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PEGASUS

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Software User Manual

Sheet **1 of 60**

Title:

PEGASUS

Software User Manual

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1. Introduction

This document is the user manual of the PEGASUS software version 3.2. It provide all information needed to install and use PEGASUS.

Intended Readership

This Manual is intended for anyone who wants to perform data processing using the PEGASUS software.

The user does not need any specific qualification nor skill to run the software, but it is desirable to be accustomed to a computer environment, especially the Microsoft Windows[®] Operating System and to the use of file-based computer programs.

To fully understand the different part of this manual and to be able to analyse the results of the PEGASUS Software, it is necessary to know the basics of GNSS, and in particular the EGNOS System TestBed (ESTB) and Signal In Space. More information related to that issue can be found in the PEGASUS modules TN [2].

Applicability statement

This Software User Manual is to be used as reference for the version 3.2 of the PEGASUS software. Each reference to the current version of PEGASUS in this document is a reference to version 3.2.

As the PEGASUS software is based on integration of PEGASUS modules, the full documentation should contain PEGASUS module documentation items. To profit from the modular structure of the software, this version of the Software User Manual contains references to the relevant Software User Manuals of PEGASUS modules.

Purpose

1.1.1. Purpose of the document

This document contains the necessary information related to the use of the PEGASUS software.

It describes the installation and de-installation procedures, the different functionality of the software, as well as what the user has to do in order to perform the individual processing tasks.

1.1.2. Purpose of the software

PEGASUS is a prototype which allows analysis of GNSS data, notably of data collected from the European Satellite Test-Bed (ESTB) operable since early 2000.

From version 1.2 of the tool the software components of the PEGASUS prototype are called PEGASUS modules and are entirely integrated in the PEGASUS tool. The version 2.0 provides a so-called file manager for easier handling and management of multiple-file data acquisition campaigns.

Document Structure

This manual shall be used as reference for the use of the PEGASUS software.

Section 1: Introduction contains a brief introduction to the PEGASUS software.

Section 2: Overview contains a reminder on the data processing procedures, together with its limitations, and offers a general description of the PEGASUS functionality.

Section 3: Installation describes the procedures needed to install the software on a new machine.

Section 4: Problem Reporting contains information on additional means to obtain support on the software and provides points of contact for the reporting of issues linked to the use of the software.

Section 5: General Use gives a step-by-step introduction to the software

Section 6: Services contains a more detailed presentation of the possible functionality of the software, describing the necessary input data, user actions and the obtained results. It is designed as a reference section.

Appendix A contains a list of error messages that might be encountered by using the PEGASUS software, together with the procedures to apply for correction.

Appendix B contains a PEGASUS History

Appendix C contains information about integrated interface for modules

Appendix D is a glossary of all the terms in use within this Software User Manual.

Related documents

- [1] "Harmonised Data Evaluation and Tool Development in Europe", S. REMARK, A. LHERMITE, E. BREEUWER, A. LIPP, GNSS 2001 Proceedings.
- [2] "SBAS Technical Notes", EEC PEGASUS Modules, Doc.-No. PEG-TN-01, issue G

- [3] "Interface Control Document", EEC PEGASUS Modules, Doc.-No.: PEG-ICD-01 issue I
- [4] "Software User Manual", EEC PEGASUS Module Convertor, Doc.-No. PEG-SUM-CNV, issue G
- [5] "Software User Manual", EEC PEGASUS Module WinGPSAll, Doc.-No. PEG-SUM-WGP, issue G
- [6] "Software User Manual", EEC PEGASUS Module MFileRunner, Doc.-No. PEG-SUM-MFR, issue G
- [7] "Software User Manual", EEC PEGASUS Module FileWatch, Doc.-No. PEG-SUM-FW, issue A
- [8] "Software User Manual", EEC PEGASUS Module Aircraft Dynamics, Doc.-No. PEG-SUM-DYN, issue A
- [9] "Software User Manual", EEC PEGASUS Module Plausibility Checks, Doc.-No. PEG-SUM-PBC, issue G
- [10] "Software User Manual", EEC PEGASUS Module MEDLL Multipath Analysis, Doc.-No. PEG-SUM-MP, issue A
- [11] "Software User Manual", EEC PEGASUS Module Prediction Tool, Doc.-No. PEG-SUM-PRE, issue A
- [12] "Software User Manual", EEC PEGASUS Module Procedure Visualisation, Doc.-No. PEG-SUM-PVI, issue A

Reference Documents:

- [R1] "Guide to applying the ESA software engineering standards to small software projects", ESA, BSSC(96)2 Issue 1
- [R2] Eurocontrol Experimental Centre Software Engineering Unit (SEU) SUM Template Document

This Software User Manual corresponds to the user part of the PEGASUS documentation set.

2. Overview

PEGASUS Objectives

The aim of PEGASUS is:

- To automate the GNSS Data processing process in a customisable way.
- To log the different data processing activity in order to keep traceability of the process.
- To find a data & results storage solution allowing the combination and the easy access to all the data.

2.1.1. Concepts

In contrast to the previous versions of PEGASUS, this version addresses all three points mentioned above.

PEGASUS proposes a way to automate the data processing, together with an easy access to the results (M-Files Graphics). In order to synchronise the tool the PEGASUS programs are called PEGASUS Modules.

PEGASUS offers the possibility to define data processing jobs (simply named jobs), composed of a data processing scenario (list of data processing tasks to be run in sequence), a data processing parameter set (list of parameters customising the data processing), and the location of the input file containing the data to be processed.

A file manager is provided to simplify operations on multiple files at the same time. This includes archiving, search and extract features, quick-look and traceability management across groups consisting of multiple files.

Note:

A scenario is composed of a list of tasks.

For example, the standard data processing scenario for PEGASUS Processing would be : *Conversion + WinGPSAll + Display of results*.

Each task can be composed of sequenced subtasks (named commands).

For example, the list of commands for the conversion would be: *Copy of the input file to the working directory + Convertor program run on the copied file*.

The defined jobs are stored in a database in the order of their creation, the last one defined being put at the end of the sequence.

The jobs stored are started by a software engine named scheduler. This scheduler takes into account the sequencing order of the different jobs, and starts them accordingly. For each job, the scheduler runs the sequenced data processing commands contained in the job.

The scheduler can be stopped and restarted on user action, as well as permits changes in the default order between the different jobs, allowing the user to organise his data processing activity.

For the jobs where the data processing is finished, PEGASUS provides an easy access to the results of the data processing, either by visualising the results on the computer screen, or by producing a standard report (Word document) containing the results.

The input data, results and parameters related to a job are stored in a dedicated directory on the computer file system.

The logging of the data processing activity in order to keep traceability is automatically performed since the different jobs, their parameters and the status of the data processing tasks (status + processing dates) are stored in the database and can be accessed at every moment through the PEGASUS interface.

In addition, in order to allow maximum flexibility, PEGASUS also allows the user to start the data processing programs as stand-alone programs.

3. Installation

System Requirements

3.1.1. Hardware

- IBM-PC or compatible with a Intel (or compatible) Pentium-n processor (At least 350 Mhz)
- 60 MB hard-disk space are needed for installation
- Significant hard-disk space, at least 1 GB for the data processing (5 GB recommended)
- At least 128 Mb of Random Access Memory (RAM) (256 MB recommended)

3.1.2. Software

The PEGASUS software has been designed, developed and extensively tested for Windows NT 4.0 SP5/6, UK. However, installation and running of the software is possible under Windows 2000, 95, 98 and Millenium Edition. No liability on the results for those operating systems can be given with regards to PEGASUS.

No installation procedure has been described for Windows 95, 98 and Millenium Edition, but they are quite similar to the previous one.

Installation Procedure

The PEGASUS Software is delivered as an installation program.

To perform a complete installation, the following steps are necessary:

- Insert the CD in the CD drive.
- If the installer program doesn't start automatically, run the "Setup.exe" program at the root of the CD from the windows explorer.
- Push the next button

If the software is downloaded from Internet, the following steps are necessary:

- Run the downloaded executable zip file
- Select the extracting folder and unzip the file
- Run the setup.exe from the selected folder

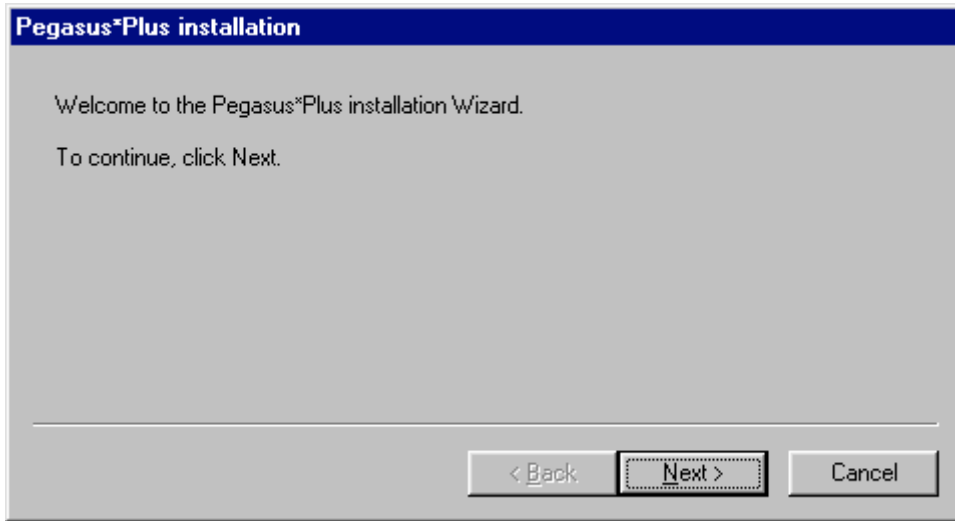


Figure 1: Installation procedure - welcome window

This installation program automatically detects if an old version of PEGASUS has already been installed.
In this case, it will update the version, without asking for a installation path.

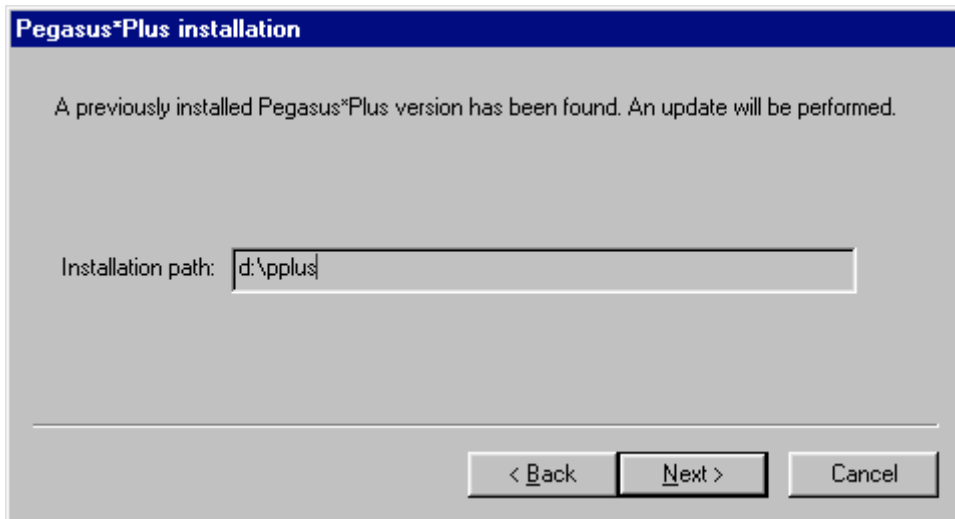


Figure 2: Installation procedure – Update case.

In the second case, the installation program will ask for entering an installation path.

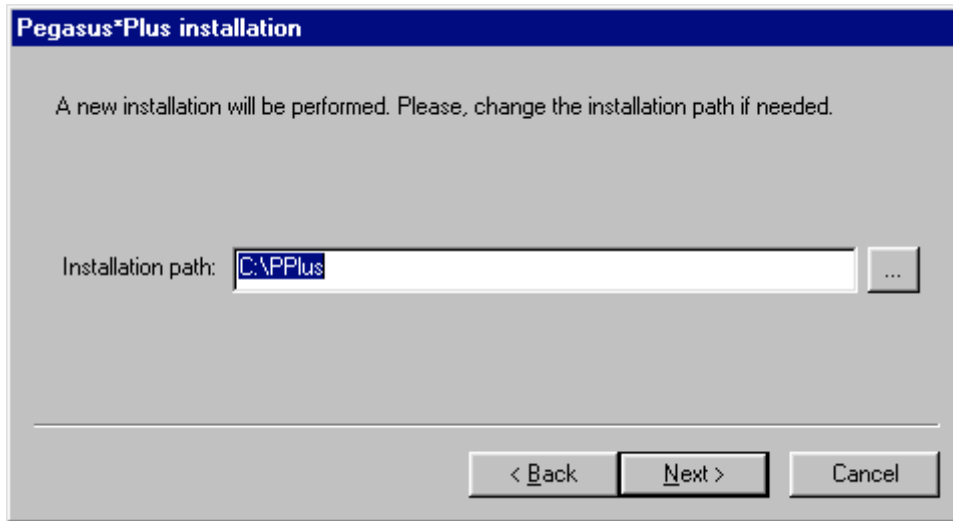


Figure 3: Installation procedure – New installation case.

- Select the installation path : be sure not to select a path containing blank chars. For example, “c:\Program Files\PPLUS” is not a valid directory choice.

- Push the next button

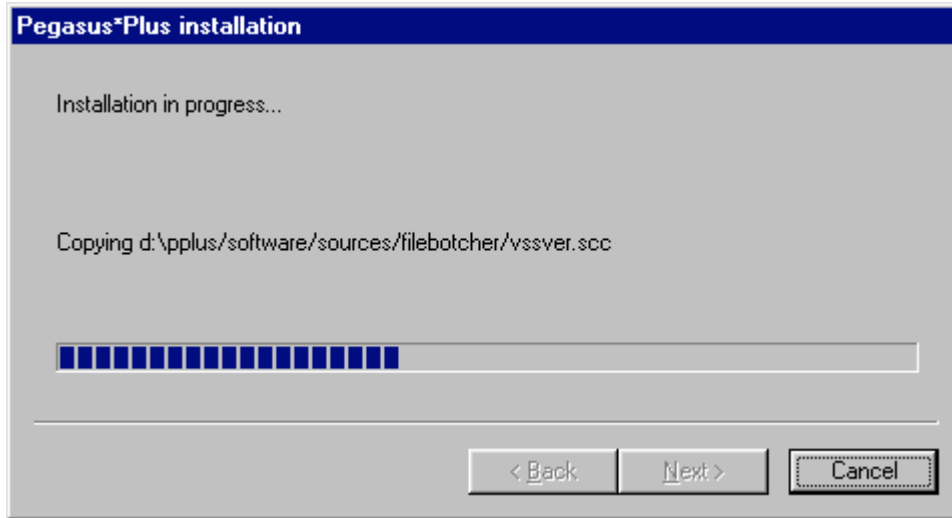


Figure 4: Installation procedure – Installation in progress...

- Push the Finish button

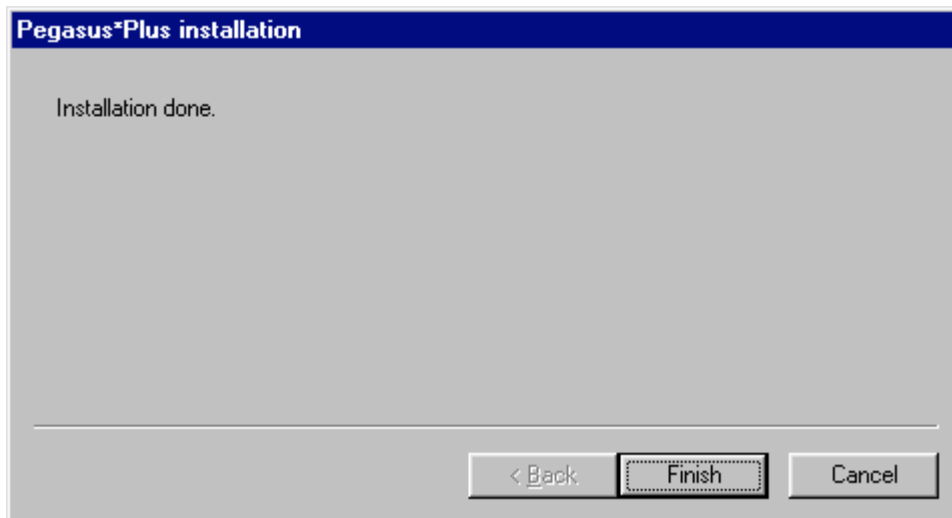


Figure 5: Installation procedure – finish window

To start the PEGASUS software; Click on the icon which was created on the desktop, or select the “Pegasus Plus” shortcut in the “Start” menu “Pegasus Plus” folder.

This user manual is also accessible in the “Start” menu “Pegasus Plus” folder.

De-installation Procedure

To uninstall the software : Look at the “uninstall.exe” program in the installation directory and start it by double-clicking on its icon.

4. Problem Reporting Instructions

PEGASUS is a software prototype under development for Eurocontrol in support of the GOV Working Group activities. The Eurocontrol Experimental Centre has been defined as a focal point for User Feedback Reporting.

An ftp server in the Eurocontrol Experimental Centre has been established in order to exchange data and report anomalies: ftp://sly_ftp@ftp.eurocontrol.fr/. The access to this ftp server is restricted, so the user should request a login and password from: santiago.soley@eurocontrol.int

Today a web-site for the GOV Working Group is already operable inside the Eurocontrol GNSS-Programme SBAS Project web-site:

<http://www.eurocontrol.fr/projects/sbas/pegasus/>

The user should download the [User Feedback Report Template](#) and edit it with Microsoft Office Word 97, completing the parameters:

- Severity of the Incident
- Description of the Anomaly
- Data Provided (if any data is attached to the report)

Once the login and password have been obtained, the user should deposit the data and the report into the ftp folder SBAS/GOV/PEGASUS. Also an e-mail to eec.pplus.support@eurocontrol.int would be helpful in order to track the delivery of user incident reports and data.

This form can be found directly here:

<http://www.eurocontrol.fr/projects/sbas/pegasus/PEG-FDB.doc>

5. General Use

Graphical Interface

The general interface of the PEGASUS Software is the following.

It is composed of three parts.

- Starting data processing
- Displaying results
- Visualisation of data processing progress

Each part is separated from others on the interface and is retractable by clicking on a small button at its left.

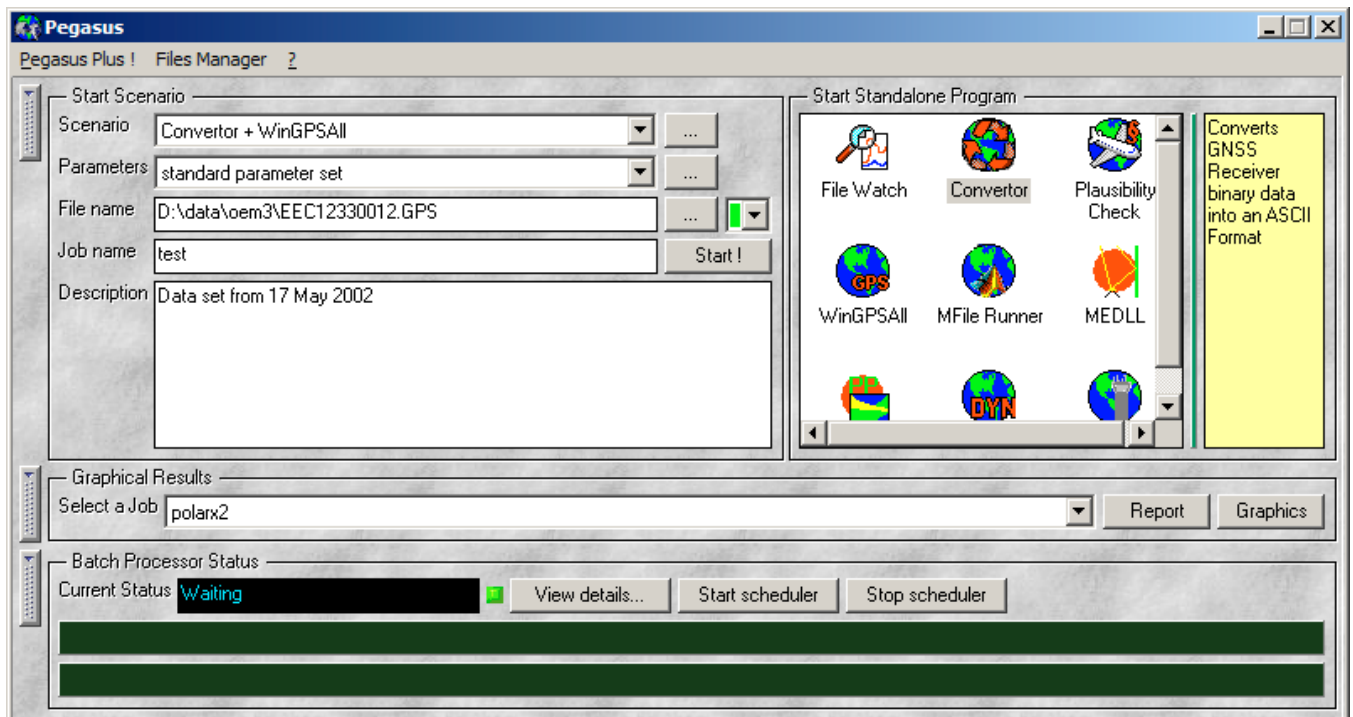


Figure 6: General interface

As shown on this figure, the "Starting data processing" part is the upper one. It is composed of two main subparts named "Start Scenario" and "Start Standalone Program", which will be described below.

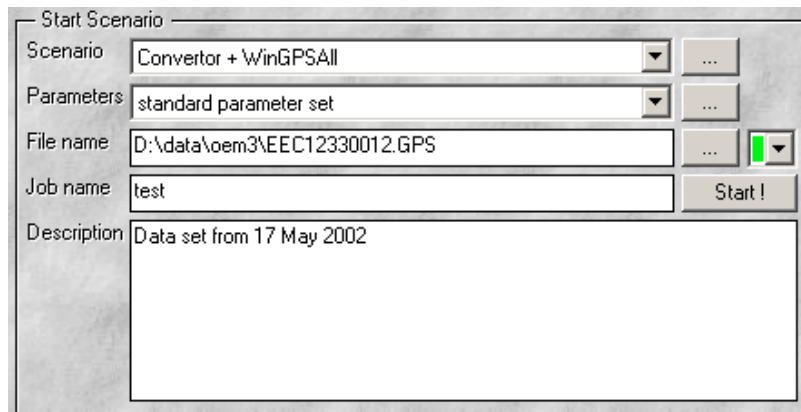
The "Displaying results" part, in the middle, is named "Graphical results" on the interface.

The "Visualisation of data processing progress" part, the last one, is named "Batch Processor Status".

Step-by-step Overview

There are two possibilities to start data processing with PEGASUS.

- Automated processing (see chapter 0)
- Manual processing (see chapter 6.1.5)



5.1.1. Automated processing : Start Scenario

The automated way is intended to simplify data processing by running programs in a predefined sequence, with predefined parameters, and some input data.

Figure 7: Start Scenario

The predefined sequence is named a "Scenario", and the set of predefined parameters, a "parameter set".

To start a data processing job, the user has to:

- Choose or define a Scenario. (see chapter 6.1.1)
- Choose or define a Parameter Set. (see chapter 6.1.2)
- Choose an input file or a group of files to be processed.
- Give a name and a description to the data processing job to be started.
- Press the Start button.

5.1.2. Job scheduling

The PEGASUS Program includes a scheduler which runs scheduled jobs, one after the other. It will be described in detail in the "Visualisation of data processing progress" chapter.

After the selection of a scenario, a parameter set, and an input file, and after a job name is entered, the user should press the "Start" button to schedule the job.

The scheduler will then run the programs included in the chosen scenario after scheduled jobs.

5.1.3. Menus

In order to access additional functions in PEGASUS a menu is implemented. It is composed of a several menus : "Pegasus Plus!", "File Manager" and "?".

The "Pegasus Plus!" menu is composed of the following submenus:

- "Settings" – used to set several behaviour of the frame program trough various options (see chapter 6.1.13)
- "Exit" – exit from the program

The "?" menu is composed of the following submenus:

- "Help" – used to access the PEGASUS Helpdesk(see chapter 0)
- "About" – opens a dialog window with information for the version and the copyrights of the program

The "File Manager" menu contains a submenu:

- "Edit Groups..." – used to access the Groups management Window (for more details see chapter 6.1.10)

Help

In addition to this Software User Manual, a Helpdesk covering all the aspects of the tool is available, either by the Menu Bar (?->Help), or by pressing the F1 key. The F1 key allows a contextual help, meaning that the section of the Helpdesk displayed corresponds to the part of the software which is currently being used.

(For example, pressing F1 while modifying the WinGPSAll parameters of a Parameter set displays the Help on the WinGPSAll parameters.)

Operating Modes

The software is operated interactively via the GUI.

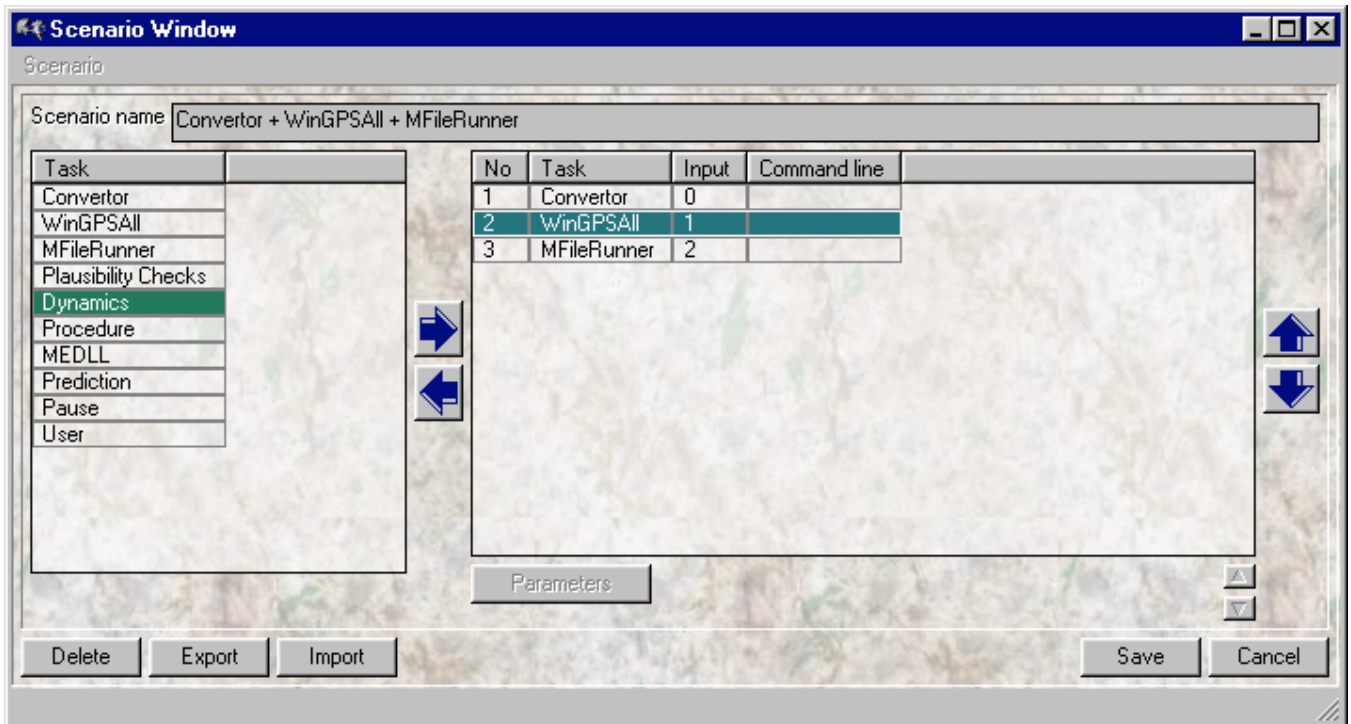
6. Services (Reference Section)

Data processing

6.1.1. Scenario

A scenario is a sequence of tasks defined by the user in order to customise his data processing. Once the scenario is defined by the user and stored in the database, it can be used again for any further data processing jobs. A user scenario is composed of a sequence of data processing tasks chosen and sequenced by the user.

The button is used to create and update user-defined scenarios.



The Scenario Window is then displayed :

Figure 8: Scenario window

For the sequencing organisation, each task is given an identifier corresponding to its rank in the scenario.

For each task, the input data for the task have to be specified as following:

Per default, the output of the previous task in taken, displaying a number corresponding to the rank of the previous task.

This default can be changed by the user (using the small up and down arrows at the bottom right of the window), i.e.:

_ another input can be chosen by entering the rank of another task. The input will then be the output of this other task.

_ "None" to indicate that either no input data shall be used, or that (in case of a user task) the command line already contains input data specifications.

The value 0 corresponds to the input given by the user for in the general interface.

The data processing tasks to be offered as a choice are the following:

Module:

This task corresponds to the running of the specified module included in the program. For more information look at the specific module description in Appendix C: Integrated Interface for modules

Mfiles:

This task corresponds to the running of the M-File Runner Program including the graphics for result displays.

User (command line entered by the user):

The user task corresponds to a command line defined by the user. In order for the user to use results of previous tasks, or to output results, %x%, where x represents the task id, is used.

%x% represents the name of a file, without extension.

To specify the extension, for example .csv, %x%.csv is used.

For example, to display the results of a plausibility check log where the Plausibility Check task has an id of 3, the following command line can be used:

`"C:\WinNT\notepad.exe %3%.log"`.

The value 0 still represents the input file.

Note: The value on the interface corresponding to the input data for a user task is always "None", since the data are specified in the command line.

Using MATLAB in command line

MATLAB could be started from a command line and could be used as a user command in a scenario. This gives the possibility to run automatically a specified M-file in a user scenario together with the other modules of PEGASUS. In this case the following command line can be used:

```
matlab -r function(data') /nosplash /nodesktop -logfile logfile
```

where:

function is the name of the MATLAB function file to be run

data is the parameters of the MATLAB function

logfile is the name of the file where the MATLAB output is automatically written.

`-r`, `/nosplash`, `/nodesktop`, `-logfile` are Startup options for MATLAB

WARNING! MATLAB uses a search path to find M-files and other MATLAB related files, which are organised in directories on your file system. To run a user file in MATLAB it must reside in a directory that is on the search path or the file location folder should be added to the search path before calling the function (use the command `addpath`). Otherwise the file could not be found by MATLAB.

WARNING! To assure the continuity of the data process, in order to pass to the next task in the scenario, the user should add the *exit* command at the end of the M-file used in the scenario sequence. In case of not including this command the MATLAB window stays open and needs to be closed by the user in order to continue with the next task. However, in case of use of graphical visualisation in the M-file it is advisable not to use the *exit* command because the graphical window is closed with the general MATLAB window.

The call of MATLAB can be combined with the user tasks predefined variables, which makes the use of MATLAB in PEGASUS more flexible. The following example can be used to run a MATLAB file in PEGASUS

```
matlab -r addpath('%ppluspath%/mfiles/sources');ViewMessageDistrPie('%1%')  
/nosplash /nodesktop -logfile %2%.log
```

In this example the file M-file *ViewMessageDistrPie* is run with MATLAB in a scenario using the name of the output file of the first task as parameter. The function *addpath* is necessary to define the path to the *ViewMessageDistrPie.m* file, which is situated in the installation folder of PEGASUS. The output from MATLAB is written to the log file, which is situated in the second task subfolder of the job folder. For more information refer to the MATLAB User manual and to the **User tasks predefined variables** chapter in this manual.

Pause:

This command, when inserted in a scenario, automatically sets in pause mode the tasks that follow when the scenario is scheduled. When running, a manual intervention will then be needed in the Batch Processor to restart the tasks.

User tasks predefined variables:

In order to create more flexible scenarios, some predefined variables can be used in user scenarios:

- **Input file name variables:**

The following variables contain useful derivatives of the file name chosen as input for the job.

An example is given for each variable with this input file name:

```
"d:\data\inputfile.ext"
```

`%inputname%` contains the entire file name: "d:\data\inputfile.ext".

`%inputreduced%` contains the file name without path nor extension: "inputfile".

`%inputpath%` contains only the file path: "d:\data"

`%inputfile%` contains the file name without the path: "inputfile.ext".

- **Paths variables:**

These variables contain some useful paths.

%jobpath% contains current job's path.

%pluspluspath% contains the directory from where PEGASUS was started. Most of the time, it will be "<install_folder>\software\exe" (where <install_folder> is the installation folder name)

%programpath% contains the directory of the components programs.
This directory is "<install_folder>\software\exe\programs".

Some user programs can be added in this directory to simplify their call.

For the user task, double-clicking on the task or selecting the task and pressing the "Parameters" button the command line is displayed and the user can modify it.

For the pause task, the parameters do not make any sense, and are therefore not accessible.

In addition, within a scenario, it is possible to either add new tasks from the left list using the left/right arrows, or to change the order of the tasks within a scenario using the up/down arrows. In that last case, the organisation of the input of the different tasks is updated to keep the consistency within the input of the different tasks.

The deletion of a scenario is performed using the "Delete" button.

Pressing the "Save" button allows the storage of the scenario in the database for later use.

The button "Export" allows the storage of the user scenario in a user defined file.

The button "Import" allows the import of a user scenario from a user defined file.

The following rules have to be respected by the user in order for the scenario to be valid:

Rule [1] The input of the Convertor task can be the general Pegasus* Plus input or the output of a user task.

Rule [2] The input of the WinGPSAll task can be the general Pegasus* Plus input, the output of the Convertor task or the output of a user task.

Rule [3] The input of the Plausibility Check task can be the general Pegasus* Plus input, the output of the Convertor task, the output of the WinGPSAll task or the output of a user task.

Rule [4]: The input of the Truth Reference task can be the general Pegasus* Plus input; the output of the WinGPSAll task or the output of a user task.

Rule [5] The input of the MFileRunner task can be the general Pegasus* Plus input, the output of the Convertor task, the output of the WinGPSAll task or the output of a user task.

Rule [6] A task cannot have as input the output of a task with superior order number.

Rules on the Input types:

The tasks should be classified in two groups depending of the input type they take (ASCII or Binary).

These two groups are:

ASCII type entry: WinGPSAll, Plausibility Check, and MFile Runner

Binary type entry: Convertor.

Rule [7] Two tasks with different input type cannot have the same input.

6.1.2. Parameter sets

The parameter sets are grouping all the parameters needed to execute a scenario under a single label.

Parameter sets are user-defined. In order to define one of them, the user should click on the button "...".

The parameters are grouped in five sections:

- "Convertor" section groups Pegasus Convertor program specific parameters
- "WinGPSAll" section groups Pegasus WinGPSAll program specific parameters
- "Plausibility Check" section groups Pegasus Plausibility Check program specific parameters
- "M Files" section groups M-File Runner program specific parameters
- "MEDLL" section groups MEDLL Multipath analysis program specific parameters
- "Prediction" section groups Prediction Tool program specific parameters
- "Dynamics" section groups Aircraft Dynamics program specific parameters
- "Procedure" section groups Procedure visualisation program specific parameters

Additionally of the parameters sections there is seven general buttons always accessible:

- OK – saves the parameters internally in the program memory and closes the dialog. Saved like this, the parameters can be used for data processing but they are lost when the parameter set is changed or the program is closed.
- Cancel – closes the dialog without saving the parameters.
- Help – opens a help window.
- Save – saves the parameters in the database with a user defined name. Saved in this way, the parameters can be used after restarting the program.
- Delete – deletes a parameter set from the database. A message appears before final deleting, asking a confirmation from the user. Once deleted, the parameter set can not be restored from the data base.
- Export – exports a parameter set to a user defined file.
- Import – imports a parameter set from a user defined file.

The Parameters will be briefly explained in Appendix C. The explanation can be found as well in the PEGASUS online help. For more details of the parameters description on a given module, see the related Module User Manual [4], [5], [8], [9], [10], [11], [12].

6.1.2.1. Input File Selection

The user should select an input file. The first program of the selected scenario will use this input file as input data.

6.1.2.2. Input File Group

Instead of selecting one input file, PEGASUS has the possibility to use a group of files as input, which facilitate the task to process automatically large number of data files.

The procedure to create groups is described in chapter 0

When a file group is selected as an input all the files in the group are processed successively in the same way, with same scenario and same parameter set as different jobs.

To use this functionality, a group should be selected from the group menu situated near the input file button.

In the group menu, the user can find all the groups that he has defined and a set of default groups, containing different files found in the defined searching folders (see chapter 6.1.11.1 for more information). The default group names are enclosed in brackets (“<>”). Additional colour mark is added to stress the differences.(green – for single file, blue – for default group, violet – for user defined group and olive for all files)

When a group is selected from the list, the single input file interface is disabled and the files from the group are taken as input for the job. To reactivate the single input, select from the group list “<Single file>”.

If the selected input group contains more than one file several jobs are created when the button “Start” is pushed. The number of the created jobs is equal to the number of the input files in the group. The names of the jobs are composed from the user input job name adding a number at the end of the job name. For example if the user select an input group with 3 files and a name of the job “test”, three jobs are created and started with names “test_0001”, “test_0002” and “test_0003”.

6.1.3. Job Name and Description

The user should give a name to the job he wants to schedule, in order to recognise it in the Batch Processor Window described in the "Displaying results" chapter.

A description can be added to the job name in order to keep interesting information about it.

6.1.4. Output and directory organisation

The results of the job named "jobname" are stored in the software\exe\jobs\jobname directory.

In order to simplify the data storage organisation, each task of a scenario will trigger the creation of a dedicated directory named *x_tasktype*, *x* being an integer corresponding to the rank of the task in the scenario, *tasktype* being the type of task (convertor, wingsall, plausibilitycheck, user).

The input file(s) will be contained in the subdirectory named *00_input*.

The result of each processing task will have the same name as the directory (Ex: *01_convertor.1HZ*).

In addition, except for the user task type where the use of an initialisation file cannot be guaranteed, each directory will contain an ini file (named *x_tasktype.ini*) containing the parameters used for the task.

For the task type Mfiles where the storage of images is required, a subdirectory (named *img*) of the *x_mfile_out* directory will contain the pictures required.

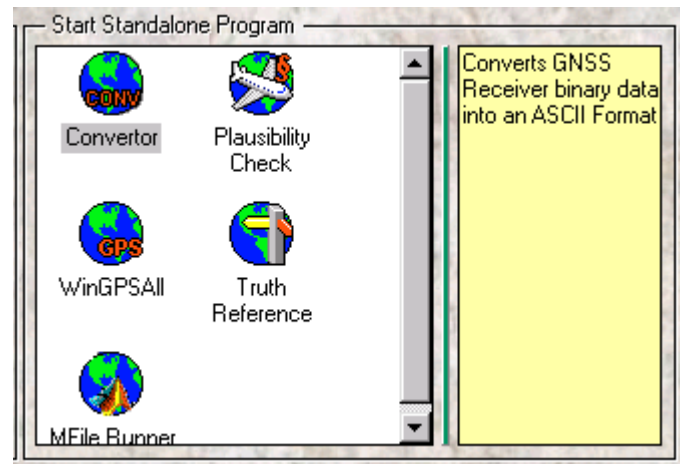
6.1.5. Manual processing

All the 5 modules which are included in the PEGASUS delivery can be used in a standalone mode.

The frame interface offers a direct access to them.

The right subpart of the "Starting data processing" part contains a list of those standalone programs which can be run as if they were started by simply clicking the icons with Windows Explorer.

The standalone programs in this list are the standard PEGASUS modules (Convertor, WinGPSAll, Plausibility Check, Truth Reference) and the M-File Runner program, which is described in "Displaying results" chapter.



The Pegasus Programs functionality are described in the Pegasus User Manual Document [4].

The yellow field at the right of the list shows a description of the selected program.

To start a program, the user can double click on the corresponding icon.

The behaviour of such the programs started this way is the same as if they were started by simply clicking their icons with Windows Explorer.

The user can add some standalone programs by modifying the PPLUS.SPL file, in the software\exe directory.

Displaying results

6.1.6. Visualising graphical results

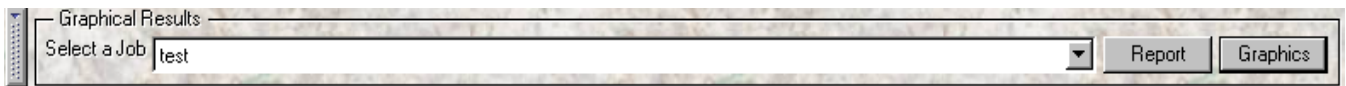
In order to provide graphical results at the end of a job, two features have been implemented permitting to directly visualise predefined graphs and to automatically create reports.

In PEGASUS all the graphical results are visualised with M-File Runner. For more information on how to use M-File Runner see the M-File Runner User manual [6]

Note: In the current version the visualisation of graphical results, using the interface, can only be done for the jobs started using scenarios containing Converter or WinGPSAll. It is not applicable for jobs without one of those two modules, since there are no visualisation procedures developed for the other modules.

6.1.6.1. Graphical Results Interface

The interface of the graphical result part is here present:



This interface is composed of three elements.

- 1) **Select a Job List** where is presented all finished jobs in the database.
- 2) **Report** button to create a standard report for the selected job.
- 3) **Graphics** button to visualise the M-File Runner interface and to select the scripts to be run.

6.1.6.2. Visualising graphical results for a job

To display the graphical results for a job in the Graphical Results part of the PEGASUS interface, the desired job must be selected in the **Select a Job List** and the **Graphics** button must be pressed.

The M-File Runner interface is shown and the execution of the desired scripts must be performed manually.

The user should select the scripts to be executed via the Graphical User Interface of M-File Runner and press the button OK. The displayed results use the data from the selected job.

6.1.6.3. Creating standard report for a job

To create the standard report for a job in the Graphical Results part of the PEGASUS interface the desired job must be selected in the **Select a Job List** and

the **Report** button must be pressed. An interface allowing to input some user defined data related to the report appears and the mandatory fields should be filled. The input values can be used on each report generation automatically if the check box "Use this information for all reports" is checked.

The M-File Runner is started in Image extraction mode and the report is produced. The report can be found in the job directory, subfolder report. The name should be the same as selected by the user on the interface with extension xml.

In order to open this document, a browser supporting XSLT v 1.0 defined by W3C should be installed (IE 6.0 or Mozilla)

Hint: If the check box "Use this information for all reports" is checked, in order to change the data, use the menu Tool->Options...

Visualisation of data processing progress

6.1.7. Visualisation of data processing progress - Batch Processor

In order to visualise the progress of different tasks in a job, a batch processor status part is added to the general interface in PEGASUS. This interface shows the progress of the currently executed job and the tasks of this job.

An additional Batch Processor window shows the number of performed jobs, status of the jobs and other information for each performed job.

The Batch Processor is the software engine that performs the running of the different data processing tasks.

Starting PEGASUS starts at the same time the Batch Processor if all the jobs present in the database are finished or stopped.

If there were jobs remaining from a previous PEGASUS session, the Batch Processor is in a stopped status at the start of PEGASUS.

6.1.8. Batch Processor status interface

The interface of the Batch Processor status part is here present:

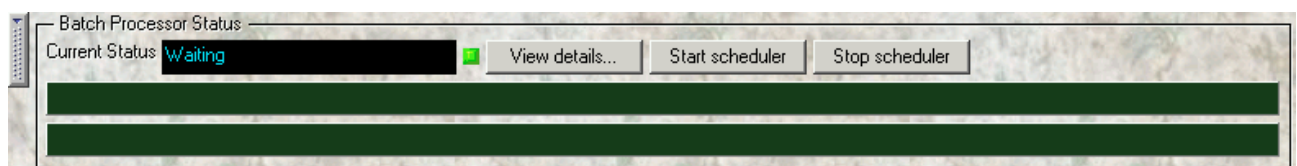


Figure 9: Batch Processor status interface

This interface is composed of seven elements.

- 1) **Current status** window showing the status of the batch processor

Waiting – The batch processor is not running and is waiting for a job.

Busy – The batch processor is running.

Stopped – The batch processor is stopped.

2) **Light indicator** showing the status of the batch processor

Waiting – blue.

Busy – yellow.

Stopped – red.

3) **View details...** button opening the Batch processor window(see Error! Reference source not found. [Error! Reference source not found.]

4) **Start scheduler** button allowing to start manually the running of the Batch Processor.

5) **Stop scheduler** button allowing to stop manually the running of the Batch Processor.

6) **Job progress bar** showing the number of jobs to be performed and the name of the current executed job.

7) **Task progress bar** showing the progress of execution of the tasks in the currently running job and the name of the running task.

6.1.9. Batch Processor window

The Batch processor window visualises all the performed jobs registered in the database and the relative information.

The Batch Processor Window is the following:

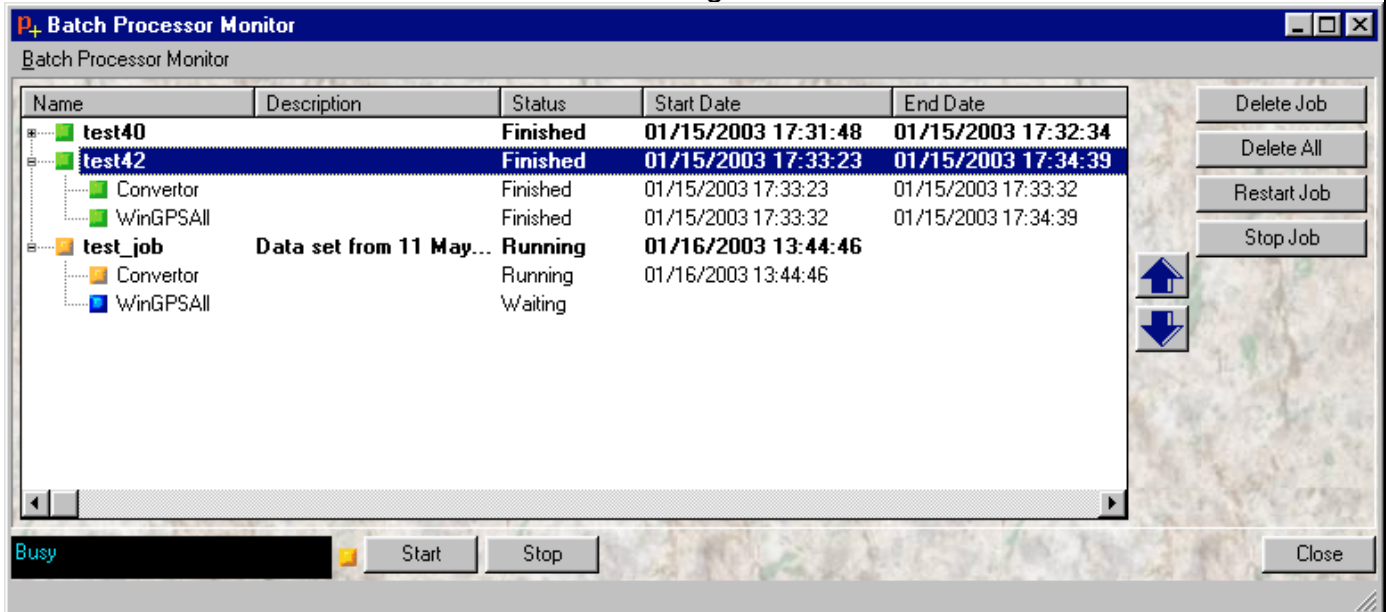


Figure 10: Batch Processor window

A more detailed description for each element is done below:

Job window – lists all the jobs in the database and the relative information- Description of the job, status, start and end date, and command line (available for subtasks only).

The tree structure gives the possibility to visualise only jobs or different elements of a job.



(**Up** and **Down** buttons) – move the selected job up or down in the job list. Moving a job can change the priority of the execution. The first waiting job to be executed is the first encountered in the list.

Delete Job button deletes the selected job from the database (respectively from the interface).

WARNING!

This button deletes the selected job from the database, but does not delete the folder with the results. To delete the results as well, the corresponding job directory on the file system shall be deleted, renamed or moved to another location.

Delete All button deletes all jobs from the database (respectively from the interface)

WARNING! See the warning for *Delete Job* button.

Stop Job button stops the running of the current jobs. It waits until the current task is finished and puts all the remaining tasks of the job in a waiting status. The job is then put in the Stopped status. To stop a job, the job name has to be selected with the cursor, and not a subtask belonging to this job.

Restart Job button allows to restart a job which has been put in the Stopped status. (either using the Stop Job button or due to a Pause task in the scenario).

Current status window showing the status of the batch processor

Waiting – The batch processor is not running and is waiting for a job.

Busy – The batch processor is running.

Stopped – The batch processor is stopped.

Light indicator showing the status of the batch processor

Waiting – blue.

Busy – yellow.

Stopped – red.

Start button – starts the batch processor.

Stop button – stops the batch processor.

Close button - closes the Batch processor window.

File Manager

The File Manager is a functionality included in the frame that allows to easily manage, analyse and combine data from input files collected during long term recording campaigns. This manager allows:

- the combination of results from different measurement campaigns and the multi-criteria extraction of a subset of data
- the search for individual elements in a large set of data files and its organisation.
- start scenarios on a group of selected files.

6.1.10. General Interface

The File Manager menu in PEGASUS has a submenu named “Edit Groups...” which creates a new window named “Groups window”

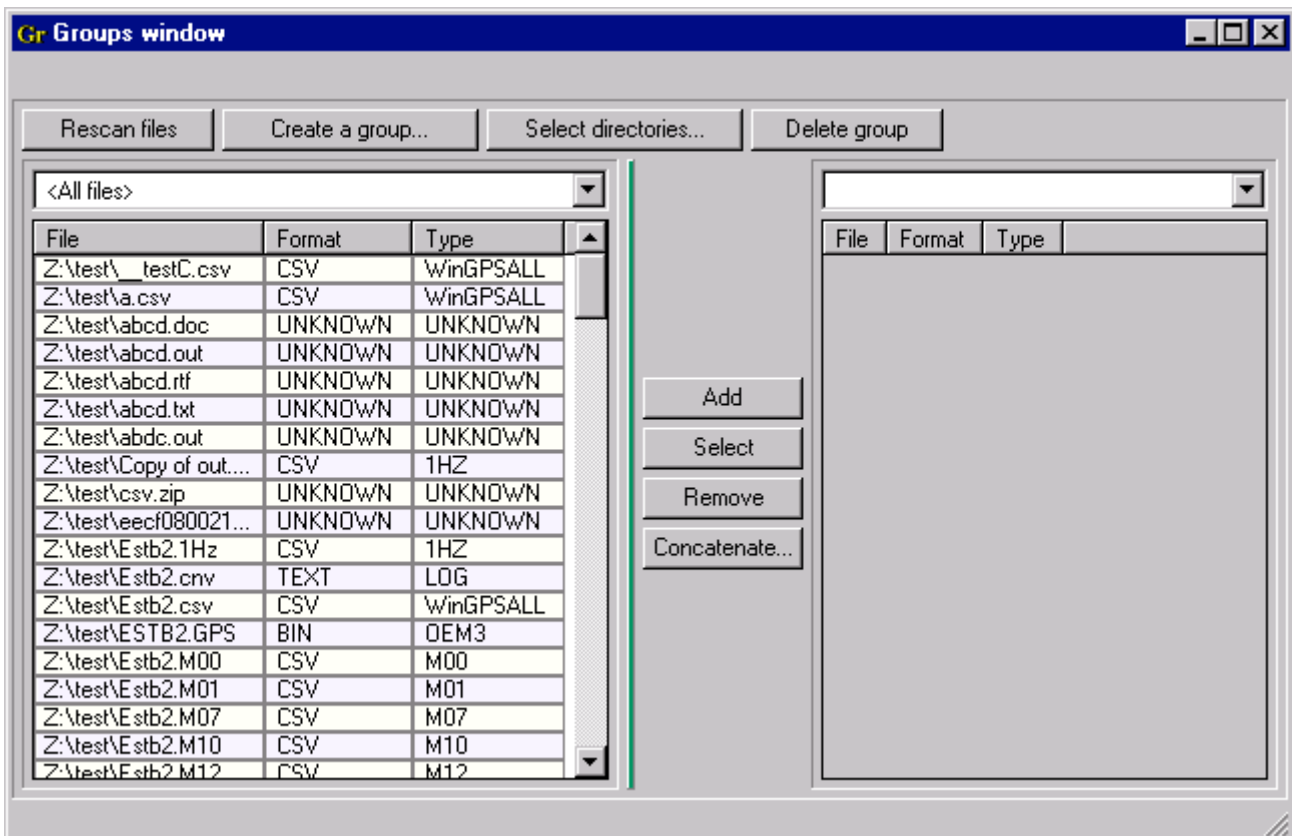


Figure 11: Groups window

The aim of this window is to manage groups of files, and the files themselves. It is composed of four parts: A button bar, two lists, and a set of buttons in the middle of the window.

The button bar contains four buttons:

- The button “**Select directories...**” allows the user to select the directories where the file manager will look for files that will be added to the left list.
- The button “**Create a group...**” allows the user to create a new group to the two selectors (on top of the two lists).
- The button “**Delete group**” button allows the user to delete the Group selected in the right list.
- The button “**Rescan files**” button allows the file manager to verify if new files have been added in or remove from the selected directories.

The left list contains information for the files present in the previously selected directories. It is organised in three columns as follows:

- “File”: contains the paths and names of the files.
- “Format”: contains the different formats of the files, as the File Manager has discovered them during the scanning. There are three main files formats: CSV files, TEXT files, and BIN files (binary files). When the File Manager was not able to determine the format of a file, then the column contains UNKNOWN.
- “Type”: describes the type of the file if it is known(1Hz file, OEM4 binary file, WinGPSAll output file, log file, etc) or UNKNOWN appears in the list if the file type is not recognised.

The right list contains the user selected file with the same information as the list in left.

Between the two columns four additional buttons are available:

- “**Add**” button: adds selected files from the left list to the right list.
- “**Remove**” button: removes selected files from the right list.
- “**Concatenate...**” button: concatenates selected files in the left list depending on the file format. (the CSV files are concatenated in the same way as the binary files).
- “**Select**” button: used to select a file with rules necessary to check the lines of an input csv file following criteria stored in the rules, to export lines of an input csv file according to multiple criteria or to reject a file based on limits of individual rule violations

A file type selector is on top of the left list. It allows the user to filter the files types he wants to see in the left list. By default, the selection is “<All Files>”, but it also offers to select any of the types of files, and any of the user-defined groups. After having selected an item in the selector, the left list will only contain the files that belong to the selected item, like a file type or a group (See figure 3).

The selector on the top of the right list only contains the user-defined groups. This selector has the same functionality for the right list as the left one for the left list (see figure 3).

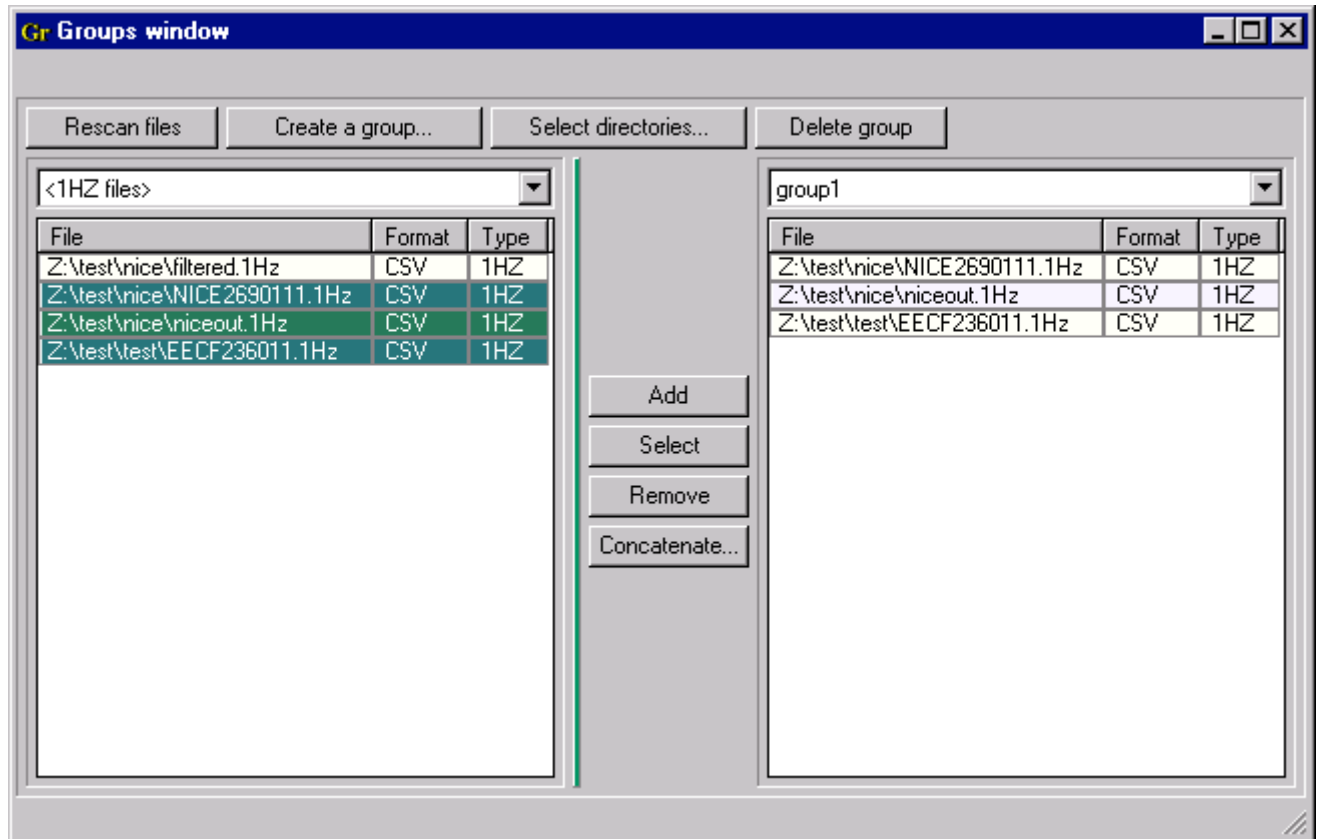


Figure 12: Selectors and lists

6.1.11. File Manager functionality

6.1.11.1. Define searching folders

In order to allow the file manager to search for files, the location of these files should be specified. This is done using the **"Select directories..."**.

The interface for selecting searching folders is presented on the next figure.

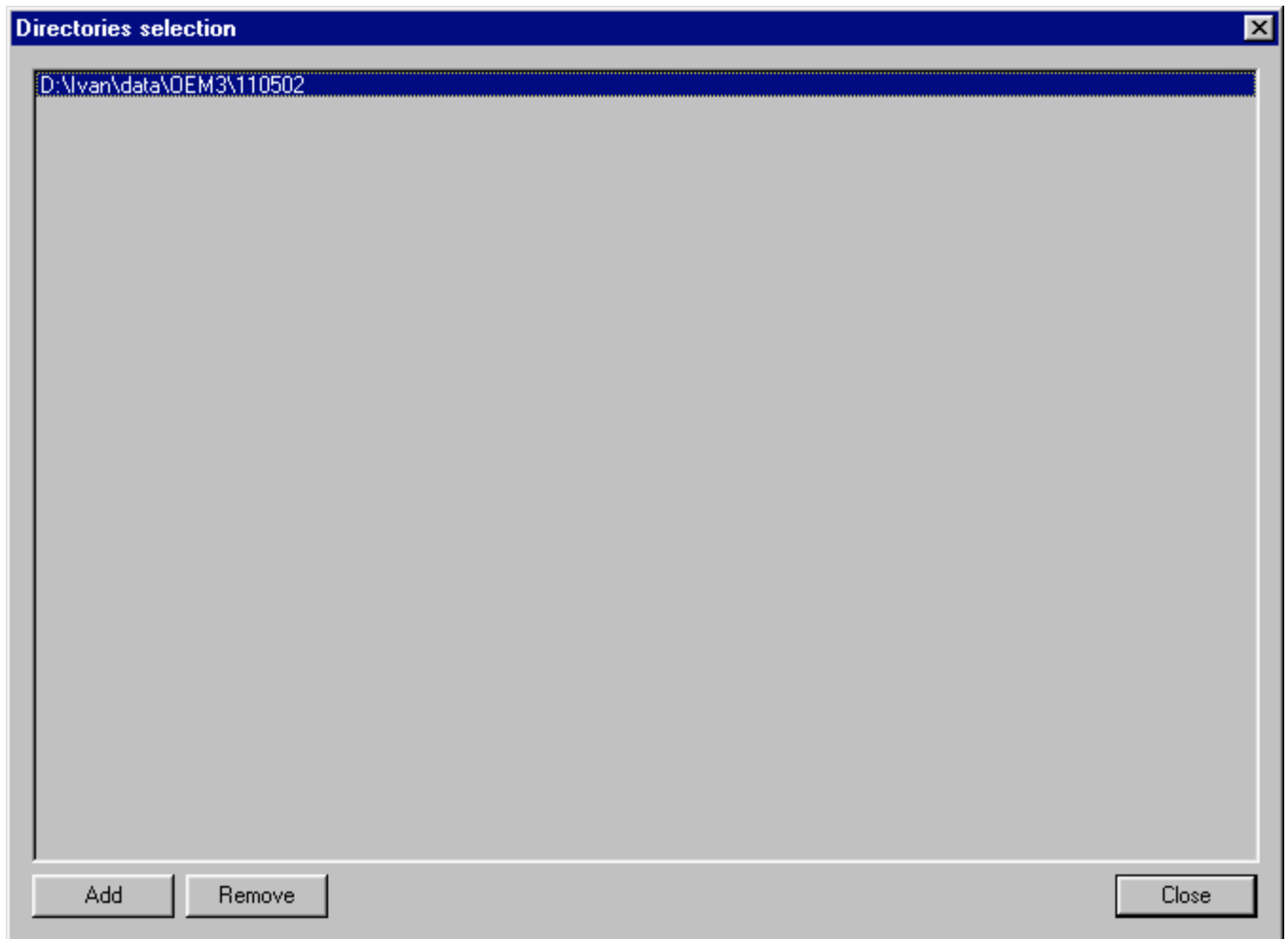


Figure 13: Select Searching folders in File Manager

To select a searching folder use the “**Add**” button, select it from the open interface and press OK. Once the folder is selected the path appears in the list. Multiple folders can be selected and all appear in the list.

To remove a folder, select it in the list and press the “**Remove**” button.

When the folders are defined exit with the “**Close**” button. The File Manager will search in all the defined folders and will update the left list with all the available files in these folders.

To rescan the folders manually use the “**Rescan Files**” button on the Groups Window.

6.1.11.2. Create/Delete Groups

The main functionality of the File Manager is to create groups of files, which can be used to create multiple jobs with the same scenario and different inputs.

To create a group using the File Manager the first step is to press the “**Create a group...**” button and to enter a name for the group. Once the group is created its name appears on the top of the right list and this list is empty.

To add files to the group, select a file from the available files in left and use the button “**Add**”. When the file is added into the group its name is displayed in the right list. Multiple files can be added as one in the group using the concatenate button. For more information how to concatenate file see chapter 6.1.11.3

A possibility to insert files to the group matching some set of criteria described in a rule file is implemented and can be used pressing the “**Select**” button. This functionality can be used to:

- check each line of an input csv file following criteria stored in a rules file.
- export lines of an input csv file according to multiple criteria.
- reject a file based on limits of individual rule violations

A file can be removed from the group selecting it and using the “**Remove**” button.

After having created a new group of files, on the main window, the user can select, in the group list, the group to be started on.

6.1.11.3. Concatenate files

Together with the simple adding of files in the group the user can add multiple files by concatenating them in one bigger file. To concatenate files, first select them from the list and use the Concatenate button. The concatenation takes into account the format of the files in order to process intelligently (the CSV files are not concatenated in the same way as the binary files). A popup window appears before the concatenation to allow the user to reorder the files if needed. To concatenate the files press the button “Concatenate”. A dialog box allowing to select the name of the result file appears.

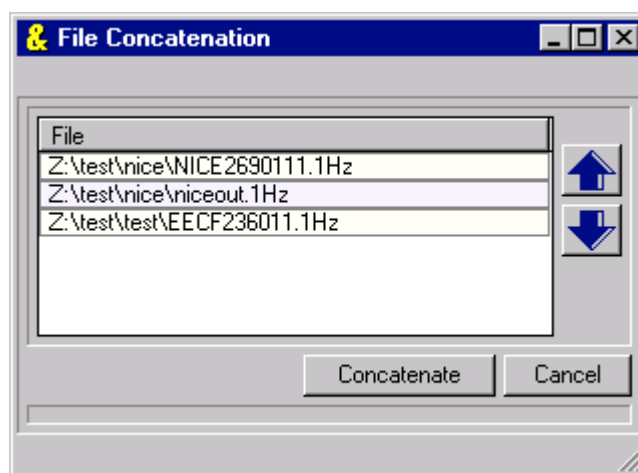


Figure 14: File concatenation window

Once the files are concatenated in one, the file is added to the group and its name appears in the right list.

6.1.12. Criteria File Selecting Rules

6.1.12.1. Rules file grammar

A rule files is basically a list of mathematical expressions named rules. A rule must be written on only one line.

The variables of these rules are the column names:

```
Sample >= 0
```

A rule can contain logical operators (OR, AND...):

```
Sample >= 0 AND Sample <= 12345678
```

And mathematical functions (log, sin, cos, exp, frac...):

```
frac(Sample) = 0
```

A rule can access previous and next rows values using brackets after the column names:

```
Sample-Sample[-1] = 1  
Sample[1] - Sample[-1] = 2
```

Rules can be grouped into classes of rules, using a bracketed class name before a set of rules:

```
[samples]  
Sample >= 0 AND Sample <= 5241600  
frac(Sample) = 0  
Sample-Sample[-1] = 1
```

```
[GMODE]  
GMODE >= 0 AND GMODE <= 7  
frac(GMODE) = 0
```

A rule can be followed by semicolon and a maximal number N, which means that if the count of rows not in line with this rule is greater that N, then the input file is declared a bad file:

```
Sample >= 0 AND Sample <= 5241600 ; 30
```

A maximal percentage of bad lines could also follow the semicolon:

```
Sample >= 0 AND Sample <= 5241600 ; 50%
```

Maximal numbers and percentages can also be used on an entire class:

```
[samples ; 30]
```

Or:

```
[samples ; 50%]
```

A rule can also be followed by a colon and a file extension, which means that all rows not in line with this rule will be dispatched in an output file using this extension:

```
Sample >= 0 AND Sample <= 5241600 : bad_sample
```

The same thing is applicable to classes:

```
[samples : bad_samples]
```

A combination of max numbers, and file extension, is possible in that order, for rules, and classes:

```
Sample >= 0 AND Sample <= 5241600 ; 30 : bad_sample
```

Or:

```
[samples ; 20% : bad_samples]
```

To dispatch good lines to a file using a chosen extension (for example ".good"), the user has to add a line at the top of the file:

```
:good
```

6.1.12.2. Output file format

The output log file contains qualitative and statistical information about the checked input files.

At the top of the file, a single qualifier "GOOD" means that none of the maximal numbers and percentages of rules and classes have been exceeded. The qualifier "BAD" appears when this is not the case.

The next information is the list of lines that do not follow the rules:

```
*****  
Lines hits:
```

```
1: GMODE          [33] GMODE >= 0 && GMODE <= 7  
275: MS           [55] MS4 >= 0 && MS4 <= 15  
276: MS           [55] MS4 >= 0 && MS4 <= 15  
889: GMODE        [33] GMODE >= 0 && GMODE <= 7
```

The first column is the line number, the second one is the class of the violated rule, the third one is the rule number, and the last one is the rules itself.

After this list appears the list of violated classes:

```
*****  
Classes hits:
```

```
GMODE          6          0.107%  
MS             791         14.085%
```

The first column represents the classes names; the second one is the count of violating rows and is followed by the percentage of those violating rows.

And after this appears the list of violated rules:

```
*****  
Rules hits:
```

```
33  GMODE          6          0.107%  
51  MS             73          1.300%  
52  MS             246         4.380%
```

The first column is the rule number, the second one is the class of the rule, the third one is the count of violating rows, and is followed by the percentage of those violating rows.

The last information represents some time considerations:

```
*****  
178 secs elapsed.  
5616 lines processed (31 lines/secs).
```

Advanced Functionality

6.1.13. Settings.

PEGASUS has in addition a few settings to customise the tool and its appearance. The Settings can be modified in the Menu bar, under the Pegasus Plus! -> Settings menu.

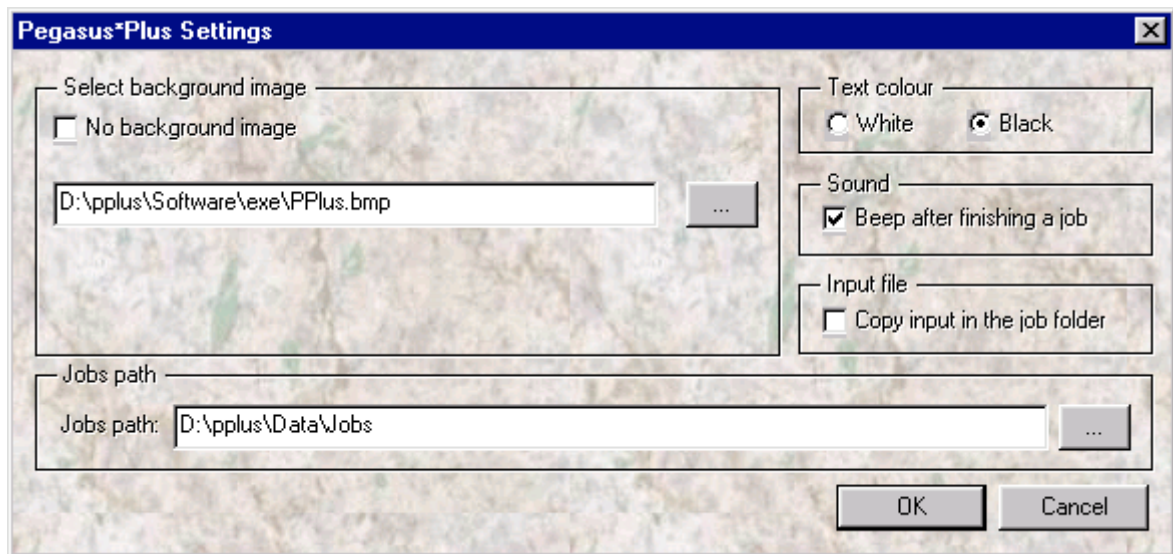


Figure 15: Settings Window

The following settings can be modified:

- The background image can be customised. Another bitmap file (.bmp) can be chosen to be used as background image.
- The colour of the text can be set to black or white, in order for the user to specify bright or dark background images.
- The software can be configured to beep after the completion of a job.
- The software can be configured not to copy the input file into the job folder. Per default the input file is copied to the subfolder named 00_input in the job folder. This option can be used in case of not sufficient disk space.
- The default directory where the Jobs are stored can be changed.

WARNING !!! Changing this directory while jobs have already been started and not finished may make those jobs unusable because PEGASUS cannot find the location of the files anymore. Make sure that no job is running or is waiting before changing this directory.

6.1.14. Import/Export of Database

For portability of the database a functionality of import/export is implemented in PEGASUS. It can be accessed using the Menu Pegasus Plus -> Import Database or Pegasus Plus -> Export Database

The Export database functionality exports the current scenario and job structure to an external file selected by the user.

The Import database functionality imports a scenario and job structure from an external file and add its contents to the current structure in PEGASUS

WARNING!!! The Import database functionality adds the non-existing elements into the database, but replaces the existing ones with the corresponding elements in the file, which have the same name

6.1.15. Insert/Deletes Modules

WARNING!!! These functions are recommended only for advanced users and developers of new modules.

In order to insert or delete additional modules in the PEGASUS frame, in the main menu a Modules submenu is available.

To insert a new module the user should select the menu Pegasus Plus ->Modules->Insert Module. The insertion is done via an interface where the module dialog displayed by the frame and the executable file for the module are selected.

To insert a new module two steps should be followed:

- First step: the user should select the corresponding dll file implementing the user interface for the module. If the dll file is correct the name of the module is recognised automatically.
- Second step: the user should select the executable file corresponding to the dll.

To delete a module use the menu Pegasus Plus ->Modules->Delete Module. An interface showing all the available modules is displayed. To delete a module select it in the list and press the Delete button. To close the interface press the Exit button.

Note: Once a module is deleted the action can not be undone. Be sure that the selected module should be deleted before and than press the button Delete.

Additional Services

6.1.16. GPS/UTC Time Converter (Tzolkin)

6.1.16.1. Introduction

Tzolkin is a simple GPS/UTC time converter program allowing to transform GPS time to UTC time and vice versa including the leap seconds. It is a stand alone program that can be used as a part of the PEGASUS software or independently.

6.1.16.2. GPS to UTC Time transformation

In order to transform GPS to UTC time put the GPS week and seconds in the corresponding boxes of the interface. Transformation is done automatically

6.1.16.3. UTC to GPS time transformation

In order to transform GPS to UTC time put the Year, Month, Day, Hour, Minutes and Seconds in the corresponding boxes of the interface. Transformation is done automatically.

Note: If the GPS time is out of range a notification message appears on the interface

6.1.16.4. Leap Seconds

The corresponding leap seconds appear automatically depending on the time if the automatic detection check box is checked. The user can use values different from the automatic detected values if this box is not checked.

In order to facilitate the introduction of new leap seconds, a file called `leapsecs.dat` containing UTC time of introduction of leap seconds and the number of introduced leap seconds could be used. This file should be located in the same folder as the executable of the program. If this file is not found the program uses the default values.

Appendix A: Error messages and recovery procedures

Error	Solution
Cannot start this job	An unknown reason prevents the job to be started. This message can follow the "Select a valid receiver" message described below
Choose a Job First	The results buttons should be pressed after a job has been selected.
Input a scenario name	A scenario cannot be saved without a name. Either put a name to the newly created scenario, or press Cancel.
Invalid job name	Job name should not contain non standard characters.
Invalid Scenario	Select a scenario in the list.
Job name is missing	Enter a job name
Job replacement failed!	A file or folder of the job to be replaced is in use by another program. Exit or stop the program using this file or folder and restart the job
Select a valid receiver	The Converter program is not implemented for this type of receiver. Select another receiver type
The connection to database failed:	The ODBC source "PPLUS" doesn't exist, or the database file was deleted
The MRUNNER.DSC file wasn't found	This file is needed by PEGASUS.
The PPLUS.SPL file wasn't found:	This file is needed by PEGASUS.
This job can not be restarted	The job cannot be restarted because it is not in Stopped status. Only the jobs stopped can be restarted.
This scenario is standard and can not be modified	A standard scenario cannot be modified by the user. Only user-defined scenario (the ones listed with Usr:) can.
Can not create <i>folder name</i> : Access is denied Job starting failed!	A file or folder of the job to be replaced is in use by another program. Exit or stop the program using this file or folder and restart the job

Appendix B: PEGASUS History

Background on PEGASUS

PEGASUS (Prototype EGNOS GLONASS Analysis System Using SAPPHIRE) is a software prototype to process data collected in-flight and on-ground with the European Satellite Test-Bed (ESTB).

PEGASUS consists of four major software components.

The CONVERTOR translates receiver-native GNSS data into a generic format [3].

The PLAUSIBILITY CHECK Program checks the output of the converter and uses user-defined plausibility rules to detect any anomalies in the data set.

The WinGPSALL program uses the output of the CONVERTOR to determine a GNSS navigation solution

The ALGORITHMS use the output of the CONVERTOR and the WinGPSALL to analyse the satellite constellation, to determine predictive integrity monitoring qualifiers and to perform integrity monitoring using Receiver Autonomous Integrity Monitoring (RAIM) or Aircraft Autonomous Integrity Monitoring (AAIM) algorithms.

This particular design of the PEGASUS architecture allows the access to all the data – even at intermediate stages of the data evaluation – and its display and visualisation.

A complete data processing sequence can be summarised by the following figure:

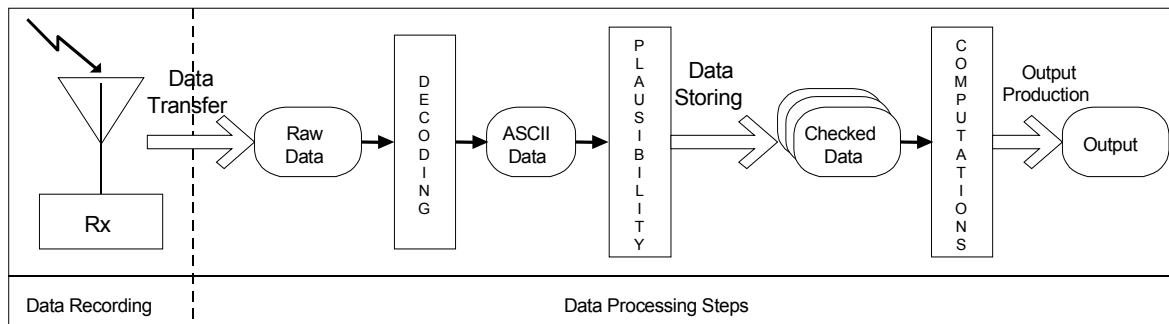


Figure 16:PEGASUS Structure

In addition, a set of Matlab M-Files supports the development of PEGASUS, allowing a standardised and direct display of the results of the Converter and of the WinGPSAll processing.

Appendix C: Integrated Interface for modules

Convertor parameters

The screenshot shows a 'Parameters' dialog box with the following settings:

- Receiver: <automatic>
- GPS week rollover: 1
- Correction mode: SBAS MODE 0
- PRN: IOR-W (126)
- Leap Seconds: User (radio button selected), value: 13
- Output: All (checked), Range-Position (checked), ESTB Data (checked), Orbital Data (checked)
- Delimiter: Semicolon (radio button selected)

Figure 17: Convertor parameters

The user can select between the following options to configure the running of the PEGASUS module Convertor:

- **Receiver** Option: The receiver can be selected using the drop-down list. The following receiver types can be used:
 - NovAtel™ WAAS/Millennium
 - NovAtel™ OEM4
 - DSNP Aquarius 5000
 - Septentrio™ PolaRx-1
 - NovAtel™ MEDLL
 - RINEX Format

The <automatic> option could be used for automatic detection of the receiver type.

Note: It is possible that the module could not be able to detect the receiver type automatically. In this case the user should select manually one of the present possibilities if the receiver is known.

- **GPS week rollover** Option: the user must provide the numbers of GPS week rollovers (week numbers crossing the value 1023). Default value : 1.

For the creation of the range- and position data file, the current number of leap seconds must be known. There are two possible methods of providing this data item. Either it is contained in the stored data or the user must supply this information.

- **Correction mode Option:** The user can select one of the two correction modes that are used for the decoding of the input file (SBAS MODE 0/2 and SBAS MODE 0)
The difference of the two modes is the way to process the Message type 0.
SBAS MODE 0/2 - process the MT0 as it is intended to be, but copy the content of the body of MT0 into a MT2 message.
SBAS MODE 0 - process the MT0 as it is intended to be.
- **Leap Seconds from Data Option:** Using that option, the current number of leap seconds is read from the stored data.
- **Leap Seconds from User Option:** Using that option, the current number of leap seconds is provided by the user by entering the number in the field below. The information about leap seconds coming from the data file is ignored.
- **Leap Seconds Option:** If the option **Leap Seconds from User** is selected, the user can enter the current number of leap seconds using the field below. This input is then used for the creation of the range- and position data file, regardless of any additional information found in the data input file.
- **Output Option:** the user can select the following output options: ranging and position data for GNSS (option GPS), ephemeris and almanac data for GNSS (option NAV) and ESTB raw data (option ESTB). Default value: all
- **Delimiter:** The user has the possibility to change which delimiter shall be used in the data processing chain. The output as well as the intermediate data csv files will have the selected value as a delimiter.

When a receiver able to track more than one geo satellite, an additional option for the converter module is available:

- **PRN Option:** the user can select the PRN of the satellite, which data have to be decoded. This choice is implemented because the NovAtel OEM4 receiver can track more than one GEO satellites. To assure a secure functioning of the software only data from one satellite have to be present in the output files.



Correction mode PRN

Figure 18: Additional Converter Parameters

WinGPSAll parameters

Figure 19: WinGPSAll parameters

Ranges:

The user can select the ranging sources by checking the appropriate checkboxes **GPS**, **GLONASS** and **GEO**. At least one ranging source must be chosen for the position computation process. Individual satellites can be selected and de-selected pressing the "SV Selection" button.

General Options:

There are four different pre-set modes for the data evaluation run provided in the GNSS mode drop-down list.

- **GPS standalone:** The position is determined using only the range measurements from the GNSS
- **GPS local area:** The position is determined using the range measurements from the GNSS. Correction data is determined using range measurements from a local area reference station.
- **SBAS NPA:** The position is determined using the range measurements from the GNSS. Correction data is determined using the fast and slow corrections provided by the ESTB.
- **SBAS PA:** The position is determined using the range measurements from the GNSS. Correction data is determined using the fast, slow and ionospheric corrections provided by the ESTB.

A weighted position solution is implemented in the **SBAS PA** mode. In the **SBAS NPA** mode, the user can select a weighted position solution by checking the box **Weighted**.

A standard pseudorange smoothing is implemented. The time constant for the filter can be modified by the spin-button **Smoothing**. A range of values between 0 and 100 is provided, where a selection of the value 0 implies no smoothing.

If the line-of-sight to satellite has been lost for a short period of time or if the raw data check for the range measurements of a satellite has failed, the carrier-phase range smoothing filter should be re-set, resulting in a period where the received ranging data of that satellite can not be used due to the fact that the carrier-phase smoothing filter must be settled. The spin button **Max DataGap** specifies a short period of time for which the ranging filter is not re-set.

The satellite is not used for ranging (since there is no ranging data or bad ranging data), but the carrier-phase smoothing filter is kept alive for this short period of time. Only if the gap in the ranging measurements reaches the maximum allowable gap, the carrier-phase ranging filter is re-set.

The drop-down list **Tropospheric Corrections** contains a list of implemented tropospheric correction models.

- **No**: no tropospheric corrections are determined
- **Standard**: the standard GPS tropospheric corrections are determined
- **Do 229B**: tropospheric corrections using the RTCA DO 229B are determined.

The actual appearance of this drop-down list is modified according to the selected GNSS mode. For GPS standalone or GPS local area differential, only the first two options are presented. For SBAS NPA or SBAS PA, all tropospheric options are presented.

The drop-down list **Ionospheric Corrections** contains a list of implemented ionospheric correction models.

- **No**: no ionospheric corrections are determined
- **Standard**: the standard GPS ionospheric corrections are determined
- **Do 229A**: ionospheric corrections using the RTCA DO 229A are determined.

The information about the selected **minimum elevation** angle must be provided by the user in the field Min. Elevation.

File Selection:

If the GPS local area differential mode is selected, then the file for the reference station must as well be selected. This file must contain the GNSS range measurements for the reference station, (e.g. have the extension "*.1Hz", but other extensions are possible as well). This can be done by pressing the "...” button next to the **File Selection, Ref. Receiver** field. A standard windows file selection box will then appear. Alternatively, the user can enter the reference file directly in the **Ref. Receiver** field.

For path & file-name, only 256 characters are supported.

If the SBAS NPA mode or the precise wide area GNSS mode is selected, then it will be assumed that the other files that contain the SBAS correction and ranging processing will follow the naming convention that is provided in the Interface Control Document ICD.

User Station:

When the box **Use Initial WGS84 Position** is checked, the user is able to provide the position of the antenna in a static measurement setup or the starting point of a dynamic measurement setup. This position then will be used in the determination of the deviations in north-, east- and up-directions. This initial position must be given in WGS84 co-ordinates, i.e. latitude and longitude in degrees and altitude as Height above ellipsoid (not above MSL).

If no initial position is specified by the user in the GPS standalone mode, SBAS NPA mode or the SBAS PA mode, the first receiver-computed position will be used to initialize the process and to determine the position errors. This position will be displayed in the appropriate field. Thus, the user navigation input file **must** contain at least one valid receiver-computed position.

If no initial position is specified in the local area differential mode, then the specified antenna position of the local area differential reference station will be used to initialize the process and to determine the position errors.

The receiver can be selected using the drop-down list **Receiver**. The following receiver types can be used.

- **NovAtel™ WAAS/Millennium**: GPS standalone mode, GPS local area differential mode, SBAS NPA mode and SBAS PA mode.
- **NovAtel™ OEM4**: GPS standalone mode, GPS local area differential mode, SBAS NPA mode and SBAS PA mode.
- **DSNP Aquarius 5000**: GPS standalone mode, GPS local area differential mode, SBAS NPA mode and SBAS PA mode.
- **Septentrio™ PolaRx-1**: GPS standalone mode, GPS local area differential mode, SBAS NPA mode and SBAS PA mode.
- **Litton 8 channel**: GPS standalone mode, GPS local area differential mode (implemented in SAPPHIRE phases 1 and 2)
- **Honeywell 16 channel**: GPS standalone mode, GPS local area differential mode (implemented in SAPPHIRE phases 1 and 2)
- **D920 12 channel**: GPS standalone mode, GPS local area differential mode (implemented in SAPPHIRE phases 1 and 2)

The <automatic> option could be used for automatic detection of the receiver type.

Note: It is possible that the module could not be able to detect the receiver type automatically. In this case the user should select manually one of the present possibilities if the receiver is known.

The information for the field **Data Rate** must be provided by the user, since the nominal update rate of the range measurement data will be used to check the consistency of the data internally.

The checkbox **UTC/GPS Time Transformation** is provided for consistency and compatibility reasons only. The receivers implemented in SAPPHIRE phases I and II use a time synchronisation scheme which is based on UTC time. However, the receivers implemented in the PEGASUS development will use a time synchronisation scheme which is based on the receiver delivered GPS time. Thus, this box will only be enabled when an appropriate receiver is selected.

Ephemeris Data Directory:

The user must select a source for the satellite position information. The ephemeris data is contained in standard RINEX navigation files for the GPS satellites. For the ESTB satellites, a format only slightly different from the GLONASS RINEX navigation files has been defined in the Interface Control Document ICD.

The user has the option of either selecting externally supplied RINEX data files or selecting user data RINEX ephemeris files. This can be done by checking the appropriate box **External** or **User Data**.

- If the **User Data** ephemeris option is checked, the **Ephemeris Source** field will display the name base including directory structure for the ephemeris files. The ephemeris files are assumed to follow the naming convention provided in the Interface Control Document ICD.
- If the **External** ephemeris option is checked, the **Ephemeris Source** field will display a path in which the externally supplied ephemeris data is assumed to exist. The directory structure and the naming convention for the externally supplied ephemeris data is contained in the relevant SAPPHIRE documentation. This directory structure can be changed by pressing the "...” button. A file selection box then appears. The selected directory structure file is displayed.

Output:

For the output of the computation process, the user can choose between the SAPPHIRE and the PEGASUS format.

The PEGASUS output file (General Options) will contain PEGASUS-relevant information, i.e. position- and time-solution, protection levels and position errors.

It should be noted that the co-ordinate system used for the computation of the position deviation is not a right-handed system (north-east-up instead of north-east-down).

The SAPPHIRE output file (General Options) will contain the original SAPPHIRE-relevant information, i.e. position-, velocity- and time-solution and range-related information for every satellite.

The exact content of both the output files is described in detail in the Software User Manual for PEGASUS Modules [4].

Reference Station:

The Reference Station button will only be enabled, if the local area differential GNSS mode is selected.

The Reference Station options are accessible using this button. The interface is similar to the User Station interface.

Reference Station parameters

Reference Station

UTC/GPS Time Correction

Receiver: NovAtel OEM4

Latitude (°) 43.68648

Longitude (°) 3.402158

Height (m) 56.84

Data Rate [Hz] 1.0

File Selection

Ref. Receiver

d:\data\OEM4\EEC_ref.1.hz

OK Cancel

Figure 20: WinGPSAll reference Station Parameters parameters

The operator must specify the location of the antenna of the local area reference station. This position must be provided in WGS84 co-ordinates, i.e. latitude and longitude in degrees and altitude as Height above ellipsoid (and not above MSL).

The receiver can be selected using the drop-down list **Receiver**. The following receiver types can be used.

- **NovAtel™ WAAS/Millennium**
- **NovAtel™ OEM4**
- **DSNP Aquarius 5000**
- **Septentrio PolaRx-1**
- **Litton 8 channel**
- **Honeywell 16 channel**
- **D920 12 channel**

The information for the field **Data Rate** must be provided by the user, since the nominal update rate of the range measurement data will be used to check the consistency of the data internally.

The checkbox **UTC/GPS Time Transformation** is provided for consistency and

compatibility reasons only. The receivers implemented in SAPPHIRE phases I and II use a time synchronization scheme which is based on UTC time, whereas the receivers implemented in the PEGASUS development will use a time synchronization scheme which is based on the receiver delivered GPS time. Thus, this box will only be enabled when an appropriate receiver is selected.

The satellite selection of WinGPSAll is accessible by clicking the "SV Selection" button, which opens the next Window.

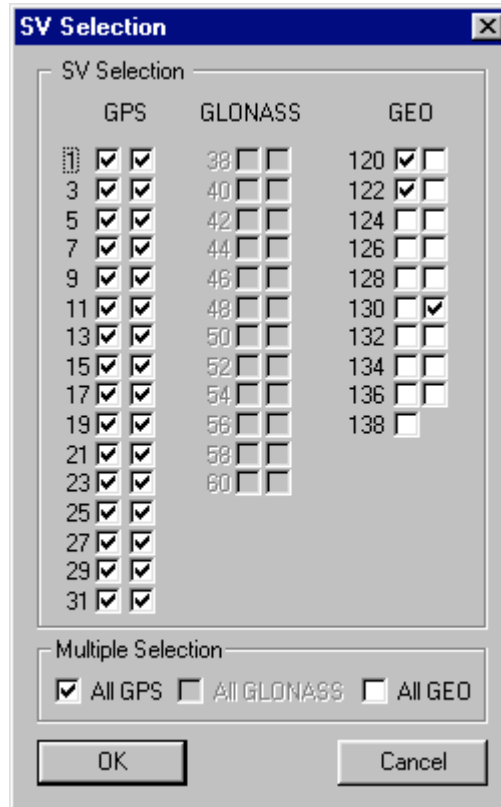


Figure 21: Satellites selection

The additional "Multiple Selection" check boxes could be used to select or deselect all the satellites at the same time.

PlausibilityChecks parameters

Parameters

1. Plausibility Check

Parameters

Maximum number of faulty lines allowed: 1000

Rule File:
D:\plusplus\Software\exe\Rules\EGNDS_MT00.rul ... Edit Rules...

Input

Type of input file:
Message Types 00 User extension: m00

Delimiter

Semicolon Space
 Comma Tab

Save Delete Export Import OK Cancel Help

Figure 22: Plausibility Check parameters

Maximum Number of Faulty Lines Allowed:

The '**Maximum number of faulty lines allowed**' edit field takes the maximum number of erroneous lines. If this number is exceeded when performing the plausibility test, the check is aborted. For example: if the maximum number is set to 100 only the first 100 erroneous lines detected are written out to the log file; the output file is then incomplete and contains only the results up to the specified maximum number of faulty lines.

"..." Button: The user should choose a rules file in order Plausibility Check program to work.

Edit Rules Button:

After pressing the '**Edit Rules**' button, a dialog window appears showing all the rules defined in the selected rule file. The rules for each parameter defined in the rule file will be displayed in the appropriate fields. If rules for a particular check type are defined, this will be indicated with a check mark. It should be noted that the rules cannot be modified using this window.

Type of input file:

In order for Plausibility Checks to know on which type of data file the rules have to be performed, it is necessary to give the file extension of the file to be checked (Message Types 12).

User Extension:

This field contains the extension of the files to be checked. For a User file type, this extension shall be input by the user. For the other file types, it is updated and not modifiable.

MFileRunner parameters

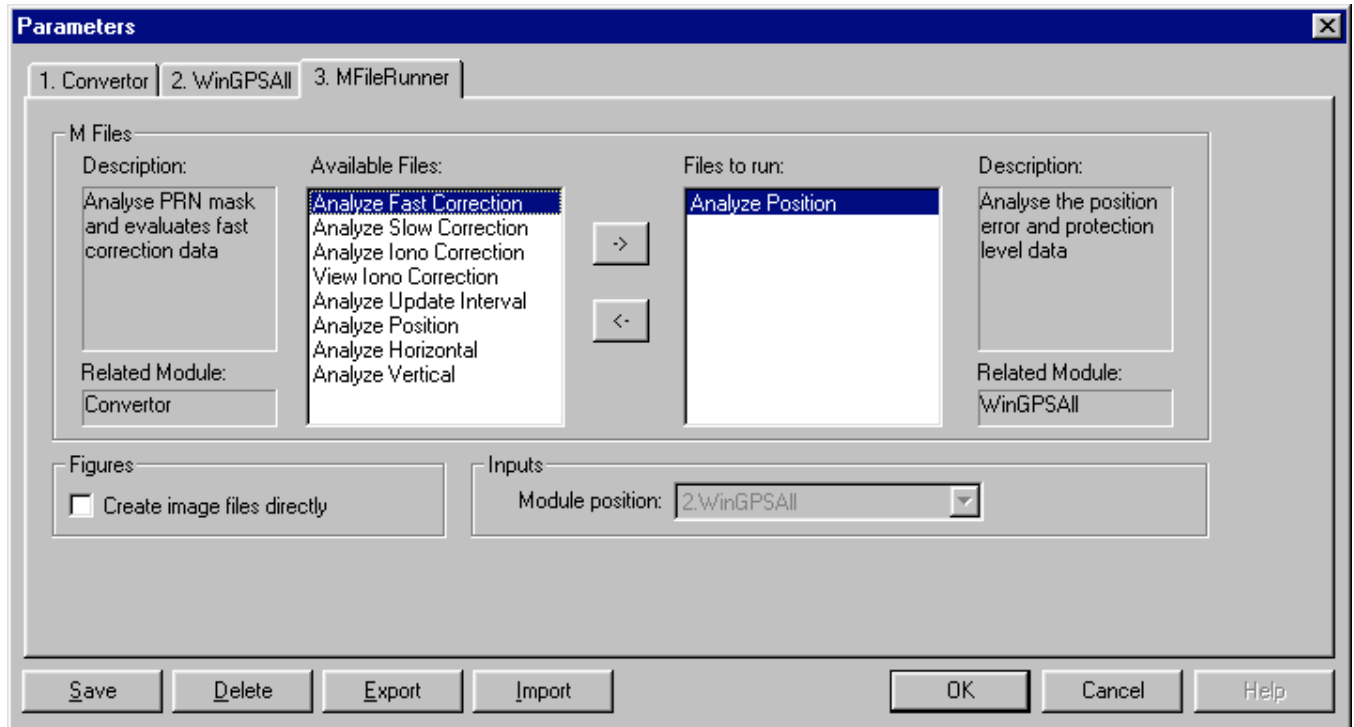


Figure 23: M Files parameters

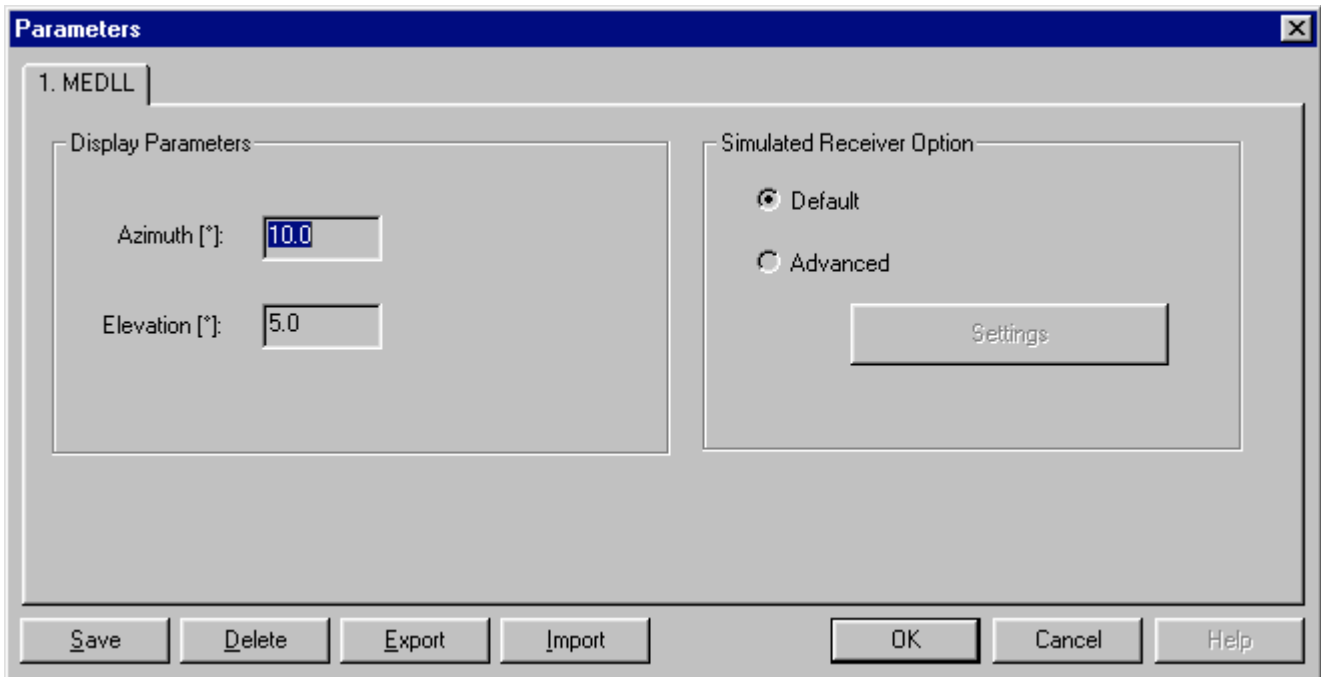
The **Available files** contains all the available scripts for the display of the results. Some description for each script is available in the **Description** box. All the items in the list are executable files, which are described in the description file of the software (mrunner.dsc) and can be executed independently. This file contains also some description for each script.

The **Files to run** presents the user selected files to be executed.

For the different **Files to run**, instead of displaying the results on the screen, it is possible to directly write them under a .png by selecting the Create image files directly checkbox. The selected scripts will then write their results on the disk directly.

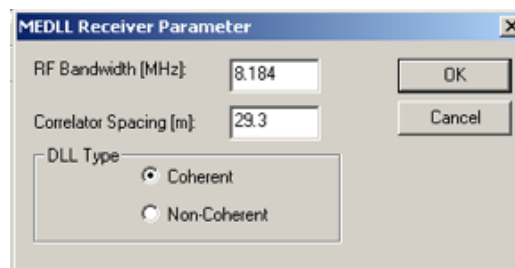
The **Inputs** section allows the user to select one of the related modules from the preceding scenario modules. This is needed only if there are more than one module that could be used as input, otherwise the selection is done automatically and the existing modules are given by default.

MEDLL Multi-Path Analysis Module



The user has the option additionally to select the 'elevation' and 'azimuth' bin size for later visualization. The default value for azimuth is 10° and 5° for elevation. The user can change this value by changing the values in the edit fields of the 'Display Parameters' group box.

The user has the option in the 'Simulated Receiver Option' group box to either use 'default' values for the receiver simulation or setting different ('advanced') values using a special dialog (see next figure). To see this dialog, the user has to select first the 'Advanced' radio button. Then the button 'Settings' will be enabled, allowing the user to show the following dialog:



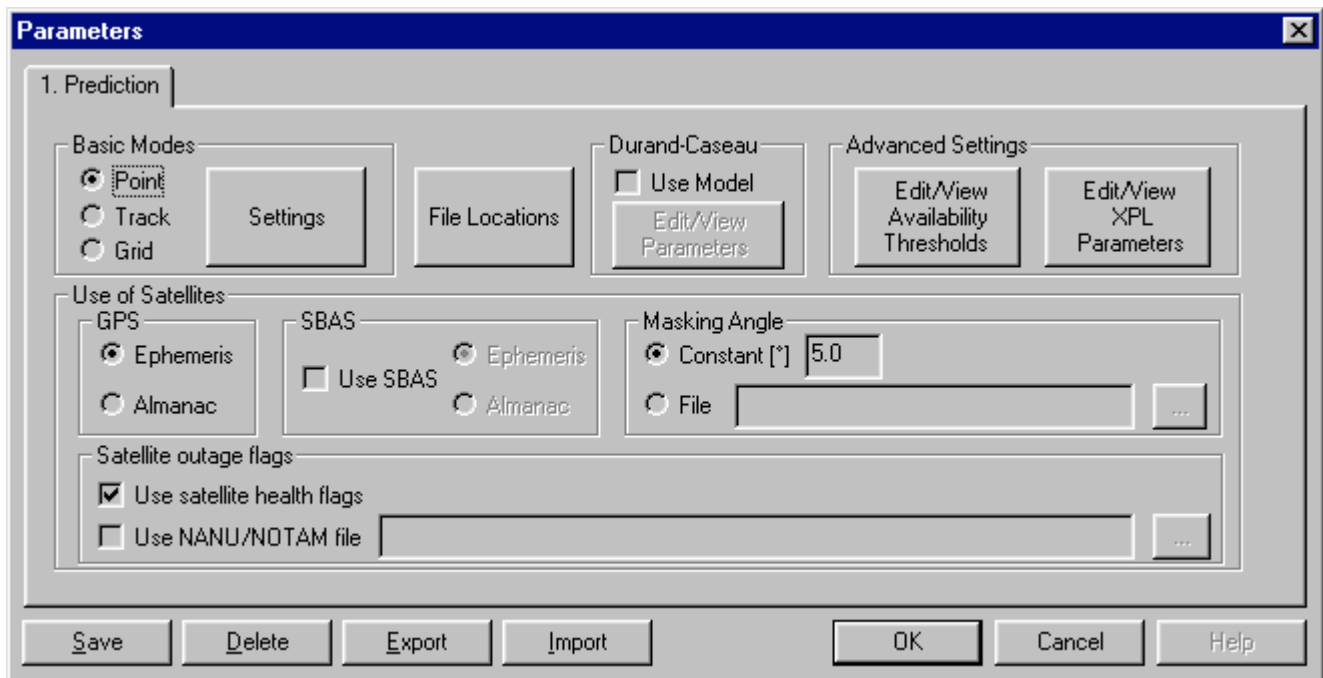
Again in this dialog at first the default values will be shown. The module will simulate the behaviour of the NovAtel OEM3 receiver. Therefore it is recommended that the user will not change these values.

The calculation is straightforward. There are just a few options for advanced users experimenting with the software. These advanced options determine the simulated receiver processing:

- Two-sided RF-bandwidth of the simulated receiver
 - Early-Late Correlator Spacing
- Coherent or Non-coherent receiver processing architecture

For more information refer to the MEDLL Multipath Analysis Module Software User manual [10]

Prediction Tool Module



The **Basic Modes** group contains the data processing parameters (i.e. start/stop time, etc.). The user can select one of the three available processing modes (single point mode, track mode or grid mode) and set the corresponding data processing parameters via pressing the 'Settings' button

The **File Locations** button allows the input data directories selection.

The **Durand-Caseau** group contains the Durand-Caseau model parameters (i.e. GPS satellite MTBF/MTTR, etc.).

The **Edit/View Availability Thresholds** button allows the user to select satellite visibility, XDOP, XNSE and XPL thresholds/alarm limits.

The **Edit/View XPL Parameters** button allows the horizontal/lateral/vertical protection level parameters selection regarding the NED and ACU coordinate systems, respectively.

The **Use of Satellites** group contains the parameters of GPS/SBAS almanac/ephemeris data, satellite health flags, NANUs and NOTAMs as well as the elevation mask parameters. Within the **GPS** and **SBAS** group inside the 'Use of Satellites' group, the user can select if GPS/SBAS ephemeris or almanac data has to be used for the data processing. The application of satellite health flags, NANUs and NOTAMs is selectable within the 'Satellite outage flags' group and the user has also the possibility to choose either a constant elevation mask angle or the filename of an azimuth dependent elevation mask input data file within the **Masking Angle** group.

For more detailed information for the configuration of the module parameters refer to the Prediction Tool Module Software User manual [11]

Aircraft Dynamics module

The screenshot shows the 'Parameters' dialog box for the Aircraft Dynamics module. The '1. Dynamics' tab is active. On the left, the 'Calculation' group has checkboxes for NSE, FTE, TSE, CMN, PFE, Dyn., Meteo, and ALL, all of which are checked. The 'Input Files' section contains four rows: AFP, DFP, NSFP, and Aircraft, each with a text box and a browse button (...). The 'Filter Configuration Input Files' section has two rows: CMN filter and PFE filter, each with a text box containing a path and a browse button (...). The 'Data Interpolation' section has three radio buttons: None, Linear (selected), and Higher Order. Below them is a 'Max DT' spinner box set to 0.1. A button labeled 'Lever-arm and G-force parameters ...' is located at the bottom right of the main panel. At the very bottom of the dialog are buttons for Save, Delete, Export, Import, OK, Cancel, and Help.

The **Calculation** group allows the user to select the calculation performed by the module.

The **Data interpolation** group contains the Interpolation level and the Max DT value used for the data processing. The allowed data interpolation values are: None – for no interpolation performed, Linear – for First order interpolation and Higher - for Higher order interpolation. For the Max DT parameter values between 0 and 1s are allowed but a value greater than 0.3 is not recommended.

The section **Filter Configuration Input files** contains the location of the PFE/CMN default band-pass filter description files needed to calculate the CMN and PFE

The Button **Configuration of Lever-arm and G-force parameters** opens an interface specifying following parameters:

- the 3 co-ordinates of the static (on-ground) position of the centre of gravity,
- the 3 co-ordinates of the static (on-ground) lever-arm to apply to AFP, NSFP
- INS and the five coefficients K0 to K4 needed to model the G-force correction

By default, no lever-arm and G-force correction is performed unless this button is clicked

For more details refer to the Aircraft Dynamics User manual [8]

Procedure Visualisation Module

1. Selection of GBAS approach procedure (Section **Precision Approach Procedure**)

The user selects in pre-defined list the airfield (either using Country / City or ICAO code), the runway QFU and selects the GBAS approach procedure from a pre-defined set of recorded procedure or by creating a new procedure (button Edit/Create).

2. Options for DFP Calculation (Section **Desired Flight Path**)

The user selects the option for precision approach segment extend (final approach and / or missed approach), the reference units for distance (NM or m) or altitude (MSL

geoids in ft, WGS84 ellipsoid in m), as well as the location of the DFP calculation output file (format .csv).

3. Options for GBAS Message Calculation (Section **GBAS Message 2 and 4 Visualisation**)

The user selects the message types to be visualised (type 2 and / or type 4) and inputs the location of message files.

4. Options for Terrain and Obstacles Visualisation (Section **Geographical Information**)

The user select the geographical information to be displayed together with flight paths

For more information refer to the Procedure Visualisation Module User Manual [12]

Appendix D: Glossary

This appendix contains the list of all the specialised terms used within this Software User Manual, together with their definition.

Term	Definition
Algorithms	Software tool used for GNSS integrity monitoring computations.
Command	Action to be run by the scheduler . Ex: Convertor using a .ini file.
Convertor	Software tool used to translate receiver-native GNSS data (binary format) into a generic format (ASCII).
Dll	Dynamic Link Library: separate files containing functions that can be called by programs.
EGNOS	European Global Navigation Overlay Service: European space based augmentation system for GPS.
EGNOS System Test Bed (ESTB)	Experimental EGNOS System developed to perform tests and experiments before the implementation of the full EGNOS system.
GNSS	Global Navigation Satellite Systems: term encompassing all the navigation systems based on satellite navigation. (Ex: GPS)
Job	High-level data processing task composed of: <ul style="list-style-type: none"> • a scenario. • a parameter set • location of the input file for data.
Matlab	Customer Off The Shelves scientific software.
M-Files	Matlab Scripts, written in the Matlab language
M-File Runner	Software tool used to run Matlab scripts (M-Files) compiled in C/C++ and stored in executable files.
ODBC	Open DataBase Connectivity: universal database interface allowing to connect to a database without any knowledge about its physical implementation.
PEGASUS	Prototype EGNOS Analysis using SAPPHIRE: prototype software allowing the analysis of data collected from the ESTB.
Plausibility Check	Software tool to perform some value checks on data stored under a csv format.
Registry	Windows registry, storing all the information about the windows operating system.
Rule File	File containing plausibility rules to be used for plausibility checking on GNSS data.
Scenario	List of data processing tasks: Ex: Conversion + WinGPSAll + Display of results.
Scheduler	Software engine managing the data processing jobs, allowing to start, stop, sequence or delete the different jobs.
SIS	Signal In Space: Electro-magnetic signal sent by satellite and received by the GNSS Receivers. This comprises the physical signal itself and the information contained in that signal.
Stand-alone Program	Software tool allowing to be started independently from the scheduler. Ex: PEGASUS Convertor
Standard scenario	A standard scenario is a scenario defined per default in the installation of PEGASUS, and corresponds to a standard sequence of data processing.

	<p>It cannot be modified nor deleted by the user. The standard scenarios are the first ones displayed in the scenario list, and their names always begin with "Std:".</p>
Task (data processing)	<p>Unit of a data processing scenario. It can be composed of several commands: Ex: File copy + Converter program started.</p>
TN	Technical Notes
User-defined scenario	<p>A user-defined scenario is a scenario defined by the user in order to customise his data processing. Once the scenario is defined by the user and stored in the database, it can be used again for any further data processing jobs. A user scenario is composed of a sequence of data processing tasks chosen and sequenced by the user. In a user scenario, each task is associated a parameter set in order to customise the data processing.</p>
WinGPSAll	<p>Software tool used to compute a navigation solution from converted GNSS data.</p>