

GoldenTouch is post-capture image processing software suite that creates technically accurate image rendering and white balance derivative images based on a user's selected tonal aim. It can be used to correct for deviations from a required or customized rendering aim (e.g. gamma 2.2, 1.8, or eciV2). It requires the use of either the GoldenThread object targets (18", 9", or 4.5") that is placed in the field of view for every image, or the GoldenThread device target which is used on a session-to-session basis. Images of these targets are shown below.

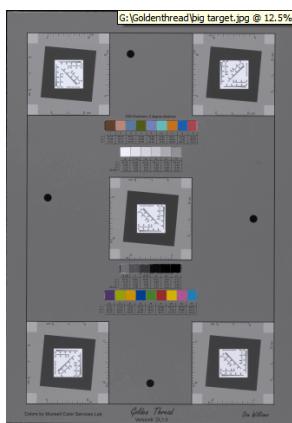
This version of the software was designed to work well with flat 2-D objects with reasonably even illumination across the field of view. An accompanying document, *GoldenTouch Image Capture Guidelines*, makes suggestions on the best way to capture images for high success rates. Historically, target detection, crop and save success rates have been 95-98%. Should failures occur, the software reverts to a manual intervention mode to assist in identifying key target features.

The current version of the software has the following features:

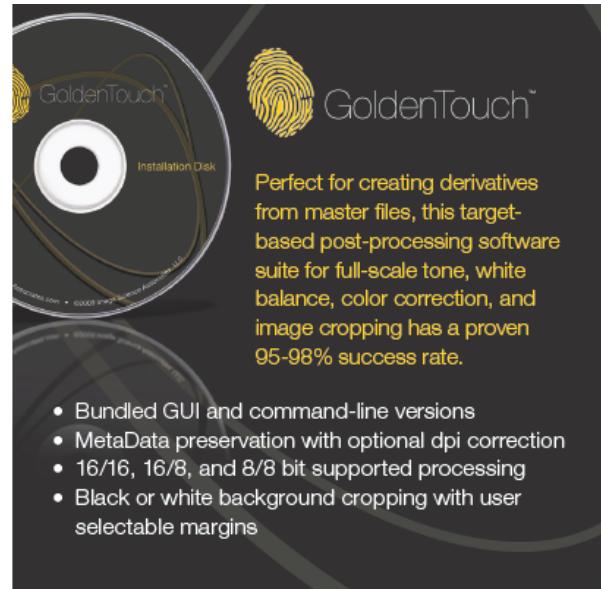
- Performs full scale tone and white balance processing (12 gray patches)
- 16/16, 8/8 bit or 16/8 bit processing for RGB images.
- Single image, Accept/Reject Batch, or Express Batch modes
- Target and content cropping with user selected crop margins
- Deskewing
- Processed and unprocessed files saved to separate directories

Future versions are expected to have color correction and book gutter cropping also.

Device Target

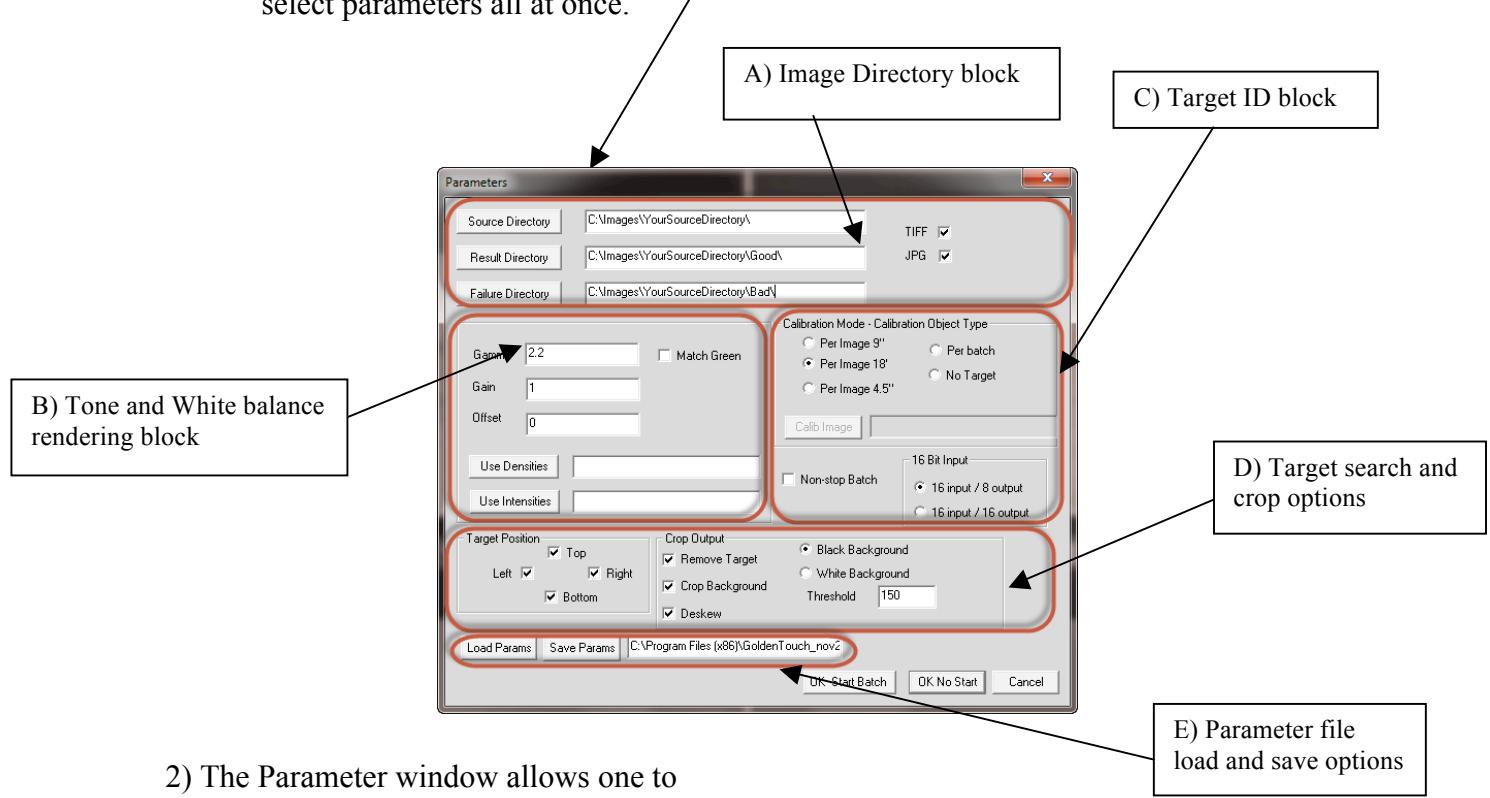


Object Target



Getting Started – Creating processing parameters

- 1) Launch GoldenTouch.exe,
- 2) Select **File > Quick Start** to create a parameter file that will guide the user step-by-step through creating the parameter file or....
- 3) Select **File > New Batch**. A parameter window appears where the user may select parameters all at once.



- 2) The Parameter window allows one to

- A) Select image directories
 - Identify Source image directories
 - Select a Result image directory for all properly processed images
 - Select a Failure image directory for rejected or improperly processed images
 - B) Select tone and white balance rendering options
 - Select Gamma, Offset, Gain (GOG) parameters for aim tone response curve
 - White balance the red and blue channels to match that of the green channel
 - Identify custom set of twelve density patch values. To be used only if the standard set of densities change or fade over time and have been re-measured and placed in a new text file. (optional)
 - Identify a custom set of twelve output count values. To be used if the desired aim response curve is not well modeled by the GOG model parameters. (optional)
- See annex on how to create custom files for Load Densities and Load Intensities options**

C) Choose the type of target to be used.

- **Per Image calibration** is used for the standard 4.5", 9", and 18" Golden Thread object targets that are expected to appear in every image of the Source image directory.
- **Per Batch calibration** uses the larger device target to calibrate against. The selected calibration image is used to create a set of calibration files that are then universally applied to all subsequent image files in the Source image directory.
- **Input/Output bit depth** allows the user to define the input/output file bit depth. Choose 16/8 for both 16/8 and 8/8 input/output bit depth processing. The user is cautioned that 8/8 processing is not recommended when aggressive image processing to match tonal image aims is needed. High noise levels and missing count levels especially in dark tones are likely to occur.
- **Non-Stop Batch** – allows GoldenTouch to perform continuous image processing without explicit operator approval/rejection of each image.
- **No Target** – Crop, Deskew only if no target of any kind is in the field of view.

D) Target search and crop options

- **Target Position** – These options allow the user to specify, explicitly, which margins GoldenTouch should search for the indicated object level target. The greater number of boxes selected the longer the search time.
- **Crop Output** – Allows the user to select whether to crop out the object level target alone or add a black or white background crop to the original image by selecting the appropriate threshold level.

NOTE - The black or white background crop is only done on a single iteration level within the field of view. For instance, if a white matted object is placed on a black background, only the black background will be cropped. An iterative process to also crop the white matte of the object is not possible on this version of the software. The amount of crop margin (i.e. # of pixels) can also be selected by manually editing the parameter file.(see line item below)

```
Crop Target      : 0
Crop Background  : 0
Crop White       : 0
Crop Threshold   : 90
Crop Margin      : 10
// QA Parameters
QA Neutrality   : 4.000000
QA Aim           : 5.000000
```

E) Parameter file load and save options

- **Load/Save** - in order to save and recall parameters for future use one may archive the files to any selected directory. These parameter files are text editable and can also be used for the command line version of GoldenTouch software.

Saved images file names can be appended with other names by manually editing the parameter files used for the processing. Below is an example of a line in the parameter file text where it can be edited. All saved and processed file names will then be appended with the “_processed” text.

```
// Batch Parameters
Source Directory      : C:\images\
Destination Directory : C:\CalibResults\good\
Failure Directory    : C:\CalibResults\bad\
// Allowed file format: 0 - no, 1 - yes
TIFF Output          : 1
JPEG Output          : 1
// Output file name format: "" - original name, "%gamm;
Output File Name     : _processed"
// Create output text files (lut,gamma etc.): 0 - no, 1
Output Text Files    : 0
// Enabled 16bit depth input, processing and output: 0
16bit InOut          : 0
// Enabled batch non-stop (no interaction) processing : 0
Non-stop mode         : 0
Parameter File        : C:\My Programs\colorcalib\colorc;
// Tonal Curve Parameters
// Tonal curve params: gamma, gain, offset
Gamma                 : 2.200000
```

Per Image Calibration – Manual Mode **(object level targets only)**

Once the image directories have been identified and parameters for the tone response curves selected, one can become familiar with the flow of the software. Since this is in manual mode, (notice that the batch mode button is not selected) select the **OK, No Start** button. The user will be taken to the original startup panel.

Select **Load Image**. Identify an image file with the appropriate sized object level target, and the image is loaded. A split screen is provided with identical images on each side. Select **Algorithm > Run** and target identification begins.

The object target must be near the perimeter of the image file for identification to succeed*. Once identified, the twelve gray patches will be analyzed within the red squares. These areas are selected to minimize the overall noise to avoid areas of dust and scratches. The dotted line along side the target indicates where that target will be cropped from the saved file.

If background cropping is selected but is in error, adjustment of threshold may be necessary. Re-opening the batch parameter window and adjusting the threshold level will and then selecting **OK, No Start** will allow the user to see the new crop result immediately.

The left image displays the original image while the right image displays the aim corrected and white balanced image. Depending on the target crop and background crop options selected dashed lines of the crop region will be displayed. If acceptable, select **ACCEPT**. The image will be saved to the **Result** Directory. If **REJECT** is selected the original un-processed image will be saved to **Failure** directory. The lower right corner of the window provides a dynamic display of the original and processed RGB values of the area where the cursor is placed. This may help the user decide if the values are acceptable.

Another image may then be selected and the process repeated for any number of other images with the object target included.

* If the algorithm is unable to automatically detect the target, a manual intervention option is available under **Target > Add Fiducials**. Selecting this option and then clicking on the two endpoint circles in the left most image will then allow the processing to proceed.

Per Image Calibration – Batch Mode

The batch mode for the object target is straightforward.

The same directory selections as before are used. ALL of the images within that directory will be processed. Except to stop the batch job, there will be no option for manual intervention. Any images that cannot be processed will be saved in the selected Failure directory. The user may then elect to re-evaluate these Failed images more critically in the manual mode with the batch option de-selected.

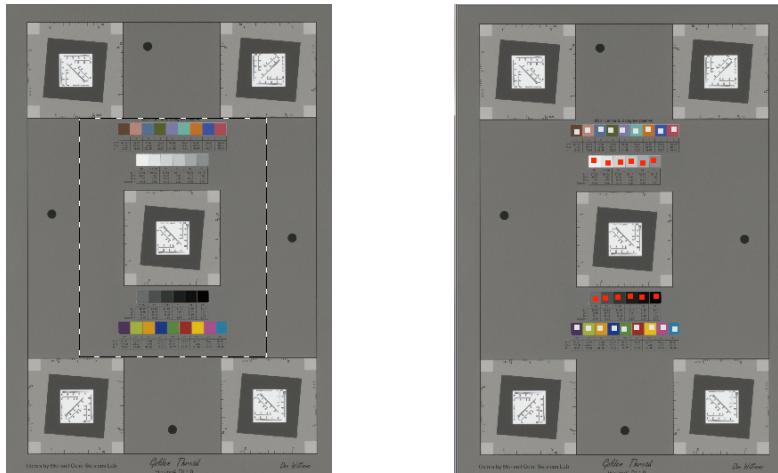
Per Batch Processing – Using the device target

(Please see accompanying videos for more details)

There are times when placing the small object target in the field of view for each image is just not practical in imaging workflows. In such cases photographing the larger device target for calibration purposes before and after an imaging session is appropriate. These targets act as a batch calibration target for processing the images captured during the imaging session. As in the **per image calibration** mode, calibration LUTS are created by comparing a selected device target image values against the identified aims provided in the Parameters window.

To start, select the **Per Batch Calibration** button. The **Calib Image** button will then be highlight. Click on this button and a browser window will open. Select an image of the Device target to be used for the calibration and then click on **OK, No Start**.

An image of the selected Device target will appear. Click and drag a rectangular region of interest over the area containing the gray patches. (See below)



If the patches are successfully detected, red rectangular regions over the individual patches will appear and the calibration file will have been successfully

created. This calibration file is now stored in memory and will be applied to all subsequent images until or if a new device target is selected for calibration.

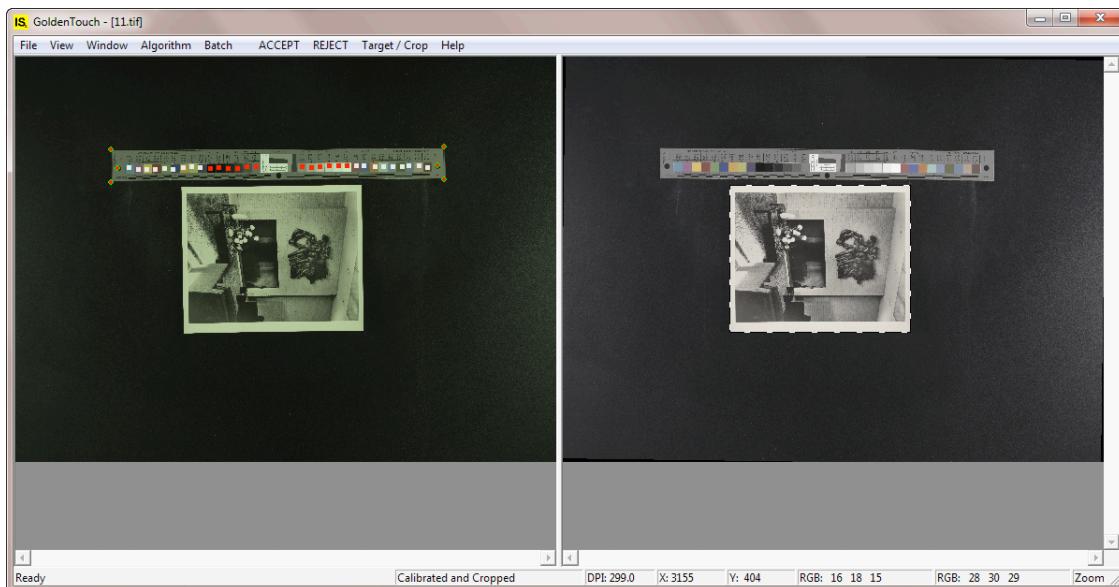
If the program cannot detect the gray patches, click on **Target > Draw Region** to reset the box drawing feature and try again. Occasionally, the program may need to be re-started if no amount of re-drawing the box allows calibration. Sometimes it needs a dope slap.

To apply the new calibration file from the device target to other images in the selected source directory simple click **Batch > Start**. Remember, if the **Non-Stop Batch** button on the parameters folder has been selected, the calibration file will be applied to all of the images in the source directory automatically without stopping. The batch can be stopped by selecting **Batch > Abort**.

If the **Non-Stop Batch** has not been selected, the program requires either an **ACCEPT** or **REJECT** intervention by the user to continue on to the next image.

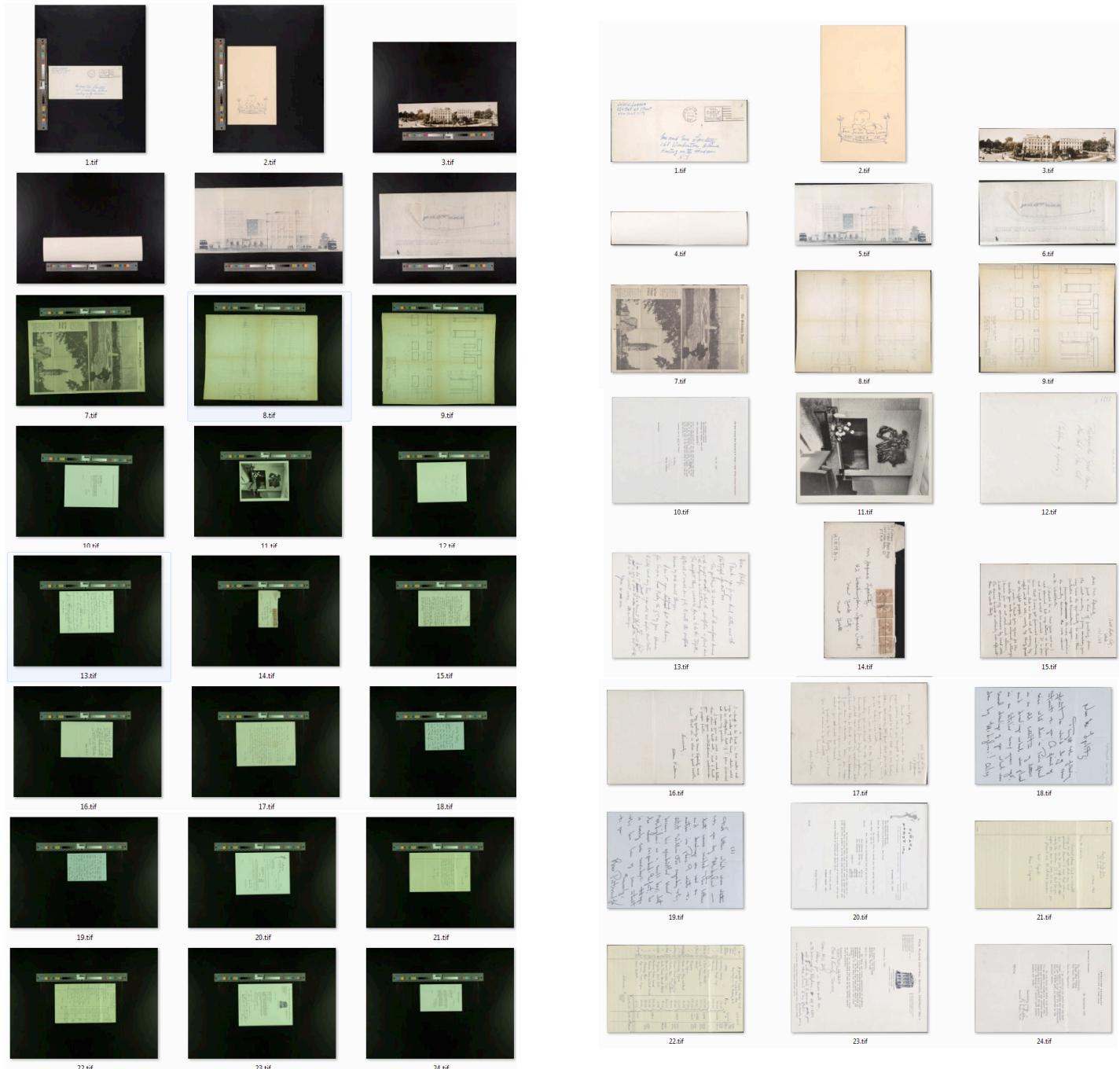
Example cropping and tone correction

Below is a simple example of a poorly white balanced image on the left and the corrected tone (gamma =2.2) and full scale white balanced image on the right. The software, 1) automatically locates the target, 2) analyzes the target in the input image, and 3) applies the appropriate image processing to correct the tone and white balance. 4) The final image (lower right), defined by the dashed lines, is then saved to the user selected directory with the target cropped out and tone and color corrected.



The next page shows a24 image before/after series processed in a non-stop batch mode where the target and background crop were selected for an 18" object target.

Before (left) / After (right) images using GoldenTouch processing.



Annex A

Custom aims and target density files for Load Densities and Load Intensities options

The **Load Densities** option is intended to provide the user an option for defining any set of 8 bit count value aims for each of the twelve neutral density patches. The aim values should appear in ascending order. It is especially useful when a particular tonal aim does not fit the parametric GOG model. For instance, S- shaped curves with inflection points tend to fall into this category.

The **Load Intensities** option is intended to provide an ability to modify the measured target densities should they change over time. It is, in essence, a target calibration file. Like the **Load Density** option, the file should contain twelve density values in ascending order.

While the **Density** and **Intensity** files are simple txt files they must be created with a “Carriage return only” option. An example of how to do so in Word is provided below for the eci_v2 tonal aim provided in the packet.

