

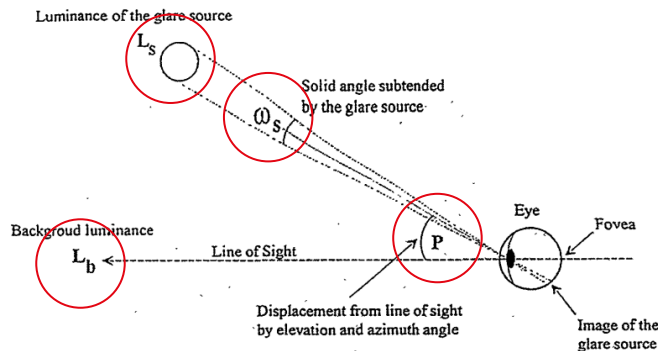
The background image shows a lecture hall with a dark ceiling featuring several large, brightly colored circular lights in shades of cyan, magenta, yellow, and green. Rows of desks and chairs are visible in the foreground, and the overall scene is dimly lit, emphasizing the colorful lights.

Dealing with Lens Flare in Captured HDR Images with Electric Light Sources for Glare Metric Calculations Using Evalglare

**Beatrice Yuen
(Presenter)
with
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28 August 2025

- "Condition of vision in which there is discomfort or a reduction in the ability to see details or objects, caused by an unsuitable distribution or range of luminance, or by extreme luminance contrasts" (CIE, 2011)
- Unified Glare Rating (UGR): predicting discomfort glare with electric light condition (CIE, 1995)
- Four main parameters:



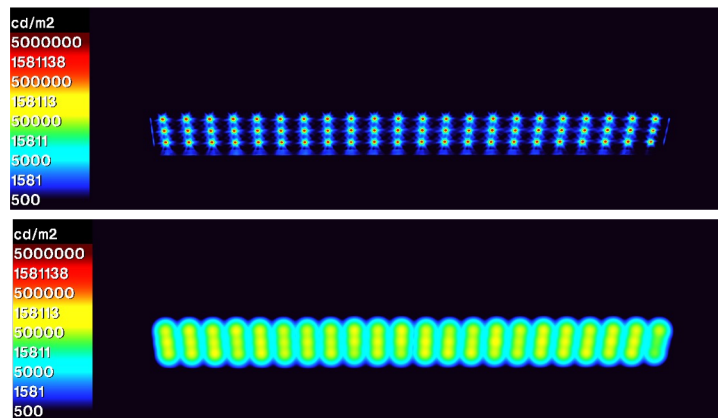
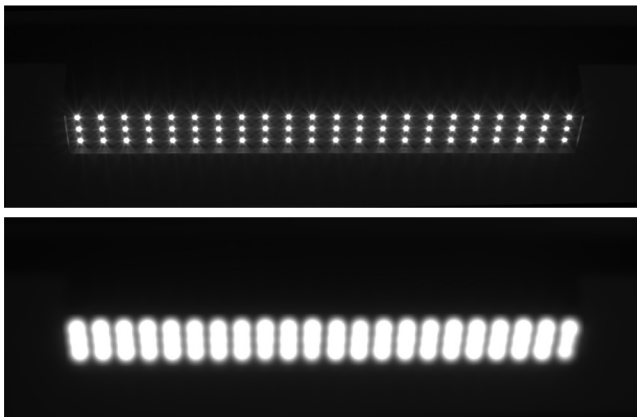
$$UGR' = 8 \log \left(\frac{0,25}{L_b} \sum_{i=1}^n k^2 \frac{L_{s,i}^2 \omega_{s,i}}{P_i^2} \right)$$

- L_s : Luminance of the glare source (cd/m^2)
- ω_s : Solid angle of the glare source (steradians)
- L_b : Background luminance (cd/m^2): Adaptation level
- P : Position Index

Glare Evaluation with HDR Imaging

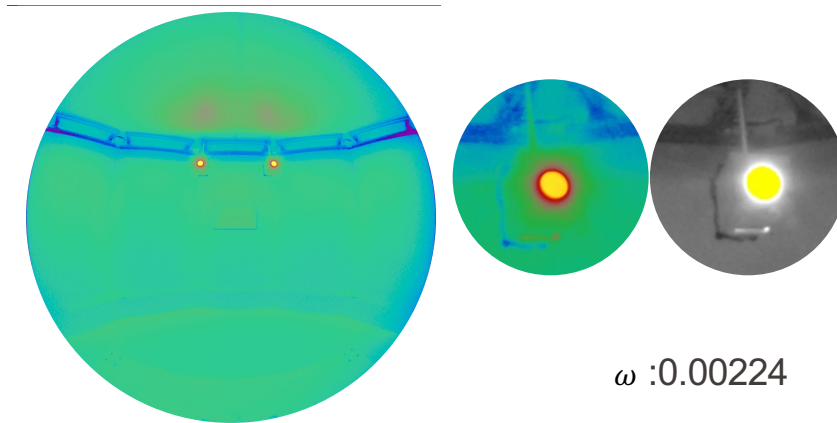
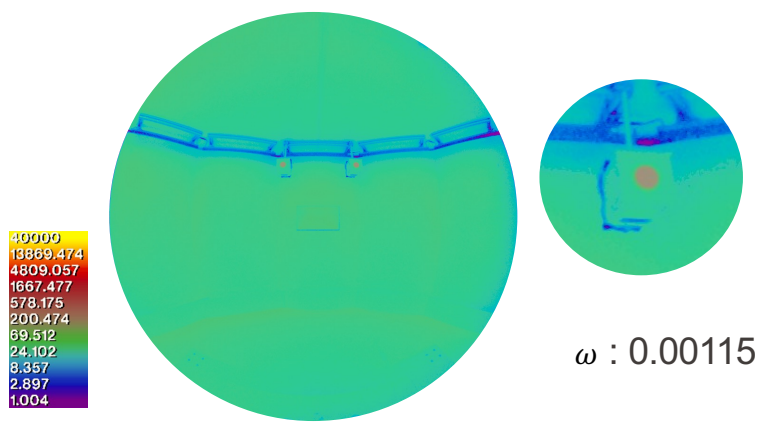
- UGR was developed without the HDR imaging
- Luminance threshold value of 500 cd/m^2 is recommended for HDR-based glare evaluation for electric light (CIE 232:2019)
 - Command

```
evalglare -c output.hdr -b 500 -r 0.1 -x -f -d input.hdr
```
- Non-uniform light source: Uniformity correction parameter K : Filter image to correct for eye resolution (Gaussian with 12mm FWHM at luminaire) (CIE 232:2019)

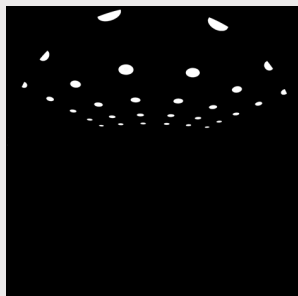


Glare Evaluation with HDR Imaging

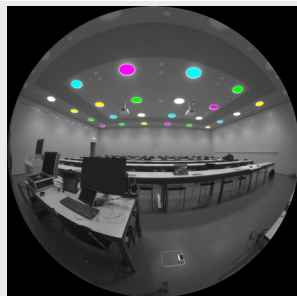
- HDR imaging with fisheye lenses is the presence of lens flare
 - overestimated solid angle
 - underestimated the average luminance of the light source



`evalglare -c zd14L_eg.hdr -b 500 -x -r 0.02 -d zd14L.hdr`



- Create a mask file
- Check the solid angle of each luminaire
 - Command
`evalglare -b 150 -x -r 0.1 -d input.hdr > output.txt`


 $\omega^{(masked)}$


- 500 as threshold
 - Command
`evalglare -c output.hdr -b 500 -r 0.1 -x -f -d input.hdr`


 $L_S^{(threshold)}$

 $\omega^{(threshold)}$


$$L_S^{(masked)} \times \omega^{(masked)} = L_S^{(threshold)} \times \omega^{(threshold)}$$

Glare in Realistic Workplace Environments: A Comparative Analysis of UGR Values

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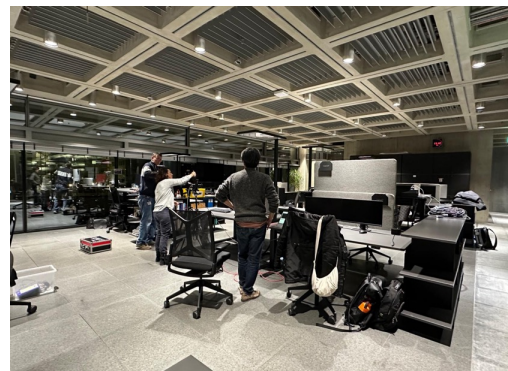
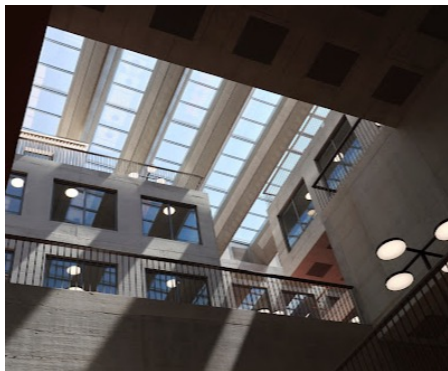
³ Chair of Architecture and Building Systems, ETH Zürich, Switzerland

- Compare the UGR evaluation methods
 - Lighting simulation software : Relux
 - HDR images : evalglare in Radiance
 - L_S (500 or 750 or 1000 or 1250)
 - L_S (masked)

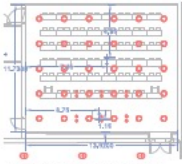
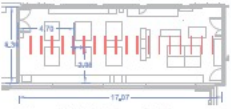
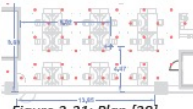
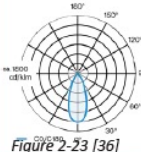
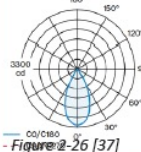
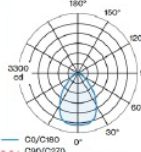


Case study

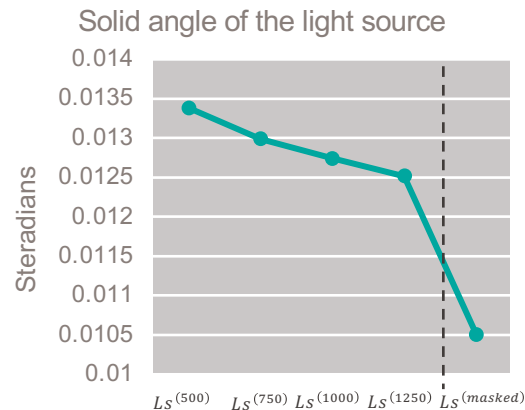
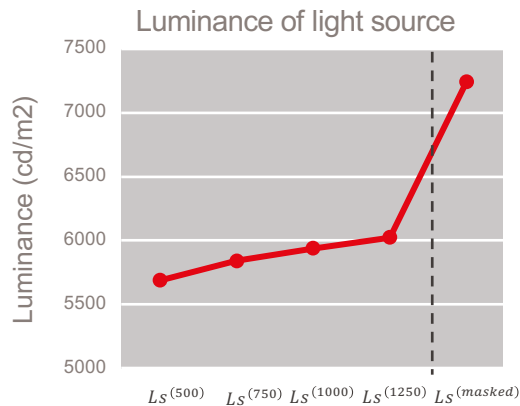
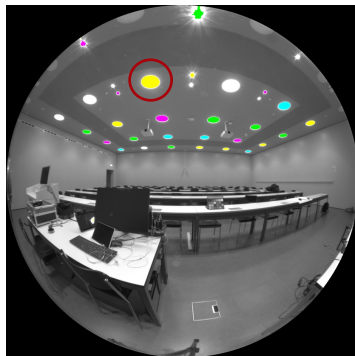
- Two field studies
 - A University in Winterthur
 - An office building in Zurich



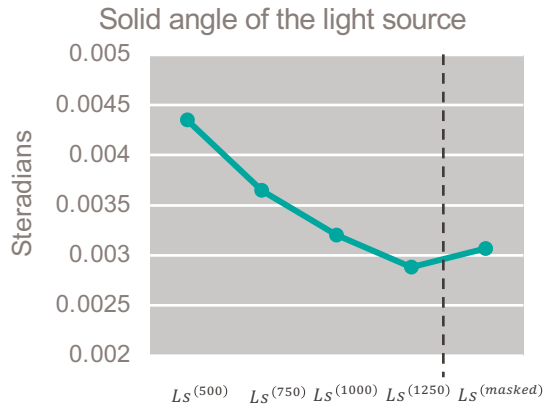
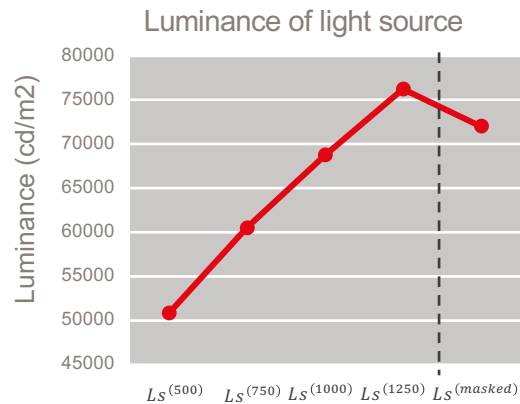
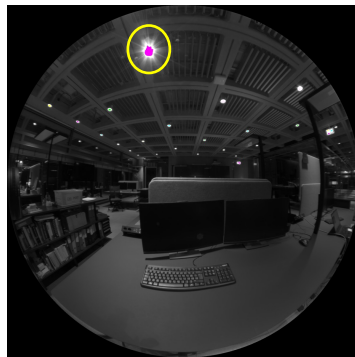
- Four rooms
- Six view positions or light scenes
- Different type of luminaire

Ceiling plan	Product image and description	Luminaire specifications	Light distribution
Room 1  Figure 2-13: Plan [22]	 Figure 2-14: Regent, Solo Skim Office [23] Round recessed luminaire with microprismatic cover	Size: Ø514 mm UGR: 18.8 Wattage: 31W Lumen output: 4000lm Colour temperature: 4000K	 Figure 2-15 [33]
	 Figure 2-16: Regent, Tekla LED [24] Round recessed downlight with brushed aluminum housing and wide beam angle 36°.	Size: Ø152 mm UGR C0: 14.6 UGR C90: 14.7 Wattage: 11W Lumen output: 1100lm Colour temperature: 4000K	 Figure 2-17 [34]
Room 2  Figure 2-18: Plan [26]	 Figure 2-19: Regent, Channel [27] Surface mounted linear luminaire with microprismatic cover	Size: Lx90x(H)100mm UGR: <19 Wattage: 16W/m Lumen output: 1830lm/m Colour temperature: 4000K	 Figure 2-20 [35]
Room 3  Figure 2-21: Plan [28]	 Figure 2-22: XAL, Sasso Top Maxi [29] Surface mounted round downlight with flood beam angle of 41°.	Size: Ø100mmx(H)300mm UGR: N/A Wattage: 36.4W Lumen output: 2889lm Colour temperature: 3500K	 Figure 2-23 [36]
Room 4  Figure 2-24: Plan [30]	 Figure 2-25: XAL, Unico L4 [31] Surface mounted downlight with flood round beam angle 49°.	Size: x89x(H)28mm UGR: <19 Wattage: 20W Lumen output: 1960lm Colour temperature: 4000K	 Figure 2-26 [37]
	 Figure 2-27: XAL, LENO [32] Suspended linear luminaire with microprismatic cover and diffuse filter	Size: Lx89x(H)28mm UGR: <19 Wattage: 16W/m Lumen output: 2010lm/m Colour temperature: 4000K	 Figure 2-28 [38]

Room 1

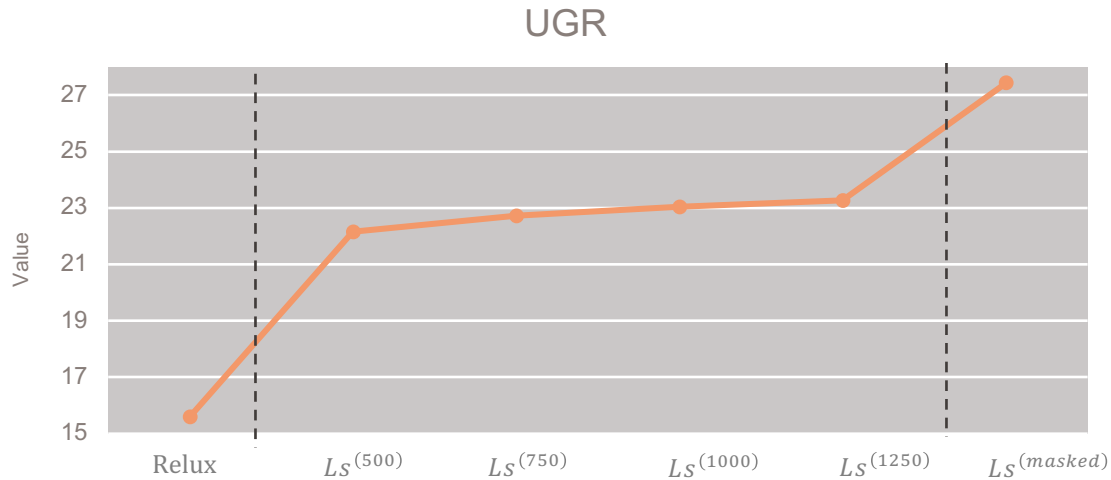


Room 3

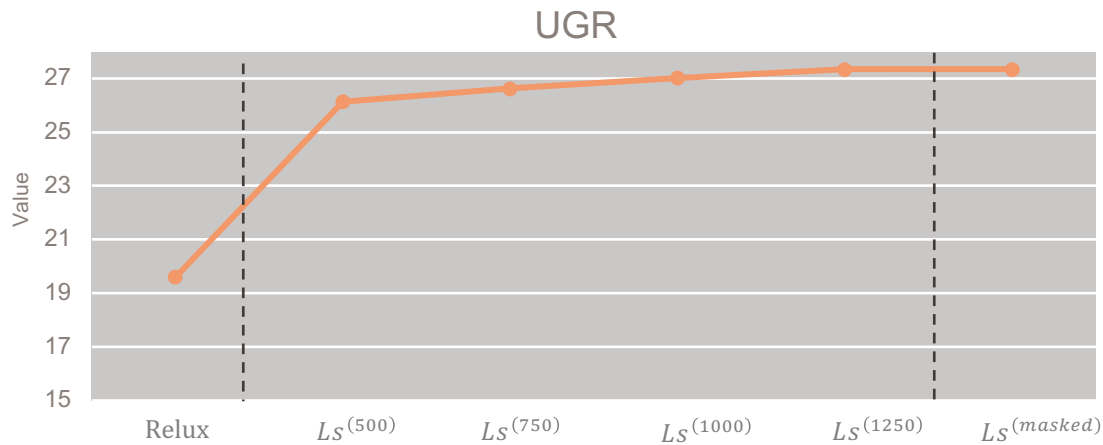


Result

Room 1



Room 3



- No user assessment
- No uniformity correction (K) applied
- Restricted scenarios
- Default reflectance assumptions

Summary

- What is a glare source?
- Which part of the area counts as a glare source?
- Apply HDR imaging in presence of electric light conditions



Thank you for your attention!

