

# Tunable White :

## Explanation, Expectation & Controls

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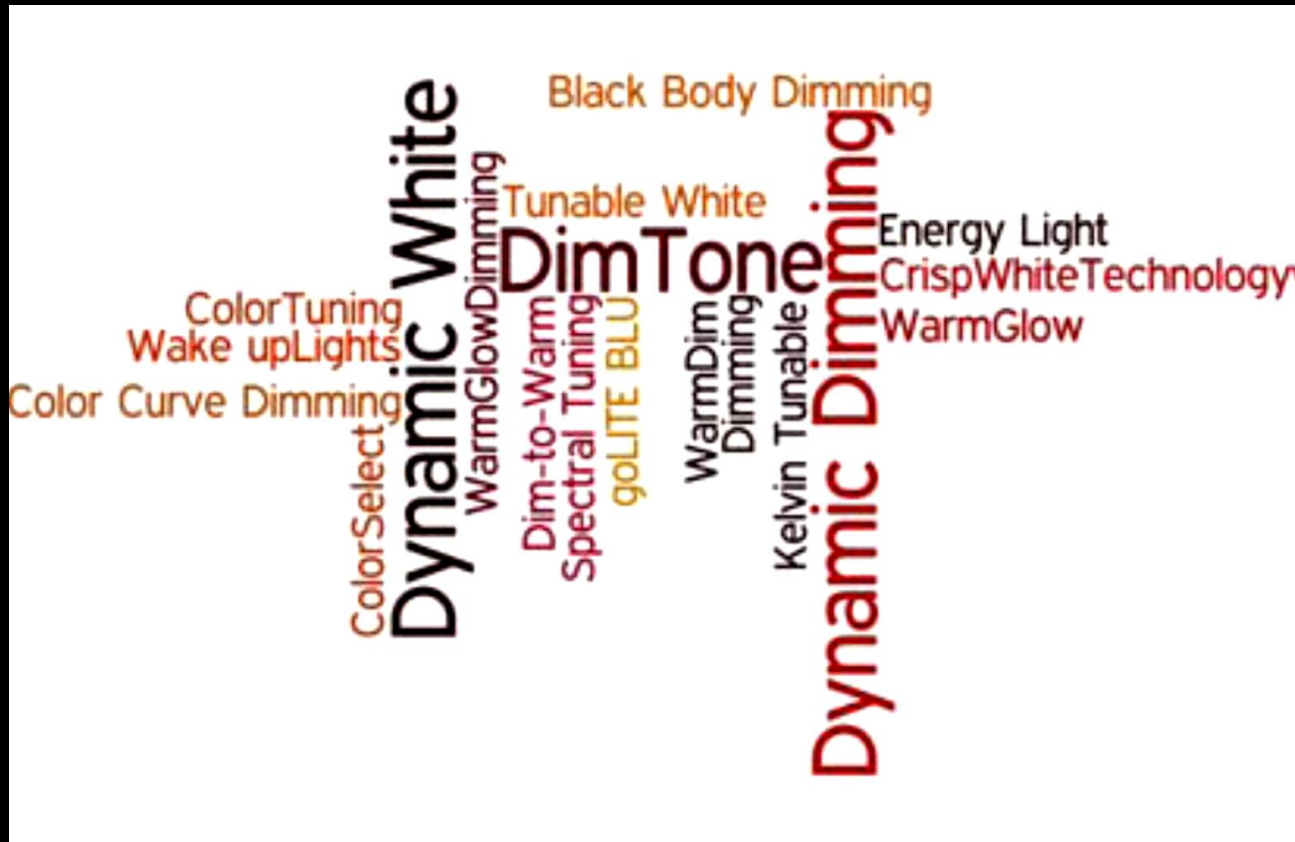
## **4. Controls**

## LED Progression: From static color to Dynamic Experiences

- Tunable White is becoming increasingly mainstream
- Designers are moving from just dimming to wanting total control of the Kelvin temperature, color consistency, warm dimming and color points
- Picking a lamp CRI and CCT to best enhance the environment is no longer sufficient.



Tunable White –  
What's in a Name?



## Tunable White

1. **Full color tuning** / Spectral Tuning / RGB / RGBW
2. **Warm Dimming** / Sunset Dimming / Warm Glow
3. **CCT Tuning** / Tunable White / Dynamic White
  - Circadian Tuning

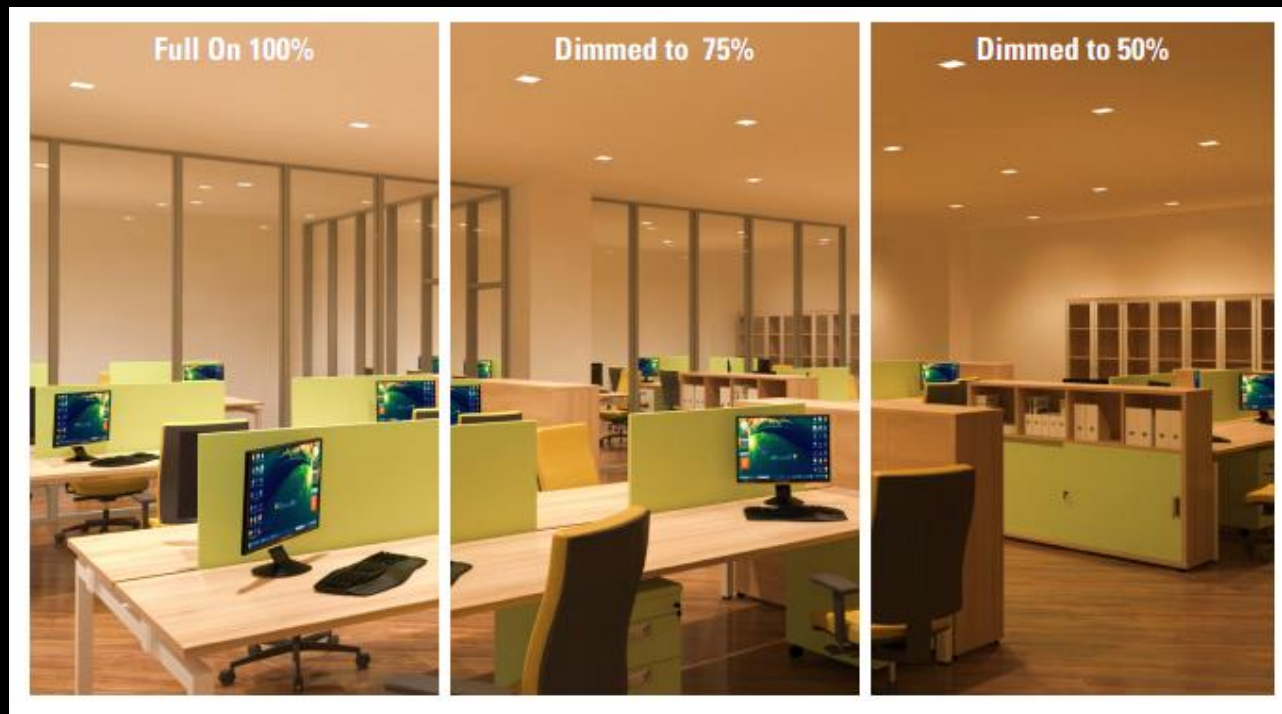
## What is Full Color Tuning

- Tuning RGB of LED products in a space to match the color requirement in the space
- Creative appearance of space (3500K at one work station, pool of reddish light in corridor, wash of purplish light on lobby wall, for example)



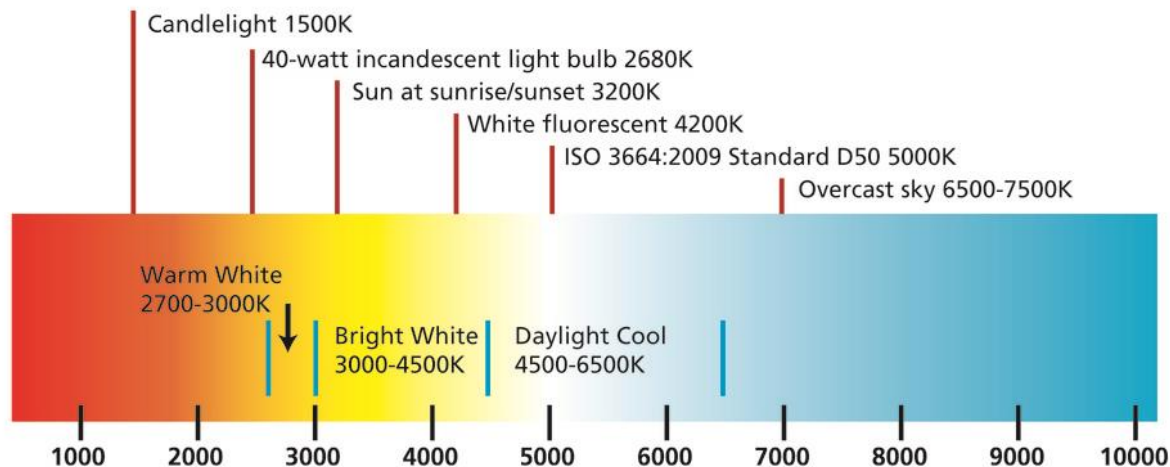
## What is Warm Dimming?

- Through a combination of LEDs within the luminaire, the CCT will shift as dimmed from cool to warm
- This could be along the black body curve or shift from it with dimming Range will vary from manufacturer to manufacturer, 2700K to 2000K or 1800K is common



## Why Warm Dimming?

- Taps into innate human expectations that light sources “warm up” as intensity is reduced
- Mimicking incandescent (3500K-2200K) or quartz halogen(3000K-1800K) , especially when dimmed
- Impacts ambience, mood, relaxation, intimacy





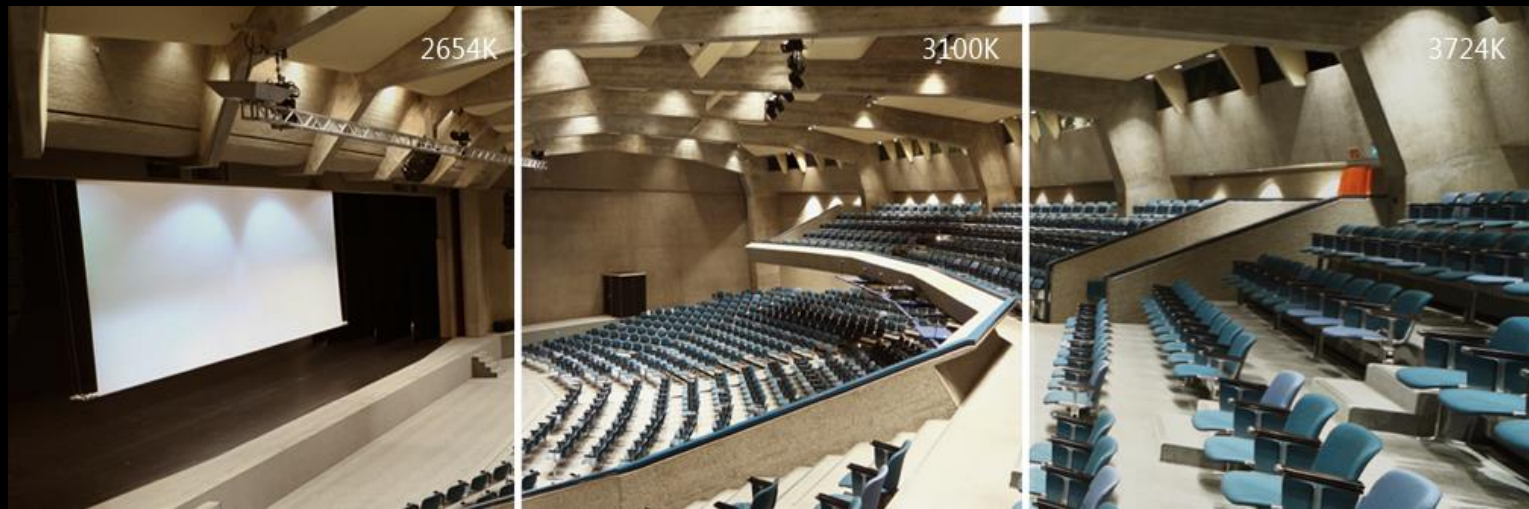
## What is CCT Tuning (Tunable White)?

- Two sets of LEDs, one warm and one cool. By fading from warm LEDs to cool LED sets, with the intermediate CCTs created by mixing different levels of warm and cool LEDs, a range of colors very close to the black body locus is possible.



## Why Use CCT Tuning (Tunable White)?

- Circadian stimulation or to suppress circadian stimulation, especially if the space has multiple occupancies or uses over the course of 24 hours
- Throughout the course of the day the CCT can be varied, tuned in response to daylight or activities within the space
- Create a different atmosphere or mood or application
- Change the environment for retail displays and dressing rooms



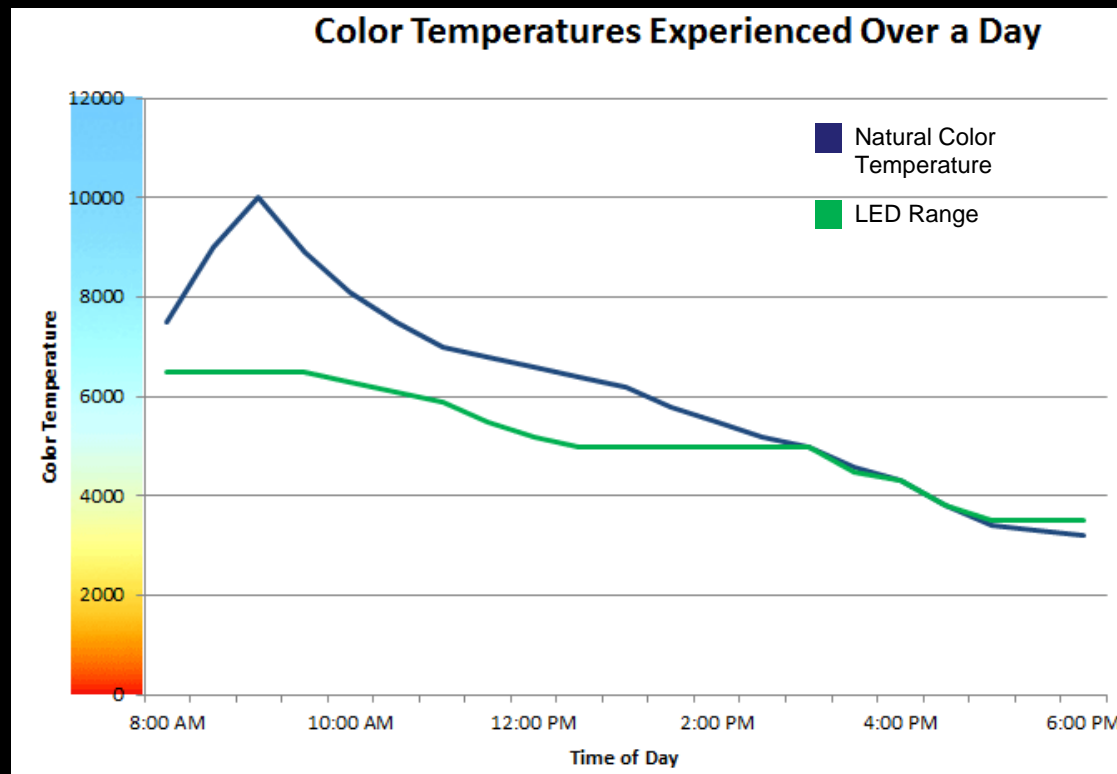
## Case Study - Hillsdale college, MI



- Use different fixture in multifunction space to for different application
- METEOR CS-195 : 3000K
- Florescent: 4500K

## Circadian Tuning

- Adjusting the spectrum of the source to help to stimulate the circadian rhythm



## Circadian Tuning

- Promote better health, quicker healing and improved sleep
- Behavior control (calming, invigorating children in classroom) ,
- Offset the impact of jet lag and foster alertness/calmness
- Matching color of daylight during day, warmer dimmer light in evening



24/7 Occupancy



Long-Term Care



Residences



Prisons



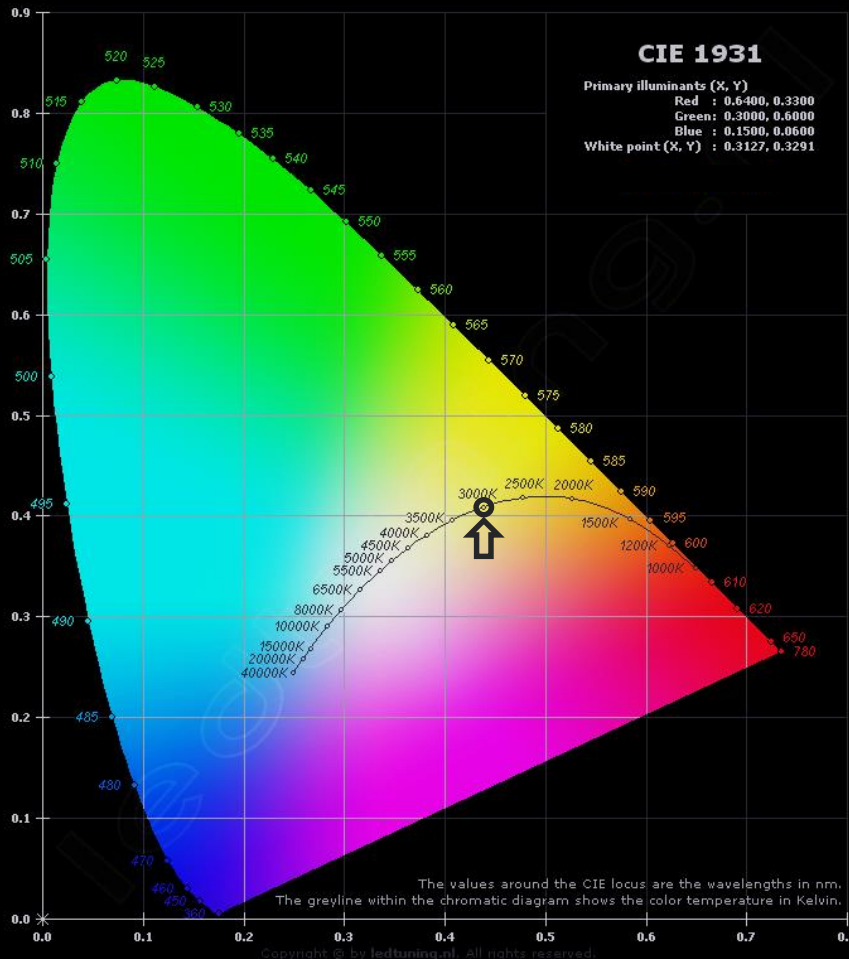
Offices

## Key Attributes of Dynamic Lighting

- Excellent Dimming Performance
- High Quality Light, perfect for the job
- Driver Development Capability
- Interactive (DMX / RDM)
- Complicated/Expensive/Fussy/High Maintenance



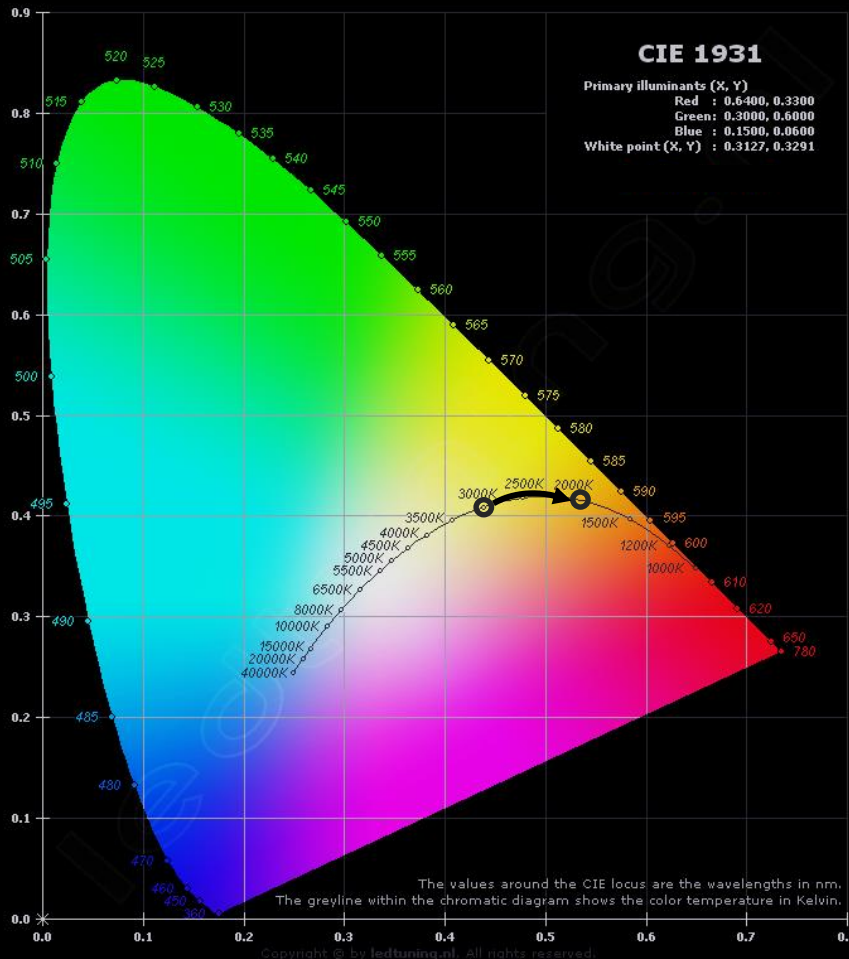
## Technical Definitions



## Static White

- Color point remains constant
- Intensity change is a dynamic feature
- Measure of quality is smoothness and deepness of dimming

## Technical Definitions

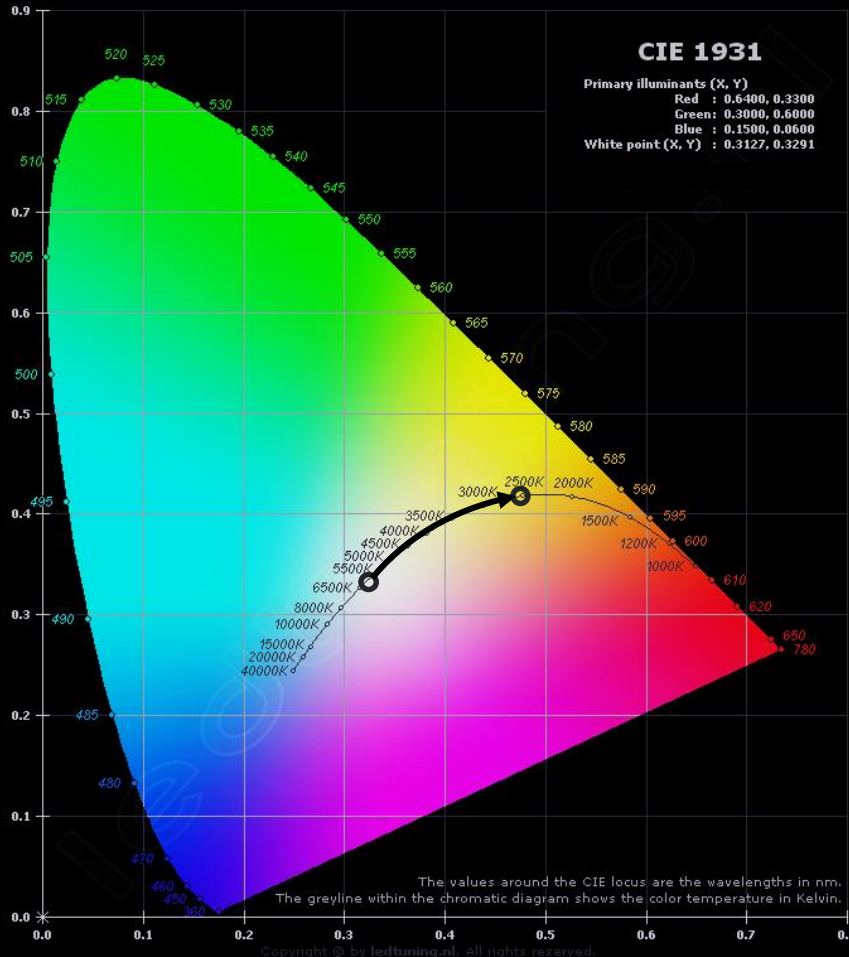


## Warm Dimming

- Tune towards Warm Incandescent Path
- Lighting should do what we expect
- Measure of quality is accuracy of pathway



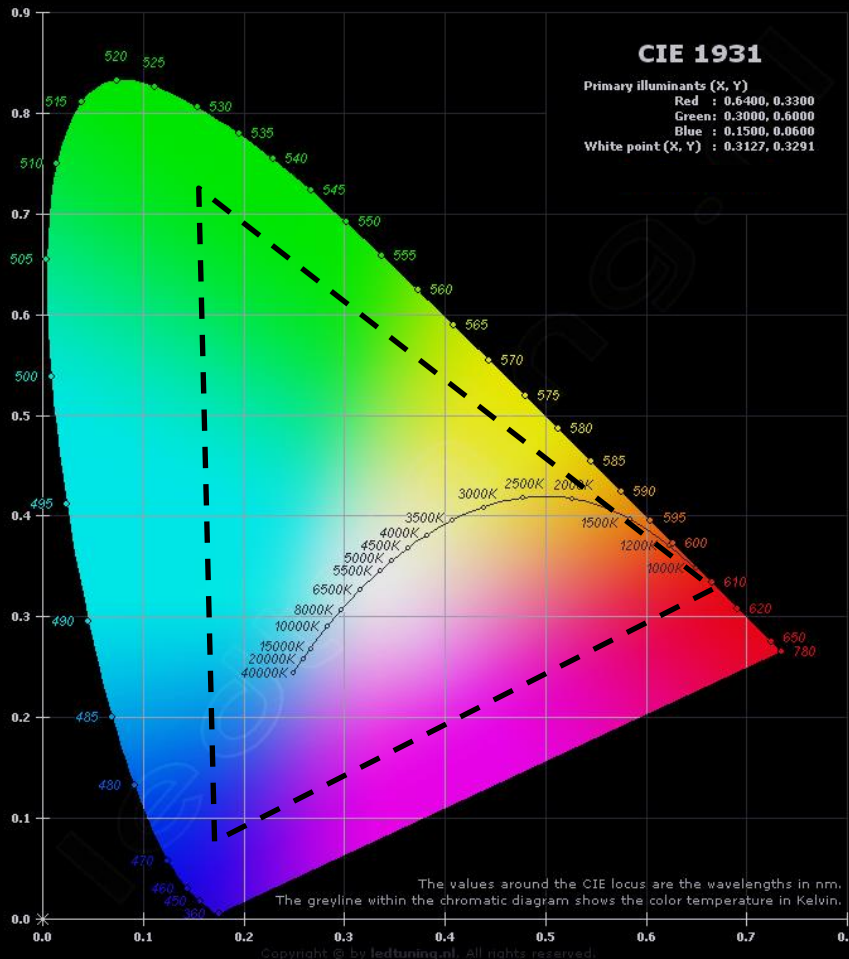
## Technical Definitions



## Tunable White

- Tune Along BBL
- Mimic Natural Light
- Affect Mood, Health, and Well Being

## Technical Definitions



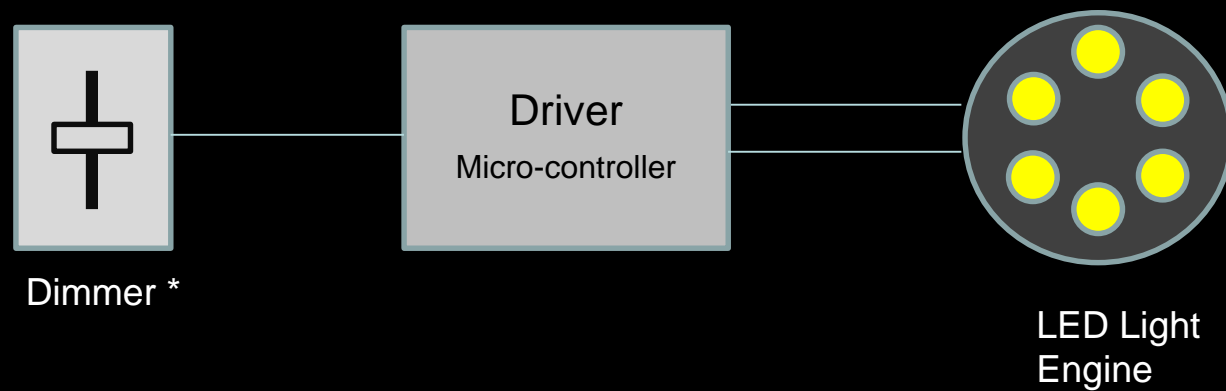
## Full Color Tuning

- Architectural
- Entertainment
- Measure of quality is consistency, dimming, range and controllability

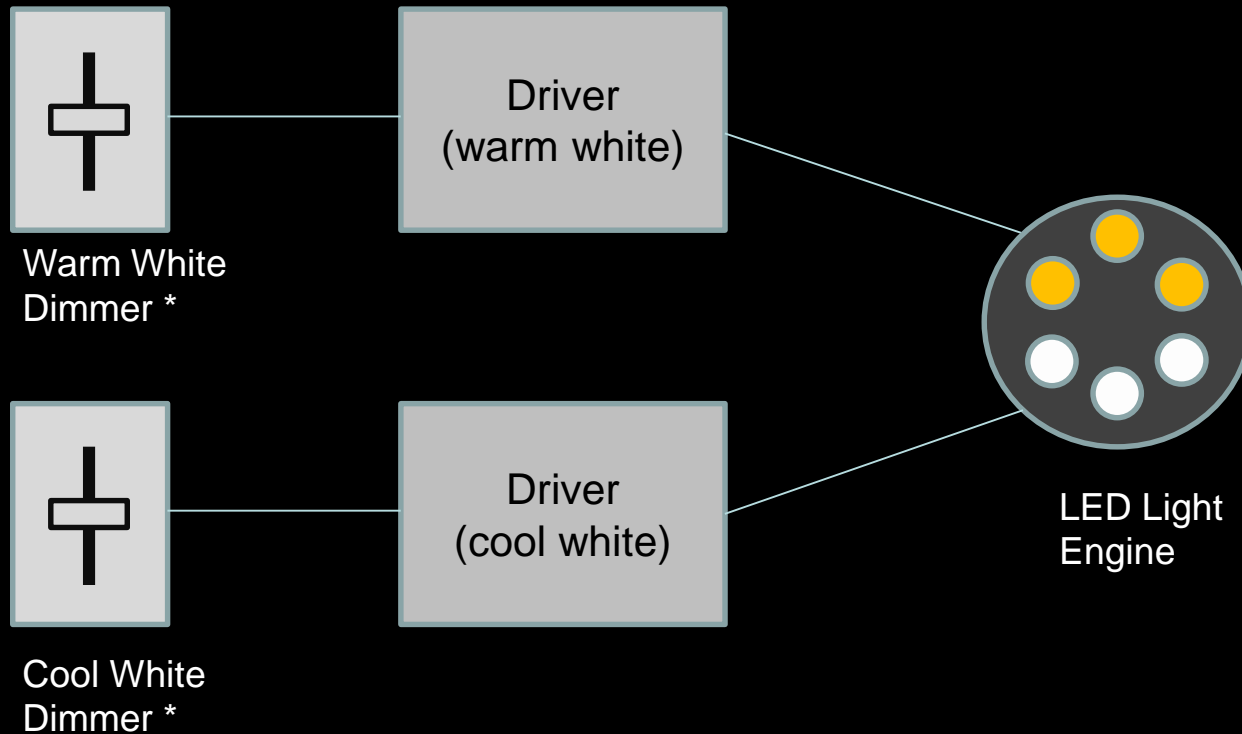
## Control

- **More importantly** – How do you specify the controls?

## Warm Dimming (Sunset Dimming)

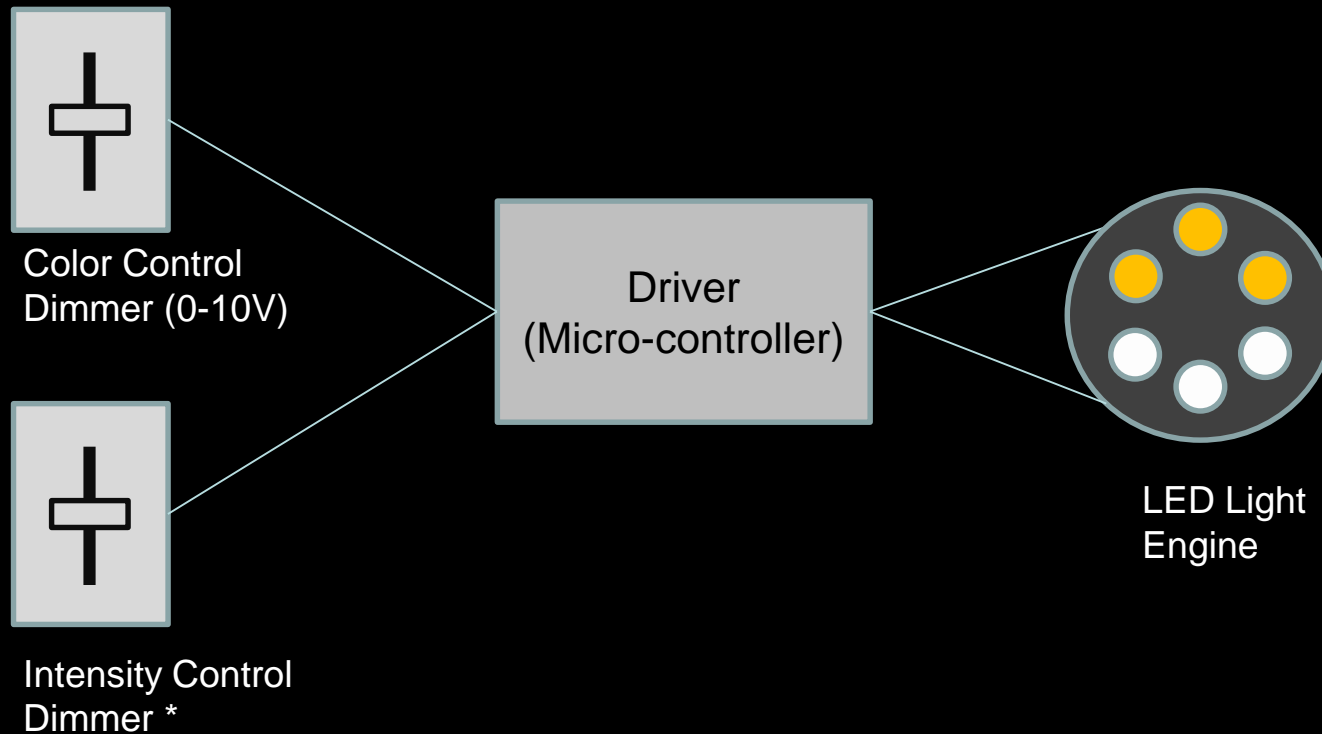


## Tunable White - Sample System



\* METEOR Drive support 0-10V, DMX, Triac, 2 wire/3wire, Ecosystem dimming

## Tunable White - Complex Controls



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## Tunable White - Complex Controls

