Inertial particle accelerations in a turbulent boundary layer ZELL-
MAN WARHAFT, Cornell University, SERGIY GERASHCHENKO, California In-
stitute of Technology, NICOLE SHARP, STEPHANIE NEUSCAMMAN, Cornell
University — Two dimensional Lagrangian acceleration statistics of inertial parti-
cles in a turbulent boundary layer with free stream turbulence are determined by
means of a high speed particle tracking technique (Ayyalasomayajula et al. PRL, 95,
144507, 2006). The boundary layer is formed above a flat plate, and water droplets
are fed into the flow from sprays placed down-stream from an active grid, and from
tubes fed into the boundary layer from humidifiers. The free stream Stokes number
is varied from 0.035 to 0.47. As the boundary layer plate is approached, the tails
of the pdfs narrow, become negatively skewed, and their peak occurs at negative
accelerations (decelerations in the stream-wise direction). The mean deceleration
and its r.m.s. increase to large values close to the plate and are more pronounced
with increasing Stokes number, in marked contrast to what is found in isotropic
turbulence where the acceleration r.m.s. decreases with increasing Stokes number.
A model shows the significance of the combined effects of shear and gravity on the
acceleration statistics. The work is funded by the US NSF.

Zellman Warhaft
Cornell University

Date submitted: 06 Aug 2008   Electronic form version 1.4