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An experimental technique for simultaneous measurement of fluid flow and particle kinematics in particle-laden flows AUDRIC COLLIGNON, EVAN VARIANO, UC Berkeley, Civil & Environmental Engineering Dpt — A significant challenge facing laboratory measurements of particle-laden flow is the simultaneous resolution of both fluid and particle phases. We present a simple technique to resolve the kinematics of individual particles and the surrounding flow. Most importantly, this technique reveals the full angular velocity vector of each particle. We use water as our fluid (allowing high Reynolds number flow) and particles that have the same refractive index as water. Results from spherical hydrogel particles will be presented and other options will be discussed. Refractive index matching allows light to propagate undisturbed through particles, even at high volume loading. We apply PIV simultaneously to the fluid phase and to the interior of each particle. We then use the velocities measured inside each particle to solve an inverse problem giving particle location, translation and angular velocity. We present the technique, including details of the optical setup and image processing methods. We also present a validation and uncertainty analysis covering random and bias errors.

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