

Goniophotometric Test Report



TEST ARTEFACT

The measurement device (DUT) was LED linear light of type ActivePAQ Linear Performer 2Ft 4000 lm. The DUT was mounted onto the goniometer i.e. the cable was located in the direction of the C270. Tc temperature was 53.7 degC measured by K type thermocouple. The effect of the burning position was measured and the correction was less than <0.3%.

Customer: Tepcomp Oy

MEASUREMENT METHOD

The test method is with accordance of LM-79-08 / CIE S025 test standards. The measurements were made by a goniospectrophotometer SSL LUMI-160 (SN: C-1R.1600-001) at the dark room of SSL Resource Ltd. The spectral radiant intensities of a light source at different directions were measured with a calibrated spectrometer and photometer located at a known distance from the light source.

MEASUREMENT UNCERTAINTY

The photometer (SSL L-200, sn L200-009 & LH200-010 18f3-003) used in goniophotometer is traceable to national standard of illuminance responsivity at PTB (Certificate of calibration TR 0066, calibrated 14 May 2019). The power meter was of type The expanded uncertainties of the luminous flux and efficacy are $\pm 3.8\%$ and 4.0% ($k = 2$), respectively.

The measurement uncertainty of the $u'v'$, CCT, and Ra are ± 0.002 , ± 80 K, and ± 1 ($k = 2$), respectively (SM240-SVOP5221, Calibration certificate CR 0055).

MEASUREMENTS

Table below describes the measurement conditions. The luminaire under test and photometer/spectrometer were mounted onto the same optical axis and perpendicular by an alignment laser. The measurement distance from the rotation axis to the photometer optical receiving surface was measured by laser distance meter.

Table - Measurement information

Ambient temperature of the laboratory	25.0 degC
Power supply	230.0 Vac
Measurement distance	8847 mm
Location of the rotation axis (behind the outermost surface of the optics)	0 mm
Angular step, C plane	15.0 deg
Angular step, gamma angle	2.5 deg
Maximum gamma angle	90.0 deg
Stabilization time	35 min

Table. Luminous intensity data (cd) at measured C planes (rows) and gamma angles (columns)

	0	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225	240	255	270	285	300	315	330	345
0.0	1339	1339	1339	1339	1339	1339	1339	1339	1339	1339	1339	1339	1339	1339	1339	1339	1339	1339	1339	1339	1339	1339	1339	1339
2.5	1338	1338	1338	1338	1338	1337	1338	1337	1338	1338	1338	1338	1338	1338	1338	1338	1338	1337	1338	1337	1338	1338	1338	1338
5.0	1334	1334	1334	1334	1334	1334	1334	1334	1334	1334	1334	1334	1334	1334	1334	1334	1334	1334	1334	1334	1334	1334	1334	1334
7.5	1328	1329	1328	1328	1328	1328	1328	1328	1328	1328	1328	1329	1328	1329	1328	1328	1328	1328	1328	1328	1328	1328	1328	1329
10.0	1319	1321	1320	1320	1320	1319	1319	1319	1320	1320	1320	1321	1319	1321	1320	1320	1320	1319	1319	1319	1320	1320	1320	1321
12.5	1309	1310	1309	1309	1309	1309	1309	1309	1309	1309	1309	1310	1309	1310	1309	1309	1309	1309	1309	1309	1309	1309	1309	1310
15.0	1296	1297	1296	1296	1296	1296	1296	1296	1296	1296	1296	1297	1296	1297	1296	1296	1296	1296	1296	1296	1296	1296	1296	1297
17.5	1280	1281	1281	1281	1281	1281	1281	1281	1281	1281	1281	1280	1281	1281	1281	1281	1281	1281	1281	1281	1281	1281	1281	1281
20.0	1262	1263	1263	1263	1263	1263	1263	1263	1263	1263	1263	1263	1262	1263	1263	1263	1263	1263	1263	1263	1263	1263	1263	1263
22.5	1242	1242	1242	1243	1243	1243	1243	1243	1243	1243	1242	1242	1242	1242	1242	1243	1243	1243	1243	1243	1243	1243	1242	1242
25.0	1217	1216	1217	1219	1220	1220	1221	1220	1220	1219	1217	1216	1217	1216	1217	1219	1220	1220	1221	1220	1220	1219	1217	1216
27.5	1186	1182	1182	1193	1195	1195	1195	1195	1195	1193	1182	1182	1186	1182	1182	1193	1195	1195	1195	1195	1195	1193	1182	1182
30.0	1150	1141	1139	1160	1167	1168	1168	1168	1167	1160	1139	1141	1150	1141	1139	1160	1167	1168	1168	1168	1167	1160	1139	1141
32.5	1109	1100	1096	1119	1137	1138	1138	1138	1137	1119	1096	1100	1109	1100	1096	1119	1137	1138	1138	1137	1119	1096	1100	1100
35.0	1063	1061	1059	1074	1104	1105	1105	1105	1104	1074	1059	1061	1063	1061	1059	1074	1104	1105	1105	1105	1104	1074	1059	1061
37.5	1017	1023	1024	1032	1069	1071	1071	1071	1069	1032	1024	1023	1017	1023	1024	1032	1069	1071	1071	1071	1069	1032	1024	1023
40.0	973	984	986	993	1031	1034	1034	1034	1031	993	986	984	973	984	986	993	1031	1034	1034	1034	1031	993	986	984
42.5	931	943	945	953	991	994	995	994	991	953	945	943	931	943	945	953	991	994	995	994	991	953	945	943
45.0	889	899	901	909	946	953	954	953	946	909	901	899	889	899	901	909	946	953	954	953	946	909	901	899
47.5	846	855	858	859	894	909	910	909	894	859	858	855	846	855	858	859	894	909	910	909	894	859	858	855
50.0	801	810	812	802	833	862	862	862	833	802	812	810	801	810	812	802	833	862	862	862	833	802	812	810
52.5	753	762	765	747	778	812	812	812	778	747	765	762	753	762	765	747	778	812	812	812	778	747	765	762
55.0	702	712	715	695	727	761	762	761	727	695	715	712	702	712	715	695	727	761	762	761	727	695	715	712
57.5	649	659	663	644	674	706	708	706	674	644	663	659	649	659	663	644	674	706	708	706	674	644	663	659
60.0	591	602	608	589	615	649	651	649	615	589	608	602	591	602	608	589	615	649	651	649	615	589	608	602
62.5	531	540	550	533	549	585	593	585	549	533	550	540	531	540	550	533	549	585	593	585	549	533	550	540
65.0	466	475	487	476	484	512	533	512	484	476	487	475	466	475	487	476	484	512	533	512	484	476	487	475
67.5	401	410	421	417	426	450	471	450	426	417	421	410	401	410	421	417	426	450	471	450	426	417	421	410
70.0	343	351	355	355	367	379	408	379	367	355	355	351	343	351	355	355	367	379	408	379	367	355	355	351
72.5	288	294	295	289	306	313	345	313	306	289	295	294	288	294	295	289	306	313	345	313	306	289	295	294
75.0	234	237	239	230	244	245	281	245	244	230	239	237	234	237	239	230	244	245	281	245	244	230	239	237
77.5	178	181	183	177	181	185	218	185	181	177	183	181	178	181	183	177	181	185	218	185	181	177	183	181
80.0	129	130	131	127	129	131	158	131	129	127	131	130	129	130	131	127	129	131	158	131	129	127	131	130
82.5	81	82	82	82	83	83	103	83	83	82	82	82	81	82	82	82	83	83	103	83	83	82	82	82
85.0	49	49	47	44	44	44	56	44	44	44	47	49	49	49	47	44	44	56	44	44	44	47	49	49
87.5	24	24	23	21	18	17	18	17	18	21	23	24	24	24	23	21	18	17	18	17	18	21	23	24
90.0	12	12	11	10	8	6	2	6	8	10	11	12	12	12	11	10	8	6	2	6	8	10	11	12

Table. Measurement results of the main luminous parameters

Luminous flux	Input power	Luminous efficacy	LOR	DWFF	Luminous intensity (g=0)
3886.1 lm	26.90 W	144.5 lm/W	100.0 %	100.0 %	1339 cd

Table. Electrical parameters during the light measurements.

	Pin	PF	Vin	If
Value	26.94 W	0.9810	230.0 V	0.1190 A
St.dev.	0.04 %	0.00 %	0.00 %	0.00 %

Table. Maximum luminous intensity and its direction

Iv	g	C plane
1339 cd	-0.0 deg	0.0 deg

Table. Beam widths at two perpendicular planes

	Beam angle, FWHM, 50% (deg)	Beam angle, 10% (deg)	Effective beam direction from g=0
C0-180	113.0	159.5	-0.0
C90-270	118.4	162.2	0.0

Figure. Polar curve of the angular luminous intensity distribution at two perpendicular C planes and at C plane with maximum luminous intensity.

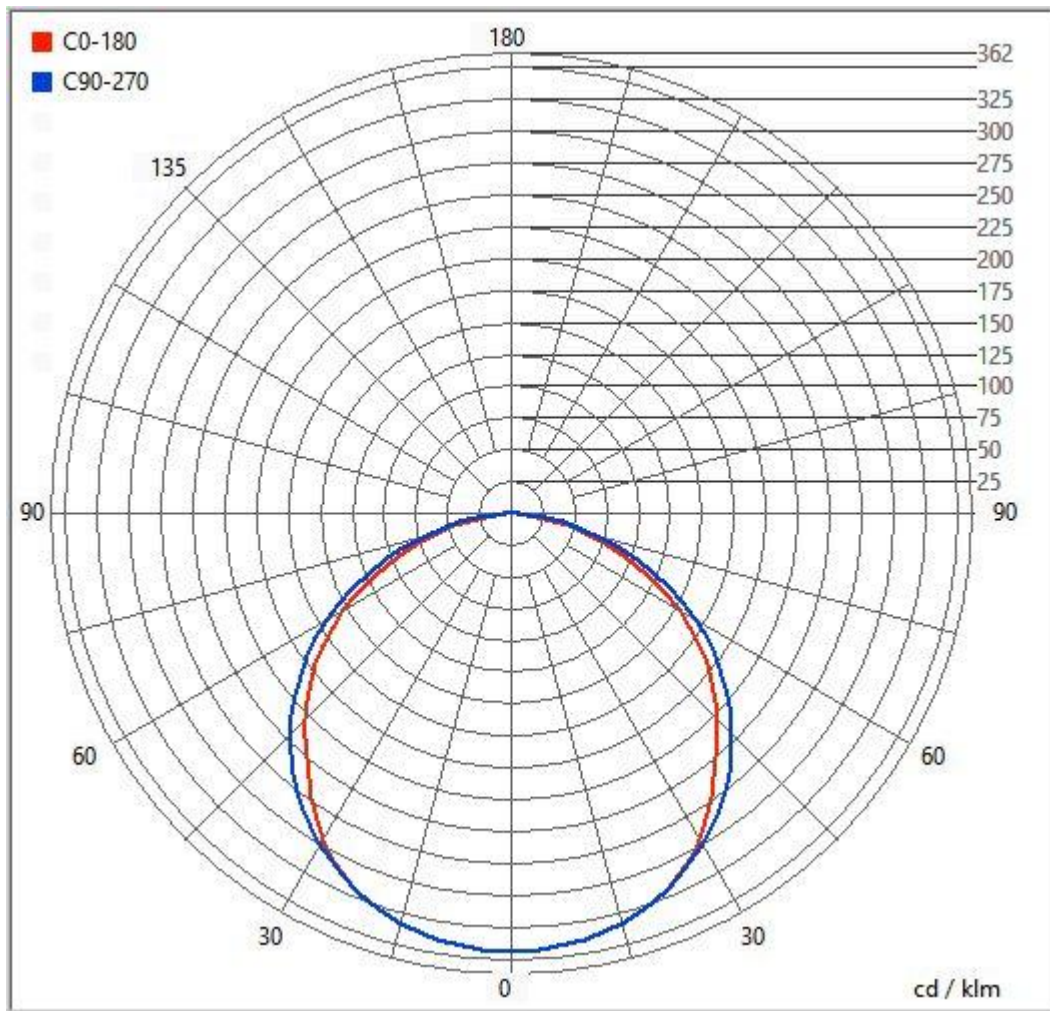


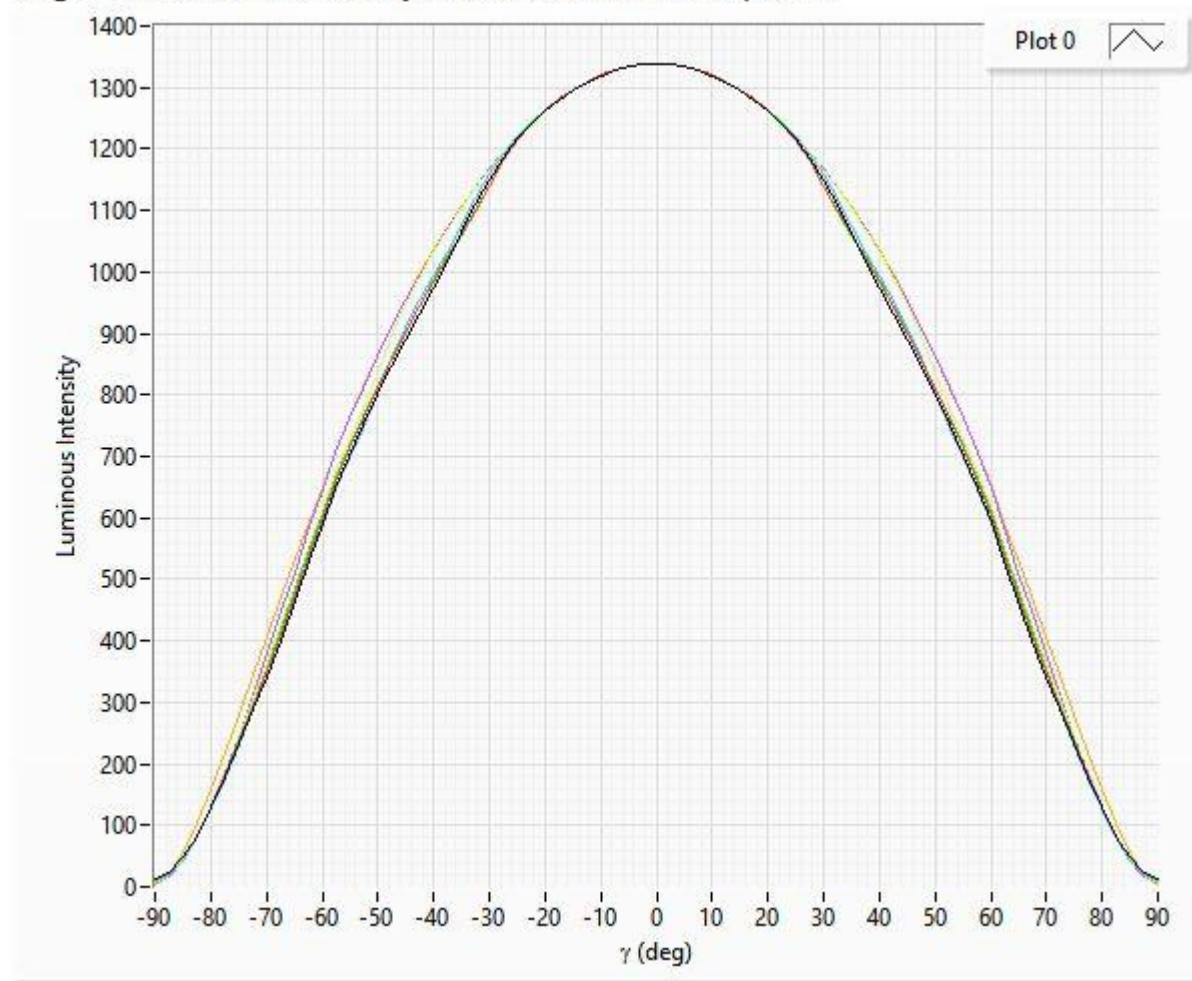
Figure. Luminous intensity distribution in cartesian diagram at all measured C planes**Angular luminous intensity distributions at all C planes**

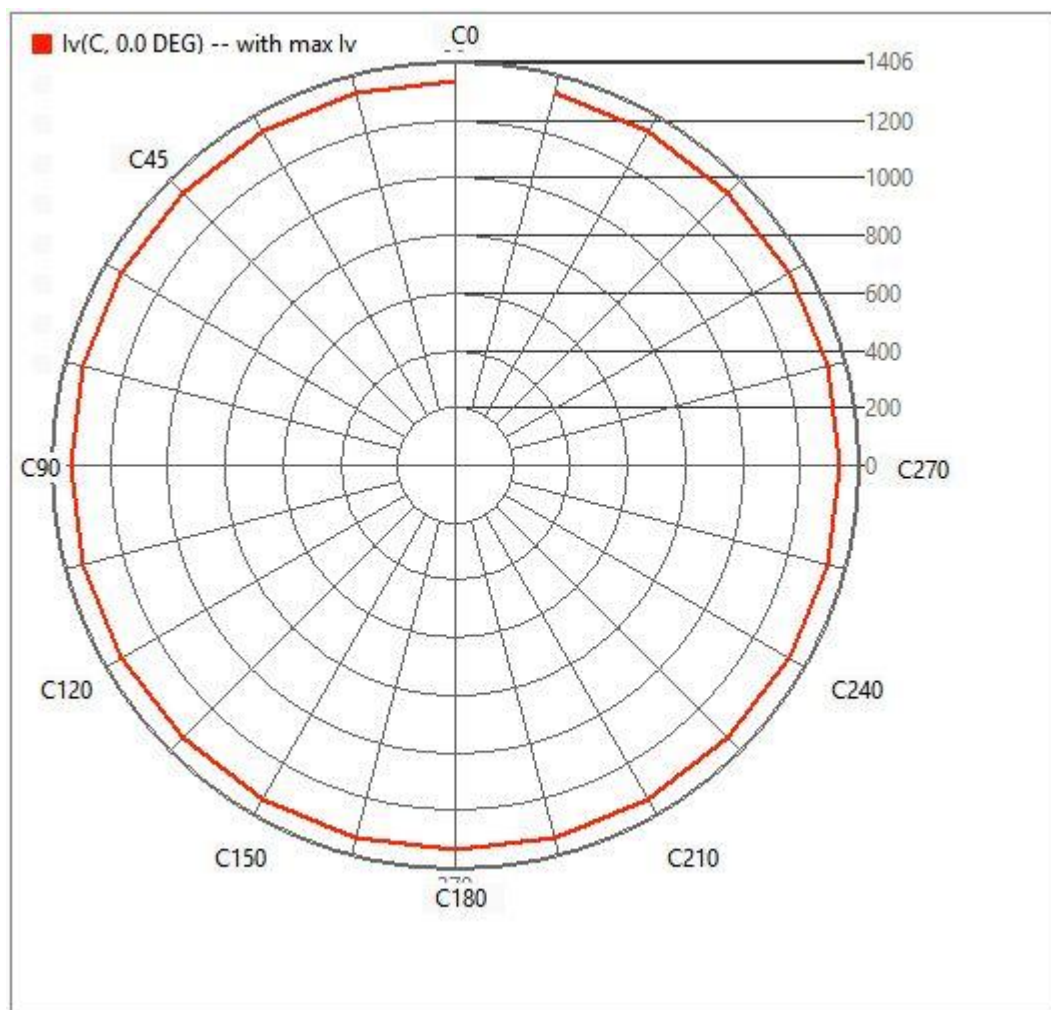
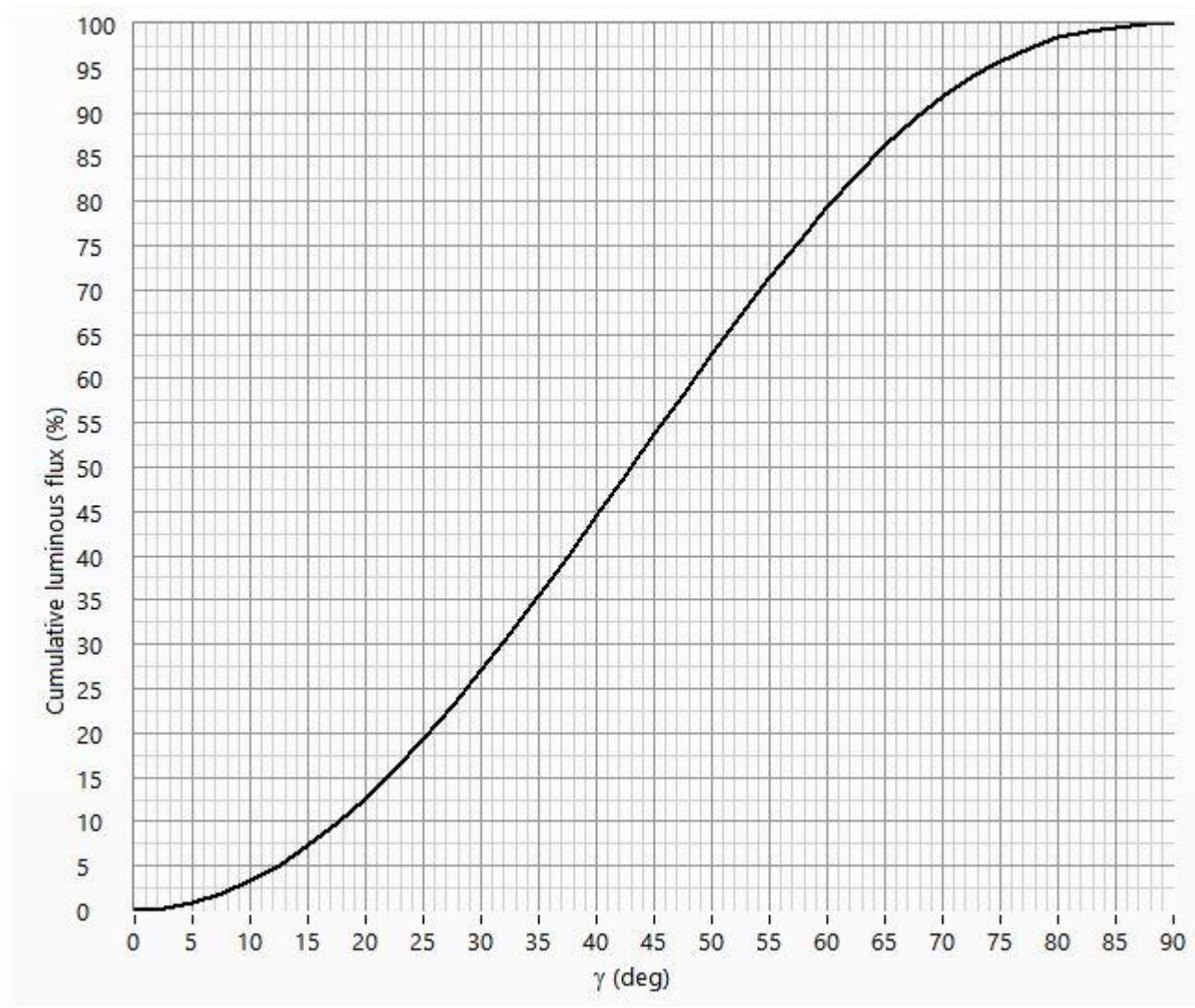
Figure. Isocandela as a function of C plane at gamma angle with maximum luminous intensity

Table. Zonal lumen summary

	Lumens	Relative lumens (%)
0-20	492.70	12.68
0-30	1053.10	27.10
0-40	1729.90	44.52
0-60	3084.90	79.40
0-80	3825.80	98.46
0-90	3885.50	100.00
10-90	3758.70	96.74
20-40	1237.20	31.84
20-50	1946.70	50.10
40-70	1838.80	47.32
40-90	2155.60	55.48
60-80	740.90	19.07
60-90	800.60	20.60
70-80	257.10	6.62
80-90	59.70	1.54
90-110	0.00	0.00
90-120	0.00	0.00
90-130	0.00	0.00
90-150	0.00	0.00
90-180	0.00	0.00
110-180	0.00	0.00
0-180	3885.50	100.00

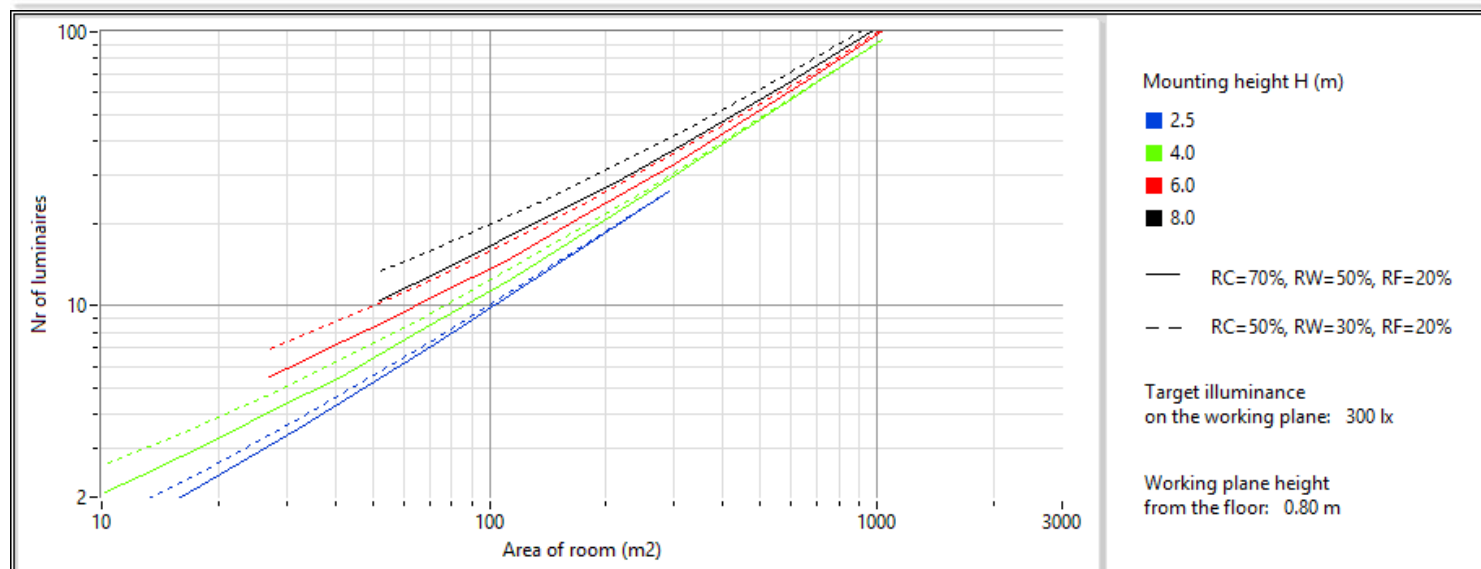
Figure. Cumulative luminous flux

UGR table

Ceiling		70	70	50	50	30	70	70	50	50	30
Walls		50	30	50	30	30	50	30	50	30	30
Floor		20	20	20	20	20	20	20	20	20	20
Room size		Viewing direction at right angles to lamp axis					Viewing direction parallel to lamp axis				
X	Y										
2H	2H	27.9	29.5	28.2	29.8	30.1	28.3	29.9	28.6	30.2	30.5
	3H	29.5	31.0	29.9	31.3	31.7	30.0	31.5	30.4	31.8	32.2
	4H	30.1	31.5	30.5	31.8	32.2	30.6	32.0	31.0	32.4	32.7
	6H	30.5	31.8	30.9	32.1	32.5	31.1	32.4	31.5	32.7	33.1
	8H	30.6	31.8	31.0	32.2	32.6	31.2	32.4	31.6	32.8	33.2
	12H	30.6	31.8	31.1	32.2	32.6	31.3	32.4	31.7	32.8	33.2
4H	2H	28.5	29.9	28.9	30.2	30.6	28.8	30.2	29.2	30.5	30.9
	3H	30.3	31.5	30.7	31.9	32.3	30.7	31.9	31.1	32.3	32.7
	4H	31.0	32.1	31.4	32.5	32.9	31.5	32.5	31.9	32.9	33.4
	6H	31.5	32.4	32.0	32.9	33.3	32.0	32.9	32.4	33.3	33.8
	8H	31.7	32.5	32.1	33.0	33.4	32.1	33.0	32.6	33.4	33.9
	12H	31.8	32.5	32.2	33.0	33.5	32.2	33.0	32.7	33.5	33.9
8H	4H	31.3	32.2	31.7	32.6	33.1	31.7	32.5	32.1	33.0	33.5
	6H	31.9	32.6	32.4	33.1	33.6	32.3	33.0	32.8	33.5	34.0
	8H	32.1	32.7	32.6	33.2	33.7	32.5	33.1	33.0	33.6	34.1
	12H	32.2	32.8	32.7	33.3	33.8	32.6	33.2	33.1	33.7	34.2
12H	4H	31.3	32.1	31.8	32.6	33.0	31.7	32.5	32.2	33.0	33.4
	6H	31.9	32.6	32.4	33.0	33.6	32.3	33.0	32.8	33.4	34.0
	8H	32.2	32.7	32.7	33.2	33.8	32.6	33.1	33.1	33.6	34.2

CU table

RC	80				70				50			30			10		
RW	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10
RF / RCR	20				20				20			20			20		
0	119	119	119	119	116	116	116	116	111	111	111	106	106	106	102	102	102
1	88	84	80	77	89	85	82	79	88	85	83	91	88	86	93	91	89
2	84	77	71	66	84	77	72	67	79	74	70	80	76	72	81	77	74
3	79	70	63	57	79	70	63	58	70	64	59	71	65	61	71	66	62
4	74	63	56	49	73	63	56	50	63	57	51	63	57	52	63	58	53
5	69	58	49	43	69	58	50	44	57	50	45	57	50	45	57	51	46
6	65	53	44	38	64	52	44	39	52	45	39	52	45	40	51	45	40
7	61	48	40	34	60	48	40	34	47	40	35	47	40	35	47	40	36
8	57	44	36	31	56	44	36	31	44	36	31	43	36	32	43	36	32
9	54	41	33	28	53	41	33	28	40	33	28	40	33	28	39	33	29
10	51	38	30	25	50	38	30	25	37	30	26	37	30	26	36	30	26



CONE DIAGRAM

- Cone is limited by the beam angle at the planes of C0 and C90
- H = Mounting Height
- D = Cone diameter
- Ev Edge = illuminance at the edge of the cone of the C0/90 plane
- Ev Center = illuminance at the center of the cone

H (m)	D (m) C0-180	D (m) C90-270	Ev (lx) Center	Ev (lx) Edge, C0-180	Ev (lx) Edge, C90-270
1.0	3.0	3.4	1339	112	90
2.0	6.0	6.7	335	28	22
2.5	7.6	8.4	214	18	14
3.0	9.1	10	149	12	10.0
4.0	12	13	84	7.0	5.6
5.0	15	17	54	4.5	3.6

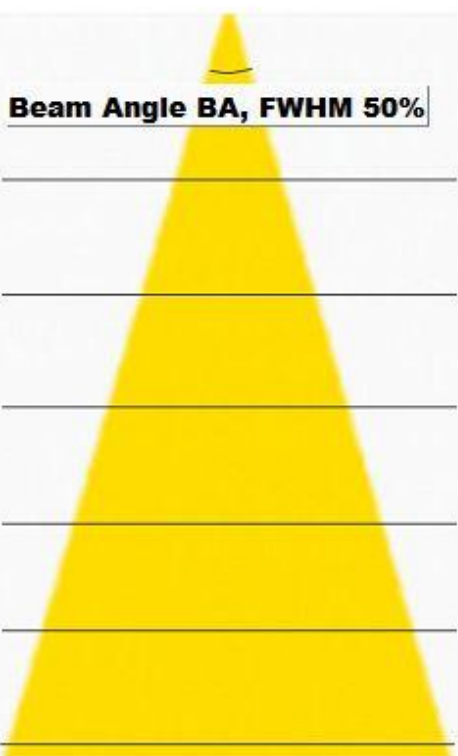


Table - Measurement information of Goniospectrometric measurement

Ambient temperature of the laboratory	25.0 degC
Power supply	230.0 Vac
Measurement distance	3150 mm
Location of the rotation axis	0 mm
Angular step, C plane	90.0 deg
Angular step, gamma angle	10.0 deg
Maximum gamma angle	80.0 deg
Stabilization time	35 min

Table - Measurement results of the total colorimetric parameters

Color coordinates in CIE 1931 diagram	x,y	(0.3790, 0.3755)
Color coordinates in CIE 1976 diagram	u',v'	(0.2246, 0.5008)
Correlated color temperature	CCT	4031 K
General color rendering index	CRI, Ra	84.2
Spatial color uniformity	SDCM	2.7
Distance from Planckian locus	Du'v'	0.000

Weighted average of the angular color measurements. --SDCM = Maximum deviation of the angular u' , v' measurements from the weighted average. -- SDCM corresponds 1-step MacAdam Ellipse, 1 SDCM corresponds to $u'v' = 0.001$

Table - Total special color rendering indices















R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
82.8	91.6	96.0	82.0	82.9	87.9	85.5	64.8	11.6	79.8	81.2	65.2	85.2	98.4
													

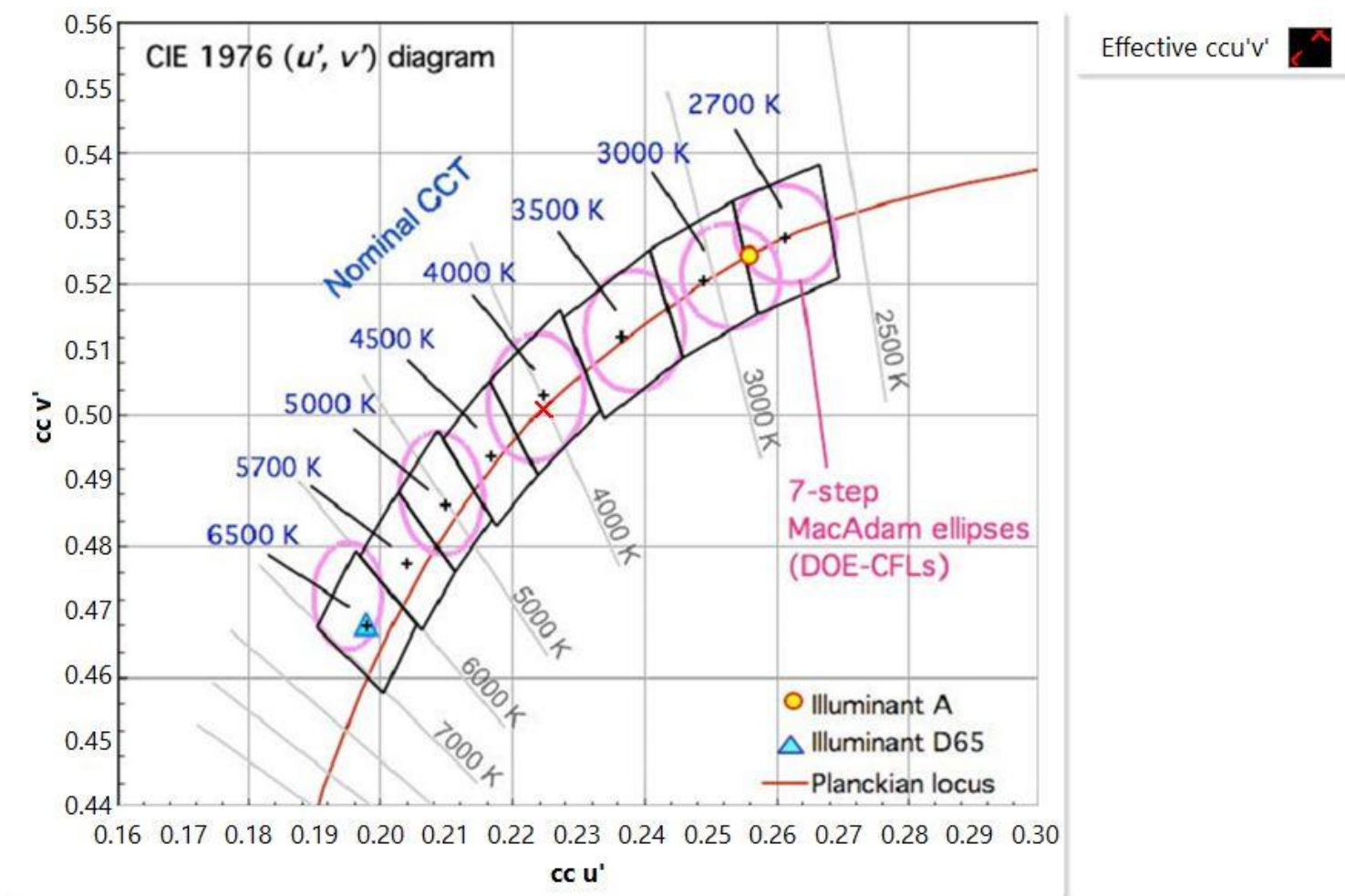
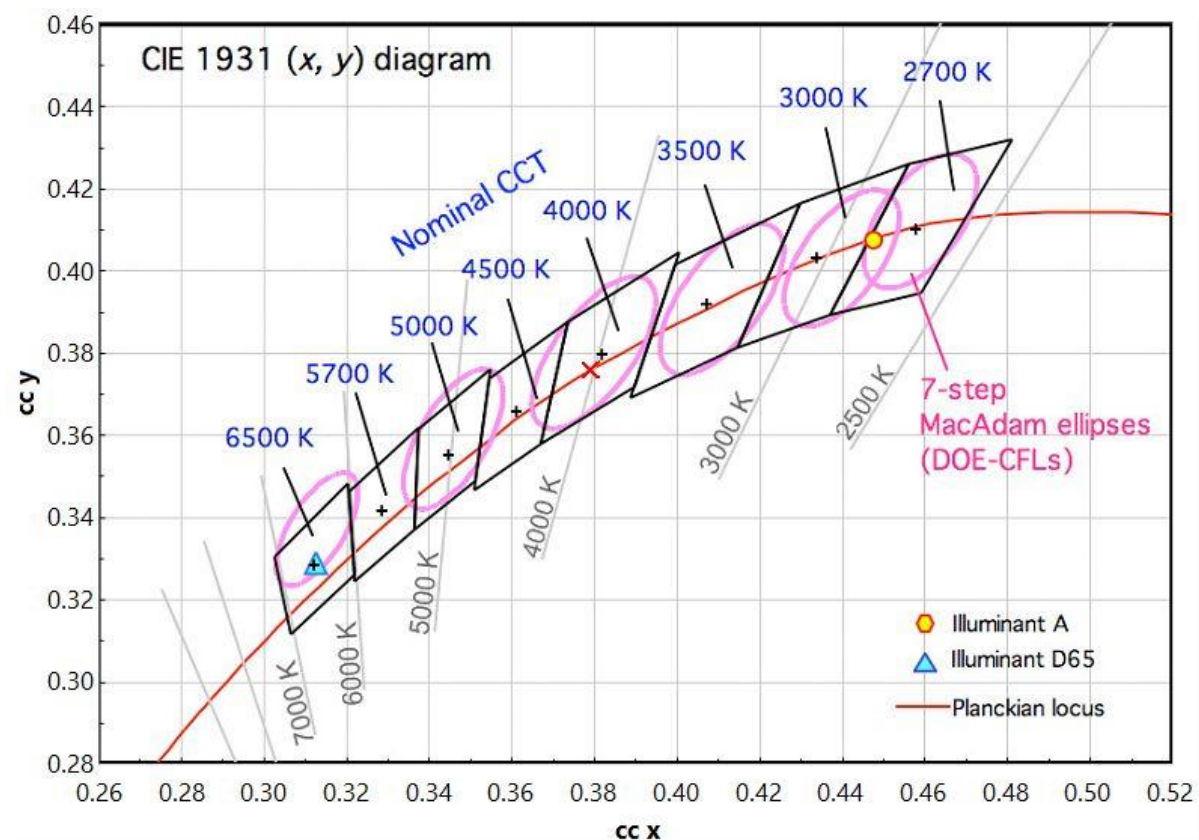
Figure - Weighted average color coordinates (u' , v') in CIE 1976 color diagram

Figure - Weighted average color coordinates (x,y) in CIE 1931 color diagram

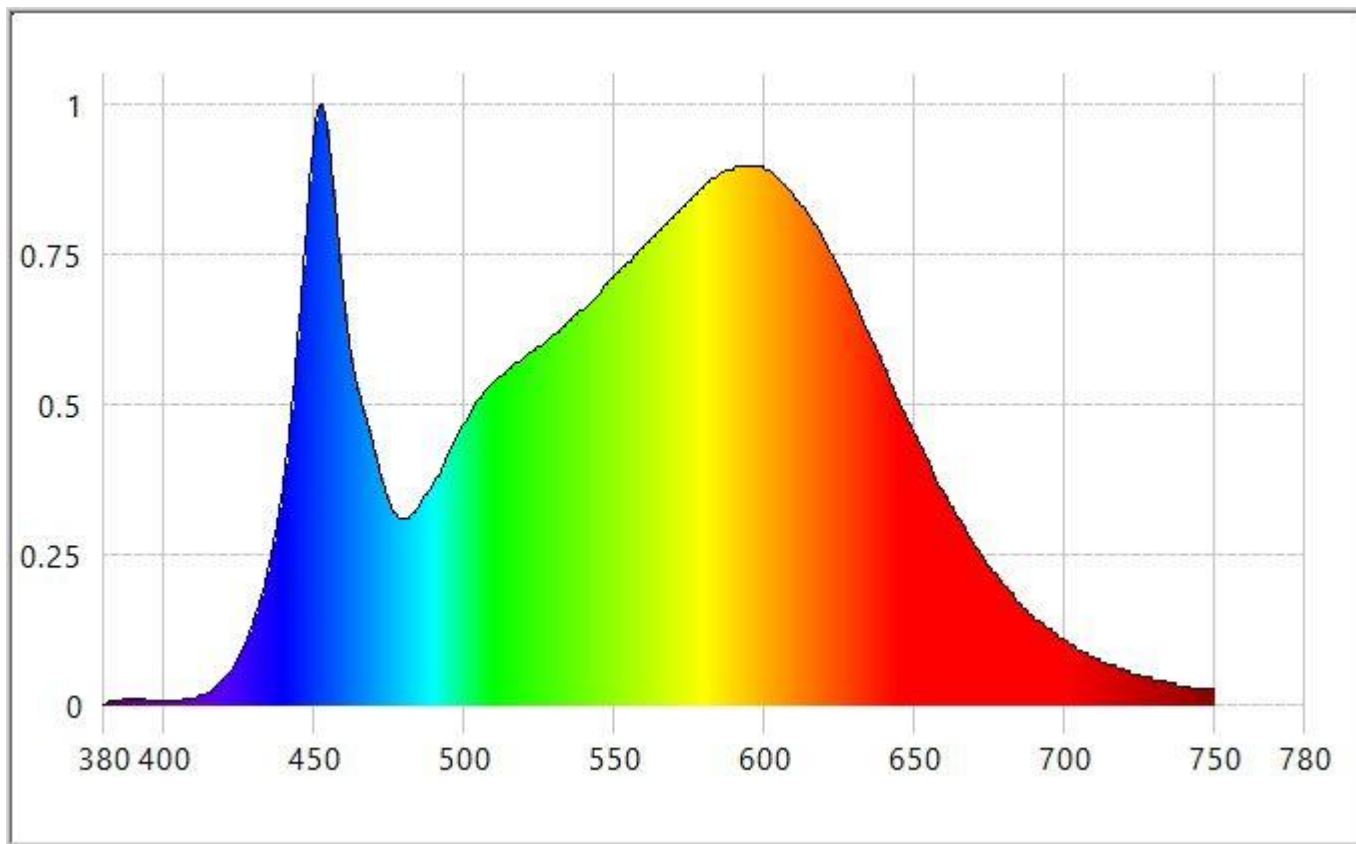


Figure - Total spectral radiant flux

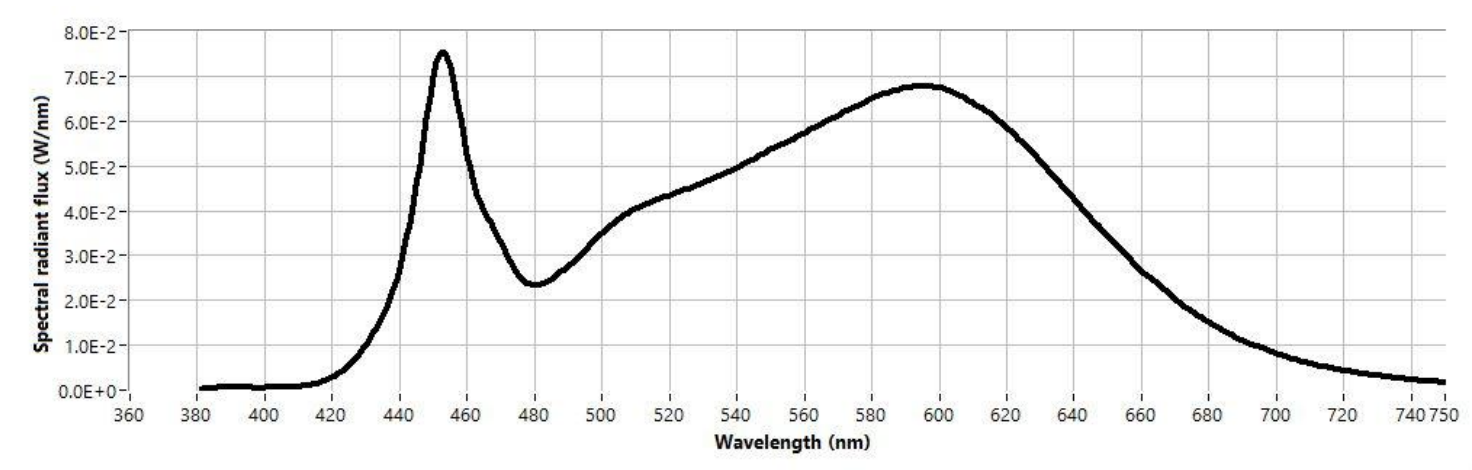
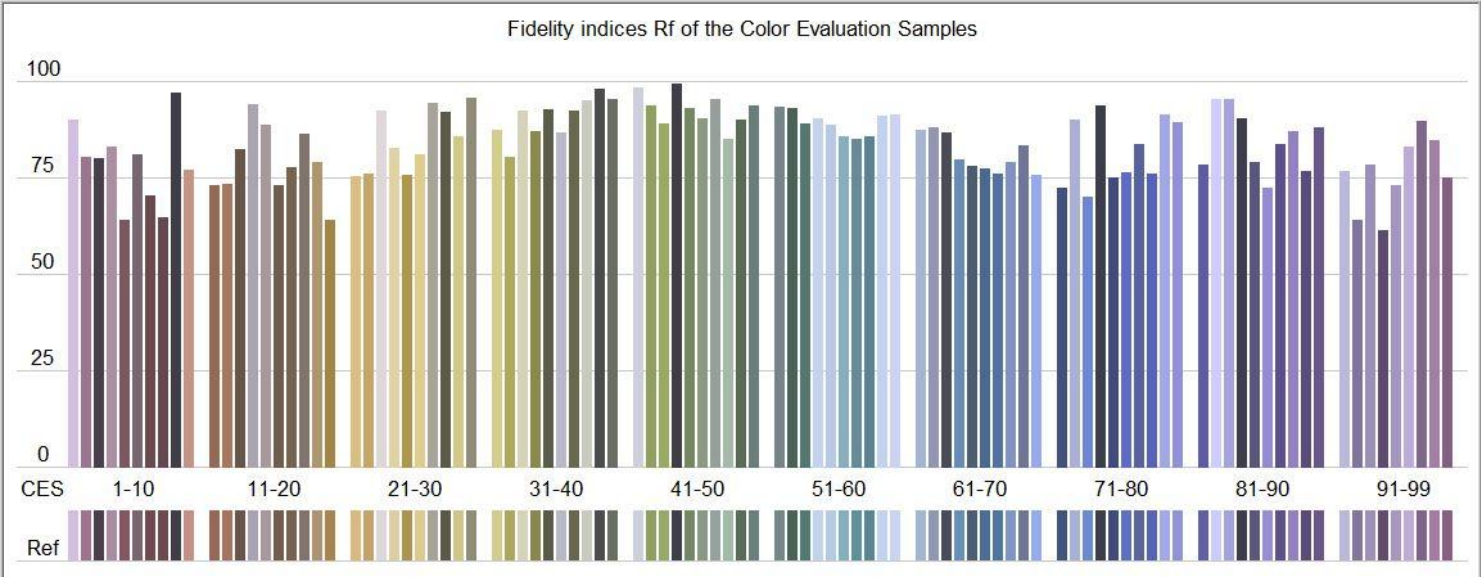
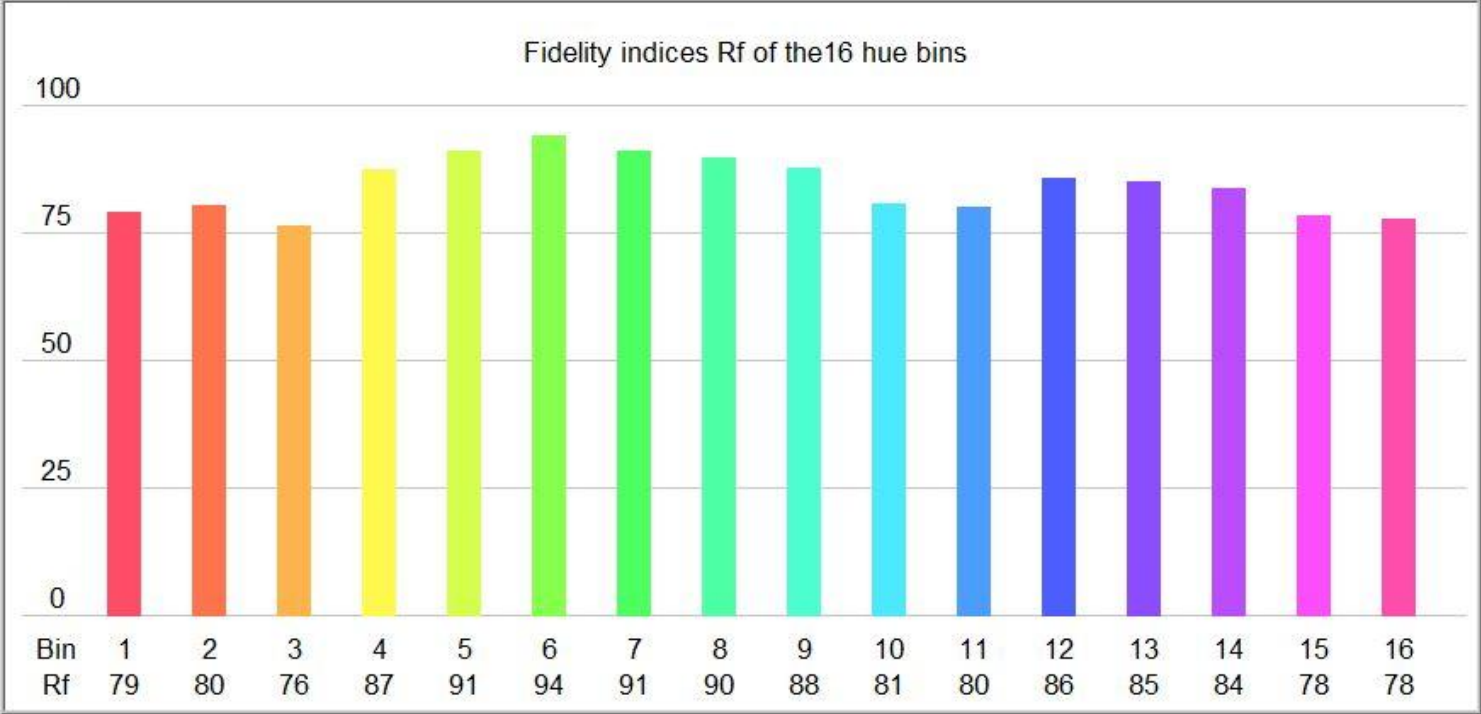


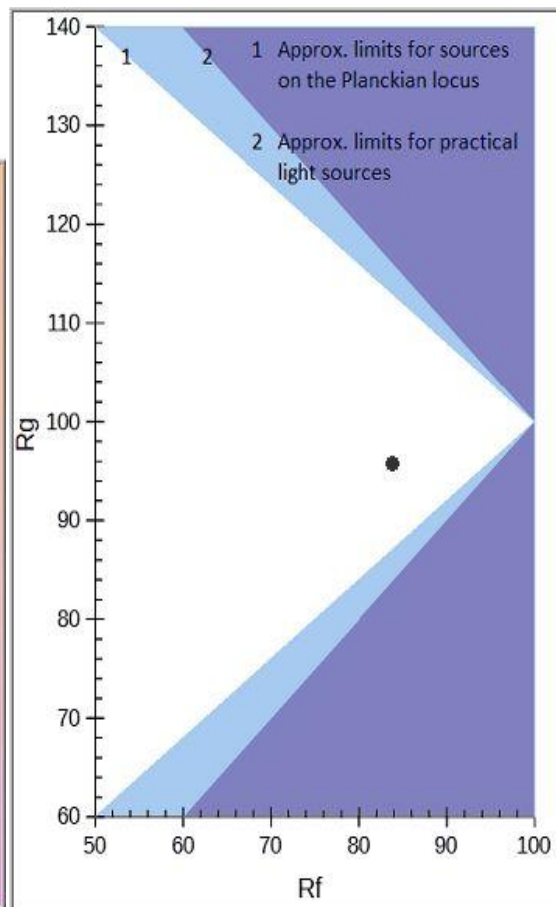
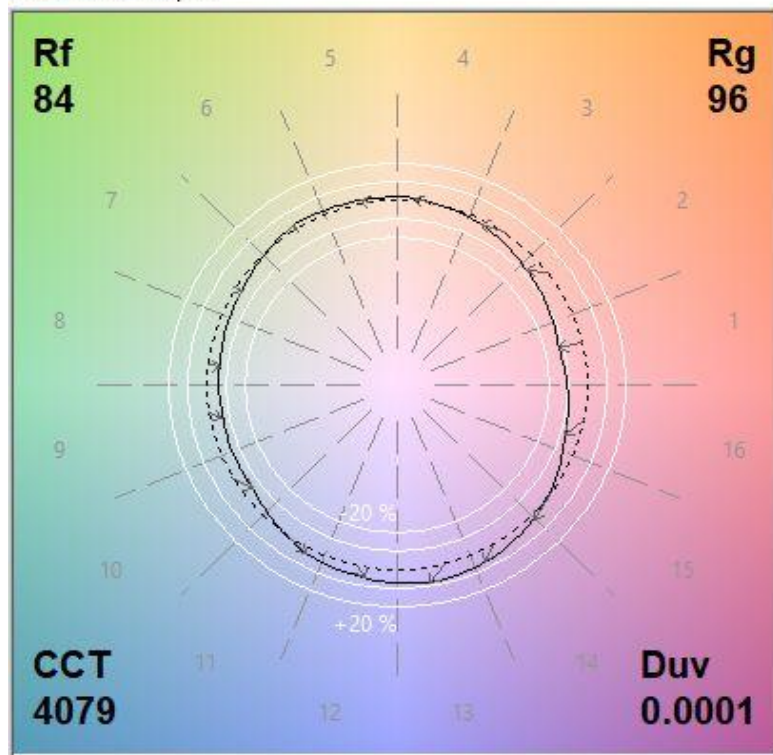
Table - Color rendition values according to TM30-18



Fidelity index



Color Vector Graphic



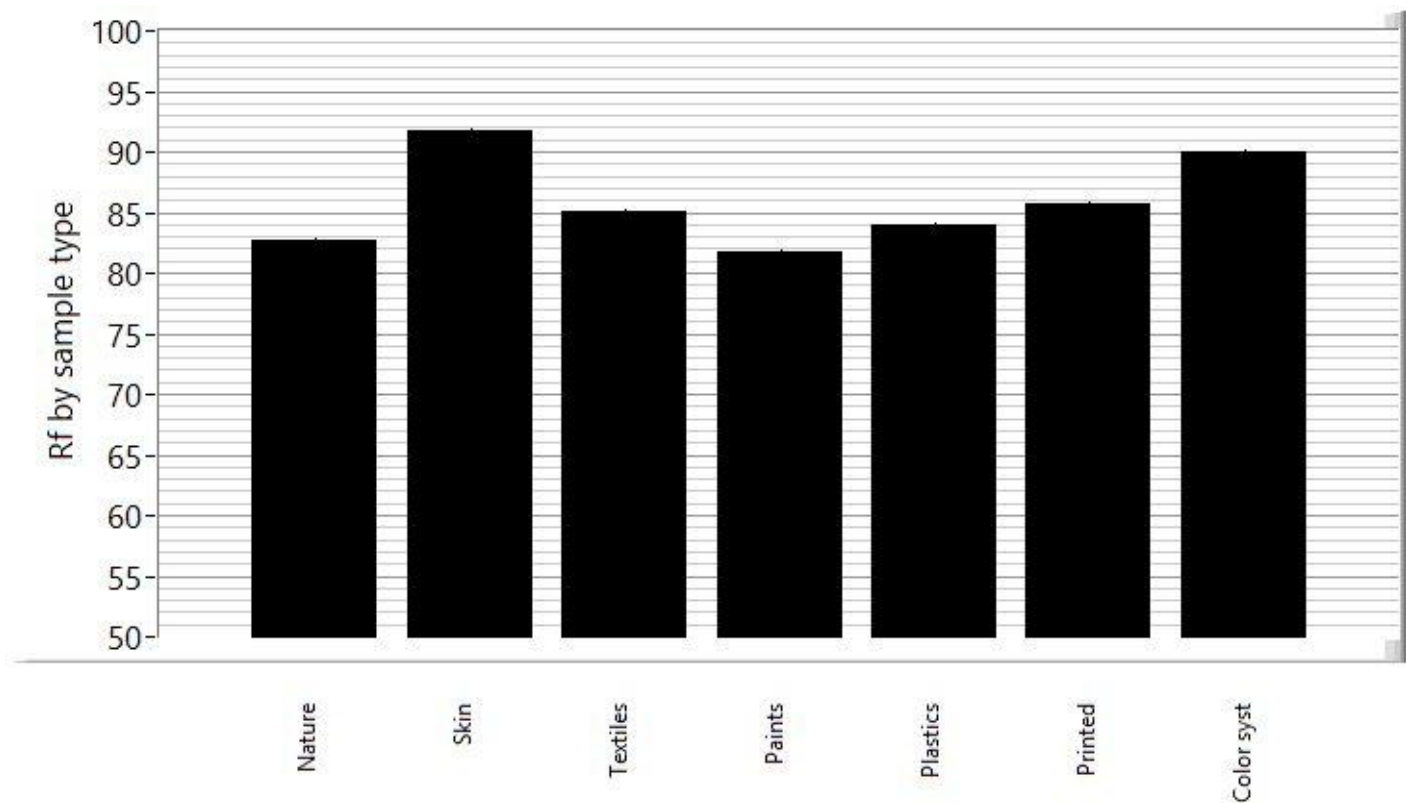


Table - Color coordinates u'v' at different angles in CIE1976 color diagram

C-plane	gamma	u'	v'
0	80	0.2257	0.5033
0	70	0.2255	0.5023
0	60	0.2253	0.5015
0	50	0.2250	0.5012
0	40	0.2248	0.5013
0	30	0.2244	0.5008
0	20	0.2244	0.5007
0	10	0.2243	0.5006
0	0	0.2243	0.5005
180	80	Iv < 10%	Iv < 10%
180	70	0.2255	0.5022
180	60	0.2252	0.5014
180	50	0.2250	0.5011
180	40	0.2248	0.5009
180	30	0.2244	0.5005
180	20	0.2244	0.5004
180	10	0.2242	0.5004
180	0	0.2242	0.5003
90	80	0.2241	0.4996
90	70	0.2246	0.5007
90	60	0.2247	0.5007
90	50	0.2245	0.5006
90	40	0.2244	0.5006
90	30	0.2243	0.5005
90	20	0.2243	0.5004
90	10	0.2242	0.5003
90	0	0.2242	0.5003
270	80	0.2241	0.4994
270	70	0.2246	0.5008
270	60	0.2246	0.5007
270	50	0.2246	0.5005
270	40	0.2245	0.5005
270	30	0.2245	0.5003
270	20	0.2243	0.5004
270	10	0.2242	0.5002
270	0	0.2241	0.5002

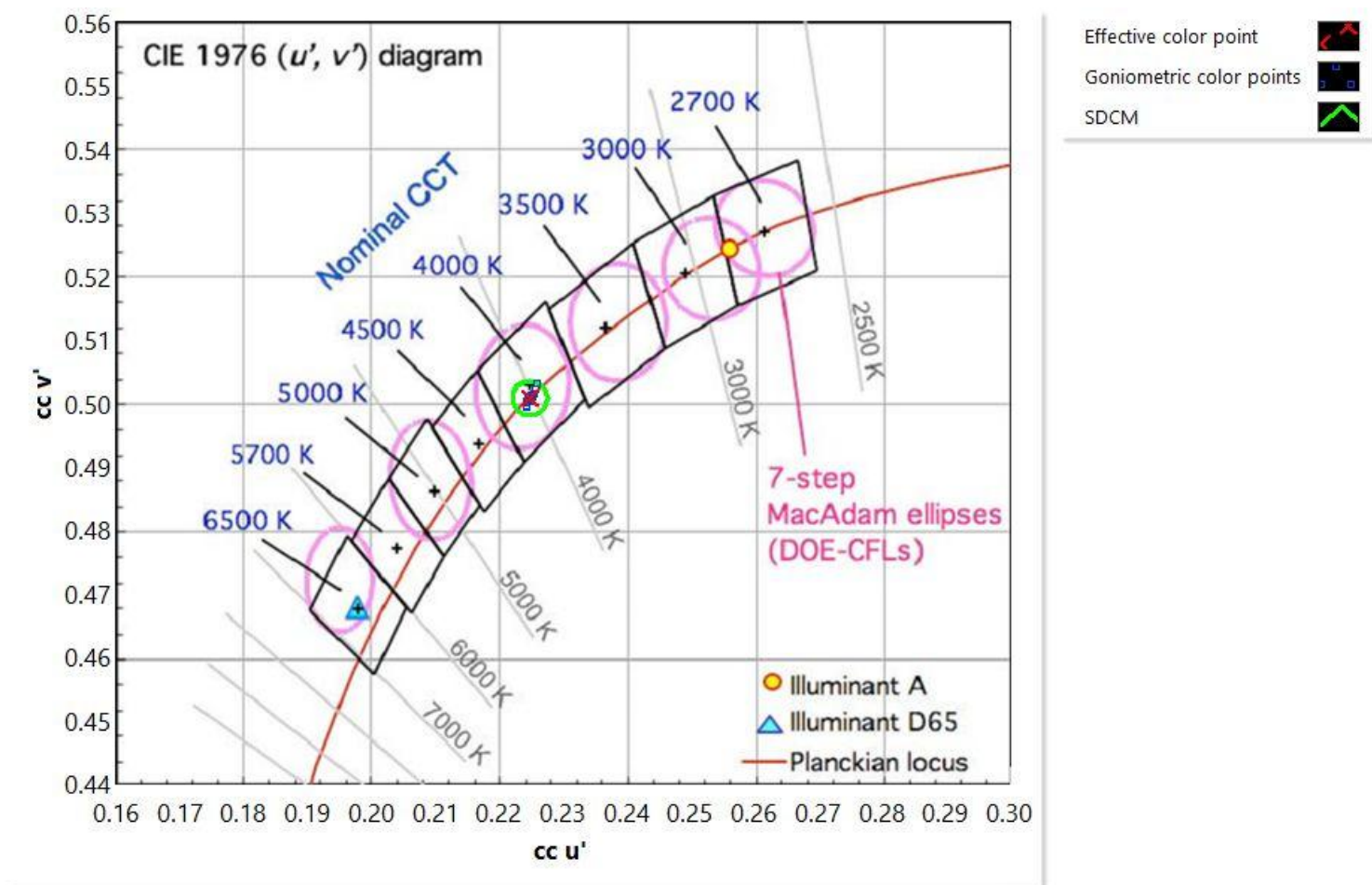
Figure - Spatial color uniformity in CIE1976 diagram

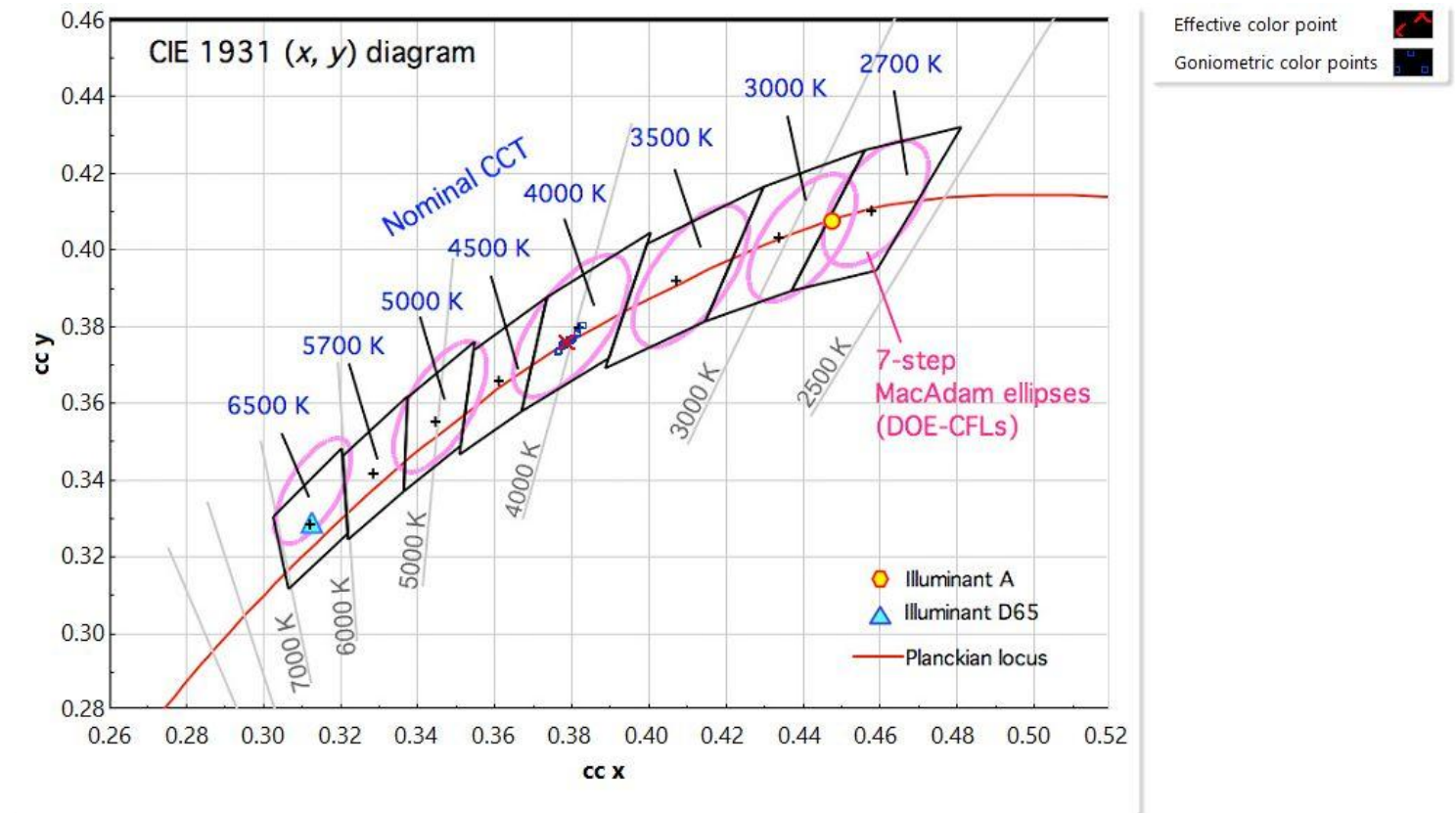
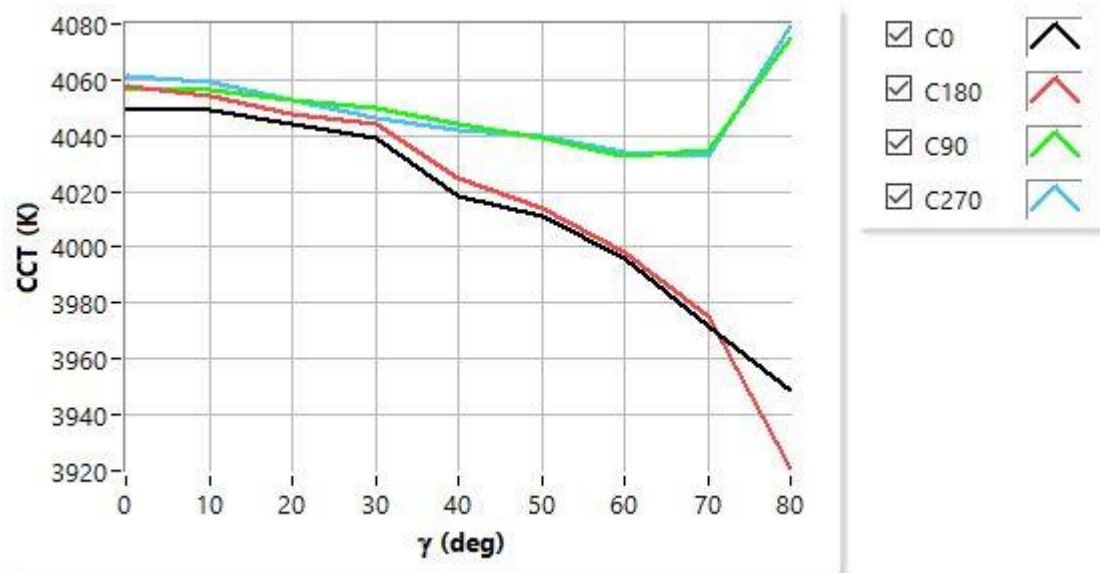
Figure - Spatial color uniformity in CIE1931 diagram

Figure - CCT as a function of angle**Figure - CRI, Ra as a function of angle**