



## FLOW VISUALIZATION CAMERAS

The use of camera(s) in the visualization of multiphase flow is an important part of an experimental program because the visual observations not only confirm the flow patterns but also can reveal quantitative information obtained via image processing and/or show detailed flow structures.

In the current state-of-the-art multiphase flow research conducted at the University of Tulsa, there are several types of visualization tools being used depending on the project objectives. These are high speed camera, in-line camera and videoscope. Below, the specifications of these devices are given together with the device photographs (Figures 1 and 2) and sample flow visualization results (Figures 3 and 4) are presented.

High speed camera	Photron SA3 (Qty. x2)	Image Sensor	CMOS
		Resolution (at Max. Frame Rate)	1024 × 1024 (1 MP)
		Max. Frame Rate	1,000 fps
		Recording Memory	2 GB
	Ultima APX	Image Sensor	CMOS
		Resolution (at Max. Frame Rate)	1024 × 1024 (1 MP)
		Max. Frame Rate	2,000 fps
		Recording Memory	2.6 GB
In-Line camera	Basler IP Fixed Box (BIP2)	Image Sensor	CCD
		Resolution (at Max. Frame Rate)	640 × 480
		Max. Frame Rate	60 fps
Videoscope	Olympus IPFLEX FX	Scope diameter	4.0 mm
		Scope length	2.0 m
		Field of view (by using Tip Adapters)	40°, 80°, 120°



**Figure 1. Photron SA3 (on the left) and BIP2 (on the right).**



**Figure 2. Olympus IPFLEX FX Videoscope.**



**Figure 3. Interfacial waves observed for the two-phase (MEG/Air) flow in a 6-in. ID, horizontal pipeline. Photograph is taken with BIP2 installed within the pipeline facing the flow.**



**Figure 4. The interfacial waves observed for the two-phase (Mineral Oil/Nitrogen) flow in a high pressure, 6-in. ID horizontal pipeline. Photograph is taken from the bottom of the pipe using Photron SA3 in the Canty Device.**