National Renewable Energy Laboratory

Calibration Report

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Subject: Calibration of SRRL BMS Quantum Sensors
Instruments: Licor LI-190 s/n Q8432 (BMS Global Horiz.) and s/n Q20555 (BMS Upwelling)

NREL PV Radiometric Measurements Task monitored the millivolt output of two (2) SRRL BMS LI-190 Quantum Sensors while measuring the spectral distribution of natural sunlight in global horizontal incidence mode on 9 September 2010 from 300 nm to 1100 nm at 2nm intervals using a LICOR LI-1800 Spectroradiometer. The millivolt output from the BMS sensors were recorded by the BMS CR23X data logger.

The LI-1800 S/N PRS-158 spectrometer was calibrated against NREL's National Institute of Standards and Technology (NIST) Standard of spectral irradiance F620 on 17 August 2010.

The LI-1800 has a command ("PP") to automatically integrate the data between 400 and 700nm and display the result in the Quantum (PAR) units of µmol/s/m^2/nm. All data were used to compute the calibration factors shown in Table 1.

Table 1. September 9, 2010 NREL Quantum LI-190 Calibration Summary

Time (MST)	LI-1800 PP µmol/s/m^2	Q8432 mV (avg.)	µmol/s/m^2/mV CF	Q20555 mV (avg.)	µmol/s/m^2/mV CF
12:18	1873	-8.4728	-221.061	5.5657	336.523
12:25	1878	-8.4988	-220.971	5.5821	336.435
12:26	1868	-8.4505	-221.051	5.5491	336.631
12:27	1863	-8.4245	-221.142	5.5279	337.018
12:30	1852	-8.3810	-220.976	5.5044	336.458
		Avg.	**-221.04**	**Avg.**	**336.61**
		Sigma	**0.0702**	**Sigma**	**0.2388**

UNCERTAINTY

The estimated uncertainty in the LI-1800 spectral irradiance calibration is ±4.0% from 400 nm to 700nm. The accuracy of the CR23X data logger was about 0.8%. Estimated uncertainty in the derived calibration factor is ±4.8% (limit of error). Spectral data is plotted below.

Figure 1. Measured Spectral Distributions indicated by LI-1800 Spectroradiometer 9 September 2010