Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Investigation of a transonic axisymmetric backward-facing step flow by means of time-resolved PIV and PSP SVEN SCHARNOWSKI, MARTIN BITTER, CHRISTIAN J. KÄHLER, Bundeswehr University Munich — The results presented here are obtained within a sub project of the SFB TRR 40 program (founded by the German research foundation), which focuses on the analysis and modeling of coupled liquid rocket propulsion systems and their integration into the space transportation system. The overall objective is to develop technological foundations for the design of thermally and mechanically highly loaded components of future space transportation systems. The interaction between the shear layer and the nozzle in the wake of the launcher is particularly important. Therefore, detailed analyses of a generic space launcher model's wake flow are the main emphasis of this sub project. The combination of time-resolved PIV and PSP provide deep insights into the flow physics: The separation at the end of the main body, the formation of the shear layer, its growth and its reattachment, as well as the surface pressure fluctuations, are analyzed in detail. The results reveal unsteady loads caused by shear layer motion which could interfere with structural modes of a space launcher main engines' nozzle.

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Date submitted: 07 Aug 2012 Electronic form version 1.4