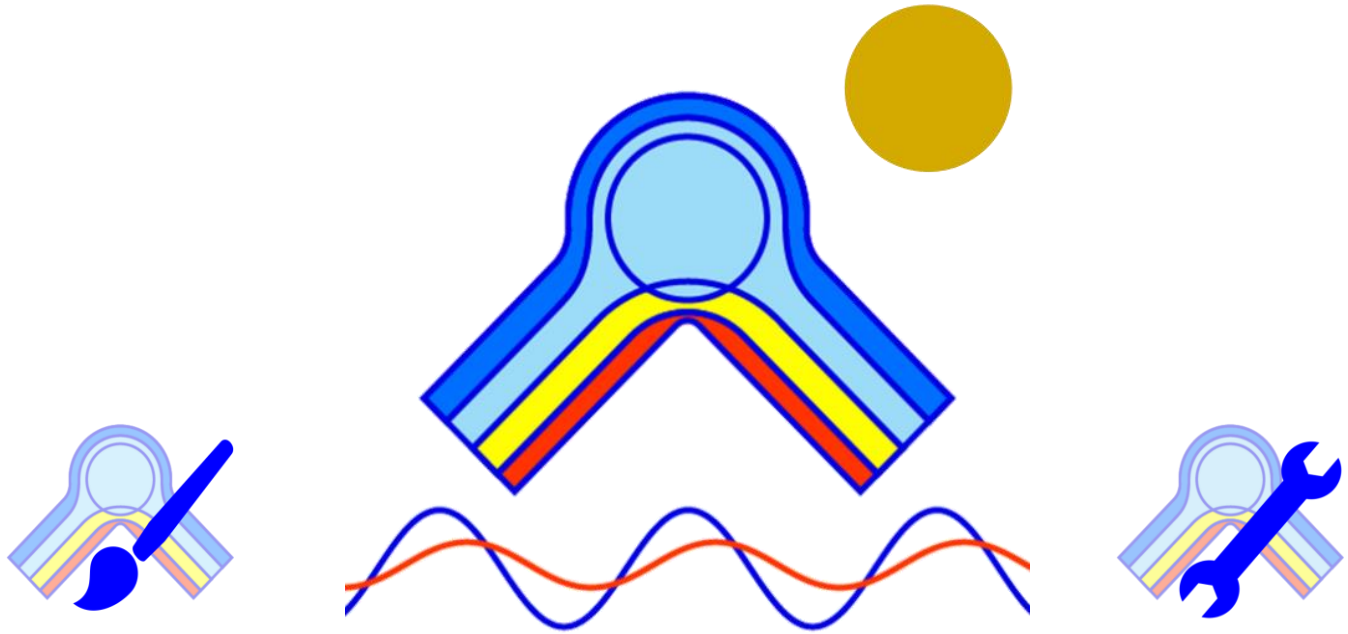
physibel

BISTRA v5 New program performances



BISTRA v5

BISTRA v5 – Overview

overview

A Solar processor – feature RADCON

- A.1 Specular reflection of solar radiation
- A.2 Handling of opaque materials in contact with transparent materials
- A.3 Revised Solar Data input - option to fix sun position
- A.4 Improved algorithms – reduced calculation time

B Climatic data

- B.1 Input of EPW and TRY files
- B.2 Handling sub-hourly solar data from hourly solar data
- B.3 User defined start time

C EN ISO standards

- C.1 Revision of Colours Window in line with BISCO v12
- C.2 Gas mix according to EN 673
- C.3 Cavities and layers according to EN ISO 6946

D Bitmap editing

- D.1 New function 'Bisect'
- D.2 Snap to pixel
- D.3 New drawing functions
- D.4 Miscellaneous

E Reporting: Graphic output

- E.1 Sun position
- E.2 Visualisation of absorbed solar radiation
- E.3 Revised legend: clustered cavities + material names
- E.4 Miscellaneous

F Reporting: Text output

- F.1 New report definitions: ΔT_{max}, E_{tot}, E_{diff}, E_{dir}, E_{gr}
- F.2 Absorbed solar flux/energy into materials (q_{sol} ,Q_{sol})
- F.3 Option to save data as .csv
- F.4 Miscellaneous

G Online Physibel Portal

- G.1 User management
- G.2 Support
- G.3 Physibel Knowledge Base
  - Documentation
  - Tutorials and examples
  - Videos

H Licencing

- H.1 Perpetual licence (USB key)
- H.2 Subscription licence (software key)

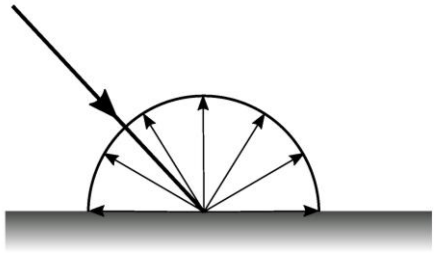
A1. Specular reflection of short-wave radiation

overview

New parameter in Colour window:

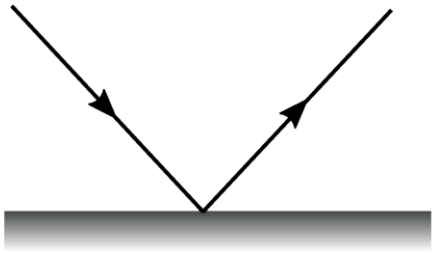
Specularity (%) = percentage specular reflection of direct solar radiation

Diffuse reflection



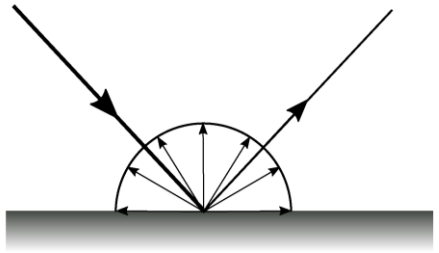
S=0%

100% specular reflection



S=100%

Partial specular reflection



0%<S<100%

Colours

Col.		Type	Name	λ [W/mK]	ε [-]	θa [°C]	hc [W/m²K]	θr [°C]	Sun	ρs [-]	Specular [%]	τs [-]	Standard
2		MATERIAL	100% specular reflection	10.000	0.00					1.00	100	0.00	
4		MATERIAL	100% absorption (inner ring)	0.040	0.00					0.00	0	0.00	
7		MATERIAL	100% reflection surface (outer ring)	0.040	0.00					1.00	0	0.00	
8		MATERIAL	filling	0.040	0.00					0.10	0	0.00	
170		BC_SKY	solar zone			0.0	2.50	0.0	YES				

α_s : solar absorption factor (-)

ρ_s : solar reflection factor (-)

τ_s : solar transmission factor (-)

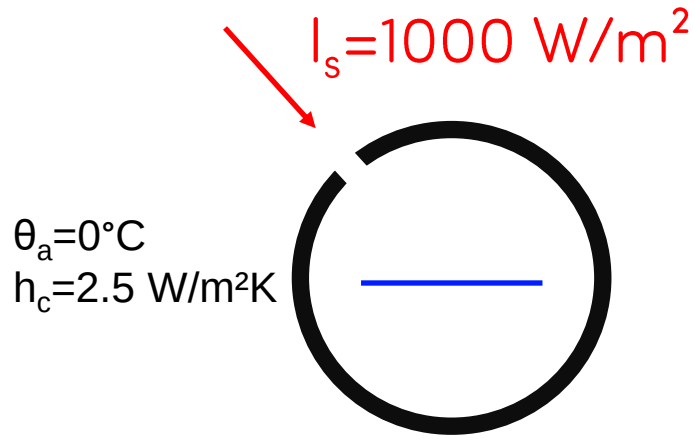
S: specularity (%)

A1. Specular reflection of short-wave radiation

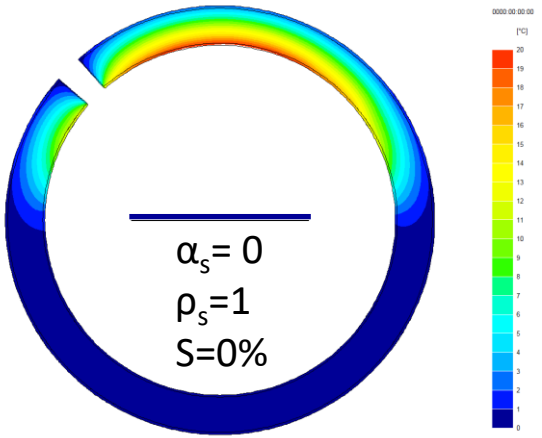
overview

Theoretical example:

- Insulated circle with small opening
  - Outside surface: $\alpha_s = 0$, $\rho_s = 1$
  - Inside surface: $\alpha_s = 1$, $\rho_s = 0$
  - Horizontal opaque plate
- Solar radiation
  - 1000 W/m²
  - Fixed sun position (45°)

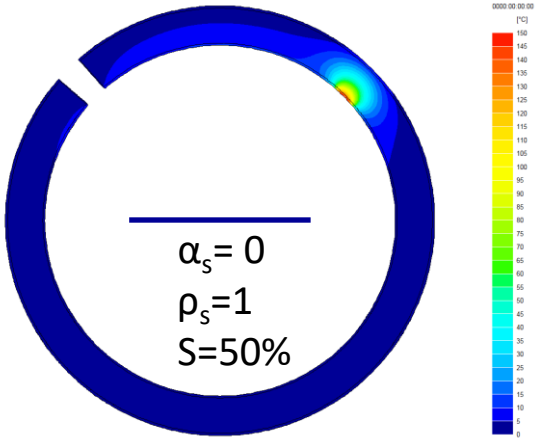


0% specular
(100% diffuse)



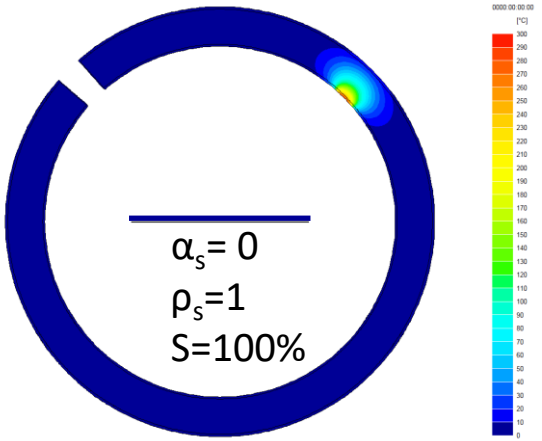
0°C – 20°C

50% specular



0°C – 150°C

100% specular

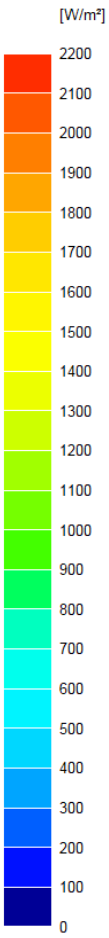


0°C – 300°C

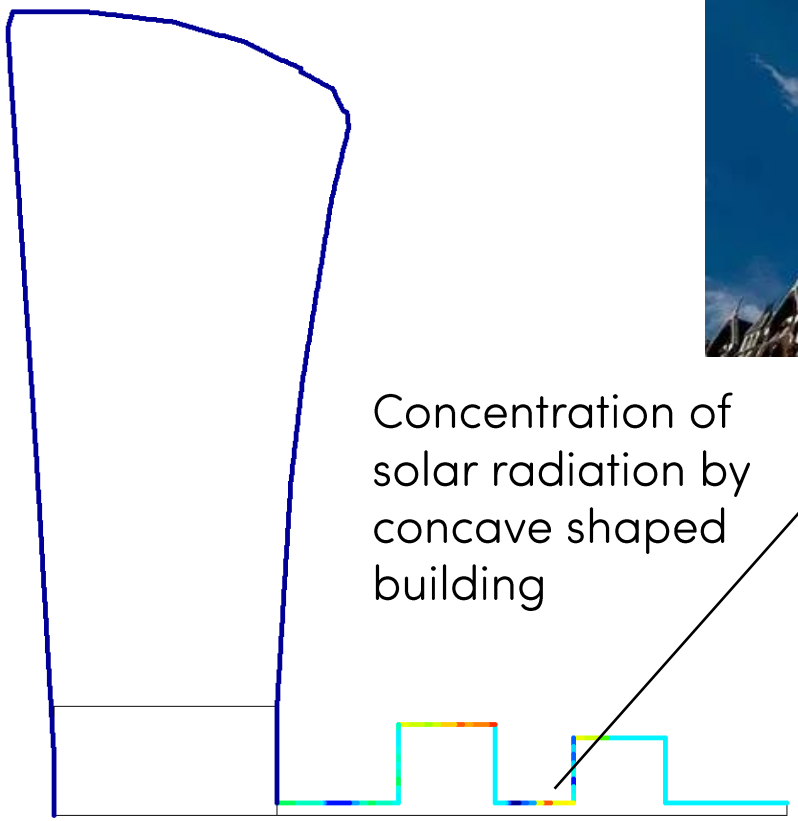
A1. Specular reflection of short-wave radiation

overview

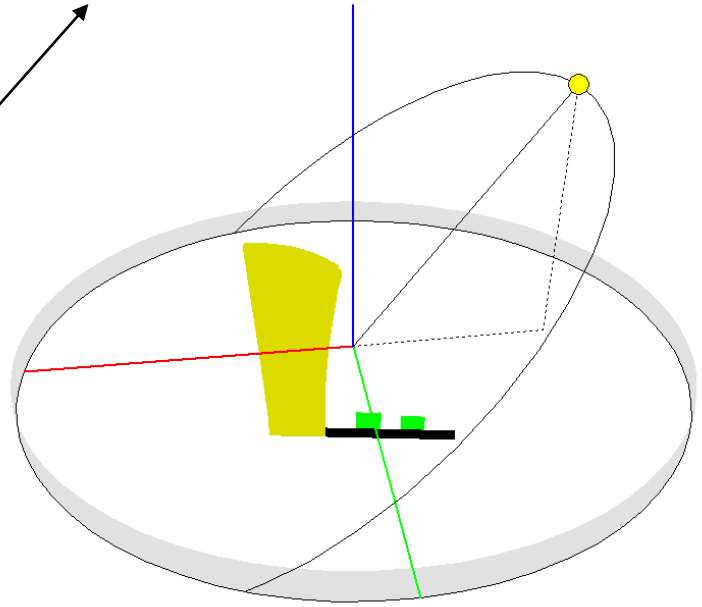
Practical example 1 : specular reflection from built environment



(*)



Concentration of solar radiation by concave shaped building

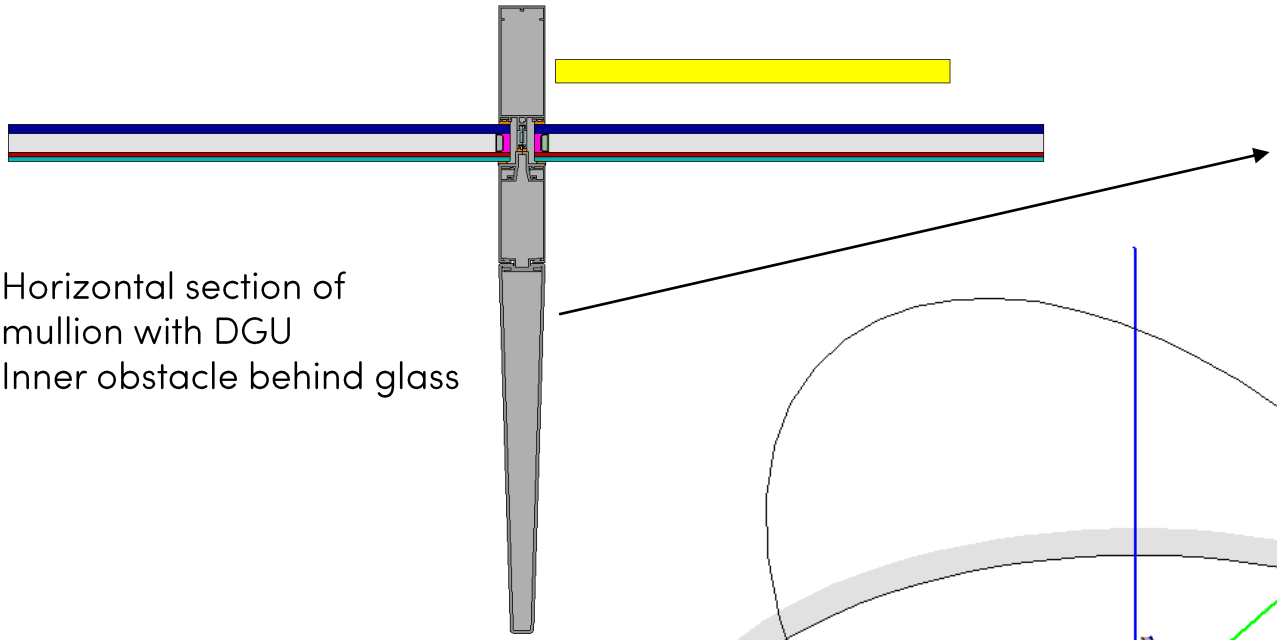


*https://www.theguardian.com/uk-news/video/2013/sep/03/london-walkie-talkie-skyscraper-video

A1. Specular reflection of short-wave radiation

overview

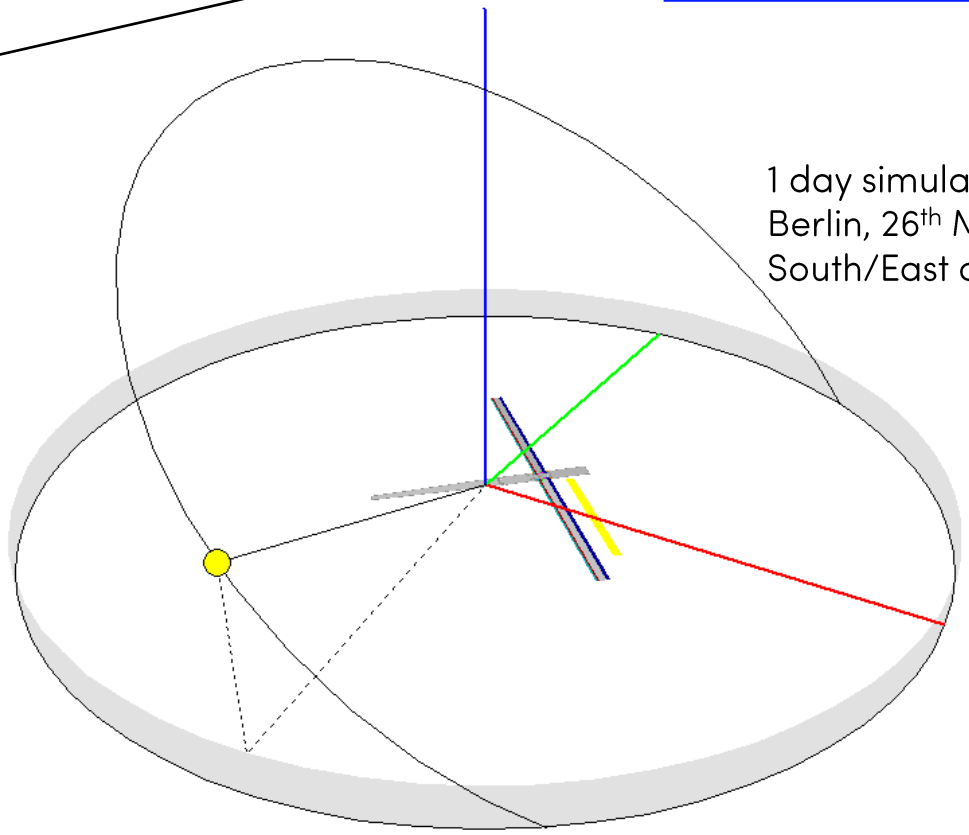
Practical example 2 : specular reflection of façade elements



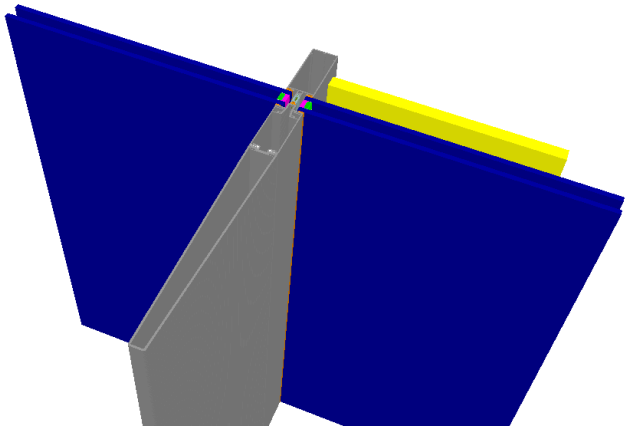
Horizontal section of
mullion with DGU
Inner obstacle behind glass

Façade fin – parameter:

- Case 1: 90% specular
- Case 2: 100% diffuse



1 day simulation
Berlin, 26th May
South/East orientation

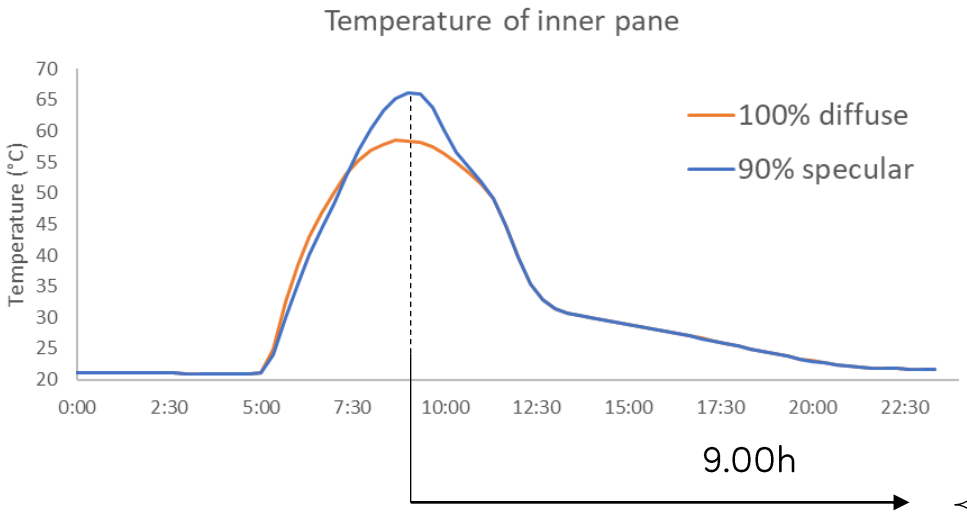


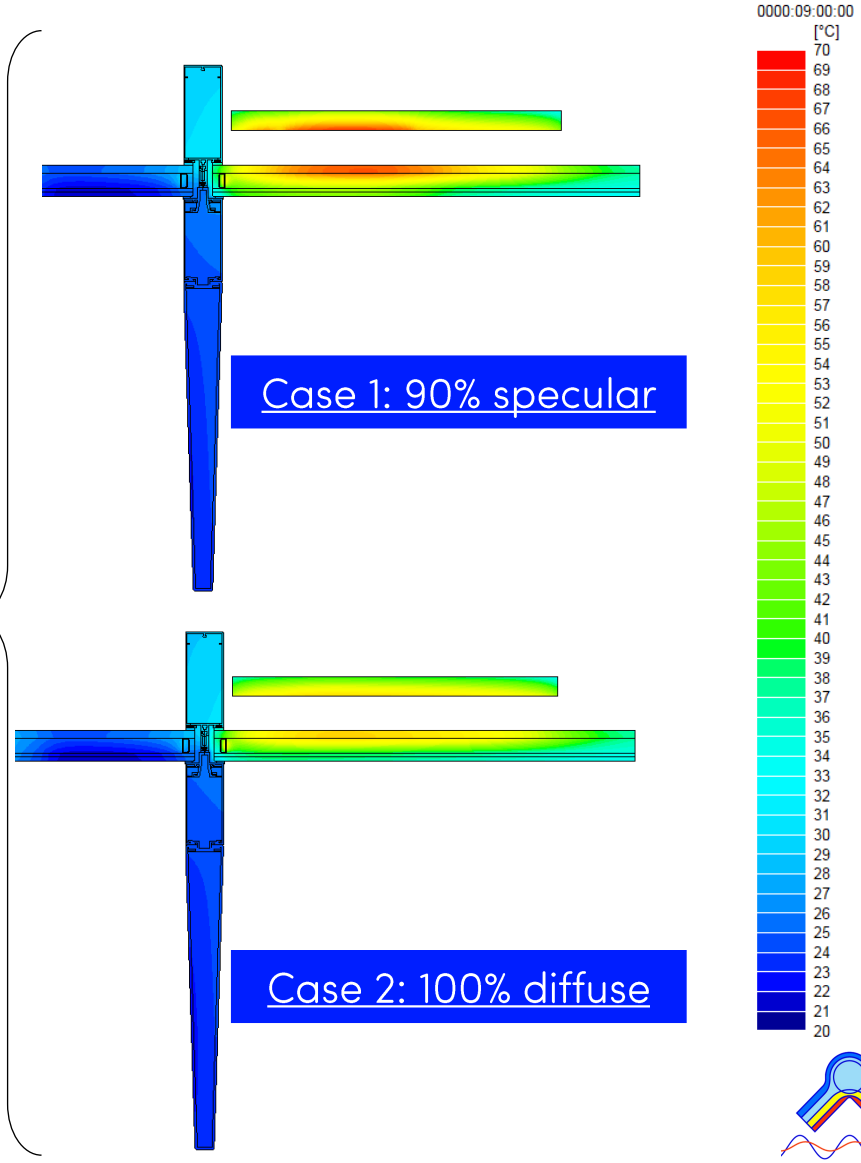
BISTRA v5

A1. Specular reflection of short-wave radiation

overview

Practical example 2 : specular reflection of façade elements





Specular reflection on the outer fins can result in zones with concentrated solar radiation

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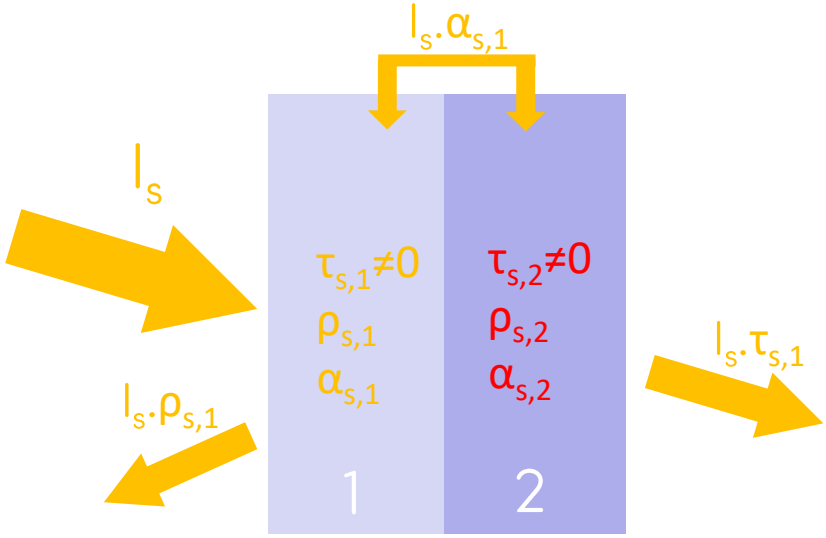
BISTRA v5

A2. Contact between opaque & transparent materials

overview

Absorption and interreflections at opaque materials behind transparant material are considered.

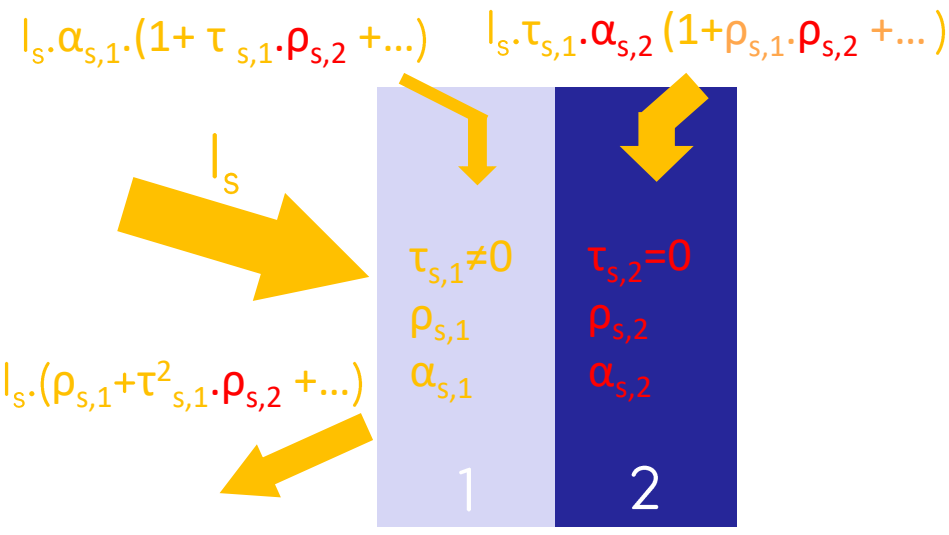
Transparent materials



Solar properties at incident side are applied.

Same as in BISTRA v4

Opaque behind transparent material



Absorption and interreflections at intermediate opaque materials are considered.

New in BISTRA v5

(BISTRA v4: required trick with virtual layer of RADCON type to consider absorption in opaque material behind transparent material)

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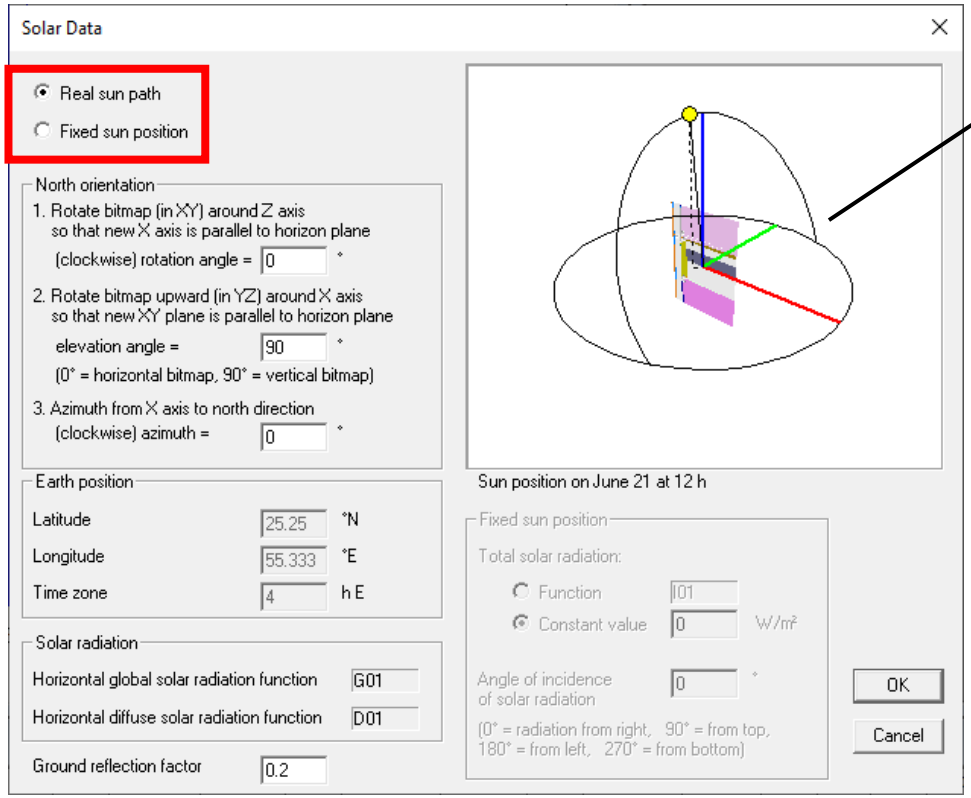
BISTRA v5

A3. Revised Solar data – Option to fix sun position

overview

Solar Data:

- Real sun path
- Fixed sun position



Solar data dialog box

- Visualisation of bitmap orientation (for June 21th at 12h)
- Rotation possible with mouse cursor

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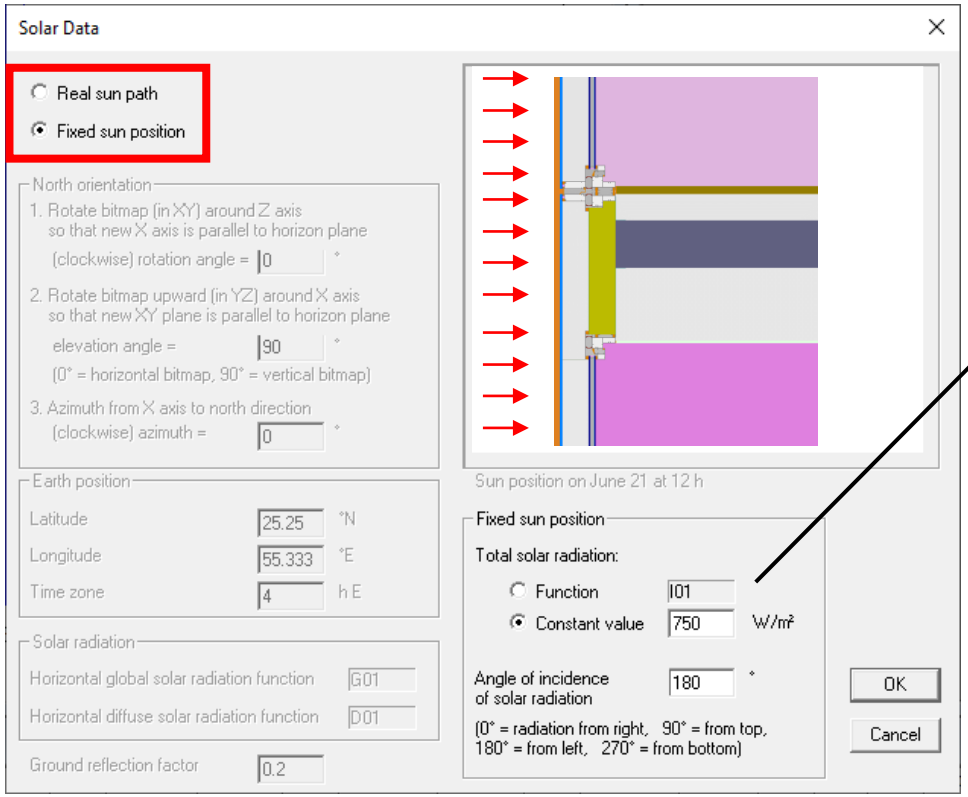
BISTRA v5

A3. Revised Solar data – Option to fix sun position

overview

Solar Data:

- Real sun path
- Fixed sun position



- Total (direct) solar radiation via:
  - Function (I01)
  - Constant value
- User-defined angle of incidence

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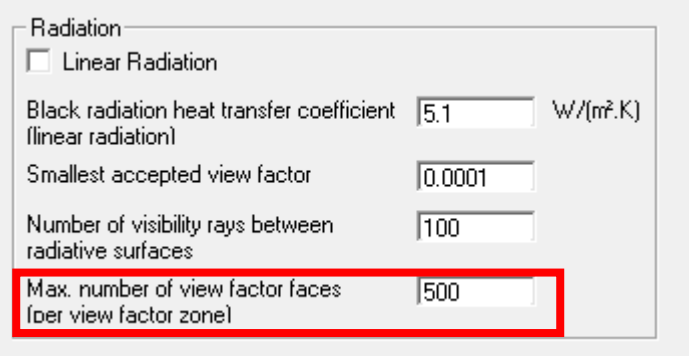
BISTRA v5

A4. Improved algorithms – reduced calculation time

overview

- Clustered triangle faces for larger view factor faces in RADCON zone
- Number of rays for sky visibility calculation is a calculation parameter
- Increased calculation speed due to improved neighbouring nodes algorithm for view factor zones (RADCON)



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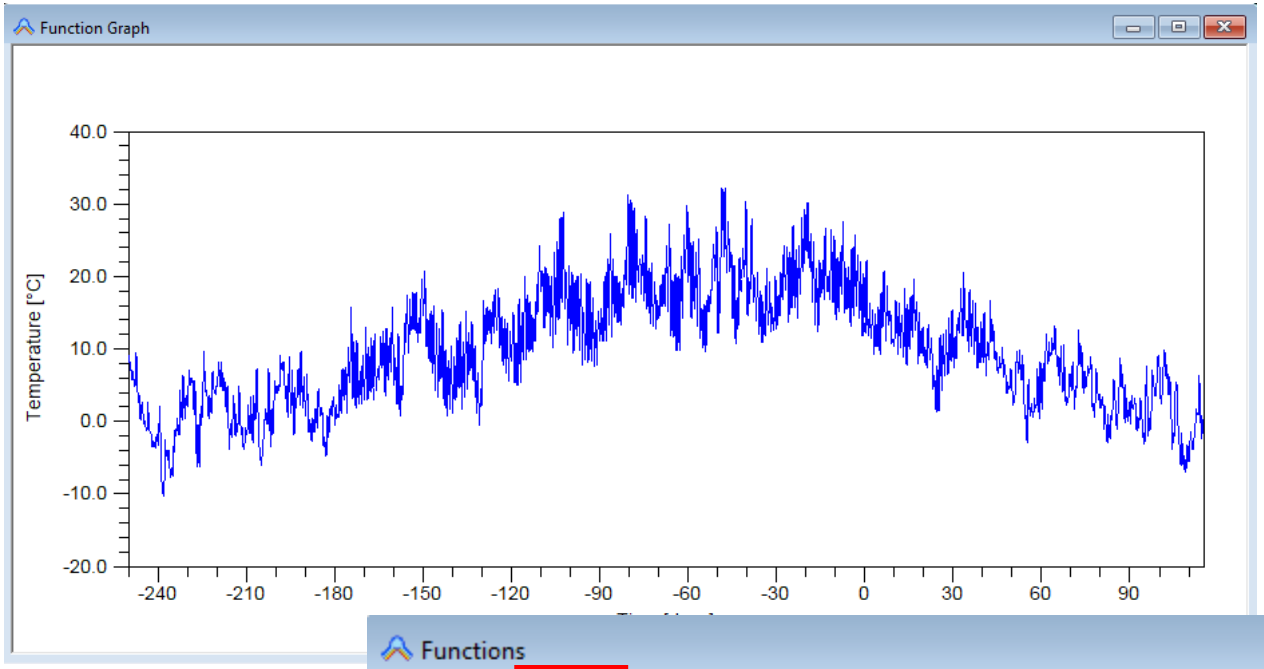
BISTRA v5

B1. Input of EPW and TRY files (climate files)

overview

Standardised climate data formats EPW and TRY3 are available as input for temperature, global and diffuse radiation



Functions

No.	Ref.	Type	Filename	Prm.1	Prm.2	Prm.3	Prm.4	Prm.5	Prm.6
1	T01	EPW	Berlin_Tempelhof-hour						
2	G01	EPW	Berlin_Tempelhof-hour						
3	D01	EPW	Berlin_Tempelhof-hour						

Available via new function types

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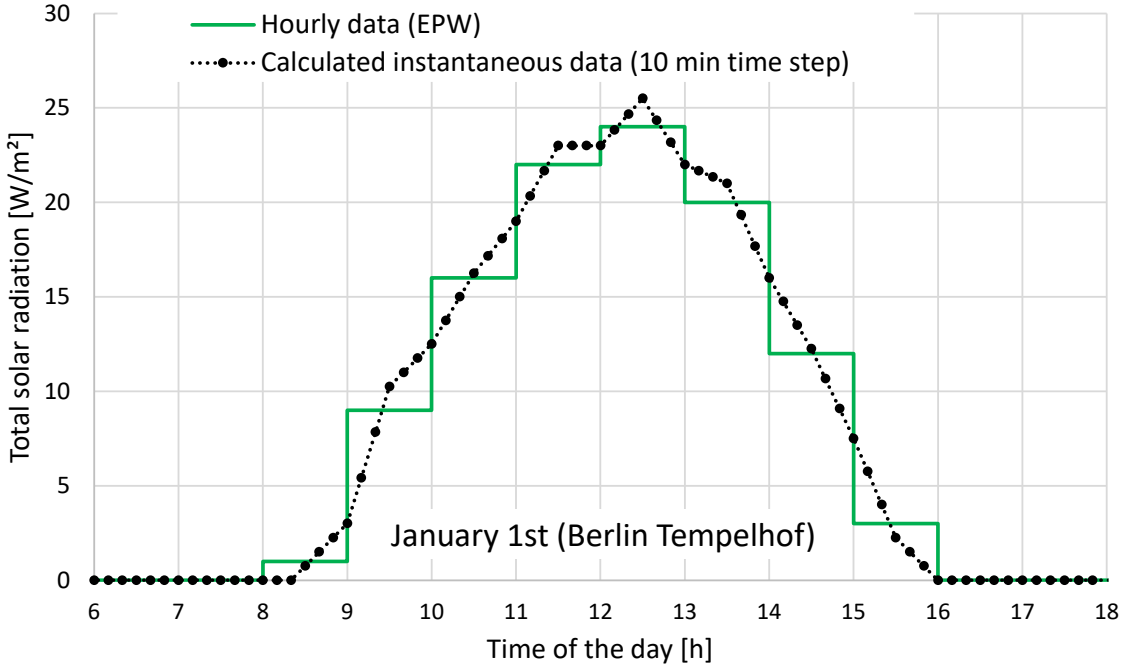
BISTRA v5

B2. Handling sub-hourly data from hourly solar data

overview

Solar (climate) data is typically only available on hourly basis, where façades need often to be modelled with smaller time steps (e.g. 10 min).

An algorithm* to handle sub-hourly solar data when using stepped climate data is included.

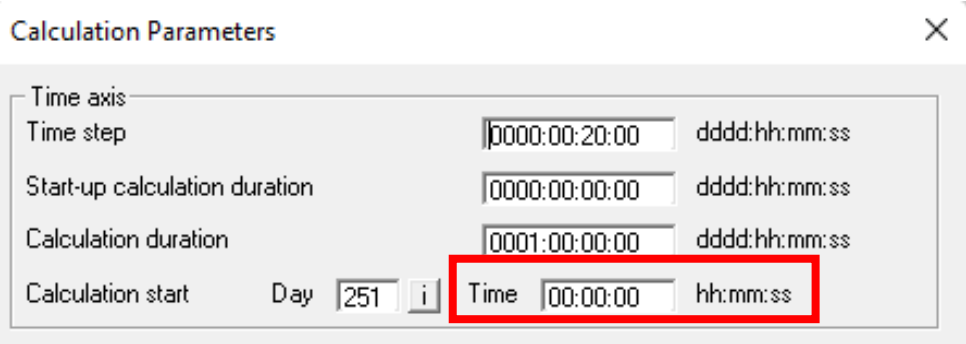


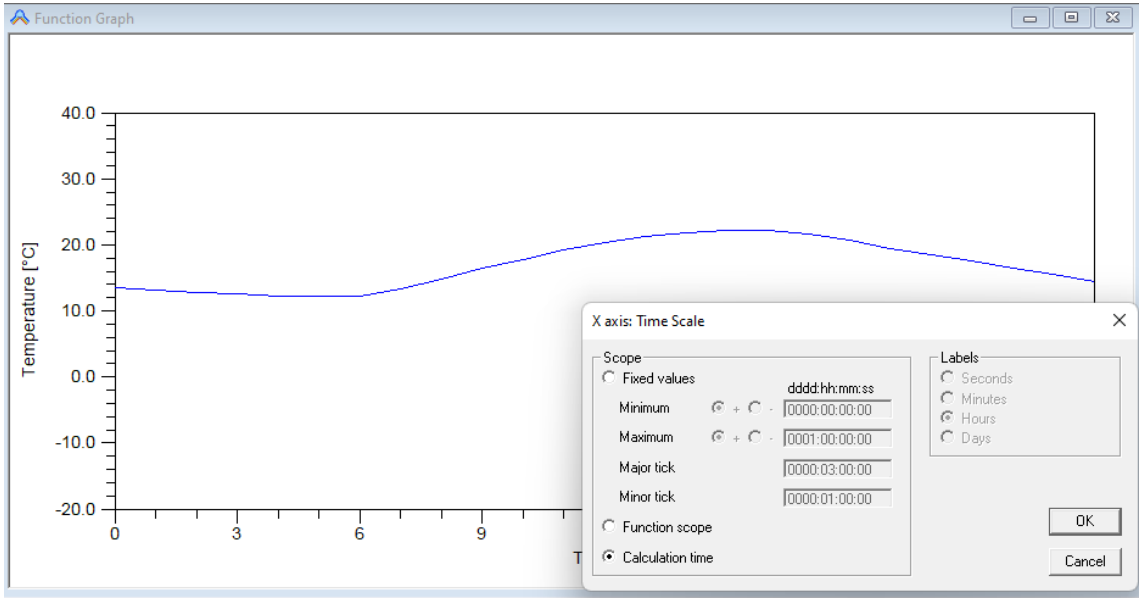
*McDowell T. et al., A new method for determining sub-hourly solar radiation from hourly data, Proceedings of the 2018 Building Performance Analysis Conference and Simbuild, p. 518-252 (2018)

B3. User-defined start time

overview

Calculation Parameters are extended allowing to define start time (in addition to start day)





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BISTRA v5

C.1 Revision of Colours Window in line with BISCO v12

overview

The Colours window is revised to allow conformity with different EN standards:

- Rule → Subtype
- Physical flow direction (horizontal, up, down): defined by the user (and standard)
- Geometrical flow direction (X, Y)
- Standard (EN10077, EN6946, EN673)
- ε1/ ε2: emissivity's linked to a cavity ("single equivalent thermal conductivity method")
- ε emissivity linked to a material ("radiosity method")
- Improved navigation in Colours Window: mouse wheel scroll

Colours

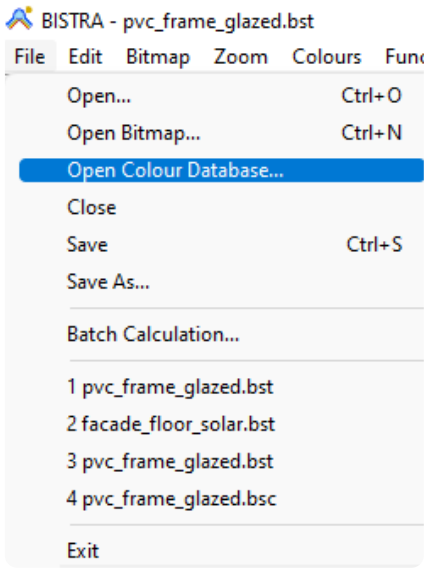
Col.		Type	Subtype	Physical flow dir.	Geometrical flow dir.	Name	ε1 / ε2 [- / -]	λ [W/mK]	ε [-]	θ [°C]	h [W/m²K]	q [W/m²]	θa [°C]	hc [W/m²K]	Pc [W/m]	θr [°C]	Standard
18		MATERIAL				soda lime		1.000									
60		MATERIAL				EPDM		0.250									
86		MATERIAL				polysulfide		0.400									
92		MATERIAL				butyl hot melt		0.240									
105		MATERIAL				molecular sieve		0.100									
170		BC_SIMPL	HE	HOR		exterior				0.0	25.00	0					EN10077
174		BC_SIMPL	HI_NORML	HOR		interior (normal)				20.0	7.70	0					EN10077
182		BC_SIMPL	HI_REDUC	HOR		interior (reduced)				20.0	5.00	0					EN10077
192		EQUIMAT	CAVITY	HOR	Y	cavity (CEN)	0.90 / 0.90	0.079									EN10077
193		EQUIMAT	CAVITY	HOR	Y	cavity (CEN)	0.90 / 0.90	0.052									EN10077
195		EQUIMAT	CAVITY	HOR	X	cavity (CEN)	0.90 / 0.90	0.037									EN10077
214		EQUIMAT	CAVITY	HOR	Y	cavity (CEN)	0.90 / 0.90	0.065									EN10077
215		EQUIMAT	CAVITY	HOR	Y	cavity (CEN)	0.90 / 0.90	0.102									EN10077

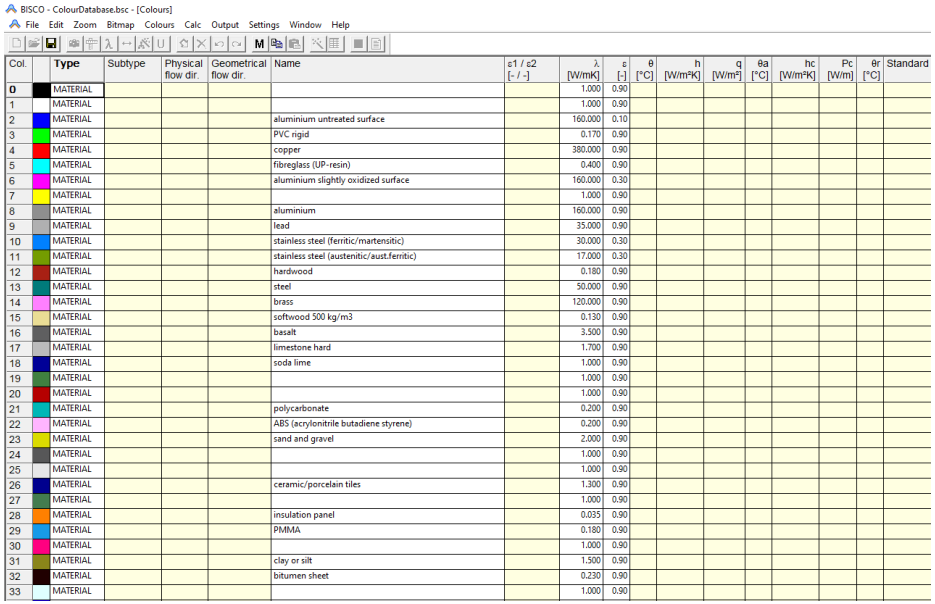
C.1 Revision of Colour Window in line with BISCO v12

overview

Customisable Colour Database with predefined colours

File → Open Colour Database... allows to quickly adjust frequently used materials and boundary conditions.

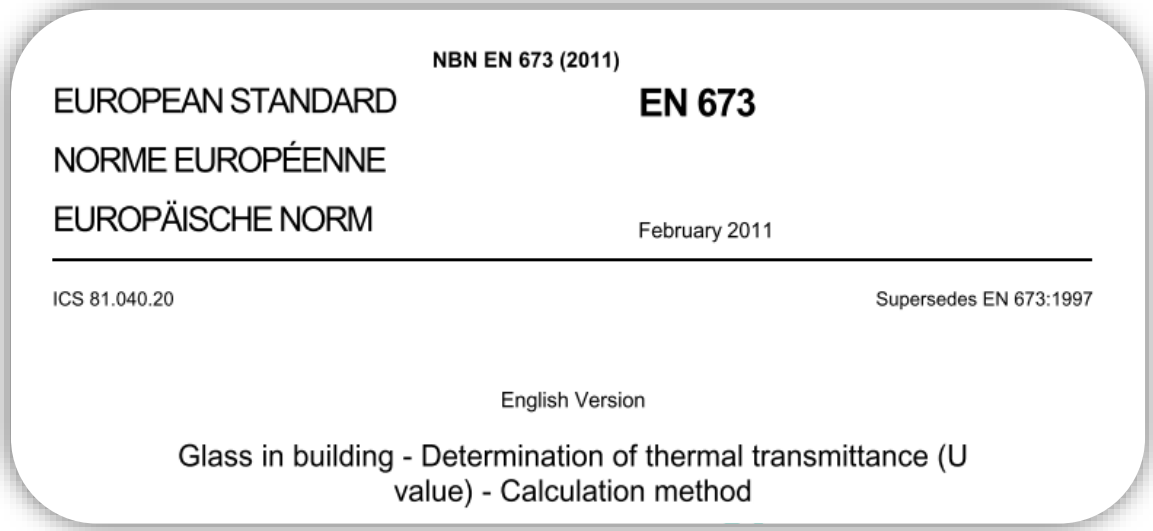




Col.		Type	Subtype	Physical flow dir.	Geometrical flow dir.	Name	ε1 / ε2 [- / -]	λ [W/mK]	ε [-]	θ [°C]	h [W/m²K]	q [W/m²]	θa [°C]	hc [W/m²K]	Pc [W/m]	θr [°C]	Standard
0		MATERIAL						1.000	0.90								
1		MATERIAL						1.000	0.90								
2		MATERIAL				aluminium untreated surface		160.000	0.10								
3		MATERIAL				PVC rigid		0.170	0.90								
4		MATERIAL				copper		380.000	0.90								
5		MATERIAL				fibreglass (UP-resin)		0.400	0.90								
6		MATERIAL				aluminium slightly oxidized surface		160.000	0.30								
7		MATERIAL						1.000	0.90								
8		MATERIAL				aluminium		160.000	0.90								
9		MATERIAL				lead		35.000	0.90								
10		MATERIAL				stainless steel (ferritic/martensitic)		30.000	0.30								
11		MATERIAL				stainless steel (austenitic/aust.ferritic)		17.000	0.30								
12		MATERIAL				hardwood		0.180	0.90								
13		MATERIAL				steel		50.000	0.90								
14		MATERIAL				brass		120.000	0.90								
15		MATERIAL				softwood 500 kg/m3		0.130	0.90								
16		MATERIAL				basalt		3.500	0.90								
17		MATERIAL				limestone hard		1.700	0.90								
18		MATERIAL				soda lime		1.000	0.90								
19		MATERIAL						1.000	0.90								
20		MATERIAL						1.000	0.90								
21		MATERIAL				polycarbonate		0.200	0.90								
22		MATERIAL				ABS (acrylonitrile butadiene styrene)		0.200	0.90								
23		MATERIAL				sand and gravel		2.000	0.90								
24		MATERIAL						1.000	0.90								
25		MATERIAL						1.000	0.90								
26		MATERIAL				ceramic/porcelain tiles		1.300	0.90								
27		MATERIAL						1.000	0.90								
28		MATERIAL				insulation panel		0.035	0.90								
29		MATERIAL				PMMA		0.180	0.90								
30		MATERIAL						1.000	0.90								
31		MATERIAL				clay or silt		1.500	0.90								
32		MATERIAL				bitumen sheet		0.230	0.90								
33		MATERIAL						1.000	0.90								

C.2 EN 673 – Gas mixes

overview



NBN EN 673 (2011)

EUROPEAN STANDARD **EN 673**

NORME EUROPÉENNE

EUROPÄISCHE NORM

February 2011

ICS 81.040.20 Supersedes EN 673:1997

English Version

Glass in building - Determination of thermal transmittance (U value) - Calculation method

Implementation of equivalent thermal conductivity of gas mixes according to EN 673 for the types:

- EQUIMAT
- TRANSMAT
- BC_FREE

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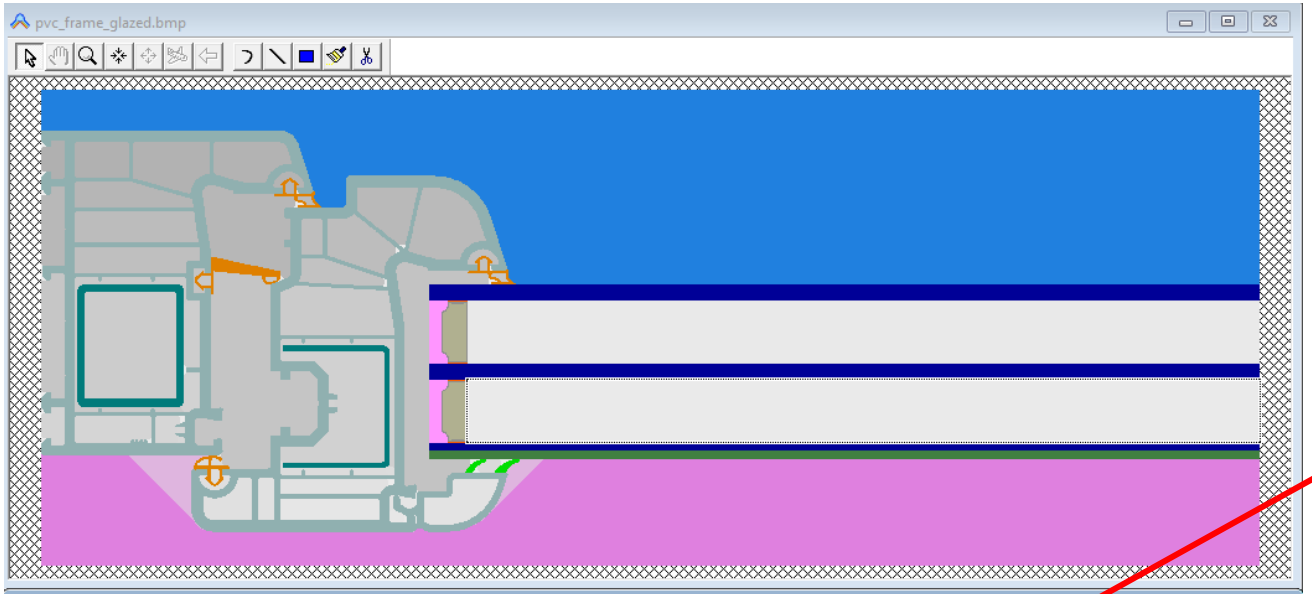
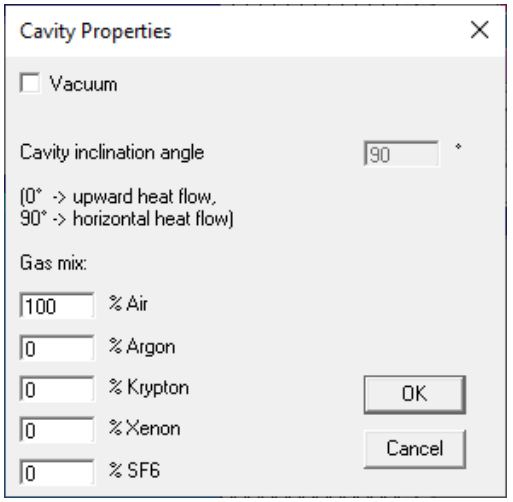
C.2 EN 673 – Gas mixes

overview





(accessible by double clicking)

Colours

Col.		Type	Subtype	Physical flow dir.	Geometrical flow dir.	Name	ε1 / ε2 [- / -]	λ [W/mK]	ε [-]	ρ [kg/m³]	c [J/kgK]	Specular [%]	τS [-]	Standard
243		EQUIMAT	CAVITY	HOR	Y		0.90 / 0.90	0.056	0.90	1.2	1008.0			EN10077
244		EQUIMAT	CAVITY	HOR	Y		0.90 / 0.90	0.033	0.90	1.2	1008.0			EN10077
245		EQUIMAT	CAVITY	HOR	Y		0.90 / 0.90	0.033	0.90	1.2	1008.0			EN10077
246		EQUIMAT	CAVITY	HOR	Y		0.90 / 0.90	0.046	0.90	1.2	1008.0			EN10077
247		EQUIMAT	CAVITY	HOR	Y		0.90 / 0.90	0.034	0.90	1.2	1008.0			EN10077
249		TRANSMAT	LAYER	HOR	Y	90%Argon 10%Air		0.019		1.7	567.0			EN673
250		TRANSMAT	LAYER	HOR	Y	90%Argon 10%Air		0.019		1.7	567.0			EN673
252		MATERIAL				cavity <2x2 mm2		0.031	0.90	1000.0	1000.0	0	0.00	

Set heat flow direction: X, Y

Selection of standard

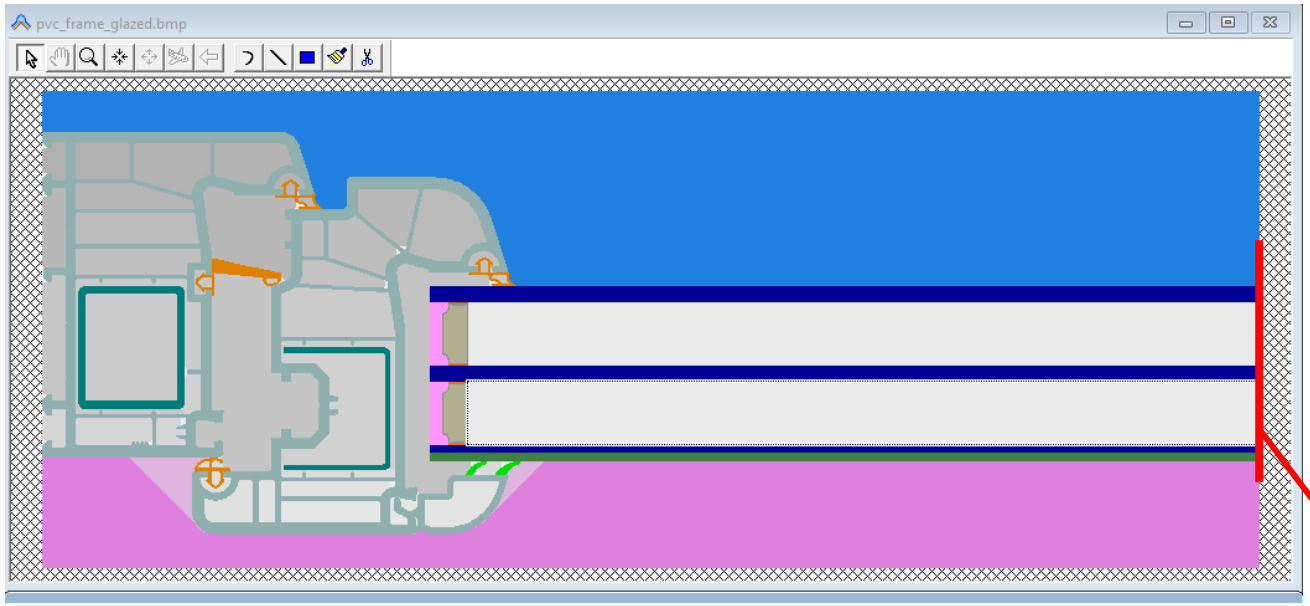
Set physical flow direction:
horizontal, downwards, upwards

physibel

BISTRA v5

C.2 EN 673 – Gas mixes

overview



Bitmap border U Values

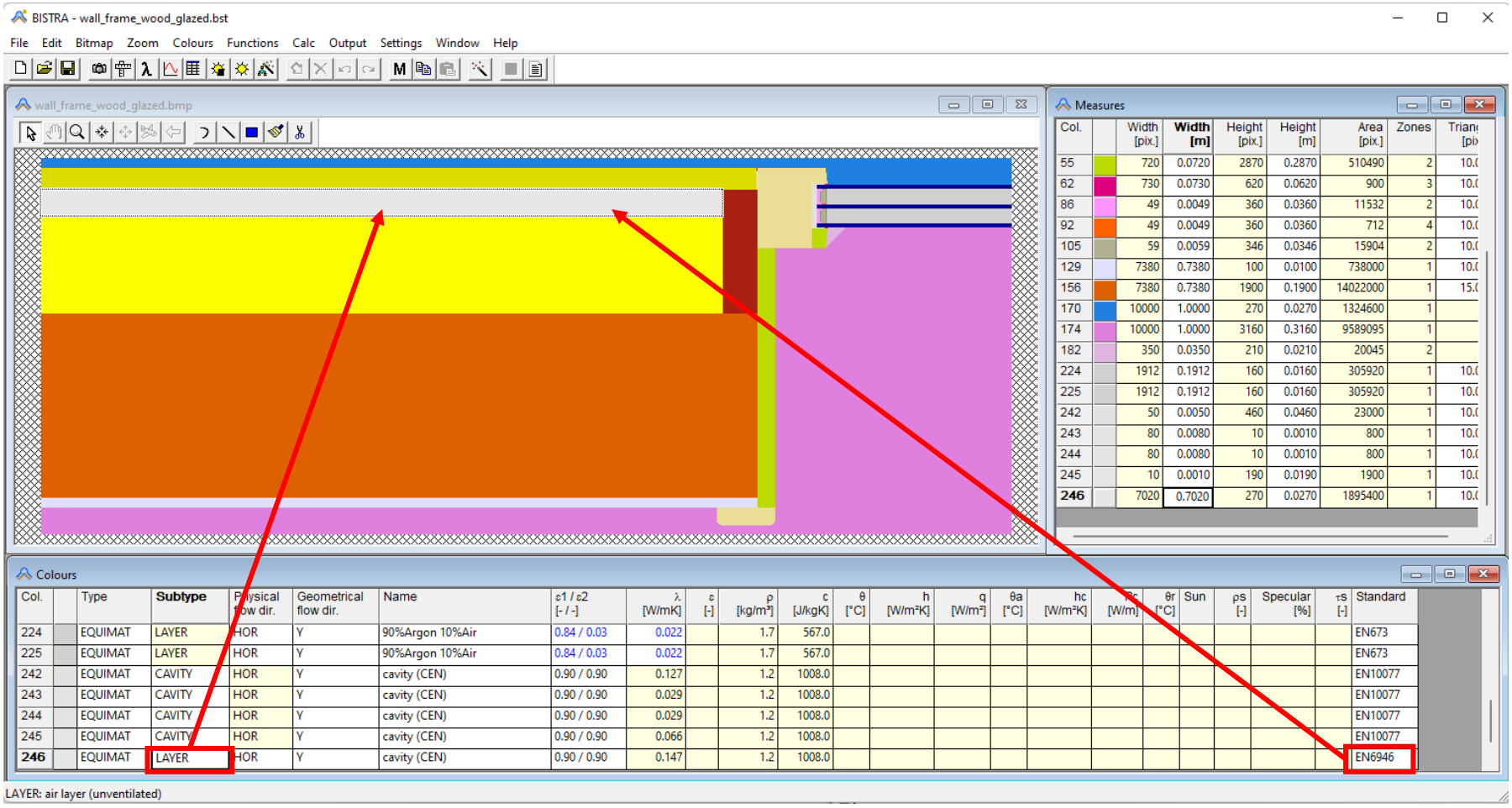
Bitmap Border	U [W/m²K]
Left	2.015
Right	1.093
Top	
Bottom	

Calculation of U-value at border of bitmap

C.3 EN ISO 6946 – cavities and layers

overview

Example 1: window-wall connection: air layer in wall → EN ISO 6946



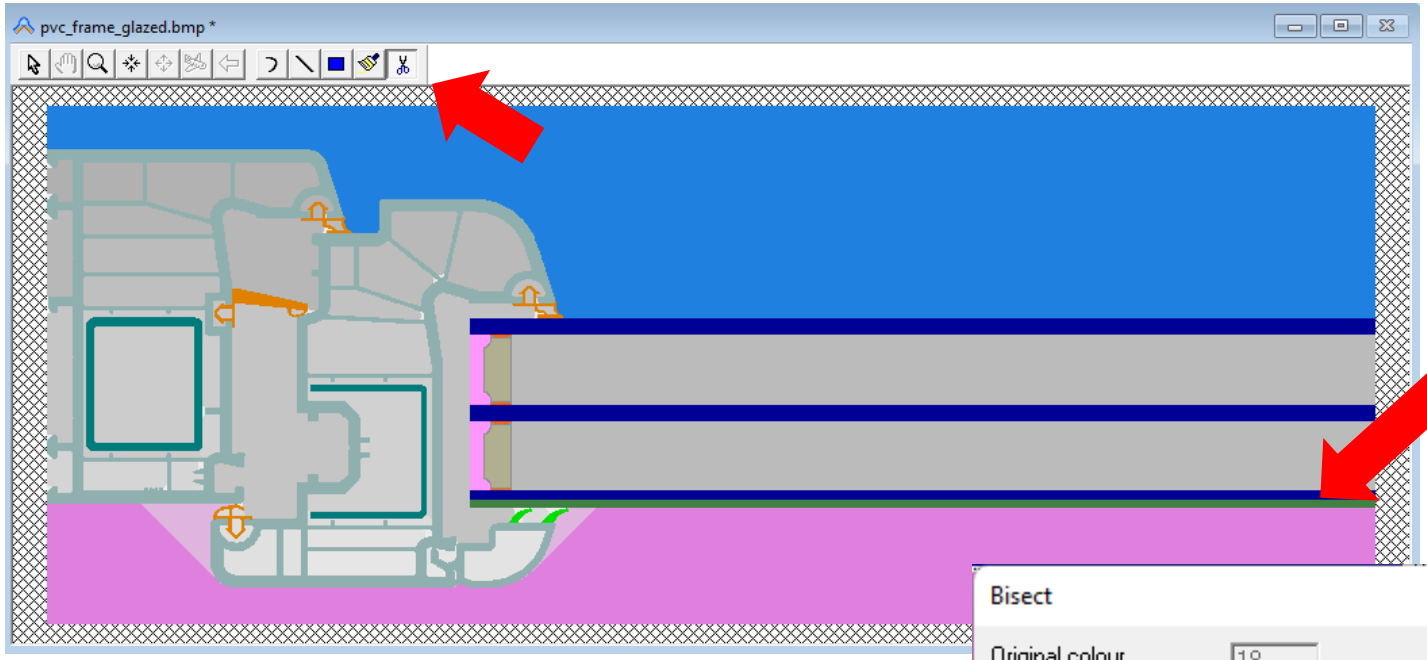
D.1 Bitmap editing – New function 'Bisect'

overview

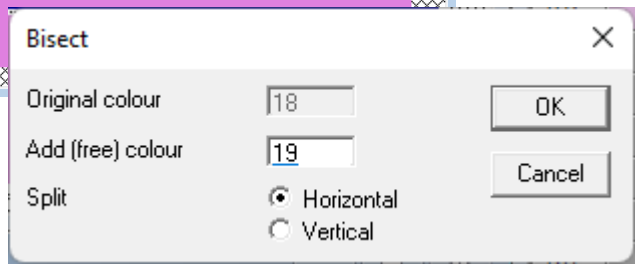
Bisect: Split a colour in two equal parts.

Applications:

- definition of solar properties on glazing sides
- splitting type BC_FREE for definition of ventilation paths



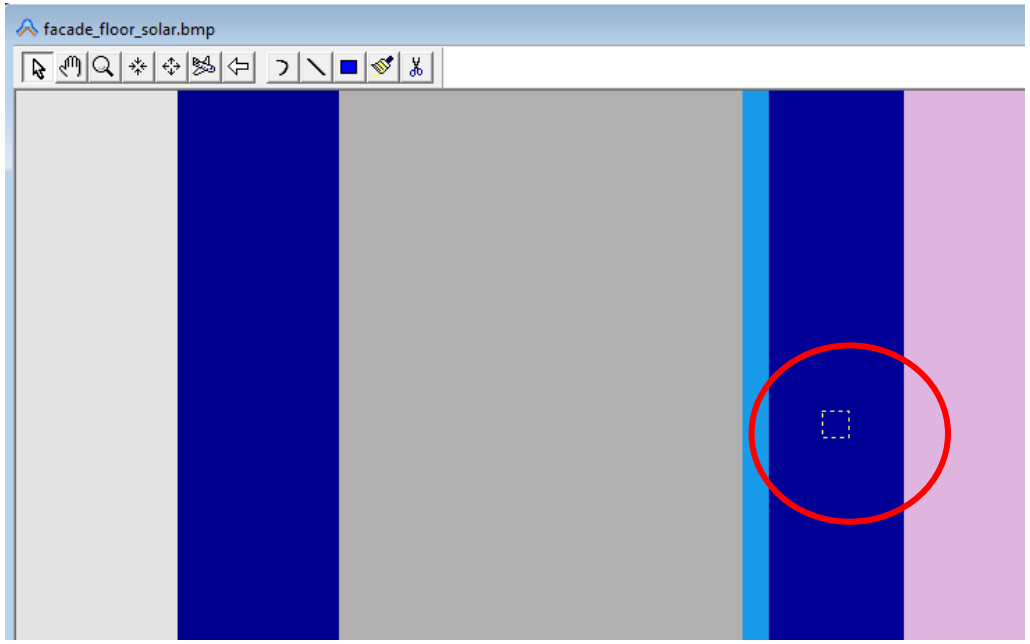
Bisect in 2 colours



D.2 Bitmap editing – snap to pixel

overview

Pixel is highlighted when in 'selection' mode or in 'drawing' mode



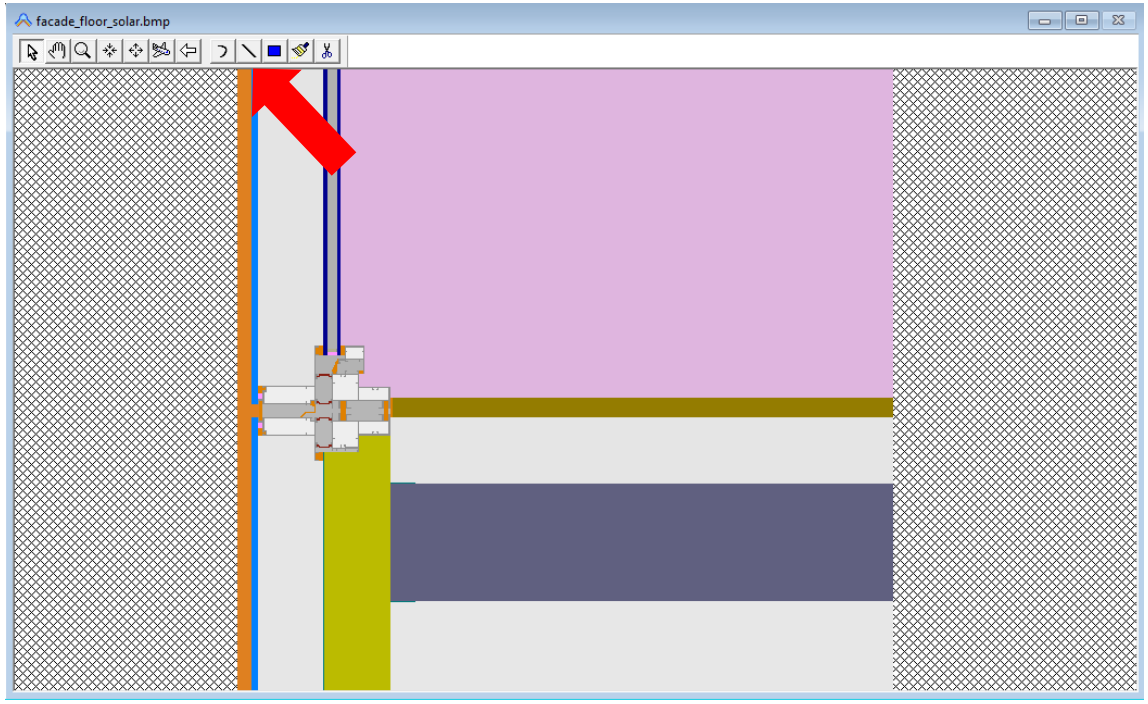
Snap to pixel simplifies:

- drawing
- Selecting colours

D.3 Bitmap editing – New drawing functions

overview

New drawing functions in line with BISCO v12: rectangles & lines

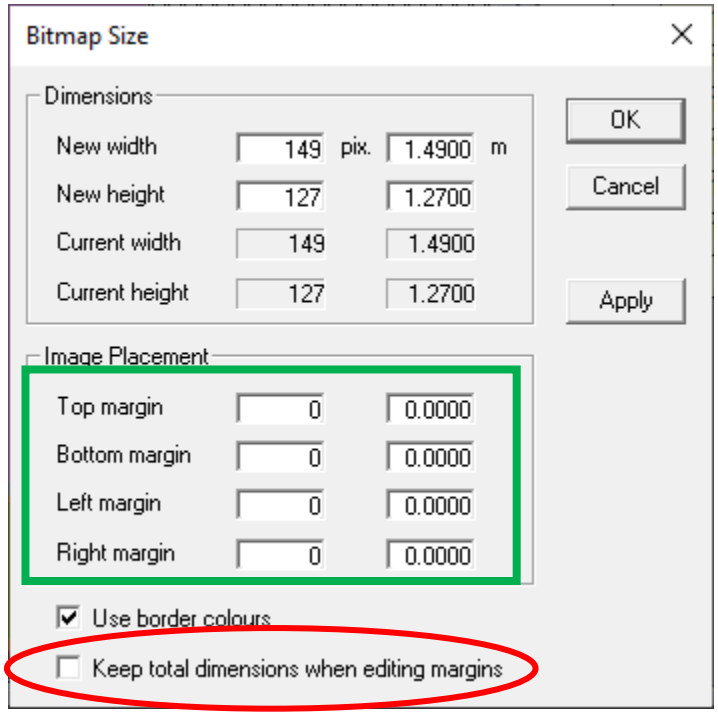


D.4 Bitmap editing – Miscellaneous

overview

Bitmap size: option to keep dimension when editing margins

Allows to easily extend the bitmap borders with desired extension length



D.4 Bitmap editing – Miscellaneous

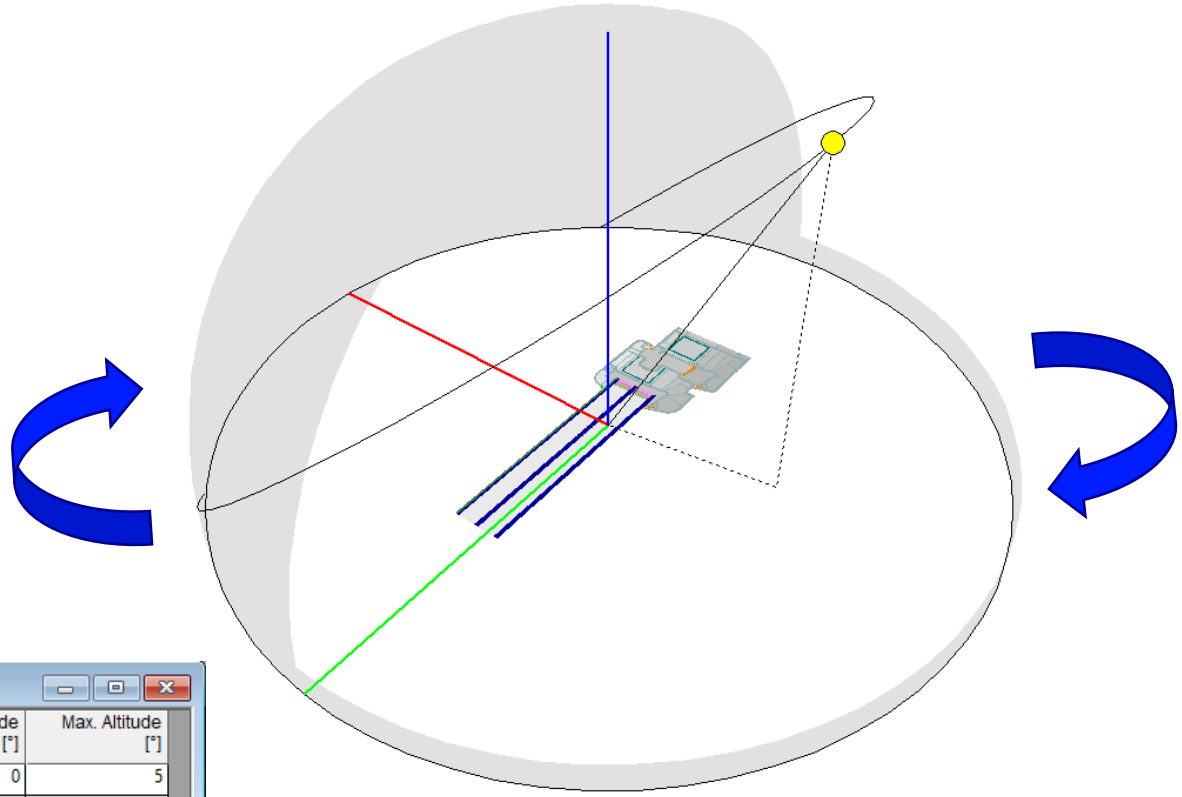
overview

- Cursor colour adjusted for background colour
- Zoom and draw function buttons moved to Bitmap window
- Pan: drag mode changed to 'drag object'
- Mouse scroll to navigate through grid control (e.g. Colours Window)
- 'Change Colour...', 'Split Zones...' and 'Copy Row' are available with active Image Window

E.1 Graphic output – Sun position

overview

- Visualisation of Sun Obstacles in Sun Position view 
- Rotation possible in Sun Position view (left mouse click or keyboard arrows)



Sun Obstacles

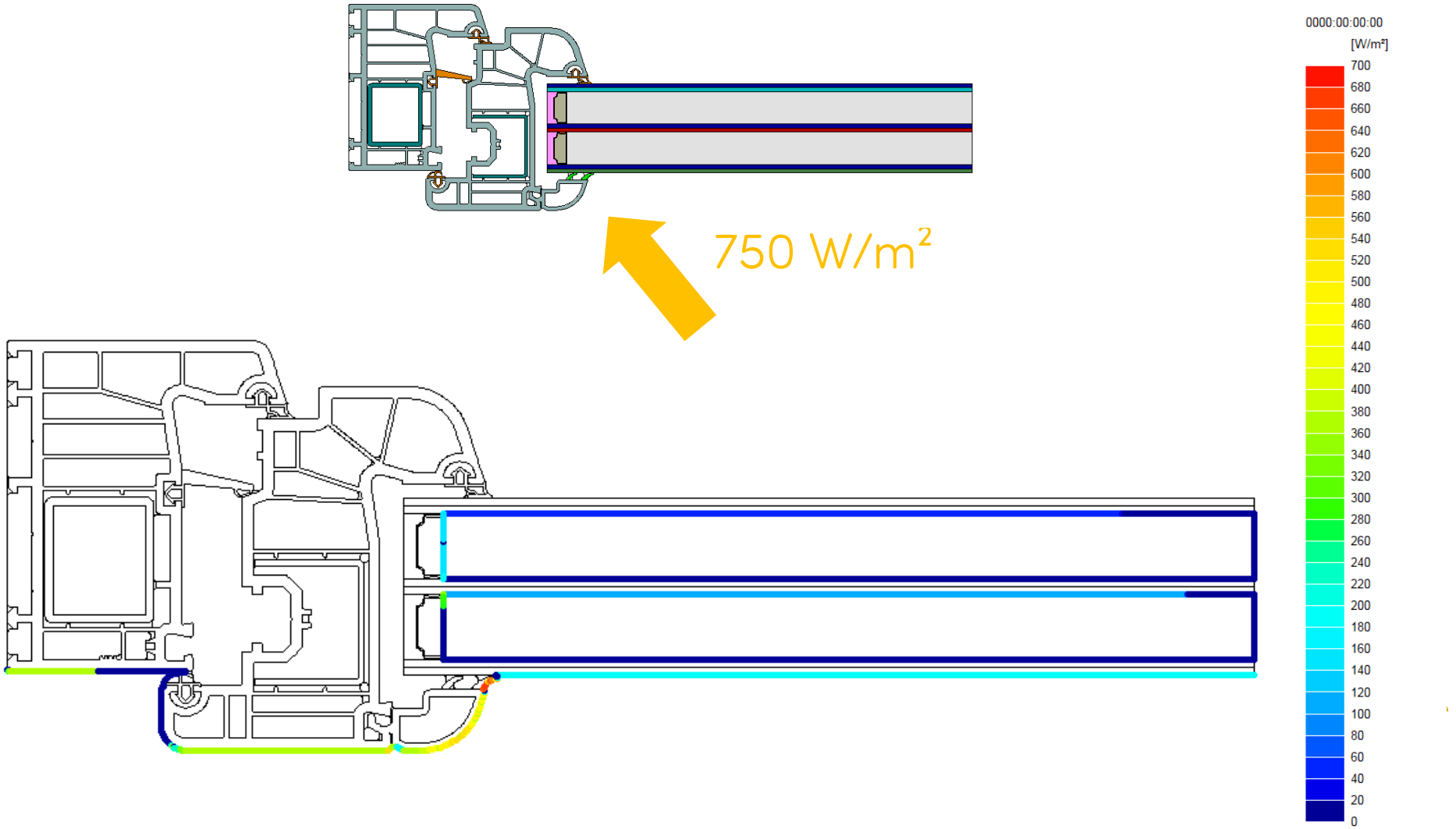
No.	Min. Azimuth [°]	Max. Azimuth [°]	Min. Altitude [°]	Max. Altitude [°]
1	-180	180	0	5
2	90	270	0	90

E.2 Visualisation of absorbed solar radiation

overview

- Visualisation of absorbed solar radiation

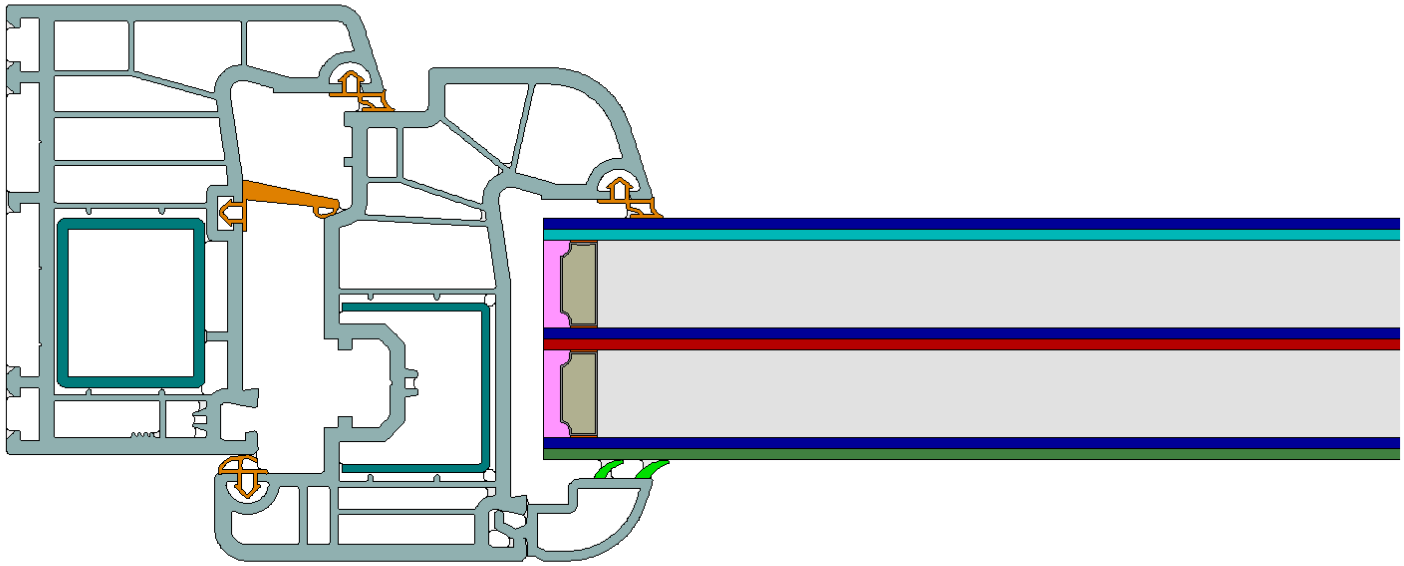
Example of PVC window profile under solar exposure (315°, 750W/m²)

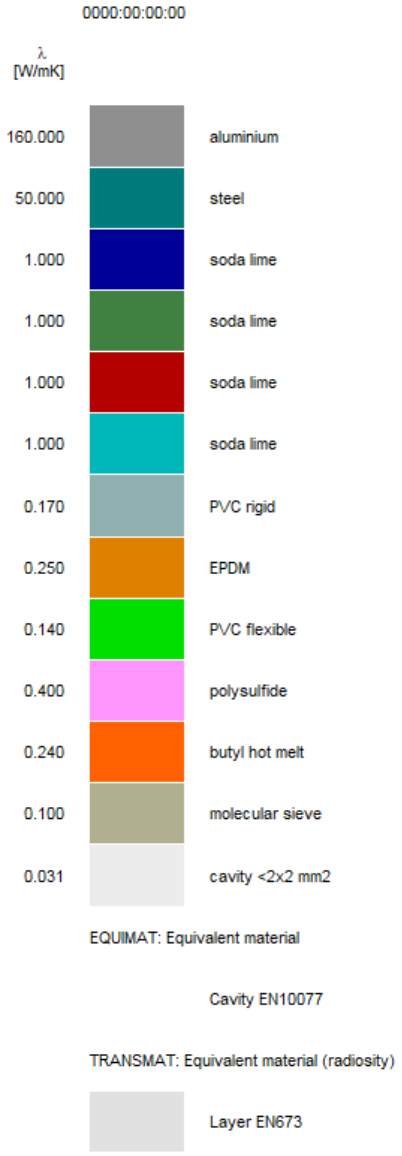


E.3 Graphic output – Legend

overview

Fill materials → revised legend: material name + clustered cavities





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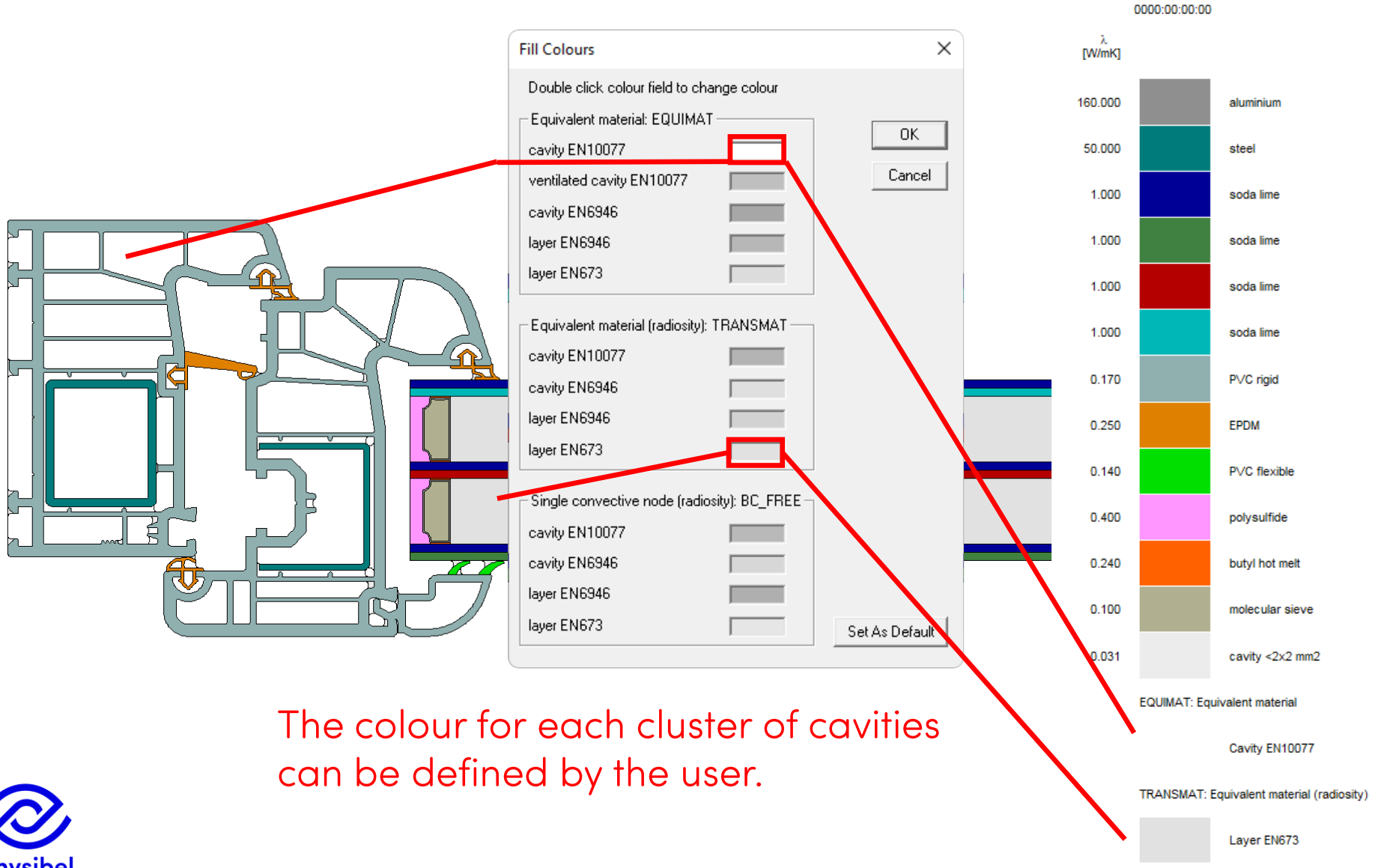
E.3 Graphic output – Legend

overview

Fill materials → revised legend: material name + clustered cavities



The colour for each cluster of cavities can be defined by the user.

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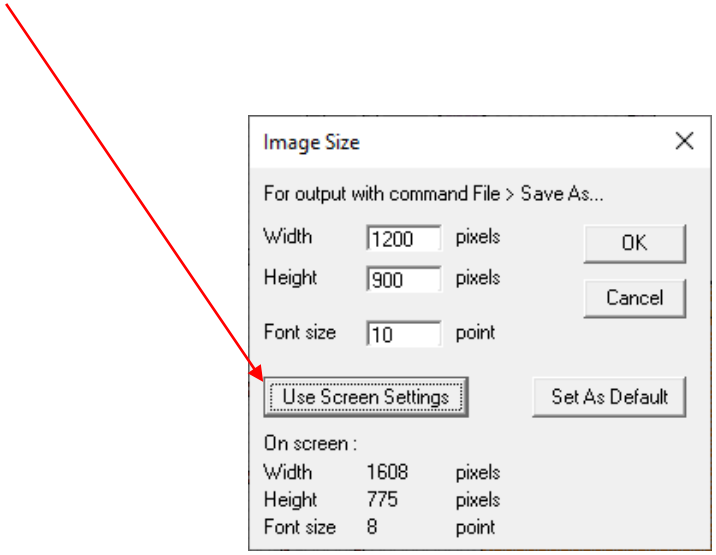
E.4 Graphic output – Miscellaneous

overview

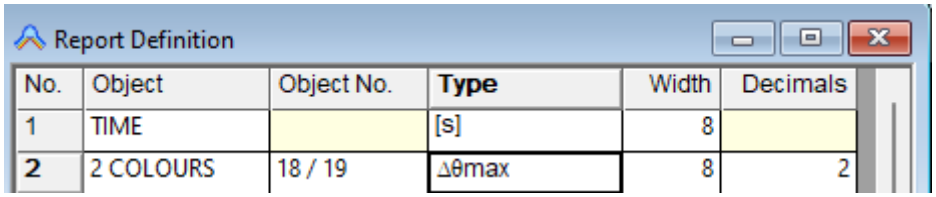
- Triangulation mesh only visible when image has relevant scale
- Faster image processing algorithm (for complex files)
- Improved algorithm for visualizing BC_FREE in graphic output resulting in higher rendering speed
- Image Size: possible to use Screen Settings for image output



F.1 New report definitions: ΔTmax, Etot, Ediff, Edir, Egr

overview

- ΔTmax: maximum temperature difference within 1 or 2 colours



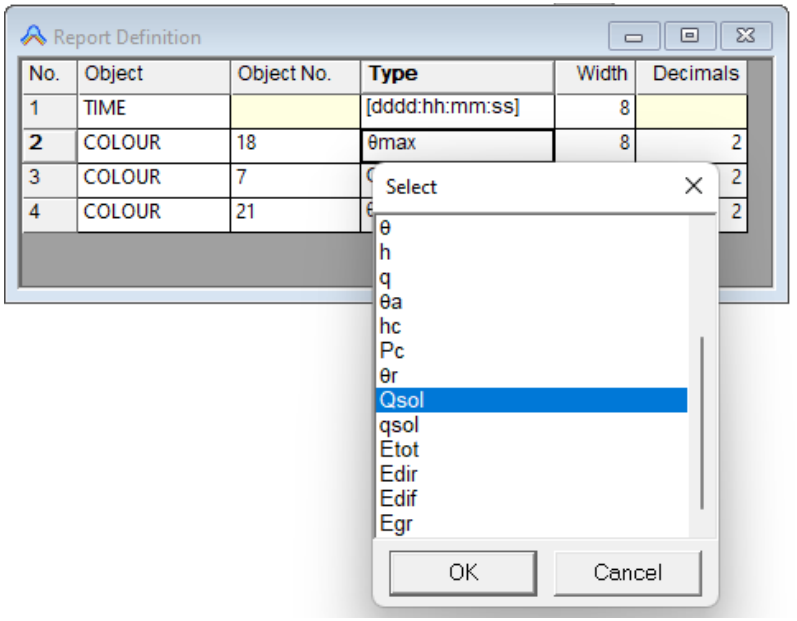
No.	Object	Object No.	Type	Width	Decimals
1	TIME		[s]	8	
2	2 COLOURS	18 / 19	Δθmax	8	2

Solar radiation received on materials exposed to a solar zone

- Etot: Total irradiance (W/m^2)
- Ediff: Diffuse sky irradiance (W/m^2)
- Edir: Direct irradiance (W/m^2)
- Egr: Ground reflected irradiance (W/m^2)

F.2 Absorbed solar flux/energy into materials (q_{sol} , Q_{sol})

overview

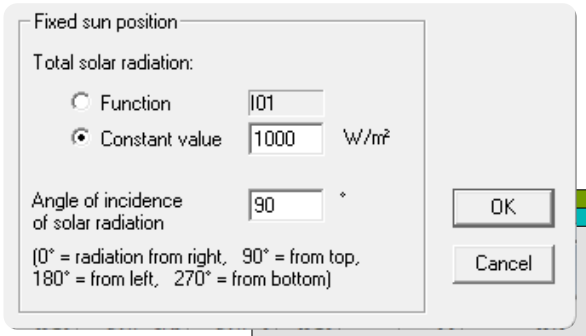


The report definitions Q_{sol} and q_{sol} allow to report the energy and heat flux absorpted into materials (not limited to materials facing the solar zone)

F.2 Absorbed solar flux/energy into materials (q_{sol}, Q_{sol})

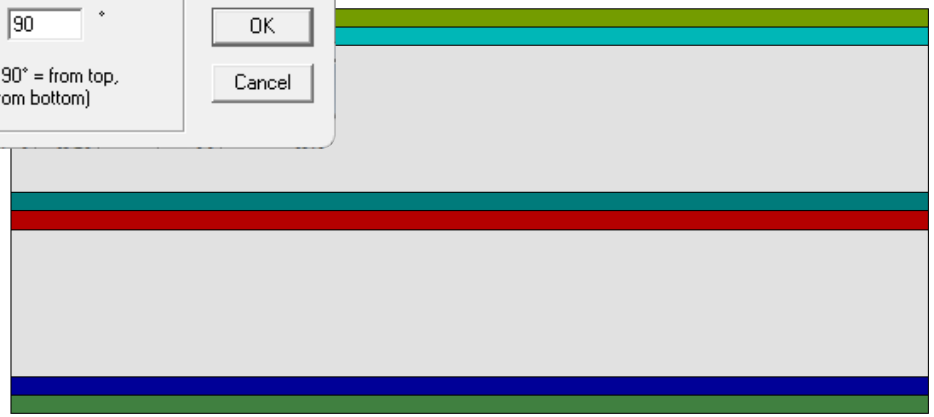
overview

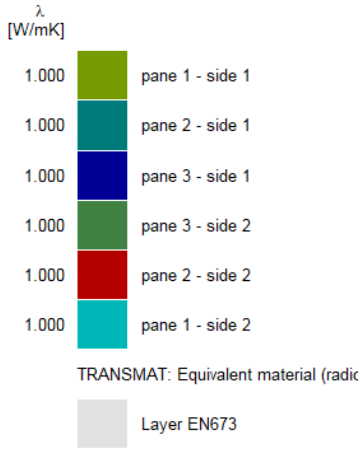
Application: effective solar absorption according to EN 410



Report Definition

No.	Object	Object No.	Type	Width	Decimals
1	TIME		[s]	8	
2	COLOUR	11	qsol	8	2
3	COLOUR	21	qsol	8	2
4	COLOUR	13	qsol	8	2
5	COLOUR	20	qsol	8	2
6	COLOUR	18	qsol	8	2
7	COLOUR	19	qsol	8	2






```
BISTRA - Report Output

BISTRA data file: glazed.bst

Column 1: Time [s]
Column 2: Colour 11 (pane 1 - side 1), absorbed solar flux [W/m²]
Column 3: Colour 21 (pane 1 - side 2), absorbed solar flux [W/m²]
Column 4: Colour 13 (pane 2 - side 1), absorbed solar flux [W/m²]
Column 5: Colour 20 (pane 2 - side 2), absorbed solar flux [W/m²]
Column 6: Colour 18 (pane 3 - side 1), absorbed solar flux [W/m²]
Column 7: Colour 19 (pane 3 - side 2), absorbed solar flux [W/m²]

        0      360.00       23.96      198.22       10.34      108.57        0.00
```

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BISTRA v5

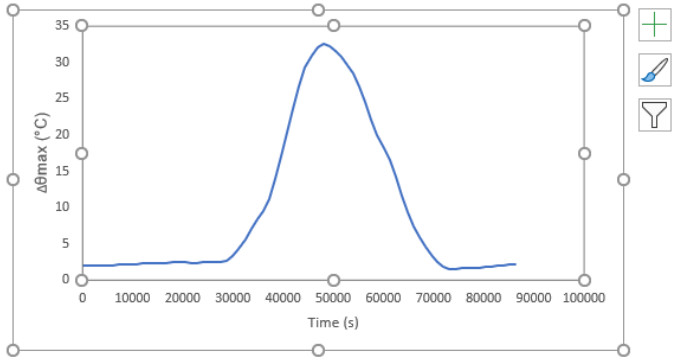
F.3 Option to save data as .csv

overview

Report data is also saved in .csv format allowing to simplify post-processing

```
Time [s],Colour 10 (ext glazing ): temperature difference [°C]
0,1.96
1200,1.96
2400,1.96
3600,1.96
4800,2.00
6000,2.05
7200,2.11
8400,2.16
9600,2.21
10800,2.25
12000,2.27
13200,2.27
14400,2.26
15600,2.31
16800,2.41
18000,2.52
19200,2.53
20400,2.46
21600,2.39
22800,2.39
24000,2.43
25200,2.50
```

Time [s]	Colour 10 (ext glazing): temperature difference [°C]
0	1.96
1200	1.96
2400	1.96
3600	1.96
4800	2
6000	2.05
7200	2.11
8400	2.16
9600	2.21
10800	2.25
12000	2.27
13200	2.27
14400	2.26
15600	2.31
16800	2.41
18000	2.52
19200	2.53
20400	2.46
21600	2.39
22800	2.39
24000	2.43
25200	2.5



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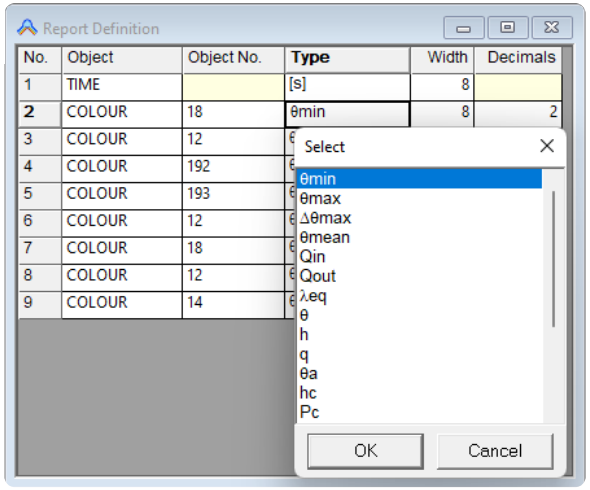
BISTRA v5

F.4 Miscellaneous

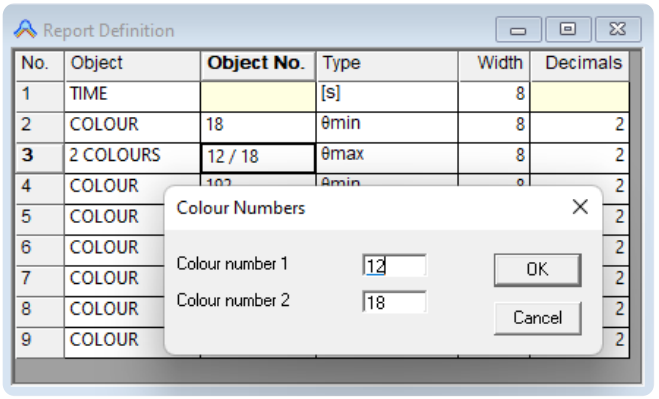
overview

1. Introduction of Listbox to select Report Definition 'Type'
2. Temperature outputs of combination of 2 colours possible
3. Colour name included in header of Report output
4. Text output: always entirely visible (no memory caps)
5. Text output: column with non-valid results show '-' (e.g. θ_a for BC_SKY)

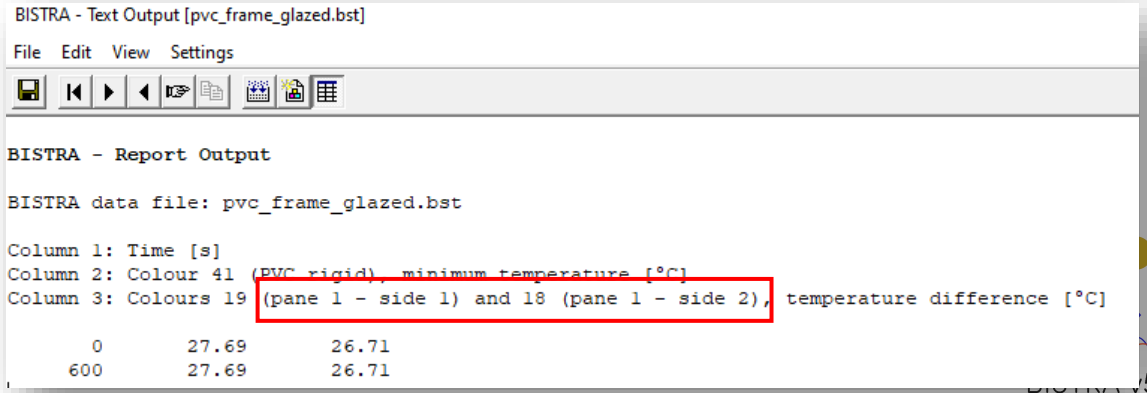
1



2



3



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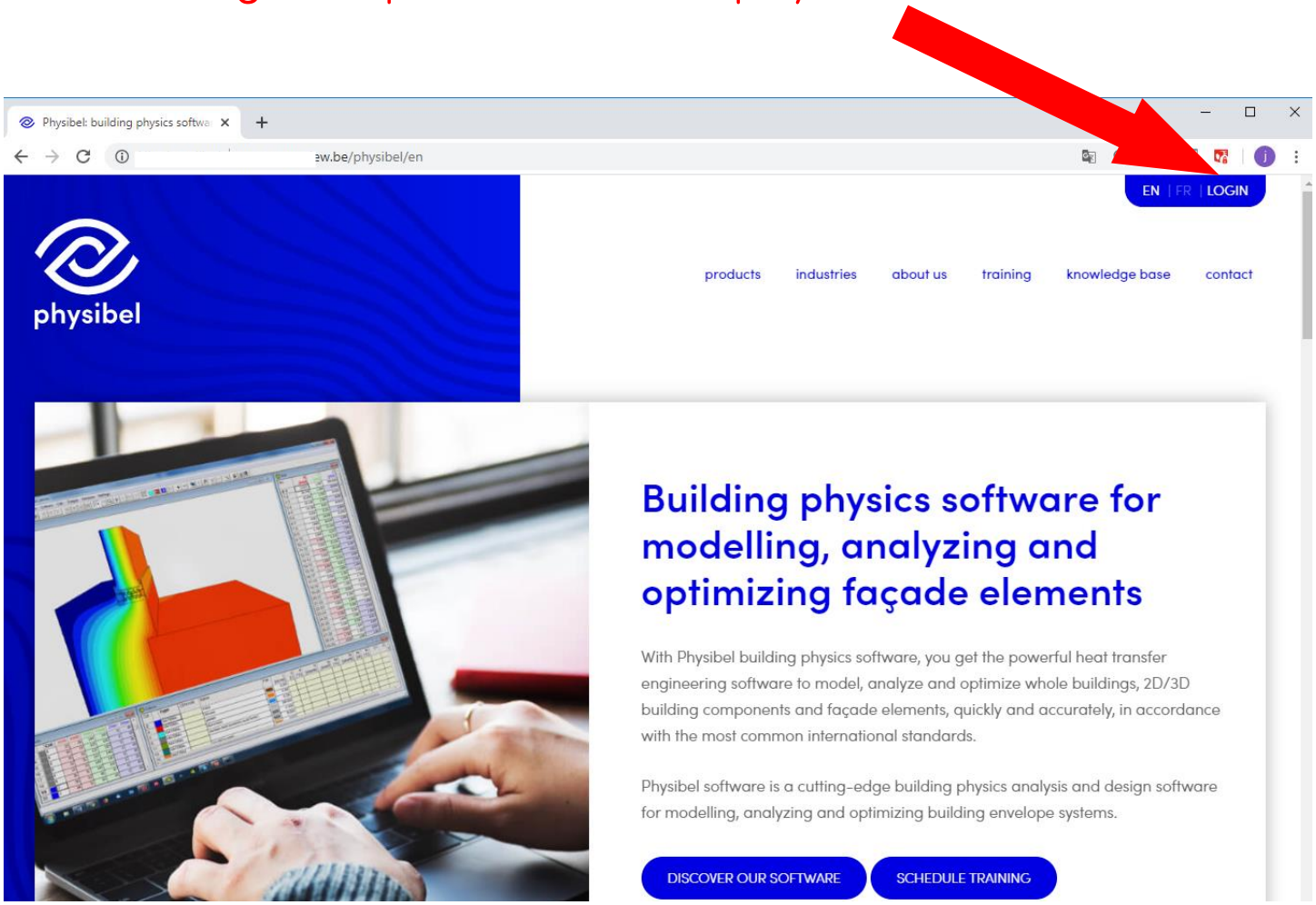
G.1 Online Physibel Portal

overview

log in to portal via www.physibel.be



G.1 Online Physibel Portal

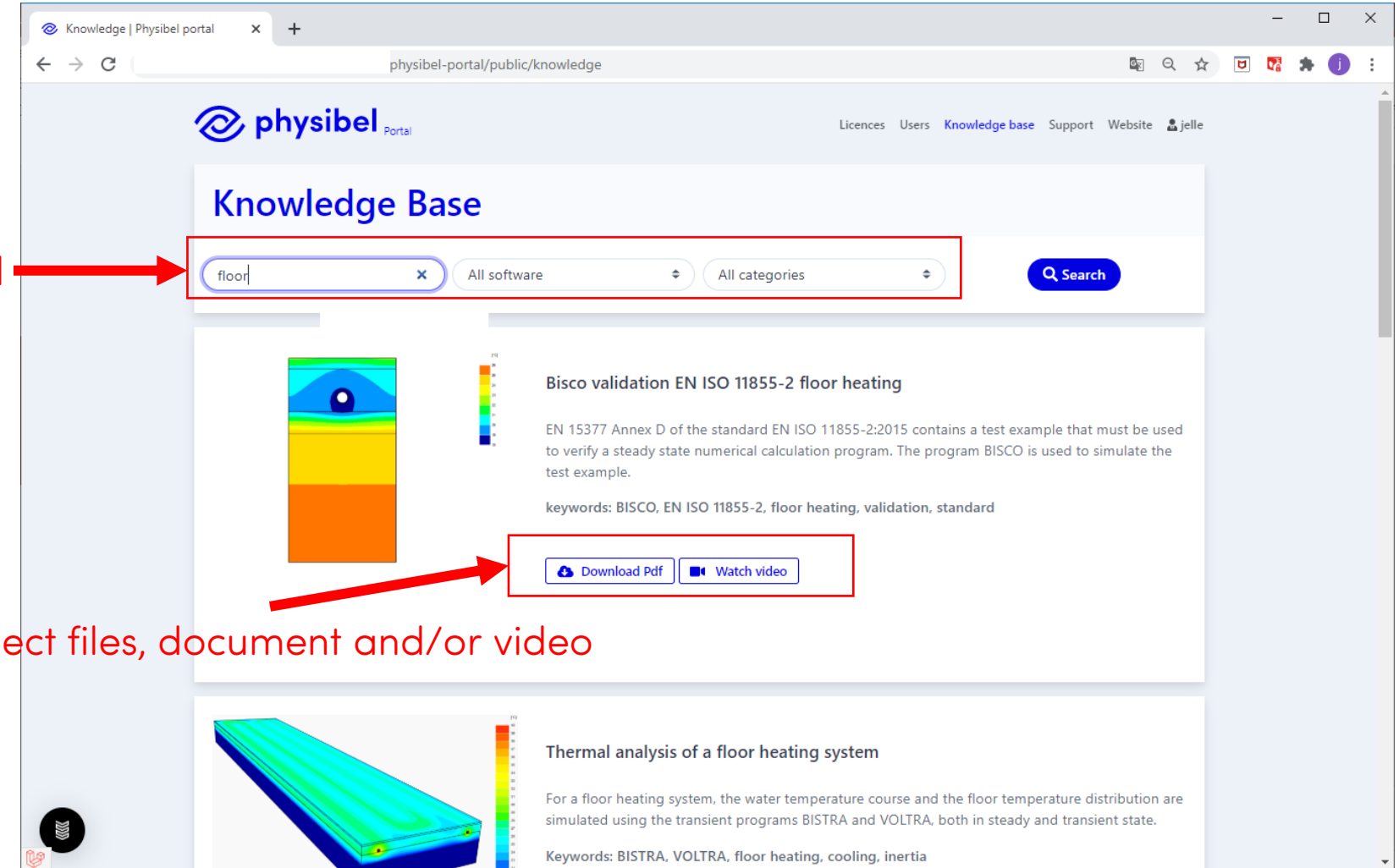
overview

Access to

- Knowledge Base with example projects, tutorials and videos

Search tool

Access project files, document and/or video

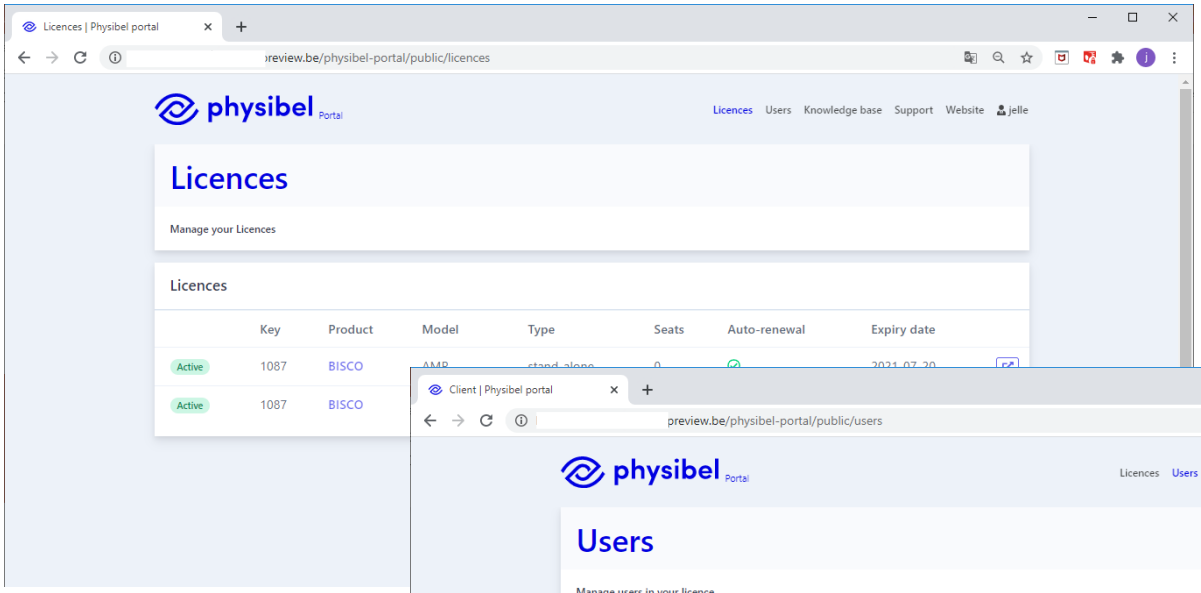


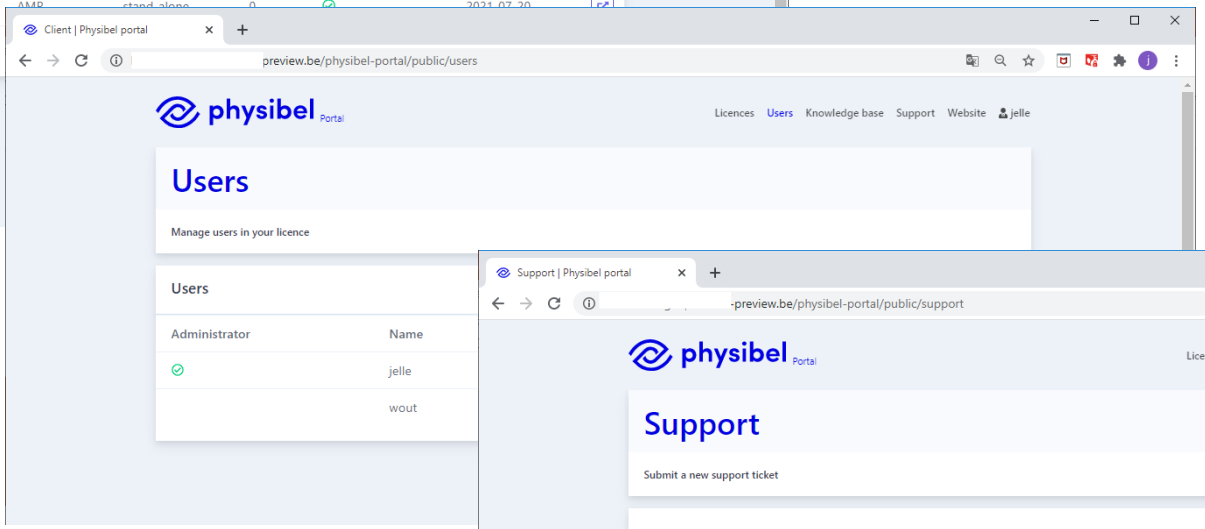
G.1 Online Physibel Portal

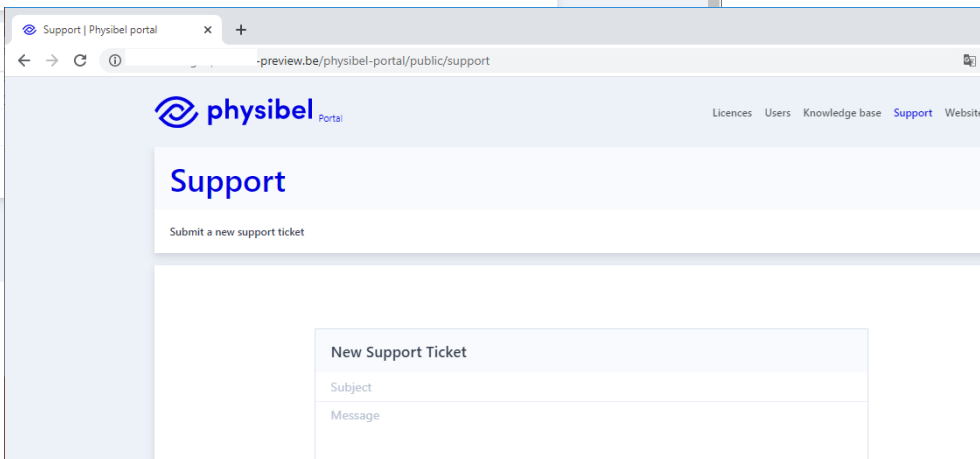
overview

Access to

- Licence and user management
- Support







H Licencing options

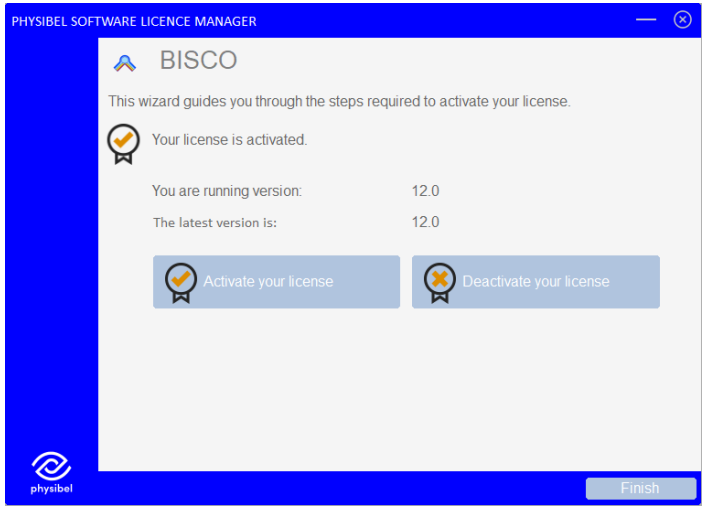
overview

Option 1: hardware key

- Stand-alone
- Model: perpetual
- Updates and support via Annual Maintenance Plan (AMP)

Option 2: Software licence

- Stand-alone / network floating / cloud-based floating
- Model: subscription (1 or 3-yearly)
- Updates and support included in subscription



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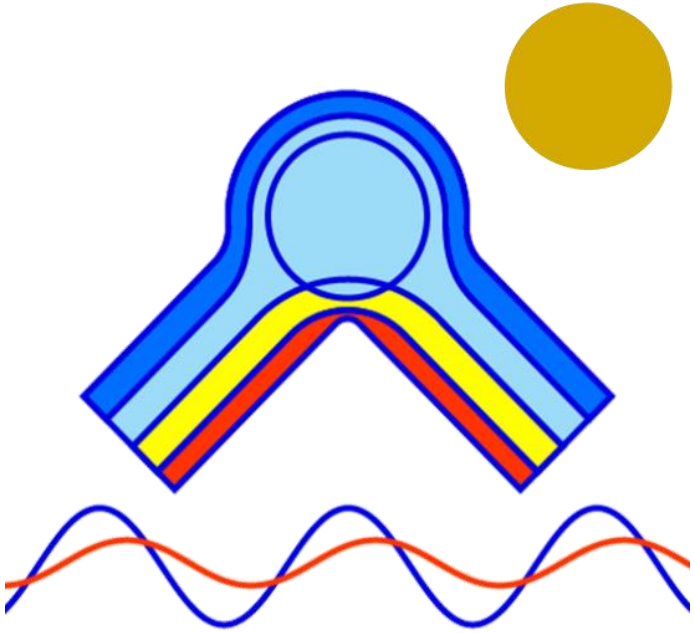
BISTRA v5 New program performances



www.physibel.be/bistra

downloadable program demo version