



Advanced Planning & Scheduling



## APS (Advanced Planning & Scheduling) –

IT solutions class, which allows for composing and optimisation of complex production plans.

### Qguar APS:

APS class solution, supporting management and planner in sophisticated production scheduling and optimisation

### Lowering of costs and optimisation of production and related processes time :

- ✓ Production to order
- ✓ Processes which require frequent and not predictable changes in the production schedule
- ✓ Products which require many components or complicated manufacturing processes
- ✓ Production by using many, different resources
- ✓ Manufacturing many different products in one factory.

The screenshot displays the Qguar APS software interface. At the top, there are tabs for 'Planning', 'Results', and 'Administration'. Below this, the 'Plan's versions' section contains a table with the following data:

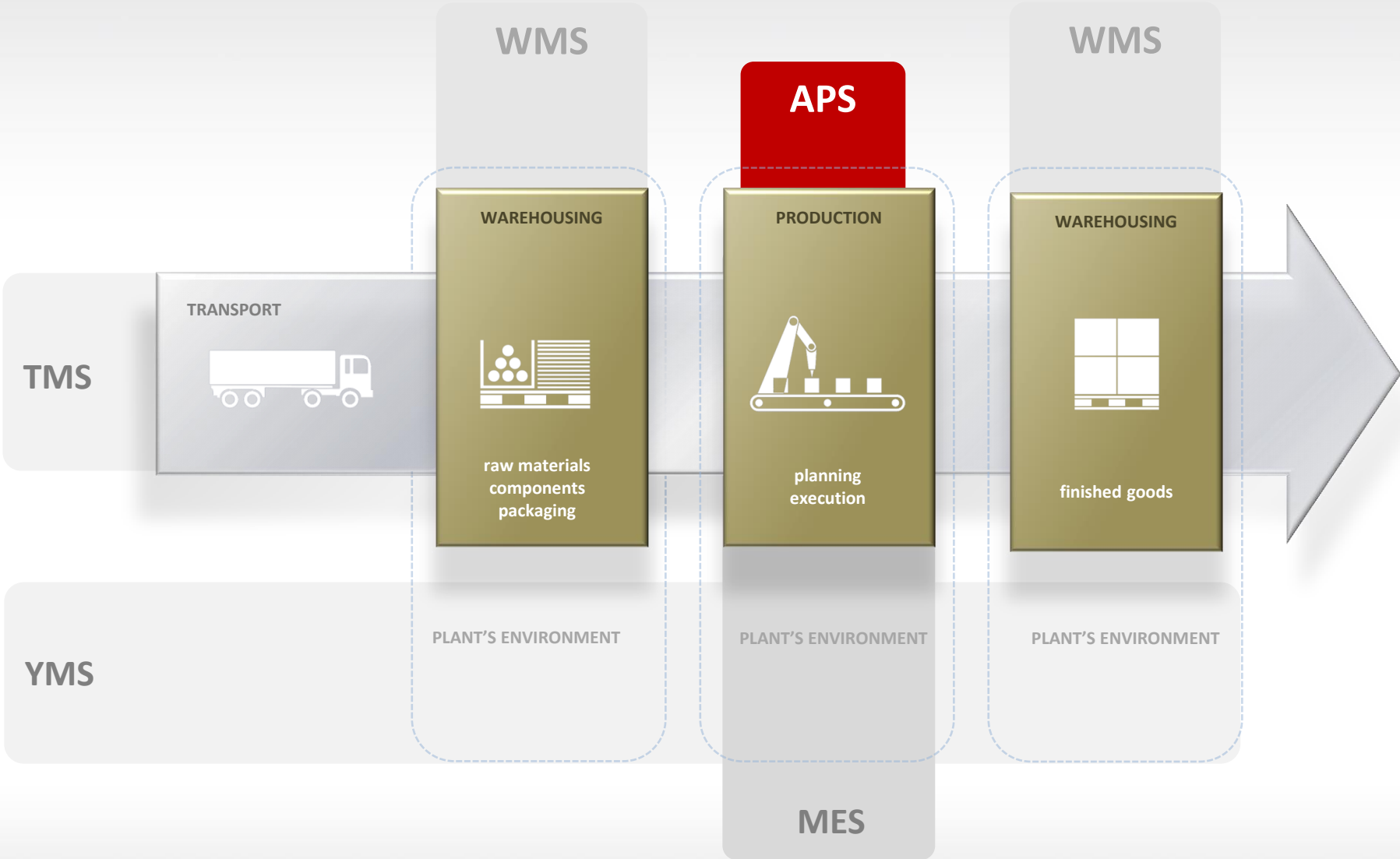
Date of creation	Name	Created by	Chosen
2016-04-12 09:10:07	Current plan (not saved)	PLANNER	Yes
2016-04-12 09:07:04	Version no. 4 (First FIT)	PLANNER	No
2016-04-12 09:06:52	Version no. 3 (SJF)	PLANNER	No
2016-04-12 09:06:47	Version no. 2 (NEH)	PLANNER	No
2016-04-12 09:06:42	Version no. 1 (Priority and lead time)	PLANNER	No

Below the table is a search bar and a 'Delete' button. The 'Plan's version rating' section shows a table with criteria, values, and relative values represented by progress bars:

Criteria's name	Values	Relative value
Idle and downtime time	139d 20min	70%
The absolute net production time	58d 3h 54min	99%
The duration of production	4d 4h 59min	47%
The absolute time gross production	58d 23h 40min	100%
Idle time	139d 20h 6min	71%
Orders in time	28	20%
The number of changeovers	28	7%
Changeover time	19h 46min	1%
The degree of fulfillment of priorities	28	100%

At the bottom of the interface, there is a search bar and a row of buttons: 'Plan', 'Stop', 'Finished', 'Keep plan's version', 'Confirm plan's choice', 'Schedule', 'Rate plan's version', 'Rate plan', 'Plan's comparis', 'Refresh', 'Save', and 'Cancel'.

# Company as element in the supply chain and main Quantum's solutions



# General QGUAR APS flow-chart (split into main processes)



## APS

**Visualisation of schedule**

**Creation of production schedule**  
(including dates of completion)

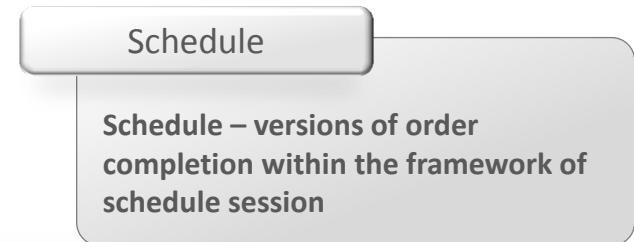
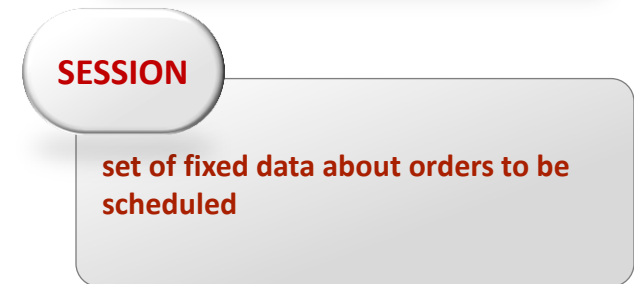
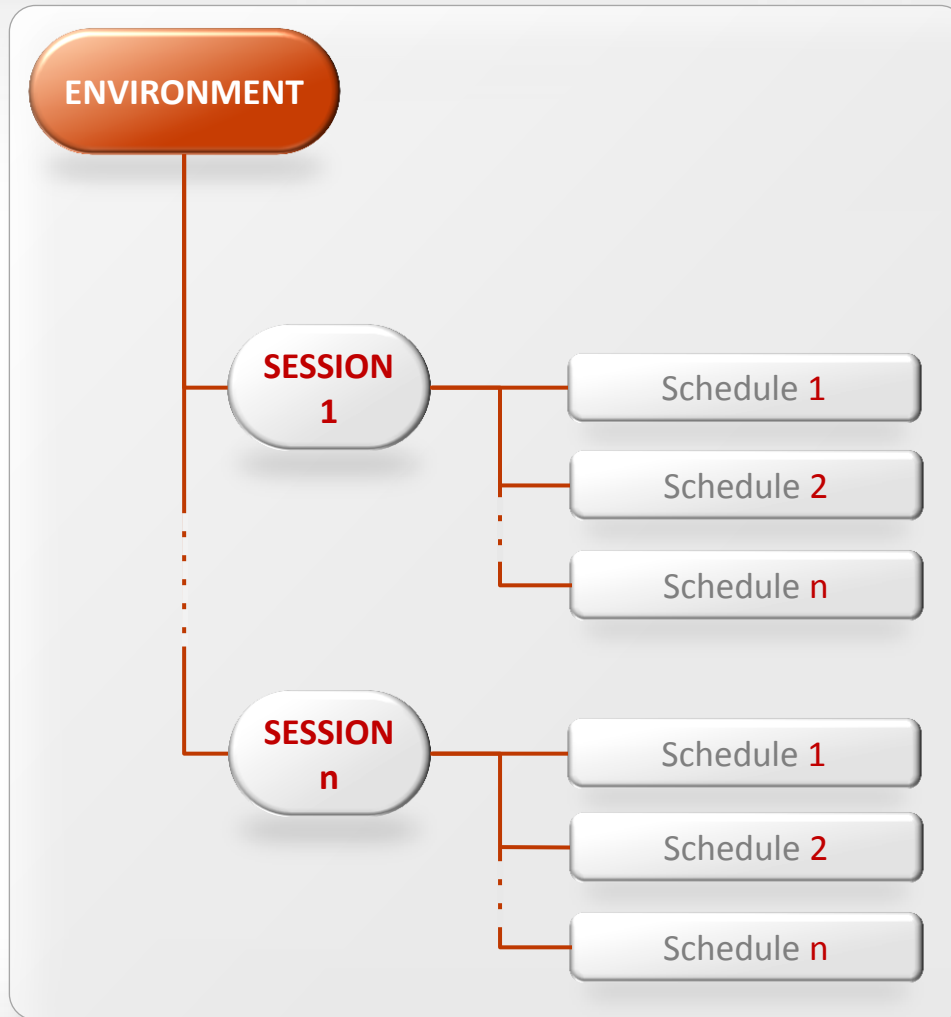
**Parallel management of many production plans**  
(with simulation of plans on the daily weekly or monthly basis)

**Production planing**  
for many production facilities,  
branches, departments and stations

**Number of KPIs**  
enabling evaluation of particular  
scenarios and choosing optimal  
production plan

**Integration with external  
solution MES and ERP solutions**

Data structure in Qguar APS allows for adaptation of the solution to production organisation scheme in the company.



## Data from external solutions

- ✓ **Production orders**
- ✓ **Technology of production**  
(including resources to be used for orders completion)
- ✓ **Information about order's progress (MES)**  
(from location – to location)

## Qguar APS internal configuration data

- ✓ **Masterdata (callendars, resources)**
- ✓ **Set up times scheets**
- ✓ **Schedule's configuration (indicators)**
- ✓ **Orders for completion of single works**



## Features

- ✓ Unlimited number
- ✓ Identification of days off and holidays
- ✓ Definition of name and scope of validity
- ✓ Each day can have different hours structure

Generation of free days and absences

Generation of free days and absences

Date From:  To:

Calendar kind:

Employee:

Return:

**Free days**

Monday  Wednesday  Friday

Tuesday  Thursday  Saturday

Generate

Cancel

April 2016

S	M	T	W	T	F	S
27	28	29	30	31	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
1	2	3	4	5	6	7

Today

## Types of basic resource

- ✓ Machinery
- ✓ Workers
- ✓ Cooperating resources

## Features

- ✓ **Production capacity**  
limited/unlimited, daily/weekly
- ✓ **Resources**  
alternative/subordinate
- ✓ **Optimal load**
- ✓ **Efficiency**
- ✓ **Work calendar**

## Features

- ✓ **Production capacity**  
limited/unlimited, daily/weekly
- ✓ **Resources**  
alternative/subordinate
- ✓ **Optimal load**
- ✓ **Efficiency**
- ✓ **Work callendar**

## Subordinate ▼

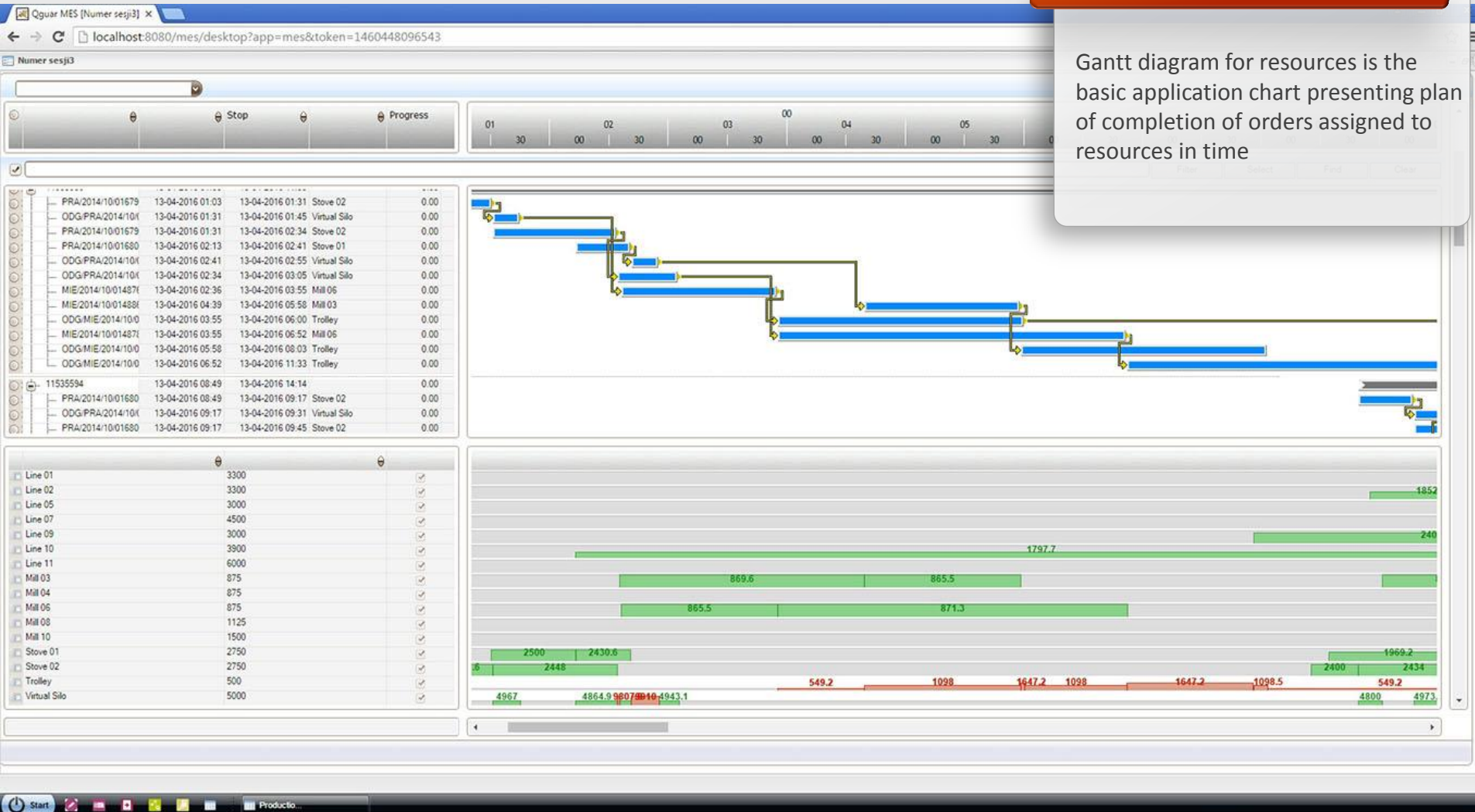
- ✓ **Warehouse, storage location**
- ✓ **Form / matrix**
- ✓ **Tool**
- ✓ **Accessories**
- ✓ **Transportation / route**

**Subordinate resources** have assigned callendar, which together with callendar of main resource create a grid for schedule definition

# Gantt diagram - Resources

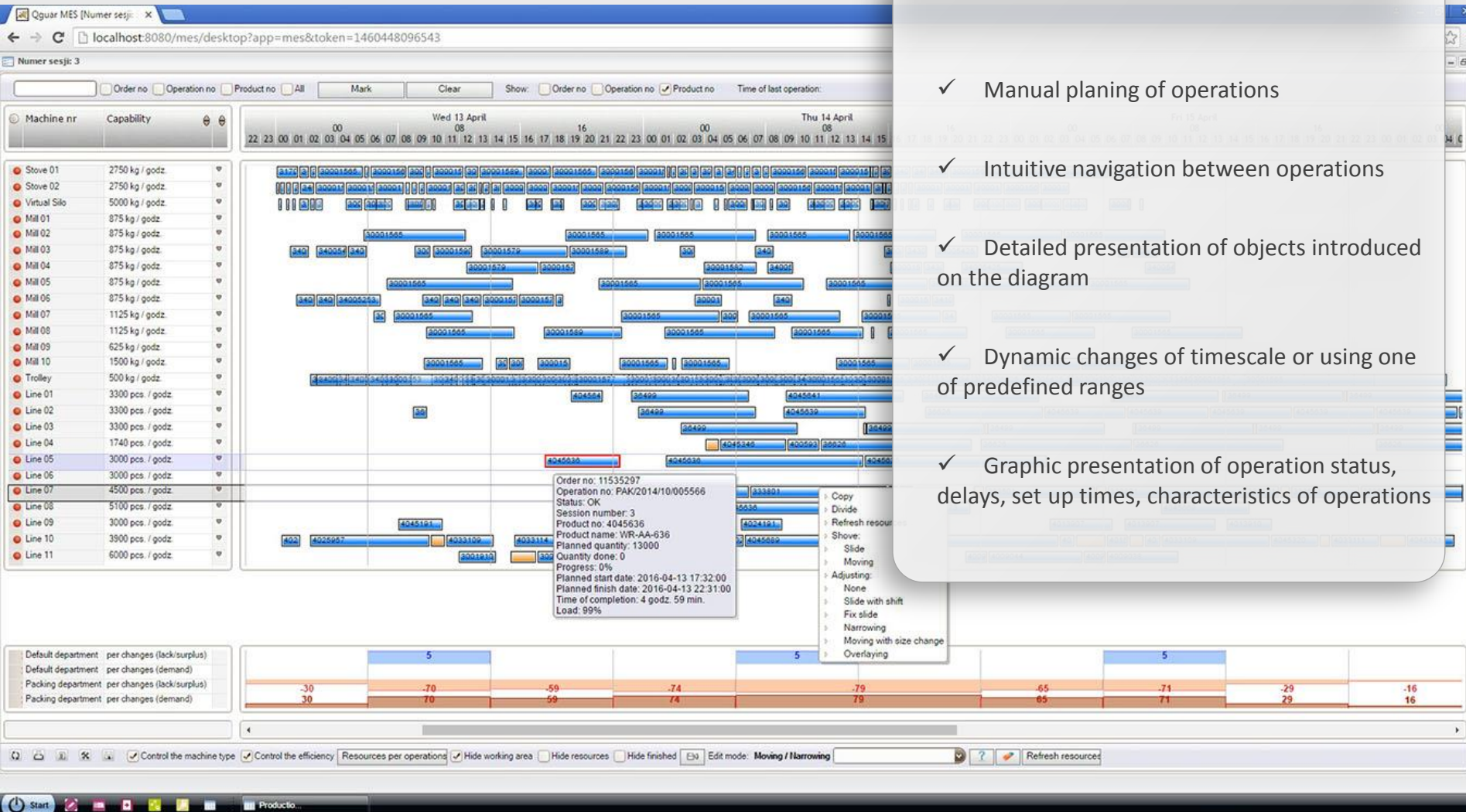
## Gantt diagram

Gantt diagram for resources is the basic application chart presenting plan of completion of orders assigned to resources in time



## Basic features

- ✓ Manual planing of operations
- ✓ Intuitive navigation between operations
- ✓ Detailed presentation of objects introduced on the diagram
- ✓ Dynamic changes of timescale or using one of predefined ranges
- ✓ Graphic presentation of operation status, delays, set up times, characteristics of operations



# Characteristics

localhost:8080/mes/desktop?app=mes&token=1460448096543

Attribute's list

Filters

Code: Name: Description: Data type: Values kind: Unit: Product's attribute: Batch's attribute: Modified attribute: Possibility of parallel setup:

Pre - configuration:

Code	Name	Description
FORMAT	FORMAT	FORMAT
KOLOR	KOLOR	KOLOR
TEMPERATURA	TEMPERATURA	TEMPERATURA
UWAGI	UWAGI	UWAGI

Page 1 Quantity of rows on site 200

Attribute's definition Administration

Code: UWAGI

Name: UWAGI

Description: UWAGI

Data type: CIAGLY

Values kind: TEKSTOWY

Product's attribute  Batch's attribute  Modified attribute

Pre - configuration  Possibility of parallel setup

Attribute's values

Values	Pre - configuration
SIZE	Yes
TEMP	No

+ Add / Change / Delete

New Save Cancel

Modified attribute Possibility of parallel setup Pre - configuration

No	No	No
Yes	No	No
Yes	No	No
Yes	No	No

Displayed 1 - 4

+ Add / Change / Delete

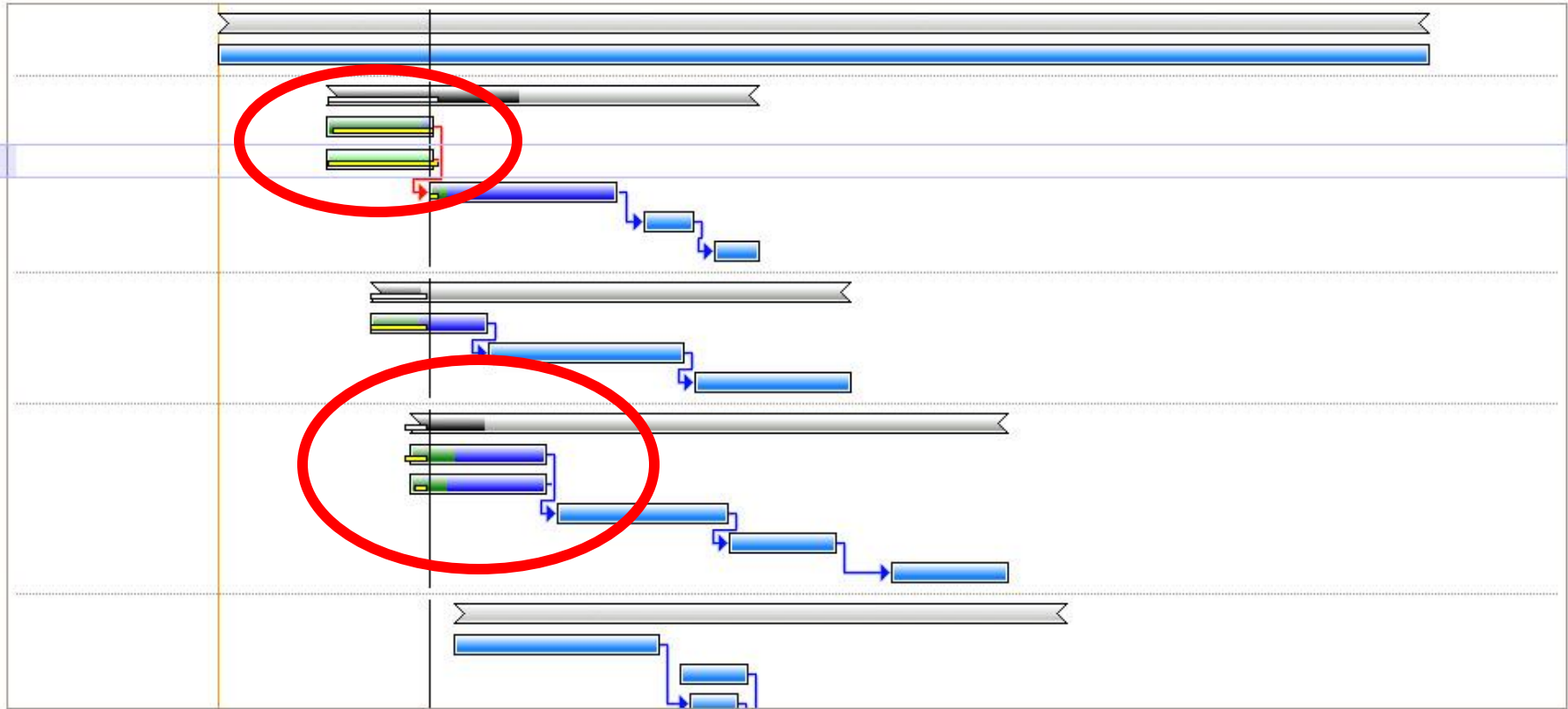
Finish

PL 10:08

Definition of characteristics for operations/products used for identification of set up times in case of operations with different features

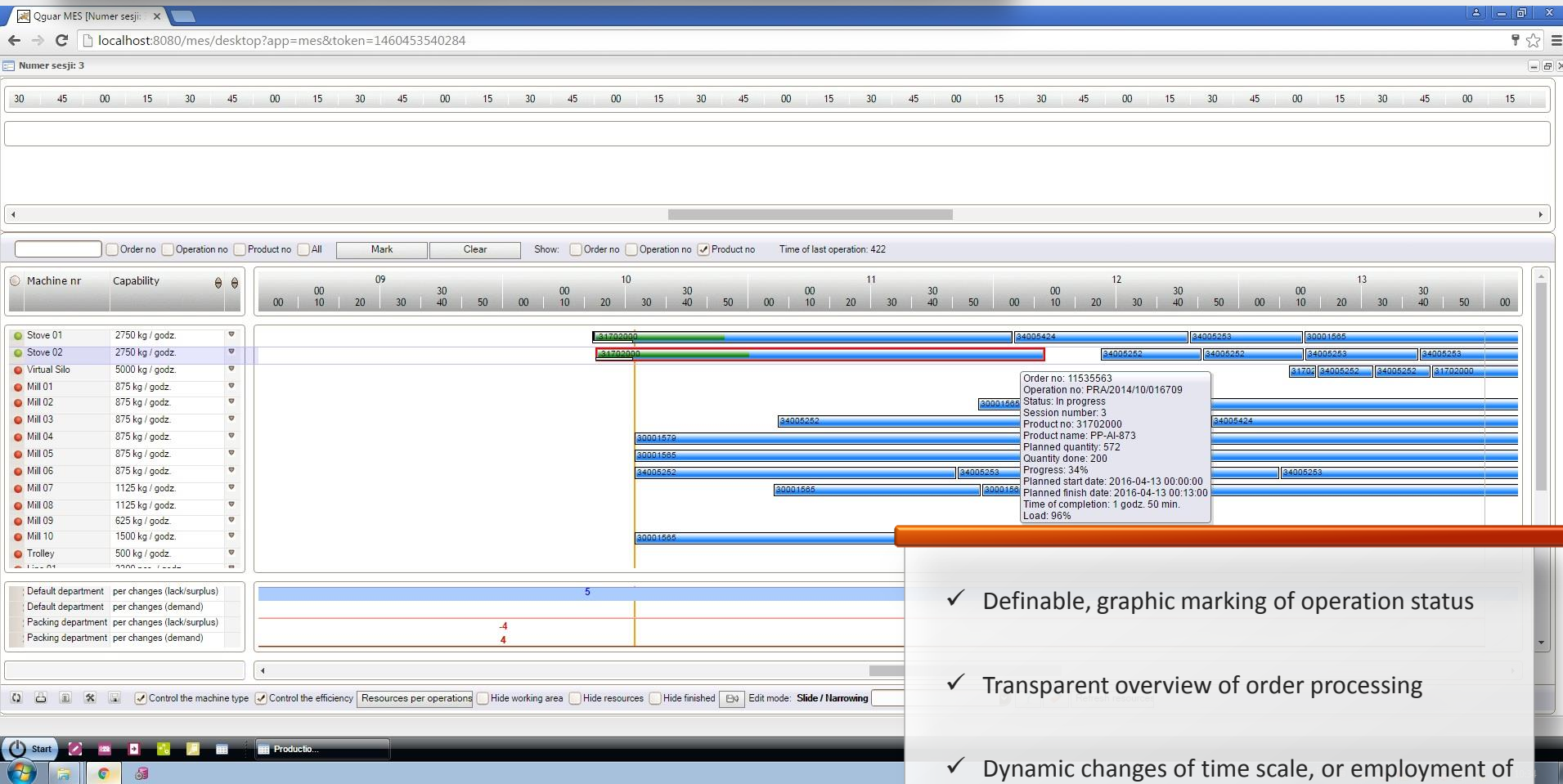
# Input resources

Operations done by using input resources can be done simultaneously



# Gantt diagram – production orders

Gantt chart for production orders is auxiliary diagram for Wykres Gantta dla zleceń jest diagramem pomocniczym obrazującym visualisation of order processing in time

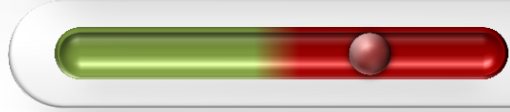


- ✓ Definable, graphic marking of operation status
- ✓ Transparent overview of order processing
- ✓ Dynamic changes of time scale, or employment of one of predefined time intervals
- ✓ Automatic, configurable information including details of any object presented on the chart.

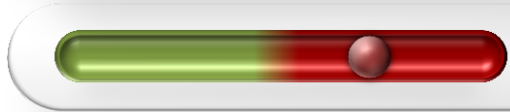




**Minimizing of waiting time**



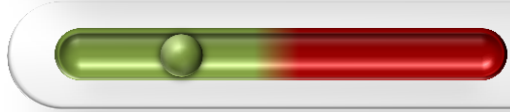
**Maximizing resource load**



**Maximizing revenue in the time period**



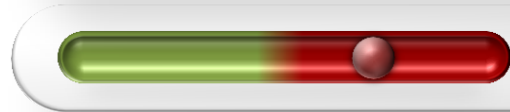
**Minimizing delays**



**Minimizing the greatest delays**



**Minimizing of deviation from the terms of delivery**



**Maximizing the implementation of orders priorities**



**Minimizing set up times**

Optimization algorithm depends on the user having the ability to determine weight of each criterion of optimization

Results obtained on the optimization process can be traced by analyzing changes in key indicators

The screenshot displays the 'Results' tab of the QGUAR APS software. It is divided into two main sections: 'Plan's versions' and 'Plan's version rating'.

**Plan's versions:**

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## OPERATIONS BY RESOURCES

list of scheduled operations on particular resources.  
Activities to be carried out on a workplace in a line with the production plan

## OPERATIONS BY ORDER

list of operations in different orders . Activities to be done in order to carry out given production order.

## OPERATIONS BY RECEIPTS

list of operations for particular receipts.  
Activities to be done in order to carry out orders for given receipt.

## SUBORDINATE RESOURCE

Information about utilization of secondary resources in the created plan.

## DETAILS OF THE BATCH CYCLE

Information on implementation of work in the batch resource

## DETAILS OF SCHEDULING

List of production operations planned for particular resources.  
List of all production operations occurring in the production plan.

# Report - example

Monitoring of the work in progress

List of the production orders    Operation list    Machine's work

Production orders

Page 1    Quantity of rows on site 200    Displayed 1 - 6

Order no.	Type of shipment	Status	Product number	Planned start date	Planned end date	Actual start date	Planned	Made	Work advancement	Progress of the article's production	Time usage
11421840	PACK - Pakowanie	W realizacji	31183	2013-09-03 19:17	2013-09-03 20:12	2014-02-10 13:30	1890	800	42%	42%	127%
11421859	PACK - Pakowanie	W realizacji	4009128	2013-09-04 16:30	2013-09-04 23:01	2014-02-10 13:33	20471	2023	10%	10%	17%
11421879	PACK - Pakowanie	W realizacji	31050	2013-09-03 20:12	2013-09-03 23:59	2014-02-10 13:29	10800	4270	39%	39%	32%
11421910	PACK - Pakowanie	W realizacji	36626	2013-09-06 00:53	2013-09-06 07:11	2014-02-10 13:32	11340	1500	13%	13%	18%
11421989	PACK - Pakowanie	W realizacji	4025153	2013-09-03 02:23	2013-09-03 09:27	2014-02-10 13:33	19440	2000	10%	10%	16%
11422007	PACK - Pakowanie	W realizacji	36499	2013-09-03 23:55	2013-09-04 07:12	2014-02-10 13:31	22032	4000	18%	18%	16%

Order's products

Page 1    Quantity of rows on site 25    Displayed 1 - 2

Product number	Operation type	Unit	Planned	Made	Quality status	Progress of the production realization
31050	Pakowanie	szt.	10800	20	BAD	0%
31050	Pakowanie	szt.	10800	6220	GOOD	58%

Cancel

Start    Monitor...

vmglobo.quantum.pl/SafenaMES/desktop?app=SafenaMES&token=1392038198562#



## Diagram Pareto czasu trwania przestoju wg przyczyn

Data od: 2014-03-26 00:00:00

Typ maszyny:

Typ zlecenia

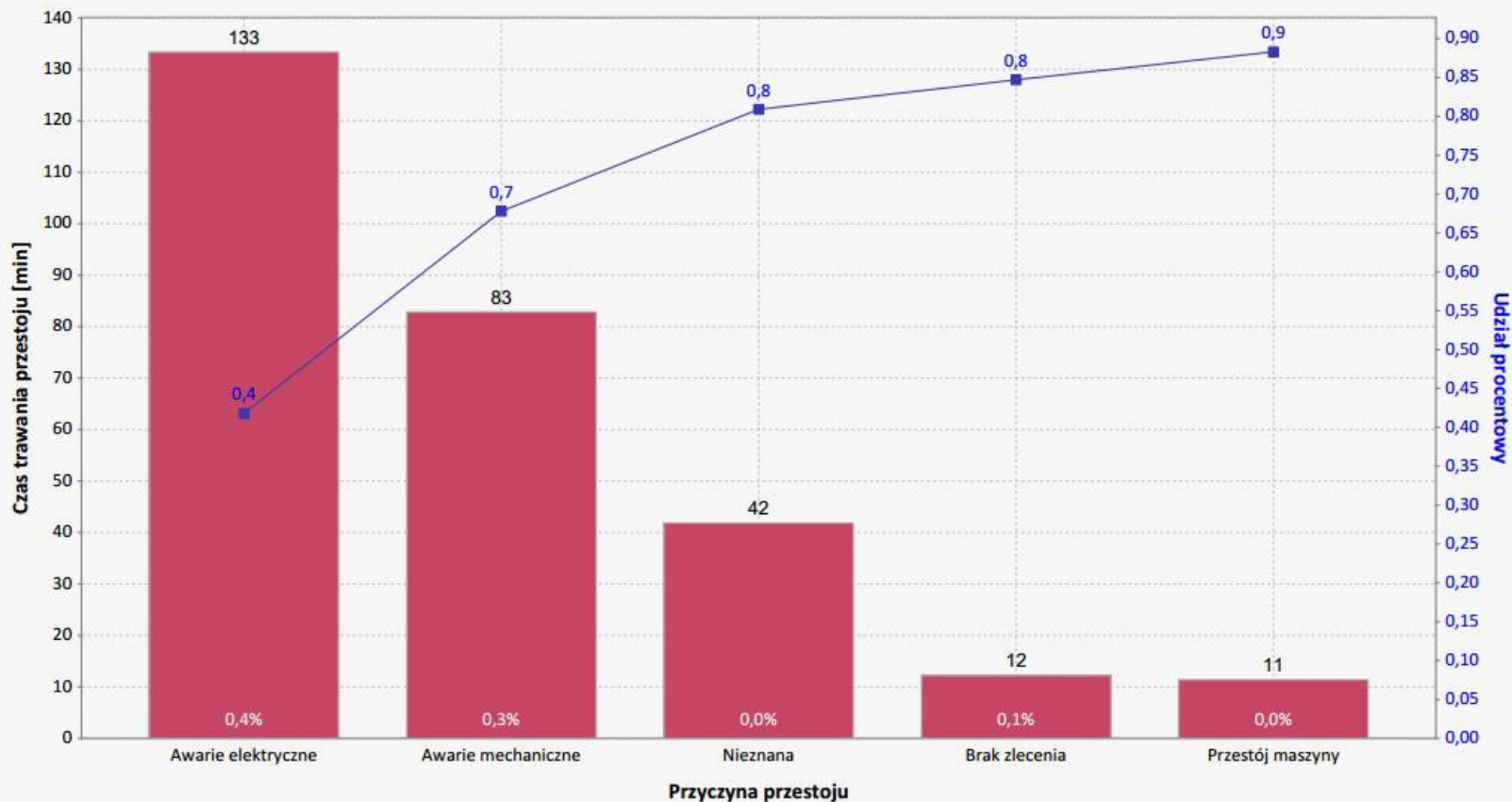
Centrum kosztów:

Data do: 2014-03-26 23:59:00

Nr maszyny:

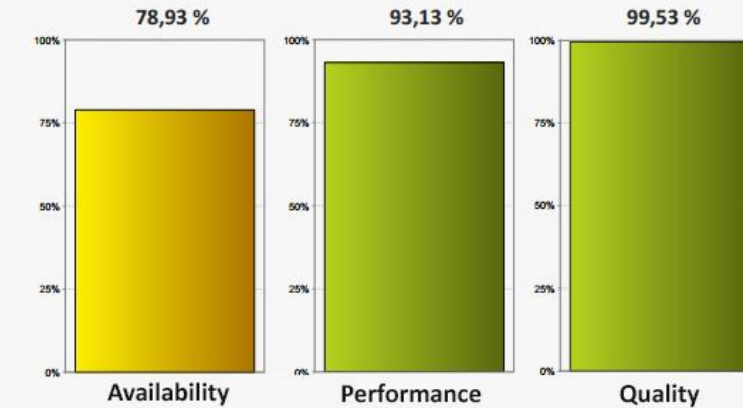
Nr zlecenia:

Wydział:

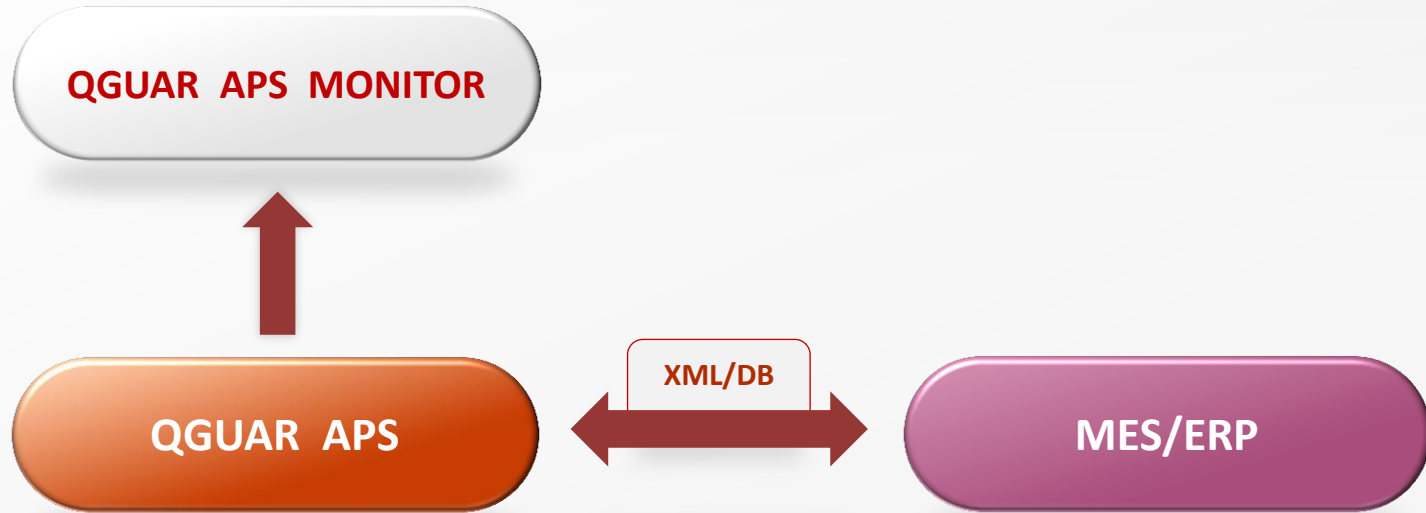


## OEE Indicator – Packaging line 01

The report presents Overall Equipment Efficiency for selected machine or group of machines.



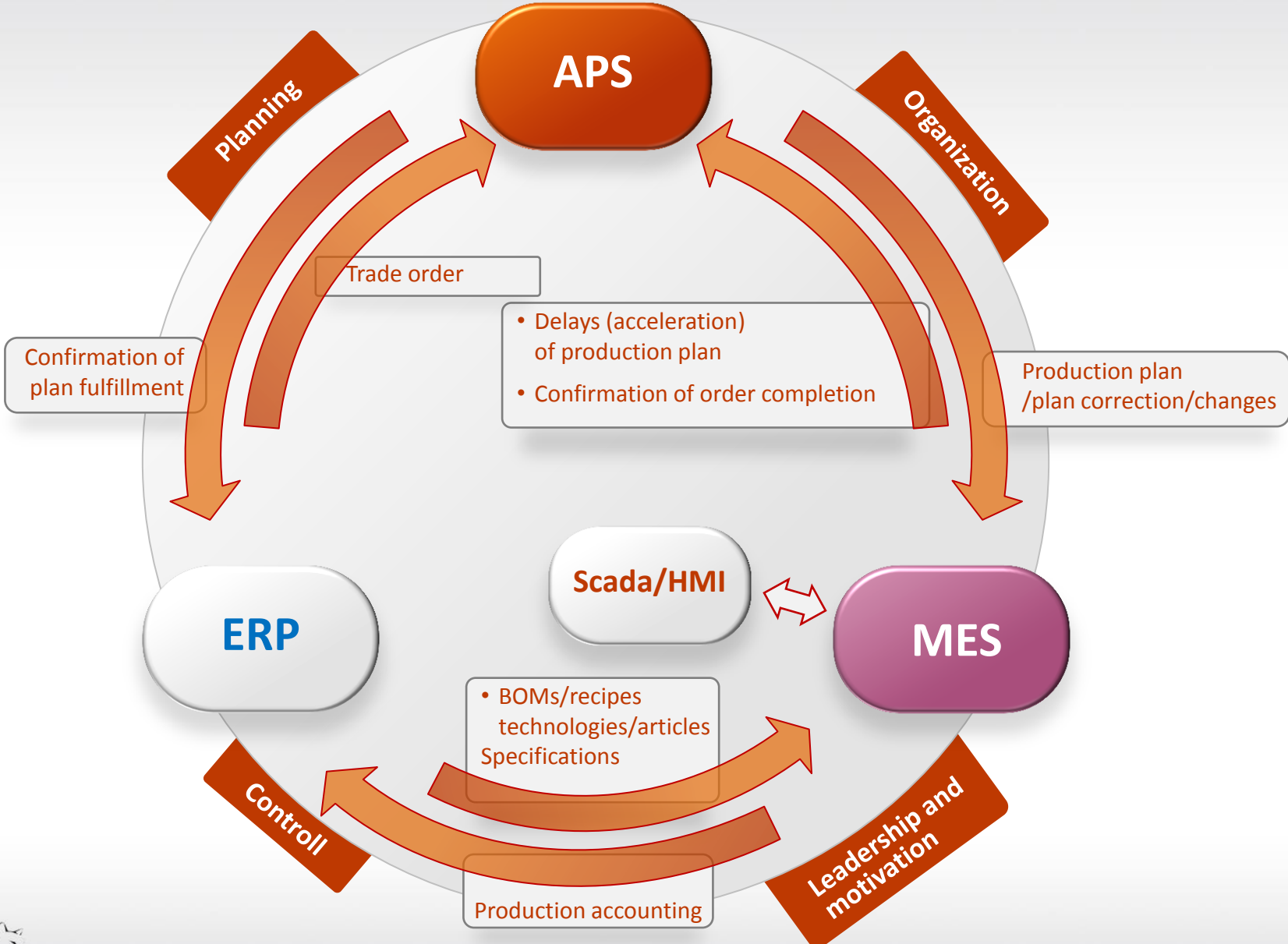
## Architecture



## Technical conditions

- ✓ System delivering technology and data about machines (Qguar MES or ERP)

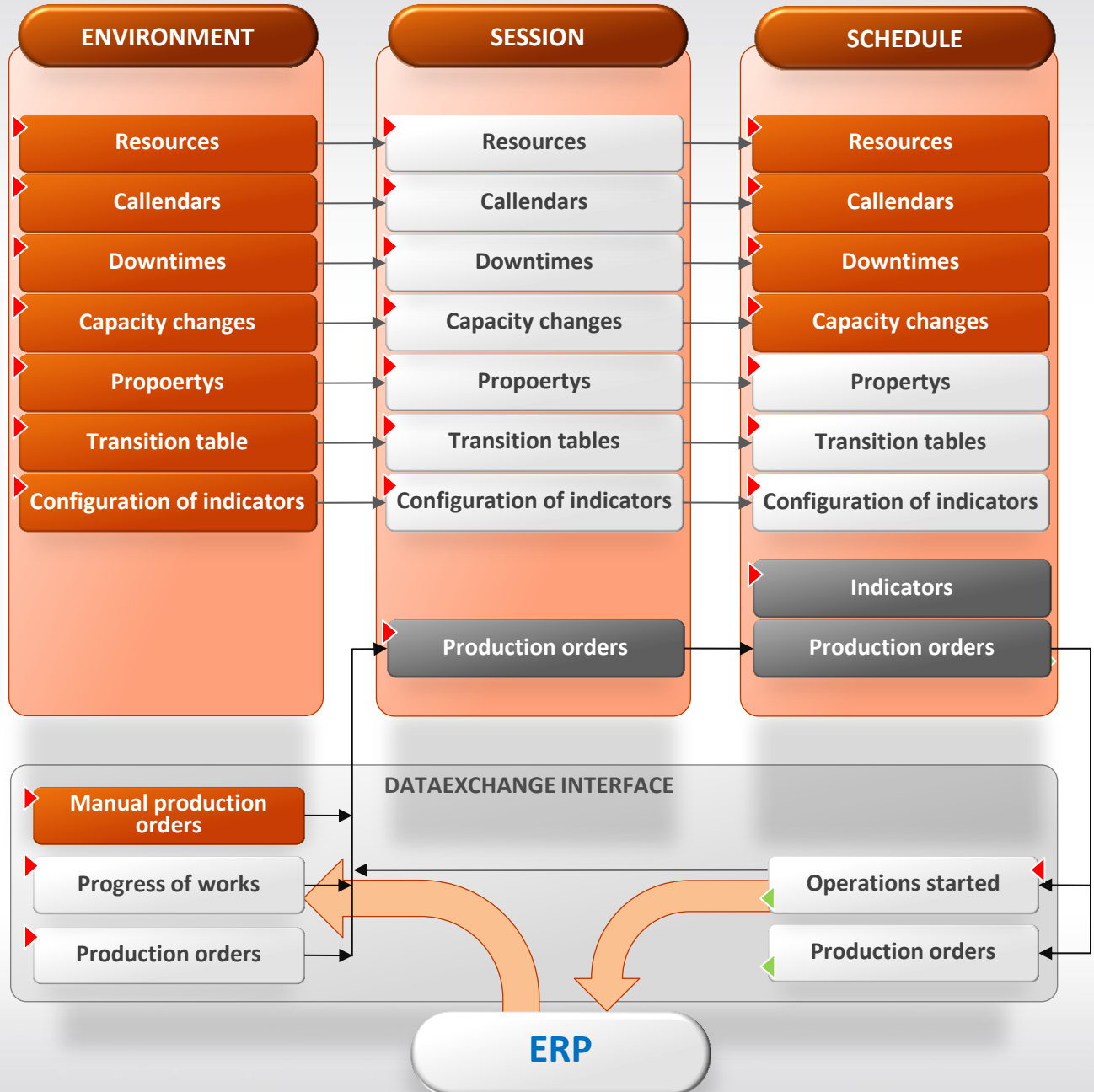
# Interfaces – dataexchange: strickt integration with ERP





# Interfaces – details of dataexchange

- ✓ Open interface enabling integration with other solutions
- ✓ Qguar APS is integrated with Qguar MES
- ✓ Integration with ERP solutions



Possible indicators enabling definition of the schedule's quality with respect to the assumed value:



- ✓ Idle time and downtime
- ✓ The average delay in days
- ✓ Production time
- ✓ Cooperation time
- ✓ Degree of implementation of priorities
- ✓ Ahead of the average delivery dates
- ✓ Accelerated order



- ✓ Optimization of production scenarios
- ✓ Reaction to production changes
- ✓ Definition of critical path, which illustrates the shortest possible time of order completion
- ✓ Identification of processes which in case of delay can cause delay of whole order completion.
- ✓ Definition of bottle necks in production
- ✓ Control over meeting the delivery deadlines
- ✓ Reduction of set up time



Thank you for your time

