

# FLUENT - Turbulent Pipe Flow - Step 7

## Problem Specification

### 1. Pre-Analysis & Start-Up

### 2. Geometry

### 3. Mesh

### 4. Setup (Physics)

### 5. Solution

### 6. Results

### 7. Verification & Validation

#### Problem 1



#### Site Under Construction

We are working on updating this part of the tutorial. Please come back soon.

## Step 7: Verification & Validation

In order to assess the numerical accuracy of the results obtained, it is necessary to compare results on different meshes. We'll re-do the calculation on a 100x60 mesh which has twice the number of nodes in the radial direction as the 100x30 mesh. You can download the 100x60 mesh [here](#).

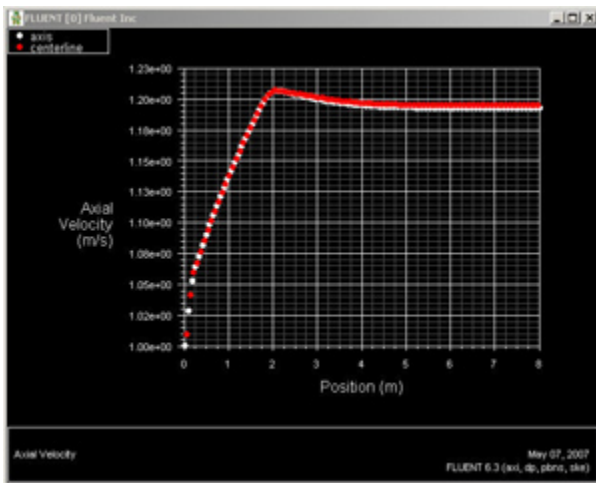
File > Read > Case...

Navigate to your working directory elect the `pipe100x60.msh` file you have created. Click **OK**. Display the grid. Check its size.

### Finer Mesh Analysis

Repeat steps 4, 5, and 6 of this tutorial with the finer mesh.

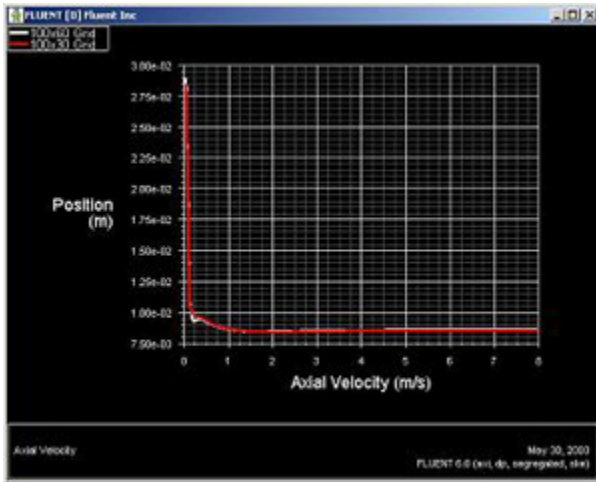
When you get to step 6 of the tutorial, plot each of the graphs as described. However, for each of the plots, overlay the corresponding result for the coarser mesh so that we may compare them. To do this, after the plotting the finer mesh result, in the *Solution XY Plot Window*, click on **Load File...**. Navigate to your working folder, click on the appropriate filename for the previous result, eg. `vel1.xy` for centerline velocity, and click **OK**. Click **Plot**. You'll see both results plotted in the same the graphics window.



[Higher Resolution Image](#)

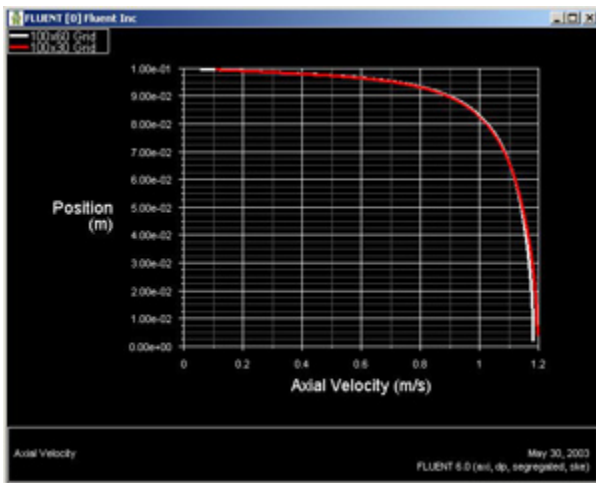
In the centerline velocity plot above, the white line represents the centerline velocity of the finer mesh, while the red line represents the velocity of the coarser mesh from before. As we can see, there isn't too much of a difference between the two plots. Save this plot as `vel12.xy`.

Now, let's take a look at the coefficient of skin friction. This time, load the `cf.xy` file to compare against the plot. This is the coefficient of skin friction plot:



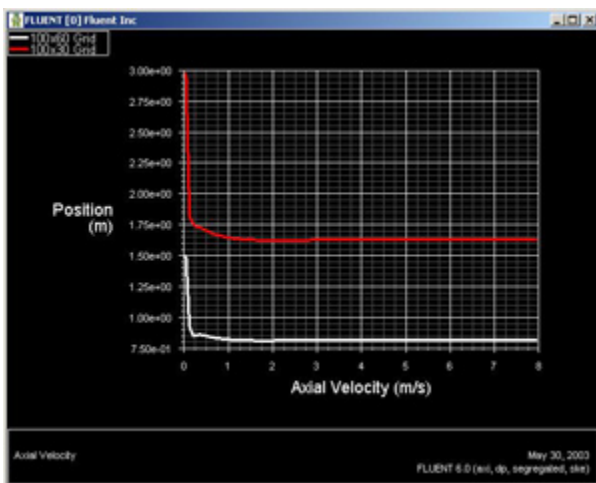
[Higher Resolution Image](#)

Once again, we can see that due to the fine degree of each mesh, there isn't much difference between the two plots. Save this plot as `cf2.xy`. Now, study the velocity of the outlet by plotting and comparing to the graph in `profile.xy`.



[Higher Resolution Image](#)

Once again, the finer mesh in this case doesn't offer much more precision than the coarser mesh. Save this plot as `profile2.xy`. Now let's take a look at the YPlus plot.



[Higher Resolution Image](#)

As we can see, there is a significant increase in the accuracy of the plot from the finer mesh. Save this plot as `yplus2.xy`.

You may want to experiment with meshes of other granularities and compare their plots with the plots saved from the 100x30 and 100x60 meshes.

In Problem 1, we will be looking at the effect of coarse meshes with uniform granularity.

Go to [Problem 1](#)

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