Dependence of higher-order passive-scalar structure functions on the scalar-field initial conditions\textsuperscript{1} JASON LEPORÉ, LAURENT MYDLARSKI, McGill University — To investigate the dependence of structure function scaling exponents of a turbulent passive scalar on the (scalar-field) initial conditions, higher-order structure functions of temperature are measured in the turbulent wake of a circular cylinder ($R_\lambda = 388$). The turbulent scalar field is generated by two different means. It is first created by heating the cylinder. It is then produced using a mandoline.\textsuperscript{2} Though the second-order statistics (e.g., power spectra, second-order structure functions) of the scalar field are experimentally indistinguishable (in the inertial and dissipative ranges) for the two cases, we observe notable differences in the inertial-range scaling exponents ($\zeta_n$) of the $n^{th}$-order passive-scalar structure functions at higher orders ($n \geq 4$). The implication is that the variations in previous estimates of $\zeta_n$ observed in different experiments may be i) attributable to differences in the scalar field initial conditions, and therefore ii) inconsistent with a universal nature of the small-scale statistics of a passive-scalar field.

\textsuperscript{1}Support has been graciously provided by the NSERC (Canada).

Laurent Mydlarski
McGill University

Date submitted: 30 Jul 2008