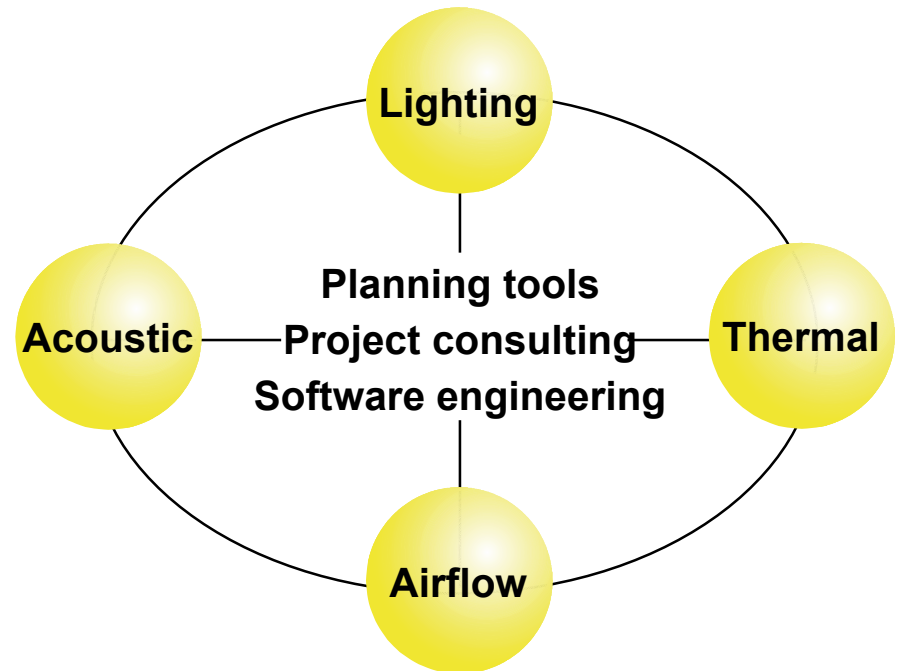# Way of planning via simulation

in the early design phase and during the planning process of buildings

➔ Questions ....

➔ **Input ....**

➔ **Export ....**

➔ **Calculation ....**

➔ **Results ....**

➔ **Variation ....**

Optimization

➔ **Documentation ....**

➔ Evaluation and Recommendation ....

Lighting

Acoustic

Planning tools
Project consulting
Software engineering

Thermal

Airflow

Planning tools from ALware (Overview)

Way of planning via simulation:

➔ Questions

➔ **Input** ....

➔ **Export** ....

➔ **Calculation** ....

➔ **Results** ....

➔ **Variation** ....

➔ **Documentation** ....

➔ Evaluation and Recommendation

3D solar

Lighting   Thermal   Airflow   Acoustic

Rayfront [1]   BSim [2]   CFX [3]   Fluent [4]   Catt-Acoustic [5]

Optimization

Reference: [1] (www.schorsch.com); [2] (www.dbur.dk); [3] (www.cfx-berlin.de); [4] (www.fluent.de); [5] (www.catt.se)

3D Lighting: Simulations for daylight + artificial light

Possible component parts of the planning tool (1):

➔ Questions

➔ **Input** ....

➔ **Export** ....

➔ **Calculation** ....

➔ **Results** ....

➔ **Variation** ....

Optimization

➔ **Documentation** ....

➔ Evaluation and Recommendation
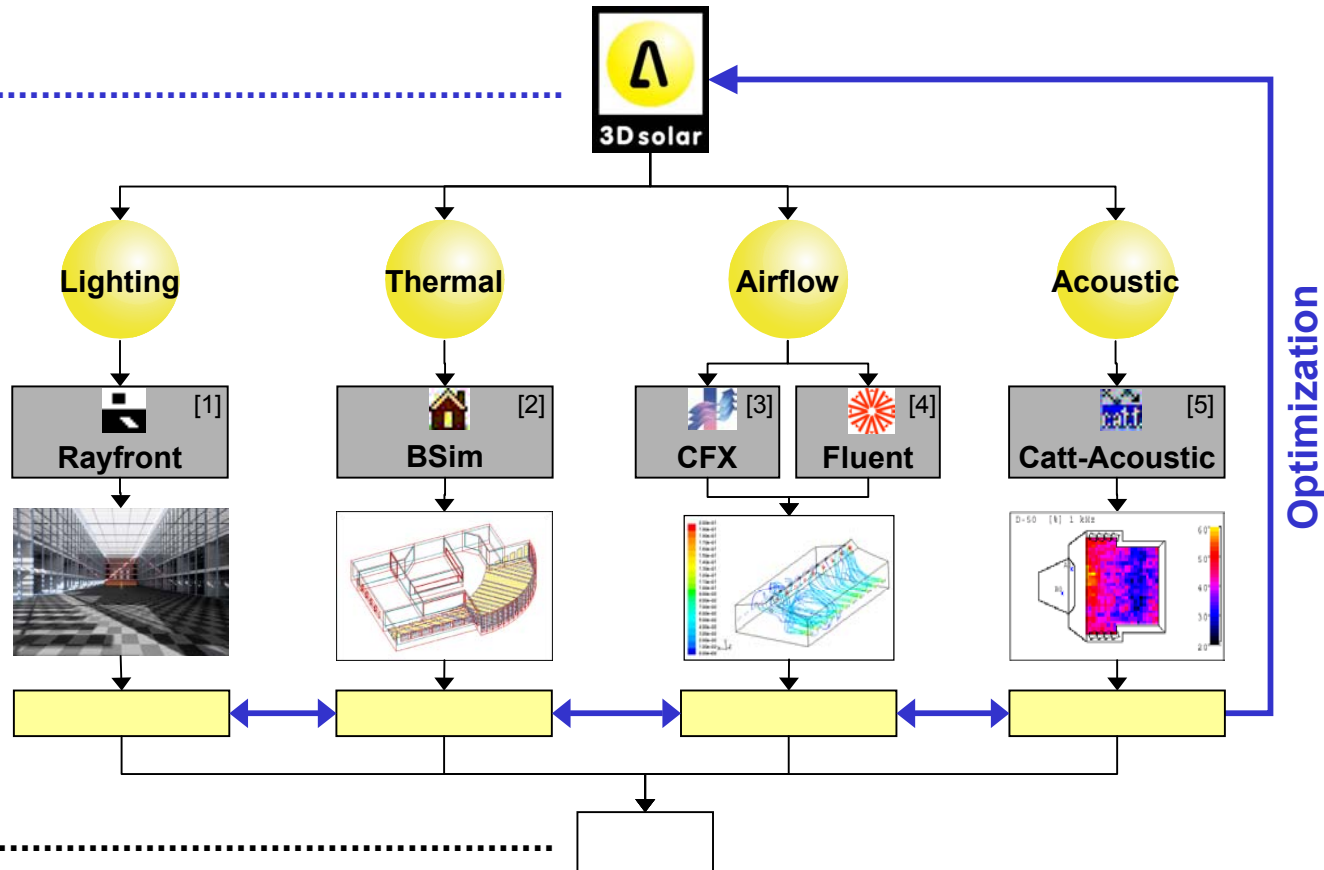
- **3Dsolar:**
  Simple and flexible 3D input for simulation with the planning tools of ALware

- **Plugin 3Dsolar-VRML:**
  For walking through the geometry constructed in 3Dsolar

- **Export 3D-DXF:**
  Export of the geometry constructed in 3Dsolar in DXF format for CAD applications

- **Export Rayfront:**
  Optimized export for lighting simulation via Rayfront with Radiance

- **Rayfront:** [1]
  Software for calculation of lighting simulations with the calculation engine Radiance [1] (**contains Radiance**)

- **Plugin Raydirect:** [1]
  Calculation of daylight redirection systems (requires at least Rayfront)

Reference: [1] Mischler, Georg, München (www.schorsch.com); [2] Greg Ward-Larson, LBL, USA (http://radsite.lbl.gov)

3D Lighting: Simulations for daylight + artificial light

Possible component parts of the planning tool (2):

➔ Questions

➔ **Input** ....

3Dsolar

➔ **Export** ....

Lighting

➔ **Calculation** ....

Rayfront

➔ **Results** ....

➔ **Variation** ....

Optimization

➔ **Documentation** ....

➔ Evaluation and Recommendation
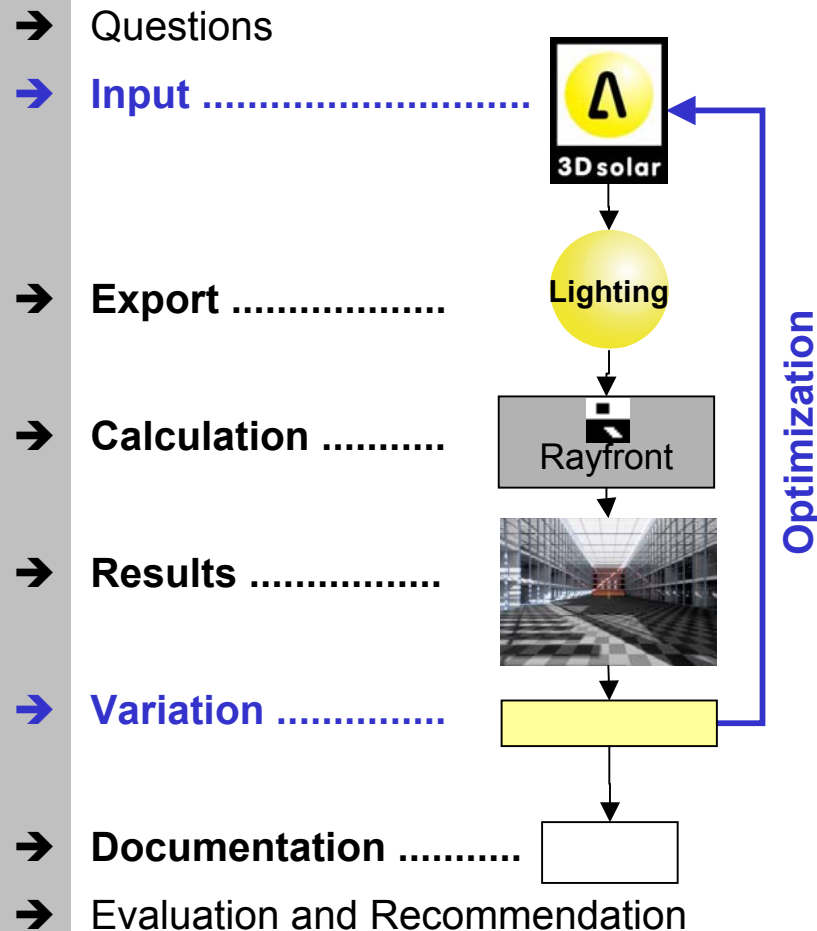
- **3D Lighting-Batch:**
  For creating and viewing calculation processes paths with solar radiation on the basis of an existing Rayfont variation (requires at least Rayfront)

- **3D Lighting-LuxView:**
  For presenting results of illuminance and daylight factors with the calculation of the daylight autonomy and electric current savings for artificial lighting (requires at least Rayfront)

- **3D Lighting-Doc:**
  For documentation of input & results of a lighting simulation in comparison with automatic analyses of result images via Radiance (requires at least Rayfront)

3D Lighting: Simulations for daylight + artificial light

3Dsolar: Simple and flexible 3D input for simulation (1)

➔ Questions

➔ **Input ....**
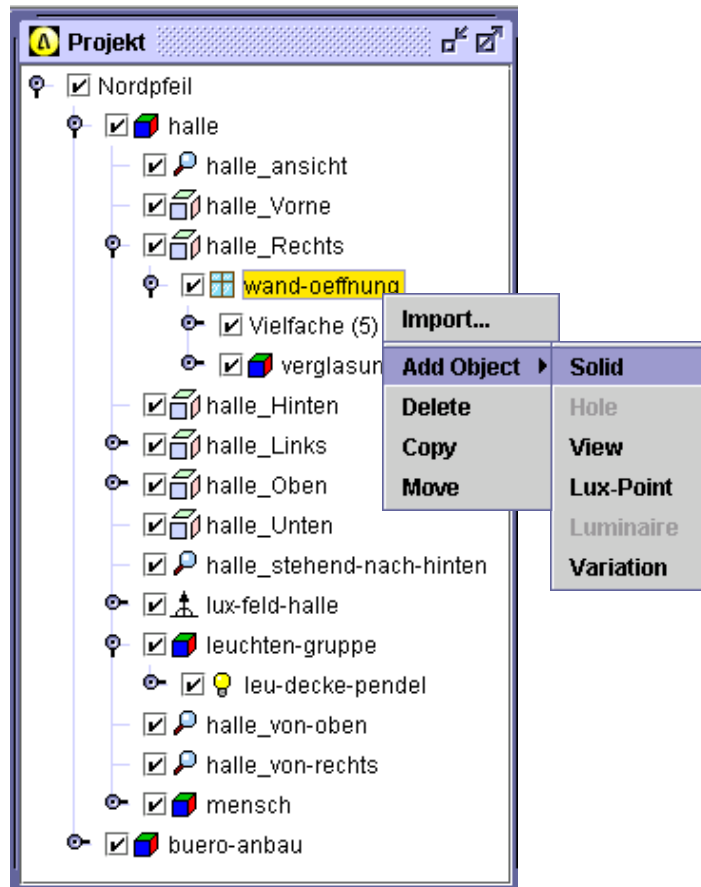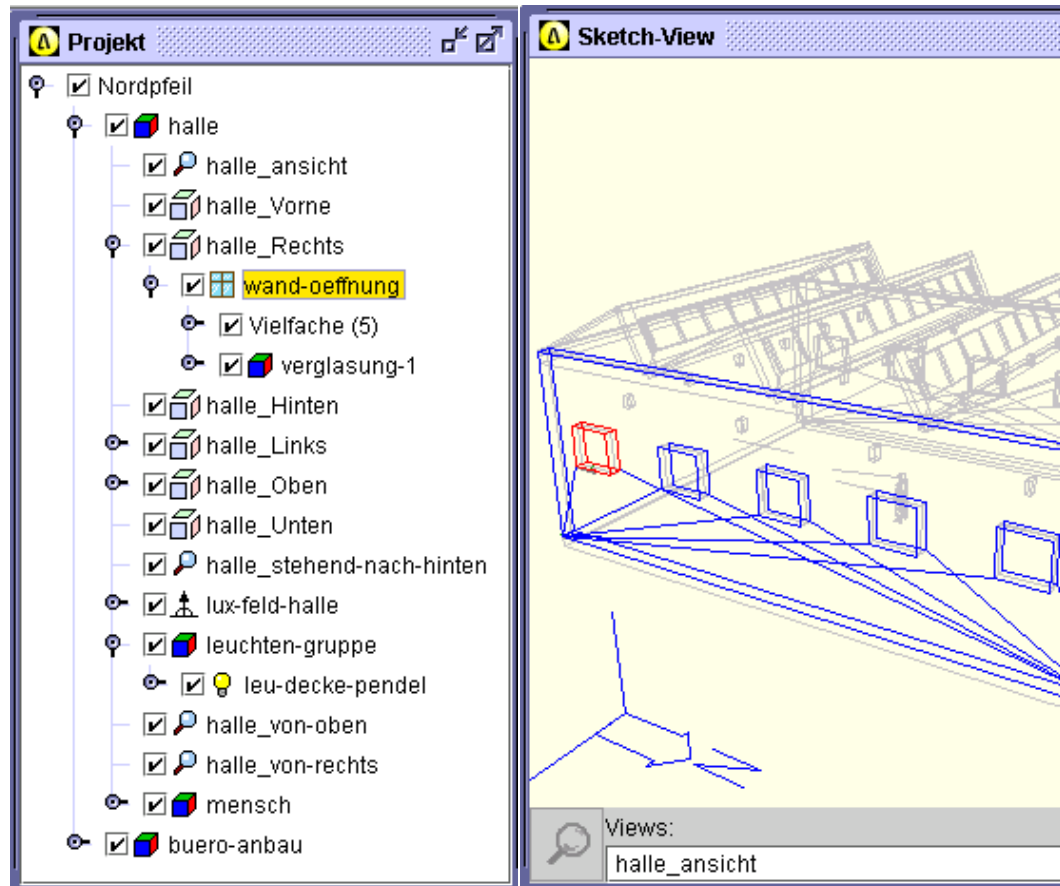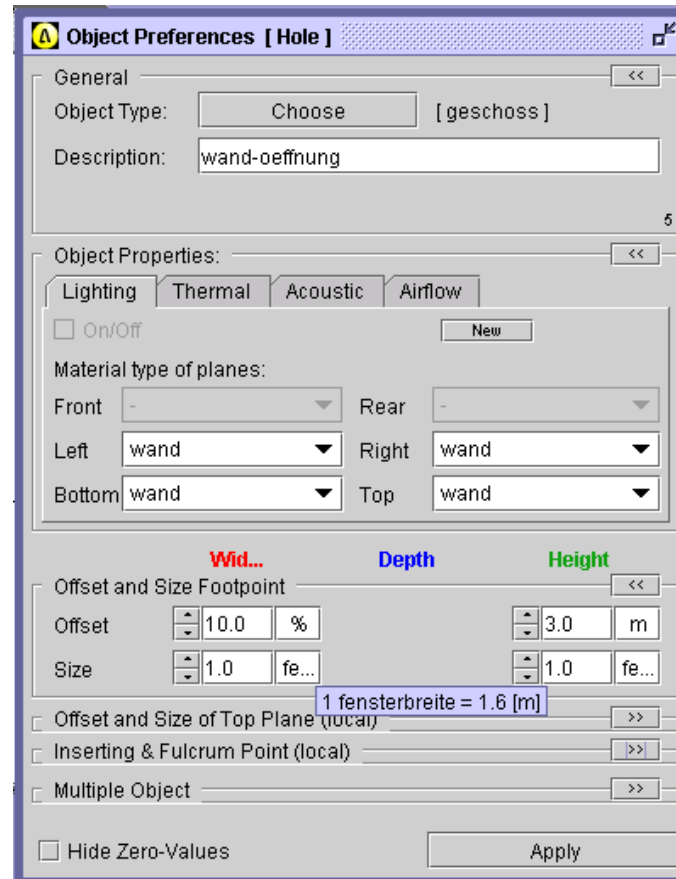
3Dsolar

➔ **Export ....**

➔ **Calculation ....**

➔ **Results ....**

➔ **Variation ....**

➔ **Documentation ....**

➔ Evaluation and Recommendation

Projekt

☑ Nordpfeil
☑ halle
☑ halle_ansicht
☑ halle_Vorne
☑ halle_Rechts
☑ wand-oeffnung
☑ Vielfache (5)
☑ verglasun
☑ halle_Hinten
☑ halle_Links
☑ halle_Oben
☑ halle_Unten
☑ halle_stehend-nach-hinten
☑ lux-feld-halle
☑ leuchten-gruppe
☑ leu-decke-pendel
☑ halle_von-oben
☑ halle_von-rechts
☑ mensch
☑ buero-anbau

Import...
Add Object ▶ Solid
Delete   Hole
Copy   View
Move   Lux-Point
                    Luminaire
                    Variation

• via right mouse-click

Adding of geometry objects in the window Project

3Dsolar: Simple and flexible 3D input for simulation (2)

➔ Questions

➔ **Input ....**

➔ **Export ....**

➔ **Calculation ....**

➔ **Results ....**

➔ **Variation ....**

➔ **Documentation ....**

➔ Evaluation and Recommendation

Geometry objects in the window Project and Sketch-View

3D Lighting: Simulations for daylight + artificial light

3Dsolar: Simple and flexible 3D input for simulation (3)

➔ Questions

➔ **Input ....**

3Dsolar

Lighting

➔ Export ....

➔ Calculation ....

➔ Results ....

➔ Variation ....

➔ Documentation ....

➔ Evaluation and Recommendation

• Object Type

• Properties

• Geometry

Geometry object in the window Objekt Preferences

3D Lighting: Simulations for daylight + artificial light

Plugin 3Dsolar-VRML: For walking through the geometry constructed in 3Dsolar

→ Questions

→ **Input** ....

→ **Control**

→ Export ....

→ Calculation ....

→ Results ....

→ Variation ....

→ Documentation ....

→ Evaluation and Recommendation
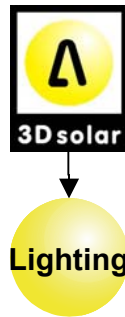
3Dsolar

Lighting

- Displays geometry in solid mode
- Choose of existing views
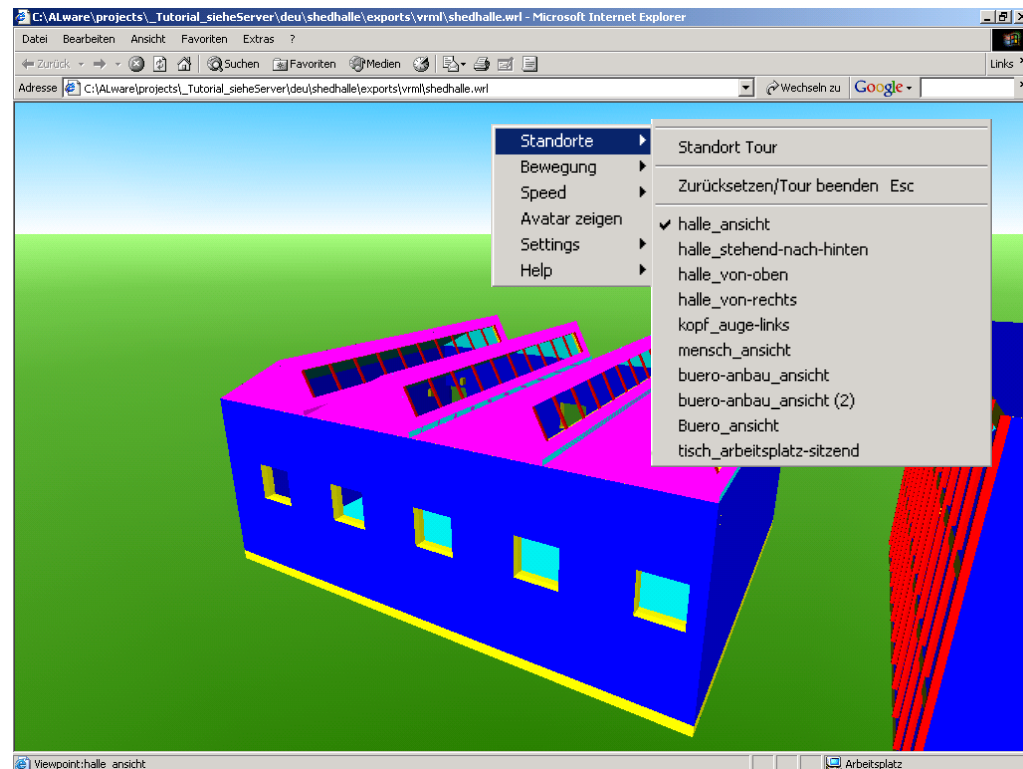
View of geometry in format VRML in the Internet-Explorer

3D Lighting: Simulations for daylight + artificial light

Plugin 3Dsolar-VRML: For walking through the geometry constructed in 3Dsolar

→ Questions

→ **Input** ....

→ **Control**

3Dsolar

Lighting

→ **Export** ....

→ **Calculation** ....

→ **Results** ....

→ **Variation** ....

→ **Documentation** ....

→ Evaluation and Recommendation

- View mode of geometry for controlling
- Transparency of not selected elements

Program GUI of plugin 3Dsolar-VRML

3D Lighting: Simulations for daylight + artificial light

Export 3D-DXF: From 3Dsolar for other CAD applications

➔ Questions

➔ Input ....

3Dsolar

Lighting

➔ **Export ....**

➔ **Control**

➔ Calculation ....

➔ Results ....

➔ Variation ....

➔ Documentation ....

➔ Evaluation and Recommendation
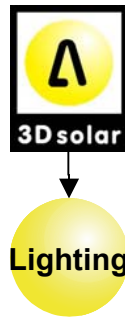
- The plane names from 3Dsolar are converted to layer names, where lighting properties can be assigned.
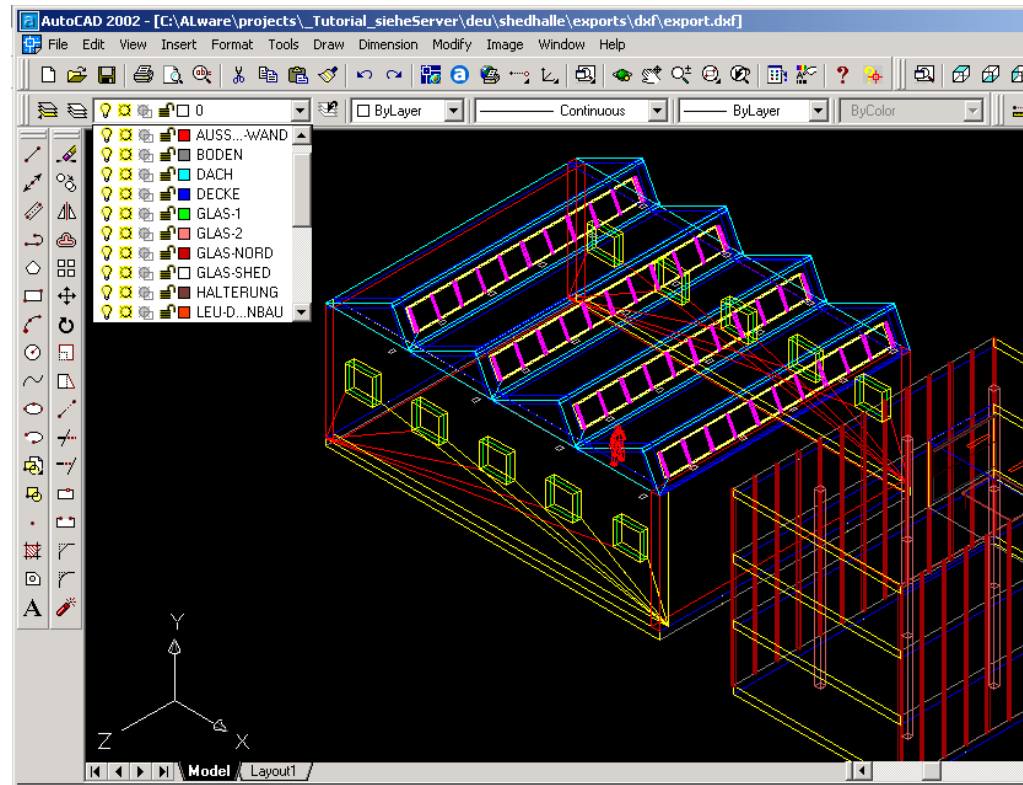
View of the exported 3D geometry in AutoCAD

3D Lighting: Simulations for daylight + artificial light

Export Rayfront: **From 3Dsolar for lighting simulation via Rayfront with Radiance**

➔ Questions

➔ Input ....

➔ **Export ....**

➔ Calculation ....

➔ Results ....

➔ Variation ....

➔ Documentation ....

➔ Evaluation and Recommendation
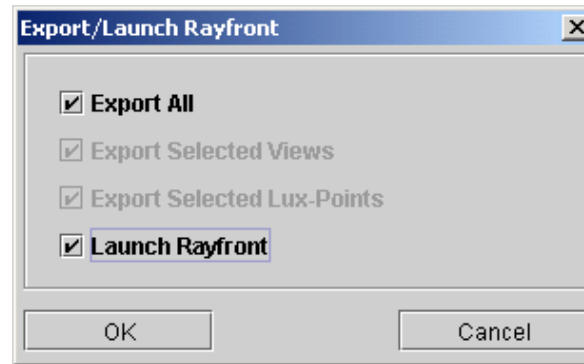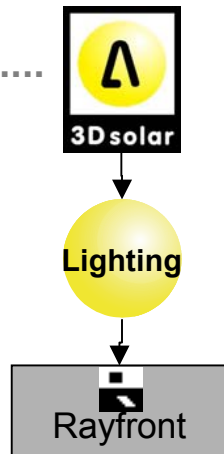
- Planes

- Holes

- Luminaires

- Variation

- Views

- Lux-Points

Export of objects for the light simulation with Rayfront

3D Lighting: Simulations for daylight + artificial light

Rayfront: **Setup of the lighting simulation via Rayfront** [1]

➔ Questions

➔ Input ....

➔ Export ....

➔ **Input ....**

➔ Calculation ....

➔ Results ....

➔ Variation ....

➔ Documentation ....

➔ Evaluation and Recommendation
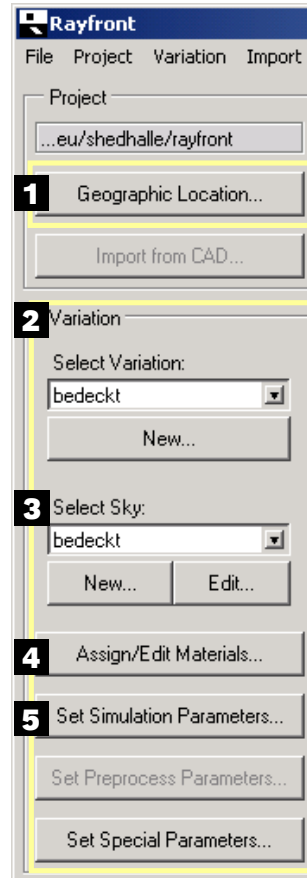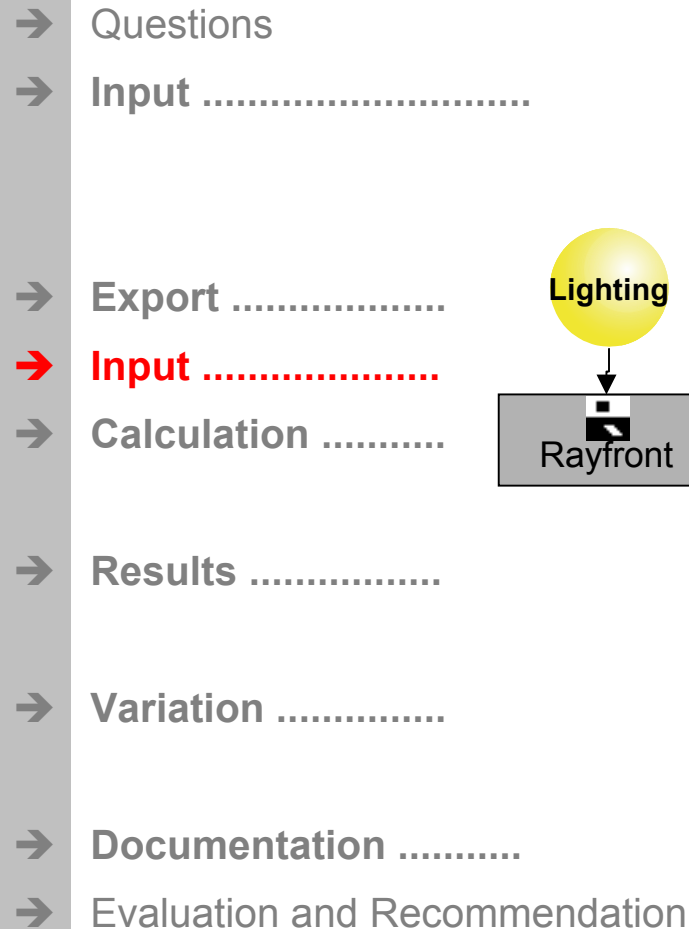
Lighting

Rayfront

• **Choose Geografic Location**

• **Setup a variation**
  - Giving a name to the variation

• **Choose daylight sky**

• **Add geometry objects**
  - Assign lighting properties to the plane names of 3Dsolar

• **Set Simulation Parameters**

Program GUI of Rayfront (1)

Reference: [1] Mischler, Georg, München (www.schorsch.com)

3D Lighting: Simulations for daylight + artificial light

Rayfront: Setup of lighting simulation via Rayfront [1] with Radiance [1a]
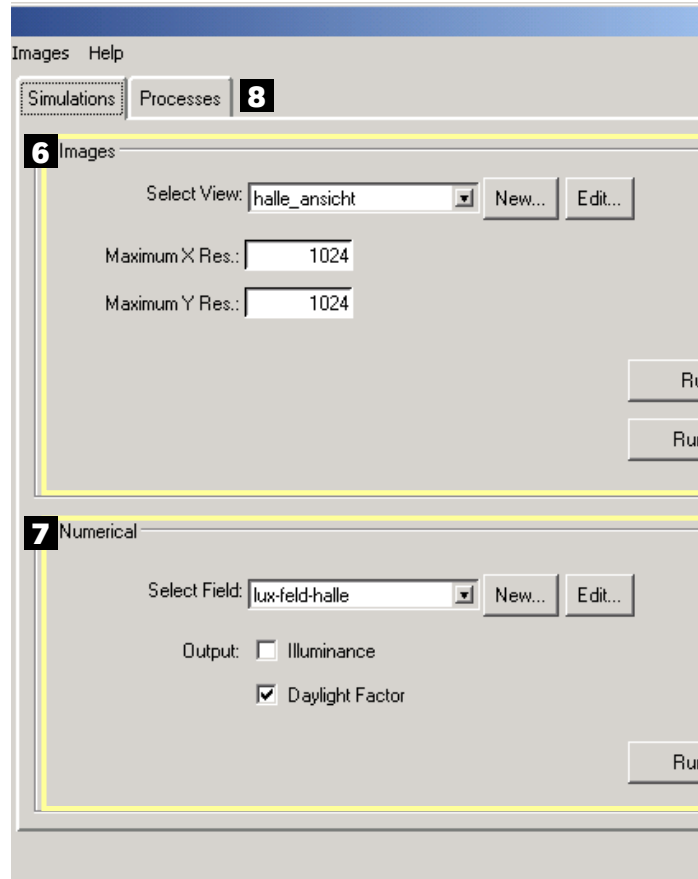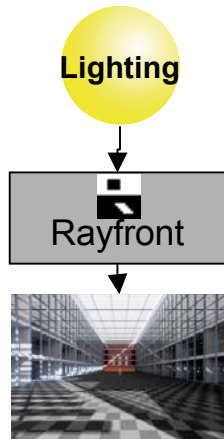
➔ Questions

➔ Input ....

➔ Export ....

➔ Calculation ....

➔ Results ....

➔ Variation ....

➔ Documentation ....

➔ Evaluation and Recommendation

Lighting

Rayfront

Images   Help

Simulations | Processes | **8**

6 Images

Select View: halle_ansicht   New...   Edit...

Maximum X Res.:   1024

Maximum Y Res.:   1024

Run

Run

7 Numerical

Select Field: lux-feld-halle   New...   Edit...

Output: ☐ Illuminance

☑ Daylight Factor

Run

Program GUI of Rayfront (2)

• Control the simulation processes

• Calculate images from the views

• Calculate Lux-Points
  - Illuminance [lux]
  - daylight factor [%]

Reference: [1] Mischler, Georg, München (www.schorsch.com); [1a] Greg Ward-Larson, LBL, USA (http://radsite.lbl.gov)

3D Lighting: Simulations for daylight + artificial light

Rayfront: **Lighting simulation via Rayfront** [1] **with Radiance** [1a]

➜ Questions

➜ Input ....

➜ Export ....

Lighting

➜ **Calculation** ....

Rayfront

➜ **Results** ....

➜ Variation ....

➜ Documentation ....

➜ Evaluation and Recommendation

• International acknowledged calculation engine
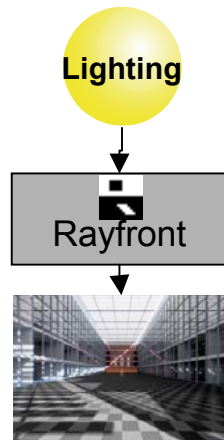
Shed hall (Outside- and Inside view) under an overcast sky

3D Lighting: Simulations for daylight + artificial light

Rayfront: Lighting simulation via Rayfront [1] with Radiance [1a]
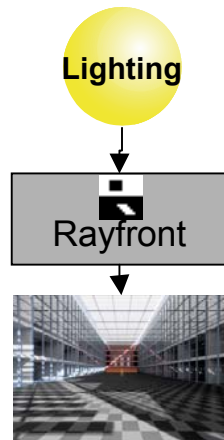
➔ Questions

➔ **Input ....**

3Dsolar

➔ Export ....

Lighting

➔ Calculation ....

Rayfront

➔ Results ....

➔ **Variation ....**

Optimization

➔ Documentation ....

➔ Evaluation and Recommendation

• Variationen von Sheddachform und Seitenfenster
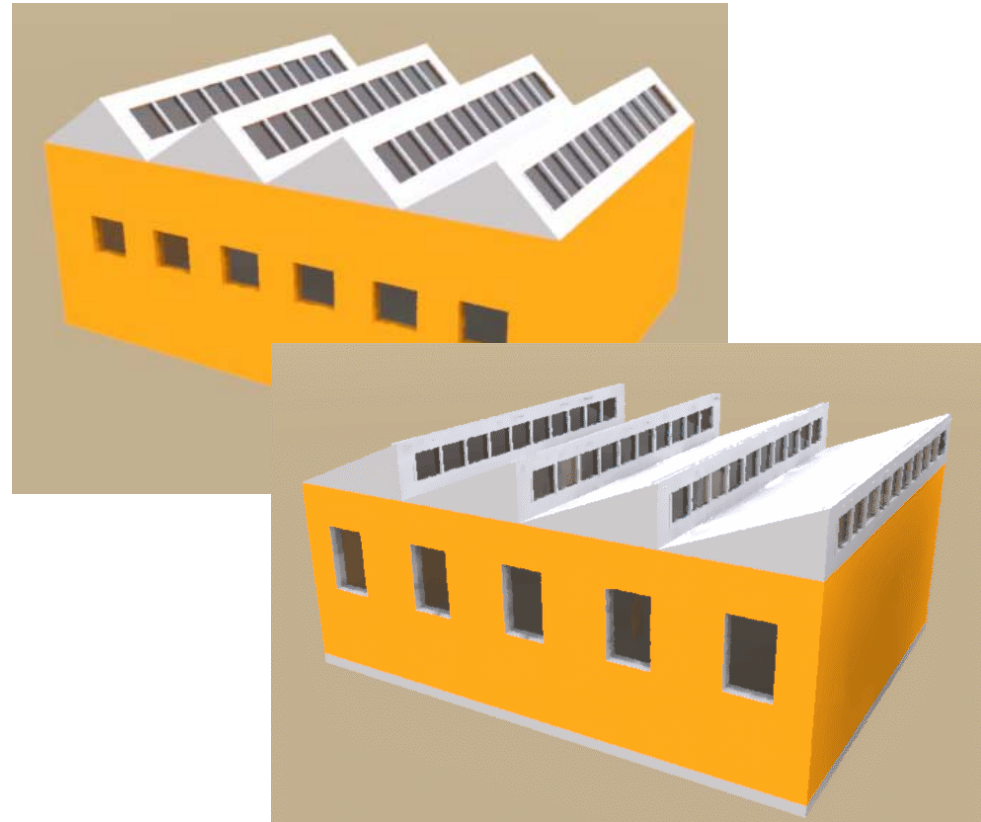
Shedhalle (Außen- und Innenansicht) bei bedecktem Himmel

Reference: [1] Mischler, Georg, München (www.schorsch.com); [1a] Greg Ward-Larson, LBL, USA (http://radsite.lbl.gov)
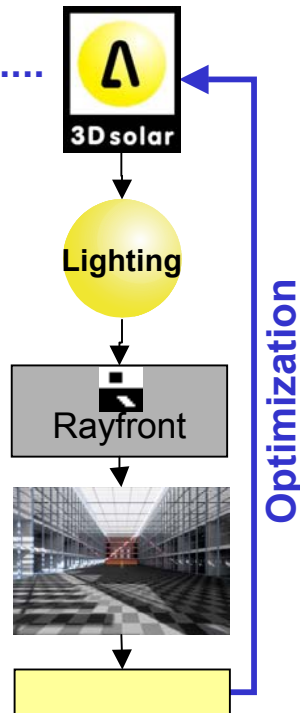
3D Lighting: Simulations for daylight + artificial light

3Dsolar: Fast changes of 3D geometry for variations

→ Questions

→ **Input** ....

→ **Export** ....

→ Calculation ....

→ Results ....

→ **Variation** ....

→ Documentation ....

→ Evaluation and Recommendation

Optimization
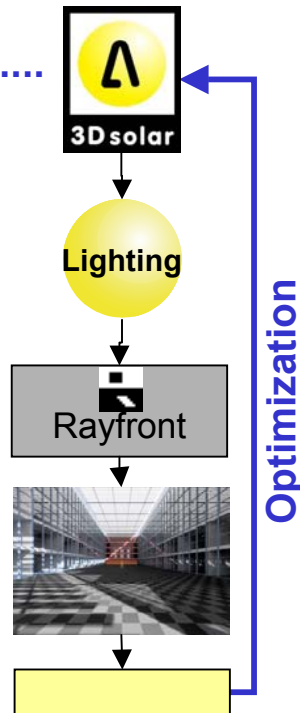
- Central changes in the Unit-Editor
- Definition of own unit names

Unit-Editor

Type of unit: Lengths

Name: shedfirst

Factor: 4.0

1 shedfirst = 4.0 m

All Units

1 raster = 1.3 m
1 raumbreite = 15.0 m
1 raumhoehe = 7.0 m
1 raumtiefe = 20.0 m
1 shedbreite = 5.0 m
1 shedfirst = 4.0 m
1 shedhoehe = 2.0 m
1 wanddicke = 0.5 m

Delete

Apply   Close
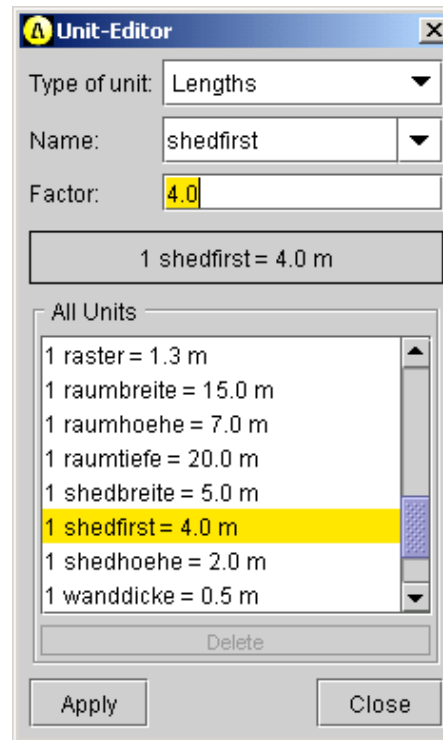
- Types of units:
  - Lengths
  - Angle
  - Counter

- Changes:
  - shedfirst: 4.0 m > 5.0 m
  - fensterhoehe: 1.5 m > 2.5 m
  - fenster-anzahl: 6 x > 5 x

- Working time: 1 minute

Central changes of geometry in the Unit-Editor of 3Dsolar

3D Lighting: Simulations for daylight + artificial light

Rayfront: Lighting simulation via Rayfront [1] with Radiance [1a]

➔ Questions

➔ **Input** ....

➔ **Export** ....

➔ **Calculation** ....

➔ **Results** ....

➔ **Variation** ....

➔ **Documentation** ....

➔ Evaluation and Recommendation

Lighting

Rayfront

• How does the hall look with artificial lighting?

Inside view ot the shed hall under day and artificial lighting

Reference: [1] Mischler, Georg, München (www.schorsch.com); [1a] Greg Ward-Larson, LBL, USA (http://radsite.lbl.gov)

3D Lighting: Simulations for daylight + artificial light

Rayfront: Import of luminaire data of manufactures

➔ Questions

➔ **Input ....**

➔ **Export ....**

Lighting

➔ **Import ....**

➔ **Calculation ....**

Rayfront

➔ **Results ....**

➔ **Variation ....**

➔ **Documentation ....**

➔ Evaluation and Recommendation

• Supported formats of light distribution curves LDT:
  - Eulumdat, IESNA (Type A+C), CIBSE TM 14
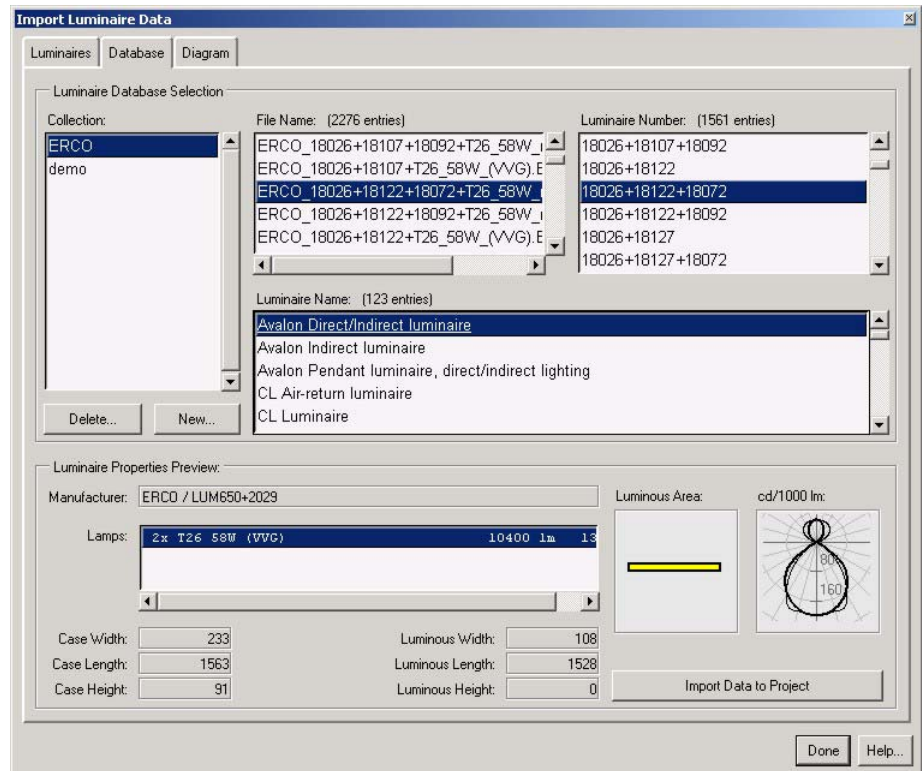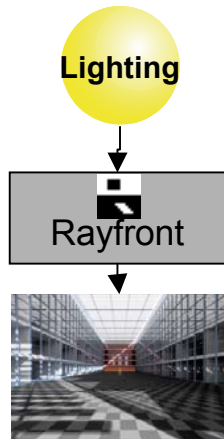
Collection of 2276 LDT of a manufacture in Rayfront

3D Lighting: Simulations for daylight + artificial light

Rayfront: Import of CAD / DXF geometry

→ Fragestellung ....

→ Eingabe ....

→ Export ....

→ **Import ....**

→ Berechnung ....

→ Ergebnisse ....

→ Variation ....

→ Dokumentation ....

→ Bewertung und Empfehlung

• Import and conversion of DXFin the Radiance format for the lighting simulation

Lighting

Rayfront

Import Geometry from DXF

Geometry to Convert:
- ☑ 3D FACEs
- ☑ Extruded and Flat 2D SOLIDs
- ☑ Extruded and Flat TRACEs
- ☑ Extruded 2D PLINEs
- ☑ Wide 2D PLINEs
- ☑ Closed 2D PLINEs as Polygons
- ☑ 3D MESHes
- ☑ POLYFACEs
- ☑ Extruded LINEs
- ☑ Extruded ARCs
- ☑ Extruded and Flat CIRCLEs
- ☐ POINTs as Sphreres

Import Settings:

Distance Tolerance for Arc Approximation: 0.1

Angle Tolerance for Arc Approximation: 15.0

Scaling Factor: 1.0

Ok   Cancel   Revert   Help...

Dialog for Import of geometry of DXF in Rayfront

3D Lighting: Simulations for daylight + artificial light

3D Lighting-Batch: For creating + viewing calculation batch runs (1)

➔ Questions

➔ Input ....

➔ Export ....

➔ Calculation ....

➔ Results ....

➔ Variation ....

➔ Documentation ....

➔ Evaluation and Recommendation

• How is the sun penetration ot the user areas in an office for different yearly and daily times?

Lighting

Rayfront

8:00 h	10:00 h	12:00 h	
			Dec
			Mar
			Jun
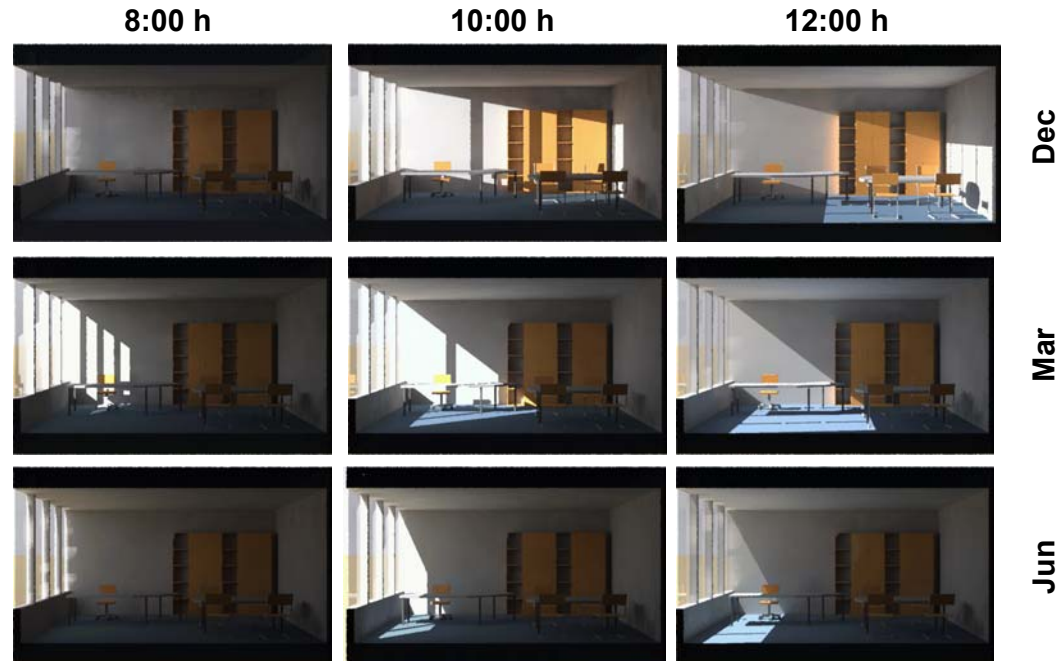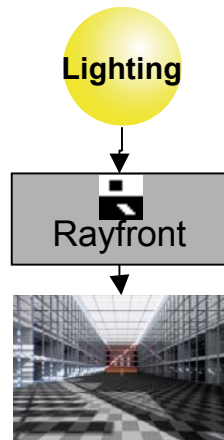
Sun penetration for a south oriented office

3D Lighting: Simulations for daylight + artificial light

3D Lighting-Batch: For creating + viewing calculation batch runs (2)

➔ Questions

➔ **Input ....**

➔ **Export ....**

➔ **Input**

➔ **Calculation ....**

➔ **Results ....**

➔ **Variation ....**

➔ **Documentation ....**

➔ Evaluation and Recommendation

Lighting

Rayfront

- based on existing variations in Rayfront
- Choose of views of variations to be calculated
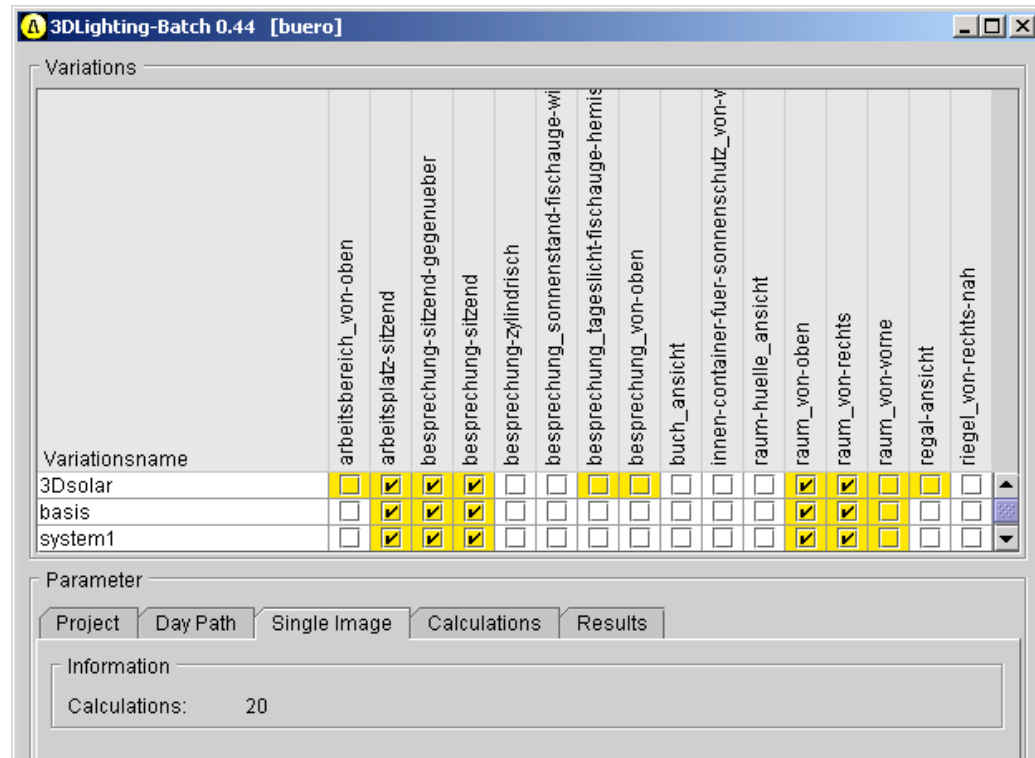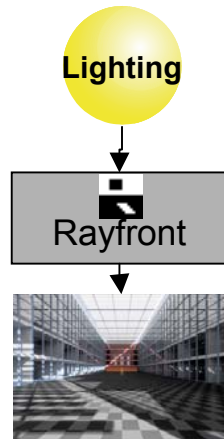
Program GUI of 3D Lighting-Batch ‚Single Image'

3D Lighting: Simulations for daylight + artificial light

3D Lighting-Batch: For creating + viewing calculation batch runs (3)
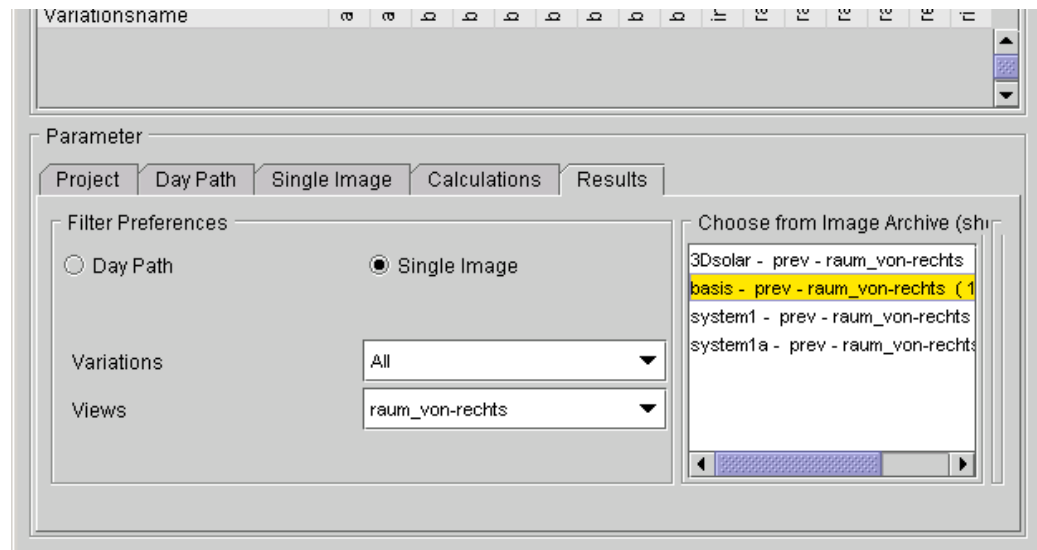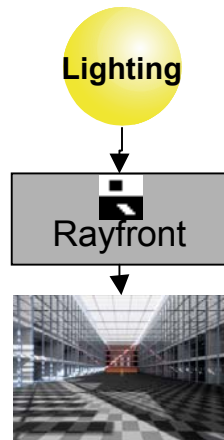
➔ Questions

➔ **Input** ....

➔ **Export** ....

➔ **Input**

➔ **Calculation** ....

➔ **Results** ....

➔ **Variation** ....

➔ **Documentation** ....

➔ Evaluation and Recommendation

Lighting

Rayfront

- Choose of views for day paths
- Choose of months, day, daytime and time step

3DLighting-Batch 0.44 [buero]

Variationsname	arbeitsbereich_von-	arbeitsplatz-sitzend	besprechung-sitzen	besprechung-sitzen	besprechung-zylindr	besprechung_sonn	besprechung_tages	besprechung_von-o	buch_ansicht	innen-container-fuel	raum-huelle_ansich	raum_von-oben	raum_von-rechts	raum_von-vorne	regal-ansicht	riegel_von-rechts-n
3Dsolar	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐
basis	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
system1	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Parameter

Project | Day Path | Single Image | Calculations | Results

Start-Date

☐ January   ☐ July

☐ February   ☐ August

☐ March   ☐ September

☐ April   ☐ October

☐ May   ☐ November

☑ June   ☐ December

Day: 21

Time Preferences

Start: 08 h

End: 14 h

Interval: 30 Min.

Information

Pics/Daypath: 13

Calculations: 1

Total Images: 13

Program GUI of 3D Lighting-Batch ‚Day Path'

3D Lighting: Simulations for daylight + artificial light

3D Lighting-Batch: For creating + viewing calculation batch runs (4)

→ Questions

→ **Input ....**

→ **Export ....**

Lighting

Rayfront

→ **Calculation ....**

→ **Results ....**

→ **Variation ....**

→ **Documentation ....**

→ Evaluation and Recommendation
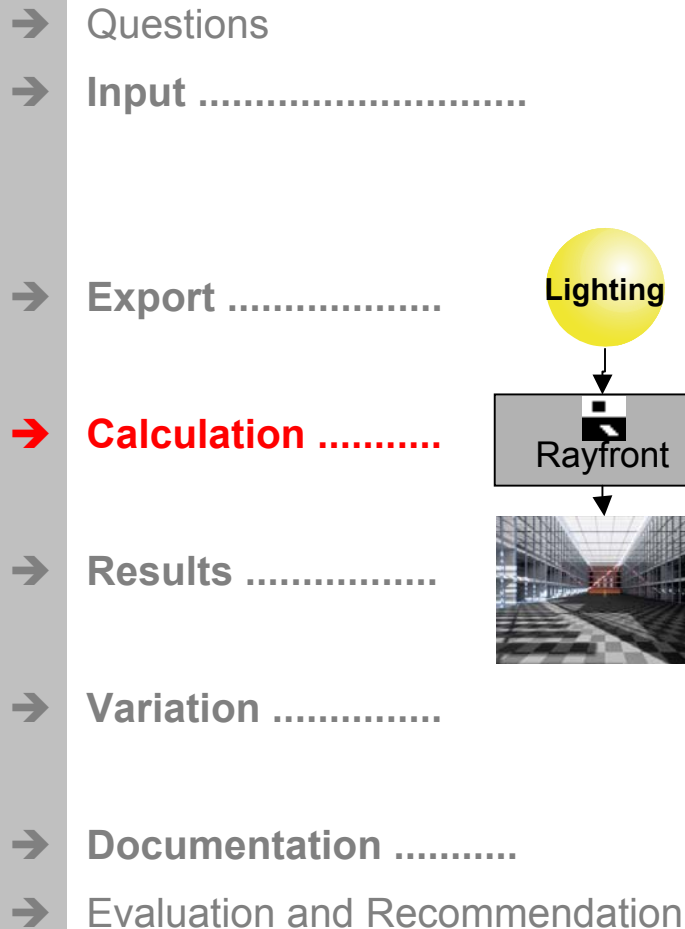
- Activate batch run for Day Path / Single Image
- Choose set of parameters for calculation resolution
- Create and start the calculation processes sequentially
- Control the processes via Rayfront
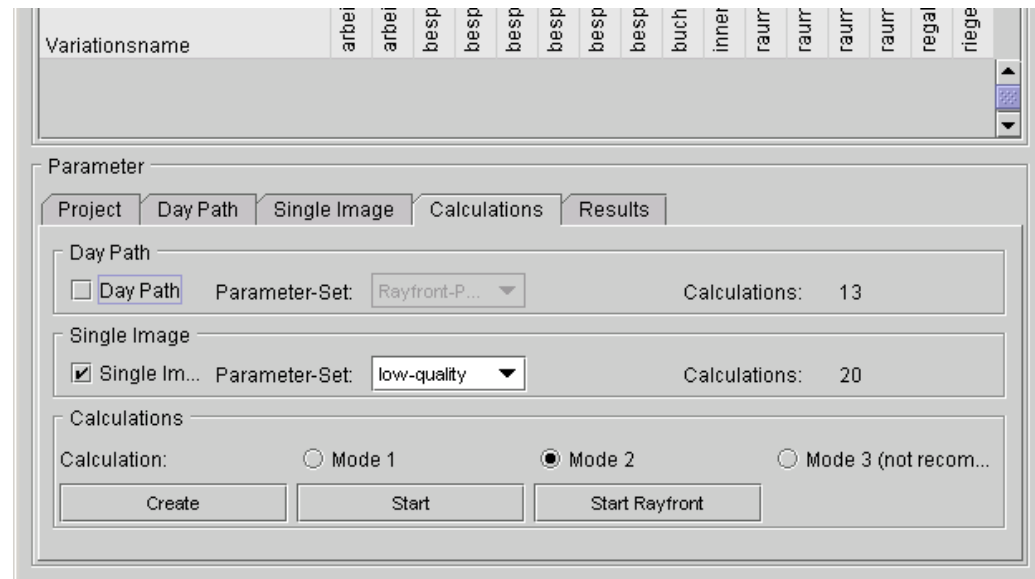
Program GUI of 3D Lighting-Batch 'Calculations'

3D Lighting: Simulations for daylight + artificial light

3D Lighting-Batch: For creating + viewing calculation batch runs (5)

➔ Questions

➔ **Input** ....

- • Choose from existing results
- • Single image or day path
- • Filter for variation and view

➔ **Export** ....

Lighting

➔ **Calculation** ....

Rayfront

➔ **Results** ....

➔ **Variation** ....

➔ **Documentation** ....

➔ Evaluation and Recommendation

Program GUI of 3D Lighting-Batch 'Results'

3D Lighting: Simulations for daylight + artificial light

3D Lighting-Batch: For creating + viewing calculation batch runs (6)

➔ Questions

➔ Input ....

➔ Export ....

➔ Calculation ....

➔ Results ....

➔ Variation ....

➔ Documentation ....

➔ Evaluation and Recommendation

- View images of day paths as a movie
- Play with different speed
- View single time points via scroll bar

Lighting

Rayfront

Film-Betrachter

Abspielen

Geschwindigkeit: Normal   3Dsolar_03-21-10-00_raum_von_rechts.gif
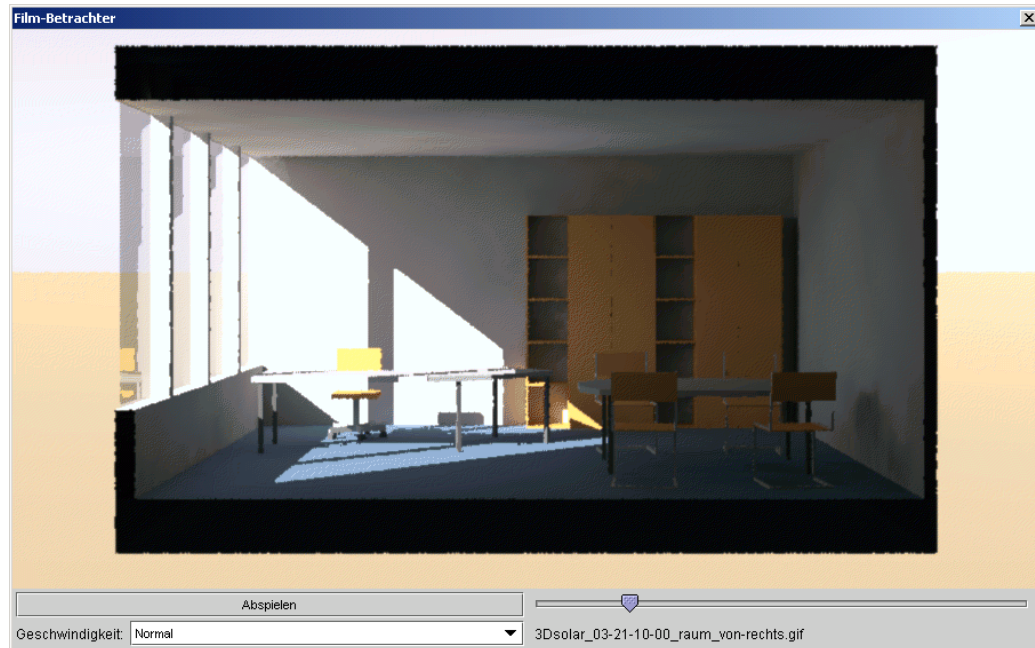
Result images in the Movie-Player of 3D Lighting-Batch

3D Lighting-Doc: Documentation of input and results in comparison (1)

➔ Questions ....

➔ **Input** ....

➔ **Export** ....

Lighting

Rayfront

➔ **Calculation** ....

➔ **Results** ....

➔ **Variation** ....

➔ **Documentation** ....

➔ Evaluation and Recommendation
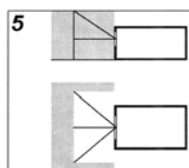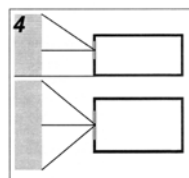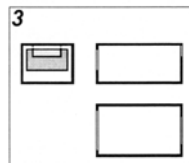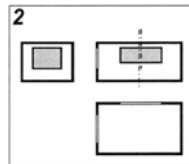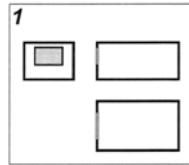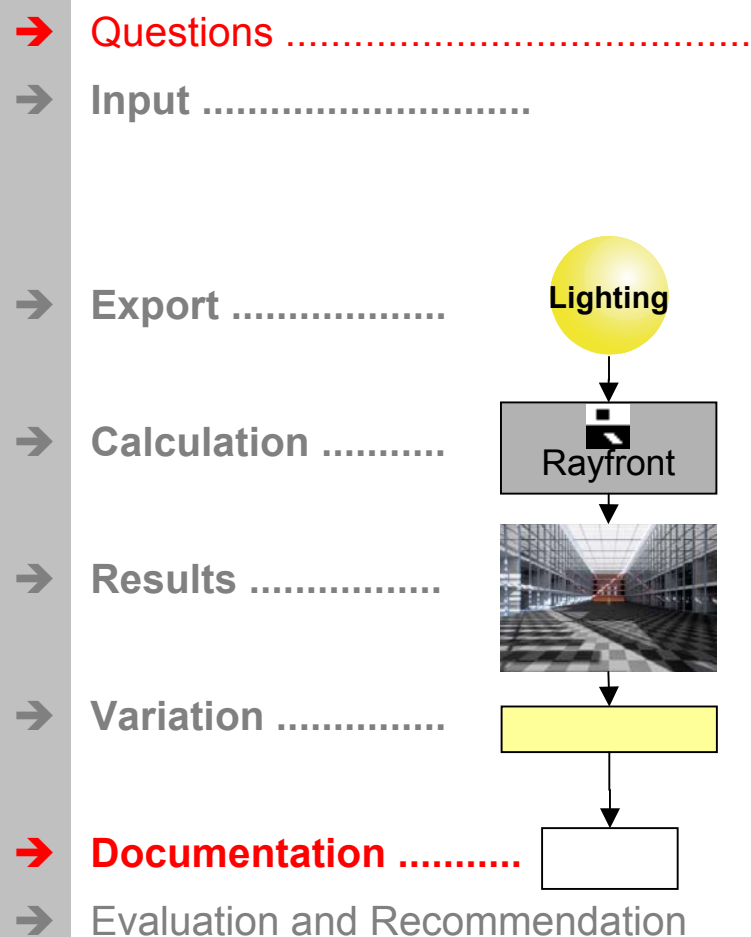
- How are variations different?
- Does input errors exist?

1. Single sided daylit room
2. Via corner daylit room
3. Daylit room with opposite windows
4. Single sided daylit room with opposite building
5. Single sided daylit room at an atria
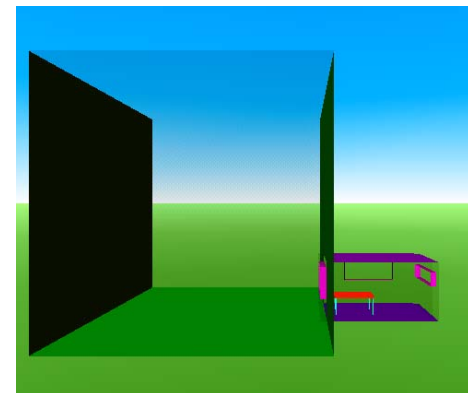
Room types; Type 4: Single sided daylit room with opp. buildin

3D Lighting-Doc: Documentation of input and results in comparison (2)

→ Questions

→ Input ....

→ Export ....

→ Calculation ....

→ Results ....

→ Variation ....

→ **Input**

→ **Documentation ....**

→ Evaluation and Recommendation

Lighting

Rayfront
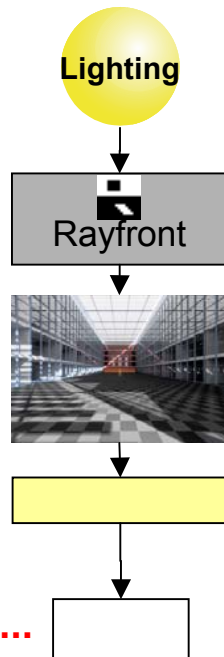
- Choose of variations to be documented

- Choose of assigned result images

- Choose of analysis' with Radiance to be created

- Choose of results of Lux-Points to be shown

Program GUI of 3D Lighting-Doc

3D Lighting-Doc: Documentation of input and results in comparison (3)

➔ Questions

➔ Input ....

➔ Export ....

➔ **Input**

➔ Calculation ....

➔ Results ....

➔ **Variation ....**

➔ **Documentation ....**

➔ Evaluation and Recommendation

Lighting

Rayfront
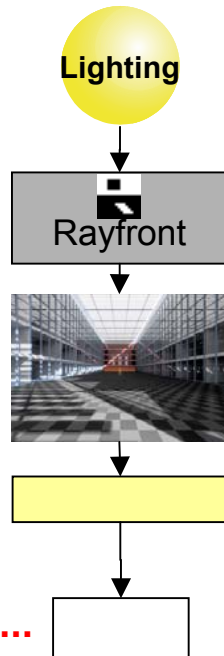
- • Used geometry with assigned material
- • Daylight and artificial lighting of variations

Software: 3Dsolar Plugin: 3DLighting-Doc 2.0 Copyright: ALware - Planungstools . Projektberatung . Softwareentw					
Projekt: shedhalle Lizenznehmer: not registered Datum: 16.2.2004 22:49					
3DLighting-Documentation: Overview of variations in Rayfront					
Geometry (components):	Typ1	Typ2	Typ3	Typ4	Typ5
aussen-wand	44-2_1002_s	44-2_1002_s	44-2_1002_s	44-2_1002_s	44-2_1002_s
boden	21-4_5012_l	21-4_5012_l	21-4_5012_l	21-4_5012_l	21-4_5012_l
decke	grey_080	grey_080	grey_080	grey_080	grey_080
glas	glass_070	glass_070	glass_070	glass_070	glass_070
laibung	grey_050	grey_050	grey_050	grey_050	grey_050
wand	grey_050	grey_050	grey_050	grey_050	grey_050
tisch	grey_040-gl	grey_040-gl	grey_040-gl	grey_040-gl	grey_040-gl
tisch-bein	grey_010	grey_010	grey_010	grey_010	grey_010
glas2	grey_050	glass_070	grey_050	grey_050	grey_050
glas3	grey_050	grey_050	glass_070	grey_050	grey_050
bebauung	-	-	-	grey_040	grey_040
bebauung-vorne	-	-	-	grey_040	grey_040
bebauung-unten	-	-	-	grey_020	grey_020
bebauung-links	-	-	-	-	grey_040
bebauung-rechts	-	-	-	-	grey_040
Daylight:	Typ1	Typ2	Typ3	Typ4	Typ5
	bedeckt	bedeckt	bedeckt	bedeckt	bedeckt
Daylight redirection system:	Typ1	Typ2	Typ3	Typ4	Typ5
Artificial lighting:	Typ1	Typ2	Typ3	Typ4	Typ5
ALware Planungstools . Projektberatung . Softwareentwicklung Lighting . Shading . Airflow . Thermal . Acoustic					

Example: Overview of input of variations in comparison

AL ware For better buildings

3D Lighting-Doc: Documentation of input and results in comparison (4)

➜ Questions

➜ Input ....

➜ Export ....

➜ **Input**

➜ Calculation ....

➜ Results ....

➜ Variation ....

➜ **Documentation ....**

➜ Evaluation and Recommendation

Lighting

Rayfront

- Properties of used materials
- Description of daylight skies of the project
- Key values of the artificial luminaires of the project

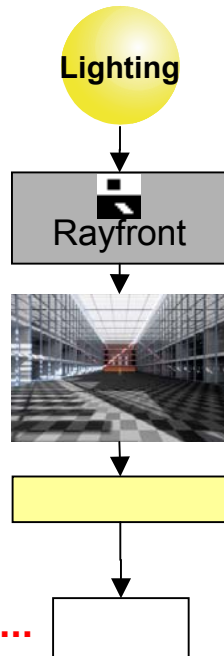| Project: shedhalle		Lizenznehmer: not registered			Datum: 16.2.2004 22:49	
3DLighting-Documentation		Overview of photometric characteristics in Rayfront				
Materials:	**Name**	**Reflexion**	**Transmission**	**Radiance**	**Sonstiges**	
	grey_080	80.0%	-	plastic	-	
	grey_050	50.0%	-	plastic	-	
	grey_040	40.0%	-	plastic	-	
	grey_010	10.0%	-	plastic	-	
	glass_070	-	70.0%	glass	-	
	44-2_1002_sand-gelb	44.3%	-	plastic	-	
	21-4_5012_licht-blau	21.5%	-	plastic	-	
	grey_040-glanz	40.0%	-	plastic	-	
	grey_020	20.0%	-	plastic	-	
Daylight:	**Ort**	**Längengrad**	**Breitengrad**	**Zeitzone**		
	Braunschweig	52.27	10.51	1.0		
		Himmel	**Sonne**	**Monat**	**Tag**	**Uhrzeit**
	bedeckt	bedeckt	nein	3	20	10.5
	default	klar	ja	3	20	10.5
	sun_0310	klar	ja	3	20	10.0
Artificial lighting	**Name**	**Lichtstrom**	**Lampen-Typ**	**Leistung**	**Bezeichnung**	**Herste**

AL ware   Planungstools . Projektberatung . Softwareentwicklung   Lighting . Shading . Airflow . Thermal . Acoustic   ww

Example: Overview of photometric properties

3D Lighting: Simulations for daylight + artificial light

3D Lighting-Doc: Documentation of input and results in comparison (5)

➔ Questions

➔ Input ....
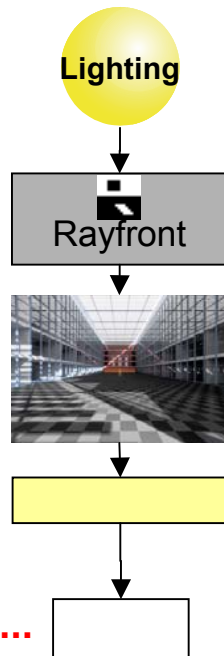
➔ Export ....

➔ Calculation ....

➔ **Results ....**

➔ **Variation ....**

➔ **Documentation ....**

➔ Evaluation and Recommendation

1. Single sided daylit room
2. Via corner daylit room
3. Daylit room with opposite windows
4. Single sided daylit room with opposite building
5. Single sided daylit room at an atria

Lighting

Rayfront

Projekt:	Raumtypen1-5	Lizenznehmer: not registered		Datum:	16.2.2004 22:49	Seite

3DLighting-Dokumentation: Übersicht der berechneten Ergebnisse für die Variationen in Rayfront

Ansichten (Views)		Typ1	Typ2	Typ3	Typ4	Typ5
	raum_von-rechts	fls	fls	fls	fls	fls
		pcd	pcd	pcd	pcd	pcd

pic=Radiance, hum=human visible response, fls=falseColor

Lux-Feld:		Typ1	Typ2	Typ3	Typ4	Typ5
	lux-feld-25x25	df	df	df	df	df
		min:0.58	min:1.02	min:0.92	min:0.27	min:0.14
		max:20.73	max:22.22	max:21.11	max:17.46	max:10.78
		mean:3.2	mean:6.3	mean:4.5	mean:2.2	mean:1.1

if=illuminance (Beleuchtungsstärke [Lux]), df=daylight factor (Tageslichtquotient [%])

Example: Comparison of results of variations

3D Lighting: Simulations for daylight + artificial light

3D Lighting-LuxView: **Presenting results of illuminance and daylight factors**

➔ Questions

➔ Input ....

➔ Export ....

➔ Calculation ....
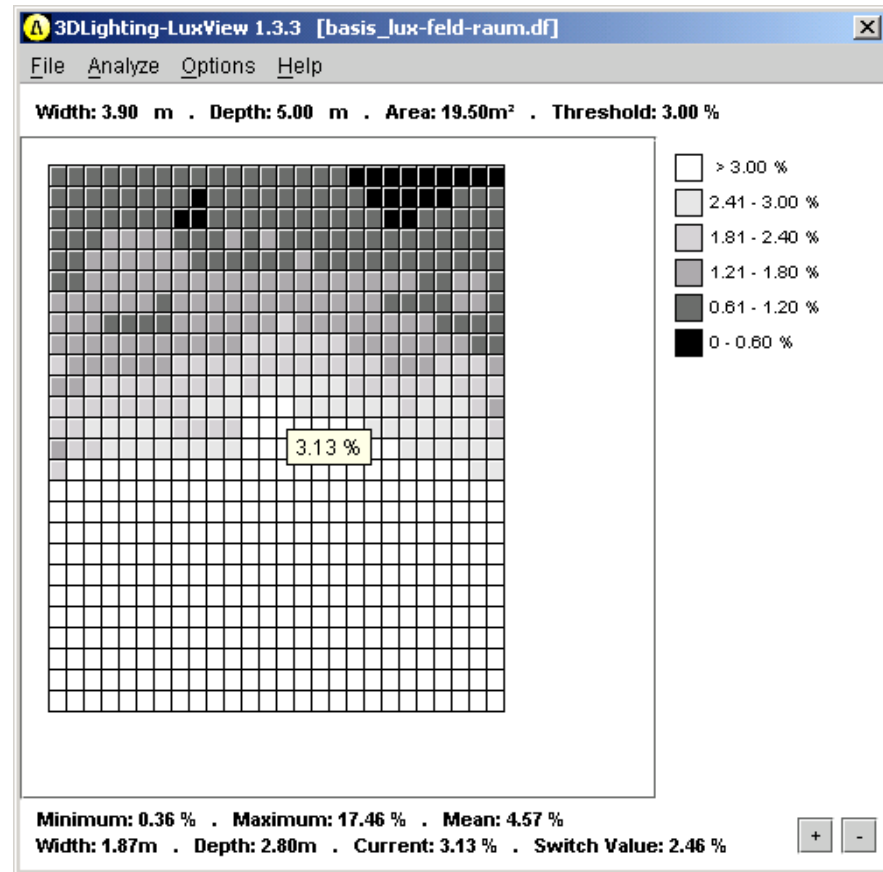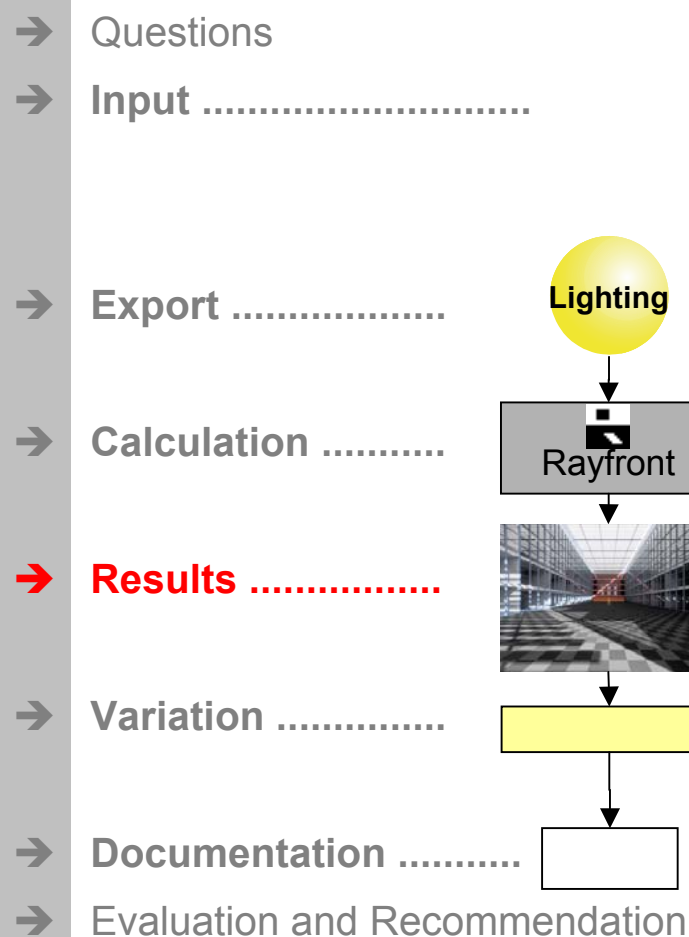
➔ **Results** ....

➔ Variation ....

➔ Documentation ....

➔ Evaluation and Recommendation

Lighting

Rayfront

3DLighting-LuxView 1.3.3 [basis_lux-feld-raum.df]

File   Analyze   Options   Help

Width: 3.90 m . Depth: 5.00 m . Area: 19.50m² . Threshold: 3.00 %

3.13 %

> 3.00 %
2.41 - 3.00 %
1.81 - 2.40 %
1.21 - 1.80 %
0.61 - 1.20 %
0 - 0.60 %

Minimum: 0.36 % . Maximum: 17.46 % . Mean: 4.57 %
Width: 1.87m . Depth: 2.80m . Current: 3.13 % . Switch Value: 2.46 %

**Example: Daylight factors of a single sided daylit room**

3D Lighting: Simulations for daylight + artificial light

3D Lighting-LuxView: Daylight autonomy [6] + electricity demand for art. lighting

→ Questions

→ Input ....

→ Export ....

→ Calculation ....

→ **Results** ....

→ Variation ....

→ Documentation ....

→ Evaluation and Recommendation

Lighting

Rayfront
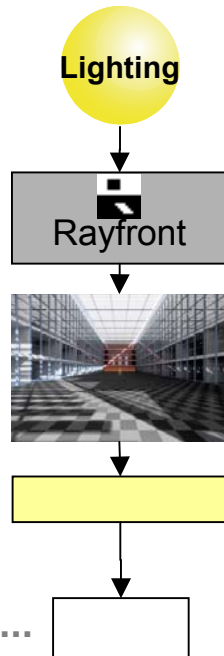
No use of daylight:	D =0%	0% daylight autonomy
Daylight factor:	D= 2.5%	27% (ON / OFF)
		60% (dimmed control)
	D = 30%	90% (maximum)

2.5%

Tageslicht-Autonomie [%] — Strombedarf [kWh/m²]
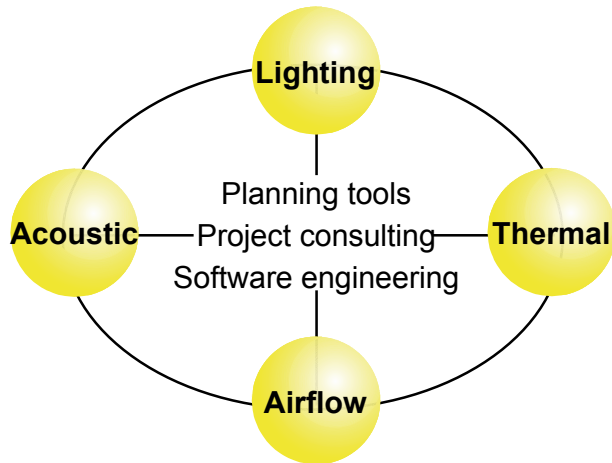
Tageslicht-Quotient [%]
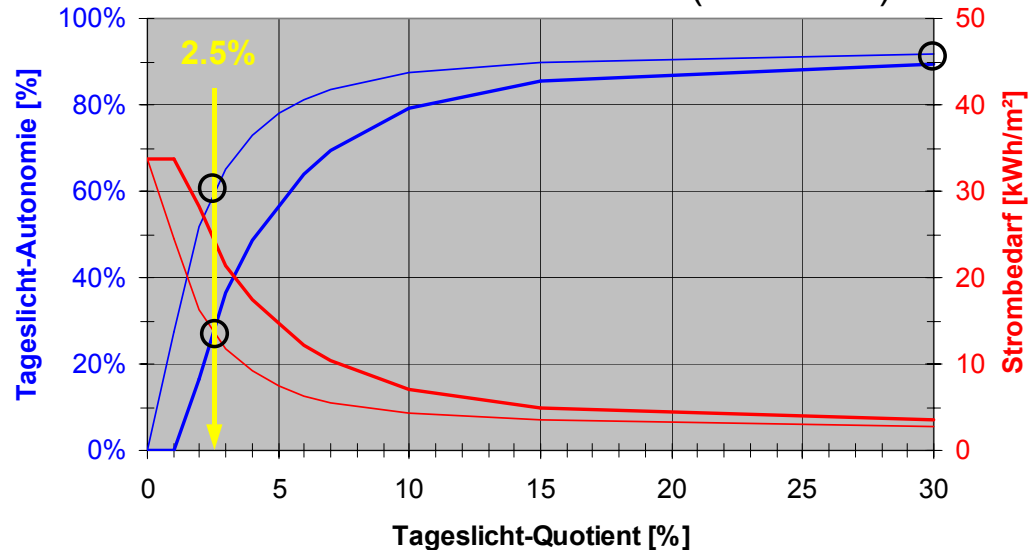
— Tageslicht-Autonomie . ein/aus   — Tageslicht-Autonomie . gedimmt
— Strombedarf-Kunstlicht . ein/aus   — Strombedarf-Kunstlicht . gedimmt

Based on the switch value of daylight factor for a lighting zone

Reference: [6] Hennings, D.: New method for calculation of daylight autonomy (DL_frac); 2002; www.eclim.de

www.alware.de

Planning tools from ALware

Portfolio

Lighting

Acoustic

Planning tools
Project consulting
Software engineering

Thermal

Airflow

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- From plan via the simulation model to results and their evaluation.

- And this with your topical project.

- We help you to perform your project consulting effectively and economically.

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Lighting

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