

CIE DIV. 1 (色彩與視覺) 近況 光源演色性評估方式與 標準光源之最新發展

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Aug 12, 2015

2015 CIE 28th Session



CIE 2015
MANCHESTER UK
JUNE 28 - JULY 4, 2015

CIE Division 1 Meeting -

- June 30th~July 4th, 2015
- @ University of Manchester, UK

CIE SESSION SCHEDULE OVERVIEW

	Morning	Afternoon	Evening
Friday, June 26, 2015	Finance Committee and Division Directors' Meeting*		
Saturday, June 27, 2015	Board of Administration Meeting*		
Sunday, June 28, 2015	General Assembly Meeting*		Welcome Reception
Monday, June 29, 2015	Conference	Conference	
Tuesday, June 30, 2015	Conference	DIV/TC Meetings	
Wednesday, July 1, 2015	Conference	DIV/TC Meetings	Gala Dinner
Thursday, July 2, 2015	Conference	DIV/TC Meetings	
Friday, July 3, 2015	Conference	DIV/TC Meetings	
Saturday, July 4, 2015	DIV/TC Meetings	DIV/TC Meetings	
		Board of Administration Meeting*	

Division Officers

<http://div1.cie.co.at/>



COMMISSION INTERNATIONALE DE L'ECLAIRAGE
INTERNATIONAL COMMISSION ON ILLUMINATION
INTERNATIONALE BELEUCHTUNGSKOMMISSION

WHAT'S NEW

MINUTES & REPORTS

TERMS OF REFERENCE

DIVISION OFFICERS

OFFICIAL DIVISION MEMBERS

TECHNICAL COMMITTEES

REPORTERS & LIAISONS

PUBLICATIONS FROM DIVISION 1

DIVISION 1 - MAILING LIST

CONTACT

Division Officers

Division Director	Youngshin Kwak
Associate Director - Vision	Miyoshi Ayama → Nana Itoh
Associate Director - Colour	Ellen Carter
Division Secretary	Mike Pointer → Li-Chen Ou
Division Editor	Phil Green

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Official Members

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AUSTRIA	Heinz Grösswang	MALAYSIA	John See Keat Siang
BELGIUM	Peter Hanselaer	NETHERLANDS	Kees Teunissen
BRAZIL	Ana Paula Dornelles Alvarenga	NEW ZEALAND	Andrew Chalmers
CANADA	Sharon McFadden	NORWAY	Jan Henrik Wold
CHINA	Haisong Xu	POLAND	Agnieszka Wolska
CROATIA	Vladimir Kocet	ROMANIA	Corina Martineac
CZECH REPUBLIC	Michal Vík	RUSSIAN FEDERATION	Vladimir Snetkov
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GREECE*	TBN	SPAIN	Manuel Melgosa Latorre
HONG KONG	Patrick Wong	SWEDEN	Ludovic Coppel
HUNGARY	Klára Wenzel	SWITZERLAND	TBN
INDIA	Asit K Datta	CHINESE TAIPEI*	Tsung-Hsun Yang
ISRAEL	Yochanan Di Segni	TURKEY	Rengin Ünver
JAPAN	Nana Itoh	UKRAINE	TBN
		USA	Ellen Carter

* CIE Associate National Committee

36 National Members

3 Associate National Members

Italy resigned

Term of Reference

- To study visual responses to light
- To establish standards of
 - response functions, models
- To establish procedures of specification relevant to
 - photometry,
 - colorimetry,
 - colour rendering,
 - visual performance
 - visual assessment of light and lighting.

Technical Committees

- **TC 1-93:** Calculation of self-luminous neutral scale
- **TC 1-92:** Skin Colour Database
- **TC 1-91:** *New Methods for Evaluating the Colour Quality of White-Light Sources*
- **TC 1-90:** *Colour Fidelity Index*
- **TC 1-89:** Enhancement of Images for Colour Defective Observers
- **TC 1-88:** Scene Brightness Estimation
- **TC 1-86:** *Models of Colour Emotion and Harmony*
- **TC 1-85:** **Update CIE Publication 15:2004 Colorimetry**
- **TC 1-84:** Definition of Visual Field for Conspicuity
- **TC 1-83:** Visual Aspects of Time-Modulated Lighting Systems
- **TC 1-81:** Validity of Formulae for Predicting Small Colour Differences

Technical Committees

- **TC 1-76:** Unique Hue Data
- **TC 1-63:** Validity of the Range of CIE DE2000
- **TC 1-55:** Uniform Colour Space for Industrial Colour Difference Evaluation
- **TC 1-36:** *Fundamental Chromaticity Diagram with Physiologically Significant Axes*

15 Technical Committees

Reporters

x 10 Reporters

R#	Reporter	Title
R1-42	Changjun Li	Extensions of CIECAM02
R1-52	Danny Rich	Spectral Data Interpolation
R1-53	Frédéric Leloup	Gloss Perception and Measurement
R1-58	Phil Green	Liaison with ISO TC130 Graphic Technology
R1-60	Guihua Cui	Future colour-difference evaluation
R1-61	Aurelien David	Source whiteness metric
R1-62	Sophie Jost	Typical LED spectra
R1-63	Ken Sagawa	Principle and use of equivalent luminance
R1-64	Changjun Li	Tristimulus Integration
R1-65	Changjun Li	Real Colour Gamut

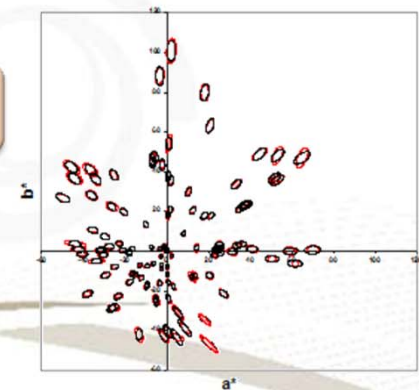
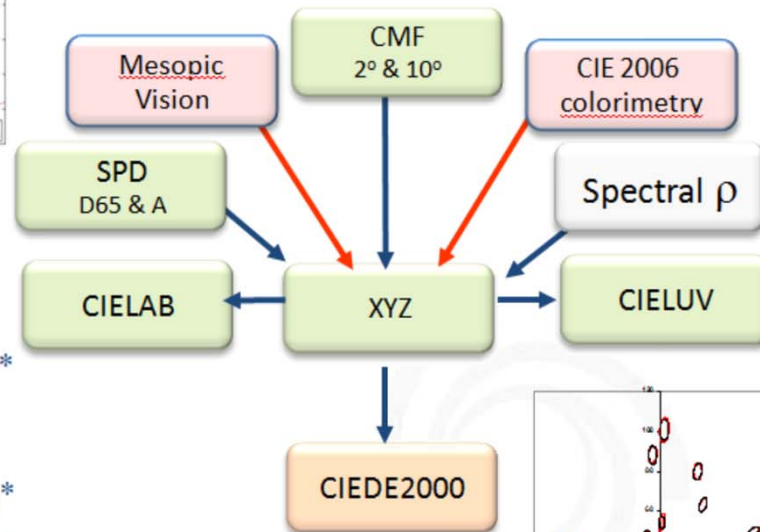
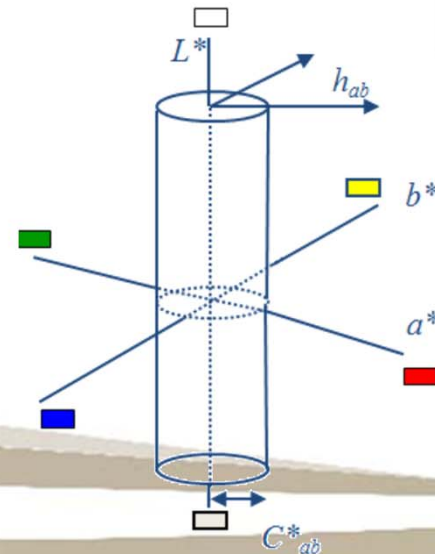
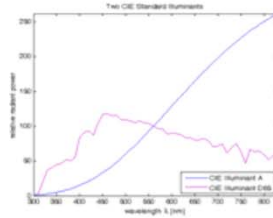
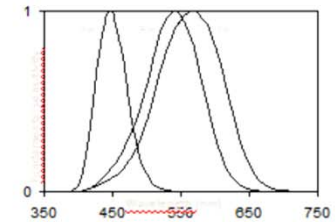
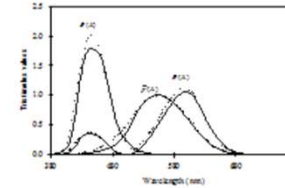
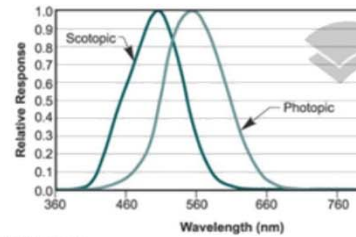
Liaisons

x 10 Liaisons

	Organisation/Subject	Liaison Officer
L1-1	AIC - Association International de la Couleur to CIE D1	Paula Alessi
L1-2	BIPM/CCPR: Comite Consultatif de Photometrie et Radiometrie to CIE D1	Michael Stock
L1-3	ISO/TC6/WG3: Paper, boards & pulps: Optical Properties to CIE D1	Joanne Zwinkels
L1-4	ISO/TC 38/SC1: Textiles. Colour fastness & measurement to CIE D1	Ronnier Luo
L1-5	ISO/TC 42: Photography to CIE D1	Klaus Richter
L1-6	ISO/TC 130: Graphic Technology to CIE D1	Danny Rich
L1-7	ISO/IEC/JTC 1/SC 28 Office Equipment to CIE D1	Hirohisa Yaguchi
L1-8	IALA: International Association of Lighthouse Authorities to CIE D1	Malcolm Nicholson
L1-9	ISO TC 159 WG2 Design Issue for Elderly and Disabled People to CIE D1	Ken Sagawa
L1-10	CIE D1 to ISO TC 42: Photography	Jack Ladson

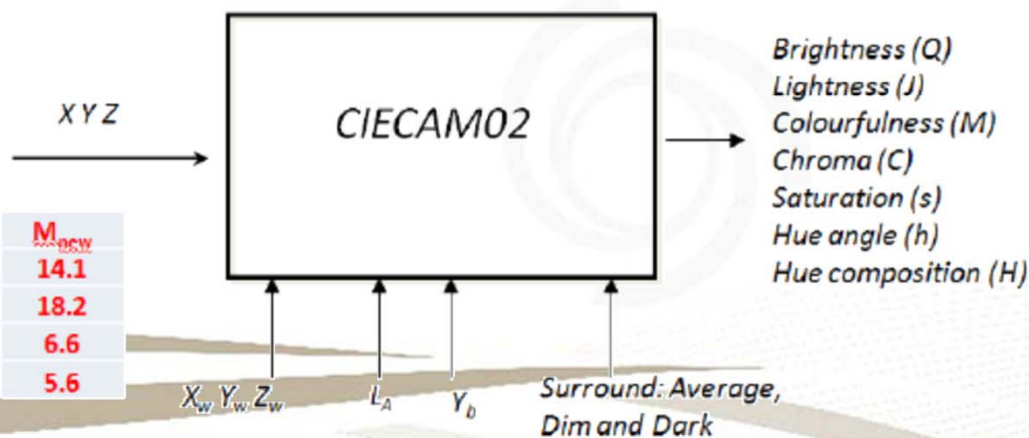
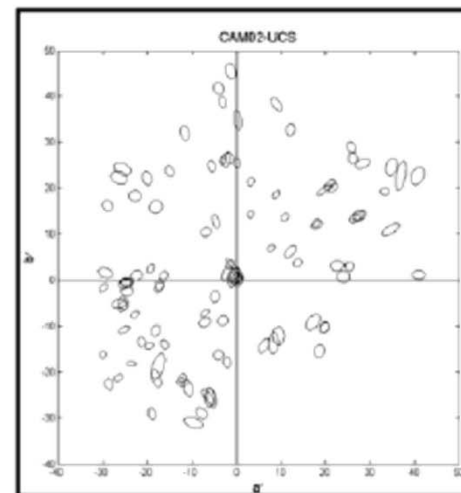
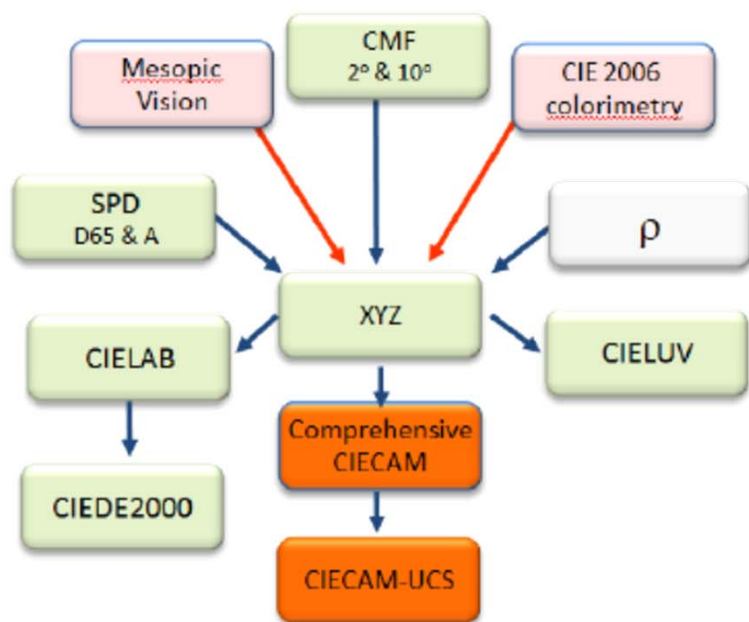
Division Strategy

1. CIE Colorimetry
 - CIE Publication 15 revision
 - ISO/CIE colorimetry series
 - SPD, Observers, XYZ, CIELAB, CIELUV, CIEDE2000
 - CIE 2006 Colorimetry
 - CIE Mesopic Vision



Division Strategy

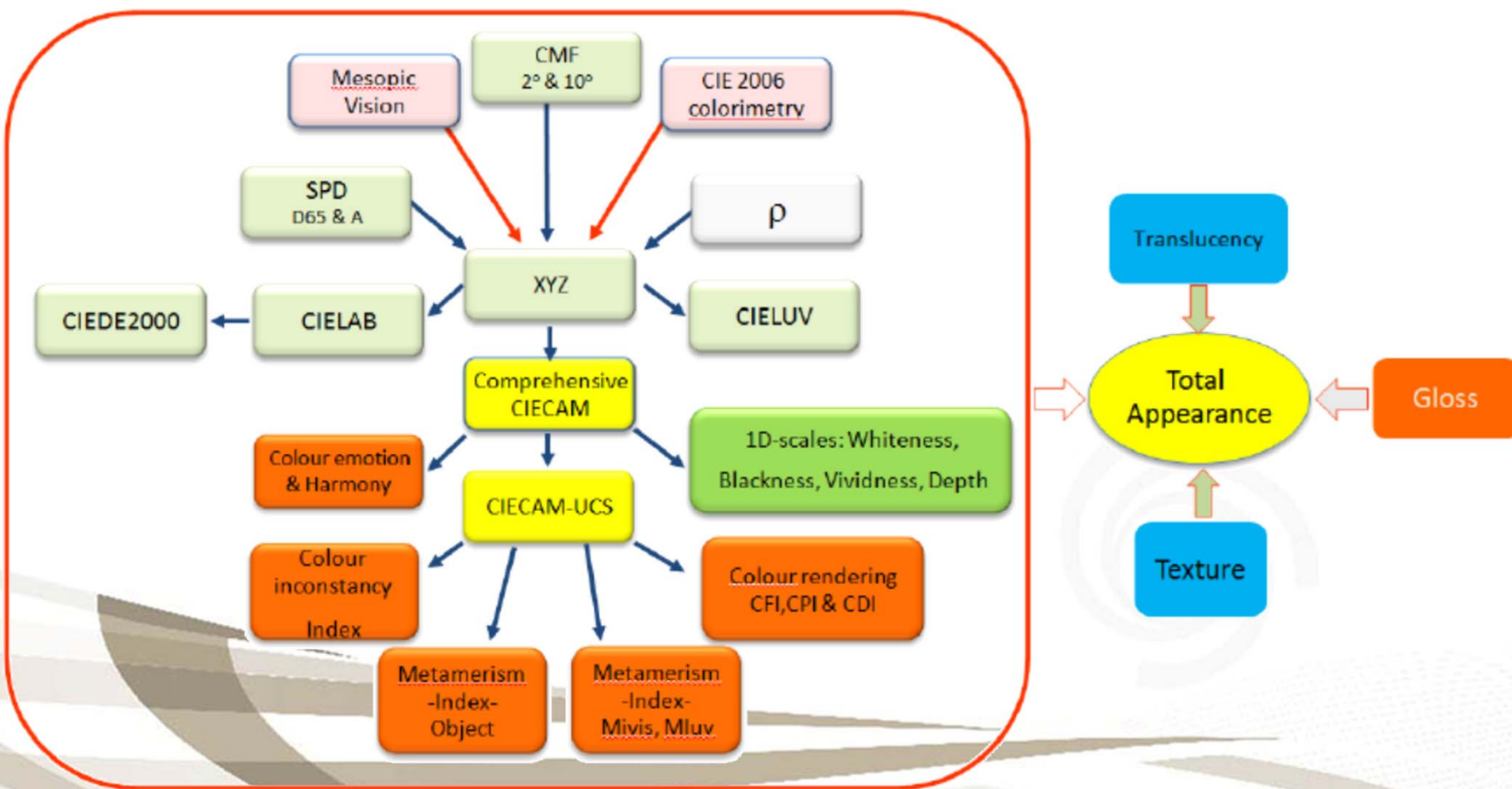
2. Comprehensive Colour Appearance Model



	Measure	M_{02}	M_{opt}	M_{ocw}
Lightness	CV	14.0	14.2	14.1
Colourfulness	CV	18.6	18.7	18.2
Hue	CV	6.9	6.9	6.6
Corresponding data	CIE LAB	5.5	6.5	5.6

Division Strategy

3. D1 Roadmap – The Future



Division Strategy

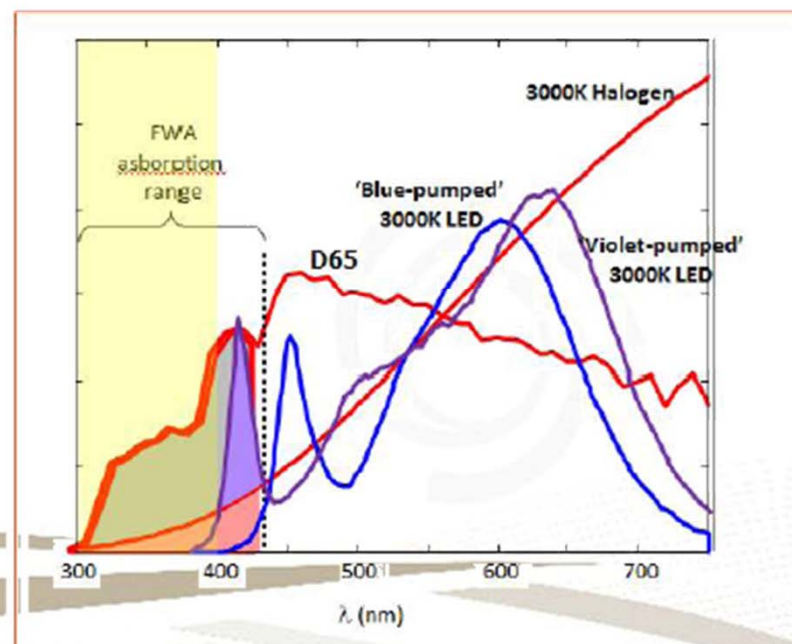
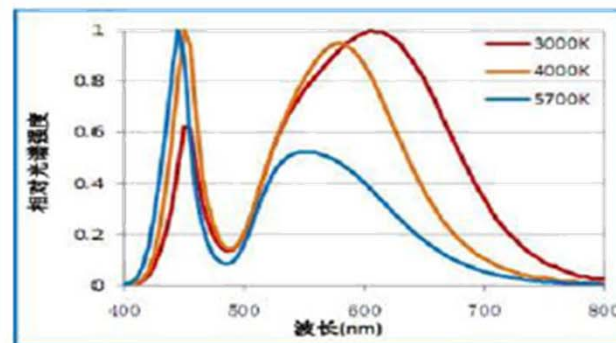
4. Important Tasks

Ongoing:

- CIE 2006 colorimetry
- Mesopic vision
- Comprehensive CIECAM
- Colour rendering (CRI + CPI)

New:

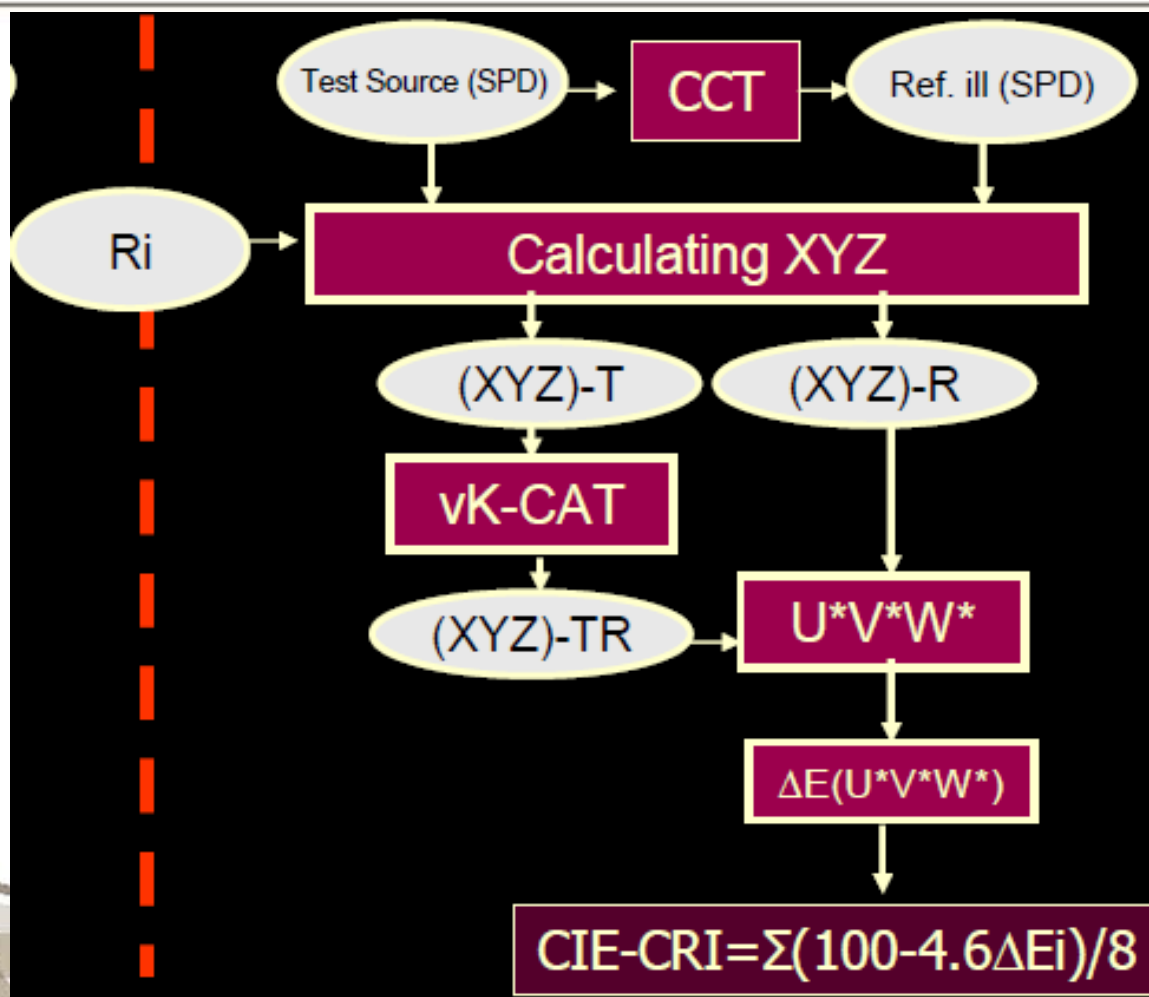
- Standard LED illuminant
- White perception locus
- Whiteness index for LED lights
- Whiteness for object colours
- LED daylight simulator



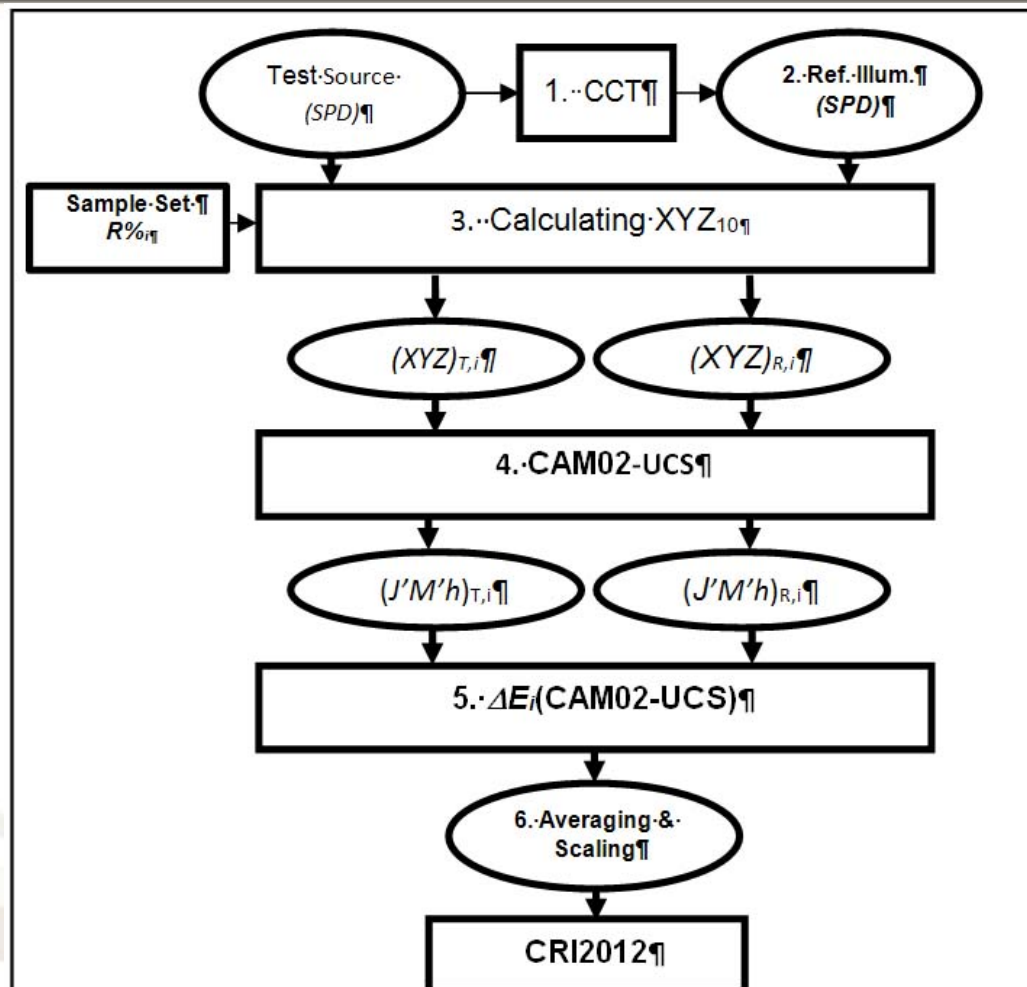
Next Meetings

- CIE Lighting Quality and Energy Efficiency Conference,
3-5 March 2016, Melbourne, Australia
- Expert Symposium on Appearance,
29 August – 2 September 2016, Prague, Czech Republic
- AIC Congress – In conjunction with CIE Mid-term Meeting,
16-20 October 2017, Jeju, Korea

Calculation Scheme of CIE CRI



Recommended CRI2012



Flowchart of the new metric:

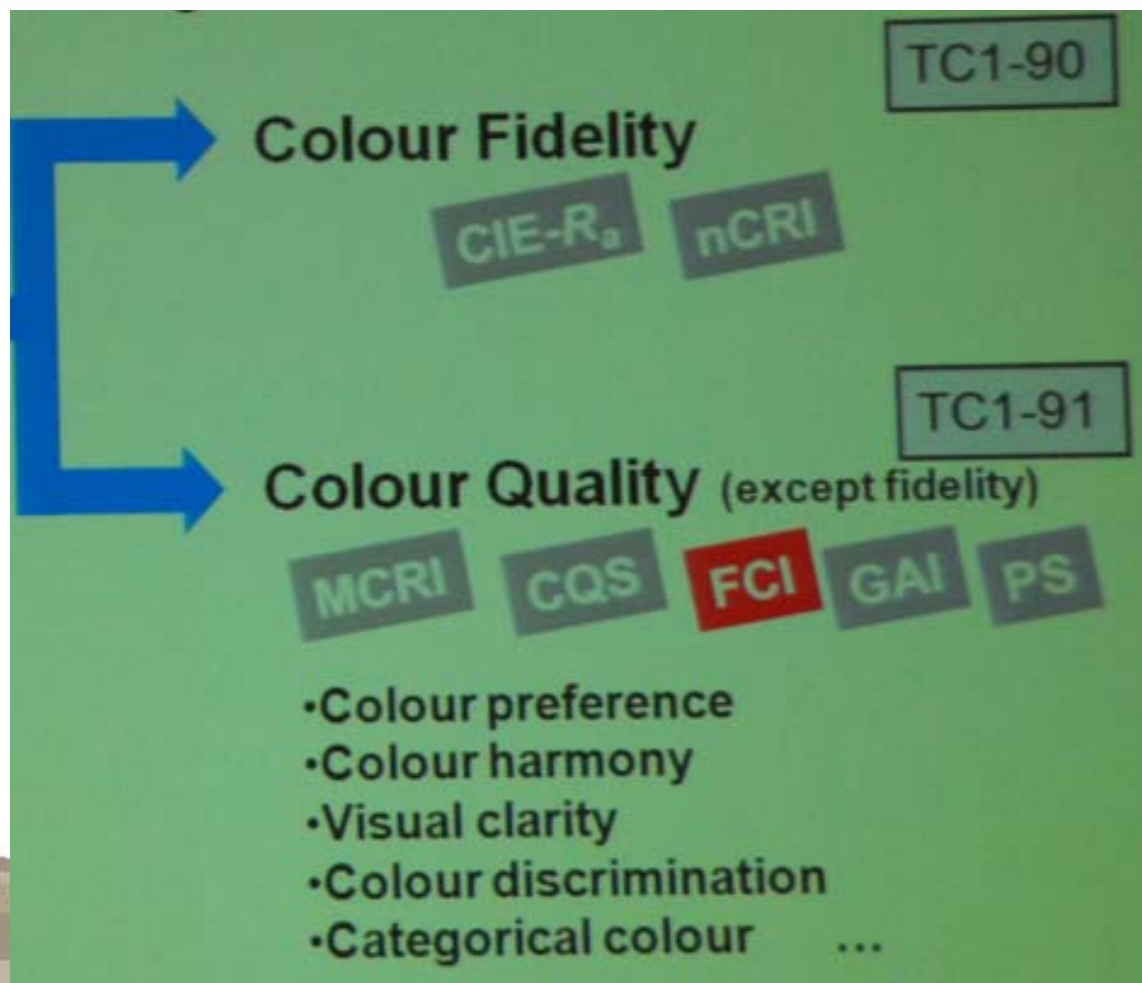
1. **Determine. Ref. Ill. SPD**
2. **Use new test samples**
3. Calc. 1964 Tristim. Values
4. Transform to CAM02-UCS
5. Calc. Col. Diff.
6. Average

$$\Delta E_{rms} = \sqrt{\frac{\sum_{i=1}^N \Delta E_i^2}{N}}$$

7. Calculate CRI2012

$$R_{a,2012} = 100 \cdot \left(\frac{2}{e^{k \cdot |\Delta E_{rms}|^{1.5}} + 1} \right)^2$$

Color Rendering



IES TM-30-15

- Two-metric system
 - R_f : color fidelity
 - R_g : color gamut
- **99** color evaluation samples (CES) with color space and wavelength uniformity
- Reference Light Sources
 - CCT < 5,000K → Blackbody Radiator
 - CCT > 5,000K → Daylight
 - 4,500K < CCT < 5,500K → BBR + DL Mixing
- Uniform Color Space
- Appropriate Color Appearance Model

R 1.62 - Typical LED Spectra

- **Year Established:** 2014
- **Reporter:** S Jost FR
- **Terms of Reference:** 1) To collect available LED spectra, 2) Analyze the difference among the spectra with the aim of finding possible typical spectra for various classes e.g, cool white, and warm white

Methods

- 1- SPECTRA COLLECTION
- 2-CLASSIFICATION BY:
 - TECHNOLOGY (Mixed, phosphor)
 - CCT (Warm, middle, cool)
- 3-CLUSTERING
 - SELECTION TESTS
 - CONDUCTING TESTS

Results

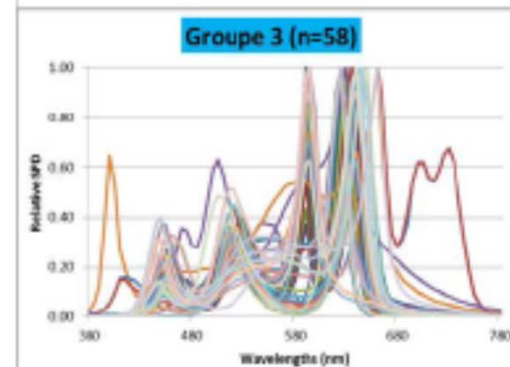
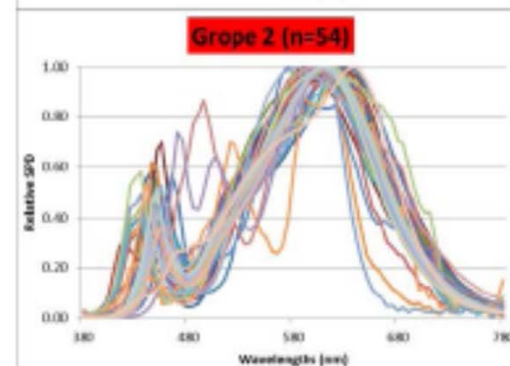
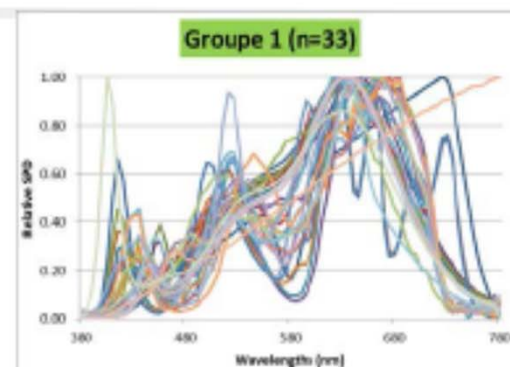
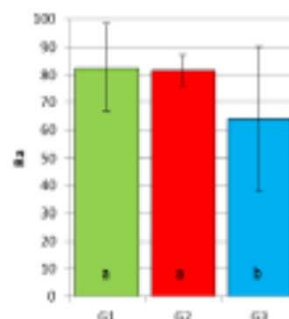
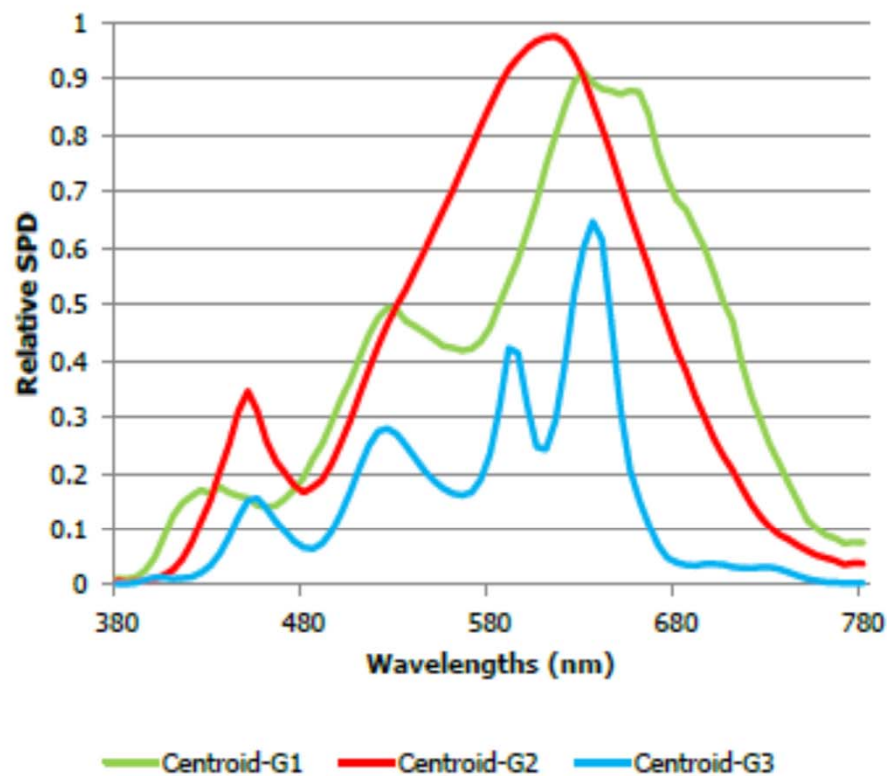
- A) ALL LEDs
 - ALL DATA
 - BY CCT:
 - WARM (< 3000 K)
 - MIDDLE (3000 K - 5000 K)
 - COOL (> 5000 k)

- B) PHOSHOR LED s
 - ALL DATA
 - BY CCT:
 - WARM (< 3000 K)
 - MIDDLE (3000 K - 5000 K)
 - COOL (> 5000 k)

4.A.Results Warm LEDs (<3000K)

3 groups (n=145)

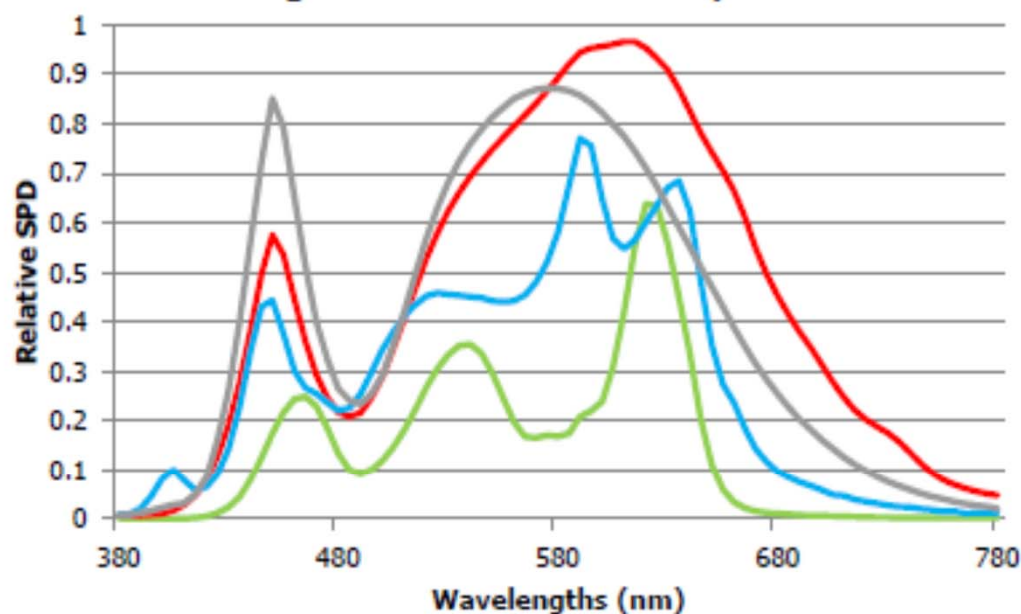
[similarities 93% (AHC vs. K-means)]



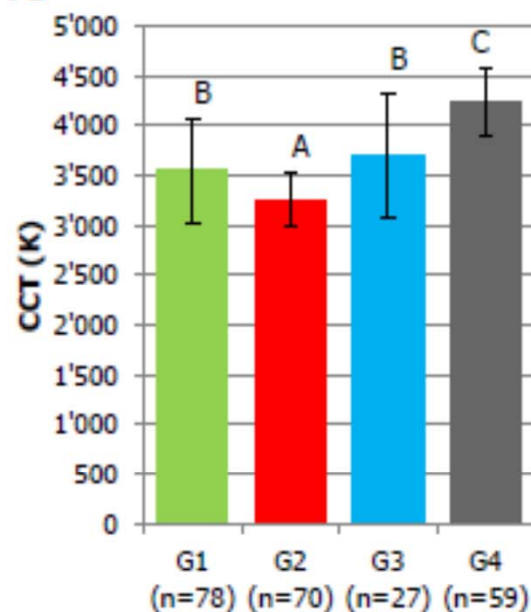
4.A. Results Middle LEDs (3000K-5000K)

- 4 groups (n=234)

- [similarities 92% (AHC vs. K-means)]

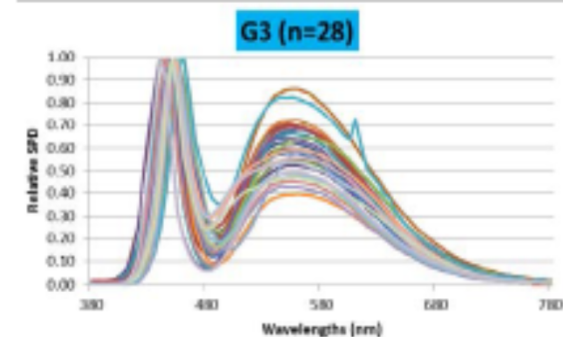
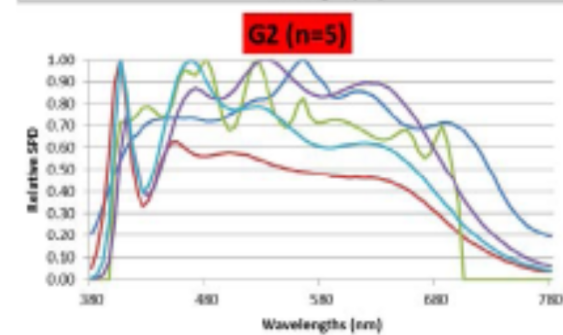
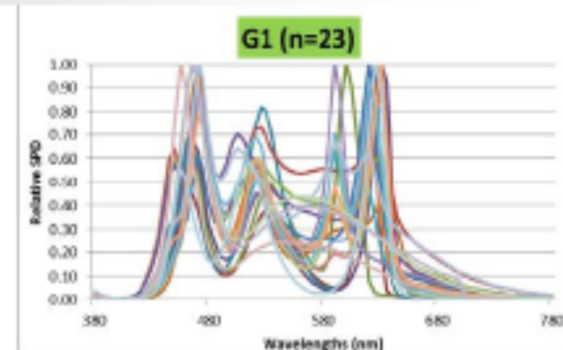
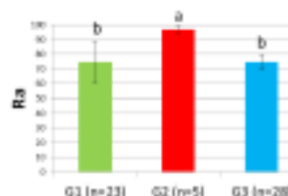
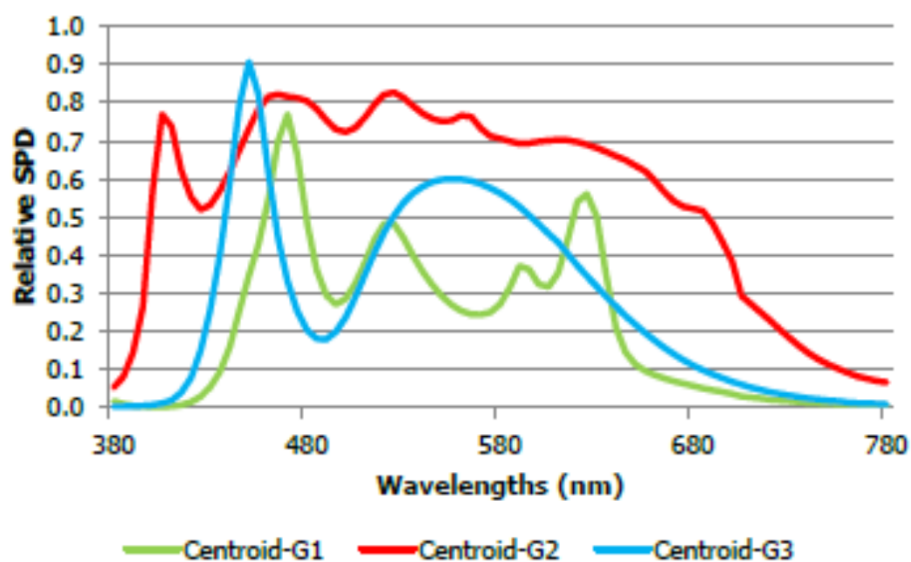


— Centroid-G1 — Centroid-G2 — Centroid-G3 — Centroid-G4



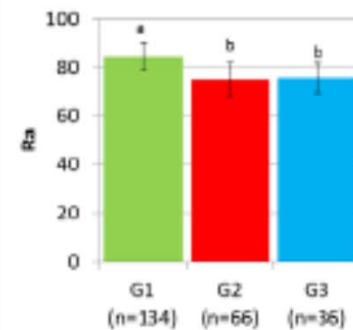
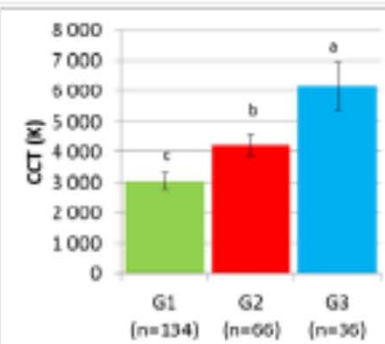
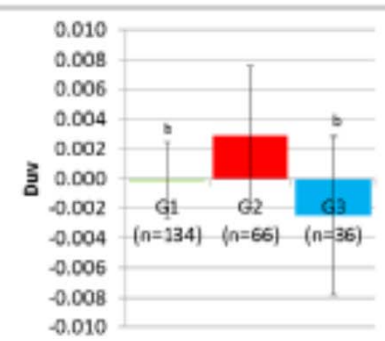
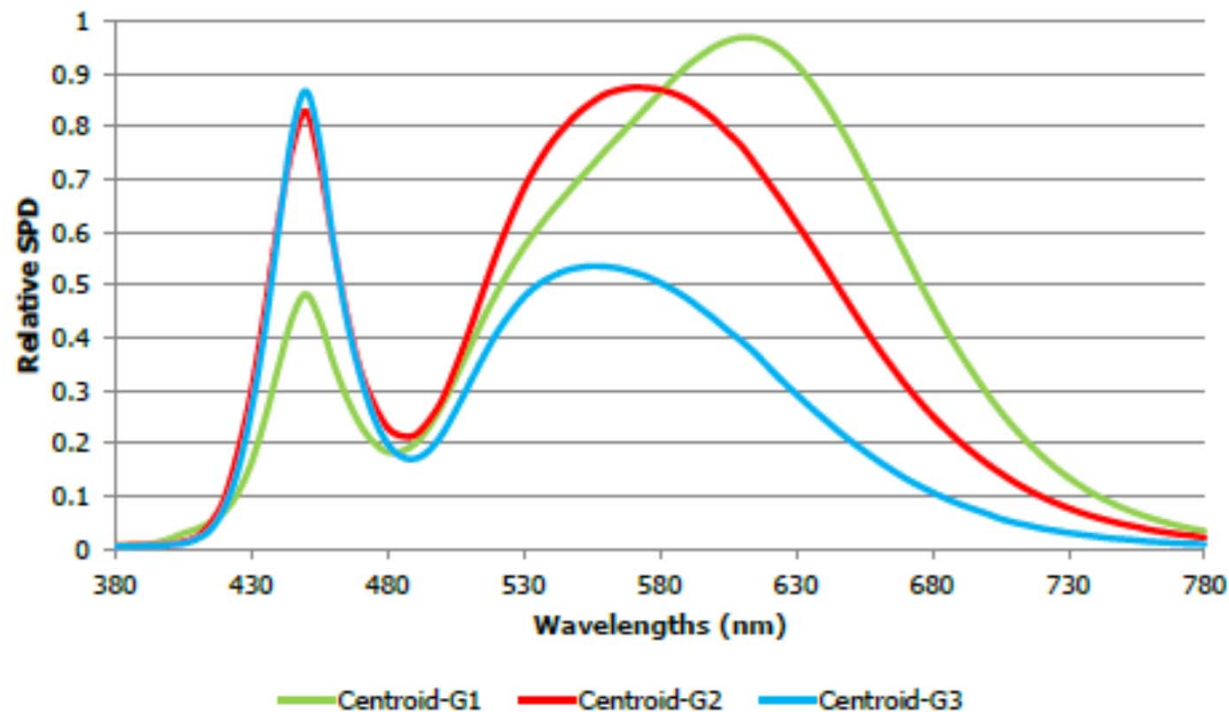
4.A. Results cool LEDs (>5000K)

- 3 groups (n=56)
 - [similarities 100% (AHC vs. K-means)]



4.B.Results all phosphor LEDs

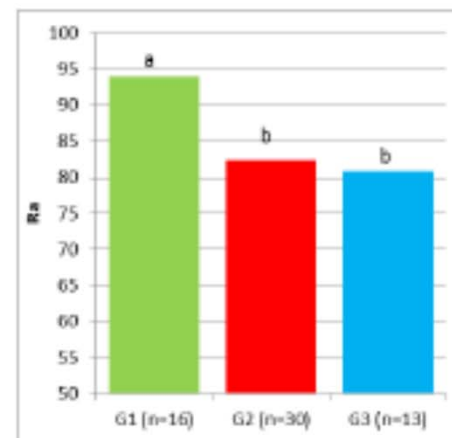
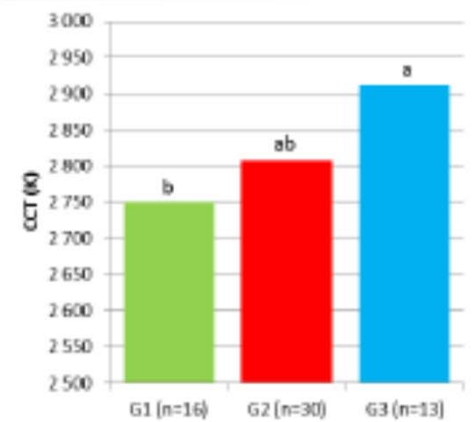
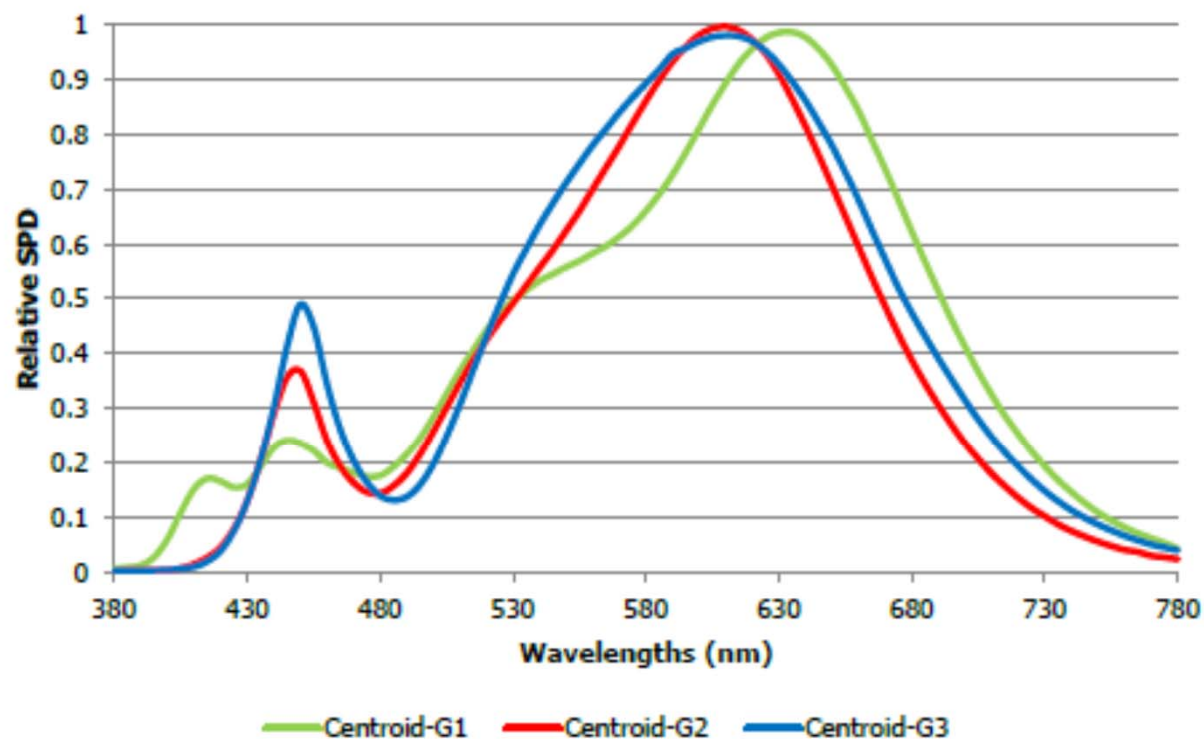
- 3 Groups (n=236)
 - [similarities 94% (AHC vs. K-means)]



Results warm phosphor LEDs

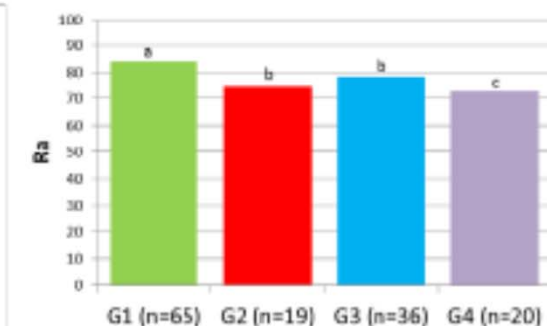
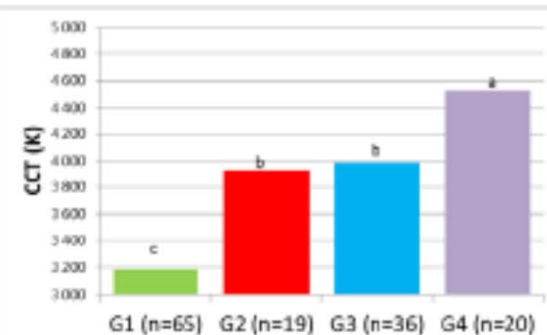
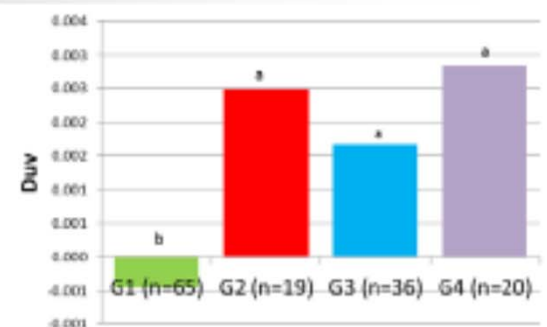
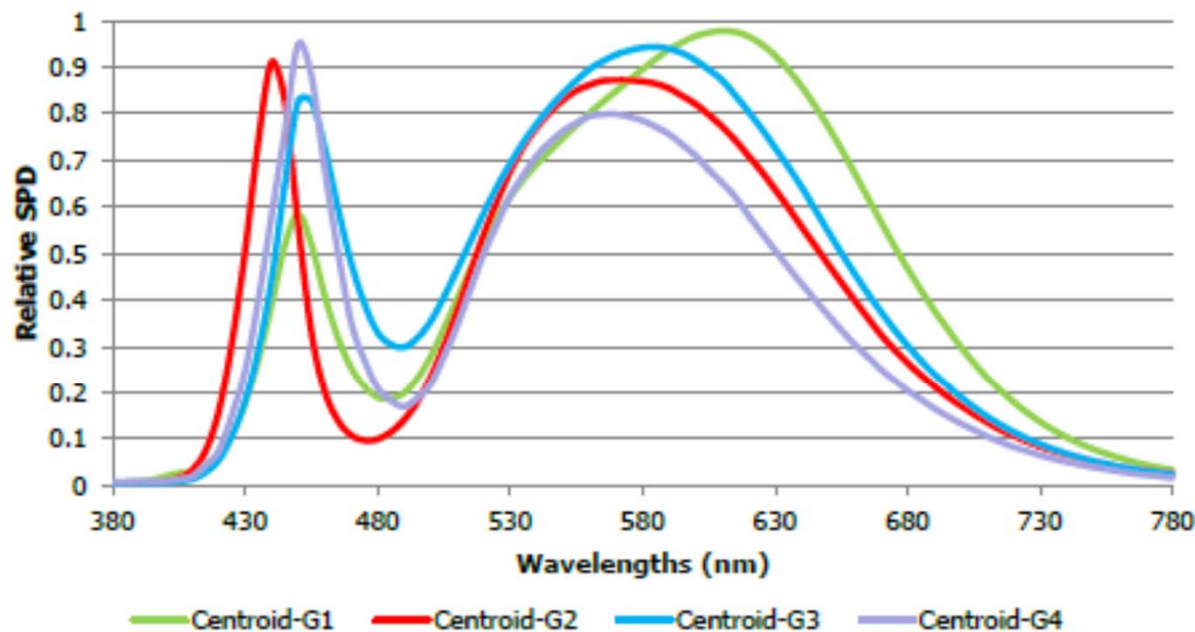
3 Groups (n=59)

- [similarities 94% (AHC vs. K-means)]



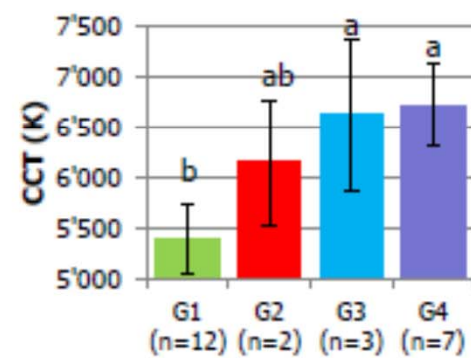
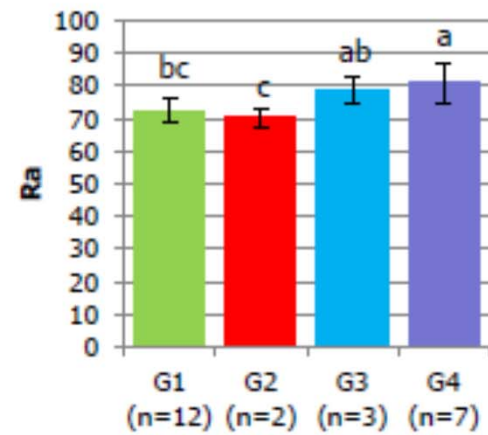
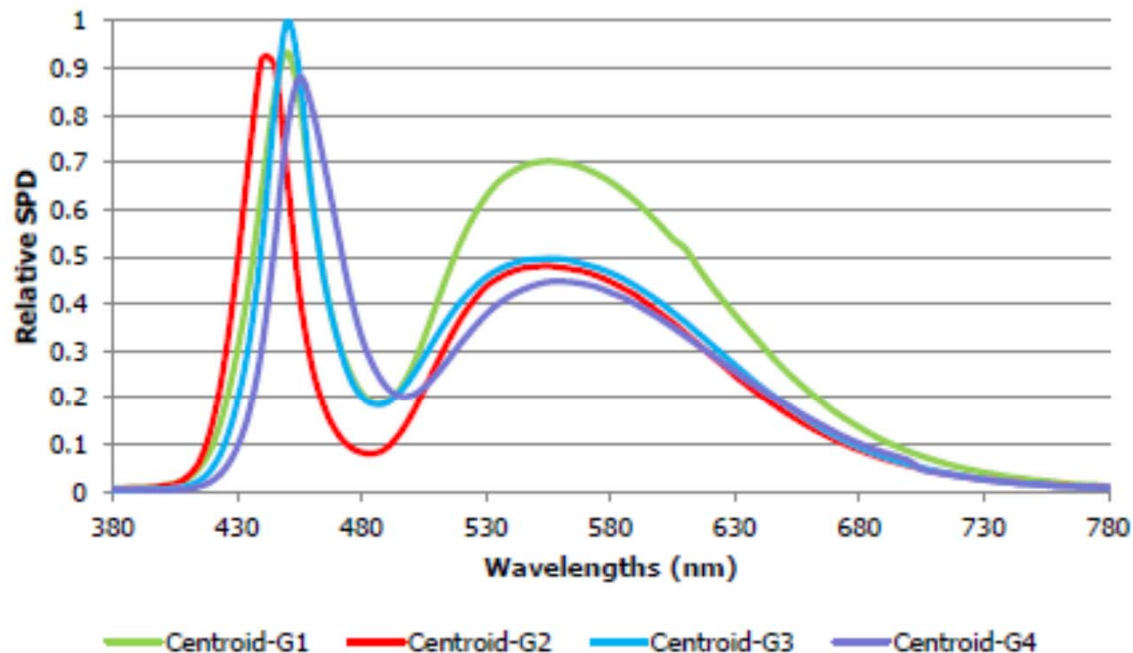
Results middle phosphor LEDs

- 4 Groups (n=140)
 - [similarities 95% (AHC vs. K-means)]



Results cool phosphor LEDs

- 4 Groups (n=140)
 - [similarities 95% (AHC vs. K-means)]



The End