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Kinematics and flow fields in 3D around swimming lamprey using light field PIV ANDREA M. LEHN, ALEXANDRA H. TECHET, MIT — The fully time-resolved 3D kinematics and flow field velocities around freely swimming sea lamprey are derived using 3D light field imaging PIV. Lighthill's Elongated Body Theory (EBT) predicts that swimmers with anguilliform kinematics likened to lamprey, and similarly eels, will exhibit relatively poor propulsive efficiency. However, previous experimental studies of eel locomotion utilizing 2D PIV suggest disagreement with EBT estimates of wake properties; although, the thrust force generated by such swimmers has yet to be fully resolved using 3D measurements. A light field imaging array of multiple high-speed cameras is used to perform 3D synthetic aperture PIV around ammocoete sea lamprey (*Petromyzon marinus*). Fluid mechanics equations are used to determine thrust force generation, leading experimental studies closer to underpinning the physical mechanisms that enable aquatic locomotion of long, slender undulatory swimmers.

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