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Smartphone based Tomographic PIV using colored shadows ANDRES A. AGUIRRE-PABLO, MESHAL K. ALARFAJ, ER QIANG LI, SIGURDUR T. THORODDSEN, King Abdullah University of Science and Technology — We use low-cost smartphones and Tomo-PIV, to reconstruct the 3D-3C velocity field of a vortex ring. The experiment is carried out in an octagonal tank of water with a vortex ring generator consisting of a flexible membrane enclosed by a cylindrical chamber. This chamber is pre-seeded with black polyethylene microparticles. The membrane is driven by an adjustable impulsive air-pressure to produce the vortex ring. Four synchronized smartphone cameras, of 40 Mpx each, are used to capture the location of particles from different viewing angles. We use red, green and blue LED's as backlighting sources, to capture particle locations at different times. The exposure time on the smartphone cameras are set to 2 seconds, while exposing each LED color for about 80 μs with different time steps that can go below 300 μs. The timing of these light pulses is controlled with a digital delay generator. The backlight is blocked by the instantaneous location of the particles in motion, leaving a shadow of the corresponding color for each time step. The image then is preprocessed to separate the 3 different color fields, before using the MART reconstruction and cross-correlation of the time steps to obtain the 3D-3C velocity field. This proof of concept experiment represents a possible low-cost Tomo-PIV setup.

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