

PRELIMINARY



Soraa Internal Report: IES LM79-08

Test results reported for:

Part Number: SM16-09-36D-930-03

Soraa MR16, GU5.3/12V, 3000K, 95CRI, 9W, 36degree

Relevant Standards

IES LM-79

ANSI C78.377

IES PR-16

Soraa Lamp Lab

1.0 Description of test sample

Customer reference ID	SM16-09-36D-930-03
Manufacturer reference ID	SM16-09-36D-930-03
Lamp description	Vivid 3000K 95CRI 9W 36 degree
Rated voltage	12V
Rated power	9W
Nominal CCT	3000K



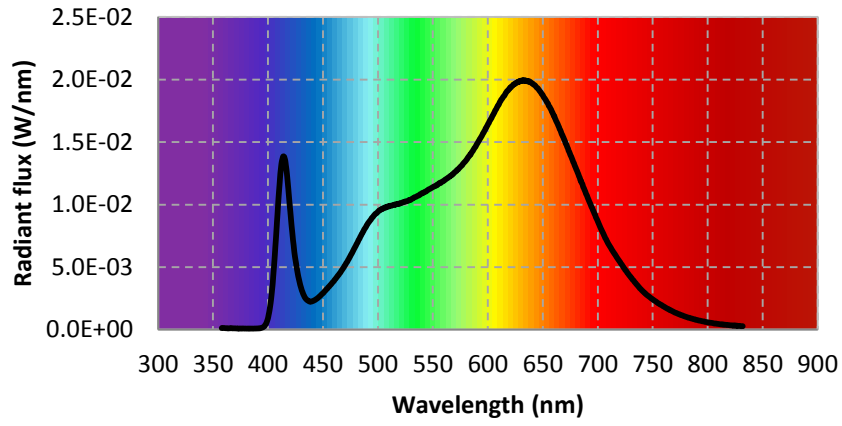
2.0 Results - Sphere Measurements

Test conditions	
Orientation	Horizontal
Stabilization time (min)	50-55
Correction factor applied	Self absorption correction
Sphere geometry	65" Sphere
	95% coating reflectance
	2pi geometry
Ambient temperature (°C)	25±1

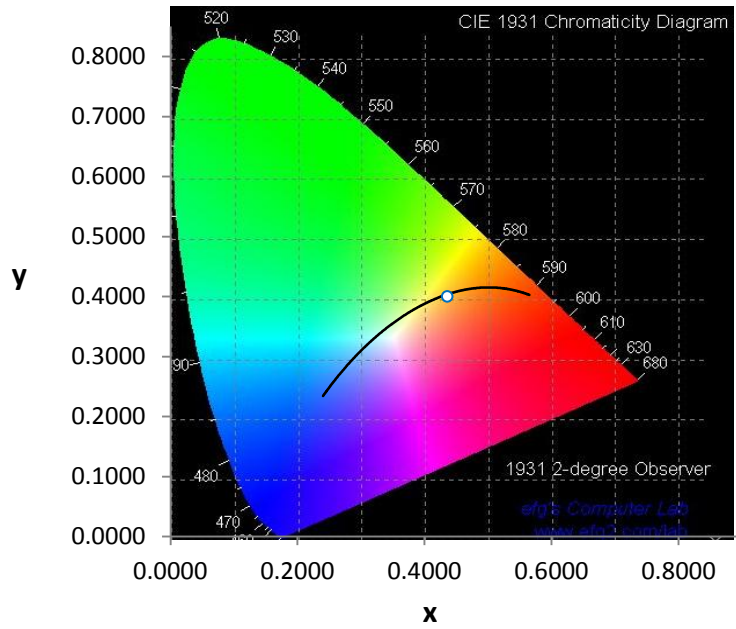
Instrument				
	Instrument	Manufacture	Model	
Photometric	Spectrometer	Instrument systems	CAS 140T	
	Integrating sphere	Labsphere	65"	
	Standard lamp	Labsphere	CSFS-1400 lamp	
Electrical instrument	Power supply for standard lamp	Labsphere	LPS-150-0268	
	Power supply for aux lamp	Labsphere	LPS-100-0833	
	Power supply for test lamps	APT	Variplus 105	
	Power meter for test lamps	Chroma	66202	
Thermometer	Digital multimeter	YOKOGAWA	TY720	

Measurement results				
	Photometric		Electrical	
Total lumen (lm)	487		Input voltage (V)	12.0
Luminous efficacy (lm/W)	54		Current (A)	0.820
Chromaticity coordinates	$u' = 0.2500$		Power (W)	9.0
	$v' = 0.5214$		pf	0.915
	$x = 0.4362$			
	$y = 0.4000$			
CCT (K)	3015			
CRI	96			
R9	95			
Duv				

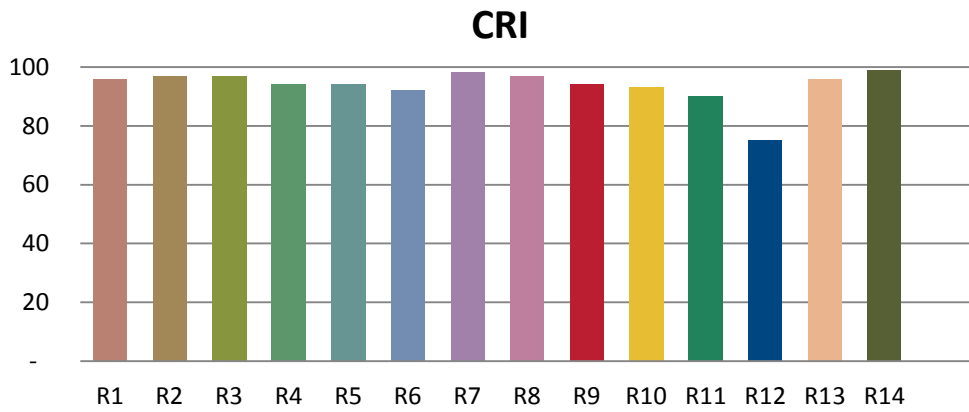
Spectral power distribution



Chromaticity on CIE1931



CRI	
R1	96
R2	97
R3	97
R4	94
R5	94
R6	92
R7	98
R8	97
R9	94
R10	93
R11	90
R12	75
R13	96
R14	99
Ra	96



Spectral Power Distribution									
WL (nm)	SPD(W/nm)	WL (nm)	SPD(W/nm)	WL (nm)	SPD(W/nm)	WL (nm)	SPD(W/nm)	WL (nm)	SPD(W/nm)
380	8.49E-05	421	8.75E-03	462	4.13E-03	503	9.61E-03	544	1.11E-02
381	8.34E-05	422	7.83E-03	463	4.25E-03	504	9.65E-03	545	1.11E-02
382	8.60E-05	423	6.98E-03	464	4.35E-03	505	9.72E-03	546	1.12E-02
383	8.23E-05	424	6.19E-03	465	4.48E-03	506	9.75E-03	547	1.12E-02
384	8.64E-05	425	5.57E-03	466	4.60E-03	507	9.76E-03	548	1.13E-02
385	8.63E-05	426	5.02E-03	467	4.74E-03	508	9.81E-03	549	1.13E-02
386	8.50E-05	427	4.51E-03	468	4.87E-03	509	9.85E-03	550	1.14E-02
387	8.63E-05	428	4.08E-03	469	4.99E-03	510	9.86E-03	551	1.15E-02
388	9.13E-05	429	3.69E-03	470	5.14E-03	511	9.90E-03	552	1.15E-02
389	9.06E-05	430	3.37E-03	471	5.29E-03	512	9.90E-03	553	1.15E-02
390	9.23E-05	431	3.09E-03	472	5.42E-03	513	9.94E-03	554	1.16E-02
391	9.81E-05	432	2.86E-03	473	5.59E-03	514	9.96E-03	555	1.16E-02
392	1.15E-04	433	2.67E-03	474	5.75E-03	515	9.97E-03	556	1.17E-02
393	1.14E-04	434	2.52E-03	475	5.91E-03	516	1.00E-02	557	1.17E-02
394	1.42E-04	435	2.41E-03	476	6.07E-03	517	1.00E-02	558	1.18E-02
395	1.75E-04	436	2.34E-03	477	6.23E-03	518	1.00E-02	559	1.19E-02
396	2.24E-04	437	2.28E-03	478	6.41E-03	519	1.01E-02	560	1.19E-02
397	3.17E-04	438	2.25E-03	479	6.57E-03	520	1.01E-02	561	1.20E-02
398	4.47E-04	439	2.24E-03	480	6.74E-03	521	1.01E-02	562	1.20E-02
399	6.49E-04	440	2.26E-03	481	6.91E-03	522	1.02E-02	563	1.21E-02
400	9.32E-04	441	2.30E-03	482	7.08E-03	523	1.02E-02	564	1.22E-02
401	1.36E-03	442	2.34E-03	483	7.25E-03	524	1.02E-02	565	1.22E-02
402	1.91E-03	443	2.39E-03	484	7.43E-03	525	1.03E-02	566	1.23E-02
403	2.60E-03	444	2.45E-03	485	7.60E-03	526	1.03E-02	567	1.24E-02
404	3.46E-03	445	2.51E-03	486	7.75E-03	527	1.03E-02	568	1.24E-02
405	4.56E-03	446	2.59E-03	487	7.92E-03	528	1.03E-02	569	1.25E-02
406	5.73E-03	447	2.67E-03	488	8.08E-03	529	1.04E-02	570	1.26E-02
407	7.03E-03	448	2.75E-03	489	8.21E-03	530	1.04E-02	571	1.27E-02
408	8.40E-03	449	2.84E-03	490	8.37E-03	531	1.05E-02	572	1.28E-02
409	9.77E-03	450	2.91E-03	491	8.51E-03	532	1.05E-02	573	1.28E-02
410	1.10E-02	451	3.02E-03	492	8.63E-03	533	1.06E-02	574	1.29E-02
411	1.22E-02	452	3.11E-03	493	8.74E-03	534	1.06E-02	575	1.30E-02
412	1.31E-02	453	3.21E-03	494	8.87E-03	535	1.06E-02	576	1.31E-02
413	1.36E-02	454	3.29E-03	495	8.98E-03	536	1.07E-02	577	1.32E-02
414	1.39E-02	455	3.40E-03	496	9.09E-03	537	1.07E-02	578	1.33E-02
415	1.37E-02	456	3.50E-03	497	9.20E-03	538	1.08E-02	579	1.34E-02
416	1.33E-02	457	3.59E-03	498	9.28E-03	539	1.08E-02	580	1.35E-02
417	1.26E-02	458	3.70E-03	499	9.33E-03	540	1.09E-02	581	1.36E-02
418	1.17E-02	459	3.80E-03	500	9.43E-03	541	1.09E-02	582	1.38E-02
419	1.07E-02	460	3.90E-03	501	9.51E-03	542	1.10E-02	583	1.39E-02
420	9.71E-03	461	4.02E-03	502	9.58E-03	543	1.10E-02	584	1.40E-02

Spectral Power Distribution									
WL (nm)	SPD(W/nm)	WL (nm)	SPD(W/nm)	WL (nm)	SPD(W/nm)	WL (nm)	SPD(W/nm)	WL (nm)	SPD(W/nm)
585	1.41E-02	626	1.98E-02	667	1.57E-02	708	7.14E-03	749	2.49E-03
586	1.43E-02	627	1.98E-02	668	1.55E-02	709	6.97E-03	750	2.42E-03
587	1.44E-02	628	1.98E-02	669	1.53E-02	710	6.81E-03	751	2.36E-03
588	1.45E-02	629	1.99E-02	670	1.51E-02	711	6.67E-03	752	2.30E-03
589	1.47E-02	630	1.99E-02	671	1.49E-02	712	6.53E-03	753	2.25E-03
590	1.48E-02	631	1.99E-02	672	1.47E-02	713	6.37E-03	754	2.17E-03
591	1.50E-02	632	1.99E-02	673	1.45E-02	714	6.23E-03	755	2.12E-03
592	1.51E-02	633	1.99E-02	674	1.42E-02	715	6.10E-03	756	2.07E-03
593	1.53E-02	634	1.99E-02	675	1.40E-02	716	5.97E-03	757	2.00E-03
594	1.54E-02	635	1.99E-02	676	1.38E-02	717	5.83E-03	758	1.96E-03
595	1.56E-02	636	1.99E-02	677	1.36E-02	718	5.70E-03	759	1.90E-03
596	1.57E-02	637	1.98E-02	678	1.34E-02	719	5.57E-03	760	1.86E-03
597	1.59E-02	638	1.98E-02	679	1.31E-02	720	5.44E-03	761	1.79E-03
598	1.61E-02	639	1.98E-02	680	1.29E-02	721	5.30E-03	762	1.75E-03
599	1.62E-02	640	1.97E-02	681	1.27E-02	722	5.18E-03	763	1.69E-03
600	1.64E-02	641	1.96E-02	682	1.25E-02	723	5.05E-03	764	1.66E-03
601	1.65E-02	642	1.96E-02	683	1.23E-02	724	4.91E-03	765	1.60E-03
602	1.67E-02	643	1.95E-02	684	1.20E-02	725	4.78E-03	766	1.56E-03
603	1.69E-02	644	1.94E-02	685	1.18E-02	726	4.67E-03	767	1.51E-03
604	1.71E-02	645	1.93E-02	686	1.16E-02	727	4.54E-03	768	1.47E-03
605	1.72E-02	646	1.92E-02	687	1.14E-02	728	4.43E-03	769	1.42E-03
606	1.74E-02	647	1.91E-02	688	1.12E-02	729	4.31E-03	770	1.38E-03
607	1.76E-02	648	1.90E-02	689	1.09E-02	730	4.20E-03	771	1.34E-03
608	1.77E-02	649	1.89E-02	690	1.08E-02	731	4.09E-03	772	1.31E-03
609	1.79E-02	650	1.87E-02	691	1.05E-02	732	3.98E-03	773	1.27E-03
610	1.80E-02	651	1.86E-02	692	1.03E-02	733	3.88E-03	774	1.24E-03
611	1.82E-02	652	1.85E-02	693	1.01E-02	734	3.76E-03	775	1.20E-03
612	1.84E-02	653	1.83E-02	694	9.89E-03	735	3.65E-03	776	1.16E-03
613	1.85E-02	654	1.82E-02	695	9.70E-03	736	3.55E-03	777	1.14E-03
614	1.86E-02	655	1.80E-02	696	9.49E-03	737	3.45E-03	778	1.10E-03
615	1.87E-02	656	1.78E-02	697	9.28E-03	738	3.34E-03	779	1.06E-03
616	1.89E-02	657	1.77E-02	698	9.07E-03	739	3.25E-03	780	1.03E-03
617	1.90E-02	658	1.75E-02	699	8.87E-03	740	3.16E-03		
618	1.91E-02	659	1.73E-02	700	8.67E-03	741	3.08E-03		
619	1.92E-02	660	1.71E-02	701	8.46E-03	742	2.99E-03		
620	1.93E-02	661	1.69E-02	702	8.25E-03	743	2.91E-03		
621	1.94E-02	662	1.67E-02	703	8.06E-03	744	2.83E-03		
622	1.95E-02	663	1.65E-02	704	7.87E-03	745	2.75E-03		
623	1.96E-02	664	1.63E-02	705	7.69E-03	746	2.69E-03		
624	1.96E-02	665	1.61E-02	706	7.49E-03	747	2.62E-03		
625	1.97E-02	666	1.59E-02	707	7.30E-03	748	2.55E-03		

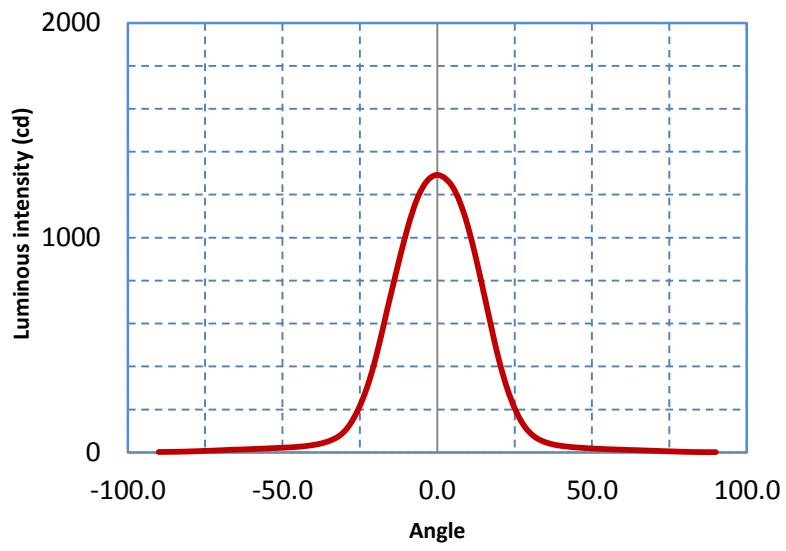
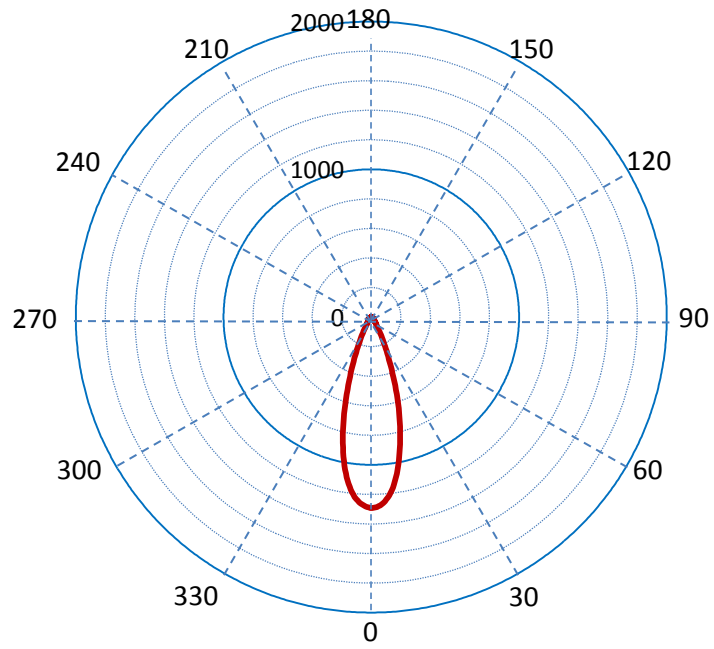
3.0 Results - Goniometric Measurements

Test conditions	
Goniometer distance (m)	1
Temperature (°C)	25±1
Stabilization time (min)	50

Instrument				
	Instrument	Manufacture	Model	
Photometric	Photometer and color meter	Minolta	CL-200A	
Electrical instrument	Power supply for test lamps	APT	Variplus 105	
	Power meter for test lamps	Chroma	66202	
Thermometer	Digital multimeter	YOKOGAWA	TY720	

Measurement results				
Photometric			Electrical	
Central beam candle power(cd)	1292		Input voltage (V)	12.0
Beam Angle (°)	33		Current (A)	0.820
Field Angle (°)	57		Power (W)	9.0
Chromaticity coordinates	u'= 0.2500		pf	0.9150
	v'= 0.5214			
	x = 0.4362			
	y = 0.4000			
CCT (K)	3015			

Luminous intensity distribution

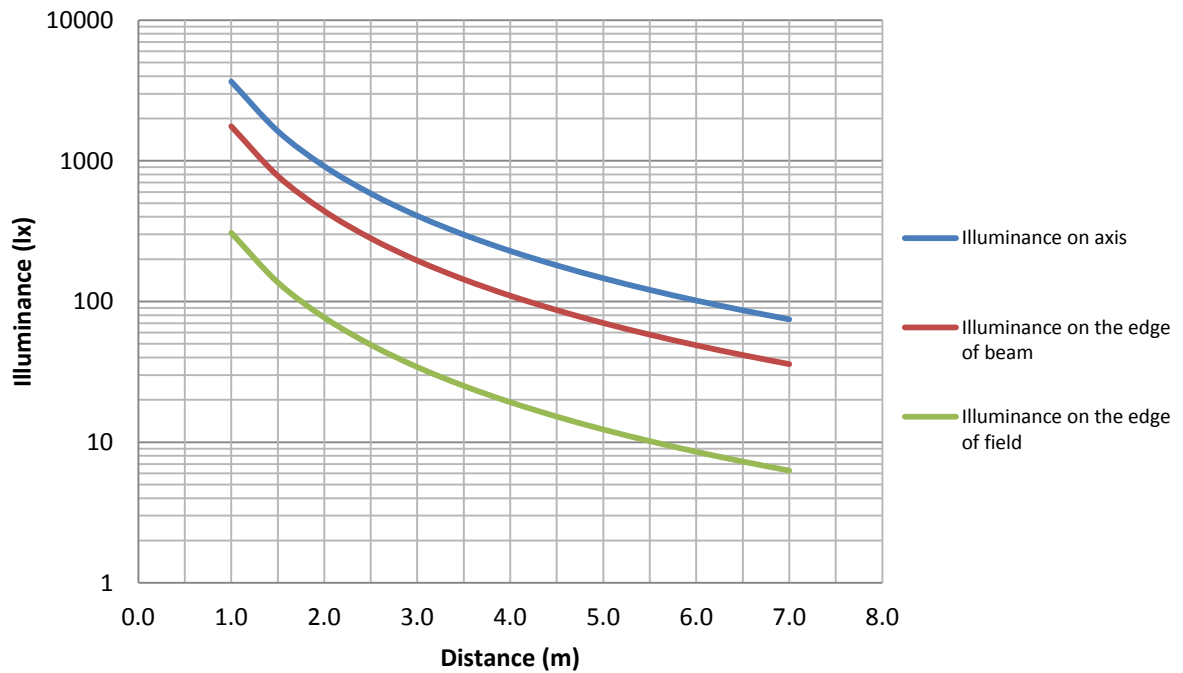


Zonal Lumen Tabulation					
Zones (°)	Lumens	%lamp	Zones (°)	Lumens	%lamp
0-5	30.1	6.2%	45-50	8.2	1.7%
5-10	81.7	16.8%	50-55	7.1	1.5%
10-15	105.8	21.7%	55-60	6.2	1.3%
15-20	94.4	19.4%	60-65	5.4	1.1%
20-25	62.4	12.8%	65-70	4.4	0.9%
25-30	34.0	7.0%	70-75	3.2	0.7%
30-35	18.3	3.8%	75-80	2.0	0.4%
35-40	12.1	2.5%	80-85	1.0	0.2%
40-45	9.6	2.0%	85-90	0.7	0.1%
				Total lumen	487

Accumulated Zonal Lumen Tabulation					
Zones (°)	Lumens	%lamp	Zones (°)	Lumens	%lamp
0-5	30.1	6.2%	0-50	456.7	93.8%
0-10	111.8	23.0%	0-55	463.8	95.3%
0-15	217.6	44.7%	0-60	470.0	96.6%
0-20	312.1	64.1%	0-65	475.4	97.7%
0-25	374.5	76.9%	0-70	479.8	98.6%
0-30	408.5	83.9%	0-75	483.1	99.2%
0-35	426.8	87.7%	0-80	485.1	99.7%
0-40	439.0	90.2%	0-85	486.1	99.9%
0-45	448.5	92.1%	0-90	486.8	100.0%

Center and edge illuminance, beam and field diameter					
Distance (m)	E on axis (lx)	Beam D(m)	E on the edge of beam (lx)	Field D(m)	E on the edge of field (lx)
1.0	3657	0.33	1758	0.7	308
1.5	1626	0.49	781	1.0	137
2.0	914	0.65	440	1.4	77
2.5	585	0.81	281	1.7	49
3.0	406	0.98	195	2.1	34
3.5	299	1.14	144	2.4	25
4.0	229	1.30	110	2.8	19
4.5	181	1.47	87	3.1	15
5.0	146	1.63	70	3.5	12
5.5	121	1.79	58	3.8	10
6.0	102	1.95	49	4.2	9
6.5	87	2.12	42	4.5	7
7.0	75	2.28	36	4.9	6
7.5	65	2.44	31	5.2	5
8.0	57	2.61	27	5.6	5
8.5	51	2.77	24	5.9	4
9.0	45	2.93	22	6.3	4
9.5	41	3.09	19	6.6	3
10.0	37	3.26	18	7.0	3

Beam illuminance vs. distance



Luminous Intensity Distribution

Angle (°C)	CP (cd)	Angle (°C)	CP (cd)	Angle (°C)	CP (cd)	Angle (°C)	CP (cd)	Angle (°C)	CP (cd)
-90.0	1.9	-69.5	10.2	-49.0	22.5	-28.5	124.4	-8.0	1120.0
-89.5	2.0	-69.0	10.5	-48.5	22.8	-28.0	135.2	-7.5	1142.4
-89.0	2.0	-68.5	10.9	-48.0	23.2	-27.5	146.6	-7.0	1162.6
-88.5	2.1	-68.0	11.2	-47.5	23.6	-27.0	159.0	-6.5	1180.5
-88.0	2.2	-67.5	11.4	-47.0	24.1	-26.5	172.1	-6.0	1197.3
-87.5	2.2	-67.0	11.8	-46.5	24.5	-26.0	186.0	-5.5	1213.0
-87.0	2.4	-66.5	12.0	-46.0	25.0	-25.5	200.9	-5.0	1226.4
-86.5	2.5	-66.0	12.2	-45.5	25.5	-25.0	216.8	-4.5	1238.7
-86.0	2.6	-65.5	12.4	-45.0	26.1	-24.5	233.6	-4.0	1251.0
-85.5	2.7	-65.0	12.8	-44.5	26.7	-24.0	251.2	-3.5	1260.0
-85.0	2.8	-64.5	13.0	-44.0	27.3	-23.5	270.0	-3.0	1269.0
-84.5	2.9	-64.0	13.2	-43.5	28.0	-23.0	289.7	-2.5	1275.7
-84.0	3.0	-63.5	13.6	-43.0	28.8	-22.5	310.6	-2.0	1281.3
-83.5	3.2	-63.0	13.8	-42.5	29.6	-22.0	332.8	-1.5	1285.8
-83.0	3.4	-62.5	14.1	-42.0	30.5	-21.5	356.3	-1.0	1289.1
-82.5	3.6	-62.0	14.3	-41.5	31.5	-21.0	380.5	-0.5	1291.4
-82.0	3.7	-61.5	14.7	-41.0	32.5	-20.5	406.3	0.0	1292.5
-81.5	3.9	-61.0	14.9	-40.5	33.5	-20.0	433.4	0.5	1291.4
-81.0	4.1	-60.5	15.2	-40.0	34.6	-19.5	461.7	1.0	1289.1
-80.5	4.3	-60.0	15.6	-39.5	35.8	-19.0	490.7	1.5	1285.8
-80.0	4.6	-59.5	15.8	-39.0	37.2	-18.5	520.5	2.0	1282.4
-79.5	4.8	-59.0	16.1	-38.5	38.5	-18.0	550.8	2.5	1276.8
-79.0	5.0	-58.5	16.5	-38.0	40.1	-17.5	581.6	3.0	1270.1
-78.5	5.3	-58.0	16.7	-37.5	41.8	-17.0	612.9	3.5	1263.4
-78.0	5.6	-57.5	17.0	-37.0	43.7	-16.5	644.3	4.0	1255.5
-77.5	5.8	-57.0	17.4	-36.5	45.6	-16.0	675.0	4.5	1246.6
-77.0	6.0	-56.5	17.7	-36.0	47.8	-15.5	705.4	5.0	1235.4
-76.5	6.3	-56.0	17.9	-35.5	50.2	-15.0	735.5	5.5	1223.0
-76.0	6.6	-55.5	18.3	-35.0	52.8	-14.5	765.4	6.0	1208.5
-75.5	6.8	-55.0	18.6	-34.5	55.6	-14.0	795.2	6.5	1193.9
-75.0	7.1	-54.5	18.9	-34.0	58.6	-13.5	825.0	7.0	1177.1
-74.5	7.4	-54.0	19.2	-33.5	61.8	-13.0	854.7	7.5	1158.1
-74.0	7.6	-53.5	19.5	-33.0	65.4	-12.5	884.0	8.0	1139.0
-73.5	7.8	-53.0	19.8	-32.5	69.3	-12.0	913.0	8.5	1117.8
-73.0	8.2	-52.5	20.2	-32.0	73.8	-11.5	941.5	9.0	1096.5
-72.5	8.4	-52.0	20.5	-31.5	78.8	-11.0	969.2	9.5	1071.8
-72.0	8.7	-51.5	20.8	-31.0	84.3	-10.5	996.2	10.0	1047.2
-71.5	9.0	-51.0	21.1	-30.5	90.6	-10.0	1022.7	10.5	1020.3
-71.0	9.3	-50.5	21.4	-30.0	97.7	-9.5	1049.4	11.0	993.4
-70.5	9.6	-50.0	21.8	-29.5	105.6	-9.0	1074.1	11.5	964.3
-70.0	10.0	-49.5	22.2	-29.0	114.6	-8.5	1097.6	12.0	935.2

Luminous Intensity Distribution

Angle (°C)	CP (cd)	Angle (°C)	CP (cd)	Angle (°C)	CP (cd)	Angle (°C)	CP (cd)		
12.5	904.4	33.0	59.4	53.5	15.8	74.0	5.5		
13.0	873.4	33.5	55.8	54.0	15.5	74.5	5.3		
13.5	841.9	34.0	52.6	54.5	15.2	75.0	5.0		
14.0	810.0	34.5	49.7	55.0	14.9	75.5	4.8		
14.5	777.5	35.0	47.0	55.5	14.7	76.0	4.6		
15.0	744.8	35.5	44.7	56.0	14.4	76.5	4.3		
15.5	712.2	36.0	42.4	56.5	14.1	77.0	4.0		
16.0	679.4	36.5	40.4	57.0	13.9	77.5	3.8		
16.5	646.5	37.0	38.6	57.5	13.7	78.0	3.6		
17.0	613.6	37.5	36.8	58.0	13.4	78.5	3.2		
17.5	580.9	38.0	35.4	58.5	13.1	79.0	3.0		
18.0	548.5	38.5	33.9	59.0	12.9	79.5	2.9		
18.5	516.3	39.0	32.7	59.5	12.7	80.0	2.7		
19.0	485.4	39.5	31.6	60.0	12.3	80.5	2.6		
19.5	455.7	40.0	30.5	60.5	12.1	81.0	2.4		
20.0	426.8	40.5	29.6	61.0	11.9	81.5	2.2		
20.5	399.3	41.0	28.7	61.5	11.6	82.0	2.0		
21.0	373.1	41.5	27.8	62.0	11.4	82.5	1.9		
21.5	348.1	42.0	27.0	62.5	11.2	83.0	1.8		
22.0	324.4	42.5	26.2	63.0	11.0	83.5	1.8		
22.5	301.7	43.0	25.5	63.5	10.8	84.0	1.7		
23.0	280.2	43.5	24.8	64.0	10.5	84.5	1.6		
23.5	260.2	44.0	24.2	64.5	10.3	85.0	1.5		
24.0	241.1	44.5	23.6	65.0	10.1	85.5	1.5		
24.5	223.1	45.0	23.1	65.5	9.9	86.0	1.3		
25.0	206.2	45.5	22.5	66.0	9.5	86.5	1.3		
25.5	190.3	46.0	22.0	66.5	9.3	87.0	1.2		
26.0	175.4	46.5	21.5	67.0	9.1	87.5	1.2		
26.5	161.3	47.0	21.1	67.5	8.8	88.0	1.2		
27.0	148.3	47.5	20.6	68.0	8.6	88.5	1.2		
27.5	136.3	48.0	20.2	68.5	8.4	89.0	1.1		
28.0	125.3	48.5	19.6	69.0	8.2	89.5	1.1		
28.5	115.4	49.0	19.2	69.5	7.8	90.0	1.1		
29.0	106.3	49.5	18.7	70.0	7.6				
29.5	98.1	50.0	18.4	70.5	7.3				
30.0	90.6	50.5	17.9	71.0	7.1				
30.5	83.9	51.0	17.6	71.5	6.8				
31.0	77.8	51.5	17.1	72.0	6.5				
31.5	72.5	52.0	16.8	72.5	6.3				
32.0	67.5	52.5	16.5	73.0	5.9				
32.5	63.2	53.0	16.1	73.5	5.7				