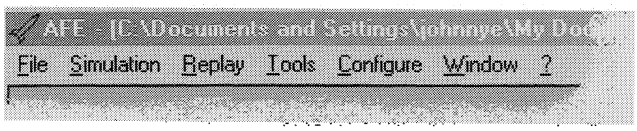
4. USER GUIDE

4.1. The main menu



This chapter describes all commands available from the main menu. Several of these commands can also be given through the toolbar buttons or through keyboard shortcuts.

4.1.1. File

This submenu contains commands for administration of files, and for ending the program.

New Creates a new empty simulation. Start parameters and window layout is maintained from the previous simulation.

Open Opens a simulation previously saved on a file. The Windows standard dialog box for filename selection is used.

Save Saves a simulation to a file using the current filename. If no filename exists, the user is asked for one by the Windows standard dialog box for filename selection.

Save As Saves a simulation to a file. The Windows standard dialog box for filename selection always asks for the filename used.

1...5 Recently loaded or saved files. The filename follows the number. Selection of one of these menu items opens the file.

Exit Exits the program. All open windows maintained by the program are closed. If necessary, the user is given an opportunity to save modified configuration and data to disk before the program is finally closed.

4.1.2. Simulation

This submenu contains commands for controlling a simulation.

Start Starts a new simulation, or continue one that was previously paused.

Pause Pauses a running simulation.

Stop Aborts a running or paused simulation permanently.

Clear Prepares the program for a new simulation. Data collected from the last simulation run are discarded. Start parameters are not affected.

Parameters Opens the "Start parameters" dialog box.

4.1.3. Replay

This submenu contains commands for controlling a replay from an earlier simulation.

Start Starts a replay from the current time. If the current time is the last possible time, the replay is started from the beginning.

Stop Interrupts a replay.

Reset Resets the current time to the beginning.

Step Forward Moves the current time forward one step. If the shift key is held down, the move is 10 steps, and correspondingly for the ctrl key and the alt key the move is 100 and 1000 steps. One step is the same as an ACSL communication interval.

Step Backward Moves the current time backward one step. If the shift key is held down, the move is 10 steps, and correspondingly for the ctrl key and the alt key the move is 100 and 1000 steps. One step is the same as an ACSL communication interval.

4.1.4. Tools

Commands for opening or closing the tools on the toolbar, and the options dialog box. All tools can be floated.

Standard Shows or hides the standards tool.

Window Shows or hides the windows tool.

Simulation Shows or hides the simulations tool.

Replay Shows or hides the replay tool.

Time Shows or hides the times tool.

Options Opens the options dialog box.

4.1.5. Configure

Commands for configuring AFE to fit a particular ACSL model.

Configuration File Opens the "Save/Open configuration file" dialog box.

Model Opens the "Configure simulation model" dialog box.

Variables Opens the "Configure Variables" dialog box.

Start Parameters Opens the "Configure start parameter pages" dialog box.

Status Line Opens the "Configure the status line" dialog box.

Windows Opens the "Configure Windows" dialog box.

Select Window(s) Opens the "Configure Select Window(s)" dialog box.

Show Errors Opens the "Configuration Errors" dialog box.

Refresh Reloads all X-files in use, and updates all open windows.

4.1.6. Window

This submenu contains commands for administration of windows.

Output Window Selection Opens the "Select Window(s)" dialog box.

Model Output Window Opens the "Model Output" window.

Cascade	Cascade all open windows.
Tile	Tile all open windows side by side.
Close All	Closes all open windows.
Arrange Icons	Arrange all icon windows at the bottom of the main window.
1..n	A list of currently open windows. If selected the window is activated and brought to the top. If the window is minimized, it is restored.

4.1.7. ? (Help)

The only command currently available is for opening the about box.

4.2. Tools

This chapter describes the toolbar, which is normally found below the main menu. The toolbar is divided in several tools. These can be floated and docked with the mouse. A tool can be docked on any side of the main window. A floated tool is displayed as a miniature dialog box. In the description below all tools are printed as dialog boxes.

4.2.1. Standard

Contains buttons for administration of files, and a button for opening the "About" box.

 Creates a new empty simulation. Start parameters and window layout is maintained from the previous simulation.

 Opens a simulation previously saved on a file. The Windows standard dialog box for filename selection is used.

 Saves a simulation to a file using the current filename. If no filename exists, the user is asked for one by the Windows standard dialog box for filename selection.

 Opens the "About" dialog box.

4.2.2. Window

Contains buttons for administration of windows.

 Opens the "Select Window(s)" dialog box.

 Cascade all open windows.

 Tile all open windows vertically side by side.

 Tile all open windows horizontally side by side.

 Closes all open windows.

4.2.3. Simulation

Contains buttons for controlling a simulation.

 Starts a new simulation, or continue one that was previously paused.

 Pauses a running simulation.

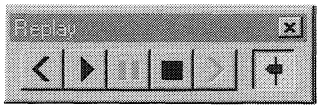
 Aborts a running or paused simulation permanently.

 Prepares the program for a new simulation. Data collected from the last simulation run are discarded. Start parameters are not affected.

 Opens the "Start parameters" dialog box.

4.2.4. Replay

Contains buttons for controlling a replay.



 Moves the current time backward one step. If the shift key is held down, the move is 10 steps, and correspondingly for the ctrl key and the alt key the move is 100 and 1000 steps. One step is the same as an ACSL communication interval. If you have a wheel mouse, turning the wheel forward will activate this function.

 Starts a replay from the current time. I the current time is the last possible time, the replay am started from the beginning.

 Interrupts a replay.

 Resets the current time to the beginning.

 Moves the current time forward one step. If the shift key is held down, the move is 10 steps, and correspondingly for the ctrl key and the alt key the move is 100 and 1000 steps. One step is the same as an ACSL communication interval. If you have a wheel mouse, turning the wheel backward will activate this function.

 Opens or closes the times tool.

4.2.5. Time

The time tool, the slider, is normally docked to the right border in the main window. By moving the slider, the current time can be moved forward or backward. The slider also supports a mouse with a wheel button. Rotating the wheel one notch forward or backward is the same as pushing the forward or backward button once in the replay tool. Also the shift and control keys can be used to increase the number of time step used for each notch.

4.3. Keyboard shortcuts

The following keyboard shortcuts can be used to trigger menu commands.

F1 Opens the "About" box.

F2 Opens the "Start parameters" dialog box.

F3 Opens the "Select Window(s)" dialog box.

F5 Starts a new simulation, or continue one that was previously paused.

F6 Pauses a running simulation.

F7 Aborts a running or paused simulation permanently.

F8 Prepares the program for a new simulation. Data collected from the last simulation run are discarded. Start parameters are not affected.

↑ Starts a replay from the current time. If the current time is the last possible time, the replay is started from the beginning.

↓ Interrupts a replay.

→ Moves the current time forward one step. If the shift key is held down, the move is 10 steps, and correspondingly for the ctrl key and the alt key the move is 100 and 1000 steps. One step is the same as an ACSL communication interval.

← Moves the current time backward one step. If the shift key is held down, the move is 10 steps, and correspondingly for the ctrl key and the alt key the move is 100 and 1000 steps. One step is the same as an ACSL communication interval.

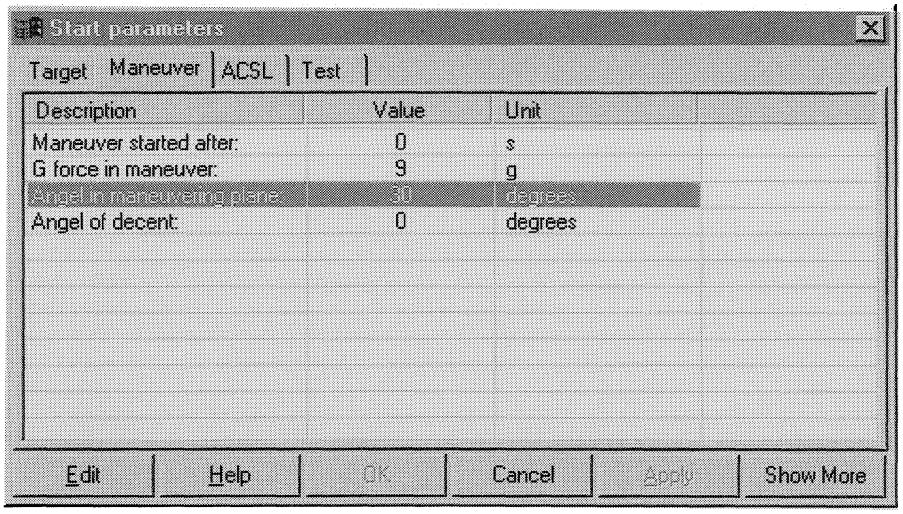
Home Resets the current time to the beginning.

End Sets the current time to the end of the simulation.

Also available are the usual Windows keyboard shortcuts and shell extensions.

4.4. View and edit start parameters

The purpose of the dialog box "Start parameters" is to view and edit the start parameters in a simulation.



The tabs are used to select among available sets of start parameters, which are displayed in the list. The contents in the list, and the number and definition of tabs can be configured. The window can be resized, and the buttons have the following function:

Edit Opens the dialog box "Edit *type* value", in which the user can edit the current start parameter marked in the list. *Type* indicates what kind of value is currently being edited. Double clicking on a row in the list can also activate this button, unless the value is of the type logical. If so the value is toggled instead.

Help Opens a window with an explaining configurable text for the current start parameter.

OK Closes the dialog box and makes changes available for a simulation. If a simulation had been run before this button was pressed, a new simulation is started immediately.

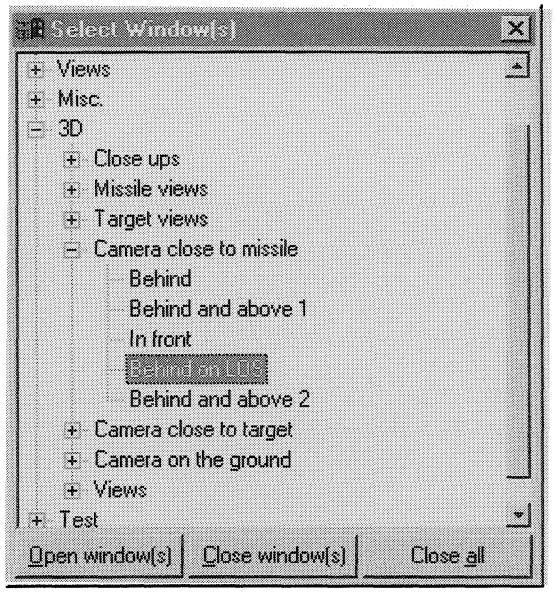
Cancel Closes the dialog box and discards any changes made.

Apply Makes changes available for a simulation. If a simulation had been run before this button was pressed, a new simulation is started immediately. The dialog box remains open.

Show More Expands the **Value** column into four new columns. **New Value** corresponds to the previous **Value** column. **Old Value** displays the last value applied. **File Value** displays the value in the last loaded or saved simulation, i.e. the .SIM file. **Model Value** displays the original value from the simulation model, i.e. the .PRX file.

4.5. Viewing simulation results

With the dialog box "Select Window(s)" the user can open and close the windows that shows the result from a simulation run. The windows can be opened, closed and moved during both simulation and replay.



The list displayed is hierarchical. A level can be expanded and contracted by clicking on the "+" and "−". The lowest level corresponds to one output window, and a higher level corresponds to all output windows in the underlying levels up to the current, or top, level. The contents in the displayed list and its structure, as well as the contents of the windows, are configurable. The window can be resized, and the buttons have the following function:

Open window(s) Opens the windows that correspond to the current item in the list. Already open windows are not affected. This button can also be activated by a double click on an item in the list.

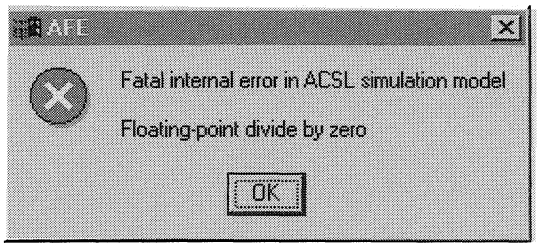
Close window(s) Closes the output windows that correspond to the current item in the list. Any other open window is not affected. This button can also be activated by holding down the shift key and double clicking on an item in the list.

Close all Closes all open output windows.

The "Model Output" window can only be opened from the main menu.

4.6. Error handling during a simulation

In case of an unexpected error in the ACSL model during a simulation, AFE tries to displays the following message box where the second line describe the type of error.



The example shows an error of type division by zero. The message is also added as the last line in the "Model Output" window.

WARNING: Even if it is possible to close the message window and continue running AFE, it is important not to do so. Instead it is necessary to exit AFE and restart. If you are running on Window 9x you should also restart Windows. Do not save any files after this error has occurred. If files are saved they may be corrupt. If you ignore this warning and continue running AFE after this error has occurred, AFE may behave unpredictable.

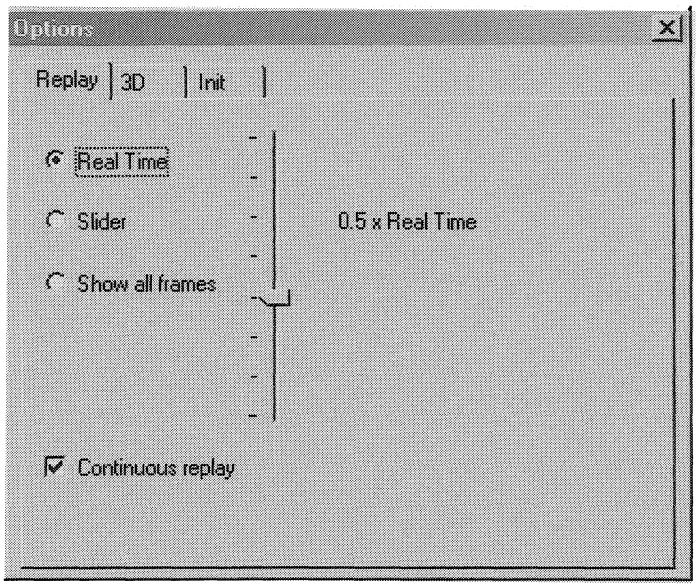
Some of the errors handled by the FORTRAN run-time system used by the ACSL model cannot be handled properly by AFE. Ex. if the ACSL model tries to read (with a ACSL/FORTRAN READ statement) from an empty file without specifying any error handling, the FORTRAN default behavior is to terminate the program. This behavior is built into FORTRAN and cannot be changed from outside FORTRAN. The immediate result of an error of this kind is that the AFE main window disappears from the screen without displaying any message to the user. Error handling for this kind or error must therefore be built into the simulation model, it cannot be added by AFE to an existing model.

4.7. Program options

The "Options" dialog box is used for changing various general options in the program. All changes take effect immediately, so there is no need for an Apply-button. The options are grouped together in three tabs. The settings are saved in the INI-file between invocations of the program.

4.7.1. Replay

Replay options affect the speed and behavior of a replay.



Real Time The replay is always performed in real time (wall clock time). The frame rate is controlled to be as fast as possible with the available data and hardware performance.

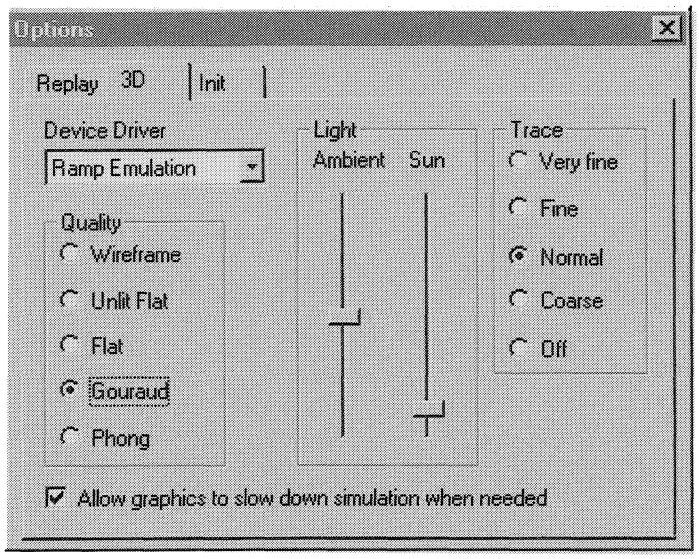
Slider The replay speed is selected by the slider. The selection is displayed to the right of the slider.

Show all frames The program displays all available frames in sequence as fast as possible. The actual replay speed compared to real time cannot be determined; it will vary with the current computer load and hardware performance.

Continuous replay If this option is selected replay restart from the beginning rather then terminate when it reaches the final time.

4.7.2. 3D

3D options affect only animation (3D) windows. Windows containing graphs or text are not affected.



Device Driver Selects one of the available DirectX device drivers. The available drivers can vary depending on the actual hardware and software in use. The first driver displayed in the pull down list is generally the fastest, but also least accurate.

Quality Selects the shading method. The button list is ordered so that faster methods come first.

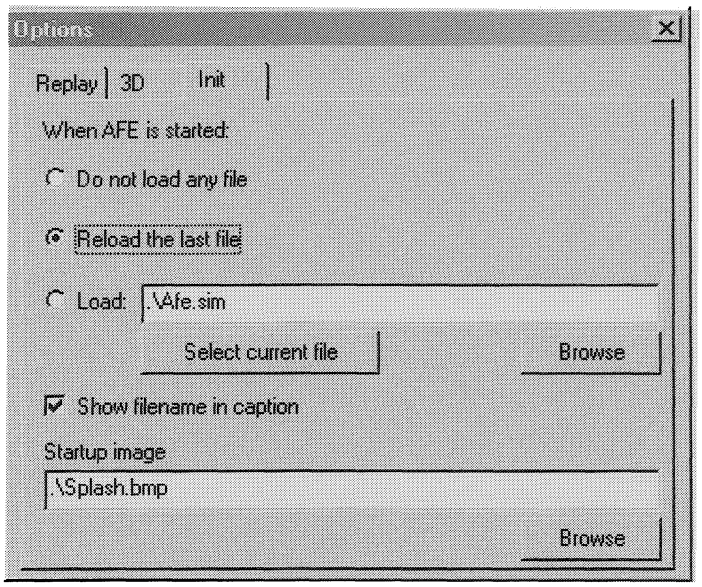
Light Sets the level of ambient and directed (sun-) light. The settings do not affect performance.

Trace Selects, or deselects, trace from moving objects. The finer trace, the slower frame rate. In order for trace to be visible it must also be configured for the 3D-object in use. (The setting "Very fine" is also very slow on most hardware, and should be avoided).

Allow... When this checkbox is marked AFE is allowed to slow down a simulation if it is needed for the graphics to keep up with the simulation. AFE may display very pore response time to user interactions if this option is disabled.

4.7.3. Init

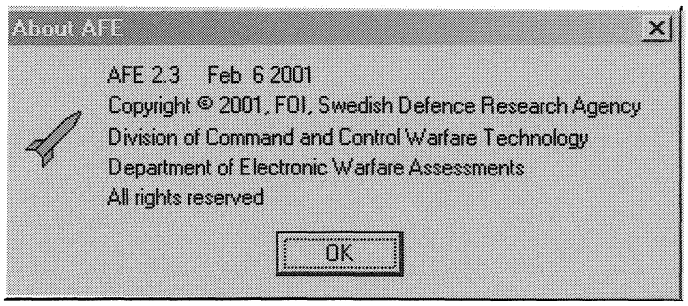
On this page some initial startup properties are configured.



Do not load any file	Setup AFE to start with no initial simulation file loaded.
Reload the last file	Setup AFE to load the last simulation file in use when AFE was last run.
Load:	Setup AFE to load the specified simulation file when started.
Select current file	Selects the currently loaded simulation file as the initial file to be loaded.
Browse	Allows the user to select a file to be loaded with the **Select file** common dialog box.
Show filename in caption	Setup AFE to display the filename of the initially loaded file in the caption of the main window.
Startup image	Setup an initial image to be displayed during program startup. Clear this field to disable the startup image. The image must be in the bitmap (.BMP) format.

4.8. About AFE

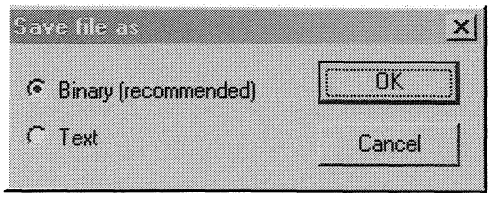
This is the "About box" for the program. The date on the first line is the system build date.



4.9. Format for simulation results.

The results from a simulation can be saved to a file in binary or text format. The syntax for the text format is described below. The binary format is not described in this document.

The file type (or file name extension) decides if binary or text format is used when a file is saved. The file type `TXT` selects text format, and `SIM` selects binary format. If some other file type is specified, AFE asks for the file format to use with the following dialog box.



The correct file format is selected automatically when a file is opened.

The purpose of the text file format is for data exchange with other programs. A binary file should normally be selected for saving simulation results to a file.

4.9.1. Syntax specification for text files

```
<SYNTAX> -> ´AFE´ <number> ´MODEL´ <id>
            ´INITIAL´  {+ <id> }     ´;´
            ´DATA´     {+ <VALUE> } ´;´
            ´DYNAMIC´  {+ <id> }     ´;´
            ´DATA´     {+ <VALUE> } {+ ´,´ <number> } ´;´
            ´TERMINAL´ {+ <id> }     ´;´
            ´DATA´     {+ <VALUE> } ´;´
<VALUE> -> <SIMPLE-VALUE> | ´[´ {+ <SIMPLE-VALUE> } ´]´
<SIMPLE-VALUE> -> <number> | <string>
```

The actual number of values supplied after the DATA keyword must be the same as the number of names supplied after the INITIAL and TERMINAL keywords preceding the DATA keyword. Also the number of columns after the DATA keyword following the DYNAMIC keyword must be the same as the number of names supplied after the DYNAMIC keyword. The values in a vector, surrounded by the [...] syntax, are counted as one column. The number of values supplied between the brackets must match the length of the vector exactly. Any number of lines can be supplied in DATA after DYNAMIC. The first name after DYNAMIC must always be the time, and the corresponding columns in DATA must contain monotonically raising values. The character '!' (Exclamation) can be used to start a comment, valid to the end of line. Apart from this, the text can be freely formatted. All names supplied after INITIAL, DYNAMIC, and TERMINAL must in number and position match the current configuration exactly.

Example:

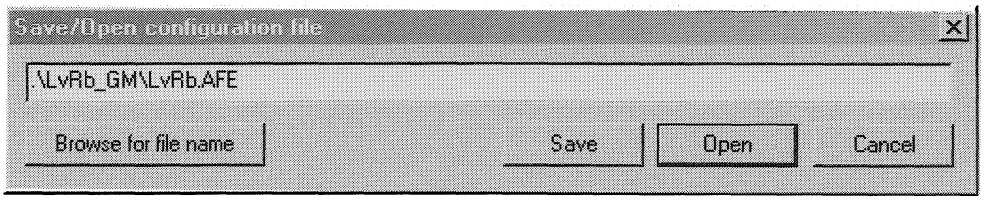
```
AFE 1.2
MODEL LvRb
INITIAL tsm acc vtgt ;
DATA 0.6 70 300 ;
DYNAMIC t tgt2_xte tgt2_yte tgt2_zte kin_xm kin_ym kin_zm ;
DATA 0.0 1.1 1.2 1.3 5.1 5.2 5.3 ,
1.2 1.3 1.4 5.2 5.3 5.4 6.8,
...
5.5 9.1 9.2 9.3 11.1 11.2 11.3 ;
TERMINAL miss1_bomt miss1_bomd ;
DATA 5.5 4.6 ;
```

5. CONFIGURATION FOR AN ACSL MODEL

This chapter describes how AFE is configured to a particular ACSL simulation model. The configuration information is saved in a special file, known as the AFE-file or configuration file, between invocations of AFE. The recommended file type for this file is **.AFE**, and AFE automatically tries to load the last saved or opened configuration file when it is started. There is also a so-called INI-file used for maintaining information between invocations of AFE. The INI-file contents are automatically maintained by AFE.

5.1. The configuration file

The configuration file is administrated from the "Save/Open configuration file" dialog box.



The edit control shows the filename for the configuration file last saved or opened. It can be edited manually or looked up by the **Browse** button. Relative file names using "." or ".." can be used. The "." always refers to the same directory as the INI-file and usually the AFE program file AFE.EXE is placed in. The filename is saved in the INI-file during invocations of AFE.

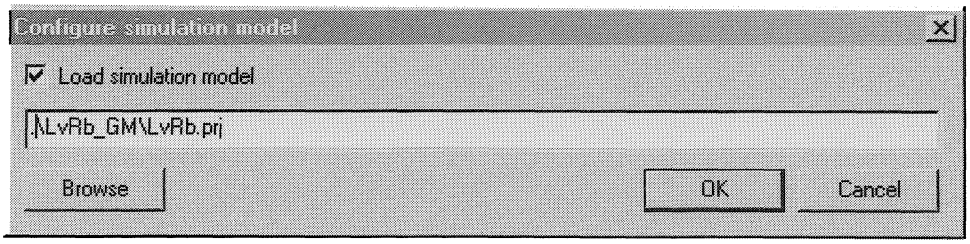
Browse... Opens the common dialog box for filename selection. The edit control is set to the file path selected.

Save Saves the configuration file using the filename in the edit control.

Open Loads a configuration file using the filename in the control. The current configuration is lost and replaced by the content of the loaded file. The user is prompted to save the current configuration if necessary.

5.2. The model files

The dialog box "Configure simulation model" is used for specifying the file path to the ACSL .PRJ file for the selected model.



The file path for the model .PRJ file is shown in the edit control. It can be edited manually or looked up by the **Browse** button. Relative file names using "." or ".." can be used. The "."

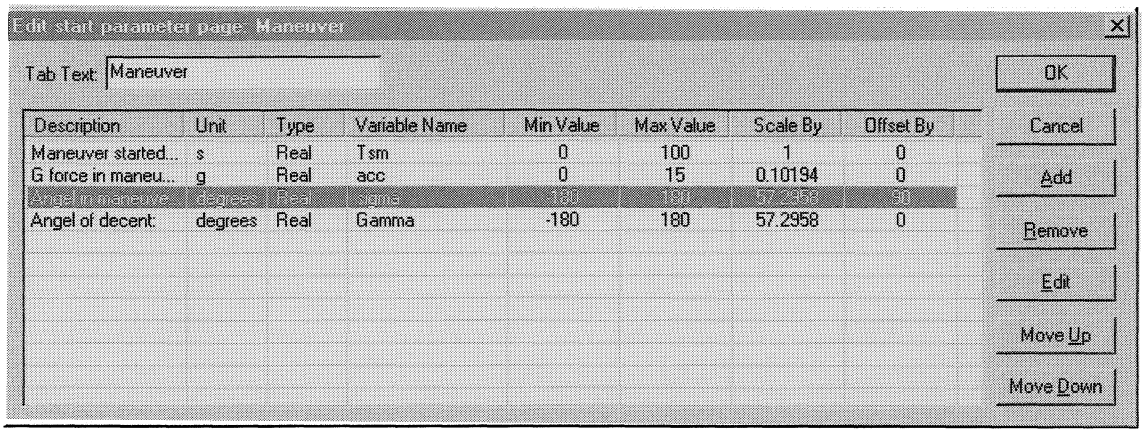
always refers to the same directory as the INI-file and usually the AFE program file AFE.EXE is placed in. The path is part of the current configuration.

Load... This checkbox controls if the simulation model is loaded or not. To use AFE without a model, uncheck this box.

Browse Opens the common dialog box for filename selection. The edit control is set to the file path selected.

5.3. List controls and common buttons in dialog boxes

Many of the dialog boxes described in this chapter have one or more list controls as showed by this example.



The buttons to the right of the list control appears in most cases where a dialog box has a list control. Therefore, these buttons are described once here instead of in several other places. Each line in a list control, displays a few important properties of an object displayed in the dialog box. A list can be sorted or unsorted. Usually if the list is unsorted, the order in which the items in the list are ordered are significant. The column header buttons can in some dialog boxes, where the order is not significant, be used for sorting the lines in the list in ascending or descending order.

Add Add a new line or item. If an item is selected this operation displays a dialog box with a copy of the selection. If no item is selected, an empty dialog box is displayed. If the list is unsorted, the new item appears directly below the selected item, or last if no item is selected.

Remove Remove the selected item.

Edit Edit the selected item. Same function can be activated by a double click on a list item. In most cases opens the same dialog box as the **Add** button, but for editing an existing item.

The following two buttons are only displayed for unsorted lists where the list order is significant.

Move Up Move the selected item up one line.

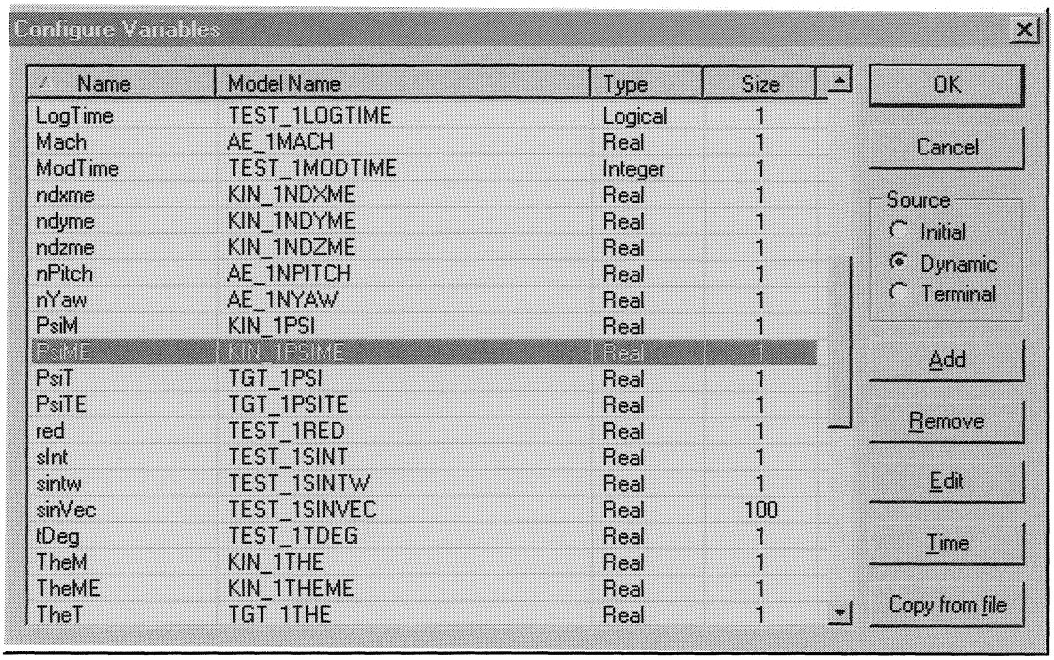
Move Down Move the selected item down one line.

5.4. Shortcut commands

The dialog boxes described in this chapter are sometimes deeply nested. Therefore a shortcut command has been implemented to facilitate enter and exit of nested dialog boxes. To exit an open dialog box, hold down **shift** while pressing **OK** or **Cancel**. This closes the current dialog box and all the dialog boxes that were opened in order to get to the current dialog box. To reenter the same dialog box closed in this way, hold down **shift** and select the same configuration command again.

5.5. Simulation model interface

The model interface is made up of the set of model variables communicated back and forth between AFE and the simulation model. The dialog box "Configure Variables" manages the variables.



A selected variable always belongs to one of three subsets. These subsets are named **Initial**, **Dynamic** or **Terminal**. The name of a variable must be unique in the total set of all variable names, including both the **Name** and **Model Name**.

Name A short and more convenient name to be used as a nickname for the real name the variable has in the model. This name is later used to refer to the variable in the rest of the configuration.

Model Name The real name of the variable used in the ACSL model.

Type The base type of the variable. AFE currently supports **Real**, **Integer**, **Logical**, and **Character**. A **Logical** value is represented in AFE by the numeric value one (1) for a true value, and zero (0) for a false value.

Size The number of values in the variable. For numeric values one (1) means that the variable is a single valued variable. A value greater then one means that

the variable is a one-dimensional vector declared with exactly that size in the model. For non-numeric values (i.e. **Character**) the size specifies the number of elements in the value. These values are always regarded as a single value.

Source Selects which subset of variables is displayed in the list.

Initial These are the start parameter variables. AFE sends their current values to the model before a new simulation is started. The variables are expected to be ACSL **CONSTANTS**.

Dynamic This set of variables represents the set of data collected by AFE each ACSL "communication interval" (as set by CINT) when a simulation is running. They can be any variable including state variables. Data in this set are also collected once after the simulation has terminated, unless the termination time happens to occur on a communication interval.

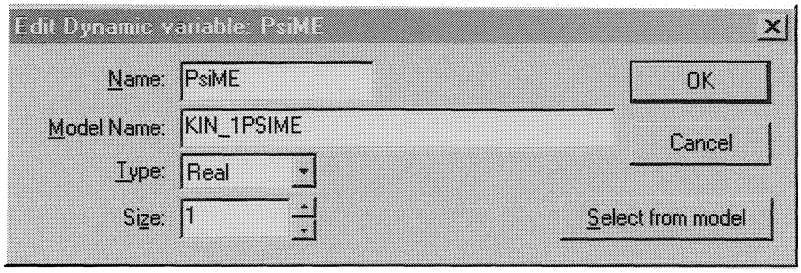
Terminal This set of variable values is collected by AFE once after a simulation has terminated. They are expected to be final values.

Time Modify the variable representing the model time. It must be the variable declared as **VARIABLE** in the model. ACSL also calls this variable the "independent variable". It is usually called **T**. It must always be defined in the current configuration even if no model is loaded. The time variable belongs to the **Dynamic** subset of variables.

Copy from file Copy variables from another configuration file.

5.5.1. Modify variable properties

To add or modify an existing variable in the set of model interface variables the following dialog box is used.



Name A short and more convenient name to be used as a nickname for the real name the variable has in the model. This name is later used to refer to the value of the variable in the rest of the configuration.

Model Name The real name of the variable used in the model. This name can also be used later in all contexts a **Name** is used. This field can be left empty when AFE is used without a model to load data from text files.

Type The base type of the variable. AFE currently supports **Real**, **Integer**, and **Logical**. A **Logical** is represented in AFE by the numeric value one (1) for true and zero (0) for false.

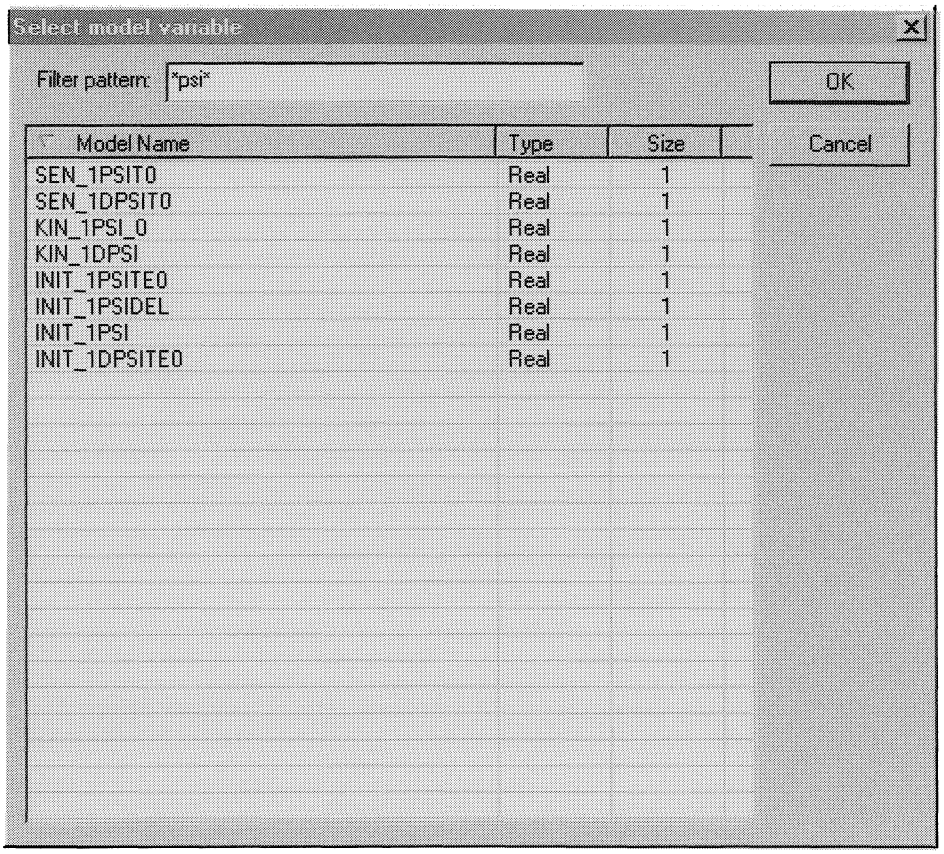
Size The number of values in the variable. For numeric values one (1) means that the variable is a single valued variable. A value greater then one means that the variable is a one-dimensional vector declared with exactly that size in the model. For non-numeric values (i.e. **Character**) the size specifies the number of elements in the value. These values are always regarded as a single value.

Select from model Opens the dialog box "Select model variable" used for selecting existing model variables. This button is only available when a model is loaded.

The variable properties **Model Name**, **Type**, and **Size** must match an existing variable in the model exactly. If this is not the case a configuration error is generated. For a variable with a configuration error the following happens if a simulation is run. For a variable in the **Initial** subset no value is sent to the model, and for a variable in the **Dynamic** or **Terminal** subset it will always appear to have the numeric value zero (0), or empty for a **Character**.

5.5.2. Selecting an existing variable from the model

The dialog box "Select model variable" is used for browsing and selection of an existing variable name from the simulation model. This dialog box is only available if a model is loaded.

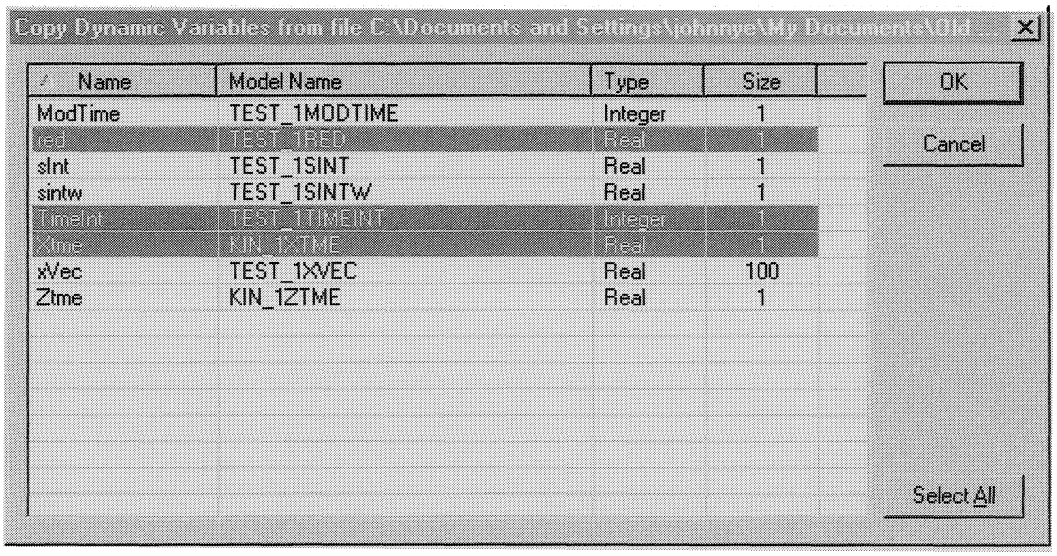


If the dialog box is opened in an **Initial** subset context, only ACSL **CONSTANT** names are listed. If the subset context is **Dynamic** or **Terminal** only non **CONSTANT** names are listed.

Only user model variable names are displayed in the list. Predefined system variable names (ACSL system symbols) are not listed, but can be entered manually in the previous dialog box. In the **Terminal** context, the user must remember only to select variables that represent final values. The edit control with the label **Filter pattern:** can be used for filtering out a subset of available variable names in the list. The special character '*' can be used for matching a sequence of any characters, including zero. Also the special character '?' can be used for matching any single character. The column header buttons can be used to sort the corresponding column in ascending or descending order.

5.5.3. Copy variables from a file

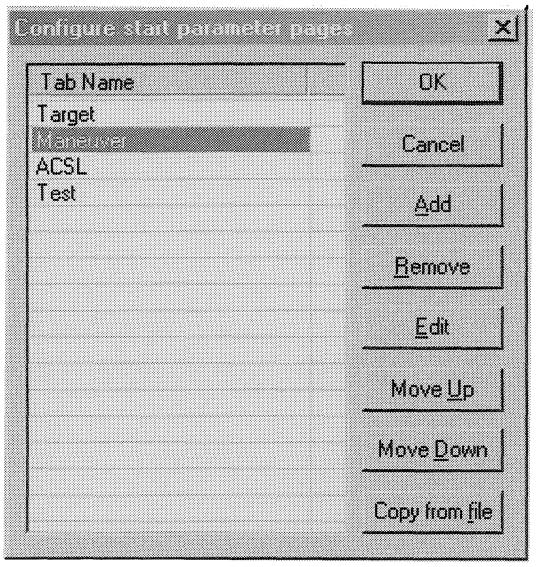
This dialog box is used for copying variables from a configuration file to the current configuration.



The list shows variables from the selected configuration file that is not already in use in the current configuration. To copy variables already in use these must first be removed from the current configuration. The button **Select All** selects all items in the list.

5.6. Start parameters

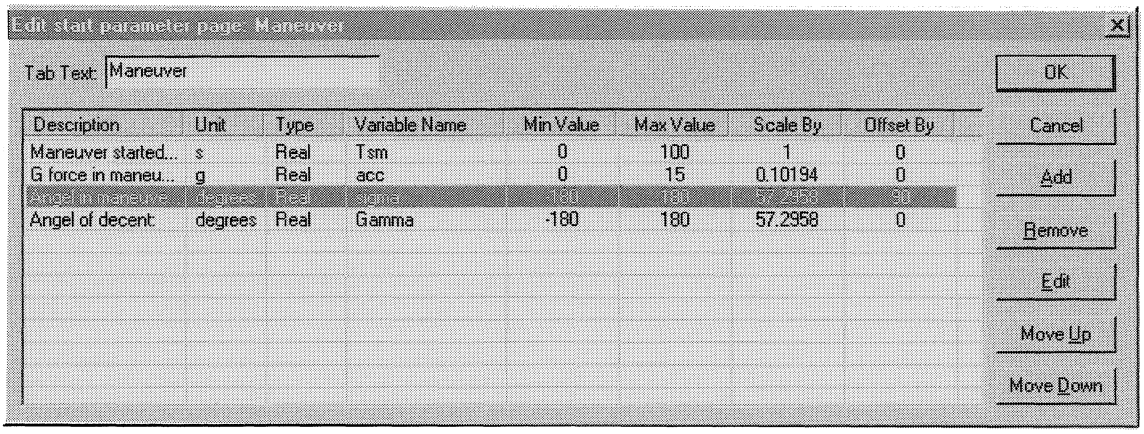
The dialog box "Configure start parameter pages" is used for configuring pages of start parameters. These pages are displayed and used in the dialog box "Start parameters", described in section 4.4. In the text below "displayed value" and "displayed text" means a value or text presented to the user of the "Start parameters" dialog box. In addition, a reference made to the user means the user of the "Start parameters" dialog box.



Each page is displayed in the "Start parameters" dialog box with a separate tab in the order they are listed. The list shows the tab names used for each page.

5.6.1. Modify start parameter pages

This dialog box is used for managing the start parameters on a single page.



Each item in the list represents a single **Initial** variable in the model to be assigned a start value before a simulation is started.

Tab Text The text displayed on the tab used for selecting the page.

Description The text displayed before a start parameter value.

Unit The text displayed after a start parameter value.

Type The type of the value displayed. This value affects how the user is allowed to modify a value. In the current version of AFE, it must match the type of the variable.

Variable Name The name of the variable to be assigned the displayed start value. This variable must be from the **Initial** set of variables. This field can be left empty to introduce an empty line on the page.

Min Value The minimum displayed value allowed for this variable.

Max Value The maximum displayed value allowed for this variable.

Scale By A value used to scale the variable value before it is displayed.

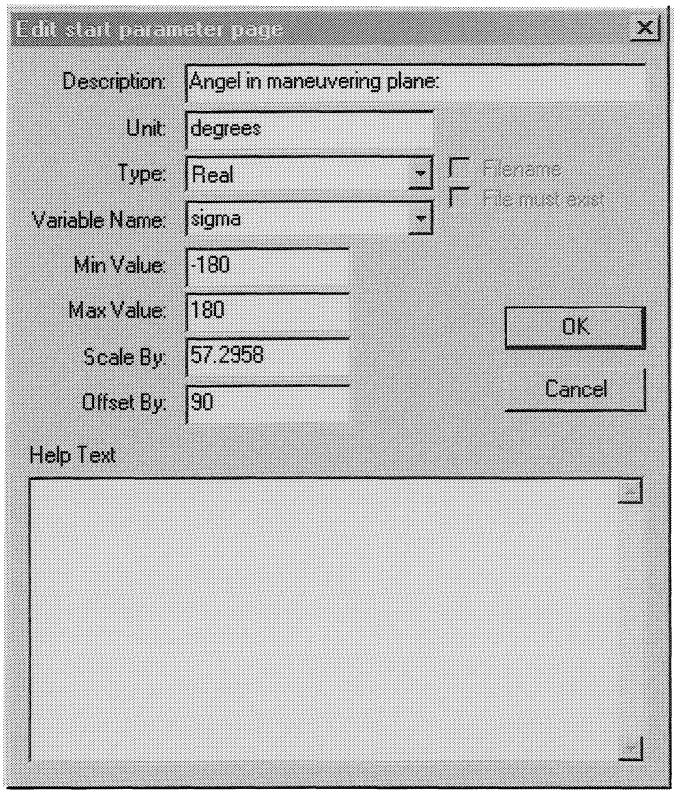
Offset By A value used to offset the scaled variable value before it is displayed.

The following relation holds (in both directions) between the displayed value (**D**) and the variable value (**V**):

```
D = ScaleBy*V + OffsetBy
```

5.6.2. Modify start parameter properties

This dialog box is used for editing the properties of a single start parameter.



Description The text displayed before a start parameter value. It can be used to give the user some idea of what the start parameter is intended for in the model.

Unit The text displayed after a start parameter value. It can be used to specify the unit of the displayed value.

Type The type of the value displayed. This value affects how the user is allowed to modify a value. In the current version of AFE it must match the type of the variable.

Filename If **Type** is set to **CHARACTER** and this checkbox is selected the value is regarded as a filename. Windows standard dialog box for selecting files are used for modifying the value.

File must exist When this checkbox is selected only filenames corresponding to an existing file can be selected. A simulation cannot be started if the actual file does not exist.

Variable Name The name of the variable to be assigned the displayed start value. This variable must be from the **Initial** set of variables. This field can be left empty to introduce an empty line on the page. The name can be edited directly, or selected from the drop down list. Names already in use, on some page, are not displayed in this list. If the variable name is not available a configuration

error is generated. Each **Initial** variable can only be used once; it cannot appear on several pages. If the variable is not properly configured here, the value will not be transferred to the model when a simulation is initiated.

Min Value The minimum displayed value allowed for this variable. If the user tries to enter a smaller value an error message is displayed.

Max Value The maximum displayed value allowed for this variable. If the user tries to enter a greater value an error massage is displayed.

Scale By A value used to scale the variable value before it is displayed.

Offset By A value used to offset the scaled variable value before it is displayed.

Help Text A short text intended to give a further explanation of the text entered as **Description**. This text is only displayed when the user presses the **Help** button.

The displayed value (**D**) the user sees can be different from the actual value (**V**) of the variable. When a variable value is displayed to the user the following calculation is performed:

```
D = ScaleBy*V + OffsetBy
```

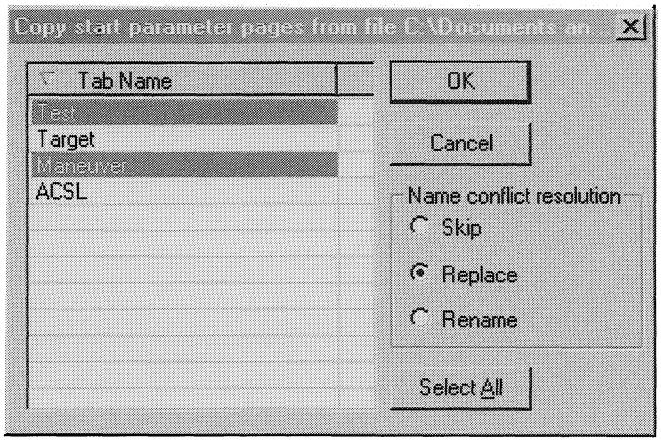
The user can then change the displayed value and when it is moved back to the variable the following calculation is performed:

```
V = (D - OffsetBy)/ScaleBy
```

For example, this can be used to perform a simple translation back and forth of the unit radians in the model to the unit degrees displayed and edited by the user.

5.6.3. Copy start parameter pages from a file

The dialog box is used for selecting and copying start parameter pages from another configuration file to the current configuration.



Tab Name The text on the tab used for referring to the start parameter pages in the configuration in the file.

Select All All lines in the list are selected.

Name conflict resolution controls what happens if a tab name selected is already used in the current configuration.

Skip The selected page is not copied to the current configuration.

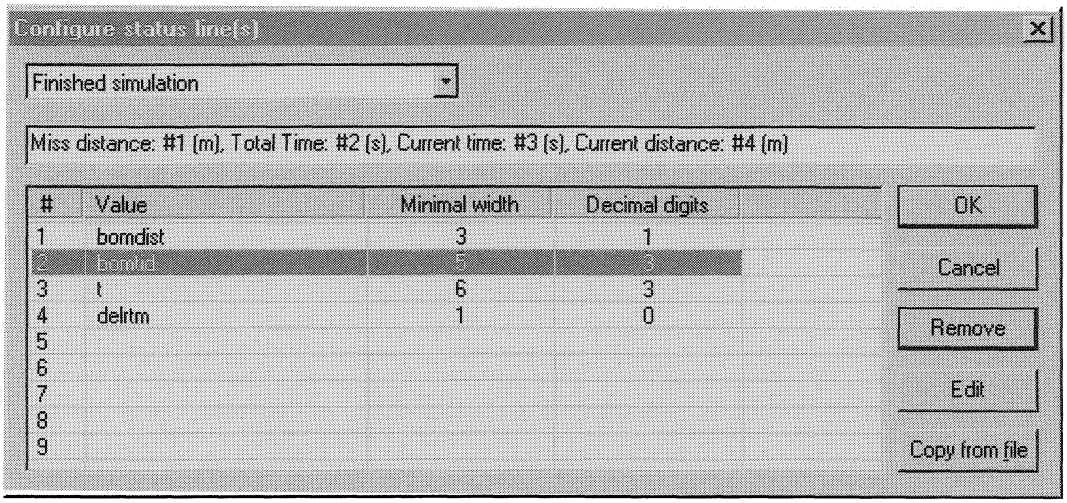
Replace The selected page is copied and replaces the window with the same name in the current configuration.

Rename The selected page is copied to a new tab name not used in the current configuration.

If a page copied contains start parameter variable names already in use in the current configuration, these names are not copied from the file.

5.7. Status line

The status line is the single line of text displayed in the bottom frame of the main window (i.e. the status bar). This dialog box is used for configuring the status text depending on the current program mode. The status line is also used for displaying short help messages, when the user is about to make a menu selection or hovers the cursor for a short period of time over a button in the control bar. These help messages are not configurable.



The combo box at the top of the dialog box selects on of the possible program modes. Each mode has it own status line definition. The corresponding status line is displayed in the edit control below the combo box. The following modes are possible.

Ready for a new simulation Displayed when the program is ready to start a new simulation. Start parameters may have been modified.

Running simulation Displayed when a simulation is running.

Paused simulation Displayed when a simulation is temporarily paused.

Finished simulation Displayed when a simulation has terminated normally.

Interrupted simulation Displayed when the user has interrupted a simulation.

Replaying Displayed during a replay of recorded data from a previous simulation.

The list below the edit control shows the values displayed in the status line.

#n The line number refers to the number followed by the #-sign in the status line text. This is replaced with the value represented by the corresponding list item when the status line is generated.

Value The value to be displayed. The available variables to choose from, depends on the program mode.

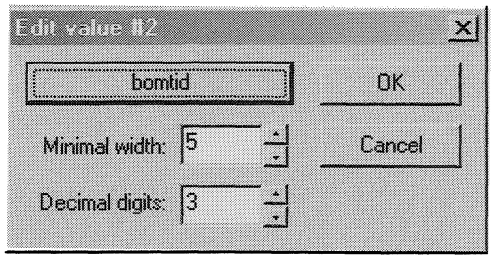
Minimal width The minimal number of character positions in the field. Extra positions are added if more characters are needed to show the whole value.

Decimal digits Number of digit positions after the "." in the number displayed. This option is only available for numeric values.

The **Copy from file** button can be used for copying status lines from another configuration file.

5.7.1. Formatting a value on a text line

This dialog box is used for configuring a single value in a line of text. A text line can appear in a text window, overlaid on a 3D-scene, or on the status line.



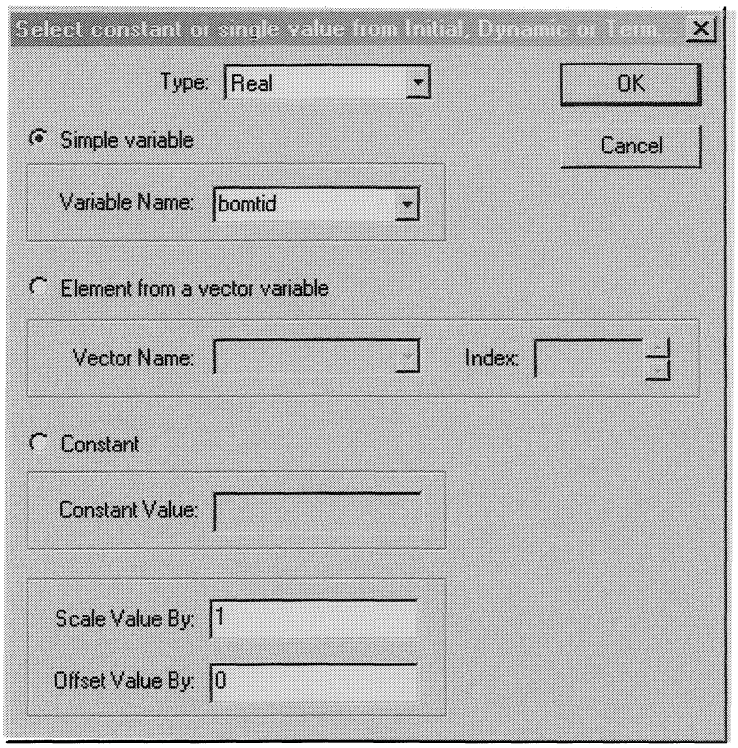
The top left button is used for selecting a value. The button text displays the source of this value by showing the variable name, possibly in a formula describing the calculations made on the value.

Minimal width The minimal number of character positions in the field. Extra positions are added if more characters are needed to show the whole value.

Decimal digits Number of digit positions after the "." in the number displayed. This option is only available for numeric values.

5.7.2. Selecting a single value

The dialog box "Select constant or single value from..." can be opened from several other dialog boxes when a single value is to be selected. The caption shows the appropriate subset of variables available depending on from where the dialog box was opened.



Type Selects the base type of the value. Controls the variable names displayed in the drop down lists.

Simple variable Selects a value from a variable that is not a vector.

Variable Name A name of a variable that is not a vector. The drop list shows the available variable names depending on the **Type** and the current available subset of variables. If the variable name does not exist an error message is displayed.

Element from... Selects an element in a vector.

Vector Name A name of a variable that is a vector. The drop list shows the available vector variable names depending on the **Type** and the current available subset of variables. If the variable name does not exist an error message is displayed.

Index A positive integer used as an index for an element in the **Vector Name** variable. If the index is out of range an error message is displayed.

Constant Selects a constant value. Selecting this option also disables the **Scale Value By** and **Offset Value By** fields.

Constant Value The constant value, possibly with a sign.

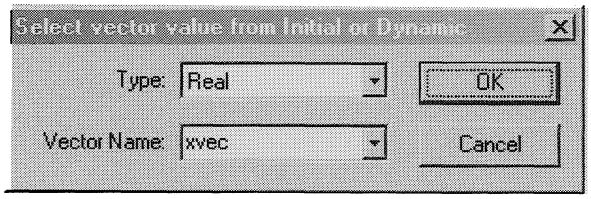
Scale Value By A single numeric constant value used for scaling the value. Default value is 1 (one). This option is only available for numeric values.

Offset Value By A single numeric constant value used for offsetting the value. Default value is 0 (zero). This option is only available for numeric values.

The fields **Scale Value By (= K)** and **Offset Value By (= L)** are used in the formula **Y = K*X+L**, where **Y** is the resulting value and **X** is the value from the simulation. It is used for implementing a linear adjustment of the value before it is used.

5.7.3. Selecting a vector value

The dialog box "Select vector value from..." can be opened from several other dialog boxes when a vector value is to be selected. The caption shows the appropriate subset of vector variables available depending on from where the dialog box was opened.

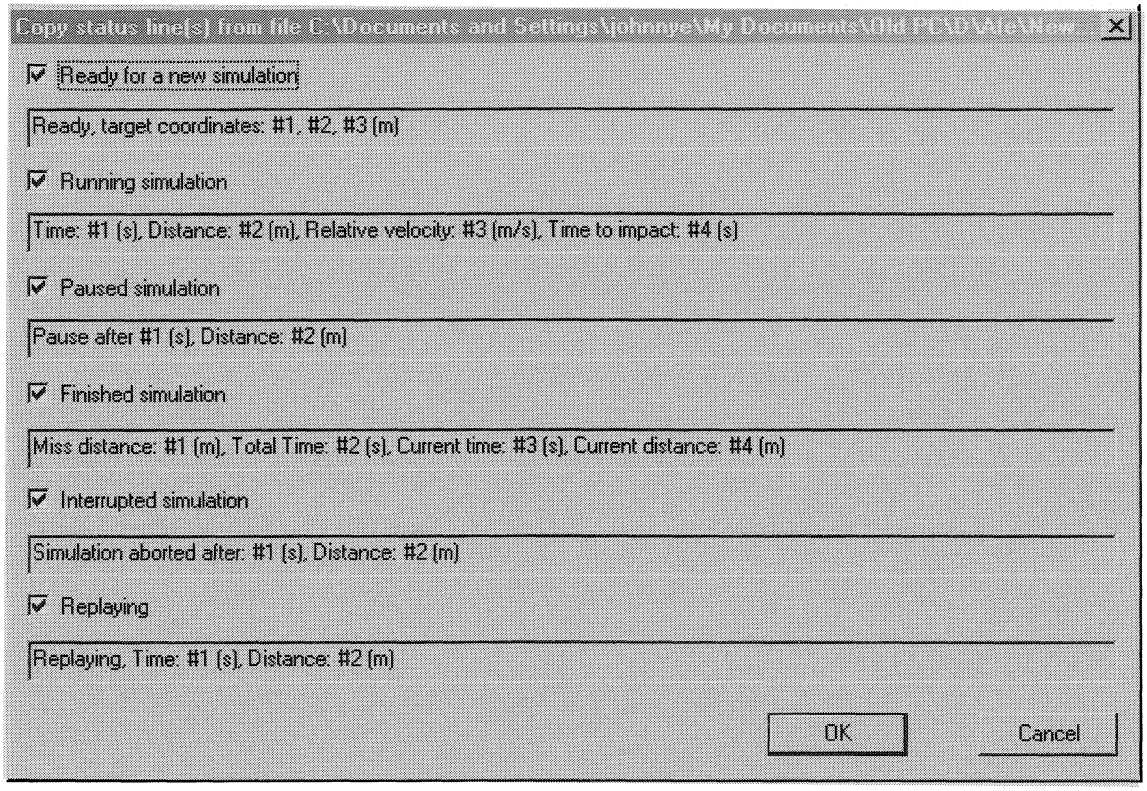


Type Selects the element type of the vector.

Vector Name A name of a vector variable. The drop list shows the available vector variables depending on the selected element **Type** and the current available subset of variables. If the variable name does not exist an error message is displayed.

5.7.4. Copy status lines from a file

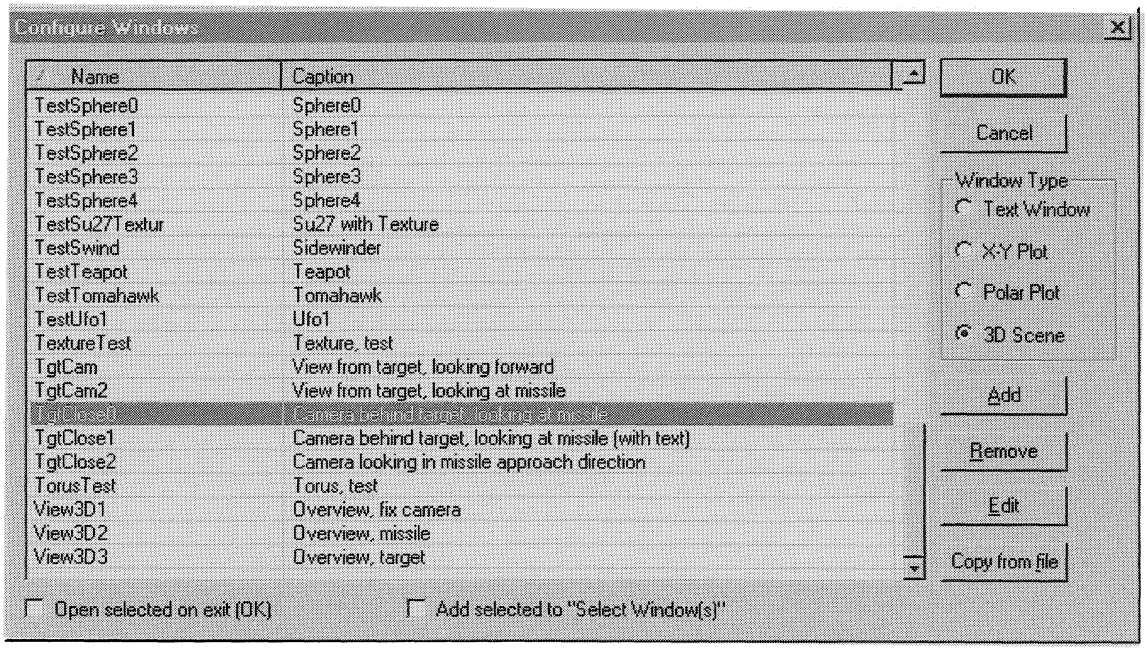
The dialog box is used for selecting and copying status lines from another configuration file to the current configuration.



The check boxes are used for selecting the status lines that are to be copied to the current configuration.

5.8. Simulation result windows

The "Configure Windows" dialog box is used for configuring of the available types of windows used for displaying simulation results.



The contents of the list show the available windows depending on the selected **Window Type**. If the check box **Open selected on exit (OK)** is checked the selected window in the list is opened when the user pushes the **OK** button. If the check box **Add selected to "Select Window(s)"** is checked the selected window is added to the "Select Window(s)" dialog box when the user pushes the **OK** button.

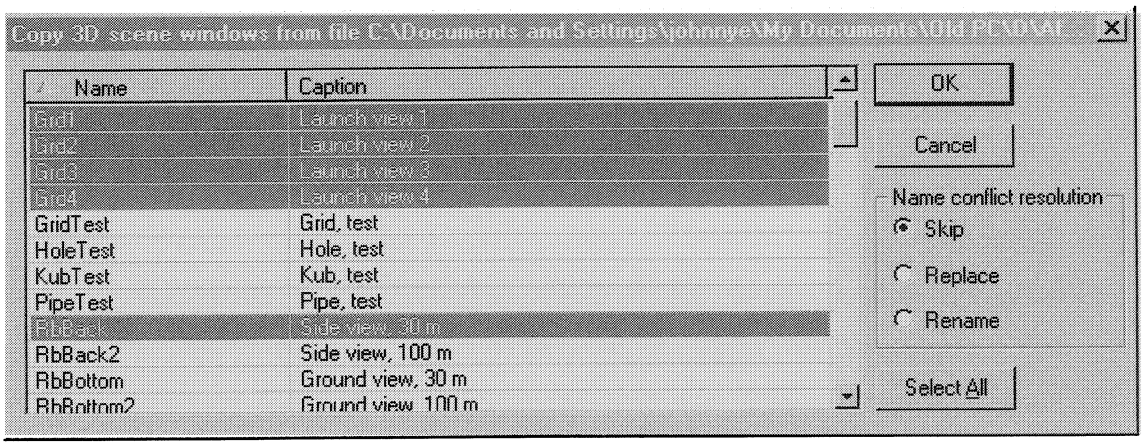
Name The name of the window.

Caption The window caption.

Copy from file Used for copying windows of the selected type from another configuration file.

5.8.1. Copy a window from a file

This dialog box is used for copying windows to the current configuration from another configuration saved in a file.



Name The name used for referring to the window in the configuration file copied from.

Select All All lines in the list are selected.

Name conflict resolution controls what happens if a name selected is already used in the current configuration.

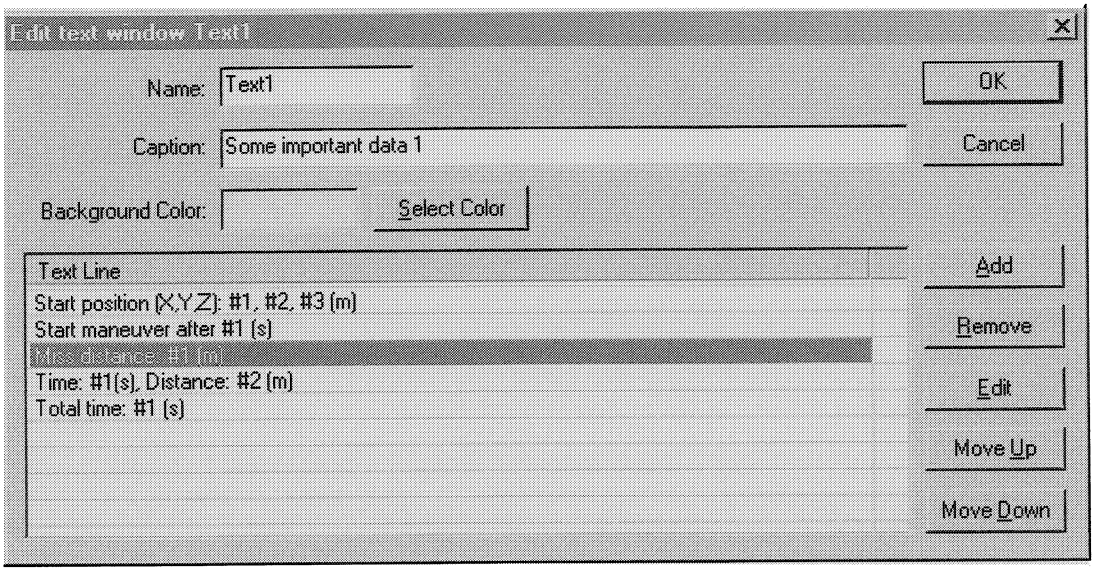
Skip The selected window is not copied to the current configuration.

Replace The selected window is copied and replaces the window with the same name in the current configuration.

Rename The selected window is copied to a new name not used in the current configuration.

5.9. Text windows

Text windows are used for displaying a few lines of text in a window.



Name The window name. The name must be unique for the window type.

Caption The window caption. The caption is the single text line displayed in the top frame of the window.

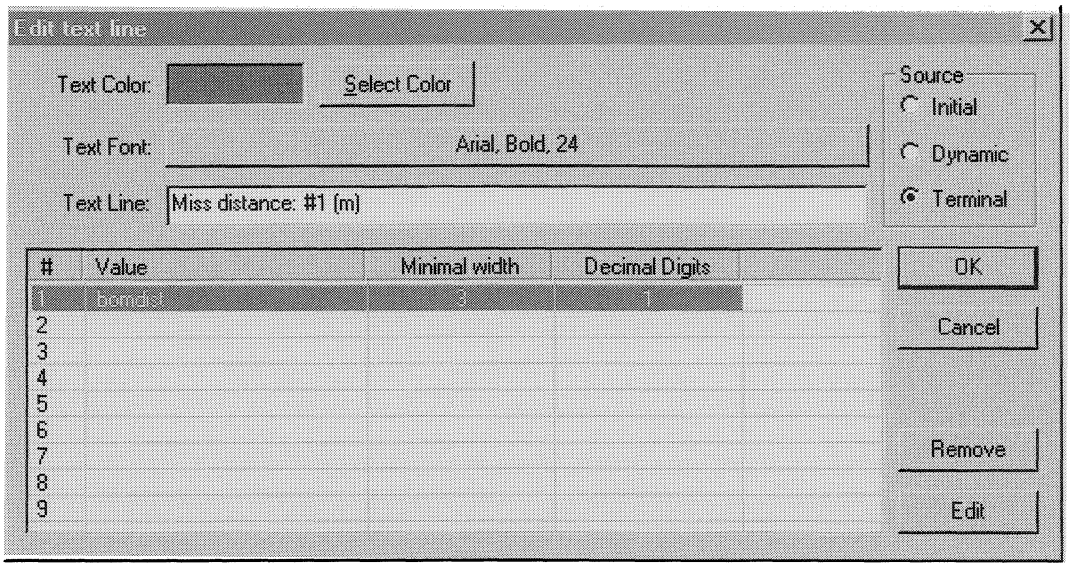
Background Color Shows the selected background color in the window. The button **Select Color** can be used to change background color.

Text Line The text lines as they are displayed in the text window. The #n is replaced with a value.

This dialog box can also be opened from an active text window by selecting **Configure** in the right mouse button menu.

5.9.1. Modify a single line of text

To modify a single line of text in a text window, the following dialog box is used.



Text Color Shows the selected text color for the line. The button **Select Color** can be used to change color.

Text Font A button where the button text shows the selected font for the line. If the button is pressed the user can choose another font.

Text Line The text line as it is displayed in the text window. The #n is replaced with the corresponding value specified in the list control.

Source Selects the variable subset variables referred to in the text lines must belong to. Also controls if lines are displayed or not depending on the program mode. **Initial** variables are always available and therefore the text line is always displayed. **Dynamic** variables are only available after or during a simulation and therefore the text line is only displayed during a simulation, after a simulation has terminated or during a replay. **Terminal** variables are only available after a simulation has terminated and therefore the text line is only displayed after a simulation or during a replay.

The columns in the list control have the following meaning.

#n The list item number 1 to 9 of available list items. The value specified in each list item is used in the **Text Line** by referring to it with the #n syntax. Each list item represents a value and how it is displayed. List items not refereed to in the **Text Line** are ignored. To modify values see page 39.

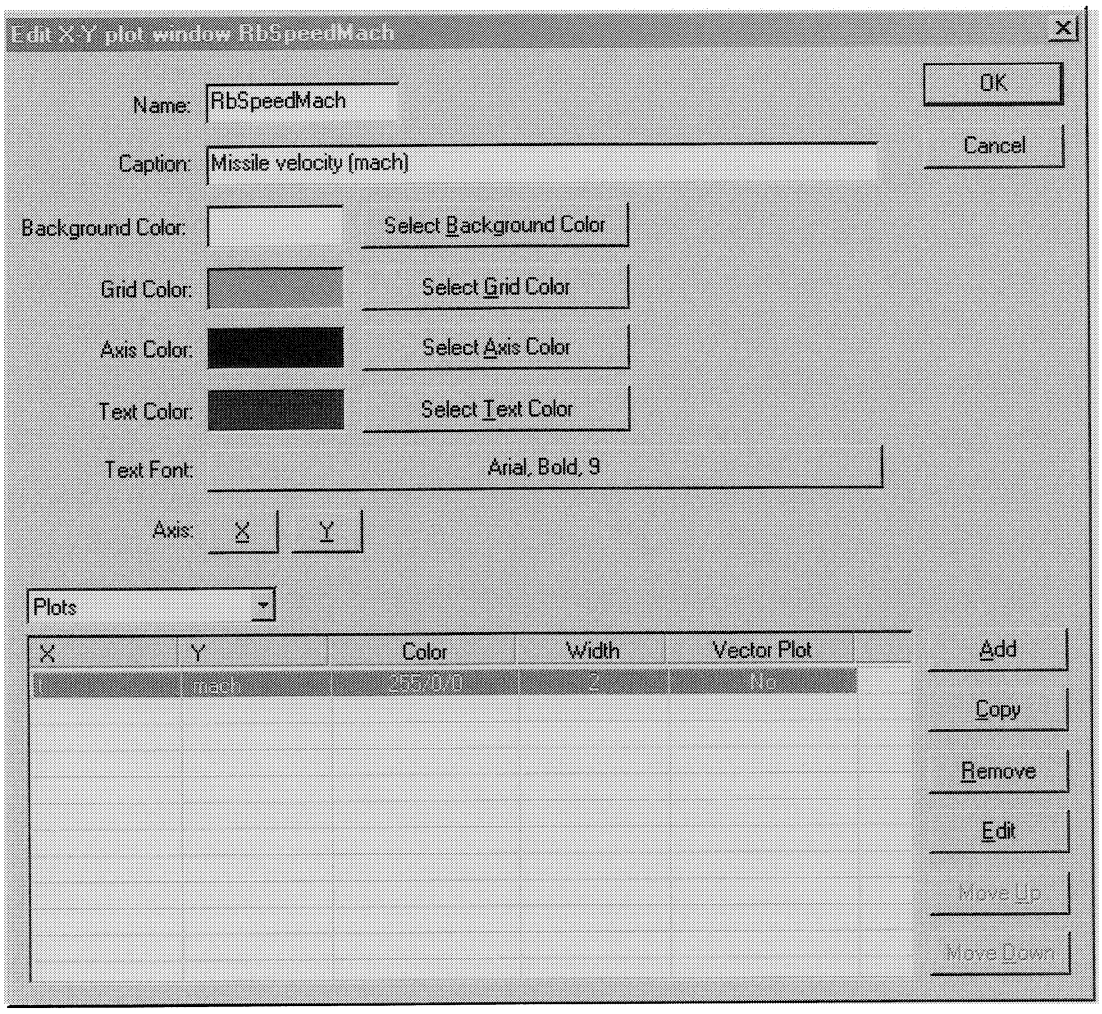
Value Shows the source of the value, usually a variable name possibly with a sign or an index.

Minimal width The minimal number of character positions in the field. Extra positions are added if more characters are needed to show the whole value.

Decimal Digits Number of digit positions after the "." in the displayed number.

5.10. X-Y plot windows

An X-Y plot window contains one or more Cartesian X-Y –plots and is configured by this dialog box. It can also be opened from an active X-Y plot window by selecting **Configure** in the right mouse button menu.



Name The window name. The name must be unique for the window type.

Caption The window caption. The caption is the single text line displayed in the top frame of the window.

Background Color Shows the selected background color in the window. The button **Select Background Color** can be used to change the background color.

Grid Color Shows the selected color for the grid. The Button **Select Grid Color** can be used to change this color.

Axis Color Shows the selected color for the axis. The Button **Select Axis Color** can be used to change this color.

Text Color Shows the selected color for all text. The Button **Select Text Color** can be used to change this color.

Text Font A button displaying the font information used for the text on the axis. By pressing the button new font information can be selected.

Axis These two buttons are used for modifying the scale on each axis.

Copy Make multiple copies of the selected plot. Any indexed vector in the plot can have its index automatically incremented.

The drop list just above the list control is used for selecting between different graphical objects that can be displayed in an X-Y plot window. The selection can be made between **Plots**, **Start parameter marks**, and **Background circles**. If the selection is **Plots** the list control shows the plots drawn in the window.

X The X-value used when drawing the curve.

Y The Y-value used when drawing the curve.

Color The color value as an RGB-code used when drawing the curve.

Width The width value in pixels of the curve.

Vector Plot **Yes** or **No** depending on if the plot is a vector plot or not.

If the selection in the drop list is **Start parameter marks**, the list control shows marks for selected start parameter values. A mark is a circle where the following properties can be modified.

X The start parameter value for the X-position.

Y The start parameter value for the Y-position.

Size The size in pixels.

Thickness The edge width in pixels.

Edge Color The edge color as an RGB-code.

Interior Color The fill color as an RGB-code.

If the selection in the drop list is **Background circles**, the list control shows data for ellipses that can be used for a background in the plot. If at least one background ellipse is specified, the plot axis will be drawn with equal length regardless of their scaling. If the axes have the same scaling the ellipse will be drawn as a circle. The ellipse is always centered on the origin.

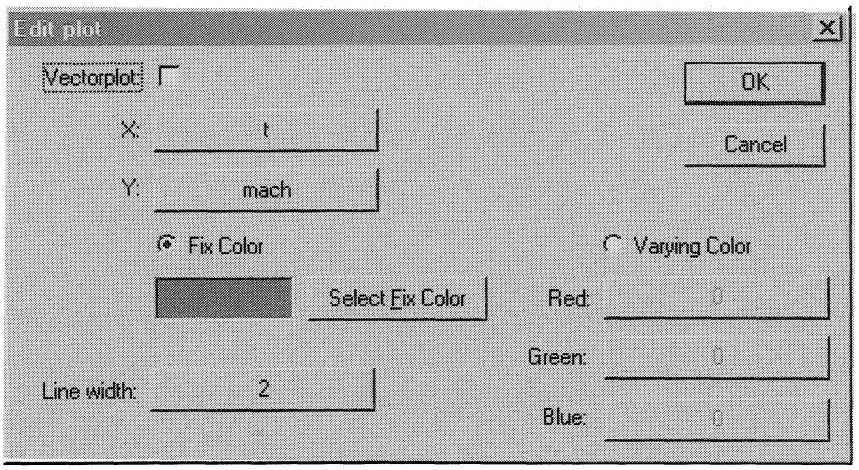
Radius The radius in axis units.

Color The fill color of the ellipse as an RGB-code.

The graphical objects are drawn in the order they are listed. This means that an object below another object may hide that object more or less.

5.10.1. Modify a single plot in a window

A single curve in an X-Y –plot or polar plot is configured with this dialog box.

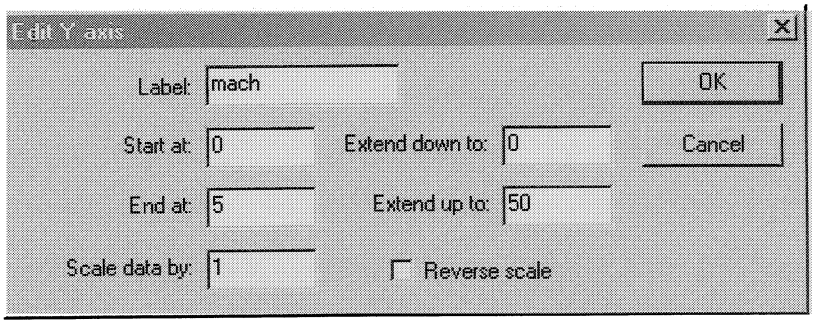


Vectorplot	Controls if the plot show a vector plot or not. If it is a vector plot then **X** and **Y** must both be vector values.
X, Y	The button text shows the values used in the plot. Values can be selected by pushing these buttons. If the dialog box is opened from a polar plot these buttons selects angle and radius value.
Fix Color	Selects a fix color for the whole plot. The button **Select Fix Color** can be used to change the fix color.
Varying Color	Selects varying plot color.
Red, Green, Blue	The button text shows the values used for controlling the color of the plot as RGB-codes. The buttons can be used to select new values. These values are automatically limited to the interval **0..255** when the plot is drawn.
Line width	The button text shows the value used for controlling the line with when the plot is drawn. If the button is pushed, a new value can be selected.

How plot values are selected is described on page 40.

5.10.2. Modify an axis in a plot window

The axis of an X-Y –plot, and the radius of a polar plot are configured with this dialog box.



Label The axis label.

Start at The start point of the axis scale.

End at The end point of the axis scale.

Scale data by A scaling factor for the displayed values. All values drawn are multiplied by this value.

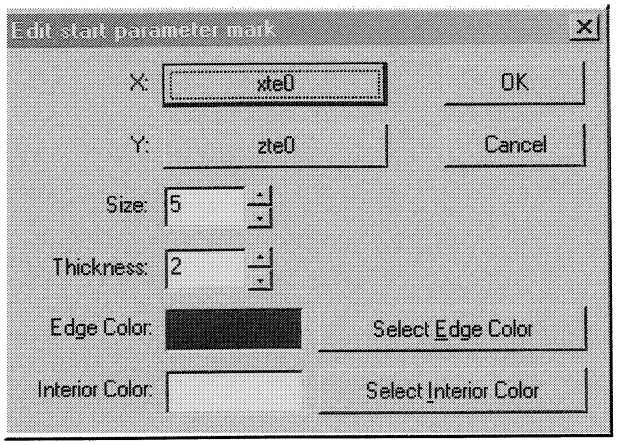
Extend down to The extended start point. The axis scale is allowed to automatically extend down to this value.

Extend up to The extended end point. The axis scale is allowed to automatically extend up to this value.

Reverse scale If checked, the axis scale is drawn in reverse order.

5.10.3. Modify a start parameter mark

A start parameter mark in an X-Y –plot is configured with this dialog box. A start parameter mark is a circle used for displaying a start parameter value. They are always displayed and do not move during a simulation or replay.



X, Y The start parameter values used for the X, and Y-position. The buttons can be used to select new values. If variables are used, they must belong to the **Initial** subset of variables.

Size The total size in pixels.

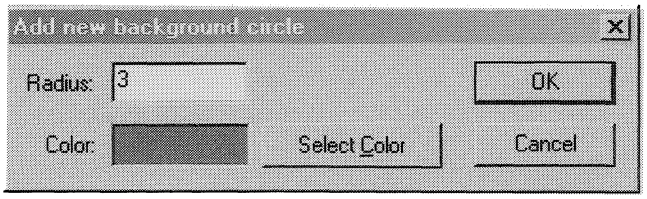
Thickness The edge width in pixels.

Edge Color The edge color. The button **Select Edge Color** selects a new color.

Interior Color The fill color. The button **Select Interior Color** selects a new color.

5.10.4. Modify a background circle

A background circle, or ellipse, in an X-Y –plot is configured with this dialog box.

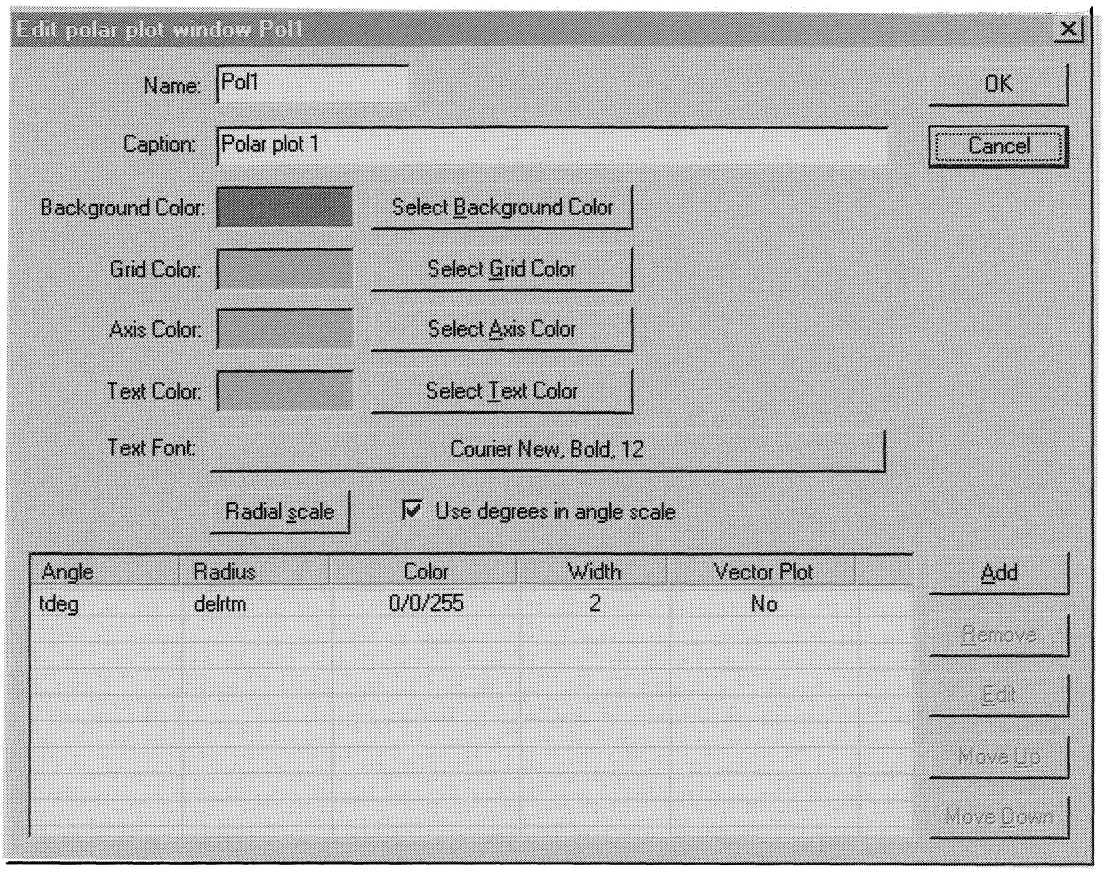


Radius The radius in axis units.

Color The fill color. The button **Select Color** can be used to change the color.

5.11. Polar plot windows

A polar plot window contains a circular plot, and is configured by this dialog box. It can be opened from the **Configure** menu or by selecting **Configure** from the right mouse button menu.



Name The window name. The name must be unique for the window type.

Caption The window caption. The caption is the single text line displayed in the top frame of the window.

Background Color Shows the selected background color in the window. The button **Select Background Color** can be used to change the background color.

Grid Color Shows the selected color for the grid in the plot. The Button **Select Grid Color** can be used to change this color.

Axis Color Shows the selected color for the axis in the plot. The Button **Select Axis Color** can be used to change this color.

Text Color Shows the selected color for the text in the plot. The Button **Select Text Color** can be used to change this color.

Text Font A button displaying information about the font used for the text. By pressing the button a new font can be selected.

Radial scale The button is used for modifying the radial scale.

Use degrees... If checked the angle is expected to be in degrees rather than radians.

The list shows the plots drawn in the window.

Angle The value used for the angle.

Radius The value used for the radius.

Color The color value as an RGB-code used when drawing the plot.

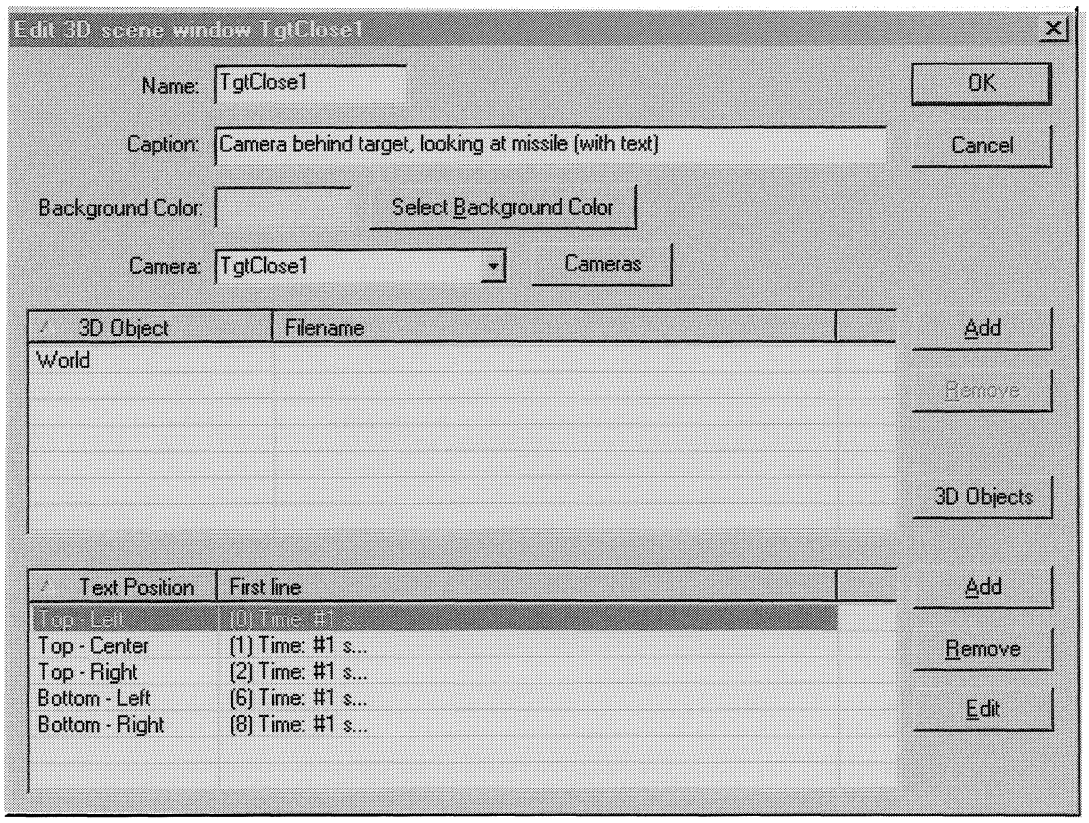
Width The width value in pixels of the plot.

Vector Plot **Yes** or **No** depending on if the plot is a vector plot or not.

How to select values to be plotted is described on page 49.

5.12. 3D Scene windows

A 3D scene window can contain 3D objects and overlaid text. Its purpose is to show simulation results in the form of animations. Configuration is made by this dialog box. It can also be opened from an active 3D scene window by selecting **Configure** in the right mouse button menu.



Name The window name. The name must be unique for the window type.

Caption The window caption. The caption is the single text line displayed in the top frame of the window.

Background Color Shows the selected background color in the window. The button **Select Background Color** can be used to change the background color.

Camera The selected camera through which the scene is viewed by the user. The drop list shows all available cameras.

Cameras This button allows the user to configure available cameras.

The first list control shows the 3D objects in the scene. Multiple selections can be made in this control.

3D Object The name of a 3D object.

Filename The filename of the 3D object. All 3D objects must be located in the X-Files directory specified in the INI-file.

3D Objects Configures the available 3D objects.

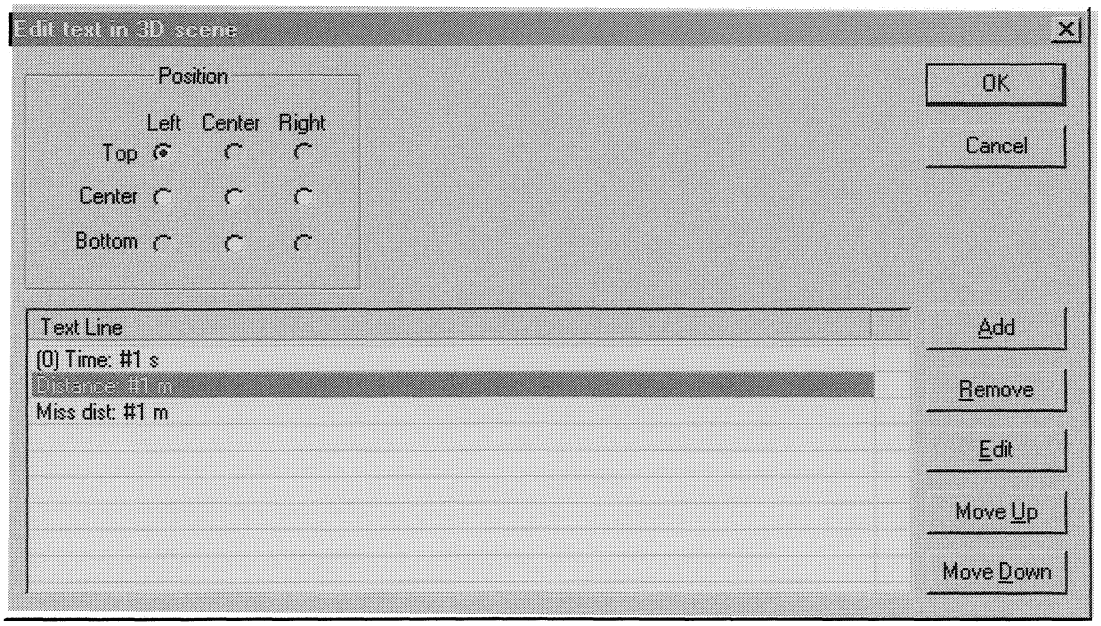
The second list control shows any overlaid text lines in the scene.

Text Position The position in the window where the text appears.

First line The fist line of the text.

5.12.1. Text lines in 3D Scenes

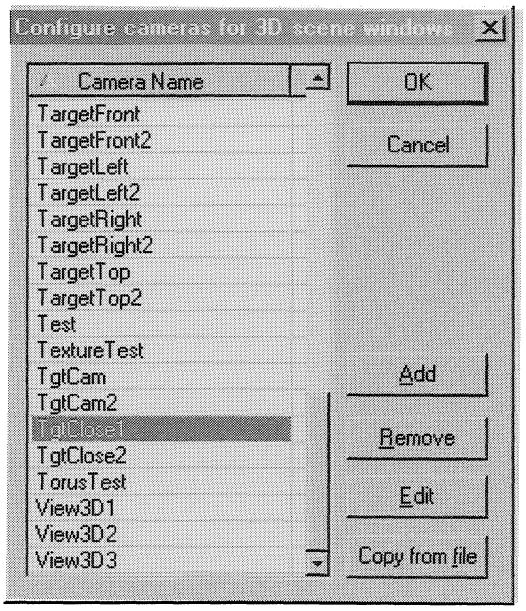
Overlaid text in a 3D scene window is configured with this dialog box.



The **Position** field allows selection of a position for the overlaid text. Positions already in use are dimmed. The list control shows the text lines. The dialog box used when editing a line is described on page 46.

5.13. Cameras

This dialog box is used for managing cameras. It can also be opened from an active 3D scene window by selecting **Cameras** in the right mouse button menu.

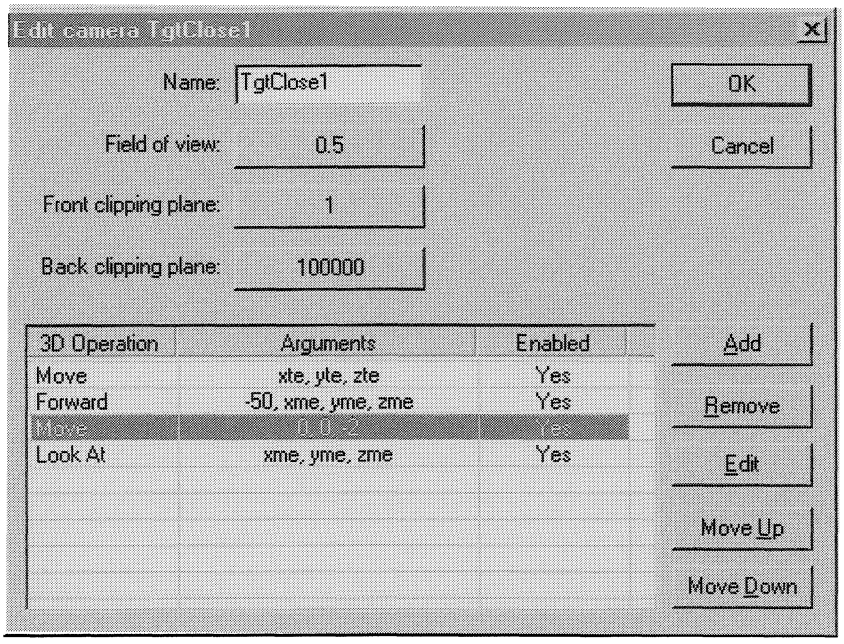


Camera Name The name used for referring to a camera in a 3D scene. It must be unique.

Copy from file Used for copying cameras from another configuration file.

5.13.1. A single camera

A camera is configured with this dialog box.



Name The unique name of the camera. Used for selecting the camera in a 3D scene window.

Front clipping plane Objects closer to the camera than this value are not visible. A new value can be selected by pushing the button. If the value supplied is negative or to small, a default value is used instead.

Back clipping plane Objects further away from the camera than this value are not visible. A new value can be selected by pushing the button. If the value supplied is negative or to small, a default value is used instead.

Field of view The value used for controlling the field of view of the camera. A new value can be selected by pushing the button. If the value supplied is negative or to small, a default value is used instead.

The list shows the 3D operations that control the camera during a simulation or replay. They are executed in the order they are listed. Before the first operation is executed the camera is located in the center of the world coordinate frame, oriented in the opposite direction of the Y-axis.

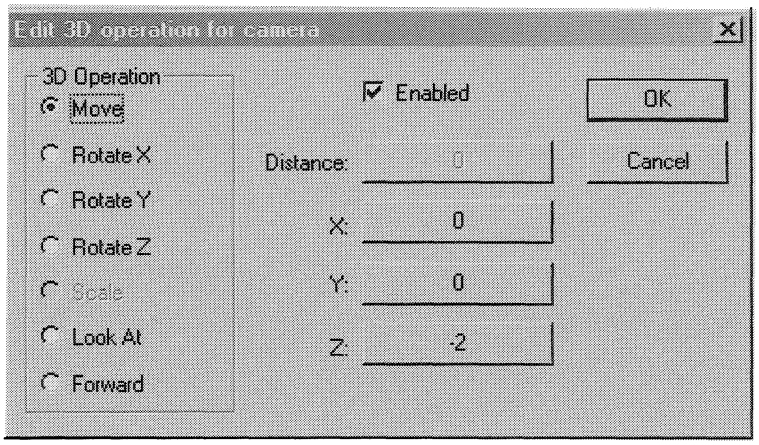
3D Operation The name of the 3D operation.

Arguments The value, or values, used for argument to the operation.

Enabled **Yes** or **No** depending on if the operation is enabled or not.

5.13.2. A single 3D Operation

This dialog box is used for configuring a single 3D operation for a camera or a 3D object.



The radio buttons in the **3D Operation** frame selects among available 3D operations. The **Distance, X, Y,** and **Z** buttons are used for selecting argument values to the operation.

Move Move the object or camera from its current location in the world coordinate frame a relative distance given by the **X, Y,** and **Z** arguments.

Rotate X, Y, Z Rotate the object or camera from its current orientation around one of the axis X, Y, or Z. The amount is given by the corresponding arguments **X, Y,** and **Z**. The rotation center is always the center of the world coordinate frame. When a rotation is applied to an object, its local coordinate frame is also rotated relative to the world coordinate frame.

Scale Scale the object along its main axis directions X, Y, and Z using the values of the arguments **X, Y,** and **Z**. This operation can only be applied to 3D objects.

Look At This operation is only available for a camera. It orients the camera to view the point given by the arguments **X, Y,** and **Z**. The camera is oriented so that its roll angle always is zero. Note that this operation supersedes previous **Rotate** operations.

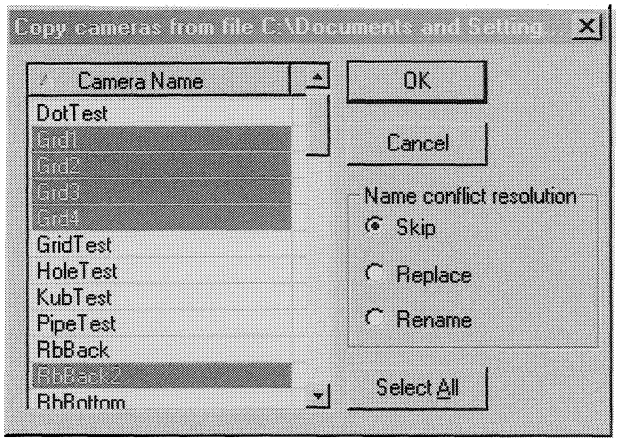
Forward This operation is only available for a camera. It moves the camera the distance given by the argument **Distance** from its current location towards the point given by the arguments **X, Y,** and **Z**. If **Distance** has a negative value the camera is moved away from the point.

Enabled This checkbox can be used for disabling the operation temporarily. This can be very useful when testing out a new object or camera.

The dialog box used for selecting values is described on page 40.

5.13.3. Copying cameras from a file

The dialog box is used for copying cameras to the current configuration from another configuration saved in a file.



Camera Name The name used for referring to a camera in the configuration file copied from.

Select All All cameras in the list are selected.

Name conflict resolution controls what happens if a name selected is already used in the current configuration.

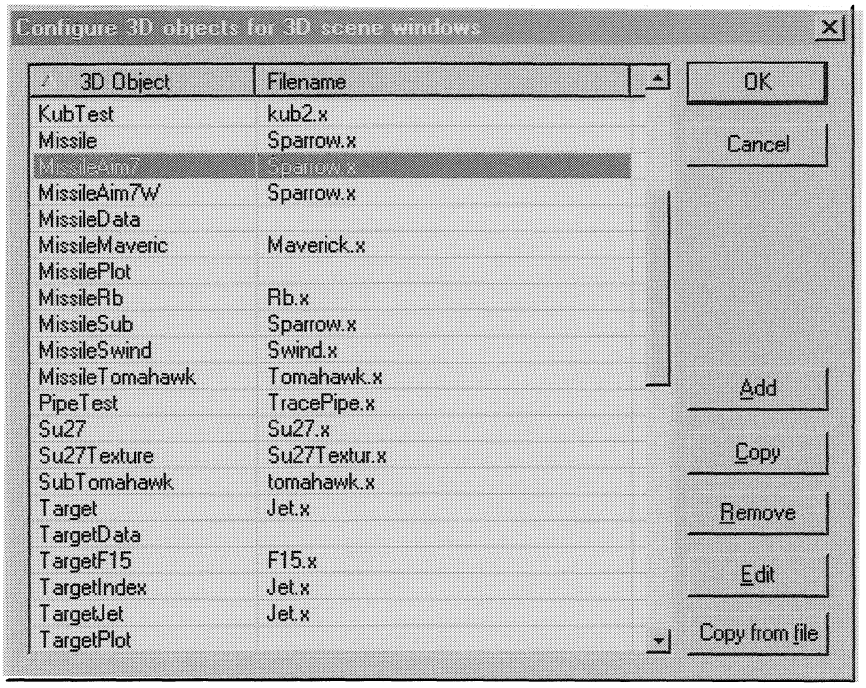
Skip The selected camera is not copied to the current configuration.

Replace The selected camera is copied and replaces the camera with the same name in the current configuration.

Rename The selected camera is copied to a new name not used in the current configuration.

5.14. 3D Objects

This dialog box is used for managing 3D objects. It can also be opened from an active 3D scene window by selecting **3D Objects** in the right mouse button menu.



3D Object The name used for referring to an object in a 3D scene. It must be unique.

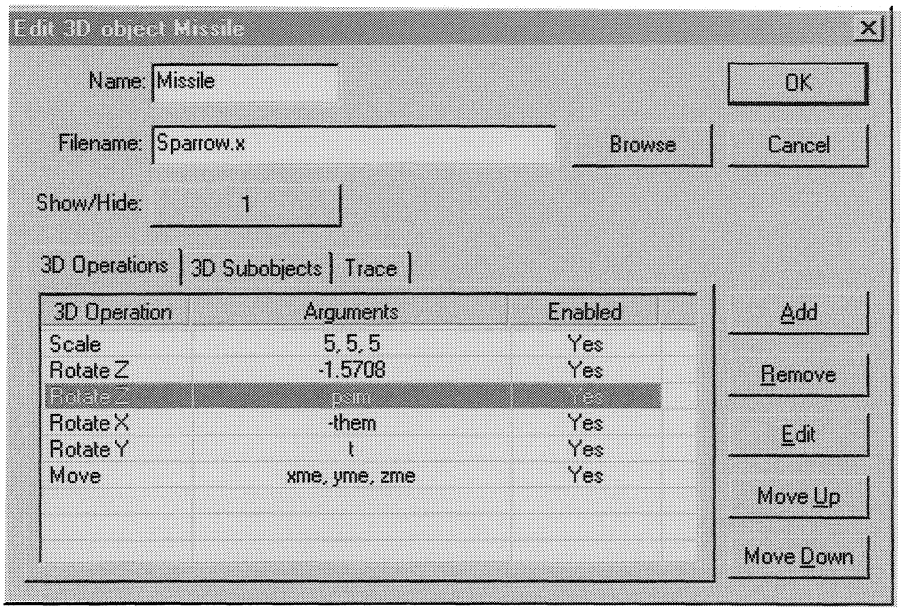
Filename The DirectX file used for storing the object. The file location must be specified in the INI-file. The object can be stored either as a "mesh" or a "frame". If the file internally reefers to any texture files these must be located at the same directory as the file.

Copy Make multiple copies of the selected object.

Copy from file Copies 3D objects from another configuration file.

5.14.1. A single 3D Object

This dialog box is used for configuring a 3D object.



Name The name used for referring to an object in a 3D scene. It must be unique. The name is also used for referring to an object that is part of another object, a "sub-object".

Filename The name of the DirectX file where the object is stored. The common location for all DirectX files must be specified in the INI-file. The object must be stored either as a DirectX "mesh" or "frame". If the file contains more than one object, only the first is used. If the file internally reefers to any texture files these must be located at the same directory as the file. Pathnames in texture files are ignored. No error message is produced if a texture file fails to load correctly. The filename must only contain the name and the type (extension), the directory path and device unit must be left out. The **Browse** button can be used for changing the filename.

Show/Hide The object is not visible if this value is zero. Any other value different from zero makes the object visible in a scene. By pressing the button the user can select a new value.

3D Operations

This tab shows the 3D operations that control the objects motion during a simulation or replay. They are executed in the order they are listed. Before the first operation is executed, the object is located in the center of the world coordinate frame. Its local coordinate frame is oriented so that forward is in the positive x-axis direction, and upwards is in the negative z-axis direction. A single 3D operation is managed with the same dialog box used for managing of a 3D operation for a camera, see page 57

3D Operation The name of the 3D operation.

Arguments The value, or values, used for argument to the operation.

Enabled **Yes** or **No** depending on if the operation is enabled or not.

3D Subobjects

A "sub-object" is an object that is a moving part of another object. The 3D operations for this type of object controls the motion of the object relative to its "parent" object, regardless of how that object moves. When this tab is selected the list shows:

3D Subobject The name of the sub-object.

Filename The filename of the DirectX-file where the object is stored.

Trace

This tab shows a list with the traces enabled for the object. A trace is a "trail" which a moving object leaves behind. The ordering of the traces is not significant.

Trace Color Show the color as an RGB-code used for displaying the trace.

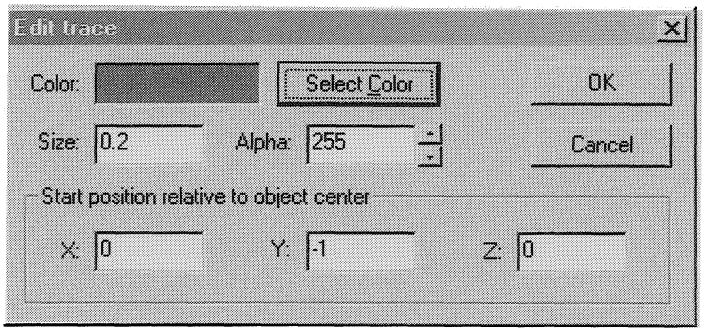
Size The width of the trace.

Position The starting position relative the center of the object of the trace.

Alpha The visibility factor of the trace.

5.14.2. Trace on a 3D Object

Trace from a 3D object used in a scene is configured by this dialog box.



Trace is used for generating a "trail" from a moving object. It can be used to visualize smoke from an engine or creating a 3D plot of some moving objects.

Color Shows the color of the trace. A new color can be selected with the **Select Color** button.

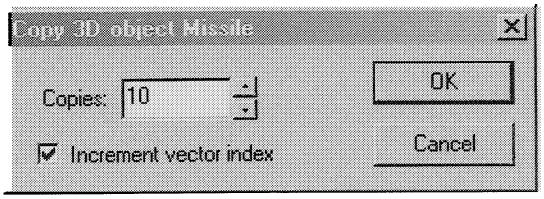
Size The size or width of the trace.

Alpha This value controls the visibility of the trace.

X, Y, Z The starting position relative the center of the object of the trace.

5.14.3. Copying of 3D Objects

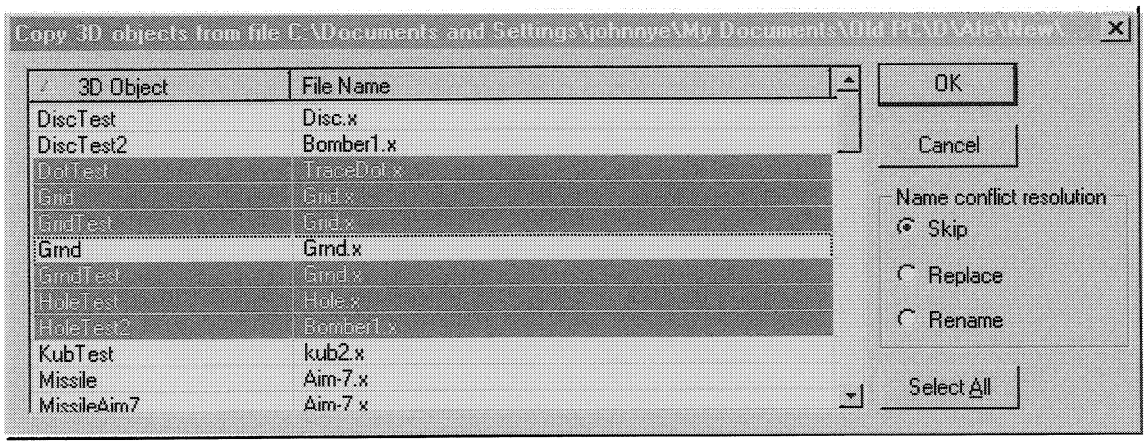
This dialog box is used when making multiple copies of a 3D object.



The **Copies** control specifies the number of copies to produce. If the **Increment vector index** check box is checked all vector values used by the object will have their index automatically incremented for each copy made.

5.14.4. Copy 3D Objects from a file

This dialog box is used for selecting and copying 3D objects in the current configuration from another configuration saved in a file.



3D Object The name used for referring to a 3D object in the configuration file copied from.

Filename The DirectX file used for storing the object. The content of the file is not copied.

Select All All 3D-objects in the list are selected.

Name conflict resolution controls what happens if a name selected is already used in the current configuration.

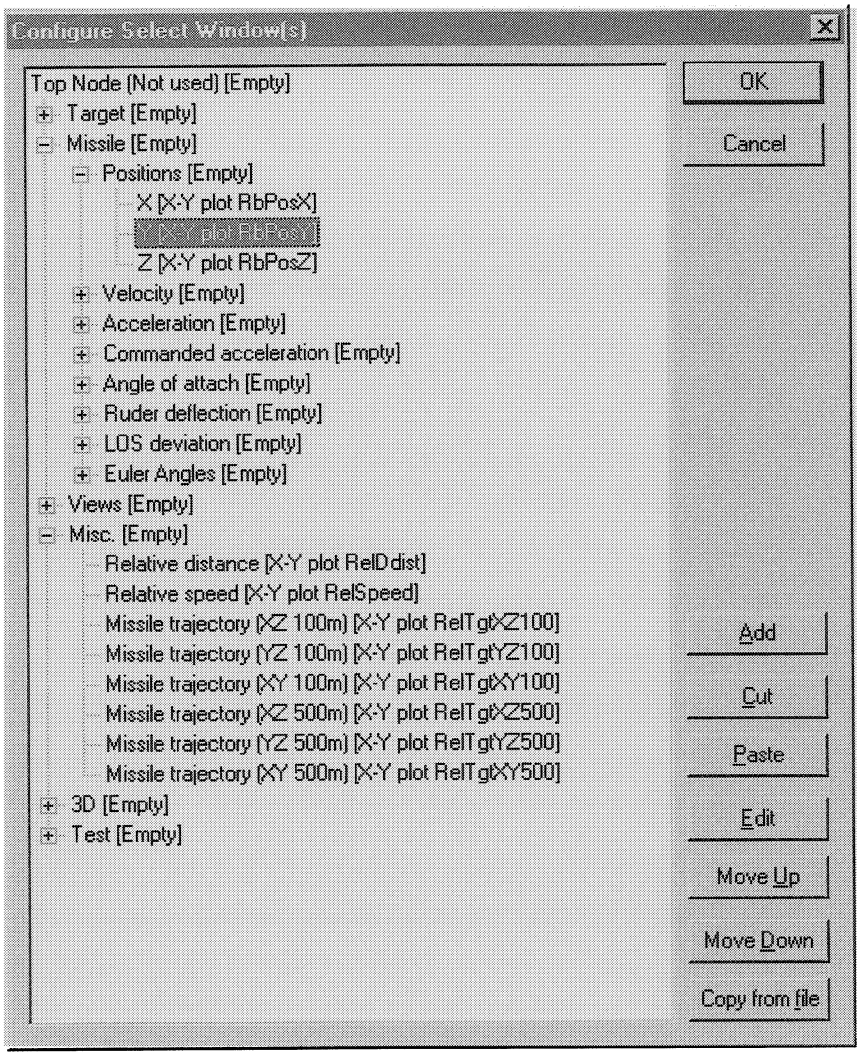
Skip The selected 3D object is not copied to the current configuration.

Replace The selected 3D object is copied and replaces the 3D object with the same name in the current configuration.

Rename The selected 3D object is copied to a new name not used in the current configuration.

5.15. Management of result windows

This dialog box is used for configuring what is displayed in the dialog box "Select Window(s)".



Each node in the tree control represents a result window that can be opened with the dialog box "Select Window(s)".

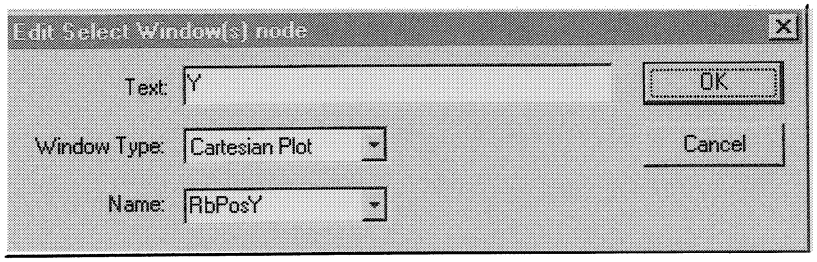
Cut Remove the selected node. The last removed node is saved for possible use by **Paste.**

Paste Insert the last removed node as the first child of the selected node.

Copy from file Copies "Select Window(s)" information from another configuration file.

5.15.1. Managing a single result window

This dialog box is used for editing a single node in the "Select Window(s)" dialog box.



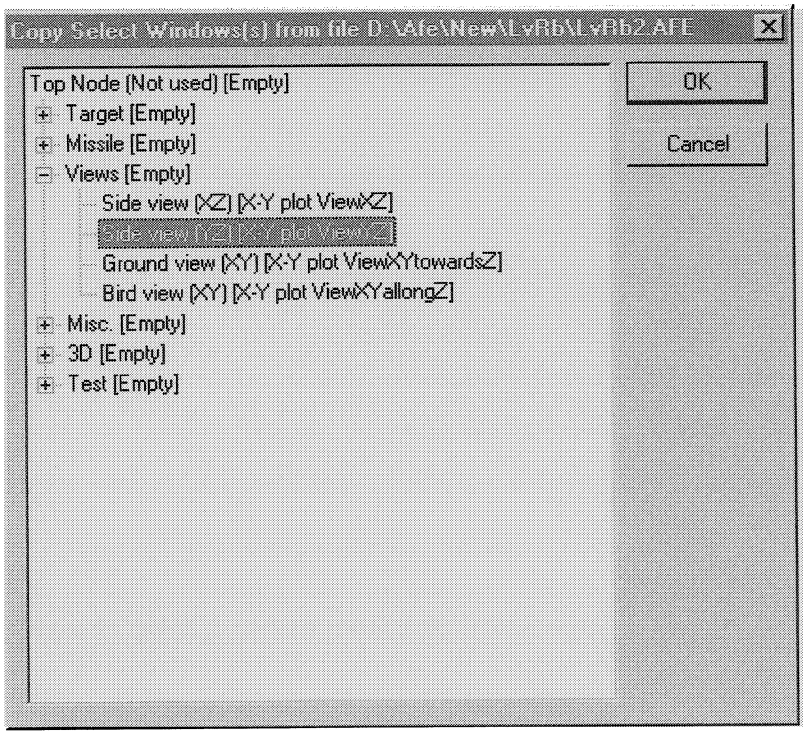
Text The node label to be displayed to the user.

Window Type The type of result window associated with this node.

Name The name of the result window.

5.15.2. Copying management information from a file

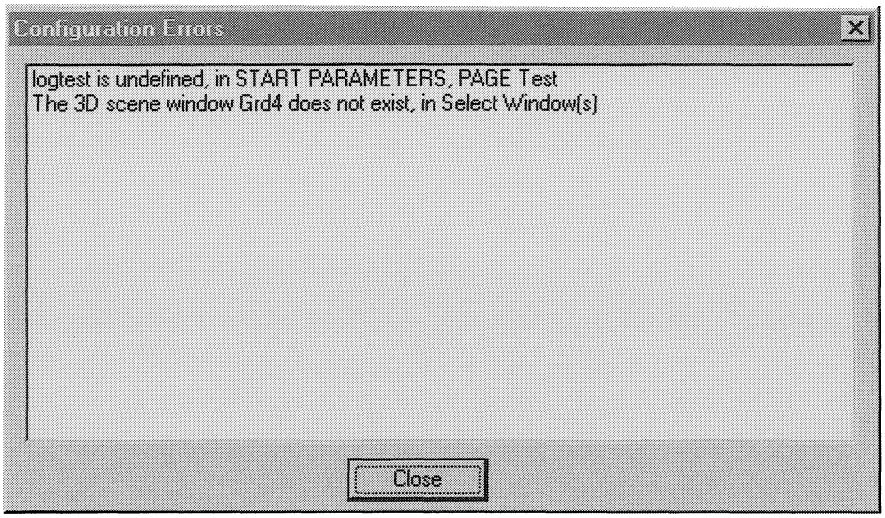
This dialog box is used for copying "Select Windows(s)" information to the current configuration from another configuration file.



The selected node, or tree, is inserted as a child node to the node selected in the "Configure Select Windows(s)" dialog box when the **OK** button is selected.

5.16. Configuration errors

This window shows a list of configuration errors, if any.



The configuration errors describe the discrepancies between how AFE is configured and which data (variable names) are available in the ACSL model. It also shows if any names of result windows are used but not defined. The window is automatically displayed when AFE is reconfigured if there are any errors present. If a value is used but not defined its value is zero. If a name of a result window is used but not defined, nothing happens if the window is opened.

5.17. Demands on the simulation model

For AFE to be able to run an ACSL model, it must at least conform to the following demands:

- Run time errors such as; divide by zero, indexing outside of tables, trying to open non-existing files, etc. must not occur. This is very important because AFE can't handle all types of run time errors.
- The model internal time must not be reset; i.e. the model must not run more than one simulation for every start command. If the model contains a jump instruction from its terminal section to its initialize section this jump must not be executed when the model is executed from AFE.
- It must be possible to run the model several times without restarting ACSL.
- If the model opens and read internal files the file names must not be hard coded, i.e. the model must not be dependent on from which directory it is run. (Relative path names are OK).
- There must be no temporary constant values in the model, se the dialog box "Constants Info" in ACSL/GM. AFE can only use constants that are saved to the GM file (i.e. the CSL and .PRX files).
- The model should not have any accumulating result files that are not automatically reset after a simulation.

- If the model is dependent on a default command file (.CMD) it must not have a start command in it.

5.18. Required files

An installation of AFE, with an ACSL model, must always include the following files.

`AFE.EXE` The AFE program.

`AFE.INI` The AFE INI file, properly configured.

`xxx.AFE` The `.AFE` file, where `xxx` is the name of the model.

`xxx.PRX` The ACSL model executable file.

`xxx.PRJ` The ACSL model project file.

`xxx.CMD` If applicable, the ACSL model startup command file. This is executed once when AFE is started. Note that this file must not have a start command in it.

`yyy.zzz` Any other data files which are necessary for the model to run. AFE cannot handle missing data files opened internally by the model.

The ACSL model files (`PRX`, `PRJ` and `CMD`) are not necessary when AFE is configured for replay only.

5.19. The INI file

The format used in the INI file follows the normal Windows standard with section names between brackets followed by a number of entries. The following definitions are defined:

Section **[XFILES]**

Path The path to the directory where the DirectX-files are stored. If this value is not supplied it defaults to the directory where the INI-file is located. The path can include drive and/or directory, a relative path, or a combination of these. AFE expands the path completely on start. It cannot be changed when AFE is running.

Section **[INIT]**

The entries in this section are maintained and updated automatically by the program. They should not be altered directly by the user.

Section **[OPTIONS]**

This section may contain a number of entries used to save the contents of the "Options" dialog box. Values should not be altered directly by the user. To restore the default settings, exit AFE and remove these entries from the INI file and then restart AFE.

It is recommended that an installation procedure (SETUP or INSTALL program) generate a complete INI file together with the rest of the installation. The INI file must be placed on the same directory as AFE.EXE, or on a default directory established through a Windows shortcut.

6. REFERENCES

[ACSL] ACSL (Advanced Continuous Simulation Language) for Windows, Version 11, AEgis Technologies Group Inc, Huntsville, Alabama 35806, USA.

[VISUAL] Microsoft Visual C++ 6.0, Microsoft Corporation, USA.

[AFE 1.1] AFE 1.1 - Ett generellt grafiskt användargränssnitt för simuleringsmodeller, FOA-R--97-00424-616--SE, ISSN 1104-9154, in Swedish.