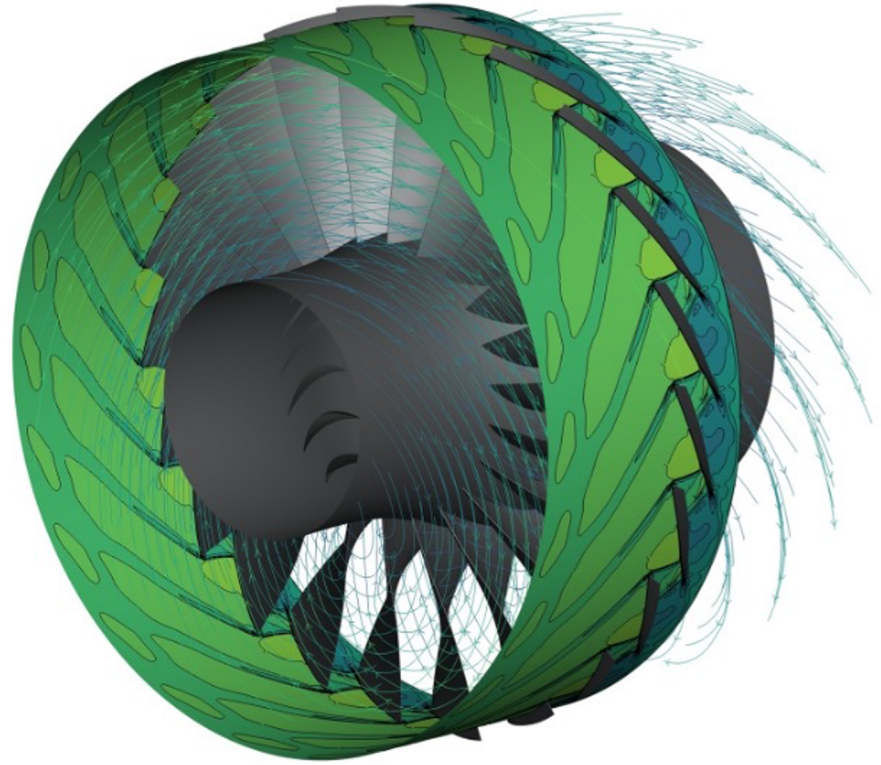# SU2-Turbo WG

A brief overview on the (new) turbomachinery working group of the SU2 community
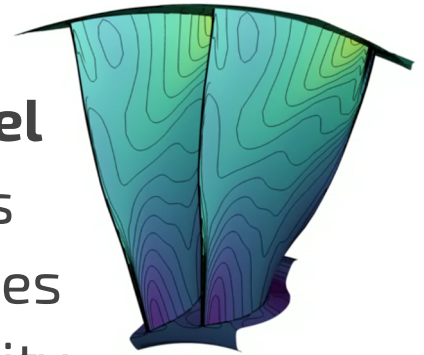
1

Mission and and Objectives

Mission: *Incentivize cooperation and cross-fertilization, and be a gateway to open turbomachinery knowledge*

Objectives:

- ■ Coordinate the development of the **turbo-kernel**
- ■ Create and maintain a set of relevant test cases
- ■ Establish a forum to exchange ideas/solve issues
- ■ Provide up-to-date information to the community

Affiliated Institutions & Members

▰ Coordinator: M. Pini (TU-Delft)

▰ Initial members

○ Imperial College

○ Universidad Politecnica de Madrid

○ Tsinghua University

○ Liverpool University

○ Cenaero

○ TU-Delft

○ …

Turbo Features (SU2 v7.X)

- ■ Non-reflecting boundary conditions

- ■ Mixing-plane and frozen-rotor interface

- ■ Sliding plane for unsteady computations (even pitches)

- ■ Test cases:
  - ○ Axial turbine stage (2D)
  - ○ APU turbine (3D)

APU turbine

4
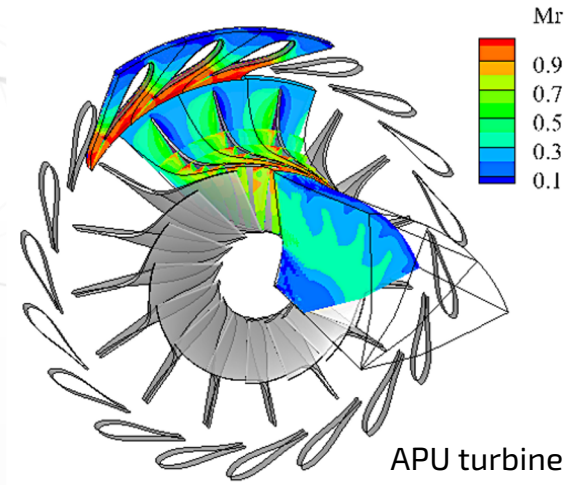
Roadmap – Short Term Goals

■ **Merge** in *develop* turbo features available in branches for steady/unsteady flow simulations

■ Create set of new V&V test cases:
- ○ Axial compressors: TUDa-GLR-OpenStage & NASA Stage-35
- ○ Radial compressors: Eckhardt O & MTU-Radiver
- ○ Axial turbines: Aachen turbine
- ○ Radial turbines: ORCHID turbine

■ Tutorials: NASA Stage-35 & MTU-Radiver
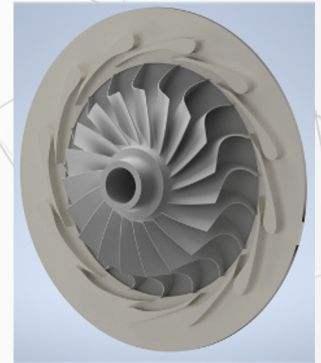
ORCHID turbine, TU-Delft

Roadmap – Long Term Goals

■ Numerics
  ○ Improve solver efficiency (e.g., Jacobians, Newton-Krylov)
  ○ Improve multi-grid capability
  ○ Revamp/improve non-linear harmonic balance solver

■ Physics
  ○ High-fidelity: hybrid RANS/LES, LES
  ○ Aero-thermo-mechanics

■ Design
  ○ Unsteady adjoints
  ○ Multi-row, multi-point, multi-disciplinary

APU Turbocharger test case, BCGSTAB solver

no multigrid (zone 0)
no multigrid (zone 1)
2-level V-Cycle (zone 0)
2-level V-Cycle (zone 1)
2-level W-Cycle (zone 0)
2-level W-Cycle (zone 1)

ρ residuals (log₁₀)

Iterations

SU2
foundation