Study of Flow Regime for Two Phase Gas-Liquid Flow in Large Diameter Riser

Presented by
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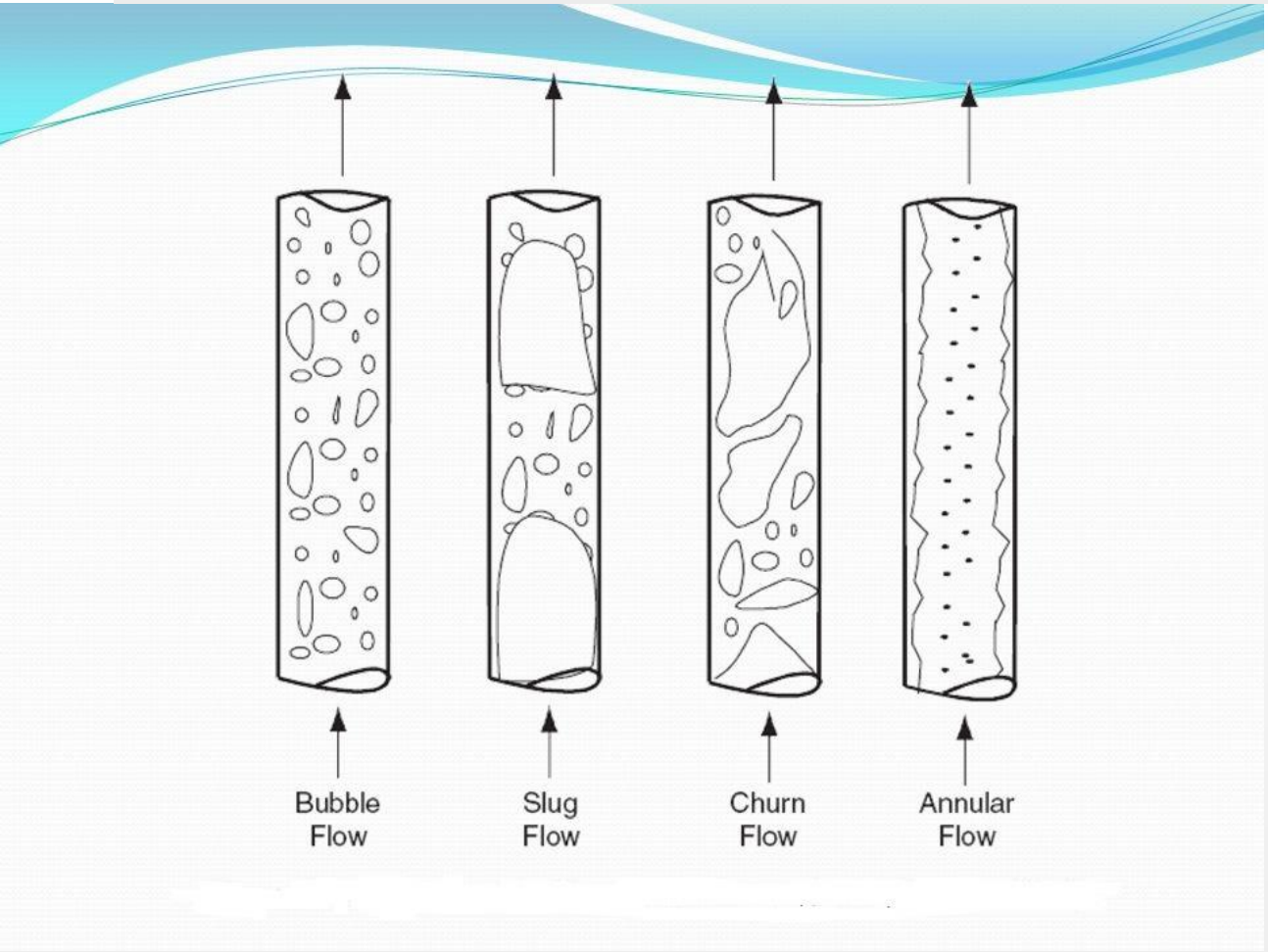
Types of Flow Regime



- Bubble Flow
- Slug Flow
- Churn Flow
- Annular Flow

Flow regime-experiment Annular Flow

Vertical upward two phase flow regime [Shoham, 1982]

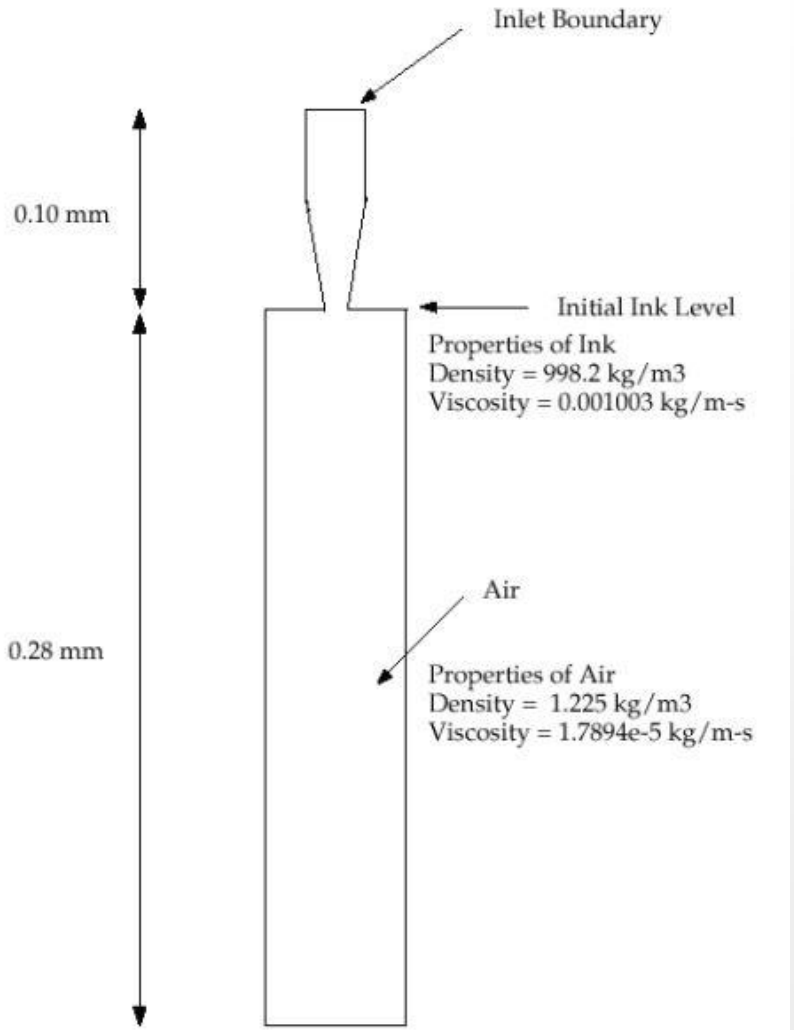
Objectives

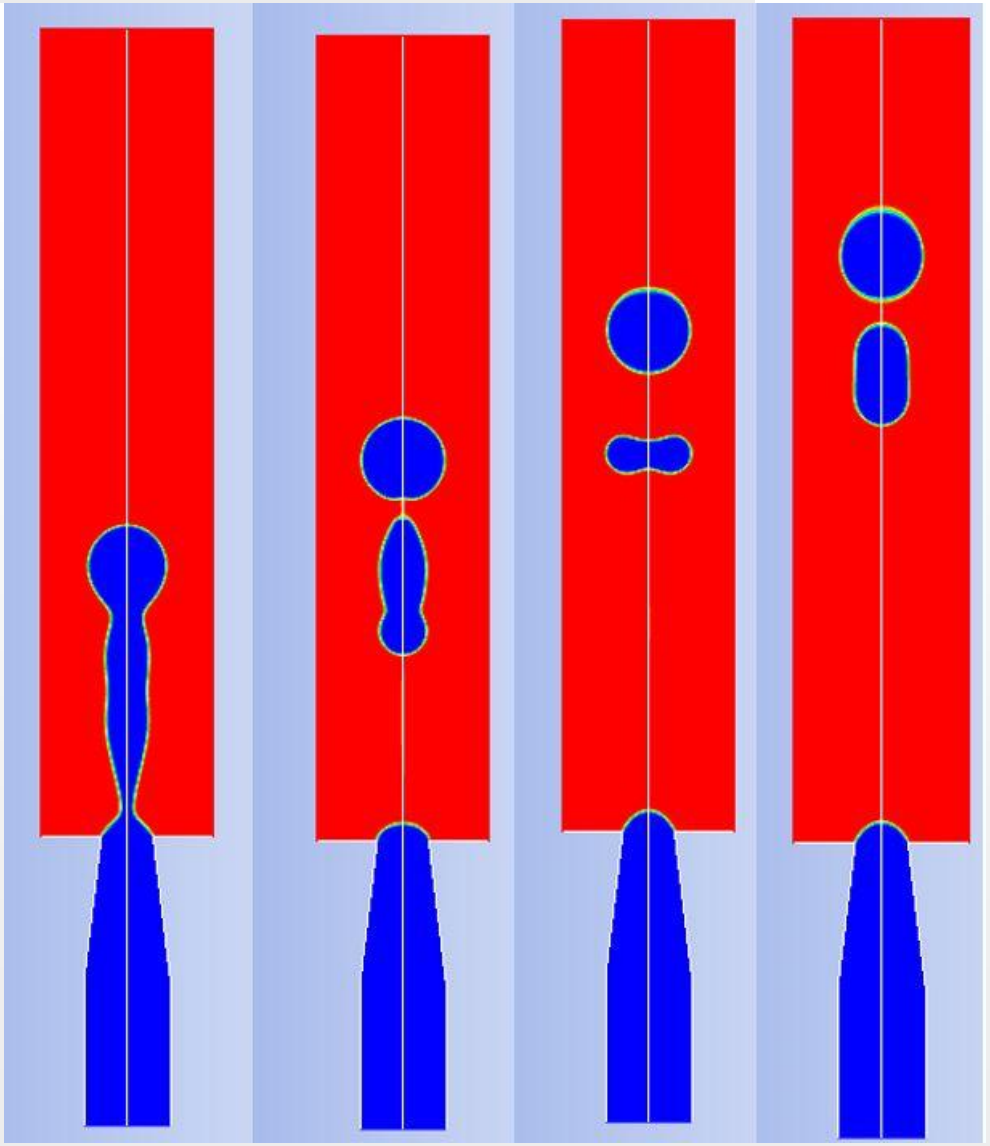
- Air-water 2-phase flow simulation
- Axisymmetric upward Slug flow simulation
- Develop Flow pattern map for two large diameter pipe and their comparison
- Validating result from highly cited literature

Challenges

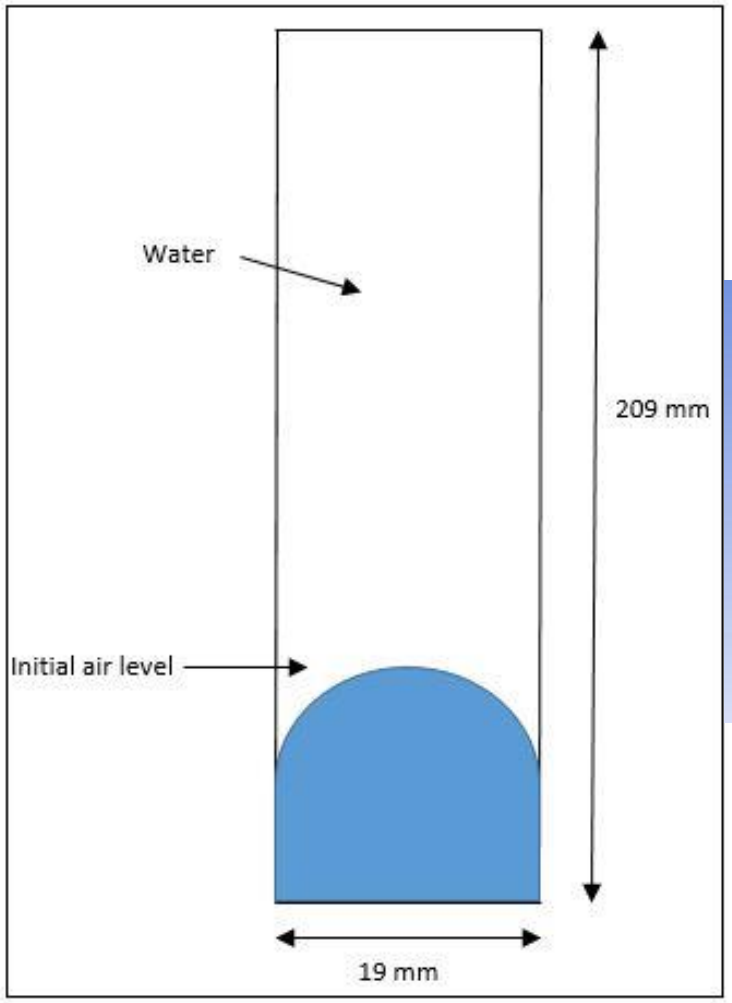
- Resources. Time step, $\Delta t = C \frac{\Delta x}{v_{fluid}}$; C=0.25
- High number of mesh element due to uniform mesh requirement in whole domain
- Scarce numerical work
- Deviation from experimental results on literature due to lack of detail information and difference in experimental setup

Simulation-1

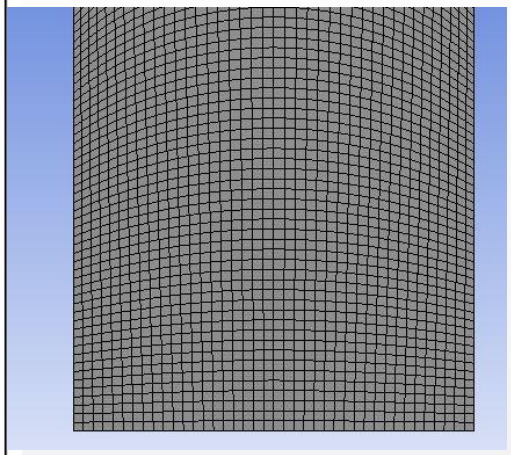




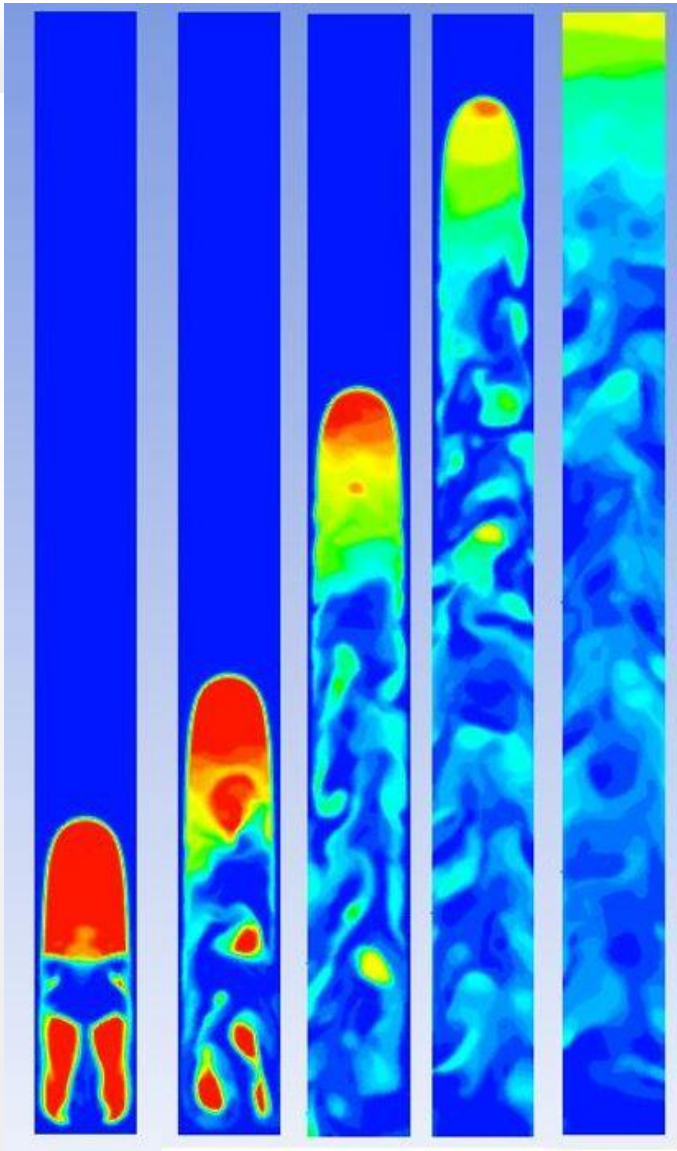
Simulation-2



Schematic Diagram

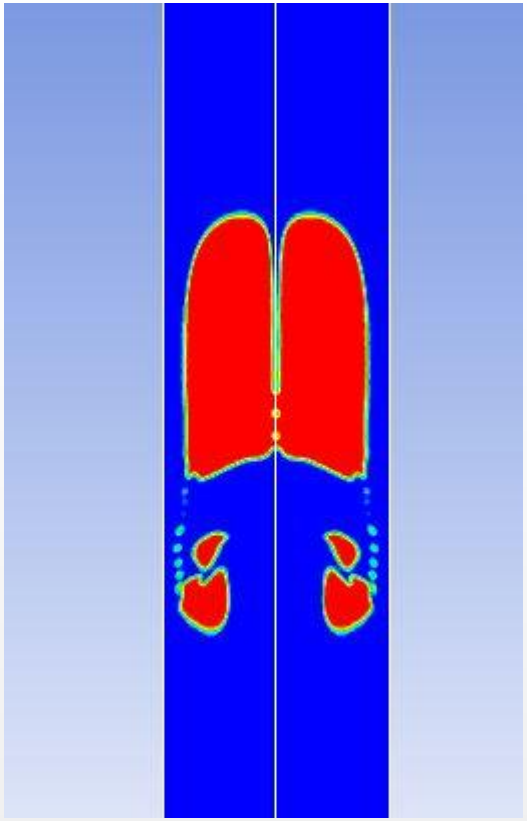


Mesh

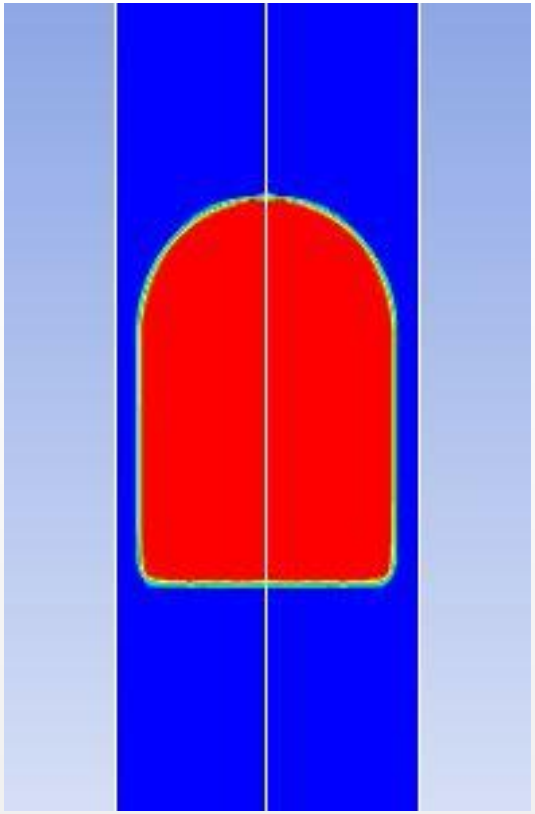


Taylor bubble in symmetric pipe

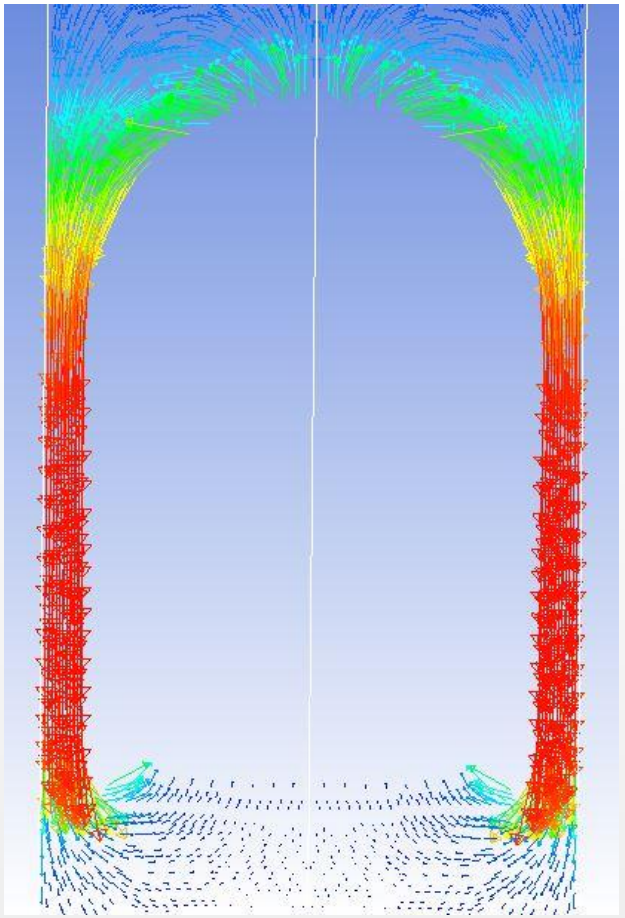
Axisymmetric Slug Flow



Axisymmetric Slug (Re=84)

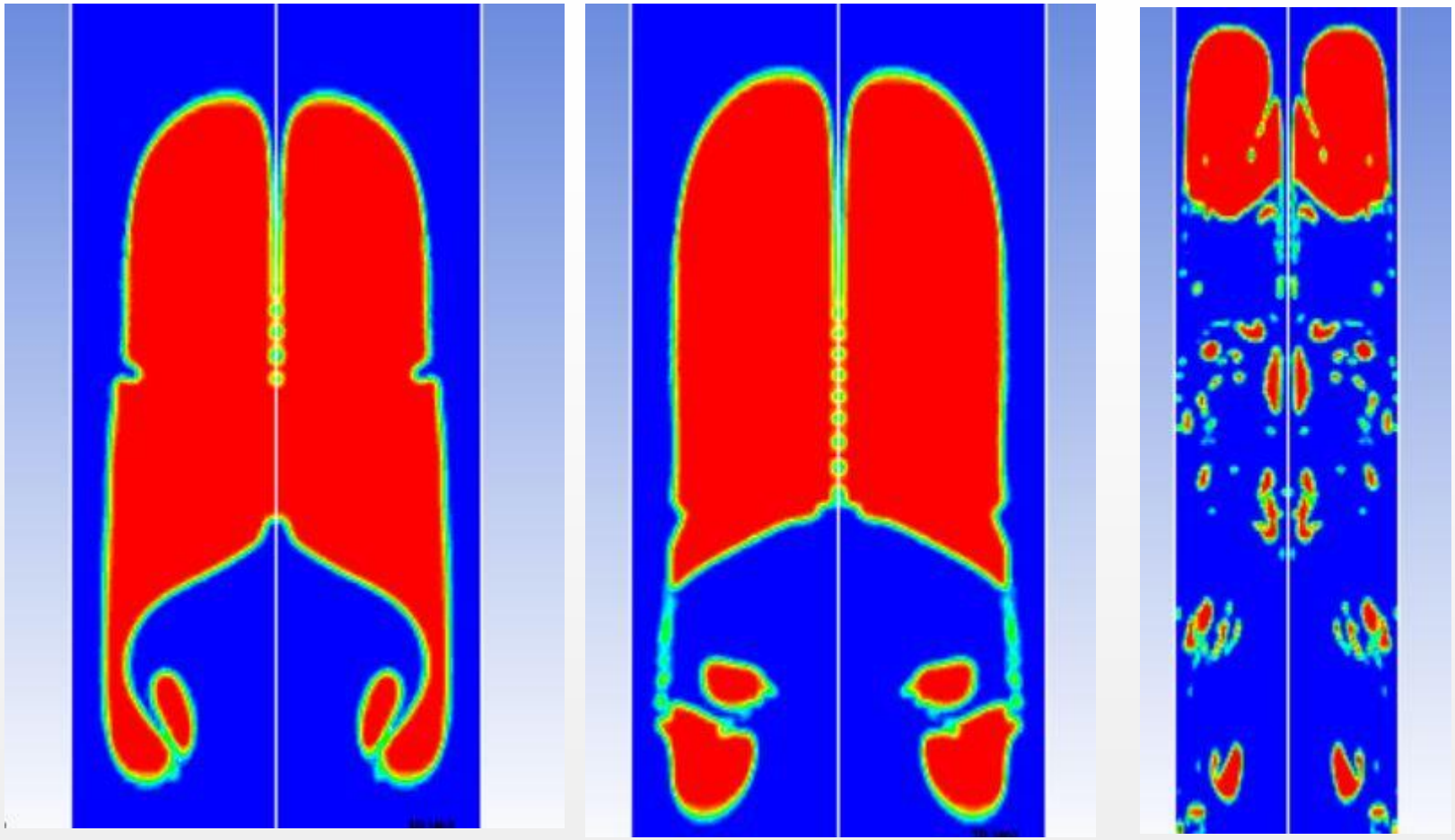


Axisymmetric Slug (Re=1290)



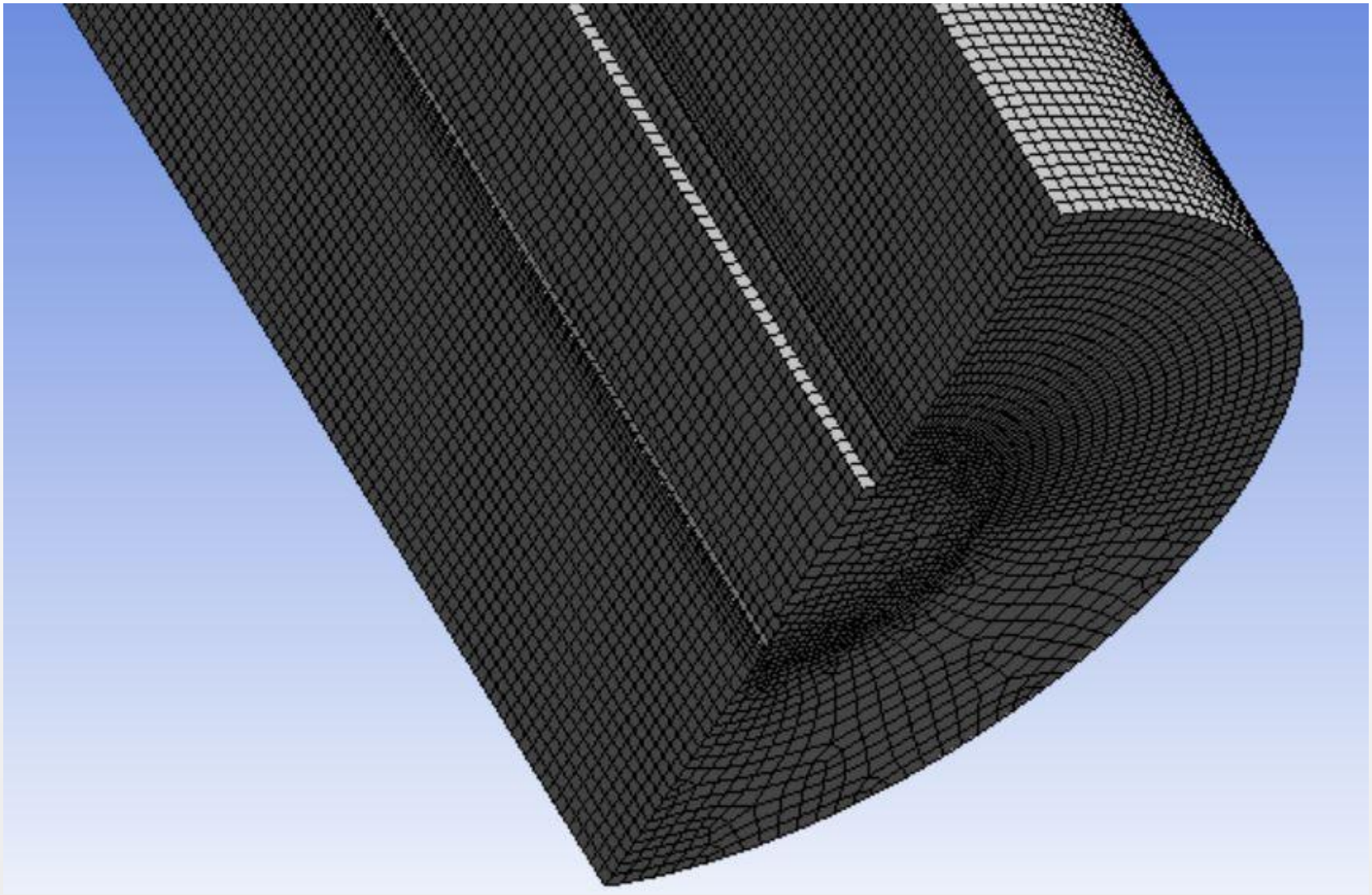
Velocity Vector
Axisymmetric Slug (Re=1290)

Axisymmetric Slug Flow

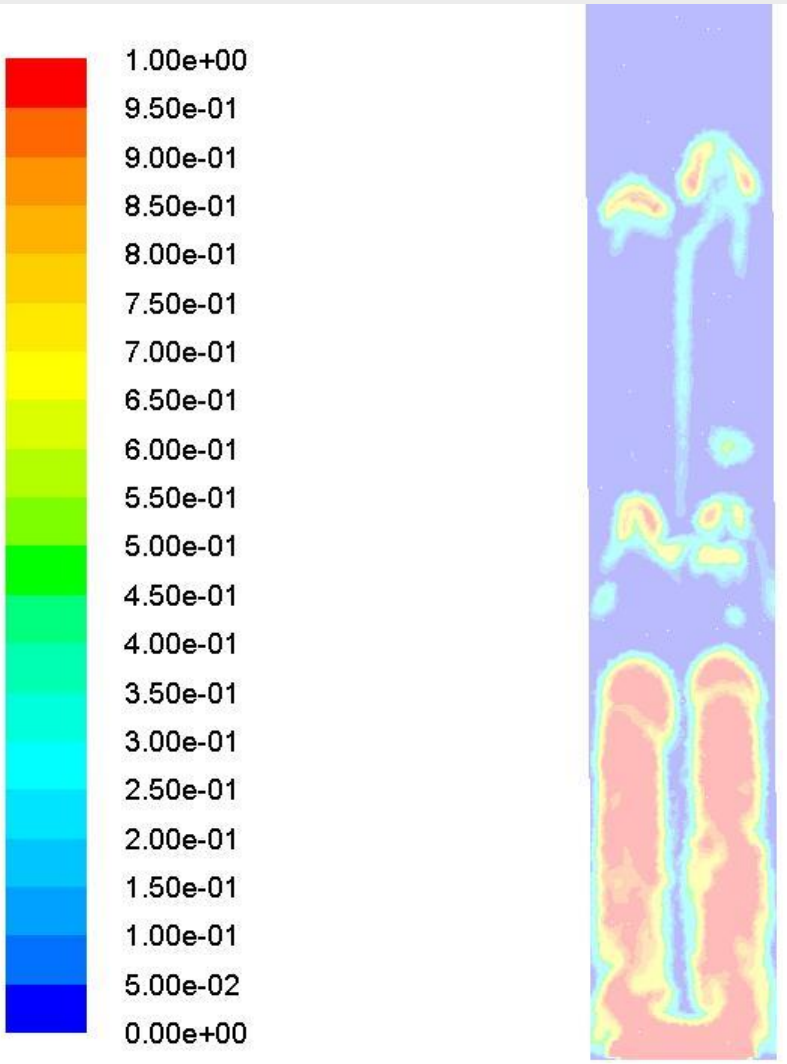


Axisymmetric Slug (Re=2500)

Mesh – 3D Riser



3D-Vertical Riser



U_{GS} m/s	U_{LS} m/s	Air Volume Fraction	Flow Regime
0.1	1	0.09	Bubble
1	0.01	0.99	Slug
8	0.01	0.998	Churn
15	0.01	0.999	Annular

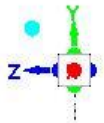


Figure: Flow in 25 mm diameter vertical riser

Thank You