Extract BC from EFD Data Reduction Sheet

- Calculate inlet velocity from venturi meter flow rate measurement
- Outlet pressure is pressure measurement at tap #4

ANSYS Schematic Layout

- Drag 1 **Geometry** component
  - Rename **"pipe"**
- Drag 2 **Mesh** component
  - Rename 1 **"non-uniform"**
- Drag 2 **Fluent** component
  - Rename 1 **"turbulent"**
- Create Folder on H:Drive called *CFD Lab and Lab 1*
- Save project file in new folder and call it *Lab 1*

Geometry Creation

- Select **Meter**
- Create **New Sketch** on **XY Plane** and **Look At**
- Draw **Rectangle** and dimension as follows:
  - Length = 6.096m
  - Radius = 0.02619m
- **Concept** > **Surface from Sketch** > select *Sketch 1* click **Apply** and **Generate**
- **File** > **Save Project**

Mesh Generation

- **Insert** > **Mapped Face Meshing**
- **Insert** > **Sizing** for top and bottom
  - **No of Divisions** = 564
  - **Behavior** = **Hard**
  - **Bias Type** =**No Bias**
- **Insert** > **Sizing** for left and right
  - **No of Divisions** = 15
  - **Behavior** = **Hard**
  - **Bias Type** =**Fine on wall**

    - **Bias Factor** =**3.1117**
- **Generate Mesh**
- **Create Named Selection**
    - *inlet*, *outlet*, *wall*, and *axis*
- **Update Mesh** on **Project Schematic**

Solution Setup

- Change **2D Space** to **Axisymmetric**
- Models is **k-e model with default parameters**
- Use average measured temperature to calculate density and viscosity
- Cell zone conditions change to fluid **Air**
- BC: axisymmetric, measured inlet velocity, outlet pressure, and given wall roughness
    - **Inlet:** measured inlet velocity, turbulent intensity=0.01%, turbulent length scale=0.000294m
    - **Outlet:** measured pressure at tap4, turbulent intensity=5%, turbulent viscosity ratio=10
    - **Wall:** no-slip, roughness=2.5e-5m, roughness constant=0.5
    - **Axis:** symmetry
    - **Operating conditions:** reference pressure is 97225.9 Pa
- Change **Reference Values** as follows:
    - **Area** = **0.002154869**
    - **Density** = **Based on Measured Temperature**
    - **Length** = **0.05238**
    - **Temperature** = **Measured**
    - **Inlet Velocity** = **Based on Measured Temperature**
    - **Viscosity** = **Based on Measured Temperature**
- **Solution Methods**
    - **Green Gauss Cell Based**

    - **Second Order schemes for all equations**
- **Monitors**
    - All three eqns = **1e-06**
- **Solution Initialization**
    - **Standard**
    - **Measured inlet velocity and outlet pressure**
    - **Turbulent kinetic energy=0.09m^2/s^2**
    - **Turbulent dissipation rate=16m^2/s^3**
- **Run Calculation**
    - **Number of Iterations** = **1000**

Data to save

- **Residuals image**
- **Centerline pressure with EFD image**
- **Centerline velocity distribution image**
- **Wall shear stress distribution image**
- **Export wall friction factor distribution and calculate shear stress C=8*t/(rho*U^2)**
- **Axial velocity with EFD image**

Surface Name	X0	Y0	X1	Y1
x=10d	0.5238	0	0.5238	0.02619
x=20d	1.0476	0	1.0476	0.02619
x=40d	2.0952	0	2.0952	0.02619
x=60d	3.1428	0	3.1428	0.02619
x=100d	5.238	0	5.238	0.02619

- **Export velocity profile at x=100d and normalize it then save image**

- **Contours of radial velocity**
- **Velocity vector at region where flow is becoming fully developed**
- **Image of normalized CFD laminar and turbulent velocity profile at the developed region**