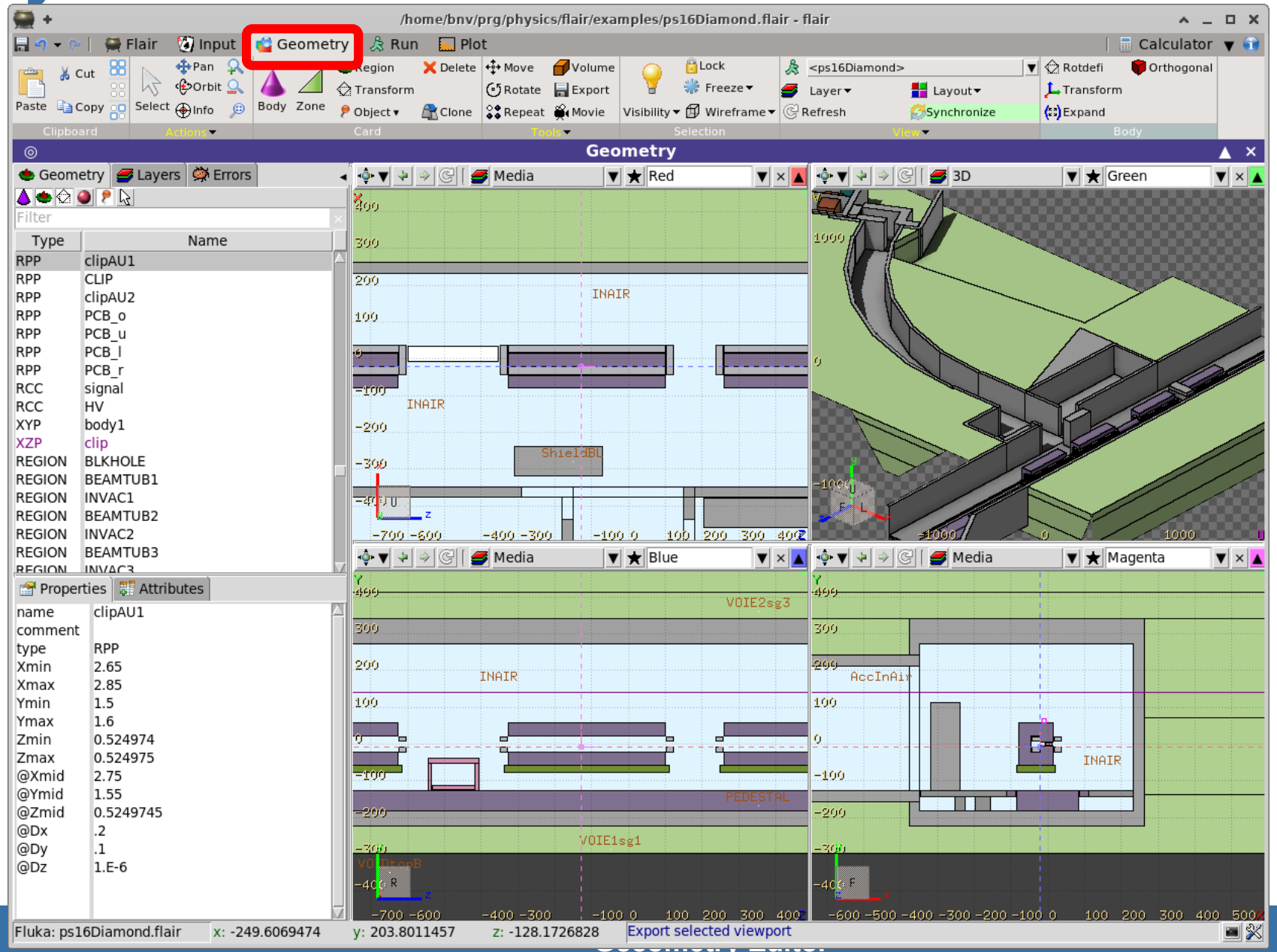
Flair Geometry Editor

Creating and editing graphically the FLUKA geometry

Geometry Editor

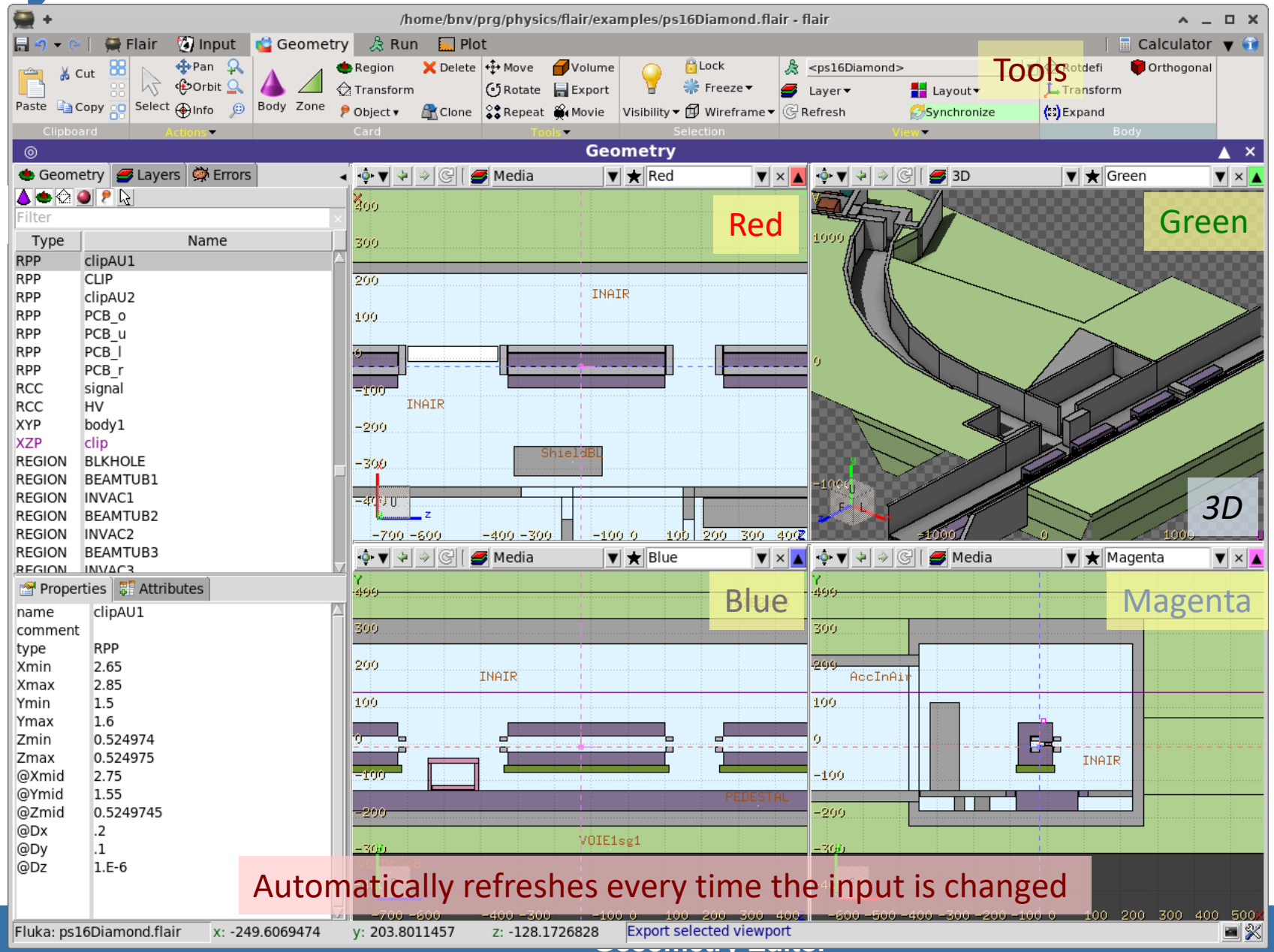


Geometry Editor

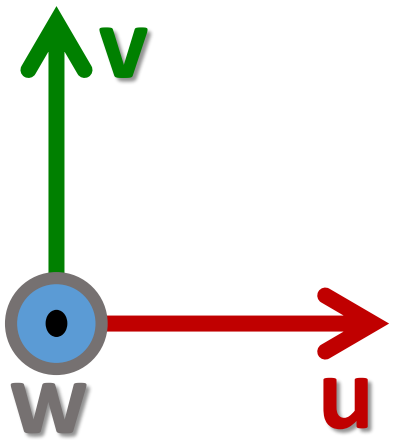
Filter

Filtered Objects

Properties & Attributes

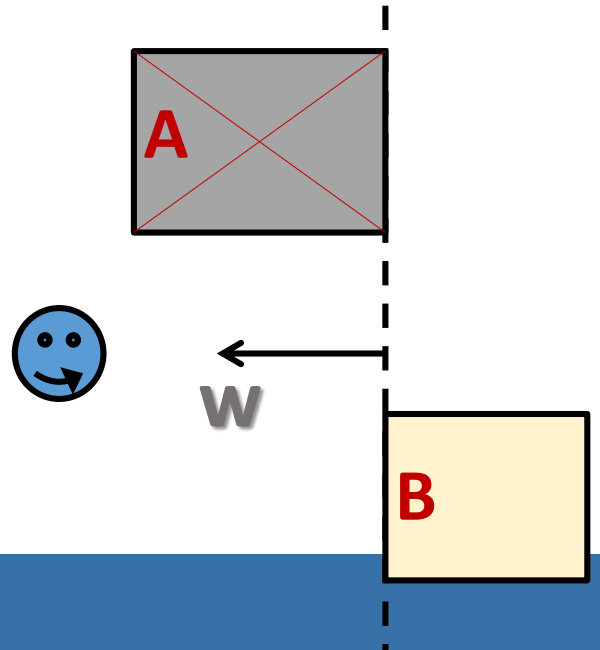


Viewport axes System



Each viewport is defined by:

- Origin — center of viewport
- Basis — relative axes system u, v, w. w is coming out of the screen towards the user
- Extends — zooming



Note:

- Each viewport is facing towards negative **–w**
- If bodies A, B are touching the viewport like on the plot.
- Only body B will be visible

Navigation - Keyboard

• [*arrows*]	pan viewport
• Ctrl + [*arrows*] + [Shift]	orbit viewport around **u,v** axes rotates by 90º
• Page Up/ Page Down	pan viewport front/back
• Ctrl + PgUp/PgDn	rotate viewport around **w** axis
• = / -	zoom in / zoom out
• o	open projection dialog to set the **o**rigin/basis/save/recall etc…
• Ctrl-0 (zero)	Center to origin
• C-1, C-2	**front [X:Y] / back [-X:Y]**
• C-3, C-4	**left [Z:Y] / right [-Z:Y]**
• C-5, C-6	**top [Z:X] / bottom [-Z:X]**

Assuming: *Z = direction of the beam (horizontal)*
X = horizontal
Y = vertical

Navigation – Mouse [1/2]

With the left mouse button:

1. Select the appropriate action pan/orbit/zoom with:
   I. Menu → Tools
   II. Toolbar
   III. Keyboard shortcut
2. Click and drag the desired viewport

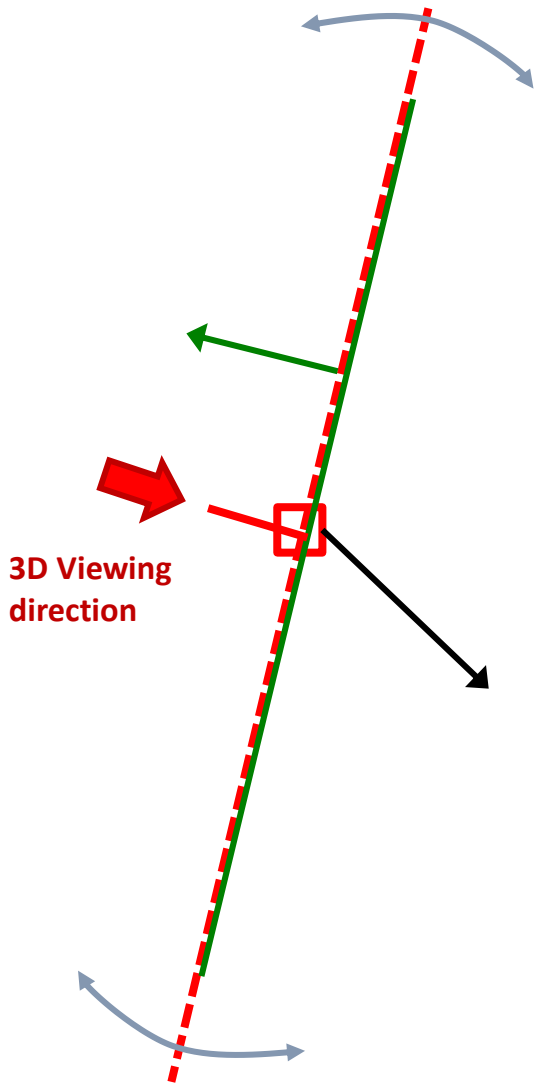
	function	key	description
	Pan	x	Pan viewport
	Orbit	t	Orbit viewport using a virtual **t**rackball
	Zoom	z	Drag area to **z**oom In ([**Ctrl**] to zoom out)
		Shift-Z	Zoom viewport on selected items
		Alt-Left	Go to previous in history projection
		Alt-Right	Go to next in history projection

Navigation – Mouse [2/2]

- With the middle mouse button
  - alone Pan/Move viewport
  - Ctrl orbit projection using a virtual trackball
  - Ctrl-Middle-Shift orbit projection using a virtual trackball with steps of 15 degrees
  - Shift select rectangle region and zoom into
  - Shift-Middle-Ctrl select rectangle region and zoom out
- Wheel (if any) zoom in/zoom out
  - Ctrl-Wheel pan/move forward or backward
  - Ctrl-Shift-Wheel smoother pan/move forward/backward
- With the right mouse button
  - alone opens popup menu
  - Shift pan/move viewport
  - Ctrl orbit projection using a virtual trackball

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

Navigation – Viewport lines [1/2]



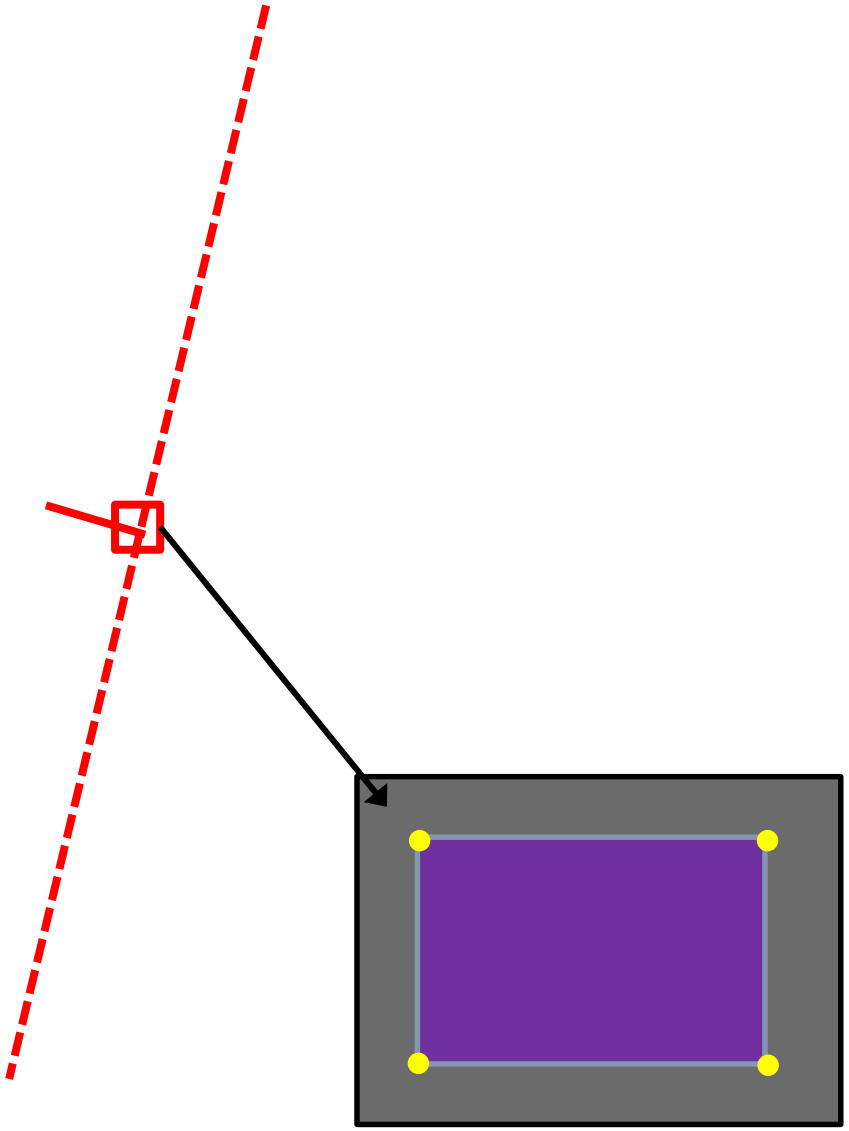
Description:

- Dashed lines represent other viewports (the intersection of other viewports with the current one);
- The center is represented with a square;
- Viewing direction **w** is indicated by a short line;
- When another 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 to rotate it

Navigation – Viewport lines [2/2]



Centering Viewports

- When snapping to grid is activated
- The center of the viewport will be aligned to the grid (step of 1/10 of the main grid)
- [Shift] key while toggle the snapping action;
- Alternative, 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.

Shortcut “**c**” centers all other viewports (except 3D) at the mouse pointer

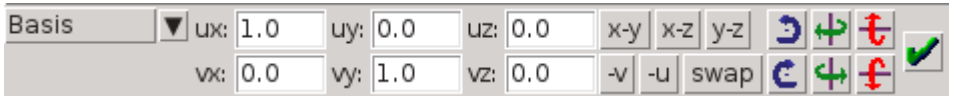
Navigation – Projection dialog

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

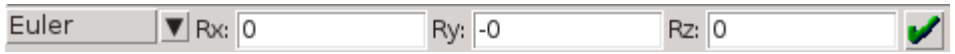
Shift the coordinate system

Set the **o**rigin of the viewport

Change the reference axis



Rotate around the Cartesian axis

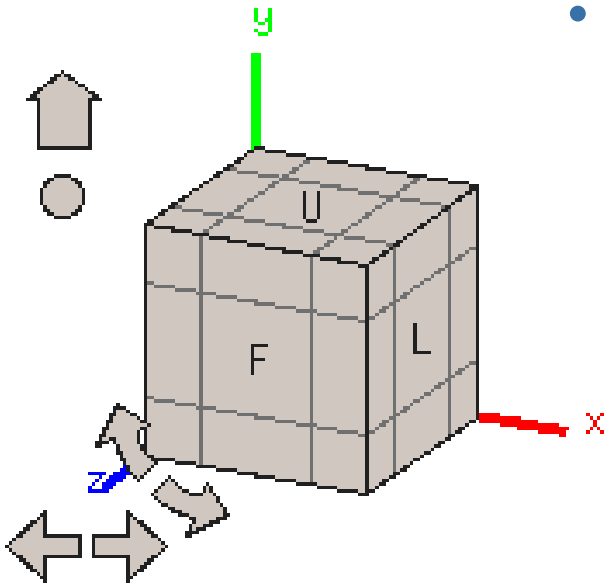


Shortcut: Ctrl + (1-6)

Add and Select Bookmark

Select Transformation

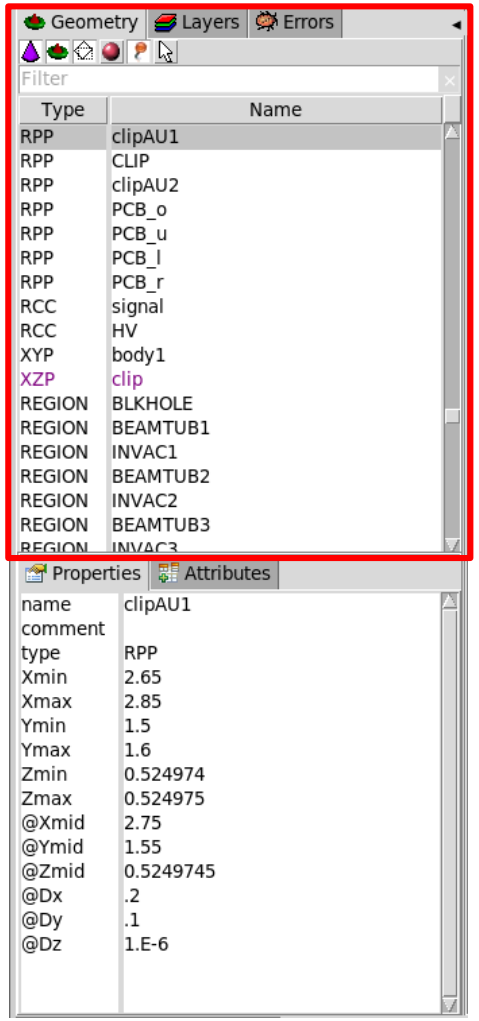
Navigation – Orientation Cube



- The orientation cube is the cube showing the axes system located on the bottom-left corner of each viewport
- Hovering the mouse over the cube, it will enlarge in size and show more detail waiting for mouse click commands

Name	Side description
Front	X-Y plane towards the positive Z
Back	X-Y plane towards the negative Z
Up	X-Z plane towards the positive Y
Down	X-Z plane towards the negative Y
Left	Y-Z plane towards the positive X
Right	Y-Z plane towards the negative Y

Listbox - Objects

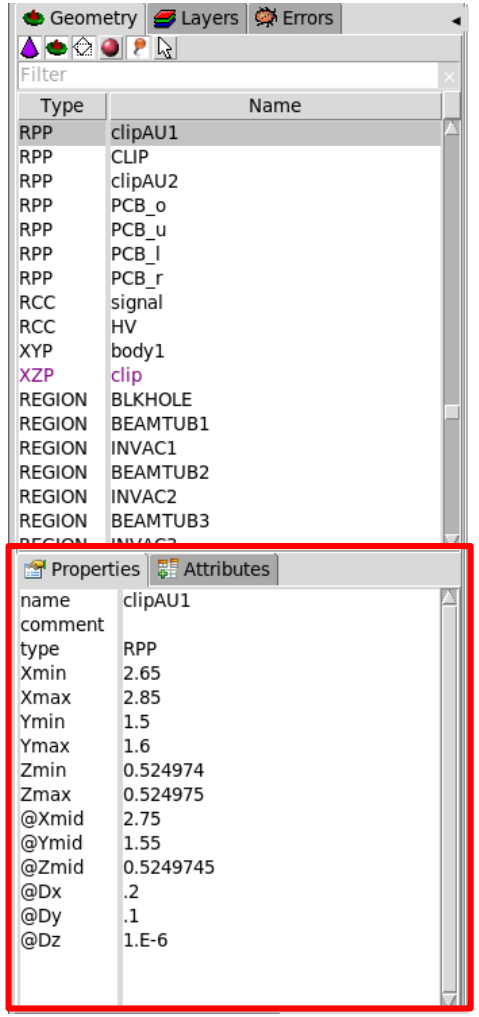


- Lists the type/name of bodies, regions, objects
- Text coloring:
  - RED Error in the card description
  - Magenta Visible body/object
  - Orange Selection locked
- Filtering text box can narrow the list with items containing the typed-in text

Buttons – on/off the display of

- Bodies
- Regions
- Transformations
- Materials
- Objects
- Selected or Visible items

Listbox – Properties / Attributes



Properties:

- Displays the common WHATs of the selected cards
- **REGION**:
  - If one **REGION** and Bodies are selected the **REGION** will stay visible
  - Additionally one can select the **MATERIAL** and automatically an **ASSIGNMAt** will be created/modified
    WARNING: Only if this region is not part of a range or inside an **#if..#endif**

Tips:

- [**Enter**] moves to the next field
- Typing multiple values splits them into many fields:
  e.g. x: **1 2 3** [**Enter**]
  will split it to x: 1, y: 2, z: 3

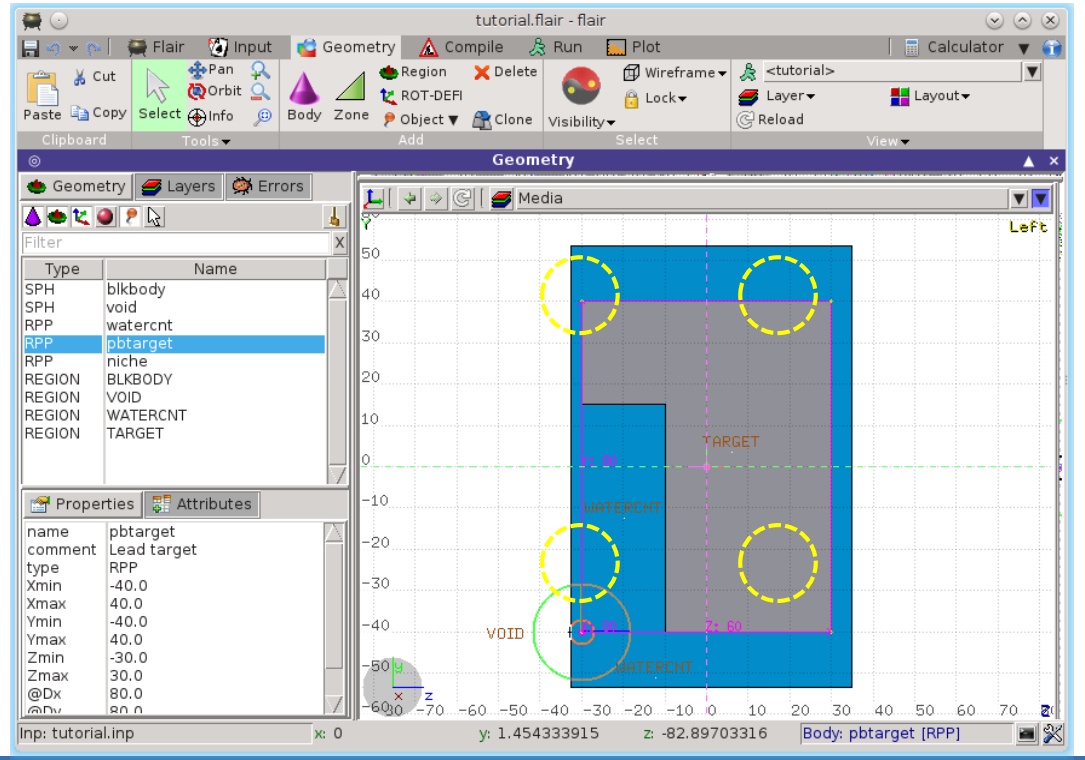
Attributes:

- Displays auxiliary information related to the card
- Bodies: Visibility, Selection Locking, Wireframe
- Regions: NAZ, Alpha(Transparency), **ROT-DEFI**…

Selection

- Objects/Bodies/Regions/Zones can be selected using:
  - Object and/or Properties list boxes
  - graphically with the action [**s**]  using the **left mouse button** on the viewport;
- [**Ctrl**] + left mouse button: allows to toggle the selection (select/unselect);
- Area selection: Click on the background and drag the mouse to draw a rectangle area. Everything inside the area will be selected.
  - The selected bodies are:
    - outlined in magenta
    - yellow dots appear on their vertices;
    - highlighted also into the object list in the left bar;
    - Their common properties & attributes will be displayed on the list boxes.
  - The selected regions are shaded;
  - The select zones are shaded with a hash pattern; To select a zone first you have to select the REGION

  [**ESC**ape] cancels the selection



Objects

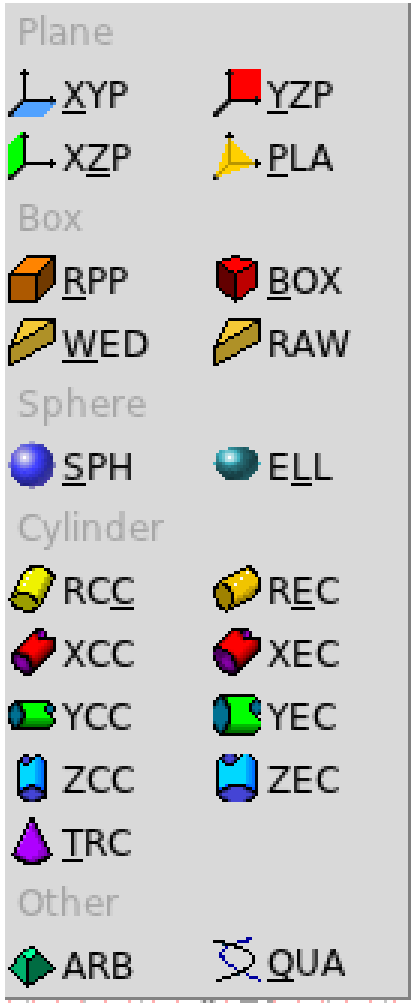
- Arrow
  - provide basic drawing/pointing means to the user
  - can be used as snapping points
- Camera
  - used for creating movies, assigning a viewport to follow the camera
  - The camera can be assigned to follow a spline path as a function of the “**frame**” variable
- Mesh
  - import a 3D STL mesh, used only for visualization for the moment.
  - There is an experimental code to convert it to bodies
- Point [**p**]
  - to be used as snapping points
  - provide help text to the user
  - automatically generated after image calibration
- Ruler simple or angle
  - to measure distances and angles
  - to project snapping points to a different location
  - to be used as snapping points
- Light
  - used for illuminating 3D renderings
- Spline
  - Create a Cardinal cubic time-spline path for a set of nodes, closed or open
  - Used to define the paths of moving objects (e.g. camera or light)

New Body

- Add a body: Right-Click, or [**b**] or [**Space**] or [**Ins**] Menus is organized in sub-categories
- [**B**] (capital) to repeat last add body
  - left-click on the wished location of the new body
  - keeping the left-button pressed drag to the location of the first extend of the body
  - release and continue with the next one…

Renaming a body will automatically rename any reference to it without asking the user

- All new bodies will use the same name prefix from the last body renaming
- [**n**]ame allows to fast edit the name of the object



New Body Mouse Steps

The default dimension/radius of all new bodies is one grid unit

XYP, ZXP, YZP: Viewport should not be parallel to body

Location

PLA: ⊥ viewport

Location → Second point belonging on the plane

RPP: symmetric around the w-axis

Location → Outer corner on the viewing plane

BOX: XY plane // viewport, Z vector = **-w**

Location → X-vector end → Move outer plane

WED: as in BOX

Location → X-vector → Y-vector (forced ⊥ X)

New Body Mouse Steps

RCC: Height will be lying on viewport

Location → Height → Radius

REC: Height will be lying on viewport

Location → Height → Radius-X [→ Radius-Y if viewport permits it]

XCC, YCC, ZCC

Location → Radius

XEC, YEC, ZEC: *be careful on the chosen viewport*

Location → Radius-X [→ Radius-Y if viewport permits it

TRC: Height will be lying on viewport

Location → Height → Apex radius → Base Radius

ARB: not possible for the moment

QUA: will generate a sphere at desired location

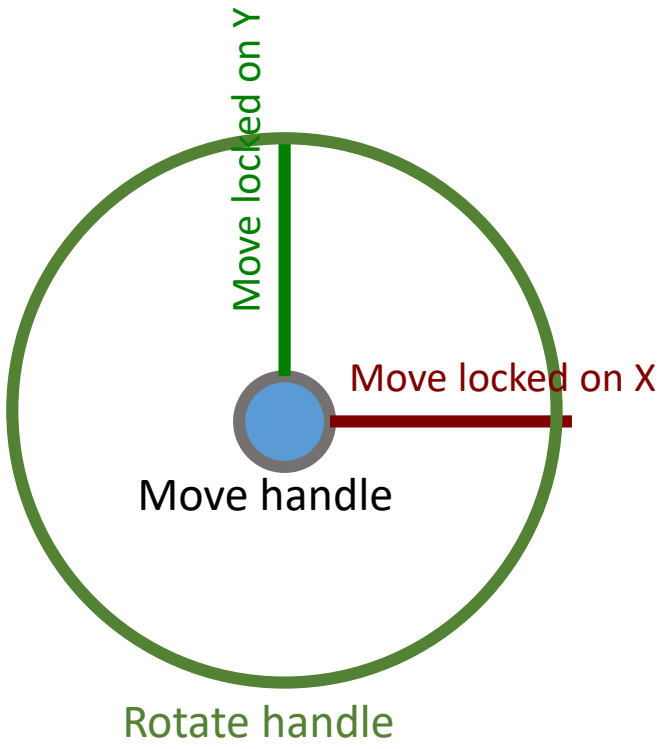
Location

Body Visibility

- Default: Body segments are only visible when they represent borders of REGIONs
- In order to make them visible (to be able to visually select them):
  - Select the body (from the list box, or from its visible segment) and

  Either
  - Go to the Attributes and click on Visible [X] check box
  - Right-click → Visibility → Set
  - Shortcut [**v**]
  - Icon on Toolbar
- Wireframe (experimental) display an approximate 3D wireframe of the bodies. Useful to select or visualize bodies that do not intersect the viewport
  - Go to the Attributes and click on Wireframe [X] check box
  - Right-click → Wireframe → Set
  - Shortcut [#]
  - Icon on Toolbar 

Body Editing



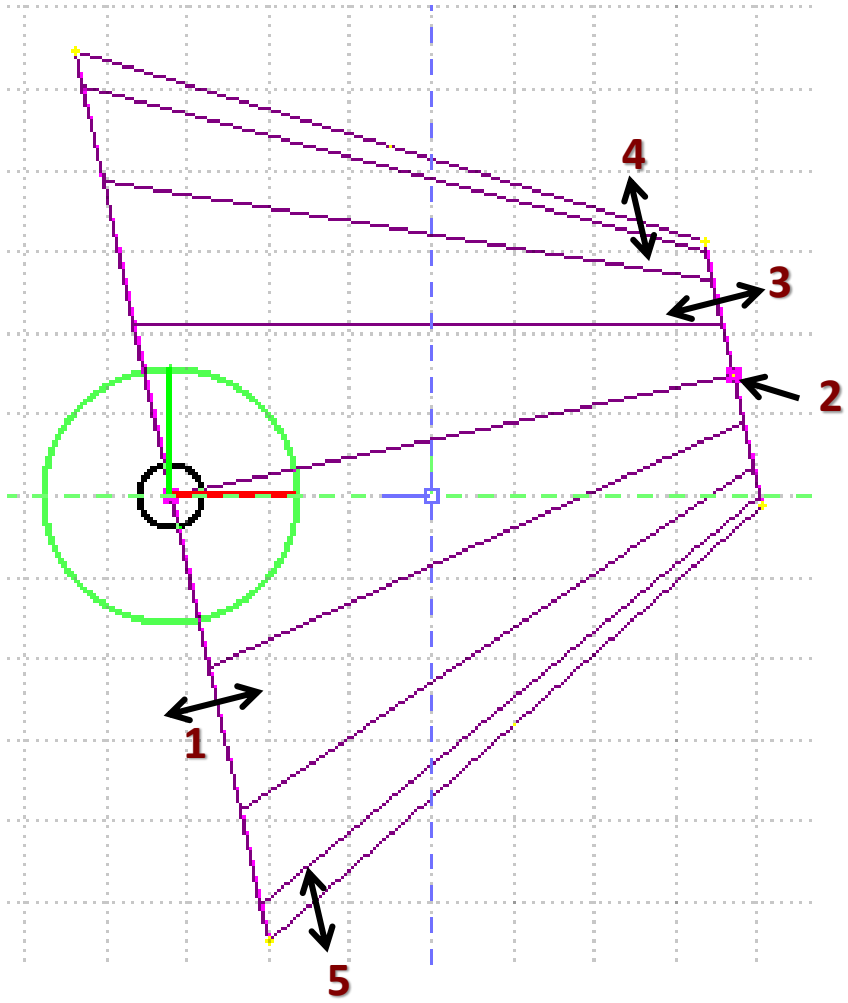
Text:

- Bodies can be edited by typing the correct coordinates in the Properties or in flair

Graphically:

- Select the body and the action handler(s) will be displayed
- Click with the mouse for a second time:
  - on the small circle to freely move [**g**]rab
  - on the large circle to rotate [**r**]otate around **w** axis
  - on the red/green/blue line to move but locked on X, Y or Z axis
  - Hitting [**x**], [**y**], [**z**] while moving a body toggles the locking on the axis
  - Typing the coordinates moves or resizes the objects
    e.g. 100 50 10
- Shift-Click the mouse to clone the body/object
  - Using /nnn or *nnn multiple clones can be generated divided or multiple of the distance specified
    e.g. /5 creates 5 clones in 1/5th of the distance

Body Editing



- When a body is selected and the action handlers are shown you can either click ‘n drag the handlers for moving, rotating, resizing the object:

TRC example, click `n drag:

1. On the base plane, to move it perpendicular ⊥ to height vector
2. On the small square handler on the apex plane, to freely move the height, axis or normal of body
   This handler appears only if it lies on the viewing plane
3. On the apex plane, to move it perpendicular to the height vector
4. On the conic surface close to the apex to resize the apex radius
5. On the conic surface close to the base to resize the base radius

Region Editing

- Add a REGION: Right-Click or [**R**] or [**Space**] or [**Ins**]
- Immediately the properties listbox will be activated to edit the name
- Renaming a region will automatically rename any reference to it without asking the user
- 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

Zone editing

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 two zones:

zone01: +a +b

zone02: +c –d

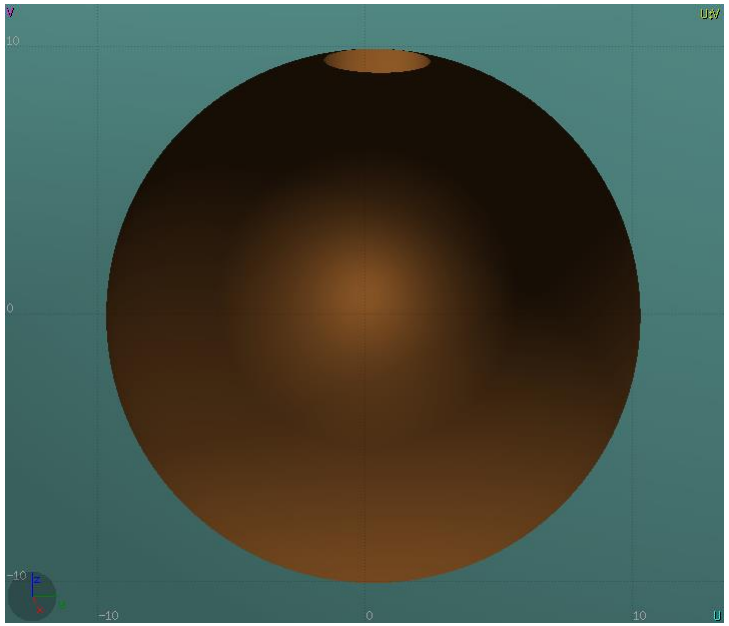
Zone editing

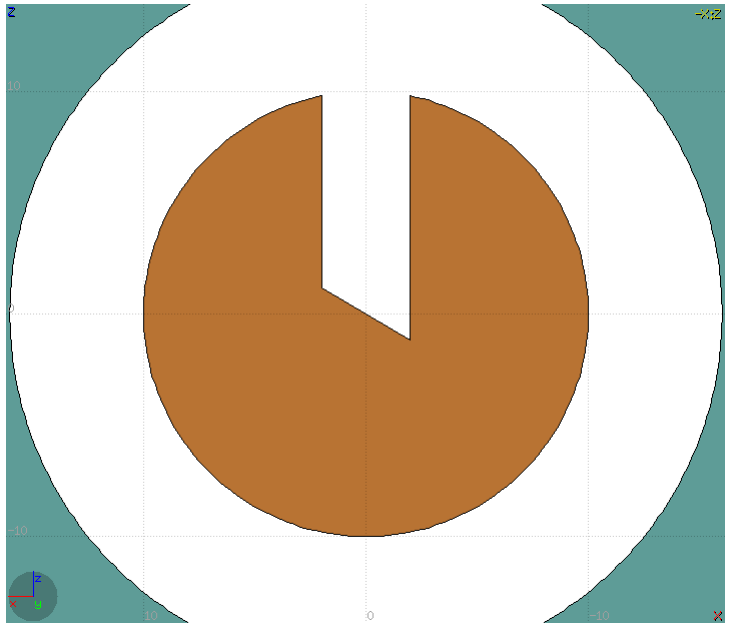
Graphically

- First select the desired REGION to add/modify the zone
- Add a new zone:
  - Verify that there is no zone selected in the property listbox.
    If there is any hit Escape to unselect them
  - Add on the selection **ONLY** the bodies representing the borders of the zone
  - Click on Right-click or [Space]->Zone  or with [**D**]efine (*capital*)
  - Move the mouse and click in one of the viewports a point that should belong to the wished zone
  - Automatically the zone expression will be created
- Modify/Edit an existing zone:
  - 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 “Zone” or with [**d**]efine (*small*) and click on point that belongs to it


Do not select bodies that you don’t need

Zone Editing: Example [1/7]





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

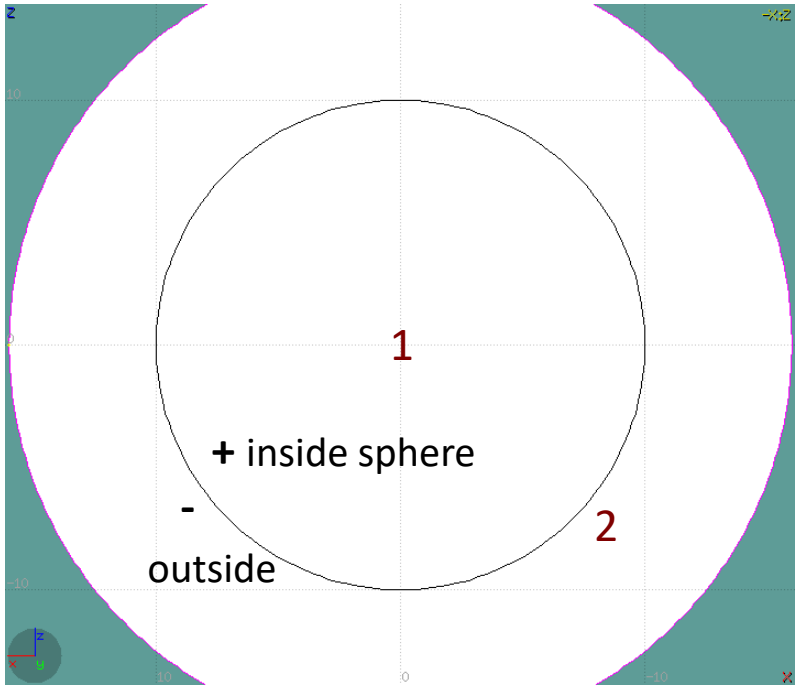
Zone Editing: Example [2/7]

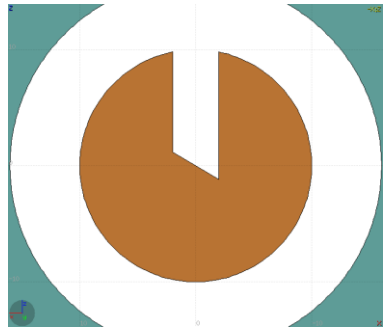
- Then we add a new REGION
  [**Spacebar**] → Region
- The region expression is empty
- Type-in the name and select the appropriate material
- Press [**ESC**ape]

The region should remain selected

- Each body e.g. sphere divides the space into 2 zones
- Add to the selection the sphere (holding [**Ctrl**] pressed) and the sphere outline will be highlighted
- The sphere divides the space into two zones:

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



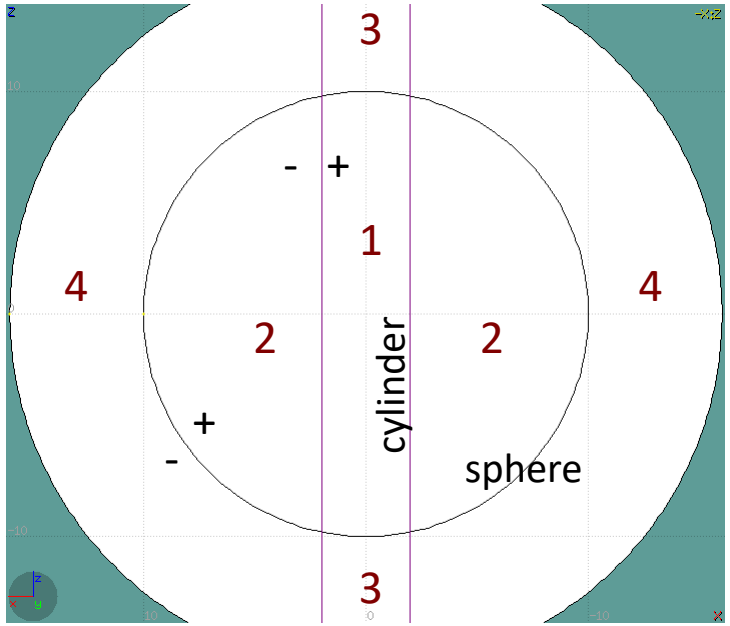


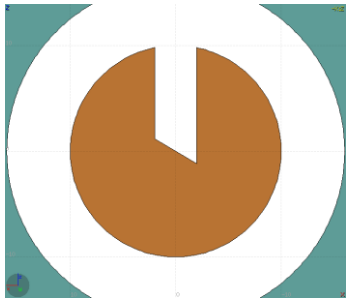
Reference image

Zone Editing: Example [3/7]

- Add to the selection the infinite cylinder with [**Ctrl**] + Left mouse click
- The 2 selected bodies divides the space into 4 zones

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





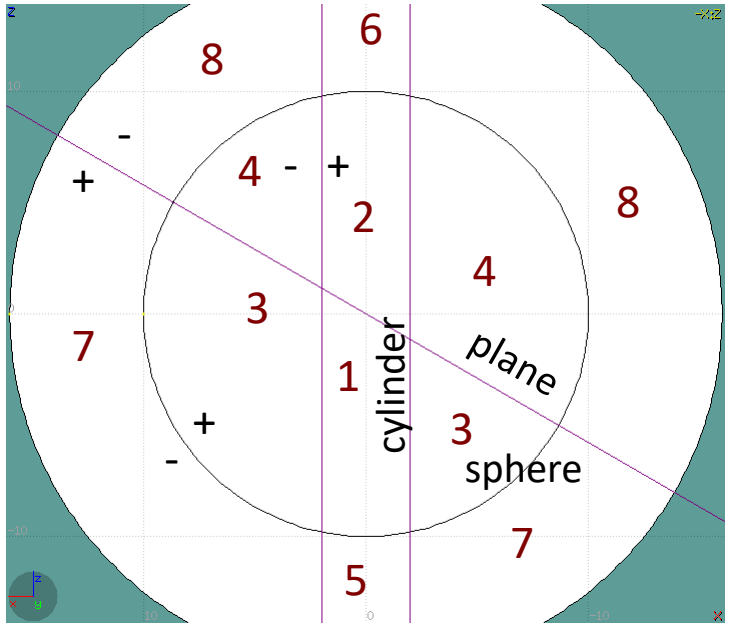
Reference image

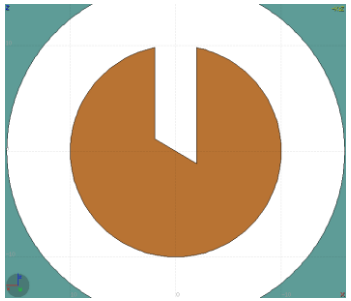
Zone Editing: Example [4/7]

- Add to the selection [**Ctrl**]+left click the tilted plane.
- Now the space is divided 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 ≤ 2^{bodies}

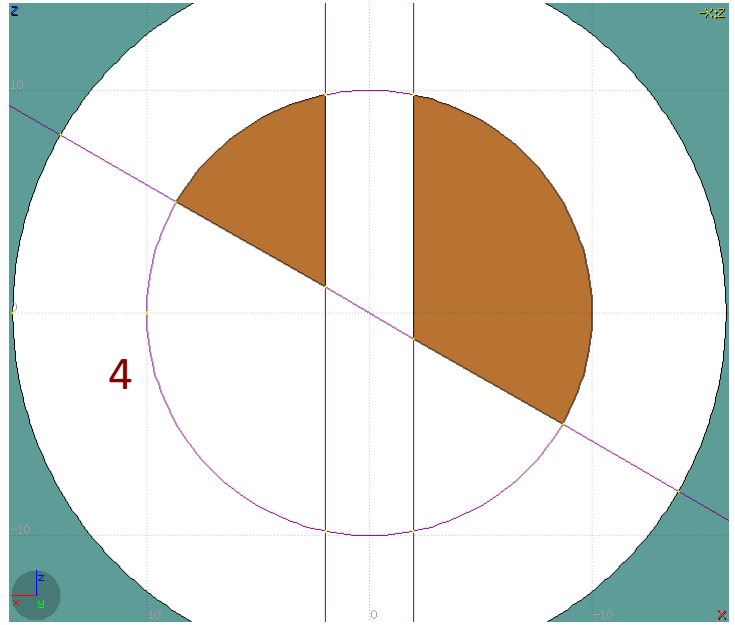


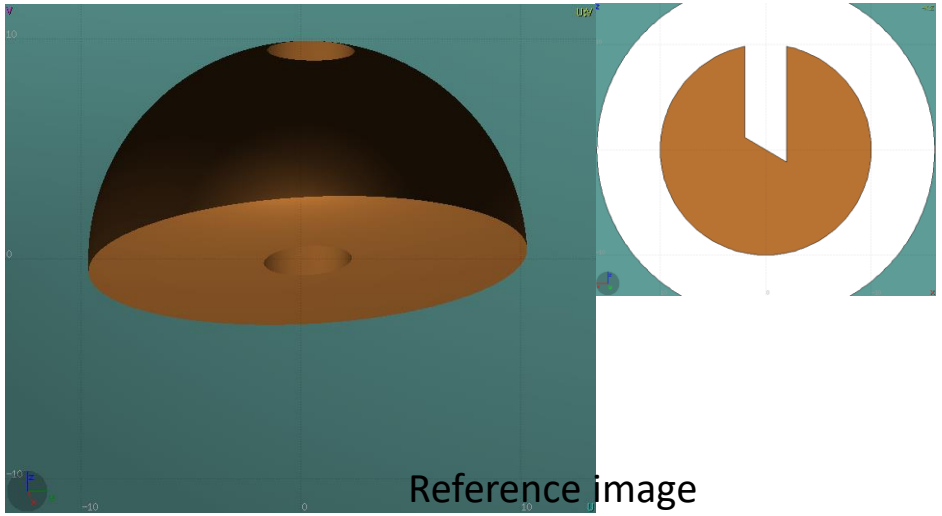


Reference image

Zone Editing: Example [5/7]

- Press [**Spacebar**] and select the action **Zone** or with the shortcut [**d**]efine
- Moving the mouse, shows the various subdivisions of space and their corresponding expression.
- 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]

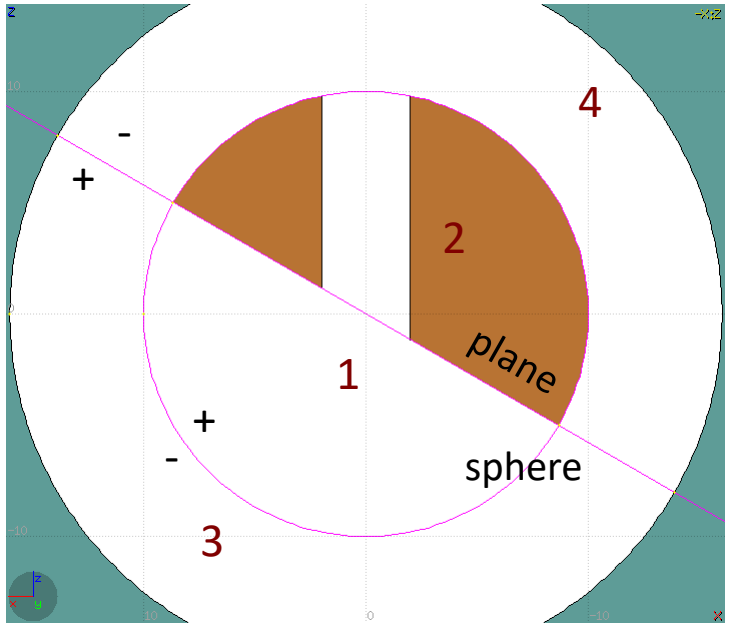
- Finally we have to add as second zone the lower half of the sphere.
- Press once [**ESCape**] to unselect the bodies, but to **leave the region selected**
- Select the sphere and plane (or by deselecting the cylinder)
- Again the space is divided into 4 regions

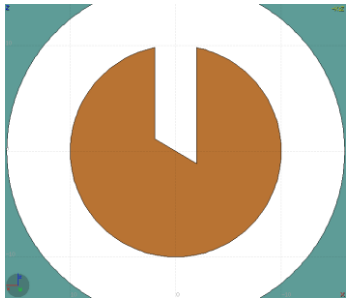
1 +sphere +plane

2 +sphere - plane

3 - sphere +plane

4 - sphere - plane

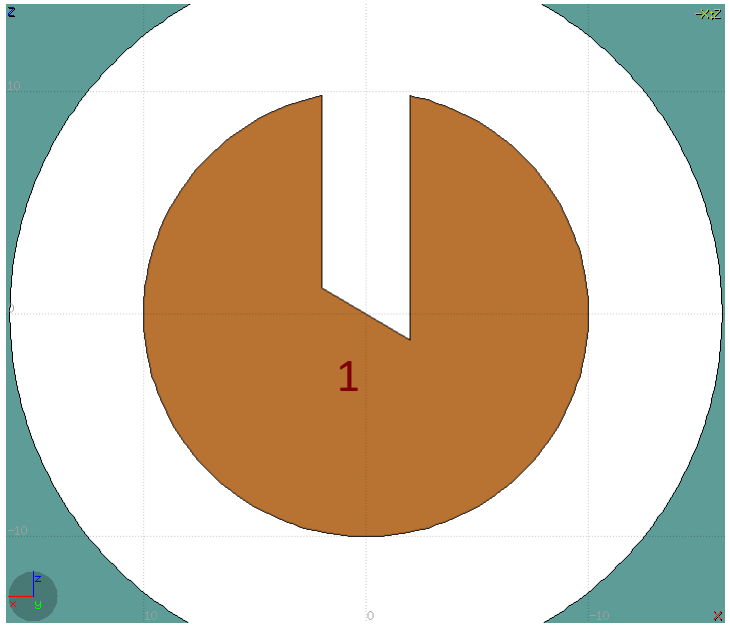


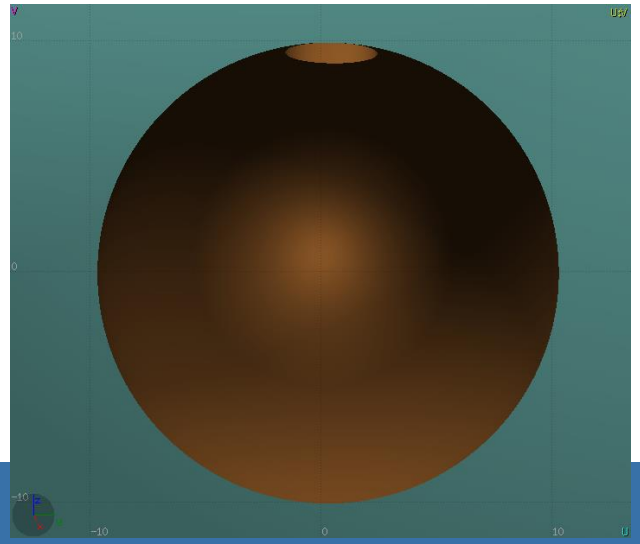


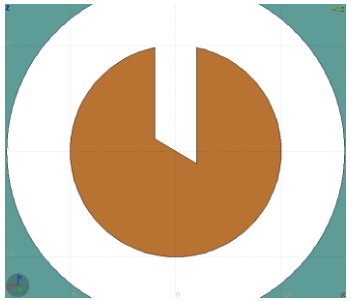
Reference image

Zone Editing: Example [7/7]

- Press [**Spacebar**] and select the action **Zone** or with the shortcut [**d**]
- Point and click with the mouse somewhere inside zone 1
- Automatically the zone expression
  +sphere +plane
  will be appended to the REGION







Reference image

Summary: Region and Zone Editing

Remember the sequence:

1. Create or Select the region to edit
2. Select the REGION if not selected
3. Select a zone to modify or none to add a new one
4. Add on the selection the bodies that involve in the zone expression
5. Click on the [**Spacebar**] "Zone  " action [**d**] or [**D**]
6. Move the mouse and click to a point that belongs to the wished zone
7. Repeat steps 2-6 as many times as required

You have to create a selection containing:

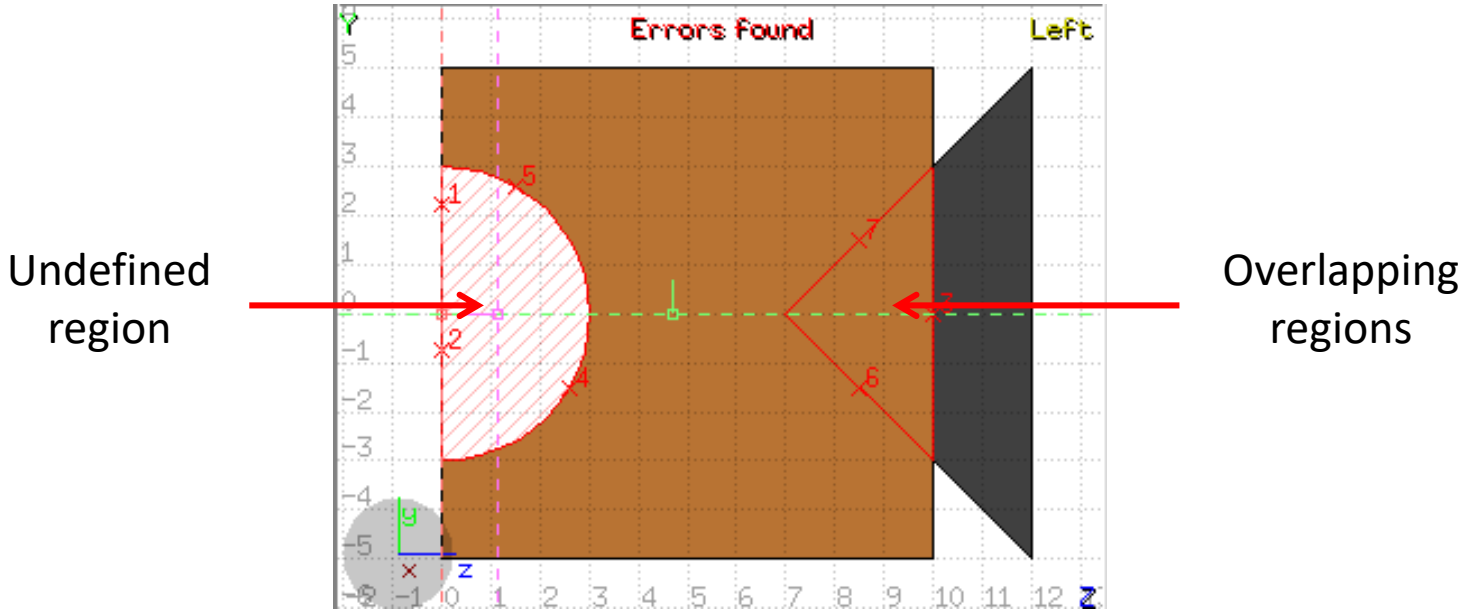
- the REGION to edit;
- the bodies representing the boundaries of the new zone;
- optionally an existing zone if you want to modify it
- Verify the selected items and do NOT select bodies that you don't need

ESCape

[**ESC**ape] will stop/unselect in the following order on item at a time:

1. Stop the current action e.g. during rotation or panning
2. If a zone is selected unselected the zone
3. Unselect any selected bodies
4. Unselect any selected region

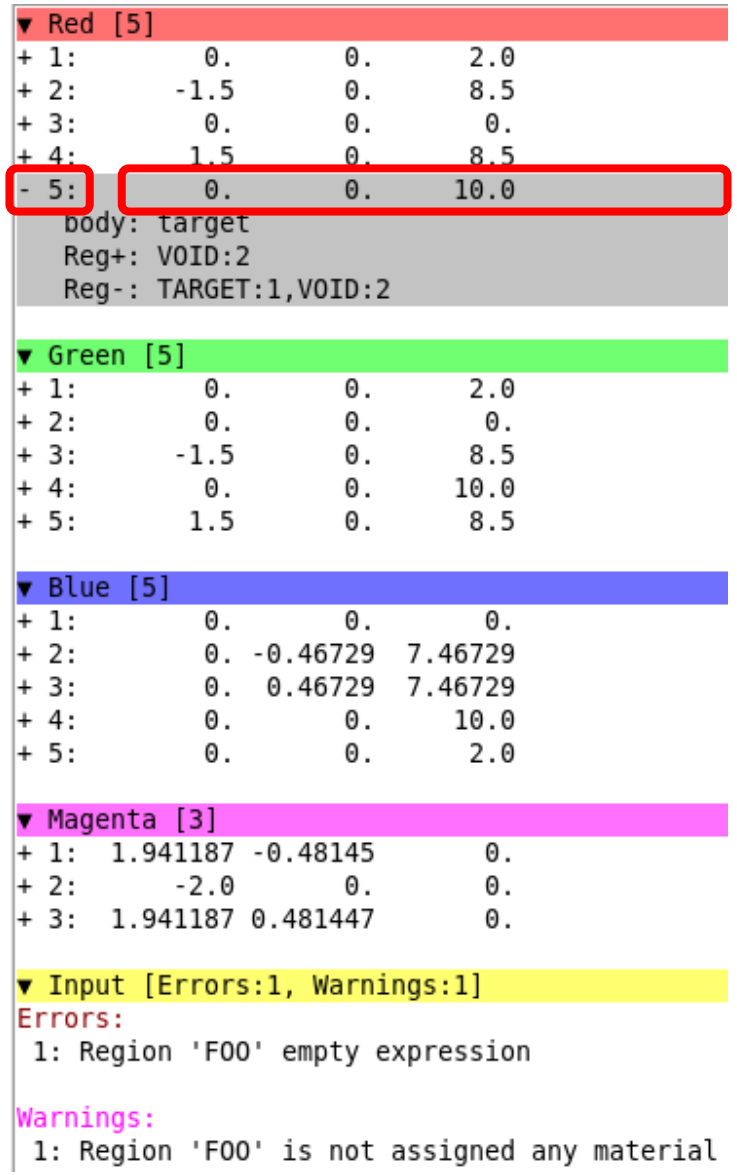
Debugging Geometry Errors



Errors found notifies that are errors in the geometry (on the current projection):

- 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 lines correspond to a missing region definition;
  - Body segments that are involved in the errors are numbered;
- Clicking the  Errors tab (on the left) 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;

Geometry Errors Tab



+ n:	error index in the viewport. click to expand and get more info
x y z:	position of error click to zoom on error
body:	body that is involved in the error
Reg+:	regions found on the + side of body
Reg-:	regions found on the – side of the body
Errors:	click to focus the problematic card
Warnings:	-//-


FLUKA