



# Lighting Research for Efficiency

Heike Schumacher | 30.03.2021

---



# Agenda

- I. Short introduction
- II. Motivation for our research
- III. The LEDWalkway
- IV. Current research projects
- V. Outlook, Experiences and recommendations



# TU Berlin

- One of Germany's largest universities
  - Over 35.000 students
  - Nearly 24 percent from foreign countries
  - Most of them studying engineering Sciences





## Our chair

- Oldest chair of lighting technology at a German university
- Teaching & Research since 1882
- Two main research areas:



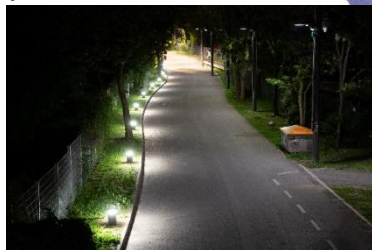
Dr. Martine Knoop



Prof. Dr.-Ing. Stephan Völker



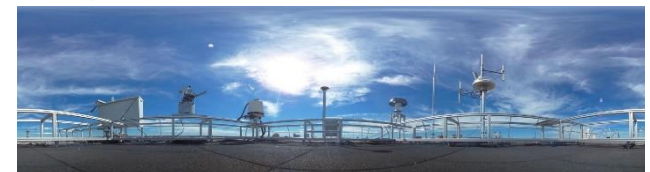
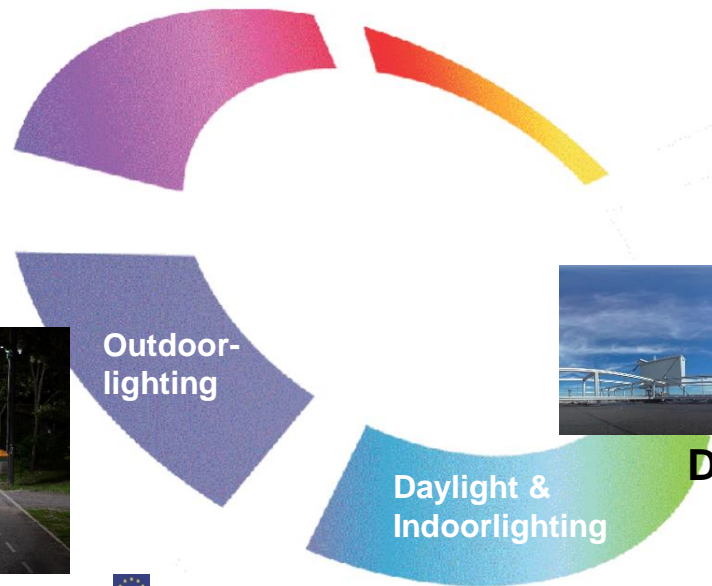
**LEDWalkway**



Funded by Berlin (UEP II) und  
cofinanced by the European  
Union (EFRE)



berlin



**Daylight measuring side**



## Motivation

### High Potential of the LED

- Efficiency
- Traffic safety

### Reality

- Increase of illumination level & Straylight
- Poor visibility conditions

### Reasons

Outdated  
lighting  
systems

Missing  
limit values

Missing  
concepts

Missing lighting  
planning



Picture: Denny Franzkowiak on Pixabay



[http://www.lichtverschmutzung.de/karten/2012\\_eu\\_viirs\\_gr.jpg](http://www.lichtverschmutzung.de/karten/2012_eu_viirs_gr.jpg)



**26.000 accidents with pedestrians  
and cyclists 2002 - 2014 in Berlin**





# Motivation

## Aims

1. Greater dissemination of efficient high-quality LED solutions
2. Better lighting concepts



© ZVEI



Involving Public, Politics, Industry and Research

**Need for an outdoor testing area for  
research and demonstration!**



## LEDWalkway – From idea to reality



2012

2014

2015

- Power supply: 4.500 m cable
- Connections: LAN, Powerline, Glasfaser, WLAN
- 39 poles & 74 luminaires
- Every luminaire & every electronic ballast EVG controllable separately



# Overview



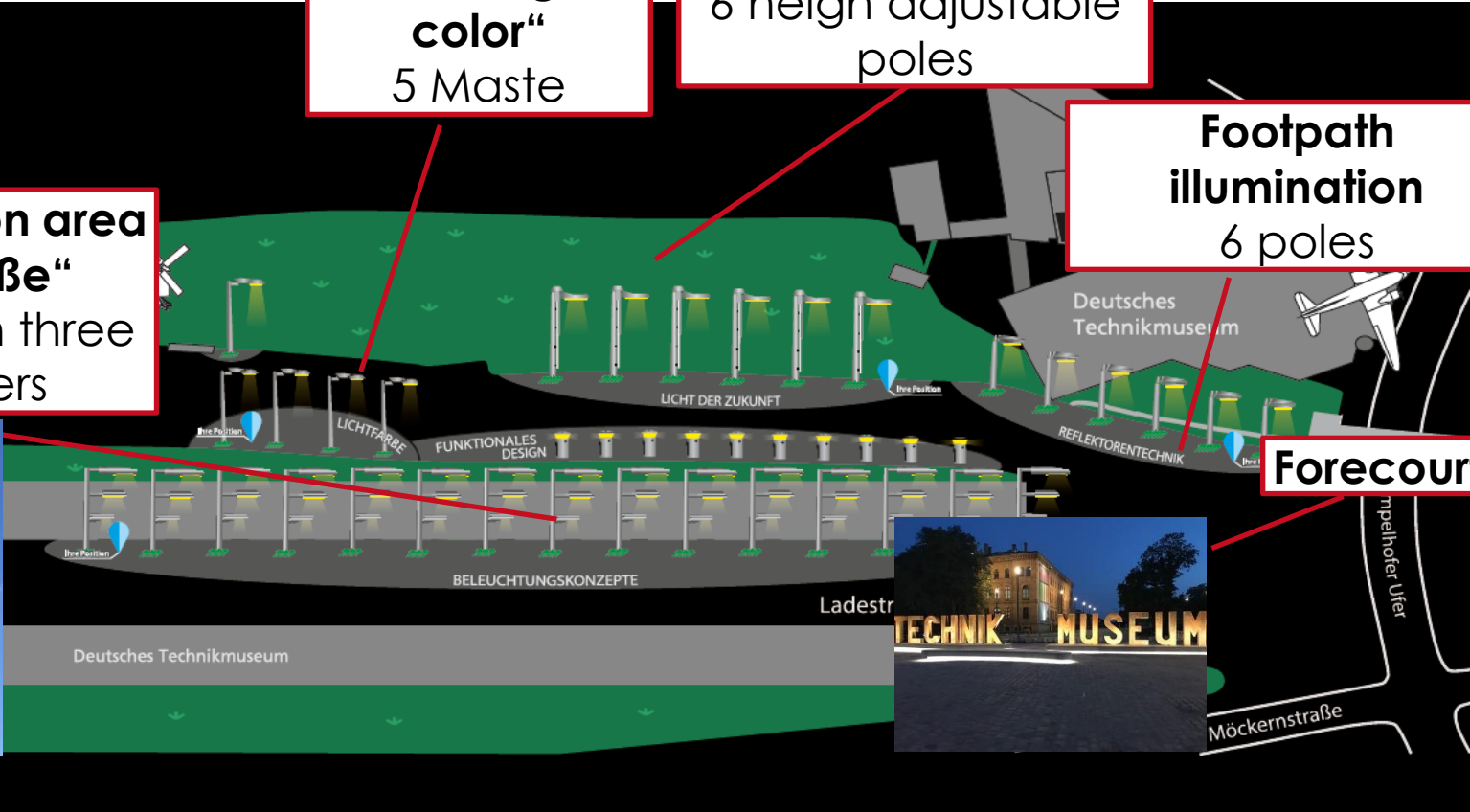
**Demonstration area „Light color“**  
5 Maste

**Research area**  
6 heigh adjustable poles

**Footpath illumination**  
6 poles

**Demonstration area „Ladestraße“**  
15 poles with three cantilevers

**Forecourt**








## LEDWalkway – Special equipment



### Sprinkler truck



## Aim 1: Dissemination of efficient high-quality LED solutions

 Demonstration of lighting quality, traffic safety and energy efficiency  
... and their influencing variables

- Uniformity
- Glare
- Light distribution
- Correlated color temperature

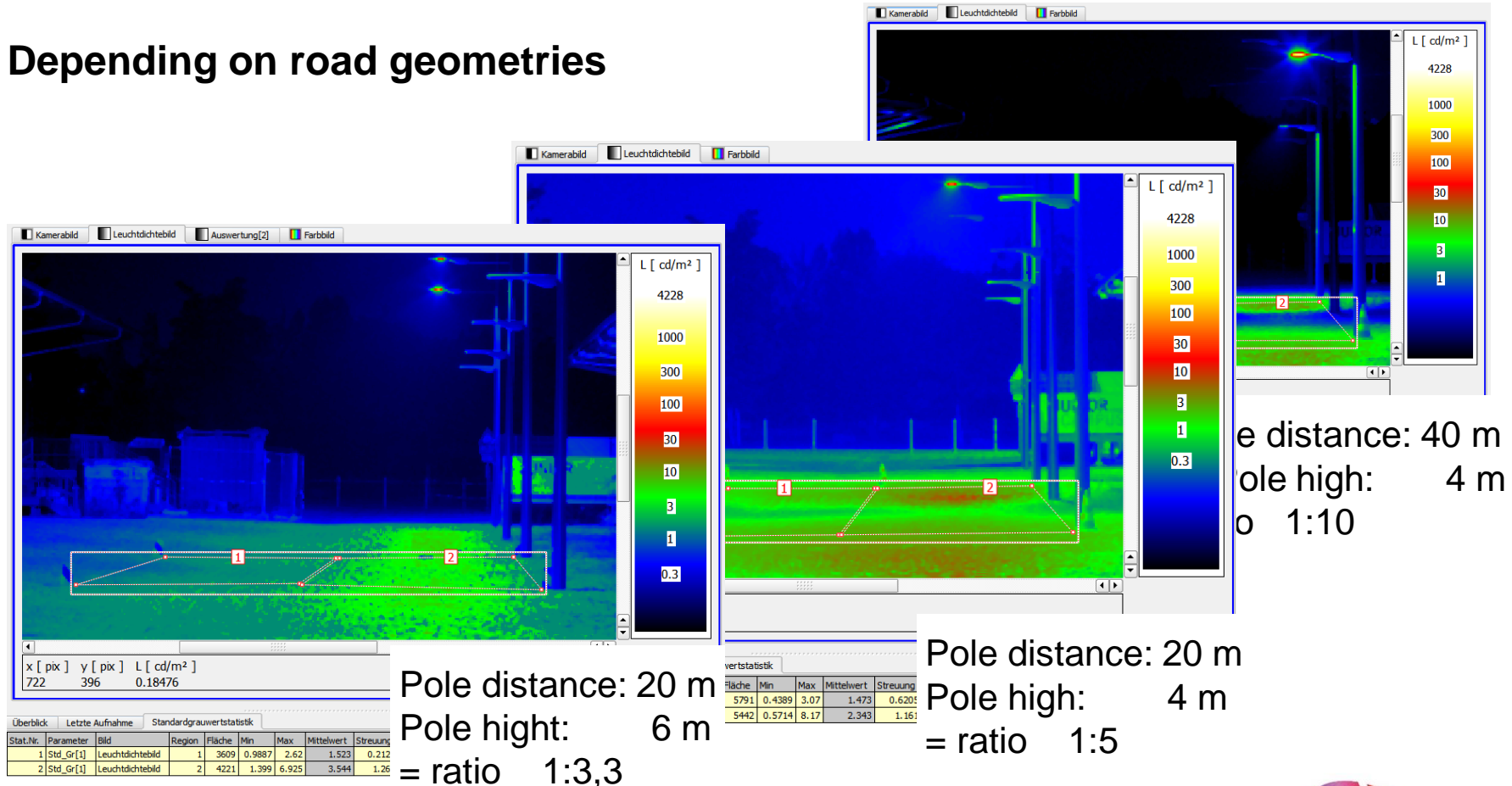


**Over 2.000 visitors**



# Uniformity

Depending on road geometries

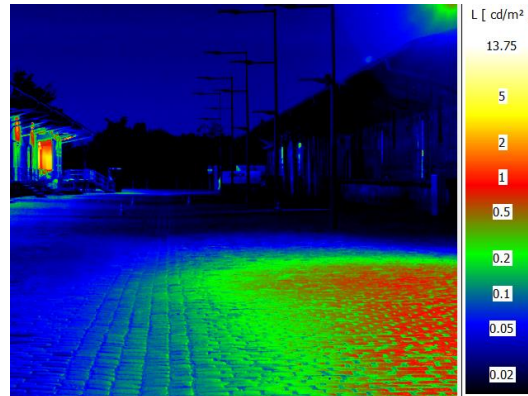


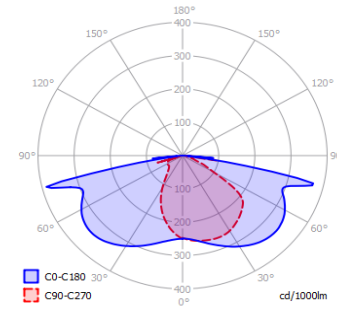


# Glare

## Depending on

- Pole high
- Distance & Amount of LEDs in the luminaire





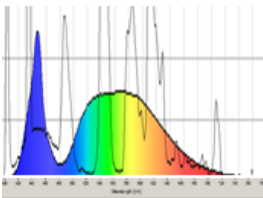
## Lighting distribution

- Optimized for better visibility
- Adapted on different areas

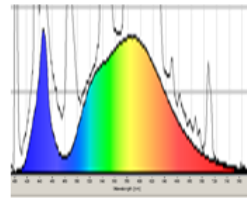




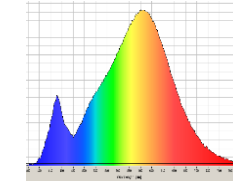
## Correlated color temperature



5700 K, 139 lm/W



4000 K, 136 lm/W



3000 K, 113 lm/W

- Cool white: less acceptance, but efficient
- Warm white: higher well-being, but not efficient
- Neutral white: good compromise between efficiency and user acceptance



## Aim 2: Better lighting concepts



### Developing of new lighting concepts

- Less light better distributed
  - Higher uniformity with lower lighting level
  - Locally adapted lighting
  - Time-adapted lighting

.....within the framework of research projects

Senatsverwaltung  
für Stadtentwicklung  
und Umwelt

berlin Berlin

Nearly 3 Mio. funding

Gefördert durch:



Bundesministerium  
für Wirtschaft  
und Energie

aufgrund eines Beschlusses  
des Deutschen Bundestages



Bundesministerium  
für Verkehr und  
digitale Infrastruktur

GEFÖRDERT VOM



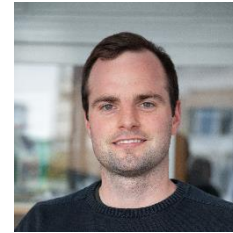
Bundesministerium  
für Bildung  
und Forschung



EUROPÄISCHE UNION  
Europäischer Fonds für  
regionale Entwicklung  
Investition in Ihre Zukunft

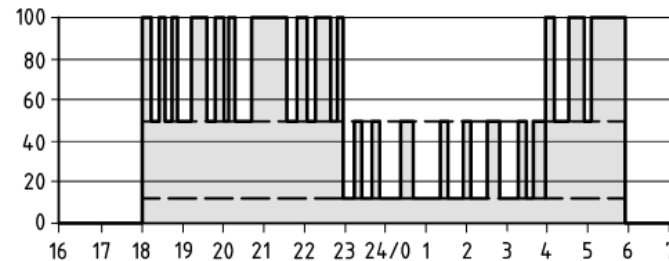
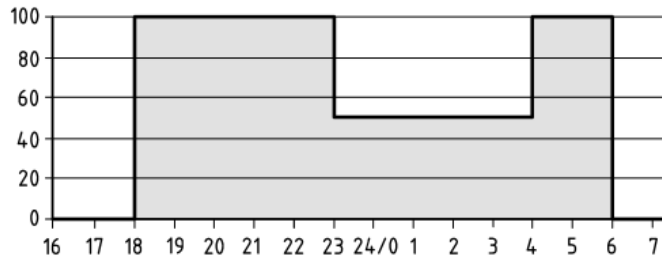


TRILUX  
SIMPLIFY YOUR LIGHT.

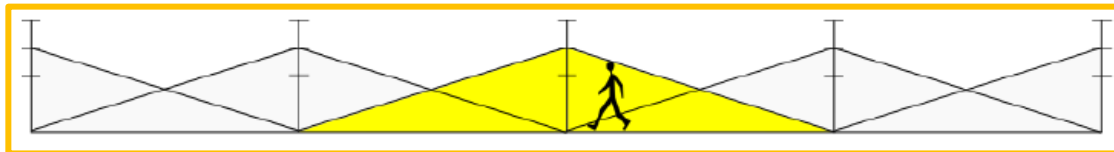


# DymPro

- Demand-oriented dimming & Tracking light
- Evaluation of offered control systems



© DIN EN 13201 - 5

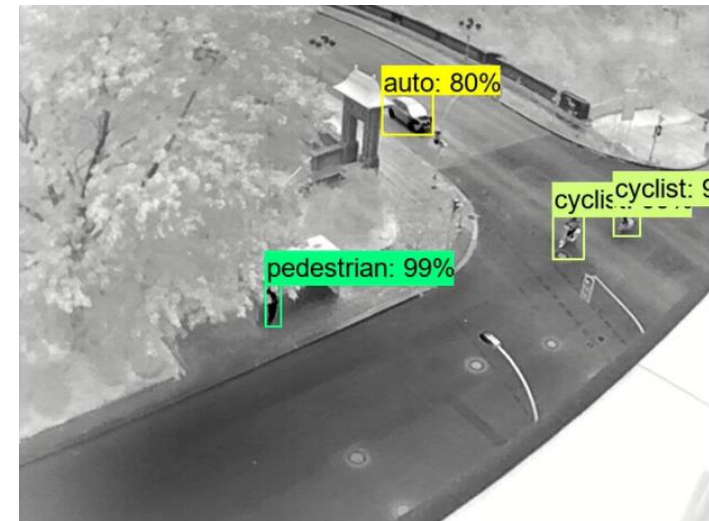
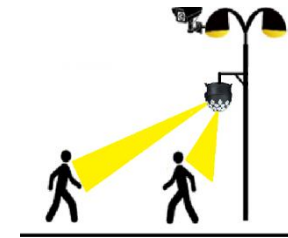


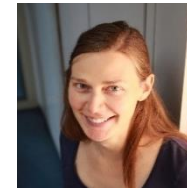




## Fixed marker light

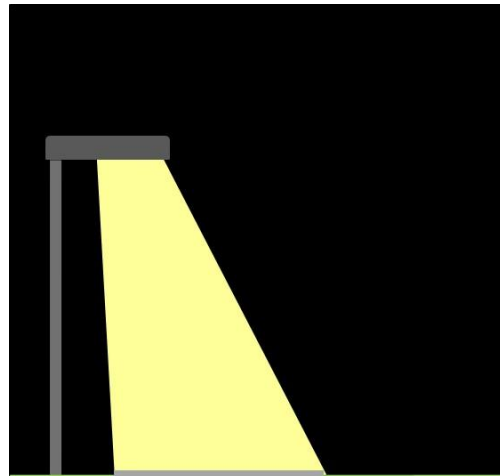
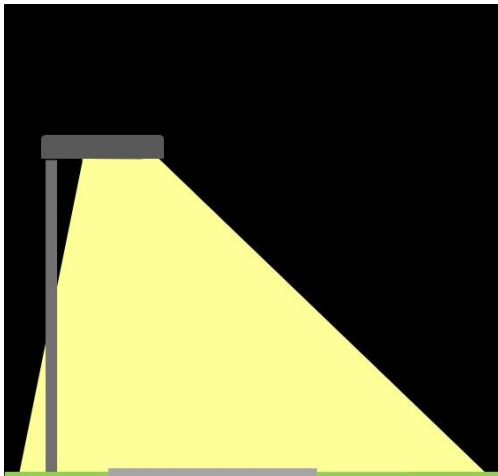
- Targeted illumination of vulnerable road users
- Technical development of sensor and light source
- Visibility & acceptance studies





## AuBe

- Species protection through environmentally friendly lighting
- Minimization of the attraction and barrier effect
- Development of a special luminaire design

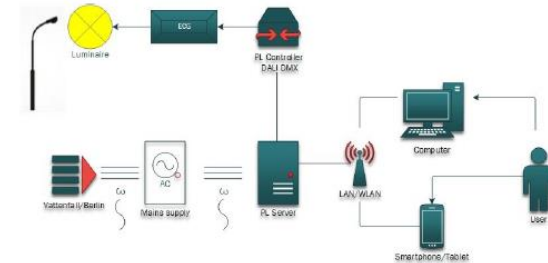
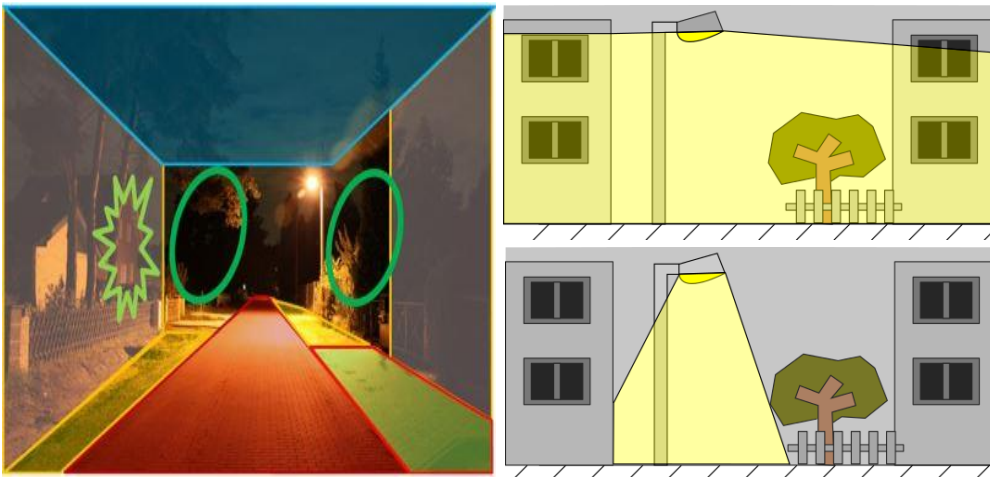


Picture: Hans Braxmeier on Pixabay



## Selection of recently completed projects

- UNILED II – Luminaires with multivariable light distributions
- StEffi – Optimised light distributions for different task areas
- Dignet-PS – Lighting concept for autonomous driving

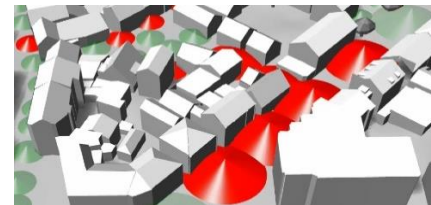
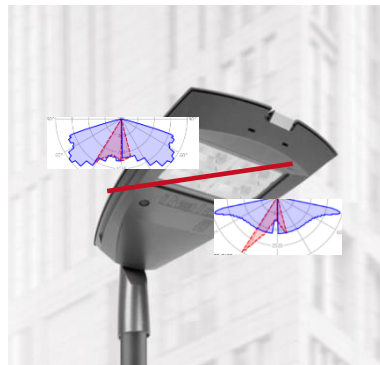
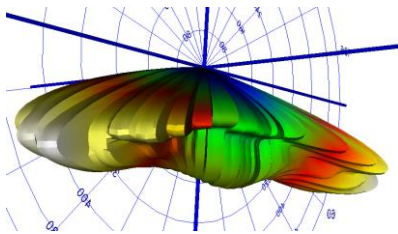




# Outlook

## We need

- Luminaires and steering for adaptive lighting
- Revision of standards
- Lightplanning & binding remeasurement

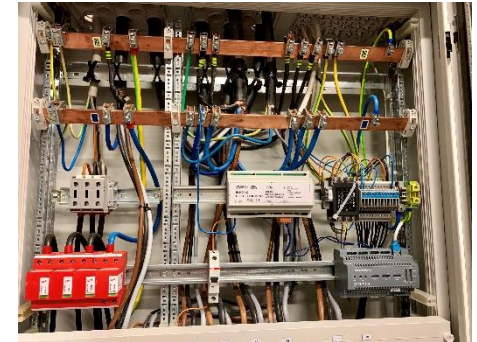




# Experiences with the LEDWalkway

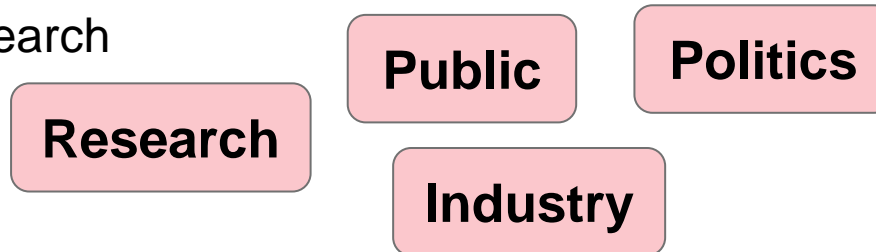
## Challenges

- Funding
- Participation of industry
- Permanent improvements
- Stay present



## Success

- High interest from politics, industry and public
- Funding for research





## Recommendations for a demonstration side

- Patience 😊
- Partnerships/Networking with
  - Luminaire manufacturers
  - Politics
  - Stakeholder organizations
- Time & Knowledge
- Project documentation
- Widespread public relations



Picture: Felix Oberhage





# Thank you!

## Contact:

Fachgebiet Lichttechnik

Einsteinufer 19

10587 Berlin

<http://www.li.tu-berlin.de>

<http://www.led-laufsteg.de>



Heike Schumacher

heike.schumacher@tu-berlin.de

+49 30 314 - 22156