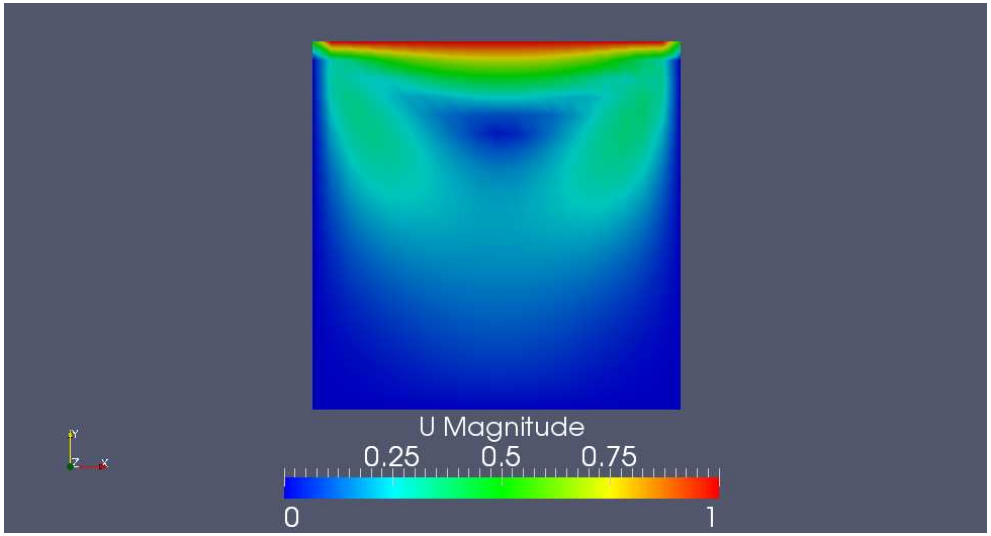
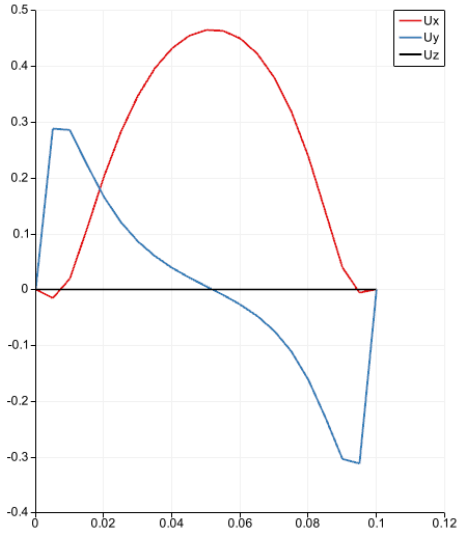
Assignment 1

CFD with OpenSource software

2010

icoFoam: cavity

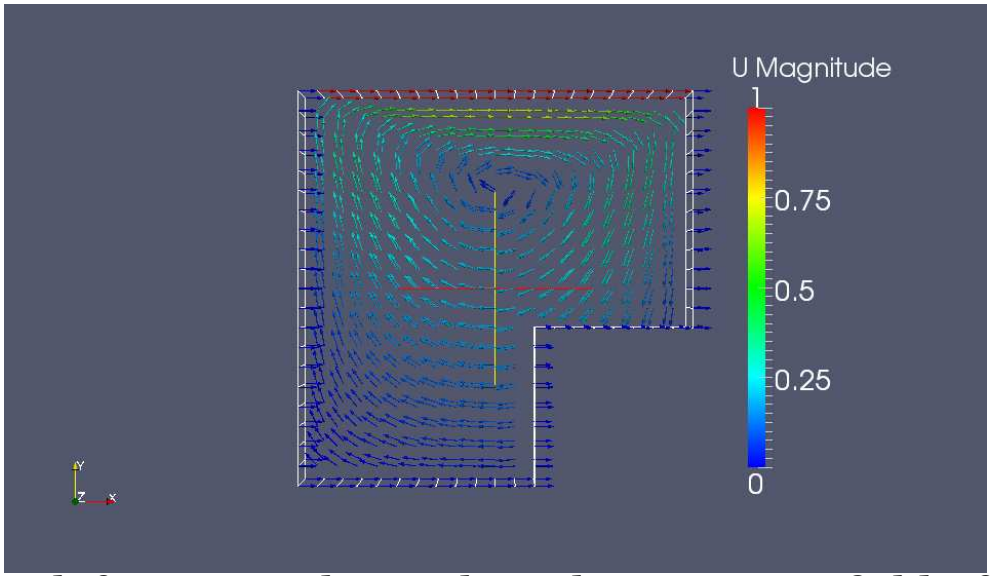


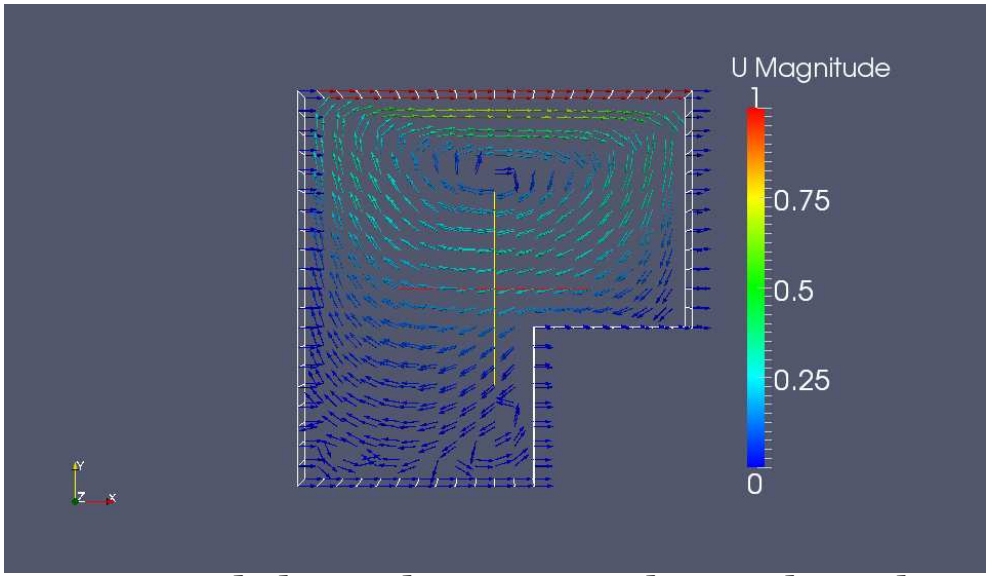


The left picture shows the interpolated velocity field. This can be visualized using ”Display → surface” and ”color by → • U”. Also, the color legend (Visualized by pressing ”Toggle Color Legend Visibility”) has been edited in ”Edit Color Map” to ”blue-to-red”.

The right picture shows the velocity components plotted from (0,0.09,0.005) to (0.1,0.09,0.005). This is accomplished via ”Filters → Data Analysis → Plot Over Line”.

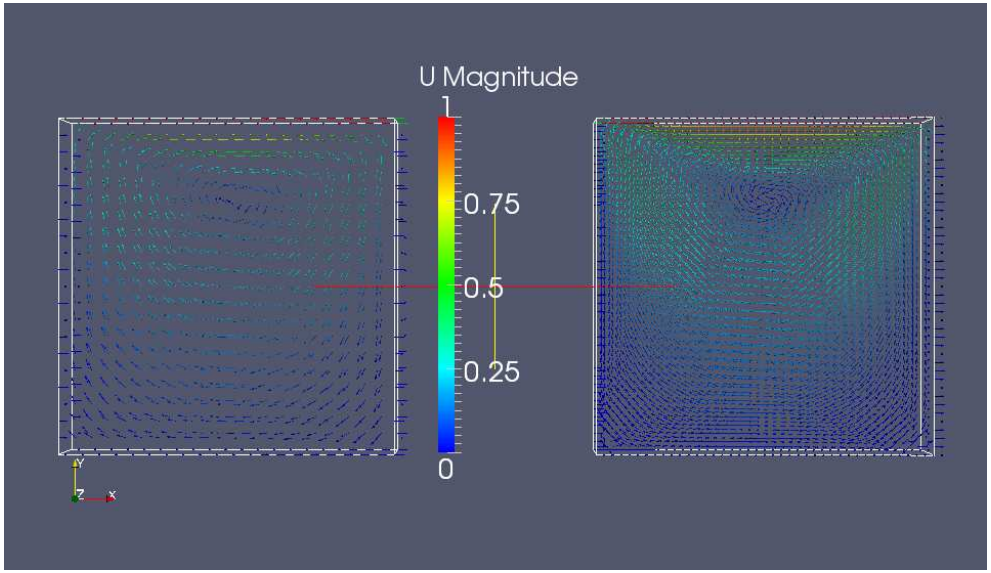
icoFoam: cavityClipped

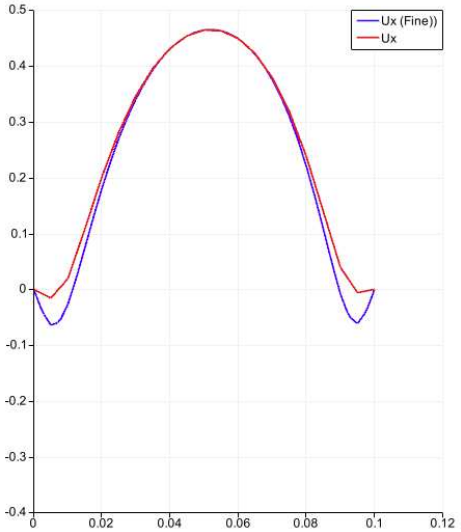




The left picture shows the velocity vector field after 0.5s and the right picture shows the velocity vector field after 0.6s. These are both visualized using ”Glyph”. The vectors are not scaled, but instead colored by ”• U”.

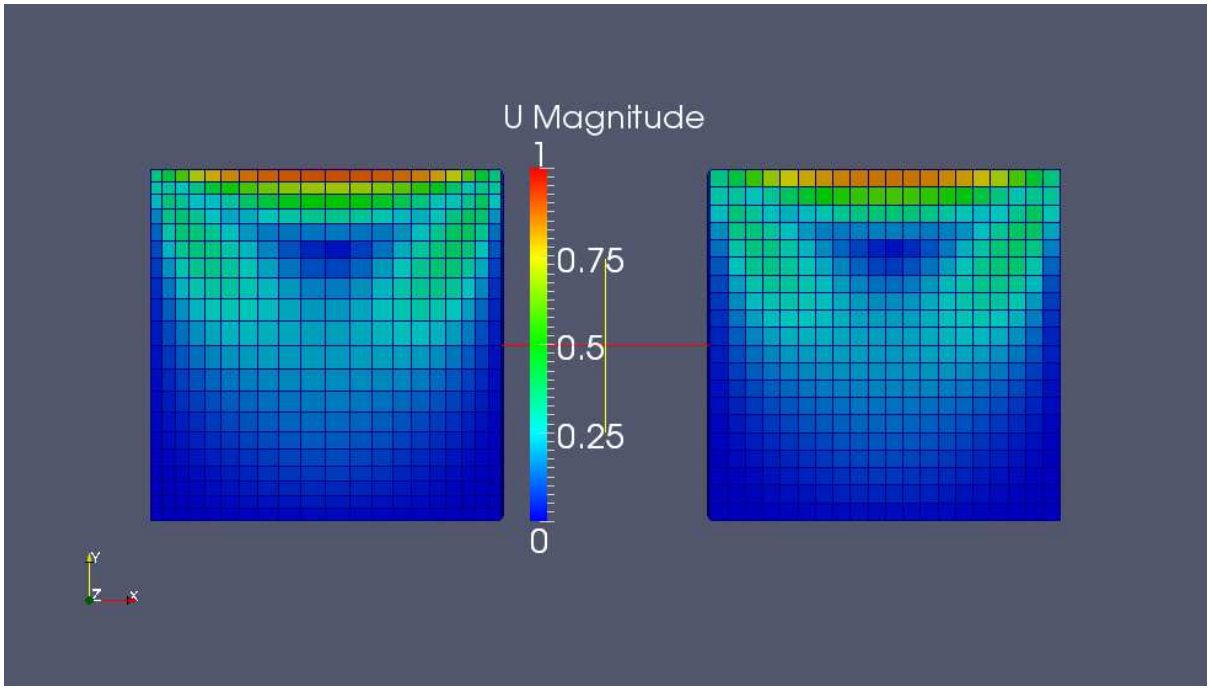
icoFoam: cavityFine





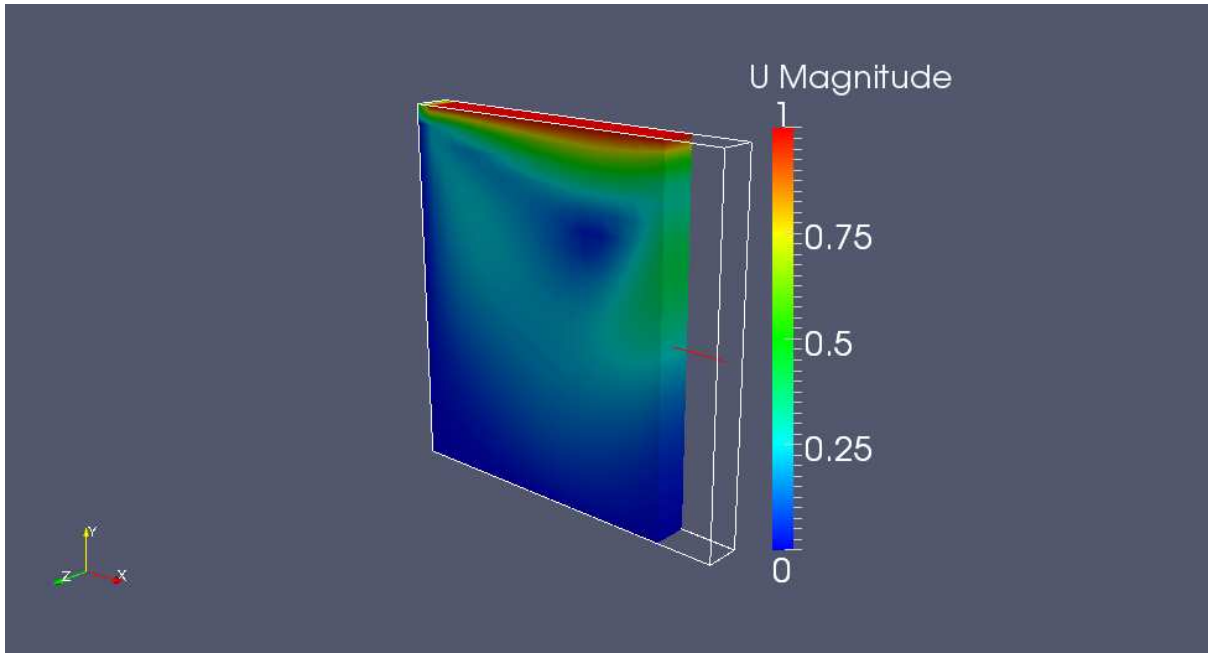
The left picture shows the velocity vector fields for a coarse and fine mesh respectively. The vector fields have been positioned next to eachother using ”Display → Translate”. The right picture shows a comparison of the Ux velocity component for a coarse and fine mesh respectively, between the points (0,0.09,0.005) and (0.1,0.09,0.005).

icoFoam: cavityGrade



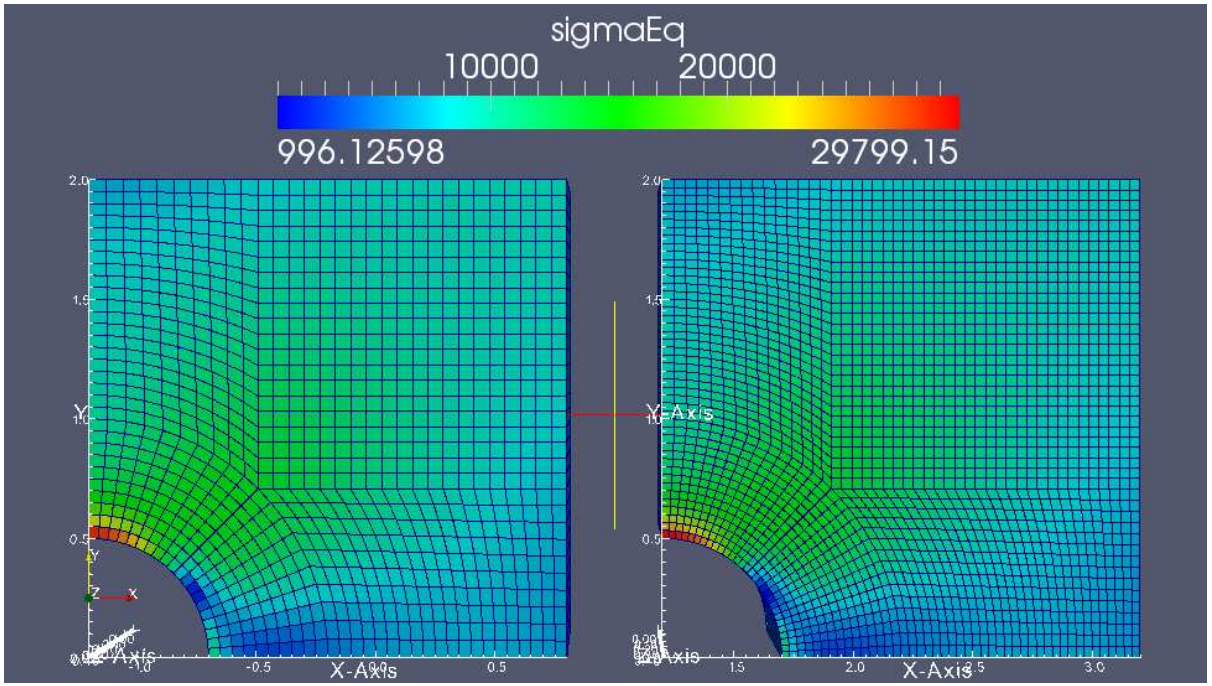
The picture shows the velocity fields for a graded and coarse mesh respectively. The vector fields have been positioned next to eachother using ”Display → Translate”. The right picture shows a comparison of the Ux velocity component for a coarse and fine mesh respectively, between the points (0,0.09,0.005) and (0.1,0.09,0.005).

icoFoam: cavityHighRe



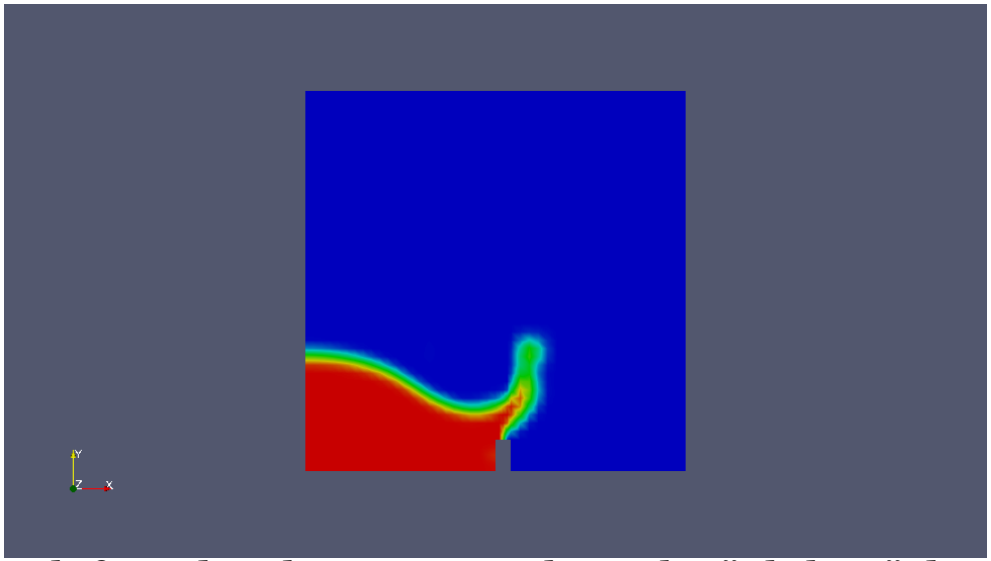
The picture above shows a clip done in the interpolated (i.e. colored by ”• U”) velocity field. A clip is done using the ”Clip” button, and it can be positioned either by giving exact coordinates or by dragging it into place. Also, the entire domain is visualized by a frame using the ”Outline” option.

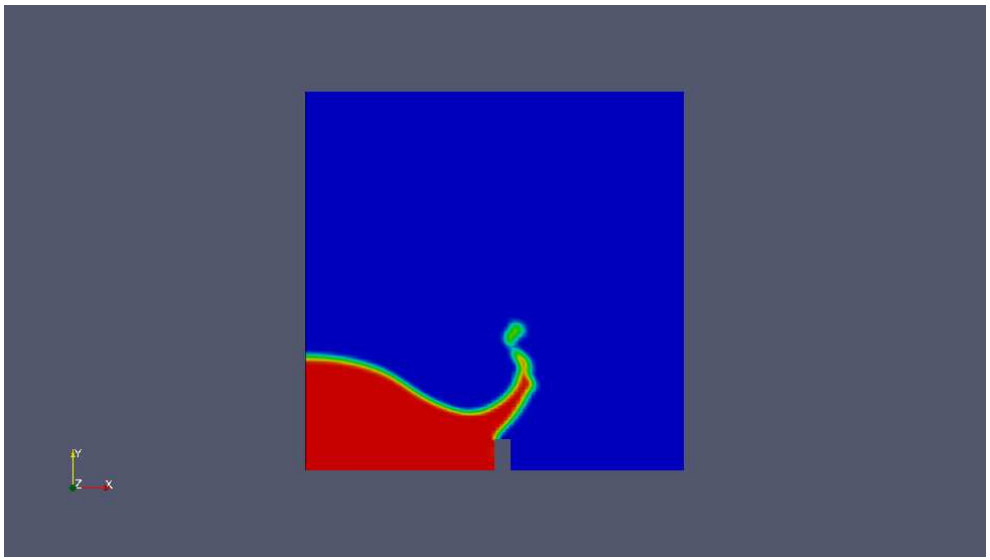
solidDisplacementFoam: plateHole



The picture above shows a comparison of the equivalent stress distribution between a coarse and a finer (x1.5 in x and y direction) mesh. They are colored using cell values (i.e. not interpolated). Also, the axes are visiualized via ”Display → Show cube axes”.

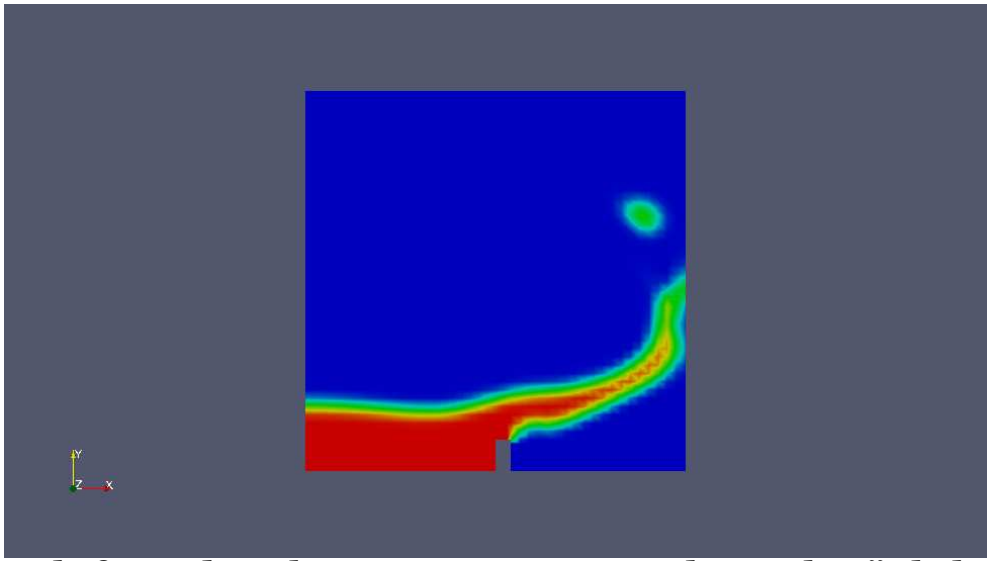
interFoam/laminar: damBreak, damBreakFine

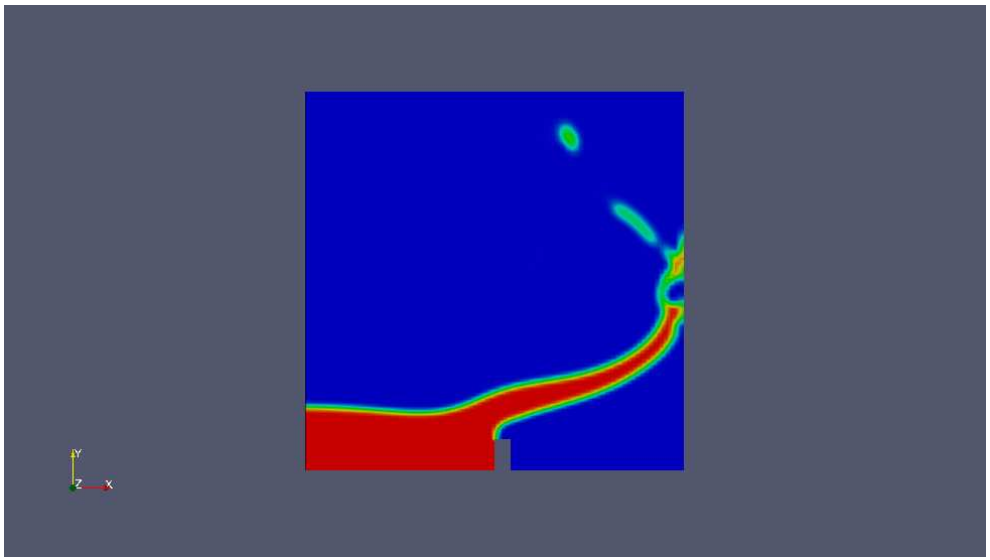




The left and right pictures show the ”alpha1” distributions using a coarse and fine mesh respectively; both at t=0.2s. Snapshots from different timesteps can be achieved by clicking back and forth in the menubar between the loaded frames.

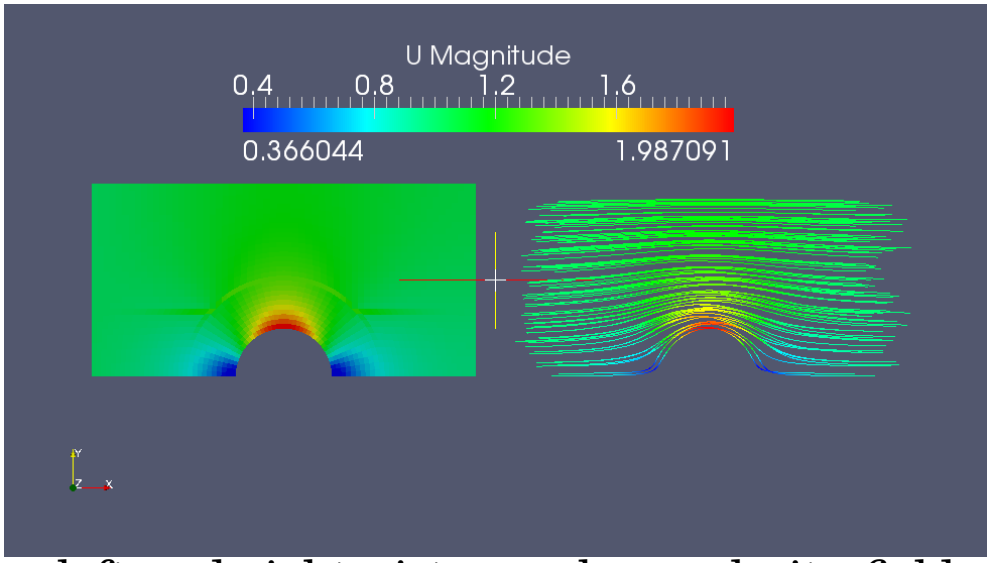
interFoam/laminar: damBreak, damBreakFine

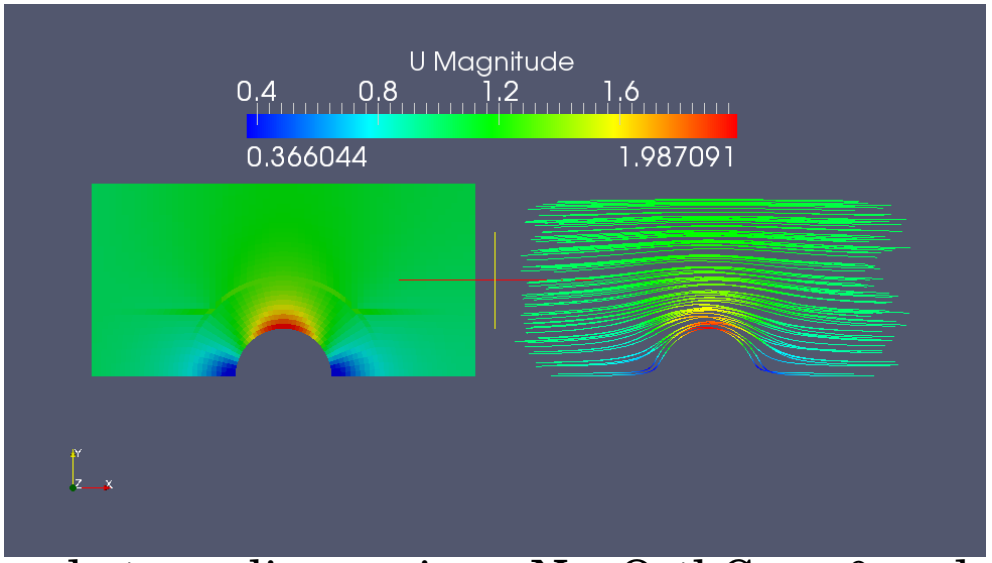




The left and right pictures again show the ”alpha1” distributions using a coarse and fine mesh respectively; this time at t=0.35s. As can be seen in this and the preceding slide, the mesh resolution clearly influences the results.

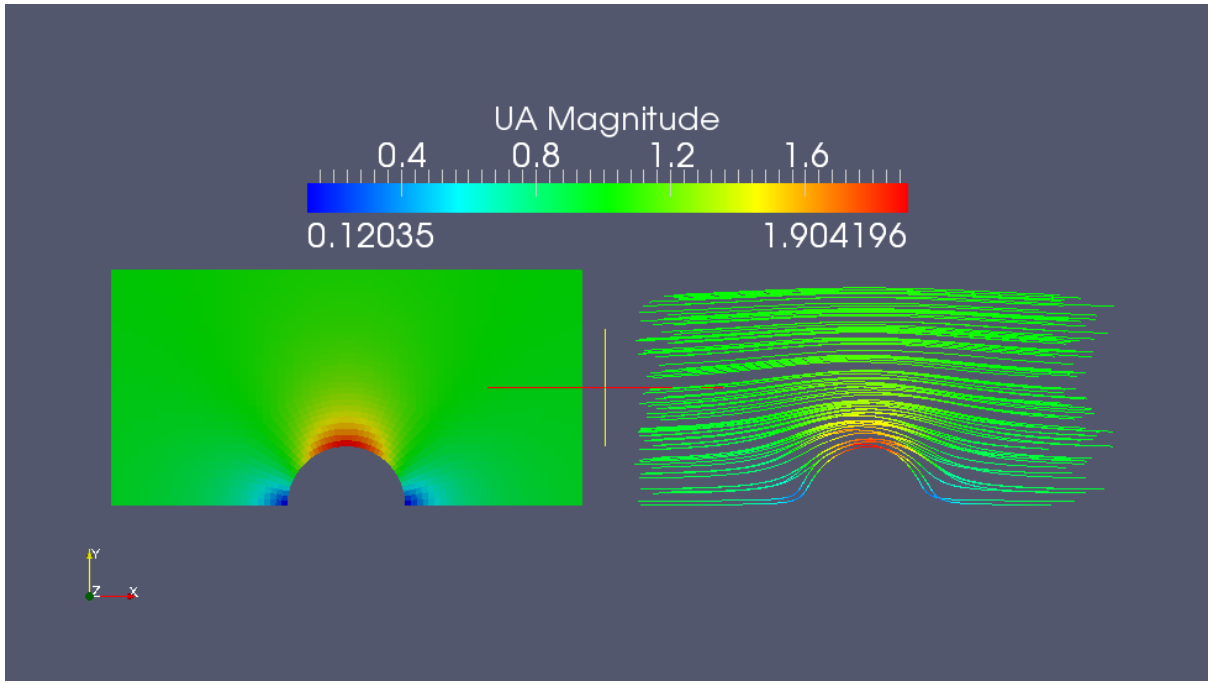
potentialFoam: cylinder





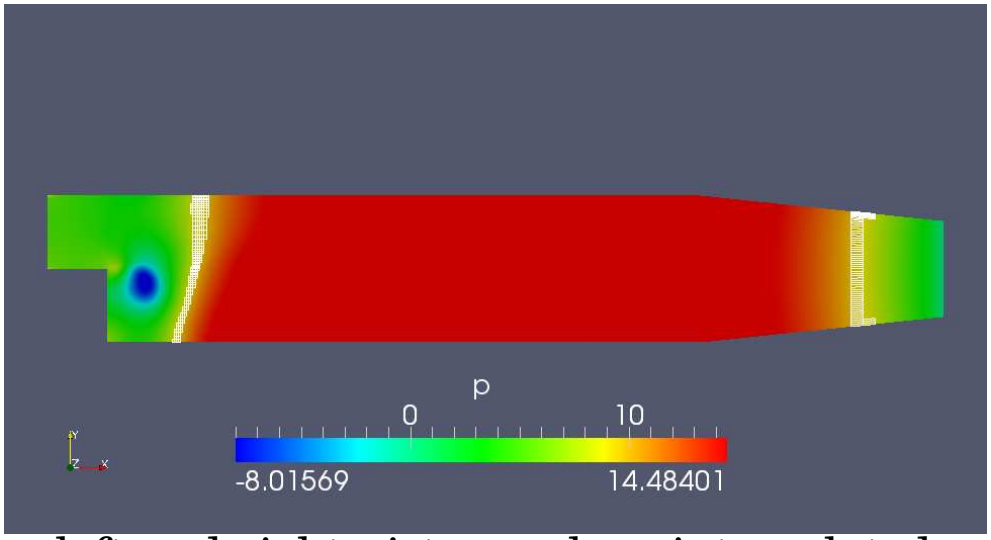
The left and right pictures show velocity fields and streamlines using nNonOrthCorr=0 and nNonOrthCorr=3 respectively. The velocity fields are visualized in the mid-plane of the domains using ”Slice” from the menubar. The streamlines are visualized using the ”Stream Tracer” option.

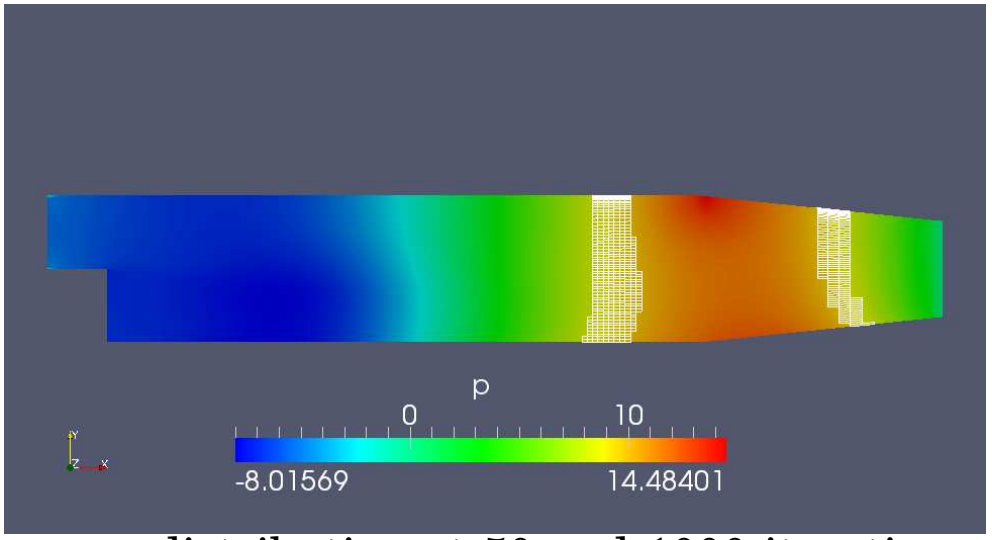
potentialFoam: analyticalCylinder



The picture above shows the analytical solution, visualized in the same way as in the previous slide.

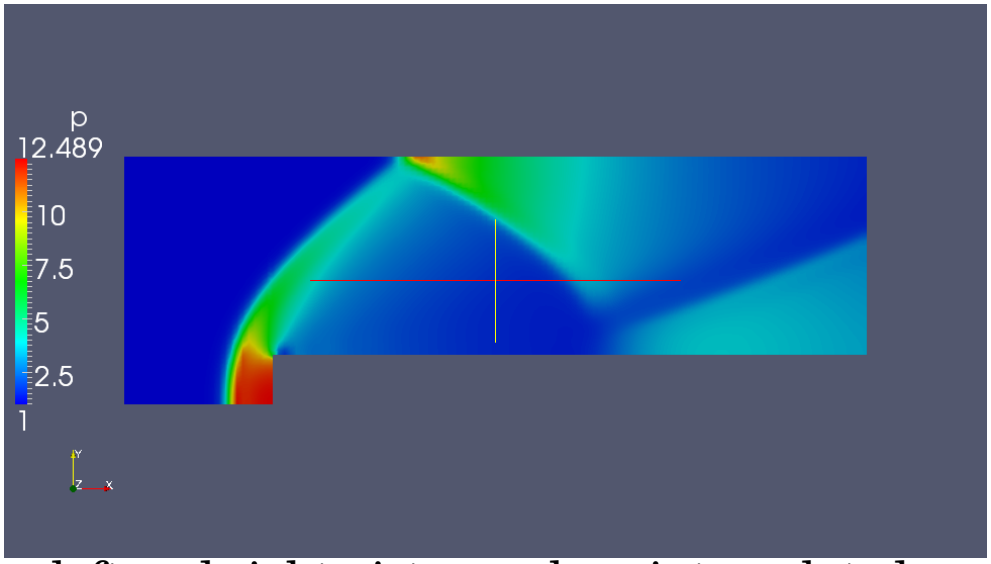
simpleFoam: pitzDaily

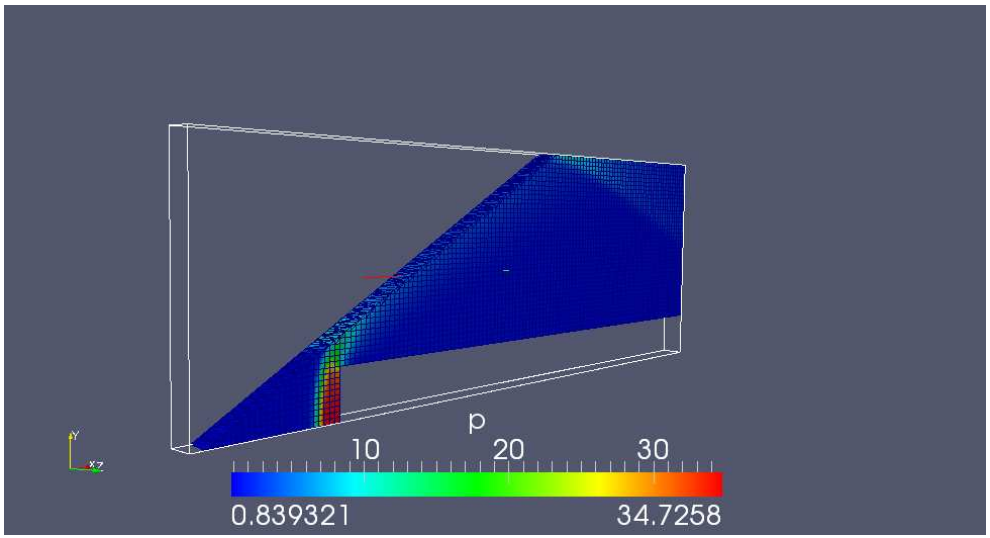




The left and right pictures show interpolated pressure distribution at 50 and 1000 iterations respectively. The mesh formations show areas where $8 \leq p \leq 10$. This effect is achieved using the ”Threshold” option.

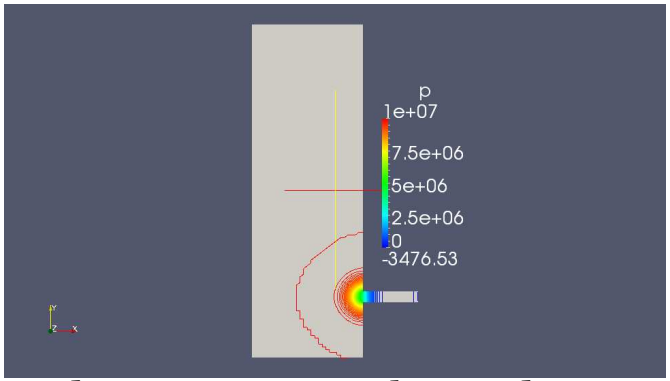
sonicFoam: forwardStep

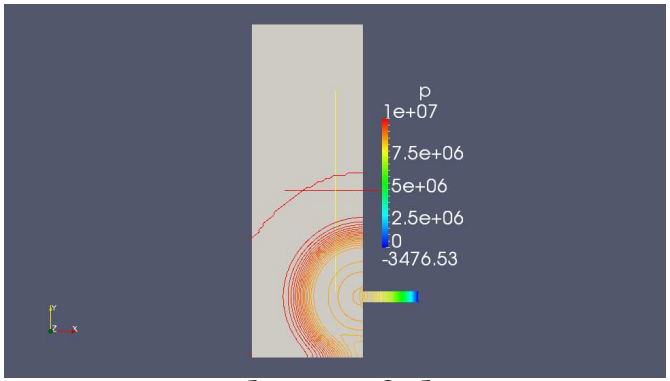


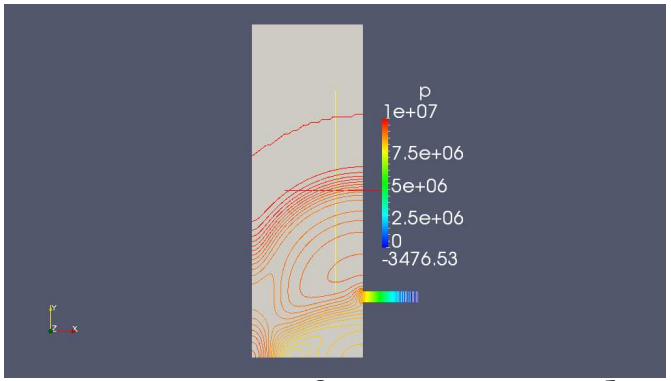


The left and right pictures show interpolated pressure distributions after 10 seconds with inlet velocity 3m/s and 5m/s respectively. The right picture features a ”Clip” done along a shock wave and it is colored using the option ”Surface With Edges” to show the mesh.

sonicLiquidFoam: decompressionTank

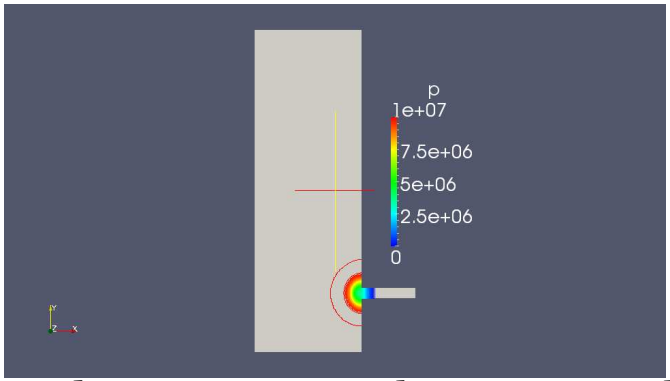


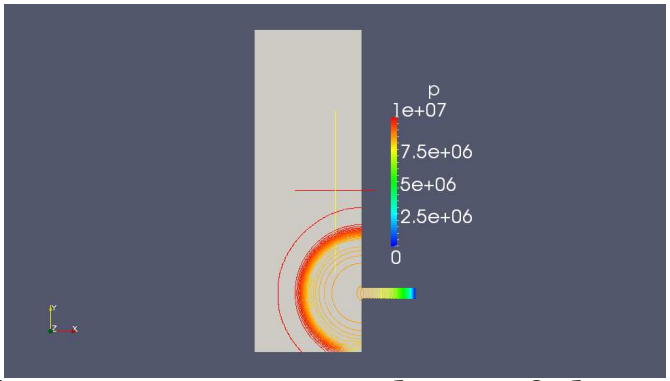


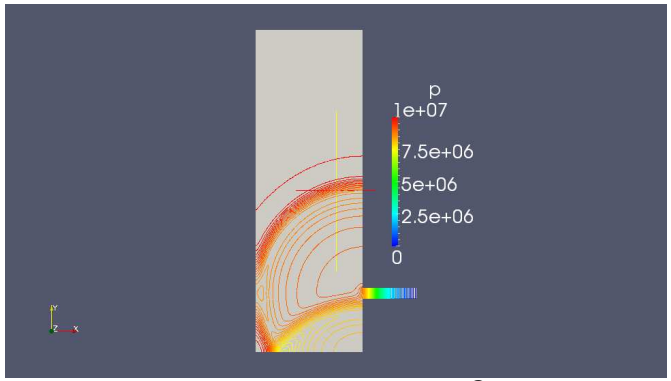


The three pictures above show contour snapshots of the pressure propagation after 40, 70 and 100 micro-seconds respectively. Contour plots are ahieved by simply using the ”Contour” button on the menubar.

sonicLiquidFoam: decompressionTankFine

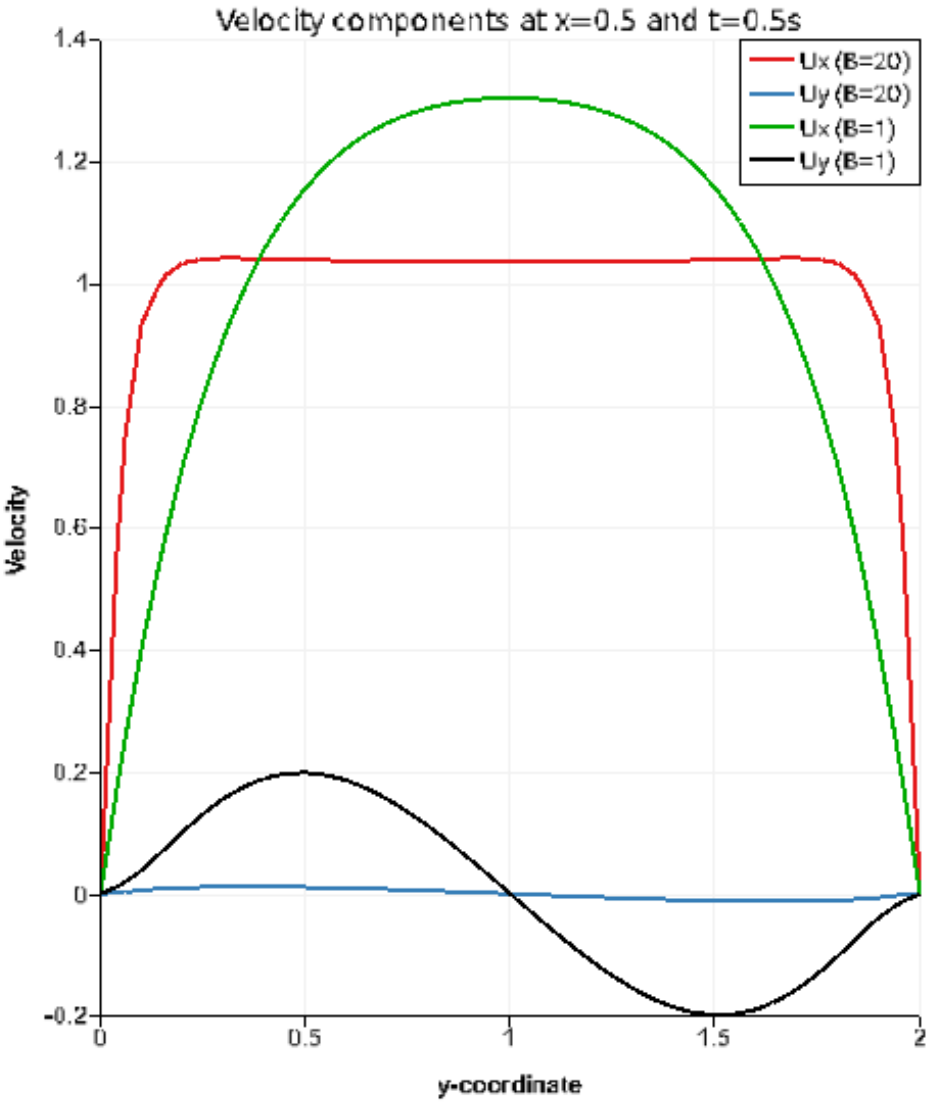






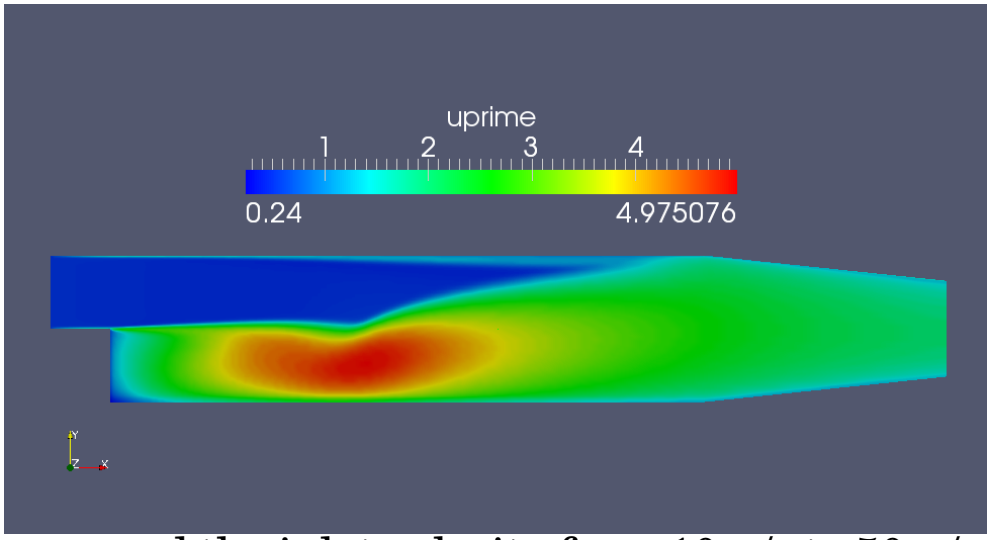
The three pictures above again show contour snapshots of the pressure propagation after 40, 70 and 100 micro-seconds respectively, but using a finer mesh than on previous slide.

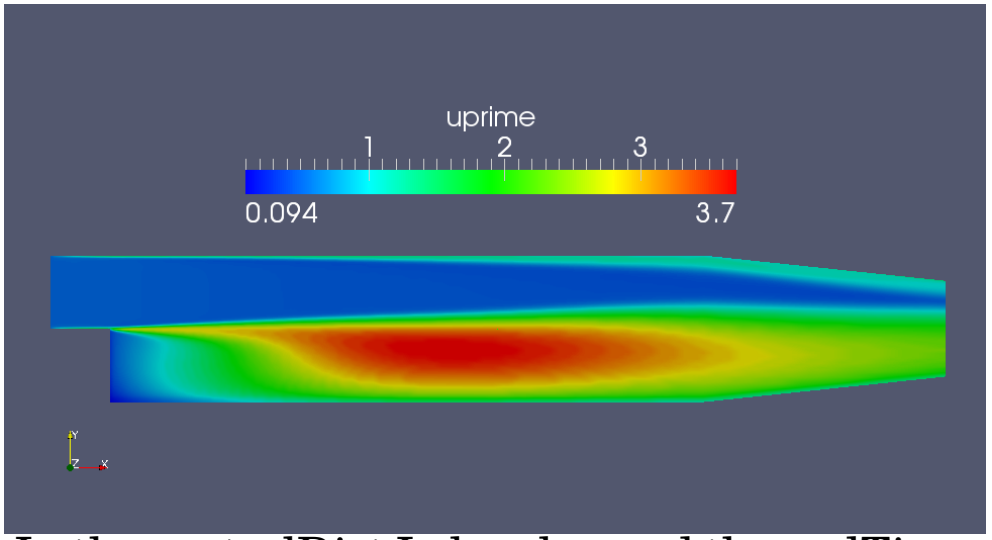
mhdFoam: hartmann



The picture to the left shows a comparison of the Ux and Uy velocity components for B=20 and B=1, at x=0.5 and t=0.5s, respectively. The plot is achieved using "Filters → Data Analysis → Plot Over Line", and the axes can be edited by clicking "Edit View Options" on the top of the plot window.

Modified case
simpleFoam: pitzDaily





I increased the inlet velocity from 10m/s to 50m/s. In the controlDict I also changed the endTime to 240, the writePrecision to 2 and the writeInterval to 20. I then tried the utility *uprime* to compute and visualize the scalar field of u'. These scalar fields are shown above at two different time steps.