EDCF Update

Understanding
Laser Illuminated Projector
Safety Regulations with focus on Cinema

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* With thanks to Pete Ludé and Bill Beck

What is LIPA?

Laser Illuminated Projector Association

Global Trade Association

- LIPA members produce and sell more than 75% of all main-stream and high-end laser-illuminated projectors globally[1]

Founded in 2011 as single industry voice to

- Promote adoption and reduce regulatory hurdles to LIP expansion
- Rationalize & harmonize various laser regulations with IEC Standards
- Negotiate regulatory matters with agencies such as FDA and other national norms
- Provide a forum to develop evaluation methods and provide guidance to standards bodies
- Educate constituencies and coordinate best practices

1. PMA 2020CYQ1 Worldwide PJ Census Revenues

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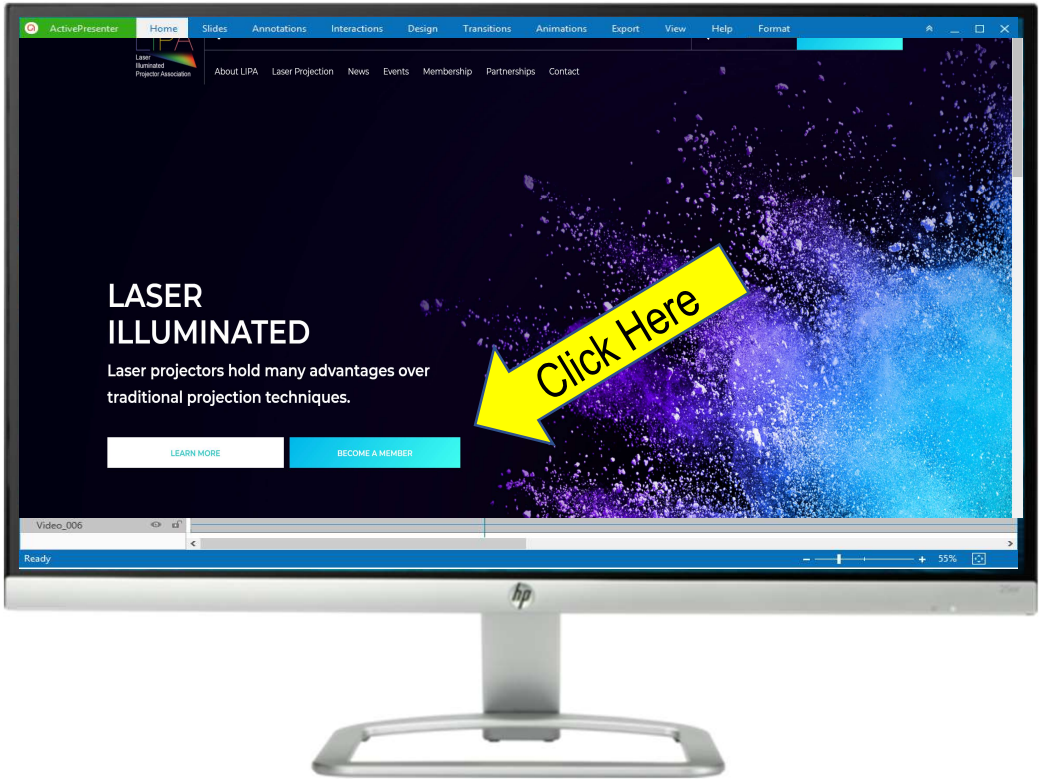


Agenda

- The Scientific and Regulatory Section
- The Practical Section
- Summary

Disclaimer

- This presentation focuses on regulations in the EU region and all other regions that follow the international IEC regulations (e.g. Latin America, APAC, China etc).
- Specific USA-based FDA regulations are not covered here. Please refer to LIPA's Webinar from 2019 for more info on the US regulatory landscape.
- https://www.lipainfo.org/lipa-webinars/

The Scientific and Regulatory Section

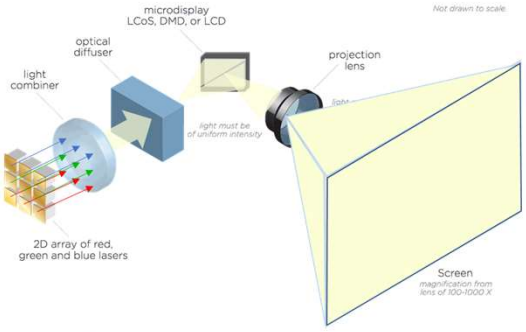
Understanding brightness, radiance and optical hazard
Understanding regulations

Why “Laser Illuminated”?

LIPA
Laser
Illuminated
Projector Association

A “Laser Projector”

A “Laser Illuminated Projector”



Three scientific things to remember

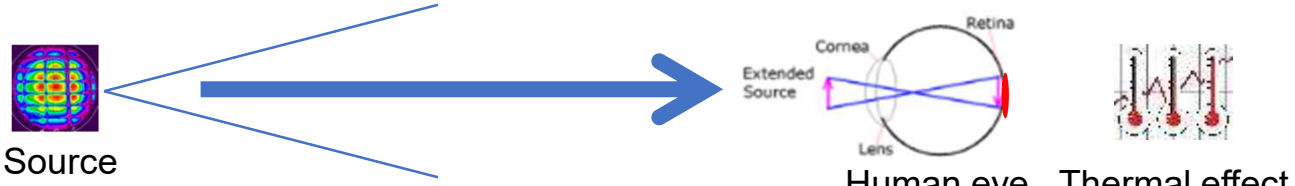
1. Watts, not lumens
   - Optical hazard relates to emitted optical power (Watts), not human brightness sensitivity (Lumens)

2. Most important parameters:
   - Lens Exit Pupil, its radiance, size and filling (power distribution across the pupil)

3. The **eye injury** mechanism is identical for laser or lamp illuminated projectors
   - All things being equal, like radiance, exit pupil etc.

LIPS and Lamp-based projectors have the same potential hazard mechanism

- The **eye injury** mechanism:
  - **Imaging** the **exit pupil** to the **retina**
  - **Retinal image → Thermal** induced retinal injury if the blink reflex is not sufficient:
    - 0.25s **accidental exposure (blink reflex time)**
    - through 7mm eye pupil (adapted to dark cinema conditions)
- Hazard is identical for laser or lamp illuminated projectors
  - For same exit pupil size/filling and same radiance



Source
L [W/m²/sr]

Human eye

Thermal effect
[W/m²]

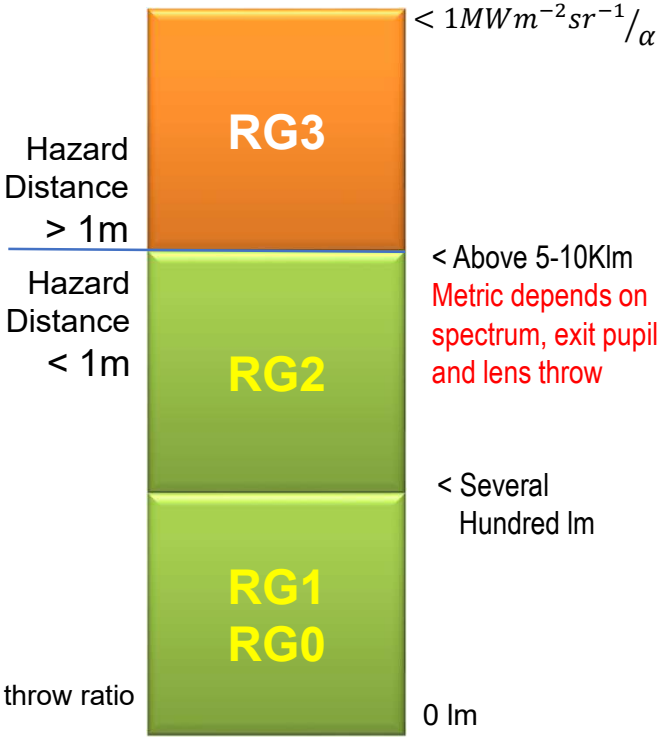
IEC Laser Regulations

IEC **60825-1** Ed **3** (2014)
Safety of Laser Products
Part 1: Equipment classification & Requirements

IEC **62471-5** Ed 1 (2015)
Photobiological safety of Lamp Systems
for Image Projectors

Carve-out for projectors with radiance < $\frac{1\ \text{MW} / \text{m}^2\text{sr}}{\alpha}$

Risk Group (RG) Classifications



RG 3 – **Potentially hazardous** at close distance

Professional Use Projectors

IEC 62471-5:2015 requires:

- Sold only to professionals. Warning labels
- No access to beam within hazard distance
- Use & installation requirements, Soft start

RG 2 - Safe based on aversion response *(blink reflex)*

Home/office use projectors

IEC 62471-5:2015 requires:

- Caution labels, Soft start, User information and instruction

RG 0/1 - Inherently Safe

Pico Projectors

IEC 62471-5:2015 requires:

- User information

How about Lamp Illuminated Projectors and laser retrofits/upgrades?

- A lamp projector **upgraded** to a **RG3 LIP** falls under the same regulation; compliance with the same rules as for LIPs is required

- Any **new** lamp projector brought on the market needs to be evaluated under this standard, be measured and have a Risk Group determined.

- Regulation about lamp projectors might change, stay tuned with LIPA for more news

The Practical Section

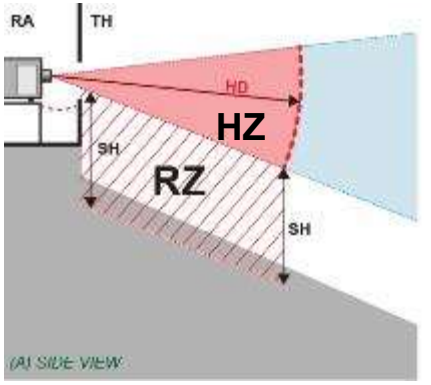
Hazard Distance and Risk Group depend on lens throw

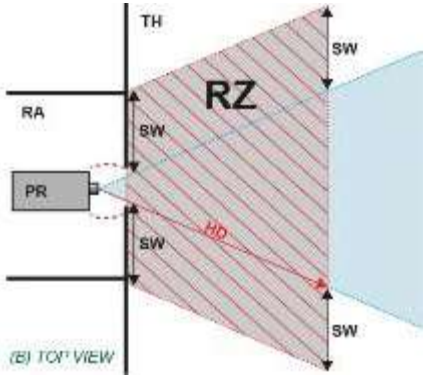
- **Hazard Distance**: The distance in front of the lens where the optical hazard is still **greater than the Emission Limits for RG2.**

- **Longer Throw Ratios** produce higher hazard and **longer HD due to smaller divergence**
- **Some** projectors can be RG2 with short throw lenses but not all

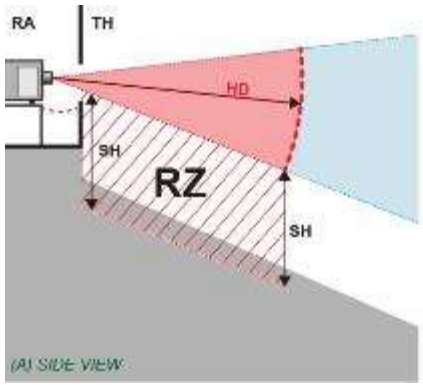
Restriction Zone and Separation Distances

- **Hazard Zone (HZ)** - a 3-dimensional **Zone encompassing the beam "cone" or "pyramid" within the Hazard Distance (HD)**
- **Separation Height (SH) –** height between the floor and bottom of the beam. The floor is a restriction zone if the SH < 2 meters.
- **Restriction zone (RZ) –** area **around the HZ**, delimited by certain separation distances
- **Separation Width (SW)** – lateral separation to the projected beam "pyramid". A minimum of 1 m is required.

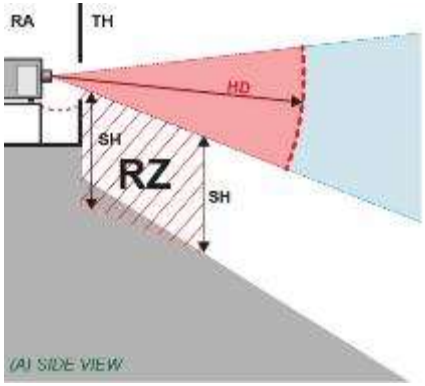




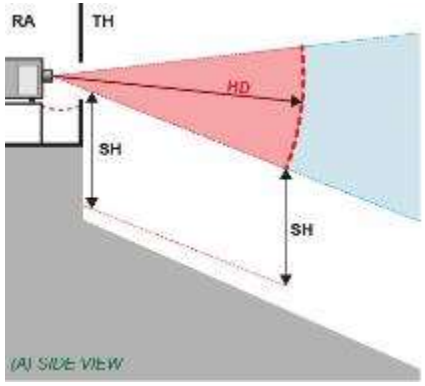
Restriction Zone cases in a Cinema auditorium



1. Entire beam is too low – resulting in area closure beneath HZ since it's in RZ



2. First part of the beam is too low – Closed area only where SH<2 m

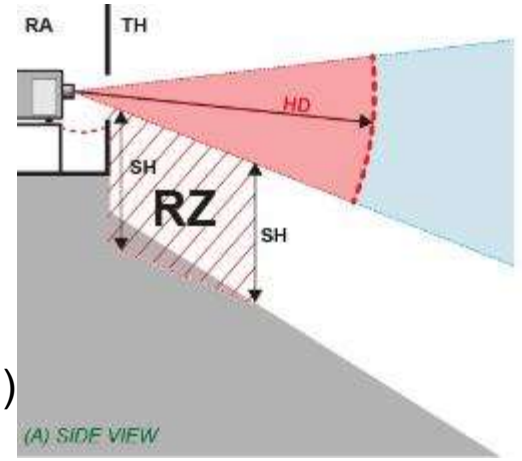


3. Entire beam within HD is higher than 2m – no RZ and no impact in auditorium

Responsibilities of Cinema Owners

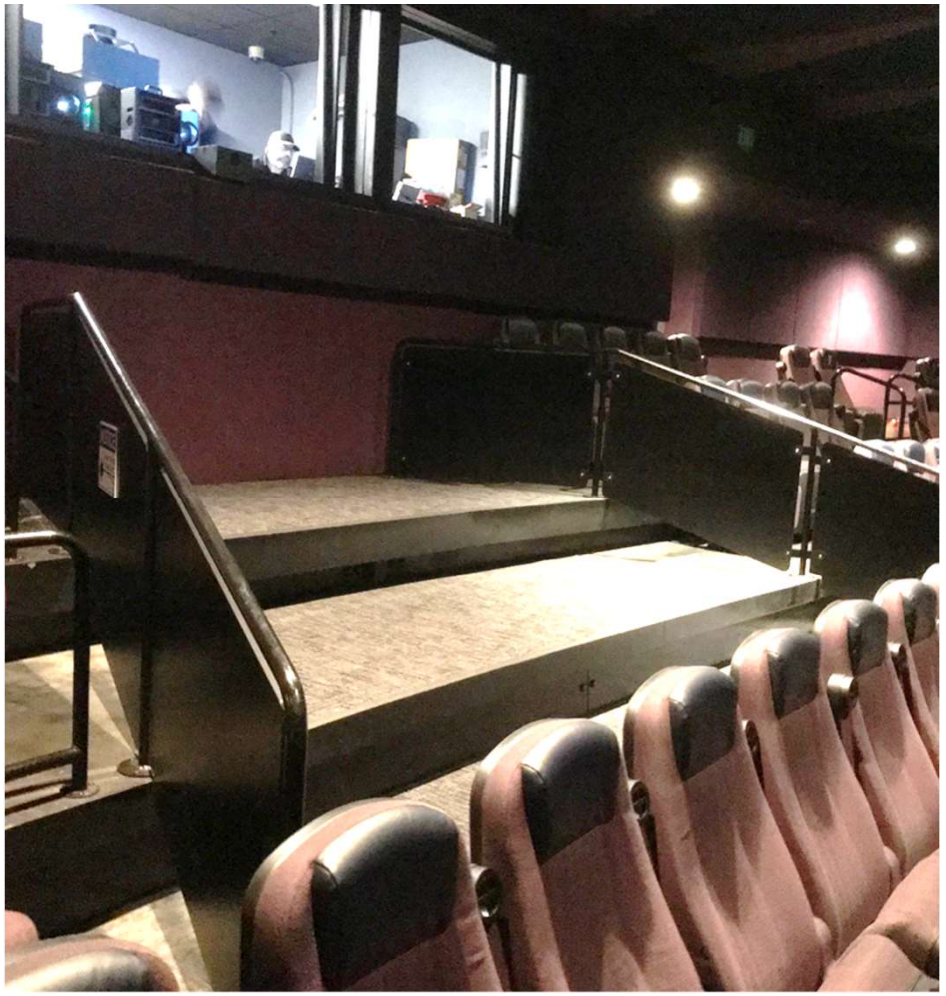
- Booth (LIP **operator) – OHS rules**
  - Provide Safety Training to operators
  - Projection booth requirements (restricted area, door signage)

- Auditorium (general **public**)
  - Restrict access to Restriction Zone where Separation Height is insufficient (barrier and labeling)
  - Can result in seat loss
  - Alternative: lift projector, pull back to shorten HD protrusion into the seating area



Example:

A cinema case where the Separation Height to the beam in the HZ is not sufficient.



Credit: MIT, US installation where 2.5 m separation height is required!

Luckily a rare case in Europe, given a 2 m (only) separation requirement

Summary

Summary

- All things being equal (radiance, lens throw), LIPs are no more hazardous than lamp projectors;
  - Output from lens diverges, very unlike raw laser beams
- LIPs today are classified according to the Lamp standard, resulting in a Risk Group (RG)
- Most cinema LIPs are RG3 → requiring specific installation conditions for operator and audience safety
- Hazard distances are specific to the projector & lens!
  - Impact depends on PJ location and auditorium design
  - Work closely with your supplier to understand the specific requirements
- Review safety instructions / Hazard Zone constraints carefully
- Special care / training required for servicing LIPs


Thank you!