



Flair – Geometry Editor

Beginners' FLUKA Course

Geometry editor 2D

- Working on 2D cross sections of the geometry;
- Interactive editing of the geometry in 2D;
- Debugging bodies/regions in a graphical way;
- 3D rendering of the geometry;

Pros

- Fast display of complex geometries;
- Visual selection and editing of zones **w/o the need to know the orientation of bodies;**
- Use real curve of bodies with no conversion to vertices/edges;
- Interactive debugging with information of problematic body regions and zones;

Cons

- Tricky to orientate in an unknown geometry.

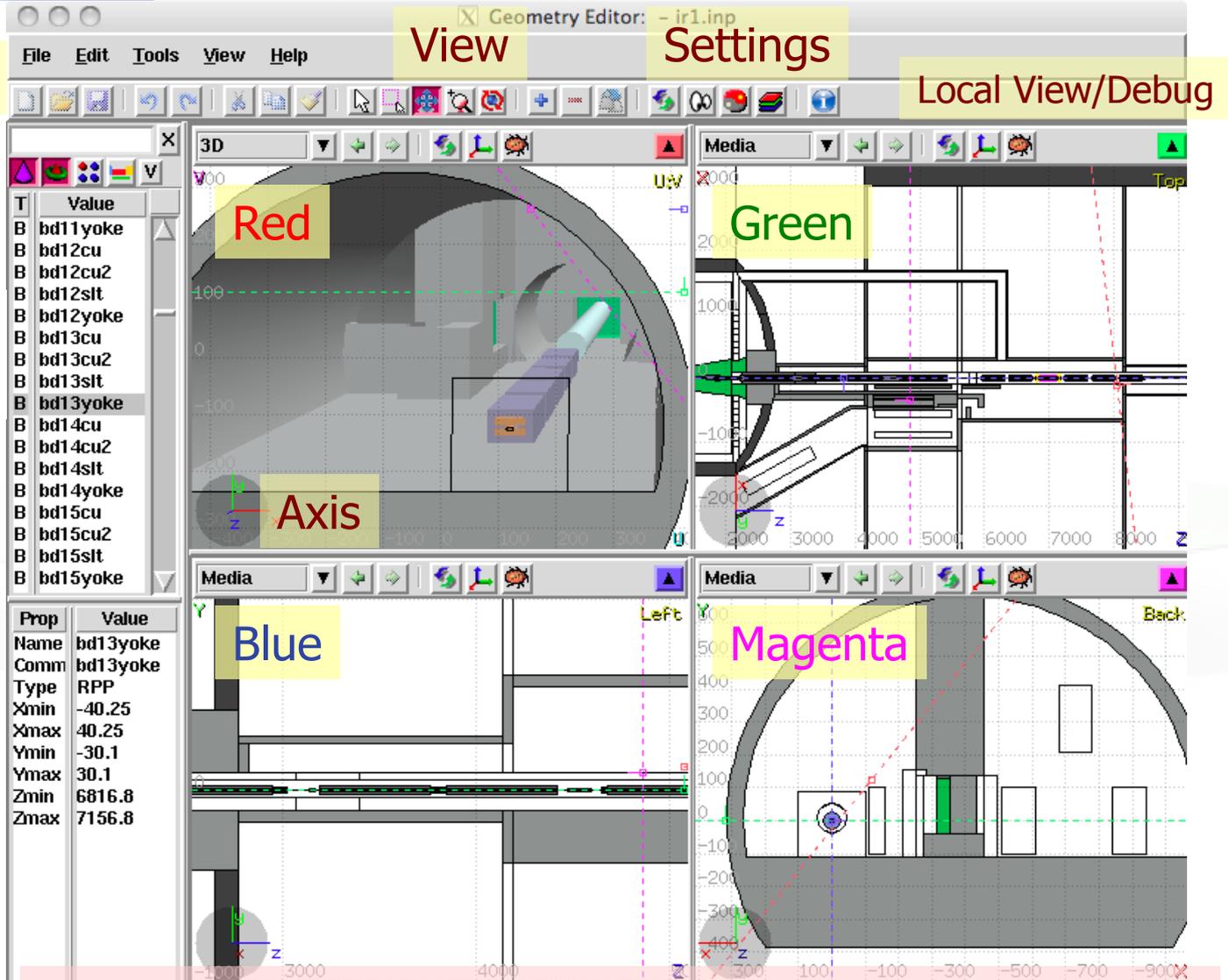
Geometry Editor: Interface

Tools

Filter

Filtered Objects

Properties



Automatically refreshes every time the input is changed

Some Basic Keyboard shortcuts [1/2]

Modifiers:

- **Ctrl** "controls" or changes the action
- **Shift** aligns to grid
- **Escape** cancels the active action
- **Spacebar** pop-up menu

Navigation:

- **[Arrows]** move viewport
- **Ctrl + [Arrows]** rotate viewport around **u,v** axes
- **Page Up/ Page Down** move viewport front/back
- **Ctrl + PgUp/PgDn** rotate viewport around **w** axis
- **= / -** zoom in/ zoom out
- **0** zoom in/ zoom out
- **1 / 2** set viewport to **front / back** view
- **3 / 4** set viewport to **left / right** view
- **5 / 6** set viewport to **top / bottom** view
- **o** open projection dialog

Some Basic Keyboard shortcuts [2/2]

Selection:

- a, Ctrl-a / A, Ctrl-A select/unselect all bodies
- s, S single/area selection mode
- e, Ctrl-E toggle edit mode of regions
- v toggle visibility of objects
- l toggle selection locking of objects

Insert:

- Insert, Ctrl-Enter insert menu
- b add a new body
- R add a new region
- O add a new point

Standard keys:

- Ctrl-x, Ctrl-c, Ctrl-v, Ctrl-d std cut, copy, paste, duplicate
- Ctrl-z, Ctrl-y, Ctrl-Z std undo, redo
- Delete std delete body, region, object

Most of the action keys are located on the left side of the keyboard

Mouse actions

Mouse:

- **Left** button: User selectable action from the tools
- **Middle** button (or Left+Right if 3rd-button emulation is enabled):
 - alone Pan/Move viewport
 - **Shift** select rectangle region and zoom into
 - **Shift-Middle-Ctrl** select rectangle region and zoom out
 - **Ctrl** rotate projection using a virtual trackball
 - **Ctrl-Middle-Shift** rotate projection using a virtual trackball with steps of 15 degrees
- **Right** button pop-up menu
- **Wheel** (if any) zoom in/zoom out
 - **Ctrl-Wheel** pan/move forward or backward



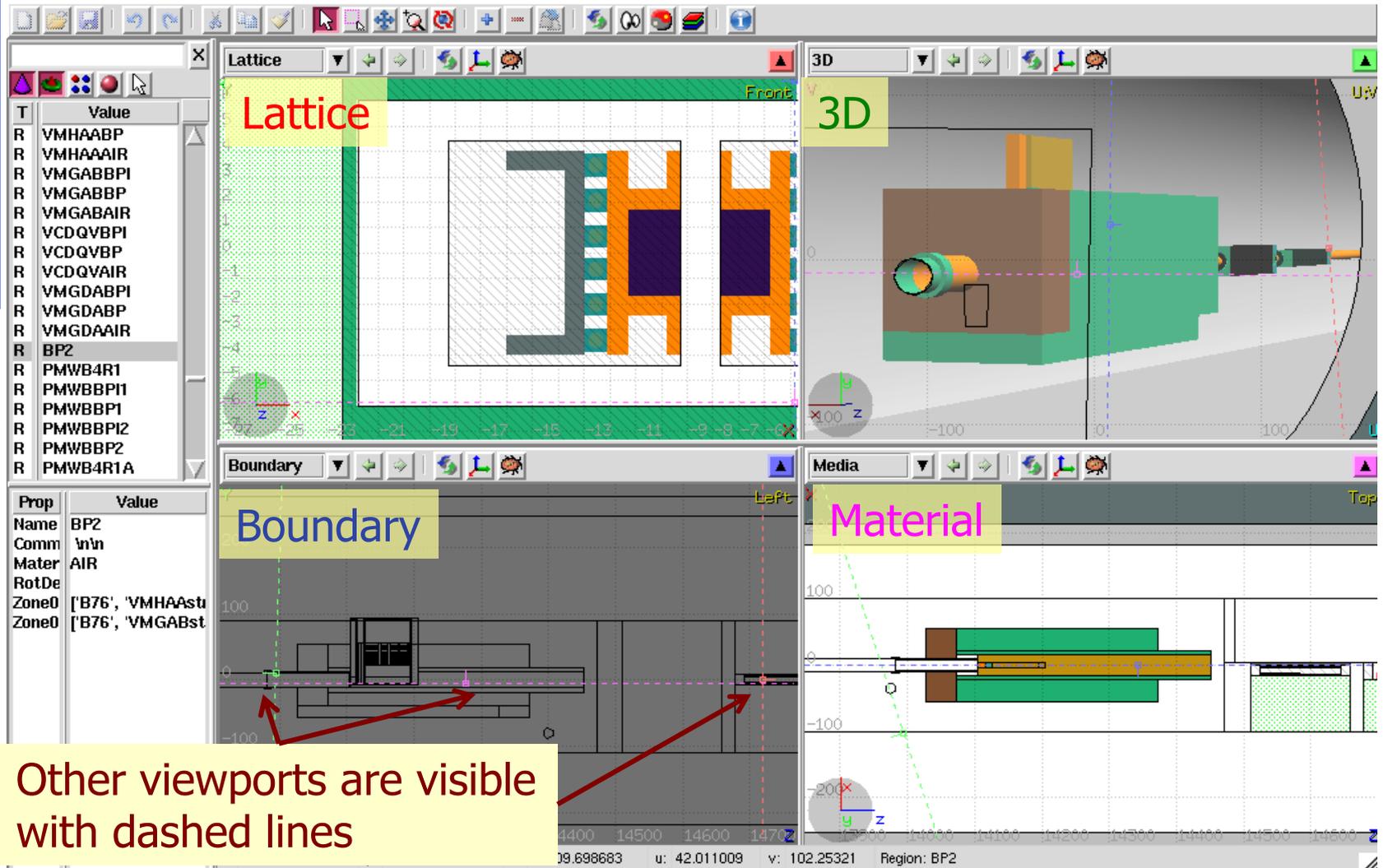
When laptop mode is enabled in the Preferences then the middle and right buttons are swapped

Toolbar and keyboard shortcuts

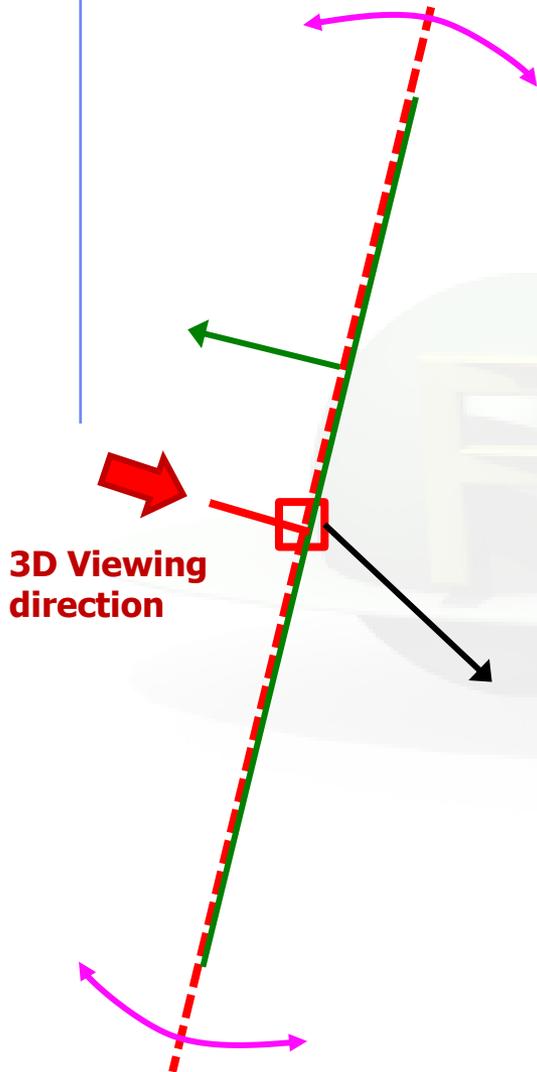
	function	key	
	Select	s	bodies, regions or modify viewports
	Region select	Shift + S	Select the bodies in a certain region
	Pan	x	Move viewport
	Zoom In/Out	z	Draw area to zoom In (Ctrl to zoom out)
		Shift-Z	Zoom viewport on selected items
	Rotate	t	Rotate viewport
	Define zone	d	Define and add zone
	Add	Ins	Insert new body/region or object
	Delete	Del	Delete selected items
	Refresh	Ctrl + r	Refresh all viewport
	Draw type		Change the draw type in all viewports
	Toggle visibility	v	Toggle the visibility of bodies and objects
	Layers	Ctrl + L	Configure the view mode (Layers)
	Axis	o	Origin and projection setup
	Errors	Ctrl-g	Show error in geometry

The Viewports

4 predefined geometry Layers: **Boundary**, **Media**, **Lattice** and **3D**



Navigation [1/3]



Description:

- Dashed lines represent viewports (the intersection of other viewports with the current one);
- Center is represented with a square;
- Viewing direction is indicated by a short line;
- When the other-viewport is outside the view window, the viewport-line will be displayed on the closest edge;

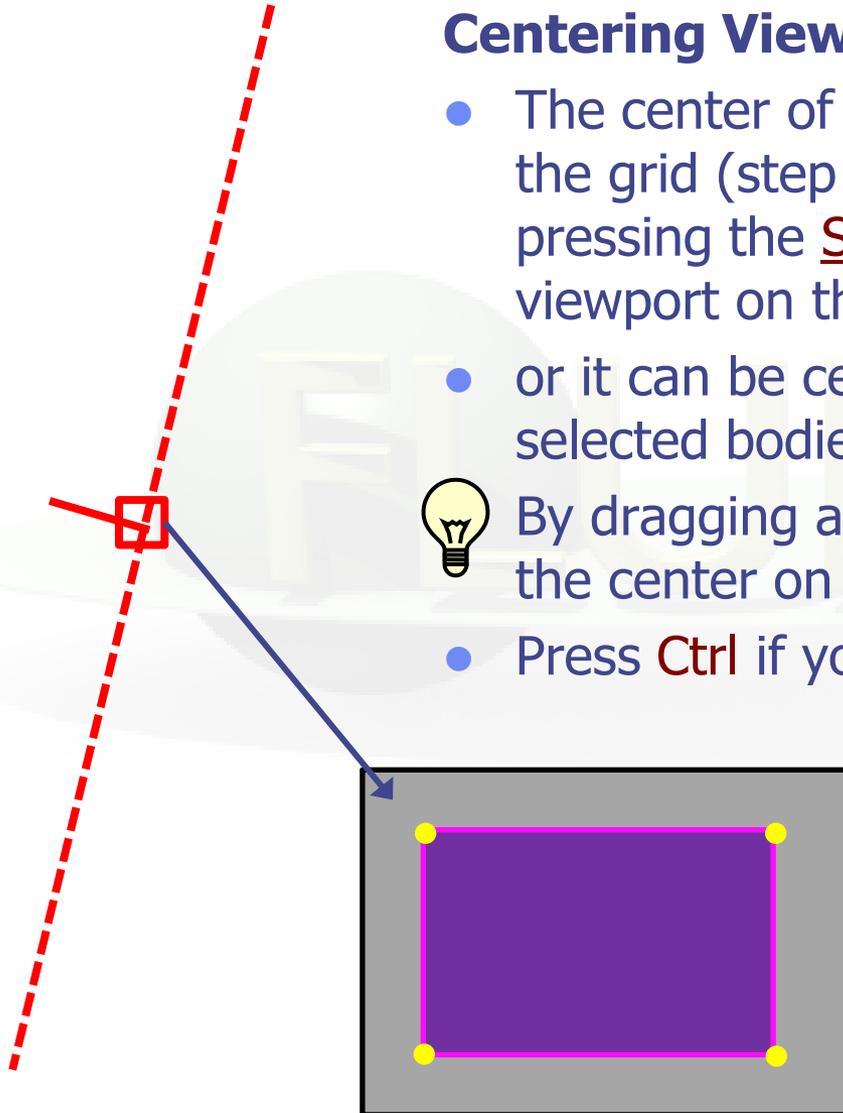
Actions: Select  + left mouse button

- Drag the center square to reposition the viewport
- Drag the line close to the center to reposition the viewport along the vertical **w** axis
- Drag the extremities of the viewport-line to rotate the viewport

Navigation [2/3]

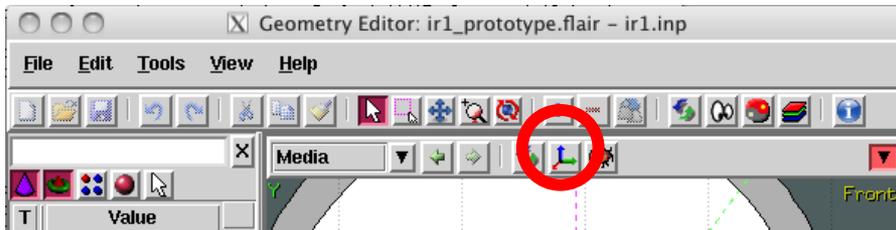
Centering Viewports

- The center of the viewport can be aligned to the grid (step of 1/10 of the main grid) by pressing the **Shift** key while dragging the viewport on the screen;
- or it can be centered on the vertices of the selected bodies;
-  By dragging a viewport center it always moves the center on the current viewing plane.
- Press **Ctrl** if you want to have a relative move



Navigation [3/3]

With the projection [o] button you can change, move, shift, rotate, save and reload the origin and projection of a viewport



Set the origin of the viewport

Origin	Move	Basis	Euler	Rotate
x: 0				
y: 0				
z: 13000				
<input type="button" value="Ok"/> <input type="button" value="Apply"/> <input type="button" value="Cancel"/>				

Rotate around the Cartesian axis

Origin	Move	Basis	Euler	Rotate
Rx: 0				
Ry: -0				
Rz: 0				
<input type="button" value="Ok"/> <input type="button" value="Apply"/> <input type="button" value="Cancel"/>				

Shift the coordinate system

Origin	Move	Basis	Euler	Rotate
Δu :				
Δv :				
Δw :				
<input type="button" value="Ok"/> <input type="button" value="Apply"/> <input type="button" value="Cancel"/>				

Change the reference axis

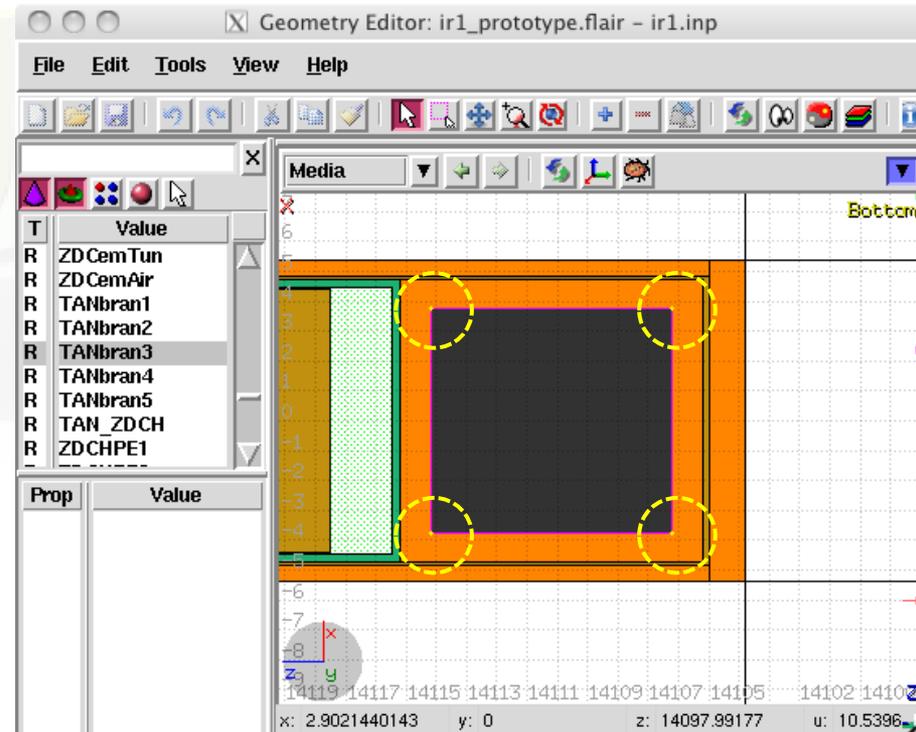
Origin	Move	Basis	Euler	Rotate
u: 1.0	0.0		0.0	
v: 0.0	1.0		0.0	
x-y	x-z	y-z	swap	-u -v norm
<input type="button" value="Ok"/> <input type="button" value="Apply"/> <input type="button" value="Cancel"/>				

Rotate around the (u,v,w) axis

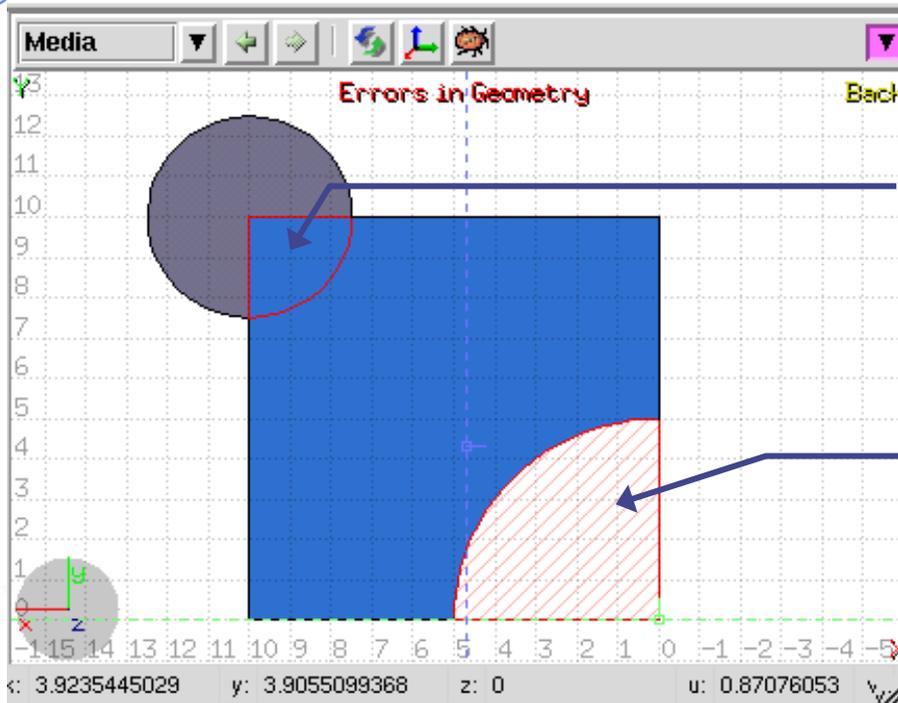
Origin	Move	Basis	Euler	Rotate
Ru:				
Rv:				
Rw:				
<input type="button" value="Ok"/> <input type="button" value="Apply"/> <input type="button" value="Cancel"/>				

Object selection

- Objects can be selected from the Object List box on the left or graphically by the action [s]  + **left mouse button** on the viewport or on the object list in the left bar;
- Multiple bodies/regions can be **selected (or unselected)** by pressing the **Ctrl** key while clicking with the mouse;
- Using **Shift+left mouse button** you can drag an area and all intersected bodies will be selected
- Bodies and regions can be selected at the same time;
- The selected bodies are:
 - outlined in **magenta** and **yellow** dots appear on their vertices (viewports) ;
 - highlighted also into the object list in the left bar;
- The selected regions are shaded.



Debugging Geometry Errors [1/2]



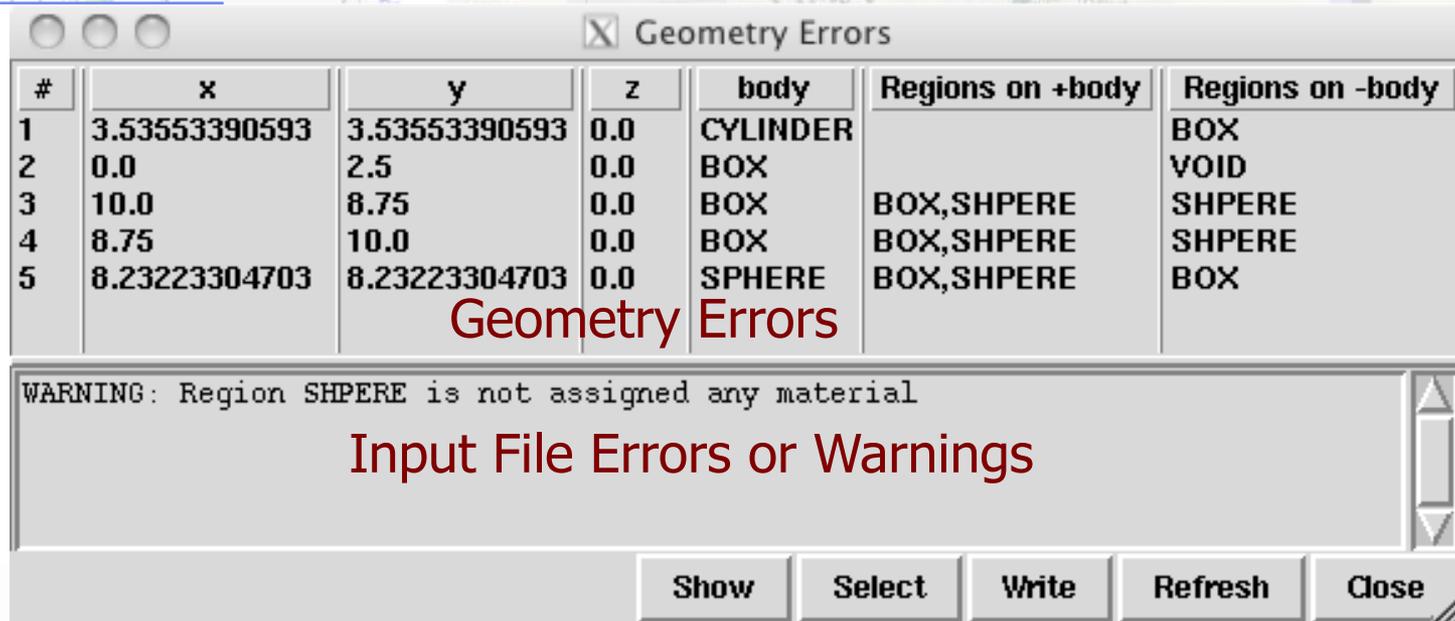
Overlapping regions

Missing region definition

Errors in Geometry notifies that are errors in the geometry:

- The areas affected by the errors are outlined with a **Red** stroke:
 - Areas filled with a full color correspond to overlapping regions;
 - Areas filled with red line correspond to a missing region definition;
- Clicking the  icon displays the dialog with the errors.
- Touching surfaces are checked against 10 significant digits
- Non-strictly geometrical errors (i.e. missing Material Assignment to a region, non recognized cards) are also notified;

Debugging Geometry Errors [2/2]



The screenshot shows a window titled 'Geometry Errors' with a table of error data and a warning message below it.

#	x	y	z	body	Regions on +body	Regions on -body
1	3.53553390593	3.53553390593	0.0	CYLINDER		BOX
2	0.0	2.5	0.0	BOX		VOID
3	10.0	8.75	0.0	BOX	BOX,SHPERE	SHPERE
4	8.75	10.0	0.0	BOX	BOX,SHPERE	SHPERE
5	8.23223304703	8.23223304703	0.0	SPHERE	BOX,SHPERE	BOX

WARNING: Region SHPERE is not assigned any material

Buttons: Show, Select, Write, Refresh, Close

Geometry Errors

Input File Errors or Warnings

- x, y, z** Coordinates of the error (on the surface of **body**)
- body** Body with the **x,y,z** point on surface generating the error
- +body** Regions that are on the **+** side of the **body**.
Regions where the body should be **subtracted** to remove the error
- body** Regions that are on the **-** side of the **body**.
Regions that the **body** should be **intersected** to remove the error
- +/-** are defined according to the normal on the surface, **+** refers to outside, **-** to inside

Bodies Editing

- Add a body: **Right-Click**, or **[b]** or **Ins** or **Ctrl-Enter**
- Body-lines (default) are **ONLY** visible when they appear in the boundaries of regions. Otherwise they will not show.
- To display the bodies either you have to select them from the object listbox
- To permanently toggle their visibility click on **[v]** or **Right-Click → Visibility → Set**
- Renaming a body will automatically rename any reference to it without asking the user



For the moment bodies cannot be edited graphically

Region Editing

- Add a region: **Right-Click** or [R] or **Ins** or **Ctrl-Enter**
- After adding a region the **"Edit"** mode is automatically turned on:
- **Edit mode:**
 - Locks the current object for editing
 - Selecting any other object will not deselect the editing object
- When changing the material or transformation of a region flair will automatically add the appropriate **ASSIGNMAT** and/or **LATTICE** cards
- However deleting a region will not delete the associated **ASSIGNMAT** and/or **LATTICE** cards
- Renaming a region will automatically rename any reference to it without asking the user

Zone editing [1/2]

With the keyboard:

- **Add:** Enter an expression in the "+zone" field
- **Modify:** Select the zone to modify and alter with the keyboard the zone expression
- **Delete:** Select the zone and then **Right-Click**→**Delete** or hit the **Del** key **INSIDE** the Property Listbox!

Zone: is a subregion expressed in terms of + and – only

e.g. REGION +a +b | +c –d

contains three zones

zone01: +a +b

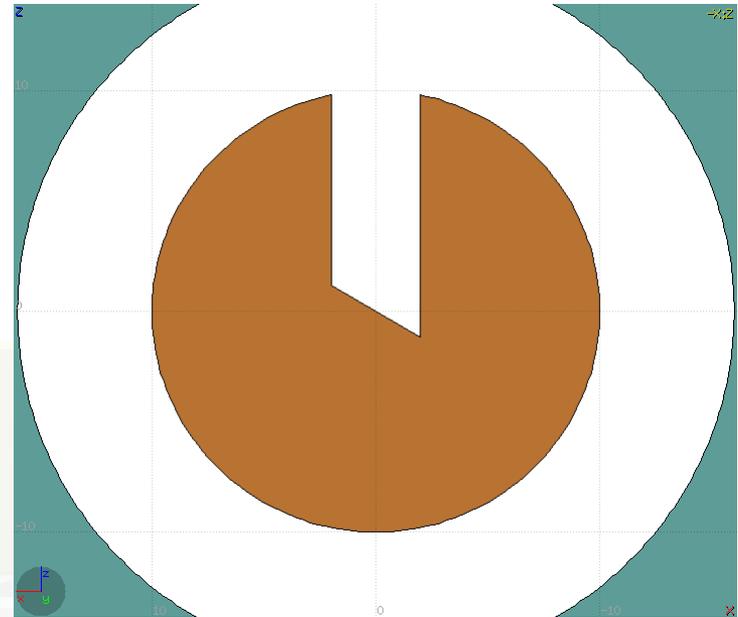
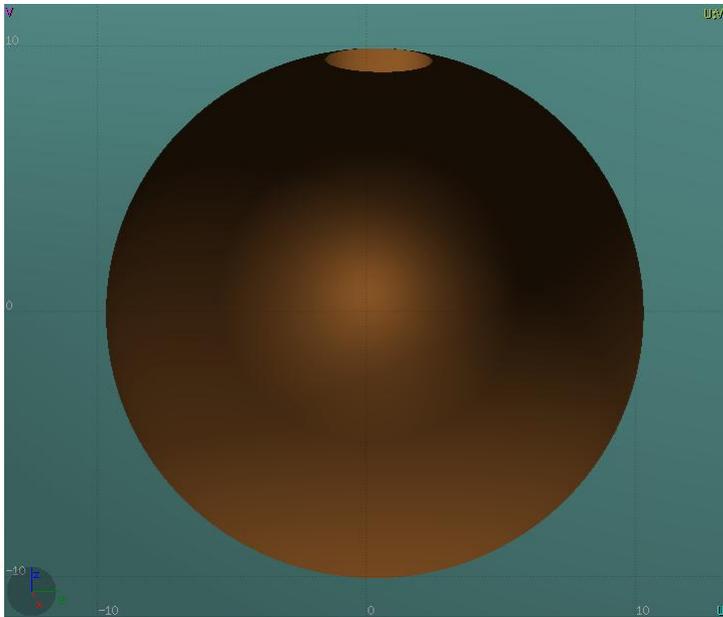
zone02: +c –d

Zone editing [2/2]

Graphically: *Only when the Edit mode is enabled*

- **Add** a new zone:
 - Verify that there is no zone selected in the property listbox. If there is any hit **Escape** to unselect them
 - Select the bodies you want to involve in the zone expression
 - Click on  or by [D] or Right-Click→Define Zone
 - Click with the mouse in one of the viewports a point that should belong to the wished zone
 - Automatically the zone expression will be created
- **Modify**:
 - Select the zone either on the property listbox or graphically in any viewport clicking a point that belongs to it
 - Automatically all bodies involved in the zone expression will be selected
 - With the zone selected, select or unselect additional bodies if needed
 - Then like in the “Add a new zone” click on “Define Zone” and click on point that belongs to it

Zone Editing: Example [1/7]

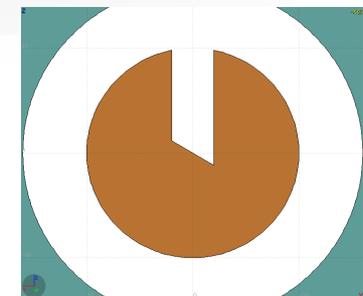
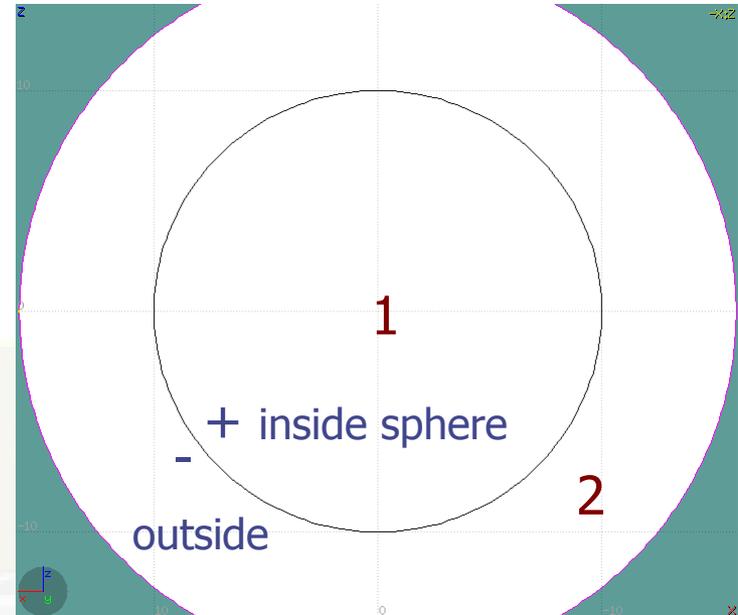


- In this example we will create a sphere with a cylindrical hole cut with a tilted plane (@ 30°)
- First we have to create all necessary bodies
 - sphere
 - infinite cylinder
 - tilted plane

Zone Editing: Example [2/7]

- Then we add a new REGION
Initially the region expression is empty
- Type-in the name and select the material
- Each body e.g. **sphere** divides the space into 2 zones
- Select the **sphere** and the projection of the sphere will appear
- The space is now divided into two zones:

1	+sphere	inside the sphere
2	-sphere	outside the sphere

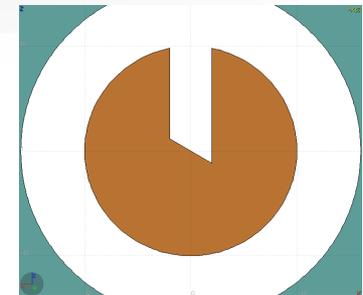
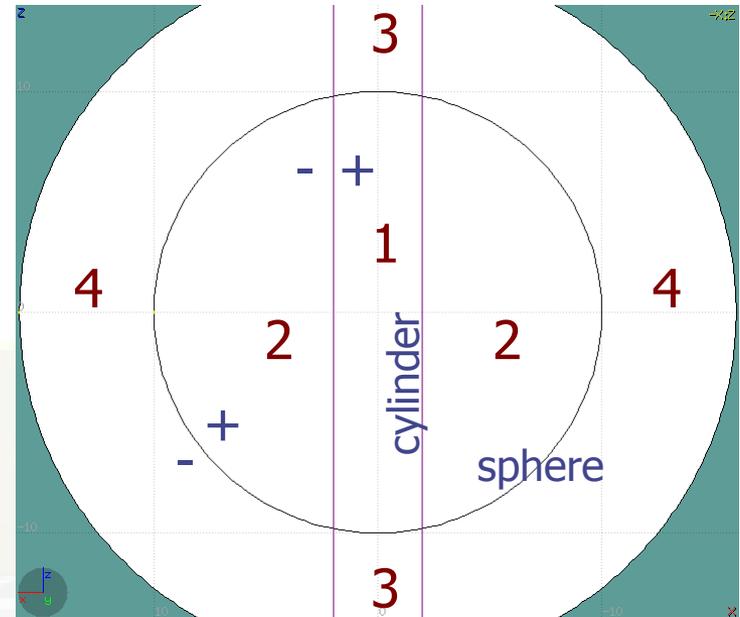


Reference image

Zone Editing: Example [3/7]

- Add to the selection the infinite **cylinder** with Ctrl + Left mouse click
- Now we have divided the space into 4 zones

- | | | |
|---|----------|------------|
| 1 | +sphere | +cylinder |
| 2 | +sphere | - cylinder |
| 3 | - sphere | +cylinder |
| 4 | - sphere | - cylinder |



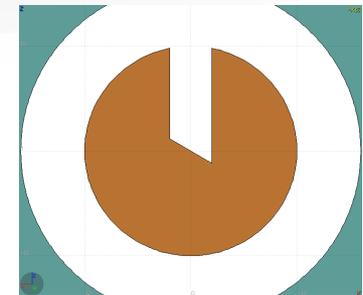
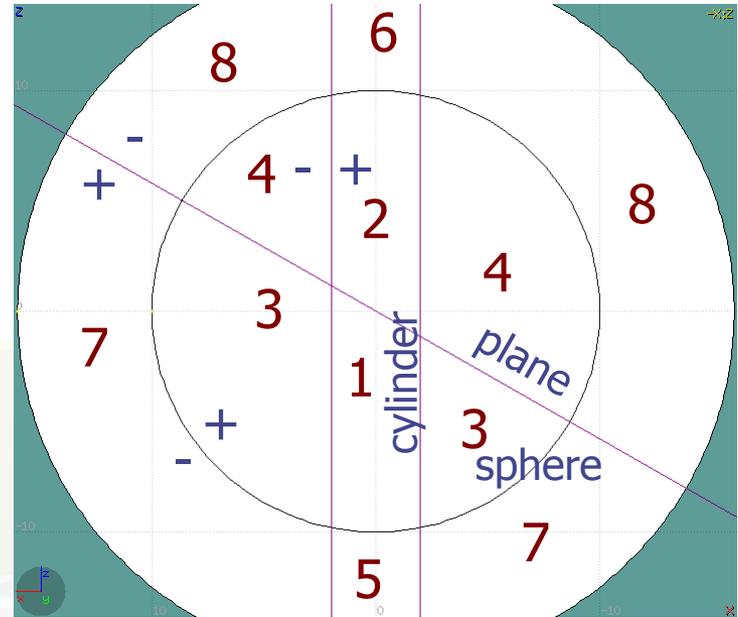
Reference image

Zone Editing: Example [4/7]

- Add to the selection the tilted plane.
- Now we have divided the space into 8 zones

- | | | | |
|---|----------|------------|---------|
| 1 | +sphere | +cylinder | +plane |
| 2 | +sphere | +cylinder | - plane |
| 3 | +sphere | - cylinder | +plane |
| 4 | +sphere | - cylinder | - plane |
| 5 | - sphere | +cylinder | +plane |
| 6 | - sphere | +cylinder | - plane |
| 7 | - sphere | - cylinder | +plane |
| 8 | - sphere | - cylinder | - plane |

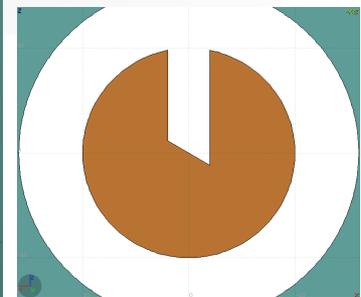
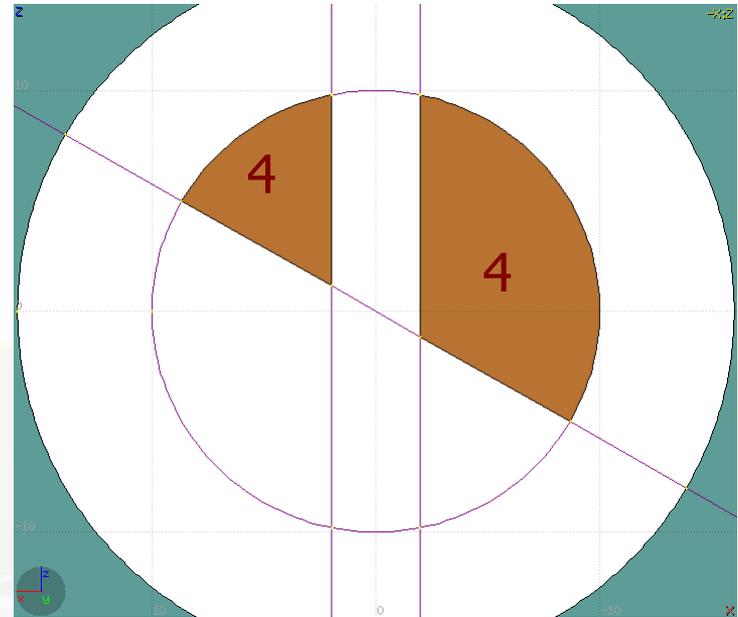
Number of valid zones $\leq 2^{\text{bodies}}$



Reference image

Zone Editing: Example [5/7]

- Enable the action "Define Zone" with the key [d] or 
- Point and click with the mouse somewhere inside zone 4
- Automatically the zone expression
+sphere -cylinder -plane
will be added to the REGION

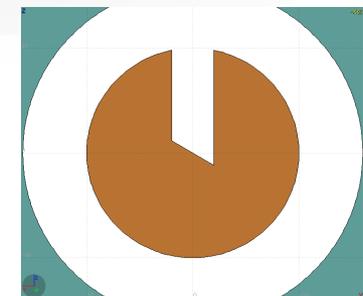
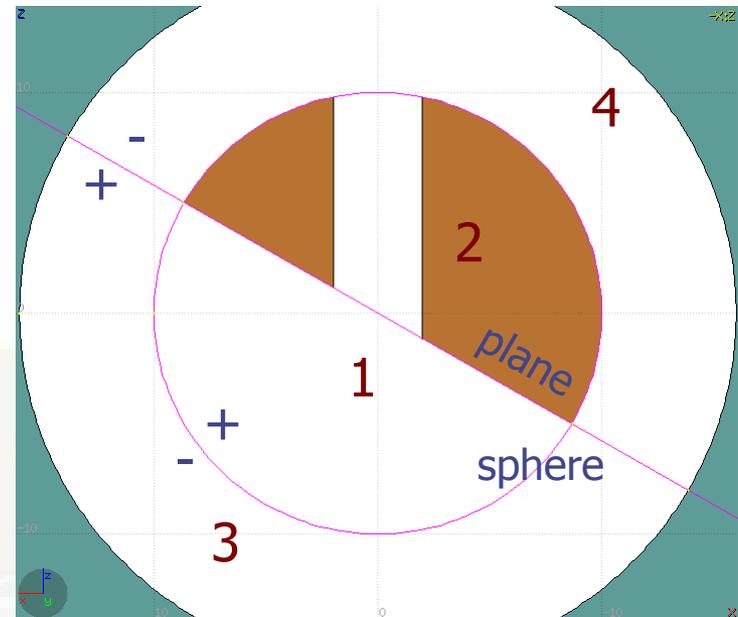


Reference image

Zone Editing: Example [6/7]

- Finally we have to add as second zone the lower half of the sphere.
- Select again only the **sphere** and **plane** (or by deselecting the cylinder)
- Now the space is divided into 4 regions

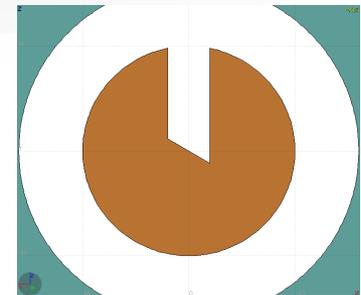
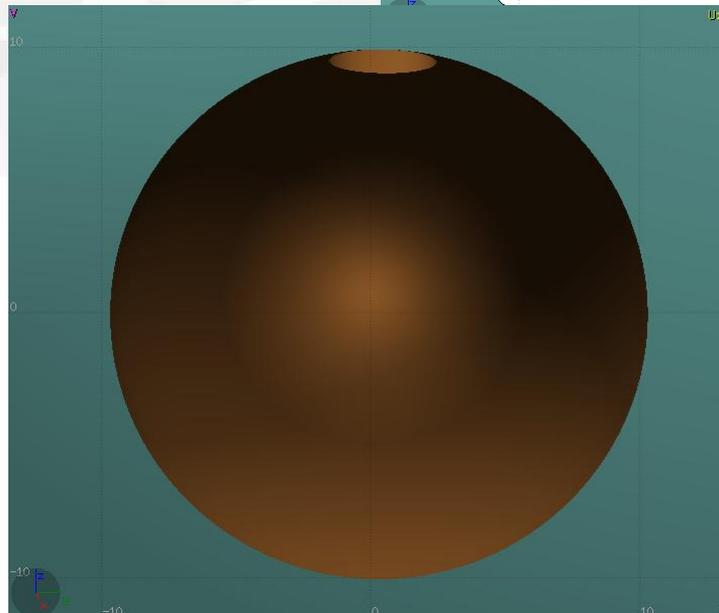
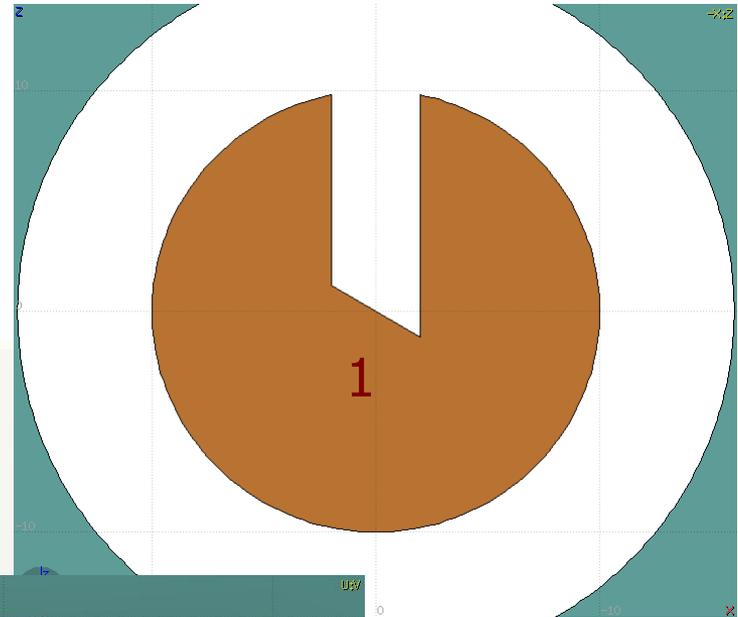
- | | | |
|---|----------|---------|
| 1 | +sphere | +plane |
| 2 | +sphere | - plane |
| 3 | - sphere | +plane |
| 4 | - sphere | - plane |



Reference image

Zone Editing: Example [7/7]

- Enable again the action "Define Zone" with the key [d] or 
- Point and click with the mouse somewhere inside zone 1
- Automatically the zone expression
+sphere +plane
will be appended to the REGION



Reference image

Region and Zone Editing

Remember the sequence:

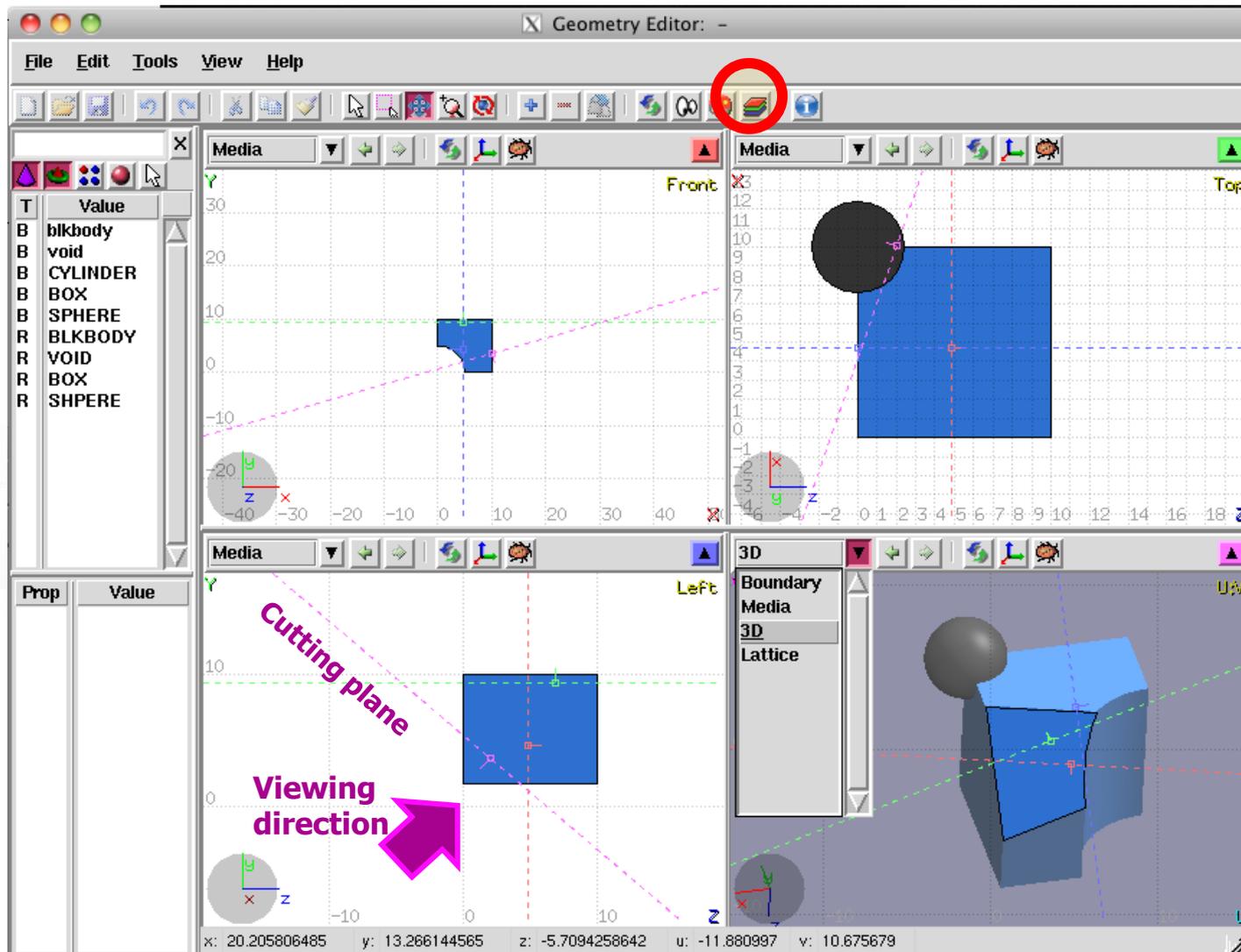
1. **Create** or **Select** the region to edit
2. Click on **Edit** button (or [e] or Double click) to **lock the edit mode**
3. Select a **zone to modify** or **none** to **add** a new one
4. **Select the bodies** that involve in the zone expression
5. Click on the **“Define Zone”** action [d] or [D]
6. **Click a point** that belongs to the wished zone
7. Repeat steps 3-7 as many times as required
8. Click on **Edit** or [e] to **stop the editing mode**

Escape will stop/unselect in the following order:

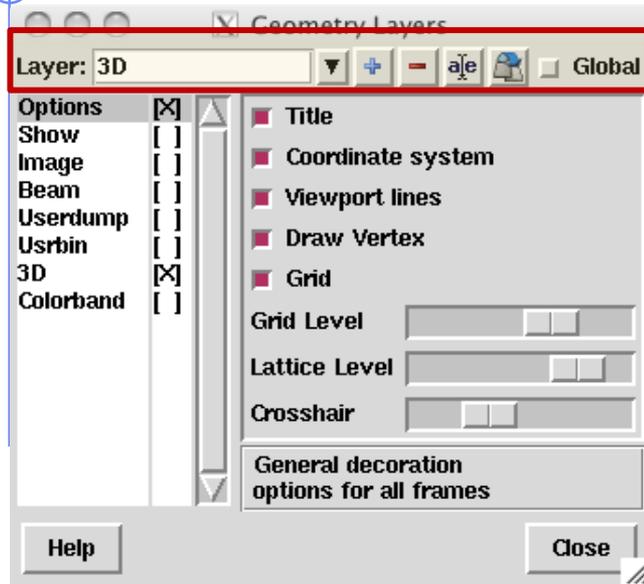
1. Stop the current action
2. Unselect the selected bodies
3. Unselect the selected zone

Geometry Layers [1/6]

Custom Layers can be specified in the "Configure Layer menu" ()



Geometry Layers [2/6]



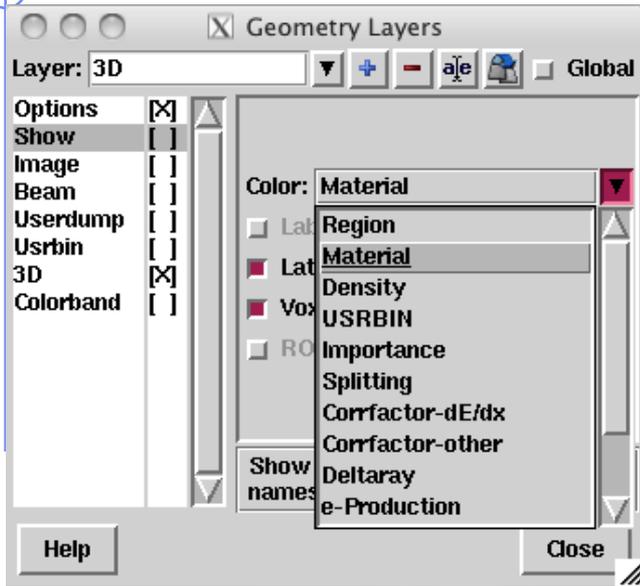
Toolbar:

- **Add/delete/rename/clone layers.**

Options:

- **Enable/Disable:** Title, Coordinate system, Viewport lines, Vertexes and Grid;
- **Adjust:**
 - **Grid level** (set gridline intensity);
 - **Lattice level** (set lattice hash line intensity);
 - **Crosshair** (dimension of the crosshair in the center of the project)

Geometry Layers [3/6]



Show:

- **Enable/Disable:** Lattice and Voxel;
- **Associate Region Colors to:**
 - Regions
 - Materials
 - Density
 - Importance Biasing
 - Splitting
 - Corrfactor
 - Deltaray
 - Thresholds
 - ...



Geometry Layers [4/6]

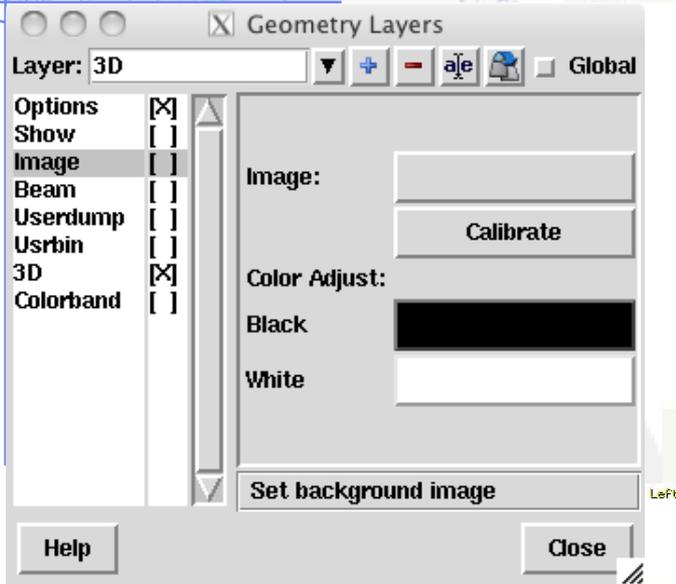
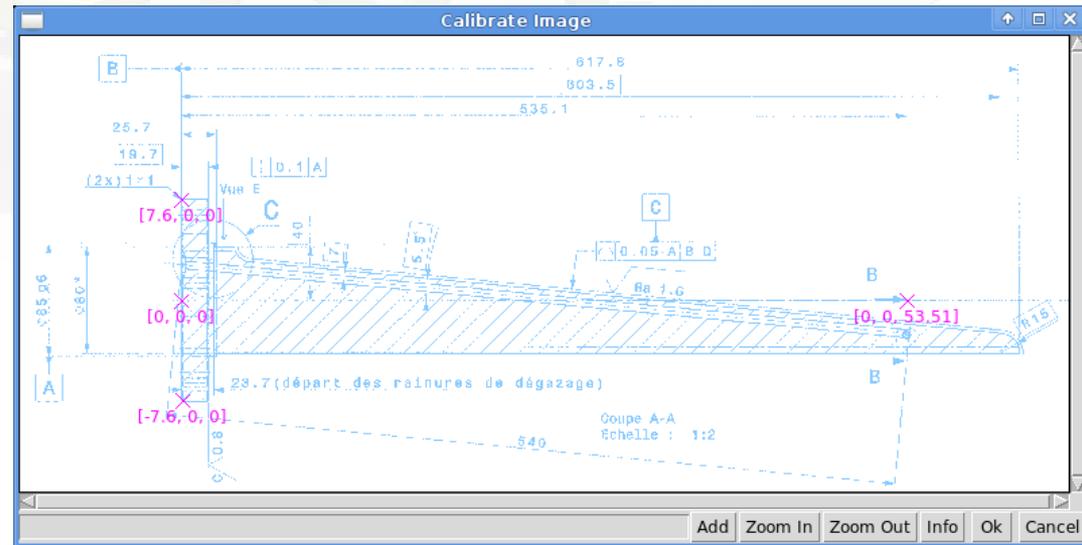
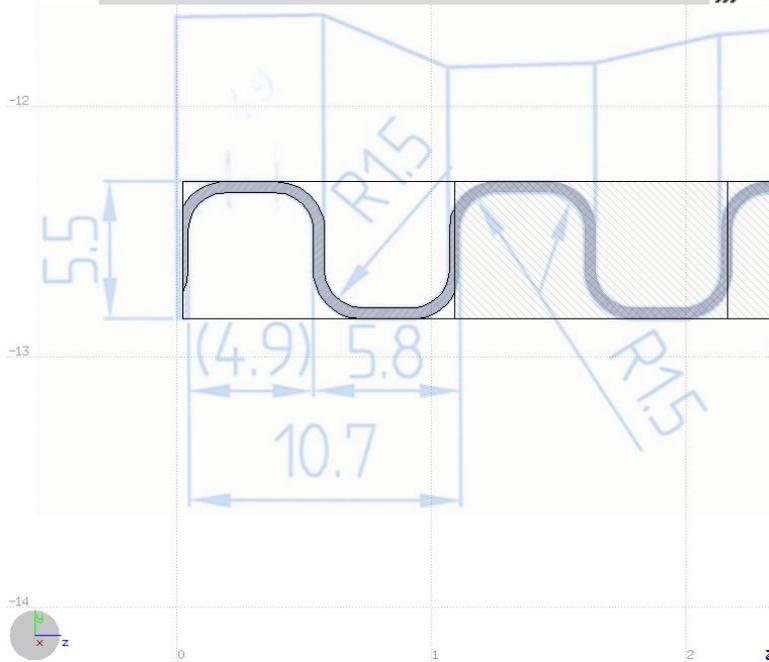
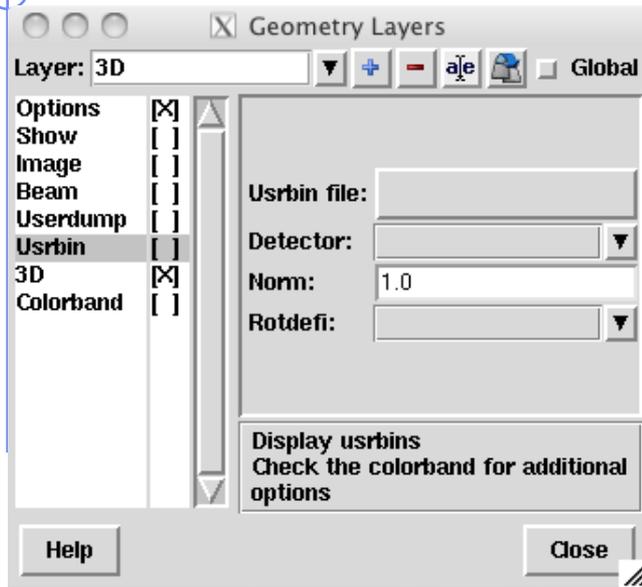


Image: set a background image to the geometry (i.e. a CAD-drawing);

- **Image**: load an image file (.png, .gif or .jpg);
- **Calibrate**: calibrate the image. Define a set of points (min. 3) on the image and specify their coordinate;
- **Transparency**: of the image
- **Color Adjust**: readjust the **black** and **white** colors of the loaded image.



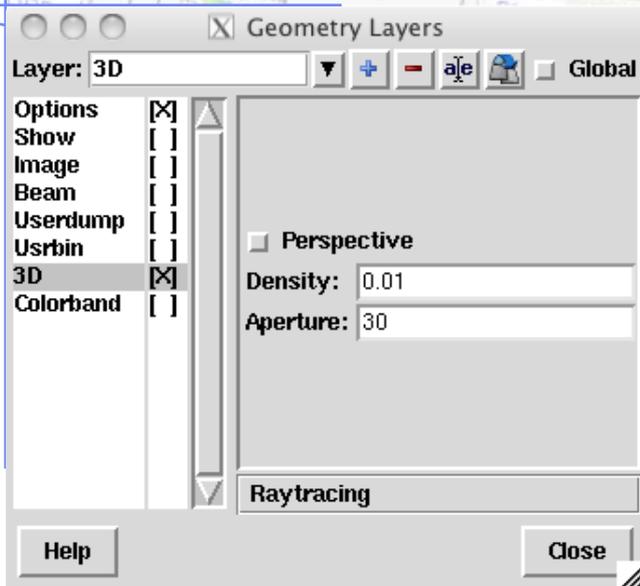
Geometry Layers [5/6]



USRBIN:

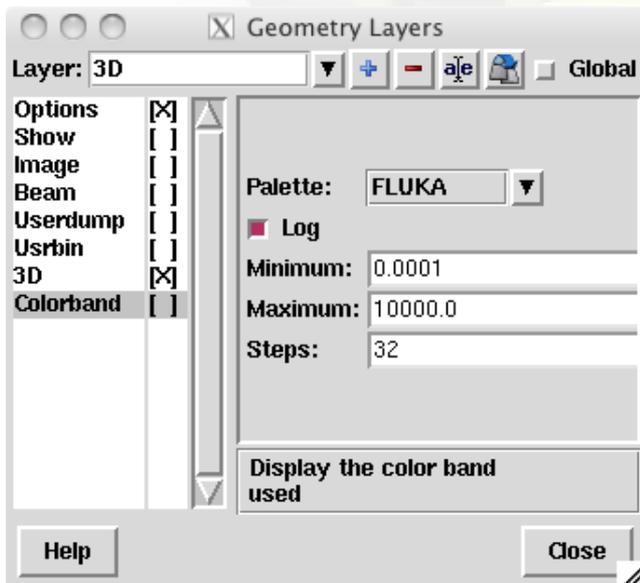
- Load **USRBIN file** (see SCORING lecture);
- Select a **detector** (or URSBIN) among the ones present in the file;
- **Normalization** constant;
- Associate a **ROT-DEFI** transformation;

Geometry Layers [6/6]



3D: enable 3D rendering

- **Enable/Disable Perspective**;
- Set transparency threshold **density**;
- Set camera **aperture** angle.



Colorband: enable/set color band properties

- Change the default color **Palette**;
- **Enable/Disable Log** scale;
- **Set: Maximum, Minimum** and color **steps**.