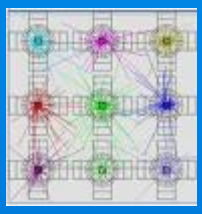
TriSOL ™ Large Area Solar Simulator

0.5m x 0.5m to 5m x 5m



KEY FEATURES

- **Testing of Large Military Equipment, Camera Optics, PV Modules and Other Devices**
- **Beam Size 0.5m x 0.5m to 5m x 5m**
- **Depth up to 10ft**
- **Long Working Distance – up to 3m**
- **Large Depth of Field: ±150mm**
- **Various AM1.5G and AM0 Spectrum Options: 280 – 1800nm, 300 – 1800nm and 700- 1100nm (IR)**
- **Meets JIS, IE C, ASTM Standards**
- **Perfect for Research and Development**
- **Multiple configurations: Downward, Horizontal or Upward Beams, or at and angle**

- **Contact OAI: sales@oainet.com**

OAI's *TriSOL*™ Class AAA, ABA & ACA Large Area Solar Simulators are engineered with OAI's high performance, quality and reliability. The following are the available models:

1. Large Area Full Room Solar Simulators: 5m(W) x 5m(L) x 5m(H); 1 Sun, AM1.5G 280 – 1800nm, Class ACA, 10% Beam Uniformity **for *testing large equipment*.**

2. Large Area IR Solar Simulators: 0.5m x 0.5m to 2.0m x 2.0m, 1 Sun, AM1.5G, 700 – 1100nm, Class AAA or ABA, ≤2-5% Beam Uniformity for ***testing of camera optics and various other devices.***

3. Large Area Photovoltaics (PV) Solar Simulators: 0.5m x 0.5m to 2.0m x 2.0m, 1 Sun, AM0 or AM1.5G, 280 – 1800nm or 300 – 1800nm or 400 – 1100nm Class AAA or ABA, ≤2-5% Beam Uniformity for ***testing solar panels and other devices.***

OAI's offers these large area solar simulators with various beam sizes and different lamp power configurations ranging from 0.5m x 0.5m to 5m x 5m and 4KW to 540KW, respectively. These simulators are built using Xe short arc lamp housing. The beam size can be with square or rectangular shape, and can be configured to provide various beam directions; *vertically downward, horizontal, upward and at an angle.*

These simulators are manufactured with custom optics and corresponding Air Mass (AM) filters, including other components to provide various Sun spectrums in AM0 (280 – 1800nm), AM1.5G (300 – 1800nm) and IR (700 – 1100nm) ranges with spectrum match to the Sun within ±15%. This provides a highly accurate Sun beam with the longest working distances. OAI's Solar Simulators are certified to ASTM E927-05, IEC 60904-9 2007, and JIS C 8912 standards for Class AAA or ABA or ACA performance.

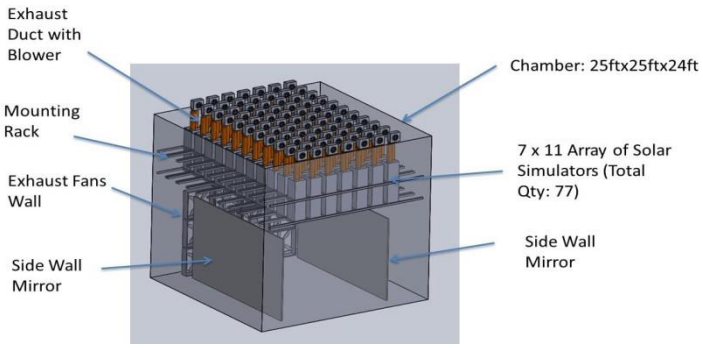
The table below provides a detailed specifications of various large area solar simulator configurations:

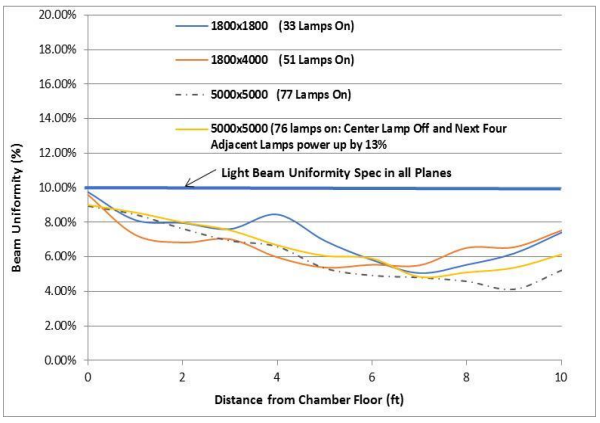
OAI Model #	Large Area Full Room Solar Simulator	Large Area IR Solar Simulator	Large Area PV Solar Simulator
Special	Constant Current and Intensity	Constant Current and Intensity	Constant Current and Intensity
Spectral Type	AM 1.5G and D, AM0	AM 1.5G and D, AM0	AM 1.5G and D, AM0
Spectrum Range Options	280 - 1800nm	700 - 1100nm	1 : 280-1800nm 2: 300 - 1800nm
Beam Direction Configuration Options	1. Horizontal 2. Downward 3. Upward	1. Horizontal 2. Downward 3. Upward	1. Horizontal 2. Downward 3. Upward
Illumination Area	up to 5m x 5m x 5m (Volume)	up to 2m x 2m	up to 2m x 2m
Collimated angle	Half angle: <±30°	Half angle: <±2°	Half angle: <±2°
Typical Power Output	100mW/cm^2 (1Sun)	38.1mW/cm^2 (0.382Sun, 700 - 1100nm)	100mW/cm^2 (1Sun)
Spatial Uniformity	≤10% (Class C)	≤5% (Class B)	≤5% (Class B)
Temporal (ST)	<0.5% STI & <2.0% LTI (Class A)	<0.5% STI & <2.0% LTI (Class A)	<0.5% STI & <2.0% LTI (Class A)
Spectral Match	≤±15% (Class A+)	≤±15% (Class A+)	≤±15% (Class A+)
Working Distance	up to 5m	up to 5m	up to 5m
Lamp Power	up to 77 x 7KW	up to 16 x 4KW or 16 x 7KW	up to 16 x 4KW or 16 x 7KW
Power Requirements	up to 600KW 460/265VAC, 5Wire, 3P, 1100A	up to 76KW 400/230VAC, 5Wire, 3P, 200A	up to 76KW 400/230VAC, 5Wire, 3P, 200A

1. Large Area Full Room Solar Simulator

The building block of the large area Full Room Solar Simulator is a single simulator which is built using a 8KW power supply with 7KW Xe-short arc lamp, ellipsoid, fly's eye, automatic shutter, AM1.5G filter and filter holder and motorized ND filer stand with various attenuation filters set. This provides a single beam of 0.5m x 0.5m. For example, to make a beam of size 5m x 5m, OAI uses and array of 7 rows and 11 columns equaling 77 simulators. The beams are stitched together with use of wall mirrors and optics providing uniform beam coverage in volume

A design concept and beam uniformity profile of the large area room solar simulator is given below:

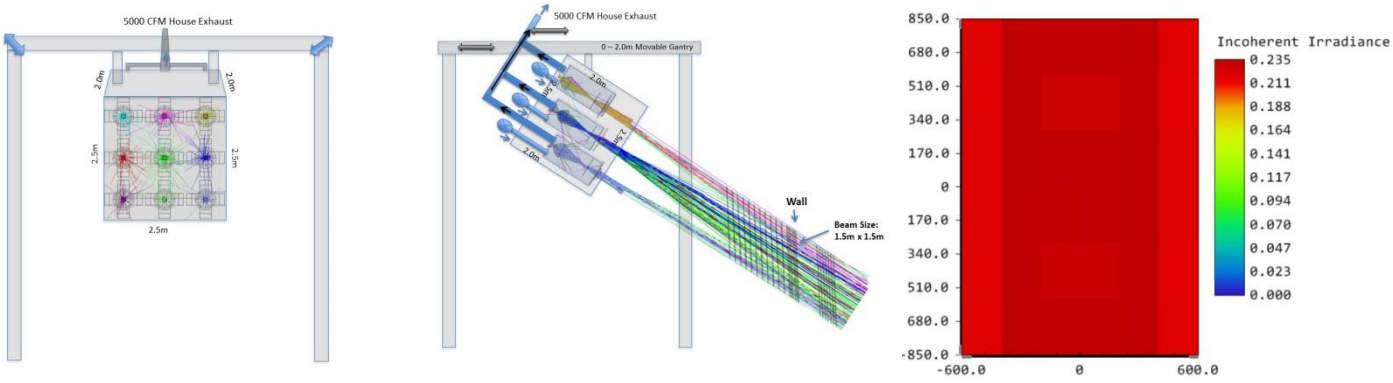




2. Large Area IR Solar Simulator

The building block of the Large Area IR Solar Simulator is a single simulator which is built using a 4KW (or 8KW) power supply and with 4KW (or 7KW) Xe-short arc lamp, ellipsoid, fly's eye, automatic shutter, AM1.5G filter and filter holder and motorized ND filer stand with various attenuation filter sets. This provides a single beam of 0.5m x 0.5m. For example, to make a larger beam size , 1.5m x 1.5m, OAI uses an array of 3 rows by 3 columns of the IR solar simulators each with a 0.5mx0.5 meter beam size. The beams are stitched together to provide uniform beam coverage in volume.

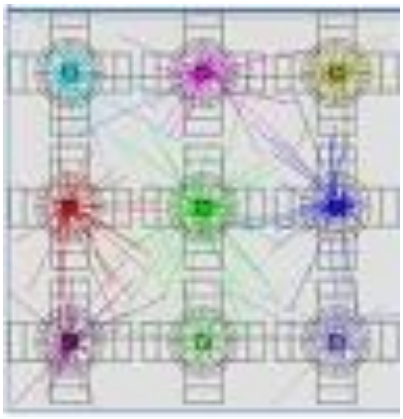
A design concept and beam uniformity profile of the Large Area Room Solar Simulator is given below:

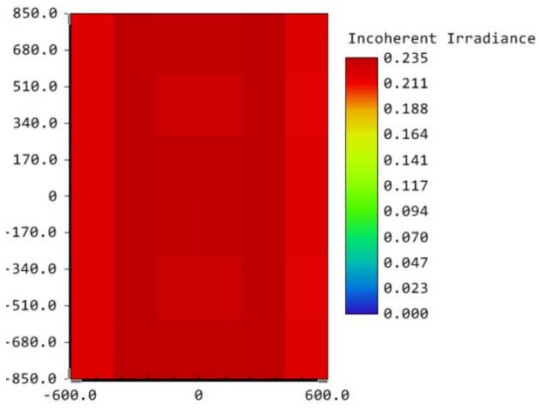


3. Large Area Photovoltaic (PV) Solar Simulator

The building block of the Large Area PV Solar Simulator is a single simulator which is built using a 8KW power supply and with 7KW Xe-short arc lamp, ellipsoid, fly's eye, automatic shutter, AM1.5G filter and filter holder and motorized ND filer stand with various attenuation filter sets. This provides a single beam of 0.5m x 0.5m. For Example, t a larger beam size, 1.5m x1.5m, uses an array of 3 rows by 3 columns of the PV Solar Simulators each with a beam size of 0.5m x 0.5m. The beams are stitched together to provide uniform beam coverage in volume.

Design concept and beam uniformity profile of the large area room solar simulator is given below:



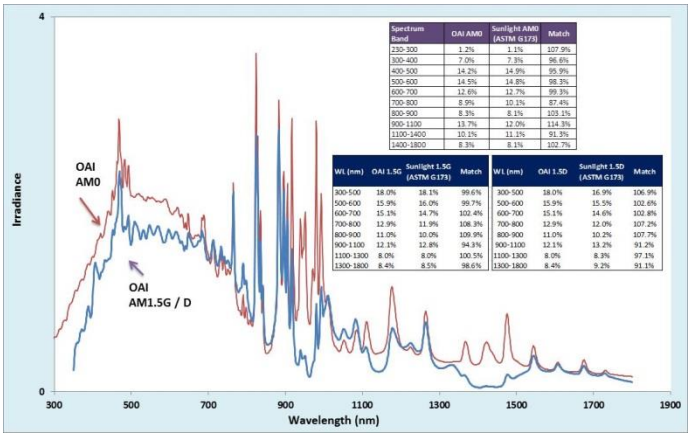


Class AAA or ABA or ACA Performance and Certification:

All of OAI's Solar Simulators are manufactured and certified by our engineering staff and go through a rigorous calibration procedure that includes testing of the lamp housing, mirrors and filters. Each system is then fine-tuned to achieve a Class AAA certification. A typical final test report contains the following set of data:

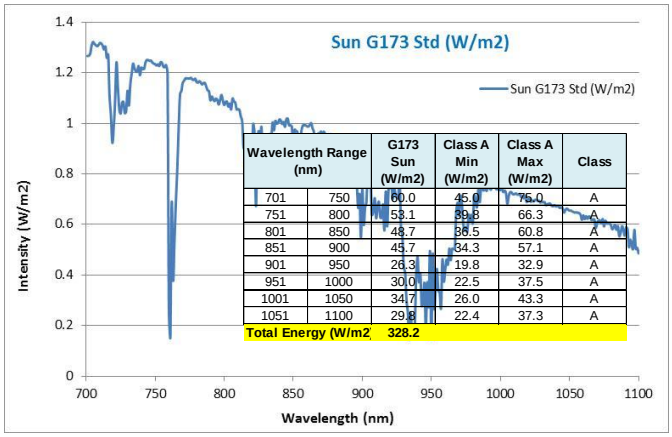
1. Class A+ AM0 and AM 1.5G Spectrum 280 – 1800nm, 300 – 1800nm and 700 – 1100nm

OAI provides spectrum match in each zone and overall within ≤±15%.. The graph below shows a typical AM0 and am1.5G spectrum derived from OAI's solar simulators:



Spectrum Band	OAI AM0	Sunlight AM0 (ASTM G173)	Match
230-300	1.2%	1.1%	107.9%
300-400	7.0%	7.3%	96.6%
400-500	14.2%	14.9%	95.9%
500-600	14.5%	14.8%	98.3%
600-700	12.6%	12.7%	99.3%
700-800	8.9%	10.1%	87.4%
800-900	8.3%	8.1%	103.1%
900-1100	13.7%	12.0%	114.3%
1100-1400	10.1%	11.1%	91.3%
1400-1800	8.3%	8.1%	102.7%

WL (nm)	OAI 1.5G	Sunlight 1.5G (ASTM G173)	Match	WL (nm)	OAI 1.5D	Sunlight 1.5D (ASTM G173)	Match
300-500	18.0%	18.1%	99.6%	300-500	18.0%	16.9%	106.9%
500-600	15.9%	16.0%	99.7%	500-600	15.9%	15.5%	102.6%
600-700	15.1%	14.7%	102.4%	600-700	15.1%	14.6%	102.8%
700-800	12.9%	11.9%	108.3%	700-800	12.9%	12.0%	107.2%
800-900	11.0%	10.0%	109.9%	800-900	11.0%	10.2%	107.7%
900-1100	12.1%	12.8%	94.3%	900-1100	12.1%	13.2%	91.2%
1100-1300	8.0%	8.0%	100.5%	1100-1300	8.0%	8.3%	97.1%
1300-1800	8.4%	8.5%	98.6%	1300-1800	8.4%	9.2%	91.1%



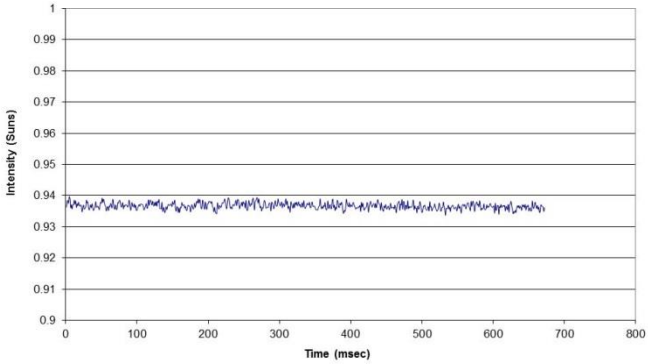
Wavelength Range (nm)		G173 Sun (W/m2)	Class A Min (W/m2)	Class A Max (W/m2)	Class
701	750	60.0	45.0	75.0	A
751	800	53.1	39.8	66.3	A
801	850	48.7	36.5	60.8	A
851	900	45.7	34.3	57.1	A
901	950	26.3	19.8	32.9	A
951	1000	30.0	22.5	37.5	A
1001	1050	34.7	26.0	43.3	A
1051	1100	29.8	22.4	37.3	A
Total Energy (W/m2		328.2			

2. Irradiance Uniformity:

The Spatial Uniformity Map of large area solar simulators can vary from Class A (≤ ±2%) to Class B (≤ ±5%) and Class C (≤ ±10%), as the beam size increases from 0.5m x 0.5m to 1.5m x 1.5m to 5m x 5m, respectively.

3. Temporal Instability:

The Class A temporal instability of OAI's typical 0.5m x 0.5m Solar Simulator system is shown in the graph to the below. The data is taken at 100ms time intervals. For accurate and repeatable solar cell performance measurements, lamp fluctuations from reading to reading should not cause data instability. Per the IEC 60904-9-2007 requirement as well as ASTM and JIS specifications, the measured data fluctuation for the short-term instability is within 0.5% and the long-term instability is <2% per the specifications for Class A.



About OAI

For over 47 years, OAI has been a leader in the generation, control, and measurement of light. Supplying advanced precision equipment for both R&D and production, OAI has gained a worldwide reputation in the PV/SOLAR, MEMS, Semiconductor, Microfluidics, MicroTAS, and Flat Panel industries. The company offers a broad portfolio of field-proven products that include: solar simulators, IV testers, solar power meters, calibrated reference cells, outdoor panel IV tracer, UV exposure systems, UV light sources, mask aligners, nano imprint modules, UV Measurement Instruments and numerous custom-engineered solutions. OAI's products deliver exceptional performance, high versatility and outstanding reliability. Based on a proven platform of modularized subsystems, many of these advanced tools can be custom configured to meet your specific requirements. With thousands of systems and instruments in use around the world, OAI prides itself on highly responsive customer service and superior engineering support.

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