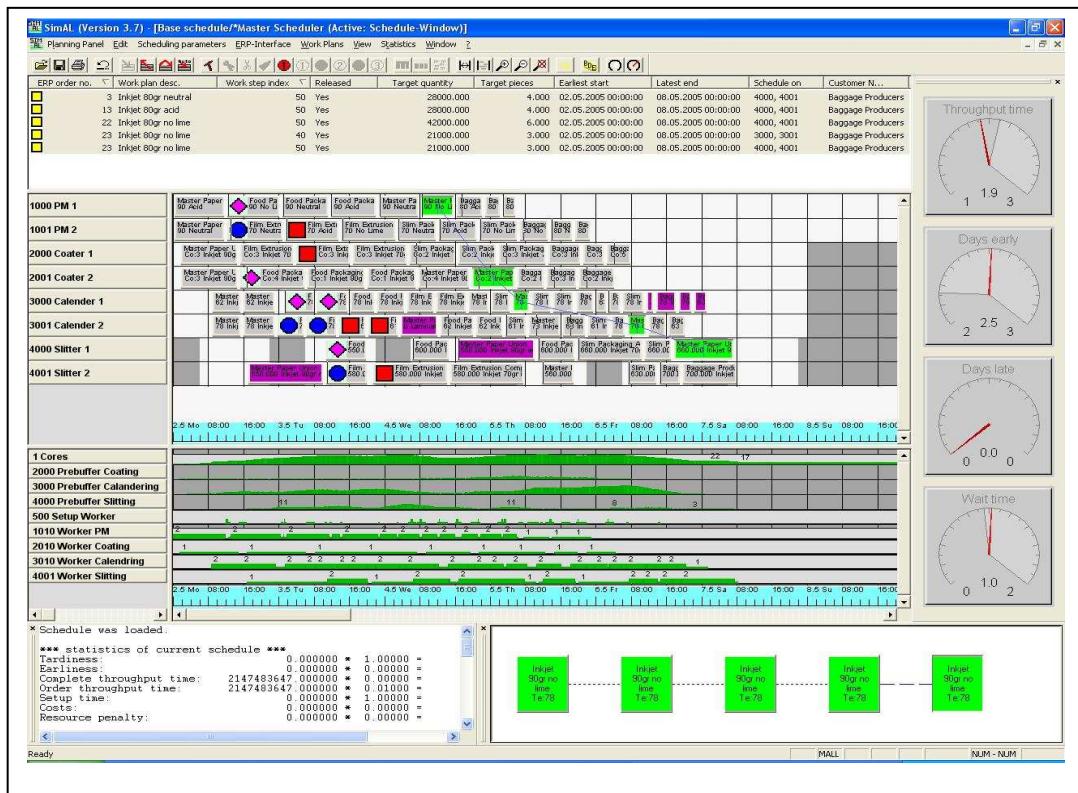


SimAL

User Manual

Version 3.7.100



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1. Introduction

The following Volume 1 of the SimAL user manual describes the standard functions of the program. This instruction is thereby meant for users. Customization as well as data and programming interfaces have been described in other documentations.

1.1 Typographic convention

Before you can use SimAL, you must first carry out some basic settings. By experience, the first steps with new software are the hardest. To make your introduction to SimAL as easy as possible, there are typographic conventions to understand this manual better.

| Representation in the manual | Meaning |
|-----------------------------------|--|
| MASTER DATA / USER ADMINISTRATION | Text in small capital letters indicates the menu of the same name. Many functions of SimAL can only be called up through sub-menus. The individual menu entries are separated from each other by a slash (/). In the accompanying example, this means that you first click MASTER DATA on the menu bar; in the dropdown-menu which subsequently appears, you have to click USER ADMINISTRATION with the left mouse button. |
| [Ctrl] + [F10] | This notation refers to the similarly marked keys on your keyboard. This representation is normally used at the beginning of each chapter of this manual, when the calling of a program is being described. If two keys follow each other without a + between their symbols, then the first key must be kept pressed when pressing the second key. |
| [Shift] | This representation indicates the SHIFT key, with which, for example, you switch to capital letters in your word processing. |
| [Caps Lock] | This representation indicates the CAPS LOCK key, with which, for example, you permanently switch to capital letters in your word processing. |

| Representation in the manual | Meaning |
|------------------------------|--|
| [Return] | This symbol indicates the RETURN or ENTER key. [Enter] on the numeric keypad can be alternatively used. |
| [SPACEBAR] | This representation is used for the SPACEBAR. |
| [New] | Text in squared brackets indicates command buttons in the respective dialog boxes. The text in squared brackets corresponds to the title of the indicated command button – the example along-side therefore concerns the command button with the name “New”. |
| <i>Example</i> | <p>Text in italics refers to examples. In this case, you must replace the text in italics with an entry corresponding to your requirements.</p> <p>When two details in italics directly follow each other, the valid entry range is being described. The example “1 ... 9” means that your entry must lie in the range between 1 and 99.</p> |
| Obligation | Bold text refers to entries, which must be exactly followed as per the given text. Here, writing in capitals or small letters must also be followed. |
| »User« | This type of writing is used to indicate the text boxes, checkboxes, etc. of the same name in the dialog boxes. |
| [OK] | Clicking of this command button saves the entries in a dialog box and closes it. |
| [Cancel] | Clicking of this command button closes the dialog box without saving any possible changes or entries. |

1.2 Logging on to SimAL

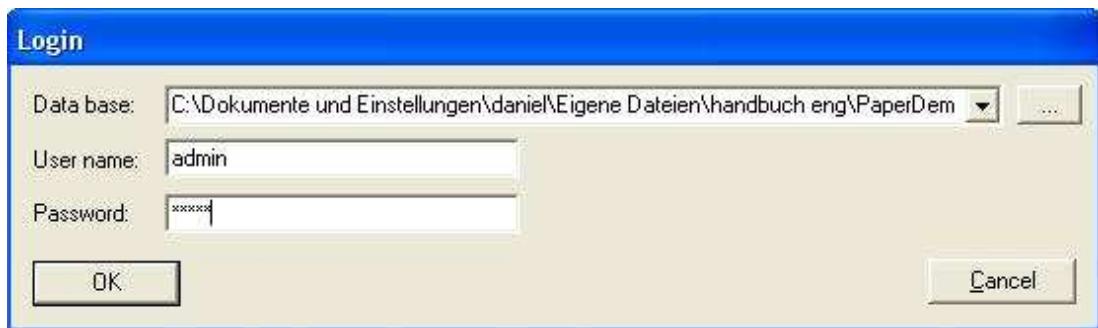


Figure 1: Logging on to the system

After you have started SimAL, the logging in of the user follows, without which you cannot work with the program. The dialog box for logging in of the user has three text boxes:

In the box »Database«, enter the database, with which SimAL should work. If you use Access as a database, then it is possible to choose the Access database (*.mdb) by clicking the [...] button. For other types of databases, the name of the database to be used by SimAL has to be entered. The complete path of the database must be entered. Figure 1 shows an example.

Click in the box »Name« and enter your username, as it was issued by the system (Chapter 2.1 [User administration](#)). If you do not know your username, check with your system administrator. With [TAB] or clicking with the left mouse button in the box »Password«, you reach the demand for the password. Enter your user password here.

In each database, which has been delivered empty, there is a predefined user with complete access rights. This user has the name *admin* and also the password *admin*.

Once you have carried out these entries, click the command button [OK] with the left mouse button and you reach the work screen of SimAL, under the condition that your entry was correct. If you decide while logging in that you would rather not work with SimAL at the moment, click [Cancel] or press the [Esc] key.

1.3 Schedule and control elements of SimAL

1.3.1 The Work Screen

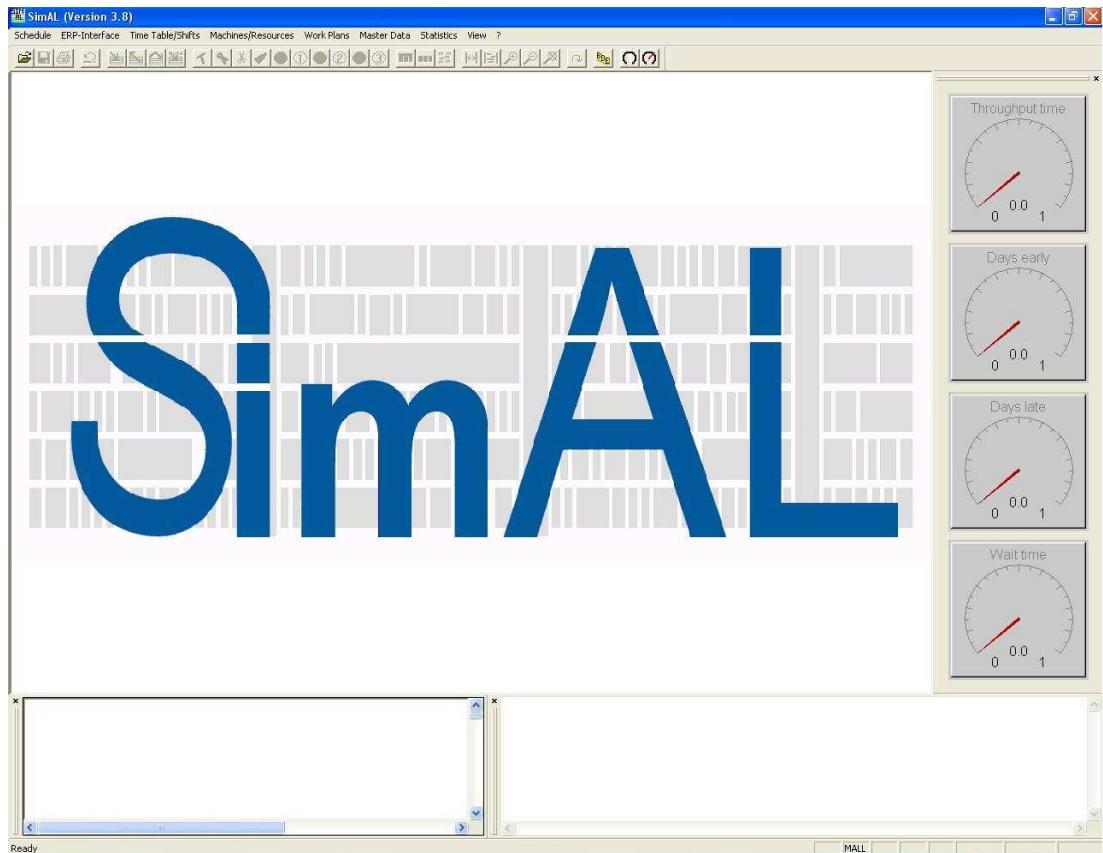


Figure 2: The program screen of SimAL

The schedule and control elements of SimAL comply with the universal conventions for WINDOWS™-Applications. The uppermost window edge shows the title bar with a dark background, which contains the program name and the three buttons typical for WINDOWS™ to minimize the window, to switch between window and full-screen mode and to end the program.

Below the title bar is the menu bar, from which all the functions of SimAL can be accessed. Menus are opened by clicking with the left mouse button, or with the keyboard by pressing [Alt] + [underlined alphabet] in combination. For example, when you press [Alt] + [P] in the work screen of SimAL, the menu SCHEDULE is opened. Through the toolbar, which is placed under the menu bar, frequently used functions of SimAL can be accessed without having to click the program

menus (under the condition that the toolbar is activated in the menu VIEW Chapter 8.8.19 [Toolbar](#)). Shaded symbols cannot be activated.

In future, no difference will be made in this manual between the left and right mouse buttons. If you are requested to perform a mouse-click, the left mouse button is always meant. By right-clicking selected objects, the context menu will be shown, which offers the choice of the most important entries of the current menu bar.

Most of the display is occupied by the SimAL symbol after starting the program. In this window area, the dialog boxes, schedule windows and similar objects are shown depending on which program function has been accessed.

The status bar is located in the bottom window edge, which shows information or support options for the chosen function. Immediately after program start, the message “Ready” is shown (under the condition that the status bar has been activated in the menu VIEW Chapter 8.8.18 [Status bar](#)).

After the initial program start, three so-called dock windows are shown in the background. You should first drag these windows to the bottom of your screen. When the window has reached the bottom of the screen, it automatically changes its form. Release the window and it then “docks” itself to the screen edge. Perform the same with the second window. If both the windows (message window and order graph window) are not shown automatically after starting the program, they can be activated later by activating the respective command in the menu VIEW.

1.3.2 Control elements in the dialog boxes

Within the dialog boxes, SimAL has five different types of entry boxes.

- **Text box:**

Alphanumeric or numeric entries can be carried out in this box type. Which of these is allowed depends on the box type.

- **Drop-down list box:**

You can choose from a list of given possibilities. By clicking the small black triangle on the right window edge, the provided choices are shown.

If the user becomes familiar with the choices of such a field in the course of time, he can enter the starting alphabet of the desired option to make his choice. If several entries exist with the same starting alphabet, the first entry with this alphabet is chosen. A repeated entry of the starting alphabet chooses the second option with the same starting alphabet.

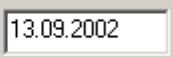
- **Checkbox:**  Chargenfertigung

Here, the user has the possibility to “check” or “uncheck” the field. “Checking” is performed by clicking with the left mouse button or with the [SPACEBAR]. Clicking once again removes the marking. It can be said that checkboxes function according to the principle of an on- and off-switch. If several checkboxes are there in a group, then several fields can be activated as well.



- **Option button:**

In principle, option buttons are used like checkboxes. The only difference is that only one choice can be activated within a group. If you try to activate a second option, the option initially chosen is deactivated.

- **Date box:** Datum:  13.09.2002

This is a special type of text box. Only numeric entries in the format DD.MM.YYYY are possible (or in the currently set date format Chapter 6.7 [Setting options](#)). Some boxes in dialog boxes of SimAL require a combined entry of date and time; in such cases, the date has to be entered first in the above format followed by the time in the format hh:min:ss; for example, 01.01.2005 06:50:00. Clicking with the right mouse button in this field opens a window of a calendar to enter the date.

1.3.3 List functions

Many data lists can be found in the main area as well as in the schedule window described later. These lists are to a large extent parameterized and defined by the user. In all these lists, the buttons [Columns], [Filter], [Print] and [Clipboard] are on the upper left side. Therefore, they are described once here.

In principle, you can personally specify which data must be shown in which column for almost all data types in SimAL. The individual data boxes are called Attributes in SimAL. One attribute can be represented in each column. Depending on the type of the data to be shown in the list, different attributes can be chosen. One click on the title can sort according to this column. Another click reverses the sorting. In case sorting is required according to several columns, then the further columns can be clicked while keeping the [Shift] key pressed.

1.3.3.1 Setting columns

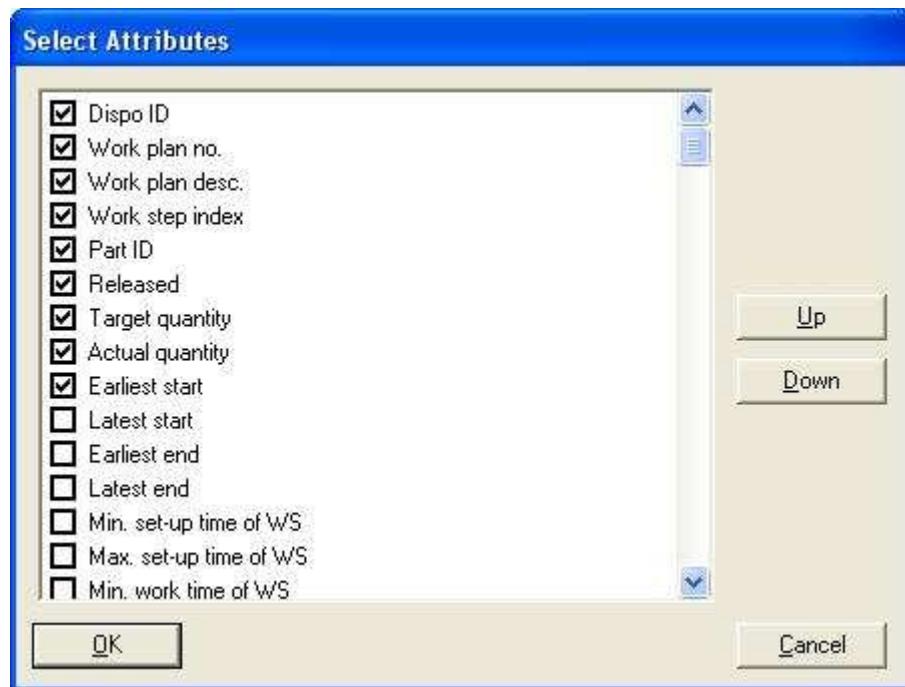


Figure 3: Setting columns

When you click [Columns], the dialog box shown in Figure 3 is opened. Choose the columns by clicking the box next to the attribute description. Through the command buttons [Move up] and [Move down], you can set the order of the columns. The higher a selected attribute appears on the list, the farther the column is on the left side in the list. When this dialog is closed and opened once again, all selected attributes automatically appear at the beginning of the list.

1.3.3.2 Filtering



Figure 4: Filtering

Through the button [Filter], you can choose which data should be shown in a list. Furthermore, up to three conditions can be defined, in which an attribute is compared with a value. The conditions work simultaneously (AND-connection). Choose which conditions are active by clicking the checkbox. Then choose the attribute, through which you wish to Filter. The operator for comparison and the comparison value have to be chosen now. Depending on the type of the attribute, the entry field for the comparison value is formatted differently. For text attributes, the symbols '*' and '?' can be used as jokers.

- A '*' at the end of the search term stands for any order of symbols.
- A '?' in the search term stands for any symbol here.

If the comparison value is a date box, right-clicking in the entry field opens a calendar.

ATTENTION: Filters are saved and stay as they are unless they are removed (even during several program-runs!). So, if you find that you are missing some data at a place, first check if an undesired filter is running.

1.3.3.3 Printing

Clicking [Print] prints the current data shown on the list. First, a dialog box appears, in which you can set the printer and print alignment. In the printout, the defined column width from the dialogue for calculation of column width of printouts is adopted. You must consider that shifting of format between representation on the monitor and in the printer is possible, and you might have to re-justify the column width on the monitor.).

1.3.3.4 Clipboard

Through the button [Clipboard], data in the list (such as tabular calculations) are copied into the Windows-Clipboard to be used in other programs. The columns and rows are copied exactly as they have been defined by the functions [Columns] and [Filter]. In most other programs, these data can be taken over through the menu command EDIT / PASTE.

1.4 Configuring the Work Screen

Through the main menu item VIEW, the toolbar and status bar can be shown or hidden. The menu VIEW contains only four entries:

1. VIEW / TOOLBAR; the toolbar can be switched on and off through this menu item.
2. VIEW / STATUS BAR; the status bar, whose function is described in Chapter. 1.3.1 [The Work Screen](#) can be switched on and off through this menu item.
3. VIEW / MESSAGE WINDOW; the message window can be shown or hidden through this menu item.
4. VIEW / ORDER GRAPH; the order graph can be shown or hidden through this menu item.
5. VIEW / KPI WINDOW; the window for display of logistical characteristic quantities (Key Performance Indicators) can be shown or hidden through this menu option.

You can recognize whether a function is activated by a small black checkmark next to the menu command; the toolbar and status bar are normally activated in SimAL. A mouse-click on an entry deactivates the respective bar, while another mouse-click activates it again.

The message window, order graph window, KPI window as well as the menu bar can be docked or represented as free tool windows. To dock such a window, drag it by its

border to the edge of the SimAL-work screen. To position a window in an undocked condition, drag the window while keeping the [Ctrl] key pressed.

1.5 Exiting SimAL

SCHEDULE / EXIT

To exit SimAL, either perform the menu sequence shown above or use one of the typical WINDOWS™ methods to close a program by

- Clicking the cross in the upper right-hand side of the title bar.
- Double-clicking the program symbol in the upper left-hand corner of the title bar.
- Or pressing the keys [Alt] + [F4].

If you have already opened a schedule window, a few special rules apply when exiting the program, which are explained in Chapter 8.3.3 [Closing](#).

2. Organizing the System

Every staff member who works with SimAL must first be acquainted with the system (Chapter 2.1 [User administration](#)). A user group must also be allocated to each user. The program functions, which can be seen or edited by the members of a group, are specified in a user group.

The schedule window can basically be opened by every user. Permission to edit in the schedule window is controlled by so-called “views” in SimAL. The areas, machines and resources that should be viewable for a particular user are defined in a view. It is also defined in the view, whether the areas, machines and resources are only viewable for the user or whether they can also be scheduled. Since areas, machines and resources are needed for the setting-up and administration of views, we will at first deal with areas, machines and resources in chapters 3, 4 and 5. A detailed explanation on the setting-up and administration of views can be found in chapter 1.1 [Editing views](#) in this manual.

2.1 User administration

MASTER DATA / USER ADMINISTRATION

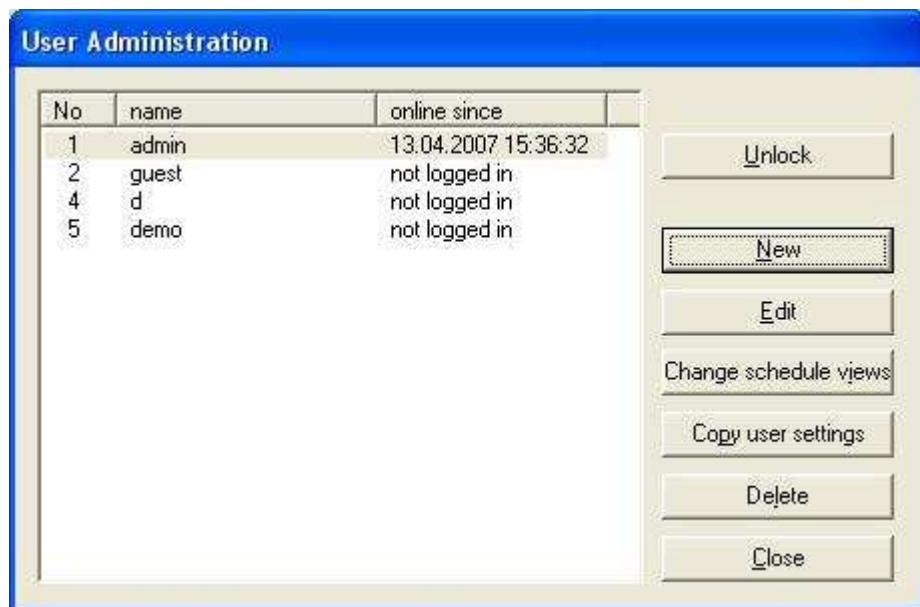


Figure 5: User administration

After the menu sequence described above, the dialog box for user administration (Figure 5) is opened. All recorded users until now are shown in the list box, while the users can be edited, setup or deleted through the command buttons on the right side of the dialog box.

2.1.1 **Unlock**

If SimAL has not been properly closed — for example, by improper shutting down of the computer or a power failure —, the user is still considered as logged on for SimAL and cannot log on under his username after restarting SimAL. In this case, another colleague or the system administrator has to choose the concerned person by clicking in the list box and log him off later. This is performed by clicking the command button [Unlock]. The user can then log on normally after accessing SimAL and continue his work.

Please note that users who are currently working in the system should never be unlocked, since their SimAL will be ended immediately after unlocking without being saved. The users who were unlocked will receive an indication of the time of unlocking and the user who unlocked them the next time they log on.

2.1.2 **New**

Click this command button to register a new user in the system. After activating the command button [New], a new dialog box (Figure 6) is opened.



Figure 6: Setting up a new user

To set up a new user, a unique number must be allocated to him in the box »Number«. SimAL suggests a default value of the *'highest occupied number + 1'*; you can however overwrite this value and allocate another number. Enter the complete name of the user to be set up in the box »Name«; this name must be entered by the user each time when logging on to SimAL. Allocate a password to the user by entering in the box »Password« and repeat the entry in the box »Confirmation«.

If the entry in »Confirmation« does not match with the entry in »Password«, SimAL will remind of you this and will accept the entered password only when it has been correctly repeated in the box »Confirmation«.

You must then allocate a user group to the new user. Choose the desired entry from the list in the box »Group«. The initial settings of the new user can be defined by choosing the settings of either the standard user or of an already existing user in the box »Copy settings from: «. The settings for the chosen user are adopted as the settings of the new user.

2.1.3 Edit

Click this command button to change the details of a user for logging on to the system. The function [Edit] refers each time to the user chosen in the list of existing users. The chosen user is shown darkly highlighted in the list and can thereby be recognized. Choose the user to be edited simply by clicking his name in the list. After a user has been chosen to be edited, a new window appears. This window is identical to the window for setting up of a new user (Figure 6). It only serves to subsequently change the details while setting up a user.

2.1.4 Changing views

The views (Chapter 1.1 [Editing views](#) for the topic “Views” and defining views) to be made available to the chosen user can be defined through this dialog box (Figure 7).

Please note that only existing views can be allocated or taken back here; new views have to be defined through SCHEDULE – EDIT VIEWS (Chapter 1.1 [Editing views](#)).

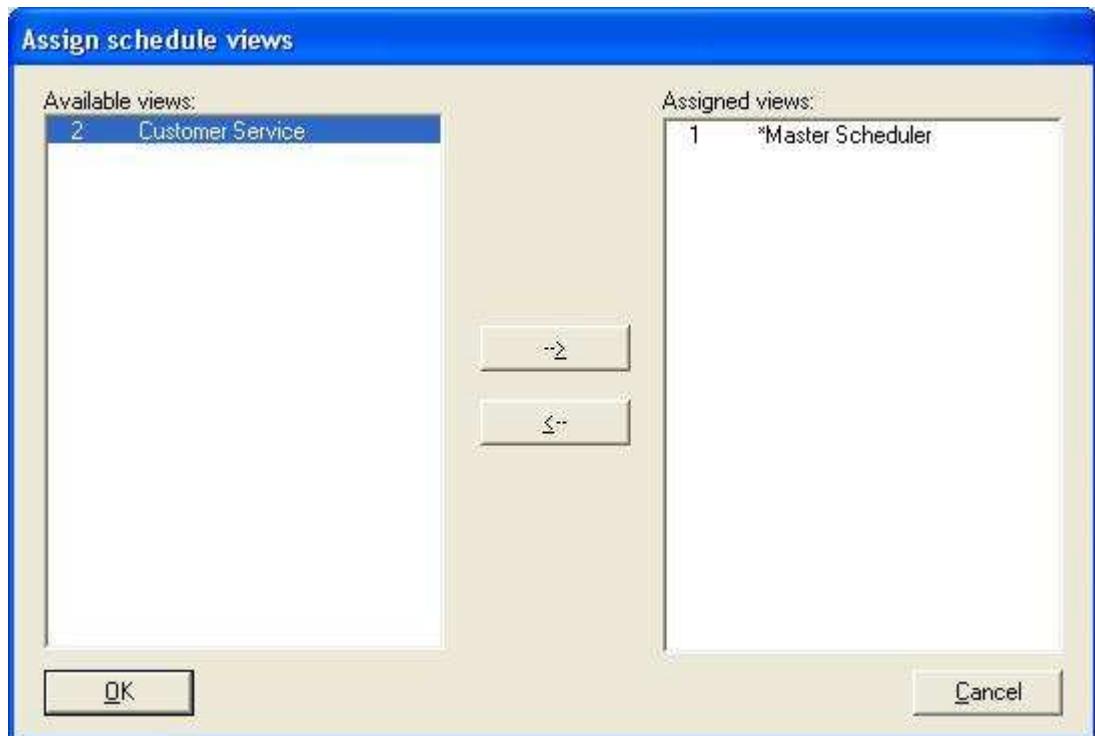


Figure 7: Allocating views

The dialog box “Allocate views” has two parts. On the left side is a list box, which lists out all the views that have not yet been allocated; the list box on the right side displays the views allocated to the currently chosen user. Choose a view in the left list box and click the command button [→] to allocate it to the user. An allocated view can be removed from the user by clicking [←]. You can alternatively use [Alt] + [Shift] + [>] to add views and [Alt] + [Shift] + [<] to remove views.

2.1.5 Delete

If a staff member is not supposed to work with SimAL in future, his access can be deleted through this command button. A deleted staff member, who needs to be entered once again as a user at a later stage, must be set up again through the command button [New].

Make sure that you have chosen the correct staff member to be deleted. The delete function always refers to the user whose name is darkly highlighted in the list box.

2.1.6 Copy settings

Clicking this command button opens a dialog box, with which you can copy all the user-dependent settings from one user to another.



Figure 8 Copying user settings

2.1.7 Closing

This command button ends the user administration.

2.2 Editing user groups

MASTER DATA – EDIT USER GROUPS



Figure 9: List box of user groups

After the menu sequence shown in the beginning, a list box (Figure 9) is opened, which lists out all existing user groups. With the command buttons [New], [Edit] and [Delete], the user groups can be accordingly managed. Click [New] to set up another user group, a further dialog box will subsequently be opened (Figure 10).

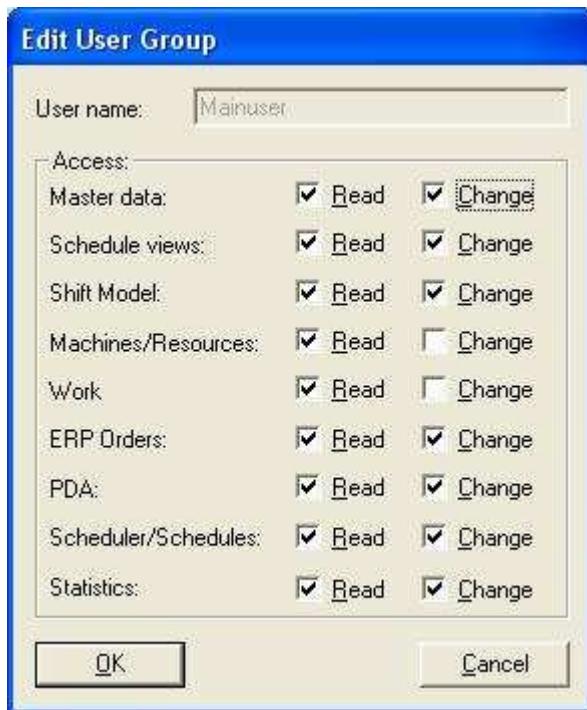


Figure 10: Parameterizing a user group

First allot a name for the group to be set up in the box »Name«. SimAL enters a default value as "New Group"; entering the first letter of the new group name overwrites this default.

In the group box "Rights", click the respective reading or reading/writing rights, which a new user group should receive. The box »Reading« allows only the viewing of the concerned area, while the activated box »Change« enables the concerned areas to be viewed as well as changed. The areas in which authorizations can be allotted have the following meanings:

| Authorization area | Meaning with activated function (Authorization to read or change) |
|---------------------------|---|
| Master data | All functions of the main menu MASTER DATA are available in this area. |
| Views | The functions of the main menu Schedule, excepting the points Copy schedule and Delete schedule, are available in this setting. |
| Shift model | All functions of the main menu Company holidays/Shifts are available in this area. |
| Machines/ Resources | All functions of the main menu MACHINES/RESOURCES are available in this area. |
| Work plans | All functions of the main menu WORK PLANS are available in this area. |
| ERP Orders | All functions of the main menu ERP ORDERS are available in this area. |
| PDA | The PDA authorization allows the acquisition, changing or viewing of PDA messages (Chapter 1 Production Data Acquisition (PDA)). |
| Schedules | This authorization decides whether the user may copy or delete schedules. |

Your entries are saved with [OK] and the new user group with its corresponding authorizations is established.

Only users with the permission to change master data can set up user groups!

The rights of an existing user group can be changed by first marking the desired group in the list box (Figure 9) by clicking it and then activating [Edit]. The dialog box to parameterize the user groups (Figure 10) is opened and the entered rights are shown. Adjust the user rights for this group or allot a new name for the group. After you have carried out all the changes, click [OK] to save the new settings.

Remember that changes to the rights of a user group affect all users allocated to this group! Changes in access rights of a user group become effective only with the next log-on to Si-mAL!

An existing user group can be deleted by clicking the group to be deleted in the list box (Figure 9) and subsequently activating [Delete].

Deleting a user group is only possible when there is no user allocated to this group! First allocate all the users of the group to be deleted to another user group and then delete the group!

2.3 Company holidays

COMPANY HOLIDAYS/SHIFTS – EDIT OPERATION CALENDAR

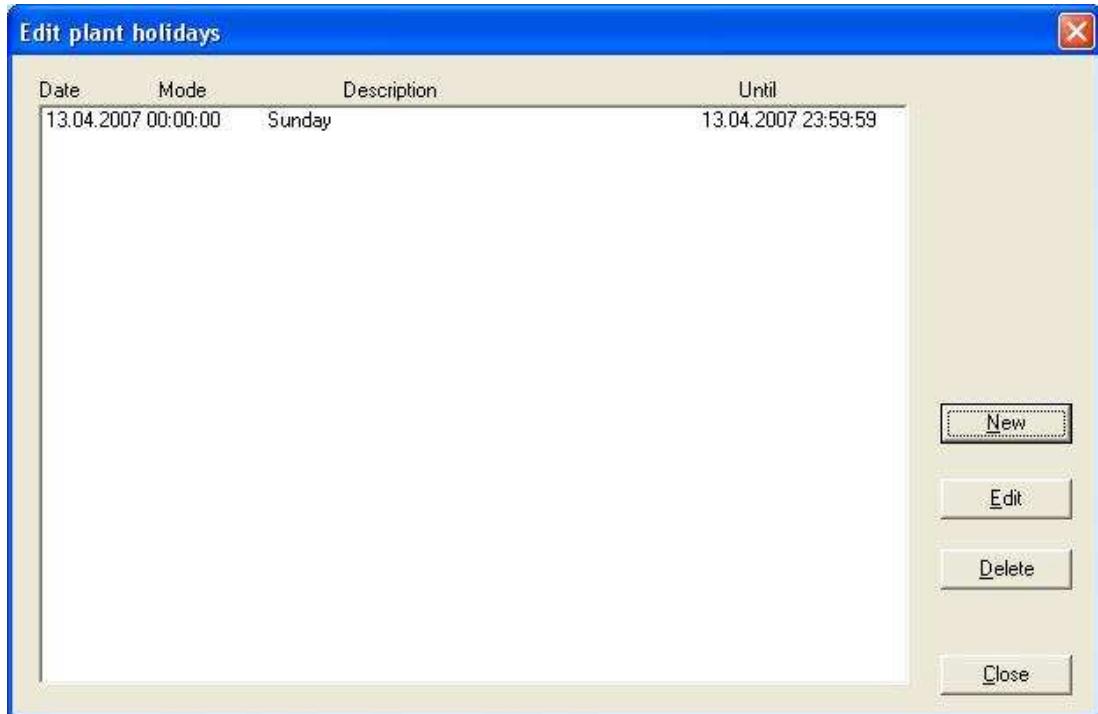


Figure 11: Editing company holidays

With this function, days are defined on which operation is stopped, for example festivals or company holidays. Either single days or complete time periods can be defined as company holidays here. Clicking the command buttons [New] and [Edit] opens another dialog box (Figure 12). To delete already existing periods of rest, choose the appropriate entry from the list and activate [Delete]. [Close] ends the editing of the operator calendar.



Figure 12: Setting up or changing the company holidays

To enter periods of rest in the company holidays, enter the date of the day, on which the company is closed, in the box »Date«; for periods of rest of several days in length, enter the date of the first day of closure. With »Description«, you have the possibility to name the period of rest. In the box »Type«, it is defined whether it is a single holiday (**Sunday/ Festival**) or a longer period of time (**Company holidays**). For longer periods of rest such as company holidays, you must additionally enter the last day of the holidays in the box »Till«. The box »Till« cannot be edited if Sundays and Festivals has been entered.

2.4 Configuring the printer

SCHEDULE – CONFIGURE PRINTER

Any printer which can be installed and operated in WINDOWS 2000 or XP can be used in the operation of SimAL. If you haven't already installed a printer, you may need your WINDOWS CD to register a printer in the system. After accessing the program to set up the printer, the dialog box to configure the printer is opened. Using the dialog box to configure the printer must already be familiar to you from the WINDOWS™ installation. Therefore, an explanation of the individual text boxes has been left out. If you still have questions or problems while configuring the printer, consult your WINDOWS™ manual. The printer dialog on your system may vary slightly from that shown, since the exact options are dependent on the operating system being used and on the installed printer drivers.

3. Machines and Resources

Orders are always scheduled based on limited capacities in SimAL. A single capacity is called a machine in SimAL. This term is used for a unit to be scheduled. Manual jobs or outside processing can however also be set up as machines without any problems. Basic differences are made between machines and additional resources:

- Machines are directly scheduled units (orders can be placed, moved around and further unscheduled on machines). Machines have a shift calendar with times of operation and standstill. It can be decided through views, which planner is allowed to schedule which machines.
- Resources are units, whose loading or utilization normally automatically results from loading of the machines. For example, tools that are necessary can be thus defined as resources. When a machine is scheduled for an order, which needs this tool, the corresponding resource is, for example, loaded for the duration of working time. Resource-loading is automatically determined from the machine-loading 99% of the time. Manual shifting of loadings is not possible with resources (irrespective of machine scheduling).

The necessary production locations, machines, personnel and materials must be documented, so that production orders can be scheduled in SimAL. The production areas must first be defined.

3.1 Areas

WORK PLANS / EDIT AREAS

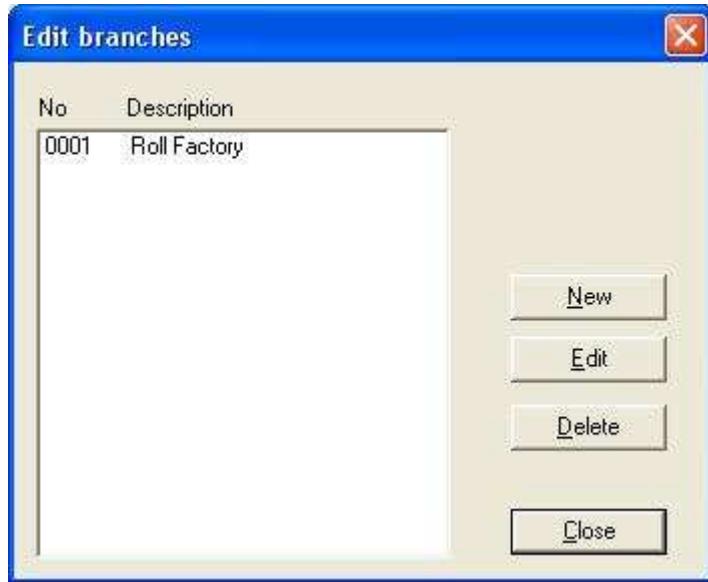


Figure 13: Configuring production areas

SimAL offers the possibility to define production areas. This function is offered especially for companies which are divided into several production areas. With the help of areas, different scheduling groups can be created, which correspond to these production areas (for example, *Production and Paint Shop*), so that the scheduling is created in a more transparent way (the planner responsible for the paint shop would only be able to see and edit machines relevant to the paint shop in SimAL, since machines of the production area are of no importance to his work).

While defining views (Chapter 1.1 [Editing views](#)), one can also specify that only orders from particular areas can be viewed and scheduled in particular views.

After the menu sequence shown above, the list box illustrated in Figure 13 is shown. In this dialog box, four command buttons for different functions are also found:

1. [New] (Chapter 3.1.1 [Setting up areas](#)) sets up a new area.
2. [Edit] (Chapter 3.1.2 [Editing areas](#)) allows the renaming of an existing area.
3. [Delete] (Chapter 3.1.3 [Deleting areas](#)) removes an area from the list.
4. [Close] The list box is closed and you return to the work screen of SimAL.

3.1.1 Setting up areas

To set up a new area, click [New]. A new dialog box with two text boxes is opened. A unique number must be allotted in the box »Number«; SimAL allots the ‘highest

occupied number +1' as a default value. You can manually change this default value, but we recommend leaving the numbering of the areas to SimAL, since a manual number allocation brings no real advantage to running of the program.

Name the area to be set up in the box »Description«. A maximum of 20 characters can be used.

3.1.2 Editing areas

To edit a production area which has already been set up, you must first choose the required production area in the list box and then click the command button [Edit]. The dialog box, already familiar from initial setting up of a production area, is opened. The only box you can edit is »Description«; enter the new description there. The box »Number« is visible but cannot be edited. If you have to change the box »Number«, you have to first delete the area and create it once again.

3.1.3 Deleting areas

To delete a production area, choose it in the list box and click the command button [Delete].

An area cannot be deleted, if it has been allocated to a process.

3.2 Machines

MACHINES/ RESOURCES / EDIT MACHINES

Edit machines

The screenshot shows a Windows-style dialog box titled "Edit machines". On the left is a table with columns: No., Description, Perf..., Fix..., Op..., Units, Utilizatio..., Set-up ..., and Batch m... . The table lists several machine entries, such as "1000 PM 1", "1001 PM 2", etc. To the right of the table is a vertical toolbar with buttons for "Columns", "Filter", "Print", "Define set-up matrix", "Resources", "Down times", "Additional availability", "New", "Edit", "Delete", and "Close".

| No. | Description | Perf... | Fix... | Op... | Units | Utilizatio... | Set-up ... | Batch m... |
|------|-------------|---------|----------|------------|-------|---------------|------------|------------|
| 1000 | PM 1 | 100 | 1200.000 | 9800.000 | 1 | 1 | Yes | No |
| 1001 | PM 2 | 100 | 0.000 | 10588.0... | 1 | 1 | Yes | No |
| 2000 | Coater 1 | 100 | 0.000 | 7800.000 | 1 | 1 | Yes | No |
| 2001 | Coater 2 | 100 | 0.000 | 8200.000 | 1 | 1 | Yes | No |
| 3000 | Calendar 1 | 200 | 0.000 | 15888.0... | 1 | 1 | Yes | No |
| 3001 | Calendar 2 | 200 | 0.000 | 14256.0... | 1 | 1 | Yes | No |
| 4000 | Slitter 1 | 130 | 0.000 | 5667.000 | 1 | 1 | Yes | No |
| 4001 | Slitter 2 | 130 | 0.000 | 5667.000 | 1 | 1 | Yes | No |

Figure 14: Configuring master data for machines

Every machine to be scheduled has to be registered with SimAL.

After the menu sequence shown above, a list is opened which not only shows all machines currently documented, but also offers a wide option of editing possibilities to parameterize and manage the machines.

The following command buttons are available to manage the machines.

3.2.1 Creating a machine

Click [New] to define a new machine. If you have already defined machine classes, the window shown in Figure 15 appears. The type of machine to be set up has to be chosen there.

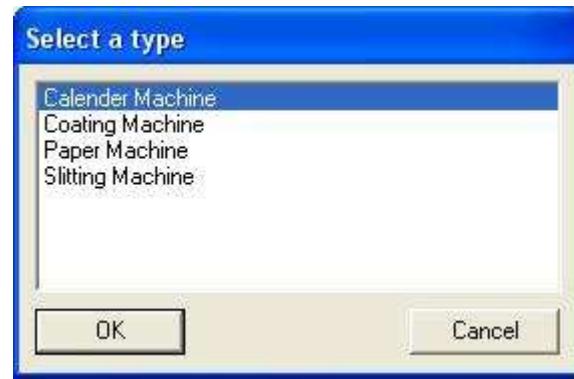


Figure 15: Choosing machine type

The window “Edit machines” is subsequently opened (Figure 16).

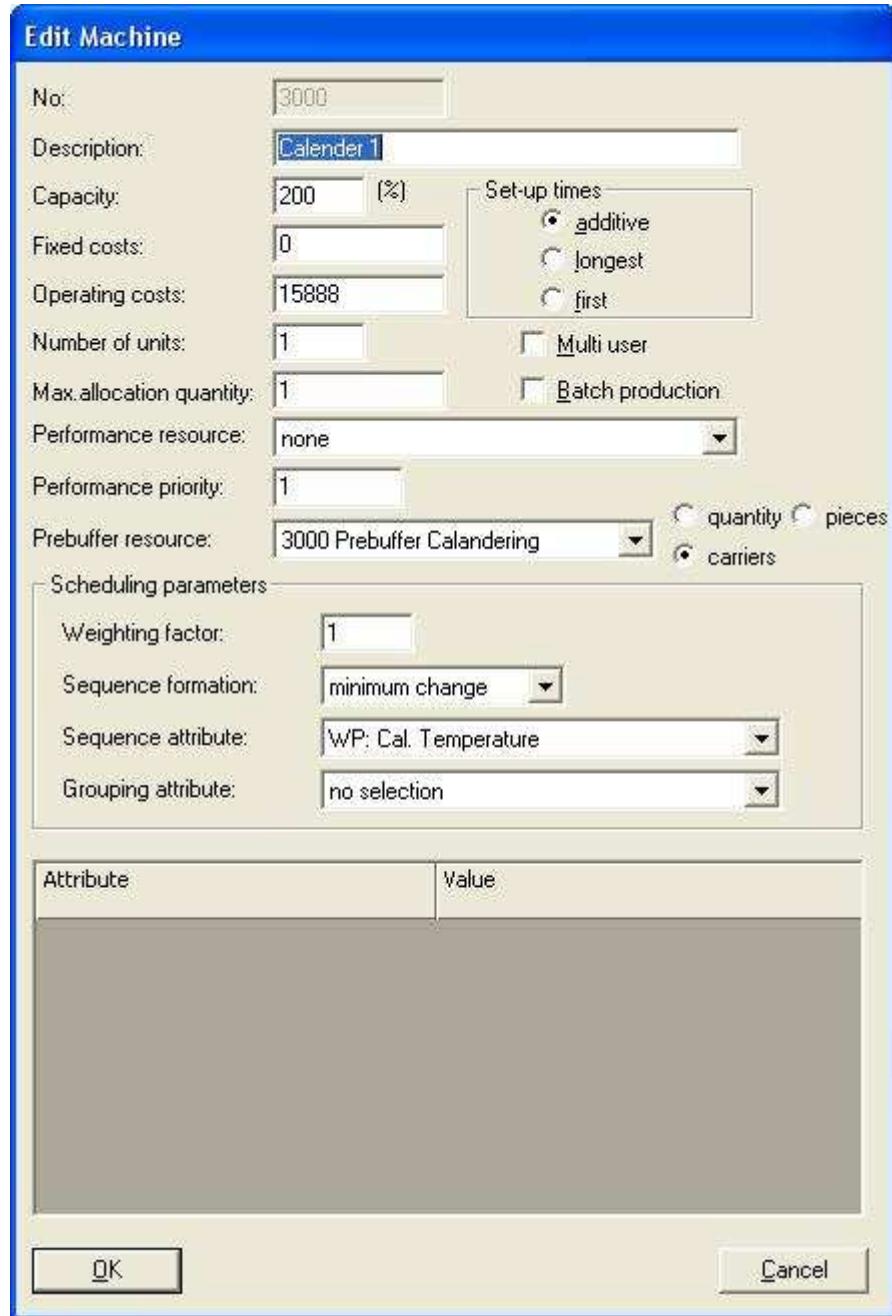


Figure 16: Editing a machine

Each machine has to get a unique number in SimAL, which is allotted in the box »Number«. SimAL suggests a default value of the ‘*highest allotted number + 1*’; you may individually change the default value, for example, to give the machine number as the cost location number. The number can be chosen from the range 1 to 99999999.

In the box »Name«, a name of up to 50 characters in length can be given to the machine.

The performance rate (in percent) of the machine can be fixed in the box »**Performance**«. This box is particularly important, when several machines of the same type are being used and you are working with machine groups (Chapter 3.7 [Machine groups](#)). With the help of the box »**Performance**«, you can specify individual differences in performance of structurally or functionally identical machines. If you are working with only one model of the machine type to be documented, *100* is usually entered; the entry *100%* means that the machine exactly requires the time specified in the process. A higher value leads to a shorter working time and a lower value to a higher working time. Increases in performance of machines (for example, through technological developments) can be parameterized without changing the work plan data.

In the box »**Fixed costs**«, those costs, which the respective machine creates, are to be entered, irrespective of whether it is used or not. Maintenance costs, consumption of electricity in standby mode, tax write-offs or similar quantities count as such operational cost factors.

The costs which arise when the machine is in use are entered in the box »**Running costs**«. Such costs could arise through the consumption of lubricants or materials (such as ink for a printing machine).

Fixed costs as well as running costs are used for purposes of evaluation and control of scheduling logic. In case you do not have any secured costs, you may parameterize these boxes with 0. It is not compulsory to parameterize the costs.

In »**Number of units**«, the number of orders which can be carried out in parallel is entered for the corresponding machine. For example, if 3 is entered, it means that SimAL can schedule up to 3 different orders at the same time on this machine, under the condition that the »**Max. Loading Quantity**« is not exceeded. With »**Max. Loading Quantity**«, the loading capacity of a machine is determined. The unit can be chosen freely by the user; sensible entries could be in percent, metric units or units of weight. The connection between »**Number of units**« and »**Max. Loading Quantity**« can be made clearer with the help of a small example:

Example:

An extruder for production of foils can be equipped with a maximum of three cutters, so that up to four orders can be worked on simultaneously. The machine can produce foils of up to 3 m in width. Therefore, 4 has to be entered in »Number of units« and 300 has to be entered in »Max. Loading Quantity«.

If orders for foils of width *80, 60, 75* and *140* are scheduled, only three of these four orders can be scheduled simultaneously, since a »Max. Loading Quantity« = *355* would be necessary.

In »**Set-up times**«, you define whether the duration of all set-up processes of the set-up classes should be summed (**additive**) or whether the duration of the most time-intensive set-up process (**longest**) is to be used as set-up time. The choice you make depends primarily on whether the set-up steps can be carried out in parallel or whether they should be built up on each other. More information on parameterizing set-up times can be found in Chapter 3.4 [Defining the set-up matrix](#) of this manual.

If you activate the checkbox »**Multi-user**«, several users can change a machine at the same time. Machines that are not multi-user can be changed by only one user at a time. All other users receive only reading rights provided the machine has been opened by the first user. In case a machine must be scheduled by many planners, it has to be set as “multi-user”. Multi-user machines, however, reduce the speed of the schedule window, since each change in the schedule has to be updated in the database. The undo-function is highly limited when using multi-user machines. It is therefore recommended to only mark machines as multi-user, when there is no other organization possibility.

Changes for multi-user machines are automatically saved in the database without any warning beforehand.

With the help of the checkbox »**Batch production**«, you can define whether orders scheduled for the machine can be combined into blocks with the same starting and ending times and thereby allow simultaneous processing. The representation within the schedule window changes for batch machines. Furthermore, batch machines can only be set up as single-use machines. The parameter **Max. Loading Quantity** determines the maximum size of the batches for batch machines based on the target quantity of the orders to be scheduled.

Performance Resource and **Performance Priority**: With the help of these settings, the duration of processing of orders that mutually influence each other can be changed. Performance resources are described further in Chapter 4.3 [Performance Resources](#).

Pre-buffer resource: Pre-buffer resources help in visualizing the current inventory of semi-finished materials before a machine. With each scheduled order for a machine with defined pre-buffer resource, the resource for the scheduled provi-

sion of the order is loaded. With the help of the options Quantity, Piece and Load Carrier, it can be defined, in which units and how often the resource is loaded for an order.

The **Scheduling parameters** are to adapt the scheduling automatism. In the box »**Sequence building**«, you can select the sequence building as ***none***, ***ascending*** (saw-tooth profile), ***descending*** (reflected saw-tooth profile), ***alternating***, or ***minimal change***. They all refer to the size of the sequence attribute.

- No sequence building means that the automatic scheduling is executed in a more-or-less random fashion.
- For ascending sequence building, scheduling is carried out in an ascending fashion starting with a machine with the smallest sequence attribute. When the maximum is reached, it is started once again with the smallest. The sketch in Figure 17 shows the process.

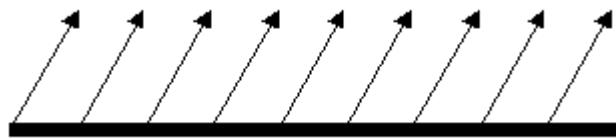


Figure 17: Ascending sequence building

- The decreasing sequence building is a counterpart to ascending sequence building. Figure 18 shows a sketch of this.



Figure 18: Descending sequence building

- An alternating ascending and descending sequence is scheduled in an alternating sequence building. It is randomly chosen, whether to start as ascending or descending. Both possibilities are illustrated in Figure 19 and Figure 20.

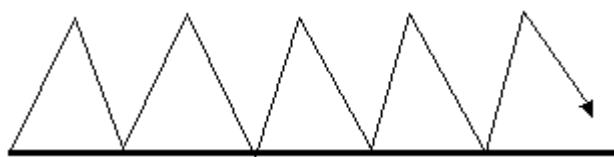


Figure 19: Alternating sequence beginning with ascension

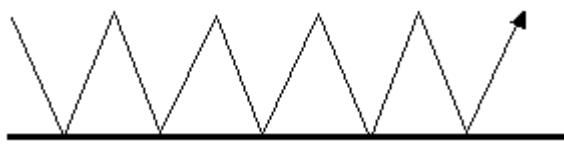


Figure 20: Alternating sequence beginning descending

- The procedure for minimal change of the sequence is that the machine to be scheduled next is always the one whose scheduling causes the least change from the current position. The beginning is chosen randomly.

With the help of the combo box »**Sequence attribute**«, the attribute on which the sequence is built is determined. A numerical attribute has to be chosen. With »**Group attribute**«, it is defined that a new sequence is begun when the value of the group attribute deviates from the value of the predecessor scheduled for the machine. The parameter »**Weighting factor**« enables a machine-dependent weighting for automatic scheduling. It is included as an additional factor in the scheduling goals: minimization of set-up matrix and machine sequence. It is pre-defined with the value 1.0 and does not affect the automatic scheduling if it is left unchanged. This parameter should be increased for machines with expected bottlenecks in order to penalize set-up matrix times harder and to rate the machine sequence value higher.

The attribute window is shown below in Figure 16. Data boxes that were set up from derived classes in the Data Dictionary are shown in the attribute window (Chapter 10.12 [Data Dictionary](#)). The standard machine type in SimAL has no additional attributes. The definition of attributes in the Data Dictionary is not only implemented for the machine types, but also for other diverse objects in SimAL (machines, resources, work plan, process, PDA message, disposition order and ERP order).

3.2.2 Editing a machine

Click [Edit] to edit the machine master data. The dialog box to edit an already documented machine is identical to that of setting up a machine.

You can only edit a machine when you have chosen one from the overview box (Figure 14)!

3.2.3 Deleting a machine

Click [Delete] to remove an existing machine. First choose a machine to be deleted from the list (Figure 14) and then click the command button [Delete]. The machine will be deleted immediately.

A machine can only be deleted when the following conditions are fulfilled:

1. The machine has not been allocated to any view.
2. No resources have been allocated to the machine.
3. There are no downtimes allocated to the machine.
4. The machine has not been indicated in any process.
5. The machine has not been allocated to any shift.

3.2.4 Assigning machines-resources

The resources to be loaded for selected machines during scheduled orders can be set through the command button [Resources] (for example, personnel resources or set-up tools). To be able to define machines-resources, these have to be first set-up as resources (Chapter 3.3 [Editing resources](#)). The parameterization of machines-resources corresponds to the parameterization of process resources, which have been described in Chapter 3.3 [Editing resources](#).

3.2.5 Defining set-up matrix

Sequence-dependent set-up times can be parameterized for machines with the help of [Define set-up matrix]. The entry is described in Chapter 3.4 [Defining set-up matrix](#).

3.2.6 Downtimes

With [Downtimes], downtimes (scheduled or unscheduled standstill) of the currently selected machine can be recorded beyond the currently valid shift model. Downtimes are periods of time, in which a particular machine is not available for production. One reason could be that a machine needs to be serviced every four weeks. The machine cannot be used in production during the inspection. After you have clicked the command button [Downtimes], the recorded downtimes of the machine are shown. Downtimes overwrite the shift model.

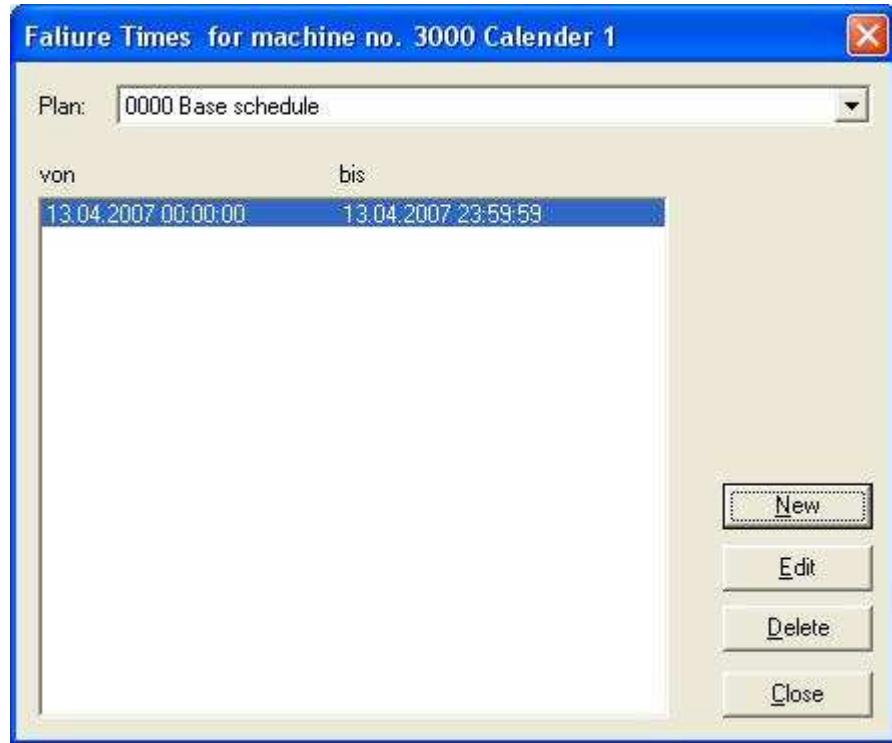


Figure 21: Overview of dialog box of downtimes

The possibilities of editing in this dialog box are limited to three:

1. [New]; a new downtime can be recorded. To set up a downtime, a new dialog box is opened (Figure 22).
2. [Edit] allows changing of downtime.
3. [Delete]; the selected downtime entry is deleted.
4. [Close]; the dialog box is closed and you return to the dialog box “Edit machines”.



Figure 22: Recording downtimes

Enter the date and time of the day, from which the machine is longer available in the box »**from**«. The end point of the downtime is entered in the box »**to**«.

3.2.7 Machine additional times

With [Additional times], times, in which the machine is definitely working (example, extra shifts) can be recorded for the currently selected machine. Additional times overwrite downtimes and the shift model. The setting of additional times is done in an analog fashion, similar to setting of down times. Additional times are periods of time, in which a machine works in spite of shift breaks.

3.3 Editing resources

MACHINES/ RESOURCES / EDIT RESOURCES

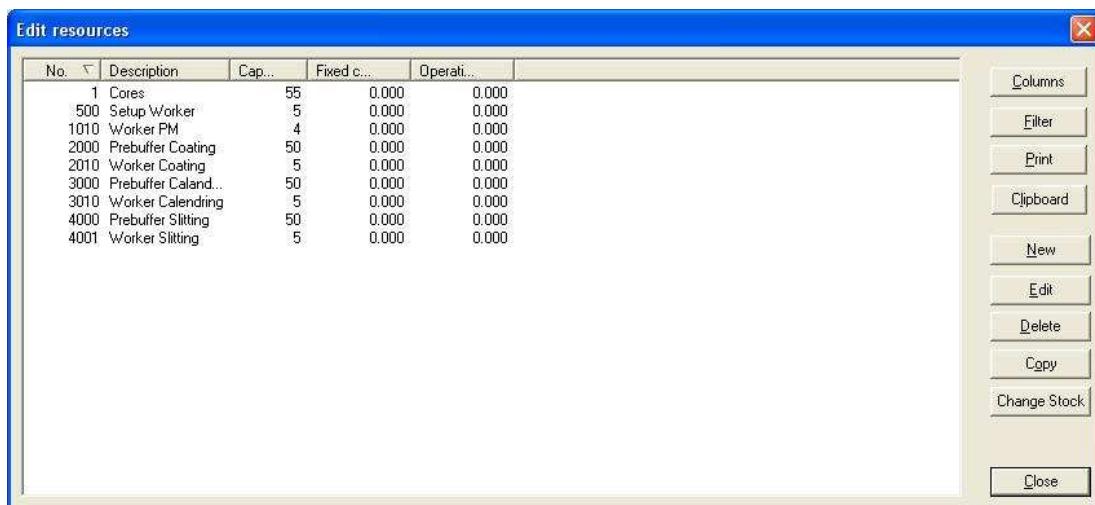


Figure 23: Overview of dialog box of resources

All units which are needed additionally for a scheduled machine for finishing of a part are called resources. A resource could be a worker (with a particular qualification), a tool, electricity or water, for example. In order to produce bread, one would define, for example, *flour*, *salt*, *water*, *yeast*, *electricity* and the *baker* as resources. The baking oven would, however, be defined as a machine.

After the menu sequence shown above, an overview box is opened, which lists out all the already recorded resources (Figure 23). The obligatory command buttons [New], [Edit], [Delete] as well as [Close] are available to manage resources.

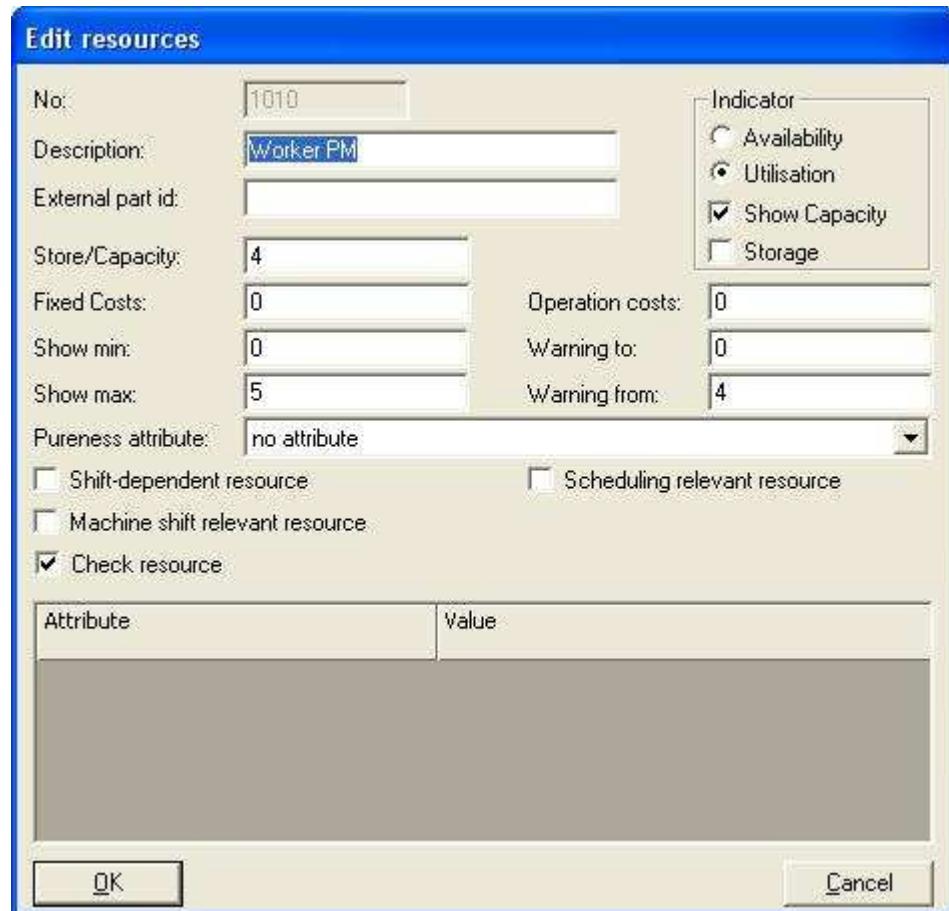


Figure 24: Setting up/editing resources

To record a new resource, click [New] in the overview box (Figure 23). A new dialog box is then opened (Figure 24).

SimAL automatically enters the '*highest allotted number + 1*' in the box »**Number**«. This default can be overwritten. A maximum of 50 characters can be used in the box »**Description**« to name the resource. The box »**External parts number**« is to parameterize the part numbers from superior ERP systems. The available quantity of the resource is recorded in »**Stock/Capacity**« the entry in this box has to be a whole number (1 or greater).

Costs independent of usage are to be entered in the box »**Fixed costs**«. Similarly, costs which accrue in the case of usage of the resource can be recorded in »**Running costs**«. Costs are needed only for evaluation in standard SimAL. If you do not have any cost data at your disposal, parameterize these text boxes with 0.

In »**Display min.**«, a whole number equal to or less than zero is to be entered. This entry is the largest deficit, which is allowed to arise at this resource. Enter accordingly in the box »**Display max.**«

Safety limits, which, when exceeded or are fallen short of, ensure that resource utilization is highlighted in a warning color (standard orange), are entered in »**Warning from**« and »**Warning till**«. »**Warning from**« defines the lower limit and »**Warning till**« defines the upper limit. The entries in the "Warning..." boxes do not affect the automatic scheduling.

By checking the checkbox »**Shift-dependent resource**«, you define that the resource in the shift model should be managed (Chapter 5 [Managing shifts](#)). Shifts can only be allotted to resources, which have been marked as shift-dependent (Chapter 5).

Activating the checkbox »**machine-shift-dependent resource**« causes the shift model of the machines to follow your own shift model. If an order is scheduled for a machine and there is break for the time period in which the resource is demanded, the resource demand is withdrawn for the period of the break.

By checking the checkbox »**schedule-relevant resource**«, you define that the resource is controlled and not overloaded during automatic scheduling. **Controlling of resource utilization is very CPU-intensive and should only be activated for the most important resources!**

With the checkbox “Check resource”, consideration of the resource in checking of scheduling is determined.

Settings under “Display” determine which resource conditions are to be displayed during scheduling. With the option button »**Utilization**«, the respective utilization of the resource is shown. With »**Availability**«, the resource quantity still available is shown. In both cases, the checkbox »**Total**« can be activated and allows the absolute available resource quantity to be shown. This gives the planner a better overview of the resource quantity.

Example:

A planner has defined 10 workers as the resource and then scheduled a process, which needs 7 workers. If he activated »**Utilization**«, 7 is shown as the utilization of this resource, with »**Availability**« shown as 3 ($10-7 = 3$) as the number of available workers. In both cases, the option »**Total**« can be activated. The total available quantity (in this case, 10 workers) is then displayed. Without seeing the total available quantity, the planner would not have an overview of how many workers are still available when he only sees the utilization.

To guarantee a flexibility as large as possible, the entries in the boxes »**Fixed costs**« and »**Running costs**« are absolute numbers; i.e. it is the responsibility of the user to enter either € values per day or, for example, work units as per an external value chart. If fixed costs and running costs are recorded for a resource – for example, a pieceworker – it must be taken care of, that the basic pay is entered as »**Fixed costs**« and the additional piece rates as »**Running costs**«.

The process of editing a resource is mostly identical to the new setting up of one. To edit a resource, one must first select an entry in the overview box (Figure 23) and then click [Edit]. The dialog box to parameterize resources (Figure 24) is opened and the original values are shown. All boxes except »Number« can be edited.

To delete a resource, select the desired entry in the overview box (Figure 23) and click [Delete].

A resource can only be deleted when it is no longer allocated to any process, shift and set-up process.

3.4 Defining the set-up matrix

Different set-up times can be assigned for a particular machine in a set-up matrix. A simple example is that of a printing machine: if the machine has to be changed over from the color *white* to the color *black*, it should normally suffice to just change the color. But if the machine is to be changed over from *black* to *white*, the nozzle must be cleaned in addition to changing the color, what would lead to a higher set-up time.

To create a set-up matrix, at least one set-up class has to exist.

3.4.1 Creating/editing set-up classes

MACHINES/ RESOURCES – EDIT SET-UP CLASSES

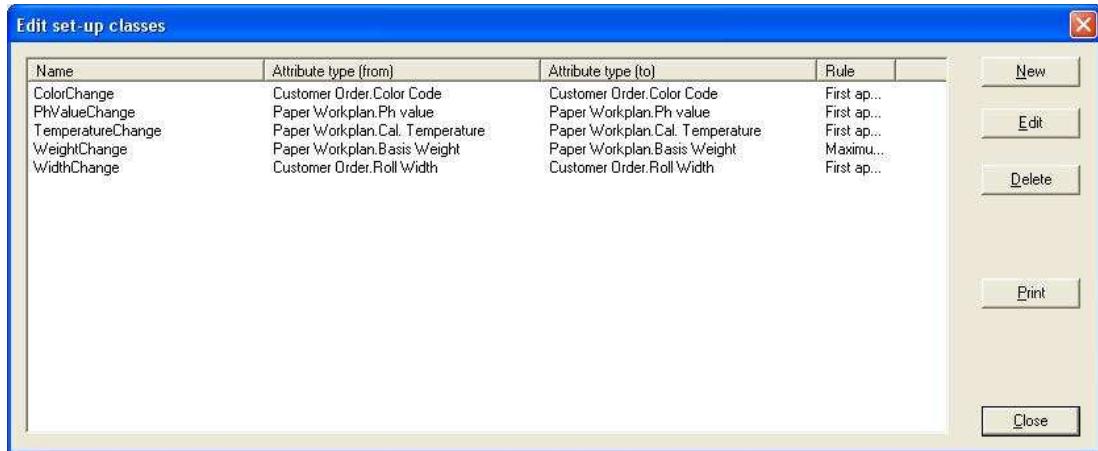


Figure 25: Editing set-up classes

After the menu sequence shown above, an overview box of “Set-up classes” is opened (Figure 25). This box shows all set-up classes already created.

There are five command buttons on the right side to manage the set-up classes or attributes. A selected entry is removed from the list with [Delete].

A set-up class can only be deleted once all set-up entries in the machines for this set-up class have been deleted. If you still try to delete a set-up class, you get an error message saying that there are still set-up matrix entries assigned to the set-up class.

With [Close], you close the overview box of set-up classes and return to the work screen. By clicking [Print], you can print out the list.

[New] and [Edit] call the dialog boxes to set up and edit set-up classes respectively.

To set up a set-up class, click the command button [New]. The dialog box shown below is then opened.

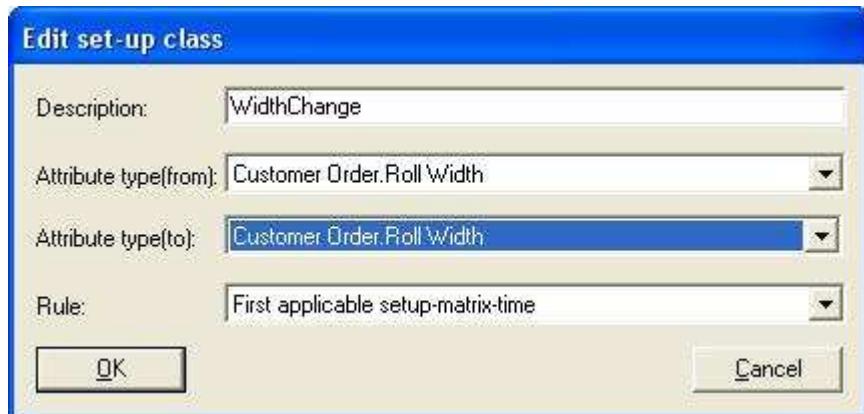


Figure 26 Editing set-up classes

A name of up to 20 alphanumeric characters in length can be given to the set-up class in »**Name**«. With the drop-down combo box »**Attribute type (from)** «, the attribute type of the previous order of the machine is selected, whose value is used in the calculation of the set-up matrix. With the drop-down combo box »**Attribute type (to)** «, the attribute type of the successive order of the machine is selected, whose value is used in the calculation of the set-up matrix.

Checking the checkbox »**Additive**« determines how SimAL works when several applicable entries in the set-up matrix are present in this set-up class. If "Additive" is selected, the times of the individual entries are added otherwise the longest time (maximum) is calculated.

To edit an existing set-up class, first select an entry in the overview box and then click [Edit]. The editing possibilities correspond to the possibilities described before of setting up a new set-up class.

Please note that you sometimes have to first set up the needed attribute types in the Data Dictionary and derive classes for them. A description on how this is done is described in Chapter 10.12 [Data Dictionary](#) of this manual.

3.4.2 Creating/editing the set-up matrix

To set up or edit a set-up matrix, click [Define set-up matrix] in the dialog box “Edit machines” (Figure 14). The overview box shown below is then opened.

The screenshot shows a Windows-style dialog box titled "Define set-up matrix". At the top left, there is a text input field labeled "Machine no." containing the value "3000". Below this is a table with the following data:

| Position | Set-up class | Operation | Parameter 1 | Parameter 2 | Time |
|----------|-------------------|------------------------------|-------------|-------------|-----------|
| 001 | TemperatureChange | higher | - | - | 000 00:0C |
| 002 | TemperatureChange | negative [parameter 1] lower | 10 | - | 000 00:1C |
| 003 | TemperatureChange | negative [parameter 1] lower | 20 | - | 000 00:2C |
| 004 | TemperatureChange | negative [parameter 1] lower | 30 | - | 000 00:3C |
| 005 | TemperatureChange | unequal | - | - | 000 01:0C |

On the right side of the dialog box, there are several buttons: "Copy", "New", "Edit", "Delete", and "Close".

Figure 27: Overview box of the set-up matrix

All the defined set-up processes for this machine are shown in the list box of this overview box. The command buttons [New], [Edit], [Delete], [Copy] and [Close] are available for purposes of editing.

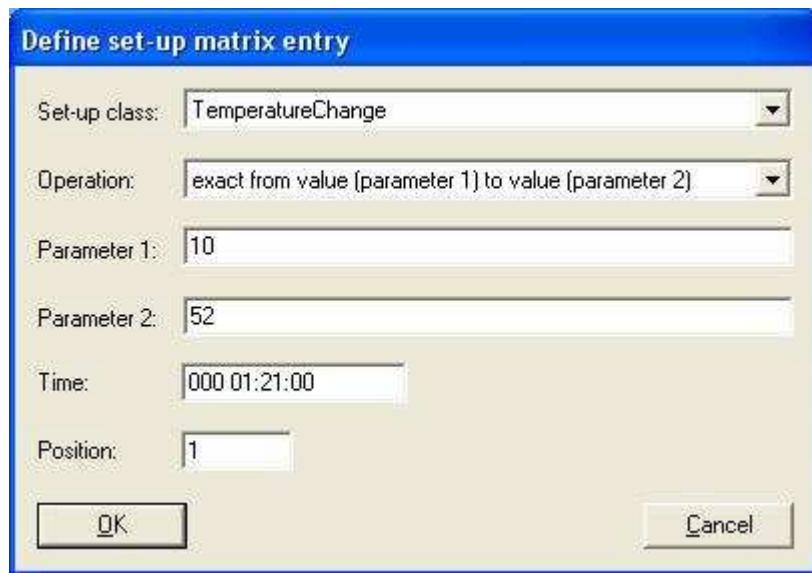


Figure 28: Setting up/editing a set-up matrix

The dialog boxes to set up and change set-up entries are identical and are therefore described together here. It is sufficient to click [New] to set up a new set-up matrix, while an entry has to be first selected from the list box and then [Edit] to be clicked to edit an existing entry.

Choose the set-up class in the drop-down combo box »**Set-up class**«, to which a matrix entry has to be set up and then choose the desired operation in the box »**Operation**«. Enter the parameters, which have to be compared with the values of the attributes defined in the set-up class in »**Parameter 1**« and »**Parameter 2**«. For some operations, only "Parameter 1" or none at all has to be entered.

The following operations are available:

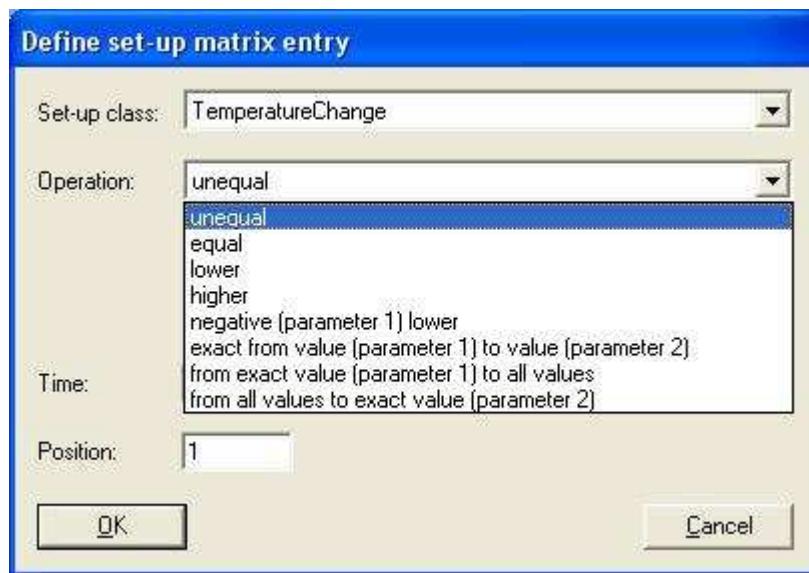


Figure 29: Set-up matrix entry Operations

- **unequal:** The entered set-up time is accrued when the attributes of the previous and successive orders differ. This applies for numeric as well as alphanumeric attributes. It is not necessary to enter more parameters.
- **equal:** The entered set-up time is used when the attributes of the previous and successive orders are identical. This applies for numeric as well as alphanumeric attributes. It is not necessary to enter more parameters.
- **smaller:** The time is used when the attribute of the previous order is smaller than that of the successive order. It is not necessary to enter more parameters.
- **larger:** The time is used when the attribute of the previous order is larger than that of the successive order. It is not necessary to enter more parameters.
- **minus (Parameter 1) smaller:** The time is used when the difference of the attribute values is smaller than Parameter 1. This option is only usable for numeric attributes.
- **exactly from ... to ...:** The entered set-up time is accrued when the value in the previous order matches the value of Parameter 1 and the value in the successive order matches the value of Parameter 2.

The necessary time span for a specific set-up process is defined with the box »**Time**«.

Please note that only set-up classes and attributes already defined are available in the boxes »**Set-up class**«, »**from attribute**« and »**to attribute**«. The definitions of set-up classes and set-up attributes are found in Chapter 3.4.1 [Creating/editing set-up classes](#) in this manual.

A small practical example on working with set-up matrices can be found in Chapter 3.6.2 [Working with a set-up matrix](#).

3.5 Machines-Resources

| List No. | Factor% | Resource | Allocation | Release | Amount | Dyn. | Factor |
|----------|---------|--------------|----------------------|--------------------------|--------|------|--------|
| 1 | 100.00 | Setup Worker | Start of set-up time | Start of processing time | 1 | No | 1 |

| Allocation | Release | Amount | Dyn. | Factor |
|--------------------------|--------------------------|--------|------|--------|
| Start of processing time | Start of processing time | 1 | No | 1 |
| End of shut down time | End of shut down time | 1 | No | 1 |

Figure 30: Resource list for machines

After you have selected a machine in the dialog box “Edit machines” (Figure 14) and have clicked [Resources], a two-part overview box is shown (Figure 30). The left part of the box has a list of the resource lists entered till now, while the right part shows the resources allocated to the list. Only the set-up resources of one list can be shown at a time in the right part of the box. Depending on the selected entry in the left box, the right part shows the appropriate contents.

Since there is the possibility of allotting several resource lists to a machine, scheduling can be very flexible in SimAL. The first entry in the list box always has the highest priority; i.e. SimAL tries to allot the stored resources in this list to the respective machine while scheduling. If these resources are not completely available, SimAL takes the resources of the next list; this process is repeated till all the resources in a list are available, or, if this is not possible, the first list is used and the corresponding conflicts are shown in the resource display of the schedule window (Chapter 8.1.3

[The resource display](#)). Small examples can be found in Chapter 3.6.1 [Working with resource lists](#) to better illustrate working with resource lists.

There are four command buttons underneath the two boxes apart from [OK] and [Cancel]:

- | | |
|--------------------|--|
| [New list] | With this button, a new resource list can be set up for the chosen machine (Chapter 3.5.1 Setting up a new resource list). |
| [Delete list] | With this button, a resource list can be deleted (Chapter 3.5.2 Deleting a resource list). |
| [Enter resource] | With this button, a new resource demand is allotted to a resource list (Chapter 3.5.3 Adding a resource to a list). |
| [Edit resource] | With this button, a new resource demand is allotted to an already existing resource list (Chapter 3.5.4 Editing a resource entry in a list) |
| [Remove resources] | With this button, a resource demand is removed from a resource list (Chapter 3.5.5 Removing resources from a list). |

3.5.1 Setting up a new resource list



Figure 31: Parameterizing a resource list

After you have clicked [New list], a new dialog box is opened, which has two text boxes:

- | | |
|----------|---|
| »Number« | Allot a unique number for the resource list in this box; the resource list of each machine is independent of the list numbers of the other machines. SimAL enters ' <i>the highest occupied number +1</i> ' as a default value. The |
|----------|---|

default value can be changed as long as the entered number is unique.

»Performance factor (in %) «

Depending on the resource list being used or the recorded resource demands, the performance factor, which can be reached with the respective resources, can vary from list to list. The performance factor for every resource list can therefore be given in percent. The allowed range of entry lies between 0.00001 and 100000. *The value entered here is used by SimAL only for documentation, but can be used in other customized programming.*

3.5.2 Deleting a resource list

First select a resource list in the left part of the box (Figure 30), and then activate [Delete list] to remove this list. A resource list can only be deleted when it has no entries.

3.5.3 Adding a resource to a list

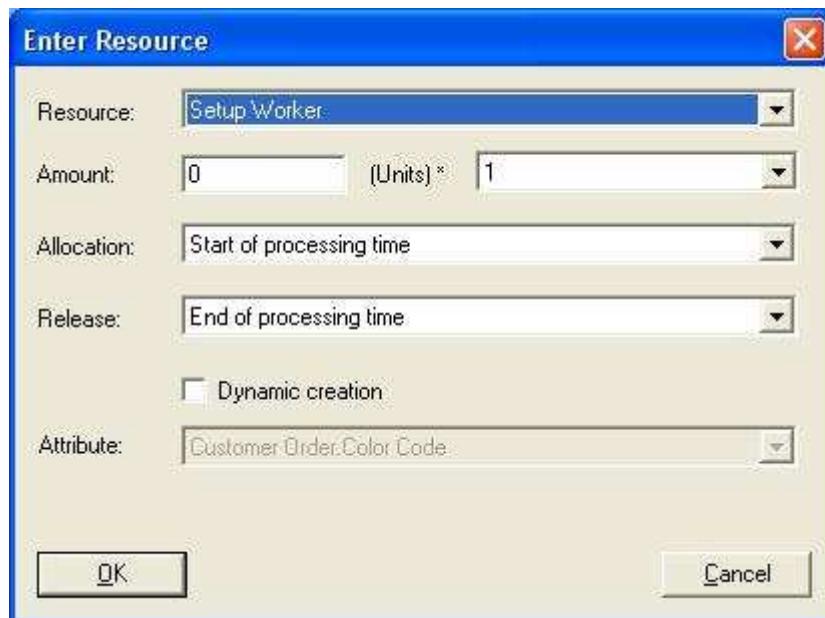


Figure 32: Allotting machines-resources

First select a resource list in the left part of the box (Figure 30) and then activate [Enter resource] to open the dialog box for adding of resources (Figure 32).

Choose the resource, which you want to allot to the machine, in the box »Resource« and enter the required number of this resource in »Number«. If the number has to be multiplied with a numerical attribute, then choose this in the drop-down combo box “Units”.

With the demand time and release time, it is determined when the resource is to be loaded (depending on the scheduling of the order for the machine).

If resources don't already exist, they can be set up automatically with the help of “Dynamic creation”. The system then checks if there is already a resource in the schedule with the value of the parameterized attribute. If this is the case, this resource is used. If this resource doesn't exist, it temporarily created in the main memory (for the duration of working of the schedule). The parameterized resource is then copied and given a unique number and is renamed according to the attribute value.

The resource allocations are saved and the dialog box is closed with [OK].

You can only choose from already configured resources here. If a needed resource is not in the list, it first has to be set up (Chapter 3.3 [Editing resources](#)).

3.5.4 Editing a resource entry in a list

To change an entry (for example, to edit the number of required resources), select a resource entry and click "Edit resource". The same dialog box as in [Setting up a resource] is opened.

3.5.5 Removing resources from a list

First select a resource list in the left part of the box (Figure 30) and then the resource to be removed in the right part of the box. After clicking [Remove resource], the resource entry is removed from the list. However, only the entry in the resource list is deleted, i.e. the resource is available in other lists.

3.6 Excursus: Examples on machines-resources and set-up matrices

Due to the complexity and wide possibilities of working efficiently with SimAL, we would like to make the functioning clearer with the help of simple examples.

3.6.1 Working with resource lists

MACHINES/ RESOURCES – EDIT MACHINES

Let us assume that you have not set up any resource lists and that one worker, one lift-truck driver and one forklift as resources.

The same task can also alternatively be performed with two workers and one forklift, if the resources listed above are not available. Since a worker using a forklift is not as well acquainted as a lift-truck driver, it is preferable to use a lift-truck driver. This leads to the following priority list:

| Resource list | Needed resources |
|---------------|---|
| 1 | <ul style="list-style-type: none"> • 1 worker • 1 lift-truck driver • 1 forklift |
| 2 | <ul style="list-style-type: none"> • 2 workers • 1 forklift |

Since the assignment is only possible with two profiles with respect to resources for the sake of ease, two resource lists are needed. Since SimAL grants the highest priority to the resource list with the lowest number – normally, the list 1 – for scheduling, this list should contain optimal resources. *List 2* receives the second best resource constellation. With this process, you can create any number of alternative resource profiles; while scheduling, SimAL tries to first reserve those resources in the list with the lowest number. If these resources are not completely available, SimAL tries to reserve the resource list with the next higher number. This process is repeated until SimAL finds a resource list whose resource entries are completely available. If there is no resource list, whose entries are completely available, list 1 is used and the corresponding resource conflict is shown in the schedule window (Chapter 8.1.3 [The resource display](#)). Please remember that testing a resource list requires time in automatic scheduling. Therefore, it is advisable to always define a small number (< 10) of resource lists.

After the menu sequence shown above has been performed, the dialog box to edit machines is opened (Figure 14). Click [Resources]. In the dialog box which subsequently opens, click [New list] and accept the default values of SimAL in the box »Number« as *1* and »Performance grade« as *100%* by clicking [OK]. Allocate the first resource (in the example, the workers) to this list as *1* by clicking [Enter resource] and then clicking [OK]. Repeat the process for the resources *lift-truck driver* and *forklift*.

After you have set up the resource list 1, you must now set up the alternative resource list. Click [New list] to set up resource list 2 and enter **90** in the box »Performance grade« to indicate that performing the assignment with these resources needs more time. This percent value, however, has no effect on calculation of work times in standard SimAL. Follow the process described for list 1 when you click [Enter resource].

3.6.2 Working with a set-up matrix

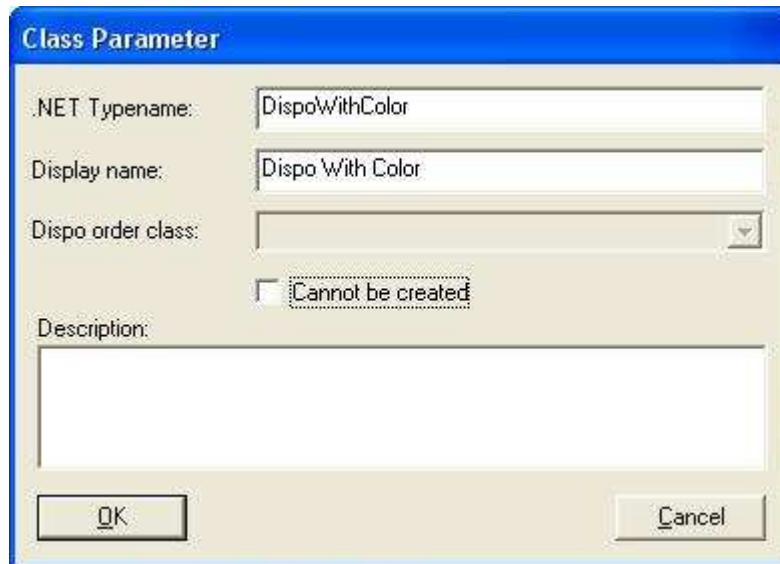
In the following example, a set-up matrix is configured for a printing machine, which can print in four colors (example, *cyan*, *magenta*, *yellow* and *black*). The following modification processes follow:

| From | To | Time | Comment |
|---------|---------|--------|--|
| Cyan | Magenta | 5 min. | A normal cleaning of the nozzle is necessary. |
| Cyan | Yellow | 8 min. | Since <i>yellow</i> is lighter than <i>cyan</i> , a particularly intensive cleaning of the paint nozzle must be performed. |
| Cyan | Black | 3 min. | Since <i>black</i> is darker than <i>cyan</i> , the paint nozzle can be cleaned faster. |
| Magenta | Cyan | 5 min. | A normal cleaning of the nozzle is necessary. |
| Magenta | Yellow | 8 min. | The nozzle must be completely cleaned since it is a changeover to a lighter color. |
| Magenta | Black | 3 min. | Since <i>black</i> is darker than <i>magenta</i> , the nozzle can be cleaned faster. |
| Yellow | Cyan | 3 min. | Since <i>cyan</i> is darker than <i>yellow</i> , the nozzle can be cleaned faster. |
| Yellow | Magenta | 3 min. | Since <i>magenta</i> is darker than <i>yellow</i> , the nozzle can |

| From | To | Time | Comment |
|--------|---------|--------|--|
| | | | be cleaned faster. |
| Yellow | Black | 1 min. | Since <i>black</i> is significantly darker than <i>yellow</i> , the nozzle needs only to be roughly cleaned. |
| Black | Cyan | 8 min. | Due to changeover into a lighter color, the nozzle must be completely cleaned. |
| Black | Magenta | 8 min. | Due to changeover into a lighter color, the nozzle must be completely cleaned. |
| Black | Yellow | 8 min. | Due to changeover into a lighter color, the nozzle must be completely cleaned. |

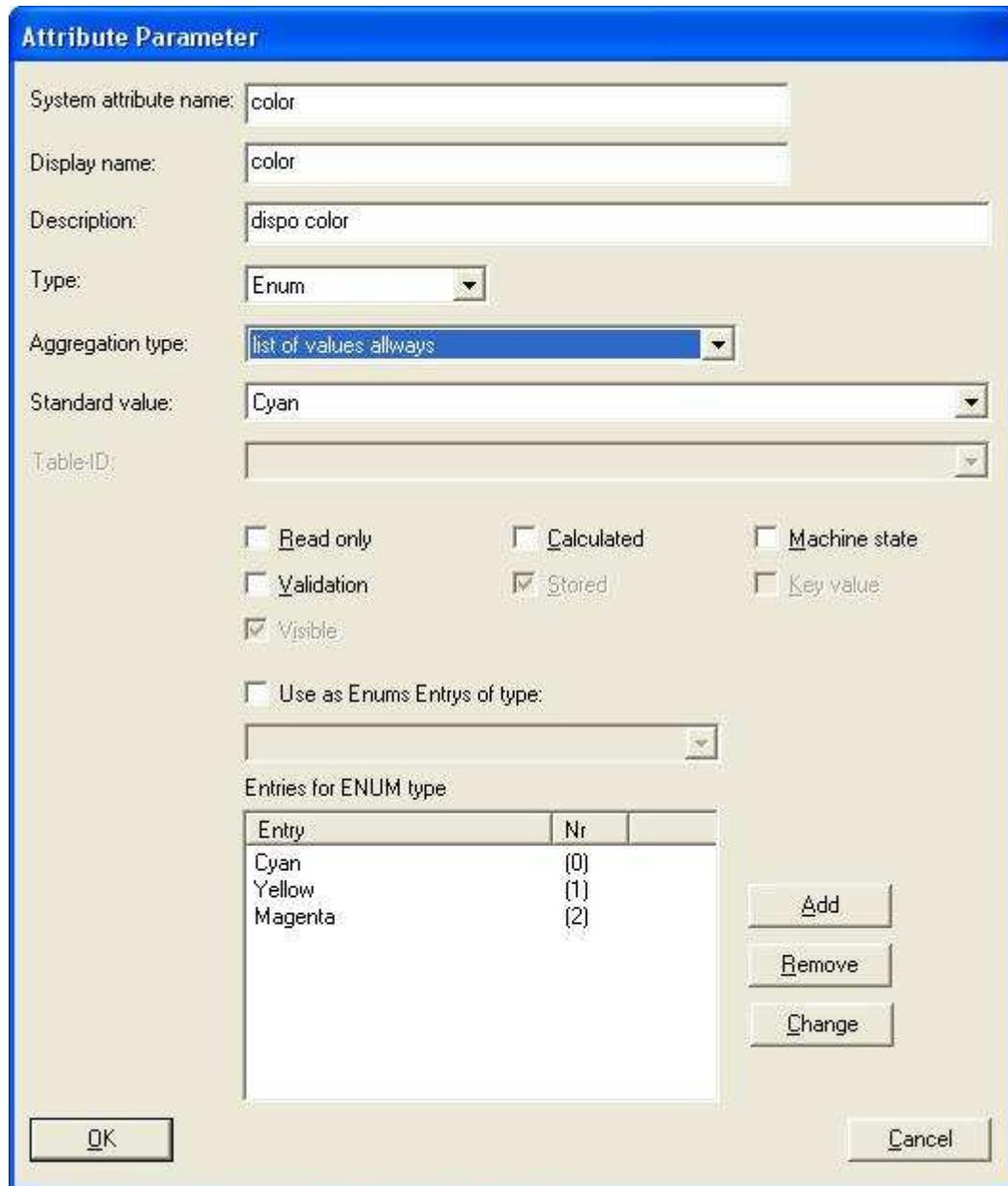
The modification table above shows that 12 entries are needed in the set-up matrix to be defined.

To create a set-up matrix, a new set-up class has to be first defined for the paint nozzle. Before you can create a set-up class, you must first create the attributes for the set-up class in the Data Dictionary. In this example, open the Data Dictionary window (MASTER DATA → DATA DICTIONARY). Choose the class **DispoOrder** and then click [Derive]. Enter *DispoWithColor* in .NET type name (class name) and Display name. Confirm the entries with [OK].



Now choose your new disposition-order class as “DispoWithColor”. To create a new attribute for color, click [New]. Enter *Color* as the »Class name« and »Display name«. Choose “Enum” under »Type«. Activate »Only display« and click [Add].

Enter *Black* in the opened box. Repeat this thrice to add *Cyan*, *Yellow* and *Magenta*. Choose one color as a default value in the box »**Default value**«. Accept these entries by clicking [OK]. Close the Data Dictionary window by clicking [OK]. The necessary attribute is thus created.



Perform the menu sequence MACHINES/RESOURCES / EDIT SET-UP CLASSES and set a new set-up class with the »Name« *Paint nozzle* and choose ***DispoWithColor.Color*** in both »Attribute type (from) « and »Attribute type (to) «. Accept the entries by clicking [OK].

Perform the menu sequence MACHINES/RESOURCES / EDIT MACHINES. Choose the machine, for which a set-up matrix has to be defined — for this example, a printing machine would have to be chosen/set up — and click [Define set-up matrix]. Click [New] in the dialog box which subsequently opens. The window in Figure 33 is then opened. Choose “Paint nozzle” in the box »Set-up class«. Then choose *exactly from value (Parameter 1) to value (Parameter 2)* in the box »Operation«. Choose cyan as parameter 1 and magenta as parameter 2 for a changeover from cyan to magenta. The duration also has to be entered. It is 5 minutes as per our table.

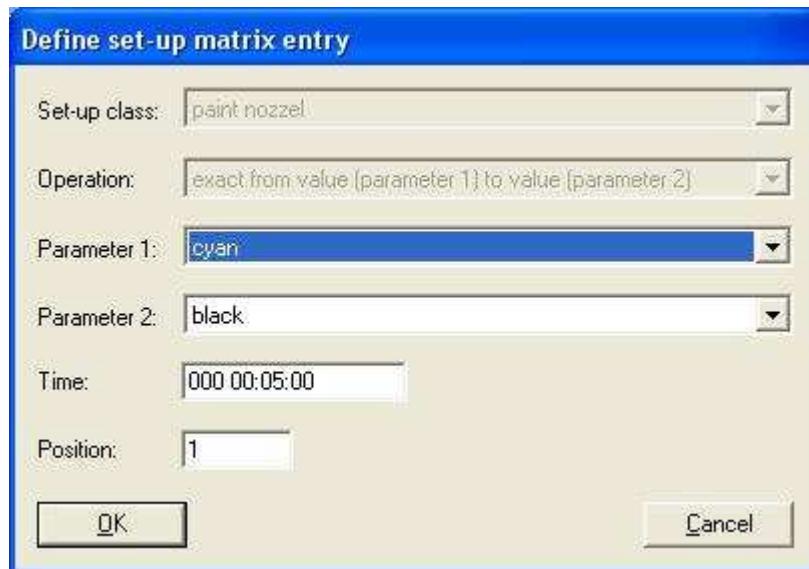


Figure 33: Example for definition of a set-up matrix

Repeat this process till all modification processes shown in the table have been entered. There are totally 12 entries.

3.7 Machine groups

MACHINES/ RESOURCES / EDIT MACHINE GROUPS

Machines that perform the same activities can be grouped together as machine groups in SimAL. While scheduling, SimAL checks for machines, on which a special process can be carried out, which of these machines are available, and distributes the processes to the corresponding machines.



Figure 34: Choice of machine groups

After performing the menu sequence shown above, a choice list is opened, which shows all the machine groups already recorded. There are four command buttons available to manage machine groups:

1. [New] to set up a new machine group (Chapter 3.7.1 [Setting up a machine group](#))
2. [Edit] to edit an existing machine group (Chapter 3.7.2 [Editing a machine group](#))
3. [Delete] to remove a machine group (Chapter 3.7.3 [Deleting a machine group](#))
4. [Close] closes the choice list.

3.7.1 Setting up a machine group

To record a new machine group, click [New]. A dialog box is opened which has two text boxes.

The box »Number of the machine group« is automatically pre-allocated as the '*highest distributed number + 1*' by SimAL. You can change the allocated number; we

however recommend that you leave the numbering of machine groups to SimAL since individual number allocation doesn't offer any program advantages.

The name of the machine group to be set up can be entered in the box »Name of the machine group«. Up to 20 characters can be used.

After you have saved your entries with [OK], the dialog box to edit and parameterize the machine group is automatically called (Chapter 3.7.2 [Editing a machine group](#)).

3.7.2 Editing a machine group

In order to parameterize a machine group, you must first click the desired machine group in the overview box (Figure 34) and then click [Edit] to call up the dialog box for definition of machine groups (Figure 35).

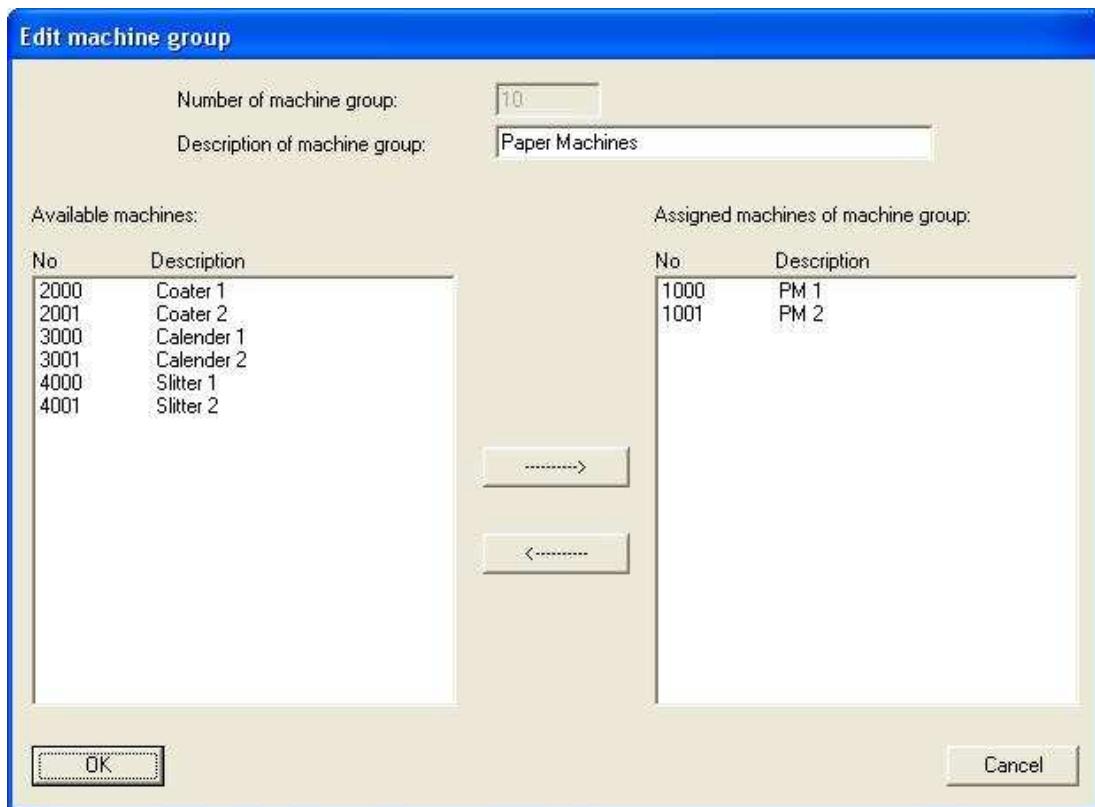


Figure 35: Editing of machine groups

The box »Number of the machine group« cannot be edited. The »Name of the machine group« can however be changed. There are two list boxes underneath these text boxes; the left list shows all available machines while the right list shows all the allotted machines to the currently chosen machine group.

If you have chosen a machine group to be edited, which has just been set up, there will be no machines allotted to it; i.e. the left list will show all available machines while the right list will be empty. The command buttons (\rightarrow) and (\leftarrow) are present between the two lists, with which machines can be allotted to the group or removed from the group.

In order to allocate a machine to the group, first click the desired machine in the left list and then click \rightarrow . The display is updated immediately, since the allocated machine will be shown in the right window and will no longer be available in the left window.

In order to remove a machine from the group, select the appropriate machine in the right list and then click \leftarrow . The display is updated here as well; the chosen machine from the right list will no longer be displayed and instead will be available in the left list.

Allocate all the machines to the group according to this method and then click [OK] to save the entries.

3.7.3 Deleting a machine group

Choose the machine in the overview box (Figure 34) and then click [Delete]. The machine group is immediately deleted.

A machine group can be deleted only when it is not being used in any process!

4. Work plans

The production process is illustrated with the help of production graphs and work plans in SimAL. Work plans illustrate linear production sequences with process alternatives. With the help of production graphs, several work plans can be chained together in nearly any structure. Work plans, on the other hand, consist of one or more processes.

WORK PLANS / EDIT WORK PLANS

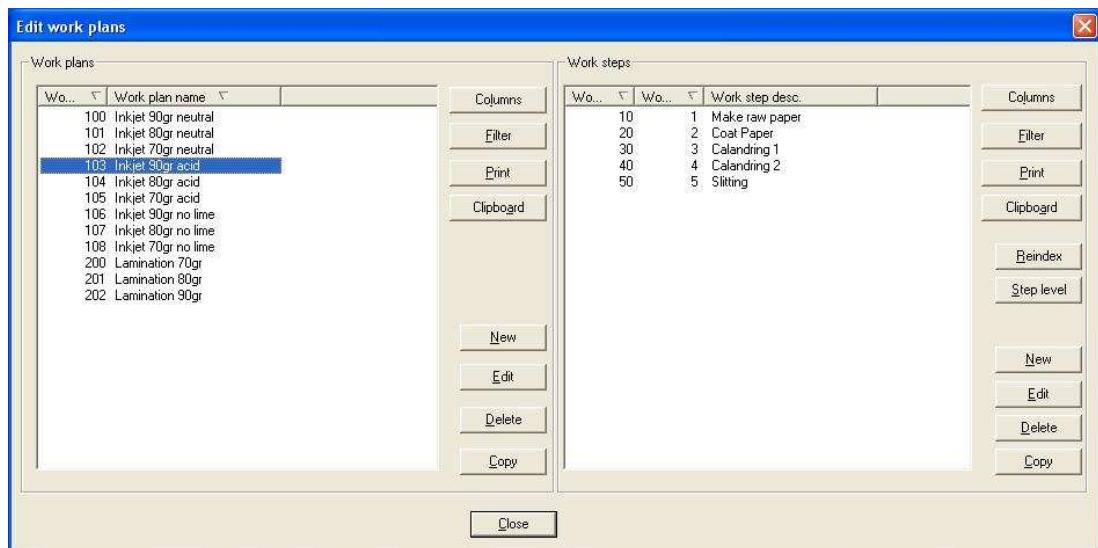


Figure 36: Overview box of work plans

After selecting the menu entry, an overview box consisting of two parts is opened (Figure 36); the left window shows all the currently set-up work plans while the right window lists the processes which belong to the chosen work plan. There are different command buttons on the right of each window to manage and edit work plans and processes.

The first step involves setting up a work plan (Chapter 4.1 [Creating work plans](#)), to which one or more processes are allotted in the second step.

4.1 Creating work plans

A new work plan is set up with the help of [New]. Activating this command button opens a dialog box, which consists of the text boxes »Number« and »Name«. SimAL

automatically enters a default value, which can be overwritten with a unique number, in the box »**Number**« as the ‘*highest existing number + 1*’. The box »**Name**« offers the possibility to name the new work plan with up to 50 characters including spaces and special characters.

An existing work plan can be renamed by clicking [Edit]. The same dialog box to newly set up a work plan is opened; the box »**Number**« can, however, not be changed when using the Edit function. [Copy] simplifies the setting up of work plans, when several complex work plans with numerous, mostly identical process have to set up. With the help of the Copy function, an existing work plan can be duplicated. First select the work plan which serves as a template and then click [Copy]. The same dialog box to newly set up a work plan is opened. Fill out the boxes »**Number**« and »**Name**« and click [OK] to store the new, copied work plan. You can now set the changes in the processes by using Change, Add and Delete.

To delete a work plan select the appropriate schedule by clicking it and then click [Delete]. All allotted processes are also deleted when deleting a work plan.

The processes are shown in the right window of the overview box (Figure 36) as soon as a work plan is selected from the left window by mouse-click. The operations of the processes of a work plan are performed in the order of the production-step numbers; i.e. the *process* with the smallest number is carried out first. To manage the processes of a work plan, there are six command buttons available:

- | | |
|----------|---|
| [New] | A new process is attached after requesting for the production-step number. Processes with the same production-step number are considered as “ alternative processes ”, i.e. it is carried out in the sequence of one of these processes. After entering the production-step number, a dialog box to parameterize the process is opened (Figure 37). An explanation on using this dialog box can be found later in this chapter. Note that the class of the process has to be selected first, when you have derived process classes in the Data Dictionary. The Data Dictionary is described in Chapter 10.12 Data Dictionary . |
| [Edit] | Clicking this command button opens a dialog box which shows all the parameters of the chosen process. If this process has not been referred to yet in the scheduling, then all parameters can be changed; otherwise, this dialog is only to inform the user. |
| [Delete] | Select the process to be deleted in the right window of the overview box (Figure 36) and click [Delete]. |
| [Copy] | Processes can be duplicated as alternatives with the help of this |

function. Select the process you wish to copy and click [Copy]. The chosen process is then duplicated as a process with the same name *Process Name*; the necessary changes of the parameters can follow by clicking [Edit].

After clicking [New before], [New alternatively], [New behind] or [Edit], the dialog box shown below to parameterize the processes is opened.

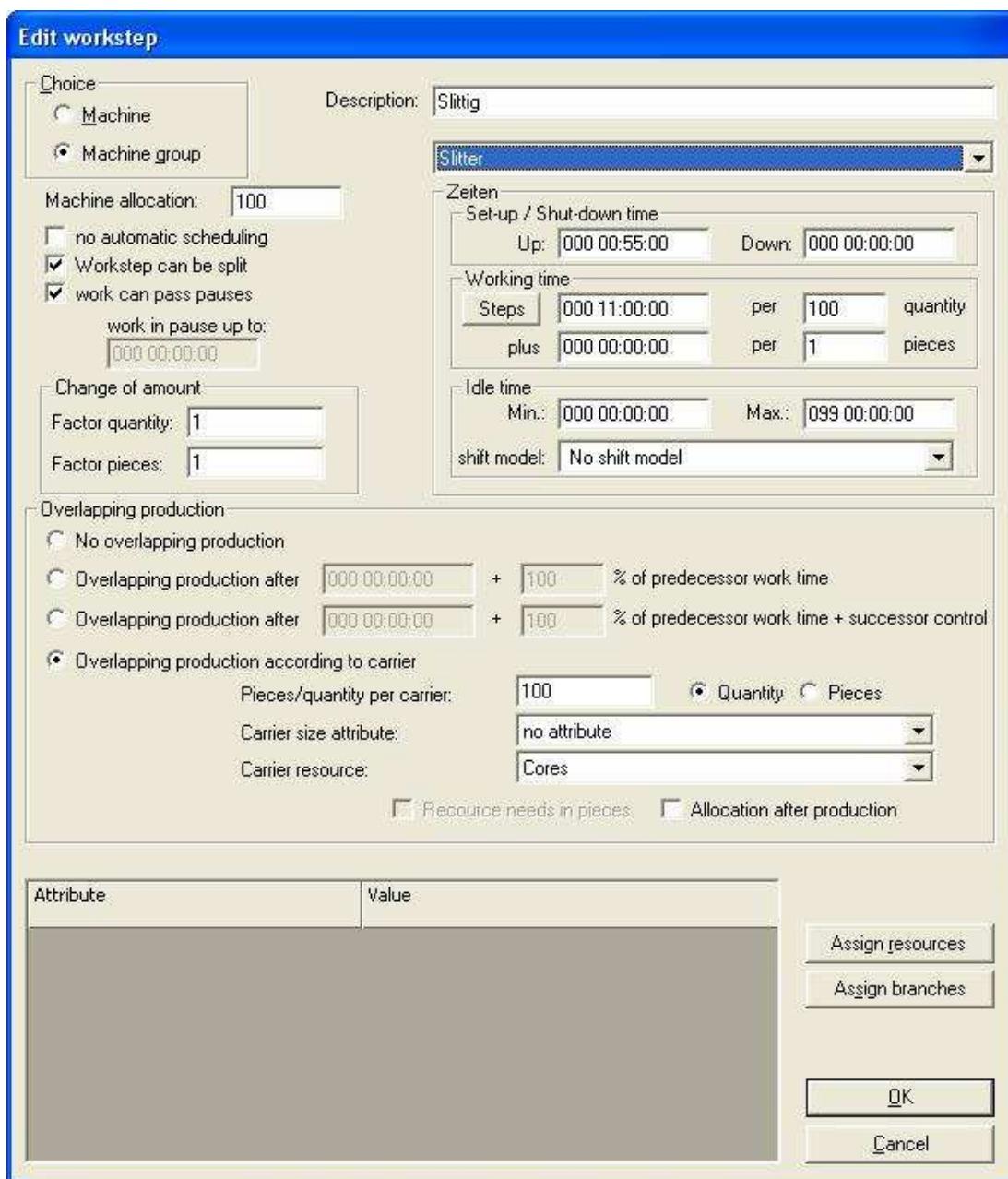


Figure 37: Editing a process

A maximum of 50 characters including spaces and special characters are available to name the process in »**Name**«. In the group box **Choice**, you can determine if the chosen process should be carried out on one particular machine or any machine. If you choose *Machine*, all the stored machines (Chapter 3.2.1 [Creating a machine](#)) are available through the adjacent drop-down list box; if you have chosen *Machine groups*, you have to choose from the set-up machine groups.

Only one machine or one machine group can be allocated to a process. If it happens that a process can be carried out on two machines (which have not been defined as machine groups), then two alternative processes have to be set up, in which one of the two machines (machine groups) is allocated in each case.

A fixed set-up time, which accumulates at the beginning of the process, can be parameterized in the box »**Set-up time**«.

The necessary processing time with respect to the work factor “per quantity” or “per piece” is defined in the box »**Processing time**«. If a processing time factor is entered as 0 in »**Pro**«, the parameterized processing time is drawn up for calculation independent of the production quantity. The processing time can alternatively be calculated from the sum of sub-steps. For this, click [Steps]. A dialog box is opened, in which the individual sub-steps can be parameterized (Figure 38).

Substeps work time / resources

| No. | Alt.-No. | Description | Standard | Time | Attribute | Per value | In steps |
|-----|----------|------------------------------|----------|--------------|-----------------------------|-----------|----------|
| 1 | 1 | Time neede with one Person | Yes | 000 00:03:00 | Dispo order.Target quantity | 5.000000 | Yes |
| | 2 | Time neede with two Personis | No | 000 00:02:00 | Dispo order.Target quantity | 5.000000 | Yes |

Figure 38: List of sub-steps to calculate processing time

Each sub-step consists of at least one sub-step alternative. Exactly one sub-step has to be marked as the standard alternative. This is chosen as the pre-setting for calculation of the time. The planner then has the possibility to manually select another alternative. The time requirement of a sub-step is each time calculated as the product of a basic time and an attribute. There is also the possibility to choose “1” as an attribute, to parameterize a fixed time. The step width, to which the time refers and whether this width follows in steps or continuously, can be given as well. An example should illustrate parameterizing possibilities (Figure 39): the time requirement is 3 minutes for every 5 units of the required quantity and should be carried out in steps. For 33 units (required quantity), seven of the five-steps and thereby 21 minutes are therefore required. If “continuously” was chosen instead of “in steps”, the time would be 19 minutes and 48 seconds.

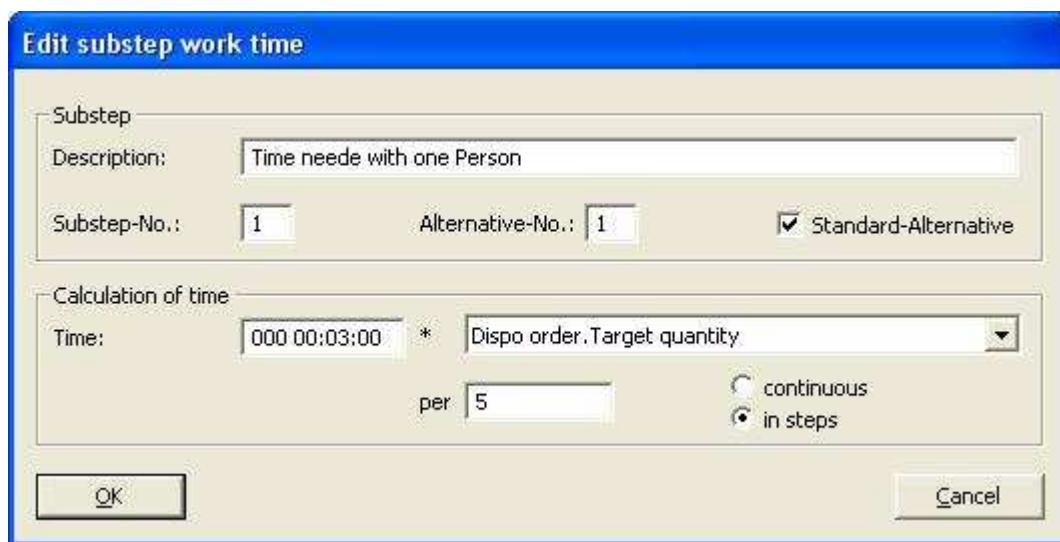


Figure 39: Editing a sub-step alternative

Resource demands can be recorded for each sub-step alternative (Figure 40).

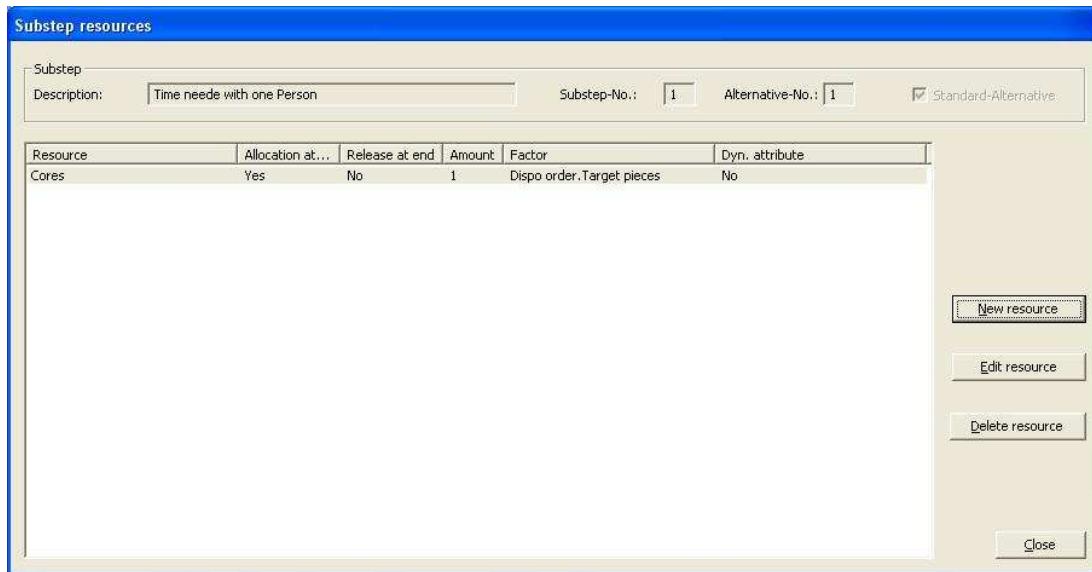


Figure 40: Editing the resource list of a sub-step alternative

It is possible to choose the demand and release time as begin or end of the respective time. Apart from the number of the required resource, which can either be defined through an attribute as constant (Factor “1”) or variable, a dynamic resource creation depending on an attribute is possible (compare part 4.1.1).

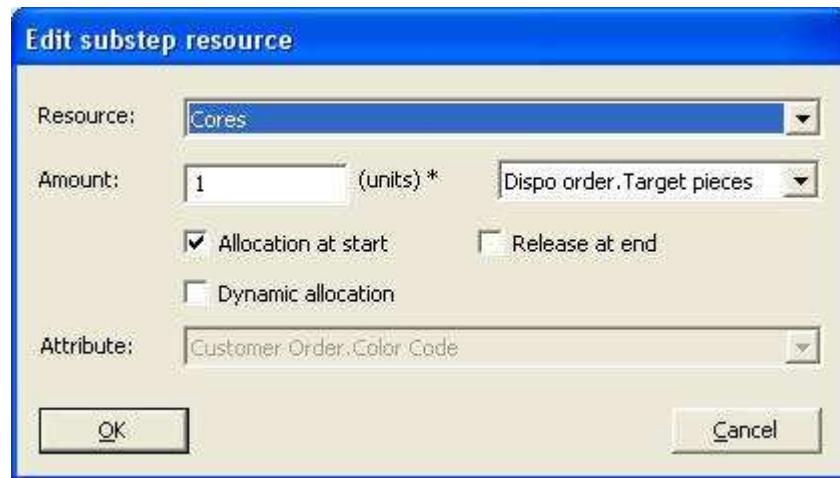


Figure 41: Editing the resource demand of a sub-step alternative

As soon as a sub-step has been set up, it is no longer possible to edit the simple possibilities to calculate processing time through quantity and/or piece in the main dialog box. For this, all sub-step alternatives would have to be deleted.

The minimal idle time shows how much time has to elapse at the end of a process before the processing time of the next process can start. With the maximum idle

time, you indicate the maximum time that can elapse before the start of the next process. ***Automatic scheduling considers the maximum as well as minimum idle time. It, however, cannot always guarantee adherence to the maximum idle time!***

The utilization of the machine is to be entered in the box »**Machine loading**«. This box corresponds to the box »**Max. Loading Quantity**« of the machine and is considered by SimAL only for multi-user machines.

Processes that can only be scheduled in manual production and those not to be considered in automatic scheduling are marked with »**no automatic scheduling**«. This occurs often in the combination with alternative processes and machine groups: an alternative process refers to the preferred machine. An alternative process exists for this, which is referred to the machine group and “no automatic scheduling”, to enable a manual balancing of load.

Activation of »**Process can be split**« means that orders that are based on this process are split in the schedule window. Splitting in the schedule window is not possible without this activation. The splitting and pasting of processes is explained in Chapter 8.4.11 [Splitting a graph](#) and Chapter 8.4.16 [Splitting](#) respectively.

The option “Production can be paused” determines whether the process can be paused during a break. If an interruption of the production is not possible, for example, due to technical reasons, the checkmark of this option is to be removed.

The checkboxes »**Factor Quantity**« and »**Factor Piece**« help in describing how a process affects the quantity and number of pieces of the orders. For example, in a "sawing process", in which a part is cut in two, the »**Factor Piece**« is to be parameterized with 2. If there is also a small material loss of 0.1% while sawing, the »**Factor Quantity**« would have to be parameterized with 0.999.

The entries in the area **Overlapping Production** from Figure 37 are only relevant if »**Overlapping Production** « has been chosen. Overlapping production has to be parameterized when the successive process should start before the current process is completed. Depending on the chosen mode, the overlapping is more-or-less exactly illustrated.

| | |
|---|--|
| No overlapping production | The processing time + min. idle time of the current process must completely finish before the successor can start. |
| Overlapping production after x + y % of the previous proc- | The successor can only start after a fixed time of x + a percent value of the processing time + the minimum idle time of the current process. This mode is used in most of the ERP systems. It can however happen that the successors end before the current |

| | |
|--|--|
| essing time | process! |
| Overlapping production after $x + y \%$ of the previous processing time + control of the successor | The successor can start after a fixed time of $x +$ a percent value of the processing time + the minimum idle time of the current process. It is however controlled that the successors do not end before the current process (precisely: The end of the successor must not lie before the end of the current process + the parameterized overlapping time + the minimum idle time). Use this overlapping time when the successive process is usually faster than the current one. |
| Overlapping time according to load carriers | <p>The parts are passed on in lots of “Piece/Quantity per load carrier” to the successive process. The model behind this considers a machine as a process which frees up load carriers at the entrance and loads them at the exit through its operation. The load carriers at the entrance and exit can thus have different types and capacities.</p> <p>If the used load carriers are less or if their utilization is to be visualized, a resource for the utilization of the load carrier can be given in the process. Whenever an empty load carrier is needed from the machine, this resource is loaded by 1. Choose the corresponding resource in the box “Load-carrier resource”.</p> <p>If the overlapping size is chosen as “Piece”, the resource can also be loaded with the number of pieces instead of with 1. For this, activate the option “Resource requirement in pieces”.</p> <p>A free load carrier is usually required when the first part is being produced that has to be loaded on the load carrier. The load carrier can alternatively be required when the number of produced parts fills up the load carrier. For this, activate the option “Requirement after production”.</p> <p>Finally, there is the possibility to determine the number of parts that fit on a load carrier through an attribute. This would be parameterized, when the same work plan is used for parts of different sizes. The number of parts that can be transported no a pallet is, however, dependent on the size. A calculated attribute can thus be defined in the Data Dictionary, which calculates the number of parts per pallet based on the order data. If the load – carrier size attribute has been defined, the entry “Piece/Quantity</p> |

per load carrier” is not possible. A previously parameterized value will be ignored.

4.1.1 Assigning resources to the process

The assigning of resources to a process is the same as allocation of resources to machines (Chapter 3.2.4 [Machines-Resources](#)).

To assign resources to a process, click [Allocate resources] in the window “Edit process” (Figure 37); the window shown in Figure 42 is then opened.

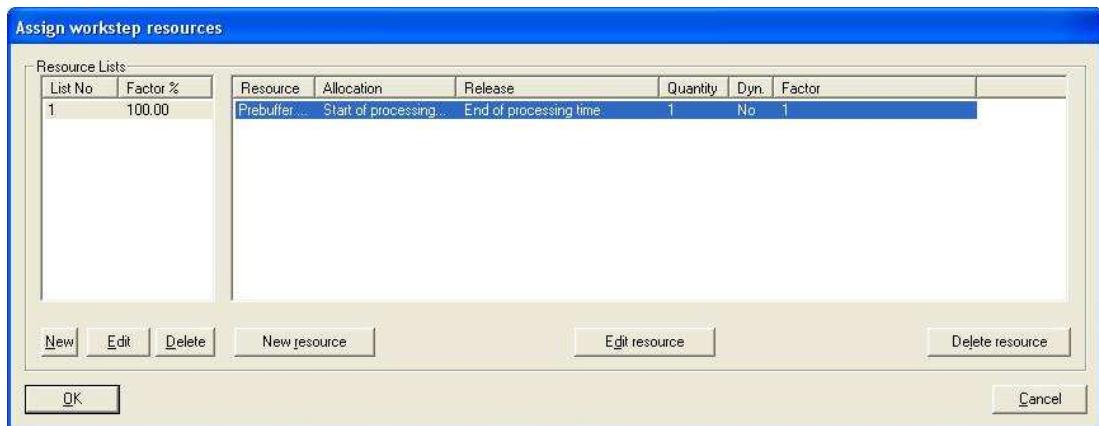


Figure 42: Allocating resources to a process

Create a new list by clicking [New] and enter the performance factor (default value of 100%) in the dialog box which opens. The performance factor is only for purposes of documentation in standard SimAL but can be used in other customized programming. The selected list can be edited and deleted with the command buttons [Edit] and [Delete] respectively.

To assign resources to a process, first select a resource list and then click [Enter resources]. The window in Figure 43 is then opened.

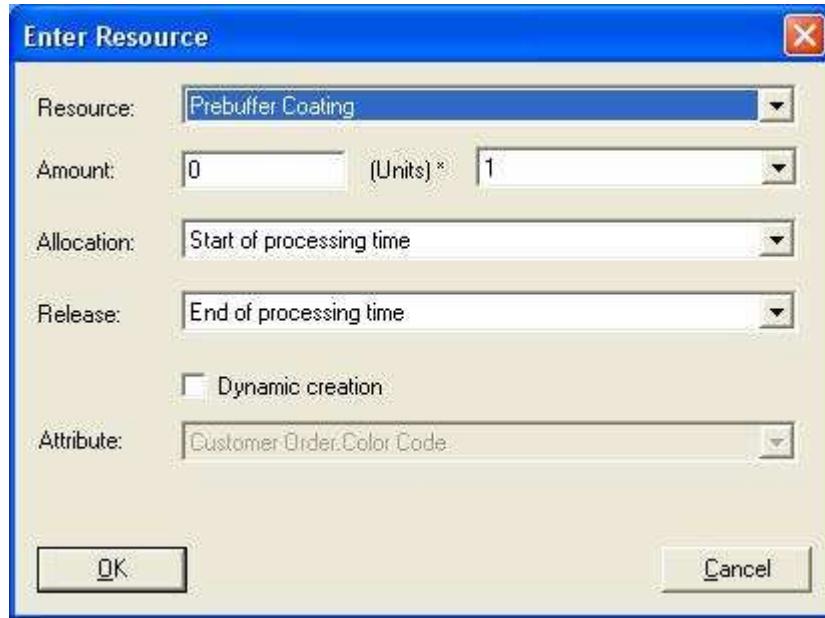


Figure 43: Entering resources

The resource has to be chosen in the box »**Resource**« and the number of resources required in the box »**Number**«. The times of resource loading and release are defined in the boxes »**Demand**« and »**Release**«. Please note that resources can also only be demanded and released in a process. With this mechanism, for example, buffers can be modeled in addition to overlapping production.

The number of demanded resources cannot be defined for many processes, since it can, for example, depend on the required quantity of the order. In this case, the demanded quantity can be multiplied with an attribute value. This attribute can be chosen in the drop-down combo box to the right of the box “Number”.

Resources can be automatically set up with the help of “Dynamic creation”, if they don’t already exist. For this, the system checks if a resource with the name of the value of the parameterized value already exists in the schedule. If that is the case, this resource is used. If this resource doesn’t exist, it is temporarily created in the main memory (for the duration of processing the schedule). The parameterized resource is copied and allotted a unique number and is renamed in accordance with the attribute value.

The entries are accepted by clicking [OK].

4.1.2 Assigning areas to resources

By clicking [Assign areas] in the dialog box “Edit process” (Figure 37), the dialog box shown in Figure 44 is opened, by clicking [→] or [←] one or more areas can be assigned, where the process has to be performed.

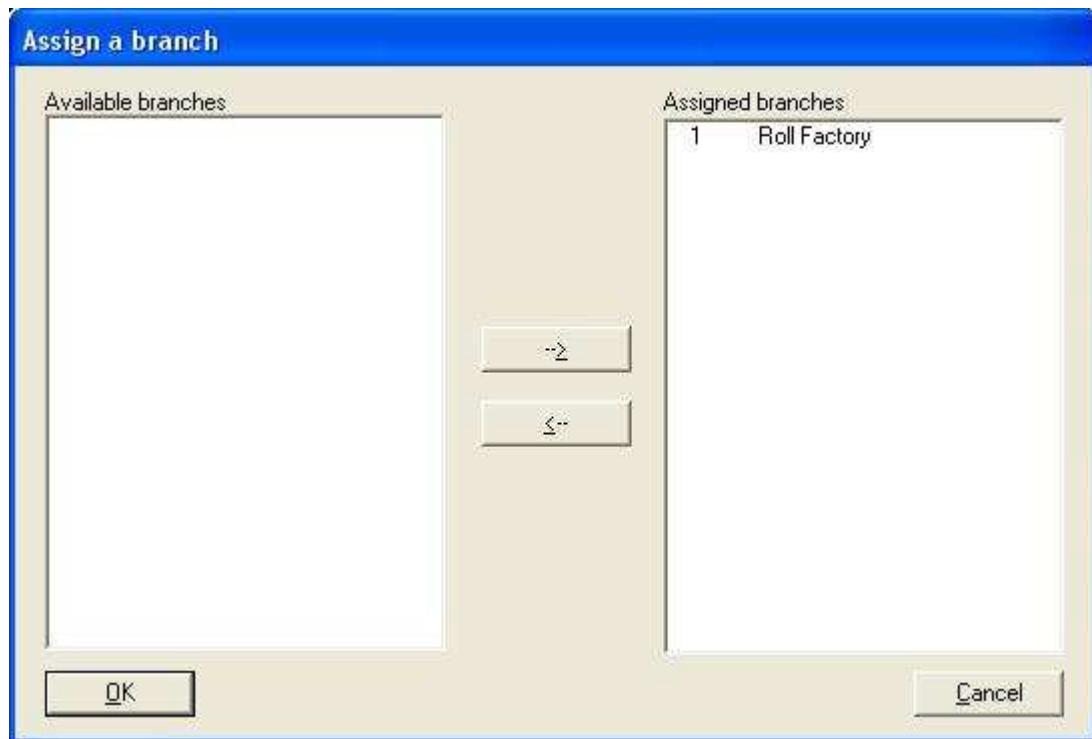


Figure 44: Assigning areas to a process

Each process must be assigned to at least one area, so that it is shown the order pool (Chapter 8.1.1 [The order pool](#)) and can be scheduled as well.

4.2 Editing production graphs

WORK PLANS / EDIT PRODUCTION GRAPHS

Production graphs are used in SimAL when work plans are no longer sufficient to describe the production path. Mostly linear work sequences can be described with work plans. If parts from different sources come together, such as for mounting, or take different routes through the production after some common processing, such as for dismounting, production graphs must be used. Production graphs determine how work plans are networked. The order doesn't refer to a work plan then, rather to a production graph.

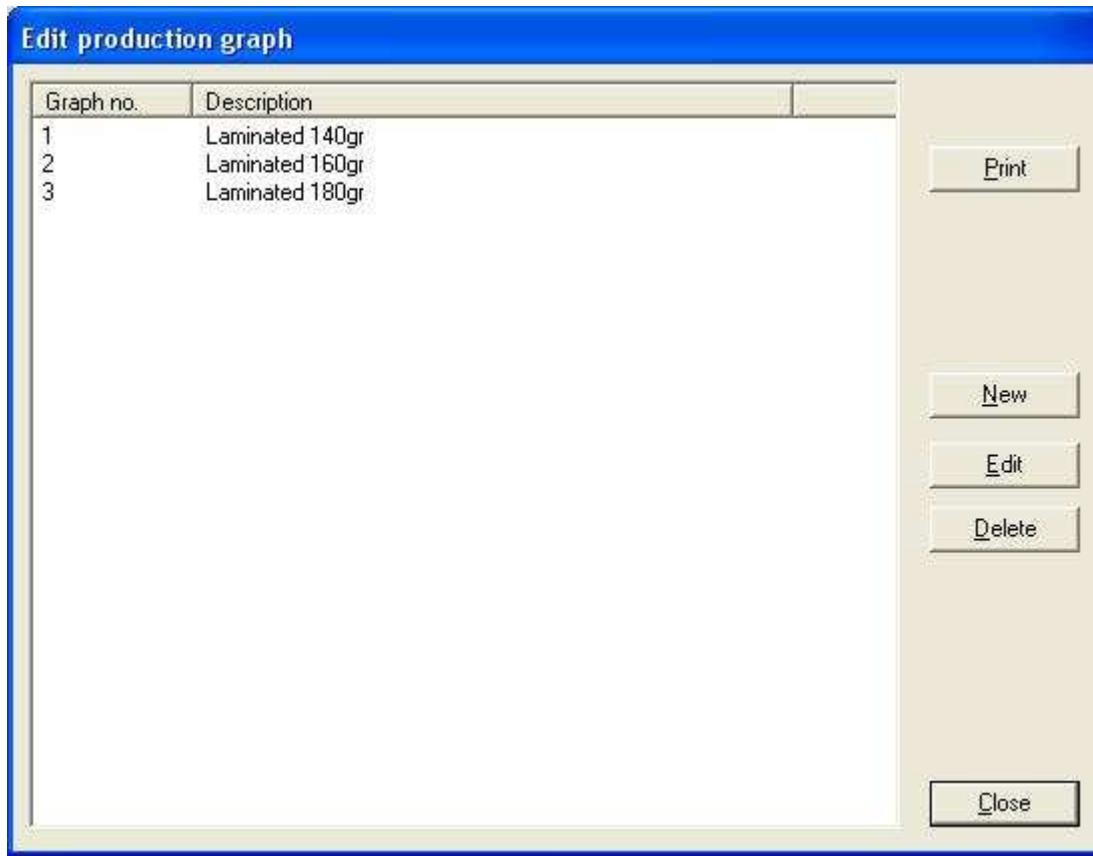


Figure 45: Overview box of production graphs

After performing the menu sequence shown above, an overview box is opened (Figure 45), which lists out all the production graphs set up so far.

- [Print] The list is printed out with one click.
- [New] To set up a new production graph.
- [Edit] The parameterization of an existing production graph can be modified through this function.
- [Delete] The production graph selected in the overview box will be deleted.

After clicking [New], the production graph must first be given a number. Confirm the entry by clicking [OK]. The dialog box shown in Figure 46 is opened immediately afterwards.

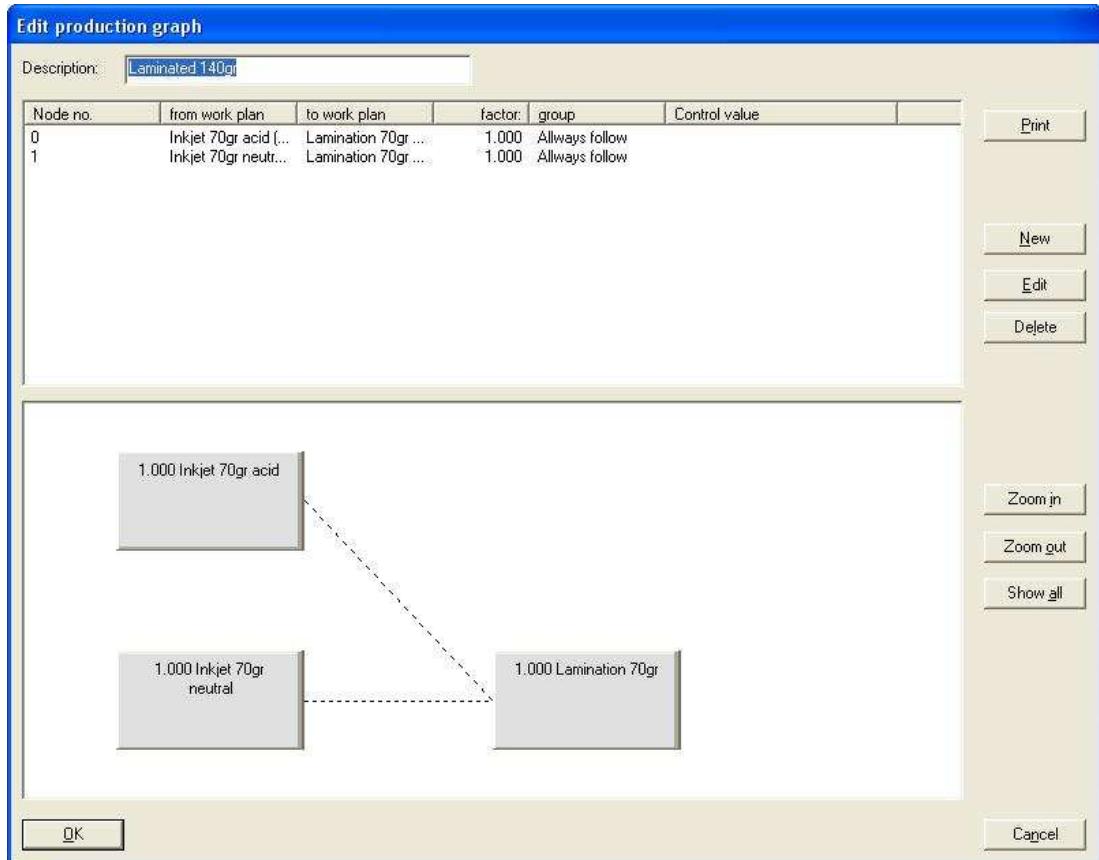


Figure 46: Defining a production graph

The production graph can be given a name of up to 50 characters in length including spaces and special characters through »Name«. Another dialog box, shown in Figure 46: Defining a production graph is opened by clicking [OK]. Choose the previous and successive work plans in the boxes »from work plan« and »to work plan« respectively. A chaining means that the successive work plan can only start after all processes of the previous work plan have been completed. The value in »Factor« defines the relation between previous and successive work plan in terms quantity and number of pieces. A factor of 0.5, for example, means that two pieces of the objects from the last process of the previous order are needed to produce 1 piece of the objects in the first process of the successive work plan.

The boxes »Group« and »Control value« are to define variant productions. If an attribute of a ERP order was chosen in the box “Group”, the work plan chaining will only be accepted in the schedule window, when the »Control value« matches the value of the chosen attribute in the ERP order.

During the ERP acceptance (Chapter 6.2 [Accepting ERP orders](#)), the production graph from the previous work plan will traverse backwards with the help of its work plan chaining and a so-called disposition order will be created for each production

step. The quantity factors of the processes and the work plan chaining are considered in the production graph here.

It is ensured while entering production graphs that there has to be exactly one work plan which has no successors, so that a unique starting point is defined. It is also ensured that the production graph has no cycles.

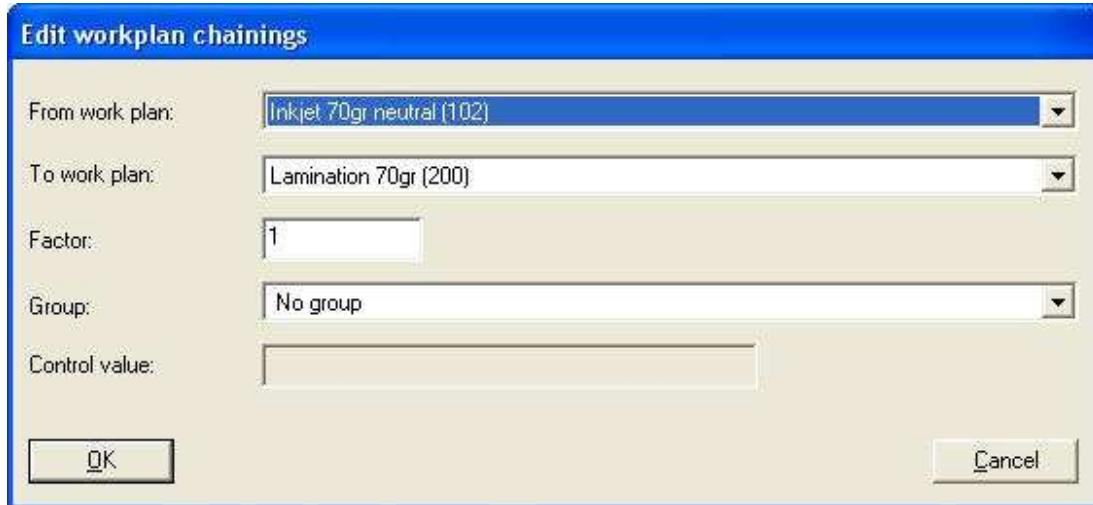


Figure 47: Editing work plan chaining

You have to have set up work plans (Chapter 4.1 [Creating work plans](#)) that are needed for the production graph before you actually define the respective production graph!

4.3 Performance resources

Performance resources are normal resources, which were chosen as performance resources while defining machines (Chapter 3.2.1 [Creating a machine](#)). The necessary processing time of a process can be extended with their help depending on the surrounding conditions. A small example for this:

A worker is utilized up to 70% while working at a machine. When he has to work at a second machine, he can only perform 30%, and the processing time is accordingly extended there.

This scenario is illustrated with a performance resource:

- For both machines, a resource is entered as a performance resource (the worker with “stock” of 100).

- Now, if a scheduling order is scheduled for machine 2 (while machine 1 is working), the processing time of the disposition order for machine 2 is accordingly extended as follows:

(Demanded performance / Available performance) * calculated processing time

- The available remaining performance will be controlled again for each change of the resource.
- By scheduling the second scheduling order, the processing time of the first disposition order is not changed.
- A hierarchy is generally determined between the machines through performance priority. If a disposition order for a machine is scheduled with a capacity resource, it is performed before all disposition orders which have been scheduled with a lower performance priority. If the performance priority is the same for two machines, the machine with the higher machine number “wins”.
- For multiple-unit machines, there is a different rule: The disposition order with the earliest set-up start wins of all the different units.

The following scenarios can be done well with performance resources:

- First come – first serve machines
- Machines, which can process several orders simultaneously, whose processing time is then however extended.

Unscheduled processes that are depicted with a idle time, for example, quality control, can also be scheduled this way.

5. Managing shifts

Managing of shifts by SimAL offers the highest flexibility without needing complicated entries from the user. The main aspect here is defining all necessary shift schedules in four steps, which are based on each other and which can be supplemented or extended at any time:

1. **Shifts:** a shift is the smallest unit, which SimAL makes available. In a shift, the following are defined - the resources and machines active in a shift and the times of breaks.
2. **Shift lists:** a shift list is created from several shifts.
3. **Day lists:** day lists are built up from shift lists.
4. **Week lists:** based on day lists, week lists are built up.

5.1 Editing shifts

COMPANY HOLIDAYS/ SHIFTS / EDIT SHIFTS

After performing the menu sequence shown above, an overview box (Figure 48) to edit the shift model is opened. The dialog box has four parts:

1. Shift types (Chapter 5.1.1 [Editing shift types](#))
2. Day types (Chapter 5.1.2 [Editing day types](#))
3. Week types (Chapter 5.1.3 [Editing week types](#))
4. Timetable types (Chapter 5.1.4 [Editing timetable types](#))

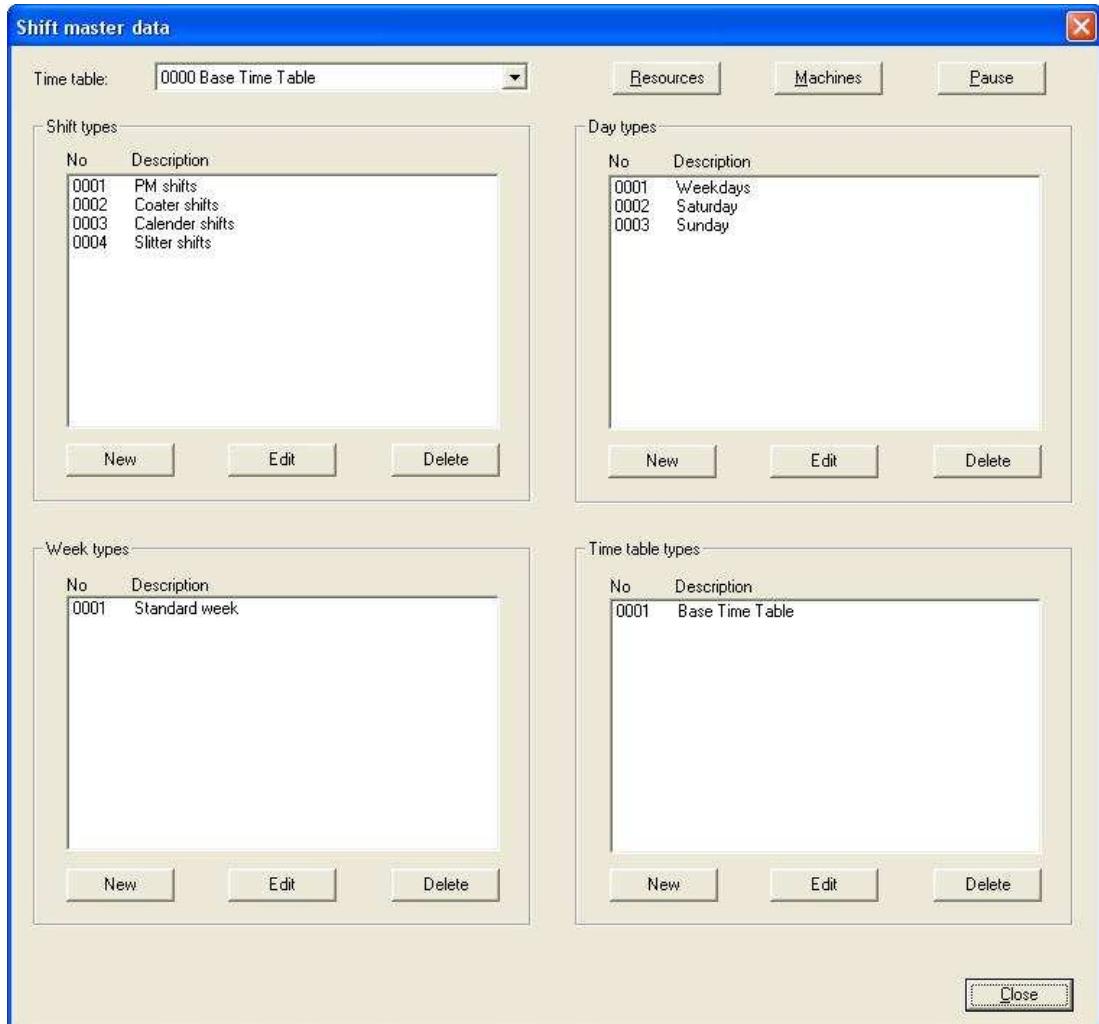


Figure 48: Overview of shifts to be edited

5.1.1 Editing shift types

A shift is the smallest unit that can be edited in the shift model of SimAL. All the already recorded shifts are shown in the list box. The functions concerning editing can be accessed through the three standard command buttons, namely [New], [Edit] and [Delete]. There are three additional command buttons - [Resources], [Machines] and [Breaks].

1. [New] A new shift can be set up with the help of this button.
2. [Edit] The name of an existing shift can be changed with this function.
3. [Delete] This removes a shift from the shift model.
4. [Resources] The necessary resources are allocated to the chosen shift.

5. [Machines] The machines necessary for the shift are allocated.
6. [Breaks] One or more breaks can be stored for each shift.

[New]

A dialog box, which has two text boxes, is opened after clicking this command button.

A unique number must be given in the box »**Number**«; SimAL automatically enters a default value as the ‘*highest allocated number + 1*’. You can manually change this default value, but we recommend leaving the numbering to shifts to SimAL since manual allocation of numbers doesn’t have any advantages when running the program.

Name the shift to be set up in the box »**Description**«. You may use up to 20 characters. Normally, a self-explanatory name such as *Early shift*, *Midday shift* and so on is entered.

[Edit]

Click the shift in the list box, whose description you would like to change. After clicking the command button [Edit], the same dialog box to newly set up a shift is opened. The box »**Number**« cannot be changed in this editing mode. You may carry out the desired changes in the box »**Description**«.

[Delete]

Choose the shift to be deleted from the list box and then click the command button [Delete]. If the chosen shift is allowed to be deleted, the action is performed without any further questions, if you really want to delete the shift. It will be deleted immediately.

[Resources]

A new dialog box is opened by clicking [Resources], through which the resources needed by the shift, can be allocated. At the top of the dialog box, there are two combo boxes, in which the number and description of the shift just chosen are shown. Through the boxes »**Number**« or »**Shift**«, you can choose the shift to be edited without having to leave the dialog box to allocate resources. Below both of these boxes, there are two list boxes; the right list box lists out all the resources allocated to the current shift including the required quantity while the left list box shows the resources that are still available.

There are two command buttons [→] and [←] between the list boxes, with which resources can be allocated to a shift or removed from a shift. Only the resources

marked as shift-dependent can be allocated (Chapter 3.3 [Editing resources](#)). Therefore, resources not selected as shift-dependent will not be shown at all.

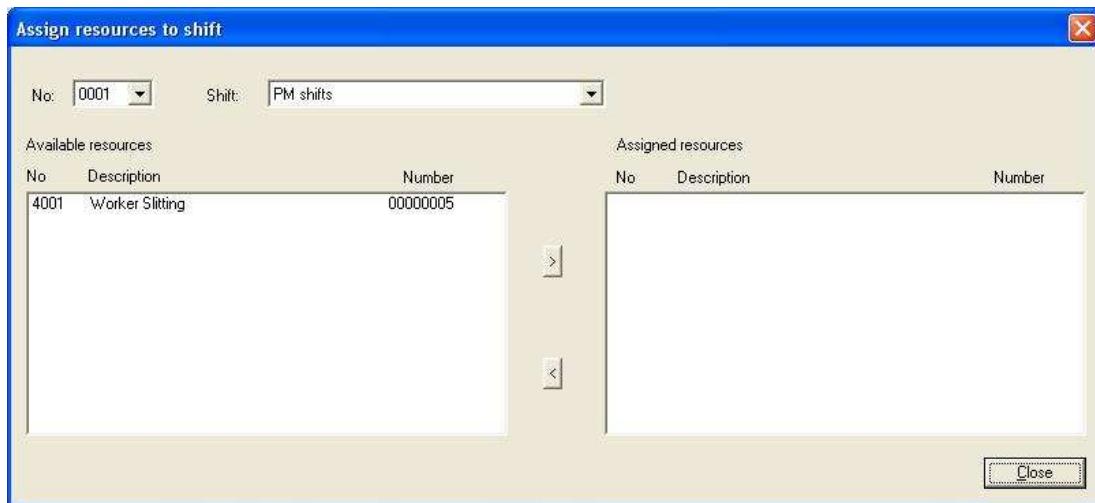


Figure 49: Resource-Shift allocation

Assign a resource to a shift by clicking the required resource in the left list box and then activating [→]. Before the resource is actually allocated, a dialog box is first opened, in which you have to enter the required resource quantity. The permitted value range depends on which absolute resources were entered in the resource management (Chapter 3.3 [Editing resources](#)). SimAL enters the maximum available quantity as a default value; this value can be changed and must be changed based on the actual demands. If you allocate the maximum available quantity of this resource to the shift, the resource will not be seen any more in the left list box.

The quantity of allocated resources can be changed later by first double-clicking the resource to be changed. The dialog box to enter the quantity is then opened.

Allocated resources can be removed by choosing the resource in the right list box and then clicking the command button [←]. If you wish to only lessen the quantity of the resource instead of removing it, the dialog box to enter the quantity is opened and you must then enter the resource quantity, by which the shift is to be reduced. SimAL enters the actually allocated quantity as a default value. You can change this default value in the range *1 to max. Value-1*.

It is not possible to remove a resource by opening the dialog box and entering ‘0’. Removing a resource is only possible by clicking the command button [←]!

[Machines]

After clicking [Machines] in the overview box (Figure 48), the dialog box for allocation of machines is opened.

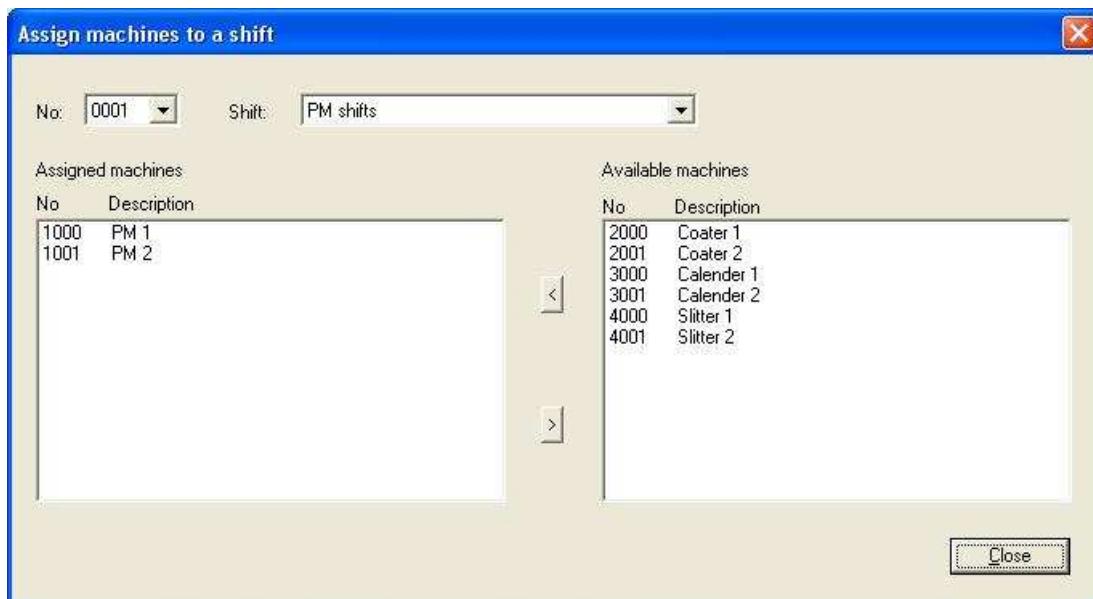


Figure 50: Machine-Shift allocation

The dialog box for allocation of machines is principally identical to the dialog box for allocation of resources to shifts (Figure 49). However, since no quantities need to be recorded, there is no additional dialog box here to enter quantities.

The shift to be edited can be chosen through the boxes »Number« or »Shift« without having to leave the dialog box for allocation of machines.

A machine can be allocated to the chosen shift by selecting it and then clicking the command button [>->]. An already allocated machine can be removed from the shift by selecting it in the right list box and then clicking [<-<].

Alternatively, a machine can be allocated to the shift by double-clicking the machine in the left-list box. A double-click on an already allocated machine in the right list box removes the allocation.

By clicking [Close], you leave the dialog box for allocation of machines to shifts.

[Breaks]

After clicking the command button [Breaks], a new list box is opened (Figure 51), which has two parts. The left list shows all the already set-up shifts while the right lists shows the breaks allocated to the shift chosen. First choose the desired shift in

the left list to view the breaks in the right list. You can allocate any number of breaks to a shift.

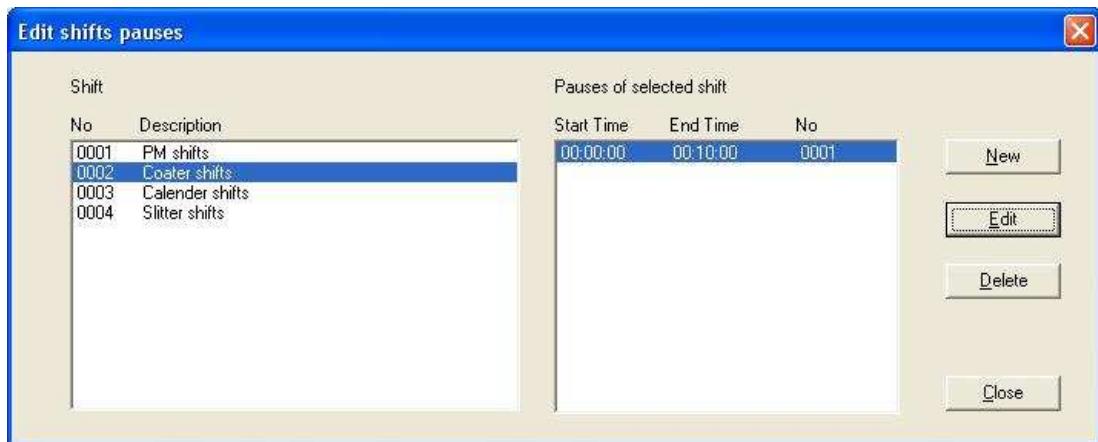


Figure 51: List box to edit shift breaks

To allocate a new break to the chosen shift, click [New]. The dialog box to enter and edit break times is opened. First enter the time at which the break should begin after start of the shift in the box »**relative starting time**«. The entry must be in the format *hh:mm:ss*. The end of the break can be entered in the box »**relative ending time**«, whose format must be the same as for »**relative starting time**«.

Entry of the **relative** times must be observed to be able to create the whole shift model of SIMAL more flexibly. Till creation of a shift list (Chapter 5.2 [Editing shift lists](#)), only relative times are used.

A break already set up can be parameterized again by selecting the shift in the list box (Figure 51) and then clicking the command button [Edit]. The parameter dialog box can alternatively be opened by double-clicking the corresponding entry in the right window. Enter the new starting and ending times and then save your entries by clicking [OK] or pressing [Return].

A break can be deleted by choosing the *Shift* and *Break* just as in editing of breaks and then clicking [Delete].

The break data are deleted immediately with this function, i.e. there is no safety question.

[Close] ends the edit process for breaks and the dialog box shown in Figure 51 is closed.

5.1.2 Editing day types

There are three command buttons to edit the day types:

1. [New] to set up a new day type
2. [Edit] to edit a new day type
3. [Delete] to remove a day type no longer needed

The dialog boxes to set up and edit a day type are principally the same and are, therefore, explained together. The dialog box has two text boxes: »**Number**« and »**Description**«.

SimAL automatically gives the '*highest occupied number + 1*' as the default value when setting up a new day type. This default value can be changed manually, but has no meaning for the application; the number suggested by SimAL should, therefore, generally be accepted. The box »**Number**« cannot be edited while editing an existing day type.

A name for the day type can be given in the box »**Description**«. When newly setting up a day type, this box is empty, but when using the function [Edit], the originally entered name is shown, which can be changed any number of times.

To edit a day type, an entry in the list box has to first be selected. Otherwise, SimAL gives a message that no choice has been made.

A day type which is no longer required can be deleted by selecting the corresponding entry in the list box and then clicking [Delete].

The parameterization of the days is performed through the menu sequence COMPANY HOLIDAYS/ SHIFTS / EDIT DAY LISTS. The working times are compiled from the individual shifts. An explanation on using the dialog box can be found in Chapter 5.3 [Editing day lists](#).

5.1.3 Editing week types

To edit the week types, there are three command buttons available:

1. [New] to set up a new week type.
2. [Edit] to edit a new week type.
3. [Delete] to delete a week type no longer needed.

The dialog boxes to set up and edit a week type are principally the same and are, therefore, explained together. The dialog box has two text boxes: »Number« and »Description«.

SimAL automatically gives the '*highest occupied number + 1*' as the default value when setting up a new week type. This default value can be changed manually, but has no meaning for the application; the number suggested by SimAL should, therefore, generally be accepted. The box »Number« cannot be edited while editing an existing week type.

A name for the week type can be given in the box »Description«. When newly setting up a week type, this box is empty, but when using the function [Edit], the originally entered name is shown, which can be changed any number of times.

To edit a week type, an entry in the list box has to first be selected. Otherwise, SimAL gives a message that no choice has been made.

A week type which is no longer needed can be deleted by choosing the corresponding entry from the list box and then clicking [Delete].

The parameterization of the weeks is performed through the menu sequence OPERATION CALENDAR/ SHIFTS – EDIT WEEK LISTS. The working weeks are compiled from individual days. An explanation on using the dialog box can be found in Chapter 5.4 [Editing week lists](#).

5.1.4 Editing timetable types

To edit the timetable, there are three command buttons available:

4. [New] to set up a new week type.
5. [Edit] to edit a new week type.
6. [Delete] to delete a week type no longer needed.

The dialog boxes to set up and edit a timetable type are principally the same and are, therefore, explained together. The dialog box has two text boxes: »Number« and »Description«.

SimAL automatically gives the '*highest occupied number + 1*' as the default value when setting up a new timetable type. This default value can be changed manually, but has no meaning for the application; the number suggested by SimAL should, therefore, generally be accepted. The box »Number« cannot be edited while editing an existing timetable type.

A name for the timetable type can be given in the box »**Description**«. When newly setting up a timetable type, this box is empty, but when using the function [Edit], the originally entered name is shown, which can be changed any number of times.

To edit a timetable type, an entry in the list box has to first be selected. Otherwise, Si-mAL gives a message that no choice has been made.

A timetable which is no longer needed can be deleted by choosing the corresponding entry from the list box and then clicking [Delete].

The parameterization of the timetables is performed through the sequence OPERATION CALENDAR/ SHIFTS – SET TIMETABLES. The timetables are compiled from the individual weeks. An explanation on using the dialog box can be found in Chapter 5.6 [Setting Timetables](#).

5.2 Editing shift lists

OPERATION CALENDAR/ SHIFTS / EDIT SHIFT LISTS

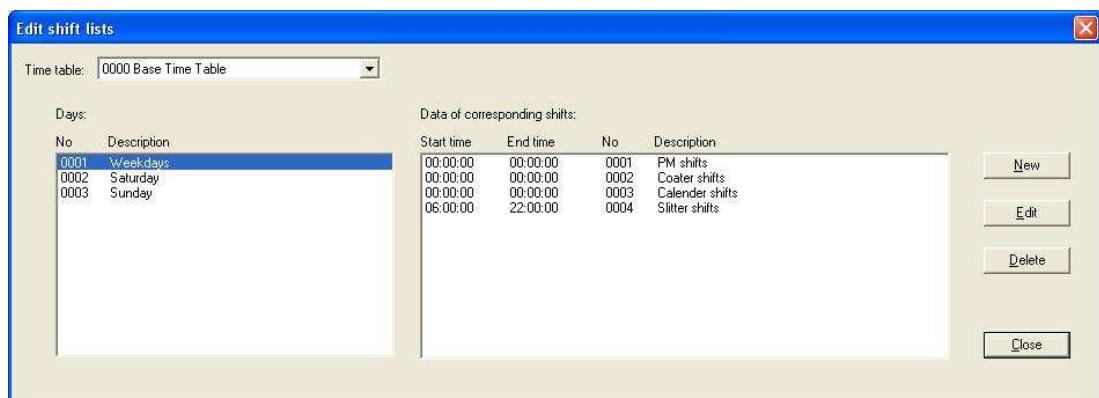


Figure 52: Overview box of shift lists

Each day type has a list of shifts which happen on this day. For example, there can be the three early, late and night shifts on a weekday and only early and late shifts on a Saturday. After performing the menu sequence shown above, the dialog box with two parts to edit the shifts is opened. The left list box contains all recorded day types (Chapter 5.1.2 [Editing day types](#)). Click the desired day type to see its shift list in the right list box. The starting and ending time and number and name are shown for each shift. Further shifts can be allocated; shifts can be edited or deleted through the command buttons [New], [Edit] and [Delete]. The editing of the shift lists is closed with [Close].

5.2.1 Allocating a new shift

A new shift can be added to a chosen day by clicking [New] to open the dialog box shown below.

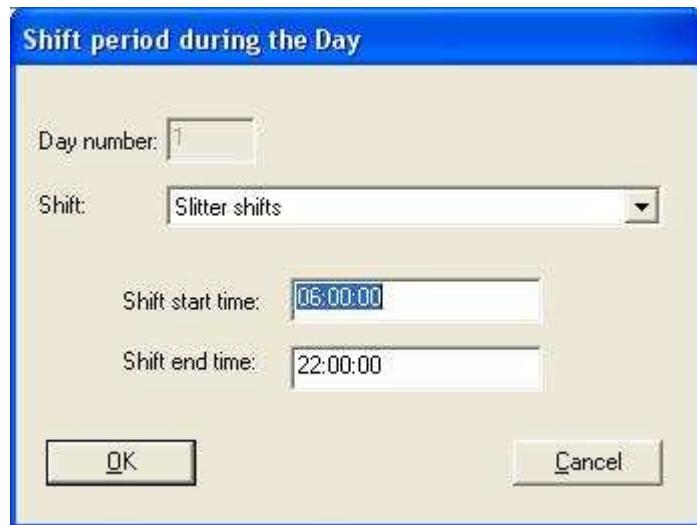


Figure 53: Parameterizing shift lists

One of the set-up shifts can be selected from the drop-down combo box »Shift«. The starting and ending times of the shift can be entered in the boxes »Starting time« and »Ending time«; the entry must be in the format *hh:mm:ss*.

Please note that by choosing the shift in »Shift« not only means accepting the name of the shift, but also the resources, machines and break times connected to the shift.

5.2.2 Editing shift parameters

To edit a shift assigned to the day, you have to first select the shift in the left list box of the overview box, select the shift to be edited in the right list box and then click [Edit]. The boxes »Shift«, »Starting time« and »Ending time« can be edited just like when setting up a new shift (Chapter 5.2.1 [Allocating a new shift](#)).

The changes in this dialog box affect only the shift which is being edited. If, for example, you want to change the early shift to start at 7 a.m. instead of at 6 a.m., this change does not affect all shifts which have the name ‘Early shift’.

5.2.3 Deleting a shift

Choose the day whose shift list you would like to delete in the left list box and then choose the shift list to be deleted in the right list box before clicking [Delete] to remove the chosen shift from the shift list.

5.3 Editing day lists

OPERATION CALENDAR/ SHIFTS – EDIT DAY LISTS

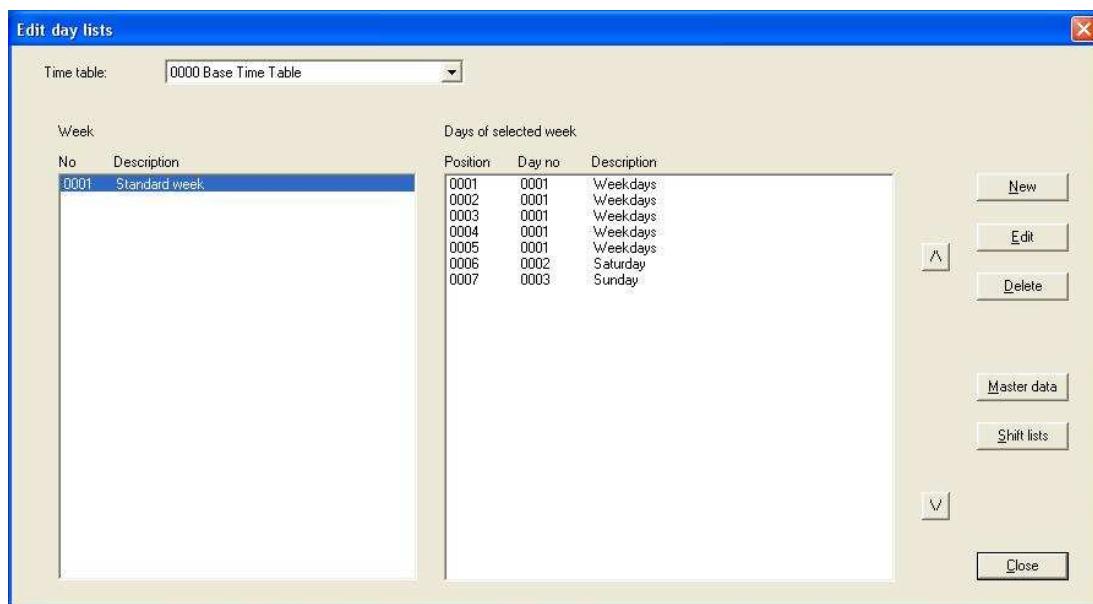


Figure 54: Overview box of day lists

Using the dialog box “Edit shift list” is basically comparable to the dialog box “Edit shift list” just described. The difference lies in the fact that the day lists are on a higher hierarchy level than the shift lists.

The left list box shows the set-up week types (Chapter 5.1.3 [Editing week types](#)). After a week is selected by clicking it, the allocated day lists are shown in the right list box.

The list box titled “Days of the chosen week” has the following elements to parameterize the entries in the right list box:

[\wedge]

The selected day in the list is moved one position up.

[\vee]

The selected day in the list is moved one position down.

[New]

A new dialog box is opened after clicking the command button [New]. Choose the desired type of day through the combo box »Day«. Close the dialog box and accept the changes by clicking [OK]. Clicking [Cancel] closes the dialog box without having set up a new day.

If no day was selected in the right list box and if you clicked [New], the newly set up day is added to the end of the day list.

If a day was selected in the right list box before clicking [New], the newly set up day will be added to the day list just behind the selected position.

[Edit]

Select the desired day in the right list box and click [Edit]. A new dialog box is opened, which has only one box, the combo box »Day«. Choose the necessary day type.

[Delete]

Select the day to be removed from the currently chosen week and click [Delete].

[Master data]

The dialog box to manage shifts, days, weeks and timetables is opened. A detailed description can be found in Chapter 5.1 [Editing shifts](#).

[Shift lists]

The dialog box to parameterize the shift lists is opened (Chapter 5.2 [Editing shift lists](#)).

[Close]

The dialog box “Edit day lists” is closed.

5.4 Editing week lists

OPERATION CALENDAR/ SHIFTS / EDIT WEEK LISTS

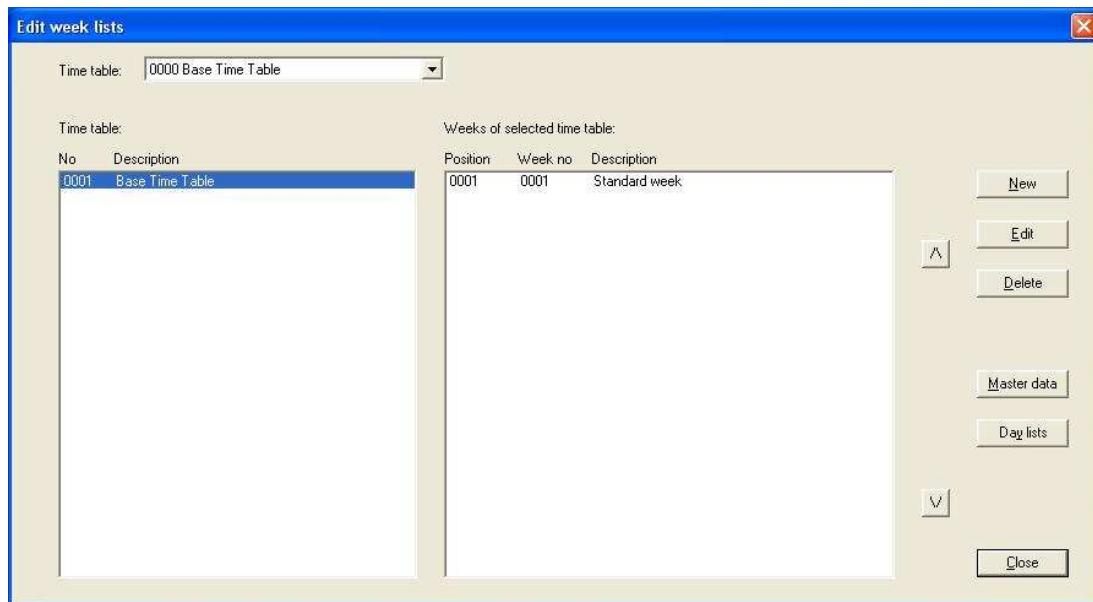


Figure 55: Overview box of week lists

The left list box shows the set-up timetables. After a week has been selected there, the allocated week lists are shown in the right list box.

The dialog box of “Week lists” has the following elements to parameterize the entries in the right list box:

[**^**]

The selected week in the list is moved up one position.

[**V**]

The selected week in the list is moved down one position.

[New]

A new dialog box is opened after clicking [New]. Choose the desired week type in the combo box »**Week**«. The dialog box is closed and the entries are accepted with [OK]. [Cancel] closes the dialog box without having set up a new week.

If no entry was selected in the right list box and you clicked [New], the newly set-up week is added to the end of the week list.

If a week was chosen in the right list box before clicking [New], the newly set-up week is added behind the selected position in the week list.

[Edit]

Select the desired week in the right list box and click [Edit]. A new dialog box is opened whose only box is the combo box »Week«. Choose the necessary week type.

[Delete]

Select the week to be removed from the currently chosen timetable and then click [Delete].

[Master data]

The dialog box to manage shifts, days, weeks and timetables is opened. A detailed explanation of this dialog box can be found in Chapter 5.1 [Editing shifts](#).

[Day lists]

The dialog box to parameterize day lists is opened (Chapter 5.3 [Editing day lists](#)).

[Close]

The dialog box “Edit week lists” is closed.

5.5 Copying timetables

OPERATION CALENDAR/ SHIFTS / COPY TIMETABLES

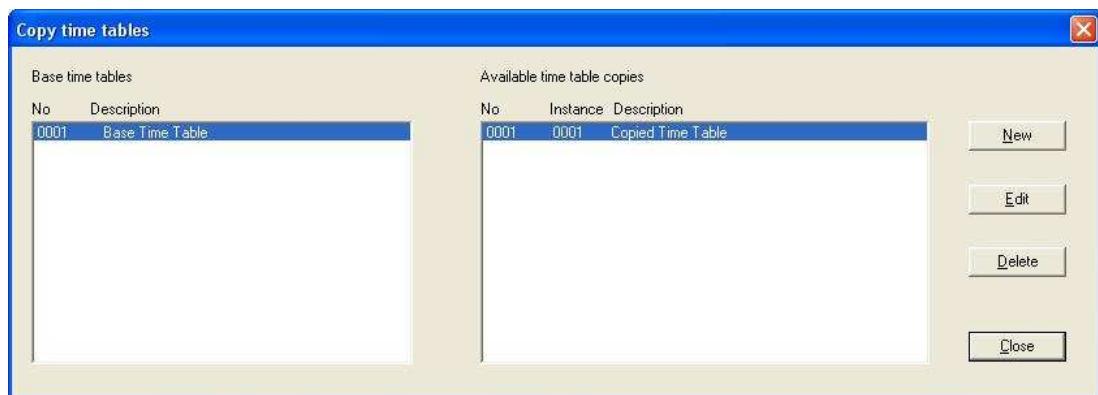


Figure 56: Copying timetables

After performing the menu sequence shown above, the overview box showing all existing timetables is opened (Figure 56).

Double-clicking an entry in the left list box or choosing [New] creates a copy of the timetable, which is then shown in the right list box, which lists out all copied timetables.

5.6 Fixing timetables

OPERATION CALENDAR/ SHIFTS – FIX TIMETABLES

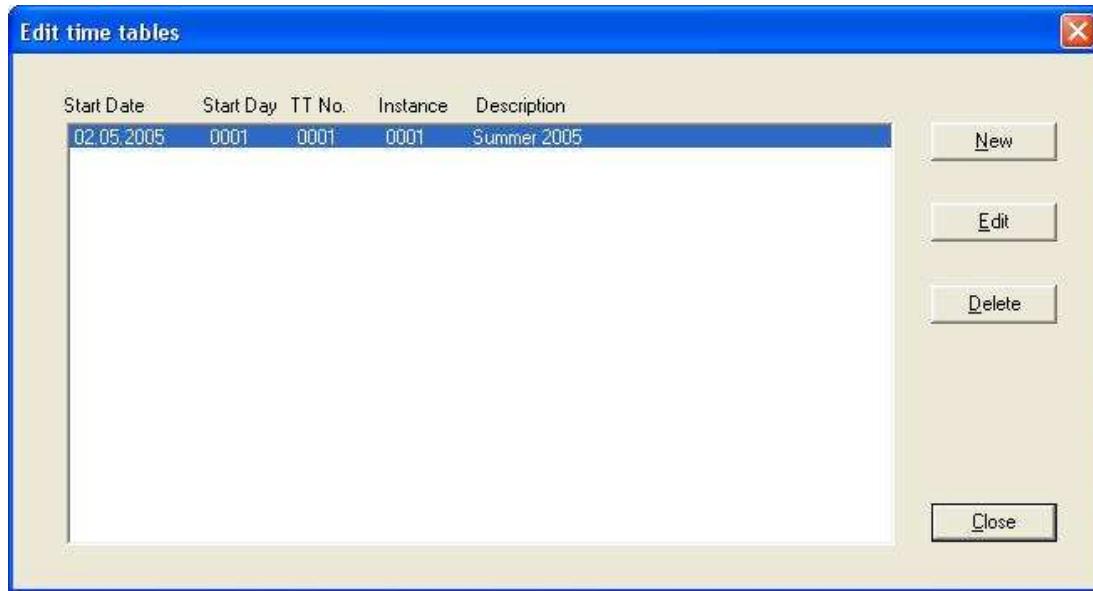


Figure 57: Overview box of fixing timetables

After performing the menu sequence shown above, an overview box is opened, which shows all the timetables already set up (Figure 57). Timetables can be managed with the help of [New], [Edit] and [Delete].

5.6.1 Setting up a new timetable

Click [New] in the overview box (Figure 57) to define a new timetable. A new dialog box is opened (Figure 58), which has seven text boxes:

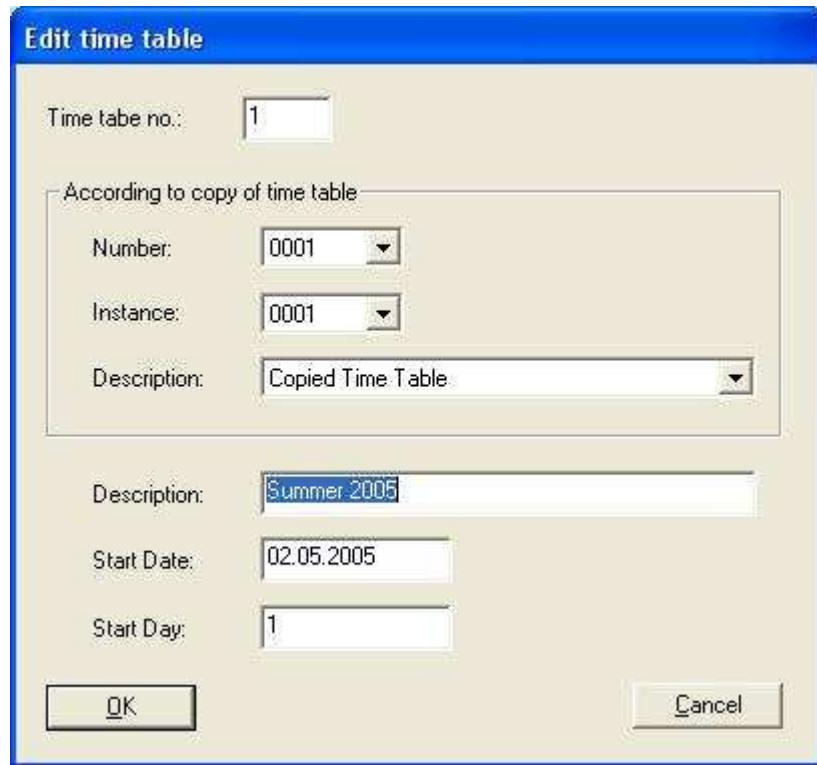


Figure 58: Dialog box to fix a timetable

»Timetable Number«

Every timetable must have a unique number. SimAL enters a default value of the '*highest existing number + 1*'. This default value can be replaced with any number not already allotted.

After Timetable Copy

»Number«

Choose an already copied timetable.

»Description«

Choose an already copied timetable.

»Instance«

Choose an already copied timetable.

»Description«

A name for the new timetable to be set up is given here. It can be up to 20 characters long including spaces.

»Starting date«

Enter the date, from which the timetable has to be used. The timetable I used till the starting date of the next timetable is reached.

»Starting day«

A starting point within a new timetable can be set through this box. If, for example, the timetable has been set for two work weeks with alternate shifts and you would like to start with the second week, enter 8. After the 14th day of the work plan is reached, it starts again with day 1 and runs in a cyclic manner till another timetable becomes valid.

5.6.2 Editing a timetable

Click [Edit] in the overview box (Figure 57) to modify a timetable. A new dialog box is then opened (Figure 58), which shows the parameters set up before. All boxes in the dialog box can be edited. Since using and parameterizing the dialog box are identical to the dialog box to set up a timetable, you can refer to Chapter 5.6.1 [Setting up a new timetable](#).

5.6.3 Deleting a timetable

Select the timetable to be deleted and then click [Delete]. The selected timetable is deleted immediately without any question.

6. ERP Interface

In the menu entry ERP INTERFACE, all the functions to manipulate ERP orders can be found. This includes editing, accepting and deleting of ERP orders as well as functions for communication of SimAL with connected Enterprise Resource Planning Systems (ERP) and Production Data Acquisition (PDA) systems.

6.1 Editing ERP orders

ERP INTERFACE / EDIT ERP ORDERS

After performing the menu sequence shown above, a dialog box with all created and error-free, but not yet accepted ERP orders is shown (Figure 59).

The screenshot shows a Windows-style dialog box titled "ERP orders". On the left is a grid table with columns: ERP no, ERP sub no, Prod.Graph.No., Prod.Graph.Desc., Work plan no, Prio..., and Status. A single row is visible with values: 28, 1, 1, "Laminated 140gr", 0, 1, and "Entered". To the right of the table is a vertical toolbar with buttons: Columns, Filter, Print, Clipboard, Insert, Edit, Delete, Copy, Predecessor, Release, and Close. At the bottom are standard window controls for minimizing, maximizing, and closing.

| ERP no | ERP sub no | Prod.Graph.No. | Prod.Graph.Desc. | Work plan no | Prio... | Status |
|--------|------------|----------------|------------------|--------------|---------|---------|
| 28 | 1 | 1 | Laminated 140gr | 0 | 1 | Entered |

Figure 59: ERP orders

[Insert]

Clicking the command button [Insert] opens a dialog box, in which you have to give a number for the new ERP order. The number must be unique. SimAL independently allot a number of its own, and it is recommended to leave the numbering to SimAL. By clicking [OK], the window “Create/Edit ERP orders” is opened (Figure 60). New orders can be created/edited here.

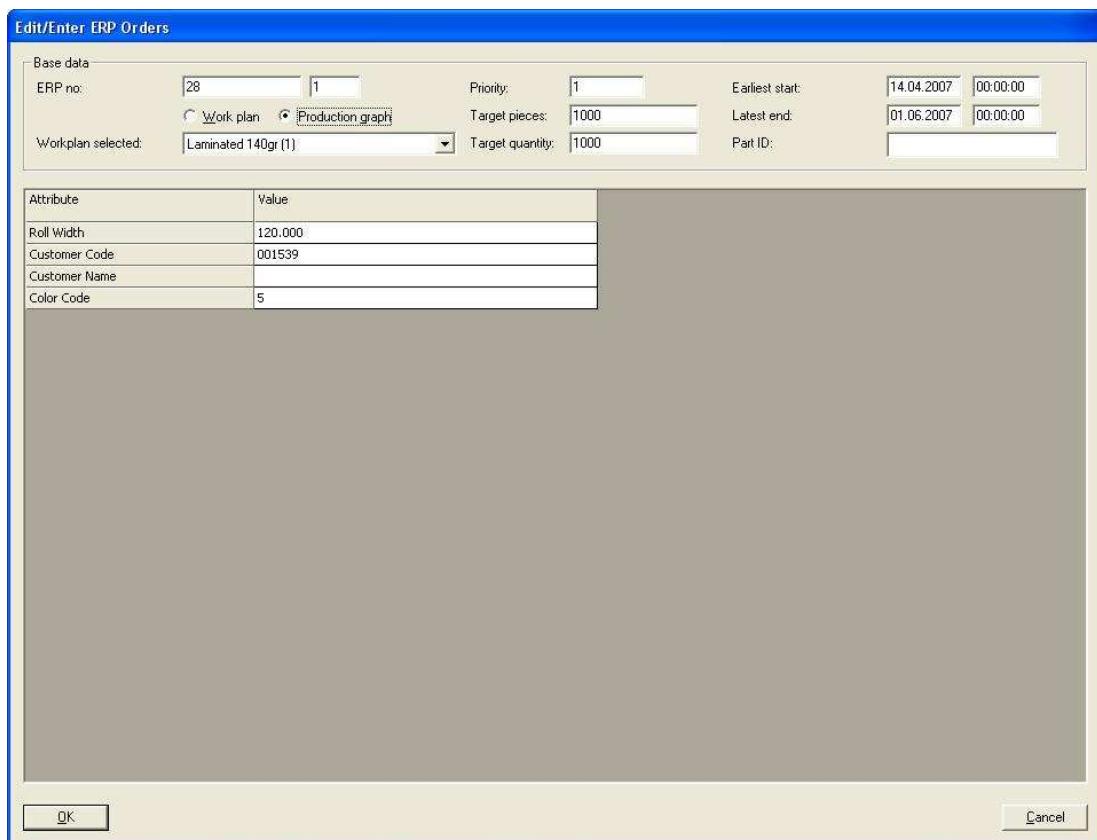


Figure 60: Editing ERP orders

»Order number«

This is the number allotted by the user while setting up the order. An order is uniquely identified by its order number and position number. The position number cannot be defined when entering an order in SimAL and is usually 1.

»Work plan« or »Production graph«

You have to choose between work plan and production graph.

»Work plan/Prod. Graph«

Depending on whether you chose a work plan or production graph, the corresponding work plan or production graph has to be chosen from the combo box. The work plan/production graph determines how many processes have to be carried out on which machines to fulfill an order.

»Priority«

A higher number represents a higher priority. This priority can be used in automatic scheduling in the schedule window to improve the rating of orders with high priority.

»Required Quantity«

The quantity of the part to be processed has to be entered here.

»Required pieces«

The number of pieces to be produced has to be entered here. SimAL has two frameworks for quantities which are independent from each other. The order quantity is for poorly countable units such as weight in kilograms or liter. The entry for pieces describes the number of parts to be produced. The meaning of the values enters depends on the parameterization of the processes of the chosen work plan/production graph.

»Earliest starting time«

The date and time, from which the order can be scheduled, can be entered here. This is usually the day on which all initial materials are available.

»Latest finishing time«

The latest finishing time is the time, before which the work of the last process has to be finished and the idle time to elapse. This is usually the day of providing the finished parts to be sent.

[Copy]

It is possible to copy ERP orders in SimAL. This makes the creation of identical ERP orders or those ERP orders, which have very little difference between each other, much easier. To copy a ERP order, you have to first select the ERP order to be copied from the list (Figure 59) and then click the command button [Copy]. By confirming the order number suggested by SimAL, a copy is created.

[Predecessors]

A chaining of ERP orders in the schedule window means that all processes of the previous order have to completed before the first process of the successive order can be begun.

One or more predecessors can be defined for each ERP order. The defined predecessors are entered in a predecessor list. During automatic scheduling, the ERP orders from this predecessor list are scheduled first. To create a predecessor list, first select a ERP order (Figure 59). By clicking the command button [Predecessors], the predecessor list for the chosen ERP order is opened (Figure 61).

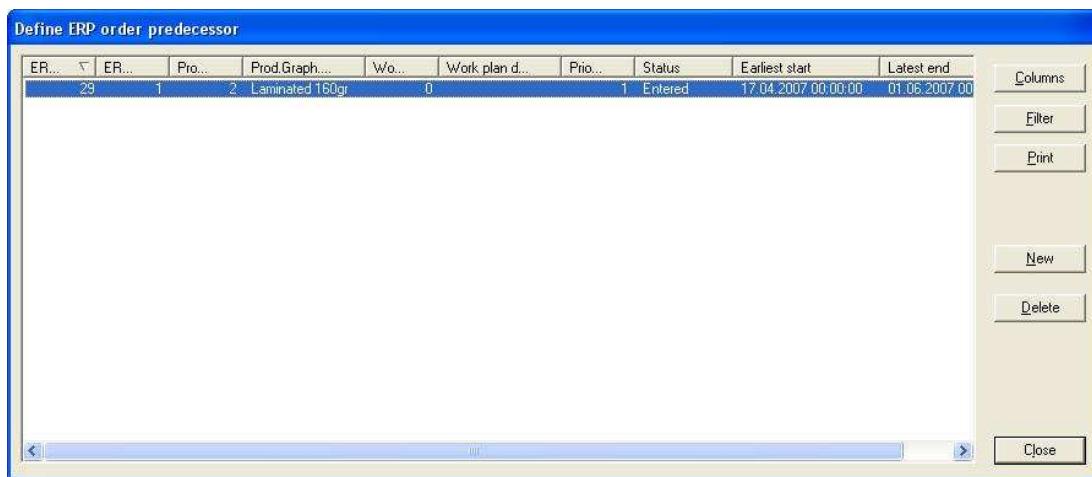


Figure 61: Predecessor list of the ERP order

To define a ERP order as a predecessor, click the command button [New] and enter the order number of the ERP order in the dialog box which subsequently opens. The ERP order with the entered number if entered into the list. Clicking [Delete] deletes any chosen entry from the list.

6.2 Generating Dispo orders

ERP INTERFACE / GENERATE DISPO ORDERS

Before the processes of a ERP order can be scheduled in the schedule window, they first have to be generated into the schedule window. Here, a “Disposition order” is created for each production step of the work plan/production graph of the ERP order. A disposition order is one of several activities which are necessary to produce the required parts from the ERP order. Disposition orders are always created in the **Base schedule** (Plan 0). These disposition orders are not scheduled afterwards (not allocated to any machine) and are found in the pool of the base schedule.

All referenced work plans are additionally copied to the ERP order. A ERP order therefore always refers to the work plan based on how it was parameterized at the time of accepting the ERP order. Any changes to the work plan in the master data at a later point do not affect the accepted ERP order any more.

After performing the menu sequence shown above, a dialog box is opened. All available ERP orders are accepted by clicking »Start«. The orders are then no longer visible in the dialog box of ERP orders.

6.3 Deleting accepted orders

ERP INTERFACE / DELETE ACCEPTED ORDERS

The disposition orders created while accepting the ERP order can be deleted using this function. Please note that this function is only available to SimAL users who belong to the group “Administrator”.

After performing the menu sequence shown above, the dialog box shown in Figure 62 appears. There are two ways of choosing the order to be deleted. All ERP orders between the number range in the boxes **from ERP number** or **to ERP number** can be deleted. Deleting can alternatively be performed around the scheduled ending time of the last process. All ERP orders/disposition orders are deleted, whose last process happens before the latest ending time or whose latest end from the ERP order is before this time.

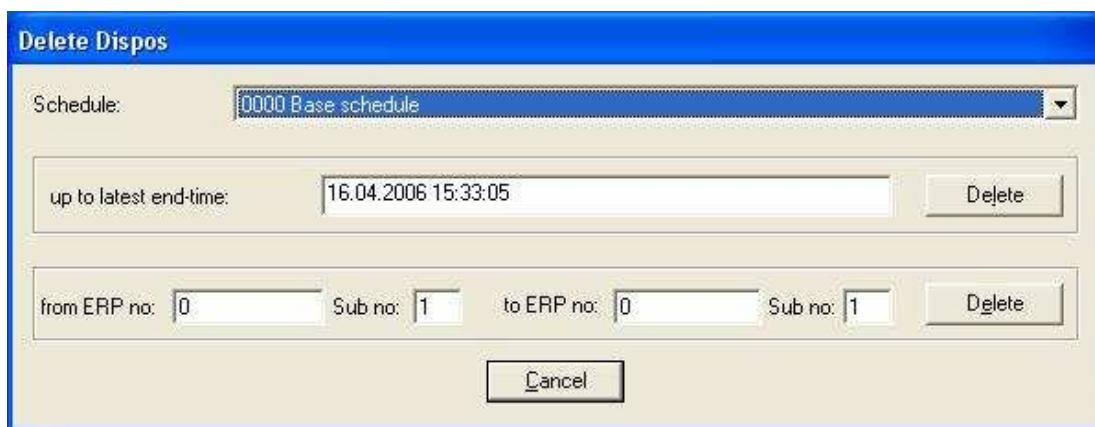


Figure 62: Deleting accepted orders

Please note that deleting is final and cannot be taken back or undone!

6.4 ERP Interface

ERP INTERFACE / ERP INTERFACE

With this function, the order adjustment is initiated with a connected ERP or ERP system. Since this process depends strongly on the connected system, you must refer to the installation manual and the description of standard interfaces in SimAL. The ERP acceptance is automatically initiated when the communication is successful in order to transform new ERP orders into the base schedule.

6.5 Import error

With this dialog box, the errors which occur during communication with the ERP/ERP system are shown or printed. Clicking the command button [Delete] deletes all old error messages.

6.6 Importing a ERP order as a CSV file

ERP INTERFACE / IMPORT .CSV

ERP orders can be entered, accepted through the ERP interface or imported as CSV files. CSV is a popular exchange format for files which can, among other ways, also be created from tabular calculations like in Excel.

This function serves as an upstream loader of data in standard interface tables. For all non-PDA interface tables, a search is carried out in the ERP Import directory for similar sounding files with the ending “.csv” in order to import the same. The PDA interface tables are loaded from the PDA Import directory. Both directories can be set in the options dialog (Chapter 6.7 [Setting options](#)). The format of CSV files can be taken from the description of SimAL standard interfaces.

6.7 Setting options

MASTER DATA / OPTIONS

The basic options are set this dialog, which apply for all users of SimAL.

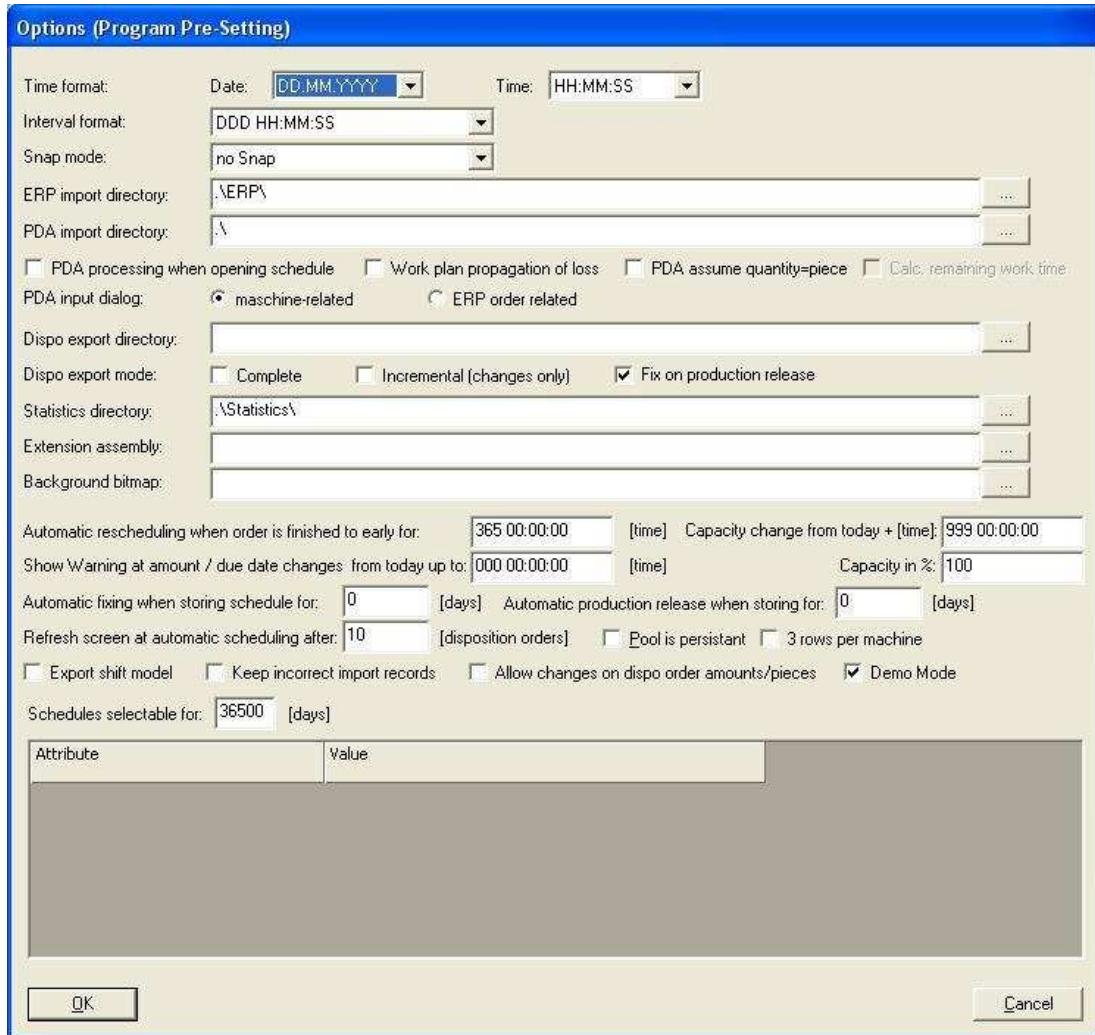


Figure 63: Setting options

- How points of time and time intervals are represented and entered in the dialogs of the program are defined in the boxes »**Time format**« and »**Time interval format**«.
- The precision of time shifts during manual shifting in the schedule window can be set in the box »**Snap while scheduling**«. Read Chapter 8 for a description on working with the schedule window.
- Enter the path from which SimAL should import CSV files in the box »**ERP import directory**«. The command [...] behind the text box enables choosing the directory.
- The »**PDA import directory**« is not used by standard SimAL but can be asked for in customized programming.

- The »**Disposition export directory**« is not used by standard SimAL but can be asked for in customized programming.
- The »**Statistics directory**« is not used by standard SimAL but can be asked for in customized programming.
- **Type of disposition export:** SimAL is familiar with complete and incremental export of schedule window data for connected programs. A complete export writes all disposition orders in the schedule into the export tables. Incremental export, however, writes only those disposition orders, which were deleted or had at least one data field changed, into the export tables. Please read the documents on standard interfaces of SimAL to understand export tables.
- **PDA processing while opening the schedule window:** New PDA messages are automatically processed when opening the schedule window if this field is activated. The schedule thereby changed is automatically saved (Chapter 1 [Production Data Acquisition \(PDA\)](#)).
- **Propagation of required PDA quantities:** Quantity shortages in production affect the successive processes when this option is activated, i.e. the required quantities of the successive processes in the same schedule are corrected accordingly by the suspended production factor. Please note that the propagation stops at the end of the work plan and is not continued with chained disposition orders or the successive work plan-successive ERP order (Chapter 1 [Production Data Acquisition \(PDA\)](#)).
- **Quantity = Piece:** When only one quantity box is required in SimAL, this option can be activated. Only the respective quantity box is then free to edit. The piece box is then closed and is given the same value as in the quantity box by SimAL.
- **PDA dialog box:** There are two dialog boxes to record PDA messages in SimAL. One is meant to run directly on a PC during production next to the machine. The other is meant for later recording of PDA messages with the help of shift reports. With this option, you define which dialog box appears while recording PDA messages (Chapter 1 [Production Data Acquisition \(PDA\)](#)).
- You also have the option to use a different background picture in SimAL (your company logo, for example). To do this, enter the path for the picture file in BMP format in the box “Background picture”.

- The checkbox “**Export shift model**” defines whether the shift model (breaks and processing times of the machines) is exported into the tables meant for this purpose while performing a schedule export.
- Activating the option “**Do not delete incorrect import sets**” does not delete the error messages shown in the dialog box “Import errors” at the beginning of a new import. It is, where appropriate, **advisable** to activate this option for interface tests.
- **Allow disposition-order quantities/piece changes:** Order quantities in the schedule window can only be performed by changing the appropriate ERP order, if this option is not activated. Activating this option allows quantity or piece changes directly in the disposition orders. The consistency of the ERP order is not checked in this case!! If the interface uses `exp_demand`, this option must never be activated, since this interface requires consistency in the scheduled quantities of scheduling and ERP orders.
- **Automatic new scheduling when finished at least too soon:** All disposition orders are unscheduled in automatic scheduling and the quantity of the disposition orders to be scheduled, which, in addition to the parameterized interval, are finished before their “latest end” and are scheduled for a machine, is added.
- **Warning for quantity and date changes from today till** gives an error message at the ERP interface, when a new order or a change in the order, whose latest end is between today and today + ‘the parameterized interval’ is imported.
- **Capacity change from today + time, Capacity in %:** With both of these text boxes, it can be defined when all capacities are increased or decreased at some point in the future. For example, a capacity buffer for urgent orders from next week onwards can be set up for a parameterization of 7 days and 90%. If you have customers, who frequently cancel at short notice, you could parameterize 3 days and 110%.
- **Extension assembly:** A DLL with .NET customized programming can be given here. Read the manual on SimAL programming interfaces for more details.
- **Automatic setting while saving for:** While saving a schedule, all scheduled disposition orders, whose set-up start lies between today and today + ‘parameterized number of days’ are set automatically. The length of the “frozen

zone” must, therefore, be parameterized in days in this box. If 0 is entered, there is no automatic setting.

- **Automatic production release while saving for n day:** While saving a base schedule, all disposition orders between today and today + ‘parameterized number of days’ are released for production. If 0 is entered, there is no automatic production release.
- **New drawing during automatic scheduling for every n disposition orders:** The setting of how often the schedule window is refreshed during automatic scheduling is performed here. The rule is: the higher the value, the faster the automatic scheduling. The lower the value, the higher the comfort. A starting value between 50 and 200 is a good beginning point for most systems.
- **Machines of three lines:** All machines are drawn in three lines when this option is activated. The different lines are given different color functions as well:
 - **First line:** The status for “Set” (in standard yellow) and PDA release (in standard turquoise) is shown.
 - **Second line:** Any earliness and delay is shown (in standard orange and red).
 - **Third line:** Overlapping conflicts (in standard purple), predecessors PDA-ready (in standard turquoise) and any damage to the minimal or maximal idle time (in standard purple) are shown.

7. Scheduling

The scheduling menu contains all the entries to edit schedules as well as to edit the schedule window.

7.1 Editing views

SCHEDULE / EDIT VIEWS

The areas, machines and resources to be shown in the schedule window can be determined with the help of Views. Any number of shifts can be allocated to each staff member (Chapter 2.1.4 [Changing views](#)) so that the scheduling work of each member can be built optimally with each member only seeing and being able to edit machines relevant to his work.

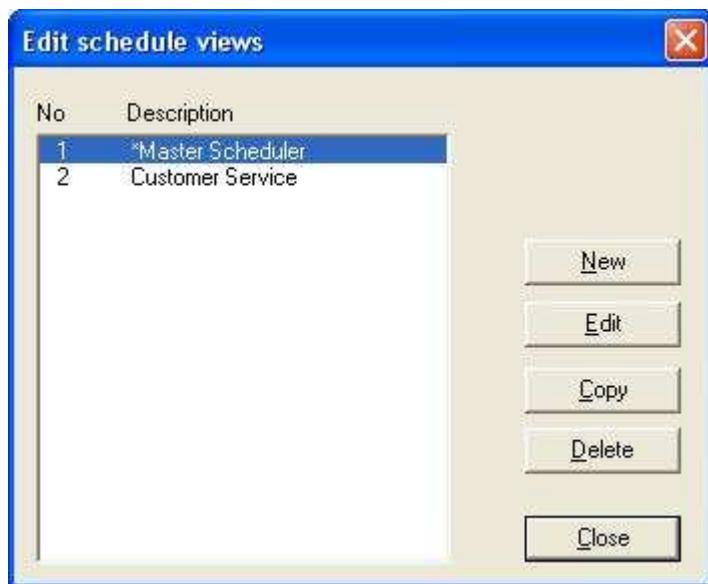


Figure 64: Edit views

After performing the menu sequence shown above, an overview box is first opened which lists out all the views already set up. There are four command buttons to edit views; [Close] closes the overview box.

7.1.1 Creating a new view

Click [New] in the overview box to create a new view. A new dialog box with two text boxes is opened. SimAL enters the lowest unallocated number in the box »**Number**« as a default value. You may change this default value to any number not already being used; this is however not recommended for practical use since the number is only used for internal program purposes and manual entry from the user does not have any advantages.

The shift to be created can be given a name of up to 20 characters in length in the box »**Name**«.

Clicking [OK] confirms your entries, and another dialog box (Figure 65) is opened, in which you can define the new view. [Cancel] closes the dialog box without setting up a new view; you return to the overview box (Figure 64) in this case.

7.1.2 Editing a view

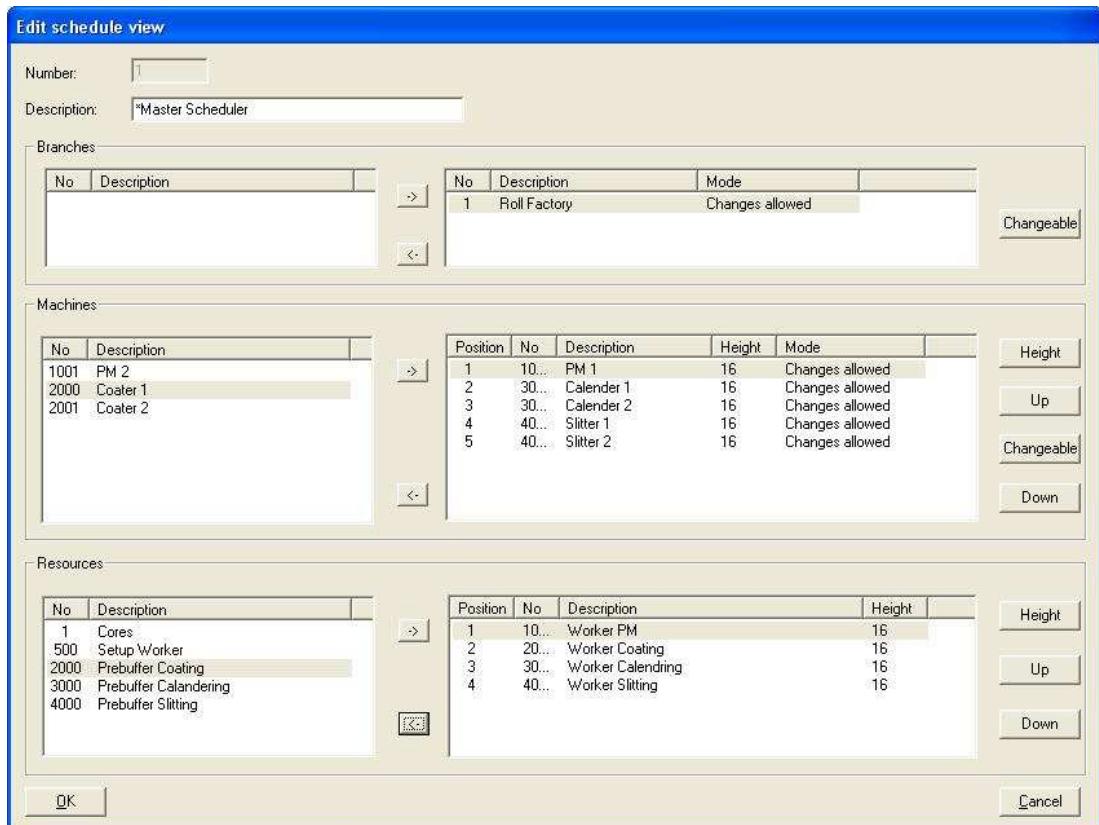


Figure 65: Editing views

The two boxes at the top of the dialog box to edit views show the »Number« and »Name« of the currently chosen view. While »Number« cannot be edited, you can change the name of the view in »Name«.

Below this title information, there are three group dialog boxes, which show all important information concerning the areas, machines and resources.

Click [OK] to save the entries described in Chapter 7.1.2.1 [Allocating areas to a view](#) and Chapter 7.1.2.3 [Allocating resources to a view](#) and close the dialog box. [Cancel] undoes any changes or entries that were carried out, and closes the dialog box.

7.1.2.1 Allocating areas to a view

The allocation of areas to a currently chosen view is carried out through two windows: all the available areas are listed out in the left list box, while the right list box shows all views allocated to the chosen view. You can add an area to the view by double-clicking the desired view in the left list box to transfer it to the right list box or by selecting the desired area in the left list box and then clicking [->].

An area allocated to the view can be removed by selecting it in the right list box and then clicking [<-] or by double-clicking the entry to be removed in the right list box.

You can additionally decide if the user of this view can parameterize the area or not. When an area is allocated to a view, the default status from SimAL is *changing not allowed*. You can allow each allocated area to be parameterized by selecting the corresponding entry in the right list box and then clicking [changeable]. You will then see in the right list box that the entry in the column “Status” is changed to *changing allowed* for this area.

7.1.2.2 Allocating machines to a view

This procedure is largely similar to the allocation of areas to a view. In the left list box, all the available machines in the system are shown, while the right list box lists out all the machines allocated to the view.

A machine can be allocated to the currently chosen view by double-clicking the desired machine in the left list box or by selecting it and then clicking [->].

A machine can be removed from the current view by double-clicking the desired machine in the right list box or by selecting it and then clicking [<-].

You also have the possibility here for each machine to determine whether the parameterization of the machine from the user of the view can be changed or not. The de-

fault status from SimAL is *changing not allowed*. The machine can be made changeable by selecting it in the right list box and then clicking [changeable].

In some conditions, the list of the allocated machines can become very long. In this case, SimAL offers the possibility to individually sort the machines in the list. Select the machine whose position you wish to change by moving it up or down by one position and then click [up] or [down] respectively.

7.1.2.3 Allocating resources to a view

All viewable resources can be allocated to a view with SimAL. The left list box shows all the resources not yet allocated, while the right list box contains all the resources allocated to the current view.

A resource is allocated to the current view by double-clicking the desired resource in the left list box or by selecting it and then clicking [->].

A resource can be removed from the current view by double-clicking it in the right list box or by selecting it and then clicking [<-].

In some conditions, the list of the allocated resources can become very long. In this case, SimAL offers the possibility to individually sort the resources in the list. Select the resource whose position you wish to change by moving it up or down by one position and then click [up] or [down] respectively.

7.1.3 Copying a view

Select the view to be copied in the overview box (Figure 64) and then click [Copy]. Another dialog box is then opened, which has the boxes »**Number**« and »**Name**«.

The statement in Chapter 7.1.1 [Creating a new view](#) about the boxes »**Number**« and »**Name**« is valid here as well. The difference from setting up a view is that all allocated areas, machines and resources will be copied to the new view.

Copying a view is also recommended when a new view has to be set up and matches an existing view to a large extent. In this case, first copy the existing view and then make changes as per the differences with [Edit].

7.1.4 Deleting a view

A view can be deleted by selecting the desired entry in the overview box (Figure 64) and then clicking [Delete].

All allocated areas, machines and resources have to be deleted from the view before you can delete it! Make sure that the view to be deleted is not being simultaneously by another user.

7.2 Opening the schedule window

SCHEDULE / OPEN SCHEDULE

SimAL is capable of managing different schedules and views; you have to therefore select a schedule and a view before the desired schedule can be viewed or edited. After the menu sequence, list box (Figure 66) is opened, in which all available schedules and views are shown. You can alternatively use  or   to open a schedule. Please note that the base schedule is the deciding schedule for production. All other schedules are only for simulation of definite situations. All new orders and PDA message run only in the **base schedule** (plan 0). In standard SimAL only the **base schedule** (plan 0) is similarly exported to the secondary production controls.

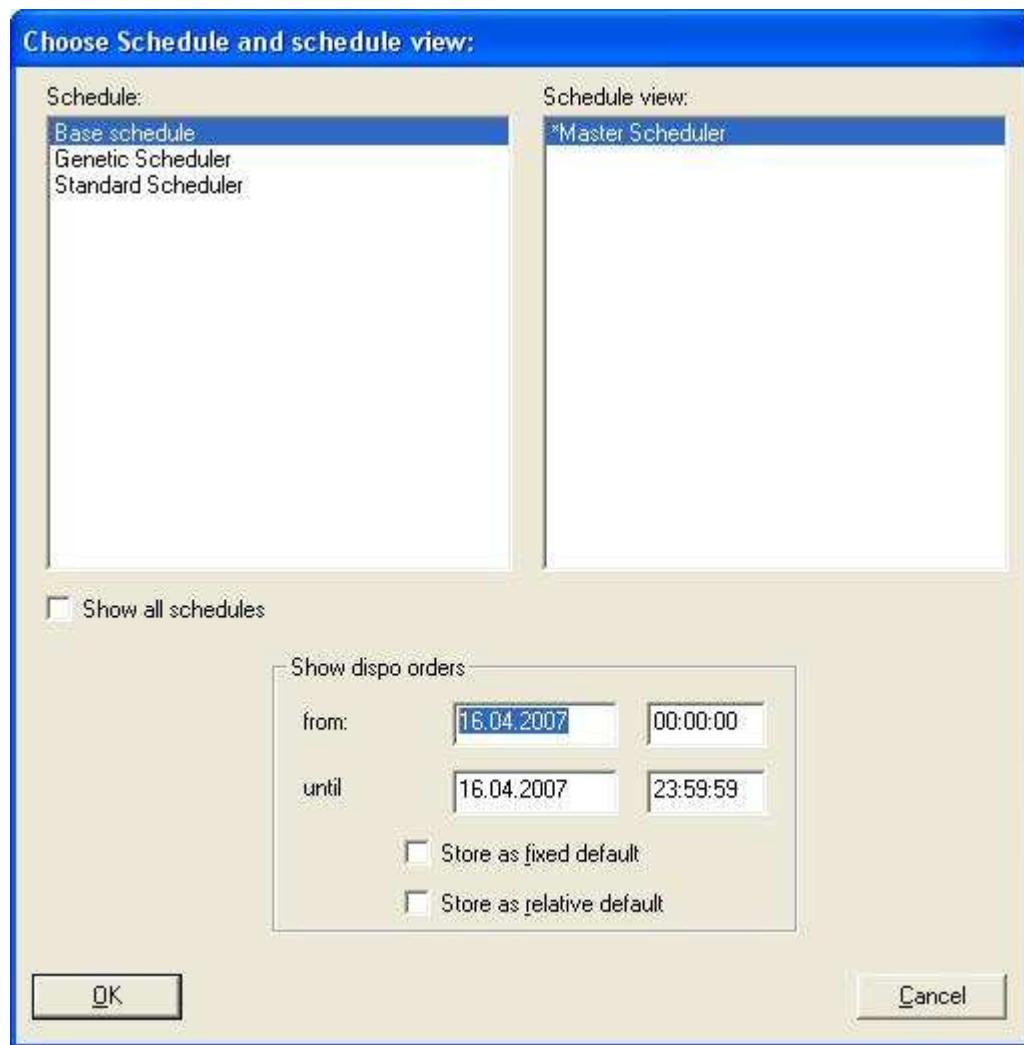


Figure 66: Choosing the schedule and view

The left list box lists out all available schedules, while the right list box shows all views allocated to the user (Chapter 2.1.4 [Changing views](#)). Click the desired schedule and desired shift to choose them for your scheduling work.

There is the additional possibility to limit the scheduling time shown in the schedule, so that you can only view the time span relevant for your current work (for example, the current month). Enter the respective date and time of the time span to be considered in the boxes »**Show disposition orders from**« and »**Show disposition orders till**«. You have the possibility to fix the observed time period through »**Save as fixed default**«, so that the starting and ending times need not be entered again every time, if you would like to schedule with the same time period regularly. The currently set time window changes according to the system time of your computer with the option »**Save as relative default**«: The earliest time and latest time will be a day later tomorrow.

Note that you have no other option to increase the observed time period than to open the schedule window once again after opening the schedule window for the settings in the boxes »Show disposition orders from« and »Show disposition orders till«! In views where there is at least one machine available with writing rights, all disposition orders are loaded independent of the set time period.

With [OK], the chosen schedule and the chosen view for the desired time period are opened. Working with the schedule window is described in Chapter 8 [Working with the schedule window](#).

7.3 Copying a schedule

SCHEDULE / COPY SCHEDULE

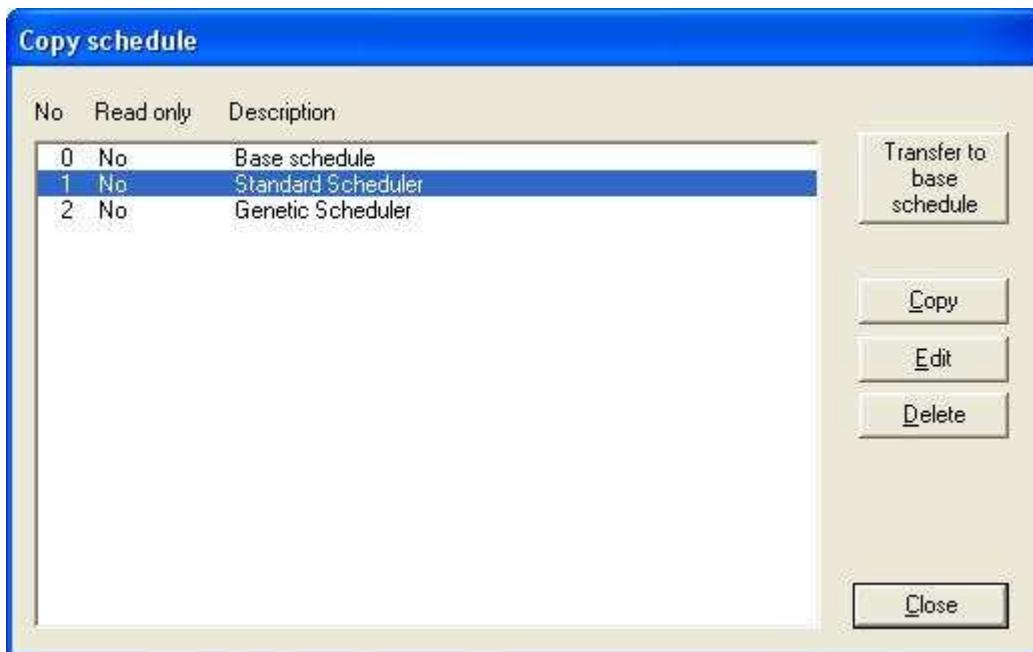


Figure 67: Copying a schedule

This function is suited to test variations of an existing schedule without changing the original schedule. After you have carried out the menu sequence shown above to copy a schedule, a list box (Figure 67) is opened, which lists out all existing schedules. Select the schedule you wish to copy and click [Copy]. A new dialog box is then opened (Figure 68), which has two text boxes:

»Number«

Enter a unique and unused number for the copied schedule. SimAL enters the `highest existing schedule number + 1`.

»Name«

Enter a name for the schedule. Up to 20 characters including spaces and special characters are possible.

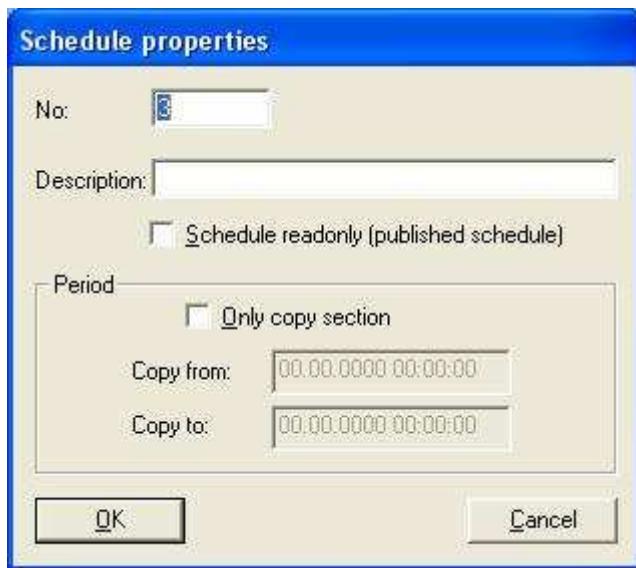


Figure 68: Naming a copied schedule

Clicking [OK] accepts your entries, and the new (copied) schedule is set up. [Cancel] closes the dialog box without creating a copy.

A schedule can be copied back into the base schedule as long as none of the following actions are carried out:

1. ERP acceptance
2. ERP interface
3. Process PDA messages
4. Delete accepted orders
5. Release disposition orders for production

Before copying a schedule, ensure that there is sufficient memory space on your hard disk/in the database being used, since all data are also duplicated when copying a schedule! For “large” schedules, this can certainly demand more than 100 MB storage space.

7.4 Deleting a schedule

SCHEDULE / DELETE SCHEDULE

After you have called up the function to delete a schedule, a list box is first opened, which shows all the existing schedules. Select the schedule you wish to delete and then click [Delete].

The “base schedule” (plan 0) is the only schedule which cannot be deleted!

7.5 Renaming a schedule

You can rename a schedule by performing the menu sequence SCHEDULE / COPY SCHEDULE or SCHEDULE / DELETE SCHEDULE, selecting the schedule to be renamed and then clicking [Edit]. A dialog box is opened (Figure 68). You can only edit the box »Name«; enter the new name of the schedule and click [OK] to save the changes.

The “base schedule” is the only schedule which cannot be renamed! If you would like to make changes to the “base schedule”, you have to first create a copy of the base schedule (Chapter 7.3 [Copying a schedule](#)) and this can then be edited!

7.6 Exporting a schedule

This function initiates the Schedule-Export of SimAL. Schedules can either be exported in the main menu or from the schedule window. If this function is called up from the main menu, only the **base schedule** (plan 0) can be exported.

The SimAL export tables are updated to the last saved condition of the base schedule. Depending on whether you have chosen complete or incremental export in the global options (Chapter 6.7 [Setting options](#)), only changes since the last export or all scheduling of the base schedule are exported.

Attention: Only one export is initiated. If you have chosen global and incremental export, the complete export will be carried out.

8. Working with the Schedule window

SCHEDULE / OPEN SCHEDULE WINDOW [Ctrl] + [O]

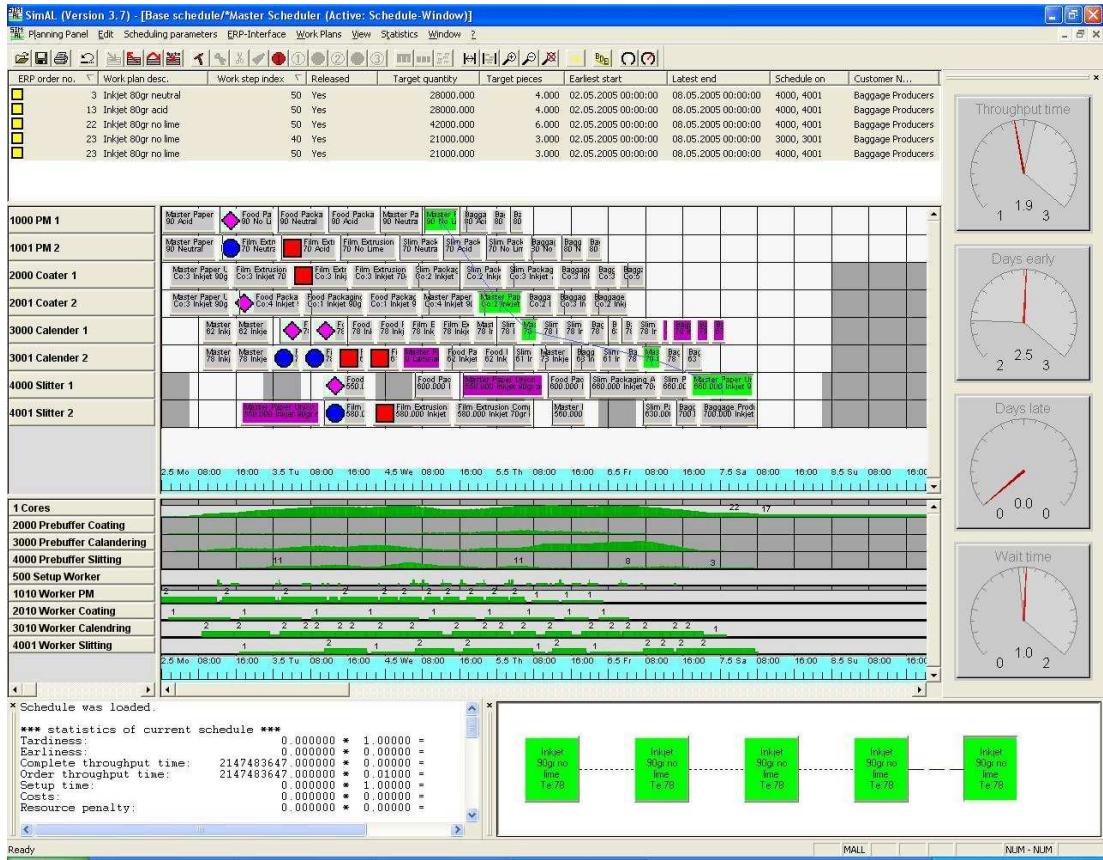


Figure 69: Schedule window

The schedule window (Figure 69) is opened after you have chosen a schedule in the desired view (Chapter 7.2 [Opening the schedule window](#)). Descriptions of the individual functional areas can be seen in Chapter 8.1 [Functional areas of the schedule window](#).

8.1 Functional areas of the schedule window

The purpose of the SimAL schedule window is to dispatch the ERP orders that have been broken down into single production steps in the best possible sequence. A disposition order was created in addition to each processing step during ERP acceptance. An extension of the well-known Gantt representation was used for this purpose. The schedule window is sub-divided into three areas.

The size of each schedule window area can be individually set. To enlarge or reduce one of these areas, move the mouse pointer to the frame between two areas. Once the pointer changes to a double-headed arrow, you have to click and drag the frame till the area attains the desired size.

8.1.1 The order pool

All disposition orders, which have not yet been scheduled and were previously provided for SimAL through a ERP acceptance (Chapter 6.2 [Accepting ERP orders](#)) are shown in a table in the order pool. No capacity is to be loaded as long as the disposition orders stay in the pool.

| ERP order no. | Work plan desc. | Work step index | Released | Target quantity | Target pieces | Earliest start | Latest end | Schedule on | Customer N... |
|---------------|---------------------|-----------------|----------|-----------------|---------------|---------------------|---------------------|-------------|-------------------|
| 3 | Inkjet 80gr neutral | 50 | Yes | 28000.000 | 4.000 | 02.05.2005 00:00:00 | 08.05.2005 00:00:00 | 4000, 4001 | Baggage Producers |
| 13 | Inkjet 80gr acid | 50 | Yes | 28000.000 | 4.000 | 02.05.2005 00:00:00 | 08.05.2005 00:00:00 | 4000, 4001 | Baggage Producers |
| 22 | Inkjet 80gr no lime | 50 | Yes | 42000.000 | 6.000 | 02.05.2005 00:00:00 | 08.05.2005 00:00:00 | 4000, 4001 | Baggage Producers |
| 23 | Inkjet 80gr no lime | 40 | Yes | 21000.000 | 3.000 | 02.05.2005 00:00:00 | 06.05.2005 00:00:00 | 3000, 3001 | Baggage Producers |
| 23 | Inkjet 80gr no lime | 50 | Yes | 21000.000 | 3.000 | 02.05.2005 00:00:00 | 08.05.2005 00:00:00 | 4000, 4001 | Baggage Producers |

Figure 70: Order pool

The pool offers the possibility here to **set the columns** that are shown. This setting can be performed through the function Set columns (Chapter 1.3.3.1 [Setting columns](#)) in the menu Scheduling parameters and is saved by SimAL depending on the user. Clicking the column title sorts the pool **according to this column**. Another click on the same column reverses the sorting. To sort according to several columns, the first column has to be clicked and the other columns have to then be clicked while keeping the [Ctrl] key pressed. Another click on the same column reverses the sorting here as well.

Individual orders can be selected by clicking them. If several disposition orders have to be selected, the [Ctrl] key has to be kept pressed while clicking the other disposition orders.

With the function Search disposition orders (also with the key [F3]) in the menu Edit, disposition orders, which satisfy the given criteria in the Search/Filter dialog (Chapter 1.3.3.2 [Filtering](#)), can be selected.

If only certain disposition orders are to be shown in the pool, choose the function Filter in the menu View. After entering the search criteria in the Search/Filter dialog (Chapter 1.3.3.2 [Filtering](#)), all disposition orders, which do not correspond to the entered criteria, are removed from the pool.

The filter remains active till it is switched off, even if the program is restarted in between.

8.1.2 The Gantt chart window

All disposition orders are in the order pool (Chapter 8.1.1 [The order pool](#)) after ERP acceptance. They can be sorted, filtered and further edited there.

Individual disposition orders can be allocated to a machine at a particular scheduling time either with the mouse by drag-and-drop, by the keyboard in the dispo-info dialog or by automatic scheduling (Chapter [Graphic scheduling](#)). All the necessary running times (set-up times, processing times and idle times) are conveyed immediately with the help of the process defaults while scheduling for a machine and can be visualized by the length of the order bar.

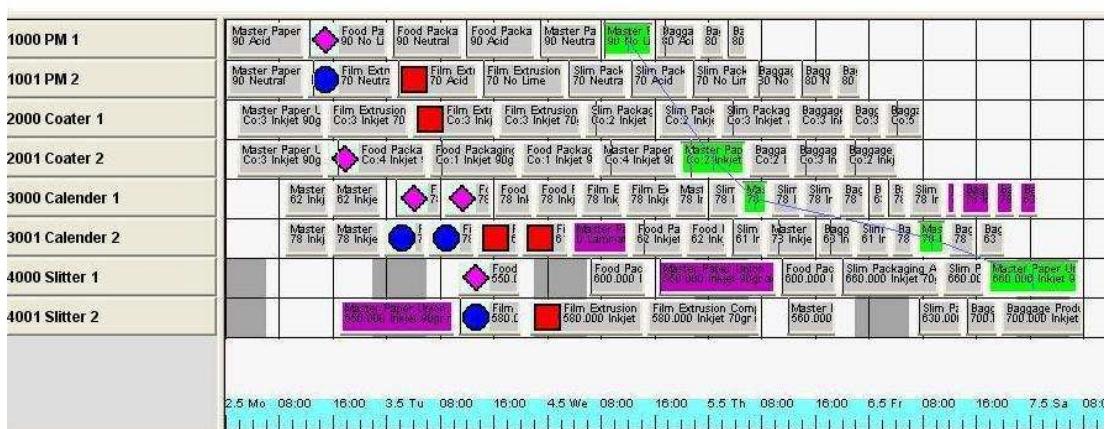


Figure 71: The Gantt chart window

By right-clicking the name of a machine, a menu is opened, which has several functions.

| | |
|-------------------------|---|
| Machine scheduling list | Opens the machine scheduling list (Chapter The machine-dispo list) |
| Machine schedule dialog | Opens the machine schedule dialog (Chapter The machine schedule dialog) |
| Downtimes | This function corresponds to the same function in the machine master data (Chapter Downtimes), but enables the entry of downtimes while having an opened schedule window. The changes are visualized immediately after closing |

| | |
|------------------|---|
| | the dialog. |
| Additional times | This function corresponds to the same function in the machine master data (Chapter Machine additional times), but enables the entry of additional times while having an opened schedule window. The changes are visualized immediately after closing the dialog. |

8.1.3 The resource display

The resource window helps in visualizing any further constraints. While machines can be scheduled directly by scheduling disposition orders, orders cannot be placed directly on resources. Resource-loading is thereby dependent on concrete scheduling of the machines.

The resource display informs the user about the status of resource availability in the current scheduling. The utilization of each of the resources in the opened view is shown. Each resource is marked with a color to avoid any conflicts; “green” means that the resource is sufficiently available, while “red” means that a larger quantity of the resource is needed than what is available.

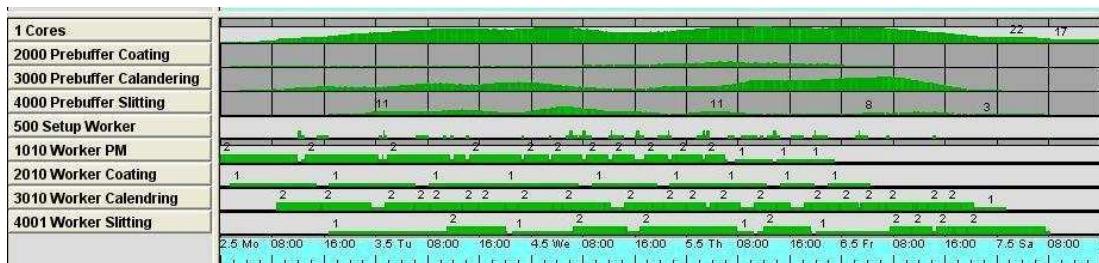


Figure 72: Resource loading

It is advisable to have other dock windows visible, which do not necessarily belong to a schedule window window. The following windows are available:

8.1.4 The message window

This can be shown or hidden through the View menu. SimAL enters text messages here, which, for example, indicate a scheduling problem or entry error.

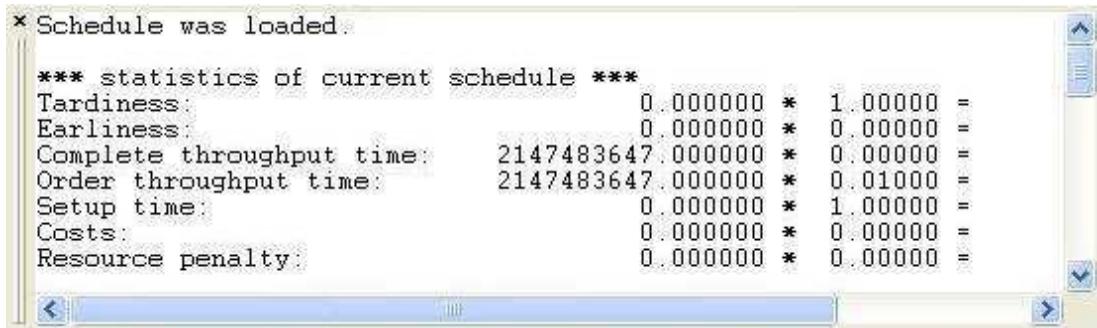


Figure 73: Message window

8.1.5 The order graph window

The chaining of connected disposition orders can be seen here. The chaining of the last selected disposition order (depending on the pool or schedule window) is always shown. Clicking a small box of the graph selects the respective disposition order. Double-clicking it selects the respective disposition order and represents it concentrically centered.

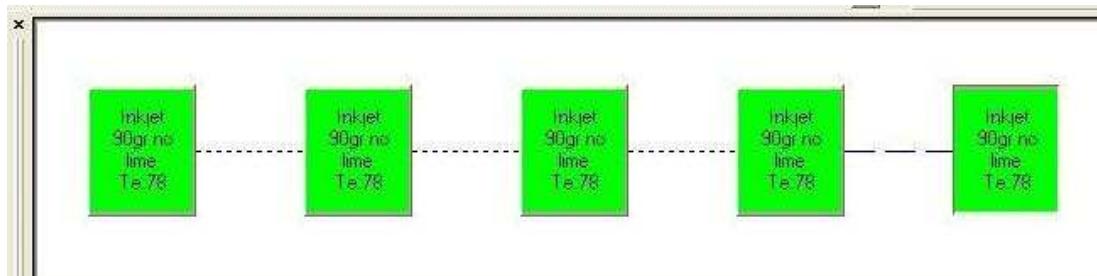


Figure 74: Order graph

8.1.6 The KPI window

The KPI window shows four characteristic quantities, with whose help you can evaluate the quality of the changed schedule (in case of re-scheduling) in comparison to the previous schedule. All the values are visualized in days. The cycle time shows the average required gross time (including breaks) from the start of the first process till the end of the last process of all orders. The earliness shows the average number of days, by which orders are completed too early. The delay similarly shows the average number of days, by which the time of production completion is overshot. With blockade/idle time, the average sum of times for which disposition orders have to wait at a free machine is shown.

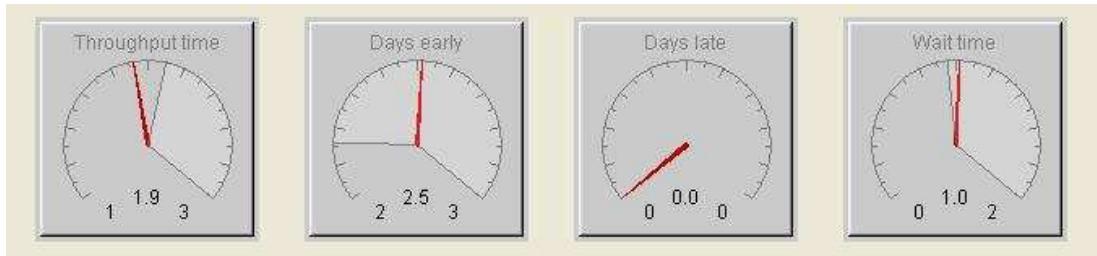


Figure 75: KPI window

8.1.7 The toolbar

The toolbar is positioned below the menu bar. The most important and frequently used functions of the schedule window can be activated by clicking the respective symbol. The buttons shown in light grey are not available in their respective context. The symbols are represented by the names of the respective functions.

8.2 Automatic scheduling algorithms

SimAL offers the user different algorithms, which can be combined depending on the case of use. SimAL basically allows the grouping of scheduling runs, whose individual scheduling steps affect only particular orders, machines or time areas as the case may be. An adapted scheduling run, which considers your operational facts and helps to minimize costs and difficulties and to improve delivery reliability, comes into being only through effective combination.

8.2.1 Standard scheduling automatic

Standard scheduling automatic is a very fast scheduling run, which generates a scheduling through a row of local decisions. Each decision is made only once per scheduling run and is not rechecked. The scheduling principles function very easily:

1. Whenever a machine becomes free, evaluate all the disposition orders, which can be scheduled there.
2. Choose the disposition order with the best evaluation.
3. Continue till all disposition orders are scheduled.

This scheduling process delivers very good results in a few minutes if rough scheduling has preceded it.

8.2.2 Rough scheduling run

The purpose of the rough scheduling run is to have orders start at their latest possible times. It itself does not load any machines with disposition orders, but rather calculates the earliest start of disposition orders based on capacity factors.

- The scheduling time is divided into so-called capacity jars (for example, 1000 parts per day).
- Based on the latest completion date, it is attempted to put all the disposition orders in one of the capacity jars as late as possible. To ascertain the respective capacity jars of all disposition orders, the latest ends of each of the disposition orders are determined by backward calculation.
- If a capacity jar is full, the disposition orders must be placed in the preceding capacity jar (for example, the previous day). This is decided depending on the latest end possible and a priority-attribute to be defined.
- Disposition orders are placed in the preceding capacity jars till no jar is overloaded.

The result is that the rough scheduling start is set in the scheduled disposition order. Then again, this can be considered by the standard scheduling automatic.

8.2.3 Genetic optimization

Genetic optimization is a global optimization functionality, which uses the mechanisms of evolution to create very good schedules. Because of the applied process, genetic optimization is much longer than the standard scheduling automatic and is recommended only for a small number of disposition orders. Some time for the optimization run also has to be available (overnight, for example), since this can quite certainly last for several hours.

The basic process, on the other hand, has a very similar principle:

1. Create several complete machine loadings and evaluate this as complete (per complete schedule).
2. Now randomly choose some schedules from the available schedules (population) and combine these according to definite rules (recombination).

3. Change one or more schedules randomly (mutation).
4. Now choose the best of the available schedules and continue with point 2.
5. End the optimization after a number of iterations.

Since this algorithm evaluates complete schedules and not only single disposition orders, it can also create good schedules when the evaluation of only single disposition orders can be misleading.

8.2.4 Move-right function

The move-right function is actually not a scheduling run by itself. Its purpose is to postpone orders, which have been scheduled too early, from other scheduling runs, so that these disposition orders are completed as late as possible. The sequence at the scheduled machine is, however, not changed. This algorithm is, therefore, considered as a repairing function that is later applied to the result of a scheduling run.

8.2.5 Combinations in scheduling runs

Different scheduling automatics are usually combined. As an example, one scenario is described:

- A very good schedule in the absolute short-term range is created with the help of genetic optimization.
- Any disposition orders scheduled too early are postponed with the move-right function.
- The machines are then heavily loaded with the standard scheduling automatic.
- Orders in the distant future are subsequently allocated an earliest possible start. These disposition orders are then dispatched with the standard scheduling automatic by the combining of blank spaces on the machines.

Manual intervention is naturally possible at any time. It must however be noted that all processes excepting the move-right function conduct a scheduling operation, i.e. only those orders which have not been dispatched to the machines are changed. Therefore, the user has to unschedule those orders, which should be optimally scheduled by automatic scheduling, before such a scheduling run.

8.3 The Schedule window menu

This menu sums up schedule-related functions such as opening or saving.

8.3.1 Opening

This function is the same as the functions described in Chapter 7.2 ([Opening the schedule window](#)) to open the schedule window from the main menu. Several schedules can consequently be opened at the same time (even in different views). It is, however, not possible for a user to open the same schedule twice at the same time.

8.3.2 Saving the schedule window

SCHEDULE / SAVE

This menu entry saves changes made to the currently opened schedule window. A successful save will be indicated by a message in the text window.

If you not only use persistent machines, you have to make your scheduling safe so that it is not lost when ending the program. Click either  or perform SCHEDULE / SAVE or use the key combination [Ctrl] + [S].

You should not only save the scheduling results at the end of a sitting, but also regularly while working just like any other software!

8.3.3 Closing the schedule window

SCHEDULE WINDOW / CLOSE

This function closes the current schedule. If the schedule has not yet been saved, SimAL asks if the schedule should be saved before closing the window. If you choose Cancel, the schedule will not be closed. Choose Yes or No and the schedule is either saved or not based on your decision, and it is then closed.

There are different methods to close the current schedule window and return to the work screen after starting SimAL:

- Perform SCHEDULE WINDOW / CLOSE. A question is asked, if the schedule has any unsaved entries. After you have answered this question with [Yes] or [No], you return to the starting screen (Figure 2) of SimAL.

- Use the keyboard function [Ctrl] + [F4]. After you answer the question of whether the changes should be saved, you return to the starting screen (Figure 2) of SimAL.

To close the schedule window and exit SimAL at the same time, use the keyboard function [Alt] + [F4]. The same question of saving any entries, if the schedule has any unsaved entries, is asked and SimAL is then exited. The other methods to exit SimAL shown in (Chapter 1.5 [Exiting SimAL](#)) have the same effects.

8.3.4 Sending a message

With this function, you can send a short text message to other SimAL users (just like an SMS). Those users, who had opened a schedule at the time of sending the message, can be reached.

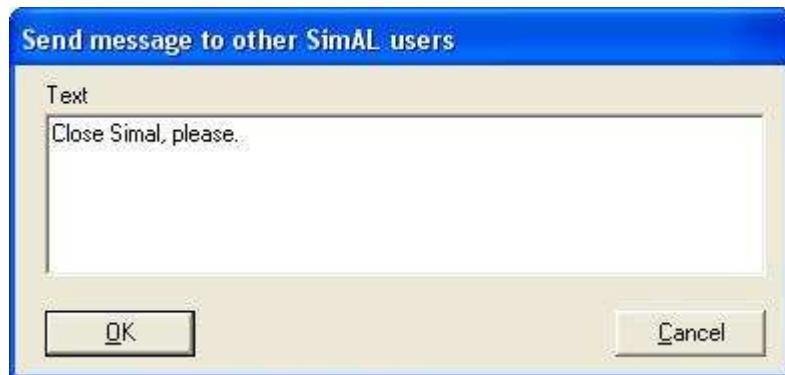


Figure 76: Sending a message

The text typed by the sender is then shown in the text window of the other users after a maximum of 5 minutes.

8.3.5 Checking the schedule

When schedules have many disposition orders, particularly when the length of the disposition order bars vary a lot, the planner can easily lose oversight of them. With the function “Check schedule”, the planner can see whether all the formal criteria of the schedule have been fulfilled. All disposition orders that have been scheduled in the opened schedule window time period are checked:

Is there no invalid overlapping in the sequence of the disposition orders?

- Have the minimum and maximum idle times been considered through scheduling?
- Were all resources used within the frame of their usability?
- Have any delays come into being?
- Have all disposition orders been scheduled according to their earliest start?

For any of these error possibilities, a sentence with a description of the problem is shown in the message window while checking the schedule. Double-clicking the sentence in the message window causes the disposition order with the error to be zoomed and selected (when it is clear enough).

Example:

```
*** Started plan checking ***
(0/55/1/5/1) -> Planning error: Violation of early start
*** Ended plan checking ***
```

8.3.6 Releasing for production

Disposition orders must be explicitly released for production to be transferred to the subordinate production system. The following is affected while releasing for production:

- The status is changed to “Released for production”.
- For batches, a unique ID is calculated for each of the disposition orders contained in a batch and is set in all contained disposition orders.

8.3.7 Undoing release for production

In the case of mistaken production orders, the release for production can be undone with this function. The disposition order is brought back to its normal status.

Release for production can also be undone with the Undo function (Chapter 8.4.1 [Undo](#)) as long as the schedule window was not yet saved.

8.3.8 Taking the sequence from another schedule

To be able to work in the base schedule even during long-running optimizations, the base schedule can be copied into another schedule and the optimization run begun. The work in the current schedule is thereby not disturbed.

To transfer the results of the optimization into the base schedule, this function can be used. It moves disposition orders in the base schedule exactly to the place which takes the disposition orders in the optimized schedule copy. Disposition orders already scheduled there are forced out.

Choose the original schedule, from which you wish to transfer the sequence as well as the time period and machines, whose scheduling you wish to transfer, and then confirm this with [OK]. The disposition orders are then loaded in the same sequence in the chosen time period as in the original schedule.

Attention: This function transfers only the sequence. All other changes such as order splitting or pasting as well as quantity changes, etc. are not transferred!!!

8.3.9 Saving and exporting the schedule

With the help of this menu entry, the schedule is first saved (Chapter 8.3.2 [Saving the schedule window](#)) and then exported (Chapter 7.6 [Exporting a schedule](#)).

8.3.10 Exporting PDA messages

This function has no effect in standard SimAL. A request in the programming interface is generated, through which the programmer can add functionality.

ERP systems as well as SimAL need PDA messages in many installations. These must be prepared in advance and filtered if necessary. This menu entry was initially intended for user-specific filtering and forwarding of PDA data.

8.3.11 Exporting the schedule to XML

After a safety request, this function creates an XML export (web export). A previous export is then overwritten. The export is shown in the path given in the options dialog (Chapter [Setting options](#)). The data to be exported are set with the function Set XML export columns (Chapter [Set XML export columns](#)).

8.3.12 Exporting the pool to the clipboard

With this function, the content of the pool is copied to the clipboard and can then be easily exported into other Windows programs in tabular form via the Paste function.

8.3.13 CSV Export

A previously defined CSV export run is carried out with this function. Choose the run as well as the time window and then confirm with [OK]. CSV export runs are defined with the function “Set CSV export types” (Chapter [Set CSV export types](#)).



Figure 77: Carrying out a CSV export

8.3.14 Dosimis3 Export

With this function, all selected disposition orders are exported in the Dosimis3 work-schedule format. For this, you have to choose a directory and give a filename. Si-MAL then creates a *.apd as well as a *.txt file, which can be read by Dosimis3 (a material flow simulator created by SDZ).

8.3.15 Printing work lists

With this function, it is very simple to print the scheduled disposition orders of several machines in a list format for a time period that can be parameterized.

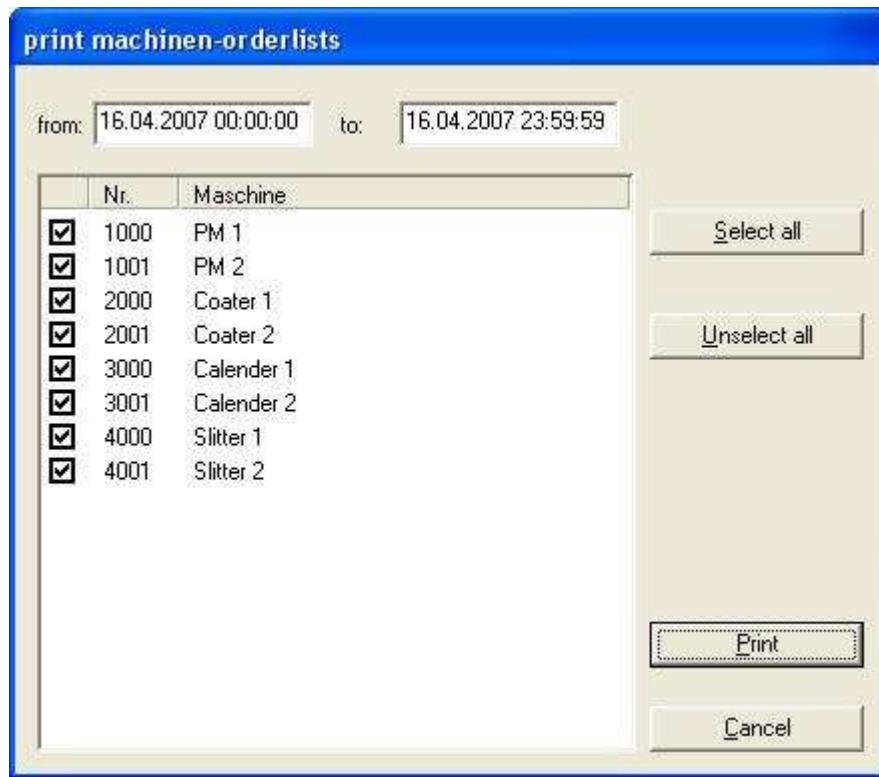


Figure 78: Printing work lists

After choosing this menu entry, the dialog box shown in Figure 78 is shown. Select the machines, for which the work lists have to be printed (a new page is started for each machine) and set the time period, for which the disposition orders have to be printed. All disposition orders whose set-up times or processing times that fall in this range (the bars represented in the Gantt chart) are printed.

Click Print and choose one of the installed printers.

8.3.16 Printing

With this function, the currently shown section of the schedule window (Gantt chart window) is printed.

The best results are with the landscape format.

8.3.17 Page view

This function shows a preview of the print function (Chapter 8.3.16 [Printing](#)). This representation is therefore dependent on the chosen printer model.

8.3.18 Printer settings

This menu entry leads to the same functionality as in the main menu (Chapter 2.4 [Configuring the printer](#)).

8.3.19 Exiting the program

This menu entry exits the program. A check is first carried out whether the current schedule should be saved (if any changes are there). If you answer with Yes, the schedule is saved before exiting the program. If you answer with No, the last changes are irreversibly lost!

8.4 The Edit menu

Functions which can directly be used on disposition orders and ERP orders are in the Edit menu.

8.4.1 Undo

EDIT / UNDO 

This function enables you to undo the last operations and their effects and thereby recreate the scheduling state before these operations. The number of undo steps is limited by the main memory of your computer and lies between 5 and 20. In some operations, however, it is not possible to undo the present steps:

| | |
|-------------------|--|
| Save schedule | All operations, through which the current schedule is saved, lead to losing the previous undo steps. |
| ERP-order changes | All operations that affect change of a ERP order (including |

| | |
|---------|---|
| | updating the work plan) lead to losing the previous undo steps. |
| Refresh | Changes from other users, which are automatically worked into the current schedule (for example, after saving by another user or for persistent machines after schedule changes of this machine), lead to losing the previous undo steps. |

8.4.2 Scheduling

EDIT / SCHEDULE 

Manual scheduling can be performed either completely with the mouse or with the help of the keyboard. First ensure that the machine, for which the disposition order has to be scheduled, is visible and also that a suitable observing time period has been set in the graphic scheduling.

First select the disposition order to be scheduled in the order pool. Keep the mouse-button pressed and drag the disposition order to the desired position in the graphic scheduling. While the disposition order is being moved, its current duration and bar length depending on the scheduling position are constantly calculated. The upper left corner of the disposition order is calculated as the scheduling position.

If the mouse pointer is moved to the edge of the Gantt chart window and if the mouse button is kept clicked, the window is scrolled in the corresponding direction. The scrolling speed is determined by how far you have the mouse pointer in the corresponding direction.

Another possibility to vertically scroll through the window is to rotate the mouse wheel. If the mouse wheel is rotated while keeping the [Shift] key pressed, scrolling is horizontally performed. Rotate the mouse wheel while keeping the [Ctrl] key pressed to change the zoom settings.

As an alternative to the drag-and-drop method shown above to schedule an order, you can press [Insert] after selecting an order, perform the menu sequence EDIT / SCHEDULE or click ; the mouse pointer then takes on a square shape. Move the mouse pointer to the position where the disposition order has to be scheduled and place it there with just a mouse-click.

If you try to schedule a disposition order for a machine, on which this order cannot be carried out, or a machine which you are not allowed to edit, the disposition order is placed back into the order pool!

8.4.3 The dispo-info dialog

DOUBLE-CLICK DISPO IN THE POOL OR IN THE GANTT CHART WINDOW

There is a third possibility in scheduling, namely through the dispo-info dialog. This dialog can be made available in the pool as well as in the Gantt chart window by double-clicking. It serves to show information on individual disposition orders and to carry out certain actions. The standard values are shown in the upper part, while the attributes added in the Data Dictionary are shown in the lower part.

The following actions are possible in this dialog:

| | |
|---|--|
| Schedule | Select the checkbox “Schedule” and choose the machines, their units and starting set-up time. Then click OK or Accept. |
| Unschedule | Select the checkbox “Unschedule” and then click OK or Accept. |
| Reschedule | Select the checkbox “Reschedule” and choose the new machines, their units and starting set-up time. Then click OK or Accept. |
| Change in the earliest set-up start or latest waiting-time end: | Enter the new value in the corresponding box and the click OK or Accept. |
| Setting the disposition order for the machine or in the pool | Select the check box “Set” or “cannot be scheduled” and then click OK or Accept. |
| Change in the comment text | Change the comment and then click OK or Accept. |
| Change in the attribute values added in the Data Dictionary | Change the attribute value if it was allowed in the Data Dictionary and then click OK or Accept. |
| Change in required quantity and required number of parts | A change in the quantity is only possible when it was allowed in the options dialog (Chapter 6.7 Setting options). Please note that quantity changes in disposition orders while simultaneously using the material-requirement export lead to |

| | |
|--|--|
| | wrong quantities in the material requirement. The respective first disposition orders of ERP orders are affected here. Material requirement quantity is calculated as follows: The quantity of the disposition order is divided by the total quantity of the first production step of the ERP order. This value (between 0 and 1) is multiplied with the ERP order quantity. |
|--|--|

The additional attributes from the Data Dictionary can either be shown under or next to the standard boxes (Chapter [Wider dispo-info dialog](#)). For each disposition-order class, the user must once set which attributes should be shown in which sequence. To set this, click the command button [Select]. The choice of attributes shown here is the same like in many other places in SimAL.

If all attributes have to be temporarily shown, the option “Show all” can be activated. This option will however not be saved.

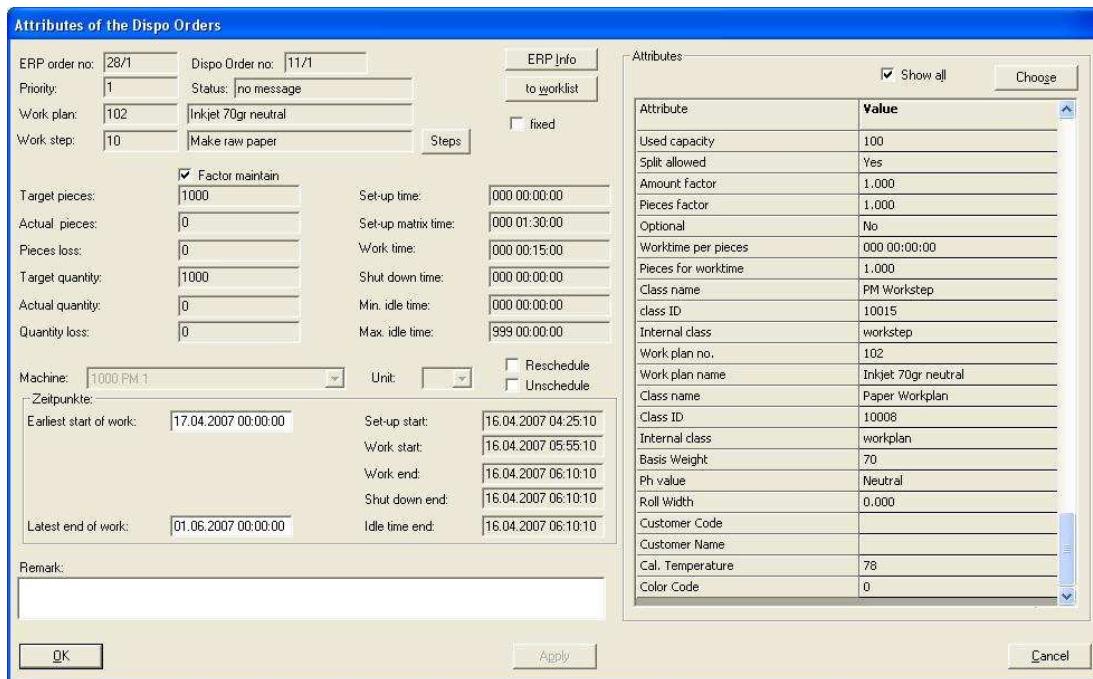


Figure 79: The dispo-info dialog

8.4.4 The machine-dispo list

DOUBLE-CLICKING A MACHINE NAME IN THE GANTT CHART WINDOW OR CHOOSING A MACHINE NAME FROM THE GANTT CHART WINDOW IN THE CONTEXT MENU (RIGHT-CLICK)

This dialog shows a tabular list of all disposition orders scheduled for a machine. Other than the common list function “Print”, which is shown here as [Print all], there is also the function [Print selection], which allows the user to print only chosen orders which have been selected.

The list settings (column choice, column width) in this dialog are also used for printing the work lists (See Chapter 8.3.15 [Printing work lists](#)).

The following scheduling functions can be used in this dialog: [Unschedule] to unschedule selected disposition orders and place them in the pool (they are subsequently deleted from the list); [Edit] to access individual disposition orders and change them.

By clicking the command button [Display], the dialog is closed and the selected disposition order/disposition orders are shown.

| Dispo ID | Wo... | Work st... | Machine de... | Part ID | set-up start |
|-------------|-------|------------|---------------|---------|---------------------|
| 21/1 - 10/1 | 100 | 2 | Coater 2 | | 02.05.2005 01:30:00 |
| 25/1 - 4/1 | 106 | 2 | Coater 2 | | 02.05.2005 14:50:00 |
| 5/1 - 4/1 | 100 | 2 | Coater 2 | | 03.05.2005 06:10:00 |
| 15/1 - 4/1 | 103 | 2 | Coater 2 | | 03.05.2005 19:50:00 |
| 4/1 - 4/1 | 100 | 2 | Coater 2 | | 04.05.2005 07:30:00 |
| 24/1 - 4/1 | 106 | 2 | Coater 2 | | 04.05.2005 19:30:00 |
| 12/1 - 4/1 | 104 | 2 | Coater 2 | | 05.05.2005 05:50:00 |
| 13/1 - 4/1 | 104 | 2 | Coater 2 | | 05.05.2005 12:30:00 |
| 2/1 - 4/1 | 101 | 2 | Coater 2 | | 05.05.2005 19:50:00 |
| 29/1 - 10/1 | 101 | 2 | Coater 2 | | 17.04.2007 00:00:41 |

Figure 80: The machine-dispo list

8.4.5 The machine-schedule dialog

OPTION IN CONTEXT MENU (RIGHT-CLICK) ON THE MACHINE NAME IN THE GANTT CHART WINDOW

This dialog offers a number of scheduling functionalities for a machine in list format. It can be accessed for sequential machines and only accessed when the user is allowed to schedule for the concerned machine.

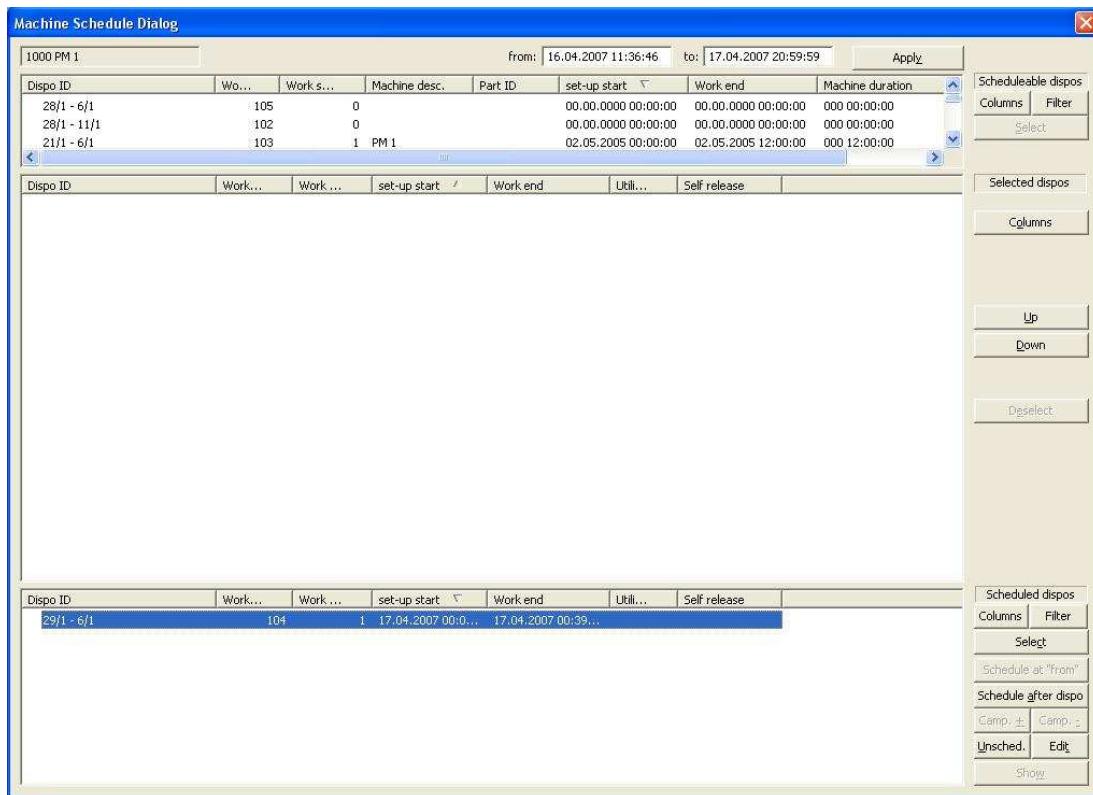


Figure 81: The machine-schedule dialog

The dialog has three lists described from top to bottom:

1. The list of disposition orders that can be scheduled: all disposition orders that can be scheduled by the user for the concerned machine are shown here, regardless of whether they are in the pool, scheduled for another machine or for the concerned machine. Disposition orders which have not been released for scheduling in the pool or which have been scheduled for machines, that the user has no access to, are not shown.
2. The list of chosen disposition orders: this list is a cache memory and is used to gather and sort disposition orders for later scheduling or re-scheduling.
3. The list of scheduled disposition orders: all disposition orders that have been scheduled for the given time period for the concerned machine are shown here. It thereby corresponds to the machine-scheduling list (see Chapter 8.4.4 [The machine-scheduling list](#)) and is limited to a definite time period.

The following are transferred from the schedule window through the context menu when opening this dialog:

- The concerned machine (the machine from which the dialog was accessed) is shown on the upper left side.
- The current zoom setting as a time period (“from”, “to”) for the dialog.
- The selected disposition orders in the list of the chosen ones, if they could be scheduled for the concerned machine later by the user.

The following actions are possible in this dialog:

| | |
|-------------------------|---|
| Unschedule | Select one or more disposition orders in the list of the scheduled order and click [Unschedule]. The disposition orders are thus removed from the machine and are returned to the pool. |
| Scheduling/Rescheduling | <p>The scheduling happens in three steps:</p> <ol style="list-style-type: none"> 1. Bring the disposition orders to the list of the chosen orders. This is possible by selecting them and clicking [Select] in the list of those which can be scheduled or in the list of the scheduled ones or by double-clicking in both these lists. Wrongly chosen disposition orders can be removed through [Remove] or by double-clicking in this list. 2. Bring the disposition orders to the list of the chosen orders in the desired sequence. This can be performed through the sorting function of the list (see Chapter 1.3.3 List functions) and through the command buttons [Move up] and [Move down]. These command buttons move a selected disposition order in the list of the chosen orders by one position up or down. 3. No changes have been carried out yet for the scheduling condition. With the command buttons [Schedule with “from”] or [Schedule behind], the disposition orders are scheduled behind each other for the concerned machine in the given sequence in the list of chosen orders. The starting time of the first disposition order is the time period given in the box “Time period from” or the end of a selected disposition order in the list of scheduled orders. The disposition orders are obviously therefore removed from the pool or un- |

| | |
|------------------------|--|
| | scheduled from the concerned machine or another one. |
| Edit disposition order | With the command button [Edit], the dispo-info dialog (see Chapter 8.4.3 The dispo-info dialog) for a selected disposition order in the list of scheduled disposition orders is shown; the user has access to its scheduling functionalities. |
| Build campaign | With the button [Build campaign], the selected disposition orders are built together into a campaign in the list of scheduled orders, when it is possible (scheduled directly behind each other). |
| Break up campaign | With the button [Break up campaign], all selected campaigns in the list of scheduled orders are broken up into single disposition orders. |

8.4.6 Re-scheduling

EDIT / RESCHEDULE 

The simplest way to reschedule a disposition order is to shift the scheduled disposition order in the Gantt chart window. Select the disposition order and drag it to the new position.

You can alternatively select a disposition order the graphic scheduling and then press **[Ctrl] + [U]**, perform the menu sequence EDIT / RESCHEDULE or click . The mouse pointer changes to a square. Move the mouse pointer to the new position and place the disposition order there by clicking!

Several disposition orders can also be rescheduled simultaneously using the alternatives shown above. The third alternative is available in the dispo-info dialog for single disposition orders (Chapter 8.4.3 [The dispo-info dialog](#)).

Attention: If you want to reschedule several orders simultaneously and have activated the option Snap Predecessor, it can lead to unexpected results. Therefore, temporarily deactivate this option, if you wish to reschedule several disposition orders at once.

Ensure that you have selected an order in the screen area “Scheduling”! Otherwise, the function RESCHEDULE will not be available! If the rescheduling cannot be carried out successfully, the disposition order to be rescheduled is returned to the order pool and you are informed accordingly in a message window!

8.4.7 De-allocating

EDIT / UNSCHEDULE 

With this function, an order placed in the Gantt chart window is shifted back to the order pool. The following methods are available to unschedule an order:

- Select the orders to be unscheduled and press [Del].
- Select the orders to be unscheduled and then perform the menu sequence EDIT / UNSCHEDULE.
- Select the orders to be unscheduled and click .
- Double-click a disposition order and unschedule it in the dispo-info dialog (Chapter 8.4.3 [The dispo-info dialog](#)).

After de-allocation, the disposition order is in the order pool and should either be automatically or manually scheduled again.

8.4.8 Changing a ERP order

EDIT / CHANGE ERP ORDER

This function enables you to edit ERP orders even after they have been accepted into the schedule window. The disposition orders are either deleted, re-created or updated depending on the change.

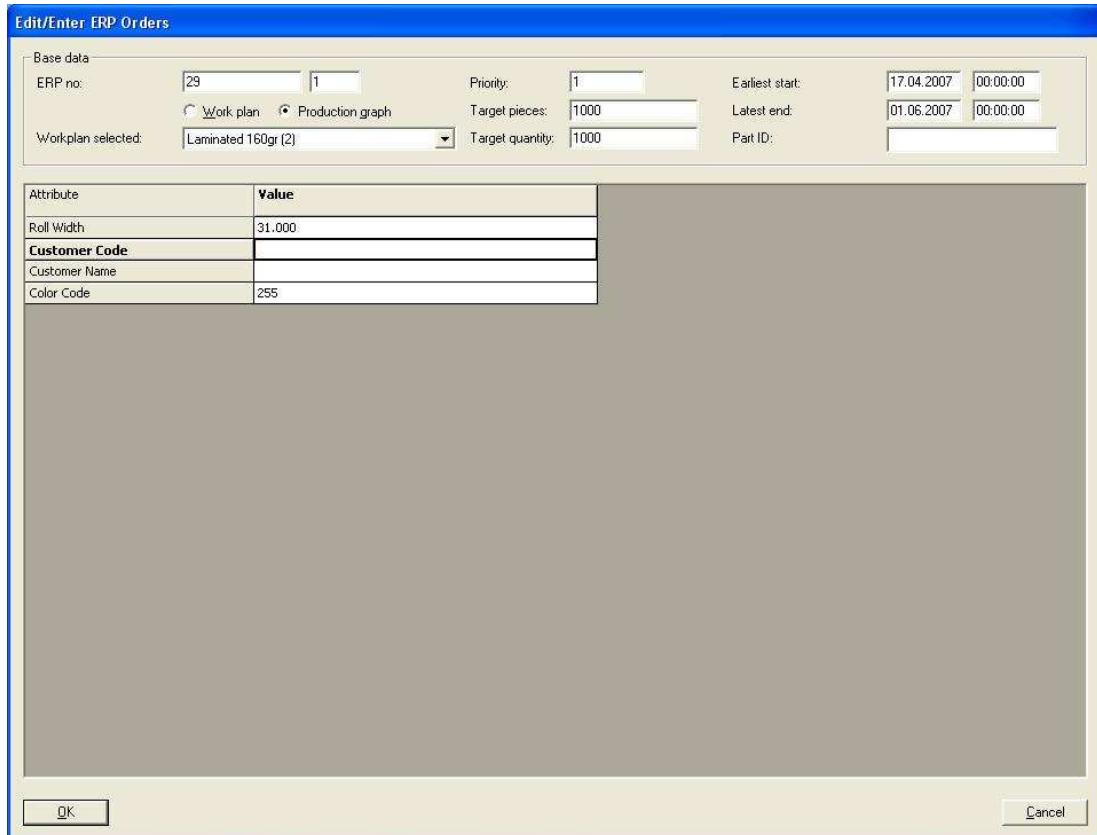


Figure 82: Changing a ERP order

The disposition orders can only be updated when no work plan or production graph was changed or no attribute value, which forces a new creation of disposition orders, was changed (see .NET Programming interface, Class `ErpOrder`).

When a ERP order is changed, previous operations can no longer be reversed with the undo function.

Attention: If the disposition orders have been deleted and created newly, not only their scheduling positions (time and machine) and splitting, but also any of their changed attribute values are lost!

8.4.9 Updating the work plan

EDIT / UPDATE WORK PLAN

This function enables use of work plan changes for a ERP order that were carried out after ERP acceptance. All disposition orders are also deleted and re-created based on

the current situation of the work plans/production graphs. All scheduling, splitting and changes in attribute values of disposition orders of the concerned ERP order are lost when performing this function!

8.4.10 **Changing the graph Quantity/Time**

EDIT – CHANGE GRAPH QUANTITY/TIME

With this function, the quantity/number of parts as well as the earliest starting time or latest finishing time can be changed at once for a number of related disposition orders.

Select an exact disposition order either in the pool or in the Gantt chart window. SimAL now ascertains all disposition orders which cannot be linked from the selected disposition order. All these disposition orders build the graph to be changed. A parameter dialog is then opened and pre-allocation is performed based on the values of the last disposition order of the chaining.

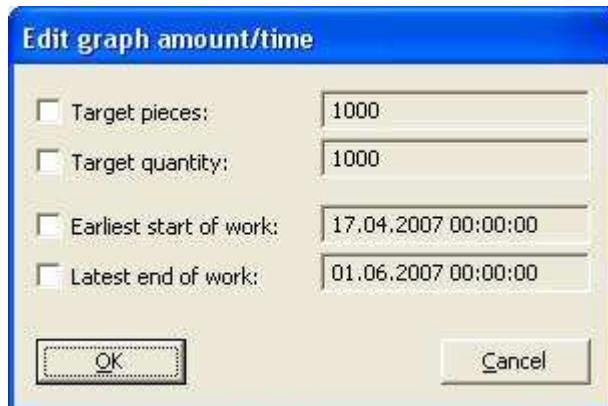


Figure 83: Changing the graph Quantity/Time

Activate the checkboxes for those entries that you wish to change. The respective text boxes are then opened for your entry. Confirm with [OK] or cancel with [Cancel].

8.4.11 **Splitting a graph**

EDIT / SPLIT GRAPH

This function is meant to split a chain of disposition orders. First select a (related) chain of disposition orders and then choose this function. Parameterize the quantity/number of parts to be split in the dialog box which appears. The maximum quan-

tity/number of parts to be split is shown as a default, which is calculated as the smallest difference between required and actual quantity/number of parts. This means that you can split up to the maximum quantity to be produced.

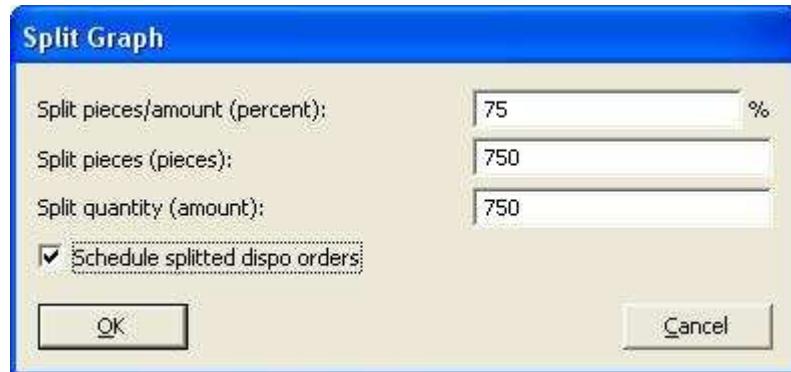


Figure 84: Splitting a graph

Please note that this function is either used for the disposition orders in the pool or the disposition orders in the Gantt chart window depending on which window is the current one. To split a complete order graph, it must be completely scheduled or unscheduled and completely selected!

8.4.12 Deleting a ERP graph

EDIT / DELETE ERP GRAPH

Complete disposition order graphs can be permanently deleted with this function. All disposition orders of the graph have to be unscheduled for this. Select one disposition order of the graph to be deleted in the pool. The other disposition orders are automatically determined by SimAL through checking of the connections. If you answer the safety question with Yes, all of these disposition orders and their ERP orders are deleted permanently. The undo history is also accordingly updated so that undoing is not possible.

8.4.13 Selecting disposition orders

Operations in the schedule window are mostly carried out for selected disposition orders either in the pool or the Gantt chart window. Individual disposition orders can

be selected by clicking them. To select more disposition orders, the [Ctrl] key has to be kept pressed while selecting the orders.

A set of rows can be selected in the pool by clicking the first row and then clicking the last row while keeping the [Shift] key pressed. All enclosed rows are thus selected.

A set of disposition orders can be selected in the Gantt chart window by dragging a rectangle with the mouse. All disposition orders within the rectangle are selected.

The following functions can help make the selection easier in particular situations:

| | |
|--------------------|--|
| Select all | Keyboard combination [Ctrl] + [A]. It selects all disposition orders in the pool or Gantt chart window. |
| Select ERP orders | [F2] on the keyboard. It selects all disposition orders of the same ERP order in the pool or Gantt chart window. |
| Select predecessor | Keyboard combination [Ctrl] + [B]. It selects all disposition orders which can be reached by the predecessor chaining. |
| Select successor | Keyboard combination [Ctrl] + [N]. It selects all disposition orders which can be reached by the successor chaining. |

8.4.14 Locking

EDIT / LOCK 

Orders can be locked within the scheduling with the help of these functions. This can be necessary if an important customer order has already been scheduled optimally and should not be shifted from the pool while scheduling other orders.

Select the order to be locked and then click . Any number of orders can be selected at the same time to be locked. Other than the menu sequence shown above, the keyboard combination [Ctrl] + [F] can be performed after selecting an order.

Individual orders within a batch cannot be locked. It is only possible to lock the whole batch with all its orders!

Orders can be locked in the pool. The releasing of the schedule is thereby no longer possible. These orders can no longer be manually or automatically scheduled till they are released again in the pool.

8.4.15 Releasing

EDIT / RELEASE 

Locked orders (Chapter 8.4.14 [Locking](#)) can be released to be edited by first selecting the locked orders and then clicking the command button . You can alternatively perform the menu sequence shown above to release locked orders or use the keyboard combination [Ctrl] + [G].

Individual orders within a batch cannot be released. It is only possible to release the whole batch with all its orders!

Orders whose schedule release is set to No can be released with this function. These orders are then considered again by the automatic scheduling.

8.4.16 Splitting

EDIT / SPLIT 

SimAL offers the possibility to split individual disposition orders; this process is useful for very large disposition orders, in which particular processing steps can be carried out on several machines at the same time. Select the disposition order to be split and then use the split function. There are three ways to split an order:

1. Perform the menu sequence EDIT / SPLIT.
2. Click  in the toolbar.
3. Use the keyboard combination [Ctrl] + [P].



Figure 85: Splitting an order

After activating the split function, a dialog box (Figure 85) is opened. The box »**Pieces of the disposition order**« is only to be viewed and shows the order quantity before the splitting. In »**Quantity to be split**«, enter the quantity by which the original order is to be reduced and for which a new disposition order should be set up. SimAL enters a default value of half of the disposition-order quantity. As usual, you can change this value with your own entry.

Through »**Schedule split disposition order**«, you determine whether the new disposition order created by splitting should be automatically scheduled by SimAL or placed in the order pool. Checking the checkbox activates this function. Clicking again deactivates this function.

Click [OK] to carry out the split function. If the disposition-order quantity is an odd number, for example 1999, and you accept the default value from SimAL in »**Quantity to be split**«, SimAL then sets up a disposition order with 1000 pieces and 999 pieces.

Disposition orders can be split any number of times; splitting is only not possible when the quantity of the order to be split = 1!

This function corresponds to the function “Split graph” (Chapter 8.4.11), if only one disposition order is selected.

8.4.17 Pasting

EDIT / PASTE 

Split orders (Chapter 8.4.16 [Splitting](#)) can be pasted together again. Pasting is usually used in graphic scheduling, but you can also paste unscheduled and split disposition orders in the order pool. The process of pasting varies based on whether you wish to paste in the order pool or in graphic scheduling.

It is only possible to paste orders with the same ERP number and same scheduling number. Disposition orders to be pasted must not be already locked. If you try to paste orders which do not fulfill these functions, a message window informs you of the mistake!

8.4.17.1 Pasting in the Gantt chart window

Select the split disposition orders you wish to paste by keeping the [Ctrl] pressed and clicking both the disposition orders. The selected disposition orders can be recognized, since they are highlighted in a different color. Then click  and the disposition orders are pasted together. You can alternatively use the keyboard combination [Ctrl] + [K] or perform the menu sequence EDIT / PASTE. The length of the pasted disposition orders is accordingly changed in its representation in the graphic scheduling, since the order quantities are added and the processing time is accordingly higher.

In contrast to pasting in the order pool, the sequence in which the orders are selected is important in graphic scheduling! The disposition order selected last is automatically pasted at the end of the disposition order selected first by SimAL. The result is that all subsequently scheduled disposition orders are shifted to the back if the time period between the split disposition order selected first and the next disposition order is smaller than the time period needed for processing of the split disposition order marked second!

8.4.17.2 Pasting in the order pool

Select the disposition orders to be pasted in the order pool and then perform EDIT / PASTE. You can alternatively use the keyboard combination [Ctrl] + [K] or click the command button . The selection sequence decides which disposition order dominates: the other disposition orders are pasted on to the disposition order selected first.

8.4.18 Pasting all orders in the pool

This function pastes all disposition orders in the pool that can be changed and are not locked. This function is similar to the following operations:

1. Select all orders in the pool (Chapter 8.4.13 [Selecting disposition orders](#))
2. Paste (Chapter 8.4.17 [Pasting](#))

8.4.19 Marking

EDIT / MARK 

This function enables you to mark one or more disposition orders with a small symbol so that they can be found easily later. Select the desired disposition orders and activate the marking function either through the menu, toolbar or the keyboard combination [Ctrl] + [M]. Click the desired symbol and then click OK or Cancel.

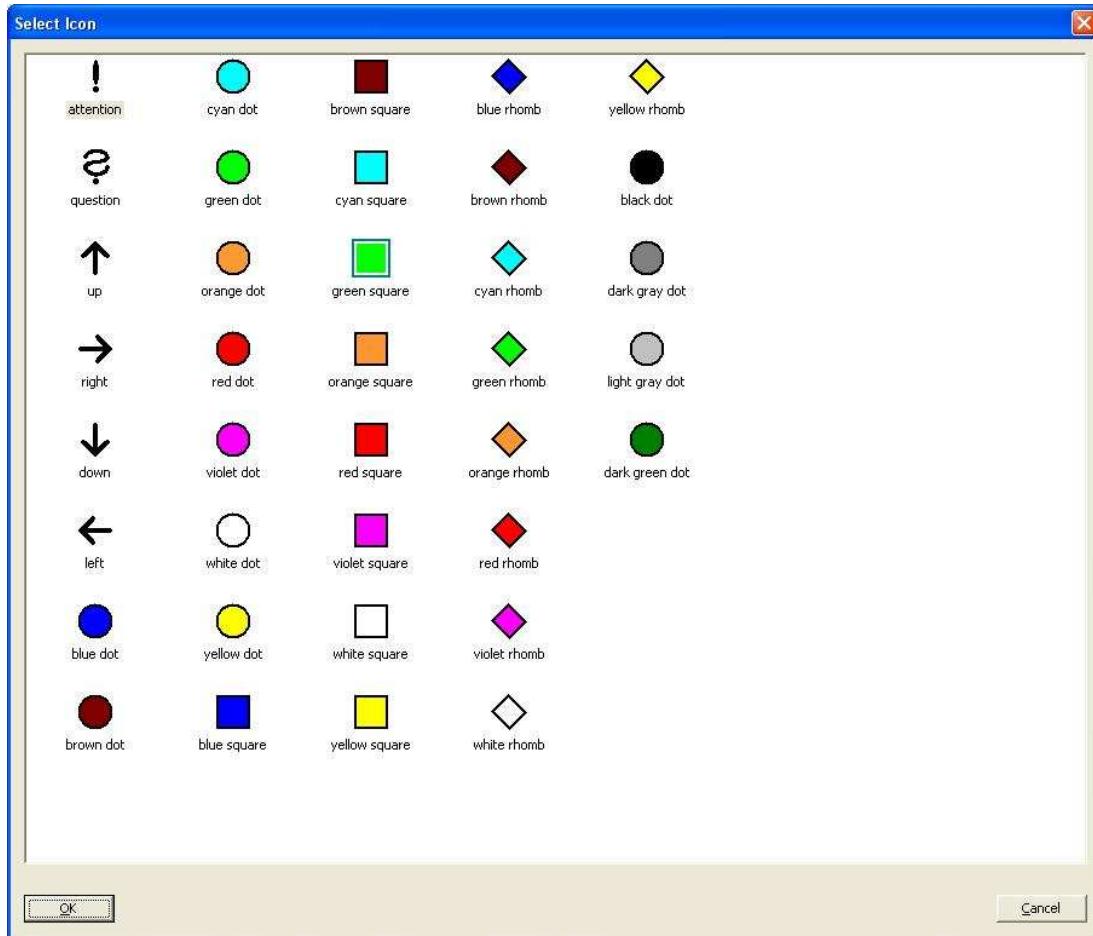


Figure 86: Marking disposition orders

8.4.20 Unmarking

EDIT – UNMARK

This is the reverse function to the marking function. The marking on the selected disposition orders is removed.

8.4.21 Building a campaign

EDIT / BUILD CAMPAIGN

It is possible to build disposition orders scheduled directly behind each other for a machine into a campaign. The disposition orders then form a unit, which stays together also during de-allocation and re-scheduling when possible. After you have chosen this function, you are asked for a name for this campaign (Figure 87). The

campaign is built by clicking [OK]. Clicking [Cancel] cancels the function and no campaign is built.



Figure 87: Name for a campaign

After you have built the disposition orders into a campaign, their bars have a common background color. They can be moved as one disposition order, but their sequence stays the same.

8.4.22 Breaking up a campaign

EDIT – BREAK-UP CAMPAIGN

This function is an opposite to the function to build a campaign. The grouping into campaigns of selected disposition orders.

8.4.23 Creating a connection

EDIT / CREATE CONNECTION

New connections between disposition orders can be added with these functions. Two disposition orders have to be selected for this. Please note that the sequence of selection is very important:

1. First select the disposition order from which the connection is to be made.
2. Then select the disposition order to which the connection is to be made while keeping the [Ctrl] key pressed.

The connection is made immediately after executing this function. In order for the function to be active, neither of the orders should be locked and the connection should not already exist.

8.4.24 Deleting a connection

EDIT / DELETE CONNECTION

Connections between disposition orders can be deleted with this function. You must however note that this function can delete complete chaining of orders which then become invalid. To delete an existing connection, select two disposition orders and then perform the function.

8.4.25 Searching disposition orders

EDIT – SEARCH DISPOSITION ORDERS

This function enables you to select disposition orders in the pool by entering comparison parameters. The following dialog box appears after selecting this function through the menu or the button:



Figure 88: Searching disposition orders

Up to three attribute values can be compared with a constant value. Each of the comparison rows can be used while searching to restrict the selection. Choose the required attribute, comparison operator and comparison value in each row. After clicking [OK], the disposition orders which match the activated comparison parameters are selected.

If the attribute to be compared is a text box, then the wildcards '*' and '?' are allowed. The question mark stands for any character while the asterisk stands for any completion of the phrase. The asterisk may only be used as the last character of the value to be compared.

8.4.26 Fixing resource selection

EDIT / FIX RESOURCE SELECTION

When a disposition order has been scheduled and the process has several resource lists, SimAL chooses the resource list with the lowest number, whose resource demand can satisfy all. In particular situations however, the resource list selection must be purposely influenced by the planner. With this function, the resource list is fixed for a disposition order, i.e. SimAL always tries first to see whether the fixed list can be taken. To execute this function, select just one disposition order and choose the resource list.

8.4.27 Unfixing resource selection

This function releases a pre-selection of the resource list for a disposition order. Select just one disposition order and execute this function.

8.4.28 Scheduling automatically

EDIT / AUTOMATIC SCHEDULING 

In automatic scheduling, SimAL schedules all orders released for scheduling from the pool into the Gantt chart window. Normally, no scheduling is unscheduled when this happens. This would only happen when the parameter “Automatic new scheduling when finished at least too soon” has been set with a value smaller than 365 days in the option dialog. These orders are unscheduled before automatic scheduling and are then available again for scheduling. Other than this functionality, automatic scheduling is purely an “additive” scheduling.

Depending on the quantity of the already scheduled orders and quantity of those orders to be scheduled, SimAL needs a time anywhere between a few seconds and several hours to schedule. A rule of thumb is that SimAL needs a maximum of 1 second per order to be scheduled. Thus, around 15 minutes is needed for 1000 orders to be scheduled. A status display informs you about the progress of the scheduling while

automatic scheduling is going on. This is shown by the quantity scheduled and quantity to be scheduled.

No other actions can be carried out during automatic scheduling! The schedule window is also closed for other users during this time.

SimAL tries to execute all processing levels as currently as possible during automatic scheduling, so that the interim storage of product parts is kept at a minimum and an order execution is performed as quickly as possible.

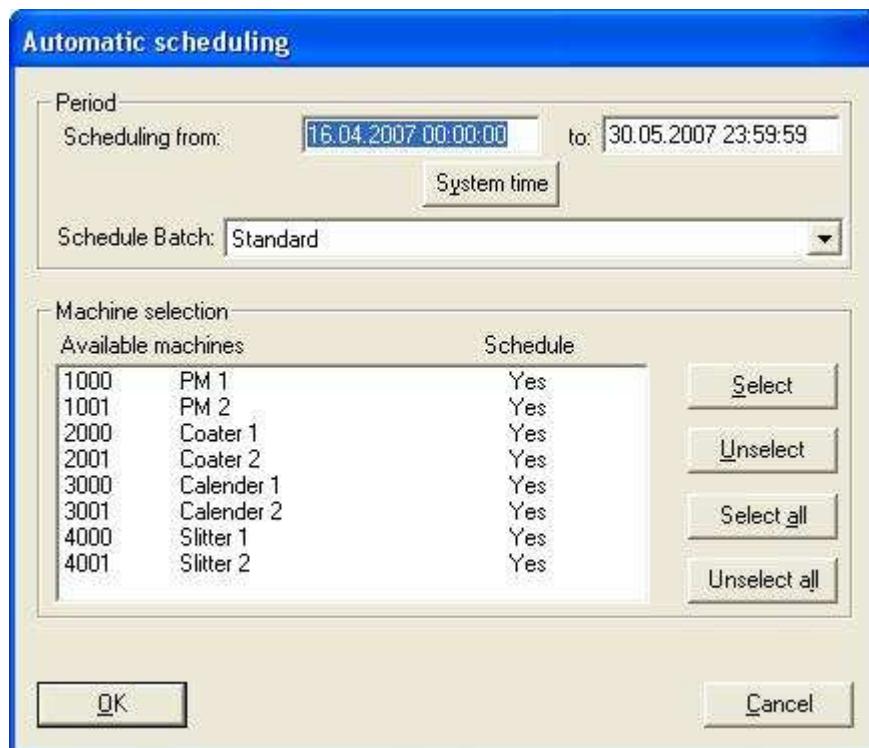


Figure 89: Automatic scheduling

The parameter dialog box in Figure 89 is opened after carrying out this function. Fix the scheduling time period and the machines to be scheduled. The current time is put in the first time box with the command button “System time”. Orders which cannot be scheduled on time by the automatic scheduling are only scheduled when the checkbox “Delayed scheduling also allowed” has been explicitly allowed.

There are four command buttons available in Figure 89 to choose which machines can and cannot be scheduled. Before you click the command buttons [Schedule] and [Do not schedule], you have to first choose a machine in the list. The machine is accordingly included or left out for scheduling. The other command buttons [Schedule

[all] and [Schedule none] refer to all machines. The automatic scheduling is started by clicking [OK].

8.4.29 Selected automatic scheduling

This function is the same as “Automatic Scheduling”. But only disposition orders selected in the pool are scheduled.

8.5 The Scheduling parameters menu

Functions that enable you to set options for automatic and manual scheduling and thereby adapt the system to your requirements are found in this menu.

8.5.1 Scheduling parameters

SCHEDULING PARAMETERS / SCHEDULING PARAMETERS

Automatic scheduling works according to an easy and very understandable principle:

1. A time window is defined for each disposition order, within which the disposition order should be scheduled.
2. The earliest scheduling possibility is searched for as long as the disposition orders to be scheduled are available.
3. An index value is calculated with the help of a local objective function for all disposition orders whose time windows overlap the scheduling time.
4. The disposition order with the largest index value is chosen.
5. Within a time period that can be parameterized, a projection is made into the future from the targeted scheduling time, whether there is a scheduling position whether this disposition order can get an even better index value.
6. If this is not the case, the disposition order is scheduled. If a better scheduling position was found, the disposition order is scheduled there.
7. Step 2 is carried out as long as there are disposition orders to be scheduled.

Through the scheduling parameters discussed here, the index calculation for all disposition orders is influenced by the user setting some variables, which are used for index calculation. Since several scheduling runs can be calculated as well, several sets of scheduling parameters can be defined.

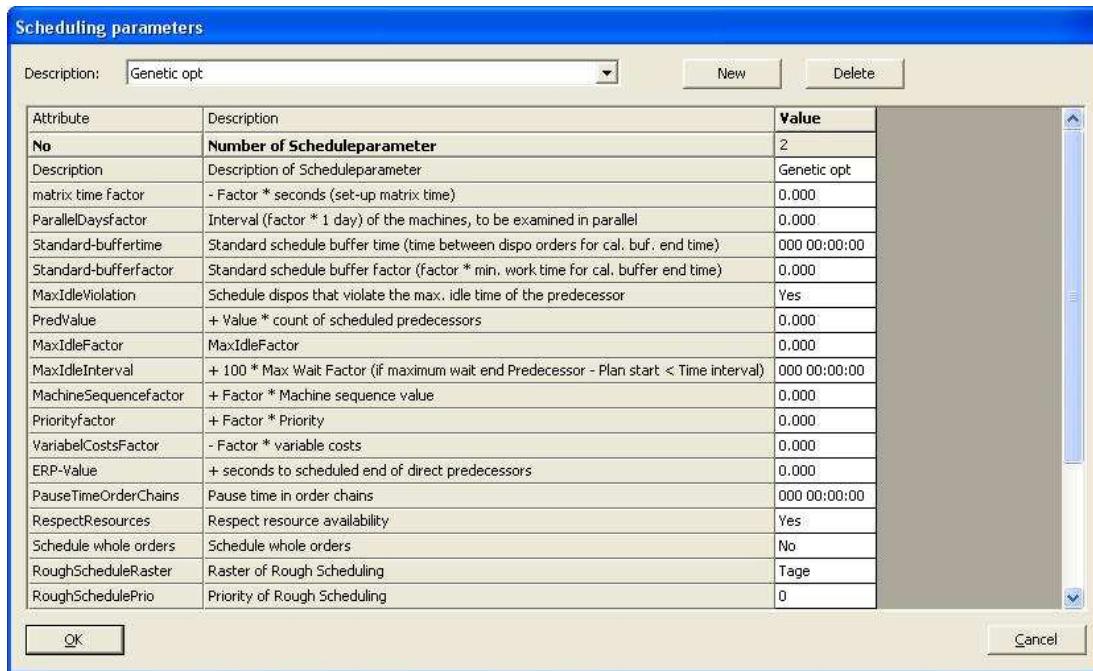


Figure 90: Scheduling parameters

After accessing this function, the window shown in Figure 90 is opened. Scheduling parameter sets can either be created or deleted with the command buttons [New] and [Delete] respectively (if they have not yet been used in the function Scheduling runs).

- **Number:** The number of the scheduling parameter set
- **Name:** The name of the scheduling parameter set
- **Set-up matrix time factor:** The set-up matrix time is determined for the candidate while considering the predecessor scheduled for the machine. This time (in seconds) multiplied with the parameterized factor here is subtracted from the index value.
- **Parallel day factor:** As has been mentioned above, a projection is carried for each candidate whether it can be scheduled in the future with a higher index value. The length of projection into the future is parameterized with this value in days. Please note that a higher value causes higher processing for the computer.
- **Standard buffer time and Standard buffer factor:** These boxes influence the on-time attainment of the scheduling goal. Critical for the user is the idea that a single disposition order becomes “urgent” after a particular time and that the scheduling goals of priority and machine performance play only a

secondary role and adherence to delivery date represents the deciding criterion for this disposition order. Since successive disposition orders also have to be scheduled on-time and finished, it would not be adequate to see the last possible starting time as the point of becoming “urgent”. A time span (buffer) is given instead, which shifts this time into the past and fixes the urgency beforehand. This time span can be seen between all disposition orders in the order graph and is similar to the time spans that are defined through the “Interim” parameter in order chains.

The security of adherence to delivery days is thus increased when the standard buffer time is chosen at a higher value. On the other hand, this parameter should not be chosen too large, since the scheduling goals of priority and machine performance would then be pushed too early to the background.

Since the exact cycle time is not yet fixed for a concrete order before concrete scheduling and the latest acceptable starting times of the individual disposition orders cannot be included, the parameter “Standard buffer factor” serves to enlarge the minimum expected machine-loading times of a disposition order (by multiplication with this factor). This is so that a very optimistic estimation of adherence to delivery time can be avoided. Even here, a larger value increases adherence to delivery time. However, just as for the parameter “Standard buffer time”, this value should not be set too high, since the scheduling goal “Adherence to delivery time” is pushed to the background.

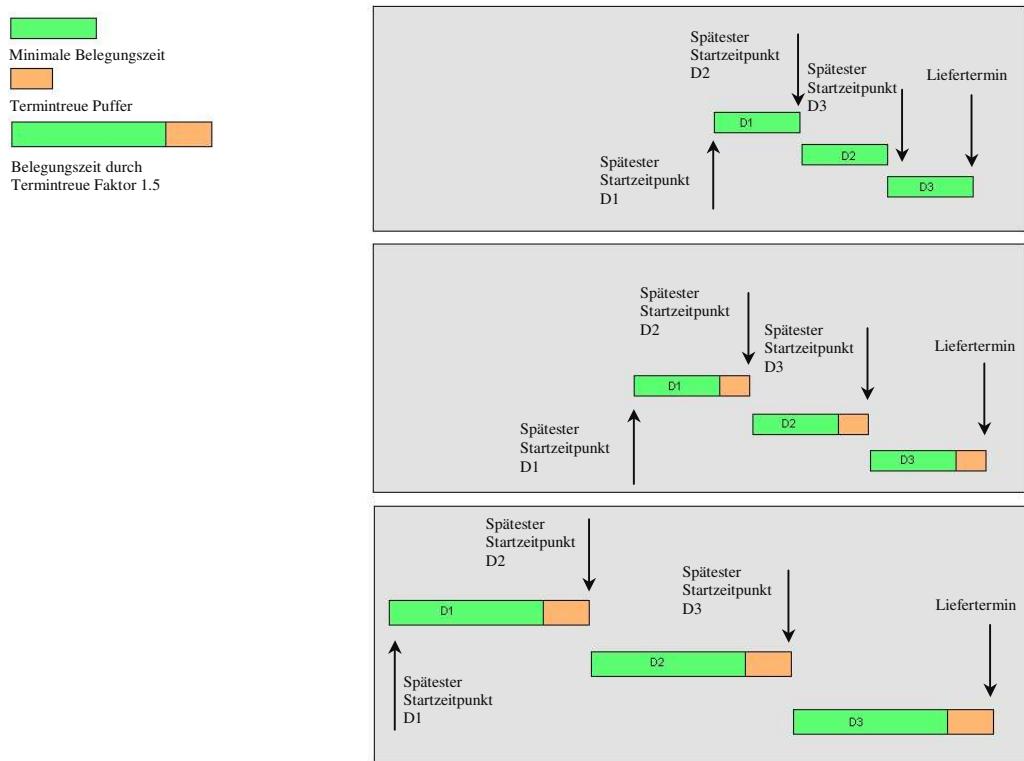


Figure 91: Calculation of buffer times

- **MaxIdleTimeViolation:** With this switch, you can set whether disposition orders should also be scheduled when they exceed the maximum idle time of a preceding disposition order. SimAL cannot always guarantee that the maximum idle time is observed. If you choose No here, it can happen that the automatic scheduling does not terminate by itself. It would then have to be ended with [Esc].
- **Predecessor value:** The value entered here is added to the index value for each scheduled disposition order which immediately precedes it. Increasing this value accelerates the order cycle time.
- **MaxIdleTimeFactor:** This determines how much the index value of disposition order is improved when it reaches the time window parameterized with **MaxIdleTimeInterval**.
- **MaxIdleTimeInterval:** If the possible scheduling time of the disposition order reaches or exceeds the time defined in **MaxIdleTimeInterval**, $100 * \text{MaxIdleTimeFactor}$ is added to the index value of this disposition order.

The MaxIdleTime parameters thus help in preferring a disposition order if it too closely nears the maximum idle time end (defined by its predecessors).

- **Machine sequence value factor:** A desired sequence (ascending, descending) can be defined for each machine as an attribute (Chapter 3.2.1 [Creating a machine](#)). During index calculation, it is also calculated how suited the candidate is with reference to this attribute sequence. The value determined is multiplied with this parameter and added to the index value. Each machine sequence has a value. The entry in this box is multiplied with the machine sequence value and the product is added to the weighting.
- **Priority factor:** This parameter defines how strongly the priority determined in the ERP order flows into the weighting of the disposition order. The priority is multiplied with this value and is added to the index value.
- **Running cost factor:** The running costs of the disposition order calculated for this scheduling position is multiplied with the parameter and the product is subtracted from the index value.
- **ERP value:** The seconds till end of processing of the last scheduled preceding disposition order are calculated and this value is multiplied with the parameter. The result is subtracted from the index value.
- **Order-chain interim time:** If successive disposition orders within an order structure cannot begin immediately after the end of idle time of their predecessors, a global time span can be fixed, by which the earliest possible starting time of successive disposition orders is increased. This interim time is considered by the automatic scheduling, but does not affect manual scheduling. The purpose of this option is to remove time for in-plant transports and to incorporate margin times.
- **Consider resources:** If you choose Yes here, only those disposition orders are scheduled, whose resource demands could be satisfied for all. If resources are not sufficiently available at the time of scheduling, the disposition order is not scheduled at this time.
- **Order-wise scheduling:** If this parameter has been chosen with Yes, all disposition orders of a ERP order are scheduled one after the other. This option is suited for scenarios in which an order begun has to definitely be brought to an end without any interruptions.
- **Rough scheduling grid:** If rough scheduling has been activated, it calculates an earliest possible load-dependent start for the disposition orders. Schedul-

ing times are then loaded based on capacity. The user can fix the length of such a time grid (capacity jar) with the rough scheduling grid. Choose between hours, days and weeks. Please note that the running time of rough scheduling increased not only with the number of disposition orders but also with the fineness of the grid!

- **Rough scheduling priority:** Enter an attribute ID here. This parameter helps in overload situations to control which orders should be shifted into a preceding capacity jar.
- **Set-up matrix average:** Rough scheduling does not calculate any concrete sequences of disposition orders and thus no sequence-dependent set-up matrix time. To balance this inequality, the average set-up matrix time can be parameterized for each disposition order here. This is then calculated into the capacity requirement.
- **MaxCycleTimeRP:** The maximum cycle time for an order graph can be parameterized here. If this cycle time is reached, the earliest possible start of rough scheduling is then no longer shifted into previous capacity jars.
- **GeneralStartRP:** The earliest determined start is transferred to all relevant disposition orders at the end of rough scheduling. The relevant orders themselves are controlled with this parameter:
 - Complete network: All disposition orders that are connected with each other.
 - ERP order: All disposition orders with the same ERP order number.
 - Disposition order: Each disposition order keeps its own earliest start.
- **RPProcessingTimeFactor:** The processing time of the disposition orders is multiplied with this factor for rough scheduling before it is loaded into the capacity jar. With this parameter, you can control how much earlier the earliest start of the disposition order will be.
- **MaxCandidateNumber:** If many disposition orders are available, it can be time consuming to evaluate all of them. The disposition orders are evaluated in the sequence of their buffer finishing time by the standard scheduling automatic. Only those disposition orders that were parameterized here are observed. Please note that a very small setting can negatively affect the quality of scheduling.
- **MinCandidateNumber:** The minimum candidate number is the number of the disposition orders to be evaluated with which the standard scheduling au-

tomatic begins. If no disposition order that can be scheduled is found within this number of disposition orders, the minimum candidate number is enlarged with the candidate number factor and a renewed attempt is made to find a disposition order that can be scheduled. The process is stopped if the maximum candidate number has been exceeded.

- **Candidate Number Factor:** The maximum candidate number or the minimum candidate number.

8.5.2 Scheduling runs

SCHEDULING PARAMETERS / SCHEDULING RUNS

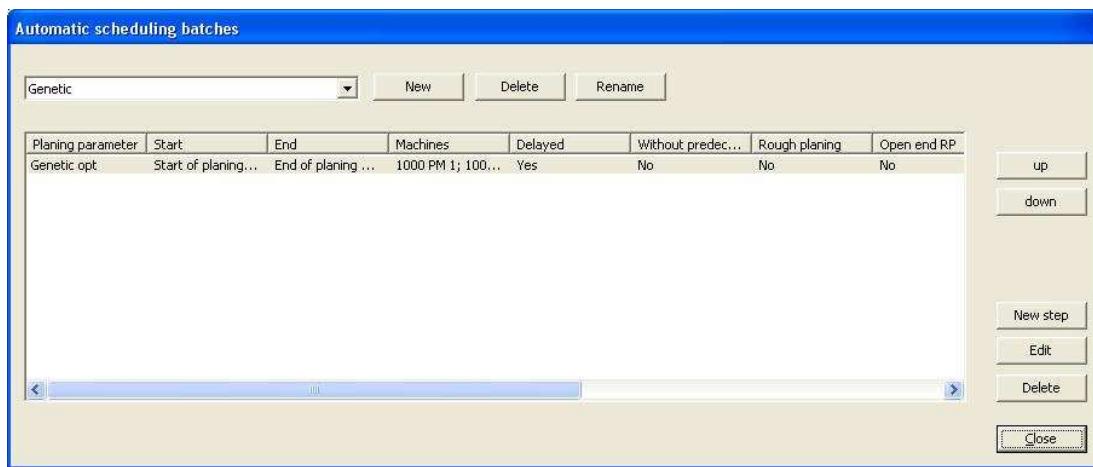


Figure 92: Scheduling runs

8.5.3 Global objective function control

SCHEDULING PARAMETERS – GLOBAL OBJECTIVE FUNCTION CONTROL

Global optimization algorithms such as genetic optimization do not evaluate single disposition orders, rather complete schedules. You can set how good a complete schedule is evaluated with this function. For each parameter, the corresponding values are collected, multiplied with the parameter and then summed. The schedule with the smallest evaluation is the best schedule.

| | |
|-----------|--|
| Delay | Delay (in seconds) of all disposition orders without successors, whose idle time end is after the latest end |
| Earliness | Earliness (in seconds) of all scheduled |

| | |
|---------------------|--|
| | disposition orders without predecessors, whose set-up start is before the earliest starting time |
| Set-up times | The sum of set-up matrix times (in seconds) of all scheduled disposition orders in seconds. |
| Order cycle times | The sum of time spans (in seconds) from set-up start of the first disposition order till end of processing of the last disposition order for each ERP order. |
| Total cycle time | The time span from set-up start of the first disposition order scheduled in the schedule window till end of processing of the last scheduled order in the schedule window. |
| Machine costs | The sum of calculated machine costs. |
| Resource violations | For each second that a resource loading exceeds its maximum stock, the value is added to the result. |

The time span is determined in seconds for all disposition orders not scheduled from the earliest start till the latest end and this is multiplied with the larger of both cycle time factors and added to the result.

For factors that are 0.0, the corresponding basic value is not calculated and processing time is thus saved.



Figure 93: Global objective function control

8.5.4 Genetic parameters

SCHEDULING PARAMTERS / GENETIC PARAMETERS

Genetic parameters control the behavior of genetic optimization.

| | |
|--------------------------------|---|
| Population size | The number of schedules being simultaneously searched |
| Recombination probability in % | When two schedules were chosen for recombination, it is carried out with the probability entered here. |
| Mutation probability in % | The probability that a disposition order will be changed is calculated as follows: $\text{Mutation probability} / \text{Number of disposition orders to be scheduled}$ |
| Descendants per generation | How often should schedules be recombedined per generation |
| Number of generations | After how many iterations does the optimization stop (you can also stop the optimization any time by pressing [Esc]). |
| Dispatch machines | Orders for these machines are scheduled as soon as all conditions are fulfilled. The |

| | |
|-------------------------|--|
| | order sequence of these machines is thereby not optimized by the genetic algorithm. |
| Minimum GA starting day | If this option is activated, the genetic algorithm tries to optimize the earliest day for ERP order group. All ERP orders which only differentiate themselves from each other by their ERP sub-number can be considered a ERP order group. The bundled release of lots at a scheduled time can, for example, be optimized. |
| Starting day | The probability (0...1) with which the minimum starting day of a group is changed during mutation operations. |
| Machine | The probability (0...1) with which a machine change is tried during a schedule. |
| Units | The probability (0...1) with which a change in units is tried during a schedule. |
| Sequence | The probability (0...1) with which a change in sequence is tried during a schedule. |
| Critical path | If a value greater than 0 (0...1) is parameterized here, the disposition orders are pulled up onto the critical path for optimization corresponding to the parameterized ratio. If, for example, 1 is parameterized, only disposition order on the critical path will be changed. |
| Earliest start | The probability (0...1) with which the minimum starting day of a group will be changed during crossover operations. |
| Priority | The probability with which the scheduled sequence of a machine will be randomly changed during mutation operations. |

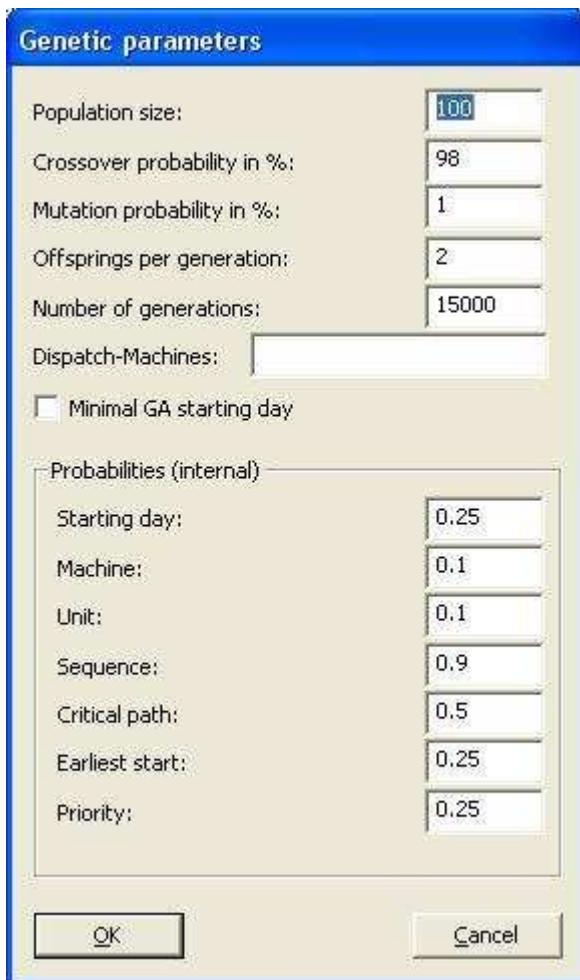


Figure 94: Genetic parameters

8.5.5 Interactive scheduling options

Interactive scheduling options enable the user to switch on and off supporting functionalities during manual scheduling. These options have no effect on the automatic scheduling algorithms.

8.5.5.1 Ignoring unscheduled disposition orders

SCHEDULING PARAMETERS – IGNORE UNSCHEDULED DISPOSITION ORDERS

Disposition orders are normally shown in color (in standard purple) if not all preceding disposition orders have been scheduled. If this option is activated, these disposition orders are shown as being normal and are colored in grey. This option is helpful if you first schedule your bottleneck machine-level which does not lie at the begin-

ning of the production chain. The order network does not additionally “skip” unscheduled disposition orders, if this option was activated. It is thus possible, for example, to only schedule the bottleneck aggregates, and to leave out non-critical or only very short-term scheduled aggregates in the order chain.

8.5.5.2 Parameter “Unscheduled disposition orders”

With this dialog, rough values can be fixed, which are not used in unscheduled disposition orders, so that overlapping conflicts with predecessors and successors can be determined. In order to use these values, the mode “Ignore unscheduled disposition orders” must be activated.

| | |
|--|--|
| Factor for minimum processing time | The shortest processing time of the production step is multiplied with this factor and thereby represents the processing time to be used for control of overlapping. |
| Minimum duration of an unscheduled production step | At least this time is used to calculate overlapping. |
| Maximum duration of an unscheduled production step | At most this time is used to calculate overlapping. |

8.5.5.3 Predecessor Snap

SCHEDULING PARAMETERS / PREDECESSOR SNAP

The predecessor snap sees to it that a disposition order is never scheduled earlier than what is allowed by the earliest starting time of the disposition order. If this option was activated, the disposition order to be scheduled jumps to the earliest place at which it can be scheduled error-free due to its predecessor situation.

Please note that shifting several disposition orders at once can have unexpected effects. Deactivate this function if you wish to shift more than one disposition order.

8.5.5.4 Building a chain

SCHEDULING PARAMETERS – BUILD CHAIN

If you activate this option, all gaps are closed for a scheduled or rescheduled disposition order for each re-scheduling for a machine. The sequence of the successive disposition orders is not changed. For this reason, it can happen that disposition orders are shifted to before their earliest start.

This function is most sensible for single-level scheduling.

8.5.5.5 Depositing only suitably

SCHEDULING PARAMETERS / DEPOSIT ONLY SUITABLY

If this function was activated, no later disposition order can be shifted for a machine to be scheduled through the scheduling of a disposition order. If this were the case, no deposition of the disposition order to be scheduled is possible.

8.5.5.6 Scheduling trace

SCHEDULING PARAMETERS / SCHEDULING TRACE

Activating this function generates statistics through the currently made decisions by the next automatic scheduling. With the help of these data, specially trained users can diagnose and solve problems with the automatic scheduling.

An example till the first scheduling of a disposition order:

```
*****
* Job dispatcher started. *
*****

New Next Start on Machine/Unit 1/0 at 2002-10-30 00:00:00: Defining Dispo = 60/1-5/1
New Next Start on Machine/Unit 2/0 at 2002-10-31 03:36:19: Defining Dispo = 100/1-6/1
New Next Start on Machine/Unit 10/0 at 2002-10-30 08:11:58: Defining Dispo = 55/1-4/1
New Next Start on Machine/Unit 11/0 at 2002-10-30 08:11:58: Defining Dispo = 55/1-4/1
New Next Start on Machine/Unit 20/0 at 2002-11-30 23:59:59: Defining Dispo = 0/0-0/0
New Next Start on Machine/Unit 21/0 at 2002-11-30 23:59:59: Defining Dispo = 0/0-0/0
New Next Start on Machine/Unit 30/0 at 2002-11-30 23:59:59: Defining Dispo = 0/0-0/0
New Next Start on Machine/Unit 31/0 at 2002-11-30 23:59:59: Defining Dispo = 0/0-0/0
Trying Machine/Unit 1/0 at 2002-10-30 00:00:00
Ignore on Machine/Unit 1/0: up to 2002-10-31 00:00:00, Dispo 100/1-6/1 Reason: violating dynamic min start
Ignore on Machine/Unit 1/0: up to 2002-10-31 00:00:00, Dispo 100/1-11/1 Reason: violating dynamic min start
Candidate Machine/Unit 1/0 at 2002-10-30 00:00:00, Dispo: 60/1-5/1 with Score=0,000000
Candidate Machine/Unit 1/0 at 2002-10-30 00:00:00, Dispo: 59/1-5/1 with Score=0,000000
Candidate Machine/Unit 1/0 at 2002-10-30 00:00:00, Dispo: 62/1-5/1 with Score=0,000000
Candidate Machine/Unit 1/0 at 2002-10-30 00:00:00, Dispo: 64/1-5/1 with Score=0,000000
Candidate Machine/Unit 1/0 at 2002-10-30 00:00:00, Dispo: 63/1-5/1 with Score=0,000000
Candidate Machine/Unit 1/0 at 2002-10-30 00:00:00, Dispo: 57/1-5/1 with Score=0,000000
Candidate Machine/Unit 1/0 at 2002-10-30 00:00:00, Dispo: 58/1-5/1 with Score=0,000000
Candidate Machine/Unit 1/0 at 2002-10-30 00:00:00, Dispo: 56/1-5/1 with Score=0,000000
Candidate found Machine/Unit 1/0 at 2002-10-30 00:00:00, Dispo: 60/1-5/1 with Score=0,000000
Scheduled Machine/Unit 1/0 at 2002-10-30 00:00:00, Dispo: 60/1-5/1
New Next Start on Machine/Unit 1/0 at 2002-10-30 21:09:50: Defining Dispo = 59/1-5/1
```

8.5.5.7 Tracing the machines that can be scheduled

SCHEDULING PARAMETERS – TRACE OF MACHINES THAT CAN BE SCHEDULED

Because of complex rules and, as the case may be, because of customizing, it can become difficult in some situations to ascertain why a disposition order cannot be scheduled. By activating this function, SimAL shows the machines that can be scheduled as well as the machines that cannot be scheduled with reasons for rejection (as far as they are communicated by the customization) for the disposition order selected in the pool.

Deactivate this mode as fast as possible after using!! Never start an automatic scheduling if this mode has been activated. It leads to huge amounts of outputs and furthermore to SimAL not reacting to your input because of this!!

8.6 The menu ERP Interface

Most of the functions that can be chosen in this menu in the schedule window match the counterparts of the same name, which can be chosen in the main menu ERP Interface (Chapter 6 [ERP Interface](#)).

The function ERP Interface itself behaves a little differently to its counterpart in the main menu: During an import from the main menu, even single erroneous import sets can be rejected. An import from the schedule window is, on the other hand, atomic in nature: If an erroneous import data set is found, the whole import is taken back. Please check that all other users cannot work within your opened schedule window during an import run.

8.6.1 PDA entry

The PDA entry dialog box is described in detail in Chapter 1 ([Production Data Acquisition \(PDA\)](#)).

8.6.2 Editing PDA messages

Editing of PDA messages is described in detail in Chapter 1 ([Production Data Acquisition \(PDA\)](#)).

8.6.3 Processing new PDA data

PDA processing of SimAL is started with this function. It is important that SimAL saves the current schedule at the end of the PDA management so that the processed PDA messages are not lost. SimAL always gives an indication of this condition. All PDA messages that were either newly recorded since the last processing or were communicated through the PDA import interface are processed, and the scheduling is corrected to the current actual status.

PDA processing is only possible in the base schedule (plan 0).

8.7 The Work plans menu

The functions that can be chosen in this menu in the schedule window exactly match those in the main menu and are described in Chapter 4 [Work plans](#).

8.8 The View menu

8.8.1 Predefined sorting of the pool

The first four menu entry of the View menu offer quick access to four predefined sorting operations of the pool.

| | |
|-----------------------------|---|
| According to ERP number | The disposition orders are shown sorted according to order number. |
| According to due dates | The disposition orders are shown sorted according to latest end and then according to earliest start. |
| According to similar orders | The disposition orders are shown sorted according to work schedule number in the pool. |
| According to stations | The disposition orders are shown sorted according to machines that can be scheduled. |

8.8.2 Filtering the pool

VIEW / FILTER

The disposition orders to be shown in the pool are restricted with this function. Using this function is similar to filtering lists (1.3.3.2 [Filtering](#)).

8.8.3 Setting pool columns

SCHEDULING PARAMETERS / SET COLUMNS

This functions helps set which attributes should be shown in the pool of the schedule window. Using this function is similar to setting columns in lists (Chapter 1.3.3.1 [Setting columns](#)).

8.8.4 Setting XML export columns

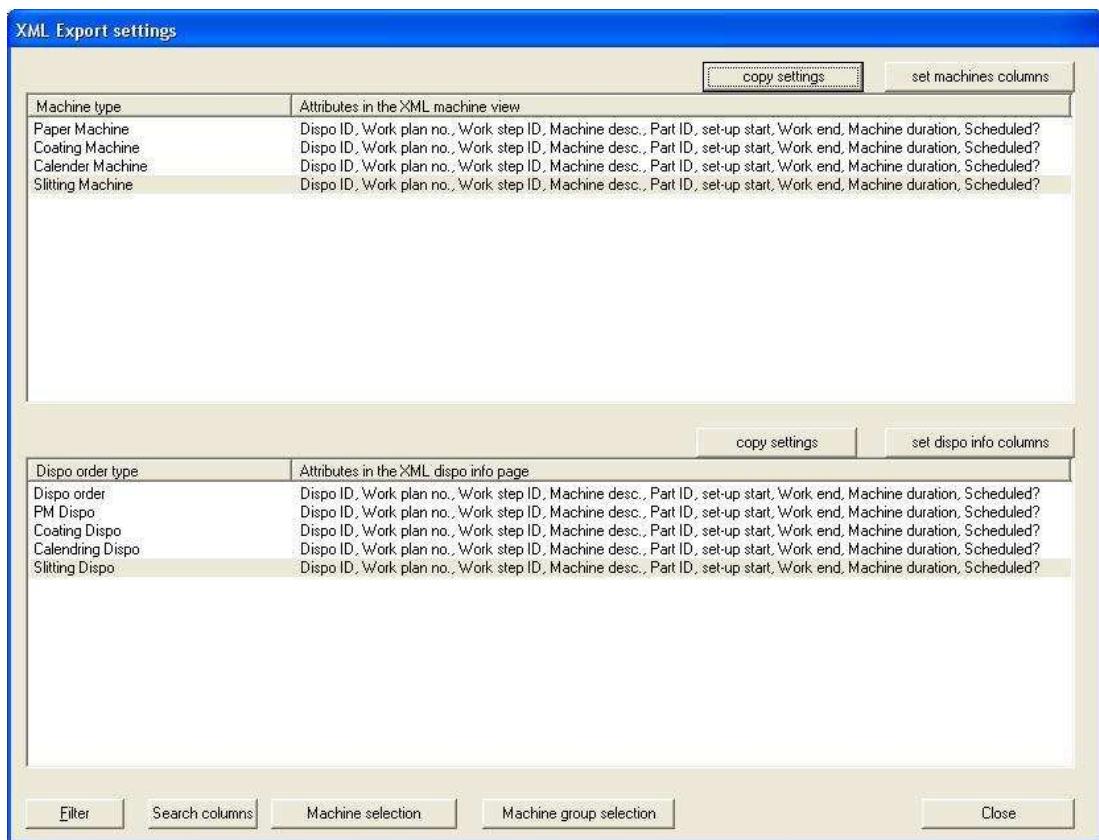


Figure 95: Setting XML export columns

With the help of this dialog box, the user can determine which attributes on the machine overview page and for the disposition order pages and search page are exported during XML export. The choice as well as the sequence must be separately fixed for

each machine class and disposition order class. The following functions are available:

| | |
|--------------------------|---|
| Set machine columns | Opens a dialog box for choosing attributes. The attributes of disposition orders for the selected machine class can be determined here. |
| Set dispo-info columns | Opens a dialog box for choosing attributes. The attributes of disposition orders for the selected disposition order class can be determined here. |
| Copy settings | Enables transferring the settings from one machine class or disposition order class to another. |
| Filter | Fixes the selection criteria for the XML export. Only disposition orders which fulfill these criteria are exported. |
| Search columns | A search page with all disposition orders is also generated during the XML export and the complete-text search function of a web-browser can be used. With this button, the attributes of the disposition orders to be exported for this search page are set. |
| Machine choice | Determine which machines are exported. |
| Choice of machine groups | Determine which machine groups are exported. These and the previous option are entered by the user, i.e. if a machine is additionally seen in another chosen group, it will be exported only once. |
| Close | Closes the dialog box and saves the settings. |

8.8.5 Setting CSV export types

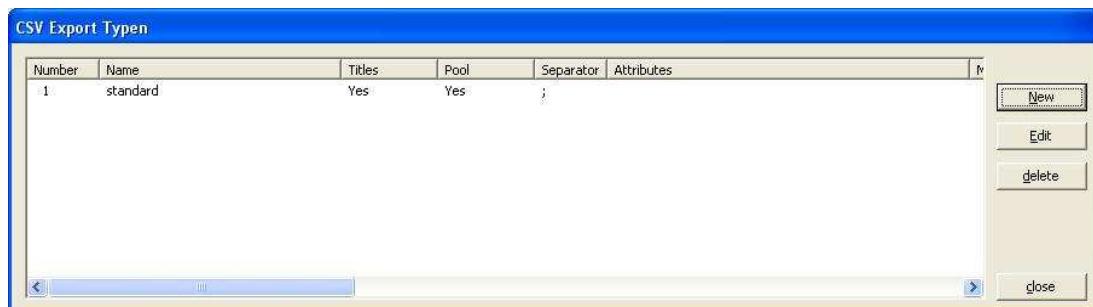


Figure 96: Setting CSV export types

With the help of CSV export types, you can create your own reports based on disposition order data and export these in the well-known CSV format or directly to Excel. Several different export types can also be predefined, which can then be accessed and used. The export types are managed with the help of the command buttons [New], [Edit] and [Delete].

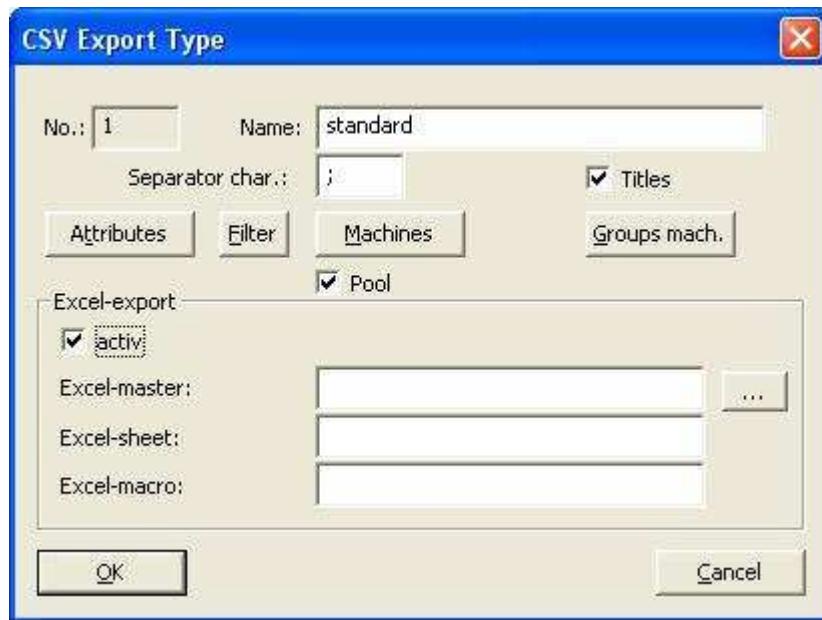


Figure 97: Setting CSV export type

Much information has to be prepared for each export type so that the export happens smoothly.

| | |
|-----------------------|---|
| Number | Unique number of the export type |
| Name | Name of the export type for the user |
| Separating character | The separating character between two attribute in an output row of the CSV file. |
| Attributes | Choose the attributes through this function and fix the sequence. |
| Filter | Fix the selection criteria. Only those disposition orders are exported which satisfy the filter conditions. |
| Machine/Machine group | Determine the machines to be exported. Only those disposition orders that have been scheduled for a chosen machine or machine group are exported. |

| | |
|---------------------|--|
| Pool | If this option is activated, unscheduled disposition orders are exported as well. |
| Excel export active | If this option is activated, the data are directly written into an Excel table. |
| Excel draft | This draft file is opened, data is written in it and it is saved under a new name. You may define definitions and macros in the draft file. |
| Excel table page | The data are written in this page. |
| Excel macro | This macro/VBA sub is carried out after writing of the data. Create your own macros in the Excel table, which further process the outputted data or create diagrams as well. |

8.8.6 Setting disposition order title

SCHEDULING PARAMETERS – SET DISPOSITION-ORDER TITLE

With this function, you determine which values are shown in the disposition-order bars in a scheduled state. Up to 25 different attributes can be represented. Choose the following

1. the attribute to be represented,
2. one or more separating characters, which are shown after the attribute (if you have chosen a multi-row representation of the disposition orders, you can perform a line break with the separating character sequence \n),
3. the maximum number of characters with which the attribute should be shown.

In order to no longer show a chosen attribute, click the command button [Delete rows]. The rows below move up by one row. To insert an attribute at a particular place, click [Insert row]. The settings are always carried out for all disposition orders of the same class. This class can be chosen with the combo box above the list. If the settings from another disposition order class are to be transferred, click [Copy settings]. You can choose the source class and destination class in the dialog box which subsequently opens.

The box Example shows how the title will look for a randomly chosen disposition order.

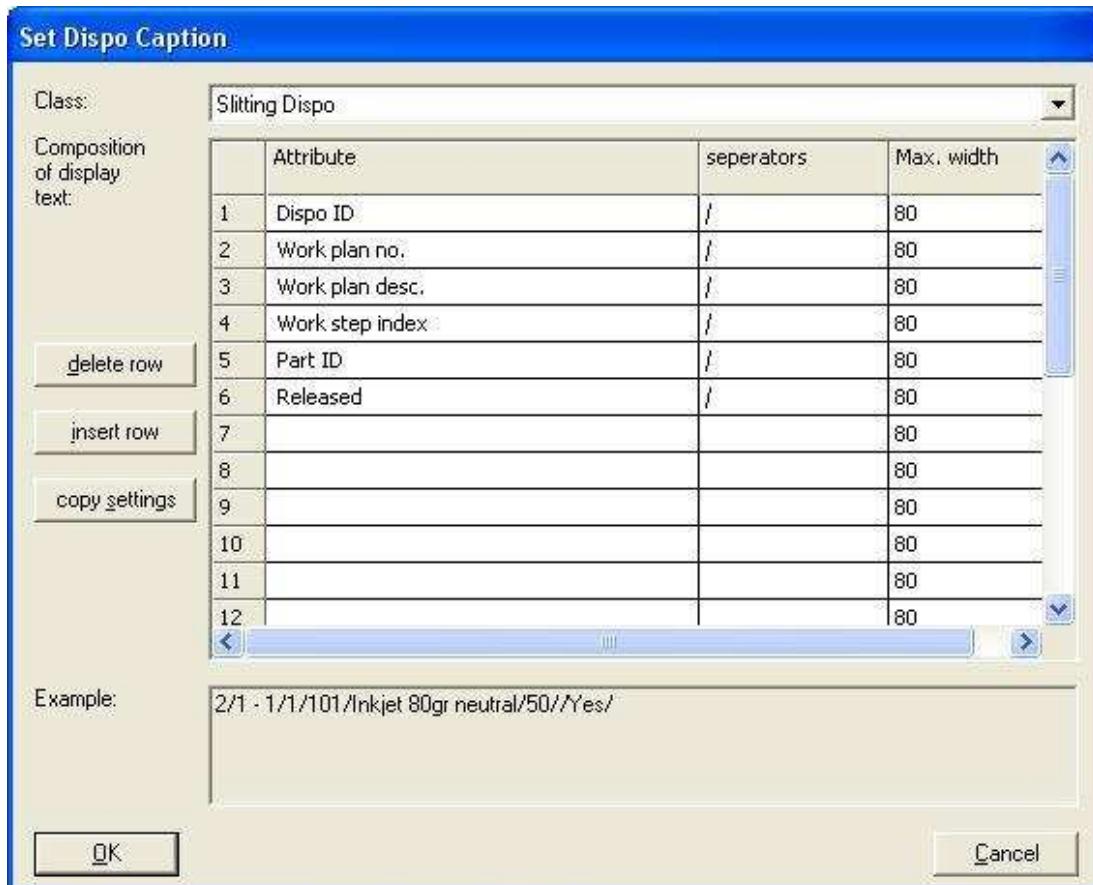


Figure 98: Setting disposition order title

8.8.7 Setting tip title

SCHEDULING PARAMETERS / SET TIP TITLE

This function helps decide which attributes appear in the tool tip. The tool tip is a yellow popup box, which appears when you let the mouse pointer hover for a moment over a scheduled disposition order bar.

Using this function is similar to Chapter 8.8.6 [Setting disposition order title](#).

8.8.8 Setting fonts

The functions available in this menu enable you to choose your own fonts for different titles. They are:

1. The title of the scheduled disposition orders
2. The title of machine names
3. The title of resource names

8.8.9 Wider dispo-info dialog

By activating this option, additional attributes are no longer shown below, rather to the right of the standard boxes. Activate this option when you have to see many non-standard attributes during your work.

8.8.10 Zoom

The functions in this menu support the user while navigating in the schedule. Functions to define the visible section (scroll functions) as well as functions to define size of the section (zoom function) are available.

8.8.10.1 Window

VIEW / ZOOM / WINDOW 

Using this function with the mouse enables interactively choosing a time range, which is then represented in the Gantt chart window or resource window. Choose the function in the menu or click the symbol in the toolbar or press the keys [Shift] + [F]. After this, drag a frame over the time range, which you would like to have enlarged.

8.8.10.2 Enlarging

VIEW / ZOOM / ENLARGE 

This function can be chosen in the menu, through the symbol or the keyboard combination [Shift] + [PgUp]; it enlarges the zoom of the active window.

8.8.10.3 Reduce

VIEW / ZOOM / REDUCE 

This function can be chosen in the menu, through the symbol or the keyboard combination [Shift] + [PgDown]; it reduces the zoom of the active window.

8.8.10.4 Selected

VIEW / ZOOM / SELECTED 

This function, accessible in the menu, through the symbol and [F4] sets the window section in such a way that all selected disposition orders are visible. It is a good aid while searching disposition orders (Chapter 8.4.25 [Searching disposition orders](#)).

8.8.10.5 Work area

VIEW / ZOOM / WORK AREA 

This function (also through [Shift] + [A]) completely switches off the zoom. The complete time section which you have given while opening the schedule is then visible.

8.8.10.6 Row

You can move the current section through the schedule with the entries in this menu. Easier than the menu is with the arrow keys on the keyboard, for which the Shift key must be kept pressed.

8.8.10.7 Page

This function enables navigating with the arrow keys, for which the Ctrl key must be kept pressed. Navigation is then performed in larger steps.

8.8.11 Row height

VIEW / ROW HEIGHT

This function enables setting the row height of a machine row or resource row in pixels.



Figure 99: Setting the row height

8.8.12 Setting begin of day

SimAL normally draws a vertical line on every day at midnight (0:00; with corresponding zoom level). When your days usually start at another time, you can fix it with this function. The vertical line is then drawn at the parameterized time (for example, 6 a.m.).

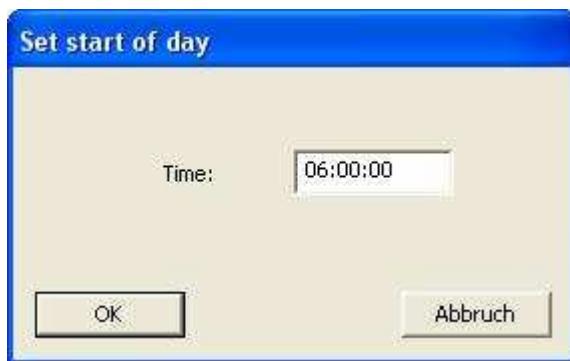


Figure 100: Setting begin of day

8.8.13 Draw order network

VIEW / DRAW ORDER NETWORK

This function activates and deactivates the order network in the Gantt chart window. It can be performed faster with the function key [F7].

8.8.14 Order network of only predecessors and successors

The order network is normally drawn for all disposition orders that are connected with the selected disposition orders in some way. For large and complex order networks, this may look confusing. Activate this function, which only draws the network of the predecessors and successors of the selected disposition orders.

8.8.15 Flagging

If you work often with markings on disposition orders, you will have the problem of not being able to recognize markings very well at smaller zoom levels. Activate this option in the menu or with the function key [F11]. Each marking is then clearly visible as a flag shown on the disposition order.

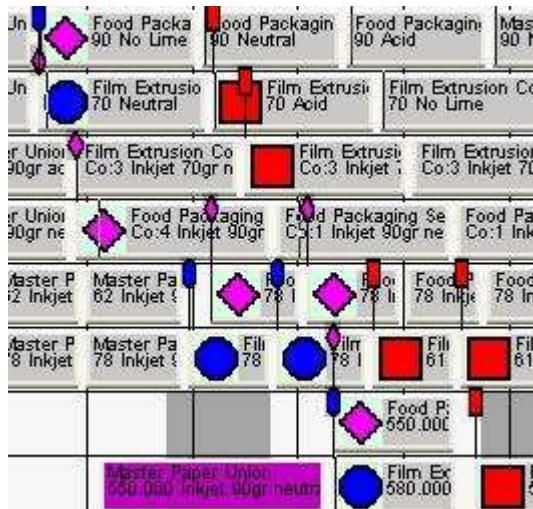


Figure 101: Flagging

8.8.16 Machine display options

If your schedule has many machines, it is sensible to limit the displayed machines from time to time to the relevant ones.

| | |
|--------------------------|---|
| Show all machines | This function removes the display limits. All machines of the opened view are always visible. |
| Show settable machines | By selecting a disposition order, the displayed machines are reduced to the quantity for which the selected disposition order can be scheduled. |
| Show machines in context | By selecting a disposition order, the displayed machines are reduced to the quantity for which a disposition order of the ERP order can be scheduled. |

8.8.17 Selected disposition orders as a list

VIEW / SELECTED DISPOSITION ORDERS AS LIST

Selected disposition orders are often scattered in terms of time in the schedule, particularly after a search function. To create a tabular overview of the selected orders, this function can be activated, which can also be performed through [Ctrl] + [F4].

| Dispo ID | Work ... | Work ... | set-up start | Work end | Utiliz... | S... |
|-------------|----------|----------|---------------------|---------------------|-----------|------|
| 29/1 - 6/1 | 104 | 1 | 17.04.2007 00:01... | 17.04.2007 00:39:46 | | |
| 29/1 - 11/1 | 101 | 1 | 17.04.2007 00:10... | 17.04.2007 00:19:14 | | |
| 29/1 - 5/1 | 104 | 2 | 17.04.2007 00:02... | 17.04.2007 02:14:01 | | |
| 29/1 - 4/1 | 104 | 3 | 17.04.2007 00:13... | 17.04.2007 00:19:47 | | |
| 29/1 - 10/1 | 102 | 2 | 17.04.2007 02:14... | 17.04.2007 02:29:43 | | |
| 29/1 - 10/1 | 101 | 2 | 17.04.2007 04:29... | 17.04.2007 04:41:08 | | |

Figure 102: Selected disposition orders as a list

8.8.18 Status bar

VIEW / STATUS BAR

This function shows or hides the status bar.

8.8.19 Toolbar

VIEW / TOOLBAR

This function shows or hides the toolbar.

8.8.20 Refreshing/Synchronizing

VIEW / REFRESH/SYNCHRONIZE

If several SimAL users are working on the same schedule, the changes are communicated between the opened schedule windows. Thus, a check is performed before every function, whether the changes of other users are to be processed first. In addition to this, a check is performed every 5 minutes for new information. If you want the refreshing to be performed more frequently, choose this function in the menu, through the symbol or with [F5].

8.9 Working with several schedule windows

You can work with several windows in SimAL at the same time and thereby avoid the cumbersome zooming in and out, what would be unavoidable in just one window. You can thus, for example, view an overview of the complete scheduling in one window while the fine scheduling for a day or a week can be carried out in another window. Each window can be iconized and can be switched between window and full-screen mode as well.

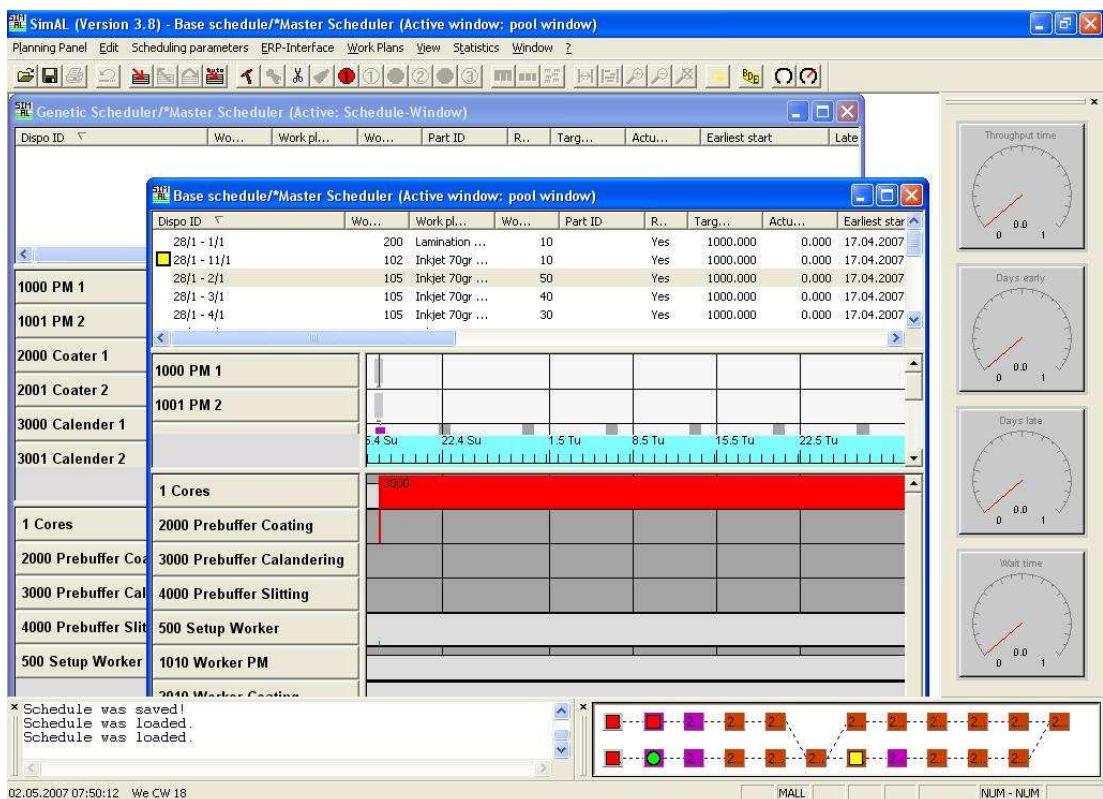


Figure 103: Working with several windows

After you have opened a schedule window (Chapter 7.2 [Opening the schedule window](#)), it is shown in a window. To open another schedule window, perform the menu sequence WINDOW / NEW WINDOW. To change between the two windows, either click the desired window or click the main-menu entry WINDOW and choose the desired window from the list by clicking it. You can alternatively change windows by keyboard; for example, [Alt] + [F] [1] for window 1, [Alt] + [F] [2] for window 2 and so on.

There are also three further entries in the menu which help in ordering the windows in the work area:

| Menu entry | Meaning |
|---------------|--|
| OVERLAPPING | All opened windows that are <u>not</u> iconized are shown in their standard size and cascaded on the screen. |
| TILE | All opened windows that are <u>not iconized</u> are ordered on the screen in the same size each. |
| ORDER SYMBOLS | All <u>iconized</u> windows are ordered at the bottom edge of the work screen. |

It is not possible to schedule disposition orders from the pool of one window into the graphic schedule window of another window!

More than one window of the same schedule cannot be opened, though it is possible to view several schedules at the same time!

8.10 The Statistics menu

The evaluation functions in this menu are identical to those described in Chapter 1 [Statistics](#). When they are accessed from the schedule window, the user can additionally decide whether the data should be taken from the current or last-saved schedule.

8.10.1 Calculating KPI values

STATISTICS / CALCULATE KPI VALUES 

The pointer in the KPI window is updated with this function (Chapter 8.1.6 [The KPI window](#)). The same function can be performed with [F9].

8.10.2 Accepting KPI comparison values

STATISTICS – ACCEPT KPI COMPARISON VALUES 

This function sets the background of the elements viewed in the KPI window (Chapter 8.1.6 [The KPI window](#)) in such a way that the actual position of the pointer is still

recognizable if new KPI values were calculated. KPI values can thus be saved at a starting point and then compared anytime later to see in what dimensions you have improved the scheduling.

8.11 The Window menu

There are diverse functions in this menu to show and hide different window types as well as to manage the schedule window and statistics window.

8.11.1 Order graph

WINDOW / ORDER GRAPH

Shows or hides the window with order graphs (Chapter 8.1.5 [The order graph window](#)).

8.11.2 Message window

WINDOW / MESSAGE WINDOW

Shows or hides the window with text messages (Chapter 8.1.4 [The message window](#)).

8.11.3 KPI window

WINDOW / KPI WINDOW

Shows and hides the window with Key Performance Indicators (Chapter 8.1.6 [The KPI window](#)).

8.11.4 New window

WINDOW / NEW WINDOW

Creates a new window for the currently opened schedule. Dragging of disposition orders between the windows is not possible.

8.11.5 Overlapping

WINDOW / OVERLAPPING

Orders the windows in an overlapping manner.

8.11.6 Over each other

WINDOW / OVER EACH OTHER

Orders the windows over each other.

8.11.7 Ordering symbols

WINDOW / ORDER SYMBOLS

Orders the iconized windows.

8.12 The Help ? menu

The Help menu offers access to the help system of SimAL (in online format in this manual) with a comfortable search function.

8.12.1 Help

This function calls the Help function. The help directory is shown in the tree. If you click the tab, you can enter a key word and Help lists out all chapters which contain the word entered. Hyperlinks are shown in blue.

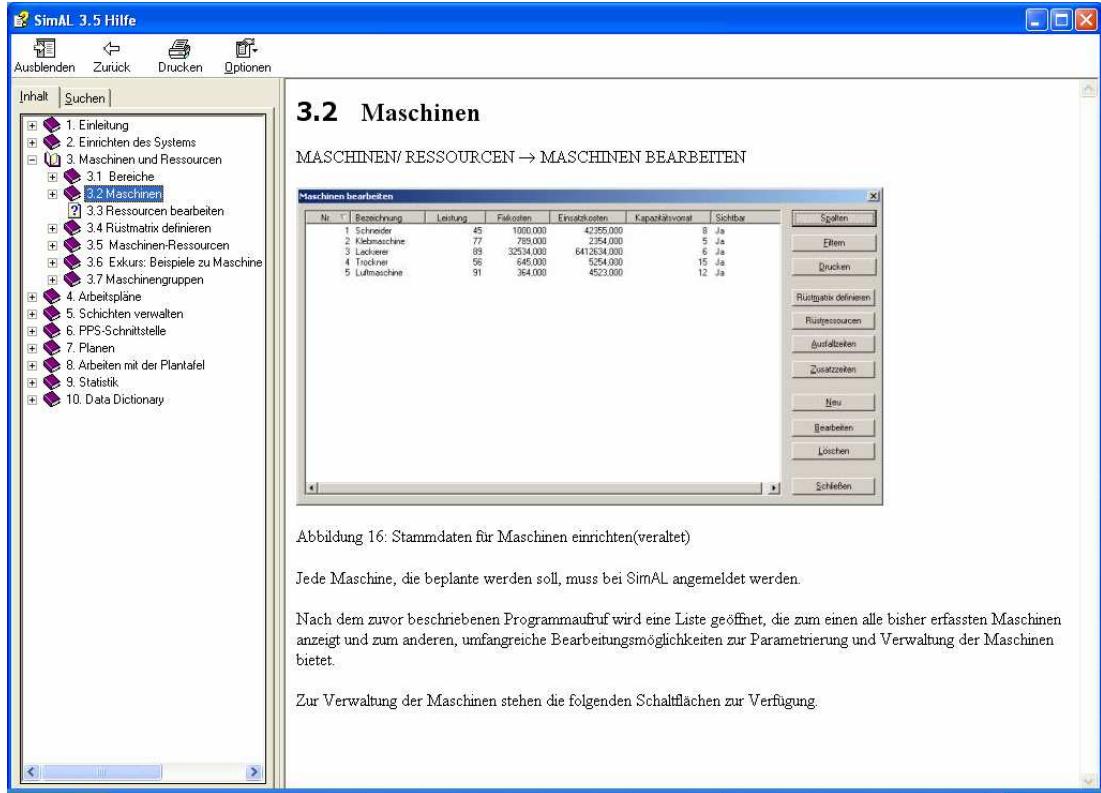


Abbildung 16: Stammdaten für Maschinen einrichten(veraltert)

Jede Maschine, die beplant werden soll, muss bei SimAL angemeldet werden.

Nach dem zuvor beschriebenen Programmaufruf wird eine Liste geöffnet, die zum einen alle bisher erfassten Maschinen anzeigt und zum anderen, umfangreiche Bearbeitungsmöglichkeiten zur Parametrierung und Verwaltung der Maschinen bietet.

Zur Verwaltung der Maschinen stehen die folgenden Schaltflächen zur Verfügung.

Figure 104: Information about SimAL

8.12.2 Information about SimAL

? / INFORMATION ABOUT SIMAL

This function shows a dialog box with version information.

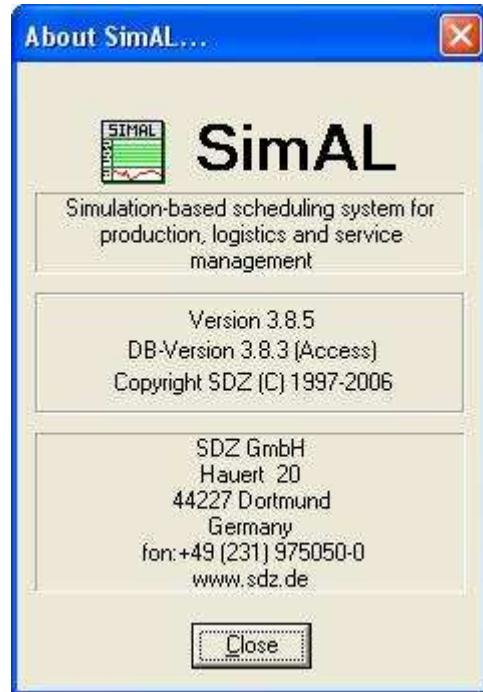


Figure 105: Information about SimAL

8.13 Color management

MASTER DATA / COLOR MANAGEMENT

In order for the planner to immediately recognize critical phases in the scheduling and react accordingly, scheduled disposition orders are represented as a rectangle, colored differently based on the status. The positioning and length of the rectangle is determined by the set-up starting time and duration of the disposition order. The set attribute values are shown in the rectangle to identify the disposition order. So that you don't need to zoom in till the information is readable, a yellow info-box (Tooltip) with attribute values is shown when the mouse pointer hovers over the disposition order for longer than one second. The info-box disappears as soon as the mouse is moved or a mouse button is clicked.

The pre-defined color settings can be changed and another color can be chosen. You have to perform the menu sequence **MASTER DATA / COLOR MANAGEMENT** when the schedule window is **not open**.

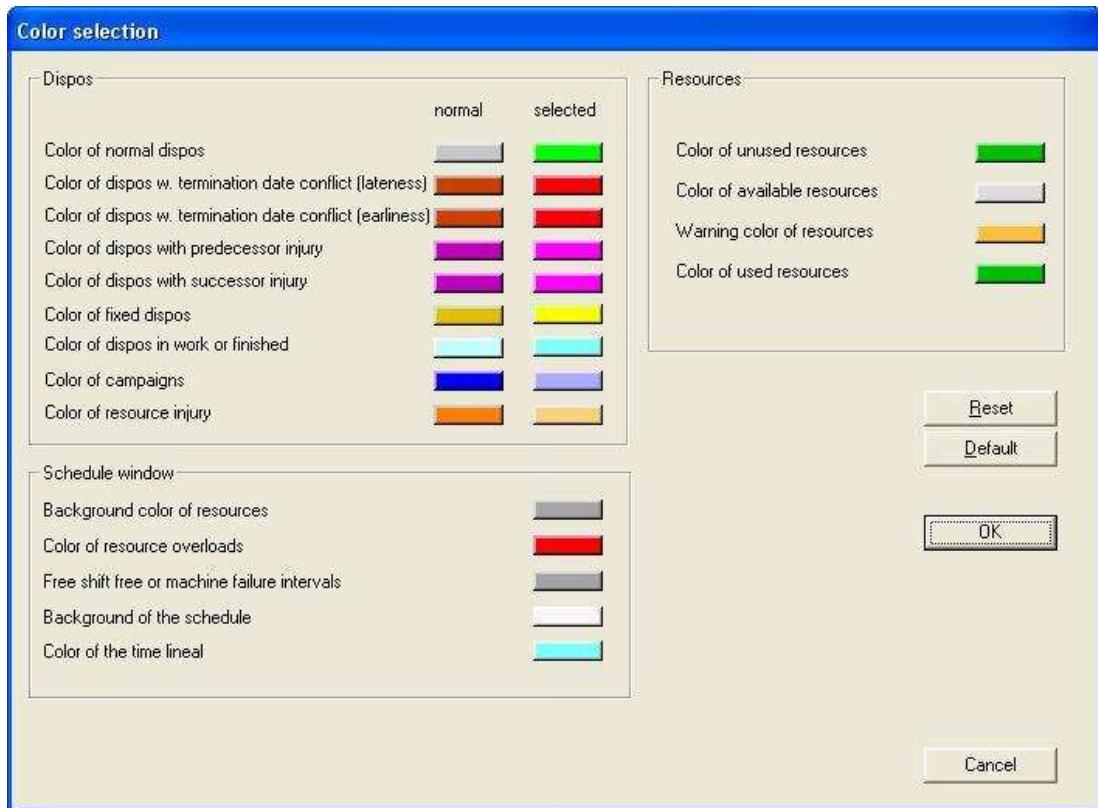


Figure 106: Color management window

Figure 106 shows the color management window. Clicking a color opens the color pad and you can choose the desired color. The change is accepted by clicking [OK] in Figure 106 while [Cancel] cancels any changes. Please note that color settings are applicable for all users of SimAL.

9. Production Data Acquisition (PDA)

ERP INTERFACE / PDA ENTRY

ERP ORDER / PDA ENTRY

Production usually varies from scheduling due to particular events. In order to synchronize the scheduling state with the actual condition of production, PDA messages are used in SimAL. In this context, PDA messages are times or quantities that change the status of a disposition order. Typical examples would be

- *Begin of work*
- *End of work, Produced quantity = 1000 pieces*

PDA messages can either be imported from a PDA system or recorded through different dialogs in SimAL. Even a mixed mode (*some machines automatically create PDA messages (MDA), others are entered in SimAL*).

The processing of PDA messages is a step separated from their recording and is carried out in the schedule window. One of the consequences of this is that a machine operator, who is supposed to record PDA messages, requires no access to the schedule window.

Recording of PDA messages in SimAL is carried out either

- Order-oriented or
- Machine-oriented.

The machine-oriented PDA dialog box was developed to run on a PC next to the machines (thus with quick access by the worker). The order-oriented PDA dialog box was optimized for a later input (works note down messages on paper, which are recorded later). The dialog box opened for the PDA entry is defined by the global options (Chapter 6.7 [Setting options](#)).

9.1 Machine-oriented PDA entry

SCHEDULE WINDOW / PDA ENTRY

This entry dialog box was optimized to be directly used by a machine operator. At the beginning of work, the worker opens the dialog box and chooses his machine. All disposition orders that can be produced on this machine are shown in the disposition order list. Clicking on the column head sorts the disposition orders such that they

match with the scheduled sequence of the chosen machine. If the worker begins with setting up or with his work, or if he ends his work, he must promptly activate the proper command button so that a PDA message is generated. The box Reporting time automatically runs with the system clock of the PC.

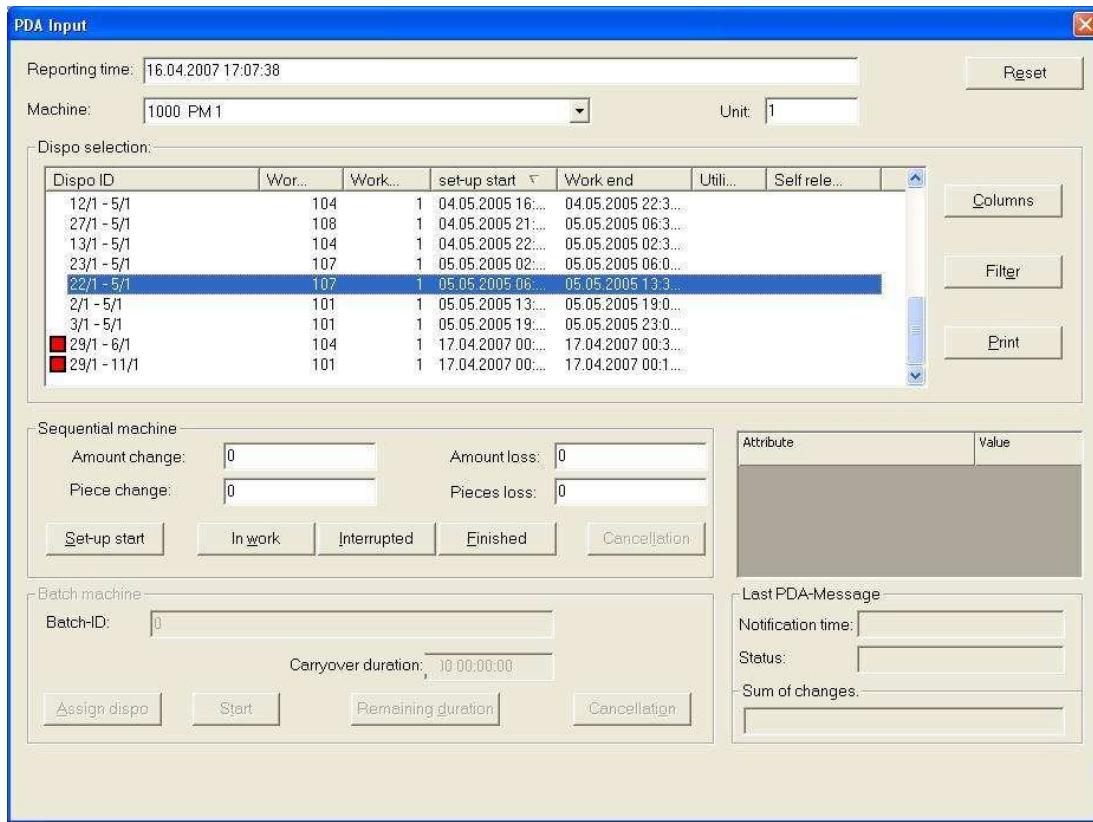


Figure 107: Machine-oriented PDA entry

If the reporting time was some time ago, then an entry can be made in the box Reporting time.

| | |
|-------------------|---|
| Machine | The machine on which production was carried out |
| Units | The units on which production is carried out |
| Reporting time | Time relevant for the PDA message to be entered |
| Disposition order | Choose the disposition order for which a PDA message is to be entered. |
| Last PDA message | Details of the last PDA message are shown in this box depending on the selected disposition order. Even PDA messages that were not yet processed are considered, so that the user has an easier control on the condition of the disposition |

| | |
|--|--------|
| | order. |
|--|--------|

Clicking the command button [**Reset**] resets all the text boxes to their default values.

Depending on whether the chosen disposition order was scheduled for a batch machine or non-batch machine (sequential machine), the respective window area is activated (see Chapter 3.2.1 [Creating a machine](#) for more on sequential/batch machines).

9.1.1 Sequential machine

The newly produced quantity/pieces since the last message are entered in this area as well as the rejected quantity (quantity or piece shortage) since the last message. Clicking the respective command button defines the new condition of the disposition order.

| | |
|---------------------------|--|
| [Set-up start] | With this command button, it is indicated that the set-up has begun. Set-up automatically ends at the beginning of processing time. |
| [Work in progress] | Progress of the work is reported with this command button. The text boxes to be changed are the new quantities/pieces since the last PDA entry for this disposition order. |
| [Interrupted] | With this message, it is communicated that the work on this disposition order was stopped. The disposition order is split with the currently reported quantity from the PDA message. The quantity produced until now remains on the machine. The split remaining quantity is placed in the pool during the PDA processing and must be scheduled again. |
| [Finished] | The quantity given is added to the actual quantity/pieces; the disposition order is completed and is then in the condition “finished”. PDA messages can also be recorded for disposition orders reported as being finished. |
| [Cancellation] | The disposition order is brought to a state as if it had never given a PDA message (actual quantity/pieces = 0, Status = Normal). This function is however not an undo function! The disposition order is not reset to the place (machine or pool) at which it was before the first PDA message through the cancel- |

| | |
|--|-----------------|
| | lation message. |
| Before activating a command button, please check whether the time in the box Reporting Time matches the required time. | |

9.1.2 Batch machine

In case a machine has been defined as a batch machine (Chapter 3.2.1 [Creating a machine](#)), the area for batch machines is active after choosing the disposition order.

While only one disposition order can be scheduled at a time for a machine for sequential machines, batches are groupings of several orders, which should be handled as one unit during production. When releasing a batch for production (Chapter 8.3.6 [Releasing for production](#)), all disposition orders in this batch are given the same PDA batch ID. This PDA batch ID is thus a unique reference about PDA messages, for which the batches are recorded.

| | |
|------------------|---|
| [Assign] | With this command button, a disposition order can be assigned to another batch. Choose the disposition order, enter the new batch ID and then click [Assign]. This disposition order is then assigned to this batch for PDA processing. |
| [Start] | The reporting time is saved as the starting time for the batch. |
| [Remaining time] | The remaining processing time from the point of the reporting time onwards is transferred in this way. If a batch is finished, this can be done with the message [Remaining time] and a remaining processing time of 0. |
| [Cancel] | All PDA messages for the disposition orders in the batch are cancelled. |

9.2 Order-oriented PDA entry

Order-oriented PDA entry is activated in the in the global options (Chapter 6.7 [Setting options](#)). It has been conceived in such a way that the input is very easy with an available job list which has comments such as the time of production completion and the produced quantity.

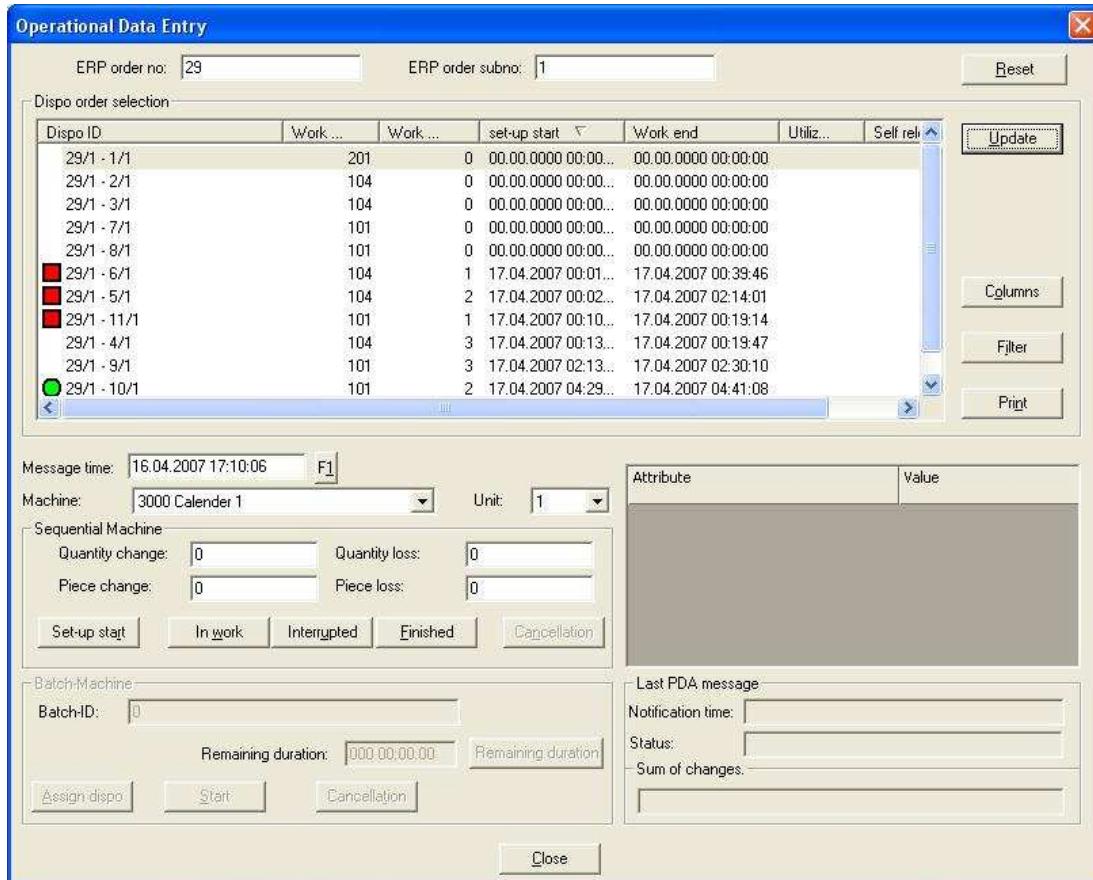


Figure 108: Order-oriented PDA entry

Entry of messages here is the same as for machine-oriented PDA entry (Chapter 9.1 [Machine-oriented PDA entry](#)), only choosing the disposition orders is carried out differently.

To choose a disposition order, first enter the ERP-order number and the Part-order number of the disposition order, for which the messages should be recorded. When leaving the text box for the Part-order number, the disposition order list is updated. All disposition orders of this ERP order are shown. Choose the corresponding disposition order here.

The rest of the dialog box functions the same as in machine-oriented PDA entry.

This dialog box was optimized for an entry only with the keyboard. Start in the box ERP-order number and press the Tab key after each entry till the cursor is in the correct box. The display is automatically updated. After saving a PDA message, the cursor automatically jumps back to the box ERP-order number.

9.3 Processing a new PDA message

ERP INTERFACE – PROCESS NEW PDA MESSAGE

All PDA messages entered are stored in the database and do not affect the schedule at this point. Processing of the PDA message is necessary to do so.

While processing PDA messages, the disposition orders are corrected according to the message contents. Any missing data is included based on the schedule data. For example, if you only report the production completion time and the produced quantity, SimAL automatically calculates the set-up start and production start from this.

PDA messages are processed in the sequence of their reporting time. Conflicting messages cannot be processed in some circumstances and cause an error message output in the message window (Chapter 8.1.4 [The message window](#)).

PDA processing can be automatically carried out while opening the base schedule, if this has been fixed in the global options (Chapter 6.7 [Setting options](#)).

9.4 Editing/setting up/deleting a PDA message

ERP INTERFACE / EDIT PDA MESSAGE

ERP ORDER – EDIT PDA MESSAGE

Editing of PDA messages is to correct wrong entries as well as to check and correct PDA messages imported by the interface.

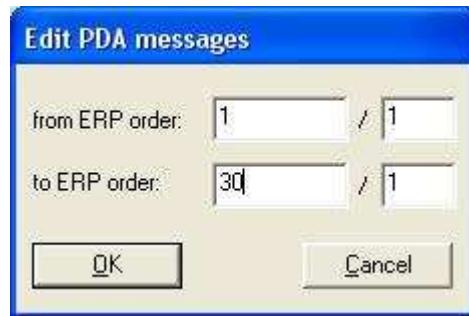


Figure 109: Defining the number range for PDA messages

After performing the menu sequence shown above, a dialog box in Figure 109 is shown. The range of the messages to be shown has to be defined in this box. After you have entered a valid range, the dialog box in Figure 110 is opened.

The dialog box is titled 'PDA messages'. It contains a table with the following data:

| PD... | Message time | ER... | ER... | Dis... | Spli... | Ma... | Ma... | Qu... | Pie... | PDA stat |
|-------|---------------------|-------|-------|--------|---------|-------|-------|-------|--------|-----------|
| 1 | 16.04.2007 17:11:47 | 29 | 1 | 3 | 1 | 3001 | 0 | 0.000 | 0.000 | Setup sta |
| 2 | 16.04.2007 17:11:52 | 29 | 1 | 11 | 1 | 1000 | 0 | 0.000 | 0.000 | Setup sta |

To the right of the table is a toolbar with buttons for 'Columns', 'Filter', 'Print', 'Zwischenablage', 'New', 'Edit', 'Delete', and 'Close'.

Figure 110: List of PDA messages

PDA messages can be edited, created or deleted in this dialog box. All the PDA messages already created that lie within the entered range are shown (including the cancelled PDA messages).

9.4.1 Creating a new PDA message

Clicking [New] in the dialog box shown in Figure 110 creates a new message. This action should only be carried out by well-trained users or by system administrators. To actually enter a PDA message, the user may refer to the following already de-

scribed dialogs (Chapter 9.1 [Machine-oriented PDA entry](#) and Chapter 9.2 [Order-oriented PDA entry](#)).



Figure 111: Choosing PDA message type

With the help of a dialog box, you must first decide what type of PDA message is being dealt with:

- A message for a sequential machine (non-batch machine) or
- A batch machine (PDA message Batch)

9.4.2 Editing a PDA message

Saved PDA messages can be changed by clicking [Edit] (whether they have already been processed or not).

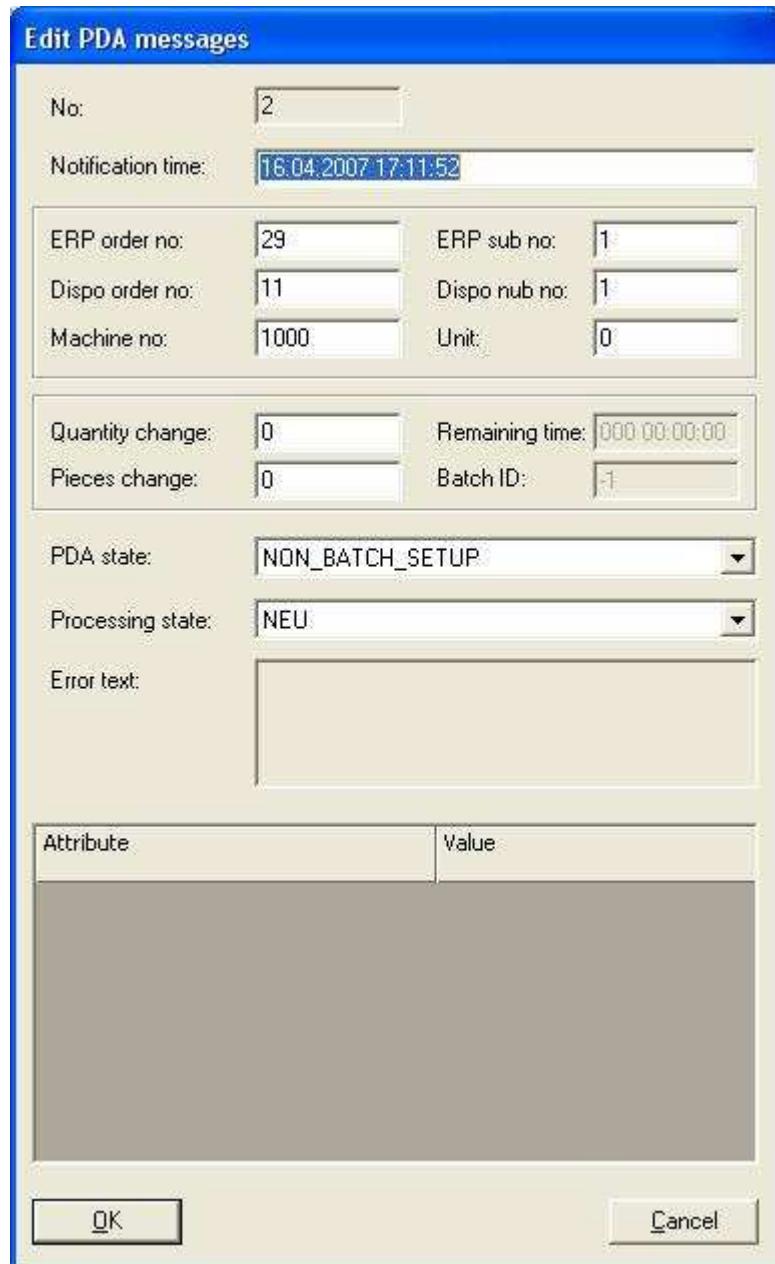


Figure 112:PDA message for a sequential machine

Through the dialog box shown above, you can directly edit the individual boxes of the PDA message. No checks of consistency are performed. Clicking [OK] saves the edited PDA message. [Cancel] cancels the editing.

The PDA status is to be chosen through a system name. The statuses NON_BATCH_WORK, NON_BATCH_INTERRUPT and NON_BATCH_FINISHED correspond to the statuses Work in progress, Interrupted and Finished (Chapter 9.1.1 [Machine-oriented PDA entry](#)) respectively.

The processing status shows whether and with what level of success the PDA message was processed. (Chapter 9.3 [Processing a new PDA message](#)).

The status NEW only says that the PDA message was newly created or imported and has not yet been processed. If there is an error while processing, the processing status is set to ERROR and the error message is shown in the box Error message. For an error-free processed PDA message, the status is set as PROCESSED.

9.4.3 PDA message (Batch)

Edit PDA messages

| | | | |
|---|---------------------|-----------------|--------------|
| No: | -1 | | |
| Notification time: | 16.04.2007 17:14:27 | | |
| ERP order no: | -1 | ERP sub no: | -1 |
| Dispo order no: | -1 | Dispo sub no: | -1 |
| Machine no: | -1 | Unit: | 0 |
| Quantity change: | 0 | Remaining time: | 000 00:00:00 |
| Pieces change: | 0 | Batch ID: | -1 |
| PDA state: | BATCH_SET | | |
| Processing state: | NEU | | |
| Error text: | | | |
| Attribute | Value | | |
| <input type="button" value="OK"/> <input type="button" value="Cancel"/> | | | |

Figure 113: PDA message for a batch machine

The differences between the editing dialog box of a PDA message and a PDA message (Batch) are that

1. the corresponding text boxes for PDA messages are activated.
2. Batch-PDA statuses can be chosen. For the PDA status, the statuses BATCH_SET, BATCH_START and BATCH_REMAIN correspond to the statuses Assign, Start and Remaining time from Chapter 9.1.2 [Batch machine](#).

9.5 Deleting a PDA message

Clicking the command button in Figure 110 permanently deletes the chosen PDA message. Please note that even processed PDA messages can be once again used by SimAL. This happens when a ERP order is changed in such a way that the disposition orders of this ERP order have to be created newly.

10. Statistics

With the help of statistical evaluation functions, it is easily possible to create numbers and diagrams with reference to a schedule. SimAL recognizes several different types of statistics that can also be saved and reopened. The data which is the basis of the statistics can additionally be exported as CSV files and then inserted later in tabular calculations..

Using the statistics is divided into a parameter dialog dependent on the statistic type and a menu for optical layout, that is however identical for all statistics.

10.1 Loading statistics

STATISTICS / LOADING

The loading statistics evaluate how heavily the machines have already been scheduled through disposition orders. Unlike utilization statistics, a machine is considered as 100% loaded as soon as a disposition order has been scheduled for some unit of the machine.

To create the diagram, the parameter dialog box shown in Figure 114 is opened. The schedule to be evaluated, the time range and the machines/machine groups to be evaluated have to be defined. Clicking [OK] calculates the statistics and the diagram is opened.

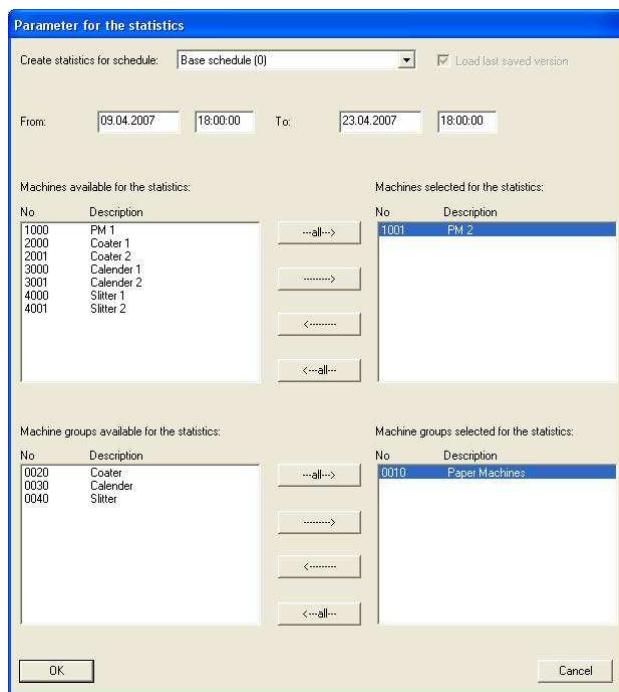


Figure 114: Parameters for loading statistics

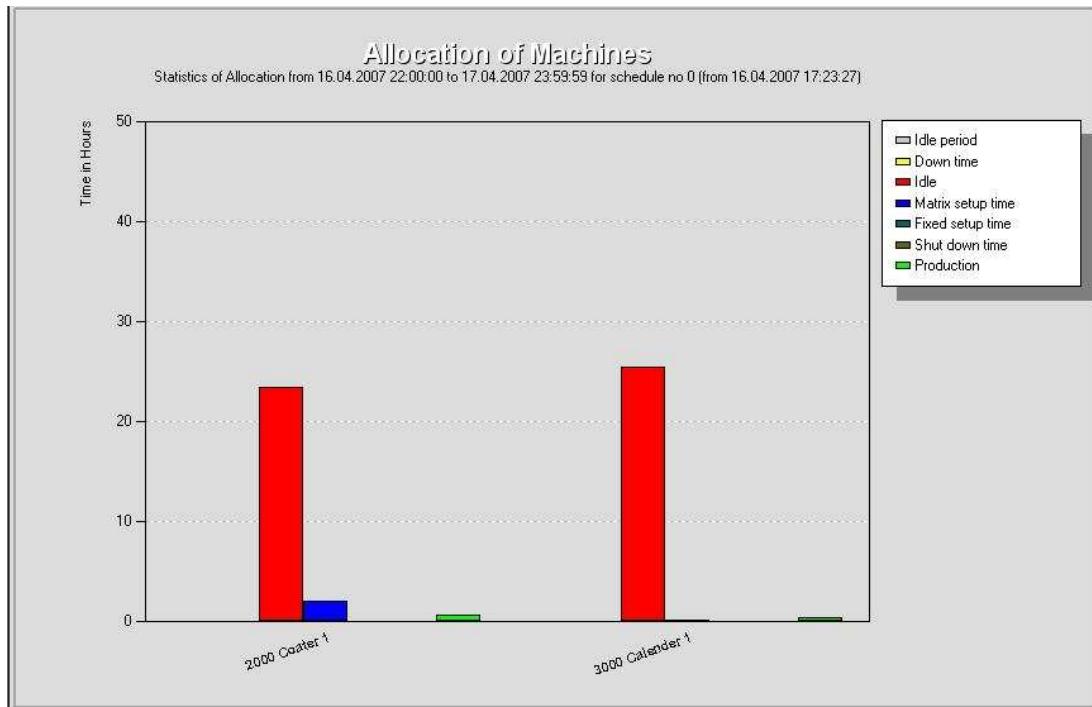


Figure 115: Loading statistics

The figures shown are calculated as follows:

| | |
|--------------------|---|
| Shift-free | The sum of the times that are defined as production-free through the shift model fixed by the timetable. |
| Breakdown | The sum of times that are defined as machine-breakdown time. |
| Free capacity | Machine time not yet loaded that is neither shift-free nor that has had a breakdown. |
| Matrix set-up time | The sum of the sequence-dependent set-up times that are determined from the set-up class and set-up matrix. |
| Fixed set-up time | The sum of set-up times that were parameterized in the processes. |
| Production | The net processing time (without shift-free and breakdown times) of the scheduled disposition orders. |

10.2 Utilization statistics

STATISTICS / UTILIZATION

Utilization statistics deliver the same results as loading statistics for single-purpose machines (Chapter 10.1 [Loading statistics](#)). The loading rate of the machine through the scheduled disposition orders with the help of the Max. Loading Quantity (Chapter 3.2.1 [Creating a machine](#)) and machine-loading (Chapter 4.1 [Creating work plans](#)) is determined only for multi-purpose machines. The determined percentage usage rate of the machines is then called up for calculation of statistics. The parameter dialog box and representation are just like in loading-statistics.

10.3 Resource statistics

STATISTICS / RESOURCES

Resource statistics ascertain the availability as well as the utilization of resources. Choose the schedule to be evaluated as well as the resources to be evaluated for this purpose.

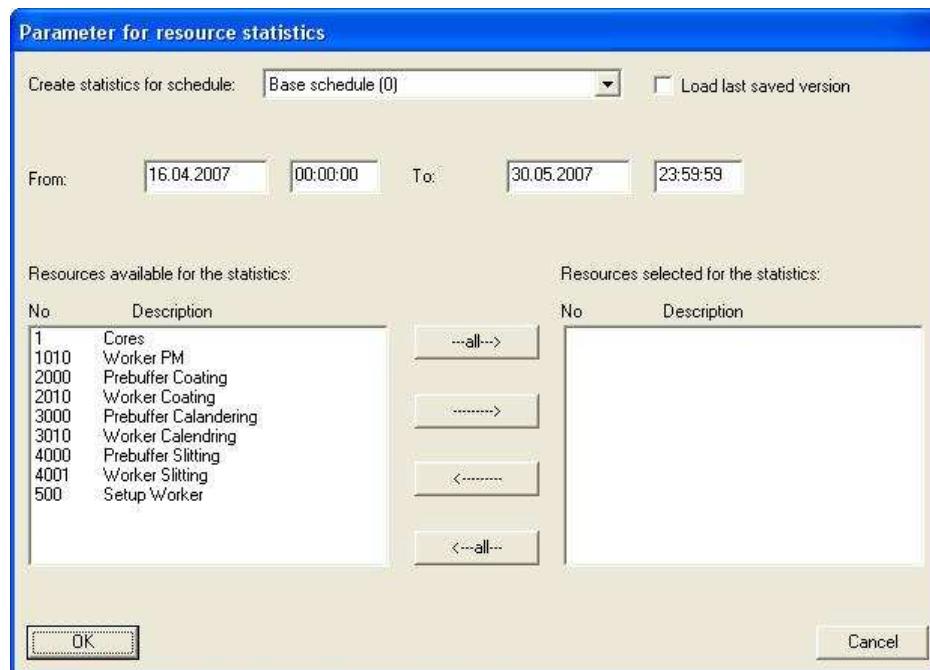


Figure 116: Parameters for resource statistics

The results are represented with the help of the following five categories for each resource:

| | |
|---------------|--|
| Used capacity | The resource was loaded for this many units-hours. |
|---------------|--|

| | |
|------------------|---|
| Usable capacity | The resource was available for this many units-hours according to the shift model. |
| Overcapacity | The used capacity beyond the usable capacity. |
| Under-capacity | The capacity that was usable but never loaded. |
| Maximum capacity | The stock-hours parameterized in the resource (Chapter 3.3 Editing resources). |

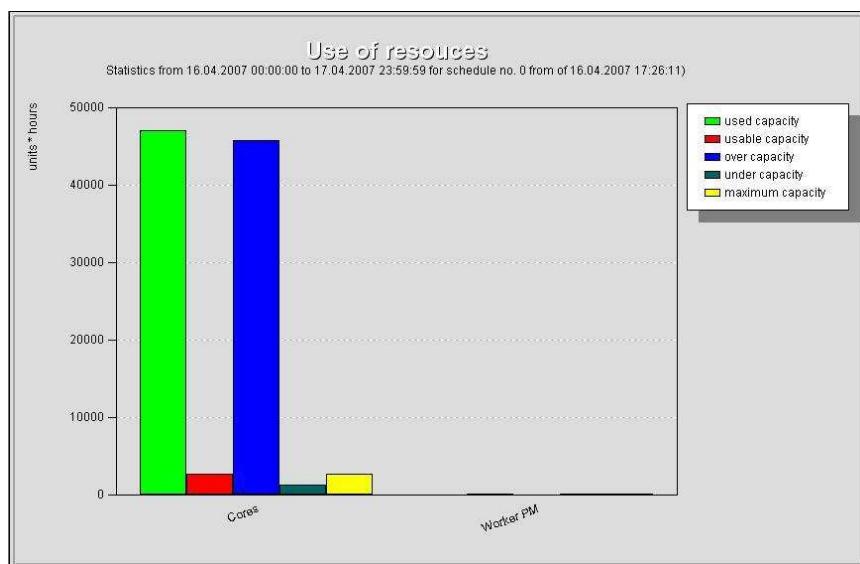


Figure 117: Resource statistics

10.4 Quantity statistics

STATISTICS / QUANTITIES

Quantity statistics deliver the scheduled production quantities in comparison to the actual quantities of the production as reported to SimAL by PDA. For excess, the size of the surplus production (> required quantity) is identified, while the quantity below the required quantity is identified in the case of shortage.

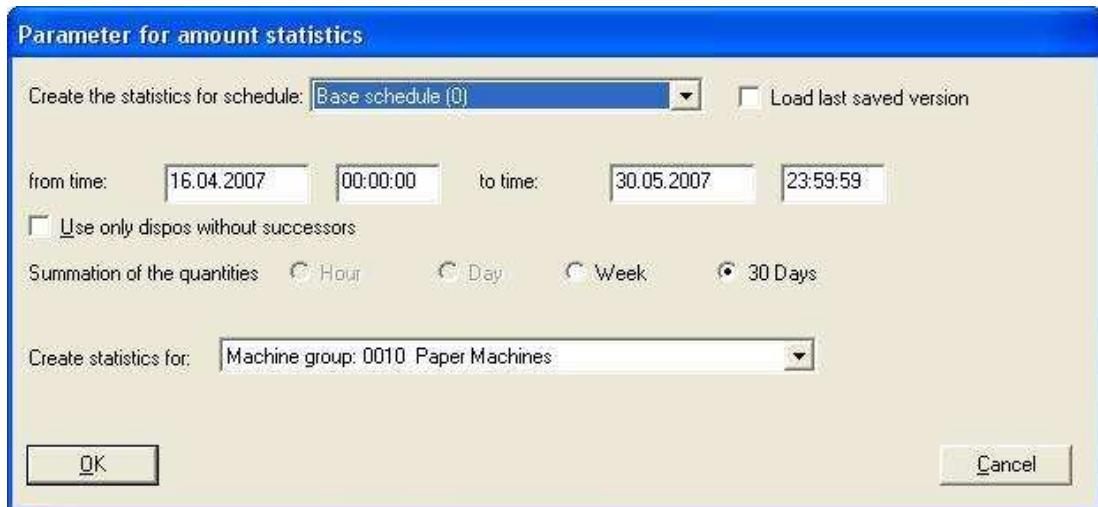


Figure 118: Parameter for quantity statistics

Choose the schedule and the time range to be evaluated. Quantity statistics can be carried out for single machine or single machine groups.

Evaluation can be limited to disposition orders without chaining to successors through “Consider only disposition orders without successors” (Number of successors = 0/finished products). By clicking [OK], the diagram shown in Figure 119.

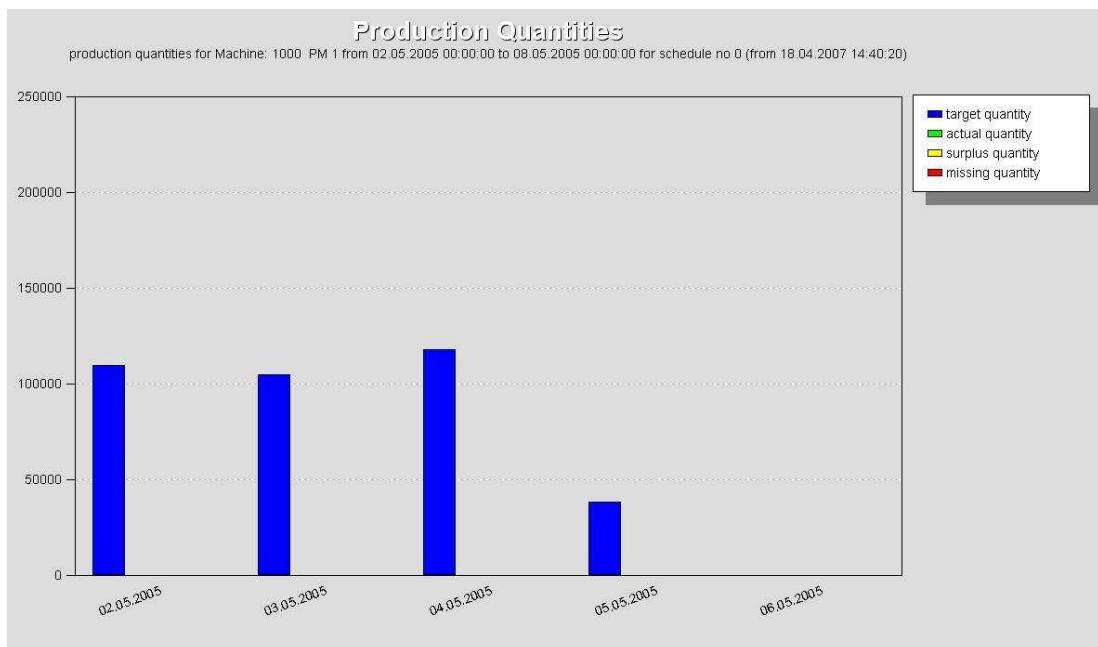


Figure 119: Quantity statistics

10.5 Throughput statistics

STATISTICS / THROUGHPUT

Throughput statistics determine the disposition order quantity that has traversed through machines or machine groups in a given time period. The possible grouping options are changed when leaving the text boxes from time and till time. Choose the machines or machine groups to be evaluated and define whether only disposition orders without successor chaining should be included in the evaluation (No successor = finished product). The result of the evaluation is shown in Figure 120 of [Throughput statistics](#).

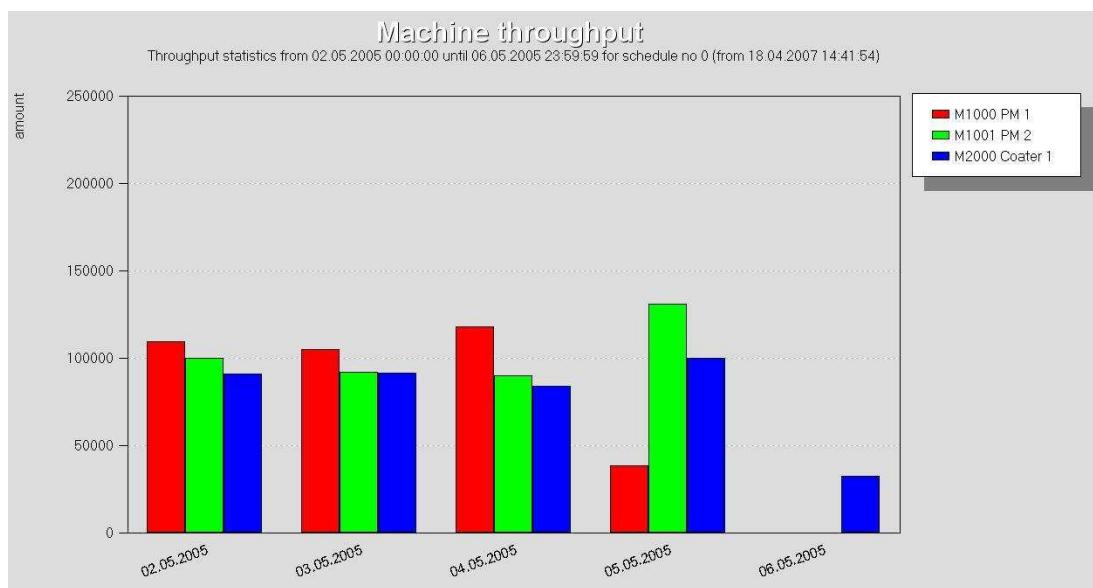


Figure 120: Throughput statistics

10.6 Machine-cost statistics

STATISTICS / MACHINE COSTS

Machine costs are parameterized in EUR/hour as fixed and running costs for each machine that is set up. With the help of usage times, machine-cost statistics calculate the accrued costs after scheduling for a time period and machines/machine groups. The parameter dialog box is the same as that for loading-statistics (Chapter 10.1 [Loading statistics](#)). An example of machine-cost statistics can be seen in Figure 121.

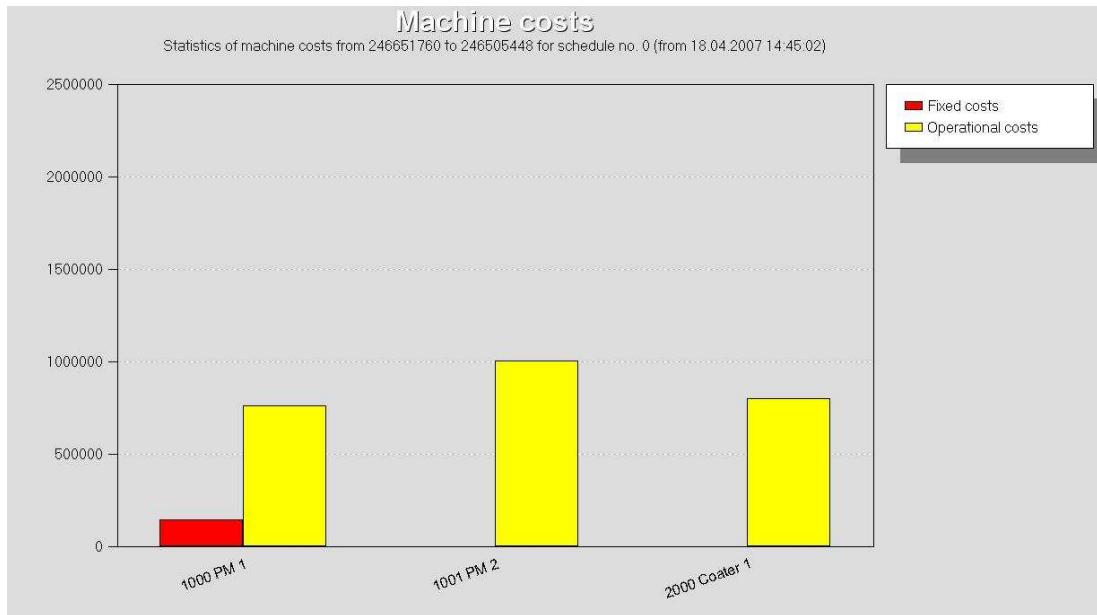


Figure 121: Machine-cost statistics

10.7 Cycle-time statistics

STATISTICS / CYCLE TIME

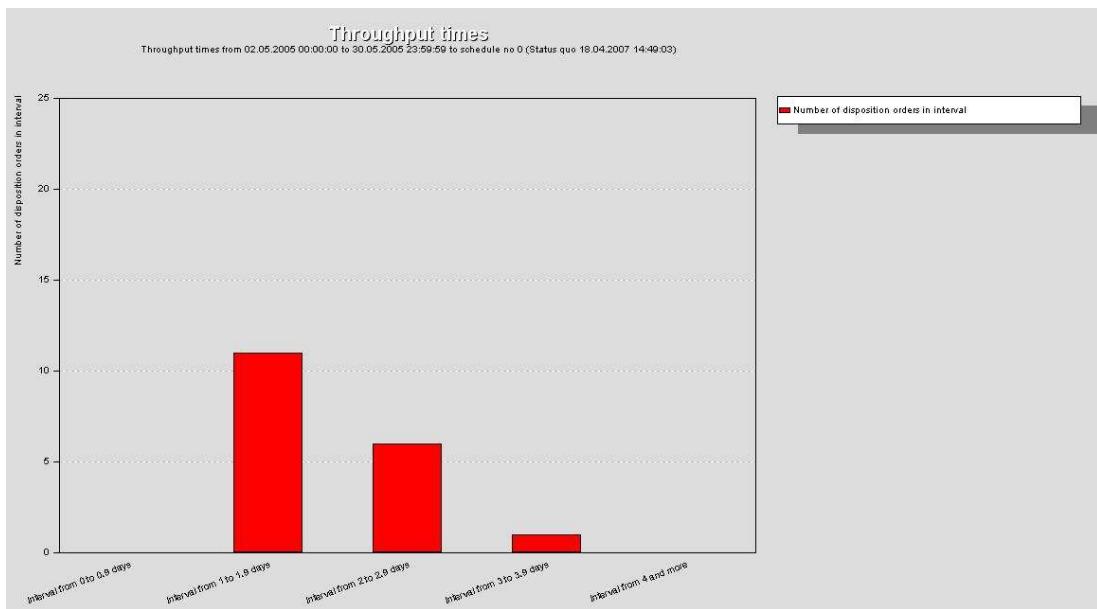


Figure 122: Cycle-time statistics

Cycle-time statistics deliver the cycle time of order chains (all disposition orders that are connected to each other by chaining) that are grouped in hours, days, weeks or

months. For this purpose, choose the evaluation time period, the grouping size as well as the number of columns to be identified.

10.8 Opening statistics

STATISTICS / OPEN

Statistics previously saved with the statistics function and put in an SIS file can be reopened and shown with this function. For this purpose, choose the SIS file and click Open. The statistics are loaded and exactly represented in the way they were saved.

10.9 Saving statistics

FILE / SAVE

Already evaluated statistics with all parameters can be saved in an SIS file on your computer's hard disk with the help of this function. It allows you to open and reproduce statistics at a later time. In the dialog box to save, you have to choose a directory in which the statistics should be saved and give a name (with the extension “*.sis”). Clicking [OK] saves the statistics in the file.

10.10 Exporting statistics

FILE → EXPORT

In order to transfer the rows of numbers that were ascertained for statistics by SimAL into another program, you can save this information as a CSV file on your hard disk.

In the dialog box to save, you have to choose a directory in which the CSV file should be saved and give a name (with the extension “*.csv”). Clicking [OK] saves the data in the CSV file.

10.11 Showing statistics as a list

FILE / SHOW AS LIST

A picture may paint a thousand words, but for several rows of data, a graphic representation can be too long-winded for the practiced user. Therefore, you have the possibility in SimAL to not only represent the statistics as a diagram, but also a table. For this purpose, choose this function from the menu.

The screenshot shows a Windows-style dialog box titled "Use of resources". At the top, it displays the text: "Statistics from 16.04.2007 00:00:00 to 17.05.2007 23:59:59 for schedule no. 0 from of 16.04.2007 17:29:39] (Angaben in units * hours)". Below this is a table with the following data:

| Resources | used capacity | usable capacity | over capacity | under capacity | maximum capacity |
|-------------------|---------------|-----------------|---------------|----------------|------------------|
| Cores | 2202458 | 42240 | 2161548 | 1330 | 42240 |
| Worker PM | 1 | 3072 | 0 | 3071 | 3072 |
| Prebuffer Coating | -20354 | 38400 | 3463 | 62217 | 38400 |
| Worker Coating | 0 | 3840 | 0 | 3840 | 3840 |

On the right side of the dialog box, there are three buttons: "Print", "Clipboard", and "Close".

Figure 123: Showing statistics as a list

10.12 Editing statistics properties

STATISTICS / EDIT PROPERTIES

An optimal representation of the statistics diagram according to individual preferences can be created with this function.

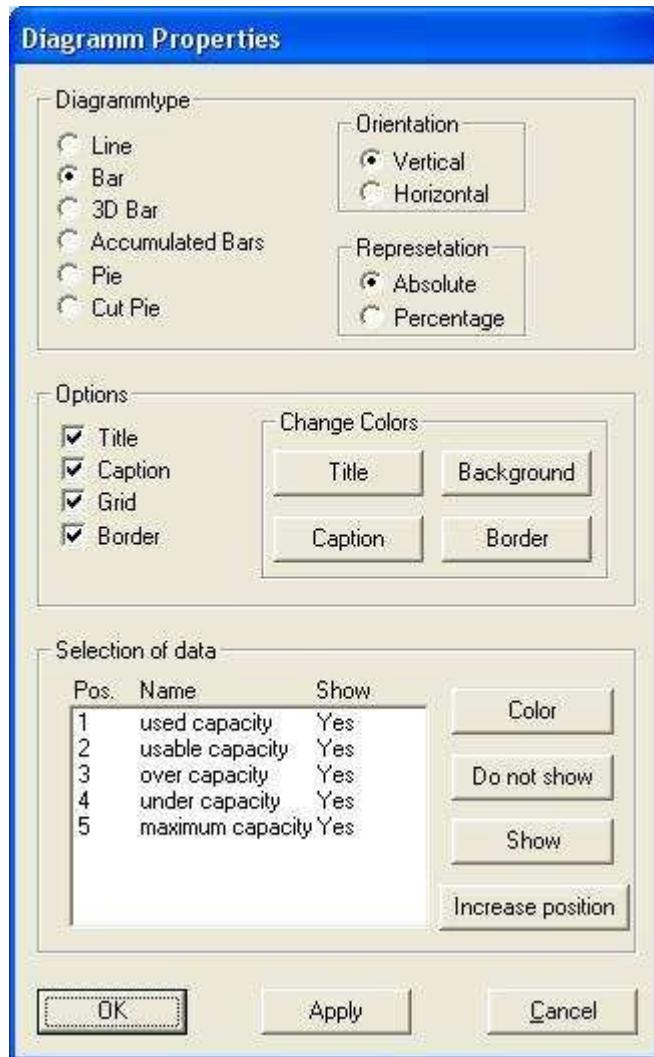


Figure 124: Diagram settings

Choose from different diagram types, alignment as well as diverse options for representation. The color, position and visibility of the individual data rows (machines, machine groups or resources) can be set in the area “Data choice”. To check and show the current entries in this dialog box , click [Accept].

11. Data Dictionary

MASTER DATA / DATA DICTIONARY

Each production process is unique and this must also be reflected in software like SimAL. It is sensible on the one hand to use standard products in order to use their powerful functionality and not have to constantly reinvent the wheel; but on the other hand, software that caters to exact restrictions of the production process to be scheduled is indispensable. The best schedule is useless if it doesn't correspond to real circumstances. The strategy to have any number of text boxes and options doesn't lead to any success either since the software is then overloaded with options that might be useful for only one use.

This balancing act of a balanced and powerful functionality that is also upgradeable is solved through the Data Dictionary in SimAL. In the Data Dictionary, all basic object types (such as the ERP order, disposition order and so on) as well as the attributes available in the types are predefined.

The adaptation to a concrete production process is now modeled by deriving the basic type (the basic class) into a subclass. Self-defined attributes can now be additionally defined in this subclass. While setting up an object in SimAL, the user is questioned about the object type, if several object types can be chosen from. For example, the following type hierarchy (class hierarchy) could be defined for customer orders and stock orders:

| | |
|----------------------|---|
| <i>ErpOrder</i> | <i>Basic class ERP order, predefined.</i> |
| <i>BasicOrder</i> | <i>Derived from ERP order, basic order of customer order and stock order, contains the attribute Color.</i> |
| <i>CustomerOrder</i> | <i>Derived from BasicOrder, contains the attribute CustomerNumber.</i> |
| <i>StockOrder</i> | <i>Derived from BasicOrder, contains the attribute DestinationWarehouse.</i> |

Classes (derived types) can also be derived from self-defined classes. The attributes defined in the derived classes can be used at all places in SimAL where attributes are processed (for example, in the pool, during calculation of matrix set-up time) just like predefined attributes. The important fact is that attributes of the basic class can be accessed just as easily as those defined in one's own class. Furthermore, even methods (functions of SimAL) can be overloaded in derived classes so that the calcu-

lation of processing time, for example, can be adapted. The overloading of methods is part of the SimAL manual on the programming interface.

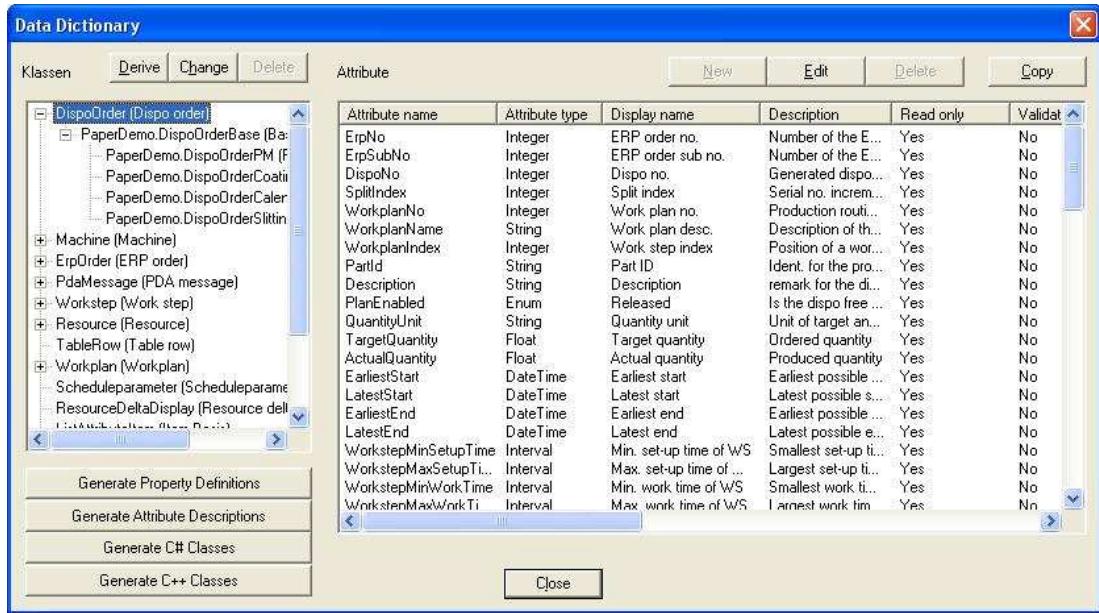


Figure 125: Data dictionary

11.1 Attribute-access hierarchy

In SimAL, you can access not only attributes of one's own class and the attributes of the basic class(es) of an object. Attributes of connected objects can also be accessed by scanning the surface of SimAL. The attributes that are accessed depend on the predefined basic class of the object.

| Predefined basic class | Classes whose attributes can be accessed by scanning |
|------------------------|--|
| Application | -- |
| Schedule | Application |
| ERP order | Application |
| Work plan | Application |
| Process | Work plan, Application |
| Disposition order | ERP order, Process, Work plan, Machine, Application |
| Table row | Application |

| | |
|----------|-------------|
| Machine | Application |
| Resource | Application |

Thus, even attributes of a ERP order can be accessed for definition of set-up class (Chapter 3.4.1 [Creating/editing set-up classes](#)).

Please note that attributes that have the same attribute name and type in the ERP order as well as the disposition order are copied from this ERP order during ERP acceptance from the ERP order into the disposition orders.

11.2 Deriving a class

When you click [Derive] in the Data Dictionary, the dialog box shown in Figure 126 is opened. This dialog box has four text boxes:

| | |
|----------------------------|--|
| .NET type name | The name of the class. This must be unique within the class and all basis classes, must only have alphabets and numbers, and must begin with an alphabet. A Class is created later with this name for programming. |
| Display name | The name of the class that appears on the surface in SimAL. This name may be totally different (for example, in another language) from the .NET type name. |
| Disposition order class | This box is only active for processes (Class Workstep) and its derived classes. During ERP acceptance, the process determines the class of the disposition order that is created for the production step. |
| Instantiation not possible | This checkbox is activated in basis classes, for which no objects are to be set up. This class is thus no longer offered during the new setting up of these objects. |

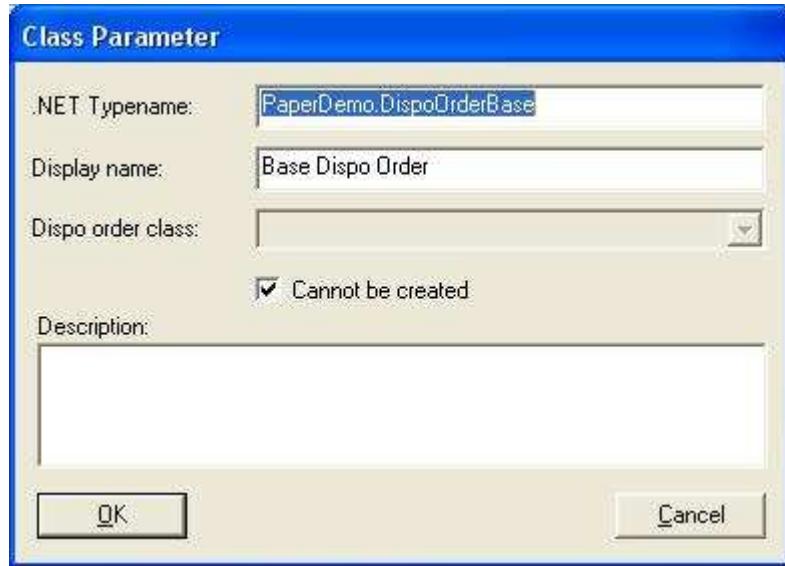


Figure 126: Deriving a class

Please note that some classes (such as Application and Schedule) cannot be derived in the Data Dictionary. In these classes, only the .NET type name and the display name can be changed. However, a derived .NET class may be associated with the SimAL class.

11.3 Creating an attribute

You can create your own attribute types in derived classes. For this purpose, click [New] in the right half of the Data Dictionary's dialog box. The dialog box shown in Figure 127 is then opened.

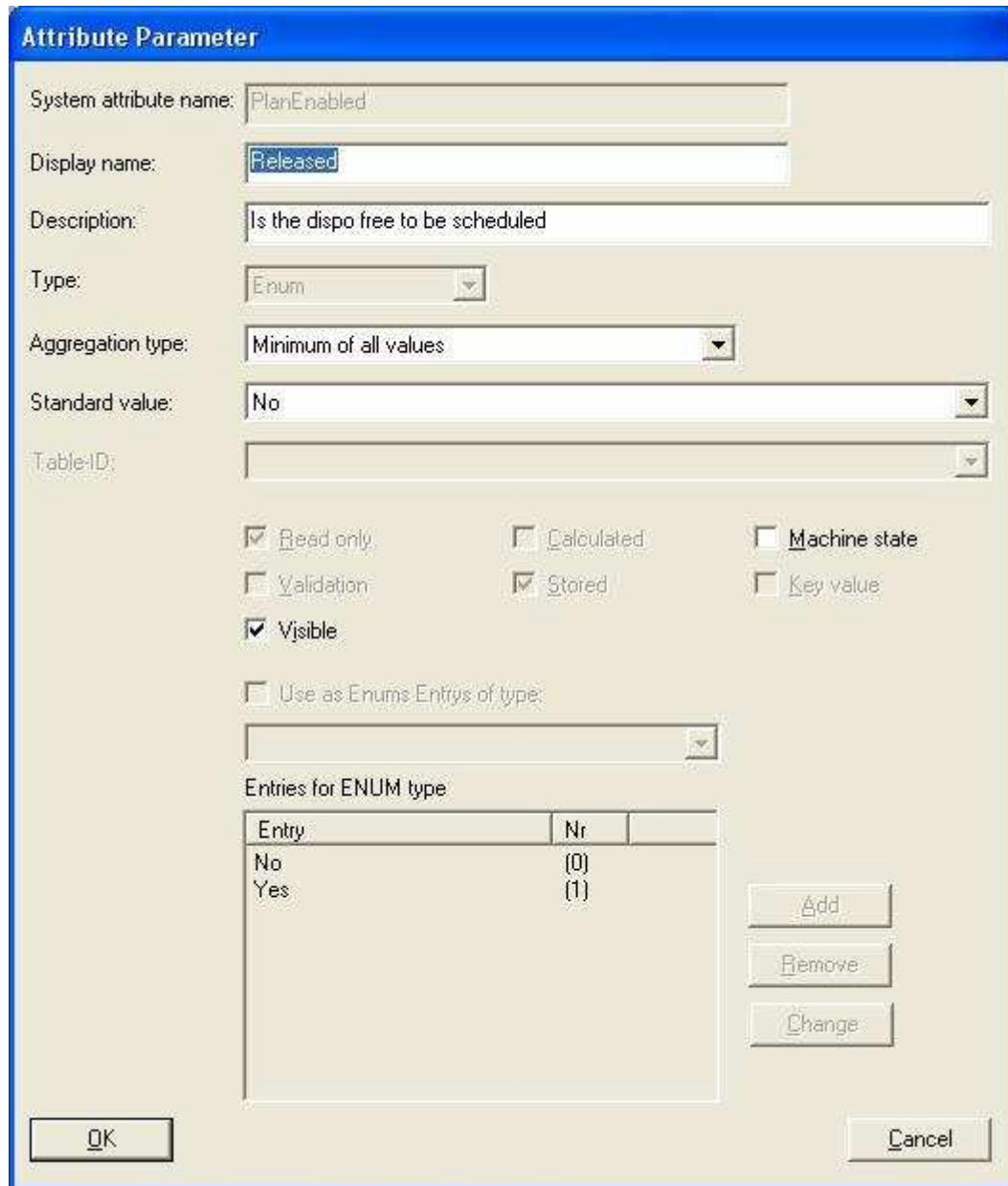


Figure 127: Creating attributes

This dialog box has several text boxes:

| | |
|---------------------------|--|
| Attribute name (Property) | The programming label of the attribute. This must be clear within the class and all basis classes, must only have alphabets and number, and must begin with an alphabet. A Property is created later with the same name for programming. |
| Display name | The name of the class that appears on the surface in SimAL. This name can be completely different (for |

| | |
|----------------|---|
| | example, in another language) from the .NET type name. |
| Description | Enter the purpose of this attribute here. |
| Type | <p>The type of the attribute. Choose between</p> <ul style="list-style-type: none"> • Integer = a whole number • Float = a number with a decimal part • DateTime = Point of time with date and time • Interval = Time span • Enum = Enumeration type; the user must choose one from several possibilities • TableRef = Reference to an existing table. All article master data could thus exist in a table. The work plan then refers only to the table, and all table attributes can thus be accessed in the work plan by scanning • List = List of objects of the entry class. The object of the input class can be saved as a defined object of this attribute any number of times. |
| Default value | The standard value with which the attribute is loaded before the first input. |
| Referred Table | The table that is allocated to a class by TableRef. |
| Input class | The classes that define the list entries. |
| Only display | This attribute cannot be changed in the dialog boxes. |
| Calculated | Whenever this attribute is accessed, an OnCalculate method (dependent on data type) is called up to calculate the value. |
| Machine state | A machine state is defined with the help of this attribute, i.e. as long as this attribute changes, the successive disposition orders for the machines are considered while scheduling. |
| Validation | Whenever this attribute is accessed, an OnValidate method (dependent on data type) is called up to calcu- |

| | |
|-----------------------------|---|
| | late the value. The textbox can only be left when the method delivers “true”. |
| Saving | Active for calculated attributes. If this option is not switched on, the values of calculated attributes are not saved in the database. |
| Key value | <p>For PDA processing and tables.</p> <p>In the tables, this means that all attribute values in a row, for which the key value was activated, have to clearly together in the table. If a table was referenced by the TableRef attribute, the key attributes are additionally shown in the attribute field of the object being referred to.</p> <p>It is possible that PDA messages that do not exactly specify the disposition order enter through the interface. As an example, the disposition order sub-number is missing. Through the key-value attributes, a decision is made to which disposition order does the PDA message refer. All disposition orders are considered, whose ERP order number, part order number and schedule number either match with the PDA message or have a value of -1 in the PDA message.</p> <p>Through the attributes of the PDA message, the disposition orders that have attributes with the same names and same values are determined. From these, the disposition order scheduled the earliest and scheduled for the machine specified by the PDA message is chosen. The disposition order is either not yet complete or was reported as cancelled.</p> |
| Visible | If this option is activated, the attribute to be represented in the ERP order dialog box or disposition-order dialog box can be selected. |
| Inputs for enumeration type | If the Type = Enum, the enumeration values have to be defined here. These values can then be chosen in the attributes through the combo box. |

11.4 Generate C# / C++ classes

Through this command button, you can have C# or C++ source files created for the classes defined in the Data Dictionary at the start of the project. For this purpose, you must choose a directory. For each self-defined class, a *.cs or *.h source file is set up with the class definition, the property definitions and, as the case may be, with On-Validate and OnCalculate methods. You can alternatively have only the source files for the selected class created.

Please note that any existing files with the same name will not be overwritten.

11.5 Generate property definitions

Through this command button, a property definition (in C#) is created for all attributes in the currently selected class and the source code is placed in the Windows clipboard. By inserting from the clipboard, you can insert the property definitions in your source code.

11.6 Generate attribute descriptions

Through this command button, a row is created in the Windows clipboard for all attributes of the selected class (and all basis classes). By inserting the clipboard contents in a text processing or table calculation, the attribute information can then be prepared for the user as a document. The documentation of the standard attributes in the appendix were created with this functionality.

11.7 Tables

MASTER DATA / TABLES

Further master data (for example, for calculation of processing time) are often required in SimAL, which cannot be allocated to any of the standard classes. SimAL allows the definition of tables for such information. A class has to first be derived

from the class `TableRow` and the columns have to be defined as attributes. In the table dialog box (Figure 128), set up a new table by clicking [New].

To set up a new table, a class that can be instantiated must be derived from `TableRow` and a class derived from `Table` (or `Table` itself) must be capable of instantiation.



Figure 128: Editing tables

Clicking [Open] opens the editing dialog box for table data. The data can be entered in the columns that were defined in the Data Dictionary.



Figure 129: Editing a table

Through the option [Row ID], you can decide whether a (compulsorily unique) row ID should be shown or not. Through [New row before] or [New row after], a new empty row can be set up. The boxes in the new row have default values of the attribute types. A chosen row can be removed with Delete.

[Copy to clipboard] copies the values of the whole table to the Windows clipboard. From there, the data can be used, for example, in a table calculation.

[Insert from clipboard] replaces the contents of the table with the contents of the clipboard. As the case may be, only data till the first incorrect row are transferred. Particularly in the case of Enum values, the text must exactly match with one of the entries.

Tables can also be copied with [With column titles] by activating the checkbox. While inserting when the checkbox is activated, the first row containing titles is not inserted.

Please note that you can leave a row and save the table only when all key attributes are clear in the edited row.

12. Appendix

Tables that help in using SimAL have been compiled in the appendix.

12.1 Symbols in the toolbar

| Symbol | Meaning | Remark | See also |
|---|--------------------------------------|---|----------------|
|  | Open schedule window | Opens a schedule | Chapter 7.2 |
|  | Save | Saves changes | Chapter 8.3.2 |
|  | Print | Prints the Gantt chart window | Chapter 8.3.16 |
|  | Schedule | This function is only available if an order has been selected in the order pool. | Chapter 8.4.2 |
|  | Unschedule | This function is only available if an order has been selected in the order pool. | Chapter 8.4.7 |
|  | Reschedule | This function is only available if an order has been selected in the schedule window. | Chapter 8.4.6 |
|  | Lock | This function is only available if an order has been selected in the pool or Gantt chart window. | Chapter 8.4.14 |
|  | Release | This function is only available if a fixed order is selected in the pool or Gantt chart window. | Chapter 8.4.15 |
|  | Split | This function is only available if one or more disposition orders are selected in the pool or Gantt chart window. | Chapter 8.4.16 |

| Symbol | Meaning | Remark | See also |
|---|---|--|------------------|
|  | Paste | This function is only available if several disposition orders of the same order are selected in the schedule window. | Chapter 8.4.17 |
|  | Mark | This function is only available if one or more disposition orders are selected in the pool or Gantt chart window. | Chapter 8.4.19 |
|  | Unmark | This function is only available if one or more disposition orders are selected in the pool or Gantt chart window. | Chapter 8.4.20 |
|  | Zoom area | This function is only available if the Gantt chart window or the resource window is activated. | Chapter 8.8.10.1 |
|  | Zoom Increase zoom | This function is only available if the Gantt chart window or the resource window is activated. | Chapter 8.8.10.2 |
|  | Zoom Decrease zoom | This function is only available if the Gantt chart window or the resource window is activated. | Chapter 8.8.10.3 |
|  | Zoom Work area | This function is only available if the Gantt chart window or the resource window is activated. | Chapter 8.8.10.5 |
|  | Refresh/Synchronize | Synchronizes one's own schedule with the changes of other users. | Chapter 8.8.20 |
|  | Production Data Acquisition (PDA) | Opens the dialog box for PDA entry. | Chapter 1 |
|  | Import KPI comparison values | Notes the currently calculated KPI values | Chapter 8.10.2 |
|  | Calculate KPI values | Updates the KPI display depending on the current scheduling | Chapter 8.10.1 |

| Symbol | Meaning | Remark | See also |
|---|---------|------------------------------------|----------|
|  | Info | Information on the program version | — |

12.2 Attribute types

All the predefined attribute types of the standard SimAL are described.

12.2.1 ERP-order attributes

| Display name | Attribute name | Attribute type | Description |
|-------------------------------|------------------|----------------|--|
| Arbeitsplan ausgewählt | WorkplanSelected | Integer | Work plan selected |
| Arbeitsplan-Name | WorkplanName | String | Name of the work plan |
| Arbeitsplan-Nr. | WorkplanNo | Integer | Work plan according to which the disposition order is produced |
| Erfassungszeitpunkt | EntryTime | DateTime | Time of entry |
| Fehlernummer | ErrorCode | Integer | Error number of the acceptance error |
| Frühester Start | EarliestStart | DateTime | Earliest starting time |
| Interne Klasse | PredefClass | Enum | Internal basic class |
| Klassen-ID | ClassID | Integer | ID of the object class |
| Klassen-Name | ClassName | String | Name of the object class |
| Mengeneinheit | Unit | String | Unit of the required and actual quantity |
| Nr. | ErpNo | Integer | ERP number of the disposition order |
| Priorität | Priority | Integer | Importance of an order |
| Prod.Graph.Name | ProdGraphName | String | Name of the production graph |
| Prod.Graph.Nr. | ProdGraphNo | Integer | Number of the production graph |
| Soll-Menge | TargetQuantity | Float | Scheduled production quantity |
| Soll-Stück | TargetPieces | Float | Scheduled number of production pieces |
| Spätestes Ende | LatestEnd | DateTime | Latest possible end time |
| Status | Status | Enum | Error status of the ERP-order acceptance |

| <i>Display name</i> | <i>Attribute name</i> | <i>Attribute type</i> | <i>Description</i> |
|---------------------------|-----------------------|-----------------------|---|
| Teile-ID | PartId | String | Identification of the produced part |
| Unter-Nr. | ErpSubNo | Integer | Sub-ERP number of the disposition order |
| Übernahmezeitpunkt | DispoGeneration-Time | DateTime | Time of ERP order acceptance |

12.2.2 Disposition-order attributes

| <i>Display name</i> | <i>Attribute name</i> | <i>Attribute type</i> | <i>Description</i> |
|-------------------------------|-----------------------|-----------------------|--|
| Arbeitsende | WorkEnd | DateTime | Ending time of work |
| Arbeitsgang | WorkstepName | String | Name of allocated production process |
| Arbeitsgang-ID | WorkstepNo | Integer | ID of the production process |
| Arbeitsplan-Name | WorkplanName | String | Name of the work plan |
| Arbeitsplan-Nr. | WorkplanNo | Integer | Work plan according to which the disposition order is produced |
| Arbeitsschritt-Nr. | WorkplanIndex | Integer | Number of production step |
| Arbeitsstart | WorkStart | DateTime | Starting time of work |
| Arbeitszeit | WorkTime | Interval | Processing time for the machine |
| Auftrags-Nr. | Key | String | ERP-order number/Part-order number/Disposition-order number and Sub-disposition-order number |
| BDE Status Bezeichnung | BDEStatusName | String | PDA status in text format |
| BDE-Status | PdaStatus | Integer | Status of an order based on feedback |
| Balken-Text | BeamText | String | Text on the scheduled disposition order |
| Batch-ID | PdaBatchID | Integer | PDA ID of batch |
| Belegung | Allocation | Integer | Quantity of loading of a machine |

| <i>Display name</i> | <i>Attribute name</i> | <i>Attribute type</i> | <i>Description</i> |
|---------------------------------|-----------------------|-----------------------|--|
| Bemerkung | Description | String | Description of disposition order |
| Bemerkung vorhanden | DescriptionExists | Enum | Has a description been entered in the disposition-order text? |
| Dispo-Nr. | DispoNo | Integer | Running number of the disposition order within a ERP order |
| Eingeplant | Scheduled | Enum | Scheduled (Yes/No) |
| Feste Rüstzeit | FixedSetupTime | Interval | Fixed set-up time |
| Frühestes Ende | EarliestEnd | DateTime | Earliest possible ending time |
| Frühstart der Nachfolger | EarliestSuccWorkStart | DateTime | Earliest processing start of successors (for overlapping production) |
| GP Auftragsstart | RSOrderStart | DateTime | Earliest start of rough scheduling |
| Gesamt-Dauer | Duration | Interval | Duration from set-up start to waiting-time end |
| Interne Klasse | PredefClass | Enum | Internal basic class |
| Ist-Menge | ActualQuantity | Float | Production quantity reported back |
| Ist-Stück | ActualPieces | Float | Produced pieces reported back |
| Kampagne Name | CampaignDescr | String | Name of campaign |
| Kampagne Nr | CampaignNo | Integer | Number of campaign |
| Kampagne SeqNr | CampaignSubNo | Integer | Sequence number within the campaign |
| Klassen-ID | ClassID | Integer | ID of the object class |
| Klassen-Name | ClassName | String | Name of the object class |
| Leigezeit-Ende | IdleEnd | DateTime | End of idle time |
| Letzte BDE-Meldung | LastPDATime | DateTime | Time of the last processed PDA message |
| Letzte Fix-Maschine | LastFixMachine | String | Machine name during last |

| <i>Display name</i> | <i>Attribute name</i> | <i>Attribute type</i> | <i>Description</i> |
|---------------------------------------|------------------------|-----------------------|--|
| | | | setup |
| Letzter Fix-Start | LastFixDate | DateTime | Time of starting of order during last setup |
| Liegezeit | IdleTime | Interval | Idle time after working on the machine (machine is then free) |
| Markierungsfarbe | MarkColor | Integer | RGB code of color marking |
| Masch.-Name | MachineName | String | Name of the scheduled machine |
| Masch.-Nr. | MachineNo | Integer | Number of the scheduled machine |
| Masch.-Nutzen | MachineUnit | Integer | Units of the scheduled machine |
| Maschinen-Dauer | MachineDuration | Interval | Duration from set-up start till end of processing |
| Max. Arbeitszeit des AS | WorkstepMaxWorkTime | Interval | Largest processing time of all processes of this production step |
| Max. Liegezeit des AS | WorkstepMaxIdleTime | Interval | Largest idle time of all processes of this production step |
| Max. Rüstzeit des AS | WorkstepMaxSetupTime | Interval | Largest set-up time of all processes of this production step |
| Max. maximale Liegezeit des AS | WorkstepMaxMaxIdleTime | Interval | Largest maximum idle time of all processes of this production step |
| Mengeneinheit | QuantityUnit | String | Unit of the required and actual quantity |
| Min. Arbeitszeit des AS | WorkstepMinWorkTime | Interval | Smallest processing time of all processes of this production step |
| Min. Liegezeit des AS | WorkstepMinIdleTime | Interval | Smallest idle time of all processes of this production step |
| Min. Rüstzeit des AS | WorkstepMinSetupTime | Interval | Smallest set-up time of all processes of this produc- |

| <i>Display name</i> | <i>Attribute name</i> | <i>Attribute type</i> | <i>Description</i> |
|---------------------------------------|------------------------|-----------------------|--|
| | | | tion step |
| Min. maximale Liegezeit des AS | WorkstepMinMaxIdleTime | Interval | Smallest maximum idle time of all processes of this production step |
| Minder-Menge | QuantityCorrection | Float | Shortage in production quantity |
| Minder-Stückzahl | PiecesCorrection | Float | Shortage in production quantity (pieces) |
| ERP-Auftrags-Nr. | ErpNo | Integer | ERP number of the disposition order |
| ERP-Teil-Auftrags-Nr. | ErpSubNo | Integer | Sub-ERP number of the disposition order |
| Planfreigabe | PlanEnabled | Enum | May the disposition order be scheduled |
| Priorität | Priority | Integer | Importance of an order |
| Pufferendzeit | BufferEnd | DateTime | Latest (estimated) end for automatic scheduling |
| Pufferstartzeit | BufferStart | DateTime | Buffer start for automatic scheduling |
| Res.-Anforderung | DisplayResourceRequest | String | Menge der ? |
| Ressource-Listen-Nr. | ResourceListNo | Integer | Number of the resource list, whose resources load the disposition order, from the process |
| Ressource-Listen-Plan-Nr. | ResourceListNoPlan | Integer | Number of the resource list, whose resources load the scheduled disposition order, from the process |
| Ressource-Listen-Soll-Nr. | ResourceListNoSoll | Integer | Number of the resource list, whose resources occupy the disposition order, from the process |
| Rüst-Ressource-Listen-Nr. | SetupResourceListNo | Integer | Number of the set-up resource list, whose resources load the disposition order, from the scheduled machine |
| Rüstmatrixzeit | SetupMatrixTime | Interval | Set-up time determined |

| <i>Display name</i> | <i>Attribute name</i> | <i>Attribute type</i> | <i>Description</i> |
|---------------------------|-----------------------|-----------------------|--|
| | | | because of the predecessor on the machine |
| Rüststart | SetupStart | DateTime | Set-up starting time |
| Rüstzeit | SetupTime | Interval | Fixed set-up time + set-up matrix time |
| Setzbare Maschinen | PlanableMachines | String | ERP order number/Part-order number/Disposition-order number and disposition order sub-number |
| Soll-Menge | TargetQuantity | Float | Scheduled production quantity |
| Soll-Stück | TargetPieces | Float | Scheduled production pieces |
| Split-Index | SplitIndex | Integer | Running number of the split disposition order within a disposition order |
| Spätester Start | LatestStart | DateTime | Latest possible starting time |
| Spätestes Ende | LatestEnd | DateTime | Latest possible end time |
| Teile-ID | PartId | String | ID of the produced part |
| Tool-Tip-Text | TipText | String | Text of the tool-tip |
| Zielfunktionswert | ObjectiveValue | Float | Evaluation of the objective function |

12.2.3 Machine attribute types

| <i>Display name</i> | <i>Attribute name</i> | <i>Attribute type</i> | <i>Description</i> |
|-----------------------------|-----------------------|-----------------------|--|
| Bezeichnung | Name | String | Name of the machine |
| Chargenfertigung | BatchMachine | Enum | Is this machine a batch machine? |
| Einsatzkosten | VariableCosts | Float | Running costs of the machine |
| Fixkosten | FixCosts | Float | Fixed costs of the machine |
| Interne Klasse | PredefClass | Enum | Internal basic class |
| Kapazitäts-Priorität | CapacityPrio | Integer | If higher, then priority during capacity bottlenecks |

| <i>Display name</i> | <i>Attribute name</i> | <i>Attribute type</i> | <i>Description</i> |
|----------------------------------|-----------------------|-----------------------|---|
| Kapazitäts-Ressourcen-Nr. | CapacityResourceNo | Integer | Number of the capacity resource |
| Kapazitätsvorrat | UtilizationCapacity | Integer | Orders can be scheduled in parallel till this value |
| Klassen-ID | ClassID | Integer | ID of the object class |
| Klassen-Name | ClassName | String | Name of the object class |
| Leistung | Performance | Integer | Performance in % (100 = Normal performance) |
| Mehrbenutzerfähig | MultiUser | Enum | Can the machine be simultaneously by several users? |
| Nicht änderbar | Static | Enum | Can the machine be changed in the current view? |
| Nr. | MachineNo | Integer | Number of the machine |
| Nutzen | Units | Integer | Number of units of the machine |
| Rüstzeit additiv | SetupTimeAdditive | Enum | Is the set-up time from different set-up classes being summed ? |
| Sichtbar | Visible | Enum | Is the machine visible in the current view? |

12.2.4 Attribute types of PDA message

| <i>Display name</i> | <i>Attribute name</i> | <i>Attribute type</i> | <i>Description</i> |
|------------------------|-----------------------|-----------------------|--|
| BDE-Nr. | PdaNo | Integer | Number of the PDA message |
| BDE-Status | PdaState | String | PDA status |
| Batch-Id | BatchId | Integer | Batch ID |
| Dispo-Nr. | DispoNo | Integer | Running number of the disposition order within a ERP order |
| Dispo-Unter-Nr. | DispoSubNo | Integer | Running sub-number of the disposition order within a ERP order |
| Fehlermeldung | ErrorText | String | Error text of the PDA message |
| Interne Klasse | PredefClass | Enum | Internal basic class |

| <i>Display name</i> | <i>Attribute name</i> | <i>Attribute type</i> | <i>Description</i> |
|-------------------------------|-----------------------|-----------------------|---|
| Klassen-ID | ClassID | Integer | ID of the object class |
| Klassen-Name | ClassName | String | Name of the object class |
| Masch.-Nr. | MachineNo | Integer | Number of the machine |
| Masch.-Nutzen | MachineUnit | Integer | Units of the scheduled machine |
| Meldezeit | PdaTime | DateTime | Time of the PDA message |
| Mengen-Änderung | QuantityChange | Float | Quantity change of the disposition order |
| Minder-Mengen-Änderung | QuantityCorrection | Float | Shortage quantity change of the disposition order |
| Minder-Stück-Änderung | StockCorrection | Float | Shortage piece changes of the disposition order |
| ERP-Auftrags-Nr. | ErpNo | Integer | ERP number of the disposition order |
| ERP-Teil-Auftrags-Nr. | ErpSubNo | Integer | Sub-ERP number of the disposition order |
| Restdauer | RemainingTime | Interval | Remaining duration of the batch |
| Stück-Änderung | StockChange | Float | Piece change of the disposition order |
| Verarbeitungs-Status | ProcessingState | String | Current processing status of the PDA message |

12.2.5 Process attributes

| <i>Display name</i> | <i>Attribute name</i> | <i>Attribute type</i> | <i>Description</i> |
|----------------------------|-----------------------|-----------------------|--|
| Arb.-Zeit pro Menge | WorkTimePerQuantity | Interval | Processing time for the machine per N quantity |
| Arb.-Zeit pro Stück | WorkTimePerPieces | Interval | Processing time for the machine per N pieces |
| Arbeitsgang-Nr. | WorkstepNo | Integer | Process according to which the disposition order is produced |
| Arbeitsplan-Name | WorkplanName | String | Name of the work plan |
| Arbeitsplan-Nr. | WorkplanNo | Integer | Work plan according to which the disposition order is produced |

| <i>Display name</i> | <i>Attribute name</i> | <i>Attribute type</i> | <i>Description</i> |
|----------------------------------|-----------------------|-----------------------|---|
| Arbeitsschritt-Nr. | WorkplanIndex | Integer | Number of the production step of the work plan according to which the disposition order is produced |
| Bezeichnung | WorkstepName | String | Name of the work plan |
| Dispoklassen Id | DispoClassID | Integer | ID of the scheduling class to be created |
| Fertigung in Pausen? | WorkOverPauses | Enum | Production can be interrupted? |
| Feste Rüstzeit | FixedSetupTime | Interval | Fixed set-up time |
| Gruppen-Nr. | MachineGroupNo | Integer | Machine group on which the process may be produced |
| Interne Klasse | PredefClass | Enum | Internal basic class |
| Klassen-ID | ClassID | Integer | ID of the object class |
| Klassen-Name | ClassName | String | Name of the object class |
| Liegezeit | IdleTime | Interval | Idle time after processing on the machine (machine is then free) |
| Liegezeit-Schichtmaschine | IdleShiftMachineNo | Integer | Number of the machine, according to whose shift model the idle time is calculated |
| Maschinen-Nr. | MachineNo | Integer | Machine on which the process may be produced |
| Maschinengruppenangabe | IsForMachine | Enum | Does the process refer to a concrete machine? |
| Maschinengruppenangabe | IsForGroup | Enum | Does the process refer to a machine group? |
| Max. Liegezeit | MaxIdleTime | Interval | Maximum idle time after processing on the machine, after which the successive process has to start |
| Menge für Arb.-Zeit | QuantityForWorkTime | Float | Gives the quantity, for which the processing time is valid (0 = Processing time constant) |

| <i>Display name</i> | <i>Attribute name</i> | <i>Attribute type</i> | <i>Description</i> |
|----------------------------|-----------------------|-----------------------|---|
| Mengen-Faktor | FactorAmount | Float | Describes the ratio of incoming quantity and outgoing quantity |
| Optional | Optional | Enum | A disposition order is created from the process |
| Pausen kürzen bis | ShortenPauses | Interval | Gives the quantity, for which the processing time is valid (0 = Processing time constant) |
| Split erlaubt | SplitAllowed | Enum | May the process be split? |
| Stück für Arb.-Zeit | PiecesForWorkTime | Float | Gives the number of pieces, for which the processing time is valid (0 = Processing time constant) |
| Stückzahl-Faktor | FactorPieces | Float | Describes the ratio of incoming number of pieces to outgoing number of pieces |
| belegte Kapazität | MachineUtilization | Integer | Gives the capacity by which the machine is loaded through the process |

12.2.6 Resource attributes

| <i>Display name</i> | <i>Attribute name</i> | <i>Attribute type</i> | <i>Description</i> |
|-----------------------|-----------------------|-----------------------|---|
| Anzeige max. | MaxScaleValue | Integer | Resource utilization is shown till this value |
| Anzeige min. | MinScaleValue | Integer | Resource utilization is shown from this value on |
| Anzeigetyp | CapacityType | Enum | Is the remaining capacity or the utilization shown? |
| Bezeichnung | Name | String | Name of the resource |
| Einsatzkosten | VariableCosts | Float | Running costs of the machine |
| Fixkosten | FixCosts | Float | Fixed costs of the machine |
| Interne Klasse | PredefClass | Enum | Internal basic class |

| <i>Display name</i> | <i>Attribute name</i> | <i>Attribute type</i> | <i>Description</i> |
|----------------------------------|-----------------------|-----------------------|--|
| Ist Lager | IsStorage | Enum | Is the resource a storage |
| Klassen-ID | ClassID | Integer | ID of the object class |
| Klassen-Name | ClassName | String | Name of the object class |
| Nr. | ResourceNo | Integer | Number of the resource |
| Planungsrelevant | ActiveConstraint | Enum | Is this resource considered during the scheduling run? |
| Ressource prüfen | CheckResource | Enum | Is this resource considered during the scheduling check run? |
| Schichtabhängig | ShiftDepended | Enum | Is the resource stock decided by the shift model? |
| Schichtabhängige Maschine | ShiftDependedMachine | Enum | Is the resource consumption decided by the shift of the machine? |
| Vorrat | Capacity | Integer | Number of this resource available |
| Warnung ab | WarningFrom | Integer | Resources are marked in yellow from this value on |
| Warnung bis | WarningTo | Integer | The resource is marked in yellow till this value |
| Zeige Vorrat | ShowCapacity | Enum | Is the resource stock additionally being shown? |

12.2.7 Work-plan attributes

| <i>Display name</i> | <i>Attribute name</i> | <i>Attribute type</i> | <i>Description</i> |
|-------------------------|-----------------------|-----------------------|--|
| Arbeitsplan-Name | WorkplanName | String | Name of the work plan |
| Arbeitsplan-Nr. | WorkplanNo | Integer | Work plan according to which the disposition order is produced |
| Interne Klasse | PredefClass | Enum | Internal basic class |
| Klassen-ID | ClassID | Integer | ID of the object class |
| Klassen-Name | ClassName | String | Name of the object class |

12.3 Standard colors

| Color | Meaning |
|--------------|---|
| Dark green | The disposition order is completed on time and is not selected. |
| Light green | The disposition order is completed on time and is selected. |
| Yellow | The disposition order has been fixed, is not selected and can neither be moved, unscheduled or rescheduled. |
| Light yellow | The disposition order has been fixed, is selected and can neither be moved, unscheduled or rescheduled. |
| Red | The disposition order is not completed on time and is not selected. |
| Light red | The disposition order is not completed on time and is selected. |
| Violet | For this disposition order, there is a sequencing problem; i.e. a processing level should start according to the scheduling, even though the previous processing level has not been completed yet. The disposition order is not selected. |
| Light violet | For this disposition order, there is a sequencing problem; i.e. a processing level should start according to the scheduling, even though the previous processing level has not been completed yet. The disposition order is selected. |
| Orange | For this disposition order, the start of processing lies either before the earliest possible or after the latest possible starting time. The order is not selected. |
| Light orange | For this disposition order, the start of processing lies either before the earliest possible or after the latest possible starting time. The order is selected. |

12.4 Parameters for the prompt

Parameters for the prompt can be either entered in small or large letters. A mixture of both is not accepted.

| | |
|-----------|--|
| /database | With this parameter, the database is entered. For Oracle, this is the user, while it is the database to be used for Access, Informix, SQL Server and DB/2. |
|-----------|--|

| | |
|-------------|--|
| | <p>SQL Server: The server and database have to be given in the format <i>Server.DBName</i>.</p> <p>Oracle: The user has to be given!</p> |
| /dbuser | <p>The user account to access the database.</p> <p>SQL Server: If neither /dbuser nor /dbpassword is given, Windows authentication is used. Otherwise, the SQL-server authentication is used.</p> <p>Oracle: The service name has to be given with this option.</p> |
| /dbpassword | The password to access the given user has to be given. |
| /logdir | SimAL saves information about its condition as well as all outputs in the message window into a log file. This is created under the name “simal*.log” usually in the %TEMP% directory of Windows. The “*” is replaced with a unique number. With the help of /logdir, you can parameterize a different directory (for example, on a common server) for easier diagnosis of errors. |
| /extension | Enter an additional programming as an extension assembly in the options dialog box. This can be entered (and thus overwrites the setting in the global options) in the phases of the development cycle, in which each user has his own status with the DLL extension, but which is used through a common SimAL database. |
| /locale | With /locale english, SimAL is started with an English surface. With /locale german, SimAL is started in German. |
| /bitmap | With this option, you can replace the SimAL background picture with one of your own choice. The picture has to be in BMP format. As a parameter, enter the path and filename together. It overwrites the setting in the global options. |
| /title | Sets the text in the SimAL title row. |
| /infile | Sets the name of the initialization file. The standard name is “simal.ini”. If this file is found in the program directory of SimAL, the options described here are read from the file. |

| | |
|---------------|--|
| /create_ini | Creates an initialization file in the program directory of SimAL. The name of the initialization file can be parameterized with /inifile. |
| /sql | Opens a simple dialog box to enter SQL commands. |
| /freeall | USE ONLY DURING SOFTWARE DEVELOPMENT! This option logs off all users when starting the program and releases all schedules that were not loaded by improperly ended SimAL instances. It corresponds to the action of releasing all users in user administration. |
| /nocrashmail | SimAL normally sends an email if it has to crash. This is also for crashes caused by loaded assemblies. If you, for example, want to check the crash in a debugger, enter the option while starting the program. A crash handler is installed by SimAL and the exception is forwarded to the debugger. |
| /nocircletest | With this option, the testing is switched off for circle references while importing chaining between ERP orders. This should only occur when the user is 100% certain that no circle references can occur through the chaining being imported. |