Asprova's "Pocket manual" series No.14

Detecting assignment changes

We will now show you a method for visually detecting changes in scheduling results on resource charts and operation tables. We will also present a method for visually comparing scheduled and actual performance.

With data

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After rescheduling where are the changes?

After rescheduling, you may want to know what effect the new settings had. Of course, two project files (.ar4 or .aru) could be used to compare the data "before and after". Or you can export the Operation table in advance and analyze the differences. However, since the simplest way is to detect differences and then display them graphically that's the method we will now explain.

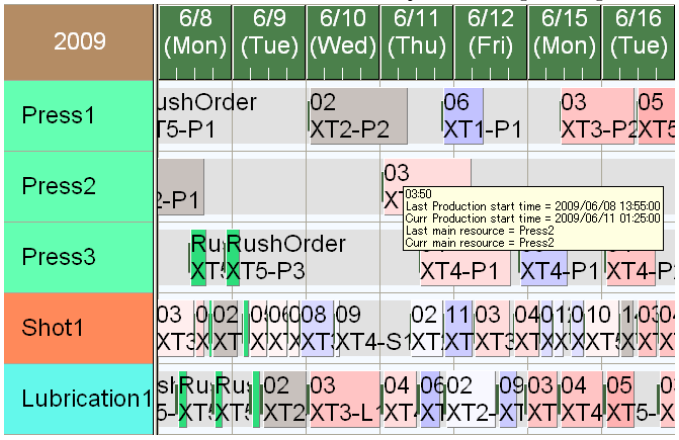
The first example is a method of detecting differences through the operation table. In Fig. 1, the data displayed in the operation table is set so that background colors are different.

The second example is one in which a Gantt resource chart is used to detect differences. Fig. 2 shows color settings given to the chart in the same way as with the Operation table.

Here you can see at a glance, by means of the color and the shading of these cells and bars whether or not a time was changed and how far ahead or backward the operation moved.

	Code	Main resource	Last production start time	Production start time	Moved time from last assigned[h]
71	05:90	Press1	2009/06/12 01:22:00	2009/06/18 08:00:10	150.7
75	06:120	AssemblyLine	2009/06/19 22:12:20	2009/06/22 05:45:00	55.6
76	06:130	Inspection2	2009/06/23 00:49:50	2009/06/23 08:22:30	7.6
79	06:40	Lubrication1	2009/06/16 06:40:00	2009/06/11 13:25:00	-113.2
80	06:50	Press1	2009/06/16 14:02:30	2009/06/11 20:47:30	-113.2
81	06:60	Shot1	2009/06/17 17:19:50	2009/06/15 04:20:00	-60.9
82	06:70	Forge1	2009/06/17 22:19:50	2009/06/15 09:20:00	-60.9
83	06:80	Lubrication1	2009/06/18 07:19:50	2009/06/18 08:00:10	0.7

▲Fig. 1 An operation table assigned for detecting differences. If the main assigned resources were changed, the background color changes to green. If the assigned time and date was changed, the display is blue for earlier and red for later. The color is shaded darker to represent a larger change.



▲ Fig. 2 A resource Gantt chart assigned for difference detection. Orders that haven't moved since last time are in gray, newly added orders are in green, and the rest are colored as for the Operation table.

Setting it up -Recording assigned positions-

To make comparisons, information about the last assigned position/resource etc of the operations must be recorded. The type of data to be recorded depends on what "before and after" comparisons you wish to make but in this case we will record the two properties shown below.

1) Production start time in the Operation table
2) Main resource in the Operation table

We add two new properties to the Operation class to store these properties.

a) Last production start time
(WorkUser_ProductionStartTimeHistory)
b) Last main resource (WorkUser_MainResHistory)

The type of these properties is 'Time' for the first and 'String' for the second.

Now create a command for assigning properties 1) and 2) to a) and b). Create a scheduling parameter having the command configuration shown in Table 3 with the Command Editor or the Scheduling Parameter table. In the Modify properties command "Operation expression" set the expressions below. Executing this "Record assigned position" planning parameter assigns the properties 1) and 2) to a) and b).

- ME.ProductionStartTimeHistory [1]=ME.OperationProductionStartTime
- ME.MainResHistory[1]=ME.OperationMainRes

	Code	Operation expression
1	Record assigned position	
2	Upload operations	
3	Filter operations	
4	Modify properties	ME.ProductionStartTimeHisto

▲ Fig. 3 Planning parameter (Scheduling Parameter table) that records currently assigned information

▲

This parameter is positioned before the main planning parameter used in rescheduling, as shown below. It allows recording of Production start time and Main resource immediately before executing rescheduling.

	Code
1	⊟Record assigned position and reschedule
2	⊞Record assigned position
3	⊞Default scheduling parameter

▲ Fig. 4 Parameter for executing assignment after recording assigned position

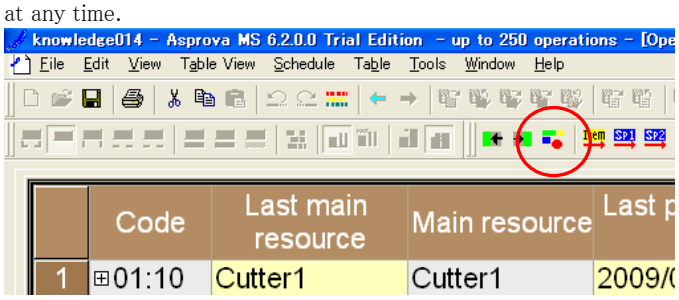
	Code	Last main resource	Main resource	Last production start time	Production start time
1	⊞01:10		Cutter1		2009/07/09 00:00:00
2	⊞01:100		Shot1		2009/07/14 08:46:40
3	⊞01:110		Lubrication1		2009/07/14 13:26:40
4	⊞01:120		AssemblyLine		2009/07/14 20:00:00
5	⊞01:130		Inspection2		2009/07/15 19:46:40

▲ Fig. 5 Operation table before recording assigned position

	Code	Last main resource	Main resource	Last production start time	Production start time
1	⊞01:10	Cutter1	Cutter1	2009/07/09 00:00:00	2009/07/09 00:00:00
2	⊞01:100	Shot1	Shot1	2009/07/14 08:46:40	2009/07/14 08:46:40
3	⊞01:110	Lubrication1	Lubrication1	2009/07/14 13:26:40	2009/07/14 13:26:40
4	⊞01:120	AssemblyLine	AssemblyLine	2009/07/14 20:00:00	2009/07/14 20:00:00
5	⊞01:130	Inspection2	Inspection2	2009/07/15 19:46:40	2009/07/15 19:46:40

▲ Fig. 6 Operation table after executing planning parameters in Fig. 3

The setup is now such that the assigned position will be recorded when the Custom toolbar icon is registered and the button is clicked at any time.



▲ Fig. 7 In the sample data a tool button used to record assigned position has been created.

Help

"Adding new property definition"(Help No. 743210)
"Modify properties command"(Help No. 778300)
"Toolbar Customize dialog"(Help No. 731000)

Other data to record and compare differences with might include Production end time, Production time, Setup start time, Setup end time, Setup time, Sub resource or Production quantity.

Setting it up -Methods of comparing assignment position-

Assign the formula shown below for the Production start time property definition's "Background color expression" so that the color of the cell for the Production start time string in Fig. 1 darkens in blue as time gets earlier and darkens in red as it gets later.

```
If(250<ME.Operation.MovedTime,RGB (255,0,0),
If(-250>ME.Operation.MovedTime,RGB(0,0,255),
If(0<ME.Operation.MovedTime,RGB(255,250-ME.Operation.Moved
Time,250-ME.Operation.MovedTime),
If(0>ME.Operation.MovedTime,RGB(250+ME.Operation.MovedTim
e,250+ME.Operation.MovedTime,255),0))))    … (expression 1)
```

The Operation table's MovedTime (time moved since last [2h] assignment) property is used. This is also a property added to the operation class and it becomes a Virtual property. The expression shown below is assigned to the Virtual property expression.

```
Roundup((ME.'Production start time'-ME.'Last production
start time'[1])/2h,0)
```

This means that the time worked is compared with previously assigned time and split into two-hour units. Two hours is a value determined by appropriate reference to the data time scale. Other data could be in one-hour or one-day units.

Making reference to this, **the expression (1) means that the hue gradually changes at differences equal to or not greater than 250 x 2 hours = 500 hours and if greater, the hue is steady at RGB(255,0,0)、RGB(0,0,255).**

Next is the method of assigning comparisons of Main resources. Assign the expression for the "Main resource" property's "Background color expression" property as shown below.

```
If(FValid(ME.MainResHistory[1]),If(ME.MainResHistory[1]==ME.
OperationMainRes,0,8),26)
```

If resources are different, the color displayed is 8 (yellow-green) and if "Last main resource" is blank, i.e., at initial assignment, the assigned color is 26 (green).

That completes settings to obtain the Operation table display in Fig. 1. Using Internal function RGB for the display color expression gives a method that returns the color property and a method that returns an integer type property. The latter method is a method for assigning 32 standard colors from 1 to 32 and uses the color assigned to the palette.

Help

"Customizing display colors"(Help No. 743350)

Setting it up -Applying the Gantt resource chart-

Next is the method for assigning the display color to the Gantt resource chart's Use instruction bar. Two styles shown in Fig. 8 have been prepared for the Gantt resource chart. The first compares only assigned time, the second reflects in color whether or not resources have changed.

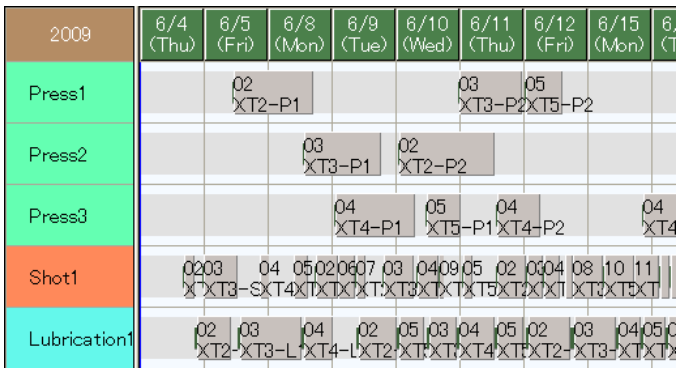
Detecting difference	Detecting difference(resource too)

▲ Fig. 8 Style in the Gantt resource chart. Use the one on the left only for detecting differences in date and time and the one on the right for detecting changes in resources.

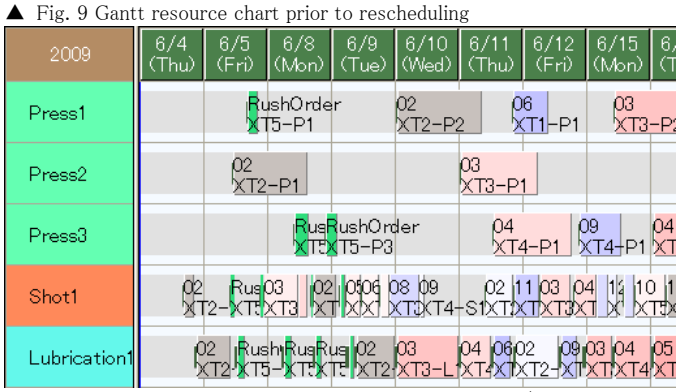
The expression below is given to the "Bar color expression" property of the style "Detecting difference (resource too)".

```
If(ME.Operation.MainResMovedColor==26,26,
If(250<ME.Operation.MovedTime,RGB(255,0,0),
If(-250>ME.Operation.MovedTime,RGB(0,0,255),
If(0<ME.Operation.MovedTime,RGB(255,250-ME.Operation.Moved
Time,250-ME.Operation.MovedTime),
If(0>ME.Operation.MovedTime,RGB(250+ME.Operation.MovedTim
e,250+ME.Operation.MovedTime,255),0))))    … (expression2)
```

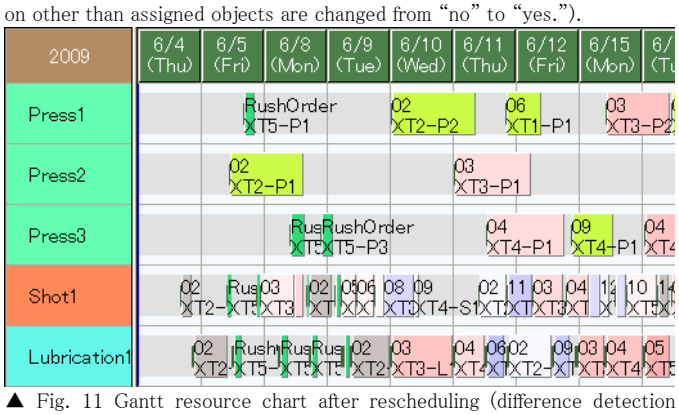
When an operation is newly assigned, set it so that it will display in green (color 26), which is almost the same as with the operations table (expression 1). This setting colors the bar as shown in Figs. 10 and 11.



▲ Fig. 9 Gantt resource chart prior to rescheduling



▲ Fig. 10 Gantt resource chart after rescheduling (color difference detection style) Gray indicates that there has been no movement in date and time for the operation since its last previous move. Operations in green are express orders that have just been newly added to the order table (flags on other than assigned objects are changed from "no" to "yes.").



▲ Fig. 11 Gantt resource chart after rescheduling (difference detection [including changes in resources] style) Yellow indicates usage instruction bars for operations that have had resources changed.

A slightly simpler setting

The changes in color shadings as determined by differences in time and date are difficult to assign. To greatly simplify that setting just eliminate the function that determines whether there will be differences from the previous schedule. To assign just one color for production start time changes in the Operation table, for example, simply assign the expression below to the Production start time's Background color expression.

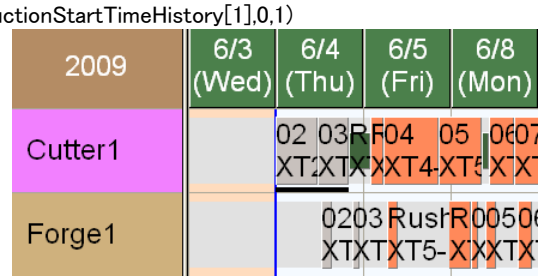
If(ME.OperationProductionStartTime==ME.ProductionStartTimeHistory[1],0,1)

	Code	Last main resource	Main resource	Last production start time	Production start time
1	⊞01:10	Cutter1	Cutter1	2009/07/09 00:00:00	2009/07/09 00:00:00
2	⊞01:100	Shot1	Shot1	2009/07/14 03:33:20	2009/07/14 08:46:40
3	⊞01:110	Lubrication1	Lubrication1	2009/07/14 08:13:20	2009/07/14 13:26:40
4	⊞01:120	AssemblyLine	AssemblyLine	2009/07/14 14:46:40	2009/07/14 20:00:00
5	⊞01:130	Inspection1	Inspection2	2009/07/15 14:33:20	2009/07/15 19:46:40
6	⊞01:20	Forge1	Forge1	2009/07/09 07:06:40	2009/07/09 07:06:40

▲ Fig. 12 An example of background color turning orange when Production start time changes

The same is true for the Resource Gantt chart's bar indicator color expression.

If(ME.Operation.OperationProductionStartTime==ME.Operation.ProductionStartTimeHistory[1],0,1)



▲ Fig. 13 Example of bar color turning orange when Production start time changes

Comparing with actual results

In exactly the same way, we will now attempt a comparison between scheduled forecast and real result. A comparison between forecast and reality is a comparison between the time and date scheduled at the time the manufacturing order was issued and the time and date on which the order was actually completed at the factory.

In the example below, the retained 'last assigned position' data is compared with the present assigned position, and the copying of the position data will not be done once the job has actually been started. In this way, the assigned position data immediately before the job began is retained even if there are multiple reschedules after the job has begun.

The assignment is extremely simple. To prevent overwriting the assigned position data for the job after it has been started, the expression shown below is assigned to the planning parameter's "Filter operations" property on line 57 in Fig. 14. This assignment is used so that fixed Time level will be 40 when operation status is started and 50 when it is completed, and as long as fixed Time level is less than 40, the assigned position data will be recorded.

ME.Operation.TimeFixedLevel<40

56	⊟Record assigned position and reschedule(compare result with schedule)
57	⊟Record assigned position(compare result with schedule)
58	Upload operations
59	Filter operations
60	Modify properties
61	⊞Default scheduling parameter

▲ Fig. 14 Planning parameters that make reference to the comparison between schedule and result. The expression is assigned to "Filter operations."

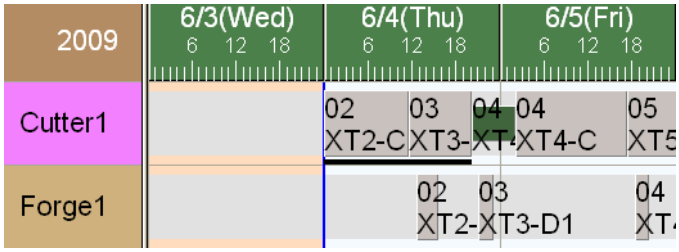
There's no need to prepare a new Bar color expression or Background color expression in the Resource Gantt chart or Operation table.

Now let's take a look at an actual case. Fig. 15 shows the initial status. Take a look at the scheduled forecast versus real results for a point one day ahead of this on June 5. The operation "02" that is assigned to resource "Cutter 1" has been completed on schedule but the "03" operation is greatly delayed and although it is supposed to have finished by this time, it is only 20 percent complete.

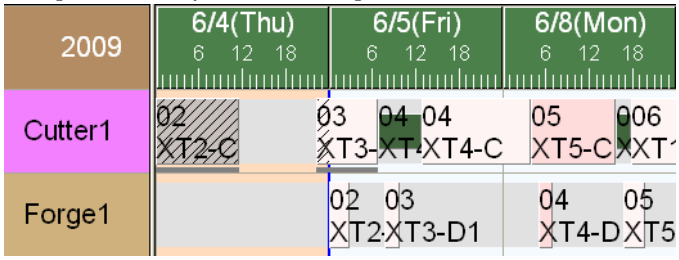
Fig. 16 shows the status immediately after rescheduling. "02" is on schedule so it is not colored, but the delay in "03" causes it to be colored.

Planning parameters can be made up to this point that do not refer to the comparison between forecast schedule and actual result, but the important point is after one rescheduling. Fig. 17 shows a Gantt chart after one more rescheduling in which only the operation "02"

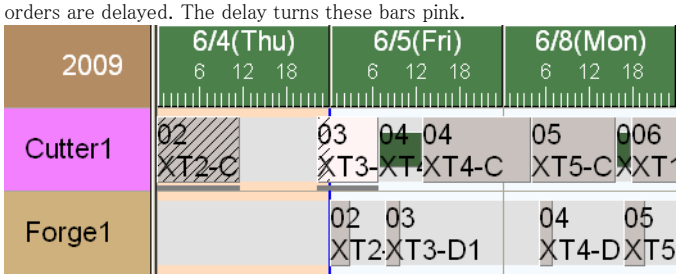
bar is in color. That is because the comparison of forecast and real result has continued to remain due to 1) repeated rescheduling without any changes, 2) assigned position data has not been overwritten after actual results are obtained and, subsequently, 3) because the initial assigned position data (i.e., the schedule forecast) has been continually saved.



▲ Fig 15 Immediately before scheduling

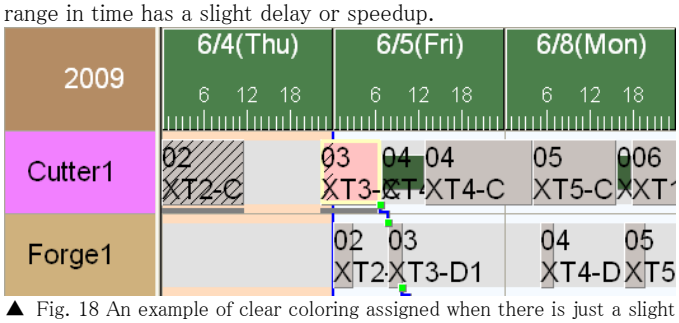


▲ Fig. 16 After rescheduling. 02 is completed as scheduled and other orders are delayed. The delay turns these bars pink.



▲ Fig. 17 After further rescheduling. Because no changes have been made ordinary color gradations do not show except for comparison between forecast and result. For operations in progress, the comparison will always be between the current position and the position scheduled for when the operation was started.

With the comparison between scheduled and real result you may use settings in this way to display a clear color even if the range in time has a slight delay or speedup.



▲ Fig. 18 An example of clear coloring assigned when there is just a slight difference between schedule and result.

In comparing schedule and results, clear timing when outputting manufacturing instructions is better for operations than the vague timing as in the example above, which was set up just prior to obtaining an actual result. In such cases, it may be better to set up some sort of flag to make it certain that subsequent assigned position data will not be recorded further.

Help

"Status"(Help No. 755000)
"Inputting results"(Help No. 13000)
"Assignment direction determination and time fixed level"(Help No. 764000)

Comparing with option recording

The method of setting introduced here records the main resource manufacturing start time in the operation table. Thus, exporting results assignment timing into a text file and then importing them allows comparisons to be made with the results of assignment not just for the previous operation but with the assignment results at any previous time. This can be used to confirm whether draft results are the same up to the point that an Asprova version is upgraded or a change is made in a plug-in program.

For more information

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