

Abstract Submitted  
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**Magnetic Resonance Imaging Measurements of Film Cooling Effectiveness** CHRISTOPHER ELKINS, MARCUS ALLEY, JOHN EATON, Stanford University — Film cooling through holes and slots is used extensively in gas turbine engines to protect combustor walls, stator vanes, and turbine blades. Film cooling effectiveness has been shown to depend on myriad geometrical and flow parameters. Magnetic Resonance Velocimetry (MRV) and Concentration (MRC) measurements efficiently acquire entire 3D velocity and scalar information making them well suited to investigate the large design parameter space. In addition, MRV and MRC provide information in the film supply plenum and hole which is traditionally unobtainable. Here, MRC is extended to near wall measurements to determine film cooling effectiveness. Measurements are made for a single film hole ( $d=5.8$  mm,  $l/d=4$  and  $\alpha=30^\circ$ ) in the wall of a square channel. Velocity and scalar concentration data are presented for multiple blowing ratios. The data show the evolution of vortices around the jets, the coolant mixing, and the 2D film cooling effectiveness distribution. Measurements within the plenum and injection hole show the origin of specific flow structures.

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