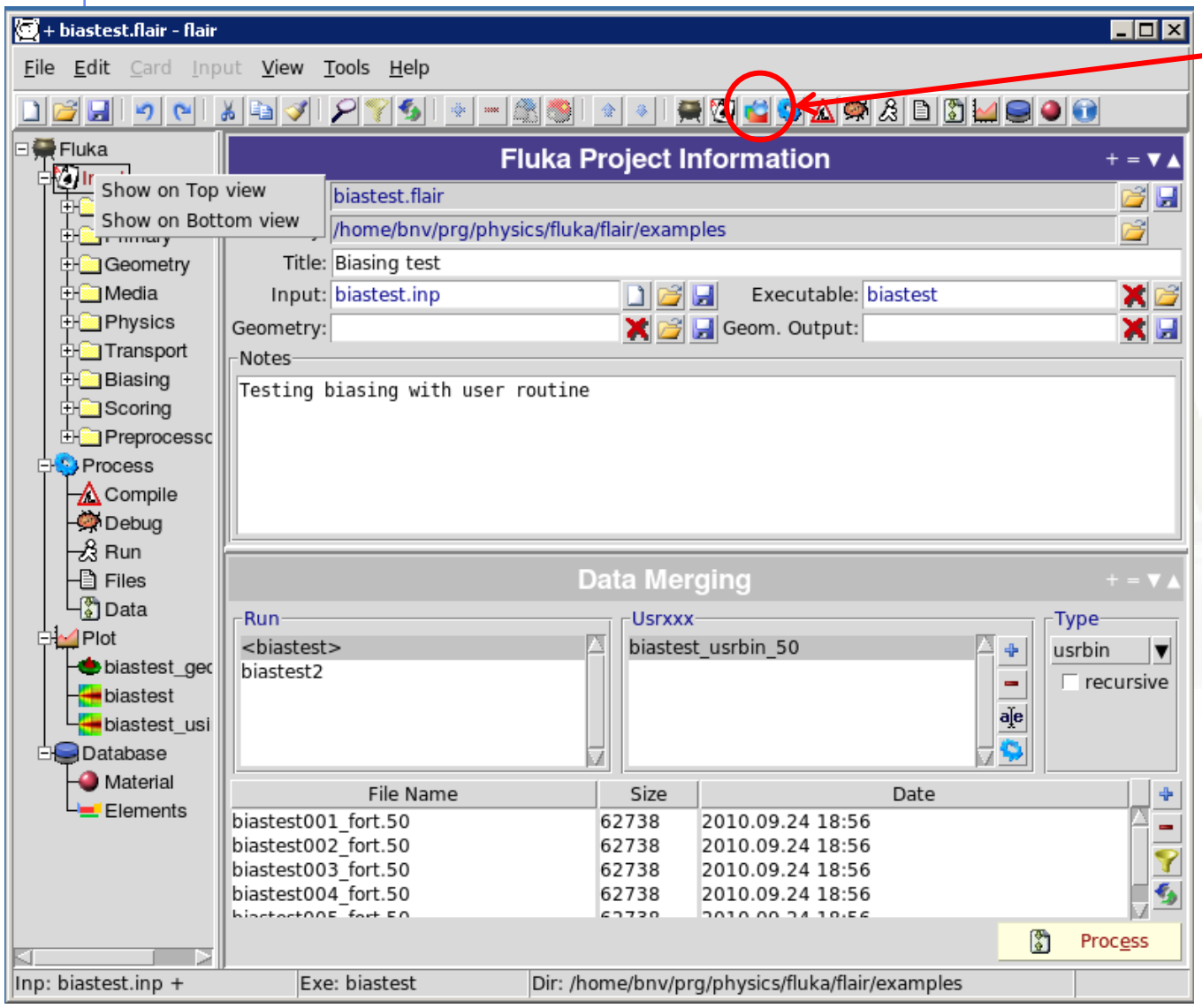
Flair Geometry Editor – Part II

FLUKA Beginner's Course

Starting the Geometry Editor



Click on icon

or from Menu
→ View
→ Geometry Editor

or with
[F4] shortcut

- Either start flair with option -g

Geometry editor

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

Pros

- Fast display of complex geometries;
- Many user-customizable layers;
- Graphical editing of the bodies with snapping mechanism to generate accurate coordinates;
- Visual selection and editing of zones w/o the need to know the orientation of bodies;
- Use full analytical curve of bodies with no conversion to vertices/edges;
- Interactive debugging with information of problematic bodies, regions and/or zones;

Cons

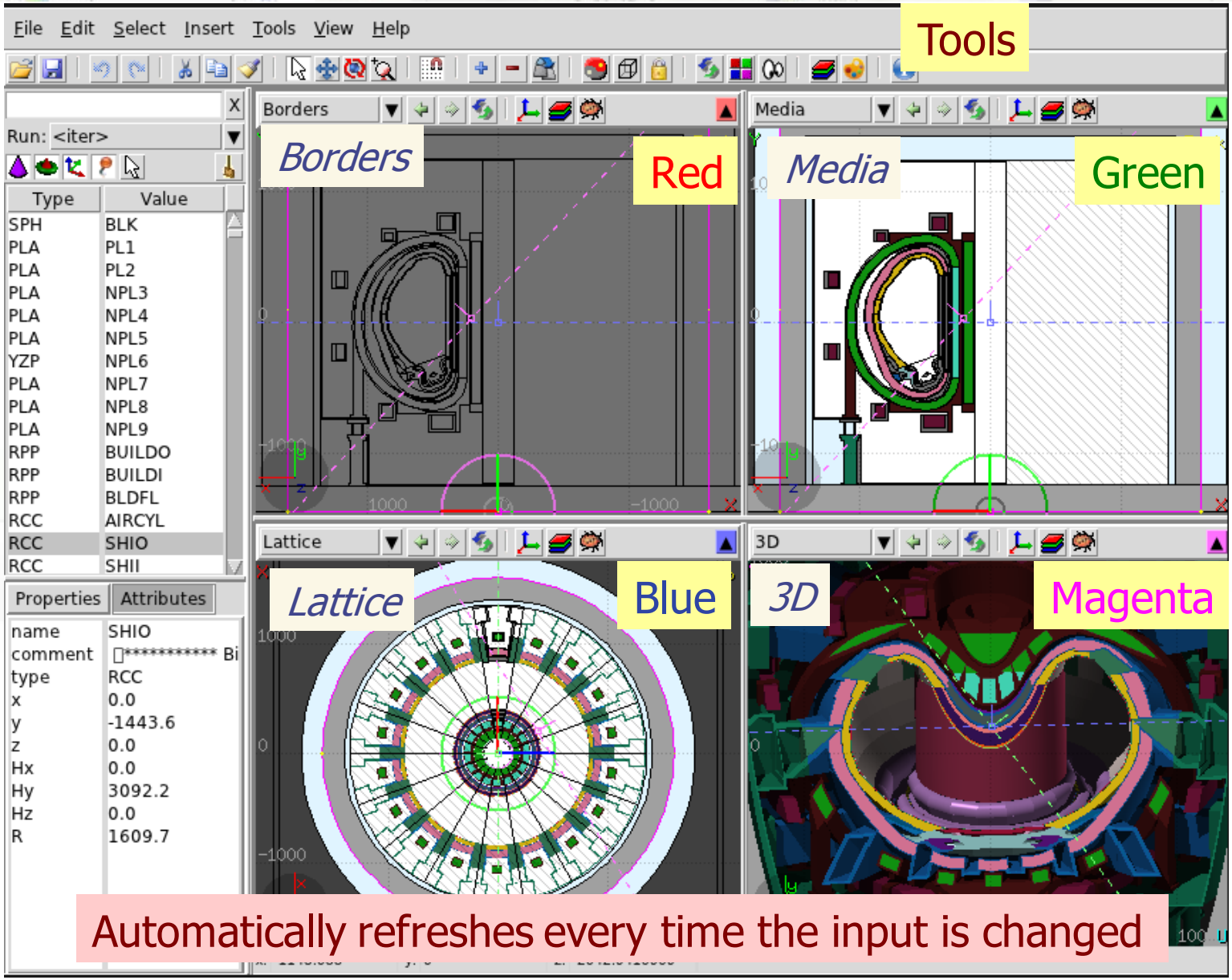
- Tricky to orientate in an unknown geometry;
- Difficult to find region using the expression;

Geometry Editor: Interface

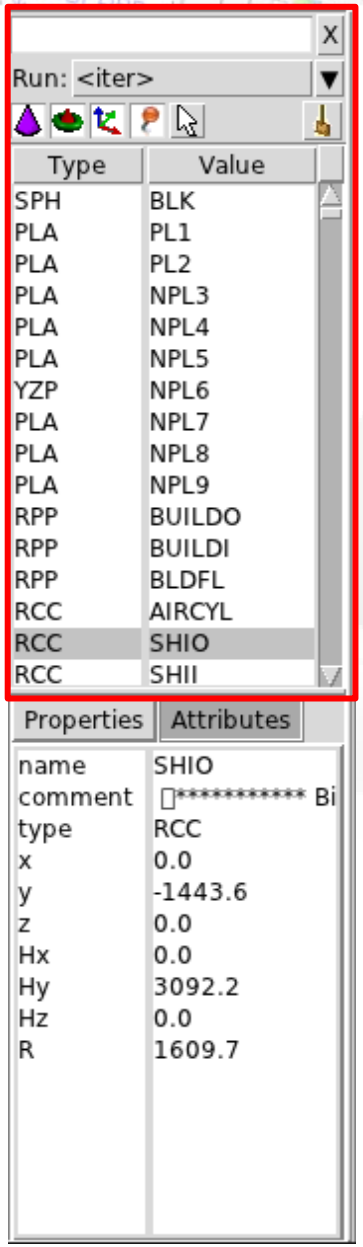
Filter

Filtered Objects

Properties & Attributes



Listbox - Objects

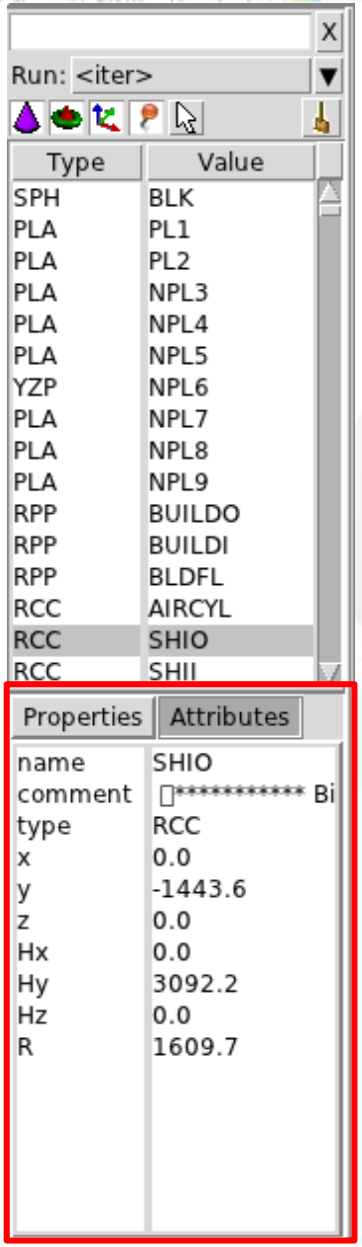


- Lists the type/name of bodies, regions, objects
- Text coloring:
  - Red Error in the card description
  - Magenta Visible body/object
  - Orange Selection locked
- Filtering text box can narrow the list with items containing the typed-in text

Buttons – on/off the display of

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

Listbox – Properties / Attributes



Properties:

- Displays the common WHAT's of the selected card
- 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:

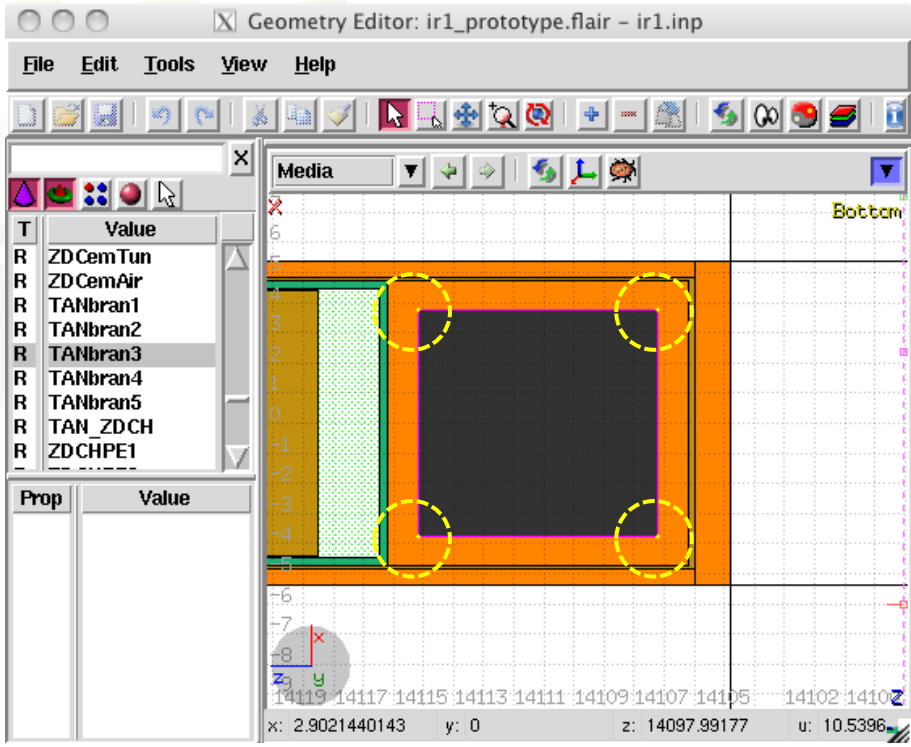
- Displays other information related to the card
- Bodies: Visibility, Selection Locking, Wireframe
- Regions: NAZ, Alpha(Transparency), ROT-DEFI…

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 selected zones are shaded with a hash pattern; To select a zone first you have to select the REGION

[**ESC**ape] cancels the selection



Objects

There are a few auxiliary objects in flair for helping the drawing

- Point [**p**]
  - to be used as snapping points
  - provide help text to the user
  - automatically generated after image calibration
- Arrow or line
  - to be used as snapping points
  - provide basic drawing/pointing means to the user
- Ruler simple or angle
  - to measure distances and angles
  - to project snapping points to a different location
  - to be used as snapping points
- Light for the 3D

The objects are stored in the input file with the special flair tags:

!point, !arrow, !ruler, !light

All tags starting with ! are treated as comments and ignore by FLUKA

New Body

- Add a body: Right-Click, or [**b**] or [**Space**] or [**Ins**] Menus is organized in sub-categories
- [**B**] (capital) to repeat last added 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 [1/2]

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 [2/2]

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

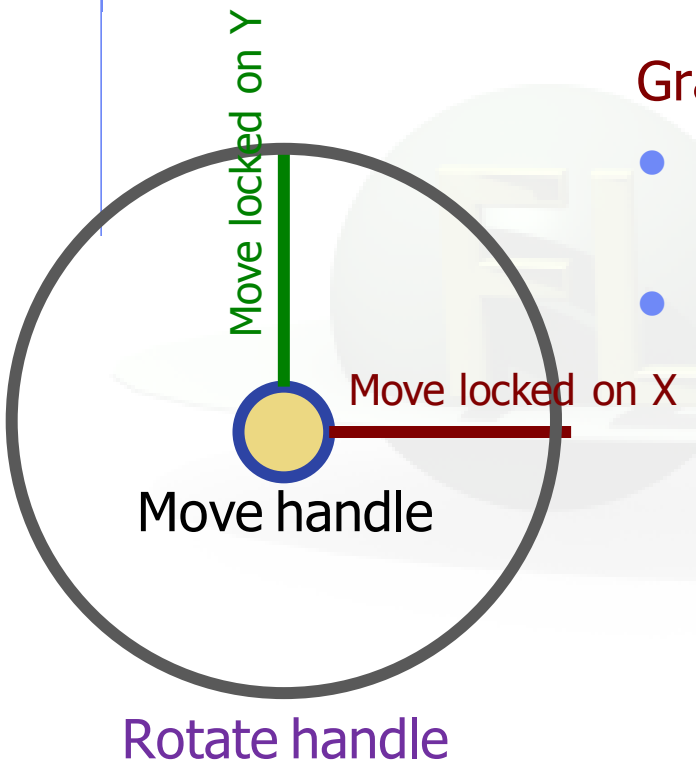
Location

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

  Perform one of these actions:
    - 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 [1/2]



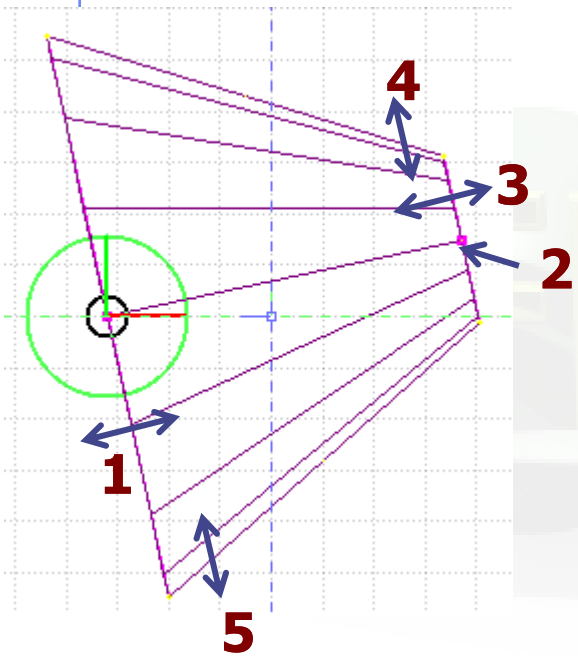
Text:

- 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 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

Body Editing [2/2]



- 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 appex 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 [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!

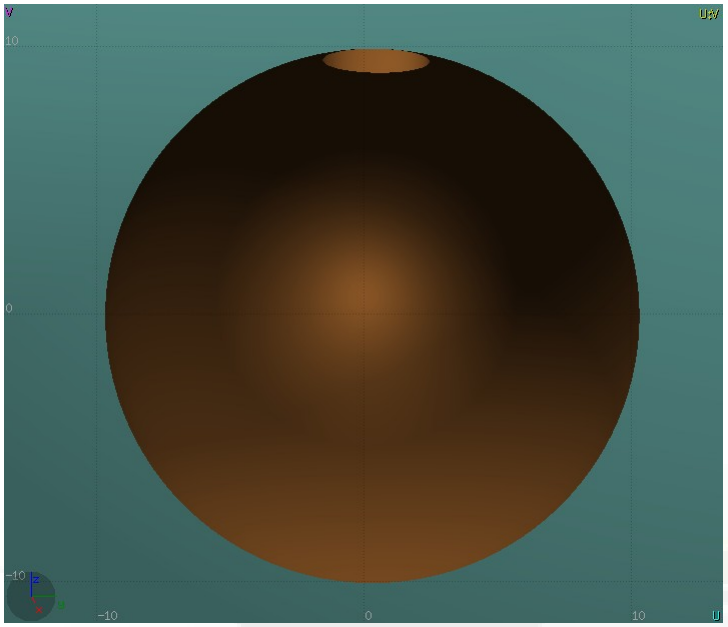
Reminder:
A zone is a subregion expressed in terms of + and – only
e.g. REGION +a +b | +c –d
contains two zones
zone01: +a +b
zone02: +c –d

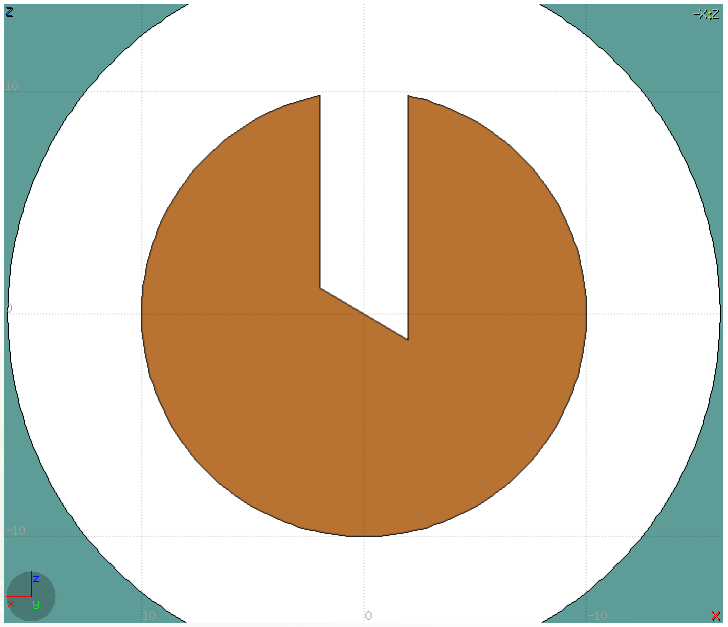
Zone editing [2/2]

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 the bodies representing the borders of the zone
  - Click on Right-click or [Space]->Zone  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

Zone Editing: Example [1/7]



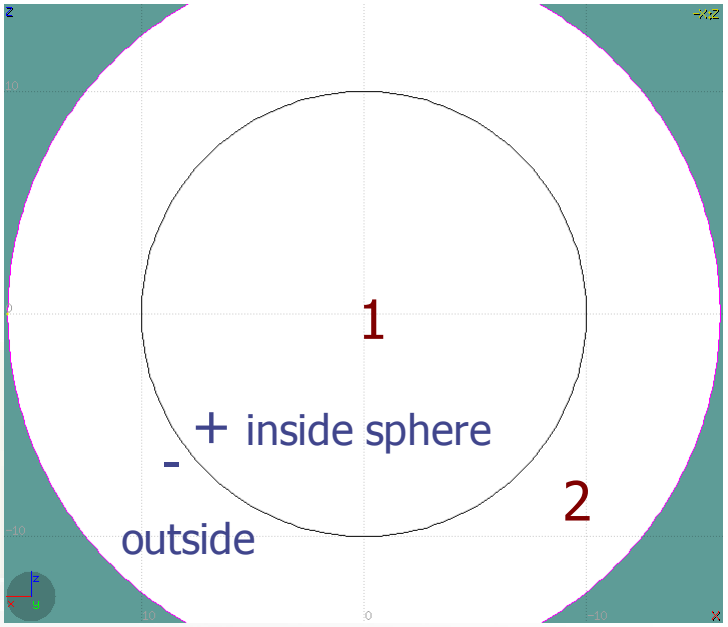


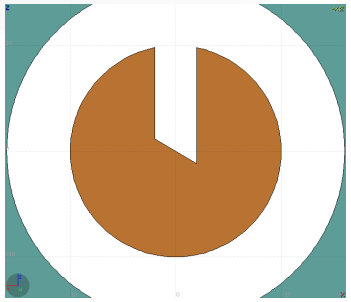
- In this example we will create a sphere with a cylindrical hole cut with a tilted plane (@ 30°)
- First we have to create all necessary bodies
  - sphere
  - infinite cylinder
  - tilted plane

Zone Editing: Example [2/7]

- Then we add a new REGION [**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



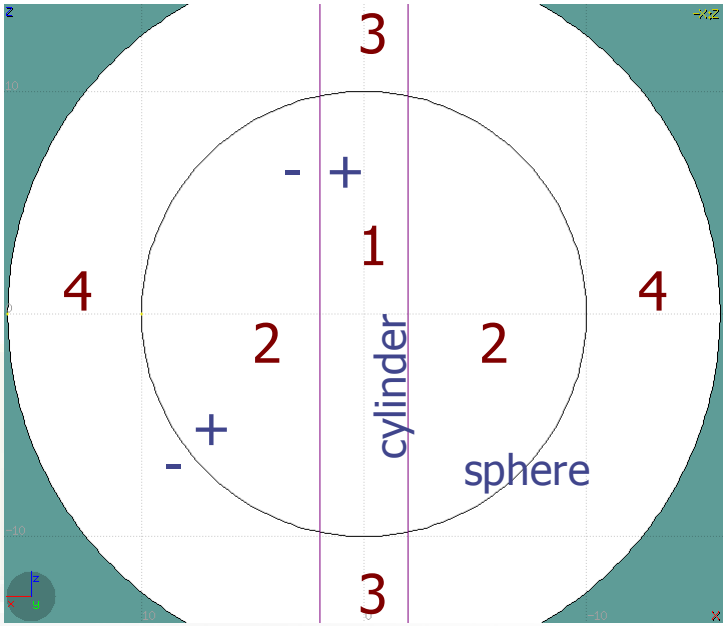


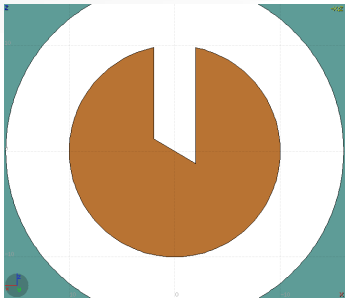
Reference image

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





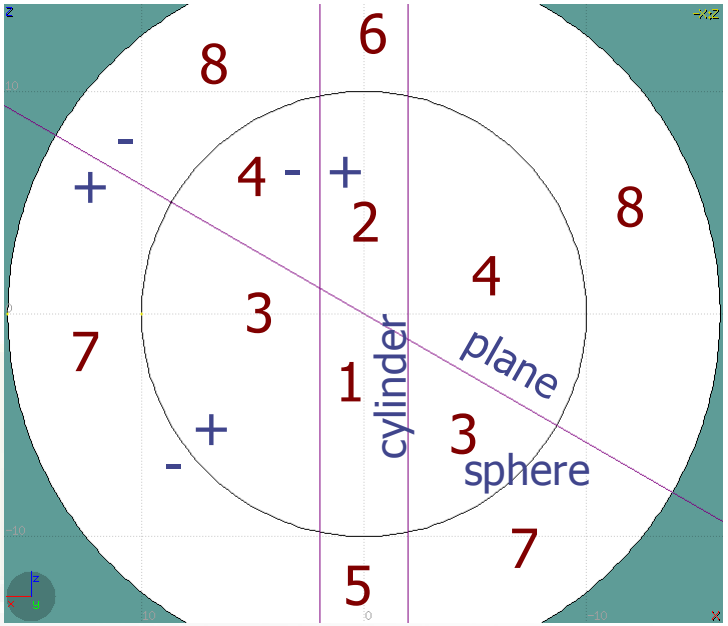
Reference image

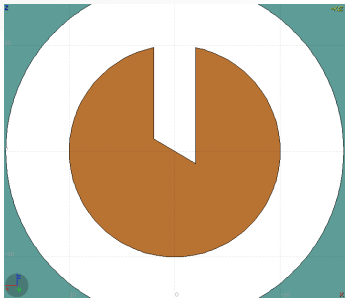
Zone Editing: Example [4/7]

- 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}

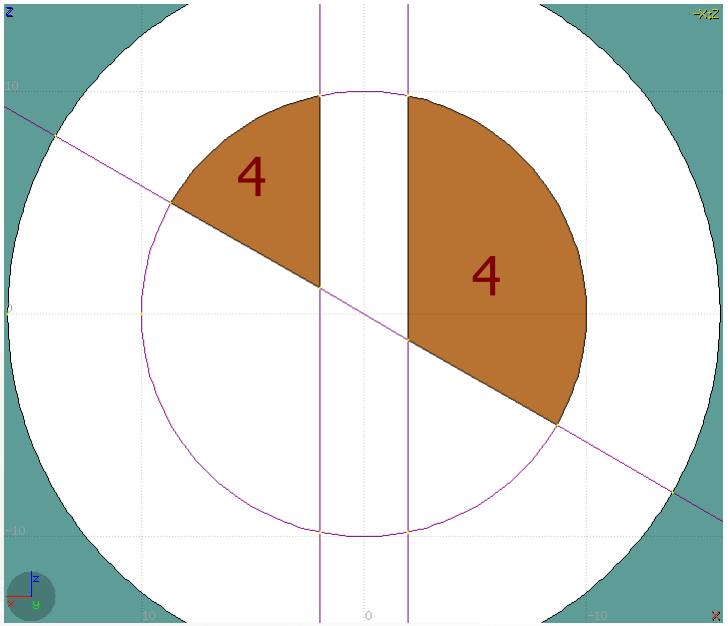


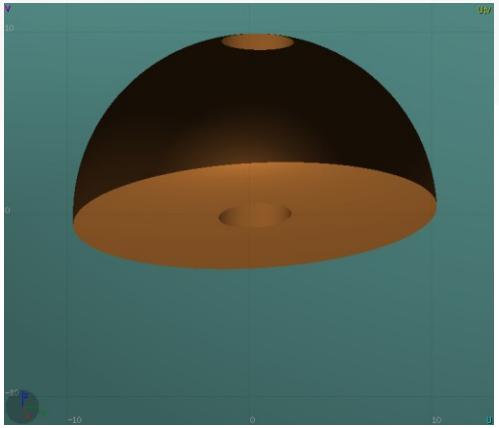


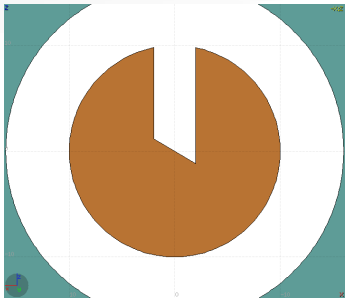
Reference image

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





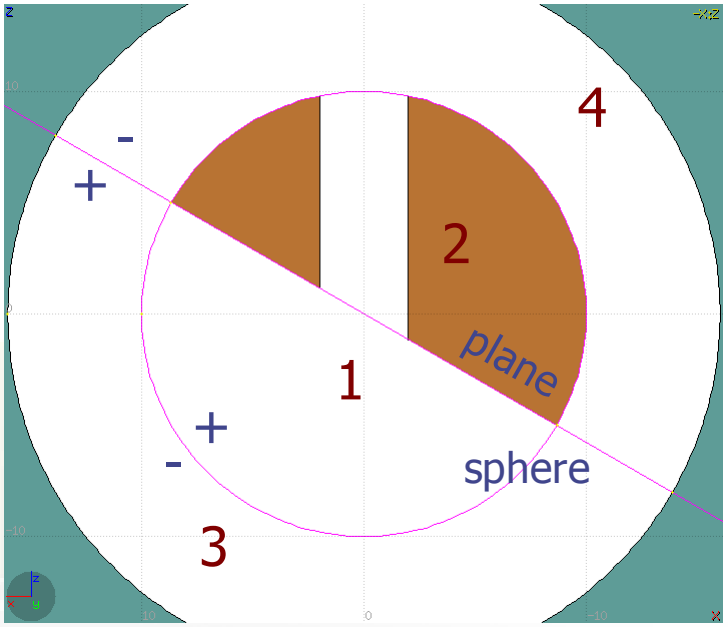


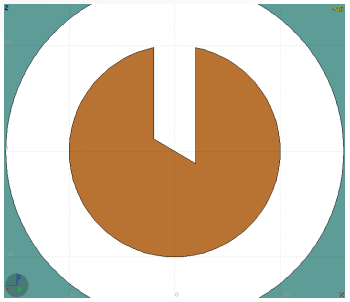
Reference image

Zone Editing: Example [6/7]

- Last, we have to add as second zone the lower half of the sphere.
- 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

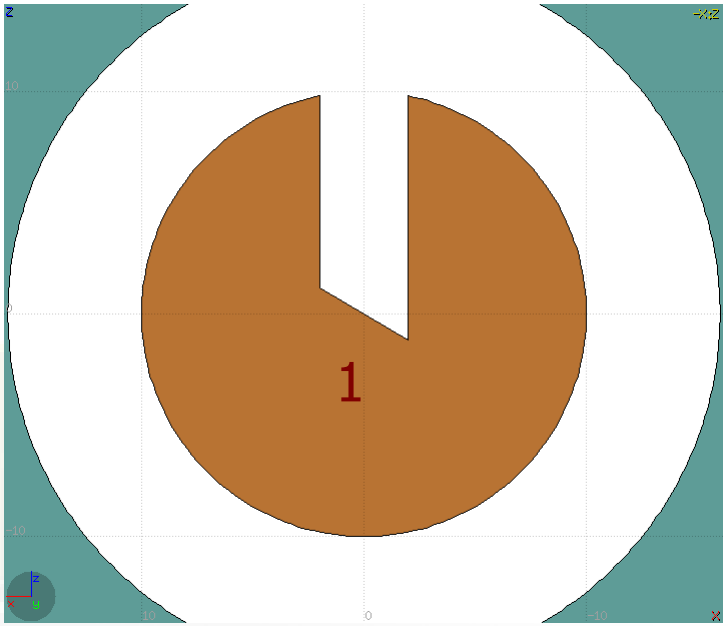


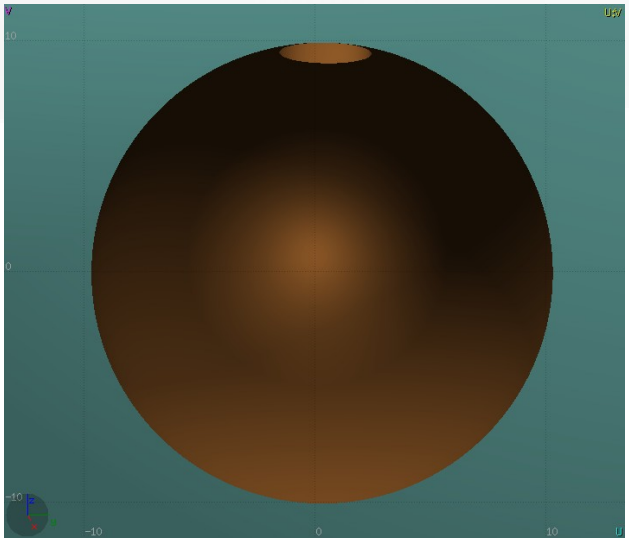


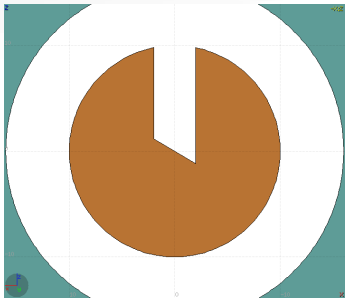
Reference image

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

Region and Zone Editing

Remember the sequence:

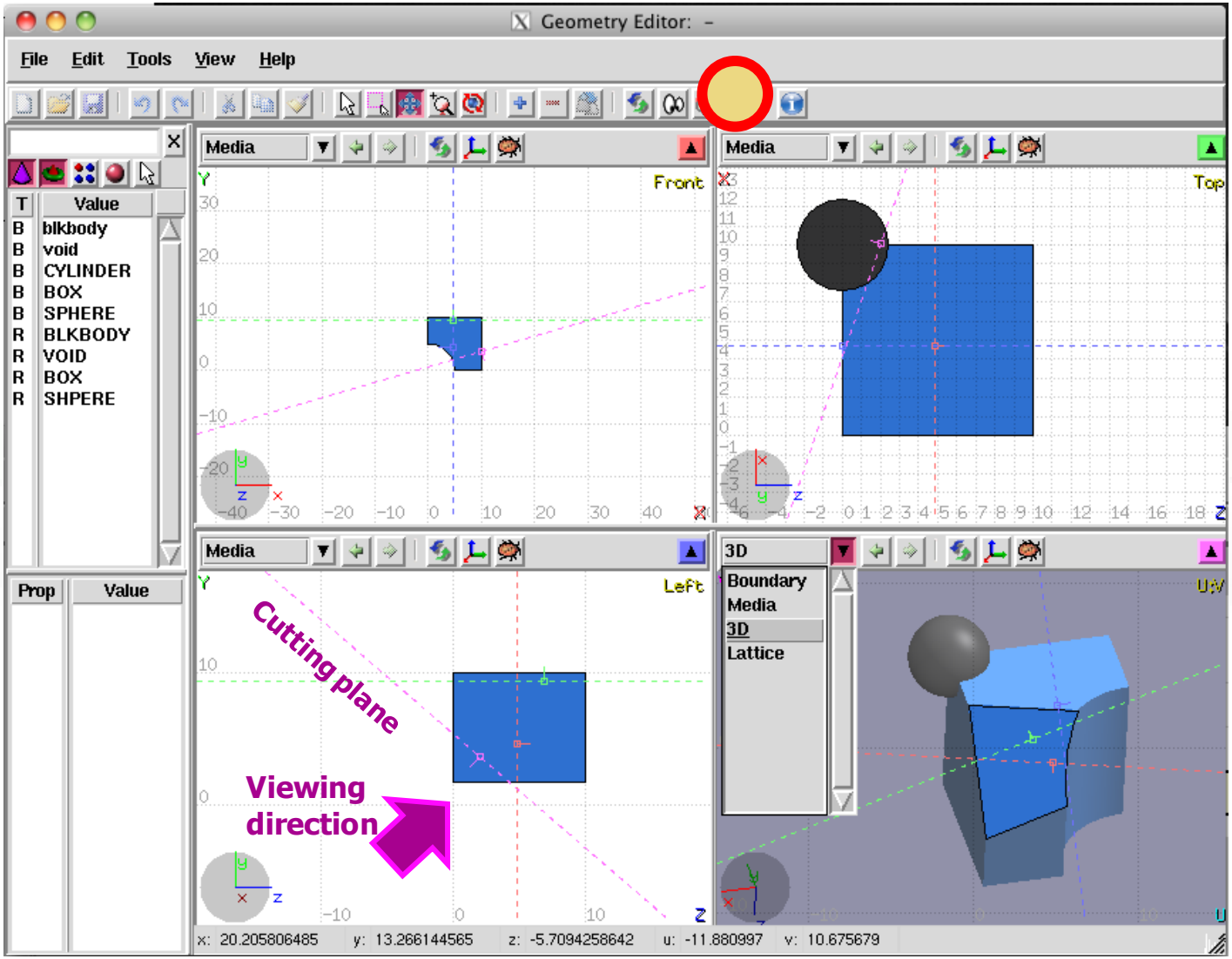
1. Create or Select the region to edit
2. Select the REGION if not selected
3. Select a zone to modify or none to add a new one
4. Add on the selection the bodies that involve in the zone expression
5. Click on the [**Spacebar**] "Zone" action [**d**] or [**D**]
6. Move the mouse and click to a point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

You have to create a selection containing:

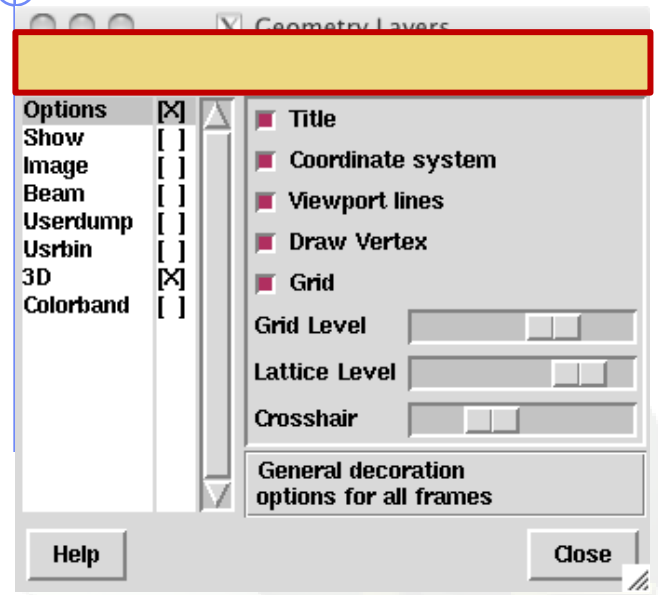
- the REGION to edit;
- the bodies representing the boundaries of the new zone;
- optionally an existing zone if you want to modify it

Geometry Layers [1/6]

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



Geometry Layers [2/6]



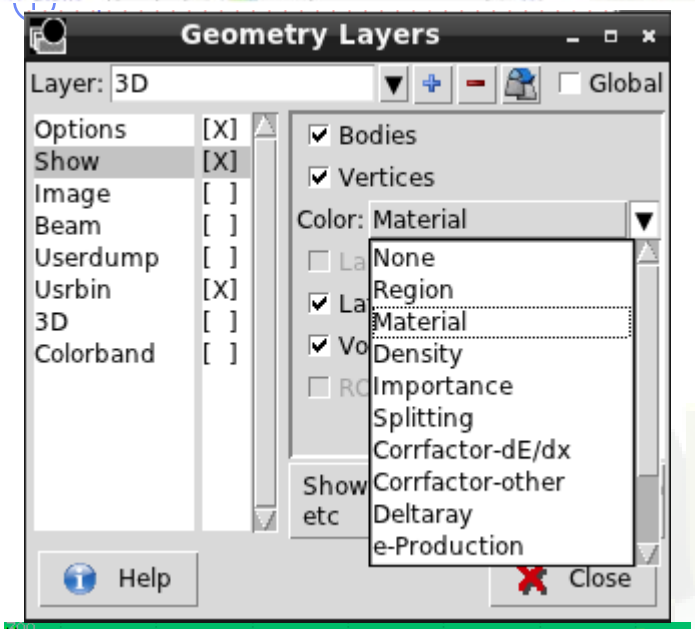
Toolbar:

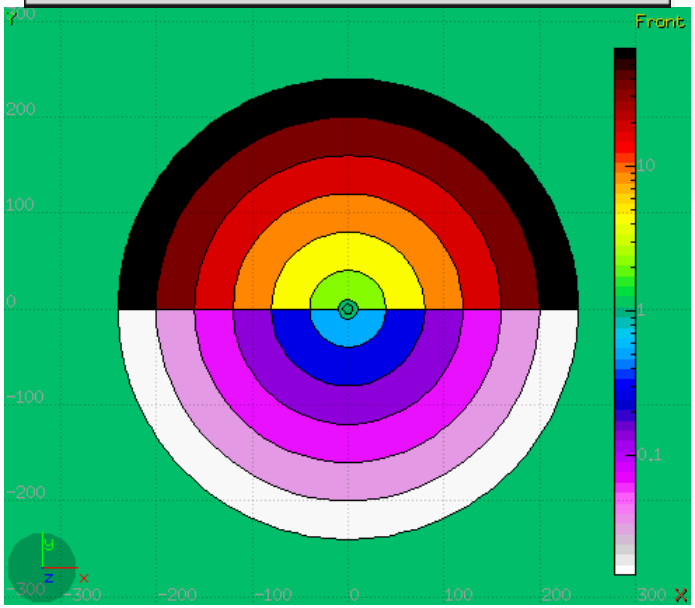
- **Add/delete/rename/clone layers.**

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)
- All layers can be combined together e.g:
  - USRBIN and 3D
  - Custom color values (EMFCUT) with 3D
  - Image and USRBIN
  - …

Geometry Layers [3/6]





Show: (2D drawing, and color filling options)

- **Bodies:** display the boundaries of bodies;
- **Vertices:** display the intersection of bodies;
- **Enable/Disable**: Lattice and Voxel;
- **Associate Region Colors to:**
  - Regions
  - Materials
  - Density
  - Importance Biasing
  - Splitting
  - Correction factors
  - Deltaray
  - Thresholds
  - …

Geometry Layers [4/6]

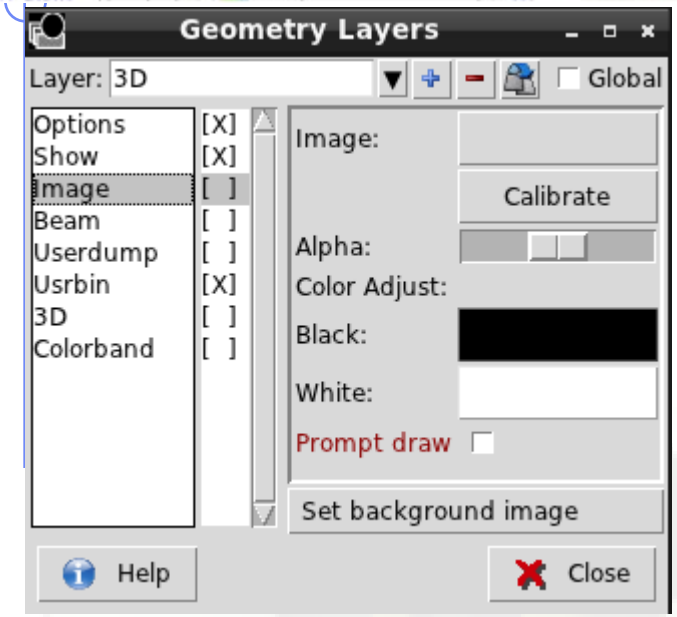
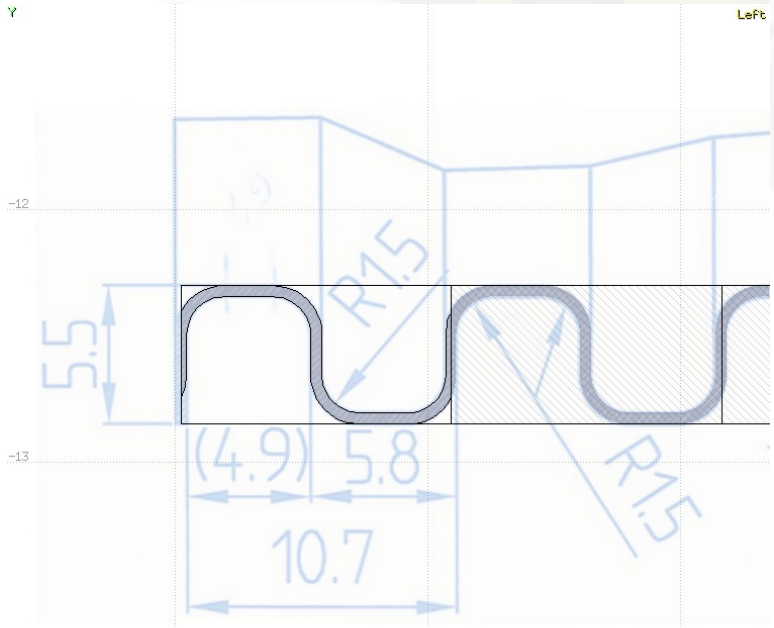
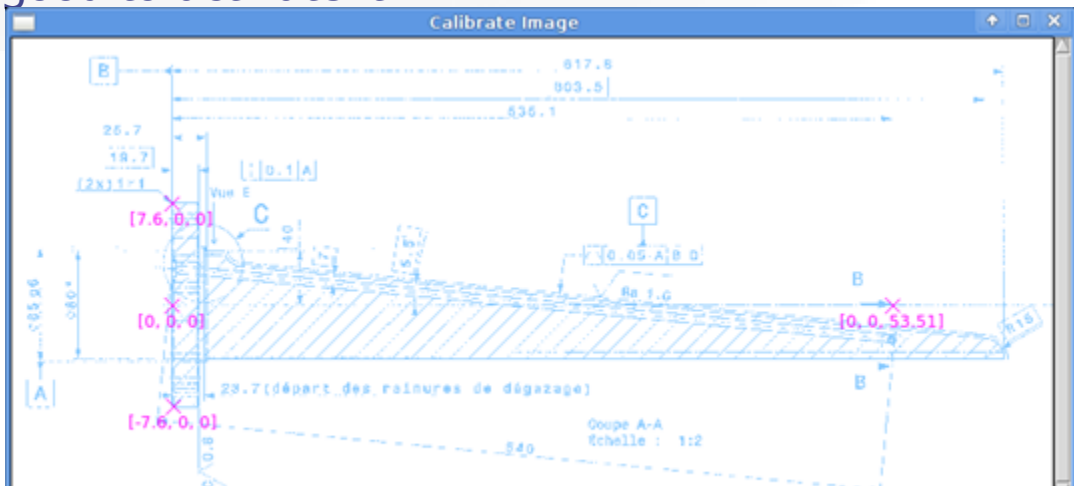


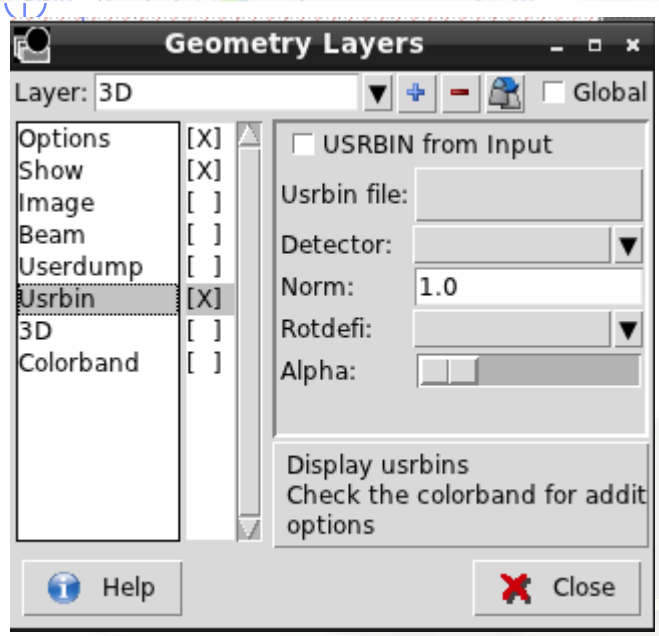
Image: set a background image to the geometry (i.e. a CAD-drawing);

- **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;
- **Alpha**: blending of the image
- **Color Adjust**: readjust the **black** and **white** colors of the loaded image.
- **Prompt draw**: immediate drawing of image (slower) or when display is idle. For editing is good to activate it.





Geometry Layers [5/6]

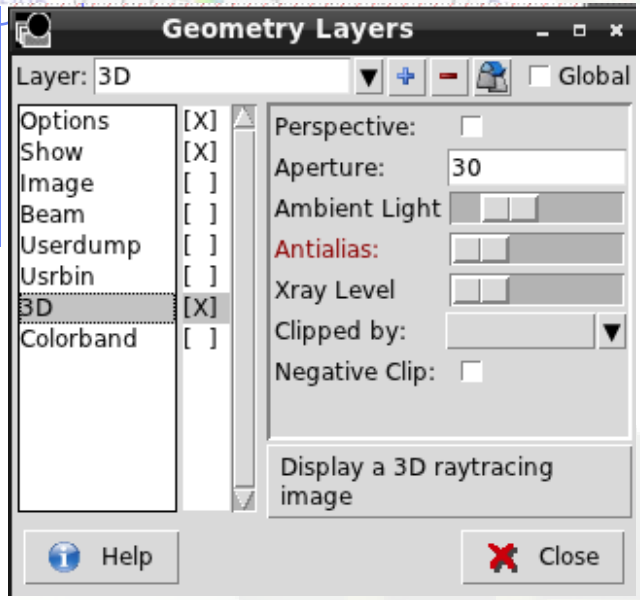


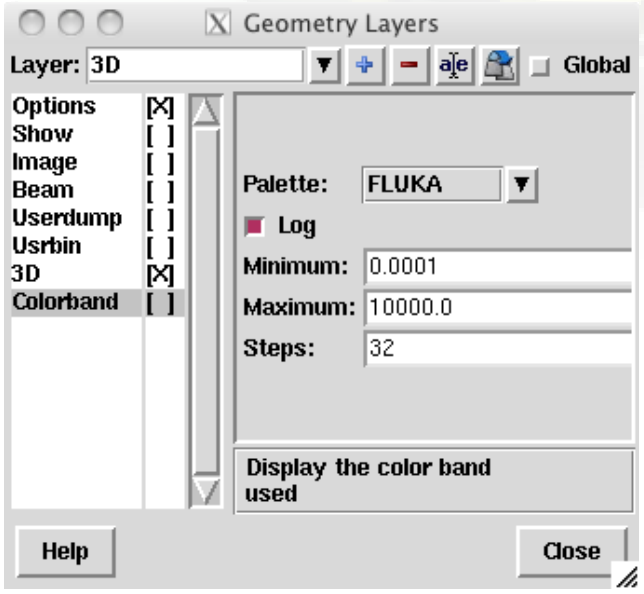
USRBIN:

- USRBIN from input: To select a USRBIN card from input and displayed with a checker pattern
- 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;
- Alpha blending between USRBIN colors and materials colors

USRBIN should be combined with the Colorband to define the color limits

Geometry Layers [6/6]





3D: enable 3D rendering

- **Enable/Disable Perspective**;
- Set camera **aperture** angle;
- Intensity of ambient light;
- **Antialias** for supersampling (slow rendering);
- Xray – automatic transparencies;
- Clipped by: setting a clipping body;
- Negative Clip: Use the –clipping body

Colorband: enable/set color band properties

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

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