Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Volumetric Echocardiographic Particle Image Velocimetry (V-Echo-PIV) AHMAD FALAHATPISHEH, ARASH KHERADVAR, Univ of California - Irvine — Measurement of 3D flow field inside the cardiac chambers has proven to be a challenging task. Current laser-based 3D PIV methods estimate the third component of the velocity rather than directly measuring it and also cannot be used to image the opaque heart chambers. Modern echocardiography systems are equipped with 3D probes that enable imaging the entire 3D opaque field. However, this feature has not yet been employed for 3D vector characterization of blood flow. For the first time, we introduce a method that generates velocity vector field in 4D based on volumetric echocardiographic images. By assuming the conservation of brightness in 3D, blood speckles are tracked. A hierarchical 3D PIV method is used to account for large particle displacement. The discretized brightness transport equation is solved in a least square sense in interrogation windows of size 16^3 voxels. We successfully validate the method in analytical and experimental cases. Volumetric echo data of a left ventricle is then processed in the systolic phase. The expected velocity fields were successfully predicted by V-Echo-PIV. In this work, we showed a method to image blood flow in 3D based on volumetric images of human heart using no contrast agent.

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Date submitted: 29 Jul 2015 Electronic form version 1.4