

## DEVELOPMENT OF THE AEROTHERMAL DISCIPLINE

The aerothermal discipline is considered an important lever able to qualify radical renewals (step change) to the aerospace propulsion.

Within this sphere, Avio is aiming to develop with great determination following objectives:

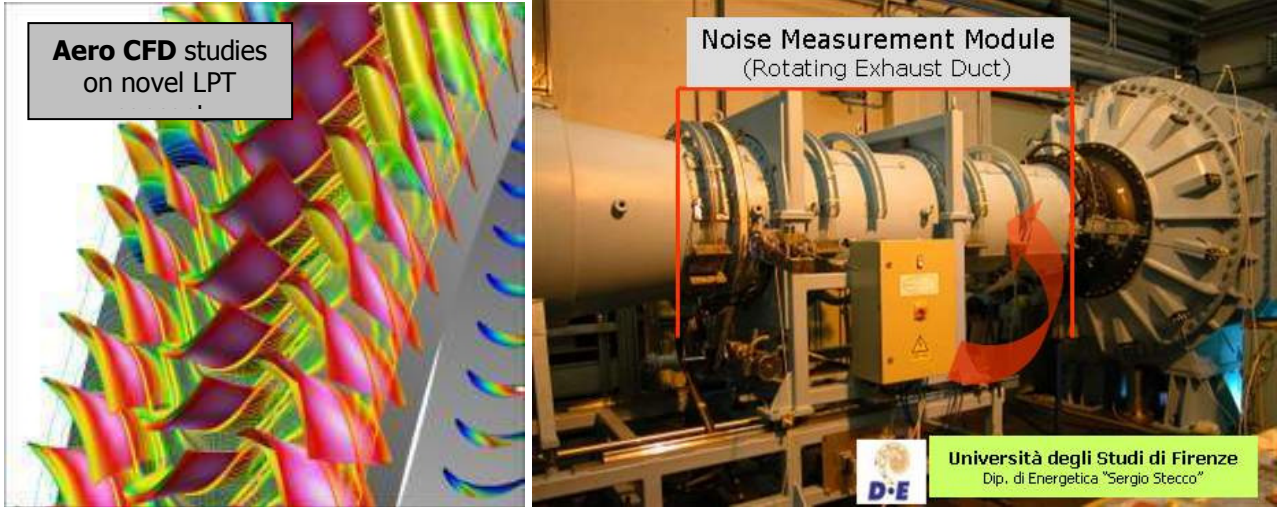
- to reduce specific consumption (SFC) of new generation engines such design regard whether the aerodynamics, and hence performances, or turbines thermal system.
- To reduce acoustic emissions of its own products.

All of this is reached in order to respect the ACARE 2020 directives that places more and more tightening requirement in terms of performances, emissions, reliability, economy and duration.

The development of research in AEROTHERMAL discipline shall take the following steps:

- **Definition of guidelines for consolidation and development of various issues on the basis of macro future development of product Avio.** These are essentially studies and analysis on new engine architectures and turbo machinery modules and related to these will be planned the developing of:
  - New technologies for design aero-thermo-mechanical and acoustic.
  - Tools multidisciplinary design simple, reliable, accurate that include the design experience of Avio.
  - Development of CFD calculation stationary and stationary aero thermal aeroelastic, CAA, with particular reference to new models of transition laminar-turbulent boundary layer.
  - development codes for internal cooling of turbine blades stator and rotor, innovative cooling systems for the use of new generation combustion chambers.
  - control of secondary air system of aircraft engine.
  - .....
- Choice and launch of research programs both European and national: at the moment research programs launched and/or are being launched are more than 20. Among them we can remember the following:
  - JTI Clean Sky (EU) : Demonstrator that incorporates the latest innovations to be applied to the engine of the future
  - DREAM (EU): study and development of counter turbines statorless
  - VITAL (EU): development platform aero-acoustic and mechanical of technology "Turbine high lift"
  - TATMO (EU): aerodynamics and turbine control systems and stand boundary layer
  - FUTURE (EU): experimental studies and developments on the numerical control of turbine flutter
  - TURNEX (EU): developing of acoustic numerical methods
  - MAGPI (EU): new innovative cooling systems for turbine blades
  - CLEARANCE (AVIO): Studies and optimization of numerical-experimental clearances of turbine flow path
- CORALE (AVIO) : Preliminary design tools and multitasking approach. **Creation and develop of a network of centers of excellence in Italy and abroad.**

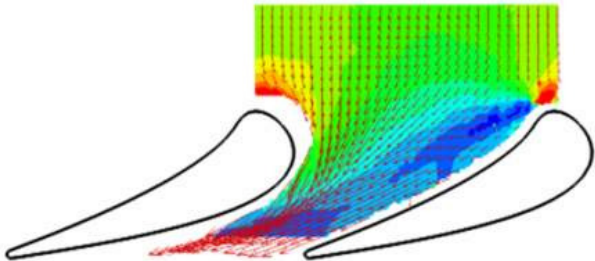
Some applications of digital development and experimental investigation are presented following



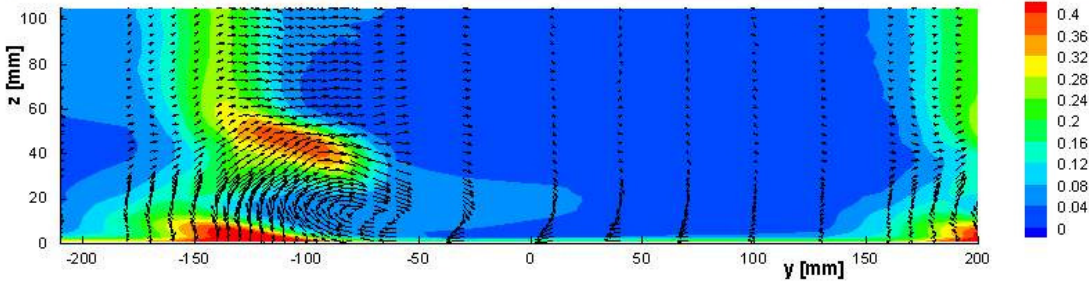
**AST5-CT2005 AITEB-2 "Aerothormal Investigations on Turbine Endwalls and Blades"**



*Blade-to-blade flow field distribution near to the endwall – PIV measurements*



*Total pressure loss coefficient with superimposed secondary flow vectors downstream of the cascade*



# Avio centers of excellence in Italy

