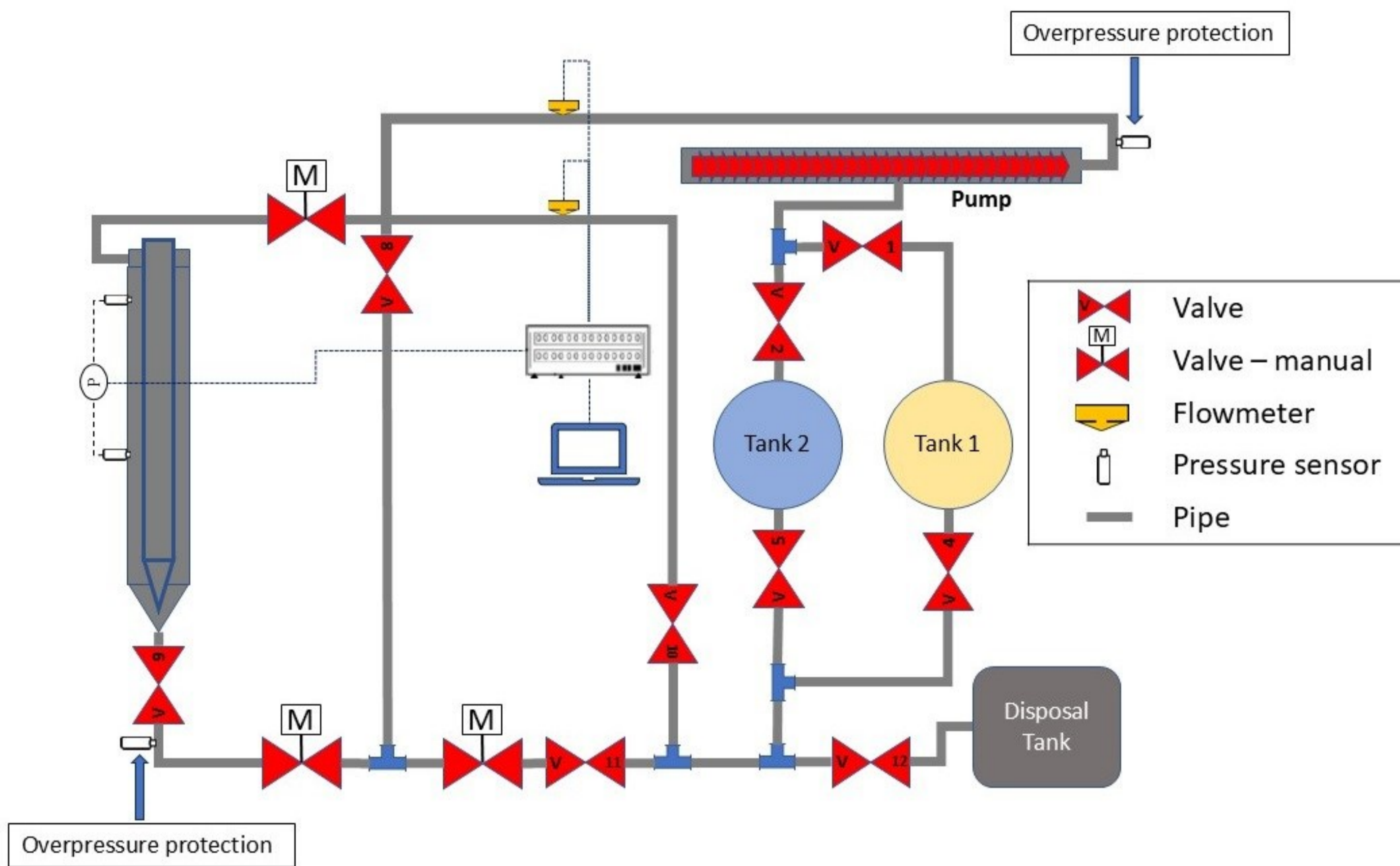


Fluid Flow Characterization Modeling and Experimental Study

Introduction

The “Digital Flow-Loop” is used to experimentally determine the flow properties and interactions of different liquids and tools in closed pipe systems.

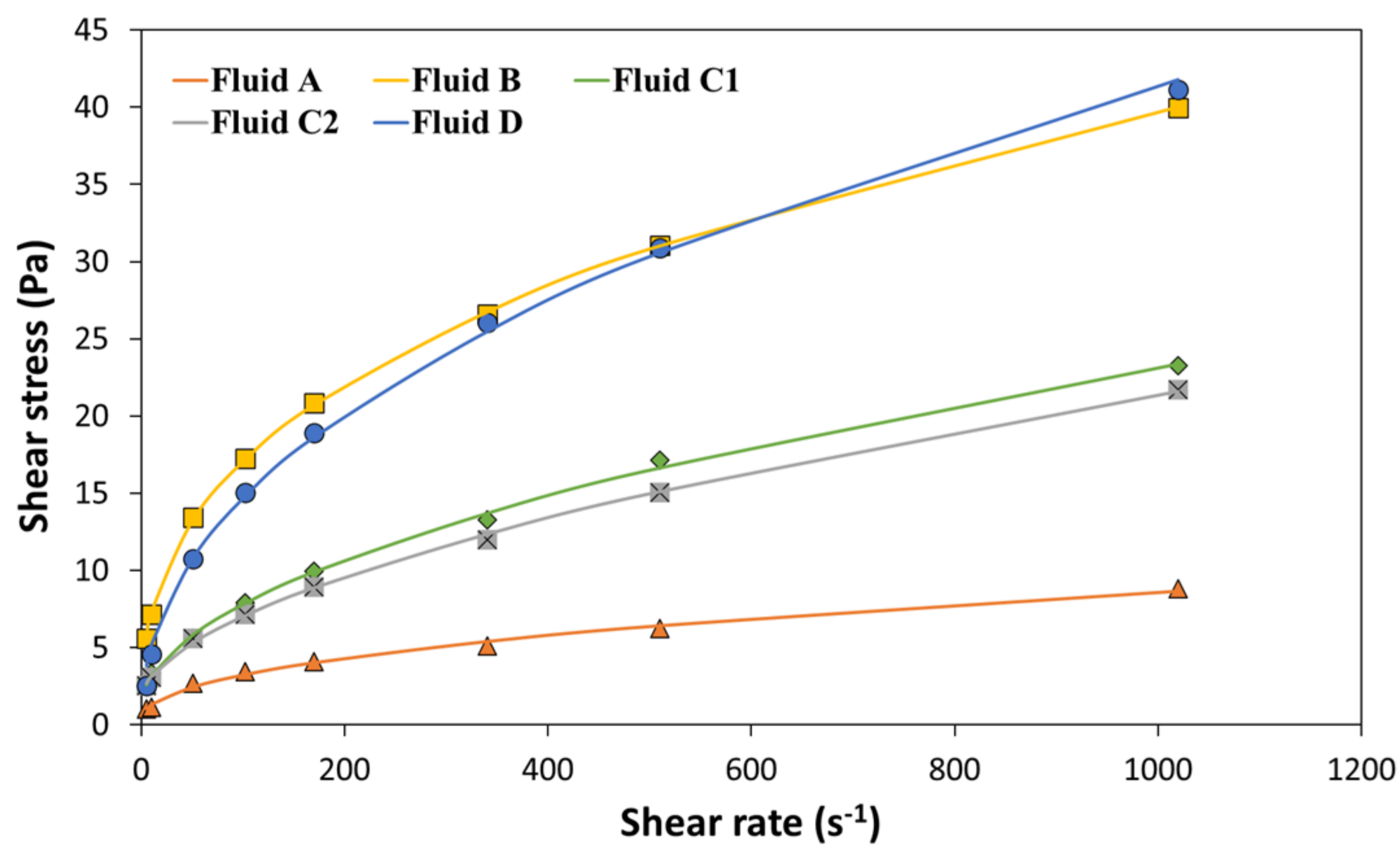


Eccentricity 55% & 100% standoff	Orientation Horizontal
-------------------------------------	---------------------------

Methodology

Water is displaced by a shear-thinning fluid

- 2 unweighted fluids (Fluid A & Fluid B)
- 2 weighted fluids (Fluid C & Fluid D)



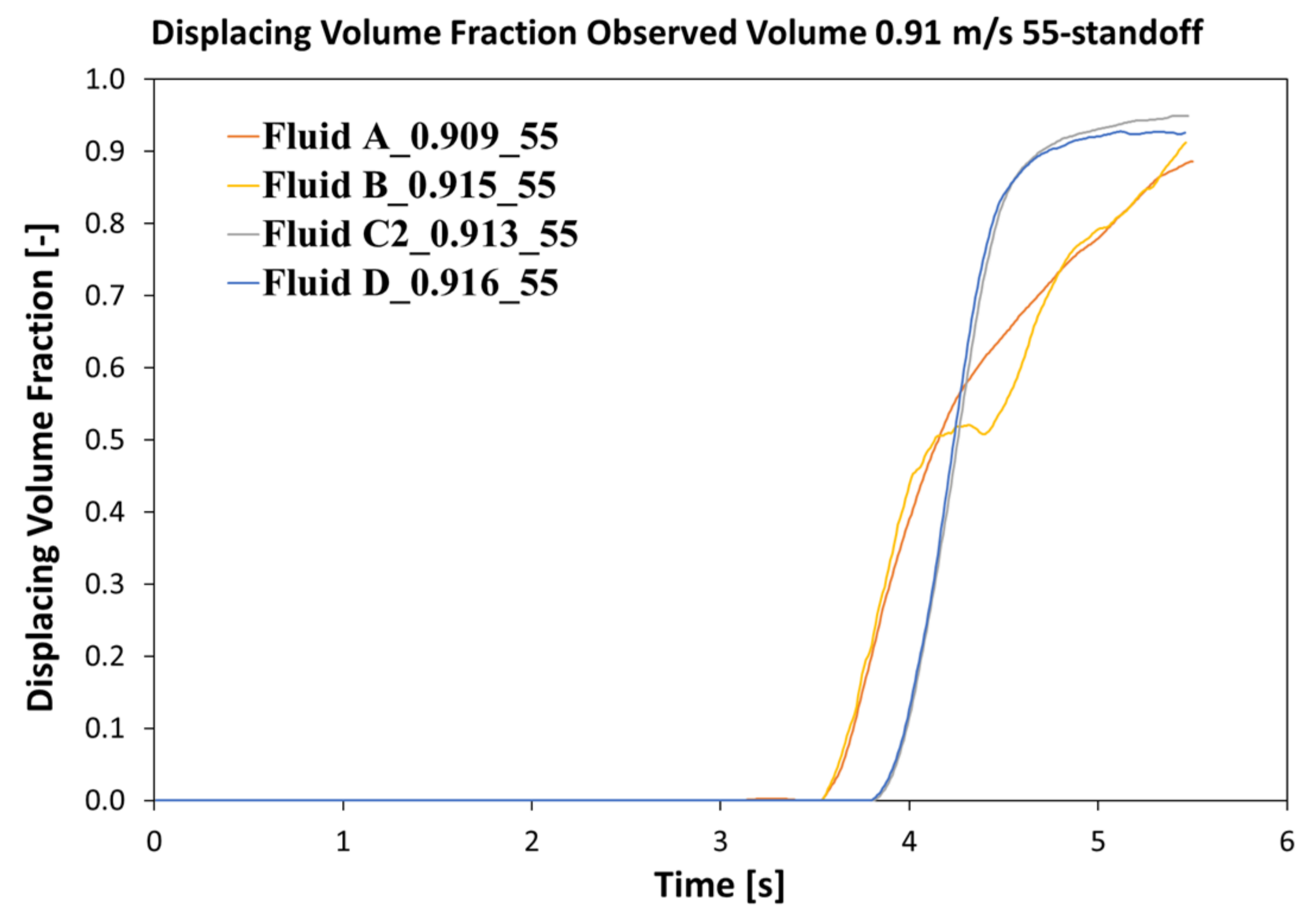
Three Complementary Approaches:

Digital Flow-Loop	CFD Model	Analytical Tool
Laboratory experiments, pressure drop, visual front tracking	Ansys Fluent simulation with VOF displacement	Iterative laminar pressure drop calculator with eccentric correlation

Results

Simulation:

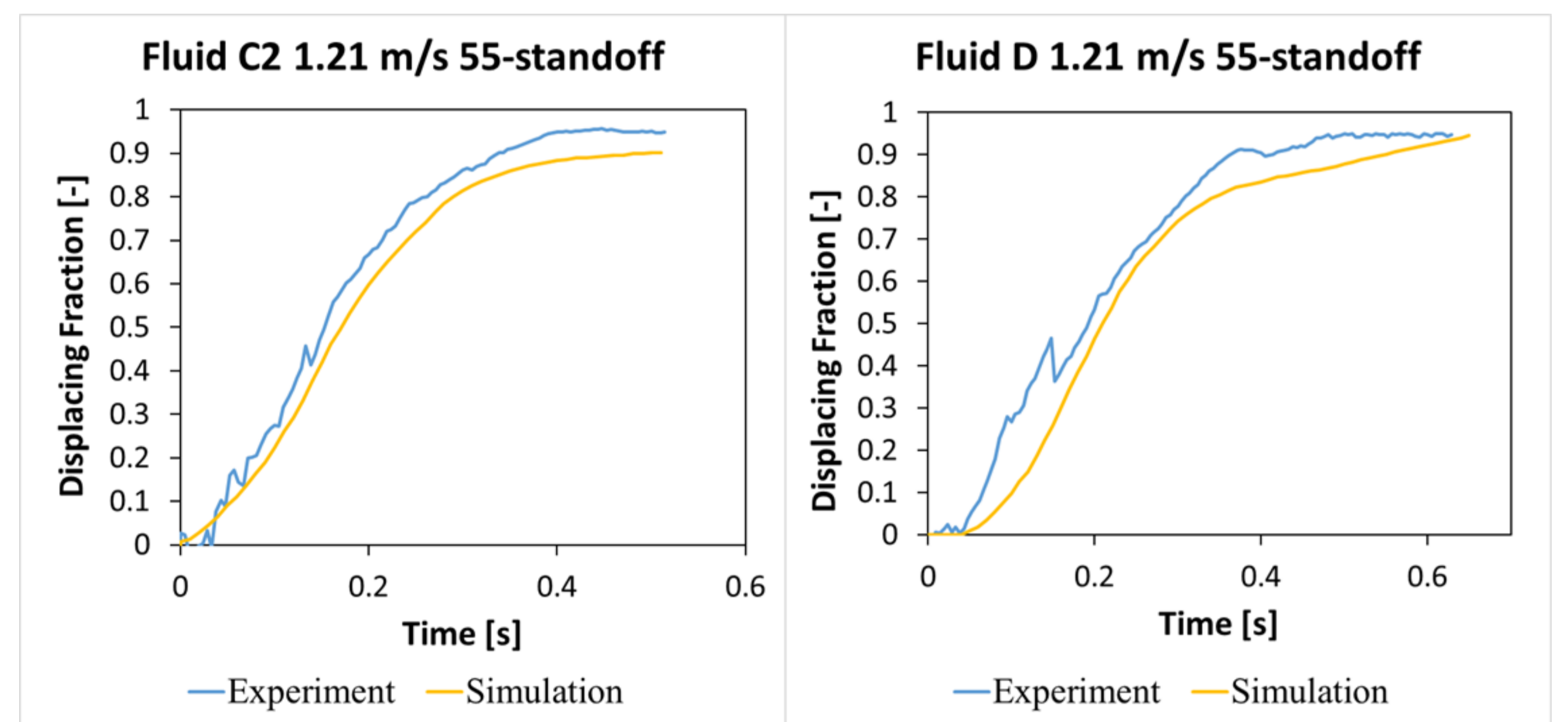
- Weighted fluids (Fluid C & Fluid D) show S-shape
- Unweighted fluids (Fluid A & Fluid B) less favorable



Maintain **10 - 15%** density contrast

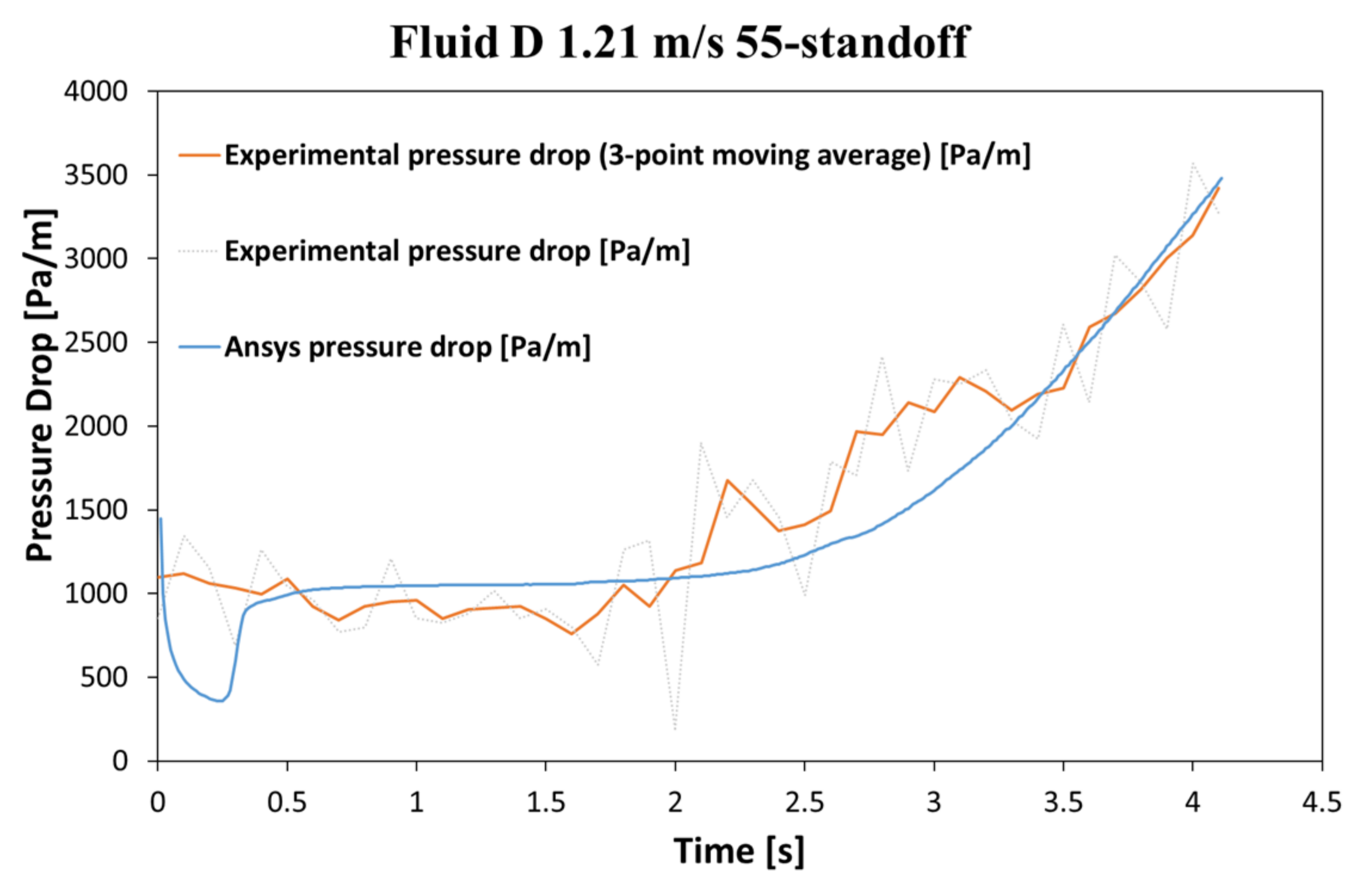
Front Tracking:

- Only works if one of the fluids is opaque
- Camera shows a line of sight representation



Pressure Drop:

Plateau phase: only water in measurement section
Pressure drop rises as water is displaced



Chair of Drilling & Completion Engineering
Technical University of Leoben

Stefan Weiskirchner
Shahin Pouralirahormozi
Shwetank Krishna

WIP WELL
INTEGRITY
PLATFORM

- Research Interests:
- Fluid flow characteristics
 - Flow digitalization
 - Hole cleanup
 - Downhole tool erosion