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A High-Speed Limited Angle X-ray Tomography System for Optically Opaque Multi-Phase Flows NICHOLAS LUCIDO, University of Michigan, Mechanical Engineering Department, HARISH GANESH, University of Michigan, Naval Architecture and Marine Engineering Department, SIMO MKIHARJU, University of California, Berkeley, Mechanical Engineering , STEVEN CECCIO, University of Michigan, Naval Architecture and Marine Engineering Department
— Diagnostics of optically opaque flows can aid in the understanding of underlying flow physics and also help advance numerical simulations by providing datasets for validation. In this study, we present the development of a true 3D (initially 4-plane) scanning electron beam X-ray tomography to image and measure void fraction distributions of optically opaque flows. The configuration consists of stationary high speed detector array located concentric around a pipe of circular cross-section. Source position is varied using a 20 kW electron beam that can be rapidly focused and deflected. This results in the ability of the system to generate limited-angle projection data of an object of interest at O(kHz) rates. A statistical reconstruction algorithm capable of reconstructing limited-angle projection data with reduced artefacts is used to produce cross-sectional images of flows. System performance is evaluated by reconstructing measured data of a static and a dynamic phantom emulating bubbly flow. Preliminary results for a bubbly flow are also presented.

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