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On the local acceleration and flow trajectory of jet flows from circular and semi-circular pipes via 3D particle tracking velocimetry JIN-TAE KIM, Mechanical Science and Engineering, University of Illinois at Urbana-Champaign, USA, ALEX LIBERZON, Mechanical Engineering, Tel Aviv University, Israel, LEONARDO P. CHAMORRO, Mechanical Science and Engineering, University of Illinois at Urbana-Champaign, USA — The distinctive differences between two jet flows that share the same hydraulic diameter $d_h = 0.01$ m and $Re \approx 6000$, but different (nozzle) shape are explored via 3D Particle Tracking Velocimetry using OpenPTV (http://www.openptv.net). The two jets are formed from circular and semicircular pipes and released in a quiescent water tank of 40 d_h height, 40 d_h wide, and 200 d_h long. The recirculating system is seeded with 100 μm particles, where flow measurements are performed in the intermediate flow field ($14.5 < x/d_h < 18.5$) at 550Hz for a total of $\approx$ 30,000 frames. Analysis is focused on the spatial distribution of the local flow acceleration and curvature of the Lagrangian trajectories. The velocity and acceleration of particles are estimated by low-pass filtering their position with a moving cubic spline fitting, while the curvature is obtained from the Frenet-Serret equations. Probability density functions (p.d.f.) of these quantities are obtained at various sub-volumes containing a given streamwise velocity range, and compared between the two cases to evaluate the memory effects in the intermediate flow field.

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