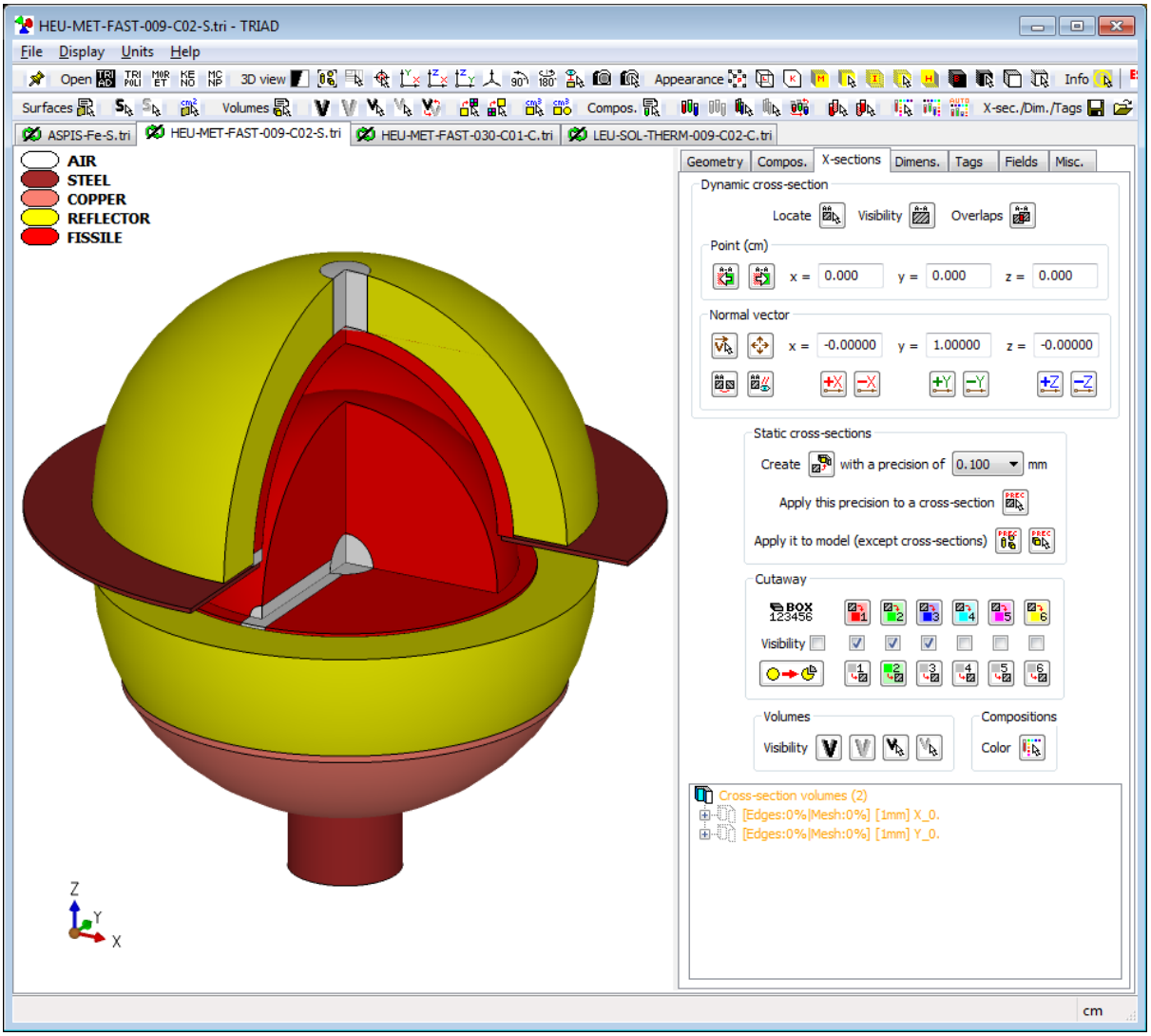
TRIAD



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1. Introduction

TRIAD software makes it possible to visualize –in 3D and interactively– the geometries of models intended for shielding and criticality codes such as TRIPOLI, MORET, KENO, MCNP…

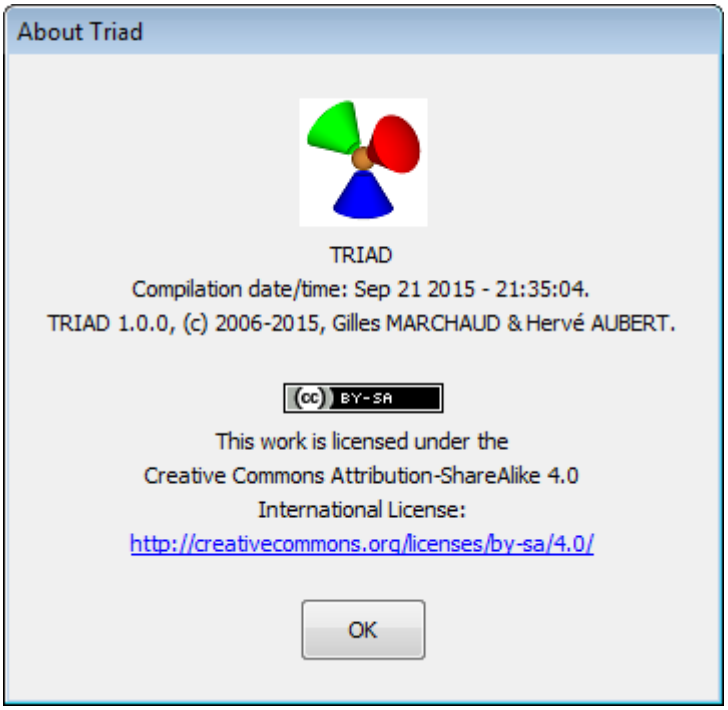
TRIAD runs under Microsoft® Windows™ XP and later versions of Windows™.

The executable works with importation plugins that are declared in “triad_plugins.ini” file. This file is read once at the start of TRIAD execution. The currently available plugins (see § 21) convert files for TRIPOLI 4, MERCURE 6.3, MORET 4 and KENO V.a into a TRIAD file (extension “.trd”, see § 22).

TRIAD reads the “.trd” file and calculates the edges (wireframe) and the mesh (faces) of each volume. The volumes are then displayed in 3D with the colors corresponding to their compositions. Several functions can be used to modify this display, explore the volumes and detect possible modeling errors.

2. License

TRIAD is licensed under the Creative Commons Attribution-ShareAlike 4.0 International License: http://www.creativecommons.org/licenses/by-sa/4.0/



3. Warnings – Limitations

Using TRIAD software does not guarantee errorless models.

TRIAD offers a vision of models that is complementary of the vision offered by a good text editor, cross-sections created by the code, diagnostics performed by this code, the analyst's skill, any other visualization software…

TRIAD hints at possible errors such as:

- volume overlaps (i.e. multiply defined space areas),
- holes in the geometry (i.e. undefined space areas),
- wrong composition-to-volume assignments,
- wrong dimensions.

The suggested errors are not necessarily real errors, and not all the real errors are detected.

Moreover, the volumes handled by TRIAD can only be based on the following quadric surfaces:

- plane,
- cylinder,
- sphere,
- cone.

The calculation of edges located at the intersection of non-coaxial conical surfaces is not implemented yet.

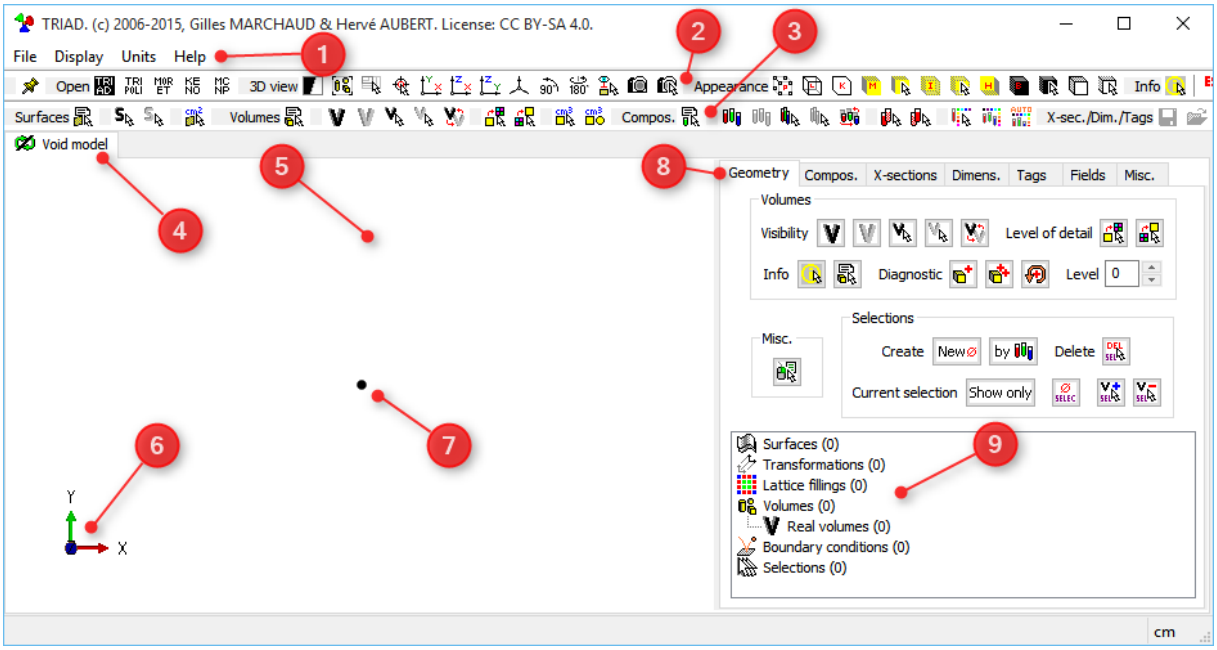
The displayed volumes are the real volumes approximated with a default precision equal to 1mm (maximum distance between the calculated edges and the real edges). Any detail with a size smaller than this precision (for instance a volume representing the thin gap between two parts) might not appear or might appear with a wrong shape.

This precision is changeable. To do so, add command "PRECISION_EDGES_CM <value>" in the ".trd" file before the volume definitions. By default, <value> = 0.1 (i.e. 1mm).

It is also possible to re-calculate all the volumes of the model (but the cross-sections) with a given precision thanks to button on the "X-Sections" tab.

Cross-sections can be created with a precision between 0.005mm and 50mm. It is recommended to use a precision for cross-sections that is better than the volumes to be cut, so that details not seen on 3D volumes can be observed on the cross-sections.

4. TRIAD main window



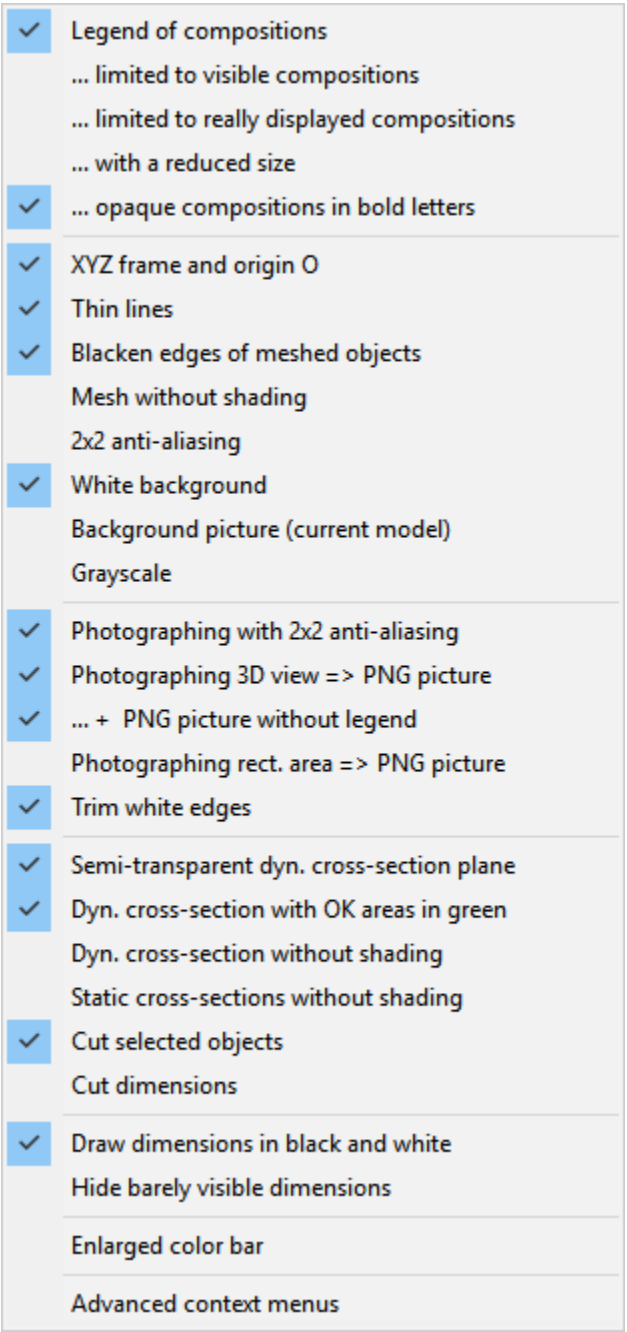
(1) Menu bar: File, Display, Units, Help.
(2) Tool bar 1.
(3) Tool bar 2.
(4) Model tab.
(5) 3D view.
(6) Trihedron (X, Y, Z).
(7) Origin O(0, 0, 0).
(8) Geometry tab, first one of seven tabs.
(9) Geometry tree.

5. Menu bar

The menu bar File Display Units Help contains the following functions:

Menu	Item	Description
File	Remark: items <1> through <99> are declared in configuration file "triad_plugins.ini" (see § 19.1).	
	Open…	Open a *.trd or *.tri* or *.cri* file
	Open Triad file…	Open a *.trd file
	Open Tripoli 4 file (with simplified lattices)…	Open a TRIPOLI 4 *.tri* file
	Open Moret 4 file (with simplified lattices)…	Open a MORET 4 *.cri* file
	Open Keno V.a file (with simplified arrays)…	Open a KENO *.in* file
	Open MCNP file (with simplified lattices)…	Open a MCNP *.* file
	<7>…	Open a … file
	<8>…	Open a … file
	…	…
	<99>…	Open a … file
	Save user preferences	Creates a new "triad_user_prefs.ini" file in the TRIAD executable directory (overwrites the old file if it exists). The options of "Display" menu below are written with the values they have when the "triad_user_prefs.ini" file is created.
	Exit	Exit program. The user is asked whether they want to save the objects they created in some models (cross-sections / dimensions / tags).
Display	-	See details on next pages
Units	Meter (m)	
	Centimeter (cm)	Default length unit
	Millimeter (mm)	
	Foot (ft)	
	Inch (in)	
Help	Mouse / keys…	Displays the dialog box "Mouse / keys" presented in § 6
	About Triad…	TRIAD logo, compilation date/time, copyright, license

“Display” menu:



Menu	Item	Description
Display	Remark: the “checked/unchecked” states of the following items are defined in configuration file “triad_user_prefs.ini” (see § 19.2). If this file is not found, the items have the states shown to the left.	
	Legend of compositions	Display or not display the legend of compositions in the 3D view
	… limited to visible compos.	The legend only shows visible compositions
	… limited to really displayed compositions	The legend only shows compositions used by graphic elements that appear in the 3D view (possibly beyond its boundaries)
	… with a reduced size	The legend is written with a small font
	… opaque compositions in bold letters	The names of opaque compositions is written using bold letters
	XYZ frame and origin O	Display the frame and the origin in the 3D view
	Thin lines	Volume edge lines drawn with a one-pixel width (by default, otherwise 3 pixels)
	Blacken edges of meshed objects	The meshed objects have their edges drawn in black (and not in the colors of their compositions)
	Mesh without shading	Display meshes with a uniform color
	2x2 anti-aliasing	Improve the definition of the 3D view
	White background	The 3D view background is either white or black
	Background picture (current model)	Display a picture (.bmp, .png, .gif) in the 3D view background. Drag the picture from the Windows™ explorer to TRIAD main window. The picture is associated to the current model.
	Grayscale	The colors are displayed in shades of gray
	Photographing with 2x2 anti-aliasing	The buttons “Take a picture of 3D view” and “Take a picture of a rect. area” captures the 3D view with anti-aliasing, whether anti-aliasing is enabled or not
	Photographing 3D view => PNG picture	The button “Take a picture of 3D view” copies a 3D view picture to the clipboard. If this item is checked, a PNG picture is also created in the directory of the current model.

Menu	Item	Description
	… + PNG picture without legend	If this item and the previous one are checked, two pictures are created, one of them without the legend of compositions
	Photographing rect. area => PNG picture	The button “Take a picture of a rect. area” copies a picture of the rectangular area to the clipboard. If this item is checked, a PNG picture is also created in the directory of the current model.
	Trim white edges	The 4 edges of the captured picture are trimmed in such a way that no more than 5 rows or columns of white pixels are remain on each edge
	Semi-transparent dyn. cross-section plane	The areas where the dynamic cross-section plane does not cut any volume are filled with semi-transparent white
	Dyn. cross-section with OK areas in green	In the “Overlap display” mode, the dynamic cross-section (that is filled with red in areas where volumes overlap) is filled with green where only one volume is cut
	Dyn. cross-section without shading	Mesh with uniform colors for the dynamic cross-section
	Static cross-sections without shading	Mesh with uniform colors for all static cross-sections
	Cut selected objects	The dynamic cross-section planes truncates the selected objects
	Cut dimensions	The dynamic cross-section planes truncates the dimensions
	Draw dimensions in black and white	Dimensions are drawn in black on a white background and in white on a black background (by default, otherwise slate blue)
	Hide barely visible dimensions	Dimensions seen sideways (> 75°) are hidden
	Enlarged color bar	The color bar to the right of the 3D view is enlarged by 50%
	Advanced context menus	The context menus of tree items give access to advanced functions

6. Dialog box “Mouse / keys”

Mouse / keys

```
                              Mouse

CTRL + mouse motion       : rotation
Right click, held pressed : pan
Mouse wheel               : zoom in / zoom out
Double right click        : interrupt current procedure

                              Keys

F        : photograph 3D view (PNG format)
R or F5 : re-read current model
CTRL + R : (de)activate auto. sync. of current model
Esc      : interrupt current procedure
Z        : zoom in on visible entities (*)
     (*) or - if it exists - on the highlighted entity
CTRL + Z : zoom in on a mouse-defined rectangle
C        : center display on visible entities (*)
X        : align view along X/Y/Z axes
V        : straighten up the most vertical axis
CTRL  + W/S/A/D : 2.5° rotation around axis // screen
        W/S/A/D : pan
SHIFT + A/D     : 2.5° rotation around axis _|_ screen
CTRL+SHIFT+ A/D : 0.1° rotation around axis _|_ screen
SHIFT + S/W     : zoom in/out by a 1.05 factor
CTRL+SHIFT+ S/W : zoom in/out by a 1.001 factor
Q / E           : zoom in/out by a 1.50 factor
SHIFT + Q/E     : div./multiply bkgd image width by 1.001
SHIFT + R       : reset bkgd image width
Y        : display/hide cross-section plane
U        : reverse cross-section plane
J        : display/hide overlaps in cross-section plane
N held   : move cross-section plane with mouse
The P/L/K/M/B/H/I/O/,/T keys only act on visible
entities. The effect of P/L/K/M/B/H/,/T keys
is reversed by pressing CTRL at the same time.
P : display points (vertices, centers)
L : display edges
K : display silhouette edges
M : display shaded mesh
B : blacken mesh
H : hide mesh front
I : display inside  (semi-transparent mesh)
O : display outside (opaque mesh)
, or / : info. about volume/surface/compos. (end with ".")
T : diagnostic of the model (overlaps and holes)
```

7. One tab per model

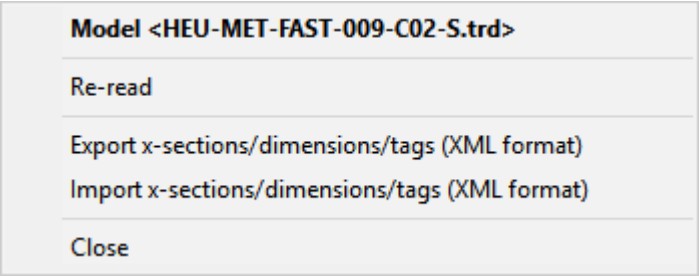
Several models can be opened successively. Each model is associated with a tab containing the imported file name.

The icon or to the left of the tab indicates whether the visualized model is up-to-date or not with respect to the imported file (that might have been modified since the importation). This icon is updated when the cursor moves on the tab or on the 3D view. If the model is not up-to-date, the file is re-read as soon as the cursor moves on the 3D view. Automatic updating can be disabled via configuration file "triad_user_prefs.ini" (see § 19.2.5). Enabling/disabling automatic updating can also be performed by typing CTRL + "R" in the 3D view. When automatic updating is disabled, the tab icon becomes or .

Left-clicking on the tabs allows for browsing the models.

Right-clicking on a tab allows for accessing its context menu and choosing to:

- re-read the original TRIPOLI, MERCURE, MORET, KENO, MCNP file (shortcut: "R" key in the 3D view), should this file have been modified (remark: it the latest importation lasted more than 30 seconds, the user is asked to confirm their request),
- export the definitions of cross-sections and dimensions (an XML file is created),
- import the definitions of cross-sections and dimensions (an XML file is read),
- close the model associated with the tab.



TRIAD can open one or several files dragged from the Windows™ explorer to TRIAD main window. These files are successively opened as though they had been opened with the first item of the "File" menu.

The title of TRIAD main window (also shown in Windows™ task bar) is the current model name.

8. 3D view

The 3D view displays the geometric model in three dimensions, the color/composition legend in the top left corner, the XYZ Cartesian frame in the bottom left corner, the origin O.

The mouse allows for changing the viewpoint and the zoom level:

- when holding the “CTRL” key down (or when holding the mouse wheel down), moving the mouse rotates the model (“virtual trackball”),
- when holding the right button, moving the mouse translates the model in a direction parallel to the 3D view plane (“pan”),
- the mouse wheel allows for zooming in or out.

The mouse usage logic is that the user remains in their position whereas the model follows the mouse motion (rotation/pan) or the upper edge of the mouse wheel (zoom).

The “Z” key (“W” for AZERTY keyboards) allows for quickly zooming in on the entire model.

The “Q” (zoom in) and “E” (zoom out) keys (“A” and “E” for AZERTY keyboards) apply a greater zoom factor (1.5) than the mouse wheel (1.05).

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9. Appearance of volumes in the 3D view

A **volume** can:

- be shown or hidden,
- have shown or hidden **points**,
- have shown or hidden **edges**,
- have shown or hidden **silhouette edges**,
- have a shown or hidden **mesh**,
- have an opaque or semi-transparent mesh,
- have a shown or hidden mesh front,
- have a shown or hidden mesh back,
- have blackened or not blackened edges,
- have a blackened or not blackened mesh,
- have a whitened or not whitened mesh,
- have a shaded or unshaded mesh (options "… without shading" in "Display" menu),
- have shown or hidden **faces**.

The **silhouette edges** are the lines where the volume faces are tangent to the view direction. For instance, they are two parallel lines for a cylinder; they are a circle for a sphere. These edges are calculated each time the 3D view is updated (rotation, pan, zoom, etc.). By default, they are not displayed. Not showing them accelerates the display updates.

The **mesh** (not to be mistaken for "mesh tallies") is composed of triangles that cover the volume faces.

The volume edges are blackened if it has been requested for the volume (item "Blacken edges" of the volume context menu in the "Geometry" tree) or if the volume is meshed and it has been requested for all meshed objects (item "Blacken mesh of meshed objects" in "Display" menu).

The **face** of a volume is associated to a triplet (composition, sign, surface equation) and is given part of the edges and part of the mesh of the volume. Each face of the volume can be displayed separately whether the volume itself is displayed or not.

If a surface equation is hidden, all the volume faces using this equation have their mesh hidden.

If a composition is hidden, any part of a volume (point, edge, mesh) using this composition will be hidden.

If a composition is semi-transparent, any part of a volume mesh using this composition becomes semi-transparent. The edges remain opaque.

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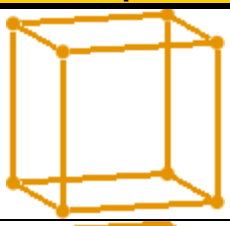
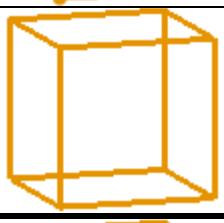
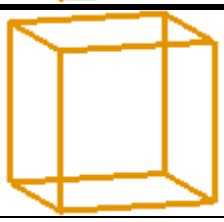
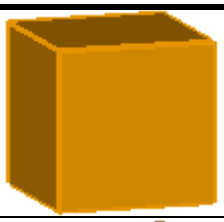
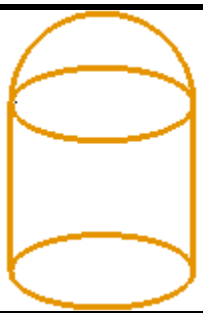
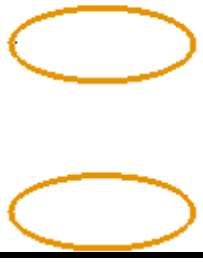
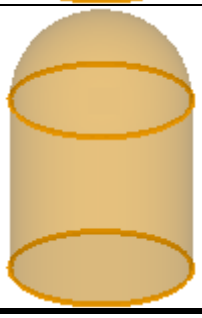
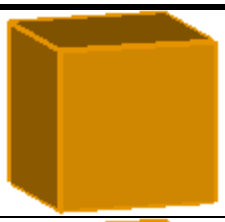
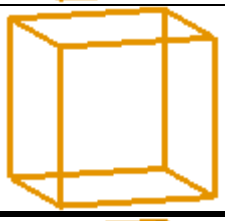
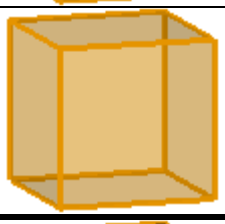
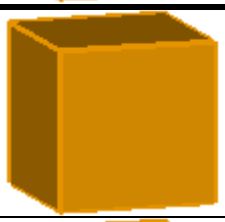
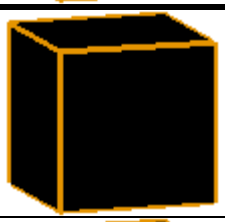
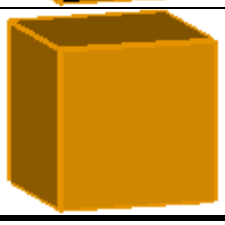
The volume appearance in the 3D view can be modified in several ways, thanks to a shortcut key or to a toolbar button, as presented in the following table:

		Example 1	Example 2	Shortcut key	Toolbar button
Points	Shown			“P”	-
	Hidden			CTRL + “P”	-
Edges	Shown			“L”	
	Hidden	-		CTRL + “L”	Right click on
Silhouette edges	Shown			“K”	
	Hidden			CTRL + “K”	Right click on

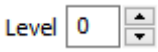
Mesh	Shown			“M”	
	Hidden	-		CTRL + “M”	Right click on
Mesh	Opaque			“O” (“outside”)	Right click on
	Semi-transparent			“I” (“inside”)	
Mesh front	Shown			CTRL + “H”	Right click on
	Hidden			“H” (“hide”)	
Mesh	Blackened			“B” (“black”)	
	Not blackened			CTRL + “B”	Right click on

10. "Geometry" tab

10.1. About geometry

On the right side of the 3D view, the "Geometry" tab allows for exploring the geometric data and tuning their display in the 3D view.

Terminology: the model is composed of **"real volumes"** (that describe the actual geometry of the model) and of **"construction volumes"** also called **"fictive volumes"** (that help in defining real volumes thanks to Boolean operations for instance). TRIAD also attributes a **"hierarchical level"** to every volume. This number appears at the start of the text that describes every volume in the trees (ex.: "`0 V1 (AIR)`"). The 0-level real volumes are the actual volumes of the model. The N-level modules (i.e. groups of volumes) and the N-level lattices contain (N+1)-level volumes. In practice, a model only composed of surface-bounded volumes (i.e. intersections of half-spaces), without any lattice, only contains 0-level real volumes. The volumes presented in the "Geometry" tab tree are those with the current level. The current level is selectable thanks to:



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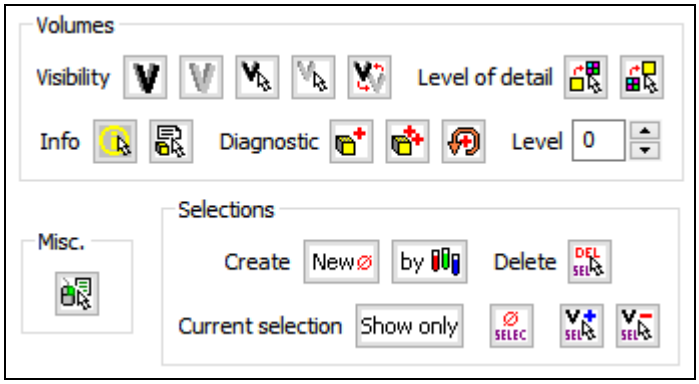
10.2. Buttons of "Geometry" tab



(*: button only applicable to volumes with the current level)

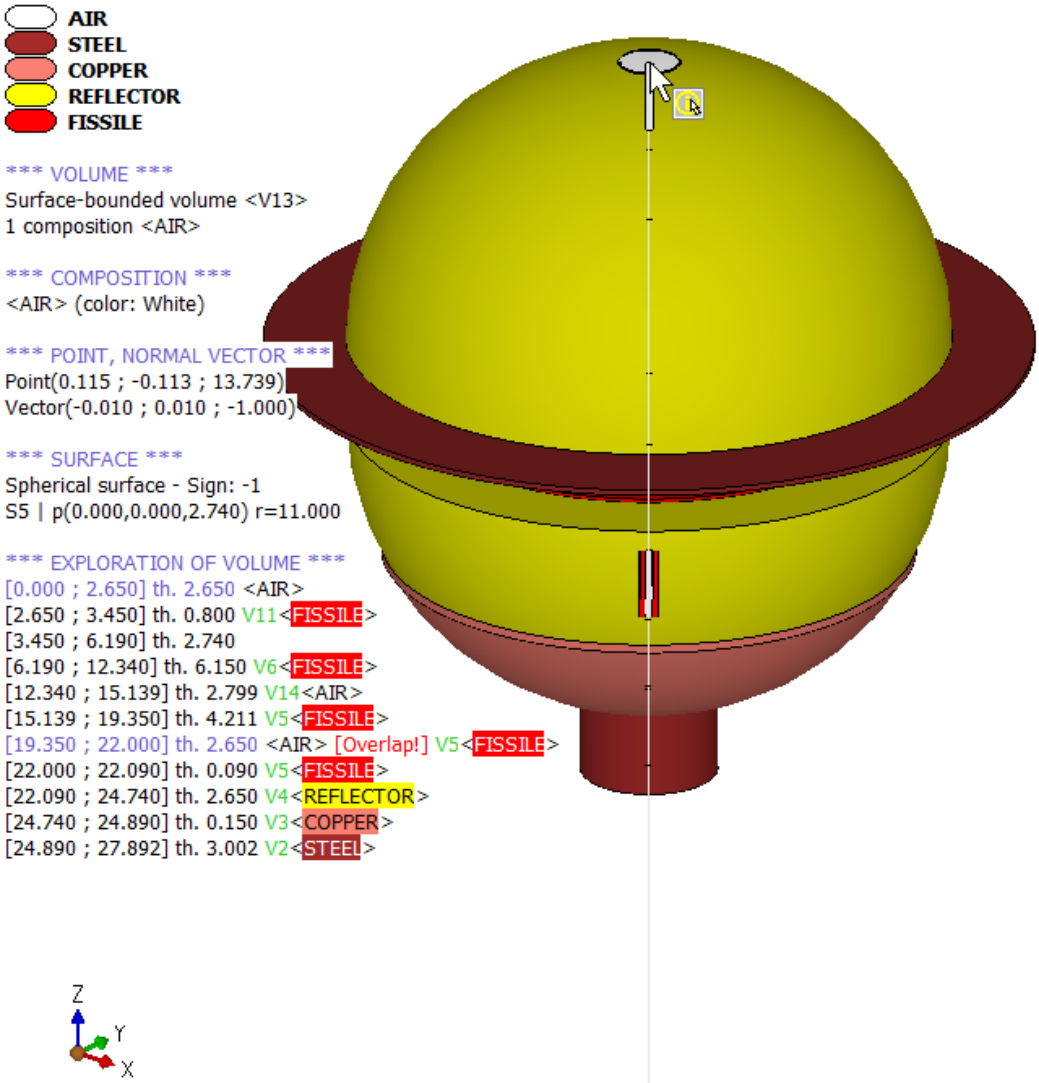
	Show real volumes (*)
	Hide all volumes
	Show volumes by clicking on them (in the volume tree)
	Hide volumes by clicking on them (in the 3D view and/or the volume tree). Multiple selection is possible in the 3D view (left button dragging) and in the volume tree (shift + left click). To interrupt the procedure in the 3D view, press "ESC" or double-click with the right button.
	Hide shown volumes and show hidden real volumes (*)

 or 	Increase or decrease the level of detail. In the imported ".trd" file, any volume can be associated with a simplified version: for instance, a module composed of a fissile cylinder and a zirconium annulus, completed with a water box, can be simplified into a "homogenized" box. In such a case, if this volume is one of the patterns of a lattice, the lattice will make copies of the simplified pattern, which will accelerate the lattice display. The button allows for replacing simplified volumes with exact volumes. Conversely, the button allows for replacing exact volumes with simplified volumes. The volume(s) affected by these buttons are determined as follows. When the cursor is located on a volume in the 3D view, the text displayed on the left side of the 3D view gives the volume name, as well as the name of the sub-volume or of the copied volume, recursively. For instance, if the cursor is on a lattice of fuel assemblies (each assembly being a lattice of fuel rods), the text may give the following information: *** VOLUME *** Lattice <**Assemblies**> 8 compositions Sub-volume : **Lat<Assemblies>1<Assembly>(5,4,1)** Copied from: **Assembly** Sub-volume : **Lat<Assembly>1<UO2_rod_pattern>(17,14,1)** Copied from: **SUO2_rod_pattern** The procedure is applied to the first simplified copy found in this volume list. In the example above, sub-volume "**Lat<Assembly>1< UO2_rod_pattern>(17,14,1)**" that is a copy of the simplified pattern "**SUO2_rod_pattern**" will be displayed as a copy of the exact pattern "**UO2_rod_pattern**". If the "MAJ" key is held when the volume is clicked, the procedure is applied to the first lattice found in the volume list that contains at least one lattice element that is a simplified copy. In the example above, lattice "**Assembly**" contains elements that are simplified copies. All the elements will be displayed as copies of the exact patterns. The procedure is applied to the first exact copy found in the volume list. If the "MAJ" key is held when the volume is clicked, the procedure is applied to the first lattice found in the volume list that contains at least one element that is an exact copy.

Information about volume/surface/composition (shortcut key “,” / stop “;” in the 3D view).

When the cursor points at a volume face, an exploration ray is cast from the pointed point and in the direction of the face normal vector, toward the volume inside. The abscissas and thicknesses of the various compositions found along the ray are listed, and the volume overlaps are indicated. Clicking on a volume hides it and makes it possible to progressively explore the model from the outside to the inside.

When a procedure is active (such as “Info.”) and the “SHIFT” key is held and some text is displayed below the composition legend, this text is copied to the clipboard. Release “SHIFT” before pasting the text. It may be useful when the exploration ray intersects many volumes and the text extends beyond the 3D view edges.



Open the imported file at the line where the volume is defined.
SHIFT + click: … where the surface is defined.
This function requires that an appropriate text editor be declared in a configuration file (see § 19.1.2).

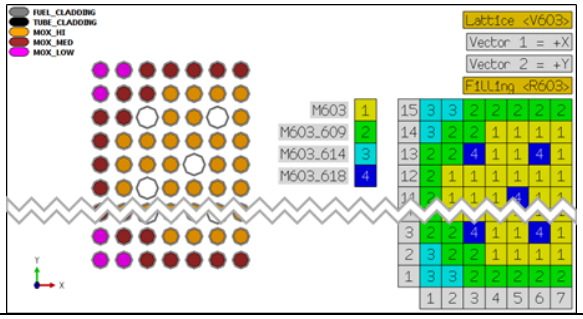
	Model diagnostic: overlaps and holes (“T” in the 3D view). The algorithm detects the overlapping volumes and the void-facing faces of volumes. In the 3D view, the overlapping volumes are displayed with their mesh (front mesh being hidden); the other volumes are displayed without their mesh. The points found in the overlap areas are marked with warning signs ⚠. The void-facing faces (holes or outer boundaries of the model) are displayed with their mesh (front mesh being hidden) using the color named “Void-facing faces” (yellow by default). Restoring the previous display of volumes can be obtained by clicking on button (or CTRL + “T” in the 3D view). In the geometry tree, two selections are created: one containing overlapping volumes, the other containing void-facing volumes. <u>Remark</u>: overlapping is indicated in the 3D view only between separate volumes, and not among sub-volumes of a module or lattice. Thus, to see overlaps between sub-volumes in the 3D view, hide the module or lattice and display its sub-volumes instead. However, the recursive overlaps within each volume of the 3D view are indicated in the geometry tree by the icon ⚠, once the diagnostic has been run.
	Intensive model diagnostic: overlaps and holes (*)
	Restore the previous display before the model diagnostic
	Display context menu of selected entities. Left-clicking on entities in the 3D view displays their context menu, as though it had been displayed by right-clicking on tree items.
New	Create a new selection (and make it current)
by	Create selections of volumes by composition. For every composition, it creates the selection of all 0-level real volumes using nothing but this composition. It also creates the selection of all 0-level real volumes using at least two compositions.
DEL SEL	Delete a selection (<u>irreversible!</u>)
Show only	Show the current selection only. The current selection item text is written in bold letters. When no procedure is active, left-click on a selection to set it as current.
SELEC	Empty the current selection
V SEL	Add volumes to the current selection
V SEL	Remove volumes from the current selection

10.3. Tree of “Geometry” tab

(*: item with a text the color of which (black / orange / brick red) indicates whether the sub-items are all shown (=> black), all hidden (=> orange) or partly hidden (=> brick red))
(any item is expandable/collapsible by double-clicking on it)

Surfaces	
	Surfaces (*)
	Surfaces (contains all surfaces) (*)
	Any surface
	Construction volumes using this surface (by default they are not displayed in the tree: see item “Show construction volumes in tree” in the context menu of main item “Surfaces”) (*)
...	Real volumes using this surface
	Plane surface
	Cylindrical surface
	Spherical surface
	Conical surface
	Torical surface *(not implemented yet)*
	Quadrical surface *(not implemented yet)*
	Plane surfaces (*)
	Cylindrical surfaces (*)
	Spherical surfaces (*)
	Conical surfaces (*)
	Torical surfaces (*)
	Quadrical surfaces (*)
Transformations	
	Transformations (used to copy a volume by translating/reshaping it)
	Transformation
Fillings	
	Lattice fillings (matrices that describe the layout of elements in a lattice)
	2D lattice filling (matrix). Left-click on this item in order to display the filling in the 3D view, left-click again to display the locations of patterns. Left-click on an item that is not a 2D filling in order to hide the filling display in the 3D view. If a hexagonal lattice uses this filling, the displayed icon is: .
	3D lattice filling (list of matrices having the same size)

Volumes (1/3)	
	Volumes (construction volumes + real volumes) (*)
	Construction volumes using this surface (by default they are not displayed in the tree: see item “Show construction volumes in tree” in the context menu of main item “Volumes”) (*)
	Real volumes (*)
	Surface-bounded volumes (intersections of half-spaces). The icon has the color of the volume composition.
	Faces (by default not displayed in the tree)
	Face (triplet: composition, sign, surface equation). Each face of the volume can be displayed separately whether the volume itself is displayed or not. The faces are affected by buttons and shortcuts that modify edge/mesh display.
	Surface (here a plane) with a sign that indicates which side of the surface is inside the volume. <u>Remark</u>: when importing a model with surface-bounded volumes, the coincident surfaces are likely to be replaced with a single surface (if the “.trd” file explicitly contains instruction “MERGE_COINCIDENT_SURFACES”). In such a case, the text of item contains the new surface name preceded by the original surface name between #...#: #(±)$S_{original}$# (±) S_{new} … (signs may be different from each other) Should some surfaces have been merged, a selection of surrogate surfaces is created with the name “Surfaces obtained by merging”. **<u>WARNING!</u>** Merging is likely to prevent the detection of holes and overlaps. If the code detects some issue not found by TRIAD or conversely, it is recommended to visualize merged surfaces. To do so, display all meshed volumes, hide all surfaces, and then show only the surfaces of the selection, which will cause the problematic faces to be the only meshed faces.
…	…
	Surface (here a cylinder) with a sign

Volumes (2/3)	
	Boolean volume
…	Volume V1
?	Any Boolean operation. This operation can be any of the following ones: ∪ : union − : subtraction (V1 minus V2) ∩ : intersection
…	Volume V2
?	Any Boolean operation
…	…
?	Any Boolean operation. All these operations are executed from the left to the right: `(((V1 ? V2) ? V3) ? …) ? Vn`
…	Volume Vn
	Module (group of volumes)
…	Volumes of the module
	Lattice
CART	Information about the Cartesian lattice
V1	Vector 1 (normalized)
V2	Vector 2 (normalized)
V3	Vector 3 (normalized)
A1	Step 1 (cm)
A2	Step 2 (cm)
A3	Step 3 (cm)
	Patterns (volumes that are repeated)
	2D filling or 3D filling. Left-click on a 2D filling in order to display the filling in the 3D view, left-click again to display the locations of patterns. Left-click on an item that is not a 2D filling in order to hide the filling display in the 3D view. 
∩	
…	Optional volume intersecting the lattice
	Elements (volumes obtained by repeating patterns)

Volumes (3/3)	
	Copy volume
…	Copied volume
…	: uses existing simplified volume : does not use existing simplified volume : would use simplified volume if it existed : would not use simplified volume if it existed
…	Simplified version of the copied volume (if it exists)
	Transformation applied to the copied volume
…	Optional volume intersecting the copy volume
	Optional composition that can be assigned to the copy volume, thus ignoring the compositions of the copied volume
	Cross-section (static cross-section, see also tab “X-sections”)
…	Cutter volume
	Cut volumes (this item is absent if all real volumes of the model are cut)
Boundary conditions	
	Boundary conditions *(not implemented yet)*

Selections	
	Selections
	Selection (group of entities such as volumes, compositions, dimensions,…). The tree item of the current selection, to which some procedures can be applied, is written with bold letters. Click on a selection to make it current (when no procedure is active). Context menu: **Selection <Real vol. with compo. <AIR>>** Rename Empty Delete Add visible volumes Add really displayed volumes Remove visible volumes Remove really displayed volumes - - - VOLUMES OF SELECTION - - - Display only these volumes Delete edges and mesh Show all Hide all Show/hide Show points Hide points Show edges Hide edges Show silhouette edges Hide silhouette edges Show mesh Hide mesh Semi-transparent mesh Opaque mesh Show mesh front Hide mesh front

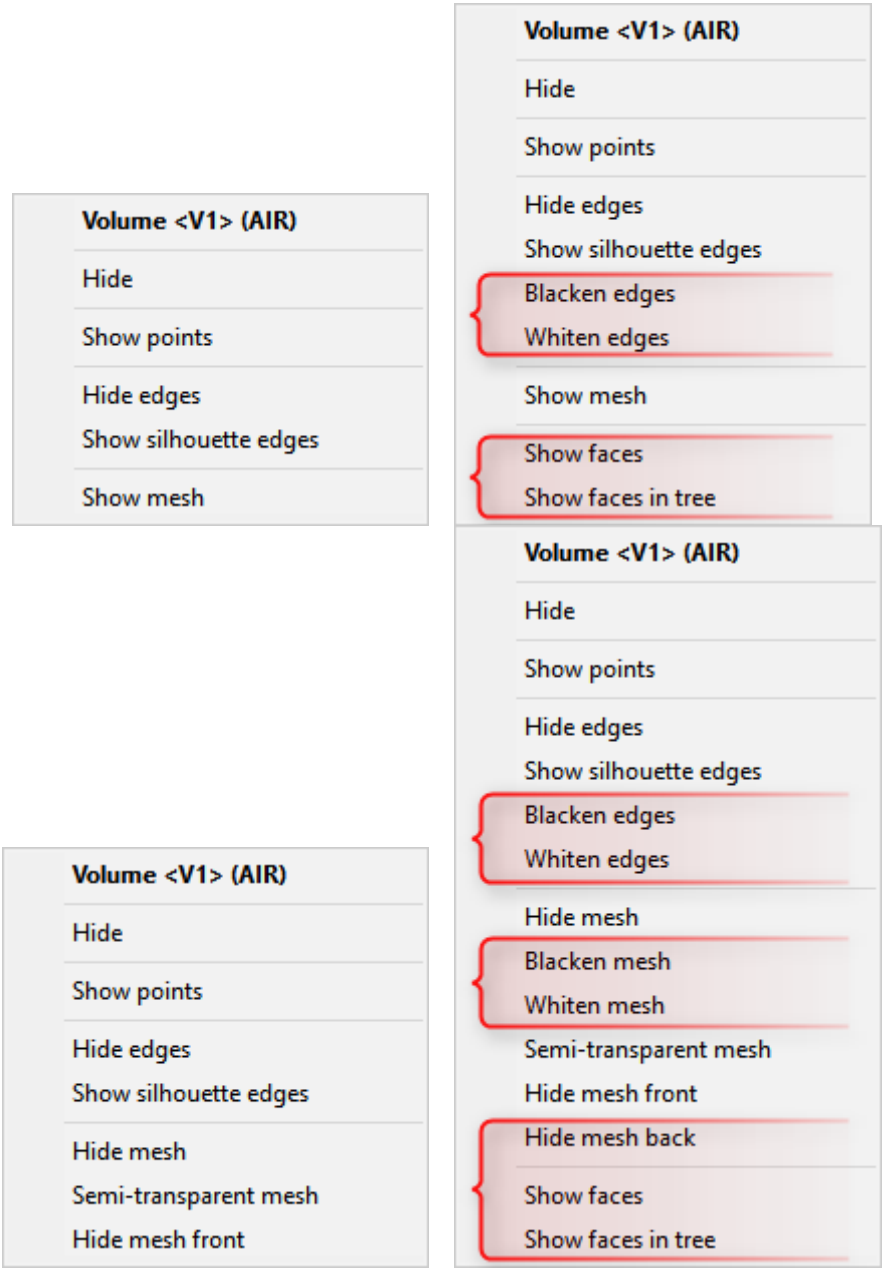
A volume is presented in the tree with a text such as 0 V12 (AIR) composed of its hierarchical level, its name and its composition between parentheses (if it has only one).

This text is written in orange (0 V12 (AIR)) if the volume is not “shown” (i.e. the user does not want to see it).

The text is preceded with an asterisk (* 0 V12 (AIR)) if the volume is “shown” (the user wants to see it) even though no graphic element appears in the 3D view. It may happen, for instance, if all the compositions of the volume are hidden. It may also happen for a complete sphere with a hidden mesh and hidden silhouette edges.

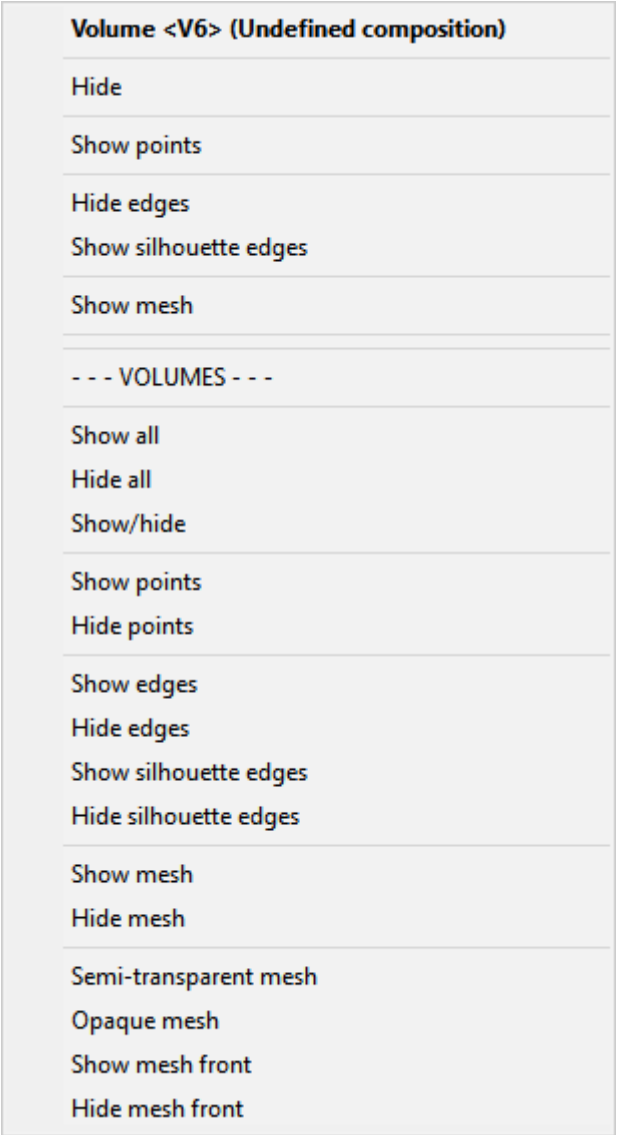
The icon of a volume is replaced with if this volume contains sub-volumes that overlap, or sub-volumes of sub-volumes that overlap,… recursively. Such a display appears if the overlap diagnostic has been run (toolbar button , or “T” key in the 3D view) and if this test was applied to at least one volume that directly or indirectly contains the volume.

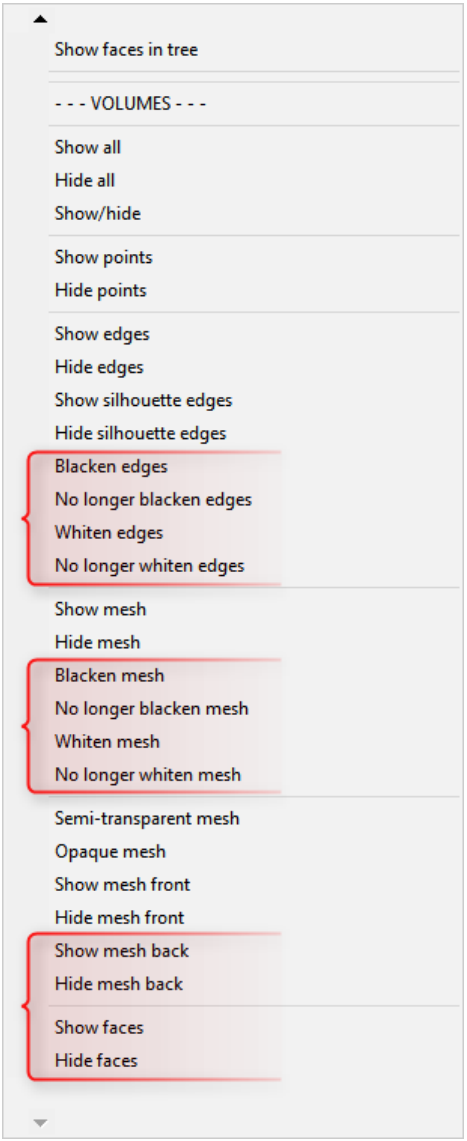
The context menu of a volume allows for modifying its appearance:



(the red-framed functions are accessible
only if item “Advanced context menus” of menu “Display” is checked)

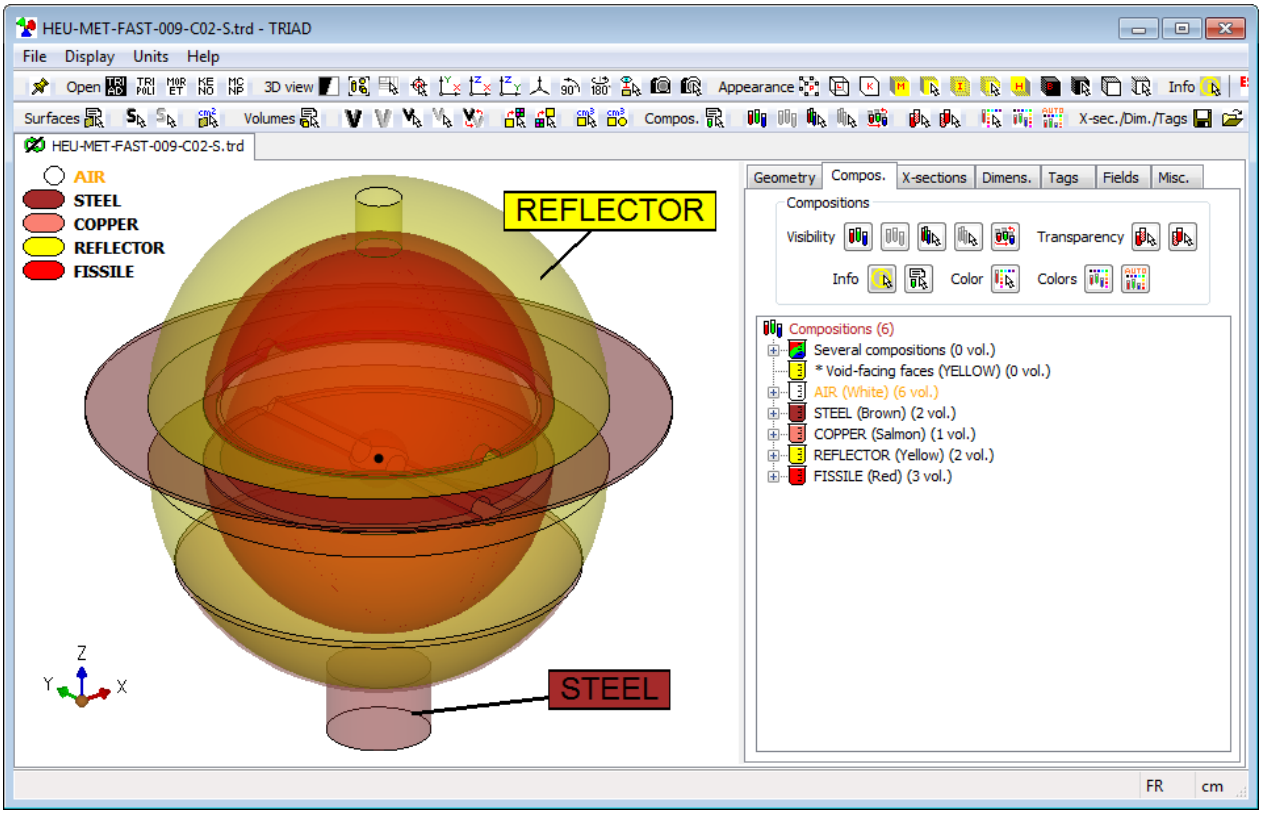
Moreover, if the volume is a module or a lattice, its context menu (see below) also allows for modifying the appearance of its sub-volumes. To see the sub-volumes correctly, it is recommended to hide the main volume.





To select several items in the trees, use “SHIFT” key. Right-clicking displays a context menu that allows for acting on selected surfaces/volumes/compositions.

11. “Compositions” tab



11.1. About compositions

A composition is characterized by a name and a color.

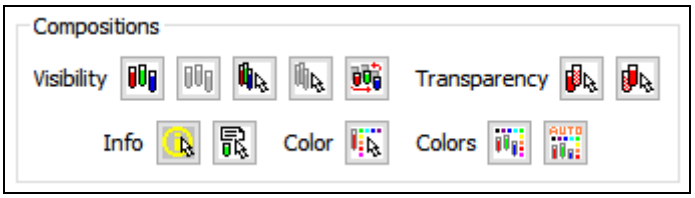
A composition can be shown or hidden, i.e. any part of a volume with this composition will be shown or hidden in the 3D view. The “shown/hidden” state of a composition can be modified either in the composition tree (right-click on the composition ➢ context menu), or in the 3D view by double-clicking on the color ellipse associated to the composition in the legend. If the composition is hidden, its name is written in orange in the 3D view legend.

Moreover, a composition can be either opaque or semi-transparent. If it is opaque, the composition name is written in bold letters in the 3D view legend. If it is semi-transparent, the name is preceded with “[semi-tr.]” in the composition tree.

If the composition is shown but no graphic element using the composition appears in the 3D view or beyond the 3D view boundaries, its name is written in gray in the 3D view legend.

The composition color on a volume in the 3D view is modified by lighting and shading. The edges are lighter, whereas the mesh is shaded as a function of the local orientation of the surface with respect to the view direction. The mesh will use the unshaded color shown in the legend ellipse if you check item “Unshaded mesh” of the “Display” menu.

11.2. Buttons of “Compositions” tab

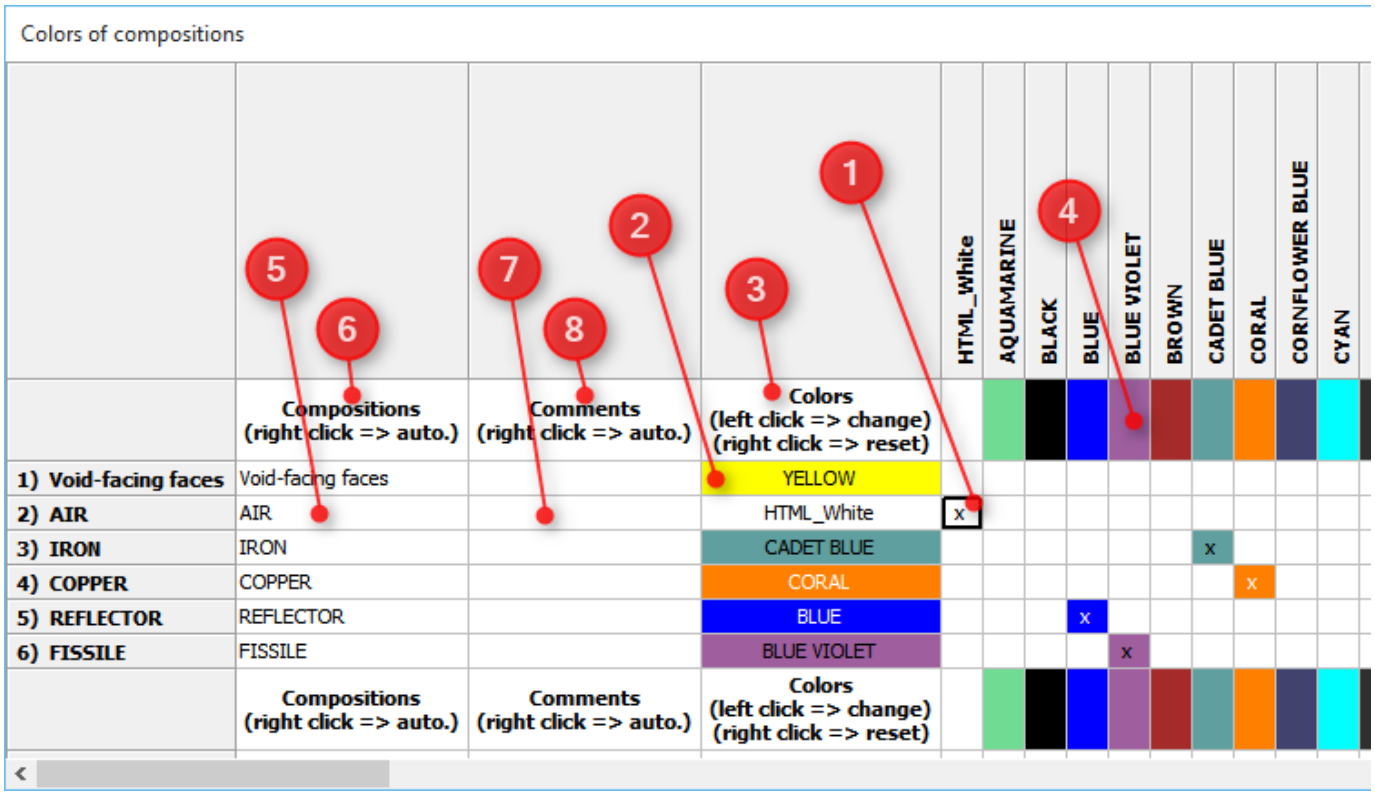


	Show all compositions	
	Hide all compositions	
	Show compositions by clicking on them	
	Hide compositions by clicking on them	
	Hide shown compositions and show compositions (*)	
	Semi-transparent composition	
	Opaque composition	
	Information about volume/surface/composition (shortcut “,” / stop “;” in the 3D view)	Same button as in “Geometry” tab
	Open the imported file at the line where the composition if defined	
	Change the color of a composition	
	Edit the colors of all the compositions of the model (see below)	
	Set all colors automatically, as a function of composition names (see § 19.2.6)	

The buttons above that require selecting one or several compositions act:

- on the items of the composition tree,
- on the color ellipses of the composition legend,
- on the volumes in the 3D view (the selected composition is the one under the cursor).

The button allows for simultaneously editing the colors of all the compositions of the model thanks to the following dialog box:



(1) Left-clicking on the cell located in a composition row and in a color column assigns the color to the composition.

(2) Left-clicking on a colored cell in the “Colors” column opens a color selection dialog box. If the “OK” button is pressed, the new color is assigned to the composition of the corresponding row.

(2) Right-clicking on a colored cell in the “Colors” column resets a color to the color initially defined when reading the model.

(3) Right-clicking on the “Colors” top cell resets all colors to the colors initially defined when reading the model.

(4) Left-clicking on a colored cell in the “Colors” row assigns the selected color to all compositions of the model.

(5) Right-clicking on a cell in the “Compositions” column assigns an automatically-defined color to the corresponding composition, depending on the composition name (see § 19.2.6). (6): all compositions are affected.

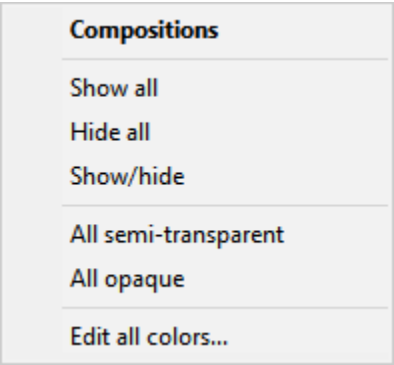
(7) Right-clicking on a cell in the “Comments” column assigns an automatically-defined color to the corresponding composition, depending on the composition comment (see § 19.2.6). (8): all compositions are affected.

Exit the dialog box by clicking on the “x” in the top right corner.

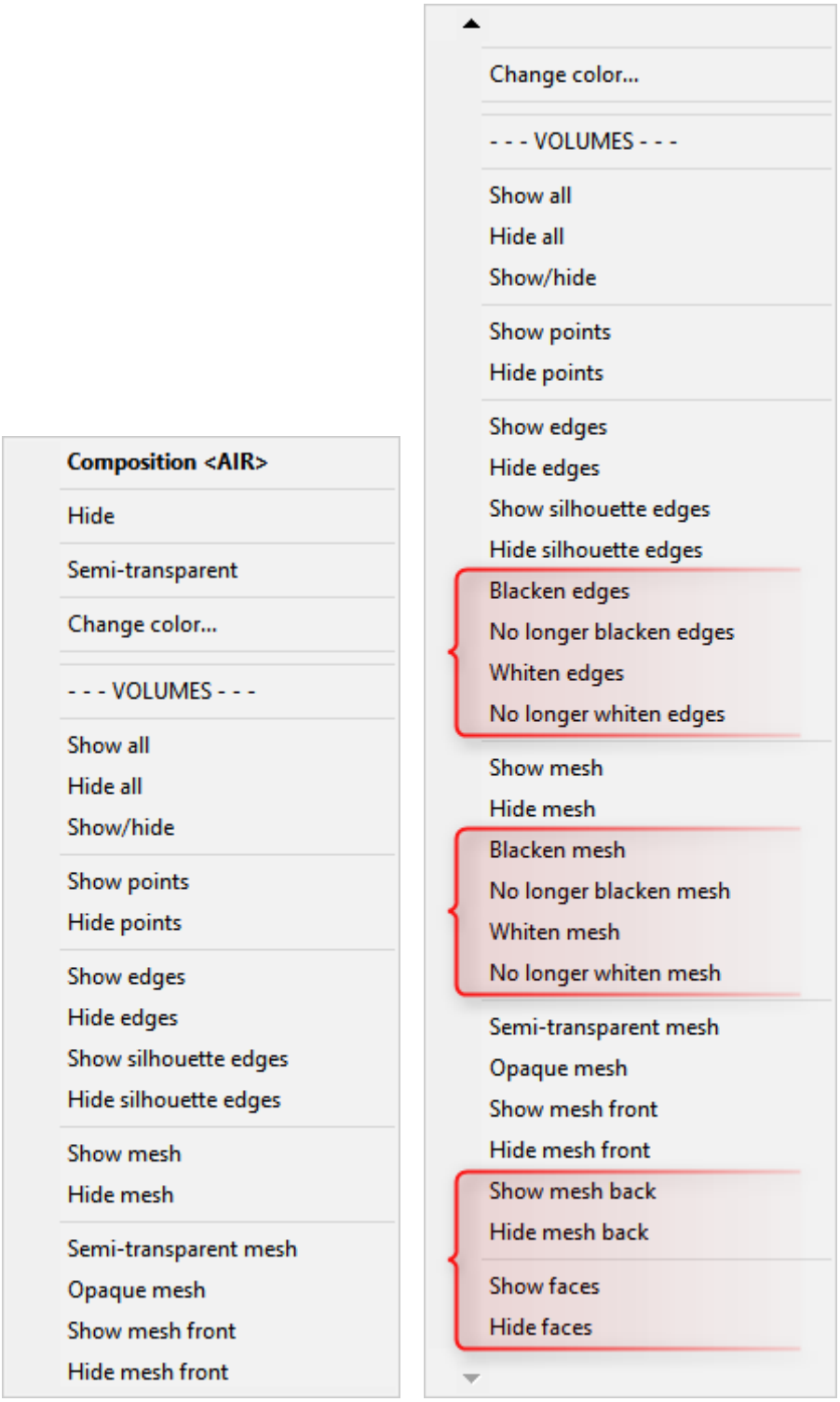
11.3. Tree of “Compositions” tab

Compositions	
	Compositions
	Several compositions
	Construction volumes using several compositions
…	
…	Real volumes using several compositions
	Composition
	Construction volumes using this composition and others
…	
	Real volumes using this composition and others
…	
	Construction volumes using only this composition
…	
…	Real volumes using only this composition
…	Composition
	Composition

Context menu of all compositions:

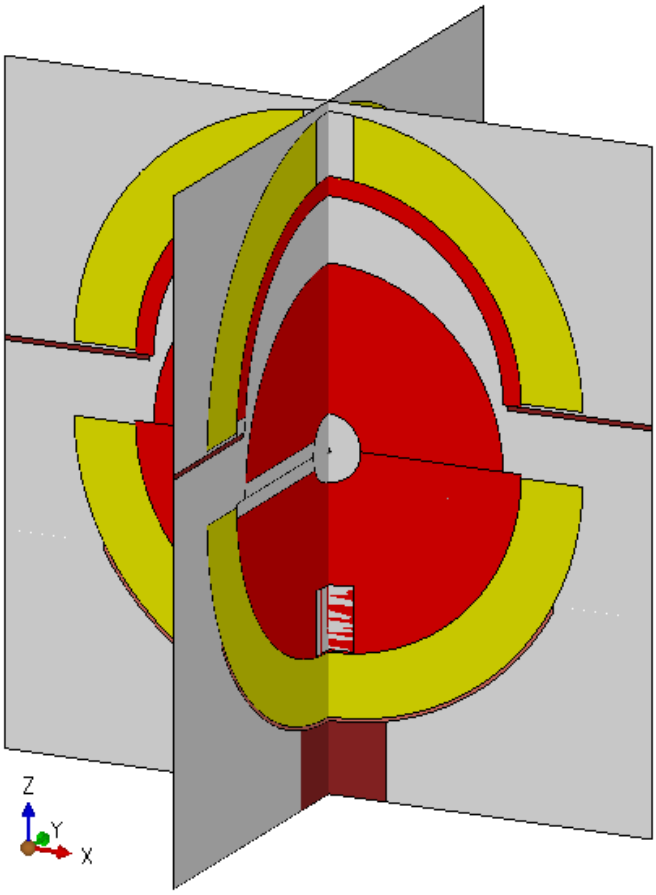


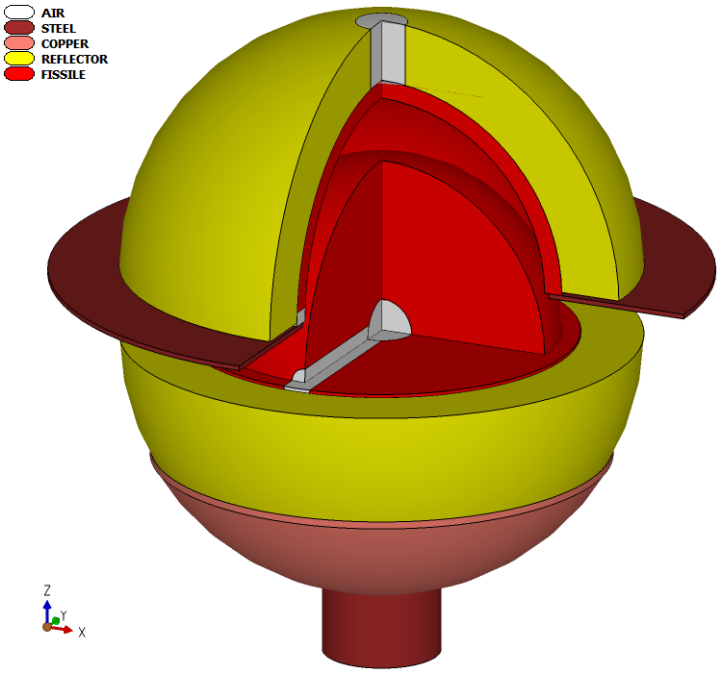
The context menu of a given composition gives access to the display options of the real volumes using this composition (volumes with the current hierarchical level):



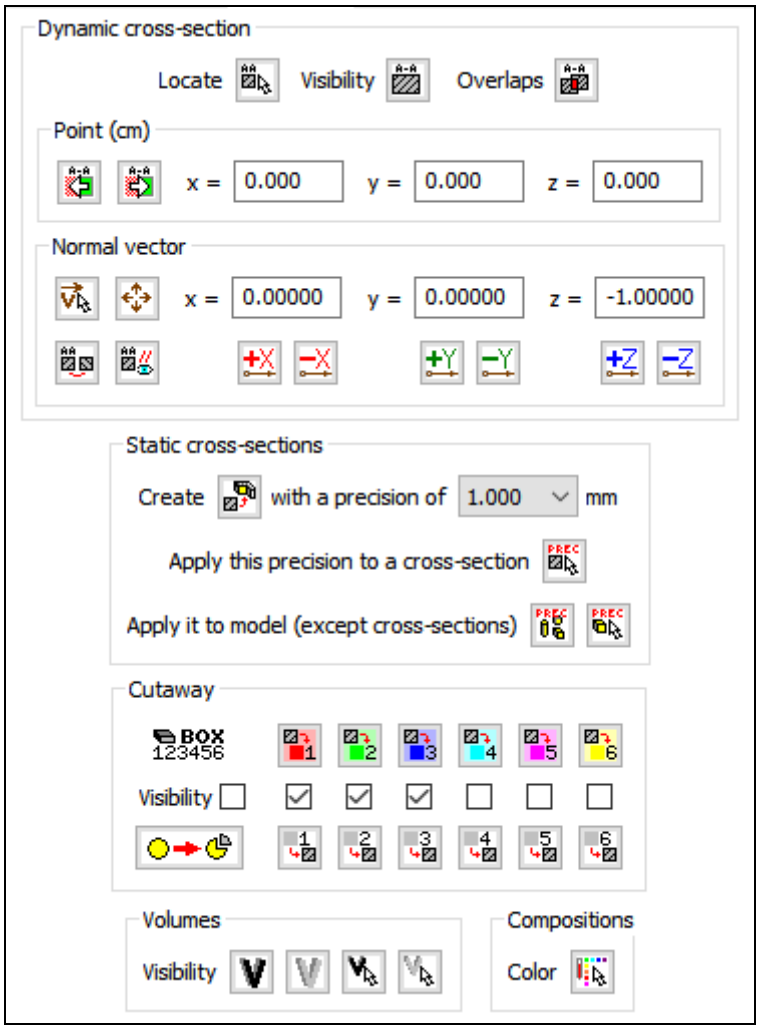
(the red-framed functions are accessible
only if item “Advanced context menus” of menu “Display” is checked)

12. “Cross-sections” tab





12.1. Buttons of “Cross-sections” tab



(*: button that shows the dynamic cross-section if it is hidden)

	Dynamic cross-section
	Locate the dynamic cross-section plane (*). If the “SHIFT” key is pressed, the plane is –as much as possible– translated without changing its normal vector. The dynamic cross-section plane is characterized by a point and a normal vector. The displayed half of the model is located on the same side as the normal vector. The dynamic cross-section plane uses hardware graphics acceleration. The dynamic cross-section plane can be translated continuously in the 3D view by moving the cursor and holding the “N” key. When no procedure is active, it is also possible to drag the mouse with the left button held. The button determines the point and/or the normal vector of the plane according to the following rules: - Clicking on any object when holding “SHIFT” translates the plane to the clicked point (see below), but the normal vector is –as much as possible– unchanged, - Clicking on a static cross-section in the “Cross-section” tree moves the plane to the static cross-section plane, - Clicking on a point makes it the new point of the plane, - Clicking on a straight edge makes the normal vector parallel to this edge, oriented away from the user (when holding “SHIFT” and if the edge is parallel to the plane, the plane is only translated to the edge), - Clicking on a circular edge makes the circle center become the new point of the plane, and the normal vector is made perpendicular to the circle plane, oriented away from the user, - Clicking on a cylindrical or conical face makes the clicked point (projected onto the cylinder/cone axis) become the new point of the plane, and the normal vector is made parallel to the cylinder/cone axis, oriented away from the user, - Clicking on a spherical edge makes the sphere center become the new point of the plane.
	Show/hide the cross-section plane (“Y” in the 3D view) (*)

	Show/hide the overlaps in the cross-section plane (“J” in the 3D view) (*). By default, the cut areas of volumes are filled with their compositions. After pressing the button, the cut areas are filled with red or green, depending on whether volumes overlap or not. After pressing the button again, compositions are displayed again. <u>Remark 1</u>: overlapping is indicated in the 3D view only between separate volumes, and not among sub-volumes of a module or lattice. Thus, to see overlaps between sub-volumes in the 3D view, hide the module or lattice and display its sub-volumes instead. <u>Remark 2</u>: for the cross-section plane to be displayed correctly, each volume shall have a closed mesh (no hidden surface, no bug in edge/mesh calculations, which might happen if a geometric detail is smaller than the edge calculation precision, by default 1mm).

	Translate the dynamic cross-section plane in order to cut the model more ( ) or less ( ), by moving the plane until the next pre-defined discrete location (*).
	
	The discrete locations are determined in the following way:
	- TRIAD makes an inventory of all the faces associated with a shown volume and a shown composition;
	- along an axis parallel to the cross-section plane normal vector, TRIAD records the following abscissas:
	  - the planes located in the middle of each pair of adjacent distinct planes perpendicular to the axis,
	  - the axes of cylindrical faces perpendicular to the axis,
	  - the centers of spherical faces,
	  - the vertices of conical faces,
	  - the centers of torical faces.
	
	<u>Remark</u>:
	
	The dynamic cross-section plane can be translated continuously in the 3D view by moving the cursor and holding the “N” key.
	When no procedure is active, it is also possible to drag the mouse with the left button held.

	Select the cross-section plane vector
	Choose among cross-section planes: right / top / left / bottom
	Reverse the cross-section plane (“U” in the 3D view) (*). Change the sign of the normal vector of the dynamic cross-section plane.
	Make the cross-section plane parallel to the view (*). Make the normal vector perpendicular to the view plane, oriented away from the user.
	Normal vector along +X (*)
	Normal vector along -X (*)
	Normal vector along +Y (*)
	Normal vector along –Y (*)

+Z	Normal vector along +Z (*)
-Z	Normal vector along -Z (*)

	Static cross-sections
	Create a static cross-section from the dynamic cross-section (see item in the table of § 12.3 below). Several static cross-sections can be created successively, their edges and mesh being computed in the background.
PREC	Apply the current precision to a static cross-section
PREC	Apply the current precision to the model. The volumes of the model (except cross-sections) are re-computed with the current precision. This precision will also be used if the model is re-read (shortcut “R” in the 3D view).
PREC	Apply the current precision to a volume

	Cutaway
BOX 123456 (12U34)56	Change the shape of the cutaway tool between a “box” and a “W”: - The box is a surface-bounded volume composed of no more than 6 planes. - The “W” is the union of 2 “V”s (each “V” being a surface-bounded volume with at most 2 planes), this union being intersected with a surface-bounded volume with at most 2 planes (which allows for subtracting a finite-length “W”).
Visibility	Checkbox used to show/hide the cutaway tool
	Cut the volumes with the cutaway tool. Each shown volume is hidden and replaced with a fictive Boolean volume equals to the volume minus the cutaway tool volume. Previously shown volumes are listed in a new selection called “N volumes to be sliced”. The new volumes are listed in a new selection called “N sliced volumes”. It is not yet possible to delete the sliced volumes. However, in order to free some RAM memory, use item “Delete edges and mesh” of the context menu of selection “N sliced volumes”. Use button PREC on the selection to re-calculate edges and mesh.
1 …	The buttons 1, 2, 3, 4, 5, 6 allow for using the dynamic cross-section plane as the Nth cutaway tool plane. 6 plane locations can be saved. More precisely, there are 6 locations for the “box” tool and 6 other locations for the “W” tool.

…	Checkboxes used to show/hide the Nth cutaway tool plane A hidden plane will not be used to define the tool shape.
…	The buttons , , , , , allow for using the Nth tool plane as the dynamic cross-section plane. The latest clicked button gets colored (e.g. , ,…) so as to remind the user which plane they wanted to modify. Once the dynamic cross-section plane is well located, save this location with the button , ,… having the same color (or the same number).

	Miscellaneous
	Show real volumes
	Hide all volumes
	Show volumes by clicking on them (in the volume tree)
	Hide volumes by clicking on them (in the 3D view and/or the volume tree). Multiple selection is possible in the 3D view (left button dragging) and in the volume tree (shift + left click). To interrupt the procedure in the 3D view, press “ESC” or double-click with the right button.
	Change the color of a composition

Six fields allows for entering the coordinates of the point and the normal vector of the dynamic cross-section. These new coordinates are taken into account when one coordinate is validated with the “Enter” key.

The pull-down menu “Precision (mm)” defines the edge calculation precision applicable to any subsequent static cross-section calculation requested by the user (button to create a cross-section, button to re-calculate an existing cross-section). The default precision when opening a model is 1mm.

12.2. Saving or loading cross-sections/dimensions/tags

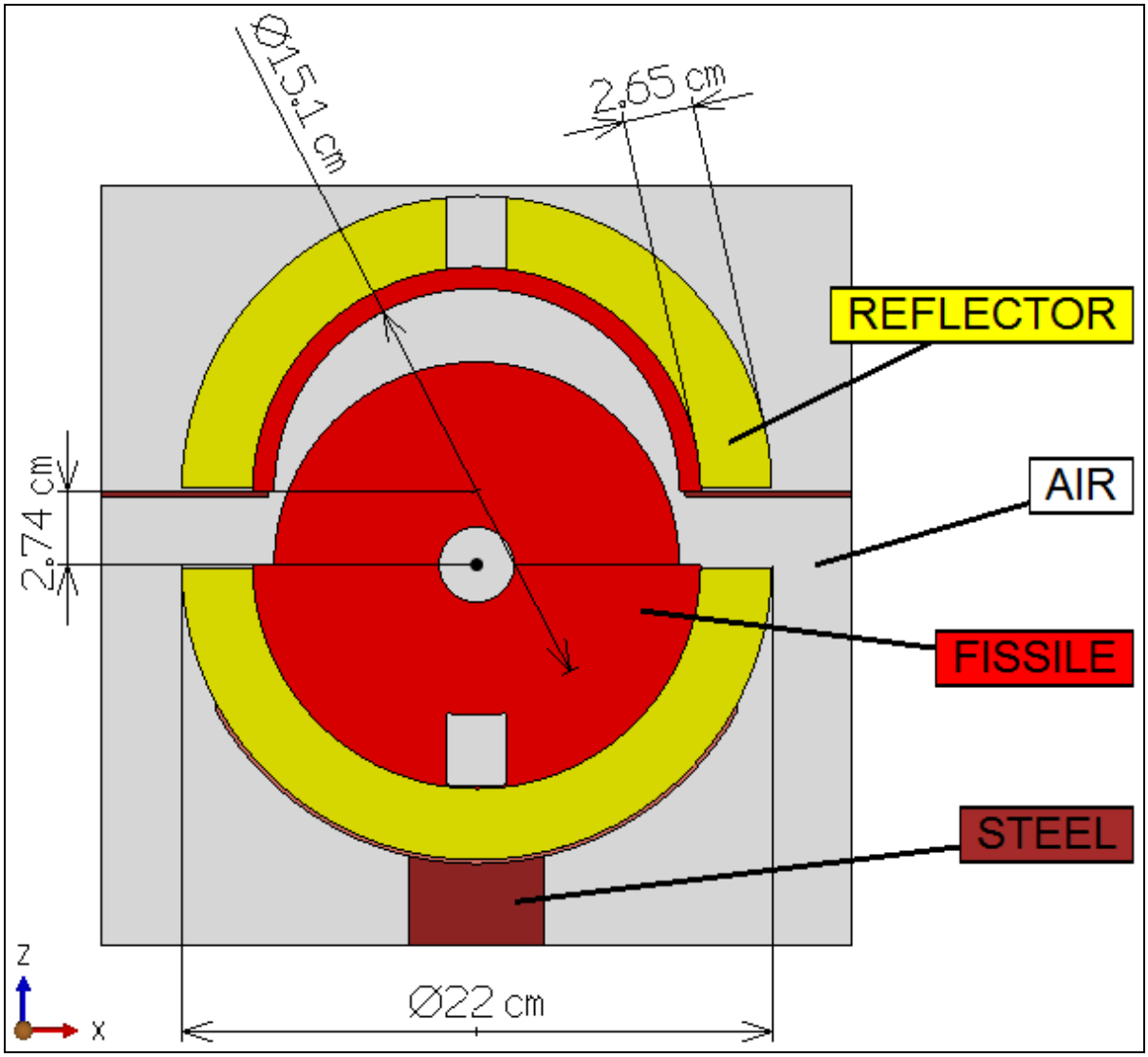
The context menu of a model tab (or toolbar button) allows for saving the cross-sections, dimensions and tags into a “aaa.XXX.xml” file (XML format) located in the same directory as the imported model. When exporting to the XML file, the first unused “XXX” number is used. When importing cross-sections, dimensions and tags (context menu of model tab or toolbar button), the file read is the file found with the greatest “XXX” number. The importation re-creates any cross-section plane that would not coincide with an existing cross-section plane in the current model. These new cross-section planes cut all 0-level real volumes of the model, even though, before being saved, they would cut another set of volumes.

12.3. Tree of “Cross-sections” tab

Remark: the tree only lists static cross-sections, not the dynamic cross-section, nor the volumes sliced by the cutaway tool (they are in the “Geometry” tree).

Cross-sections	
	Cross-sections
	Cross-section. Static cross-section, represented precisely with its edges, can be fitted with dimensions and tags, can be built from the dynamic cross-section plane using button or item “Create a cross-section” in “Cross-section” tab. The static cross-section is applied to the volumes that are shown when the cross-section is created. The progress status of the edges/mesh calculation is indicated by an icon: , , , , , and by a text “[Edges:X%|Mesh:Y%]”. When a current selection exists, the context menu of a static cross-section gives access to “Cut volumes of current selection”. The cross-section is then re-calculated with the new volume list. The edge calculation precision remains the precision of the original cross-section.
…	Cutter volume
	Cut volumes (this item is absent if all 0-level real volumes of the model are cut)

13. "Dimensions" tab



13.1. About dimensions

The dimension values are displayed in a particular format:

- lengths in m/mm/cm/ft/in, with 3 decimals (trailing zeros are hidden),
- angles in °, with 2 decimals (trailing zeros are hidden).

The length dimensions are created with the current length unit that can be modified in the "Units" menu.

Dimensions only have silhouette edges. These edges are re-calculated each time the 3D view is updated, in such a way that their text is legible from the top or right of the 3D view.

To select a dimension within a selection rectangle drawn with the mouse, the rectangle shall at least surround the dimension text.

The context menu of a dimension allows for defining a text before and/or a text after the dimension value, thus obtaining something like "Length = 50 cm (maximum)".

The text of a dimension in the tree is preceded with an asterisk if the dimension is "shown" (the user wants to see it) even though no graphic element appears in the 3D view. It may happen, for instance, if the dimension is hidden automatically when item "Hide barely visible dimensions" of "Display" menu is checked.

Remark:

Creating dimensions facilitates the verification of the geometry.

Complementary to this method, it is possible to display a drawing snapshot as a background picture, behind a view of the model edges (and maybe some semi-transparent mesh). That allows for detecting gross dimensional errors.

To this end, drag a picture (.bmp, .png, .gif) from the Windows™ explorer to TRIAD main window. The picture is associated to the current model. To hide the picture, uncheck item "Background picture (current model)" of "Display" menu. In addition to using the mouse, the superposition can be finely tuned with the following keyboard shortcuts:

- multiply/divide picture width by a factor of 1.001 using "SHIFT+Q" / "SHIFT+E" ("SHIFT+A" / "SHIFT+E" for AZERTY keyboards),
- reset the picture width using "SHIFT+R",
- zoom in/out by a factor of 1.001 using "CTRL+SHIFT+S" / "CTRL+SHIFT+W" ("CTRL+SHIFT+S" / "CTRL+SHIFT+Z" for AZERTY keyboards),
- rotate the model by 0.1° using "CTRL+SHIFT+A" / "CTRL+SHIFT+D" ("CTRL+SHIFT+Q" / "CTRL+SHIFT+D" for AZERTY keyboards).

WARNING!

Dimensions are not dynamically linked to the underlying geometry. In particular, when importing dimensions from an XML file to the current model (see § 12.2) or when reloading the model after the input file has been modified, the dimensions might be obsolete and let the user believe that they reflect the current geometry dimensions accurately. Therefore, obsolete dimensions should be deleted and re-created.

13.2. Managing dimensions and tags associated with a cross-section or with the model

In the 3D view, only the dimensions and tags of the current static cross-section are displayed. The current static cross-section item text is written in bold letters in the dimension tree and in the tag tree.

A dimension or tag is created either on the current cross-section (“local” dimension or tag), or on the whole model when no cross-section is current (“global” dimension or tag).

When created with button , the latest static cross-section becomes the current cross-section.

When no procedure is active (launched by a button with an icon with a cursor on it):

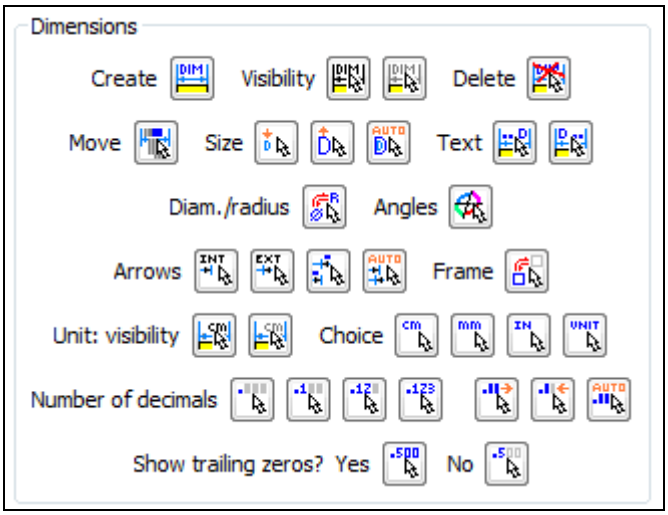
- left-clicking on item “Dimensions (...) of x-sec. <...>” or item “Tags (...) of x-sec. <...>” makes this cross-section current, displays it if it was hidden, and hides all the other cross-sections; another left click centers the 3D view on this cross-section,
- left-clicking on a dimension/tag item makes the owner cross-section current; another left click centers the 3D view on this dimension/tag,
- left-clicking on item “Global dimensions (...)” or item “Global tags (...)” hides all cross-sections and shows all dimensions/tags that do not depend on any cross-section,
- left-clicking on item “Dimensions (...)” or item “Tags (...)” shows all dimensions/tags, whether they depend or not on a cross-section.

When a procedure is active:

- left-clicking on a dimension/tag item provides the dimension/tag to the procedure,
- left-clicking on item “Dimensions (...) of x-sec. <...>” or item “Tags (...) of x-sec. <...>” provides all the dimensions/tags of the cross-section to the procedure,
- left-clicking on item “Global dimensions (...)” or item “Global tags (...)” provides all the global dimensions/tags to the procedure,
- left-clicking on item “Dimensions (...)” or item “Tags (...)” provides all the dimensions/tags of the model to the procedure.

The context menu of a tree item (right click) allows for deleting one or several dimensions/tags associated to the item. The button (resp.) applied to a tree item or to dimensions/tags in the 3D view has the same effect.

13.3. Buttons of “Dimensions” tab



	Dimensions

	Create a dimension (length, diameter, radius, angle).
	
	<u>Remark</u>: clicking on a face is impossible if a cross-section is current.
	
	The dimension is created with N+1 clicks: N clicks on N entities, then 1 click to put the dimension:
	
	- N=1; click on a cylindrical face; dimension created: diameter
	- N=1; click on a spherical face; dimension created: diameter
	- N=1; click on a conical face; dimension created: angle
	- N=1; click on a circular edge; dimension created: diameter
	
	- N=2; click on 2 cylindrical faces;
	  - coaxial cylinders => dimension created: thickness
	  - parallel cylinders => dimension created: distance between axes
	  - non parallel cylinders => dimension created: angle between axes
	- N=2; click on 2 spherical faces; dimension created: distance between centers
	- N=2; click on 2 conical faces;
	  - parallel cones => dimension created: distance between axes
	  - non parallel cones => dimension created: angle between axes
	- N=2; click on 2 plane faces;
	  - parallel planes => dimension created: distance
	  - non parallel planes => dimension created: angle

	- N=2; click on 1 plane face and 1 cylindrical face;
	  - plane and cylinder axis parallel => dimension created: distance
	  - plane and cylinder axis not parallel => dimension created: angle
	- N=2; click on 1 plane face and 1 spherical face; dimension created: distance between plane and sphere center
	- N=2; click on 1 plane face and 1 conical face;
	  - plane and cone axis parallel => dimension created: distance
	  - plane and cone axis not parallel => dimension created: angle
	- N=2; click on 2 circular edges;
	  - coplanar and concentrical circles => dimension created: distance between circles (“thickness”)
	  - coplanar circles => dimension created: distance between centers
	  - circles in parallel planes => dimension created: distance between planes
	- N=2; click on a straight edge and click on a circular edge (or vice-versa); dimension created if line and circle are coplanar: distance between line and center
	- N=2; click on 2 straight edges
	  - parallel lines => dimension created: distance between lines
	  - non parallel lines => dimension created: angle between lines
	- N=2; click on 1 point and click on 1 straight edge (or vice-versa); dimension created: distance between point and line
	- N=2; click on 1 point and click on 1 circular edge (or vice-versa); dimension created if point and circle are coplanar: distance between point and circle center
	- N=2; click on 2 points; dimension created: distance between points
	
	- N=3; click on 3 points P1, P2, P3; dimension created: angle between half-lines [P2P1) and [P2P3).
	
	For a diameter/radius dimension, just before doing the N+1th click to create it, the temporary dimension is moved by default with a rotation about the center. By holding the “SHIFT” key, the dimension orientation gets frozen and the dimension can be translated without rotation.
	
	Right-double-click before the N+1th click cancels the creation of the current dimension and exits procedure “Create a dimension”.

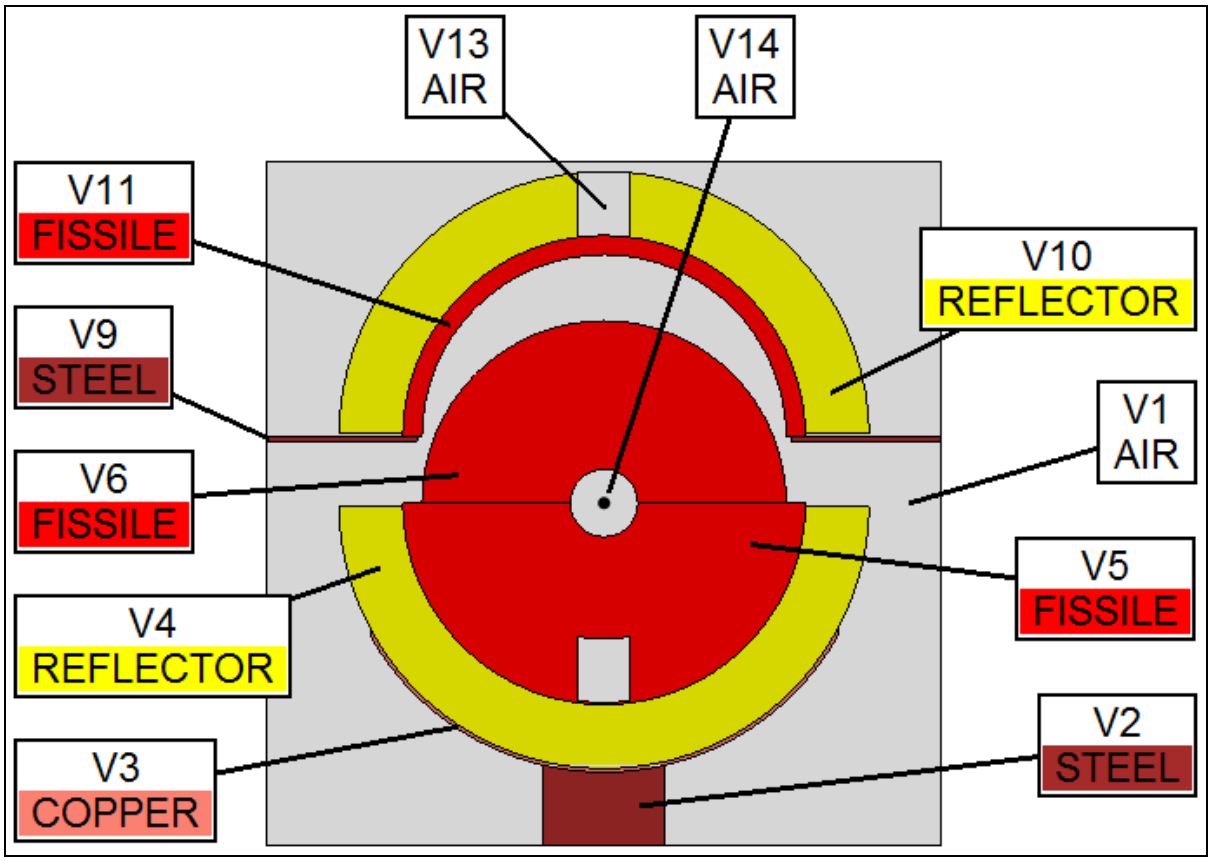
	Show dimensions
	Hide dimensions
	Delete dimensions (<u>irreversible!</u>)
	Move a dimension. For a diameter/radius dimension, just before doing the N+1th click to set it down, the temporary dimension is moved by default with a rotation about the center. By holding the “SHIFT” key, the dimension orientation gets frozen and the dimension can be translated without rotation.
	Reduce dimensions: decrease text size and arrow size
	Enlarge dimensions: increase text size and arrow size

	Adjust dimension sizes automatically. Adjust their sizes proportionally to the 3D view extent. The “zero” letter seen from the front will be 18-pixels wide and 24-pixels high.
	Edit text before value
	Edit text after value
	Swap diameter radius: transform a diameter into a radius and vice-versa
	Choose among the 4 angles formed by 2 straight lines. Each click on an angular dimension changes it into the next angle, in a circular way.
	Internal arrows
	External arrows
	Arrows on text side
	Auto-orient arrows
	Frame the dimension or remove its frame
	Show unit
	Hide unit
	Express in cm
	Express in mm
	Express in in
	Apply current (length) unit to dimensions
	No decimals
	One decimal
	Two decimals
	Three decimals
	More decimals
	Fewer decimals
	Default number of decimals
	Show trailing zeros
	Hide trailing zeros

13.4. Tree of “Dimensions” tab

Dimensions	
	Dimensions (…)
	Global dimensions (…)
	Dimension
…	…
	Dimensions (…) of x-sec. <…>
	Dimension
…	…
	Dimensions (…) of x-sec. <…>
…	…
	Dimensions (…) of x-sec. <…>

14. "Tags" tab



14.1. About tags

Tags allow for writing text in the 3D view.

Tags have a text rectangle and silhouette edges (lines between the text and the 3D model). These edges are re-calculated each time the 3D view is updated.

To select a tag within a selection rectangle drawn with the mouse, the rectangle shall at least surround the central point of the tag text.

The text is determined from a **formula** that may contain the following codes (they will be replaced automatically and will reflect what has been found under the first point clicked when creating the tag):

Code	Description
<<volu_name>>	Volume name
<<volu_comment>	Volume comment
<<volu>>	"Exact" volume value (if the volume has a simple shape; volume shape recognition will be implemented progressively in later versions of TRIAD)
<<volu_estimate>>	Volume value estimate (if or has already been used)
<<volu_error>>	Error on volume value estimate (if or has already been used)
<<volu_rel_error>>	Relative error (in %) on volume value estimate (if or has already been used)
<<subvoluN_name>>	Name of Nth sub-volume (N ≥ 1). After pressing , when the cursor is on a volume in the 3D view, the text displayed on the left side of the 3D view gives the volume name, followed by the recursive list of sub-volumes. This code is particularly useful for displaying the name of the volume cut by a static cross-section.
<<field_name>>	Field name (see § 15 "Fields" tab)
<<field_component>>	Name of current field component
<<field_componentN>>	Name of Nth current field component
<<field_value>>	Value of current field component at the clicked point location
<<field_valueN>>	Value of Nth current field component at the clicked point location
<<comp_name>>	Composition name
<<comp_color>>	Name of composition color
<<comp_color_HTML>>	Name of the closest HTML color to the composition color
<<comp_color_M>>	Name of the closest MORET color to the composition color
<<surf_name>>	Name of the surface of a volume face
<<surf_comment>	Comment about the surface of a volume face

<<surf_description>>	Description of the surface, such as:
	`Cylinder: z p(x=0.000,y=0.000) r=105.480`
	or
	`Plane: z = 215.960`

<<surf1_name>>	Name of the first surface of a volume edge
<<surf2_name>>	Name of the second surface of a volume edge
<<surf>>	“Exact” surface value (if the face has a simple shape; face shape recognition will be implemented progressively in later versions of TRIAD)
<<surf_estimate>>	Surface value estimate (if has already been used)
<<surf_error>>	Error on surface value estimate (if has already been used)
<<surf_rel_error>>	Relative error (in %) on surface value estimate (if has already been used)
<<cut_surf_name>>	Name of cut surface. This code is particularly useful for displaying the name of the surface cut by a static cross-section.
<<x>>	x coordinate of clicked point
<<y>>	y coordinate of clicked point
<<z>>	z coordinate of clicked point
	The following codes are available with x, y, z:
<<x_plane_point>>	x coordinate of plane surface point
<<x_plane_normal_vector>>	x coordinate of plane surface normal vector
<<x_cylinder_axis_point>>	x coordinate of cylindrical surface axis point
<<x_cylinder_axis_vector>>	x coordinate of cylindrical surface axis vector
<<x_sphere_center>>	x coordinate of spherical surface center point
<<x_cone_apex>>	x coordinate of conical surface apex
<<x_cone_axis_vector>>	x coordinate of conical surface axis vector
<<cylinder_radius>>	Radius of cylindrical surface
<<sphere_radius>>	Radius of spherical surface
<<cone_half_angle>>	Half-angle of conical surface (in °)
<<cone_angle>>	Angle of conical surface (in °)
	The following color codes are applied to the text located on the right side of the codes in the formula. TBG = “text background”. TFG = “text foreground” = text characters. **rrrgggbbb** = Red/Green/Blue color code (e.g.: 000255000 is green).
<<TBGrrrvvvbbb>>	Tag background color
<<TFGrrrvvvbbb>>	Tag foreground color
<<TBG<...>>>	Tag background color given by a name such as “HTML_Olive” or “M_CHAMPAGNE”
<<TFG<...>>>	Tag foreground color given by a name such as “HTML_ Chartreuse” or “M_SAUMON”

<<tag_color_TBGTFG>>	Tag background color and tag foreground color. These are the colors applied by default to the tag when its formula does not contain any color code.
<<comp_color_TBG>>	Composition color applied to the tag background
<<comp_color_TFG>>	Composition color applied to the tag foreground
<<comp_color_TBGtfg>>	Composition color applied to the tag background. The tag foreground color is selected among black and white in such a way as to guarantee the best contrast.
<<font<Arial>>>	Select font among: Arial, Times New Roman, Garamond, Courier New, Lucida Console, etc.
<<font_italic>>	Italic characters, until next code **<<font_not_italic>>**
<<font_bold>>	Bold characters, until next code **<<font_not_bold>>**
<<font_underlined>>	Underlined characters, until next code **<<font_not_underlined>>**

A code can optionally contain a unit and/or a format (in this order). For instance:

Code example	Description
<<volu_estimate%cm3>>	Volume value estimate in cm^3
<<volu_estimate%cm3%.6e>>	Volume value estimate in cm^3, with exponential format and a 6-decimal mantissa
<<volu_rel_error%.2f>>	Volume value estimate in cm^3, formatted with 2 decimals
<<surf_estimate%cm2>>	Suface value estimate in cm^3

Available length units are: m, cm, mm, ft, in.
Available surface units are: m2, cm2, mm2, ft2, in2.
Available volume units are: m3, cm3, mm3, ft3, in3.

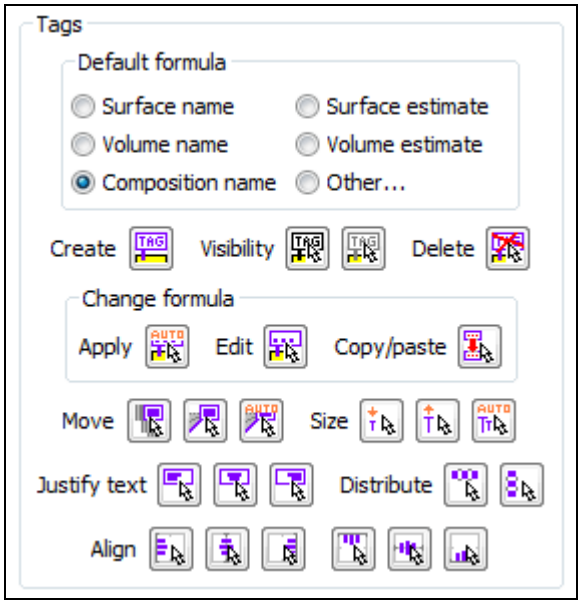
Available formats are the followings (C language syntax):

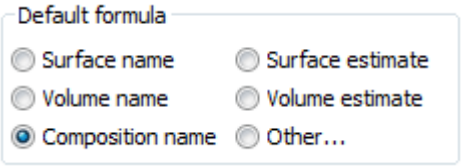
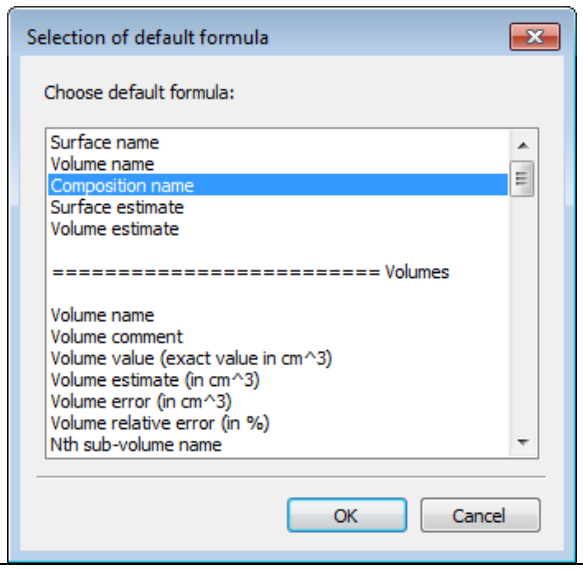
- integer: %d, %i,
- floating-point number with exponent: %e, %E,
- floating-point number: %f,
- character string: %s.

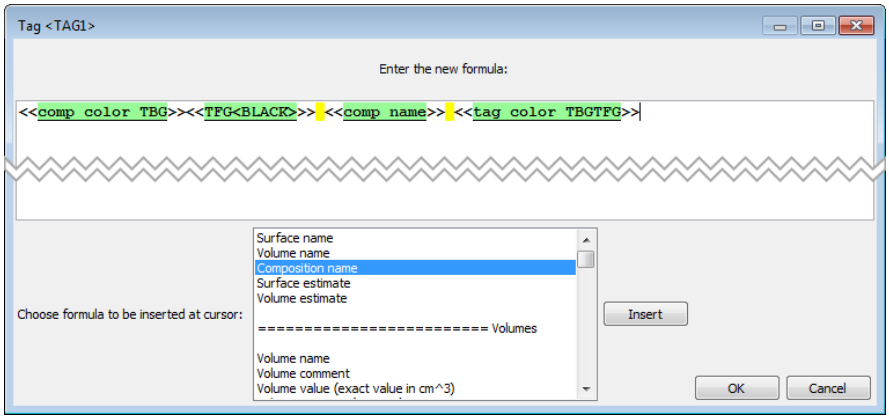
14.2. Managing dimensions and tags associated with a cross-section or with the model

See § 13.2.

14.3. Buttons of “Tags” tab



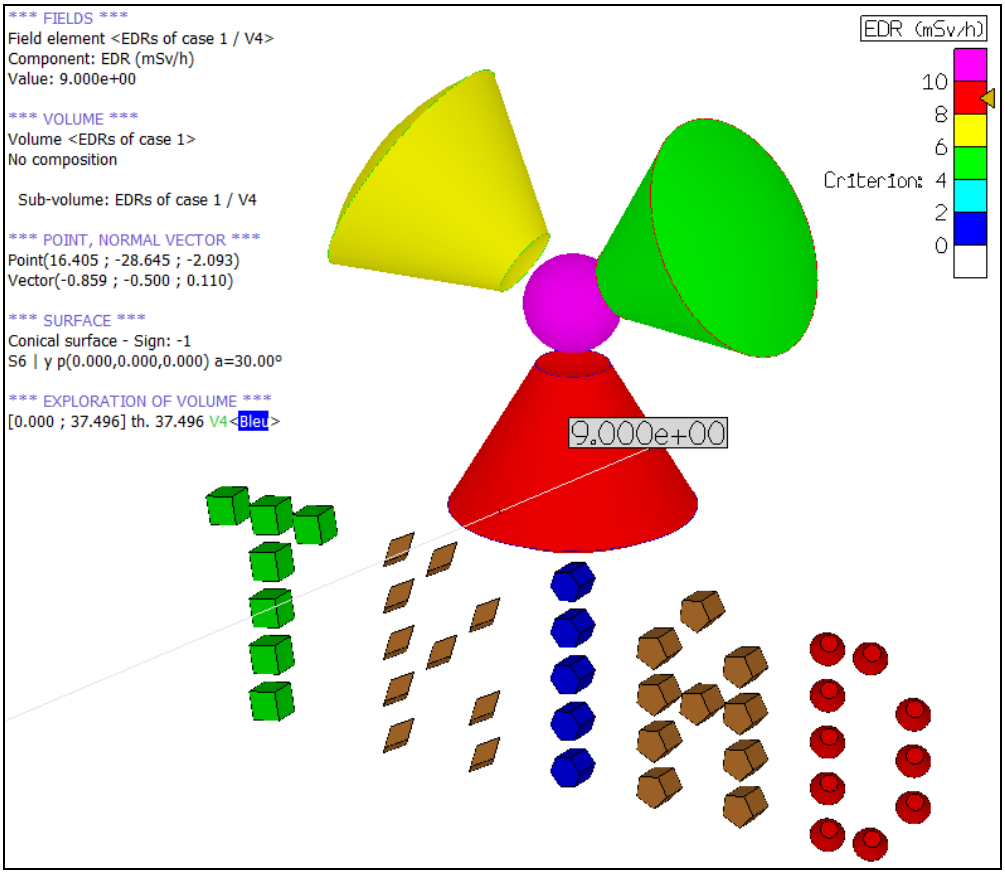
	Tags
-	To select the default formula for tag creation, click on one of the 6 following radio buttons:  Radio button “Other…” displays a dialog box with the list of predefined formulas: 

	Create a tag. Click on a volume, then click on the desired location to put the tag. If a selection rectangle is drawn in the 3D view, one tag is put on each volume that is a perfect sphere.
	Show tags
	Hide tags
	Delete tags (irreversible!)
	Apply default tag formula
	Edit tag formula 
	Copy/paste tag formula (first click on the tag that provides the formula, next clicks on the tags that adopt this formula)
	Move a tag (i.e. its text location)
	Move a tag target (i.e. the point indicated by the tag)
	Set tag targets automatically. After importing tags into the current model, use this button to re-apply these tags to the appropriate volumes of the model. These volumes must be displayed before pressing the button.
	Reduce tags: decrease text size
	Enlarge tags: increase text size
	Adjust tag sizes automatically. Adjust their sizes proportionally to the 3D view extent.
	Justify tag text left
	Justify tag text at the center
	Justify tag text right
	Distribute tags horizontally
	Distribute tags vertically
	Align tags to the left
	Align tags to the center
	Align tags to the right
	Align tags to the top
	Align tags halfway up
	Align tags to the bottom

14.4. Tree of “Tags” tab

Tags	
	Tags (…)
	Global tags (…)
	Tag
…	…
	Tags (…) of x-sec. <…>
	Tag. In the tag text, the character © stands for a color code and the character ¶ stands for a font code (see § 14.1). Codes **<<tag_color_TBGTFG>>** and **<<comp_color_TBGtfg>>** are each represented by 2 characters ©.
…	…
…	…
	Tags (…) of x-sec. <…>
…	…
	Tags (…) of x-sec. <…>

15. "Fields" tab



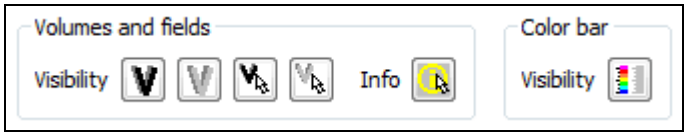
15.1. About fields and color bars

A field is a set of numerical values assigned to surfaces or volumes. Each surface is defined by a couple of adjacent volumes. A field can have several components. Only the current component is displayed in the 3D view.

In TRIAD, a field is a construction (or fictive) volume. It has no edges and only a mesh the color of which depend on the local value and on the current color bar.

Automatic color bars with 25, 10, 9, …, 2 colors are available in TRIAD. The lower and upper bounds adapt automatically to the extreme values of the current field. The intermediate threshold values (that separate the colors) are distributed equally between the lower and upper bounds.

15.2. Buttons of “Field” tab



(*: button only applicable to volumes with the current level)

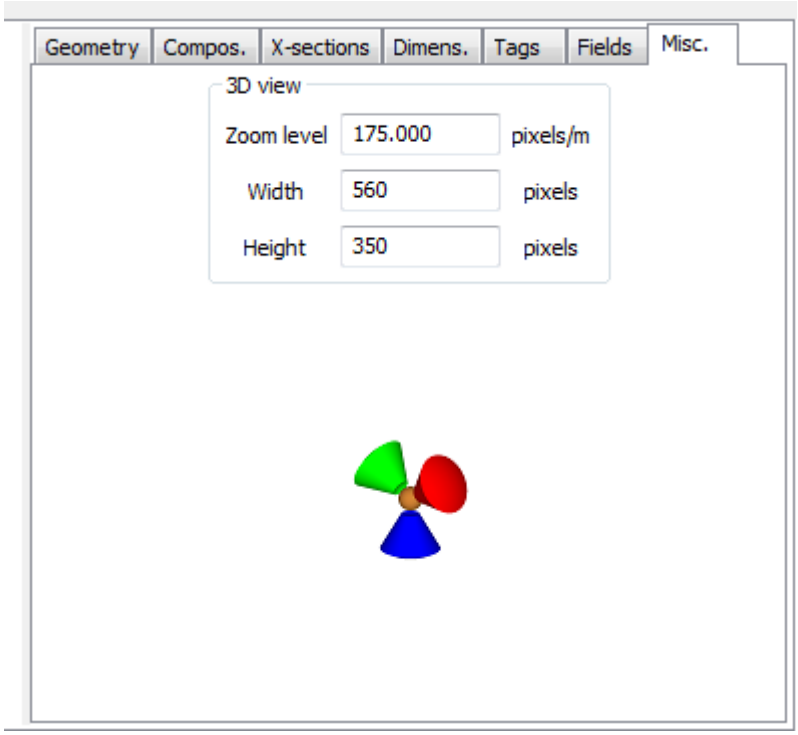
	Show real volumes (*)	
	Hide all volumes	
	Show volumes by clicking on them (in the trees)	
	Hide volumes by clicking on them (in the 3D view and/or the volume tree). Multiple selection is possible in the 3D view (left button dragging) and in the volume tree (shift + left click). To interrupt the procedure in the 3D view, press “ESC” or double-click with the right button.	
	Information about volume/surface/composition (shortcut “,” / stop “;” in the 3D view)	Same button as in “Geometry” tab
	Show/hide current color bar	

15.3. Tree of “Field” tab

Color bars	
	Color bars
	Color bar. The tree item of the current color bar, used to color fields in the 3D view, is written with bold letters. Click on a color bar to make it current.
	Color for $x > x_n$ (x_n = maximum of current field, if the current bar is automatic)
	Color for $x_{n-1} \leq x \leq x_n$
…	…
	Color for $x_{i-1} \leq x < x_i$
…	…
	Color for $x_0 \leq x < x_1$
	Color for $x < x_0$ (x_0 = minimum of current field, if the current bar is automatic)
…	…
	Color bar

Fields	
	Fields
	Field. Click on a field to display it.
	Component 1/n. The tree item of the current component, displayed in the 3D view, is written with bold letters, followed by the range of extrema [min.;max.]. Click on a component to make it current.
…	…
	Component n/n
	Surface field element (restriction of a field to a surface)
…	Volume 1
…	Volume 2
	Static cross-section volume (it represents the surface common to volume 1 and volume 2)
	Volume field element (restriction of a field to a volume)
…	Volume
…	…
	Field element
…	…
	Field

16. "Miscellaneous" tab



The zoom level in the 3D view can be entered in pixels/meter.

Defining the 3D view extent (width and height in pixels) may be useful to create pictures with a prescribed size.

17. Buttons only available in toolbars

17.1. Pin down TRIAD main window

	Pin down TRIAD main window
	Maintain TRIAD window on top

17.2. Open a model

	Open a model	
TRI AD	Open a TRIAD model	(equivalent to item <2> of “File” menu)
TRI POLI	Open a TRIPOLI 4 model	(equivalent to item <3> of “File” menu)
MOR ET	Open a MORET 4 model	(equivalent to item <4> of “File” menu)
KE NO	Open a KENO model	(equivalent to item <5> of “File” menu)
MC NP	Open a MCNP model	(equivalent to item <6> of “File” menu)

17.3. 3D view

	3D view (background color, zoom, rotation, photograph)
	Change background color (black or white)
	Zoom in on all (“Z”; “W” for AZERTY keyboards) or on highlighted object near cursor
	Zoom in on a rectangular area (CTRL + “W”; CTRL + “Z” for AZERTY keyboards)
	Center view on point. Click on a volume and the view centers on the clicked point. This point also becomes the rotation center of the view.
	XY view
	XZ view
	YZ view
	Isometric view (the closest one to the present view)
90°	Rotation +90° (right click -> -90°). The rotation is performed about the axis perpendicular to the view plane.

	Rotation +180°
	View perpendicular to a volume view: - The first click makes the view direction perpendicular to the normal vector of the volume face, at the clicked point. The view gets centered on this point. - The second click makes the most vertical axis vertical (same as shortcut key “V”).
	Take a picture of the 3D view (format PNG) (shortcut key “F”). If the model “reactor.tri” has been imported, the pictures are created in the same directory and are successively named “reactor.tri.001.png”, “reactor.tri.002.png”, and so on. It does not overwrite any existing file named “reactor.tri.XXX.png” and uses the first unused “XXX” number.
	Take a picture of a rectangular area (format PNG) (shortcut key CTRL + “F”)

17.4. Appearance of 3D objects

	Appearance of 3D objects (including volumes)
	See points (“P”) (right click on button -> hide)
	See edges (“L”) (right click on button -> hide)
	See silhouette edges (“K”) (right click on button -> hide). The silhouette edges are the lines where the volume faces are tangent to the view direction. For instance, they are two parallel lines for a cylinder; they are a circle for a sphere. These edges are calculated each time the 3D view is updated (rotation, pan, zoom, etc.). By default, they are not displayed. Not showing them accelerates the display updates.
	See mesh (“M”) (right click on button -> hide)
	See mesh of volumes by clicking on them (right click on button -> hide)
	Semi-transparent mesh (“I”) (right click on button -> opaque)
	See semi-transparent mesh of volumes by clicking on them (right click on button -> opaque)
	Hide mesh front (“H”) (right click on button -> show)
	Blacken mesh (“B”) (right click on button -> no longer blacken)
	Blacken mesh of volumes by clicking on them (right click on button -> no longer blacken)
	Whiten mesh (“B”) (right click on button -> no longer whiten)
	Whiten mesh of volumes by clicking on them (right click on button -> no longer whiten)

17.5. Interruption of current procedure

	Interruption of current procedure
ESC	Interrupt current procedure (“ESC”). Right-double-clicking in the 3D view has the same effect.

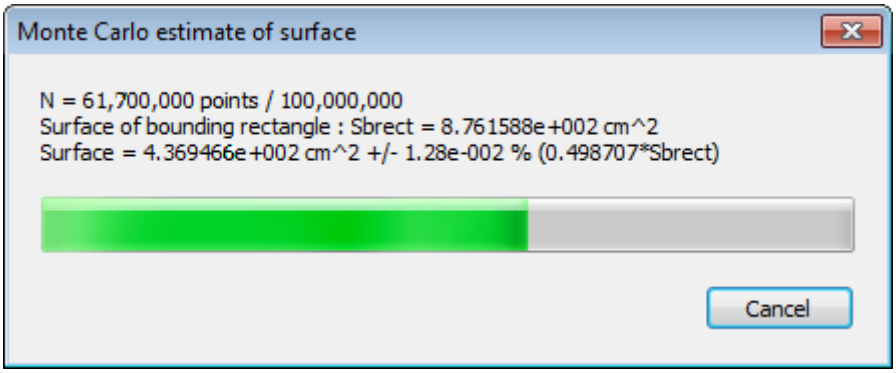
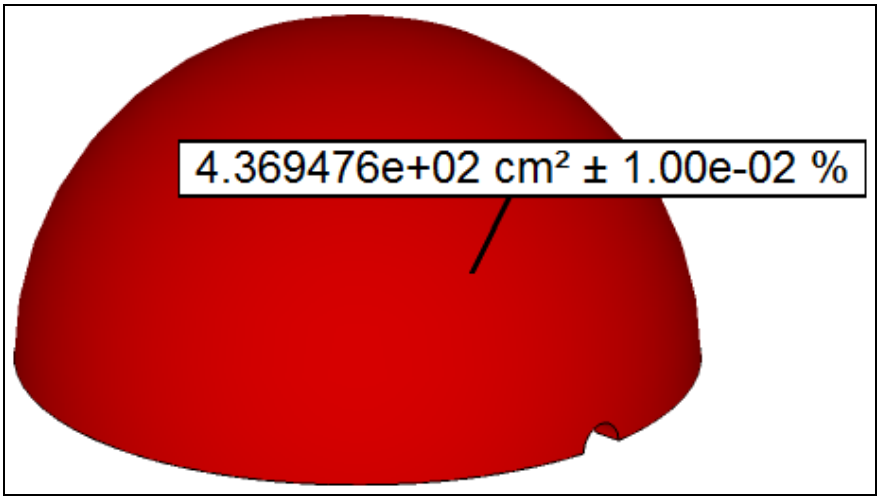
17.6. Diagnostic of the model

	Diagnostic of the model
	Intensive model diagnostic: overlaps and holes. Compared to the normal diagnostic, 10 000 points are drawn on each face instead of 100.

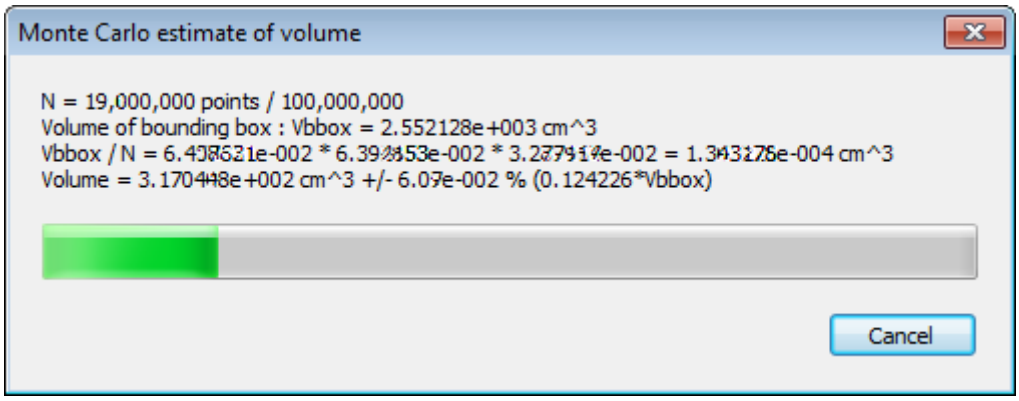
17.7. Management of display change history

	Management of display change history
	Undo display change (shortcut key “G” in the 3D view)
	Undo display change (shortcut key CTRL + “G” in the 3D view)

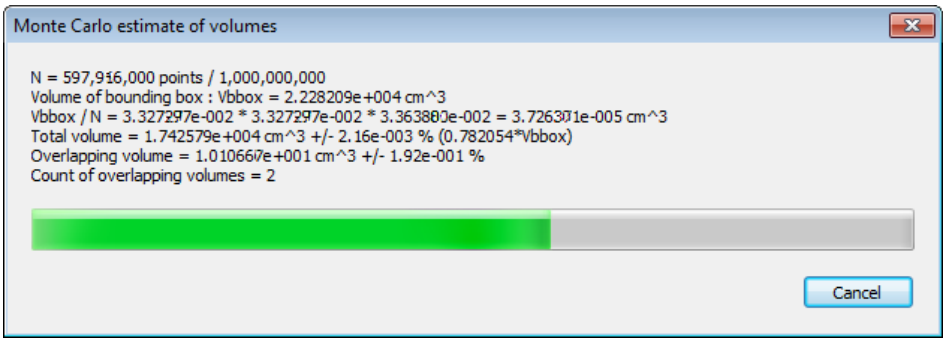
17.8. Surfaces

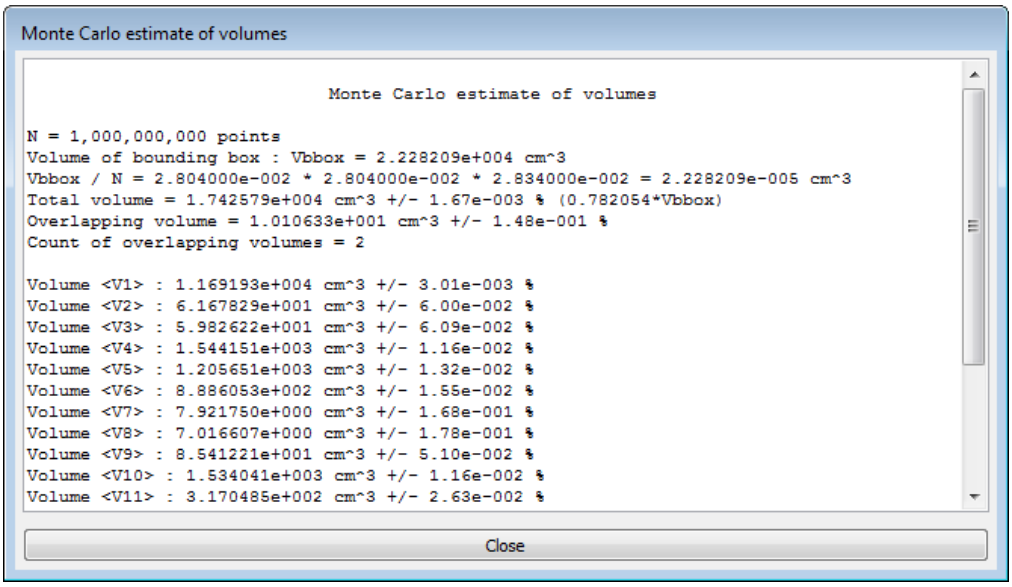
	Surfaces
	Open the imported file at the line where the surface is defined
	Show surfaces by clicking on them (right click -> hide)
	Hide surfaces by clicking on them (right click -> show)
	Estimate the surface of a volume face with the Monte Carlo method.   After 100 million iterations (possibly interrupted by pressing “Cancel” button), the text of the estimate is copied to the clipboard. The surface estimate is assigned to the volume face (and displayed when using) if the relative error is less than any previous estimate. **Warning**: the actual error might exceed the error estimate… Moreover, a volume face is not necessarily a connected domain and might extend well beyond the neighborhood of the clicked point.

17.9. Volumes

	Volumes
	Estimate the volume of a volume with the Monte Carlo method.  After 100 million iterations (possibly interrupted by pressing “Cancel” button), the text of the estimate is copied to the clipboard. The volume estimate is assigned to the volume (and displayed when using) if the relative error is less than any previous estimate. **Warning**: the actual error might exceed the error estimate… Moreover, a volume is not necessarily a connected domain and might extend well beyond the neighborhood of the clicked point.

Estimate the volume of shown volumes with the Monte Carlo method.





After 100 million iterations (possibly interrupted by pressing “Cancel” button), the estimate volume of each volume is displayed in a dialog box. The text is copied to the clipboard. The volume estimate is assigned to each volume (and displayed when using) if the relative error is less than any previous estimate. Should some points be found simultaneously in several volumes, a selection of overlapping volumes is created.

Warning: the actual error might exceed the error estimate… Moreover, a volume is not necessarily a connected domain and might extend well beyond the neighborhood of the clicked point. Overlaps might alter volume estimates.

17.10. Cross-sections

	Static cross-sections
PREC 1cm	Precision 1 cm
PREC 1mm	Precision 1 mm
PREC 0.1mm	Precision 0.1 mm

17.11. Tags

	Tags
	Define tag formula: surface name
	Define tag formula: volume name
	Define tag formula: composition name (on colored background)
	Define tag formula: surface estimate (S cm^2 +/- Err %)
	Define tag formula: volume estimate (V cm^3 +/- Err %)

17.12. Save or load cross-sections/dimensions/tags

	Save or load cross-sections/dimensions/tags
	Save cross-sections/dimensions/tags (into an XML file; see § 18)
	Load cross-sections/dimensions/tags (from an XML file; see § 18)

18. Input files – Output files

Input / Output	File name	Location	Description
Input	"triad_plugins.ini"	Same directory as TRIAD	This configuration file declares the execution syntax of importation plugins for TRIPOLI, MERCURE, MORET, KENO, MCNP,… (cf. § 19.1). Each plugin with its options can then be run by one of the "File" menu items.
Input / Output	"triad_user_prefs.ini"	Same directory as TRIAD	This configuration file defines the display options described in § 19.2.
Input	"aaa"	Any	TRIPOLI, MERCURE, MORET, KENO, MCNP model, to be imported
Input	"*.trd"	Same directory imported file "aaa"	TRIAD model (geometry + compositions). This file is created by the appropriate plugin from a TRIPOLI, MERCURE, MORET, KENO, MCNP model. This file can also be modified in a text editor, for instance to define cross-sections.
Output	"triad_log_file.txt"	Same directory as TRIAD	This file records all messages generated when TRIAD reads a model.
Output	"triad_timing_file.txt"	Same directory imported file "aaa"	Temporary date-stamping file created by TRIAD when opening file "aaa" via a plugin. This file allows for recording the current date of the file system where file "aaa" is, in order to make sure that the converted ".trd" file be more recent (which avoids opening an obsolete ".trd" file). It also allows for indicating that file "aaa" has been modified after being imported.
Output	"aaa.XXX.png" where XXX = 001, 002,…		Picture with PNG format, created by TRIAD. TRIAD does not overwrite any existing "aaa.XXX.png" file and uses the first unused "XXX" number.
Output	"aaa.triad_ diagnostic.txt"		Results of the model diagnostic.
Input / Output	"aaa.XXX.xml"		Exportation/importation of cross-sections/ dimensions/tags. When exporting, the first unused "XXX" number is used. When importing, the file found with the greatest "XXX" number is read.

19. Configuration files

Remark: configuration files “triad_plugins.ini” and “triad_user_prefs.ini” are read once at the beginning of each TRIAD run. Each file is created with default values if it does not exist when running TRIAD.

19.1. Configuration file “triad_plugins.ini”

File “triad_plugins.ini” declares the execution syntax of importation plugins for TRIPOLI, MERCURE, MORET, KENO, MCNP, …

The file also declares the syntax for opening a text file at a given line number with a text editor such as “notepad++”.

19.1.1. Declaration of execution syntax of importation plugins

Each plugin with its options can be run by one of the items in “File” menu or by one of the buttons TRI POLI, MOR ET, KE NO, MC NP in the first toolbar.

Each plugin shall be declared in this way:

```
menu_item_id                = <n>
menu_item_text_EN           = <text_in_English>
menu_item_text_FR           = <text_in_French>
dlg_box_wild_card_EN        = <dialog_box_info_in_English>
dlg_box_wild_card_FR        = <dialog_box_info_in_French>
triad_file_name_root_regex  = <regex>
conversion_syntax           = <commd>
```

Value	Description
<n>	Integer between 1 and 99
<text_...>	Text of item no. **<n>** in “File” menu
<dialog_box_...>	Information about the file opening dialog box (see syntax of class wxFileDialog of wxWidgets 2.8.12). The name of the file selected by the user can then be used in **<commd>** by writing **%input_file**.
<regex>	Regular expression the first capture of which is used to build the name of the converted TRIAD file by adding extension “.trd”. The name of the TRIAD file can then be used in **<commd>** by writing **%triad_file**.
<commd>	Command line for conversion. May be empty. May use **%input_file**, **%triad_file**

	and **%language**. "**%language**" is replaced with "english" or "french" depending on whether TRIAD is configured in English or in French (see § 19.2.1).

Remark:

Variables **triad_file_name_root_regex** and **conversion_syntax** may have several values (each having the same value count) separated with @.

For instance:

```
triad_file_name_root_regex = regex1@regex2@regex3
conversion_syntax          = commd1@commd2@commd3
```

means that a file matching **regexi** will be converted by **commdi**.

Example:

Variable	Value
menu_item_id =	1
menu_item_text_EN =	Open...
menu_item_text_FR =	Ouvrir...
dlg_box_wild_card_EN =	Triad or Tripoli4 or Moret4 file (*.trd;*.tri*;*.cri*)|*.trd;*.tri*;*.cri*
dlg_box_wild_card_FR =	Fichier Triad ou Tripoli4 ou Moret4 (*.trd;*.tri*;*.cri*)|*.trd;*.tri*;*.cri*
triad_file_name_root_regex =	^(.*)\.trd$@^(.*)\.tri[^.]*$@^(.*)\.cri[^.]*$
conversion_syntax =	@Plugins\tripoli4toTriad.exe -f "%input_file" "%triad_file"@Plugins\moret4toTriad.exe -f "%input_file" "%triad_file"

The first item of "File" menu will then be "Open…" or "Ouvrir…".

It opens a classical file opening dialog box that allows for exploring directories and selecting the file to be opened among the files with extension ".trd", ".tri*" or ".cri*".

The value: **^(.*)\.trd$@^(.*)\.tri[^.]*$@^(.*)\.cri[^.]*$**
can be read as a list of three regular expressions:

- Expression 1: **^(.*)\.trd$**
- Expression 2: **^(.*)\.tri[^.]*$**
- Expression 3: **^(.*)\.cri[^.]*$**

The syntax of regular expressions is explained in Wikipedia:
https://en.wikipedia.org/wiki/Regular_expression.

The value:

```
@Plugins\tripoli4toTriad.exe -f "%input_file" "%triad_file"@
Plugins\moret4toTriad.exe -f "%input_file" "%triad_file"
```

can be read as a list of three importation commands:

- Command 1: `(empty command)`
- Command 2: `Plugins\tripoli4toTriad.exe -f "%input_file" "%triad_file"`
- Command 3: `Plugins\moret4toTriad.exe -f "%input_file" "%triad_file"`

19.1.2. Declaration of text editor execution syntax

The syntax for opening a text file (here notepad++) at a given line number is as follows:

```
notepad_syntax = "C:\Program Files (x86)\Notepad++\notepad++.exe" -n%line_number "%input_file"
```

If the text editor is not found or not declared, the following paths are tested successively:

- <reg_dir> + \notepad++.exe
- C:\Program Files\Notepad++\notepad++.exe
- C:\Program Files (x86)\Notepad++\notepad++.exe
- <home_dir> + \Notepad++\notepad++.exe
- <home_dir> + \notepad++.exe
- <home_dir> + \My Documents\Notepad++\notepad++.exe
- <home_dir> + \My Documents\notepad++.exe

<reg_dir> is obtained from the registry key "HKEY_LOCAL_MACHINE\SOFTWARE\Notepad++".
<home_dir> is the home directory for the current user.

19.2. Configuration file "triad_user_prefs.ini"

The preferences described below can be saved in file "triad_user_prefs.ini" with the help of item "Save user preferences" in "File" menu.

19.2.1. Choice of language: English / French

Texts in TRIAD GUI are displayed by default in English.

Write the following line in "triad_user_prefs.ini" to display French texts:

```
bool_english = false
```

19.2.2. Keyboard configuration

The default keyboard is EN or FR depending on the language (see § 19.2.1).

Write the following line in “triad_user_prefs.ini” to change the keyboard configuration:

keyboard_config = <kbd>

where **<kbd>** can be: **EN** / **FR** / **DE**.

19.2.3. Choice of length unit: m / cm / mm / ft / in

Lengths are expressed by default in centimeters.

Write the following line in “triad_user_prefs.ini” to change the default length unit:

length_unit = <unit>

where **<unit>** can be: **m** / **cm** / **mm** / **ft** / **in**.

19.2.4. Choice of the number of decimals displayed for lengths

Write the following lines in “triad_user_prefs.ini” to change the number of decimals displayed for lengths, depending on the length unit:

```
nb_decimals_m  = 6
nb_decimals_cm = 4
nb_decimals_mm = 3
nb_decimals_ft = 6
nb_decimals_in = 5
```

(default values are used above)

19.2.5. Automatic synchronization of current model

After being imported into TRIAD, the file of the current model may have been modified by the user. In such as case, the model currently displayed by TRIAD is no longer up-to-date. The file can be automatically reloaded as soon as the mouse cursor is moved in the 3D view.

By default, automatic synchronization is disabled.

To enable it, write the following line in “triad_user_prefs.ini”:

bool_current_model_auto_sync = true

This option will be applied by default to any imported model.

It is possible to enable or disable automatic synchronization for the current model by typing CTRL + “R” in the 3D view.

19.2.6. Automatic definition of composition colors

The button in “Compositions” tab allows for automatically defining the colors of compositions depending on their names or on their comments (descriptive texts assigned to them by the plugins).

To do so, write a list of couples (regular expression; color name) as **"exp reg" => "color"** in file “triad_user_prefs.ini”:

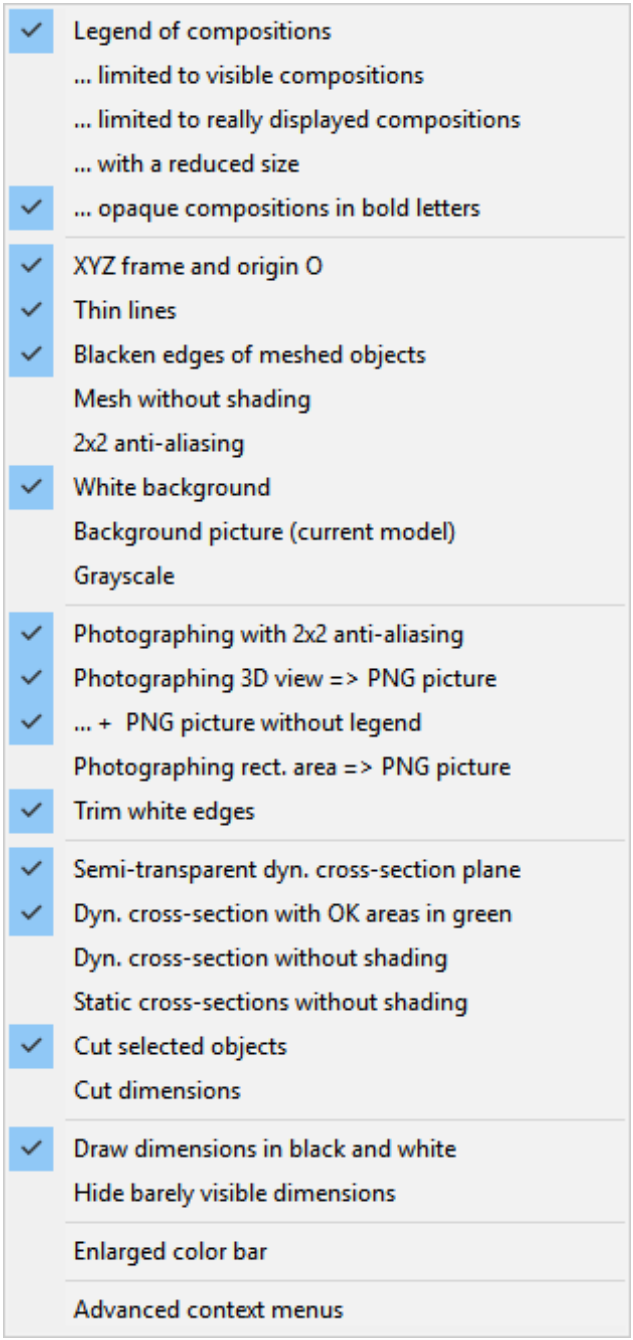
```
"Void-facing faces"          => "M_JAUNE"
"Faces donnant sur le vide" => "M_JAUNE"

"h2o"                        => "M_LAGON"
"water"                      => "M_LAGON"
"eau"                        => "M_LAGON"

"steel"                      => "M_GRIS"
"acier"                      => "M_GRIS"

and so on...

".*"                         => "M_BLANC"
```

The regular expressions are applied successively to each composition name? Case and accents are ignored. The first matching regular expression defines the color and subsequent regular expressions are ignored.

With the couples defined above, composition “**water**” will be assigned color “**M_LAGON**”.

19.2.7. Syntax for defining display options

The configuration file “triad_user_prefs.ini” also defines the “checked/unchecked” states of display options in “Display” menu:



To do so, write such lines in file “triad_user_prefs.ini”:

`variable = true` or **`variable = false`**

The variable names to be used and their default values are listed in the following table:

Item of “Display” menu	Variable in file “triad_user_prefs.ini”	Default value
Legend of compositions	bool_material_legend	**true**
… limited to visible compos.	bool_visible_material_legend	false
… limited to really displayed compositions	bool_displayed_material_legend	false
… with a reduced size	bool_small_material_legend	false
… opaque compositions in bold letters	bool_bold_material_legend	**true**
XYZ frame and origin O	bool_trihedron	**true**
Thin lines	bool_thin_lines	**true**
Blacken edges of meshed objects	bool_blacken_meshed_object_lines	**true**
Mesh without shading	bool_unshaded_mesh	false
2x2 anti-aliasing	bool_antialiasing_2x2	false
White background	bool_white_background	**true**
Background picture (current model)	Not defined in “triad_user_prefs.ini”	–
Grayscale	bool_grayscale	false
Photographing with 2x2 anti-aliasing	bool_photo_with_antialiasing	**true**
Photographing 3D view => PNG picture	bool_photo_3Dvw_PNG_picture	**true**
… + PNG picture without legend	bool_photo_3Dvw_without_legend	**true**
Photographing rect. area => PNG picture	bool_photo_rect_PNG_picture	false
Trim white edges	bool_trim_white_edges	**true**
Semi-transparent dyn. cross-section plane	bool_semitransparent_dynamic_cross_section	**true**
Dyn. cross-section with OK areas in green	bool_fill_non_interfering_regions_with_green	**true**
Dyn. cross-section without shading	bool_unshaded_mesh_for_dynamic_cross_section	false
Static cross-sections without shading	bool_unshaded_mesh_for_static_cross_sections	false
Cut selected objects	bool_clip_selected_objects	**true**
Cut dimensions	bool_clip_dimensions	false
Draw dimensions in black and white	bool_draw_dims_in_black_white	**true**
Hide barely visible dimensions	bool_hide_tiny_dimensions	false
Enlarged color bar	bool_big_color_bar	false
Advanced context menus	bool_advanced_context_menus	false

19.2.8. Syntax for defining toolbars

The configuration file “triad_user_prefs.ini” allows for customizing the toolbars located below the menu bar. To do so, write such lines in the file:

```
TOOLBAR
  { EN="   "; FR="   " }
  ID_BUTTON_STAY_ON_TOP
  { EN="   Open"; FR="   Ouvrir" }
  ID_OPEN_FILE_02
  ID_OPEN_FILE_03
  ID_OPEN_FILE_04
  ID_OPEN_FILE_05
  ID_OPEN_FILE_06
  { EN="   3D view"; FR="   Vue 3D" }
  ID_BUTTON_BKGD_COLOR
  ID_BUTTON_ZOOM_ALL
  ...
  { EN="   Info"; FR="   Info" }
  ID_BUTTON_INFO
  SEPARATOR
  ID_BUTTON_ESCAPE
  SEPARATOR
  ID_BUTTON_DIAGNOSTIC
  ID_BUTTON_DIAGNOSTIC_PLUS
  SEPARATOR
  ID_BUTTON_UNDO_DISPLAY_CHANGE
  ID_BUTTON_REDO_DISPLAY_CHANGE
END_TOOLBAR

TOOLBAR
  { EN="   Surfaces"; FR="   Surfaces" }
  ID_BUTTON_OPEN_NOTEPAD_AT_SURF_LINE
  { EN="   "; FR="   " }
  ID_BUTTON_SHOW_SURFACE
  ...
  ID_BUTTON_AUTO_MAT_COLORS
END_TOOLBAR

...

TOOLBAR
  ...
END_TOOLBAR
```

The button IDs can be chosen in the following list:

Group	Icon	Button ID
-		ID_BUTTON_STAY_ON_TOP
Open		ID_OPEN_FILE_02
		ID_OPEN_FILE_03
		ID_OPEN_FILE_04
		ID_OPEN_FILE_05
		ID_OPEN_FILE_06
3D view		ID_BUTTON_BKGD_COLOR
		ID_BUTTON_ZOOM_ALL
		ID_BUTTON_DRAG_ZOOM
		ID_BUTTON_CENTER_ON_POINT
		ID_BUTTON_VIEW_XY
		ID_BUTTON_VIEW_XZ
		ID_BUTTON_VIEW_YZ
		ID_BUTTON_VIEW_ISOM
		ID_BUTTON_VIEW_ROTZ90DEG
		ID_BUTTON_VIEW_ROTY180DEG
		ID_BUTTON_ORIENT_VIEW_PERP_FACE
		ID_BUTTON_PHOTO
		ID_BUTTON_PHOTO_RECT
Appearance		ID_BUTTON_SHOW_POINTS
		ID_BUTTON_SHOW_LINES
		ID_BUTTON_SHOW_SLINES
		ID_BUTTON_SHOW_MESH
		ID_BUTTON_SHOW_V_MESH
		ID_BUTTON_SHOW_SEMITR
		ID_BUTTON_SHOW_V_SEMITR
		ID_BUTTON_HIDE_FRONT
		ID_BUTTON_BLCK_MESH
		ID_BUTTON_BLCK_V_MESH
		ID_BUTTON_WHIT_MESH
		ID_BUTTON_WHIT_V_MESH
Info		ID_BUTTON_INFO
-		ID_BUTTON_ESCAPE
		ID_BUTTON_DIAGNOSTIC
		ID_BUTTON_DIAGNOSTIC_PLUS
		ID_BUTTON_UNDO_DISPLAY_CHANGE
		ID_BUTTON_REDO_DISPLAY_CHANGE
Surfaces		ID_BUTTON_OPEN_NOTEPAD_AT_SURF_LINE
		ID_BUTTON_SHOW_SURFACE
		ID_BUTTON_HIDE_SURFACE
		ID_BUTTON_CALC_AREA
Volumes		ID_BUTTON_OPEN_NOTEPAD_AT_VOLU_LINE
		ID_BUTTON_SHOW_ALL_REAL_VOLS

		ID_BUTTON_HIDE_ALL_VOLS
		ID_BUTTON_SHOW_VOL
		ID_BUTTON_HIDE_VOL
		ID_BUTTON_SHHI_ALL_VOLS
		ID_BUTTON_INCREASE_LOD
		ID_BUTTON_DECREASE_LOD
		ID_BUTTON_CALC_VOL
		ID_BUTTON_CALC_ALL_VOLS
Miscellaneous		ID_BUTTON_DISPLAY_POPUP_MENU
Selections	New	–
	by	–
		–
	Show only	–
		–
		–
		–
Compos.		ID_BUTTON_OPEN_NOTEPAD_AT_MATE_LINE
		ID_BUTTON_SHOW_ALL_MATS
		ID_BUTTON_HIDE_ALL_MATS
		ID_BUTTON_SHOW_MAT
		ID_BUTTON_HIDE_MAT
		ID_BUTTON_SHHI_ALL_MATS
		ID_BUTTON_SHOW_MAT_SEMITR
		ID_BUTTON_SHOW_MAT_OPAQUE
		ID_BUTTON_CHANGE_MAT_COLOR
		ID_BUTTON_EDIT_MAT_COLORS
		ID_BUTTON_AUTO_MAT_COLORS
Dyn. x-section		ID_BUTTON_LOCATE_CLIPPING_PLANE
		ID_BUTTON_TOGGLE_CLIPPING_PLANE
		ID_BUTTON_TOGGLE_INTERF_CLIPPING_PLANE
		ID_BUTTON_CUT_LESS
		ID_BUTTON_CUT_MORE
		ID_BUTTON_SELECT_CLIPPING_PLANE_VECTOR
		ID_BUTTON_CHOOSE_AMONG_CLIPG_PLANE_VS
		ID_BUTTON_TOGGLE_CLIPPING_PLANE_VECTOR
		ID_BUTTON_ALIGN_CLIPPING_PLANE_VIEW
		ID_BUTTON_SET_CLIPPING_PLANE_PLUS_X
		ID_BUTTON_SET_CLIPPING_PLANE_MINUS_X
		ID_BUTTON_SET_CLIPPING_PLANE_PLUS_Y
		ID_BUTTON_SET_CLIPPING_PLANE_MINUS_Y
		ID_BUTTON_SET_CLIPPING_PLANE_PLUS_Z
		ID_BUTTON_SET_CLIPPING_PLANE_MINUS_Z
Static x-sections		ID_BUTTON_SET_PRECISION_1CM
		ID_BUTTON_SET_PRECISION_1MM
		ID_BUTTON_SET_PRECISION_01MM
		ID_BUTTON_CREATE_CROSS_SECTION
		ID_BUTTON_APPLY_PRECISION_TO_XSEC
		ID_BUTTON_APPLY_PRECISION_TO_MODEL

		ID_BUTTON_APPLY_PRECISION_TO_VOL
Cutaway		–
	...	–
		–
		–
	...	–
		–
Dimensions		ID_BUTTON_CREATE_DIM
		ID_BUTTON_SHOW_DIM
		ID_BUTTON_HIDE_DIM
		ID_BUTTON_DELETE_DIM
		ID_BUTTON_MOVE_DIM
		ID_BUTTON_DECREASE_DIM_SIZE
		ID_BUTTON_INCREASE_DIM_SIZE
		ID_BUTTON_AUTOSCALE_DIM_SIZE
		ID_BUTTON_TOGGLE_DIM_FRAME
		ID_BUTTON_SWAP_DIAMETER_RADIUS
		ID_BUTTON_CHOOSE_AMONG_ANGLES
		ID_BUTTON_EDIT_TEXT_BEFORE_DIM_VALUE
		ID_BUTTON_EDIT_TEXT_AFTER_DIM_VALUE
		ID_BUTTON_APPLY_ACTIVE_LEN_UNIT_TO_DIM
Tags		ID_BUTTON_CREATE_TAG
		ID_BUTTON_SHOW_TAG
		ID_BUTTON_HIDE_TAG
		ID_BUTTON_DELETE_TAG
		ID_BUTTON_APPLY_DEFAULT_TAG_FORMULA
		ID_BUTTON_EDIT_TAG_FORMULA
		ID_BUTTON_COPY_PASTE_TAG_FORMULA
		ID_BUTTON_SET_TAG_FORMULA_SURF_NAME
		ID_BUTTON_SET_TAG_FORMULA_VOLU_NAME
		ID_BUTTON_SET_TAG_FORMULA_MATE_NAME
		ID_BUTTON_SET_TAG_FORMULA_SURF_ESTI
		ID_BUTTON_SET_TAG_FORMULA_VOLU_ESTI
		ID_BUTTON_MOVE_TAG
		ID_BUTTON_MOVE_TAG_TARGET
		ID_BUTTON_AUTOSET_TAG_TARGET
		ID_BUTTON_DECREASE_TAG_SIZE
		ID_BUTTON_INCREASE_TAG_SIZE
		ID_BUTTON_AUTOSCALE_TAG_SIZE
		ID_BUTTON_JUSTIFY_TAG_LEFT
		ID_BUTTON_JUSTIFY_TAG_CENTER
		ID_BUTTON_JUSTIFY_TAG_RIGHT
		ID_BUTTON_DISTRIBUTE_TAG_HORIZ
		ID_BUTTON_DISTRIBUTE_TAG_VERTI
		ID_BUTTON_ALIGN_TAG_LEFT
		ID_BUTTON_ALIGN_TAG_CENTER
		ID_BUTTON_ALIGN_TAG_RIGHT
		ID_BUTTON_ALIGN_TAG_TOP

		ID_BUTTON_ALIGN_TAG_MID
		ID_BUTTON_ALIGN_TAG_BOT
X-sec./Dim./Tags		ID_BUTTON_SAVE
		ID_BUTTON_LOAD

20. Running TRIAD in the command line

Run TRIAD in **interactive mode** by typing:

```
triad.exe -f "my_file"
```

If an instance of TRIAD is already running, the file will be opened by this instance.

The model diagnostic can be run in **batch mode** (i.e. without displaying TRIAD GUI) with the following syntax:

```
triad.exe –b –f "my_file"
```

Or, for an **intensive diagnostic**:

```
triad.exe –bi –f "my_file"
```

Files “triad_log_file.txt” and “my_file.triad_diagnostic.txt” are then created. The latter contains the text that would have been displayed in the diagnostic result dialog box in interactive mode.

Remark: the model diagnostic in interactive mode also creates a “my_file.triad_diagnostic.txt” file.

21. Available importation plugins

The currently available importation plugins allows for opening TRIPOLI, MERCURE, MORET, KENO and MCNP models.

These plugins convert the models into TRIAD files (syntax: see § 22).

They are provided with “Readme_...toTriad.txt” files.

22. Syntax of TRIAD files

The TRIAD files, with extension “.trd” and created by importation plugins, have the following syntax:

File « triad_2015_09_12_syntax.trd »

```
# Length unit
# ===========
#
# This length unit is used in the definitions of
# transformations, surface equations, volumes.
#
# UNIT = <x> <unit>
#    // <x>   : real number
#    // <unit>: m, cm, mm, ft, in
#    // Optional. To be used before definitions. Default value: 1 cm.

UNIT = 1 cm


# Composition
# ===========
#
# <id_compo> = COMPOSITION NAME <name> COLOR <id_color>
#
# <id_compo> = COMPOSITION NAME <name> COLOR <red> <green> <blue>
#              // In this case, TRIAD will name the color with the name
#              // of the closed color among the colors listed below.
#
# <id_compo> = COMPOSITION NAME <name> COLOR <color_name> <red> <green> <blue>
#              // In this case, TRIAD will name the color explicitly.
#
# <red>, <green>, <blue> : integers between 0 and 255
#
# <id_color> :
#
#   Tripoli4.3
#
#       BLACK,         BLUE,  BROWN,   CORAL,  CYAN,   GOLD,
#       GRAY ou GREY,  GREEN, MAGENTA, NAVY,   ORANGE, PINK,
#       PLUM,          RED,   SALMON,  VIOLET, WHITE,  YELLOW
#     These colors recognized by wxWidgets will not always appear correctly.
```

```
#      Preferably use the following HTML colors:
#        HTML_Black, HTML_Blue,  HTML_Brown,   HTML_Coral,  HTML_Cyan,   HTML_Gold,
#        HTML_Gray,  HTML_Green, HTML_Magenta, HTML_Navy,   HTML_Orange, HTML_Pink,
#        HTML_Plum,  HTML_Red,   HTML_Salmon,  HTML_Violet, HTML_White,  HTML_Yellow
#
#    wxWidgets
#
#      AQUAMARINE,         BLACK,                BLUE,              BLUE_VIOLET,
#      BROWN,              CADET_BLUE,           CORAL,             CORNFLOWER_BLUE,
#      CYAN,               DARK_GREY,            DARK_GREEN,        DARK_OLIVE_GREEN,
#      DARK_ORCHID,        DARK_SLATE_BLUE,      DARK_SLATE_GREY,   DARK_TURQUOISE,
#      DIM_GREY,           FIREBRICK,            FOREST_GREEN,      GOLD,
#      GOLDENROD,          GREY,                 GREEN,             GREEN_YELLOW,
#      INDIAN_RED,         KHAKI,                LIGHT_BLUE,        LIGHT_GREY,
#      LIGHT_MAGENTA,      LIGHT_STEEL_BLUE,     LIME_GREEN,        MAGENTA,
#      MAROON,             MEDIUM_AQUAMARINE,    MEDIUM_BLUE,       MEDIUM_FOREST_GREEN,
#      MEDIUM_GOLDENROD,   MEDIUM_GREY,          MEDIUM_ORCHID,     MEDIUM_SEA_GREEN,
#      MEDIUM_SLATE_BLUE,  MEDIUM_SPRING_GREEN,  MEDIUM_TURQUOISE,  MEDIUM_VIOLET_RED,
#      MIDNIGHT_BLUE,      NAVY,                 ORANGE,            ORANGE_RED,
#      ORCHID,             PALE_GREEN,           PINK,              PLUM,
#      PURPLE,             RED,                  SALMON,            SEA_GREEN,
#      SIENNA,             SKY_BLUE,             SLATE_BLUE,        SPRING_GREEN,
#      STEEL_BLUE,         TAN,                  THISTLE,           TURQUOISE,
#      VIOLET,             VIOLET_RED,           WHEAT,             WHITE,
#      YELLOW,             YELLOW_GREEN
#
#    HTML (the "HTML_" prefix is hidden when TRIAD displays the color name)
#
#      HTML_AliceBlue,        HTML_AntiqueWhite,          HTML_Aqua,
#      HTML_Aquamarine,       HTML_Azure,                 HTML_Beige,
#      HTML_Bisque,           HTML_Black,                 HTML_BlanchedAlmond,
#      HTML_Blue,             HTML_BlueViolet,            HTML_Brown,
#      HTML_BurlyWood,        HTML_CadetBlue,             HTML_Chartreuse,
#      HTML_Chocolate,        HTML_Coral,                 HTML_CornflowerBlue,
#      HTML_Cornsilk,         HTML_Crimson,               HTML_Cyan,
#      HTML_DarkBlue,         HTML_DarkCyan,              HTML_DarkGoldenRod,
#      HTML_DarkGray,         HTML_DarkGreen,             HTML_DarkKhaki,
#      HTML_DarkMagenta,      HTML_DarkOliveGreen,        HTML_Darkorange,
#      HTML_DarkOrchid,       HTML_DarkRed,               HTML_DarkSalmon,
#      HTML_DarkSeaGreen,     HTML_DarkSlateBlue,         HTML_DarkSlateGray,
#      HTML_DarkTurquoise,    HTML_DarkViolet,            HTML_DeepPink,
#      HTML_DeepSkyBlue,      HTML_DimGray,               HTML_DodgerBlue,
#      HTML_Feldspar,         HTML_FireBrick,             HTML_FloralWhite,
#      HTML_ForestGreen,      HTML_Fuchsia,               HTML_Gainsboro,
#      HTML_GhostWhite,       HTML_Gold,                  HTML_GoldenRod,
#      HTML_Gray,             HTML_Green,                 HTML_GreenYellow,
#      HTML_HoneyDew,         HTML_HotPink,               HTML_IndianRed,
#      HTML_Indigo,           HTML_Ivory,                 HTML_Khaki,
#      HTML_Lavender,         HTML_LavenderBlush,         HTML_LawnGreen,
#      HTML_LemonChiffon,     HTML_LightBlue,             HTML_LightCoral,
#      HTML_LightCyan,        HTML_LightGoldenRodYellow,  HTML_LightGreen,
#      HTML_LightGrey,        HTML_LightPink,             HTML_LightSalmon,
#      HTML_LightSeaGreen,    HTML_LightSkyBlue,          HTML_LightSlateBlue,
#      HTML_LightSlateGray,   HTML_LightSteelBlue,        HTML_LightYellow,
#      HTML_Lime,             HTML_LimeGreen,             HTML_Linen,
#      HTML_Magenta,          HTML_Maroon,                HTML_MediumAquaMarine,
#      HTML_MediumBlue,       HTML_MediumOrchid,          HTML_MediumPurple,
#      HTML_MediumSeaGreen,   HTML_MediumSlateBlue,       HTML_MediumSpringGreen,
#      HTML_MediumTurquoise,  HTML_MediumVioletRed,       HTML_MidnightBlue,
#      HTML_MintCream,        HTML_MistyRose,             HTML_Moccasin,
#      HTML_NavajoWhite,      HTML_Navy,                  HTML_OldLace,
```

```
#      HTML_Olive,            HTML_OliveDrab,            HTML_Orange,
#      HTML_OrangeRed,        HTML_Orchid,               HTML_PaleGoldenRod,
#      HTML_PaleGreen,        HTML_PaleTurquoise,        HTML_PaleVioletRed,
#      HTML_PapayaWhip,       HTML_PeachPuff,            HTML_Peru,
#      HTML_Pink,             HTML_Plum,                 HTML_PowderBlue,
#      HTML_Purple,           HTML_Red,                  HTML_RosyBrown,
#      HTML_RoyalBlue,        HTML_SaddleBrown,          HTML_Salmon,
#      HTML_SandyBrown,       HTML_SeaGreen,             HTML_SeaShell,
#      HTML_Sienna,           HTML_Silver,               HTML_SkyBlue,
#      HTML_SlateBlue,        HTML_SlateGray,            HTML_Snow,
#      HTML_SpringGreen,      HTML_SteelBlue,            HTML_Tan,
#      HTML_Teal,             HTML_Thistle,              HTML_Tomato,
#      HTML_Turquoise,        HTML_Violet,               HTML_VioletRed,
#      HTML_Wheat,            HTML_White,                HTML_WhiteSmoke,
#      HTML_Yellow,           HTML_YellowGreen
#
#    HSV
#
#      HSV_000_1_1 (red),
#      HSV_010_1_1, HSV_020_1_1, HSV_030_1_1 (orange),
#      HSV_040_1_1, HSV_050_1_1, HSV_060_1_1 (yellow),
#      HSV_070_1_1, HSV_080_1_1, HSV_090_1_1,
#      HSV_100_1_1, HSV_110_1_1, HSV_120_1_1 (green),
#      HSV_130_1_1, HSV_140_1_1, HSV_150_1_1,
#      HSV_160_1_1, HSV_170_1_1, HSV_180_1_1 (cyan),
#      HSV_190_1_1, HSV_200_1_1, HSV_210_1_1,
#      HSV_220_1_1, HSV_230_1_1, HSV_240_1_1 (blue),
#      HSV_250_1_1, HSV_260_1_1, HSV_270_1_1,
#      HSV_280_1_1, HSV_290_1_1, HSV_300_1_1 (magenta),
#      HSV_310_1_1, HSV_320_1_1, HSV_330_1_1,
#      HSV_340_1_1, HSV_350_1_1, HSV_360_1_1 (red)
#
#    Moret (the "M_" prefix is hidden when TRIAD displays the color name)
#
#      M_EAUX,      M_COBALT,    M_CHROME,    M_ROUGE,
#      M_ANIS,      M_MANDARINE, M_GRIS,      M_CIEL,
#      M_OLIVE,     M_BISMARK,   M_JAUNE,     M_PARME,
#      M_SAUMON,    M_MAGENTA,   M_VERT,      M_ACIER,
#      M_ROUX,      M_CANARI,    M_CORAIL,    M_MENTHE,
#      M_CYAN,      M_CUIVRE,    M_MAUVE,     M_CELADON,
#      M_NOISETTE,  M_BONBON,    M_EMERAUDE,  M_BLEU,
#      M_ABRICOT,   M_LILAS,     M_AMBRE,     M_TOURTERELLE,
#      M_GARANCE,   M_POMME,     M_AZUR,      M_SIENNE,
#      M_MOUTARDE,  M_VIOLET,    M_DRAGEE,    M_TOMATE,
#      M_HERBE,     M_ROYAL,     M_AUBURN,    M_CHARTREUSE,
#      M_POURPRE,   M_TURQUOISE, M_BANANE,    M_INDIGO,
#      M_MERS,      M_FRAMBOISE, M_SAPHIR,    M_MIEL,
#      M_ABSINTHE,  M_CHAIR,     M_BEIGE,     M_PRINTEMPS,
#      M_AIGUE,     M_ISABELLE,  M_BISQUE,    M_FUCHSIA,
#      M_PLATINE,   M_CELESTE,   M_PISTACHE,  M_FRAISE,
#      M_SOUFRE,    M_TANIN,     M_GLYCINE,   M_CARNE,
#      M_CRABE,     M_LICHEN,    M_FUMEE,     M_LAGON,
#      M_ROSE,      M_CHAMPAGNE, M_JADE,      M_VANILLE,
#      M_COUCHANT,  M_GUIMAUVE,  M_AMANDE,    M_QUETSCHE,
#      M_BLANC,     M_NOIR

C1 = COMPOSITION NAME Gold       COLOR GOLD
C2 = COMPOSITION NAME Red        COLOR RED
C3 = COMPOSITION NAME Green      COLOR GREEN
C4 = COMPOSITION NAME Blue       COLOR BLUE
C5 = COMPOSITION NAME Yellow     COLOR MyYellowColor  255 255   0
```

```
C6 = COMPOSITION NAME Magenta   COLOR MyMagentaColor 255   0 255
C7 = COMPOSITION NAME Cyan      COLOR MyCyanColor      0 255 255
C8 = COMPOSITION NAME Crab      COLOR M_CRABE
C9 = COMPOSITION NAME Champagne COLOR M_CHAMPAGNE


# Composition-to-volume assignment
# ================================
# COMPOSITION <id_compo> VOLUMES <id_volume1> <id_volume2> ...

COMPOSITION C1 VOLUMES V1 V2a V4a
COMPOSITION C2 VOLUMES V2 V5a
COMPOSITION C3 VOLUMES V3 V1a
COMPOSITION C4 VOLUMES V4 V3a


# Isometric coordinate transformation
# ===================================
# <id_transfo> = ISOMETRY TRANSLATION [xv yv zv]
# <id_transfo> = ISOMETRY ROTATION    [xp yp zp] [xv yv zv] angledeg
#
# Composition of transformations:
# <id_transfo> = COMPOSE_TRANSFORMATIONS <id_transfo1> ... <id_transfon>
#                // Transformed point M'=(f1 o ... o fn)(M) = f1(...(fn(M))...)

identity       = ISOMETRY TRANSLATION [  0.0    0.0 0.0]

translation_T1 = ISOMETRY TRANSLATION [-70.0 -100.0 0.0]
translation_T2 = ISOMETRY TRANSLATION [-40.0 -100.0 0.0]
translation_T3 = ISOMETRY TRANSLATION [  0.0 -100.0 0.0]
translation_T4 = ISOMETRY TRANSLATION [+20.0 -100.0 0.0]
translation_T5 = ISOMETRY TRANSLATION [+60.0 -100.0 0.0]

rotation_R     = ISOMETRY ROTATION    [0.0 0.0 0.0] [0.0 0.0 1.0] 10.0

transfo_T1oR   = COMPOSE_TRANSFORMATIONS translation_T1 rotation_R
transfo_T2oR   = COMPOSE_TRANSFORMATIONS translation_T2 rotation_R
transfo_T3oR   = COMPOSE_TRANSFORMATIONS translation_T3 rotation_R
transfo_T4oR   = COMPOSE_TRANSFORMATIONS translation_T4 rotation_R
transfo_T5oR   = COMPOSE_TRANSFORMATIONS translation_T5 rotation_R


# Lattice filling
# ===============
# The & character defines the position of the patterns.
# Each matrix element can contain: i(&j)(&k)...(&l).
#
# <id_fill2d> = FILLING_2D
#   0 1   1   1 0             /|\ j
#   1 2   1   2 1              |
#   1 1   1&1 1 1              |
#   1 2&2 1   2 1              |
#   0 1   1   1 0              +-----------> i
# END_FILLING_2D
#
# <id_fill3d> = FILLING_3D <id_fill2d1> ... <id_fill2dk>&1 ... <id_fill2dn>    //
Increasing k index

R_2D = FILLING_2D
  1  1  1    0     2  2 0    0     3     0     0  4 0    0     5  5 0
  0  1  0    0     2  0 2    0     3     0     4  0 4    0     5  0 5
```

```
  0  1  0    0     2  2 0    0     3     0     4  4 4    0     5  0 5
  0  1  0    0     2  0 2    0     3     0     4  0 4    0     5  0 5
  0 1&1 0    0    2&2 0 2    0    3&3    0    4&4 0 4    0    5&5 5 0
END_FILLING_2D

R_3D = FILLING_3D R_2D


# Surface equation
# ================
#
# <id> = SURFACE SPHERE [0.0 0.0 0.0] 1.0
#
# QUADRIC    a b c d e f g h i j             // ax2+by2+cz2+dxy+eyz+fzx+gx+hy+iz+j=0
# PLANE_X    x0                              // x-x0=0
# PLANE_Y    y0                              // y-y0=0
# PLANE_Z    z0                              // z-z0=0
# PLANE      [xp yp zp] [xv yv zv]
# PLANE_ABCD  a b c d                        // ax+by+cz+d=0
# CYLINDER_X [xp yp zp] r
# CYLINDER_Y [xp yp zp] r
# CYLINDER_Z [xp yp zp] r
# CYLINDER   [xp yp zp] [xv yv zv] r
# SPHERE     [xp yp zp] r
# CONE       [xp yp zp] [xv yv zv] half_angle_deg
# TORUS      [xp yp zp] [xv yv zv] large_r small_r
#
# By default, the surface equations that are found by TRIAD to be coincident
# with previously defined equations remain distinct.
#
# When the instruction "MERGE_COINCIDENT_SURFACES" is present,
# the surface equations defined after the instruction and found to be coincident
# with a previously defined equation are merged with it.
#
# The instruction "DO_NOT_MERGE_COINCIDENT_SURFACES" restores the default treatment.

S1 = SURFACE SPHERE [ 0.0 0.0 0.0 ] 10.0
S2 = SURFACE SPHERE [ 0.0 0.0 0.0 ] 15.0
S3 = SURFACE SPHERE [ 0.0 0.0 0.0 ] 50.0
S4 = SURFACE CONE   [ 0.0 0.0 0.0 ] [ +0.866 +0.500 0.0 ] 30.0
S5 = SURFACE CONE   [ 0.0 0.0 0.0 ] [ -0.866 +0.500 0.0 ] 30.0
S6 = SURFACE CONE   [ 0.0 0.0 0.0 ] [  0.000 -1.000 0.0 ] 30.0
S7 = SURFACE PLANE  [ 0.0 0.0 0.0 ] [ +0.866 +0.500 0.0 ]
S8 = SURFACE PLANE  [ 0.0 0.0 0.0 ] [ -0.866 +0.500 0.0 ]
S9 = SURFACE PLANE  [ 0.0 0.0 0.0 ] [  0.000 -1.000 0.0 ]


# Volume
# ======
#
# EDGE_PRECISION_CM <value>
#    // Optional. To be used before defining volumes.
#    // Default value:   0.1   (0.1 cm, i.e. 1 mm).
#
# <id> = VOLUME (FICTIVE) SPHERE          [0.0 0.0 0.0] 1.0
# <id> = VOLUME (FICTIVE) SURFACE_BOUNDED -S1 +S3
# <id> = VOLUME (FICTIVE) CROSS_SECTION   ...
# <id> = VOLUME (FICTIVE) COPY            ...
# <id> = VOLUME (FICTIVE) MODULE          V1 V2 V3
# <id> = VOLUME (FICTIVE) LATTICE         ...
# <id> = VOLUME (FICTIVE) BOOLEAN         V1 - V2 * V3
```

```
#
# BOX              [xmin ymin zmin] [xmax ymax zmax]
# PARALLELEPIPED   [xp yp zp] [xv1 yv1 zv1] [xv2 yv2 zv2] [xv3 yv3 zv3] Lv1 Lv2 Lv3
# PRISM            [xp yp zp] [xv1 yv1 zv1] [xv2 yv2 zv2] rinscribedcircle nbsides hmin
hmax
#                  // where v2 is the outward-oriented normal vector of a side face
# CYLINDER_X       [xp yp zp] r            xmin xmax
# CYLINDER_Y       [xp yp zp] r            ymin ymax
# CYLINDER_Z       [xp yp zp] r            zmin zmax
# CYLINDER         [xp yp zp] [xv yv zv] r hmin hmax
# SPHERE           [xp yp zp] r
# CONE             [xp yp zp] [xv yv zv] halfangledeg hmin hmax
# TORE             [xp yp zp] [xv yv zv] large_r small_r
#
# SURFACE_BOUNDED <+/-><id_surf1> ...  <+/-><id_surfn>
#
# CROSS_SECTION   VOLUMES <id_volume1> ... <id_volumen> PLANE [xp yp zp] [xv yv zv]
# CROSS_SECTION   VOLUMES <id_volume1> ... <id_volumen> CUTTER_VOLUME <id_volume>
#
# CROSS_SECTION   ALL_REAL_VOLUMES PLANE [xp yp zp] [xv yv zv]
# CROSS_SECTION   ALL_REAL_VOLUMES CUTTER_VOLUME <id_volume>
#                 // Cut all 0-level real volumes that are not cross-sections
#
# COPY      <opt> VOLUME <id_volume> ISOMETRY <id_isometry>
#                 // If a composition is assigned to a copy volume
#                 // via instruction "COMPOSITION <id_compo> VOLUMES ...",
#                 // the copy will ignore the compositions of the copied volume.
#
# MODULE          VOLUMES <id_volume1> ... <id_volumen>
#
# LATTICE   <opt> PATTERNS <id_volume1> ... <id_volumen> ... followed by 3
possibilities:
#
#   1) CARTESIAN   [xv1 yv1 zv1] [xv2 yv2 zv2] [xv3 yv3 zv3]
#                  STEP step1 step2 step3
#                  FILLING <id>
#
#   2) CARTESIAN   [xv1 yv1 zv1] [xv2 yv2 zv2] [xv3 yv3 zv3]
#                  STACKING {dx11 dx12 ...} {dx21 dx22 ...} {dx31 dx32 ...}
#                  FILLING <id>
#                  // Lattice elements are stacked contiguously.
#                  // Lattice elements in column (resp. row, resp. layer) no. <i>
#                  // are assumed to have a dimension of dx1<i> (resp. dx2<i>,
#                  // resp. dx3<i>) in the direction of vector v1 (resp. v2,
#                  // resp. v3). For instance, the step between columns no. 3 and 4
#                  // is: (dx13+dx14)/2.
#
#   3) CYLINDRICAL [xp yp zp] [xv yv zv] [xpatterncenter ypc zpc]
#                  PAS step_radius step_angledeg step_z ROTATE_PATTERN <YES/NO>
FILLING <id>
#
#   // Provide the name of a 2D or 3D lattice.
#
#   // A lattice is considered hexagonal if vectors V1 and V2 are
#   // at an angle of 60° or 120° (+/-10°) with each other.
#
#   // If a hexagonal lattice uses a 2D filling (directly
#   // or indirectly via a 3D filling), this filling will be
#   // displayed by TRIAD with the icon of a hexagonal 2D filling.
#
#   // The CYLINDRICAL lattice is not implemented yet.
```

```
#
# <opt> = (EXACT or SIMPLIFIED) (INTERSECTED_WITH <id_vol_int>)
#
#   // Both options are optional and shall appear in this order, without parentheses.
#   // EXACT or SIMPLIFIED           => see below.
#   // INTERSECTED_WITH <id_vol_int> => the copy volume or lattice is intersected
#   //                                  with volume <id_vol_int>.
#
# VOLUME_AND_SIMPLIFIED_VOLUME <id_volume> <id_simplified_volume>
#   //
#   // This instruction associates a volume and its simplified volume.
#   // The simplified version of a volume, if it exists, will possibly be used
#   // in the COPY and LATTICE volumes:
#   //
#   //   - if <id_volume> is the copied volume, the COPY volume will make
#   //     a copy of the simplified volume, only if explicitly requested:
#   //
#   //        <id_volume> = VOLUME COPY            VOLUME ...  => exact copy (default)
#   //        <id_volume> = VOLUME COPY EXACT      VOLUME ...  => exact copy
#   //        <id_volume> = VOLUME COPY SIMPLIFIED VOLUME ...  => simplified copy
#   //
#   //   - if <id_volume> is one of the patterns of a lattice,
#   //     the LATTICE volume will make copies of the simplified pattern,
#   //     unless exact copying is explicitly requested:
#   //
#   //        <id_volume> = VOLUME LATTICE            PATTERNS ...  => simplified
lattice (default)
#   //        <id_volume> = VOLUME LATTICE EXACT      PATTERNS ...  => exact lattice
#   //        <id_volume> = VOLUME LATTICE SIMPLIFIED PATTERNS ...  => simplified
lattice
#   //
#   // When no simplified volume is provided, the exact volume is used.
#
# <id> = VOLUME BOOLEAN <id_volume1> <op1> ... <op2> <id_volumen>
#   // No parentheses. Priority from left to right, equivalent to
(((V1+V2)+V3)+V4)+...
#
# Implemented boolean operations: V3 = V1 <op> V2
# +---------+-----------------------------------------+---------------------+
# |  V3 =   |              Operation <op>             | Compositions of V3  |
# +---------+-----------------------------------------+---------------------+
# | V1 + V2 | or    (union)                           | Those of V1 and V2  |
# | V1 - V2 | minus (subtraction)                     | Those of V1         |
# | V1 * V2 | and   (intersection)                    | Those of V1         |
# | V1 : V2 | "or"  (union with merged compositions)  | 1st compos. of V1   |
# +---------+-----------------------------------------+---------------------+
# If one of the operations is ":", the resultant boolean volume
# only has the first composition of the first volume.

EDGE_PRECISION_CM 0.1

V1 = VOLUME SURFACE_BOUNDED -S1
V2 = VOLUME SURFACE_BOUNDED +S2 -S3 -S4 +S7
V3 = VOLUME SURFACE_BOUNDED +S2 -S3 -S5 +S8
V4 = VOLUME SURFACE_BOUNDED +S2 -S3 -S6 +S9

V1234 = VOLUME FICTIVE BOOLEAN V1 : V2 : V3 : V4

V11 = VOLUME FICTIVE CROSS_SECTION VOLUMES V1 V2 V3 V4 PLANE [ 0.0 0.0 -20.0 ] [ 0.0
0.0 1.0 ]
V12 = VOLUME FICTIVE CROSS_SECTION VOLUMES V1 V2 V3 V4 PLANE [ 0.0 0.0 -15.0 ] [ 0.0
```

```
0.0 1.0 ]
V13 = VOLUME FICTIVE CROSS_SECTION VOLUMES V1 V2 V3 V4 PLANE [ 0.0 0.0 -10.0 ] [ 0.0
0.0 1.0 ]
V14 = VOLUME FICTIVE CROSS_SECTION VOLUMES V1 V2 V3 V4 PLANE [ 0.0 0.0  -5.0 ] [ 0.0
0.0 1.0 ]
V15 = VOLUME FICTIVE CROSS_SECTION VOLUMES V1 V2 V3 V4 PLANE [ 0.0 0.0   0.0 ] [ 0.0
0.0 1.0 ]
V16 = VOLUME FICTIVE CROSS_SECTION VOLUMES V1 V2 V3 V4 PLANE [ 0.0 0.0   5.0 ] [ 0.0
0.0 1.0 ]
V17 = VOLUME FICTIVE CROSS_SECTION VOLUMES V1 V2 V3 V4 PLANE [ 0.0 0.0 +10.0 ] [ 0.0
0.0 1.0 ]
V18 = VOLUME FICTIVE CROSS_SECTION VOLUMES V1 V2 V3 V4 PLANE [ 0.0 0.0 +15.0 ] [ 0.0
0.0 1.0 ]
V19 = VOLUME FICTIVE CROSS_SECTION VOLUMES V1 V2 V3 V4 PLANE [ 0.0 0.0 +20.0 ] [ 0.0
0.0 1.0 ]

V1a = VOLUME FICTIVE BOX   [ -3.0 -3.0 -3.0 ] [ +3.0 +3.0 +3.0 ]
V2a = VOLUME FICTIVE PARALLELEPIPED [ -5.0 -5.0 0.0 ] [ 3.0 1.0 0.0 ] [ 1.0 2.0 0.0 ]
[ 1.0 1.0 1.0 ] 6.0 5.0 3.0
V3a = VOLUME FICTIVE PRISM [ 0.0 0.0 0.0 ] [ 0.0 0.0 1.0 ] [ 0.0 1.0 0.0 ] 3.0 6 -3.0
+3.0
V4a = VOLUME FICTIVE PRISM [ 0.0 0.0 0.0 ] [ 0.0 0.0 1.0 ] [ 0.0 1.0 0.0 ] 3.0 5 -3.0
+3.0
V5a = VOLUME FICTIVE CONE  [ 0.0 0.0 0.0 ] [ 1.0 1.0 1.0 ] 30.0 -6.0 -3.0

V1b = VOLUME FICTIVE COPY VOLUME V1a ISOMETRY transfo_T1oR
V2b = VOLUME FICTIVE COPY VOLUME V2a ISOMETRY transfo_T2oR
V3b = VOLUME FICTIVE COPY VOLUME V3a ISOMETRY transfo_T3oR
V4b = VOLUME FICTIVE COPY VOLUME V4a ISOMETRY transfo_T4oR
V5b = VOLUME FICTIVE COPY VOLUME V5a ISOMETRY transfo_T5oR

V6  = VOLUME LATTICE PATTERNS V1b V2b V3b V4b V5b CARTESIAN [ 1.0 0.0 0.0 ] [ 0.0 1.0
0.0 ] [ 0.0 0.0 1.0 ] STEP 10.0 10.0 1.0 FILLING R_2D


# Comments attributed to surfaces or volumes
# ==========================================
#
# COMMENT_COMPOSITION <id_compo>   "<comment>"
# COMMENT_SURFACE     <id_surface> "<comment>"
# COMMENT_VOLUME      <id_volume>  "<comment>"

COMMENT_COMPOSITION C1 "Solid gold"
COMMENT_COMPOSITION C8 "Delicious crab"
COMMENT_COMPOSITION C9 "Sparkling"

COMMENT_SURFACE S1 "Spherical surface of logo"

COMMENT_VOLUME V1 "Sphere of logo"
COMMENT_VOLUME V2 "Red cone of logo"
COMMENT_VOLUME V3 "Green cone of logo"
COMMENT_VOLUME V4 "Blue cone of logo"

COMMENT_VOLUME V6 "Letters T-R-I-A-D"


# Attribution of line numbers to compositions/surfaces/volumes
# ============================================================
#
# COMPOSITION_AND_LINE_NUMBER <id_compo>   <no_ligne>
# SURFACE_AND_LINE_NUMBER     <id_surface> <no_ligne>
```

```
# VOLUME_AND_LINE_NUMBER      <id_volume>  <no_ligne>
#
# These numbers make it possible for the TRIAD user to open
# an imported file at the line where the selected
# composition, surface or volume is defined.
#
# When the imported file has a TRIAD syntax,
# instructions "..._AND_LINE_NUMBER" are ignored and
# the line numbers are attributed automatically.
# Otherwise (file converted via a plugin), the plugin shall
# attribute appropriate line numbers.


# Selection of volumes
# ====================
#
# <id_selection> = SELECTION_OF_VOLUMES NAME "<selection_name>"
#   VOLUME <id_volume1>
#   ...........
#   VOLUME <id_volumen>
# END_SELECTION_OF_VOLUMES
#
# In order to limit the edge/mesh calculation to some volumes
# (and to volumes that depend from them), list these volumes
# in a selection named "Selectively imported volumes" or
# "Volumes importés sélectivement".

Selection1 = SELECTION_OF_VOLUMES NAME "Volumes of TRIAD logo"
  VOLUME V1
  VOLUME V2
  VOLUME V3
  VOLUME V4
END_SELECTION_OF_VOLUMES


# Selection of compositions
# =========================
#
# <id_selection> = SELECTION_OF_COMPOSITIONS NAME "<selection_name>"
#   COMPOSITION <id_compo1>
#   ...........
#   COMPOSITION <id_compon>
# END_SELECTION_OF_COMPOSITIONS

Selection2 = SELECTION_OF_COMPOSITIONS NAME "Compositions of TRIAD logo"
  COMPOSITION C1
  COMPOSITION C2
  COMPOSITION C3
  COMPOSITION C4
END_SELECTION_OF_COMPOSITIONS

Selection3 = SELECTION_OF_COMPOSITIONS NAME "Compositions of cones of TRIAD logo"
  COMPOSITION C2
  COMPOSITION C3
  COMPOSITION C4
END_SELECTION_OF_COMPOSITIONS


# Group of selections
# ===================
#
```

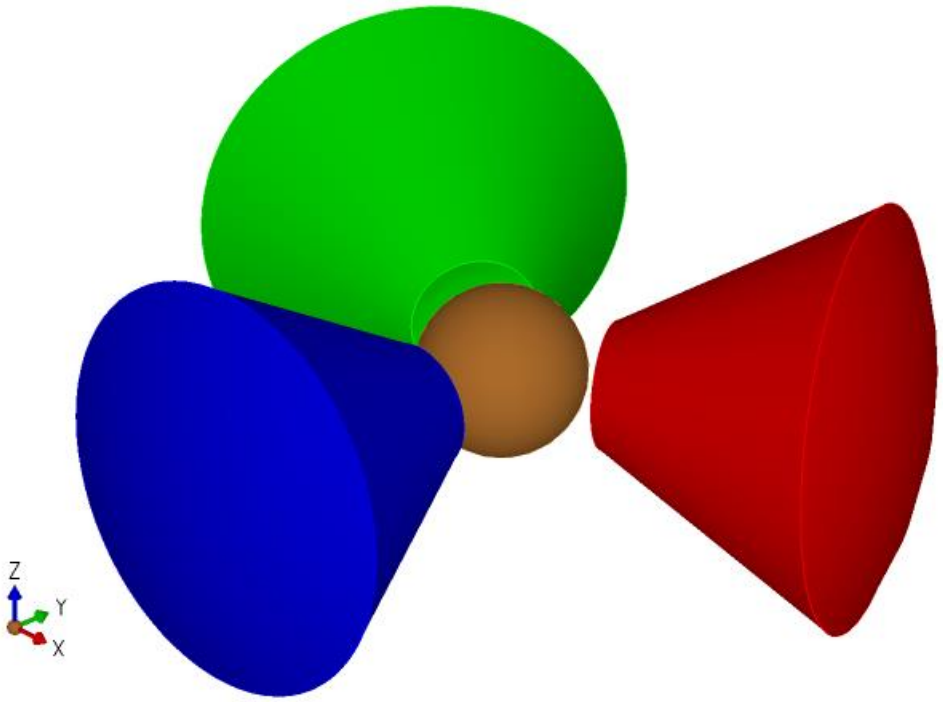
```
# <id_sel_grp> = GROUP_OF_SELECTIONS NAME "<sel_grp_name>"
#   SELECTION <id_selection1>
#   ...........
#   SELECTION <id_selectionn>
# END_GROUP_OF_SELECTIONS
#
# The listed selections will appear in the geometry tree,
# being grouped under the item named "<sel_grp_name>".

Group1 = GROUP_OF_SELECTIONS NAME "Selections of compositions"
  SELECTION Selection2
  SELECTION Selection3
END_GROUP_OF_SELECTIONS


# Color bar
# =========
#
# <id_bar> = COLOR_BAR NAME "<bar_name>"
#   COLOR <id_color0>
#   VALUE <x0> TEXT "<text0>"
#   COLOR <id_color1>
#   VALUE <x1> TEXT "<text1>"
#   ...........
#   COLOR <id_colorn>
#   VALUE <xn> TEXT "<textn>"
#   COLOR <id_colorn+1>
# END_COLOR_BAR
#
# The values shall be given in the ascending order.
# The texts are written along the color bar in the 3D view.
#
# As well as for a composition, the color can be defined in different ways:
#   COLOR <id_color>
#   COLOR <red> <green> <blue>
#   COLOR <color_name> <red> <green> <blue>

Bar1 = COLOR_BAR NAME "Color bar {0;2;4;6;8;10}"
  COLOR M_BLANC
  VALUE   0.0    TEXT " 0"
  COLOR M_BLEU
  VALUE   2.0    TEXT " 2"
  COLOR M_CYAN
  VALUE   4.0    TEXT "Criterion: 4"
  COLOR M_VERT
  VALUE   6.0    TEXT " 6"
  COLOR M_JAUNE
  VALUE   8.0    TEXT " 8"
  COLOR M_ROUGE
  VALUE  10.0    TEXT "10"
  COLOR M_MAGENTA
END_COLOR_BAR


# Field
# =====
#
# <id_field> = FIELD NAME "<field_name>" COMPONENTS "<comp.1>" ... "<comp.n>"
#   VOLUME_VOLUME <id_volume_from> <id_volume_to> VALUES <x1>  ... <xn>
#   VOLUME        <id_volume_in>                  VALUES <x'1> ... <x'n>
# END_FIELD
```

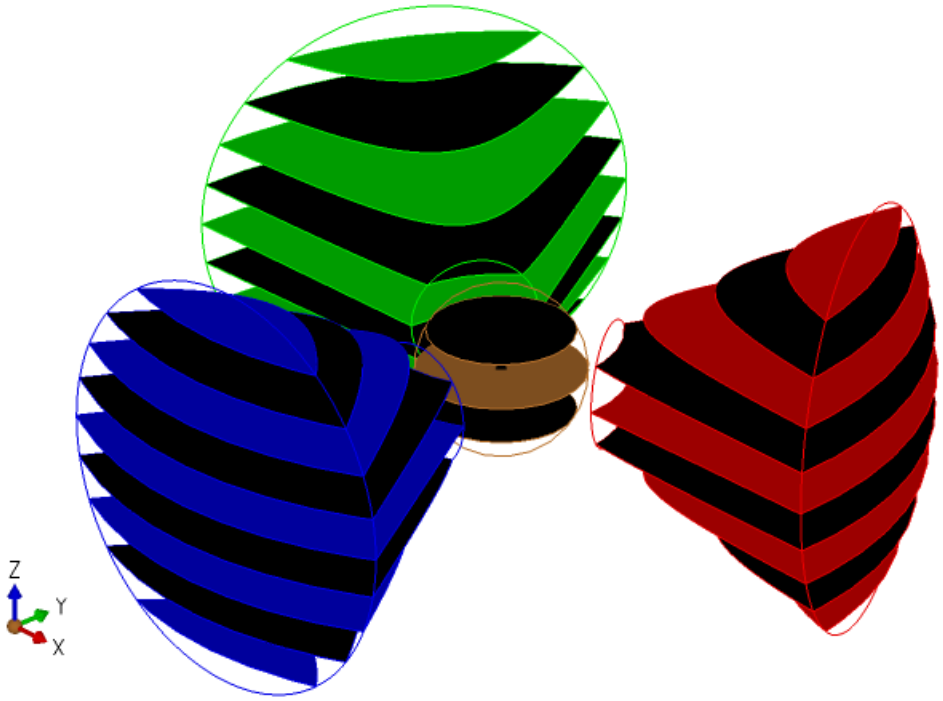
```
#   // The VOLUME_VOLUME and VOLUME lines may be repeated in any order.

Field_EDR_case1 = FIELD NAME "EDRs of Case 1" COMPONENTS "EDR (mSv/h)" "Criterion
(mSv/h)" "EDR/criterion ratio"
  VOLUME V1 VALUES 12.0 10.0 1.2
  VOLUME V2 VALUES  5.0 10.0 0.5
  VOLUME V3 VALUES  7.0 10.0 0.7
  VOLUME V4 VALUES  9.0 10.0 0.9
END_FIELD


# Field defined on a voxel lattice
# ================================
#
# <id_field> = FIELD NAME "<field_name>" VOXEL_LATTICE <voxel_lattice> COMPONENTS
"<comp.1>" ... "<comp.n>"
#   (i,j,k) <x1>  ... <xn>
# END_FIELD
#   // The "(i,j,k) <x1>  ... <xn>" lines may be repeated in any order.
#
# <voxel_lattice> can be:
# - either:
#    CARTESIAN   <orig> <v1> <v2> ISOMETRY <id_isometry> COORDINATES <coords>
#    where:
#       <orig>   = [xorig yorig zorig]      // Origin point
#       <v1>     = [xv1 yv1 zv1]            // "x" axis vector
#       <v2>     = [xv2 yv2 zv2]            // Vector in the half-plane containing "y"
axis
#       <coords> = {x11 x12 ...} {x21 x22 ...} {x31 x32 ...}  // x,y,z
# - or:
#    CYLINDRICAL <orig> <v1> <v2> ISOMETRY <id_isometry> COORDINATES <coords>
#    where:
#       <orig>   = [xorig yorig zorig]      // Origin point
#       <v1>     = [xv1 yv1 zv1]            // "z" axis vector
#       <v2>     = [xv2 yv2 zv2]            // Vector in the half-plane theta=0°
#       <coords> = {x11 x12 ...} {x21 x22 ...} {x31 x32 ...}  // r,theta(radians),z
#
# Remarks:
# - Vector <v2> is made orthogonal to <v1>.
# - The coordinates shall be given in the ascending order.
# - The zero-valued voxels are not displayed by TRIAD.

translation_T6 = ISOMETRY TRANSLATION [-80.0 -120.0 0.0]

Field_EDR_case2 = FIELD NAME "EDRs of Case 2" VOXEL_LATTICE CARTESIAN [0 0 0] [1 0 0]
[0 1 0] ISOMETRY translation_T6 COORDINATES {0 10 20 30 40 50 60 70 80 90 100 110 120
130 140 150 160} {0 2 4 6 8} {-5 5} COMPONENTS "EDR (mSv/h)"
  ( 1, 1, 1)  1.0
  ( 2, 2, 1)  2.0
  ( 3, 3, 1)  3.0
  ( 4, 4, 1)  4.0
  ( 5, 3, 1)  5.0
  ( 6, 2, 1)  6.0
  ( 7, 1, 1)  7.0
  ( 8, 2, 1)  8.0
  ( 9, 3, 1)  9.0
  (10, 4, 1) 10.0
  (11, 3, 1) 11.0
  (12, 2, 1) 12.0
  (13, 1, 1) 13.0
  (14, 2, 1) 14.0
```

```
  (15, 3, 1) 15.0
  (16, 4, 1) 16.0
END_FIELD

translation_T7 = ISOMETRY TRANSLATION [0.0 0.0 0.0]

Field_EDR_case3 = FIELD NAME "EDRs of Case 3" VOXEL_LATTICE CYLINDRICAL [0 0 0] [0 0
1] [1 0 0] ISOMETRY translation_T7 COORDINATES {60 65 70 75 80} {-0.6 -0.5 -0.4 -0.3 -
0.2 -0.1 0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9
2.0 2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8 2.9 3.0 3.1 3.2 3.3 3.4 3.5 3.6 3.7 3.8} {-5 5}
COMPONENTS "EDR (mSv/h)"
  (1,  1, 1)  1.0
  (2,  2, 1)  2.0
  (3,  3, 1)  3.0
  (4,  4, 1)  4.0
  (3,  5, 1)  5.0
  (2,  6, 1)  6.0
  (1,  7, 1)  7.0
  (2,  8, 1)  8.0
  (3,  9, 1)  9.0
  (4, 10, 1) 10.0
  (3, 11, 1) 11.0
  (2, 12, 1) 12.0
  (1, 13, 1) 13.0
  (2, 14, 1) 14.0
  (3, 15, 1) 15.0
  (4, 16, 1) 16.0
  (3, 17, 1) 17.0
  (2, 18, 1) 18.0
  (1, 19, 1) 19.0
  (2, 20, 1) 20.0
  (3, 21, 1) 21.0
  (4, 22, 1) 22.0
  (3, 23, 1) 23.0
  (2, 24, 1) 24.0
  (1, 25, 1) 25.0
  (2, 26, 1) 26.0
  (3, 27, 1) 27.0
  (4, 28, 1) 28.0
  (3, 29, 1) 29.0
  (2, 30, 1) 30.0
  (1, 31, 1) 31.0
  (2, 32, 1) 32.0
  (3, 33, 1) 33.0
  (4, 34, 1) 34.0
  (3, 35, 1) 35.0
  (2, 36, 1) 36.0
  (1, 37, 1) 37.0
  (2, 38, 1) 38.0
  (3, 39, 1) 39.0
  (4, 40, 1) 40.0
  (3, 41, 1) 41.0
  (2, 42, 1) 42.0
  (1, 43, 1) 43.0
END_FIELD


# Instruction to skip the end of the file
# ========================================
#
# STOP
```

```
STOP


# Standard characters, special characters
# =======================================
#
# The strings between "..." may contain the following characters:
#
# 1) Standard characters:
#
#    ABCDEFGHIJKLMNOPQRSTUVWXYZ
#    abcdefghijklmnopqrstuvwxyz àâäéèêëîïôöùûü ç µ
#    1234567890+-.,;:/*=#<>
#    ()[]{}?!&'|_\^@°$€%
#
# 2) Special characters (between <<...>>):
#
#    The strings between <<...>> and preceded by * are replaced with the
#    corresponding special character only in dimensions in the 3D view.
#
#  * <<sup>>           The characters after this code are written as superscripts,
#                      until the next <<end_sup>> code.
#
#  * <<sub>>           The characters after this code are written as subscripts,
#                      until the next <<end_sub>> code.
#
#    <<half-space>>    Reduced-width space
#    <<hs>>              Idem
#    <<+/->>           Symbol "plus or minus"
#    <<+->>              Idem
#    <<mult>>          Symbol "multiplied by"
#    <<~=>>            Symbol "approx. equals to"
#    <<approx>>          Idem
#    <<!=>>            Symbol "different from"
#    <<diff>>            Idem
#    <<<=>>            Symbol "less than    or equal to" (lower bar of "=" is
horizontal)
#    <<>=>>            Symbol "greater than or equal to" (lower bar of "=" is
horizontal)
#    <<<=FR>>          Symbol "less than    or equal to" (lower bar of "=" is oblique)
#    <<>=FR>>          Symbol "greater than or equal to" (lower bar of "=" is oblique)
#    <<arrowN>>        Arrow oriented to the top
#    <<arrowS>>        Arrow oriented to the bottom
#    <<arrowE>>        Arrow oriented to the right
#    <<arrowW>>        Arrow oriented to the left
#  * <<arrowNE>>       Arrow oriented to the top right
#  * <<arrowNW>>       Arrow oriented to the top left
#  * <<arrowSE>>       Arrow oriented to the bottom right
#  * <<arrowSW>>       Arrow oriented to the bottom left
#    <<DIAM>>          Symbol "diameter" (large crossed circle)
#    <<diam>>          Symbol "diameter" (small crossed circle)
#
#    <<alpha>>         Lower-case Greek letter "alpha"
#                      Similarly:
#                        beta gamma delta epsilon zeta eta theta
#                        iota kappa lambda mu nu xi omicron pi
#                        rho sigma tau upsilon phi khi psi omega
#
#    <<ALPHA>>         Upper-case Greek letter "alpha"
#                      Similarly:
```

```
#                          BETA GAMMA DELTA EPSILON ZETA ETA THETA
#                          IOTA KAPPA LAMBDA MU NU XI OMICRON PI
#                          RHO SIGMA TAU UPSILON PHI KHI PSI OMEGA
#
#    <<micro>>           Greek letter "µ" (also a standard character)
#    <<^2>>              Squared (to the power of 2)
#    <<^3>>              Cubed   (to the power of 3)
#    <<perp>>            Symbol "perpendicular to"
#    <<_|_>>             Idem
#    <<warning>>         Triangular warning sign, with red edges
#    <<\/!\>>            Idem
#  * <<radioactive>>     Radioactive sign
#
#    <<U+XXXX>>          Unicode character U+XXXX where X = 0,...,9,A,B,C,D,E,F
#                        Examples:
#                          <<U+0041>> = A
#                          <<U+0061>> = a
#                          <<U+0391>> = Alpha
#                          <<U+03B1>> = alpha
```





TRIAD

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