3D Presentation of FEATFLOW Data with GMV

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Contents

1 3D Presentation of scalar 2D data **1**
1.1 Setting a Cutplane 1
1.2 Extrusion into 3D 1

2 Presentation of scalar 3D data **5**
2.1 Setting Cutsurfaces 5
2.1.1 Cutplanes 5
2.1.2 Cutspheres 5
2.2 Setting Isosurfaces 9
2.3 Setting Isovolume 9

3 Presentation of vector-valued data **12**

4 Movie generation in 3D **12**

1 3D Presentation of scalar 2D data

1.1 Setting a Cutplane

To prepare the following example, after starting GMV, we first deactivate 'Faces' at 'Display/Cells' and close the box. The normal display of our data is now disappeared.
At 'Calculate/Cutplanes', select the scalar data which should be displayed by all cutplanes and define up to five different cutplanes (see fig.1). One can select the scalar data by 'Node Field/New Field' (here: temperature). If you click at one of these cutplane slots, a new box appears named 'Cutplane 1' (see fig.2). A cutplane is defined by three different points on that plane (they must not be on a line!). The 2D data produced by FEATFLOW are all in the x/y-plane. Therefore one can use the three points (0,0,0), (1,0,0) and (0,1,0). Click at 'Add' or activate 'On' and then press at 'Apply Field Change' in the box 'Cutplanes'. Then you should see something like in figure 3. A click at 'Options' gives a new box called 'Cutplane Options' (see fig.4). There one can add contour lines, mesh display and additional vectors.

1.2 Extrusion into 3D

First you should perform a rotation to get a sideview of your data (see fig.5). In the box called 'Cutplane Options' you have to activate 'Ht.' (see fig.4). Now you can extrude your data along

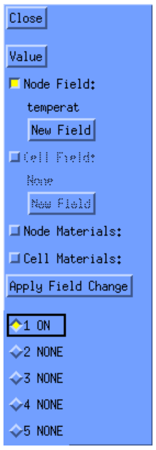

Figure 1: Box 'Cutplanes'

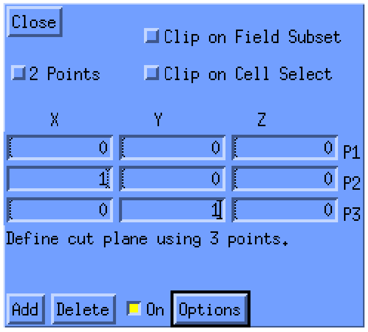

Figure 2: Box 'Cutplane 1'

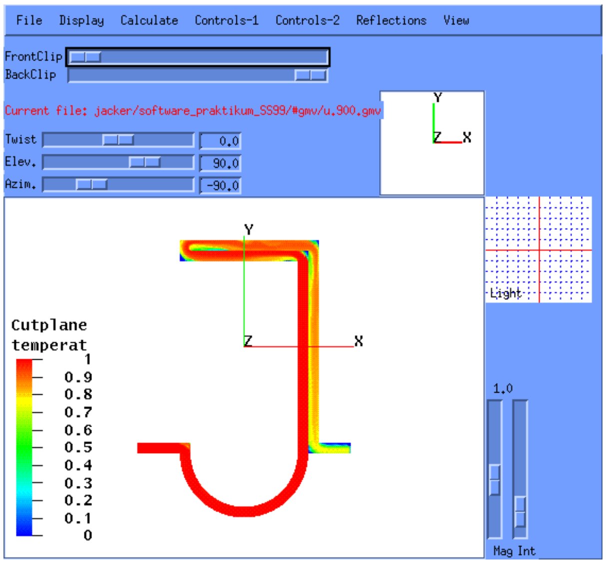

Figure 3: Cutplane Example

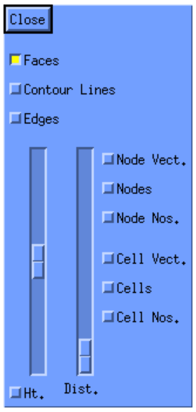

Figure 4: Box ‘Cutplane Options’

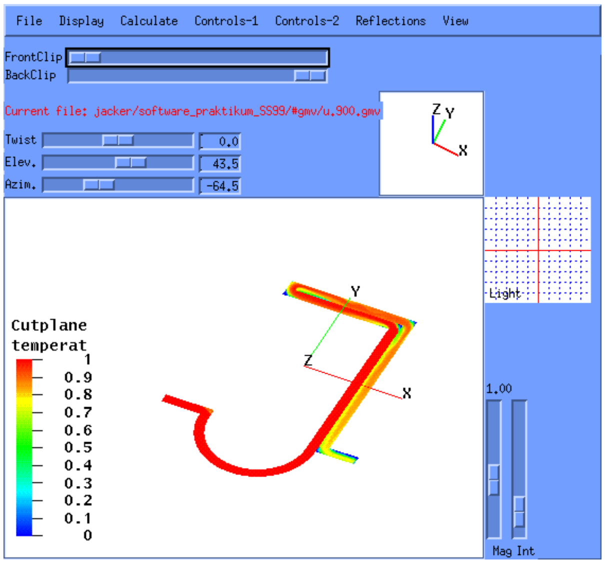

Figure 5: Cutplane Example (continued)

the surface normal to your cutplane with the left slider up (see fig.6) or down (see fig.7). A corresponding page in the ‘Virtual Album’ with many MPEG videos of this type is also available!

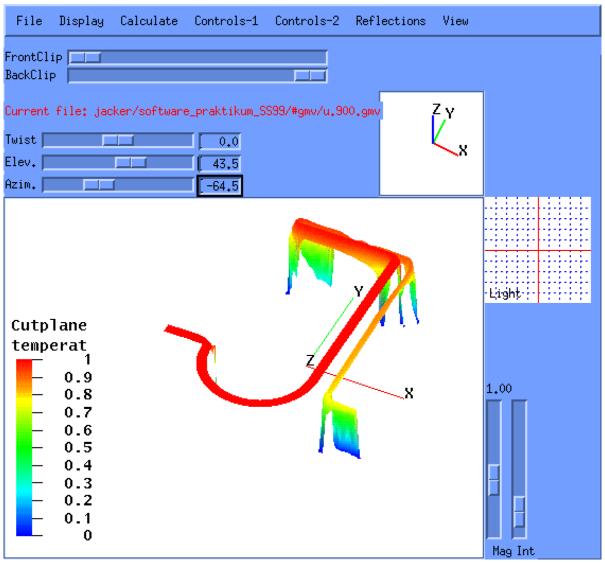

Figure 6: Cutplane Example extruded upwards

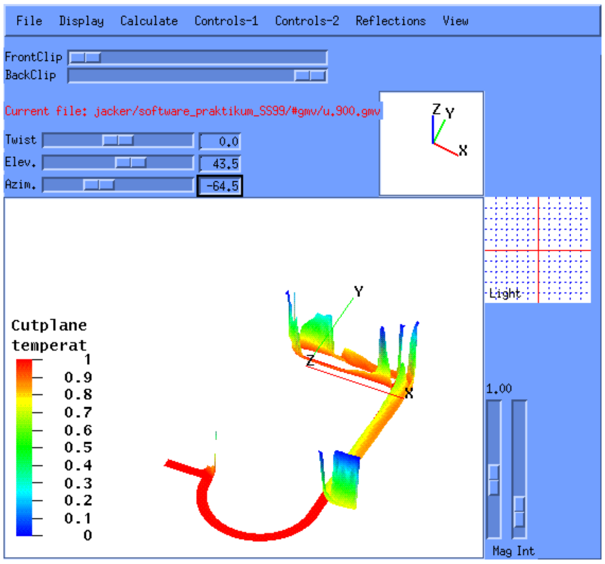

Figure 7: Cutplane Example extruded downwards

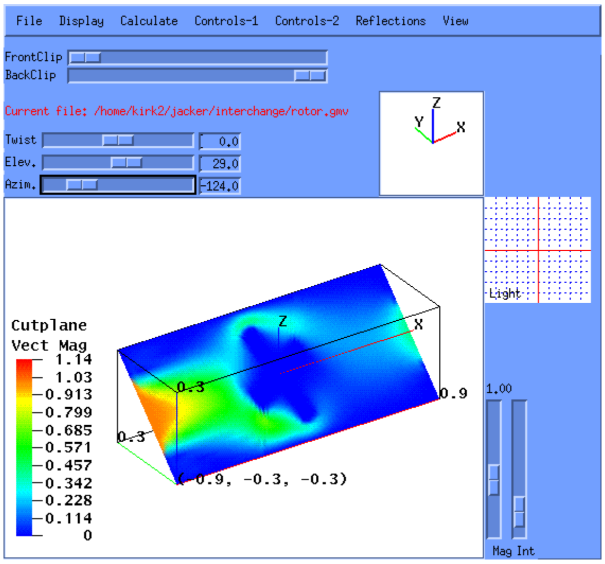

Figure 8: Cutplane (faces)

2 Presentation of scalar 3D data

We will explain different techniques to visualize scalar 3D data, using the example of a flow around a rotor. Corresponding examples as MPEG videos can be found in the 'Virtual Album'. One should do the same preparation as in section 1.1 on page 1 to get an empty display. For a better overview one should also activate 'On' at 'Controls-1/Bounding Box'.

2.1 Setting Cutsurfaces

2.1.1 Cutplanes

This topic was previously considered in section 1.1. But we change the viewed node field to 'Vect. Mag.' (=norm of velocity) and define the cutplane by the three points (0,0,0), (0,0.3,0.3) and (0.9,0.3,0.3). At 'Cutplane Options' (see fig.4) one can choose to view combinations e.g. from faces (see fig.8), contour lines (see fig.9), edges (this is the intersection of the cutplane and our mesh, see fig.10) and vectors (different vectors than in section 3, unicolored, without arrow heads, see fig.11). Faces, contour lines and edges can also be extruded along the surface normal as in section 1.2.

2.1.2 Cutspheres

At 'Calculate/Cutspheres' one can get the box 'Cutspheres' which shows exactly the same functionality as the box 'Cutplanes' (see fig.1). By clicking at one of these cutsphere slots, one can get a new box called e.g. 'Cutsphere 1' (see fig.12). There one can input the center and radius of the desired cutsphere, e.g. center at the origin and radius 0.3. If one clicks at 'Options', one can get the already known box 'Cutplane Options' (logically it should be named 'Cutsphere Options', see fig.4). For an example see fig.13. One can set the same options as for cutplanes (e.g. see fig.14).

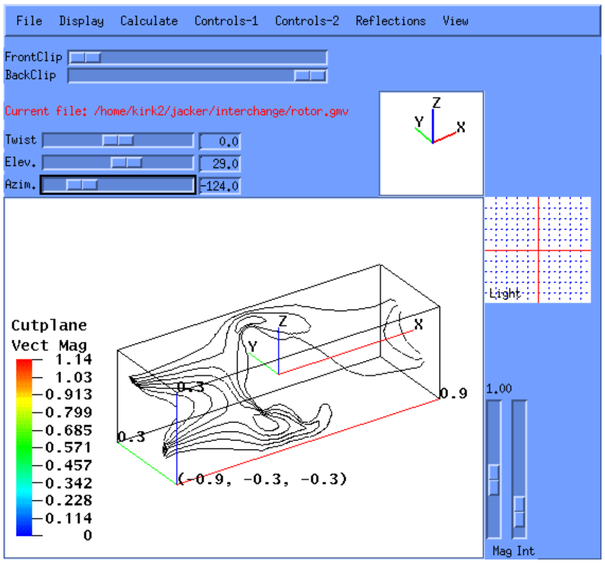

Figure 9: Cutplane (lines)

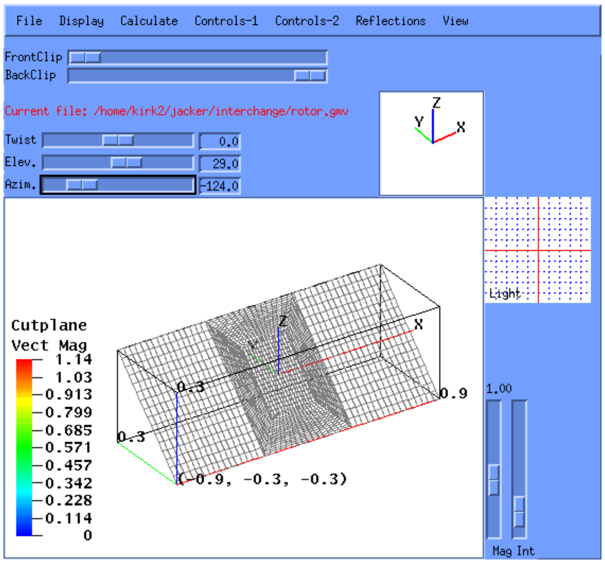

Figure 10: Cutplane (edges)

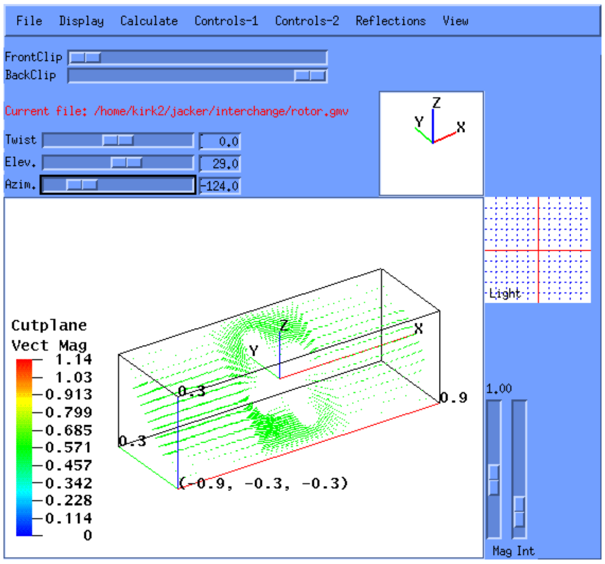

Figure 11: Cutplane (vectors)

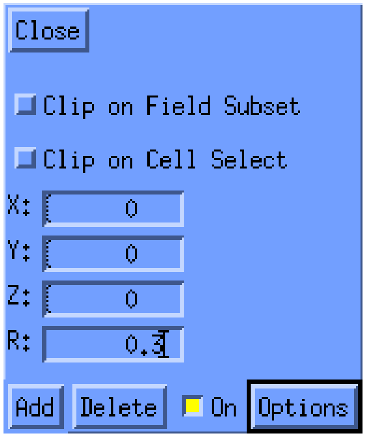

Figure 12: Box 'Cutsphere 1'

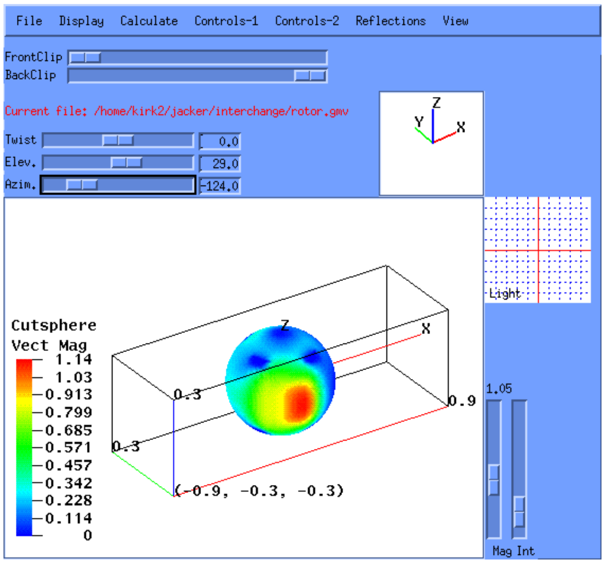

Figure 13: Cutsphere

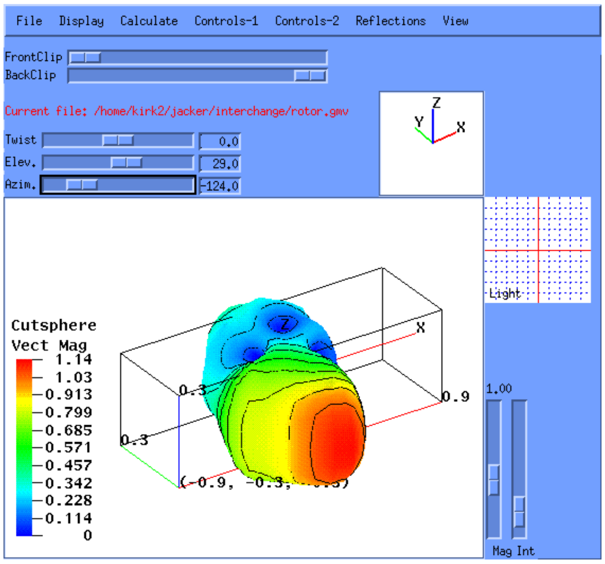

Figure 14: Continued Cutsphere (faces, isolines, extruded)

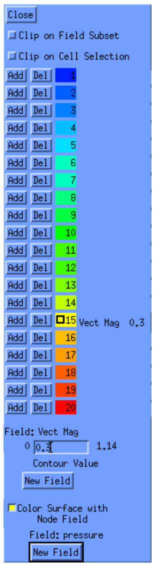

Figure 15: Box ‘Field Isosurfaces’

2.2 Setting Isosurfaces

At ‘Calculate/Isosurfaces/Fields’ one can get the box ‘Field Isosurfaces’ (see fig.15). With the upper ‘New Field’ one can select the node field for the calculation of an isosurface. One must also input a value for the isosurface. By clicking on ‘Add’ at one of these twenty colored slots, one can create an isosurface in this color at the defined value for the current node field (one can create isosurfaces at different values and different node fields!). By activating ‘Color Surface with Node Field’ one can colorize all isosurfaces by a certain node field, which can be selected with the lower ‘New Field’. For an example see figure 16.

2.3 Setting Isovolume

At ‘Calculate/Isovolume’ one can get the box ‘Isovolume’ (see fig.17). With the upper ‘New Field’ one can select the node field for calculating the isovolume. At ‘Isovolume Range’ one has to input the value range for the desired isovolume. By clicking on ‘Add’ one can create an isovolume with the current settings. By activating ‘Color Surface with Node Field’ one can colorize the default grey isovolume by a certain node field (not necessarily the same!). For an example see figure 18. If one wants to get an overview of the geometry of a domain, one can use a grey isovolume with full value range for any node field (see fig.19, the example is for a different configuration from the FEATFLOW homepage!).

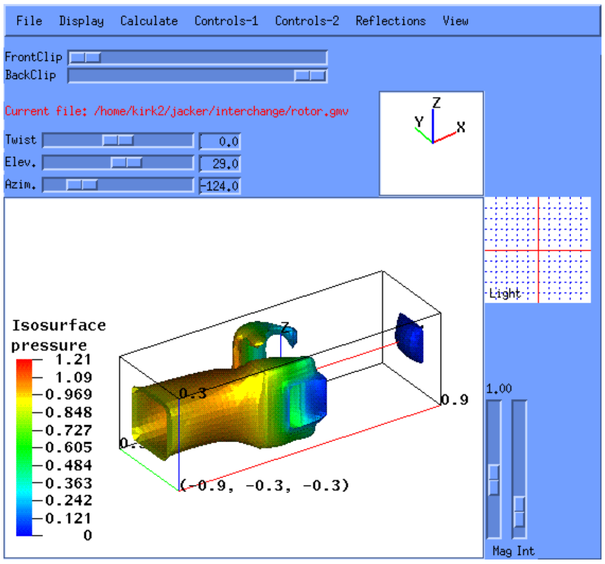

Figure 16: Isosurfaces Example

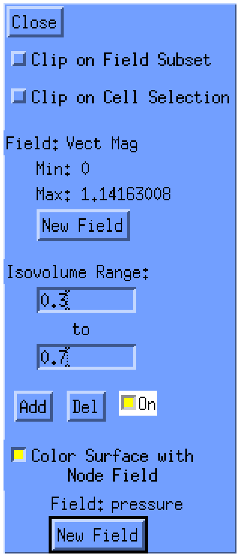

Figure 17: Box 'Isovolume'

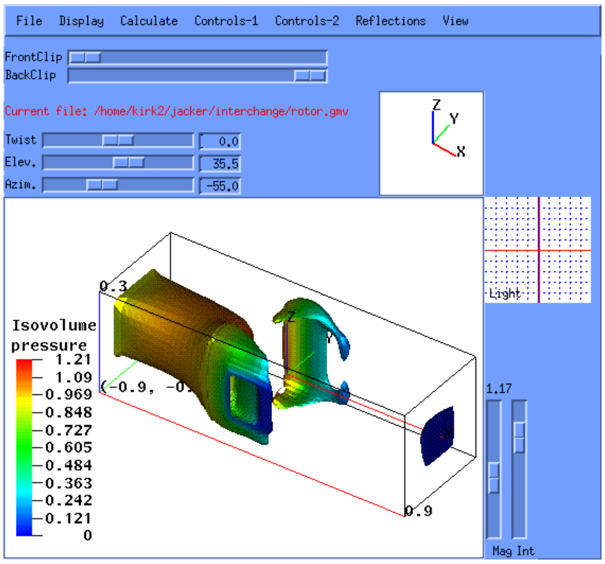

Figure 18: Isovolume Example

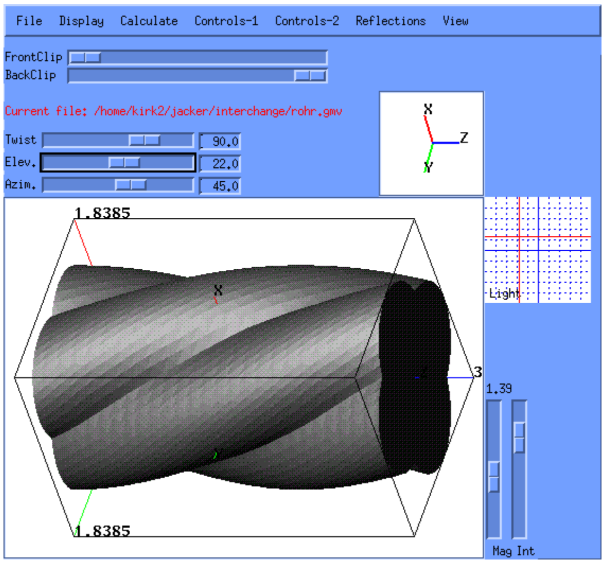

Figure 19: Geometry Example

Figure 20: Box 'Nodes'

3 Presentation of vector-valued data

If one wants to add vectors to a visualization, one has to do the same steps in 3D as in 2D. Clear the display as in prior sections and get at 'Display/Nodes' a box 'Nodes' (see fig.20). Activate 'Vectors/On', select 'Colored By: Node Field', choose a field by using 'New Field' and click at 'Apply'. By doing this, one can get a vector on each mesh node, colored by a certain node field, pointing by default in the direction given by the node fields 'U', 'V' and 'W'. One can change the node fields used to calculate the direction of the vectors in the box 'Build Node Vector' found at 'Vectors/Build Vector' (see fig.21). There one can select the node fields used in each direction component. In the box 'Nodes' one can also choose the used nodes to restrict the number of displayed vectors. At 'Select' one can get the box 'Node Select' (see fig.22). There one can use different criteria to choose the used nodes, e.g. 'Node Numbers' gives the box 'Node Select - Node Numbers' (see fig.23). To select nodes by a range of node numbers, one has to write the range separated by a colon (e.g. 1:1000 to select the nodes 1 up to 1000). Then activate 'Select On' and click on 'Apply'. Now only the selected nodes have vectors. If one wants to adjust the length of the vectors or to remove/add the arrow heads, one can do that in the box 'Vector Controls' given by 'Controls-2/Vector Controls' (see fig.24). The slider 'Vector Scale' adjusts the size of the vectors and the switch 'Arrow Heads On' controls if arrow heads are used or not. Finally see our 2D and 3D vector examples (see fig.25 and fig.26).

4 Movie generation in 3D

The same mechanism as in 2D is applicable, but one has to generate an attribut file for each fixed viewpoint. For further information look at the older paper 'Working with GMV under FEATFLOW' located at our homepage wich discusses the MPEG generation. Additionally, look at the (recent) GMV manual to obtain much more complete information about the GMV tool which is located at 'http://www-xdiv.lanl.gov/XCM/gmv/GMVHome.html'.

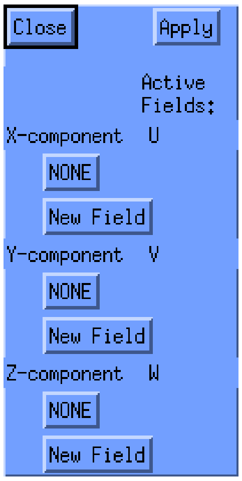

Figure 21: Box ‘Build Node Vector’

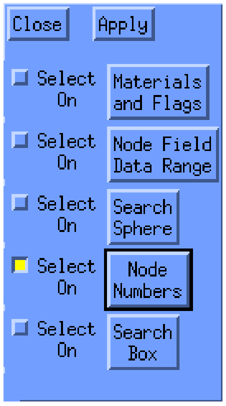

Figure 22: Box ‘Node Select’

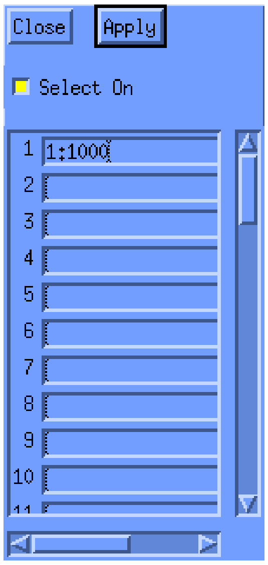

Figure 23: Box ‘Node Select - Node Numbers’

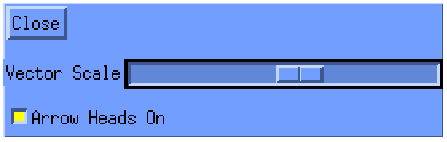

Figure 24: Box ‘Vector Controls’

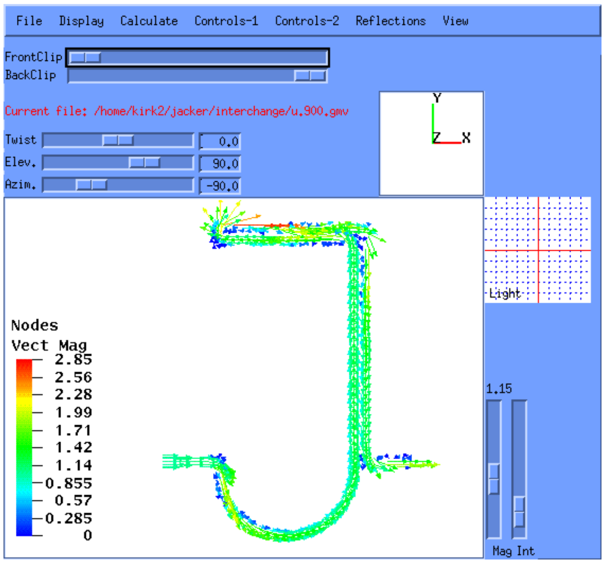

Figure 25: 2D Vector Example

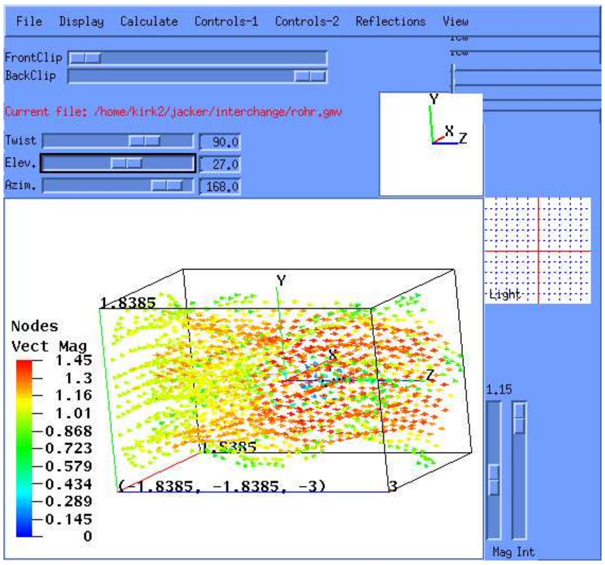

Figure 26: 3D Vector Example