

Development of a Simplified, Spectral and Direction-Dependent Daylight Sensor

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Agenda

- why?
- what exactly?
- hypothesis
- simplification
- equipment
- summary

▼
why?
what?
hypothesis
spectral
spatial
equipment
summary

Daylight Provision

- Daylight is the preferred light source
- We know too less, especial spectral
 - We have to measure to get the know-how

↓ why?

what?

hypothesis

spectral

spatial

equipment

summary

Measuring Site TUB



TLM
 $5 \times E_v$, $\alpha/2 = 90^\circ$
coverage: $>100\%$

spectral sky scanner
 $145 \times L_e(\lambda)$, $\alpha/2 = 5^\circ$
coverage: $\approx 55\%$



Not optimized to derive the indoor situation

why?

what?

hypothesis

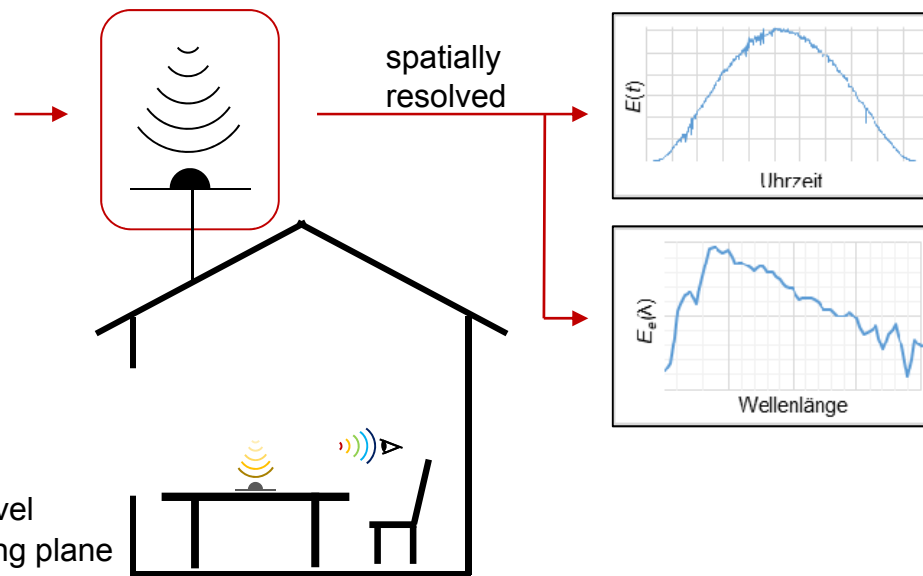
spectral

spatial

equipment

summary

What We Need



why?

what?

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Simplification

Hypothesis:

- With a simplified sensor
- based on the system of the spectral Sky scanner –
it is possible to calculate the daylight provision
for standardized offices in real time.

Two steps of simplification:

- Spectral measurement
- 145 different directions (spatial resolution)

why?

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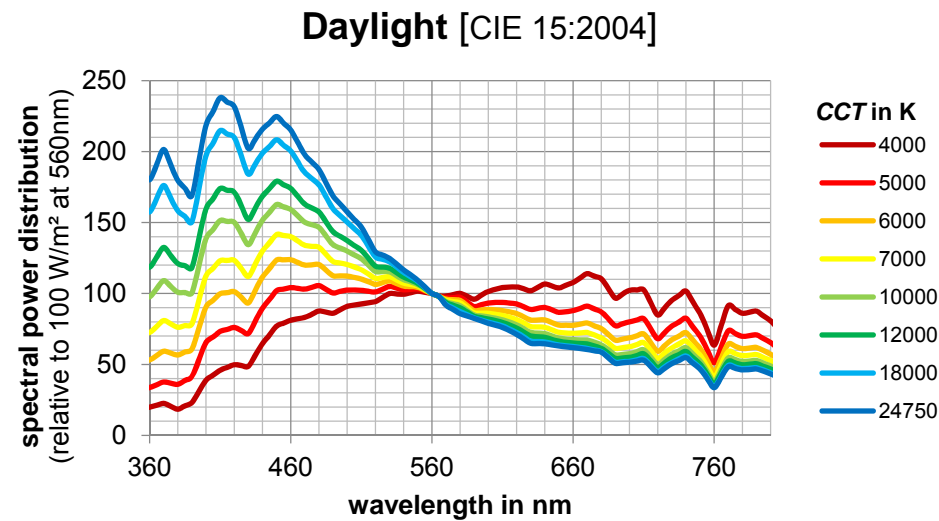
Spectral Measurement

explicit connection*:

$SPD_{\text{daylight}} \leftrightarrow CCT_{\text{daylight}}$

simplification:

→ rgb colour sensor



why?

what?

hypothesis

↓ spectral

spatial

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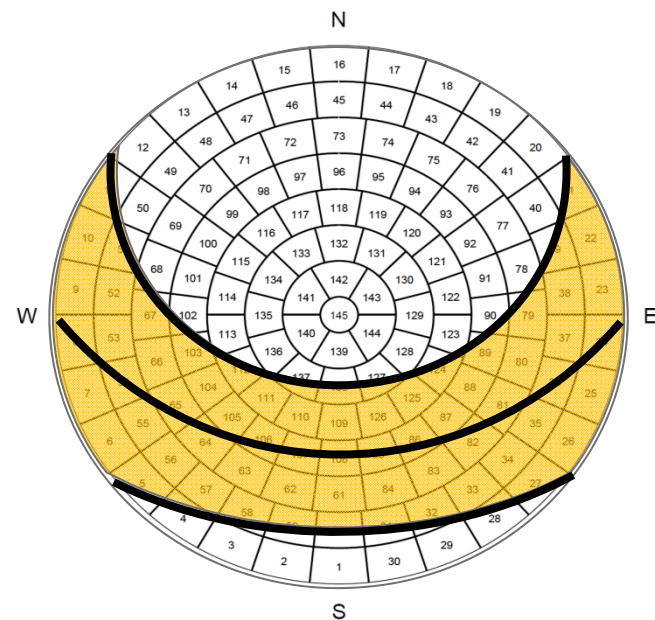
*is currently being evaluated at TUB

Spatial Resolution

Resolution: how high?

Which measuring directions?

Other simplification by:
Chain, C. and Kobay, M.



why?

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Minimum Spatial Resolution

target figures:

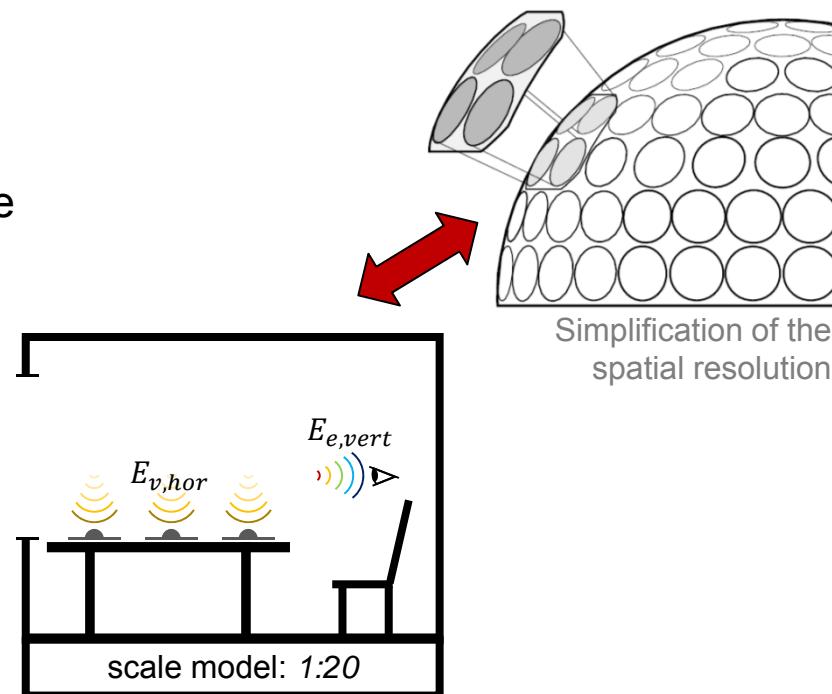
$$E_{e,vert}(\lambda)$$

$$E_{v,hor}$$

at eye level
on working plane

Comparison:
calculated vs. measured values

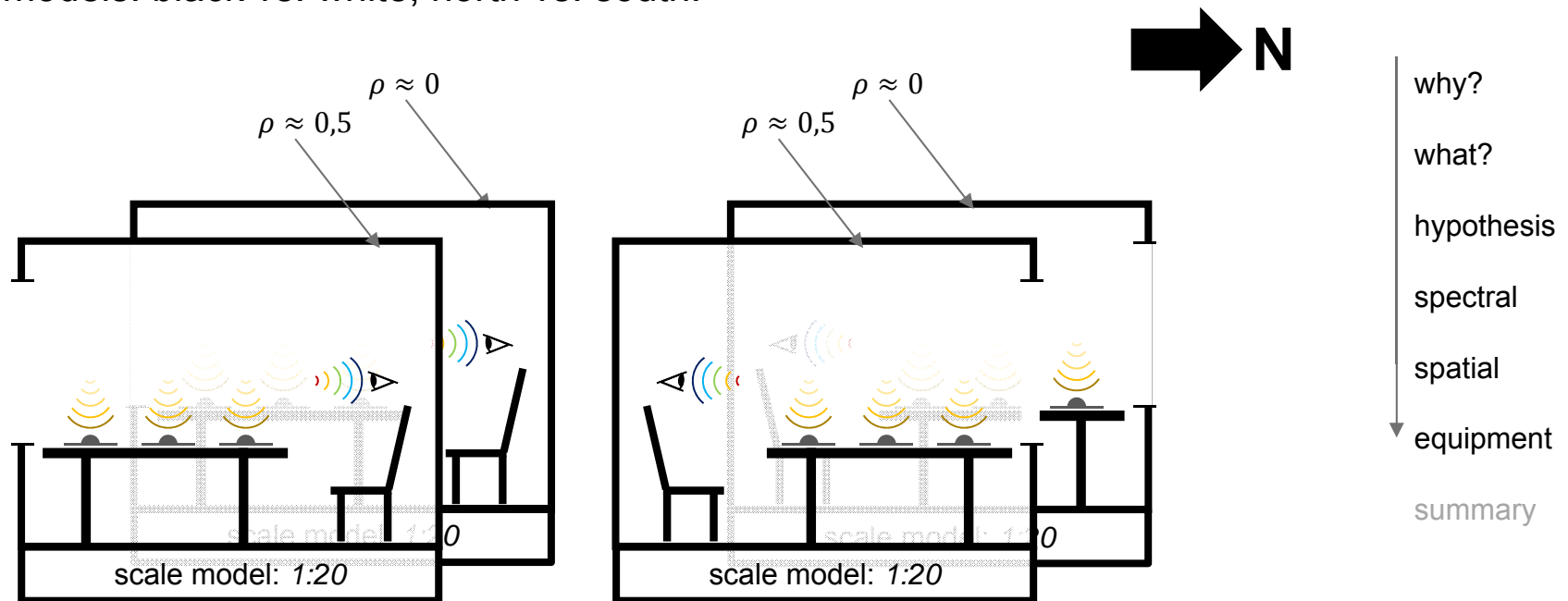
different spatial
resolutions



why?
what?
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spatial
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Scale Model Differences

4 models: black vs. white, north vs. south.



Equipment

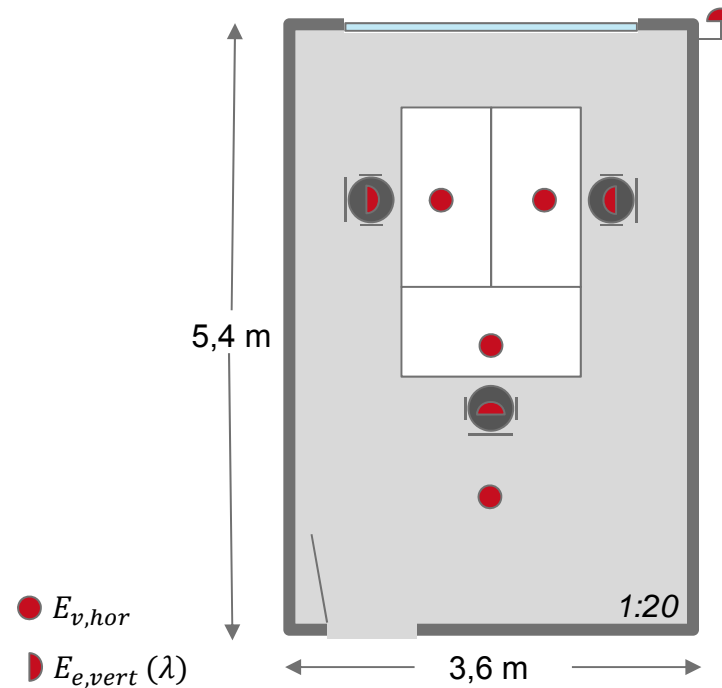
scale models (4x)

- 4x illuminance sensor $E_{v,hor}$
- 3x rgb sensor $E_{e,vert}(\lambda)$

roof & façade

- 3x rgb sensor
- north façade
- south façade
- roof (horizontal)

- 16x illuminance sensor
- 15x rgb sensor



why?
what?
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spectral
spatial
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Summary

Development of a simplified daylight sensor

1. spectral measurement replaced by rgb sensors [CIE 15:2004]
2. spatial resolution optimized (theoretical)
by clustering of measured sky patches
3. verification with measured target figures
in four scale models
4. prototype

why?

what?

hypothesis

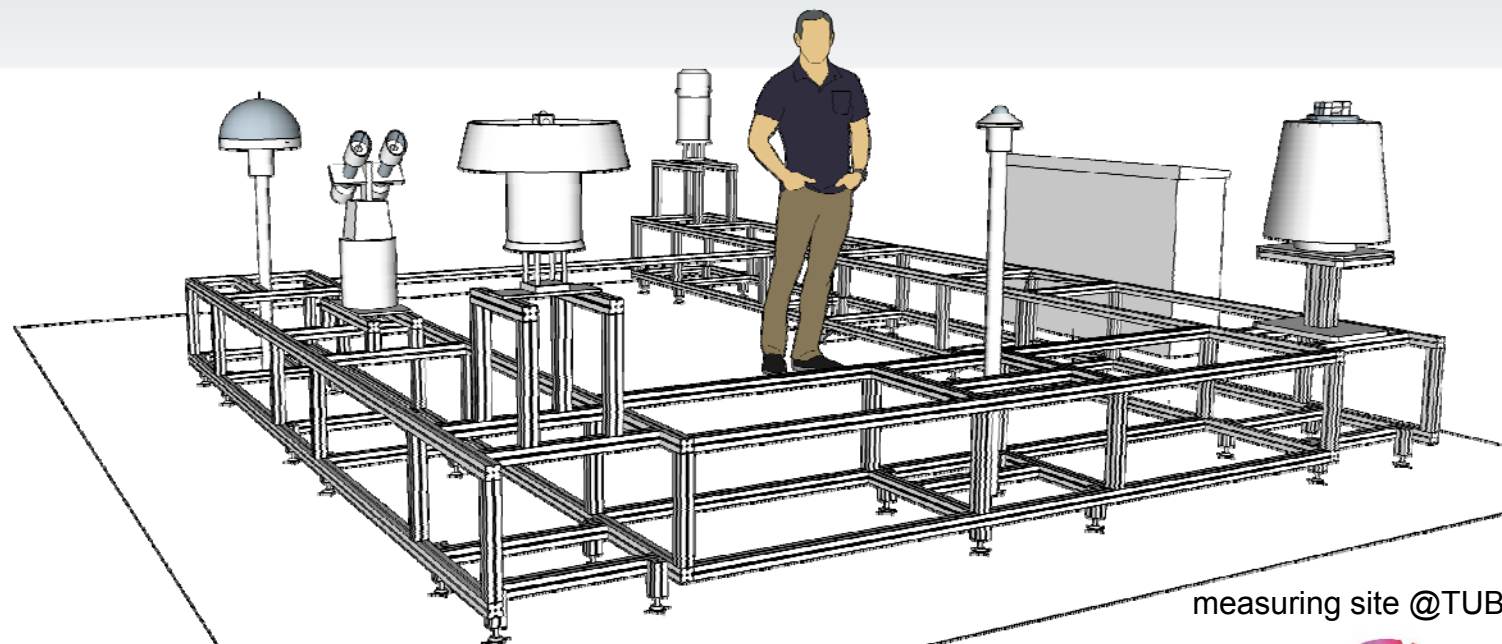
spectral

spatial

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Thank You



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