



CORRELATED COLOR TEMPERATURE CALIBRATION SERVICE AUTOMATION USING LABVIEW GRAPHIC ENVIRONMENT

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Abstract: The automation of measurement systems plays an important role in metrology in the control and interface of all system components in order to ensure reliability, accuracy and repeatability of measurements. In addition, automation permits the ease of data storage and data processing and helps to reduce costly man power. The goal of this work is to present the automation system for the Correlated Color Temperature (CCT) calibration procedure at Lacoé reducing the time of human interaction and eliminating errors.

Key words: automation, metrology, quality, optimization.

1. INTRODUCTION

With the advent of globalization and the consequent growth of market competitiveness, the contribution of metrology is becoming increasingly important in industry. This is because metrology is directly related to the production process. Thus, there is no quality management without management metrology of measurement systems.

The Colorimetry and Spectrophotometry Laboratory (Lacoé) of Inmetro has recently offered for their customers a new calibration service for Correlated Color Temperature (CCT). CCT is a parameter used by the lighting industry for indoor lighting, photography, arts, and architecture to cite a few applications. CCT relates to the color appearance of the light emitted by a lamp with respect to a Black body source at that temperature. Low or high CCT rating for a lamp expresses the "warmthness" or "coolness" measure of its appearance. CCT rating below 3200 K are usually considered "warm" sources, while those with a CCT above 4000 K are usually considered "cool" in appearance. As one can see, the qualitative classification is exactly the opposite as the actual temperature.

To achieve this service, a large number of calculations are necessary accordingly to the chosen method, such the table color matching functions of CIE 1931 to CIE 1960) and the choice of the Robertson Method to perform the calculation for the estimation of the CCT.

As the database is relatively large and both Robertson Method and the uncertainty budget of the Correlated Color Temperature calculations are extensive, the whole

automation of the correlated color temperature service became necessary.

2. GOAL

Seeking a greater reliability for CCT calibration of lamps, great care is taken with the experimental procedures, providing accurate measurements of the spectral power distribution of the lamp, providing trustful data for handling and computational analysis that decreases operational efforts and eliminates the possibility of errors caused by the operator.

3. METHODOLOGY

The Correlated Color Temperature Automation System was all developed in LABVIEW 2010 (Laboratory Virtual Instrument Engineering Workbench) due to the facilities this language provides for automation systems development such as a whole routine library focused on the measurement area, interface with most measurement devices and the capability to develop a user friendly interface.

To a better result, the system got to interact with external objects as shown in Figure 1, below:



Fig 1: Interaction with external objects

The CCT system is composed by three measurement devices: a multimeter, a thermohygrometer and a spectroradiometer. As a multimeter we have an Agilent 34970A used to monitor the lamp under test, although the multimeter measurements (temperature, current and voltage) are not directly used to calculate the Correlated Color Temperature. As a thermohygrometer we have a SATO SK-L200THII_Q used to monitor the humidity and temperature of the environment. These measurements are also not directly used to calculate the Correlated Color Temperature. As a spectroradiometer we have a Photo Research PR650 spectroradiometer. The CCD spectrophotometer generates ten reads in ".txt" files, so the CCT system

imports these files to perform the calculations as shown in Figure 2.

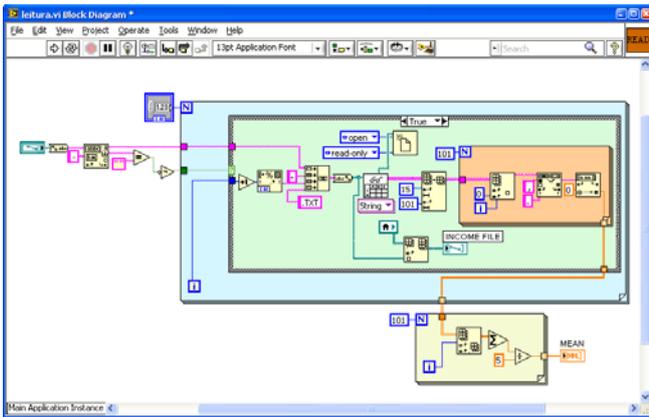


Fig. 2: Read block diagram

4. DISCUSSION

The present system allows for a continuous improvement of the methods, since it leaves the final user to include updated modules with new parameters calculation, enabling measurements which meet a great variety of light sources.

The diagram in Figure 3 shows the method used to calculate the Correlated Color Temperature. The Robertson's Method calculations are encapsulated in a subVI allowing the final user to replace it as long as necessary when changes in the calculations are realized.

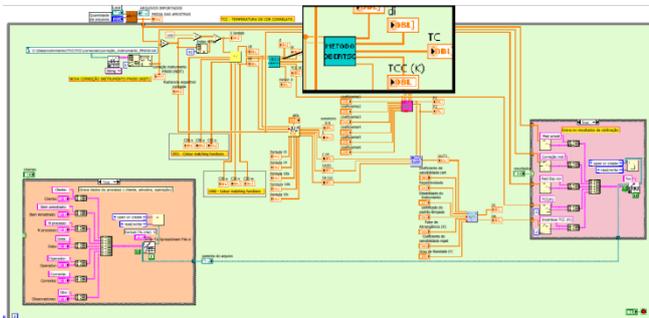


Fig 3: Robertson's method at Main Block Diagram

The CCT's uncertainties, the same way as the Robertson's Method, are also encapsulated in subVIs, so the final user can replace it for new Vis when needed.

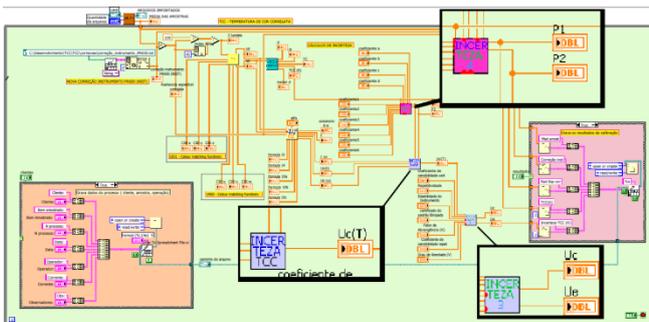


Fig 4: Correlated Color Temperature uncertainty modules

Comparing and analyzing the Correlated Color Temperature calibration procedures it became clear how repetitive was the old process and how high was the possibility of errors. For this reason, the need of a system capable to decrease the human interaction became primary.

5. CONCLUSION

An automation system was developed in order to ensure the continued uniformity and quality of our calibration procedure for our clients' benefit. The CCT Automation System became an important tool at the calibration process as it increases reliability at the final results. This tool helps the process goes faster and reduces the chance of some kind of error at the process.

6. NEXT GOALS

The next step of this work is to develop a VI module able to create a certificate file containing all the calibration results to completely eliminate the human interaction at the CCT calibration process results.

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