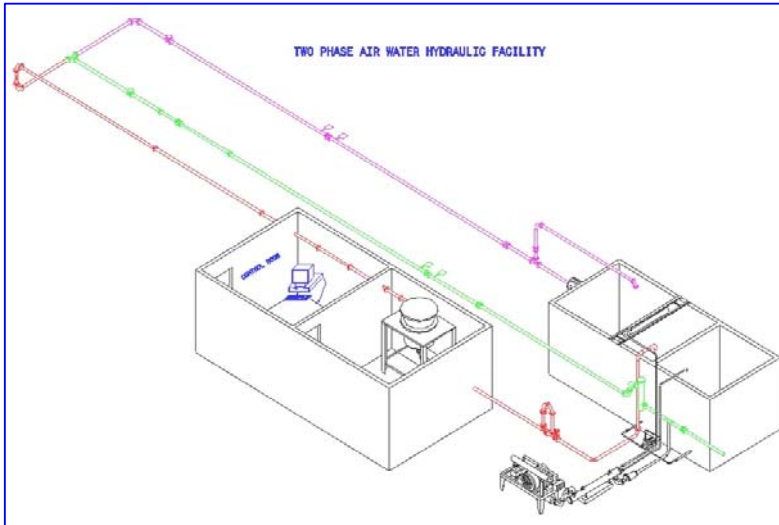


Multiphase Flow Facility

It is a known fact that Multi-phase flow, a phenomenon of critical importance to Oil and gas sector and Nuclear power plants, have measurement uncertainties of unacceptably high orders when conventional single-phase flow meters are used. Multiphase flows are characterized by extreme variations in viscosity, density and velocity between phases. The phase distribution in multiphase flow vary both spatially as well as with reference to time besides being affected by conditions such as geometry, orientation, etc. of pipe and piping elements in the flow conduit.



During the last more than a decade, FCRI has executed a number of projects in the area of two-phase and multiphase flows for many clients in India and abroad pertaining to applications such as characterization of automotive engine-oil under aeration conditions, Scale-down experimental studies

on Gas Entrainment in surge-tanks, related assemblies/auxiliaries of power stations, Computational



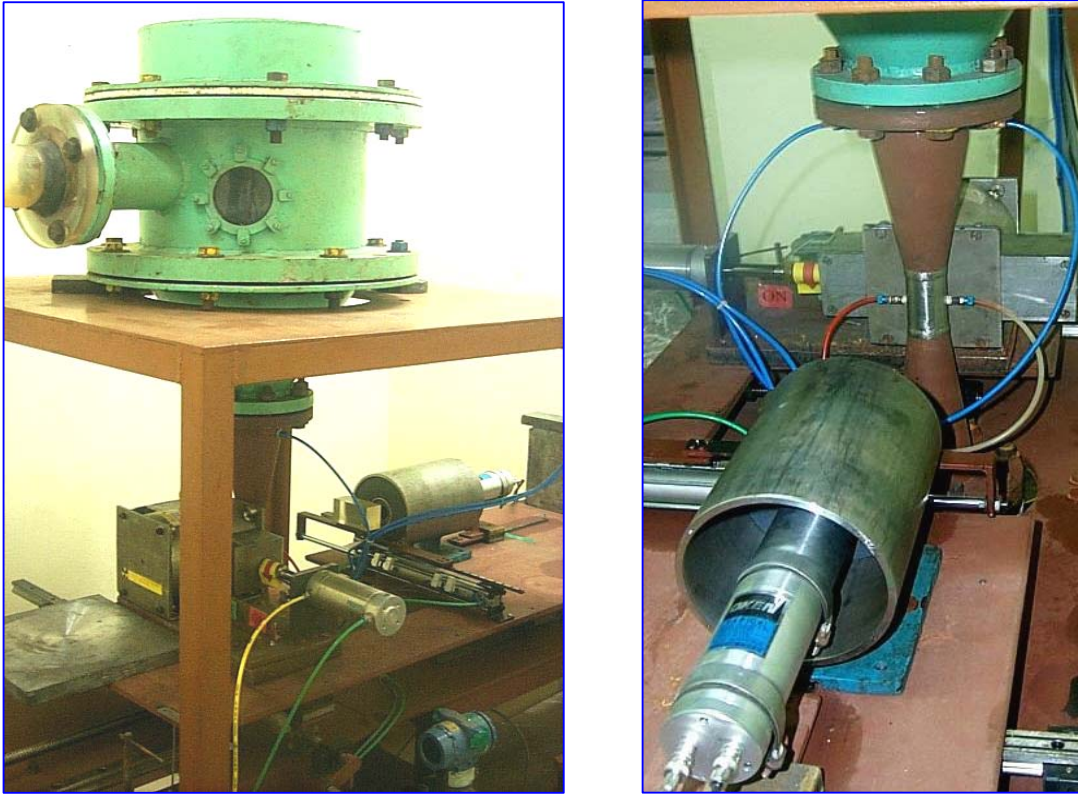
Fluid Dynamics simulation/modeling for homogeniser/mixer assemblies for multiphase flow, Computational Fluid Dynamics simulation/modeling for Gas-entrainment behaviour in power-station sub-assemblies such as surge-tanks, Wet-gas Flow studies and performance of venturies and differential pressure flowmeters under oscillating flow conditions, Design, development, performance testing of Capacitance-based phase-fraction meter for two-phase measurements.

Steady-state two-phase flowmeter

With support from Board for Research in Nuclear Sciences (BRNS), FCRI has undertaken research studies towards development of two-phase and

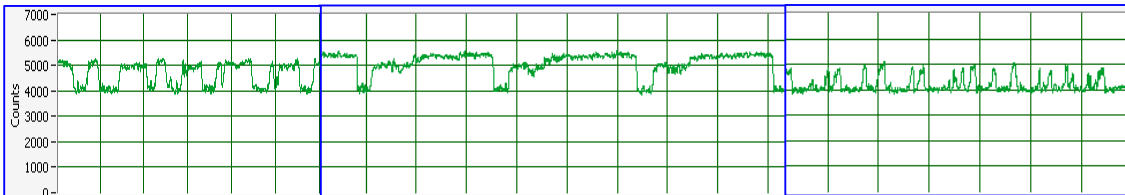
multiphase flowmeter systems for steady-state and high-response needs for heat-exchanger safety related monitoring in power plants. Towards research and development activities a Multiphase Flow Facility has been established at FCRI for basic measurements in two-phase air-water mixtures. The

outcome of the research has been multiphase flowmeters for measurements in steady-state and transient state for high temperature high pressure conditions such as steam-water mixture flows.



Validation Experiments in progress for transient two-phase Flowmeter

The unique feature about the latest flowmeter system developed for transient measurements is its collimated multi-beam gamma-ray scheme which permits inline non-intrusive tomography / visualization. The system also has fast high response of 2-5ms permitting it to be used for transient gas-liquid flows such as steam-water break flows in heat exchanger systems of power plants. The system has been designed for handling high flow velocities at extreme conditions upto 340°C temperature and 125bar pressure.



Typical two-phase air-water flow patterns captured by transient flowmeter.

FCRI has embarked on a phase-by-phase programme for long-term research in multiphase flow comprising two and three phase gas-liquid, liquid-liquid, liquid-solid and gas-solid flows. FCRI welcomes Research and Development organizations and Industry for short-term and long-term collaborations in the area of two-phase and three-phase flows.