Tsinghua University

Imperial College London

Steady RANS Simulation of the TUDa-GLR-OpenStage Using the Open-source Code SU2

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- Computation Setup
- Overall Performance
- Radial Profiles

The Open-Source Code SU2

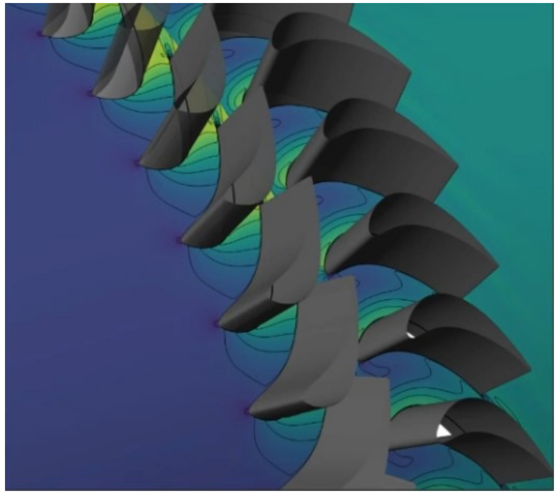
Features of SU2

- Adjoint Optimization
- Compressible Flow from start
- Unstructured grid
- Dynamic Mesh

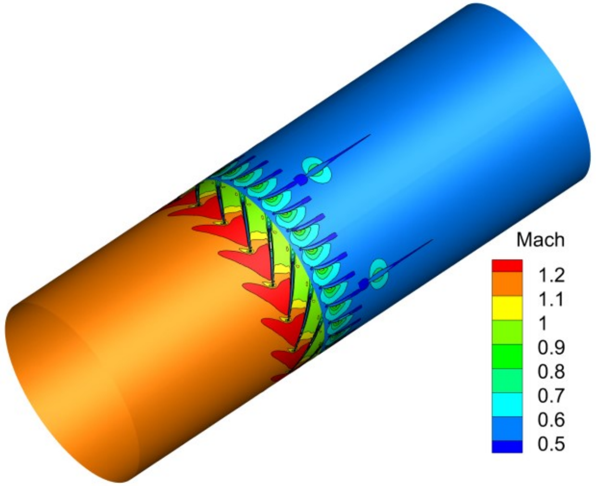
Turbo Features of open SU2 up to now

- Multi-stage RANS
- Axial/Radial turbomachinery
- Harmonic Balance
- Body Force

Validated with Aachen Turbine case and NASA Rotor 67



Aachen Turbine*



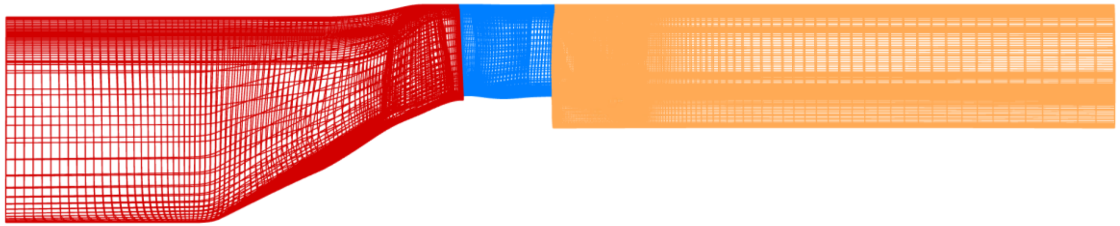
TUDa-GLR-OpenStage

* Vitale, S., M. Pini, and Piero Colonna. "Multistage turbomachinery design using the discrete adjoint method within the open-source software su2." *Journal of Propulsion and Power* 36.3 (2020): 465-478.

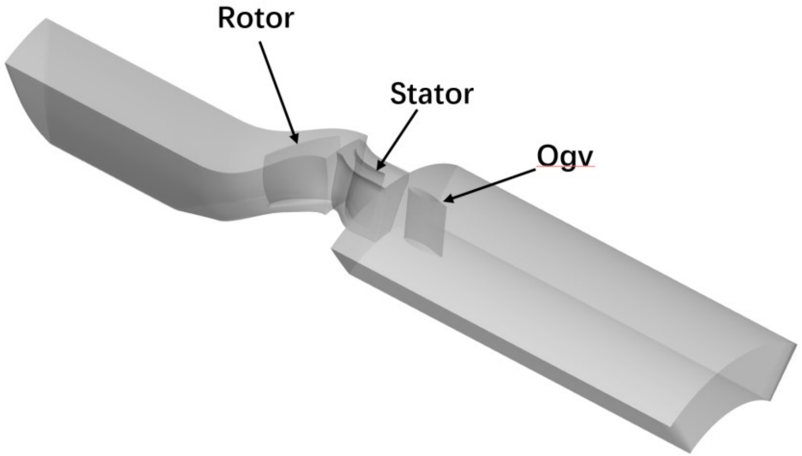
Computation Setup

☐ Grids

- **Five Official Grids**
- **Tip gap**
- **Fillet**



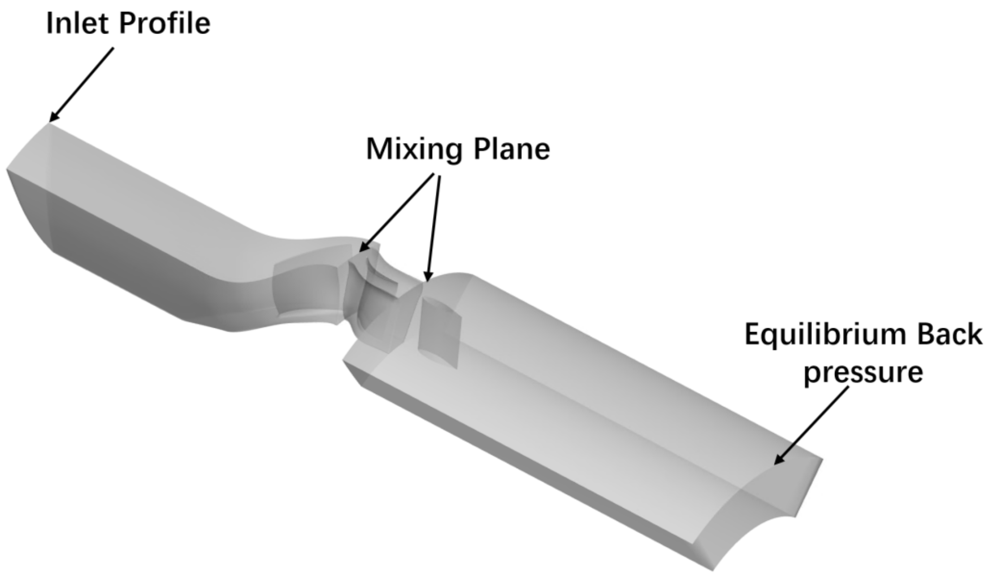
	Ultracoarse	Coarse	Medium	Fine	Ultrafine
Rotor	0.11	0.30	1.05	3.29	11.60
Stator	0.04	0.15	0.51	1.76	5.71
OGV			8.24		



Computation Setup

RANS Solver

- JST convective scheme
- FGMRES linear solver
- SST and SA turbulence model
- Without wall function

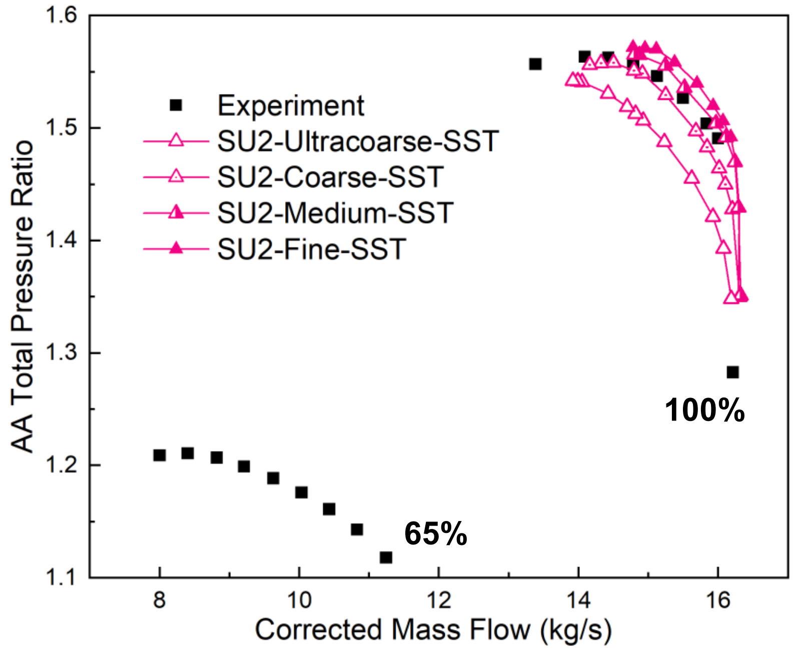


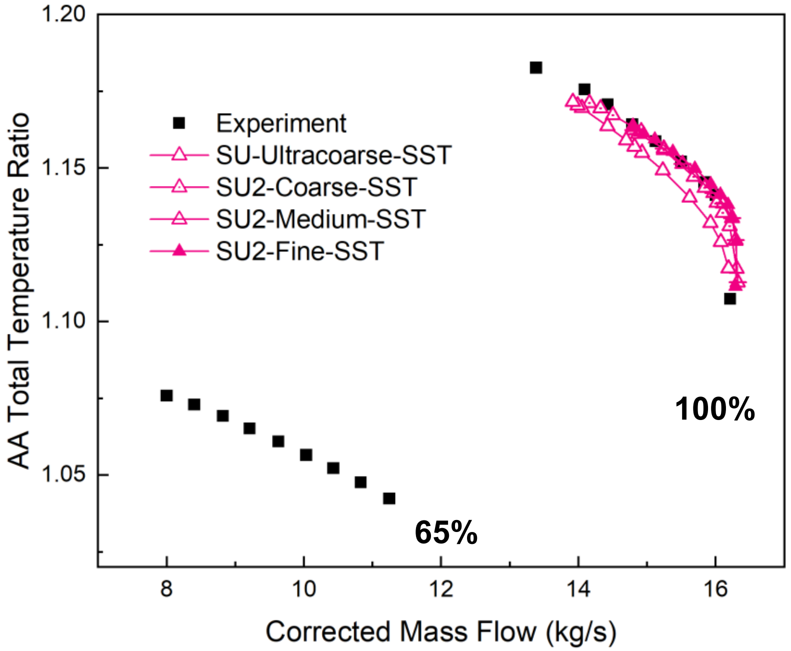
Boundary Conditions

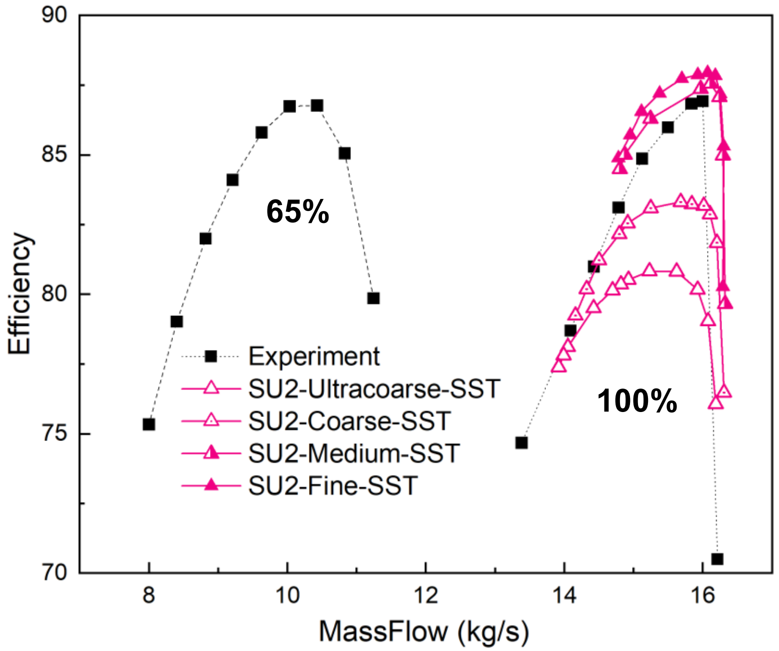
- Inlet: official inlet profile
- Outlet: radial equilibrium static pressure
- Mixing Plane Interface

Overall Performance

☐ Comparison between Different Grids

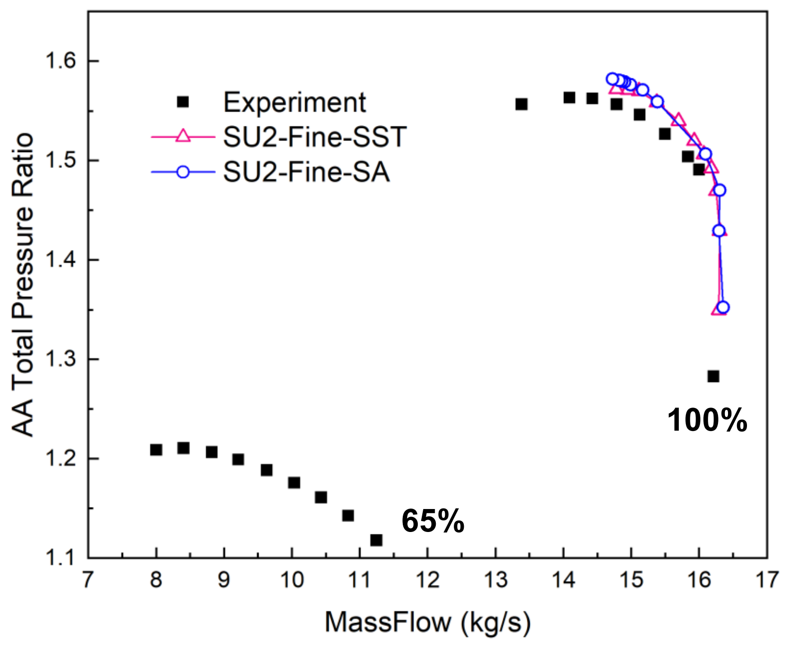


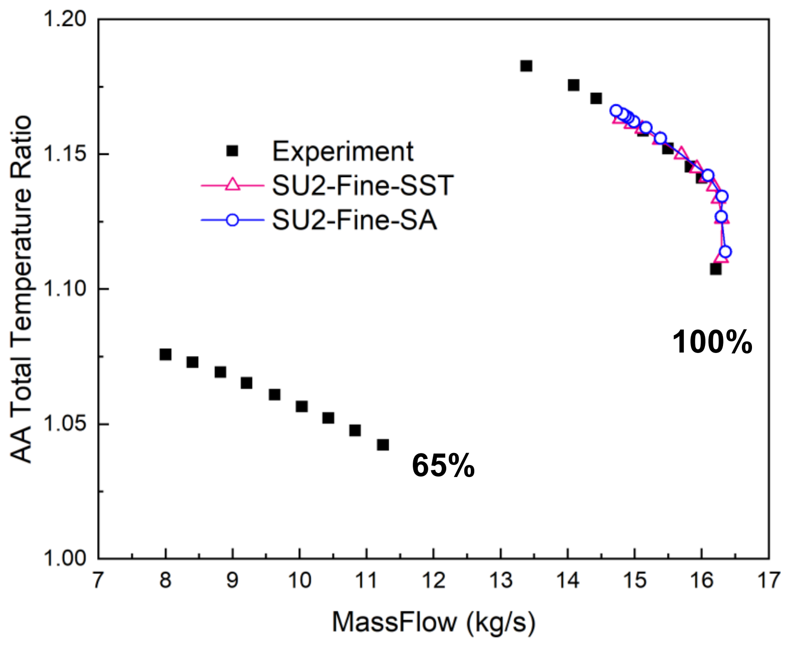


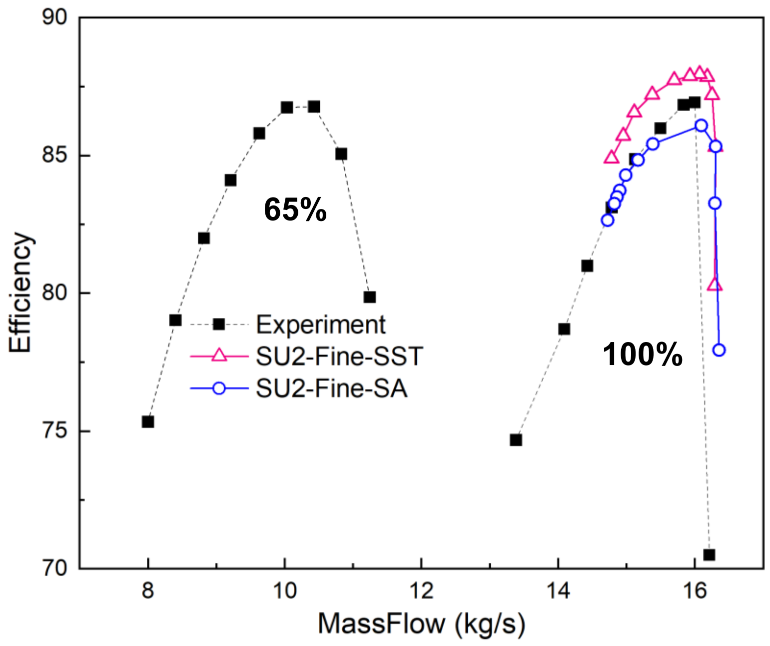


Overall Performance

□ Comparison between Different Turbulence Models

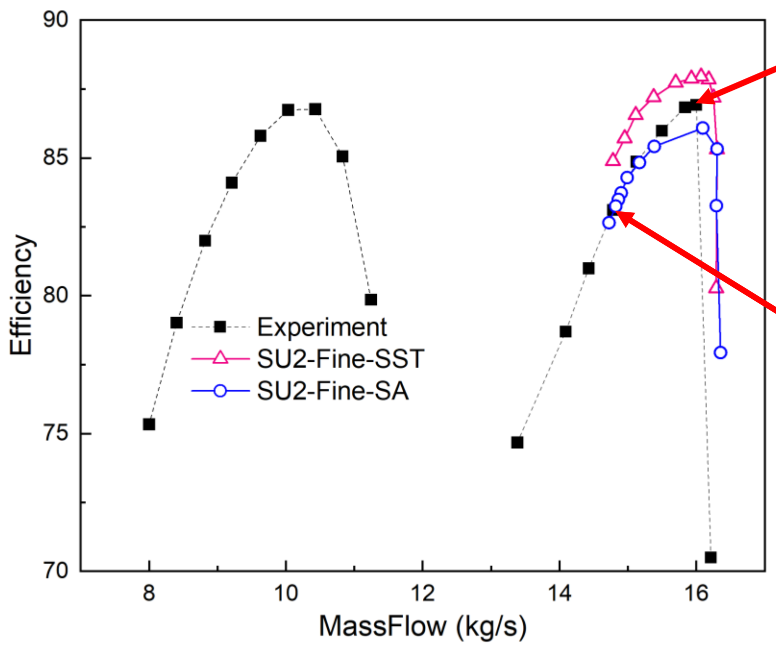






Radial Profiles

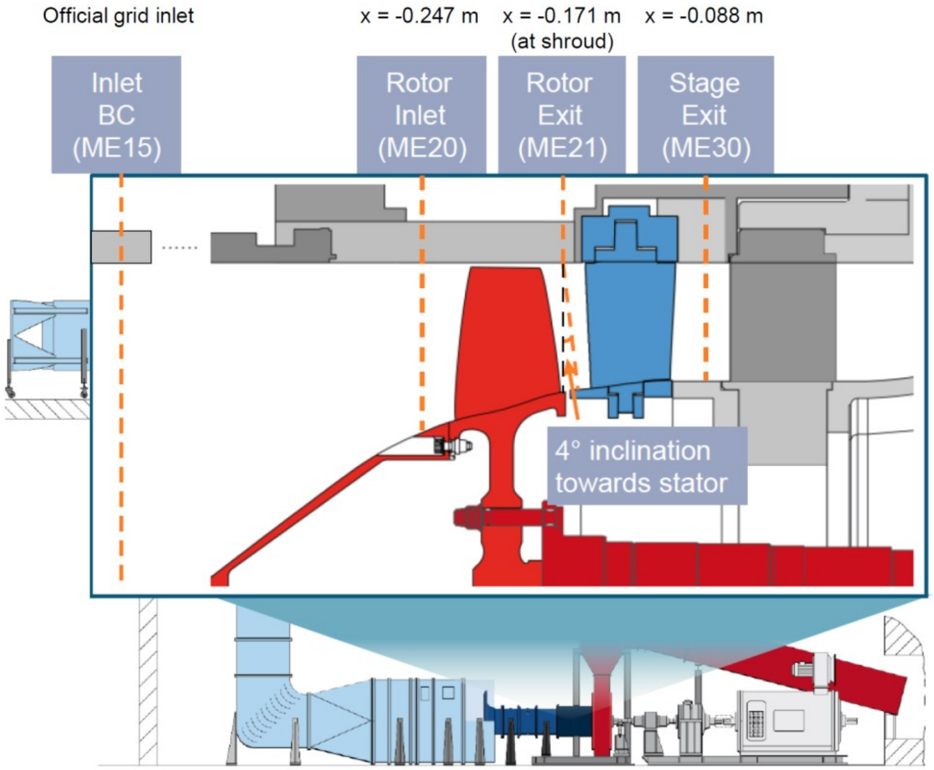
☐ Comparison between Different Grids



PE ME21

ME30

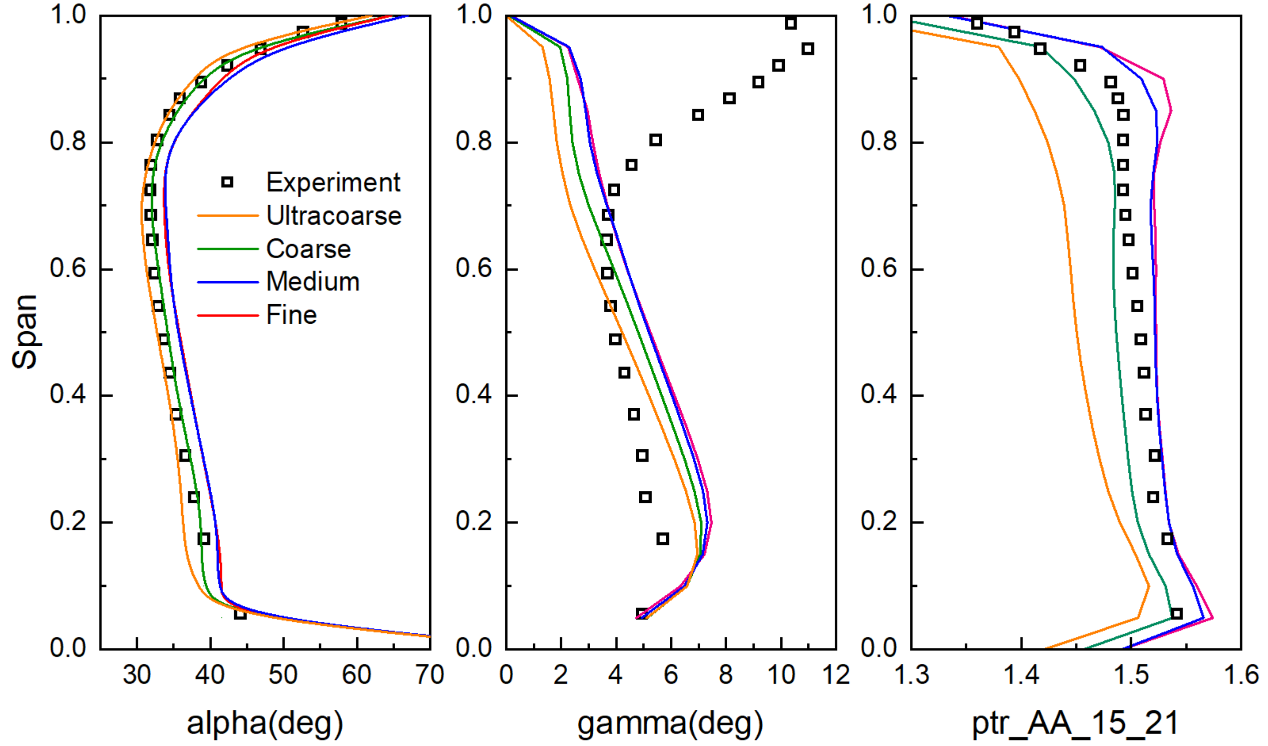
NS ME30



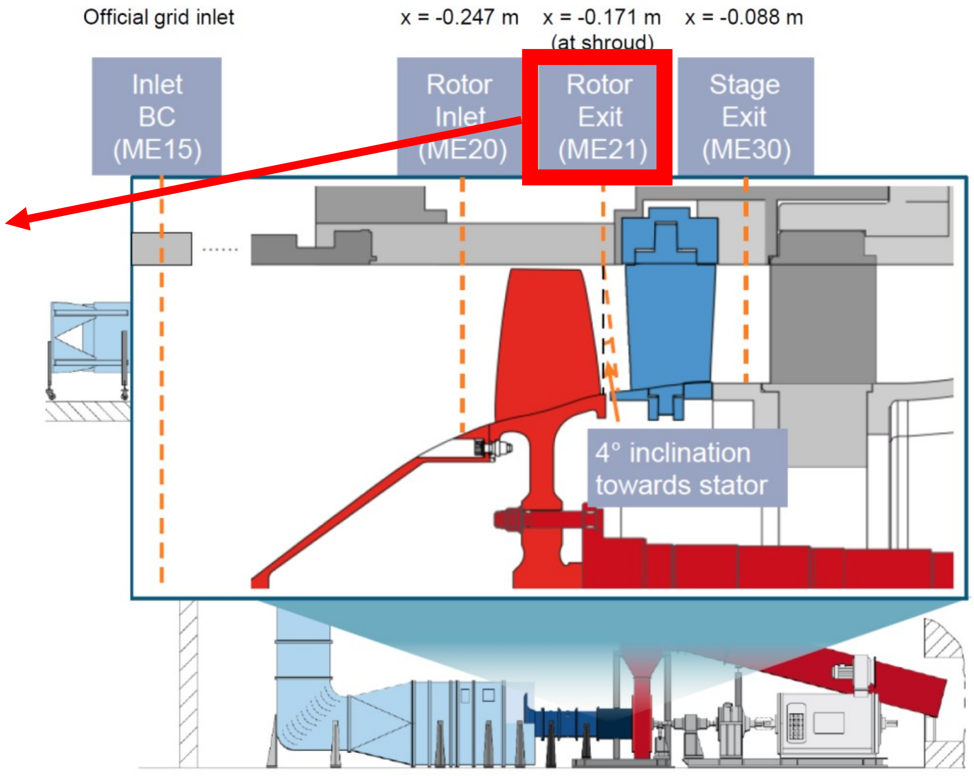
Radial Profiles

Comparison between Different Grids

- **PE**



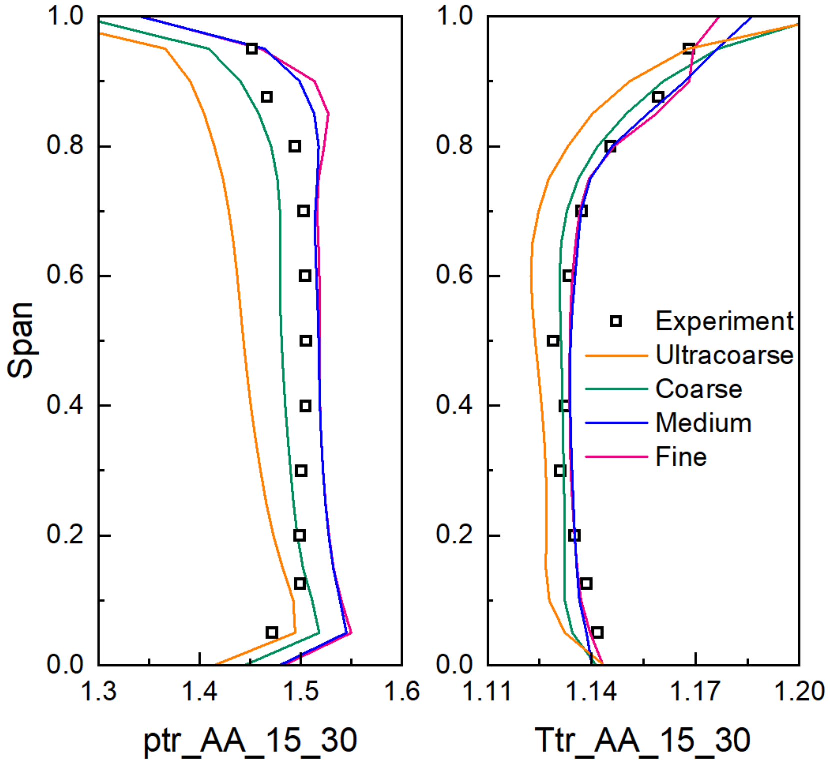
alpha: the angle of circumferential velocity
gamma: the angle of radial velocity

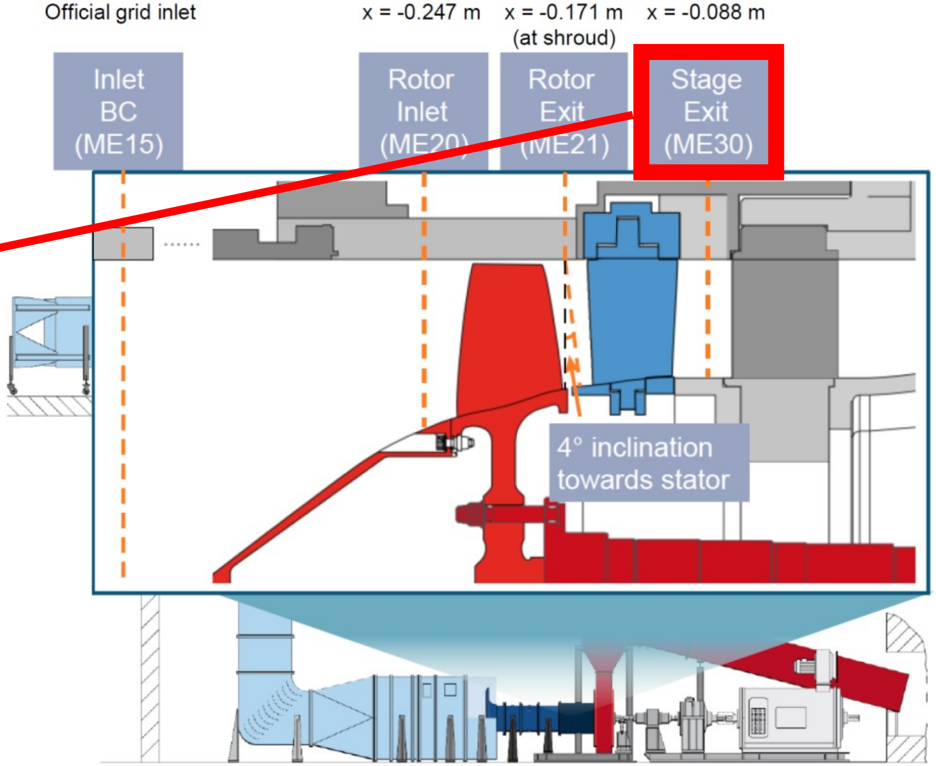


Radial Profiles

Comparison between Different Grids

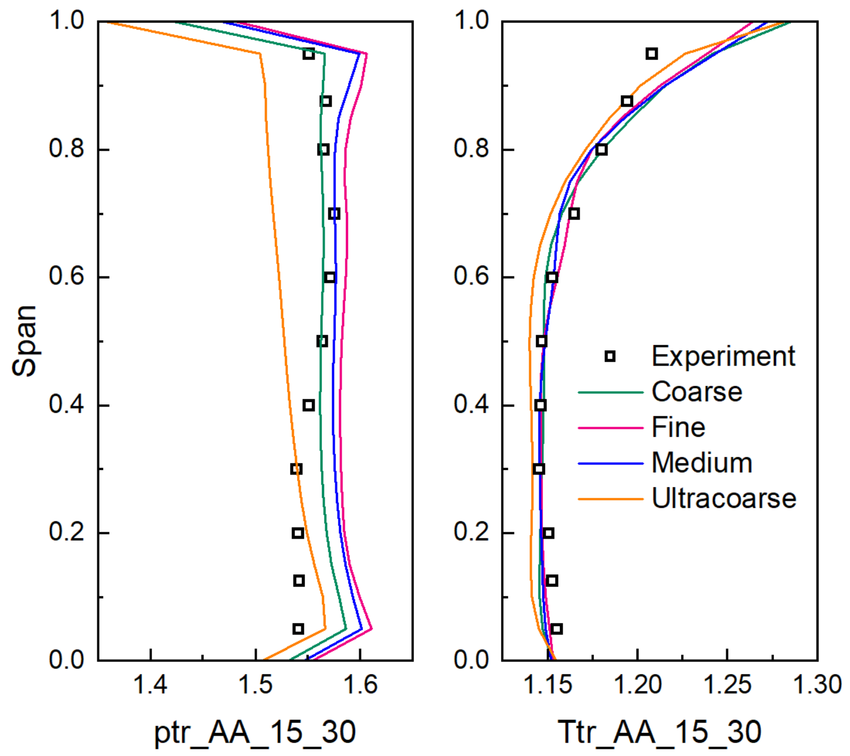
- **PE**

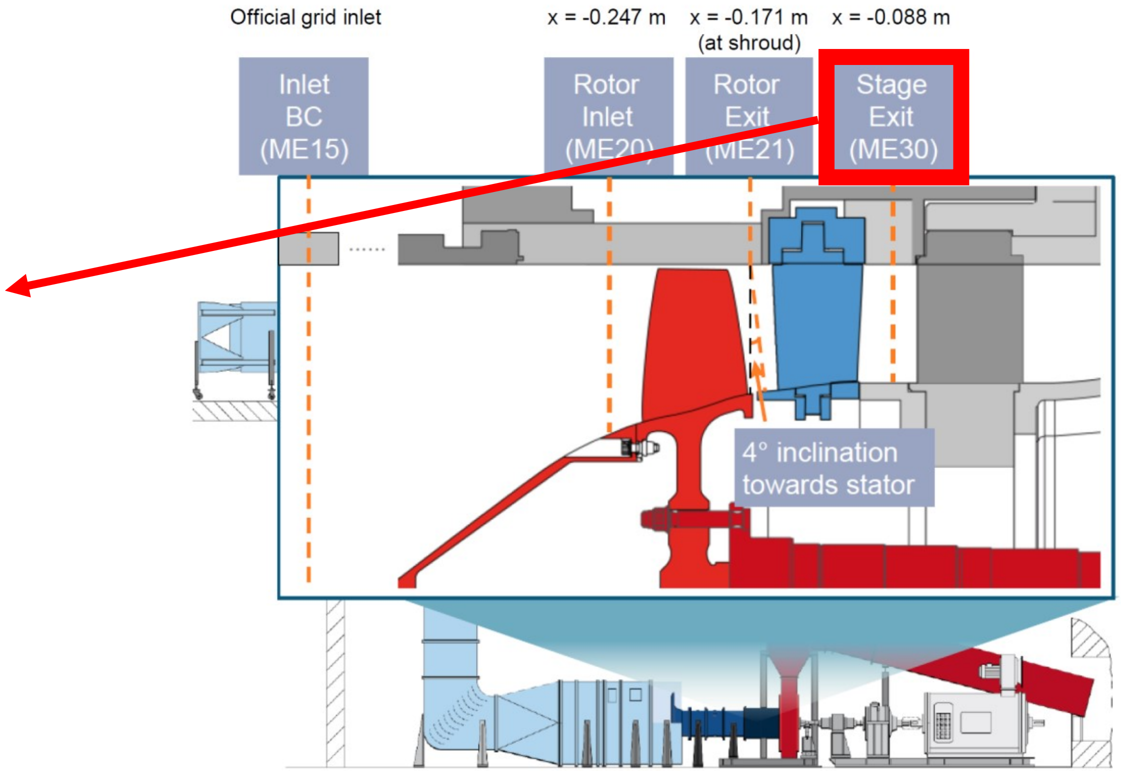




Comparison between Different Grids

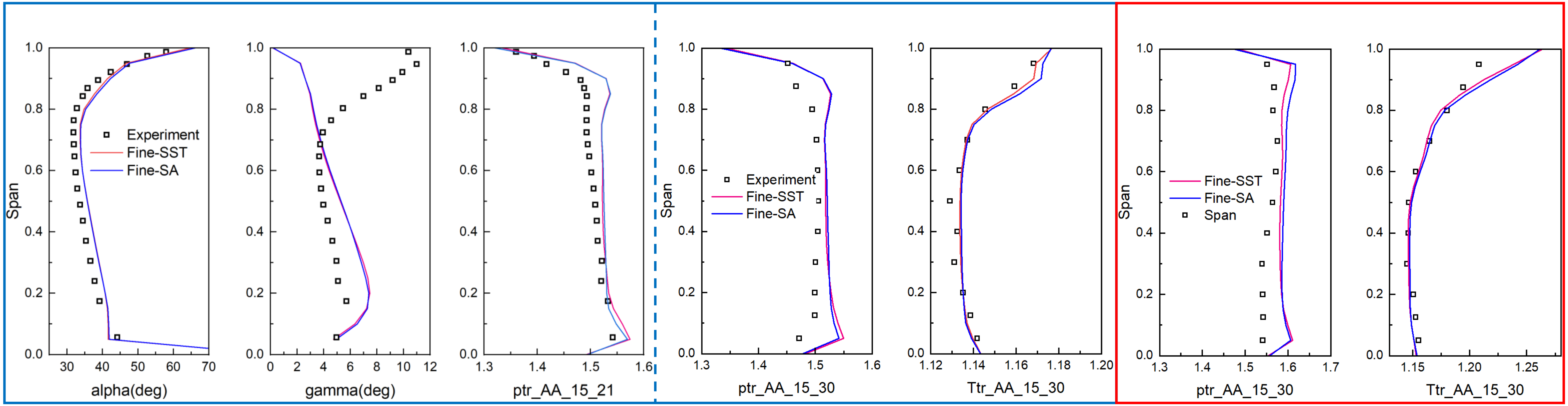
- **NS**





- **Comparison between Different Turbulence Models**

PE **NS**



Rotor Exit **Stage Exit** **Stage Exit**

Thanks