Study of the Effect of Boundary Layer Ingestion (BLI) on Aircraft Propulsion / Distributed Propulsion Technology with Superconducting Motors

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Abstract

In this study, evaluation of unsteady aerodynamics in aircraft fan under strongly distorted inflow condition simulating airframe/engine integration configuration with Boundary Layer Ingestion (BLI) benefit suited for future electric aircraft. Under these BLI conditions, aircraft fan suffers almost all the flight path strongly distorted inflow conditions, the present study investigates the fan flows in detail through the numerical simulations.

Reasons and benefits of using JAXA Supercomputer System

It is necessary to perform unsteady calculations around the full-annulas fan calculations. So the calculation cost is huge.

Achievements of the Year

To analyze the influence of boundary layer ingestion (BLI) to the fan rotor performance, sweep and dihedral blade shapes were applied to the fan rotor and the performance of sweep and dihedral shapes were compared with the base fan rotor blade.

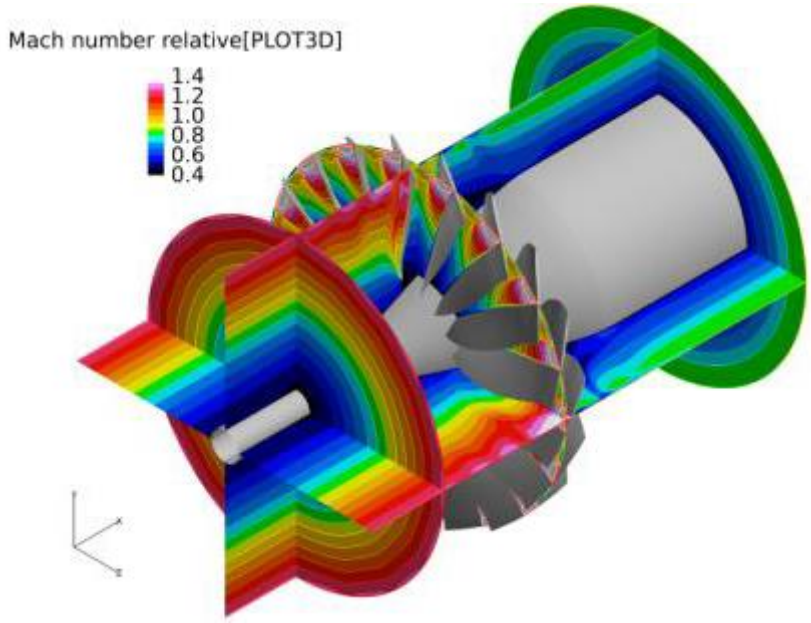

Fig. 1: Relatice Mach Number Contours (Whole Section)

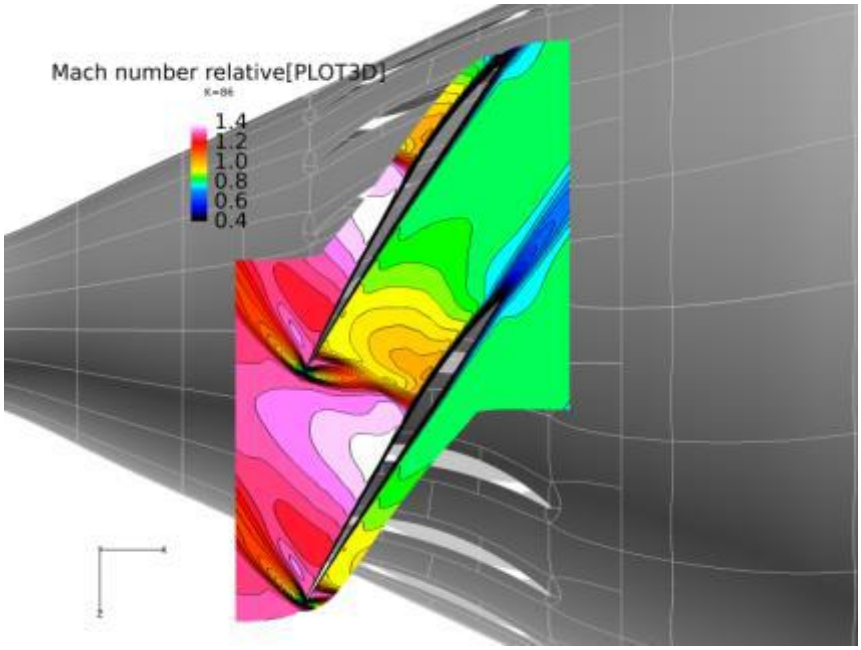

Fig. 2: Relatice Mach Number Contours (90% Span)

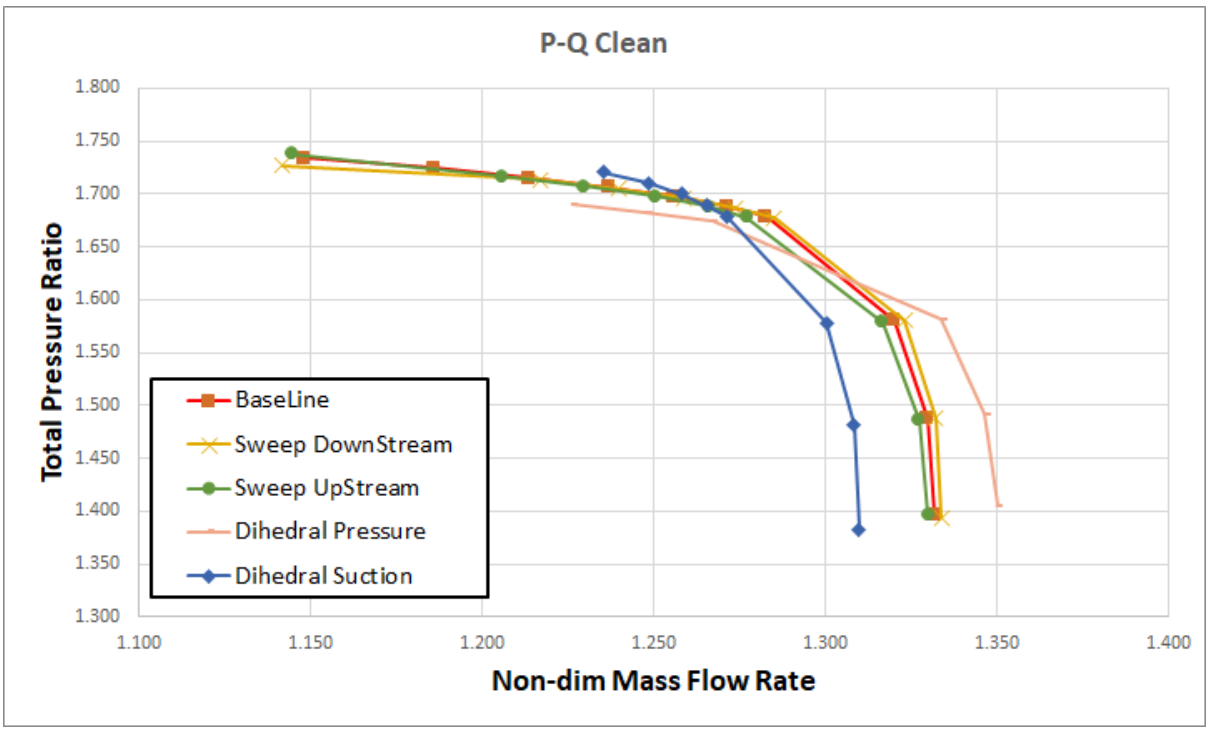

Fig. 3: Mass Flow Rate v.s. Total Pressure Ratio

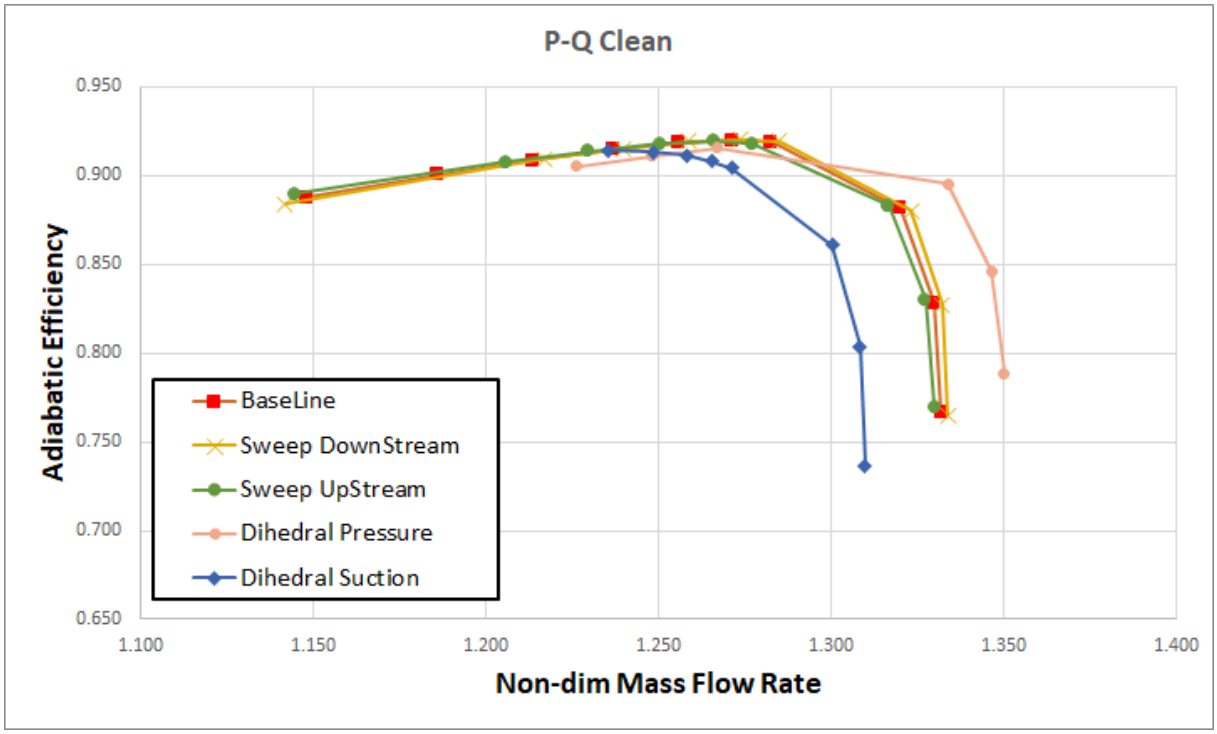

Fig. 4: Mass Flow Rate v.s. Adiabatic Efficiency

Publications

N/A

Usage of JSS

Computational Information

Process Parallelization Methods	MPI
Thread Parallelization Methods	Automatic Parallelization
Number of Processes	240 - 576
Elapsed Time per Case	24 Hour(s)

JSS3 Resources Used

Fraction of Usage in Total Resources[*1](%): 0.24

Details

Computational Resources		
System Name	CPU Resources Used (core x hours)	Fraction of Usage[*2](%)
TOKI-SORA	3,257,848.55	0.14
TOKI-ST	45,296.59	0.05
TOKI-GP	0.00	0.00
TOKI-XM	0.00	0.00
TOKI-LM	231,369.49	15.50
TOKI-TST	1,296.03	0.03
TOKI-TGP	0.00	0.00
TOKI-TLM	0.00	0.00

File System Resources		
File System Name	Storage Assigned (GiB)	Fraction of Usage*2 (%)
/home	1,777.04	1.61
/data and /data2	102,555.11	0.79
/ssd	592.96	0.08

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage*2 (%)
J-SPACE	0.13	0.00

*1: Fraction of Usage in Total Resources: Weighted average of three resource types (Computing, File System, and Archiver).

*2: Fraction of Usage：Percentage of usage relative to each resource used in one year.

- **ISV Software Licenses Used**

ISV Software Licenses Resources		
	ISV Software Licenses Used (Hours)	Fraction of Usage*2 (%)
ISV Software Licenses (Total)	6,505.48	4.53

*2: Fraction of Usage：Percentage of usage relative to each resource used in one year.