

An Improved Energy Star CFL Color Specification

- Background
- Specification: Basis & Brief Explanation
- Looking Forward on Color

Background

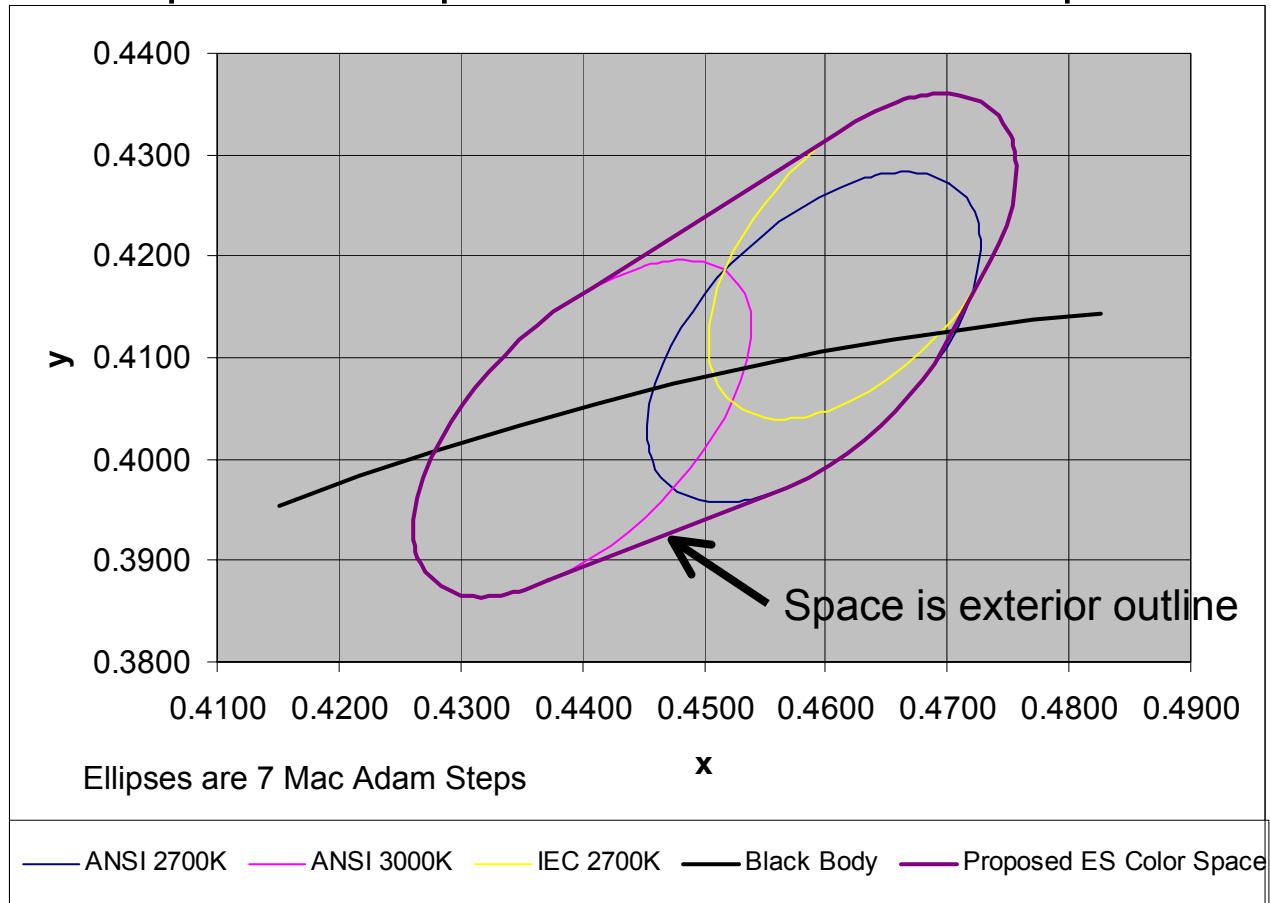
- LRC Color Round Table -- Feb 26, 2004
- Participants
 - Agreed current Energy Star CFL CCT color spec needs better definition
 - Agreed to define a 'hockey stick' 2700-3000K CCT color space to approximate the broad color range of 'incandescent'
 - Agreed the space would include ANSI 3000K, ANSI 2700K, and IEC 2700K color spaces
 - Agreed *intermediate* color targets within the defined space would be acceptable (i.e., 2850K)
 - Tasked NEMA with developing a practical (from a CFL design & manufacturing perspective) but more specific definition of the 2700-3000K CCT color space

Approach

- Issues considered by NEMA LSTC:
 - Used existing standardized colors as basis for ‘hockey stick’
 - Realistic color measurement variability among NVLAP labs (based on NVLAP round robin testing)
 - Practical issues controlling color across different CFL configurations
 - Covered vs Uncovered
 - Clear or translucent filtering impact of covered types
 - Arc loading effects of color, especially for 2700K bi-phosphors and newer, higher wattage CFLs
 - Compaction method interactions - spiral, bent tube
 - Amalgam vs non-amalgam designs
 - Practical manufacturing process control issues
 - Resources, costs, timing

CFL Energy Star Color - Spec 4

Proposed Composite 2700-3000K CCT Space



Application of the 2700-3000K Color Space

- Initial Submissions (100 Hrs, base up reference case)
 - All individual lamps must fall within the defined color space
- Ongoing Production
 - Intent: Approximately 90% production would fall within the color space
 - Manufacturers should strive to minimize excursions outside a 7 step oval associated with a color (2700, 2850, 3000K, etc)
- Third Party (e.g. PEARL) Testing
 - 1/5 outside- Discretionary DOE follow up
 - 2/5 outside space- Mandatory mfr follow up response
 - Mfrs are expected to maintain production within the 7 step oval

Other Colors & Color Spaces

- Today: Energy Star requires colors above or below '2700-3000K' to be labeled either 'warm or cool'
- Energy Star needs to determine
 - how to handle other colors
 - how to designate colors so end users can either seek out or avoid colors that they either like or dislike (names, numbers)
- Proposal
 - Base all colors on similar step ovals
- Key Question: Allow any color outside the 2700-3000K space, or only certain standardized colors ?
 - 6500, 5000, 4100, 3500, etc

Other Color Issues

- Color is a complex subject
- Other key color perception issues that CFL mfrs cannot control:
 - Personal color sensitivity and preferences
 - Aesthetic or ‘design’ orientation of the individual
 - Cultural preferences for warmer or cooler colors
 - Color appearance/variation introduced by the luminaire, ambient application temperature, dimming, lamp orientation, proximity to other lamps or luminaires
 - Color of the surface being illuminated, surface material and texture, background color, shade or lens material, etc.
 - Variation between manufacturers, and production batches

Comments

- Proposed specification solves immediate deficiencies with the current CCT specification
 - Bounds **both** x& y (current spec has no limits for y above or below the black body curve)
- Will eliminate most serious color variation
- Can be implemented without major design changes or major manufacturing process change
- Provides a basis for tracking progress in improving color uniformity, assessing program-wide improvement via 3rd party test data
- More consumer research is needed to more fully drive future color specifications (i.e. 'How green is OK?')

Final Caveats

- A tighter color space may ultimately be necessary, but should be based on actual (documented) end user complaint and color preference research data (e.g. tailored focus groups)
- A tighter color space, if implemented, should be proven to *significantly* increase likely penetration of CFLs
- Significantly tighter color control will result in additional production, product, & end user costs
- Remember: Color and Efficacy interact!