Tutorial for a short “quick” demo

IMS Quick-Demo with a empty IMS database (approx. 20 - 30 minutes)

One Pager „Quick-Example“

Explanation

- A company has two production areas. Once the "prefabrication" and secondly the "final assembly". Both areas are connected to each other via a bearing (buffer).

  Prefabrication has a whole process time (cycle time) of 1 h, the final assembly takes a total of 4 hours. Task of the planner is to determine if 20 orders can be produced within one week. And what impact has it, when a new scheduled order with 5 parts of a customer pushed in between. And how the production capacity has to be adjusted, if necessary, in order to reach the target of the specified one week.

Production:

- Order volume, 20 contracts (‘1st Scenario 50 orders, 2nd Scenario 55 orders), only one product variant
- Production split into pre-assembly and final assembly
- Interim storage for decoupling of the pre- and final assembly
- Interim storage has a maximum capacity of 20 parts

Questions

1. Complete design and createn of the basic data in the IMD (product, process resource)
2. Set of the configuration and netplan
3. Creation of a simulation project (Orders, Scenario, Sim-model, simulation run)
4. First scenario with 50 orders, analysis with Excel whether contracts can be produced on time.
5. Create a new scenario, extend this with a order consisting of 5 parts.
6. Analysis with Excel or in IMV directly whether objective can be produced within the given week.

Content

☐ Group production	☑ IMD / IMV	☑ Bottleneck Analysis
☐ Flow production	☐ IMC Simulation	☐ Variation of shift schedules
☐ Large quantity	☐ IMC Line Balancing	☐ Optimization production scheduling
☐ Purchased parts	☐ VSM	☑ Optimization Station utilization
☐ KANBAN	☐ VSM Simulation	☐ Ramp-Up
☐ Process time on netplan	☐ Configuration management	

Customer benefits

- Simple introduction to the software and the main basic functions of IMS.
- Rapid built up of a simulation in IMS for simple analyzes is possible.
- Understand the method of IMS to create, perform and analysis a simulation.

Purpose of the document

This tutorial describes the creation of a short demo for IMS (IMD & IMV). The demo should perform not longer than round about 15 minutes (max. 20). To be able to reach this target, some “try runs” are necessary to reach this time. This tutorial should help you to consider all relevant steps and settings to perform a runnable simulation at the end of the presentation – with some simple analysis reports.

Intention of the demo: The demo should introduce a potential customer, that’s possible to get quick-wins and reasonable results with IMS only with a simple structure and model. It’s not necessary to know and use all features and functions of IMS to apply the tool. In next planning steps the complexity of the structure and model can be increase, corresponding to the needs and requirements. As example the process structure can have more detailed processes (times) or the simulation model (material flow-model) can have station-types with a higher granularity and complexity.

<u>What are the professional targets (quick-wins) which can be shown with the illustration?</u>

- assure the delivery targets of the existing production orders.
- impact of extraordinary production orders.
- Investigation of possible solutions (shift extension) to comply the scheduling dates.

Business Case

A company has two productions sectors. The first is the “pre-assembly” and the second sector is the “final-assembly”. Both sectors are joint with a warehouse or stock (buffer) with a maximum capacity of 20 parts from the pre-assembly.

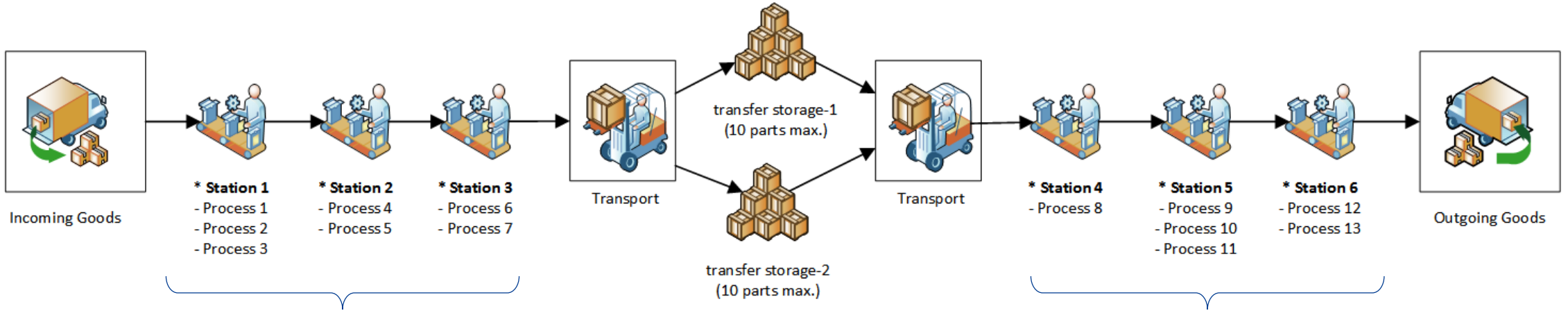
The pre-assembly has a total lead-time (cycle time) of 1 hour. The final assembly takes 4 hours. For the simplification of the structure in the pre- and final-assembly, there is only one process for pre- and one for the final-assembly. Therefore each sector has only one station in the simulation. Both sector have the same type of personal resource.

The task of the planer (customer) is, to check and verify if 40 orders which are already placed at the sales department can be arranged in time. And on the other hand, which consequences can have a new order with a high customer priority. In the example here (second scenario) there will be set a new task (high priority) with 5 parts which have to deliver by the existing production.

Illustration of the production line

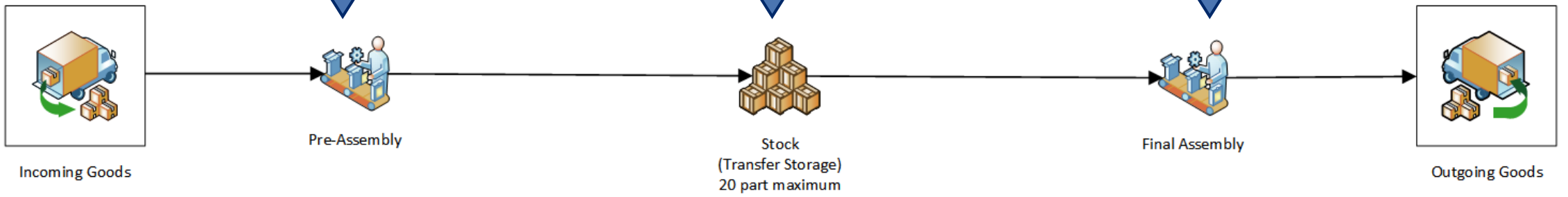
real production line (example)

(6 stations with different processes)



for simulation simplified production line

(2 stations with one process)



The times for transport will be reproduced in the assembly processes.

Overview procedures in IMD

1. Create a **product** folder structure (product group  , product  ,assembly )
2. Create a **product** configurations on product nodes 

3. Create a **resource** structure and resources („logical“ stations  teams 

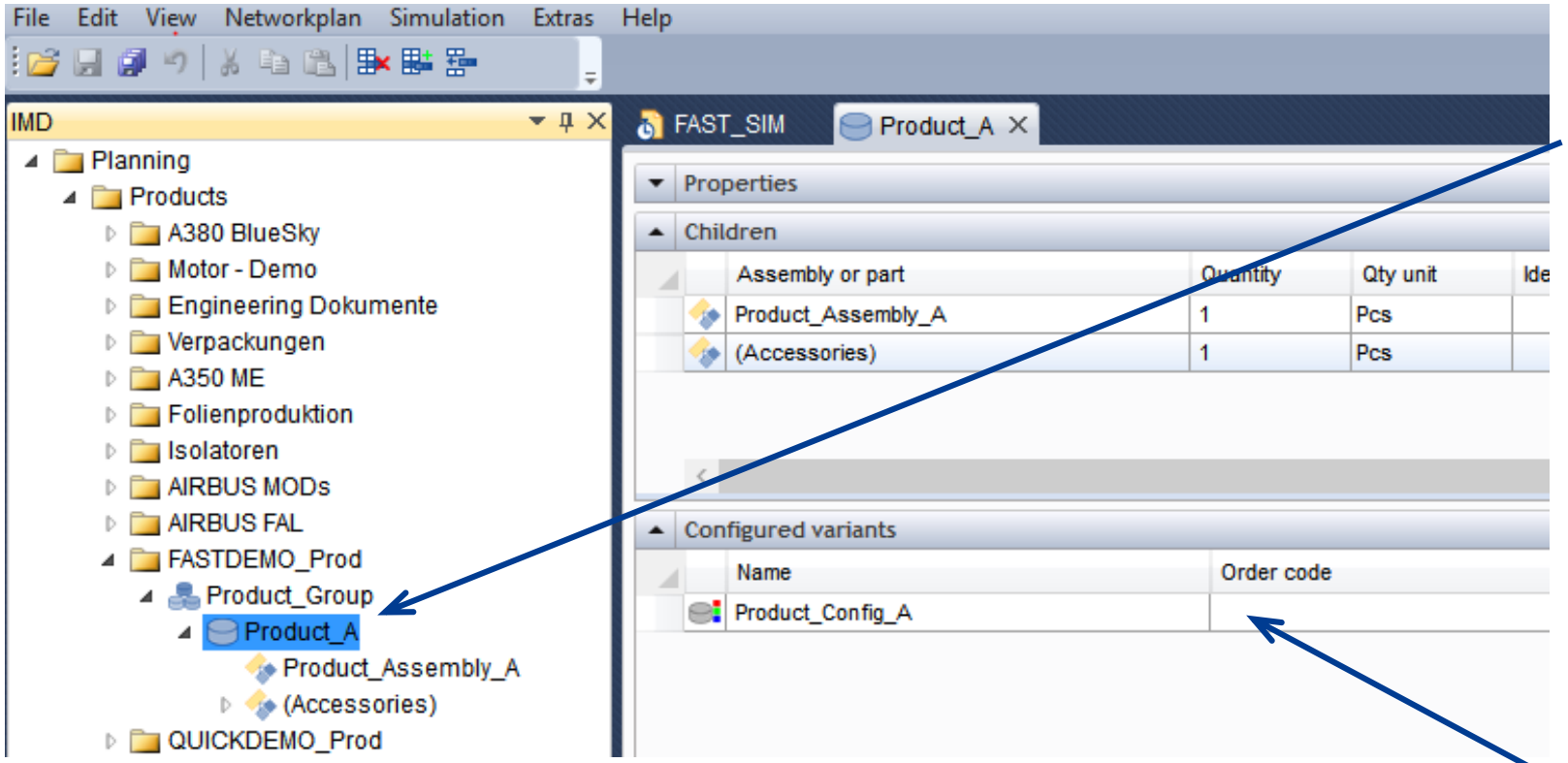
4. Create a **process** structure and processes (production  line  2 x work plan  process  per work plan
5. Define **process** parameters
    a. personal time (1 h pre assembly, 4 h final assembly)
    b. link (logical) stations
    c. link personal

6. link assembly group  to pre-assembly process  and define material flow 
    a. Input: Source (order entry)
    b. Output: Successor (next process)

7. link assembly group  to final-assembly process  and define material flow 
    1. Input: Predecessor (previous process)
    2. Output: Sink (order exit)

8. create a new network plan  on the “line”  process node
    1. link configuration to network plan

Create product structure



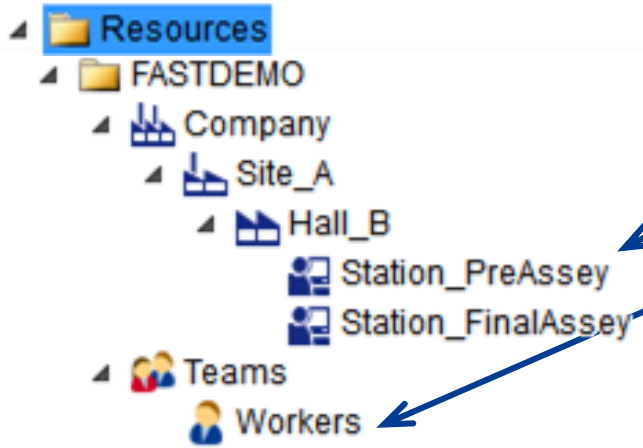
1. Create folder structure on assembly node.
2. Rename one of to two automatically created assembly nodes in e.g. „Product_Assembly_A“.

   (*Note:* the two assemblies *) will be created always automatically when set a “product nodes” and can’t be deleted in the first moment. Therefore let the assembly-note „Accessories“ as it is and don’t try to delete it.

3. create only one product configuration

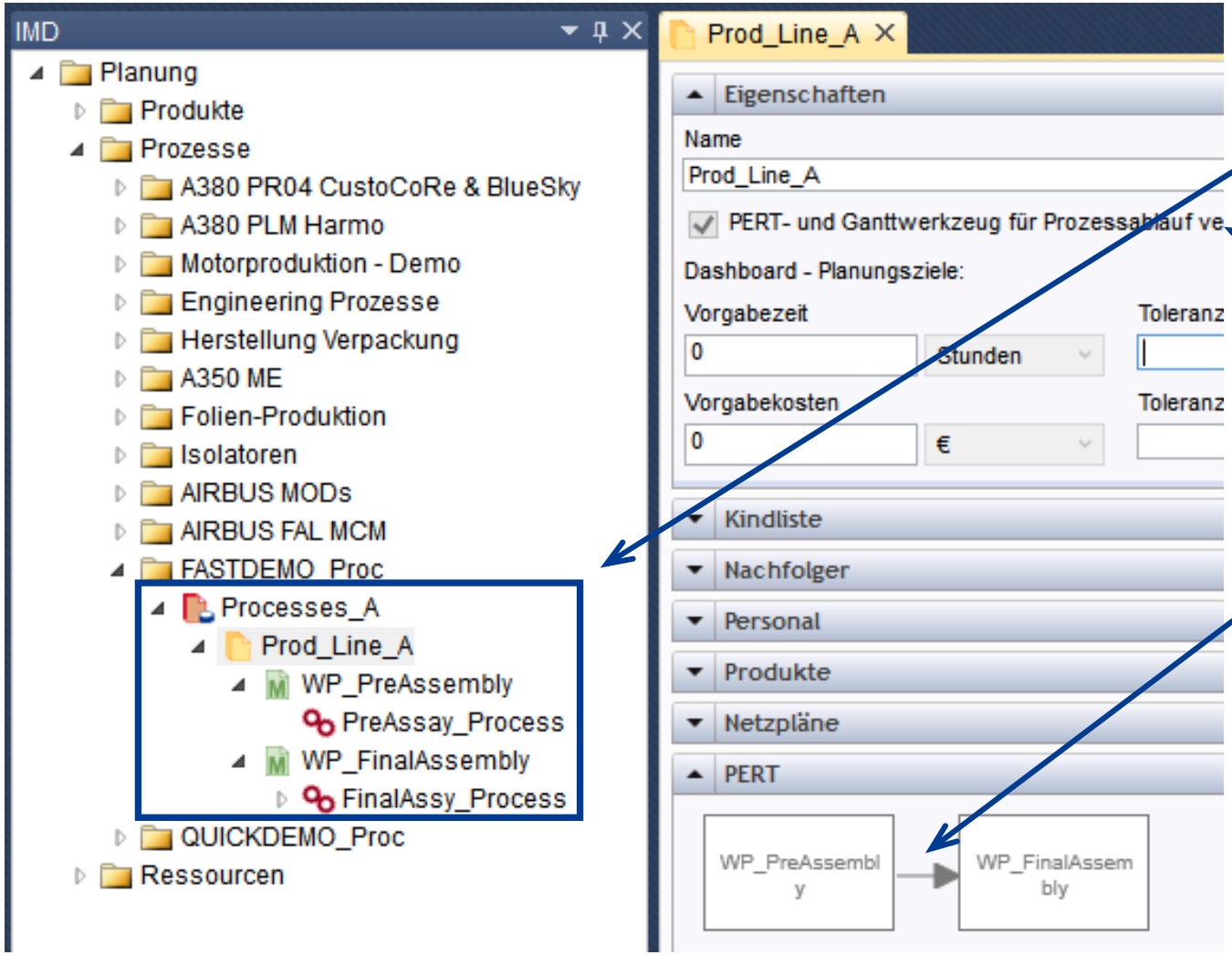
*) New Apparat
   (Base Assembly)
   (Accessories)

Create resource structure



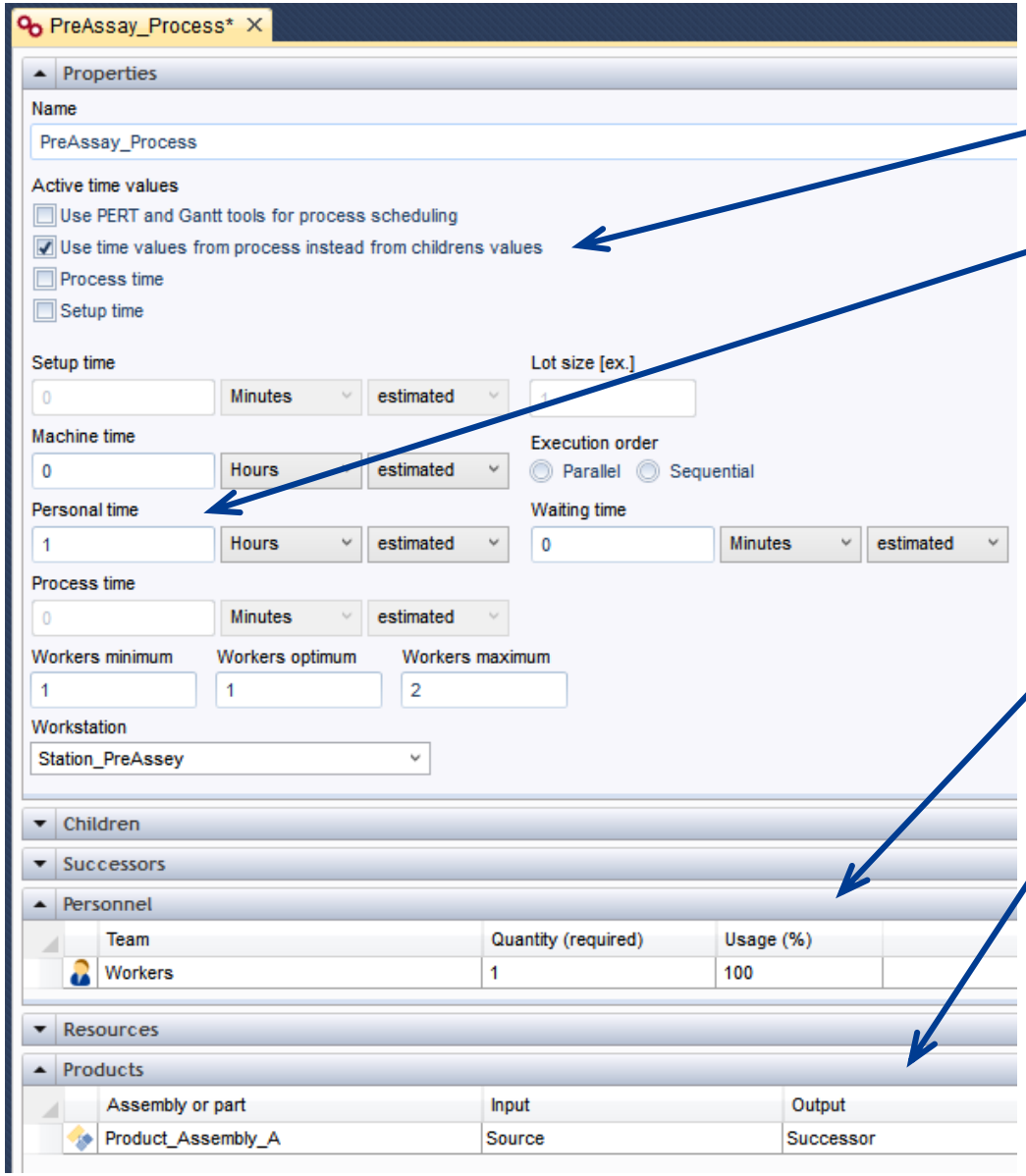
1. Create resource structure for two stations (pre- and final-assembly)
2. Create one team with one worker.

Create process structure



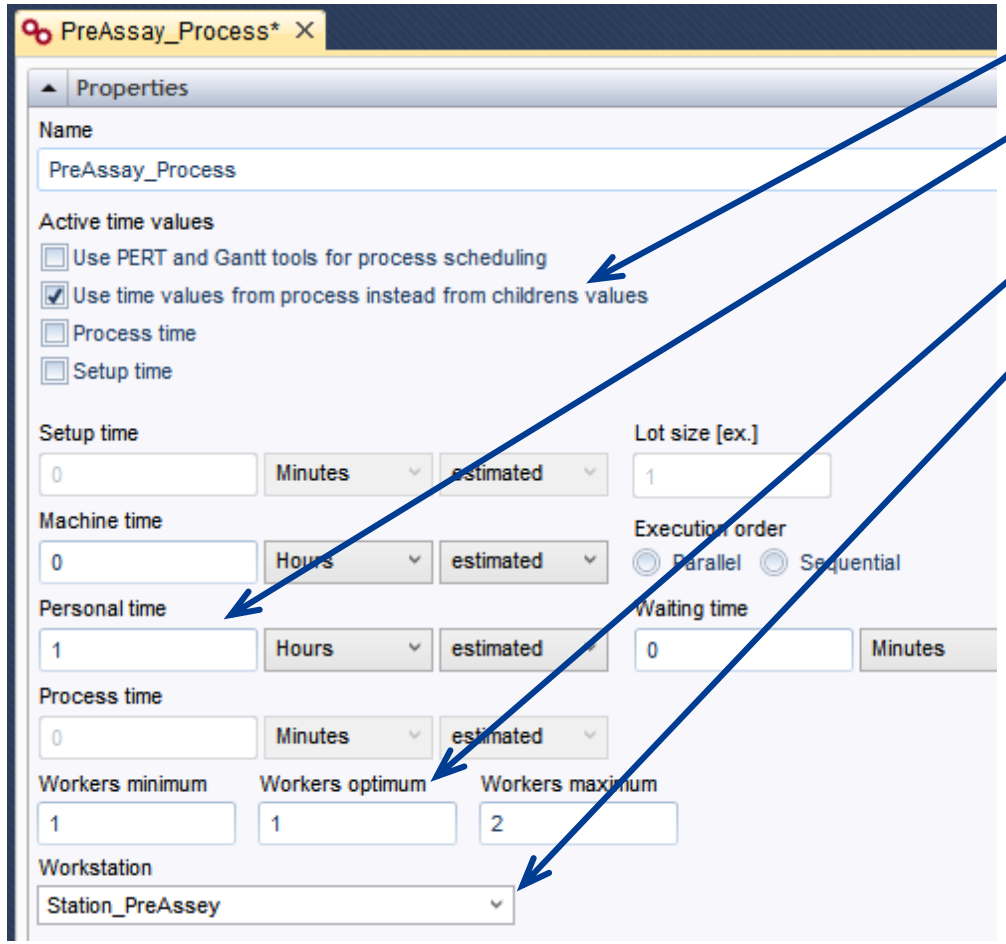
1. Create process structure under a brown process node. Create two processes, to better simulate a material flow with a buffer.
2. Define process order ☑
   a. activate checkbox „PERT- und Gantt…“.
   b. join sequence relations between processes (arrows).

Assign process parameter 1



1. Activate check-Box ☑ „Use time values from processes …“
2. Set process times (on brown processes) to 1 h for „**pre-assembly**“ and 4 h for „**final-assembly**“.
   methods to set the times are directly on the (brown) process like shown left, or (after step 3) over the network plan.
3. Link personal (worker) from resource stricter node (tree view).
4. Set material flow for each process (Input and Output).

Assign process parameter 2



2a) activate check-box „Use time values from processes … “

2b) process times (times on brown processes) set 1 hour für „Pre-Assembly“ und and 4 hours for „Final-Assembly“.

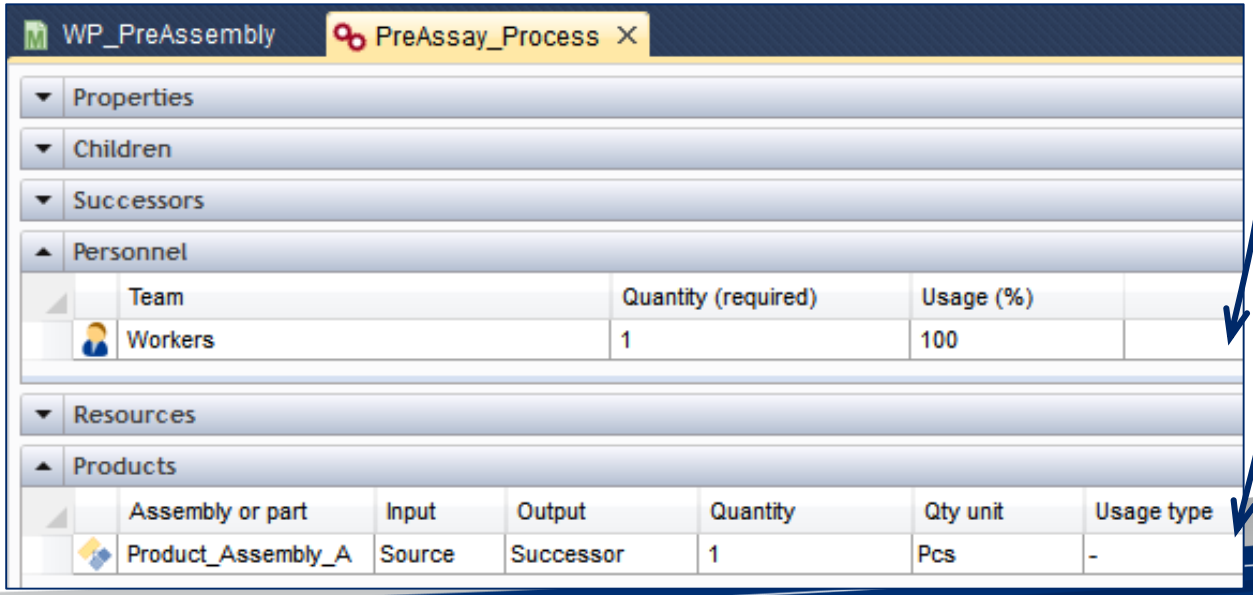
2c) set „workers optimum“ to “1”

2d) select a logical work station (here: “Station_PreAssey”)

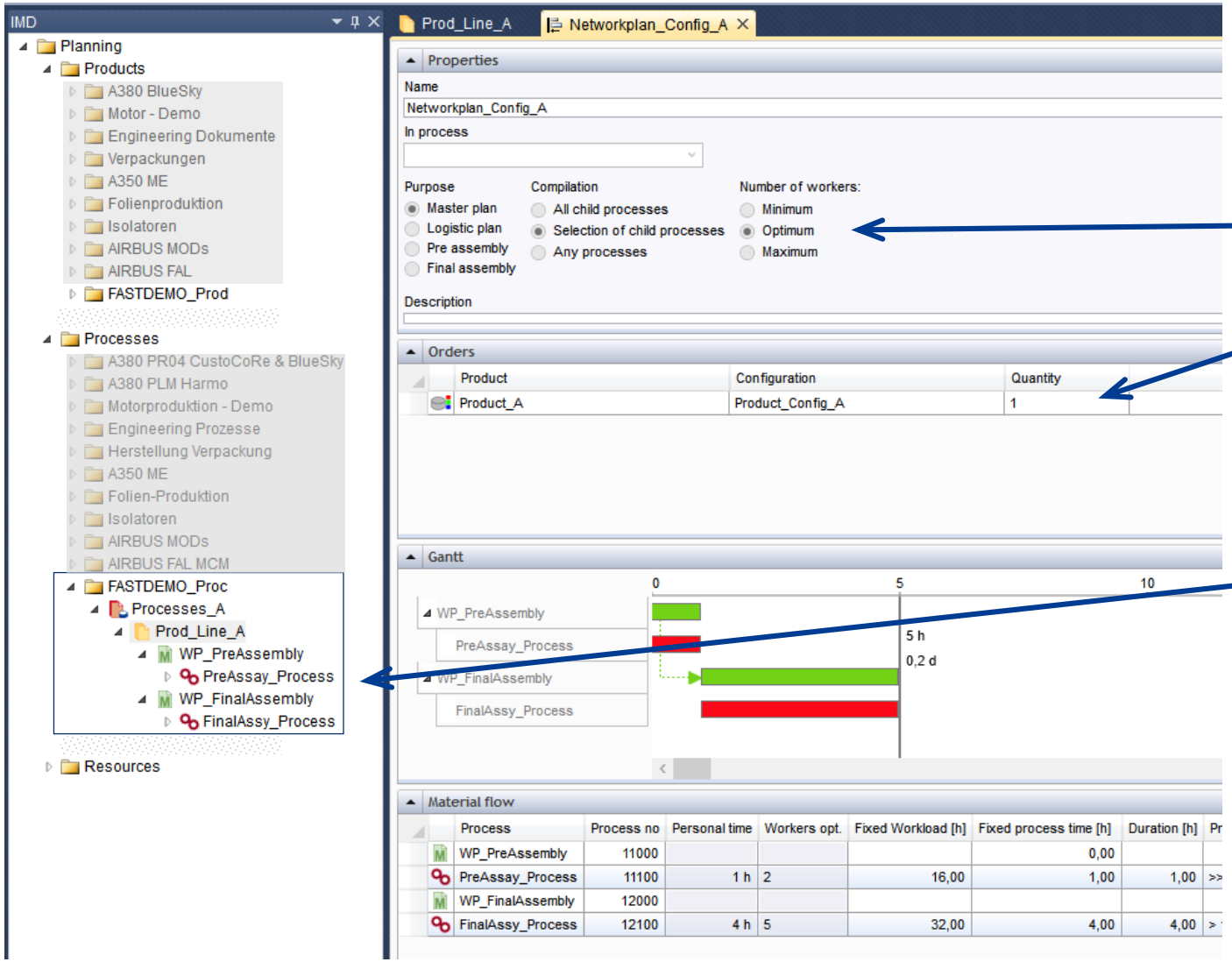
2e) link a person from the resource structure.

2f) link the assembly group “Product_Assembly_A” and set on Input „Source“ and for Output „Successor“.

2g) The same for process „FinalAssembly-Process“, but for Input now choose “Predecessor” and for Output “Sink”.



Create network plan

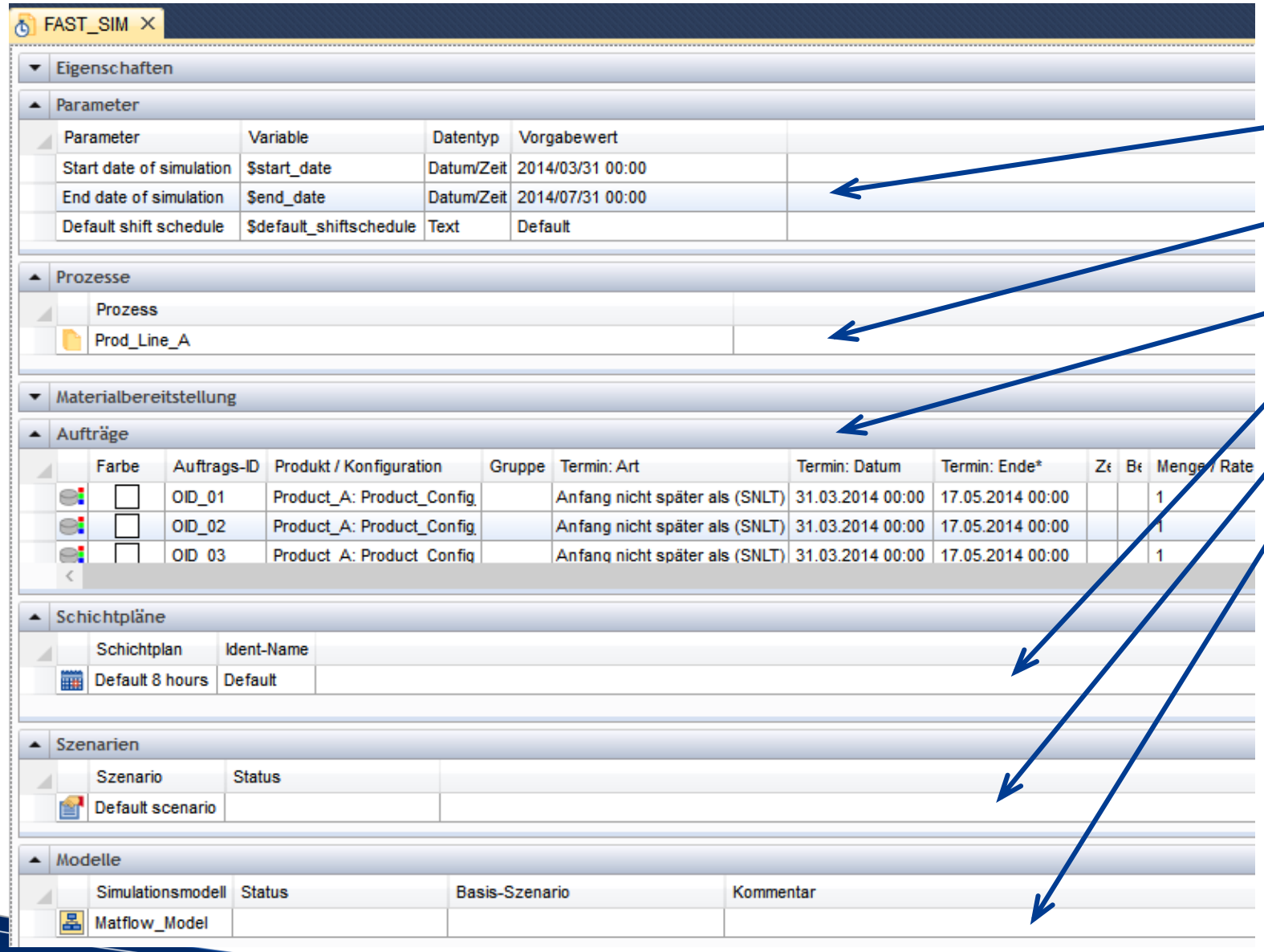


1. Create only one network plan on the “yellow-node” “Prod_Line_A” for the one given product configuration.
2. Use following settings when using the wizard or define it directly in the plan.
3. link product configuration to network plan
4. link the two green process nodes to the material flow view (list).
5. link both green process nodes into the network-plan („Material flow“ view) from the process tree view.
6. Balance (right mouse click in „Gantt“ view) and save the network-plan.

Overview process – IMV

1. Create simulation project 
2. Set simulation parameter
    a. start time
    b. end time
    c. shift model (use default)
3. Link process from IMD
4. Define orders 
5. Adapt shift plan if necessary (8 h shift is standard) 
6. Create (set) scenario 
    a. link network plans from IMD
7. Generate the simulation model 
    a. add station objects and link them to the logical stations from IMD (resource view)
    b. select/define the product configuration at the order entry and order exit
8. Create a simulation run 

Create simulation project



1. Set standard parameters
   a. Start date
   b. End date
   c. Shift model (use default)
2. Link process node on which the network plan are defined to the simulation project.
3. Define orders (see slide 13)
4. Adapt shift plan if necessary (Indent-Name „Default“ has a 8 h shift).
5. Create scenario (see slide 14)
6. Create simulation model (see slide 15)

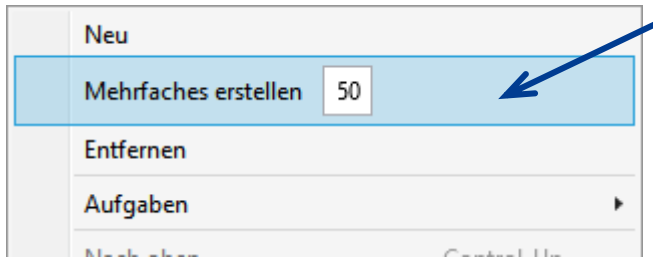
Define orders

pre define orders in Excel first, then copy & paste them into the grid view in IMS
(sort columns first in IMS)

*)

Orders

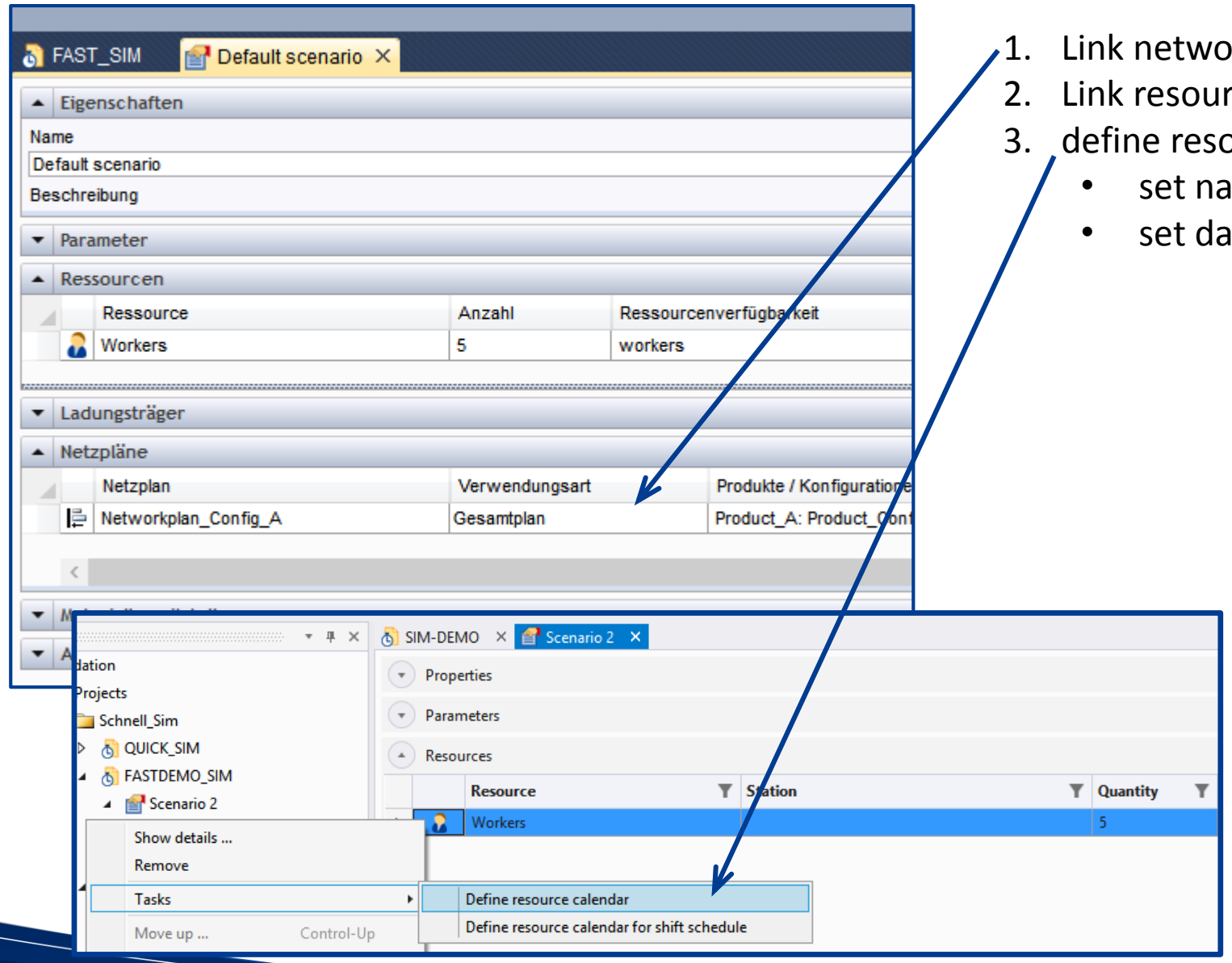
Color	Order ID	Product / Configuration	Scheduling target	Date start	Date end	Quantity/C
	OID_01	Product_A: Product_Config_A	Start no later than (SNLT)	31.03.2014 07:00	04.04.2014 00:00	1
	OID_02	Product_A: Product_Config_A	Start no later than (SNLT)	31.03.2014 07:02	04.04.2014 00:00	1
	OID_03	Product_A: Product_Config_A	Start no later than (SNLT)	31.03.2014 07:04	04.04.2014 00:00	1
	OID_04	Product_A: Product_Config_A	Start no later than (SNLT)	31.03.2014 07:06	04.04.2014 00:00	1
	OID_05	Product_A: Product_Config_A	Start no later than (SNLT)	31.03.2014 07:08	04.04.2014 00:00	1



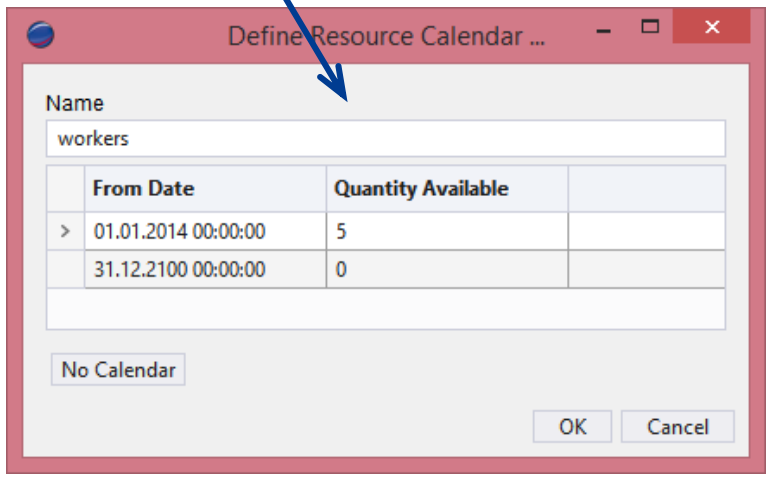
1. define 50 orders („multi create“)
2. pre define orders in excel first. (marked table)
   a. Set a specific start date and „end date“ for each order
   b. pay attention to use unique order-IDs
   c. copy columns (the matrix) from Excel to IMV
   d. allocate the product configuration from IMD (product structure) to all orders.

***) Important: pay attention that there have to be a difference of approx. 1-2 minutes between the start time of the orders!**

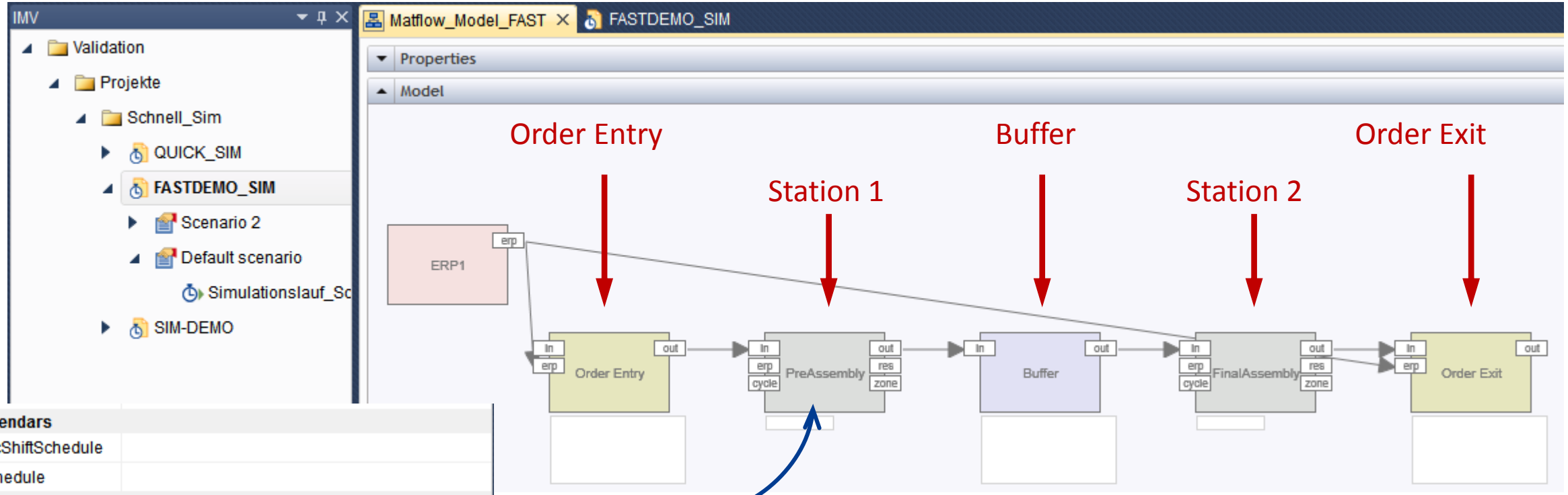
Define scenario

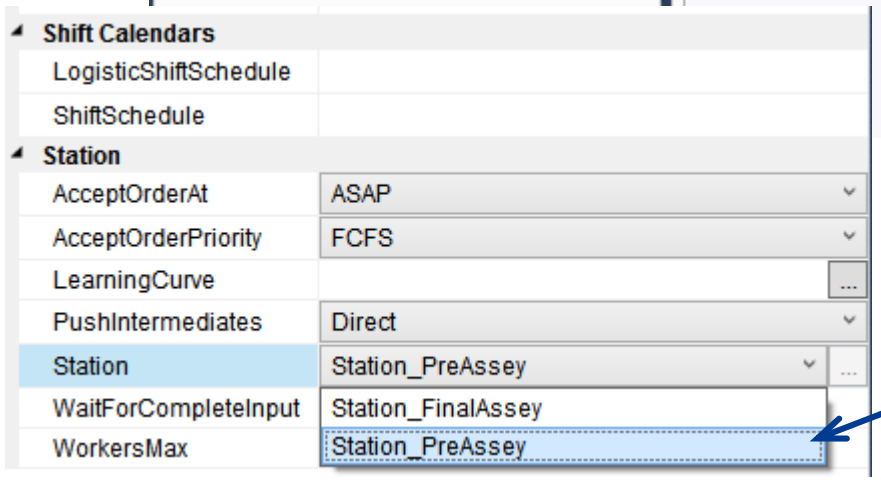


1. Link network plans from IMD process node to the scenario
2. Link resource (personal) from resource structure
3. define resource calendar at the resources
   - set name for the calendar
   - set date when resource is available (e.g. 01.01.2000)



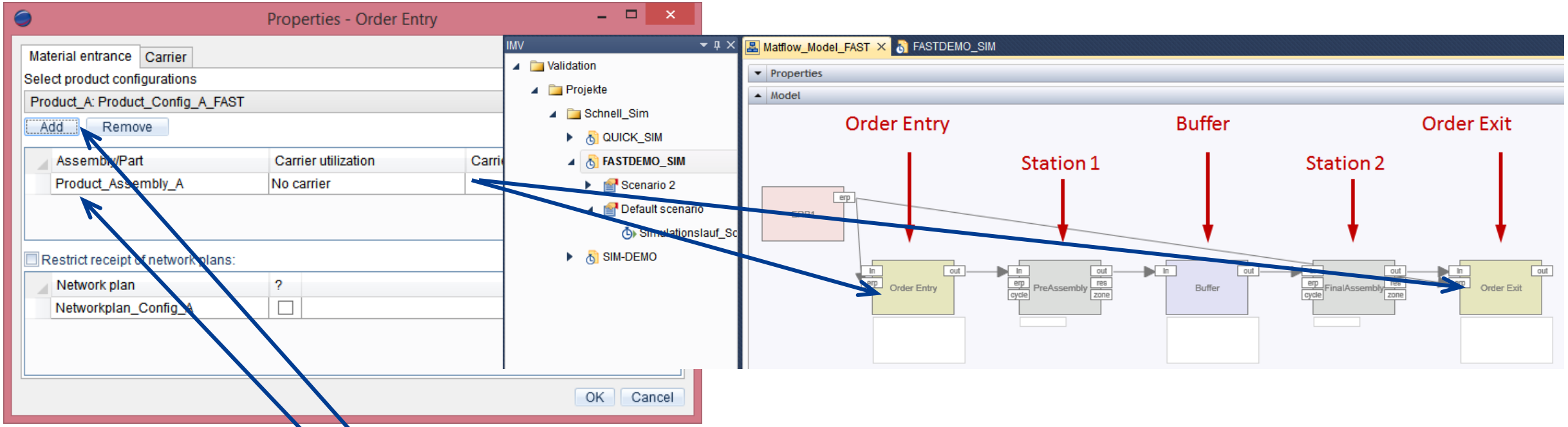
Create simulation model





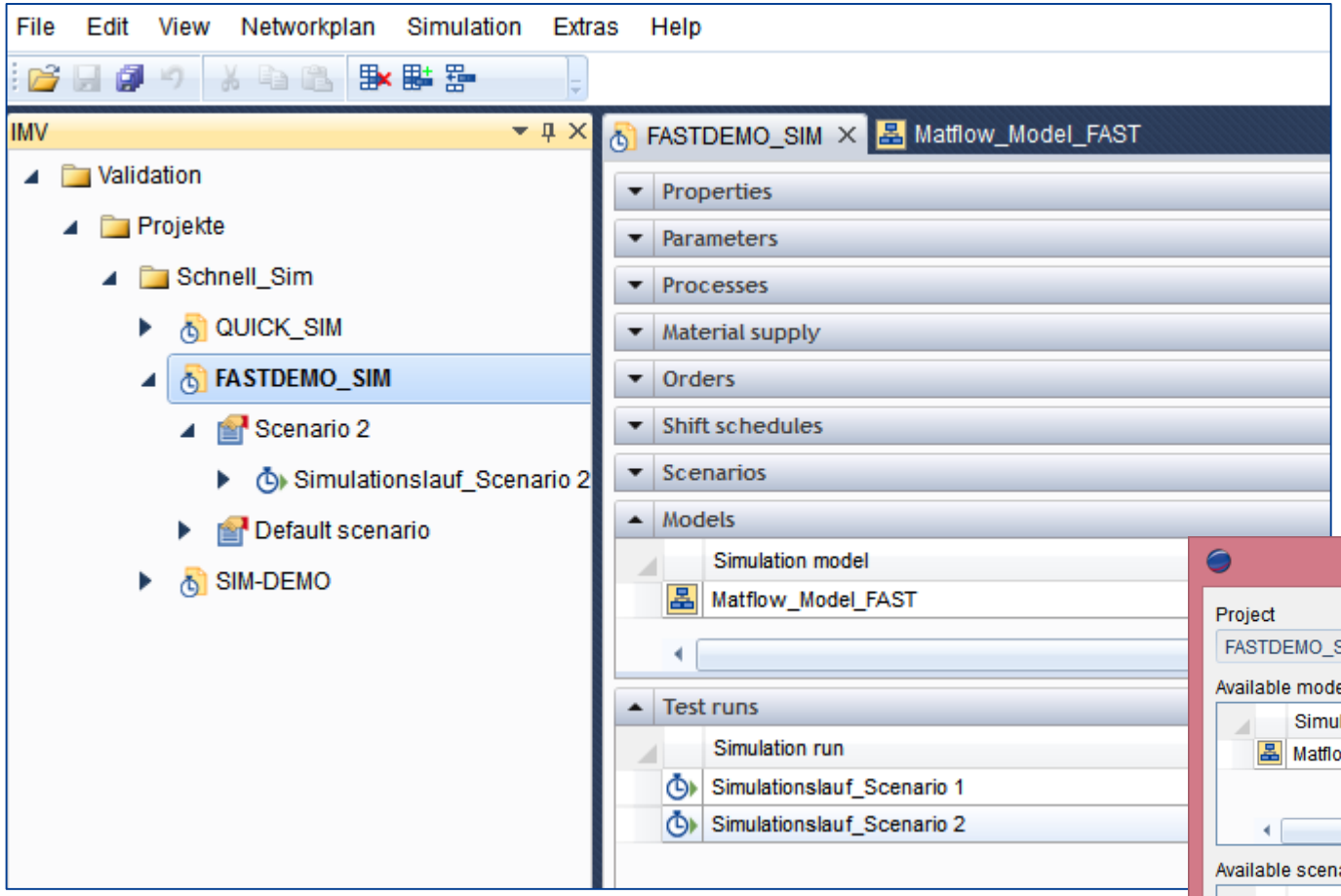
1. Add the object shown in the map above and connect them in sequence.
2. Connect the ERP node with the order entry and order exit only.
3. Apply the stations the corresponding logical station from IMD
4. … next slide

Create simulation model

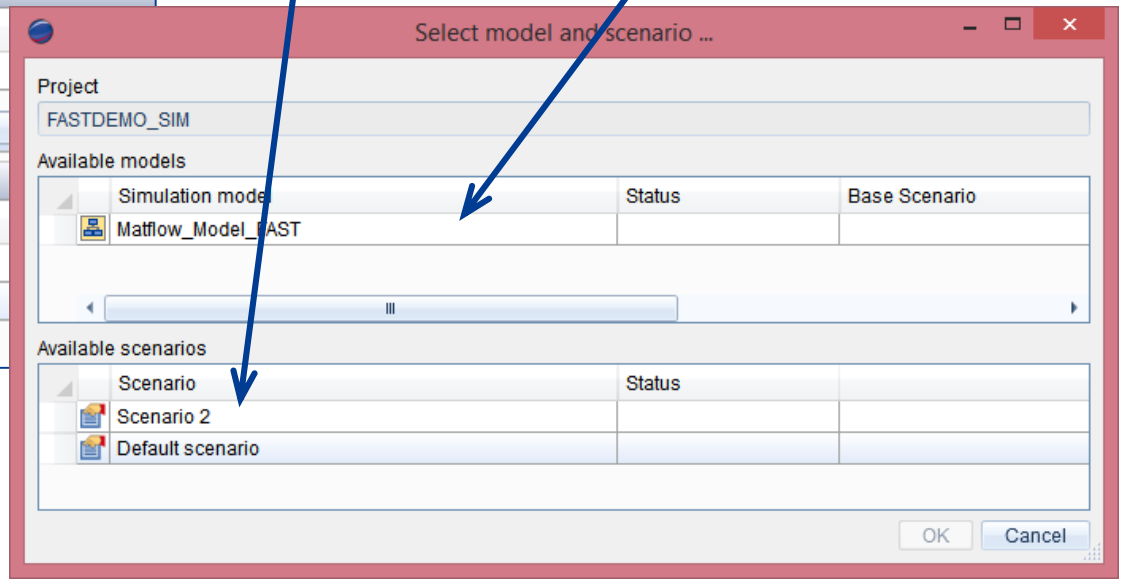


5. Apply the product configurations from IMD which have to produce (there is only one in this demo) to the “order entry” and “order exit” objects -> (*right mouse button, „Advanced properties“)*
   a. Select product configuration („Add“)
   b. In case attach the part/assembly manually (*right mouse „new“*) to the configuration. Normally it’s should be already applied automatically.

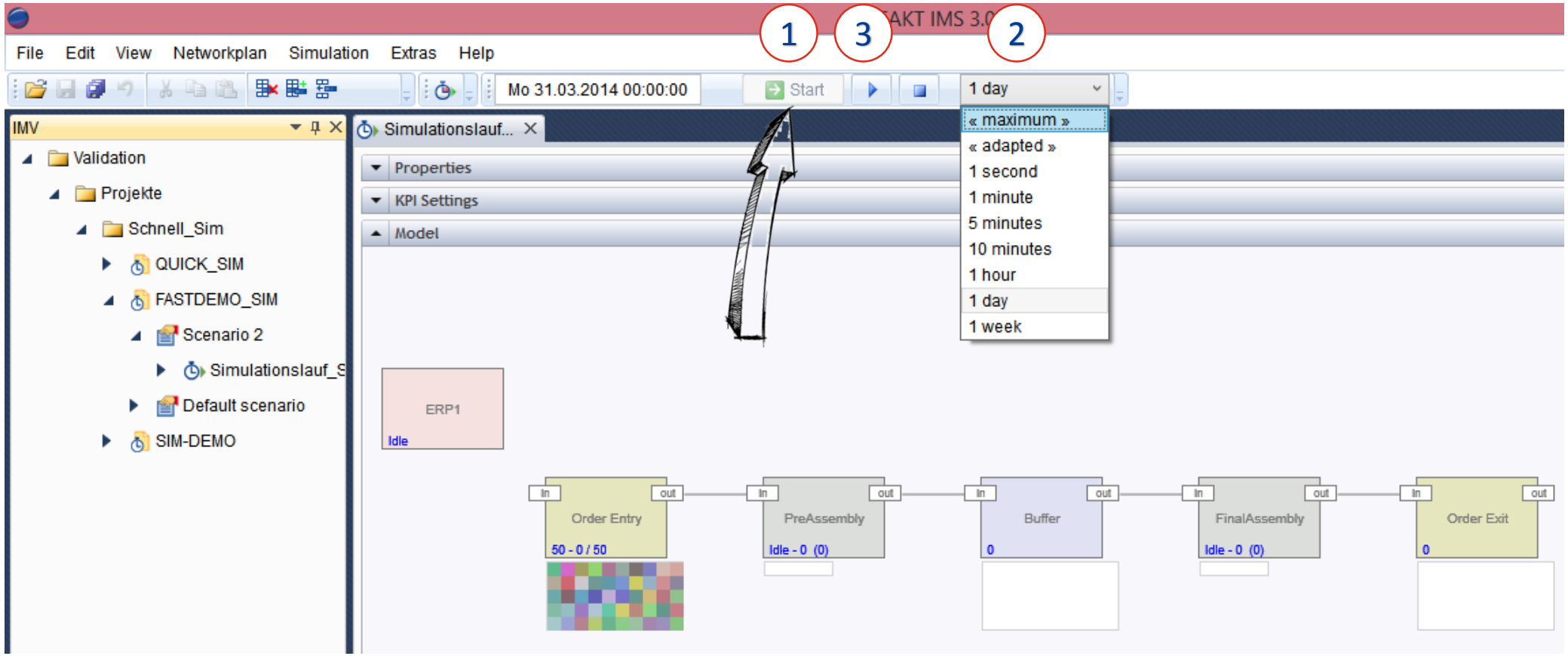
Define simulation run



1. Create a simulation run in “Test runs” by „right mouse click” -> New.
2. Select corresponding simulation model and scenario.
3. Confirm with „OK“

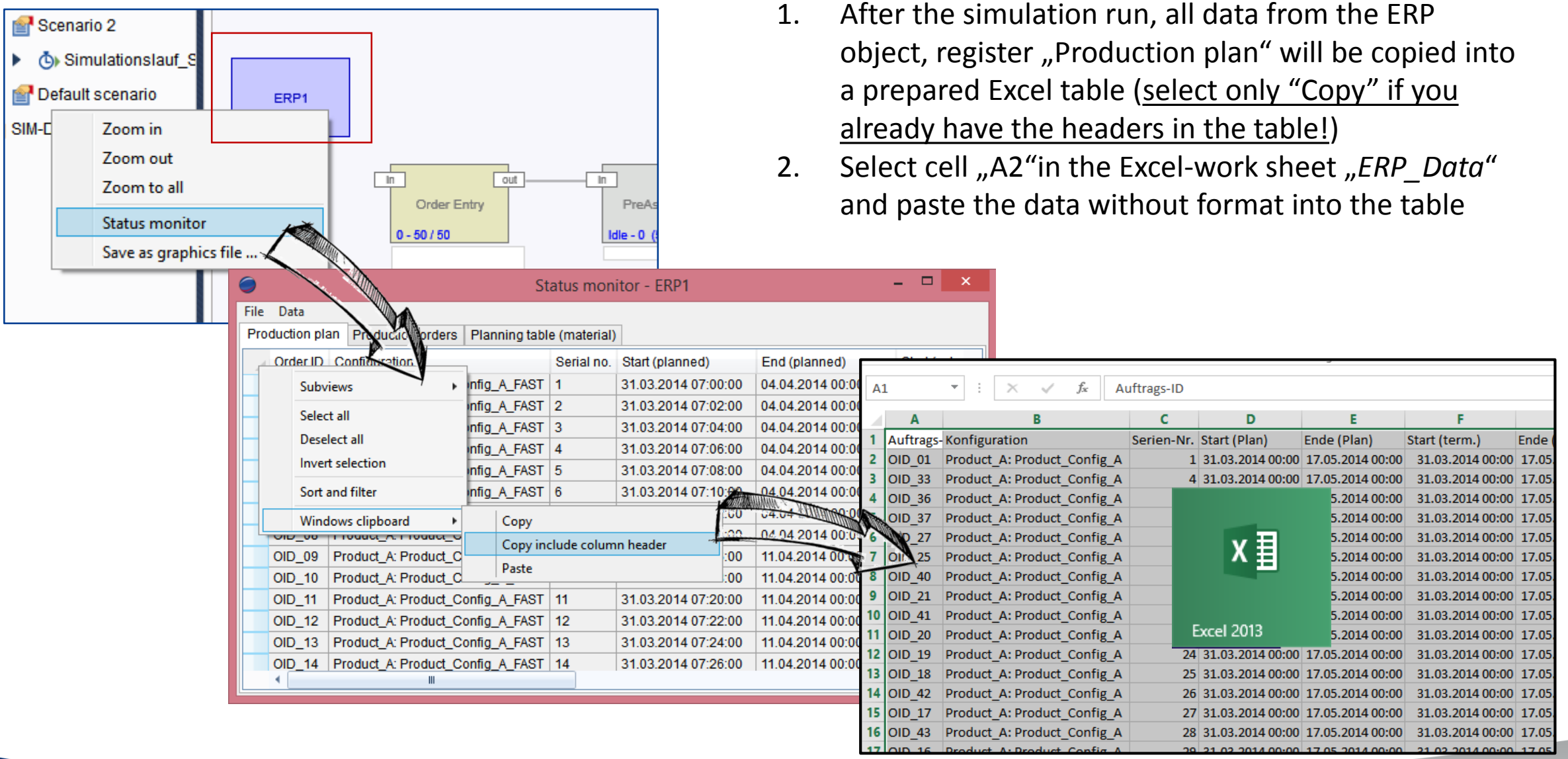


Start simulation



1. Press „start“-bottom (activates simulation)
2. set time interval to “maximum”
3. start simulation run by pressing “play”-bottom (start sim run)
4. Alternative: Press F9 (Quick-Sim)

Analysis scenario 1 – order analysis



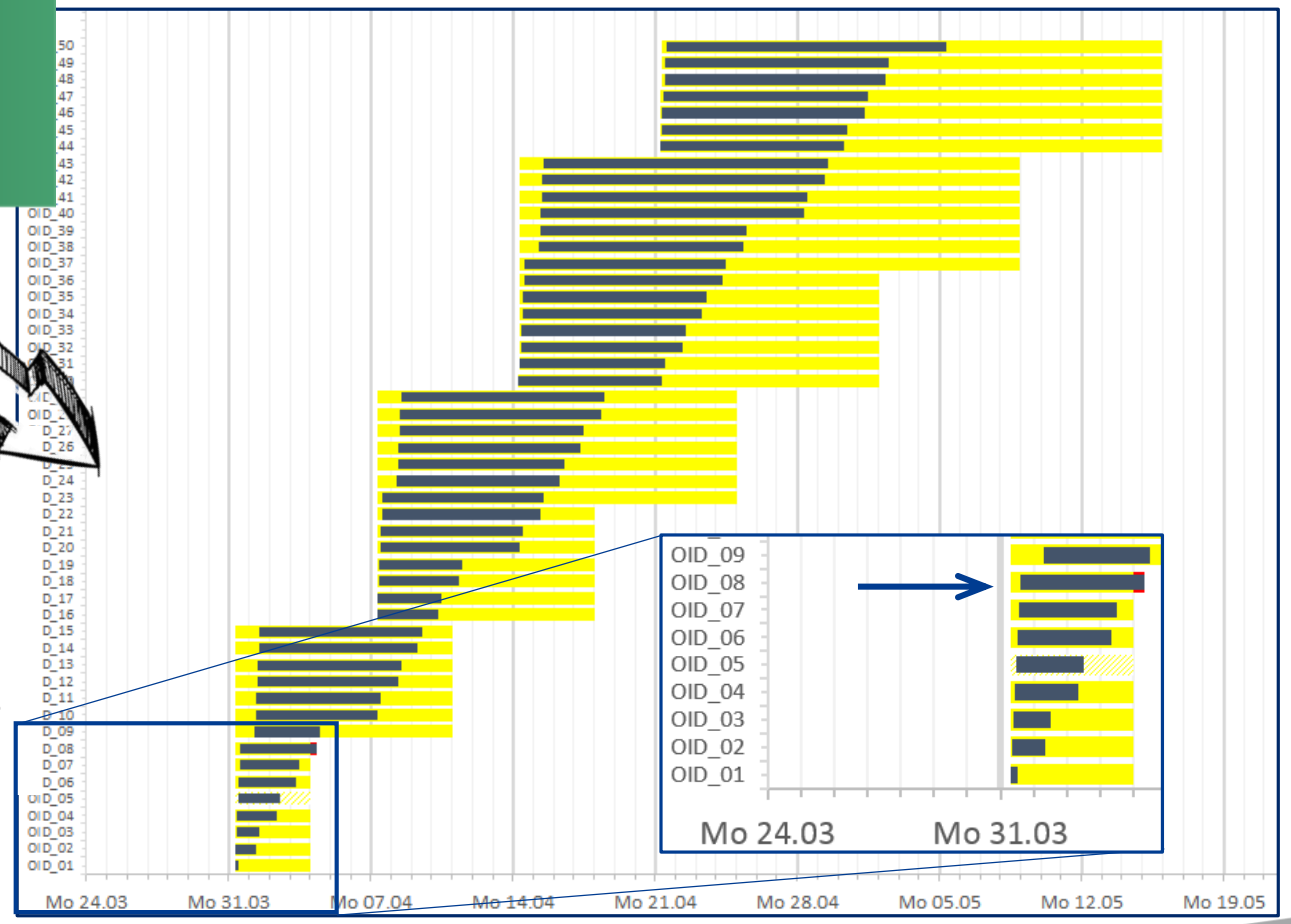
1. After the simulation run, all data from the ERP object, register „Production plan“ will be copied into a prepared Excel table (<u>select only “Copy” if you already have the headers in the table!</u>)
2. Select cell „A2“in the Excel-work sheet „*ERP_Data*“ and paste the data without format into the table

Result Scenario 1 – order analysis

A1 | Auftrags-ID

	A	B	C	D	E	F	
1	Auftrags-	Konfiguration	Serien-Nr.	Start (Plan)	Ende (Plan)	Start (term.)	Ende (
2	OID_01	Product_A: Product_Config_A	1	31.03.2014 00:00	17.05.2014 00:00	31.03.2014 00:00	17.05.
3	OID_33	Product_A: Product_Config_A	4	31.03.2014 00:00	17.05.2014 00:00	31.03.2014 00:00	17.05.
4	OID_36	Product_A: Product_Config_A	6	31.03.2014 00:00	17.05.2014 00:00	31.03.2014 00:00	1
5	OID_37	Product_A: Product_Config_A	10	31.03.2014 00:00	17.05.2014 00:00	31.03.2014 00:00	1
6	OID_27	Product_A: Product_Config_A	13	31.03.2014 00:00	17.05.2014 00:00	31.03.2014 00:00	1
7	OID_25	Product_A: Product_Config_A	16	31.03.2014 00:00	17.05.2014 00:00	31.03.2014 00:00	1
8	OID_40	Product_A: Product_Config_A	18	31.03.2014 00:00	17.05.2014 00:00	31.03.2014 00:00	1
9	OID_21	Product_A: Product_Config_A	21	31.03.2014 00:00	17.05.2014 00:00	31.03.2014 00:00	1
10	OID_41	Product_A: Product_Config_A	22	31.03.2014 00:00	17.05.2014 00:00	31.03.2014 00:00	1
11	OID_20	Product_A: Product_Config_A	23	31.03.2014 00:00	17.05.2014 00:00	31.03.2014 00:00	1
12	OID_19	Product_A: Product_Config_A	24	31.03.2014 00:00	17.05.2014 00:00	31.03.2014 00:00	17.05.
13	OID_18	Product_A: Product_Config_A	25	31.03.2014 00:00	17.05.2014 00:00	31.03.2014 00:00	17
14	OID_42	Product_A: Product_Config_A	26	31.03.2014 00:00	17.05.2014 00:00	31.03.2014 00:00	17.
15	OID_17	Product_A: Product_Config_A	27	31.03.2014 00:00	17.05.2014 00:00	31.03.2014 00:0	17.05.
16	OID_43	Product_A: Product_Config_A	28	31.03.2014 00:00	17.05.2014 00:00	31.03.2014 00:00	17.05.
17	OID_16	Product_A: Product_Config_A	29	31.03.2014 00:00	17.05.2014 00:00	31.03.2014 00:00	17.05

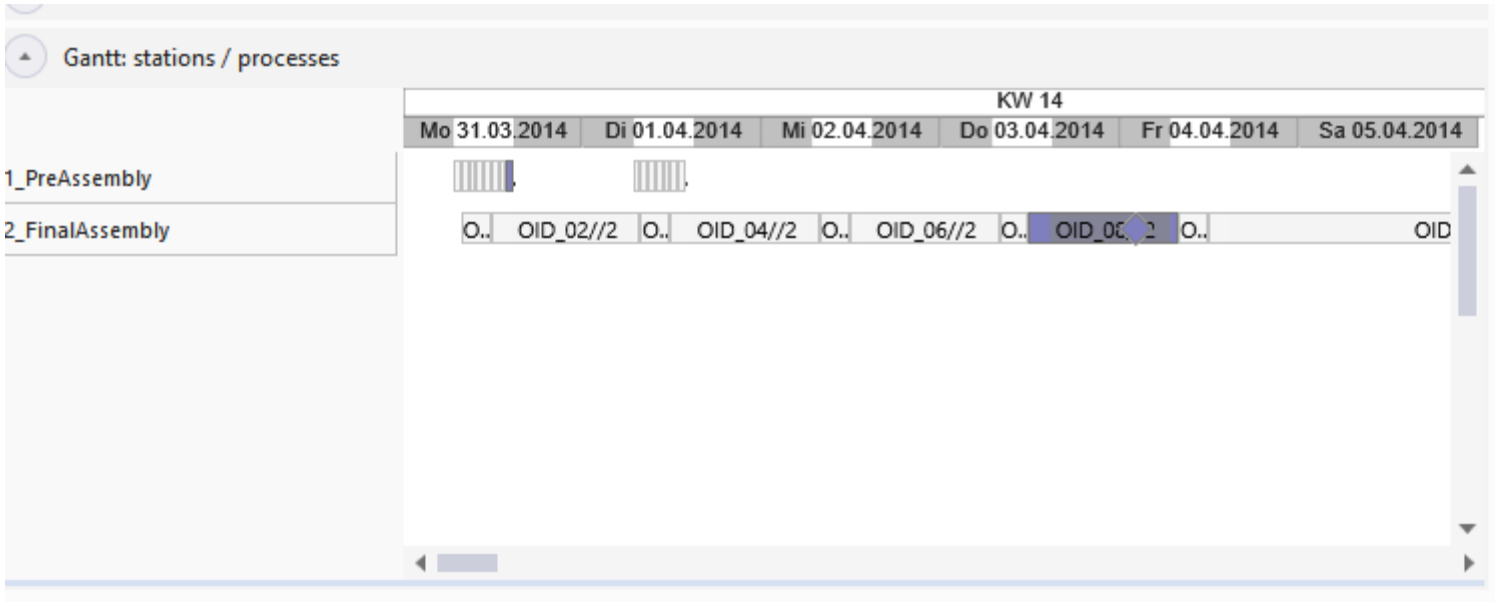
Excel 2013

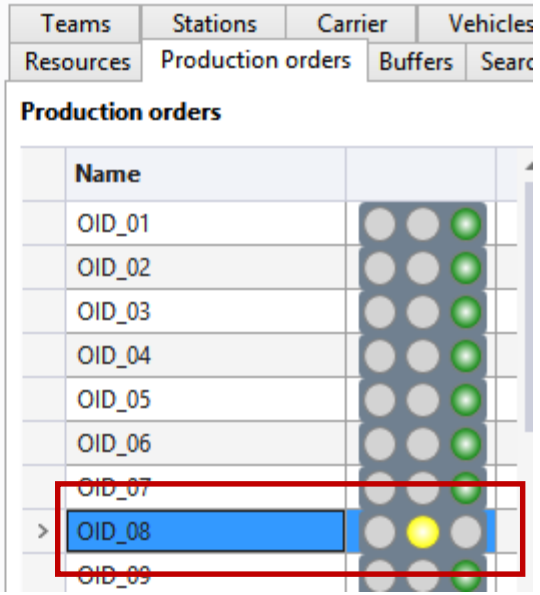


1. The first simulation run (scenario 1) will get the result shown in the picture right.
   a. yellow bar is the given target date scope
   b. dark blue is the simulated date scope
2. Almost all orders are in time (target date). Only order no. eight is be hard up outside the target.

Result Scenario 1 – order analysis

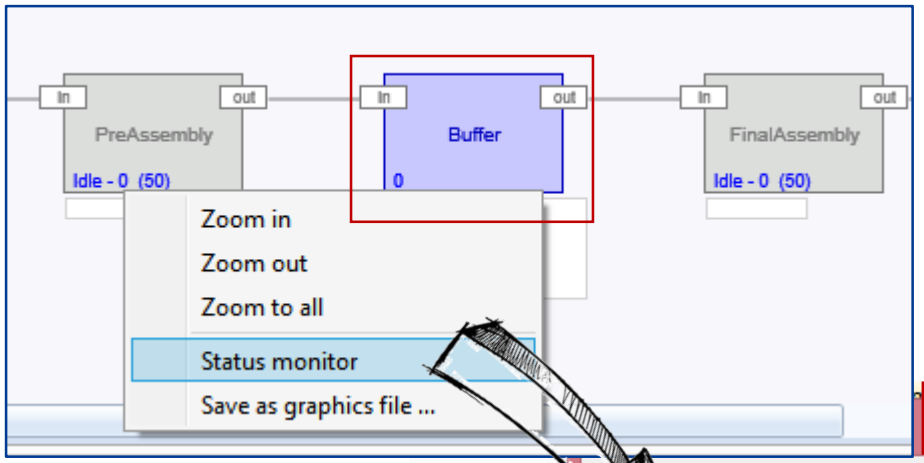
This can also displayed very quickly in the “Production orders” list,
right hand in the dashboard. But only as a quantity value not with exact times.

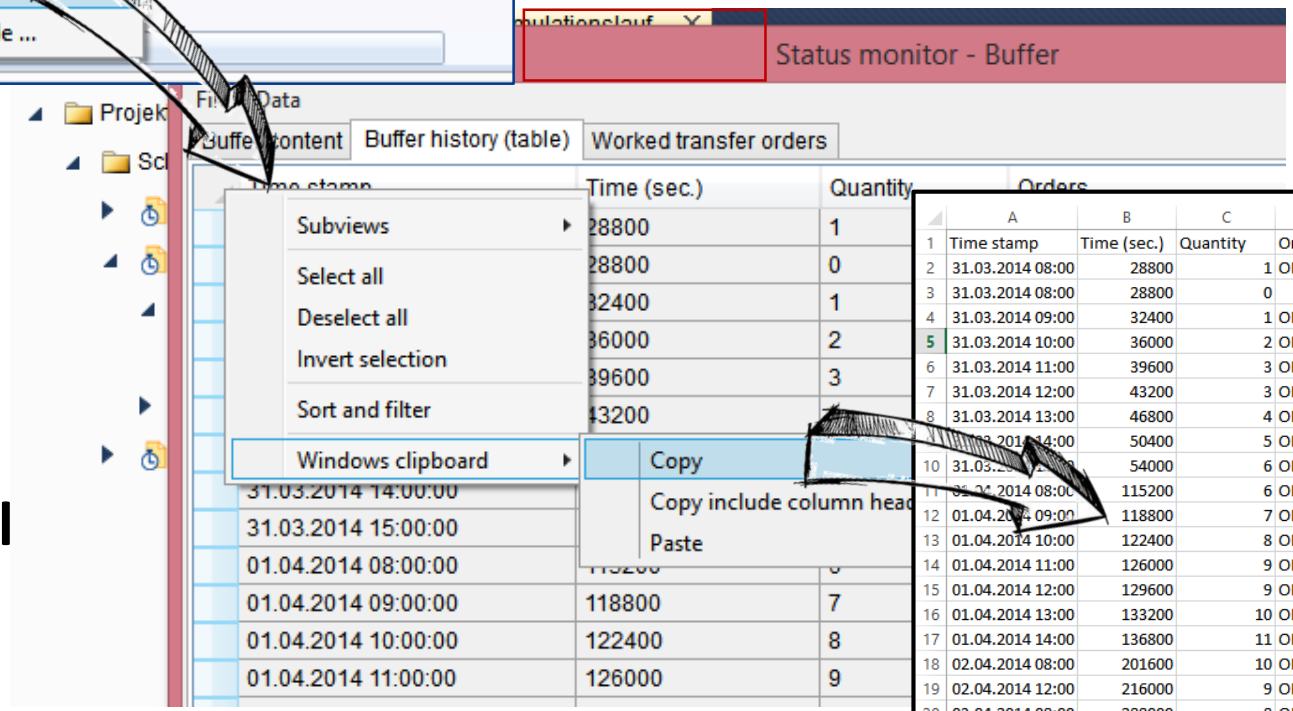


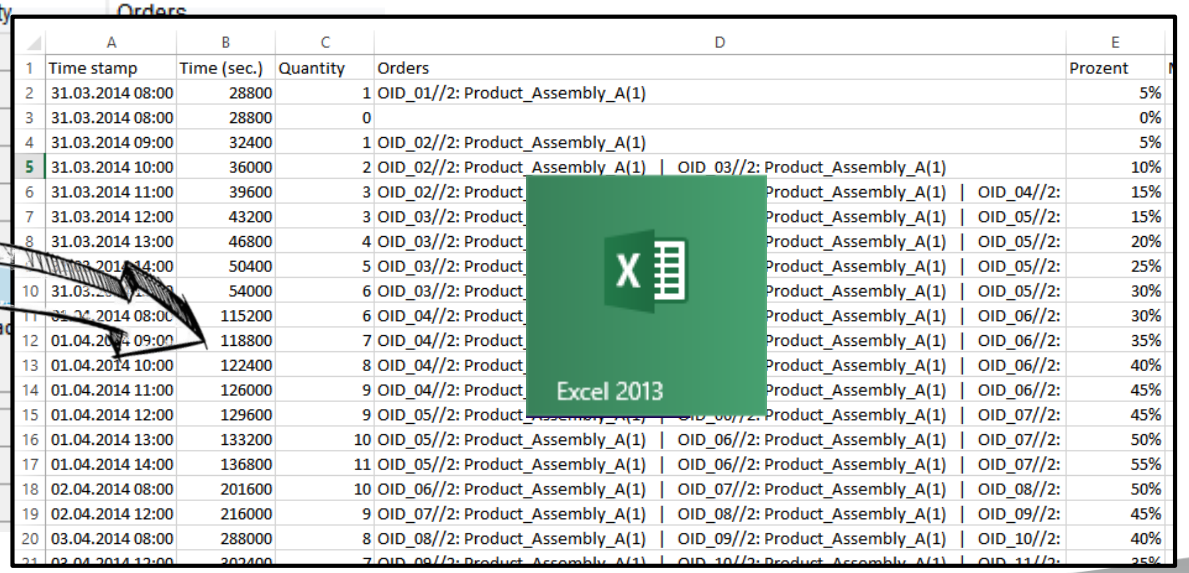


Analysis Scenario 1 – buffer analysis

1. After the simulation run the data from the Buffer object, register „Buffer history (table)“ will be copied to an prepared sample Excel table (<u>select only “Copy” if you already have the headers in the table!</u>).
2. Select cell „A2“ in the Excel work sheet „*Buffer state*“ and paste the data without format into the table







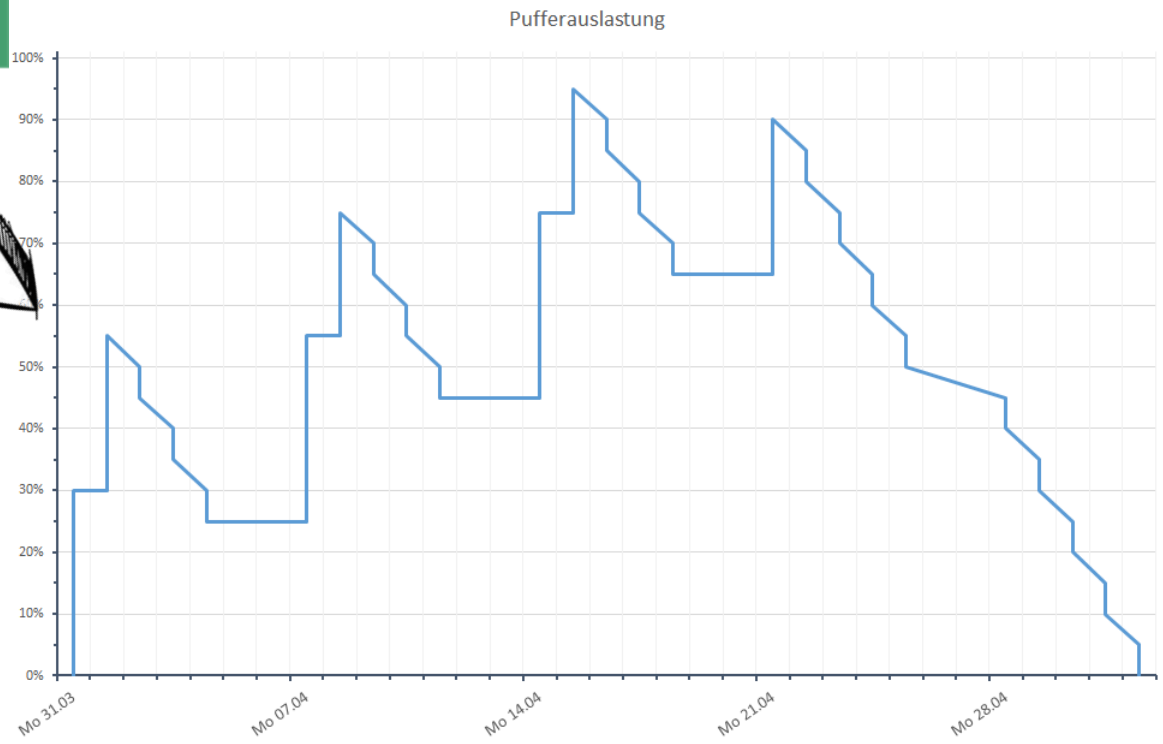
first select all with *Ctrl + A*

Result Scenario 1 – buffer analysis

A1 | Auftrags-ID

	A	B	C	D	E	F	
1	Auftrags-	Konfiguration	Serien-Nr.	Start (Plan)	Ende (Plan)	Start (term.)	Ende (
2	OID_01	Product_A: Product_Config_A	1	31.03.2014 00:00	17.05.2014 00:00	31.03.2014 00:00	17.05.
3	OID_33	Product_A: Product_Config_A	4	31.03.2014 00:00	17.05.2014 00:00	31.03.2014 00:00	17.05.
4	OID_36	Product_A: Product_Config_A	6	31.03.2014 00:00	17.05.2014 00:00	31.03.2014 00:00	17.
5	OID_37	Product_A: Product_Config_A	10	31.03.2014 00:00	17.05.2014 00:00	31.03.2014 00:00	17.
6	OID_27	Product_A: Product_Config_A	13	31.03.2014 00:00	17.05.2014 00:00	31.03.2014 00:00	17.
7	OID_25	Product_A: Product_Config_A	16	31.03.2014 00:00	17.05.2014 00:00	31.03.2014 00:00	17.
8	OID_40	Product_A: Product_Config_A	18	31.03.2014 00:00	17.05.2014 00:00	31.03.2014 00:00	17.
9	OID_21	Product_A: Product_Config_A	21	31.03.2014 00:00	17.05.2014 00:00	31.03.2014 00:00	17.
10	OID_41	Product_A: Product_Config_A	22	31.03.2014 00:00	17.05.2014 00:00	31.03.2014 00:00	17.
11	OID_20	Product_A: Product_Config_A	23	31.03.2014 00:00	17.05.2014 00:00	31.03.2014 00:00	17.
12	OID_19	Product_A: Product_Config_A	24	31.03.2014 00:00	17.05.2014 00:00	31.03.2014 00:00	17.05.
13	OID_18	Product_A: Product_Config_A	25	31.03.2014 00:00	17.05.2014 00:00	31.03.2014 00:00	
14	OID_42	Product_A: Product_Config_A	26	31.03.2014 00:00	17.05.2014 00:00	31.03.2014 00:00	17.05.
15	OID_17	Product_A: Product_Config_A	27	31.03.2014 00:00	17.05.2014 00:00	31.03.2014 00:00	17.05.
16	OID_43	Product_A: Product_Config_A	28	31.03.2014 00:00	17.05.2014 00:00	31.03.2014 00:00	17.05.
17	OID_16	Product_A: Product_Config_A	29	31.03.2014 00:00	17.05.2014 00:00	31.03.2014 00:00	17.05.

Excel 2013

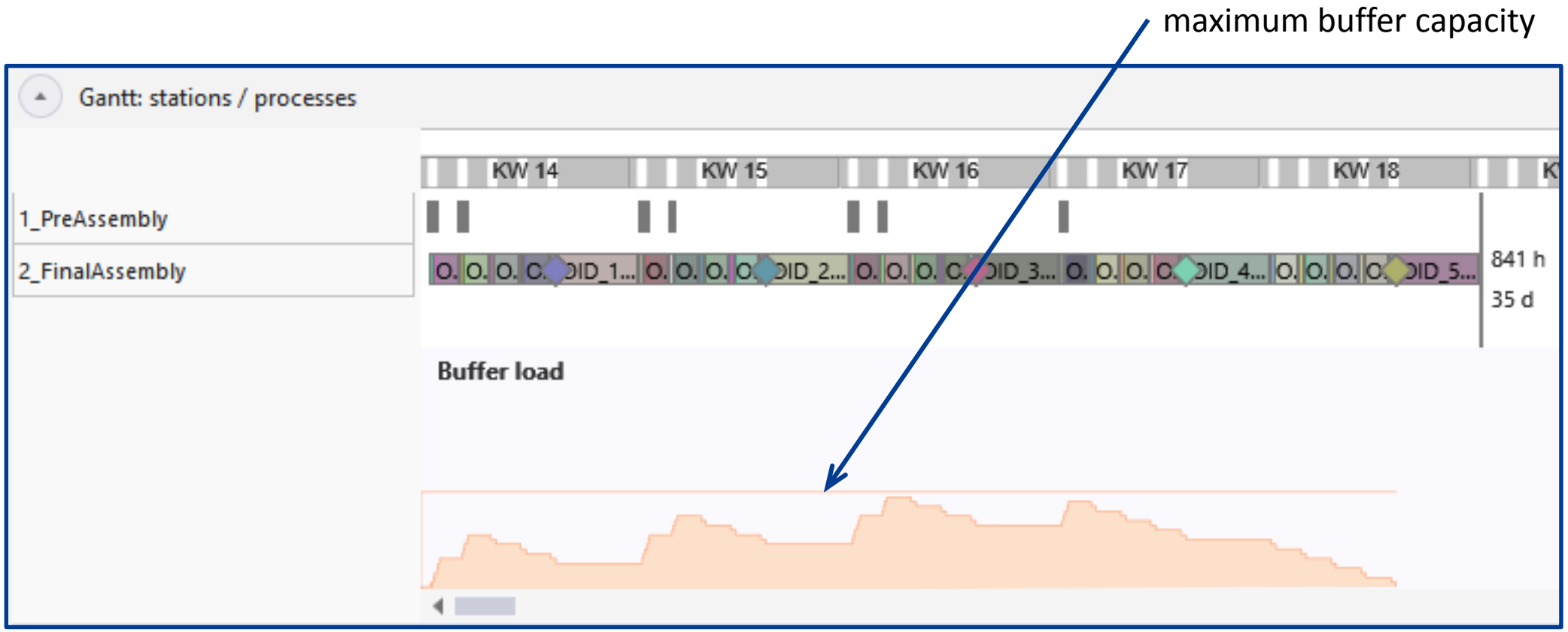


The result of the first simulation (scenario 1)) will get the result shown in the picture right.

Because the final assembly needs more time than the preassembly, the buffer capacity is increasing. But is not reaching the limit of 20 parts.

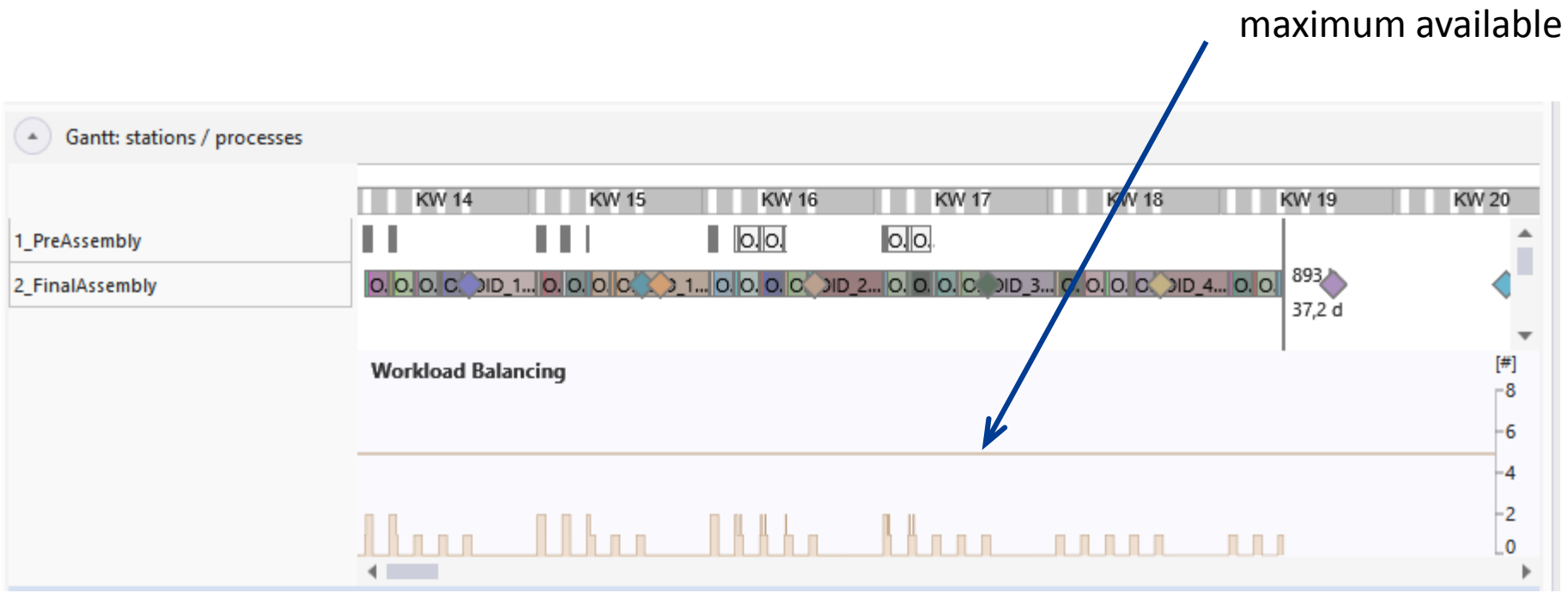
Result Scenario 1 – buffer analysis

It’s also possible to activate the buffer analysis in the simulation GANTT.
For this press right mouse button an select “Show buffer analysis”.

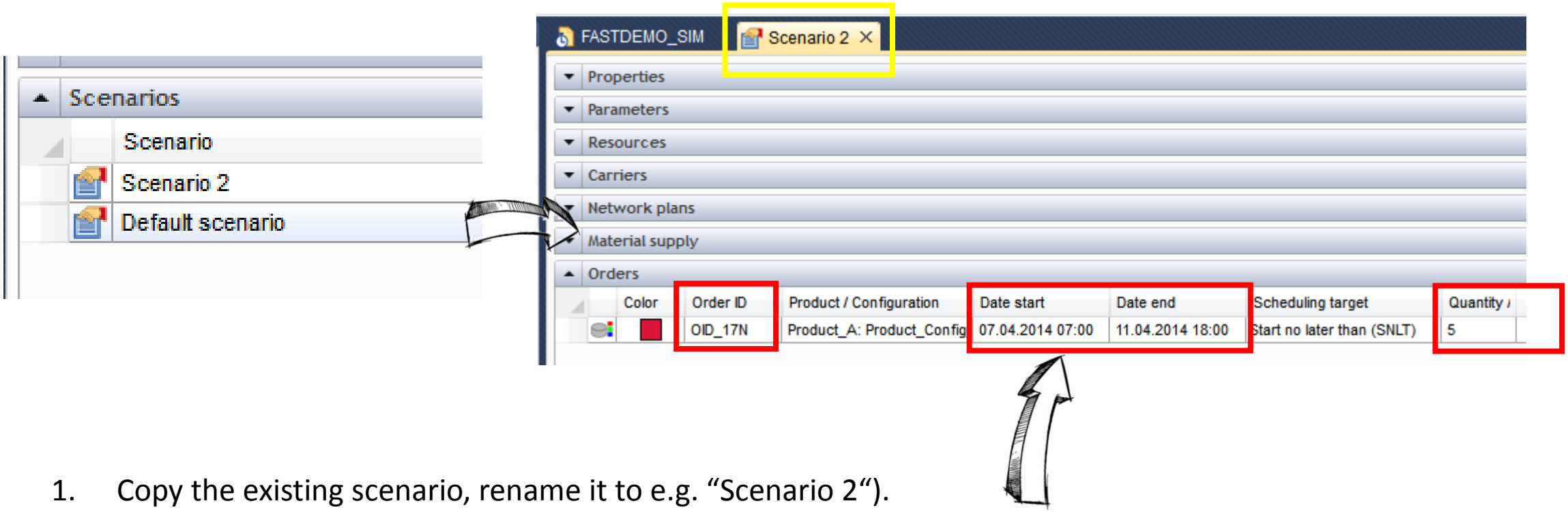


Result Scenario 1 – resource analysis

The same with the resource (worker) analysis.
For this press right mouse button an select “Show buffer analysis”.

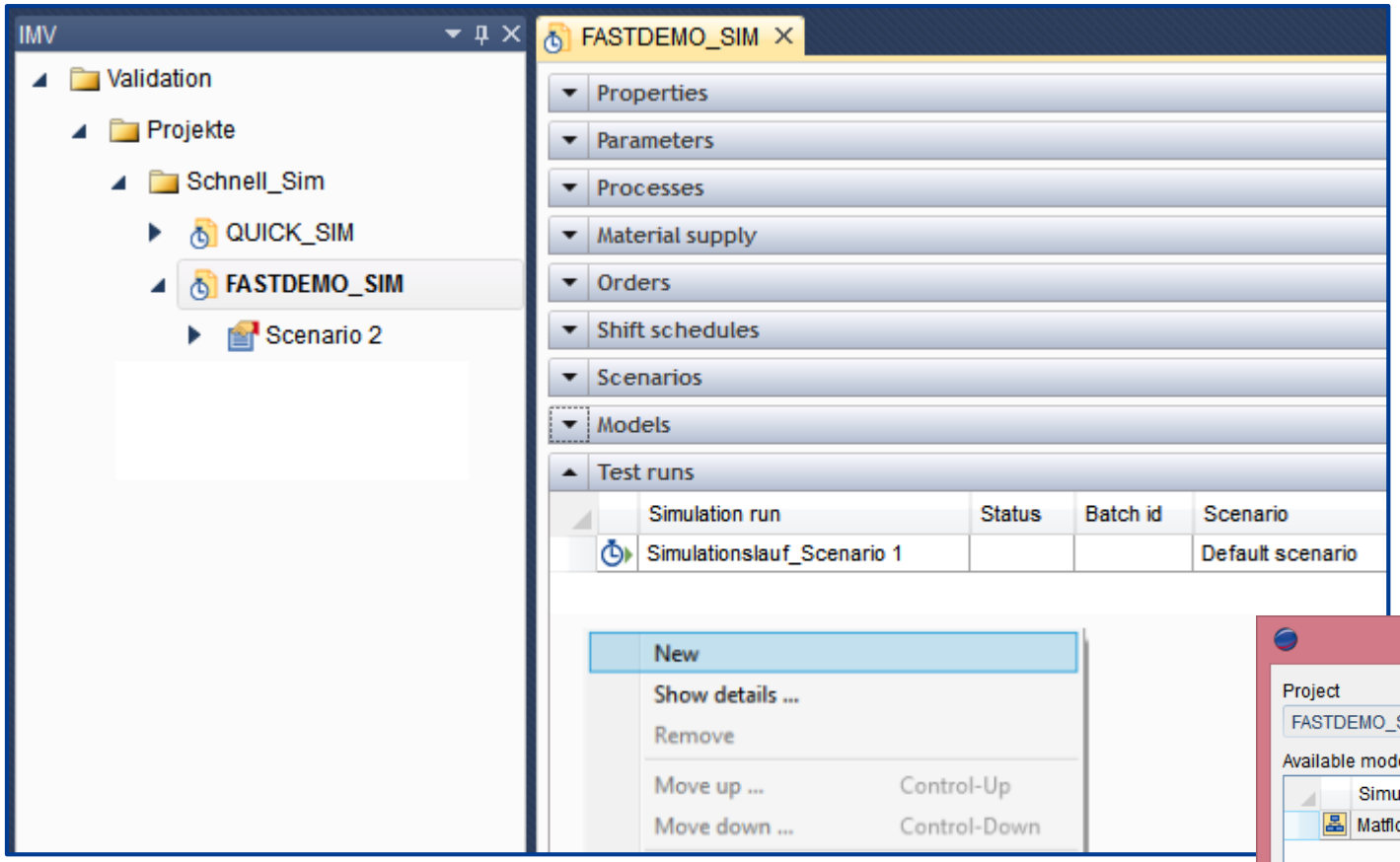


Modifications for Scenario 2

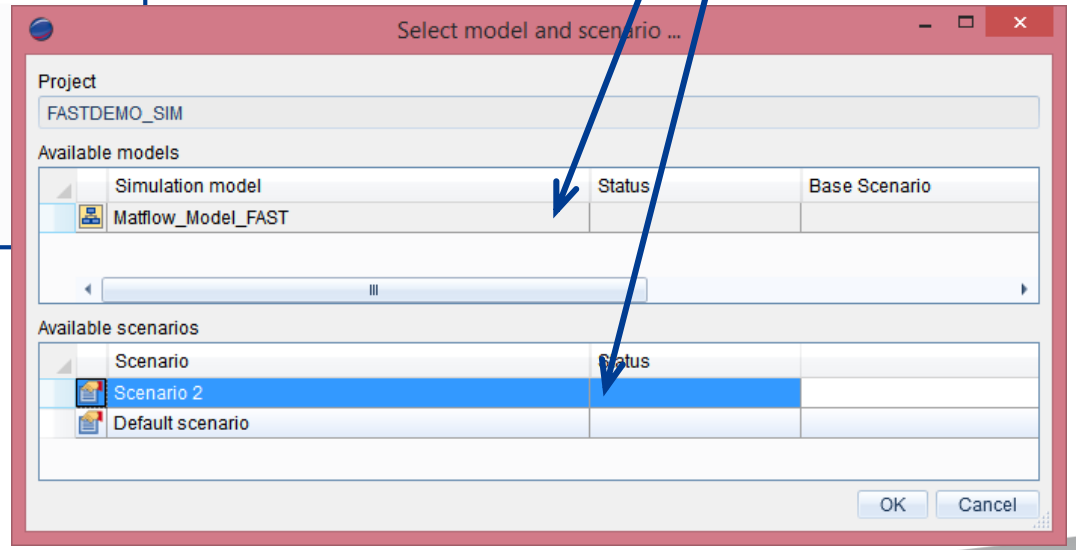


1. Copy the existing scenario, rename it to e.g. “Scenario 2“).
2. Define of an unscheduled order (name e.g. „OID_17N“) with a start date (Date start) of 07.04.2014 7:00 and an end date (Date end) of 11.04.2014 18:00 in the 2nd scenario. Therefore the date is between 17th and the 18th order.
3. The new order has an order quantity of 5 parts (important!).
4. Link the product configuration from IMD.
5. Save everything

Define simulation run for scenario 2

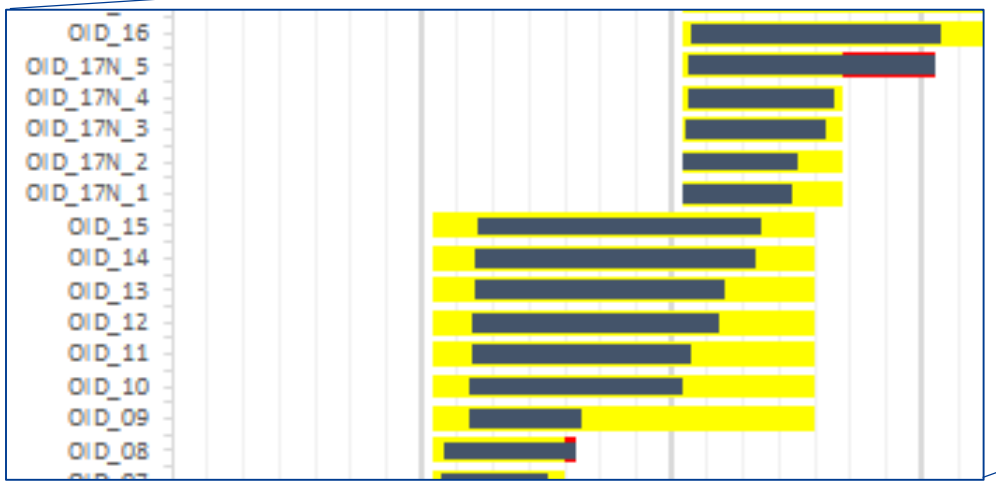


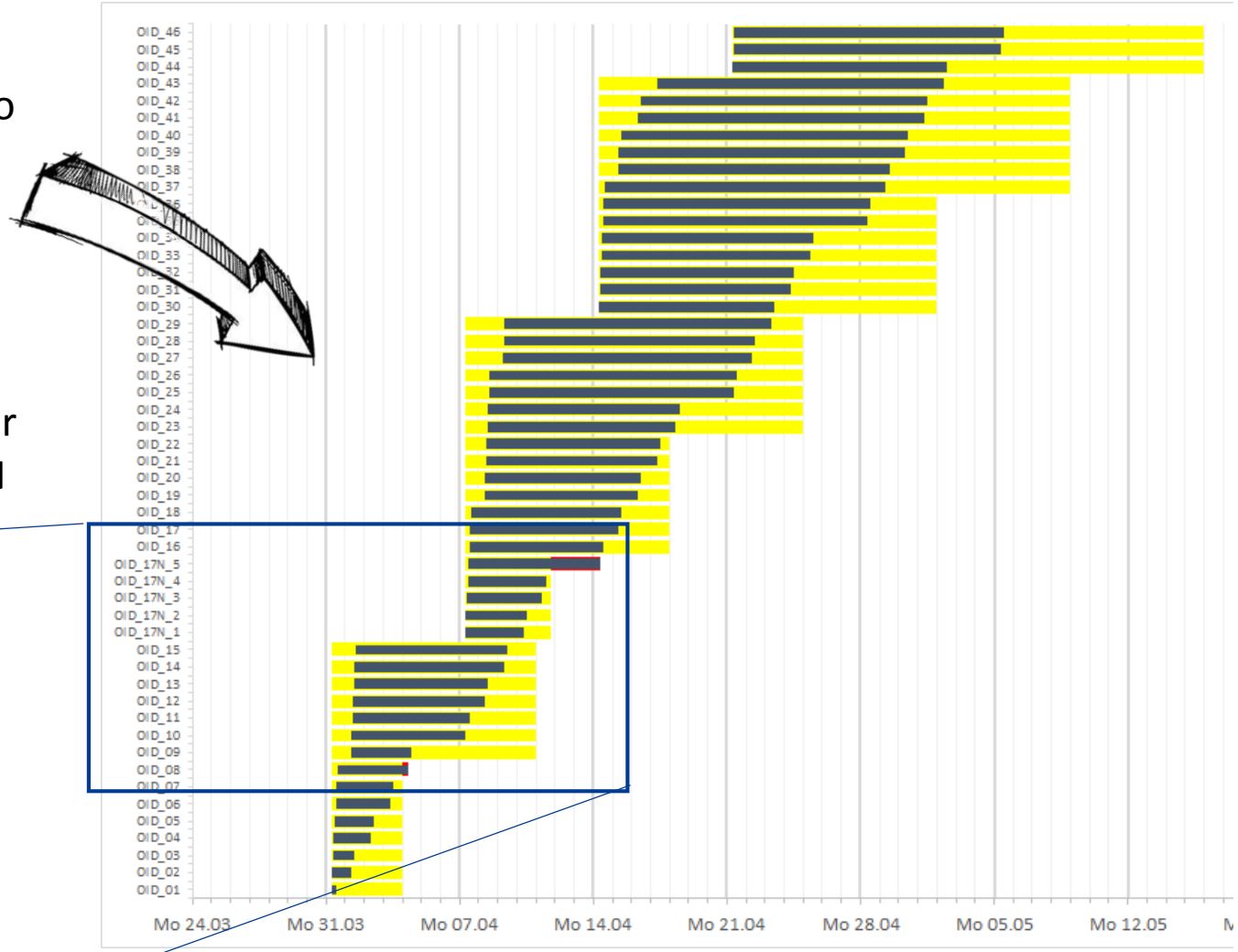
1. Define a new simulation run in „Test runs“ by the right mouse button.
2. Select the same simulation model like before and now the 2nd scenario („Scenario 2“).
3. Confirm with „OK“ and save.
4. Open the simulation run and start the simulation (like described on page 17).



Result Scenario 2 – order analysis

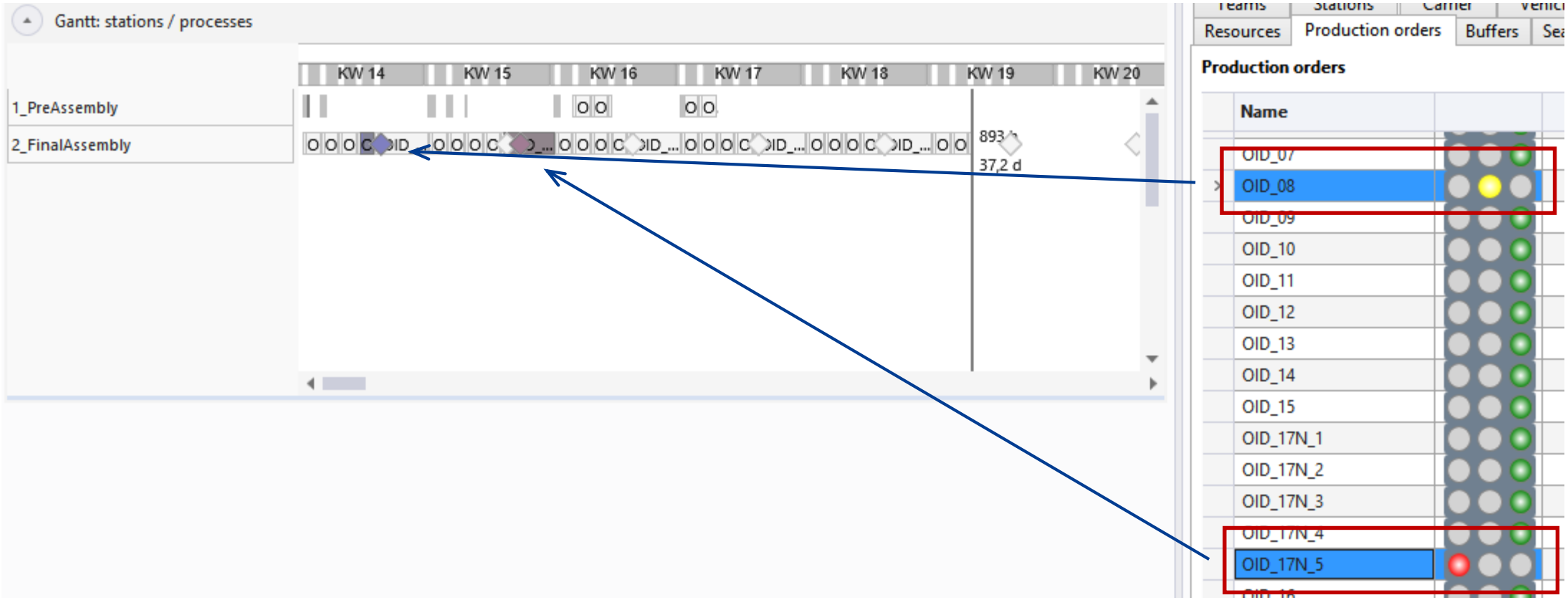
1. Open new, empty („prepared“) Excel sheet.
2. Copy the simulation data from the ERP node into the Excel sheet (like scenario 1)
3. Result is shown in the picture right.
4. For the 8th order and order 17_5 occur delays from round about 8 h and 2 days. Otherwise no delays are expected.
5. In a next step the point is now to move the other orders in a way that the „important“ order 17_N can be delivered in time.





Result Scenario 2 – order analysis

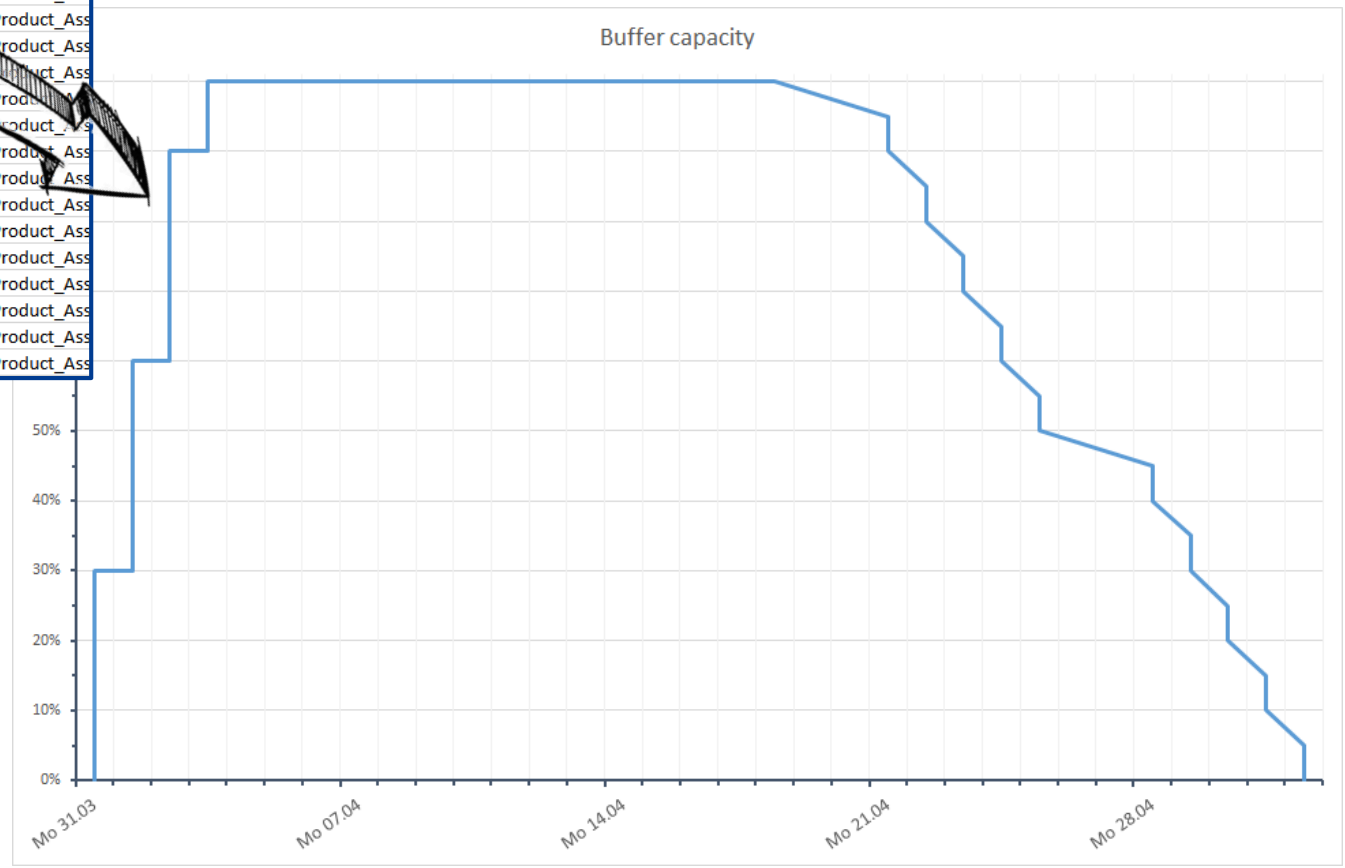
This can also displayed very quickly in the “Production orders” list,
Right handed in the dashboard. But only as a quantity value not with exact times.



Buffer Analysis

	A	B	C	D
1	Time stamp	Time (sec.)	Quantity	Orders
2	31.03.2014 08:00	28800	1	OID_01//2: Product_Assembly_A(1)
3	31.03.2014 08:00	28800	0	
4	31.03.2014 09:00	32400	1	OID_02//2: Product_Assembly_A(1)
5	31.03.2014 10:00	36000	2	OID_02//2: Prod…03//2: Product_Assembly_A(1)
6	31.03.2014 11:00	39600	3	OID_02//2: Prod…03//2: Product_Assembly_A(1) | OID_04//2: Product_Ass
7	31.03.2014 12:00	43200	3	OID_03//2: Prod…04//2: Product_Assembly_A(1) | OID_05//2: Product_Ass
8	31.03.2014 13:00	46800	4	OID_03//2: Prod…04//2: Product_Assembly_A(1) | OID_05//2: Product_Ass
9	31.03.2014 14:00	50400	5	OID_03//2: Prod…04//2: Product_Assembly_A(1) | OID_05//2: Product_Ass
10	31.03.2014 15:00	54000	6	OID_03//2: Prod…04//2: Product_Assembly_A(1) | OID_05//2: Product_Ass
11	01.04.2014 08:00	115200	6	OID_04//2: Prod…05//2: Product_Assembly_A(1) | OID_06//2: Product_Ass
12	01.04.2014 09:00	118800	7	OID_04//2: Prod…05//2: Product_Assembly_A(1) | OID_06//2: Product_Ass
13	01.04.2014 10:00	122400	8	OID_04//2: Prod…05//2: Product_Assembly_A(1) | OID_06//2: Product_Ass
14	01.04.2014 11:00	126000	9	OID_04//2: Product_Assembly_A(1) | OID_05//2: Product_Assembly_A(1) | OID_06//2: Product_Ass
15	01.04.2014 12:00	129600	9	OID_05//2: Product_Assembly_A(1) | OID_06//2: Product_Assembly_A(1) | OID_07//2: Product_Ass
16	01.04.2014 13:00	133200	10	OID_05//2: Product_Assembly_A(1) | OID_06//2: Product_Assembly_A(1) | OID_07//2: Product_Ass
17	01.04.2014 14:00	136800	11	OID_05//2: Product_Assembly_A(1) | OID_06//2: Product_Assembly_A(1) | OID_07//2: Product_Ass
18	02.04.2014 08:00	201600	10	OID_06//2: Product_Assembly_A(1) | OID_07//2: Product_Assembly_A(1) | OID_08//2: Product_Ass
19	02.04.2014 12:00	216000	9	OID_07//2: Product_Assembly_A(1) | OID_08//2: Product_Assembly_A(1) | OID_09//2: Product_Ass
20	03.04.2014 08:00	288000	8	OID_08//2: Product_Assembly_A(1) | OID_09//2: Product_Assembly_A(1) | OID_10//2: Product_Ass

Excel 2013



→ Additionally the buffer capacity which is located between the two production sites can be analyzed.

→ How it can seen left, the buffer reach his capacity limits in the calendar week 16th and 17th. Accordingly this needs a temporary expansion of the buffer to be sure that the order 17_N can be delivered in time.

Result Scenario 2 – buffer analysis

The same view than in scenario 1, when the buffer analysis will be again activated in the simulation GANTT.
For this press again right mouse button an select “Show buffer analysis”.