

Community Christmas Competition IV

Simulation of the backward facing step

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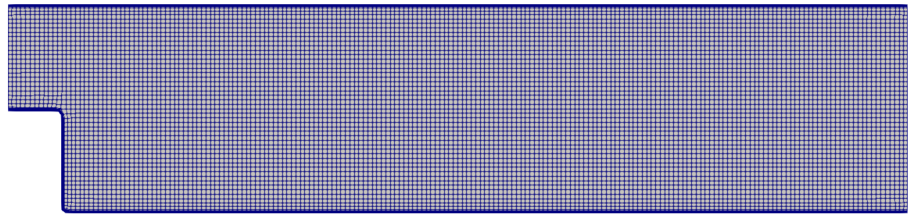
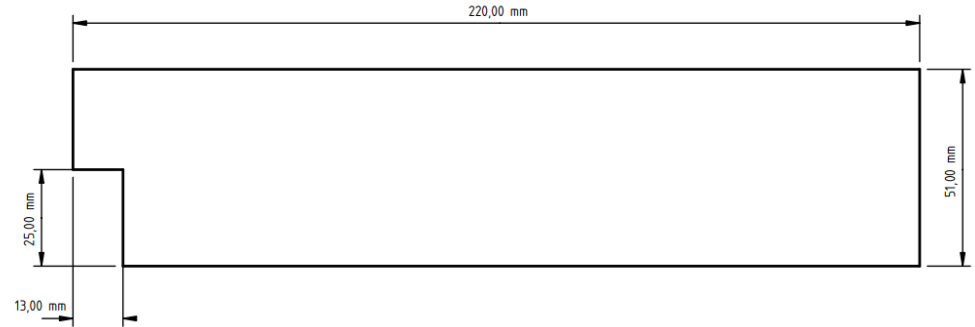
Model setup

- pimpleFoam – RAS
- k- ϵ model
 - Does not need resolved boundary layer
 - Expected to work better at higher Re
- Turbulence intensity **4%**
- Eddy viscosity ratio **10**
- noSlip wall condition
- Simulation time 400s
- Time step 1s

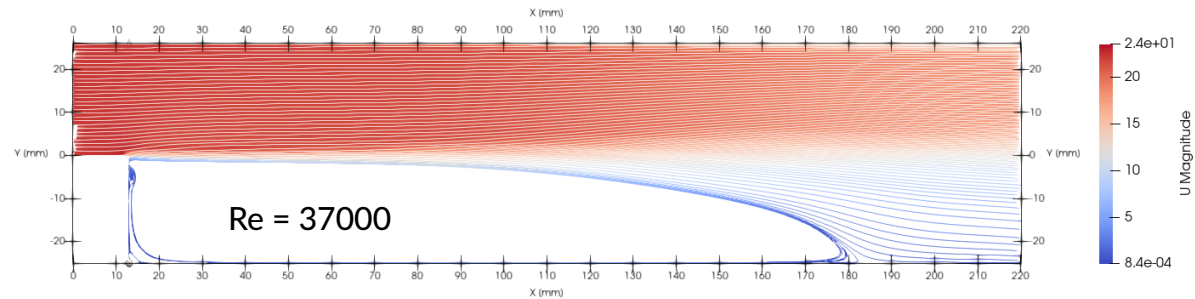
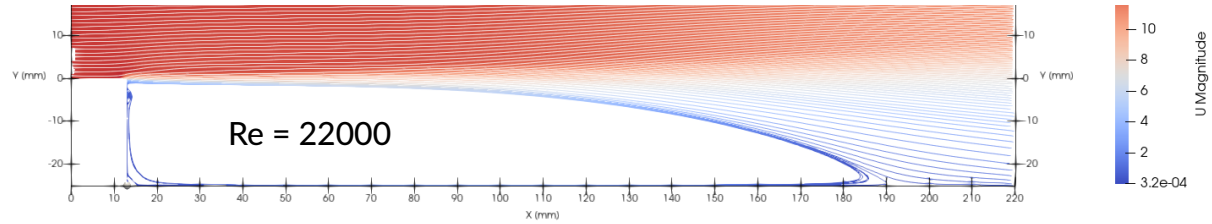
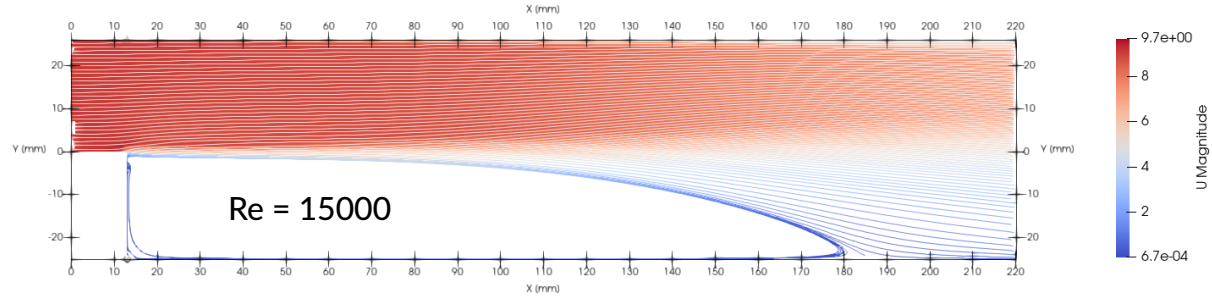
| Turbulence Method | k-epsilon | | |
|---------------------|-----------|----------|----------|
| Reynolds number | 15000 | 22000 | 37000 |
| Velocity | 9.1 | 13.3 | 22.2 |
| Kinematic viscosity | 1.52E-05 | 1.51E-05 | 1.50E-05 |
| k | 0.198744 | 0.424536 | 1.182816 |
| epsilon | 23.6995 | 108.1385 | 839.4322 |

Geometry and mesh setup

- Geometry from flame stabilization
- Cartesian mesh using cfMesh
 - Cell size 1.1 mm
 - Number of cells 13154
- Boundary layer
 - Number of layers 10
 - Thickness ratio 1.4
 - First layer y^+ 30



Velocity Results



Results

- Reattachment point @ zero net flow reversal
- More accurate result at high Re number

| Re | Experiment | | Simulation | | /% |
|-------|------------|------------|------------|------------|-------|
| | x_R/H | x_R [mm] | x_R/H | x_R [mm] | |
| 15000 | 6.5 | 162.5 | 7.0 | 175 | +7.69 |
| 22000 | 7.0 | 175 | 7.2 | 180 | +2.86 |
| 37000 | 6.8 | 170 | 6.8 | 171 | +0.59 |

