SPECTRAL EVOLUTION

Monitoring the Performance of a Solar Simulator with an SR-1901PT

ASTM standard E927-05 defines a solar simulator as a device that contains three major components: *(1)* light source(s) and associated power supply; *(2)* any optics and filters required to modify the output beam to meet the classification requirements (e.g., AM1.5 Global Tilt) ; and *(3)* the necessary controls to operate the simulator, adjust irradiance, etc. For a solar simulator to be classified as "Class A, " its light source must put out energy as a function of wavelength, as defined by Table 1. SPECTRAL EVOLUTION's SR-1901PT spectroradiometer is designed to measure the spectral distribution of both continuous and pulsed solar simulators for AM0, AM1.5 and AM1.5 Global tilt. The SR-1901PT has a broad spectral range of 280-1900nm, ensuring that each interval is adequately covered.

TABLE 1 Spectral Distribution of Irradiance Performance Requirements (Small and Large Area Simulators)

Wavelength interval, μm	Percent of Total Irradiance		
	Direct AM 1.5	Global AM 1.5	AM 0
0.3 to 0.4	Not Specified	Not Specified	8.0
0.4 to 0.5	16.9	18.4	16.4
0.5 to 0.6	19.7	19.9	16.3
0.6 to 0.7	18.5	18.4	13.9
0.7 to 0.8	15.2	14.9	11.2
0.8 to 0.9	12.9	12.5	9.0
0.9 to 1.1	16.8	15.9	13.1
1.1 to 1.4	Not Specified	Not Specified	12.2

SPECTRAL EVOLUTION's SR-1901PT spectroradiometer allows end users to validate Class A performance of solar simulators very quickly and easily with minimal set up time. The small size and weight of these systems (~11x8x3 inches; 7lbs) means that they can be set up anywhere as space dictates. (Figure 1)

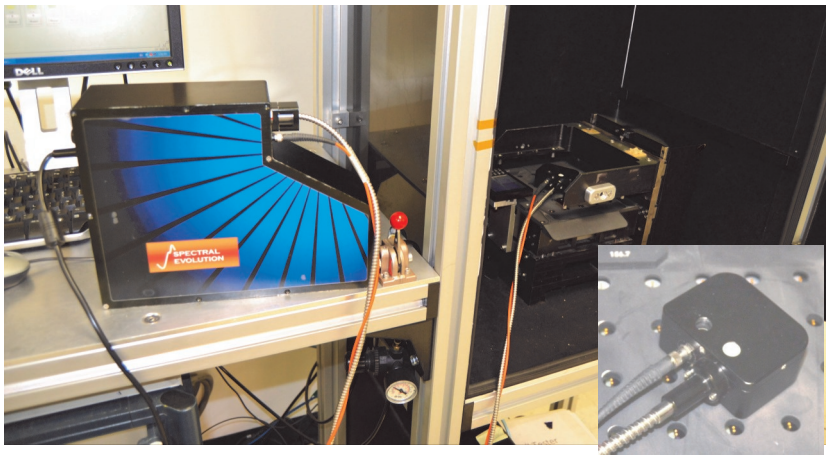

Figure 1—The SPECTRAL EVOLUTION SR-1901PT spectroradiometer has a compact footprint for use with any solar simulator. It communicates via wireless Bluetooth with any Windows 10-based laptop or desktop computer for easy setup. The irradiance diffuser (inset) is easy to place within the illumination zone and can be moved throughout the measurement plane for verification of uniformity. The irradiance diffuser also features a photocell sensor to detect the initiation of a pulsed measurement. A 2 meter fiber optic assembly is offered; longer lengths are available.

Most commercial solar simulators use bulbs that may shift in wavelength over time; therefore it is important to measure the spectral output of a simulator to certify that it still falls within its rated class of performance. If the system drifts off class A output, it may be necessary to add additional filtering to the system and make additional adjustments to the power level of the bulbs to maintain the desired class of performance.

An example of a solar simulator that has drifted out of class A specification is shown in Figure 2, as measured by the SPECTRAL EVOLUTION SR-1901PT. The included DARWin SP Data Acquisition software offers a Spectral Match utility for easy viewing of simulator performance at a glance. Within the orange measurement error bars, it is very easy to see that the simulator has drifted out of class A performance.

In Figure 3, a subsequent measurement was taken with filters applied to attenuate the signal in the near infrared; lamp power was also increased to offset filter attenuation. This brings the simulator performance back to Class A as seen in the Spectral Match utility.

Contact SPECTRAL EVOLUTION today for a demonstration of our systems.

26 Parkridge Road ◊ Suite 104
Haverhill, MA 01835 USA
Tel: 978 687-1833 ◊ Fax: 978 945-0372
Email: sales@spectralevolution.com
www.spectralevolution.com

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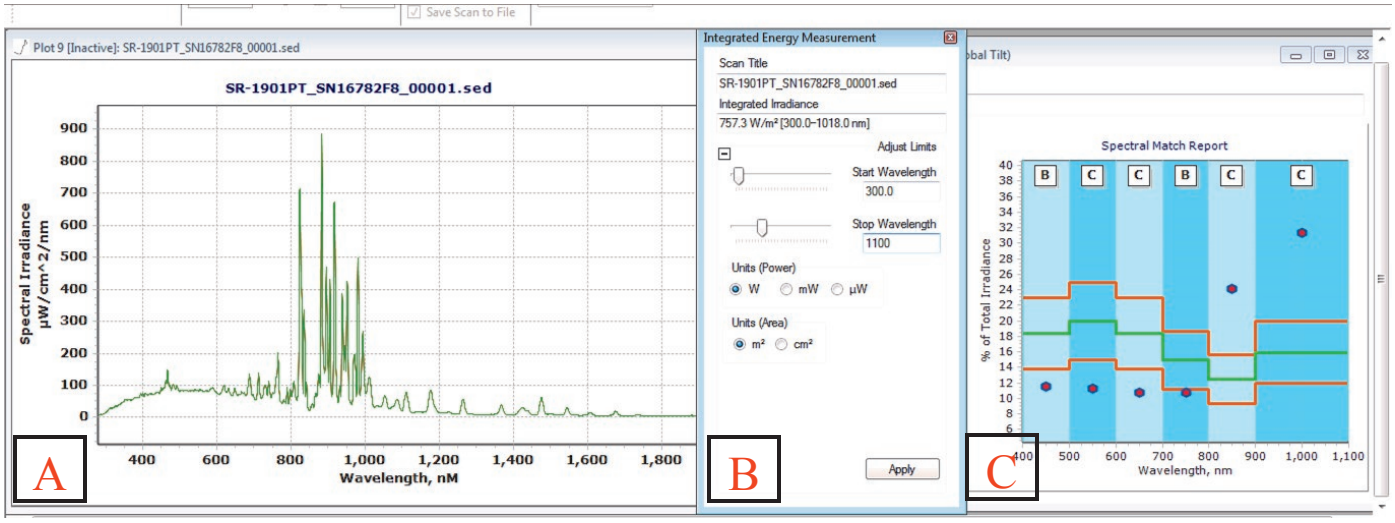

Figure 2– All SPECTRAL EVOLUTION SR-1901PT systems come with exclusive DARWin SP data acquisition software for easy data acquisition and visualization of results within seconds of each measurement. (A) A commercial pulsed solar simulator was measured using the SR-1901PT within the spectral range of 280-1900nm. A 5 millisecond offset was applied to the data collection; data integration measurement time was set to 1 millisecond. (B) Darwin software includes a utility that allows the end user to integrate total irradiance power under the curve throughout a preselected wavelength interval. Total integrated power from 300-1100nm for AM1.5GT was 757.3 watts/square meter. (C) DARWin software includes a utility to chart a spectral match report for easy graphical viewing of class performance. The green line represents the ideal values shown in Table 1 within error bars (orange lines). Points falling within the orange borders for each interval represent class A performance.

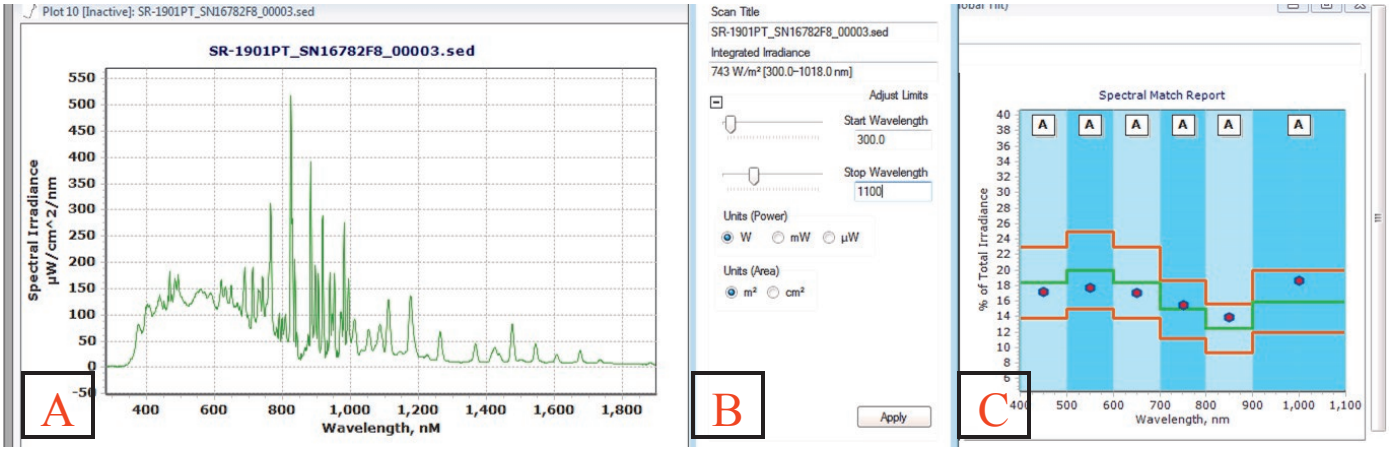

Figure 3– Solar simulator measurement after filter and power corrections to bring performance to Class A specification. Total integrated power for the measurement (B) from 300-1100nm was 743 watts/square meter. The Spectral Match report generated via DARWin software shows Class A performance for AM1.5 global tilt. Measurement integration time: 1 millisecond with a 5 millisecond delay offset.

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