



CORM 2009

Forward Flux Standard Addresses Calibration Needs

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Labsphere forward flux standard



What is a forward spectral flux standard?

- Calibrated total forward spectral radiant flux standard light source.
- Provides a projected beam of light for situations where calibration calls for the standard source to have a geometry similar to the source being measured
 - SSL fixtures
 - Flashlights
- Minimizes substitution error in an integrating sphere measurement since the standard and the device under test are both external to the integrating sphere.

Need for a forward spectral flux standard

- Solid state lighting flux measurements using an integrating sphere
 - IESNA LM-79
- Flashlight flux measurement using an integrating sphere
 - ANSI/NEMA FL1-2009
- Labsphere's Integrating Hemisphere Light Measurement Systems



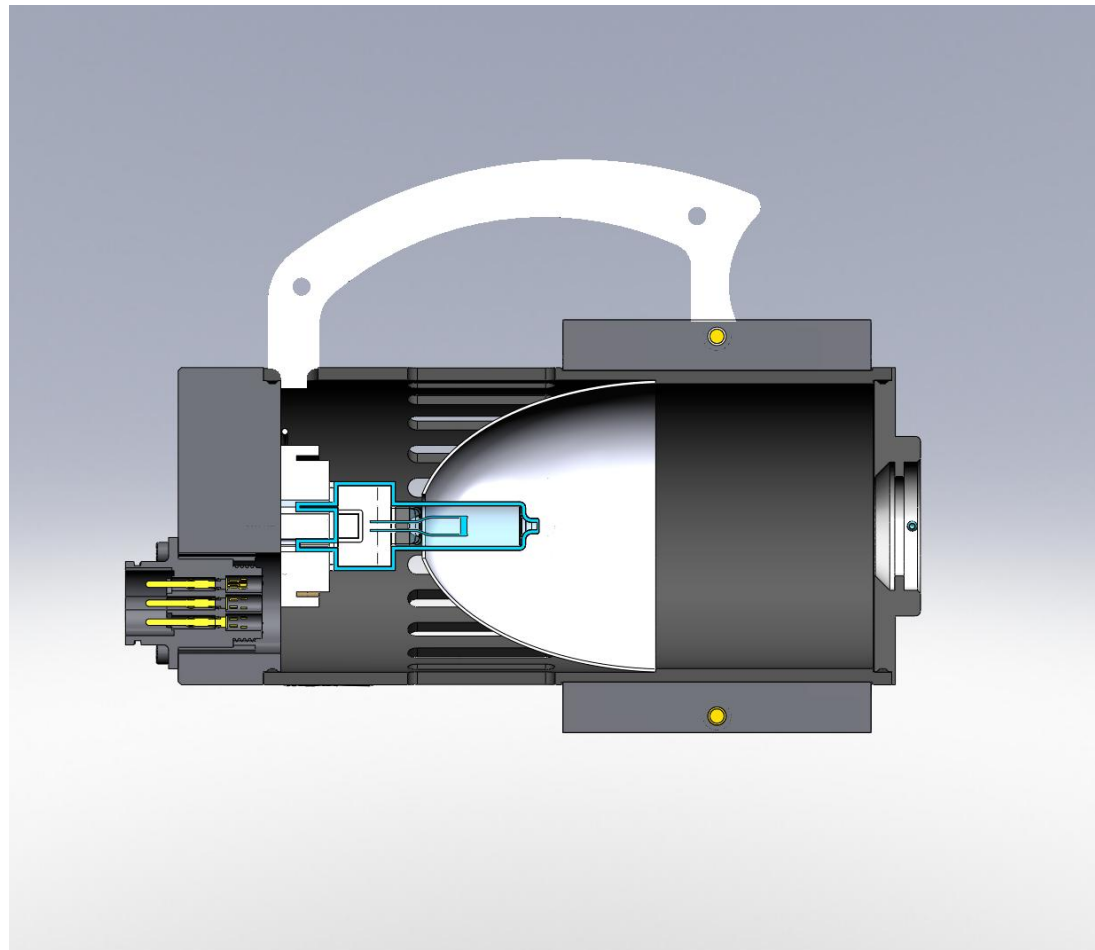
New Products, New Technology



Design of the forward flux standard

Requirements

- Robust
- Stable
- Repeatable
- Reproducible
- Continuous
- Current Regulated



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Design of the forward flux standard

- Based on Labsphere's external halogen light source
- Elliptical rhodium reflector for efficient light collection
- Projector lamps with kinematic ceramic base for positive/secure lamp location
- Tungsten halogen lamps are seasoned and screened before selection for installation in the forward flux standard
- Radiative cooling using heat sink fins in housing. No microphonic vibration from a fan.
- Powered by Labsphere's preset constant current tungsten halogen lamp power supplies for stable operation.

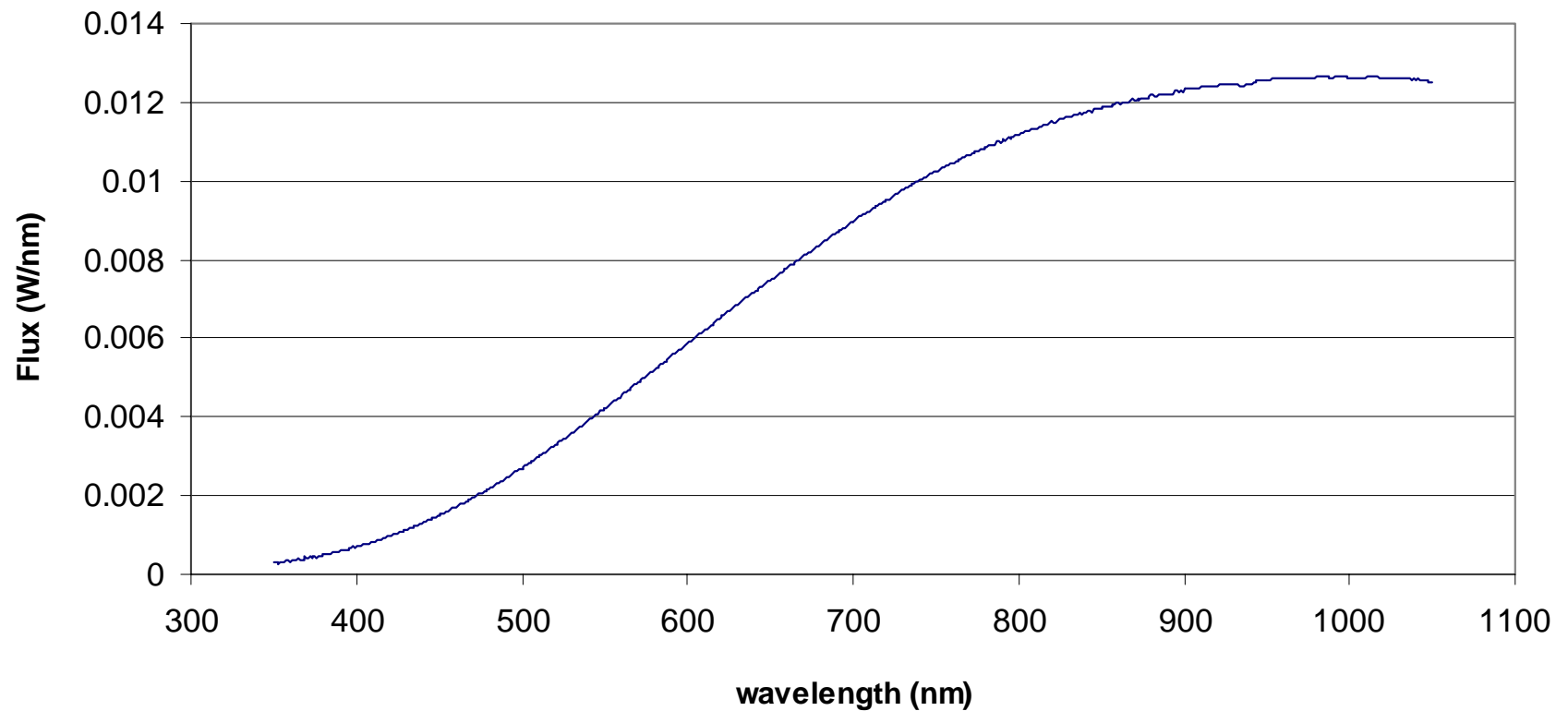


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Performance Results

Continuous Spectrum of Calibrated Spectral Flux Standard



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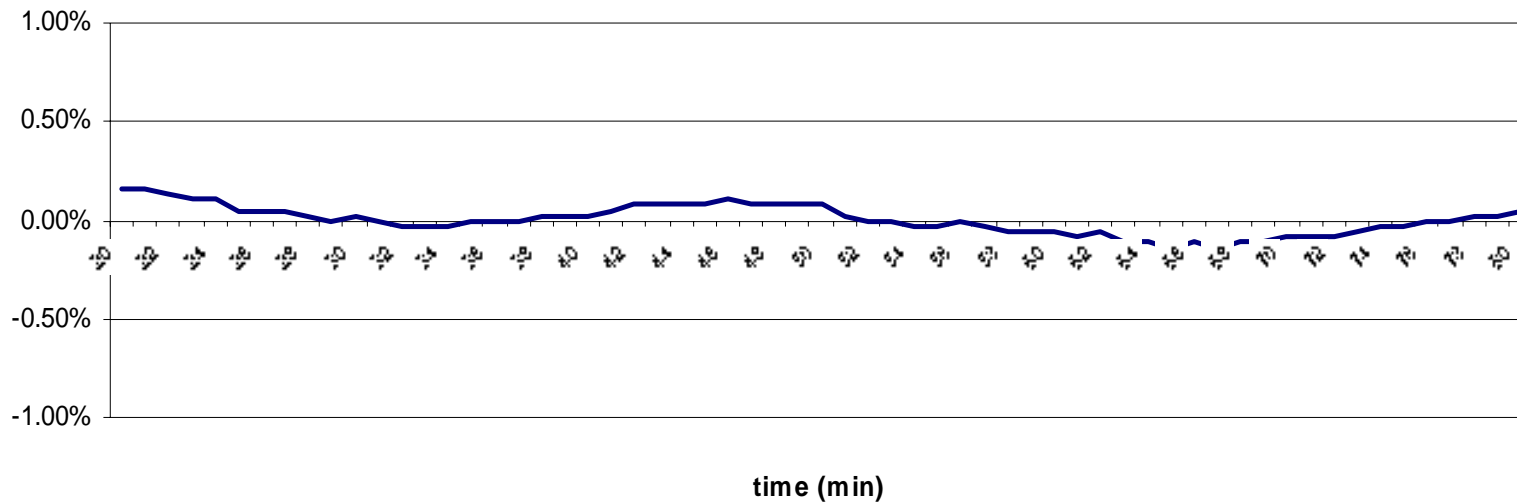
Performance Results

Lumen Stability: 368 +/-0.9 lm



50W
4.167A
370 lm

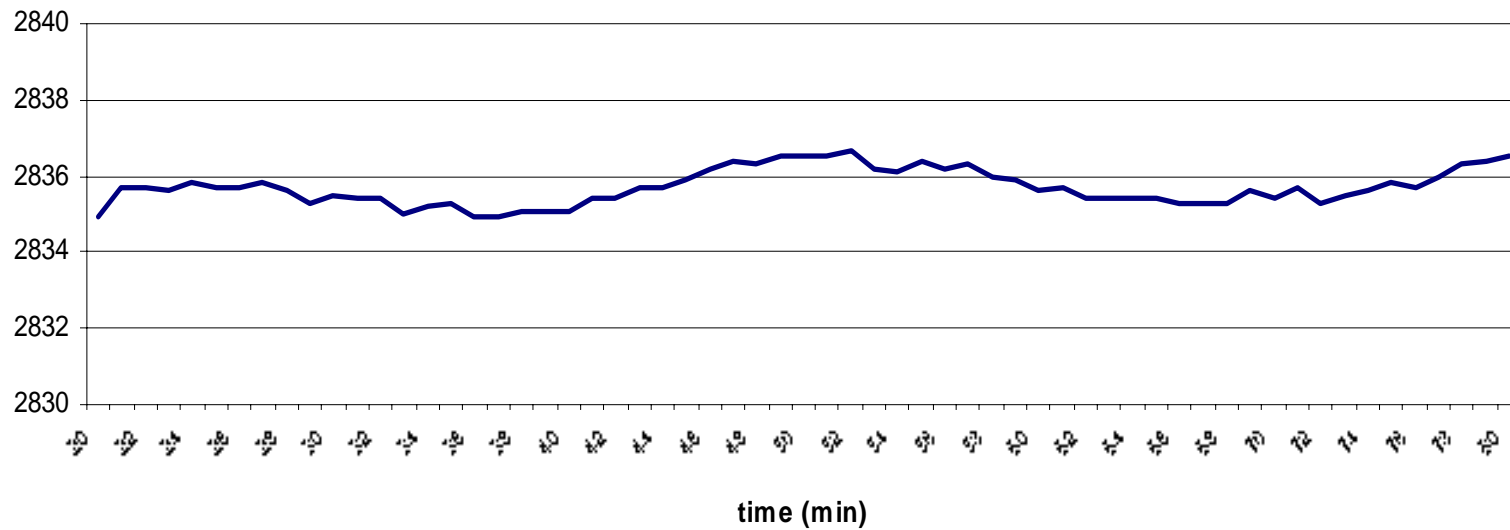
Relative Lumen Stability (std = 0.270)



Performance Results

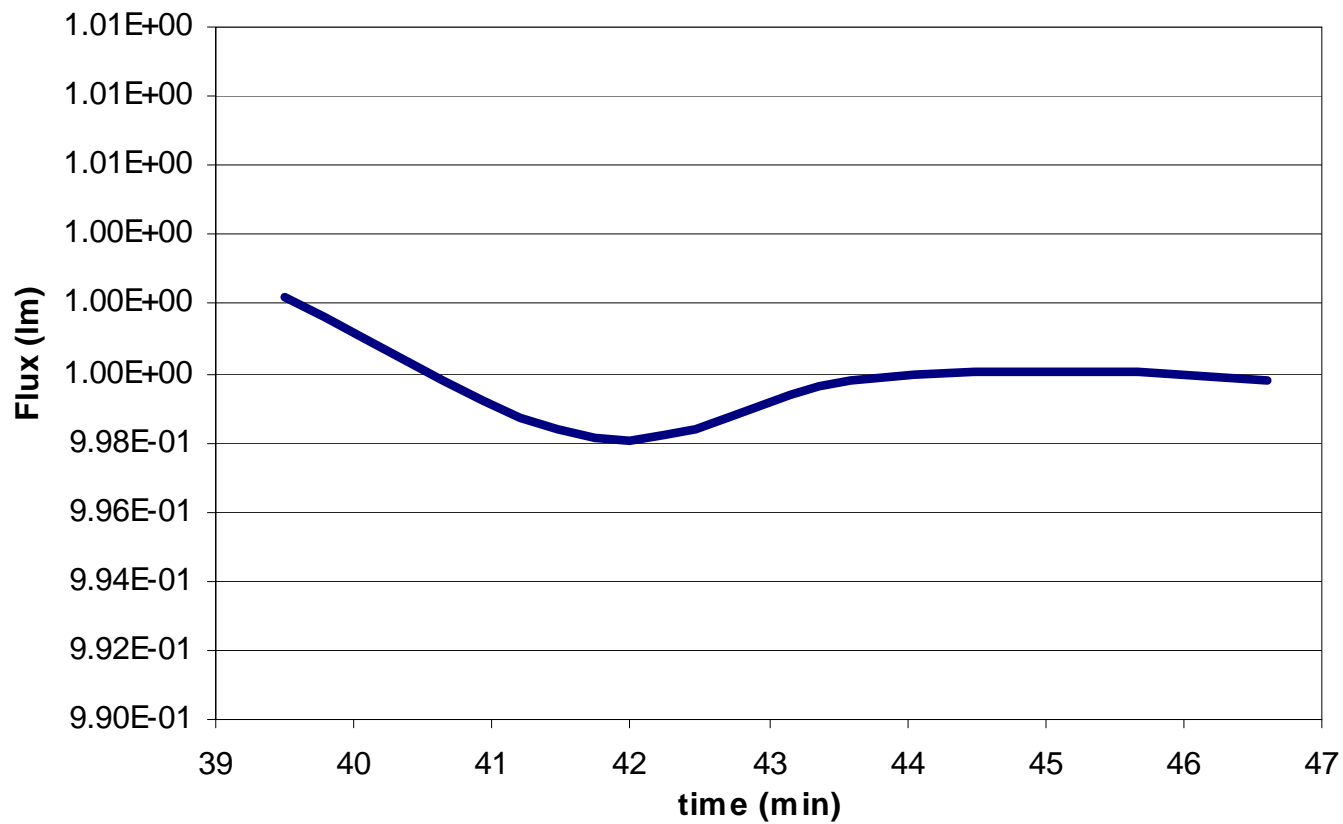
CCT Stability 2836 +/-0.9

CCT Stability (stdev = 0.4)



Performance Results

Lumen Reproducibility: 0.2%



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Luminous Flux Uncertainty budget

Description	u	value	units	type	DOF	Sensitivity	contribution
certified luminous flux of working standard w1	4.91E+00	1.71E+03	<i>lm</i>	B	inf	1.00E+00	4.92E+00
working standard w1 current monitor voltage	1.00E-05	2.68E-01	<i>volt</i>	A	16	4.39E+04	4.39E-01
working standard w1 current monitor resistor	5.00E-06	1.00E-01	Ω	A	10	1.18E+05	5.88E-01
working standard w1 current-flux relationship factor	1.44E-01	6.87E+00	<i>NA</i>	B	inf	6.39E-01	9.20E-02
working standard w1 aging factor	1.41E-03	9.80E-04	<i>NA</i>	B	inf	1.71E+03	2.42E+00
detector reading of luminous flux output from w1	1.00E-10	7.71E-07	<i>Amp</i>	A	25	3.75E+08	3.75E-02
detector reading of luminous flux output from FFS lamp	1.00E-10	1.30E-07	<i>Amp</i>	A	25	2.22E+09	2.22E-01
Luminous flux repeatability	1.52E-09	1.30E-07	<i>Amp</i>	A	18	2.22E+09	3.37E+00
combined uncertainty (lm)							3.35
expanded relative uncertainty (k=2)							1.67%



Acknowledgement

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Dante D'Amato

Others who contribute to this project

Thank you!

Questions?



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