Longood LED 250W — Cucumber Greenhouse, Fresno CA

Customer: Demo Project

Project	Longood LED 250W — Cucumber Greenhouse, Fresno CA	**Fixture**	Longood LED 250W TOP
Crop	Cucumbers (250 µmol)	**Area**	144.0 × 72.0 m
Mounting height	3.20 m	**Spacing X×Y**	1.32 × 1.81 m
Fixtures	4440 pcs	**Calculation method**	Point-by-point (LM-63)
Roof transmission coeff.	0.88	**Maintenance factor (LLF)**	0.85
Wall reflection coeff.	0.50		

1. Calculation Summary

Parameter	Value	Crop Standard	Status
Fixture model	Longood LED 250W TOP	—	—
Average illuminance, E_avg	283.6 µmol/m²/s	250 µmol/m²/s	meets target
Minimum, E_min	269.0 µmol/m²/s	180 µmol/m²/s	
Maximum, E_max	319.5 µmol/m²/s	500 µmol/m²/s	OK
Uniformity U0 = Emin/Eavg (g1)	0.95	≥ 0.80	
U1 = Emin/Emax (g2)	0.84	—	—
DLI (photoperiod 18 h)	16.3 mol/m²/day	16 mol/m²/day	
Fixtures in layout	4440 pcs	—	—
Power density	107.1 W/m²	—	—
PPF efficacy	3.50 µmol/J	—	—

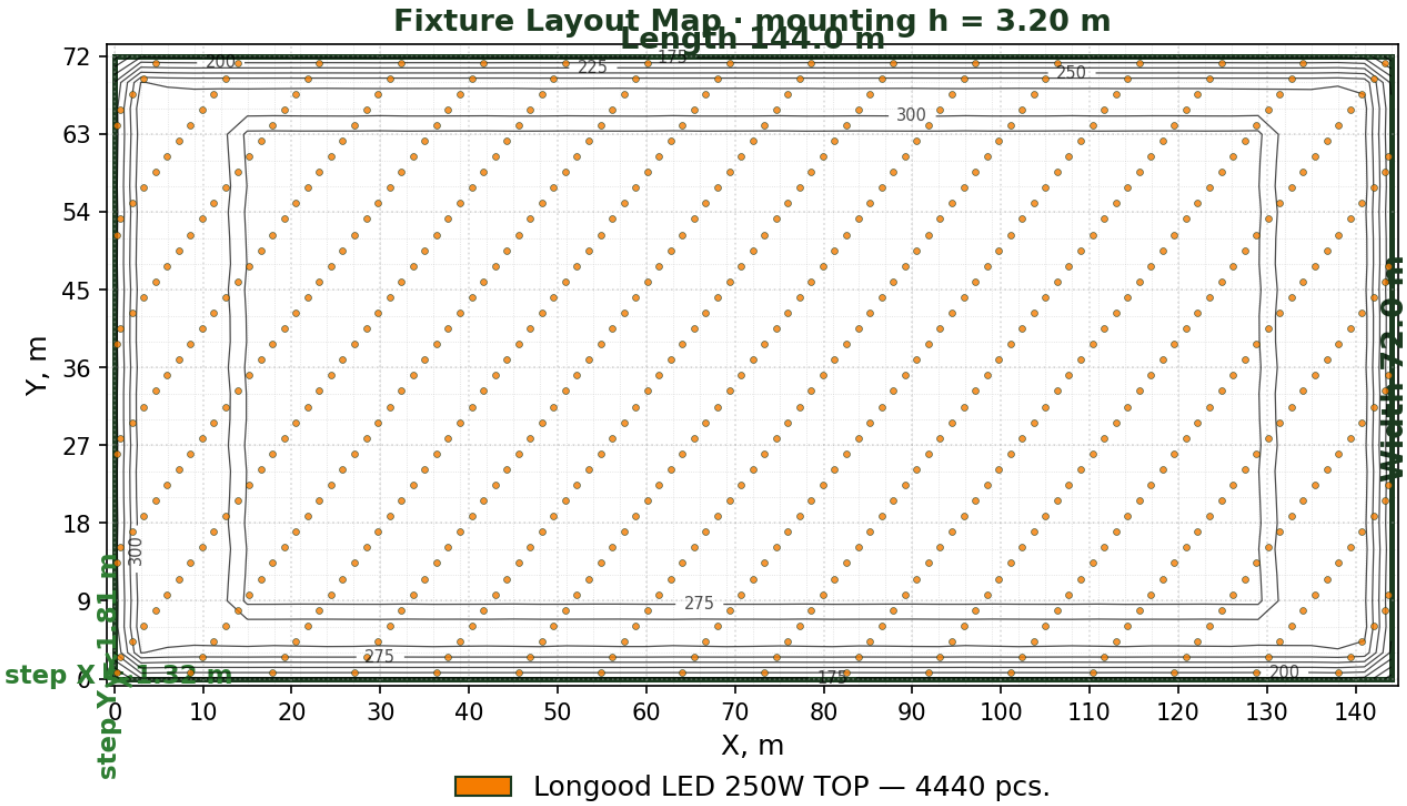
Calculation meets the standard for crop «Cucumbers (250 µmol)»: average, minimum, and uniformity values are within recommended limits.

Fixture Parameters and Power Consumption

Brand / Model	Longood · LED 250W TOP
Technology	LED · —
Spectrum / CCT	—
PPF (rated)	875 µmol/s
Power	250 W
Efficacy	3.50 µmol/J
Fixtures in layout	4440 pcs
Total photon flux	3 885 000 µmol/s
Total power consumption	1110.00 kW
IP rating	IP65

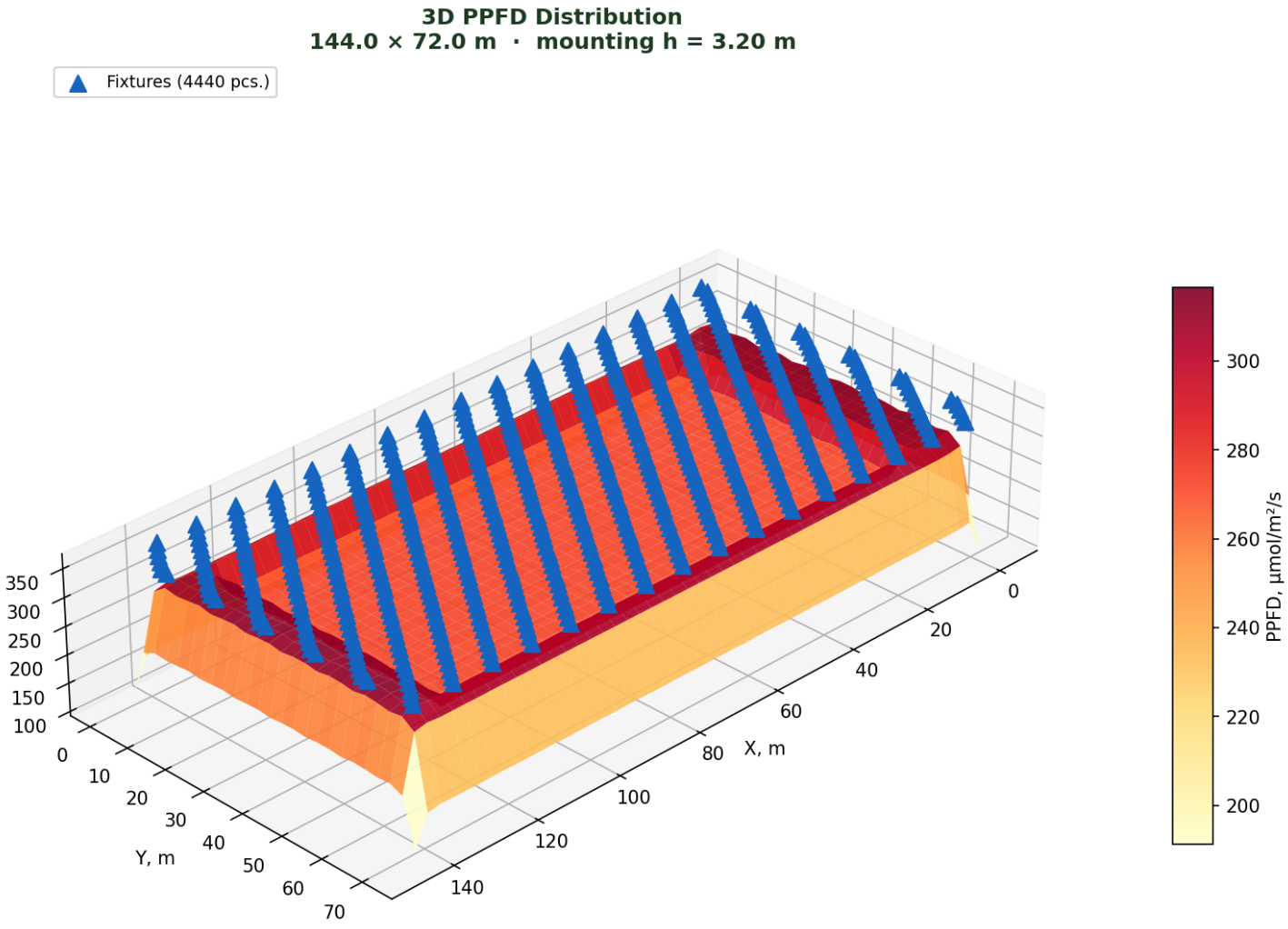
2. Fixture Layout Map

Regular grid with spacing 1.32 × 1.81 m. Total fixtures placed: 4440. Mounting height above plants: 3.20 m.



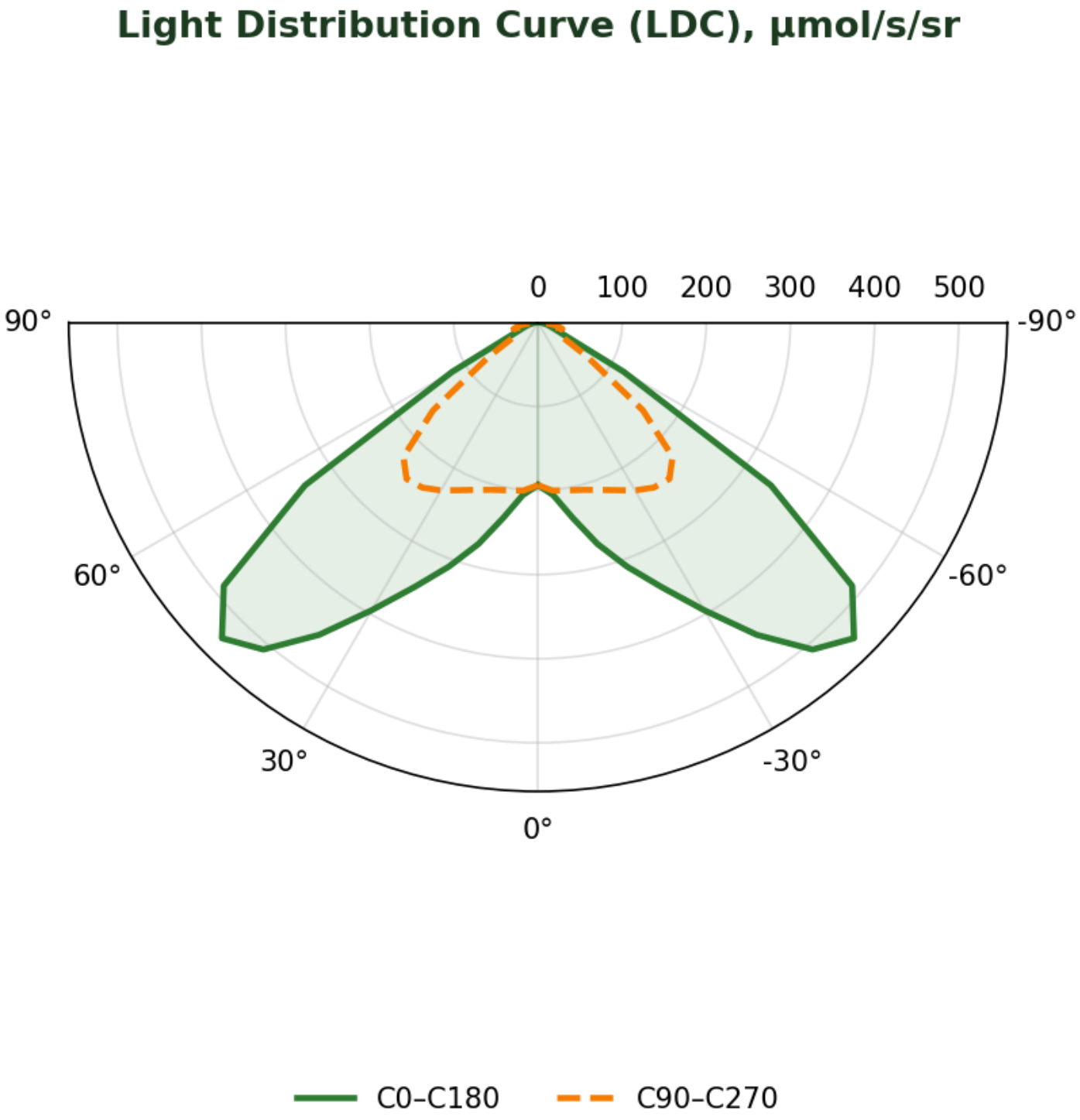
3. 3D Isometric PPFD Distribution

Isometric top-side view: surface height corresponds to the PPFD value at each point of the working plane. Blue markers indicate fixture positions above the surface.



4. Luminaire Intensity Distribution Curve (LDC)

Polar diagram of luminous intensity distribution built directly from the luminaire IES file. Used in the inverse-square-law calculation.



Equipment Specification

Bill of materials for luminaires based on calculation results.

Description	Unit power, W	Unit PPF, µmol/s	PPE, µmol/J	Qty, pcs	Total power, kW	Total PPF, µmol/s
Longood LED 250W TOP — Main supply	250	875	3.50	4440	1110.00	3 885 000
Longood LED 250W TOP — Hot standby	250	875	3.50	45	11.25	39 375
TOTAL				**4485**	**1121.25**	**3 924 375**

Luminaire Installation Coordinates

Planned luminaire centre coordinates in the plot coordinate system.

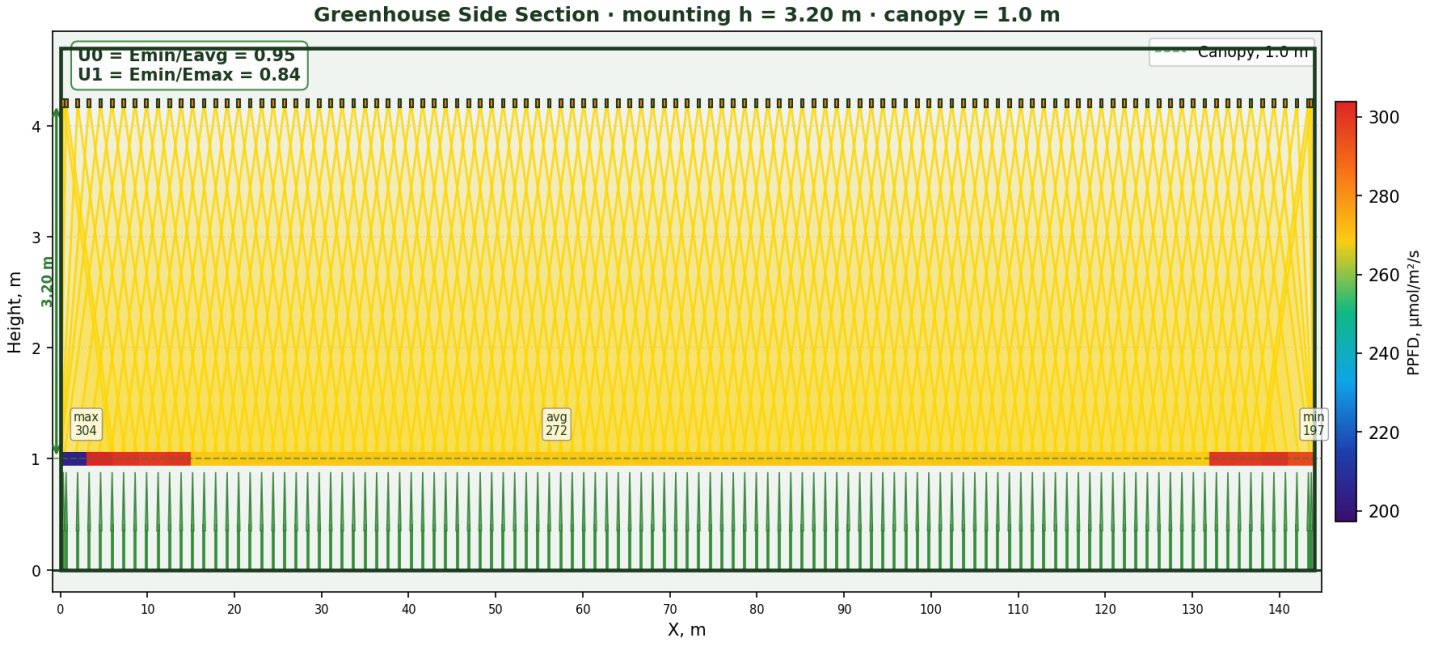
No.	X, m	Y, m	Height, m
1	0.33	0.70	3.20
2	0.66	0.70	3.20
3	1.98	0.70	3.20
4	3.30	0.70	3.20
5	4.62	0.70	3.20
6	5.94	0.70	3.20
7	7.27	0.70	3.20
8	8.59	0.70	3.20
9	9.91	0.70	3.20
10	11.23	0.70	3.20
11	12.55	0.70	3.20
12	13.87	0.70	3.20
13	15.19	0.70	3.20
14	16.51	0.70	3.20
15	17.83	0.70	3.20
16	19.16	0.70	3.20
17	20.48	0.70	3.20
18	21.80	0.70	3.20
19	23.12	0.70	3.20
20	24.44	0.70	3.20
21	25.76	0.70	3.20
22	27.08	0.70	3.20
23	28.40	0.70	3.20
24	29.72	0.70	3.20
25	31.05	0.70	3.20
26	32.37	0.70	3.20
27	33.69	0.70	3.20
28	35.01	0.70	3.20
29	36.33	0.70	3.20
30	37.65	0.70	3.20
31	38.97	0.70	3.20
32	40.29	0.70	3.20
33	41.61	0.70	3.20
34	42.94	0.70	3.20
35	44.26	0.70	3.20
36	45.58	0.70	3.20
37	46.90	0.70	3.20
38	48.22	0.70	3.20
39	49.54	0.70	3.20
40	50.86	0.70	3.20
41	52.18	0.70	3.20

42	53.50	0.70	3.20
43	54.83	0.70	3.20
44	56.15	0.70	3.20
45	57.47	0.70	3.20
46	58.79	0.70	3.20
47	60.11	0.70	3.20
48	61.43	0.70	3.20
49	62.75	0.70	3.20
50	64.07	0.70	3.20
51	65.39	0.70	3.20
52	66.72	0.70	3.20
53	68.04	0.70	3.20
54	69.36	0.70	3.20
55	70.68	0.70	3.20
56	72.00	0.70	3.20
57	73.32	0.70	3.20
58	74.64	0.70	3.20
59	75.96	0.70	3.20
60	77.28	0.70	3.20

Full coordinate list available in the CSV file.

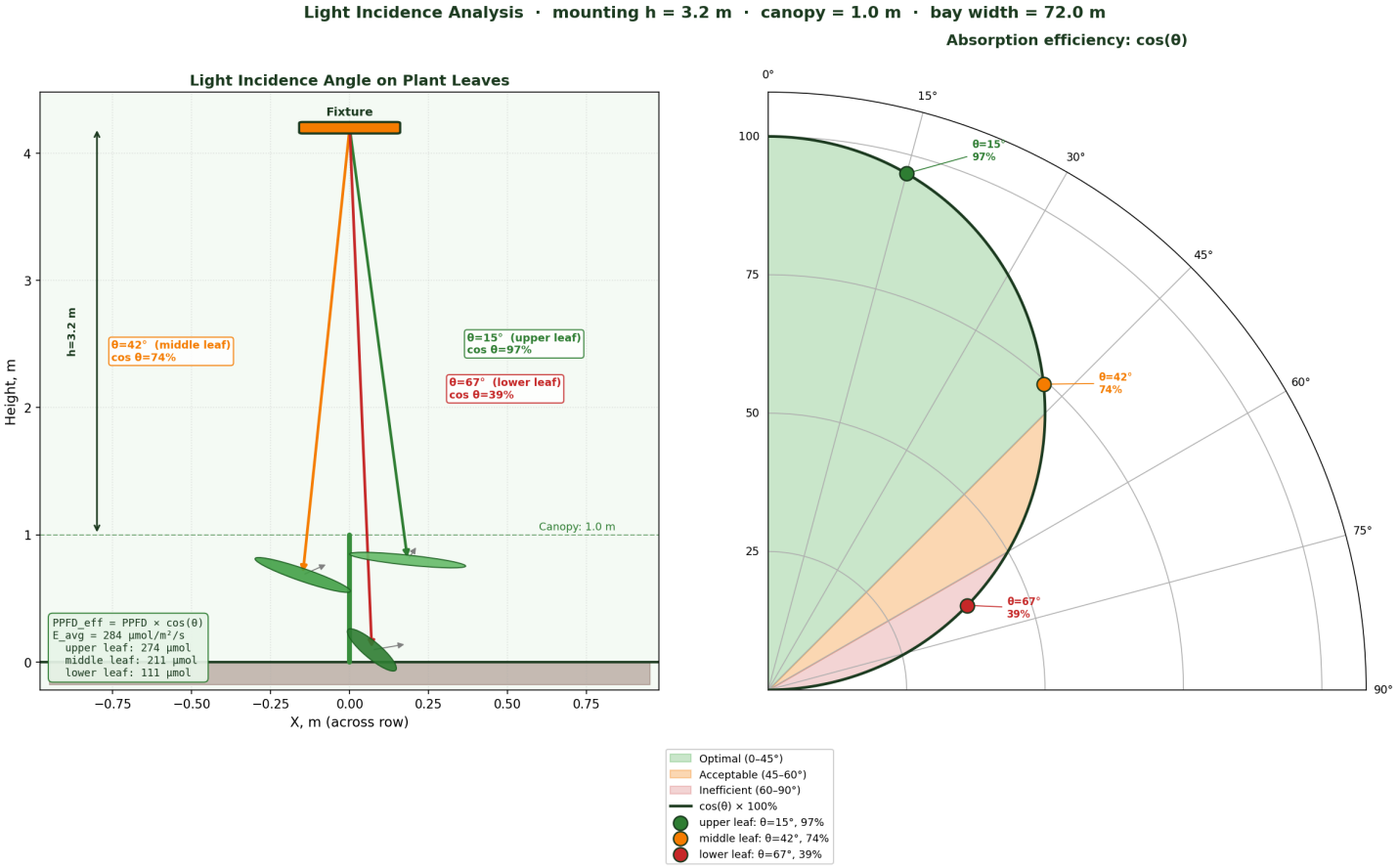
5. Greenhouse Side Section

Schematic side section: fixtures at mounting height, emission cones (yellow lines) and PPFD distribution at plant canopy level (colour gradient).



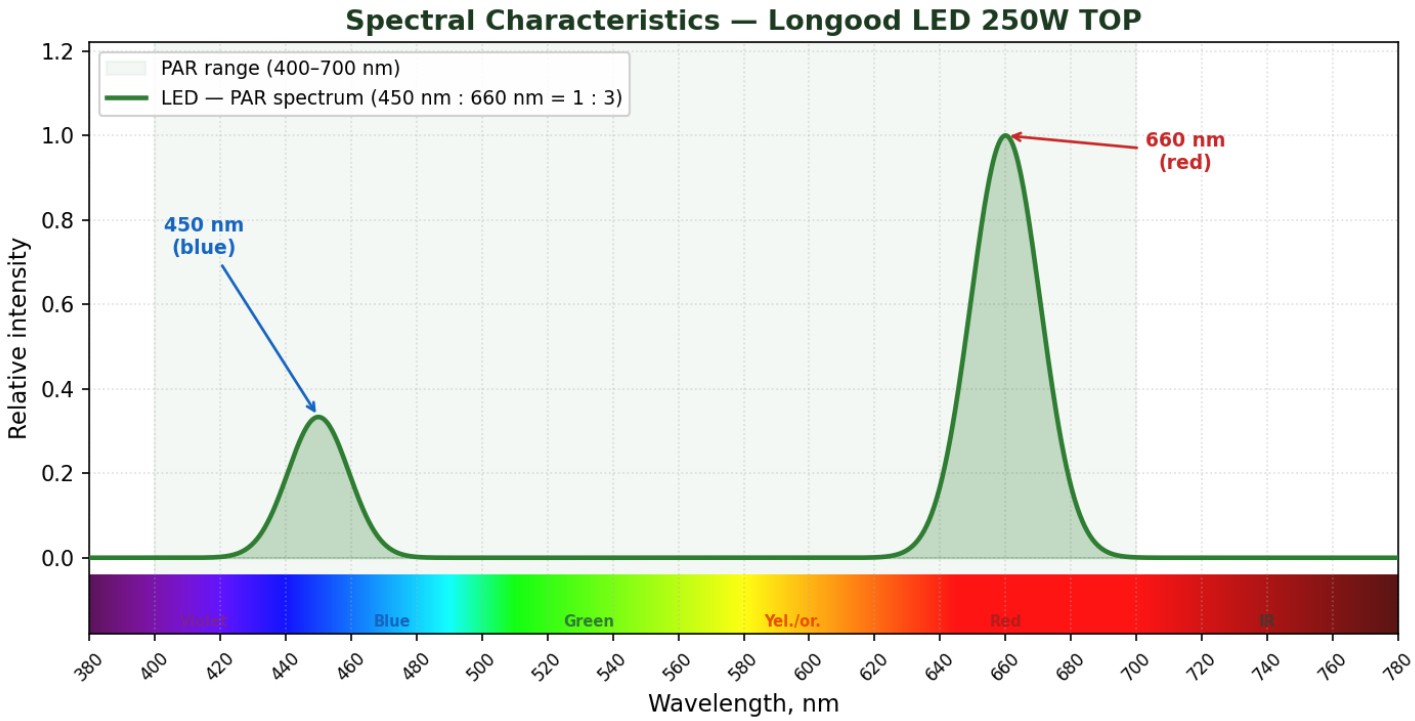
6. Light Incidence Analysis on Plant

Diagram illustrates how the incidence angle θ between the light ray and the leaf surface normal affects absorption. Effective flux: PPFD_eff = PPFD × cos(θ). Green zone (0–45°) — optimal; yellow (45–60°) — acceptable; red (>60°) — significant losses.



7. Luminaire Spectral Characteristics

Relative spectral power distribution across the PAR wavelength range (380–780 nm). For LED: peaks at 450 nm (blue) and 660 nm (red). For HPS: broad peak 565–620 nm.



Solar Radiation and Supplemental Lighting Need

Insolation analysis based on NASA POWER data (2021–2023). City: Fresno (36.74°N, -119.78°E).

Month	Sun DLI, mol/m²/d	Suppl. DLI, mol/m²/d	Total DLI, mol/m²/d	Status
Jan	4.3	16.3	20.6	sufficient
Feb	6.3	16.3	22.6	sufficient
Mar	8.0	16.3	24.3	sufficient
Apr	11.1	16.3	27.4	sufficient
May	12.7	16.3	29.1	sufficient
Jun	13.2	16.3	29.5	sufficient
Jul	13.0	16.3	29.4	sufficient
Aug	11.5	16.3	27.8	sufficient
Sep	9.6	16.3	25.9	sufficient
Oct	7.2	16.3	23.5	sufficient
Nov	5.1	16.3	21.4	sufficient
Dec	3.2	16.3	19.6	sufficient

Sunlight is sufficient all year round.

Luminous Flux Degradation over 3 Years

Year	LLF	PPFD, µmol/m²/s	Deviation	Status
Year 0	1.00	283.6	+13.4%	OK
Year 1	0.95	269.4	+7.8%	OK
Year 2	0.88	249.6	-0.2%	below target
Year 3	0.82	232.5	-7.0%	below target

If PPFD drops below the crop target, clean the optics and check drivers.

Thermal Balance and Ventilation

Roofing material	polycarbonate
Greenhouse temperature (crop optimum)	24.0 °C
Outdoor temperature (NASA POWER, мин. месяц JAN)	-4.2 °C
Temperature differential	28.2 °C
Thermal Balance	
Fixture heat output (48% of power)	538.2 kW
Heat loss through envelope (12398.4 m²)	1223.7 kW
Excess heat	**-685.5 kW**

Fixtures contribute to greenhouse heating. No excess heat, forced ventilation is not required.

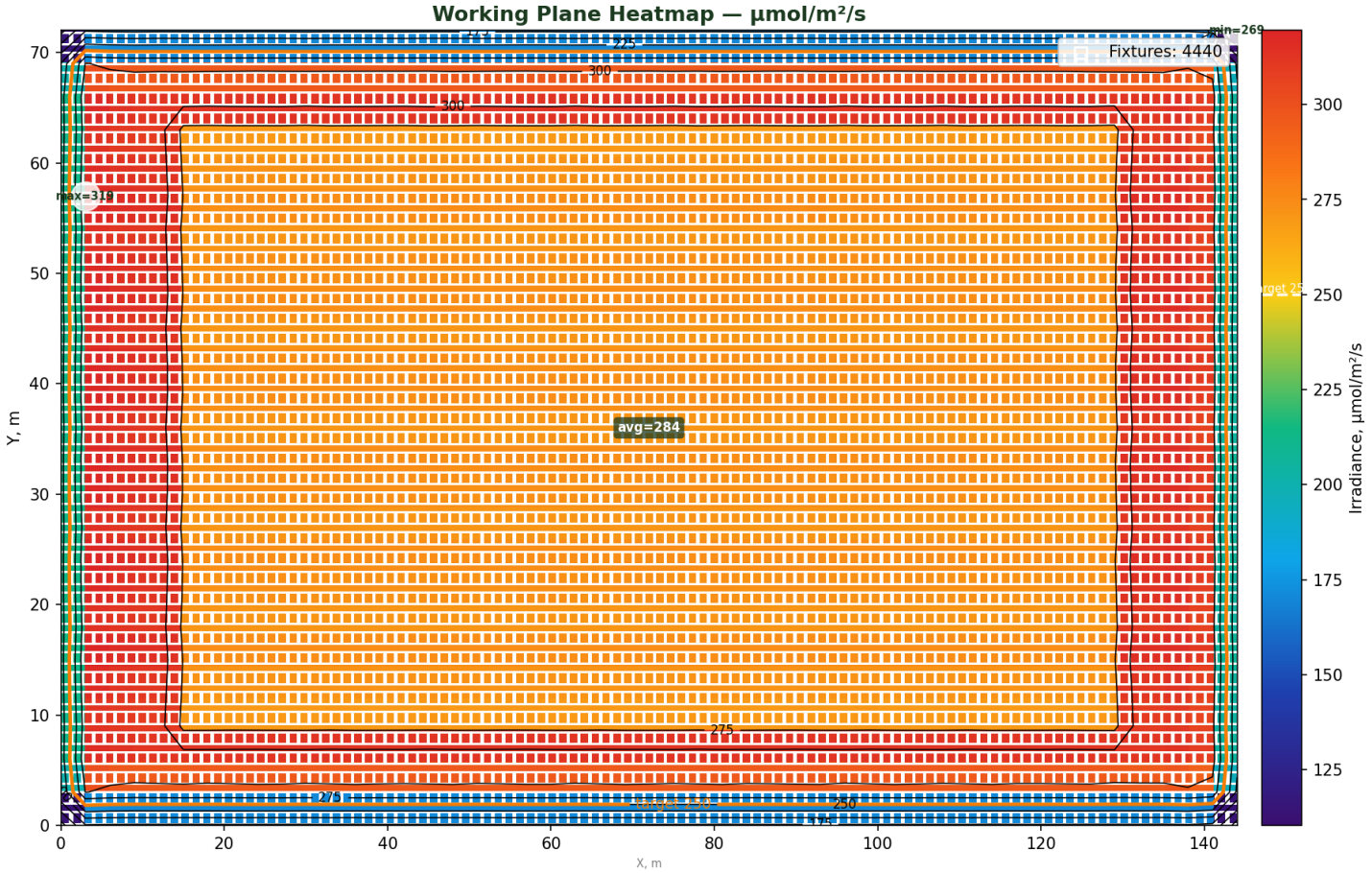
Economic Assessment (ROI)

Equipment (4485 pcs × 280)	1 255 800
Installation and commissioning (20%)	251 160
Total CAPEX	**1 506 960**
Lighting hours per year	2 880 h
Energy consumption, kWh/year	3 229 200 kWh
Electricity costs, /year	581 256

Insufficient data to calculate payback period.

8. Working Plane Heatmap

Light distribution (µmol/m²/s) at plant canopy level. Fixtures placed: 4440. Area: 144.0 × 72.0 m, mounting height: 3.20 m, spacing 1.32 × 1.81 m.

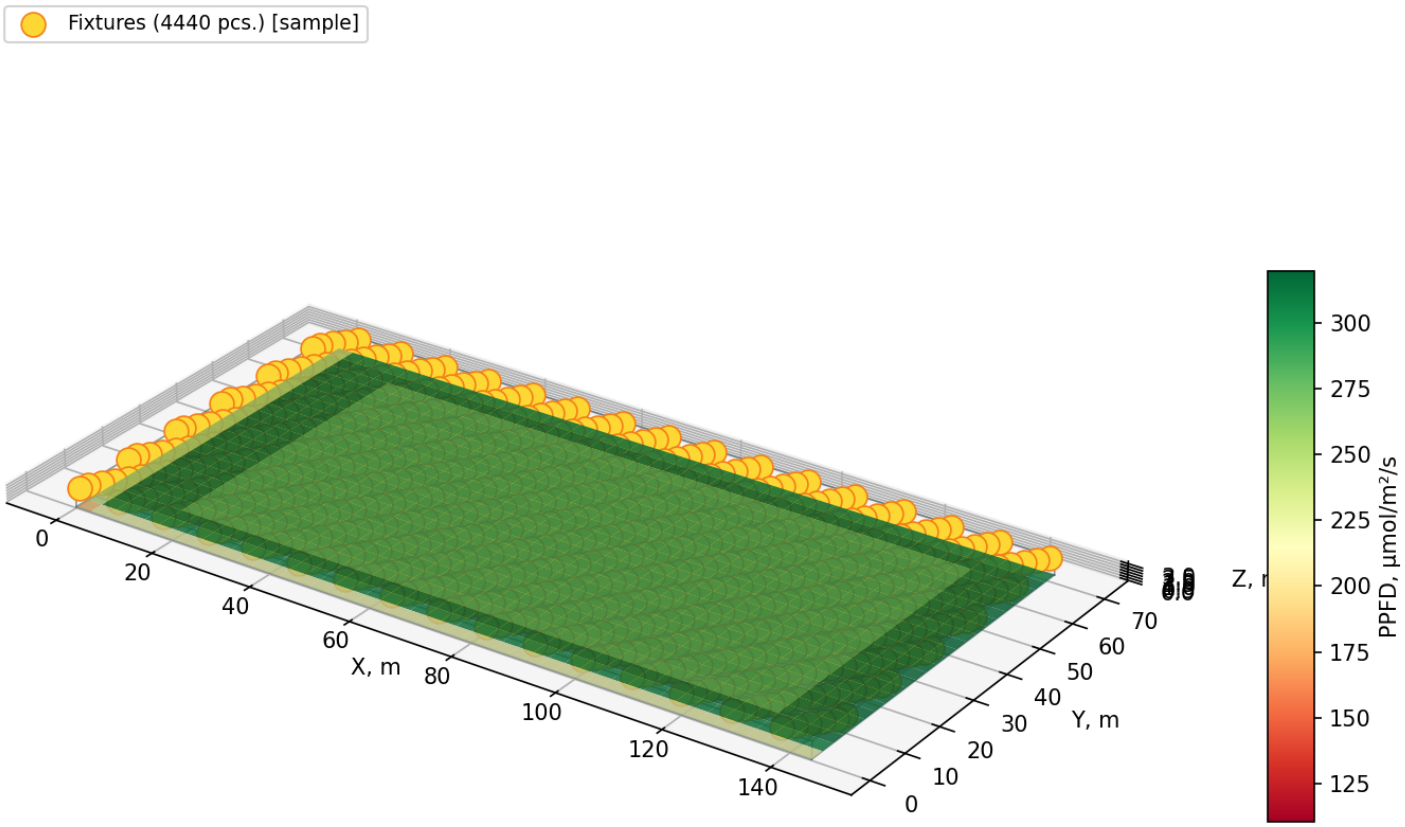


Edge attenuation is a physical norm: edge fixtures illuminate only the inner zone.
In a real greenhouse, side walls reflect light and edge values are higher than calculated.

Fixture Layout — Isometric View

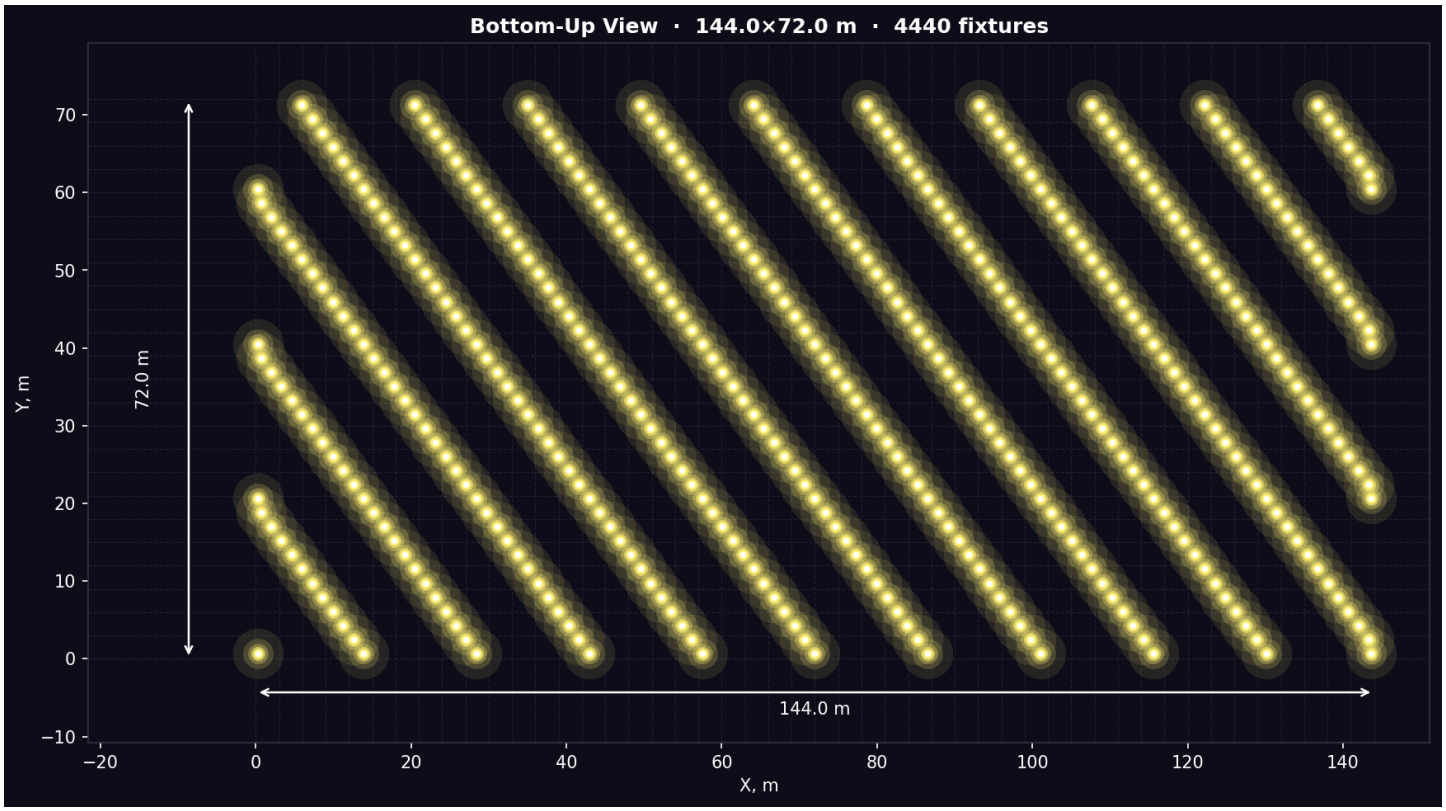
Fixture placement and PPFD at plant canopy level

Isometric View · 144.0×72.0 m · h=3.2 m



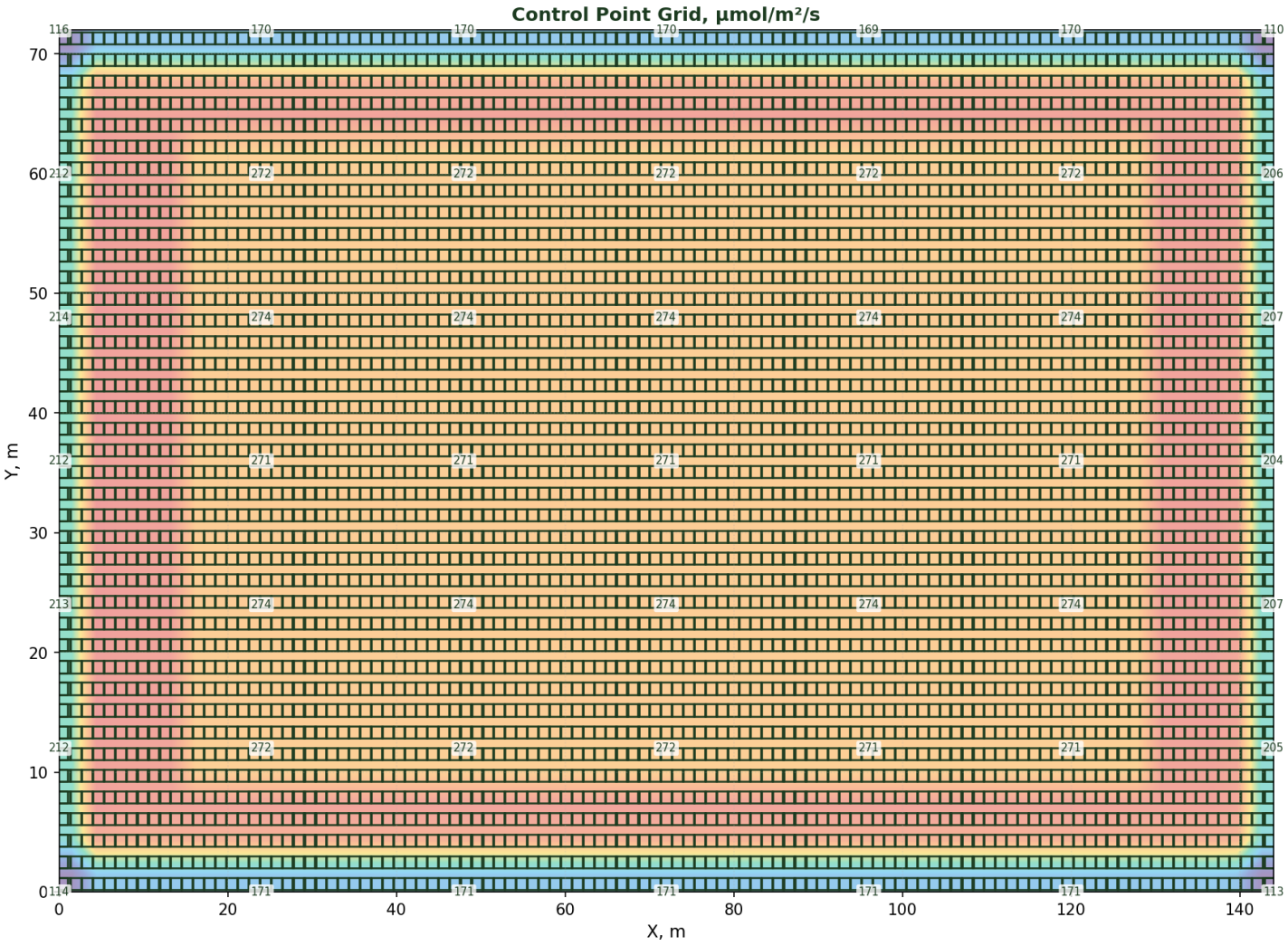
Plant Level View

Fixture distribution above growth zone



9. Control Point Grid

Numerical values at representative points of the working plane. Grid is thinned for readability; full data is available in the API JSON response.



Lighting Optimisation Recommendations

Generated automatically from calculation results

Layout is optimal. U0=0.95

These recommendations are engineering guidance and require verification in accordance with the greenhouse structure and crop agrotechnical requirements.

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