Numerical Simulations
Investigation of Turbomachinery Flows

TECHNISCHE UNIVERSITÄT DARMSTADT

GLR High Performance Cluster

The cluster at GLR is a self-administrated, Linux-based network equipped with 300 cores and 40 workstations for research assistants as well as students.
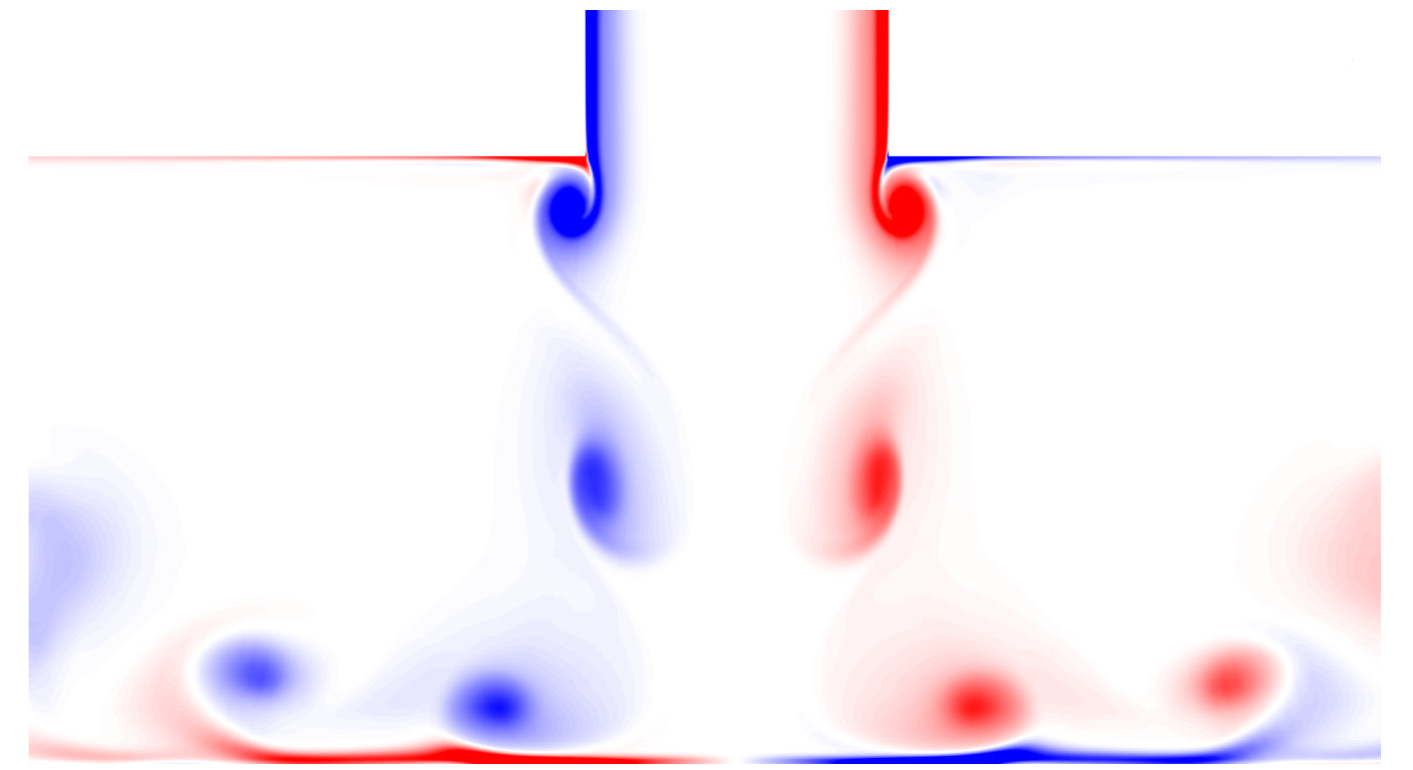
Software Tools

The group at GLR is experienced in a variety of numerical tools for both, meshing and simulations. The used commercial and research codes include
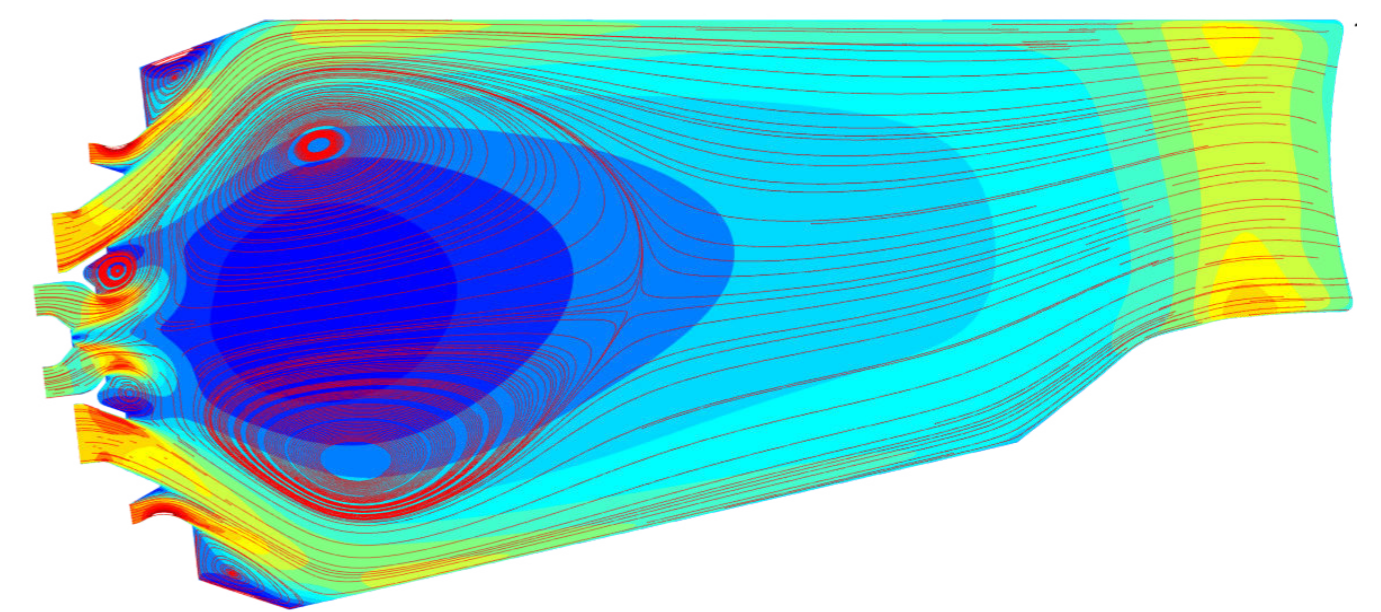
- ANSYS
- TRACE by DLR
- NUMECA
- Centaur

ANSYS NUMECA INTERNATIONAL DLR Deutsches Zentrum für Luft- und Raumfahrt

Ring vortices in a pulsating impinging jet resolved by means of a Scale Adaptive Simulations (SAS)


Visualisation of the recirculation zone in a burner impacting the efficiency of the downstream turbine

Current Research Projects

Scale resolving simulations of highly unsteady flow phenomena in turbine cooling applications are carried out in order to improve the design of novel efficient cooling methods.

In the current *Combustor-Turbine-Interaction* projects guidelines for the optimisation of the first high pressure turbine stage in the context of lean combustion are developed.
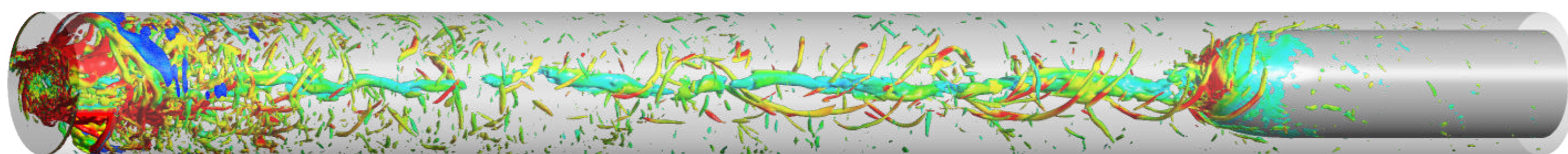
Coherent structures inside a swirl tube resolved by means of a Large Eddy Simulation (LES)

Numerical investigations of the flow in the Darmstadt Transonic Compressor are carried out with special interest in the simulation of *fluid-structure interaction*. The combined evaluation of highly resolved simulations and experimental data contributes to the identification and understanding of fundamental mechanisms causing self-excited blade vibrations in compressors.

Complex geometries are optimised in fully automated processes using genetic algorithms combined with artificial neuronal networks.
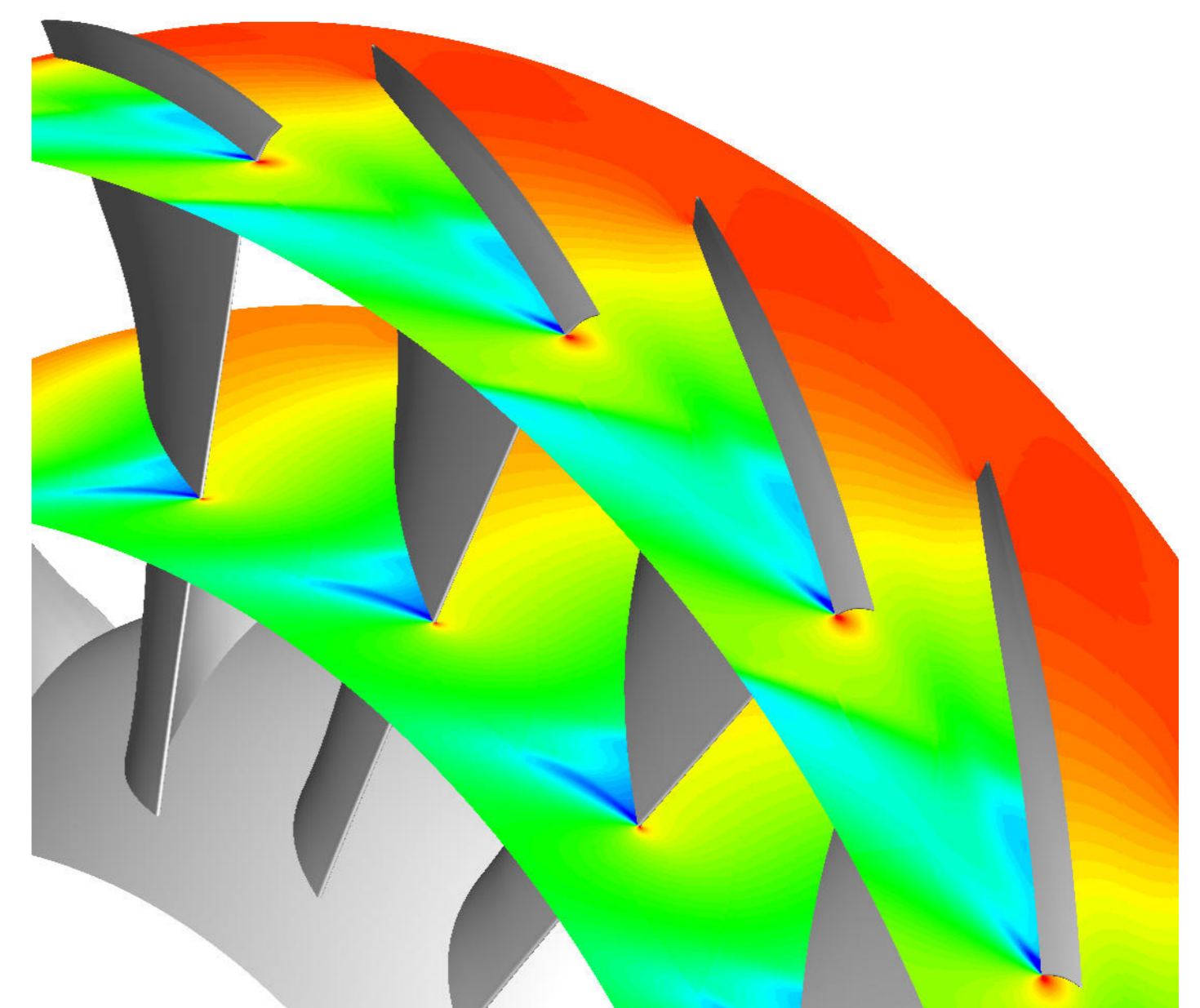
Research Interests

Research activities at GLR are

- compressor aerodynamics and aeroelasticity
- combustor-turbine-interaction
- unsteady impingement cooling
- cyclone cooling
- turbine film cooling
- turbochargers
- component optimisation
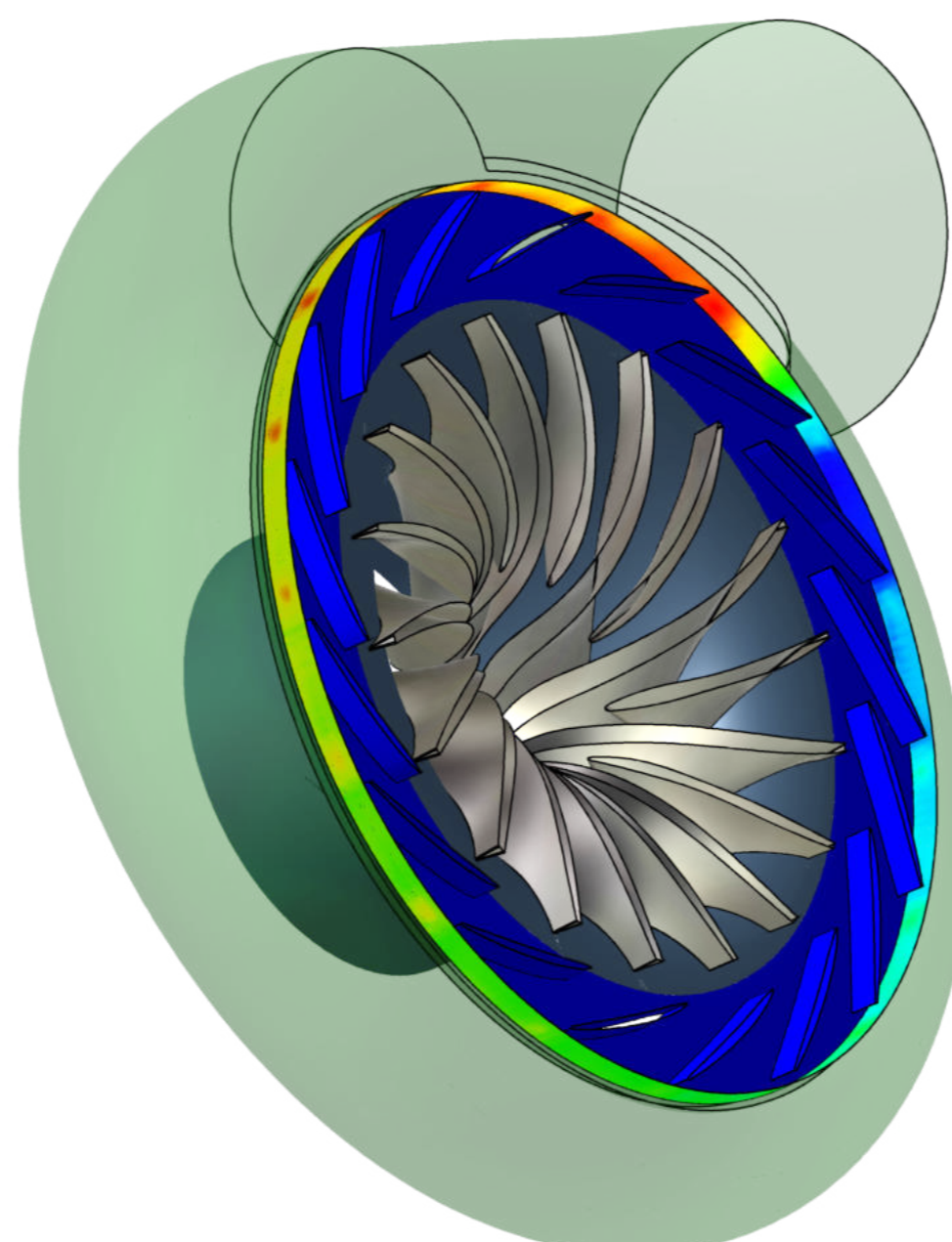
Geometry of a turbocharger compressor subject to an optimisation process

Pressure contours from simulations of the Darmstadt Transonic Compressor