

Simulation Study of Daylight in Office Buildings Situated in the Southern Part of Poland as a Way of Achieving Energy Savings and Sustainable Development of Built Environment

PolSCA Meeting: "Sustainable Lifestyles and Green
Economy. Post Carbon Cities in Europe"

23 October 2012, Brussels, Belgium

D.Masly, Ph.D. Eng. Arch.



STRUCTURE OF PRESENTATION

- introduction - the high performance office building of the XXI century
- part I: the analysis of the influence of various architectural solutions on daylight availability
- part II: the comprehensive analysis of lighting conditions throughout the year for selected architectural solutions used in an example office building
- the research outcomes





Today we are surrounded by glass,
high-rise, air-conditioned offices



A new model of sustainable development is based on:



[źródło: Navitas Park, Kjaer & Richter Architects, 2010, www.archdaily.com]

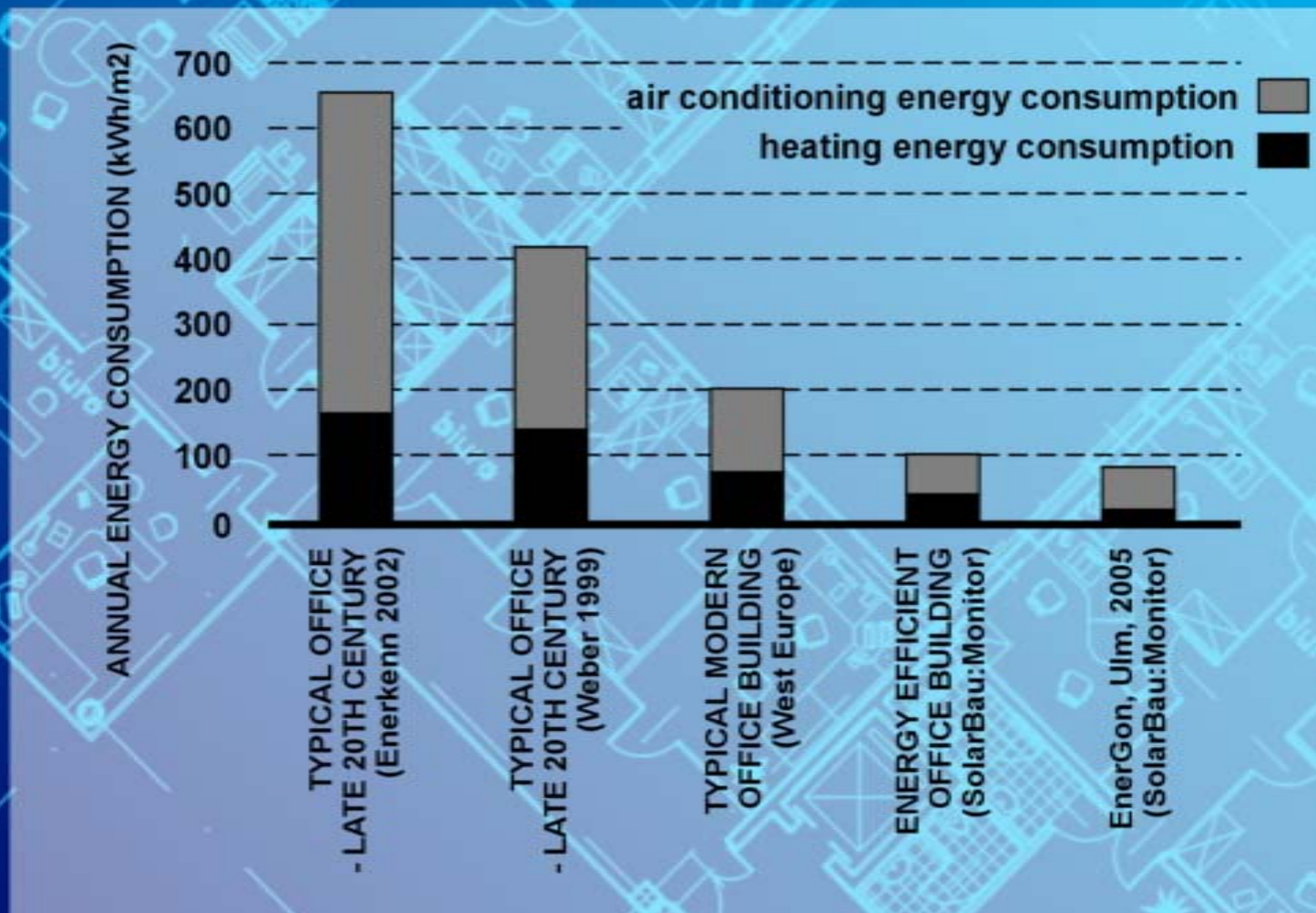
- **reducing energy demand**
- **improving building performance and process**





Energy-efficiency

The annual HVAC energy consumption



Energy-efficiency

**EnerGon, Ulm
(Germany)
81 kWh/m²**



[www.energon-ulm.de]

**Manitoba Hydro Place
(Canada)
100 kWh/m²**



[Manitoba Hydro, KPMB Architects, 2009]



State-of-the-art, highly efficient offices

are extended along the east-west axis, then it is much easier to manage heat gain and daylighting

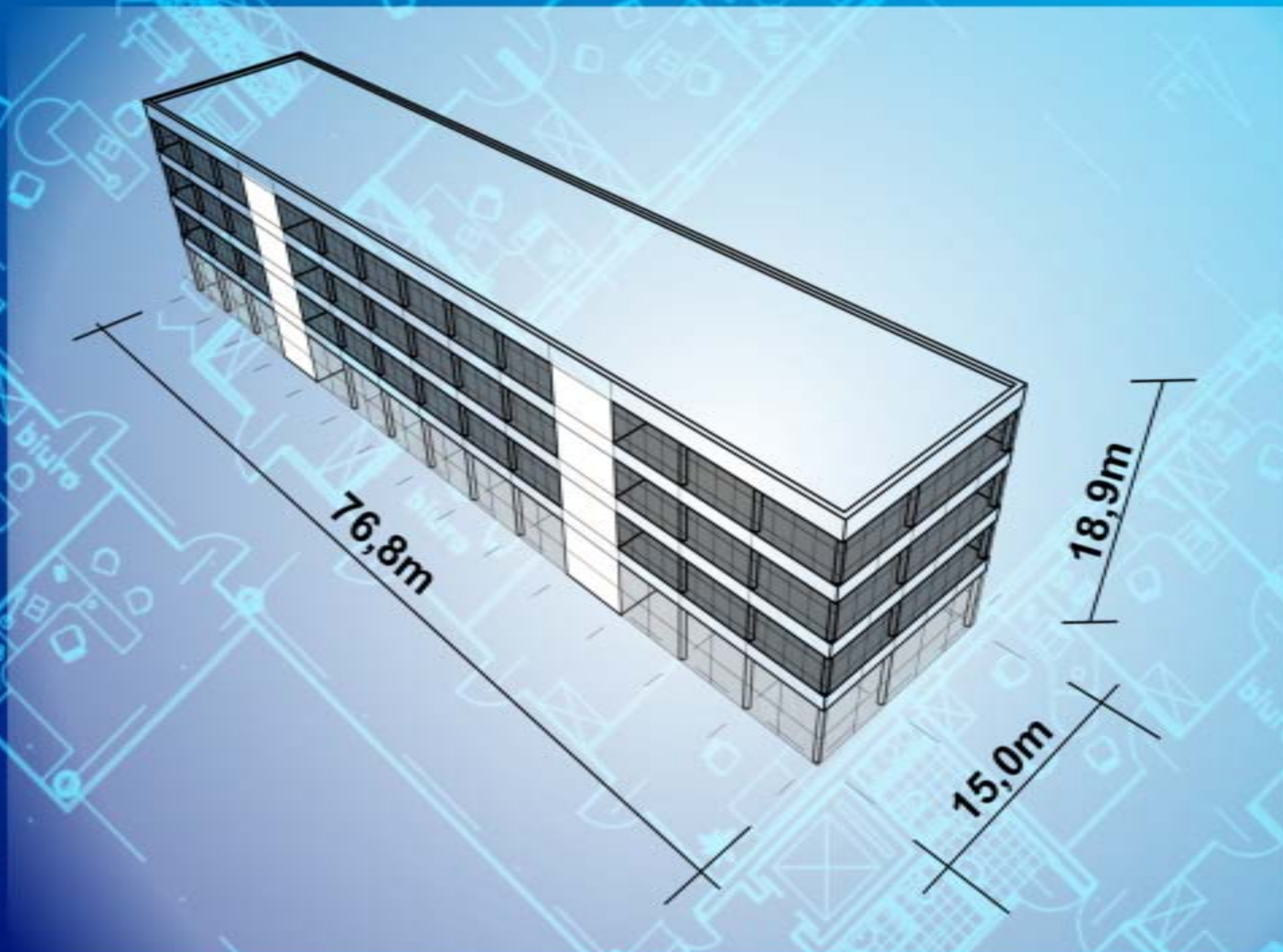


SOKA BAU, Wiesbaden, Germany



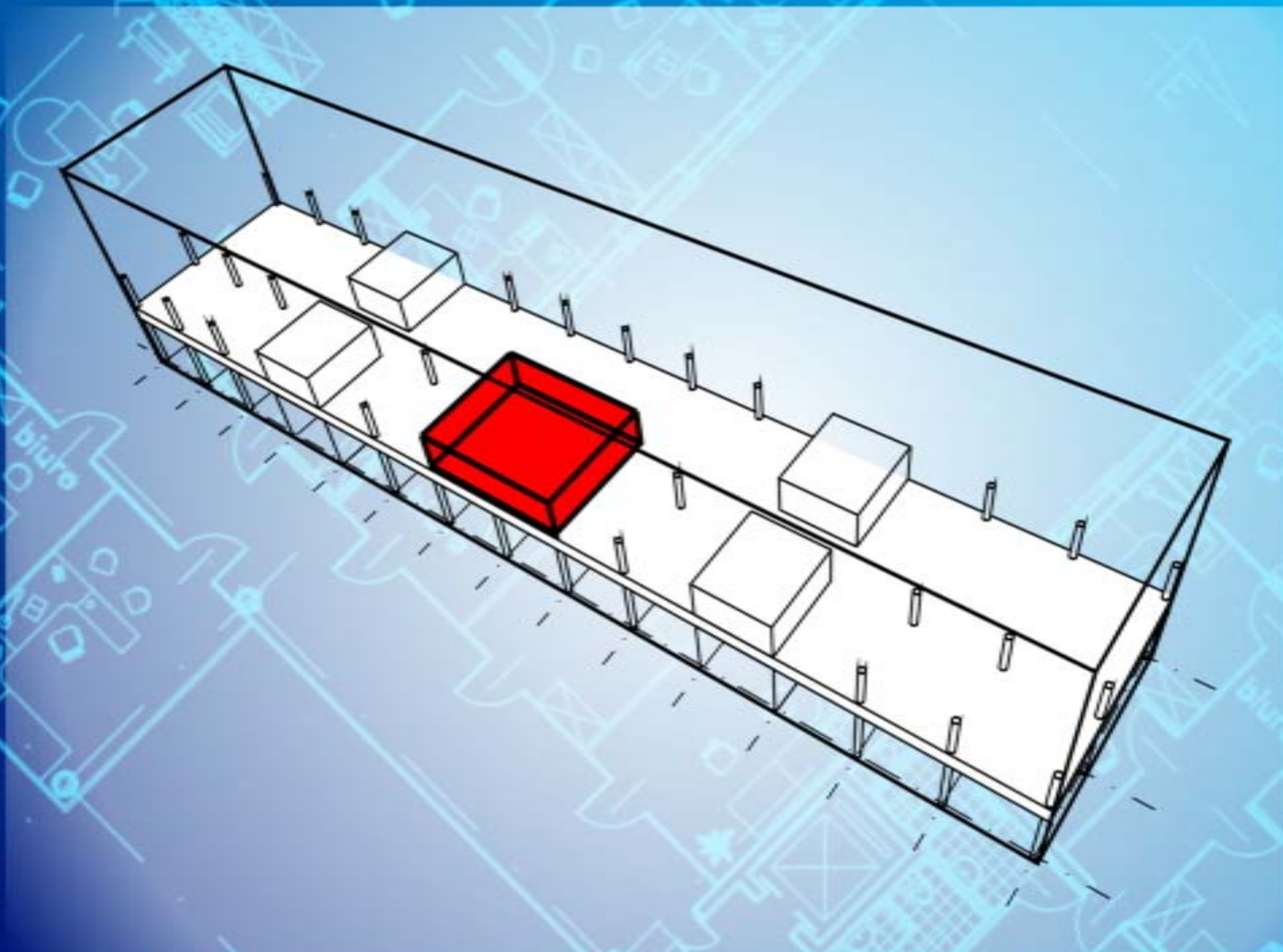


Office building designed for the analysis



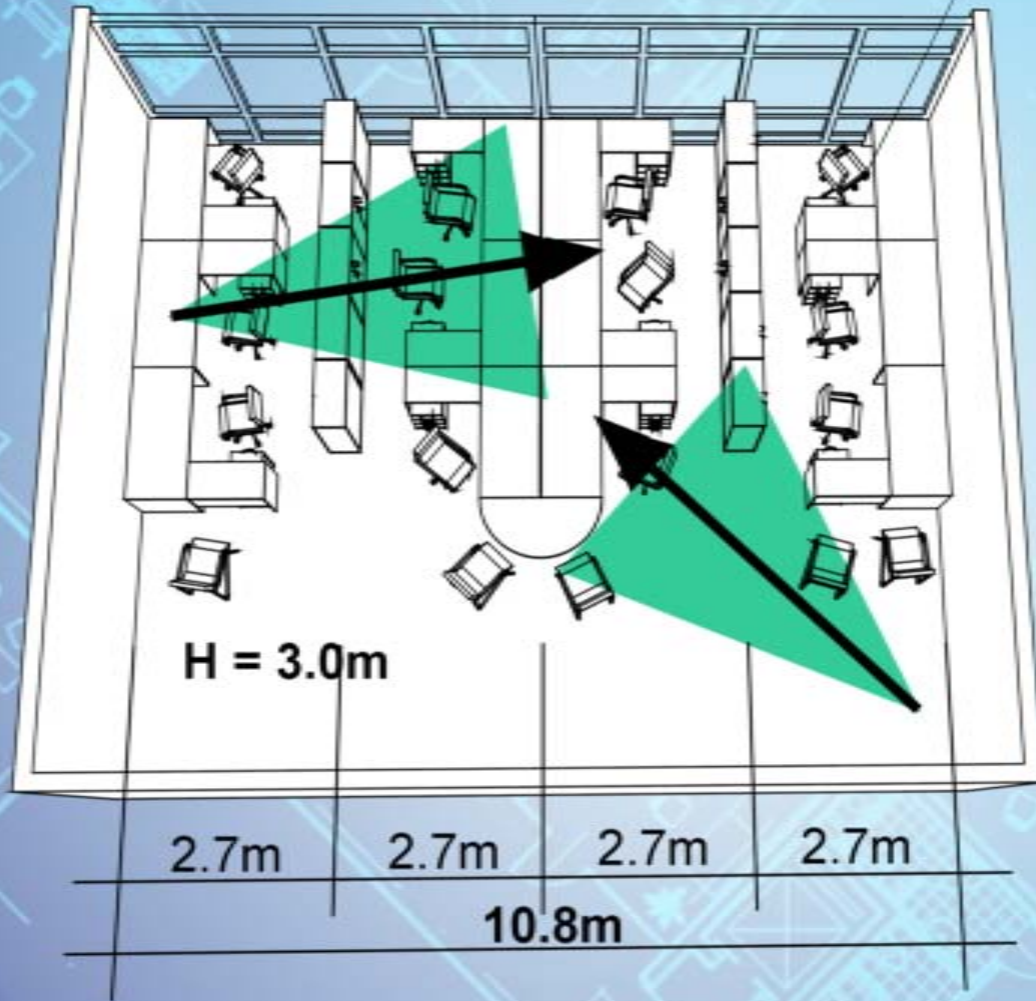


Analysed floor area - location

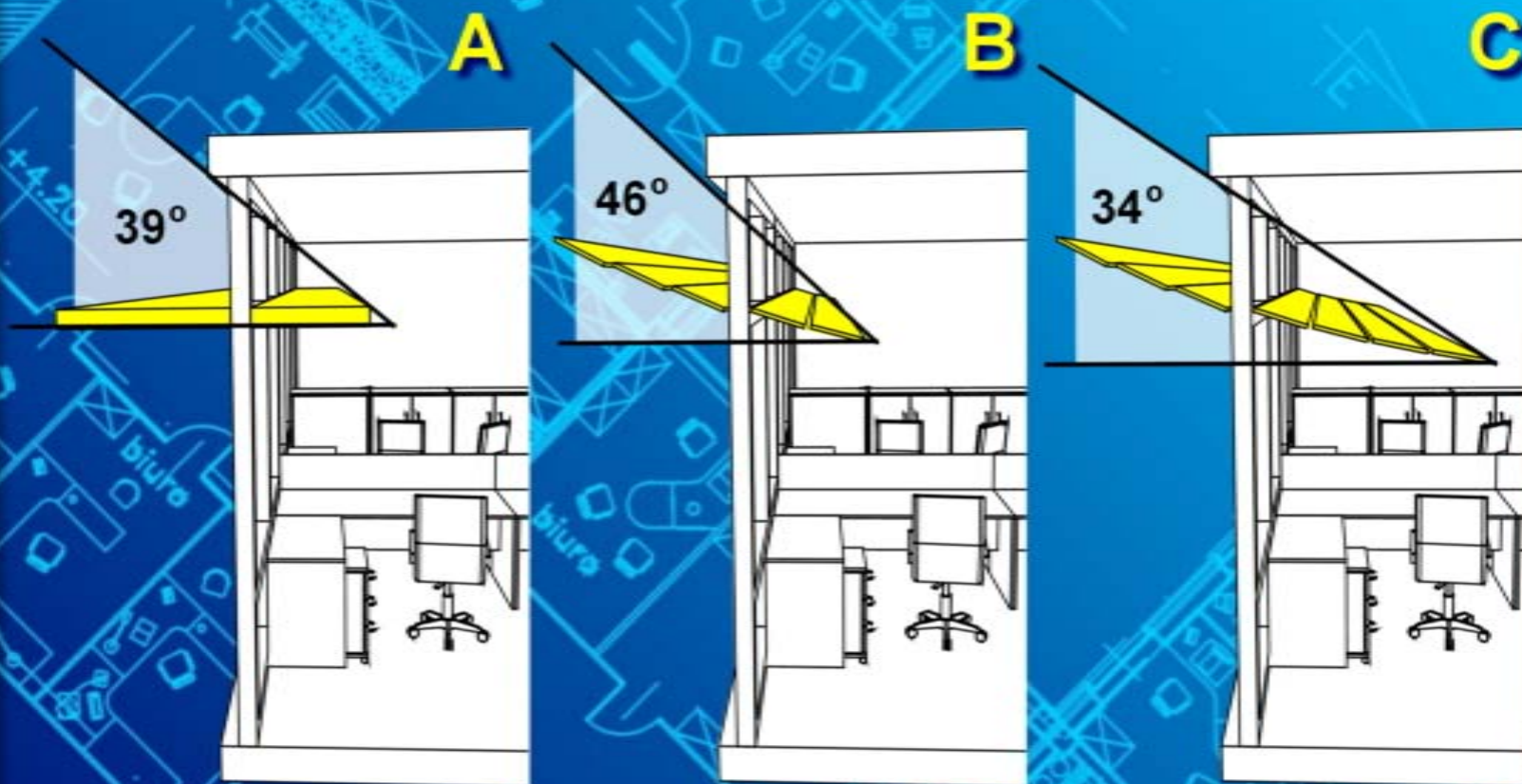




Analysed floor area - details



Part I: Daylight Factor - lightshelves



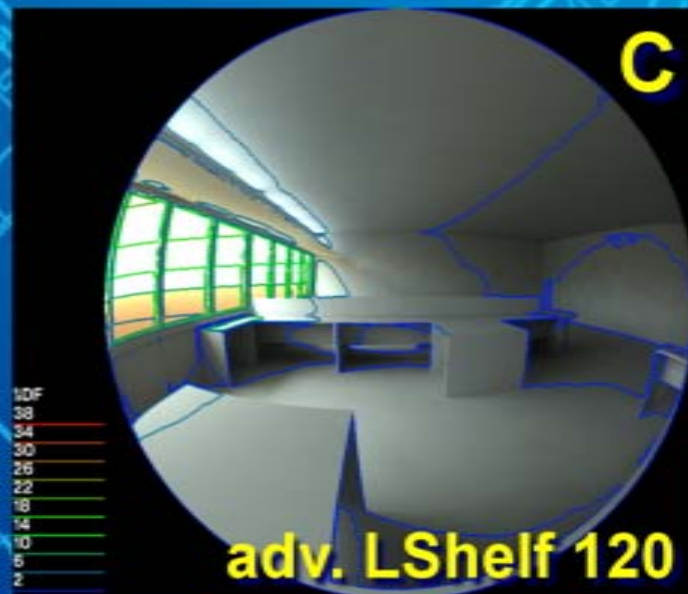
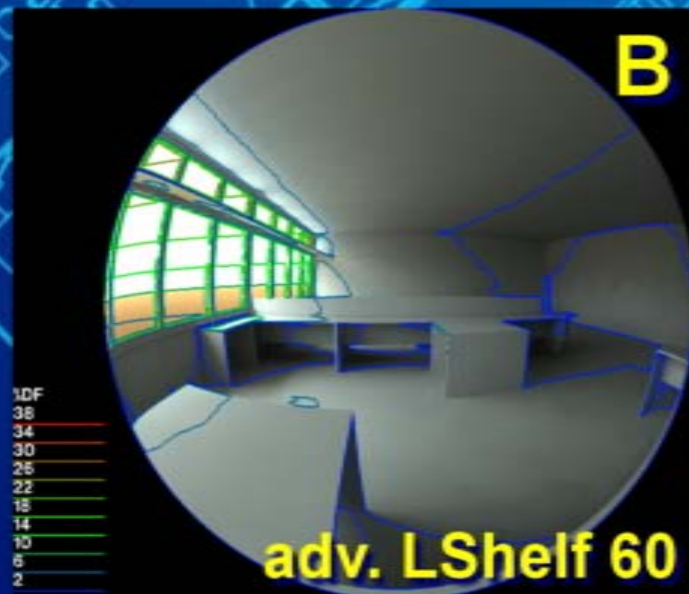
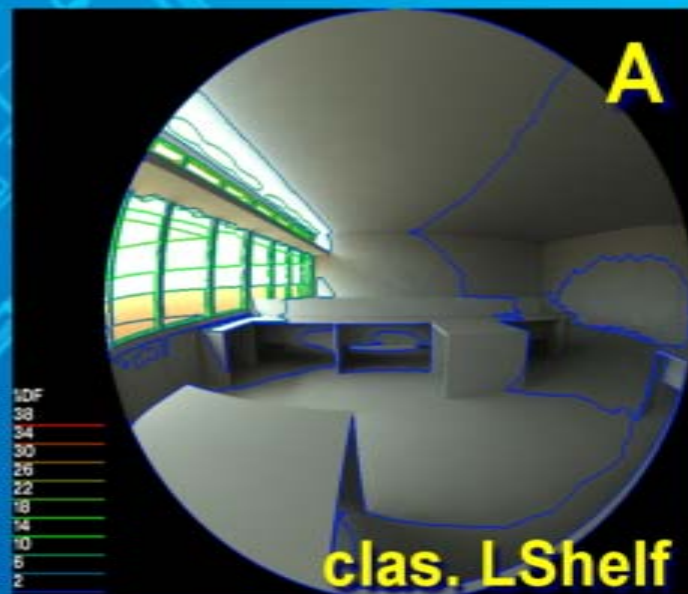
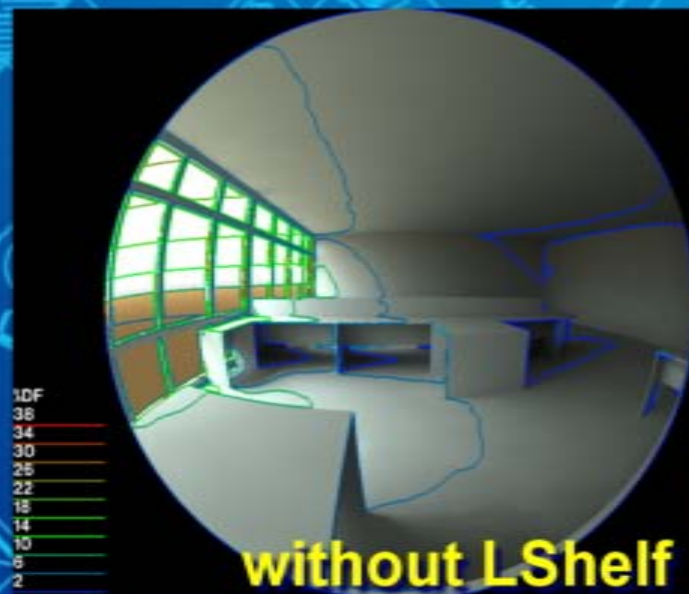
**classic
lightshelf**

**advanced
lightshelf 60**

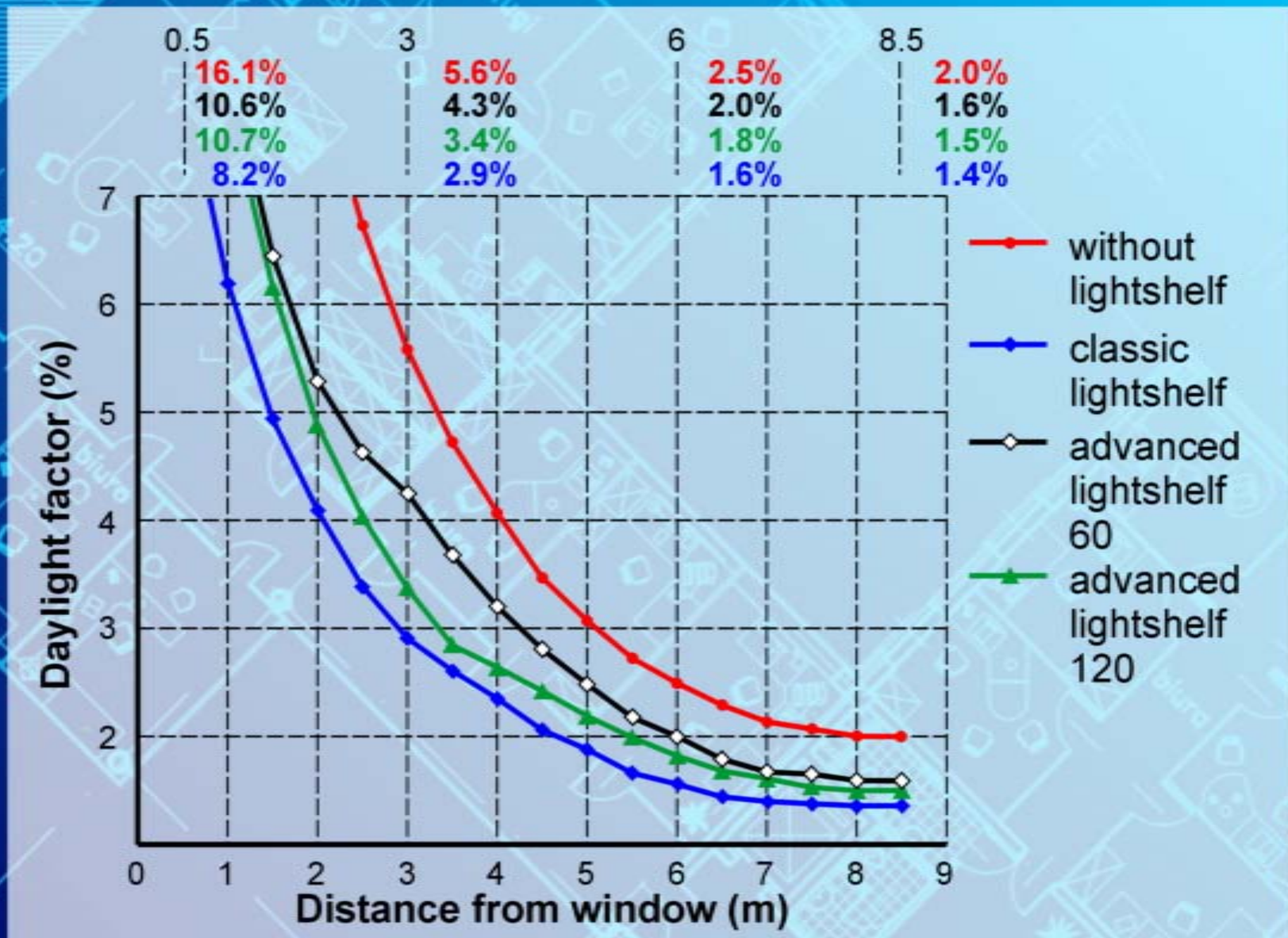
**advanced
lightshelf 120**



Part I: Daylight Factor - lightshelves

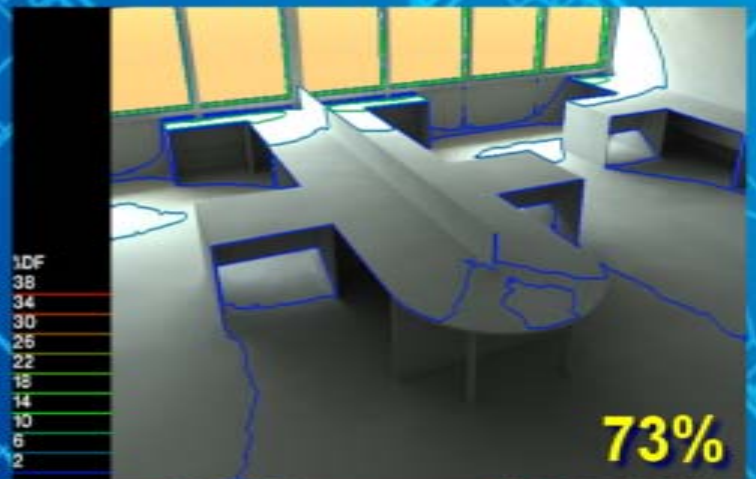
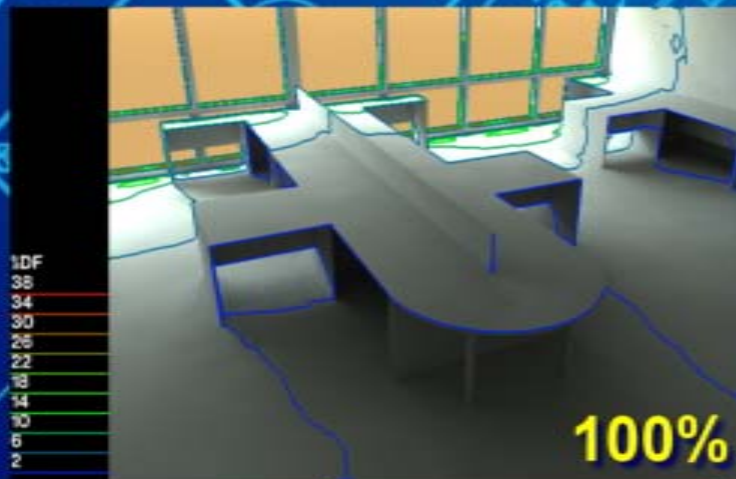
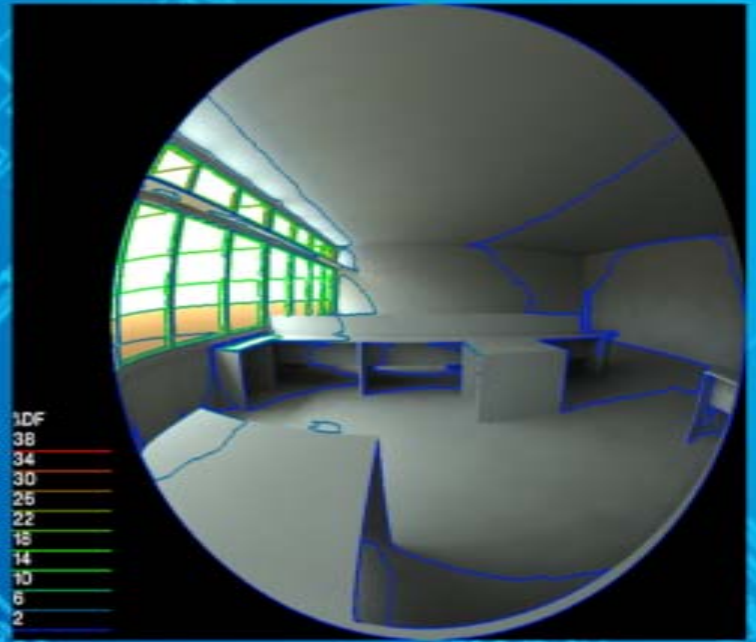
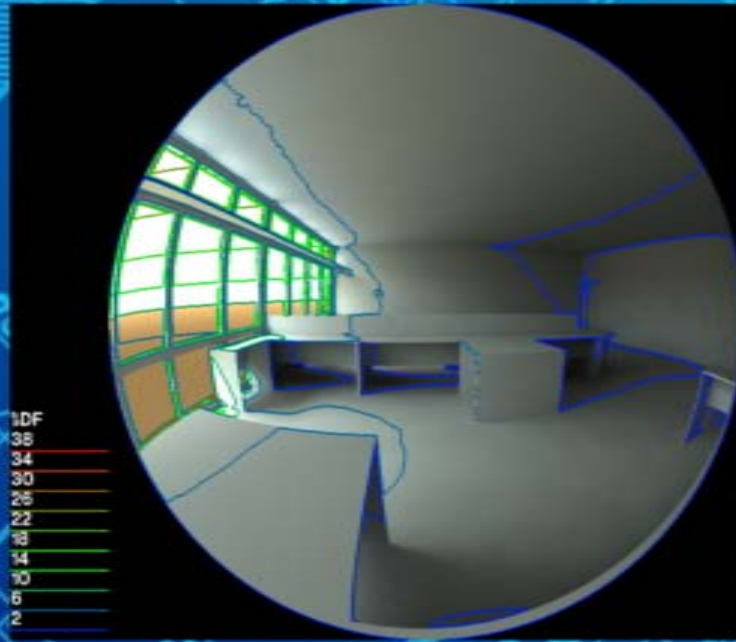


Part I: Daylight Factor - lightshelves



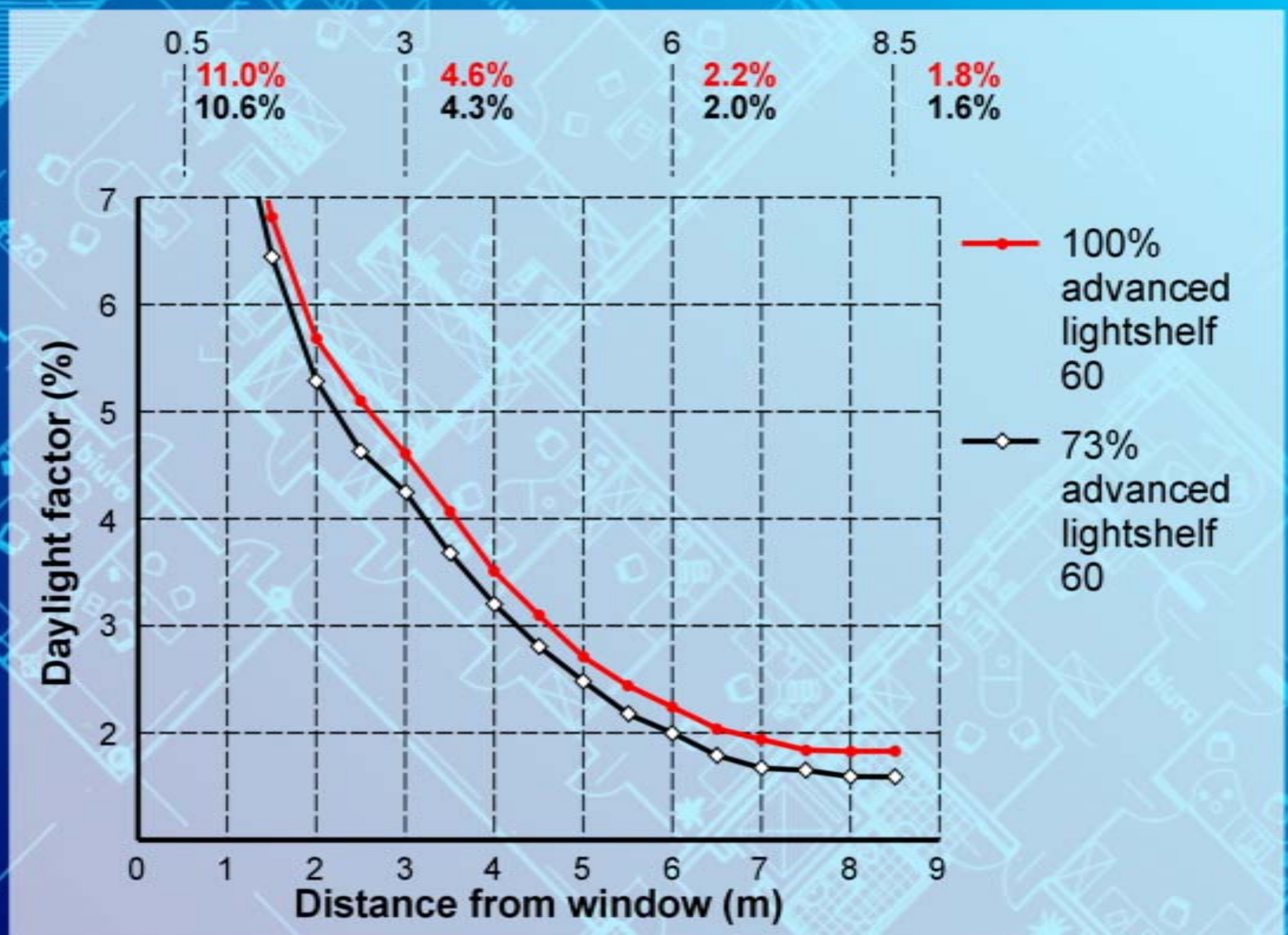


Part I: DF - glass area of the facade



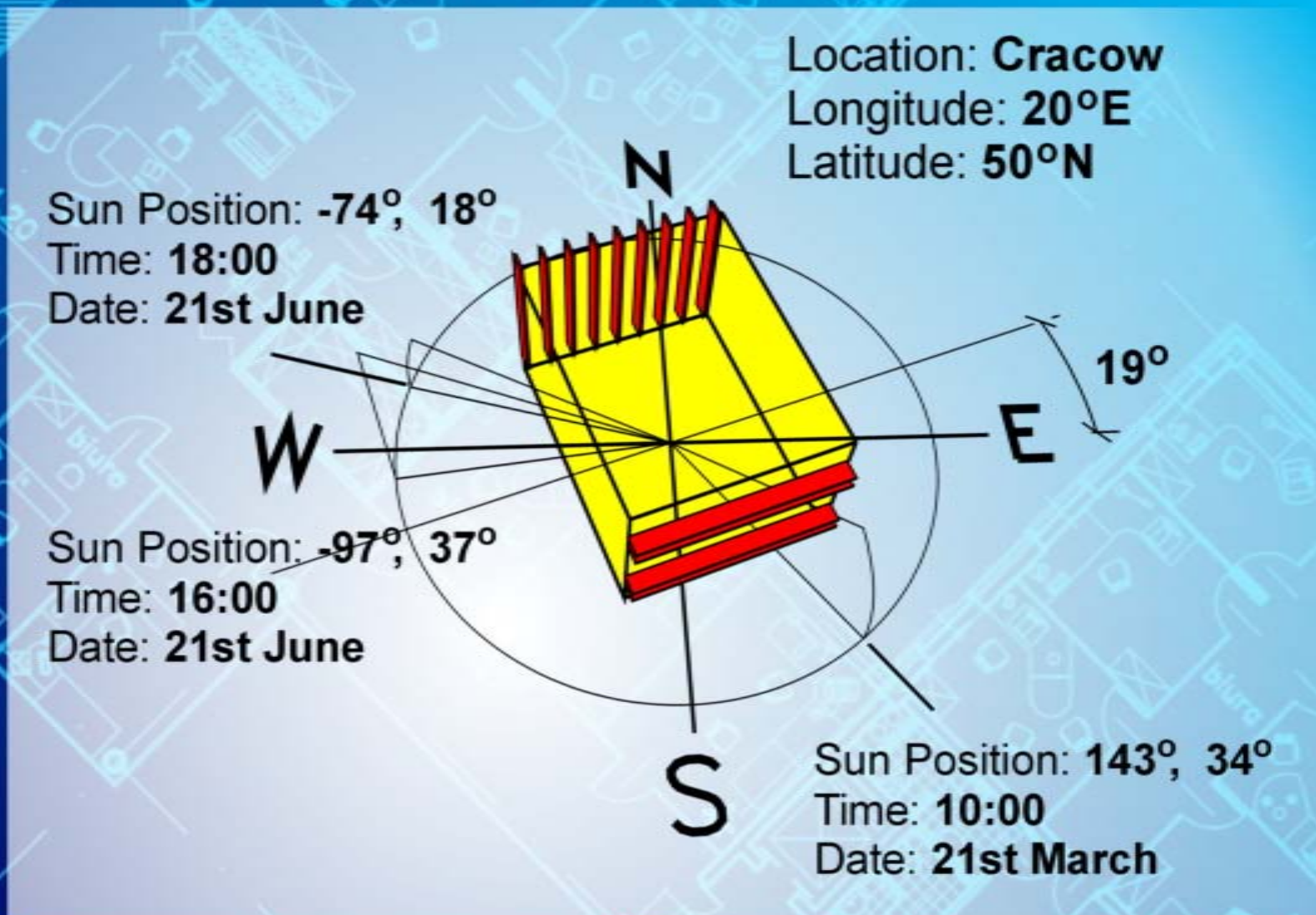


Part I: DF - glass area of the facade





Part II: analysed building's orientation



Part II: view of room without shading



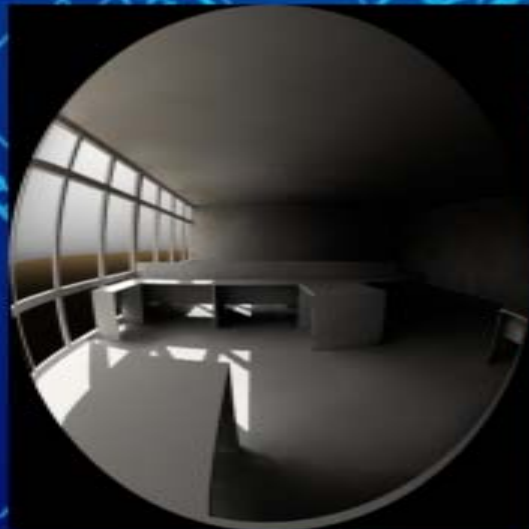
8:00



10:00



12:00



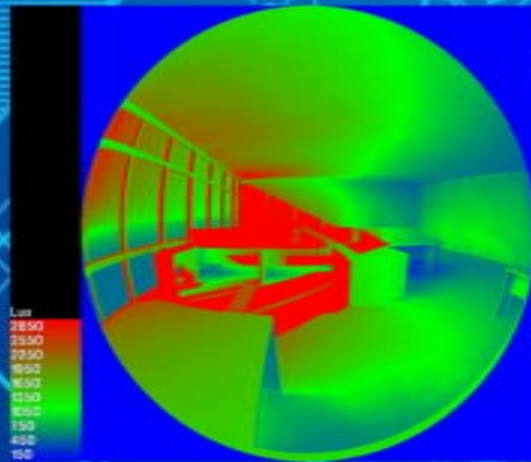
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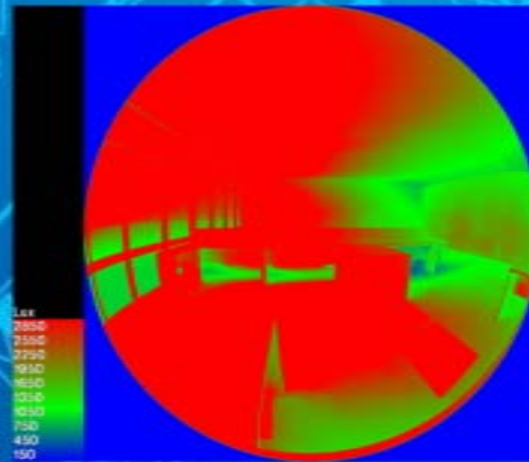
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March 21st

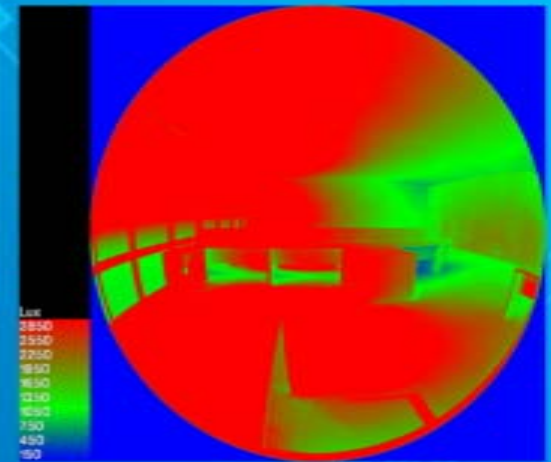
Part II: view of room without shading



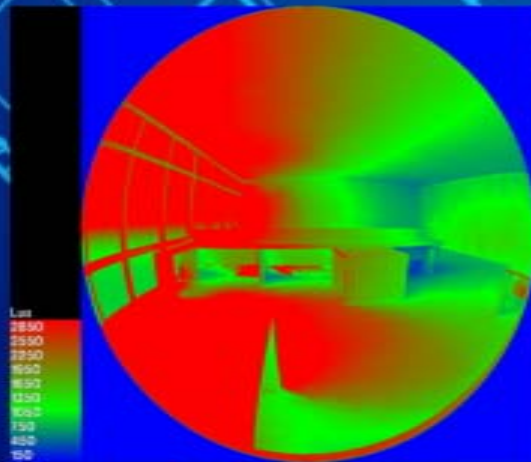
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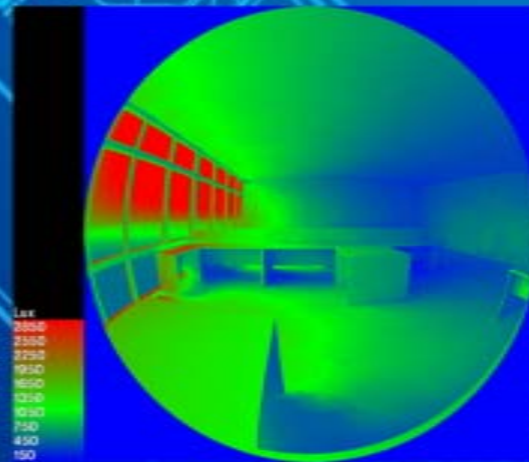
10:00



12:00



14:00



16:00

March 21st



Part II: shading devices



A

fixed horizontal shading + classic lightshelf



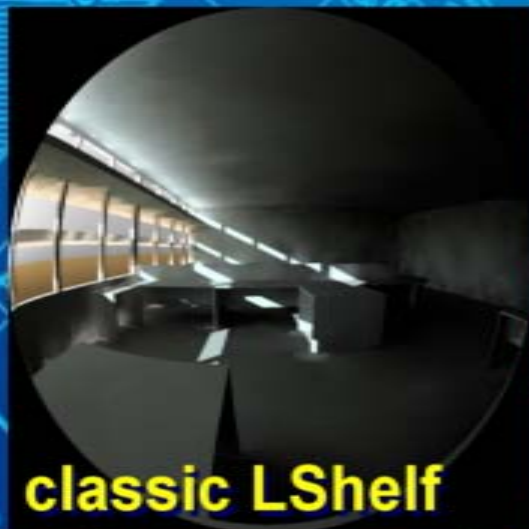
B

fixed horizontal shading + adv. lightshelf 120



Part II: performance of louvers

March 21st



classic LShelf

8:00



adv. LShelf 120



classic LShelf

10:00

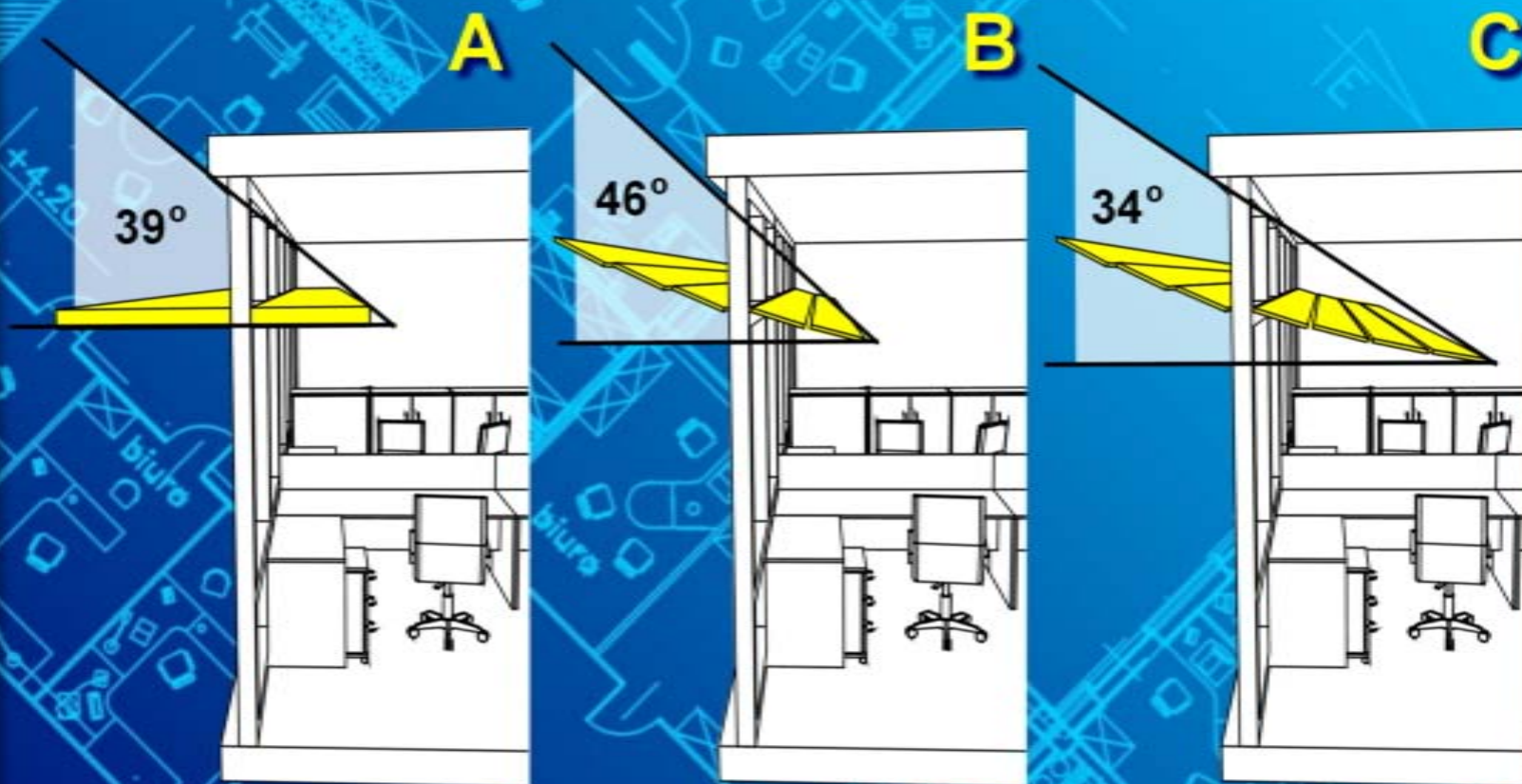


adv. LShelf 120



adv. LShelf 60

Part I: Daylight Factor - lightshelves



**classic
lightshelf**

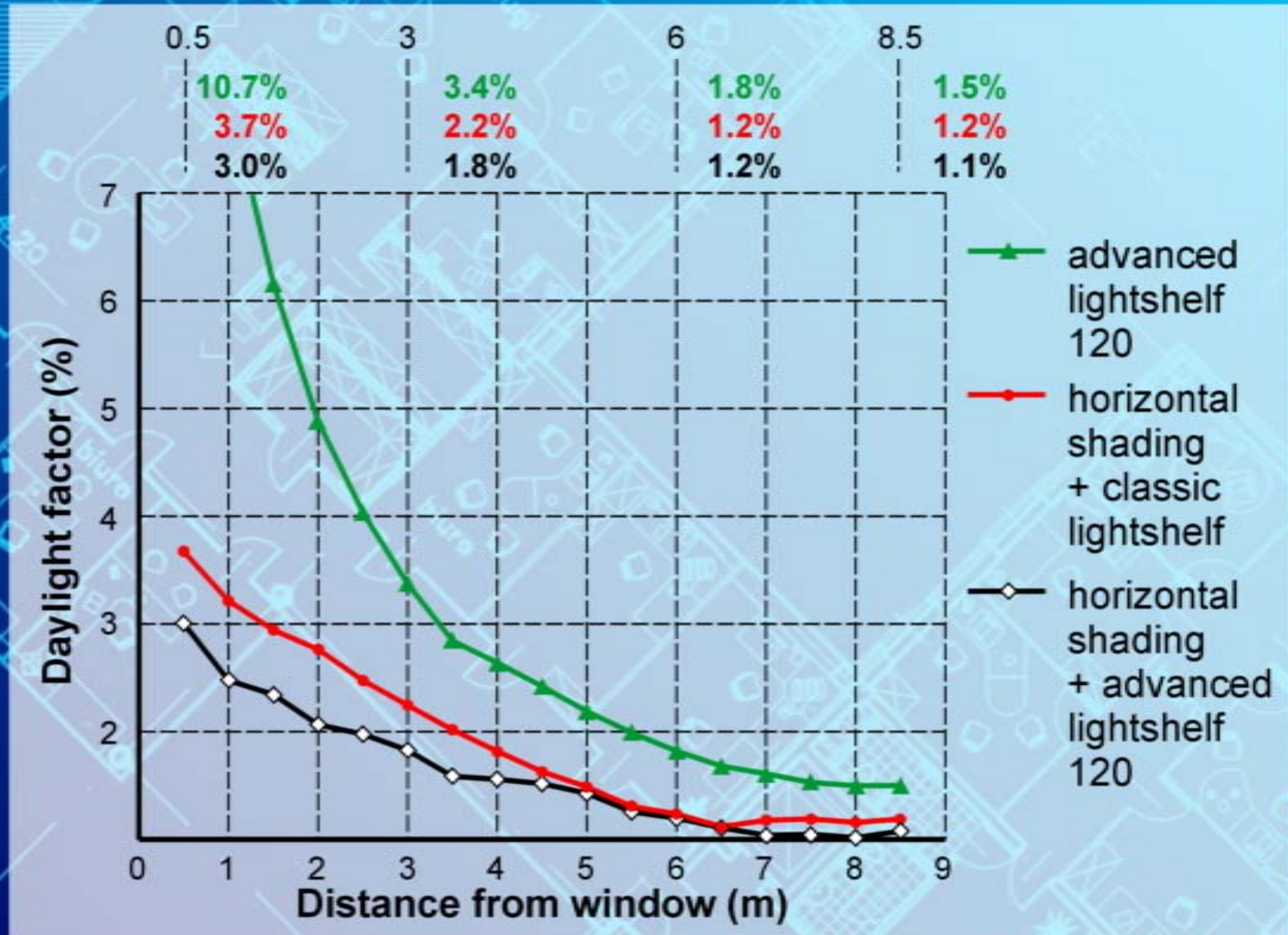
**advanced
lightshelf 60**

**advanced
lightshelf 120**





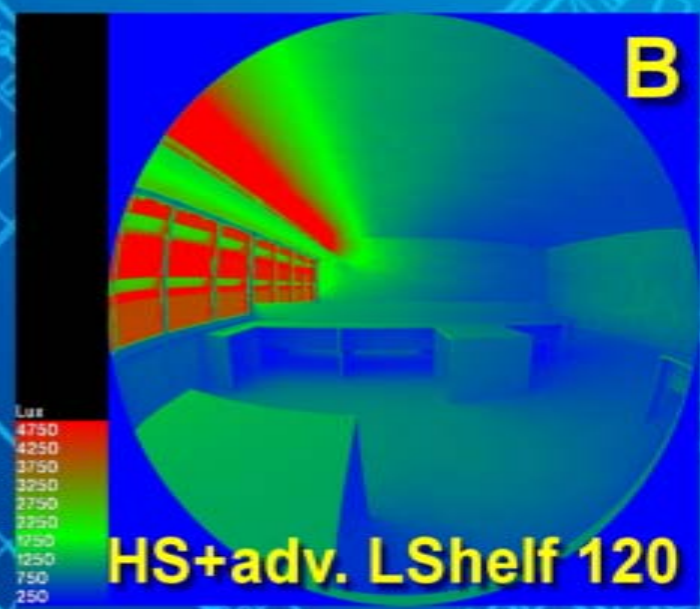
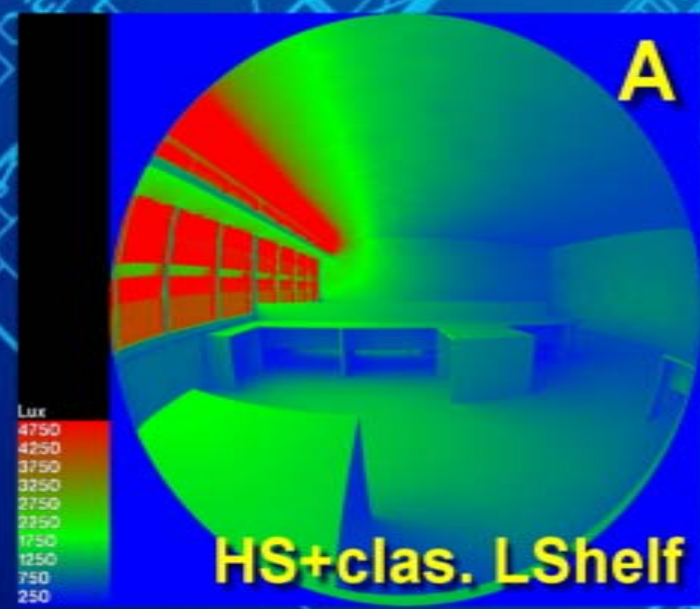
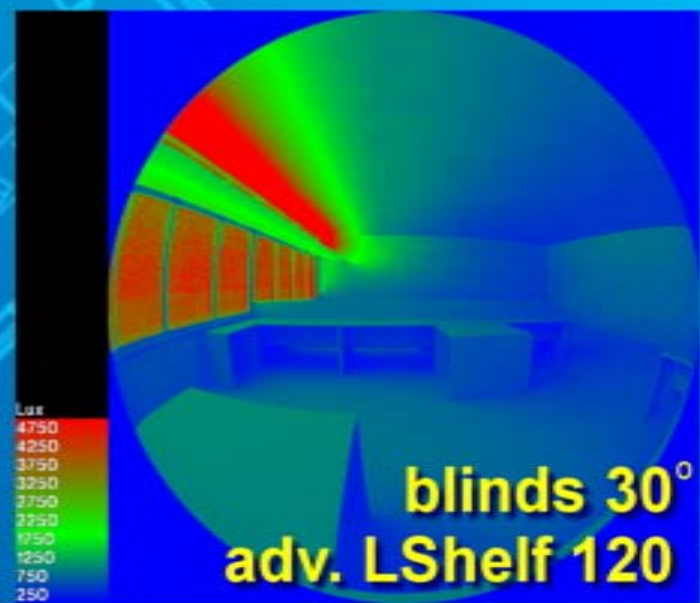
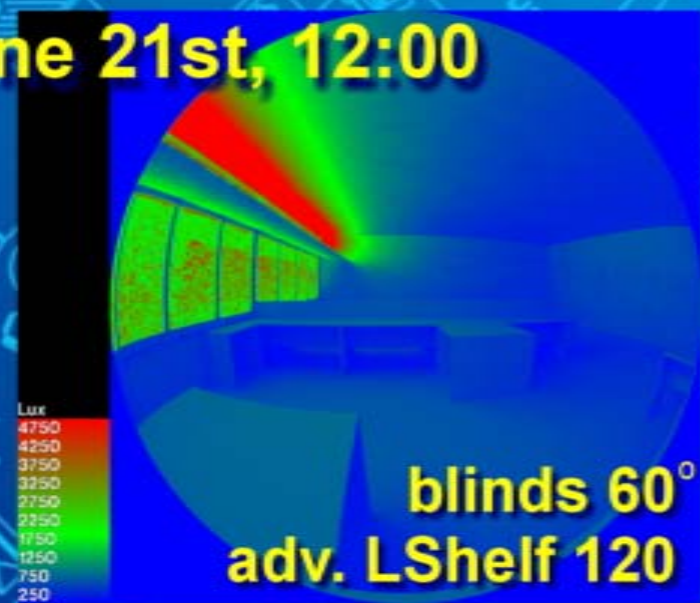
Part II: DF - shading devices





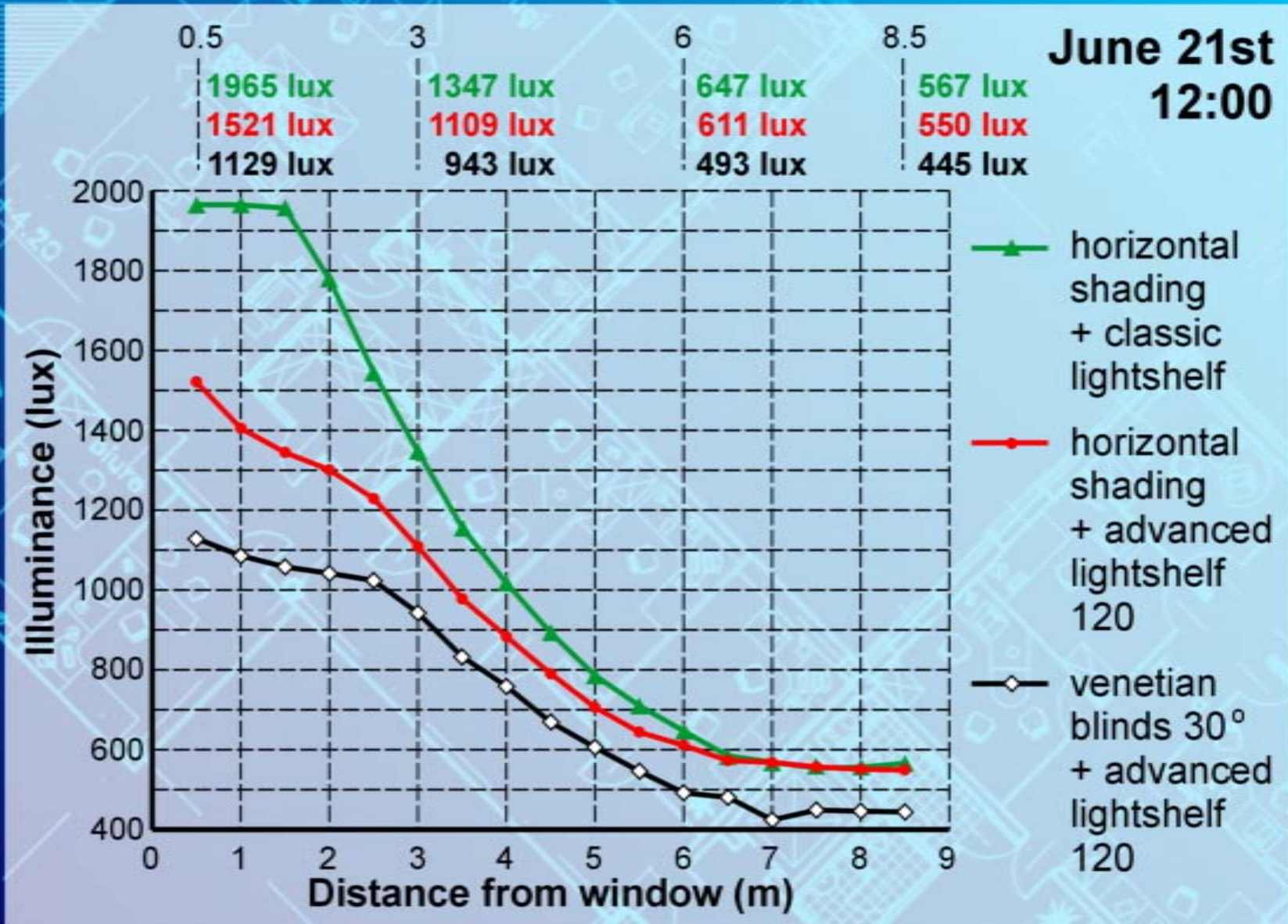
Part II: illuminance at summer solstice

June 21st, 12:00



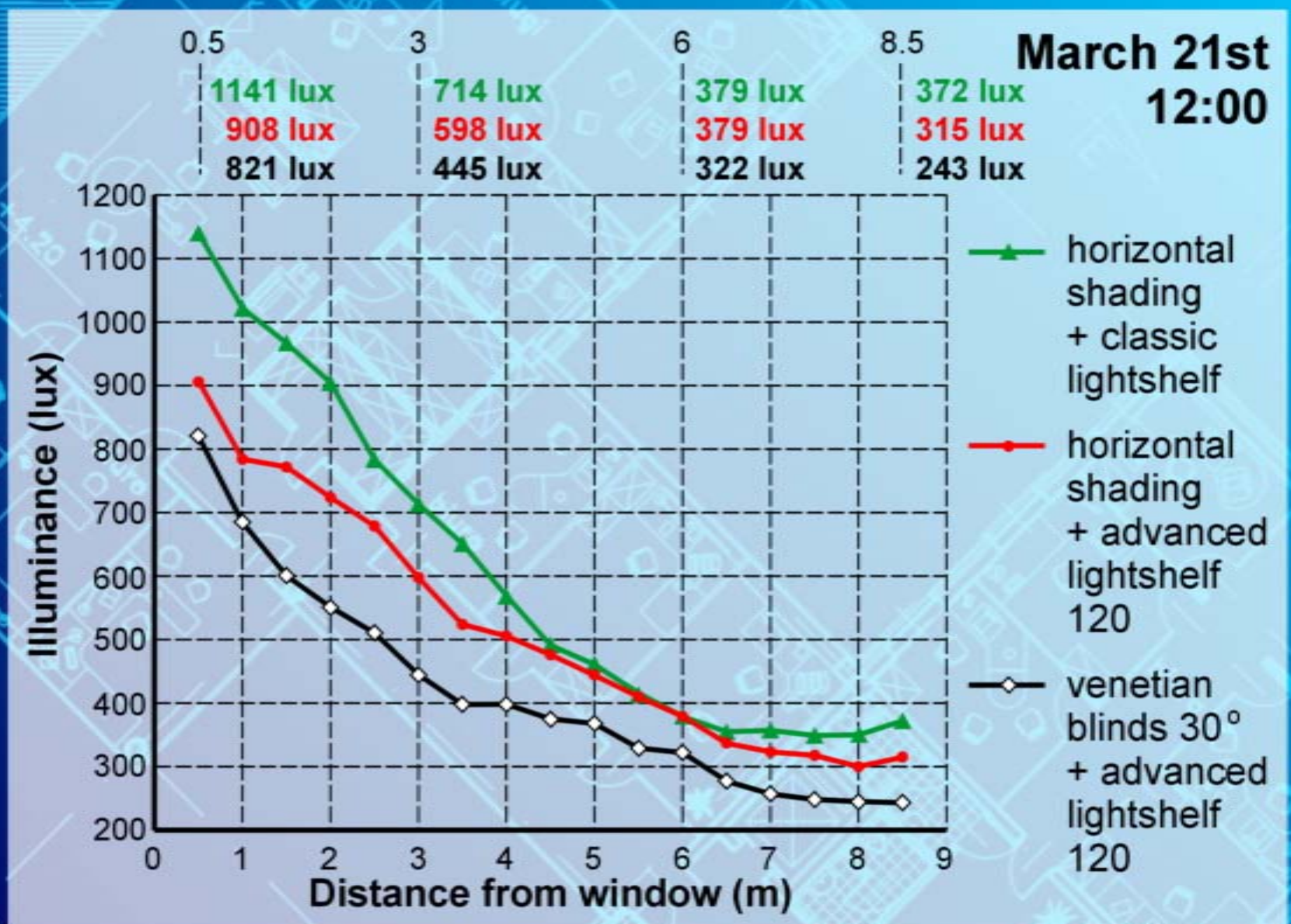


Part II: illuminance at summer solstice



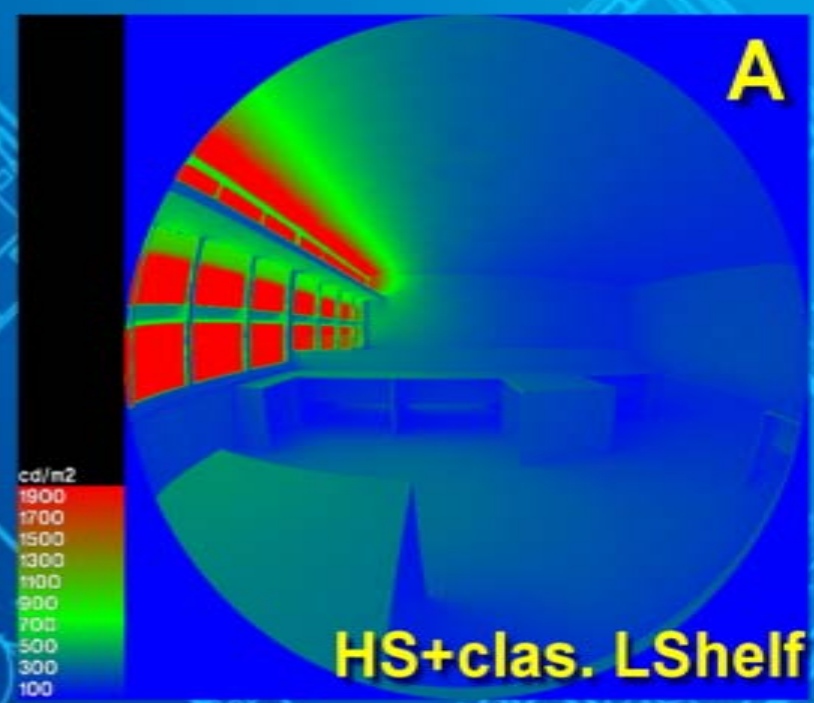
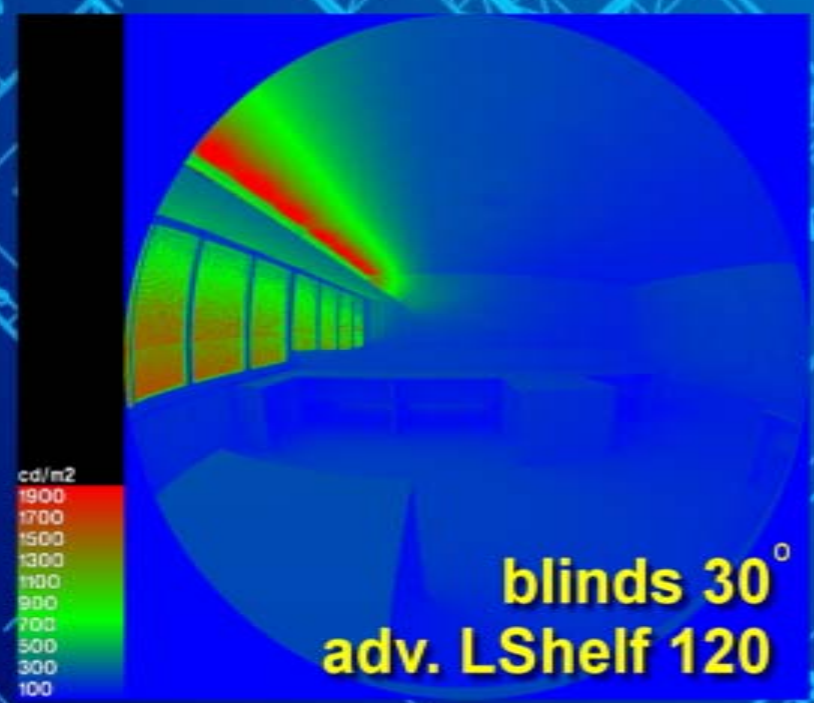
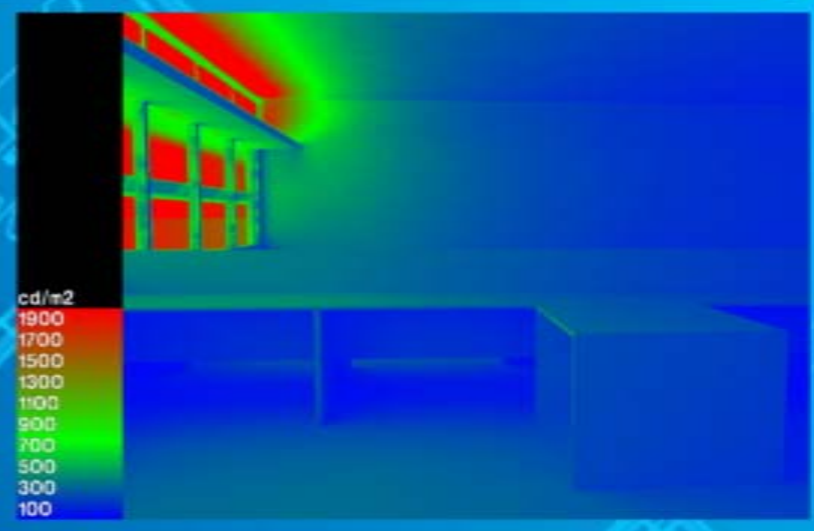
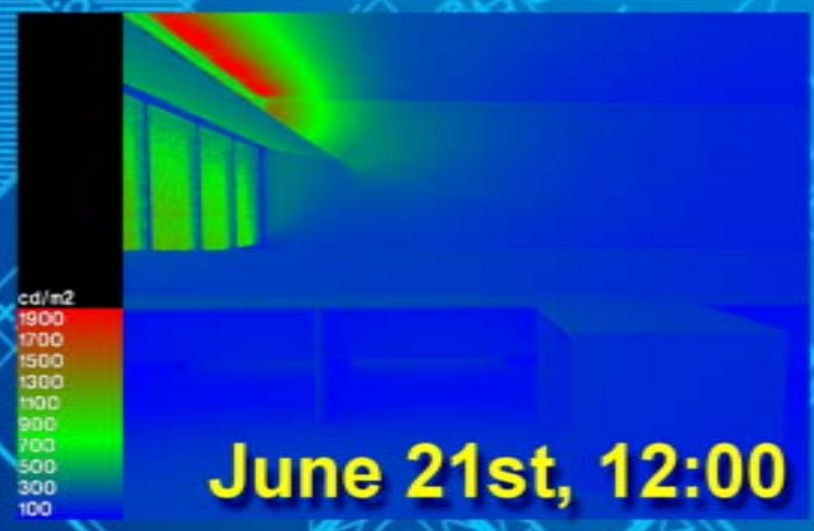


Part II: illuminance at equinox





Part II: luminance at summer solstice





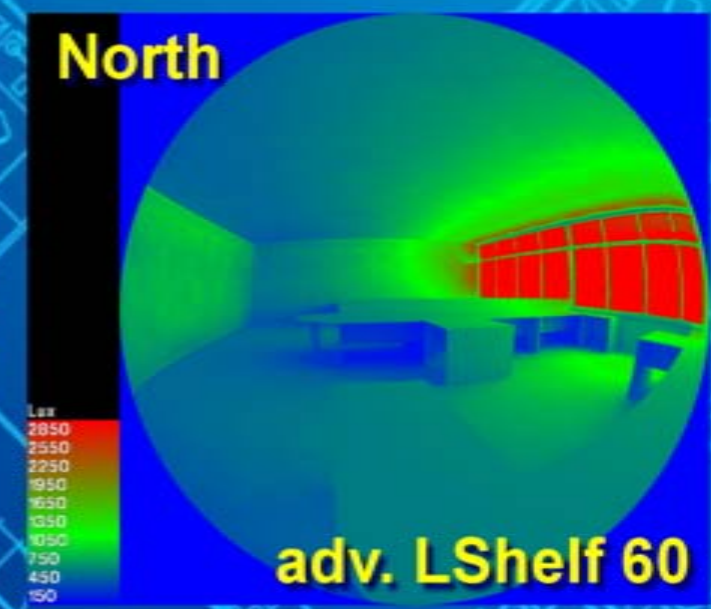
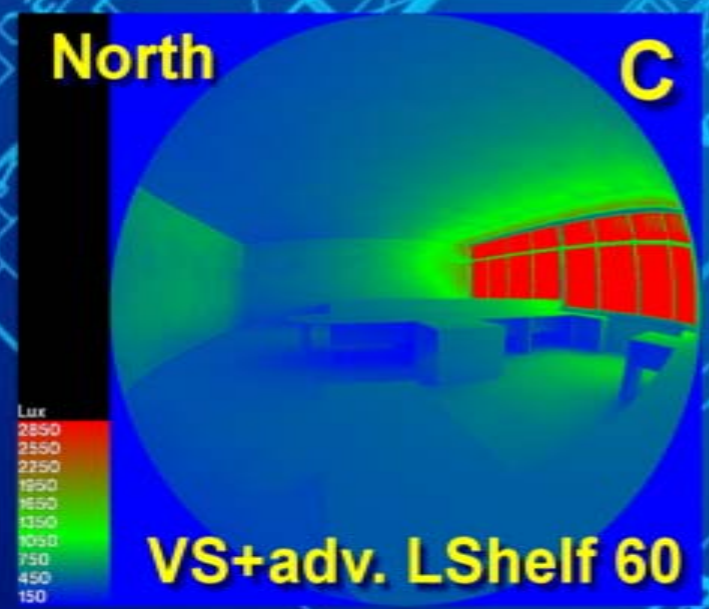
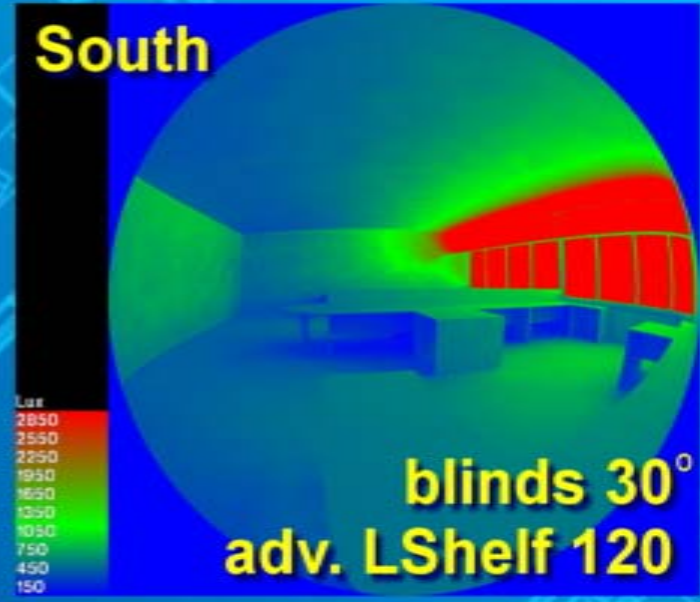
CONCLUSIONS

- various light shelves which relate to building orientation should be taken into consideration
- the use of exterior automated retractable venetian blinds appears to be the most promising strategy for offices in Poland, but its success depends on occupant behaviour and automated systems' efficiency
- window to wall ratio: glazing from table height up to a suspended ceiling is the best solution
- it is much easier to manage heat gain and daylighting when a building is extended along the east-west axis, the lighting conditions inside an office are equally good on south and north side



Part II: illuminance at summer solstice

June 21st, 12:00



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