Innovative Lighting Concept for Next Generation Train

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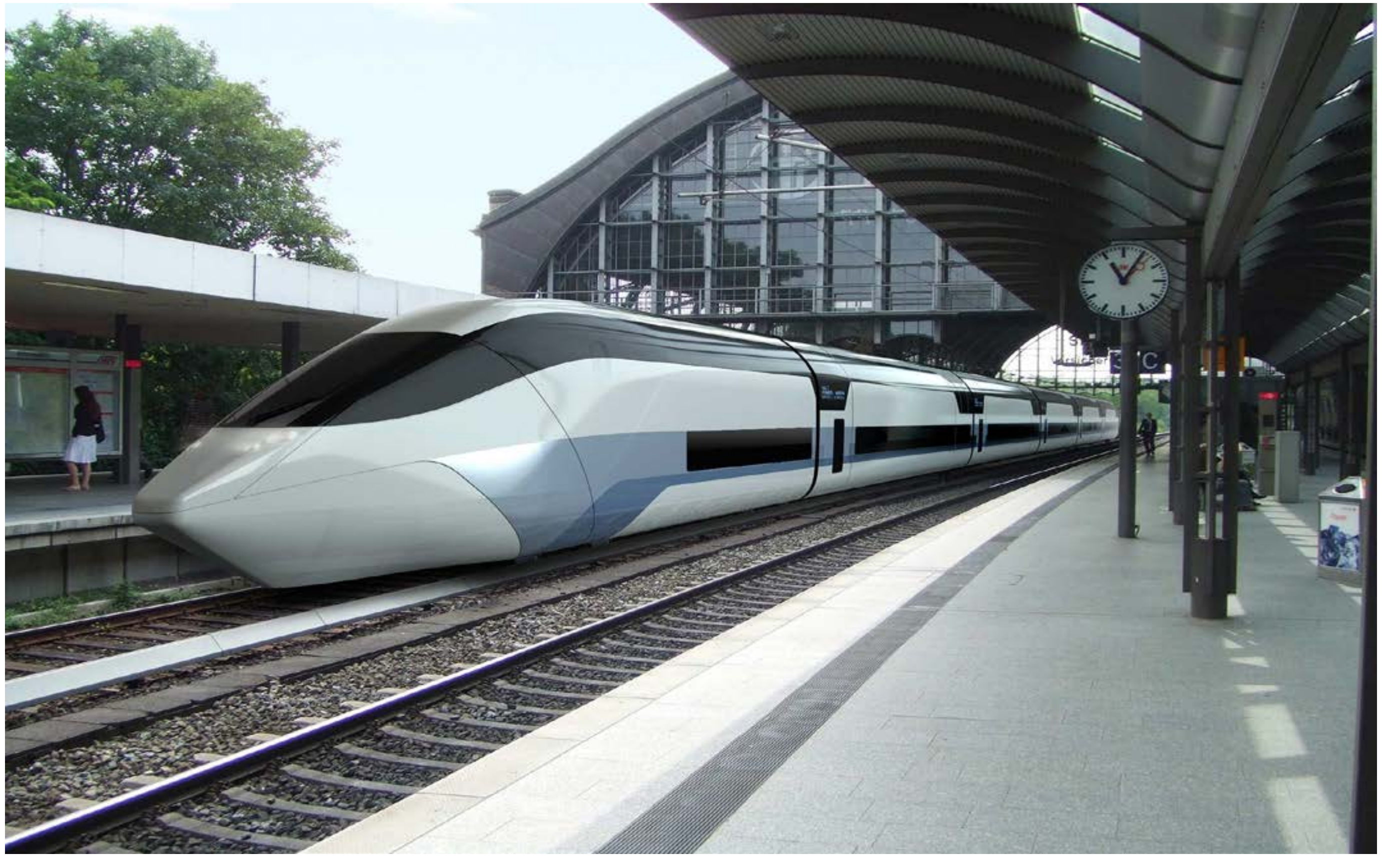
Railway interiors EXPO 2015

DLR

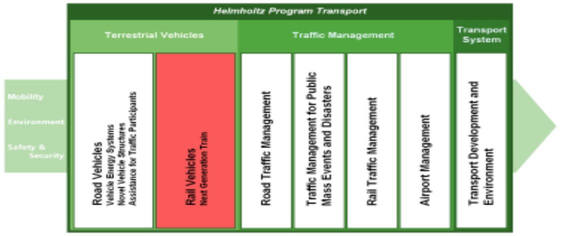
Next Generation Train
2035 Hamburg Dammtor ready for departure



streamlined double deck cab car; single wheels; electric drive 18 MW; 400 km/h;
aerodynamic + magnetic braking, distance 8 km; performance 100.000 km/month

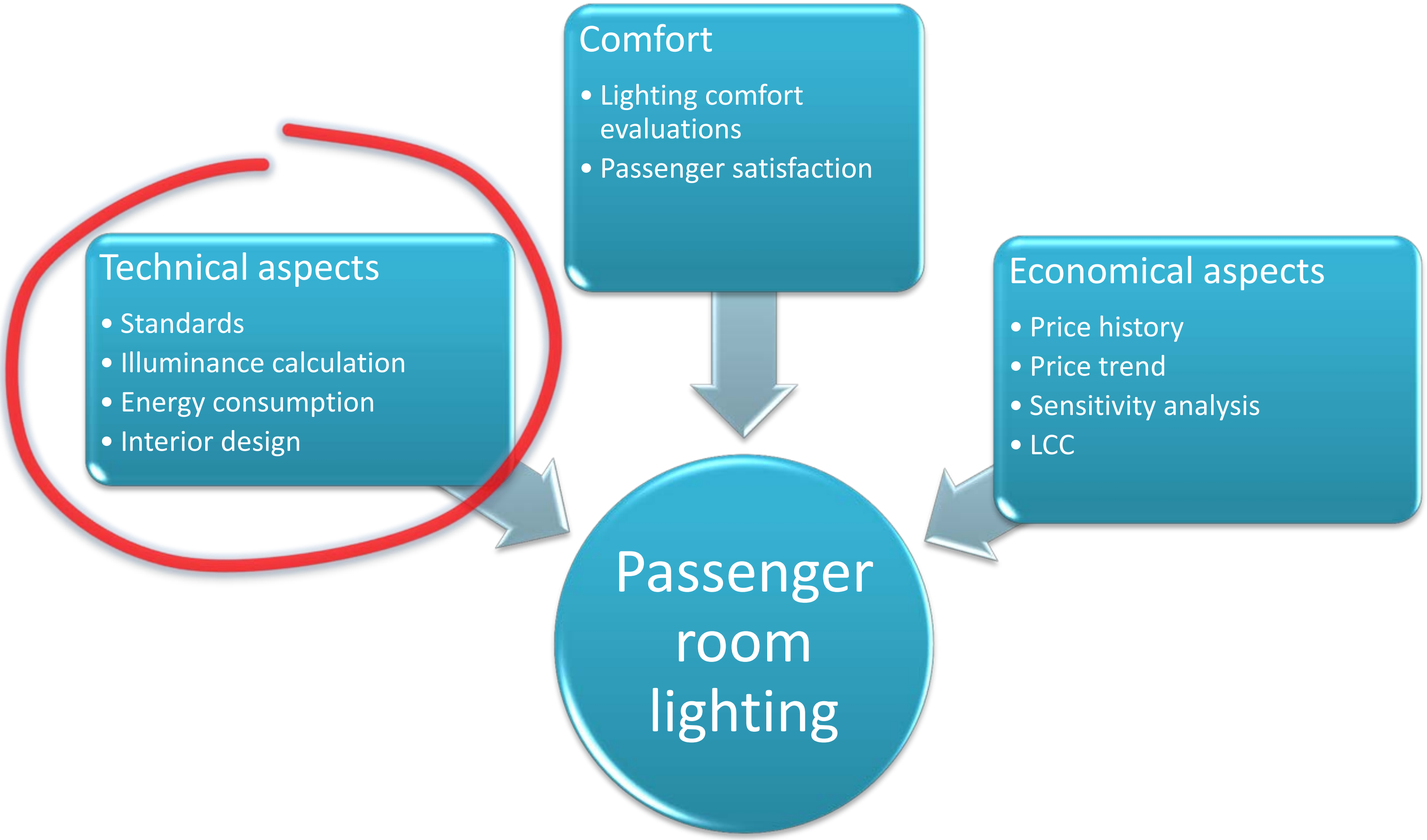
Next Generation Train
Topics and Goals

1. **Increasing the certified train speed to 400 km/h**
2. **Halving the specific energy consumption (compared to ICE-3[1] at 300 km/h)**
3. **Noise reduction**
4. **Increase of passenger comfort**
5. **Improvement of driving safety**
6. **Reduction of wear and life cycle costs**
7. **Cost-efficient design: by modularization and system integration**
8. **Increasing efficiency of development and permission processes**



[1] ICE – InterCity Express

Lighting: systematic investigation

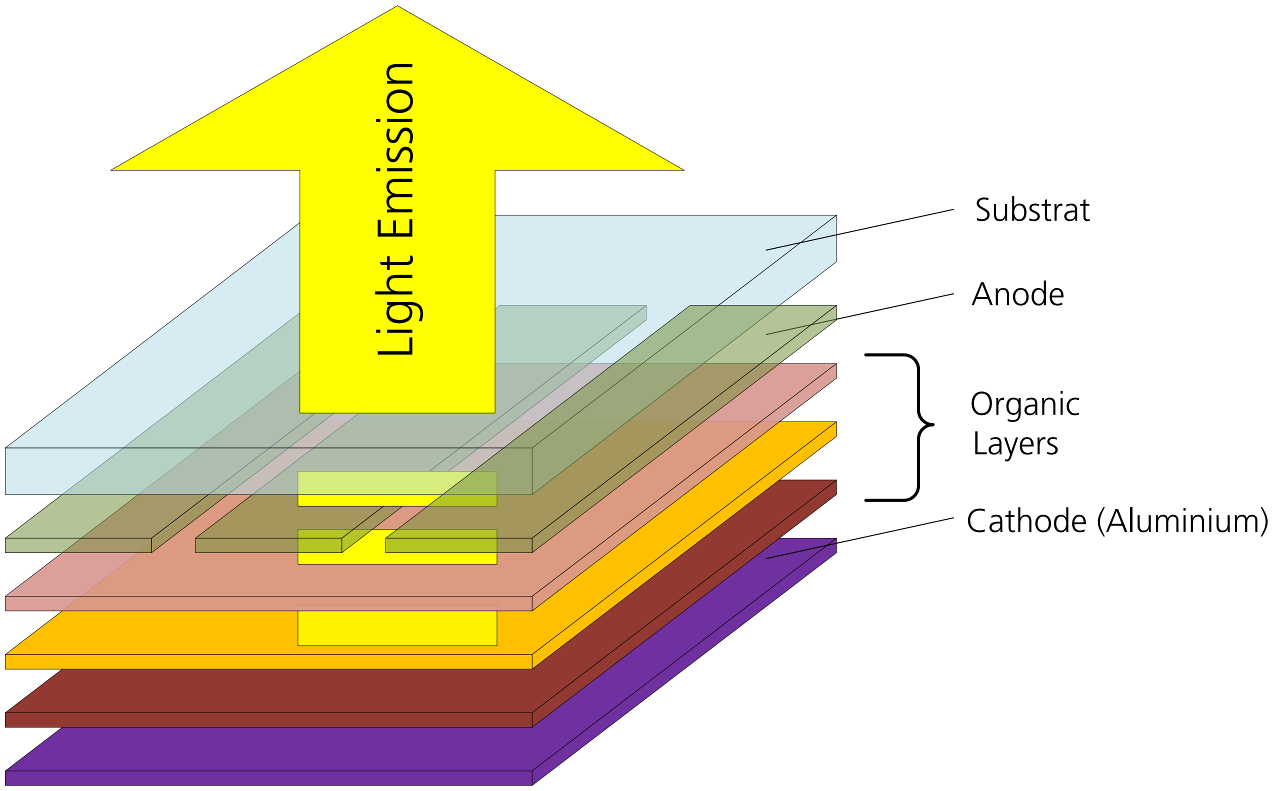


Light sources

OLED = Organic Light Emitting Diode

series of thin nm-layers:

- substrate (plastic, glass, foil)
- transparent Indium Tin Oxide (ITO) – anode
- amorphous layers of organic semiconductor
- Metal cathode



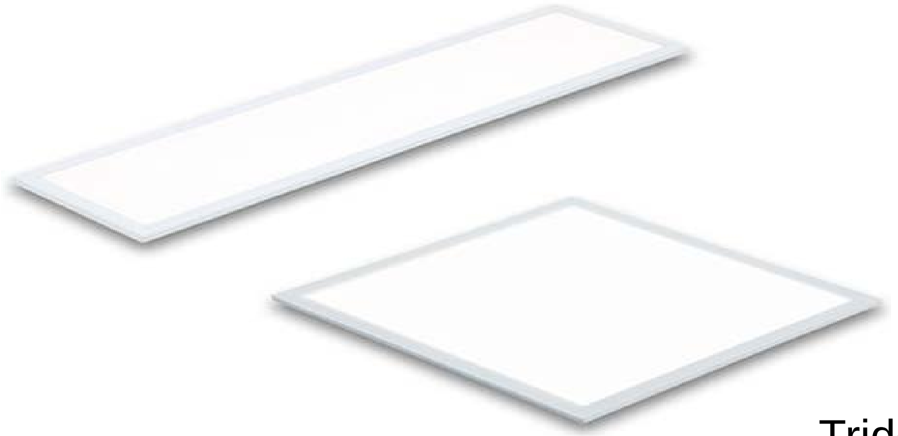
OLED - layers can be spread over very large areas, making them ideal as two-dimensional light sources

Light sources

OLEDs

- Homogeneous, non-glare and area light
- Dimmable neutral white light (4 000 K)
- Excellent colour rendering (CRI[1] up to 90)
- Efficient OLED modules (> 50 lm/W)
- Slim form factor (< 2.5 mm) and low weight
- Low surface heating (typ. T = 40°C)

- Limited in size (max. 145 x 145 mm)
- Service life only 15 000 h (ca. 2 years in trains)
- Still expensive (ca. 60 €/module = 600 €/klm)



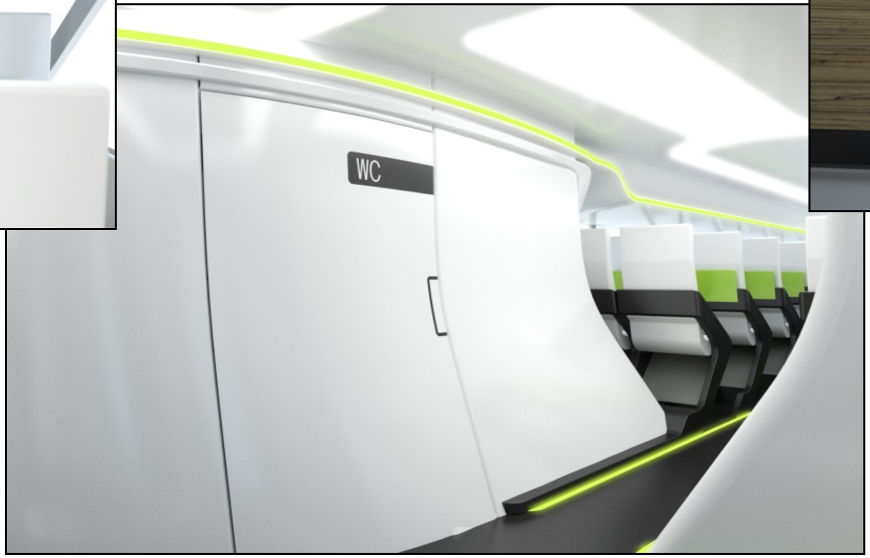
Tridonic®

[1] CRI – Color Rendering Index

NGT lighting concept

- an energy-efficient, compact, comfortable and low-maintenance lighting system had to be developed within the NGT project

lower deck



upper deck

Calculation method: DIALux

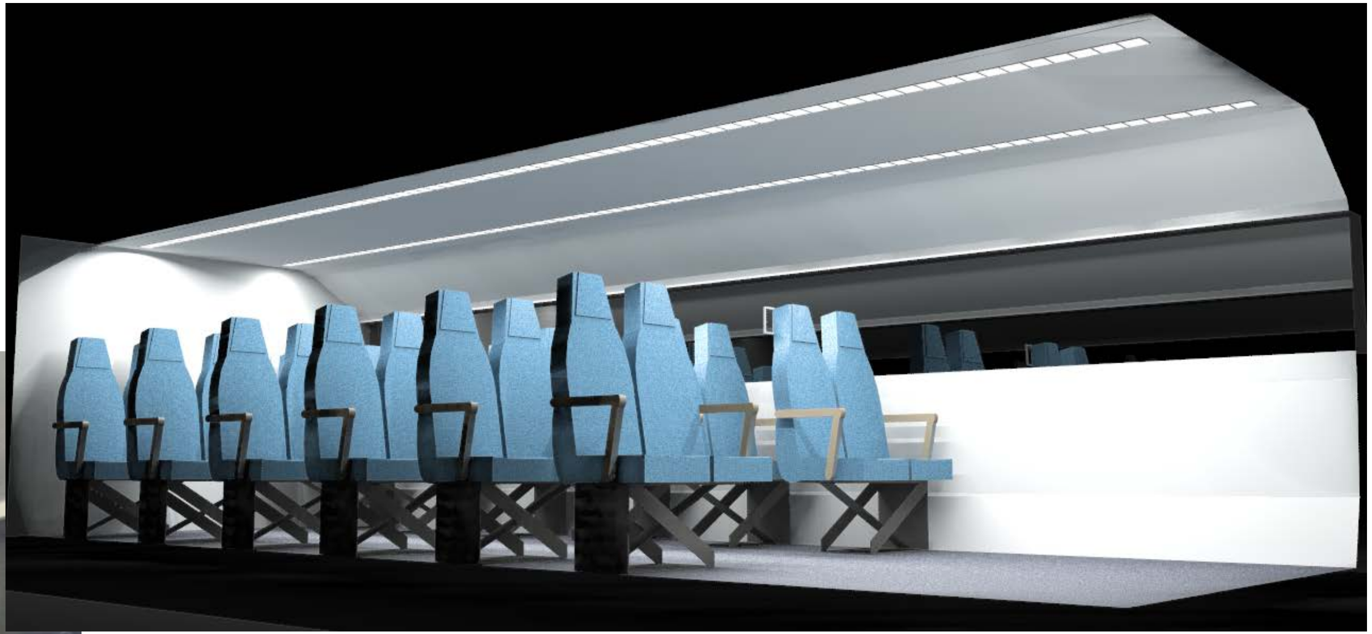
- well-established software for light planning in buildings and outdoor spaces
- free software
- import of CAD[1] data
- import of OLED specifications
- photorealistic visualizations

the model of NGT was developed and validated within the project

[1] CAD – Computer -aided Design

Model validation
Experiment Design

- Measuring points according to EN 13272 – standard in model and in full-size mock-up

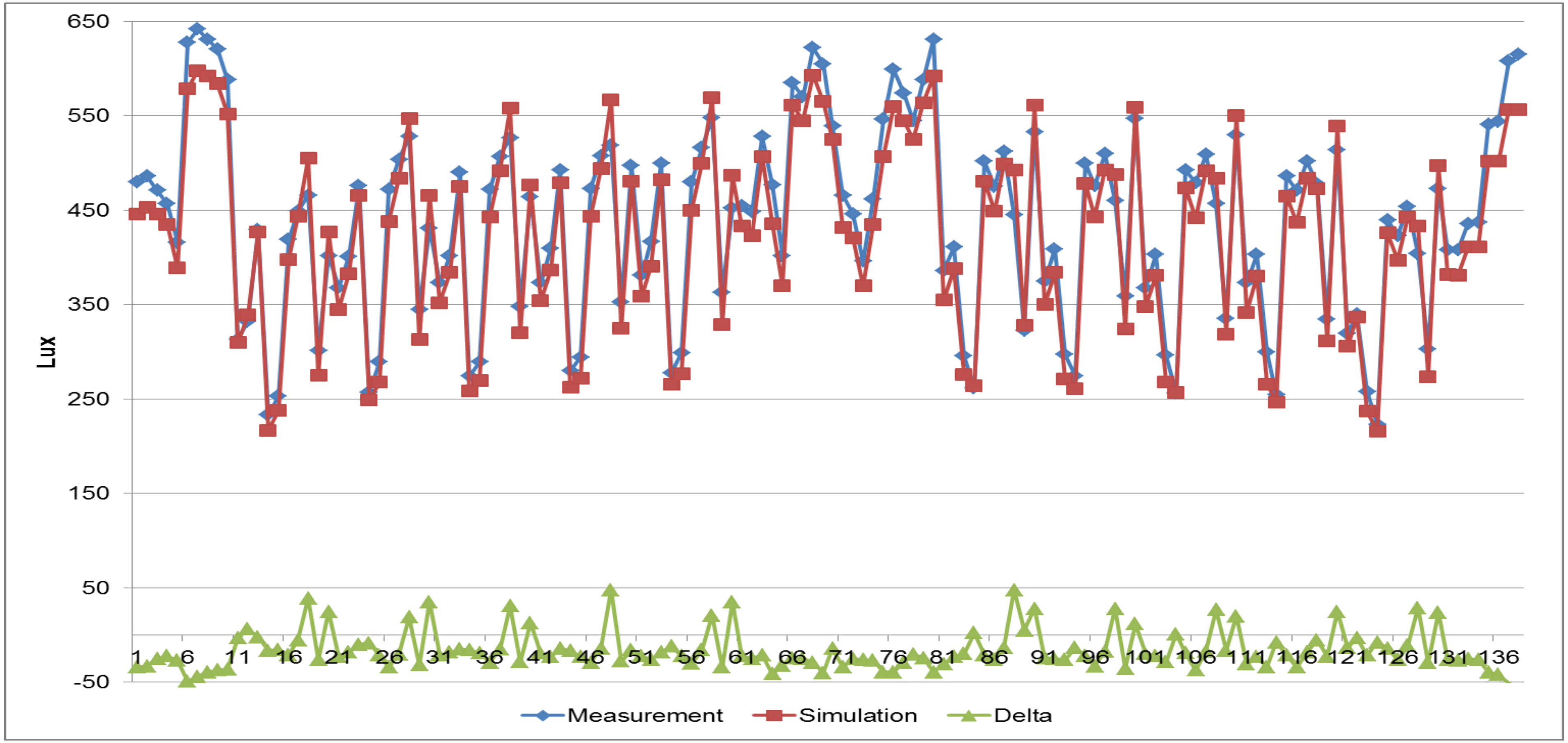


- 136 measuring points on lower deck
- 54 measuring points on upper deck

Model validation
Experiment results

- average difference of 4.5% on lower deck (LD)

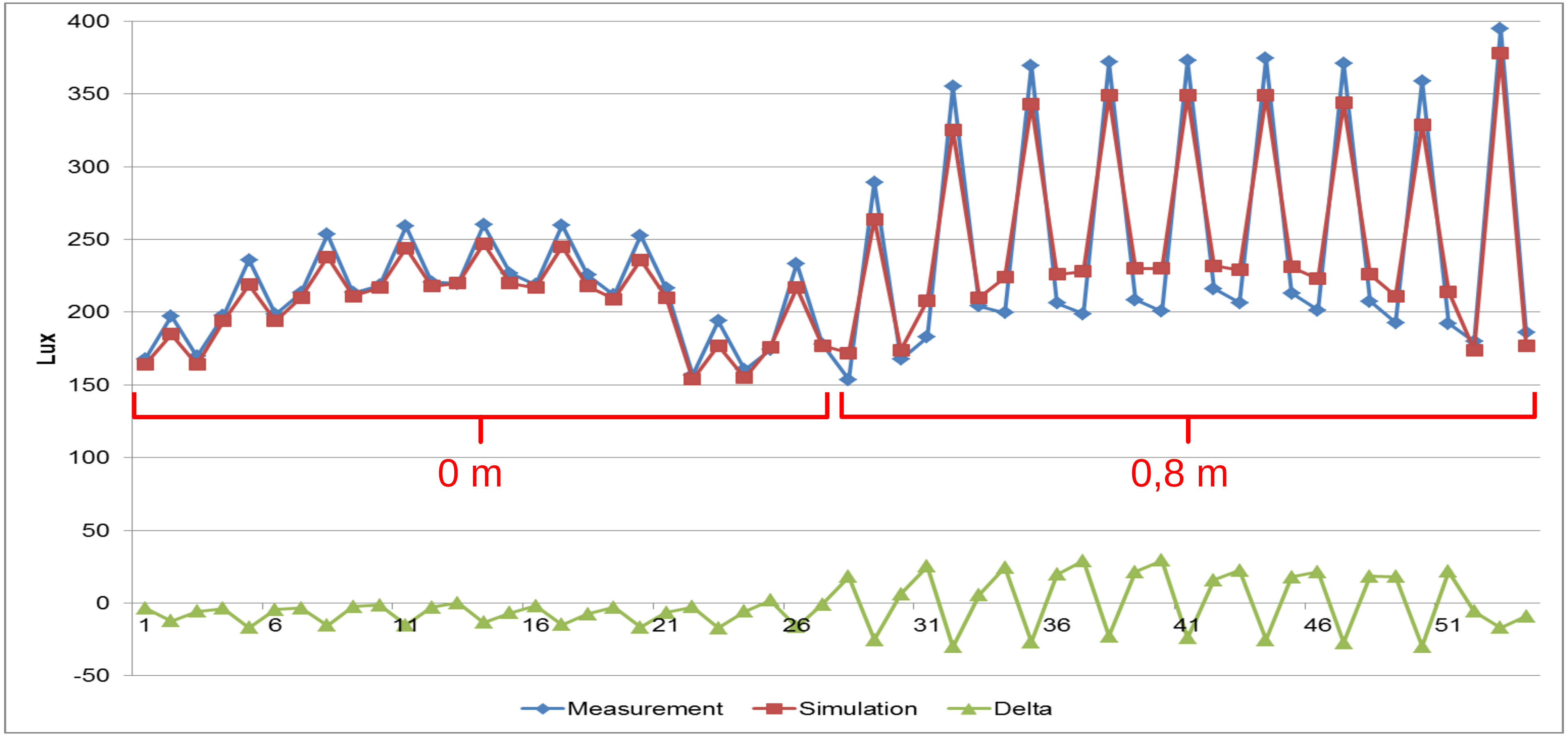
LD



Model validation
Experiment results

- average difference of only 0.5% on upper deck (UD)

UD



Lighting concept for NGT Lower deck (second class)

- 302 Tridonic® ‘Lureon REP 20w5-40 DC’ modules

- 634 Watt total

→ 12.2 W/passenger

(ICE[1] 23.2 W/passenger)

→ 48% power saving

[1] ICE – InterCity Express

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Lighting concept for NGT
Upper deck (first class)

- 349 Tridonic® ‘Lureon REP 20w5-40 DC’ modules
- 733 Watt total → 15.6 W/passenger (ICE[1] 33.5 W/passenger) → 47% power saving

[1] ICE – InterCity Express

Summary

- *innovative passenger area lighting for double-decker cars has been developed within the Next Generation Train project*
- *technical, economical and comfort aspects of the lighting were investigated*
- *due to the use of innovative illuminants (OLEDs) energy-efficient, compact, comfortable and low-maintenance lighting according to EN 13272- Standard is possible*
- *modular system allows realizing a lot of design ideas and smart lighting control*

Outlook

- combined control (centrally + individually)
- lighting control using <u>R</u>ailway <u>C</u>ustomer <u>C</u>ard (RCC)

THANK YOU FOR YOUR ATTENTION!

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