Leica ADS40 Ground Processing Software GPro

User Manual

Version 3.3.3
English

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Leica Geosystems

Document release: July 2009

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Read carefully through the User Manual before you use the product.

Table of Contents

In this manual

1 Preface

1.1 About ADS GPro Documentation

The ADS GPro documentation consists of several chapters and an appendix.

Chapter Descriptions

- GPro Installation and Configuration - This chapter contains instructions for installing software and hardware components.
- GPro User Interface - This chapter contains descriptions of the user interface.
- GPro Workflows - This chapter contains instructions for downloading and preparing imagery collected with the Leica Geosystems ADS Airborne Digital Sensor.
- IPAS Pro - As the IPAS Pro software has its own set of documentation, this chapter consists only of a brief description of the IPAS Pro process as used in connection with ADS data.
- ORIMA - As the ORIMA software has its own set of documentation, this chapter consists only of a brief description of the ORIMA triangulation process as used in connection with ADS data.

Validity of this manual

This manual applies to software version 3.3.3.

1.2 Conventions Used in This Book

The names of menus, menu options, buttons, and other components of the interface are shown in bold type. For example:

"In the Select Layer To Add dialog, click the **Fit to Frame** option."

When asked to use the mouse, you are directed to click, double-click, Shift-click, middle-click, right-click, hold, drag, etc.

- click — click once with the left mouse button.
- double-click — click twice with the left mouse button.
- Shift-click — hold down the Shift key on your keyboard and simultaneously click the left mouse button.
- middle-click — click once with the middle mouse button.
- right-click — click once with the right mouse button.
- hold — press and hold the left (or right, as noted) mouse button.
- drag — drag the mouse while holding the left mouse button.

The following paragraphs are used throughout the documentation:

These paragraphs contain strong warnings.

These paragraphs contain important tips.

Notes give additional instruction.

These paragraphs refer you to other areas of this book or other manuals for additional information.

Blue Box

These boxes contain supplemental technical information.

Blue text indicates that it is a link to another topic, figure or table.

1.3 More Information/Help

There are several ways to obtain more information regarding dialogs, tools, or menus, as described below.

On-Line Help

There are three main ways you can access On-Line Help:

- Click the word **Help** in the menu bar and select **Contents**.
- Click the **Help** button that is located in every dialog.
- Press F1 on your keyboard.

Status Bar Help

The Status Bar at the bottom of the parent dialog displays a quick explanation for buttons when the mouse cursor is placed over the button. It is a good idea to keep an eye on the status bar, since helpful information displays here, even for other dialogs.

Bubble Help

Bubble Help, when available, displays directly below your cursor when your cursor rests on a button or part. This is helpful if the status bar is obscured by other windows.

Internet

www.leica-geosystems.com/GPro

1.4 Product Identification

The model and serial numbers of the components of the ADS system are indicated on the housings. Enter them in the table below and always refer to this information when you need to contact your agency or service center.

Device	Model Number	Serial Number
Leica Geosystems DA45		
Leica Geosystems PS45		

2 GPro Installation and Configuration

2.1 Introduction

This document contains detailed information about the ADS Ground Processing Workstation (GPro) and all phases of its operation. GPro is a customized suite of software used for downloading and preparing imagery collected with the Leica Geosystems ADS Airborne Digital Sensor. It works in conjunction with several software packages to accomplish this. This includes IPAS Pro and ORIMA DP.

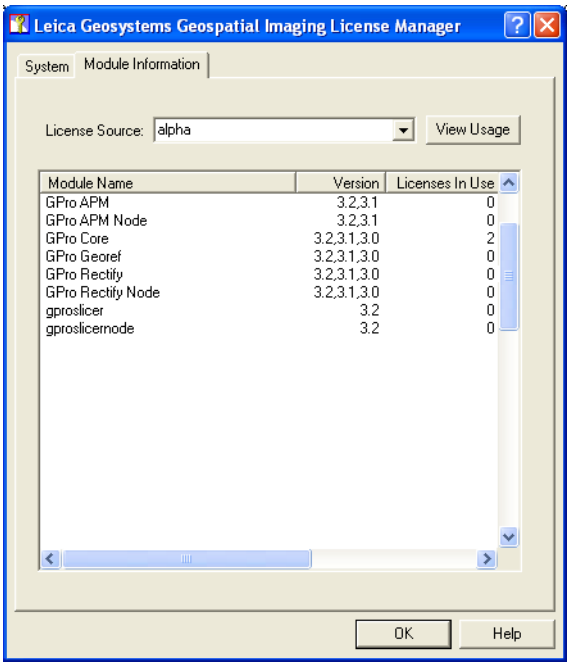
This chapter describes the installation of the GPro software and associated hardware for connecting to the MM data storage unit.

2.2 Software Installation

Licensing

GPro is now licensed using the FlexLM system. Please refer to the Leica Licensing system documentation found at ftp://ftp.gi.leica-geosystems.com/Software/LicenseTools.

Figure 1: LGGI License Manager



Installing GPro

To install the GPro software:

1. First install LPS on your machine. Refer to the LPS documentation for more information.
2. Run the **setup.exe** from the CD and the installation shield will guide you through the process of installing GPro.

Installing ADS Calibration Files

The ADS contains up to 12 CCD lines, each of which is calibrated at the factory. The factory calibration values are stored in individual files for each CCD line. These files are delivered with each ADS.

Copy the factory calibration files into the location accessible for the GPro processing environment.

Make GPro aware of the location of calibration files by defining the path in the GPro General Global Preferences menu.

Installing ORIMA and IPAS Pro

To utilize GPro fully, ORIMA and IPAS Pro software must also be installed. Refer to the ORIMA and IPAS Pro documentation for installation instructions.

GPro will work without these software packages installed, but you will be unable to perform GPS-IMU processing or aerial triangulation on your machine.

GPro uses LPS, ORIMA, and IPAS Pro. In order to integrate these packages GPro must know where these three software packages are installed on your machine. The paths of the installed software are displayed in the preferences menu of GPro. The default installation directories in GPro are:

- C:\Program Files\Leica Geosystems\IPAS Pro\IPASPro.exe
- C:\ORIMA_DP\Programs\Orima.exe
- LPS installation path is taken from registry

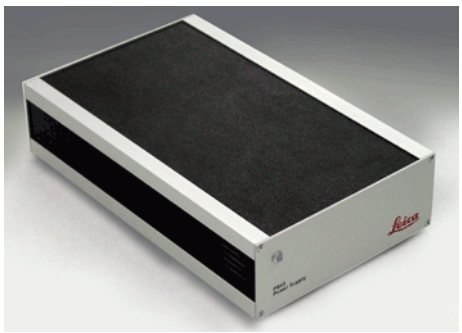
*If IPAS Pro and/or ORIMA installation directories are not set correctly in the Set General Preferences - Programs dialog (page 36) then the **Run GNSS/IMU Processing** button and/or the **Run Triangulation** button will be unable to start the necessary programs. However, you can still run them using their normal startup methods. See "To change the default path" on page 37 for instructions on changing the default directories.*

2.3 Data Download Components

DA45 Download Adapter

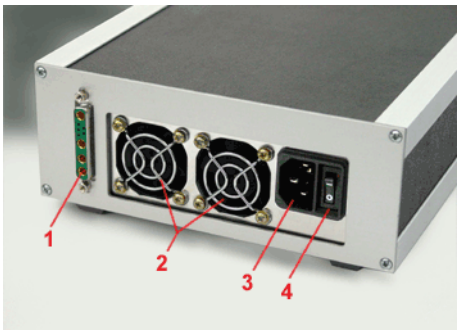
An adapter to connect power to the MM and to connect to the SCSI bus of the download workstation computer in an office environment.

PS45 Power Supply



Power Supply. Provides power from the DA45 to the MM40 for data download.

Front view:
Power indication LED On/Off



Rear view:
1. DC power connector (from DA45)
2. Cooling fans
3. AC Power connector
4. AC Power On/Off switch

Cables for PS45 and DA45

Left side:

Main power cables for PS45: one with US plug and one for SCHUKO plug. If required, the plug type to the power source must be adapted to local standards.

Right side:

SCSI cable to connect DA45 to the SCSI bus of the download workstation computer.

Care and Transport, regarding these components

- Never carry the product loose in a road vehicle, as it can be affected by shock and vibration. Always carry the product in its transport container and secure it.
- When transporting the product by rail, air or sea, always use the complete original Leica Geosystems packaging, transport container and cardboard box, or its equivalent, to protect against shock and vibration.

- Respect the temperature limits when storing the equipment, particularly in summer if the equipment is inside a vehicle. (-40°C to +85°C / -40°F to +185°F).
- Use only a clean, soft, lint-free cloth for cleaning. If necessary, moisten the cloth with water or pure alcohol. Do not use other liquids; these may attack the polymer components.
- Dry the product, the transport container, the foam inserts and the accessories at a temperature not greater than 40°C / 108°F and clean them. Do not repack until everything is completely dry.
- Keep plugs clean and dry. Blow away any dirt lodged in the plugs of the connecting cables.

Safety Directions, regarding these components

Permitted use

- Providing power with the PS45.
- Data transmission to external appliances with the DA45.

Adverse use

- Use of the product without instruction.
- Use outside of the intended limits.
- Disabling safety systems.
- Removal of hazard notices.
- Opening the product using tools, for example screwdriver, unless this is specifically permitted for certain functions.
- Modification or conversion of the product.
- Use after misappropriation.
- Use of products with obviously recognizable damages or defects.
- Use with accessories from other manufacturers without the prior explicit approval of Leica Geosystems.

Warning:
Adverse use can lead to injury, malfunction and damage.
It is the task of the person responsible for the equipment to inform the user about hazards and how to counteract them. The product is not to be operated until the user has been instructed on how to work with it.

Limits of Use

Suitable for use in an atmosphere appropriate for permanent human habitation: not suitable for use in aggressive or explosive environments.

Hazards of Use

Warning:
The absence of instruction, or the inadequate imparting of instruction, can lead to incorrect or adverse use, and can give rise to accidents with far-reaching human, material, financial and environmental consequences.
Precautions:
All users must follow the safety directions given by the manufacturer and the directions of the person responsible for the product.

Warning:
Only Leica Geosystems authorized service workshops are entitled to repair these products.

Warning:
The product may not be used in wet and adverse environments, as a damp product may cause electric shocks.
Precautions:
Only use the product in the dry, e.g. in rooms or vehicles.
Keep the product dry. Never use the product when it is damp!

Warning:
If the product is opened, either of the following actions may cause an electric shock:
• Touching live components
• Using the charger after incorrect attempts were made to carry out repairs.
Precautions:
Do not open the product. Only Leica Geosystems approved technicians are authorized to repair it.

2.4 Hardware Installation

Attaching the Download Adapter to the MM

Figure 2: Connecting Download Adapter

Procedure:

1. Connect the SCSI cable to the DA45.
2. Connect DA45 Power cable to the PS45.
3. Attach DA45 to the Plug on MM40.

   Make sure that the computer is powered off before proceeding.
4. Connect SCSI cable to SCSI bus on computer.
5. Connect power cord of PS45 to main power 110V/240V 50/60Hz.

Caution:
Connect the PS45 only to an AC current wall outlet with the following specifications:
AC power capable for 10 A resp. 6.3 A minimum, 100-240 V~, 15-10 A, 50/60 Hz, fused with maximum 10 A resp. 6.3 A, and ground connection.

Caution:
Use only the AC power cords provided by Leica Geosystems with the PS45 or according to Standard IEC 60227 capable for 20A.
Do not use the PS45 outdoors.
Protect the PS45 from condensing moisture.
Do not obstruct the airflow. (Airflow slits and cooling fans)

Connecting the MM to the Workstation

Software installation must be performed first. See "Software Installation" on page 16.

Procedure:

1. Make sure that the SCSI cable is firmly connected at both ends - to the MM40 and to the workstation.
2. After you have connected the MM and powered up the system for the first time, BIOS may ask you to enter the Setup Utility. This is because the Drive Sequence on the SCSI bus(es) may have changed. Make sure you enter the correct HDD at the top of the list in the boot sequence. Also the drive letter(s) may be affected. If you have any questions about how to check or change this, ask your system administrator or look it up in your computer manual.
3. Download and install the latest driver for your SCSI card and Operating System.
4. You can only test the connection of the MM with GPro when the MM contains data.

See Set Download Preferences (page 32). for further information on adding and removing an MM.

Power-up sequence:

1. Switch on Power at the PS45
2. Switch on Power at the download workstation computer

Starting GPro

Once installation is complete, start GPro by double clicking on the GPro desktop icon  .

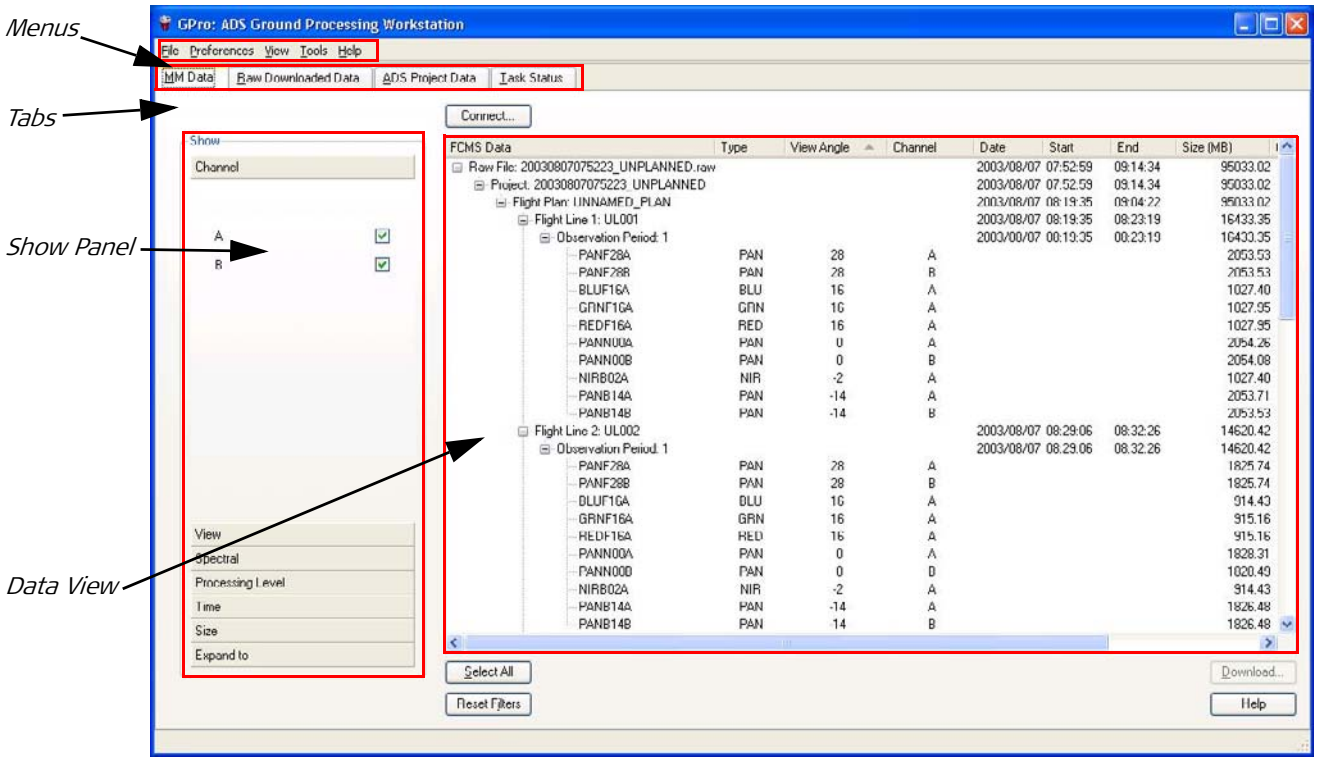
3 GPro User Interface

This chapter describes the GPro user interface elements.

3.1 ADS40 Ground Processing Workstation

The GPro workstation contains five menus and four tabs. Each of the first three tabs contains a Show Panel and a Data View. Additionally, these tabs contain buttons (above and below the data view) to initiate processes and perform functions on selected data. Some of the buttons on each dialog share common functionality and are discussed only once in "Common Buttons" on page 26. When you right-click on an image or s selected group of images, a "Context Menu" on page 26 is displayed. The fourth tab displays status information about processes.

Figure 3: Workstation Overview



Show Panel

The amount of data available from the MM can be very large. You may not have a need to access all of the data for a particular project. The "Show Panel" on page 50 allows you to filter the data that are displayed in the data view. The data are still there, they are simply not listed in the data view.

Data View

The data view may take one of two forms depending on the selected tab. When the MM Data tab or the Raw Downloaded Data tab is active, the data view consists of the "FCMS Data View" on page 64; when the ADS Project Data tab is active, the data view consists of the "Project Data View" on page 62.

Menus

The main window's menu options are as follows:

Table 1: Main window Menus & Options

Menu	Menu Choice	Description	Opened Dialog	Shortcut
File See "File menu options" on page 27.	New	Create a new workspace	"ADS Workspace" on page 29	Ctrl + n
	Open	Open an existing workspace	Select ADS Workspace	Ctrl + o
	Close	Close the current workspace		Ctrl + l
	Export Workspace LPS	Creates an LPS block file for the GPro project	Choose INFO file	
	Copy To	Copy a workspace to a new location	"Workspace Copy" on page 31	Ctrl + t
	Validate	Validates the data on the current Workspace		Ctrl + a
	Recent Files	List recently accessed workspaces		
	Quit	Quit GPro		Ctrl + q
Preferences See "Preferences menu options" on page 28.	General...	Set the general preferences for GPro. These include the program name and locations, workspace defaults and project locations.	"Set General Preferences - Programs" on page 36	Ctrl + g
	Image Download...	Set options affecting image downloading	"Set Download Preferences" on page 32	Ctrl +i
	File naming...	Set rules to govern automatic file naming	"File Naming Preferences" on page 34	Ctrl + f
	Rectification...	Set preferences for rectification.	"Set Rectification Preferences - General" on page 39	Ctrl + r
	Automatic Point Matching...	Select the image level to use for APM.	"Point Measurement Parameters" on page 45	Ctrl + p
View See "View menu options" on page 28.	Refresh	Refresh the GPro workstation display.		F5
	Customize...	Customize the data display panels of the GPro workstation. The View Customization dialog opens.	"View Customization" on page 46	Ctrl + Shift + t
Tools See "Tools menu options" on page 28.	Tonal Transfer Curve	Correct contrast and brightness of images	"Tone Curve Editor" on page 154	
	Orientation Plot	Display the orientation data file (ODF) in a graphical form.	"ADS Orientation Plot" on page 160	
	MM Analysis Tool	Analyze the data on the MM.	"ADS MM Analysis Tool" on page 163	
Help See "Help menu options" on page 29.	Contents	View the online manual	GPro On-Line Help	F1
	About GPro	Show the version number		

Tabs

The main screen of GPro is a tabbed window containing four different views. Three of these views track the current state of the data being processed while the fourth shows the status of background tasks in progress. The four views are:

MM Data This view displays the contents of an attached MM Mass Memory Unit. It is used to download image or GNSS/IMU data files associated with images selectively. For more information, see "MM Data" on page 49.

Raw Downloaded Data This view is similar to the MM Data view but displays information about the images already downloaded from a MM. It is used to store the image information temporarily until the GNSS/IMU data download is completed, at which point the images can be added to an ADS Project. From here you can run the IPAS GNSS/IMU processing software, view downloaded Level 0 imagery in GPro Image Viewer for quality control purposes, delete downloaded Level 0 images, and create reduced resolution images, also called image pyramids. For more information, see "Raw Downloaded Data" on page 54.

ADS Project Data This view displays information about the georeferenced images that have already been assigned to a particular project. Note that, until they are added to a project, images are not georeferenced. In this view most of the processing is done to prepare the data for triangulation and the creation of output products. From here it is possible to load the imagery into GPro Image Viewer, triangulate it using ORIMA and create the Level 1 and 2 image products. For more information, see "ADS Project Data" on page 58.

Task Status This view displays a status window for each background task currently running as a part of GPro. For more information, see "Task Status" on page 63.

3.2 Common Buttons

One or more of the following buttons are found on most dialogs.

OK Click this button to acknowledge correctness of the information displayed in the dialog. If this is an informational dialog, the dialog simply closes. If this is a parameter-gathering dialog, the data are passed on to the program that displayed the dialog.

Cancel Click this button to discard the changes you made, close the dialog, and cancel the process.

Close Click this button to discard the changes you made, close the dialog, and cancel the process.

Save Click this button to save the changes you made.

Help Click this button to display a context sensitive on-line help page.

< Back Click this button to return to the previous page in the process wizard.

Next > Click this button to return to the next page in the process wizard. This button may be disabled until sufficient information has been provided for the current page.

Finish Click this button to submit the collected partners and information to the process wizard.

3.3 Context Menu

For convenience, several operations can be conducted using a right mouse click when an image or a series of images are selected. The operations include **Show Status**, **View Image**, **View Support** and **View Info**.

Show Status Select this option to view the FCMS data, level of processing, and auxiliary file information for the selected image(s). The ADS Image Information dialog opens (page 65).

View Image Select this option to view the selected image(s) in the GPro Image Viewer or in the external viewer specified in "Set General Preferences - Global" on page 37.

View Support Select this option to load the image support file(s) into the GPro Text Viewer. See "GPro Text Viewer" on page 66.

View Info Select this option to load the image info file(s) into the GPro Text Viewer. See "GPro Text Viewer" on page 66.

3.4 File menu options

New

Select this option to create a new workspace. The ADS Workspace dialog opens (page 29).

Open

Select this option to open an existing workspace. A standard file selector opens.

Close

Select this option to close the currently open workspace. This option is enabled only when a workspace is open.

Workspace Management

Select this option to add and remove flights, projects, and image locations from the current workspace. The ADS Workspace dialog opens (page 29). This option is enabled only when a workspace is open.

Export Workspace

LPS

Select this option to create an LPS block file and store the GPro project information. A file Selector dialog opens.

Specify the location and the name for project file (*.info). Click Open. GPro will create an LPS block file.

Socet Set

Select this option to create a Socet Set project file (*.prj) and store the GPro project information. A file Selector dialog opens.

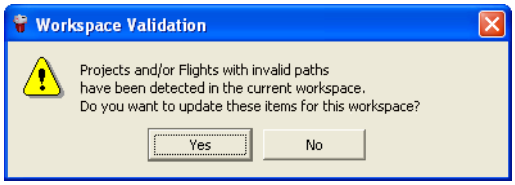
Specify the location and the name for project file (*.info). Click Open. GPro will create a Socet Set project file.

Copy To

Select this option to copy a workspace from one location to another. The Workspace Copy dialog opens (page 31). This option is enabled only when a workspace is open.

Validate

Select this option to validate data paths specified in the workspace file. If a workspace has been manually copied to another location and the original deleted, there will be a problem with the workspace paths because the original paths are no longer valid. If this has happened, you will get an error message like this:



You can choose to ignore this problem or attempt to update the paths within this workspace to make it usable. If you choose to ignore the problem, you will get error messages when you attempt to open some or all of the projects or flights within the workspace.

If you choose to fix or update the workspace, then click **Yes**; the Workspace Update dialog opens (page 84).

Recent Workspaces

Select this option to display a list of recently accessed workspace files (.wks). Simply click on the one you want to open.

Quit

Select this option to exit the program. Upon exit, GPro saves the current settings. If there are background tasks currently running, the exit command opens a confirmation dialog. Select **Cancel** to return to the program and let the background tasks finish, or **Exit** to abort them and exit.

It is not advisable to exit GPro while background tasks are running. Corrupted output files may result, large temporary files may not be deleted, and machine resources may not be properly released.

3.5 Preferences menu options

The **Preferences** menu contains the following options in a pull-down menu.

General

This dialog sets up the working environment for GPro. Select this option to set default preferences for external programs, global workspace and viewers. It is used to identify directories and programs that GPro utilizes during ADS40 ground processing. The Set General Preferences dialog opens. This dialog has two tabs: "Set General Preferences - Programs" on page 36, "Set General Preferences - Global" on page 37.

Image Download

Select this option to set the default preferences for image downloading. The Set Download Preferences dialog opens (page 32).

File Naming

Select this option to set the default preferences for file naming. The File Naming Preferences dialog opens (page 34).

Rectification

Select this option to set default preferences for rectification options. The Set Rectification Preferences dialog opens. This dialog has four tabs: "Set Rectification Preferences - General" on page 39, "Set Rectification Preferences - Radiometry" on page 41, "Set Rectification Preferences - Clip" on page 43 and "Set Rectification Preferences - Advanced" on page 44.

3.6 View menu options

This menu provides options to refresh or customize the views.

Refresh

Select this option to refresh the view after changes have been made.

Customize...

Select this option to select the fields that are displayed in the various view windows. The View Customization dialog opens (page 46).

3.7 Tools menu options

This menu provides access to utilities.

Tonal Transfer Curve...

Select this option to adjust the pixel value histogram to stretch the image for proper display. The Tone Curve Editor dialog opens (page 154).

Orientation Plot...

Select this option to plot exterior orientation data. The ADS Orientation Plot dialog opens (page 160).

MM Analysis Tool

Select this option to analyze the contents of the MM for troubleshooting. ADS MM Analysis Tool dialog opens (page 163).

3.8 Help menu options

This menu provides access to the on-line help and to GPro version information.

Contents Select this option to display on-line help.

About GPro Select this option to display version information about GPro.

3.9 ADS Workspace

A workspace is the collection of flights and projects that are displayed in GPro.

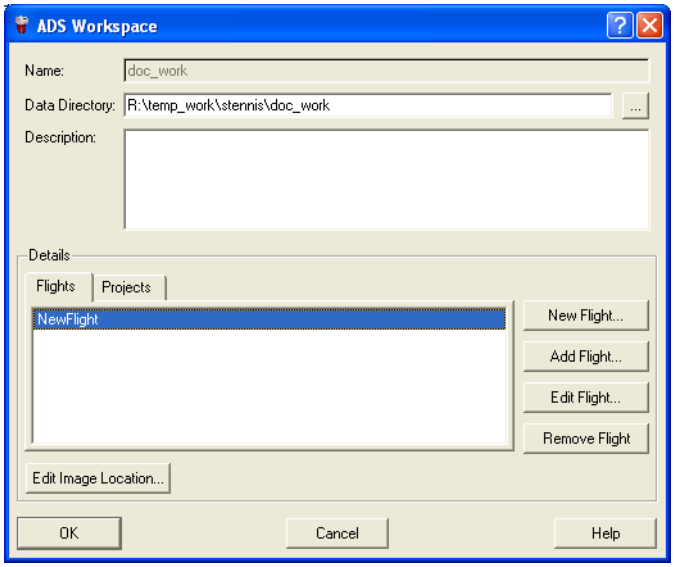
Each Project directory contains the cam and odf subdirectory. These are created automatically when you create the project. You will use the "Image Locations" on page 48 dialog to create an images folder to serve as a repository in which to place the generated pixel files for the project.

Within each Flight folder, sub-folders named images, pos, mm, and raw are created.

There is also a *.wks file that contains references to all the projects and flights for the workspace.

This dialog is accessed by selecting **New** or **Workspace Management** from the "File menu options" on page 27.

Figure 4: ADS Workspace



Name The name of the current workspace is displayed here. If this dialog was accessed by selecting **File -> New**, then the default name **NewWorkspace** is displayed. This field is editable. For a new workspace, enter the name you want for the workspace.

Data Directory The name of the current workspace data directory is displayed here. If this dialog was accessed by selecting **File -> New**, then the default folder name **NewWorkspace** is displayed. This field is editable. For a new workspace data directory, enter the name you want for the workspace data directory or browse to it by clicking the browse button.

Description The description of the current workspace (if any) is displayed here. This field is editable. For any workspace, you may enter descriptive information in this window.

Flights

Click this button to display flights associated with this workspace. Select a flight and click the **Edit** button to modify its contents or the **Remove** button to remove the flight from the workspace.

Projects

Click this button to display projects associated with this workspace. Select a project and click the **Edit** button to modify its contents or the **Remove** button to remove the project from the workspace.

New...

Click this button to add a new Flight or Project to the workspace. If a Flight is selected, the Create or Edit ADS Flight dialog opens (page 57). If a Project is selected, the Create or Edit Project dialog opens (page 59).

Add...

Click this button to add a Flight or a Project to the workspace. A file selector is opened. If you are adding a Flight, the default file extension is set to '.flt'; if you are adding a Project, the default file extension is set to '.info'.

Edit...

Click this button to edit the selected Flight or Project. If a Flight is selected, the Create or Edit ADS Flight dialog opens (page 57). If a Project is selected, the Create or Edit Project dialog opens (page 59).

Remove

Click this button to remove the selected Flight or Project from the workspace. When you select this option, the Detach/Delete dialog opens offering you the option of **Detach** or **Delete**. Detaching a Flight/Project will only remove the selected item from the current workspace. Delete removes all the files for the selected item as well as detaching it from the workspace. If you decide to delete, then the Deletion Confirmation dialog opens (page 55).

Edit Image Location...

Click this button to set or change the default image location for the workspace. The Image Locations dialog opens (page 48).

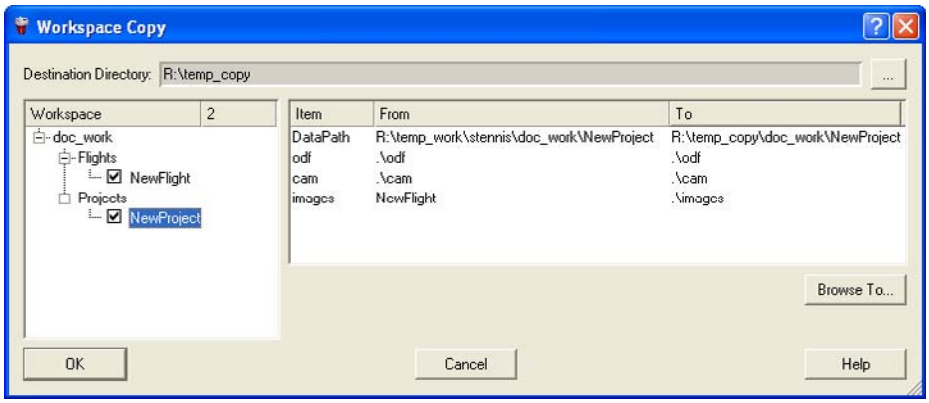
Other buttons are discussed in "Common Buttons" on page 26.

3.10 Workspace Copy

This dialog allows you to copy an entire workspace (or selected parts) to another location. You can select the specific directories in which each of the linked directories, flights, or projects are going to be copied.

This dialog is accessed by selecting **Copy to** from the "File menu options" on page 27.

Figure 5: Workspace Copy



Destination Directory

Enter the path to the location of the workspace copy or click the browse button ... to navigate to it.

Workspace View

This tree view lists all the Flights and Projects contained in the current workspace. Each one is individually selectable and can be moved/copied to a new location. Select the flights and projects to copy by ensuring the checkbox is checked. Click an unchecked box to check it. Click a checked box to un-check it.

Item

This column describes the specific Flight/Project item attribute that is to be copied, e.g. data path or image location. Within a flight or project, these are individually selectable and a specific location chosen for the new location of each of these attributes.

From

This displays the current path/location of the workspace attribute.

To

This displays the destination/target location for the copy/export.

Browse To...

This function allows you to fine tune the location of each item within the flight/project. By selecting the Name of the item, and then clicking this button, you can then select a location just for the selected item.

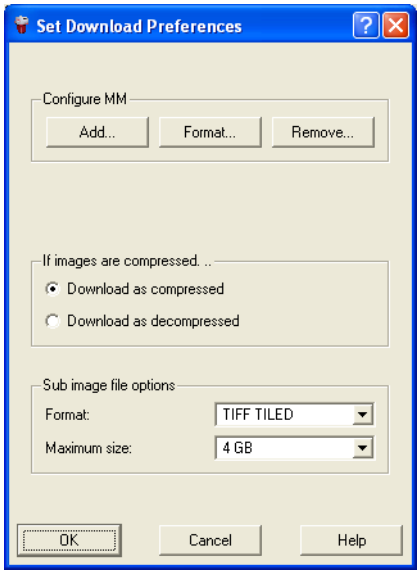
Other buttons are discussed in "Common Buttons" on page 26.

3.11 Set Download Preferences

The image download preferences are used to set options that affect the image during and immediately following download.

This dialog is accessed by selecting **Image Download** from the "Preferences menu options" on page 28.

Figure 6: Set Download Preferences



Configure MM

Add... Click this button when you are ready to configure the MM for the first time or when the SCSI card the MM is attached to is replaced.

Format... Click this button to perform a high level format on the hard drives within the MM unit. After a dialog confirming that you want to format the MM, the "Select Device" dialog is opened. Choose all Devices on MM and hit OK to format the Drive. All Data will be lost! If you need to perform a low level format use the ADS MM Analysis Tool instead

Remove... Click this button to remove the configuration for a MM. The configuration file remains, only the parameters inside change.

If Images are compressed

ADS40 can capture imagery in two modes: compressed and non-compressed (with some restrictions). In the compressed mode, all the 16-bit images are normalized to 8-bit and the result is JPEG compressed. This compression scheme leads to an unusual image format that retains the original dynamic range. This is achieved by storing the image as a series of 8-bit JPEG compressed byte streams in blocks of 8 lines by 12000 samples, along with de-normalization parameters to convert back to the full 16-bits. See "ADS 16-bit Compressed Image Format" on page 175 for details.

The compression options allow you to select how compressed imagery should be treated on download. The options are:

download as compressed Keep the imagery compressed on download. This is the default since it results in the fastest download time and minimum storage requirement.

download as decompressed Uncompress and de-normalize images at download time. This typically results in an increase of the storage requirement on download as compared to keeping the imagery compressed. It also significantly increases the time required to perform the download.

Sub-Image File Options

ADS40 imagery can typically be very large, often larger than the maximum allowed by commercial image formats such as TIFF. Yet, it is desirable to treat an ADS40 image as a single image. To accommodate this, all imagery created or downloaded by GPro can be split between multiple pixel files and in addition, a special "ADS Image File" is always generated. The ADS Image File is not really an image file at all, but rather a simple ASCII text file that defines the sub-image pixel files that comprise the complete image. As far as the software is concerned, this ADS Image File is the complete image. The fact that it is broken into sub-image pixel files is transparent to both you and the software. An ADS Image File can be manipulated and viewed as a single image file with any LPS compatible software. For more information, see "ADS Image Format" on page 174.

The sub-image pixel file options are:

Format TIFF TILED is the only option for downloaded files.

Maximum size Allows for specification of the maximum size for a sub-image pixel file. The choices are 650 MB, 1 GB, 2 GB, 3 GB or 4 GB. Any image larger than this size is split into multiple sub-image pixel files that are less than this limit. The default is 4GB (the maximum allowed by the TIFF specification).

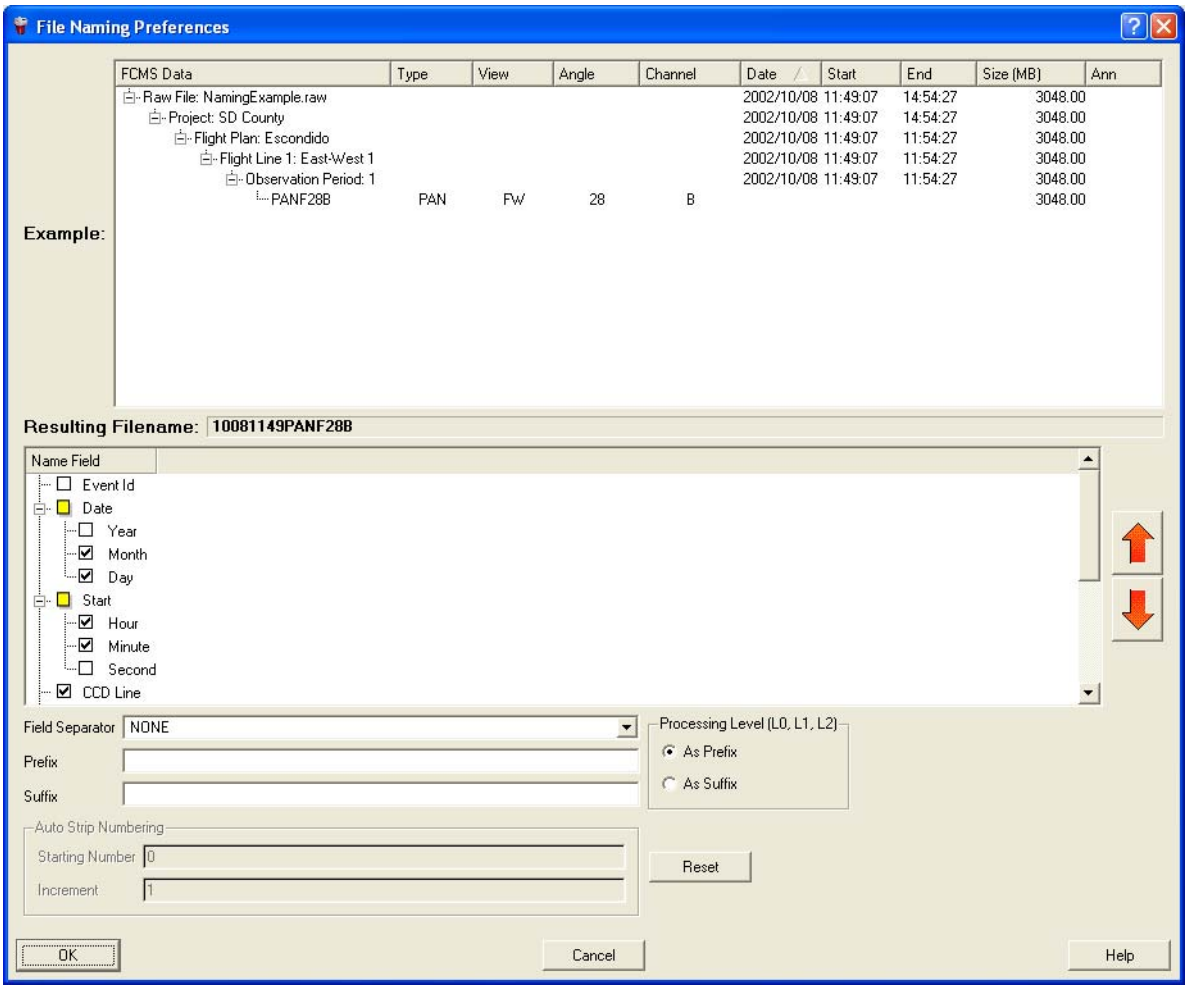
Other buttons are discussed in "Common Buttons" on page 26.

3.12 File Naming Preferences

The File Naming Preference dialog is used to automate the naming of image and GNSS-IMU files. It relieves you of the burden of giving names for the hundreds of images that may be downloaded from a single flight. Moreover, it is helpful in that it makes filenames meaningful since it uses their FCMS (Flight Control Management System) history to generate the names.

The **Example** box shows an example FCMS history and the **Resulting Filename** box shows the filename that would be automatically generated from that example using the currently selected preferences.

Figure 7: File Naming Preference



Example

This window displays an example of the FCMS data fields. You can see how these fields relate to those listed in the Name Field below.

Resulting Filename

This field provides instant feedback as you change the naming preferences listed in the Name Field.

Name Field

This window displays all the naming options that are available. Click a checkbox to change its state. When an option is checked, it is used to construct file names. Use the arrow buttons at the right to move a selected option or option category up or down in the structure. This determines the left-to-right order of the options as they are used in building the file name. Top-most in the list are left-most in the file name. To select an option or option category, click on its name.

Field Separator If you want to separate the fields, you may use this popup list to select the separator character. The default is NONE.

Prefix You may specify an alpha-numeric prefix for each file name by typing it in this field.

Suffix You may specify an alpha-numeric suffix for each file name by typing it in this field.

Auto Strip Numbering To enable these fields for automatic strip numbering, you must check the box for **Auto Strip** in the **Name Field**.

Starting Number Enter the number of the first strip. The default is 0.

Increment Enter the step value or increment for each new strip. The default is 1.

To change the file naming preferences

1. Turn on/off the desired **Name Field** by toggling the radio buttons in the naming hierarchy. The default naming options use CCD name (see below), date (YY-MM-DD) and time (HH-MM). If an option has sub-options, double click on it to expand it.
2. Rearrange the order of the fields to reflect the desired **Filename** concatenation by selecting the field name and using the up and down arrow buttons to move the selected field. The **Resulting Filename** box is updated indicating what the output filename would be.
3. Select the **Field Separator** used to separate each of the fields extracted and the **Suffix** and **Prefix** as desired. Again, all changes are reflected in the **Resulting Filename** box.
4. If **Auto Strip** is one of the fields selected in step 2, insert the auto strip **Starting Number** and **Increment** in the Auto Strip Numbering fields. Images are automatically numbered starting with this strip id whenever a new observation period is encountered in the FCMS history.

Care should be taken to select a meaningful combination of fields so that the resulting filename is easily identifiable and unique.

CCD Naming

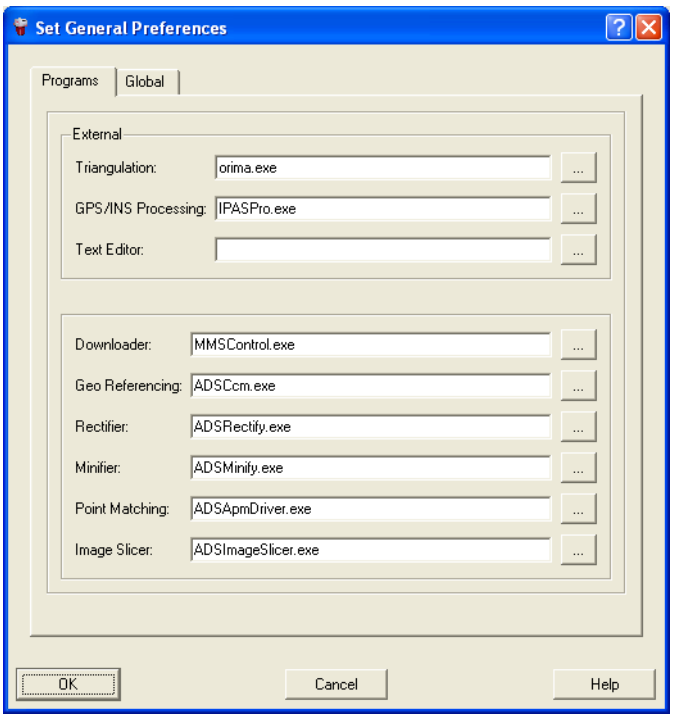
CCD naming describes the sensor CCD lines with respect to their position on the focal plane. A flexible naming system identifies the spectral characteristics, position, angle, and channel of each CCD line. CCD naming is displayed in all data viewers in the corresponding **Type**, **View Angle** and **Channel** columns. GPro has the flexibility to handle current sensors and future configurations, while retaining compatibility with older projects.

The output CCD name is exactly seven characters and therefore the filenames may be slightly longer than with older versions. The output product names, from rectification for example, are based on the CCD naming.

3.13 Set General Preferences - Programs

This tab allows setting of the directory and programs used during the workflow. This is divided into two sections, namely internal and external software. Internal software are programs that are provided with GPro; external software are programs that are acquired separately. At the end of each text box a button exists for browsing the directory structure.

Figure 8: Set General Preferences (Programs)



External The external software are add-on packages that are not developed by Leica Geosystems.

Triangulation The full path to the triangulation package to be used with the ADS40 imagery. The default is ORIMA DP-M.

GNSS/IMU Processing The full path to the GNSS/IMU post processing software. The default is IPAS Pro.

Text Editor An optional full path indicating an external text editor used by GPro. If this is left blank then GPro's internal editor is utilized.

Internal The internal software is written by Leica Geosystems for the purposes of ADS40 ground processing. These require the full path and should rarely be changed. The following describes the individual components and default filenames.

Downloader This is the executable used to download the imagery from the MM into a readable set of data for ground processing. The default is MMSControl.exe.

Geo Referencing This is the executable used to georeference the raw imagery using GNSS/IMU data. The default is ADSCcm.exe.

Rectifier This is the executable for rectification. The default is ADSRectify.exe.

Minifier This is the executable used to generate image pyramids for ADS imagery. The default is ADSMinify.exe.

Point Matching This is the executable used to encapsulate point matching within GPro. The default is ADSApmDriver.exe.

Image Slicer This is the executable that is used to slice L1 images into smaller pieces.The default is ADSImageSlicer.exe.

Other buttons are discussed in "Common Buttons" on page 26.

To change the default path

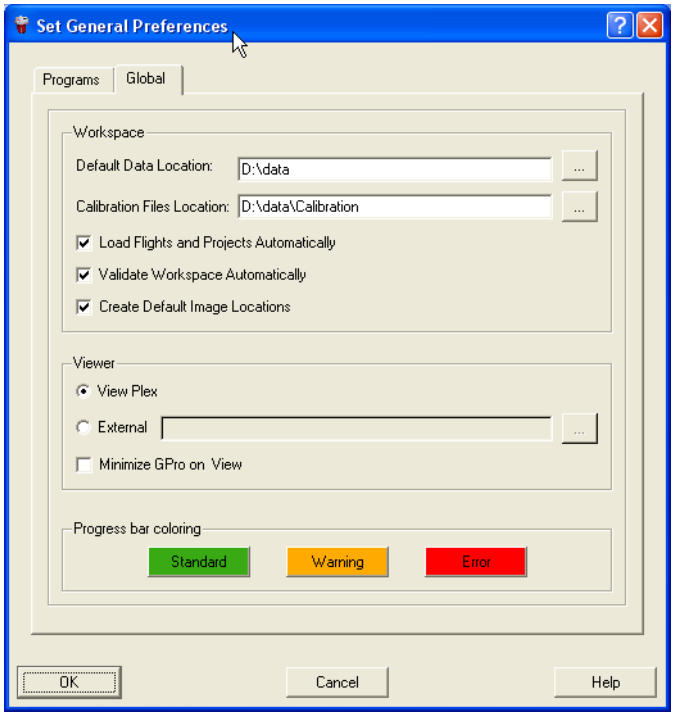
If the default directories deviate from the actual install directories, you must modify the paths specified in the General preferences.

1. Click **Preferences** and select **General** or press Ctrl G.
2. Type the path in the text field or click the browse button ... to select a path graphically.

3.14 Set General Preferences - Global

This view specifies the default location for workspace data and calibration files, the default viewer, and the default colouring scheme for the scroll bar.

Figure 9: Set General Preferences (Global)



Workspace These options allow you to establish some default workspace parameters.

Default Data Location This is where output data will be written by default. This is the starting directory for all new workspaces.

Calibration Files Location This is the default location for calibration files.

Load Workspace Automatically When checked, this option automatically opens the last used workspace.

Validate Workspace Automatically When checked, this option automatically validates the workspace. See Workspace Update (page 84).

Create Default Image Locations When checked, this option automatically creates folders for new flights or projects. Otherwise, you will have to specify locations in the wizard.

Viewer These options allow you to choose the default viewer. This is the image display software that is called when you click a **View** button.

Viewplex When selected, the Leica Geosystems Viewplex is the default viewer.

External When selected, the specified program becomes the default viewer.

Minimize GPro on View When checked, this option causes GPro to be minimized when viewing imagery.

Progress bar colouring The colour of the progress bars are used to indicate the success or failure of the process. These options allow you to customize the colours that are associated with the different completion messages.

Standard Click this button to select the progress bar colour that will be displayed when the process runs successfully.

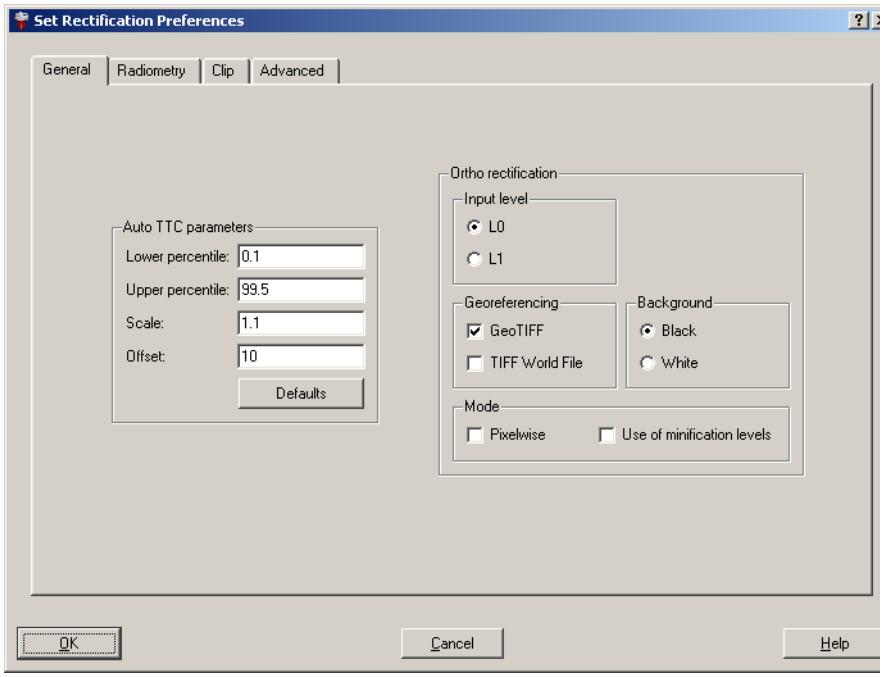
Warning Click this button to select the progress bar colour that will be displayed when the process completes, but a warning is generated.

Error Click this button to select the progress bar colour that will be displayed if the process encounters an error and does not complete.

Other buttons are discussed in "Common Buttons" on page 26.

3.15 Set Rectification Preferences - General

Figure 10: Set Rectification Preferences (General)



Auto TTC Select this checkbox to enable this function and the editing of its parameters.

Lower Percentile This is the percentile to cut off the histogram at the lower end. Anything lower than this value is considered to be noise. Note that the histogram computed does not contain black pixels, as these are considered to be no data values. Default: 0.1%.

Upper Percentile This is the percentile used to cut the data off at the top end of the histogram. Again, anything above this point is considered to be noise or useless data. Default: 99.5%.

Scale The scale is used to increase or decrease the span between the upper and lower percentiles. Default: 1.1.

Offset The offset is used to decrease the lower percentile computed. This allows for any potential discrepancies in the lower percentile computation and hence errs on the side of caution. Default: 10.

Defaults Clicking this resets the factory defaults.

3.16 Orthorectification Preferences

Input Level

This portion of the orthorectification parameters allows the user to select the input level for the orthorectification. Typically this should be left at L0, the default, as it assures that the pixel values in the image are not resampled twice.

L0 This sets the input level for orthorectification to be the L0. This is the default.

L1 This sets the input level of the orthorectifier to be a L1 image, i.e. a planar rectified image.

Georeferencing

Optionally allows georeferencing of the imagery.

GeoTIFF This georeferences a TIFF image with a geoTIFF tag. Note every sub-block in the image will be georeferenced. This is the default.

TIFF World File Click this writes a TIFF world file for every sub-block in the image. Note that the image does not necessarily have to be a TIFF to derive this file.

Background

Optionally the background of the image can be set.

Black Sets the background color to black. This is the default.

White Sets the background color to white.

Mode

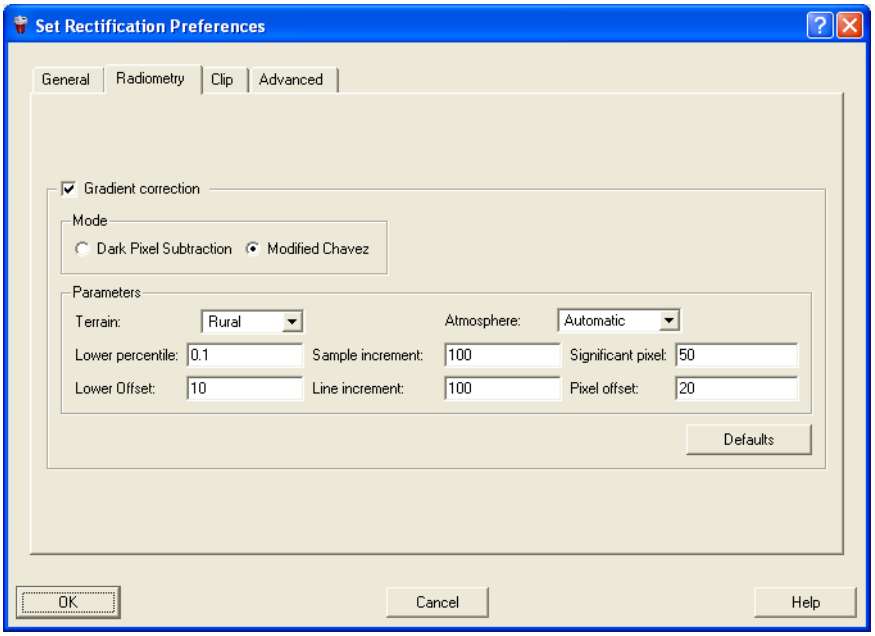
Pixelwise Forces the rectifier to rectify each pixel in the image rather than applying a localized optimization. This method, although rigorous, is substantially slower than the default 4 by 4 pixel sub patch rectification.

Use of minification levels When this mode is selected, rectifier uses minification layers according to the set GSD on ortho wizard. Full minification layers should be created first for all input images in order to run this mode of rectification.

Other buttons are discussed in "Common Buttons" on page 26.

3.17 Set Rectification Preferences - Radiometry

Figure 11: Set Rectification Preferences (Radiometry)



Gradient Correction

To enable this function and the editing of its parameters, ensure the **On** checkbox is checked.

Gradient Correction - Mode

Dark Pixel Subtraction Setting this mode enables the classical dark pixel subtraction technique for removing adverse gradients in the cross track direction. The basic assumption of the computation is that some pixels can be assumed to be black, i.e. lie in shadows. If this is correct, then the gradient can be computed across the image.

Modified Chavez The Modified Chavez gradient correction uses a predictive method of haze reduction given knowledge of the sensor radiometry, such as the radiometric gain, integration time and the "center of gravity" wavelength. Additional knowledge of the flying and terrain height allows us to classify the atmosphere type automatically.

Gradient Correction - Parameters

The first two options, Atmosphere and Terrain, are only used with the Modified Chavez Gradient Correction method.

Terrain Select the terrain type that constitutes the majority of the image coverage.

Select **Rural/Urban** *if the image has significant areas of both rural and urban landcover.*

Atmosphere Select the atmospheric conditions that prevailed at the time of image capture. Leave this set to **Automatic** to have the program automatically determine the haze classification.

Lower percentile This is the percentile to cut off the histogram at the lower end. Anything lower than this value is considered to be noise. Note that the histogram computed does not contain black pixels, as these are considered to be no data values. Default: 0.1%.

Lower Offset The lower offset is used decrease the lower percentile computed. This allows for any potential discrepancies in the lower percentile computation and hence errs on the side of caution. Default: 10.

Sample increment This is the sampling increment in the cross flight, or sample, direction. The increment determines the number of histograms collected along the flight direction. Default: 100 pixels.

Line increment The sampling increment in the flight, or line, direction. Default: 100.

Significant pixel The significant pixel denotes the offset used from the edge of the image. Default: 50.

Pixel offset To potentially resolve pixel underflow in the imagery, i.e. negative pixel values, an offset is employed to guarantee positive pixel values. Default: 20.

Defaults Click this button to restore all default values after edits have been made.

Other buttons are discussed in "Common Buttons" on page 26.

3.18 Set Rectification Preferences - Clip

Figure 12: Set Rectification Preferences (Clip)

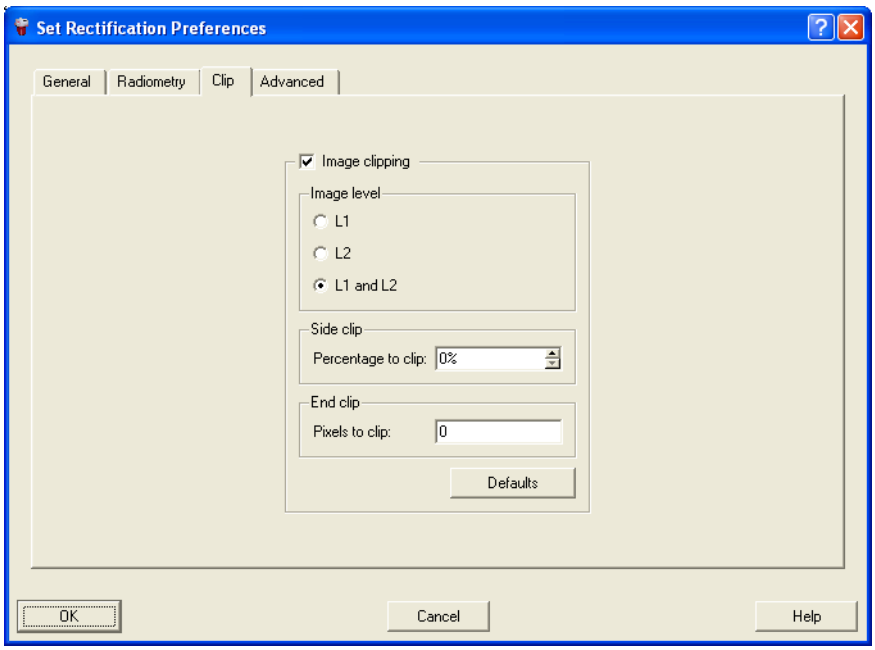


Image Clipping

Image clipping allows the user to cut the image size on rectification. This mode is only applied when the whole image is selected for rectification. The default value is off.

Image Level

This section allows the user to discriminate at which level the clipping should be applied. The default is L1 and L2.

L1 Select L1 to clip only L1 imagery.

L2 Select L2 to clip only L2 images.

L1 and L2 Clip both L1 and L2 imagery.

Side Clip

This parameter allows a percentage of the image to be clipped in the cross flight direction. Note that the percentage indicated will be clipped from both sides of the image.

Percentage to clip: The percentage to clip.

End Clip

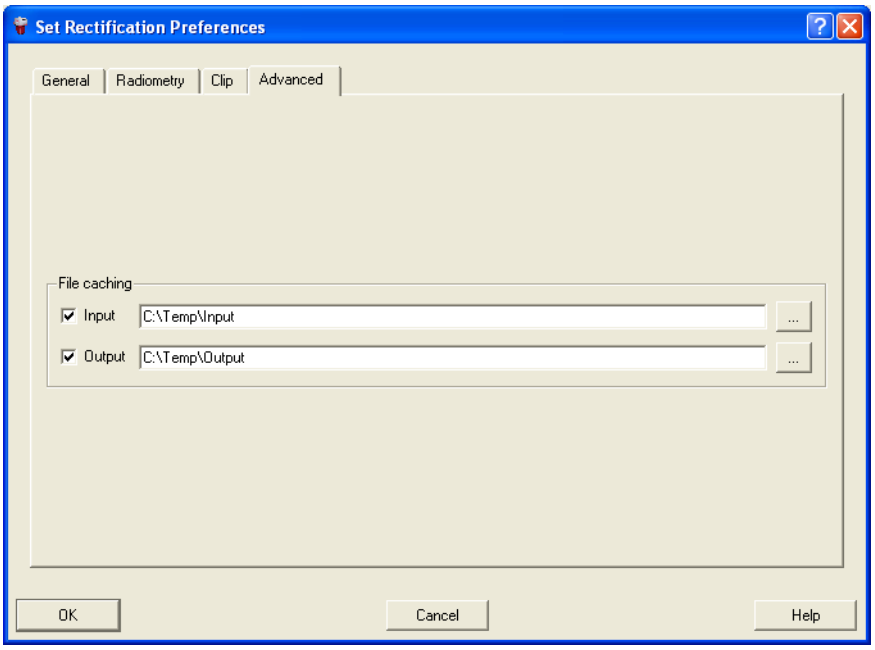
This parameter allows a number of pixels to be clipped from the ends of the image. The value is quoted in pixels. This feature is useful for clipping banked sections of imagery. Note that both ends are clipped.

Pixels to clip: Number of pixels to clip in the flight direction.

3.19 Set Rectification Preferences - Advanced

The purpose of this dialog is to allow the distribution of the input and output away from the original source. This is useful only when you have a High Performance Computing (HPC) network established. The input and output directories can be distributed on different machines and disks thereby optimizing the processing. The degree of optimization is dependent on the network and machine configuration.

Figure 13: Set Rectification Preferences (Advanced)



File Caching

Input This is the input folder where the rectification files will be copied. After rectification these will be deleted.

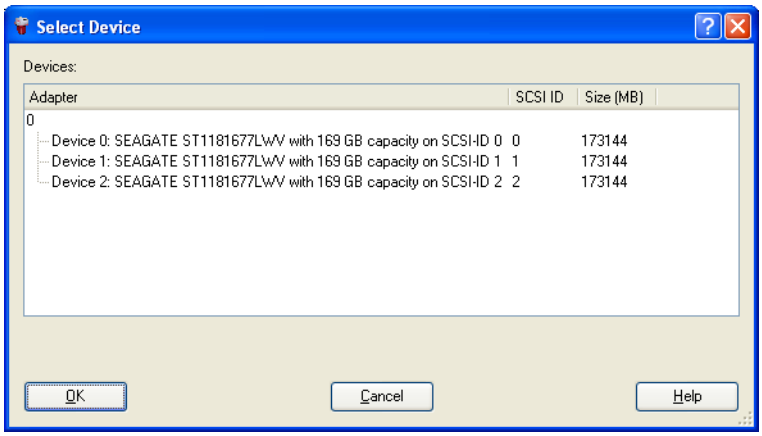
Output This is the folder in which the rectification output files will be generated. After rectification these are copied back to the original location. Finally they are removed from this directory.

Other buttons are discussed in "Common Buttons" on page 26.

3.20 Select Device

This dialog allows you to select which MM that is connected to the system should be formatted.

Figure 14: Select Device dialog



Devices: Select the disk(s) that you would like to format.

OK Format the selected disks and close this dialog.

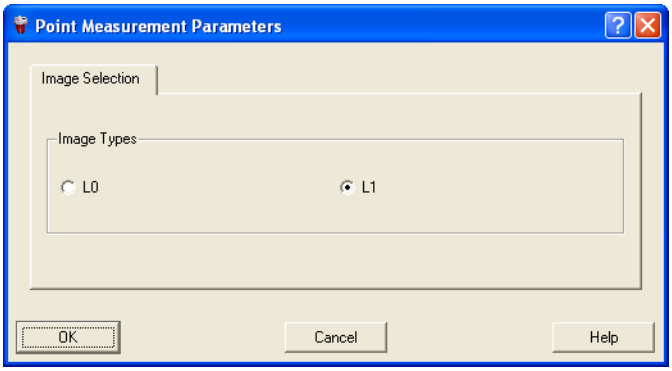
Cancel Cancel the formatting process without formatting the selected disks.

Help Display this on-line help document.

3.21 Point Measurement Parameters

This dialog allows you to select the processing level of the images you want to use for Automatic Point Matching (APM).

Figure 15: Point Measurement Parameters



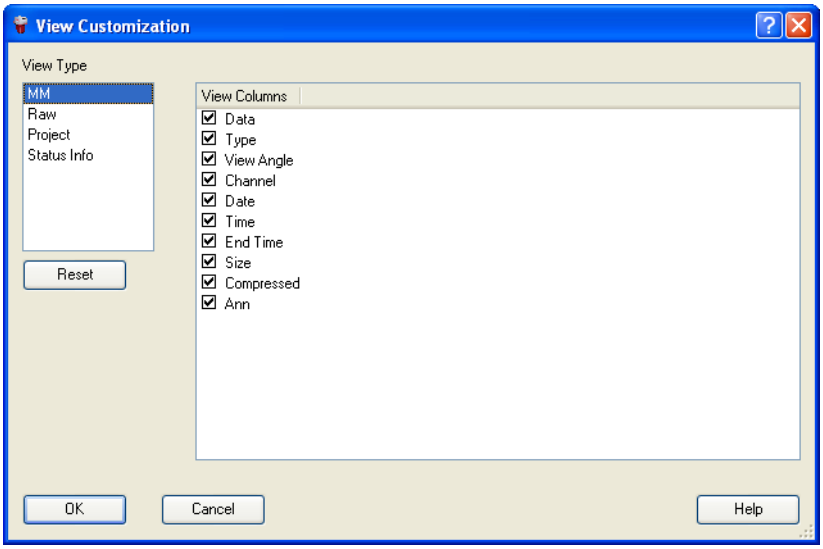
L0 Select L0 to run APM on Level 0 images. This is the default setting.

L1 Select L1 to run APM on Level 1 imagery.

3.22 View Customization

The View Customization dialog allows you to select the fields that are displayed in the various view windows. The default settings show all fields. Click a checked box to uncheck it and thus remove that column from the display.

Figure 16: View Customization



MM Select this View Type when you want to customize the columns displayed in the Data View of the MM Data tab.

Raw Select this View Type when you want to customize the columns displayed in the Data View of the Raw Downloaded Data tab.

Project Select this View Type when you want to customize the columns displayed in the Data View of the ADS Project Data tab.

Status Info Select this View Type when you want to customize the columns displayed when the ADS Image Information dialog opens (page 65). This dialog opens when you right-click on an image name and select **Show Status**.

Reset Click this button to enable all columns for the selected View Type.

View Columns Data fields that are checked in this column are displayed in the various types of data view. Uncheck the data fields you do not want to display in data views. They are listed in alphabetical order here for easy reference. The order of display is fixed for each view type. Not all data fields are available for all view types.

Adj If the image was triangulated using ORIMA, this field will display “Y”; otherwise “N”.

Ann If an annotation exists for an image or data file, this field is marked “Y”. Annotation can only be added in flight while the data is being collected.

Channel Up to two channels may exist for each CCD (A and B). This field indicates from which channel the data was collected.

Compressed This field shows the size of the compressed data file on the MM.

Data For the MM and Raw Downloaded Data tabs, this field contains the raw file, project, flight plan, flight line, observation period, and sensor designations. For the ADS Project Data tab, this field contains the data collection date stamp and the file name as established using the File Naming Preferences dialog (page 34).

Date For the MM and Raw Downloaded Data tabs, this field contains the date of data capture. For the ADS Project Data tab, this field contains the date the data was added to the project.

End Time For the MM and Raw Downloaded Data tabs, this field contains the start time of data capture.

Min Displays the level of minification (pyramid layers) for each image.

Processing Displays the level of processing for each image. See "Processing Level" on page 51.

Size Displays the size of the uncompressed file.

Time For the MM and Raw Downloaded Data tabs, this field contains the start time of data capture. For the ADS Project Data tab, this field contains the time the data was added to the project.

Type Displays the sensor type.

View Angle The number of degrees forward, half forward, half backward or backward the sensor is angled. A nadir view is shown as 0.

How To...

... change the view customization settings:

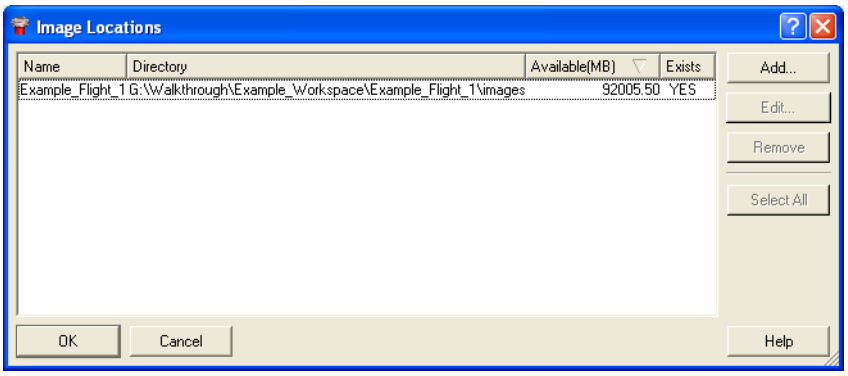
1. select the view type to modify
2. click the checkbox in the **View Columns** column to hide (unchecked) or show (checked) the field
3. click **OK**.

... restore the default settings:

1. select the view type to modify
2. click the **Reset** button

3.23 Image Locations

Figure 17: Image Locations



Add or Edit

Click this button to add a new image location or to edit an existing image location. The Add New or Edit Image Location dialog opens (page 49).

You can double-click the name of an existing image location to open the Edit Image Location dialog.

Remove

Click this button to remove the selected image locations. This removes the pointer to the data, not the data.

Select All

Click this button to select all of the images listed. This option is disabled if fewer than two images are in the project.

How To...

- To edit an existing image location, double-click on the image location. Modify the name or directory path as needed.
- To remove existing image locations, select the image locations to be removed and click the **Remove** button or press Alt + R.
- To add an image location click the **Add** button or press Ctrl + A. The Edit Image Location dialog will pop up. Enter a name for the image location and a directory path to associate with that name. The **Browse** button can be used to navigate to a desired directory path.

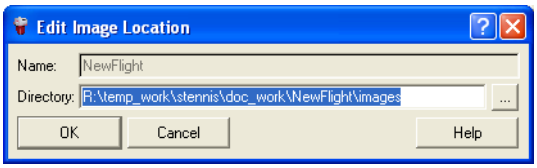
Other buttons are discussed in "Common Buttons" on page 26.

3.24 Add New or Edit Image Location

This dialog provides a simple mechanism to add, or edit image locations. Image locations are directories where image files can be stored.

This dialog opens when you click the **Add** button on the Image Locations dialog (page 48) or when you double click on an image

Figure 18: Image Location



Name

If you are adding an image location, enter the name in this field. If you are editing an existing image location, this field is not editable.

Directory

Type the path to the image location or click the browse button to navigate to it.

Other buttons are discussed in "Common Buttons" on page 26.

3.25 MM Data

This view shows information about the data stored in the MM. It is nearly identical to the layout of the Raw Downloaded Data view. There is a "Show Panel" on page 50 on the left and a "FCMS Data View" on page 64 on the right. The Show Panel controls what is displayed in the FCMS Data Window.

Connect

Click this button to connect to the MM.

Select All/Deselect All

Click this button to select or deselect all images in the data view.

Reset Filters

Click this button to return all Show Panel settings to their default. The default settings allow you to see all of the data that is available on the MM. Note that not all types of data are collected in every flight.

Download...

Click this button to download the selected data from the MM. This starts the Processing Wizard. The Select GNSS-IMU Processing Stage dialog opens (page 68).

Other buttons are discussed in "Common Buttons" on page 26.

3.26 Show Panel

Typically, a large amount of data may be displayed in the data view. By selectively filtering, you can reduce the amount of visible data to a more manageable level. You can apply multiple filters to the same data view to help streamline your workflow.

For more information on using the Show Panel, see "Filtering Examples" on page 85.

Channel

This filter allows you to view only images from the **A** channel, only images from the **B** channel, or images from both the **A** and the **B** channels. If the data does not contain any images for a particular channel, that selection will be greyed out. By default, both **A** and **B** channels are displayed.

A Select this checkbox to display the images from the A channel.

B Select this check box to display the images from the B channel.

Select both the **A** and the **B** checkboxes to view all of the images.

View

You can also filter the images based on the view angle in which they were captured. If the data does not contain any images for a particular view that selection will be greyed out. By default, all views are displayed.

Forward Select this checkbox to display all of the images from the Forward view.

Half Forward Select this checkbox to display all of the images from the Half Forward view.

Nadir Select this checkbox to display all of the images from the Nadir view.

Backward Select this checkbox to display all of the images from the Backward view.

Half Backward Select this checkbox to display all of the images from the HalfBackward view.

Spectral

You can filter the images displayed in the FCMS Data view based upon its spectral CCD line.

Pan Select this checkbox to display all of the Panchromatic images.

Red Select this checkbox to display all of the Red images.

Green Select this checkbox to display all of the Green images.

Blue Select this checkbox to display all of the Blue images.

NIR Select this checkbox to display all of the Near Infra-Red images.

Multi-Band Select this checkbox to display all of the Multi-Band images that have been created in GPro.

Processing Level

Another filtering method allows you to display images based upon their level of processing.

Raw Select this checkbox to display all of the unprocessed images

L0 Select this checkbox to display all of the L0 georeferenced images.

L1 Select this checkbox to display all of the L1 rectified images.

L2 Select this checkbox to display all of the L2 orthorectified images.

Time

You may also filter the displayed images based on the starting and ending date and time of image acquisition. Only those images acquired between the start and end date/time are displayed. The default start date/time is that of the first image in the data and the default end date/time is that of the last image.

Starting at Date Click this button to set the starting date. Only those images captured on or after this date will be displayed.

Starting at Time Click to set the starting time. Only this images captured on or after this time will be displayed.

Ending at Date Click to set the Ending Date. Only those images captured on or before this date will be displayed.

Ending at Time Click to set the Ending Time. Only those images captured on or before this time will be displayed.

Size

You may also filter the images displayed in the FCMS Data window based on file size of the image.

Greater Select this check box to display only those images whose sizes are greater than the specified size threshold.

Enter the desired size threshold in the number field and press Enter to update the FCMS Data View.

Less Select this checkbox to display only those images whose sizes are less than the specified size threshold.

Enter the desired size threshold in the number field and press Enter to update the FCMS Data View.

Disable both check boxes to show all the available images

Expand to

This is a simple method of collapsing or expanding the FCMS data hierarchy to pre-defined levels. When you are selecting large groups of data, it might not be desirable to see the entire data hierarchy. You can use the Expand to look at as much or as little of the data hierarchy as you need when selecting large groups of data.

Projects Select this radio button to expand the data hierarchy only out to the Project level.

Flight Plans Select this radio button to expand the data hierarchy only out to the Flight Plan level.

Flight Lines Select this radio button to expand the data hierarchy out to the Flight Line level.

Observation Periods Select this radio button to expand the data hierarchy out to the Observation Period level.

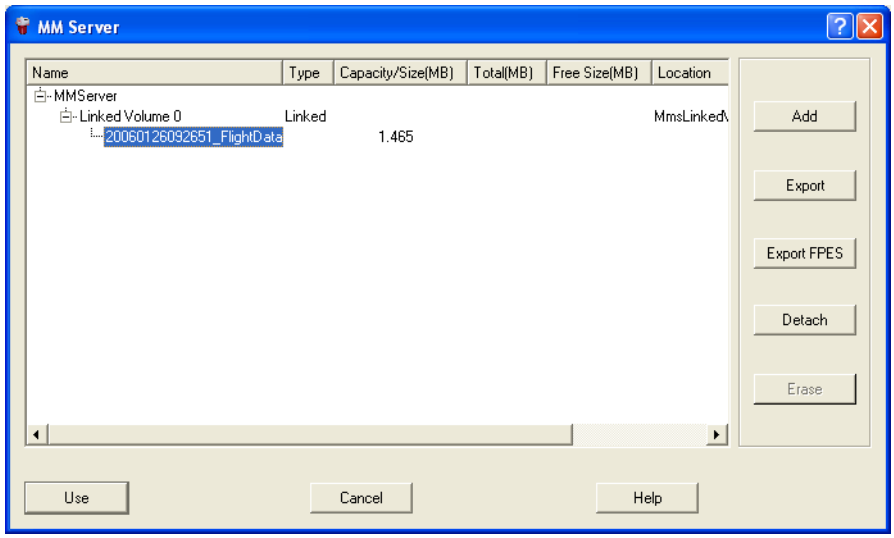
Images Select this radio button to expand the data hierarchy all the way out to the Image level.

3.27 MM Server

The MM Server dialog allows you to manipulate the data in a real or virtual MM. From this menu you can perform the following actions:

- add and detach MM units
- export flight data to local hard drives
- erase the MM to clear space for new flights
- select the flight data to be used for download

Figure 19: MM Server



Add Click this button to select a directory in which to create a virtual volume and add it to the list of volumes. This directory should contain files exported from a real MM or another virtual MM using the **Export** command. The downloader program adds all the MM server-related files found in this directory to the virtual volume. After adding the files you need to reconnect to see the new volume.

All virtual volumes will be added as "Linked" volumes with no "Free" or "Total" sizes since that information is only meaningful for real volumes.

You cannot mix data from different types of hardware in one linked list volume. Flight data from 3 hard drive MMs and 4 hard drive MMs must be added as separate linked volumes.

Export Click this button to export the selected flight data to local hard drives. The MM Export dialog opens (page 53).

Export FPES Click this button to export only the FPES Data to local hard drives. The MM Export dialog opens (page 53).

Detach Click this button to remove a Linked volume from the MM Server. Detaching does not delete the files associated with a volume. You must manually remove these files if they are no longer required.

Erase Click this button to erase the contents of an attached (real) MM.

Clicking Erase will delete the entire MM volume. You must make sure that all the data has been exported or downloaded before erasing a real MM.

If you would like to erase a single flight, you should do it in the Flight Control Management Software (FCMS) on the CU40.

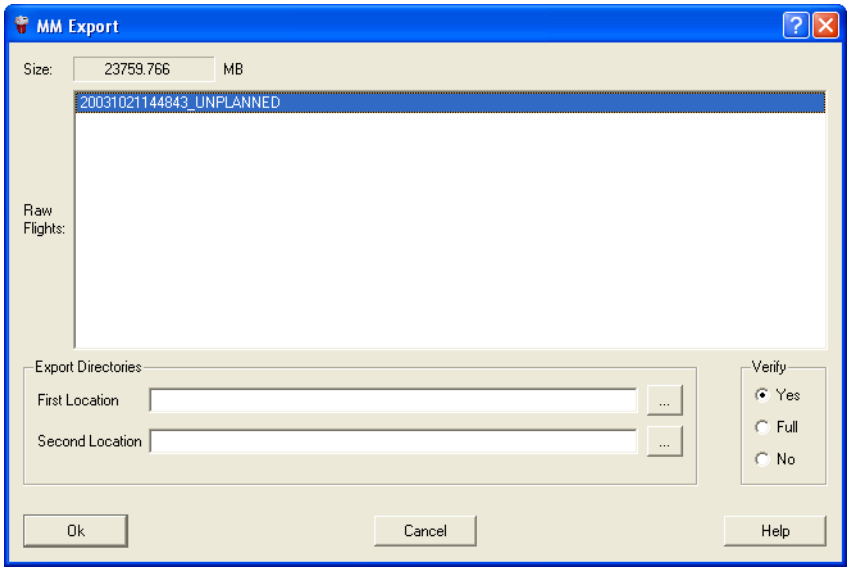
Use Click this button to use the selected volume for downloading. Multiple volumes can be selected to download in one session.

3.28 MM Export

This dialog allows you to specify the directories to which the selected volumes are exported. In most cases, after a flight the data stored in the MM is exported and shipped to the main office for processing. Since these files are exact replicas of the data as it exists on the MM they could also be backed up on tape or permanent media for long term archiving. Exporting allows you to write to two locations and perform different levels of checking to ensure that the data is consistent.

A linked volume uses the flight data to simulate a real MM.

Figure 20: MM Export



Size This field reports the size of the data on the MM.

Raw Flights This window lists the flights saved on the MM.

Export Directories

Enter or navigate to the location where you want to export the MM data to. Use the Second Location to make copies to two different devices.

Verify

Select the method of verification of the data copy.

- **Yes** is for basic verification of the copy. Default setting is YES.
- **Full** verification is the most secure, but takes the longest time, as it performs a byte-wise verification.
- **No** performs copy without verification.

Other buttons are discussed in "Common Buttons" on page 26.

3.29 Raw Downloaded Data

This view displays information about the images already downloaded from a MM. It is used to store the image information temporarily until the GNSS/IMU data download is completed, at which point the images can be added to an ADS Project. From here you can run the IPAS GNSS/IMU processing software, view downloaded Level 0 imagery in GPro Image Viewer for quality control purposes, delete downloaded Level 0 images, and create reduced resolution images, also called image pyramids.

Set Flight

Click this button to create or edit a named subset of images from the available downloaded data. The Flight Selection dialog opens (page 56).

Run GNSS/IMU Processing

Click this button to run the program listed in the **GNSS/IMU Processing** field of the Set General Preferences - Programs dialog (page 36). This is normally the IPAS Pro application.

Select All / Deselect All

Click this button to select (or deselect) all data listed in the data view.

Reset Filters

Click this button to return all options in the Show panel to their default setting. By default, the Show panel options are set to display all available data.

Add to Project

Click this button to initiate the GPro Processing Wizard. The Select ADS 40 Workflow dialog opens (page 69).

View

Click this button to display the selected image(s) in the viewer specified in the **Viewer** section of the Set General Preferences - Global dialog (page 37).

Minify

Click this button to initiate Minification. The Minification dialog opens (page 80).

Delete

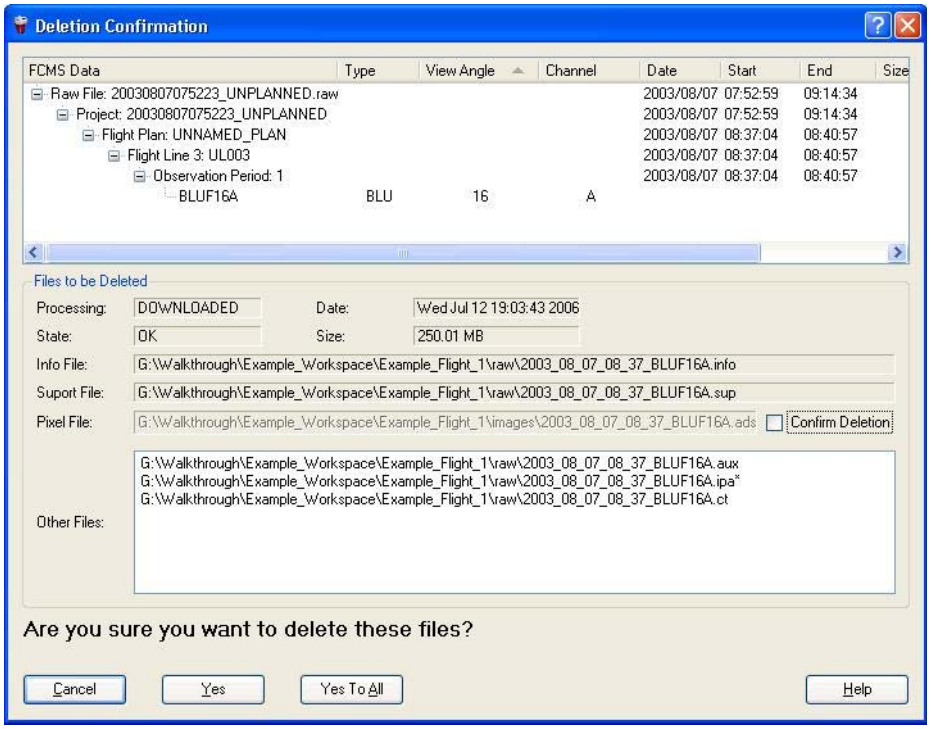
Click this button to delete the selected image(s). The Deletion Confirmation dialog opens (page 55).

Other buttons are discussed in "Common Buttons" on page 26.

3.30 Deletion Confirmation

This dialog lists the images to be deleted and provides information about the processing level, date, and size of the image file as well as information about related files such as ODF and support files.

Figure 21: Deletion Confirmation

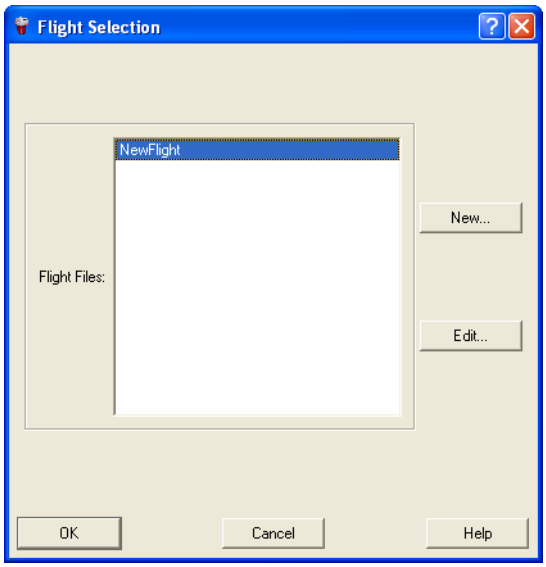


If you want to delete the associated pixel file and ODF file, you must explicitly check the **Confirm Deletion** *checkboxes.*

To delete only the data file, click **Yes**. To delete the data file and all of its associated files (including the ones with **Confirm Deletion** checked), click **Yes To All**.

3.31 Flight Selection

Figure 22: Flight Selection



Flight Files This space lists all flights associated with the current data.

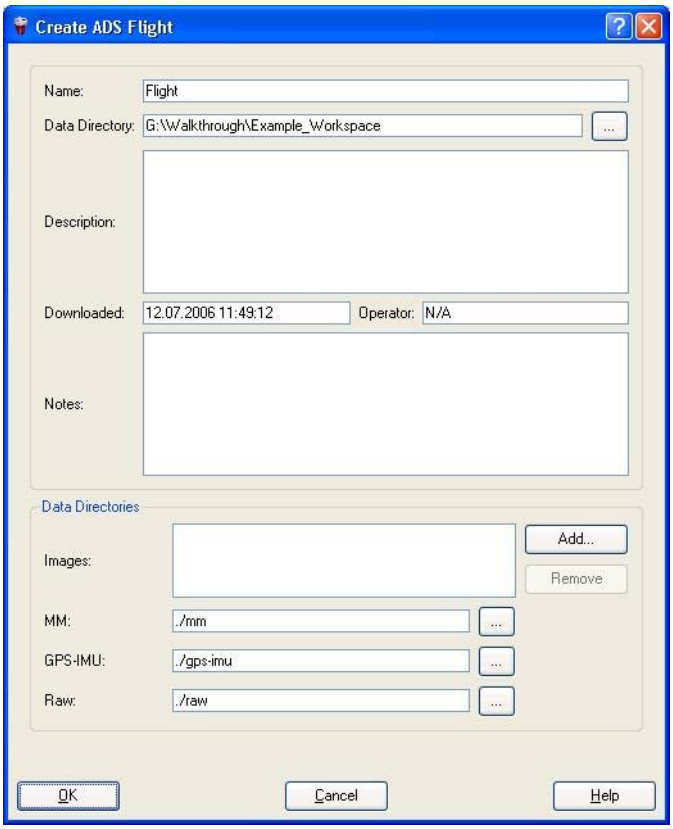
New Click this button to create a directory in your workspace for imagery, GNSS-IMU data, raw data (ct files, etc.). The Create or Edit ADS Flight dialog opens (page 57).

Edit Select an existing flight and click this button to edit the contents. The Create or Edit ADS Flight dialog opens (page 57).

Other buttons are discussed in "Common Buttons" on page 26.

3.32 Create or Edit ADS Flight

Figure 23: ADS Flight



Name — If you are creating a new flight, enter the name of the flight in this field. If you are editing an existing flight, you cannot change the name.

Data Directory — Enter or modify the path to the flight directory or click the browse button ... to select a path graphically.

Description — Enter or modify a description of the flight.

Downloaded — The date and time of image download are displayed here.

Operator — Enter or modify the name of the originator of the flight.

Notes — Enter or modify any notes specific to this flight.

Images — A list of image locations associated with the current project is displayed here. Click an image location to select it.

MM — Enter or modify the location where the exported data from the mass memory would be copied to. The data in this directory could be accessed by GPro, as an archive, for the downloads in later stage.

GNSS-IMU — Enter or modify the location of the position data.

Raw — Enter or modify the location of the raw downloaded data. This data has been unpacked from the raw binary file.

Add — Click this button if you want to add or edit image locations. The Image Locations dialog opens (page 48).

Remove

Click this button to remove the image location selected in the **Images** window.

Other buttons are discussed in "Common Buttons" on page 26.

3.33 ADS Project Data

The **ADS Project Data** view provides the interface to manage all of the images in an ADS40 project.

Set Project

Multiple ADS projects can be created and used in GPro. Click on the **Set Project** button in the **ADS Project Data** view to select (or create) a project to view. The Project Selection dialog opens (page 71). Once an ADS project is selected, the data in the **ADS Project Data** view is updated to show the images in the project.

Run Triangulation

Click this button to start the ORIMA triangulation software. ORIMA requires the LPS block file. Before running triangulation, GPro project needs to be exported to LPS block file. To export a project, select Export Workspace from the File menu options.

Select All

Click this button to select all images in the data view. Remember, the images in the data view are controlled by the filter settings in the Show panel.

Reset Filters

Click this button to reset the filters in the Show panel to the default settings.

Rectify

Click this button to begin the Rectification workflow. See "Rectifying Imagery" on page 114.

Run APM

Click this button to begin the Automatic Point Matching workflow. See "Running APM" on page 120.

Products

Click this button to generate Level 2 imagery. The Product Selection dialog opens (page 74).

Slice

Click this button to slice the selected Level 1 imagery into multiple pieces for easier dissemination. The Image Slicer dialog opens (page 158).

View

Click this button to launch the default image viewer. This option is specified in Set General Preferences - Global dialog opens (page 37).

Minify

Click this button to initiate Minification. The Minification dialog opens (page 80).

Delete

Click this button to delete the selected image(s). The Deletion Confirmation dialog opens (page 55).

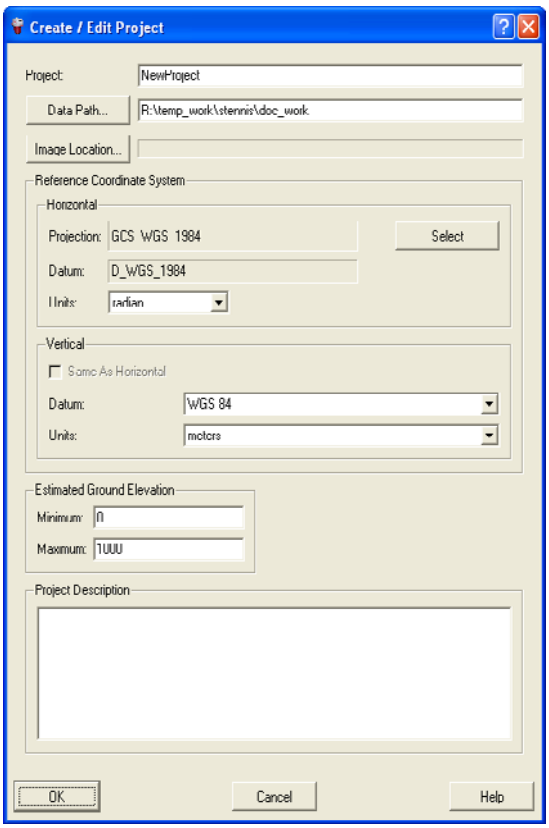
Other buttons are discussed in "Common Buttons" on page 26.

3.34 Create or Edit Project

This dialog allows you to specify many of the parameters that define your project. You can Name your project, locate where the data and images will be stored, specify the Reference

Systems and Estimated Ground Elevation range, as well as add a description to help identify the project.

Figure 24: Create / Edit Project



Project Enter the new project name in this field. If you are editing an existing project, this field is not editable.

Data Path Click this button if the currently displayed data path is not correct. A folder browser opens. The text field at the right of this button displays the current data path. If you are editing an existing project, this field is not editable.

Image Location Click this button if you want to modify the output image folder. The name of the current output image folder is displayed in the text field to the right.

Horizontal

Projection The current projection is displayed in this text field.

Select Click this button if you want to change the projection or datum. The Coordinate System Selection dialog opens (page 61).

Datum The current horizontal datum is displayed in this text field.

Units Select the units of measure for the projection.

Once a project has been created the coordinate system can not be changed. therefore all coordinates system related dialogs will be greyed out in edit mode.

Vertical

Same As Horizontal When checked, this option applies the horizontal datum and units to the vertical.

Datum The current vertical datum is displayed in this field. Click the dropdown button to select from the list of available vertical datums.

Units Select the units of measure for the vertical datum.

Once a project has been created the coordinate system can not be changed. therefore all coordinates system related dialogs will be greyed out in edit mode.

Estimated Ground Elevation

The Estimated Ground Elevation Min and Max are conservative estimates that must fit between the actual minimum and maximum elevation values.

The Estimated Ground Elevation should be in the same units as is displayed in the Vertical Units just above.

Minimum Set the ground elevation minimum (in the specified vertical datum units) in this field.

Maximum Set the ground elevation maximum (in the specified vertical datum units) in this field.

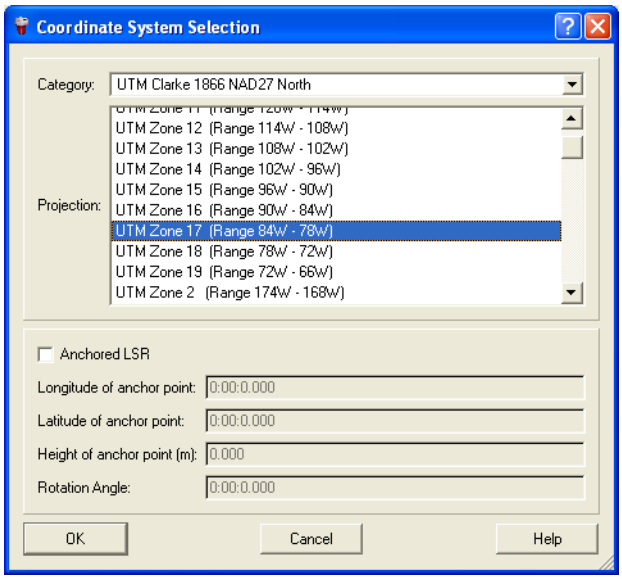
In order to have the most accurate Rectification and APM results, you must supply accurate and realistic Minimum and Maximum estimated elevation values.

Project Description

This window displays a description of the project if there is one. Type a new description or update the existing one.

3.35 Coordinate System Selection

Figure 25: Coordinate System Selection



Category — Select the projection category from this dropdown list. This is the name of a library in which the projection is saved. Once a category is selected, the available projections are listed in the **Projection** window below.

Projection — Select the name of the projection from the scrolling list. The number in parentheses is the State Plane Zone.

Anchored LSR — If your project uses LSR, this box should be checked.

Longitude of anchor point — Enter the longitude of the anchor point. The units for longitude are degrees, minutes, and seconds. The format is DDD:MM:SS.SS.

Latitude of anchor point — Enter the latitude of the anchor point. The units for latitude are degrees, minutes, and seconds. The format is DDD:MM:SS.SS.

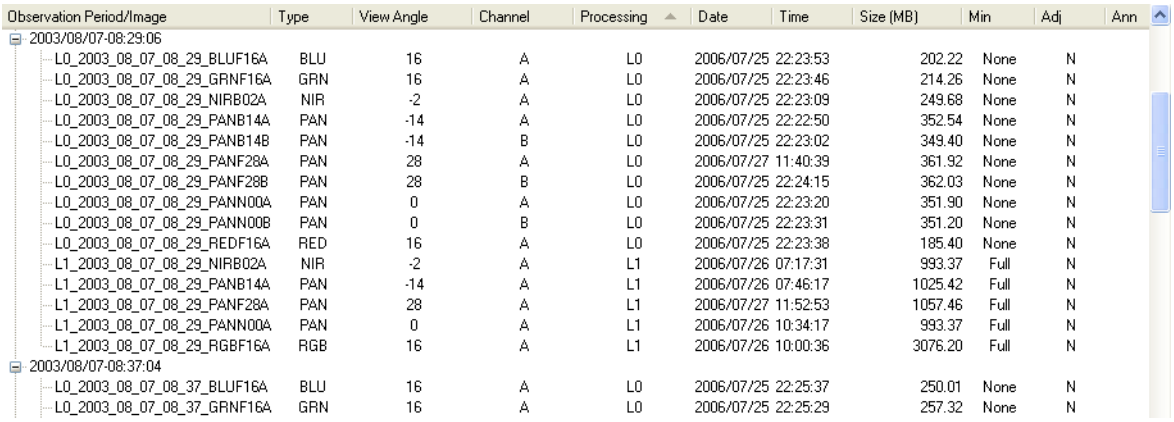
Height of anchor point — Enter the elevation of the anchor point. The unit for elevation is meters.

Rotation Angle — Enter the rotation of the Y axis of the anchor point from North. Positive values are clockwise. The units for rotation angle are degrees, minutes, and seconds. The format is DDD:MM:SS.SS.

3.36 Project Data View

The main part of the **ADS40 Project** data view is a tabular listing of images that are in the project. The layout is similar to the **FCMS Data** window in the **MM Contents** and **Raw Downloaded Data** views. But there are some differences as in this view only the FCMS Observation Period is displayed and the image is shown by name as well as by CCD line.

Figure 26: ADS Project data view.



Observation Period/Image	Type	View Angle	Channel	Processing	Date	Time	Size (MB)	Min	Adj	Ann
2003/08/07-08:29:06										
L0_2003_08_07_08_29_BLUF16A	BLU	16	A	L0	2006/07/25	22:23:53	202.22	None	N	
L0_2003_08_07_08_29_GRNF16A	GRN	16	A	L0	2006/07/25	22:23:46	214.26	None	N	
L0_2003_08_07_08_29_NIRB02A	NIR	-2	A	L0	2006/07/25	22:23:09	249.68	None	N	
L0_2003_08_07_08_29_PANB14A	PAN	-14	A	L0	2006/07/25	22:22:50	352.54	None	N	
L0_2003_08_07_08_29_PANB14B	PAN	-14	B	L0	2006/07/25	22:23:02	349.40	None	N	
L0_2003_08_07_08_29_PANF28A	PAN	28	A	L0	2006/07/27	11:40:39	361.92	None	N	
L0_2003_08_07_08_29_PANF28B	PAN	28	B	L0	2006/07/25	22:24:15	362.03	None	N	
L0_2003_08_07_08_29_PANN00A	PAN	0	A	L0	2006/07/25	22:23:20	351.90	None	N	
L0_2003_08_07_08_29_PANN00B	PAN	0	B	L0	2006/07/25	22:23:31	351.20	None	N	
L0_2003_08_07_08_29_REDF16A	RED	16	A	L0	2006/07/25	22:23:38	185.40	None	N	
L1_2003_08_07_08_29_NIRB02A	NIR	-2	A	L1	2006/07/26	07:17:31	993.37	Full	N	
L1_2003_08_07_08_29_PANB14A	PAN	-14	A	L1	2006/07/26	07:46:17	1025.42	Full	N	
L1_2003_08_07_08_29_PANF28A	PAN	28	A	L1	2006/07/27	11:52:53	1057.46	Full	N	
L1_2003_08_07_08_29_PANN00A	PAN	0	A	L1	2006/07/26	10:34:17	993.37	Full	N	
L1_2003_08_07_08_29_RGBF16A	RGB	16	A	L1	2006/07/26	10:00:36	3076.20	Full	N	
2003/08/07-08:37:04										
L0_2003_08_07_08_37_BLUF16A	BLU	16	A	L0	2006/07/25	22:25:37	250.01	None	N	
L0_2003_08_07_08_37_GRNF16A	GRN	16	A	L0	2006/07/25	22:25:29	257.32	None	N	

Observation Period/Image

All images collected during the same observation period are grouped together for convenience. The start date/time of the observation period is displayed with the names of the images in the ADS project for that period grouped beneath it. The display can be sorted by this column.

Type

This column displays the CCD line(s) from which the image was captured or derived. The image types are shown in Table 2 below.

Table 2: Image Type

Pan	Individual or composite panchromatic lines (Level 0, 1, or 2)
RED, GRN, BLU, NIR	Individual spectral lines (Level 0, 1, or 2)
RGB	Merged Red, Green, Blue spectral lines into a single colour image (Level 1 or 2)
Multi-band	Multi-band products compiled in user specified band order (Level 2 only)

View Angle

This column displays the view angle in which the images are captured.

Channel

This column displays the colour channel of the image.

Processing Level

This column displays the processing level for each image in the project. The three levels are shown in Table 3 below.

Table 3: Processing Levels

L0	Processed Level 0 image
L1	Level 1 planar rectified image
L2	Level 2 orthorectified image

Date

This column displays the creation date of image.

Time

This column displays the creation time of image

Size (MB) This column displays the size of image in megabytes

Min This column displays the display of the minification of the image (Fill, Partial, Quick, None).

Adj This column displays the whether or not the exterior orientation has been adjusted.

Ann This column displays the annotations made during the flight (a star appears in this column) - like if clouds were present.

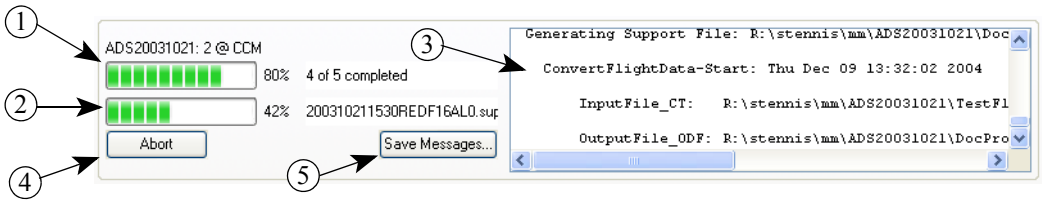
Viewing Image FCMS History To view the FCMS history for an image, select the image in the list, right-click the mouse, and select **View Info**.

3.37 Task Status

The Task Status view is where the various background tasks report the result and progress of their operation. Each task creates a Task Status display in the Task Status view. This is used primarily to report its progress and log messages, but can also be used to abort running tasks prematurely. The background tasks are:

- MM connection and download
- Minification
- Level 0 ODF creation
- Image rectification
- APM

Figure 27: Task Status view



Task Status Parts

1. overall progress bar that shows the percent completed for the overall operation
2. sub-task progress bar showing the current task percent completed
3. message box that reports information, warnings and errors. The contents of this window can be written to a log file by clicking the **Save Messages** button.
4. **Abort**/**Close** button used to abort the program reporting to this window while the process is running or to close the status window after the process is finished.
5. **Save Messages** button used to save the messages to a log file.

3.38 FCMS Data View

The FCMS Data window is embedded in both the "MM Data" on page 49 and "Raw Downloaded Data" on page 54 views. It contains the FCMS history of the particular data in the view. This section explains the different filters and options that are common to these two views.

Figure 28: FCMS Data window

FCMS Data	Type	View Angle	Channel	Date	Start	End	Size (MB)	Compressed (MB)	Ann
Raw File: 20030807075223_UNPLANNED.raw				2003/08/07	07:52:59	09:14:34	95033.02	23758.26	
Project: 20030807075223_UNPLANNED				2003/08/07	07:52:59	09:14:34	95033.02	23758.26	*
Flight Plan: UNNAMED_PLAN				2003/08/07	08:19:35	09:04:22	95033.02	23758.26	
Flight Line 1: UL001				2003/08/07	08:19:35	08:23:19	16433.35	4108.34	
Observation Period: 1				2003/08/07	08:19:35	08:23:19	16433.35	4108.34	*
PANF28A	PAN	28	A				2053.53	513.38	
PANF28B	PAN	28	B				2053.53	513.38	
BLUF16A	BLU	16	A				1027.40	256.85	
GRNF16A	GRN	16	A				1027.95	256.99	
REDF16A	RED	16	A				1027.95	256.99	
PANN00A	PAN	0	A				2054.26	513.57	
PANN00B	PAN	0	B				2054.08	513.52	
NIRB02A	NIR	-2	A				1027.40	256.85	
PANB14A	PAN	-14	A				2053.71	513.43	
PANB14B	PAN	-14	B				2053.53	513.38	
Flight Line 2: UL002				2003/08/07	08:29:06	08:32:26	14620.42	3655.11	
Observation Period: 1				2003/08/07	08:29:06	08:32:26	14620.42	3655.11	*
PANF28A	PAN	28	A				1825.74	456.44	
PANF28B	PAN	28	B				1825.74	456.44	
BLUF16A	BLU	16	A				914.43	228.61	
GRNF16A	GRN	16	A				915.16	228.79	
REDF16A	RED	16	A				915.16	228.79	
PANN00A	PAN	0	A				1828.31	457.08	
PANN00B	PAN	0	B				1828.49	457.12	
NIRB02A	NIR	-2	A				914.43	228.61	
PANB14A	PAN	-14	A				1826.48	456.62	
PANB14B	PAN	-14	B				1826.48	456.62	

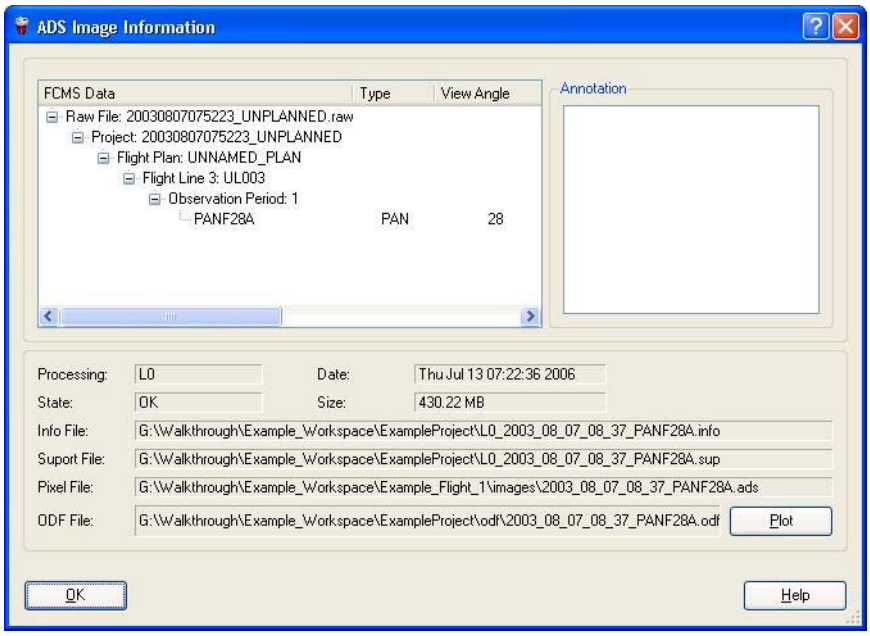
The FCMS Data window displays information about the imagery in the context of its flight history. It is used to view and select imagery for further processing. The data is hierarchically organized and can be expanded or collapsed by clicking [+] or [-]. The headings at the top can be used to sort by date/time or image size.

CCD naming columns are **Type**, **View Angle** and **Channel**. Additionally, there are minification (**Min**), adjustment (**Adj**) and annotation (**Ann**) columns. The "View menu options" on page 28 allow you to refresh project views and also customize the columns to display in the different views.

3.39 ADS Image Information

This dialog shows the status of the files associated with the selected images. It opens when you select **Show Status** from the "Context Menu" on page 26. The **FCMS Data** window details the hierarchy of the image within the FCMS view and shows the constituent images. The **Processing** text box indicates the category of the image, namely downloaded, L0, L1 or L2. The **Date** text box indicates the creation date of the image. **State** denotes whether or not the image was created without failure. The **Size** is the total size of the image on the storage media. All related files are listed, for example, the **Info**, **Support**, **Pixel**, and **ODF** files. If any of these is red then the file does not exist.

Figure 29: ADS Image Info window



If the status of multiple images was requested, then **Next** and **Previous** buttons are displayed. Use these to navigate through the image list. If the ODF file is present, then a **Plot** button is displayed. When you click the **Plot** button, the ADS Orientation Plot dialog opens (page 160).

Processing — Displays the category of the image, namely downloaded, L0, L1 or L2.

Date — Displays the creation date of the image.

State — Denotes whether or not the image was created without failure.

Size — Displays the total size of the image on the storage media.

Info File — Displays the location of the .info file.

Support File — Displays the location of the .sup file.

Pixel File — Displays the location of the .ads file.

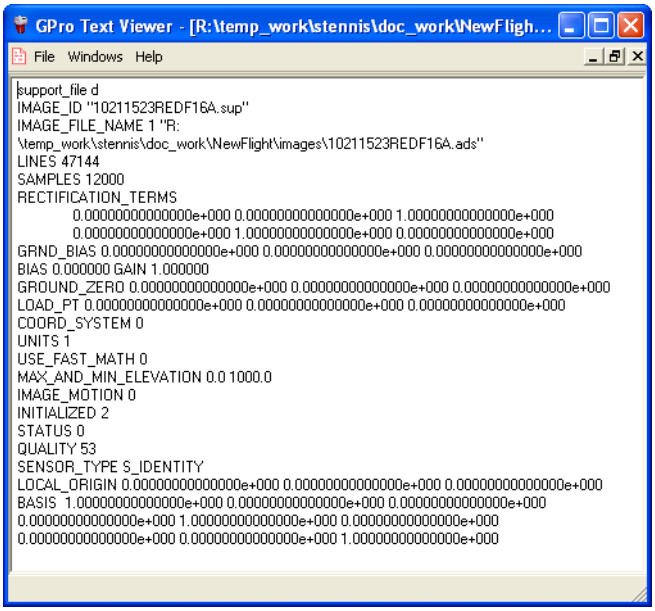
ODF File — Displays the location of the .odf file.

Plot — This button is displayed only when an ODF file exists. Click this button to open the ADS Orientation Plot dialog (page 160).

3.40 GPro Text Viewer

The GPro Text Viewer facilitates the reading of text files associate with images and projects. It opens when you select **View Support** or **View Info** from the "Context Menu" on page 26. The Text Viewer has three menus described below.

Figure 30: Text Viewer



File

Open Select this option to open a text file. A file selector so opened where you can enter a file name or select a file by browsing.

Close Select this option to close the active file.

Quit Select this option to quit the GPro Text Viewer.

Windows

Cascade Select this option to arrange all open files in a minified overlapping fashion. This allows you to see each file window but not its contents until you bring it to the front of the stack by selecting it.

Tile Select this option to display all open files in a non-overlapping fashion. File windows are sized to fit the number of files into the available space. Maximize the GPro Text Viewer to maximize the file window size when using this option.

Help

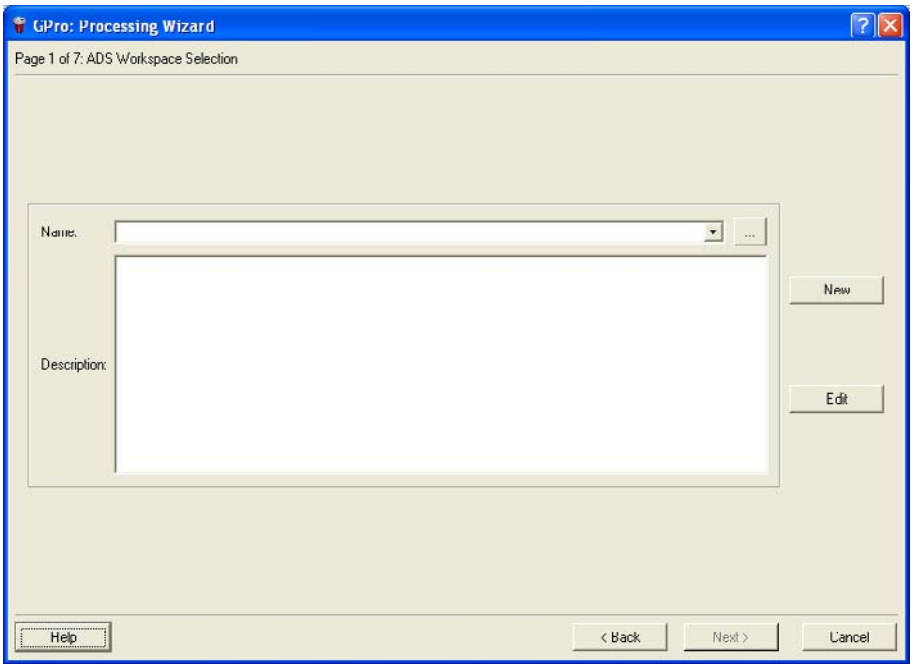
Text Viewer Select this option to display this help topic.

About Select this option to display version number, date, and contact information.

3.41 ADS Workspace Selection

This dialog allows you to select or create a workspace in which to download data from the MM server.

Figure 31: ADS Workspace Selection



Name This field displays the path and file name of the current workspace file. To use a different workspace file, select it from the popup list of click the ... button and browse to the file.

Description Displays the workspace file description.

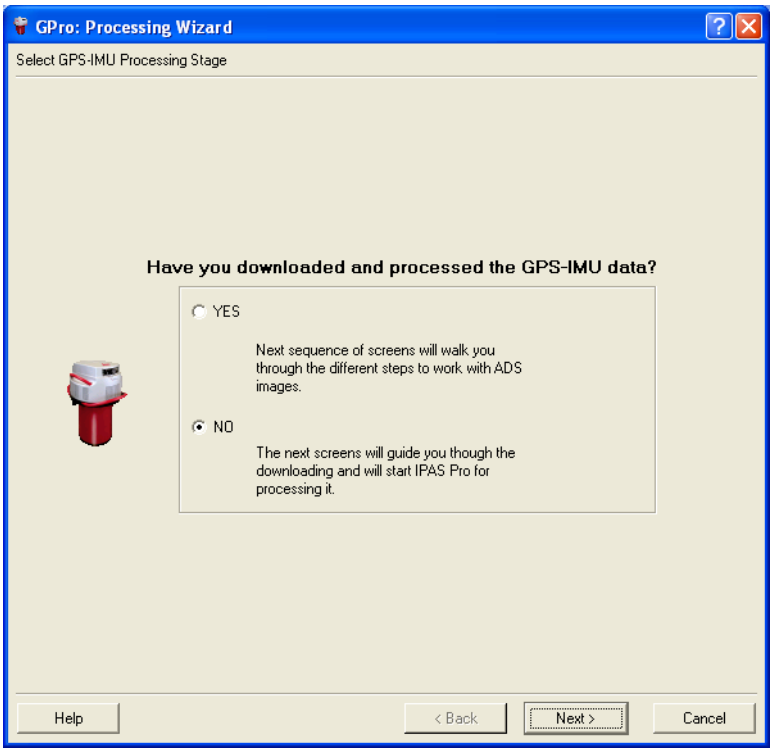
New Click to create a new workspace file. The "ADS Workspace" on page 29 dialog is displayed.

Edit Click to Edit the current workspace file. The "ADS Workspace" on page 29 dialog is displayed.

3.42 Select GNSS-IMU Processing Stage

When downloading data from the MM, you must specify whether GNSS-IMU data has already been downloaded and processed. If GNSS-IMU data has already been downloaded and processed, select **Yes**; if not, select **No**.

Figure 32: Select GNSS-IMU Processing Stage



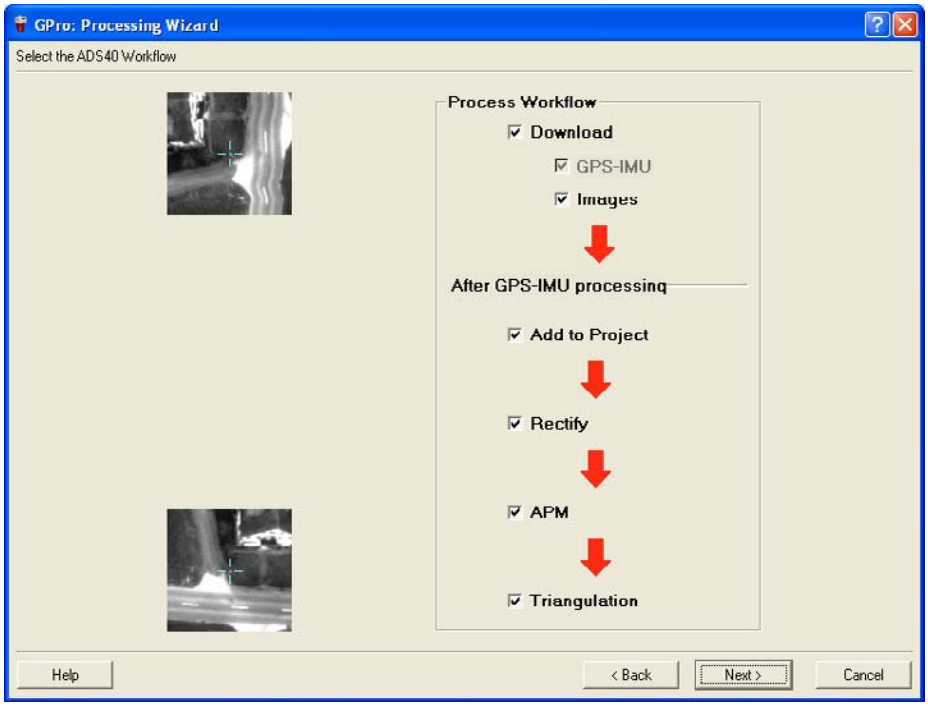
In either case, the Select ADS 40 Workflow dialog opens (page 69).

3.43 Select ADS 40 Workflow

This is the main workflow launch page. From here you may elect to simply download images or you may decide to set up the entire workflow to be processed automatically without further operator intervention.

The ADS Workflow processes are logically ordered from the top down and the deselection of a higher process will automatically switch off the ones below it.

Figure 33: Select ADS40 Workflow



The Wizard will walk you through all of the selected steps in order.

Process Workflow

Download GNSS-IMU Select this checkbox run the wizard to help set up the required framework for download the GNSS-IMU data from the MM Data Storage unit. When you click **Next**, the "Downloading GNSS-IMU Data" on page 94 page will be displayed.

Download Images Select this checkbox to download the images from the MM Data Storage unit. After completing the steps required for setting up the GNSS-IMU Data download, the "Downloading Raw Imagery" on page 92 workflow will be displayed.

After GNSS-IMU processing

This section identifies the tasks you want to run after GNSS-IMU processing. The three tasks are sequential and must be run in order. None of these tasks may be run until after the GNSS-IMU data has been processed.

Add to Project Select this checkbox to add the selected images to an ADS project and create Level 0 (L0) georeferenced images that have been rotated for optimal stereo viewing. The "Adding Files to a Project" on page 105 workflow will be displayed.

Rectify Select this checkbox to rectify the selected L0 images into orthorectified L1 images. The "Rectifying Imagery" on page 114 workflow will be displayed.

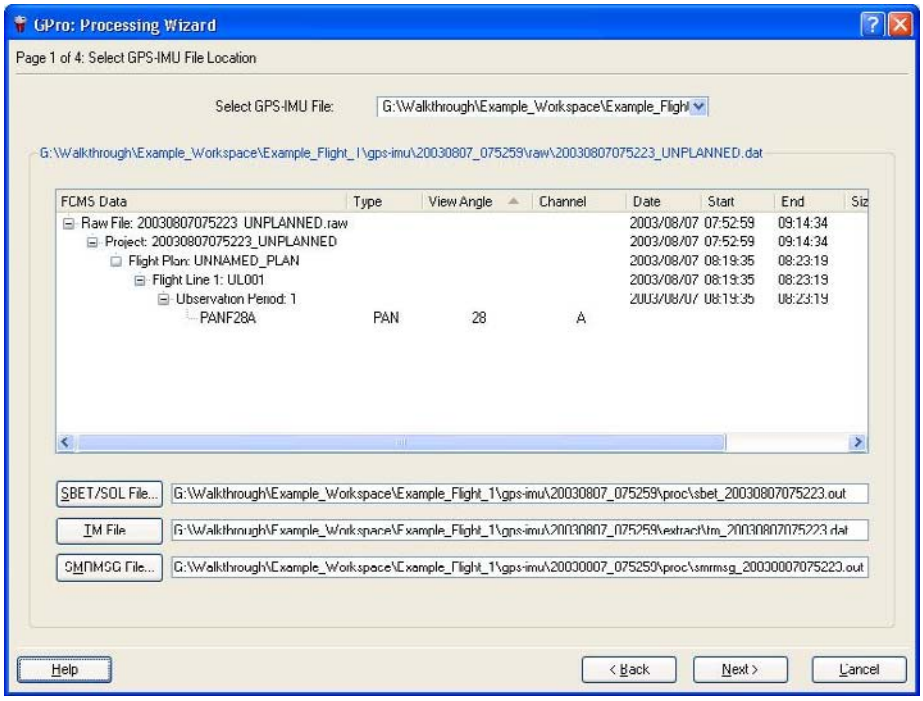
APM Select this checkbox to run Automated Point Matching (APM) on the selected images. The "Running APM" on page 120 workflow will be displayed.

Triangulation Select this checkbox to launch ORIMA and run CAP-A for triangulation and bundle block adjustment after APM finishes running.

3.44 Select GNSS-IMU Files Location

This page allows you to select the location and filename for each RAW GNSS-IMU file that you have selected to be downloaded from the MM. This wizard page is also used to identify where to deposit the output from the GNSS/IMU processing.

Figure 34: Select GNSS-IMU Files Location



Select GNSS-IMU File Select a GNSS-IMU file from this popup list to display the associated FCMS data in the window below.

The following option is only displayed if you are downloading and processing the GNSS-IMU data.

Raw GNSS-IMU Displays the location where the GNSS-IMU file will be created. If the file already exists, it will be overwritten. Click the button to open a file selector and navigate to the correct location. This option is displayed only during download from the MM.

The following options are displayed only when running GNSS/IMU processing.

SOL/SBET File The expected location of the SOL or SBET file is displayed in the text box. If the file is not found, it is displayed in red. Click the button to open a file selector and navigate to the correct location.

TM File

The expected location of the TM file is displayed in the text box. If the file is not found, it is displayed in red. Click the button to open a file selector and navigate to the correct location.

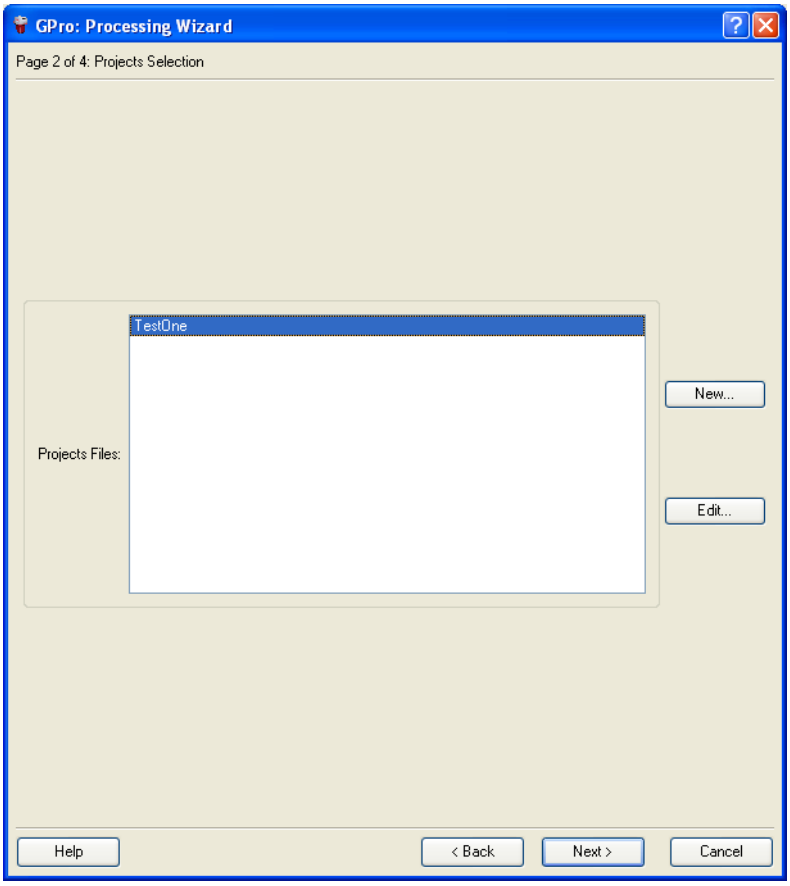
SMRMSG File

The expected location of the SMRMSG file is displayed in the text box. If the file is not found, it is displayed in red. Click the button to open a file selector and navigate to the correct location.

3.45 Project Selection

This dialog allows you to select (or create) the ADS Project to which the imagery should be added.

Figure 35: Projects Selection



Project Files

This field lists all of the ADS project files that have been created. Select a project by clicking on it.

New

Click this button to create a new ADS project. The "Create or Edit Project" on page 59 dialog is displayed.

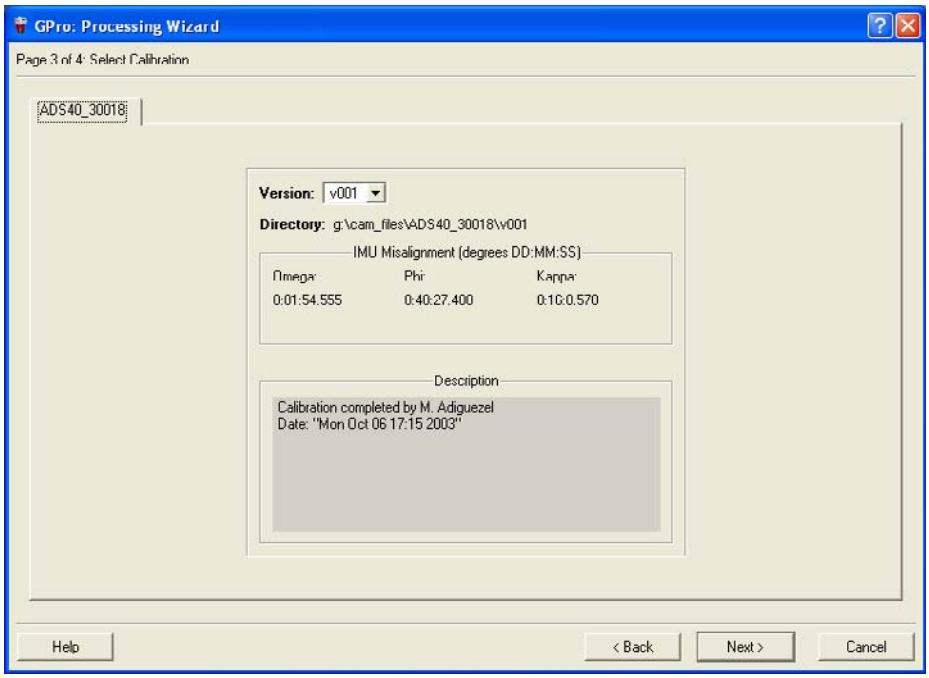
Edit

Click this button to edit the selected ADS project. The "Create or Edit Project" on page 59 dialog is displayed.

3.46 Select Calibration

This dialog allows you to select different versions of the calibration file. There is a tab for each sensor.

Figure 36: Select Calibration



Version

Select the version of the calibration file that should be used. By default, the most recent calibration file is selected.

For best results, you should always choose a calibration file whose date precedes the date of image capture.

Directory

Displays the location of selected calibration file.

You can change the calibration files directory in the GPro Preferences. See "Installing ADS Calibration Files" on page 17 for more information.

IMU Misalignment

Displays the IMU Misalignment figures in the selected calibration file for your review.

Description

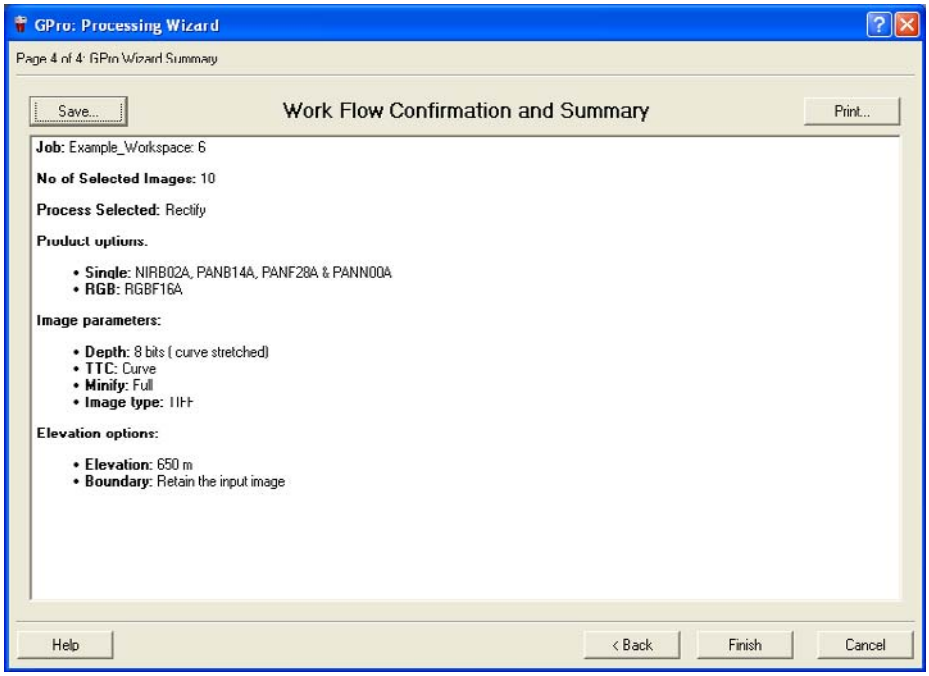
Displays name of the engineer and date of the calibration.

For best results, you should always choose a calibration file whose date precedes the date of image capture.

3.47 GPro Wizard Summary

This page displays at the end of each Wizard and summarizes all of the selections you made while you were completing the wizard.

Figure 37: GPro Wizard Summary



Save Saves the summary to a text file. This file can be included in a production report for the job.

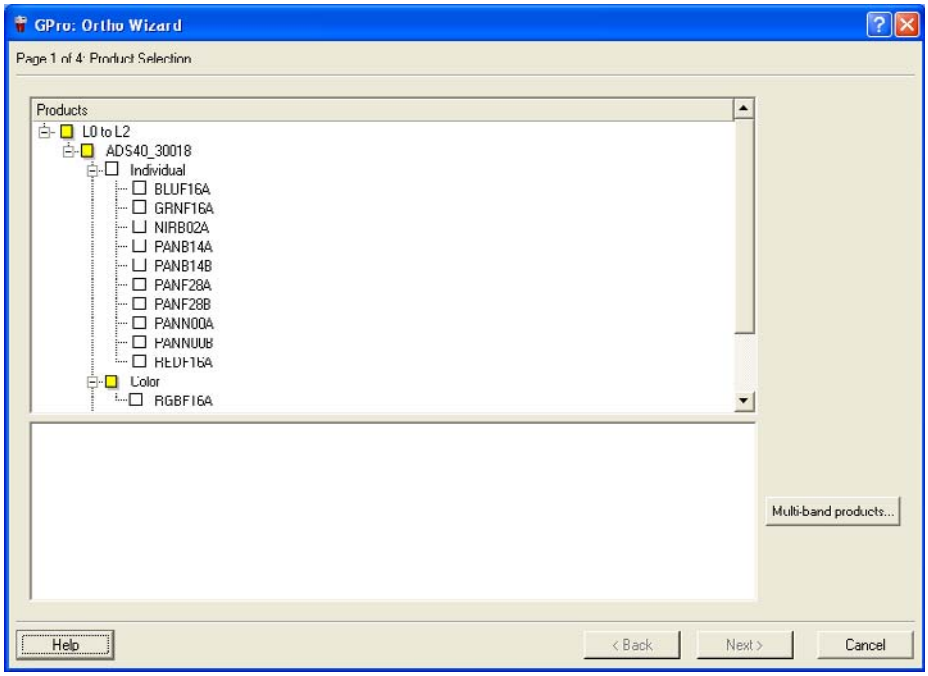
Print Sends the summary report to the default printer.

3.48 Product Selection

This dialog allows you to select which rectification products you would like to create from the selected images.

This dialog is displayed when you are creating L1 or L2 images.

Figure 38: Product Selection



Products

Choose the Products you would like to create from the list by selecting the checkbox next to it.

Multi-band products

Click this button to create customized multiband orthorectified images. The Multi-band Product Creation dialog opens (page 81).

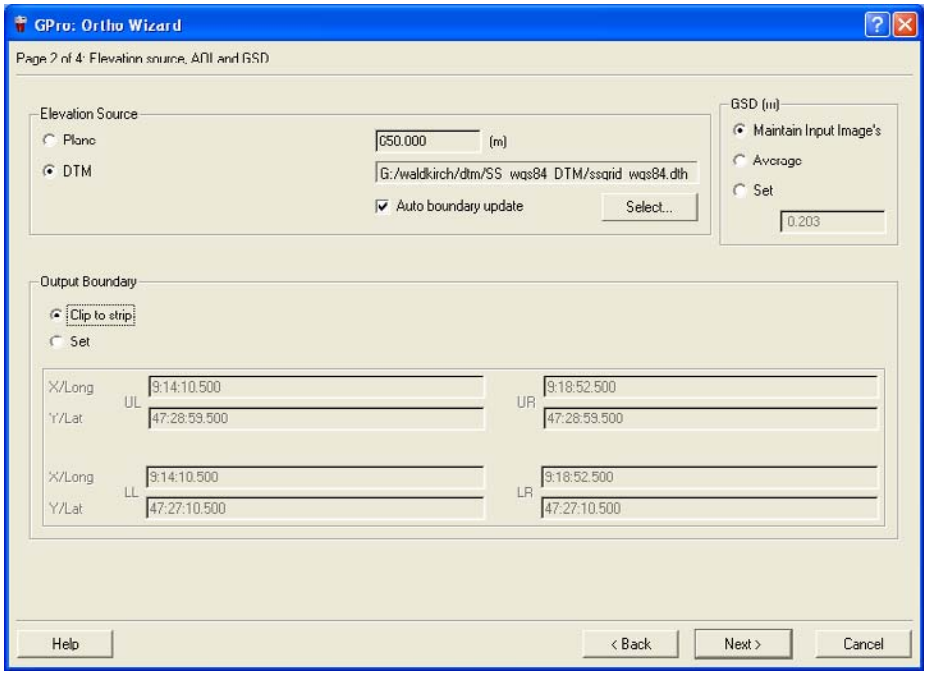
This button is only displayed if you are creating L2 orthorectified images.

3.49 Elevation Source, AOI, and GSD

This wizard page allows you to specify the source of the elevation data to which the image will be rectified and define the boundary of the output image. It is displayed when you click **Next** from the "Product Selection" on page 74 dialog.

If you are creating an L1 image, a subset of these options will be available. If you are creating an L2 image, the options specific to orthorectification will be displayed.

Figure 39: Elevation Source, AOI and GSD dialog



Elevation source

Allows you to select the source of the elevation data used for rectification. If you are performing a planar rectification, you must set the elevation of that plane. For orthorectification, you must load a Digital Terrain Model (DTM) to be used as the elevation source.

A DTM can be a Digital Elevation Model (DEM) or Triangulated Irregular Network (TIN) file. It must be in .pro, .img or .ltf format. The selected DTM must cover the entire extent of the image area that is being rectified.

The DTM file must be in the same geographic coordinate system as the selected project to be considered a valid DTM.

It is important that the Figure Of Merit (FOM) values for the DTM "posts" are not set to "Out of boundary" or to "Zero" for the rectification area. Depending on the source of the DTM the FOM values may have been assigned to the DTM automatically during the correlation, manual editing or import processes.

Plane Select this radio button to perform a planar rectification of the image. Enter the height of the rectification plane in the units indicated in parenthesis.

DTM (L2 Only) Select this radio button to use a DTM as the source of the elevation data. The name of the currently selected file is displayed. If no file is displayed, you must browse to a valid file.

Select Click this button to browse to a DTM file to use as the Elevation Source. This option is only available if you have selected the DTM radio button.

Auto boundary update This option is only available if you have selected the DTM radio button. If you have already entered the coordinates of the output boundary below, deselect this check box to keep the boundary fields from updating when you load the DTM.

GSD (L2 Only) Sets the Ground Sampling Distance (GSD) to be used in the output images. This is used to define the size of the pixels in the output orthorectified image.

Maintain Input Image's Select this radio button to preserve the GSD of the input image. This is the default mode for the L1 rectification.

Average Select this radio button to set the GSD to the average of selected images.

Set Select this radio button to set a your own GSD. Enter the GSD in the number field.

Output Boundary Allows you to set the boundary extent of the output image.

Keep Input Image Select this radio button to use the extent of the input image strip as the output image boundary.

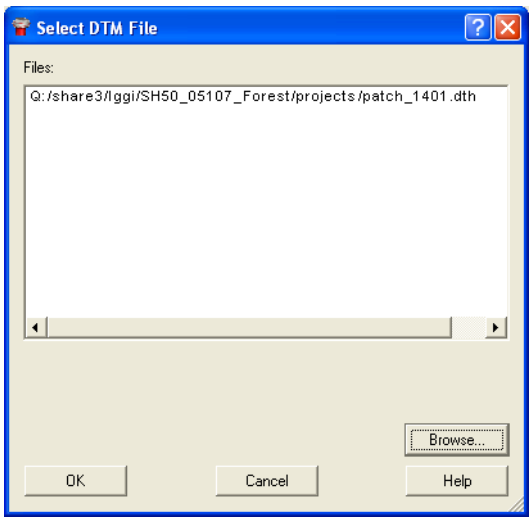
Clip to Strip Select this radio button to crop the output image to only the area of overlap between the image and the DTM.

Set Select this radio button to set the clipping boundary manually. Enter the output image extent in either image or ground space.

3.50 Select DTM File

This dialog allows you to select the Digital Terrain Model file that should be used for elevation data during the generation of L2 orthorectified images.

Figure 40: Select DTM File dialog

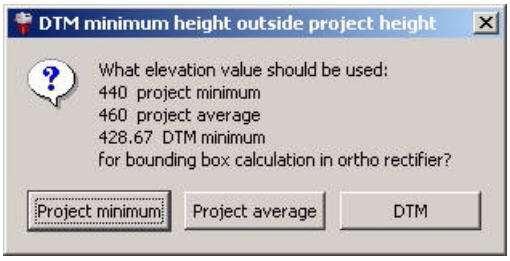


Files Select the DTM to use during L2 generation by clicking on it.

Browse Click this button to add a new DTM to the list of available DTM files.

The minimum value in the DTM is used to calculate the footprint of the ortho-photo area. If the minimum value is outside of the min-/max- height specifications of the project the user is asked to choose the correct minimum height.

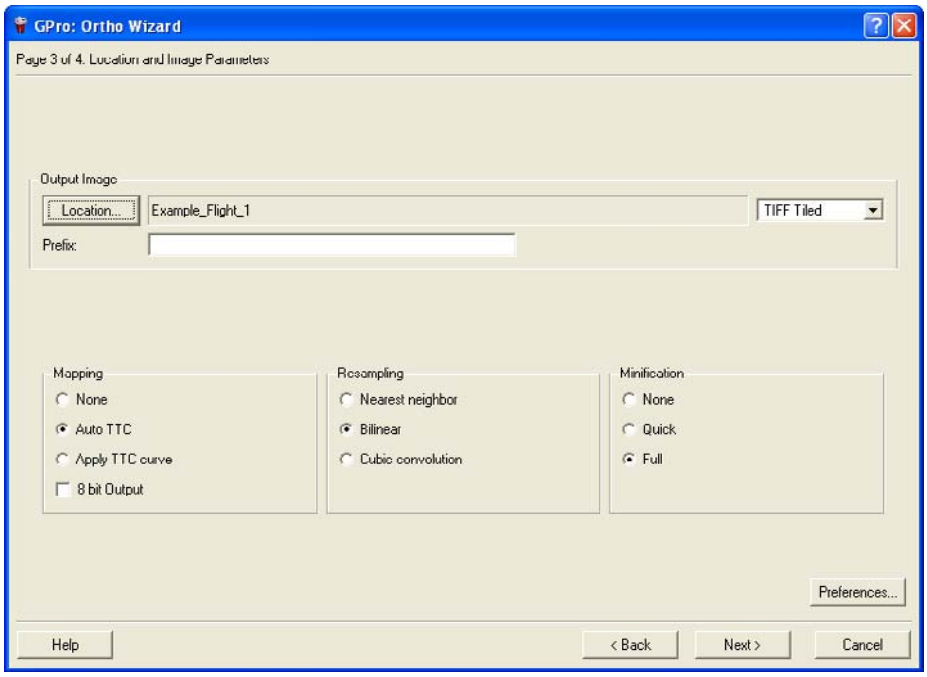
Figure 41: DTM minimum height dialog



3.51 Location and Image Parameters

This dialog allows you to set the parameters that are used during the rectification and orthorectification images.

Figure 42: Location and Image Parameters dialog



Output Image

These options define the location, file name, and format of the output image.

Location Displays the current output Image Location. Click the **Location** button to change the output images are generated. The "Image Locations" on page 48 dialog is displayed.

Output Image Pixel Format Select the output pixel type from this popup list. If you change the Output Image Pixel Format, the "Image Type Settings" on page 79 dialog is displayed.

The output image is always an .ads file. Changing the output image pixel format only changes the format of the individual pixels, not the actual output file.

Prefix Enter an optional prefix to be added to the name of the generated file.

Mapping

These options allow you to apply tonal transfer curves to the output file.

None Do not adjust the tonal transfer curve of the output file.

Auto TTC Select this radio button to apply the default TTC tonal transfer curve to the output file. The Auto TTC limits are set in the "Set Rectification Preferences - General" on page 39 dialog.

Apply TTC curve Select this radio button to apply a manually adjusted colour curve.

8 bit Output Selecting this checkbox will convert the output file from 16-bit to 8-bit imagery.

Resampling

These options allow you to define the technique used to interpolate the original image pixels to their new orthorectified positions.

Nearest Neighbour

This technique uses the value of the closest pixel to assign the output pixel value.

Bilinear

This method uses the data file values if all four pixels in a 2 × 2 window to calculate the output value with a bilinear function.

Cubic Convolution

This technique uses the data file values of sixteen pixels in a 4 × 4 window to calculate an output value with a cubic function.

Minification

These options allow you to generate minification levels (pyramid layers) for the output images for use with Point Matching and fast zooming.

None

Do not generate any minification levels.

Quick

Select this radio button to creates only a selected minification. If the image is not used for point matching, this option is useful for quality control by just minifying 1:16 for quick viewing without wasting space.

Full

Select this radio button to generate all the minification level from 1:2 to 1:2048 that are used for fast zooming and point matching.

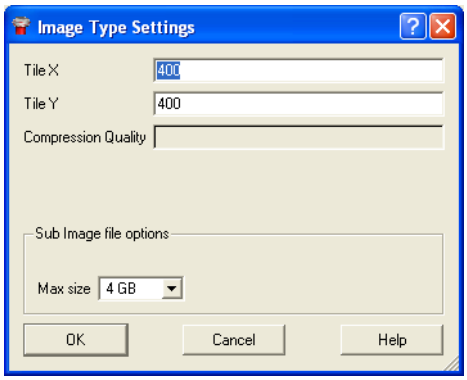
Preferences

Click this button to check or change the Rectification Preferences without cancelling the Wizard. The "Set Rectification Preferences - General" on page 39 dialog is opened.

3.52 Image Type Settings

This dialog allows you to define the format and size of the output image tiles. It is displayed when you change the Output Image Pixel Type on the "Location and Image Parameters" on page 78 dialog.

Figure 43: Image Type Settings



Tile X

Enter the image tile size in the X direction. The tile size is measured in pixels.

Tile Y

Enter the image tile size in the Y direction. The tile size is measured in pixels.

Compression Quality

Select the compression quality for the output image.

Max Size

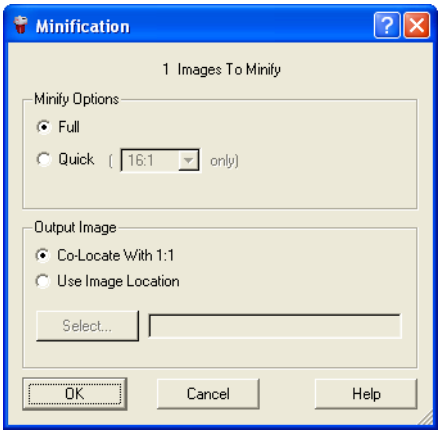
Set the maximum file size for each image tile.

3.53 Minification

This dialog allows you to generate minification levels on the images in your workspace. It is opened when you select one or more images in the Raw Downloaded Data view or the ADS Project Data view and click the **Minify** button.

All of the image generation functions have an auto-minification option built in, so it is not typically necessary to minify an image explicitly in this manner.

Figure 44: Minification dialog



Minify Options

Full Generates all the minification level from 1:2 to 1:2048 that are used for fast zooming and point matching.

Quick Creates only a selected minification. If the image is not used for point matching, this option is is useful for quality control by just minifying 1:16 for quick viewing without wasting space.

Output Image

These options allow you to specify where the minification files should be saved.

Co-Locate With 1:1 This default option puts the minified images in the same directory as the original image.

Use Image Location Select this option to store the minification levels in a directory of your choosing. This is useful if there is not enough room in the image's directory to store both the image and the minifications.

Select Click this button to open a file selector and browse to the location in which you want to store the minification images.

3.54 Multi-band Product Creation

The Multi-Band Product Creation tool allows you to customize the output L2 orthorectified imagery to suit your own purposes.

This allows you to create a multi-banded image of your specification.

<sensor>

This field lists all of the CCD lines in the current sensor. Each line is labelled, and each sensor has its own tab.

<arrows>

Move the selected CCD lines into the currently selected multi-band product.

Move the selected CCD line up one band in the current product.

Move the selected CCD line down one band in the current product.

Multi-band

On loading the dialog box the right hand view should be populated with a number of tabbed sensors and CCD names within them. These are used to build the multi-band product.

The first stage of generation is to create a new product using the new button. On selection of the image name CCDs can be added to the product by clicking on the right arrow button. These will then be transferred under the image name.

Because the band order is important the order can be changed by highlighting the CCD name, in the right view, and using the up and down arrows to get the desired band ordering. Pushing the space bar also moves the CCD ordering upwards.

Clicking the save button forces the product to be saved for future runs of GPro. These become accessible from the production selection option. Clicking OK without the save allows a one time only definition of the multi-band product.

New

This button is used to create a new multi-band image. On depression a new image will appear in the right hand view of the dialog. The sensor name will be inserted with the product name being the child. The name of the product can be changed by selecting the name and clicking within the text line. Name as appropriate. Note that this has to be unique.

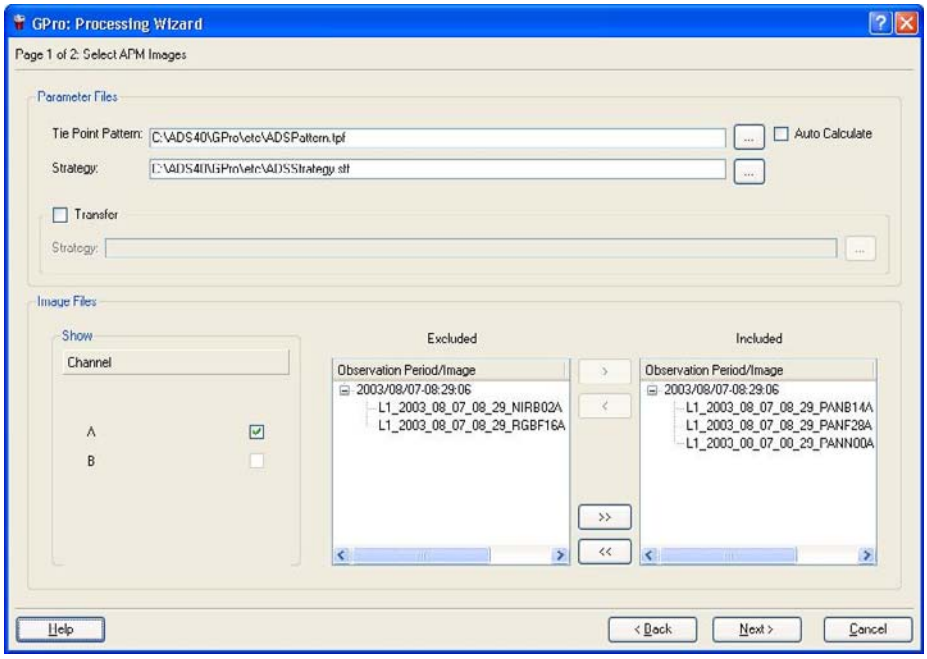
Remove

Selecting an image name or sensor in the product hierarchy deletes the images from the list.

3.55 Select APM Images

This dialog allows you to set all of the options required for conducting Automated Point Matching (APM). APM will calculate numerous homologous points on the selected overlapping ADS strips to achieve a better correlation between the points on each image.

Figure 45: Select APM Images



Parameter Files

These files define the parameters that are used to generate correlating points during APM.

Tie Point Pattern

Enter the path to the tie point pattern used to define how APM defines its measurement points within the imagery. By default, GPro will use ADSPattern.tpf, which is distributed with the software.

The Tie Point Pattern file may be edited in ORIMA.

For more detailed instructions on Tie Point Patterns, refer to the ORIMA documentation.

Strategy

Enter the path to the Strategy file used to define the geometric constraints APM should use when measuring points in the imagery. By default, GPro will use ADSStrategy.stf, which is distributed with the software.

For more detailed instructions on Strategies, refer to the ORIMA documentation.

The Strategy file may be edited in any text editor.

Auto Calculate Select this checkbox to automatically calculate the point density in the flight direction. When checked, APM will calculate the optimal number of image points for orientation fixes, statistic calculation, and blunder detection.

Transfer Select this checkbox to specify the strategy file APM should use when measuring points from one strip to another.

Strategy Enter the path to the strategy file used to define the geometric constraints should use when measuring a point in one strip and a point in a different strip.

For more detailed instructions on Strategies, refer to the ORIMA documentation.

The Strategy file may be edited in any text editor.

Show Panel This panel assists you in selecting images based on filters. It is fully described in "Show Panel" on page 50.

Images for APM Select the images to be included in APM.

Excluded This field displays the L1 images that will not be included in the APM run. Select an image by clicking on it.

Click the > button to include the selected image in the APM run. The selected image is moved to the Included display.

Click the >> button to include all of the L1 imaged in the APM run. All of the images are moved to the Included display.

Included This displays all of the images that will be included in the APM run. Select an image by clicking on it.

Click the < button to exclude the selected image from the APM run. The selected image is moved to the Excluded display.

Click the << button to exclude all of the images from the APM run. All of the images are moved to the Excluded display.

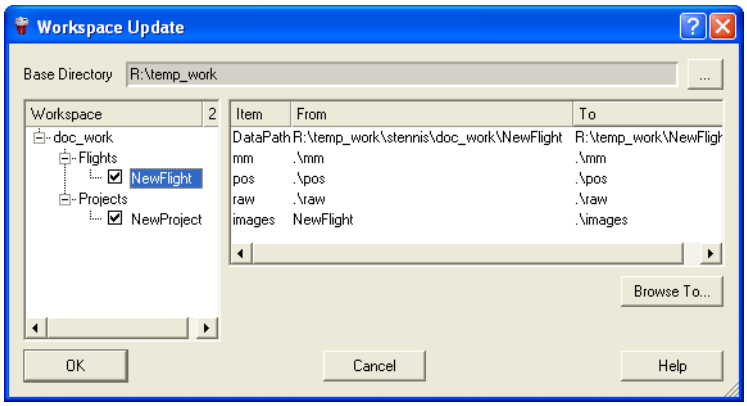
3.56 Workspace Update

In the event that a workspace has been manually moved to another location, this dialog can help you restore the integrity of the workspace. It provides you with a way to re-connect your data with the workspace file.

Validating a workspace checks that the data path of the loaded workspace matches the actual location on the disk. It also checks that the FLT and BLK files exist in the path described by the workspace. If the actual data path and all the block files and flights match the specifications of the workspace, then the workspace is considered to be valid. The check does not validate the integrity of the block file and all it's contents.

To validate the current workspace, select **Validate** from the "File menu options" on page 27. Workspace Validation is a general preference setting that can be turned on if you wish to have all workspaces validated at load time. See Set General Preferences - Global (page 37).

Figure 46: Workspace Update



Base Directory

The actual path of the workspace is displayed in the Base Directory edit box. Enter the path to the location of the workspace file or click the browse button ... to navigate to it.

When you choose a Flight or Project, the Base Directory is used as the default To location to change all the paths for that particular Flight or Project. Once you choose the flights or projects that you wish to update from the tree view and select OK, GPro will map and update all the current paths in this invalid workspace to the Base Directory.

Workspace

This tree view lists all the Flights and Projects contained in the current workspace. Each one is individually selectable and can be individually re-linked with the workspace. Select the flights and projects to re-link by ensuring the checkbox is checked. Click an unchecked box to check it. Click a checked box to un-check it.

Item

This column describes the specific Flight or Project item attribute that is to be re-linked (e.g. **Data Path** or **images** location). Within a flight or project, these are individually selectable and a specific path can be specified for each of these components.

From

This displays the current path/location as specified in the workspace.

To

This displays the actual location for the component.

Browse To...

This function allows you to fine tune the location of each item within the flight/project. By selecting the **Item** (such as **Data Path** or **images**), and then clicking this button, you can then select a location just for the selected item.

Other buttons are discussed in "Common Buttons" on page 26.

3.57 Filtering Examples

By Spectral Type

The following example shows you how to filter the Data View to only display only the Panchromatic Spectral Type.

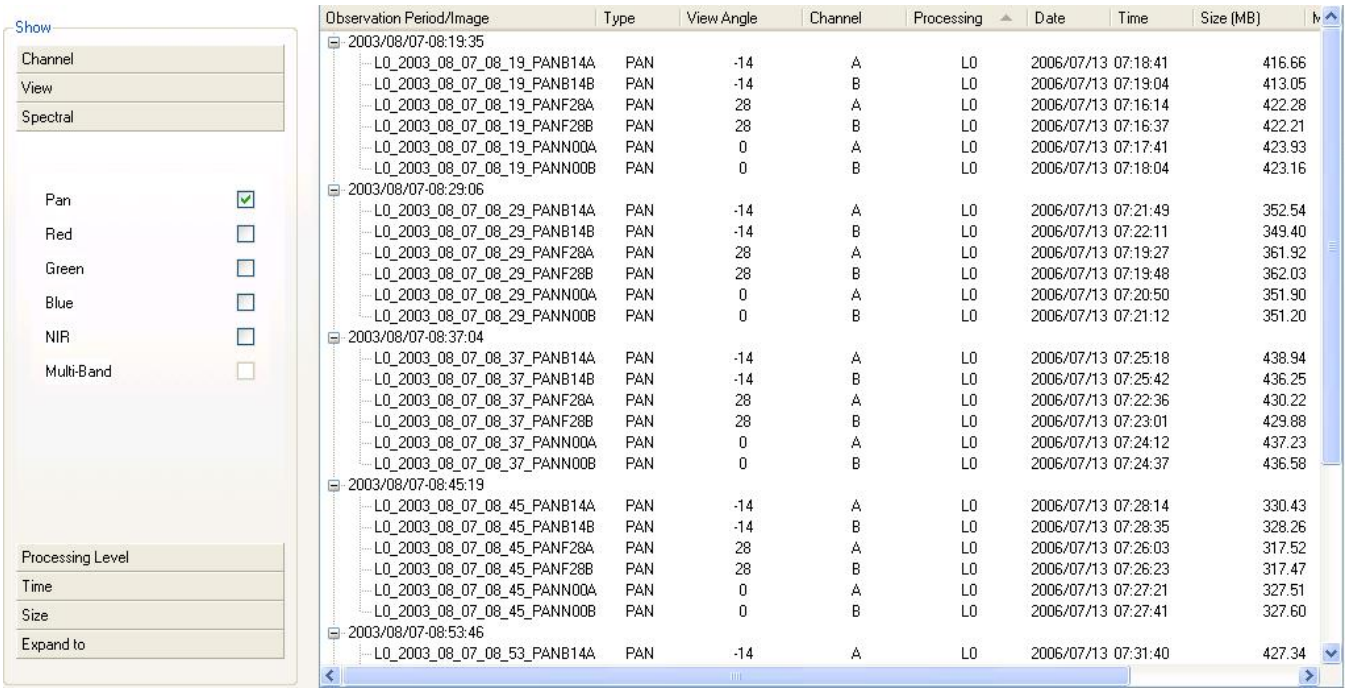
1. In the Show Panel, click on the **Spectral** button.

   The Spectral Filter list is expanded.

2. Deselect the **Red**, **Green**, **Blue**, **NIR** and **Multi-Band** checkboxes.

   As you deselect the checkboxes, the corresponding images are hidden in the Data View.

Figure 47: Filtering by Spectral Type



By Channel

To the Spectral Type filtering, you will now also filter the display to show only the images from the A channel.

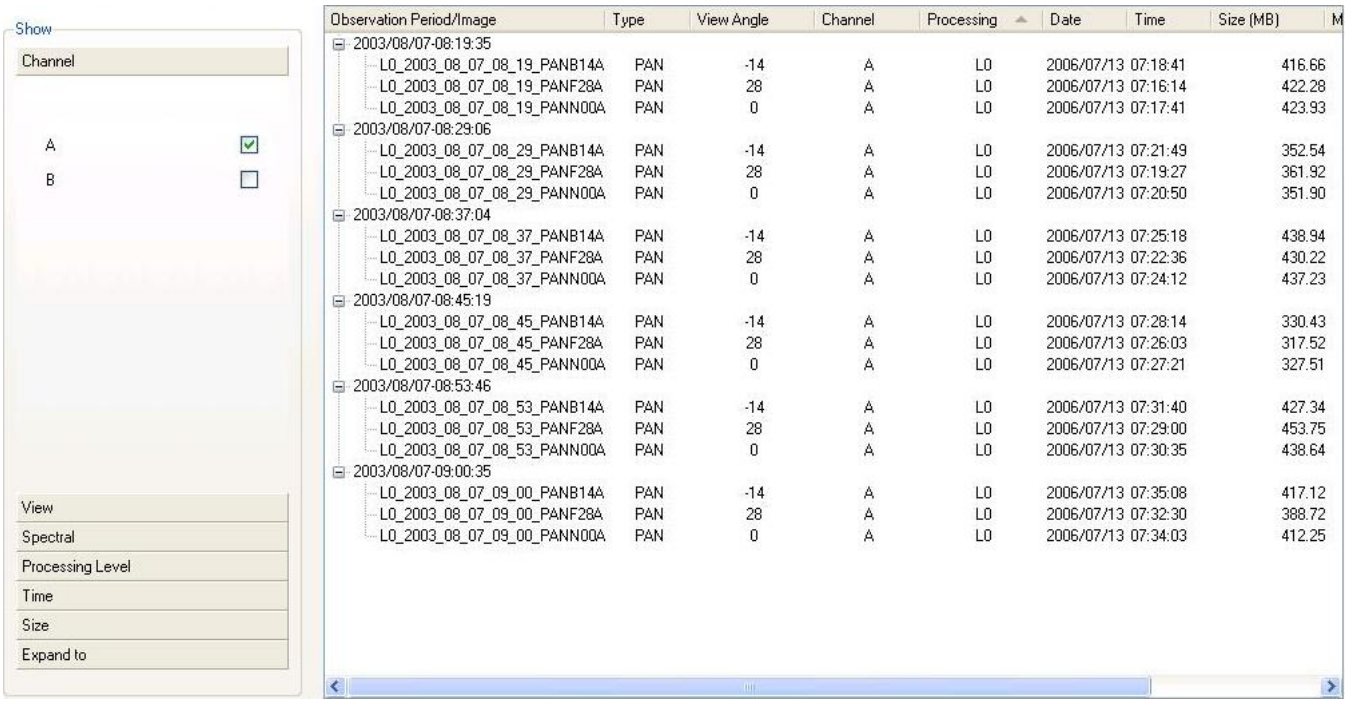
1. In the Show Panel, click the **Channel** button.

   The Channel Filter list is expanded.

2. Deselect the **B** checkbox by clicking on it.

   As you deselect the checkbox, the corresponding images are hidden in the Data View.

Figure 48: Filtering by Channel



By View

In addition to the Spectral and Channel filtering, we will now filter the Data View to only show those images captured at the nadir angle.

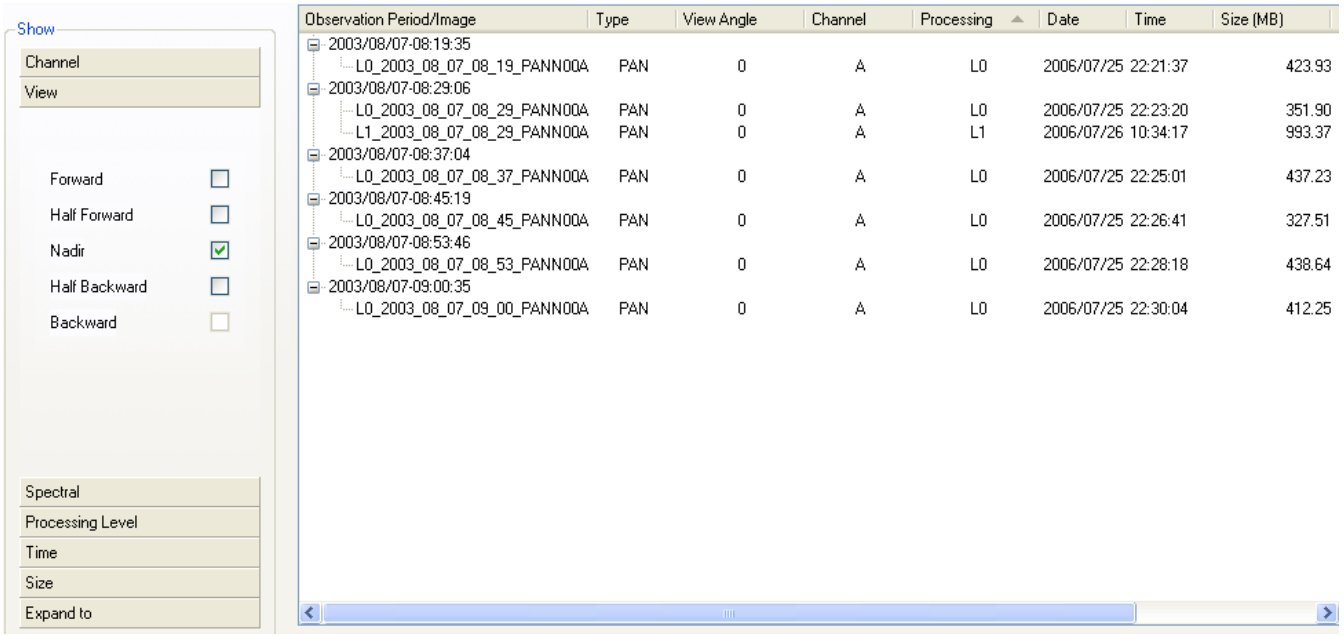
1. In the Show Panel, click the **View** button.

   The View Filter list is expanded.

2. Deselect the **Forward** , **Half Forward**, **Backward**, and **Half Backward** checkboxes by clicking on them.

   As you deselect the checkboxes, the corresponding images are hidden in the Data View.

Figure 49: Filtering by View



By Date

Now we will add the Time filtering to all of the above filters. In this example, the Data View will be filtered to only display images that have been created between 12:30:00 and 22:35:00 on 2006/07/25:

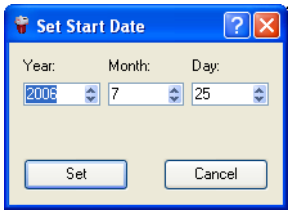
1. In the Show Panel, click the **Time** button.

   The Time Filter list is expanded.

2. In the **Starting at** group, click the **Date** button.

   The Set Start Date dialog is displayed.

Figure 50: Set Start Date dialog



3. Enter the starting date. This is the earliest date that should be displayed in the Data View.

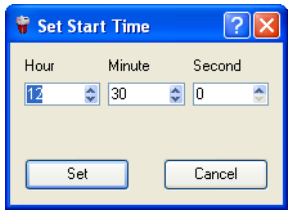
4. Click **Set**.

   You are returned to the Data View. The **Start at Date** button should show the date you just entered.

5. In the Start at group, click the **Time** button.

   The Set Start Time dialog is displayed.

Figure 51: Set Start Time dialog

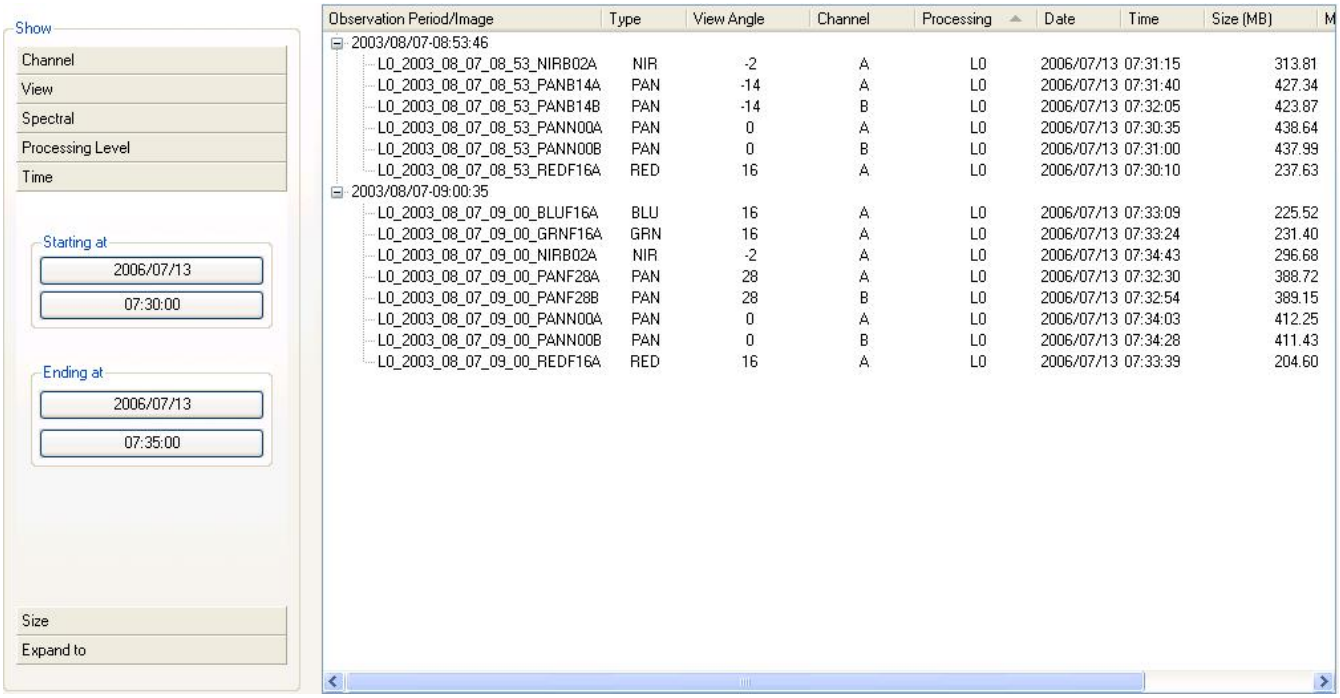


6. Set the starting time. This is the earliest time that should be displayed in the Data View.

7. Repeat these steps to set the Ending at date and time.

   Figure 52 displays the result of filtering by dates.

Figure 52: Filtered by Time



Expansion Levels

Another means of simplifying the process of image selection is using the different expansion levels. The Data Expansion Levels are used to simplify selection within the hierarchy.

This example will show you how to use the Expansion Levels to collapse the hierarchy to flight line level, manually expand selected observation periods (4 and 6) and then apply a filter to show only the Red, Green, and Blue images.

1. In the **Show** panel, click the **Expand to** button.

   The Expand to list is displayed.

2. Select the **Flight Lines** radio button.

   The Data View collapses all of the hierarchies down to the Flight Line level.

3. Click the ⊞ button to expand the hierarchies in which you are interested.

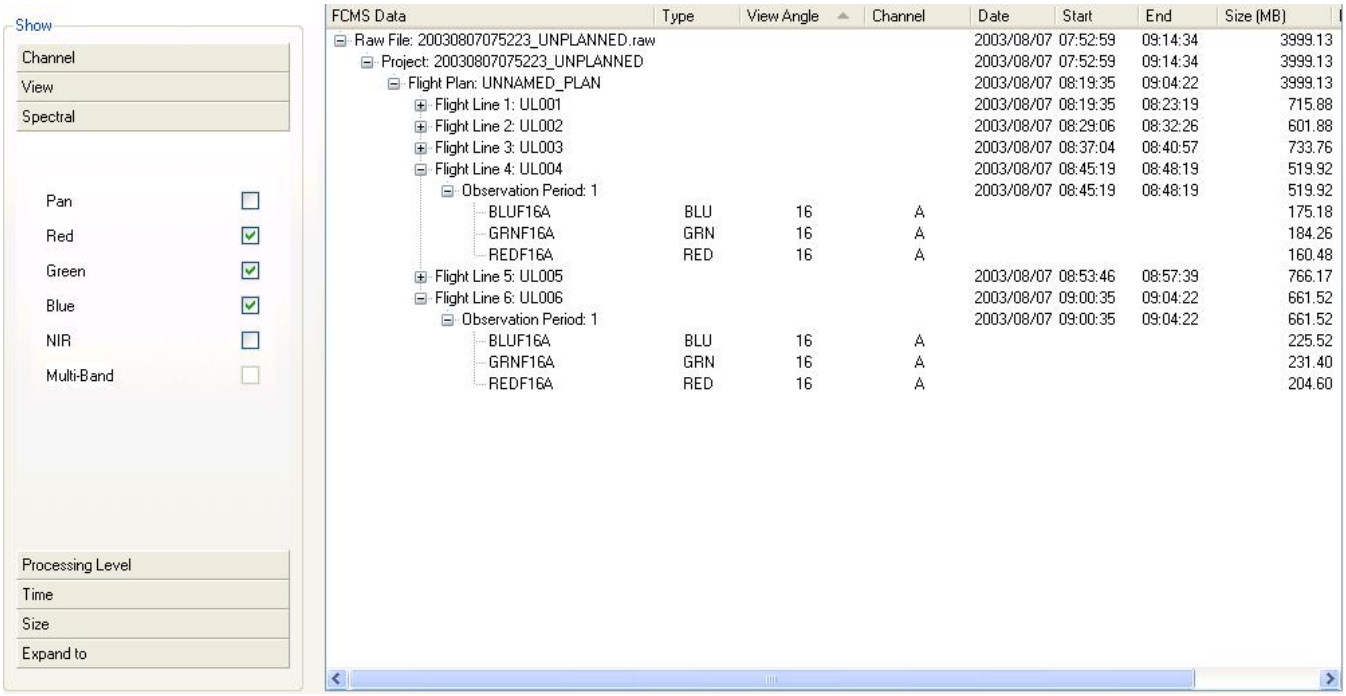
4. In the **Show** panel, click the **Spectral** button.

   The Spectral Filter list is expanded.

5. Select the Red, Green, and Blue checkboxes. Deselect the Pan, NIR, and Multi-Band checkboxes.

   As you check and uncheck the boxes, the Data View displays and hides the selected images.

Figure 53: Expanded to flight line



Selecting Images in the Data View

Once the Data View display is reduced to your images of interest, you are ready to select the images you need. There are three ways to select images in the Data View.

- Click on individual images from different flight lines, plans, projects or observation periods. The selected images are highlighted and the total number of selected images and their size is updated on the status bar.

You may use Shift-click to select multiple images that are adjacent in the Data View. To select multiple nonadjacent images, use Ctrl-click.

- Click on a project/flight plan/flight line/observation period to select all of the displayed images in that hierarchy.
- Click the **Select All** button to select all images displayed in the data window. Clicking **Deselect All** will deselect all images.

4 GPro Workflows

4.1 ADS Imagery Workflow

ASD40 imagery must go through a series of processing steps to make it ready to be exploited by image processing systems. There are nine basic steps required to transform ADS imagery into standard orthorectified image files.

1. "Downloading Raw Imagery" from the MM data storage unit.
2. "Downloading GNSS-IMU Data" from the MM data storage unit.
3. Processing the GPS/IMU data.
4. "Adding Files to a Project" will create ground-controlled support data for Level 0 (L0) raw imagery.
5. "Rectifying Imagery" to a plane and generating a Level 1 (L1) image rotated for stereo viewing.
6. "Running APM" to determine homologous points in the imagery.
7. "Triangulating Imagery" for improved ground control.
8. Generating a DTM with LPS.
9. "Orthorectifying Imagery" with a DTM and creating a Level 2 (L2) image.

For a complete understanding of the functionality and operation of the system, you should take a ADS Ground Processing software training course.

4.2 GPro Image Products

There are several different imagery products that can be created in GPro. Each of these products corresponds to a level of processing that has been performed on the imagery.

Level 0 images are georeferenced directly from the GPS/IMU data captured during flight. These images contain distortions due to aircraft motion and are not oriented properly for ideal stereo viewing. In addition, potential IMU misalignment and calibration errors can negatively affect the accuracy of Level 0 imagery.

Although Level 0 images may not be suitable as final image products and may require additional processing, they make excellent backup data sets, as most of the subsequent processing may be performed relatively quickly from the Level 0 data.

There are two different kinds of final products: Level 1 and Level 2 images. Level 1 images are corrected for aircraft motion, rotated for optimal stereo viewing, and are typically triangulated to increase the accuracy of the georeferencing. Level 2 images are orthorectified to remove elevation distortions and projected to standard map orientation. Level 2 images may also merge spectral and panchromatic bands to create colorized orthophotos.

Creation of Level 2 images requires the use of a Digital Terrain Model (DTM), which can be created from the Level 1 images in LPS or imported from an outside source.

Level 1 Products

Using GPro, you can create the following types of Level 1 image products:

- Panchromatic (Forward A/B, Nadir A/B, Backward A/B)
- Spectral (R, G, B, NIR and RGB)

Level 2 Products

Using GPro and a DTM, you can produce the following types of Level 2 images:

- Panchromatic (Forward A/B, Nadir A/B, Backward A/B)
- Spectral (R, G, B, NIR and RGB)
- User-defined Multi-band Products

GPro allows you to create customized final image products that meet your specifications. You can also view, delete and minify final image products without ever leaving the **ADS Project Data** view. The more sophisticated image processing tools available in LPS can be used directly on imagery within an ADS project. Because Level 2 images are standard orthorectified images, they can be mosaicked in a wide variety of mosaicking software.

4.3 Processing ADS Imagery

The GPro interface is divided into the following four views: "MM Data", "Raw Downloaded Data", "ADS Project Data" and "Task Status".

The first three views represent basic steps in processing and have been organized in workflow order from left to right. Each view is designed to help you perform the steps necessary to promote the data to the next level.

GPro uses a wizard to create a smooth and flexible workflow, pausing at the key points that require your interaction. The wizard is available from each of the processing views and guides you through the processing steps.

You can use the wizard to set up the entire workflow, or to perform only the stages of the workflow that satisfy your current needs. For example, your data may not need the high degree of accuracy that can be obtained by triangulation. In this case, you can use the wizard to download and process the imagery and GNSS-IMU data, georeference the imagery, and produce ortho products. Eliminating the intensive processes of planar rectification, automatic point measurement, and triangulation can save you significant amounts of time.

The **Task Status** view displays processing information such as progress meters and error messages.

4.4 Downloading Raw Imagery

Downloading raw imagery from the MM can be a lengthy process and therefore requires careful planning.

Preparation

First, you must physically connect the MM to the SCSI connector of the computer.

This connection must be made while the computer is powered off.

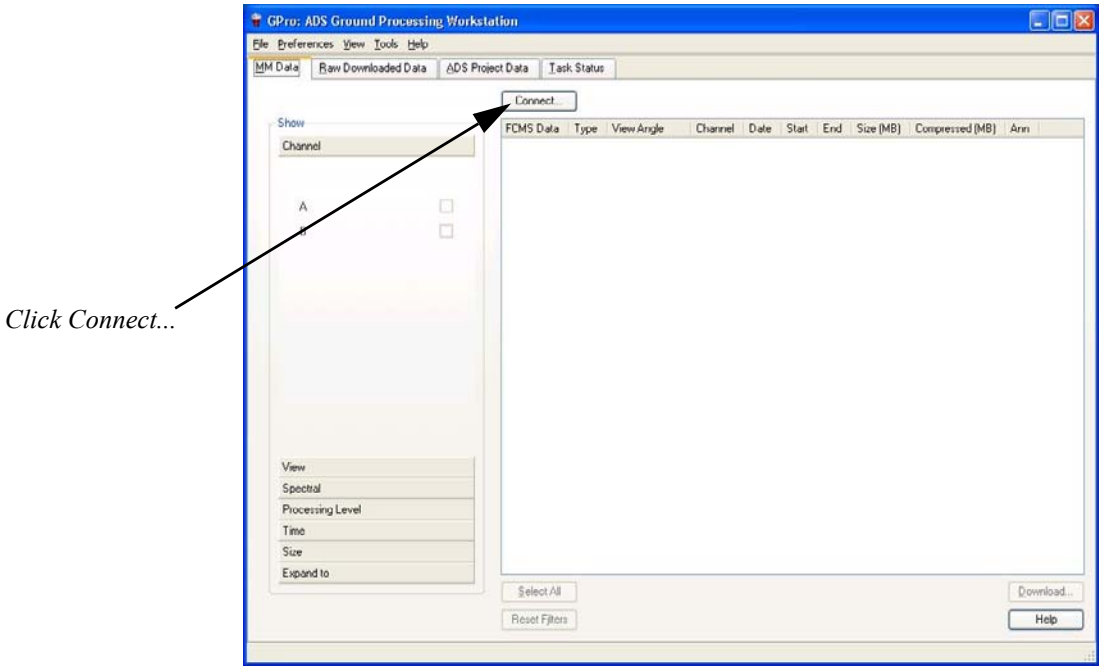
See "Hardware Installation" on page 21 for details.

Once the MM is properly connected, you can turn on the computer and start GPro.

Connect to the MM

1. After preparation is complete, click the **Connect...** button on the MM Data tab of the GPro workstation.

Figure 54: The MM Data Tab



The time required to read the MM depends on the amount of data collected.

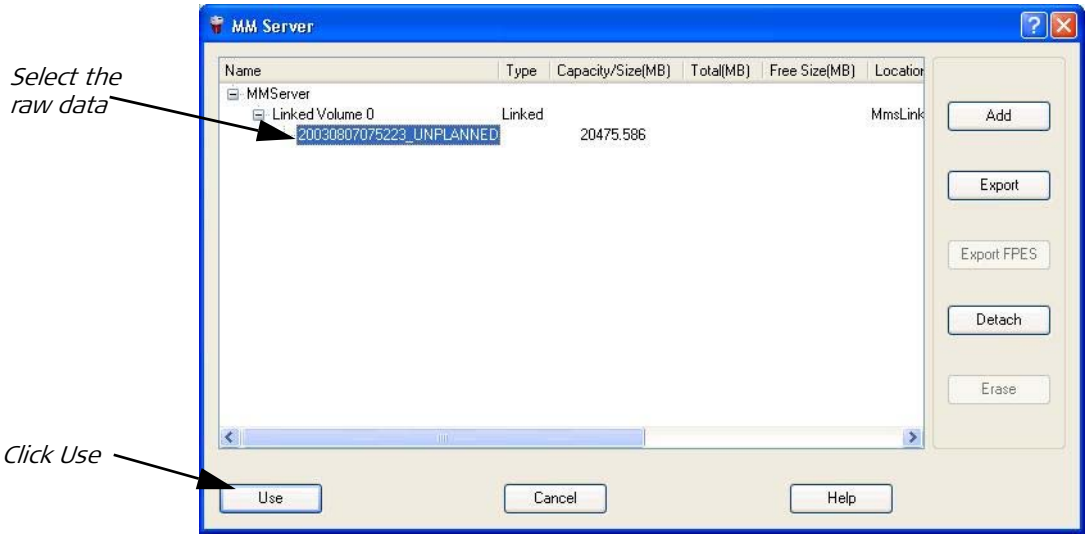
The **Connect to the MM** warning message is displayed.

2. Click **Yes** to connect to the MM and display its contents.

The GPro workstation changes to the **Task Status** tab and displays the progress as it gets the data structure from the MM.

After the Task Status reaches 100%, the **MM Server** dialog is opened. This dialog provides a hierarchical display of all data saved on the MM unit.

Figure 55: MM Server dialog



3. Select the raw MM data to which you would like to use by clicking on the data file.

4. Click the **Use** button.

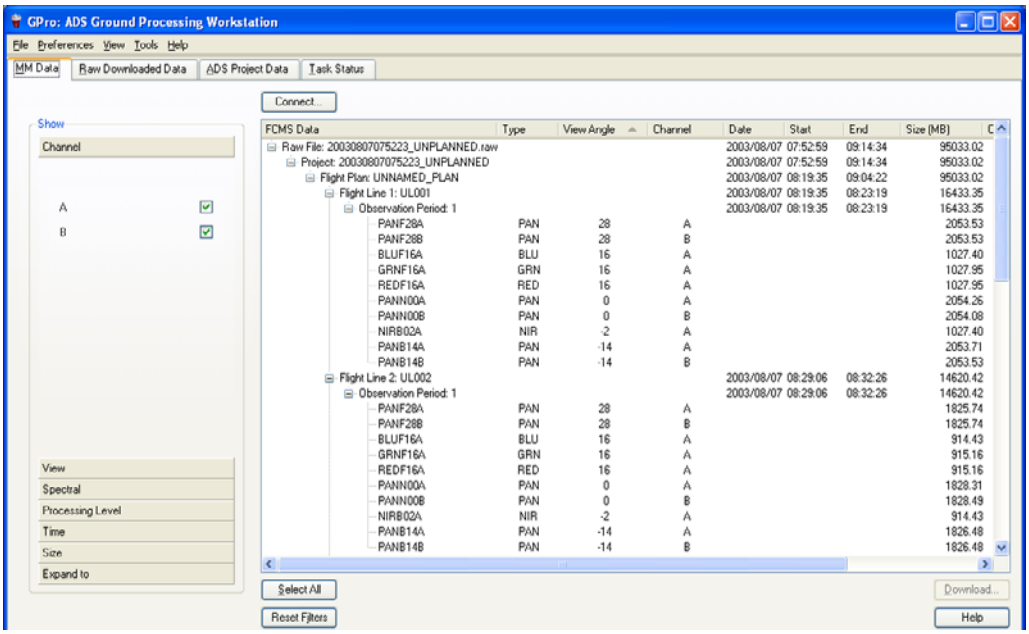
   The GPro workstation changes to the Task Status tab and displays the connection progress.

   While the connection is in progress, all actions within GPro are disabled.

   Once the progress meter reaches 100%, the view changes back to the MM Data tab.

   The selected data on the MM is displayed in the FCMS Data view.

Figure 56: MM Data Tab with Data



For more information see "FCMS Data View" on page 64.

4.5 Downloading GNSS-IMU Data

Once the MM Data view is populated with the contents of the MM, you need to download the images onto your computer for further processing.

This workflow assumes that the GNSS-IMU data associated with your data has not already been downloaded and processed.

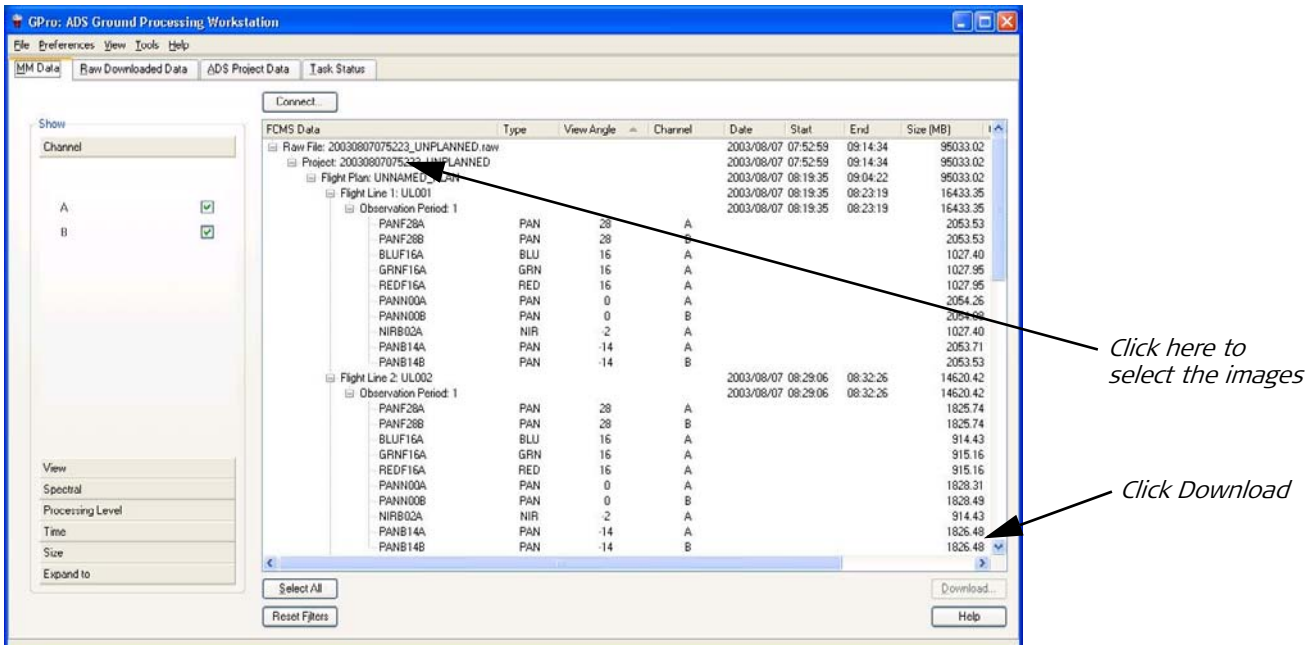
The filters discussed in "Filtering Examples" on page 85 will help you to display only the data in which you are interested.

Select Images to Download

In the first step of this workflow, you will examine the images that are stored on the MM and select those you wish to download for processing.

1. In the FCMS Data View, select all of the images you want to download.

Figure 57: Select the Images to Download



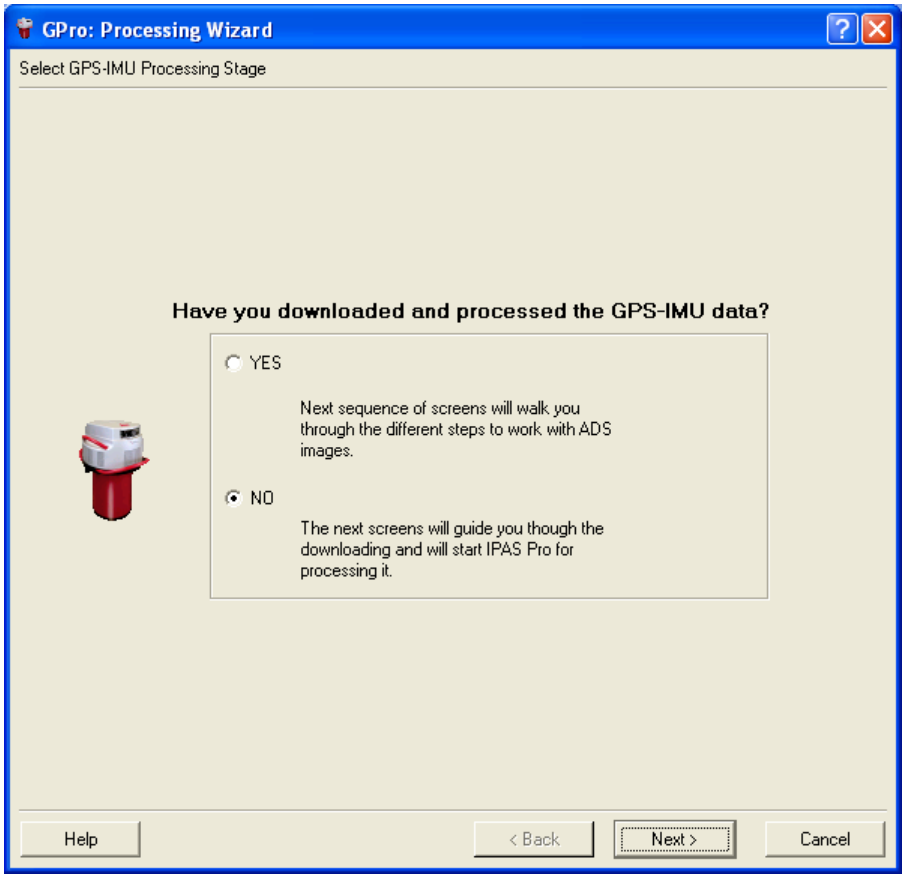
2. Click the **Download...** button at the lower right corner of the GPro Workstation. The GPro Processing Wizard is opened.

Please note that any values you have changed in the Preferences menu are not reflected in this wizard.

Select GNSS-IMU Workflow

The **Select GNSS-IMU Processing Stage** step asks you to select the GNSS-IMU workflow you want to follow.

Figure 58: Select GNSS-IMU Processing Stage dialog

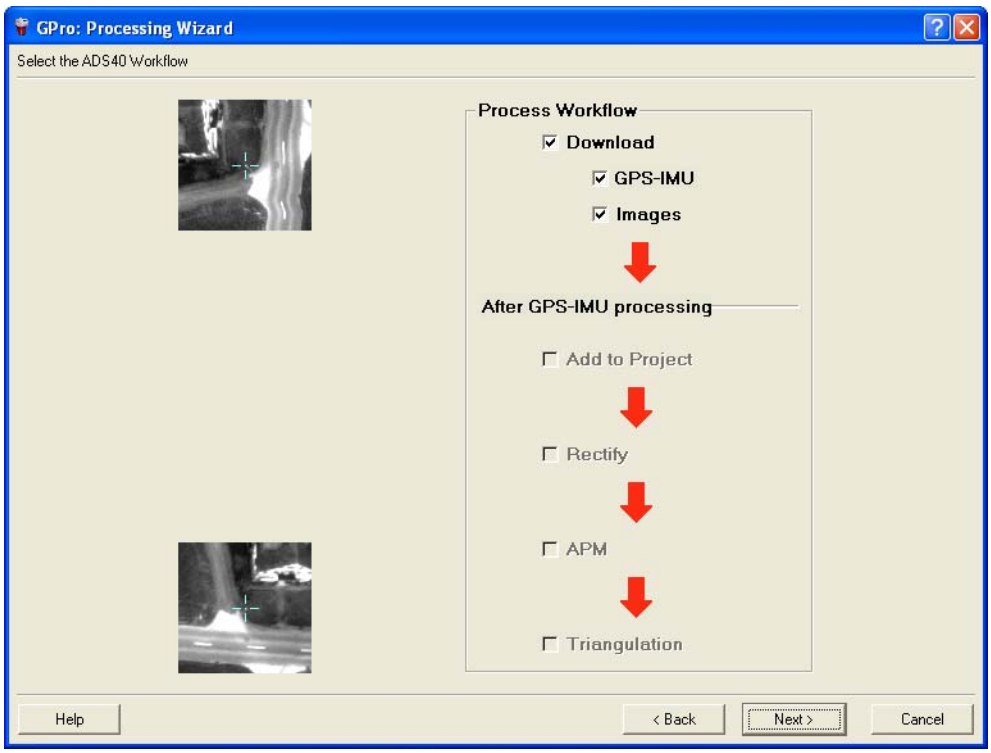


If you had already downloaded and processed the GNSS-IMU data for this flight, you would select YES and proceed to "Adding Files to a Project" on page 105.

1. Select the **NO** radio button and click **Next**.

   The **Select the ADS40 Workflow** step is displayed in the GPro Processing Wizard.

Figure 59: Select the ADS40 Workflow step



2. Select the **Download**, **GNSS-IMU**, and **Images** checkboxes to download both the selected images and the GNSS-IMU data associated with the selected flight.

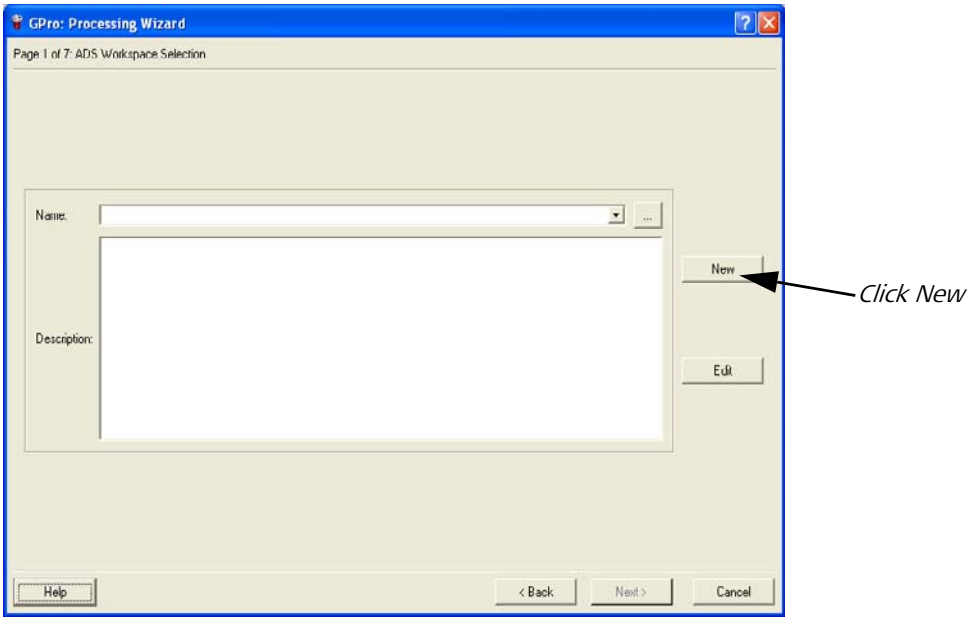
3. Click **Next**.

   The "ADS Workspace Selection" page is displayed.

ADS Workspace Selection

The GPro Process Wizard opens to the ADS Workspace Selection page. This allows you to select, create, or edit an ADS project workspace.

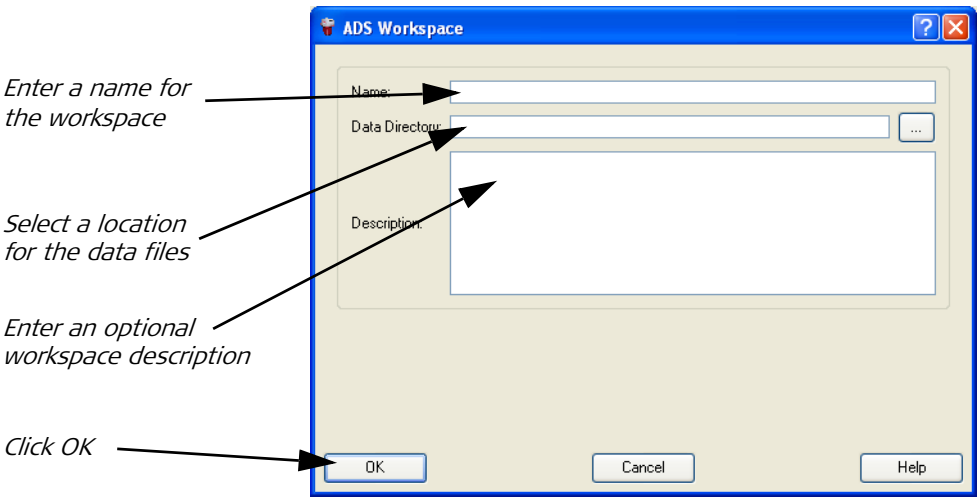
Figure 60: Select ADS Workspace dialog



1. Click **New** to create a new workspace.

   The ADS Workspace dialog is opened.

Figure 61: ADS Workspace dialog



2. Enter the Name of the new workspace.
3. Type or browse to the location in which all of the data will be added.
4. You may optionally enter a description for this workspace.
5. Click **OK**.

   A File Selector is opened so you can create the new Workspace file.

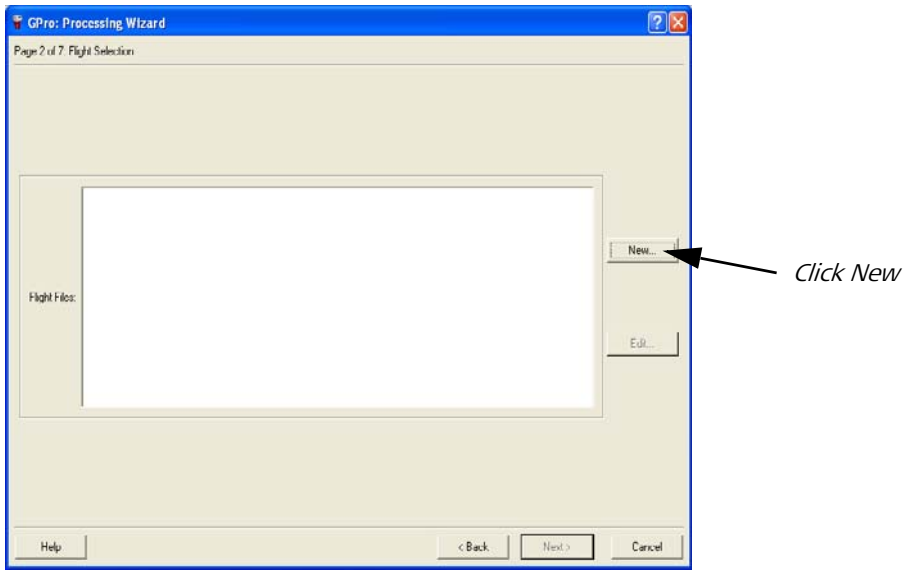
6. After checking the file name, click **Save**.
7. Click **Next** on the ADS Workspace Selection page.

   The "Flight Selection" page is displayed.

Flight Selection

The Flight Selection page allows you to create, edit, and select the Flights that will be associated with the Workspace.

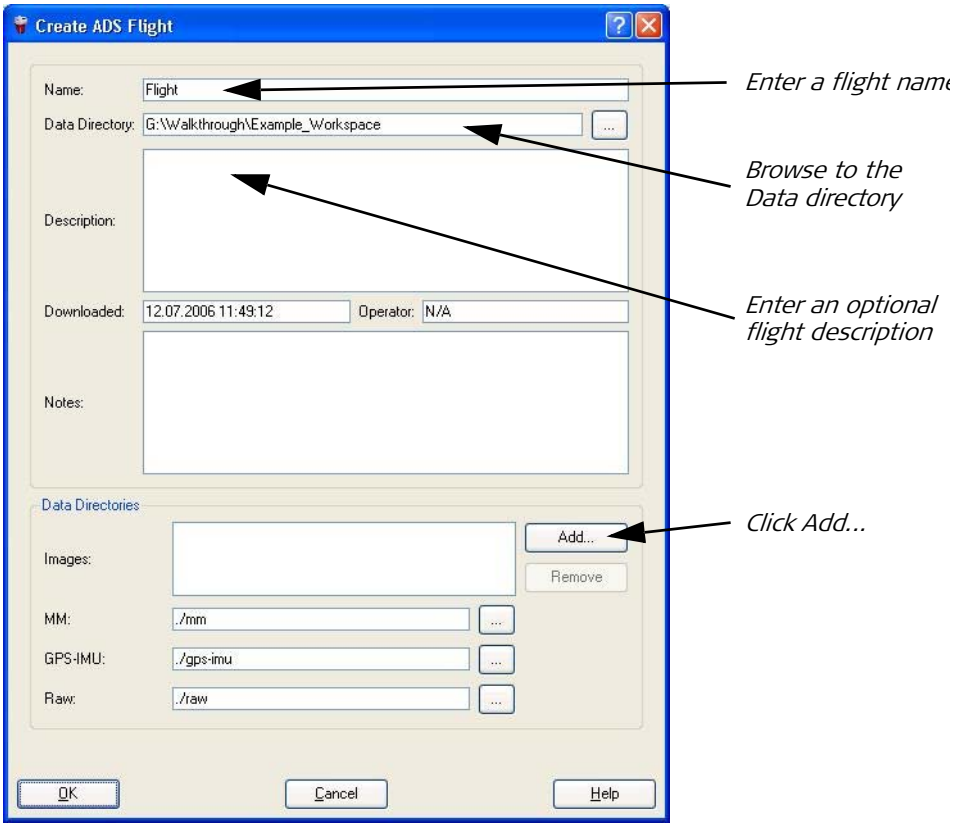
Figure 62: Flights Selection dialog



1. Click **New**.

   The Create ADS Flight dialog is displayed.

Figure 63: ADS Flight dialog



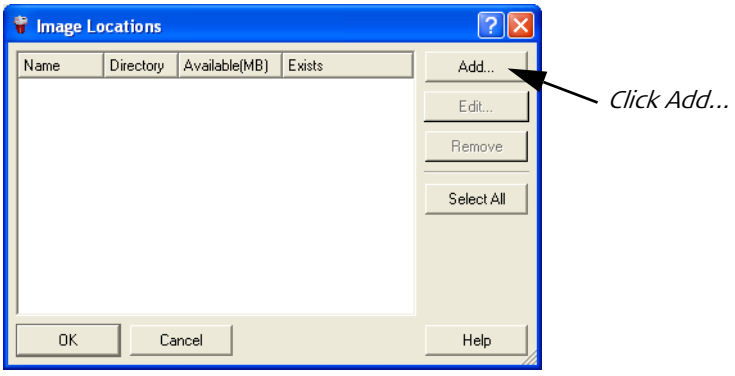
2. Enter a name for the new flight in the **Name** field.

3. Type or browse to the location in which you want to create the new flight file in the **Data Directory** field.

4. Enter an optional flight description in the **Description** field.

5. Click **Add...** to specify where the images associated with the flight will be stored. The Image Locations dialog is opened.

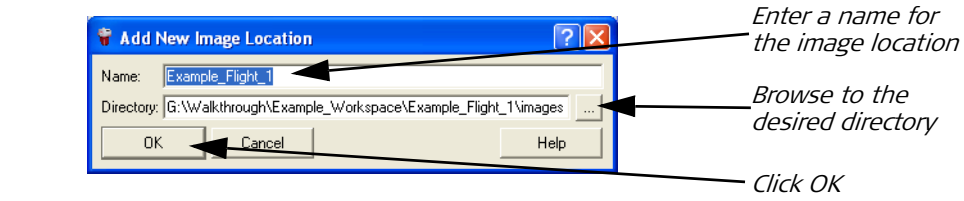
Figure 64: Image Locations dialog



6. Click **Add...** on the Image Locations dialog to add a valid image directory to the list of image locations.

The Add New Image Location dialog is opened.

Figure 65: Add New Image Location dialog



7. Enter a name for the flight's image repository.

8. Type the path or click ... and browse to the directory where this repository should be located.

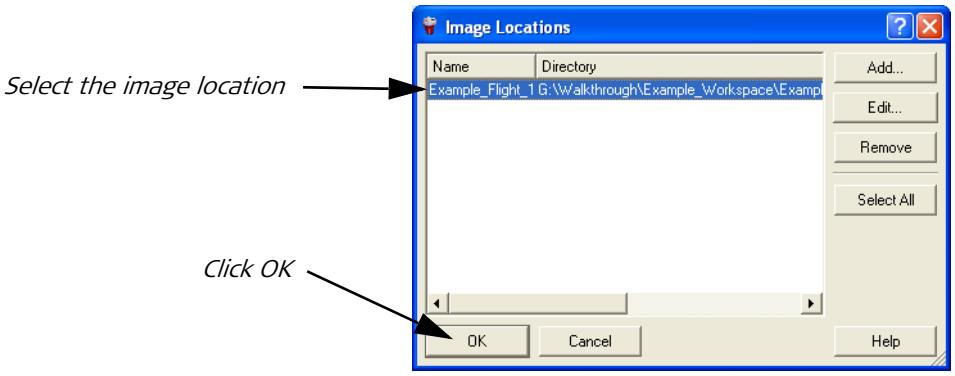
9. Click **OK** to add this location to the list of image repositories in the Image Locations dialog.

   If the specified directory does not exist, a dialog is displayed asking permission to create it.

10. Click **Yes** to create the directory.

    The new image location is added to the list of available Image Locations.

Figure 66: Added New Location in Image Locations dialog



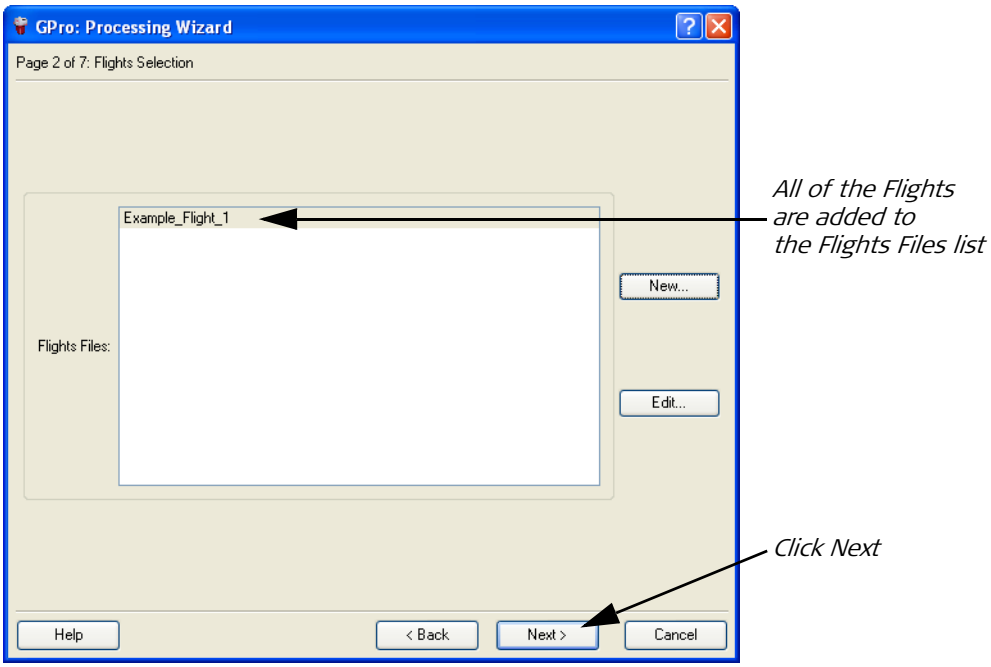
11. Select the Image Location by clicking on it and then click **OK**.

    You are returned to the Create or Edit ADS Flight dialog. Note that the Image Location has been added to the **Images** list in the **Data Directories** group.

12. Click **OK** on the Create or Edit ADS Flight dialog.

    You are returned to the Flight Selection page of the GPro wizard.

Figure 67: Completed Flights Selection dialog



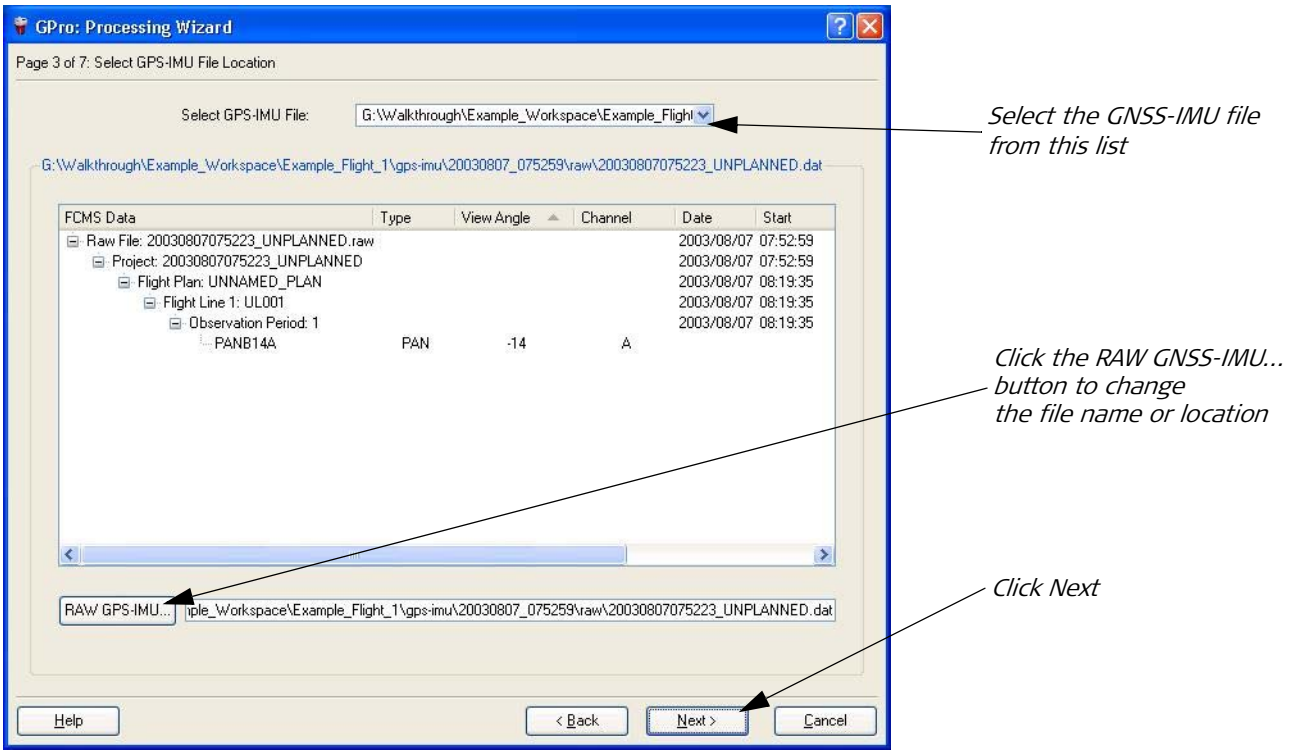
13. Click **Next**.

    The "Select GNSS-IMU Files Location" page is displayed.

Select GNSS-IMU Files Location

This page allows you to select the location and filename for each RAW GNSS-IMU file that you have selected to be downloaded from the MM.

Figure 68: Select GNSS-IMU Files Location dialog



Changing the default naming scheme can slow down later processing. It is therefore recommended that you keep the default naming scheme if at all possible.

1. If you want to change the default naming scheme for your GNSS-IMU files, select the first GNSS-IMU file from the **Select GNSS-IMU File** popup list.

   The Data View displays the information for the selected GNSS-IMU file.

   The default name and location for the selected GNSS-IMU file is displayed in the text box to the right of the **RAW Pos...** button.

2. To change the default name or location, click the **RAW Pos...** button.

   A **Save As** dialog is displayed.

3. After making your changes to the filename and location, click the **Save** button.

4. Repeat these steps for each of the selected GNSS-IMU files.

5. Click **Next**.

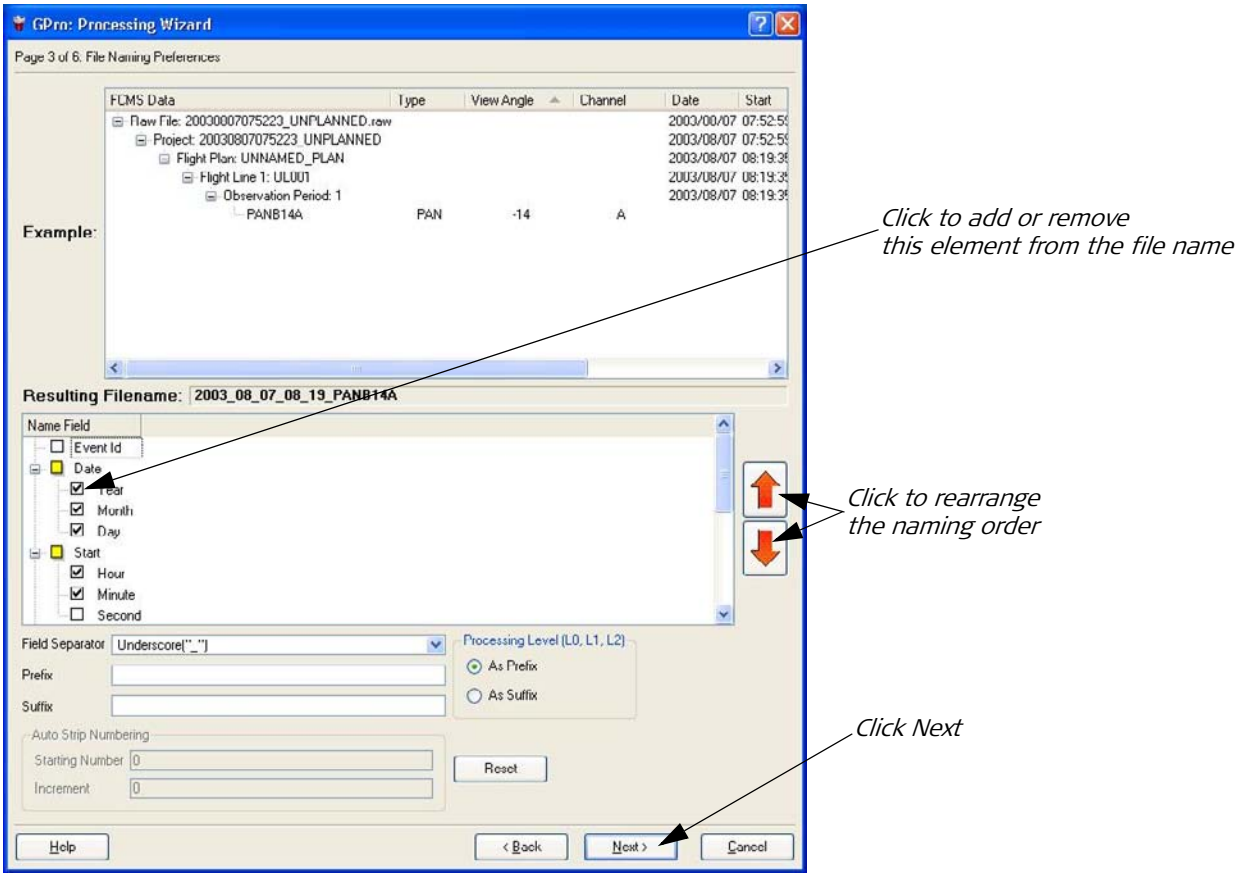
   If you are only downloading the GNSS-IMU data, the "GPro Wizard Summary" dialog is displayed.

   If you are downloading GNSS-IMU data and images, the "File Naming Preferences" dialog is displayed.

File Naming Preferences

The File Naming Preferences dialog allows you to specify a naming scheme that will create unique file names for the automatically generated files.

Figure 69: File Naming Preferences dialog



1. To add a naming element to the filename, select the checkbox next to that element.
2. To remove a naming element, deselect the checkbox next to that element.
3. To rearrange the order in which the naming elements are added to the file name, click the red arrow buttons.

   As you change the naming scheme, the example filename in the Resulting Filename text box automatically updates to reflect your changes.

   When adjusting the file naming scheme, be sure to include enough information so that each resulting file will be given a unique filename. This will ensure that you do not overwrite any files.

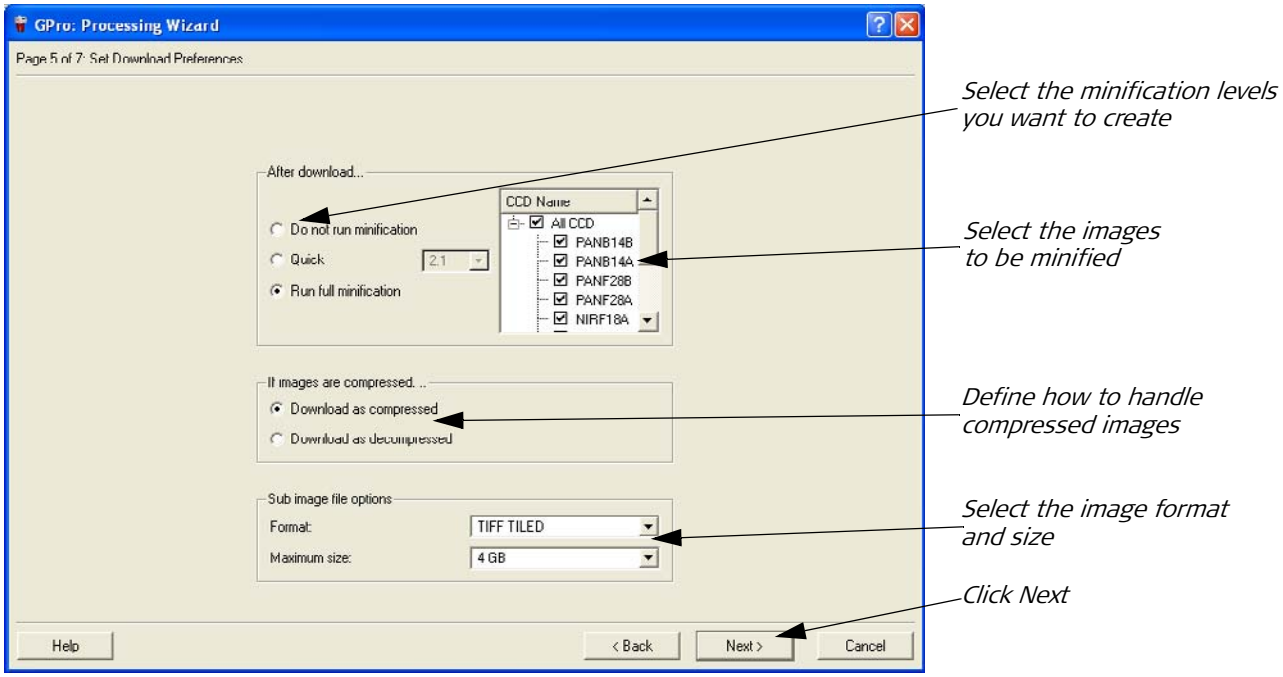
4. When you are satisfied with the naming scheme, click **Next**.

   The "Set Download Preferences" page is displayed.

Set Download Preferences

The Set Download Preferences page allows you to specify the format of the data and what actions to perform after the images are downloaded.

Figure 70: Set Download Preferences dialog



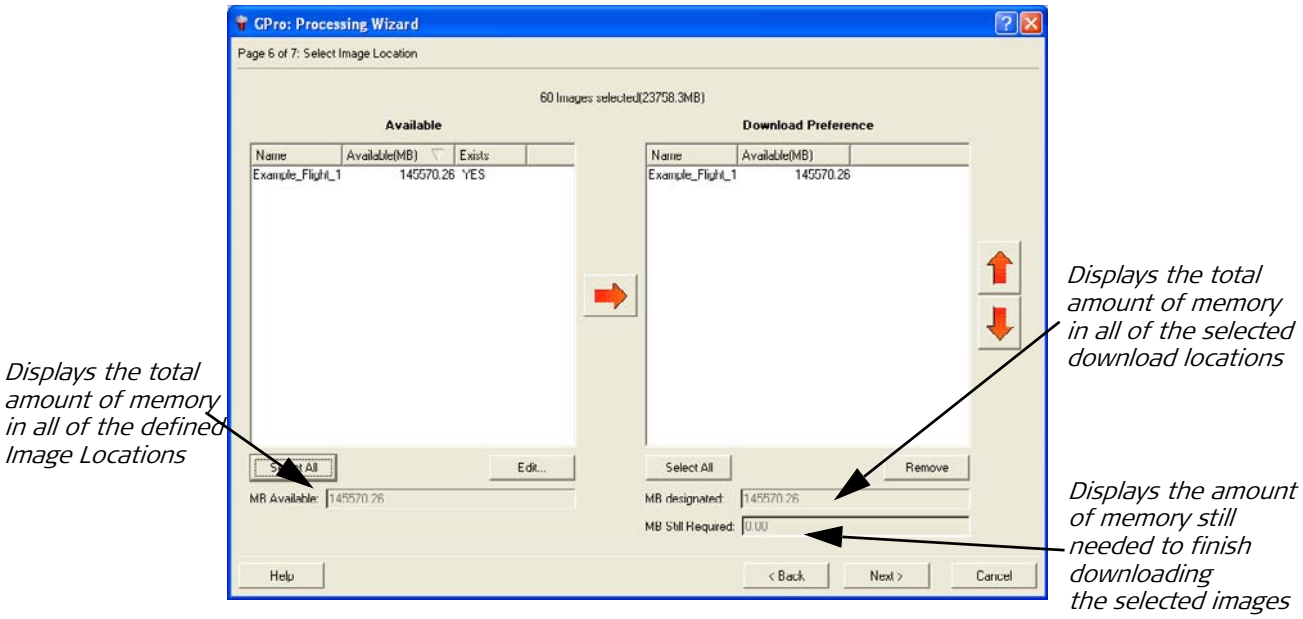
1. If you want to generate minification levels for the images, select the bands of the image on which to perform the minification as well as the minification levels.
2. Select whether you want to decompress the images after downloading them.
3. Select the format and size of the downloaded images.
4. Click **Next**.

   The "Select Image Location" page is opened.

Select Image Location

The Select Image Location page allows you to specify which of the available download locations should be used to store the downloaded images.

Figure 71: Select Image Location dialog



1. Select an Image Location from the list of Available image locations by clicking on it.

2. Click the  button to move the selected Image Location to the Download Preference column.

   The MB Still Required field will update to display the amount of memory that is still required to complete the download. If this value is greater than 0, you need to add another image location to the Download Preference list before you can proceed to the next step.

   When you have added enough image locations, the **Next** button is enabled.

   If you have large images, you can sometimes have designated more memory than is required, but the Next button remains disabled. This is because the program would need to split an image between two locations, which is not allowed. You must add another image location with sufficient space to hold the entire image.

3. If you have added more than one Image Location to the Download Preference column, you may arrange the locations in the order in which they will be used by clicking the  and  buttons.

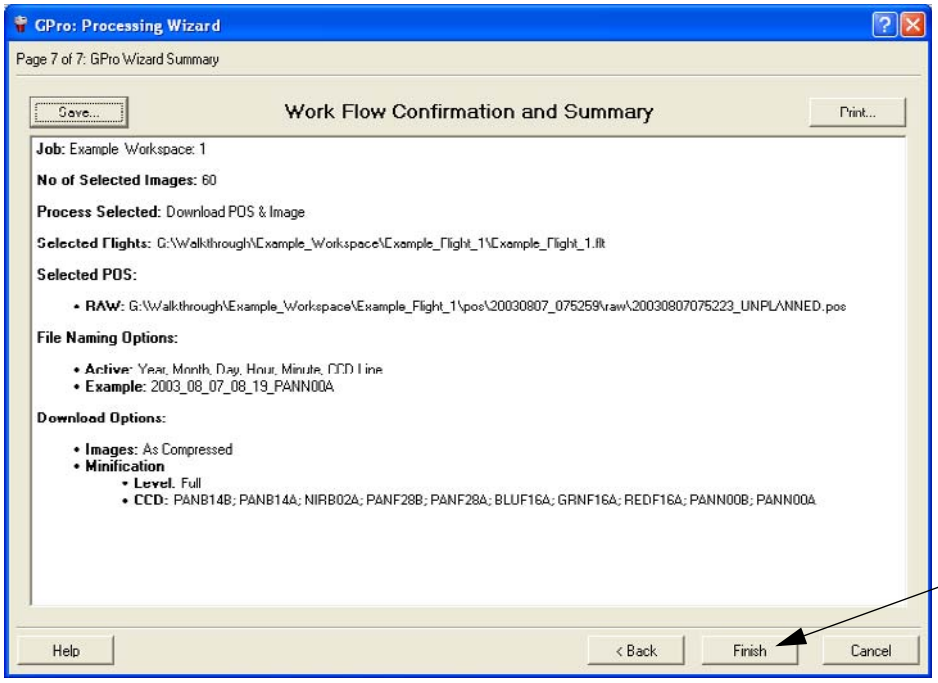
4. When you have added all of the necessary Image Locations, click **Next**.

   The "GPro Wizard Summary" page is opened.

GPro Wizard Summary

The final wizard page is a summary page. It is displayed at the end of each wizard and summarizes all of the selections you made while you were completing the wizard.

Figure 72: GPro Wizard Summary



1. To save backup of the Summary, click the **Save...** button.
2. To print the Summary for your files, click the **Print...** button.
3. Click Finish to accept all of the settings and begin downloading and processing the data.

   The **Task Status** view is opened and the processing progress is displayed.

   Upon completion, the GNSS-IMU software will start automatically, if it is loaded and has the correct path defined in "Set General Preferences - Programs". You can use the GNSS-IMU software to process the GNSS-IMU data while the images download.

   See the GNSS-IMU software documentation for help running the software.

   After the images have finished downloading they are displayed in the Raw Downloaded Data tab of the GPro workstation.

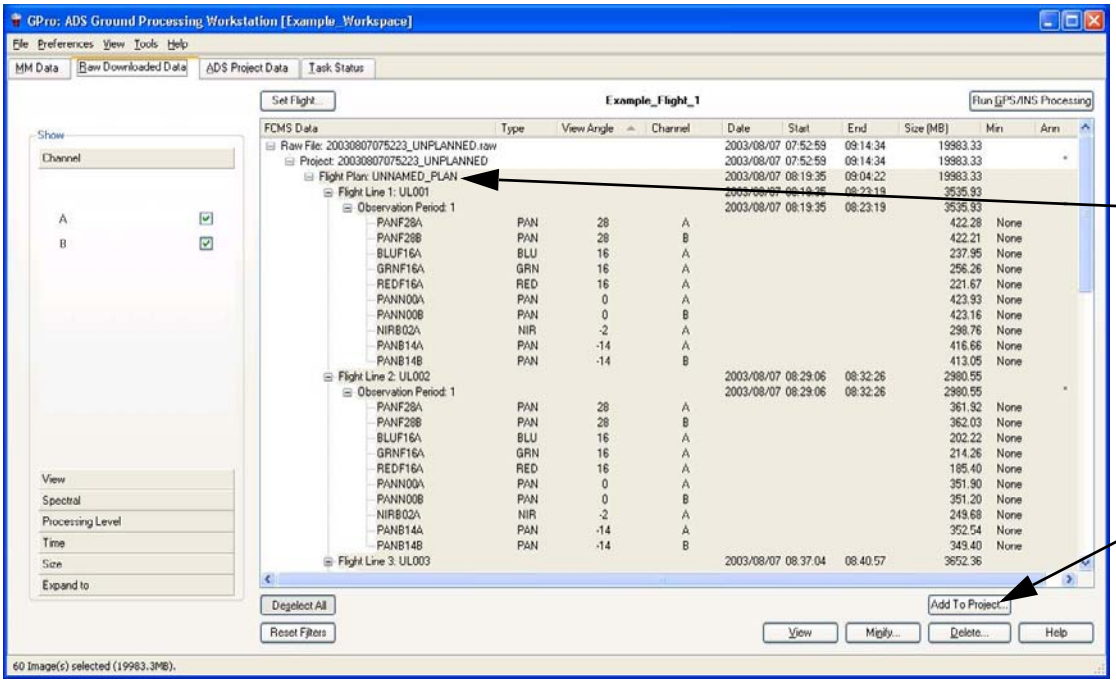
4.6 Adding Files to a Project

After the GNSS-IMU data and images have been downloaded and processed, the next step in the workflow is to georeference the images. A georeferenced image, or a Level 0 image, has had georeferencing information added to the raw image.

☞ *Once you have downloaded the images and processed the GNSS-IMU data, it is possible to run all of the After GNSS-IMU processing in one workflow, but this guide will break the workflow into its constituent parts.*

1. To view the downloaded data in the GPro Workstation, select the Raw Downloaded Data tab.

Figure 73: Raw Downloaded Data view



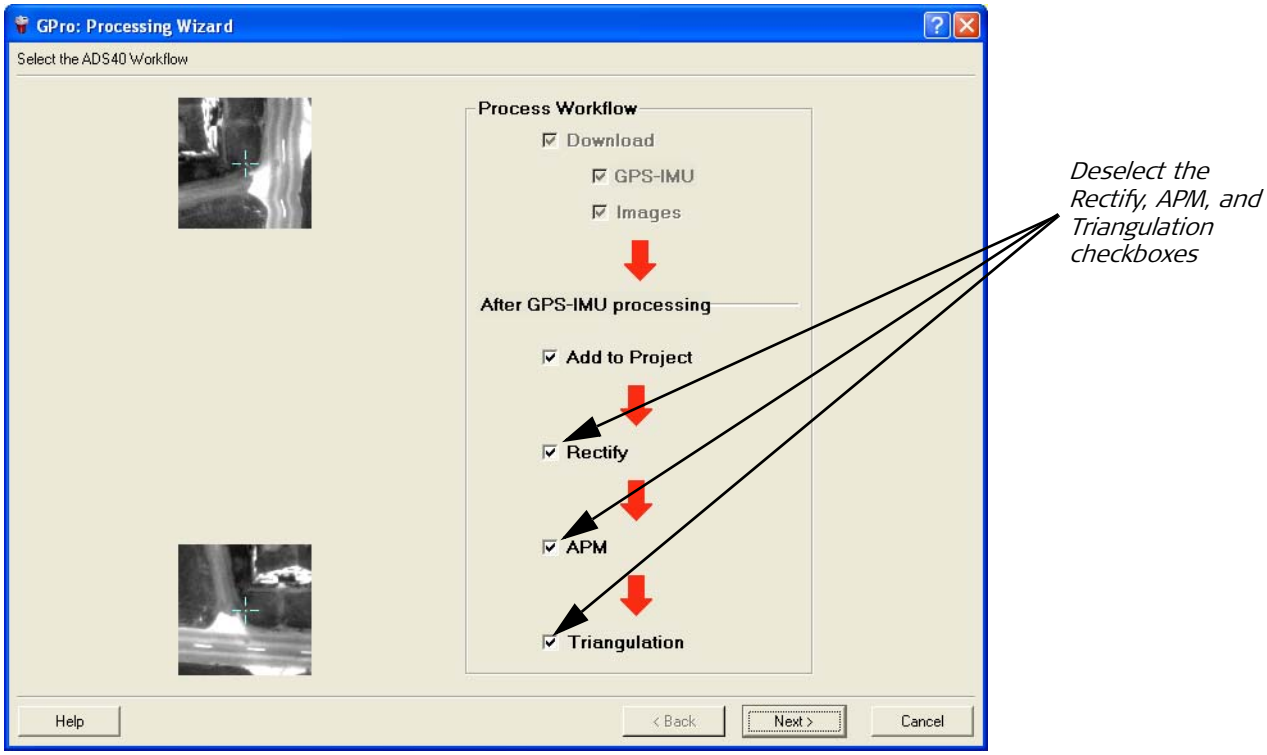
2. Select the flight, flight line, observation period, or individual lines you want to add to the project by clicking on them.

Note that when you select a line further up the project hierarchy, all of the subordinate files are automatically selected. For instance, if you click on a flight line, all of the downloaded observation periods and lines under that flight line are selected.

3. Click the **Add to Project** button.

The GPro Wizard opens to the Select the ADS40 Workflow page.

Figure 74: Select the ADS40 Workflow



The processes are logically ordered from the top down and the de-selection of a higher process will automatically switch off the ones below it. Note that downloading the GNSS-IMU is no longer enabled.

4. Deselect the **Rectify** checkbox. The **APM** and **Triangulation** checkboxes are automatically deselected.

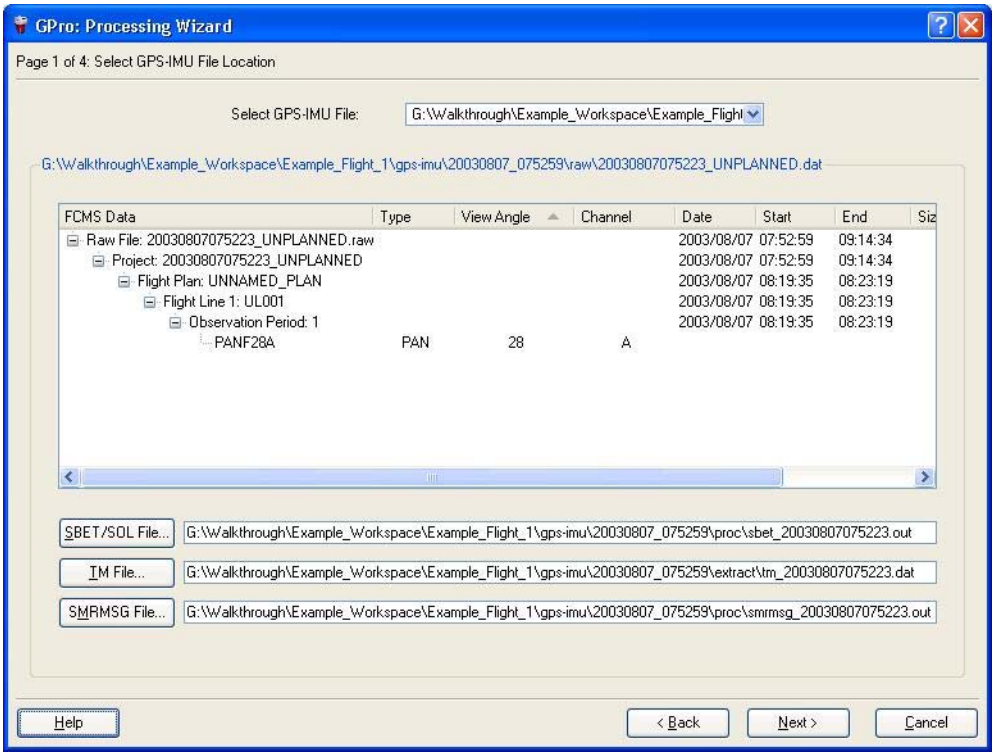
5. Click **Next**.

   The "Select GNSS-IMU Files Location" page is displayed.

Select GNSS-IMU Files Location

This wizard page asks you to locate the IPAS software output files. Specifically, you must locate the SBET or SOL, TM, and SMRMSG files.

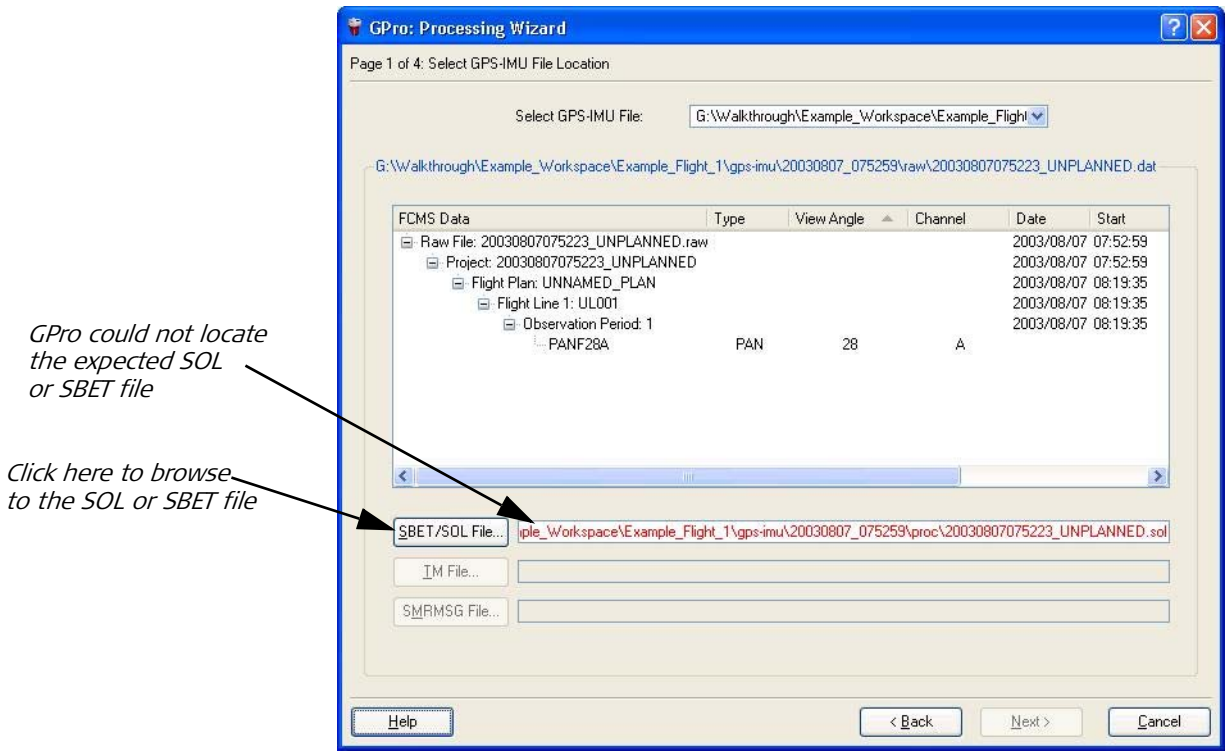
Figure 75: Select GNSS-IMU Files Location



When you downloaded the GNSS-IMU data, you also set up a GNSS-IMU data directory structure. See "Select GNSS-IMU Files Location" on page 100. After running the GNSS-IMU software you should have copied these files into the appropriate directories.

This page looks into the directories that you specified during download. If it finds the expected files with the expected file names, the file paths will be black. If the expected filenames are not found, the file paths will be red, warning you that you must locate the correct files.

Figure 76: Select GNSS-IMU Files Location, SOL/SBET Not Found



1. If the SOL or SBET file is not in the expected location, click the **SOL/SBET File...** button.

   A **File Open** dialog is opened.

2. Browse to the SOL or SBET location, select the file and click **Open**.

   When the appropriate file is chosen, GPro makes a logical guess at the location of the **TM File** and **SMRMSG File** locations. If the recommended default file naming options were followed in the processing of the GNSS-IMU data, GPro will find these files automatically.

3. If the TM file is not in the expected location, click the **TM File...** button.

   A **File Open** dialog is opened.

4. Browse to the TM File location, select the TM file and click **Open**.

5. If the SMRMS file is not in the expected location, click the **SMRMS File...** button.

   A **File Open** dialog is opened.

6. Browse to the SMRMS File location, select the SMRMS file and click **Open**.

   After GPRO can locate the SOL or SBET and TM files (the SMRMS file is optional), the **Next** button is enabled.

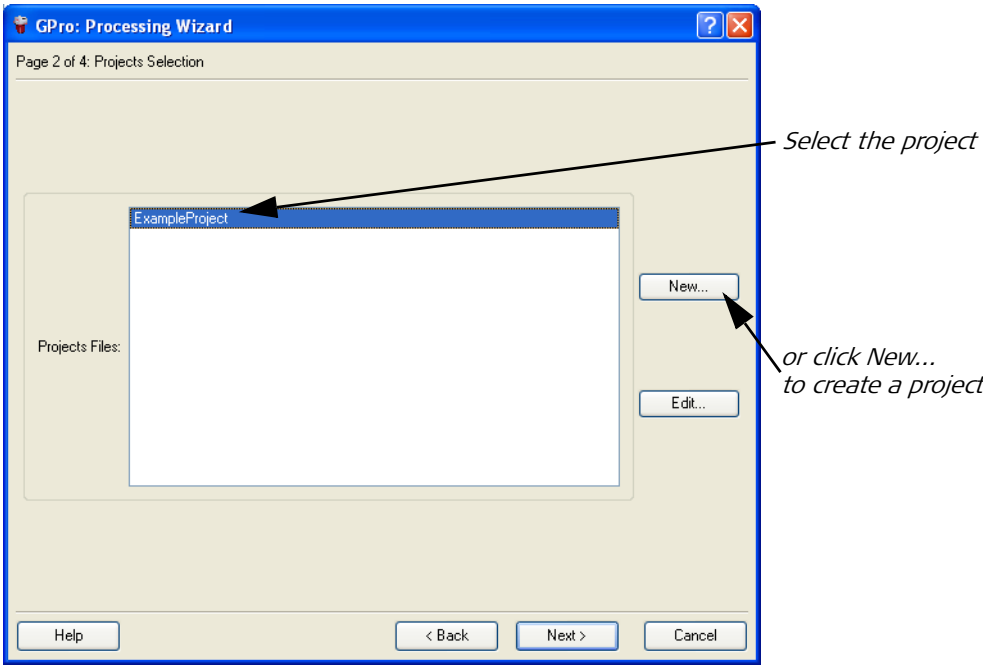
7. Click **Next**.

   The "Project Selection" page is opened.

Project Selection

This page allows you to select the ADS project to which the imagery should be added.

Figure 77: Projects Selection dialog



If you need to create a new project, skip to "Creating a New Project" below.

1. If your Project already exists, select it by clicking on it.

   You may edit the Image Location, Estimated Ground Elevation, and Project Description by clicking the **Edit...** *button. The Create/Edit Project dialog is opened.*

2. Click the **Next** button.

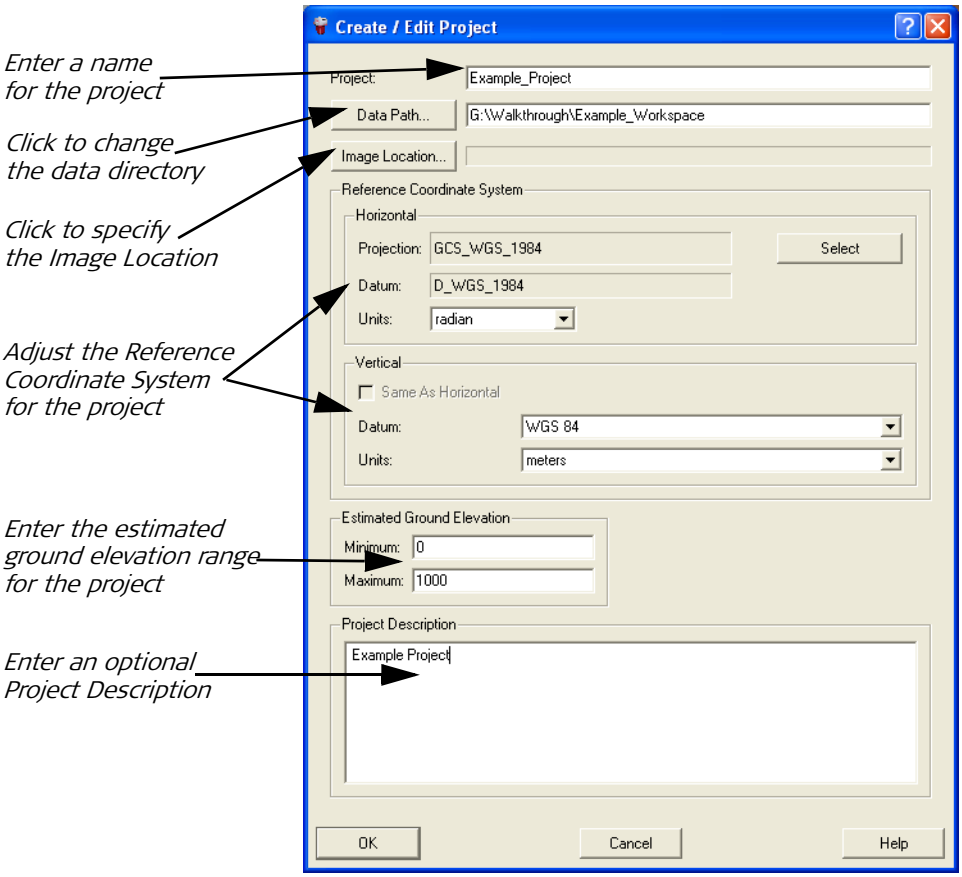
   The "Select Calibration" page is displayed.

Creating a New Project

1. If an ADS project does not exist, click the **New...** button.

   The **Create/Edit Project** dialog is opened.

Figure 78: Create/Edit Project dialog



2. Enter a name for the ADS project.

3. If you want to change the default data directory, click the **Data Path...** button.

   A **Browse For Folder** dialog is opened.

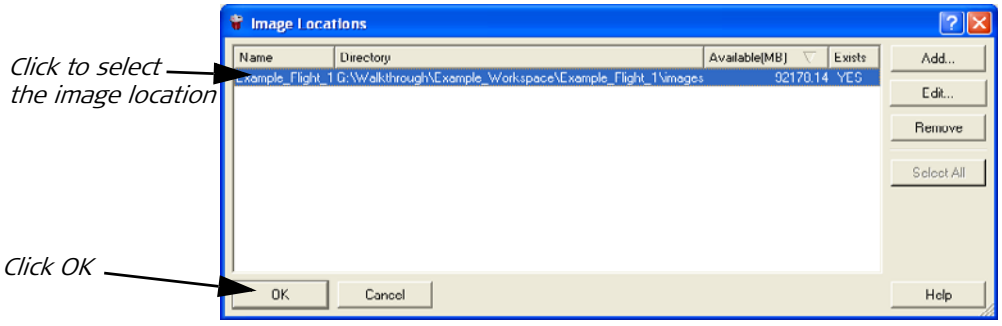
4. Browse to the data directory and click **OK**.

   The **Browse For Folder** dialog is dismissed and the **Data Path** field is updated to reflect the new data directory.

5. Click the **Image Location...** button.

   The **Select Image Locations** dialog is opened.

Figure 79: Select Image Locations dialog



The Image Location is the directory in which the new L0 images will be created.

6. Select the Image Location by clicking on it.

For information on how to add a new image location, see step 6. in "Flight Selection" on page 98.

7. Click **OK**.

The **Select Image Locations** dialog is dismissed and the **Image Location** field is updated.

8. Adjust the **Reference Coordinate System** settings to reflect the needs for your project.

You can change the horizontal projection by clicking the **Select** *button.*

9. Enter the **Estimated Ground Elevation** for your project.

The Estimated Ground Elevation Min and Max are conservative estimates that must fit between the actual minimum and maximum elevation values.

The Estimated Ground Elevation should be in the same units as is displayed in the Vertical Units just above.

10. Enter an optional **Project Description**.

11. Click **OK**.

The **Create/Edit Project** dialog is closed. GPro will create an ADS Project and return to the **Project Selection Page** wizard.

Project Selection

1. Select the ADS project into which you will be adding images by clicking on it.

You may edit the Image Location, Estimated Ground Elevation, and Project Description by clicking the **Edit...** *button. The Create/Edit Project dialog is opened.*

2. Click the **Next** button.

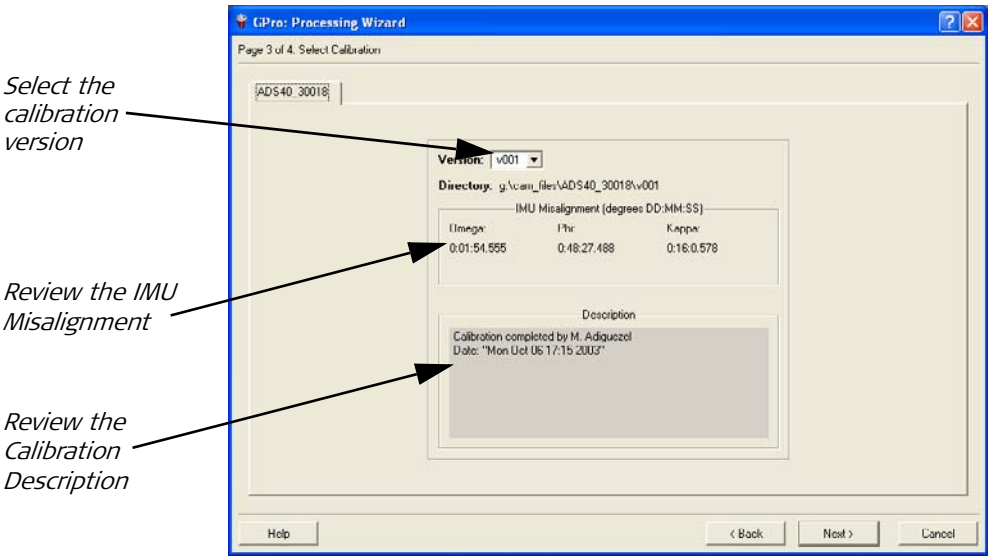
The "Select Calibration" page is displayed.

Select Calibration

This wizard page displays the calibration information for the ADS that will be used when calibrating the imagery.

For more information on obtaining and installing calibration files, see "Installing ADS Calibration Files" on page 17.

Figure 80: Select Calibration



GPro analyzes each the selected images and determines which sensors were used to capture the imagery. Each sensor that was used will have its own tab on the Select Calibration page.

If the Calibration Information does not display, you may need to adjust the location of the calibration files in the GPro Preferences. See "Installing ADS Calibration Files" on page 17 for more information.

1. Select the version of the calibration file that should be used in calibrating the imagery. By default, the most current calibration file is selected.

   For best results, you should always choose a calibration file whose date precedes the date of image capture.

2. Review the IMU Misalignment figures for accuracy.
3. Review the Calibration Description.
4. If necessary, change the Calibration Version by selecting the correct file from the popup list.
5. Click **Next**.

   The calibration files will be copied into the Project directory.

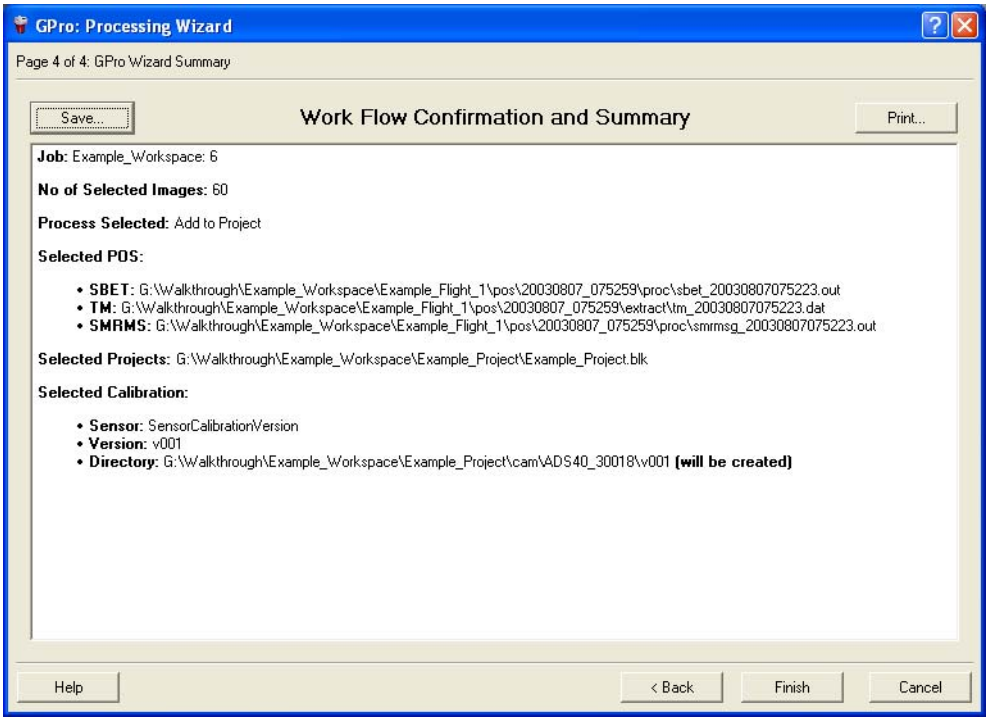
   The "GPro Wizard Summary" page is displayed.

GPro support files always reference camera calibration files that reside within the project.

GPro Wizard Summary

The final wizard page is a summary page. It is displayed at the end of each wizard and summarizes all of the selections you made while you were completing the wizard.

Figure 81: GPro Wizard Summary



1. To save backup of the Summary, click the **Save...** button.
2. To print the Summary for your files, click the **Print...** button.
3. Click **Finish** to accept all of the settings and begin processing the data.

   The **Task Status** view is opened and the processing progress is displayed.

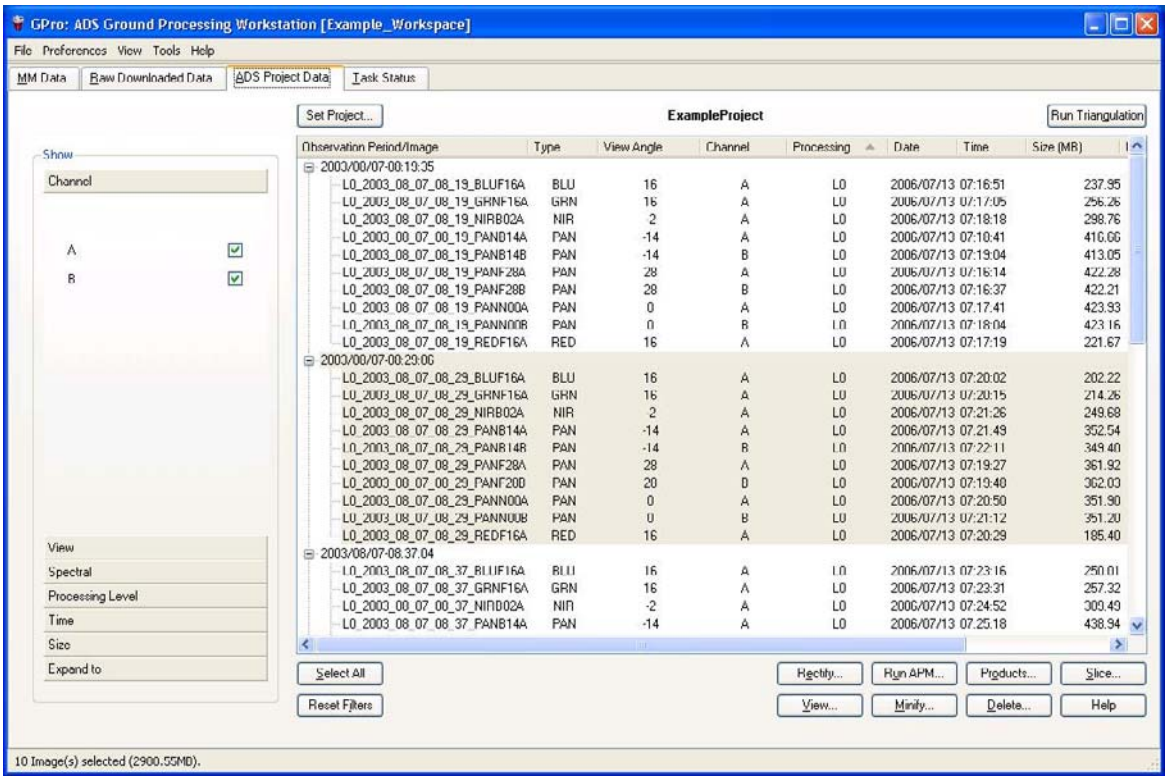
   The GPro software will analyze the TM, SBET, SOL and SMRMSG files for gaps and consistency, create an interior orientation file for each image, and generate a Level 0 file for each of the selected images.

4.7 Rectifying Imagery

Once you have a Level 0 (georeferenced) image, the next step is to create a Level 1 (rectified) image. This step will take the georeferenced image and will attempt to correct the image distortions caused by aircraft motion and rectify the image to a plane. This process will also resample the image and rotate it in the epipolar direction for stereo viewing.

1. Click on the **ADS Project Data** tab to display the ADS Project Data view.

Figure 82: ADS Project Data view

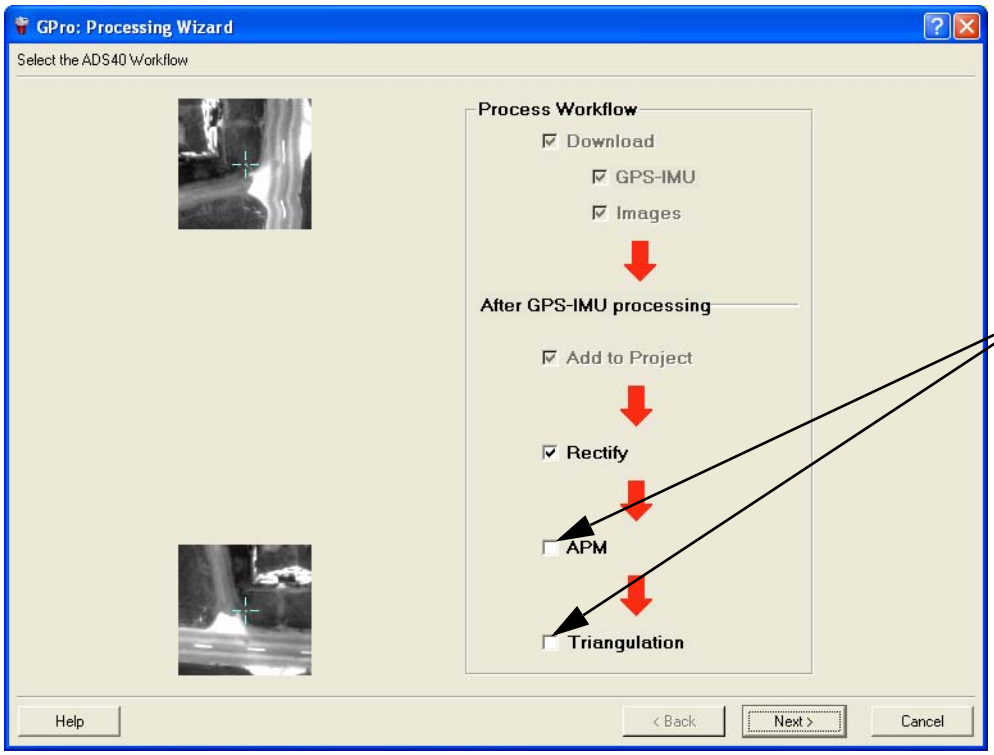


2. Select only the Level 0 images you want to rectify.

The Level 0 images have either the L0 prefix or suffix, depending on the Process Level file naming preferences set in the "File Naming Preferences" on page 101.

3. Click the **Rectify...** button.

Figure 83: Select the ADS40 Workflow



The ADS Workflow processes are logically ordered from the top down and the de-selection of a higher process will automatically switch off the ones below it. Note that the **Download the GNSS-IMU and Images** and **Add to Project** workflows are no longer enabled.

4. Deselect the **APM** checkbox by clicking on it. The **Triangulation** checkbox is automatically deselected.

5. Click **Next**.

   The "Product Selection" page is displayed.

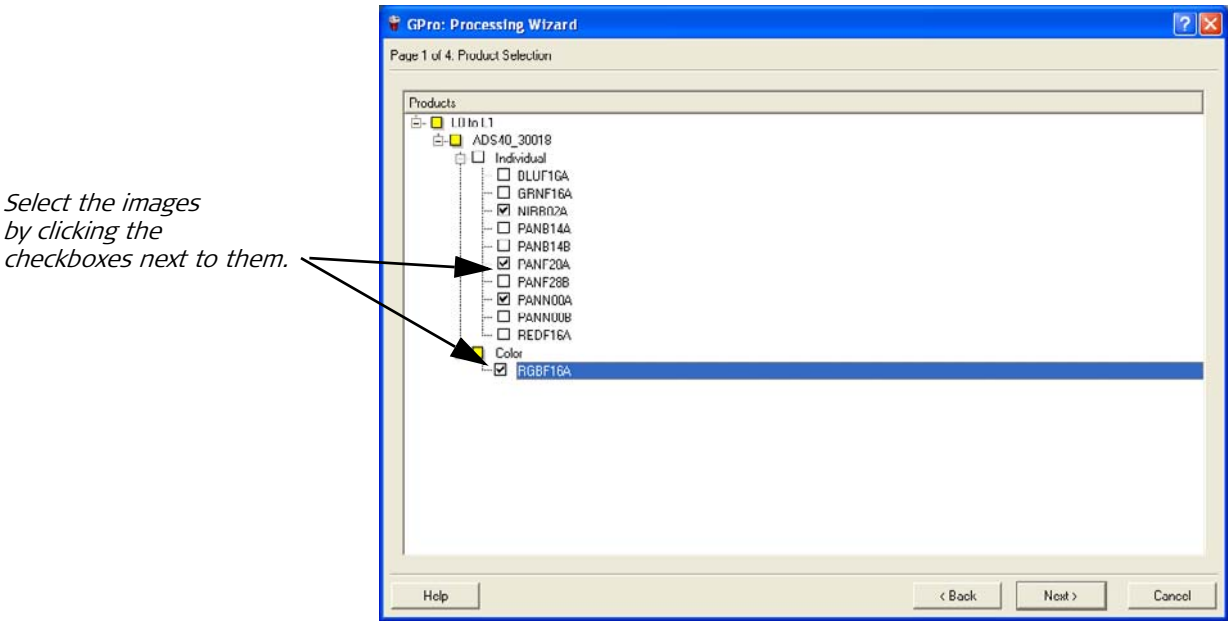
Product Selection

This page allows you to select which products you want to output. The available output products will depend upon which images were selected in the ADS Project Data view.

In addition to being able to output individual rectified images, you may also choose to merge the Red, Green, and Blue lines from the same sensor angle into a Level 1 RGB image.

Selecting the **Individual** checkbox will select all of the images in its hierarchy.

Figure 84: Product Selection dialog



6. Select the Products you would like to output by checking the checkboxes.

Selecting the **Individual** *checkbox will select all of the images in its hierarchy.*

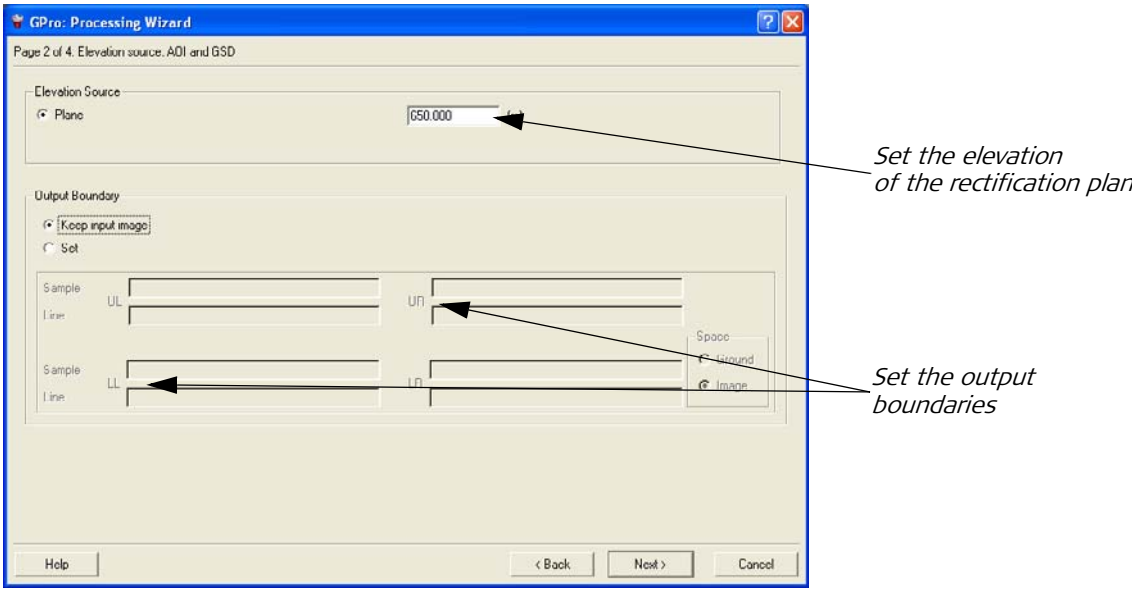
7. Click **Next**.

   The "Elevation Source, AOI, and GSD" page is displayed.

Elevation Source, AOI, and GSD

This wizard page allows you to specify the planar elevation to which the image will be rectified and define the boundary of the output image.

Figure 85: Elevation Source, AOI, and GSD dialog



8. Set the elevation of a plane to which the image(s) should be rectified. If you know the approximate ground elevation of the images, you should enter it here.

The default elevation is the average terrain height of the project you entered when "Creating a New Project" on page 109.

9. If you want to rectify the entire image extent, select **Keep input image** as the Output Boundary.

10. If you want to specify a subset of the input image, select the **Set** radio button and then enter the file coordinates for the four output corners.

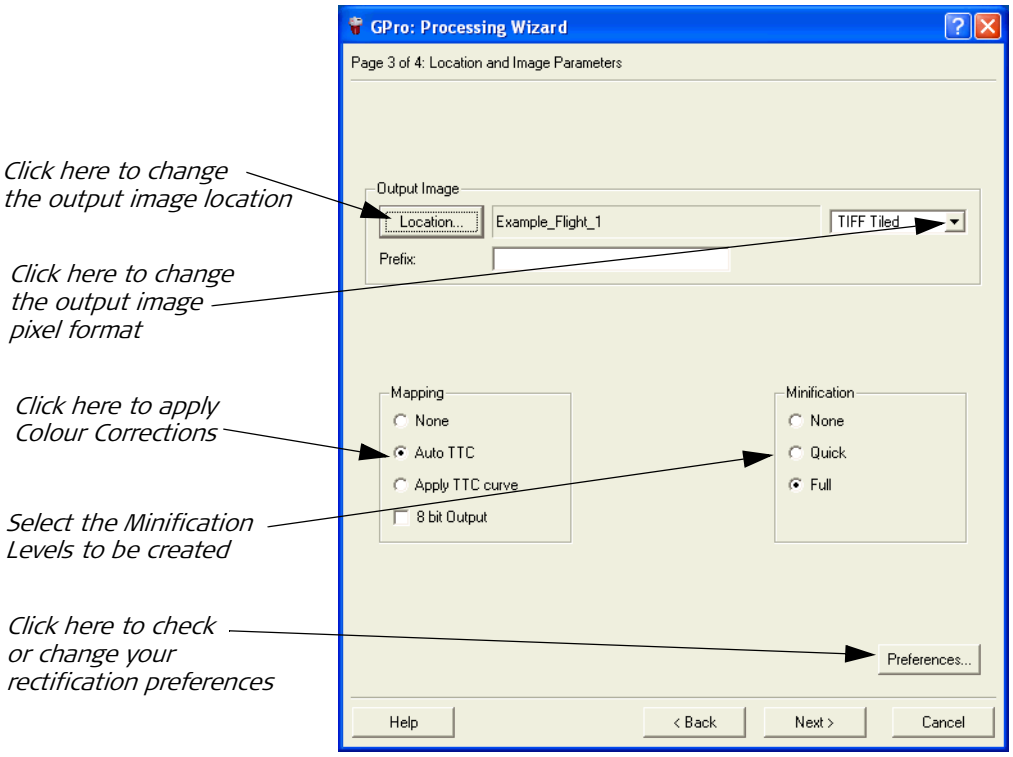
11. Click **Next**.

    The "Location and Image Parameters" page is opened.

Location and Image Parameters

This wizard page allows you to define the format of the output images and where they will be saved. You may also choose to generate some minification levels (these are required if you plan to run APM on the images) and to perform some colour mapping corrections to the output imagery.

Figure 86: Location and Image Parameters dialog

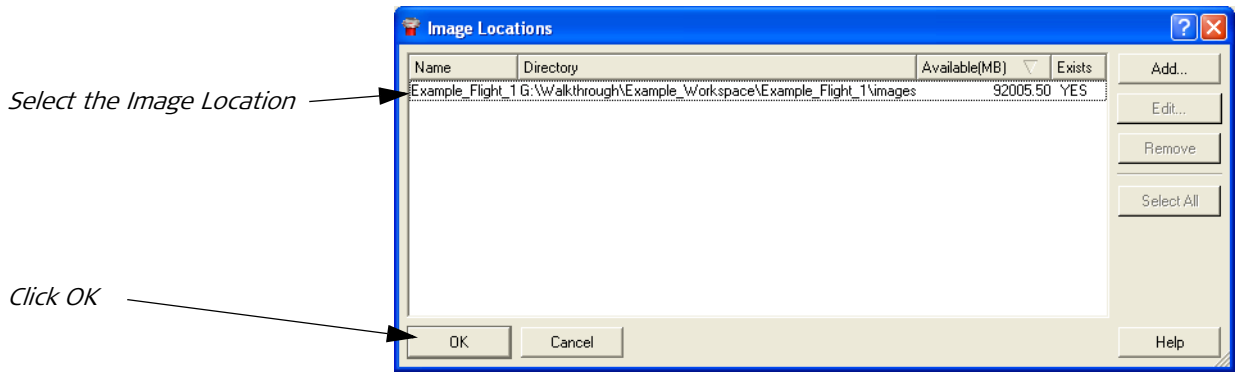


Changing Image Locations

1. To change the location of the output images, click the **Location...** button.

   The **Image Locations** dialog is opened.

Figure 87: Image Locations dialog



2. Select the Image Location you would like to use by clicking on it.
3. Click **OK**.

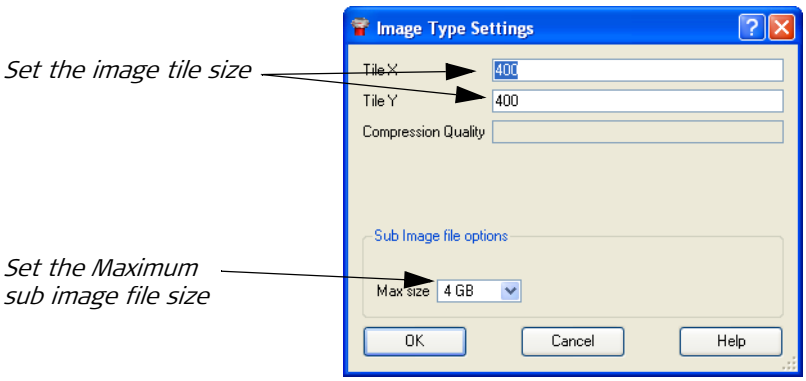
Changing the Output Image Pixel Format

1. To change the Output image pixel format, select a file type from the Output Image popup list.

   The Image Type Settings dialog is opened. This dialog lets you define the format and size of the output image pixels.

   The output image is always an .ads file. Changing the output image pixel format only changes the format of the individual pixels, not the actual output file.

Figure 88: Image Type Settings dialog



2. Set the image tile size in the X and Y directions.
3. Select the maximum sub image file size from the popup list.

   To be able to place your output images on CD, select 650 MB from the Max size popup list.

4. Click **OK**.

   The Image Type Settings dialog is dismissed and you are returned to the Location and Image Parameters page of the wizard.

1. Optionally, select **Apply TTC** to apply a tonal transfer curve to the output image.

See "Set Rectification Preferences - General" on page 39 to change the tonal transfer curve settings.

2. Optionally, select **8 bit Output** to convert the 16-bit ADS output to an 8 bit image.

3. Select the **Minification Levels** that you want to create with the output image.

Minification Levels are necessary for running APM.

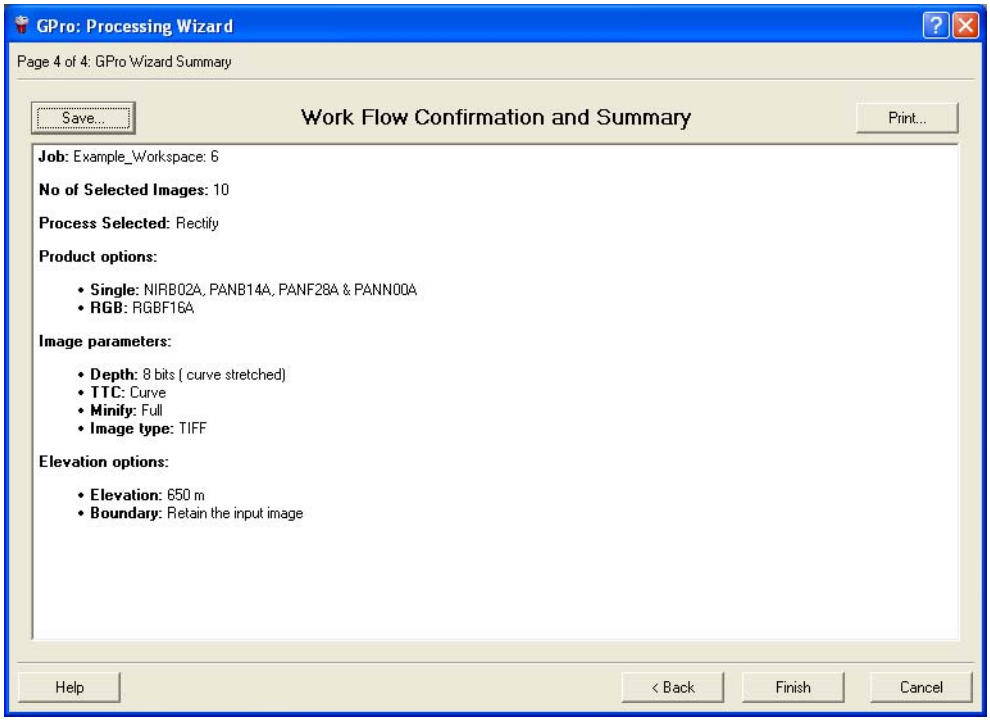
4. Click **Next**.

The "GPro Wizard Summary" page is displayed.

GPro Wizard Summary

The final wizard page is a summary page. It is displayed at the end of each wizard and summarizes all of the selections you made while you were completing the wizard.

Figure 89: GPro Wizard Summary



1. To save backup of the Summary, click the **Save...** button.

2. To print the Summary for your files, click the **Print...** button.

3. Click **Finish** to accept all of the settings and begin processing the data.

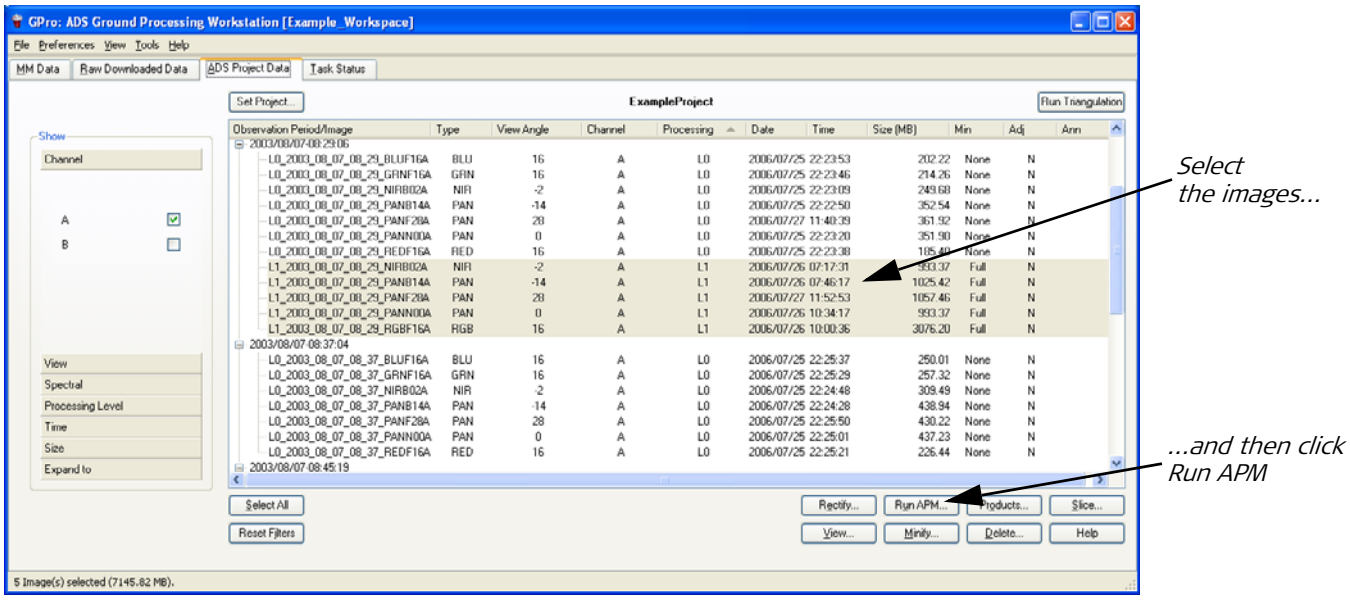
The **Task Status** view is opened and the processing progress is displayed.

4.8 Running APM

This wizard specifies the parameters for running the automatic point measuring (APM) process. This process will triangulate points on multiple ADS strips to achieve a better correlation between the points on each image.

Full minification layers must be present to run the APM algorithm.

Figure 90: Select Images



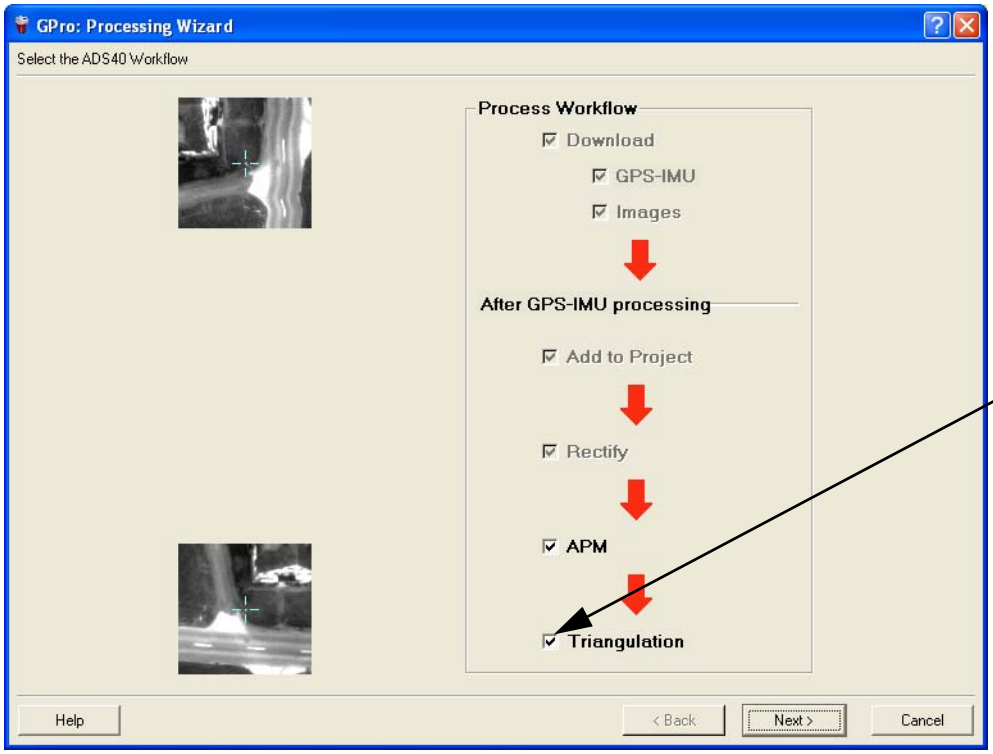
1. Select the block of images to be used in the APM process.

   You will be able to specify exactly which Observation Periods will be matched in the APM Wizard.

2. Click the **Run APM** button.

   The GPro Wizard opens to the Select the ADS40 Workflow page.

Figure 91: Select the ADS40 Workflow



To automatically start ORIMA after running APM, leave the Triangulation box checked.

3. To automatically launch ORIMA and run CAP-A for triangulation measurement and bundle bock adjustment, leave the **Triangulation** box checked.

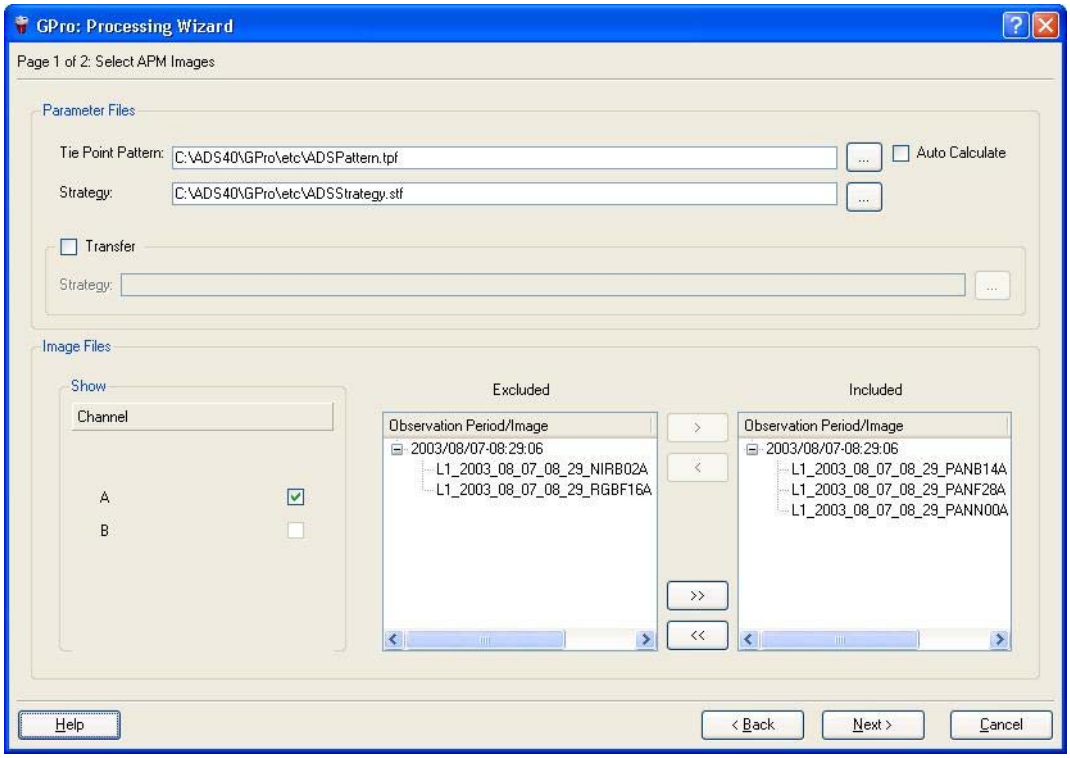
4. Click **Next**.

   The "Select APM Images" page is displayed.

Select APM Images

This page of the wizard allows you to specify the parameter files to be used in the APM process and to select the Observation Periods to be matched.

Figure 92: Select APM Images



1. Enter the path to the **Tie Point Pattern** file to use in APM or browse to the file location. By default, GPro will use ADSPattern.tpf, which is distributed with the software.

   The Tie Point Pattern file may be edited in any text editor.

   For more detailed instructions on Tie Point Patterns, refer to the ORIMA documentation.

2. Enter the path to the **Strategy** file to use in APM or browse to the file location. By default, GPro will use ADSStrategy.stf, which comes bundled with the software.

   The Strategy file may be edited in any text editor.

   For more detailed instructions on Strategies, refer to the ORIMA documentation.

3. You may optionally use the Transfer section to specify a different Strategy file used when measuring points measured between strips.

4. To include an image in the APM process, select it by clicking on it in the list of **Excluded** images.

5. Click the › button to move the select image to the **Included** list. Click the ›› button to include all of the images.

The panchromatic observation periods are best suited for APM processing.

By default, a panchromatic line is chosen for each of the forward, nadir and backward lines, if available.

6. In the list of **Included** images, select only the images from the nadir observation periods.

For ADS scenes it is usually sufficient to apply the pattern to the nadir lines only. This will reduce time required for APM processing.

7. Under **Pattern**, click the **Selected** radio button. This will apply the Tie Point Pattern to only the selected nadir line and save processing time.

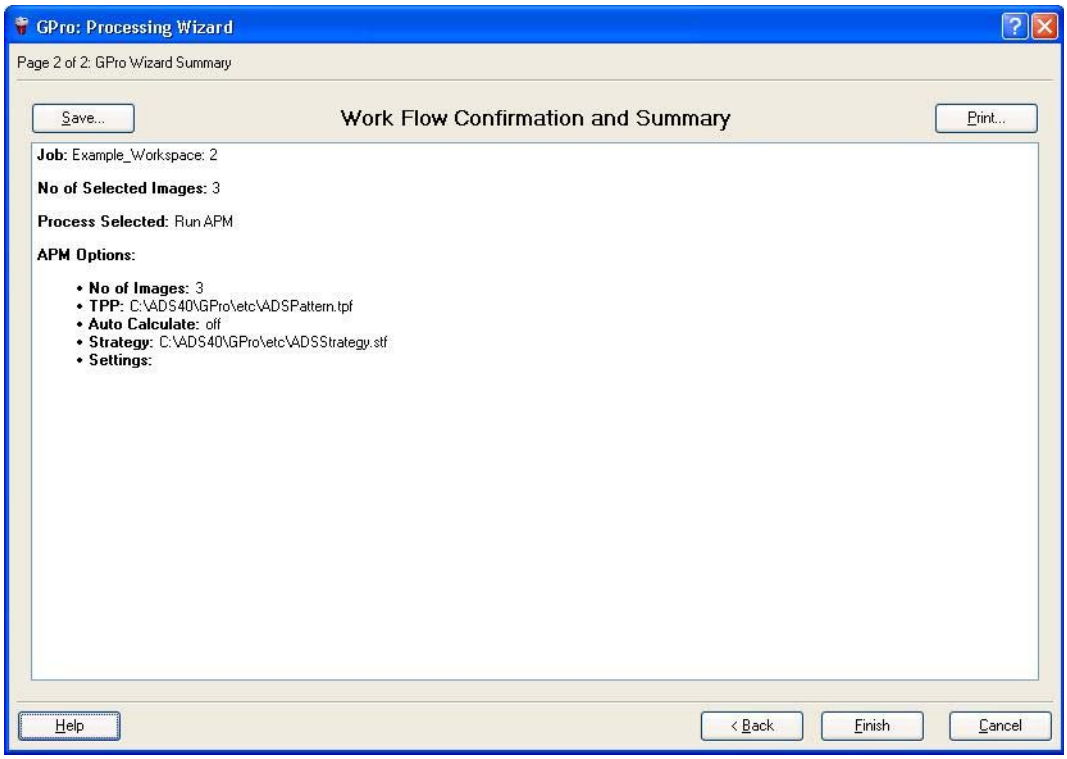
8. Click **Next**.

   The "GPro Wizard Summary" page is displayed.

GPro Wizard Summary

The final wizard page is a summary page. It is displayed at the end of each wizard and summarizes all of the selections you made while you were completing the wizard.

Figure 93: GPro Wizard Summary



1. To save backup of the Summary, click the **Save...** button.

2. To print the Summary for your files, click the **Print...** button.

3. Click **Finish** to accept all of the settings and begin processing the data.

   The **Task Status** view is opened and the processing progress is displayed.

If you selected the **Run Triangulation** checkbox, ORIMA will open when APM has finished processing.

4.9 Triangulating Imagery

There are two main reasons that you would want to run aerial triangulation on you imagery; one is to increase the georeferencing accuracy of your imagery and the other is to self-calibrate the ADS sensor.

You can use the ORIMA software to accomplish both of these tasks.

Aerial triangulation of imagery will typically increase the georeferencing accuracy of both Level 0 and Level 1 ADS images by providing powerful blunder detection, and calculating numerous control points to assure that your georeferencing has the best possible fit. Triangulation uses the thousands of image points calculated during APM to add a rigorous redundancy check to the georeferencing calculation. Because triangulation will write the orientation data to both the Level 0 and Level 1 images, it is an important step in creating orthorectified imagery which is as accurate as possible.

Calibration of the ADS sensor corrects for IMU misalignment and principal point offset errors and is critical to improving the initial accuracy of Level 0 images. The initial self-calibration is performed at the factory, but you may need to run this self-calibration if something happens that might cause you to suspect that the sensor is misaligned.

You may need to run a self-calibration if the IMU or focal plane is remounted or jarred.

Launching ORIMA

To launch ORIMA from GPro, click the **Run Triangulation** button on the ADS Project Data View.

For detailed instructions on running ORIMA, please refer to the ORIMA documentation.

To add support files to ORIMA, highlight the desired images in the ADS Project Data view or the Windows Explorer and drag them into ORIMA.

When ORIMA has completed the aerial triangulation, the supporting orientation data for the Level 1 and original Level 0 images are automatically updated.

If a self-calibration is run, then adjusted calibration files are also created that can be added to the factory calibration files for future projects.

4.10 Orthorectifying Imagery

One difference between Level 1 (L1) imagery and Level 2 (L2) imagery is that rather than being projected to a plane and aligned with the epipolar axis, L2 imagery is orthorectified and aligned to North (or some other user-defined orientation).

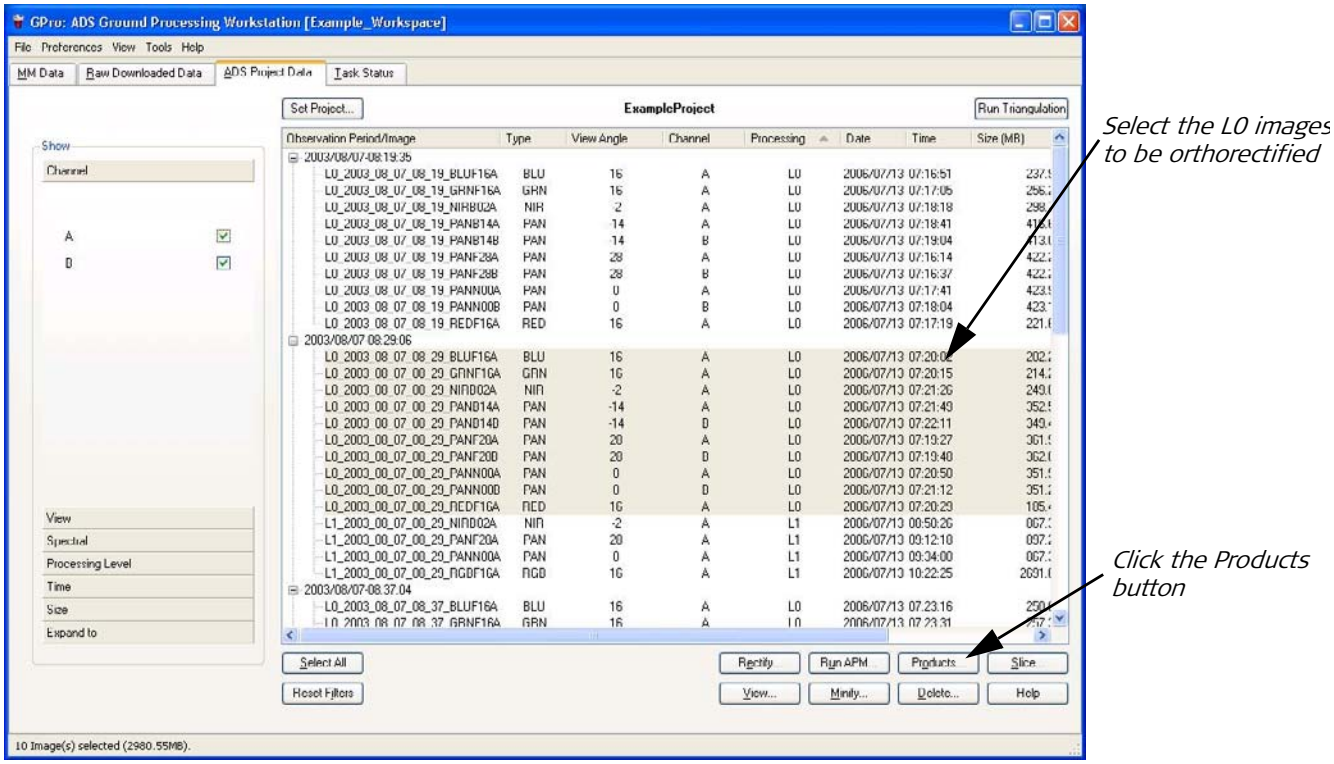
In most cases, it is undesirable to orthorectify imagery that has already been resampled, such as imagery that was generated in the L1 image creation process. Therefore, you will usually only orthorectify Level 0 (L0) images.

For best results, you should also perform aerial triangulation on your imagery. Orientation information is included in the L0 data, so it will be used in the orthorectification process.

For more information on triangulation, see "Triangulating Imagery" on page 124.

GPro uses a wizard to step you through the orthorectification process.

Figure 94: Select the Images for Orthorectification



1. Select the observation periods you want to include in the orthorectification process in the ADS Project Data tab.

In most cases, it is undesirable to orthorectify imagery that has already been resampled, like the imagery that was generated in the L1 image creation process. Therefore, you will usually only select L0 images to be orthorectified.

The triangulation information gathered if you triangulated your imagery as described in "Triangulating Imagery" on page 124 will be used when you orthorectify your L0 images.

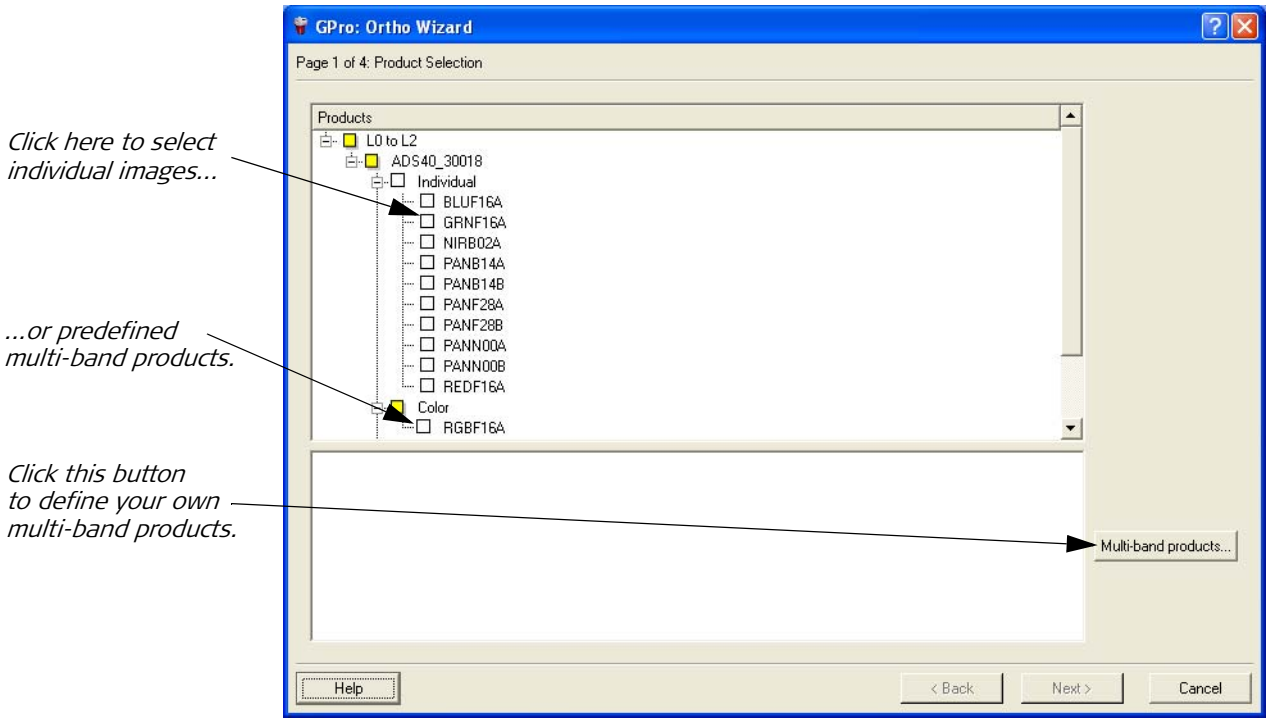
2. Click the **Products** button.

   The Ortho Wizard is opened to the "Product Selection" page.

Product Selection

The first Ortho Wizard page (Figure 95) indicates the **Products** that can be generated from the selected images.

Figure 95: Product Selection



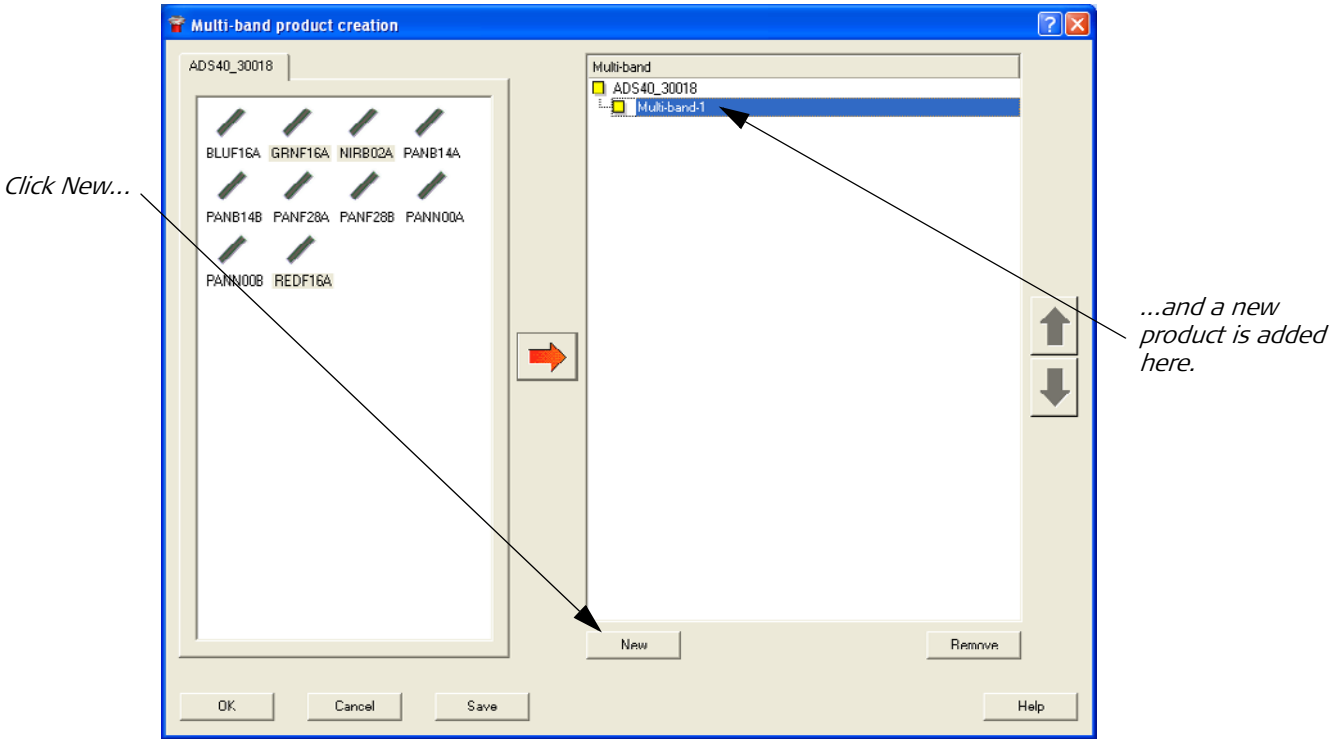
1. Select individual bands by placing a check mark next to the bands you would like to orthorectify.
2. Selecting the Colour RGB check box will create an orthorectified RGB image from the Red, Green, and Blue lines that were captured along the same angle.
3. Clicking the **Multi-band products** button allows you to combine multiple strips into a multi-band orthorectified image to fit your specific needs.

Creating Custom Multi-band Products

The multi-band products are displayed on this wizard page and are listed in the lower portion of the Product Selection page; see Figure 95. These products are stored within the registry and are loaded at runtime.

1. Click on the **Multi-band products** button.
2. The Multi-band Product Creation dialog is opened.

Figure 96: Multi-band Product Creation

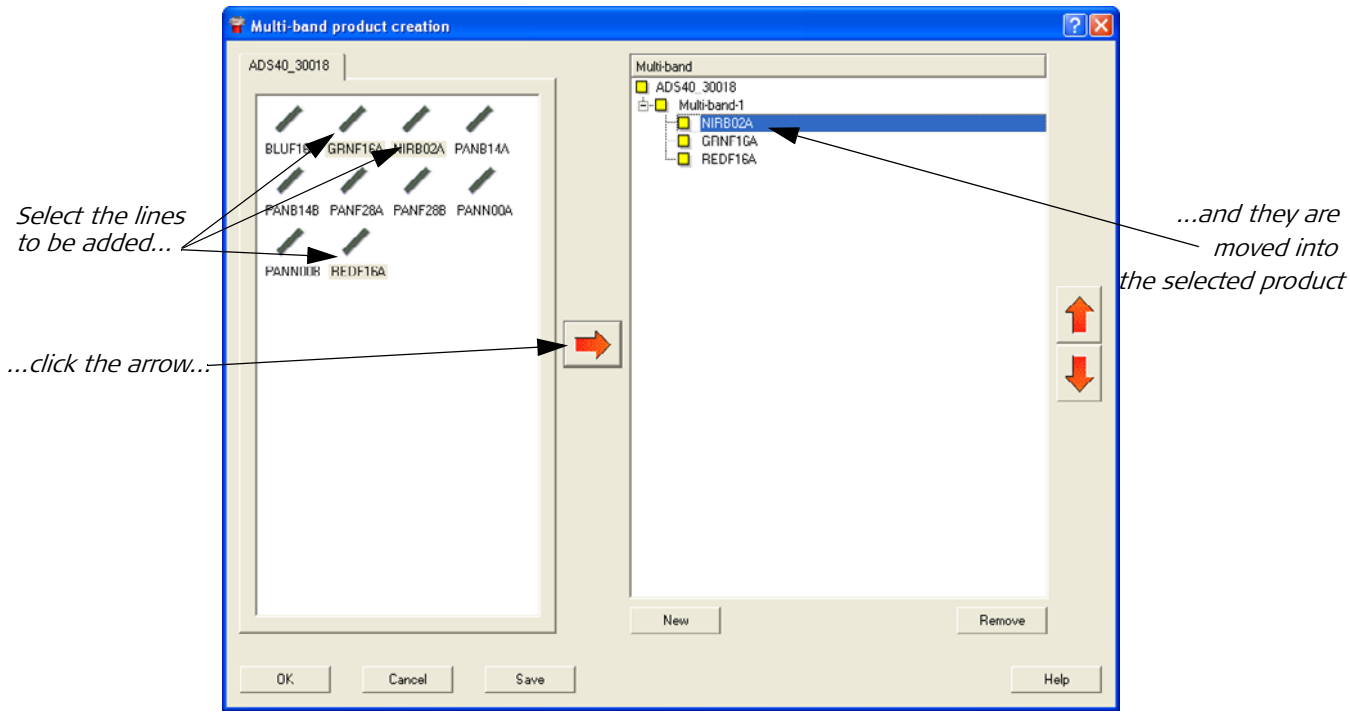


The Multi-band Product Creation dialog (Figure 96) enables you to define your own customized ortho products.

3. Click the **New** button to define a new multi-band product.

   A new product is added to the Multi-band list.

Figure 97: Adding bands to the Product



4. Select the CCD lines you would like to include in the new product by clicking on them in the ADS Sensor tab.

5. Click the button to add the selected lines to the current product.

6. Use the and buttons to rearrange the order of the CCD lines. The top-most line in the list will be associated with Band 1, the next line with band 2, and so on.

7. In the Multi-Band view, click on the name of the new Product (this usually defaults to something like Multi-band-1) to select it.

8. Click on the selected name again. The text should become editable.

9. Type the desired name for the new product. Press **Enter** to accept the new name.

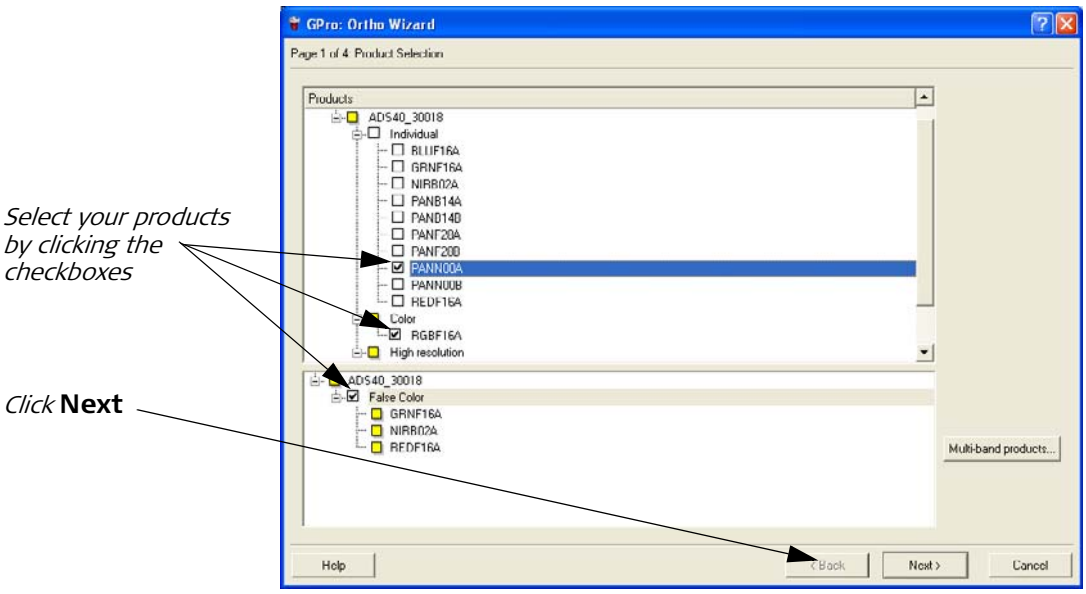
10. Click **Save** to save the current list of Multi-band products.

11. Repeat step 3. through step 10. until you have created all of your products.

12. When you have finished creating products, click the **OK** button.

    You are returned to the Product Selection dialog.

Figure 98: Selecting Ortho Products



13. Select the Ortho products you would like to create placing a checkmark in the checkbox next to them.

14. Click **Next**.

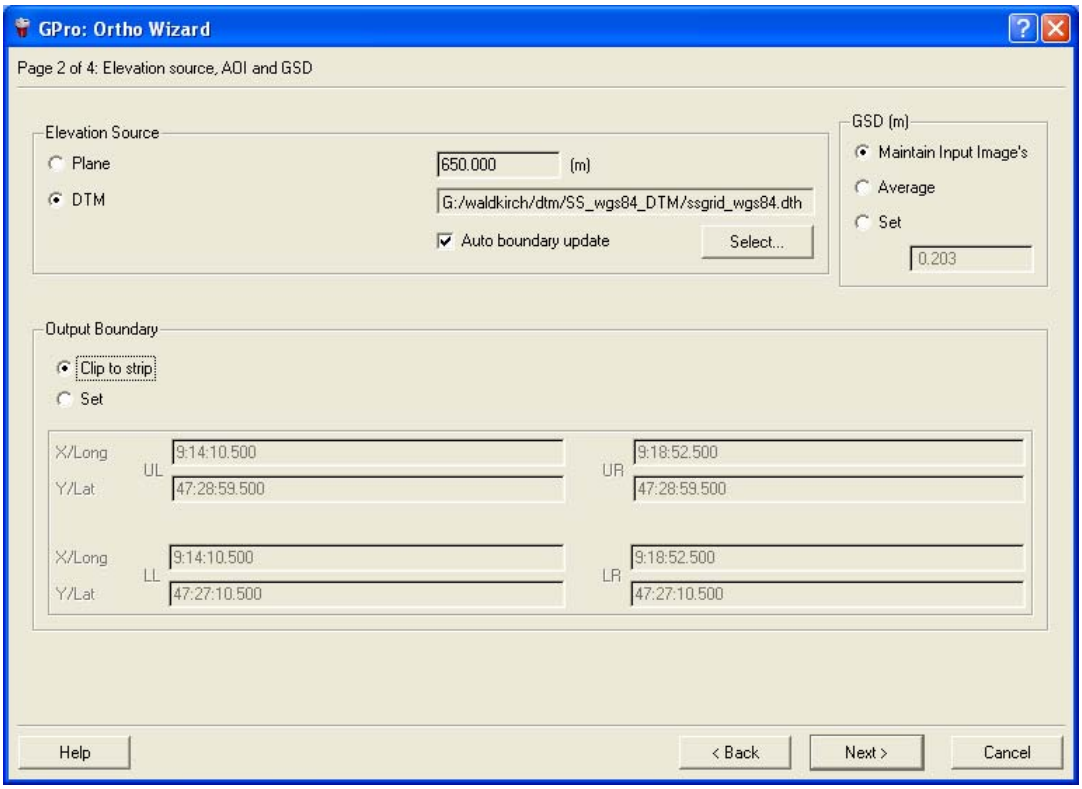
    The "Elevation Source, AOI, and GSD" dialog is displayed.

Elevation Source, AOI, and GSD

This wizard page allows you to specify the source of the elevation data to which the image will be orthorectified, select the output Ground Sampling Distance (GSD), and define the boundary of the output image.

If there is no DTM specified, or if the selected DTM is not valid, the **Select...** *button will be in red.*

Figure 99: Elevation source, AOI and GSD



Elevation Source This portion of the dialog allows you to set the source of the elevation data to be used during the orthorectification.

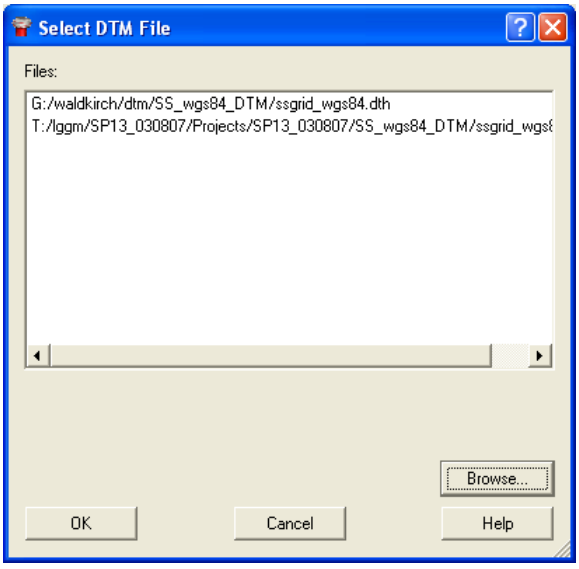
For orthorectification, it is preferable to use a DTM as the Elevation Source. If you do not have a DTM, you may specify an elevation value to use for planar rectification.

1. Click **Select...** to specify the DTM to use during orthorectification.

   The Select DTM File dialog is opened. This dialog displays all of the valid DTM files associated with the selected project.

A DTM can be a Digital Elevation Model (DEM) or Triangulated Irregular Network (TIN) file. It must be in .pro, .img or .ltf format. The selected DTM must cover the entire extent of the image area that is being rectified.

Figure 100: Select DTM File dialog



The minimum value in the DTM is used to calculate the footprint of the ortho-photo area. If the minimum value is outside of the min-/max- height specifications of the project the user is asked to choose the correct minimum height. See section "3.50 Select DTM File" for details.

The DTM file must be in the same geographic coordinate system as the selected project to be considered a valid DTM.

It is important that the Figure Of Merit (FOM) values for the DTM "posts" are not set to "Out of boundary" or to "Zero" for the rectification area. Depending on the source of the DTM the FOM values may have been assigned to the DTM automatically during the correlation, manual editing or import processes.

2. If you do not see a suitable DTM, click **Browse...** and locate the correct file.
3. Select the DTM file you want to use as the elevation source by clicking on it in the Select DTM File dialog.
4. Click **OK** to use the selected file.

You are returned to the Elevation source, AOI and GSD dialog. Note that the selected file is now displayed in the DTM File field.

GSD

5. Select one of the three methods for calculating the Ground Sample Distance you would like to have in your output file.

See "GSD" on page 76 for more information on the GSD options.

With selection of an elevation plane the output boundary must be defined and, as a consequence, the **Set** radio button is enabled. Input the coordinates in the geographic system of the project.

6. If you would like the output to be the intersection of the selected strip and the DTM, select the **Clip to Strip** radio button. (This is the default setting.)

This setting will orthorectify only the intersection of the strip and the DTM.

7. If you would like to manually specify the coordinates for the output image, select the **Set** radio button and enter the coordinates in the number fields.

This setting will orthorectify the entire area defined by the boundary coordinates.

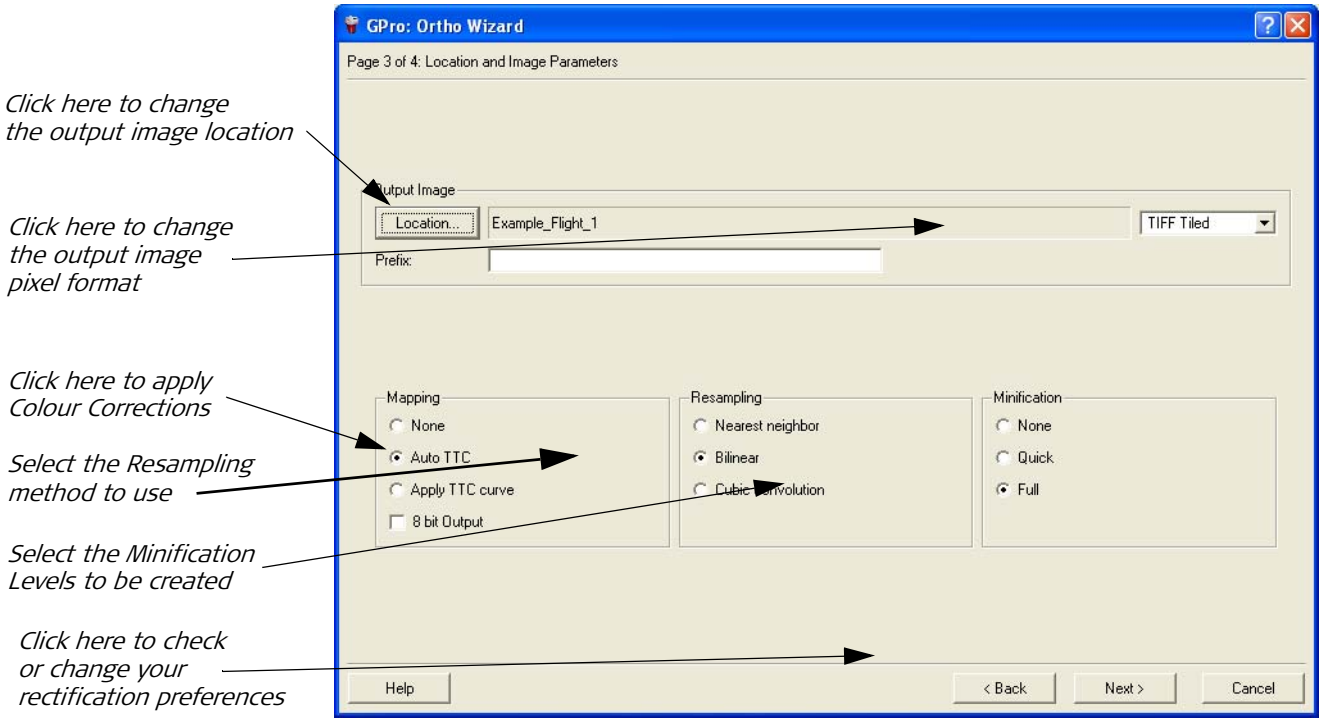
8. Click **Next**.

The "Location and Image Parameters" dialog is displayed.

Location and Image Parameters

This Wizard page allows you to define the location of the output image and its format. You may also choose to Apply colour corrections, select the resampling method, and generate minification levels.

Figure 101: Location and Image Parameters dialog

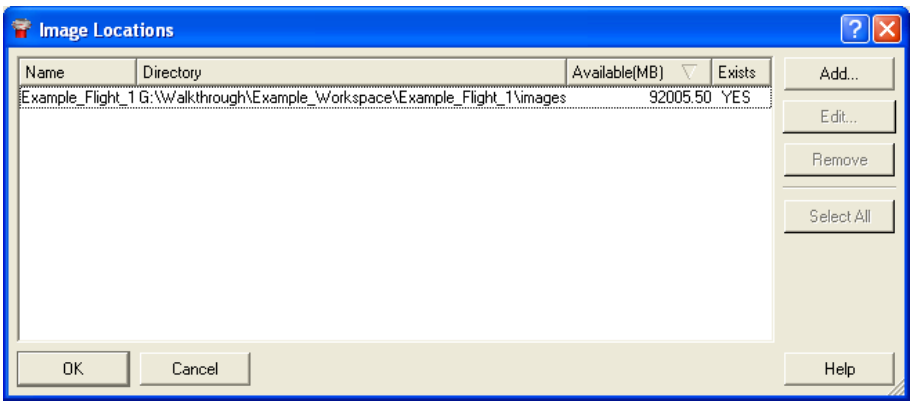


Changing Image Locations

1. To change the location of the output images, click the **Location...** button.

The "Image Locations" dialog is opened.

Figure 102: Image Locations dialog



2. Select the Image Location you would like to use by clicking on it.
3. Click **OK**.

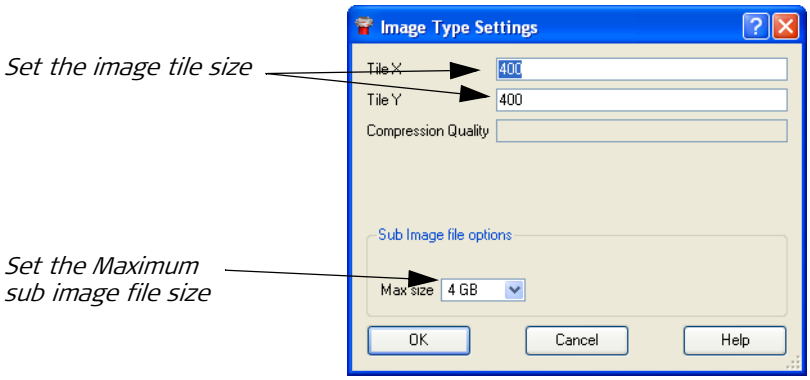
Changing the Output Image Pixel Format

1. To change the Output image pixel format, select a file type from the Output Image popup list.

   The "Image Type Settings" dialog is opened. This dialog lets you define the format and size of the output image pixels.

   The output image is always an .ads file. Changing the output image pixel format only changes the format of the individual pixels, not the actual output file.

Figure 103: Image Type Settings dialog



2. Set the image tile size in the X and Y directions.
3. Select the maximum sub image file size from the popup list.

   To be able to place your output images on CD, select 650 MB from the Max size popup list.

4. Click **OK**.

   The Image Type Settings dialog is dismissed and you are returned to the Location and Image Parameters.

1. Optionally, select **Apply TTC** to apply a tonal transfer curve to the output image.

See "Set Rectification Preferences - General" on page 39 to change the tonal transfer curve settings.

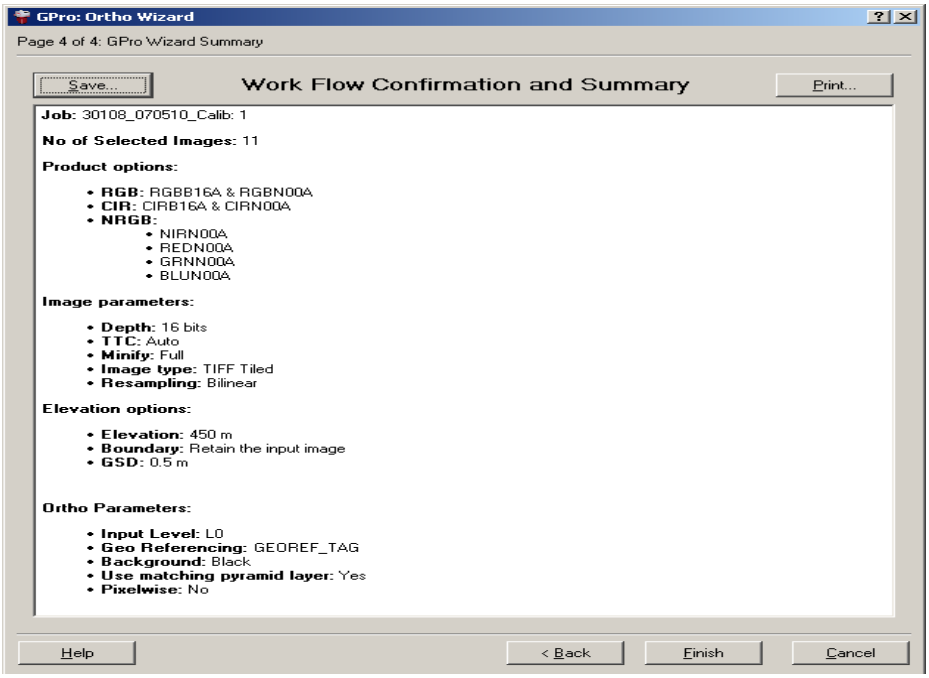
2. Optionally, select **8 bit Output** to convert the 16-bit ADS output to an 8 bit image.
3. Select the **Resampling Method** to use in the orthorectification.
4. Select the **Minification Levels** that you want to create with the output image.
5. Click **Next**.

The "GPro Wizard Summary" page is displayed.

GPro Wizard Summary

The final wizard page is a summary page. It is displayed at the end of each wizard and summarizes all of the selections you made while you were completing the wizard.

Figure 104: GPro Wizard Summary



1. To save backup of the Summary, click the **Save...** button.
2. To print the Summary for your files, click the **Print...** button.
3. Click **Finish** to accept all of the settings and begin processing the data.

The **Task Status** view is opened and the processing progress is displayed.

5 Distributed Computing

5.1 Introduction

The automated processing and management of data acquired by digital sensors requires an enormous computational effort. The Aerial Digital Sensor (ADS) from Leica Geosystems is already ahead of the curve in generating tremendous amount of data. This demand for large processing power stems from the large amount of data being generated and the high rate of automation possible in the ground processing. Using single computers one could not exploit the full automation possibility of digital acquisitions. This problem can only be addressed using High Performance Computing (HPC). High Performance Computing is defined as the technology that is used to provide solutions to problems that either require significant computational power or need to process very large amounts of data quickly. In HPC, enormous processing power, fast networks, and huge amounts of data storage are applied to solve complex problems by utilizing industry standard, volume components.

Computational parts of GPro could be distributed across a number of machines in order to reduce processing times. Ability to deliver large amounts of processing capacity over long periods of time was the main criteria used in selecting the distributed computing model. The Condor Project was chosen for its support of high throughput computing on large collections of distributively owned computing resources (Condor Team, 2003).

The distribution is achieved by using a proxy in a distributed environment. You continue to use the current process (minify, rectify, APM) with little obvious difference. From a user's point of view, there is not much change other than to install Condor on the distributed workstations and change the programs in the general preference with their respective proxy equivalent. For example, "ADSRectifier.exe" will be changed to "ADSRectify-CondorProxy.exe". You can decide which of the processes you want to distribute.

The load balancing is done per image, meaning each node is given an image to process (rectify, minify etc). The installation assumes that all the nodes have equal access to the file servers. The maximum output from this configuration realized by using high end fiber array SAN's (Storage Area Network) that provide high read and write performance. However, using Windows Distributed File System (DFS) or different image locations from different file servers to avoid the reading/writing bottleneck could also be used in normal workstation set-ups to distribute the load.

5.2 Condor

Condor is a sophisticated and unique distributed job scheduler developed by the Condor research project at the University of Wisconsin-Madison Department of Computer Science (Sterling, 2002). "Condor is a specialized workload management system for compute-intensive jobs. Like other full-featured batch systems, Condor provides a job queuing mechanism, scheduling policy, priority scheme, resource monitoring, and resource management. Users submit their serial or parallel jobs to Condor, Condor places them into a queue, chooses when and where to run the jobs based upon a policy, carefully monitors their progress, and ultimately informs the user upon completion." (Condor Team, 2003). It provides a high throughput computing environment that delivers large amounts of computational power over a long period of time even in case of machine failures. Condor has more extensive features that are well documented in the manual and appear in many publications from the research team.

Condor proxies were developed to submit jobs to the Condor pool and monitor its progress using the Condor command line executables.

5.3 GPro HPC Installation Guide

Prerequisites

A HPC Cluster consists of at least two computers. One will be the server (and submitter at the same time) and the other the node. However, it is recommended to configure the submitter on a separate workstation. Hence, this would require at least three computers. In addition it is a plus adding multiple nodes to run jobs in parallel. The more nodes a cluster consists of the faster the processing will be.

Server configuration

- 4 GB RAM (8 GB suggested)
- hard drive for OS and SW
- RAID for data
- 10Gb LAN or better
- Server OS, currently preferred Windows 2003 Standard Edition (SP 2) or better
- .Net Framework 2.0
- .Net Framework 2.0 SP1
- Condor 7.0.5
- LPS 9.2 + LPS SP1 + LPS Fix for GPro
- GPro 3.3.3
- Share drive that hold SW (LPS and GPro)
- Share drive(s) that hold data

Node configuration

- 4 GB RAM or more
- hard drive for OS, dual processor or dual dual core processor
- 10Gb LAN or better
- Windows XP or 2003
- .Net Framework 2.0

- .Net Framework 2.0 SP1
- Condor 7.0.5
- GPro HPC 3.3.3

Submitter configuration

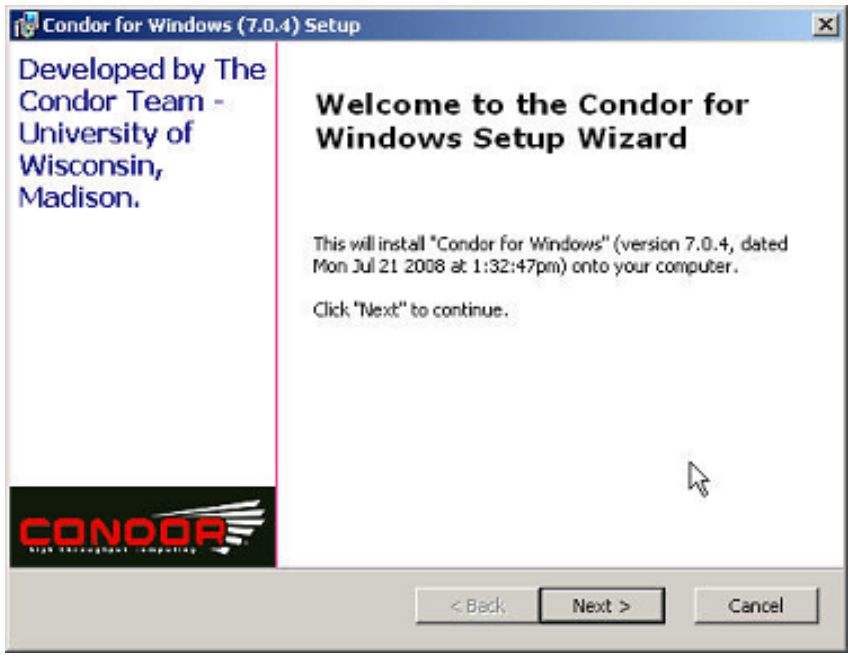
- 4 GB RAM or more
- hard drive for OS, dual processor or dual dual core processor
- Optional small but fast raid to hold a local copy of job related data
- 10Gb LAN or better
- Windows XP or 2003
- .Net Framework 2.0
- .Net Framework 2.0 SP1
- Condor 7.0.5
- Microsoft Visual C++ 2005 Redistributable Package (x86) (vcredist_x86.exe can be downloaded from Microsoft's webpage)
- GPro HPC 3.3.3

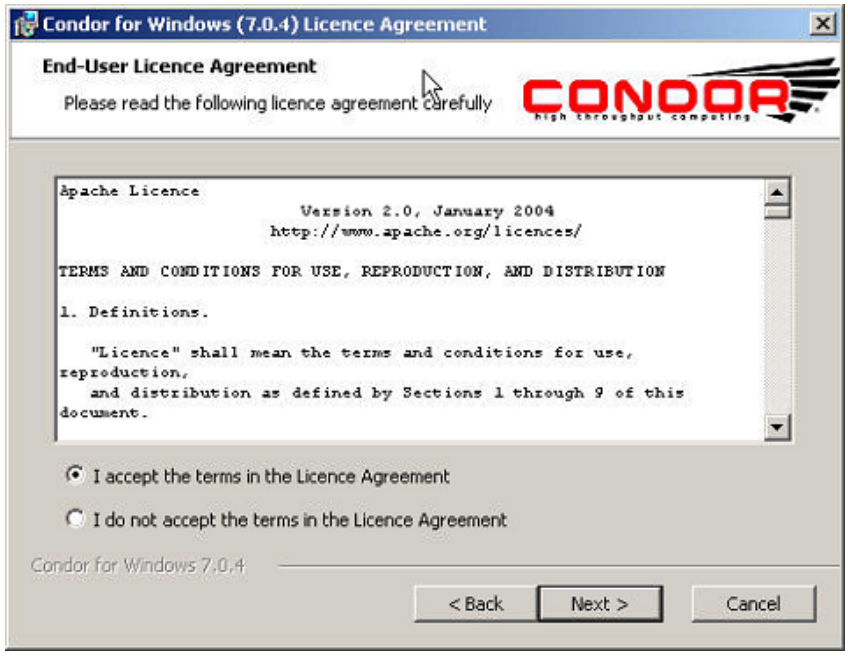
Minimal installation/ functional test configuration

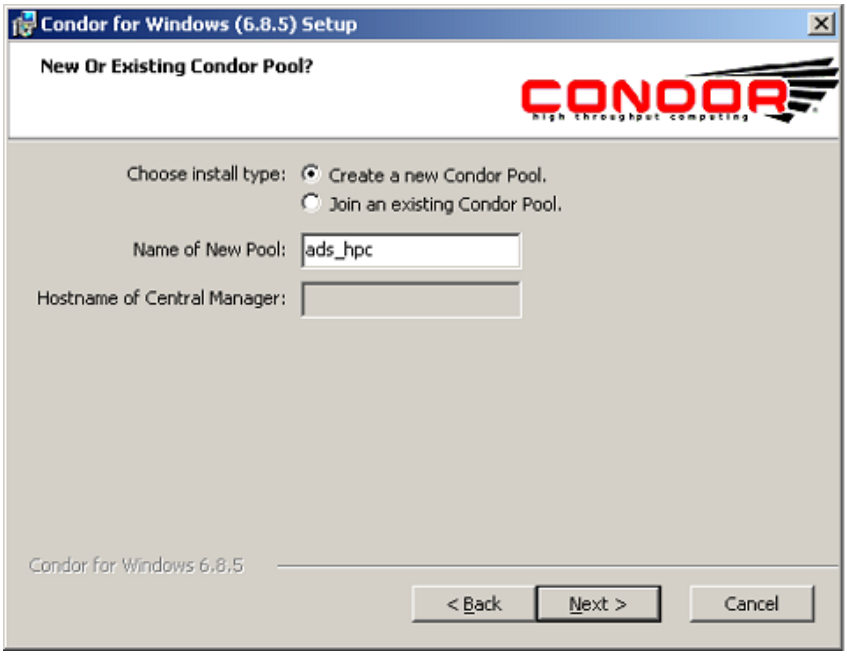
Data Server:

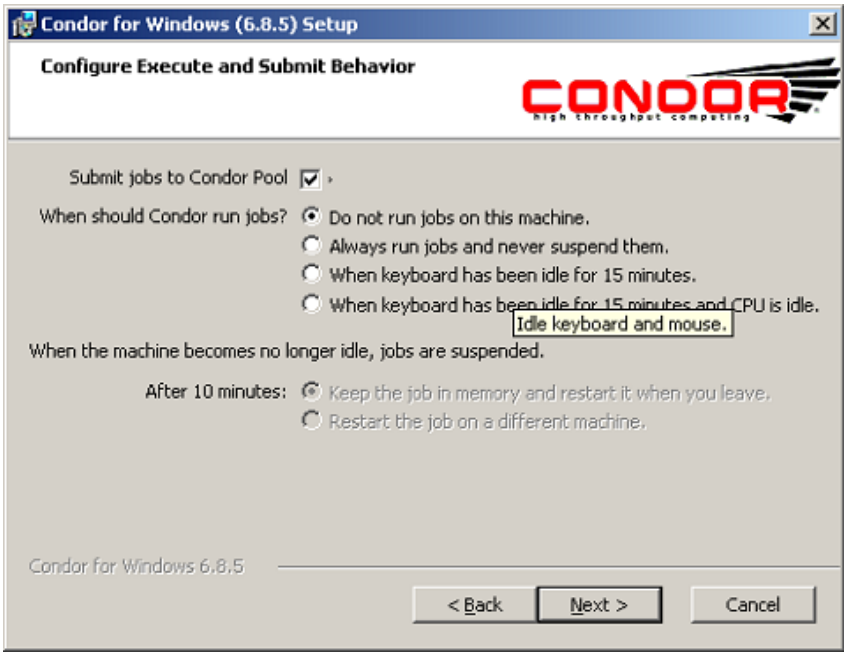
1. Turn off firewall
2. On an x86 32 bit machine install **Windows Server 2003 Standard Edition**, for now just administrator as only user account
3. Install additional drivers (e.g. Network card, graphic card)
4. OS SP2, register windows
5. Install security updates and stuff through windows update (you may deselect things like IE7 or .NET 3.0). If you decide to install IE7 then add to trusted sites the file:\\\.....condor_setup.exe
6. Install .NET Framework 2.0 and .NET Framework 2.0 SP1 by means of windows update
7. On your C: drive create a folder "q"
8. Copy SW installers to c:\q\install (LPS/ GPro/ HPC GPro/ condor)
9. Open a command window and change to C:\windows\microsoft.net\framework\v.2.0.5
10. Type "caspol -m -ag 1.2 -url file:///Q:/* FullTrust" and press *Return*
11. Type "caspol -m -ag 1.3 -url file:///Q:/* FullTrust" to change the default settings of .NET 2.0 trust configuration
12. Create user "ads40" as member of "users" (default) and add "administrators"
13. Log off and switch to user "ads40"

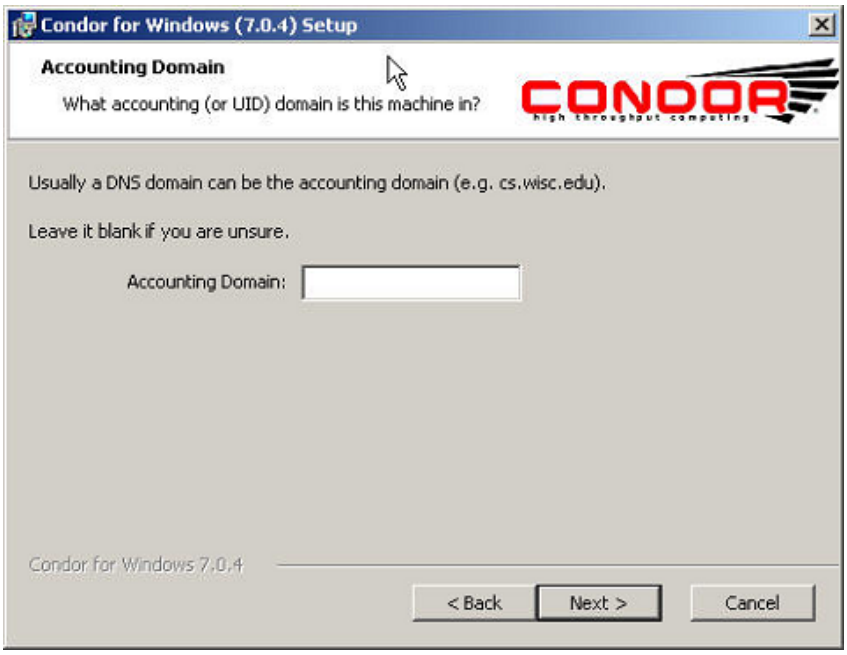
14. Install Condor according the following screen shots:

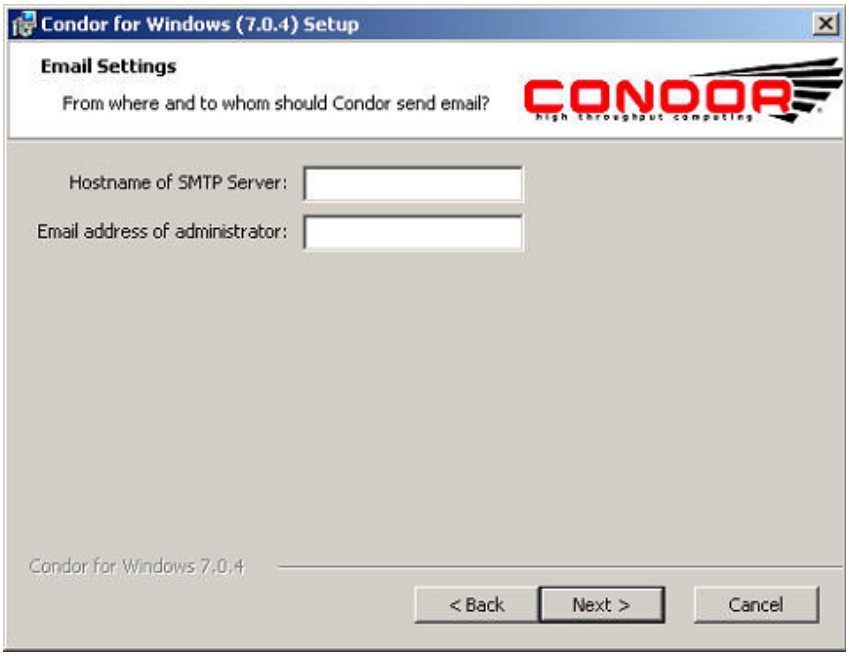




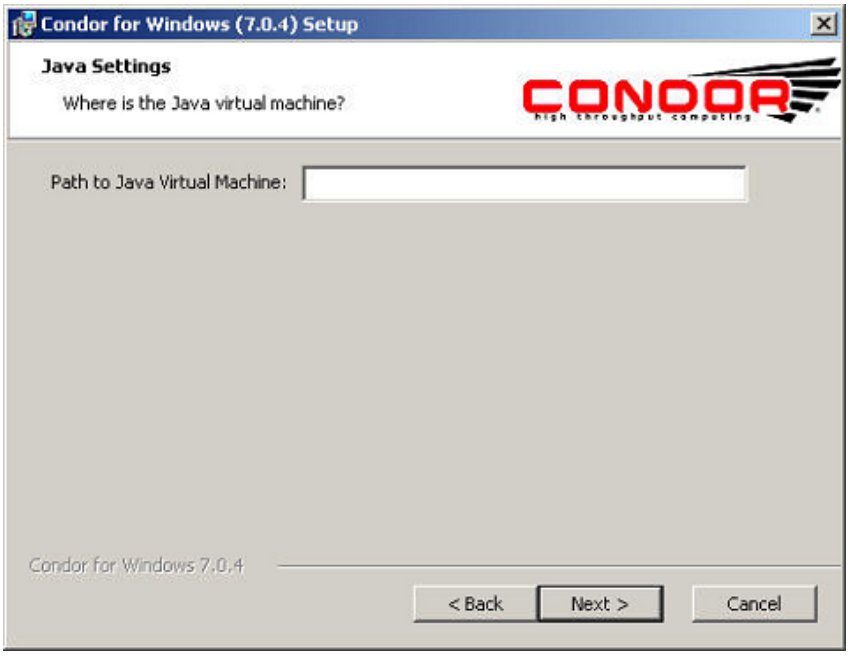

Condor for Windows (6.8.5) Setup
New Or Existing Condor Pool?
CONDOR
high throughput computing
Choose install type:
Create a new Condor Pool.
Join an existing Condor Pool.
Name of New Pool:
ads_hpc
Hostname of Central Manager:
Condor for Windows 6.8.5
< Back
Next >
Cancel


Condor for Windows (6.8.5) Setup
Configure Execute and Submit Behavior
CONDOR
high throughput computing
Submit jobs to Condor Pool
When should Condor run jobs?
Do not run jobs on this machine.
Always run jobs and never suspend them.
When keyboard has been idle for 15 minutes.
When keyboard has been idle for 15 minutes and CPU is idle.
Idle keyboard and mouse.
When the machine becomes no longer idle, jobs are suspended.
After 10 minutes:
Keep the job in memory and restart it when you leave.
Restart the job on a different machine.
Condor for Windows 6.8.5
< Back
Next >
Cancel

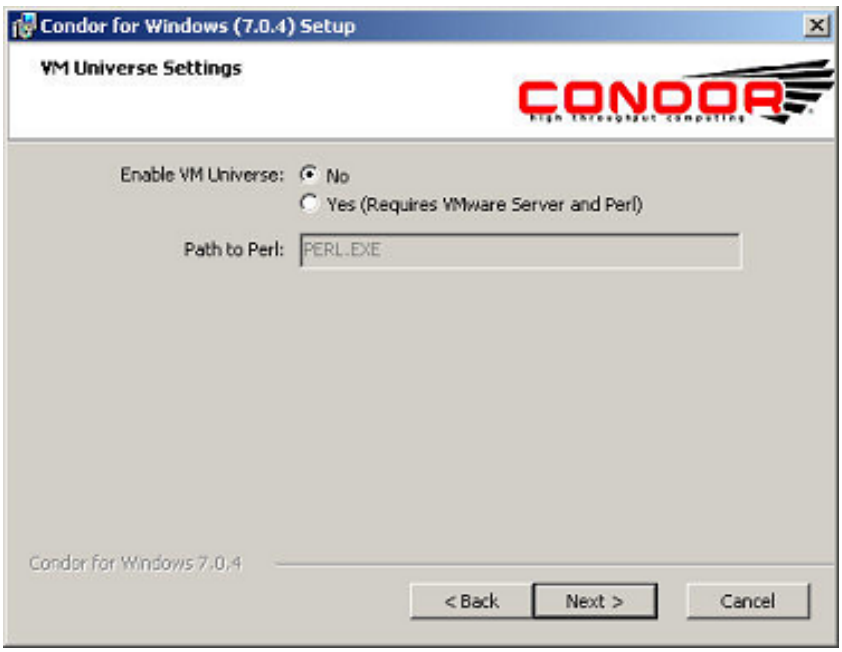


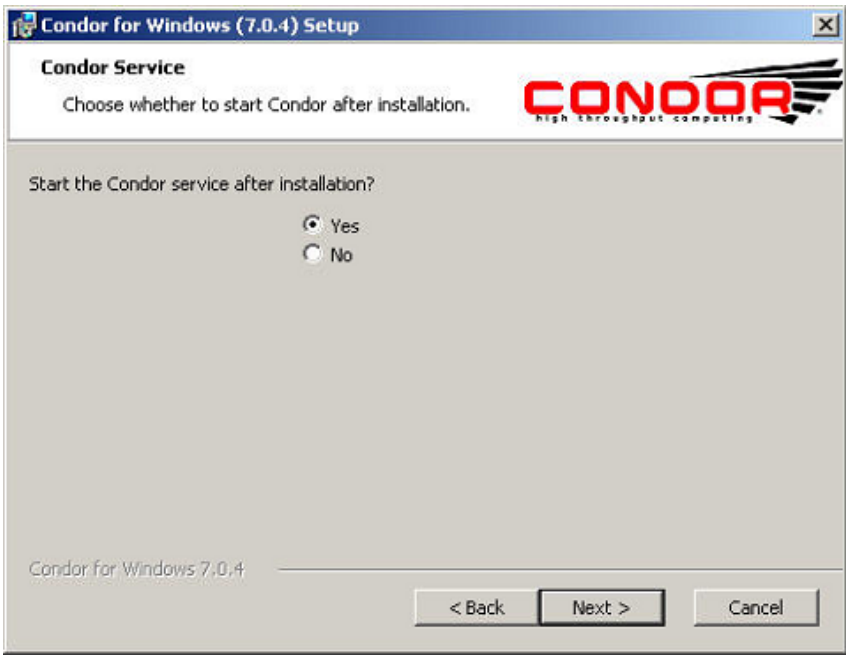


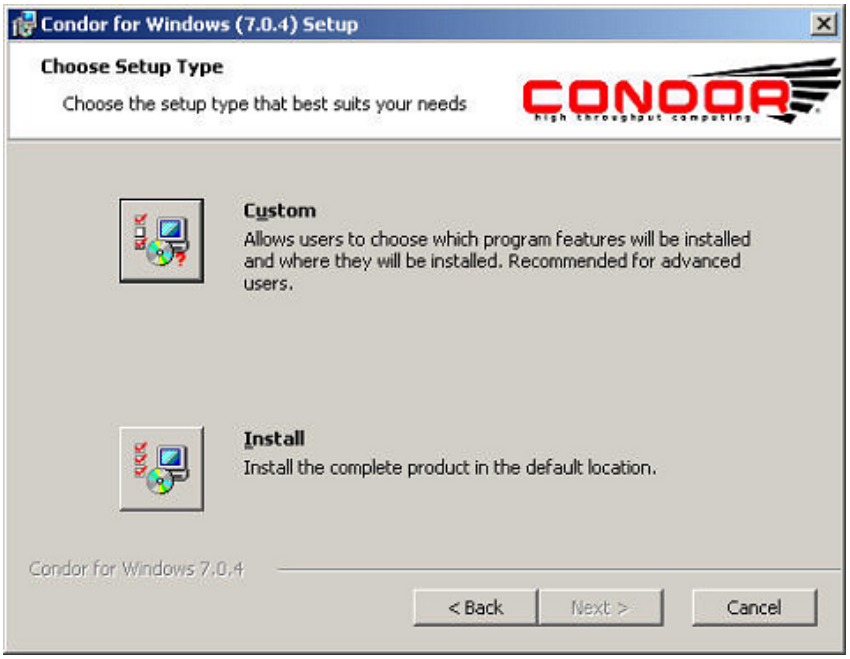
☞ *Leave blank or delete default entries.*



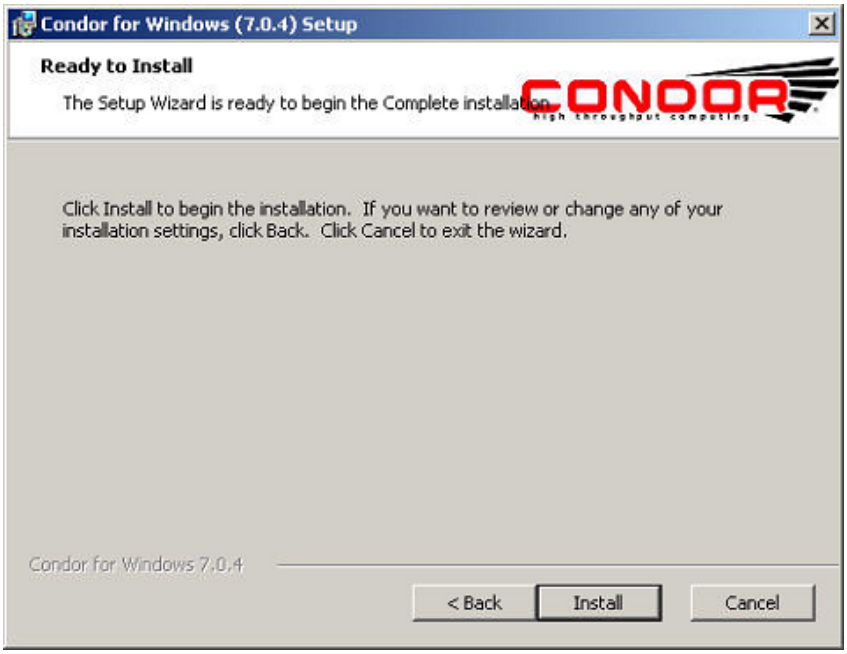
☞ *Leave blank or delete default entries!*

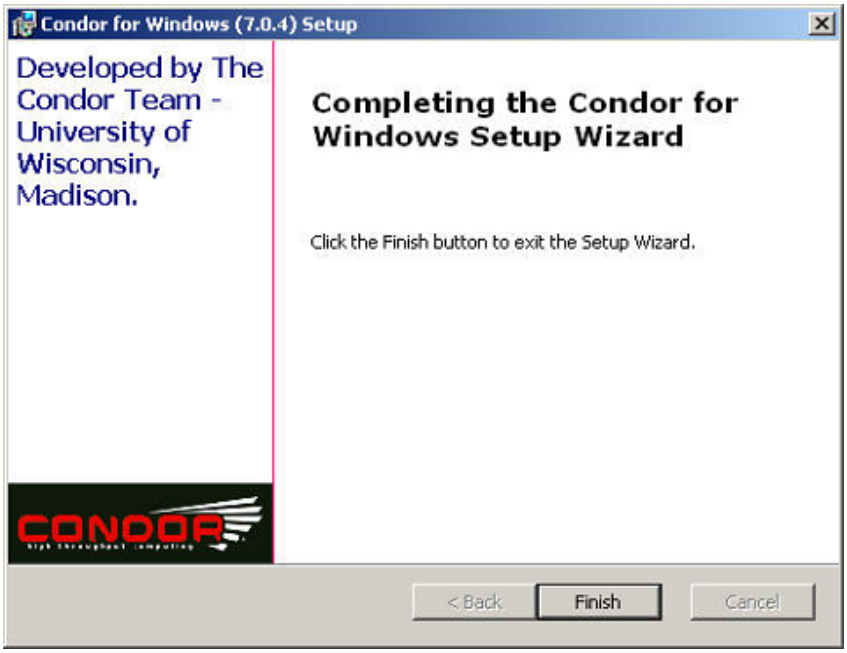






Choose Install (this activates the "Next" button).





☞ *The 2003 Server Standard edition does not have the ICS installed by default. Additionally we want to make sure that the firewall is switched off for now. Therefore go to your network connection, TCP/IP... Firewall (it will tell you that you have to install -› yes) and switch the firewall off.*

15. Restart and check that you find condor_master, condor_schedd, condor_negotiator and condor_collector running (windows task manager). This may take a few minutes.
Add c:\condor\bin to the PATH (right click on My Computer › Properties › Advanced › Environment Variables › System Variables

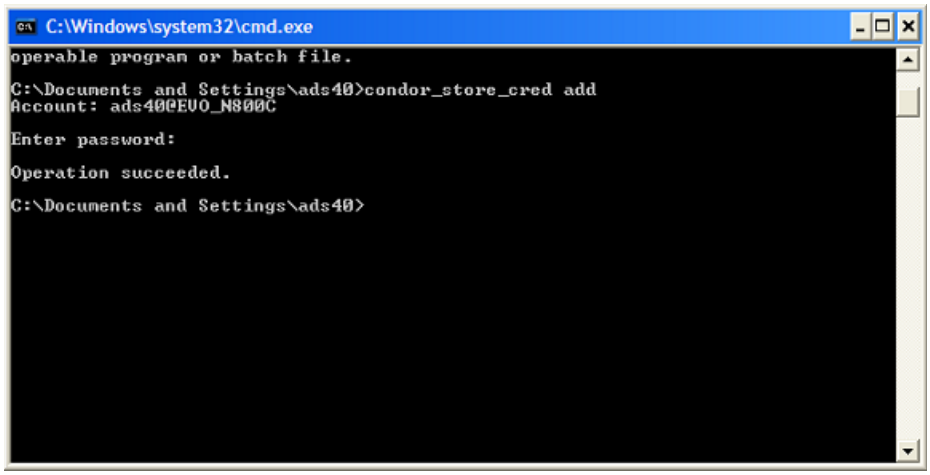
16. In c:\Condor edit the condor_config file and set (#NUM_CPUS = N)
NUM_CPUS = 1

17. Restart the Condor service (net start condor or condor restart, condor_startd)

    ☞ *The condor service might take several minutes until it starts.*

18. use command "condor_status" to check the number of virtual machines. After editing the condor_config file there should be only one machine listed per node. If until now only the server is configured AND the server is not used as a node no machines will be listed yet.

19. Use "condor_store_cred.exe add" to store the password for condor (logged in as user "ads40").



20. On command line run "condor_q.exe" (ok if it shows an empty list for now, just no error message)

21. Install LPS 9.2 to folder c:\q\Program Files\Leica Geosystems\Geospatial Imaging 9.2 (local installation, but reachable through shared drive Q:. The sharing will be done in a later step)

22. Setup license manager (see LPS user manual for details)

    ☞ *Check to find GPro and LPS licenses of matching versions*

23. Install SP1 for LPS 9.2

24. Install GPro Fix for LPS 9.2

25. Setup GPro 3.3.3 -› custom installation -› c:\q\Program Files\Leica Geosystems\GPro

26. md c:\temp and set systems variables "TEMP" and "TMP" to "c:\temp" (Right click on "my computer" › system properties › advanced › environmental variables. Delete entries "user variables for %user%". Edit system variables.)

27. Add c:\condor\bin to system variable "PATH"

28. Share folder "q" with "everybody" full access (Add user condor and add again full access to this folder).

29. Mount \\localhost\q as Q:

30. Mount \\localhost\r or a connected RAID as R:.

31. Share R: drive with "everybody" full access (Add user condor and add again full access to this folder).

    ☞ *Q: Drive holds now the complete software installation and R: Drive is used for data storage.*

32. Start GPro (Q:\Program Files\Leica Geosystems\GPro\bin\GPro.exe) to check correct settings of permissions.

33. On a command line write "cd Q:\Program Files\Leica Geosystems\GPro\bin"

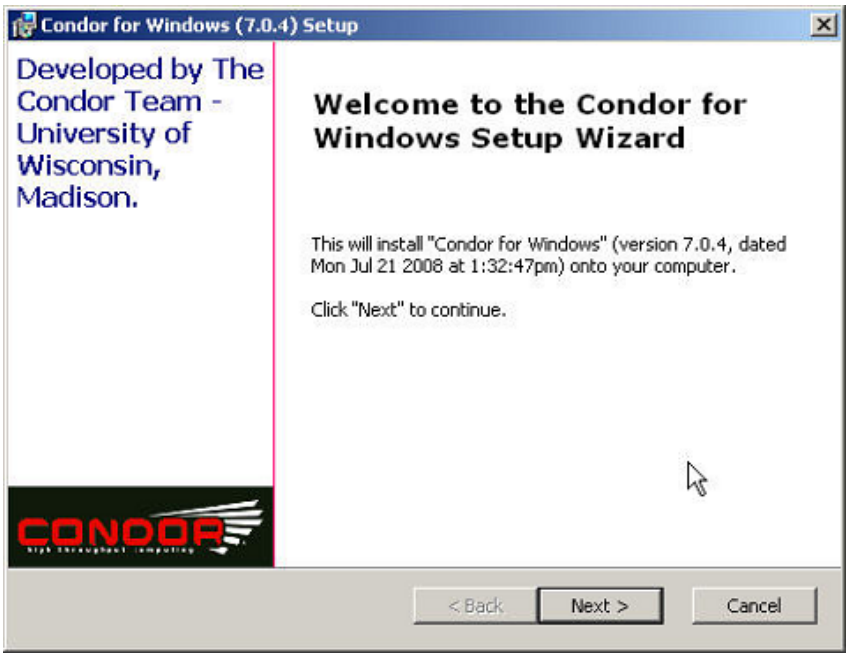
34. Key in "Condor_submit.exe name.sub"

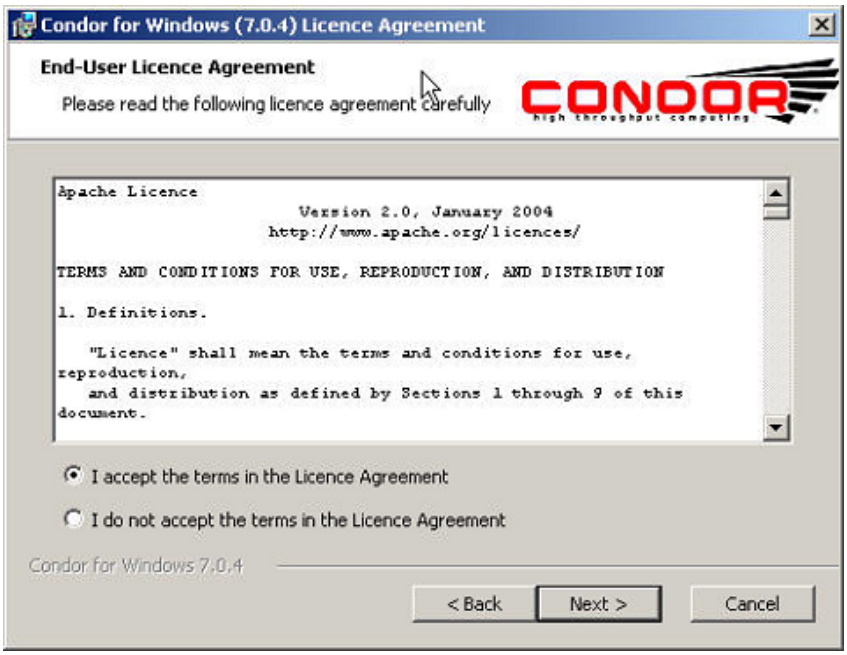
35. Check condor_q and condor_status and then printname_?.err/.log/.out (in "Q:\Program Files\Leica Geosystems\GPro\bin")

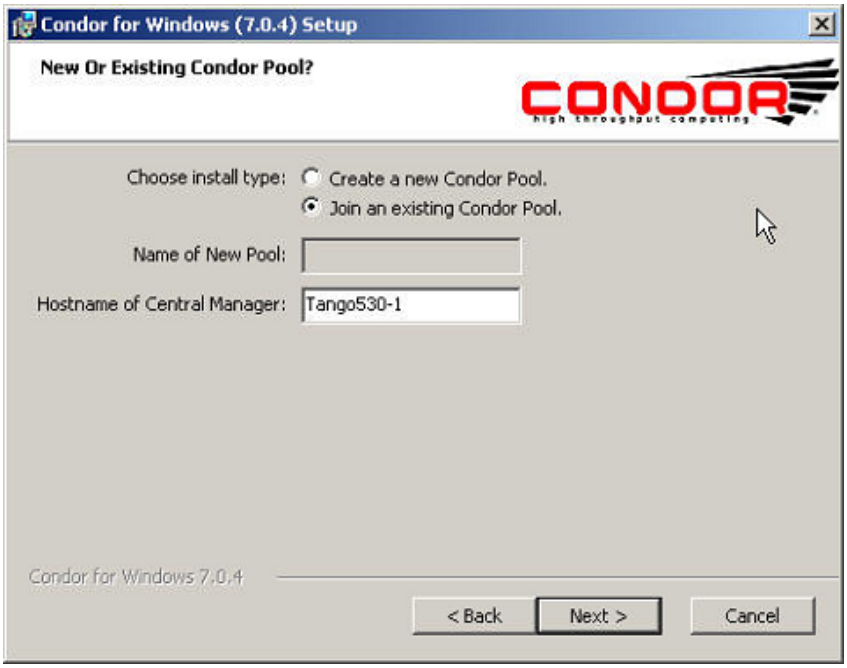
36. Copy a GPro example dataset to R:

Minimal Node installation/ functional test configuration

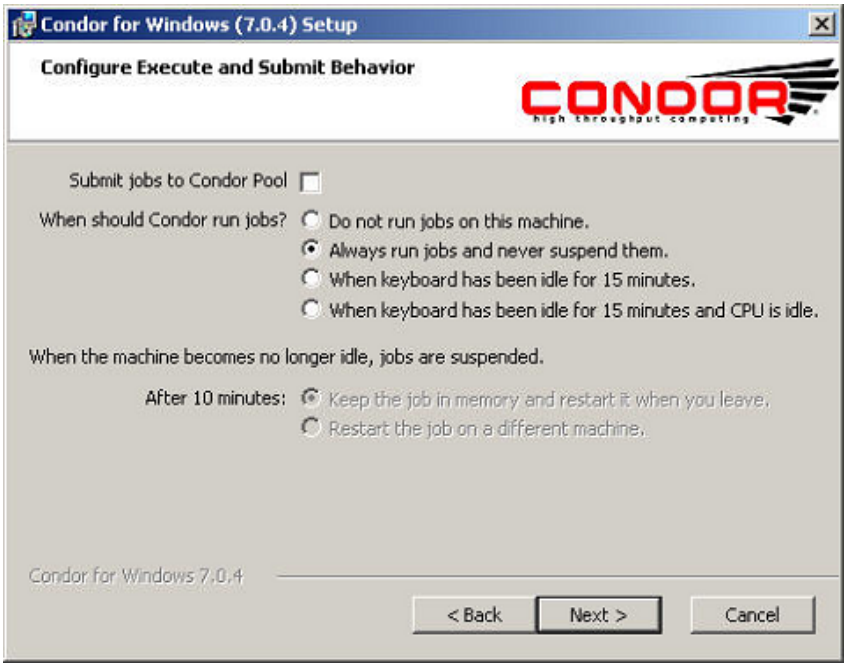
1. Install Windows XP Professional (incl. SP2).
2. Map \\remotehost\q as q: (do **not** reconnect at Logon)
3. Install .NET Framework 2.0 and .NET Framework 2.0 SP 1
4. Open a command window and change to C:\windows\microsoft.net\framework\v.2.0.5
5. Type "caspol -m -ag 1.2 -url file:///Q:/* FullTrust" and press *Return*. Type "caspol -m -ag 1.3 -url file:///Q:/* FullTrust" and press *Return* to change the default settings of .NET 2.0 trust configuration.
6. Install Microsoft Visual C++ 2005 Redistributable Package (x86).
7. Install Condor according the following screen shots:



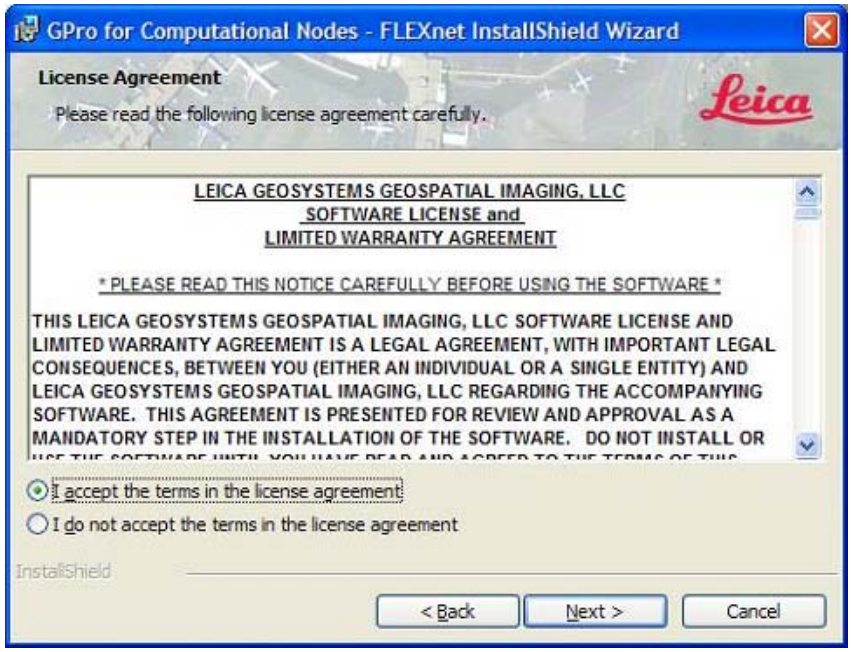


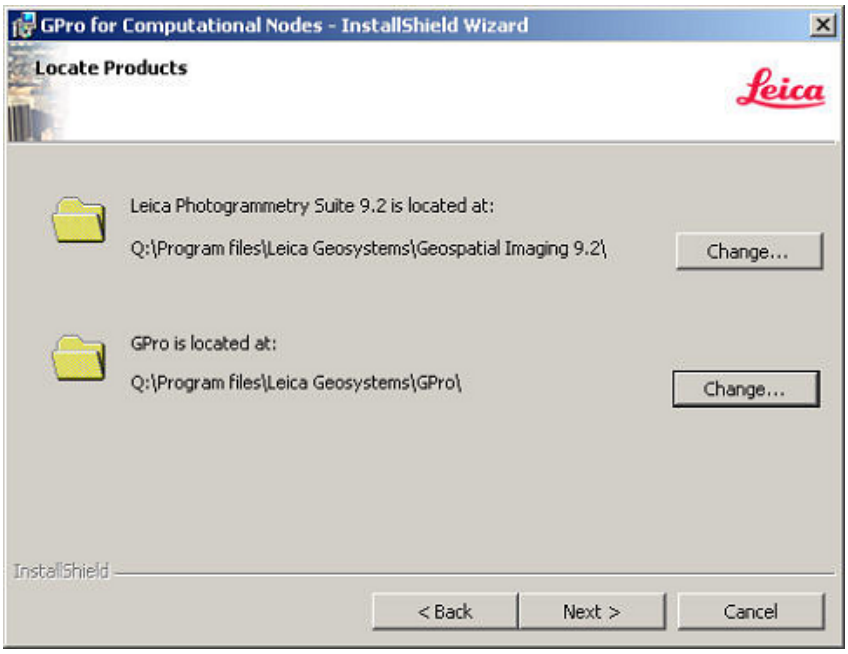


☞ *Hostname is* **machine** *name of Pool Manager*

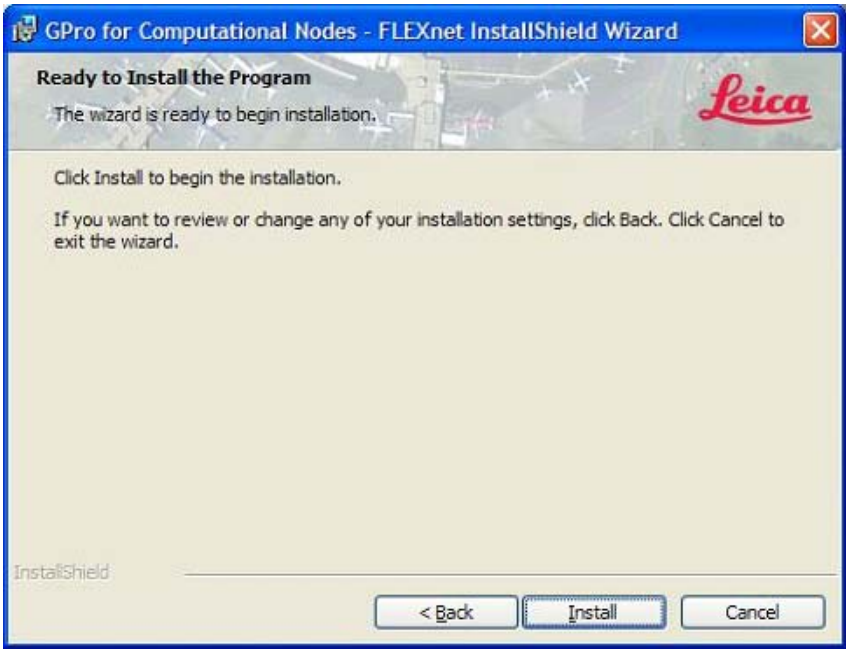


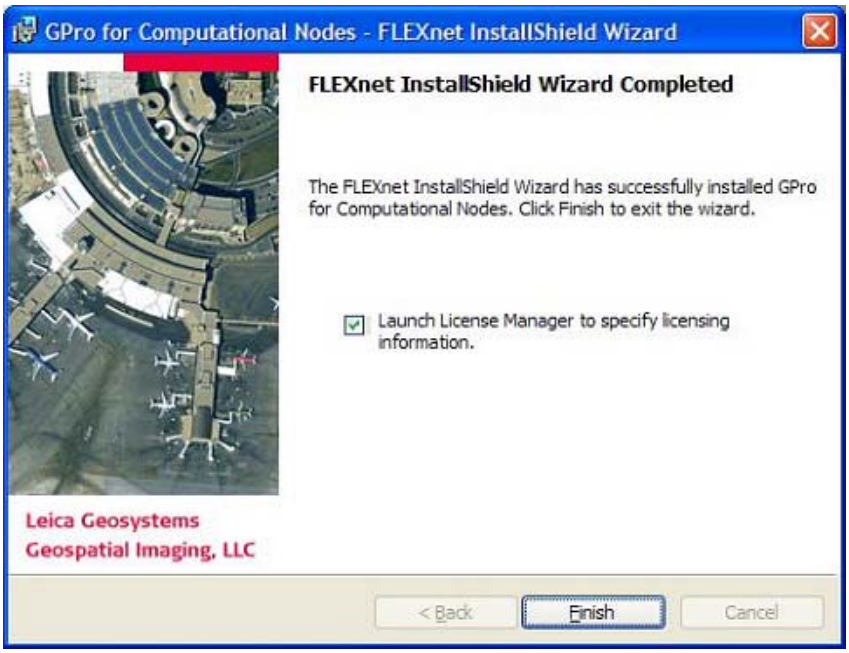
8. On the next screens use same settings as for the Pool installation (see above)
Setup GPro HPC 3.3.3 -› custom installation -› Q:\Program Files\Leica Geosystems\GPro and q:\Program Files\Leica Geosystems\Geospatial Imaging 9.2 (directly on Q:\....)





☞ *Change to correct path!*





9. Add c:\condor\bin to the PATH (right click on My Computer › Properties › Advanced › Environment Variables › System Variables

10. In c:\Condor edit the condor_config file and set (#NUM_CPUS = N) NUM_CPUS = 1 (c:\Condor)

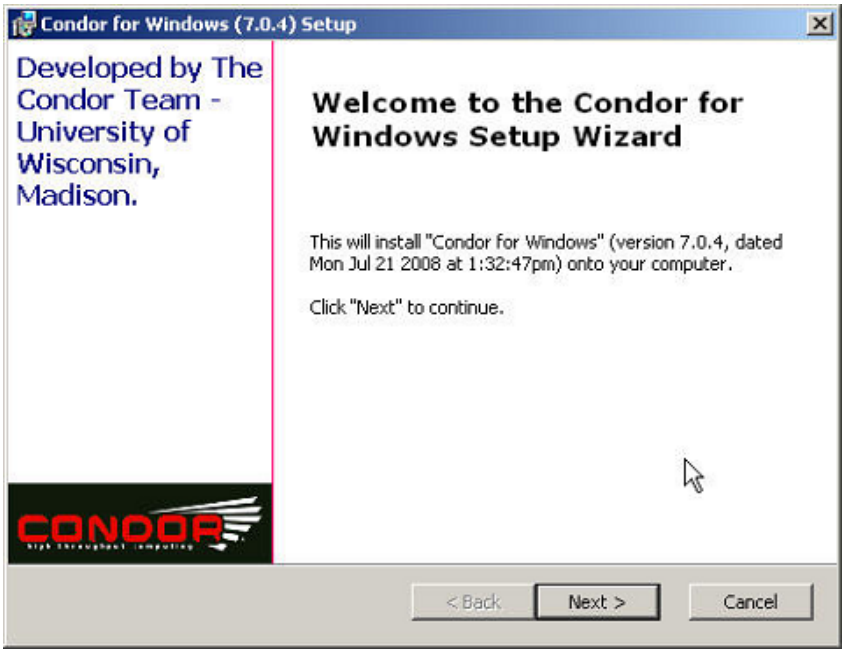
11. Restart the Condor service (net start condor or condor restart, condor_startd)

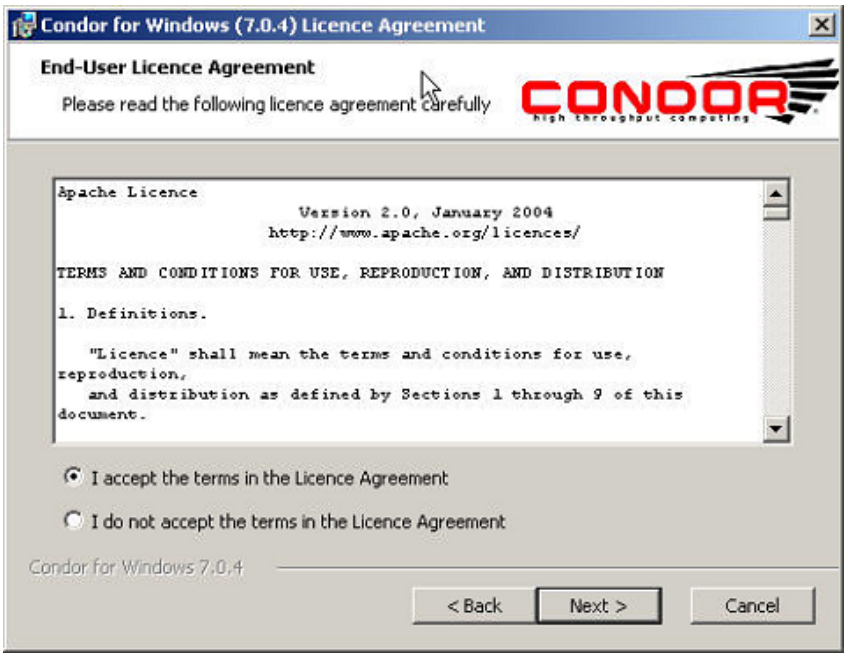
    ☞ *This may take several minutes.*

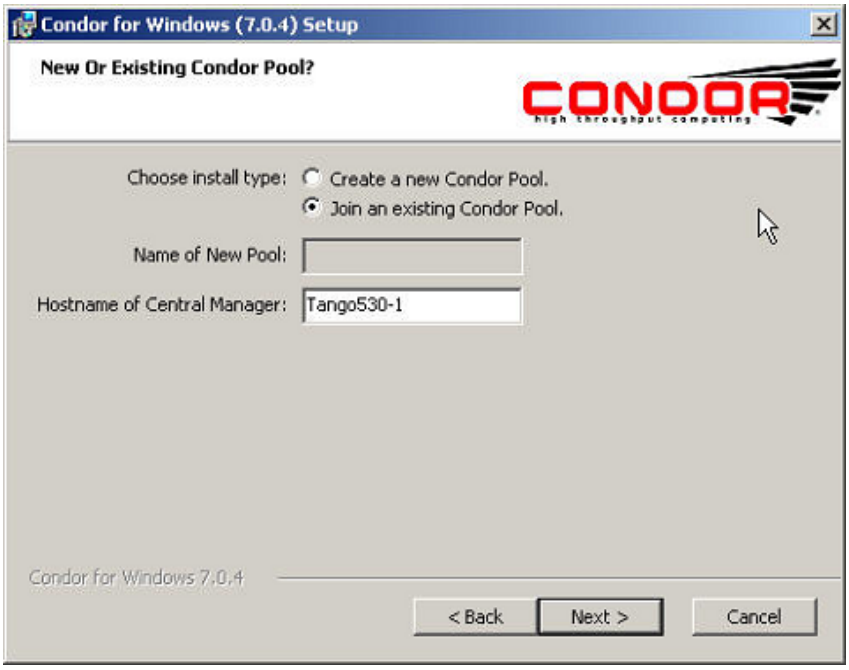
12. For a first small test log onto the server machine again and use ADSMinify.sub in "c:\q\Program Files\Leica Geosystems\GPro\bin": Test ADSMinify.sub using "printname.bat & ADSCondor.bat, modify the "Environment" string to match drive letters and User account.

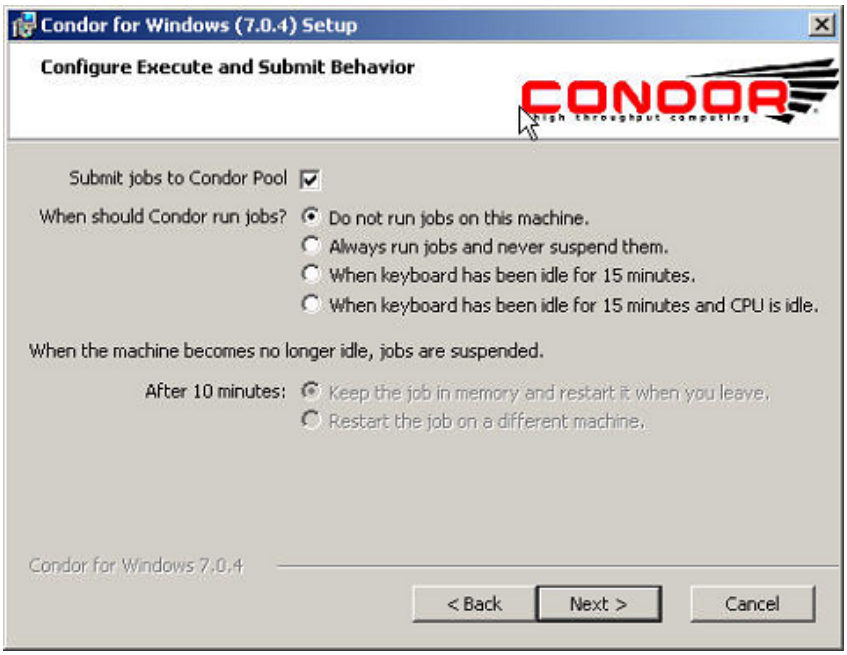
Minimal Submitter installation/ functional test configuration

1. Install Windows XP Professional (incl. SP2 and updates using windows update)
2. Install .NET Framework 2.0 and .NET Framework 2.0 SP1 by means of windows update
3. Open the command window and change to C:\windows\microsoft.net\framework\v.2.0.5
4. Type "caspol -m -ag 1.2 -url file:///Q:/* FullTrust" and press *Return*. Type "caspol -m -ag 1.3 -url file:///Q:/* FullTrust" and press *Return* to change the default settings of .NET 2.0 trust configuration.
5. Install Microsoft Visual C++ 2005 Redistributable Package (x86).
6. Login with username, which is used later on for processing (In this example "ADS40").
7. Install Condor according the following screen shots:




Condor for Windows (7.0.4) Licence Agreement
End-User Licence Agreement
Please read the following licence agreement carefully
CONDOR
high throughput computing
Apache Licence
Version 2.0, January 2004
http://www.apache.org/licences/
TERMS AND CONDITIONS FOR USE, REPRODUCTION, AND DISTRIBUTION
1. Definitions.
"Licence" shall mean the terms and conditions for use, reproduction,
and distribution as defined by Sections 1 through 9 of this document.
I accept the terms in the Licence Agreement
I do not accept the terms in the Licence Agreement
Condor for Windows 7.0.4
< Back
Next >
Cancel


Condor for Windows (7.0.4) Setup
New Or Existing Condor Pool?
CONDOR
high throughput computing
Choose install type:
Create a new Condor Pool.
Join an existing Condor Pool.
Name of New Pool:
Hostname of Central Manager:
Tango530-1
Condor for Windows 7.0.4
< Back
Next >
Cancel



8. On the next screens use same settings as for the Pool installation (see above)

9. In a command window use "condor_store_cred.exe add" to store the password for condor (logged in as user "ads40")

10. Create directory c:\program files\Leica Geosystems\GPro\bin and log

11. Create directory c:\temp (check for all necessary permissions)

12. Install GProHPC (using same settings as for the installation of the nodes. See above)

13. From Start › Run › open Regedit navigate to HKEY_LOCAL_MACHINE › SOFTWARE › Leica Geosystems › GPro › 3.3.3

14. Verify that the InstallDir key is pointing to the correct path

15. Add C:\condor\bin to the system variable "PATH"

16. Copy Q:\Program Files\Leica Geosystems\GPro\bin *.sub, *.bat to c:\program files\Leica Geosystems\GPro\bin

17. In c:\program files\Leica Geosystems\GPro\bin create a GPro.bat with the following entries:

    ```
    Setlocal
    Set PATH=C:\WINDOWS;C:\WINDOWS\SYSTEM32;Q:\Program Files\Leica Geosystems\GPro\bin; Q:\Program Files\Leica Geosystems\Geospatial Imaging 9.2\bin\ntx86;C:\Condor\bin
    Start GPro.exe
    Endlocal
    ```

18. Create a shortcut on the submitter desktop and set the *Properties › Target* to "c:\Program Files\Leica Geosystems\GPro\bin\GPro.bat". Set Start in to "Q:\Program Files\Leica Geosystems\GPro\bin", use the icon from Q:\Program Files\Leica Geosystems\GPro\bin controller_sh40.ico

19. Mount \\remotehost\q as q: and \\remotehost\r as r: (where remotehost is the server-name)

20. Start GPro from the GPro.bat

21. In *GPro Main menu › Preferences › General* set the applications to point to q:\ Program Files\Leica Geosystems\GPro\bin\ADSRectifyCondor-Proxy.exe, similar for the ADSMinifyCondorProxy.exe, ApmDriverCondor-Proxy.exe and ADSImageSlicerCondorProxy.exe

22. Edit the "environment" variable in all *.sub files accordingly. Remove any entries containing < > if not used.

    Example for ADSMinify.sub:
    Environment = ADSEXECUTABLE=ADSMinify|VMNAME=$$(NAME)|DATA_SOURCE=\\server1\r|DATA_DRIVE=r|SW_SOURCE=\\server1\q|SW_DRIVE=q|ADSUSER=ADS40|ADSPASSWORD=ADS40|PATH=C:\WINDOWS;C:\WINDOWS\SYSTEM32;Q:\Program Files\Leica Geosystems\GPro\bin;Q:\Program Files\Leica Geosystems\Geospatial Imaging 9.2\bin\ntx86

23. Register Q:\Program Files\Leica Geosystems\GPro\bin\DCLMms.dll (using C:\WINDOWS\system32\regsvr32.exes) on the submitter if used for downloading as well.

24. Depending on the network setup of the cluster it might be necessary to add Local Administrator rights to the "vm-reuse" condor user (this user is automatically created by condor) on all machines.

    ☞ *The installation on the C:| drive (Pool Manager) is suggested as "minimum installation". Once the functionality is verified to be working, assign the definitive Q:| drive (SW Application Server) and R:| drive (DATA source - output Server).*

6 GPro Utilities

6.1 Introduction

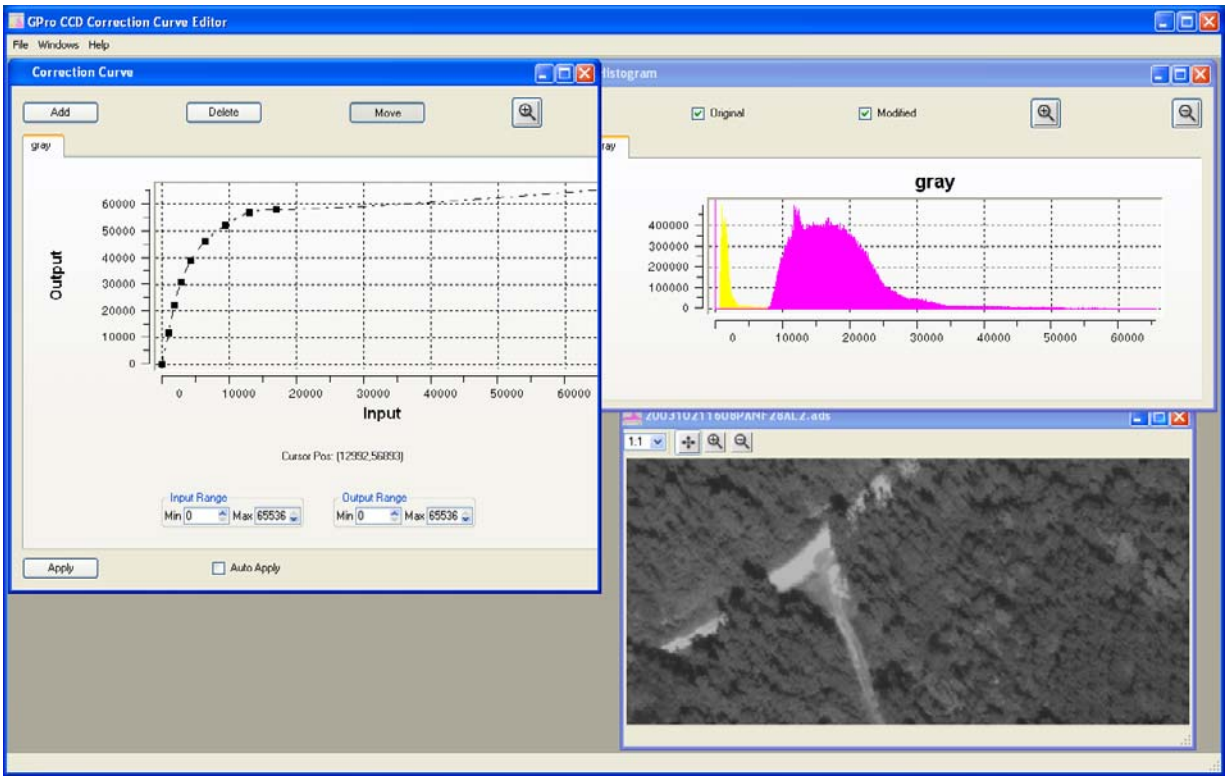
This chapter describes a couple of utility programs that you may find helpful in your work with GPro.

6.2 Tone Curve Editor

This Tone Curve Editor is used to stretch the imagery to 16 bits to achieve a visually normalized image. This is intended to be done prior to creating L2 orthos, regardless whether you are generating 8-bit or 16-bit outputs.

After starting the editor and opening an image, an initial curve, consistant to the Auto TTC, will be created so that the image can be viewed. This curve can be manipulated by using the move, add and remove point options. Spline function between the breakpoints can be used optionally.

Figure 105: Tonal Transfer Curve Editor



If an RGB or CIR curve is loaded into the editor, a composite curve will be loaded. This allows you to manipulate all three bands at once. In addition, each individual band can be modified to provide a cumulative effect. Once you have made your changes, click the **Apply** button to view the edited curves in the imagery.

File

Load Image Select this option to load an image file for correction.

Open Select this option to open an existing break point file (.bpf).

Save Select this option to save the current break points to a file (.bpf).

If you have loaded an L1 file, the default name and directory is set.

Save As Select this option to save the current break points to a different file (.bpf).

Quit Select this option to exit the Tonal Transfer Curve Editor.

Windows

Tile Select this option to tile the windows within the main editor window.

Cascade Select this option to cascade the windows within the main editor window.

Break Points Editor When checked, this option displays the "Tone Curve" window.

Histogram Plot When checked, this option displays the "Histogram" window.

Image Viewer When checked, this option displays the "Image Viewer" window.

If a NRGB file was loaded, use right mouse button to switch between RBG and CIR.

Help

Contents Select **Contents** to view this on-line help file.

About Select **About** to view the copyright and contact information for the GPro Tone Curve Editor.

6.3 Tone Curve

The tonal transfer curve derives a linear mapping for each pixel within the image; that is why the transfer curve is a straight line. The buttons surrounding the plot allow you to manipulate the curve and preview your changes in the image. The ranges reflect the depth of the image that has been loaded and allow for the same input and output depth.

Add — Click this button to add new breakpoints to the transfer curve. When this button is active, click on the curve where you want to add a new breakpoint.

Delete — Click this button to remove breakpoints from the tone curve. When this button is active, click on the breakpoint you want to delete.

You cannot delete the end or middle breakpoints.

Move — Click this button to move breakpoints within the tone curve. When this button is active, drag a breakpoint to its new location.

The end breakpoints cannot be moved.

(Zoom In) — Click this button to zoom in on breakpoints within the tone curve. When this button is active, drag a box on the grid to zoom in.

(Reset Zoom) — Click this button once to restore the tone curve to the default zoom. This also resets the **Input Range** and the **Output Range**.

(Reset Curve) — Click this button once to reset the curve to the identity curve.

(tabs) — There will be one tab for each product plus one for each constituent band. For example, if you have loaded an RGB image, there will be a tab for the RGB image as well as separate tabs for Red, Green, and Blue.

(breakpoint curve) — This is the heart of the tool. It shows how the input values are mapped to the output values.

Input Range — Set the minimum and maximum values to display on the **Input** axis of the tonal transfer curve.

Output Range — Set the minimum and maximum values to display on the **Output** axis of the tonal transfer curve.

Apply — Click this button to apply the changes you have made to the breakpoints.

Auto Apply — When checked, this option automatically applies the changes you make to the breakpoints.

Spline — When checked, a spline function is applied to the breakpoints to smooth the curve. This will normally produce a more natural-looking image.

6.4 Histogram

A histogram is a graph of data distribution. In the case of raster data, a histogram is a graph showing the number of pixels of each data value in the file or on the screen. Data values are plotted along the X axis and pixel count is plotted along the Y axis.

Original — When checked, the original (data file) histogram is displayed in yellow.

Modified — When checked, the modified (displayed) histogram is displayed in magenta.

 **(Zoom In)** — Click this button to zoom in on the histogram. When this button is active, simply drag a box on the grid to zoom in.

 **(Reset Zoom)** — Click this button once to restore the histogram to the default zoom.

(tabs) — There will be one tab for each product plus one for each constituent band. For example, if you have loaded a RGB image, there will be a tab for the RGB image as well as separate tabs for Red, Green, and Blue.

How to...

Adjust the breakpoints

1. Click the **Move** button and drag a breakpoint to its new location within the transfer curve.
2. Check either **Apply** or **Auto Apply** buttons in order to see the changes in the Image Viewer.
3. Check the Histogram window to see how the stretching is being applied.
4. Adjust the breakpoints until you achieve a visually normalized image.
5. Once you are satisfied with the correction, you can save the current break points to a breakpoints file (.bpf) and use this file to correct other imagery.

6.5 Image Slicer

The ADS Image Slicer is user to “slice” Level 1 (L1) images into smaller pieces so that they may be more easily disseminated for additional processing. For instance, you might want to use the Image Slicer to slice up a large L1 image to give to a third party stereo compiler.

Sliced images should not normally be used for APM or triangulation. They are intended to be a more efficient way of delivering imagery for stereo compilation.

This dialog is opened when you select an L1 image in the “ADS Project Data” tab and then click the **Slice...** button.

Number of Images

The top of the dialog indicates the number of images that have been selected to be sliced.

Output Image

These settings allow you to specify where the output images should be saved, and into what format they should be converted after slicing.

Location Click this button to change the Location for the sliced images. The Image Locations dialog opens (page 48).

(Image Type) Select the image format that you would like the sliced images to be saved as.

Minification

These options allow you to generate minification levels (pyramid layers) for the output images for use with Point Matching and fast zooming.

None Do not generate any minification levels.

Quick Select this radio button to create only a selected minification. If the image is not used for point matching, this option is useful for quality control by just minifying 1:16 for quick viewing without wasting space.

Full Select this radio button to generate all the minification levels from 32 pixels x 32 pixels to 1:4096 that are used for fast zooming and point matching.

Image Subdivision

Images Select this radio button to specify the number of images that each L1 image should be sliced into. Enter the desired number of images in the number field below. For instance, enter 3 to slice the L1 image into three equal pieces.

Selecting Images will create a uniform number of images per L1 image, but the size of the resulting sliced images will vary depending on the length of the L1 image that is being sliced.

Lines Select this radio button to specify the number of lines that should be contained in each of the sliced images. Enter the desired number of lines in the number field. For instance, enter 100 to slice the L1 image into segments that are 100 lines long.

Selecting Lines will result in unformity of size between output images, but the number of images that are created will depend on the length of the L1 image being sliced.

Overlap

Percent Select this radio button to specify a set percentage of each output image that should be overlapped between output images. Enter the desired percentage of overlap below.

Lines Select this radio button to specify a set number of lines that should be overlapped between output images. Enter the desired number of overlapping lines in the number field below.

6.6 Image Viewer

This window is intended to provide visual feedback on the results of your breakpoint editing.

(Scale) This popup shows the current viewing scale (zoom level). Click the popup button to select a different scale.


(Pan) Click this button to pan across the image. Click in the image to move the clicked point to the center of the image viewer.


(Zoom In) Click this button to zoom in on the image. When this button is active, simply click on the image to zoom in.


(Reset Zoom) Click this button once to restore the histogram to the default zoom.

6.7 ADS Orientation Plot

The ADS Orientation Plot uses the flight data to help you evaluate the smoothness of the flight by viewing a graphical plot of the exterior orientation information. It displays tabs that contain a graphical representation of the x, y, z, omega, phi, kappa, and the standard deviations of those values.

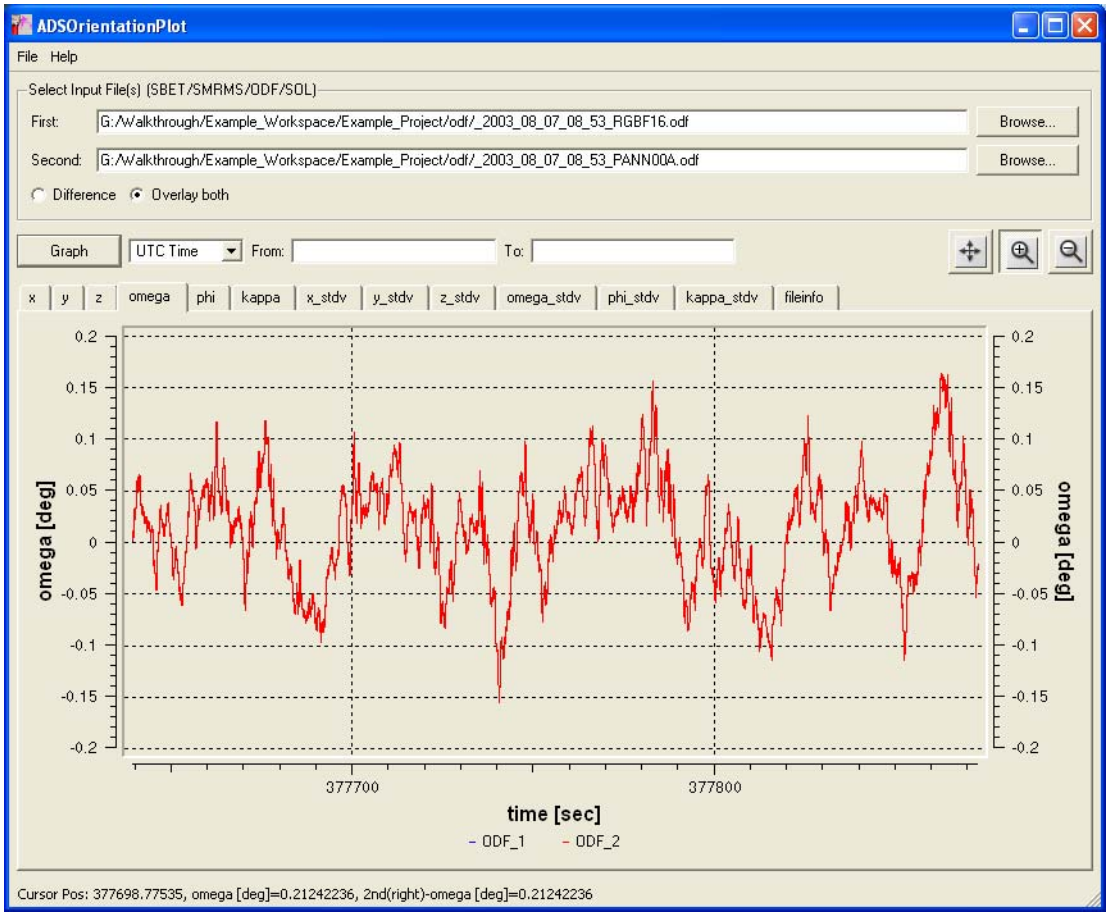
After "Triangulating Imagery", this tool will allow you to compare the original ODF files with the adjusted file.

This tool is displayed when you select **Orientation Plot** from the **Tools** menu. It is also displayed when you click the **Plot** button on the ADS Image Information dialog (page 65).

Any sudden turn or other movement that may adversely affect the accuracy of your output files will show up as a spike in the orientation graphs.

This Orientation Plot can also help you identify the amount of image clipping you need to avoid any banked sections at the start and end of the runs.

Figure 106: ADS Orientation Plot



File

Print Prints the current graph.

Quit Exits the ADS Orientation Plot program.

Help

Contents Select **Contents** to display this on-line help document.

About Select **About** to display the copyright and contact information for the ADS Orientation Plot program.

First Enter the path and filename of the first SBET, SOL, SMRMSG, or ODF file to be plotted in the Orientation Graph. Click **Browse...** to open a file chooser and locate the file.

Second Enter the path and filename of the second SBET, SOL, SMRMSG, or ODF file to be plotted in the Orientation Graph. Click **Browse...** to open a file chooser and locate the file.

Difference Select this radio button to display the differences between the two selected orientation files. This radio button is not active if you have only selected one orientation file.

If no graph is displayed when you attempt to plot the Difference between two ODF files, your files do not have sufficient overlap to be able to plot a difference between the values. See the error message in the FileInfo tab for an explanation of where the mismatch is occurring.

Overlay Both Select this radio button to view both of the selected orientation files overlaid on the same graph. This radio button is not active if you have only selected one orientation file.

If the plot in the Orientation Graph display is blue rather than red, the ODF files you selected do not have sufficient overlap to be able to plot an overlay graph.

Graph Click to update the display of the selected orientation file(s) with the selected parameter(s) in the Orientation Graph.

If you change a parameter, you must click the Graph button to update the Orientation Graph display.

(UTC Time/ LineNumber) This popup list allows you to define how the graph is plotted.

UTC Time Select UTC Time to plot the orientation data based on the UTC time of image capture.

LineNumber Select Line Number to plot the orientation data based on the line number of the image.

(Display Range) This allows you to limit the plot to display only the orientation information between the **From** and **To** boundaries.

If UTC Time is selected, this range should be in seconds. If Line Number is selected, this range should be in lines.

From Enter the beginning point of the display range.

To Enter the ending point of the display range.

 **(Cursor)** Click this button to activate the cursor tool. When activated, this tool will update the status bar with the orientation values for each image.

 **(Zoom In)** Click this button to activate the Zoom In tool. To zoom in on the graph, click and drag a box around the portion of the graph you want to see in more detail.

 **(Zoom Out)** Click this button to activate the Zoom Out tool. To zoom out of the graph, drag a box. The Orientation Graph will be redrawn so that the entire area will fit inside of the bounding box you just drew.

(Orientation Graph) The orientation graph is a plot of the flight data. This graph should be as smooth as possible. Spikes in the graph indicate sudden turns or other unexpected movement of the sensor that could adversely affect the outcome of "Rectifying Imagery", "Running APM", "Triangulating Imagery", and "Orthorectifying Imagery".

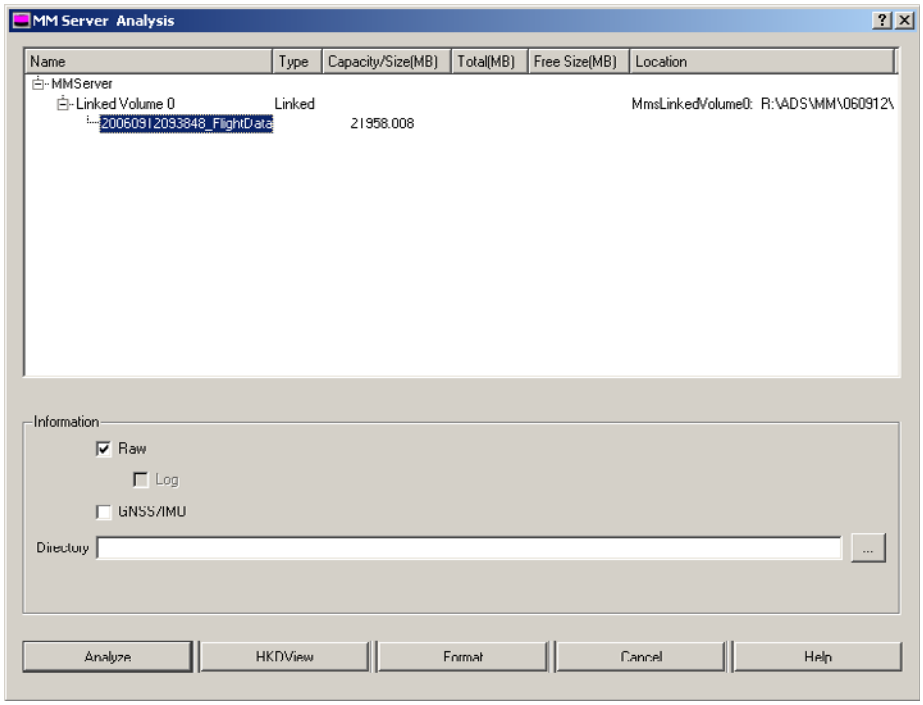
(tabs) There will be one tab for the graphs of x, y, z, omega, phi, kappa, and the standard deviations of these values. The last tab, fileinfo, displays the header information from the odf file(s).

6.8 ADS MM Analysis Tool

This tool is used to analyze the contents of the MM for troubleshooting. It is used by our support engineers to find hardware related problems and should be run only when there are problems reported in the data capture stage.

The tool extracts information on statistics and logging information for both the raw and position data. The full GNSS-IMU option is an extensive analysis and extracts the entire GNSS-IMU file and thus takes a longer time. When the "Analyze" button is pressed progress is reported to the GPro status display windows as in other programs. Once the process finishes, you must ZIP the directory with all the extracted files and send it to support for analysis for the problem.

Figure 107: MM Server Analysis Tool



Information

Raw When checked, this option generates a report about the raw data storage.

Log When checked, this option will download the log data.

GNSS/IMU When checked, this option generates a summary report of the GNSS/IMU data.

Directory Specify the directory where the analysis reports will be written. This is the directory that must be zipped and sent to the support engineer should it be necessary.

Analyze Click this button to begin generating the specified analysis reports.

Format Click this button to begin a low-level format of the attached MM device.

HKDView Click this button to view the selected flight's House Keeping Data View. This will analyze the internal structure of the selected raw data files and extract an ACII text file containing the basic structure and configuration data.

Cancel Click this button to close the MM Analysis Tool.

Help Click to display this on-line help document.

6.9 Optimizing the MM after several uses

After some time, the drives in your MM will develop bad sectors. This is part of the normal process of the writing and rewriting data to a disk. Although SCSI disks like the ones used in the MM have a way of detecting and relocating data stored in bad blocks, this process can lead to low-level fragmentation of the data. This in turn means that although the data is saved, the data is no longer stored on consecutive blocks on the disk and may take significantly longer to save and retrieve data. If enough fragmentation occurs, some data may even be skipped while recording.

Performing a low-level formatting of the disk will optimize the storage of data on the disk by erasing all data on the disk and renumbering the disk sectors to ensure that all of the data is stored in consecutive blocks.

After performing a low-level format, a high-level format will prepare the MM for use with the ADS and GPro.

The following steps will walk you through both a low-level and a high-level formatting of the MM.

Performing a Low-Level Format

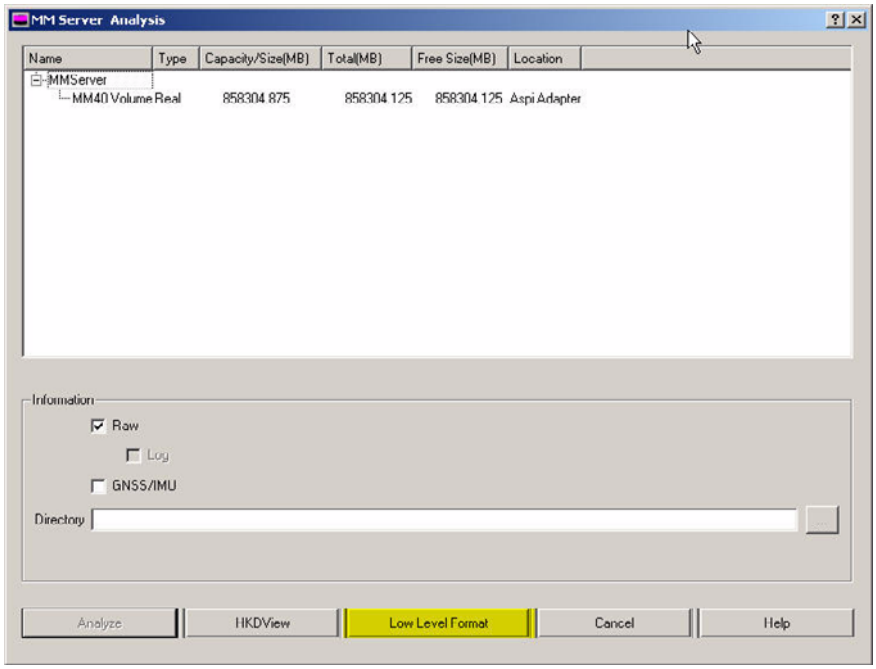
1. Connect the MM to the workstation.

   A low-level format will erase any data on the MM. Make sure that you back up any unsaved data before continuing the low-level format.

2. Start GPro and select Preferences › Image Download....
   Press "Remove.."

3. Start the Tools › MM Analysis Tool...

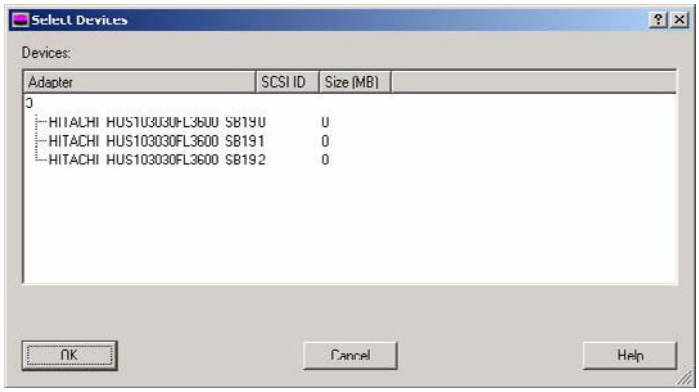
Figure 108: MM Analysis Tool



4. On the MM Analysis Tool, click the **Low Level Format** button.

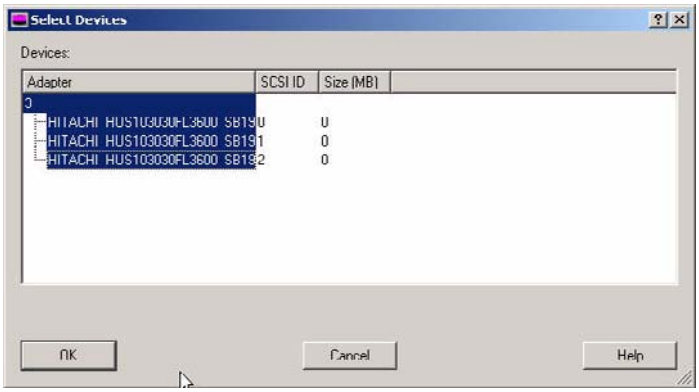
The workstation will search for disks that are connected on the hba (SCSI: host bus adapter), whicht was configured with the "Add..." function in Preferences / Download Images menu.

The **Select Device** dialog is displayed.



5. Select the device(s) in the MM that you want to format. Selecting all of the devices will ensure that all of the disks are low-level formatted together.

Figure 109: Select Devices for Low Level Formatting

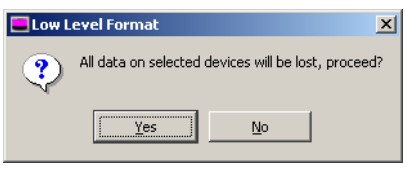


6. Click **OK** on the Select Device dialog.

Reformatting the MM will permanently erase any data on the disk.

A Warning dialog is displayed informing you that reformatting your MM will erase all data on the disk.

Figure 110: Warning that all data will be erased

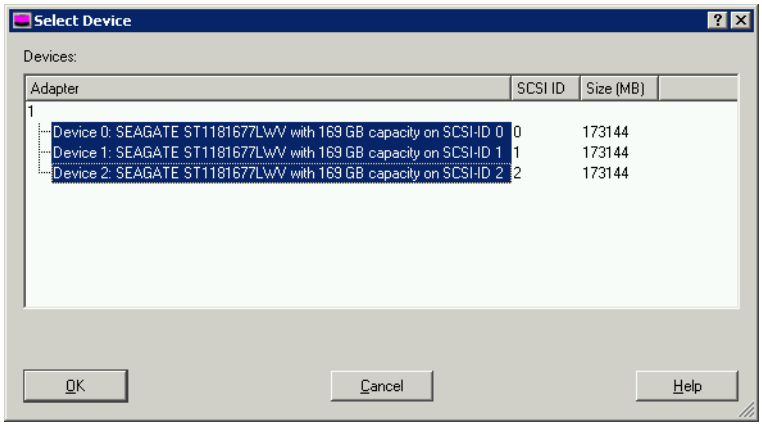


7. Click **OK** on the Warning dialog to continue.

The Low Level Format begins. If GPro is open, the GPro workstation changes to the **Task Status** tab and displays the progress as it reformats the MM.

Performing a High-Level Format

After the Low-Level Formatting is complete, the Device Selection dialog is displayed once again.



8. Select the all of the devices in the MM. This ensures that all of the disks are high-level formatted together.

   Failure to select all of the devices in the MM for high-level formatting will result in a smaller or non-functioning MM.

   The High-Level format takes only a few seconds. After it completes, the MM is optimized and ready for use.

7 IPAS Pro

7.1 IPAS Pro Introduction

This chapter contains a brief introduction to the IPAS Pro software as used in the ADS ground processing workflow. IPAS Pro is a set of software tools that work together to compute an optimally accurate blended navigation Attitude System (IPAS) that is embedded in the ADS system.

There are six basic steps required to transform ADS imagery into standard orthorectified image files. IPAS Processing is performed between the second and third steps of the workflow:

1. Download raw imagery from MM.
2. Download POS Data from the MM.
3. Process GNSS/IMU data.
4. Create ground-controlled support data for raw imagery (Level 0).
5. Create rectified imagery for stereo viewing (Level 1).
6. Triangulate the imagery for improved ground control.
7. Produce ortho-rectified imagery (Level 2).

For detailed information on how to use the IPAS software, please refer to the documentation included with the software.

For a complete understanding of the functionality and operation of the system it is necessary to participate in an ADS Ground Processing software training course.

GNSS/IMU Post-processing

GNSS and IMU data are collected during the image acquisition and written to the MM. These two data streams must be post-processed along with optional GNSS base station data, to produce a precise position and attitude stream for every line of imagery. Since different lines may be using different sampling frequencies, the data are processed into separate files for all sensor lines. Thus, at the end of this processing step, there is one data file for each sensor line, containing the position and attitude for each line of the image.

The GNSS data is recorded referenced to the World Geodetic System of 1984 (WGS 84). This gives the position of the GNSS antenna The IMU system records instantaneous changes in position and attitude of the ADS. The IMU is rigidly attached to the focal plane/lens system unit of the ADS. The high frequency readout of the IMU is used to verify the GNSS data and to provide instantaneous positioning of each line of imagery between GNSS recordings. Since the sampling frequency of the imagery may typically be as high as 800 lines per second, while the GNSS frequency may be 2 samples per second, the IMU must be used to determine the precise position between GNSS samples. The IMU system generates relative position and attitude information. Thus it provides very precise position

and attitude only over short periods of time. Over time, the elapsed position and attitude measured drifts away from the true position and attitude. This attitude data must be corrected and transformed to real world coordinates by using the GNSS data. Thus, the GNSS data is also used to correct the bias and drift of the IMU system. The IMU records attitude referenced to the “local vertical” (plumb line direction). Corrections can be applied for deflection of the vertical direction, the alignment of the IMU coordinate system with the focal plane coordinate system and the GNSS antenna offset. Furthermore, the data can be additionally corrected during a triangulation process described below.

To produce the initial position and attitude files for each image, the data must be processed into a local rectangular reference frame. This local reference frame is defined to be Cartesian and centered in the project area and is used to support the attitude data and the triangulation.

The GNSS/IMU processing is an important step towards high quality imagery and accurate measurements derived from it. The timing of IMU recording, GNSS recording and sensor line recording must be done using a synchronized clock. This allows the precise registration of each data-recording event. To perform data collection from imagery without triangulation, care must be taken to handle each error source.

The data are then un-compressed and organized into images (usually in TIFF format), metadata and positioning data. These positioning data are essential to model the position and the attitude of the sensor during the flight and to thus recover the parallelism of the scanned lines. The combination of positioning (GNSS) and inertial (IMU) measurements, measured magnitudes and measured frequencies, allows for generation of a precise and reliable trajectory (position + attitude) with a resolution of 200 Hz (depending on IMU). ADS obtains the imagery up to a maximum frequency of 800 Hz (1.25 ms).

The first step in the post processing is therefore the calculation of this trajectory with the help of the IPAS Pro software. Experience shows that a very special care has to be paid to the calculation of the GNSS trajectory (differential kinematic). This is also true for the airborne GNSS trajectory uniquely destined for classical aerial triangulation, and no less true for the trajectory from airborne GNSS and IMU data. This will be delicate as long as the processing of GNSS measurements remain separated from the inertial measurement processing. The images are then fitted to the GNSS/IMU trajectory thanks to a time based synchronization file. While adding the calibration of the focal plane (position of each pixel in x and y, as done for fiducial marks in a film camera), each pixel is then georeferenced. It is now time to rectify the raw images and to give to each pixel its relative position. This can be done to a plane of average altitude (fast rectification) or in combination with a digital terrain model (precise rectification).

8 ORIMA

8.1 ORIMA Introduction

This chapter contains just a brief introduction to the ORIMA software as used in the ADS ground processing workflow. The ADS uses a gyro system that retains the attitude data for a short period. Consequently a variant of the ORIMA aerial triangulation software is used to combine the high local, i.e. short-term, accuracy of the IMU with the high global accuracy of GNSS. In combination with a minimum number of ground control points, aerial triangulation delivers the best fitting results on the ground. The extra information added to the system by tie point measurements leads to very reliable orientation results where photogrammetric measurements serve to control GNSS/IMU measurements and *vice versa*.

There are six basic steps required to transform ADS imagery into standard orthorectified image files. ORIMA is used in the fifth step of the workflow as itemized below:

- download raw imagery and GNSS/IMU data from MM
- process GNSS/IMU data
- create ground-controlled support data for raw imagery (Level 0)
- create rectified imagery for stereo viewing (Level 1)
- triangulate the imagery for improved ground control
- produce ortho-rectified imagery (Level 2)

As the ORIMA software has its own set of documentation, all which is included in this chapter is a brief description of the ORIMA triangulation process in connection with ADS data.

Please be aware, that for a complete understanding of the functionality and operation of the system it is necessary to participate in a ADS Ground Processing software training course.

Automated Triangulation

The ADS uses a gyro system that precisely stores the attitude data over a short flight line. As a consequence, aerial triangulation is used to combine the high local, i.e. short-term, accuracy of the IMU with the high global accuracy of GNSS. In combination with a minimum number of ground control points, aerial triangulation delivers best fitting results on the ground. The extra information added to the system by tie point measurements leads to very reliable orientation results where photogrammetric measurements serve to control GNSS/IMU measurements and vice versa.

The triangulation process involves automatic measurement of tie points and interactive measurement of control points. All operations are performed using the graphical working environment of ORIMA. For automatic tie point measurement the ADS-adapted APM software module from SOCET SET is called directly. Highest quality orientation results are obtained by a combined bundle adjustment. The Combined Adjustment Program CAP-A, which is part of ORIMA, has been extended to handle all types of observations required for the ADS. The observations are image coordinates, and position and attitude values from GNSS and IMU computed by GNSS/IMU post-processing software. The post-processing includes the transformation of the raw data into the reference frame used for the aerial triangulation. The resultant values of this transformation are usually fairly close to the exterior orientation elements of photogrammetry.

To handle the multi-line sensor geometry the generalized collinearity equations described by Müller (1991) are used. This technique determines the orientation for sensor lines at a certain interval. These positions are called orientation fixes. The orientations of the sensor lines between two orientation fixes are determined by interpolation using the GNSS/IMU values.

Aerial triangulation for ADS is also required to compensate systematic effects, primarily the misalignment between IMU and camera axes and the datum difference between GNSS/IMU and the ground control coordinate system.

ORIMA allows for a combined triangulation of images from conventional aerial cameras and from the ADS.

9 Glossary

A

ADS—Airborne Digital Sensor. ADS is a digital line sensor. Each CCD line array on the focal plane generates a continuous strip/line of imagery, which may be considered to be a "single image" for most processing operations.

ADS Image Format—The Airborne Digital Sensor image format (*.ads). This image format created specifically for storing ADS imagery. Owing to operating system file size limitations, and to allow efficient processing, the image data may be required to be stored in separate "blocks" on disk. The binary file containing the image pixel data is replaced by an ASCII information file, which merely provides pointers to the multiple files containing the actual pixel data. This is transparent to all applications, which still consider the ASCII file to contain pixel data. However, when the image library opens a file of this type, it is automatically identified, and the library acts accordingly. See "ADS Image Format" on page 174 for more information.

APM—Automatic Point Matching. APM is used to determine homologous points in the imagery. The APM process will triangulate thousands of points on multiple ADS strips to achieve a better correlation between the points on each image.

C

Camera Calibration file—The camera calibration file (*.cam) contains the geometric and radiometric calibration for a CCD on the ADS sensor.

CCD—Charge-Coupled Device.

Cluster—a group of computational node computers.

Computational Node—In a Distributed Computing environment, the computational nodes receive jobs from the pool manager and perform all of the computing. When they have finished their computation, they send the results back to the pool manager. Computational nodes can be dedicated machines, or any idle machines connected to the network.

CT File—Camera Time file (*.ct). This file is downloaded from the MM and contains the camera time stamps for each image. When you add an image to a project, this file is used to synchronize the image with the processed GNSS/IMU trajectory to calculate the geographic position of each image line.

D

DTM—Digital Terrain Model. A DTM is a file that represents the elevation data for an area of the earth's surface. This file may be either a Digital Elevation Model (DEM) or a Triangulated Irregular Network (TIN). GPro accepts DTMs in .pro, or .img format.

E

Epipolar Rotation—Rotation of an image on a map or screen so that the direction of the flight path is parallel with the eye base. This positions the imagery for ideal stereo viewing.

F

FCMS—Flight Control Management System.

Flight—an individual flight mission. A flight might be comprised of multiple overlapping flight lines, or observation periods, to completely cover the target area. This is also known as a "lift".

Flight Line—a single pass of the ADS over the target area. Each flight usually consists of multiple flight lines to completely cover the target area. This is also known as an Observation Period.

FPES—Flight Planning and Evaluation System.

G

GSD—Ground Sample Distance. The ground sample distance is the distance on the earth's surface in the X and Y directions represented by each pixel.

H

Histogram—A histogram is a graph of data distribution. In the case of raster data, a histogram is a graph showing the number of pixels of each data value in the file or on the screen. Data values are plotted along the X axis and pixel count is plotted along the Y axis.

L

LSR - Local Space Rectangular; a Cartesian coordinate system. Anchored LSR provides X, Y, and Z coordinates of the anchor point (in the form of latitude, Longitude, and elevation) as well as a rotation angle from North.

M

MM — is the Mass Memory unit, which stores all of the raw imagery from the flight. MM may be used to refer to either the actual MM or a Virtual MM that is used to store the raw imagery.

O

Observation Period—a single pass of the ADS over the target area. Each flight usually consists of multiple flight lines to completely cover the target area. This is also known as a Flight Line.

ODF—Orientation Data File. This file contains the position and orientation of each scan line in an ADS image. This file is interpolated from the real time solution that is generated after the IPAS processing.

Orthorectification—a form of rectification that uses a Digital Terrain Model of the study area to correct for terrain displacement. In GPro, the process of creating a Level 2 image performs orthorectification.

P

Pool Manager—is the computer that matches submitted jobs with an available machine. This machine must be running all the time, and shouldn't be required to run jobs.

POS file— The raw GPS/IMU file that is downloaded from the MM and is used in FPES processing.

Project—The collection of images and support files which have been processed from the raw flight imagery. A project will include all of the L0 georeferenced imagery, L1 rectified imagery, and L2 orthorectified imagery, as well as the support files for the imagery. The Project directory contains the project files (*.info) and all of the files created and used during processing.

R

Raw File—This file is the raw scrambled binary data as stored in the MM.

Rectification—the process of making image data conform to a map projection system. In GPro, the image is also be rotated into the epipolar direction for optimized stereo viewing.

S

SBET - Smoother Best Estimate of Trajectory. An output file from the Applanix POSPac software, which is used for georeferencing of raw ADS data.

SMRMSG—Smoother Root Mean Square Estimation error file. An output file from the Applanix POSPac software, which is used for georeferencing of raw ADS data. The SMRMSG file provides the standard deviations for the SBET and TM files, and is used for weighted accuracy checks in GPro.

SOL—An output file from the Leica Geosystems GNSS/IMU post-processing software. It is equivalent to the Applanix SBET and SMRMSG files.

Strategy file —The strategy file is used to define the geometric constraints APM uses when measuring points in the imagery. It describes the number of passes, the patch size and the search distance used during correlation. A default APM strategy file for ADS, ADSStrategy.stf, is distributed with GPro. This file may be edited in any text editor.

Submitting Machine—in a Distributed Computing environment, the Submitting Machine is one of the systems that are authorized to submit jobs to the Pool Manager.

T

TM—Time Marker. An output file from the IPAS software that is used in the georeferencing of raw ADS data. The TM file is used for accounting for clock drift between GPS time (time at the ADS sensor) to CT time (time at the control unit).

Tie Point Pattern file—The tie point pattern defines how the Automated Point Measurement (APM) algorithm defines its measurement points within the imagery. The variable length of an ADS image requires a different tie point pattern from the tie point patterns used with traditional frame imagery. An ADS tie point pattern uses a number of vertical patterns which are repeated horizontally. These patterns can be edited in ORIMA. The example pattern, ADSPattern.tpf, comes bundled with GPro.

U

UTC—Universal Coordinated Time. This corresponds to Greenwich Mean time.

W

Workspace—a hierarchical directory structure that will contain all of the GPro project data. The Workspace file (*.wks) is an XML file that contains pointers to all of the relevant project files.

10 Appendices

10.1 ADS Image Format

The ADS image format is specific to the Leica Airborne Digital Sensor (ADS). The ADS is a digital line sensor. Each CCD line array on the focal plane generates a continuous strip of imagery, which may be considered to be a single image for most processing operations.

Owing to operating system file size limitations, and to allow efficient processing, the image data may be required to be stored in separate “blocks” on disk.

ADS Image Design

The binary file containing the image pixel data is replaced by an ASCII information file, which provides pointers to the multiple files containing the actual pixel data. None of the applications need any adjustment; they interact seamlessly with the ASCII file as if it contained pixel data.

When the image library opens a file of this type, it is automatically identified as an ACII file and not a binary file, and the library acts accordingly.

The following table is an example of the single ADS ASCII “pixel file” that all applications reference. The file points to blocks of real imagery that make up the full image.

Table 4: ADS ASCII Pixel File

ADS_HEADER	1
BANDS	1
BITS	8
LINES	100376
SAMPLES	12000
TILE_Y	256
TILE_X	256
HARDWARE_COMPRESSED	0
LINES_PER_BLOCK	32768
SAMPLES_PER_BLOCK	6000
BLOCK_DATA	0 0 escon_line_A_block_0_0.tif
BLOCK_DATA	0 1 escon_line_A_block_0_1.tif
BLOCK_DATA	1 0 escon_line_A_block_1_0.tif
BLOCK_DATA	0 1 escon_line_A_block_1_1.tif

10.2 ADS 16-bit Compressed Image Format

16-bit ADS imagery can be captured on the aircraft in a modified JPEG format. In this mode, each group of eight image lines is analyzed to determine the actual dynamic range of the pixels in those lines. This analyses is used to normalize to 8 bit and then compress the data. The normalization parameter are stored together with the image data to allow denormalization afterwards. When the option to **Download As Compressed** is used, the compressed image data is preserved in a TIFF TILED image file, where each tile is an 8 lines by 12000 samples JPEG compressed byte stream. Appended to the end of each JPEG byte stream are the parameters needed to expand it back to 16-bit. In addition, a special TIFF tag is added to the file to indicate that this is a special ADS 16-bit compressed image. The TIFF Tag ID is:

65100 (called ADS_MIN_MAX_DENORMALIZATION)

Its value is set to: 0x4144534A

This file appears as a standard 8-bit TIFF TILED JPEG image to any image processing software package which has the ability to read TIFF TILED JPEG. However, unless specifically modified to check for the ADS_MIN_MAX_DENORMALIZATION tag, image processing software packages will be unable to expand it to 16-bit and the resulting imagery will look very blocky for each set of 8 lines.

10.3 ADS Ground Processing File Formats

ADS Image Format (*.ads)

See "ADS Image Format" on page 174.

APM Strategy File (*.stf)

The strategy file is used to define the geometric constraints Automated Point Measurement (APM) uses when measuring points in the imagery. It describes the number of passes, the patch size and the search distance used during correlation.

Application Configuration File (*.cfg)

These files are ASCII text files that define the logging configuration. Logging is used to capture important information such as errors and warnings, but this file can be edited to log debugging information. GPro uses the Apache Logging configuration format. For more information, please see the Apache Logging Services at http://logging.apache.org.

Application Log Files (*.log)

The Application log file captures the information (such as errors or debugging information) specified in the Application Configuration file. GPro uses the Apache Logging configuration format. For more information, please see the Apache Logging Services at http://logging.apache.org.

Break Point File (*.bpf)

The Break Point file specifies the look up table to be used when you perform a radiometric stretch on the images.

Camera Calibration File (*.cam)

The camera calibration file contains the geometric and radiometric calibration for a CCD line on the ADS sensor.

Camera Time File (*.ct)

This file is downloaded from the MM and contains the camera time for each image. It is used in the georeferencing process to synchronize the image capture time with the processed POS information to calculate the position (exterior orientation) for each line.

Downloading Configuration Information File (*.ini)	These files contain the configuration information used by GPro when downloading information for the MM.
Flight File (*.flt)	The Flight file is an XML file that contains information used to define and
GPro INFO files (*.info)	These are XML format files used to keep track of where file information and locations. Info files are the main source of input within GPro. The project info file, <projectname>.info, contains the WGS84 anchor point used to define a local coordinate system for triangulation. The info file data is populated when the ADS project is created. The image info file,<imagename>.info, contain the image related information and reside in the project data directory as well. GPro will not recognize any image or support file if it doesn't have an info file.
Image Point File (*.ipa)	The Image Point file is used to store the image tie points found during APM for use with Bundle Block Adjustment in ORIMA.
IPAS Pro SOL file (*.sol)	The IPAS Pro SOL file is the output from Leica Geosystems GNSS/IMU post-processing software. It is equivalent to the Applanix POSPac SBET and SMRMSG files.
Job Arguments Files (*.xml)	The Job Arguments file is an XML file that contains the arguments used to run a job.
LPS Block File (*.blk)	Leica Photogrammetry Suite Block file.
Orientation Data File (*.odf)	The orientation data file contains the position and orientation of each scan line in an ADS image. This file is interpolated from the real time solution that is generated after the IPAS processing.
Processed POS File (*.out)	The IPAS real time solution generates several output files. The two most important output files for ADS have the extension *.out and have the prefix SBET (Smoother Best Estimate of Trajectory) and SMRMSG (Smoother RMS estimation errors).
Processed TM POS File (*.dat)	The IPAS real time solution file. These files are prefixed with "TM".
Raw File (*.raw)	Files with this extension are the raw binary data as stored in the MM.
Raw POS File (*.pos)	The raw GPS/IMU data downloaded from the MM and used in the IPAS processing.
Support File (*.sup)	SOCET SET support files.
Temporary files (*.tmp)	Temporary files are used to pass commands and data from one application to another. By default GPro will delete all these files found in the “TempFiles” subdirectory at the end of a session.
Tie Point Pattern File (*.tpf)	The tie point pattern defines how the APM algorithm defines its measurement points within the imagery. The variable length of an ADS image requires a different tie point pattern from the tie point patterns used with traditional frame imagery. An ADS tie point pattern uses a number of vertical patterns which are repeated horizontally. These patterns can be edited in ORIMA.

Updated Orientation Data File (*.odf.adj) Orientation data that is updated by triangulation.

Workspace File (*.wks) The Workspace file is an XML file that contains the paths to all of the Projects, Flights, Image Locations, and other data used in the current GPro workspace.

Distributed Computing File Formats

These files are created and used when you are distributing jobs in a Distributed Computing environment.

See "5 Distributed Computing" for more information.

Condor Error Log File (*.con_err) The Condor Error Log file is an ASCII file that contains a the text of any errors encountered by Condor when distributing and processing the jobs.

Condor Log File (*.con_log) The Condor Log file is used to log the progress of jobs submitted to the computational nodes by the pool manager.

Condor Output File (*.con_out) The Condor Output file is an ASCII file that contains a log of all of the text that was written to the screen while the computational node was running its job.

Condor Submit Description File (*.sub) The Condor Submit Description file is an ASCII file that contains the job description and parameters sent by the submitting machine to the pool manager.

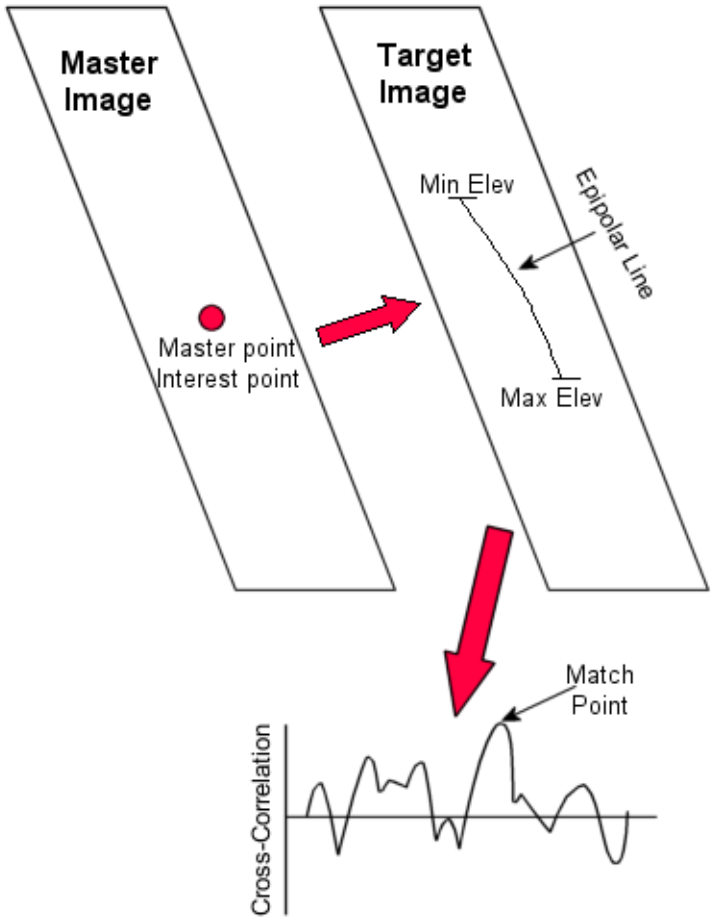
10.4 Automated Point Matching File Descriptions

This Section contains a description of different files that are used during Automated Point Matching (APM). At times, it may be necessary for you to edit the Strategy and Tie Point Pattern files to achieve the best ties between your ADS images.

Theory of Operation

1. A series of 'seed' points are pre-computed on the master image using the pattern information.
2. The seed point areas are searched to find an interest point (a point with high contrast).
3. The interest point location, along with the minimum and maximum search elevations defines an epipolar line (a geometrically constrained search area) in the target images. The area perpendicular to the line can be searched by increasing the expected parallax value.
4. The search area is evaluated by performing a cross-correlation and difference computation on each pixel.
5. The computation results are analyzed to pick the most likely match that meets your cutoff specifications.

Figure 111:



Settings File

The Level 0 (L0) APM Settings File (apm_settings.txt) is used for fine tuning APM on L0 ADS images. Changes to the file are made by hand editing the contents to suit the needs of the project. Care must be taken not to introduce errors into the file that might cause problems in reading the file.

Table 5: APM Settings File

Keyword	Value Type	Unit	Range	Default	Description
PATTERN_SAMP_START	Double	Percent	0-100	10	Across line start position of the first point to find.
PATTERN_SAMP_REPEAT	Double	Percent	0-100	20	Across line repeat positions for each row of lines to find.
PATTERN_SAMP_USER	Multi-Double	Percent	0-100		Across line positions for each row of lines to find, specified by the user (in percent), e.g. PATTERN_SAMP_USER 10.0 20.0 50.0 80.0 90.0 When this field is present, the PATTERN_SAMP_START and PATTERN_SAMP_REPEAT will be ignored.
PATTERN_LINE_START	Integer	Pixels	>0	200	Along line start position of the first pixel to find.
PATTERN_LINE_REPEAT	Integer	Pixels	>0	500	Along line repeat distance to search for points until the end of the line.

Keyword	Value Type	Unit	Range	Default	Description
PATTERN_LINE_USER	Multi-double	Percent	0 - 100		Along line positions for each set of sample patterns to find, specified by the user (in percent of total line length), e.g. PATTERN_LINE_USER 10.0 30.0 50.0 70.0 90.0When this field is present, the PATTERN_LINE_START and PATTERN_LINE_REPEAT will be ignored.
INLINE_INIT_MASTER_SEARCH_SIZE	Integer	Pixels	>0	100	This is the width and height of the initial search area around the seed point on the master image to locate an interest point.
INLINE_TARG_TEMPLATE_SIZE	Integer	Pixels	>0	24	This is the size of the image template given in pixels.
INLINE_L1_ELEV	Double	Proj Dist Unit		1000	If the ELEV_MODE from above is set to MANUAL then this is the L1 rectification elevation used within the ADS APM to rectify the master and target patches.
INLINE_MIN_ELEV	Double	Proj Dist Unit		800	If the ELEV_MODE from above is set to MANUAL then this is minimum elevation used for the epipolar search.
INLINE_MAX_ELEV	Double	Proj Dist Unit		1200	If the ELEV_MODE from above is set to MANUAL then this is maximum elevation used for the epipolar search.
INLINE_RMS_CUTOFF_PER_PIXEL	Double	Unitless	>0	2.0	Represents gray value differences between the master and target templates.
INLINE_CORRELATION_CUTOFF	Double	Unitless	0-1.0	0.6	Cross-correlation threshold for inline matches.
INLINE_PARALLAX_CUTOFF	Double	Pixels	0	3.0	Parallax threshold used for discarding points while finding points in the same strip.
INLINE_EXPECTED_PARALLAX	Integer	Pixels	>0	3	The a priori parallax error. This affects the search width and minification logic for the target area. Increasing this value will increase the number of pixels searched (at the price of speed). Increase this value (and the cutoff value) when large initial parallaxes are observed.
TRANSFER_TEMPLATE_SIZE	Integer	Pixels	>0	10	Size of the image template used for transfer operation.
TRANSFER_CORRELATION_CUTOFF	Double	Unitless	0-1.0	0.6	Threshold correlation value to accept points during transfer.
TRANSFER_PARALLAX_CUTOFF	Double	Pixels	>0	3.0	Parallax threshold used for discarding points during a transfer operation.
TRANSFER_INLINE	Integer	Boolean	0 or 1	0	This option is used when adding bands to a strip and transferring points to these new bands without having to re-run the point finding operation on the entire strip. Setting value to 1 will allow the existing points to be transferred to newly added band in the same strip.
RECTIFY_SUBBLOCK_SIZE	Integer	Pixels	>0	5	The L1 subpatch to be rectified. A larger value will increase speed but possible decrease rectification accuracy (depending on flight dynamics). A smaller value will decrease speed but increase rectification accuracy.

Keyword	Value Type	Unit	Range	Default	Description
ALLOC_MAXSIZE	Integer	Bytes	>0	4000000	The largest allowable buffer memory allocation size to be created for reading image buffers.
INTEREST_WINDOW_SIZE	Integer	Pixels	>0	7	Interest operator window size (value should be an odd number).
INTEREST_CIRCLE_CUTOFF	Double	Unitless	0-1.0	0.75	Interest operator "roundness" cutoff for determine best interest point.
APM_MODE	String		FULL, INLINE_ONLY, TRANSFER_ONLY	FULL	This tells the APM operation to find and transfer points. Allows for transfer of points only, find new points within ADS Lines only, or perform both operations.
ELEV_MODE	String		DEM, MANUAL, PROJ	DEM	This elevation mode is used to select the method which APM will use to set the terrain height seed point for finding points. Valid entries are PROJ, DEM, or MANUAL. By setting this value to PROJ, ADS APM will use the GPro project average min and max heights for seeding the elevation to begin searching for points. The DEM setting will force ADS APM to use a dem specified by the user (with the DEM_NAME). Note: As of version 3.3, in addition to the JPTF dem files supplied by Leica Geosystems as well the DEM-s in .pro, .img and .ltf formats can be used. The supplied JPTF dem files are global dems with grid spacing of 30 arc seconds (derived from USGS GTOPO30 dems). Accuracy varies by location but is typically better than 100m. While using APM in Distributing Computing mode the DEM file has to be made available for all the computation nodes. MANUAL will force the ADS APM to use elevations defined within this settings file.
DEM_NAME	String				When the elevation mode is set to DEM, this value identifies the full path of the JPTF dem file.
DEM_ACCURACY	Double	Proj Dist Unit	>0	100	This is a scalable value that allows you to set the perceived accuracy of the DEM. Since the JPTF DEM is roughly 1 km spacing, not all regions on the surface of the earth can be represented very well. For instance, mountainous regions with many valleys and fast changing terrain will not be described very well with a coarse JPTF DEM. This value allows the APM to expand the search along the epi-polar line for points. A larger DEM_ACCURACY value will open a longer search space along the epi-polar line to search for points. A larger value will also generate more samples for the APM to test, thus slowing down the overall APM process. For flat terrain this value can be set lower, but for mountainous regions, this might be set higher to aid in finding more points.
INLINE_MATCHMODE	Integer	Integer	1,4	1	This is the algorithm used to match points. 1 = Conventional epi-polar constrained cross-correlation; 4 = Hierarchical search cross-correlation

Keyword	Value Type	Unit	Range	Default	Description
TRANSFER_MATCHMODE	Integer		1,4	1	This is the algorithm used to match points. 1 = Conventional epi-polar constrained cross-correlation; 4 = Hierarchical search cross-correlation
USE_MULTITHREADING	Integer	Boolean	0 or 1	0	Whether to use multi-threaded approach
NUM_THREADS	Integer		>= 1		By default, the number of threads created will be equal to the number of processors defined in the environment variable (NUMBER_OF_PROCESSORS). The user can set this to any value they choose.
TP_FILE_FORMAT	String		IPT, IPF, BOTH	PG - IPT GPro - IPF	IPF is the old SOCET SET image point format (which can be imported directly into Orima). IPT is the new format in XPro.
PRESMOOTH_IMAGES	Integer	Boolean	0 or 1	0	Smooth the imagery before matching. This is useful with SH40 data where there is a mix of PAN and GRN lines. The GRN lines tend to be noisier than the pan, so smoothing improves matching performance. Not needed for normal SH52 data
SUBPIXEL_SEARCH	Integer	Boolean	0 or 1	0	Sets whether subpixel matching estimation will be used. Subpixel matching should improve the matching accuracy. This should be reflected in a smaller a-posteriori sigma0 in the AT. This function will increase matching time.
POINT_CLUSTER	Integer	Boolean	0 or 1	1	Option to try to match a single point at the pre-calculated line/sample position, or a cluster of 5 points at the line/sample position. The cluster will have 5 points equally distributed with an area with the width of INLINE_INIT_MASTER_SEARCH_SIZE. Final matched points will likely move from their pre-calculated positions in order to find an appropriate interest point - or no match may result due to poor imagery.

APM_MODE FULL

This is will always be set to FULL for running APM from within GPro. This tells the APM operation to find and transfer points.

ELEV_MODE PROJ

This elevation mode is used to select the method which APM will use to set the terrain height seed point for finding points. Valid entries are **PROJ**, **DEM**, or **MANUAL**.

By setting this value to **PROJ**, ADS APM will use the GPro project average min and max heights for seeding the elevation to begin searching for points.

The **DEM** setting will force ADS APM to use a USGS GTOPO30 DEM. The USGS GTOPO30 DEM is coarse, 30 arc second, grid of points with global coverage. These are freely downloadable and usable from: http://edc.usgs.gov/products/elevation/gtopo30/gtopo30.html

MANUAL will force the ADS APM to use elevations defined within this settings file.

DEM_NAME C:\ADS40\GPro\etc\ gtopoDem_ell.jptf

gtopoDem_ell.jptf unifies all GTOPO30 dems into 1 file giving the global coverage.

DEM_ACCURACY 100	This is a scalable value that allows you to set the perceived accuracy of the DEM. Since the GTOPO30 DEM is roughly 1 km spacing, not all regions on the surface of the earth can be represented very well. For instance, mountainous regions with many valleys and fast changing terrain will not be described very well with a coarse GTOPO30 DEM. This value allows the APM to expand the search along the epi-polar line for points. A larger **DEM_ACCURACY** value will open a longer search space along the epi-polar line to search for points. A larger value will also generate more samples for the APM to test, thus slowing down the overall APM process. For flat terrain this value can be set lower, but for mountainous regions, this might be set higher to aid in finding more points.
PATTERN_SAMP_START 5	Across line start position of the first point to find, this value is given in percentage.
PATTERN_SAMP_REPEAT 20	Across line repeat positions for each row of lines to find, this value is given in percentage.
PATTERN_LINE_START 500	Along line start position of the first pixel to find, this value is given in pixels.
PATTERN_LINE_REPEAT 500	Along line repeat distance to search for points until the end of the line. ADS APM will automatically adjust this value internally if the value given is too large and thus not provide the required amount of points to form a strong photogrammetric solution. The strongest geometry for ADS points is to have three columns of points between projection centers, if the value given here does not meet this criteria, the software will adjust this automatically.
INLINE_INIT_MASTER_SEARCH_SIZE 100	This is the size of search area at the seed point around the epi-polar line, given in pixels.
INLINE_TARG_TEMPLATE_SIZE 15	This is the seed size of the target template given in pixels.
INLINE_L1_ELEV 1000	If the ELEV_MODE from above is set to MANUAL then this is the L1 rectification elevation used within the ADS APM to rectify the master and target patches. This value is given in meters.
INLINE_MIN_ELEV 300	If the ELEV_MODE from above is set to **MANUAL** then this is minimum elevation used for the epi-polar search. This value is given in meters.
INLINE_MAX_ELEV 1200	If the ELEV_MODE from above is set to **MANUAL** then this is maximum elevation used for the epi-polar search. This value is given in meters.
INLINE_RMS_CUTOFF_PER_PIXEL 1.5	Represents gray value differences between template and slave on a pixel ratio. This value is unitless.
INLINE_CORRELATION_CUTOFF 0.7	Cross-correlation threshold for inline matches. Values are unitless (0-1).
INLINE_EXPECTED_PARALLAX 3	The a priori parallax error. This affects the search width and minification logic for the target area. Values are given in pixels.
INLINE_PARALLAX_CUTOFF 5	Parallax threshold used for discarding points while finding points in the same strip. Values are in pixels.

TRANSFER_CORRELATION_CUTOFF 0.7 Threshold correlation value to accept points during transfer. Values are unitless (0-1).

TRANSFER_PARALLAX_CUTOFF 5 Parallax threshold used for discarding points during a transfer operation. Values are given in pixels.

TRANSFER_TEMPLATE_SIZE 15 Size of the template used for transfer operation. Values are given in pixels.

TRANSFER_INLINE 0 This option is used when adding bands to a strip and transferring points to these new bands without having to re-run the point finding operation on the entire strip. Setting value to 1 will allow the existing points to be transferred to newly added band in the same strip. Value of 0 is default and for the normal workflow.

RECTIFY_SUBBLOCK_SIZE 8 The L1 subpatch to be rectified, unit is pixels.

ALLOC_MAXSIZE 4000000 The largest allowable buffer memory allocation size to be created for reading image buffers, values is in bytes.

INTEREST_WINDOW_SIZE 7 Interest operator window size, the value is in pixels.

INTEREST_CIRCLE_CUTOFF 0.75 Interest operator "roundness" cutoff

Strategy File

The strategy file is an XML-format text file that defines the geometric constraints used when measuring points in the imagery.

Version Enter the version number of this file.

Name Enter a name for this strategy file. This can be used to identify the situation this strategy file was created to solve.

Level Enter the processing level of the images on which APM is being run.

1 indicates Level 1 rectified imagery.

This should always be set to 1, as APM should only be run on Level 1 images.

Band Enter the image band on which APM should be run.

Correlation Limit Enter the cross-correlation coefficient limit, a value between 0.6 and 0.99. This limit measures the accuracy of the matched points in the image patches. Image points that do not reach this threshold will be discarded. A higher limit would result in fewer points being accepted, but would also have a lower error. A lower limit would result in more points being accepted, but may also have a higher error associated with them.

The default is **0.8**.

Search Window These parameters set the size of the search window to be used in APM. In most cases, the Search window can be left at the default value (21). In cases where the GPS/IMU data is found to be less accurate than a normal ADS image, you may need to increase the Search Window size for the Point Transfer.

The window size can also be related to the magnitude of parallax. You can use the following equation to help estimate the ideal Search Window size:

$$S_x = (Z_{max} - Z_{min}) / GSD / 32 / \tan\alpha$$

Where:

Z_{max} is the maximal ground elevation in the image,

Z_{min} is the minimal ground elevation in the image,

GSD is the Ground Sampling distance, and

α is the largest inclination angle of the sensor.

For a greater number of matched points, you may enlarge the S_x *by a factor of 1.2 to 1.5.*

X Enter the window size in the X direction in pixels to use for searching for corresponding points. For flat areas, this value could be smaller, for steeper areas, it could be larger. A larger value could cause more computation time and more wrong points, but a smaller value could result in fewer matched points. The default is **11**.

Y Enter the window size in the Y direction in pixels to use for searching for corresponding points. For flat areas, this value could be smaller, for steeper areas, it could be larger. A larger value could cause more computation time and more wrong points, but a smaller value could result in fewer matched points. The default is **11**.

Correlation Window The Correlation Window is used to match points across image patches. The default window size is 7 x 7. A larger window size could cause a smaller correlation coefficient due to the geometric difference within the two correlation windows and, therefore, fewer matched points. A smaller window size could result in a larger correlation coefficient due to insufficient contents and, therefore, more bad points.

X Enter the correlation window size in the X direction to be used for cross-strip correlation. The default is **7**.

Y Enter the correlation window size in the Y direction to be used for cross-strip correlation.The default is **7**.

Orientation Used Setting this value to 1 tells APM to use the orientation information available with the ADS imagery to improve the search for matching points. The default setting is **1** (On).

Avoid Shadow Turning this option on (setting it to 1) tells APM to avoid generating tie points in areas of shadow, which should improve tie point accuracy. This is useful if your images have a lot of prominent shadows. The default setting is **1** (On).

Tie Point Pattern File Format

Version Enter the version number of this file.

Unit These parameters determine the units that are used to measure the Pattern. Enter either **pixel** or **percent**.

X Enter the units in which the pattern is measured in the X direction. The default is **pixel**.

Y the units in which the pattern is measured in the Y direction. The default is **percent**.

Start Start defines the point on the image at which to begin the tie point pattern search.

X Enter the X value at which the Tie Points should be begun to be collected. The default is **250**.

Y The Y value at which the Tie Points should be begun to be collected. The default is **10**.

Repeat This defines the interval at which the tie point pattern will be repeated along the image.

X Enter the X value at which to repeat.The default is 500.

Y Enter the Y value at which to repeat. The default is **20**.

APM Settings File Example

```
APM_SETTINGS
;; apm settings file April 27

APM_MODE                    FULL
ELEV_MODE                   DEM
DEM_NAME                    C:\Program Files\Leica Geosystems\GPro\
                            etc\gtopoDem_ell.jptf
DEM_ACCURACY                50
USE_MULTITHREADING          1
NUM_THREADS                 2

INLINE_MATCHMODE            1
TRANSFER_MATCHMODE          1

PATTERN_SAMP_START          10
PATTERN_SAMP_REPEAT         40
PATTERN_SAMP_USER           5.0 15.0 50.0 85.0 95.0
PATTERN_LINE_START          500
PATTERN_LINE_REPEAT         500
```

INLINE_INIT_MASTER_SEARCH_SIZE	100
INLINE_TARG_TEMPLATE_SIZE	15
INLINE_L1_ELEV	1000
INLINE_MIN_ELEV	900
INLINE_MAX_ELEV	1100
INLINE_RMS_CUTOFF_PER_PIXEL	1.5
INLINE_CORRELATION_CUTOFF	0.7
INLINE_EXPECTED_PARALLAX	4
INLINE_PARALLAX_CUTOFF	6
TRANSFER_CORRELATION_CUTOFF	0.7
TRANSFER_EXPECTED_PARALLAX	7
TRANSFER_PARALLAX_CUTOFF	9
TRANSFER_TEMPLATE_SIZE	15
TRANSFER_INLINE	0
SUBPIXEL_SEARCH	1
RECTIFY_SUBBLOCK_SIZE	4
ALLOC_MAXSIZE	4000000
INTEREST_WINDOW_SIZE	11
INTEREST_CIRCLE_CUTOFF	0.75
TP_FILE_FORMAT	BOTH

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Original text

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- when it has to be right

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