

LIGHT FOR LIFE™



Broad Tuning Range

1650K - 8000K

WHAT IS ARAYA⁵ TUNABLE COLOR?

araya⁵ recreates daylight by mixing LED colors of the rainbow – red, amber, mint, cyan and blue – to deliver full spectrum light from 1650K to 8000K at 90+ CRI, while also providing access to a wide gamut of pastels and saturated colors.

WHY FIVE-COLOR TUNING FOR FULL SPECTRUM LIGHT?

Until recently, all light – sunlight, firelight, candlelight, incandescent light – was full spectrum light. Full spectrum light contains all of the visible colors, and, like sunlight, renders colors naturally. At Lumenetix, our goal to create electric sunlight meant that we needed to mix multiple colors (also known as channels) to replicate the color, beauty and range of sunlight. How many colors? No less than five can deliver the full spectrum of araya⁵ illumination.



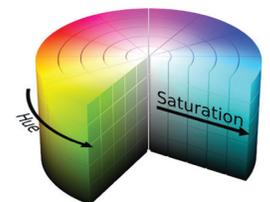
Spectral Quality of Daylight

90+ CRI

WHAT ARE THE BENEFITS OF ARAYA⁵ TUNABLE COLOR?

The 1650-8000K tunable range, 90+ CRI color quality, LED dimming to 0.1%, <2 SDCM color consistency over life, and access to a wide gamut of colors enable the delivery of lighting profiles that expertly resolve the multiple, yet specific, lighting objectives within a space.

araya⁵ dynamically and precisely tunes light with accuracy, control and consistency never before possible. Now, any subject can be displayed in an optimized lighting profile. The genius of araya⁵ is only fully realized in control of lighting sequences tailored specifically to the application. As one considers the myriad of subjects, spaces and the objectives of aesthetics, comfort, wellness, visual acuity and color communication, the potential of araya⁵ to revolutionize the world of lighting comes into focus.



Color Access

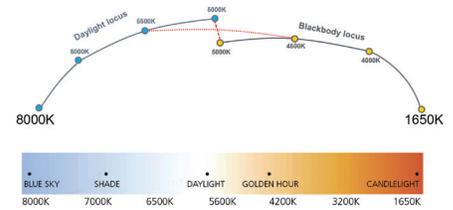
Pastels to Saturates

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WHAT ARE THE TWO LIGHTING PROFILES OFFERED?

araya⁵ Color Tuning Modules feature two lighting profiles stored in the module. The tunable color profile features a broad tunable range from 1650K to 8000K. The light tracks the CIE Blackbody locus from 1650 - 4500K and then smoothly transitions to the Daylight Curve to 8000K — emulating natural daylight from sunrise to sunset. The warm-dim halogen profile recreates traditional dimming by emulating a halogen lamp from 3050K at full brightness to 1800K at 0.1%. Both deliver the same great araya⁵ light quality metrics.

Dual profiles provide the fixture manufacturer or lighting designer the capability to choose either profile, or to combine the two profiles within the fixture.



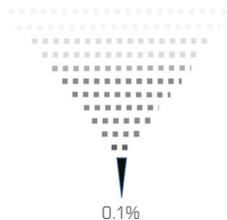
Dynamic Daylight

Blackbody to Daylight Curve



Halogen Dimming

3050 (100%) - 1800K (0.1%)



LED Dimming

100% - 0.1%

WHAT IS LED DIMMING TO 0.1%?

LED dimming to 0.1% blends dynamic current control and pulse width modulation (PWM) over 6 channels of LED color. The technique utilizes dynamic LED drive currents to 10% of output and then introduces PWM at modulation rates up to 25kHz for output levels from 10% to 0.1%.

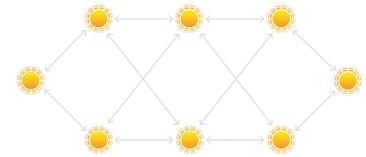
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LUMENETIX SOLVES THE COMPLEXITY

LEDs are notoriously difficult to characterize and the industry has responded with the concept of binning, which places an LED in a performance range. However, binning is not precise enough for a high quality tunable color system, so Lumenetix developed a proprietary and patented system to characterize the LED with the utmost of precision. In other words, we know the exact, unique performance characteristics of every LED in our array.

For 4 and particularly 5 or more channels, there is more than one way to create a color, each producing a unique spectral signature of differing color quality and efficiency. Our algorithms use these LED characterizations to correctly optimize each module to deliver precise color with optimal spectral content and energy efficiency.

For fixture-to-fixture color consistency, the light from araya⁵ products maintain less than 2 Standard Deviation Color Matching over life. 95% of the general population cannot distinguish any difference in the color of light that is <2 SDCM.



Color Consistency Over Life

Less than 2 SDCM

$$\frac{1}{\sqrt{n}} \sum_{n=1}^{\infty} \frac{(-1)^n}{\sqrt{n}} = -\frac{1}{\sqrt{n}} \sum_{n=1}^{\infty} \frac{(-1)^n}{\sqrt{n}}$$

Fast Inverse

Solver

LUMENETIX CALIBRATION AND CHARACTERIZATION OF LEDS

The Fast Inverse Solver uses patented techniques to characterize each and every LED in an array. This advanced technology performs millions of calculations in less than a minute. The result? We know the exact characteristics of each LED and create a color model (the instruction set used to drive each LED for each color point) that precisely generates the araya⁵ specifications.

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THE MATHEMATICS OF ARAYA⁵ COLOR SPACE

A spectrometer captures the unique spectral signature of each LED channel of a lamp. For 4 and particularly 5 or more channels, an infinite number of color combinations exist, each producing a unique spectral signature of differing color and efficiency qualities. The sheer quantity of these calculations would take months to years to perform on high-speed computers to exhaustively examine what combination best fits a given color metric.

araya⁵ applies innovative lean mathematical methods to rearrange the color metric space and speed up color calculations on the order of 5 trillion times faster than prior known methods. The nature of the araya⁵ method does not “cut corners” / “make any assumptions” and is broadly applicable across multiple color metrics (e.g. CRI, CQS, TM-30, etc.). araya⁵'s dramatic speed-up enables the “impossible” to be done at production-line speeds. The brief period of measure and solving still manages to process multiple terabytes of numeric data to find a fundamentally optimized lamp that meets a custom specification across the entire operating range. The “solved” lamp is flash tested (with all color channels uniquely firing) across a range of operating points for validation..

THE BROADEST CONTROLS COMPATIBILITY IN THE INDUSTRY

DIGITAL - araya⁵ is compatible with all industry-leading digital control systems.



ANALOG - Two 0-10 V lines can be used to control Dimming and CCT independently, or program scenes and recall them with 0-10 V presets.



iOS - Used in conjunction with Digital or Analog controls, each module can be wirelessly commissioned and then the radio turns off for enhanced security.