SageGlass®

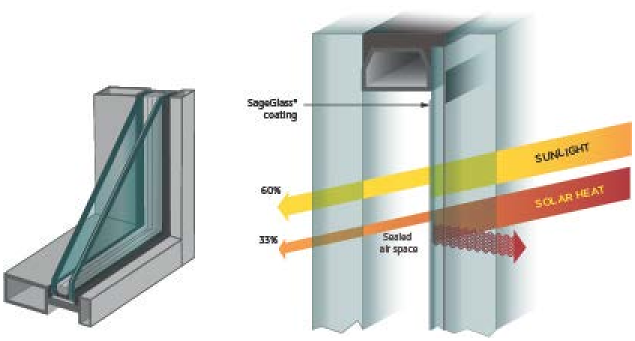
SAGEGLASS® VARIABLE TINTED GLAZING
INPUT SHEET FOR DIAL+ SOFTWARE

V1 dated 21/04/2017

The following procedure describes data input and handling for SageGlass in DIAL+ natural lighting and thermal dynamic simulation software.

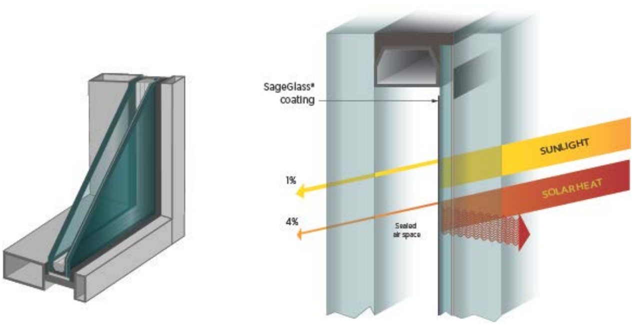
What is SageGlass ?

Cutaway view of SageGlass® IGU (clear state)



SageGlass is available in double or triple glazing IGU configuration. Under a low electrical voltage, the glass switches from a clear state to a tinted state (and inversely) while remaining always transparent. This enables to control the level of daylight (through variable light transmission), the solar heat gains (through variable g-value) and glare in the building, while keeping a view to outdoors. Applications can be vertical facades, windows and skylights.

Cutaway view of SageGlass® IGU (tinted state)



SageGlass has 4 different tint states, with a progressive switch from one state to another. It remains transparent in any state.

SageGlass control is automated, with the option of manual override at any time. Under the automated control, the glass tints in function of exterior luminosity measured by exterior light sensors. If desired, the system can be integrated into the building management system, so that it can tint in function of other parameters like occupation, season or temperature. This enables to adapt to geographical particularities, façade orientations and building usage.

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1. Defining SageGlass in DIAL+

Entering SageGlass glazing in DIAL+ is very similar to entering traditional glazing.

Once the geometry of the space and the openings have been created, SageGlass is defined in the “Glazing Properties” window by selecting “Electrochromic” in the Type of Glazing list. At this stage, only the clear glazing state is defined; the intermediate states appear in the subsequent steps. Several SageGlass standard compositions (in double and triple) are already defined and can be selected in the “Composition” list, as shown in Figure 1b. Depending on project needs, glazing properties (transmission, g-value solar factor, and u-value conductivity) can also be manually defined and modified as shown in Figure 1a.

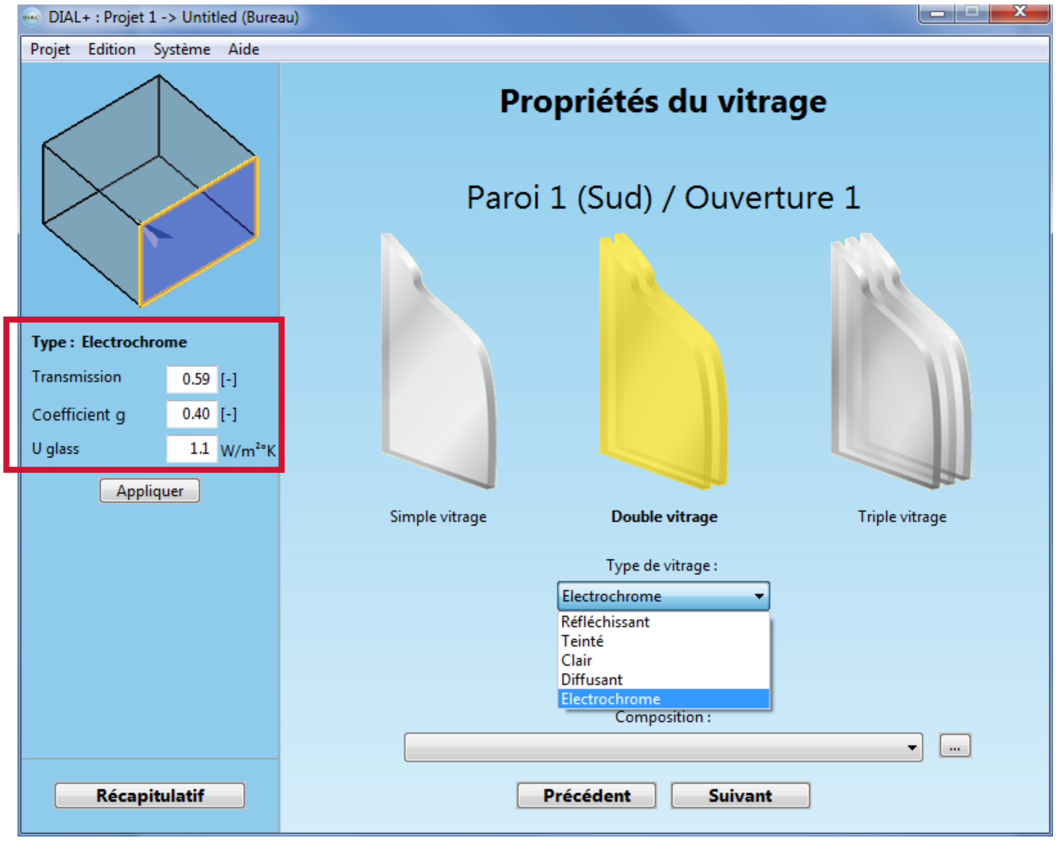

Fig. 1a: Defining SageGlass properties

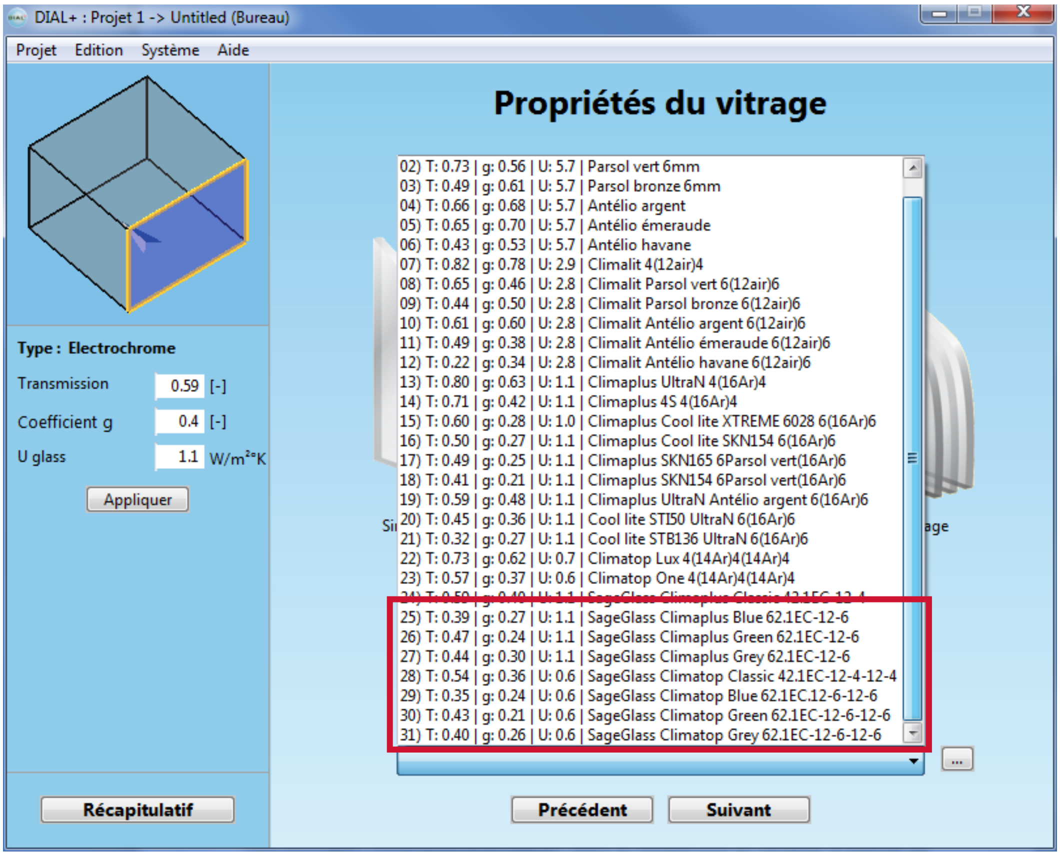

Fig. 1b: Selecting predefined SageGlass standard compositions

Once the selection has been made, the “electrochromic glass” type is automatically selected in the dynamic “Solar protections” window.

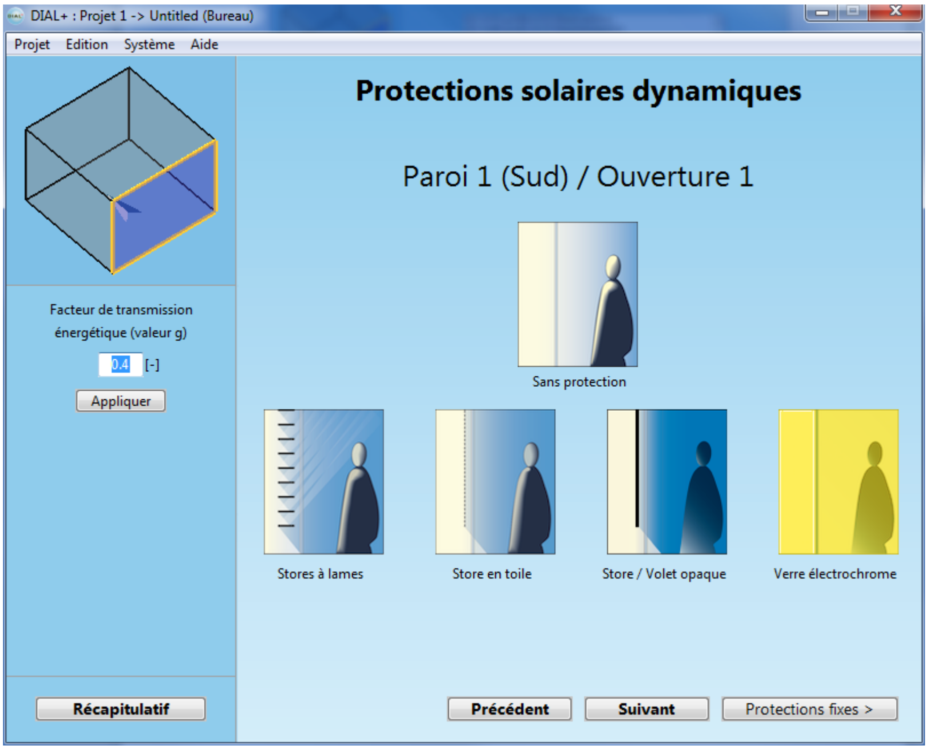

Fig. 2: Selecting electrochromic glass as dynamic solar protection

The following window “Electrochrome - Number of zones” lets you choose the number of glazing zones (1, 2, or 3) with customisable sizing and tints that can be independently controlled. As a reminder, selecting several zones gives greater flexibility to control natural lighting and glare effects.

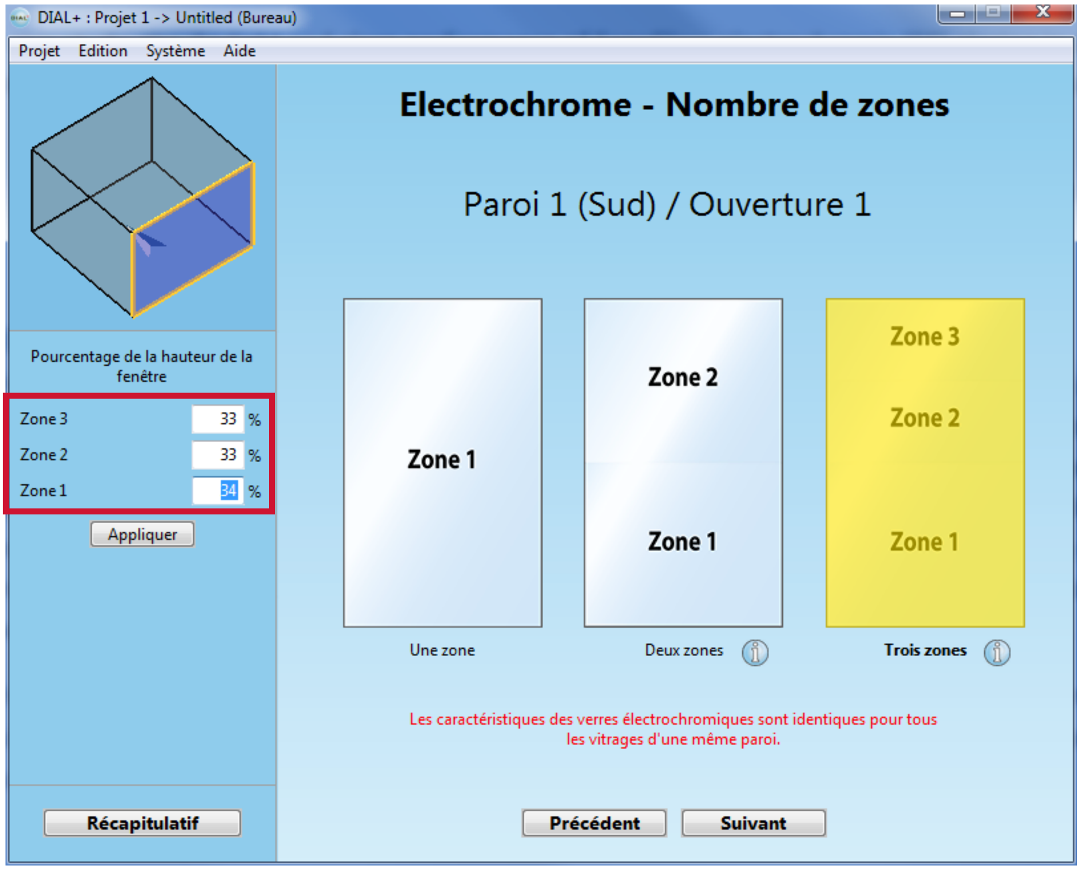

Fig. 3: Selecting the number of zones and their size

The last step consists in defining the glazing intermediate and maximum states, and their triggering threshold. Default values are already predefined, notably if one of the SageGlass compositions appearing in the DIAL+ list has been previously selected. However, these values can be modified manually depending on the parameters and needs of the project being studied. *To define and accurately configure the zones in your project, please refer to the instructions sent by SageGlass and/or you can contact our team directly.*

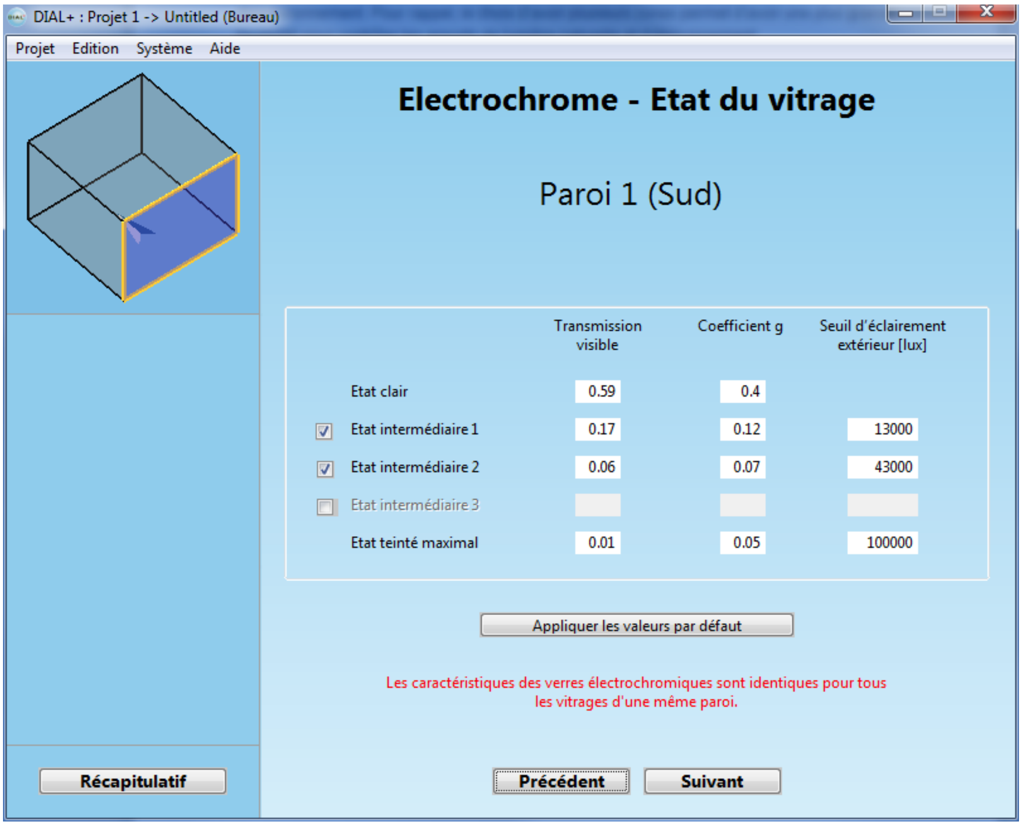

Fig. 4: Defining SageGlass intermediate and maximum states and their triggering threshold

2. Natural lighting calculation

2.1 Preparing simulations

To accurately simulate the dynamic behaviour of SageGlass and its impact on natural lighting performance in the room, launch a **dynamic simulation** which will calculate all hours of the year for the glazing state by taking into account climate-based daylight modelling for the selected location.

When this calculation method is chosen in the case of electrochromic glass, DIAL+ gives the option to include a glare algorithm in the calculation, as shown in Figure 5. If the latter is deactivated, the glazing will change tint only according to the brightness thresholds defined in the “Electrochrome – Glazing selection” stage, in order to adapt to the variations in natural outdoor light, notably in the case of partly cloudy skies, and to obtain sufficient indoor lighting levels in the room. If glare mode is activated, the glazing (or zones on a same window pane) will be able to darken to the maximum level to prevent the risks of glare, particularly coming from direct sunlight and reflections. In this case, the user is then asked to define a specific zone (height and perimeter) where they would like to limit direct sun penetration and therefore the risks of glare (for example, work station locations), as shown in Figure 6.

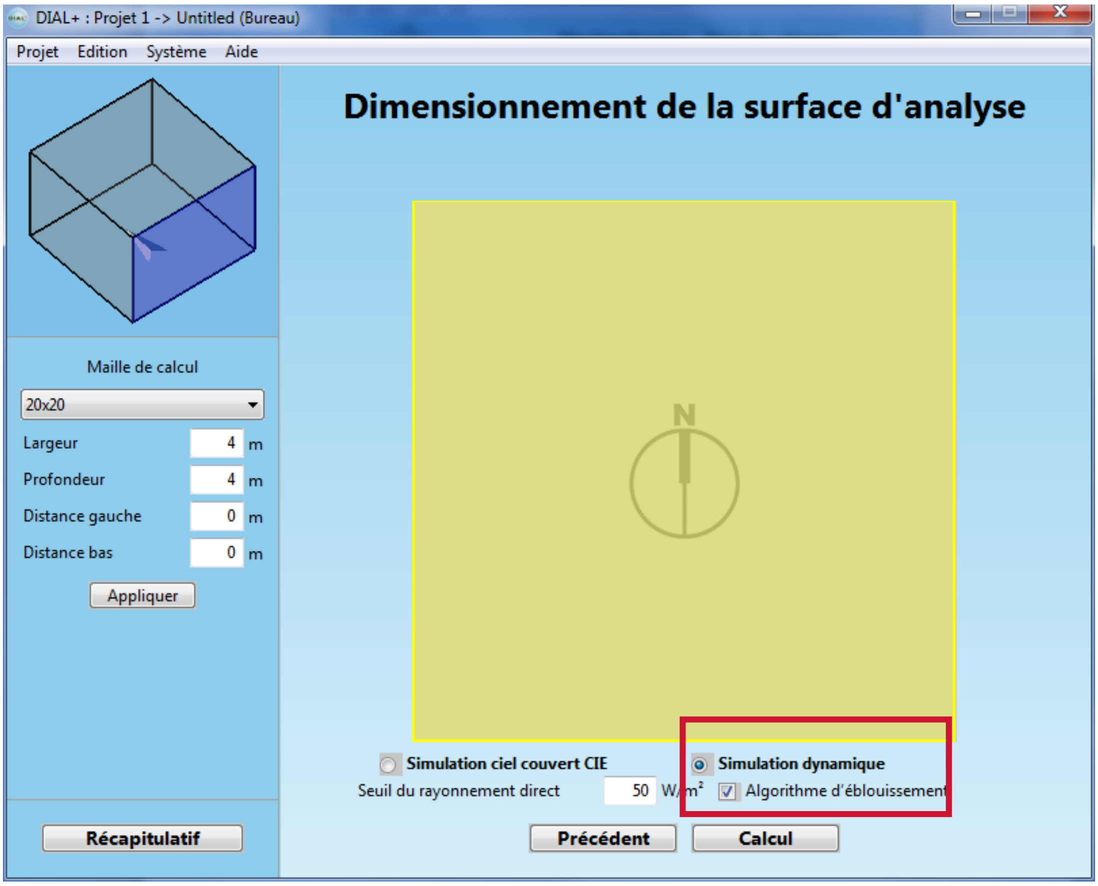

Fig. 5: Launching dynamic lighting simulations and choice of control strategy

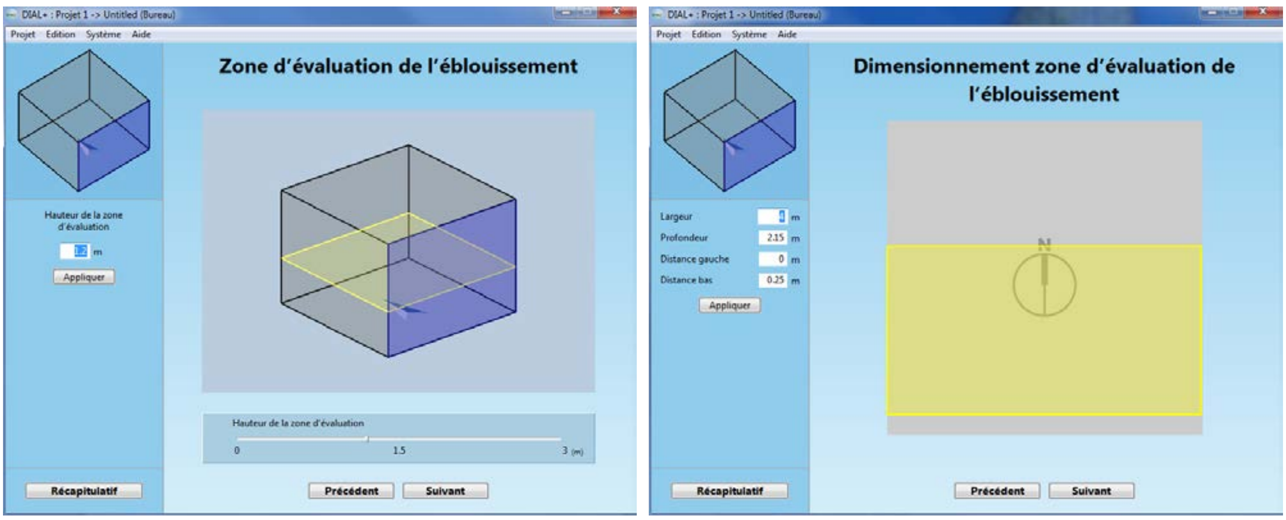

Fig. 6: Defining the glare evaluation zone

2.2 Outputs and Analysis

Contrary to standard daylight factor calculations, dynamic calculations can take several minutes depending on the project complexity.

The software output helps visualise the following results:

- The **lighting levels** in the centre of the room, on average for a year, or even a specific time of the year (to define on the left, see Figure 7). The average room lighting levels can also be viewed in the form of a temporal map by clicking “Temporal map”, as shown in Figure 8.

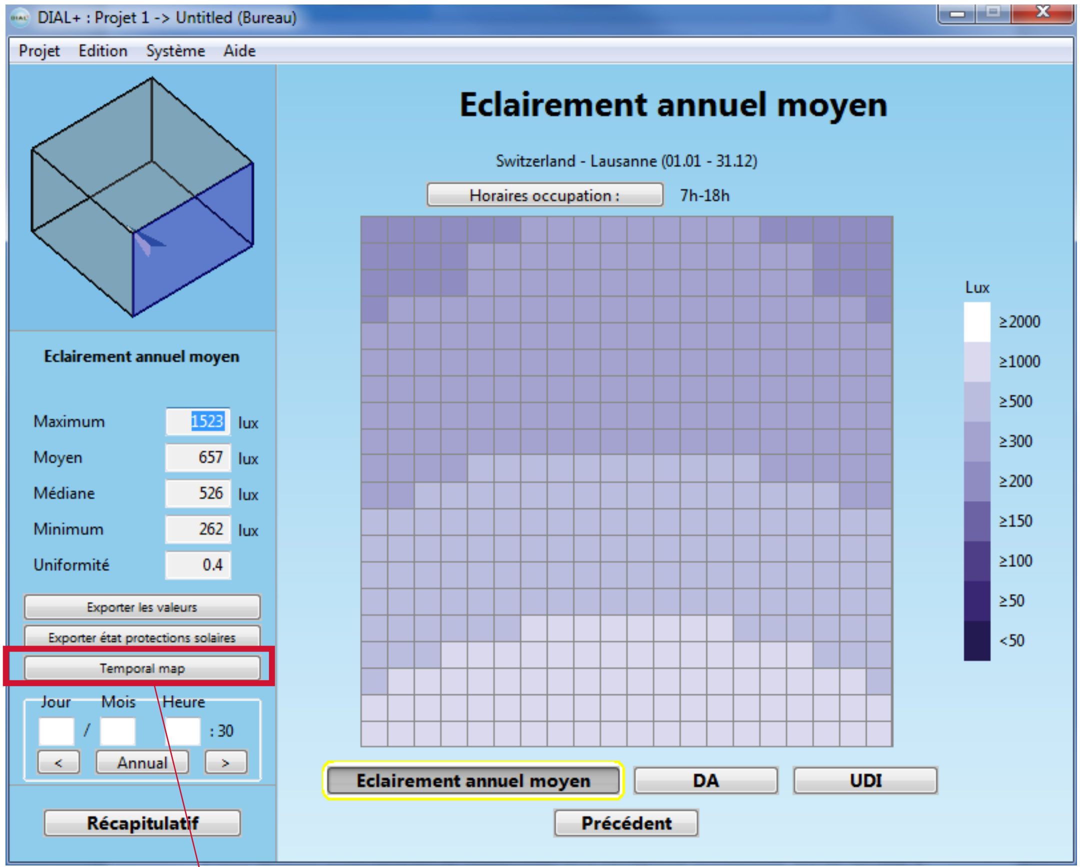

Fig. 7: Visualising average annual lighting levels in the room

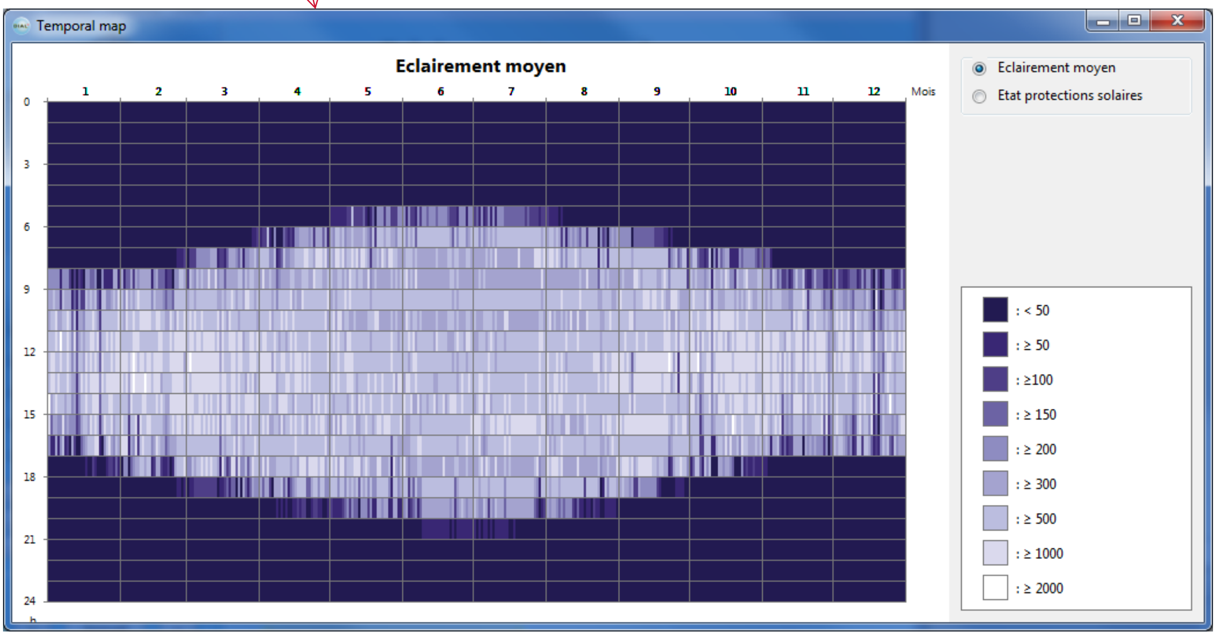

Fig. 8: Visualising average annual lighting levels

- The **SageGlass tint states** for each hour of the year and each glazing zone can be seen in the form of a temporal map by clicking "Temporal map". This can be used to check and understand the system behaviour and help to interpret the results.

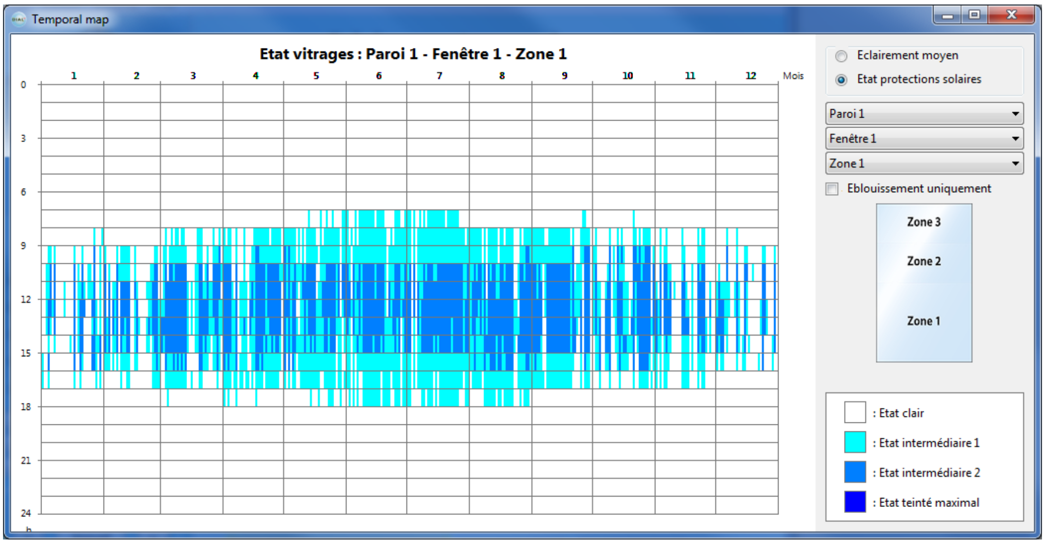

Fig. 9: Visualising SageGlass tint states per zone in the year

- **Daylight autonomy** within the room, which defines the percentage of occupation time in the year when natural lighting is above a certain threshold, usually 300 lux (this threshold may also be manually defined). **Spatial daylight autonomy** (sDA) is also displayed. It indicates the proportion of the room where daylight autonomy is greater than or equal to 50% (this threshold value may also be manually defined per user). This metric is also used by some environmental labels such as LEED V4.

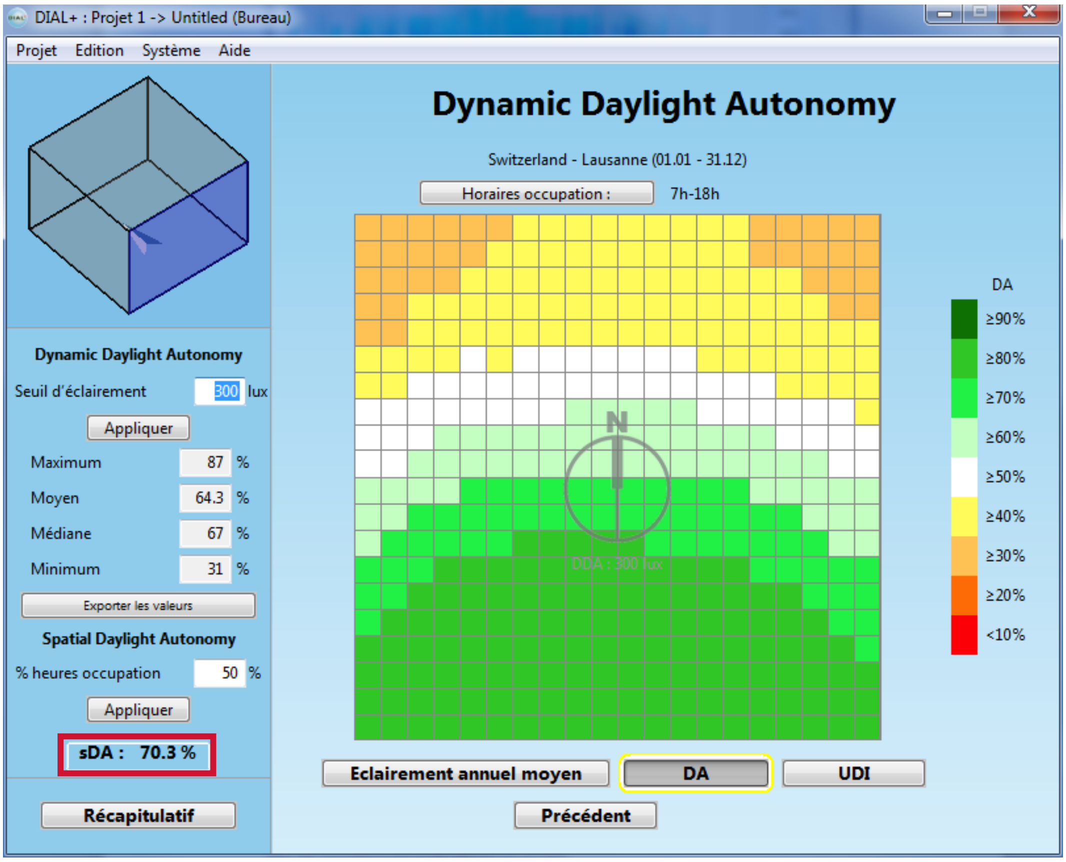

Fig. s10: Visualising daylight autonomy in the room

- **Useful daylight illuminance** within the room, defining the percentage of occupation time in the year where natural lighting is included in a specific interval of lighting values considered as useful by the user; this interval is generally taken at 100-2000 lux. This indicator may also serve to highlight the risks of glare due to too much lighting (above 3000 lux), or very dark areas (lighting under 100 lux). The upper and lower threshold values can be manually defined in the interface in order to visualise the desired indicators.

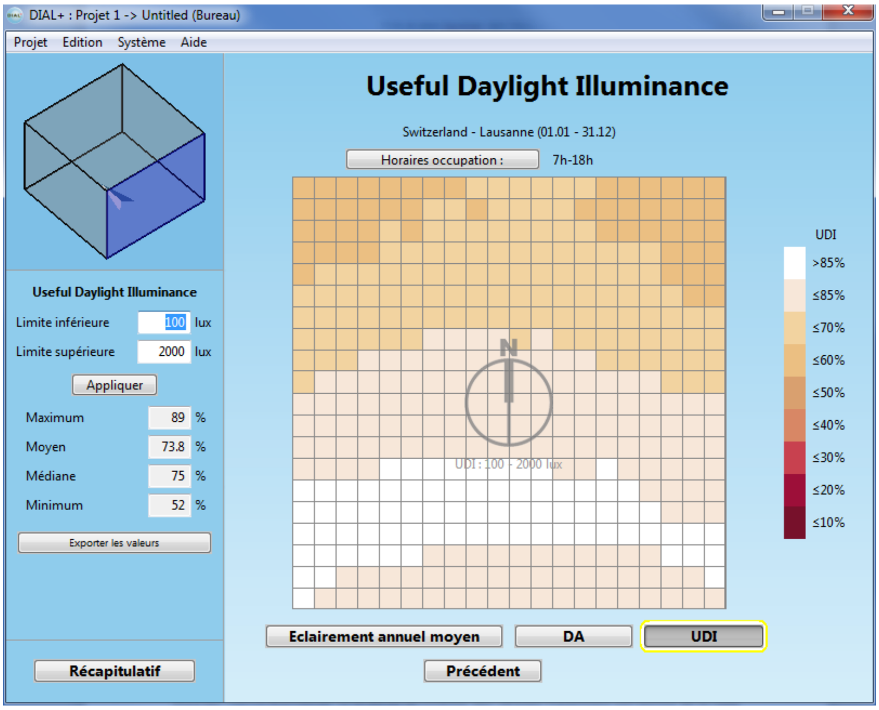

Fig. 11a: Visualising useful daylight in the room, here between 100 and 3000 lux

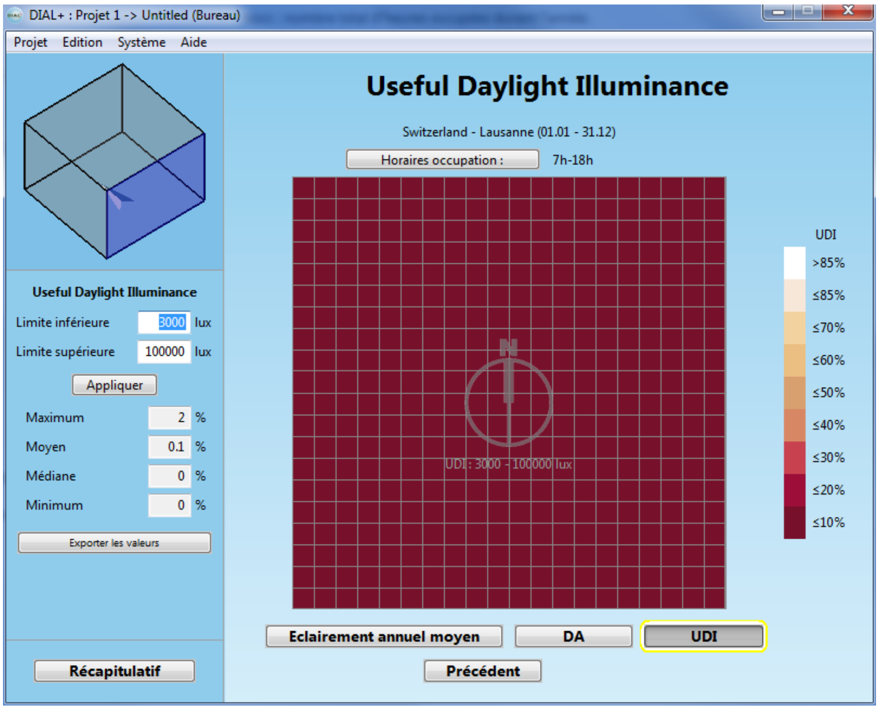

Fig. 11b: Visualising useful daylight in the room, here to detect potential glare risks (lighting greater than 3000 lux)

All of this data may be exported into an Excel file for subsequent processing and analysis.

3. Thermal calculation

For thermal calculations, the SageGlass control strategy is taken from the strategy defined for the natural lighting calculations. DIAL+ gives the user the option of whether or not to activate the glare algorithm before launching the calculations.

The software calculates the following outputs:

- Exterior, interior, operating, and surface temperatures
- Solar and internal gains
- Heating and cooling powers
- Number of discomfort and comfort hours in the year according to criteria defined in EN 15251 or defined by the user.
- Temperature distribution throughout the year

Furthermore, when the solar gains are displayed the software indicates the gains in the case where the windows are in the clear state (“without solar protection”) and in the case where they are activated (“with solar protection”) to highlight the impact of SageGlass on the control of solar contributions. It is also possible to display the glazing state at each hour of the year in order to support interpretation of the calculation results.

If you would like additional information on SageGlass modelling in DIAL+ (configuration for specific windows, control strategy, etc.), the SageGlass team is here to help you.