The WIS Program

Content

- Introduction
- Calculation modules
- Data management
- Example and Remarks

WinDat Thematic Network

Introduction

What is WIS?

- A software-tool called **W**indow **I**nformation **S**ystem 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

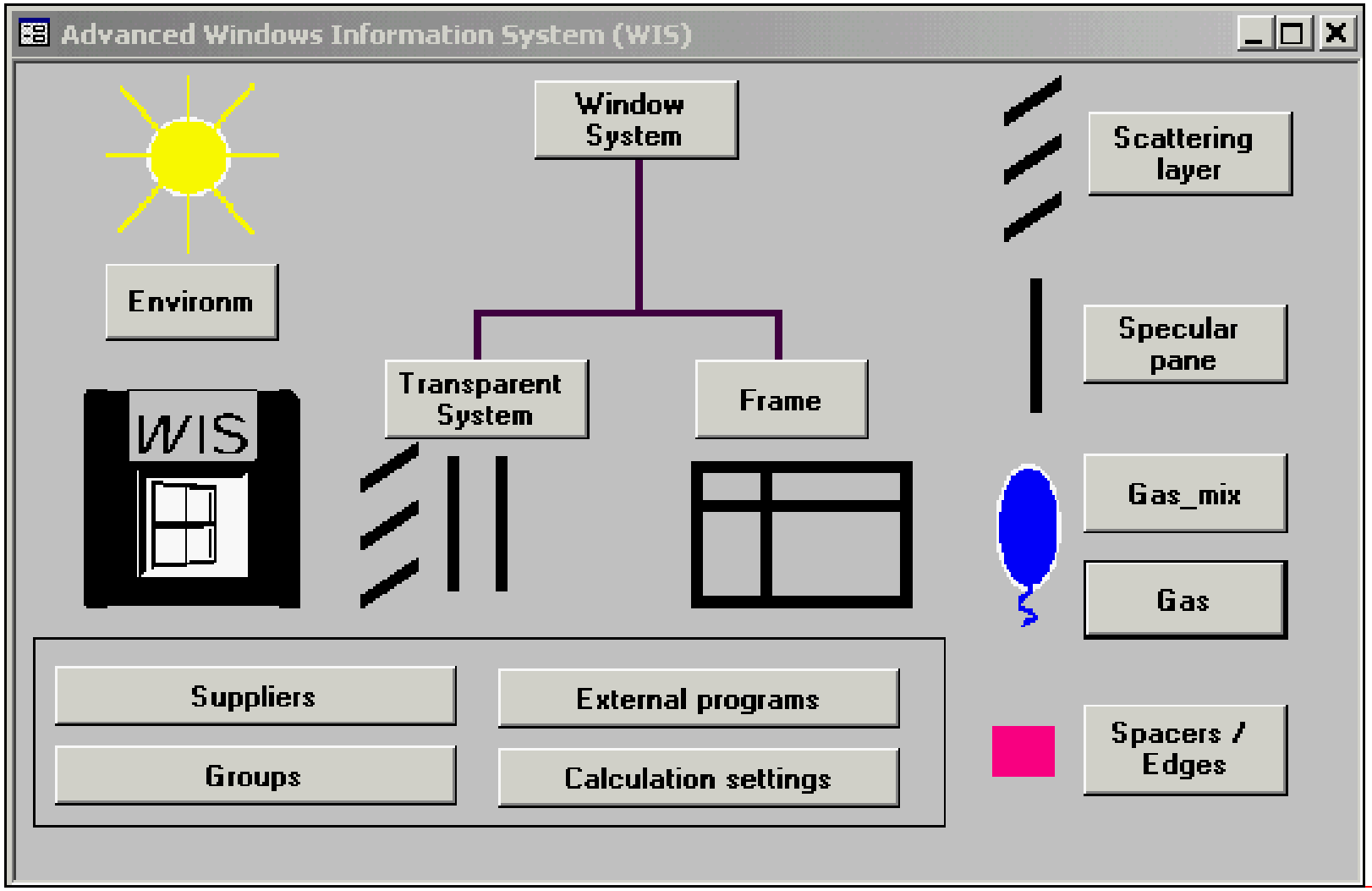
WIS has the following possibilities:

- 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



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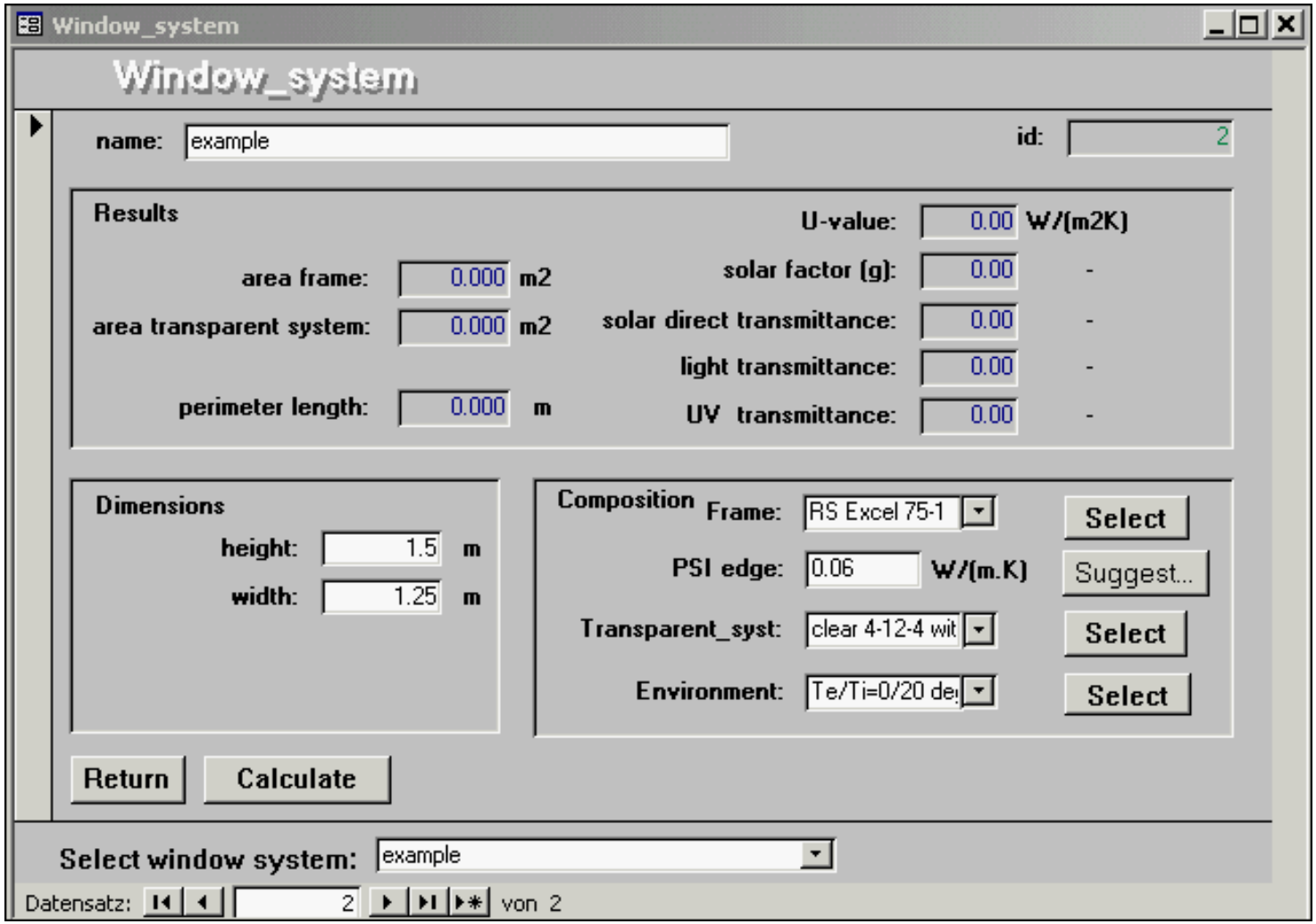
Structure of the modules

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



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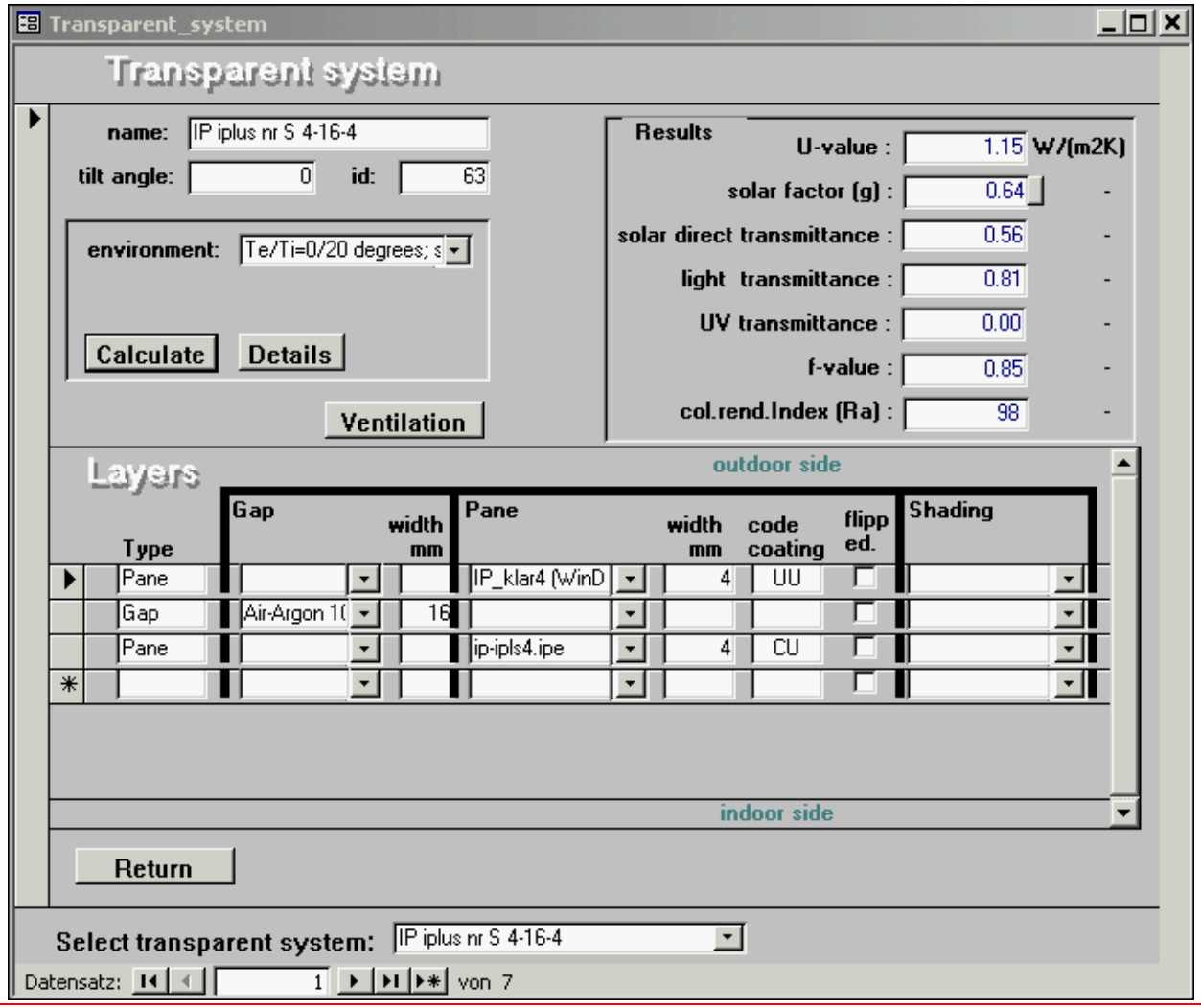
Window System Module

- 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



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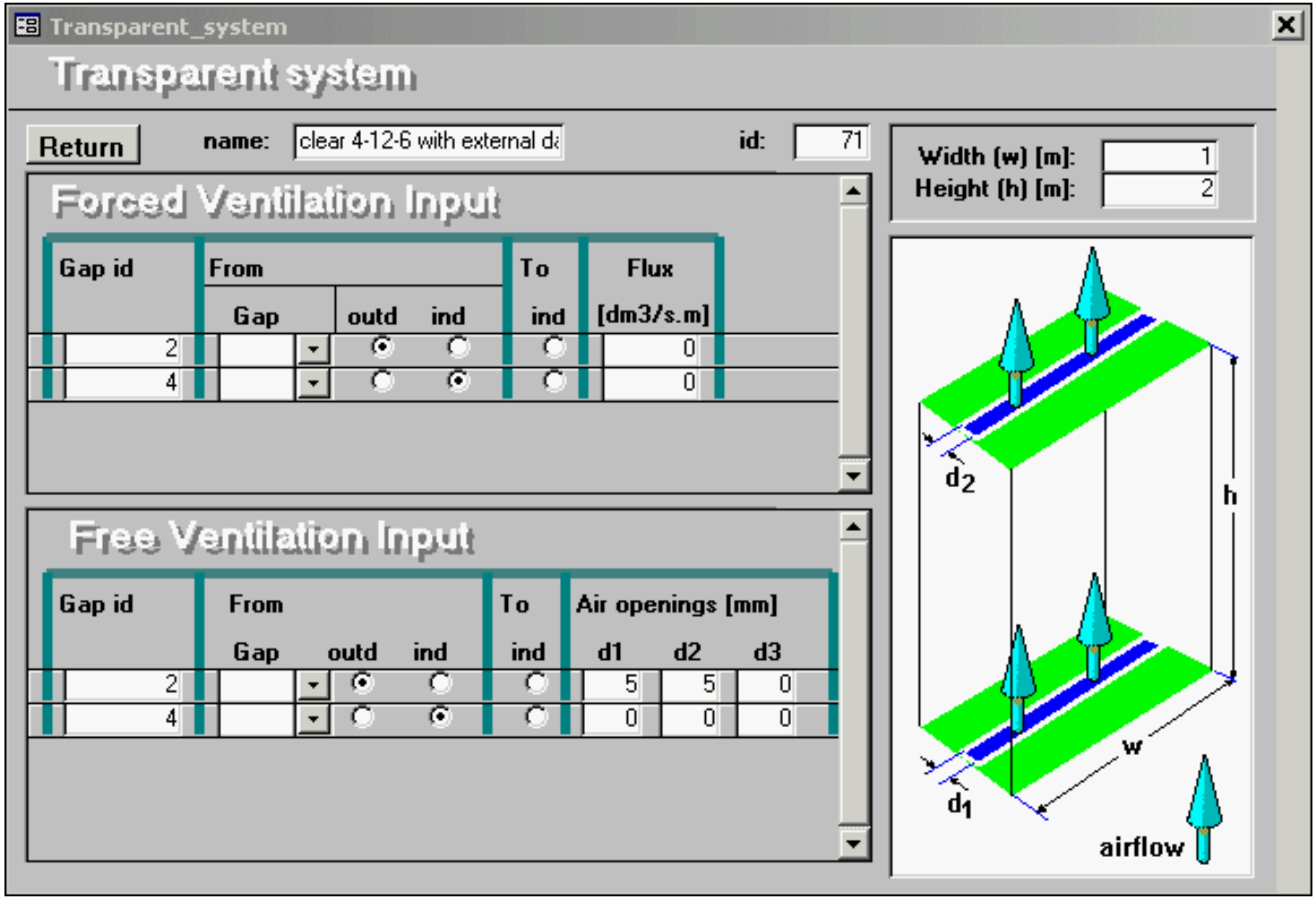
Transparent System Module

- 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



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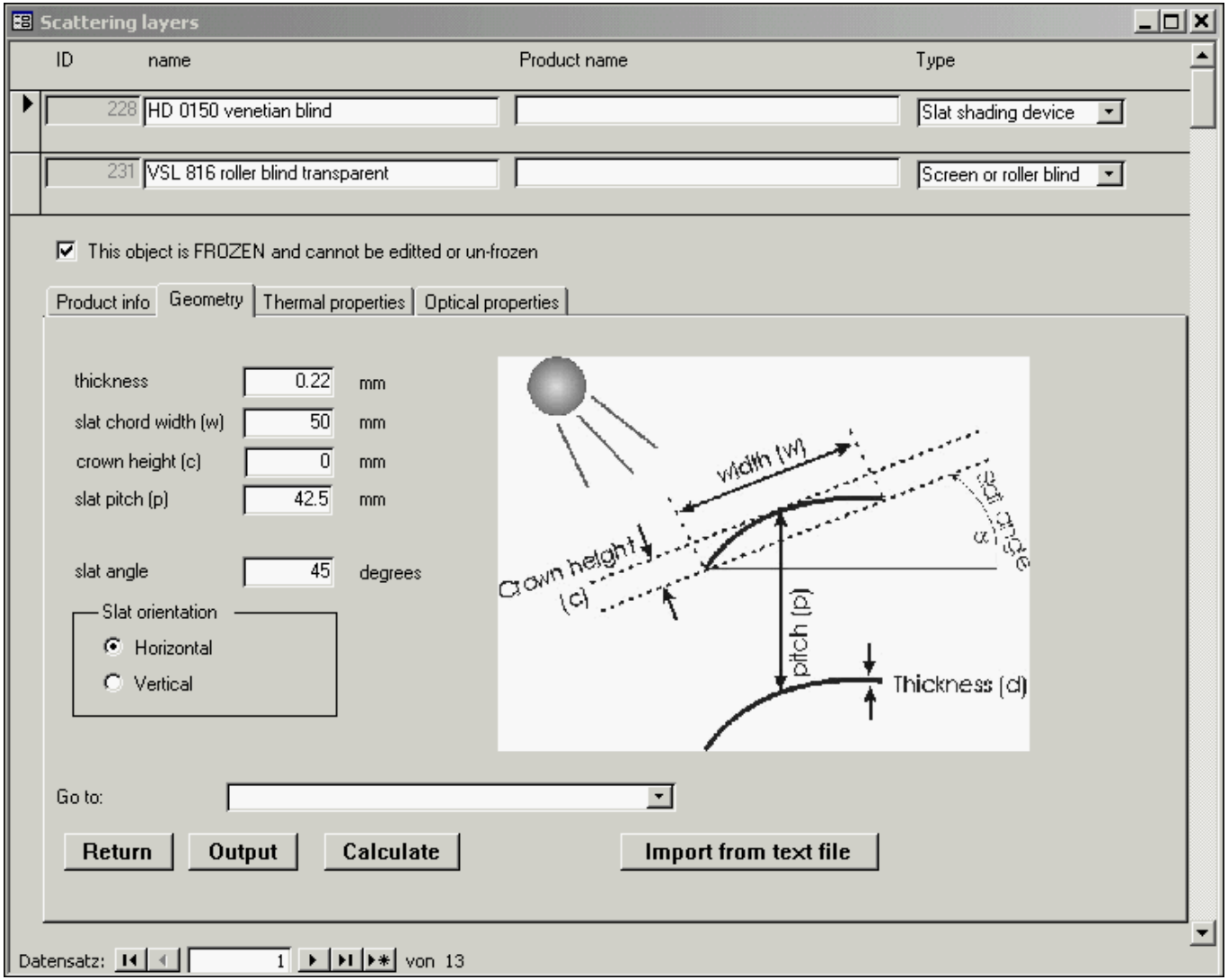
Scattering Layer Module



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Scattering Layer Module

- Input

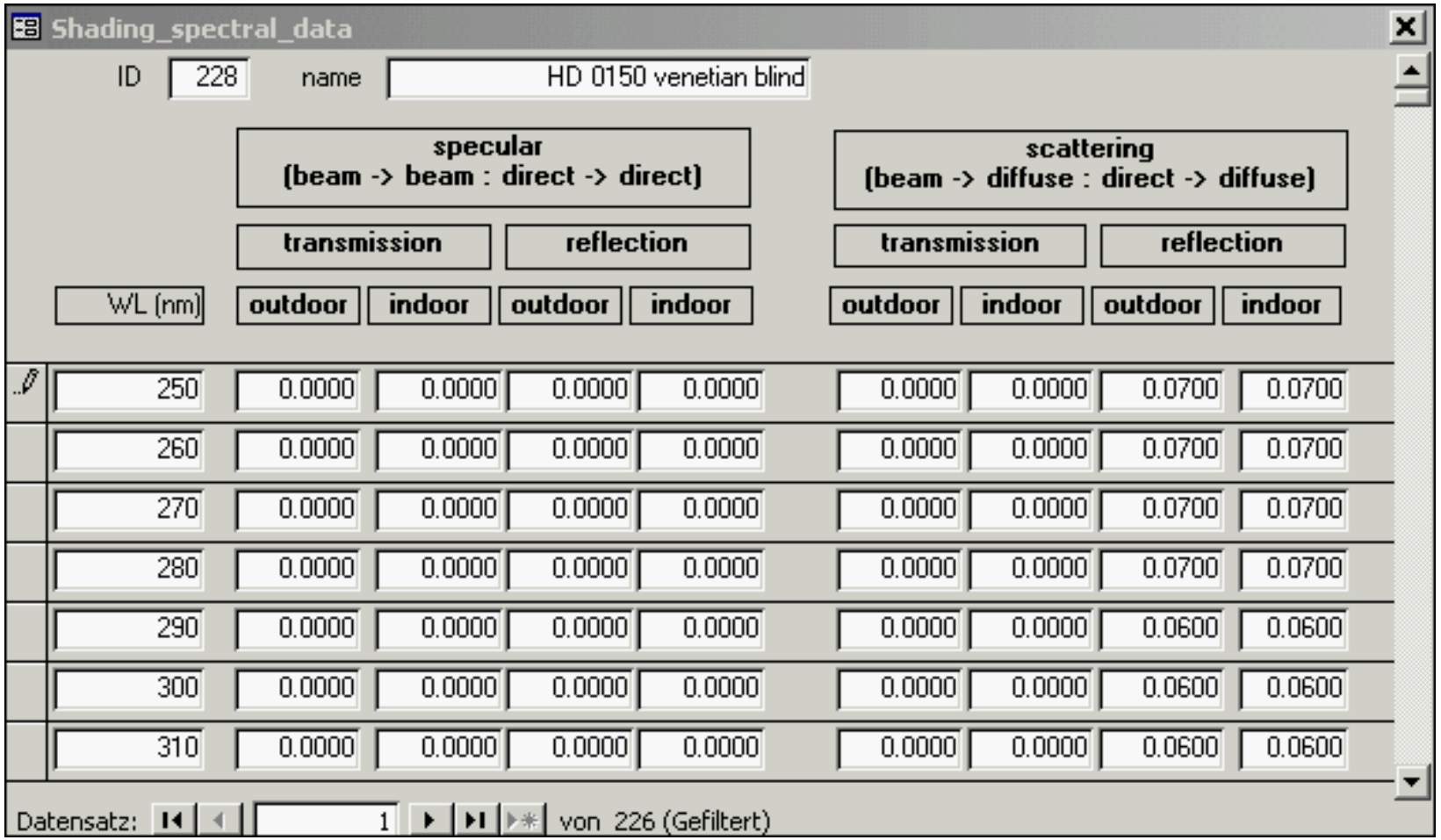
  Geometrical, thermal and optical properties such as:

  – 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



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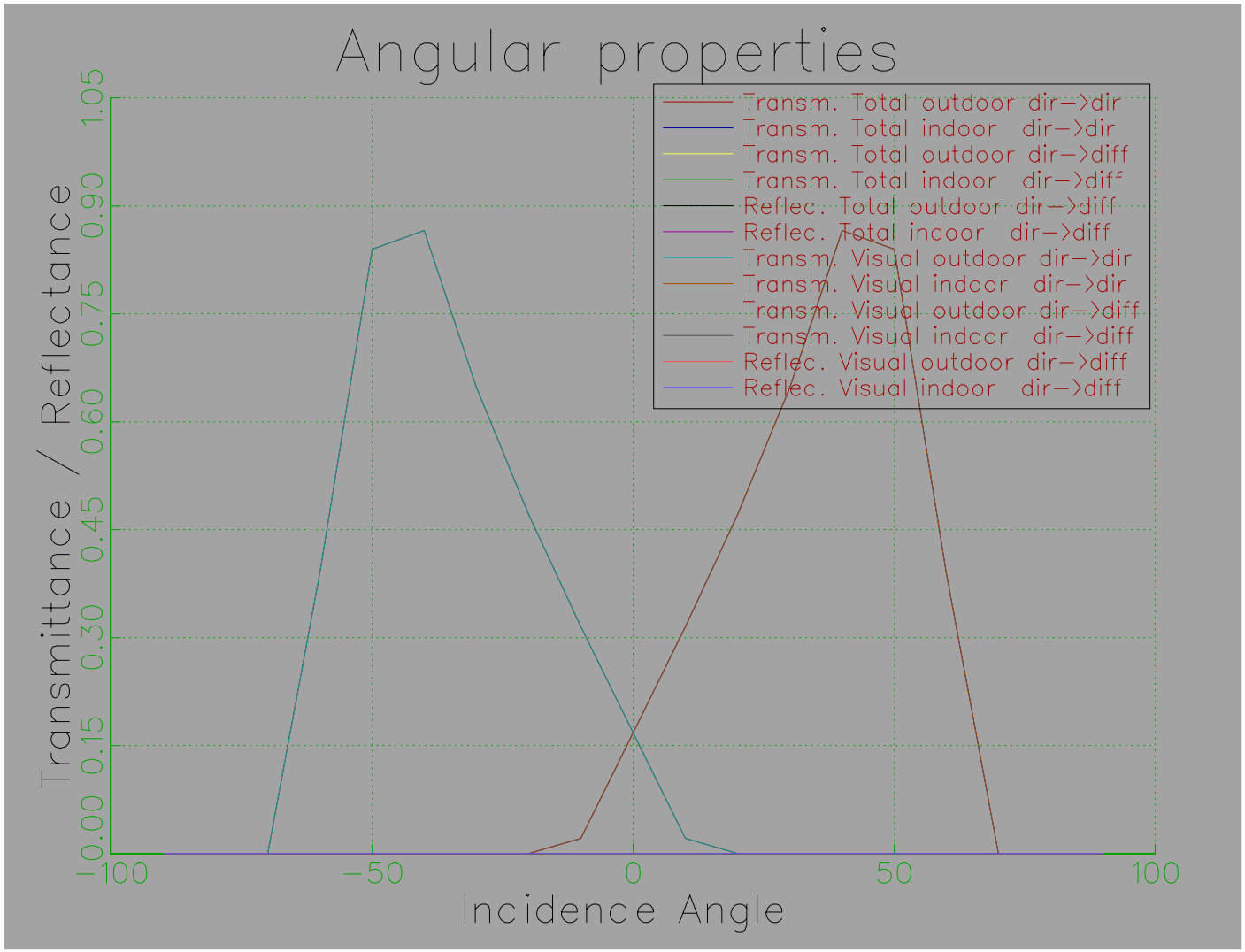
Spectral Output Data for Scattering Layer



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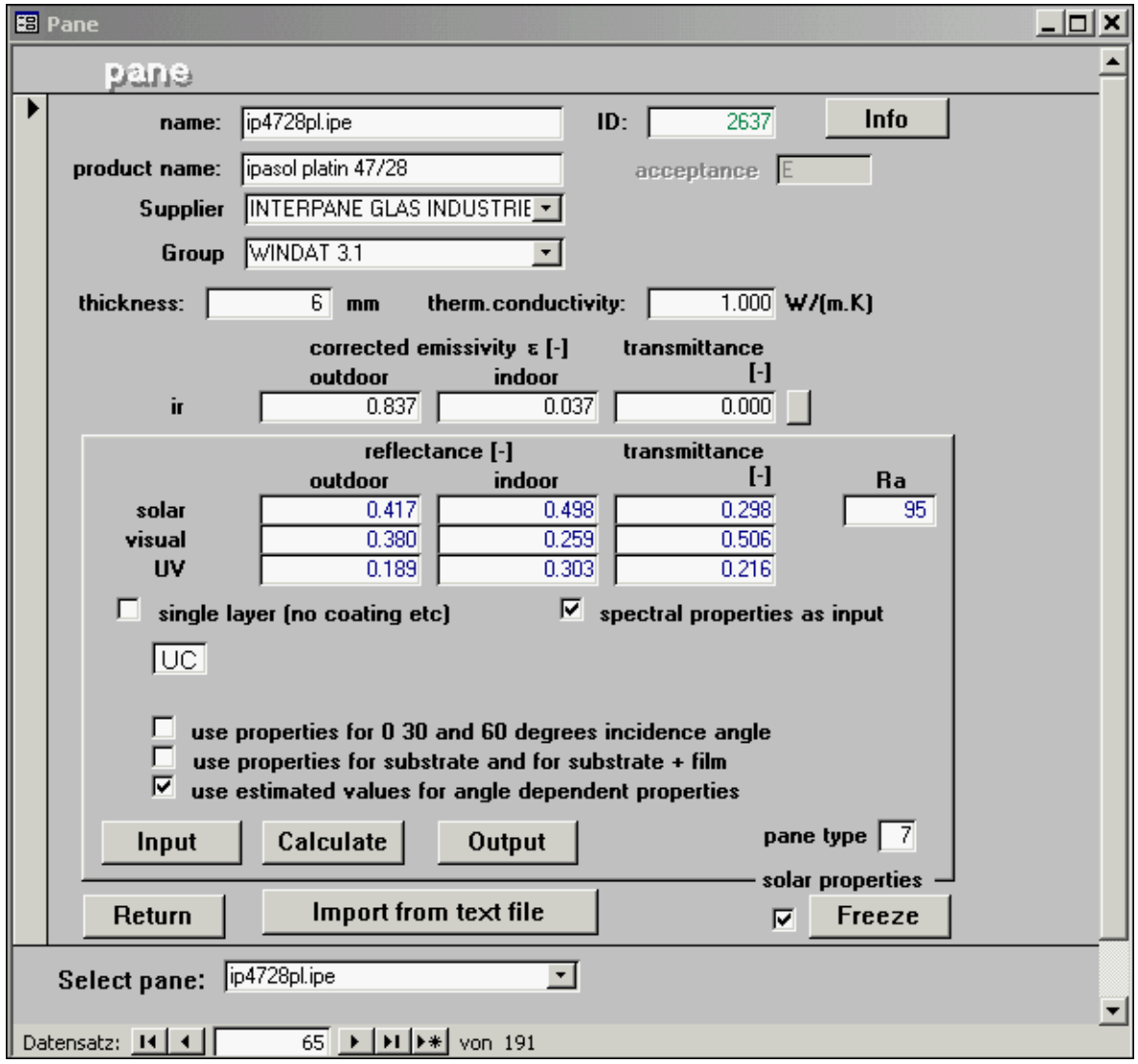
Specular Pane Module



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Specular Pane Module

- Input

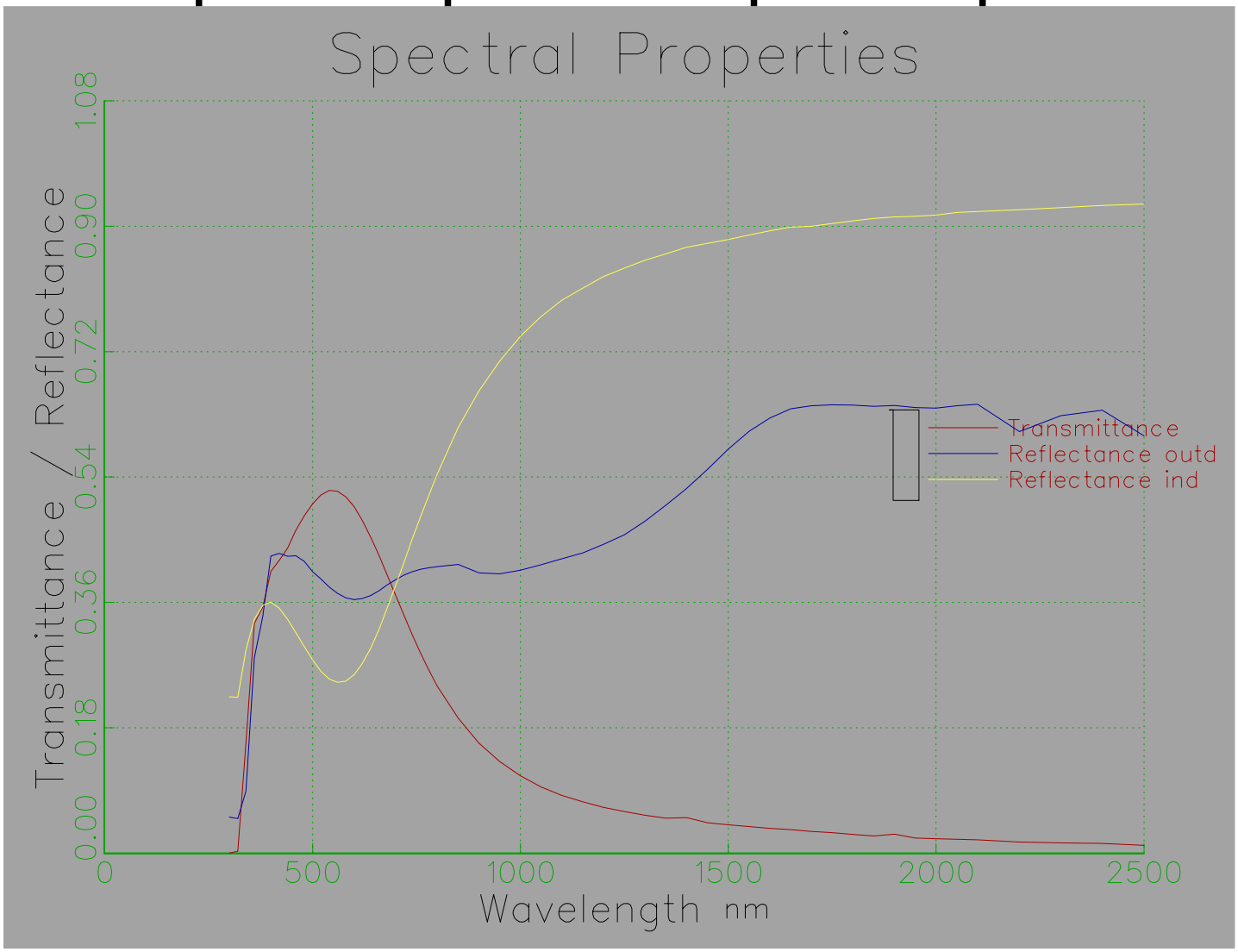
  Physical Properties such as:

  – 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



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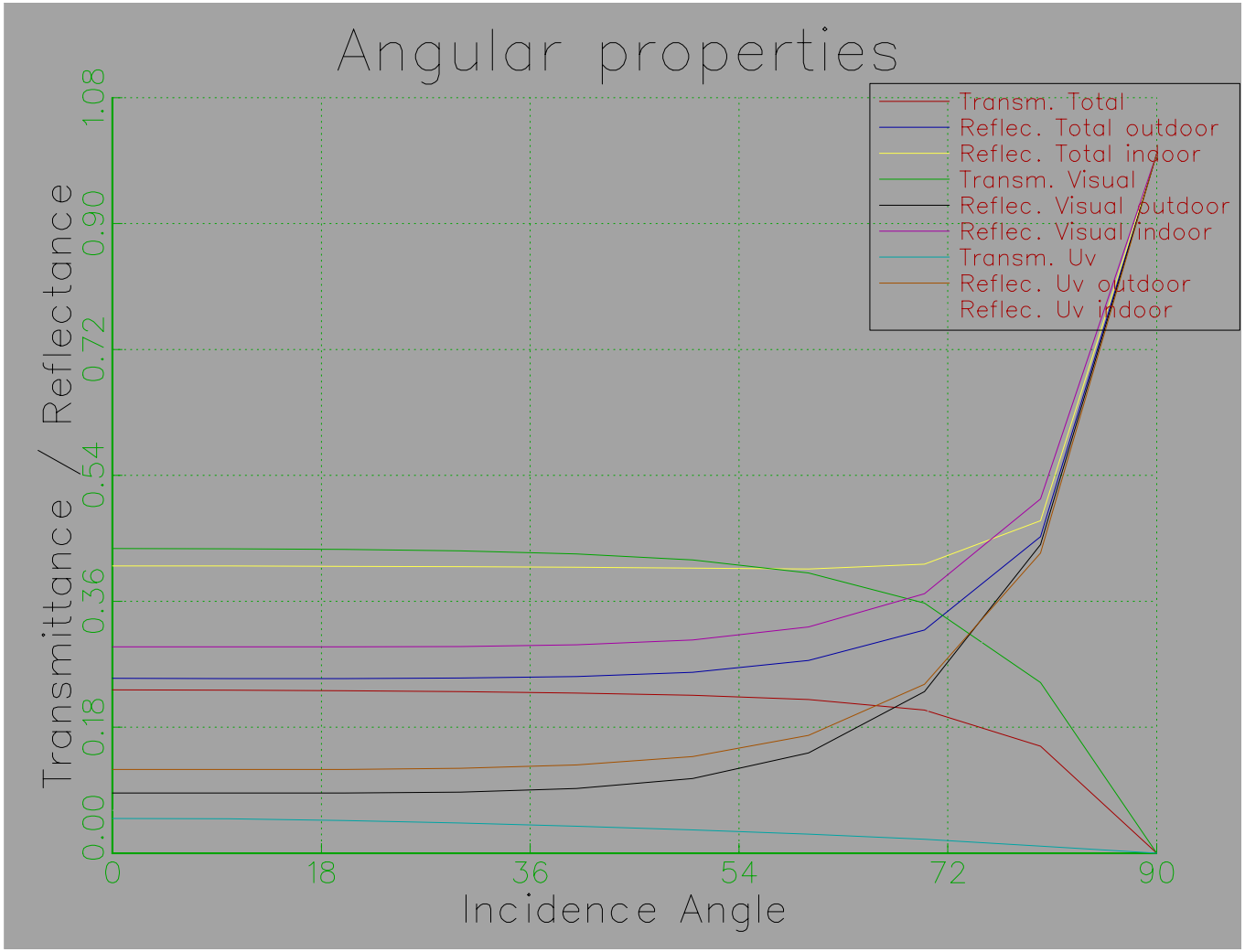
Graphical angular report of pane



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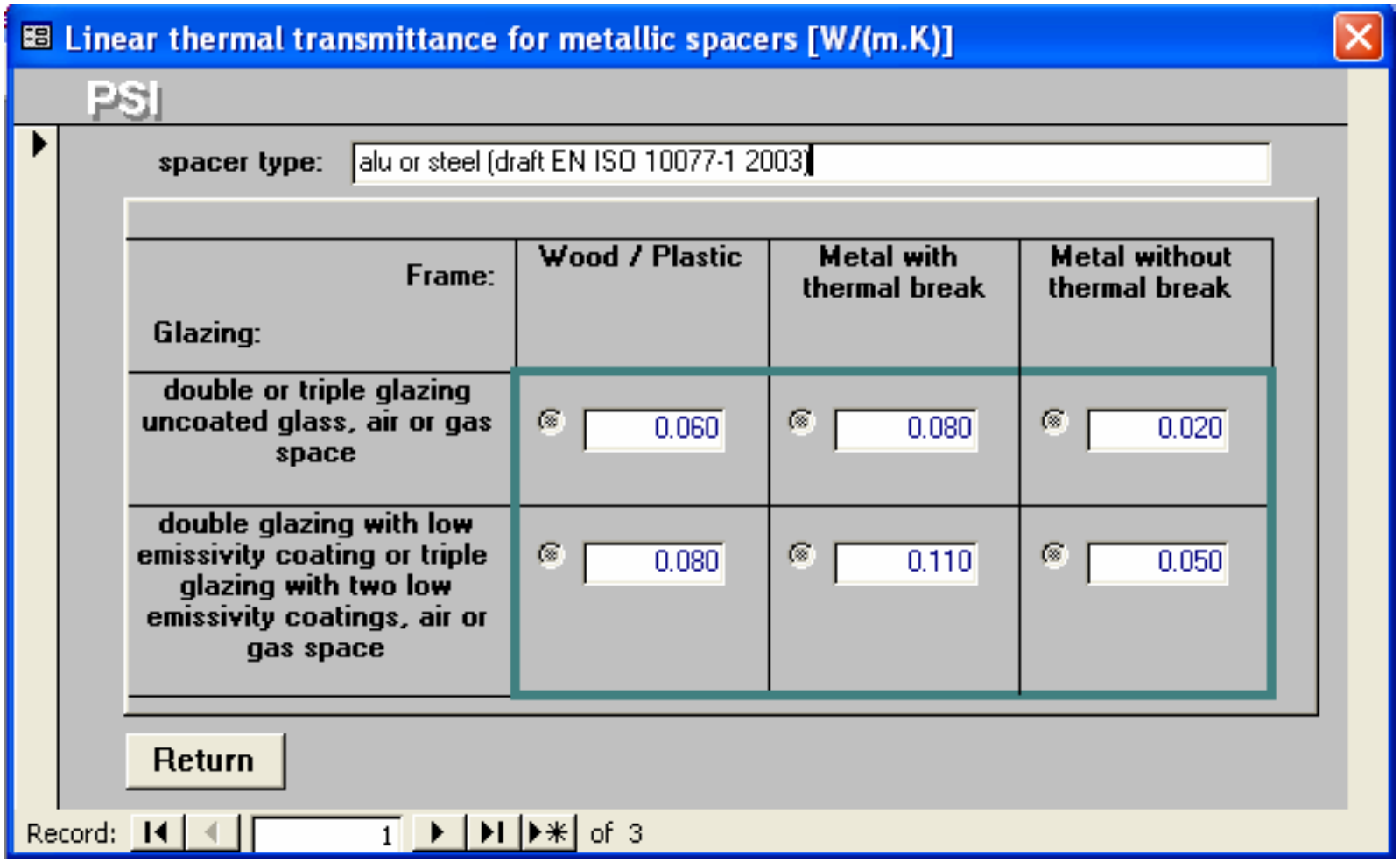
Spacers / Edges Module



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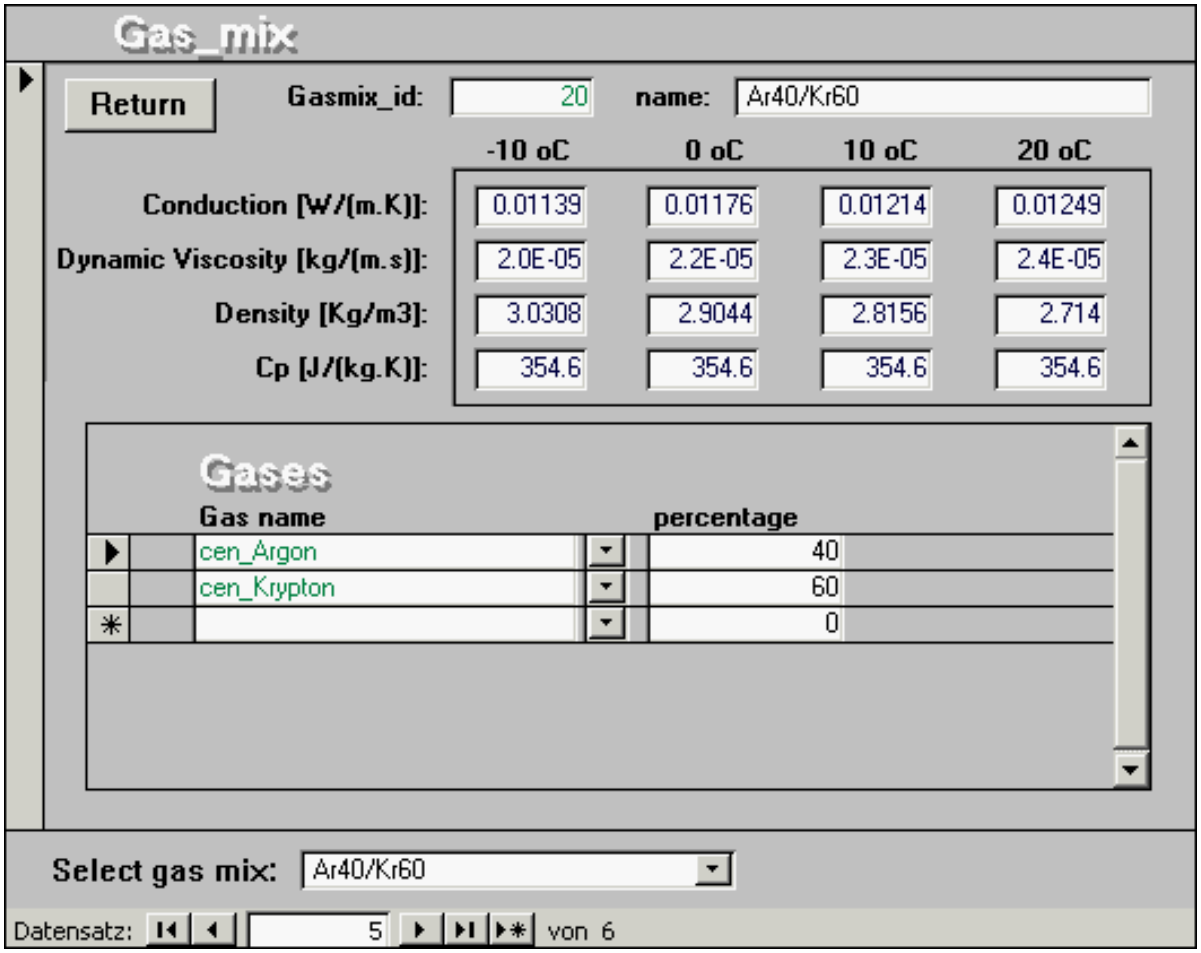
Gas Mix Module



- Input: name, percentage and gas type of mixture

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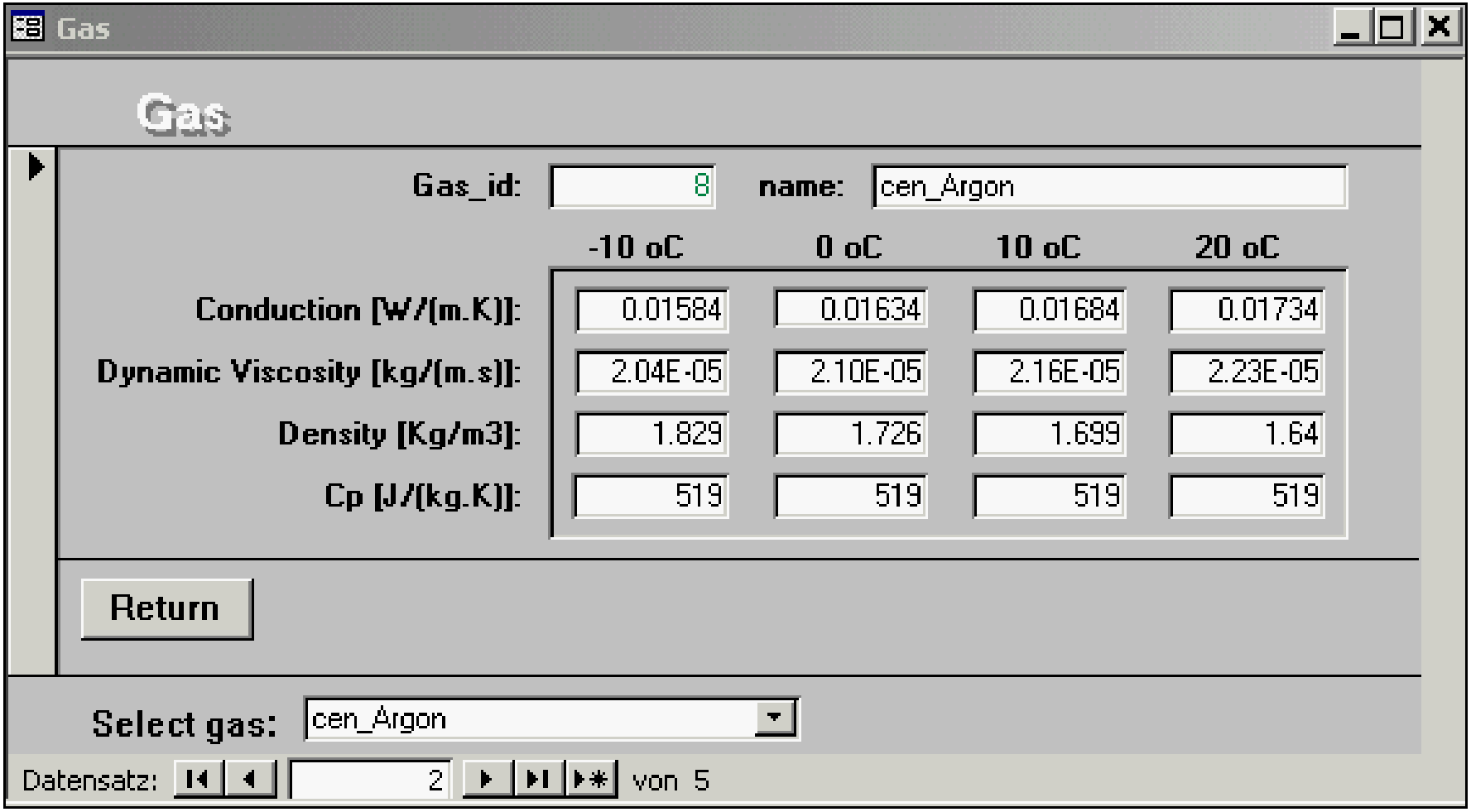
Gas Module



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Gas Module

- Input

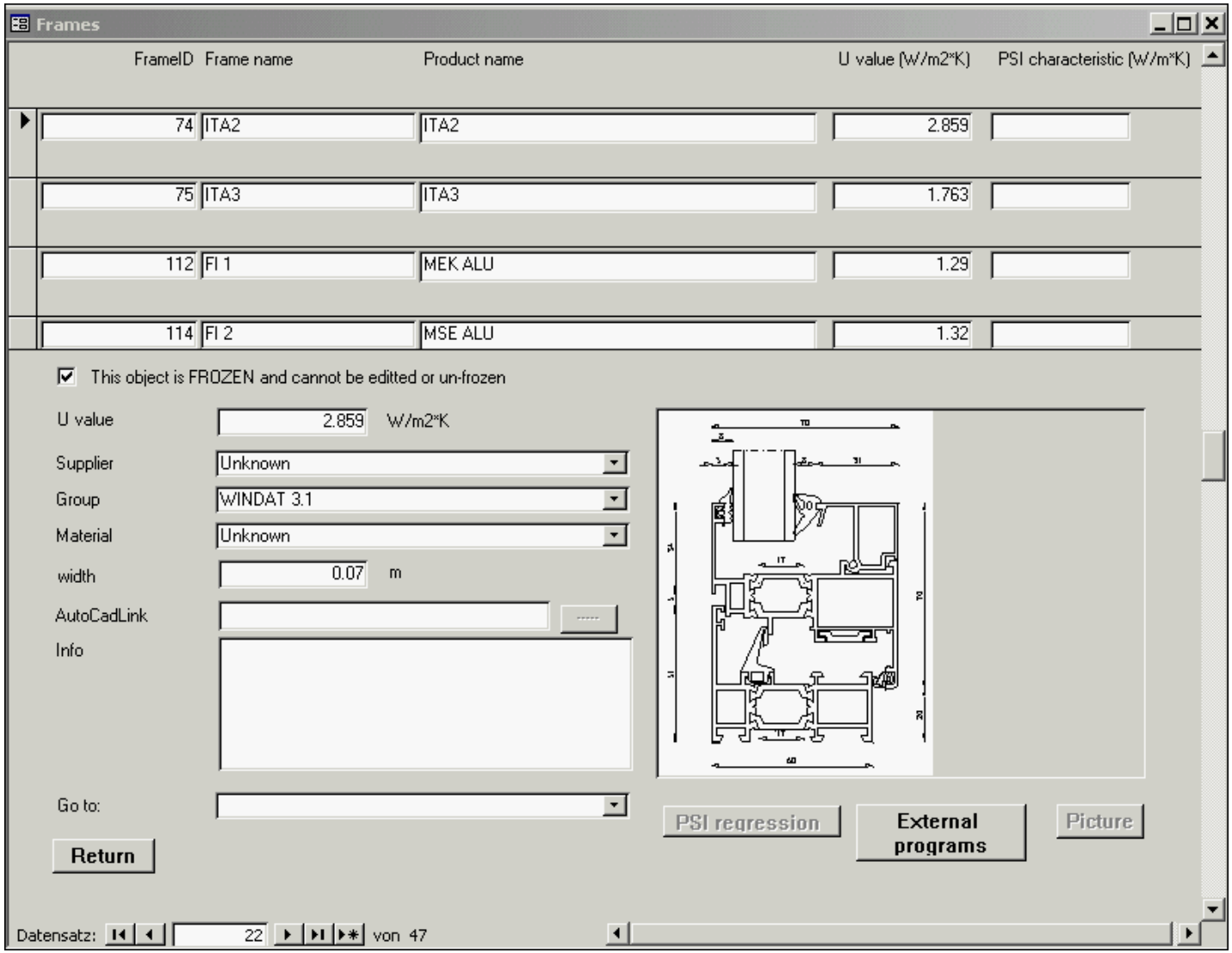
  Gas properties at four different tempertures:

  – Conduction [W /mK]
  – Dynamic Viscosity [kg/ m s]
  – Density [kg / m^3]
  – Specific heat capacity [J/ kg K]

- Output

  – new gas mixture available for gaps in glazings

Frame Module



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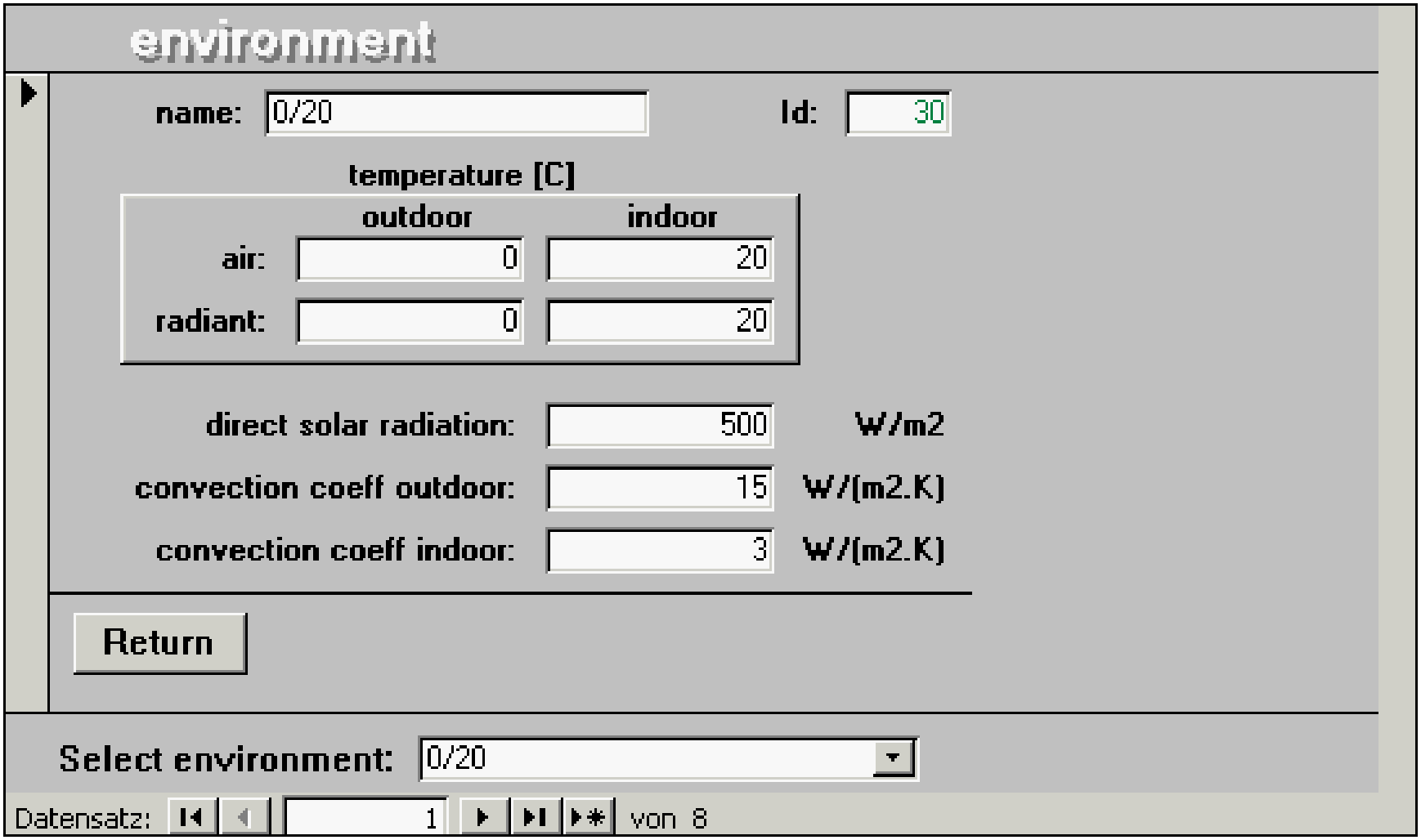
Frame Module

- 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



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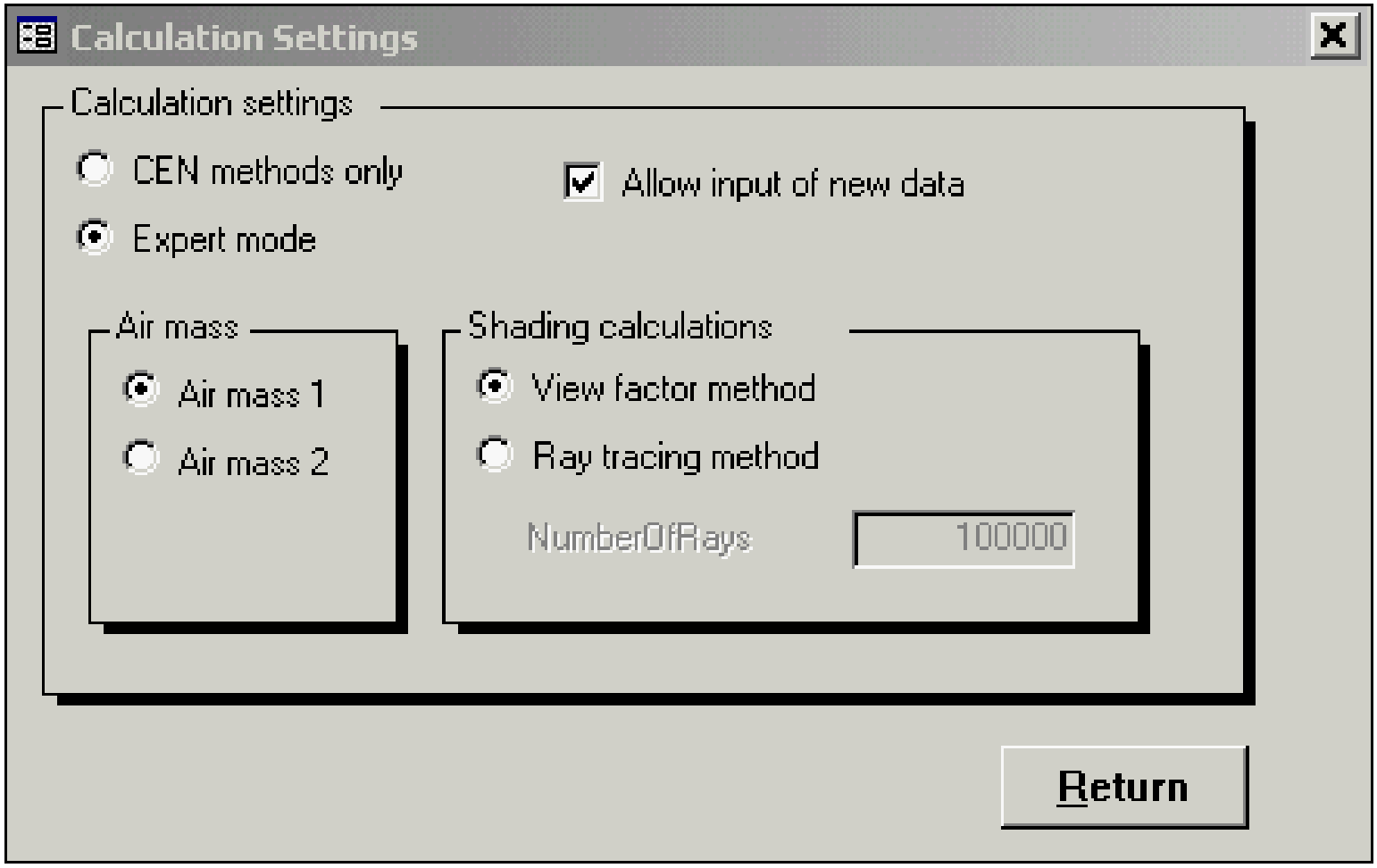
Environment Module

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



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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)

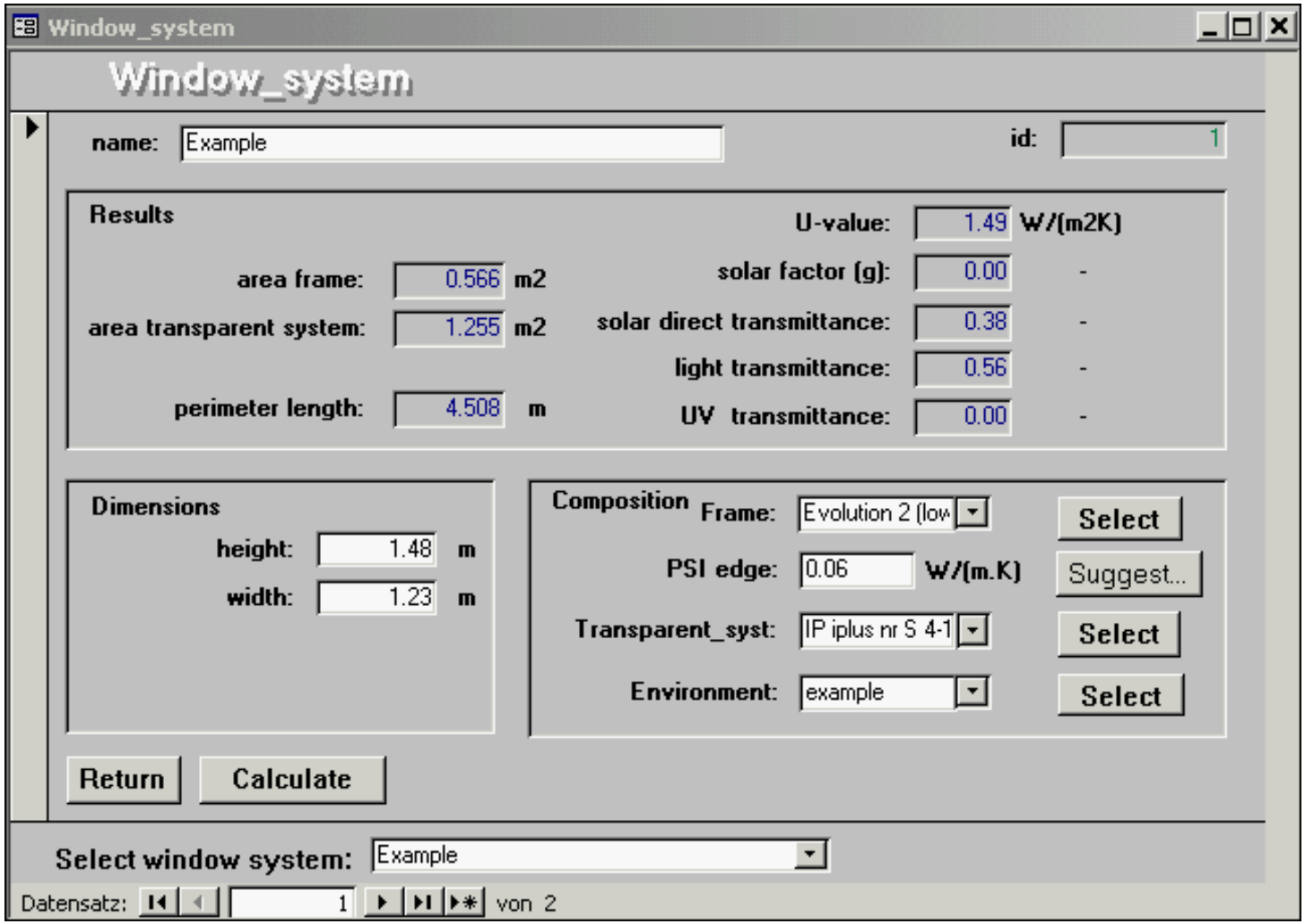
Example and Remarks

- 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 $W/m^2 K$
- 2-IGU 4/16/4 (IR), U-value: 1.1 $W/m^2 K$
- $\Psi_{edge} = 0.08$
- Boundary conditions:
  - Outdoor : 0°C; $h_c = 15\ W/m^2 K$
  - Indoor : 20°C; $h_c = 3\ W/m^2 K$

Result of Example



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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