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The Self-Similarity of the Near-Field Liquid Region from an Airblast Atomizer[1] JULIE BOTHELL, DANYU LI, TIMOTHY MORGAN, Iowa State University, ALBERTO ALISEDA, NATHANAEL MACHICOANE, University of Washington, ALAN KASTENGREN, Argonne National Laboratory, THEODORE HEINDEL, Iowa State University — The atomization process in liquid gas coaxial injectors has been the subject of intense investigation that has identified multiple break-up regimes for the liquid jet and the dominant instabilities that determine the final liquid droplet size distribution. There are, however, many unknowns in the basic physics and practical applications of this atomizer configuration including the liquid gas interface dynamics in the presence of swirl as well as injection rate fluctuations. This study uses advanced X-ray imaging to characterize the complex, two-phase system in the near-field region of a canonical coaxial airblast atomizer. The Advanced Photon Source at Argonne National Laboratory was used to collect time resolved measurements of the liquid volume fraction in the flow. The resulting data, containing quantitative information about the interface dynamics and phenomena controlling droplet break-up, was analyzed to improve the understanding of the natural mechanisms that drive the atomization process. In the analysis, self-similarity models are used to relate the upstream liquid flow structures to the downstream atomization at various flow conditions. These self-similarity models show great potential in characterizing complex liquid flow in the near-field region of the atomizer.

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