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Dark Field Imaging of Multiphase Fluid Flows BARRY SCHARFMAN, ALEXANDRA TECHET, MIT — A novel method has been developed for spatially and temporally resolving three-dimensional multiphase fluid flows. Image volumes are captured using a multiple CCD sensor array consisting of a planar array of cameras. This is similar to light field imaging, but no light enters the cameras directly; rather, lights surround the scene and a dark sheet is placed directly across from the array. Therefore, each camera records an essentially binary image of the scene from a different angle, which simplifies subsequent image processing. Synthetic aperture refocusing techniques are applied to the raw camera array images, each with large depths of field, to obtain a stack of post-processed images, with narrow depth of field, where each image in the stack is located on a specific focal plane. Then, flow features are extracted from the binary refocused volume, allowing the scene to be reconstructed in three dimensions over time. Simulations and experimental fluid flows are used to validate and improve this technique.

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