the 9th and 10th of December are off-days. Both have similar typical weeks. Nevertheless, WeldingBrand2 is also working during the weekends.

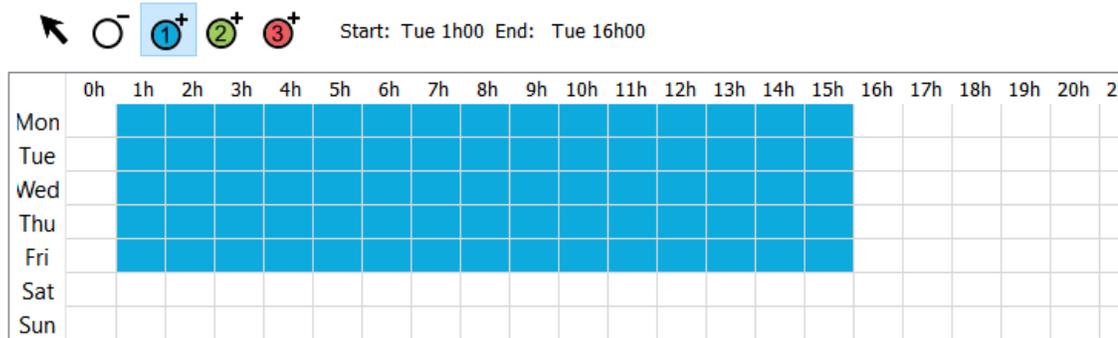
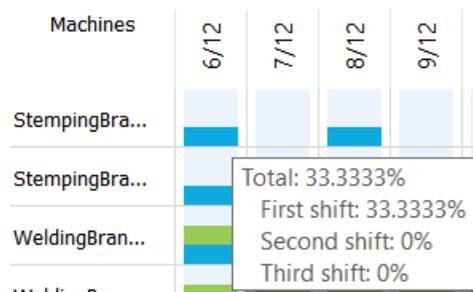
Observations on machine PaintingRed :

- The typical week is similar to the one of StempingBrand1. Indeed, the model has been duplicated and the length of the first shift extended.



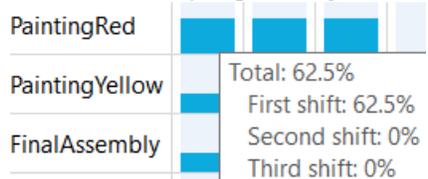
The typical week of StempingBrand1:

By hovering a machine/day cell with the mouse, the availability percentage based on a day (24h) will be displayed. For instance: by opening one shift out of three, from 8h to 16h, the availability will reach 33%.



Typical week of PaintingRed :

The availability percentage reaches 62.5% with opening hours ranging from 1h to 16h.



7.3 Products

A product is the result of a succession of operations (transformation and assembly of raw material and semi-finished products). The production process is the sum of all the production steps. Each operation is achieved by a certain, defined type of machine.

The screenshot shows a software interface with a sidebar on the left containing navigation options: Calendar, Machines, Products, Equipments (Scenario1), Consumables (Scenario1), and Operators (Scenario1). The main area is divided into two tables.

Product	Code	Quantity	Transfer Size	Batch Size	Transport Factor	Dimension
Brand1Red	B1R	10	1	10	2	L=450 x W=250 x H=170 cm
Brand1RedDoors	B1RD	40	1	40	1	L=90 x W=10 x H=120 cm
Brand1Yel	B1Y	6	1	6	2	L=450 x W=250 x H=170 cm
Brand1YelDoors	B1YD	12	1	12	1	L=90 x W=10 x H=120 cm
Brand2Red	B2R	12	1	12	2	L=460 x W=250 x H=170 cm
Brand2Yel	B2Y	4	1	4	2	L=460 x W=250 x H=170 cm

Operation	Precedences	Type	Machine	Transport Factor	Transfer Size	Batch Size	Setup Time	Load Time	Operating Time	Unload Time	Quality Check
Stamping		Stamping (Stem)	StampingBrand...	2	1		40		120		
Welding	Stamping	Welding (Weld)	WeldingBrand1...	2	1		40		180		
Painting	Welding	Painting (Paint)	PaintingRed (Pa...	2	1		40		160		
TFinalAssembly	Painting, TDoor...	TFinalAssembly ...	FinalAssembly (...)	2	1		40		240		

At the bottom left, there is a checkbox labeled "Allow to add operation via layout". On the right side, there is a legend for a diagram with four colored squares: blue for "Selected product group", light blue for "Selected product", yellow for "Selected operation", and orange for "Current precedences". Below the legend is a small diagram showing nodes and connections.

7.3.1 Products

At the left top corner are displayed the Products.

Product	Code	Quantity	Transfer Size	Batch Size	Transport Factor	Dimension
Brand1Red	B1R	10	1	10	2	L=450 x W=250 x H=170 cm
Brand1RedDoors	B1RD	40	1	40	1	L=90 x W=10 x H=120 cm
Brand1Yel	B1Y	6	1	6	2	L=450 x W=250 x H=170 cm
Brand2Red	B2R	12	1	12	2	L=460 x W=250 x H=170 cm
Brand2Yel	B2Y	4	1	4	2	L=460 x W=250 x H=170 cm

Sub-Products

A product is a succession of raw material transformation but may also contain assembly steps with other semi-finished products. The link between a product and its parent is visible when the product menu is pulled down (displayed)

- Brand1Yel
 - Brand1YelDoors
 - Brand1YelHood
- Brand2Red

Products Group

A product and its sub-products form a product group.

Actions** The user has the possibility to add a simple product or a sub-product. A product can be duplicated with or without its sub-products. The process and the operations will be duplicated.



Product

Product name

Code

Product code

*Quantity *

Quantity

Transfer size

The maximum amount of products that can be transferred between two machines. The transfer size must be a multiple of the lot size.

Lot size

The maximum amount of units that can be simultaneously produced. The quantity must be a multiple of the lot size.

Transport Factor

The transport factor is the multiple applied to the transport time/load between two machines. It allows to ponder transfer time to take into consideration difficult transfer. A slower product will have a higher transfer factor. It will also be displayed with a thicker flow in th visualization mode.

Dimension

The length, wight and height of a production. It will be taken into consideration for the visualization of the buffers.

7.3.2 Operations

At the bottom left, the principal process of the selected product is displayed. By default, the first product is selected. The product process is the sum of the operations on the product. An operation is a specific transformation of raw material of the assembly of other products and semi-finished products.

Operation	Precedences	Type	Machine	Transport Factor	Transfer Size	Batch Size	Setup Time	Load Time	Operating Time	Unload Time	Quality Check
Stemping		Stemping (Stem)	StempingBrand...	2	1		40		120		
Welding	Stemping	Welding (Weld)	WeldingBrand1 ...	2	1		40		180		
Painting	Welding	Painting (Paint)	PaintingRed (Pa...	2	1		40		160		
TFinalAssembly	Painting, TDoor...	TFinalAssembly ...	FinalAssembly (...	2	1		40		240		

Operation

Name of the operation

Precedences

List of the operations that have to be achieved before launching this operation. All of these have to be done before launching the selected operation.

Type

Machine Type that is able to execute the operation.

Machine

The machine that will run the operation amongst the different machines of this type. The displayed configuration (size, time, etc.) are dependent from the selected machine. Example: The assembly type that has two possible machines: an old one and a new one. The operation might be achieved on the new one with a certain time but we might choose to use the old one and re-assign the operation on another machine.

Transport Factor

The transport factor is a multiple applying to the transfer from one machine the one where the next operation will be achieved. If no factor is defined at the operation level, then the factor level of the transport will be taken into consideration. The factor will mostly impact the visualization of the flows. Indeed, the factor will multiply the size of the flow rendered. So that the user know that these movement have to be minimized.

Transfer size

Ht maximum amount of units that can be transferred from one machine to the next in one single movement.

Lot size The amount of units that can be produced at the same time during the operation. If no lot size is defined with the operation, the product lot size will be taken into consideration. The default lot size must be a divider of the quantity.

Setup Time

The setup time (minutes) is the amount of time needed to set the machine up. This time will be used to take the setup time into consideration when a machine will start producing a different kind of product.

Loading time

The time to load the units on the machine (minutes)

Operating time

Time (in minutes) to run the operation.

Unloading time

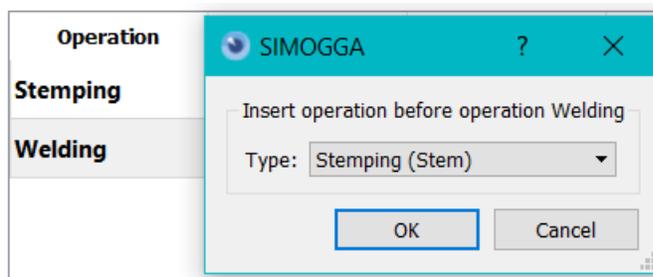
The time (in minutes) to unload the product units from the machine.

Quality check time

The time needed for quality check time.

Actions

The adding of a new operation is done at the end of the process by default. While adding a new operation that requires that selection of a machine type.



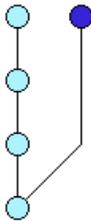
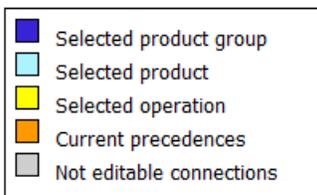
It is also possible to insert an operation after or before an existing one.

Operation	Precedences	Type
Stamping		Stamping...
Welding		Welding (...)

Delete
 Insert before...
 Insert after...
 Insert last (Ctrl N)...

7.3.3 Precedences

At the right of the tab, the process flowchart with precedences is displayed. As a reminder, the precedence B of operation A is an operation that must be achieved on a semi-finished product before that operation A may start.



An operation is depicted as a node on the graph. By hovering the node with the mouse, the user receives the informations about the operation. Une opération est représentée par un nœud sur le graphe, en passant le curseur de souris au-dessus d'un nœud, on obtient les informations sur l'opération.



Operation: Welding
Machine: Welding
Product: P9

Color code :

- Light blue : operations of the selected product
- Dark blue : operations of the product group
- Yellow : Selected operation
- Orange : Precedences of the selected operation
- Grey : Operations that can't be edited (operation that must stay at the beginning or the end of the process)

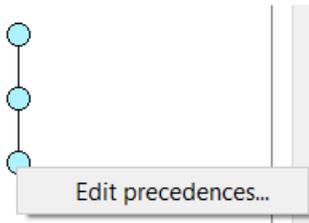
Link between the left and right panel

The same data are depicted in a different way. If you select one operation it will be selected in both panels.

edit precedences

There are two ways to edit :

- Table : double click on the cell in the precedences column
- Graph : Right click on the node and then on the menu “edit precedences”



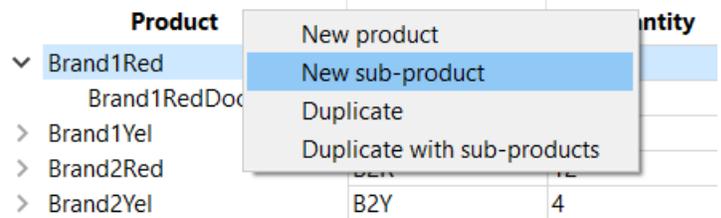
The editing is done by clicking on the nodes in the graph.

- If the clicked node was a precedence, it will be unlinked.
- If the clicked node was not a precedence, it will be added.

Example : How to add a sub-product to a product?

Exercise : add a new sub-product to « Brand1RedHood » to the product « Brand1Red ».

Steps :



1. Right click on « Brand1Red » and « Create sub-product ».
2. Double-click on the new sub-product and change the name in « Brand1RedHood », press enter to validate.



3. The sub-product is included in the product group “BrandRed1” with no operations at the moment.

Product	Code	Quantity	Transfer Size	Batch Size
Brand1Red	B1R	10	1	10
Brand1RedDoors	B1RD	40	1	40
Brand1RedHood	P10	1	1	1
> Brand1Yel	B1Y	6	1	6
> Brand2Red	B2R	12	1	12
> Brand2Yel	B2Y	4	1	4
P9	P9	1	1	1

Operation	Precedences	Type	Machine	Transport Factor	Transfer S

Allow to add operation via layout

Legend:

- Selected product group
- Selected product
- Selected operation
- Current precedences
- Not editable connections

4. Right click on the operations table and selection “insert last” in the menu.

Operation	Precedences	Type

Insert last (Ctrl N)...

SIMOGGA ? X

Insert operation last

Type: Stemping (Stem) ▼

- Stemping (Stem)
- Welding (Weld)
- Painting (Paint)
- TFinalAssembly (TFAssemb)
- TDoors (TDoors)
- THood (TM6)

5. Choose the operation type to add.

Product	Code	Quantity	Transfer Size	Batch Size
Brand1Red	B1R	10	1	10
Brand1RedDoors	B1RD	40	1	40
Brand1RedHood	P10	1	1	1
> Brand1Yel	B1Y	6	1	6
> Brand2Red	B2R	12	1	12
> Brand2Yel	B2Y	4	1	4
P9	P9	1	1	1

Operation	Precedences	Type	Machine	Transport Factor	Trans
THood		THood (TM6)	HoodBran1 (M10)	1	1

6. The new operation is now created.

7. Link the sub-product to the parent product.

7.1 Right-Click on the assembly operation of the parent product.

7.2 Click on “edit precedence”

7.3 Click on the operation to bind

7.4 Validate



The sub-product has been entirely created. You can now see that in the “Brand1RedHood” operations table that the assembly operation is visible. As this operation belongs to the parent product, it is not editable.

Product	Code	Quantity	Transfer Size	Batch Size	Transport Factor
Brand1Red	B1R	10	1	10	2
Brand1RedDoors	B1RD	40	1	40	1
Brand1RedHood	P10	1	1	1	1
Brand1Yel	B1Y	6	1	6	2
Brand2Red	B2R	12	1	12	2
Brand2Yel	B2Y	4	1	4	2
	0		1	1	1

Operation	Precedences	Type	Machine	Transport Factor	Transfer Size	Batch S
THood		THood (TM6)	HoodBran1 (M10)	1	1	
TFinalAssembl...	Painting (Brand...	TFinalAssembly ...	FinalAssembly (Fin...	2	1	

- Selected product group
- Selected product
- Selected operation
- Current precedences
- Not editable connections

The two sub-products have correctly been connected to the principal product. It can be verified by looking at the precedence tree.

7.4 Equipments

An equipment is a tool, machine or equipment that allow to move the product between machines or during a part of the whole production process. On an automated production line, a clamp will move a product from machine A to machine B. An equipment that is active throughout multiple operations can be a conveyor or an crane that will carry a car in assembly.

Data manipulation — □ ×

	Equipment Type	Code		Equipment	Code	Speed loaded	Speed empty	Type	Zone	Operator
Calendar	T_Conveyor	Conv.		Conveyor	Eq_C_1	3	6	T_Conveyor	PaintingZone, DoorsZone	<input type="checkbox"/> No
Machines	T_Trolley	Trol.		Conveyor2	Eq_C_2	2	4	T_Conveyor	PaintingZone	<input type="checkbox"/> No
Products	T_Hoist	Hoist		Trolley	Eq_T_1	5	10	T_Trolley	StemplingWeldingZone	<input checked="" type="checkbox"/> Yes
Equipments (Scenario1)				Trolley2	Eq_T_2	5	10	T_Trolley	StemplingWeldingZone, Door...	<input checked="" type="checkbox"/> Yes
Consumables (Scenario1)				Hoist	Eq_H_1	1	2	T_Hoist	CarFactory	<input type="checkbox"/> No
Operators (Scenario1)										

7.4.1 Equipments Type

An equipment type is a group of similar equipment. When inputting parameters to the planner, an operation might be linked to a certain type of equipment.

Equipment Type	Code
T_Conveyor	Conv.
T_Trolley	Trol.
T_Hoist	Hoist

Equipments Type

Name of equipment type.

Code

Equipment type code

7.4.2 Equipments

An equipment is a tool, machine or equipment that allow to move the product between machines or during a part of the whole production process.

Equipment	Code	Speed loaded	Speed empty	Type	Zone	Operator
Conveyor	Eq_C_1	3	6	T_Conveyor	PaintingZone, DoorsZone	<input type="checkbox"/> No
Conveyor2	Eq_C_2	2	4	T_Conveyor	PaintingZone	<input type="checkbox"/> No
Trolley	Eq_T_1	5	10	T_Trolley	StemplingWeldingZone	<input checked="" type="checkbox"/> Yes
Trolley2	Eq_T_2	5	10	T_Trolley	StemplingWeldingZone, Door...	<input checked="" type="checkbox"/> Yes
Hoist	Eq_H_1	1	2	T_Hoist	CarFactory	<input type="checkbox"/> No

Equipment

Equipment name

Code

Equipment code

Speed loaded

Speed in km/h when the equipment is moving and loaded (carrying product)

Speed empty

Speed in km/h when the equipment is moving and empty (not carrying product)

Type

Equipment Type

Zone

The zone where the equipment is active. Equipment can be restricted to certain zone. Zone are defined with parents (Site > Building > Floor > Room > Cell). The equipment can be assigned to a zone at different levels and will be active in all the lower level subzones.

Operator

The equipment will or won't need the presence of an operator. A cart will need an operator. An automated crane won't.

7.5 Consumables

A consumable is a kind of good that will entirely disappear in the production process (for instance: a screw, a bolt, etc.) The assignment of a consumable will be done while parameterizing the planner.

	Consumable	Code	Quantity
Calendar	Screw	screw	594562
Machines	Bolt	bolt	501500
	Nut	nut	500356
Products	Stud	stud	504896
	Nut_closed	nut_c	501257
Equipments (Scenario1)			
Consumables (Scenario1)			

7.6 Operators

An operators is a factory worker that belongs certain competencies allowing him to work on certain machines. His skills will also define which kind of equipment he will be able to manipulate (see planner configuration). The machines skills are sorted by zone. It allows to easily find the skills to assign to an operator based on the layout. Each machine skill sums up the amount of operations that are assigned to it.

Calendar										
Machines	PaintingZone	StemplingWeldingZone				AssemblyZon	DoorsZone			
Products	PaintingYellow	StemplingBrand2	WeldingBrand2	PaintingRed	DoorsBrand1	FinalAssembly	DoorsBrand2	StemplingBrand1	WeldingBrand1	
Equipments (Scenario1)	1	1	1	1	1	2	1	1	1	
Consumables (Scenario1)	StemplingOp									
	WeldingOp									
Operators (Scenario1)	PaintingOp									
	FinalAssemblyOp1									
	FinalAssemblyOp2									
	DoorsOpB1									
	DoorsOpB2									

Actions

Delete

- Select Delete action
- Select the zone to delete



Operators	PaintingZone	StemplingWeldingz		
	PaintingYellow	StemplingBrand2	WeldingBrand2	PaintingRed
	1	1	1	1
StemplingOp				
WeldingOp				
PaintingOp				

- Release the mouse button to apply delete action. The operators counters and the visual are updated



Operators	PaintingZone	StemplingWeldingZ		
	PaintingYellow	StemplingBrand2	WeldingBrand2	PaintingRed
	0	1	1	0
StemplingOp				
WeldingOp				
PaintingOp				

Assignment

- Select assignment action
- Select cells where to apply the action



Operators	PaintingZone	StemplingWeldingZ		
	PaintingYellow	StemplingBrand2	WeldingBrand2	PaintingRed
	0	1	1	0
StemplingOp				
WeldingOp				
PaintingOp				

- Release mouse button to apply assignment. Operators counters and visuals are updated.



Operators	PaintingZone	StemplingWeldingZc		
	PaintingYellow	StemplingBrand2	WeldingBrand2	PaintingRed
	1	2	2	1
StemplingOp				
WeldingOp				
PaintingOp				

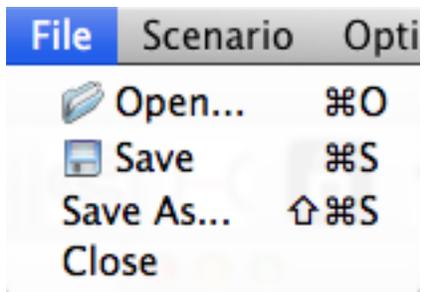
Selection

Allow to select cells without applying changes. It allows to prevent modifying cells without purpose.

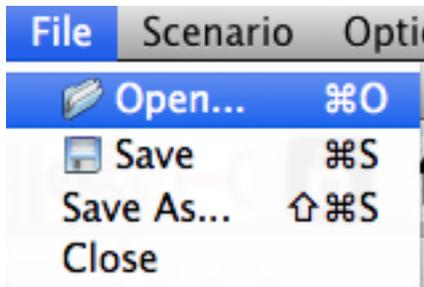


8.1 SIMOGGA

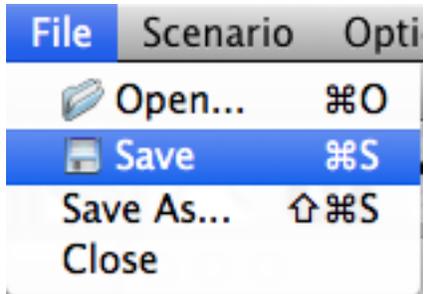
8.2 File



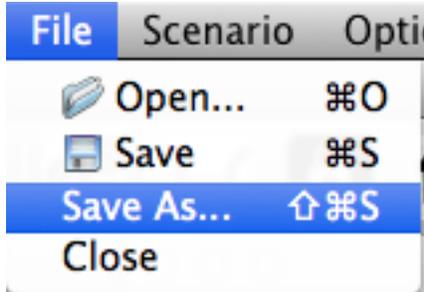
- **Open** : Open a case on the basis of a data xml file.



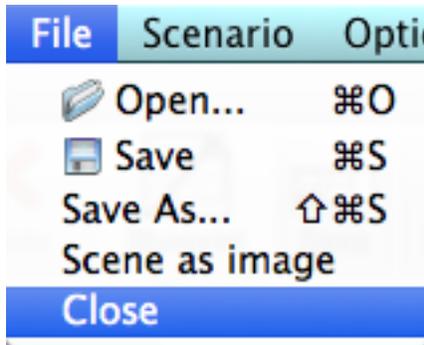
- **Save** : Save the case by changing the data file loaded.



- **Save As** : Save by allowing to choose the name and location of the xml file.



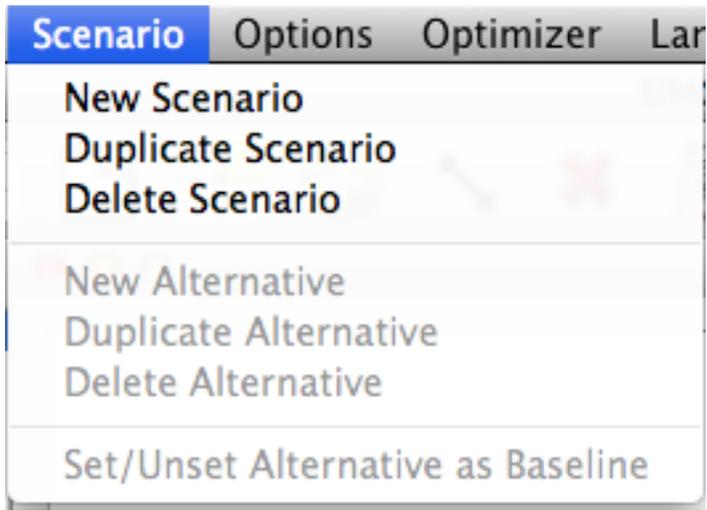
- **Close** : Close the opened case. It will first ask it a backup of any changes made to the current case is necessary.



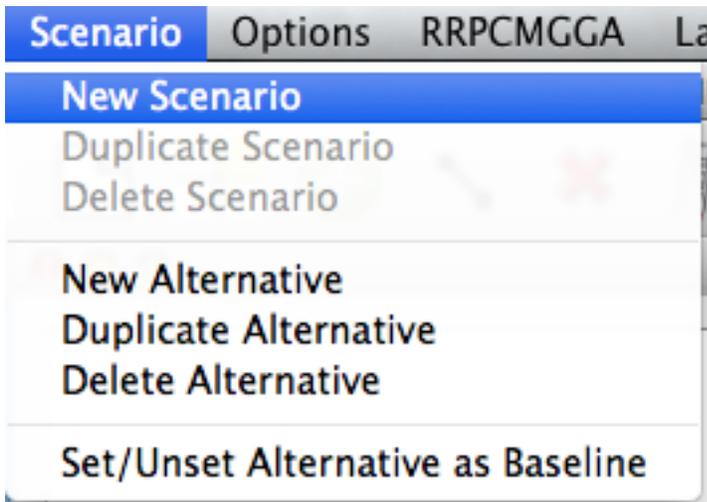
- **Exit** : Closes the application. It will first ask if a backup of any changes made to the current case is necessary.



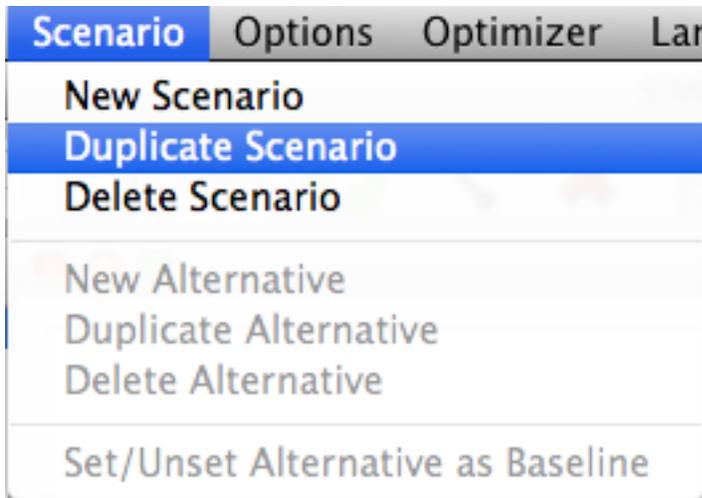
8.3 Scenario



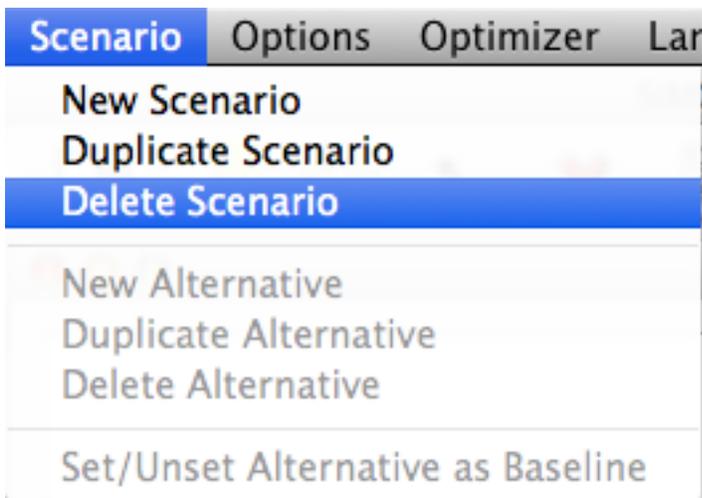
- **New Scenario** : Creates a new blank scenario with an alternative of each type.



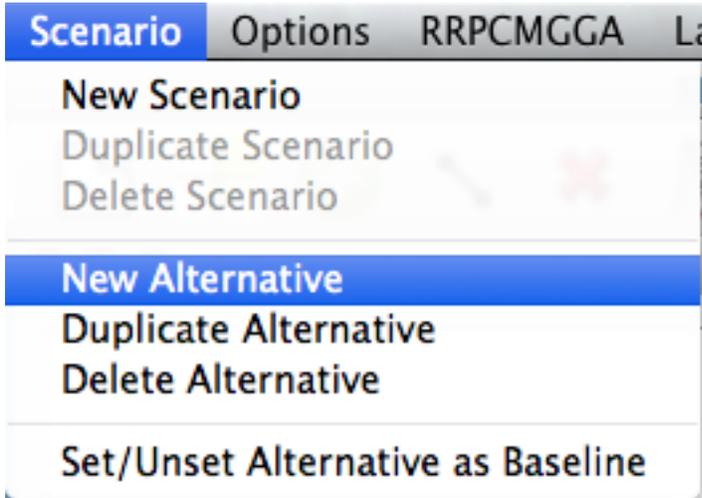
- **Duplicate Scenario** : Duplicates the current scenario.



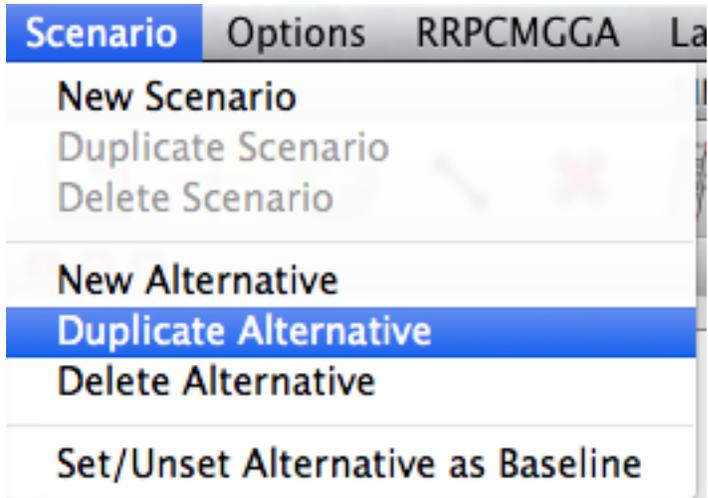
- **Delete Scenario** : Removes the current scenario and all its alternatives.



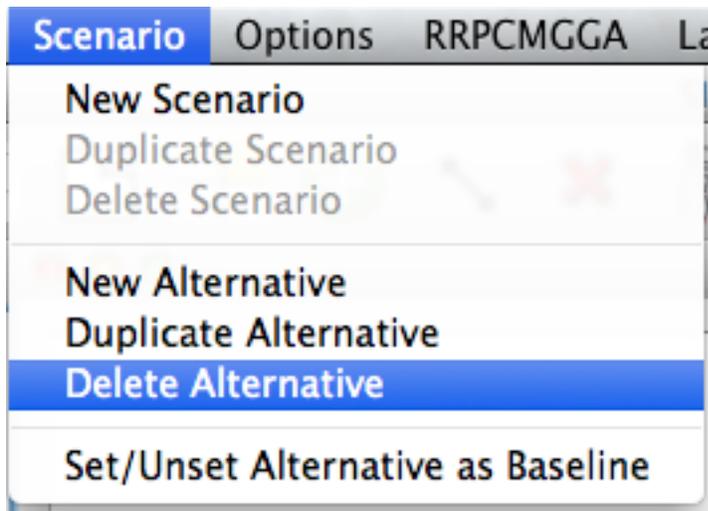
- **New Alternative** : Creates a new blank alternative.



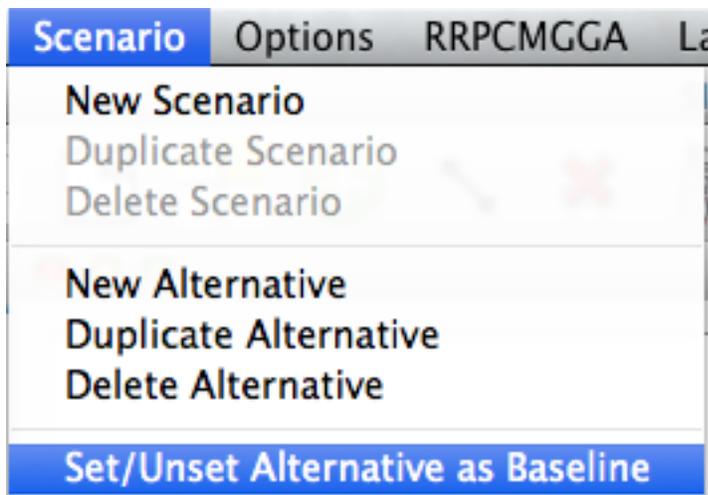
- **Duplicate Alternative** : Duplicates the current alternative.



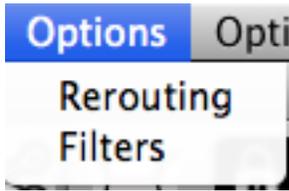
- **Delete Alternative** : Delete the current alternative.



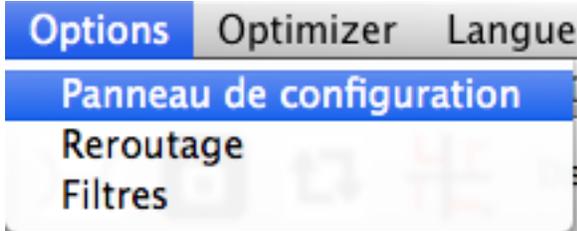
- **(Un)Select the alternative as reference** The common alternative is stored as an alternative reference at the dashboard. One alternative may be indicated as a reference. All other alternatives will be compared to the alternative reference.



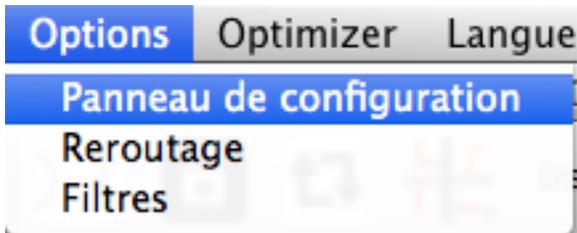
8.4 Options



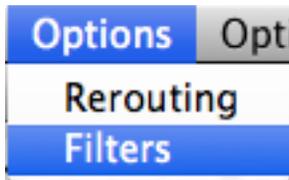
- **Configuration Panel** : Displays the panel containing the customizable settings SIMOGGA.



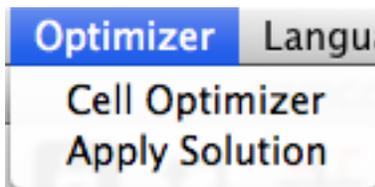
- **Rerouting** : Displays the panel to proceed rerouting products to change the flow between machines. This can not be done on the baseline (Base).



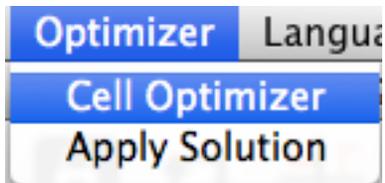
- **Filters** : Displays the panel to make filters on products and machines.



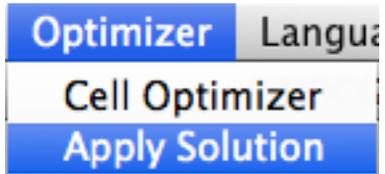
8.5 Optimizer



- **Cell Optimizer** : Display panel for generating independent cells.



- Apply Solution: Apply an optimized solution to the current alternative specifying whether the scenario must be duplicated or not.



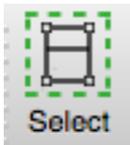
8.6 Languages

Choice of languages. Available languages: French, English, German.

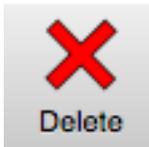
8.7 Help

Access to the detailed help

9.1 Graphical View



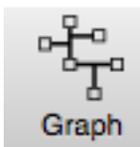
- **Multi-selection** : Select multiple machines simultaneously with a selection polygon drawn by the user (click around machines and double click to close the contour).



- **Delete object** : Deletes an item. In the graphical view, it is only possible to delete a virtual cell.



- **Show/Hide empty machines** : Allows you to hide or display machines that are not used.



- **Connect/Disconnect the machines** : Hide or display the flows passing between machines.



- **Superposition** **Prevent collision** : Prevents two machines from overlapping.



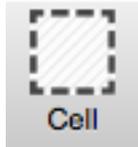
- **Lock up** **Free machines** : Allows machines no longer be locked within the cell in which they are located.



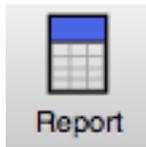
- **I/O** **Add IN/OUT** : Adds an input / output to a virtual cell by double-clicking on one of the edges of the cell.



- **Lock** **Lock/Unlock machine** : Will lock a machine. This machine can therefore cannot be moved.

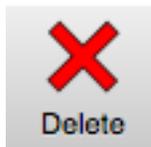


- **Cell** **Add virtual cell** : Adds a virtual cell which takes the form of an expandable rectangle. These virtual cells will define product families.

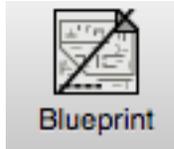


- **Report** **Show ProdByCell tab** : Displays the table containing the products associated with each virtual cell.

9.2 Blueprint View - Interaction Mode



- **Delete** **Delete object** : Deletes an object. Within the “real” view in interaction mode, it is only possible to remove input / output points.



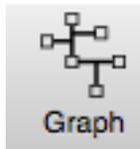
- **Show/Hide background** : Can hide or display the background image that was selected.



- **Show/Hide machine panel** : Can hide or display the tray containing the machines do not currently located within the plant.



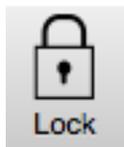
- **Show/Hide empty machines** : Allows you to hide or display machines that are not used..



- **Connect/Disconnect the machines** : Allows you to position the machines on the plan without them connected to a flow. Interesting option when the refresh is too slow. At the end of the placement of all machines, return to “Connect” position to bring the situation to date.



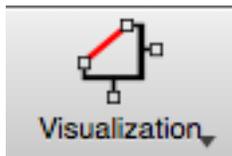
- **Prevent collision** : Prevents two machines from overlapping.



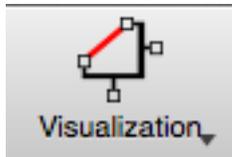
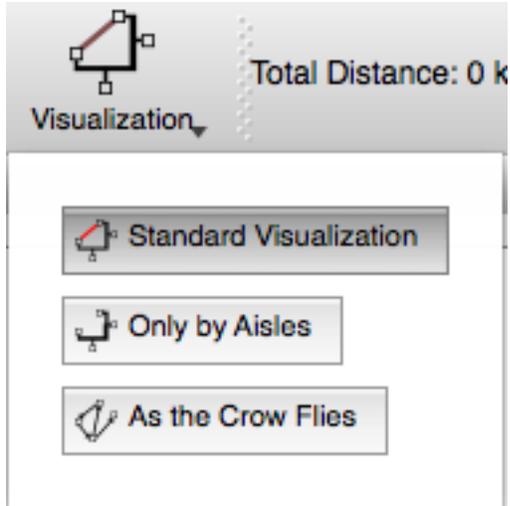
- **Lock/Unlock machine** : Will lock a machine. This machine can therefore cannot be moved.



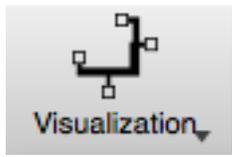
- **Rotate machine** : Enables the rotation of a machine.



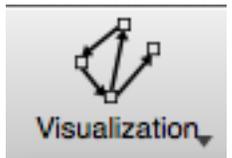
- **Visualization** : Allows to choose between different vizualisation of the traffic.



- **Visualization standard** : Connect directly all machines inside the same cell. Otherwise, the connection is made by the aisles thank to the shortest road.

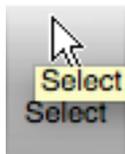


- **Visualization by aisle** : No direct connection between machines. All traffic go through the aisles.

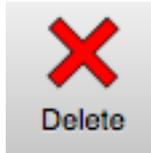


- **Visualization as crowfly** : All machines are connected via a direct connection. This visualization allow the directional traffic.

9.3 Blueprint View - Design Mode



- **Move element** : Move an object



- **Delete object** : Allows deletion of an object or multiple (the Ctrl / Cmd key) objects selected.



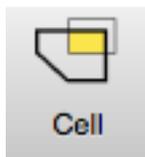
- **Add background** : Allows adding a background image to trace the factory plan.



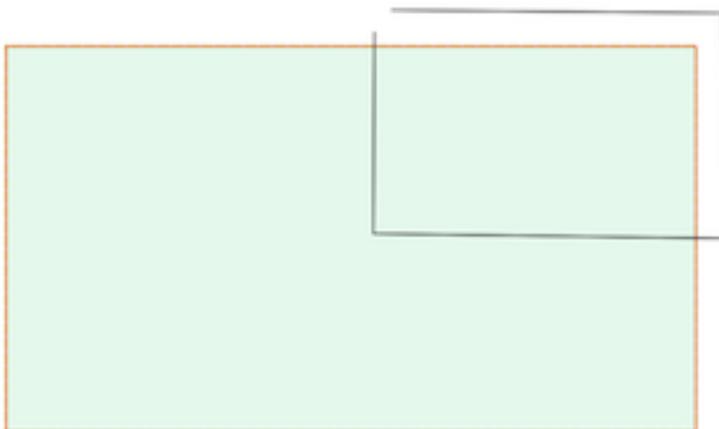
- **Set scale** : Changes the scale of the factory. The user can draw a line (click on each end) and define it's length in meters.



- **Create zone** : Allows the creation of an area (Site, Building, Floor or Area) a polygon that the user will be able to draw. Click on the map to locate the contour points. To close the box, double-click on the last point of the contour. There is no need to double click on the first point. If the area is within a parent zone (first point in a parent area), it will automatically be truncated so that their boundaries correspond to the latter.



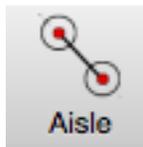
- **Create cells** : Allows the creation of a cell represented by a polygon within an area. Only that area may contain cell machinery. If the cell is within a parent zone, it will automatically be truncated so that their boundaries correspond to the latter. It is not useful to follow the contour of the plant with precision.



=>



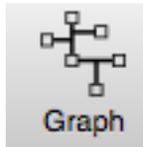
- **Crosspoint** **Add skeleton point** : Adds a skeleton point by double-clicking on the selected area. If other points are already in this area, the connection between these points, if it is possible (line internal connection to the comings and not “too close” to the corners of the cells) will happen automatically.



- **Aisle** **Add skeleton line** : Allows you to manually add a skeleton line by double-clicking on the two points that compose it.



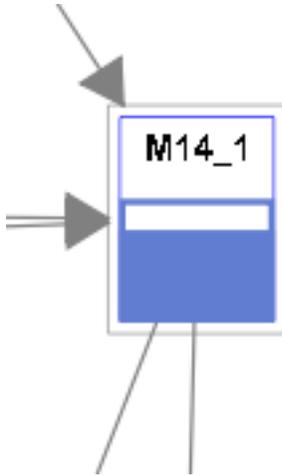
- **I/O** **Add IN/OUT** : Adds an input / output to an area by double-clicking on one of the edges of this area.



- **Graph** **View skeleton** : Displays the diagram with interconnections. This graph is the basis for the traffic display.

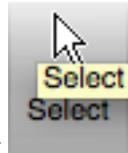
10.1 Machines

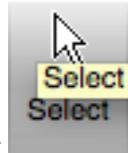
10.1.1 Characteristics



- **Colour** : The color defines the type of the machine.
- **Load** : Filled color represents the percentage of load relative to the available capacity.
- **Border** : The contour of the machine sets the floor area required for placement.

10.1.2 Machine Interaction

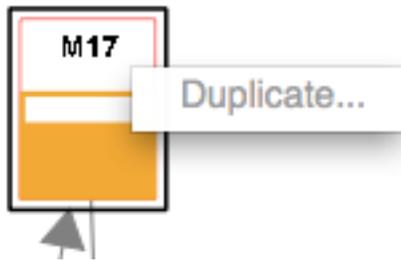


In addition to their movements using , other interactions with the machines are possible, regardless of the current “view”.

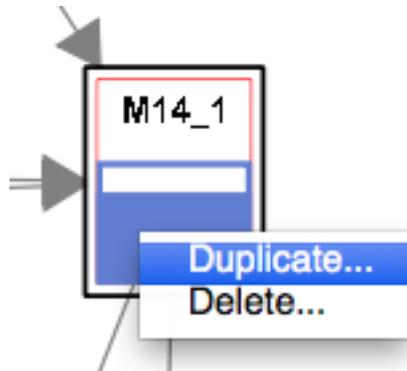
10.1.3 Possible Options

- **right click :**

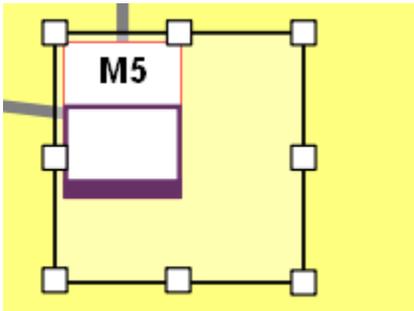
- **Duplicate** : Used to duplicate a machine. The duplicate machine appears next to the original. This action is not possible in the baseline scenario.



To duplicate a machine, it is first necessary to duplicate this scenario.

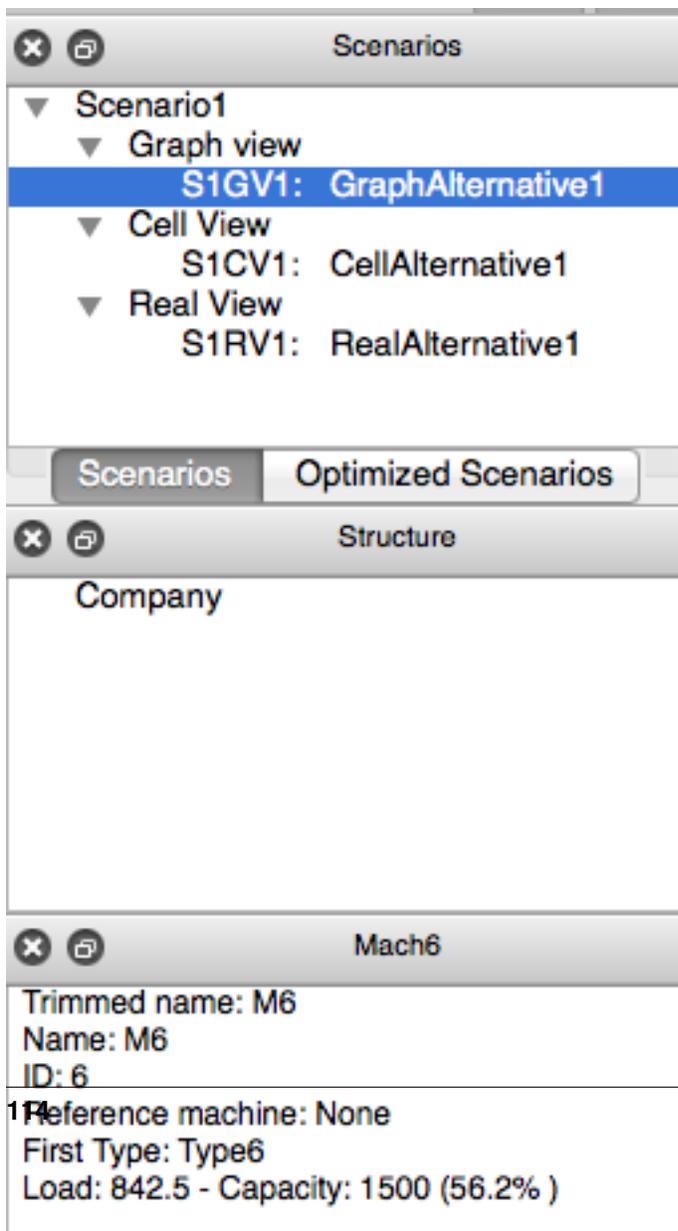


- **Resize** : When the machine is selected, you can resize the outline defining the used floor space. With the mouse, move one of the eight spots on the machines outline.

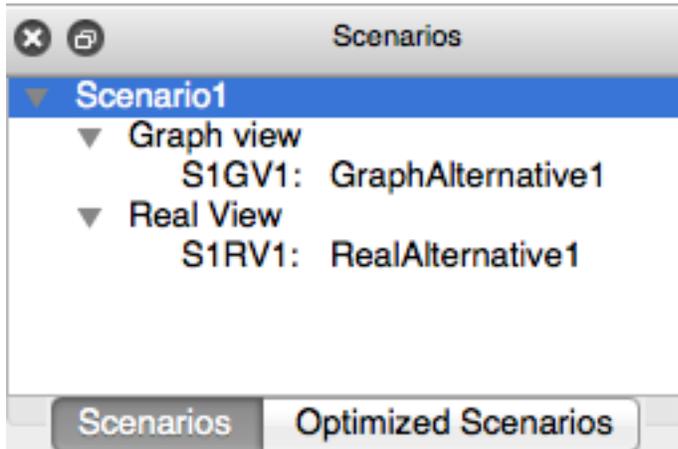


CHAPTER 11

Side Menu



11.1 Navigation panel scenarios / alternatives



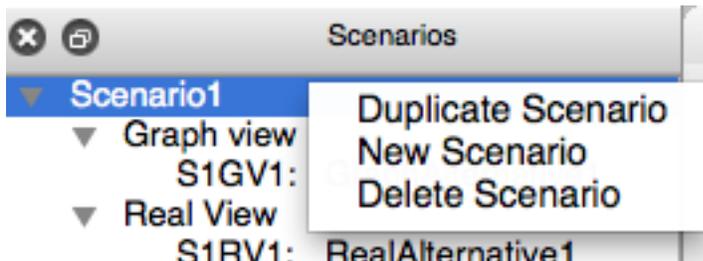
The navigation panel scenarios provides an overview of the “Graph” and “Real” (diagram) views that were created. By default, a scenario is created with a view of each type. Each alternative is defined by a code (S1RV1) that consists of

- The number of the scenario => Ex: S1
- The type of alternative GV (graphic), CV (cell), RV (actual / off plan) => Ex: RV
- The number of the alternative => Ex:1

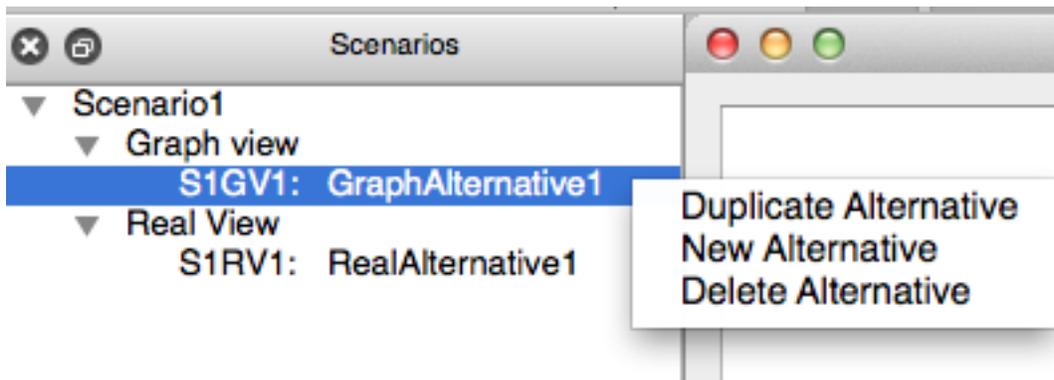
In addition to this code, the name of the alternative can be changed by double-clicking.

From this panel using the right click, it is possible to access different menus in the scenario and the alternative.

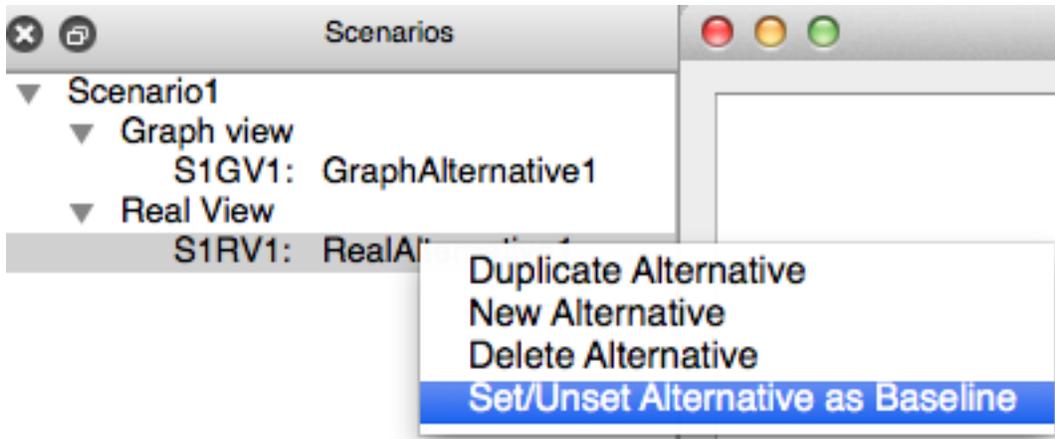
- Right-Click on the scenario:



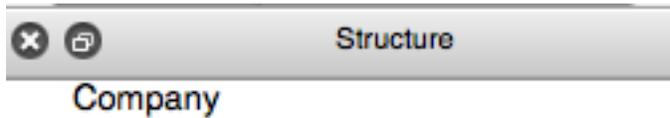
- Right-Click on the graphical alternative:



- Right-Click on the real alternative:

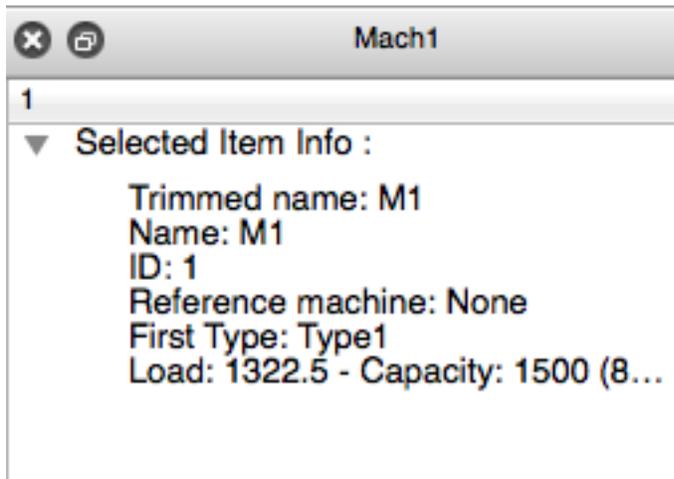


11.2 Design Panel



The navigation panel allows you to select the different elements of design made in the real view of the scenario. It is in this panel we can activate an area, in order to draw the cells or add skeleton points of an aisle. The active zone is in blue. Each zone has a “parent” is the area in which it is contained. In the example, Site2 is the parent of cell3 cells Cell6. These cells are 4 children of Site2.

11.3 Information panel



This panel displays information when you click on an object.

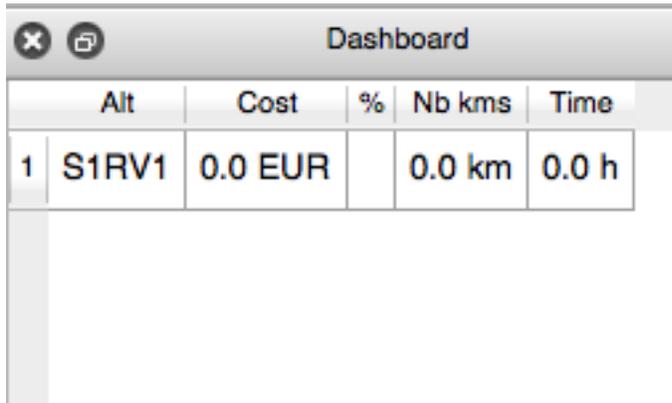
11.3.1 Machine

- Truncated Name: The name displayed on the machine
- Name: Full name of the machine
- ID: internal identifier SIMOGGA
- Reference machine: if the machine has been duplicated, the reference machine is the original Machine
- Main Type: Specifies the type of machine
- Load: defines the machine load
- Capacity: defines the capacity of the machine
- %: Set the filling rate of the machine. The colored filling machine corresponds to this value.

11.3.2 Flow

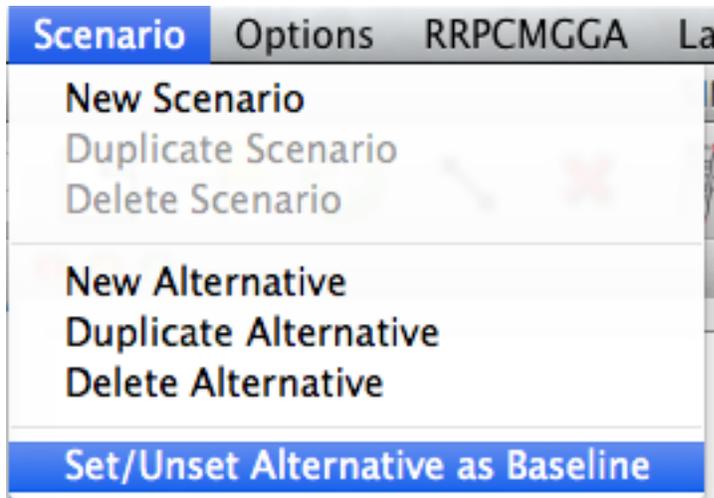
- Source : Name of the machine from which the traffic originates.
- To : Name of the machine to which the traffic is destined.
- Nb part numbers : Quantity of part numbers passing between these two machines.
- Nb pieces : Total number of pieces transferred, all part numbers combined.
- Nb transactions : Number of transactions from machine source to destination.

11.4 Dashboard



	Alt	Cost	%	Nb kms	Time
1	S1RV1	0.0 EUR		0.0 km	0.0 h

The evaluation table is based on a comparison of real alternatives with the alternative that has been selected as the baseline.



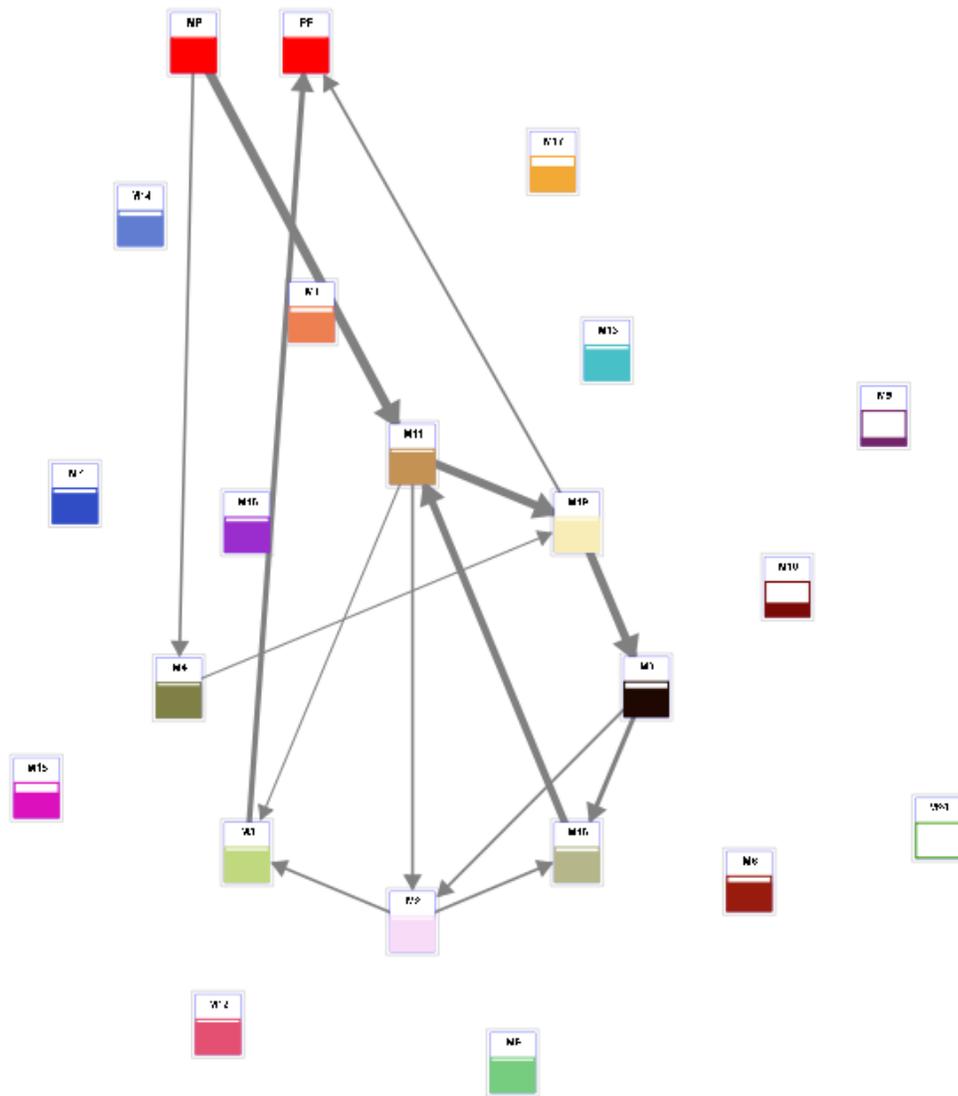
- Column 1 (Alt): code of the alternative.
- Column 2 (Cost): cost in euro of the kilometers traveled (based on the hourly cost defined in the Control Panel).
- Column 3 (%): % gain compared to the baseline.
- Column 4 (Nb kms): defines the total number of kilometers traveled by all products.
- Column 5 (Time): Sets the minimum total time dedicated to transporting products.

11.5 Bottom Menus

11.5.1 Filters

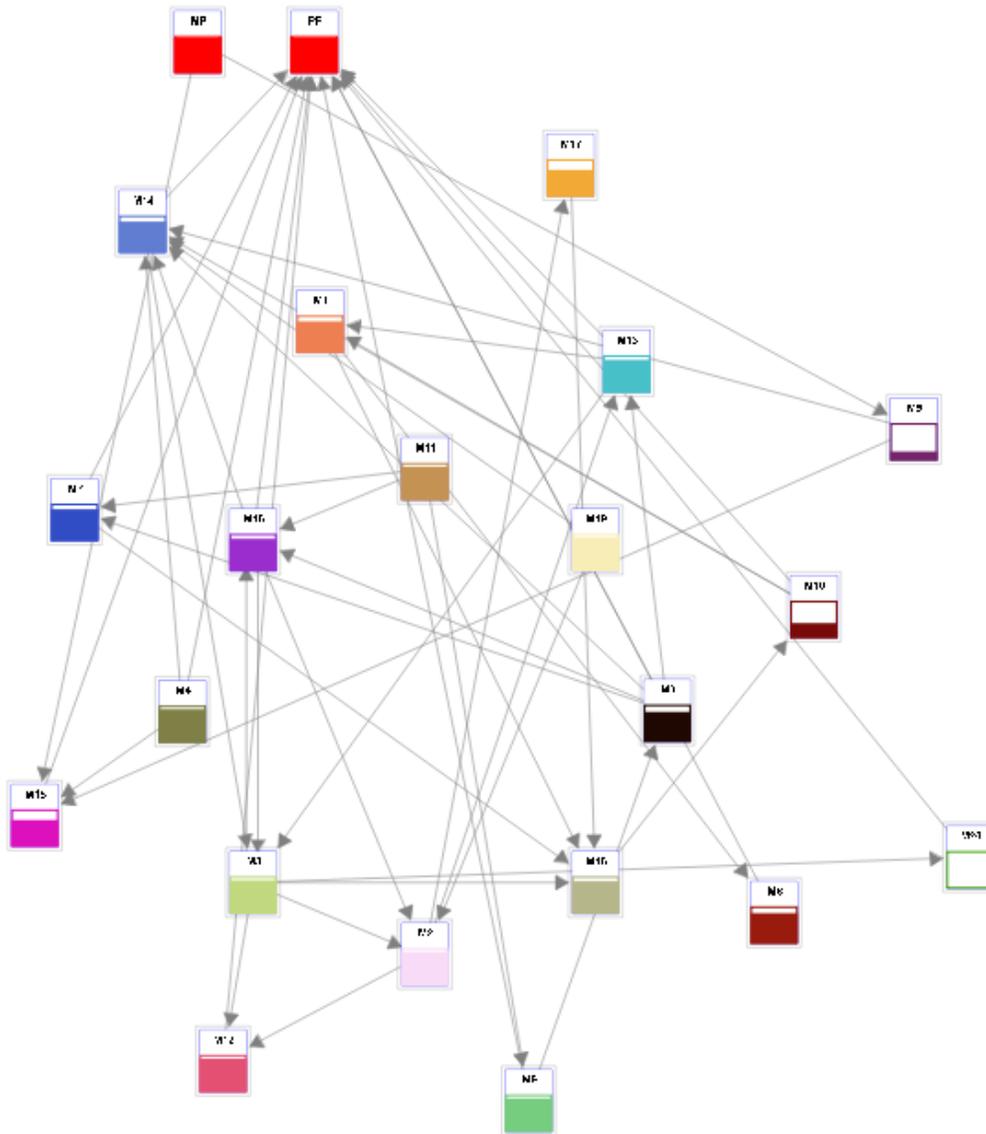
This visual filter allows to take into account all the products but display only the flows between a minimum value (bottom filter) and a maximum value (upper filter).





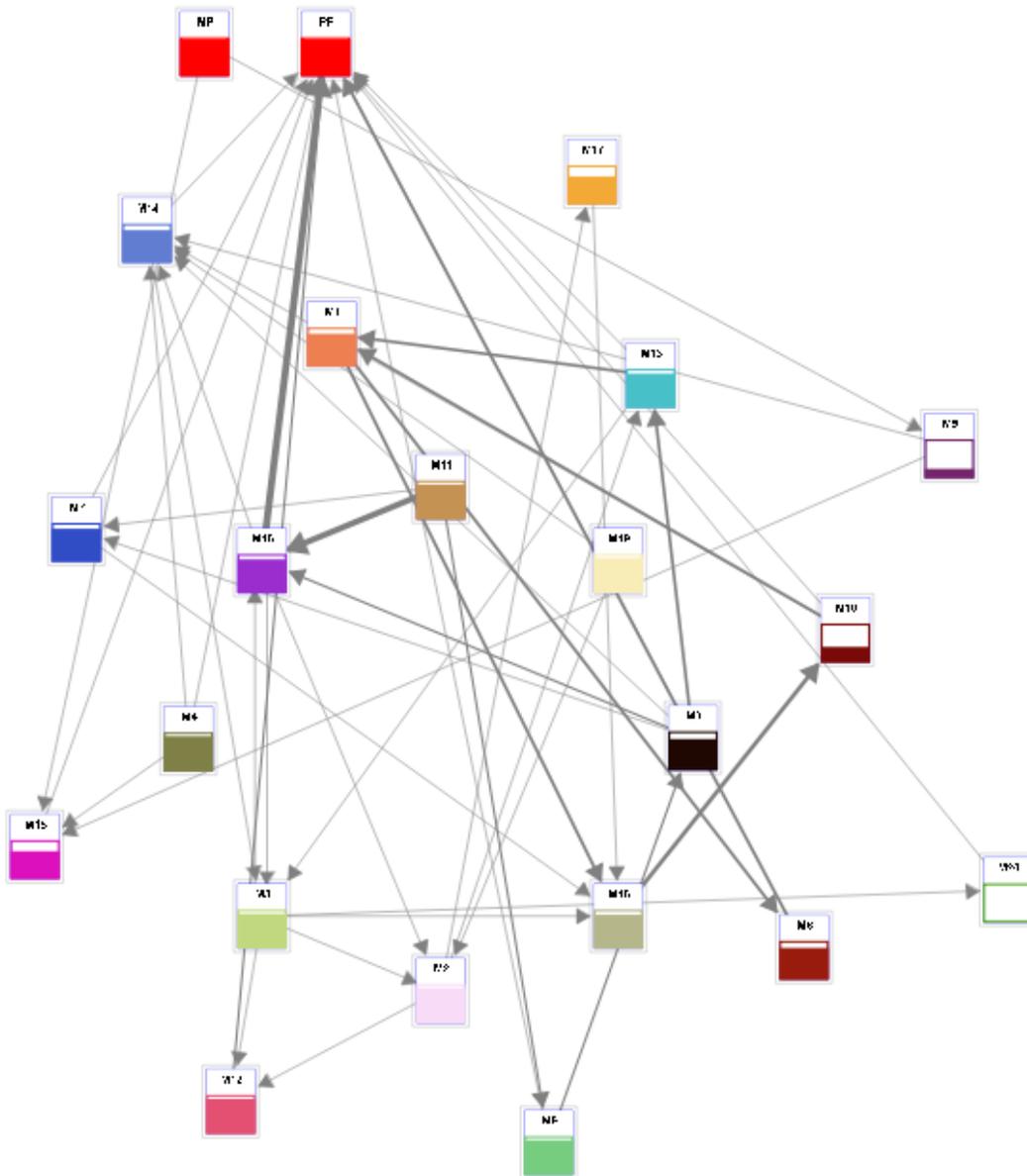
If there is a lot of flow in a segment of value (eg, between 0 and 25% of the total flow), we must focus on these values by placing filter down to 0 and the top filter 25.

Filter (%) : % % [0 - 951] Magnify

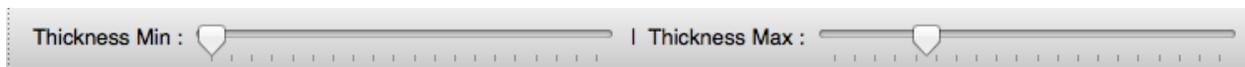


We can then amplify the view to distinguish each of these flows that may seem identical at first glance and could render the reorganization difficult.





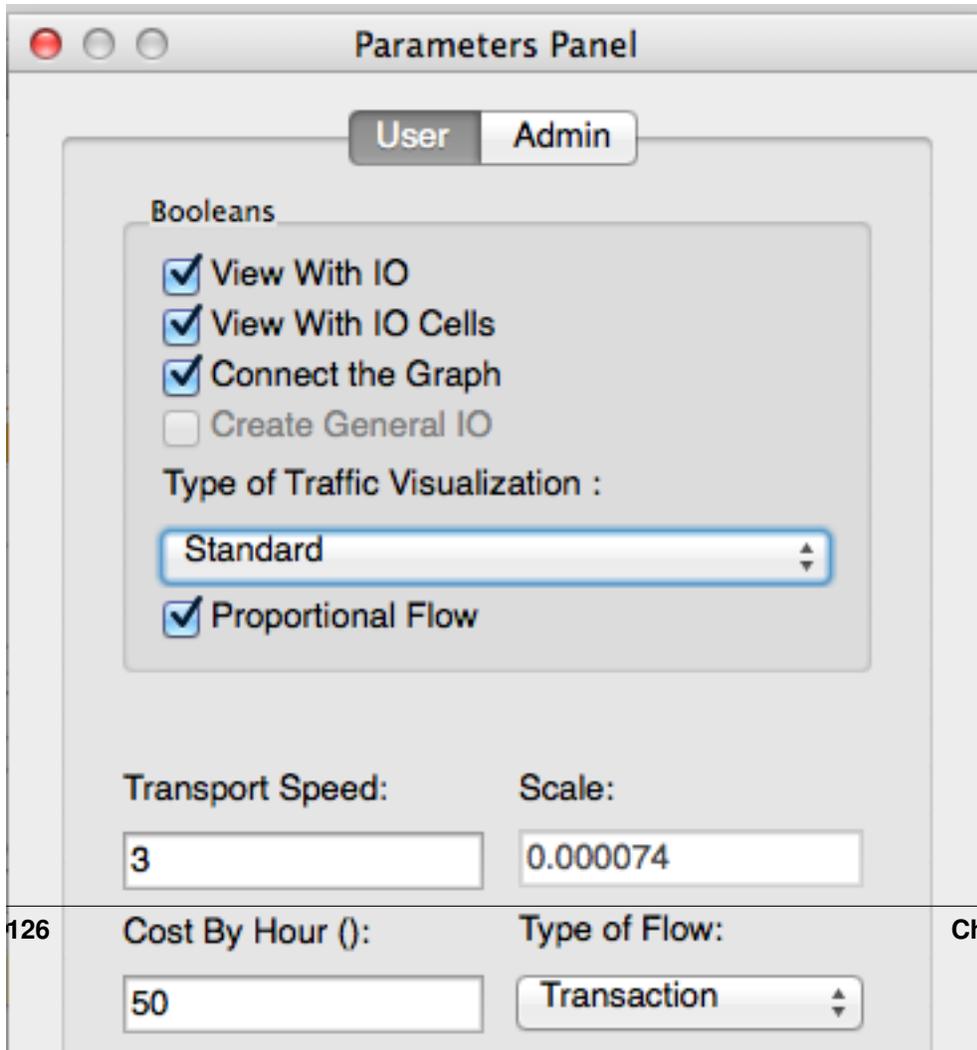
11.5.2 Flow Thickness



Two sliders are used to set the minimum and the maximum thickness for the arrows representing the traffic.

12.1 Options / Settings

12.1.1 User Settings



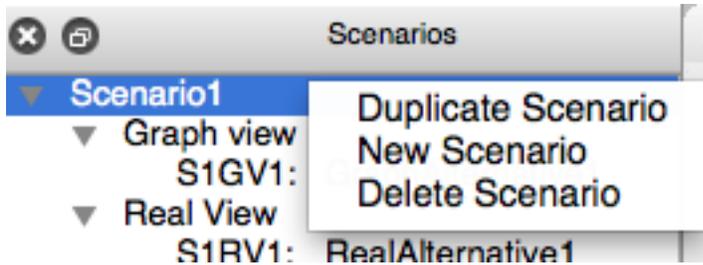
- **View with the IO** : Determines whether the raw materials / finished products must be taken into account in the flow graph.
- **View with the IO of the cells** : For the cell view, it determines whether the graphical flow must go via the input / output points.
- **Connect the graph** : Determines whether the machines must be connected to the graph. This is useful for locating all the machines on a very complex factory level, for which the analysis is too heavy.
- **The raw material MP / PF finished parts must be created by SIMOGGA** : Determines whether the raw materials / finished products must be created when opening a case. If they were added, and the file was saved, SIMOGGA doesn't create more.
- **Traffic visualization** : Determines the type of visualization to display the desired traffic. Three types are available:
 - **Standard** : Determines whether flows pass only the aisles (more intracellular connection between the machines).
 - **Via the aisles** : The machines will automatically interconnected by aisles. There will be no intracellular with the machines.
 - **As the bird flies** : The machines will be connected by the shortest distance as the crow flies.
- **Proportional flow** : Determines if the thickness of the flow shown proportionate.
- **Transport speed** : Determines the speed of transport of goods within the factory.
- **Scale** : Indicates the scale of the plan. To change, it is necessary to go through the design mode of the actual view.
- **Cost per hour** : Determines the cost per hour of transportation within the plant.
- **Type of traffic** : Determines the type of flow represented. The flow may be:
 - The number of product transactions: amount of trips made.
 - The number of products transferred: the amount of transferred items.
- **Size of the machines** : Determines the default size of the machines.
- **Maximum thickness** : Determines the maximum thickness of the flows.
- **Minimum thickness** : Determines the minimum thickness of the flows.

12.1.2 ADMIN TAB

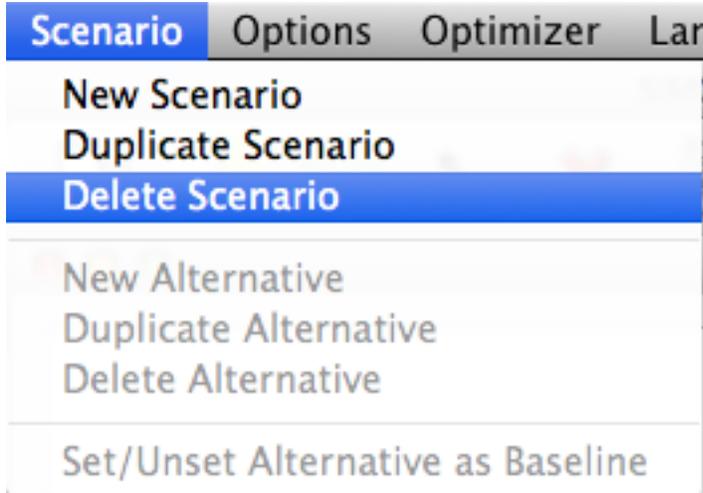
12.2 Rerouting

Rerouting allows reassigning operations performed by one machine to another machine of the same type.

Hint: Create a new scenario to compare the baseline with the new solution.



or

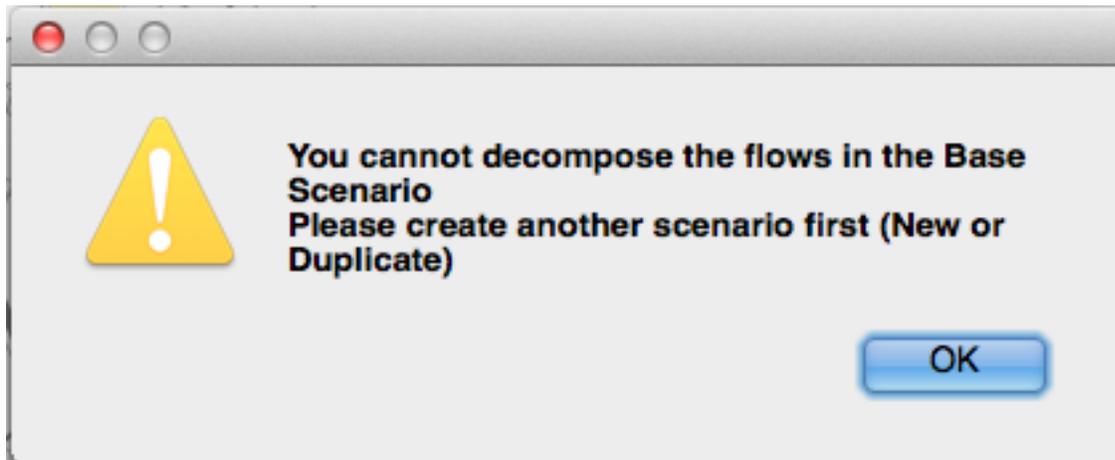


Changes made the rerouting are applied to all alternatives of the current scenario. Reminder, the characteristics of a scenario are:

- The number of machines available
- A routing solution (assignment of operations on machines defining traffic / flow between machines)
- A layout in the real view

The alternatives are used for any change of the position of the machines.

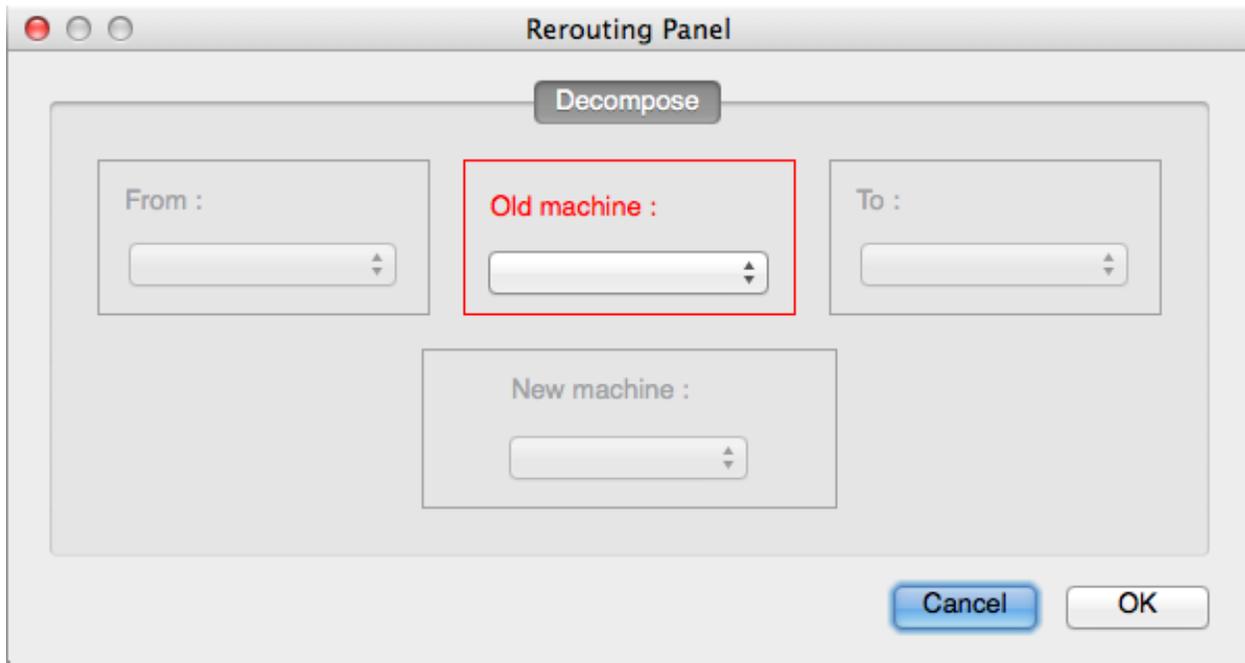
When you want to reroute in the baseline scenario, a warning message appears:



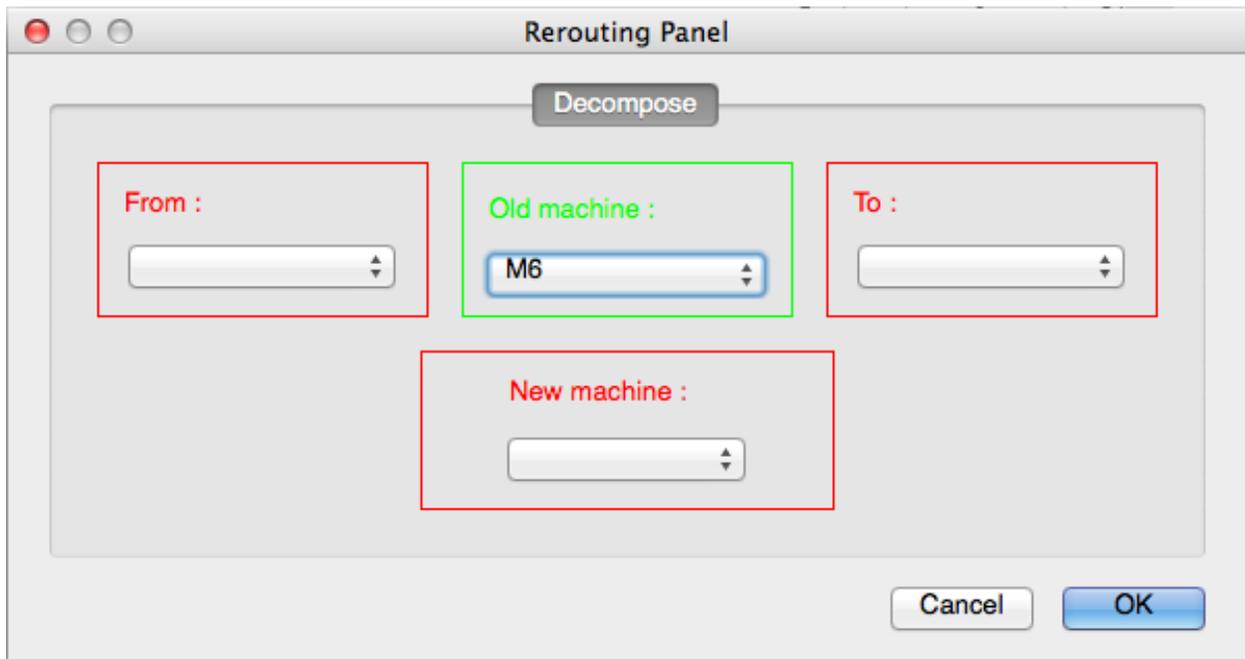
To do so, it is necessary to proceed as follows:

- Duplicate the baseline scenario.

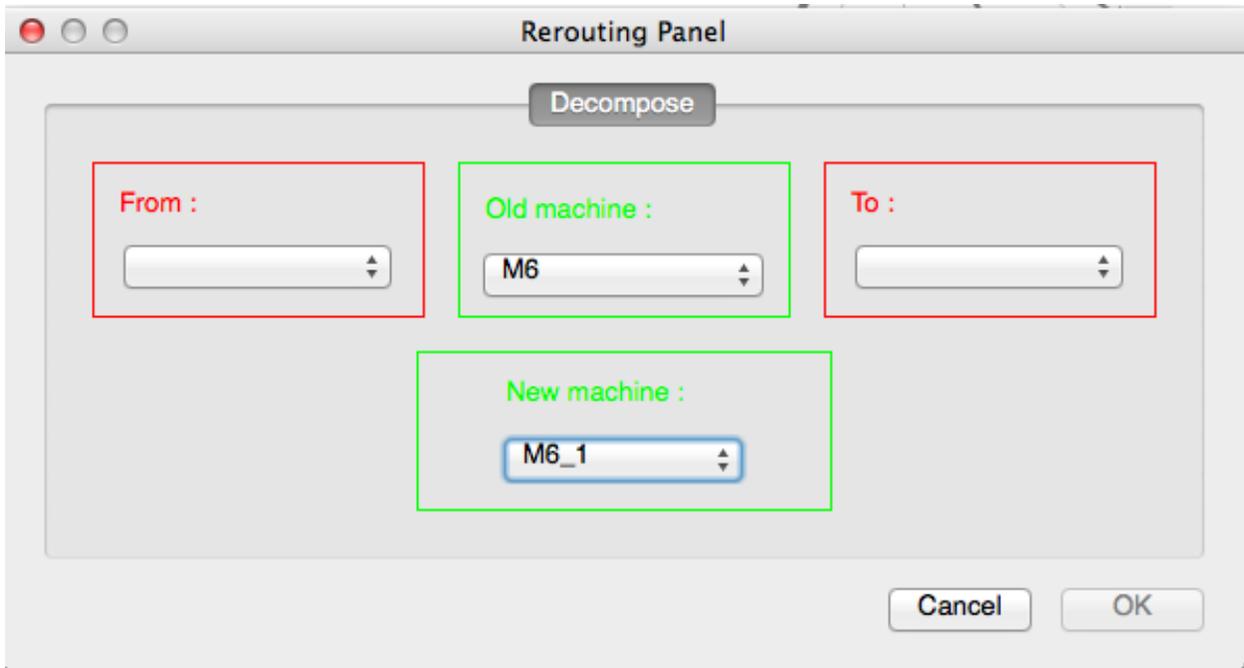
- Open the rerouting tool via the menu.



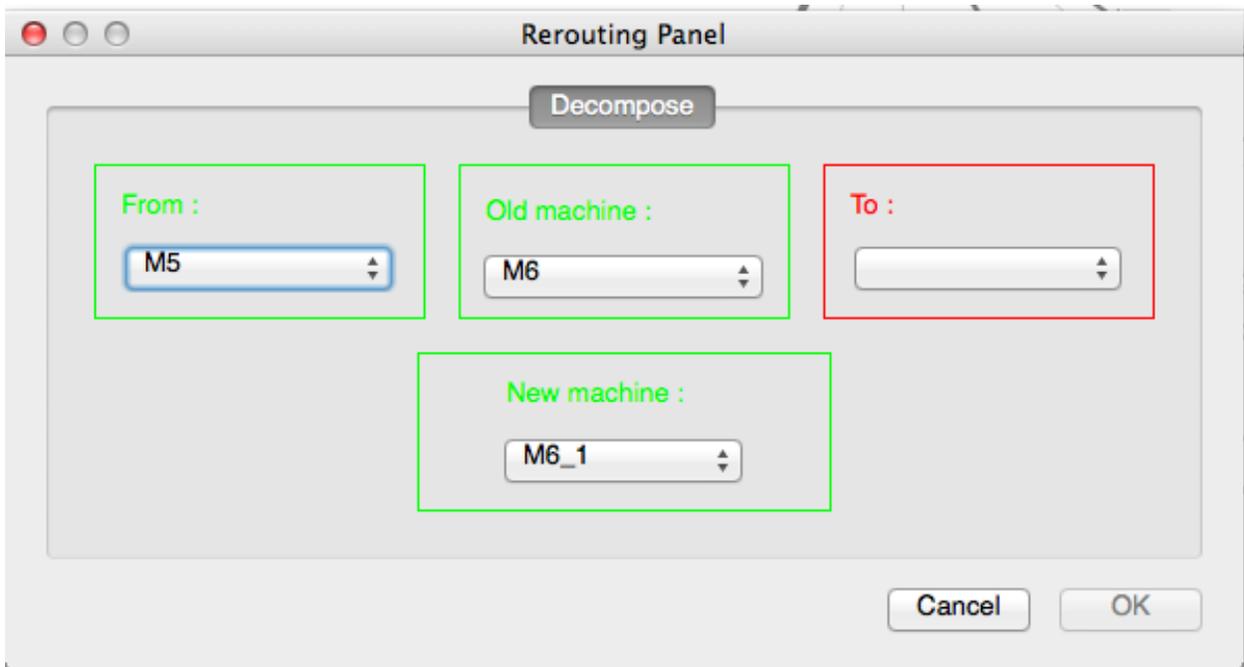
- Select the machine on which the operations are being carried out.



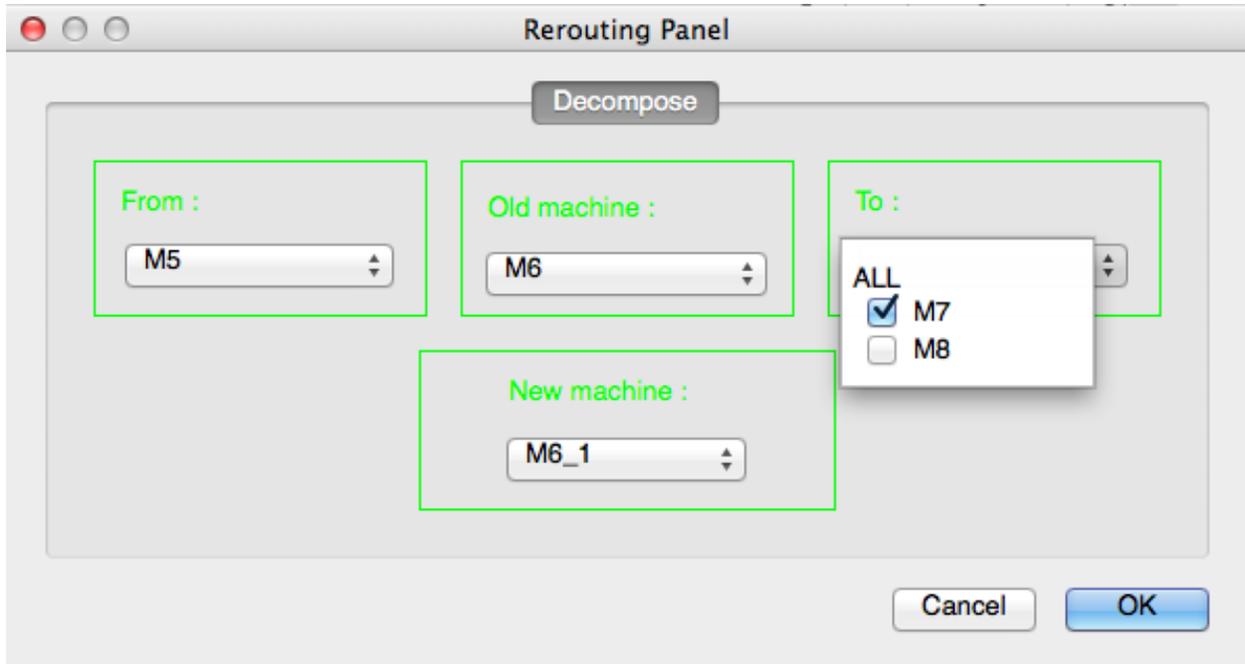
- Select the new machine upon which the flows must pass (this will be in general a machine having been duplicated).



- Select the machine(s) from where the products are to be reassigned (Origin).



- Select the machine(s) to which the products are to be reassigned (Destination).



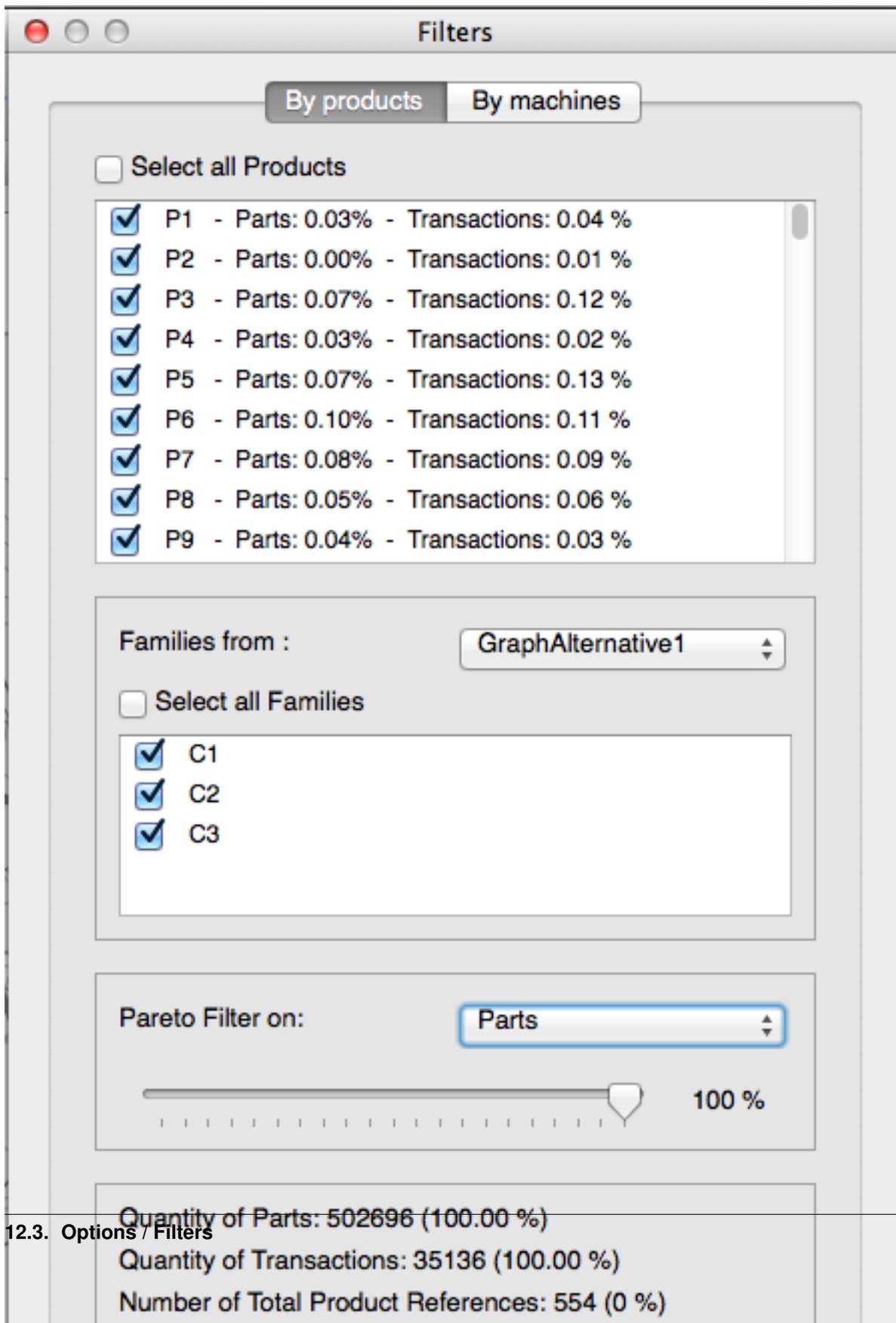
- These two machines are dependent on one another.
- After selecting one of these two machines, it is possible to select multiple machines From / To that flows to or from the selected machine are connected to more than one From/To Machine.
- In the case where the MP (raw materials) / FP (finished products) are not shown if the “old machine” is the first machine through which pass operations, IN option (entry point) will be the only available in the From box. Conversely, if the “old machine” is the latest machine through which pass the operation, the OUT (exit point) will be the only available option in the To box.
- If all the boxes are green, click on “OK” and the flow will be immediately reassigned

Remarks :

- It is not possible to reassign the flows to the baseline (Base). To perform an rerouting, you will first duplicate this scenario.
- If after selecting the “old machine”, no machine is present in the “new machine” list, then there is no other machine of this type available to reassign the flows. In this case, it will be necessary to duplicate the first “old machine”.
- The machines listed in the From and To are dependent on one another. Selecting one of these two machines will cause an update of the opposite if no machine had been selected in this list. To reset both lists, you must click on the white box located at the top.

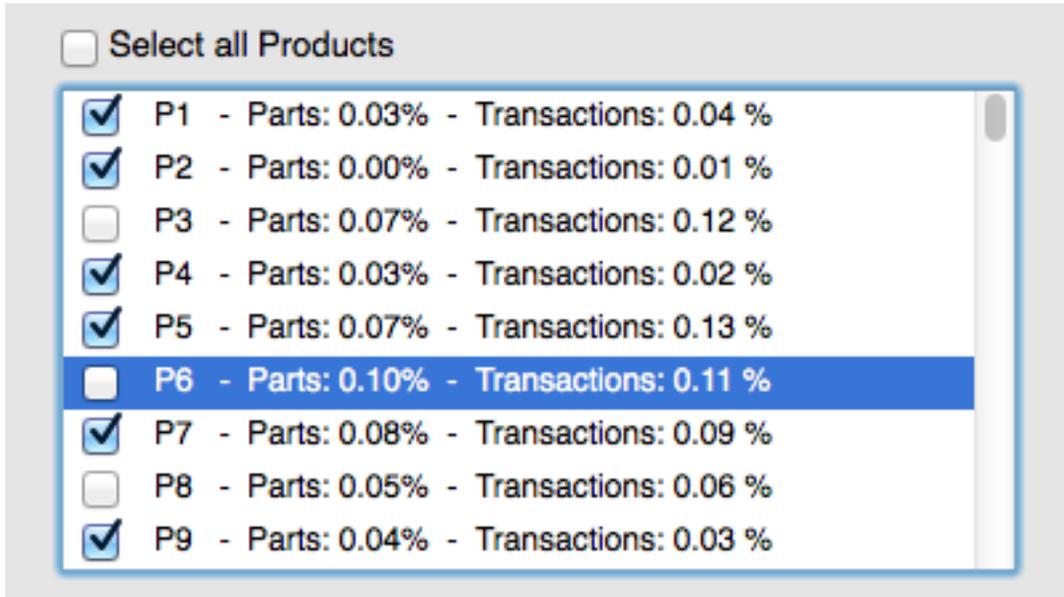
12.3 Options / Filters

12.3.1 Products



The menu of filters by product allows display only part of the graphical flows. It is possible to perform a filter:

- Based on a selection of product: Each product is characterized by its proportion of parts and transactions.



- Based on the product families: first, it is necessary to select the alternative that identifies families to view. These families will be proposed only if cells were identified in the alternative.

Select all Products

<input type="checkbox"/>	P1	- Parts: 0.03%	- Transactions: 0.04 %
<input checked="" type="checkbox"/>	P2	- Parts: 0.00%	- Transactions: 0.01 %
<input checked="" type="checkbox"/>	P3	- Parts: 0.07%	- Transactions: 0.12 %
<input type="checkbox"/>	P4	- Parts: 0.03%	- Transactions: 0.02 %
<input checked="" type="checkbox"/>	P5	- Parts: 0.07%	- Transactions: 0.13 %
<input type="checkbox"/>	P6	- Parts: 0.10%	- Transactions: 0.11 %
<input type="checkbox"/>	P7	- Parts: 0.08%	- Transactions: 0.09 %
<input type="checkbox"/>	P8	- Parts: 0.05%	- Transactions: 0.06 %
<input type="checkbox"/>	P9	- Parts: 0.04%	- Transactions: 0.03 %

Families from :

Select all Families

<input checked="" type="checkbox"/>	C1
<input type="checkbox"/>	C2
<input checked="" type="checkbox"/>	C3

- Based on a Pareto of the product transactions: Allows you to filter the products based on a percentage of items / transactions.

Pareto Filter on:

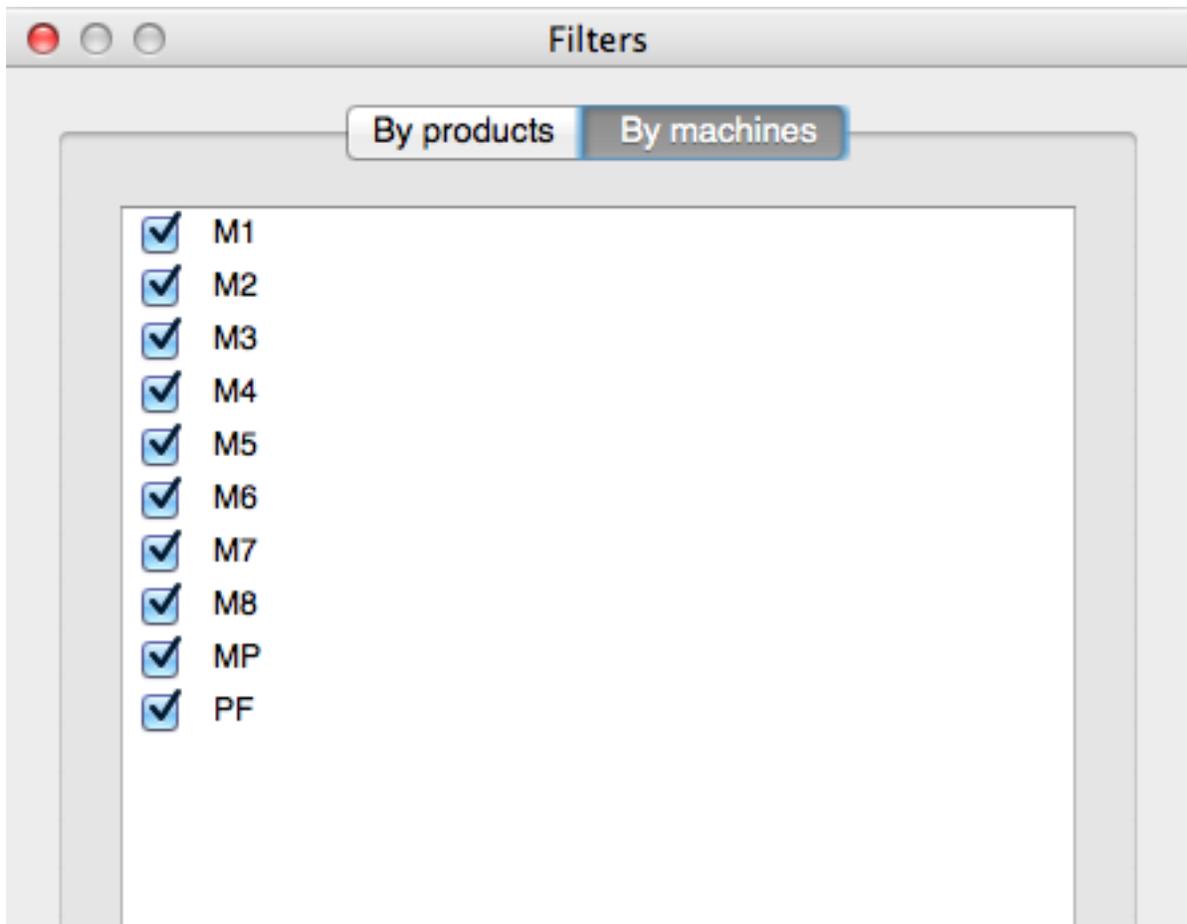
80 %

Information display :

Quantity of Parts: 402174 (80.00 %)
Quantity of Transactions: 25880 (73.66 %)
Number of Total Product References: 173 (31 %)

- **Quantity of products** : Shows the number and percentage of products / parts mentioned in the filtered products.
- **Quantity of transactions** : Shows the number and proportion of transactions affected by the filtered products.
- **Total number of product references** : Indicates the total number of products affected by the filtered products.

12.3.2 Machines

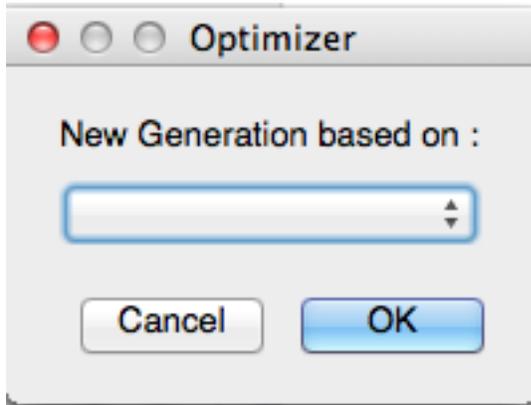


The filter menu by machines is used to display only part of the graphical flow. It is possible to filter based on a selection of machines. Only selected machines will be represented on the graph. You can (de) select all machines at once using the “select all” button.

12.4 Optimizer/Cell Optimizer

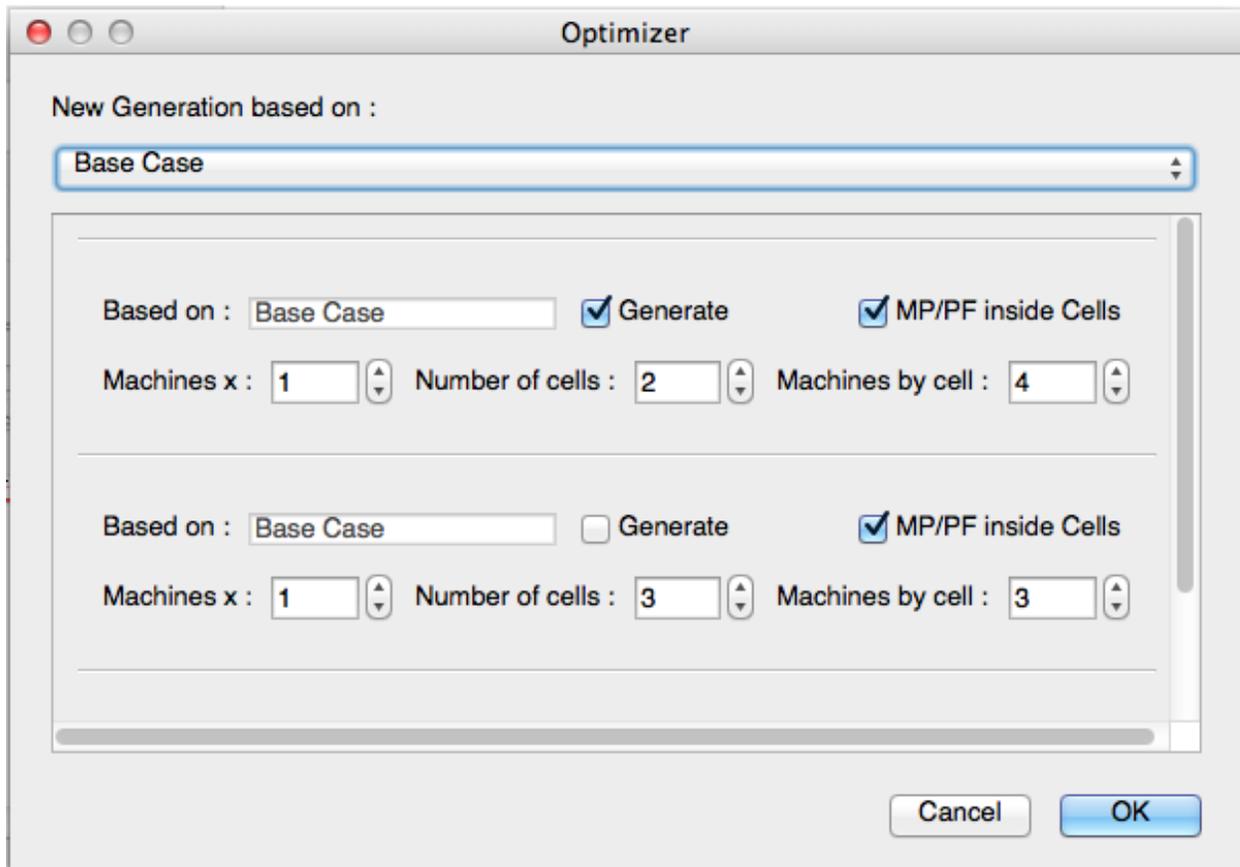
= Generation of optimized solutions

When you click on the “Cell Optimizer” option in the “Optimizer” menu, a box appears to select the scenario to which the “Cell Optimizer” will be applied.



Cell Optimizer allows the automatic generation of optimized solutions. To do this, you must first select the scenario on which we want to base the generation of solutions.

Once selected, a new screen will appear where three proposals are proposed. The first solution, which best matches the current situation, will be selected. The other two proposals are generating variants of this.



Once the base scenario has been selected, it is possible to change the following parameters for each proposal:

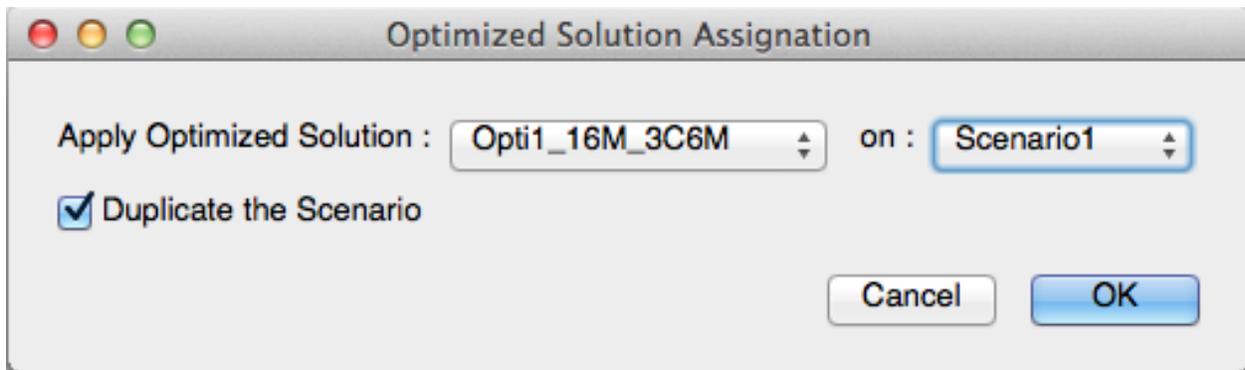
- The number of duplicates of each machine (machines x nb Occurences)
- The number of cells.
- The maximum number of machines by cell.
- Whether or not the MP (raw materials) / FP (finished products) must be found within the cells. (Caution: MP / PF are not included in the maximum number of machines per cell, there will be a much torque against MP / PF as there are cells).

In the event that another scenario is selected, it will be possible for each proposal, to change the following parameters:

- The number of cells.
- The maximum number of machines by cell.
- Whether or not the raw materials MP / PF finished parts must be found within the cells (the number of MP / PF will not be dependent on the number of cells).

Hint: In this second case, the machines taken into effect in the generation of the solution will be dependent on the machine duplications made by the user to the selected scenario.

- When the solutions are created, they can be applied on a scenario



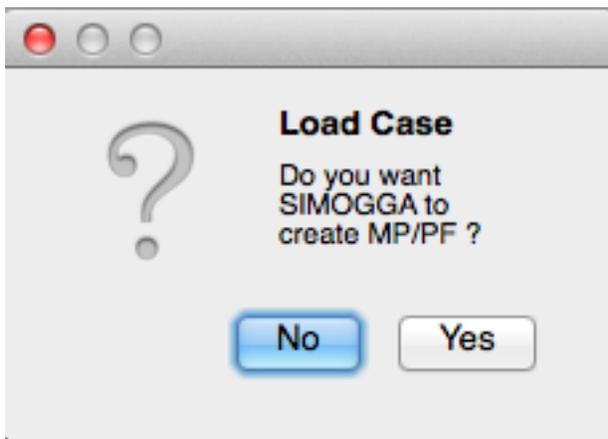
- Select the optimized solution to apply
- Select the scenario on which the solution will be applied
- Specify if the scenario must be duplicated

Hint: The cell solution is applied on the graphical view. The routing solution (operation assigned on machines) is applied to all the views of the scenario. The machines location on the real view will not be changed.

13.1 Opening and closing a case

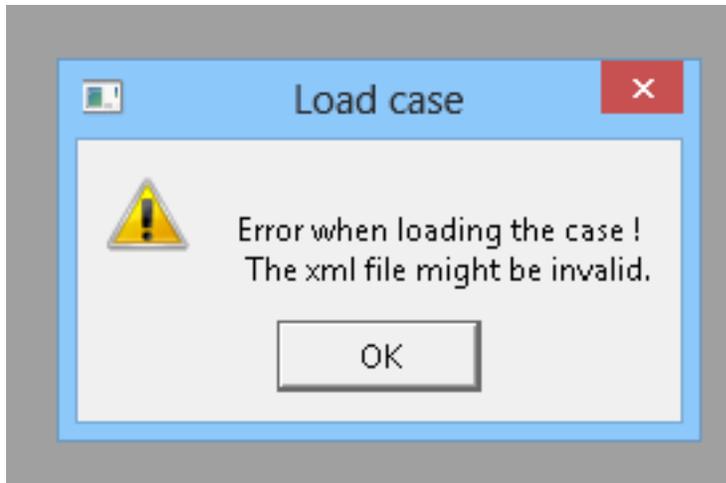
13.1.1 Opening a case

When opening a case via the “Open” command in the “File” menu, a dialog box will appear in which it is requests if the MP (Materials) / PF (finished products) must be created if they do not already exist. Whether the response is yes, two additional machines will be created: one MP and PF finished parts. Otherwise, the raw materials MP / PF finished parts will not be present.



Hint: If the user loads a case that has already been saved with raw materials MP / PF finished parts, they will appear even if the user chooses not to create them. As it has already been created previously, they are now part of machines covered by this case.

If SIMOGGA fails to load the selected XML file, an error window will appear to inform to the user. For SIMOGGA to be able to load an xml file, the structure of it should be the structure set up by SIMOGGA.



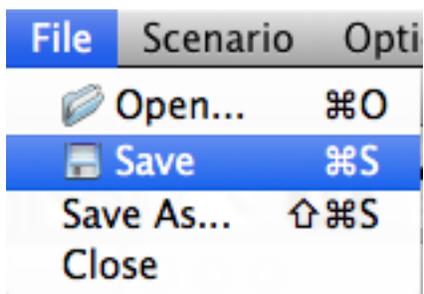
Check that the xml file does not contain special characters such as:

- #DIV/0!
- #N/A
- #VALEUR!
- /
- *
- ‘
- (or)
- &

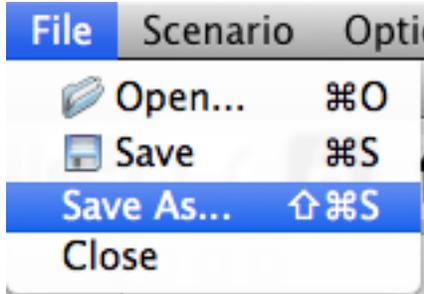
13.1.2 Saving a case

Two types of save options can be found in the “File” menu:

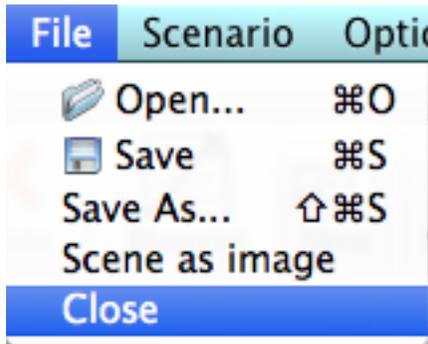
- Save: The backup will be done on the open file. The changes will be saved in the same xml file.



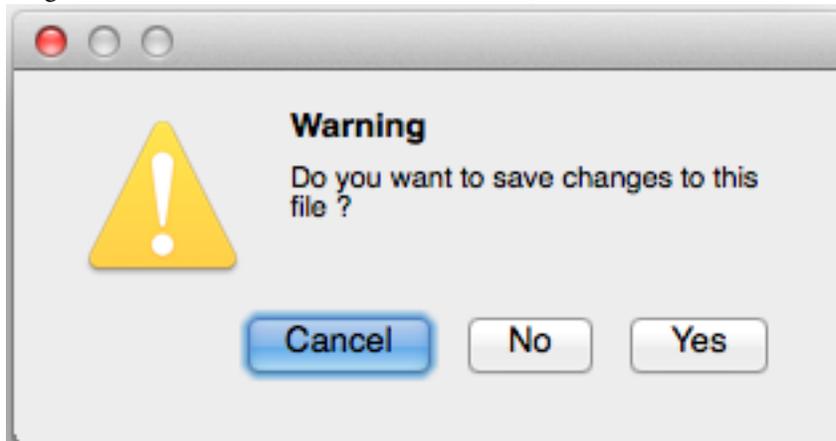
- Save As ... : The user can choose the backup location and name of the saved file.



13.1.3 Closing a case



When closing a case using the command “Close” from the “File” menu, it will ask the user if he wants to first save the



changes it has made.

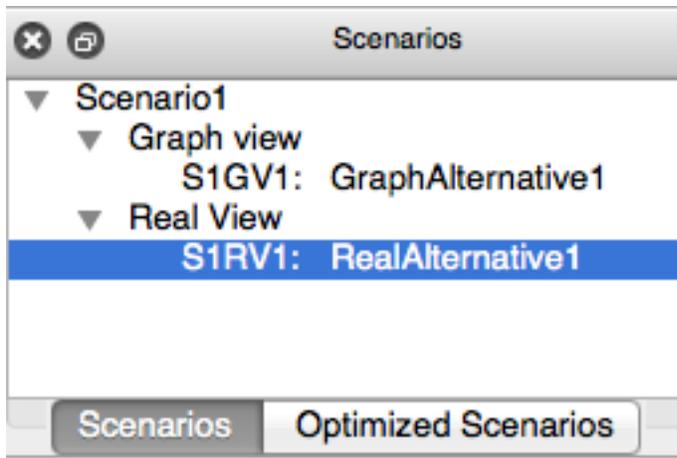
If the answer is yes, the case treated saved in the same xml file. Otherwise, changes made since the load cases will be lost.

13.2 Creating the baseline

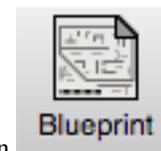
13.2.1 Creating a factory - Design mode

In the real view, it is possible to obtain a two-dimensional representation of the work area corresponding to the reality.

- Select a real alternative by clicking on the alternative in the scenario menu



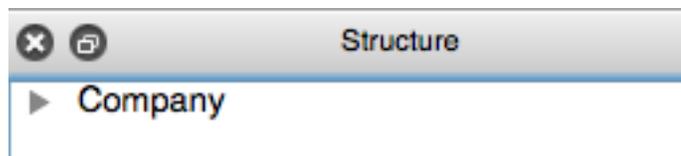
- Switching to Design mode



- Select a background image corresponding to the plant layout (png or jpeg) via the button



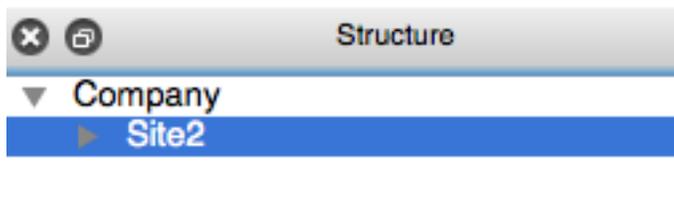
- Determine the contours of the plant
 - Info : Sidebar navigation



- Click on the icon
- Create the outline by simple successive clicks on the corners of the map. Every click is a point on the polygon representing the outline.
- End with a double-click (on the penultimate point) to indicate that the polygon is complete and it will close automatically.
- Choose the type of desired zone (site, building, floor, area)
- Rename the area

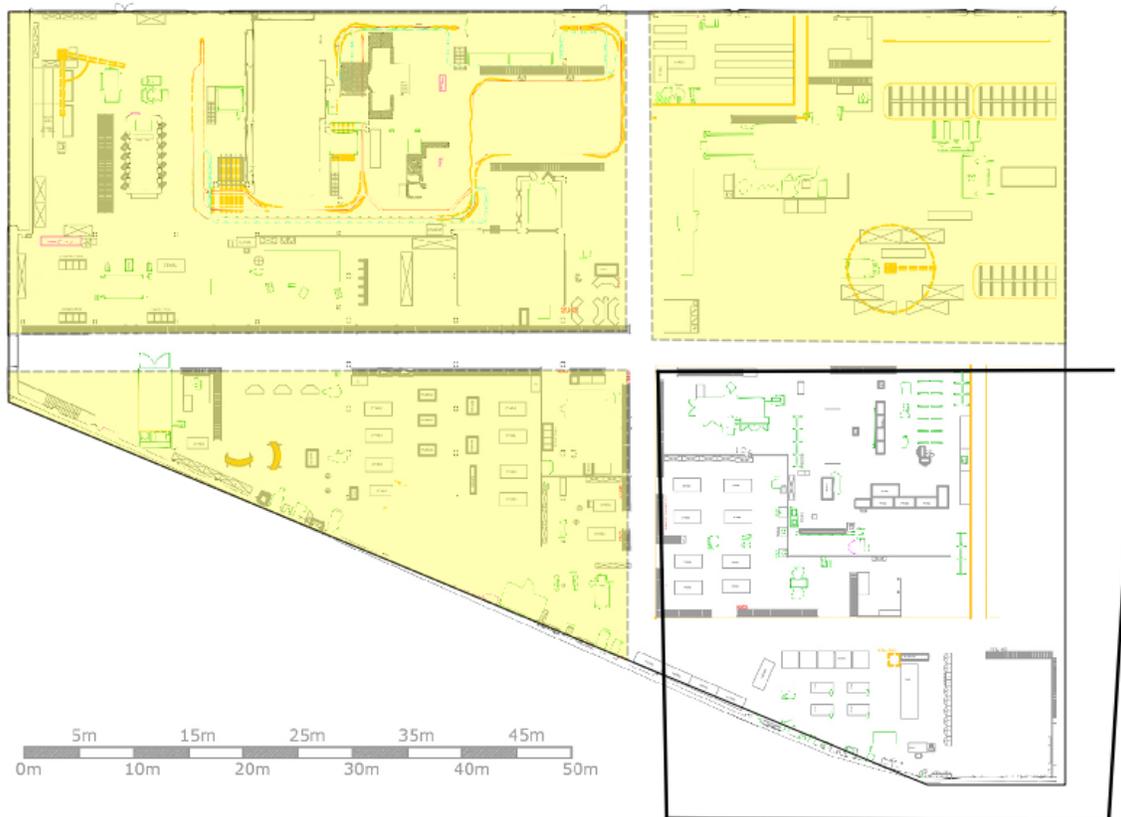


- Identify sub-areas, if necessary
 - **Select the parent zone** via a click on the area at the scene or at the navigation menu in the structure.



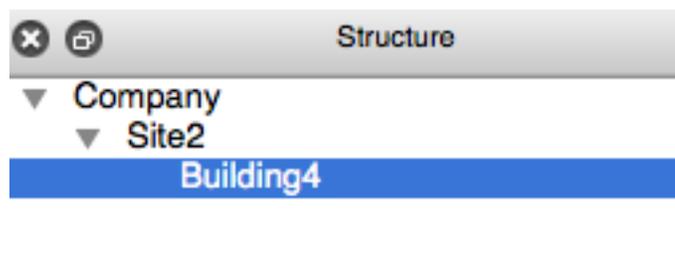
- Click on the icon
- Create the outline by simple successive clicks on the corners of the map. Every click is a point on the polygon representing the outline.
- End with a double-click (on the penultimate point) to indicate that the polygon is complete and it will close automatically.
- Choose the type of desired zone (site, building, floor, area)
- Rename the area

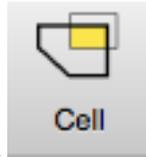
- Automatic truncation of the new area relative to the parent zone. It is therefore not necessary to be precise in the drawing at the boundaries of the parent zone.
- Identify work areas where machines may be placed.



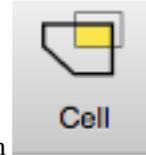
Hint: a work area may have the “parent” any area previously defined (site, building, floor, area)

- Select the parent zone via a click on the area at the scene or at the navigation menu in the structure.

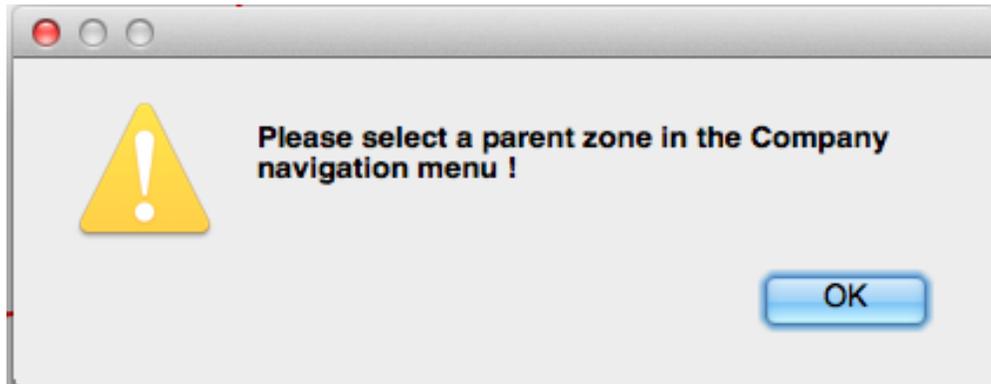




- Click on the icon
- If the parent zone is not selected, a warning message appears. We must then select the par-



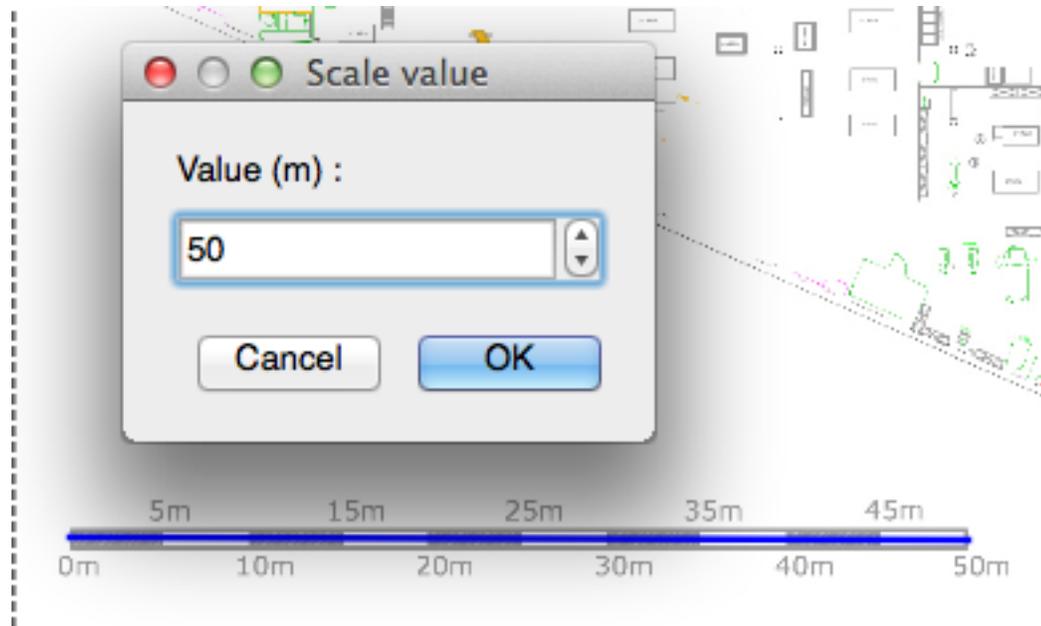
ent in the side navigation menu. The scene is not accessible until the button is pressed.



- Create a polygon using a series of mouse clicks
 - Finish with a double click to mark the automatic closing of the polygon
 - If the polygon created exceeds the area in which it is located, it will be truncated to fit the contour.
- To scale



- Click on the button
- Use a distance that is defined on the plan.
- Click (single click) on the two points defining the distance.



- Set the distance in meters
- Click OK

13.2.2 Create the skeleton of aisles

The skeleton is the graphical of view the aisles of the factory through which will pass the traffic between the work areas (intercellular traffic). This tool is available in “design mode” of the real alternative.



- Select the area where you want to put aisles using the scene or the navigation menu



- Click the icon
- Insert the junction of aisles with double clicks.
- SIMOGGA automatically connects the points if:
 - The line does not cross working areas
 - line does not go too near the corners of working areas.
 - The lines are not too close.
- Add lines manually



- Activate the button
 - Double click on two points to connect
- Remove unwanted lines

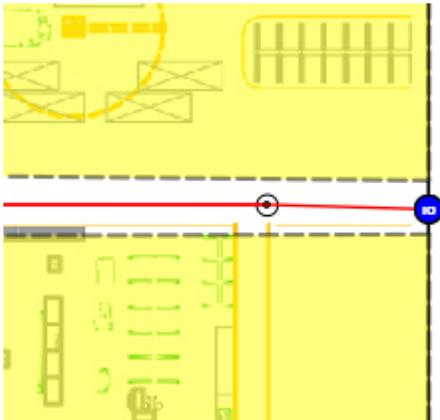
- Select the element to be deleted
- Choose several elements holding down the Ctrl / Cmd keys



- Click on the button
- Click OK

It is also possible to generate the skeleton fully automated manner using the “create automatic skeleton” button on the toolbar. If this option is chosen, SIMOGGA attempt to generate a skeleton covering all the intercell areas.

- Add inputs and outputs (IO points) on the edge of an area.

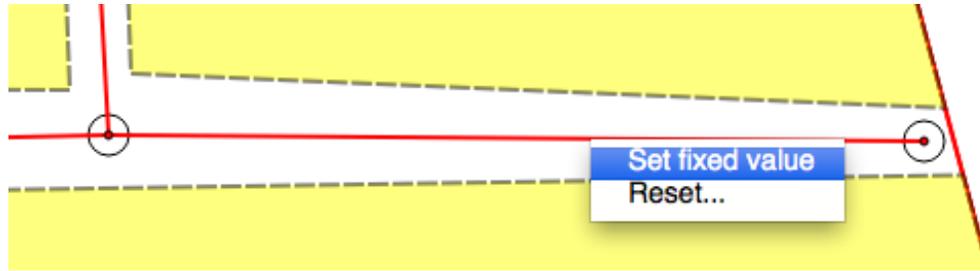


- Activate the button
- Double click the edge of the area.
- **Right-click the item added to change its type**
 - * IN :Only inflows can pass
 - * OUT : Only outflows can pass
 - * I/O : All the flows can pass.

Hint: IO points will be helpful if you find yourself facing a factory with multiple floors and / or buildings, or if one wishes to work on several sites simultaneously.

- Set a distance on a skeleton line.

Hint: This will be particularly useful when you want to work with multiple sites simultaneously, a single skeleton line maybe set in meters or kilometers.



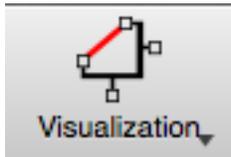
- Right click on the line to set
- Select “Set the distance”
- Enter a value in meters or kilometers
- Right-click the line to display the entered value
- Delete the value via the “Reset” option

13.2.3 Machine Placement - Interaction Mode

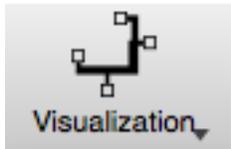
When work areas (yellow) were created in design mode, machines can be placed. To do this, a simply “drag & drop” the machines. We can therefore represent the initial situation in which the plant is located.

Different type of views are available

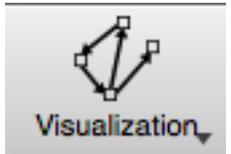
- standard : Machines are connected directly if they belong to the same area, if not traffic is through the aisles



- By the aisles only : All traffic via the aisles.



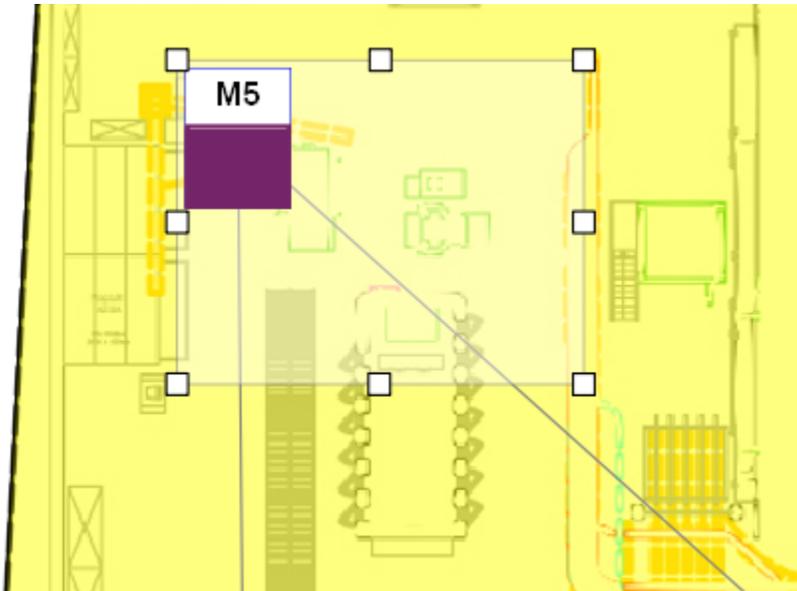
- As the bird flies :the aisle backbone is not used. The machines are connected via directional flow.



In the first two displays, the concept of direction disappears. It is all the traffic that is shown on each segment. This type of view mode is only possible if an aisle skeleton was built in design mode. Otherwise, the representation is as the crow flies.

The machines can be modified by:

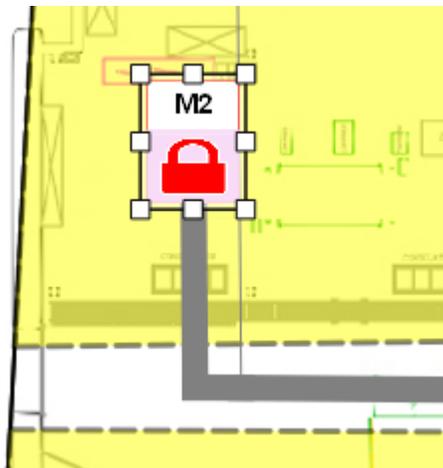
- The position with “drag & drop”.
- Their size to represent more accurately the real place that takes the machine within the factory:



- Select the machine
- Display of the squares on the contour
- Move the squares of a contour
- leur orientation :



- Click on the “Rotation” button
- Double click on the machine.
- Immobilisation. A locked machine cannot be moved:



- Click on the button

- Double click on the machine.
- The lock is displayed on the machine.

13.3 Flow analysis in the graphical view

The graphical view provides a representation of machines and directional flow (traffic) that pass between them without taking into account the design of the plant, the technical, historical or cultural.

This view allows the representation of the spaghetti diagram, a set of interlocking flows. Various tools are available to analyze these flows.

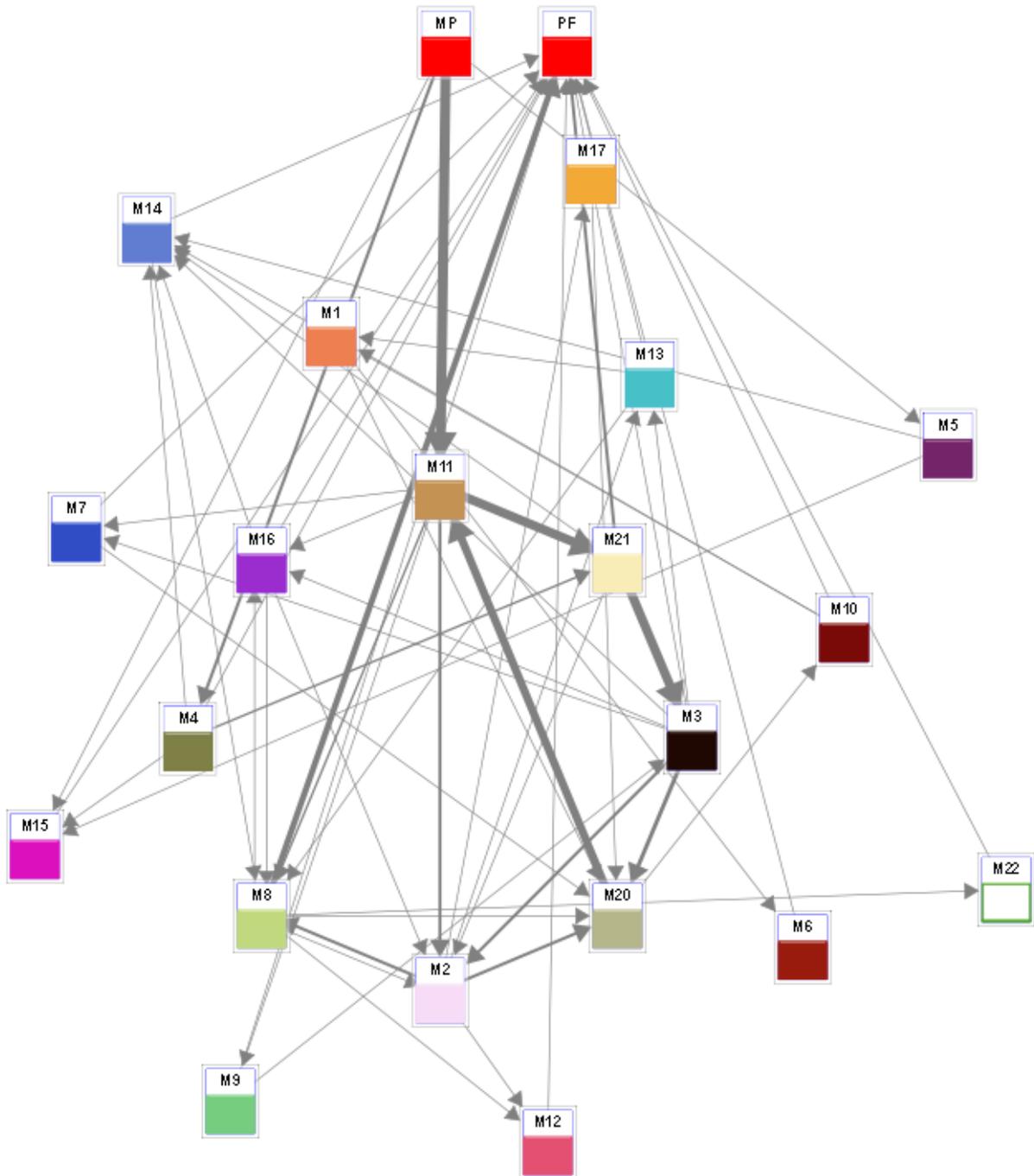
The objective of this analysis is to highlight the product families including main stream, isolating and creating groups of machines (cells) autographed with these flows.

This process takes place in two steps.

1 Reorganization machines to clear the various lines of flux.

2 Duplication and reassignment to approach a “lean” solution.

When Loaded, the graphical view shows the machines arranged in several successive circles. In general, it will not be easy to distinguish precisely how the flows are organized.



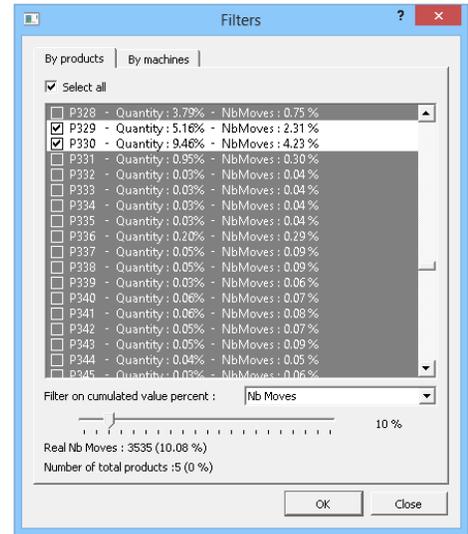
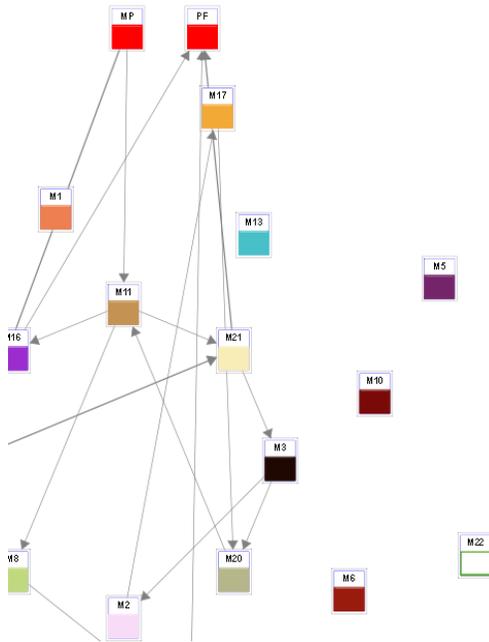
It will therefore be necessary to use the tools made available to the user to organize the flow of more visually. To do this, it will be possible:

- To use the filters to overshadow the smaller flow through the filter panel at the bottom of the screen

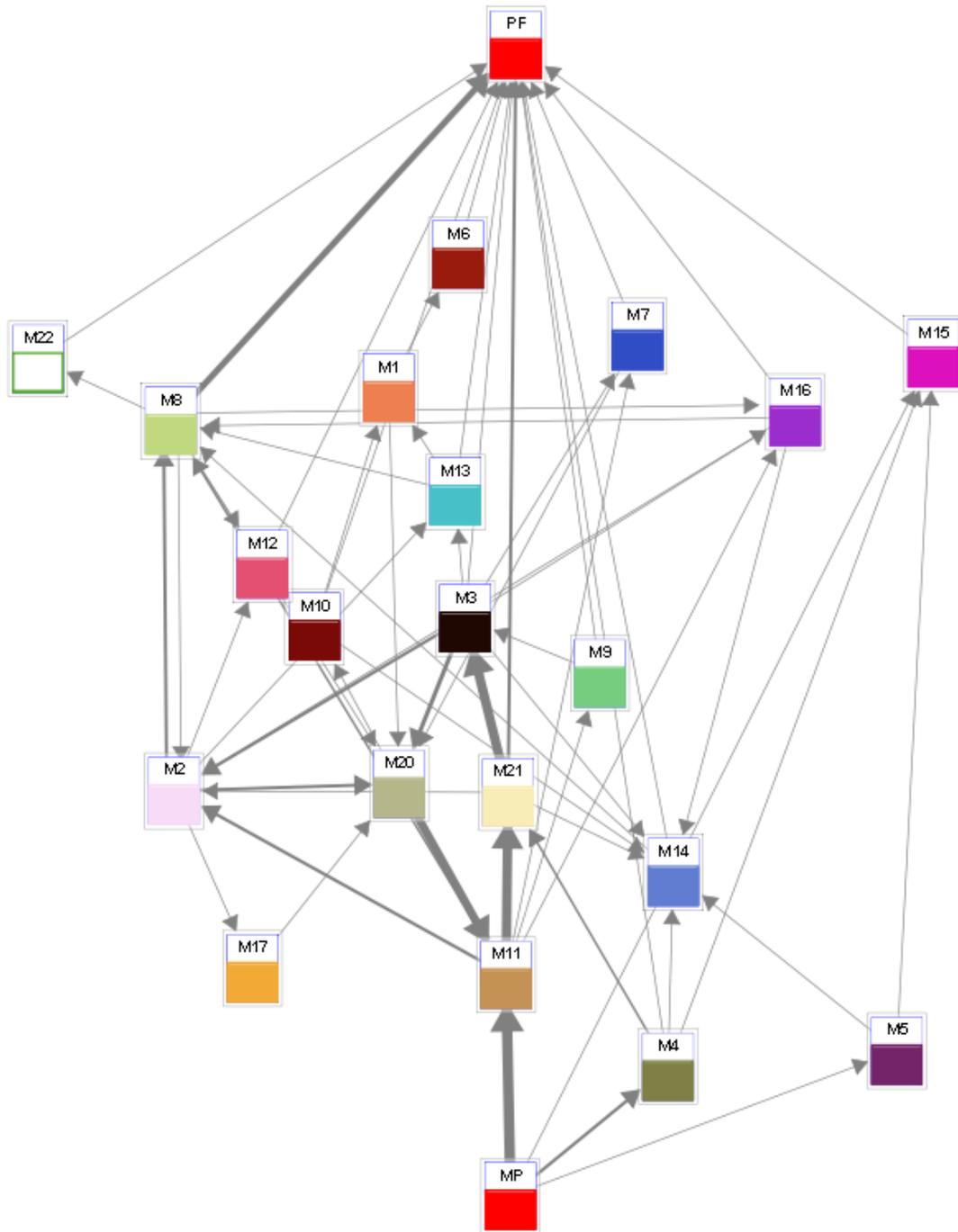




- Use the product filters :



It will then be possible to manage that part of the machine and to gradually flows appear smaller. In the end, after reorganizing the position of each machine, a more meaningful picture of the situation of flux is obtained



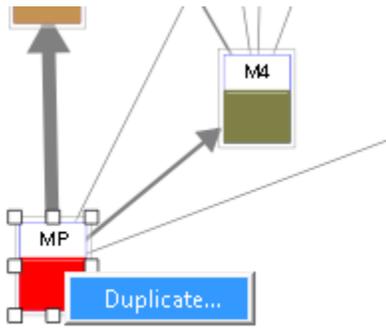
In the picture above, we can clearly distinguish a central vertical axis. However, a plurality of cross flow yet come this axis remains complicated and determine potential product families. It is the object of the second step to duplicate some machines and reassign flow thereon.

13.3.1 Duplication and reassignment

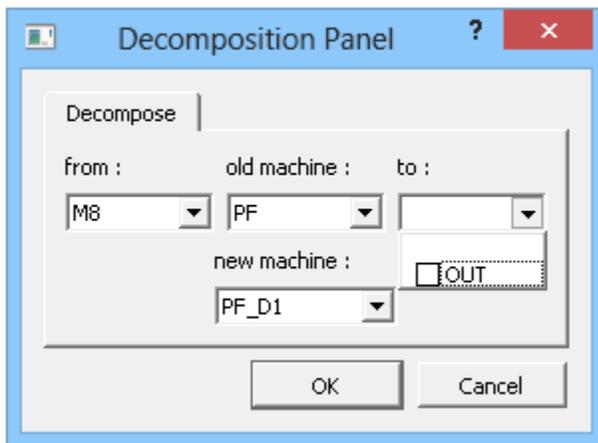
Tools to use:

- Filter graph
- Product Filters
- Thickness of flux
- Control rerouting

To duplicate machines, you will first create a new scenario based on the one we just discussed. Once done, it is possible, via a right click, duplicate each machine.

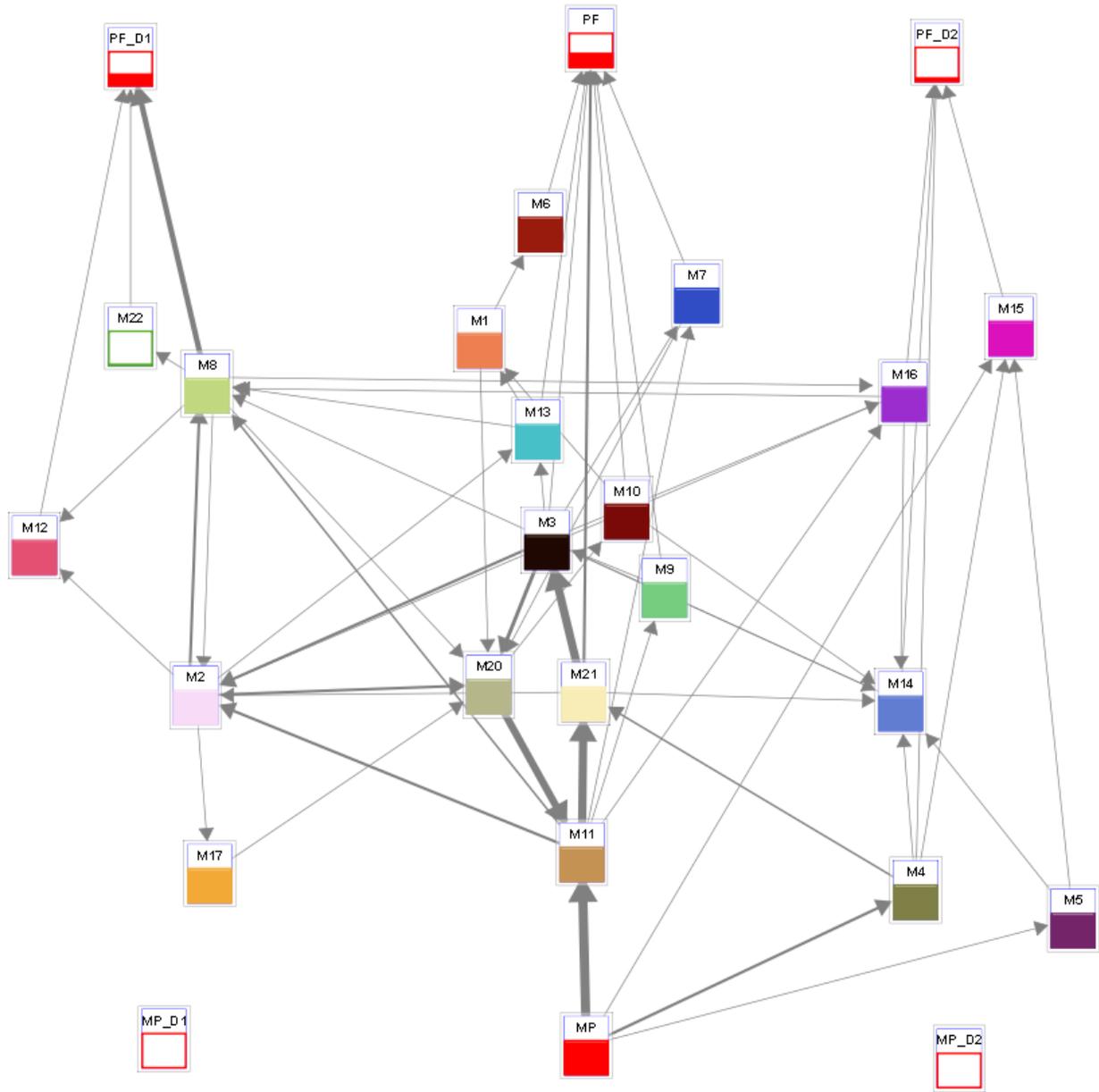


Once a machine has been duplicated, it will be possible via the control flow reassignment, change flows through this machine.

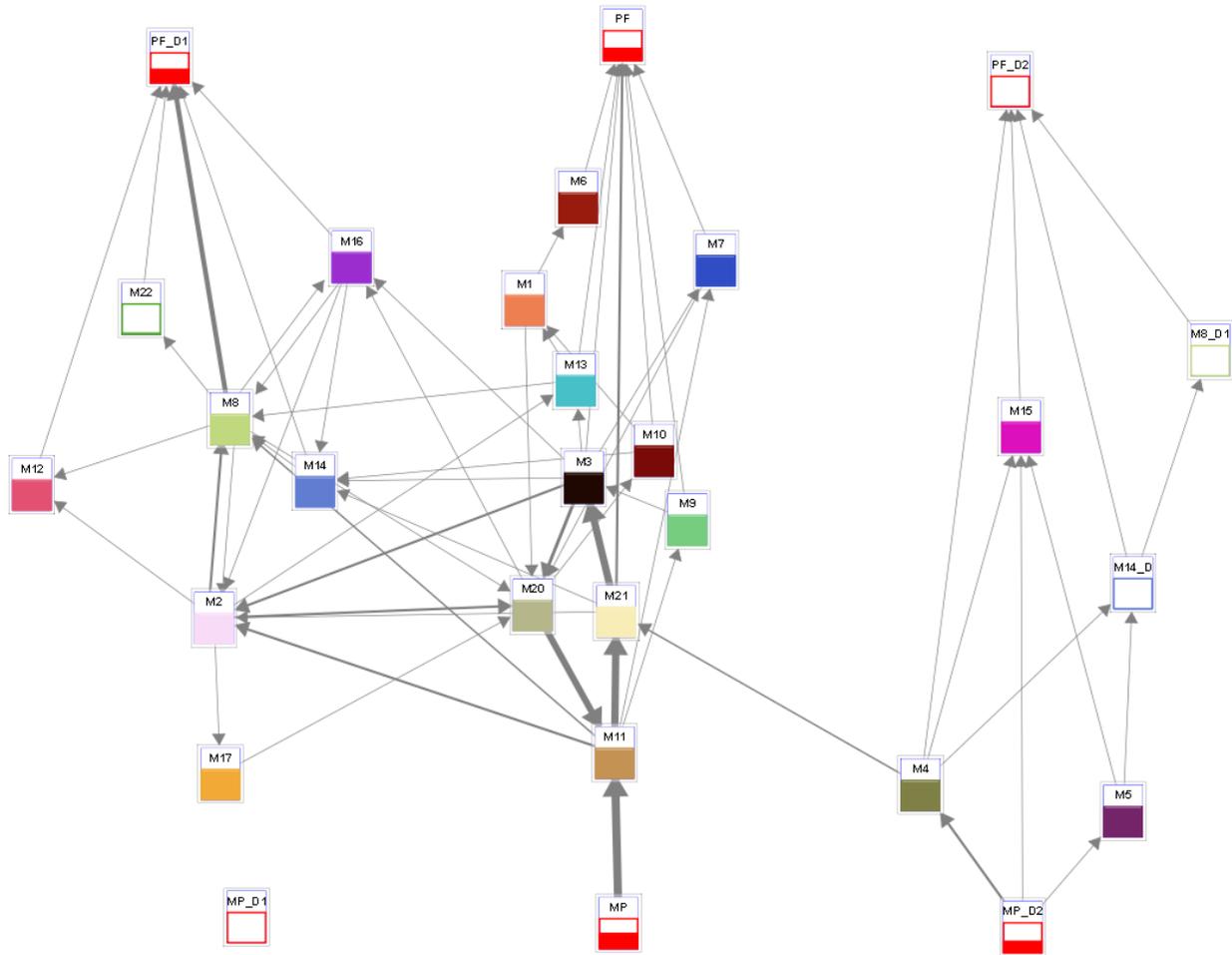


By selecting the old machine, the new machine, and both machines through which flows come and go, it is possible to change the path for these flows pass through the newly selected machine.

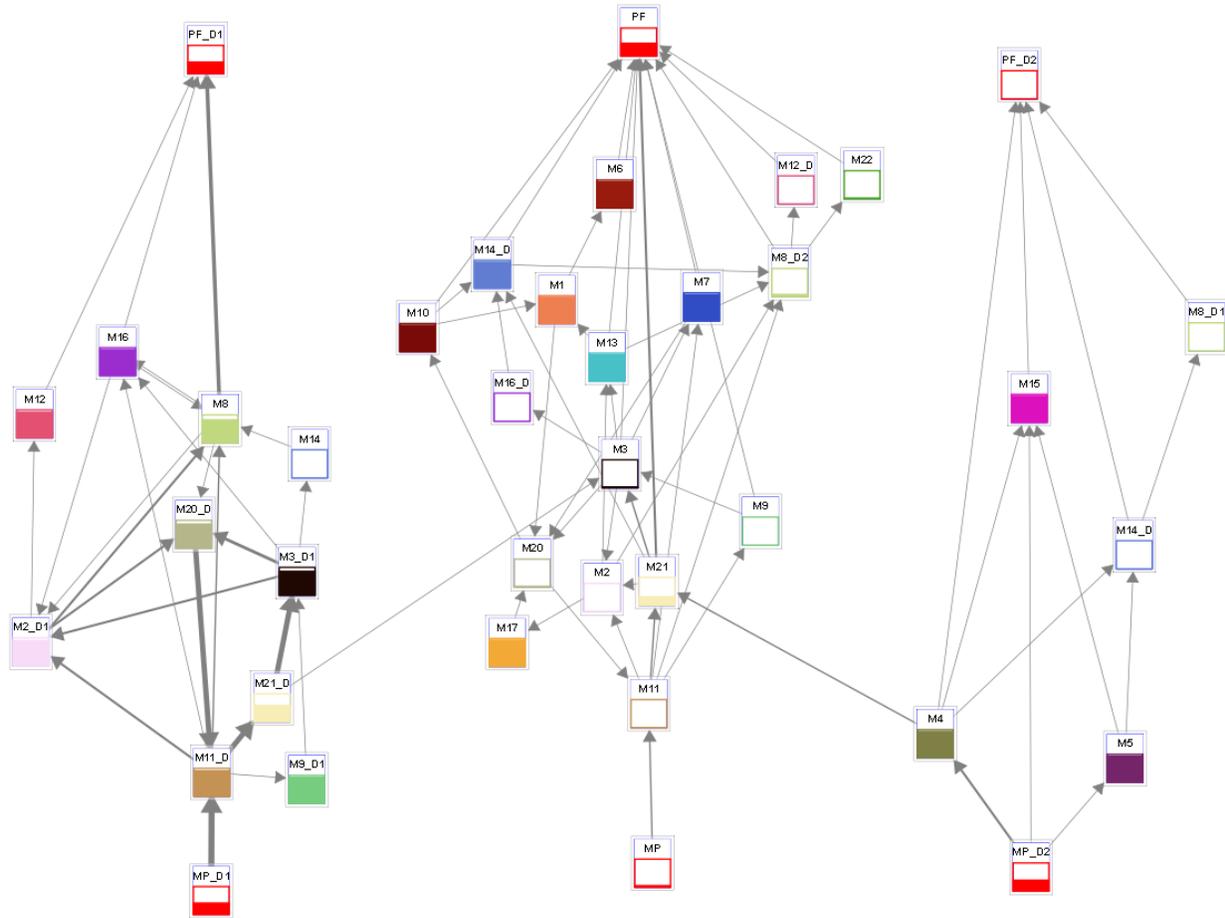
Initially, it is interesting to focus on the MP (raw materials) / FP (finished products) to identify several potential axes. In the example below, they were both duplicated 2x.



It can therefore be noted that the trend is towards three vertical axes. However, many still flows through these axes horizontally. The next step will then duplicate machines comprising most of these flows. In the example below, the machines 8 and 14 were duplicated. We note that, quickly, the right axis has become almost completely independent of the other two. As against, the left axis and the central axis are mixed too.



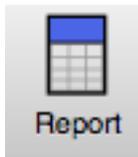
By duplicating more additional machinery is nevertheless happens to isolate these two parts of almost complete manner.



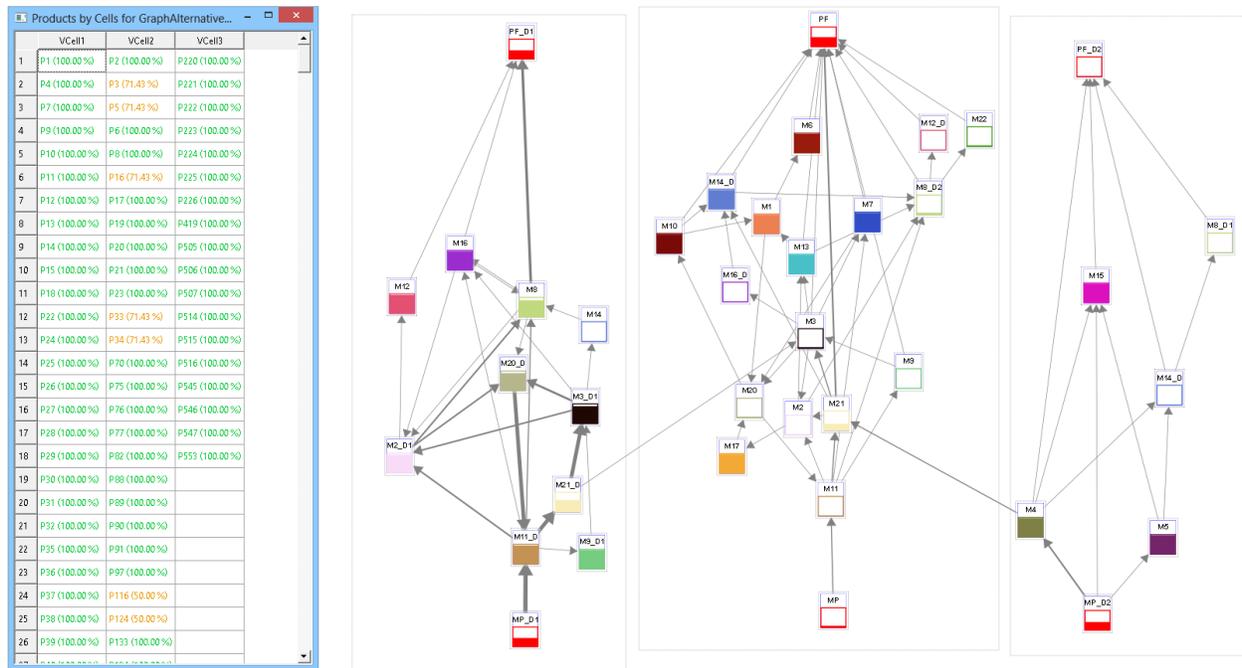
We now decomposed streams to obtain three separate axes.



It is now possible to create “product families” surrounding each axis using a virtual cell.

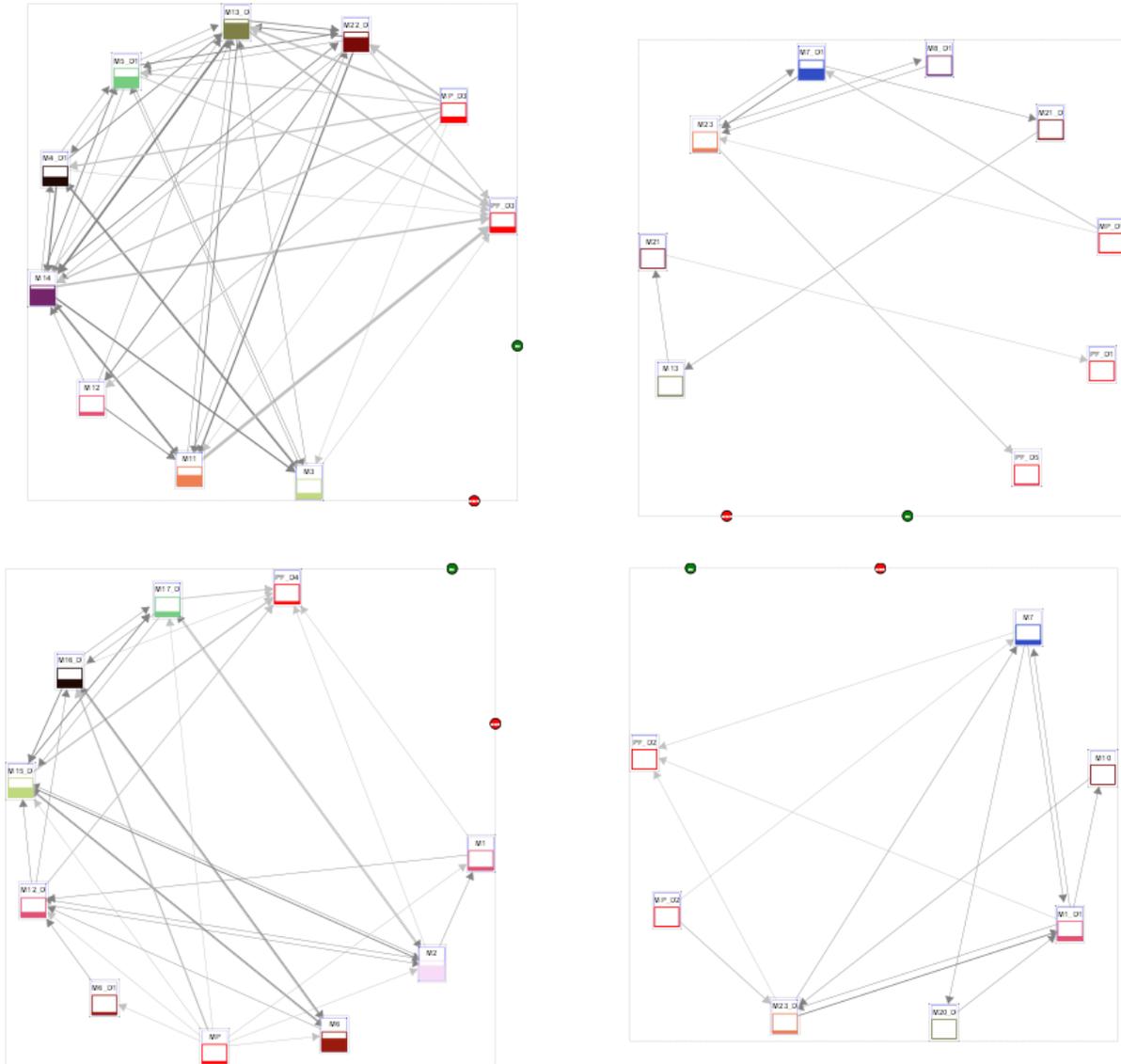


Once done, you can see a table of products by cells in order to identify product families created.

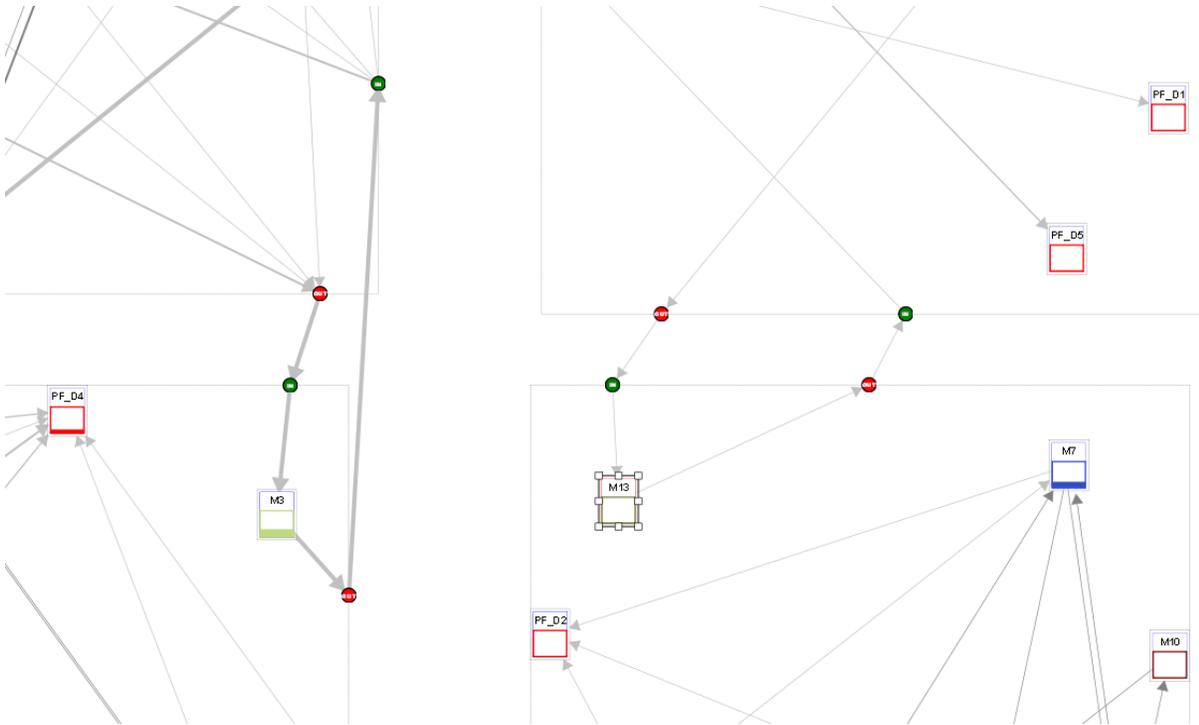


13.3.2 Setting cells

The cell allows for a representation of the flow cell. Unlike virtual cells that can be created in the graphical view, cells this time point / O through which pass the intercellular flow. When using RRPCMGGGA to create optimized solutions, cells that will be viewed will be generated. In an ideal situation, all flows should be intracellular, as in the example below

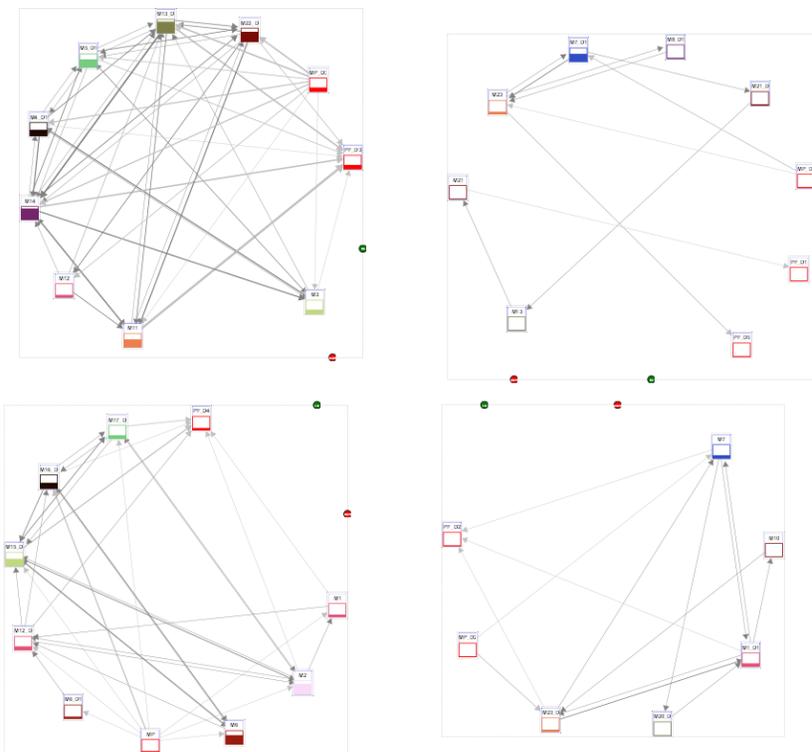


However, in most cases, a portion of this stream will intercellular. As said before, they will go through the IN / OUT points. It is possible to freely move the points on the contour of the cell, as it is also possible to modify the size of the cell. Machines that are in it will move automatically to stay on the circle they form. The minimum cell size is defined by the circle that contains the machines. The machines can overlap, it will be impossible to reduce further the size of the cell if the machines are located inside collide.



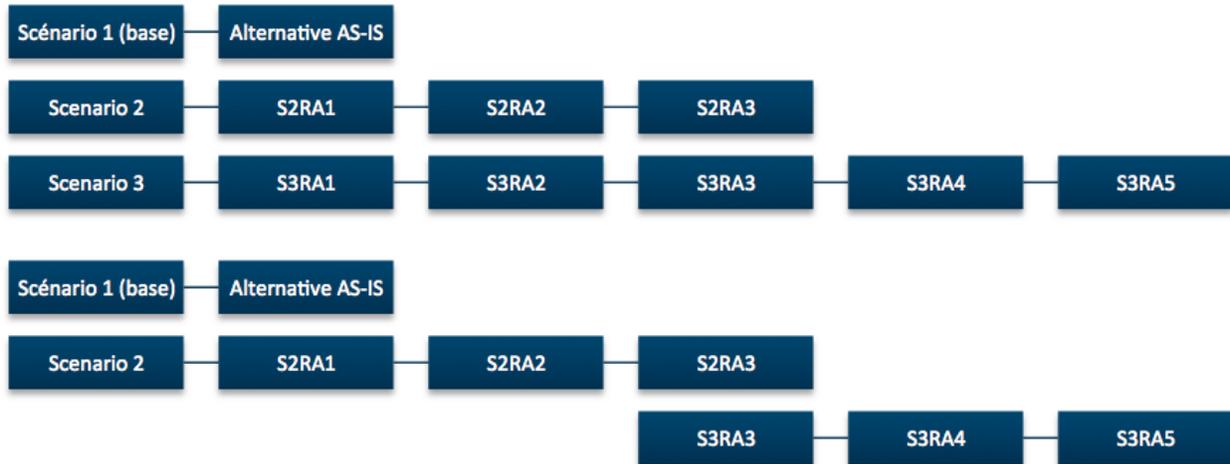
The user may at any time moving the machines but are, by default, locked within their cell. Nevertheless, it is possible to remove this limitation by enabling the “lock / unlock machines” from the toolbar. Finally, the user can, as in graphical view, access the table produced by cells.

	VirtualCell	VirtualCell	VirtualCell	VirtualCell
1	P10 (100.00%)	P11 (100.00%)	P1 (100.00%)	P14 (100.00%)
2	P15 (100.00%)	P12 (100.00%)	P2 (100.00%)	P17 (100.00%)
3	P16 (100.00%)	P13 (100.00%)	P3 (100.00%)	P18 (100.00%)
4		P19 (100.00%)	P4 (100.00%)	
5		P20 (100.00%)	P5 (100.00%)	
6		P21 (100.00%)	P6 (100.00%)	
7		P22 (100.00%)	P7 (100.00%)	
8		P23 (100.00%)	P8 (100.00%)	
9		P24 (100.00%)	P9 (100.00%)	
10		P25 (100.00%)	P28 (100.00%)	
11		P26 (100.00%)		
12		P27 (100.00%)		
13		P29 (100.00%)		
14		P30 (100.00%)		
15		P31 (100.00%)		
16		P32 (100.00%)		
17		P33 (100.00%)		
18		P34 (100.00%)		
19		P35 (100.00%)		
20		P36 (100.00%)		



13.4 Creation of Scenarios

13.4.1 How to use scenarios and alternatives



To create solutions based on the reassignment of flows performed in the graphical view of the “Scenario 2”:

- Work on Scenario 2 alternative “S2RA1”
- Determine incremental changes (in terms of positioning of machines):
- Edit “S2RA1”
- Duplicate “S2RA1” to “S2RA2”
- Edit “S2RA2”
- Duplicate “S2RA2” to “S2RA3”
- Edit “S2RA3”

..hint each state is to be saved must be duplicated to keep the changes. * Modify the design of the plant * Duplicate Scenario 2 (Scenario 3 =) * Modify the design (delete cells, create new cells ...) * Remove non useful alternatives previous Scenario 2 (“S2RA1” and “S2RA2”) * Begin to change the alternative “S3RA3” (new design with machines positioned as the last alternative scenario 2) * Proceed with incremental changes to create different alternative “S3RA3”, “S3RA4” to “S3RA5”

Incremental changes (via alternatives) can result in the release of a box and then redesign of this area (via a new scenario).

13.4.2 Using the Dashboard

Dashboard ✕					
	Alt	Cost	%	Nb kms	Time
1	Sc1-RAIt01	38113.7 EUR		2286.8 km	762.3 h
2	Sc3-RAIt01	28803.0 EUR	24.4	1728.2 km	576.1 h
3	Sc4-RAIt01	45982.9 EUR	20.6	2759.0 km	919.7 h

The dashboard allows you to compare different real alternatives to quickly and easily visualize which is the best of them. It contains several data:

- The name of the alternative and it's scenario .
- Total cost that represents the situation
- The percentage gain this situation than that indicated as the reference
- The total number of kilometers traveled by products
- The total time

To determine what is the alternative reference, you either go through the Scenario menu, or right-click on the selected alternative and choose “set as baseline” option. Computing the winning percentage of alternatives will be based on this alternative reference.

14.1 Basis of the Planner

SIMOGGA Planner comes as an extension of SIMOGGA Layout Design. In order to work, it doesn't need more than the data that have already been used to design the as-is and optimized situation of the factory. However, to obtain a more complete and accurate scheduling, configuring the Planner will be required. The following paragraphs will explain in details how to take all the constraint and the characteristics of the production into account.

14.2 Configuring the Planner

14.2.1 The Global Data

The global tab will impact general parameters for the schedule.

Setup :	<input type="text" value="0"/>	No operator ▼
Load :	<input type="text" value="0"/>	No operator ▼
Process :	<input type="text" value="1"/>	No operator ▼
Unload :	<input type="text" value="0"/>	No operator ▼
Measure :	<input type="text" value="0"/>	
Transport :	<input type="text" value="0"/>	

In this first part of the menu, it is possible to set the ‘global’ values for the schedule. These values will be taken into account if, for an operation, no value has been set on both the operation and machine level. This is, in other words, a default value. It is also possible to only use these default values for every operation to be done on the schedule. In order to do that, simply check the “Use global values over machines and operations ones” in the second part of this tab. For each kind of sub-operation, you can also set if the sub operation needs an operator or not.

Nb Operators :	<input type="text" value="1"/>
<input type="checkbox"/>	Use global values over machines and operations ones
<input type="checkbox"/>	Allow changes to machines assignation
<input type="checkbox"/>	Schedule only filtered products

- **Nb Operators** will determine the number of operators available inside the factory. These operators are independent from the ones dedicated to a specific machine and won’t be working on these machines either.
- **Use global values over machines and operations ones** will make the Planner only take into account the global values set in the first part of the tab.
- **Allow changes to machines assignation** will make rerouting possible if duplicate machines exists. If the first machine is busy, the next products requiring it will be moved to the second/. . . machines.
- **Schedule only filtered products** will limit the schedule to the products currently filtered. This means that you can schedule only a part of the production or see what would be the impact on the production by removing one or multiple products from it.

Precision :	<input type="text" value="mins"/>
Start on :	<input type="text" value="7/1/16 12:00 AM"/>
<input type="checkbox"/> End on :	<input type="text" value="7/1/16 12:00 AM"/>
<input type="checkbox"/> Allow process to continue out of shift	
<input type="checkbox"/> Batches cannot be separated	
Max number of concurrent orders :	<input type="text"/>
<input type="checkbox"/> Prioritize orders over bottleneck machine	

- **Precision** determines if the schedule will be done in seconds, minutes, or hours
- **Start on** is the day and the hour at which the schedule will start
- **End On** is the day and the hour at which the schedule must end. It will end even if all the operations were not scheduled
- **Allow process to continue out of shift** will allow a process that has been started before the shift ends to continue after the end of the shift. If this is not checked, no operation that cannot be finished before the end of the shift will be started.
- **Batches cannot be separated** will make the batches indivisible, which means the Planner will always wait that all the units of the batch are done before starting the operations on the next machine.
- **Max number of concurrent orders is the number of orders that can be treated simultaneously inside the factory. If no number is set, the limit is 1000.**
 - Prioritize orders over bottleneck machine means that if one machine is set as the bottleneck (which will also limits the number of orders inside the factory), the limit set here will have the priority.

14.2.2 The Shifts Data

<input type="checkbox"/> Use shifts		
Number of shifts :	<input type="text" value="1"/>	
Shift :	Start at	End at
First :	<input type="text" value="8"/>	<input type="text" value="16"/>
Second :	<input type="text" value="1"/>	<input type="text" value="1"/>
Third :	<input type="text" value="1"/>	<input type="text" value="1"/>
<input type="button" value="Save"/>		
<input type="checkbox"/> Work on saturday		
<input type="checkbox"/> Work on sunday		

- **Shift(s)** sets the shift schedule of the factory. At this moment, four options are possible

- No shift at all
 - 1 shift from 8am to 4 pm
 - 2 shifts from 6am to 2pm and from 2pm to 10pm
 - 3 shifts from 6am to 2pm and from 2pm to 10pm and from 10pm to 6am
- **Saturday** and **Sunday** will determine whether the factory is running on saturday and sunday

14.2.3 The Machines Data

CND
▼

<input type="checkbox"/>	Setup :	<input type="text"/>	Operator(s) ▼
<input type="checkbox"/>	Load :	<input type="text"/>	Operator(s) ▼
<input type="checkbox"/>	Process :	<input type="text"/>	▼
<input type="checkbox"/>	Unload :	<input type="text"/>	Operator(s) ▼

Use dedicated operator No ▼

Use machines values over operations ones

- The first part of this tab is the same than the one from the global tab. It will determine for each machine the time for each sub operation done on that machine. In case no value is defined at the “operation” level, the Planner will take this value into account.
- A **dedicated operator** can be set to the machine. It means this operator will take care of that machine and the operators defined in the global tabs won’t work on it. Note that it is possible to select multiple operators to work on one or multiple machines. For example, you could set the dedicated operators 1 and 2 on the machine A and the dedicated operators 2 and 3 on the machine B. It means that the dedicated operator 2 will be working specifically on both machine A and B.
- If the **Use machines values over operations ones** is checked, the Planner will take the values defined for each machine into account not matter what is set in the operation section.

<input type="checkbox"/>	Shift(s) :	1
<input type="checkbox"/>	Saturday	
<input type="checkbox"/>	Sunday	
<input type="checkbox"/>	Is the bottleneck machine	
<input type="checkbox"/>	Products can be combined	
Nb products to combine :		
		<input type="checkbox"/> Nb is fixed
Save		
Save for all machs (ops and shifts)		

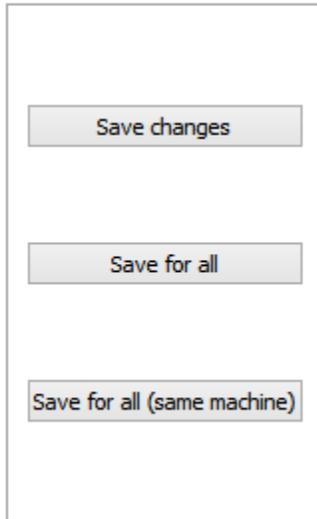
- A **specific shift** can be set for each machine, including if it works on saturday and sunday
- The machine can be set as the **bottleneck machine**. It means that the Planner will try to optimize the schedule and avoid creating a bottleneck on the specified machine by delaying the start of the orders that might cause it.
- **It is possible to specify that the machine can treat multiples products simultaneously.**
 - In this case, it is necessary to specify the amount of products to be treated simultaneously.
 - If “Nb is fixed” is checked, it means that the Planner will always wait to have to total amount our product ready before starting the operation. If it is not checked, the operations might start with one or some products even if there is less available than the number specified.

14.2.4 The Operations Data

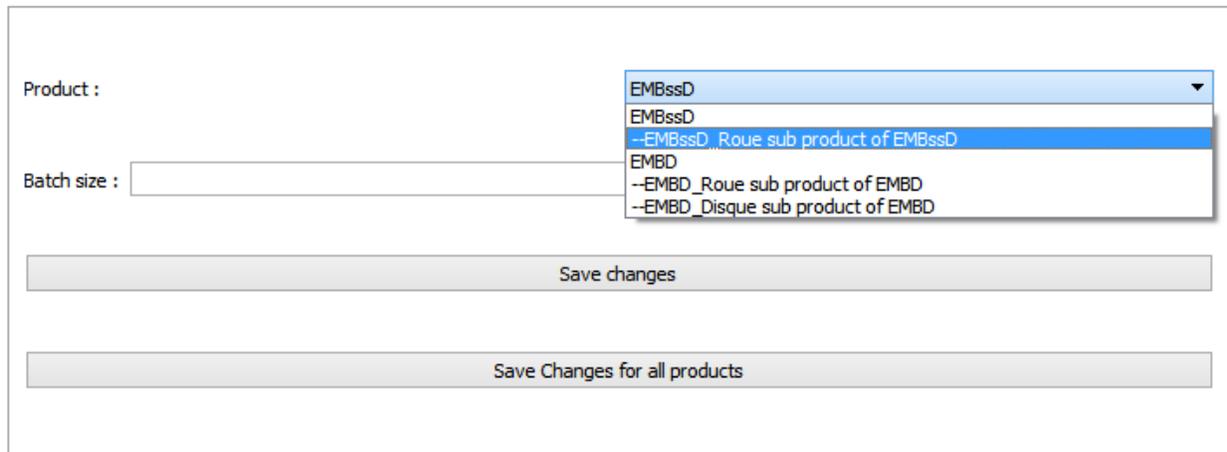
P1PA1_10 - T_VisEntree			
<input type="checkbox"/>	Setup :		Operator(s)
<input type="checkbox"/>	Load :		Operator(s)
<input checked="" type="checkbox"/>	Process :	60	
<input type="checkbox"/>	Unload :		Operator(s)
<input type="checkbox"/>		Measure :	0
<input type="checkbox"/>		Transport :	0
with Transfer size of :		1	

- Just like for the global and machine tabs, it is possible to set the time spent of each sub operation of the given operation and if an operator is needed. Unless specified otherwise by the users, the values setted in the operation tab will be the ones used by the Planner to make the schedule.

- It is possible to modify the **transfer size** of the operation. It means the amount of product transferred simultaneously to the next machine (operation).



14.2.5 The Products Data



- It is possible to change the **batch size** for each product and sub product. This can be interesting in order to test which batch size is the more adequate given the production.

14.2.6 The Orders Data

Generate orders

Order : Order1_P1 ▼

Release date : 7/1/16 12:00 AM ▼

Due date :

Fixed date : 7/1/16 12:00 AM ▼

Fixed number of days : After release date ▼

No due date

Number of units :

Save Changes

Save Changes for all

- Once the schedule has been prepared, it is possible to generate the list of orders. Once the orders are created, it is possible to edit their release and due date.
- If no **release date** is set, the Planner will consider the order available right from the start of the schedule.
- If a **release date** is set, the order will not be able to start before the schedule has reached the set release date.
- **There is multiple ways to set the due date. It can either be :**
 - At a fixed date.
 - **After a specified number of days that can either be :**
 - * Since the release date.
 - * Since the beginning of the schedule.
 - No due date at all.

Type of ordering :

By due date ▼

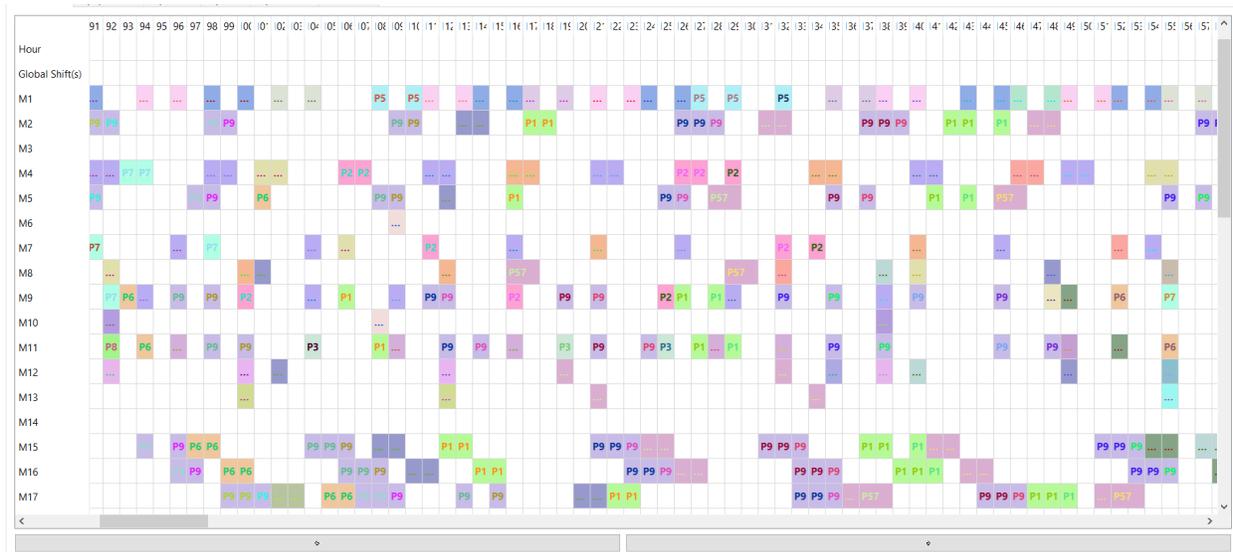
- **It is possible to specify the type of ordering (priority) for the Planner. Multiple choices are available :**

- **By due date** which is the most common. The planner will start the orders based on the closest due dates in order to avoid as much as possible late delivery.
- **By product id**. The priority will be determined by the id of the product. This is mainly used for specific test cases or testing.
- **Randomized**. The orders will be launched randomly. This is useful when the production varies continuously and the orders arrive randomly.
- **Smart**. Currently in alpha. The goal of this method is to directly prevents bottlenecks and have the best balance between lead time and minimum lateness.

15.1 Analyzing the results

For each schedule an individual tab appears displaying all the information needed to analyse this schedule but there is also a “Summary” tab allowing the comparison between the different schedules.

15.1.1 The Gantt chart



Once a schedule has been done, a detailed Gantt chart will be generated. This Gantt chart shows minute by minute which operation is done, on which product, on which machine, and if an operator is dedicated to it. To navigate further in the Gantt chart, you can use the arrows located at the bottom of the window.

15.1.2 The Operations table

The first table contains the details of each operation done during the schedule. It is possible to filter these informations based on the machine, the product, and/or the order.

- **Id** is the Id of the operation. It is only useful for sorting purposes.
- **Name** is the name of the operation. Usually, it is a combination of the product, the operation, the batch and the type of operation.
- **Started at** indicates the time at which the operation has been started.
- **Ended at** indicates the time at which the operation was ended.
- **Type** is the type of operation. It is one of the following : Setup, Load, Process, Unload, Measure or Transport.
- **Machine** is the machine on which the operation has been done.
- **Operator** is the operator who was in charge of the operation.
- **Product** is the id of the product. Use it sorting.
- **Batch** is the id of the batch. Use it for sorting
- **Piece** is the id of the piece. Use it for sorting.
- **Wait Time** is the amount of minutes the operation was on hold before being executed. 0 means that the operation started as soon as the previous one was finished.

Note that it is possible to export this table to CSV format, which can then be opened in Excel or any similar software.

15.1.3 The Orders table

The second table contains the details of each order treated during the schedule.

- **Id** is the Id of the order. It is only useful for sorting purposes.
- **Name** is the name of the order.
- **Id Product** is the id of the product. Use it for sorting.
- **Id Batch** is the id of the batch. Use it for sorting.
- **Release Date** indicates the date at which the order was available to be started.
- **Real Start Date** indicates the date at which the operations on the orders started.
- **Due Date** indicates the date at which the order should be done.
- **Real End Date** indicates the date at which the order was finished.
- **Lead Time** indicates the lead time of the order. It means the time that the order spent inside the factory, from the start of its first operation till the end of its last one.
- **Lateness** is the comparaison between the real end date and the planified due date.

Note that it is possible to export this table to CSV format, which can then be opened in Excel or any similar software.

15.1.4 The Units table

The third table contains the details of each unit processed during the schedule.

- **Id** is the Id of the order. It is only useful for sorting purposes.
- **Name** is the name of the unit.

- **Id Order** is the Id of the order. It is only useful for sorting purposes.
- **Id Product** is the id of the product. Use it for sorting.
- **Id Batch** is the id of the batch. Use it for sorting.
- **Real Start Date** indicates the date at which the operations on the unit started.
- **Real End Date** indicates the date at which the unit was finished.
- **Lead Time** indicates the lead time of the unit. It means the time that the product spent inside the factory, from the start of its first operation till the end of its last one.

Note that it is possible to export this table to CSV format, which can then be opened in Excel or any similar software.

15.1.5 The Resources table

The fourth table contains the details of each resource inside the factory.

- **Id** is the Id of the resource. It is only useful for sorting purposes.
- **Code** is the name of the resource.
- **Shift** indicates the shift on which the resource is. It can either be 1, 2 or 3.
- **Average Wait Time** is the average time a product has to wait in front of the machine before being treated by the machine.
- **Nb Setups Done** is the number of setups done on the resource for the whole schedule.
- **Total Setup Time** indicates the total time spent doing setups on the resource.
- **Total L/P/U Time** indicates the total time of load/process/unload done on the resource.

Note that it is possible to export this table to CSV format, which can then be opened in Excel or any similar software.

DAHSBOARD !!

15.1.6 The KPIs

The last tab of the schedule panel contains two parts. The first one is dedicated to the KPIs of the schedule.

KPIs	Parameters
Total makespan	: 50176
Average use of machine(s)	: 10%
Average lead time (orders)	: 1246
Average lead time (units)	: 1296
Average touch time compared to lead time (units)	: 33.4 %
Average wait time	: 91.0 mins of which 3.6 % no operator were available
Percent of wait time because of sub parts	: 0.0 %
Average lateness	: -13254
Total lateness	: -8641365
Number of setups done	: 885

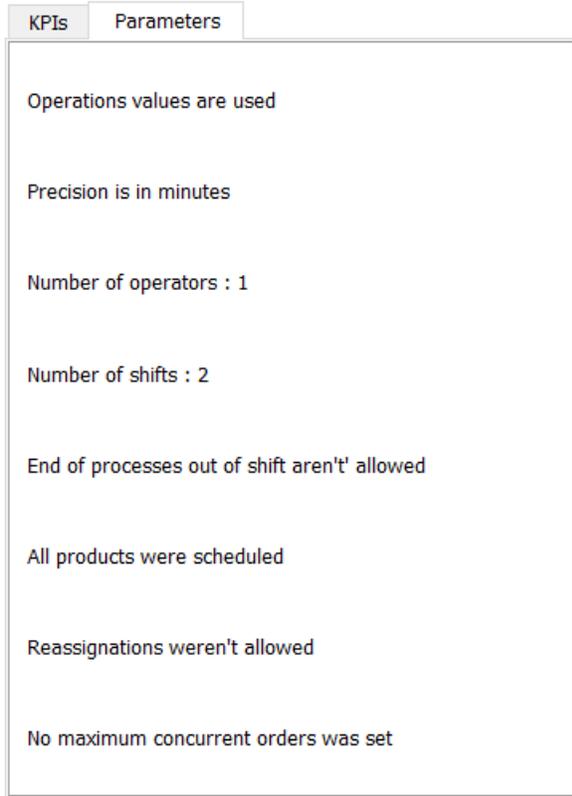
- **Total Makespan** is the total amount of time for the schedule in minutes.
- **Average use of machines** is the average percentage of machine utilization.
- **Average lead time (orders)** is the average lead time for the orders in minutes.
- **Average lead time (units)** same as above, but for each unit of product.
- **Average touch time compared to lead time (units)** is the average percentage of effective time spent on operation for each unit compared to the time it actually spent inside the factory.
- **Average wait time** is the average wait time for each operation. This also contains the percentage of wait time due to a shortage of operators.
- **Percent of wait time because of sub parts** is the percentage of wait time caused by sub parts not ready at time to be used by the main products.
- **Average lateness** is the average lateness for each order of the schedule.
- **Total lateness** is the total lateness in minutes for all the orders.
- **Number of setups done** is the total amount of setups done for the schedule.

15.1.7 The Parameters

This tab reminds the choices made before launching the schedule.

- Whether operation values are used or not
- The precision (seconds, minutes or hours)
- The number of operators

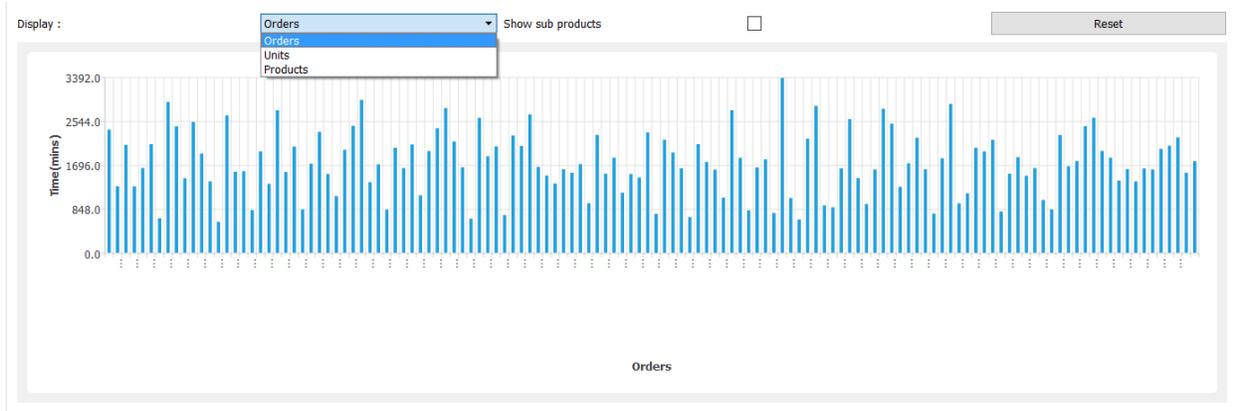
- The number of shifts
- If end of processes out of shift is allowed
- If all products were scheduled
- If reassignments are allowed
- The number of maximum concurrent orders



15.1.8 The Graphs

Each graph can be zoomed on by selecting the desired area using the mouse. There is also a reset button that reset the chart as it was before zooming.

- **Lead Time** It displays the lead time in minutes for each order, unit or product of the schedule. The different charts can be obtained by selecting them in the combo box. The order chart is displayed by default. The check box enables the inclusion of the subproducts. By default they are not included.



• **Start/End Time**

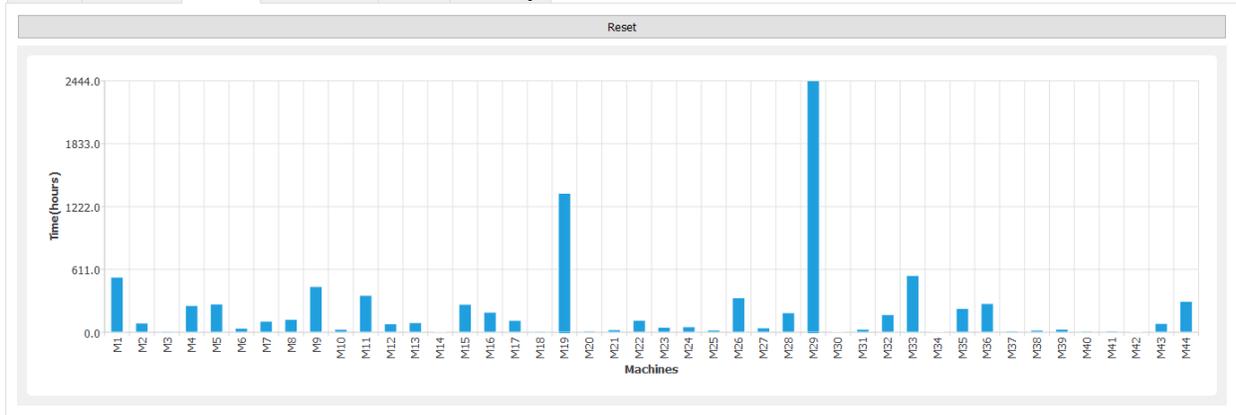
For each unit of product, it shows :

- The start time
- The end time
- The due date
- The release date
- The touch time

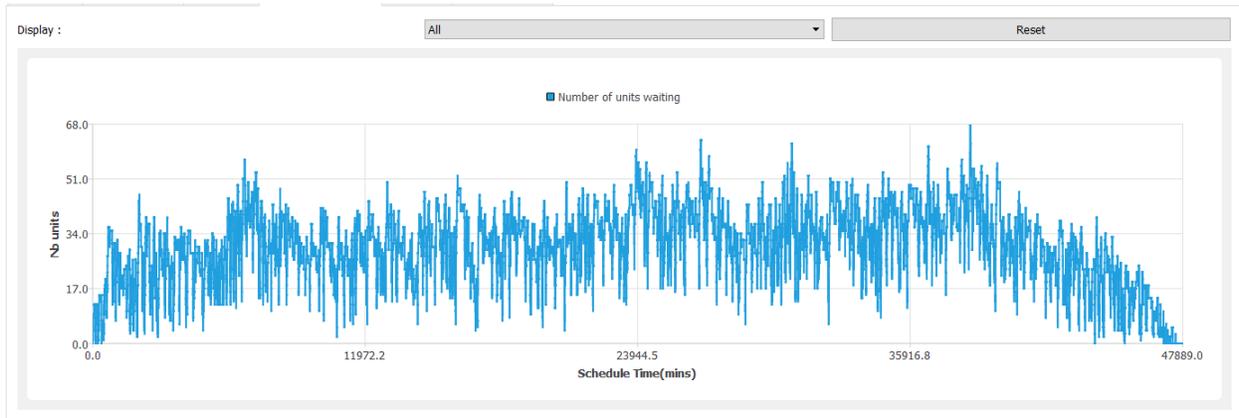


This graph is useful to have a quick look at the efficiency of the overall schedule. For a good situation, the end time should not grow much faster than the start time and it should be as close as possible to the touch time.

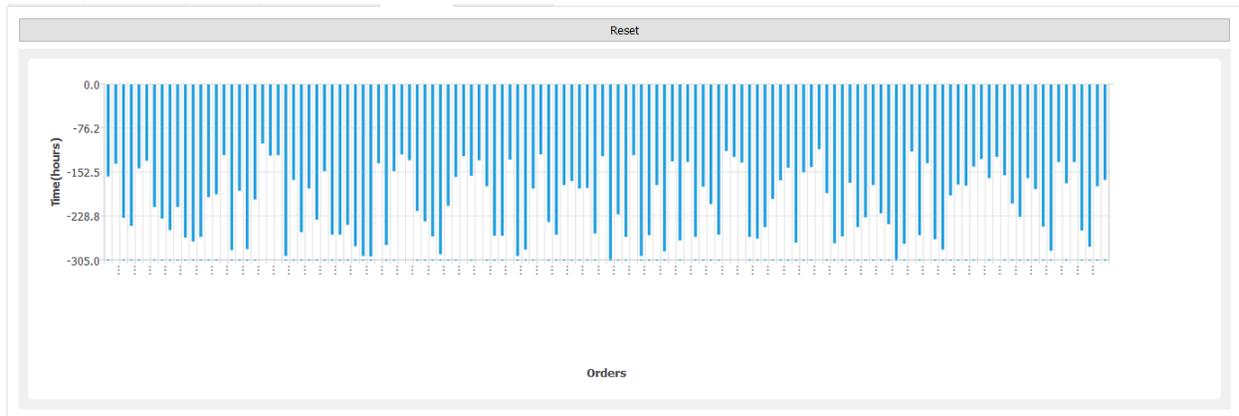
- **Wait Time** It shows the cumulated wait time (in hours) of the operations per machine. This graph can clearly indicate the bottleneck machines and where changes should be done to improve the efficiency. For instance, if such a machine is duplicated it might greatly reduce the makespan (M29 or M19 on this picture).



- Wait Time Timeline** It shows, minute by minute, the number of units of product currently waiting to be treated inside the factory. By default, all the machines are included but the combo box allows to select only the desired machines. In this case, the graph will only show the number of units of product on hold in front of the selected machines. Combined with the previous graph, it can indicate which machines slow the process down so changes can be made.



- Lateness** It shows, for each order, the lateness. If the order has a negative lateness, i.e below the zero line, it means it will be ready in advance. Whereas if the lateness is positive, i.e it goes up the zero line, it means that the order will be finished after the expected due date, thus it will be late. An ideal situation would be to have negative lateness for each order as depicted on this picture.

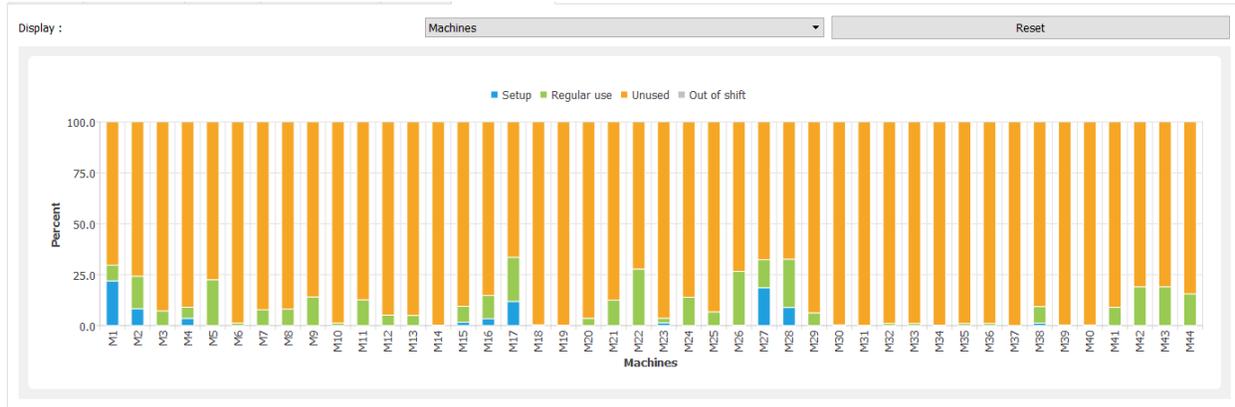


- Machine usage**

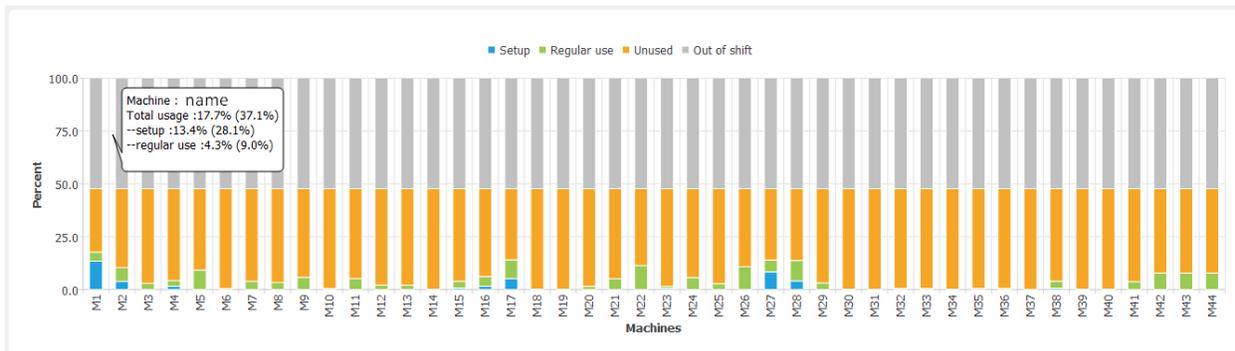
It shows, for each machine, the usage divided in :

- Setup time
- Load/Process/Unload time
- Unused

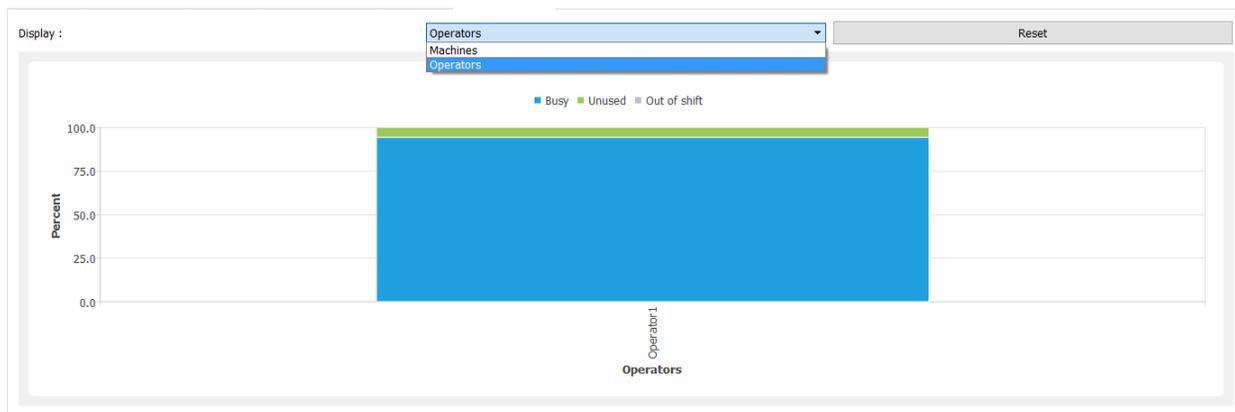
The machine can also be out of shift, in which case it will appear in grey.



When hovering on (moving the mouse above) any column, the exact name as well as the values of setup and regular use of the machine will appear in a bubble. For each data, the value indicated in brackets only takes into account the actual availability time of the machine. Whereas the first value also counts the time when the machine is out of shift. This value is thus always smaller or equal to the value in brackets.



The combo box allows to show the usage of the operators instead of the machines. If he is not out of shift, the operator can either be busy or unused.



Alternative They used to define situations where machines are moved. This allows, within a scenario to build the successive steps to be followed to arrive at the optimal situation An alternative may be seen as a picture, a backup at some point. Just duplicate the alternative being to continue the analysis process and maintain the current status.

Flow Number of movements or amount of products transferred between two machines (From - To). A flow is expressed in terms of movement and quantity.

Graphical View The graphical view shows the directional flow (From - To) The graphical view allows visualization of (technical cultural, historical) directional flow freely

Machine SIMOGGA considered a machine, machine, workstation, storage where the product is stopped, (it can be transformed by an operation of the process or just stored for some time). The machines have a **color** characterizes the type of machine The filling **level** of the colored part is the percentage of the load with respect to the ability

Movement (Flows) A movement is a transfer of a batch of parts from a position A to a position B) The flow value is the number of trips made to move all parts of a position A to a position B

Quantity (Flows) The flow value is the sum of all parts moved from a position A to a position B

Real View The actual view is summed flows on each segment without steering precision The actual includes the plant layout to accommodate the technical requirements of the plant (plant areas, entry-exit, immovable machinery)

Scenario An Operation-Machine solution that involves flow between the various machines and a specific machine utilization (load relative to the defined capacity). Each scenario is characterized by a factory design.

Scene The scene sets the graphic display area.

Views SIMOGGA is organized into different views: real view and graphical view.

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