

The Panorama Factory Batch Processing Module

User's Guide

**V5.3 for
Windows 98 / ME / NT / 2000 / XP / 2003 / x64 / Vista / 7
and
Mac OS X 10.3 / 10.4 / 10.5 / 10.6**



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The Panorama Factory Batch Processing Module User's Guide V5.3

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Contents

CHAPTER 1 INTRODUCTION TO THE BATCH PROCESSOR 1

Introduction to the Batch Processor 2

CHAPTER 2 STEP BY STEP TUTORIAL 5

Following steps in this tutorial 6

Tutorial step 1 – A systematic technique 7

Tutorial step 2 – Stitch the first set of photographs 7

Tutorial step 3 – Create the template 9

Tutorial step 4 – Capture new sets of photographs 11

Tutorial step 5 – Stitch with the Batch Processing module 12

CHAPTER 3 BATCH PROCESSING REFERENCE 15

Background 16

Batch processing step by step 16

The PFBatch program command line 17

Command line options to select output format 18

Command line options to select a VR viewer 18

Command line options for web pages and thumbnail indexes 19

Command line options for color and quality 20

Miscellaneous command line options 22

Batch processing by image type 23

CHAPTER 1 Introduction to the Batch Processor

Contents

Introduction to the Batch Processor ... 2

Introduction to the Batch Processor

The Batch Processing module of The Panorama Factory is designed for high-volume, repetitive stitching when the stitching parameters do not change from one stitching project to the next. It is intended to automate situations where a person wants to make many panoramas using a standard setup. For example, if someone wanted to make virtual reality tours of many real estate properties, she would probably use the same camera with the same setup and make the same number of photos for each virtual reality image. The Batch Processing module would be able to convert all of the panoramas with very minimal human interaction.

The Panorama Factory's Batch Processing module can produce BMP, TIF or JPEG output images.

You can use The Panorama Factory Batch Processing module when you have a lot of panoramas that are made with:

- The same digital camera model.
- The same image resolution.
- The same focal length (a small amount of variation in focal length may be acceptable).
- The same number of photos.
- A single row of photographs with a leveled camera. In other words, the camera tilt (pitch axis) must be zero.

A Panorama Factory stitching project is actually a collection of files—a main project file and a set of image files. The main project file describes the steps that must be taken in order to convert the imported images into a set of output images. The output images usually include a completed panorama but may include other images such as thumbnails computed from the panorama.

To put it another way, the main project file is a recipe for creating a panoramic image (and other, related output images) from a set of imported images. The project file doesn't actually contain any image data. The image data are stored in separate files.

This project file organization makes The Panorama Factory uniquely suited to providing a powerful batch processing capability.

The basic approach is that you:

1. Decide upon a standard photography technique. For example, you might decide to use 9 photos at 40 degree steps to cover 360 degrees.
2. Take one set of photographs using that technique and stitch them using The Panorama Factory application.
3. Save the stitching project as a template for further stitching.
4. Take many photo sets using the same technique.
5. Stitch each photo set with The Panorama Factory Batch Processing module using the template project you created in step 3.

This should save you time if you are making many similar panoramas.

CHAPTER 2 Step by step tutorial

Contents

- Following steps in this tutorial ... 6
- Tutorial step 1 – A systematic technique ... 7
- Tutorial step 2 – Stitch the first set of photographs
- Tutorial step 3 – Create the template ... 9
- Tutorial step 4 – Capture new sets of photographs ... 11
- Tutorial step 5 – Stitch with the Batch Processing module ... 12

Following steps in this tutorial

You may follow the steps in this tutorial using your own images, or if you wish you may use sample image data provided by Smoky City Design. The remainder of the tutorial assumes you are using the sample image data, so if you are using your own images you may need to make some changes to the parameters entered into The Panorama Factory.

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Download sample data for Windows

Self-extracting sample data package (934 KB):
<http://www.panoramafactory.com/pfbatsam.exe>

Note: The sample data package will load into the folder **C:\Program Files\Smoky City Design\The Panorama Factory V5\Batch Tutorial**. If you load the data into another folder, you may need to change the Run_PFBatch.bat file provided in the sample data package.

Download sample data for Mac OS X

Sample data package (disk image) (848 KB):
<http://www.panoramafactory.com/pfbatsam.dmg>

Note: The disk image for the sample data package contains a folder called **Batch Tutorial**. We recommend you drag this folder to your home directory. If you load the data to a different location, you may need to change the Run_PFBatch.command file provided in the sample data package.

Two phases

There are two phases to using The Panorama Factory Batch Processing module. In the first phase, you will create a template project:

1. Choose a systematic photography technique that you will use for many panoramas.
2. Capture one set of photographs using your technique and stitch them using The Panorama Factory application. You must use fully automatic stitching when you create your project. The Batch Processing module does not support semi-automatic or manual stitching.
3. Make final adjustments and then save the stitching project as a template for further stitching.

In the second phase, you will use the template project to stitch additional sets of images:

4. Capture new sets of photographs using the same technique.
5. Stitch each photo set with The Panorama Factory Batch Processing module using the template project you created in step 3.

Tutorial step 1 – A systematic technique

To begin your Batch Processing project, you should decide on a systematic photography technique that you will use for many panoramas. You'll use this same technique for all the panoramas to be processed by a particular template. Specifically, you should select:

- a. A particular camera model and lens (if it has interchangeable lenses).
- b. The image resolution.
- c. The focal length (i.e. zoom setting). A small amount of variation in focal length may be acceptable.
- d. The number of photos to be captured and the angular spacing between photos.

For our sample image data, we used a 35mm camera but then cropped the images to make them similar to digital camera images.

We chose an image resolution of 480x640 pixels.

We set the camera to its widest angle setting—approximately 30mm focal length. At this focal length, the camera requires 9 photographs at 40 degree steps to cover 360 degrees.

After choosing your systematic photography technique, move on to capturing and stitching your first set of images.

Tutorial step 2 – Stitch the first set of photographs

After deciding on a systematic photography technique, you should capture the first set of photographs using that technique. Then import the photographs into The Panorama Factory and stitch them. The sample image data includes a set of JPEG images you may use:

```
Template_1.jpg
Template_2.jpg
...
Template_3.jpg
```

You may get best results by using the New Project Wizard to create the initial project, but feel free to use Classic Mode to modify the project or create additional computed images.

See “Using the Wizard to make a panorama” in The Panorama Factory User’s Guide for step by step instructions on using the New Project Wizard. See “Using the Classic interface, step by step” in The Panorama Factory User’s Guide for more information about using The Panorama Factory's Classic interface.

For our tutorial, use the New Project Wizard:

Wizard step 1 -- Import your images

Import `Template_1.jpg`, `Template_2.jpg`, etc. then press the **Next** button to advance to the next step.

See also “Wizard step 1/9 – Import your images” in The Panorama Factory User’s Guide.

Wizard step 2 -- Choose stitching method

Select **Fully automatic** under **Photo stitching**. The Batch Processing module supports fully automatic stitching only. It does not support semi-automatic or manual stitching because these stitching methods required stitching points, but the stitching points cannot apply to different sets of image data.

See also “Wizard step 2/9 – Choose stitching method” in The Panorama Factory User’s Guide.

Wizard step 3 -- Describe your camera

Select **Other digital camera -- using 35mm equivalent** from the drop down list at the top of the Wizard panel.

Select **Automatically detect focal length**. We recommend that you select this option because it gives the software the most flexibility to find the best solution. You should enter the focal length yourself only if you are unable to get satisfactory results with the automatic setting.

Remove checkmarks (if present) from **Wide angle or tele converter**.

Add checkmarks to **Correct barrel distortion** and **Correct brightness falloff**.

Then press the **Next** button to advance to the next step.

See also “Wizard step 3/9 – Describe your camera” in The Panorama Factory User’s Guide.

Wizard step 4 -- Control image quality

We recommend selecting the three checkboxes:

Automatically fine tune
Enable exposure matching
Enable exposure correction

You should decide for yourself which of these options is best for your own images. Fine tuning will give you improved image quality, but at the expense of slower stitching times. Exposure matching and exposure correction will usually, but not always, produce better looking images.

Select the amount of sharpening you prefer. For this example, select **Sharpen the final image** and set **Amount** to **100%**.

Press the **Next** button to advance to the next step.

See also “Wizard step 4/9 – Control image quality” in The Panorama Factory User’s Guide.

Wizard step 5 -- Select panorama type

Select **360 degree panorama** because we are creating a full 360 degree image. You can select any **Output format** you wish because the choice of output format is controlled by the batch processing module. For this tutorial, we will just create the image file, not a QTVR, IVR or PTVviewer image, so select **Image file only** for now.

Select the type of projection you want to use. Normally you would select **Cylindrical projection** if you plan to make a QTVR and **Spherical projection** otherwise

The Batch Processing module can produce images in any of the formats that can be produced by the **Save Image As dialog box**. However, it cannot change the type of projection selected when you make the template project, so you must be sure to select the appropriate setting.

See also “Wizard step 5/9 – Select panorama type” in The Panorama Factory User’s Guide.

Wizard step 6 -- Create your panorama

You should decide what size and type of output image you want. For this tutorial, we want to make the height of the final image exactly 500 pixels and we also want to create a thumbnail for displaying in a web page. You may decide to choose different settings on this panel.

Select **Prepare image for internet display**.

Select **Image height** and enter **500** pixels for the height.

Then press the **Next** button to start stitching. We selected all of the image quality options, so please be patient while it stitches the template project.

See also “Wizard step 8/9 – Create your panorama” in The Panorama Factory User’s Guide.

Wizard step 7 -- Save & print your panorama

We are done with the Wizard. We'll need to make some adjustments to the project file in the next step of the tutorial, so don't save it yet.

Press **Done** to exit from the New Project Wizard.

Now you're ready to make the final adjustments to the project and save it for using later as a stitching template.

See also “Wizard step 9/9 – Save & print your panorama” in The Panorama Factory User’s Guide.

Tutorial step 3 – Create the template

Now that you have successfully stitched the first set of images, you need to save the project as a template for subsequent stitching. There are a few adjustments you should make to the project before you save it.

Disable copying imported images

Run the **Project properties dialog box** (**File menu**). Remove the checkmark from the **Copy imported images checkbox**.

***NOTE:** This step is absolutely essential. If you leave **Copy imported images selected**, the template will not work properly.*

If you wish, you may also choose to remove the checkmarks from the checkboxes under **Save images**. This will save time and disk space when you save the template, but it is not absolutely necessary.

Press the **OK** button to exit the Project properties dialog.

Adjust camera properties

Run the **Camera properties dialog box (Tools menu)**. This dialog shows the settings for focal length, barrel distortion correction and brightness falloff correction that the Wizard found during focal length refinement.

At this point, we recommend that you set the most restrictive settings that will cover the images that you plan to use in the future. For example, after stitching your initial project, you should probably select **I am pretty sure of the focal length** so that the focal length refinement procedure will not make large changes to the focal length.

Press the **OK** button to exit the **Project properties dialog box**. Unless you have changed the **Projection**, you should answer **No** when asked if you want to restitch with the new camera properties.

Adjust alignment properties

Run the **Alignment properties dialog box (Tools menu)**. we recommend that you set the most restrictive settings that will cover the images that you plan to use in the future. Since you are always using the same technique, and if you are using a tripod with angle markings, you may find that you can restrict the range for **Horizontal overlap limits** and **Vertical offset limit**.

The systematic technique we used for the creating sample images produces about 25% overlap, so enter 20% and 30% for **Horizontal overlap limits**.

We always use a tripod, so there is never very much vertical displacement. Enter 3% for **Vertical offset limit**.

The primary advantage to using restrictive settings is to accelerate stitching. If you get acceptable performance with the default settings, you may choose to leave camera properties and alignment properties unchanged.

Press the **OK** button to exit the Alignment properties dialog. You should answer **No** when asked if you want to restitch with the new alignment properties.

Decide what output images to save

Finally, before saving the project, decide which images you will want to save when you run new images through the Batch Processing module. Look at the thumbnails in the top pane and number them starting with "1." We will use the image numbers later when we run the Batch Processing module.

In our sample project, the images are:

1. Stitched.
2. Cropped.
3. Resized.
4. Sharpened.

We will want to save image number 4 (the sharpened image) whenever we run new images through the Batch Processing module.

Save the template project file

Use the **Save project as... command (File menu)** to save the project as a template to be used for subsequent stitching with The Panorama Factory Batch Processing module. You should probably save it with a name that suggests its purpose and is somewhat descriptive of the systematic technique used. This way if you save several different templates for different cameras or zoom settings it will be easy to keep track of them.

The sample data contains a sample template file as produced by this tutorial called:

```
Template.pfp
```

Once you have created your stitching template, you can start capturing new sets of photographs.

Tutorial step 4 – Capture new sets of photographs

Now that you created your template project, you can get started taking new sets of photographs. You must make these sets of photographs using the systematic technique you chose earlier. These new sets must match in these ways:

- a. You must use the same camera model and lens (if it has interchangeable lenses).
- b. You must use the same image resolution.
- c. You must use the same focal length (i.e. zoom setting). A small amount of variation in focal length may be acceptable.
- d. You must use the same number of photos at the same angular spacing.

The sample image data includes a set of JPEG images you may use:

```
Sample_1.jpg
Sample_2.jpg
...
Sample_3.jpg
```

Each time you capture a new set of images, you can stitch them with the Batch Processing module.

Tutorial step 5 – Stitch with the Batch Processing module

Now it is time to stitch your new set of photos with The Panorama Factory Batch Processing module.

PF Batch Wizard for Windows

On Windows, The Panorama Factory Batch Processing module is command-line program that is ordinarily run from a DOS window or by using a BAT file

Some users find Windows command-line programs to be inconvenient. David Richardson, a Panorama Factory user himself, has created a free application for building and running the BAT files used with The Panorama Factory Batch Processing module. We encourage you to try his PF Batch Wizard. For more information about the PF Batch Wizard, visit

<http://www.panoramashots.com/wizard/>

The remainder of this help file describes how to create the BAT file manually, but you may find this unnecessary if you use the PF Batch Wizard.

Windows

The Batch Processing module is a command-line program. You can run it from a DOS window or by using a BAT file. For this tutorial, we'll use a BAT file.

It is beyond the scope of this tutorial to teach you how to use DOS windows and BAT files. However, we have included a sample BAT file for you to use as a starting point for creating your own. The file is:

```
Run_PFBatch.bat
```

Run_PFBatch.bat contains two command lines. The first command line changes to the folder that contains the images we want to stitch. It is necessary to put quotation marks around the folder name because it contains spaces.

```
cd "C:\Program Files\Smoky City Design\The Panorama Factory\Batch Tutorial"
```

The second command line runs The Panorama Factory Batch Processing module. Again, it is necessary to use quotation marks because the full path name of the PFBatch program contains spaces.

```
"C:\Program Files\Smoky City Design\The Panorama Factory\PFBatch.exe" Template.pfp Sample_*.jpg -h:"Simple page" -t:"Index.html" -v+ -w4:Final.jpg
```

The PFBatch command line in the sample BAT file consists of several parts. First the folder and program name of the Batch Processing module:

```
"C:\Program Files\Smoky City Design\The Panorama Factory\PFBatch.exe"
```

Then the name of the template file (we don't need to put the full path name because the template file is in the current folder as set by the first command in the BAT file):

```
Template.pfp
```

Then the names of the new image files in order from left to right. In our example, we used the DOS "*" notation to select all the sample image files:

```
Sample_*.jpg
```

Finally, the selection of the output files:

```
-h:"Simple page" -t:"Index.html" -v+ -w4:Final.jpg
```

These parameters tell PFBatch to save the fourth image, to create a web page using the **Simple page** template, to add a thumbnail image to the file `Index.html` and to view the result in the browser after updating the thumbnail index. The names of the web page and thumbnail image will be created automatically from the output file name, so this will produce new files:

```
Final.jpg
Final.html
Final_thumb.jpg
```

And will update the file:

```
Index.html
```

You can run this sample BAT file by double-clicking it from the Windows File Explorer or by typing its name in a DOS window.

For more information about the command-line parameters you can use when you run PFBatch, see the next section, Batch Processing reference.

Mac OS X

The Batch Processing module is a command-line program. You can run it from a Terminal window or by using a shell script. For this tutorial, we'll use a tcsh shell script.

Note that it is beyond the scope of this tutorial to teach you how to use Terminal windows and shell scripts. However, we have included a sample shell script for you to use as a starting point for creating your own. The file is:

```
Run_PFBatch.command
```

`Run_PFBatch.command` contains two command lines. The first command line changes to the folder that contains the images we want to stitch. It is necessary to use "\ " within the folder name because it contain a space.

```
cd ~/Batch\ Tutorial
```

The second command line runs The Panorama Factory Batch Processing module. Again, it is necessary to use "\ " because the name of HTML template (**Simple page**) contains a space.

```
/Applications/PFactory.app/Contents/MacOS/PFBatch Template.pfp
Sample_*.jpg -h:Simple\ page -t:Index.html -v+ -w4:Final.jpg
```

The PFBatch command line in the sample shell script consists of several parts. First the folder and program name of the Batch Processing module:

```
/Applications/PFactory.app/Contents/MacOS/PFBatch Template.pfp
```

Then the name of the template file (we don't need to put the full path name because the template file is in the current folder as set by the first command in the shell script):

```
Template.pfp
```

Then the names of the new image files in order from left to right. In our example, we used the shell's "*" notation to select all the sample image files:

```
Sample_*.jpg
```

Finally, the selection of the output files:

```
-h:Simple\ page -t:Index.html -v+ -w4:Final.jpg
```

These parameters tell PFBatch to save the fourth image, to create a web page using the **Simple page** template, to add a thumbnail image to the file `Index.html` and to view the result in the browser after updating the thumbnail index. The names of the web page and thumbnail image will be created automatically from the output file name, so this will produce new files:

```
Final.jpg
Final.html
Final_thumb.jpg
```

And will update the file:

```
Index.html
```

You can run this sample shell script by double-clicking it from the Finder or by typing its name in a Terminal window.

For more information about the command-line parameters you can use when you run PFBatch, see the next section, Batch Processing reference.

CHAPTER 3 Batch processing reference

Contents

Background ...	16
Batch processing step by step ...	16
The PFBatch program command line ...	17
Command line options to select a VR viewer ...	18
Command line options for web pages and thumbnail indexes ...	19
Command line options for color and quality ...	20
Miscellaneous command line options ...	22
Batch processing by image type ...	23

Background

The batch processing capability of The Panorama Factory is based on The Panorama Factory project file organization.

A Panorama Factory stitching project is actually a collection of files—a main project file and a set of image files. The main project file describes the steps that must be taken in order to convert the imported images into a set of output images. The output images usually include a completed panorama but may include other images such as thumbnails computed from the panorama.

To put it another way, the main project file is a *recipe* for creating a panoramic image (and other, related output images) from a set of imported images. The project file doesn't actually contain any image data. The image data are stored in separate files.

Intermediate computed images are usually stored on disk in addition to the main project file and the imported images. These intermediate images allow you to open the project and generate new computed images without starting from the imported images. But if the intermediate images are lost, they are recovered automatically from the imported images.

This project file organization makes The Panorama Factory uniquely suited to providing a powerful batch processing capability. If an existing project file is combined with a new set of imported images, The Panorama Factory batch processor can repeat the steps in the recipe to create new output images.

We'll refer to this project file as a *template* for creation of new stitched images.

Batch processing step by step

To perform batch processing with The Panorama Factory, follow these steps:

1. Begin by deciding on a systematic way of capturing the imported images. These parameters must be the same for all panoramas to be processed by a particular recipe. Specifically, you should select:
 - a. A specific digital camera model.
 - b. The image resolution.
 - c. The focal length (a small amount of variation in focal length may be acceptable).
 - d. The number of photos to be captured.
2. Capture a representative set of images according to the decisions made in Step 1.
3. Create a new Panorama Factory project using the images captured in Step 2. You may get best results by using the New Project Wizard to create the initial project, but feel free to use Classic Mode to modify the project or create additional computed images.
4. Run the **Project properties dialog box** (*File menu*) and de-select the **Copy imported images** checkbox.
5. Save the project. Note that the project file name ends with a .PFP file extension. This .PFP file will be the template used for subsequent batch processing.

6. Use the PFBatch program to combine the project file template created in Step 4 with new sets of imported images.

We recommend that you adjust the settings on the **Camera properties dialog box** and **Alignment properties dialog box** to the most restrictive settings that will cover the images that you plan to use in the future. For example, after stitching your initial project, you should probably select **I am pretty sure of the focal length** on the **Camera properties dialog box** so that the focal length refinement procedure will not make large changes to the focal length.

The PFBatch program command line

The PFBatch program has the following command line syntax:

```
PFBatch project
    image1 image2 ... imageN
    [-p"filename"]
    [-options]
    [-w"filename"]
    [-wnumber:"filename"]
```

NOTE: On Windows, you may also use “-” for command line switches in addition to “-“. Both are accepted for backward compatibility.

project

The project file to use as a template. Must have a .PFP file extension. (*Input file, required.*)

image1 image2 ... imageN

The input image files to combine with the template. These may be JPG, BMP, PNG or TIF. The number of images must match exactly the number of imported images in the template. The sizes of the imported images (width and height in pixels) must match exactly the imported images in the template. (*Input files, required.*)

-p"filename"

Writes the updated project to the specified filename. This command will write the main project file and all imported and intermediate images according to the options selected on the Project properties dialog. The filename must end in .PFP. (*Output file, optional.*)

-w"filename"

Writes the final calculated image (i.e. the last image in the upper thumbnails pane) to the specified filename. The filename must end in .JPG .BMP .TIF .TIFF .PNG or .MOV to select the output file format. (*Output file, optional.*)

Example: -w:"result.jpg"

-wnumber:"filename"

Writes a particular calculated image to the specified filename. The number selects a particular calculated image. Positive numbers count from the first calculated image—the number 1 selects the first image and so on. The number 0 selects the final image. In other words, `-w0:"filename"` is the same as `-w"filename"`. Negative numbers count from the last calculated image—the number -1 selects the image just before the final image and so on. The filename must end in .JPG .BMP .TIF .TIFF .PNG or .MOV to select the output file format. (*Output file, optional.*)

Example: **-w4:"result.jpg"**

Other parameters are options that control how subsequent image files will be written. NOTE: These options must be specified BEFORE the -w options they apply to. This makes it possible to change options between one image file and the next.

Command line options to select output format

Ordinarily the file extension (e.g. .JPG .BMP etc.) selects the output file format. However, some output formats (e.g. multiple TIFF) cannot be selected by extension alone. You must use a separate command line option to choose these formats.

Multiple TIFF format

Use this option to select multiple TIFF format. The option must precede the `-w` option to which it applies.

-"multiple tiff"

Default if omitted: Use format implied by the file extension (.JPG, .MOV, etc.).

Command line options to select a VR viewer

IVR image file format

Use one of the following options to select IVR image file format. The option must precede the `-w` option to which it applies.

-ivr No viewer (IVR file only).
-ivr:java Java viewer:
-ivr:dual ActiveX and Plug-in viewers together:

Default if omitted: Use format implied by the file extension (.JPG, .MOV, etc.).

PTViewer image file format

Use the following option to select PTViewer image file format. The option must precede the `-w` option to which it applies.

`-ptviewer`

Default if omitted: Use format implied by the file extension (.JPG, .MOV, etc.).

QTVR image file format

Use one of the following options to select QTVR image file format. The option must precede the `-w` option to which it applies.

<code>-qtvr</code>	Use JPEG compression.
<code>-qtvr:jpeg</code>	Use JPEG compression.
<code>-qtvr:Sorenson</code>	Use Sorenson compression.
<code>-qtvr:cinepak</code>	Use Cinepak compression.
<code>-qtvr:png</code>	Use PNG image file format internally (uncompressed).

Default if omitted: Use format implied by the file extension (.JPG, .MOV, etc.).

Command line options for web pages and thumbnail indexes

Create web pages

Use one of these options to control web page creation. The option must precede the `-w` option to which it applies.

`-h:"filename"` Create web pages (if possible) from the specified web page template file.
Example: `-h:"c:/my templates/mypage.html"`

`-h:"template"` Create web pages (if possible) from the named web page template in The Panorama Factory application folder. This is the name of the template file without a path or file extension.
Example: `-h:"Simple page"`

`-h- -h` Cancel creation of web pages.

Default if omitted: `-h-`

Create thumbnail images

Use one of these options to control thumbnail image creation. The option must precede the `-w` option to which it applies.

`-t:"filename"` Add thumbnail images (if possible) to the specified thumbnail index page. This thumbnail index page must exist before running PFBatch. You can use the **Create new thumbnail index** button on the Save Image

As dialog box in The Panorama Factory to create new thumbnail index files.

-t- -t Cancels creation of thumbnails.

Default if omitted: **-t-**

View in browser

Use the following options to control viewing in browser after saving. The option must precede the **-w** option to which it applies.

-v+ -v View in browser (if possible) after saving.

-v- Cancel viewing.

Default if omitted: **-v-**

Image file size

Use the following options to control image file size. The option must precede the **-w** option to which it applies.

-k:number Limit the size of image files to be no larger than the specified size (in kilobytes).

-k- -k -k:0 Do not limit the size of image files.

Default if omitted: **-k-**

Viewer size

Use the following options to control viewer size on the web page. The option must precede the **-w** option to which it applies.

-s:number,number Set the viewer size (width, height) on the web page.

Default if omitted: **-s:320,240**

Command line options for color and quality

Bits per pixel

These options control the number of bits per pixel written to the image file. This applies only to TIFF image file format and PNG image file format. Images with 48 bits per pixel can be written only if the project file is defined with 48 bits per pixel on the Project properties dialog box (File menu).

The option must precede the `-w` option to which it applies.

- `-24` Write 24-bit images.
- `-48` Write 48-bit images (if possible).
- Default if omitted: `-24`

Blending

These options control the image-to-image blending when writing layered Photoshop files (.PSD) or Multiple TIFF files. These formats normally use the alpha channel to blend overlapping layers. If you choose the uncropped option, the output layers are enlarged to include the entire original image.

The option must precede the `-w` option to which it applies.

- `-x+` `-x` Write cropped layers.
- `-x-` Write uncropped layers.
- Default if omitted: `-x+`

Cropping

These options control the cropping performed when writing layered Photoshop files (.PSD) or Multiple TIFF files. These formats normally crop the layers to the cropping boundaries you defined in your stitching project with the Crop command. However, if you intend to blend the layers with Photoshop or with an external blending program (e.g. Enblend or SmartBlend), then you should choose the unblended option.

The option must precede the `-w` option to which it applies.

- `-b+` `-b` Write blended layers.
- `-b-` Write unblended layers.
- Default if omitted: `-b+`

Color correction

These options control whether corrected or uncorrected colors are written to the image file. This applies only to TIFF image file format and PNG image file format. Uncorrected colors can be written only if the project file is defined with 48 bits per pixel on the Project properties dialog box (File menu).

The option must precede the `-w` option to which it applies.

- `-c+` `-c` Write corrected colors (if 48-bit images).
- `-c-` Write uncorrected colors (if 48-bit images).

Default if omitted: **-c+**

Image quality (compression)

This option controls the image quality setting depending upon the image file format chosen. See the JPEG settings dialog box and the QTVR settings dialog box for more information about the image quality setting.

The option must precede the **-w** option to which it applies.

-u: number Set image quality for JPEG, MOV, etc. (lower quality settings reduce file size).

Default if omitted: **-u: 75**

Improve image quality

This option controls whether the Improve quality command (Image menu) is automatically used before saving image files. The option must precede the **-w** option to which it applies.

-q Apply the Improve quality command (Image menu) according to the project file.

-q+ Apply the Improve quality command before saving files regardless of the project settings.

-q- Suppress the Improve quality command before saving files regardless of the project settings.

Default if omitted: **-q**

Miscellaneous command line options

These miscellaneous options apply globally to the Batch Processing module.

-n Suppress the progress bar display.

-clone Clone mode. Create a new image stitched identically to the one in the template instead of recalculating the stitch.

-r Refresh mode. Recalculate the template from its original image files instead of reading new image files.

-y Show timing numbers.

-threads: number Set the number of execution threads. This option is only really useful for timing comparisons of multi-threaded versus single-threaded execution.

-threads: 0 Set the number of execution threads equal to the number of processor cores.

Default if omitted: `-threads:0`

Batch processing by image type

PFBatch generates new computed images according to the recipes in the project file template and then writes the output files you selected with your command line parameters. The precise way that the recipes are applied varies somewhat depending on the image type. This section gives you the important details of how the recipes are applied to the various image types.

Stitched

Each stitched image is automatically re-stitched from its source images.

The focal-length refinement procedure is performed prior to stitching unless you selected **I am certain of the focal length** on the **Camera properties dialog box (Tools menu)** when you created the template. This provides for small variations in focal length.

The image alignment procedure is performed on each pair of source images, within the overlap and offset limits you specified on the **Alignment properties dialog box (Tools menu)** when you created the template.

Alignment fine tuning is performed if you selected **Automatically fine tune** on the **Fine tuning properties dialog box (Tools menu)** when you created the template.

Finally, the images are blended and exposure corrected according to the options you selected on the **Blending properties dialog box (Tools menu)** when you created the template.

Note that you may have set some of these through the New Project Wizard when you created the template, but it is best to double-check them with the Tools dialogs before you save the template project file.

The final size of the stitched image may vary somewhat from one PFBatch run to the next depending on variations in the alignment results.

Cropped

If the template project applied the **Crop command** to any images, PFBatch re-crops them from their source images.

If the source for a cropped image is a stitched image, PFBatch resets the cropping rectangle to its default setting before cropping. The default cropping rectangle includes the maximum extent of image (excluding the scalloped top and bottom). The horizon line parallels the average rise or fall in the image from end to end.

For 360 degree panoramas (see the **Stitch 360 command**), the ends of the cropping region are set so that the lefthand and righthand edges of the cropped result will match seamlessly. This is important for VR image viewers.

See the **Crop command (New image menu)** for more information on the default cropping rectangle.

The final size of the cropped image may vary somewhat from one PFBatch run to the next depending on variations in the default cropping results.

Resized

If the template project applied the **Resize command (New image menu)** to any images, PFBatch recalculates them from their source images.

If you selected **Keep aspect ratio** when you applied the **Resize command** in the template project, the width or height will be fixed according the value you entered, but the other dimension is recalculated to maintain the aspect ratio of the source image.

If you need both width and height to be fixed, you must de-select **Keep aspect ratio** and enter both width and height.

Note that the New Project Wizard always selects **Keep aspect ratio**. This means that if you want to keep both width and height fixed and still use the Wizard to create your template, you must modify the project file produced by the Wizard.

Sharpened

If the template project applied the **Sharpen command** to any images, PFBatch recalculates them from their source images.

The size of the sharpened image will be exactly the same as the size of its source image.

Arrayed, Rotated, etc

If the template project contains other image types (e.g. Arrayed, Rotated), PFBatch recalculates them from their source images according to the options you set when you created the corresponding image in the template project.