



ENERGY STAR® Displays: DOE Testing Results

April 19, 2012

DOE Displays Team

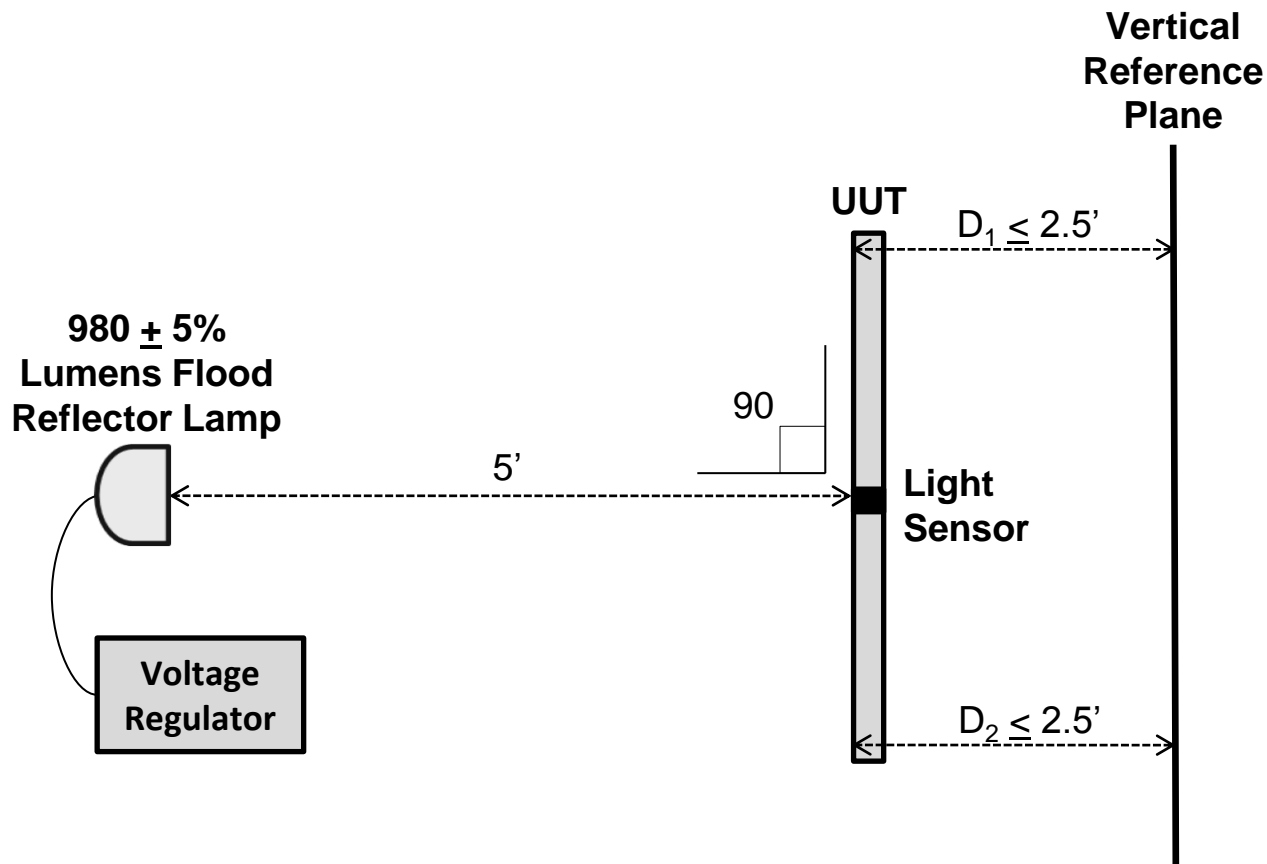
Introduction



- Testing performed to investigate:
 - Test method repeatability
 - Impact of vertical angle on power consumption at different lux
 - Impact of horizontal angle on power consumption at different lux
 - Impact of distance on power consumption at different lux
 - Impact of wattage/lumen output on power consumption at different lux
 - Direct vs. diffuse incident light

Direct Incident Light Setup

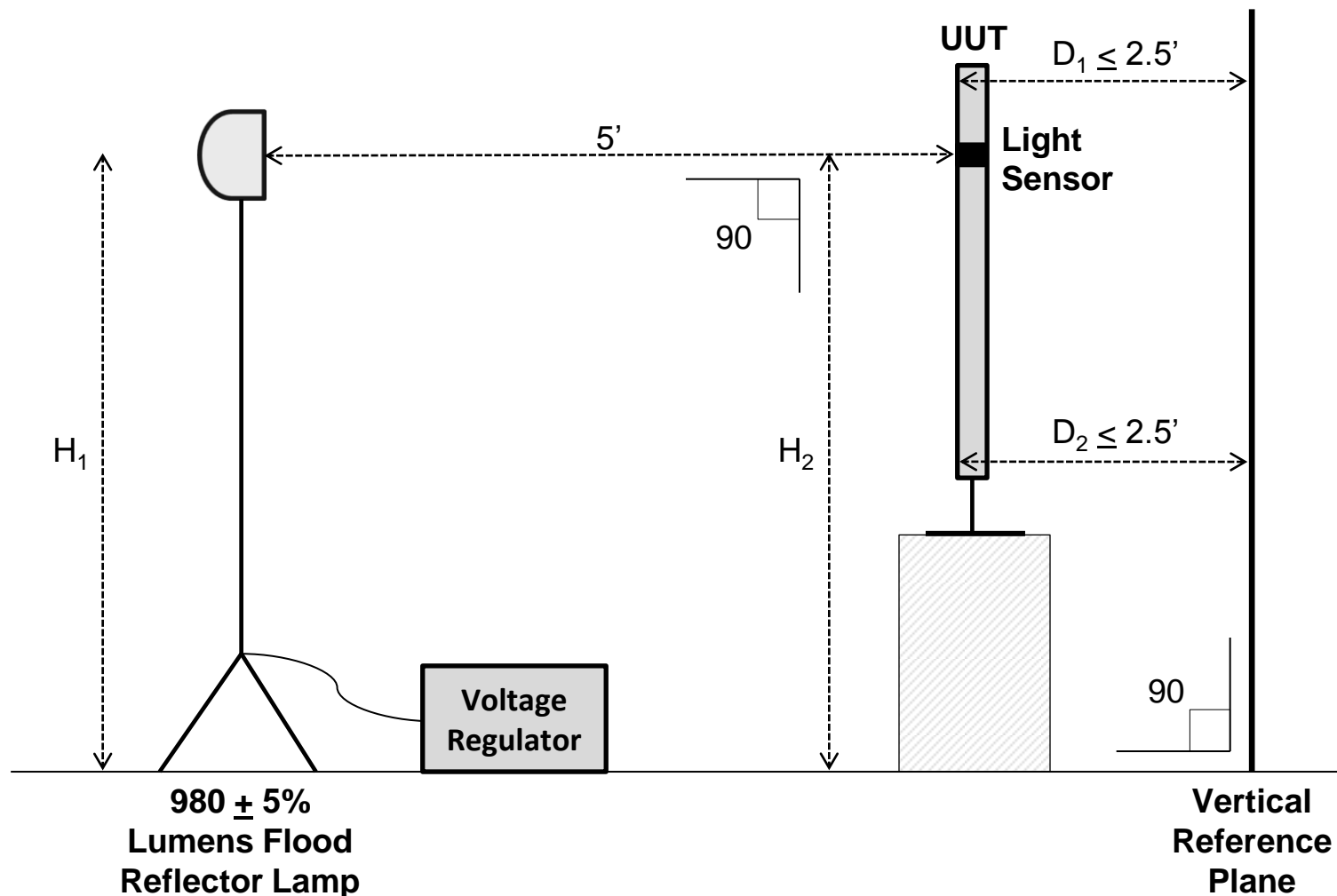
Top View



$D_1 = D_2$ with respect to vertical reference plane

Direct Incident Light Setup

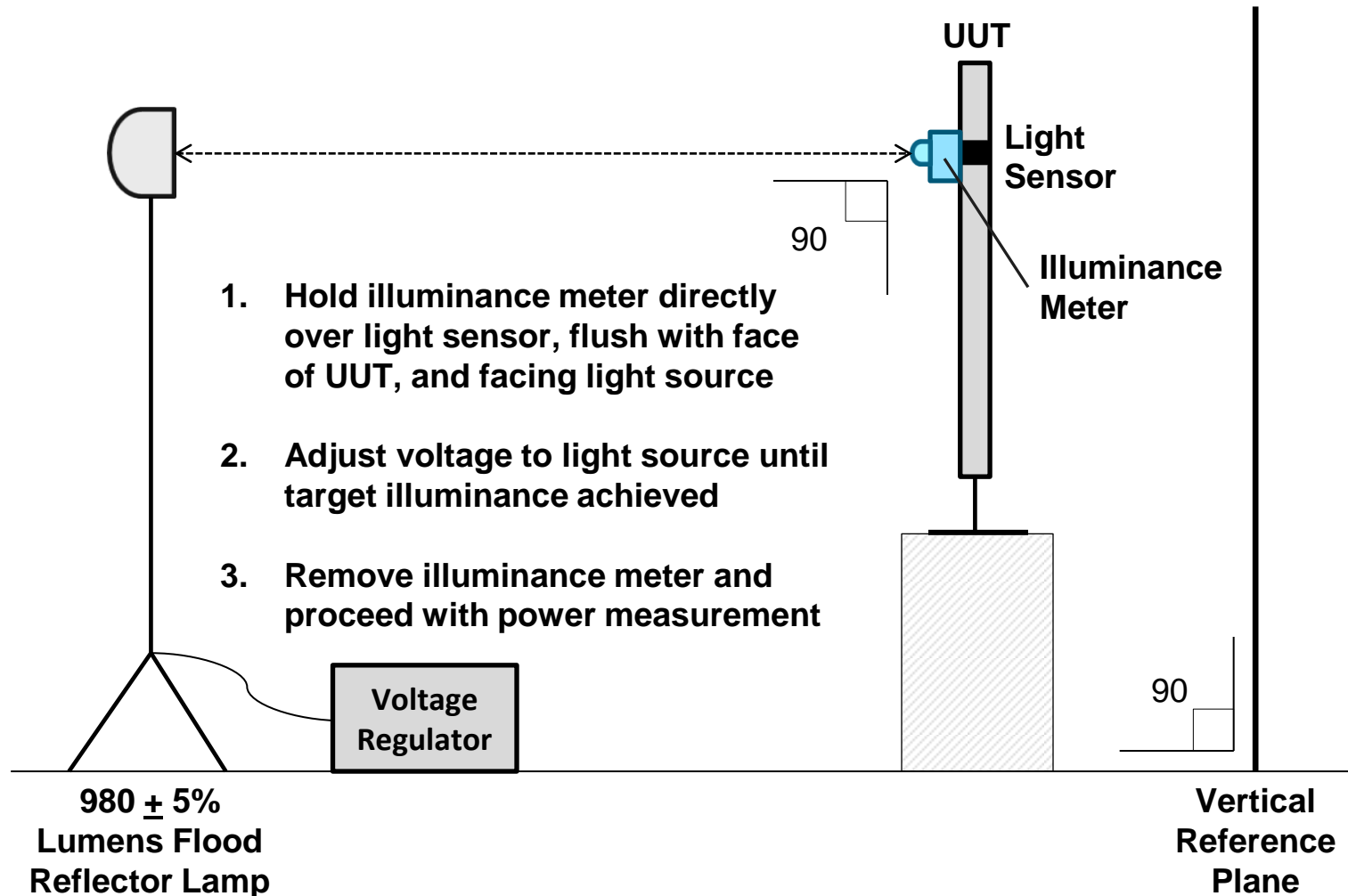
Side View



$D_1 = D_2$ with respect to vertical reference plane
 $H_1 = H_2$ with respect to floor

Measuring and Adjusting Illuminance

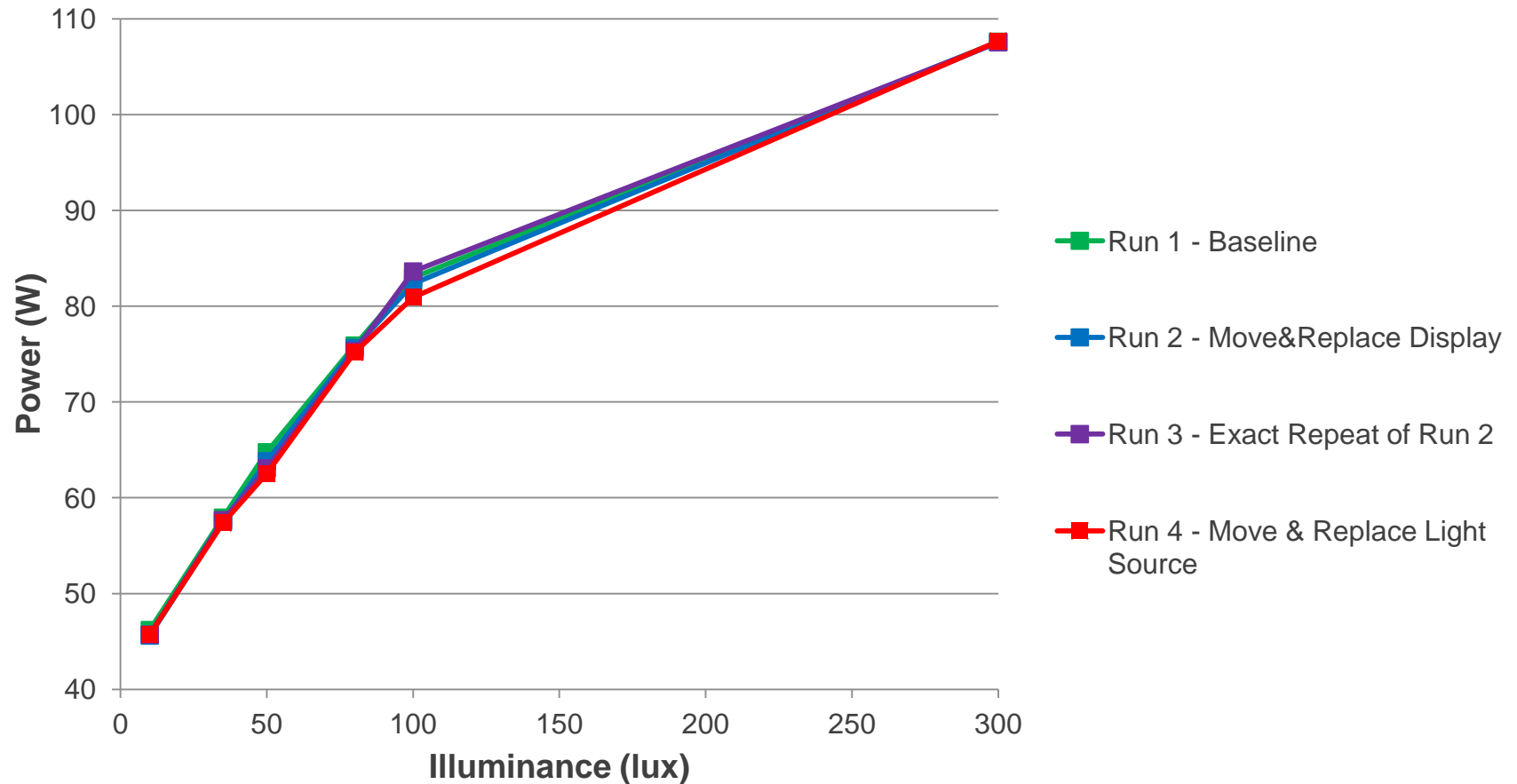
All Test Setups



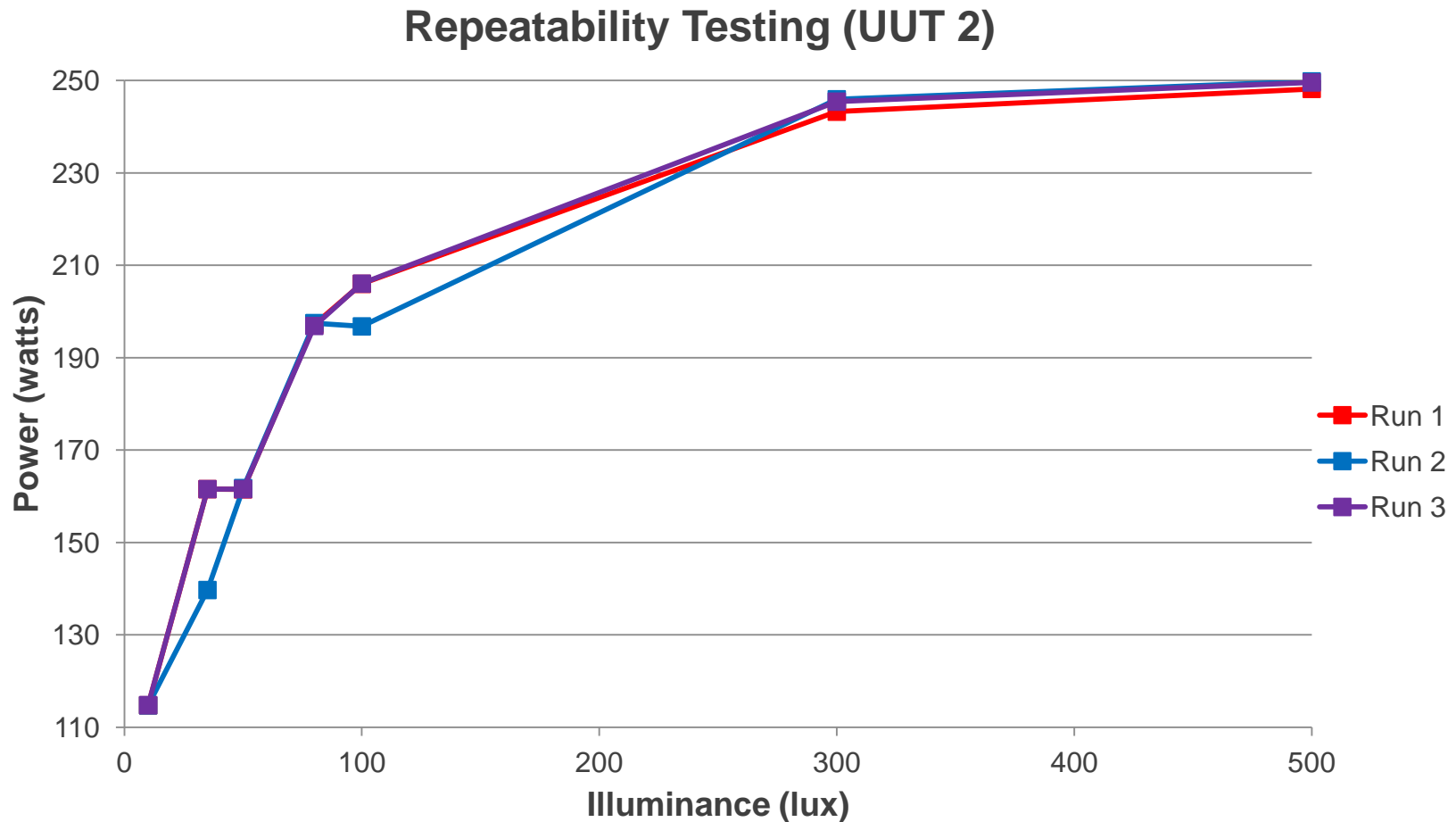
Repeatability Testing – UUT 1



Repeatability Testing (UUT 1)



Repeatability Testing – UUT 2



Repeatability Testing Variation

Average Power and Standard Deviation

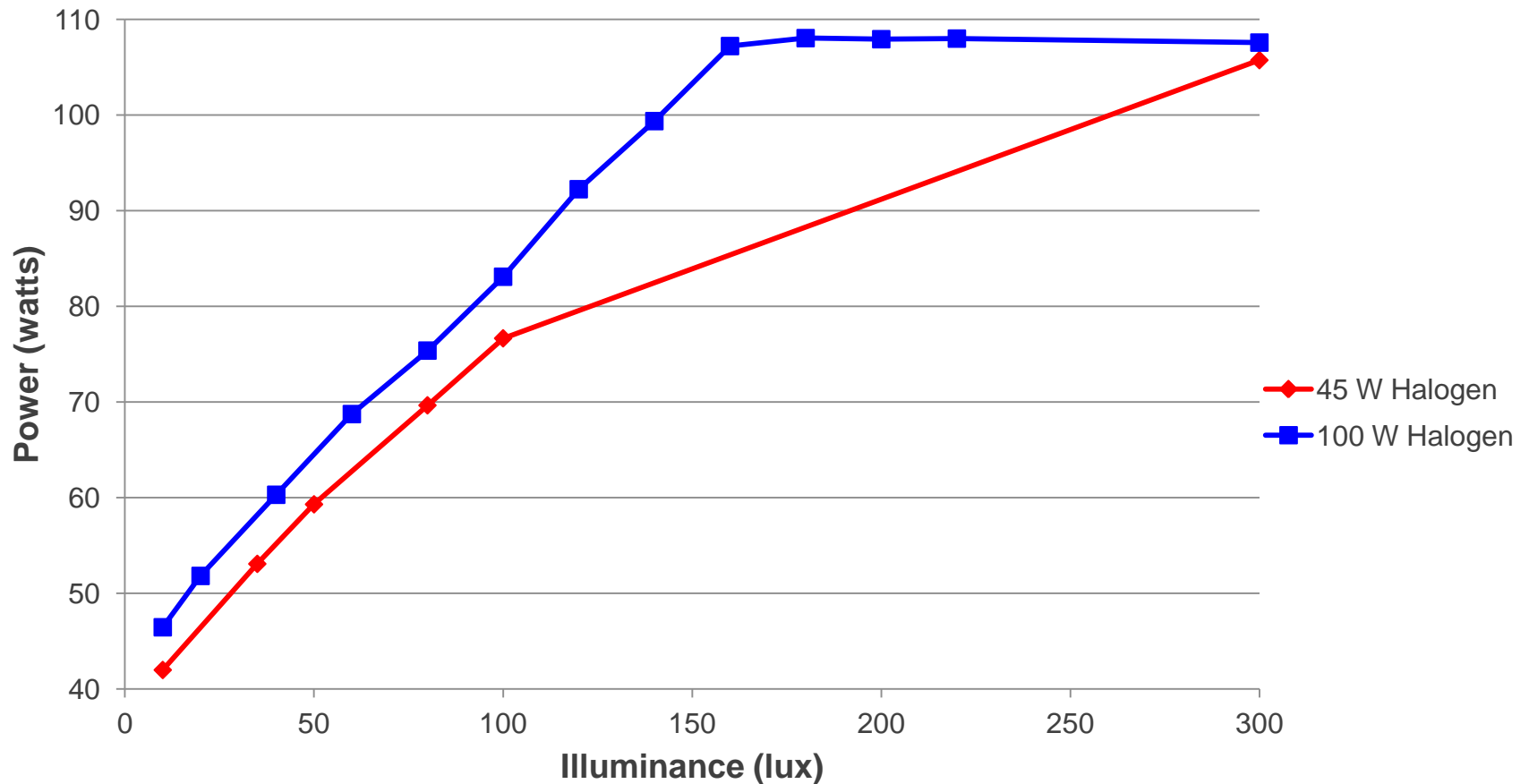


Illuminance (lux)	UUT 1 (Direct Light)		UUT 2 (Direct Light)	
	P _{AVG}	COV (%)	P _{AVG}	COV (%)
10	45.8	0.6%	114.8	0.03%
35	57.6	0.4%	154.3	8.2%
50	63.5	1.5%	161.6	0.1%
80	75.5	0.4%	197.2	0.2%
100	82.5	1.4%	202.9	2.6%
300	107.6	0.1%	244.9	0.6%
500			249.2	0.4%

Light Source – Bulb Type



45 W Halogen vs. 100 W Equivalent Halogen (UUT 1)

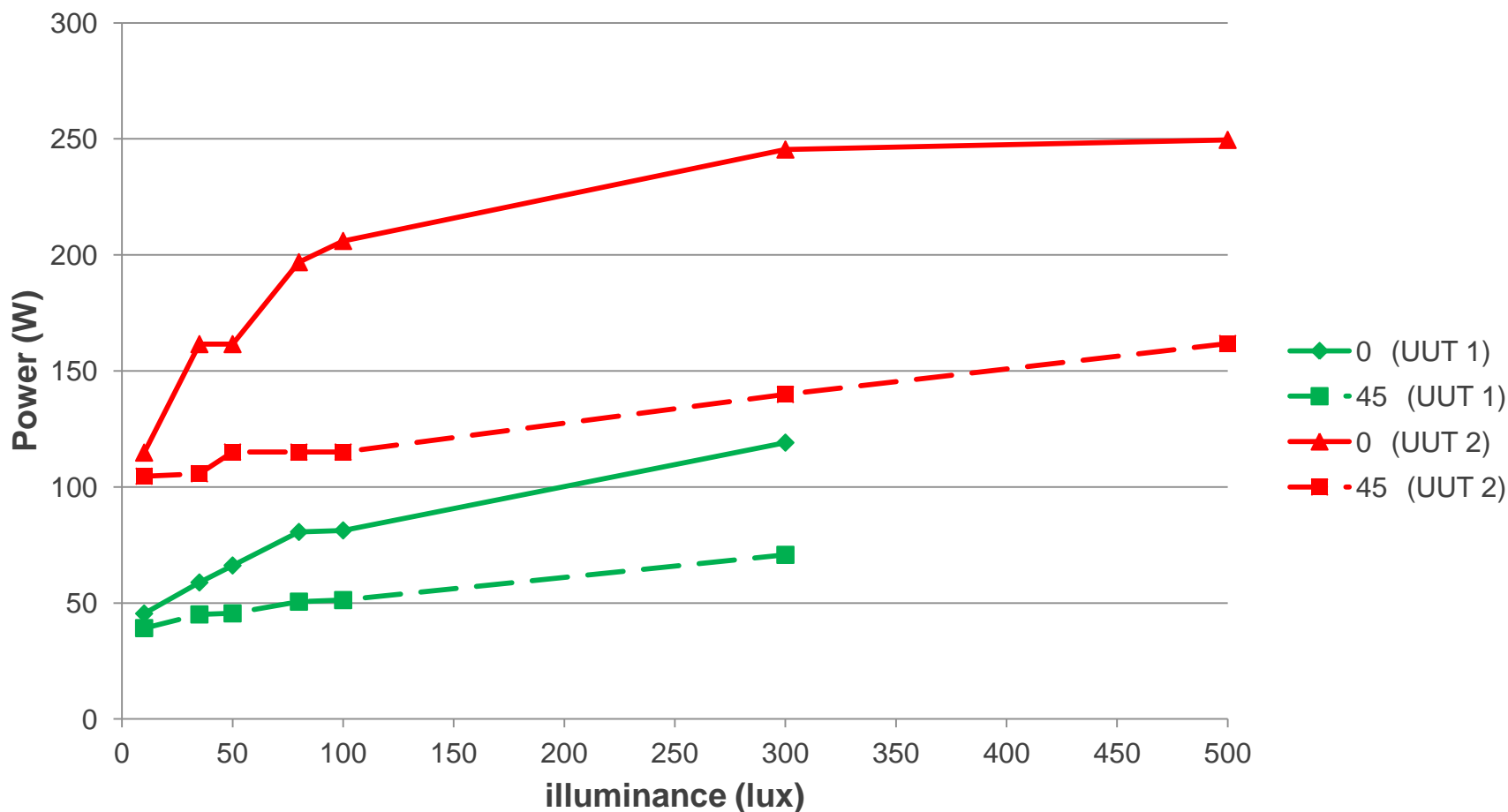


Light Source – Alignment

Vertical Angle With Respect to Light Sensor



Light Source Vertical Angle Testing (0 vs. 45)

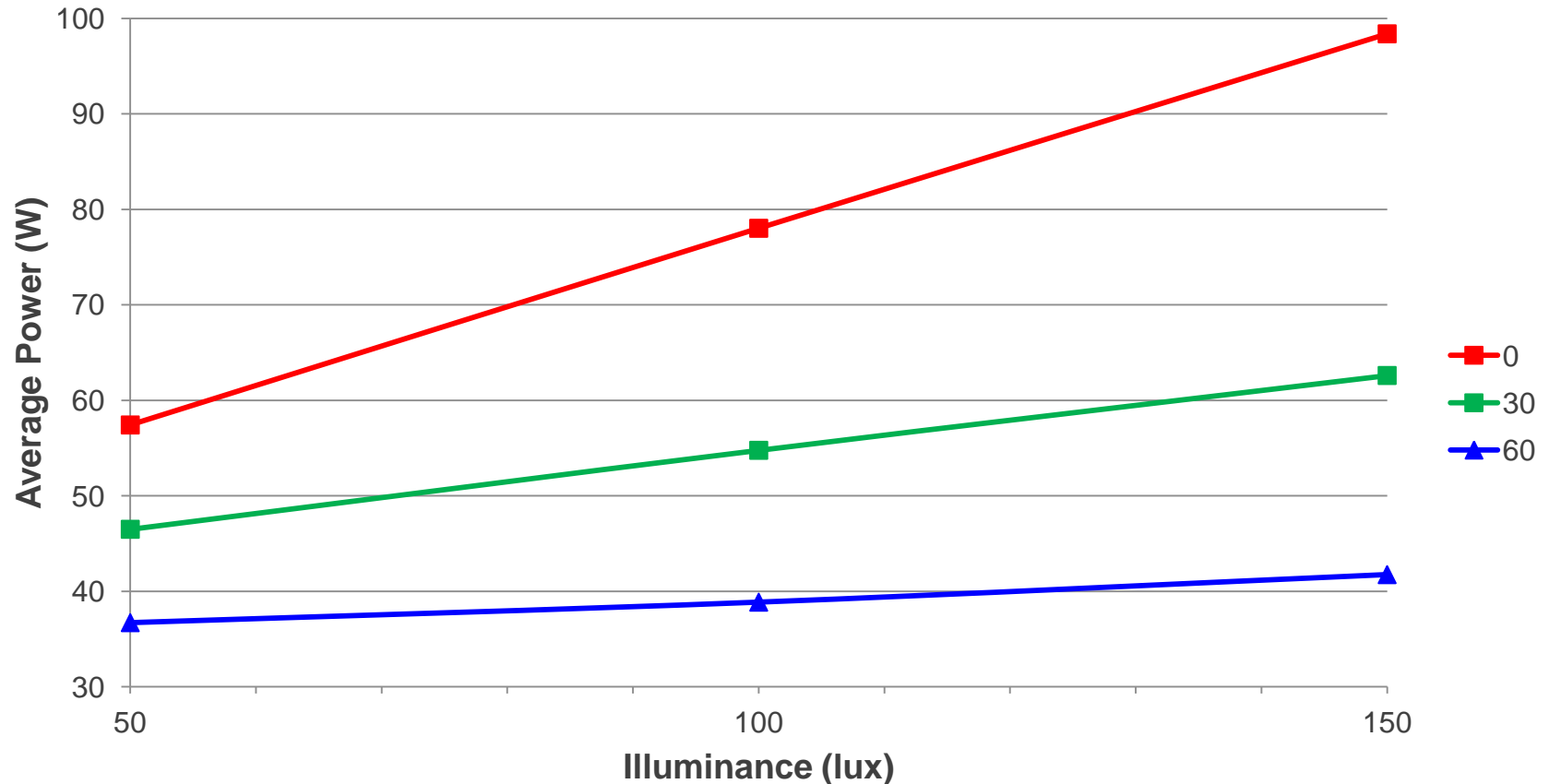


Light Source – Alignment

Horizontal Angle With Respect To Light Sensor



Light Source Horizontal Angle Testing (UUT 1)

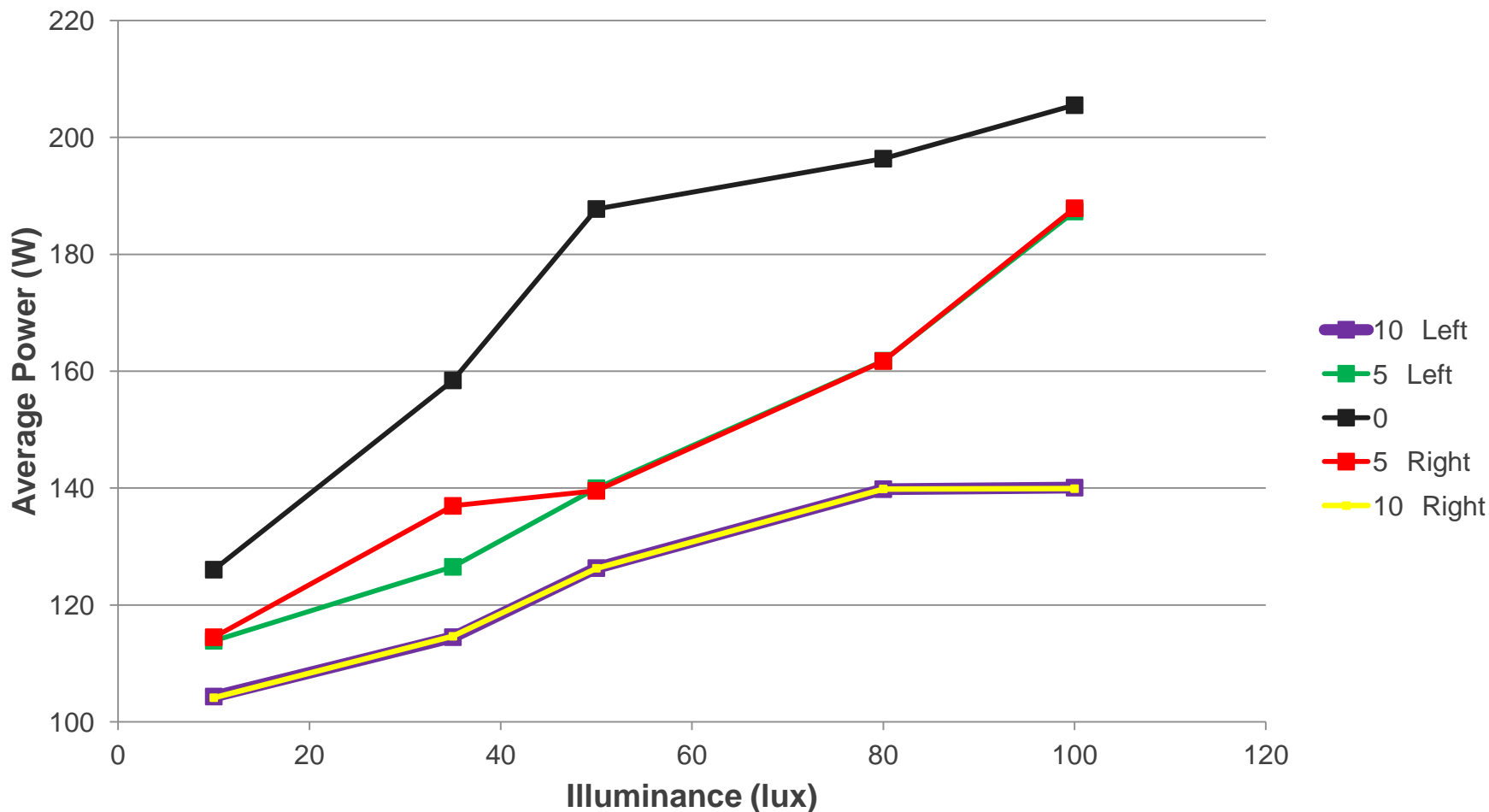


Light Source – Alignment

Horizontal Angle With Respect To Light Sensor



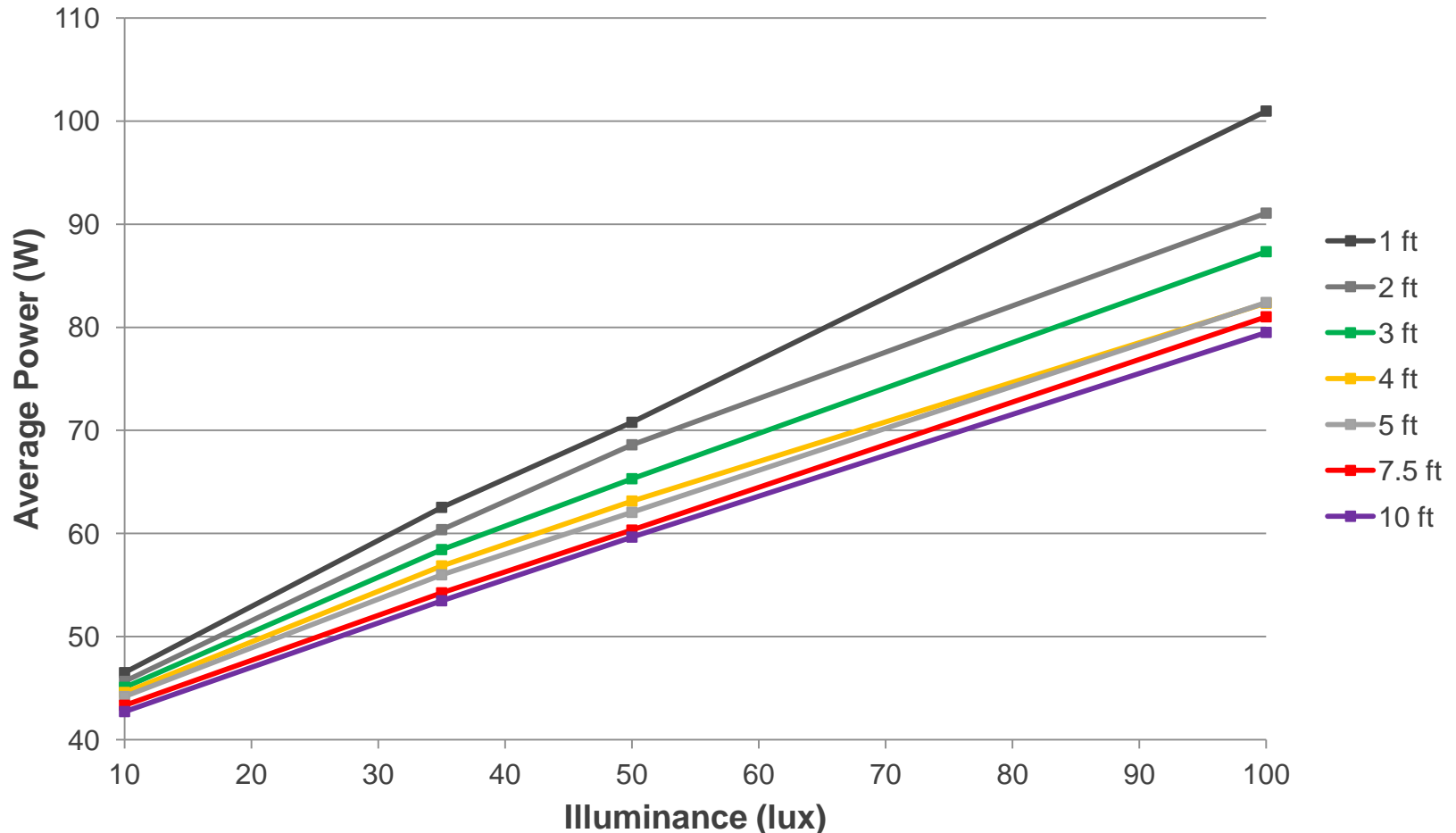
Light Source Horizontal Angle Testing (UUT 2)



Light Source – Distance



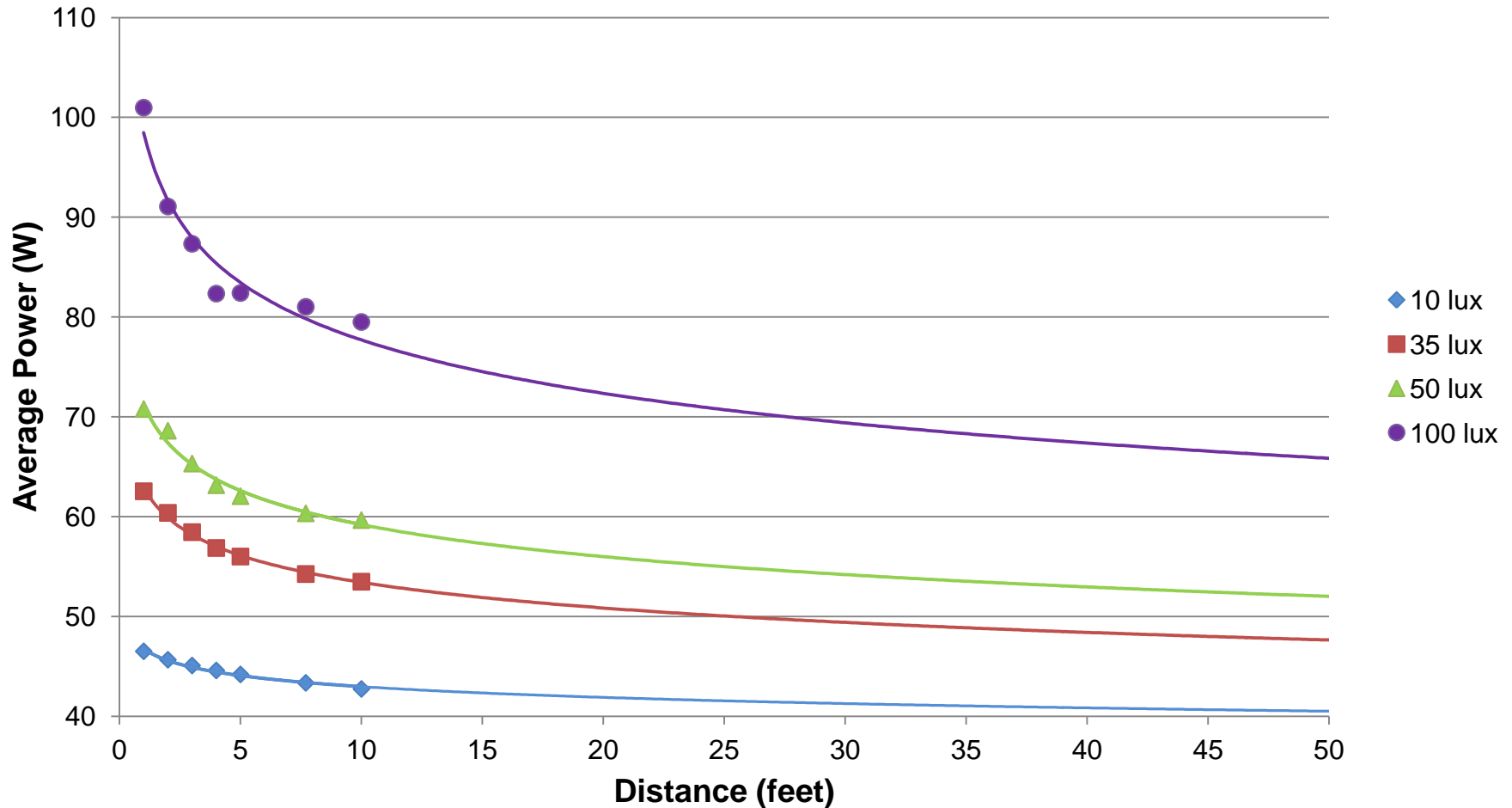
Light Source Distance Variation (UUT 1)



Light Source – Distance



Light Source Distance Variation (UUT 1)



Light Source – Type of Incident Light

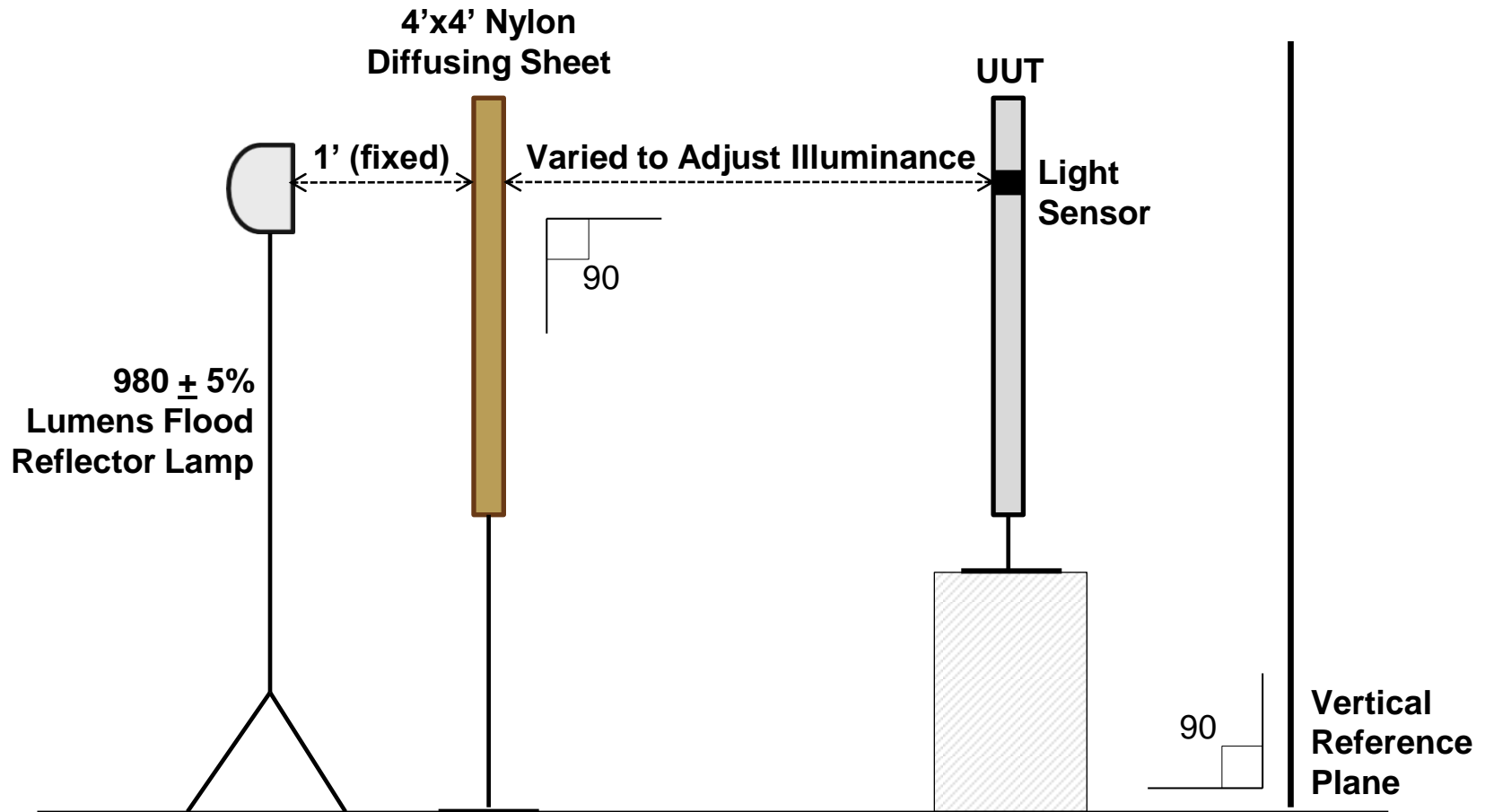
Direct vs. Diffuse



- Compared direct incident light to five different setups using a diffusing medium
- Diffuse setup diagrams provided in slides 15-19 (for illustrative purposes only)

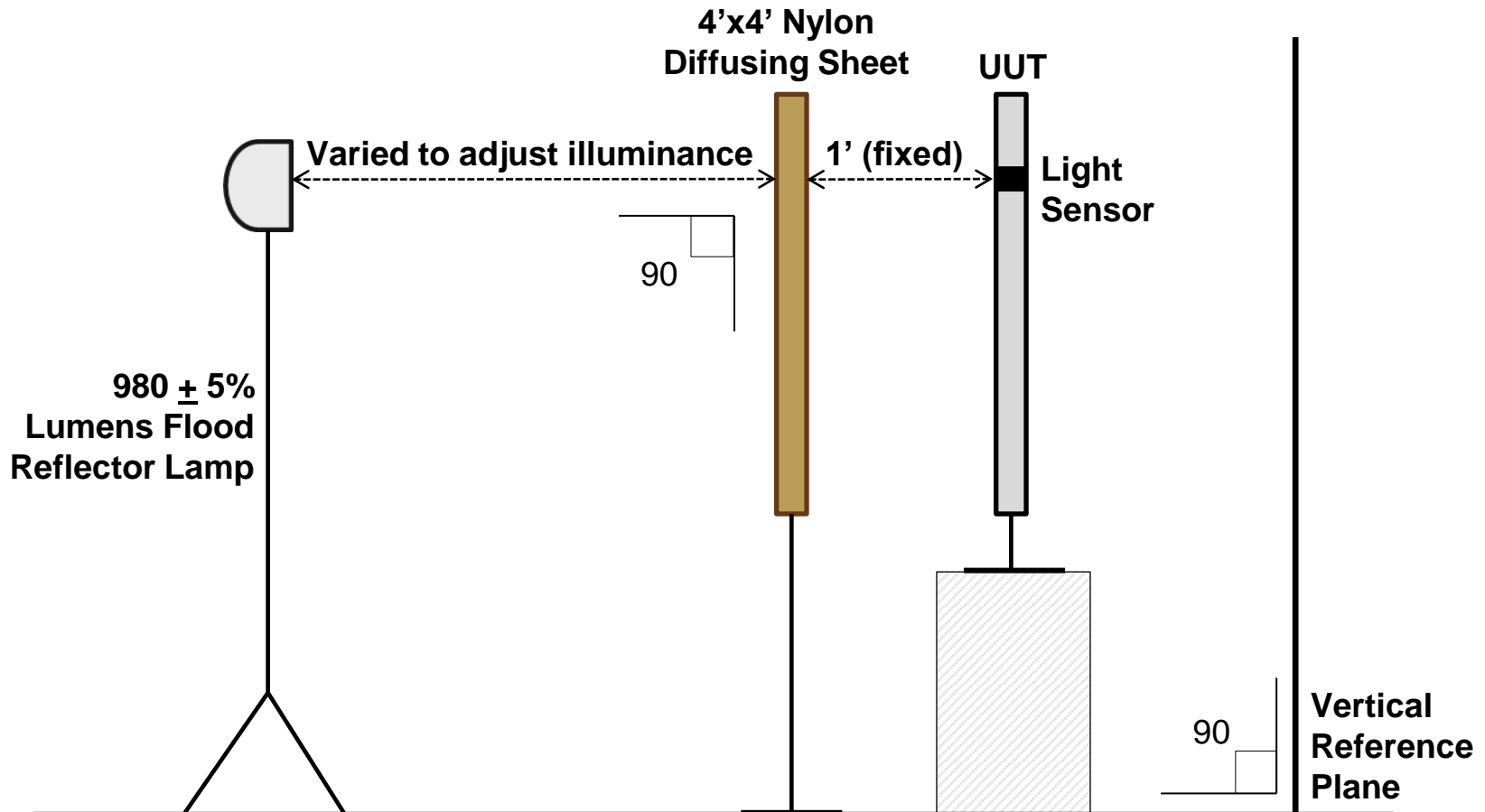
Light Source – Type of Incident Light

Diffuse Setup #1 (Transmission) – Side View



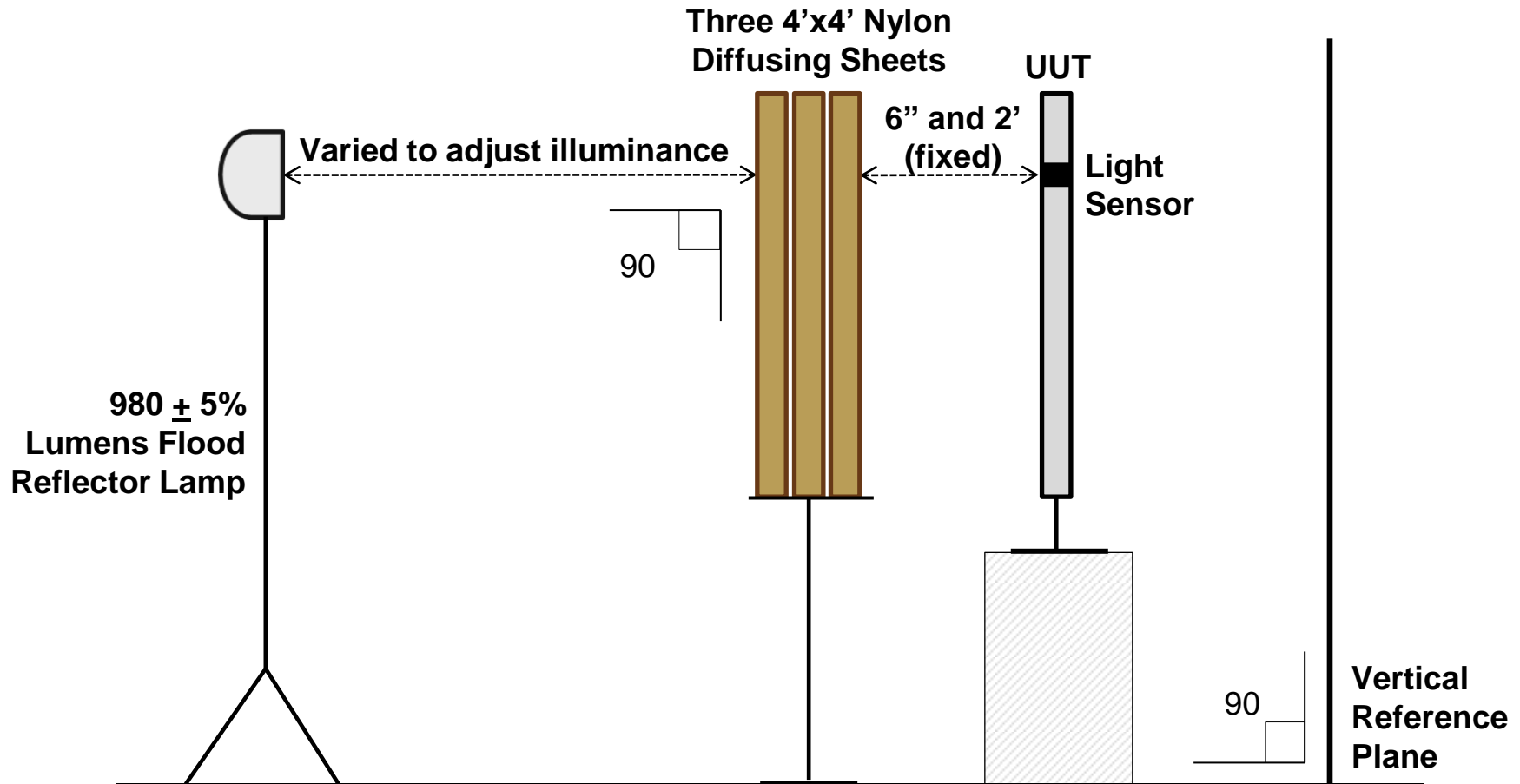
Light Source – Type of Incident Light

Diffuse Setup #2 (Transmission) – Side View



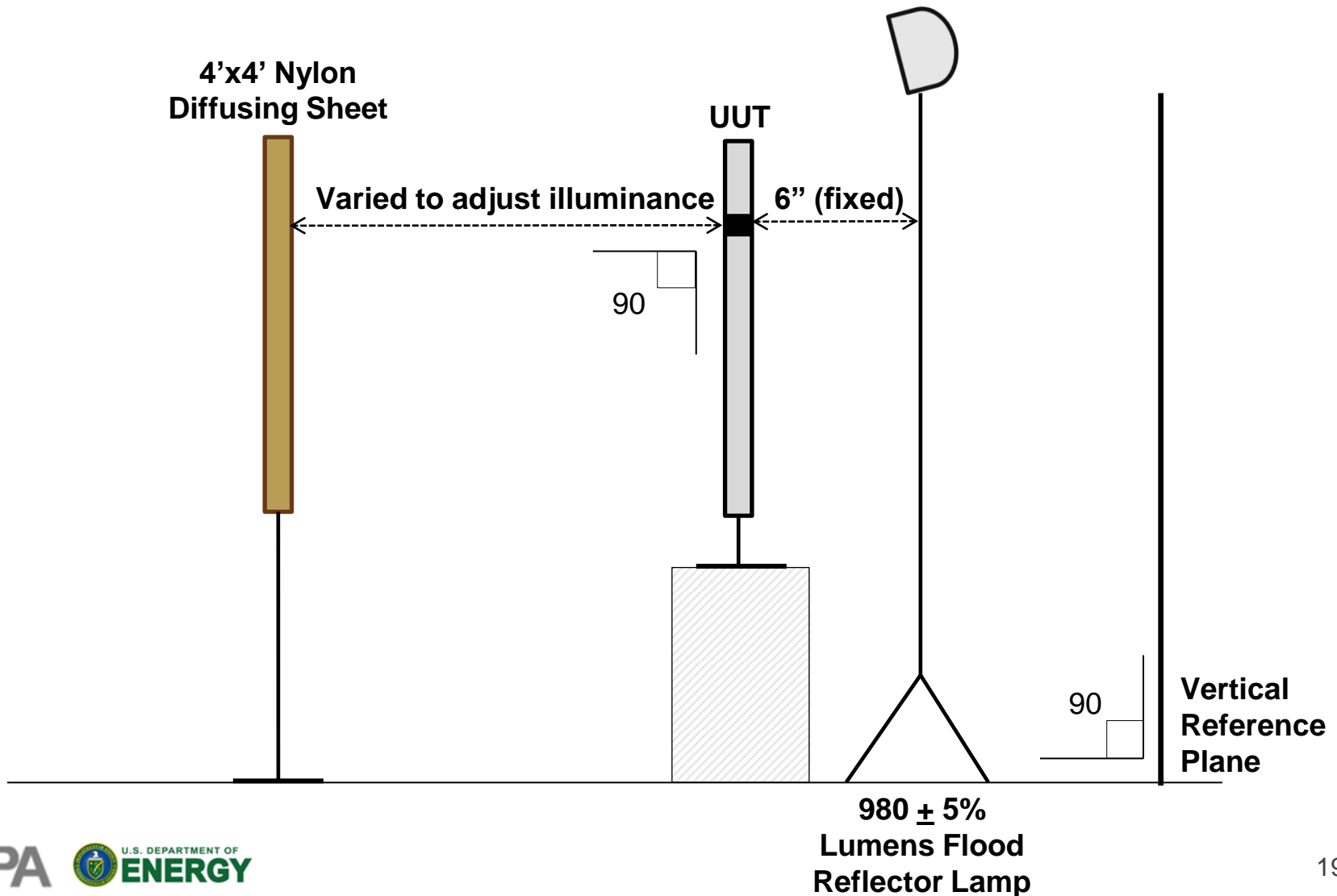
Light Source – Type of Incident Light

Diffuse Setup #3 (Transmission) – Side View



Light Source – Type of Incident Light

Diffuse Setup #4 (Reflection) – Side View

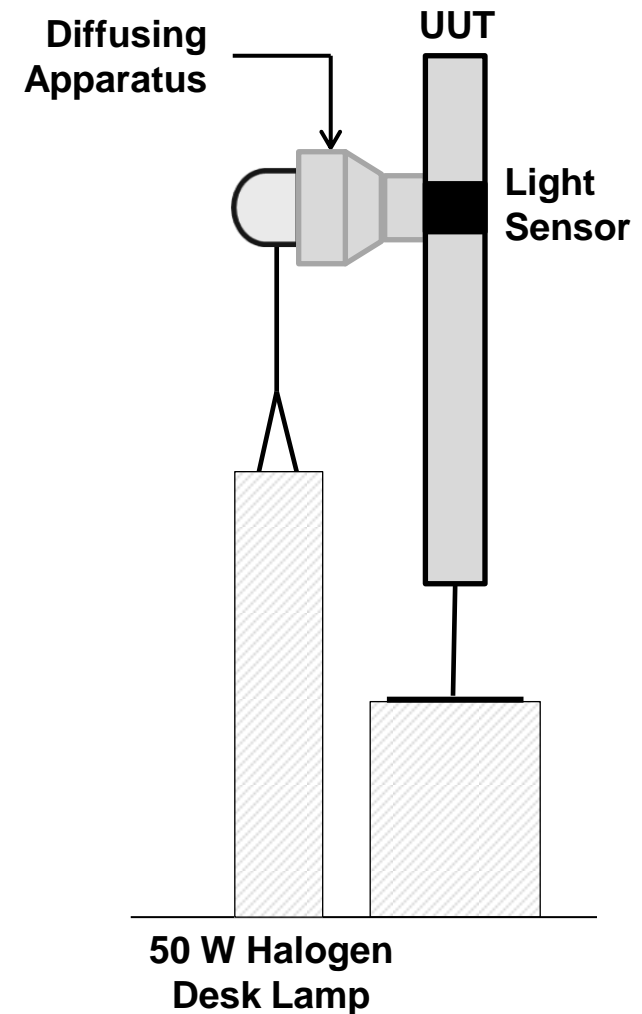


Light Source – Type of Incident Light

Diffuse Setup #5 (Transmission) – Side View



- Diffusing Apparatus:
 - 4"-to-3" reducer connected to 3"-to-1.5" reducer
 - Three nylon sheets placed between reducers as diffusing medium
- 50 W halogen desk lamp used as light source (100 W-equivalent not available)
- Illuminance measured and set at output of apparatus
- Apparatus placed flush to face of UUT for testing

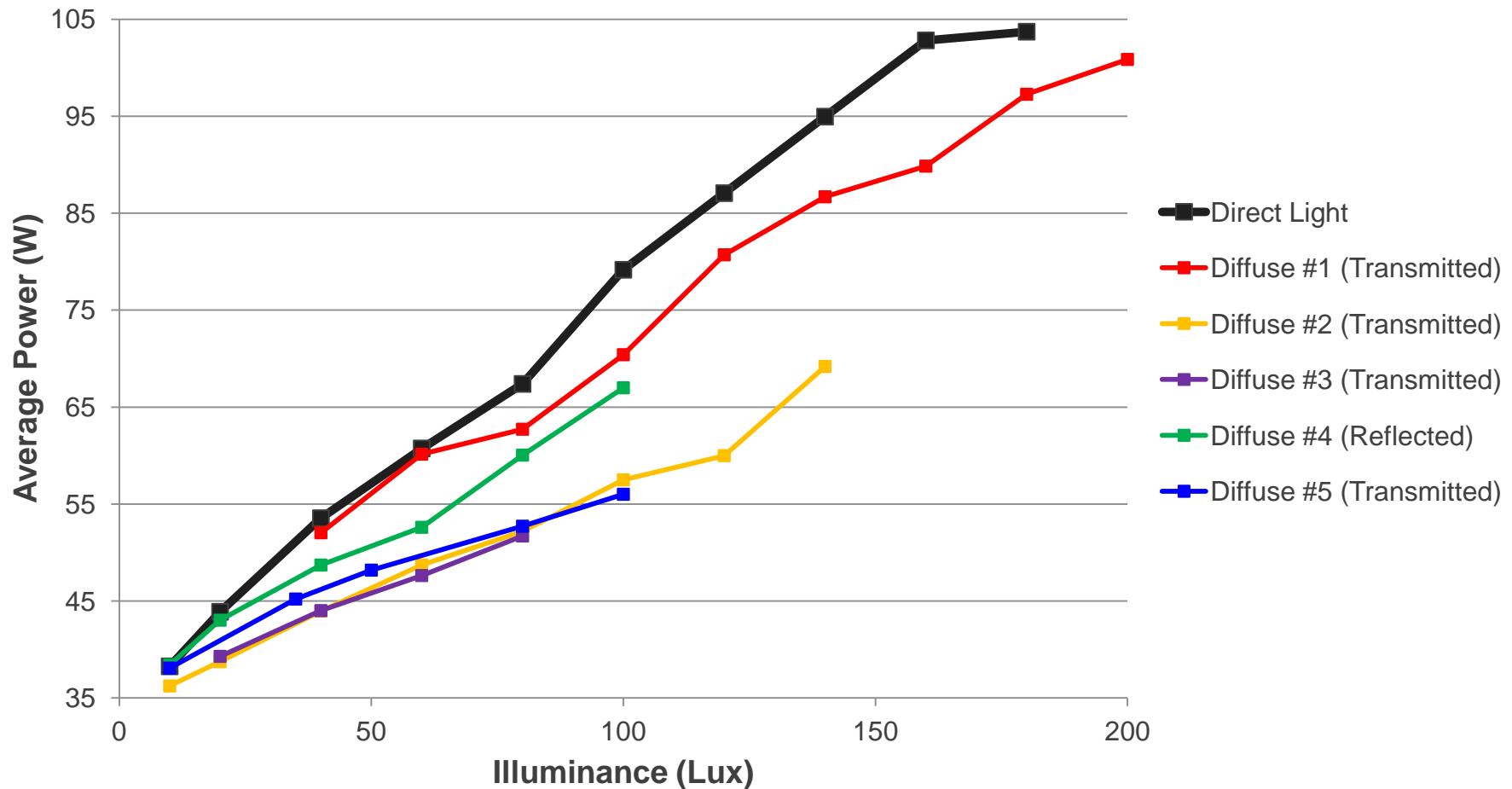


Light Source – Type of Incident Light

Direct vs. Diffuse – UUT 1



Direct vs. Diffuse (UUT 1)



Repeatability Testing Variation

Direct Light vs. Diffuse Setup #5 (UUT 1)

Average Power and Standard Deviation



Illuminance (lux)	Direct Light UUT 1		Diffuse Setup #5 UUT 1	
	P _{AVG}	COV (%)	P _{AVG}	COV (%)
10	45.8	0.6%	38.7	2.1%
35	57.6	0.4%	45.9	1.3%
50	63.5	1.5%	49.3	1.9%
80	75.5	0.4%	53.5	2.4%
100	82.5	1.4%	56.9	1.1%
300	107.6	0.1%	87.4	5.8%

Light Source – Type of Incident Light

Direct vs. Diffuse – UUT 2



Direct vs. Diffuse Testing (UUT 2)

