

The WIS Program

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Introduction

What is WIS?

- A software-tool called **Window Information System** for the design and performance assessment of windows
- An all-in-one tool for thermal, solar and optical properties of complex windows and active facades
- A tool linked to the largest existing Glazing-Database (uses high quality input data)
- A common user and expert tool structured in modules

Aim and Purpose of WIS

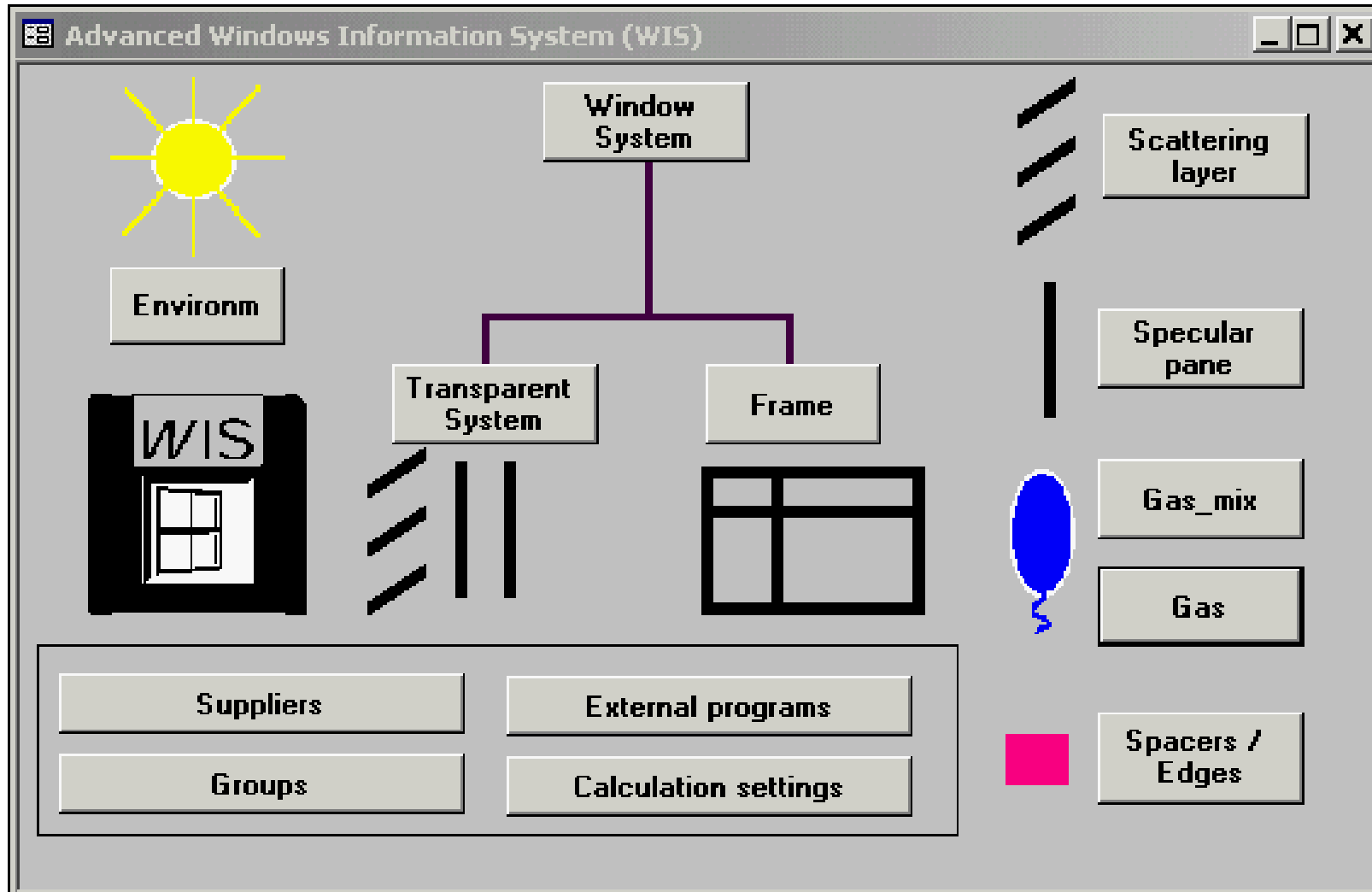
WIS has the following possibilities:

- Calculation of thermal and optical quantities of a complete window system, i.e. glazing and shading
- Wavelength and angle dependent calculations
- Capable of addressing shading and scattering
- Vented and non-vented gaps (free and forced convections)
- Calculation with user defined boundary conditions
- User composed product-comparison
- Standardized or non-standardized algorithms

Calculation Modules

- Window System
- Transparent System (complete glazing system)
- Scattering layer (all kind of shading devices)
- Specular pane (single layer of a glazing system)
- Spacers / Edges (of the glazing unit)
- Gas Mix (within the glazing system)
- Gas (properties of the gas)
- Frame (of the window)
- Environment (boundary conditions)

Structure of WIS



Structure of the modules

The modules have the following content:

- Input section (specify the basic data)
- Calculation button (not in all modules)
- Output section (specify how detailed the results have to be reported)

Window System Module

Window_system

name: id:

Results

U-value: W/(m2K)

area frame: m2 solar factor (g): -

area transparent system: m2 solar direct transmittance: -

perimeter length: m light transmittance: -

UV transmittance: -

Dimensions

height: m

width: m

Composition

Frame:

PSI edge: W/(m.K)

Transparent_syst:

Environment:

Select window system:

Datensatz: von 2

Window System Module

- Input
 - Frame (U-value and width)
 - Psi edge (of the glazing)
 - Transparent System (Glazing, Shading)
 - Environment (boundary conditions)
 - overall dimensions of the window system
 - Output
 - overall results as U- and g-value, Transmittances
 - Possibility of detailed report
-

Transparent System Module

Transparent_system

Transparent system

name: IP iplus nr S 4-16-4
 tilt angle: 0 id: 63
 environment: Te/Ti=0/20 degrees; s

Calculate Details

Ventilation

Results

U-value : 1.15 W/(m2K)
 solar factor (g) : 0.64 -
 solar direct transmittance : 0.56 -
 light transmittance : 0.81 -
 UV transmittance : 0.00 -
 f-value : 0.85 -
 col.rend.Index (Ra) : 98 -

Layers

outdoor side

Type	Gap	width mm	Pane	width mm	code coating	flipped	Shading
▶ Pane			IP_klar4 (WinD)	4	UU	<input type="checkbox"/>	
Gap	Air-Argon 1l	16				<input type="checkbox"/>	
Pane			ip-ipls4.ipe	4	CU	<input type="checkbox"/>	
*						<input type="checkbox"/>	

indoor side

Return

Select transparent system: IP iplus nr S 4-16-4

Datensatz: 1 von 7

Transparent System Module

- Input
 - Layer Construction of Transparent System
 - Environment Conditions
 - Ventilation Settings
 - Incidence Angle of radiation
- Output
 - Results of the transparent system only
(U-value, solar factor (g), Transmittances, f-value, Ra)
 - graphical or text based user-definded detailed reports

Input of Ventilation Settings

Transparent system

Return name: clear 4-12-6 with external di id: 71

Width (w) [m]: 1
Height (h) [m]: 2

Forced Ventilation Input

Gap id	From			To	Flux [dm ³ /s.m]
	Gap	outd	ind		
2		<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	0
4		<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	0

Free Ventilation Input

Gap id	From			To	Air openings [mm]		
	Gap	outd	ind		ind	d1	d2
2		<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	5	5	0
4		<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	0	0	0

Scattering Layer Module

Scattering layers

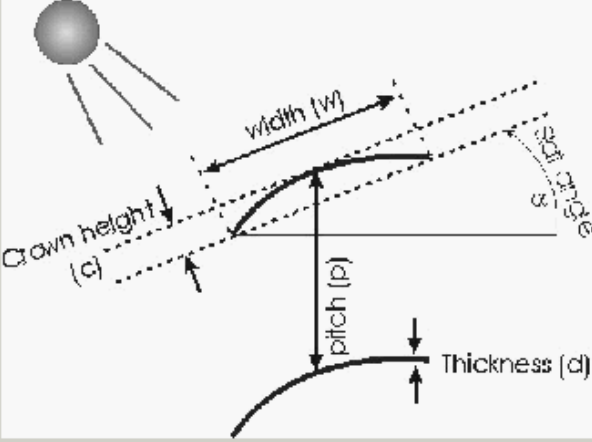
ID	name	Product name	Type
228	HD 0150 venetian blind		Slat shading device
231	VSL 816 roller blind transparent		Screen or roller blind

This object is FROZEN and cannot be edited or un-frozen

Product info | **Geometry** | Thermal properties | Optical properties

thickness: mm
slat chord width (w): mm
crown height (c): mm
slat pitch (p): mm
slat angle: degrees

Slat orientation:
 Horizontal
 Vertical



Go to:

Datensatz: von 13

Scattering Layer Module

- Input

Geometrical, thermal and optical properties such as:

- Shading Model (slat geometry)
- Thermal properties of the shading
- wavelength dependent spectral data

- Output

- Results of the Shading System
(Transmittances, Reflectances)
- graphical or text based user-definded detailed reports

Spectral Input Data for Scattering Layer

Shading_spectral_data

ID: 228 name: HD 0150 venetian blind

WL (nm)	specular (beam -> beam : direct -> direct)				scattering (beam -> diffuse : direct -> diffuse)			
	transmission		reflection		transmission		reflection	
	outdoor	indoor	outdoor	indoor	outdoor	indoor	outdoor	indoor
250	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0700
260	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0700
270	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0700
280	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0700	0.0700
290	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0600	0.0600
300	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0600	0.0600
310	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0600	0.0600

Datensatz: 1 von 226 (Gefiltert)

Spectral Output Data for Scattering Layer



Specular Pane Module

pane

name: ip4728pl.ipe ID: 2637 Info

product name: ipasol platin 47/28 acceptance: E

Supplier: INTERPANE GLAS INDUSTRIE

Group: WINDAT 3.1

thickness: 6 mm therm.conductivity: 1.000 W/(m.K)

corrected emissivity ϵ [-] transmittance [-]

ir	corrected emissivity ϵ [-]		transmittance [-]
	outdoor	indoor	
	0.837	0.037	0.000

	reflectance [-]		transmittance [-]	Ra
	outdoor	indoor		
solar	0.417	0.498	0.298	95
visual	0.380	0.259	0.506	
UV	0.189	0.303	0.216	

single layer (no coating etc) spectral properties as input

UC

use properties for 0 30 and 60 degrees incidence angle
 use properties for substrate and for substrate + film
 use estimated values for angle dependent properties

Input Calculate Output pane type 7

Return Import from text file solar properties Freeze

Select pane: ip4728pl.ipe

Datensatz: 65 von 191

Specular Pane Module

- Input

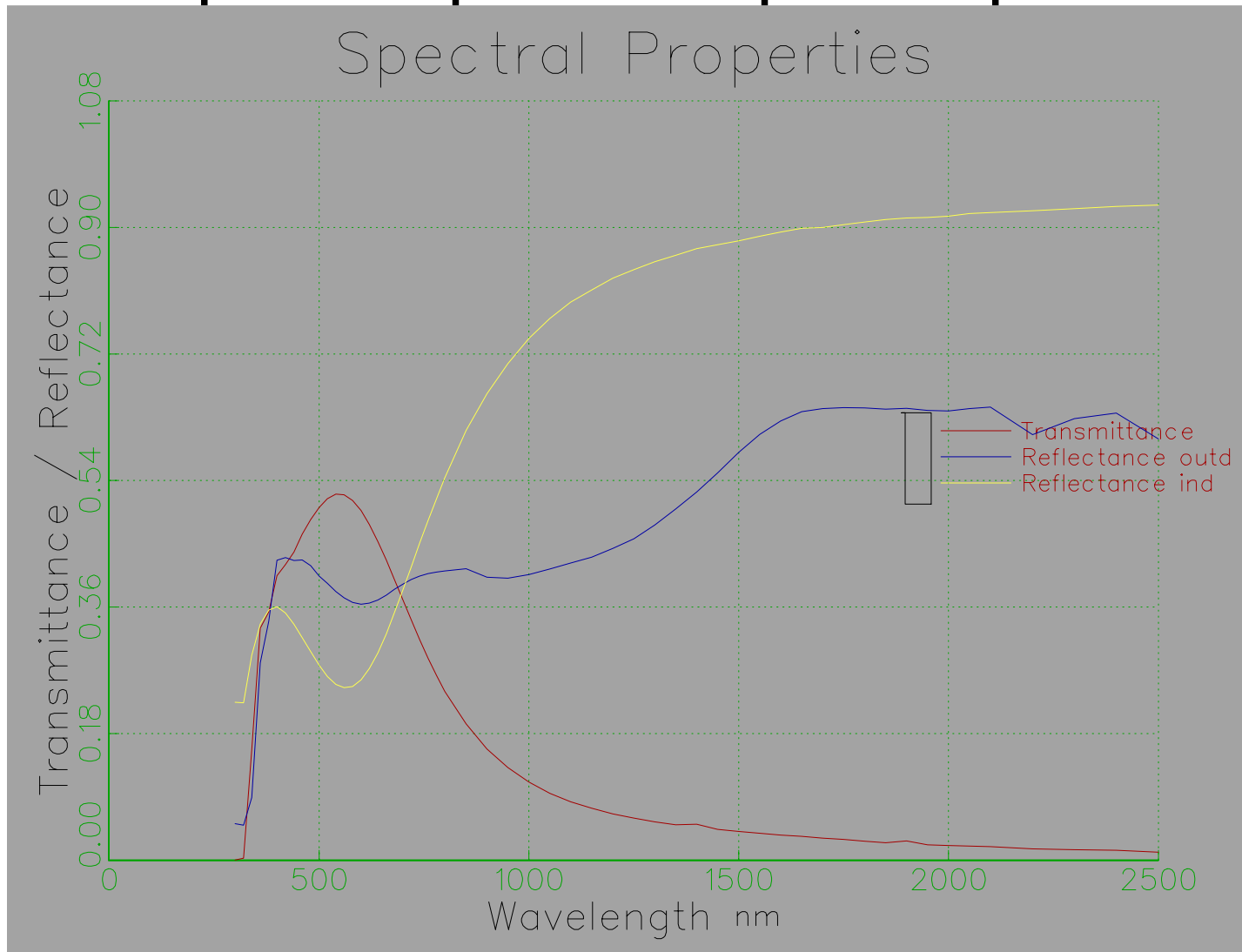
Physical Properties such as:

- spectral data or overall transmittances and reflectances
- Thickness and thermal conductivity
- Emissivities
- Coating informations

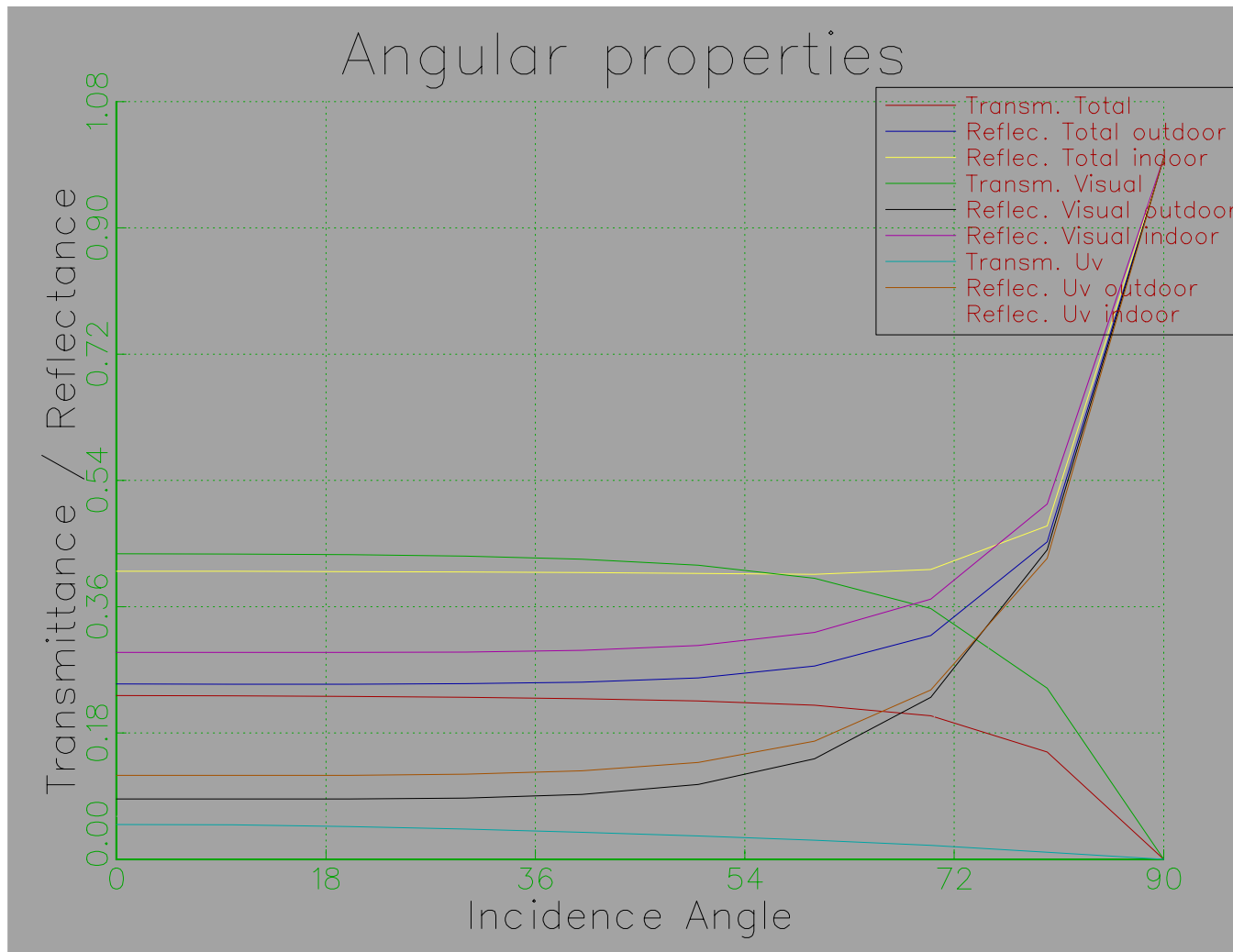
- Output

- Results of the Pane System
(Transmittances, Reflectances, Ra)
- graphical or text based user-definded detailed reports

Graphical spectral report of pane



Graphical angular report of pane



Spacers / Edges Module

Linear thermal transmittance for metallic spacers [W/(m.K)]

PSI

spacer type: alu or steel (draft EN ISO 10077-1 2003)

Frame:	Wood / Plastic	Metal with thermal break	Metal without thermal break
Glazing: double or triple glazing uncoated glass, air or gas space	⊗ 0.060	⊗ 0.080	⊗ 0.020
double glazing with low emissivity coating or triple glazing with two low emissivity coatings, air or gas space	⊗ 0.080	⊗ 0.110	⊗ 0.050

Return

Record: 1 of 3

Gas Mix Module

Gas_mix

Gasmix_id: name:

	-10 oC	0 oC	10 oC	20 oC
Conduction [W/(m.K)]:	<input type="text" value="0.01139"/>	<input type="text" value="0.01176"/>	<input type="text" value="0.01214"/>	<input type="text" value="0.01249"/>
Dynamic Viscosity [kg/(m.s)]:	<input type="text" value="2.0E-05"/>	<input type="text" value="2.2E-05"/>	<input type="text" value="2.3E-05"/>	<input type="text" value="2.4E-05"/>
Density [Kg/m3]:	<input type="text" value="3.0308"/>	<input type="text" value="2.9044"/>	<input type="text" value="2.8156"/>	<input type="text" value="2.714"/>
Cp [J/(kg.K)]:	<input type="text" value="354.6"/>	<input type="text" value="354.6"/>	<input type="text" value="354.6"/>	<input type="text" value="354.6"/>

Gases

Gas name	percentage
<input type="checkbox"/> cen_Argon	<input type="text" value="40"/>
<input type="checkbox"/> cen_Krypton	<input type="text" value="60"/>
<input type="checkbox"/> *	<input type="text" value="0"/>

Select gas mix:

Datensatz: von 6

- Input: name, percentage and gas type of mixture

Gas Module

Gas

Gas

Gas_id: name:

	-10 oC	0 oC	10 oC	20 oC
Conduction [W/(m.K)]:	<input type="text" value="0.01584"/>	<input type="text" value="0.01634"/>	<input type="text" value="0.01684"/>	<input type="text" value="0.01734"/>
Dynamic Viscosity [kg/(m.s)]:	<input type="text" value="2.04E-05"/>	<input type="text" value="2.10E-05"/>	<input type="text" value="2.16E-05"/>	<input type="text" value="2.23E-05"/>
Density [Kg/m3]:	<input type="text" value="1.829"/>	<input type="text" value="1.726"/>	<input type="text" value="1.699"/>	<input type="text" value="1.64"/>
Cp [J/(kg.K)]:	<input type="text" value="519"/>	<input type="text" value="519"/>	<input type="text" value="519"/>	<input type="text" value="519"/>

Select gas:

Datensatz: von 5

Gas Module

- Input

Gas properties at four different temperatures:

- Conduction [W /mK]
- Dynamic Viscosity [kg/ m s]
- Density [kg / m³]
- Specific heat capacity [J/ kg K]

- Output

- new gas mixture available for gaps in glazings

Frame Module

FrameID	Frame name	Product name	U value (W/m ² *K)	PSI characteristic (W/m*K)
74	ITA2	ITA2	2.859	
75	ITA3	ITA3	1.763	
112	FI 1	MEK ALU	1.29	
114	FI 2	MSE ALU	1.32	

This object is FROZEN and cannot be edited or un-frozen

U value: W/m²*K

Supplier:

Group:

Material:

width: m

AutoCadLink:

Info:

Go to:

Datensatz: von 47

Frame Module

- Input
 - U-value [$W / m^2 K$]
 - Width of the Frame [m]
 - Supplier (informative)
 - Material (informative)
- Output
 - PSI regression
 - Direct launch of related programs

Environment Module

environment

name: Id:

temperature [C]

	outdoor	indoor
air:	<input type="text" value="0"/>	<input type="text" value="20"/>
radiant:	<input type="text" value="0"/>	<input type="text" value="20"/>

direct solar radiation: W/m²

convection coeff outdoor: W/(m².K)

convection coeff indoor: W/(m².K)

Select environment:

Datensatz: von 8

Environment Module

Input

Complete boundary conditions such as:

- Air and radiant temperature on the outside
- Air or radiant temperature for the inside
- Direct solar radiation
- Indoor and outdoor **convection** coefficients (radiation coefficients will be calculated)
- Name of this boundary condition

General Calculation settings

Calculation Settings

Calculation settings

CEN methods only Allow input of new data

Expert mode

Air mass

Air mass 1

Air mass 2

Shading calculations

View factor method

Ray tracing method

NumberOfRays: 100000

Return

Results (Overview)

- U-values of window, IGU and frame
- Solar factor (glazing system)
- Transmittances, Reflectances (spectral or weighted)
- Angular spectral properties
- Air speed, flux and temperature in gaps (for free and forced convection)
- Surface convection and radiation coefficients
- Surface temperatures
- Heat fluxes
- Detailed input system description

Data management

- Calculated sets of windows will be automatically saved to the user database
- Databases-exchange of panes and frames databases is possible
- Databases-exchange of complete glazings, gas mixes, environments and complete window systems is not possible

Data management

- For panes and scattering layers:
 - Input of files with spectral / angular data
 - Input by hand of weighted data
 - Input of IGDB (International glazing database)
- For frames:
 - Input of new frames

Data management

- Spectral data can be imported for panes and scattering devices
- Panes are characterized by
 - Specular transmission (same for front and back)
 - Specular reflectance front side
 - Specular reflectance back side

Data management

- Scattering layers are characterized by
 - Specular transmission front side
 - Specular transmission back side
 - Specular reflectance front side
 - Specular reflectance back side
 - Scattered transmission front side
 - Scattered transmission back side
 - Scattered reflectance front side
 - Scattered reflectance back side

Data management

- Note:
 - All scattering is assumed to be diffuse
 - For venetian blinds, roller blinds and pleated blinds supply the spectral data of the material
 - For generic diffusing devices (such as scattering panes) supply the spectral data of the device/layer
 - Format of text files with data is given in data submission documents (see WIS website)

Data management

- Data is imported with a stand alone program, called the WIS Database Manager (DBM)
- Angular spectral data can be imported (for panes only) for 0, 30 and 60 degrees angle
- Data can be imported from:
 - Text files (panes and scattering devices)
 - IGDB (panes)
 - Other WIS databases (panes, scattering devices, frames)

Data management

- Panes and scattering devices can also be characterized by their wavelength integrated properties (solar, UV and visual range)
 - This data should be entered manually in WIS (see WIS help file)

Example and Remarks

- One fully developed example is given, even if it can not meet all possibilities given by WIS
 - currently available for WIS v. 2.0.1
 - except input of data, most is still applicable for version 3.0.1

Example

- Window size: 1.23m x 1.48m
- Wooden Frame, U-value: 1.6 W/m² K
- 2-IGU 4/16/4 (IR), U-value: 1.1 W/m² K
- $\Psi_{\text{edge}} = 0.08$
- Boundary conditions:
 - Outdoor : 0°C; $h_c = 15$ W/m² K
 - Indoor : 20°C; $h_c = 3$ W/m² K

Result of Example

The screenshot shows the 'Window_system' application window. The title bar reads 'Window_system'. The main window title is 'Window_system'. The interface is divided into several sections:

- name:** Example
- id:** 1
- Results:**
 - U-value: 1.49 W/(m2K)
 - area frame: 0.566 m2
 - area transparent system: 1.255 m2
 - perimeter length: 4.508 m
 - solar factor (g): 0.00 -
 - solar direct transmittance: 0.38 -
 - light transmittance: 0.56 -
 - UV transmittance: 0.00 -
- Dimensions:**
 - height: 1.48 m
 - width: 1.23 m
- Composition:**
 - Frame: Evolution 2 (low) [Select]
 - PSI edge: 0.06 W/(m.K) [Suggest...]
 - Transparent_syst: IP iplus nr S 4-1 [Select]
 - Environment: example [Select]
- Buttons:** Return, Calculate
- Select window system:** Example
- Datensatz:** 1 von 2

Example and Remarks

Documentation and Reports

- Integrated User manual
- Integrated documentation and description of the applied algorithms
- Different kinds of detailed reports for print out or saving as files

Example and Remarks

Online Help

- Integrated help tool:
F1-key always available
- search, sort and filter routines
- frequently asked questions (FAQ) can be printed from the WIS homepage:
<http://windat.ucd.ie/wis/html/index.html>
- Support contact is mentioned in the help