

Basic Test Kit: The Basic Test Kit is the minimum configuration required to have an effective test program. This kit includes everything that is needed to flash the lamp. This includes the below:

Lamphouse: A total of 19 mirrors are used to reflect overlapping images of a xenon arc lamp to the test plane.

Frame: Extruded aluminum adjustable frame that holds the Lamphouse in place above the test plane.

Pulse Forming Network (PFN): Generates a pulse that is sent to the xenon lamp creating the flash.

Control Console: Includes our Data Acquisition Unit (DAU) along with electronics and software that control the system.

Options: Additional Equipment to increase range of testing available.

Attenuator Set: Nickel mesh attenuators used to reduce the light levels uniformly over the test plane. Includes approximate transmission levels of 60%, 50%, 33%, 12.5%, 6.25%, 3.1%, 1.5%, .75%, .3%, .1%.

Enhanced Uniformity Mask: Provides enhanced uniformity at the test plane. Peak power is sacrificed.

DUT Platform: Dual XY stages with a platform for holding up to six devices under test (DUT) with optional vacuum attachment (normally 4 reference cells and 2 test cells), an integrating sphere and 2 temperature sensors.

Spatial/Spectral Uniformity Sensor: Custom software used in conjunction with the DUT platform that can measure spatial and spectral uniformity.

Facility Requirements: Electrical requirements are customer specified for the PFN. Available in 208/220, 380 or 480 VAC (single phase). For the Control Console, 100-120 or 240 VAC with available transformers (single phase). Optimal mounting surface is an optical breadboard on stable surface (i.e. heavy laboratory table or bench).

The information contained on this sheet is for reference only. Specifications subject to change without notice. (REV. 09/18/12)



Terrestrial - High Intensity Pulsed Solar Simulator (T-HIPSS)

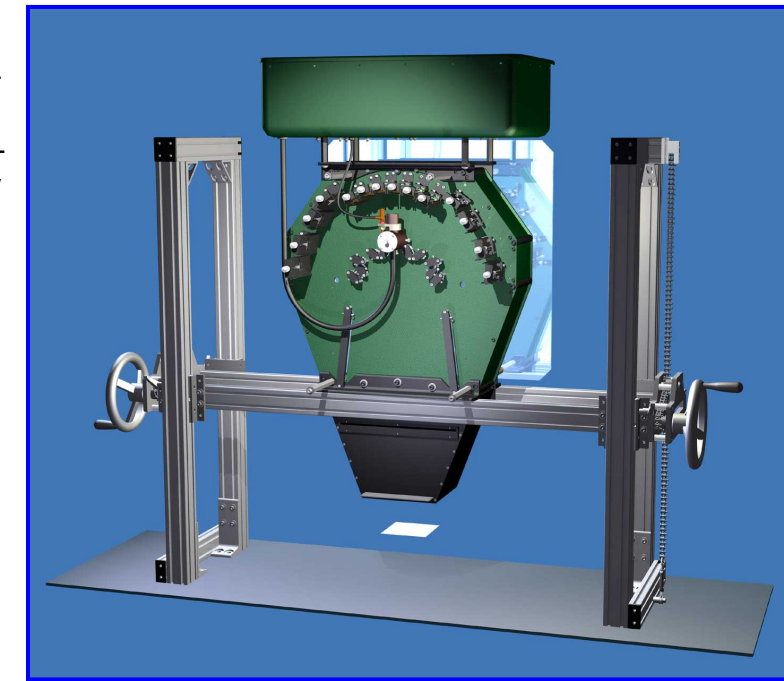
Spectrolab's T-HIPSS series are Class AAA high intensity pulsed solar simulators designed for testing Concentrated Photovoltaic (CPV) solar cells. The systems are designed to be used as table-top testers in production or laboratory environments. Nineteen overlapping images of the xenon arc lamp are produced by the lamphouse, generating a uniform high intensity test plane (Patent # 8,220,941 B2).

Available models are:

T-HIPSS 420: Offers higher irradiance intensity with good spectral match and adjustability using standard aluminum mirrors and absorptive filtering.

T-HIPSS 460: Offers highly flexible spectral adjustability using dielectric mirrors that selectively reflect specific spectral bands. The added adjustability of the 460 does result in lower overall irradiance intensity in comparison with 420.

Several 420 and 460 product configurations are possible with optional test kits available that provide added functionality and diagnostic capability.



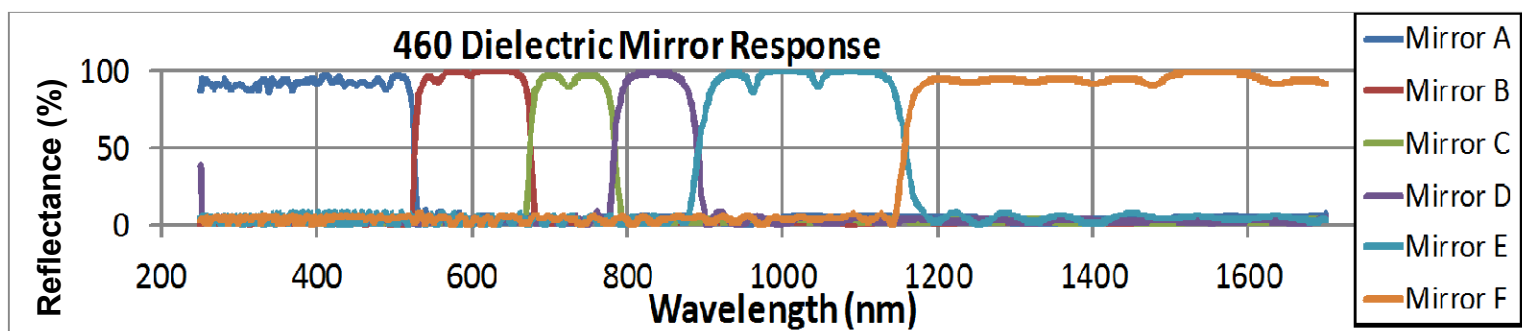
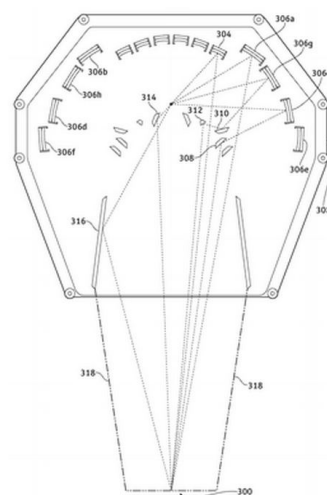
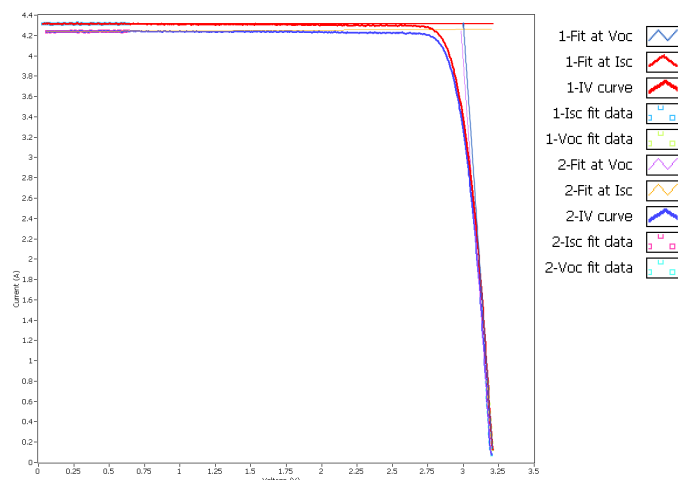
Model 420 shown with Lamphouse Lift Assembly and Attenuator Holder

SYSTEM SPECIFICATIONS:	Model 420	Model 460
Irradiance Levels	~1000-4000 Suns	~100 - 1500 Suns
Irradiance Level w/Mesh Attenuator	60%, 50%, 33%, 12.5%, 6.25%, 3.1%, 1.5%, .75%, .3%, .1%	
Test Plane Uniformity, (unfiltered with enhanced uniformity mask)	6 cm Class A (2%), parallel to lamp 8 cm Class A (2%), perpendicular to lamp	
Test Plane Distance	25" below lamp	
Spectral Match	Class A AM 1.5D	
Temporal Stability	Class A	
Spectral Adjustability	Filter Dependent	6 Bands
Type	Absorbing Filters	Dielectric Mirrors, Computer Controlled
Range	± 10% per filter pair	± 5% per dielectric mirror pair
Pulse to Pulse Variation	< 1%	
Class specifications as per ASTM E 927-05		

Features:

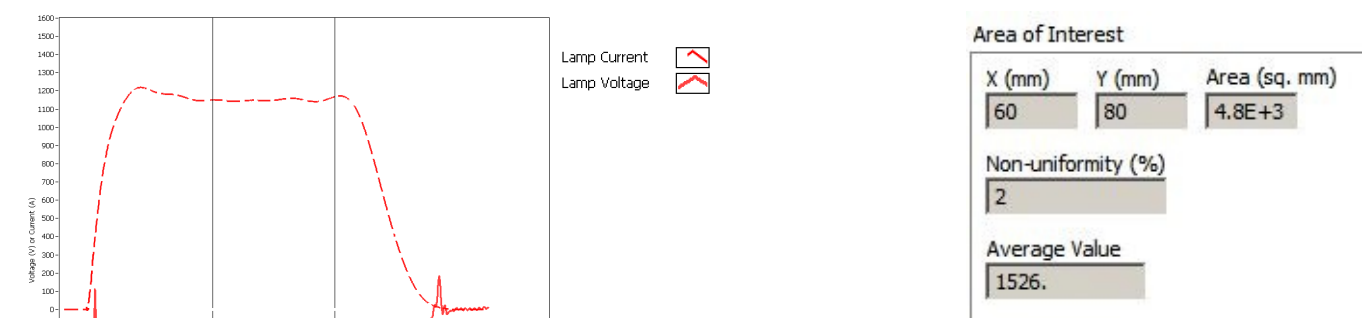
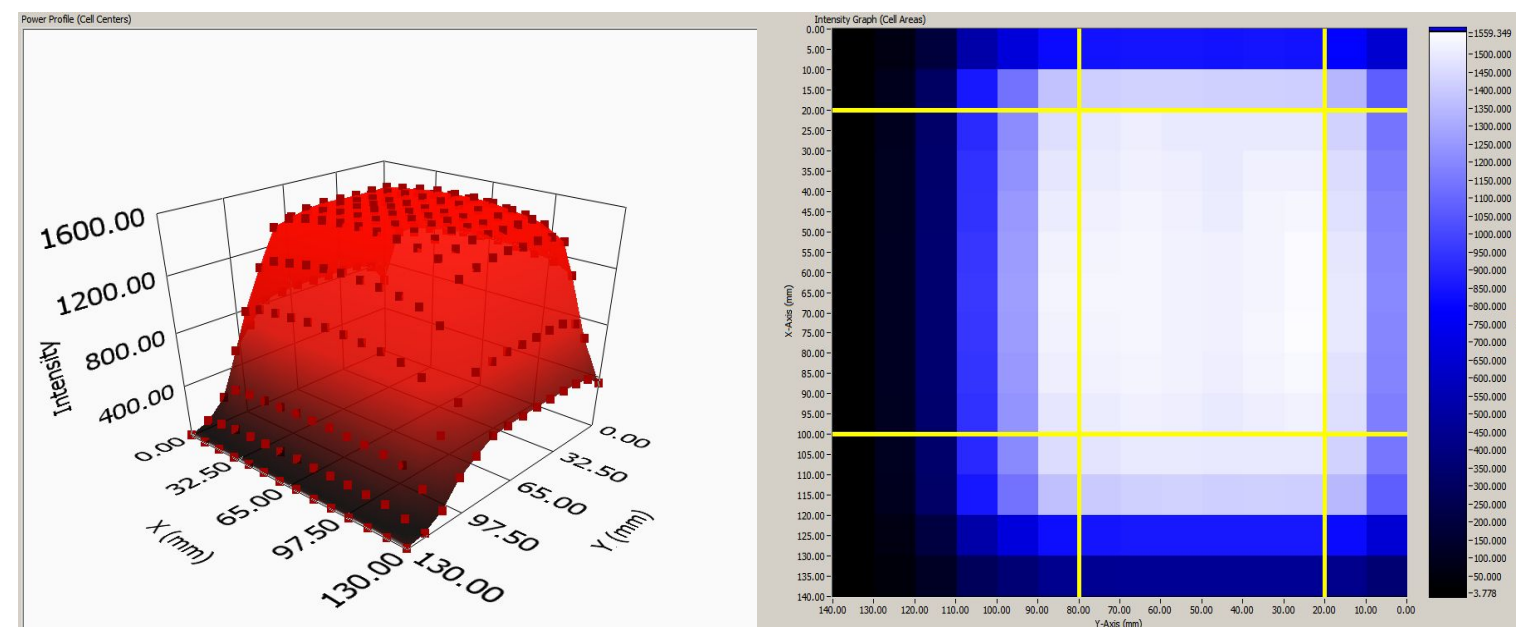
Data Acquisition Unit: The DAU is capable of testing two solar cells and four reference cells simultaneously. The two electronic loads perform IV Curve measurements using independent user defined parameters. The curve can then be temperature corrected and adjusted for any light level variation during the IV Curve Window using any of the four reference cells. The software displays I_{sc} , V_{oc} , P_{mp} , I_{mp} , V_{mp} , and the Fill Factor from the IV Curve. Data can then be saved and reopened or imported into a spreadsheet program.

Spectral Filtering: Spectral filtering is accomplished using different methods for the T-HIPSS 420 and 460. Both models use an AM1.5D coarse filter that is designed to work with the spectrum of a wide range of PFN settings. The 420 uses simple absorptive filters for spectral tuning while the 460 features 6 pairs of specially designed dielectric mirrors that selectively reflect specific bands that are matched to a typical triple junction cell for fine spectral tuning. These dielectric mirrors replace the standard aluminum mirrors and are installed in symmetric pairs to ensure a uniform test plane. Each spectral band is independently attenuated using computer controlled shutters. With the combination of these two techniques, the T-HIPSS 460 has outstanding spectral adjustability.



Irradiance Intensity Adjustability: The irradiance intensity can be adjusted using two methods: nickel mesh attenuators and changing the voltage of the flash lamp via the PFN setting. The attenuators are spectrally insensitive while changing the PFN setting changes the spectral distribution slightly. With the use of the Nickel mesh attenuators, the system can be spectrally balanced at a desired suns level and still have a wide range of intensity adjustability without having to retune the spectral filtering.

Spatial Uniformity: The T-HIPSS test plane has a large uniform area that allows for multiple reference devices along with the solar cell under test to be measured in a single flash. This Class A area can be increased with the Enhanced Uniformity Mask (graphs depicted with Enhanced Uniformity Mask).



Temporal Stability and Light Pulse Characteristics: Spectrolab's PFN produces a very flat current profile through the lamp for the duration of the 2.5ms light pulse. This produces a consistent and reliable light level during the 1ms IV Curve measurement. The PFN design has been proven over many decades and is used across the entire Spectrolab flash simulator product line.

Physical Dimensions

ITEM	WIDTH	HEIGHT	LENGTH	WEIGHT
Lamphouse	20" (508mm)	27" (686mm)	18" (457mm)	100 lbs (45.5kg)
Pulse Forming Network (PFN)	21" (533.5mm)	48.5" (1,232mm)	72" (1,829mm)	1,500lbs (680.5kg)
Control Unit	21" (533.5mm)	32.5" (825.5mm)	31.5" (800mm)	222lbs (101kg)