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Multilayer Nano-Particle Image Velocimetry[1] MINAMI YODA, HAIFENG LI, REZA SADR, Georgia Institute of Technology — Nano-particle image velocimetry (nPIV) uses evanescent-wave illumination of fluorescent colloidal tracers to measure the two tangential velocity components u and v averaged over the first 300 nm next to the wall. The evanescent-wave intensity decays exponentially with z, or the distance normal to the wall. Illuminated tracers at smaller z therefore have images that are "brighter" than those at larger z. This variation in tracer intensity suggests the possibility of "multilayer nPIV," where u and v are obtained at different z-locations within the first 300 nm next to the wall. The variation of tracer image intensity with distance from the wall is modeled using a basic diffraction optics approach. The tracer images in artificial nPIV images of plane Couette flow for various experimental parameters incorporating hindered Brownian diffusion and image noise were divided into three sub-images, or "layers," based on tracer image intensity. Standard techniques were used to extract average velocities at three different z-locations, with velocity data in the first layer obtained well within 100 nm of the wall. The results demonstrate that multilayer nPIV is feasible if appropriate classification techniques can be determined and used to separate tracer images into different layers.

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