Taylor,

Thanks for providing the forum to solicit vendor comments. Lunera lighting specializes in ballast driven retrofit lamps, thus my comments would be directed at those relevant items:

Color Angular uniformity

- As others have pointed out; this is a time consuming test (approximately 2 hrs in a high end Goniometer) and has been made relatively obsolete by advances in LED packaging technology. We would recommend dropping it.

Zonal Lumen Requirements & Efficacy in Downlights

- The optical efficiency of a downlight is a function of its cutoff angle. In all cases the LEDs + power supply have efficacies > 100lm/W
- In the low end residential market, downlight glare is accepted and thus residential downlight retrofit kits have wide cut-offs. For example the Cree LR6 retrofit kit has a cutoff angle of 40' but it only delivers 80% of its light in the 0-50' range; the remaining 20% is delivered in 50'-90' range where it appears as glare. Its achieves 90 lm/W.
    - http://www.cree.com/Lighting/Products/Indoor/Downlights-US/LR6-Series
    - IES File - https://www.creelink.com/exLink.asp?11941632OZ66F87I26390376
- On the high end residential and commercial markets, glare is not acceptable thus architectural downlight cutoff angles and efficacies are lower. The Cree KR series achieves only 53-60lm/W and its cutoff angle is similarly ~40 degress. However, it delivers 98% of its light in the 0-50' range.
    - http://www.cree.com/Lighting/Products/Indoor/Architectural-Downlights/KR-Series
    - IES file - https://www.creelink.com/exLink.asp?10838652OU77N84I26013801
- The point is that the high angle light cannot be easily re-directed
    - In a low end downlight it is emitted causing visual glare and high efficacy -> >80% optical efficiency
    - In a high end downlight, it is filtered causing low glare and reduced efficacy -> <60% optical efficiency
- When we go to retrofit a downlight we need to respect the design attributes of the space or the retrofit will not be accepted
    - We are generally replacing an isotropic emitter such as a fluorescent or incandescent lamp
    - While LEDs provide a lift in optical efficiency due to their directionality, there is no free lunch in the end for cut off angle
- It is thus our recommendation that you consider qualify downlight retrofit kits which leave the reflector in place as a separate category
    - Perhaps EPA could consider specifying performance at the raw retrofit kit level and in a set of reference fixtures

- We do not believe Zonal lumen requirements of a retrofit kit absent a reflector are relevant

Thanks for the opportunity to contribute and we look forward to working with you.

Regards,
Don

Don Barnetson | CTO and VP Product Planning | **Lunera Lighting, Inc.** | m (408) 666-4932 | www.lunera.com |