Filling in the 'Green Gap' LED challenge for microscopy and medical illumination. Providing mercury-free sustainable illumination

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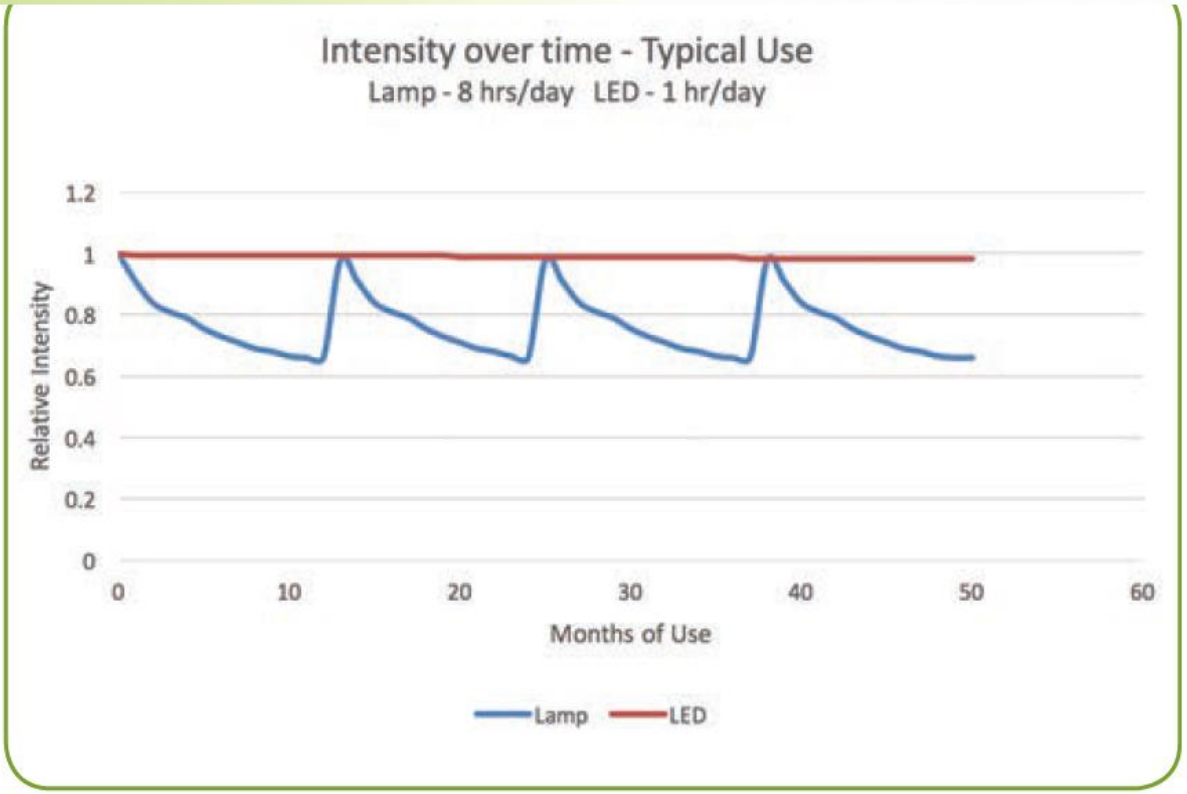
EXCELITAS TECHNOLOGIES

LED vs. Lamp

LED	Lamp
No flicker	Flicker
Instant ON/OFF	Warm-up, cool-down time
Slower intensity loss over time	30% intensity loss in first 400 hours
More stable	Less so
Repeatable output power	
Long lifetime	Lower lifetime, need bulb stock
Less phototoxic to cells	
69% less power consumption	
Zero Mercury	Larger green footprint
No consumables	Bulbs and Light guides
Selectable wavelengths	Reliant on a filter wheel

EXCELITAS TECHNOLOGIES

LED vs. Lamp intensity over time



Cost of Ownership (per 20,000 hours of "ON time")

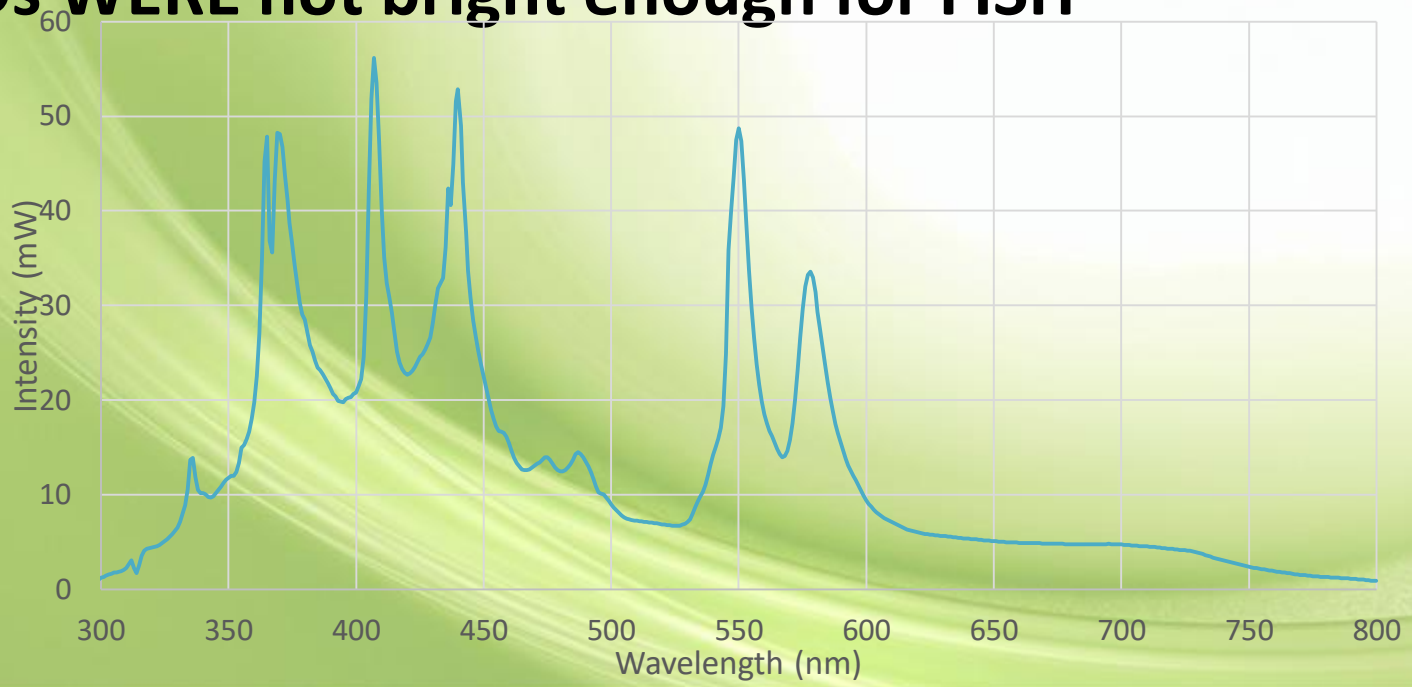
	HBO	X-Cite 120Q	X-Cite 120LED*mini*	X-Cite XYLIS
Replacement Lamps	100	10	-	-
Mercury Content	1100 mg	200 mg	-	-
Lamp Costs	$15,000	$6,250	-	-
Replacement Light Guides	-	5	-	2
Light Guide Costs	-	$1,975	-	$790
Bulb Disposal ($5/bulb)[1]	$500	$50	-	-
Maintenance Costs (bulb, $20/hr)[2]	$1,000	$17	-	-
TOTAL	**$16,500**	**$8,292**	**$0**	**$790**
Hourly Cost[3]	**$0.82**	**$0.41**	**$0**	**$0.04**
Annual Cost[4]	**$1,650**	**$829**	**$0**	**$10**

Notes:

1. Mercury-Free Microscopy white paper www.mygreenlab.org.
2. Assumes 30 min to change/align HBO lamp, 5 min for X-Cite 120Q.
3. Assumes 8 hour day, 4x15 min. imaging sessions. Arc lamps left on for the day and LEDs on continuously during each session.
4. Assumes a 5 day week x 50 weeks.

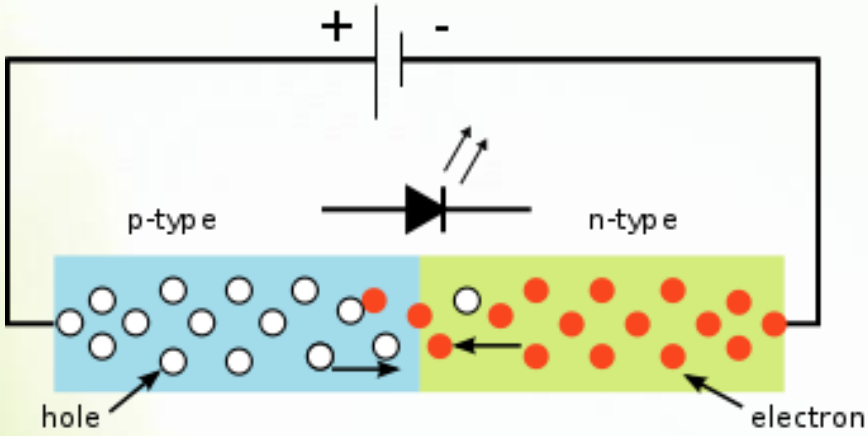
What's the issue?

- **Fluors developed using lamp spectrum**
  - No green gap in lamps
- **LEDs sufferED from the Green Gap**
- **LEDs WERE not bright enough for FISH**



EXCELITAS TECHNOLOGIES

What is the Green Gap?



- Lack of Semiconductor material that emits light between 540-590nm
- Issue for fluors – green/yellow excitation, red emission
- Lamps and Lasers used traditionally

By User:S-kei - File:PnJunction-LED-E.PNG, CC BY-SA 2.5, https://commons.wikimedia.org/w/index.php?curid=14985902

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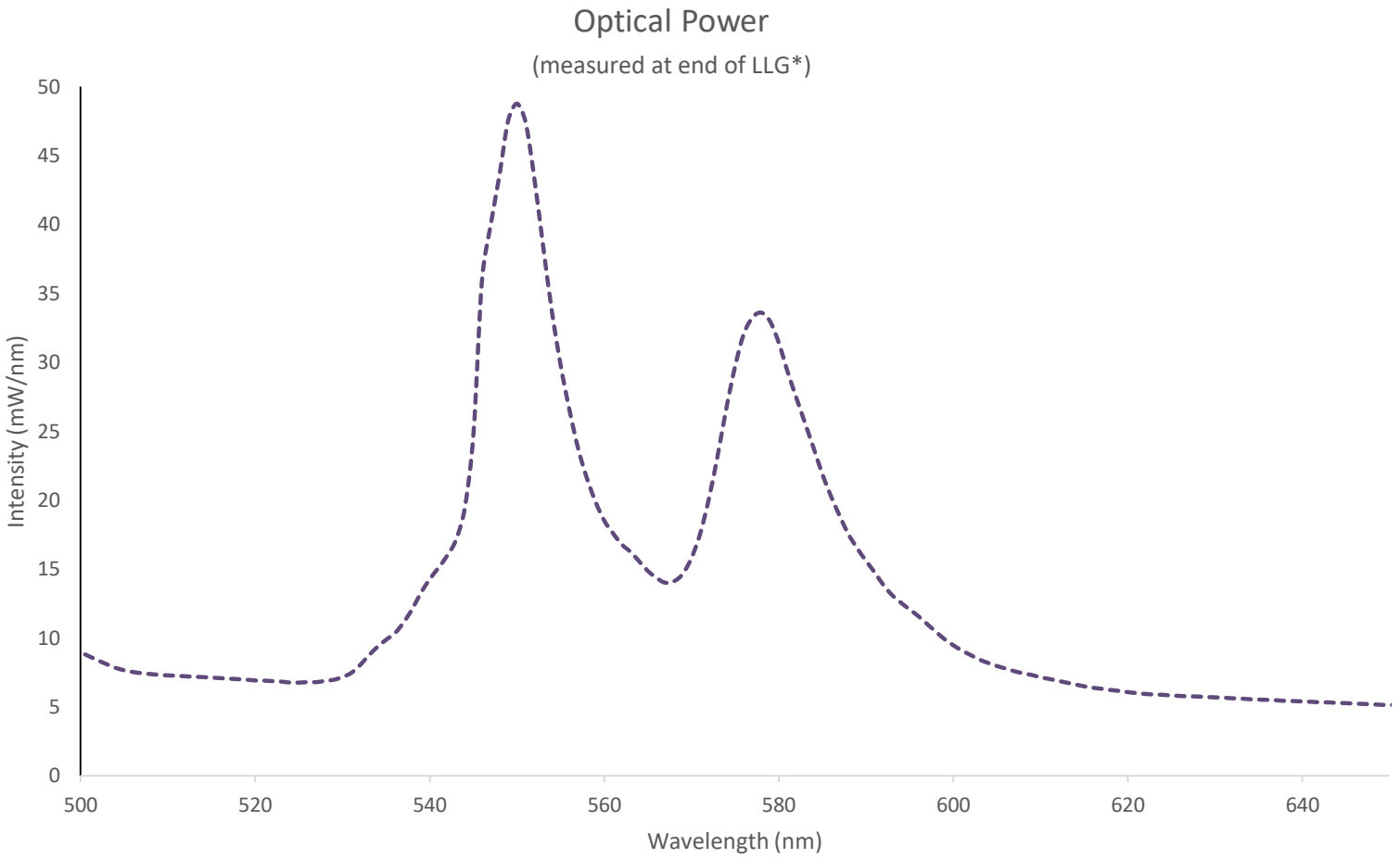
Lamp Output in the Green Gap



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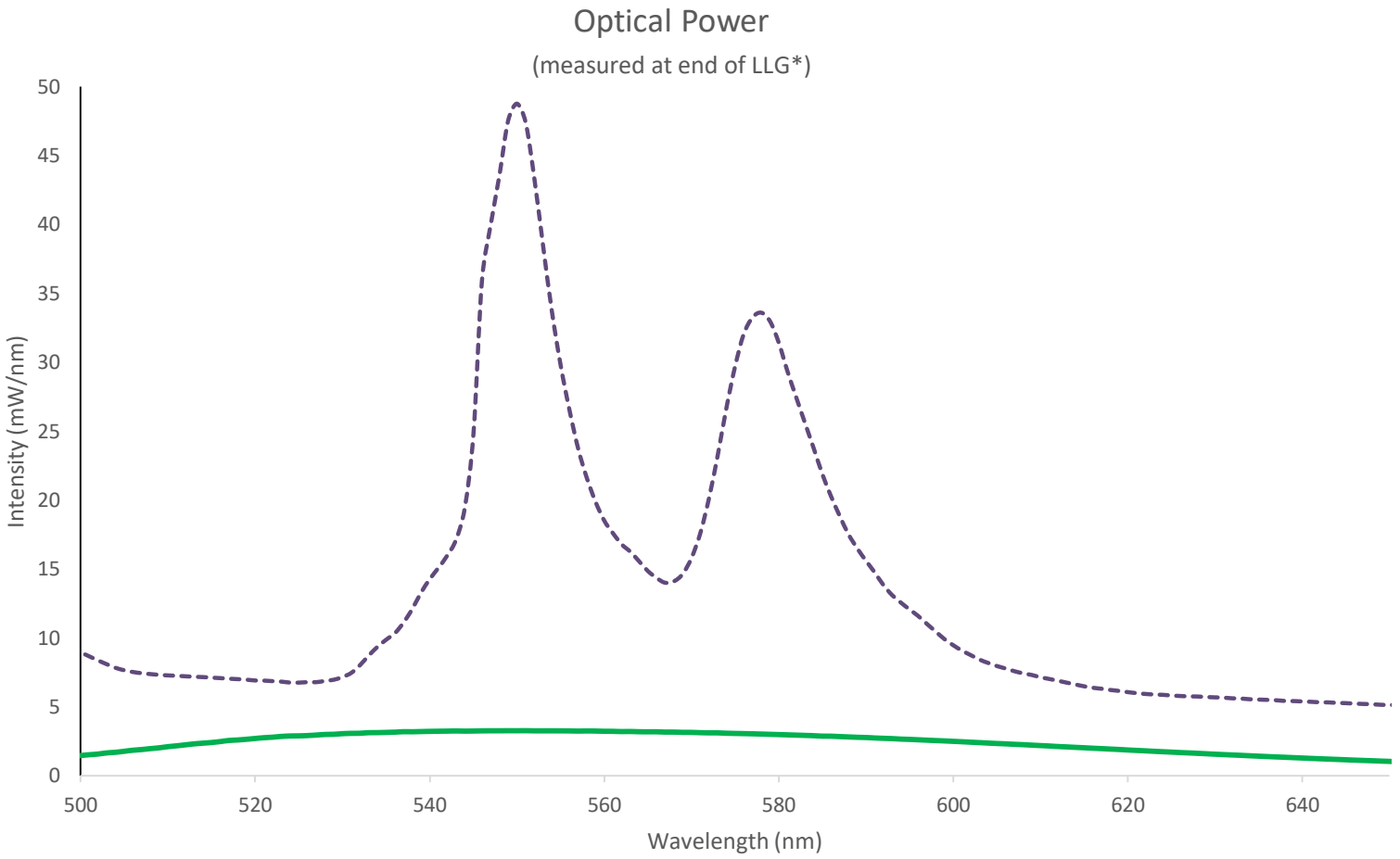
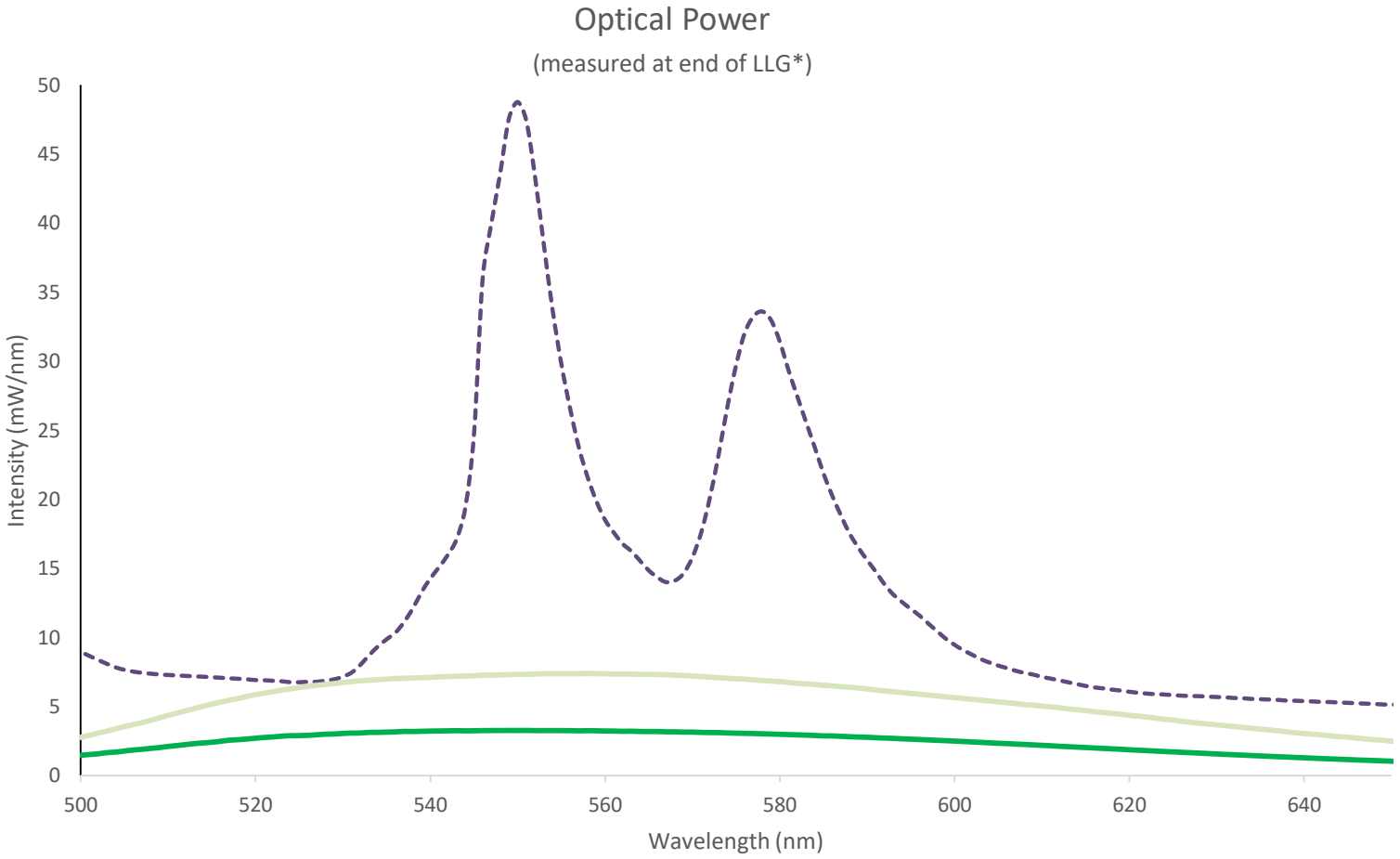
Then came LED



EXCELITAS TECHNOLOGIES



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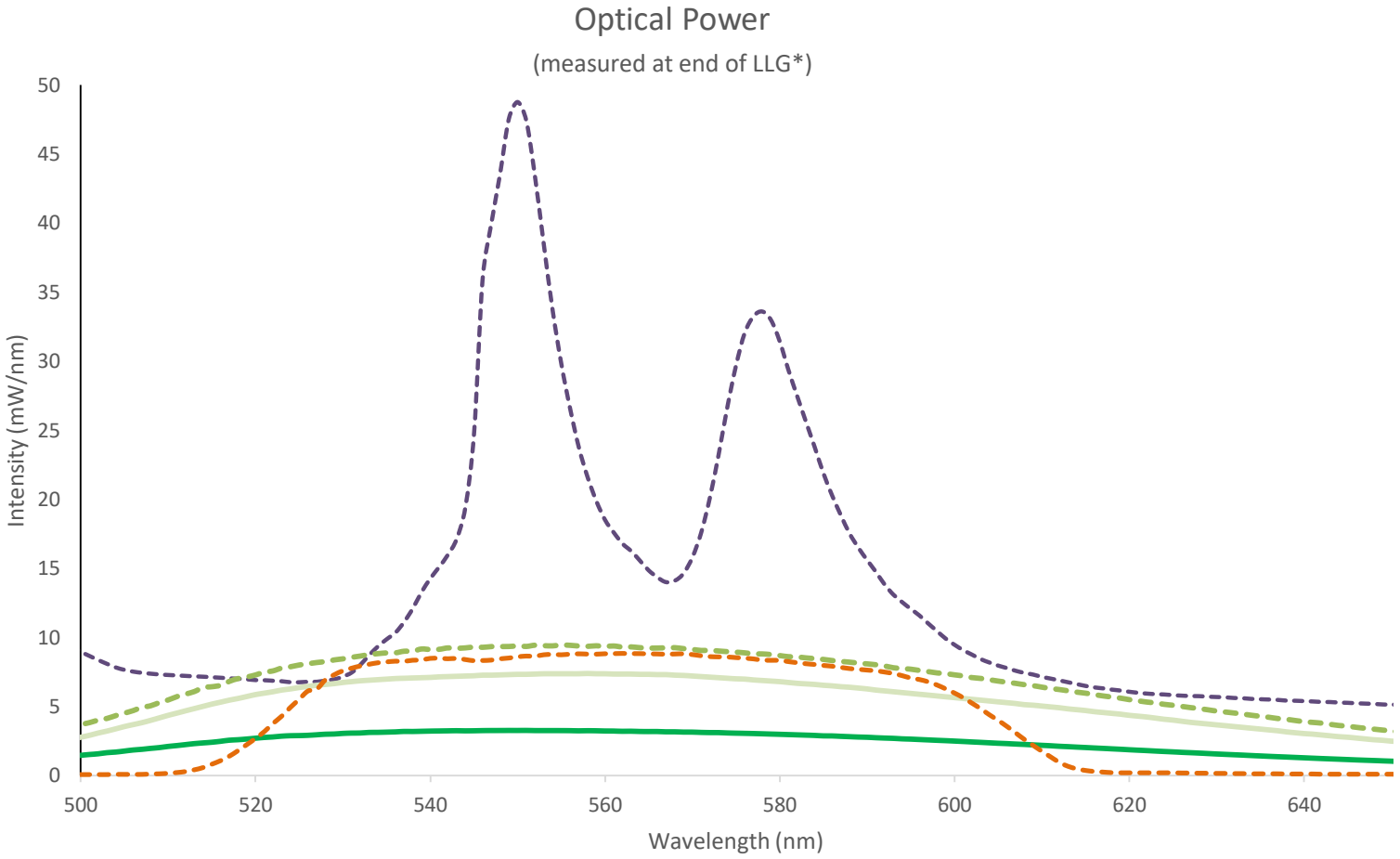

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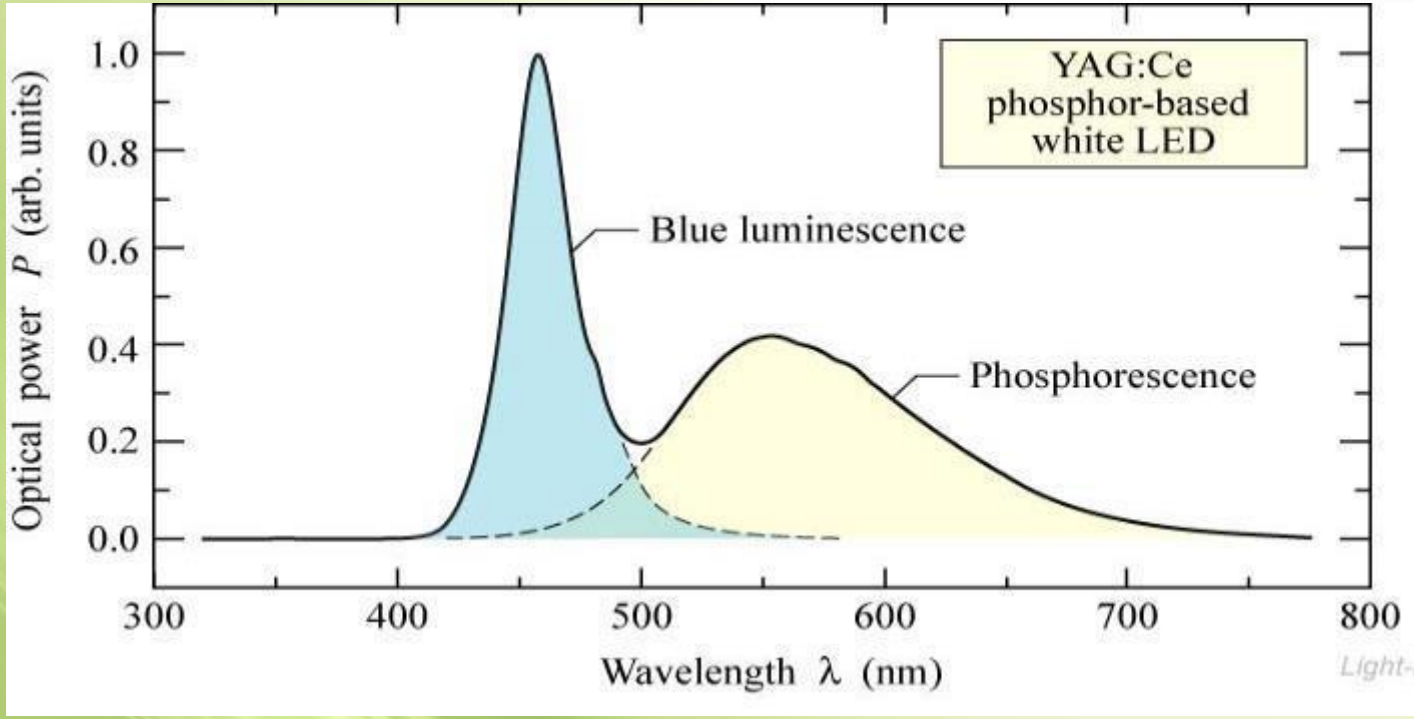
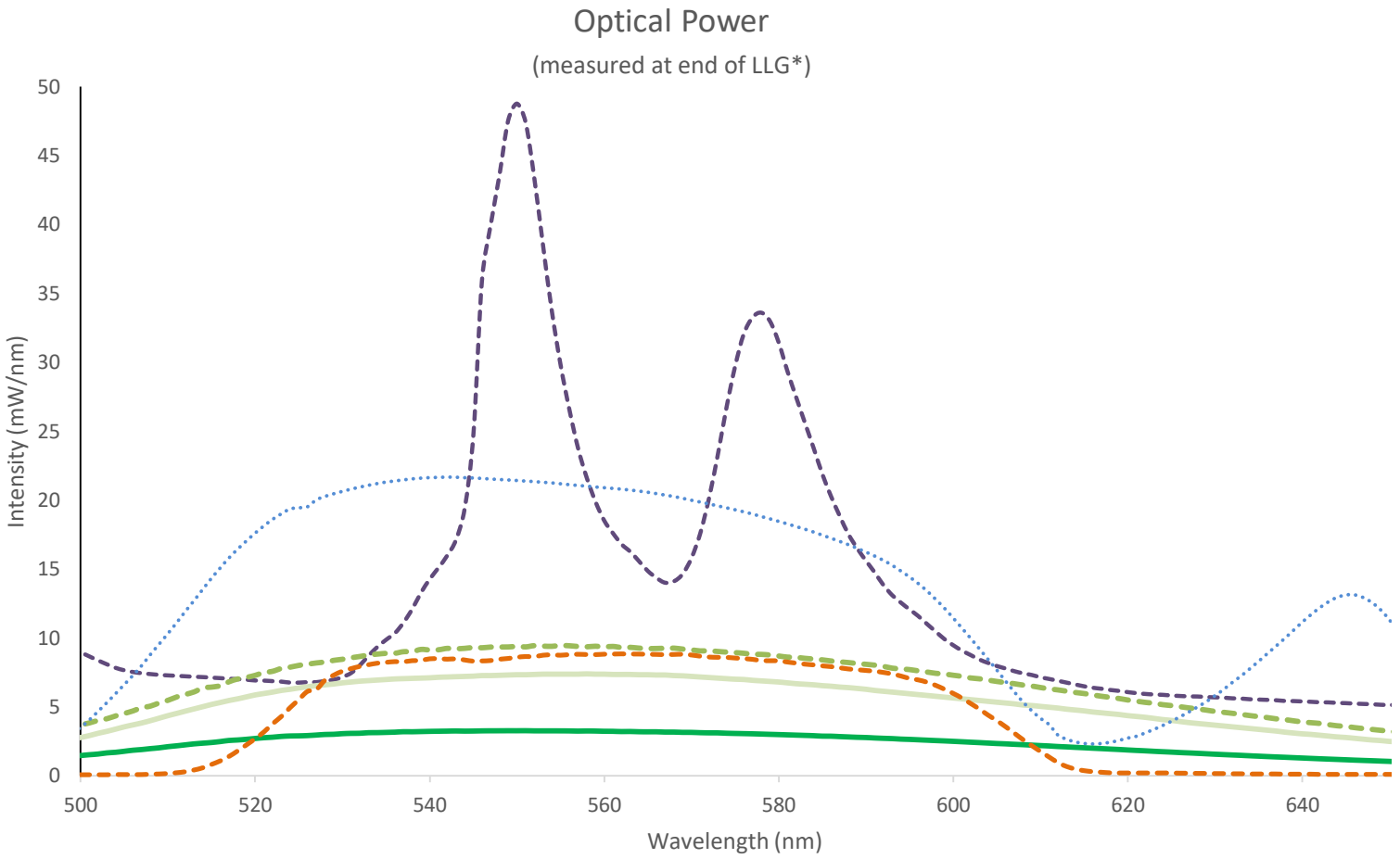
LaserLED Hybrid Drive™



Laser phosphor conversion

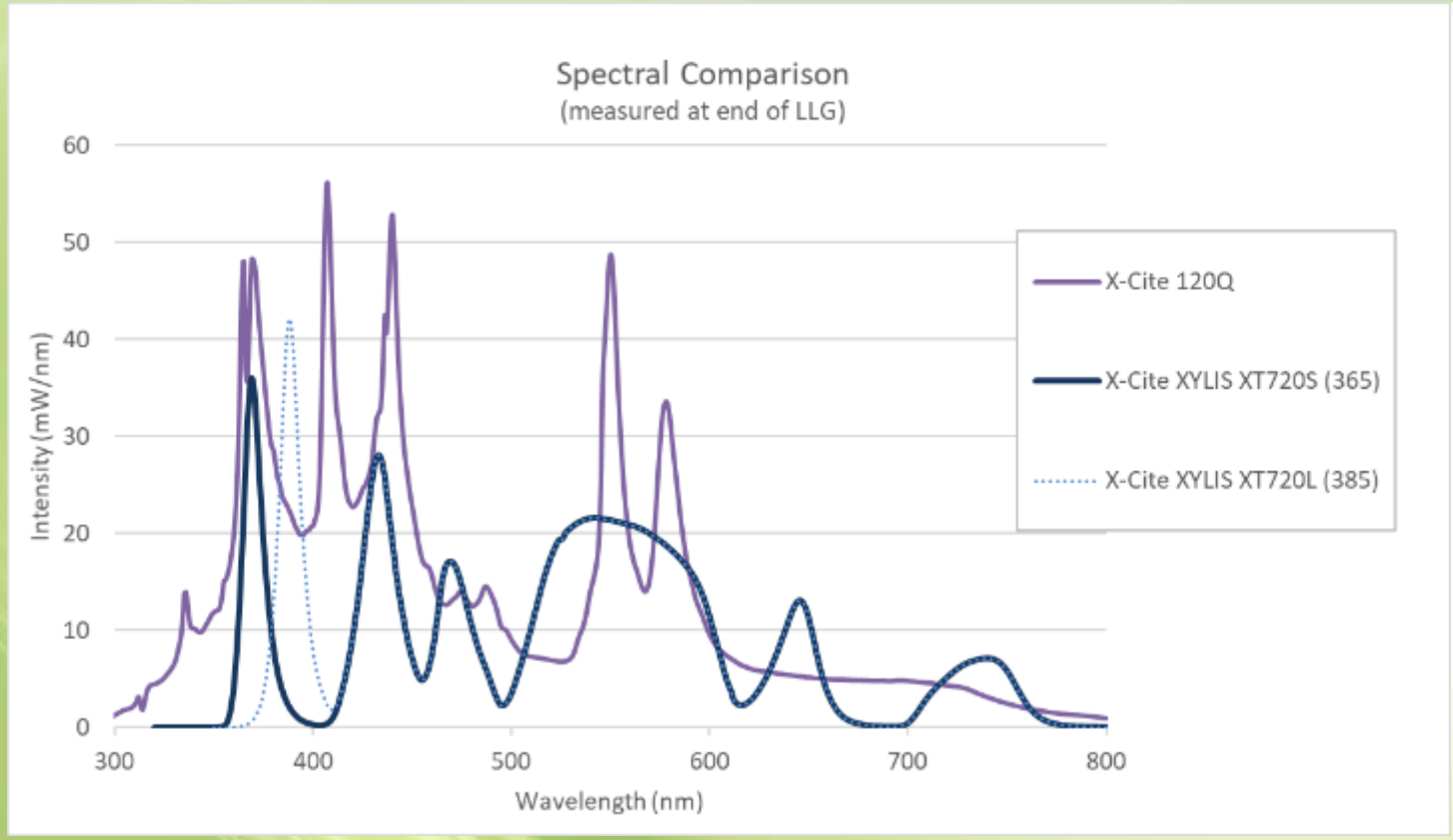
Image courtesy of www.lightemittingdiodes.com

Solving the Green Gap challenge



EXCELITAS TECHNOLOGIES

Spectral Comparison – LED vs. Lamp



Notes:

- X-Cite XYLIS Prototype Data - Beta version, August 2017
- For LLG coupled systems, measurements were obtained with 3mm x 1.5m Liquid Light Guide
- For direct coupled systems, measurements were scaled down for realistic comparison to LLG coupled systems
- In all cases, light coupling efficiency depends on the microscope optics
- Data represents typical output levels. Output will vary between individual units

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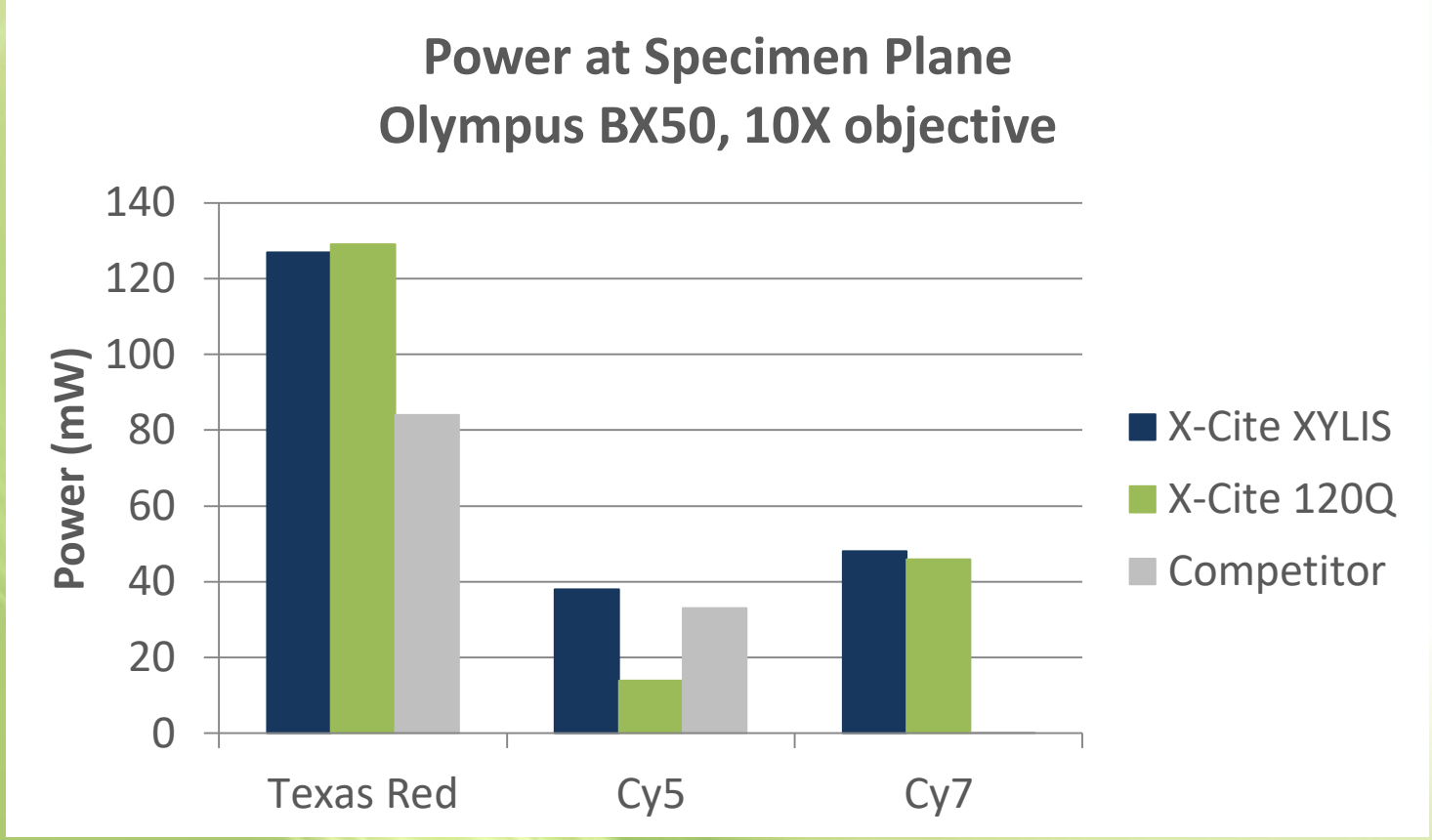
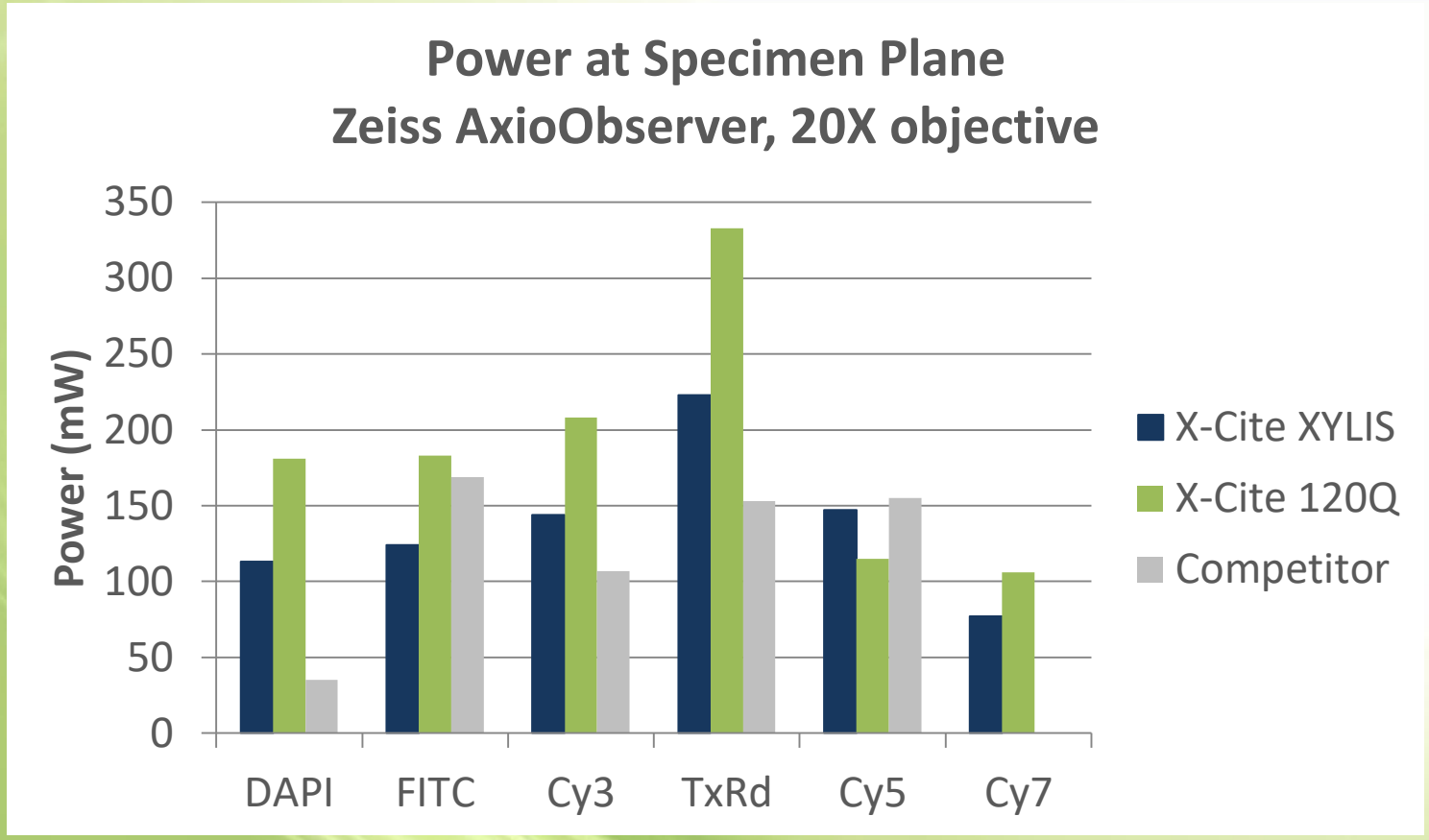
Power Comparisons



Notes:

1. X-Cite XYLIS Prototype – Beta version, August 2017
2. Measurements taken with XR2100 & XP750
3. Light sources coupled to microscope with 810-00032X adaptor
4. Excitation Filters: 560/25, 650/13, 710/75

Power Comparisons



Notes:

1. X-Cite XYLIS Prototype – Beta version, July 2017
2. Measurements taken with XR2100 & XP750
3. Light sources coupled to microscope with 810-00022X adaptor
4. Excitation Filters: 375/25, 470/40, 545/25, 560/40, 620/60, 710/75

EXCELITAS TECHNOLOGIES

Why LED?

- Less down time – no bulbs to replace
- NOW enough power for FISH
- Uniform and stable
- Repeatable exposure
- Faster throughput with switchable LEDs
- Less waste/toxic disposal
- Less energy consumption
- Less running costs

Rejuvenated LED applications

Analytical Solutions

APPLICATIONS

- Fluorescence microscopy/microfluidics
- Fluorescence slide/plate scanners
- Microscopy, DMD

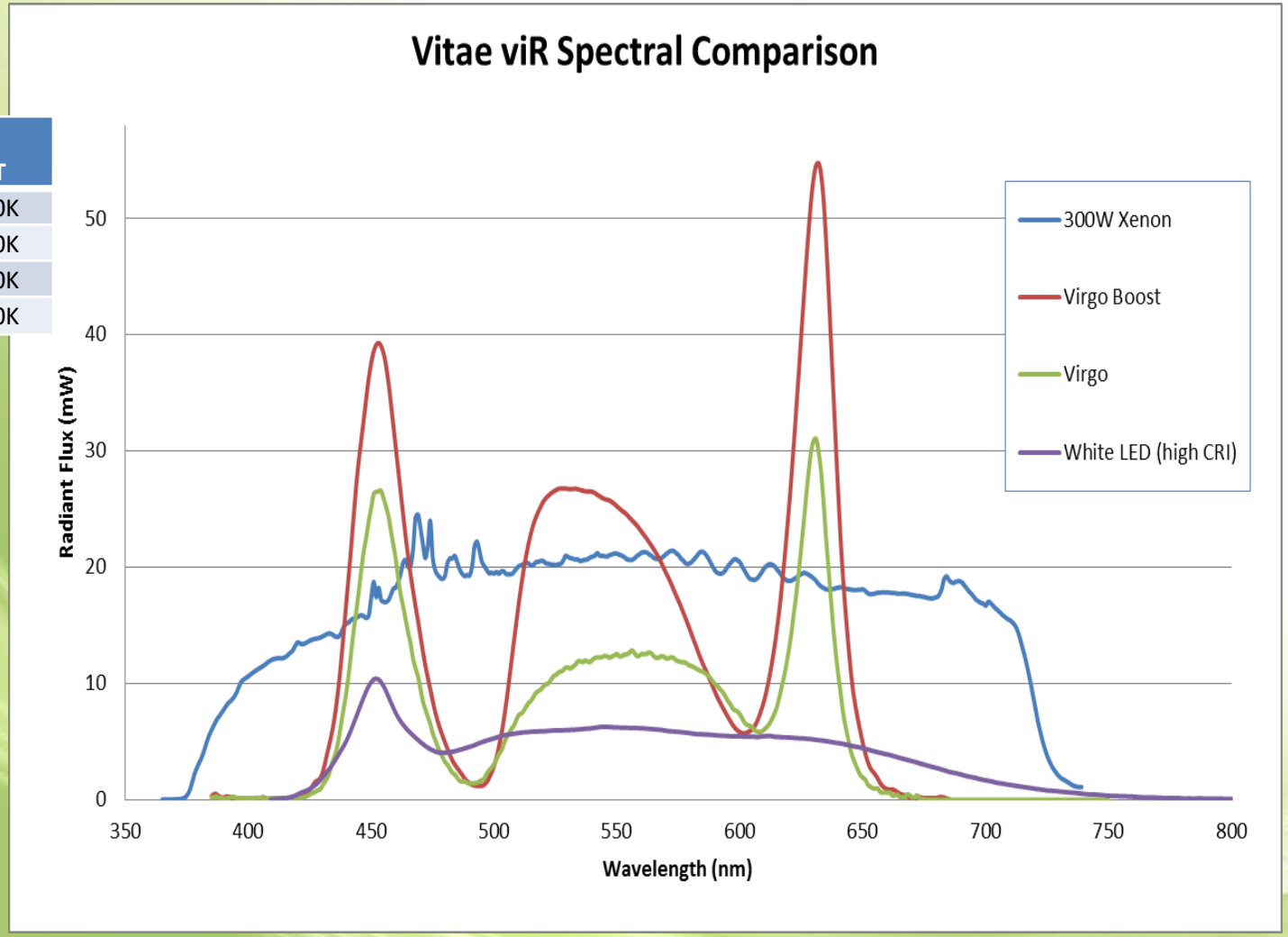
Medical Solutions

APPLICATIONS

- Endoscopy
- Surgical Visualisation

Vitae *vIR* spectra

	Radiant Flux (W)	CCT
300W Xenon	4.8	5110K
vIR Boost	4.25	5200K
vIR	2.42	5100K
White LED	1.34	5640K



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Conclusion:

- LEDs no longer have to suffer from Green Gap
- LaserLED Hybrid drive provide the closest spectrum to lamp output
- Rest easy with no lamp replacements, cost and disposal
- Keep your fluorophores and cells happy ☺

Thank you for your attention.

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