Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Exploring turbulence model uncertainties in turbomachinery applications MARCEL MATHA, CHRISTIAN MORSBACH, German Aerospace Center (DLR) — The aerodynamic design of modern jet engines is highly affected by the prediction capabilities of the CFD-solver close to the operation limits. Since Reynolds-averaged Navier-Stokes (RANS) simulations are the workhorse in industrial development of jet engines, the accuracy of turbulence closure models is one of the main limitations in that process striving for future environmental friendly designs. Due to simplifying assumptions during the creation of turbulence models, the prediction accuracy of RANS computations is reduced in the presence of adverse pressure gradient, flow separation and bursting vortices. Consequently, these assumptions lead to a significant degree of epistemic uncertainty. The methodology to quantify these structural uncertainties based on eigenspace perturbations of the Reynolds stress tensor [1] was implemented in the solver TRACE, being developed by DLRs Institute of Propulsion Technology. In this investigation, we apply this implementation to turbulent flow cases pertinent to turbomachinery applications. Across these case studies, including DLR's 3D diffuser, the uncertainty bounds on such test case with respect to the closure model are presented in comparison with experimemental data.

[1]Iaccarino et al., **Phy. Rev. Fluids** Vol.2, No.2, 2017

Marcel Matha
German Aerospace Center (DLR)

Date submitted: 10 Aug 2020 Electronic form version 1.4