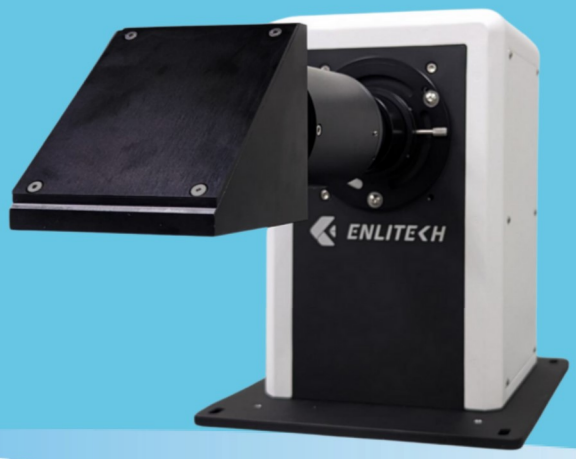
ENLITECH

HCPS-100

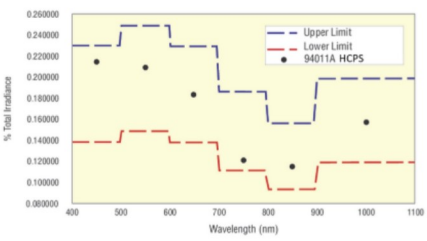
Class AAA Small Area Solar Simulator

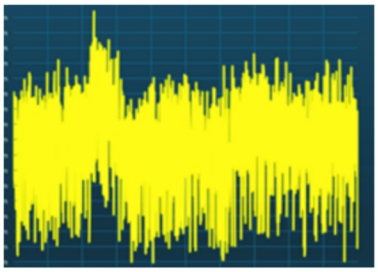


HCPS-100 is a small illumination area type solar simulator with class AAA performances. HCPS-100 is designed for many advancing solar cell researches which needs small illumination area, like perovskite solar cells.

HCPS-100 is composed with a 100 W Xe lamp light source with the light homogenizer and the high-performance power supply. With advanced optical optimization, HCPS-100 has very high performance with compact system size. **The illumination area can be larger than ≥ 40 mm x 40 mm.** The irradiance spectrum and irradiance stability with time are class A according to ASTM, IEC, and JIS several different international standards evaluations.

At the same time, the irradiance space un-uniformity can also be better than class A (≤2 %) within 400 mm². The compact system design makes HCPS-100 suitable for many novel energy research fields, such as perovskite solar cells, organic solar cells, photocatalyst, photosynthesis, or photochromic et al.





Brand	Enlitech
Model	HCPS-100
Effective Illuminance Area	40*40 mm
Spectral Match	A
Spatial Uniformity	A (20*20 mm)
Illuminance Stability	A
Power Consumption	Good (100W)
Max. Illuminance	1.4 SUN
Variable Attenuator	0.2-1.4 sun
Variable Aperture	15~100%
Beam Direction	Up/Down/Right/Left Adjustable
Device Configuration	All in one
Manual Shutter	Y (Optional Motorized shutter)
Working Distance (mm)	100mm

Class A irradiance spectral match

Irradiance spectrum match is one of the key factors of solar simulators. To better evaluate the spectrum performance of a solar simulator, the IEC 60904-9 (2007) standard divided the solar spectrum into different segments with 100nm or 200nm bandwidth from 400nm to 1100 nm. However, with the development of high-efficiency solar cell technologies, the irradiance spectral match of the solar simulator is becoming necessary.

On 2020, IEC released latest solar simulator evaluation standard IEC 60904-9:2020 which evaluate the irradiance spectrum of the solar simulator with broader wavelength range (300nm to 1200nm) and narrower band segments. The details of the evaluation method, please see our “Solar Simulator- Basic Knowledge and Working Principles” and the section “What is AAA solar simulator”. The Class A spectral match requires the deviation of each wavelength bands is within 0.75 to 1.25 both for the old and latest IEC 60904-9 standards.

The spectral match evaluations of HCPS-100 by old IEC 60904-9:2007 (Old, easier) or latest IEC 60904-9:2020 (Latest, much difficult) are both reached Class A from 300 nm to 1200 nm. It is contributed by Enlitech’s advanced AM 1.5G filter technology which makes the irradiance spectrum and sustainability of HCPS-100 solar simulator be much better other brand solar simulators in the same level size.

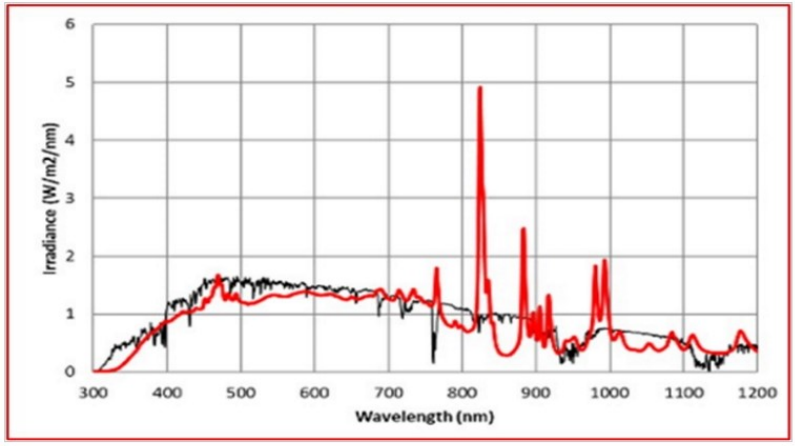


Figure 1. The irradiance spectrum of HCPS-100 solar simulator.

AM1.5G		300-1200 nm		
300 - 470 nm	16.7%	14.2%	0.85	A
470 - 561 nm	16.7%	14.6%	0.87	A
561 - 657 nm	16.6%	16.0%	0.96	A+
657 - 772 nm	16.6%	18.7%	1.13	A
772 - 919 nm	16.6%	17.6%	1.06	A+
919 - 1200 nm	16.7%	19.0%	1.14	A

Figure 3 The spectral match evaluation of HCPS-100 solar simulator with the latest IEC 60904-9:2020.

AM1.5G		400 - 1100 nm		
400 - 500 nm	18.4%	16.4%	0.89	A+
500 - 600 nm	19.9%	18.0%	0.91	A+
600 - 700 nm	18.3%	18.2%	1.00	A+
700 - 800 nm	14.9%	16.0%	1.08	A+
800 - 900 nm	12.4%	14.1%	1.14	A
900 - 1100 nm	15.9%	17.0%	1.07	A+

Figure 2. The spectral match evaluation of HCPS-100 solar simulator with the old IEC 60904-9:2007.

Class A spatial irradiance uniformity

The spatial irradiance uniformity is the second index for the solar simulator classification. It is most difficult in all the parameters. The spatial irradiance uniformity hot spot will greatly induce the power conversion efficiency testing result error and mis-certified the binning of the solar cells. HCPS-100 uses Enlitech's advanced homogenizer technology which can convert the un-regular light beam spot into the uniform spatial beam illumination area and reduce the irradiance hot spot distributions. The spatial irradiance uniformity of HCPS-100 solar simulator can achieve IEC, ASTM, and JIS standards' class A level, which is ≦ 2% within 400 mm².

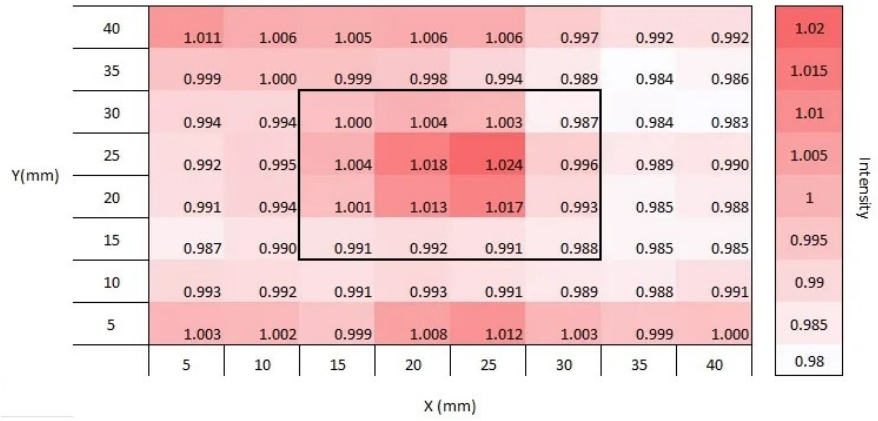


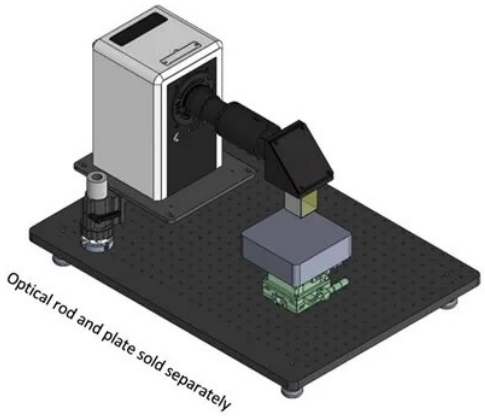
Figure 4 Class A spatial Uniformity of HCPS-100 solar simulator.

More details, please see our technical article: "Solar Simulator-Basic Knowledge and Working Principles" and the section "What is AAA solar simulator". The illumination area size of HCPS-100 solar simulator is pretty suitable for many novel solar cell research, most of which are beginning from small active area such as 2mm x 2 mm.

Class A irradiance temporal stability

The third important parameter is the irradiance temporal stability with time. The temporal stability of the solar simulator output illumination directly affects the current-voltage IV tracing curve of solar cell under testing.

The un-stable light illumination on the device under test will cause the accuracy of the conversion efficiency value of the solar cell. The HCPS-100 solar simulator adapts high-stability Xe lamp power supply system, which can keep Xe lamp irradiance output with high temporal stability without needing optical feedback control system.



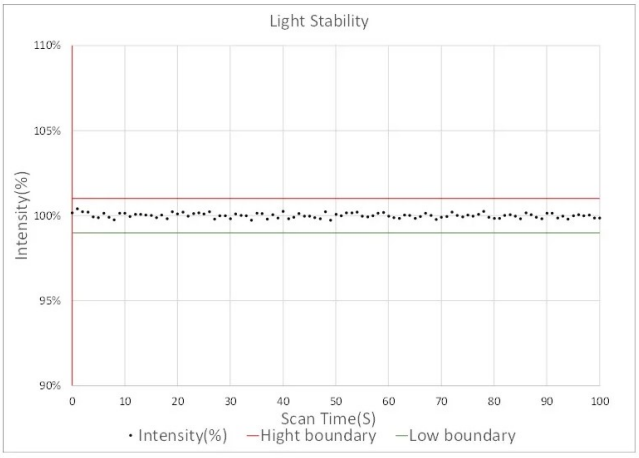


Figure 5 The short-term irradiance temporal instability of HCPS-100 solar simulator.

Specification and Options

Quantity	Specification	Note
Beam size	≥ 40 mm x 40 mm square beam shape.	
Spectral Match Classification	Class A- IEC 60904-9 (2007) Class A- IEC 60904-9 (2020) Class A- ASTM E927-10 (2015)	
Temporal Instability	Class A- IEC 60904-9 (2007) Class A- IEC 60904-9 (2020) Class A- ASTM E927-10 (2015)-	
Beam Non-uniformity	Class A- IEC 60904-9 (2007) Class A- IEC 60904-9 (2020) Class A- ASTM E927-10 (2015) Within 400 mm^2	
Collimation Angle	≦ 6 °	
Nominal Working Distance	100 mm	or 178 mm (Adjustable)
Lamp Power	100 W Xe Lamp	
Lamp Lifetime	≥ 1000 hr	Based on lamp manufacturer's report
Output illumination directions	Up, Down, Left, Right	
Typical irradiance intensity	1000 W/m^2(1 sun)	
Maximum irradiance intensity	≥ 1400 W/m2 (1.4 suns); adjustable by mechanical iris control manually.	
Optical shutter	Mechanical, manual optical shutter	
Input Power	100-240 VAC, 50/60 Hz, 5 Amp	
Cooling system	Active fan cooling system	
Overheating Protection	Auto power-off protection	

Options		
Optical breadboard plates (Al)		
Height adjustment clamp and rod	The clamp and rod can fix the optical breadboard plate and adjust the height of HCPS-100 on the plate.	
Stage and fixtures	Enlitech can help user to design and make any or customized stages and test fixtures.	"Contact Us"
AM0 filter		
Color filters	Enlitech can provide many different wavelength band filters.	
Additional filter mount		
IV testing software	IVS-KA6000	Capable with controlling Keithley or Keysight SMU
Spare Xe lamp	100 W Xe Lamp	