

# SRPSKO DRUŠTVO ZA OSVETLJENJE

## „Osvetljenje 2013“

---

**Doc. dr Ivan Rakonjac<sup>1</sup>, Ivana Rakonjac, d.i.a<sup>2</sup>**

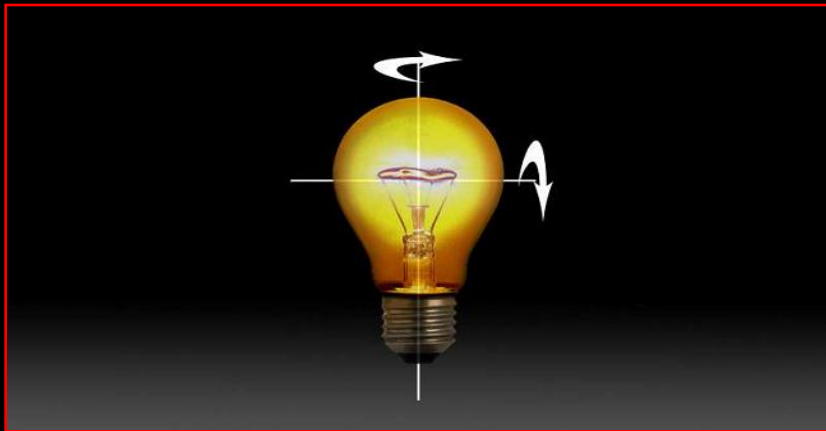
1. Meteor d.o.o. Fabrika svetiljki i stubova, Beograd
2. Arhitektonski fakultet, Beograd

**Ispitivanje svetlotehničkih karakteristika  
svetiljki u dalekom polju na primeru  
fotometrijske laboratorije Meteor Beograd**

# Goniofotometrija

Merenje raspodele intenziteta svetlosti ispitivanog izvora svetlosti ili svetiljke

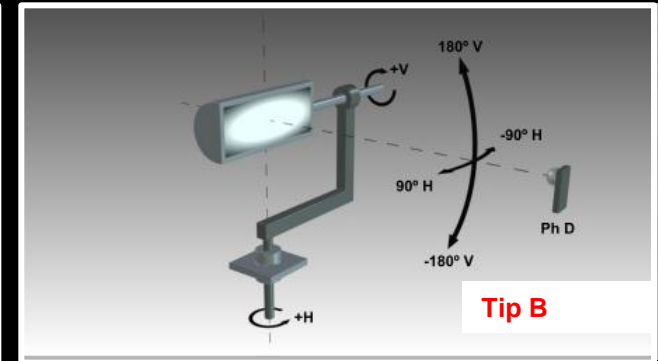
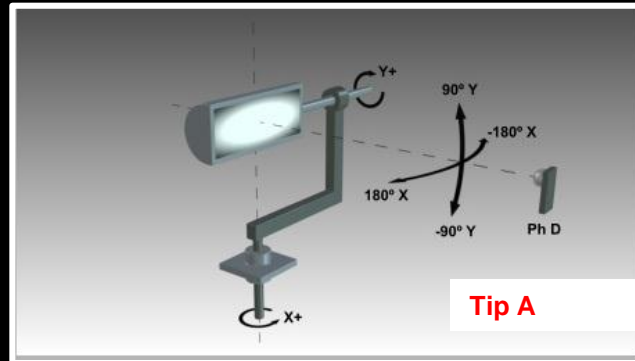
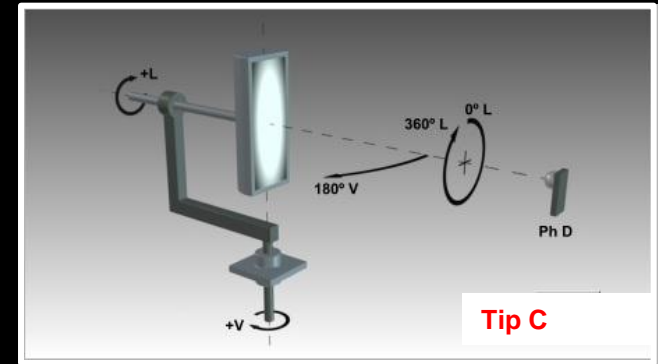
- Tipovi prema polju merenja
  - Blisko polje: osvetljenost  $E_v$  (lx;  $\text{lm}/\text{m}^2$ )
  - Daleko polje: jačina svetlosti  $I_v$  (cd;  $\text{lm}/\text{sr}$ )



# Goniofotometrija

## Tipovi prema fotometrijskom koordinatnom sistemu (IESNA LM-75-01)

- Tip A
- Tip B
- Tip C



# Goniofotometrija

## Tipovi prema poziciji detektora

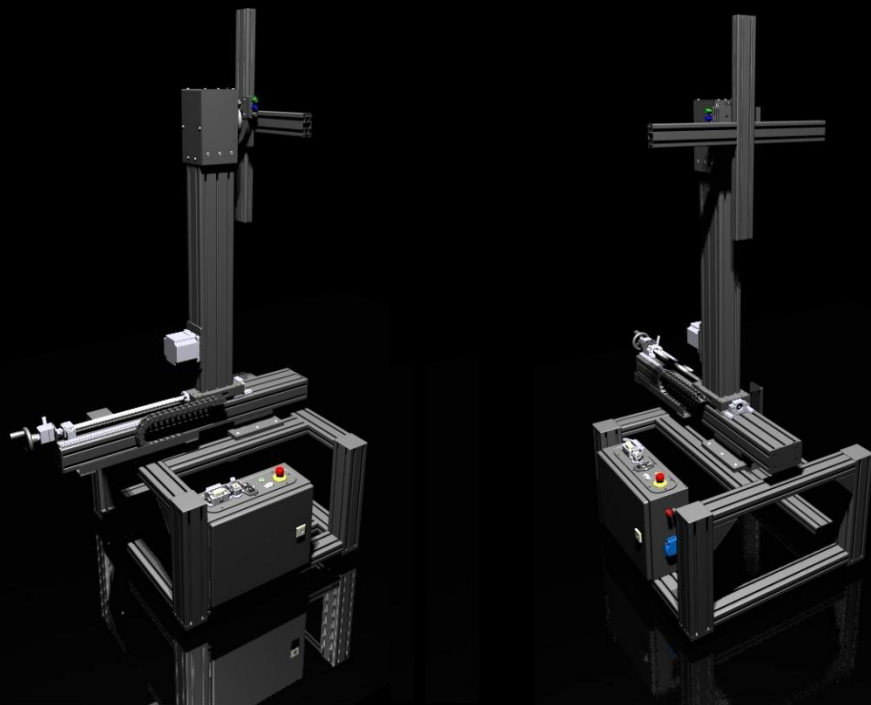
- Nepokretni detektor (Tip A, Tip B, Tip C)
- Nepokretni detektor sa ogledalom (Tip C)
- Pokretni detektor (Tip C)



# Oprema

---

## Goniofotometar Tip C



maksimalna masa  
svetiljke: 30 kg

maksimalni prečnik  
svetiljke: 1500 mm

fotometar:  
Konica Minolta CL 200-A

# Oprema

---

## Goniofotometar Tip C

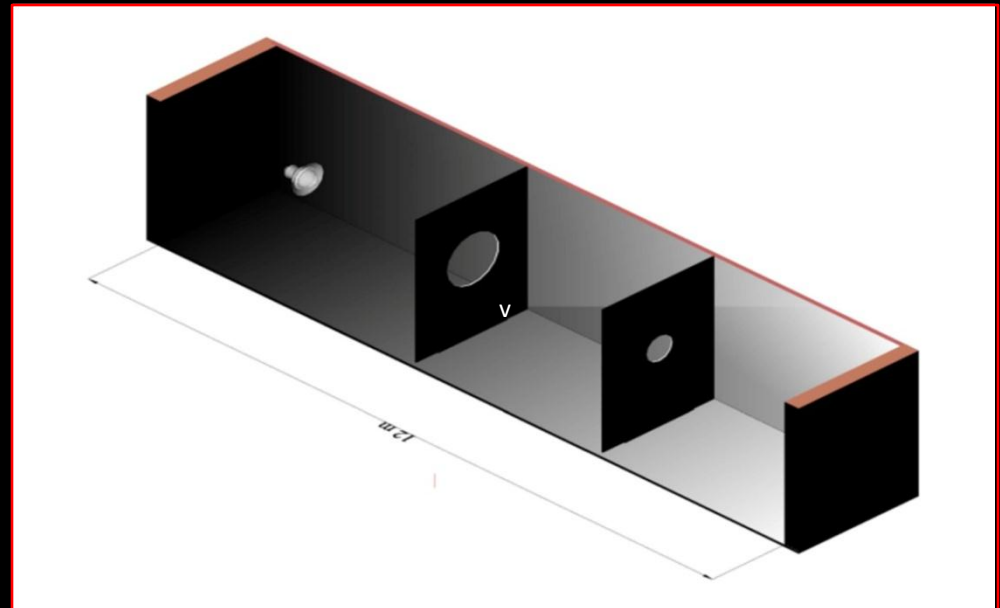
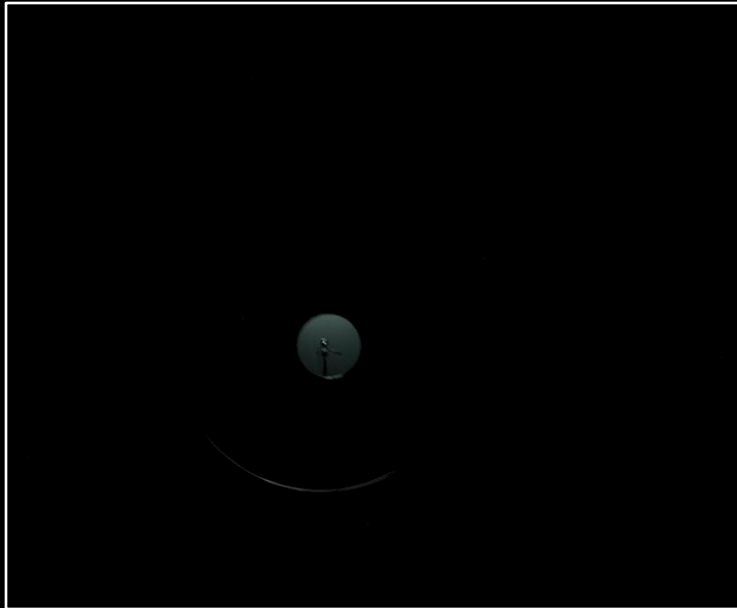


Fotometrijska laboratorija  
**Meteor** Beograd

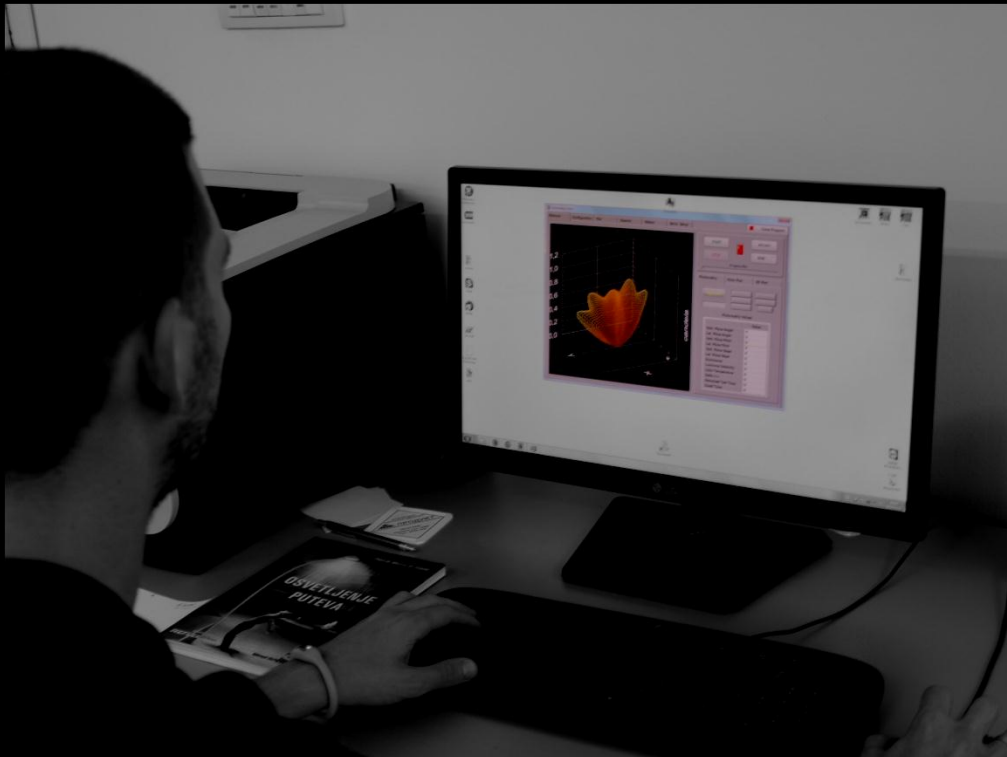
# Instalacija

Posebno projektovana mračna komora

- dužina optičkog puta 10 m (uslov  $L \Rightarrow 10 \times D$ )
- zidovi obloženi specijalnim nereflektujućim materijalom



# Upravljanje



<b>Test</b>	Linea LED 01.08/13 72W Preliminary
<b>Manufac</b>	Meteor d.o.o.
<b>Testlab</b>	Meteor Lab
<b>Lumcat</b>	Solid State Ligting
<b>Luminarie</b>	Linea - LED
<b>Lamp Cat.</b>	LED
<b>Lamp</b>	CREE 72W Ledil Strada
<b>Issue Date</b>	12.8.2013 11:14





# Merenje

## Konfiguracija

The image shows a screenshot of the 'Goniometer\_V16.vi' software interface. The main window has tabs for 'Measure', 'Configuration', and 'File'. The 'Photometric Data Setup' dialog box is open, displaying various configuration parameters for a photometric measurement.

**Photometric Data File**

- Lat. Plane Scan: [Dropdown]
- Configure: [Button]
- L Pos. Delay: [0 s]
- V Pos. Delay: [0 s]
- LDT Setup: [Button]
- Gonim. Type C: [Dropdown]
- Minolta: [Dropdown]

**Photometric Data Setup**

- L Plane Scan Angle: [360 deg]
- V Plane Scan Angle: [90 deg]
- L Plane Pitch: [2,5 deg]
- V Plane Pitch: [2,5 deg]
- Vertical Offset (B): [0 deg]
- Horizon. Offset (B): [0 deg]
- Distance: [8 m]
- Light Threshold: [1 lx]
- Default Settings: [Button]
- Asymmetrical: [Dropdown]
- Meters: [Dropdown]
- Far Field: [Dropdown]
- Rated Lumens: [7100 lm]
- Wattage: [86 W]
- Conv. Factor: [1]
- Balast Factor: [1]

**Luminous Opening**

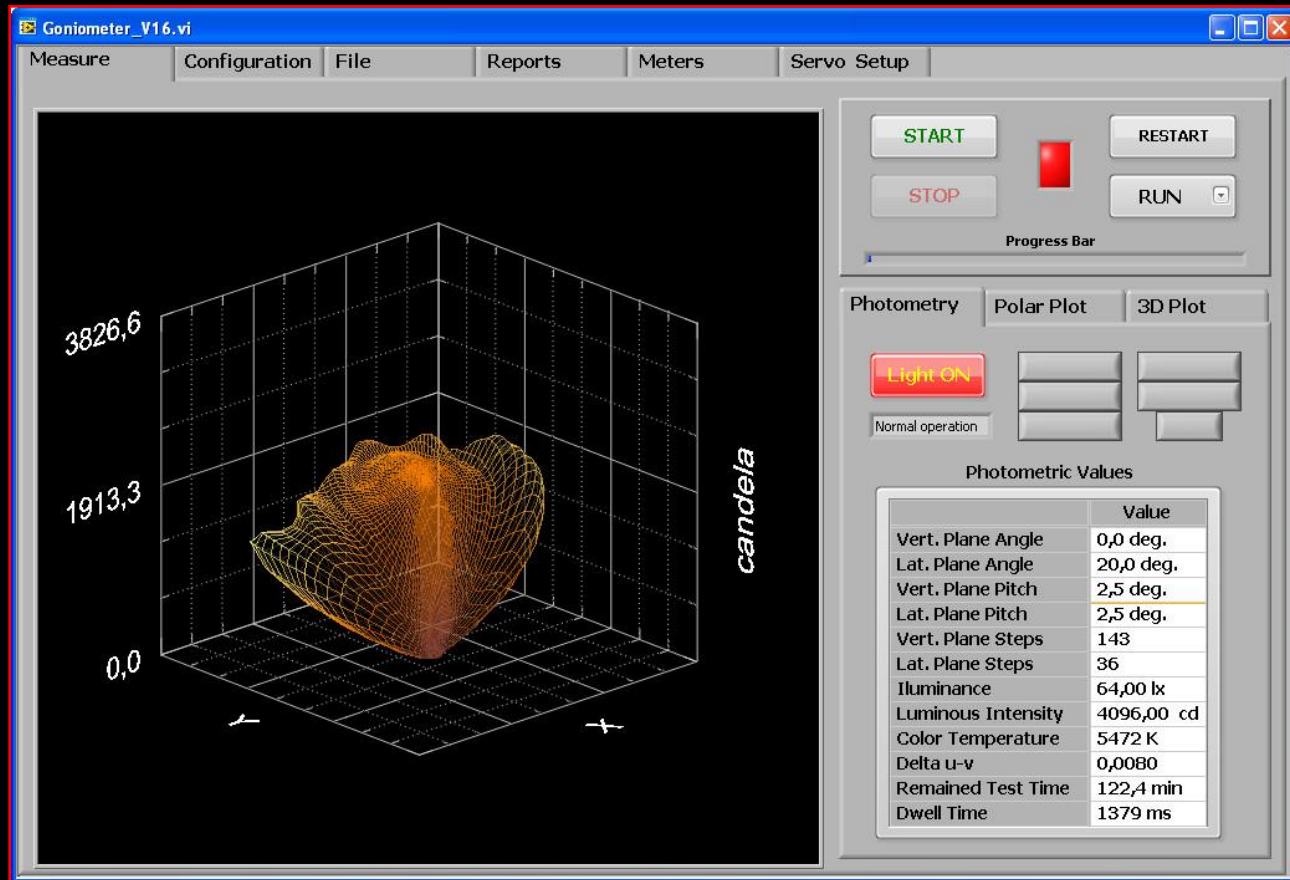
- Height: [0 m]
- Width: [0,05 m]
- Length: [0,15 m]
- Shape: [Rectang]

Buttons: OK, CANCEL

**Diagram:** A 3D diagram of a goniometer arm with a light source. The diagram shows the horizontal rotation angle (+L) and vertical rotation angle (+V). The horizontal angle is labeled as 360° and the vertical angle as 180°.

# Merenje

## Obrada podataka



# Merenje

## Jačina svetlosti

Goniometer\_V16.vi

Measure Configuration File Reports Meters Servo Setup

File Luminous Intensity Color Temperature Delta u v INI File

Luminous Intensity [Cd]

	V0.0°	V2.5°	V5.0°	V7.5°	V10.0°	V12.5°	V15.0°	V17.5°	V20.0°	V22.5°	V25.0°	V27.5°	V30.0°	V32.5°	V35.0°	V37.5°	V40.0°
L0.0°	1933.4	1939.2	1932.8	1926.4	1926.4	1926.4	1926.4	1926.4	1932.8	1932.8	1939.2	1945.6	1964.8	1984.0	2009.6	2035.2	2067.2
L2.5°	1933.4	1939.2	1926.4	1913.6	1913.6	1907.2	1907.2	1900.8	1900.8	1900.8	1900.8	1907.2	1920.0	1939.2	1958.4	1977.6	1997.6
L5.0°	1933.4	1932.8	1920.0	1900.8	1894.4	1888.0	1881.6	1875.2	1868.8	1862.4	1856.0	1849.6	1849.6	1849.6	1862.4	1868.8	1881.6
L7.5°	1933.4	1932.8	1913.6	1894.4	1881.6	1868.8	1856.0	1843.2	1830.4	1817.6	1804.8	1792.0	1785.6	1779.2	1785.6	1785.6	1779.2
L10.0°	1933.4	1926.4	1900.8	1881.6	1862.4	1843.2	1824.0	1811.2	1792.0	1772.8	1753.6	1734.4	1715.2	1702.4	1689.6	1683.2	1664.0
L12.5°	1933.4	1926.4	1894.4	1868.8	1843.2	1824.0	1798.4	1772.8	1747.2	1721.6	1696.0	1670.4	1644.8	1612.8	1580.8	1548.8	1516.0
L15.0°	1933.4	1926.4	1888.0	1856.0	1824.0	1798.4	1766.4	1734.4	1702.4	1670.4	1632.0	1593.6	1548.8	1497.6	1446.4	1401.6	1363.2
L17.5°	1933.4	1920.0	1881.6	1843.2	1804.8	1772.8	1734.4	1696.0	1657.6	1612.8	1561.6	1504.0	1440.0	1369.6	1312.0	1267.2	1228.8
L20.0°	1933.4	1920.0	1875.2	1830.4	1785.6	1747.2	1702.4	1651.2	1606.4	1548.8	1472.0	1401.6	1324.8	1254.4	1196.8	1152.0	1107.2
L22.5°	1933.4	1913.6	1868.8	1817.6	1766.4	1721.6	1664.0	1612.8	1548.8	1465.6	1382.4	1299.2	1222.4	1152.0	1094.4	1043.2	1004.0
L25.0°	1933.4	1913.6	1862.4	1804.8	1747.2	1689.6	1632.0	1568.0	1478.4	1388.8	1286.4	1203.2	1126.4	1062.4	1004.8	953.6	915.2
L27.5°	1933.4	1913.6	1849.6	1792.0	1728.0	1664.0	1593.6	1510.4	1414.4	1305.6	1203.2	1120.0	1049.6	979.2	915.2	870.4	819.2
L30.0°	1933.4	1907.2	1843.2	1779.2	1708.8	1638.4	1555.2	1452.8	1337.6	1228.8	1139.2	1049.6	972.8	902.4	844.8	787.2	742.4
L32.5°	1933.4	1907.2	1836.8	1766.4	1689.6	1606.4	1510.4	1395.2	1267.2	1158.4	1062.4	979.2	908.8	838.4	768.0	710.4	665.6
L35.0°	1933.4	1900.8	1830.4	1753.6	1664.0	1580.8	1465.6	1337.6	1203.2	1094.4	998.4	921.6	844.8	774.4	704.0	652.8	608.0
L37.5°	1933.4	1900.8	1824.0	1740.8	1644.8	1548.8	1420.8	1280.0	1145.6	1036.8	940.8	864.0	787.2	710.4	646.4	601.6	563.2
L40.0°	1933.4	1900.8	1817.6	1728.0	1625.6	1516.8	1376.0	1222.4	1094.4	985.6	889.6	806.4	729.6	659.2	601.6	563.2	524.8
L42.5°	1933.4	1894.4	1811.2	1715.2	1606.4	1484.8	1324.8	1177.6	1043.2	934.4	844.8	755.2	678.4	614.4	569.6	531.2	492.8
L45.0°	1933.4	1894.4	1804.8	1702.4	1580.8	1446.4	1280.0	1132.8	998.4	889.6	800.0	710.4	633.6	582.4	537.6	499.2	460.8
L47.5°	1933.4	1894.4	1798.4	1689.6	1568.0	1414.4	1241.6	1088.0	960.0	851.2	755.2	672.0	601.6	550.4	518.4	473.6	435.2
L50.0°	1933.4	1888.0	1792.0	1676.8	1548.8	1382.4	1196.8	1049.6	921.6	812.8	716.8	640.0	569.6	524.8	488.0	454.4	409.6
L52.5°	1933.4	1888.0	1785.6	1664.0	1529.6	1350.4	1164.8	1011.2	889.6	774.4	678.4	601.6	550.4	505.6	473.6	428.8	384.0
L55.0°	1933.4	1888.0	1779.2	1651.2	1504.0	1318.4	1132.8	979.2	857.6	742.4	646.4	576.0	524.8	486.4	454.4	409.6	371.2
L57.5°	1933.4	1881.6	1772.8	1644.8	1484.8	1292.8	1100.8	947.2	825.6	710.4	620.8	550.4	505.6	467.2	435.2	396.8	352.0
L60.0°	1933.4	1881.6	1766.4	1632.0	1465.6	1260.8	1068.8	921.6	800.0	684.8	595.2	531.2	492.8	454.4	416.0	377.6	339.2
L62.5°	1933.4	1881.6	1760.0	1625.6	1452.8	1235.2	1043.2	896.0	774.4	659.2	576.0	518.4	473.6	441.6	403.2	364.8	332.8
L65.0°	1933.4	1875.2	1753.6	1612.8	1433.6	1216.0	1024.0	876.8	748.8	640.0	563.2	505.6	467.2	435.2	390.4	352.0	320.0
L67.5°	1933.4	1875.2	1753.6	1606.4	1420.8	1190.4	1004.8	857.6	729.6	627.2	550.4	499.2	454.4	422.4	377.6	339.2	313.6
L70.0°	1933.4	1875.2	1747.2	1600.0	1401.6	1177.6	985.6	838.4	716.8	608.0	537.6	486.4	448.0	416.0	371.2	332.8	313.6
L72.5°	1933.4	1875.2	1747.2	1593.6	1395.2	1158.4	972.8	825.6	697.6	601.6	531.2	480.0	441.6	409.6	364.8	332.8	307.2

# Merenje

## Temperatura boje

Goniometer\_V16.vi

Measure Configuration File Reports Meters Servo Setup

File Luminous Intensity Color Temperature Delta u v INI File

Color Temperature K

	V0.0°	V2.5°	V5.0°	V7.5°	V10.0°	V12.5°	V15.0°	V17.5°	V20.0°	V22.5°	V25.0°	V27.5°	V30.0°	V32.5°
L0.0°	4593	4599	4606	4616	4624	4636	4648	4660	4670	4681	4692	4703	4706	4716
L2.5°	4593	4599	4604	4612	4621	4632	4645	4654	4665	4675	4685	4694	4700	4706
L5.0°	4593	4598	4601	4608	4617	4628	4641	4649	4658	4667	4674	4683	4690	4693
L7.5°	4594	4596	4599	4604	4613	4624	4635	4643	4649	4656	4666	4674	4675	4677
L10.0°	4594	4596	4597	4601	4610	4618	4630	4636	4643	4649	4651	4654	4650	4643
L12.5°	4595	4594	4595	4598	4606	4613	4624	4629	4634	4630	4628	4624	4614	4603
L15.0°	4594	4594	4593	4596	4604	4609	4619	4618	4616	4609	4599	4588	4577	4568
L17.5°	4594	4593	4590	4592	4599	4608	4610	4603	4595	4580	4567	4556	4549	4546
L20.0°	4597	4592	4589	4590	4597	4602	4596	4587	4570	4551	4539	4535	4540	4542
L22.5°	4597	4591	4586	4588	4594	4593	4583	4565	4543	4530	4522	4527	4538	4538
L25.0°	4596	4590	4585	4585	4590	4582	4566	4539	4520	4515	4517	4528	4532	4536
L27.5°	4597	4589	4583	4583	4585	4571	4547	4518	4504	4507	4519	4524	4527	4531
L30.0°	4597	4589	4581	4581	4577	4560	4526	4500	4492	4508	4517	4522	4524	4527
L32.5°	4596	4588	4579	4580	4570	4545	4510	4487	4489	4507	4513	4517	4523	4520
L35.0°	4596	4586	4578	4578	4562	4532	4492	4479	4491	4507	4516	4520	4518	4516
L37.5°	4596	4584	4575	4575	4555	4517	4480	4475	4490	4502	4514	4517	4516	4515
L40.0°	4600	4584	4574	4572	4545	4502	4468	4476	4492	4503	4513	4513	4513	4528
L42.5°	4600	4583	4572	4567	4535	4489	4462	4476	4493	4502	4511	4513	4524	4543
L45.0°	4599	4583	4572	4563	4525	4475	4445	4477	4490	4501	4506	4514	4538	4560
L47.5°	4601	4582	4570	4558	4514	4468	4462	4477	4490	4500	4508	4527	4550	4579
L50.0°	4601	4582	4569	4551	4505	4459	4462	4476	4487	4502	4512	4537	4567	4590
L52.5°	4601	4581	4569	4547	4495	4450	4460	4477	4488	4498	4520	4549	4579	4598
L55.0°	4601	4580	4568	4544	4486	4447	4461	4476	4489	4502	4537	4565	4586	4601
L57.5°	4602	4580	4567	4537	4478	4443	4458	4474	4485	4503	4543	4579	4597	4619
L60.0°	4601	4579	4567	4533	4470	4441	4457	4473	4488	4510	4549	4584	4607	4629
L62.5°	4601	4579	4566	4529	4464	4441	4454	4473	4485	4519	4557	4591	4607	4641
L65.0°	4602	4578	4566	4524	4457	4440	4455	4471	4486	4527	4566	4596	4613	4645
L67.5°	4601	4577	4564	4518	4453	4437	4453	4470	4489	4533	4575	4602	4625	4648
L70.0°	4602	4576	4563	4515	4448	4436	4452	4468	4492	4541	4582	4606	4626	4648
L72.5°	4602	4575	4561	4511	4447	4435	4452	4466	4496	4545	4585	4607	4633	4645
L75.0°	4602	4574	4560	4510	4446	4434	4451	4465	4495	4544	4584	4606	4632	4645

Max Color Temp  
5203 K

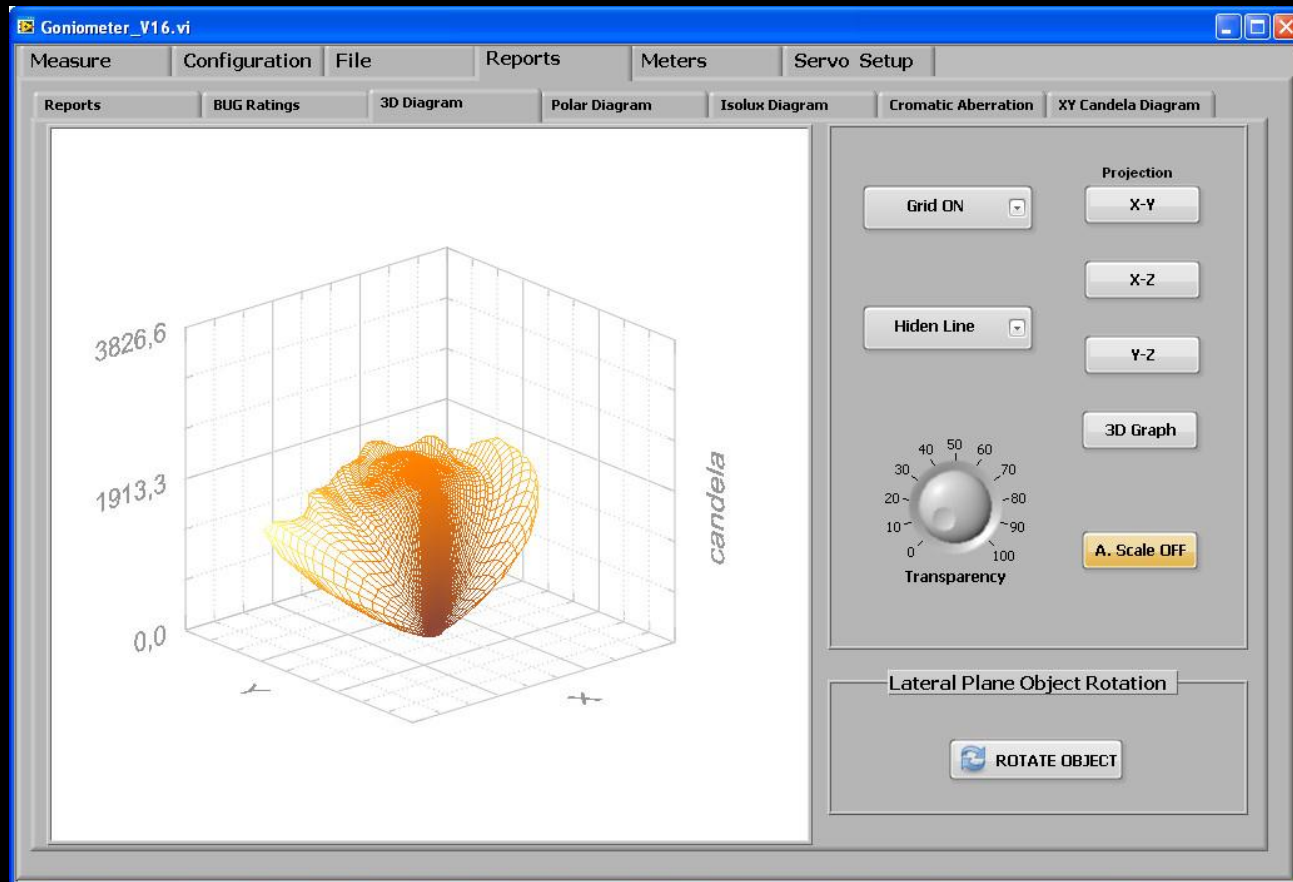
Min Color Temp  
3860 K

Average Color Temp  
4580 K

Gamma 0 Color Temp  
4590 K

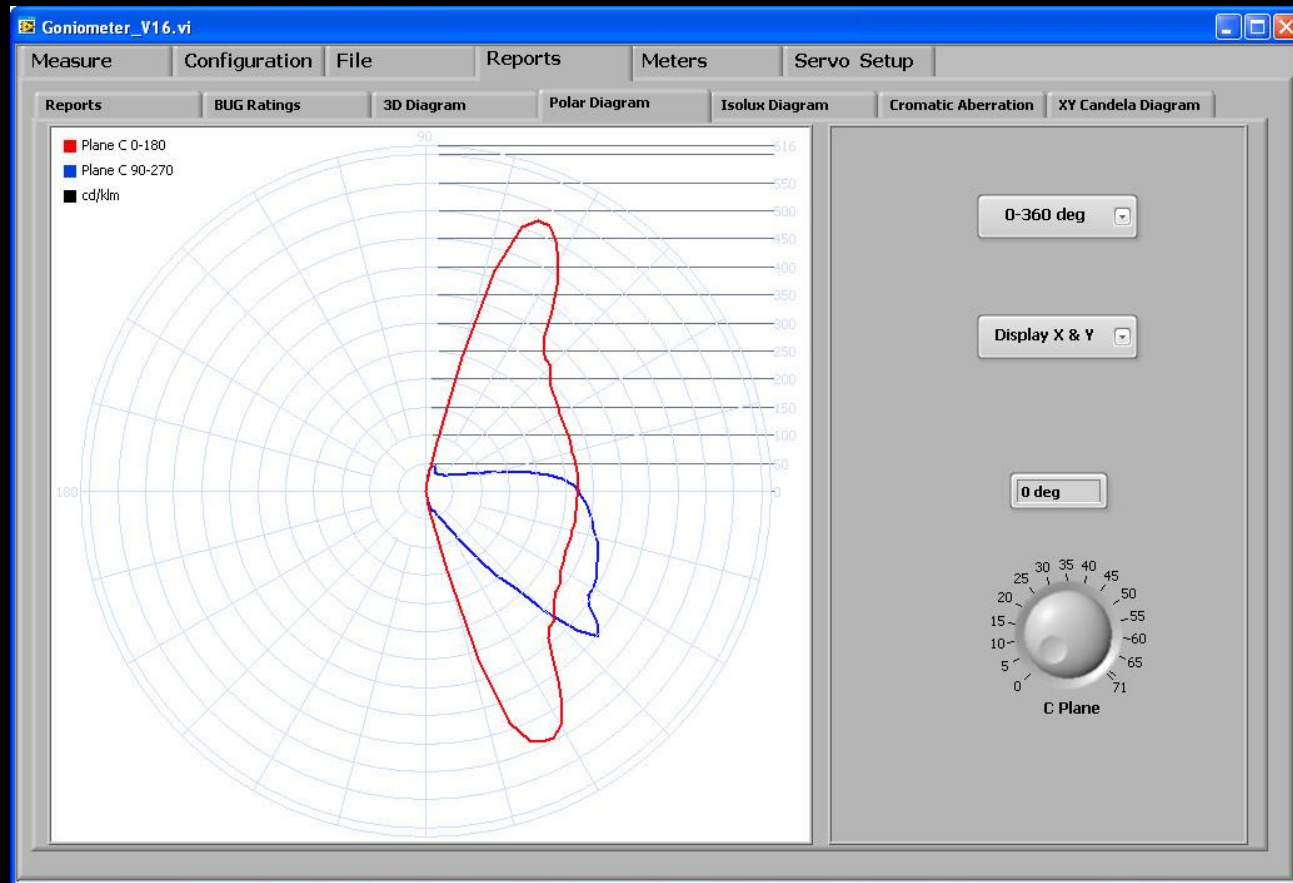
# Izveštaji

## 3D dijagram



# Izveštaji

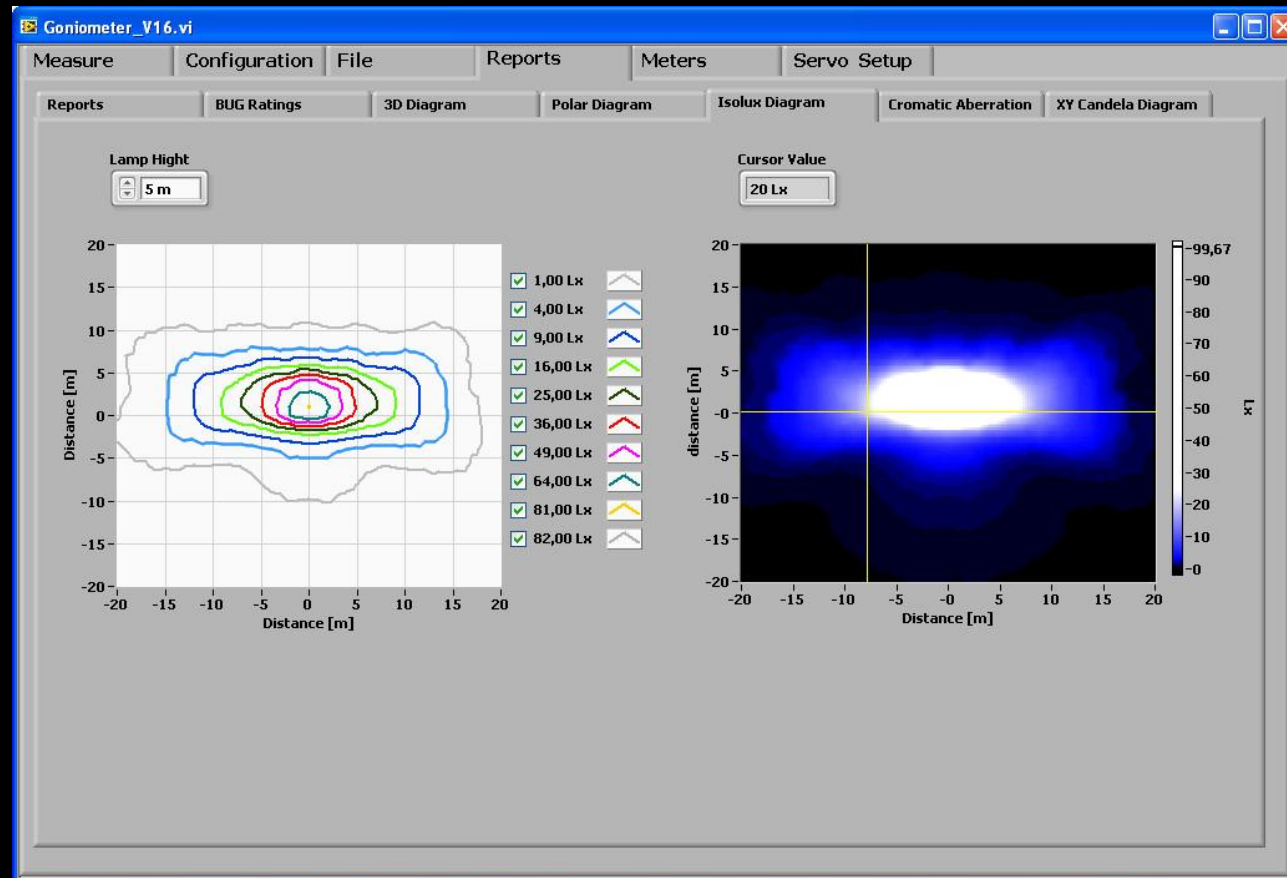
## Polarni dijagram





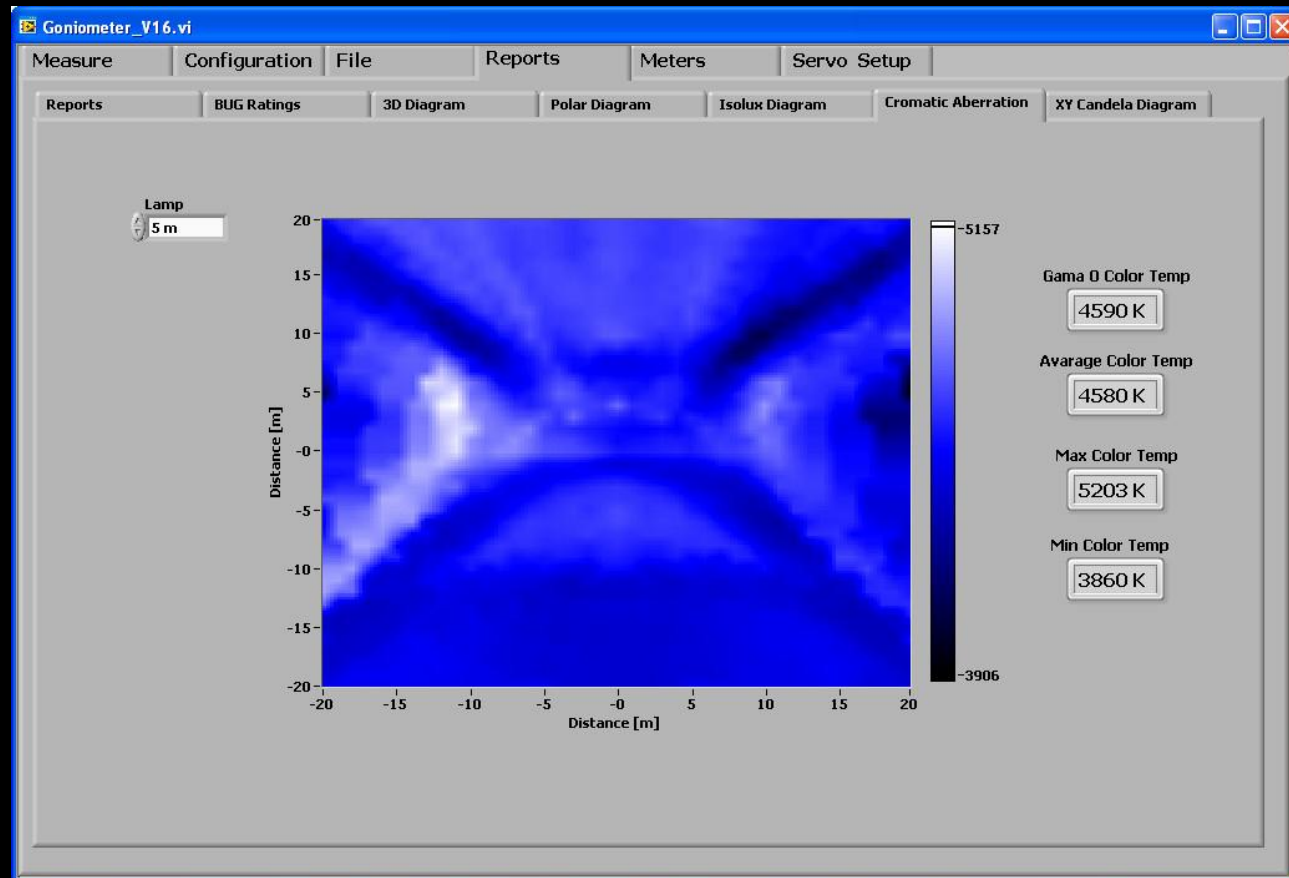
# Izveštaji

## Izoluks dijagram



# Izveštaji

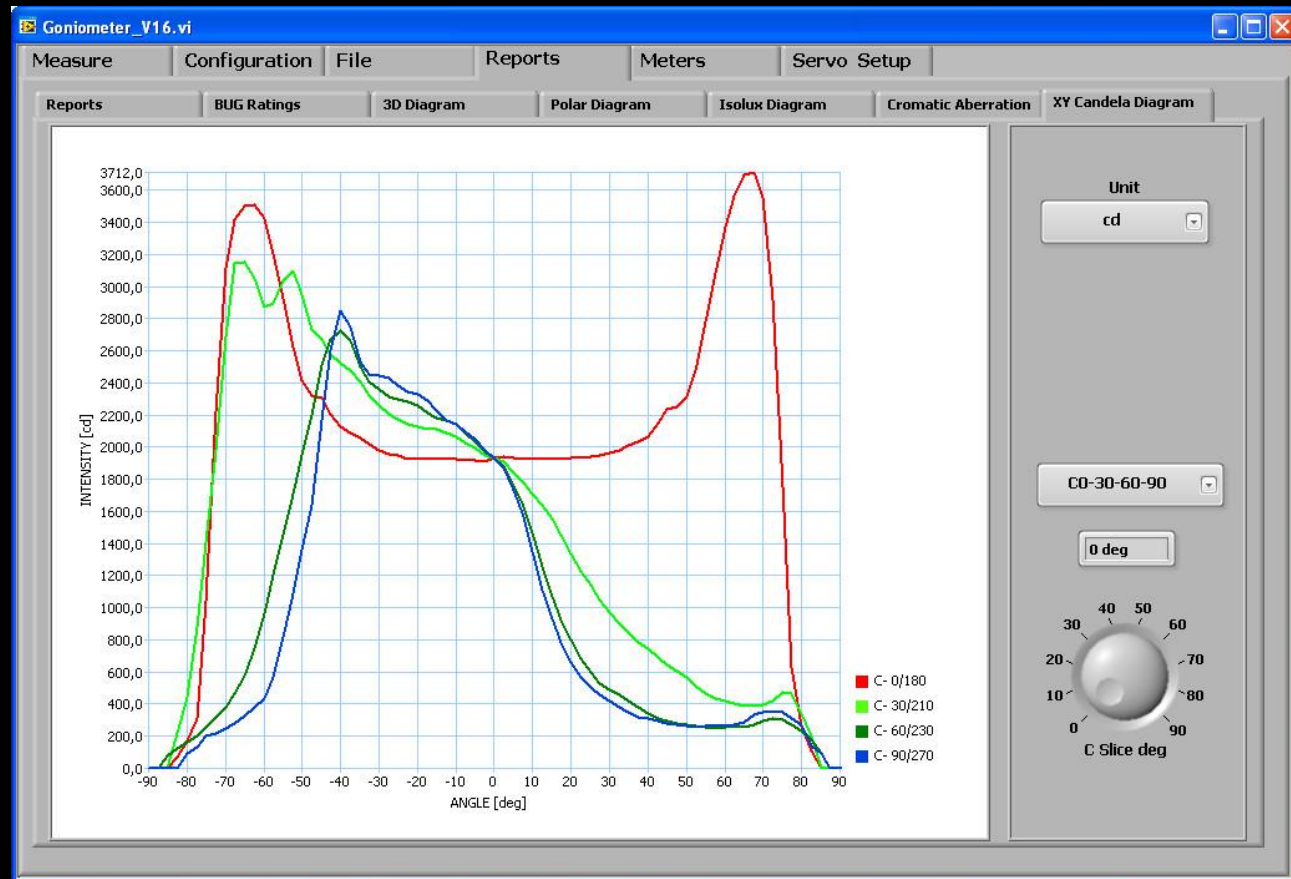
## Hromatska aberracija





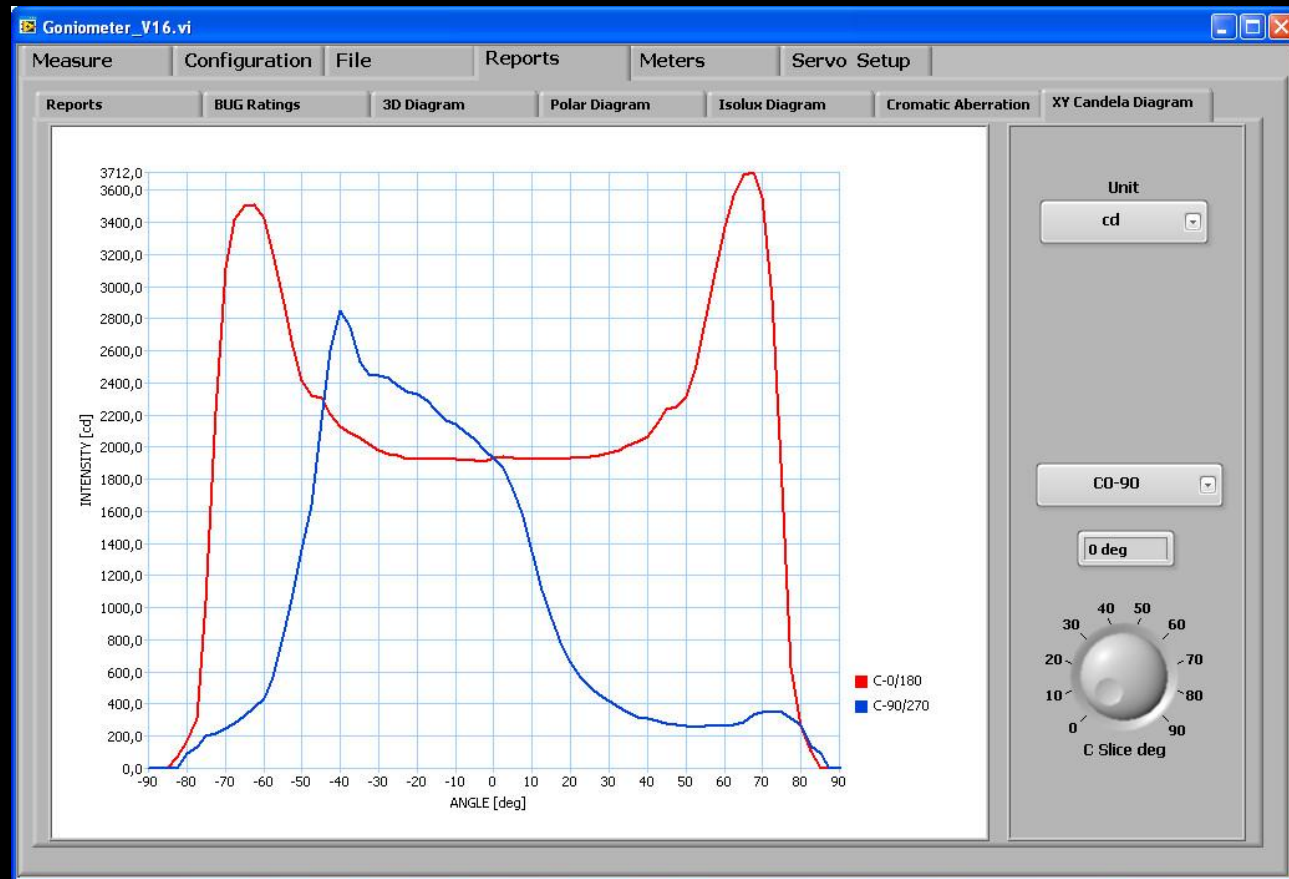
# Izveštaji

Jačina svetlosti  
u funkciji ugla



# Izveštaji

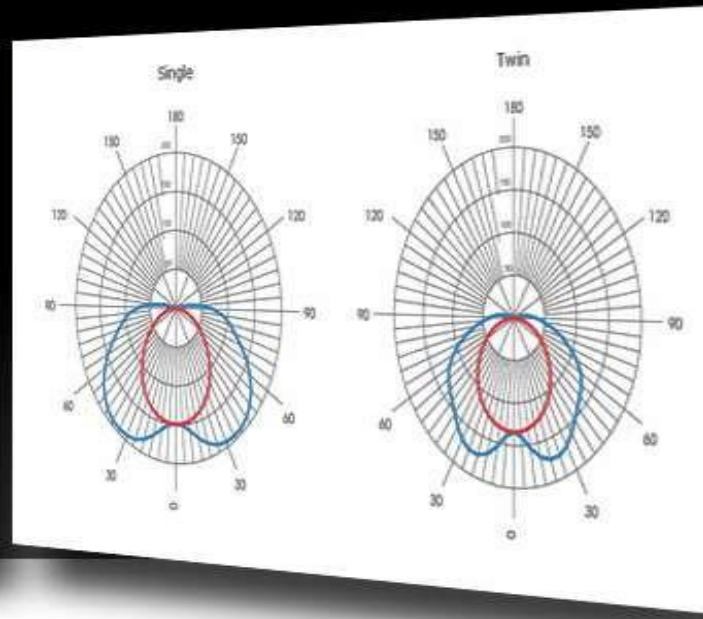
Jačina svetlosti  
u funkciji ugla



# Izveštaji

Standardne fotometrijske datoteke (.ies i .ldt)

```
designplan test - Notepad
File Edit Format View Help
IESNA:LM-63-1995
[TEST]
[TESTDATE]04-Dec-2008 11:37:20
[MANUFAC]
[LAMP]
TILT=NONE
1 1022.335 1 91 361 1 2 0 0 0
1 1 1
0.00 1.00 2.00 3.00 4.00 5.00 6.00 7.00 8.00
23.00 24.00 25.00 26.00 27.00 28.00 29.00
45.00 46.00 47.00 48.00 49.00 50.00 51.00
66.00 67.00 68.00 69.00 70.00 71.00 72.00
88.00 89.00 90.00
0.00 1.00 2.00 3.00 4.00 5.00 6.00 7.00 8.00
23.00 24.00 25.00 26.00 27.00 28.00 29.00
45.00 46.00 47.00 48.00 49.00 50.00 51.00
66.00 67.00 68.00 69.00 70.00 71.00 72.00
88.00 89.00 90.00 91.00 92.00 93.00 94.00
108.00 109.00 110.00 111.00 112.00 113.00
126.00 127.00 128.00 129.00 130.00 131.00
144.00 145.00 146.00 147.00 148.00 149.00
162.00 163.00 164.00 165.00 166.00 167.00
180.00 181.00 182.00 183.00 184.00 185.00
```



1960  
**meteor**  
fabrika dekorativnih svetiljki i stubova



osvetlite svoj put

**hvala na pažnji**

1960  
**meteor**  
fabrika svetiljki i stubova