Testing and assessment of Point light sources

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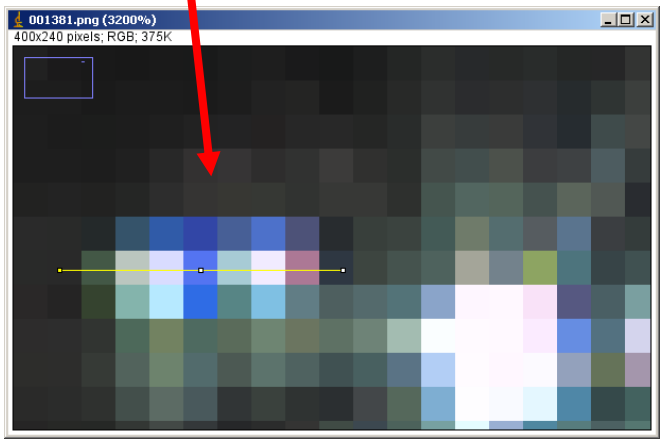
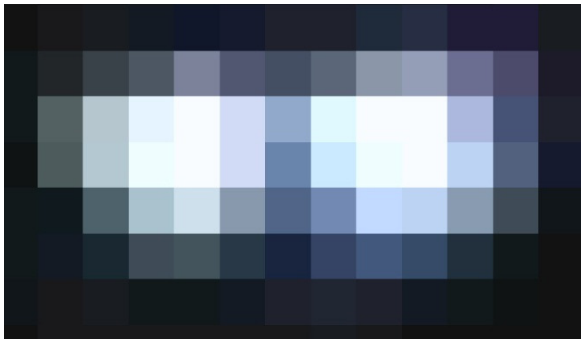
View into a mirror

A mirror renders point light sources (e.g. low beam headlights) as point light sources. This is illustrated in the following figures (examples):

Recordings from road tests with Class III CMS

The following figures show images of digital recorded point light sources.
(The images were recorded with half of the original resolution.)





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Parameters influencing the rendition of point light sources

Main parameters so far identified:

- Luminance of the point light source
- Distance between the point light sources

Other parameters

- Size of the point light source
- Spectrum
- etc./tbd.

Luminances to be expected

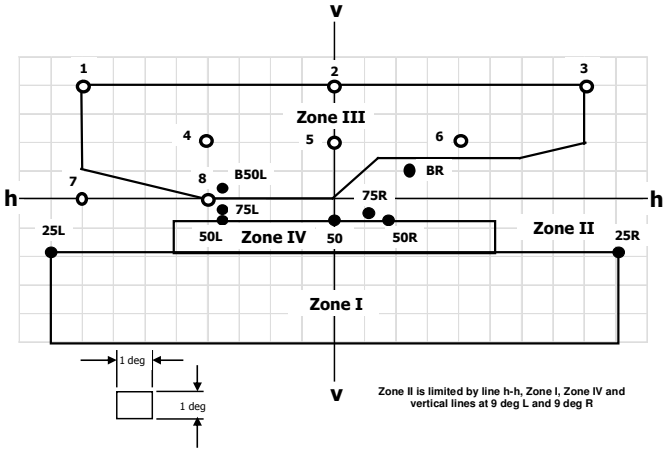
- ECE-R 112 (Revision 2 – Amendment 1)
- Luminance derived from luminous intensity or illuminance
- Reflexionssysteme A ≈ 0,03 m² (0,2 m x 0,15 m)
- Projection systems 40 mm ∅ therefore A ≈ 0,001256 m²
- Projection systems 70 - 90 mm ∅ therefore A ≈ 0,0064 m²
- assume for example a luminous intensity of 10000 cd
- Resulting in luminances of about

$$L \approx \frac{I}{A}$$

$$L \approx \frac{E \times r^2}{A}$$

$$3{,}3\text{x}10^5 – 1{,}6\text{x}10^6 – 8\text{x}10^6 \text{ cd/m}^2$$

- The data serve as an estimate due to different areas and luminous intensities
- NOTE: A wet road may lead to very high luminances due to reflections



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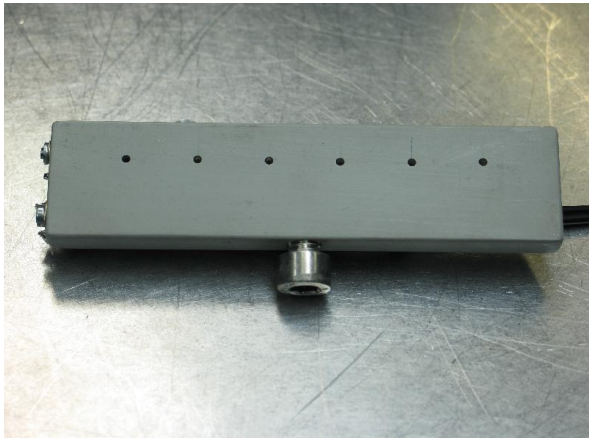
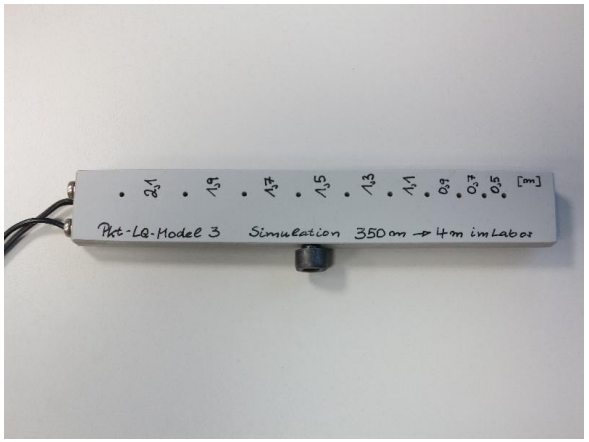
Development of a point light source lab model

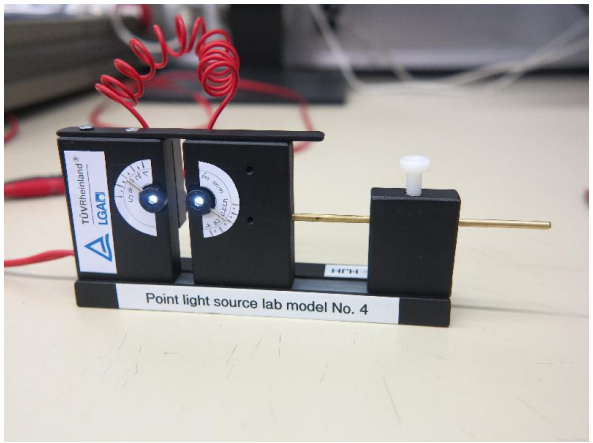
Point light source lab model 1



Point light source lab model 2



Point light source lab model 3



Point light source lab model 4

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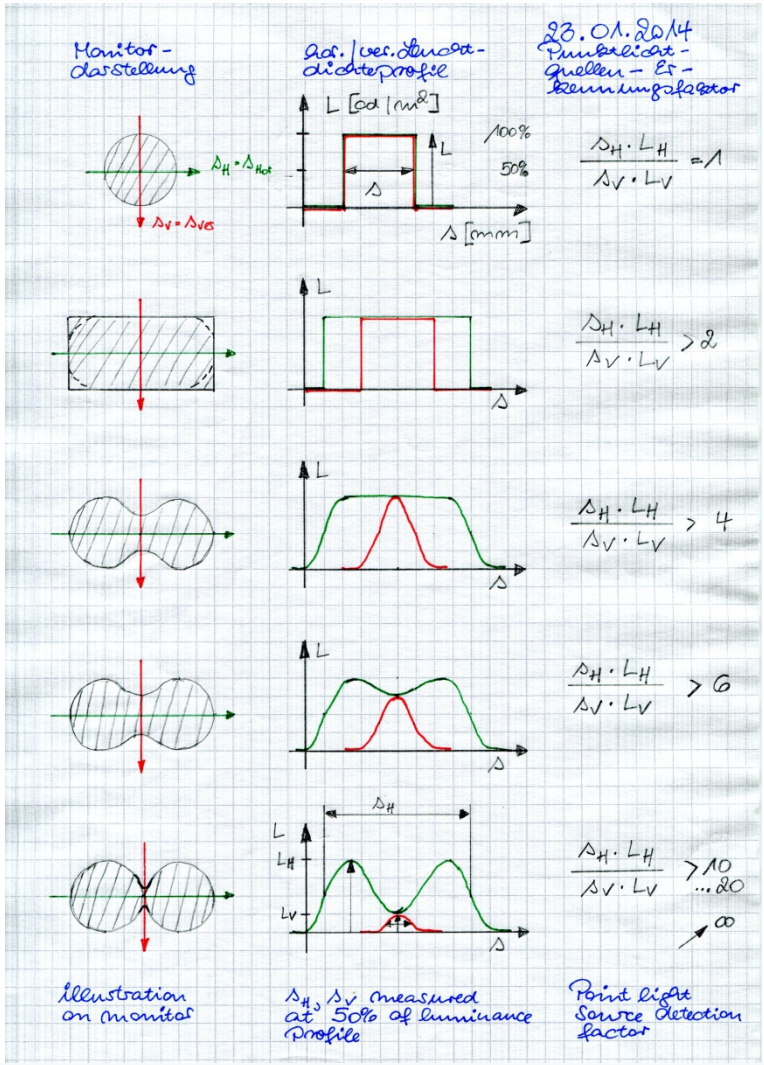
Proposed measurement method and limit



- Measurement of the horizontal and vertical luminance profile
- Determination of the width (s_V, s_H) and of the luminance (L_V, L_H) of the luminance profile
- Determination of a point light source detection factor:

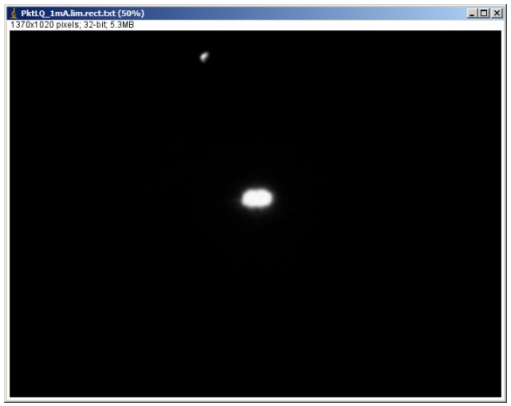
$$PLSDF = \frac{s_H \times L_H}{s_V \times L_V}$$

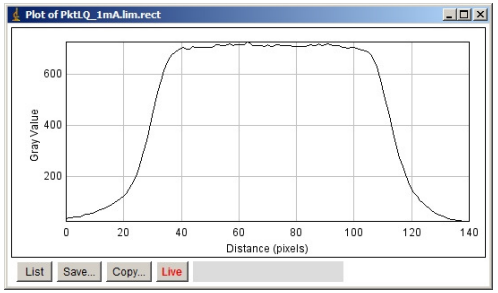
- Getting us of the Rayleigh criterion: two point lights sources will be distinguished if the point light source detection factor fulfills the criterion of:

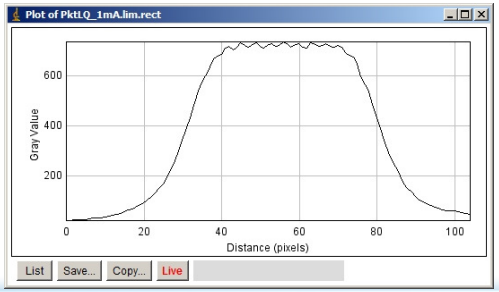
$$PLSDF = \frac{s_H \times L_H}{s_V \times L_V} \geq \approx 6$$

Point light source detection factor: evaluation example with a Class II CMS

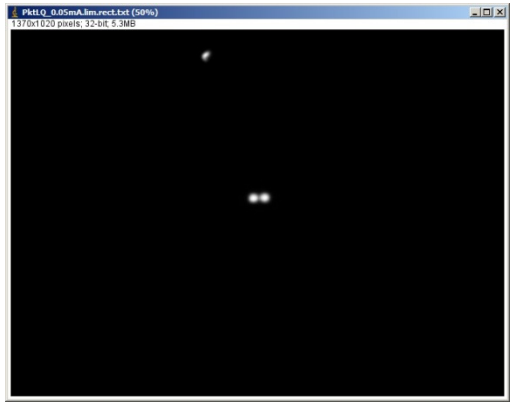
Monitor image – 1 mA drive – PLSDF = 1,7

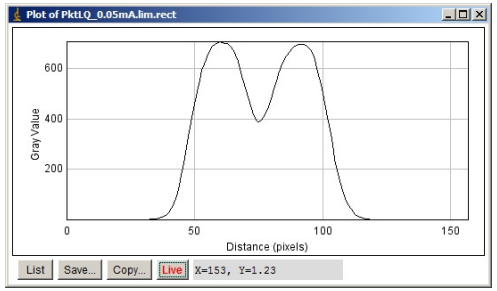




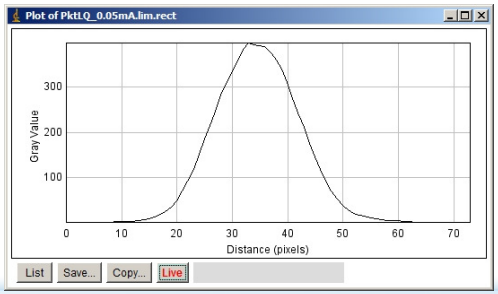


Monitor image – 0,05 mA drive – PLSDF = 5,4





horizontal luminance profile



vertical luminance profile

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Next steps

- Proposal for a minimum distance between the point light sources to be resolved
- Measurement of a Class III-CMS and of a Classe II/IV-CMS
- Investigation into test procedure details
- Proposal for a minimum luminance requirement
- Teams to be informed: national CMS group, ISO CMS group
- Requirement and measurement procedure to be delivered