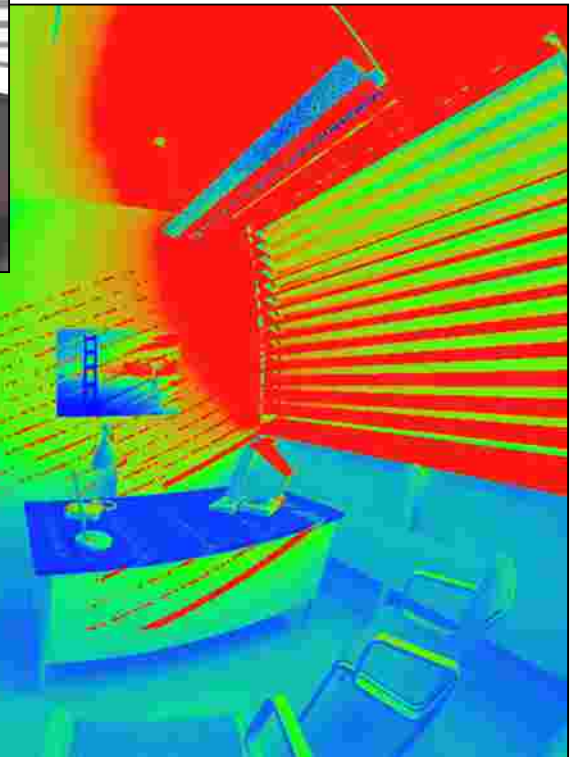




DELiNE

Lighting design
& analysis tool

Advanced Day- and Electric Lighting Integrated New Environment



cd/m²
468.75
406.25
343.75
281.25
218.75
156.25
93.75
31.25



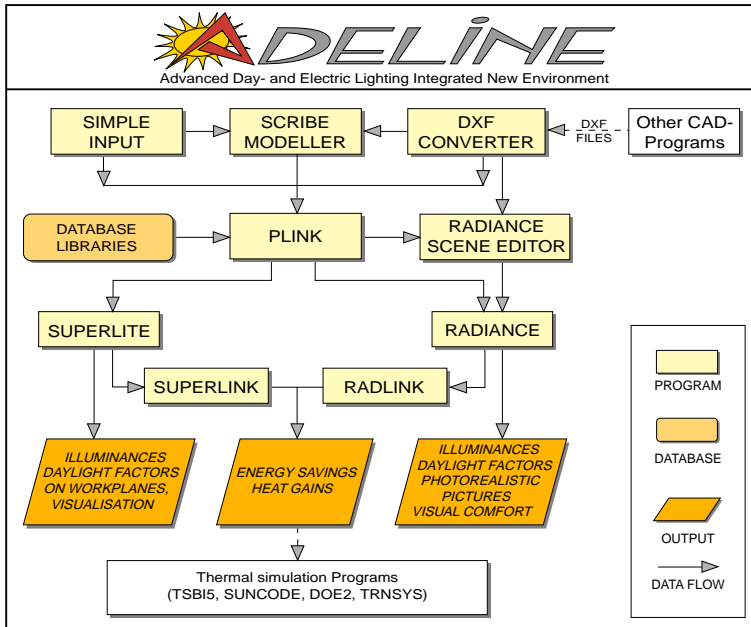
INTERNATIONAL ENERGY AGENCY
Solar Heating & Cooling Programme

INTERNATIONAL ENERGY AGENCY

Energy Conservation in
Buildings & Community
Systems Programme



GENERAL DESCRIPTION



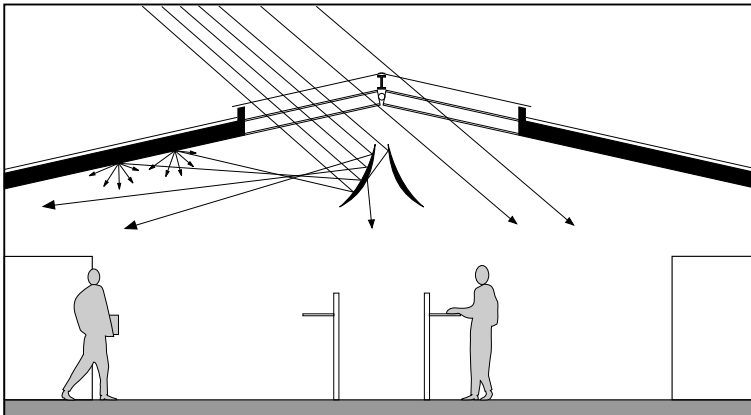
ADELINE is an integrated lighting design computer tool that provides architects and engineers with accurate information about the behaviour and the performance of indoor lighting systems.

Both natural and artificial lighting problems can be solved in simple rooms or the most complex spaces.

ADELINE produces innovative and reliable lighting design results by processing a variety of data (including: geometric, photometric, climatic, optic and human response) to perform light simulations and to produce comprehensive numeric and graphic information.

The process of day- and artificial lighting design can be divided into the successive phases that are described in the following sections.

1 DEFINITION OF ARCHITECTURAL AND LIGHTING DESIGN OBJECTIVES



The initial phase consists in clearly defining the objectives to be implemented regarding the lighting strategy and the architectural purpose.

Until now, the "prediction" of light propagation into built spaces has been generally a matter of intuition.

The extreme complexity of the problems to be solved sometimes leads architects to rely on the great adaptability of electric lighting and to design buildings as if natural light did not even exist.

ADELINE allows designers to design and analyse strategies for natural light utilisation.

Using **ADELINE** in the early stages of the design process will not only improve the lighting performance of buildings, but will also lead to the production of better architecture and energy savings.

GEOMETRICAL INPUT USING THE "SCRIBE MODELLER"

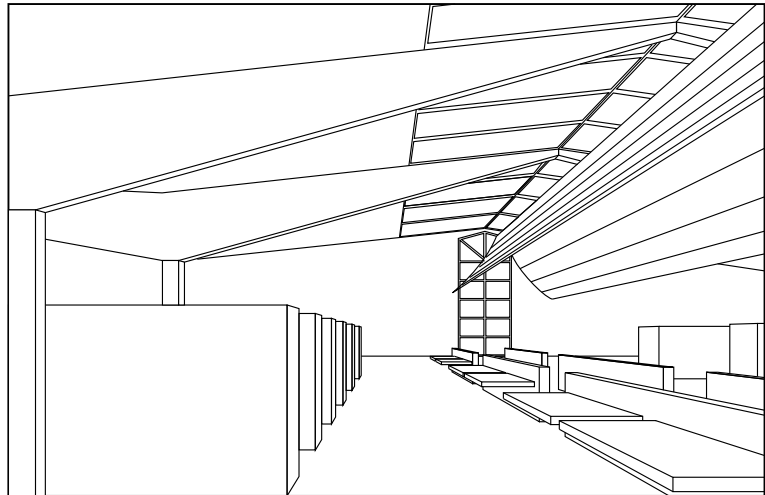
2a

After defining the architectural and design objectives, the next stage consists in developing a numerical model of the building to be analysed.

SCRIBE MODELLER is a micro computer-aided system for the modeling and evaluation of architectural designs, and the production of detailed two and three dimensional drawings.

It can be used to describe any kind of shape that can be defined by lines, edges, and planes around solids and planes.

Every component making up a model can have associated attributes such as absorption, reflectance, etc., linked directly or indirectly, which can be used later for calculation or simulation (light simulations, for example).



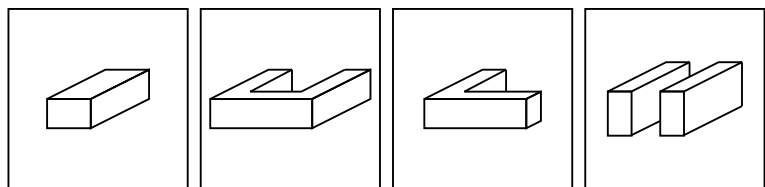
Early design phases account for the basic and often irreversible decisions concerning the daylight supply. The general floor layout, size and position of daylight openings decide whether daylight supply is sufficient or not. A tool to be used at this stage thus should allow for fast handling and quick access to the requested information while avoiding complex geometric modeling.

ADELINE supports a set of simple floorplan layouts, which rely only on parametric input.

Daylighting studies and design parameter variations can be performed in a fraction of the time usually required when applying CAD-tools. The parametrically defined layouts can be used within **ADELIN**E as starting point for more complex models.

GEOMETRICAL INPUT USING THE "SIMPLE INPUT"

2b

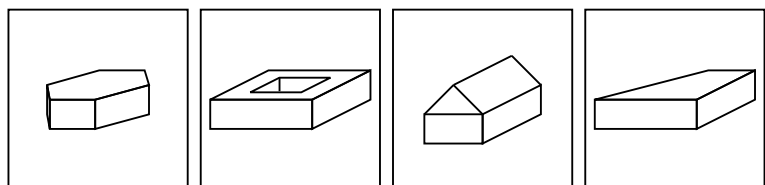


SHOEBOX

U-SHAPE

L-SHAPE

ATRIUM



POLYGONAL

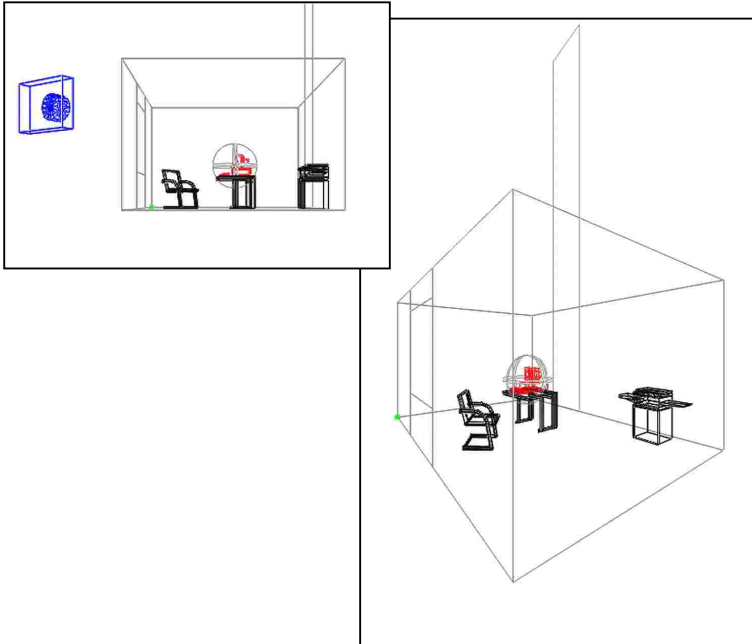
COURTYARD

SADDLE ROOF

TRAPEZOIDAL

2c

GEOMETRICAL INPUT USING THE "GRAPHICAL SCENE EDITOR"



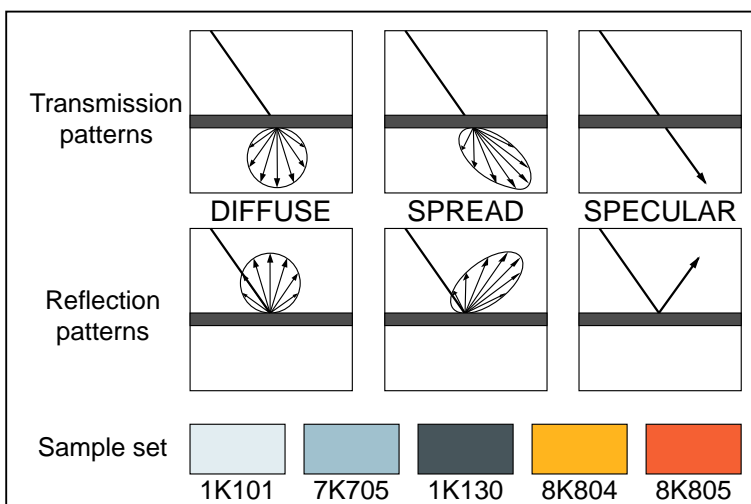
The scene editor allows for an interactive graphical composition of models made up of different predefined objects. Single objects or groups of objects can be copied, translated, rotated and scaled. The graphical representation is based on a wire frame representation with hidden line removal.

The scene editor gives direct access to libraries of furnitures, materials and luminaires.

Views which will later be rendered can be defined -cameralike- directly in the wire frame representation.

3a

OBJECT LIBRARY MATERIAL PHOTOMETRY INPUT USING "PLINK"



One of the main tasks of **PLINK** is to associate photometric properties with each component of the model described with "Scribe Modeller".

A material data base has been created in **PLINK** which includes opaque surfaces (concrete, bricks, wood, metal, paintings ...), and transparent or translucent surfaces (large choice of glass or plastic materials).

The data base includes more than 200 materials and 100 photometries can be used simultaneously for one simulation.

To facilitate the use of the data base, materials are identified by their standard denomination, and a colour sample set is available.

Special colour databases (RAL) are available.

OBJECT LIBRARY ADVANCED DAYLIGHTING SYSTEMS

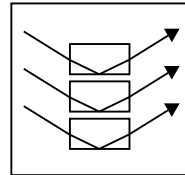
3b

For shading, glare control and light guidance advanced façade systems are currently being developed or are already in use.

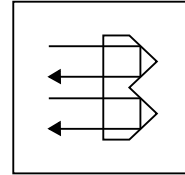
A selection of systems can be used either data- or function-based within the **ADELINE** system.

- classical venetian blinds
- prismatic elements for sunshading and light redirection purposes
- laser cut panels for sun control and light guidance
- anidolic systems for redirecting diffuse daylight
- light shelves

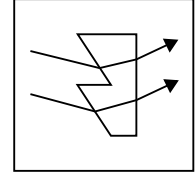
Interfaces within the software allow future elements to be integrated.



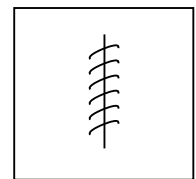
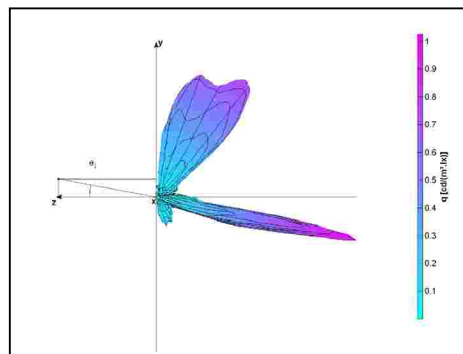
Laser Cut Panel



Sunshading Prisms



Redirection Prisms



Venetian Blinds

OBJECT LIBRARY LUMINAIRE INPUT

3c

ADELINE allows the use of the generated geometric models for both daylighting as well as artificial lighting studies. Luminaire data from different manufacturers can be organized conveniently in libraries. The most common formats IES and ELUMDAT are supported.

Dialogs for the selection and display of candlepower distribution curves, other luminaire technical data and pictures of the luminaires exist. The automatic placement of luminaires within a scene is supported.

Manufacturer

→ Manufacturer 1

→ Downlights

→ Wallwashers

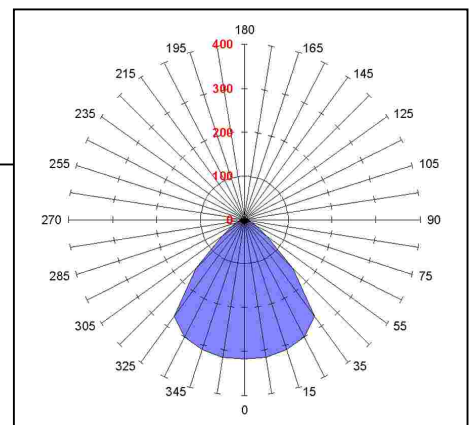
→ Spots

→ Luminaire 1

→ Luminaire 2

→ Luminaire 3

→ Manufacturer 2



3d OBJECT LIBRARY FURNITURE DATA BASE

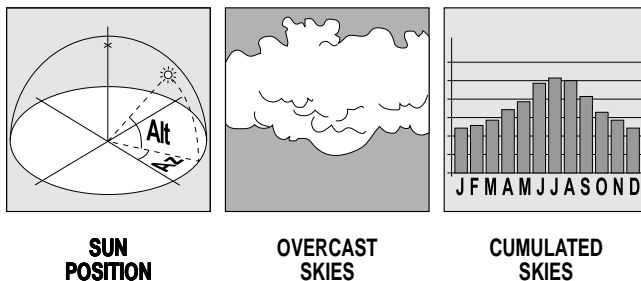


Using furniture in simulations enables more realistic and representative visualisations. Own libraries can be established or existing ones can be used.

More than 350 objects such as tables, chairs and office equipment are included.

Selection and preview dialogs allow the convenient placement and arrangement within the Graphical Scene Editor (2c).

4 CLIMATIC INPUT USING "PLINK"



Simulations can be conducted with various climatic parameters in order to reproduce realistic weather conditions.

Climatic variables that can be used as input include:

- Sunlight (direct only),
- Clear skies (diffuse / global),
- Overcast skies (uniform / CIE standard)
- Cumulative or "average" skies (from processed meteorological data).

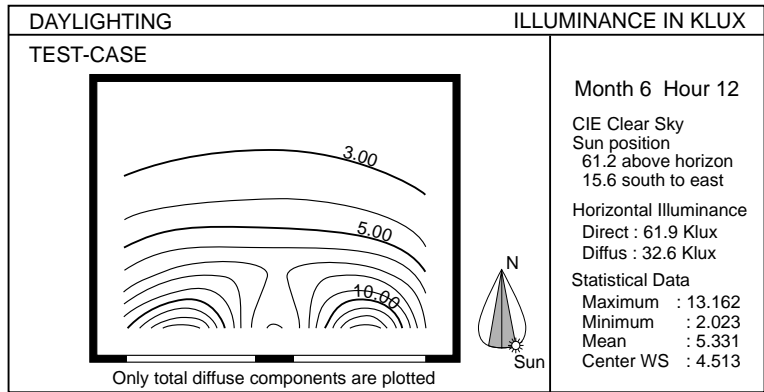
All these variables produce information about the building behaviour that is quite close to reality.

SUPERLITE produces results such as illumination levels, or daylight factors on the work plane, either from natural or artificial lighting.

The numerical models of the buildings to be tested are confined by a set of geometrical restrictions. Surfaces are planar, of trapezoidal shape and limited in number (a maximum of 100 is allowed).

SIMPLIFIED APPROACH USING "SUPERLITE"

5a

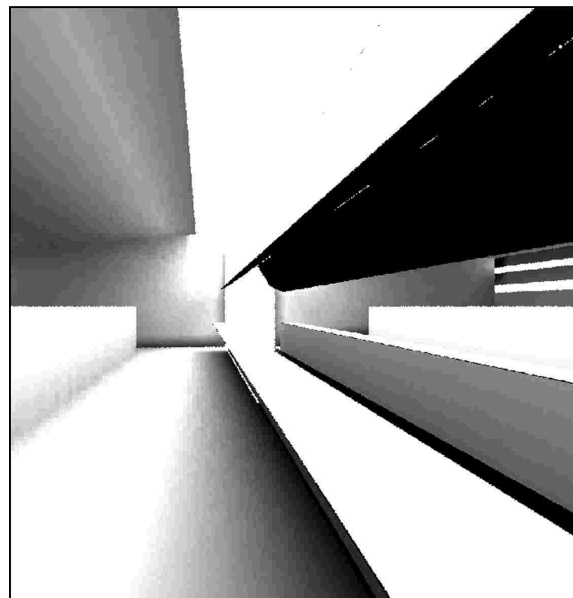


Surfaces are assumed to be perfectly diffuse reflecting and grey-scaled (colour is not taken into account). Modeling of glazing is restricted to three types.

These limitations, combined with a simplified calculation method (radiosity), allow results to be obtained with very short processing times (less than 5 min.), and lead to relevant preliminary choices in the early design process.

SIMPLIFIED APPROACH USING "SUPERLITE"

5b



6

DETAILED APPROACH USING "RADIANCE"



RADIANCE is a complete and sophisticated package of programs, whose aim is to produce realistic 3-D displays of various lighting scenarios, and to provide quantitative analysis such as visual comfort evaluation.

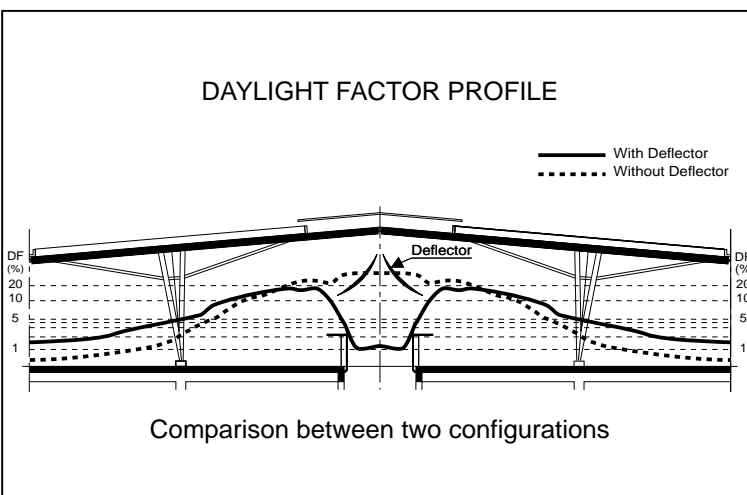
Colours are taken into account within the calculation method based on a ray-tracing technique.

The number and the shape of the elements making up the model are unlimited.

Simulation running time is longer than with **SUPERLITE**, but the accuracy of the results is very useful for visualizing the realistic behaviour of complex lighting systems.

7a

ANALYSIS DAYLIGHT FACTOR



Light distribution can be displayed through either two or three dimensional graphics, and results are given as iso-lux or iso-daylight-factors curves.

Daylight autonomy iso-curves can also be displayed.

Light penetration can be analysed through two dimensional sections of the building. This is very powerful for estimating the impact of each opening.

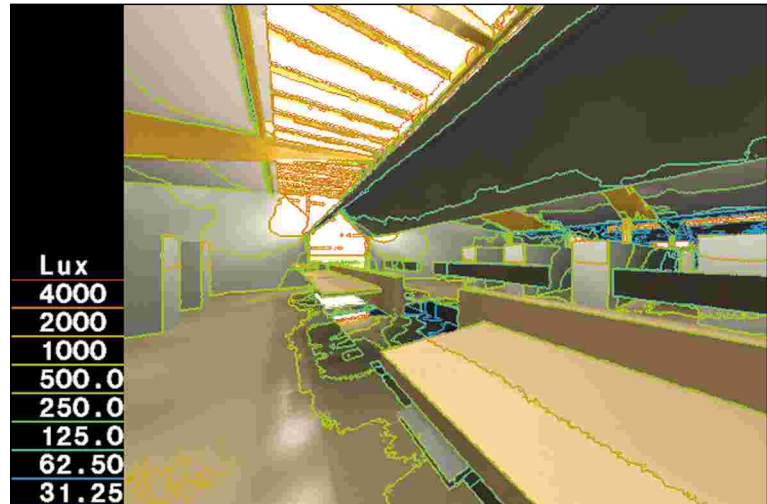
ANALYSIS ILLUMINANCE

7b

3-D displays allow the designer to view the whole space from a selected view-point, and to clearly understand the way light enters the building.

Iso-valor curves are superimposed, in order to provide accurate information.

A 3-D display is also an efficient medium for designers to communicate the "spirit" of their projects and to enhance the results of the lighting strategy they adopted.



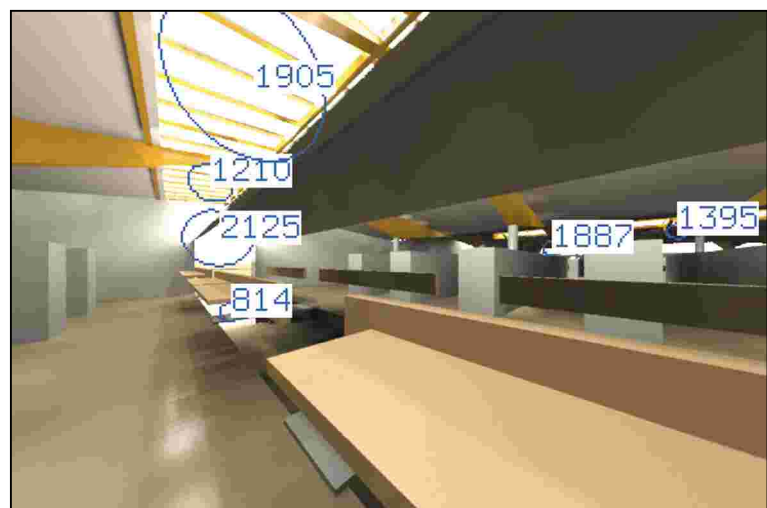
The program also allows qualification of luminance distribution by providing three dimensional displays that are made according to the eye's sensivity (non-linear-function).

Potential glare sources are identified, (they are shown by circles in the figure).

Luminance values (cd/m^2) can be displayed for each point of the picture by clicking the mouse.

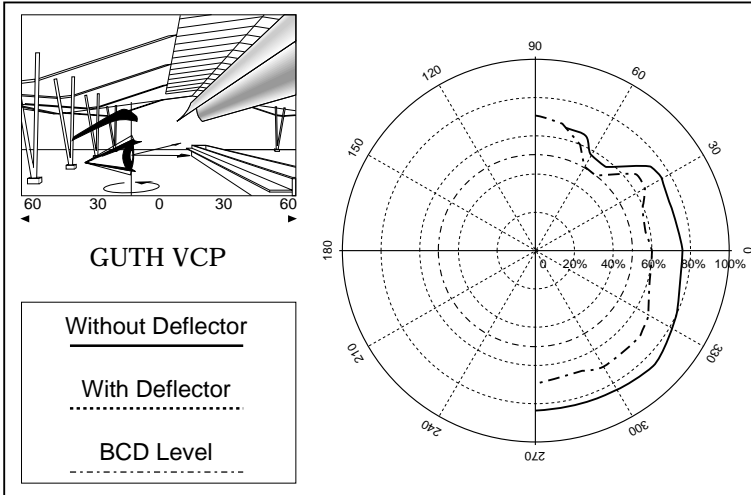
ANALYSIS LUMINANCE

7c



8

VISUAL COMFORT EVALUATION



An outstanding feature of the program is its ability to carry out visual comfort analyses.

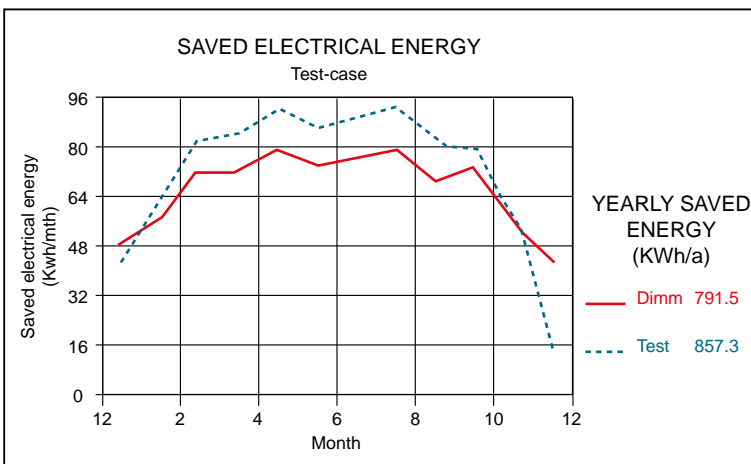
Different glare indexes can be calculated for a given rendered picture, including:

- The CIE glare index (CGI).
- The Guth Visual Comfort Probability (VCP).

Using the latter, a direct evaluation of user satisfaction can be obtained. A scanning can be made to identify the optimal viewing direction for a given position of the observer.

9

INTEGRATED ENERGY APPROACH USING "SUPERLINK" AND "RADLINK"



SUPERLINK and **RADLINK** are programs used to obtain estimates of the interaction between daylighting, artificial lighting and the dynamic thermal building performance.

The simulation is based on daylighting calculations with **SUPERLITE** or **RADIANCE**. **SUPERLINK** and **RADLINK** produce hourly values for additional artificial lighting input into a building over a complete year, taking into account:

- several lighting control strategies,
- different lamp types,
- desired work surface illuminance,
- user-defined worktime schedule,
- hourly sunshine probability.

The hourly lighting energy input can be used to perform hourly thermal simulation with dynamic building simulation programs such as tsbi5, SUNCODE, DOE2 or TRNSYS.

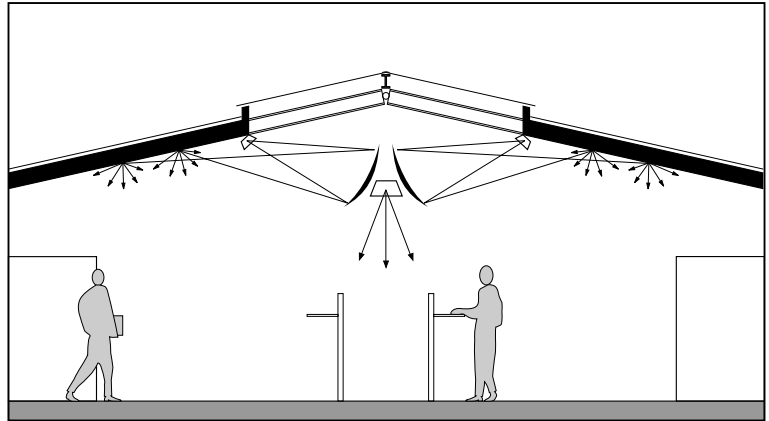
ARTIFICIAL LIGHTING DESIGN

10a

Lighting design is more and more understood as an integrated process between daylighting and artificial lighting issues.

Once the architecture is fixed, the basic daylighting strategy is confirmed and the artificial lighting system is designed. In particular cases artificial lighting may even use the same light distribution as used for daylighting.

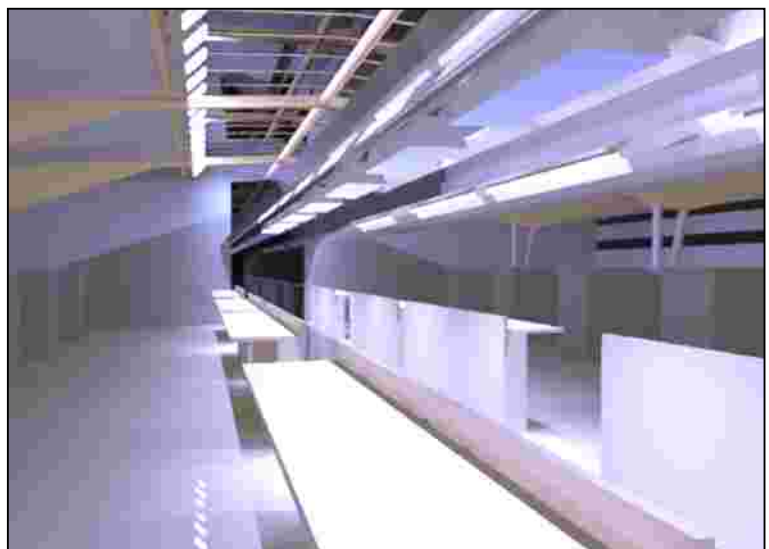
ADELIN allows the parallel use of one geometry for daylighting and artificial lighting studies.



ARTIFICIAL LIGHTING ANALYSIS

10b

All the lighting analysis features such as illuminance calculation on work surfaces, luminance analysis, visual comfort evaluation and high quality visualisations can also be used for artificial lighting "only" scenarios.



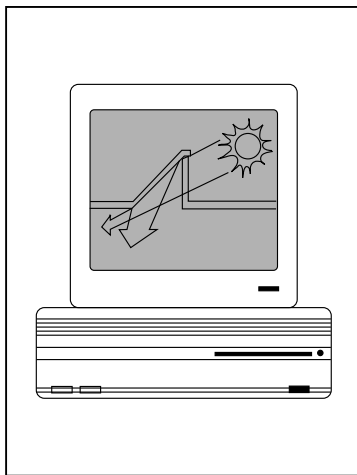


DELINE

Advanced Day- and Electric Lighting Integrated New Environment

Lighting design
& analysis tool

HARDWARE / SOFTWARE

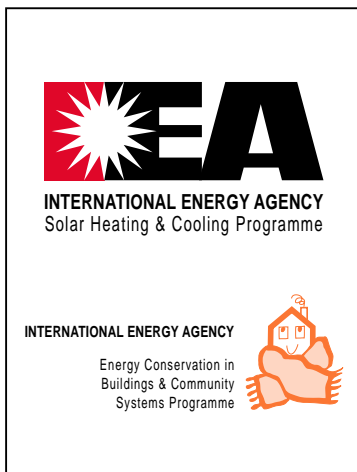


All programs of the ADELIN 3 package run on IBM or fully compatible PCs under Windows95® or Windows NT®.

Minimum system requirements are:

- Pentium I processor
- Graphics Card displaying 32 000 colors
- 50 - 80 MB free hard disk space for the installation, depending on installation options
- 32 MB total RAM installed
- 600 KB free RAM within a DOS-box (only used for SCRIBE-Modeller)

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