



## Compact Ultrafast Spectrometers Inside LED Sorting Machines

Avantes, Inc.

**L**ED sorting machines are being used for color sorting of (white) LED's. Classification of these LED's is done with ultra fast fiber optic spectrometers in a millisecond timeframe.

The lighting industry is rapidly progressing into the new dimensions of opportunity provided by solid-state lighting. Especially light emitting diodes (LED's) and Organic LED's (OLED's) will replace traditional lightning and fluorescent lights in the coming decade. Specific examples of multiple LED use can be seen already in daily life in rear lights of cars, traffic lights, portable lights, wide format displays, etc.

In order to have a uniform lightning, it is important that the LED's that are used are matching in color. These so-called color parameters of LED's can be determined by a radiometric calibrated fiber coupled spectrometer, such as the AvaSpec-2048-USB2 from Avantes. The emitted light from an LED is coupled through a diffuser into a fiber optic cable, connected to the optical entrance of a spectrometer. Inside the spectrometer's optical bench, the light is collimated onto a grating and the dispersed light is then focused onto a CCD detector array of 2048 pixels.

This detector array is being read out by fast electronics, and the powerful onboard microprocessor converts the data into colorimetric values (x and y) and LED specific quality parameters, such as dominant wavelength (see Figure 1).

The PC connected to the spectrometer gets the LED data through high speed USB2 interface and controls the sorting valves of the LED sorting machine. The PC can therefore decide to classify the LED into 64 or more different classes, depending on the values, as measured with the spectrometer.

Important aspect of this application is the speed and accuracy with which the LED's can be classified. The AvaSpec-



Figure 2: Spectral measurements inside the LED sorting machine.

2048-USB2 spectrometers can run at a 1.1 ms integration time and a 2 ms/scan data transfer time, allowing the LED sorting machine to run at maximum speed.

The advantage of using small spectrometers with no moving elements inside are the low maintenance and deadtime of the LED sorting machine.

The powerful onboard microprocessor also enables the AvaSpec to run as a stand-alone spectrometer, in which all the data processing takes place on board the spectrometer. The spectrometer then outputs digital TTL-level IO signals (yes/no) depending on the LED characteristics.

In the future, more and more spectrometers will act as stand-alone smart sensors in a product line, making in-line measurements and decisions.

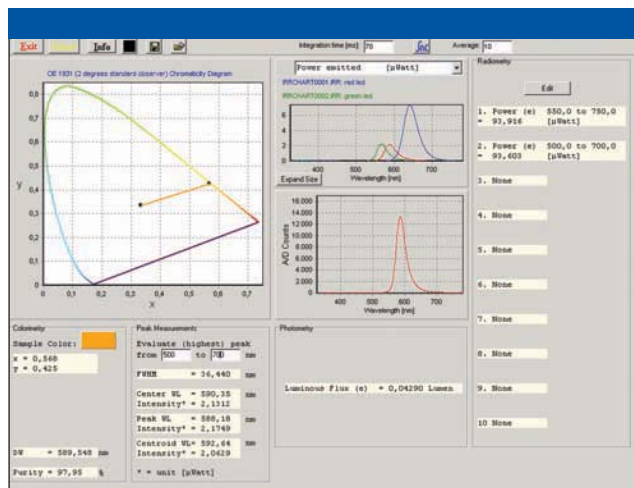


Figure 1: LED colorimetric parameters as classification criteria.

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