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Determining optimized roles for different types of light delivery sources

Workshop on Ultraviolet Disinfection Technologies

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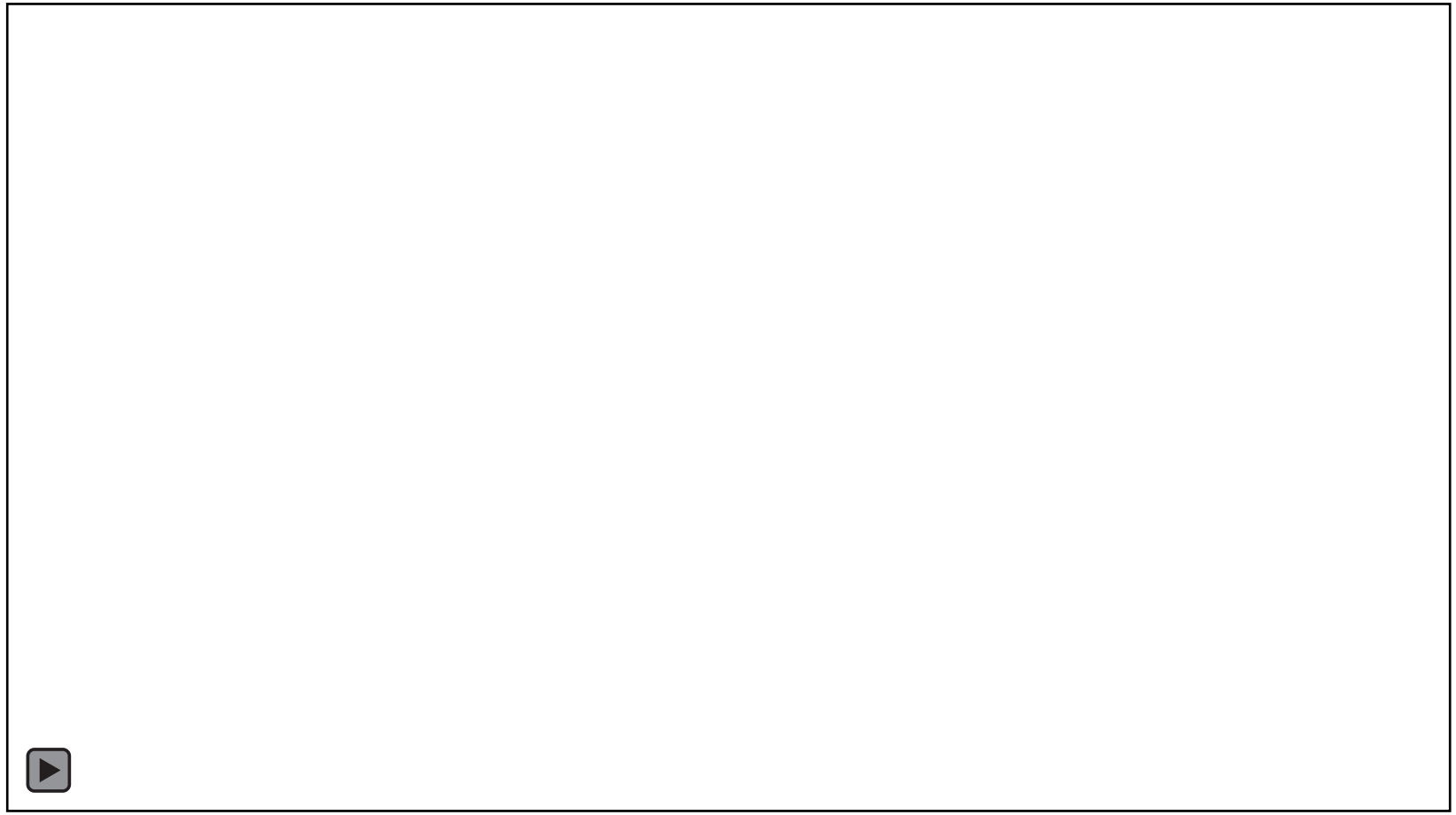
Current UV-C light delivery paradigm

- Pre-Programmed platform, Route / Task adaptable, **can smart light sources be integrated to overcome:**
- Idealized emptiness, **can it navigate and operate around clutter and people?**
- Limited range, due to battery and DC to AC conversion, **can it deliver less power hungry photons, conserve electricity?**
- Sub optimized light delivery, **can it reconfigure to deal with complex objects, orientations, sensitive materials, and contamination at close range?**
- Consistent? Replicable? No Authentication, **can it verify the job got properly done?**



Current light source of robot – LP lamp

Optical power scales in terms of increments of lamp volume (mm diameters, cm lengths) and input electrical power (W) in terms of AC amps / volts

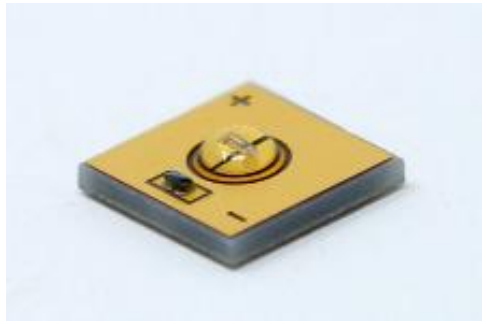
Based on Mercury Vapor / Ionization Density

+ Established / Proven / Reliable
+ Excellent for Germicidal Heavy Lifting with no one around
- Rigid. Not reconfigurable. Limited optical reach, incomplete coverage
- DC/AC conversion, power hungry. Wasted photons.
- Ballast, extra weight, breakable quartz envelope, agility compromised

Type	Lamp length (mm)	Power (W)	1 meter UV intensity(μw/cm2)	Bulb holder (optional)	Have or not the ozone
ZW4S15Y	135	4	16	G13或 G5	
ZW6S12Y	212	6	20	G13或 G5	
ZW8S12Y	288	8	22	G13或 G5	optional
ZW10S15Y	331	10	28	G13或 G5	optional
ZW15S19Y	437或380	15	40	G13	optional
ZW20S19Y	589	20	70	G13	optional
ZW30S15Y	894	30	100	G13	optional
ZW40S15Y	1199	40	120	G13	optional
	1500	55		G13	optional

Candidate for Smart light Source integrated into robot – G-LED

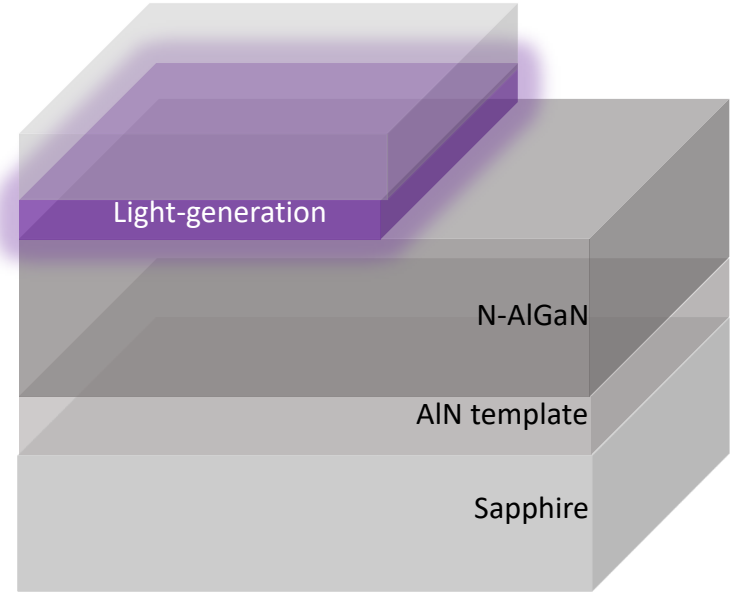
Optical power scales in terms of increments of active area (µm2)
and input electrical input power (W) in terms of DC milliamps / volts

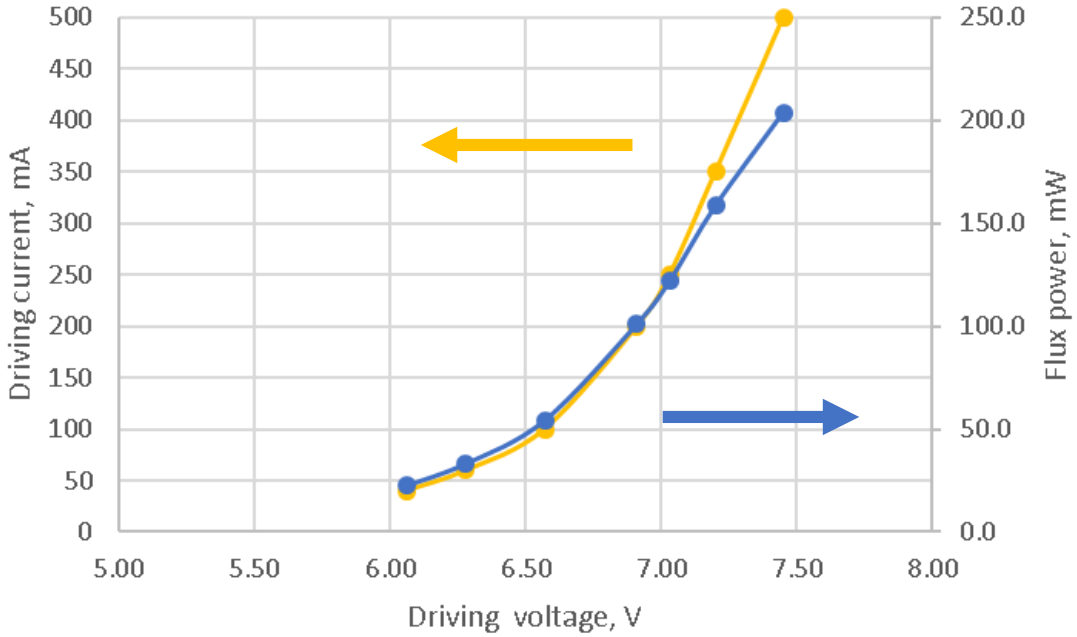


Based on Hole Gas (2DHG) / Current Density / Ionized carriers injected into MQW

+ Flexible, Robust, Densely Packed Arrays possible. Enhancing optical reach
+ Instant Tailoring of Photonic Patterns / Doses possible. Enabling Nimble / Fine Control
+ IOT can re-task / re-orient / re-position around clutter and people
+ High WPE and DC supply saves battery life
- Still requires optical power / reliability / thermal dissipation tradeoff management

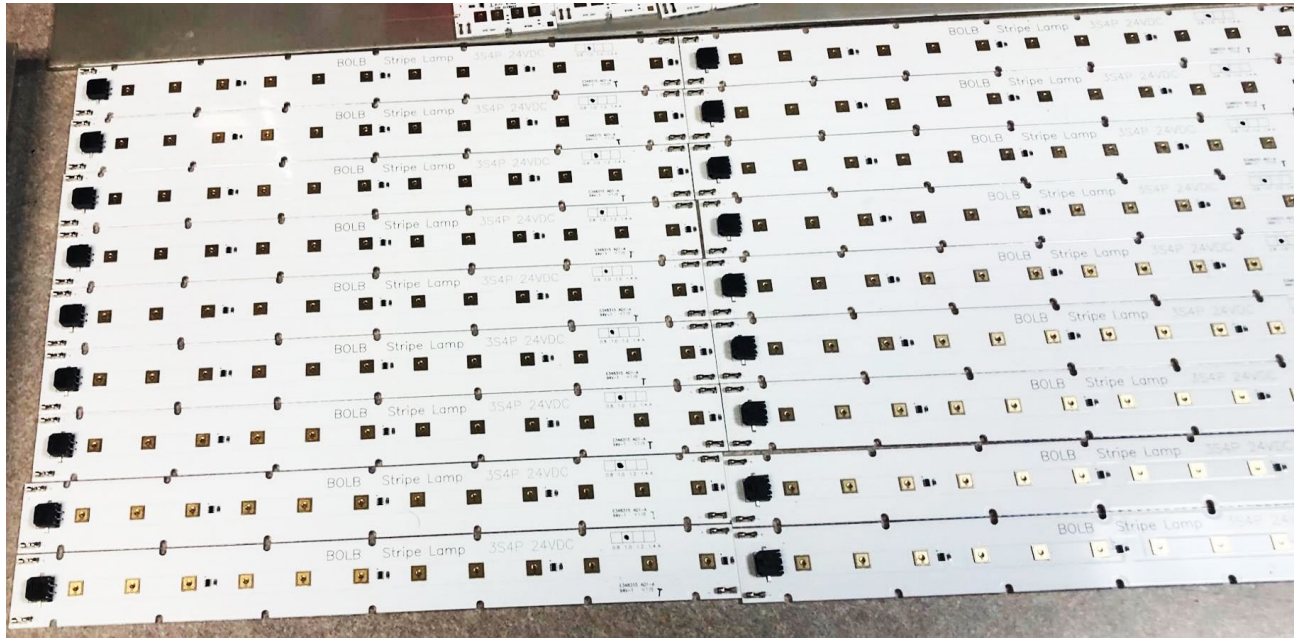
Thin P^+-AlN (1-6 nm)
Thin AlGaN 2DHG channel
P-AlGaN barrier
Thin AlGaN 2DHG channel
P-AlGaN EBL
MQW – Light generation
N-AlGaN structure
AlN template
C-plane sapphire substrate





Patent Protected G-LED enhancements to autonomous robots

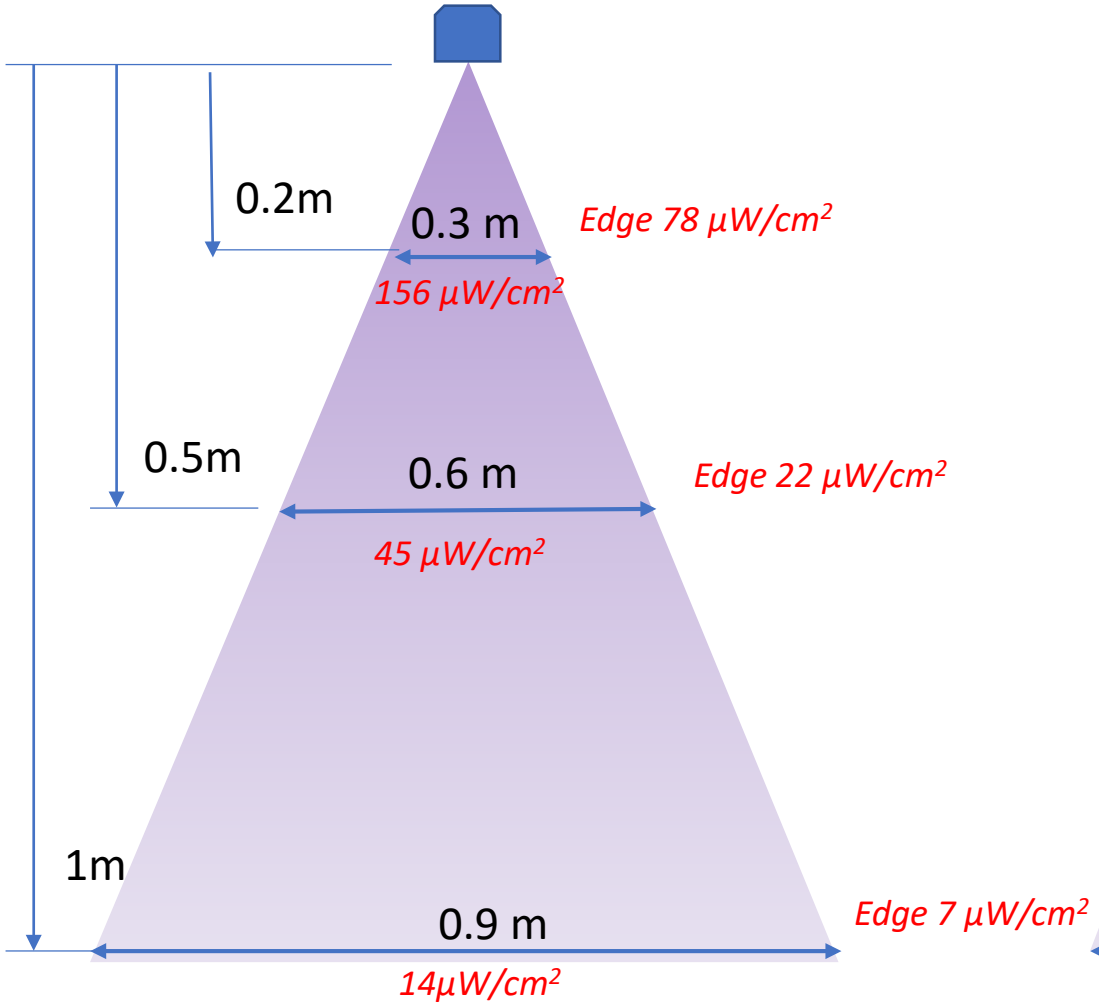
- Up to 10W of optical power using high power LED technology (258 nm - 275nm)
- Populated with optimized inactivation wavelengths or combinations of wavelengths
- Creative unfurling and articulated arms controlling placement / hovering / direction, curving of emittance mechanisms.
- Forward emittance. Pointed away from HCW, Environmental Services Personnel, Patients if in occupied space
- Optimized swap in / swap out emitters, so robot can deal with the pathogens de jour most effectively
- Lensing provides pinpoint accuracy, or wide uniform coverage on complex or hard to reach surfaces
- Self adjusting – Self UV-Correcting. Surfaces are properly exposed. Avert damage / Maintain efficacy



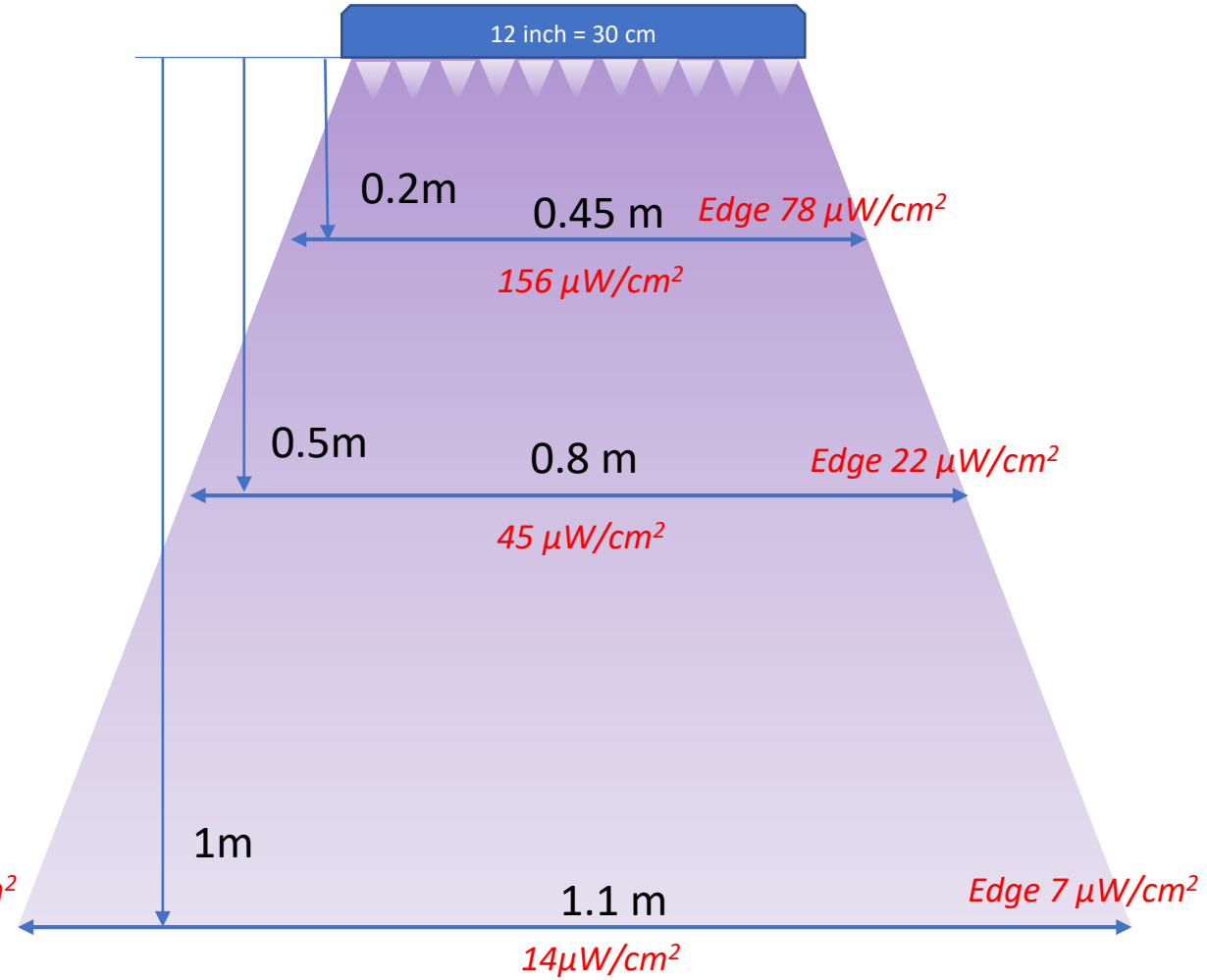
Simulated illumination patterns of 1 x 12

For equivalent rated optical output power, from 1 mm to <1 meter away -
LED arrays produce greater forward emitting intensity than LP lamps

Beam spread profile looking from one end down the length of 1.2 W segment

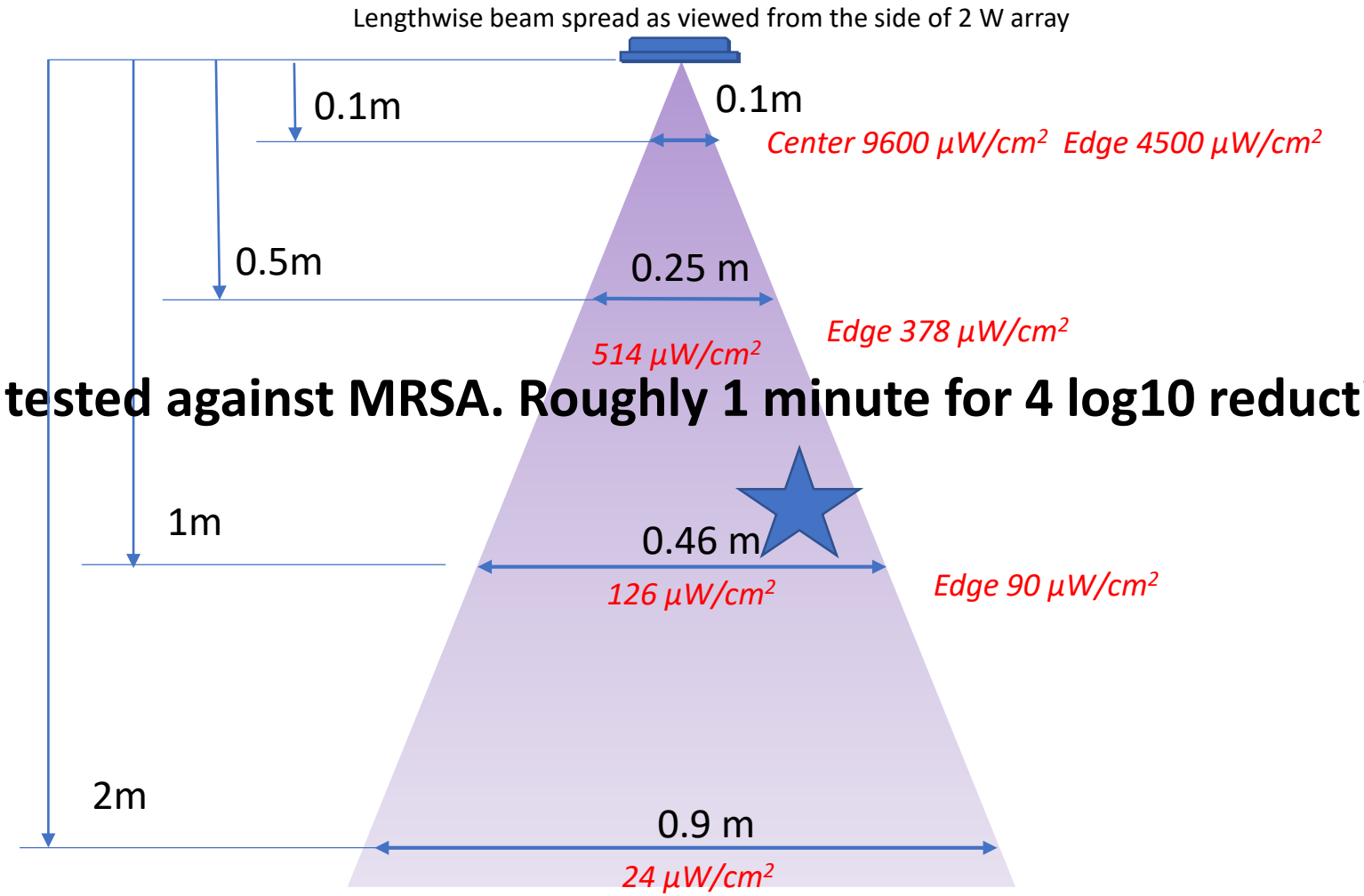


Lengthwise beam spread as viewed from the side of 1.2 W segment



Simulated illumination patterns of 5 X 5 array segment

Much more accurate and higher intensity than LP lamp for “Surgical Strikes”
Corral exposure to accommodate physical properties of target or operation necessities.
Focus on worse case offender High Touch areas.



Lab tested against MRSA. Roughly 1 minute for 4 log10 reduction at 1 meter

UV-Convergence

UV-Complementary light sources for Optimized autonomous disinfection robots

- Vertical LP Lamps fill large spaces. Big hard hitting Doses at greater than 1 meter
- G-LED populated arrays operate at close ranges under 1 meter offering precision, surgical, IOT, tailored, on-demand, select disinfection
  - ✓ Electrical Power usage management. Greater range
  - ✓ Reliability / On time management. Ease of maintenance
  - ✓ Expanded utility. Less clumsy, more nimble. Judicious use of valuable photons
  - ✓ UV-Correcting. UV-Consistent. Authentication
- UV-Combination of Roles
  - ✓ Swiss Army Knife / R2D2 approach to address complicated far distance / up close disinfection tasks in a complex operating environment

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Optimized roles for different types of light delivery sources, determined

Thank you