



Sport belysning

Bjørgulv Byre | Mars 2019 | Miljø & Teknikk

Light is **OSRAM**

siteco

OSRAM



Bjørgulv Byre

Distriktssjef

Utendørs-, idrett- og veibelysning
Ansatt i Osram / Siteco / Siemens siden 1986

Funksjoner av idrettsbelysningen

- Gode synsforhold for utøvere, dommere og publikum
- Energi besparende, smart og fleksibel lys-styring
- Unngå strølys / sjenerende belysning

Standards

- NS-EN 12193
- NFF's belysningsklasser
- Håndballforbundet
- FIFA
- UEFA
- CIE 169 – practical design guidelines for the lighting of sports events for color television and filming
- CIE 67 – Sports lighting installations
- Særforbundskrav



Standarder

Belysningsklasser – NS-EN 12193

Klasse I

Konkurranser på toppnivå.

Klasse II

Konkurranser på mellomnivå.

Klasse III

Konkurranser på lavt nivå.

Konkurransenivå	Belysningsklasse		
	I	II	III
Internasjonalt og nasjonalt	x		
Regionalt	x	x	
Lokalt	x	x	x
Trening		x	x
Fritidsaktiviteter/skoleidrett (gym)			x

Langrenn – NS-EN 12193, Tabell A.17

• Klasse I

- 20 lx
- $E_{min}/E_m \geq 0,3$
- Ra indeks 20 (NaH)

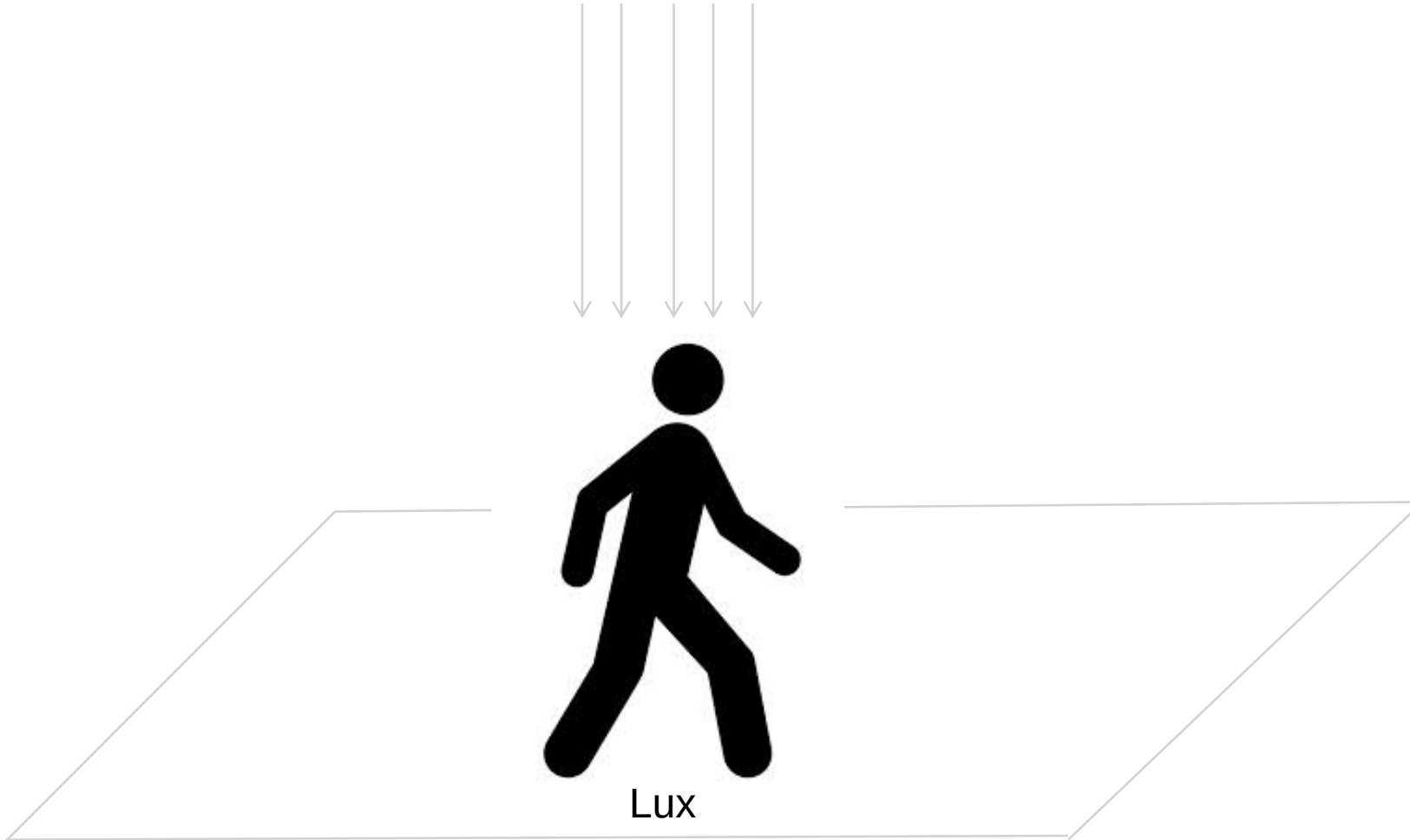
• Klasse II

- 10 lx
- $E_{min}/E_m \geq 0,3$
- Ra indeks 20 (NaH)

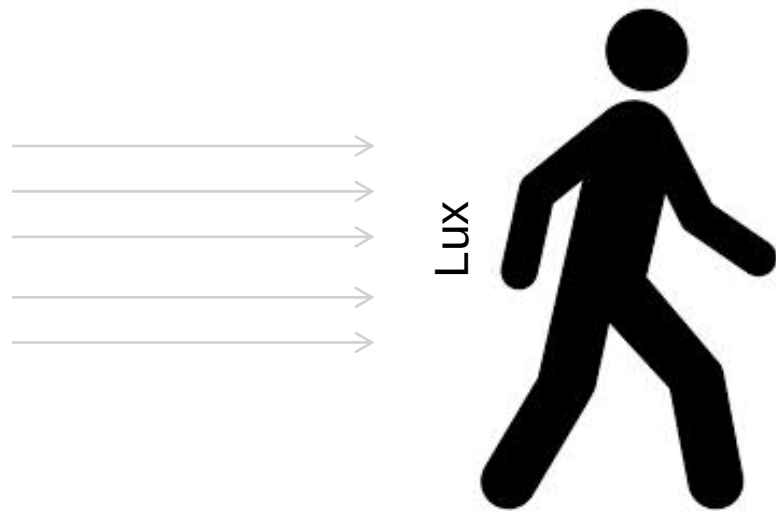
• Klasse III

- 3 lx
- $E_{min}/E_m \geq 0,1$

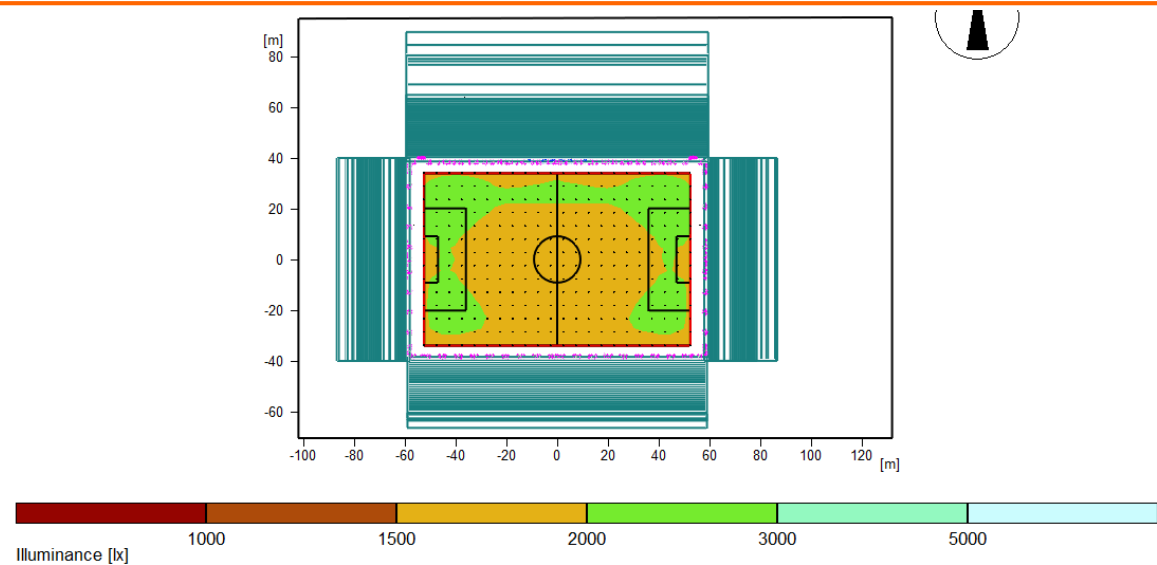
Belysningskvalitet - Horizontal belysningsstyrke



Belysningskvalitet - Vertikal belysningsstyrke



Belysningskvaliteter - Jevnhet



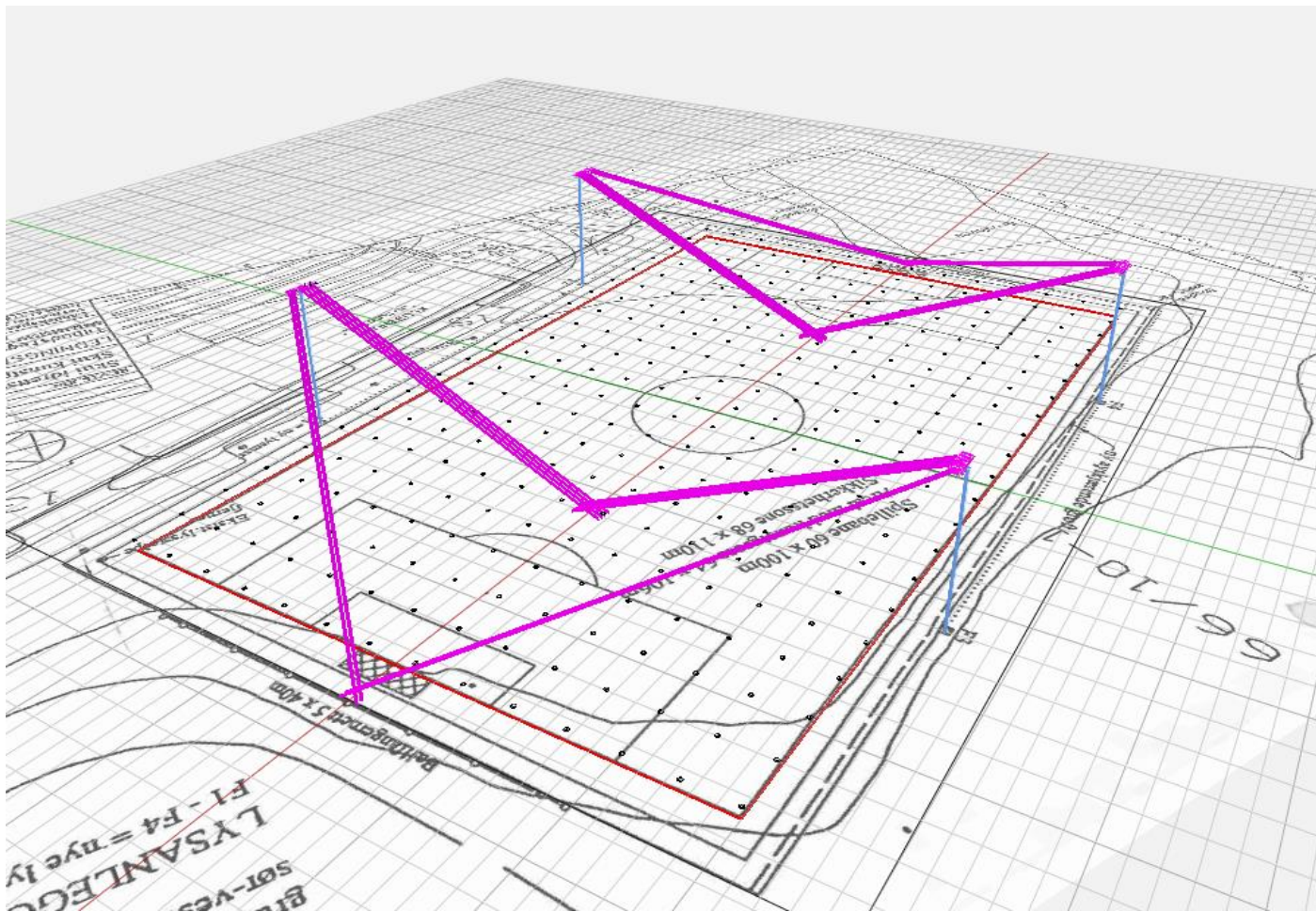
General		
Calculation algorithm used	Average indirect fraction	
Height of evaluation surface	0.00 m	
Maintenance factor	0.80	
Light flux factor (see maintenance plan)	0.92	
Total luminous flux of all lamps	42420000 lm	
Total power	424200 W	
Total power per area (38785.50 m²)	10.94 W/m² (0.56 W/m²/100lx)	
Upward light ratio (ULR)	0.00	
Illuminance		
Average illuminance	Eav	1940 lx
Minimum illuminance	Emin	1590 lx
Maximum illuminance	Emax	2400 lx
Uniformity Uo	Emin/Em	1:1.22 (0.82)
Diversity Ud	Emin/Emax	1:1.51 (0.66)

Vanligste idrettsanlegg

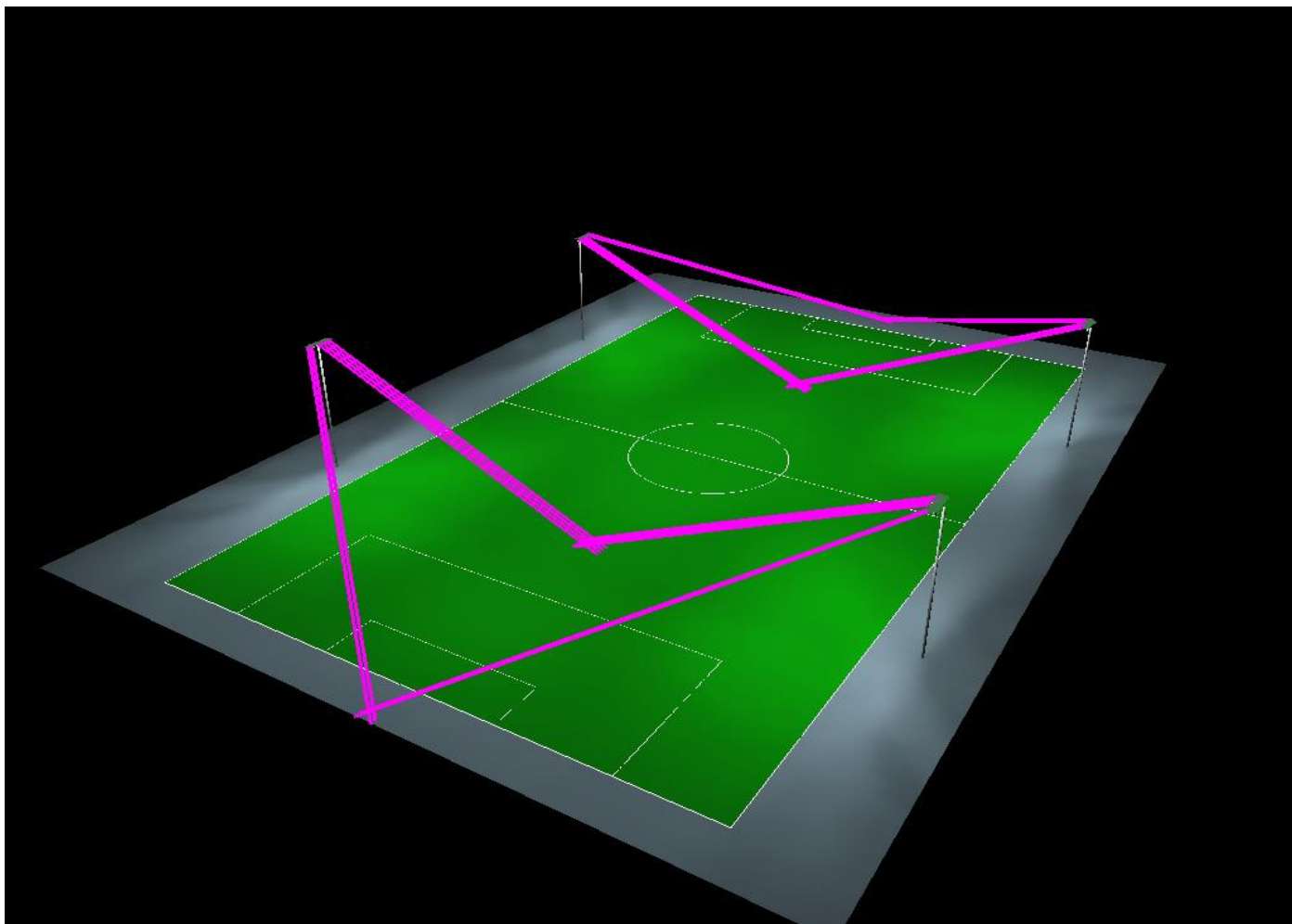
- Fotball
- Håndball
- Basket
- Ishockey
- Tennis
- Svømming
- Ski
- Skating



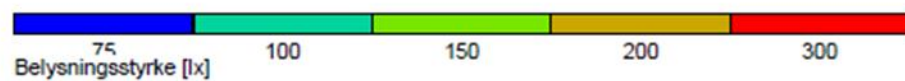
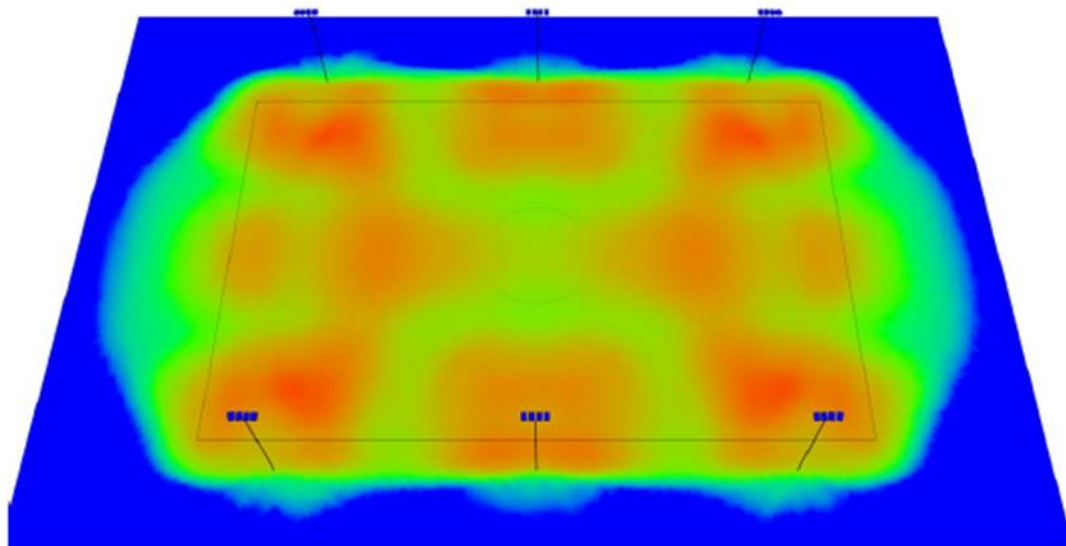
Lysberegninger



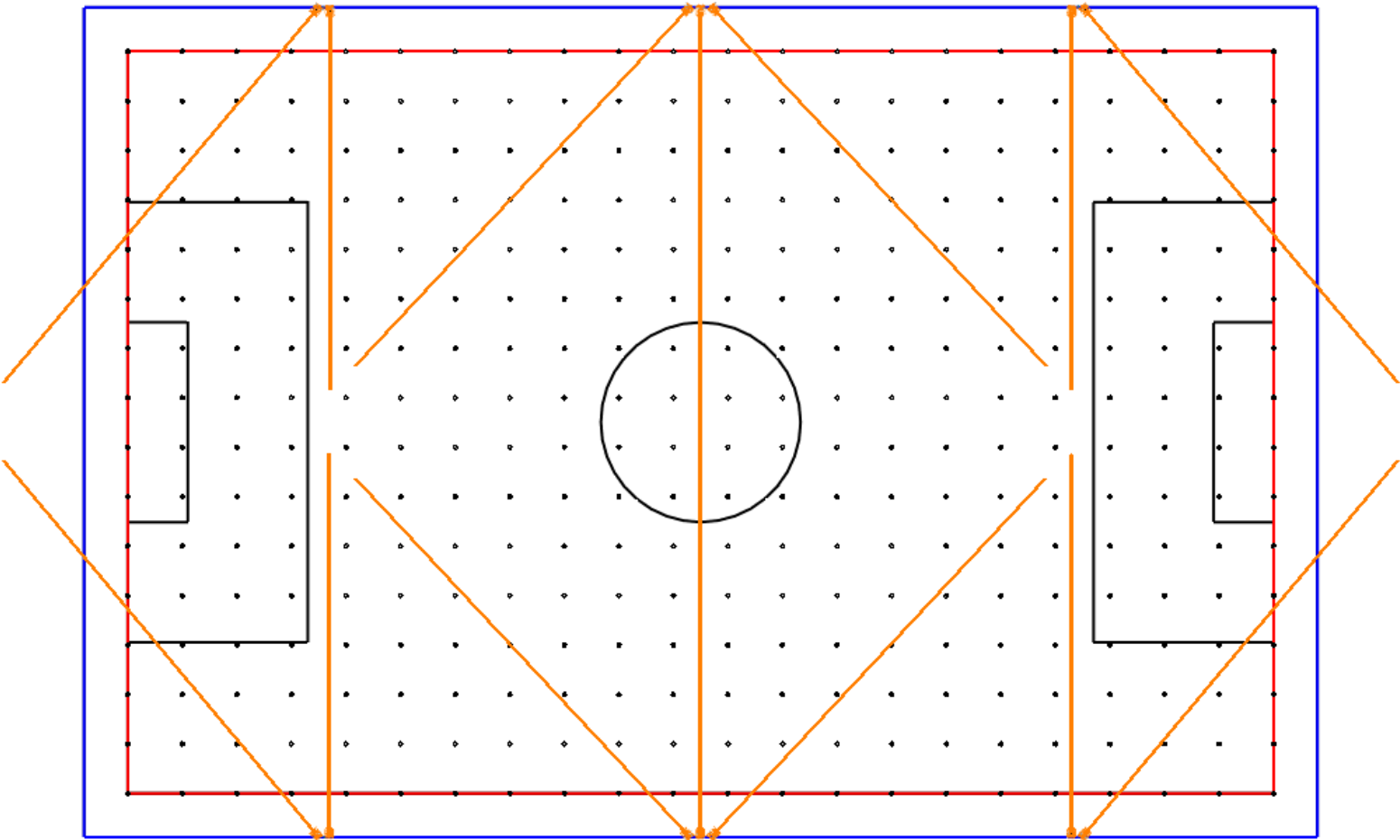
Lysberegninger



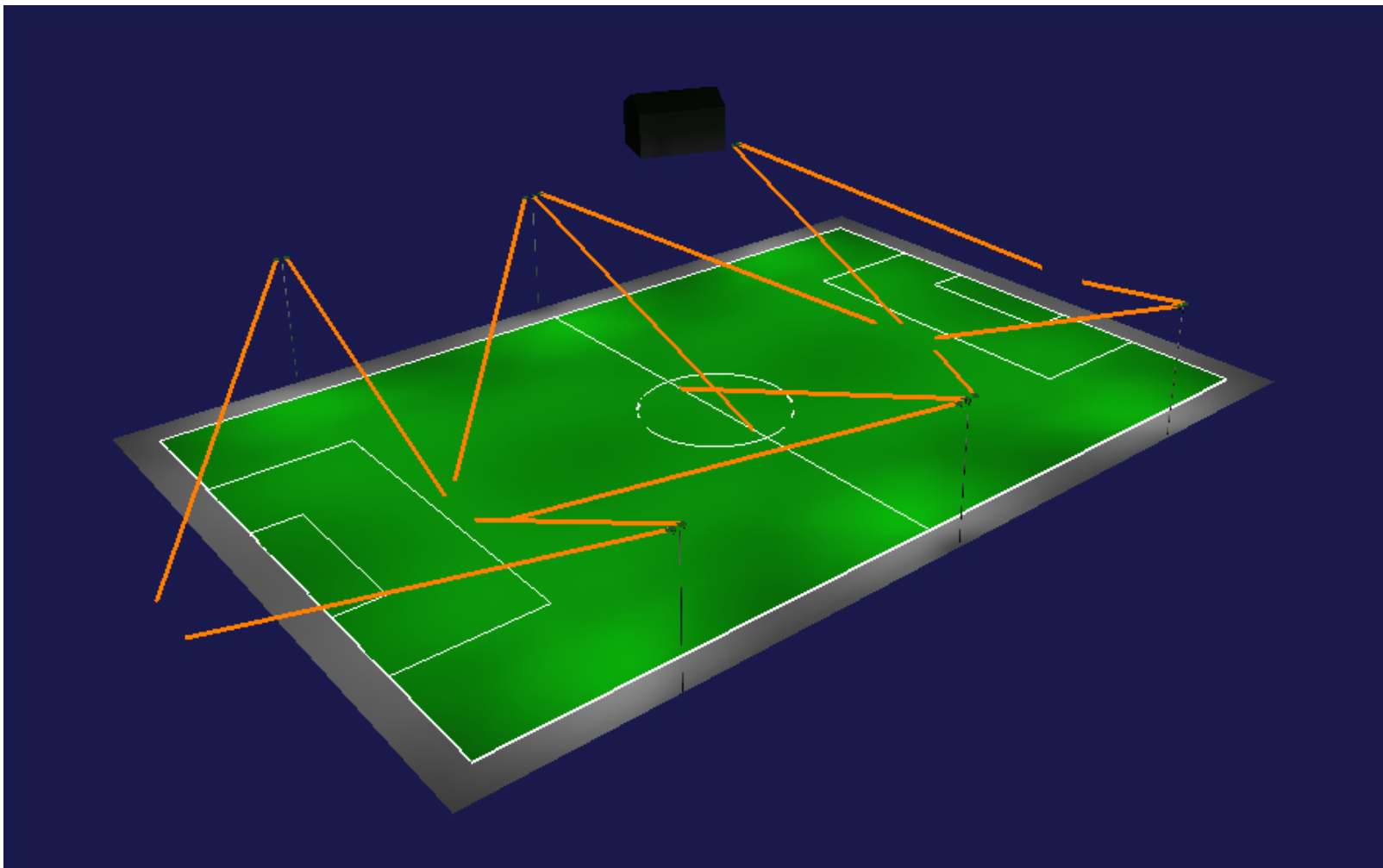
Lysberegninger



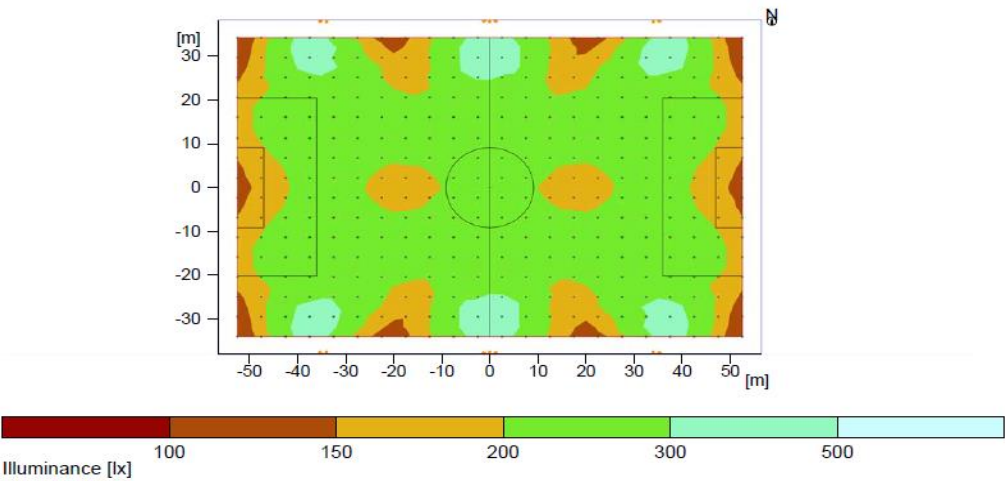
Standardløsninger – Fotball Klasse II (E) – 105 x 68m



Standardløsninger – Fotball Klasse II (E) – 105 x 68m



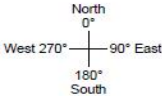
Standardløsninger – Fotball Klasse II (E) – 105 x 68m



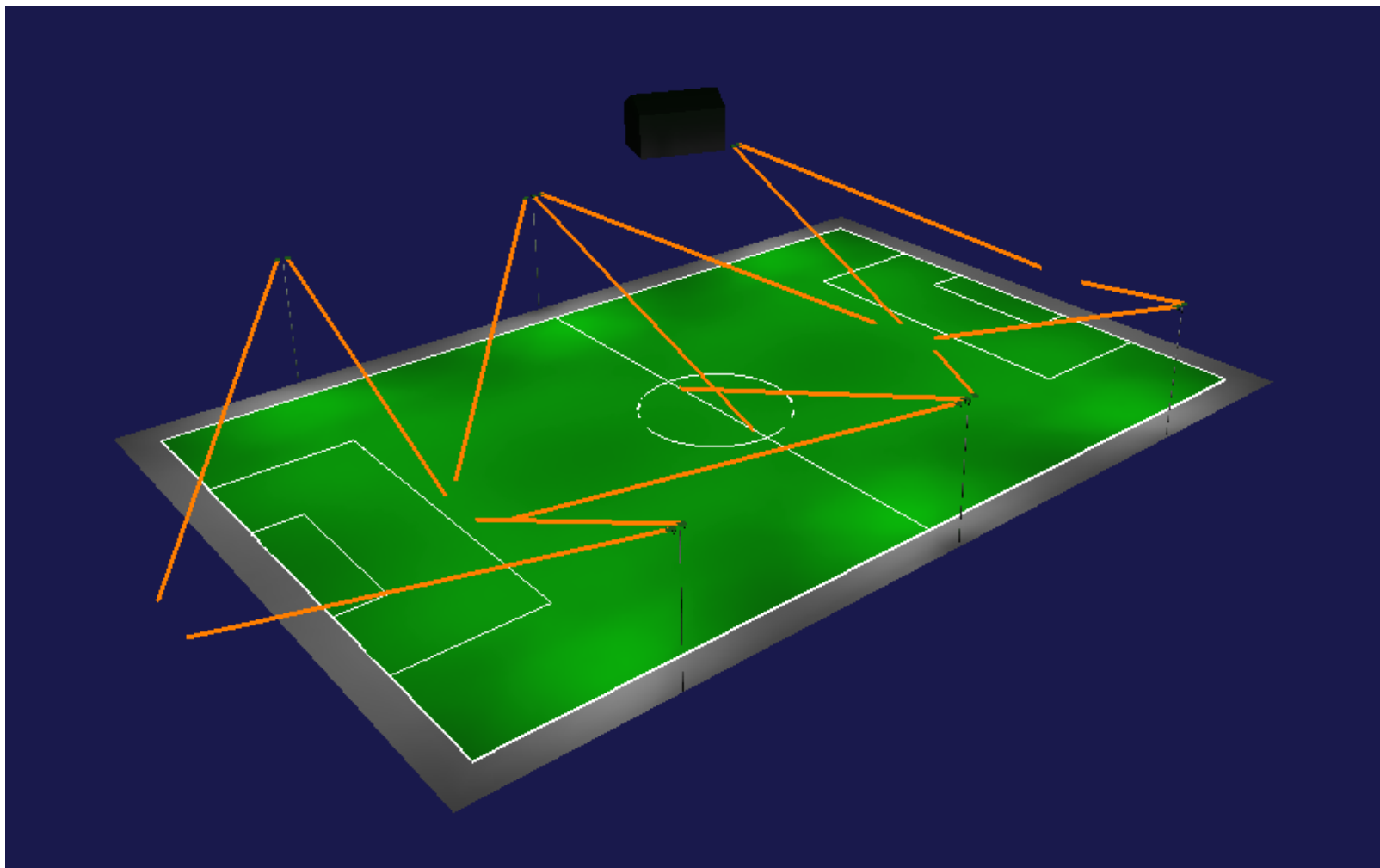
General	
Calculation algorithm used	Average indirect fraction
Maintenance factor	0.80
Total luminous flux of all lamps	3220000 lm
Total power	29400.0 W
Total power per area (8588.00 m²)	3.42 W/m² (1.50 W/m²/100lx)

Evaluation area 1	Reference plane 1.1
	Horizontal
Em	229 lx
Emin	137 lx
Emin/Eav (Uo)	0.60
Emin/Emax (Ud)	0.34
Upward light ratio (ULR)	0.00
Position	0.00 m

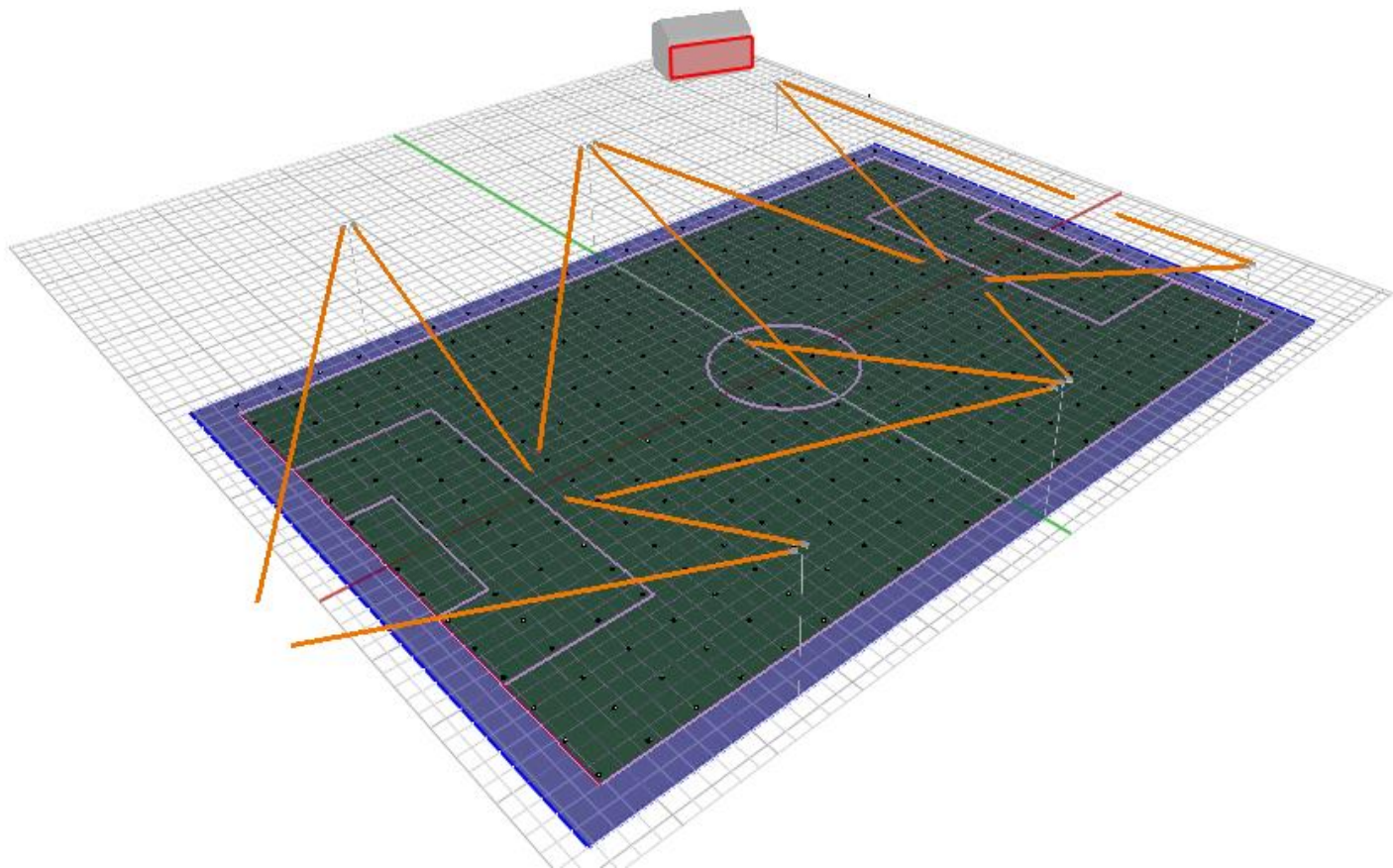
Observer GR			
Lve = 0.64 cd/m², Ehav(MF:1.0) = 290 lx, ρ = 20 %			
No.	Description	Position	Max GR
187	GR 1.187	-2.5 m/2.24 m/1.2 m	48.1
			Direction
			177° (-2°)



Men hva med strølys?



Men hva med strølys?



Belysningskvaliteter - Strølys



Men hva med strølys?

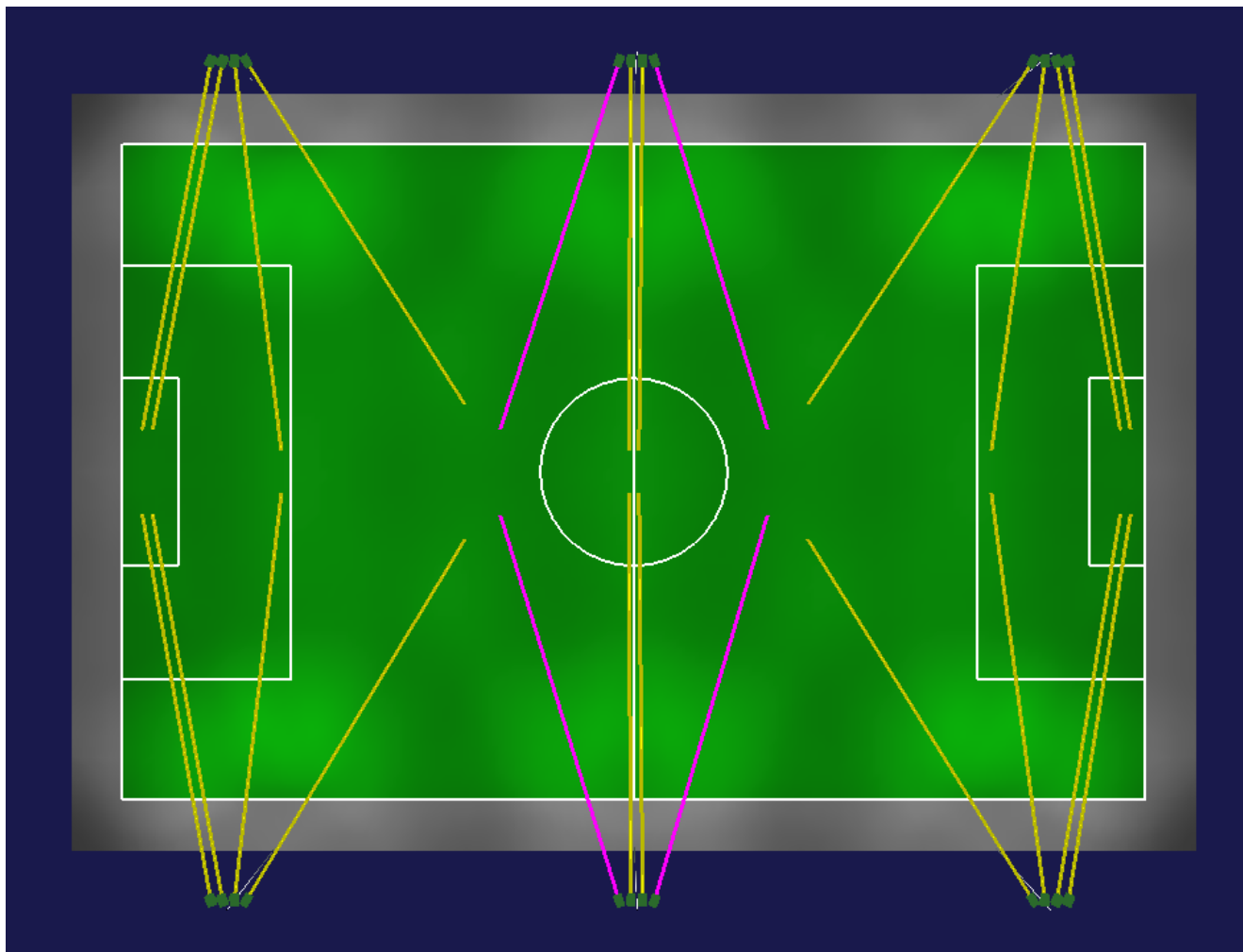
Illuminance

Average illuminance	Eav	2.14 lx
Minimum illuminance	Emin	1.39 lx
Maximum illuminance	Emax	3.57 lx
Uniformity Uo	Emin/Em	1:1.54 (0.65)
Diversity Ud	Emin/Emax	1:2.56 (0.39)

Table 1 – Maximum obtrusive light permitted for exterior lighting installations

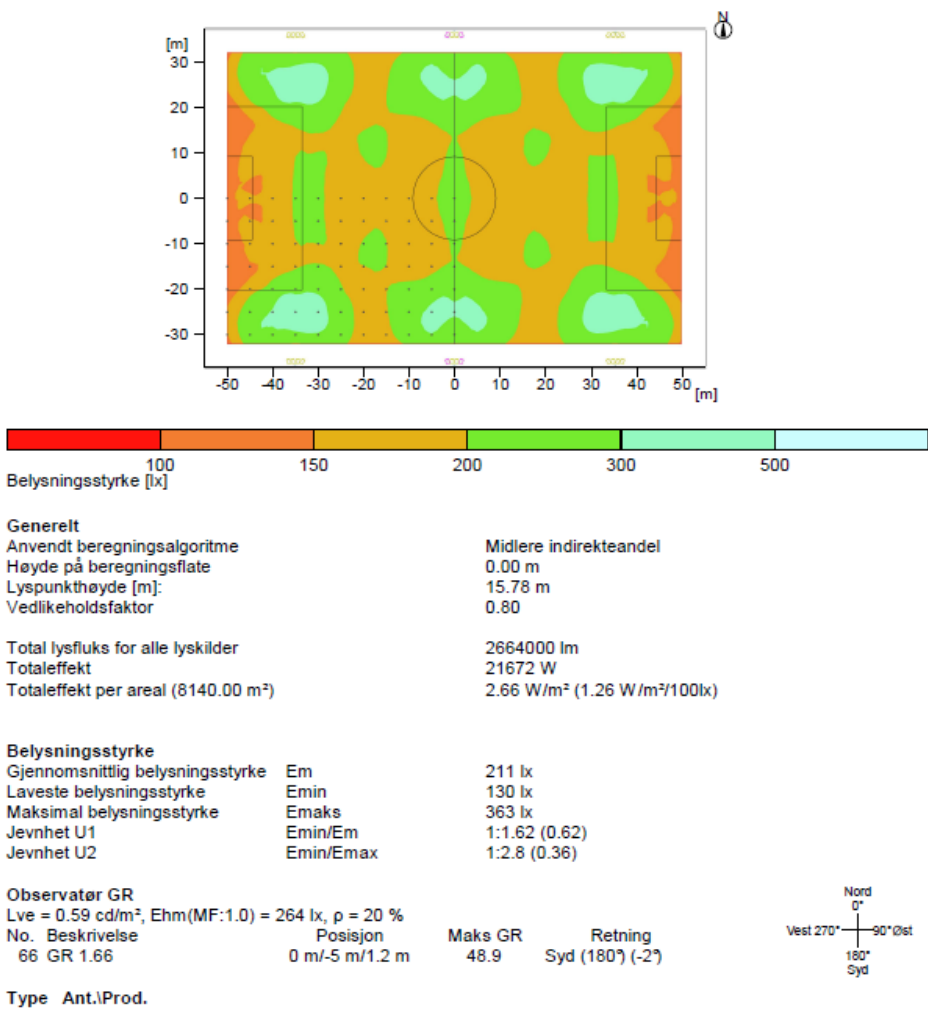
Environmental zone	Light on properties		Luminaire intensity		Upward light
	E_v lx		I cd		ULR
	Pre-curfew ^a	Post-curfew	Pre-curfew	Post-curfew	%
E1	2	0	2 500	0	0
E2	5	1	7 500	500	5
E3	10	2	10 000	1 000	15
E4	25	5	25 000	2 500	25
^a In case no curfew regulations are available, the higher values shall not be exceeded and the lower values should be taken as preferable limits.					
E1	represents intrinsically dark areas, such as national parks or protected sites;				
E2	represents low district brightness areas, such as industrial or residential rural areas;				
E3	represents medium district brightness areas, such as industrial or residential suburbs;				
E4	represents high district brightness areas, such as town centres and commercial areas;				
E_v	is the maximum value of vertical illuminance on properties in lx;				
I	is the light intensity of each source in the potentially obtrusive direction in cd;				
ULR	is the proportion of the flux of the luminaire(s) that is emitted above the horizontal, when the luminaire(s) is (are) mounted in its (their) installed position and attitude.				

Standardløsninger LED – Fotball Klasse II (D) – 100 x 64m



Standardløsninger LED – Fotball Klasse II (D) – 100 x 64m

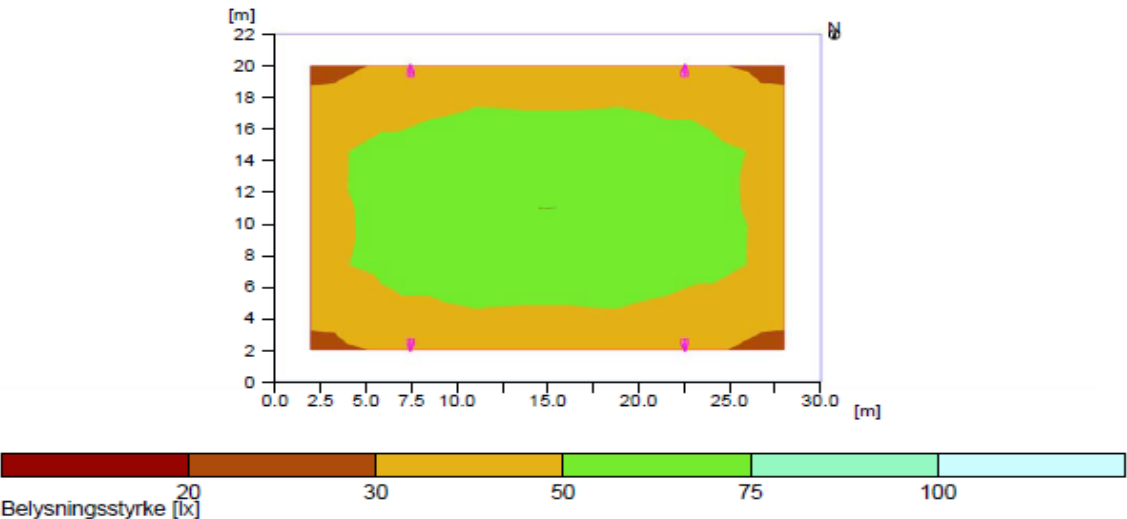
24 stk FL20 Maxi
6 stk 16m master



Ballbinger

4.2 Sammendrag, ballbinge 26x18

4.2.1 Resultatoversikt, Evalueringsområde 1



Generelt	
Anvendt beregningsalgoritme	Midlere indirekteandel
Lyspunkthøyde	8.15 m
Vedlikeholdsfaktor	0.80
Total lysfluks for alle lyskilder	53600 lm
Totaleffekt	600.0 W
Totaleffekt per areal (660.00 m²)	0.91 W/m² (1.78 W/m²/100lx)

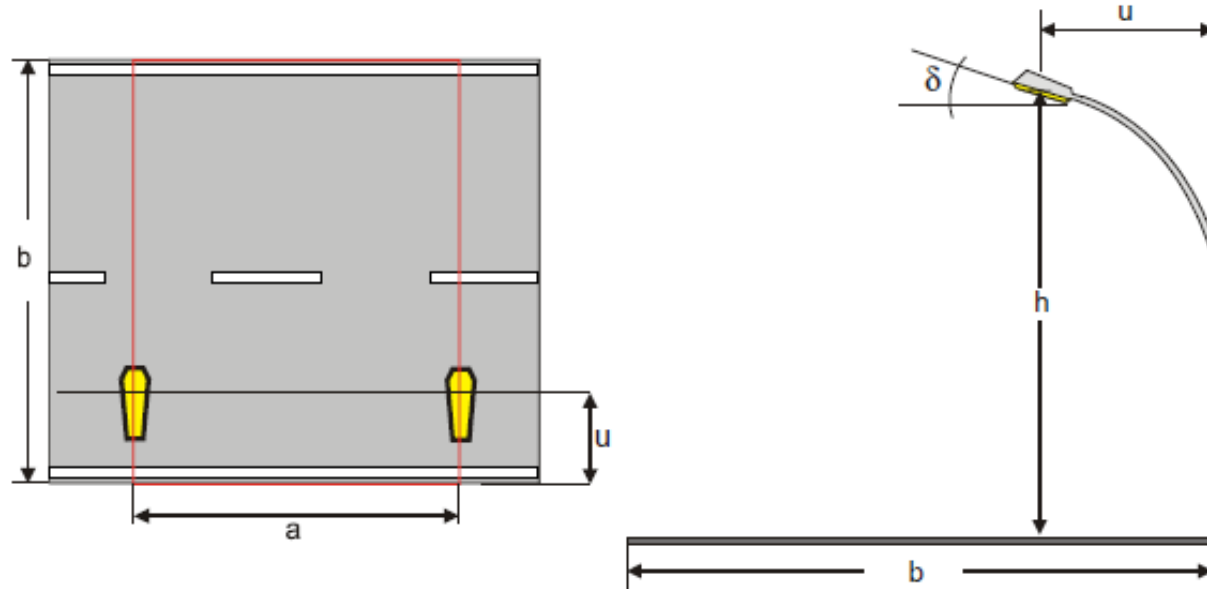
Evalueringsområde 1	Referanseplan 1.1
Em	Horizontal
Emin	51.2 lx
Emin/Emid (Uo)	32.6 lx
Emin/Emax (Ud)	0.64
Posisjon	0.49
	0.00 m

Type Ant.\Prod.

2	4	Siteco	
		Bestillingsnr.	: 5XA5823K1A08P
		Armaturnavn	: Streetlight 10 midi LED
		Bestykning	: 2 x LED 4000K / CRI >= 70 75W / 6700 lm

Lysløyper / Turveier med LED

Klasse III



Armaturdata

Fabrikat : Siteco
Bestillingsnr. : 5XB15C2B108A
Armaturnavn : Streetlight 20 micro LED | ST0.5a
Bestykning : 1 x LED 4000K / CRI $\geq$ 70 17.1 W / 1840 lm

Vegprofil : uten trafikkdelers
Bredde på kjørebane (b): 4.00 m
Antall kjørefelt : 1
Vegbelegg : R3
q0 : 0.08
Høyrekjøring

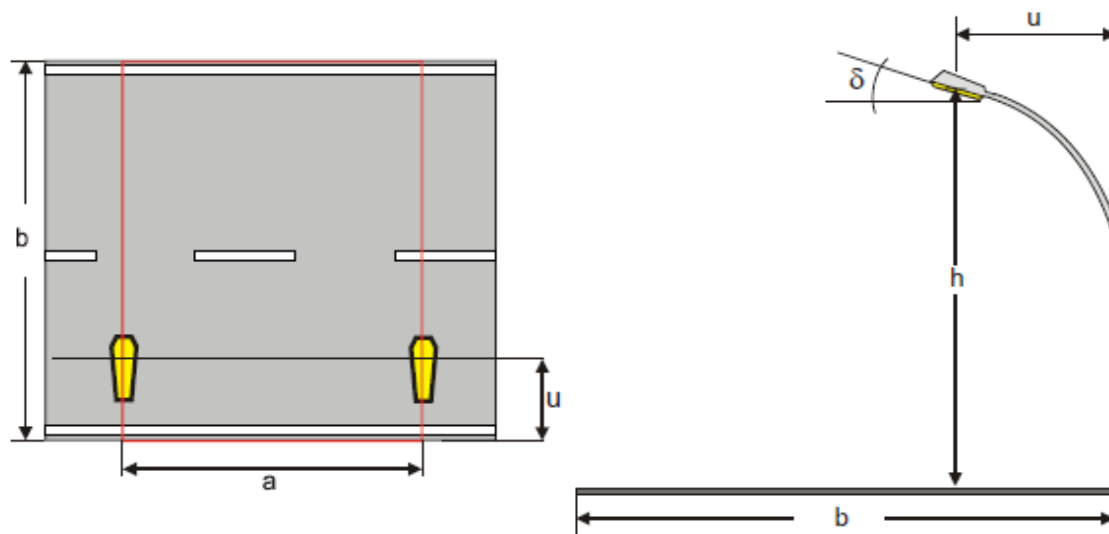
Armaturplassering : Høyre rekke
Lyspunkthøyde (h): 8.00 m
Armaturavstand (a): 35.00 m
Armatureverheng (u): -0.50 m
Helningsvinkel (δ): 0.00°
Vedlikeholdsfaktor : 0.80

Horisontal belysningsstyrke E

Midlere : 5.03 lx (LL3 min. 3)
Min/Mid : 0.42 (LL3 min. 0.1)

Lysløyper / Turveier med LED

Klasse II



Armaturdata

Fabrikkat : Siteco
Bestillingsnr. : 5XB25H2B308A/
Armaturnavn : Streetlight 20 mini LED | ST0.5a
Bestykning : 1 x LED 4000K / CRI >= 70 55 W / 6130 lm

Vegprofil : Generelt område
Bredde på kjørebane (b): 3.00 m
Antall kjørefelt : 1
Vegbelegg : CIE C2W4
q0 : 0.07
Høyrekjøring

Armaturplassering : Høyre rekke
Lyspunkthøyde (h): 8.00 m
Armaturavstand (a): 42.00 m
Armaturoverheng (u): -0.50 m
Helningsvinkel (δ): 8.00°
Vedlikeholdsfaktor : 0.80

Horizontal belyningsstyrke E

Midlere : 11.3 lx (LL2 min. 10)
Min/Mid : 0.3 (LL2 min. 0.3)

Smarte og lure løsninger?

- Hva er lurt?
- Hva er behovet?
- Hva skal det tas hensyn til?
- Driftstid?
- Kvalitet?
- Levetid?
- Service?
- Fremtidsmuligheter?
- Pris?
- Begrensninger?
- Frihet?
- Miljø?
- Fauna?

Smarte og lure løsninger?

- Styring
- Tradisjonelt? (Fotocelle og ur)
- Automatisk nattsinking?
- Mobil/PAD?
- Trykknapp
- Sentral styring?
- Behovsstyring?
- Bevegelsensor?
- Radiostyring?
- Kalenderbasert etter terminlister?
- Hvem har/skal ha tilgang?



Løsning

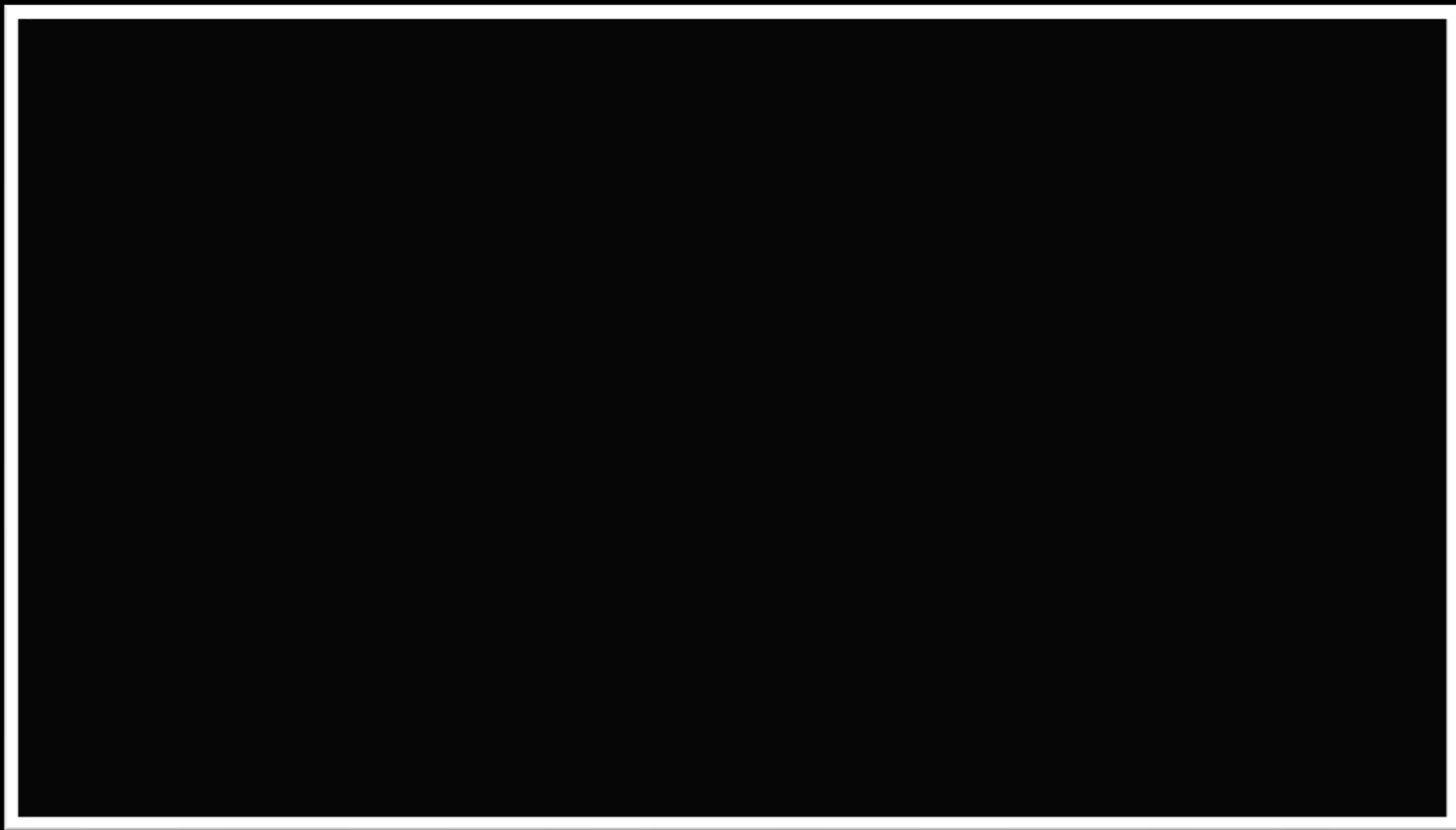


Floodlight 20 midi LED

Skatepark in Otto-Dullenkopf-Park · Karlsruhe, Germany

Client: Stadt Karlsruhe
Architect: DSGN concepts

Completion year: 2016

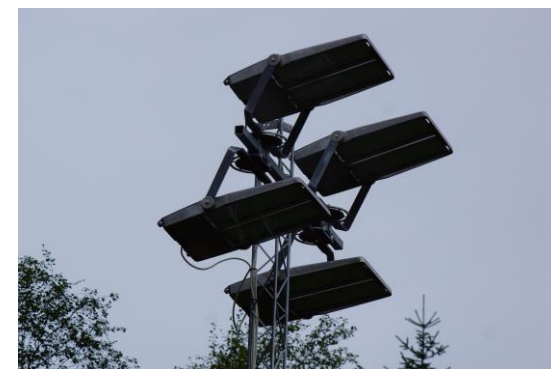


Bruksområdet

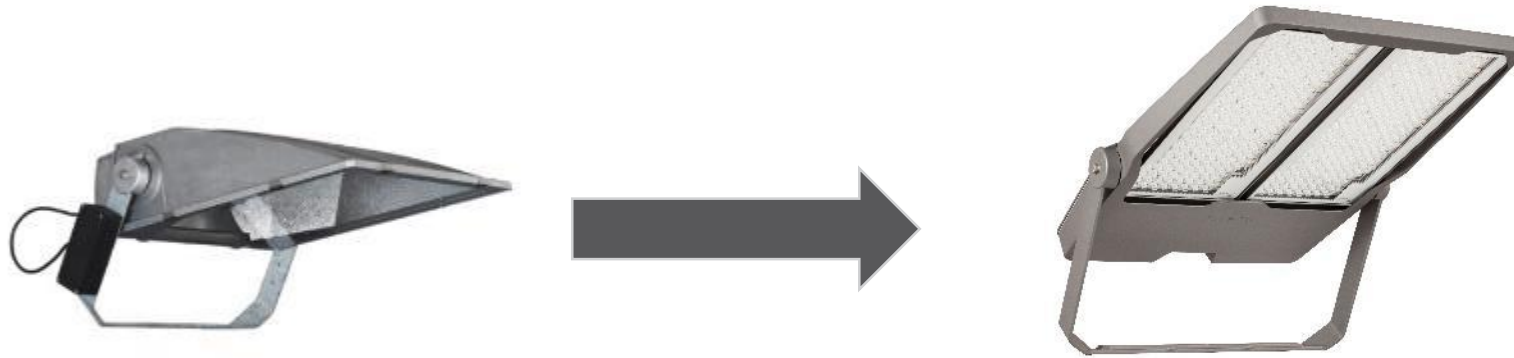
Fotballbane



Siste leverte anlegg – Hordatun Krøllgrasbane



Floodlight 20 Maxi: Historie



Floodlight 20 LED familien – en familie som løser alt

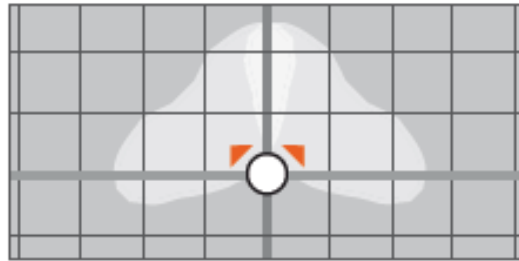


	Floodlight 20 micro LED	Floodlight 20 mini LED	Floodlight 20 midi LED	Floodlight 20 maxi LED
LED module luminous flux	4000 lm	8000 lm / 16.000 lm	24.000 lm / 36.000 lm	135.000 lm
Rated luminous flux	3010 lm	6050 lm / 12.100 lm	18.150 lm / 27.225 lm	up to 111.000 lm
Totaleffekt	29 W	56 W / 107 W	163W / 238 W	911 W
Systemeffektivitet	Opp til 110 lm/W	Opp til 120 lm/W	Opp til 120 lm/W	Opp til 122 lm/W
Fargetemperatur	3000 K, 4000 K	3000 K, 4000 K	3000 K, 4000 K, 5000 K	3000 K, 4000 K, 5000 K
Anbefalt monteringshøyde	ca. 2-5 m	Ca. 5-10m	Ca. 8-14m	> 14m
Bruksområder	• Offentlige områder • Arkitektonisk belysning • Gatelys	• Offentlige områder • Arkitektonisk belysning • Gatelys • Parkeringsplasser	• Offentlige områder • Arkitektonisk belysning • Parkeringsområder • Gatelys • Idrettsplasser og arenaer for tv-sendinger med HDTV og super saktefilm.	• Flyplasser • Kaianlegg og fergeterminaler • Belysning av store områder • Idrettsplasser og arenaer for tv-sendinger med HDTV og super saktefilm.

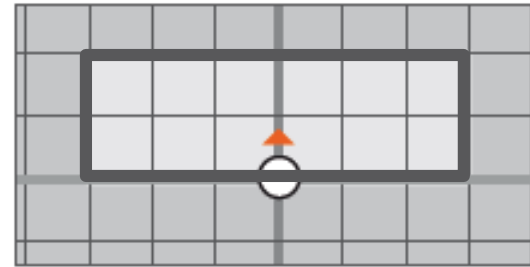
Floodlight 20 LED

Lysfordelinger

Traditional situation



Floodlight 20 LED



- Mange forskjellige lysfordelinger - PL43, PL52, PL61, PL44T, PL33

Produkt

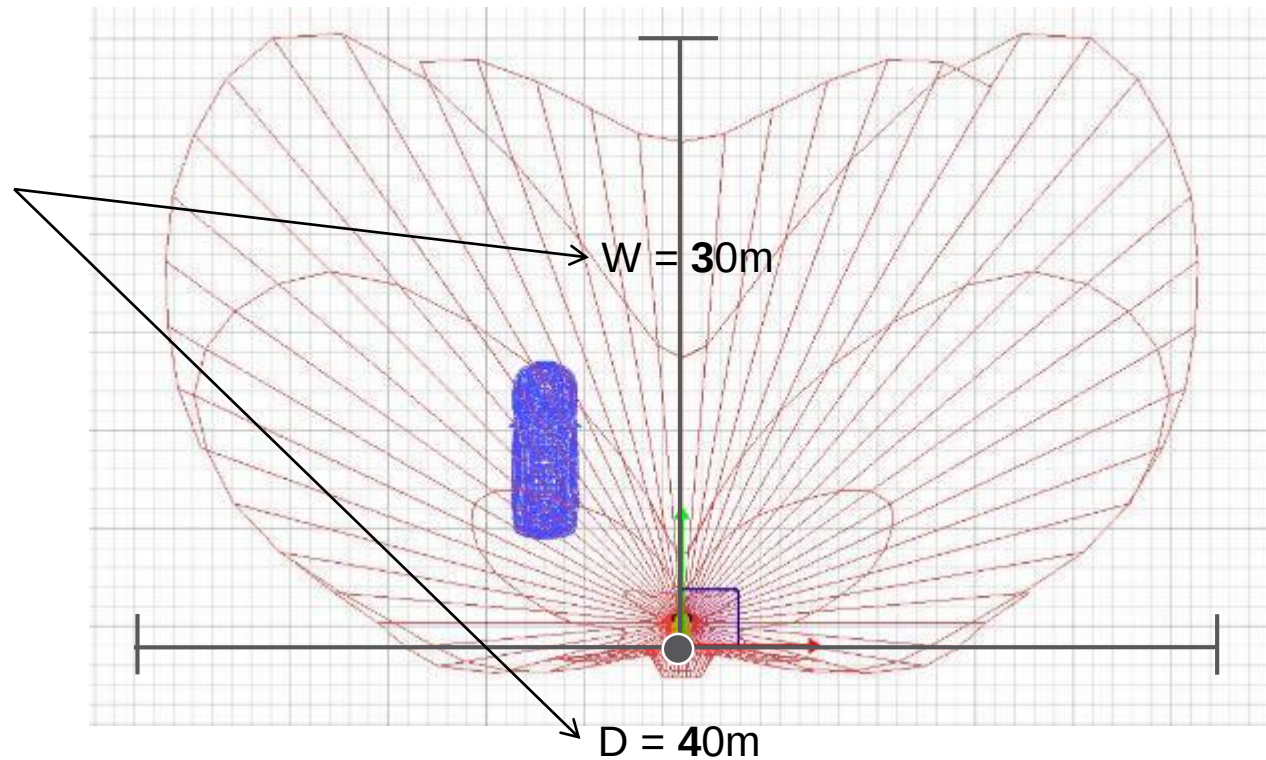
Basic, Plus og Premium



	On/Off	Power reduction with LST (100 – 50%)	DALI (2 adresses)	2 independent power supplies	DB702S
Basic	✓	✓			
Plus	✓		✓		✓
Premium	✓		✓	✓	✓

FL20 Midi eksempel

Monteringshøyde = 10m
Lysfordeling = **PL43**
FL20 Midi 238w – 26 990 lumen
120m²



Höhe der Bezugsebene	:	0.00 m
Mittlere Beleuchtungsstärke	Em	: 20.5 lx
Minimale Beleuchtungsstärke	Emin	: 5.5 lx
Maximale Beleuchtungsstärke	Emax	: 53.5 lx
Gleichmäßigkeit Uo	Emin/Em	: 1 : 3.72 (0.27)

SIRIUS® Sports

Light is excitement

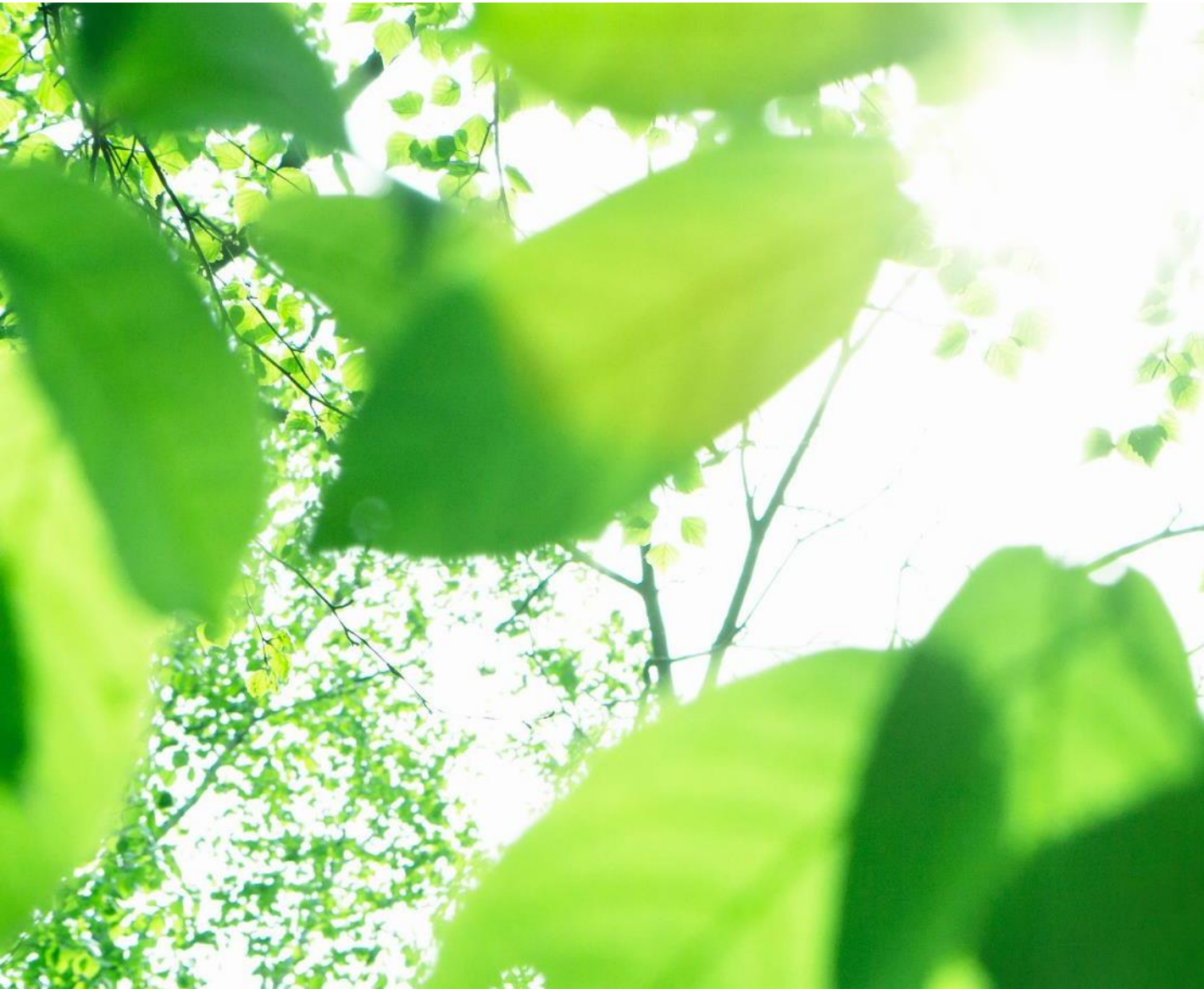
siteco



OSRAM

SIRIUS®

Advantage Dynamic Temperature Control CLO 2.0



- Constant lumen output depending on temperature / wind / rain / snow
- Longer lifetime of LED module and electronical components
- Lower energy consumption
- Lighting level remains constant regardless of the age of the components
- Lighting Design with optimised maintenance factor (LLMF) „1“

SIRIUS®

Preliminary Data depending on CRI

Preliminary data

5.700 K/CRI 95 and 5.000 K/CRI 90

Rated luminous flux and power

5.000 K/CRI 90

- Extermely narrow beam LDC~150.000 Lumen 1.500 W
- Narrow beam LDC~180.000 Lumen 1.800 W
- Wide beam LDC~230.000 Lumen 1.970 W



Requirements Colour Rendering (CRI) FIFA / UEFA

UEFA Level A Stadium > 2000 lx

Colour temperature (Tk)	5,000–6,200K
Colour rendering	≥ 80 Ra

≥ 80 Ra

FIFA (2011)

		vertikale Beleuchtungsstärke			horizontale Beleuchtungsstärke			Eigenschaften der Lampen	
		Ev cam ave	Gleichmäßigkeit		Eh ave	Gleichmäßigkeit		Farbtemperatur	Farbwiedergabe
Klasse	Berechnung für	Lux	U1	U2	Lux	U1	U2	Tk	Ra
Klasse V International	Festkamera	> 2000	0,6	0,7	3500	0,6	0,8	> 4000	≥ 65
	Spielfeldkamera (auf Feldhöhe)	1800	0,4	0,65					
Klasse IV national	Festkamera	2000	0,5	0,65	2500	0,6	0,8	> 4000	≥ 65
	Spielfeldkamera (auf Feldhöhe)	1400	0,35	0,6					

Ra
≥ 65

Source: https://resources.fifa.com/mm/document/tournament/competition/51/54/11/stadium_tech_rec_req_guide_to_lighting_en_7306.pdf

SIRIUS®

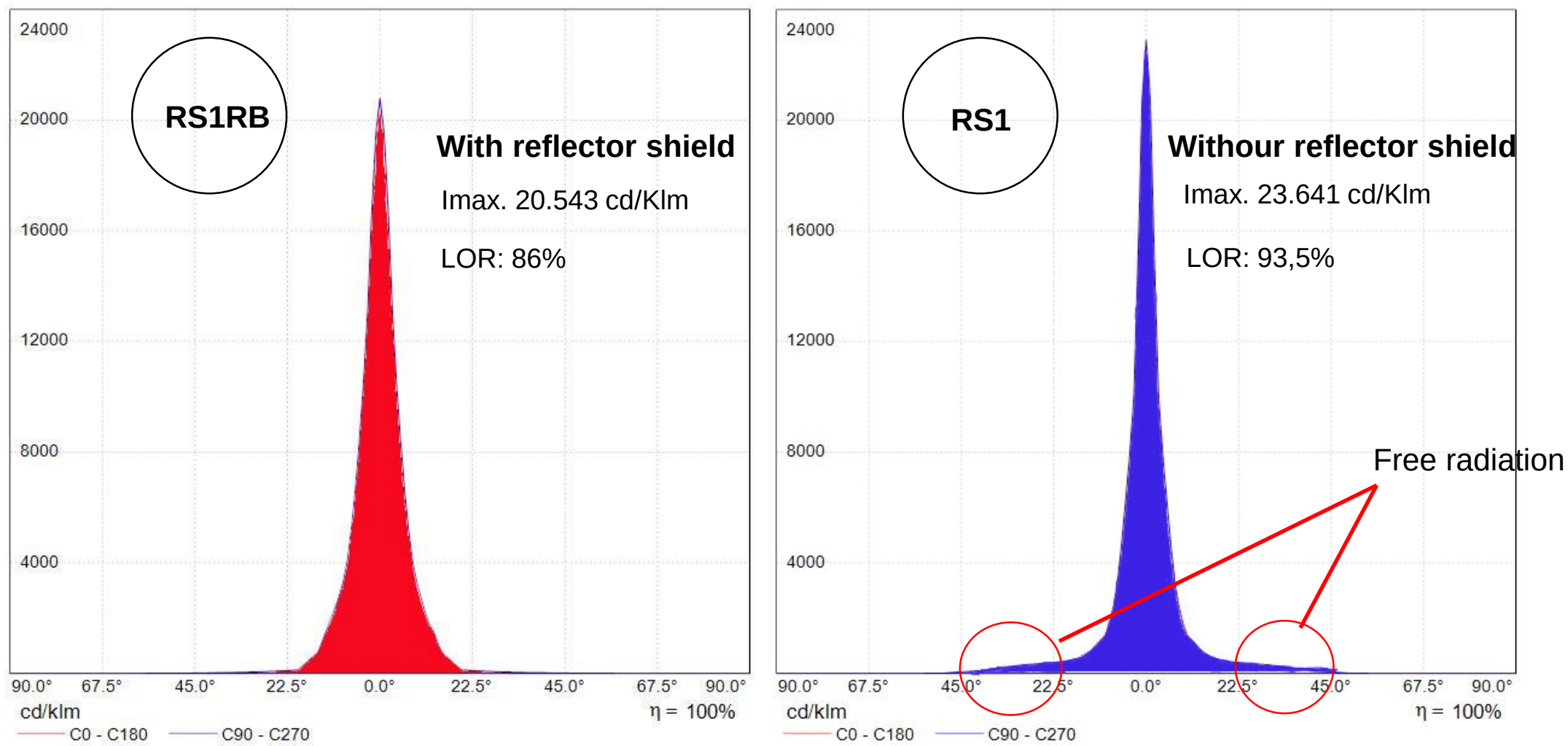
CRI & CIE, Standard of the International Lighting Commission



- CRI: comparison of 8 reference colors with a reference light source
- Test Index from the 60s

SIRIUS®

Full-Cut-Off – limitation of the free radiation



SIRIUS®

Full-Cut-Off – limitation of the free radiation

no free radiation

free radiation

RS1RB

Mit Reflektorblende

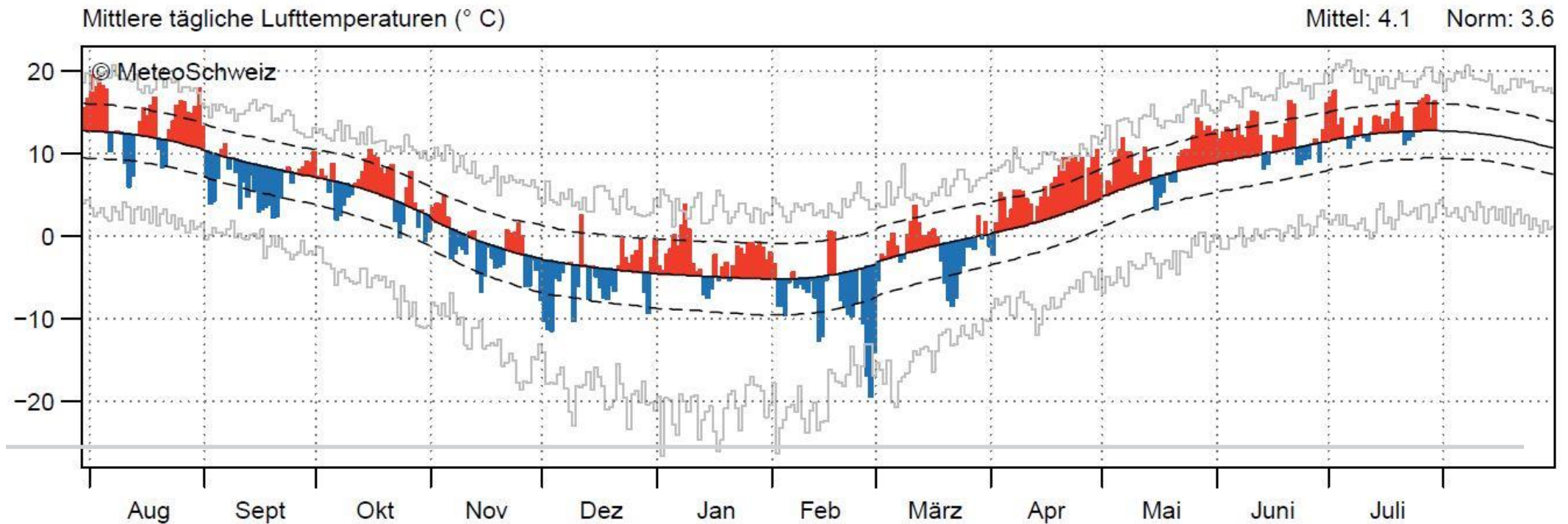
RS1

Ohne Reflektorblende

Why Dynamic Temperature Control – CLO 2.0?

Significant temperature differences over the course of the year.

25° C annual average temperature is rare.



Source: Bundesamt für Meteorologie und Klimatologie MeteoSchweiz

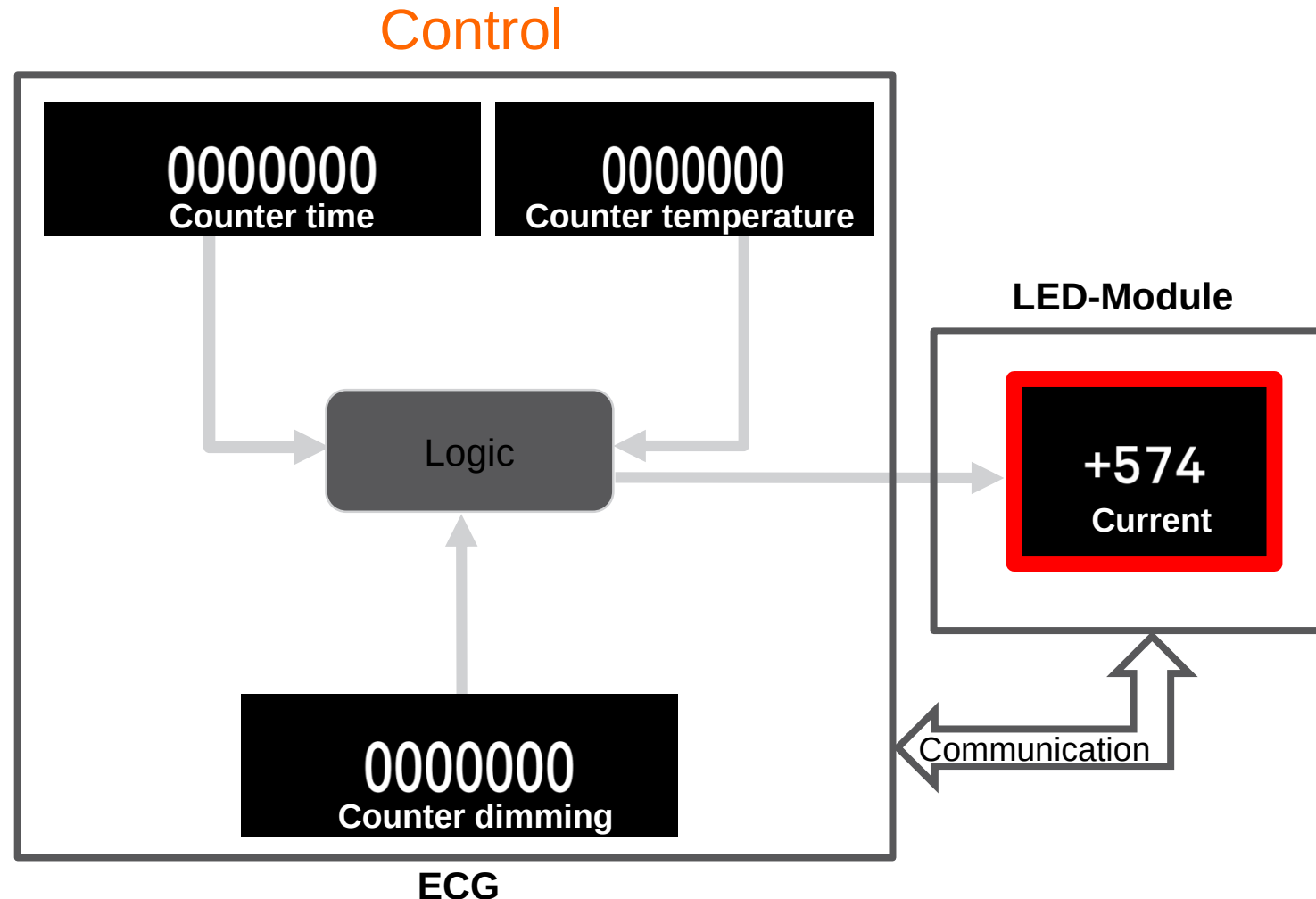
Why Dynamic Temperature Control – CLO 2.0?

Functionality CLO 2.0

- Individual current depending on:
 - Outdoor temperature
 - Dimming LED moduleA
 - LED type

Advantage CLO 2.0

- Maximum lifetime of luminaire components
- Constant lumen output thanks to individual current
- Lower energy consumption





Takk for oppmerksomheten

Kom å besøk oss på stand