Chip Scale Package, de ideale led Technolgie voor de volgende generatie verlichting

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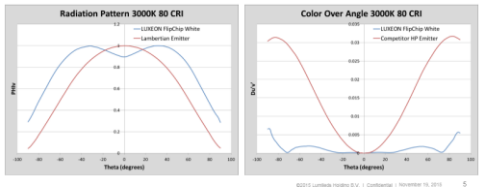
LUMILEDS

Agenda

- Waarom is Chip Scale Packaging de toekomst ?
- Waar moeten we rekening mee houden met het ontwerp als we gebruik maken van een Chip Scale Package
- Voorbeelden van applicaties met Chip Scale Package



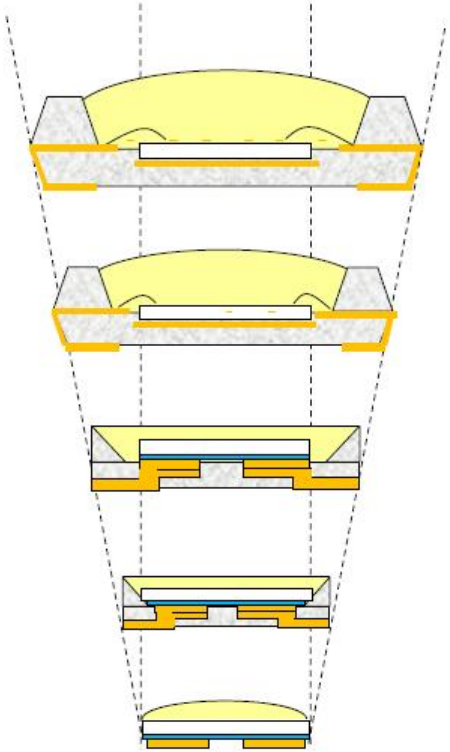
The Trend in LED industry is miniaturization

Miniaturization Trend in LED industry

Leaded – PLLC

Leadless-QFN

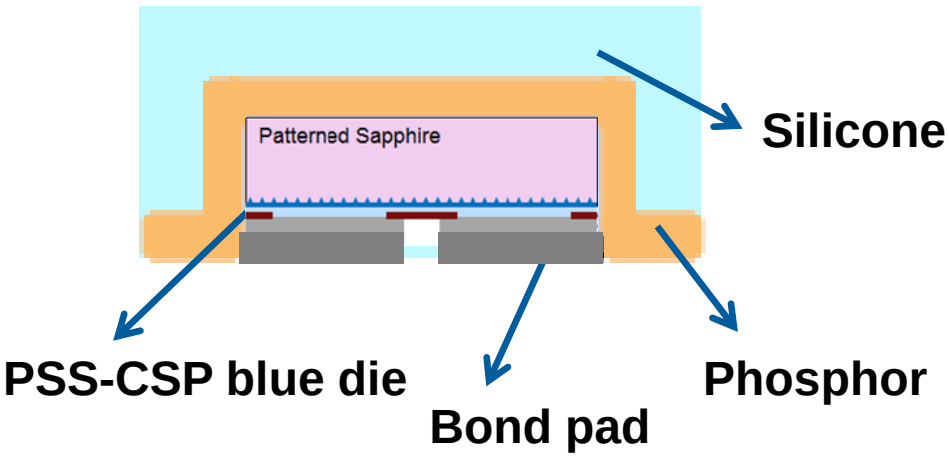
Chip Scale Package

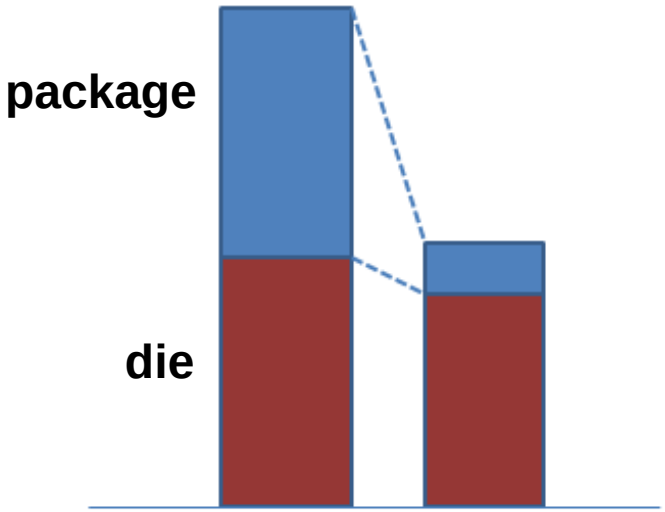


Smaller LED source will reduce eco system BOM cost

Why Use Chip Scale Package?

Removing LED packaging creating technology disruption





Chip scale package:

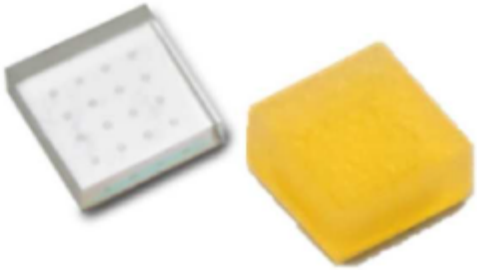
- Removes the ceramic submount
- Direct attach of the chip onto the PCB.

Next big cost down trend:

- Removes packaging and process steps
- Further cost down from scale up

Voordelen CSP technologie

High Performance Chip-Scale Package

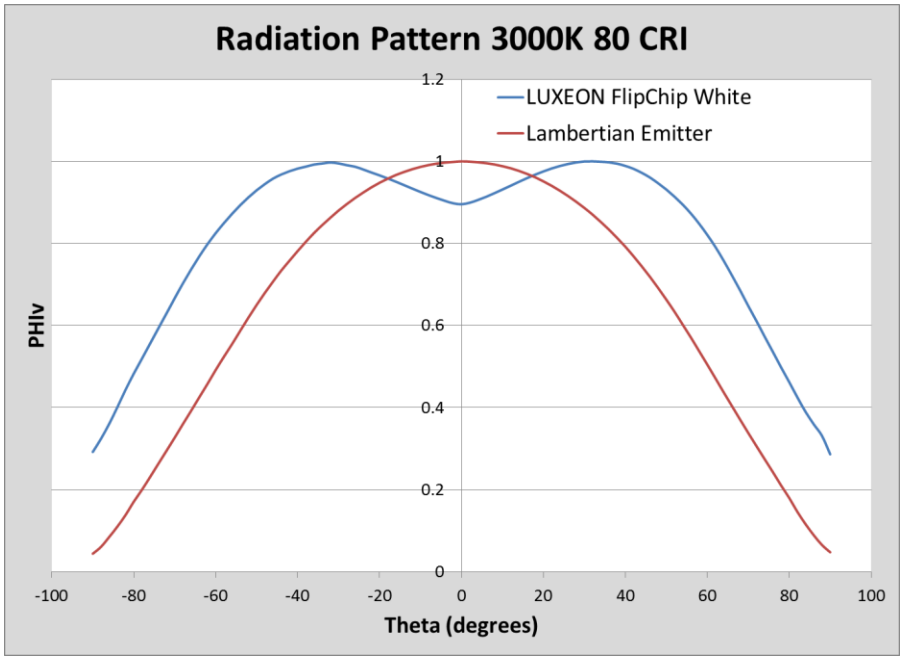


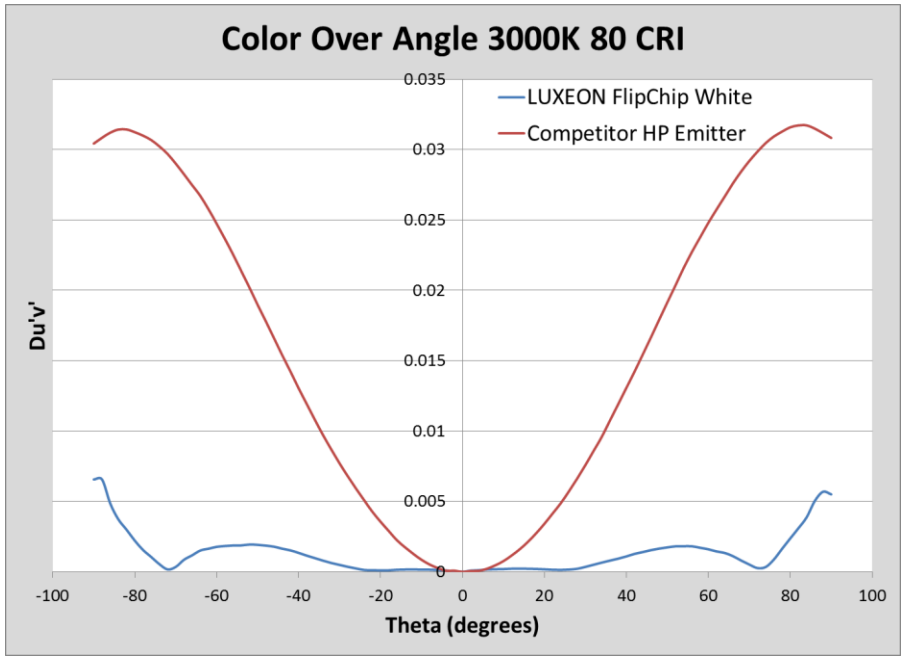
- Highest lm/W at Mid & High Drive Current Densities
  - Improved hot/cold factor and droop (compared to lateral devices)
  - Low V_f and tight V_f distribution (<3.0V with 6s within 0.3V)
- High Lumen Density
  - No wire bonds, ceramic substrate or lead frame package
  - High packaging density (e.g. for COB & high luminance applications)
- High Reliability
  - Sapphire enables heat spreading for reduced phosphor temperature
  - Low R_{th} (2 K/W) for excellent thermal performance
  - Simple robust design with no wire bonds
- High-power architecture that can scale to mid-power applications
  - CSP enables cost effective small devices due to die level processing
  - Lowers system costs due to enhanced lumen density, efficacy and reliability
  - AuSn or SAC solder directly on L2 board

Superior Optical Performance

Radiation Pattern and CoA Enabling Excellent System Optical Performance

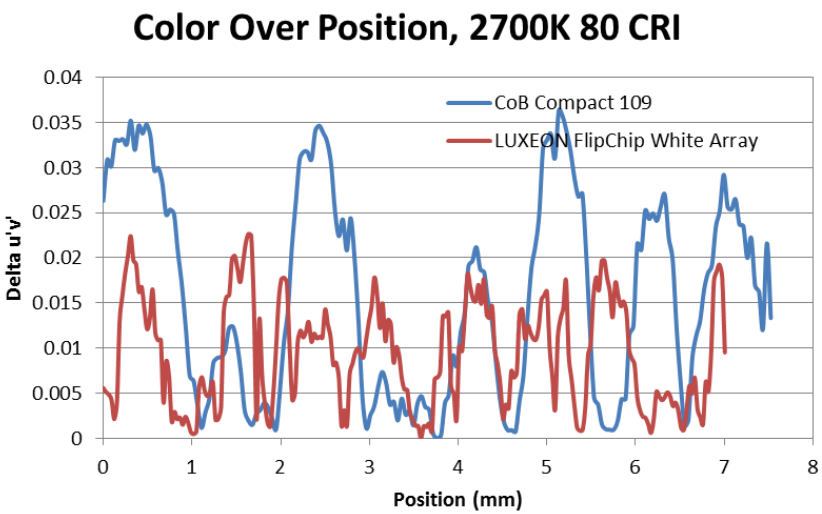
- **Wide viewing angle delivering increased uniformity for diffuse lighting and excellent beam control in reflector optics**
- **Exceptional CoA (< 10 pts vs > 30pts for typical HP conventional emitter)**

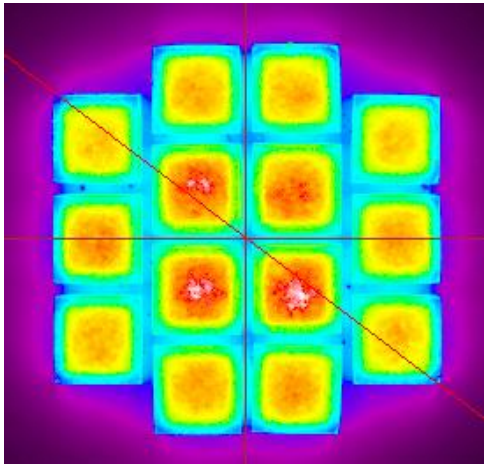




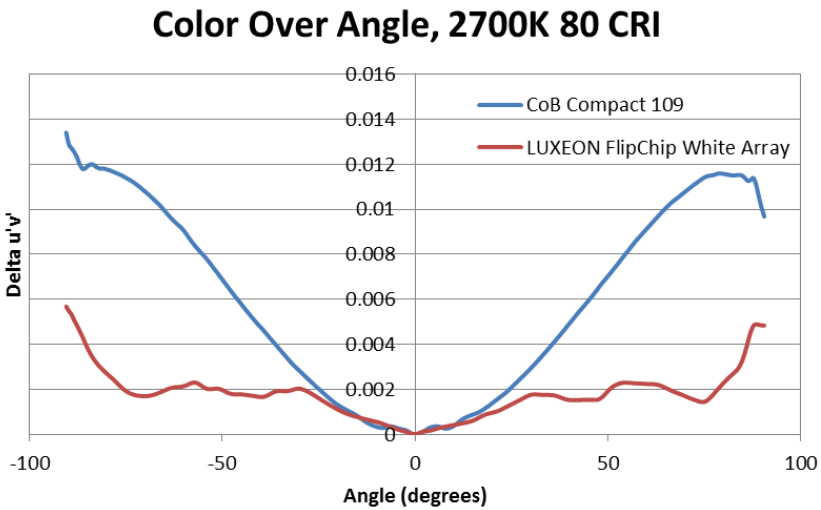
Superior Color Uniformity and Quality

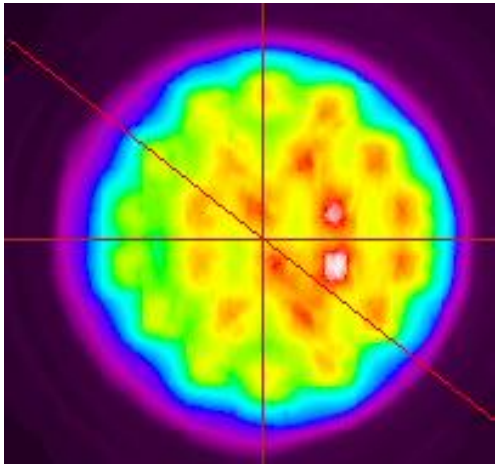
Better color over angle and color over source than CoB





LUXEON FlipChip White Array

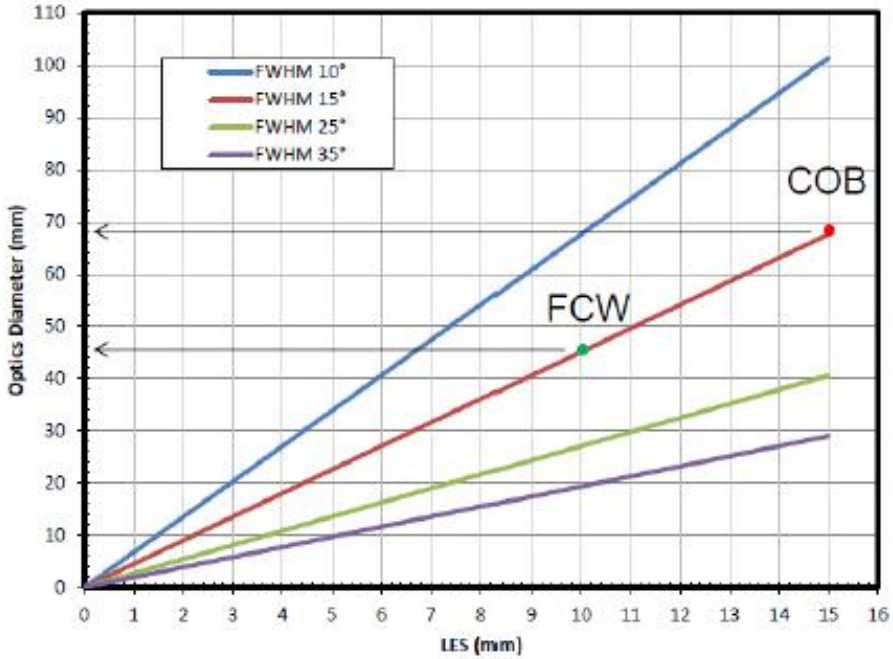




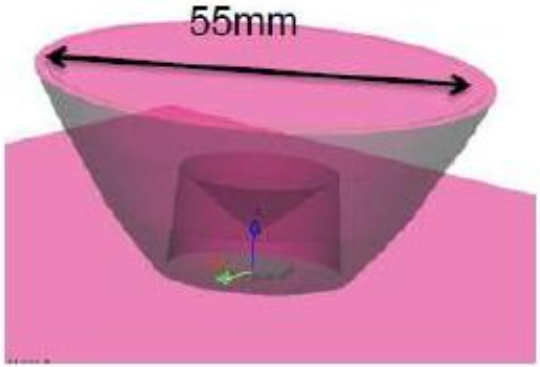
LUXEON CoB Compact 109

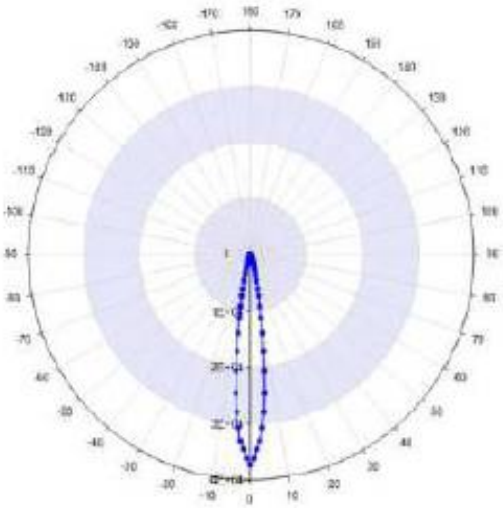
LES vs. Minimum Optics diameter

Direct system, Optical efficiency ~ 94%



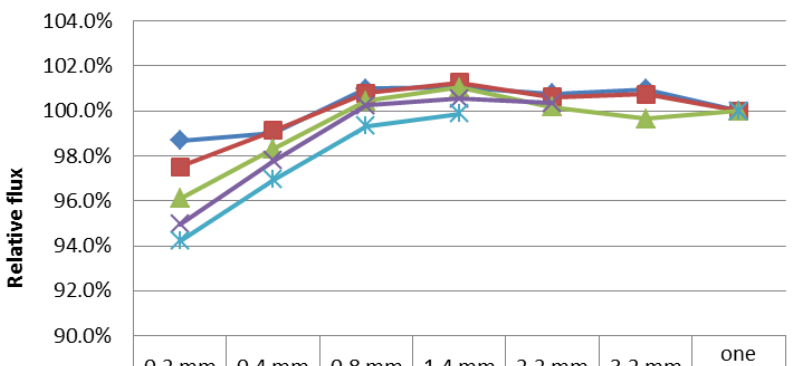
Collimator height: 23.5 mm



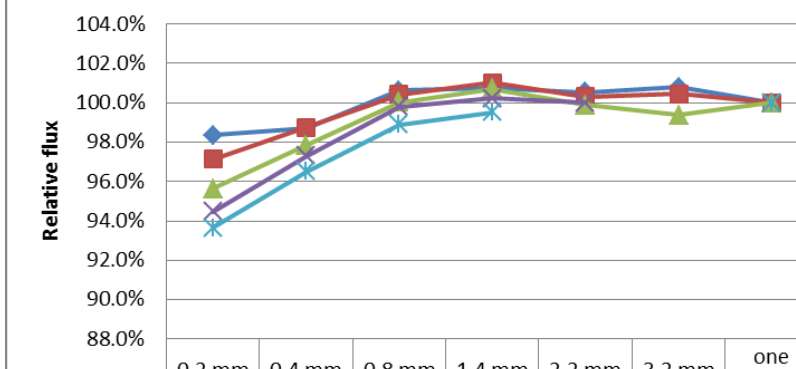


Example: Flux vs. spacing and LED count

LUXEON FCW 1mm^2 3080



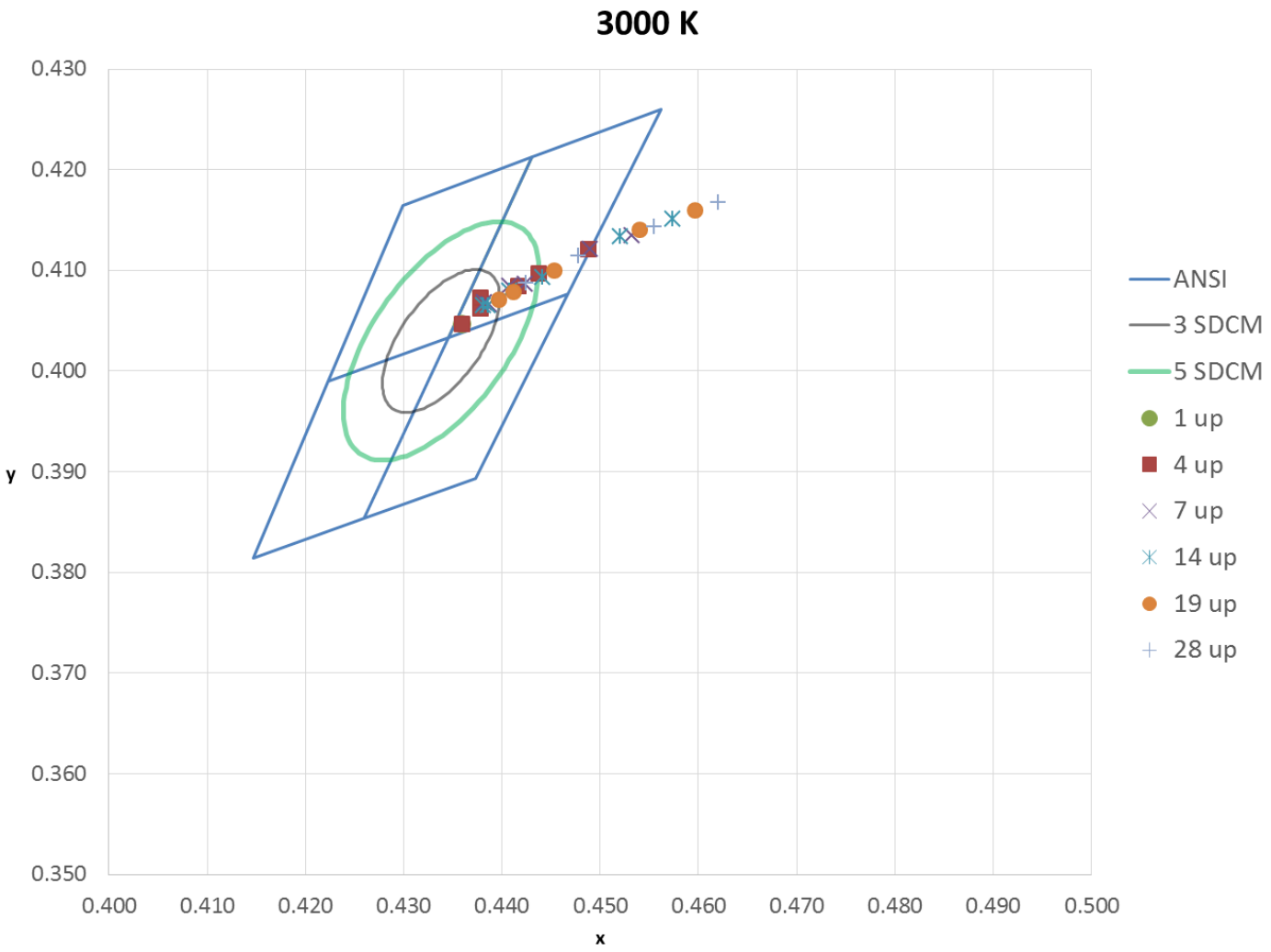
	0,2 mm	0,4 mm	0,8 mm	1,4 mm	2,2 mm	3,2 mm	one LED
4-Up	98.7%	99.0%	101.0%	101.0%	100.8%	101.0%	100.0%
7-Up	97.5%	99.1%	100.8%	101.3%	100.6%	100.8%	100.0%
14-Up	96.1%	98.3%	100.5%	101.0%	100.2%	99.7%	100.0%
19-Up	95.0%	97.8%	100.2%	100.6%	100.3%		100.0%
28-Up	94.2%	97.0%	99.3%	99.9%			100.0%



	0,2 mm	0,4 mm	0,8 mm	1,4 mm	2,2 mm	3,2 mm	one LED
4-Up	98.4%	98.7%	100.6%	100.8%	100.5%	100.8%	100.0%
7-Up	97.1%	98.7%	100.4%	101.0%	100.3%	100.4%	100.0%
14-Up	95.6%	97.8%	100.0%	100.7%	99.9%	99.4%	100.0%
19-Up	94.5%	97.3%	99.8%	100.2%	100.0%		100.0%
28-Up	93.6%	96.5%	98.9%	99.5%			100.0%

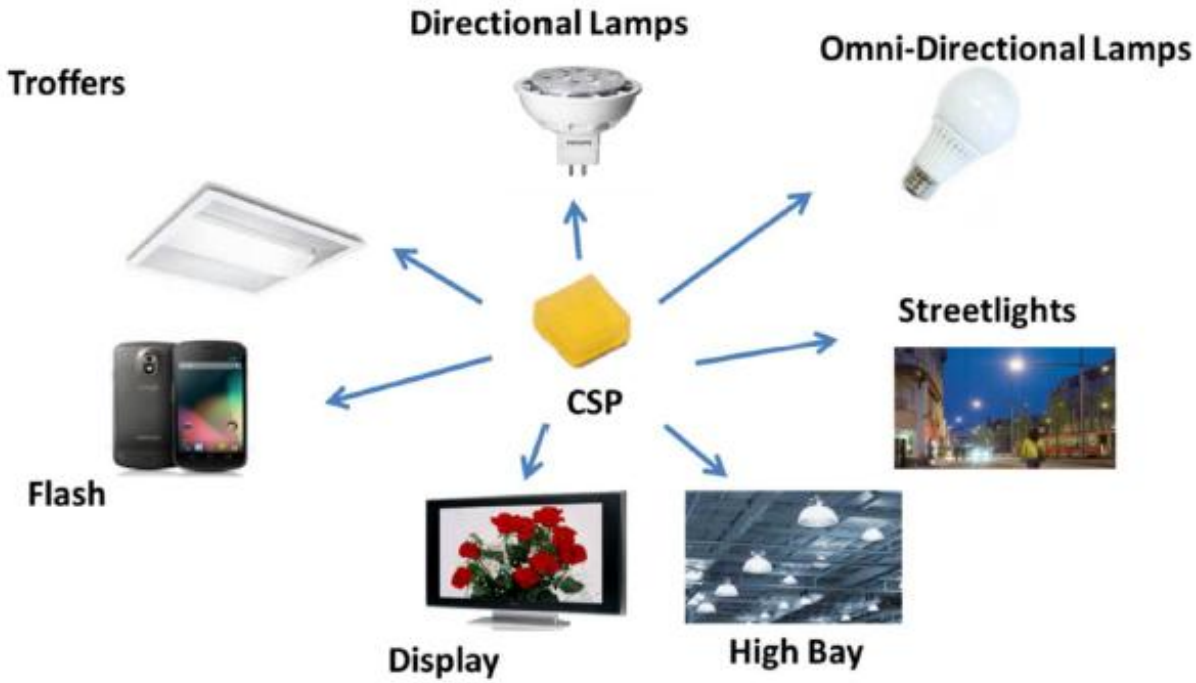
- Flux loss is observed LED spacing below 0.8 mm
- Flux loss is increasing by number of LEDs
- Current increase has no significant effect on flux loss

Example: Color point shit vs. spacing and LED count



CSP Applications

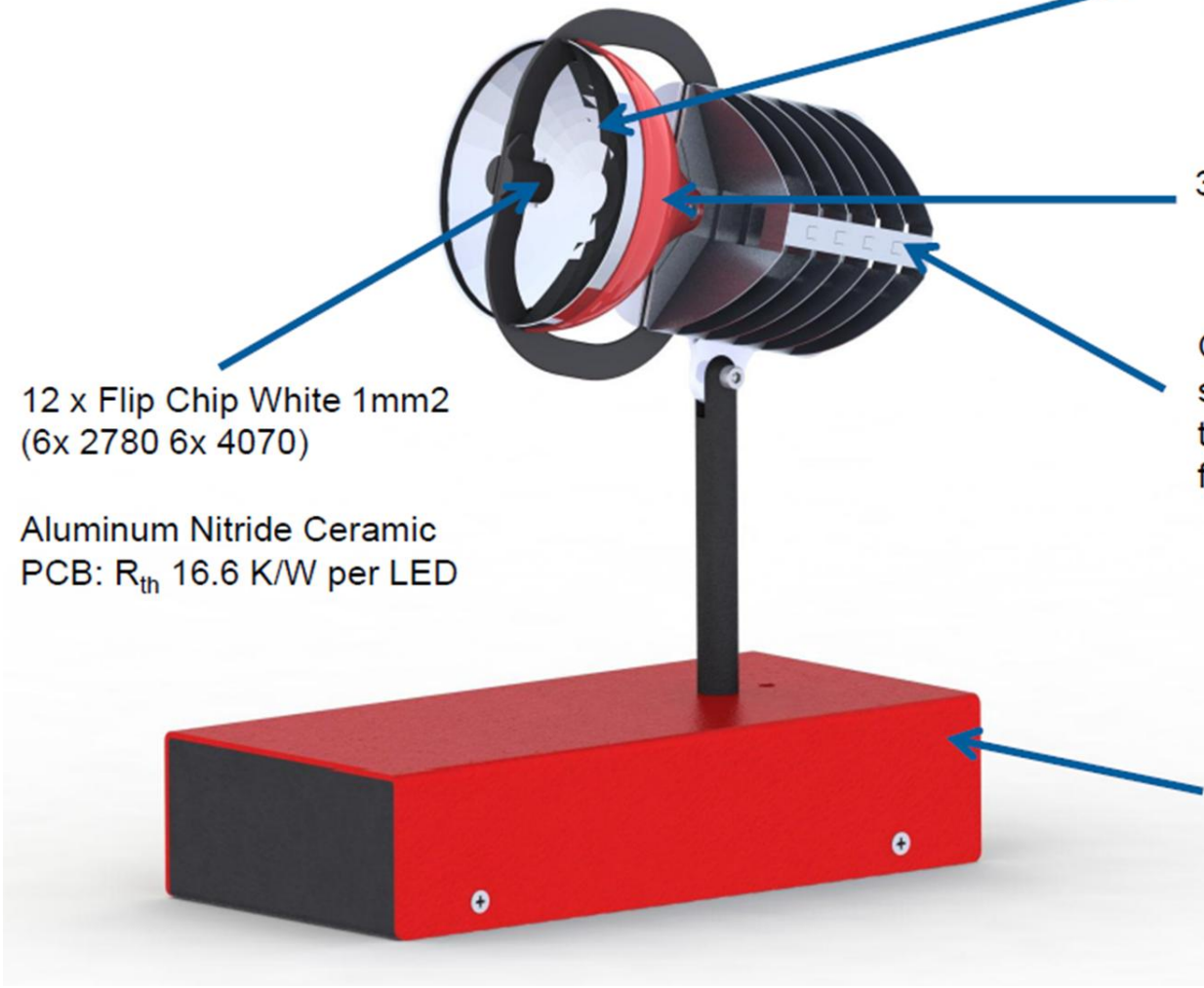
New emerging LED architecture standard for HP to MP



Conclusion:

- CSP is emerging as the new LED architecture standard that can scale from HP to MP enabling L1 and system level cost savings

DEMO DESIGN



Custom designed reflector, millec from aluminum and polished.

3D Printed reflector holder

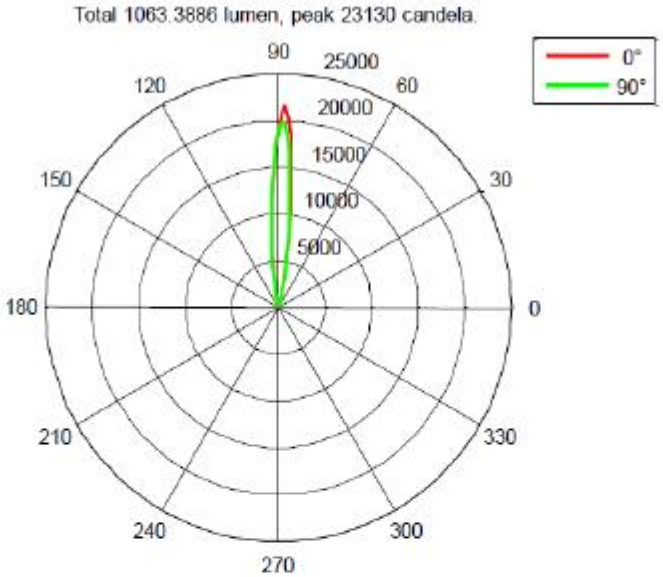
Custom designed Furukawa heat sink using 2 heat pipes to transport heat from the L2 to the fins. R_{th} 2.96 K/W

12 x Flip Chip White 1mm2 (6x 2780 6x 4070)

Aluminum Nitride Ceramic PCB: R_{th} 16.6 K/W per LED

Aluminum box containing the EldoLED DMX driver r set at 600mA

Demo Performance

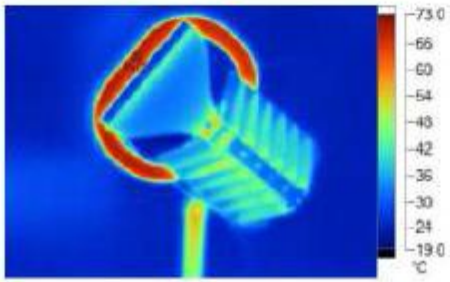


Optical results

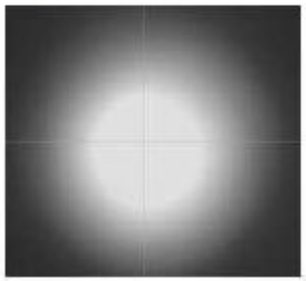
- FWHM: 11 degree
- CBI: 23130 Cd
- Flux: 1063 lm
- CCT: 2700-4000 K
- Uniform spot, color error <0.004 du'v'

Thermal results

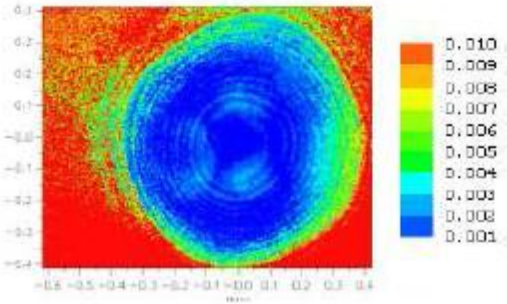
- Rth heatsink 2.96 K/W
- Thermal power LEDs 16.7 W
- T_j=92°C



Spot Uniformity

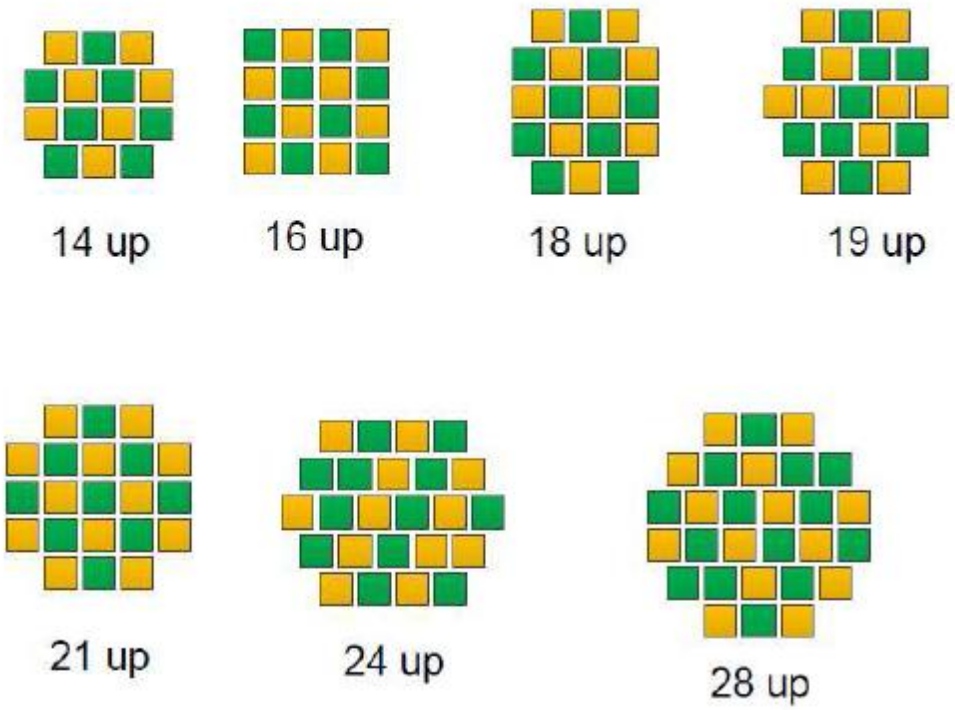


Color Error



LED Placement

Spacing 0.2 mm, LED dimension: 1.4 mm x 1.4 mm

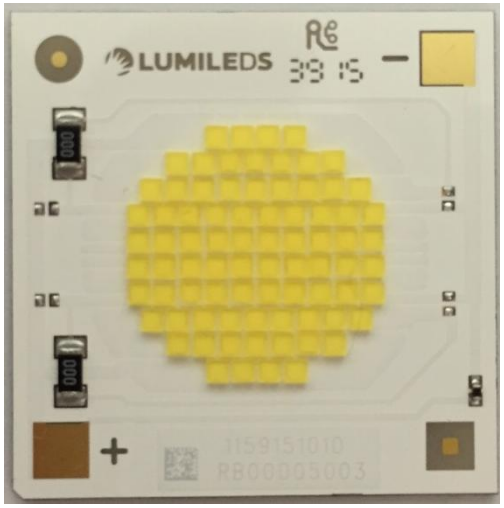


LED count	LES [mm]
14	10.0
16	11.1
18	11.3
19	11.3
21	11.3
24	12.2
28	12.7

- LES is increased by 2 mm due to light reflected by PCB

Demo Design

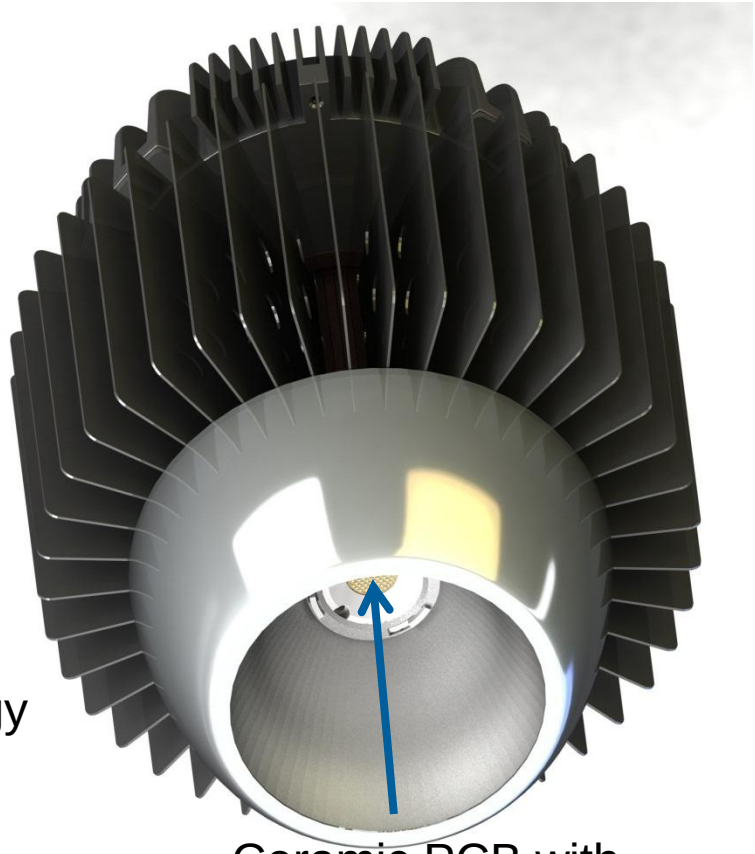
CAD Pictures



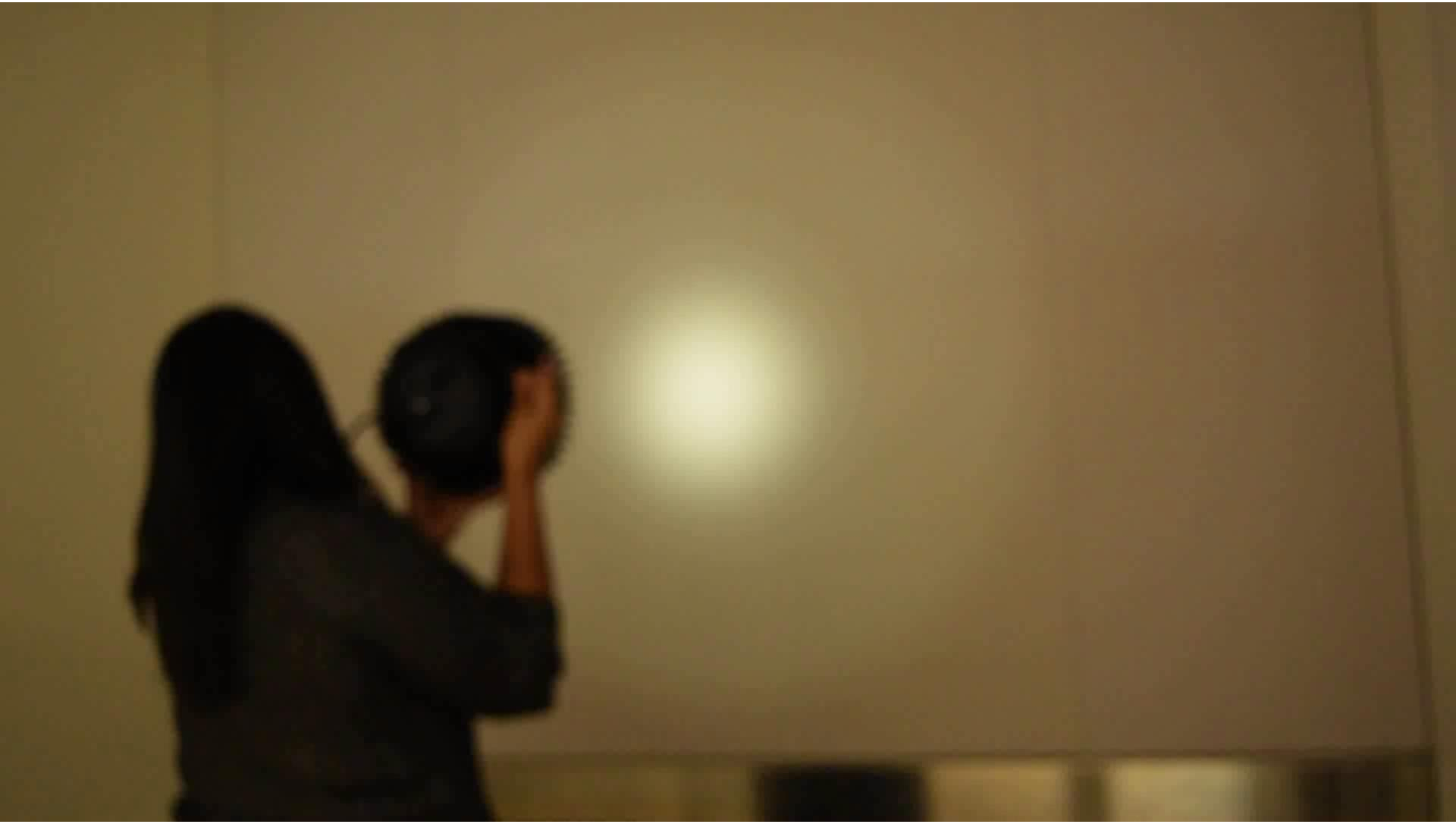
Driver
Meanwell HBG-240

Heatsink with
heat-pipe technology

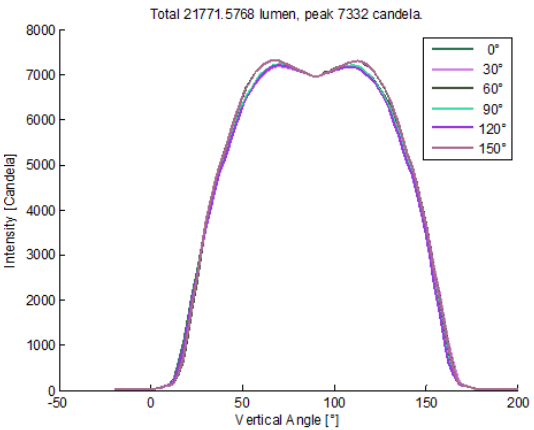
Ledil Angela-S Reflector
+ cover

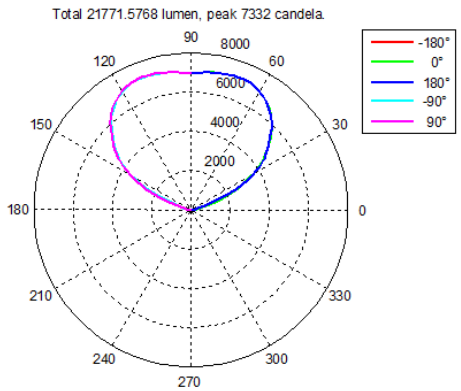


Ceramic PCB with
80x FCW



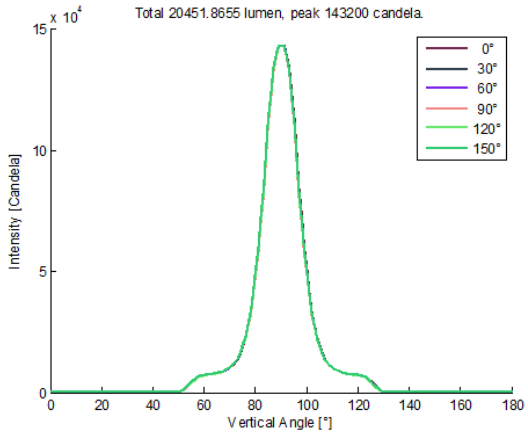
Performance without reflector

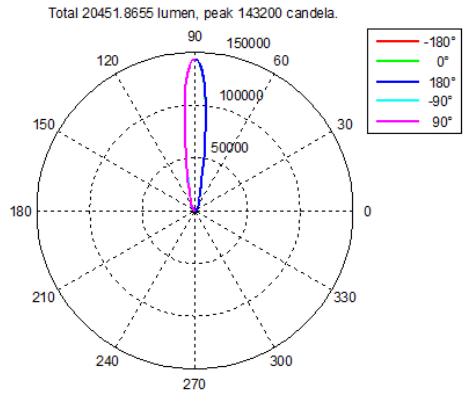




Total flux : 21772 Lm
Peak Candela : 7332 cd
Drive current 3.8Amp (950mA/led)
Driver voltage : 57.9 V
LED Power : 220 Watt
Efficacy : 99 Lm/W

Performance with reflector

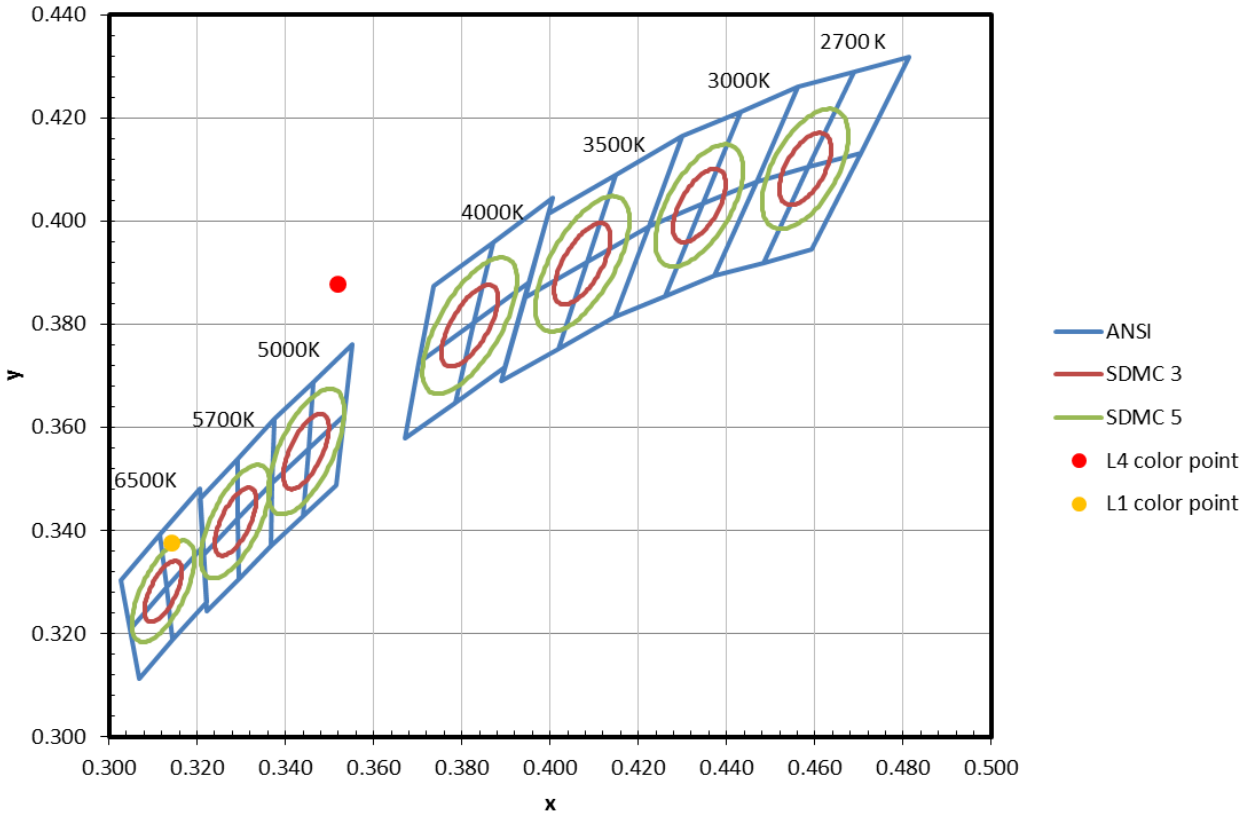


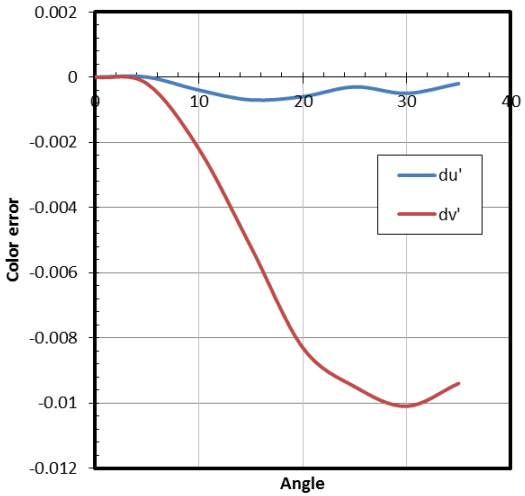


FWHM ~14 degrees
Total flux : 20452 Lm
Peak Candela : 143.200 cd
Drive current 3.8Amp
Driver voltage : 57.9 V
LED Power : 220 Watt
Efficacy : 93 Lm/W

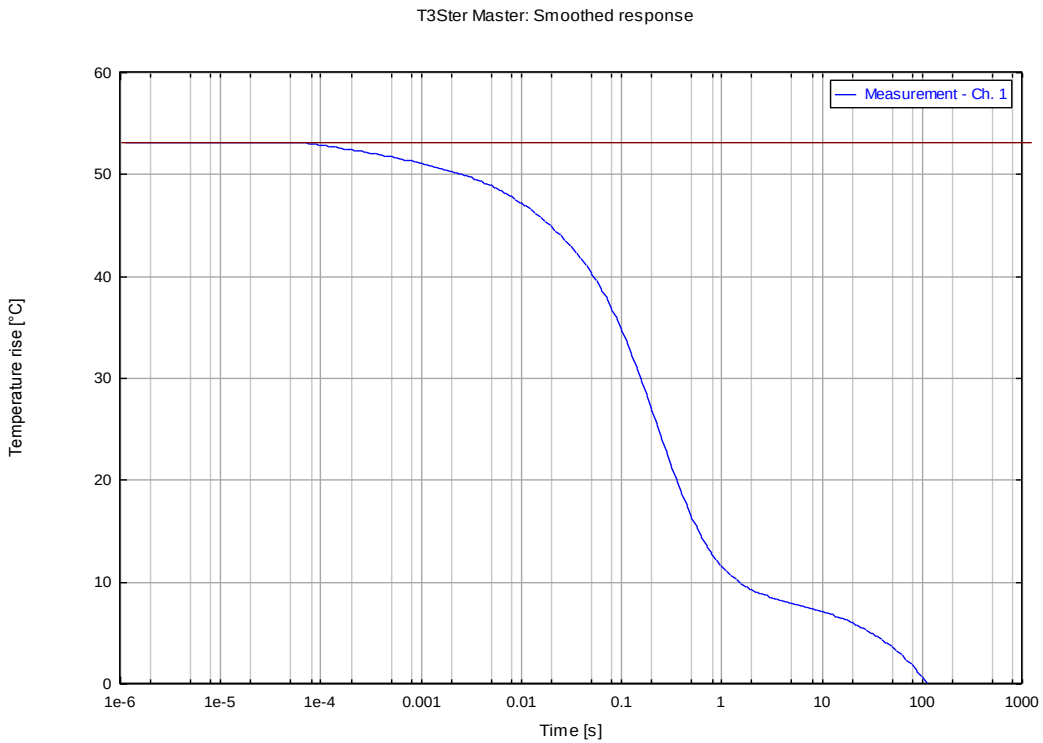
Optical efficiency : 94%

Color measurements





Thermal Evaluation



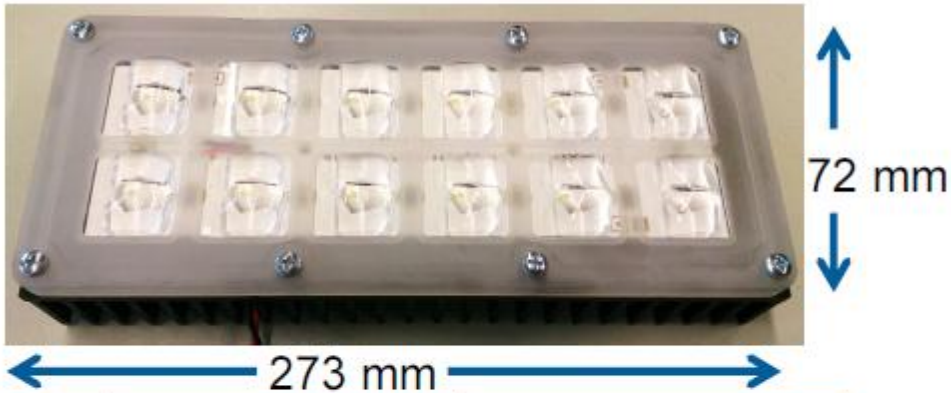
Micred Tj measurement

Drive current : 3.8A
LED current : 900 mA
Power : 216.3W
Sensitivity : -34.657mV/K
Ambient temp : 22 °C

ΔTj : 53°C
Tj= 53 + 22 = 73°C

90 lm/W & 100 lm/W Streetlight Engine

Achieve 20% to 50% LED BOM cost reduction with a 1:1 replacement.



Demonstrator	Option #1	Option #2
# of LEDs	12-up LUXEON FlipChip White 10	
LED Current	700 mA	450 mA
T solder	80 °C	58 °C
LED Power	24 W	15 W
Optical Efficiency (L3/L2)	92%	
Driver Efficiency	90%	88%
Module Flux	**2400 lm**	**1700 lm**
System Efficacy	**90 lm/W**	**100 lm/W**

Assumptions:
LED flux: D bin (130 lm @ 350 mA, 85C Tj)
PCB losses: 4%

Bedankt !

Meer info op Future stand

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