

WIR i-Star Professional Tutorial No. 4

“Comparison of OEM vs Third-Party Inks”

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.



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Tutorial Four:
Comparison of
OEM vs Third-
Party Inks

This project will analyze the quality of target image reproduction printed with Office Depot 57/58 inks and with HP 57/58 inks. Both samples were printed from Adobe Photoshop on the HP Deskjet 6540 using printer managed colors. The targets have dimensions of 25 rows by 32 columns. The Examples folder contains i-Star screen captures of both targets and the data necessary to follow this example. The purpose of this project is to analyze and quantify the deviations between prints made with OEM inks and those made with a Third Party ink set.

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 Spectrolino spectrophotometers. Because the spectral data is supplied for this project, these steps are omitted. Guidance for data collection can be found in specific instrument and software manuals.

Now, begin this project.

Start i-Star

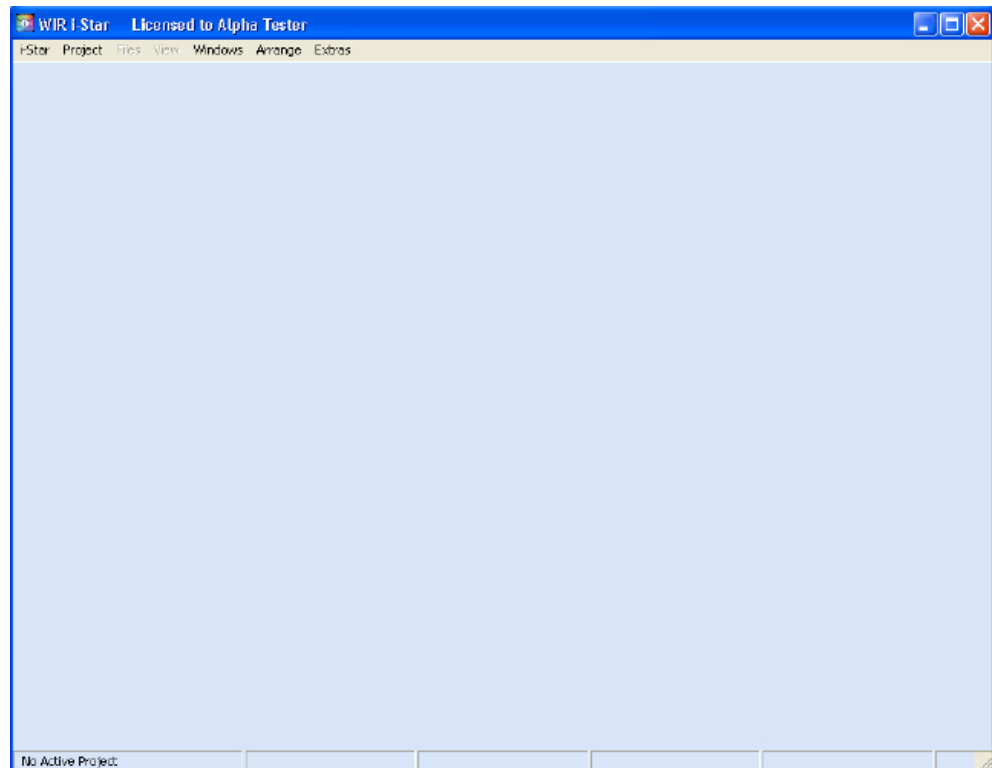


Fig. 1

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

Create a new project.

Press Ctrl + n or choose “New Project” in “Project” menu. A request for a reference measurement will appear. This measurement is considered the “ideal” or starting point. Choose Glossy Photo Paper with its appropriate printer profile as the reference measurement.

Choose “HP57_58inks.xls” in the open file dialog.

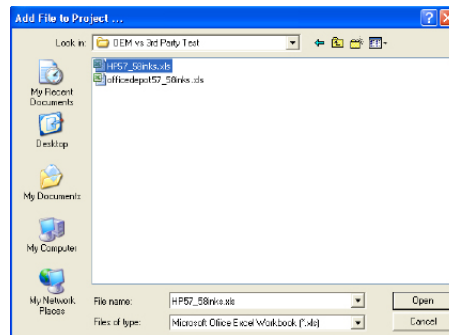


Fig. 2

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

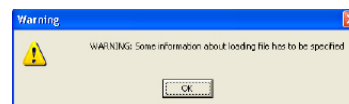


Fig. 3

This warning means the data collecting software did not report the number of columns and rows in the output file. Fill in 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.

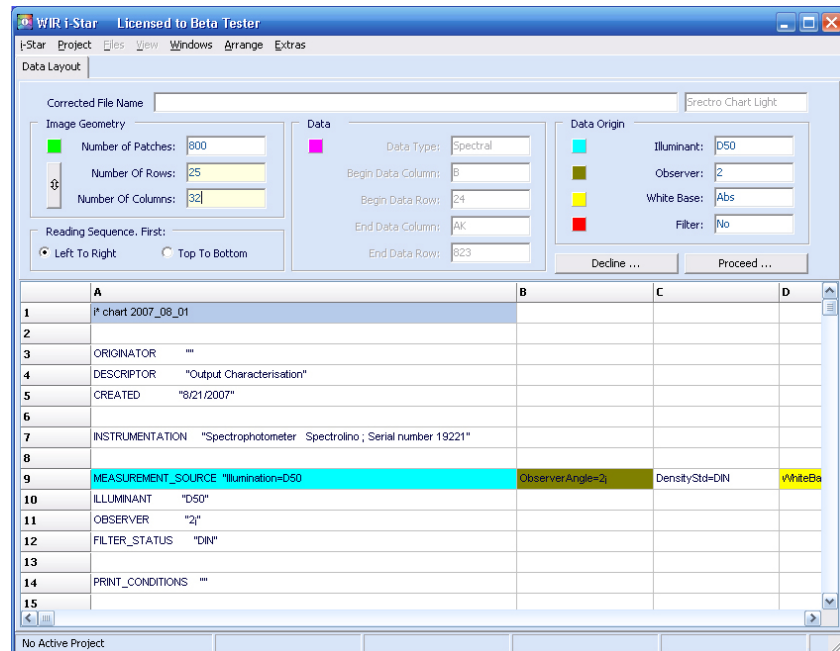


Fig. 4

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.

The color map values may be changed on the “Project Color Map” tab of the “Preferences” page.

Press F2 or choose “Preferences” in the i-Star menu.
Navigate to “Project Color Map” tab. See (Fig. 5).

i-Star must have values for the lightest and darkest (Lmax and Lmin) patches on the target. When using an ideal paper (extremely white paper) and an ideal ink set (an ink set capable of producing pure black), the measured values of Lmin and Lmax will range from 0 and 100. This scenario is almost never the case, so the tonal scale for the target must be set for i-Star.

The first option, “Defined by user,” allows manual setting of reasonable values for the test.

“Defined by image,” will analyze the image and assign values automatically.

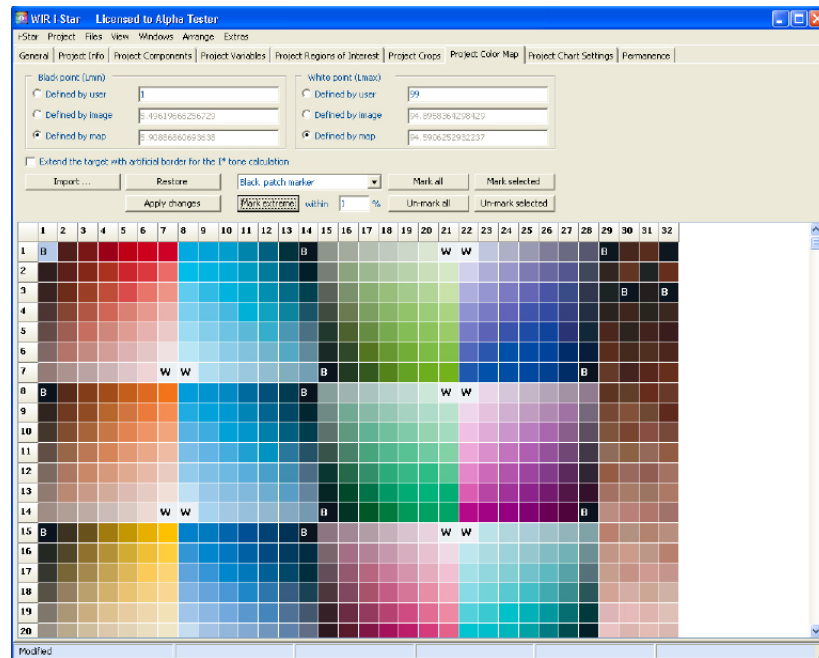


Fig. 5

“Defined by map” uses a percentage of patches from the target for each L extreme and computes a mean value. This percentage of patches is set in the text box after the “Mark Extreme” button. For this example, use a value of 1%. The Lmax is the average value of the brightest 1% of the patches on our target. Lmin is the average value of the darkest 1% of the patches on our target.

Depending on preferences and the nature of the test, choose one method. In this example, use the “Defined by map” option to calculate the Lmin and Lmax values by finding the average L values for the darkest and lightest 1% of the patches on the target, respectively.

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

The i-Star targets offer a broad selection of hues and tones to study and tools to select custom regions of the color space for evaluation. For this test, the 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 with the i-Star application, but spatial redefinition may be useful.

Navigate to “Project Crops” tab.

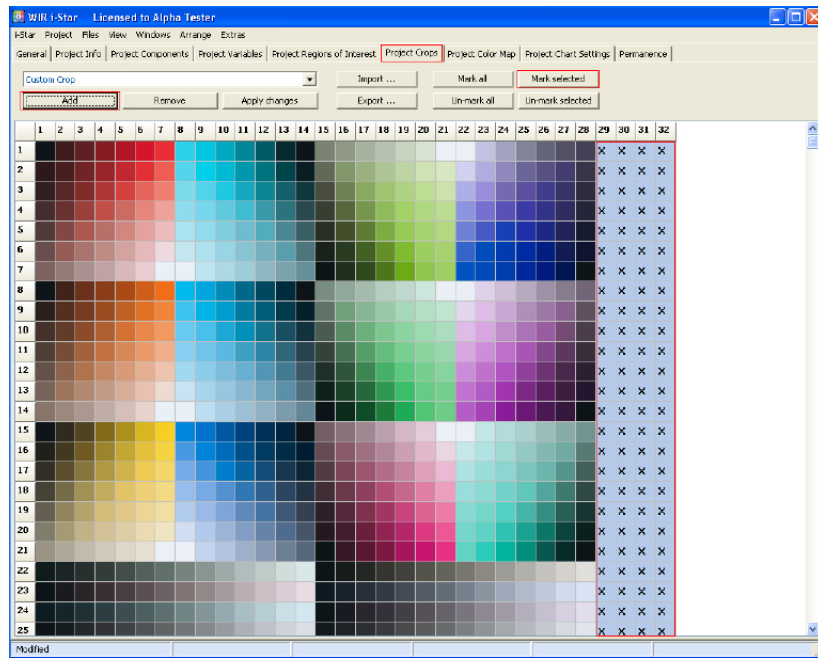


Fig. 6

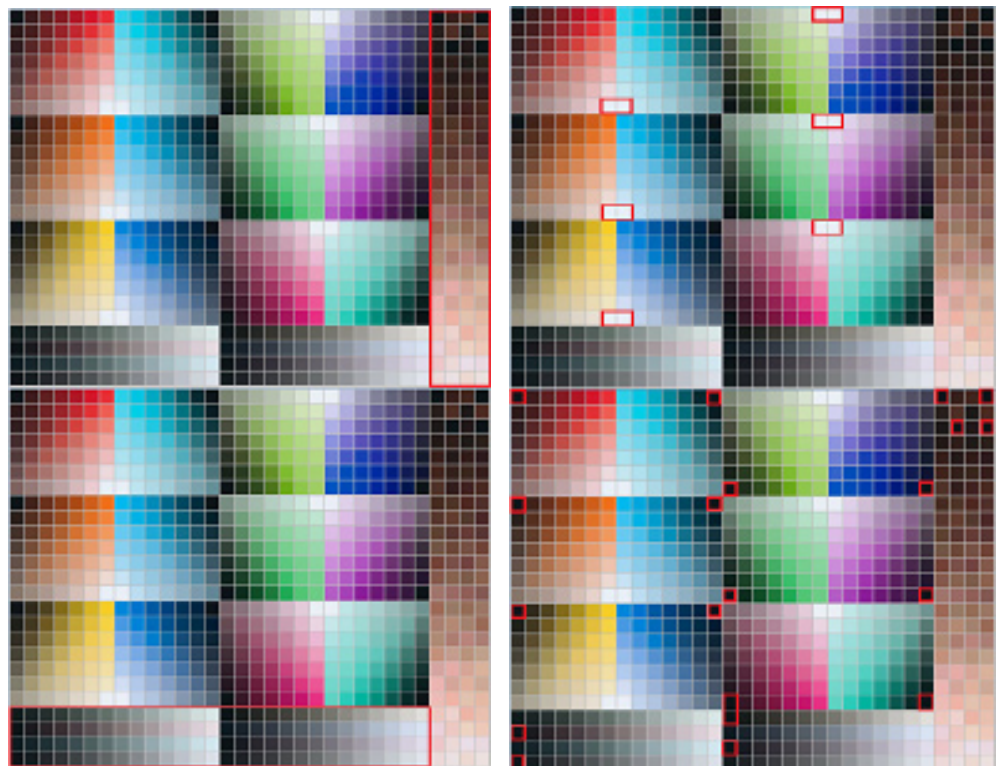


Fig. 7

The “Project Crops” function allows the creation of a spatial region of interest. The chart on the previous page show which patches are contained in each of the regions of interest. Create a custom crop for skin tones, near-neutrals, neutrals, and the Lmin and Lmax patch groups. See (Fig. 6&7).

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. To simplify, 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 dependent regions of interest. The term “region of interest” refers to mathematically defined regions on a test target.

Click “Add” button.
Enter “cc_skintones” in box.

To complete the process, name the remaining groups of patches, “cc_neutrals,” “cc_lmax,” and “cc_lmin.”

The remaining files have the same geometry as the initial file, so safe activation of the Data Import Assumptions (DIA) engine is possible. The DIA engine makes assumptions about the size and measurement parameters of the targets based on the reference file for the i-Star project. Consequently, before employing the DIA, verify the data compatibility for each measurement. Data may not be compatible if measurements were gathered using different measuring devices or software. The check boxes in the “Data import options” section will assist in verifying that the data meets necessary criteria for accurate comparison. See (Fig. 8).

Navigate to “Data import options” sub-tab on “General” tab.
Activate all assumptions, and select the sequence of patches for left-to-right.

Deactivate “Import only user confirmed data” option.

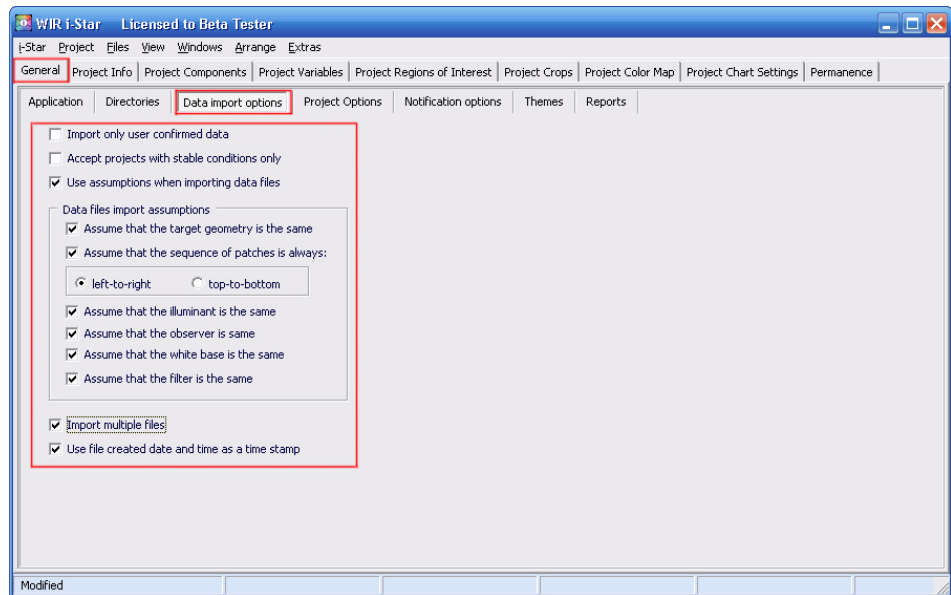


Fig. 8

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

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

Because i-Star calculates results based on parameters set in the “Preferences” page, any data-related change requires a recalculation of values. Because the color map was modified, recalculate the averaged data for the project. The remainder of files have the same geometry as the initial one, so activate the DIA engine.

Press F7 or select “Recalculate Project” in “Project” menu.



Fig. 9

Once the recalculation is complete, a notification will appear. See (Fig. 9).

Press **Ctrl + a** or choose “Add to Project” in “Files” menu.
Choose “Officedepot57_58.xls” in the open file dialog. See (Fig. 10).

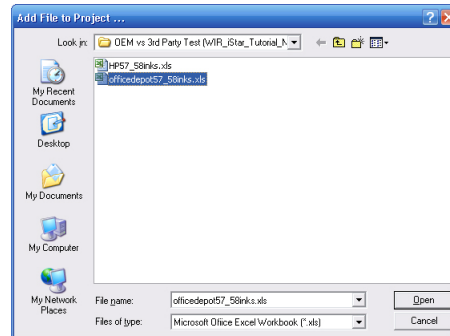


Fig. 10

i-Star will process the file and report on the “Data Layout” page. Return to “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 the visual representation of imported data and must look exactly like the target used for data collection. See (Fig. 11).

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

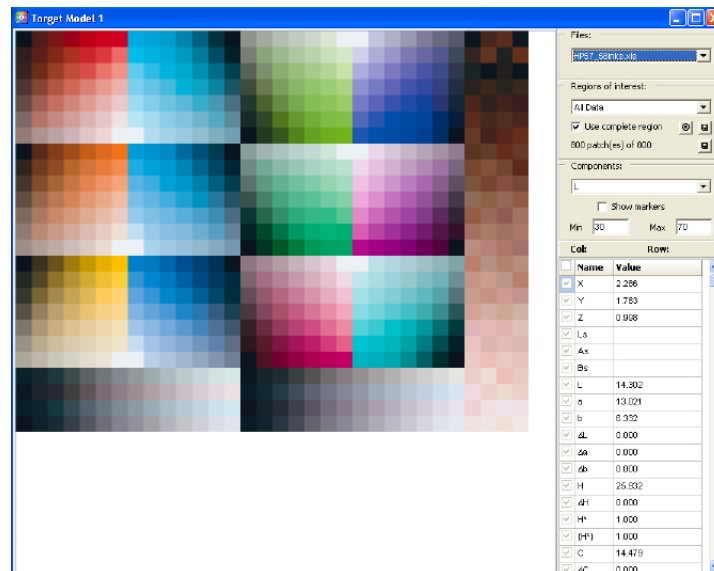


Fig. 11

The target window now shows the reference target, i.e. the print with HP57_58 inks. 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.

View the target model for Office Depot ink print. See (Fig. 12).

Select “Officedepot57_58inks.xls” in the first drop down list.

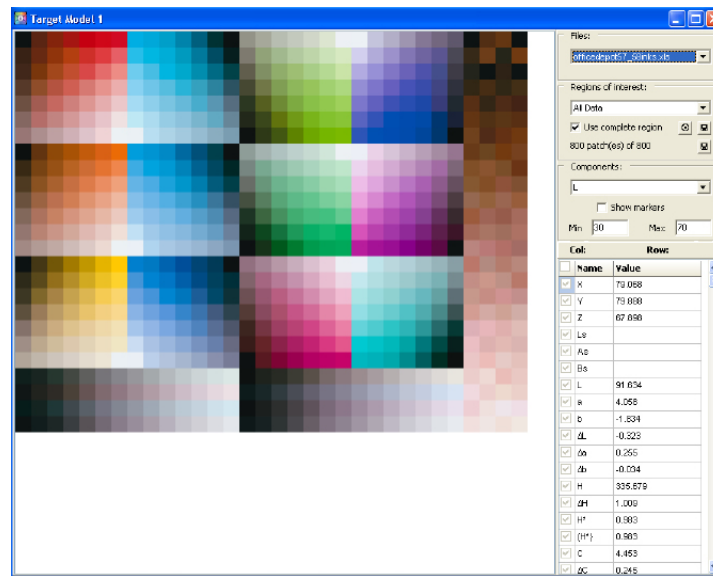


Fig. 12

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

View “General Skintones” region.

Select “General Skintones” in the second drop down list. See (Fig. 13).

The target model now shows only those patches which LAB values satisfy the condition for General Skintones. The grid on the Target model window can be removed anytime. To toggle the appearance of the grid, press g.

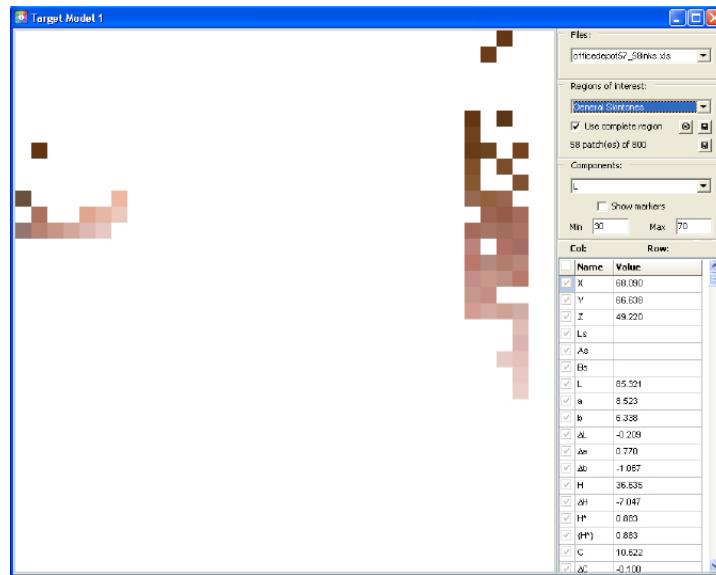


Fig. 13

After verification of all imported data, 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 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 of 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 which contain choices for all available charts. The “Settings” tab contains all controls for the appearance of charts. The individual group box titles indicate settings for the charts.

Press Ctrl + g
Navigate to “Settings” tab.

In the I* Component Results and Averaged Parameter Development check the boxes for I*color full, I*tone full, I*total, and Quality Control for I*tone, I*color, Brightness Factor full, and Contrast Factor full. See (Fig. 14).

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

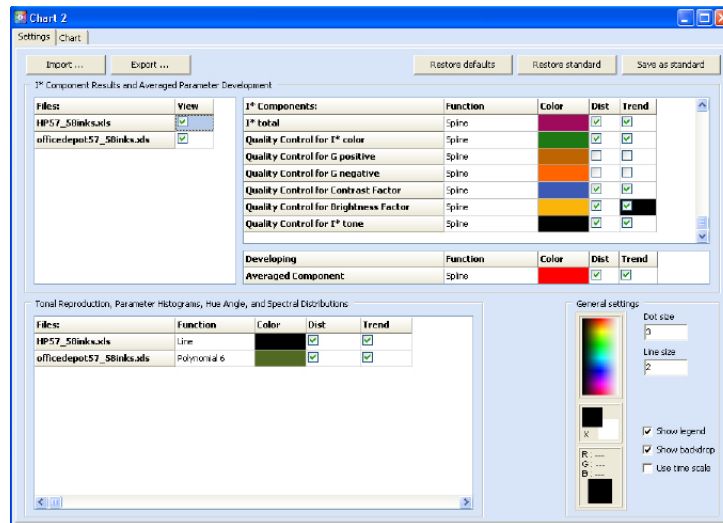


Fig. 14

The chart window will allow easy interpretation of both measurements and trend lines. See (Fig. 15). Click on each data point and the status bar will show the corresponding file and x,y coordinates.

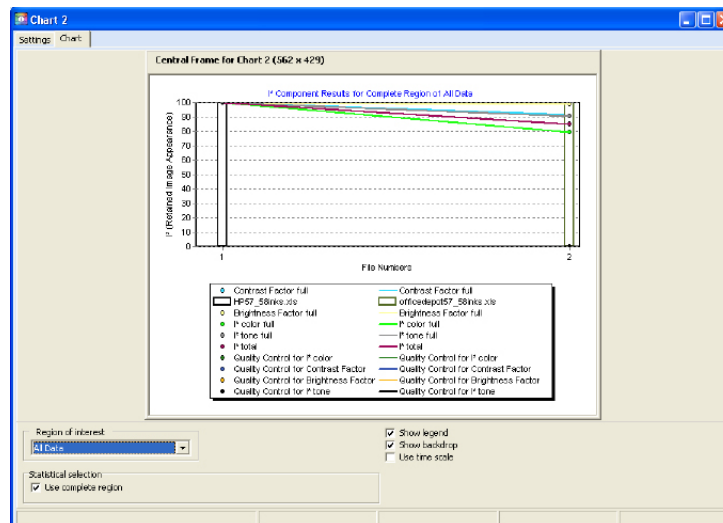


Fig. 15

Notice the “Brightness Factor full” (yellow line) is down to approximately 98% for the bond paper. These results indicate that the Office Depot inks were able to produce 98% of the brightness achieved on the HP inks when printing

the same target. All results are averaged over the whole target. To analyze the results from a specific region of interest, explore the “Region of Interest” drop down list. The “Contrast Factor” performed at approximately 90% using Office depot inks. This trend results from the Office Depot inks being incapable of producing colors as dark (L channel) as HP inks. Due to the Office Depot inks not producing lower Lmin values, the level of definition between lighter and darker portions of the target where not as high as the HP inks. “I*color Full” (green line) dropped to 80% indicating that in comparison to the photo paper, the bond paper color hues shifted, on average, by 20%.

“I*tone Full” dropped to 85% showing that, on average, the bond paper could not reproduce the tonal scale of the photo paper. Specifically, there was an average difference of approximately 15% between the L value of any given patch printed using HP inks and the same patch printed using Office Depot inks.

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

Check the spectral distributions for some skin tone patches. i-Star provides spectral distribution charts, provided the spectral data was imported. Proceed with analysis of these charts. See (Fig.16).

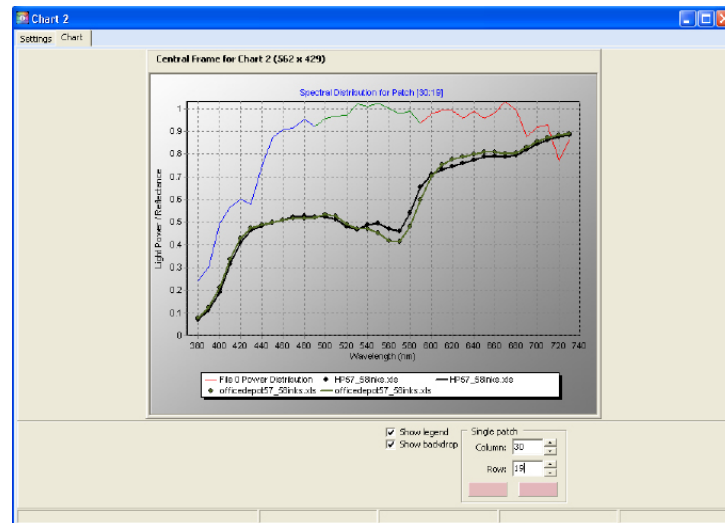


Fig. 16

Right-click on the panel and select “Spectral Distribution” in “Context Menu.”

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

The spectral distributions for the two inks show that the patch at column 30 and row 19 (this is a skin tone patch) was reproduced by Office Depot ink at approximately the spectral intensity of the HP inks across all wavelengths. Minimal deviation occurred between 540 and 600 nanometers where HP inks produced higher intensities.

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

Finally, save the project. This 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 the 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 windows. See (Fig. 17).

Although i-Star saves all project data entered in the 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.

Choose a filename for the project.

Click “Save” button.

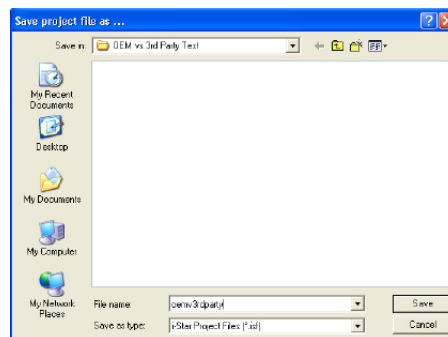


Fig. 17

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 on ‘PDF Report Preview Window’ under ‘View’ menu. See (Fig. 18).

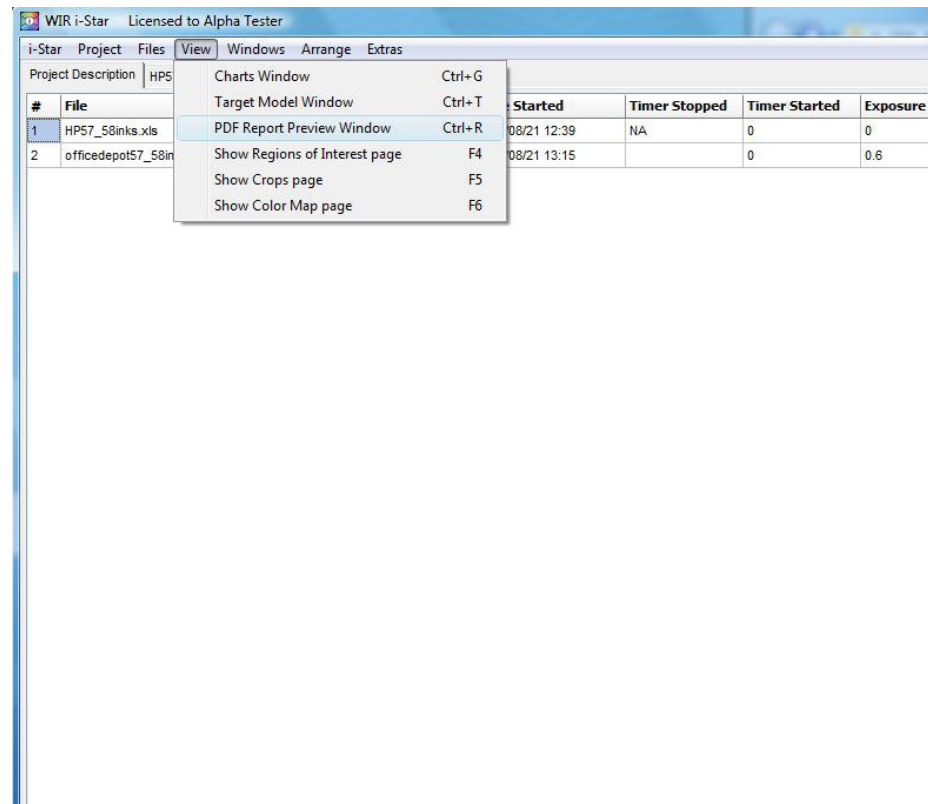


Fig. 18

The Summary page of the PDF Report Preview window will appear. The first page on the PDF will contain a summary of the project details. The filename text box displays the name of the PDF. Choose a name suitable for the project. In this example, name the PDF “WIR_oemvs3party.isf_report_2007_12_14.pdf.” The remaining three check boxes and corresponding text boxes designate the location of the PDF file. For this example, place the PDF in the same folder as the project. Check the “at project folder” check box. The remaining entries, colored white, must be filled from the “Preferences” page under the “Project Info” tab. These fields are not required, but provide more detail about the nature of the project. All yellow fields (text boxes) may be directly modified from the PDF Report page. Be sure the “Wilhelm Imaging style (short)” radio button is checked. This is the reporting format of a

standard Wilhelm Imaging Research report. See (Fig. 19).

The screenshot shows the 'PDF Report Preview' window for a 'WIR I-Star Report'. The main area contains the following fields:

- Filename: WIR_oemvs3party.isf_report_2007_12_14.pcf
- at user defined folder: C:\Users\Kabeni\Desktop\Istar\OEM vs 3rd Party Test
- at project folder: C:\Users\Kabeni\Desktop\Istar\OEM vs 3rd Party Test (checked)
- at collector folder: C:\Users\Kabeni\Desktop\Istar
- Date: 2007_12_14
- I-Star version: I-Star v.2.2
- Release: 000000014h
- Job Number: (empty)
- Project Number / Sample Number: (empty)
- Test Started: 2007/08/21 12:39
- Number of files / measurements: 2
- Last Measurement: 2007/08/21 13:15
- Total Exposure Time (Hrs): 0.6
- Reference Target had been printed with: (empty)
- Printer: HP Photosmart 7450
- Ink: HP 57/58 inks vs. Office Depot 57/58 inks
- Media: HP Premium Plus Photo Paper
- Condition name: (empty)

Below the fields, there is a section for supplemental information:

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 Office Depot 57/58 inks when compared to the same target printed with HP 57/58 inks.

At the bottom left, contact information for Wilhelm Imaging Research, Inc. is provided. At the bottom right, there are buttons for 'Include Limitations' and 'Memorize this information'.

On the right side of the window, there is a vertical navigation pane with the following sections:

- Summary: Summary (checked), Target (checked), Test info (checked), Variables (checked), Regions (checked), Criteria Set (checked), Results (checked), Worst 10% (checked), Interpolation (checked), Worst 10% (checked), Standard Chara (checked), Extra Images (checked), References (checked), Memorize Report presets (checked)
- Report Presets: Wilhelm Imaging style (short) (selected), Complete Report (radio), Custom (radio)
- Buttons: Create PDF Report, Create PDF Report and Print

Fig. 19

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 you to preview the pages before printing the PDF. A green label on the button indicates that you are currently viewing the page represented by that button. In order to view a particular page, the corresponding check box must be checked (i.e. that page must be included in the PDF report).

Complete the “Printer,” “Ink,” “Media,” and supplemental information text boxes. See (Fig. 19). Check the Wilhelm Imaging style (short) radio button. This is the preset reporting format present in standard Wilhelm Imaging Research reports.

The text boxes colored in white must be filled from the “Preferences Page.” See (Fig. 20).

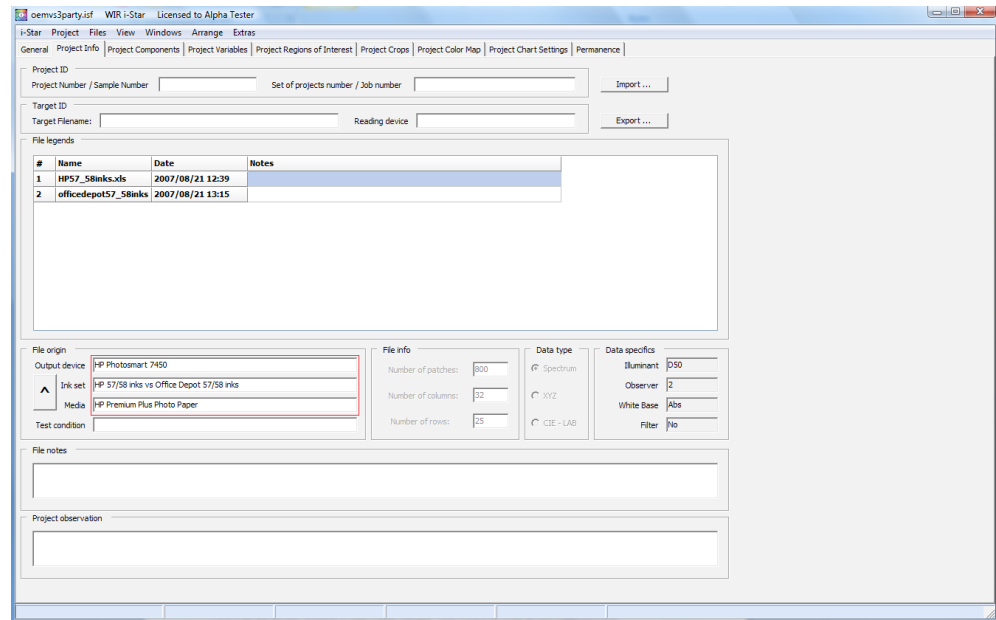


Fig. 20

Once the “Preferences Page” is complete, the corresponding fields will auto fill in the PDF Report preview page. The supplemental information may be entered manually into the PDF Report page, indicated by a yellow text area. Write a short sentence to elaborate on details of the project in the supplemental information area.

View the “Test Information” page of a standard WIR i-Star Report. See (Fig. 21). Notice for this test, the Light level (Lux) data box is left empty. In this case, 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 image exposure to other 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 in the i-Star User Guide.

The screenshot shows a software window titled "PDF Report Preview" with a "Test Information" section. The "Test Information" section contains the following fields:

Job Number:	
Project Number / Sample Number:	
Test Started:	2007/08/21 12:39
Number of files / measurements:	2
Last Measurement:	2007/08/21 13:15
Total Exposure Time (Hrs):	0.6

Below this is a section for "Reference Target" specifications:

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

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

At the bottom of the "Test Information" section is a "Reference Target notes:" text area and a "Memorize this information" button.

On the right side of the window is a vertical navigation pane with the following items:

- Summary (checked)
- Target (checked)
- Test info (checked)
- Regions (checked)
- Criteria Set (checked)
- Results (checked)
- Worst 10% (checked)
- Interpolation (checked)
- Standard Charts (checked)
- Extra Images (unchecked)
- References (unchecked)

Below the navigation pane is a "Report Presets" section with the following options:

- Memorize Report presets
- Report Presets
 - Wilhelm Imaging style (short)
 - Complete Report
 - Custom

At the bottom of the right pane are two buttons: "Create PDF Report" and "Create PDF Report and Print".

Fig. 21

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 i-Star Manual for reference. When done, press Ctrl + q or choose “Quit” in the “i-Star” menu. Save any additional changes to the project.