Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Large field of view volumetric measurement of a turbulent boundary layer[1] FELIX EICH, MATTHEW BROSS, Universität der Bundeswehr München, DANIEL SCHANZ, MATTEO NOVARA, ANDREAS SCHRÖDER, DLR Göttingen, CHRISTIAN J. KÄHLER, Universität der Bundeswehr München
— In order to understand the complex dynamics and interaction processes between coherent flow motions within turbulent boundary layers, time reolved 3D data is necessary. Therefore, a unique time resolved 3D measurement was performed at $Re_\tau = 4200$ under zero and adverse pressure gradient conditions. Using 13 high speed PIV cameras, helium filled soap bubbles as tracer particles in combination with LED illumination, it was possible to measure a turbulent boundary layer flow over $2.9 \times 0.6 \times 0.25\,\mathrm{m}^3$ at a recording frequency of 1 kHz. The acquired data was analysed with Lagrangian particle tracking techniques to generate velocity fields. The turbulent superstructures and their dynamics could be directly resolved. The interaction between the superstructures gives insight into the exchange of mass and momentum between the coherent flow motions. Furthermore the interaction between the superstructures with the flow separation line is studied. The results show that the superstructures have a significant effect on the dynamics of the line of separation.

[1]This work is supported by the German Research Foundation (Deutsche Forschungsgemeinschaft - DFG) KA1808/14 and SPP1881 Turbulent Superstructures KA1808/21 and SCHR 1165/5-1

Felix Eich
Universität der Bundeswehr München

Date submitted: 21 Aug 2019 Electronic form version 1.4