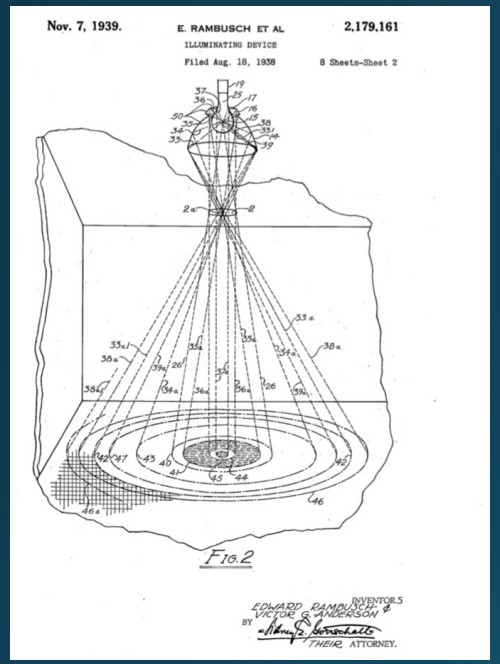
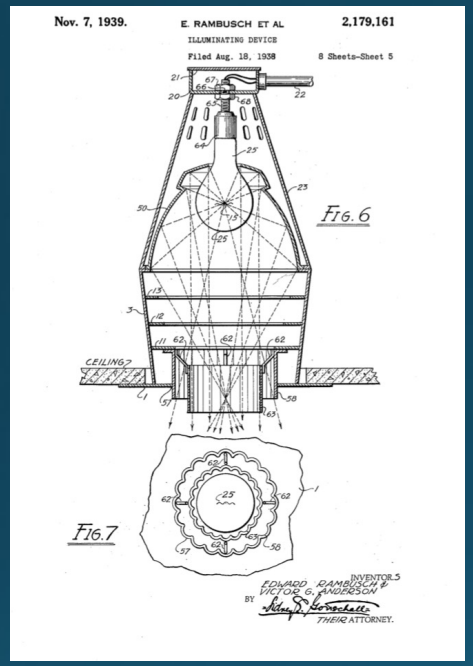

# Turning Downlights on their Heads:
## A Semi-Revolutionary Concept for Recessed Lighting

Wilson Dau, LC, MIES, LEED AP

# A Little Bit of History …


Nov. 7, 1939. E. RAMBUSCH ET AL 2,179,161
ILLUMINATING DEVICE
Filed Aug. 18, 1938 8 Sheets-Sheet 2
FIG. 2
EDWARD RAMBUSCH & VICTOR G. ANDERSON INVENTORS BY THEIR ATTORNEY.


Nov. 7, 1939. E. RAMBUSCH ET AL 2,179,161
ILLUMINATING DEVICE
Filed Aug. 18, 1938 8 Sheets-Sheet 5
FIG. 6
FIG. 7
EDWARD RAMBUSCH & VICTOR G. ANDERSON INVENTORS BY THEIR ATTORNEY.

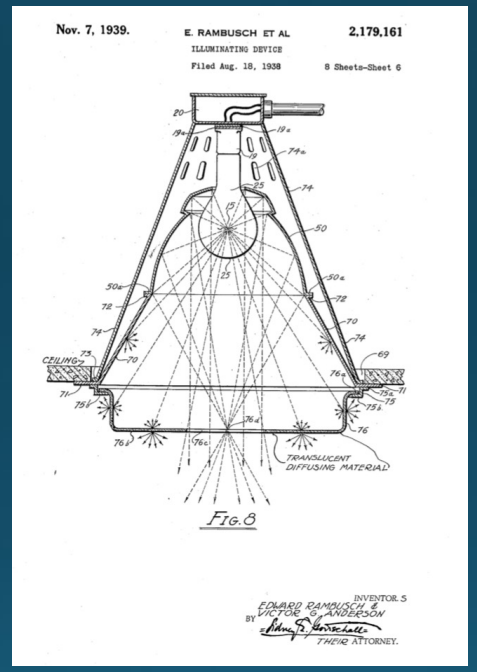

Nov. 7, 1939. E. RAMBUSCH ET AL 2,179,161
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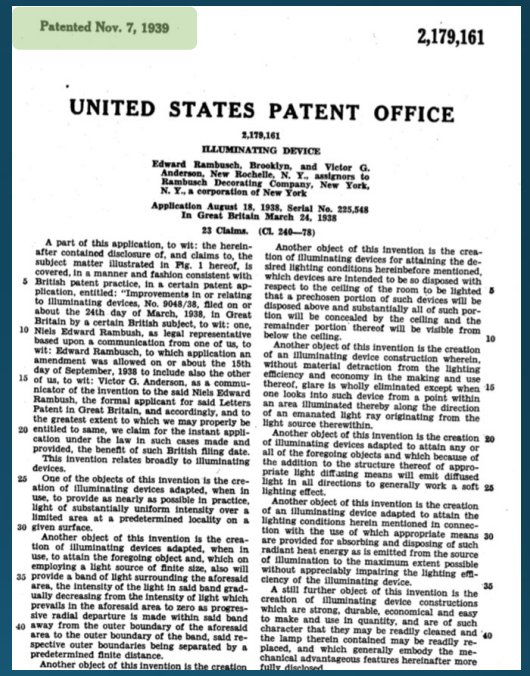
FIG. 8
EDWARD RAMBUSCH & VICTOR G. ANDERSON INVENTORS BY THEIR ATTORNEY.


Patented Nov. 7, 1939 2,179,161

UNITED STATES PATENT OFFICE

2,179,161

ILLUMINATING DEVICE

Edward Rambusch, Brooklyn, and Victor G. Anderson, New Rochelle, N. Y., assignors to Rambusch Decorating Company, New York, N. Y., a corporation of New York

Application August 18, 1938, Serial No. 225,548
In Great Britain March 24, 1938

23 Claims. (Cl. 240—78)

A part of this application, to wit: the hereinafter contained disclosure of, and claims to, the subject matter illustrated in Fig. 1 hereof, is covered, in a manner and fashion consistent with British patent practice, in a certain patent application, entitled: "Improvements in or relating to illuminating devices, No. 9048/38, filed on or about the 24th day of March, 1938, in Great Britain by a certain British subject, to wit: one, Niels Edward Rambusch, as legal representative based upon a communication from one of us, to wit: Edward Rambusch, to which application an amendment was allowed on or about the 15th day of September, 1938 to include also the other of us, to wit: Victor G. Anderson, as a communicator of the invention to the said Niels Edward Rambusch, the formal applicant for said Letters Patent in Great Britain, and accordingly, and to the greatest extent to which we may properly be entitled to same, we claim for the instant application under the law in such cases made and provided, the benefit of such British filing date.

This invention relates broadly to illuminating devices.

One of the objects of this invention is the creation of illuminating devices adapted, when in use, to provide as nearly as possible in practice, light of substantially uniform intensity over a limited area at a predetermined locality on a given surface.

Another object of this invention is the creation of illuminating devices adapted, when in use, to attain the foregoing object and, which on employing a light source of finite size, also will provide a band of light surrounding the aforesaid area, the intensity of the light in said band gradually decreasing from the intensity of light which prevails in the aforesaid area to zero as progressive radial departure is made within said band away from the outer boundary of the aforesaid area to the outer boundary of the band, said respective outer boundaries being separated by a predetermined finite distance.

Another object of this invention is the creation of illuminating devices for attaining the desired lighting conditions hereinbefore mentioned, which devices are intended to be so disposed with respect to the ceiling of the room to be lighted that a prechosen portion of such devices will be disposed above and substantially all of such portion will be concealed by the ceiling and the remainder portion thereof will be visible from below the ceiling.

Another object of this invention is the creation of an illuminating device construction wherein, without material detraction from the lighting efficiency and economy in the making and use thereof, glare is wholly eliminated except when one looks into such device from a point within an area illuminated thereby along the direction of an emanated light ray originating from the light source therewithin.

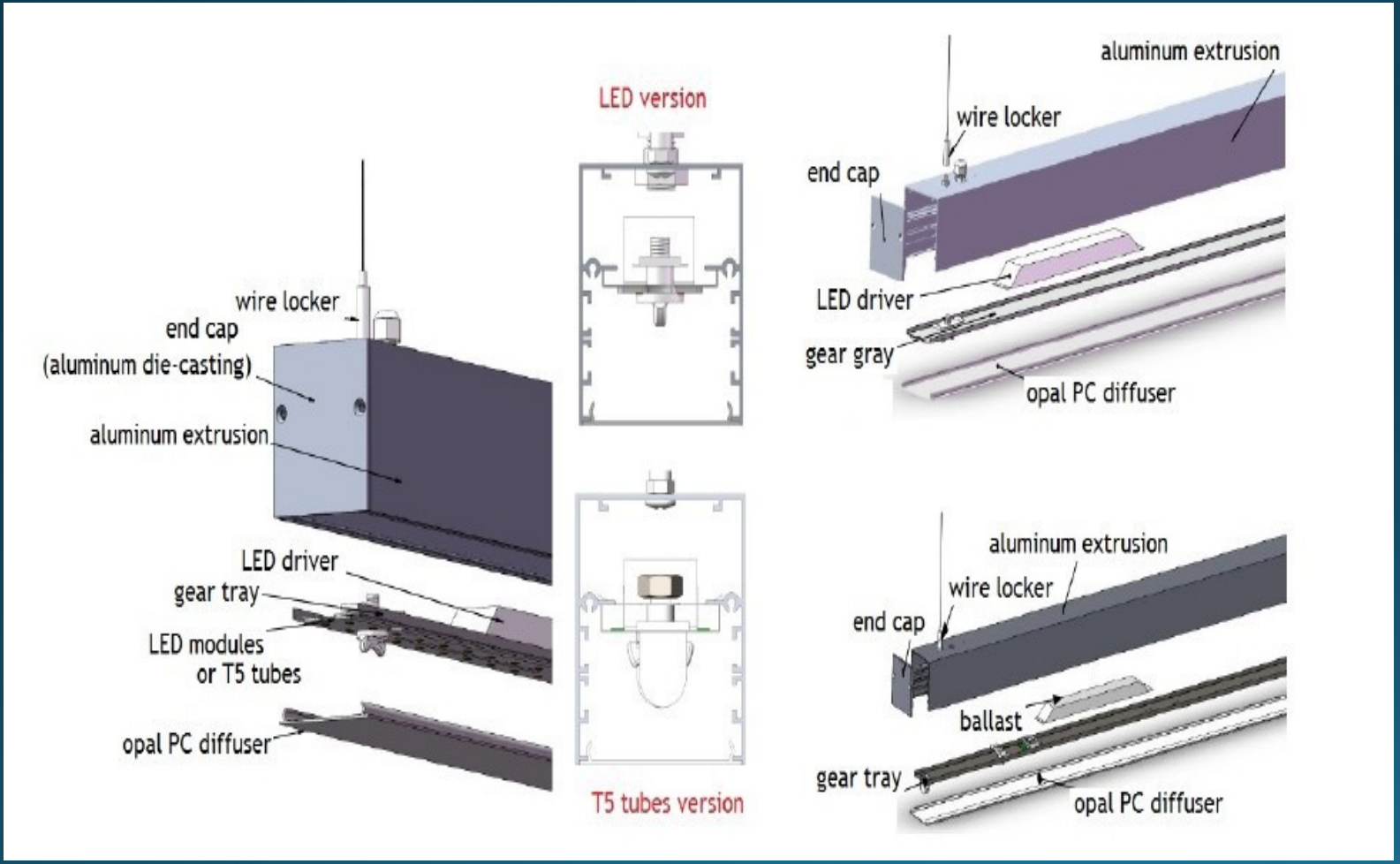
Another object of this invention is the creation of illuminating devices adapted to attain any or all of the foregoing objects and which because of the addition to the structure thereof of appropriate light diffusing means will emit diffused light in all directions to generally work a soft lighting effect.

Another object of this invention is the creation of an illuminating device adapted to attain the lighting conditions herein mentioned in connection with the use of which appropriate means are provided for absorbing and disposing of such radiant heat energy as is emitted from the source of illumination to the maximum extent possible without appreciably impairing the lighting efficiency of the illuminating device.

A still further object of this invention is the creation of illuminating device constructions which are strong, durable, economical and easy to make and use in quantity, and are of such character that they may be readily cleaned and the lamp therein contained may be readily replaced, and which generally embody the mechanical advantageous features hereinafter more fully disclosed

About 80 years of recessed downlights…

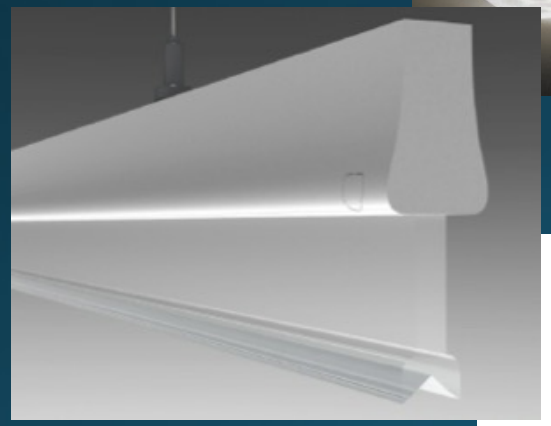
# The Evolution of Light Fixtures

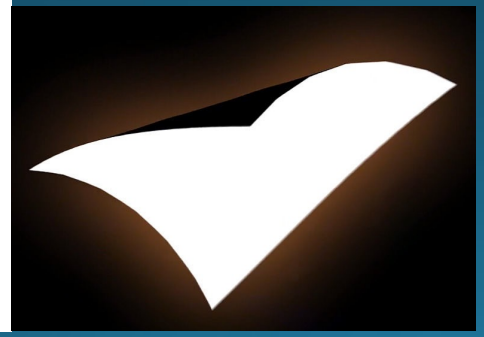


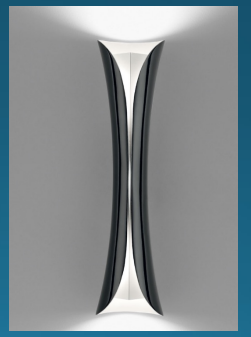

... more of the same ...

# The Evolution of Light Fixtures

…to really cool and creative stuff…







# The Evolution of Light Fixtures

# The Evolution of Light Fixtures

… things that should get people fired!

How do we move from **More of the same** to ***Beyond Cool and Creative*** ?

How about ***Cool and Creative… and we solve Glare?***

# Understanding Glare

Glare is usually categorized in 2 groups:

- Disability Glare – 'Headlamps – oncoming traffic'
- Discomfort Glare – 'A sensation of annoyance or pain caused by high luminances in the field of view'
  - Luminance of the glare source
  - Position of the source in the field of view
  - Luminance of the background

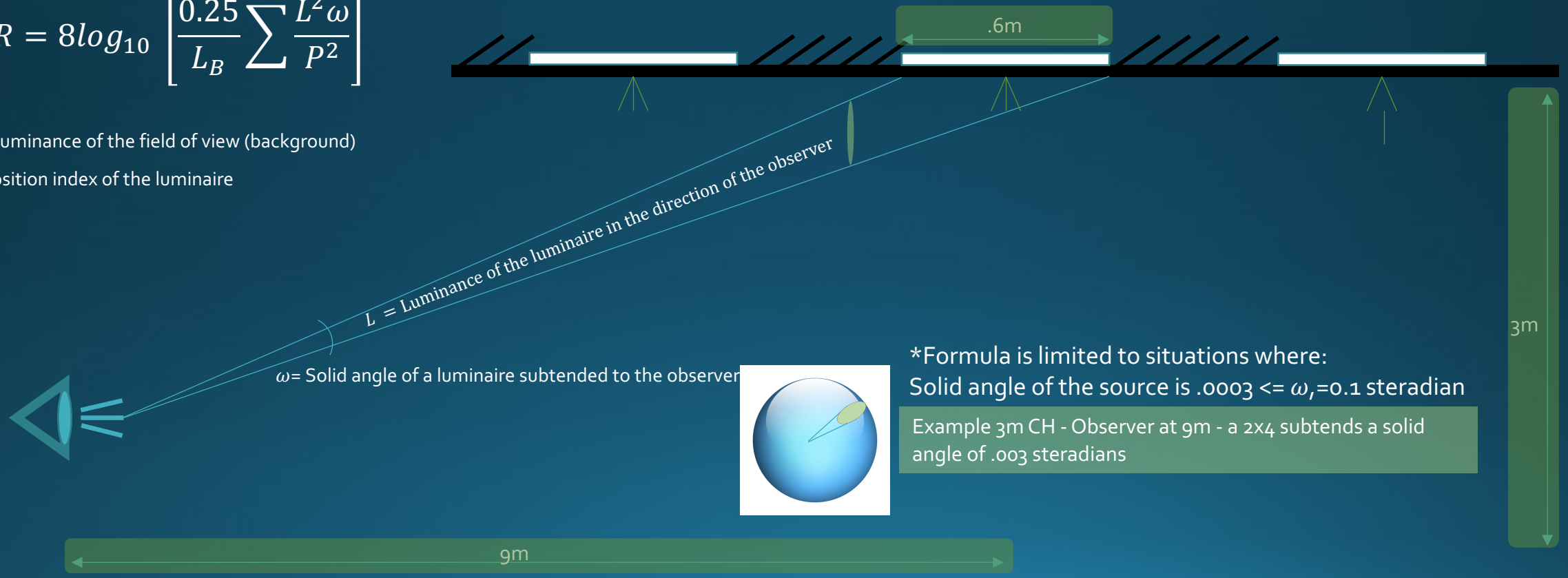
# Unified Glare Rating

## CIE Publication 117-1995

$$UGR = 8log_{10}\left[\frac{0.25}{L_B}\sum\frac{L^2\omega}{P^2}\right]$$

$L_B$= Luminance of the field of view (background)

$P$= Position index of the luminaire

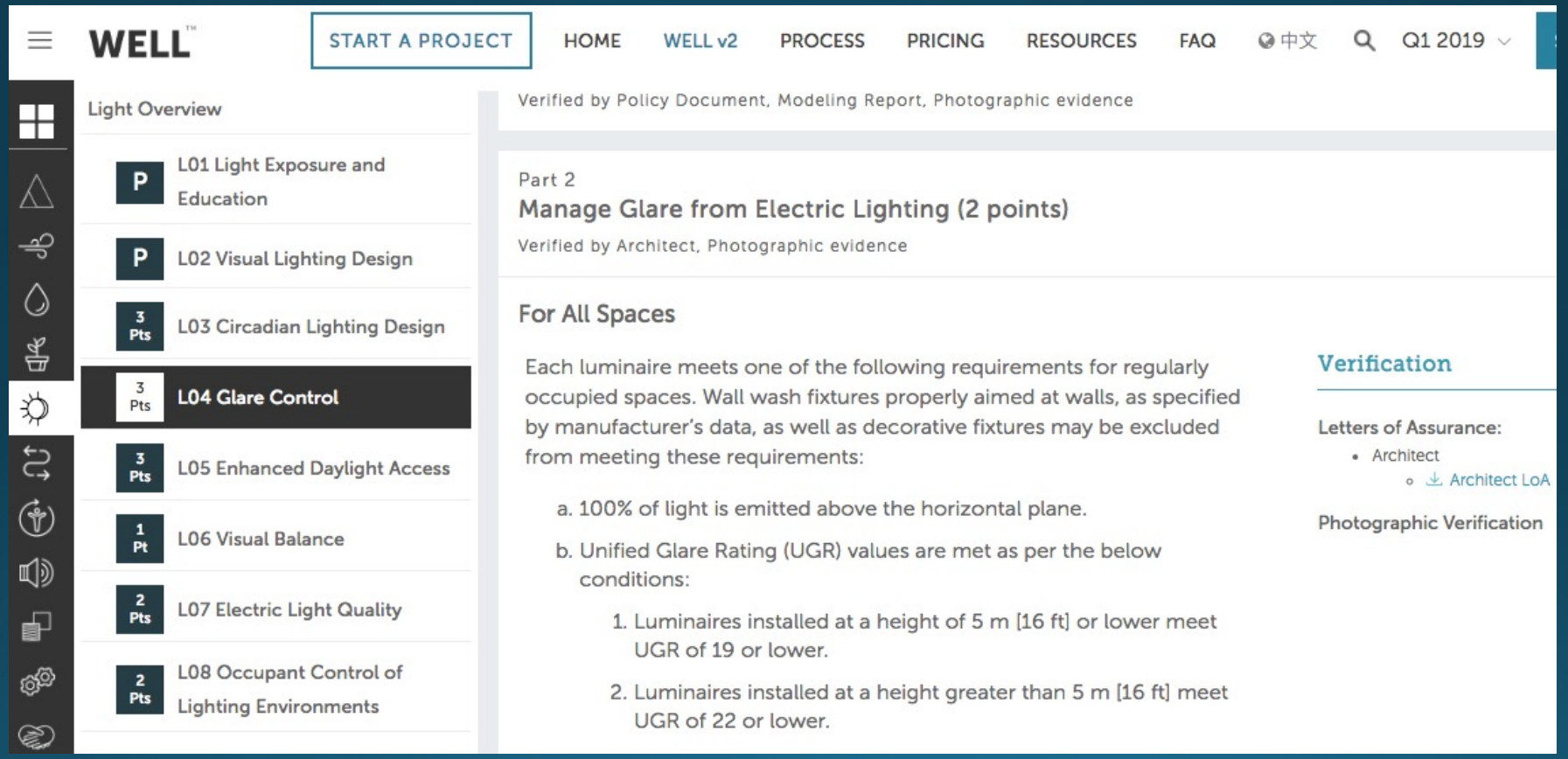




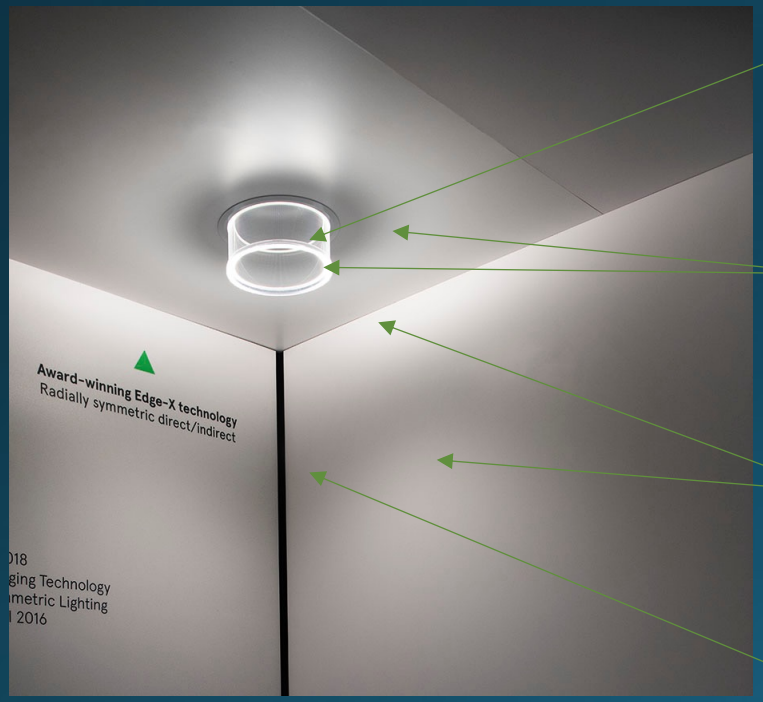

*Formula is limited to situations where:
Solid angle of the source is .0003 <= $\omega$,=0.1 steradian

Example 3m CH - Observer at 9m - a 2x4 subtends a solid angle of .003 steradians

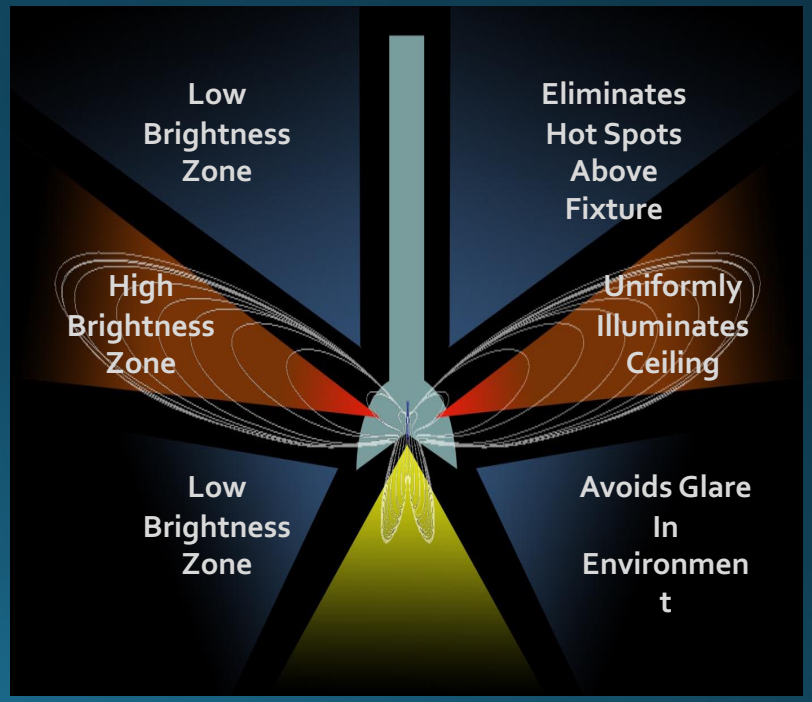
# Why Does UGR Matter



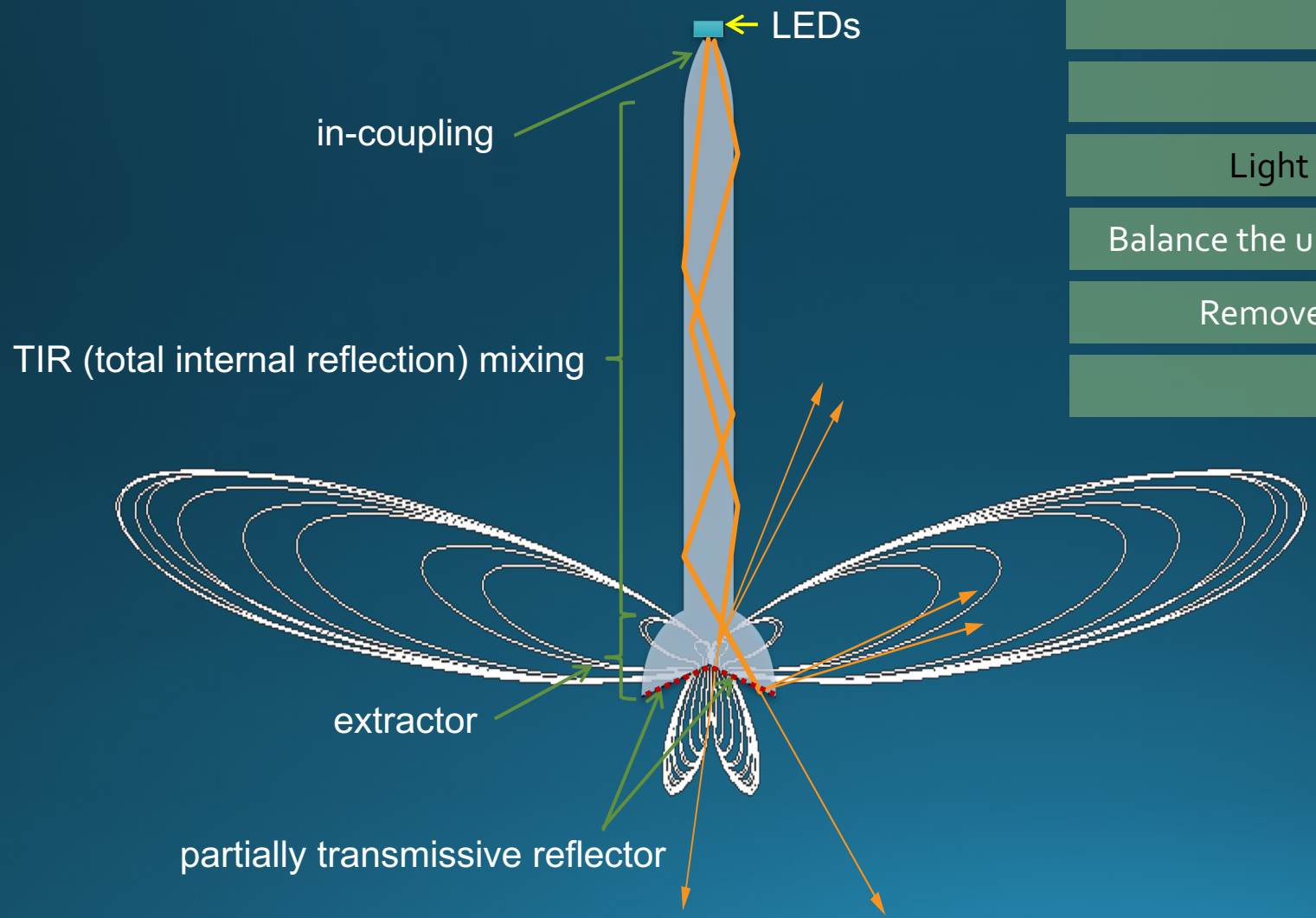
# How to Decrease Glare and Improve UGR Values




- Introduce Advanced Optical Control
- Decrease contrast between luminaire and adjacent area
- Balance the up-light and down-light components
- Remove luminance from offending angles

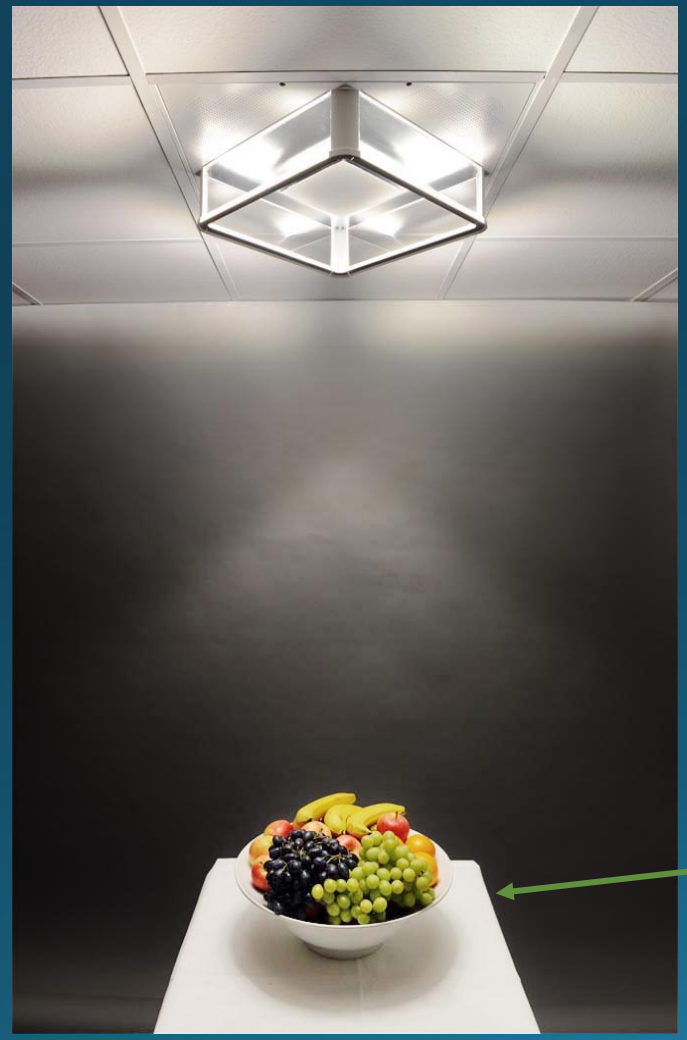


# How Does This Advanced Optical Control Work?




- Optical Efficiency > 90%
- Light is well mixed
- Light is distributed optimally in the space
- Balance the up-light and down-light components
- Remove Luminance from Offending angles
- Decrease Contrast

# Control of Light Means Control of Glare



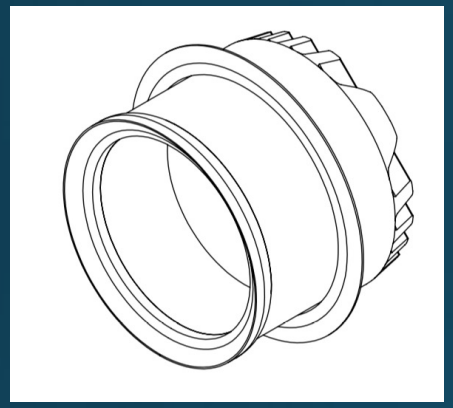
A portion of the light is directed towards the ceiling, then reflected to provide diffuse ambient light

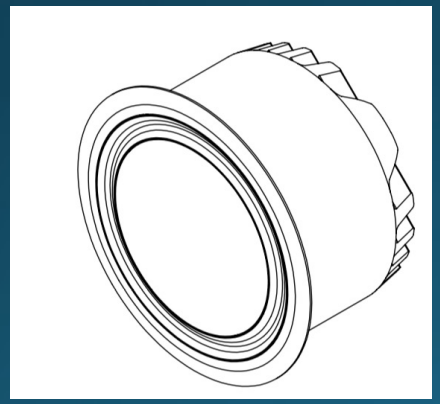
The glare zone is avoided.
No light is transmitted in this zone

Optimal balance of light is transmitted downwards to work surface

# Control of Light Means Control of Glare

… Evolution





A portion of the light is directed towards the ceiling, then reflected to provide diffuse ambient light

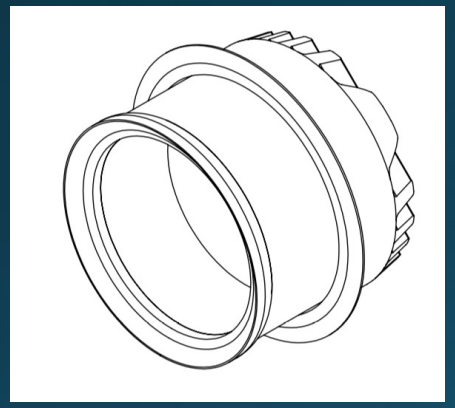
The glare zone is avoided.
No light is transmitted in this zone

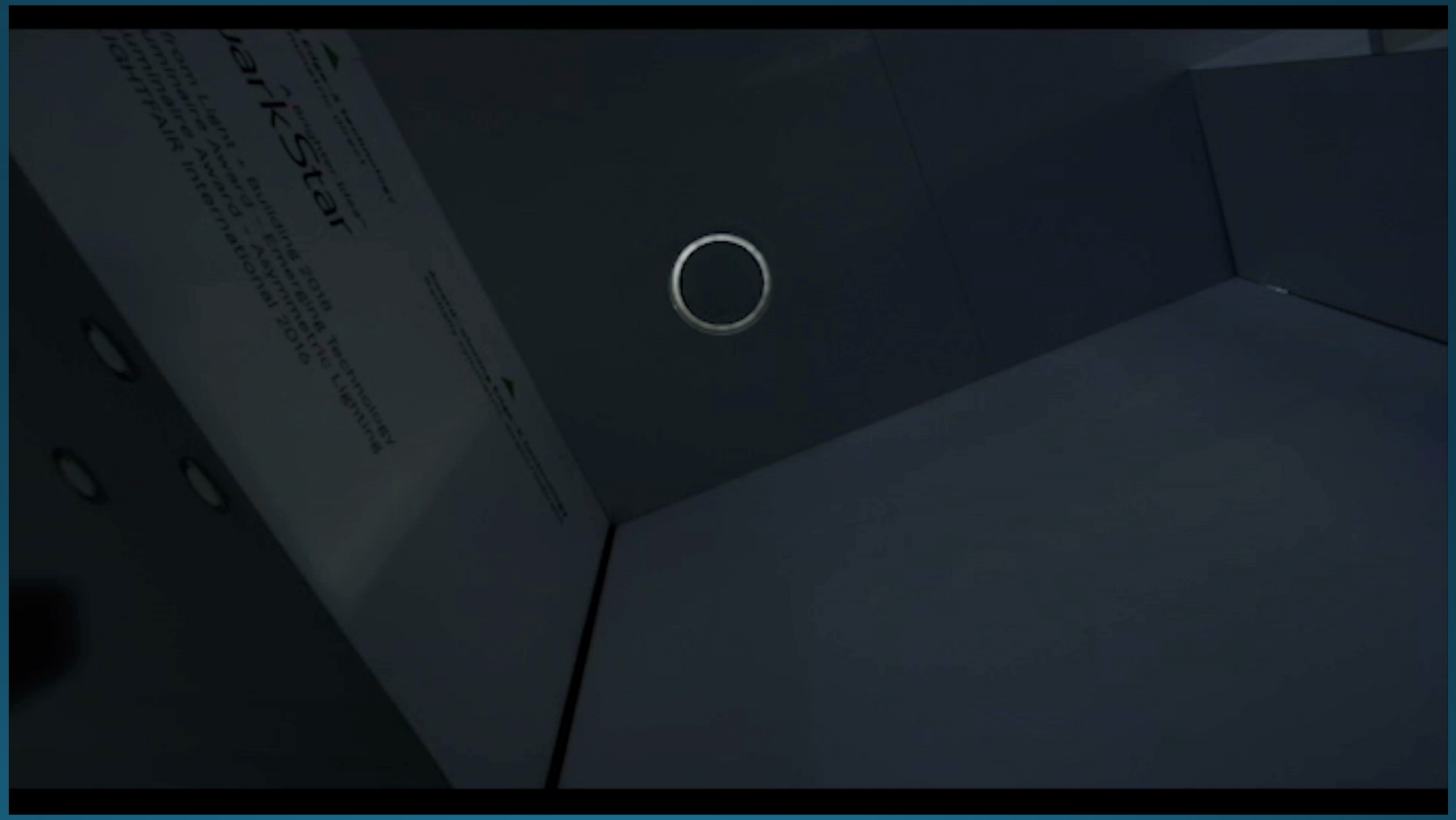
Optimal balance of light is transmitted downwards to work surface

**Turning Downlights on their Heads**

# Control of Light Means Control of Glare

… Evolution

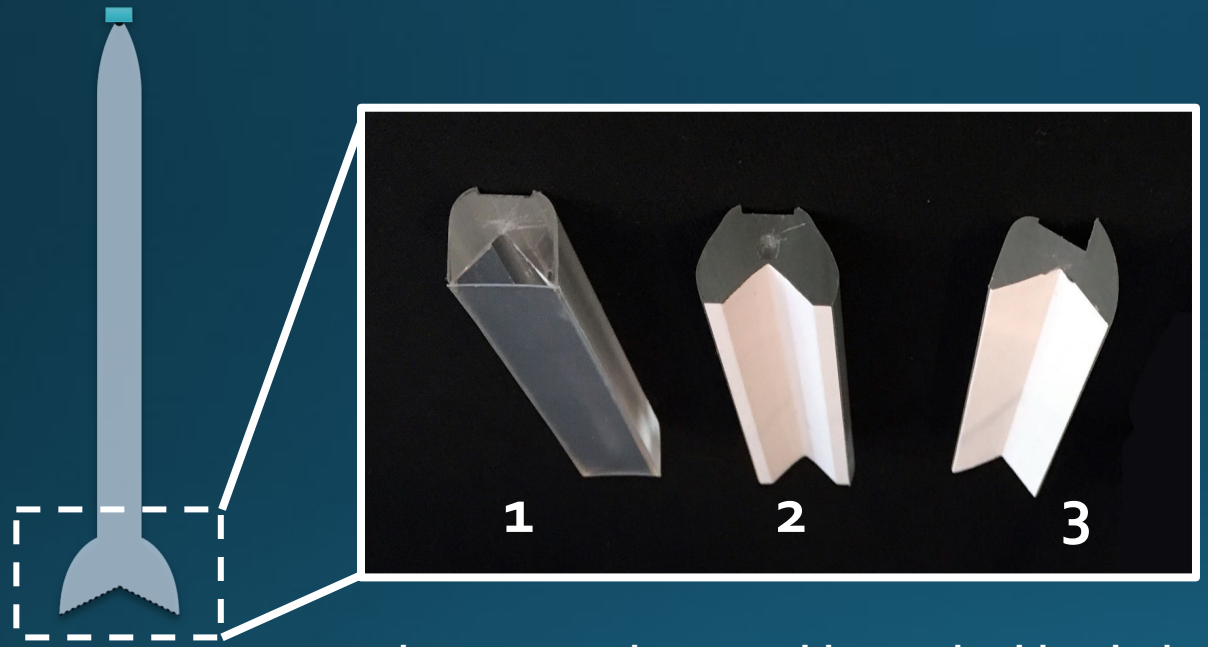




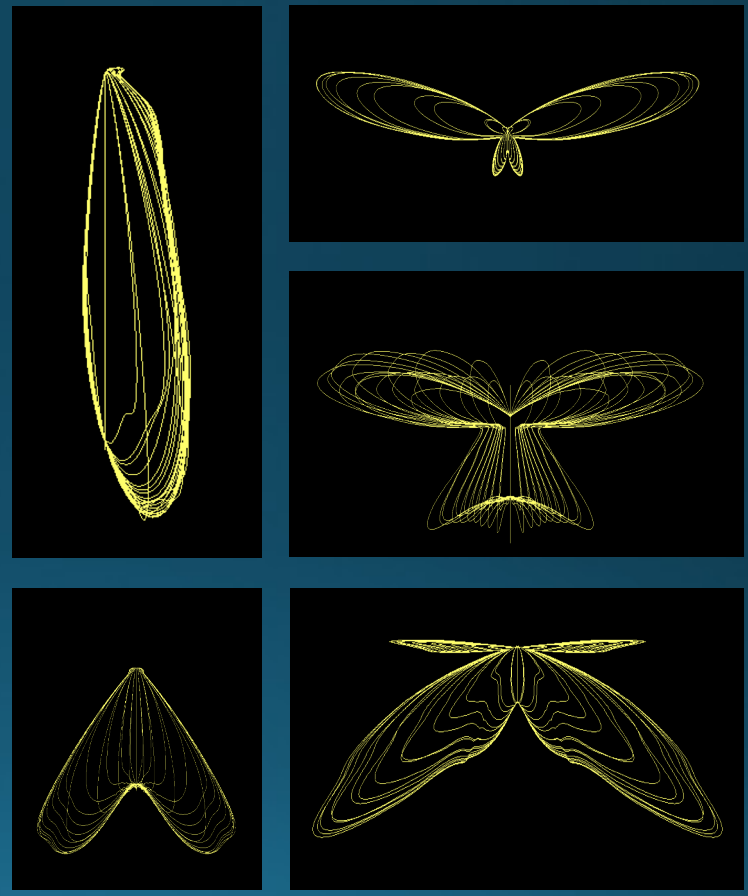
Click on image above to play video

**Turning Downlights on their Heads**

# The Extractor Determines the Application




The LEDs and waveguide can be identical between applications – *only the extractor needs to change in order to create a whole new light distribution.*



# What Else Can Advanced Optical Control Do?

9” offset from wall
This means there is no glare, as the casual observer will never be standing close enough to experience any discomfort from the light source

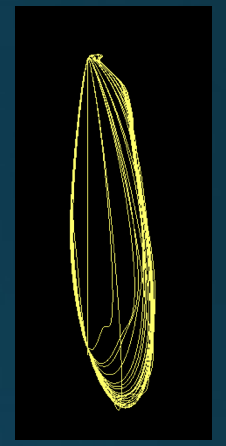
With a better than 3-to-1 uniformity even when set just 200mm away from the wall


120mm height, 75mm width
The luminaire takes up a fraction of the space compared to conventional LED wall washers, and can be chained into infinite runs

25mm Aperture
The light source can virtually disappear into the architecture while still delivering powerful and beautifully distributed light

Perfectly diffuse, no harsh shadows
Even suspended just 10mm to 4mm away from the wall, the leaves are virtually shadow-less

Powerful to the end
Even the lowest leaves are beautifully and brilliantly illuminated, with no shift in color



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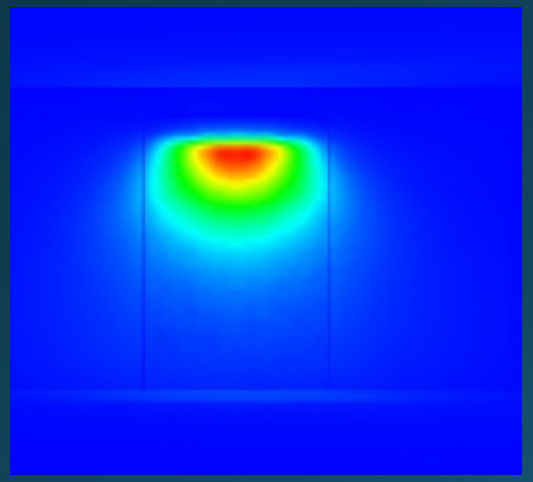
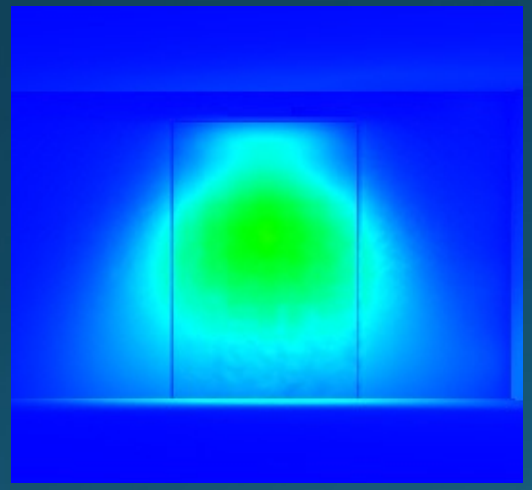
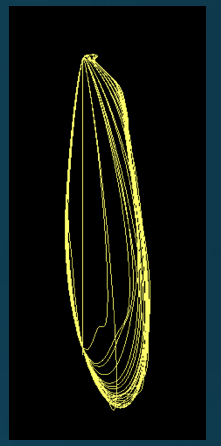


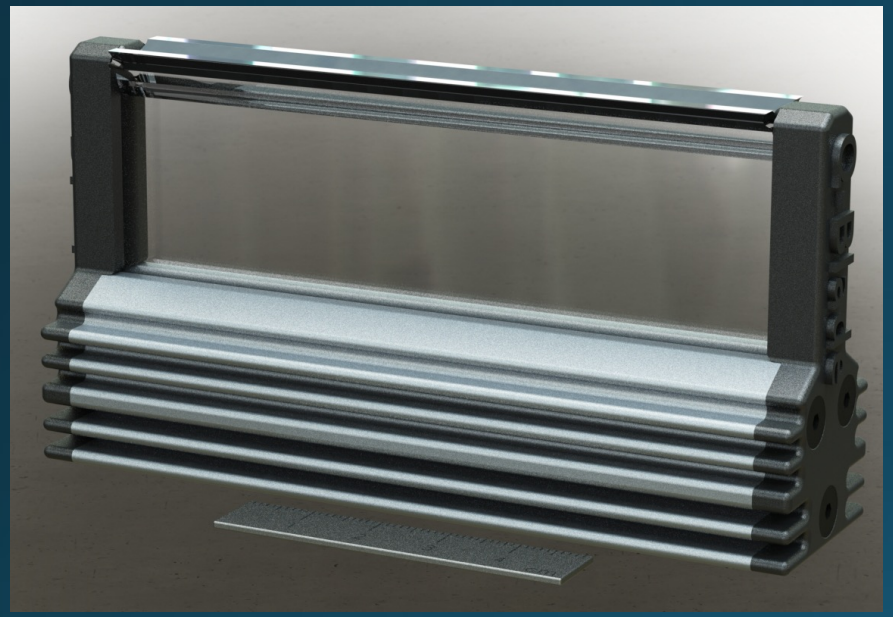
Standard SSL Wall Washer



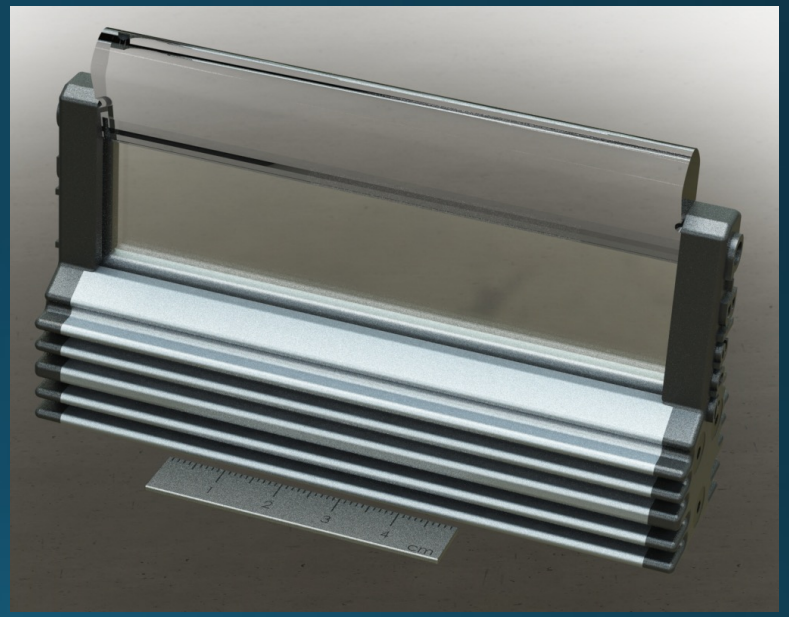
Edge-X Wall Washer

# Scalability



- Down to 3mm thickness
- Significant cost savings in manufacturing
- Capable of 2 to 3 klm/ft
- With smaller LEDs, it can get even smaller
- A new generation of micro-luminaires
- A fully controllable fixture, delivering 800 lm, with advanced optics in a package that is 100mm x 20mm x 35 mm

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