

WIR i-Star Professional Tutorial No. 1

“Comparison of Printer Profiles”

For Use With:

WIR i-Star Professional Edition

Fully-Enabled Free Public Beta – Version 7.2 (2010-01-01)

Powerful CIELAB based, full tonal scale, comparative image analysis software with simplified single-number or two-number reporting of results. Developed by Wilhelm Imaging Research, WIR i-Star also provides comprehensive analysis of image appearance differences with specific colors, including critical human skintone colors, or with user-selected pictorial “regions of interest,” in both color and black-and-white photographic images.



WIR Software Development and Documentation Team:

Dmitriy Shklyarov (chief programmer), Yaw Nti-Addae, Kabenla Armah,
Mark McCormick-Goodhart (consultant), Dimitar Tasev, Henry Wilhelm,
Tessa Bergan (editor), and Carol Brower Wilhelm

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Wilhelm Imaging Research, Inc.
Grinnell, Iowa U.S.A.

istarcolor@gmail.com

www.wilhelm-research.com

Tutorial One:

Comparison of Printer Profiles

For this project use a standard i-Star target produced on both glossy and bond paper. Create a custom-made profile for glossy paper and apply it to both prints. Use the dimensions 25 rows by 32 columns. The “Examples” folder contains i-Star screen captures of both prints. The purpose of this project is to analyze and quantify the deviations between print on plain paper to that on glossy paper.

Initially, collect the necessary data using an appropriate tool. The spectral data supplied in the “Examples” folder has been collected using Gretag Macbeth Spectrochart Lite software and Gretag Macbeth’s Spectrolino spectrophotometers. Because spectral data is supplied, instructions for data collection are omitted. Guidelines for data collection can be found in specific instrument and software manuals.

Now, begin this project.

Start i-Star

Click on the i-Star executable file. For convenience, create a shortcut to the i-Star application on the desktop. See (Fig. 1).

Create a new project.



Fig. 1

Press Ctrl + n or choose “New Project” in the “Project” menu. A request for a reference measurement will appear. See (Fig. 2). The reference measurement is considered the “ideal” or starting point. In this case, choose Glossy Photo Paper with its appropriate printer profile as the reference measurement.

Choose glossy[glossy].xls in the open file dialog.

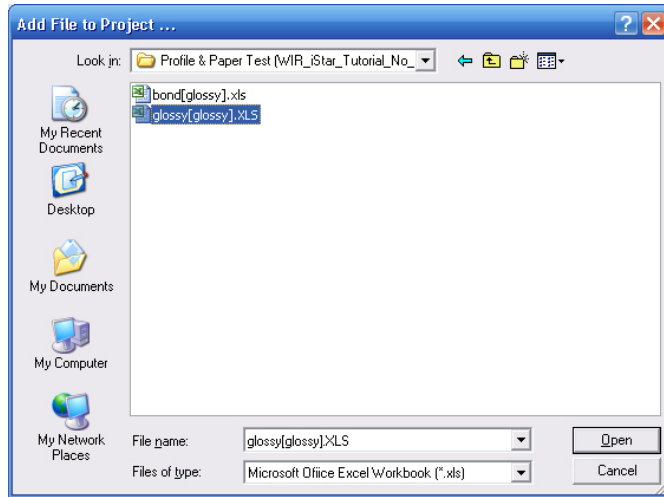


Fig. 2

i-Star will process and report the file on the “Data Layout” page. A warning will appear requiring additional information. See (Fig. 3).

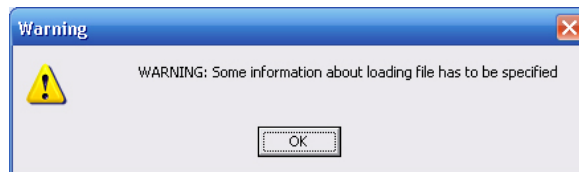


Fig. 3

This warning means the data collecting software did not report the number of columns and rows in the output file. To resolve this, fill out the “Number of Rows” and “Number of Columns” fields. See (Fig. 4). The originating data targets contain 25 rows and 32 columns each.

Enter the number of rows and columns in the appropriate fields.

Press “Proceed” button

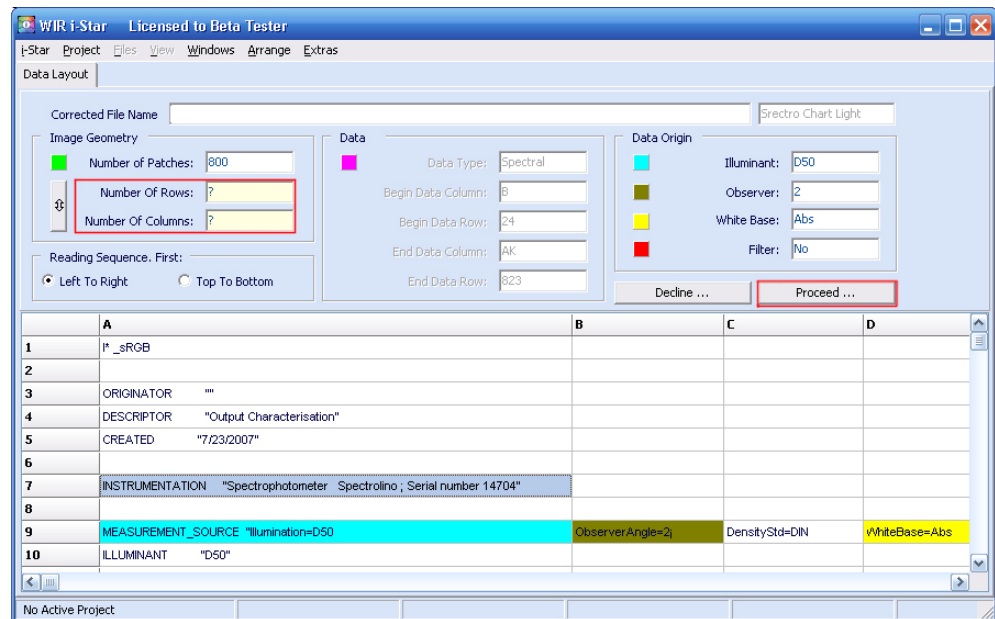


Fig. 4

i-Star will interpret the data contained in the file and evaluate the parameters for all predefined regions of interest. Unless the option is disabled, a message to check (and possibly reassign) the color map values of the target will appear. See (Fig. 5).

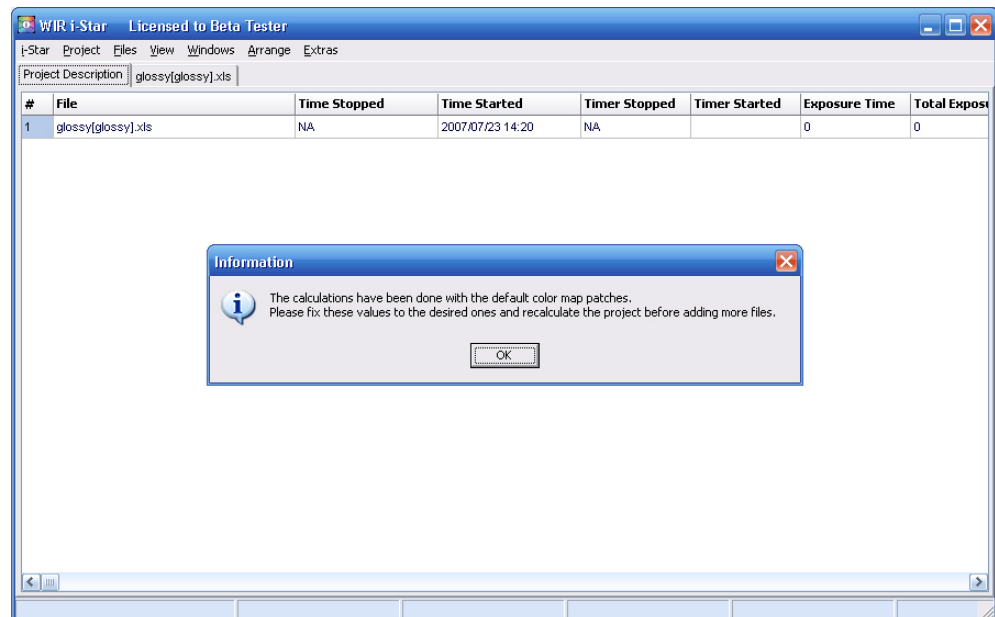


Fig. 5

The color map values may be changed on the “Project Color Map” tab of the “Preferences” page. See (Fig. 6).

Press F2 or choose “Preferences” in the i-Star menu.
Navigate to “Project Color Map” tab.

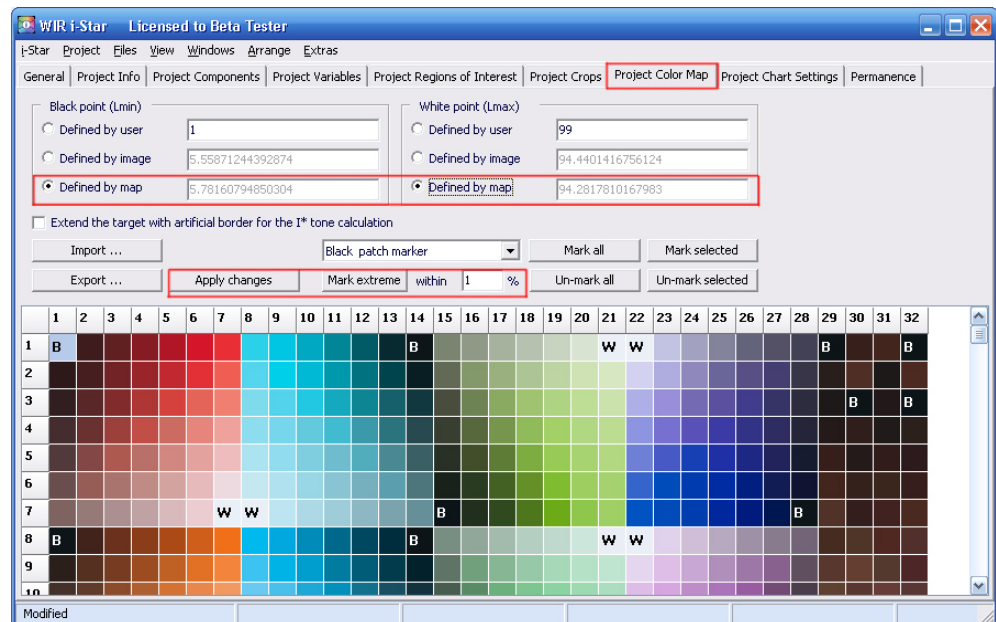


Fig. 6

i-Star has several ways to interpret extreme values of L. Ideally, on images representing the entire L band, readings of L values range between 0 and 100. In reality, only values close to these are achievable. The first option, “Defined by user,” allows manual setting of these values reasonable for the test. “Defined by image” will analyze the image and assign values automatically. Finally, “Defined by map,” evaluates the percentage of patches from the target for each L extreme and computes the mean value. Depending on project preferences and the necessity for repetition of the test, choose one setting. Keep in mind, only the first and last choices offer a basis for cross-examination of projects.

In this example, use the “Defined by map” option and calculate the Lmin and Lmax values from the first percentile of extreme L values.

Choose “Defined by map” for both black and white patches.
Click the “Mark Extreme” button for a value of 1%.
Apply changes.

The i-Star targets offer a broad selection of hues and tones. Specify regions for evaluation. For this test, the main regions of interest are the complete data set, neutrals, and near neutrals. Additionally, evaluate the differences between the patches with Lmin and Lmax. Many of these regions are mathematically

defined by the i-Star application, but spatial redefinition may be useful when printing profiles are not calibrated perfectly.

Navigate to “Project Crops” tab.

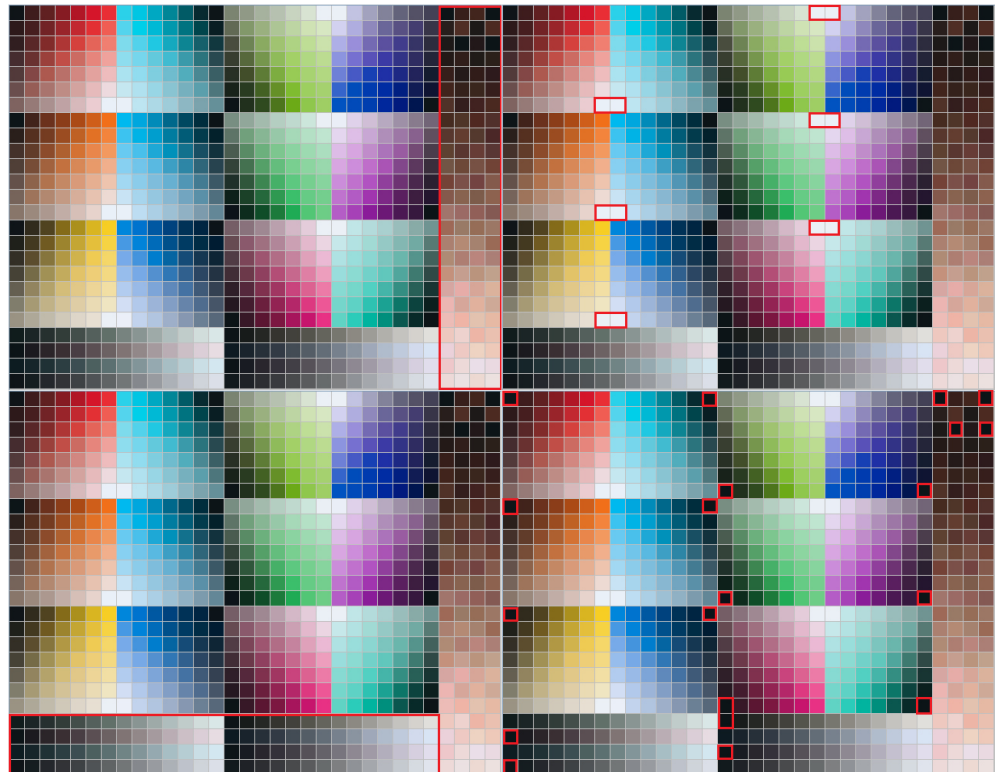


Fig. 7

The chart in Fig. 7 show which patches are contained in each of the created regions. The top left is a custom crop of skin tones, bottom left are near-neutrals and neutrals. The Lmax crop patches are found at the top right and Lmin crop patches at the bottom right.

First, create the region including skin tones. Skin tones are located in the last four columns of the target. Double-click on any of those patches. This will demarcate the patch with an “X.” All patches marked with an “X” will be included in the region of interest. To simplify the process, select the entire region for inclusion in the custom crop, and click on the “Mark selected” button.

Select the last four columns of target.
Click “Mark selected” button.

Now that all necessary patches are marked, save them as a region of interest - or in this case, a custom crop. “Custom crops” are spatially defined target regions of interest. The term “region of interest” refers to mathematically defined regions in a test target. See (Fig. 8).

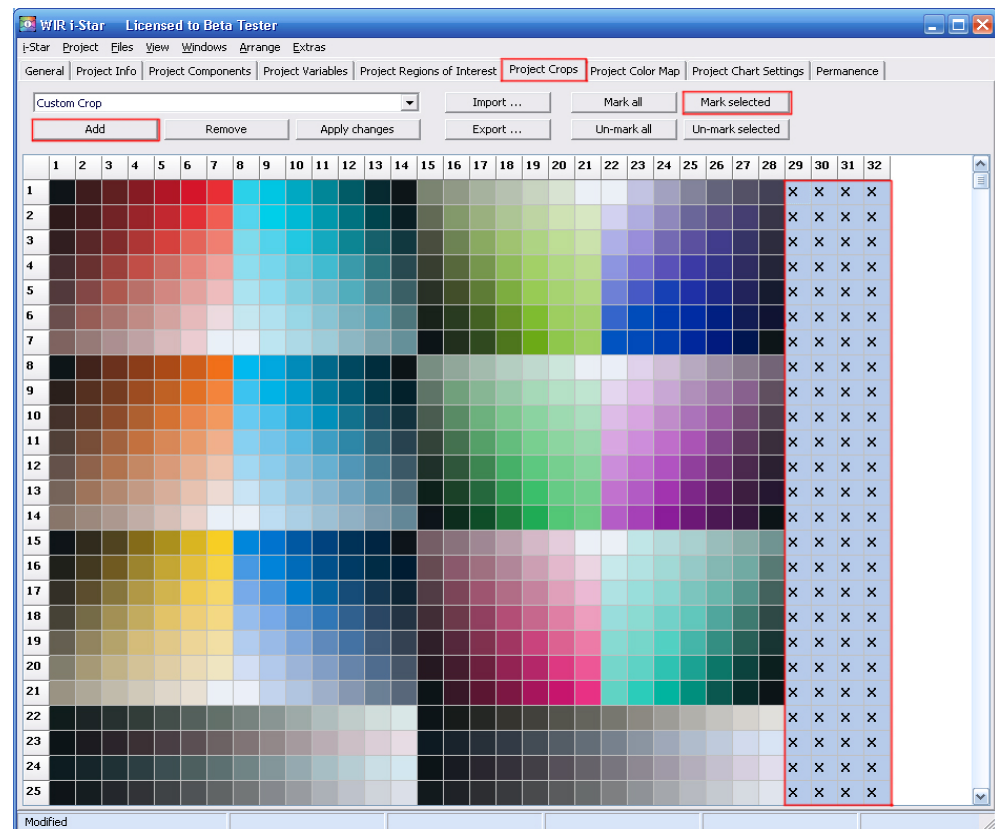


Fig. 8

Click “Add” button.

Enter “cc_skintones” in the box. See (Fig. 9).

To complete the process, continue with the remaining three groups of patches from the target. Name them “cc_neutrals,” “cc_lmax,” and “cc_lmin.”



Fig. 9

The remaining files have identical geometry as the initial file, so safe activation of the Data Import Assumptions (DIA) engine is possible. The DIA engine will make assumptions about the size and measuring parameters of the “import to” target based on the reference file for the i-Star project. Consequently, before employing the DIA, verify that the data is compatible. Data may not be compatible if it was gathered using several different measuring

devices (or software). The check boxes in the “Data import options” section will assist in verifying that all data meets necessary criteria for accurate comparison. See (Fig. 10).

Navigate to “Data import options” sub-tab on “General” tab.
Activate all assumptions, and select the sequence of patches left-to-right.
Deactivate “Import only user confirmed data” option.

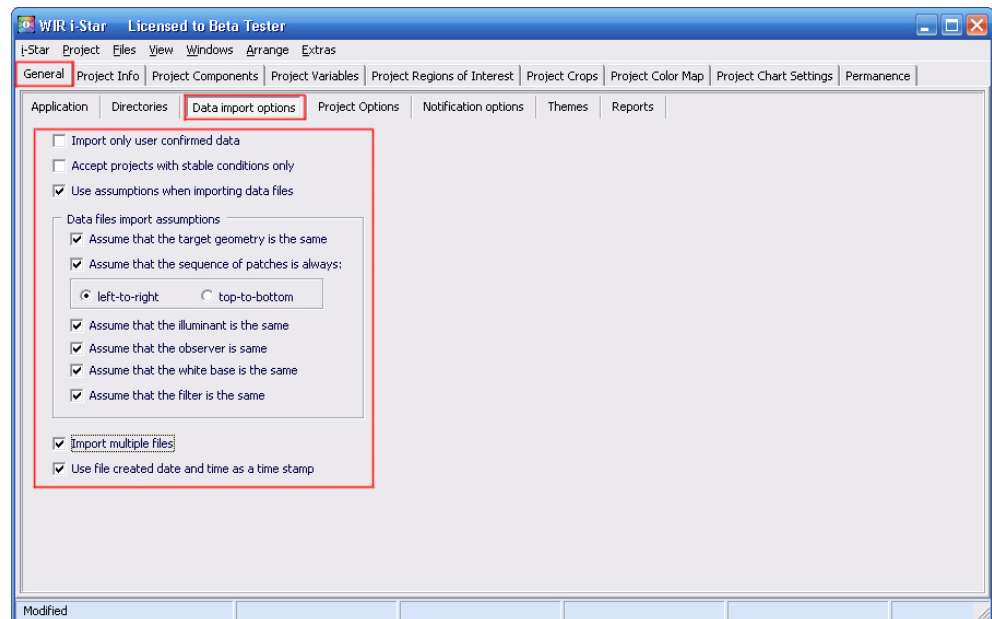


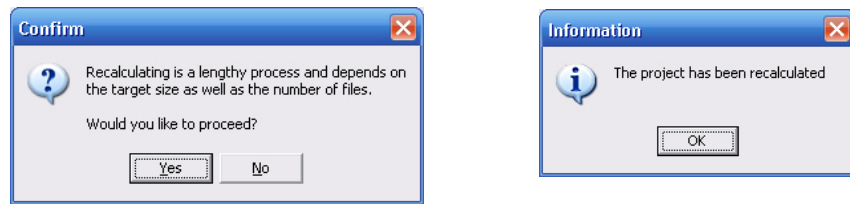
Fig. 10

Activation of the “Import only user confirmed data” option allows for additional modifications from the “Data Layout” page after completion of the DIA engine cycle.

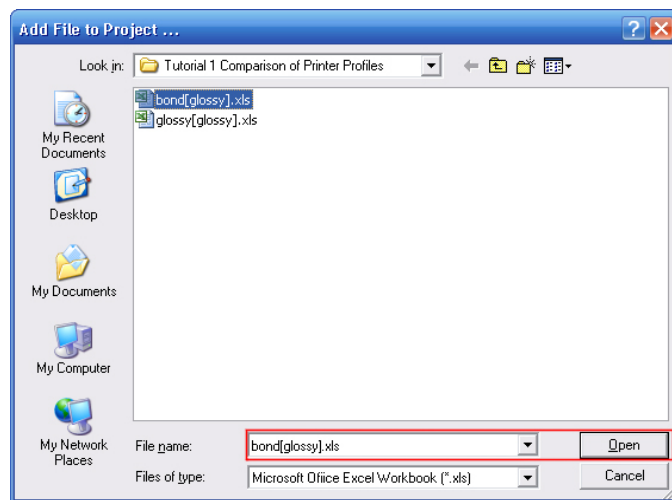
Now return to “Project Description” page.
Press F2 or choose “Preferences” in the i-Star menu.

Because i-Star calculates results based on parameters set on the “Preferences” page, any data-related change requires a recalculation of the values. Because the color map was modified, recalculate the averaged data for the project. See (Fig. 11).

Press F7 or select “Recalculate Project” in the “Project” menu.
A completion message will appear.

**Fig. 11**

Press **Ctrl + a** or choose “Add to Project” in the “Files” menu. Choose **bond[glossy].xls** in the open file dialog. See (Fig. 12).

**Fig. 12**

i-Star will process the file and report on the “Data Layout” page. Return to the “Project Description” page.

Now that all files have been imported, the data is ready for analysis. Before analysis, check the “Target Model” window. This window shows a visual representation of the imported data and must look exactly like the target used for collecting the data.

Press **Ctrl + t**, or select “Target Model Window” in the “View” menu.

The target window now shows the reference target (i.e. the print on glossy paper with the printing profile for glossy paper). This window offers a number of controls all described in the i-Star User Guide. The first control changes the file (and the corresponding target) represented by the image on the screen. See (Fig. 13).

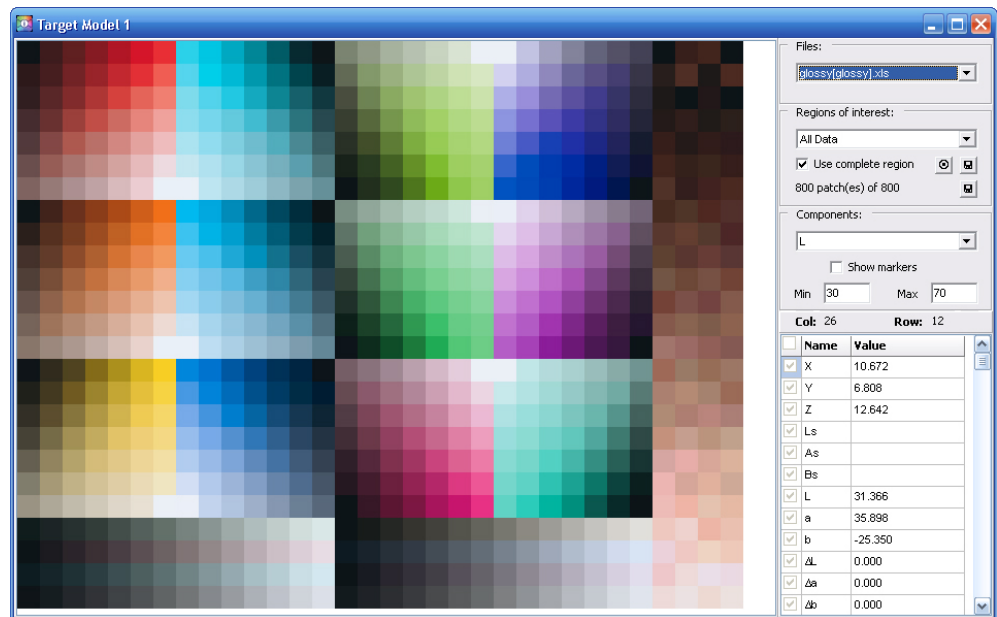


Fig. 13

View the bond paper target model.

Select “bond[glossy].xls” in the first drop down list. See (Fig. 14).

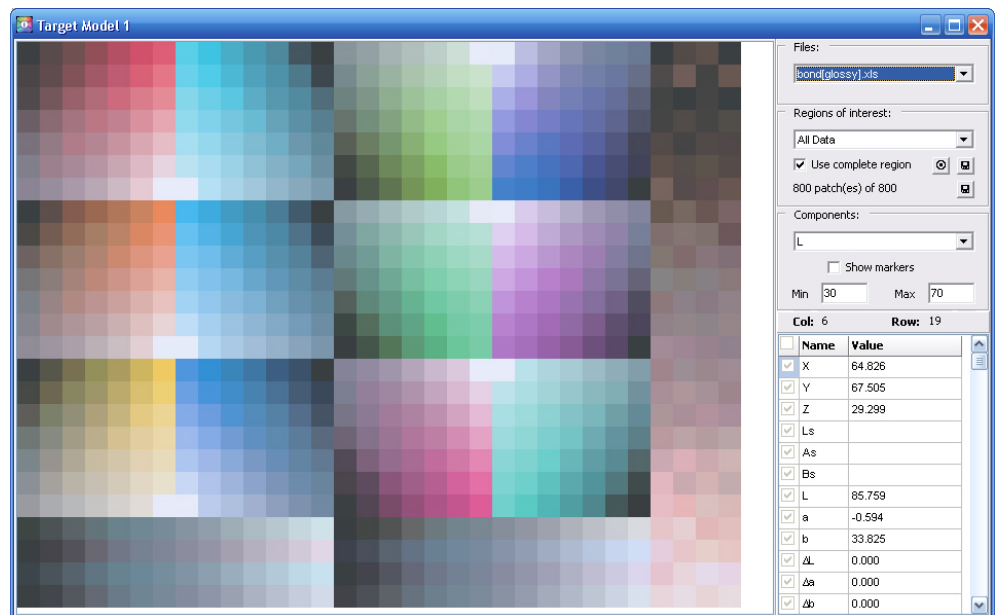


Fig. 14

The second drop down list modifies the region of interest/custom crop represented in the “Target Model” window. View the “General Skintones” region.

Select “glossy[glossy].xls” in the drop down under “Files.” See (Fig.15).
Select “General Skintones“ in the drop down under “Regions of interest.”

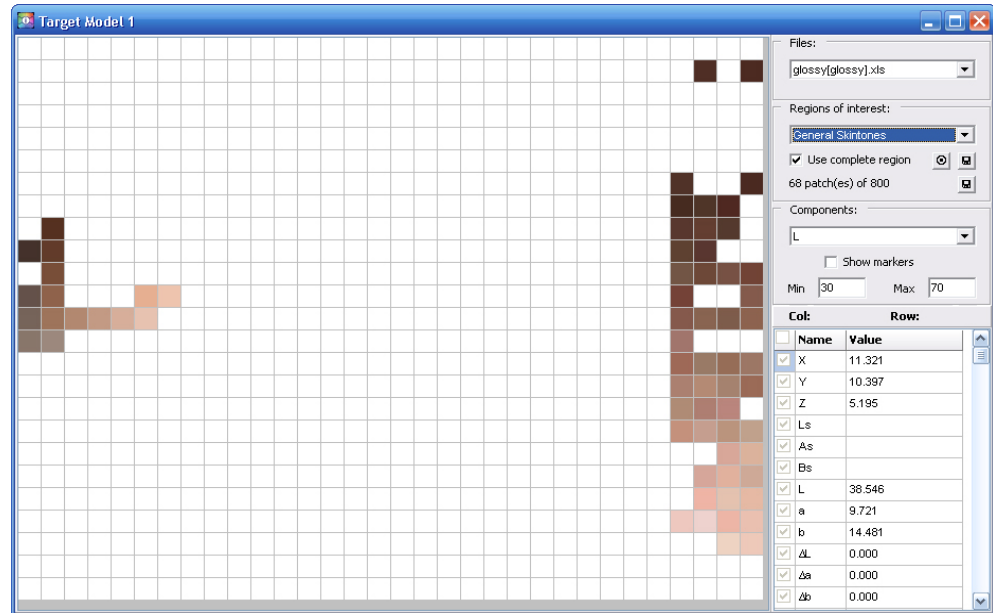


Fig. 15

The grid on the “Target Model” window can be turned on or off at any time. To toggle the appearance of the grid, simply press “g”.

Now that all data has been imported properly, close the “Target Model” window. In some instances, the “Target Model” window will be opened much sooner. For example, data sets imported from multiple measuring systems and associated software will require the “Target Model” window.

Press g.
Close “Target Model” window.

Next, consider the project charts. i-Star provides a number of easy charting options which may include spectral and hue angle distributions, i-Star component development and results, tonal reproduction charts, and component histograms. Custom specifications of the charts is possible, so becoming familiar with the manual entries on factors will lead to greater efficiency. The “Chart” window consists of a single page with the “Settings” and “Chart” tabs. The “Chart” tab contains the chart and a lower panel with controls. Right-click any unused surface on the lower panel to access the chart selection menu containing choices for all available charts. The “Settings” tab contains all controls for the appearance of charts. The individual groupbox titles indicate

settings for the charts.

Press **Ctrl + g** or choose “Charts Window” from “View” menu.

This project considers change in I^* total, I^* tone, I^* color, Δe_{2000} , hue angles, and L values. The regions of interest include the complete data set, neutrals, and near neutrals. Additionally, evaluation of differences between the patches with L_{max} and L_{min} will occur. See (Fig. 16).

Navigate to “Settings” tab.

In the “ I^* Component Results and Averaged Parameter Development” check I^* total, I^* tone full, I^* color full, Quality Control for both I^* tone and I^* color, Brightness Factor full, and Contrast Factor full.

Navigate to “Chart” tab. Check “Show legend” box.

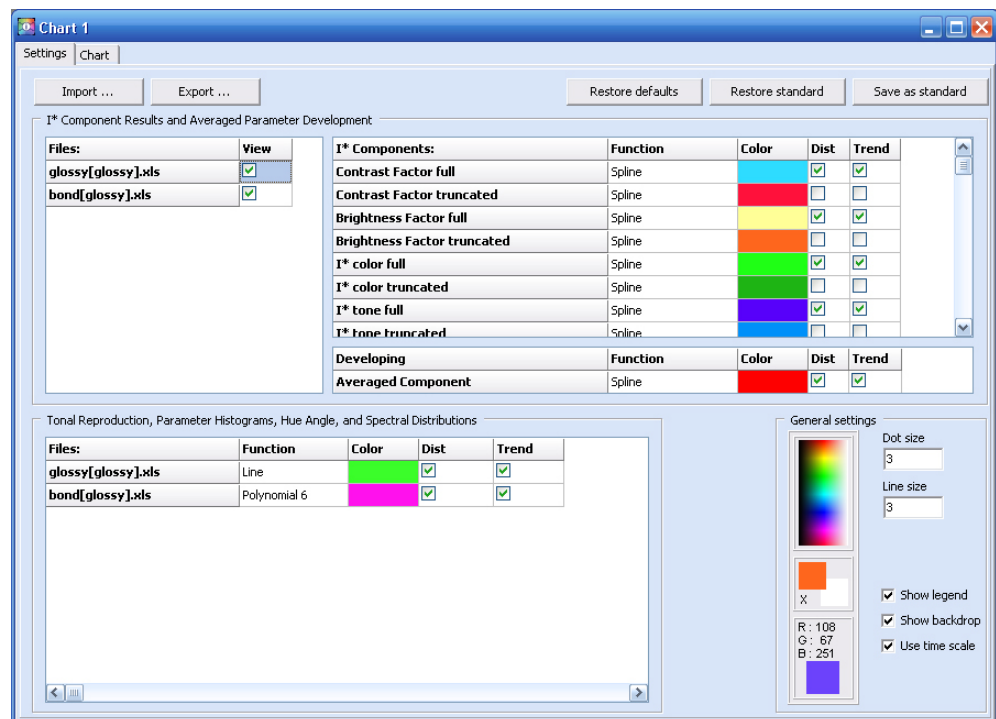


Fig. 16

The chart window will allow easy interpretation of both measurement and trend lines. See (Fig. 17). Click each point and the status bar will show the corresponding file and x,y coordinates.

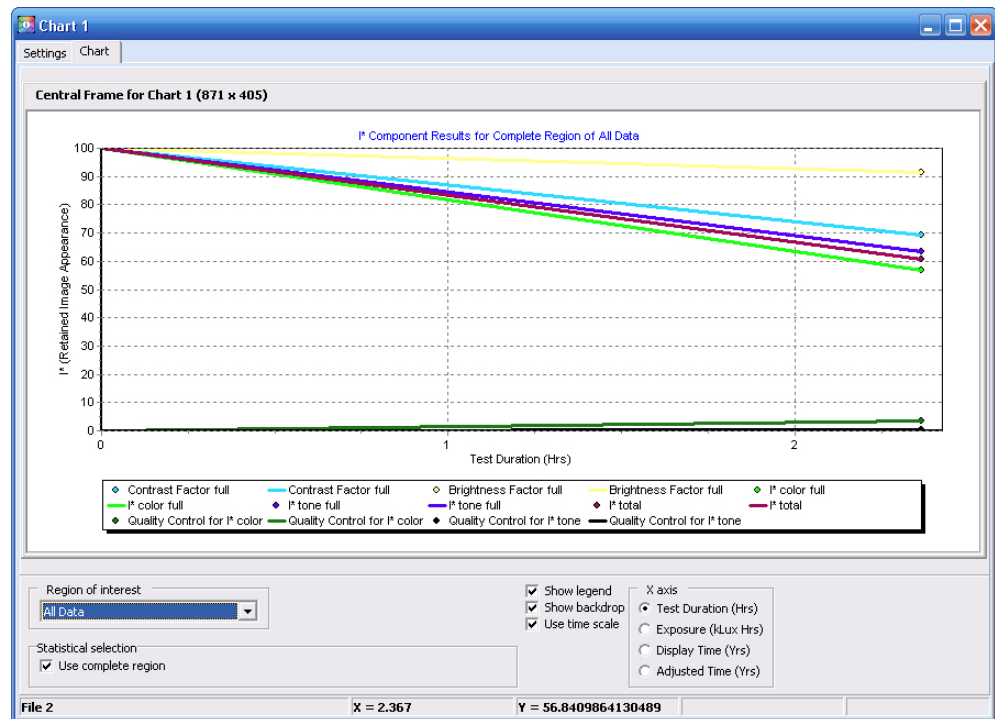


Fig. 17

Take a moment to observe the changes indicated by the chart: the Contrast Factor full is 69.172 and the Brightness Factor full is at 91.347; I* full is 63.592, I*tone 60.525, and I*color full is 56.841. Additionally, there are 0.580% falsely encoded patches according to I*tone and 3.500% according to I*color.

i-Star can also analyze data for any chosen color space region of interest. Consider the region of dark skin tones as defined in the template.

Select “Dark Skintones” in “Regions of Interest” drop down list.

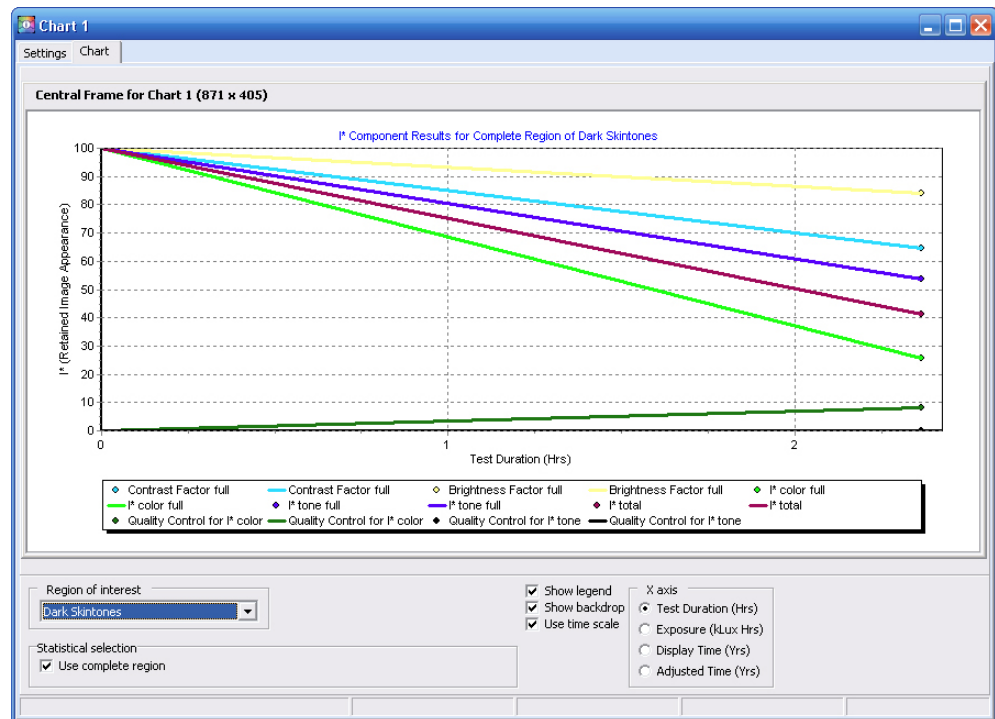


Fig. 18

The skin patches on the bond paper print are significantly degraded. The value of I^* color is as low as 25.633 with as much as 8.108% falsely encoded patches. This indicates that the skin tones have deteriorated significantly, and as much as 8.108% of the patches have a hue angle shift greater than 60° in the LAB color space. See (Fig. 18).

These results suggest a check of the spectral distributions for some skin tone patches. Use the i-Star spectral distribution charts for this analysis.

Right-click on the panel and select “Spectral Distribution” in the context menu.

Change the column value to 30 and row value to 19.

Notice when observing the spectral distributions of both prints that the print on bond paper has reduced reflectance in both the extreme high and low ranges of the visible spectrum - mainly hues of magenta, red, and orange. Because skin tones consist mainly of red and magenta hues, it is understandable with higher spectral reflectance of blues that the bond paper printout would have a washed out look in the skin tones region. In addition to the chart, the two compared patches are indicated (or in a multi-file project, the patches from first and last files). See (Fig. 19).



Fig. 19

Experiment with other row/column values and observe the spectral distribution changes.

Finally, save your project. Saving allows access to data easily without having to reenter any information. i-Star will save the complete set of data, a snapshot of the settings, and results of all calculations. Please note that i-Star will not save any open windows or generated graphs, so export either of these items before closing the window.

Although i-Star saves all project data entered in the i-Star application, as a further safeguard against data loss, keep the original source files and periodically back up all i-Star projects.

Press **Ctrl + s** or select “Save Project” in “Project” menu.
A “save file” dialog will appear. See (Fig. 20).

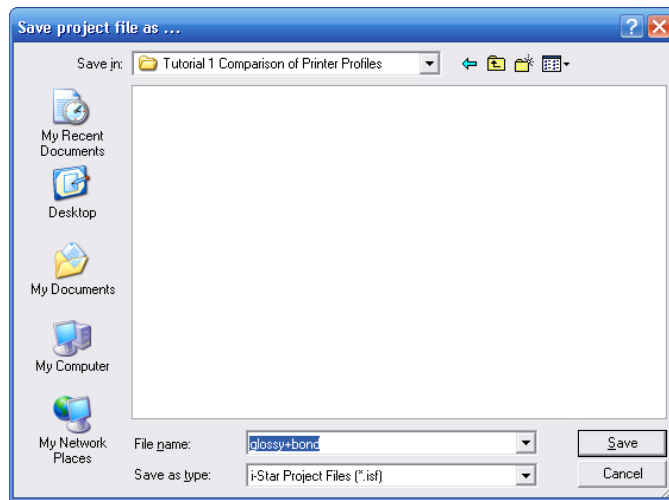


Fig. 20

Choose a file name for the project.
Click “Save” button.

WIR i-Star contains a custom report creation utility, allowing the creation of PDF reports for the analyzed data. This tutorial shows the steps taken to create a standard WIR report using the i-Star application.

Click “PDF Report Preview Window” under “View” menu. See (Fig. 21).

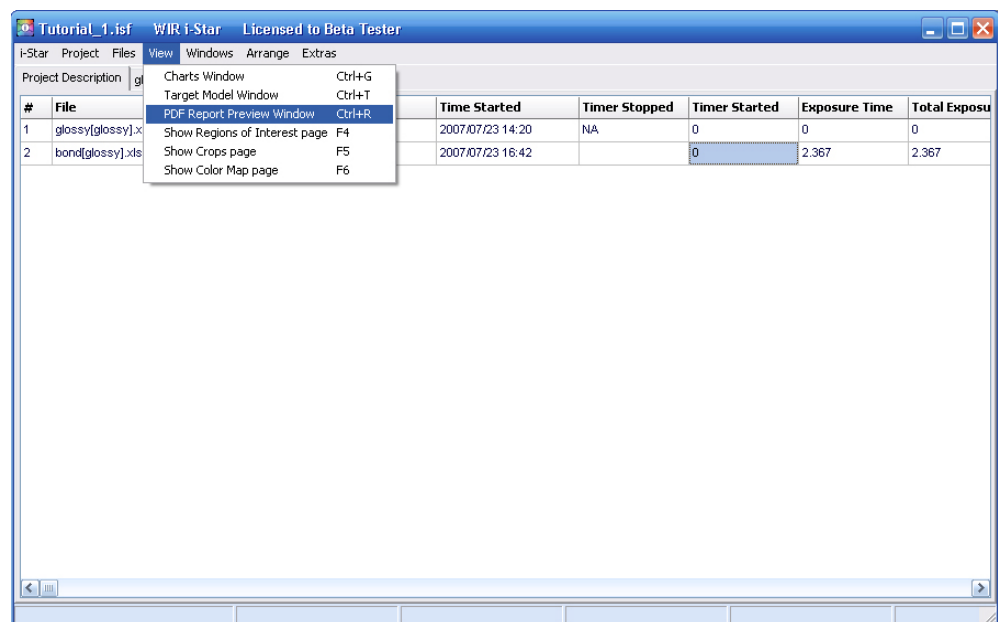


Fig. 21

The Summary page of the PDF Report Preview window will appear. See (Fig. 22). The first page on the PDF will contain a summary of the project details. The filename text box shows the name of the PDF. Choose a name for the project. In this example, use ‘WIR_report_2007_12_13.pdf.’ The three remaining check boxes and text boxes designate the location of the PDF file. For this example, place the PDF in the same folder as the project by placing a check next to ‘at project folder.’ The remaining entries, colored white, must be filled from the “Preferences” page under the “Project Info” tab (See page 14). These fields are available to include more details about the nature of the project.

PDF Report Preview

WIR I-Star Report

Filename:

at user defined folder:

at project folder:

at collector folder:

Date:

I-Star version:

Release:

Job Number:

Project Number / Sample Number:

Test Started:

Number of files / measurements:

Last Measurement:

Total Exposure Time (Hrs):

Reference Target had been printed with:

Target Name:

Printer:

Ink:

Media:

Condition name:

The following supplemental information has been added to report:

For this project we will be analyzing the quality of the reproduction of a target printed on Epson Premium Photo Paper (EPPP) when compared to the same target printed Epson Bright White Paper (EBWP) when using an Epson Premium Photo Paper profile on both targets.

Wilhelm Imaging Research, Inc.
713 State Street, P.O. BOX 775
Grinnell, Iowa 50112, U.S.A.

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Summary | Summary | Target | Test info | Variables | Regions | Criteria Set | Results | Worst 10% | Interpolation | Worst 10% | Standard Charts | Extra Images | References | Memorize Report presets

Report Presets

Wilhelm Imaging style (short)

Complete Report

Custom

Fig. 22

The check boxes on the right side of the “PDF Report Preview” show which pages are included in the current ‘Report Preset’ selection (in this case ‘Wilhelm Imaging style short’). The buttons to the right of the check boxes allow preview of the pages before printing the PDF. A green check indicates current viewing of the page. Check each button to view the pages of the PDF. The screen capture on page 15 shows a preview of the ‘Test info’ page.

Fill the “Printer,” “Ink,” and “Media” text boxes and the supplemental information box. See (Fig. 23). Check the Wilhelm Imaging style (short) radio button. This is the preset reporting format used for a standard Wilhelm Imaging Research report. The text boxes colored in white must be filled from the “Preferences Page.”

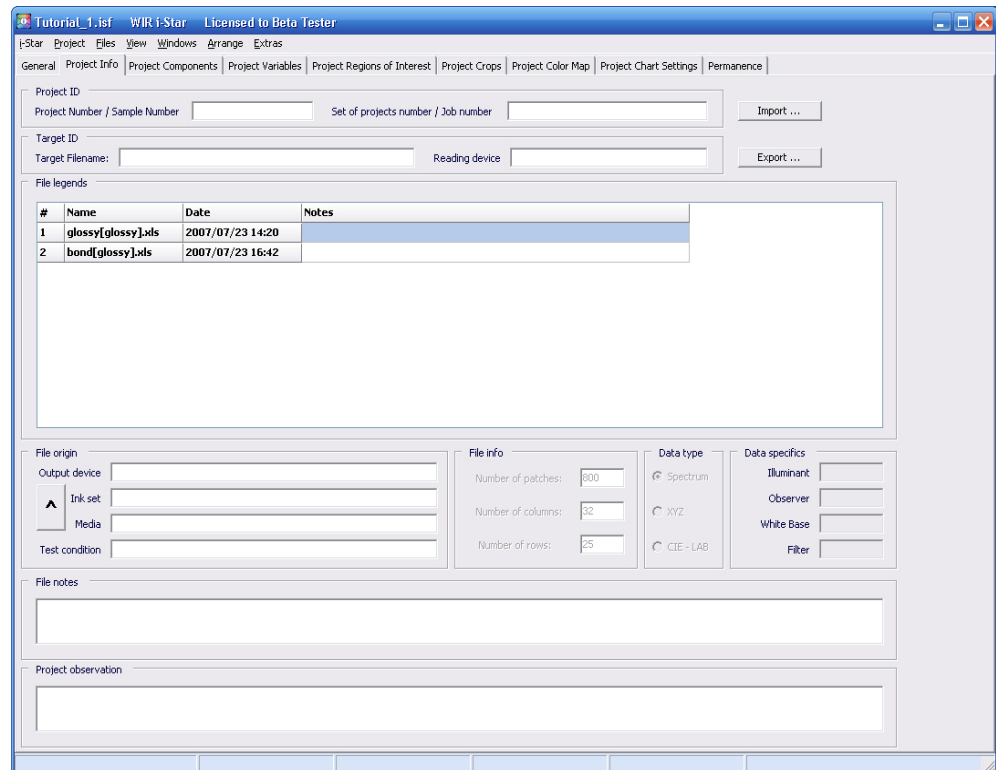


Fig. 23

PDF Report Preview

Test Information

Job Number:

Project Number / Sample Number:

Test Started:

Number of files / measurements:

Last Measurement:

Total Exposure Time (Hrs):

Reference Target has been tested according the following specification [criteria]:

Condition:	<input type="text"/>	
Light level (Lux):	<input type="text" value="?"/>	Permanence predictions have been made for:
Light cycle (hrs/day):	<input type="text" value="24"/>	Light level (Lux): <input type="text" value="450"/>
Temperature (°C):	<input type="text" value="?"/>	Light cycle (hrs/day): <input type="text" value="12"/>
Relative humidity (%RH):	<input type="text" value="?"/>	Gas fading adjustment: <input type="text" value="1"/>
Gas concentration (ppm):	<input type="text" value="?"/>	Extra adjustment: <input type="text" value="1"/>

Reference Target notes:

© 2007 Wilhelm Imaging Research, Inc. WIR_report_2009_12_29.pdf page

Summary | Target | Test Info | Regions | Results | Interpolation | Standard Charts

- Summary
- Target
- Test info
- Variables
- Regions
- Criteria Set
- Results
- Worst 10%
- Interpolation
- Worst 10%
- Standard Charts
- Extra Images
- References

Report Presets

Wilhelm Imaging style (short)

Complete Report

Custom

Fig. 24

View the “Test Information” page of a standard WIR i-Star Report. Notice that for this test, the “Light level (Lux)” is left empty because this data is not important for this test. The light level has no effect on the comparison results between the two prints. The light level fields become relevant when using i-Star to analyze the exposure of an image to elements (e.g. light, ozone, etc.). An example defining conditions, time of exposure, and periodic readings of an image is explained in another tutorial.

A detailed explanation of each page and its corresponding text field is included with the main i-Star User Guide.

After reviewing the PDF preview, click “Create PDF Report” button to print the PDF.

Continue exploring i-Star. Explanations of other controls, including those for the “Main Settings” page are available in the User Manual. When finished, press Ctrl + q or choose “Quit” from the “i-Star” menu. Save any additional changes to the project.